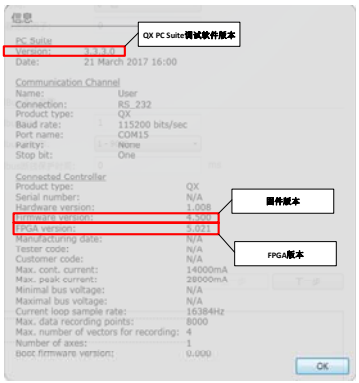
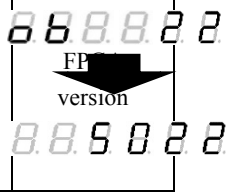
Comprehensive User's Manual Of QXM Series AC Servo Driver and Rotary AC Servo Motor

- Thanks for purchasing and using ADTECH products.
- Please read this manual carefully to ensure correct, standardized and safe use of this product.

Revision of QX Series AC Servo Driver Manual

Update Time		Version	Total pages
June, 2018		V5.0	271
Servo driver model	Applicable firmware version	Applicable FPGA version	Applicable QX PC Suite debug software version
QXMP04N#-B QXMP06N#-B	4336	5.022	
QXMP10N#-B QXMP15N#-B	4536	5.022	

The version can be viewed in the “Information” column of the QX PC Suite debug software, or on the digital operator panels “ob 21” and “ob 22”.

View on QX PC Suite debug software	View on digital operation panel
	
	

The following signs are used to indicate safety precaution in this instruction manual. Please fully observe the precautions as important contents included in the descriptions.

Safety precautions and the signs

Safety Level	Description	Sign	Sign description
DANGER	Indicates a potentially hazardous situation which, if incorrectly operated, will result in death or serious injury to personnel.		Danger, Injury hazard
			Electrical shock hazard
CAUTION	Indicates a potentially hazardous situation which, if incorrectly operated, may result in minor or moderate injury to personnel and damage to equipment. Furthermore, items marked with [CAUTION] may have important consequences depending on the situation.		Caution
			Fire hazard
			Hot surfaces, Burn injury hazard
PROHIBITION	Indicates actions that must not be done.		Prohibition
			Disassembly prohibited
MANDATORY	Indicates actions that must be carried out (mandatory actions).		Mandatory

■DANGER 

Do not use in flammable and explosive environment.	
	Injuries or danger may occur.

Do not perform wiring, maintenance, and inspection with power distributed. Make sure to start performing any tasks 5 minutes or more after power shutdown.	
	Electrical shock may occur.

Make sure to ground servo driver protective grounding terminal "⏚" to the machine or control cabinet. Make sure to ground servo motor grounding terminal to servo driver protective grounding terminal "⏚".	
	Electrical shock may occur.

Never touch inside of servo driver.	
	Electrical shock may occur.

Transportation, installation, wiring, operation and maintenance inspection must be implemented by the corresponding professionals.	
	Electrical shock may occur.

Do not damage or press the cable with heavy objects or hang heavy objects on the cable.	
	Electrical shock may occur.

Perform wiring in accordance with wiring diagram and the instruction manual.	
	Electrical shock may occur.

Never approach or touch terminals and connectors while it is energized.	
	Electrical shock may occur.

Never remove terminals and connectors while it is energized.	
	Injuries may occur.

Never remove terminals and connectors while it is energized.	
	Electrical shock may occur.

Only qualified personnel who have knowledge on related standards of safety system when utilizing safe-torque-off function after thoroughly understanding descriptions in this instruction manual.	
	Injuries and failures may occur.

■CAUTION 

Check whether it is upside downBefore unpacking.	
	Injuries may occur.

Verify no discrepancies between the product you received and the product you ordered. Installing incorrect product can result in personal injuries orproduct damages.	
	Personal injuries or product damage may occur.

Make sure to read the instruction manual and observe the instructions before installation, operation, maintenance, and inspection.	
	Electrical shock and injuries may occur.

Do not use faulty, damaged, and burnt-out servo driver and servo motor.	
	Injuries may occur.

Please be aware that temperatures on servo driver, servo motor, and peripheral equipment may become high.	
	Burn injuries may occur.

Do not use servo driver and servo motor beyond the scope of the specification.	
	Failure, personal injuries and product damage may occur.

Please use the paired servo driver and servo motor.	
	Failures may occur.
	Fire may occur.

Do not perform measurement of insulation resistance and dielectric strength voltage.	
	Product damage may occur.

Make sure to connect the wiring properly.	
	Injuries may occur.

Do not put heavy things on, or stamp on the system.	
	Product damage may occur.

Make sure to install as the specified installation direction.	
	Product damage may occur.
	Fire may occur.

Do not apply high impacts.	
	Failures may occur.

Never use in a place where it may be exposed to flammable gaseous, or by combustible material.	
	Fire may occur.

Do not apply static electrical charge and high voltage to cable for servo motor encoder.	
	Failures may occur.

Perform wiring in accordance with electrical installation technical standards and internal wiring standards.	
	Failures may occur.

Do not block or let any foreign materials get into air inlet/outlet.	
	Failures may occur.

Maintain the specified distances for installation of servo driver.	
	Fire may occur.

Please pay attention during installation to avoid falling and roll over situation. Use eyebolt if it is equipped for the servo motor.	
	Injuries may occur.
	Fire may occur.

No protection functions are supplied with servo motor. Please install the protective devices such as the over current protective device, earth leakage circuit breaker, over temperature thermostat, and emergency stop equipment for protection.	
	Product damage may occur.
	Fire may occur.

Do not touch cooling fan, regenerative resistor, or servo motor that is electrified or just after power off, since the temperatures on them may become high.	
	Burn injuries may occur.

Stop operation immediately when any abnormality occurred.	
	Injuries may occur.
	Fire may occur.

Make proper tuning gain when servo motor running becomes unstable.	
	Injuries may occur.

In test run, please separate the servo motor from mechanical systems, and then install the motor on mechanical systems after confirming the action.	
	Injuries may occur.

Holding brake is not a stop device to secure mechanical safety. Install a stop device to ensure safety in mechanical side.

	Personal injuries may occur.

When alarm is activated, eliminate the cause, secure the safety and reset the alarm before re-starting operation.	
	Injuries may occur.

Confirm that input power voltage is within the specification of supply voltage.	
	Failures may occur.

Do not approach equipment after restoration from instantaneous interruption of service, as sudden re-start can occur. (Design of the machine should ensure the restart safety of the motors.)	
	Injuries may occur.

Pay attention to the temperature rise of the servo driver when performing maintenance and spot check.	
	Burn injuries may occur.

As for the servo driver equipped with dynamic brake, do not externally and continuously rotate servo motor during servo-ON (to be closed).Because the dynamic brake will generate heat and this will cause dangers.	
	Fire and burn injuries may occur.
	Burn injuries may occur.

Expected life of electrolytic capacitor inside the servo driver is 5 years at average annual temperature of 40°C. It is recommended to replaceit with new electrolytic capacitor before the expiration of the service life. Please contact us for related issues.	
	Failures may occur.

Please contact us for repair. Do not disassemble it without permission.	
	Failures may occur.

Please be careful in carrying so as to prevent product from falling and dropping.	
	Personal injuries may occur.

Do not hold cables or output shaft of servo motor to move the motor.	
	Failures and injuries may occur.

Dispose driver and motor properly as general industrial wastes.	
	Failures and personal injuries may occur.

■PROHIBITION

Do not store the system in the area where it may be exposed to rain and water drops, or toxic gasses or liquids exist.	
	Failures may occur.

Brake built in servo motor is for holding, so do not use it for braking. Using the brake for braking will damage the brake.	
	Failures may occur.

Do not perform overhaul by yourself.	
	Failures and personal injuries may occur.

Do not remove product label (nameplate). 

■MANDATORY

Store the device within the specified temperature and humidity at "-20°C to +65°C, 90% RH or less" and away from direct sunlight.
 Failures may occur.

For long-term storage of servo driver (over 3 years), please contact us. Long-term storage will reduce capacity of electrolytic capacitor, and this can result in failures.
 Failures may occur.

Place emergency stop circuit so that operation can be stopped and power supply can be shut down instantaneously. Place a safeguard circuit outside servo driver so as to shut off main circuit power supply when alarm is activated.
 Going out of control, personalinjuries, burnout, fire, and secondary damages may occur.

Please operate within the specified range of temperature and humidity Servo driver Temperature: 0°C to 60°C Humidity: below 90%RH (No condensation) Servo motor Temperature: 0°C to 40°C Humidity: below 90%RH (No condensation)
 Burnout and failures may occur.

Load the products following the instructions indicated on outer package.	
	Personal injuries may occur.

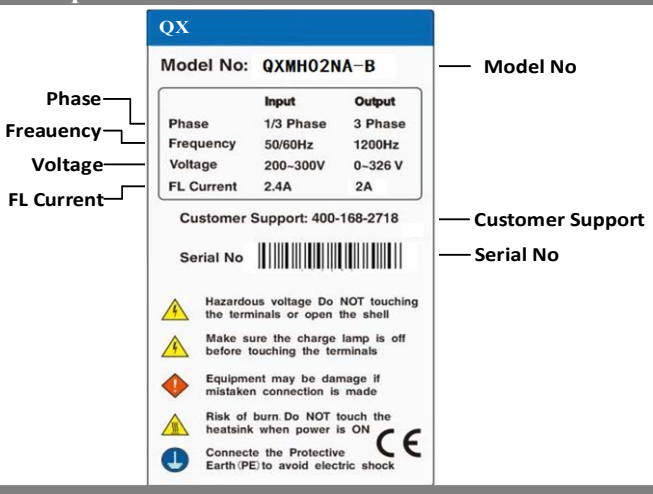
Use eyebolt of servo motor for carrying servo motor only. Do not use it for carrying equipment.	
	Injuries may occur.

Contents

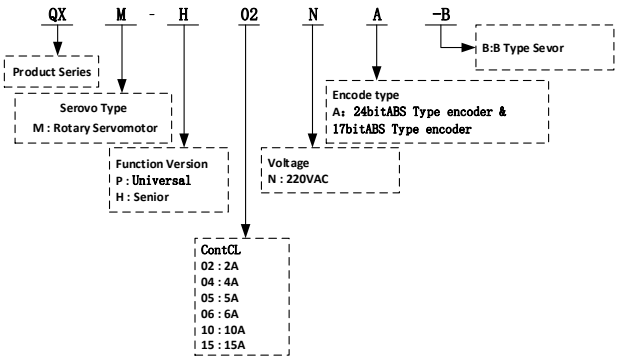
1 Product Validation

1.1 Specifications identification

Content of nameplate

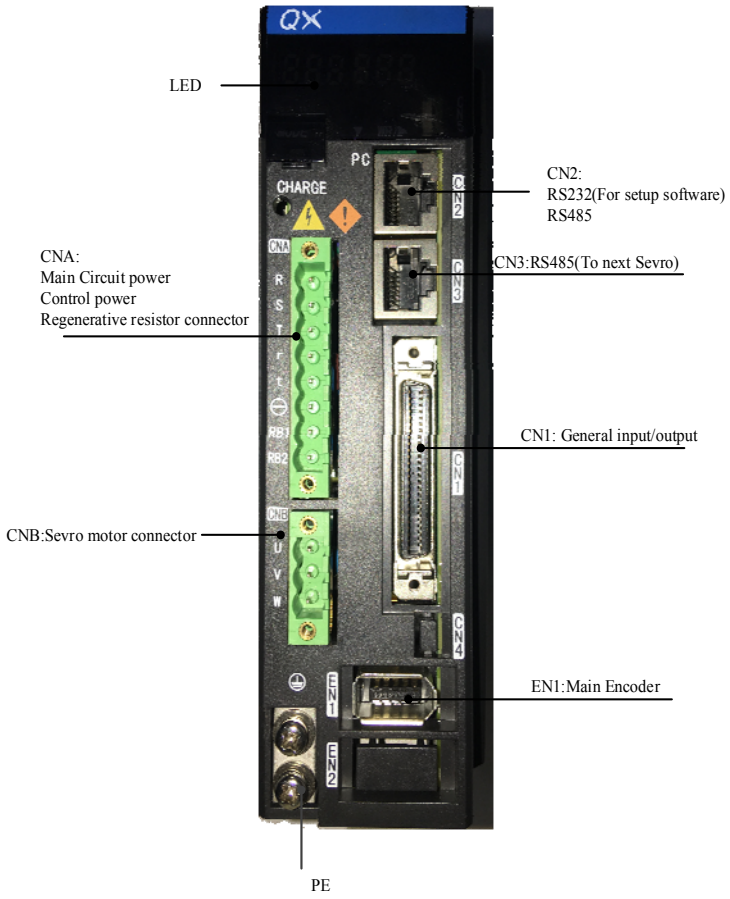


Model Description



1.2 Product description

1.2.1 Product panel description



1.3 Servo driver specifications

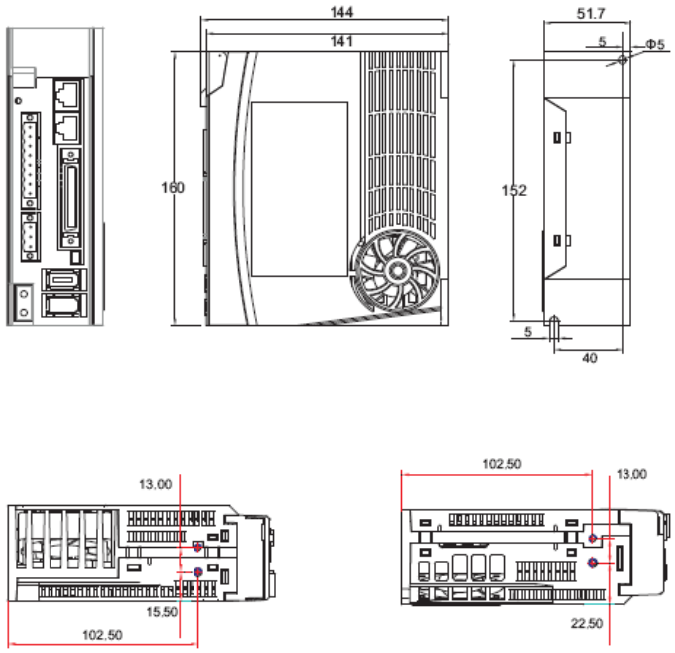
Item			Specifications
Basic specifications	Control method		IGBT PWM control sine-wave current
	Main power(line voltage)	Conventional power driver	AC220V (1Φ or 3Φ)
		High power driver	AC380V (3Φ)
General specifications	Position control	Command control mode	External pulse or internal command
		External command pulse type	PD, CW+CCW, AB
		Electronic gear ratio	1/(65536)≤Electronic gear ratio<256
Function table	Digital keypad and operation		6-digit display tube, 4 functional operating keys
	RS485 communication		Modbuscommunication protocol
	I/O		8Input 10, output 8
	RS232communication		RS232 serial port direct communication
	Vibration suppression		Mechanical system resonance suppression
			Motion end vibration suppression
	Gain switching		5-level gain switch can be performed
	Positioning judgment		0~5000Pulse
	Positive/reverse limit		Achieved through hardware and software
	Regeneration treatment		External regenerative braking resistor
	Protective function		Overcurrent, overvoltage, regenerative failure, encoder error and other alarms

2 Preparation

2.1 Driver dimensions

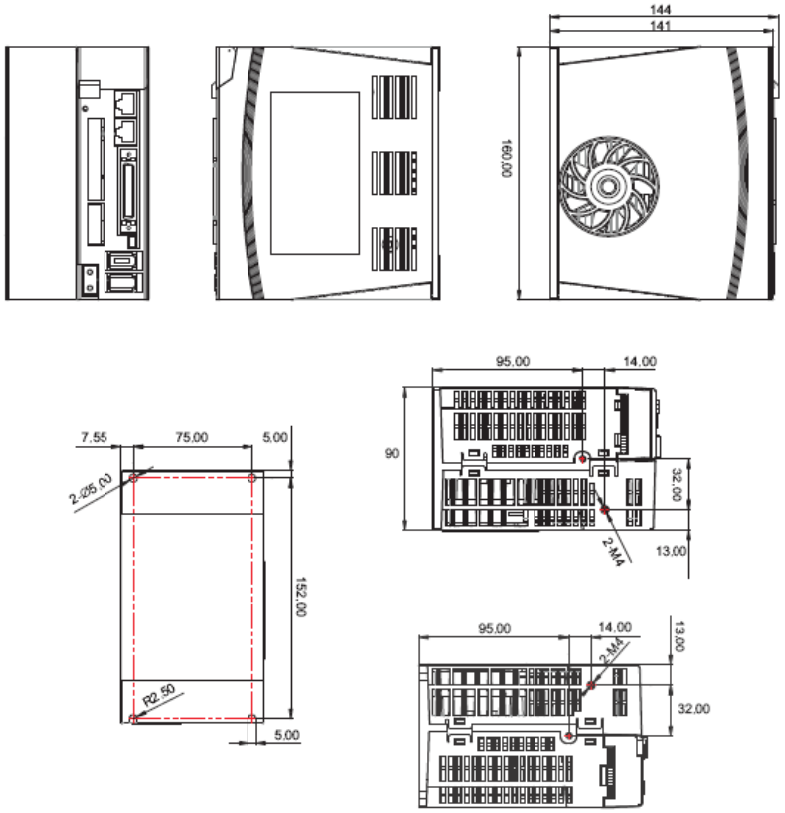
Dimensional drawing of type A (1KW (inclusive) and below)

Unit: mm



Dimensional drawings of type B (1.5KW~3KW)

Unit: mm



2.2 Installation environment of driver

Before installing the QX series servo driver, please be sure to confirm the installation environment and observe the following precautions:

Precautions

- Do not stand on, or put heavy items on the servo driver.
- Do not drop the device or subject it to excessive shock.
- The device should be installed on non-flammable surfaces only.
- Do not obstruct the air intake and exhaust vents.The installation direction should be observed strictly.
- Make sure no screws or other conductive or flammable materials are left inside the servo driver.
- Any damage occurred on appearance or abnormal running for driver can be fixed by contacting our company immediately.

Installation environment

●If installed in a cabinet

The temperature inside the cabinet can exceed the external temperature. In this installation environment, please consider the cabinet size, layout of cooling device and cabinet, and make sure the temperature around the servo driver is below 60°C. For longevity and reliability purposes it is recommended to keep the temperature below 40°C.

● If there is a vibration source nearby

Protect the servo driver from vibration by installing it on a base with a shock absorber.

●If there is a heat generator nearby

If the ambient temperature may increase due to convection or radiation, make sure the ambient temperature near the servo driver is below 60°C.

●If corrosive gas is present

Never use the device where it may be exposed to corrosive gas since long-term use in such surrounding may cause contact failure.

●If explosive or combustible gas is present

Never use the device where it may be exposed to explosive or combustible gas because the device involves relays and contacts, regenerative resistors and other parts.

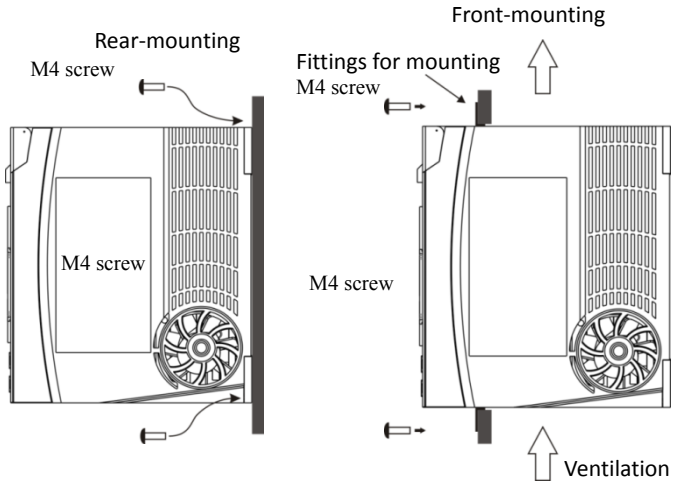
●If dust or oil mist is present

The device cannot be used where dust or oil mist is present,because dust or oil mist accumulates on the device, which can cause insulation deterioration or leakage between the conductive parts, and damage the servo driver.

- **If a large interference is present**

  If interference enters the input signals or the power circuit, it can cause a malfunction for servo driver. If so, please take appropriate interference prevention measures.

2.3 Driver installation



2.4 Installation conditions in control cabinet

• Leave at least 50 mm space at the upper and down side of servo driver to ensure unobstructed airflow from the inside of the radiator and the servo driver. If heat gets trapped around the servo driver, use a cooling fan to ensure good ventilation.

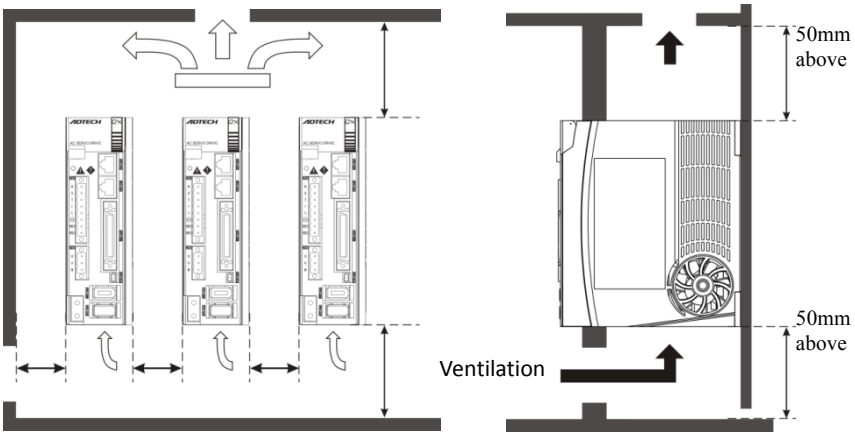
• Make sure the temperature around the servo driver does not exceed 60 ℃. For longevity and reliability purposes it is recommended to keep the temperature below 40 ℃.

• Leave at least 10 mm space on both sides of the servo driver to ensure unobstructed airflow from the heat sinks on the side and from the inside of the servo driver.

• If the servo driver is installed on its side, make sure that the ambient temperature does notexceed 50 ℃, and mount the back panel to a metal plate.

• The recommended thickness of model A iron plate is at least 2mm, and the recommend thickness of model B is at least 5mm.

• If the cooling fan is mounted at the side of model A, it is recommended to install as shown below.



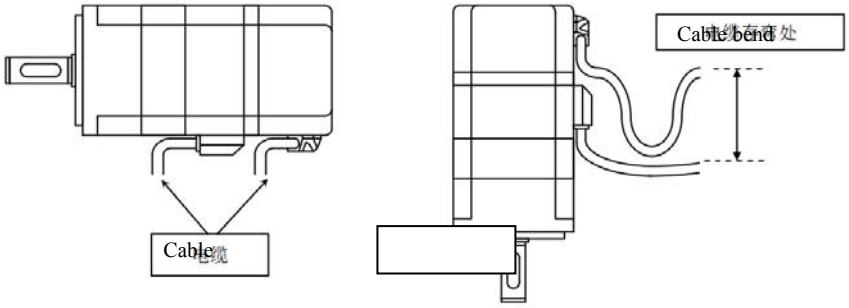
2.5 Motor installation

Followings shall be noticed for the installation location and method of the installation of motor.

- The motor is intended for use indoors, so it shall be installed indoors.
- Please do not use it in applications where the oil seal lip has been exposing in oil or there are a lot of water droplets, oil droplets and cutting fluid. The oil seal can only protect against a small amount of splashing droplets.
- Ambient temperature: 0~40°C
- Storage temperature: -20 ~ 65 ° C
- Ambient humidity: 20~90%
- A well ventilated place with no corrosive gases or explosive gases.
- A place with no dust and debris.
- A place that is easy for inspection and cleaning.

Installation Method

- It can be installed horizontally with the shaft end facing upwards or downwards.
- When the output shaft is provided with a reducer filled with lubricants such as lubricating oil or oil, or when a mechanism using liquid is used, try to install it horizontally or with the shaft facing down.
- Even if the motor with the oil seal on the output shaft is installed upwards, if the oil seal lip is often exposed in oil, the oil may seep into the motor due to the friction and breathing of the oil seal, which may cause motor failure. In this case, it is recommended to install an oil seal on the load side as well.
- Please consult us for similar applications.
- The connector of the motor and the cable interface should be installed by facing down as much as possible.
- When being installed vertically, the cable bend can be arranged to prevent oil, water, etc. from entering the motor.



Water and Dust Prevention

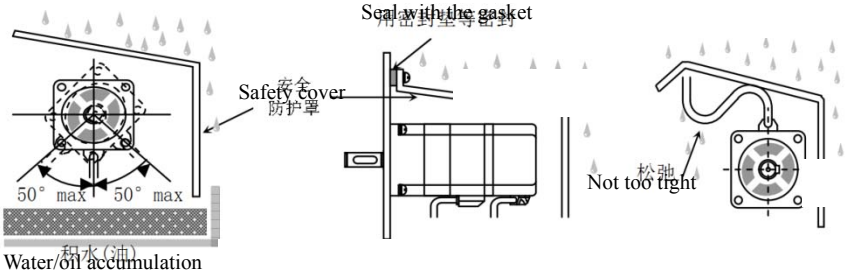
- The motor unit is protected in accordance with the IEC standard (IEC34-5). However, since this standard is a short-term performance specification, it is necessary to take measures to prevent leakage in actual use. Damage to the skin (coating) of the connector would degrade the water resistance of the motor. Special care is required when using it.
- Although the waterproofing grade of the motor is rated IPX7, if it is often placed in wet conditions, liquid may penetrate into the motor due to the absorption of the motor. Special attention shall be paid when using it.

- Some types of coolant (especially water-soluble type) may cause different degrees of erosion on the coating and protective film of the motor. So, please install a protective cover for this kind of application.
- A waterproof plug shall be used for the motor with air plug.

2.6 Protective cover mounting

When the servo motor is installed in a liquid environment, install the protective cover following the main points below.

- Please put the connector (cable interface) with its face down. Please refer to the figure below for the range of installation angle.
- Install the protective cover on the side where water and oil spill.
- To prevent water or oil accumulation, install the protective coverobliquely.
- Do not soak the cable in water or oil.
- In order to prevent water or oil from entering the motor, the wiring outside the protective cover should not be too tight.
- When you want to install the connector (cable interface) upwards, in order to prevent the water or oil from leaking inside, the cable should not be too tight.

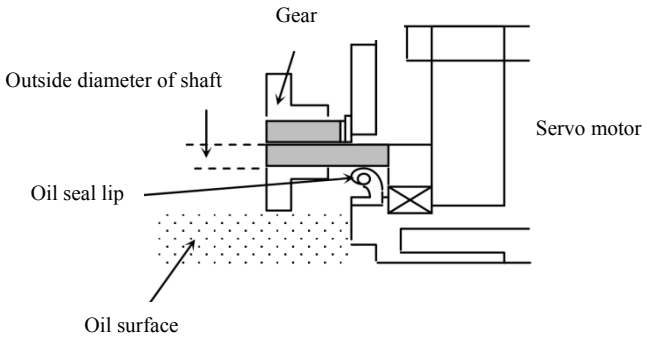


2.7 Gear installation and mechanical coordination

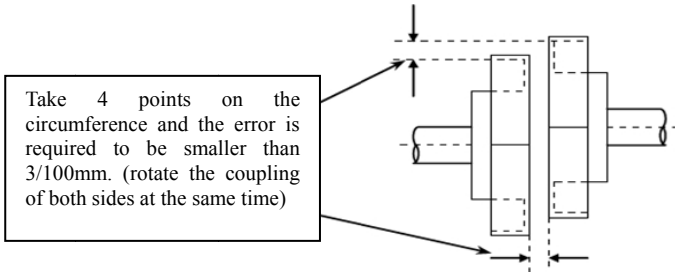
• The oil level of the gearbox should be lower than the oil seal lip, to ensure that only oil splashes onto the oil seal lip.

• Set the through-hole to prevent the internal pressure of the gearbox from rising, otherwise water or oil will leak inside the motor through the oil seal lip.

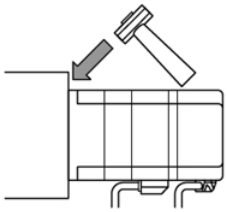
• If the motor shaft is mounted upwards, it is recommended to install an oil seal on the gear side. And an outlet shall be arranged to drain the water and oil passing through the gear side oil seal!

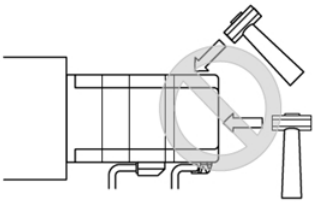


• Please perform the centering installation of motor and machine following the installation method given in figure below. When using a rigid coupling, the output shaft may be damaged due to slight deviations, so be careful when operating.



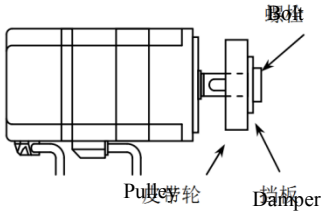
• Since the precision part encoder is directly connected to the motor, do not knock on the output shaft of the motor. In case it is inevitable to knock on the motor for such purpose as position adjustmen, you can knock on the front end of the flange with a rubber or plastic hammer.

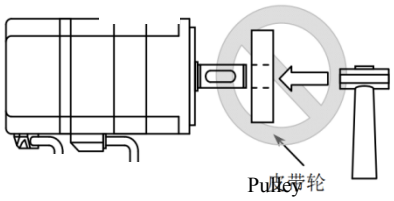




• When being installed onto the machine, process the mounting holes that allow the motor flange to be smoothly connected. In addition, please ensure the flatness of the mounting surface. If the flatness of the mounting surface does not satisfy the requirements, it may cause damage to the output shaft or bearing of the motor.

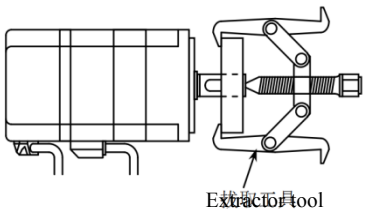
• When installing the reducer, pulley and coupling, please use the bolts at the shaft end. Do not knock on the output shaft.

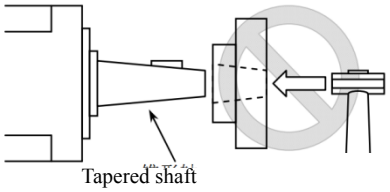




• When the motor output shaft is a tapered shaft, since the force will be transmitted through the tapered surface, do not knock when installing the key. In addition, when processing the mounting holes, it is necessary to ensure that the contact surface of the tapered surface is greater than 70%.

• When removing the reducer and pulley, a dedicated extractor tool shall be employed.





2.8 Cable installation and wiring considerations

- Prevent the cables from external pressure and damage.
- When the servo motor is mounted on the mobile part of the device, please expand the bend radius to prevent the cables from excessive external pressure (pull).
- There should be no cutting scraps that may scratch the cable sheath around the cables during wiring. Also, do not install the cables in mechanical corners or places that may be knocked by the machine or trampled.
- Fix the cables on the machine to ensure the connecting parts are not subject to bend pressure and gravity pressure. When the motor and cables are applied in moving parts, the cable bend radius should be determined according to the required bending life and cable type.
- The cables of moving parts should be replaced periodically. In addition, please consult our company for the selection of moving parts dedicated cables.

2.9 Cable specifications --- permissible current

AWG size	Cross-section [mm^2]	Conductor resistance [Ω/km]	Permissible current under different ambient temperatures[A]		
			30℃	40℃	55℃
20	0.5	39.5	6.6	5.6	4.2
19	0.75	26.0	8.8	7.0	5.4
18	0.9	24.4	9.0	7.7	5.8
16	1.25	15.6	12.0	11.0	8.3
14	2.0	9.53	23.0	20.0	15.0
12	3.5	5.41	33.0	29.0	21.8
10	5.5	3.47	43.0	38.0	28.5
8	8.0	2.41	55.0	49.0	36.8
6	14.0	1.35	79.0	70.0	52.5

2.10 Recommended cable diameter

The recommended diameter values of cables for servo drivers and servo motors are shown in the following table:

<table>
<tr><th rowspan="2">Servo drivers</th><th>Motor power line</th><th>Encoder line</th><th>Main power supply</th><th>Control power</th><th>Ground wire</th></tr>
<tr><th>mm^2</th><th>mm^2</th><th>mm^2</th><th>mm^2</th><th>mm^2</th></tr>
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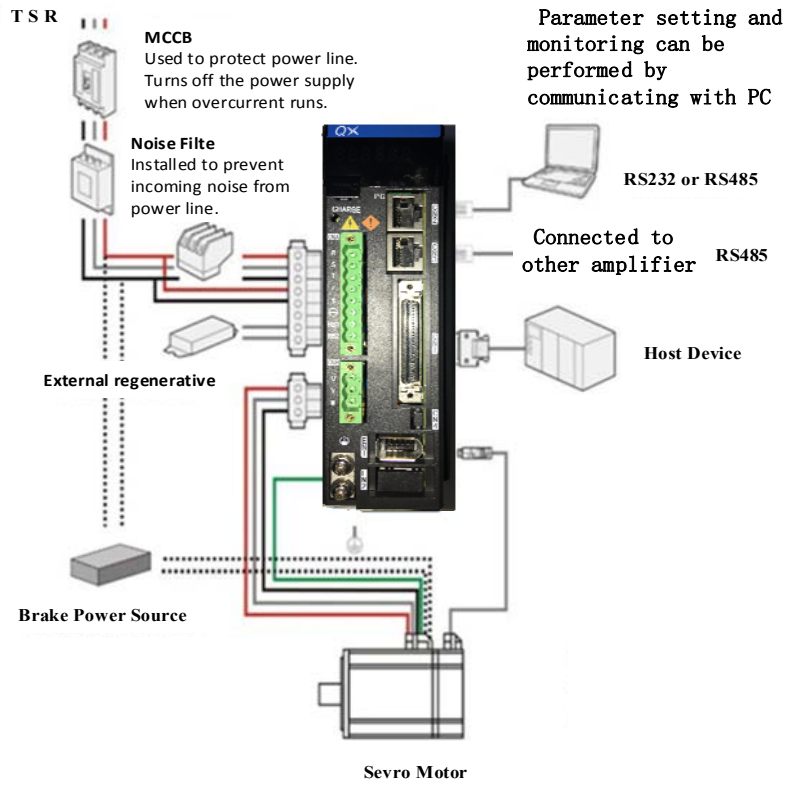
<tr><td>QXMP15N#-#</td><td>8</td></tr>
</table>

3 Wiring

3.1 Driver wiring instructions

Before using the servo driver, the user needs to complete the wiring of the driver control system, as shown below



The servo driver has various external wiring terminals. Please refer to the introduction specifically shown in table as follow:

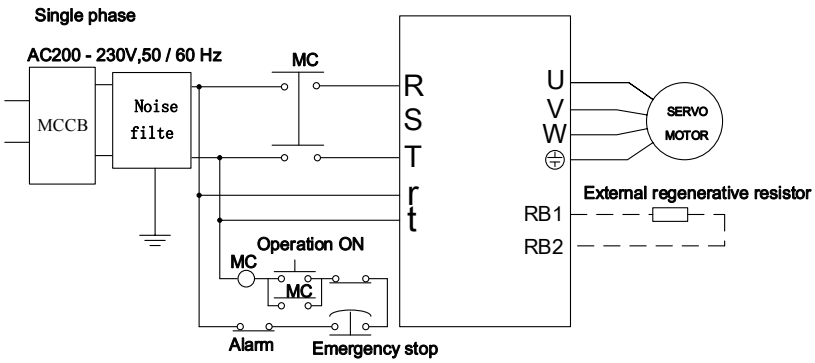
Port sign	Terminal name	Function / Remark
CNA	Main circuit power supply Terminal (R/T and R/S/T)	Single-phase AC200~230V +10%, -15% 50/60Hz±3%
		Three-phase AC200~230V +10%,-15% 50/60Hz±3%
	Control power terminal (r/t)	Single-phase AC200~230V +10%,-15% 50/60Hz±3%
	Regenerative resistor connection terminal(RB1/RB2)	Connect regeneration resistor between terminal RB1 and RB2 if regeneration is insufficient.
CNB	Servo motor connection terminal (U/V/W)	Connect the power line of servo motor
⏚	Protective earthing terminal	Connect the power ground wire and servo motor ground wire
CN1	Host device control signal port	Host device control signal I/O port connection
CN2	Host device debugging port	Communication connection of the host device debugging software
CN3	Driver connection port	Connection between the driver and the next driver for purpose of communication
EN1	Main encoder connection port	Servo motor encoder signal input

3.1.1 CNA and CNB ports

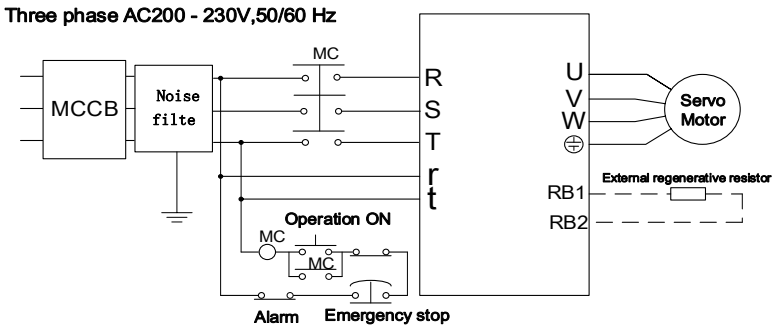
Example of wiring

There may be high voltage in the drivereven if the power supply is turned off. To prevent electric shock, do not touch the power terminals within five minutes after the power is turned off. When the discharge is complete, the CHARGE indicator will go off. Please wait for the indicator light to go off before checking the connection points.

Single-phase AC 200~230V (50/60Hz)

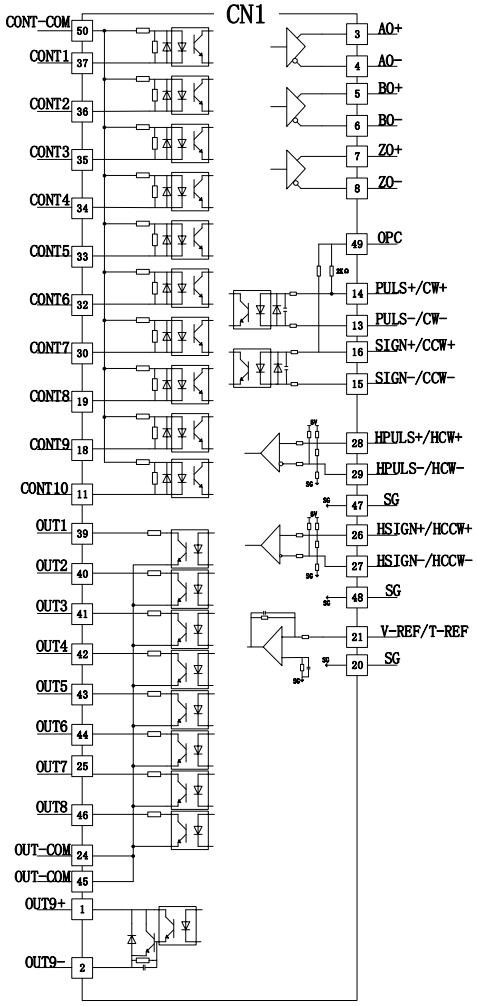


Three-phase AC 200~230V (50/60Hz)



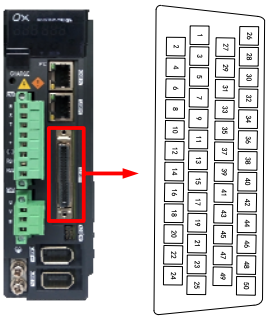
3.1.2 CN1port

◆ **CN1 signal name and pin number (wiring with host computer)**



◆ **CN1 pin definition**

The host device signal needs to be accessed via the CN1 port of the driver. As seen from the terminal side, the port sub-pins (50pin) are arranged as shown in figure below:



Each pin is defined as follows:

Pin No.	Signal name	Signal name
1	OUT9+	General-purpose output (for motor brake control)
2	OUT9-	
3	AO+	Encoder phase A pulse differential output, AO+ signal output
4	AO-	Encoder phase A pulse differential output, AO- signal output
5	BO+	Encoder phase B pulse differential output, BO+ signal output
6	BO-	Encoder phase B pulse differential output, BO- signal output
7	ZO+	Encoder phase Z pulse differential output, ZO+ signal output
8	ZO-	Encoder phase Z pulse differential output, ZO- signal output
12	SG	Pin 3-10 shared signal ground
20	SG	Corresponding signal ground of Pin 21
21	V-REF/ T-REF	V-REF: external velocity reference voltage input; T-REF: external torque reference voltage input;
22	T-COMP	Torque compensation input
23	SG	Corresponding signal ground of Pin 23
26	SIGN+/HCCW+	High-velocity pulse differential channel, with pulse input frequency of 500K~2.5MHZ In the pulse/direction mode, the direction command input; in the double pulse mode, the reverse pulse input; In AB orthogonal mode, the pulse B input;
27	SIGN-/HCCW-	

47	SG	Pin 26 and 27 shared signal ground

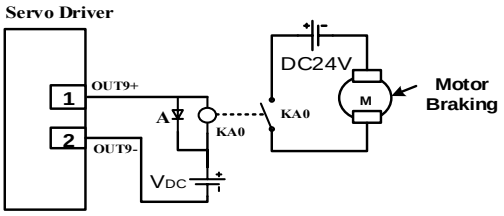
Pin No.	Symbol	Signal name
28	HPULS+/HCW+	High-velocity pulse differential channel, with the pulse input frequency of 500K~5Mpps In pulse/direction mode, the pulse command input; in double pulse mode, the forward pulse input; In AB orthogonal mode, the pulse A input;
29	HPULS-/HCW-	
48	SG	Pin 28 and 29 shared signal ground
49	OPC	Pulse optocoupler channel 24V + pulse input, common terminal
13	PULS-	Pulse optocoupler channel, for which 5v differential form pulse and 12-24V open collector mode pulse can be connected; Pulse input frequency: less than 500KHZ; In the pulse/direction mode, PULS is a pulse signal; In the double pulse mode, PULS is a CW pulse; In AB orthogonal mode, PULS is an A pulse;
14	PULS+	
15	SIGN-	
16	SIGN+	
38	SG	Pin 13-16 shared signal ground
11	CONT10	General-purpose input (open collector)
18	CONT9	General-purpose input (open collector)
19	CONT8	General-purpose input (open collector)
30	CONT7	General-purpose input (open collector)
32	CONT6	General-purpose input (open collector)
33	CONT5	General-purpose input (open collector)
34	CONT4	General-purpose input (open collector)
35	CONT3	General-purpose input (open collector)
36	CONT2	General-purpose input (open collector)
37	CONT1	General-purpose input (open collector)
50	CONT-COM	External power input for general-purpose input
39	OUT1	General-purpose output (NPN type)
40	OUT2	General-purpose output (NPN type)
41	OUT3	General-purpose output (NPN type)
42	OUT4	General-purpose output (NPN type)
43	OUT5	General-purpose output (NPN type)
44	OUT6	General-purpose output (NPN type)
45	OUT7	General-purpose output (NPN type)
46	OUT8	General-purpose output (NPN type)
24	OUT-COM	General-purpose output external power ground

25	OUT-COM	General-purpose output external power ground

◆ **Wiring of motor holding brake**

Pin No.	Symbol	Function description	Control mode		
			Position	Velocity	Torque
1	OUT9+	General-purpose output (for motor brake control)			
2	OUT9-				

The corresponding specific wiring details are:



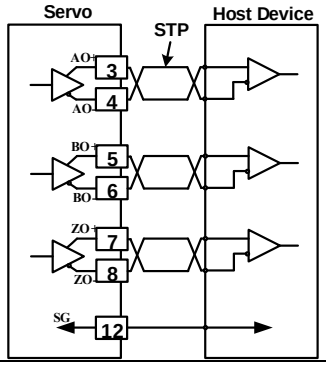
[Notes]
1. The brake coil is non-polar
2. The driver cannot supply the power for brake. The required power supply must be prepared by the customer.
3. The brake (DC24V) shall not share the power supply with the control signal (VDC).
4. To control the opening/closing of the brake, it is required to connect the intermediate relay (KA0) as shown in the figure, and connect the freewheeling diode (A) in parallel on the coil of the intermediate relay (KA0) as shown in the figure.
5. Model recommended to freewheeling diode (A): IN4007

◆ **Encoder feedback signal output wiring (5V level)**

Pin No.	Symbol	Function description	Control mode		
			Position	Velocity	Torque
3	AO+	Phase A differential output signal, AO+ output signal			
4	AO-	Phase A differential output signal, AO- output signal			
5	BO+	Phase B differential output signal, BO+ output signal			
6	BO-	Phase B differential output signal, BO- output signal			
7	ZO+	Phase Z differential output signal, ZO+ output signal	Phase Z origin pulse output signal		
8	ZO-	Phase Z differential output signal, ZO- output signal			
12	SG	Pin 3-10 shared signal ground			

When the host control device needs to obtain the actual position of the motor, it can output the signal to the host device through the encoder feedback signal.

The specific wiring details are shown below:

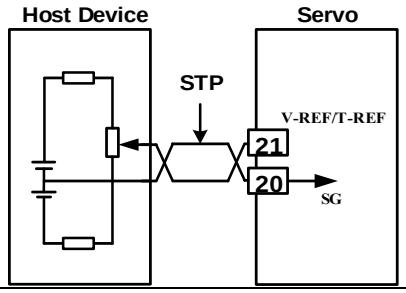


◆ **External velocity/torque command input wiring**

Pin No.	Symbol	Function description	Control mode	
			Velocity	Torque
20	SG	Corresponding signal ground of Pin 21		
21	V-REF	Velocity command input		
	T-REF	Torque command input		

In the velocity/torque control mode, the velocity/torque of the motor can be controlled by the input external analog voltage value.

The corresponding wiring is as follows:

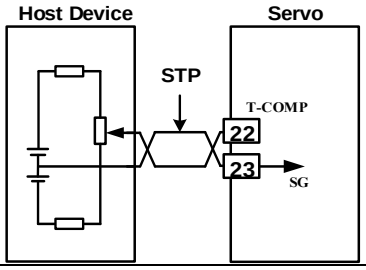


◆ **External velocity / torque command input wiring**

Pin No.	Symbol	Function description	Control mode	
			Velocity	Torque
23	SG	Corresponding signal ground of Pin 22		
22	T-COMP	Torque compensation		

In the velocity/torque control mode, the velocity/torque of the motor can be controlled by the input external analog voltage.

The corresponding wiring is as follows:



◆ **External pulse command input wiring**

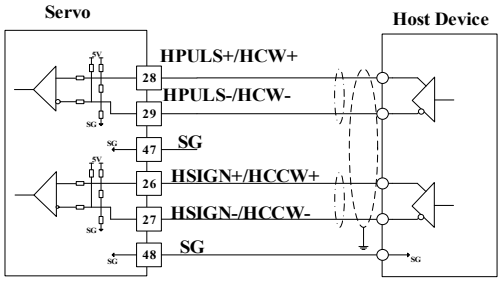
In the position control mode, the running length and velocity of the motor can be controlled by

the number of pulses and the frequency input by the external device. The driver needs different hardware interfaces for receiving the frequency and level of the input pulse of the external host device.

Pin No.	Symbol	Function description	Control mode		
			Position		
26	HSIGN+/HCCW+	High-velocity pulse input differential channel; Pulse input frequency: 500K~2.5MHZ; Pulse input voltage: DC5V; Pulse/direction mode supported; double pulse mode; AB orthogonal mode			
27	HSIGN-/HCCW-				
28	HPULS+/HCW+				
29	HPULS-/HCW-				
47	SG	Shared signal ground of Pin 26 and 27			
48	SG	Shared signal ground of Pin 28and 29			

When the external host device outputs the high-velocity pulse command in differential form, the driver side will receive using the high-velocity differential chip.

The wiring method of host device is shown in the figure below.

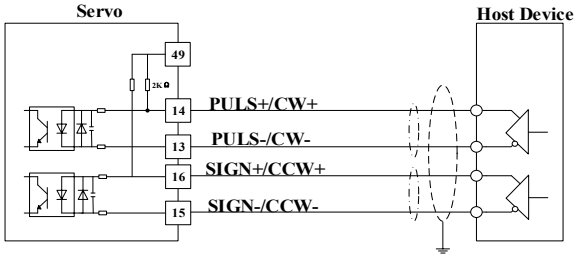


[Note]

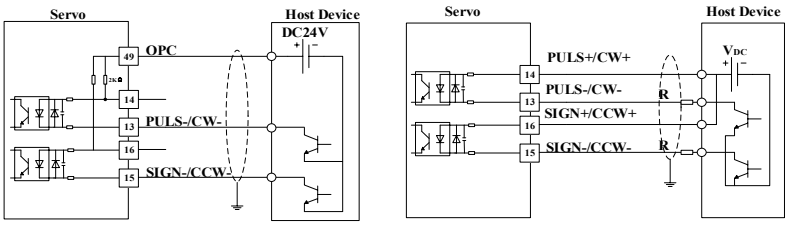
1. If the host device inputs the pulse in AB mode, connect the Pin DR to the Pulse B and the Pin PU to the Pulse A.
2. Please ensure that the input involved in the above wiring method is 5V system, otherwise it will cause the input pulse of the servo driver to be unstable. The following phenomena may occur:
   a) When the command pulse is input, the pulse may be lost;
   b) Be sure to connect the 5V ground of the host device to the corresponding SG of the driver to reduce noise jamming.

Pin No.	Symbol	Function description	Control mode		
			Position		
13	PULS-/CW-	Pulse input optocoupler channel; Pulse input frequency: within 500KHZ; 5V differential form pulse and 12V-24V open collector form pulse can be connected; PD mode: PULS is connected to the pulse command, and SIGN is connected to the direction command; Pulse/direction mode supported; double pulse mode; AB orthogonal mode			
14	PULS+/CW+				
15	SIGN-/CCW-				
16	SIGN+/CCW+				
49	CPC	Pulse optocoupler channel 24V + pulse input, common terminal			

When the external host device outputs the frequency pulse command within 500KHZ in differential form, the 13~16 pins at the CN1 port of the driver can be connected. The wiring method is as follows:



When the external host device is in the open collector mode (common cathode) output frequency pulse command of within 500KHZ, the wiring method can be shown in figure below:



[Note]

1. In the output wiring for the similar open collector, the two current limiting resistors (R) must be connected separately as shown above;

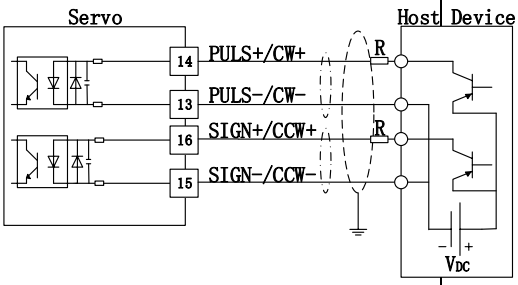
2. In the figure, VDC and 0V are the same DC power supply, which are to be provided by the

customer;

3. When VDC is DC24V, 1.8K-2KΩ 1/2W resistor shall be selected;

4. When VDC is DC12V, 0.8K-1KΩ 1/2W resistor shall be selected

When the external host device outputs the frequency pulse command within 500KHZ in the form of the open collector mode (common anode), the wiring method is as shown below:



[Note]

1. In the output wiring for the similar open collector, the two current limiting resistors (R) must be connected separately as shown above;

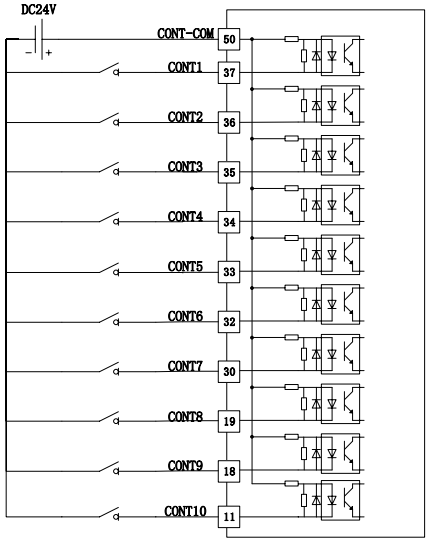
2. In the figure, VDC and 0V are the same DC power supply, which are to be provided by the customer;

3. When VDC is DC24V, 1.8K-2KΩ 1/2W resistor should be selected;

4. When VDC is DC12V, 0.8K-1KΩ 1/2W resistor should be selected.

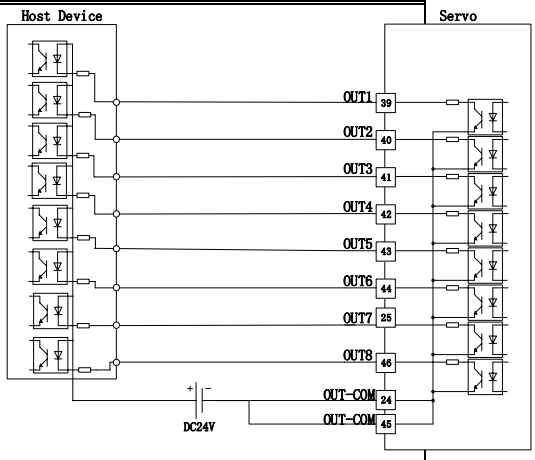
◆ **General-purpose digital input wiring**

Pin No.	Symbol	Function description	Control mode		
			Position	Velocity	Torque
11	CONT10	The external power supply (VDC): ±DC12V±5% or ±DC24V±10%, The minimum input current: 100mA. General-purpose input control function: Refer to the digital input port section of “IO Configuration”. Common general-purpose input control functions: Start motion, Clear alarm, Stop ES, Reverse limit valid, Forward limit valid, and so on. [Note] There is no strict correspondence between input signals and pins, and free configuration is supported. Input form: Open collector input The wiring of the general-purpose digital input port is shown in the figure below. In the figure, VDC and 0V are the same DC power supply, which is to be provided by the customer;			
18	CONT9				
19	CONT8				
30	CONT7				
32	CONT6				
33	CONT5				
34	CONT4				
35	CONT3				
36	CONT2				
37	CONT1				
50	CONT-COM	External power supply input			



◆ **General-purpose digital output wiring**

Pin No.	Symbol	Function description	Control mode		
			Position	Velocity	Torque
39	OUT1	External pull-up power supply specification: DC12V ~15V ±10%, when the maximum current is 30mA; External pull-up power supply specification: DC24V ±10%, when the maximum current is 50mA. The external DC24V power supply is used as the pull-up power supply of output port. When the general-purpose output is OFF, the relay cannot be picked up. General-purpose output control function: Refer to the digital output port section of "IO Configuration". [Note] There is no strict correspondence between the output signal and the pin. Output form: NPN-type open collector output			
40	OUT2				
41	OUT3				
42	OUT4				
43	OUT5				
44	OUT6				
45	OUT7				
46	OUT8				
24	OUT-COM	General-purpose output external power ground			
25					



The wiring method of the general digital output is explained by taking "OUT1" as an example, as shown below:

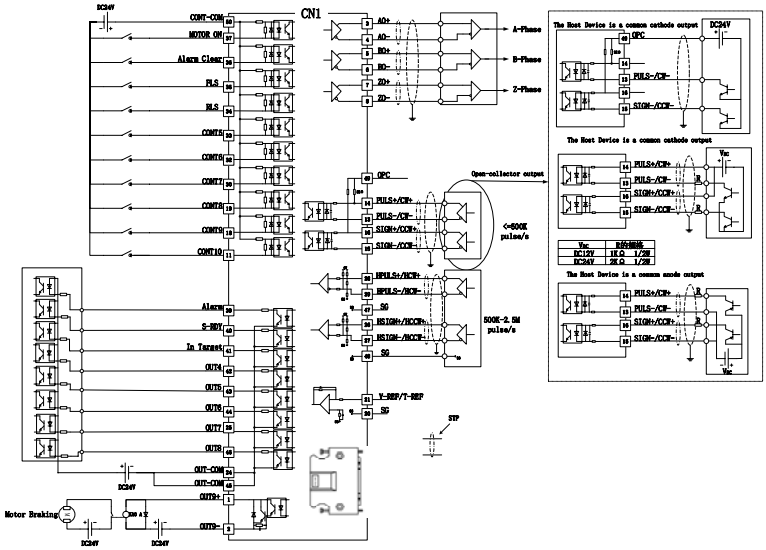
[Note]

1. The operating current of the selected relay must be less than the maximum current of the external pull-up power supply;

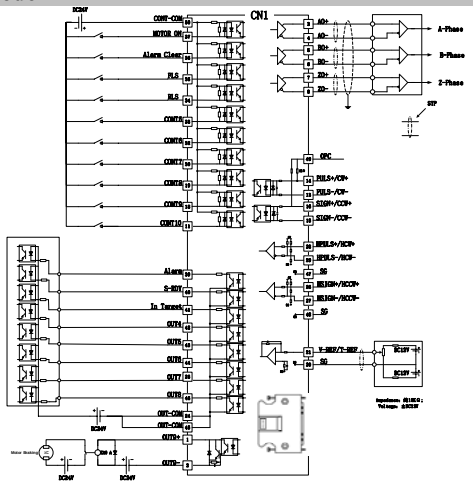
2. When connecting the intermediate relay (KA0) as shown in the figure, connect the freewheeling diode (A) in parallel to the coil of the intermediate relay (KA0), as shown in the figure. The recommended model for freewheeling diode (A) is IN4007

3.1.3 Example of wiring for each control mode CN1

Position control mode

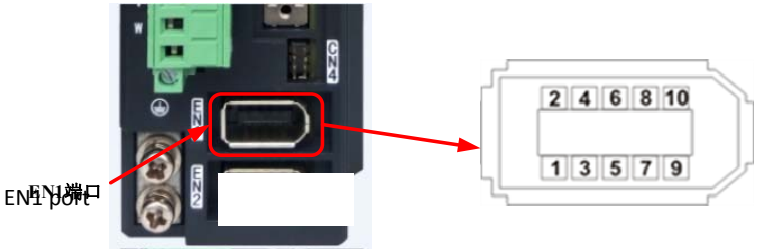


Velocity/torque mode



3.1.4 EN1 port

The servo driver EN1 port is used to connect the motor encoder. From outside view of driver, EN1 port pin arrangement is as shown in figure:



Pin definition of encoder:

Pin wiring instruction			
EN1 Terminal No.	Signal name	Description	Remarks
1	E5V	Power supply	Supply power to motor encoder
2	ESG	Power supply ground	
3	-	Not in use	-
4	-	Not in use	-
5	-	Not in use	-
6	-	Not in use	-
7	PS+	Serial data port	Used for data communication between encoder and servo driver
8	PS-		
9	-	Not in use	-
10	-	Not in use	-
Use the shielded wires to connect the metallic case of EN1 connector to earth wire of motor encoder.			

Note

1. The length of the cable between the driver and the motor is within 15m;
2. Encoder cable and main power wiring (R, S, T, r, t) should be kept more than 30cm away from each other;
3. The shield of the external position feedback sensor should be connected to the metallic case of EN1;
4. Do not connect EN1 spare pins;
5. The 5V power supply provided by EN1 can only be used as the power supply for external position feedback sensor, but not for other purposes;

6. Do not apply voltage to the E5V and E0V pins.

4 QX PC Suite Servo Debugging Software

4.1 Installation of debugging software

Before using the QX PC Suite servo debugging software, first ensure the software is properly installed. Therefore, learn more about the contents of this section.

◆ **Software installation precautions**

Prior to installation, please confirm whether the use environment of the software supports the debugging software;
During installation, please stick to the installation steps strictly;
During installation, when intercepted by the firewall, please configure the software as "Trusted" object;
The software is only applicable in QX series servo driver, and please don't put it into other use.

◆ **Software use environment**

Operation system: Windows7 32 bit/ 64 bit operation system (recommended) and above
Screen resolution: 1280 x 768 and higher

◆ **Software installation and running**

When customers purchase our QX series servo driver, we will be offer a QX PC Suite (a RAR file). Decompress it to get relevant installation files and QX PC SUITE, as shown in the right Figure.

To use the debugging software of QX series servo driver normally, the user shall complete the following steps:

1) Install Windows assembly: Microsoft .NET Framework 4.0 (not necessary for Windows 8 and higher operation system) Run "dotNetFx40_Full_x86_x64" application program and the upper computer will install it automatically. Should the upper computer have installed the software or its advanced edition, the upper computer will prompt "Installation is unnecessary" and quit installation progress.

2) Install relevant communication driver program

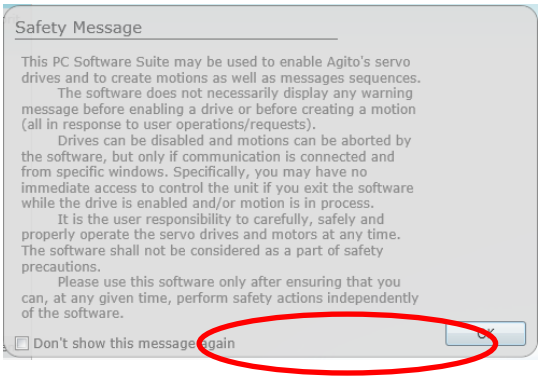
Supported communication mode	Required installation communication driver
RS-232	USB serial port driver

[Note] If the RS-232 USB serial cable is not purchased from our company, please install the RS-232 USB serial port driver individually.

3)Run debugging software: QX PC Suite

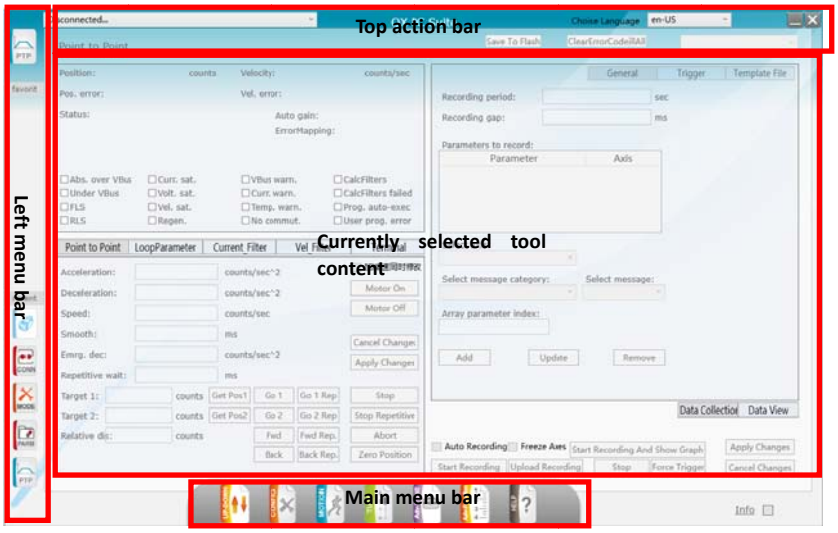
- After completing the first two installation steps, double click the icon“ AgitoPCSuite.exe ” to open the debugging software.

- When the software is running, the “QX server” icon will appear in the task bar. You can click it to view the communication data of the software, that is, the response window of communication between host computer and driver.
- Please note that do not turn off the QX Server before closing the debugging software QX PCSuite.
- When running the debugging software for the first time, the QX PC Suite interface will display “Safety Message”, as shown below. Please read it carefully and then click “OK” to close it.
- When running the debugging software again, if the user would like not to display the “Safety Message”, please tick “Don’t show this message again”.



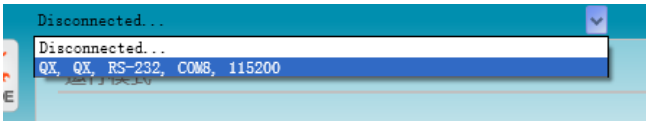
4.2 Overall software structure

Details for QX PC Suite interface arrangement are as shown:



The basic framework of the QX PC Suite software consists of the top action bar, the left menu bar, the main menu bar, and the currently selected tool.

◆ **Top action bar**



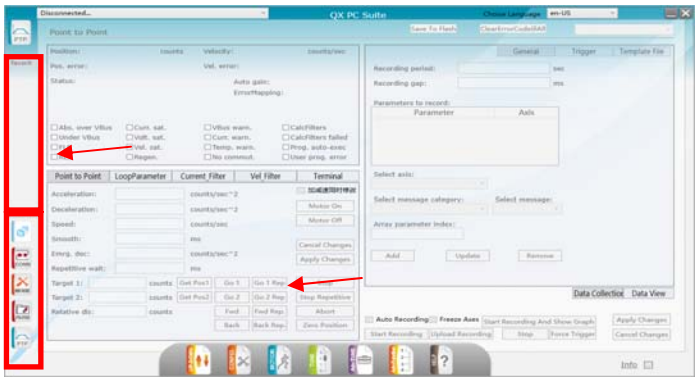
Select communication connection - select established communication connection. Click "Disconnected…"drop-down menu arrow to select established communication connection;

- SaveToFlash—Save the current parameter configuration to Flash, and users can click directly;
- ClearErrorCodeillall—User may clear the current fault alarm by clicking this parameter;
- Chiose Language—Click drop-down box to choose language, en-US: English version, zh: Chinese version (restart QX PC Suite software after choosing the language).

◆ **Left menu bar**

favorit

recent



Left menu bar content:

- Favorit—personalized settings for user tool; in order to facilitate debugging, the user can use the right mouse button to add commonly used tools in the submenu to“Favorit”;
- Recent—recently used debugging tool.

The user can right click to change the order of the tools in “Recent”/“Favorit” window, but the number of tools displayed will not exceed five.

◆ **Main menu bar**

The main menu bar is arranged at the bottom of the screen, encompassing QX driver debugging tools; the arrangement of icons is shown below:

Click any icon with left mouse button to view the sub-menu bar under the icon, and click corresponding icon in the sub-menu to enter the parameter settings window of debugging tools, as shown below.

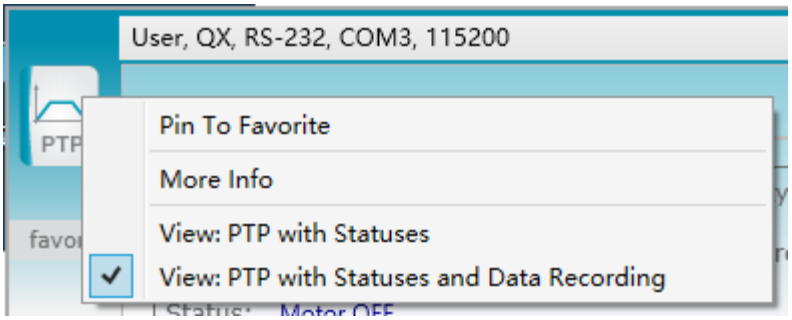
◆ **Currently selected tool**

An icon will be displayed on the left top of the software interface, which indicates the currently selected tool.

Right-click the icon to change the form of current tool displayed in the window, for example: “motion / PTP”; the display can be chosen from:

View: PTP with Statuses—Display status bar and terminal tool action bar;

View: PTP with Statuses and Data Recording—Display the status bar, data log bar, and terminal tool action bar.

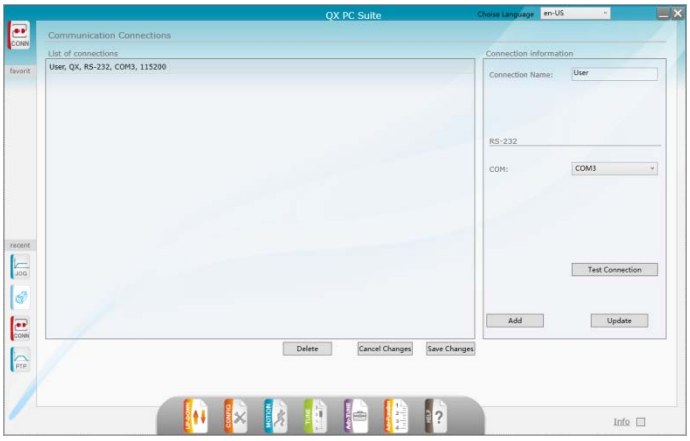


4.3 Up-Down

After opening the QX PC Suite, the user first needs to establish a communication connection between the host computer and the driver. Only the RS-232 communication method is supported by the simplified version of the software.

Communication Connections

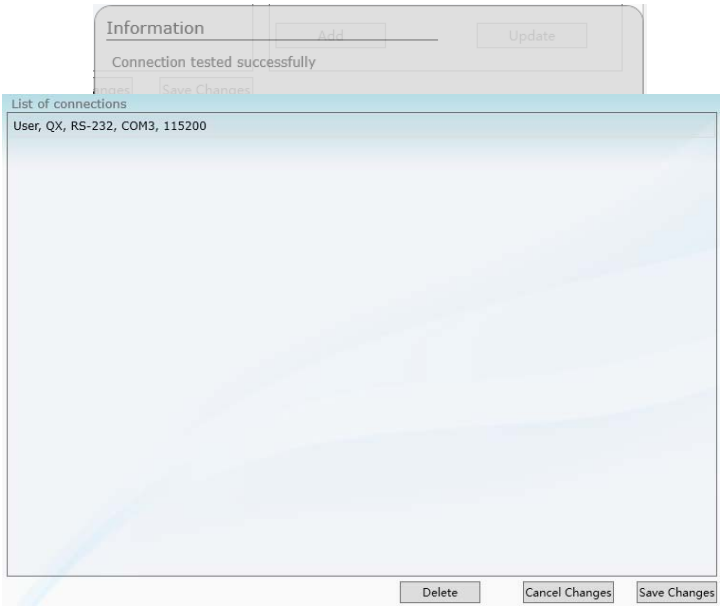
Click the “UP-DOWN→Communication Connection” tab to enter the communication connection interface:



1) In the communication connection interface, only the connection name and port number need to be set for the connection information.

- **Connection Name**: Name of the communication method, which is user defined;
- COM: You need to set the port number when the communication type is RS-232; at this time, the port number used by each computer is not necessarily the same; you can query the “Device Manager” on computer to get the port number;

- Test Connection: After the parameter is set, click "Test Connection" to test the communication connection. The communication connection prompt box will appear in the lower right corner. Click"OK" to confirm.



2) When the test is successful, click "Add" and "Save changes" to save the communication connection information to the connection list on the left side of the interface:

3) After the communication connection test is successful, enter any function interface, click the "Disconnected" drop-down box on the left side of the top action bar of the software interface to select the currently set communication connection and activate the software interface.

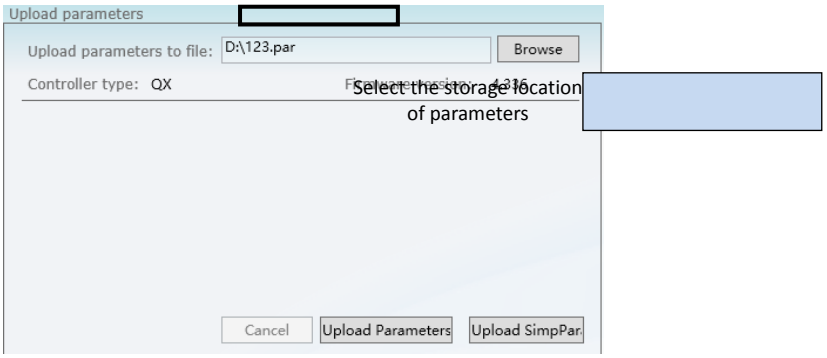
Driver parameter management function includes parameters uploading and downloading. Click the “Upload/download → Parameter file” tab to enter the upload / download parameters interface.

eters

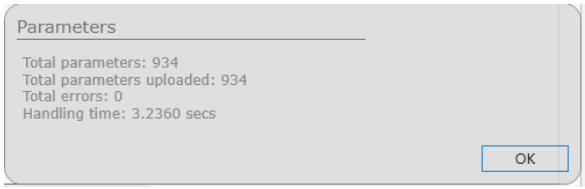
- Upload parameters: If the commissioning of the motor has been done, you can select “Upload parameters” and back up the internal parameters of current driver to the computer.
- Download parameters: If you have obtained the driver parameter file of the motor from our company, you can select “Download parameters” to download the parameter files to the driver, and perform debugging later based on the parameters.

◆ **Upload parameters**

Upload the parameters of debugged driver to the host computer and store in the selected parameter storage location. The setting interface is shown below:

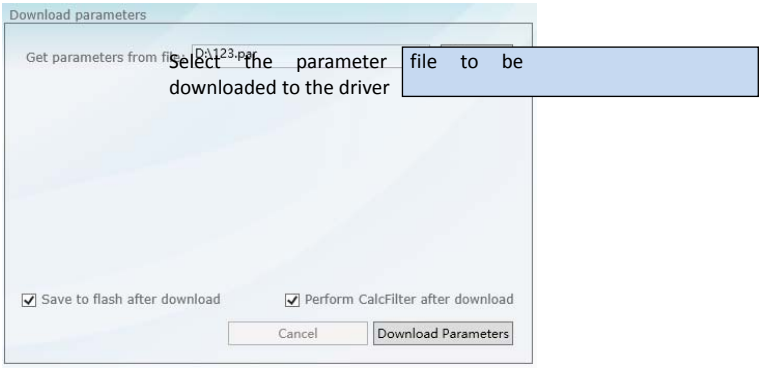


Click “Upload parameters” or “Upload SimpPar” to upload all the parameters currently stored on the driver to the host computer file (suffix.par). After all the parameters are uploaded, the prompt box will pop up in the lower right corner of the software interface. Please confirm and click “OK”.

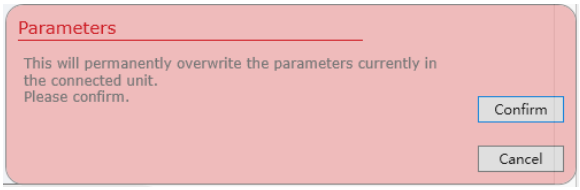


◆ **Download parameters**

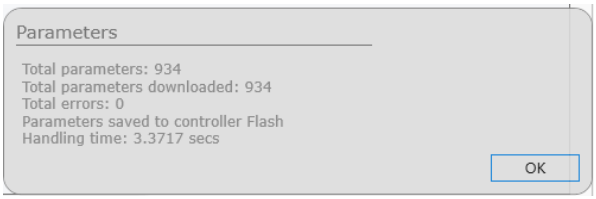
Write the driver parameters in specified file on the host computer to the current driver; the setting interface is shown below:



Before downloading the parameters, check "Save to flash download" and "Perform CalcFilter after download". Then, click "Download parameters", and the prompt box will pop up in the bottom right corner of the software interface, as shown below:



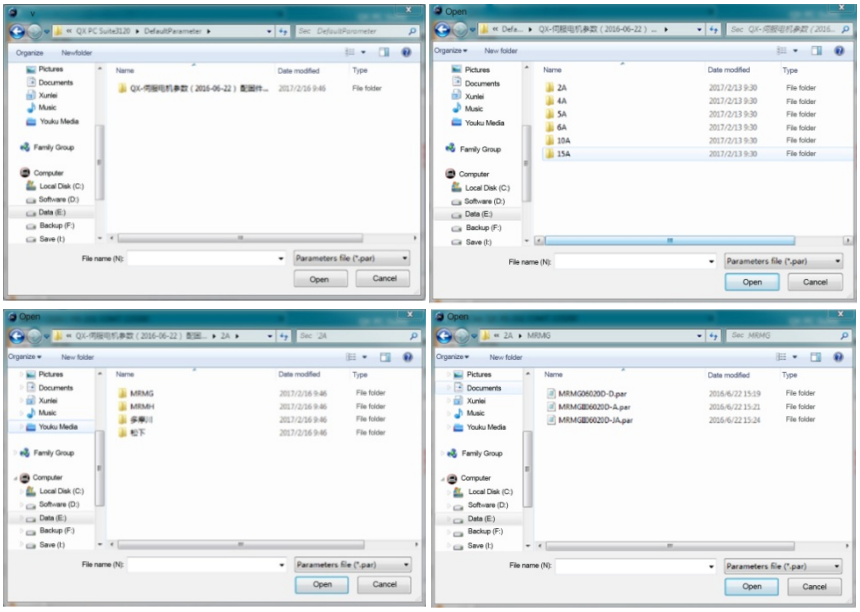
It prompts the user that all current parameters in the driver will be overwritten by the new parameters downloaded after the download parameters are executed. After confirming, click "Confirm" and the selected parameter file (suffix .par) will be downloaded to the driver.



After all the parameters are downloaded, the prompt box pops up in the lower right corner of the software interface. Click "OK".

◆ **Association of default download parameters**

In parameter download, you can associate commonly used parameter files, that is, store the commonly used parameter files in the “DefaultParameter” folder of the debug software package. You can click “Browse” of the downloaded parameters to enter associated default parameter files.



4.4 CONFIG

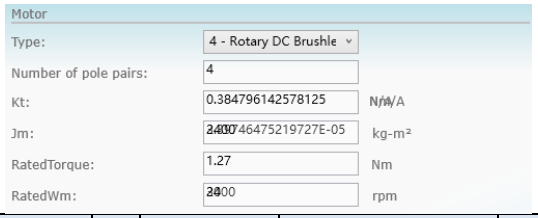
◆ **Motor parameters**

Motor parameters are currently used function parameters of the motor, including motor, main encoder, auxiliary encoder and modbus communication parameters.

[Note] When modifying the motor parameters, please ensure that the servo motor is in disabled state. After modification, click “Apply changes” and “Save to flash” and re-power the driver.

■ **Motor**

Set the motor type, number of pole pairs, torque time constant, and moment of inertia. The specific description of the parameters is shown below



Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
MotorType	0-5	-	4	Yes	**Position**	**Velocity**	**Torque**

The type of servo motor used must be the same as the actual servo motor type.

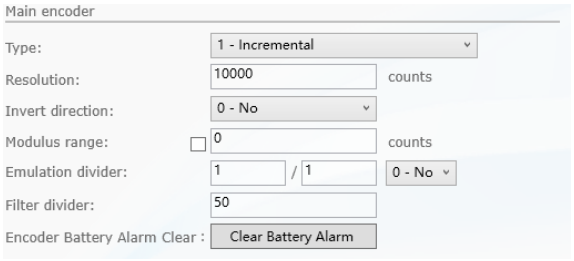
3	Linear motor
4	Rotary motor
5	DDR motor

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Pole pairs [PolePrs]	1-20	-	5	Yes	**Position**	**Velocity**	**Torque**
Each coil of three-phase AC motor will produce N and S pole, and the number of magnetic poles contained by each phase of each motor is the pole pairs. As the magnetic pole is in pairs, so the motor has pole 2,4,6,8.... Refer to the motor model for setting.							

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Torque time constant [AutoGKt]	-	Nm/Aeak	-	No	**Position**	**Velocity**	**Torque**
Moment of inertia [AutoGJm]	-	Kg-m^2	-	No	**Position**	**Velocity**	**Torque**
Rated torque [RatedTorque]	-	Nm	-	No	**Position**	**Velocity**	**Torque**
Rated velocity [RatedWm]	-	rpm	-	No	**Position**	**Velocity**	**Torque**
For the above parameters, please refer to the motor specifications. The torque time constant = (rated torque / rated current).							

■ **Main encoder**

Set parameters such as main encoder type, resolution, invert direction, rotary mode, encoder frequency dividing output, encoder filter factor, encoder battery alarm clear, etc. The specific descriptions of the parameters are as follows:



Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Main encoder type [EncType]	1-24	-	24	Yes	**Position**	**Velocity**	**Torque**

Select this option according to the actual motor encoder type

Parameter value	Encoder type	Parameter value	Encoder type
1	Incremental	13	Tamagawa Abs 17Bit
2	BISS_32X	14	TaiKing Inc 17Bit
3	BISS_64X	15	Nikon Multi_tune Abs 17Bit
4	BISS_128X	16	Panasonic 23Bit ABS
5	Nikon Abs 17Bit	17	Incremental_ABZWithHall
6	Panasonic Inc	18	Nikon Abs 20Bit
7	Panasonic ABS	19	Nikon Multi_tune Abs 20Bit
8	Panasonic Multi_tune Abs 17Bit	20	Tamagawa Abs 23Bit
9	ReservedType	21	Tamagawa Multi_tune Abs 23Bit
10	Tamagawa Multi_tune Abs 17Bit	22	Panasonic_23_ABS
11	ReservedType	23	Nikon Abs 24Bit
12	Tamagawa Inc 17Bit	24	Nikon Multi_tune Abs 24Bit

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Main encoder resolution [EncRes]	1000-16777216	counts	16777216	Yes	**Position**	**Velocity**	**Torque**
The number of pulses output by the encoder corresponding to one revolution of the motor Rotary motor: N-bit encoder, pole pairs = 2^N, Such as: 24-bit encoder resolution: 2^{24} = 16777216; 2500 line incremental motor: 2500*4 (multiplier) = 10000							

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Invert direction [EncDir]	0-1	-	0	Yes	**Position**	**Velocity**	**Torque**
Change the direction of the main encoder output, and when set to 1, the encoder reading is reversed. 0: Positive 1: Negative							

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Encoder revolution mode switch [ModRevOn]	0-1	-	0	No	**Position**	**Velocity**	**Torque**
Revolution mode [ModRev]	0-2000000000	Pulse	0	No	**Position**	**Velocity**	**Torque**

Set the encoder rotation range, that is, when the encoder feedback position value reaches the value set by the revolution mode when the revolution switch is turned on, and the encoder position value starts from 0 for a new cycle.

Assume that if the rotation range is set to 10,000 user units, then the encoder feedback position value will cycle from 0 to 10000. When the rotation range is set to 0, this function is invalid. Please set the "revolution mode" to ten times or more of the encoder;

[Note]

1. When operating in a single direction, check "Encoder Revolution Mode Switch" and set "Revolution Mode" to ten times or more of the encoder;

The revolution mode cannot be used simultaneously with track shaping.

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Encoder frequency dividing output [Emulation]	1-65535	-	1	Yes	**Position**	**Velocity**	**Torque**

Set thepulse number required to divide frequency after motor rotates a circle

Set the frequency dividing output direction

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Main encoder filter divider [EncFilt]	0-255	-	10	No	**Position**	**Velocity**	**Torque**

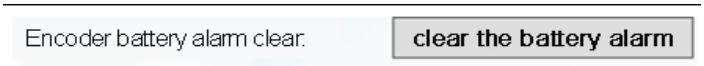
Used by parallel incremental encoder to feedback interference filtering, the greater the value, the better the filter performance is, but the lower the received frequency feedback is. Setting it to the maximum value 15 indicates to test certain output value of the encoder for 15 times. If there is any difference, then there is interference, and the encoder output will be filtered. The values corresponding to the available encoder frequencies are shown in the following table

Set value	Passing frequency (Hz)	Set value	Passing frequency (Hz)
0	11.5M	90	500K
5	4M	150	300K
10	2.5M	220	200K
30	1M	255	165K

[Note]

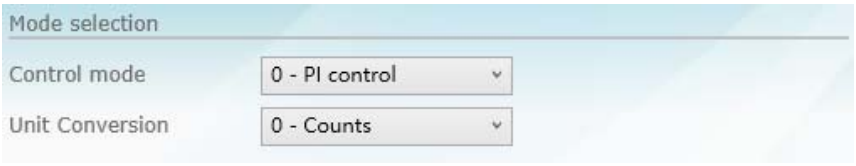
1. This filter divider is only used for parallel incremental encoders;
2. This function is invalid for serial encoders;
3. For high-precision encoders, this value should not be too large; for low-precision encoders, this value should not be too small.

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Encoder battery alarm clear	-	-	-	No	**Position**	**Velocity**	**Torque**



Battery alarm will be cleared after replacing the absolute motor battery

■ **Mode Selection**



Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Control mode [VelCtrMode]	0-1	-	0	No	**Position**	**Velocity**	**Torque**

Currently, there are two modes for adjusting the servo three-loop control (position loop, velocity loop, current loop).

0 – PI control: Adjust the servo three-loop control by means of PI;

1 – Active disturbance rejection control: Replace the velocity loop control with a new auto-disturbance rejection algorithm, which can effectively improve the motor velocity response and reduce the velocity fluctuation that is resulted from load disturbance.

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Unit Conversion [AccDeccelFact]	0-1	-	0	No	**Position**	**Velocity**	**Torque**

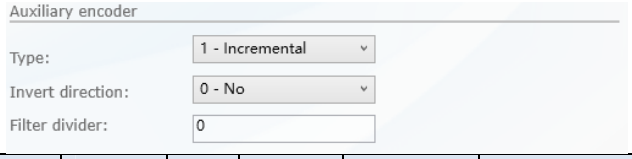
When being used for PTP running, it can change the unit of motion control parameter (including acceleration, deceleration, velocity, emergency stop velocity).

0 : Counts;

1 : rpm

◆ **Auxiliary encoder**

Set the parameters such as auxiliary encoder type, invert direction, and encoder filter factor. The details of the parameters are as follows:



Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Auxiliary encoder type [AuxEncType]	1-50	-	1	Yes	**Position**	**Velocity**	**Torque**
1	Incremental						

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Invert direction of auxiliary encoder [AuxEncDir]	0-1	-	0	Yes	**Position**	**Velocity**	**Torque**
When set to 1, the auxiliary encoder readings are reversed. 0: Positive 1: Negative							

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Auxiliary encoder filter divider [AuxEncFilt]	0-255	-	0	No	**Position**	**Velocity**	**Torque**

Used by parallel incremental encoder to feedback interference filtering, the greater the value, the better the filter performance is, but the lower the received frequency feedback is. The values corresponding to the available encoder frequencies are shown in the following table

Set value	Passing frequency (Hz)	Set value	Passing frequency (Hz)
0	11.5M	90	500K
5	4M	150	300K
10	2.5M	220	200K
30	1M	255	165K

[Note]

1. This filter divider is only used for parallel incremental encoders;
2. This function is invalid for serial encoders;
3. For high-precision encoders, this value should not be too large; for low-precision encoders, this value should not be too small.

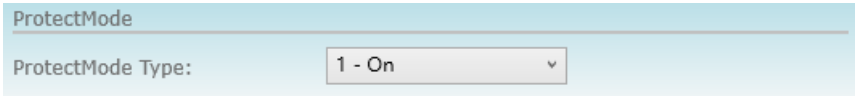
4.5 SAFE

The protection parameters are used to protect the motor and the servo driver, and limit the current, velocity, stroke and voltage of the motor accordingly.

[Note]When setting the protection parameters, please ensure that the servo motor isn't in enabled state. After changing, click "Apply changes" and "Save to flash" and re-power the driver.

◆ **Protection mode**

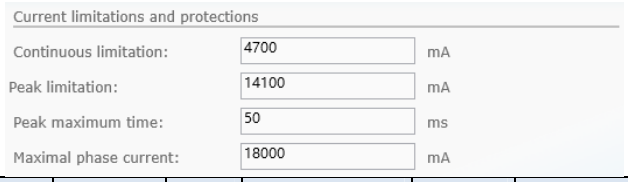
The two modes of servo on motor action when the servo driver alarms are described as follows:



Parameter	Setting range	Unit	Default setting	Take effect after restart	**Control mode**		
Protection mode type [ProtectMode]	0-1	-	0	No	**Position**	**Velocity**	**Torque**
0 - OFF: The motor is no longer enabled when the servo driver alarms 1 - ON: When the servo driver alarms, the motor can increase the motor resistance by dynamic braking, so that the motor won't run away due to the inertia of load.							

◆ **Current limit and protection**

Set the parameters such as continuous current, peak current, peak current maximum time, maximum phase current and maximum allowable motor current. The details of the parameters are as follows:



Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Continuous current limit [ContCL]	1-28000	mA	Set according to the actual situation of the motor	No	Position	Velocity	Torque
Peak current limit [PeakCL]	1-28000	mA	Set according to the actual situation of the motor	No	Position	Velocity	Torque
Peak current maximum time [PeakTime]	1-1000	msec	Set according to the actual situation of the motor	No	Position	Velocity	Torque
Maximum phase current [MaxPhaseCurr]	0-28280	mA	Set according to the actual situation of the motor	No	Position	Velocity	Torque
The limit of continuous current of the motor, set to 1.414 times of the rated current; The limit of peak current of the motor, set to 3 times of the continuous current limit; The maximum time that the current is allowed to be at the peak value; The maximum current that is allowed to pass each phase of the motor, set to 1.2 times of the peak current;							

◆ **Velocity limit**

Limit the maximum velocity of the motor in order to protect the motor. The details of the parameters are as follows:

Parameter	Setting range	Unit	Default	Take effect	Control mode

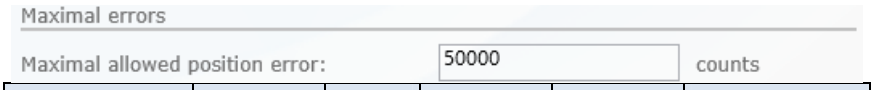
			setting	after restart			
Maximum allowable velocity [MaxVel]	0-2147483642	pulse/sec	Set according to the actual situation of the motor	No	**Position**	**Velocity**	**Torque**
To limit the maximum velocity of motor operation, which is generally set to the maximum instantaneous velocity of the motor. For example: If the maximum velocity of a 24-bit encoder motor is 6,000r/min, it should then be set to: (6000*16777216)/ 60 = 1677721600pulse/sec;							

◆ **Position limit**

Limit the maximum stroke of the motor to prevent the equipment from colliding. The detailed description of the parameters is as follows:

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Reverse position limit [RevPLim]	(-2147483648)-2147483647	pulse	0	No	**Position**	**Velocity**	**Torque**
Forward position limit [FwdPLim]	(-2147483648)-2147483647	pulse	0	No	**Position**	**Velocity**	**Torque**
In the position control mode, the motor stops moving when it moves to the positive/negative position limiting values. Turn off this feature when the setting is 0.							

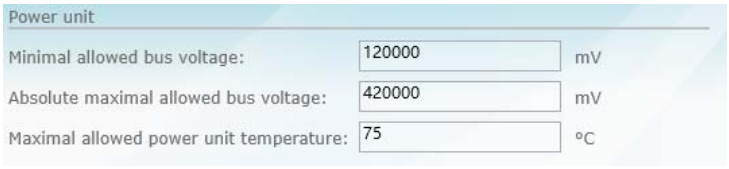
◆ **Deviation limit**



Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Maximum permissible position	0-2000000000	pulse	Set according to the actual	No	**Position**	**Velocity**	**Torque**

deviation[MaxPosErr]			situation of the motor				
The maximum allowable position error in the operation of the motor; In position control, please set it to 5 times of the encoder resolution.							

◆ **Bus voltage**



Set the bus voltage related parameters to protect the driver working in a safe voltage range. The specific description of the parameters is as follows:

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Maximum allowable bus voltage [MaxVBus]	100000-450000	mV	450000	No	**Position**	**Velocity**	**Torque**
Minimum allowable bus voltage [MinVBus]	60000-450000	mV	250000	No	**Position**	**Velocity**	**Torque**
• Maximum timing bus voltage: If the bus voltage exceeds the maximum timing voltage and the duration exceeds the maximum overvoltage time, the driver will give an "Overvoltage" alarm. The maximum timing voltage shall not exceed 450V, and the maximum overvoltage time is set by the user and shouldn't be too large; • Minimum allowable bus voltage: Limit the internal bus voltage of the driver, and the driver will give a"Low voltage"alarm when the bus voltage is lower than this value; the default setting is 100V.							

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Maximum allowable temperature of driver[MaxPwrTemp]	20-95	℃	75	No	**Position**	**Velocity**	**Torque**
The value should not be set too big in order to protect the driver; it is recommended to set to 75.							

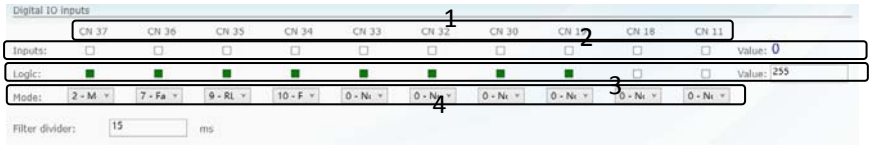
◆ **Mask**

This function is required when there is no encoder connected and does not require driver alarm. This function is also required when the parallel encoder does not have Z-phase output.

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Protection mask [ProtectMask]	-	-	0	No	**Position**	**Velocity**	**Torque**
Mask the detection of the connection between main encoder and auxiliary encoder of the driver. 0 - Not checked: detect, that is, the mask is invalid; 12 - Checked: no detection, that is, mask is effective.							

4.6 IO configuration parameters

◆ **Digital input IO**

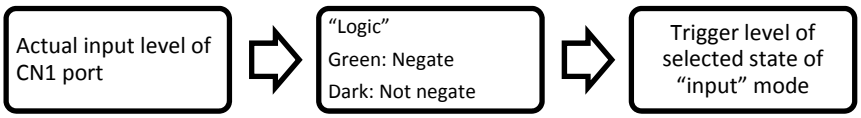


1. The pin number indicating the signal input;
2. The status of the digital input port indicates whether the current input port has a level input, and the green indicates that the input port signal is valid, otherwise it is white;
3. Indicate the signal logic of the port; green indicates the positive logic, otherwise it is white;
4. The digital input port function configuration.

Digital IO input filter factor:

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Digital IO input filter factor [DinFilt]	0-15	ms	0	No	**Position**	**Velocity**	**Torque**
The digital IO input signal is filtered.							

The relationship between the general input port level of CN1 port of the driver and the input level:



[Note]If the control level of the external input is "0", it is necessary to select "Logic" of the corresponding driver access port to make the control take effect. If the control level of the external input is "1", do not select "Logic" in order to make the control effect.

Digital input port can achieve the following control functions:

No.	Function name	Description	Control mode		
0	No function	Not use this port	Position	Velocity	Torque
1	IDE	It is used to read the input port status in the IDE	Position	Velocity	Torque
2	Enable + motor operation	When the servo is in "direct mode" or "contour mode", and when there's valid signal at the port, the motor locks shaft and it is in the running state, the motor runs after the external command pulse is input; When the servo is not in "direct mode" or "contour mode", the motor is only in locking shaft mode if there's valid signal at port.	Position	Velocity	Torque
5	Terminate running (clear pulse)	When the port signal is valid, the servo driver no longer executes external command pulse, but stops immediately.	Position		
6	Zero clamp velocity	In velocity mode, when this signal is set, the velocity is set to 0. Reset this signal, and the velocity switches to the command for the velocity reference channel.		Velocity	Torque
7	Fault reset	Clear servo alarm when port signal is valid	Position	Velocity	Torque
8	Emergency stop	When the port signal is valid, the motor is disabled and the servo stops and alarms.	Position	Velocity	Torque
9	Reverse limit	When the port signal is valid, the motor can only run forward.	Position	Velocity	Torque
10	Positive limit	When the port signal is valid, the motor can only run reversely.	Position	Velocity	Torque
11	Torque limit	When the port signal is valid, the torque limit function is enabled. Torque limit values can be set via IO function parameters.	Position	Velocity	Torque

12	Internal multi-segment speed 1	Choose internal multi-segment speed of 1-16		Velocity	
13	Internal multi-segment speed 2				
14	Internal multi-segment speed 3				
15	Internal multi-segment speed 4				
16	Position/velocity mode switching	It is the position mode when the port signal is valid; and when the port signal is invalid, it is the velocity mode. The motor must be disabled in switching mode.	Position	Velocity	
17	Velocity/torque mode switching	It is the velocity mode when the port signal is valid; and when the port signal is invalid, it is the torque mode. The motor must be disabled in switching mode.		Velocity	Torque

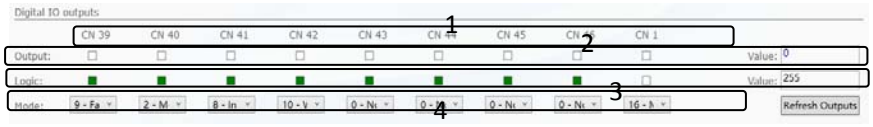
No.	Function name	Description	Control mode		
18	Position/torque mode switching	It is the position mode when the port signal is valid; and when the port signal is invalid, it is the torque mode. The motor must be disabled in switching mode.	Position		Torque
20	Fully-closed loop function	When the port signal is valid, the full-closed loop function is enabled, and when the port signal is invalid, this function is enabled.	Position		
21	Homing mode enabled	Enable the homing mode when the port signal is valid	Position		
22	IO control trigger signal	For the input IO point control, see [4.11.2 Homing and IO Point Control]	Position		
23	Internal position control 0				
24	Internal position				

	control 1				
25	Internal position control 2				
26	Internal position control 3				
27	Internal position control 4				
28	Rising edge stop/falling edge operation	The rising edge motor stops running, decelerates as per the set deceleration, and the falling edge starts running again, and runs as per the set motion mode.	Position		
29	Motor enable	When the port signal is valid, the motor is only the locking shaft	Position	Velocity	Torque
30	Origin switch	Used in conjunction with the homing mode, see [4.11.2 Homing and IO Point Control] for details.	Position		
31	Enable error compensation	When the port signal is valid, enable the error compensation function. For details. See [4.11.3 Positioning Compensation] for details.	Position		
32	JOG forward	Motor rotates forward when the port signal is valid	Position		
33	JOG reverse	Motor reverses when the port signal is valid	Position		

※ For specific wiring, refer to the pin wiring diagram for the CN1 and X4 port in "Wiring" of this manual.

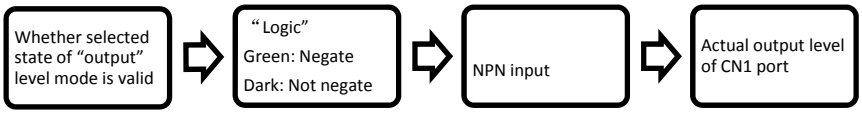
[Note] The software does not support setting both digital input ports to the same control function. For instance, it is wrong if the digital inputs 1 and 2 are set to "Motor on".

◆ **Digital output IO**



1. The pin number indicating the signal output;
2. The status of the digital output port indicates whether the current output port has a signal output, and the green indicates that the output port signal is valid, otherwise it is white;
3. Indicate the signal logic of the port; green indicates the positive logic, otherwise it is white;
4. The digital output port function configuration.

The relationship between the output level and the general output ports 1~8 of CN1 port of the driver:



[Note]If the current source is selected (option box is green), the output of the digital output port is PNP; if the current source is not selected, the output of the digital output port is NPN.

The status of the digital output ports can be monitored as follows:

No.	Function name	Description	Control mode		
0	No function	Not use this port	Position	Velocity	Torque
1	Servo ready	The port signal is valid when the servo has no alarm and the servo motor is enabled.	Position	Velocity	Torque
2	Motor enable	The port signal is valid when the servo motor is enabled	Position	Velocity	Torque
8	Positioning completed	When the servo motor is enabled and meets the requirements of positioning parameters, the port signal is valid; see IO function parameter setting [Positioning complete] for the relevant parameters	Position		
9	Alarm output	The port signal is valid when an alarm occurs on the servo driver	Position	Velocity	Torque
10	Encoder Z phase output	The port signal is valid when the servo motor is rotated to the motor encoder Z phase	Position	Velocity	Torque
12	Positive limit or reverse limit activated	The port signal is valid when the positive limit or reverse limit signal is active	Position	Velocity	Torque
13	Beyond software limit	The port signal is valid when the motor position reaches the software limit set in the protection parameter	Position	Velocity	Torque
14	Regenerative brake activated	When the braking resistor is turned on, the port signal is valid. When the braking resistor is turned off, the port signal is invalid. See IO function parameter setting [Regenerative brake]	Position	Velocity	Torque
16	Motor brake activated	This function controls the motor brake; see IO function parameter setting [Motor brake]	Position	Velocity	Torque
17	Torque arrival output	When the motor output torque reaches the set value, the port signal is valid; see IO function parameter setting [Torque arrival	Position	Velocity	Torque

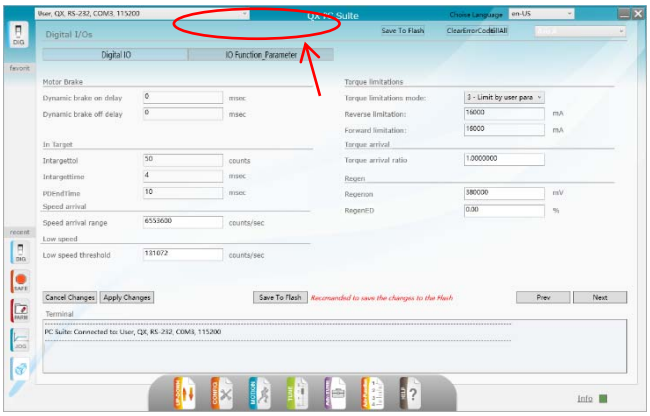
		output]			
18	Velocity arrival output	When the motor velocity reaches the set value, the port signal is valid; see IO function parameter setting [Velocity arrival output]	Position	Velocity	Torque
19	Low velocity output	When the motor velocity is lower than the set value, the port signal is valid; see IO function parameter setting [Low velocity output]	Position	Velocity	Torque
20	Homing completed signal	See the [4.11.2 Homing and IO Point Control] for details	Position		

No.	Function name	Functional description	Control mode		
21	Station detection output 0	See the [4.11.2 Homing and IO Point Control] for details	Position		
22	Station detection output 1				
23	Station detection output 2				
24	Station detection output 3				
25	Station detection output 4				

[Note] For specific wiring, refer to the pin wiring diagram for the CN1 and X4in “Wiring” of this manual.

◆ **IO function parameter setting**

When you turn on the corresponding IO function, you can set the corresponding IO functions to achieve the specified effect.



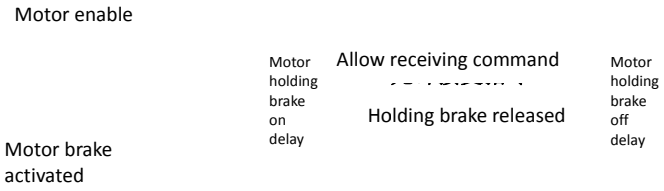
■ **Motor brake**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Motor brake on delay [BrkOnDly]	0-10000	Msec	200	No	**Position**	**Velocity**	**Torque**
Motor brake off delay [BrkOffDly]	0-10000	Msec	2000	No	**Position**	**Velocity**	**Torque**

Motor brake on delay: The delay time from motor on (servo enabled) to turning on the power of holdingbrake.

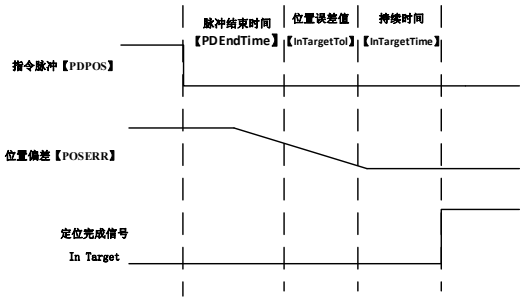
Motor brake off delay: The delay time from turning off the power of holding brake to motor off (servo disabled)

The sequence diagram is as follows:



■ **Positioning complete**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Position error value [InTargetTol]	0-2147483647	pulse/sec	200	No	**Position**	**Velocity**	**Torque**
Duration [InTargetTime]	0-16384	Msec	4	No	**Position**	**Velocity**	**Torque**
Pulse end time [PDEndTime]	0-16384	Msec	10	No	**Position**	**Velocity**	**Torque**
Relevant configuration parameters of positioning complete output signal in IO function							



■ **Velocity arrival output**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Velocity set value [VAr]	0-2147483647	pulse/sec	6553600	No	**Position**	**Velocity**	**Torque**
Threshold of velocity arrival output; when the motor reaches this value, this function takes effect, and "Velocity arrival output" signal is valid.							

■ **Low velocity output**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Low velocity threshold [LowV]	0-2147483647	pulse/sec	131072	No	**Position**	**Velocity**	**Torque**

Threshold of low velocity output; when the motor is lower than this value, this function takes effect, and “Low velocity output” signal is valid.

■ **Torque arrival output**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Torque arrival ratio [TAr]	1.0000000-0	-	1	No	**Position**	**Velocity**	**Torque**
Torque arrival ratio of torque arrival output							

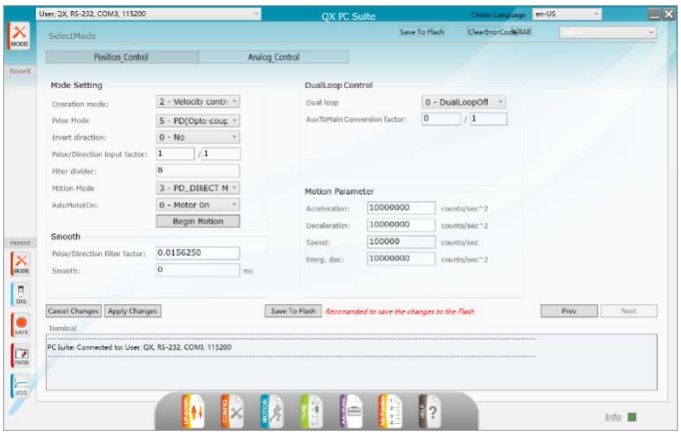
■ **Torque limit**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Torque limit mode [CurrLimMode]	0,3	-	0	No	**Position**	**Velocity**	**Torque**
Positive limit[CurrLimFwd]	0-50000	mA	20000	No	**Position**	**Velocity**	**Torque**
Reverse limit[CurrLimRev]	0-50000	mA	20000	No	**Position**	**Velocity**	**Torque**
Limit the motor output torque.							

■ **Regenerative brake**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Brake resistor on [RegenOn]	100000-450000	mV	380000	No	**Position**	**Velocity**	**Torque**
Brake operation ratio [RegenED]	0-100	%	-	No	**Position**	**Velocity**	**Torque**
Set the opening and closing voltages of the braking resistor when using external regenerative braking. Use an external regenerative resistor when the servo driver's bus voltage is greater than the value of "brake resistor on". Braking action rate: For the frequency of the brake resistor switch, when the braking action rate is higher than 30%, the servo will send alarm to remind the "Brake resistor overload", and a brake resistor with greater power will be required at this time.							

4.7 Operation mode

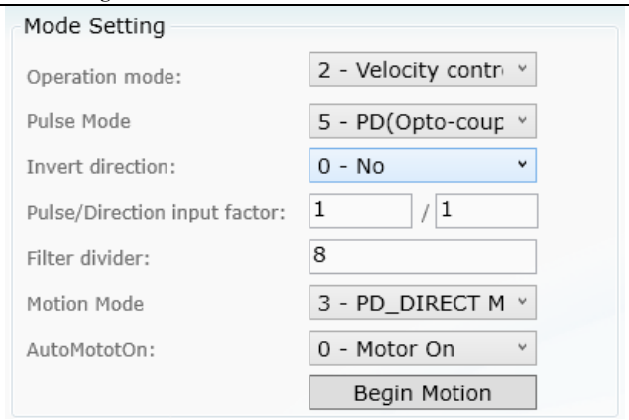


The operation mode is used to set operation control of the servo driver. It includes the position control and analog control (velocity mode, torque mode).

4.7.1 Position control

Position control is used to set the control modes related to the position such as command pulse control and the internal I/O operation of the driver.

■ **Mode setting**

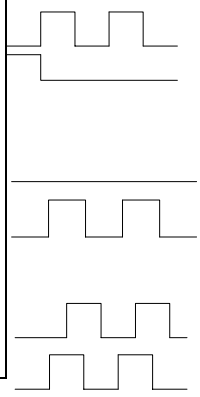


Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Control mode [OperationMode]	1-3	-	3	Yes	-	-	-
1: Torque mode External (internal) analog control Input torque command from T-REF (CN1- 20, 21 X4-14, 15) For related parameter settings, please refer to the description of "Analog Control".							
2: Velocity mode External (internal) analog control Enter velocity command from V-REF (CN1- 20, 21 X4-14, 15) For related parameter settings, please refer to the description of "Analog Control".							
3: Position mode External command pulse control, JOG control, PTP control, PTP reciprocating control Input pulse command from CN1-13, 14, 15, 16 CN1-26, 27, 28, 29 X4-1, 2, 3, 4, 5, 6 X4-44, 45, 46, 47 (for the distribution and wiring method, please refer to CN1, X4 port descriptions)							

Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Pulse mode [PDMode]	1-7	-	1	No	**Position**	-	-

The input form of command pulse is shown in the following table.

Setting	Form of command pulse	Signal name	Command for positive direction	Command for negative direction
1	Pulse/direction (differential channel)	HPULS HSING		
5	Pulse/direction (optocoupler channel)	PULS SING		
2	Double pulse (differential channel)	HCW HCCW		
6	Double pulse (optocoupler channel)	CW CCW		
3	AB orthogonal (differential channel)	HPULS HSING		



7	AB orthogonal (optocoupler channel)	PULS SING		

Invert direction [PDEncDir]	0-1	-	0	No	**Position**	-	-
When the direction in which the motor runs does not match the actual pulse output direction, select 1 to reverse the direction. This function is valid only for external pulse control. 0: No1: Yes							

Parameters	**Setting range**	**Unit**	**Default setting**	**Take effect after restart**	**Control mode**		
Numerator of electronic gear ratio [PDFact]	1-16777215	-	1	No	**Position**	-	-
Denominator of electronic gear ratio [PDFactDen]	1-16777215	-	1	No	**Position**	-	-

- Calculation formula for electronic gear ratio:
  β: The command unit (it refers to the minimum position unit to which the load moves)
  P: the amount of movement of the load shaft rotating a circle
  PG: encoder resolution
  2500 linear encoder: 2500 × 4 = 10000; 17Bit encoder: =131072; 20Bit encoder: =1048576
  m/n: reduction ratio

$$\frac{PDFact}{PDFactDen} = \frac{PG}{\frac{P}{\beta}} \times \frac{m}{n}$$

Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Pulse filtering [PDEncFilt]	0-15	-	3	No	**Position**	-	-

It is used for pulse receiving interference filtering. The greater the value, the stronger the filtering performance, but the higher the value, the lower the frequency of the pulse received.

Correspondence of each filter level to the pulse receiving frequency

Filter level	Freq.	Filter level	Freq.	Filter level	Freq.	Filter level	Freq.
-	(KHZ)	-	(KHZ)	-	(KHZ)	-	(KHZ)
0	2500	4	950	8	550	12	360
1	2000	5	810	9	500	13	340
2	1500	6	700	10	450	14	320
3	1000	7	620	11	400	15	300

The host device sends a command to the driver in a differential form. For the relevant wiring, please refer to the wiring section. The correspondence relationship between the pulse input frequency and the pulse width is as follows:

Pulse mode	Max. frequency (Hz)	Min. pulse (us)
Differential	3.5M	0.5
Collector	500K	2

[Note]When the pulse input frequency is greater than the maximum frequency, a pulse loss will occur.

Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Motion Mode [MotionMode]	1-7	-	1	No	**Position**	-	-

When the driver motor is in motion mode, the driver currently supports the following operating modes (when the motion is started directly using the debug software, the value of the motion mode is directly set to the current operating mode value)

Variable value	Mode name	Description
0	JOG motion	JOG control motor forward and reverse
1	PTP motion	Perform one-way movement between two points

2	PTP reciprocating motion	Perform two-way reciprocating between two points
3	Pulse direction (direct mode)	External pulse motion (direct mode)
4	Pulse direction (contour mode)	External pulse motion (contour mode)

Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Power-on auto enable [Automotoron]	0-1	-	0	Yes	**Position**	**-**	**-**
This function is used in a condition in which the "Motor Enable" signal is not connected but the motor enable is required. 1: On; 0: Off. [Note] After this function is set, you need to manually disable the enable and save the parameters to flash. This can be effective after the servo is restarted.							

■ **Full-closed loop control**

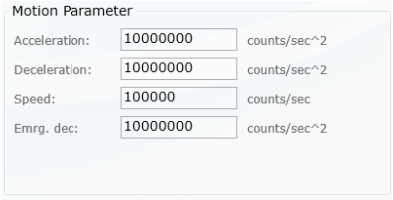
Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Full-closed loop [DualLoopOn]	0-1	-	0	No	**Position**	**-**	**-**
0: Close full-closed loop 1: Open full-closed loop Closed-loop adjustment of the system is executed by directly acquiring the actual position of the load via an external encoder. The full-closed loop is only applicable to the position control mode (see the section "Full-closed loop control" for a detailed description of this function).							

Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
The gear ratio numerator from auxiliary encoder to main encoder [ExGratingNum]	1-16777215	-	1	No	**Position**	**-**	**-**
The gear ratio	1-16777215	-	1	No	**Position**		

denominator from auxiliary encoder to main encoder [ExGratingDen]							
The auxiliary encoder resolution can be converted to the resolution of the main encoder by the set scale value. It can be calculated as follows B: The numerator; A: The denominator; PG: Encoder resolution; P: The number of pulses required for the motor to rotate one turn; $\frac{B}{A}=\frac{PG}{P}$							

■ **Smoothing function**

Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Position command filter [PDFiltFact]	1-0.015625	-	0.09375	No	**Position**	-	-
Motion smoothing filter [Jerk]	0-120	ms	0	No	**Position**	-	-



The command pulse input of a frequency can be filtered. Make motor run smoothly in the following occasions.

- When the host device issuing the command cannot perform acceleration or deceleration
- When the command pulse frequency is low
- When the command pulse is smaller than the motor encoder resolution (10 times or more)

Position command filtering imposes no effect on the amount of movement (the number of command pulses).

Hz

Command pulse frequency

Hz

Command pulse frequency when using position command filter

Hz

Command pulse frequency when using motion smoothing filter

■ **Motion parameters**

Parameters	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Acceleration [Accel]	1000-2000000000	pulse/sec^2	100000	No	**Position**	-	-
Deceleration [Dccel]	1000-2000000000	pulse/sec^2	100000	No	**Position**	-	-

Velocity [Velocity]	(-2147483642)-2147483642	pulse/sec	0	No	**Position**	-	-
ES deceleration [EmrgDecl]	1000-2000000000	pulse/sec^2	100000	No	**Position**	-	-

The motion parameters are available when [Motion Mode] is set to [Pulse Direction (Contour Mode)];

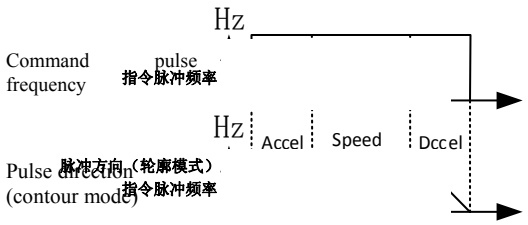
The acceleration, deceleration and velocity of the motor during operation are reasonably set according to the actual application;

Emergency stop deceleration: When the alarm is faulty, the deceleration of the emergency stop is reasonably set according to the actual application;

In [Pulse Direction (Contour Mode)], you can reprogram the command pulses in the following cases by setting [Motion Parameters].

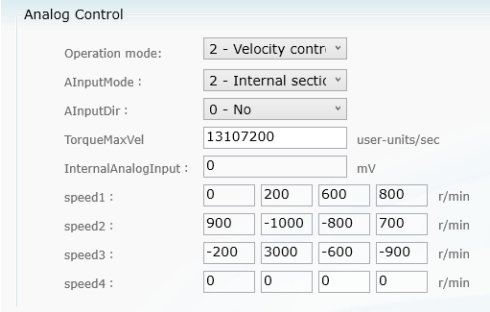
- When the host device issuing the command cannot perform acceleration or deceleration

The motion parameter imposes no effect on the amount of movement (number of command pulses), but it will lengthen the response time of the servo motor to the command pulse.



4.7.2 Internal multi-segment speed control

The QX series servo drivers provide 16-segment internal velocity control that can be switched by input I/O signals.

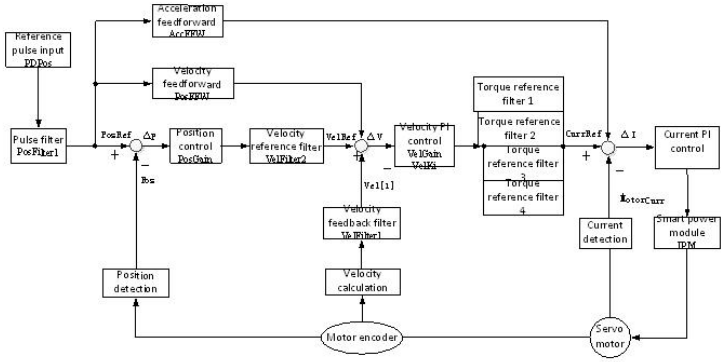


When using the internal multi-segment speed function, you need to set the operation mode [OperationMode] to 2-Velocity Mode, and set the analog input source selection [AInputMode] to 2-internal multi-segment speed setting, set the input I/O function to: 12-Internal multi-segment speed 1, 13-nternal multi-segment velocity 2, 14-internal multi-segment speed 3, 15-internal multi-segment speed 4. The correspondence between each stage of velocity and the input I/O signal is shown in the following table. OFF means that there is no signal input on the port, and ON means that there’s signal input on such port.

Velocity command selection	Internal multi-segment speed1	Internal multi-segment speed2	Internal multi-segment speed3	Internal multi-segment speed4
1st velocity	OFF	OFF	OFF	OFF

4.8 Three-loop Adjustment

The control structure of QX series servo driver is based on closed loop negative feedback regulation, from the inside to the outside: the current loop, velocity loop tuning and position closed loop tuning, as shown in figure:

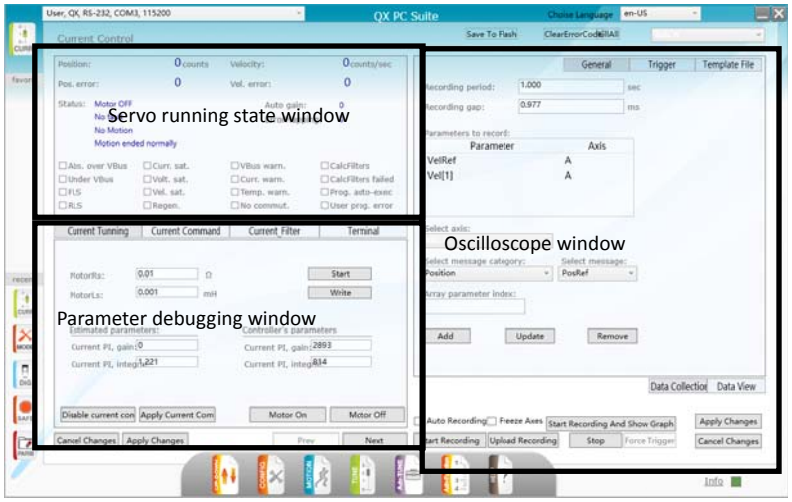


In order to control the servo motor running accurately, the users need to adjust current loop, velocity loop and the position loop to obtain their control parameters.

4.8.1 Current Loop

Current Loop

Enter the interface of current loop tuning tools as shown in the figure:



The current loop tuning tool interface includes servo running status window, parameter debugging window, and oscilloscope window, of which the servo running status window indicates the current status of the control system (motor + driver), the parameter debugging window is used to set the “current command” and perform “current regulation”, and the oscilloscope window is used to view the current loop tuning state in real time.

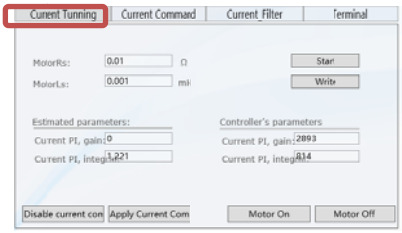
◆ **Servo running status window**

Each tuning tool window has a status bar, which displays relevant data of current motor, such as current position, velocity, position deviation, velocity deviation, servo status and alarm information. Through the status bar, you can be aware of the real-time servo status. The status bar is a very important tool in servo debugging process.

◆ **Current loop tuning window**

The parameter debugging window includes current loop control parameters such as current direction, current loop gain, current loop integral, current command related parameters, and torque command filter parameters.

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Line resistance	-	Ω	-	No	**Position**	**Velocity**	**Torque**
Line inductance	-	mH	-	No	**Position**	**Velocity**	**Torque**
Evaluation of current loop gain	-	-	-	No	**Position**	**Velocity**	**Torque**
Evaluation of current loop integral	-	-	-	No	**Position**	**Velocity**	**Torque**
Current loop gain [CurrGain]	0-100000	-	Set according to the actual situation of the motor	No	**Position**	**Velocity**	**Torque**
Current loop integral [CurrKi]	0-10000	-	Set according to the actual situation of the motor	No	**Position**	**Velocity**	**Torque**

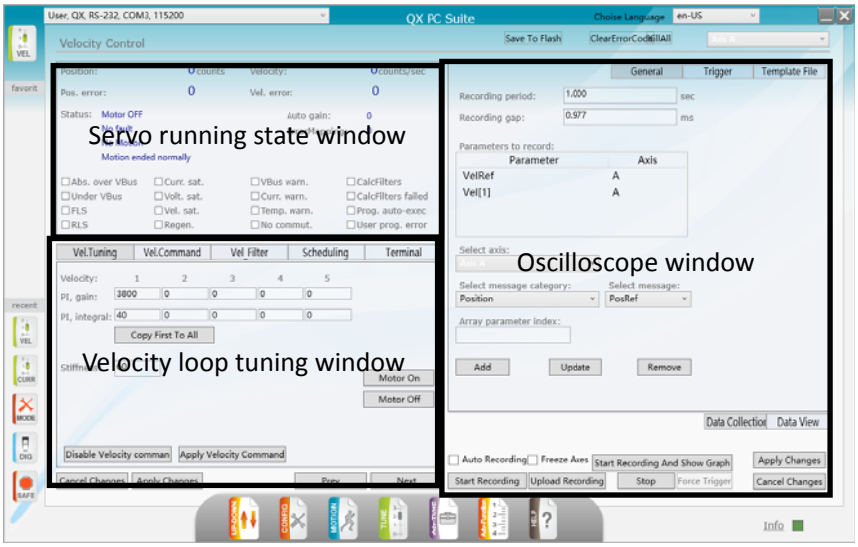


Notes:

1. This set of parameters can be used to evaluate the current loop parameters of the motor that is connected to the driver.
2. Before testing, you need to ensure that the relevant parameter settings in the “Protection Parameters” are completely correct, and the motor power line and the encoder feedback line are connected normally. In this case, you only need to click the “Start” button and test the line resistance and inductance of the motor, and evaluate the current loop parameters. By clicking "Write parameters", you can write the evaluation parameters into the driver parameters.
3. After knowing the line resistance and line inductance of the motor, you can input the values into the line resistance and line inductance, respectively. And then, click “Apply changes” and debug the software, and then you can get the evaluation parameters.
4. After the test completes the current loop, it is necessary to perform the “Execute commutation” again in the commutation adjustment.

4.8.2 Velocity Loop

Velocity loop



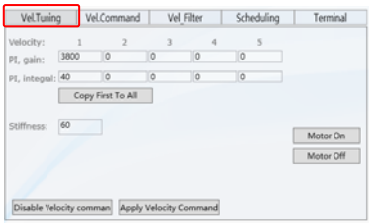
Enter velocity loop tuning interface, which is as shown in figure:

The velocity loop adjustment interface is the same as the current loop, also consisting servo running window, oscilloscope window, and velocity loop tuning window.

◆ **Velocity loop tuning window**

The velocity loop tuning window includes the velocity loop control parameters such asvelocity direction, velocity loop gain, velocity loop integral, velocity command related parameters and torque command filter parameters.

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Velocity loop gain [VelGain]	0-1000000	-	-	No	**Position**	**Velocity**	-
Velocity loop integral [VelKi]	0-100000	-	-	No	**Position**	**Velocity**	-

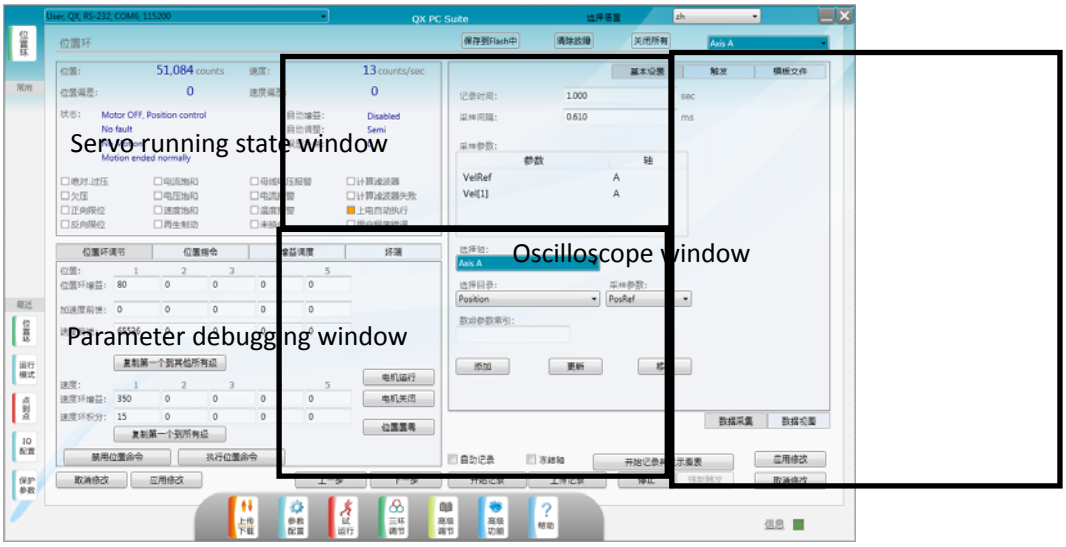


Adjust according to the actual feedback value and the reference value.

4.8.3 Position Loop

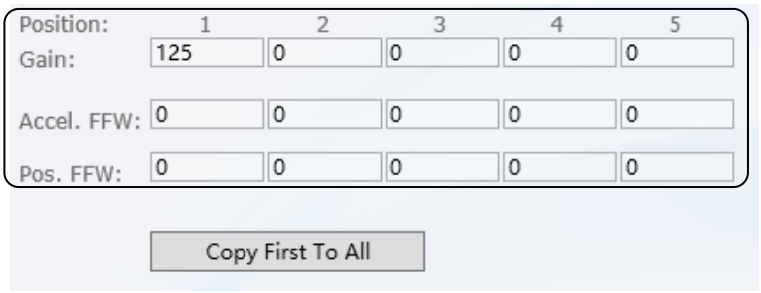
Position Loop

Enter position loop tuning interface as shown in Figure below. The structure and layout are similar with current loop tuning interface, which will be repeated no more.



◆ **Position tuning window**

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Position loop gain [PosGain]	1-300	-	125	No	**Position**	-	-
Acceleration feedforward [AccFFW]	0-65536	-	0	No	**Position**	-	-
Velocity feedforward [PosFFW]	0-65536	-	0	No	**Position**	-	-



Position loop gain: The gain value of the position command in the position loop adjustment. The greater the value, the servo motor can reach the target position faster.However, this value should not be too large, otherwise vibration and noise will be produced to the motor. The setting range can be 0-300.
Acceleration feedforward: Acceleration feed forward setting in velocity loop adjustment; range:0~65536;

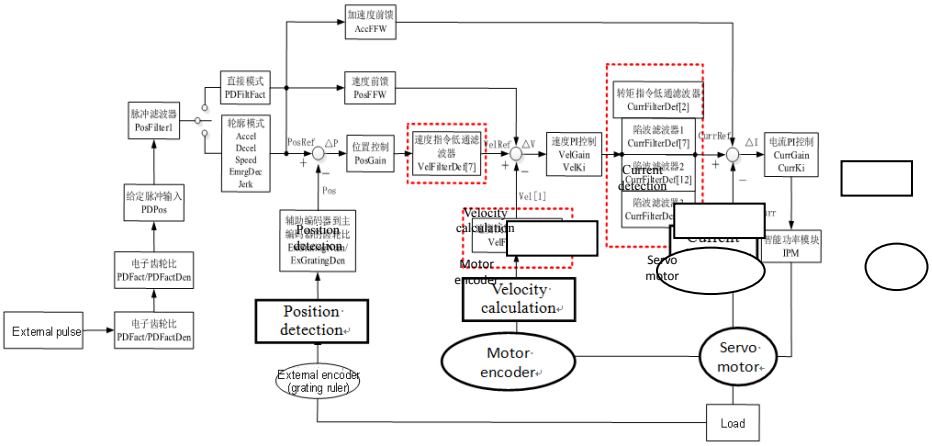
Velocity feedforward: Velocity feed forward setting value in velocity loop adjustment. The setting range is 0~65536, and 65536 corresponds to velocity feed forward of 100%;

4.8.4 Filter

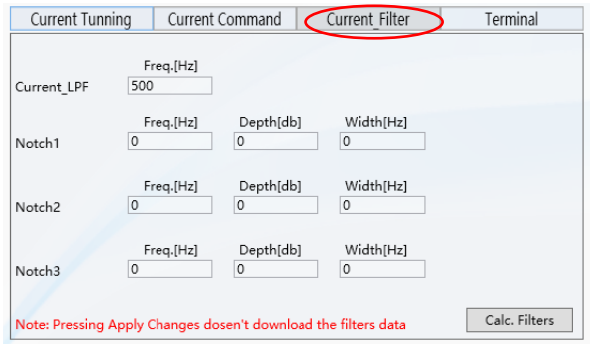
In the complex industrial environment that has high-velocity high-precision process requirements, the servo motor and mechanical load will be subject to different degrees of mechanical vibration. QX series servo driver provides seven filters to filter given signals and feedback signals and to meet the specific needs of occasions with different requirements and complex conditions.

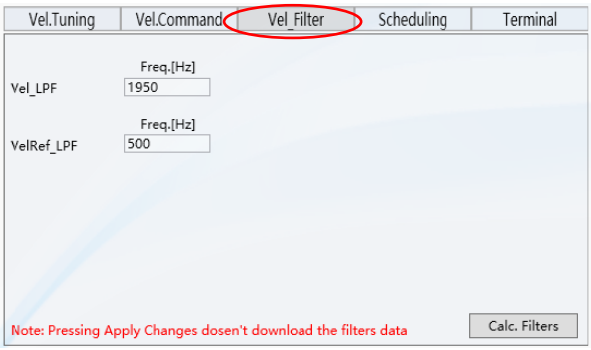
The pulse filter, velocity reference filter and torque reference filter will filter the position reference, velocity reference and torque reference signal respectively before PI adjustment, and the velocity feedback filter is to filterthe feedback velocityfed back and calculated from the encoder. Through QX PC Suite debugging software, you can set the corresponding filter to the one with a specific function, generally as low-pass filter or notch filter.

The following figure shows the specific position of the six filters in three-loop control, which are three low-pass filters and three notch filters.



In the adjustment window of the three-loop adjustment, the filter can be set. The corresponding interface window is as follows:





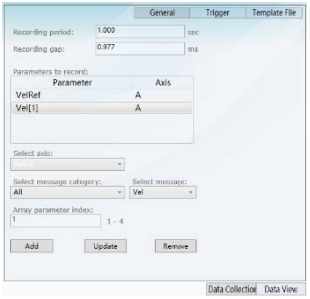
- Freq[Hz]: The frequency of the filter; if the frequency setting is too small, the frequency response of the velocity loop will be reduced. Please set according to the application requirements;
- Width[Hz]: The width of the notch filter, which is set according to the resonance condition of the device, and is generally set to 0.38 times of the notch frequency;
- Depth[db]: The depth of the notch filter, which is set according to the resonance of the device, set this figure firstly to 3, and gradually increase based upon its effect..

[Note]After setting the relevant parameters of the filter, you must click “Calculate filter” to execute the filter calculation before you can write the update of filter parameters.

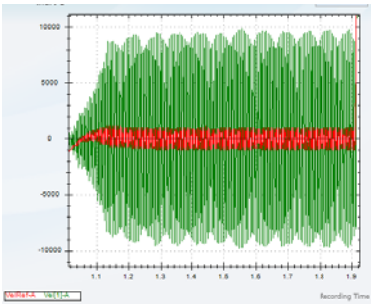
4.8.4.1 Use of notch filters

If the mechanical rigidity is insufficient, the motor itself is close to smooth running (or stationary), and the mechanical transmission end will still oscillate continuously. In this case, the notch filter can be used to slow the oscillation of the mechanical transmission end. The low-frequency vibration frequency ranges from 1.0Hz to 100.0HZ. At this point, we can obtain the low-frequency vibration frequency by the following method.

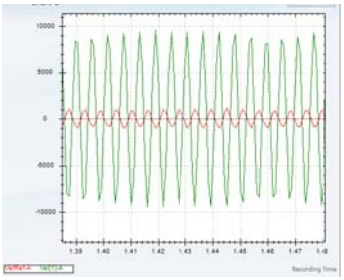
1. Set the data acquisition parameters of the debugging software oscilloscope, as shown below:



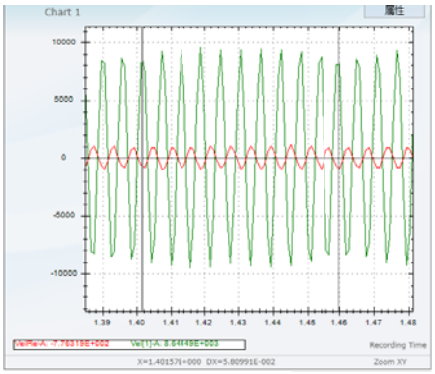
2. Obtain the waveform diagram when the low-frequency vibration occurs to the machine:



3. It is shown as follows after zooming in:

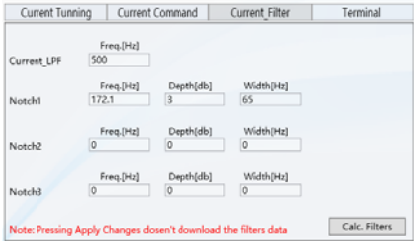


4. Get the time of 10 crests through the vertical mark of the oscilloscope, as shown below:



DX = 5.80991E-002, that is, 0.0580991s is derived. Thus, a cycle of a vibration waveform we get is 0.00580991s, and the vibration frequency of 172.1 Hz can finally be derived.

5. Enter the resulting frequency into the notch filter.



- Freq[Hz]: The frequency of the filter
- Width[Hz]: The width of the notch filet, which is set to 0.38 times the notch frequency;
- Depth[db]: The depth of the notch filter. Set this figure firstly to 3, and gradually increase based

upon its effect.

[Note]After setting the relevant parameters of the filter, you must click "Calculate filter" to execute the filter calculation before you can write the update of filter parameters.

The QX series servo driver can record the notch frequencies of three frequency segments at the same time.

4.9 Motion

After completion of basic parameter setting and gain tuning, the motor can be taken for a Motion to test if the current parameter is reasonable and if the motor can operate normally. QX series servo driver provides two kinds of basic Motion modes:

①PTP motion;

②JOG motion.

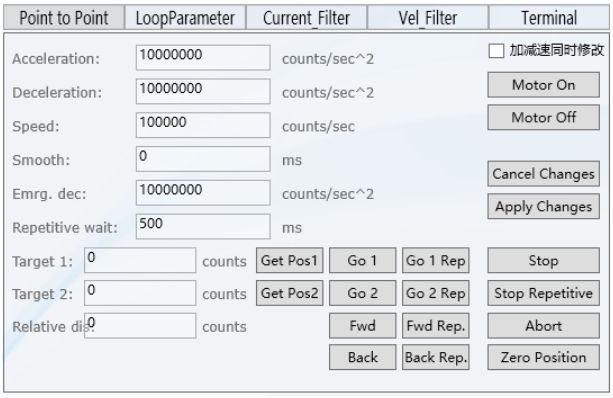
4.9.1 PTP

PTP

When executing PTP motion, the motion system will move from the current position to the appointed absolute target position.

Click "Motion→PTP" to enter PTP motion mode setting interface as shown in Figure:

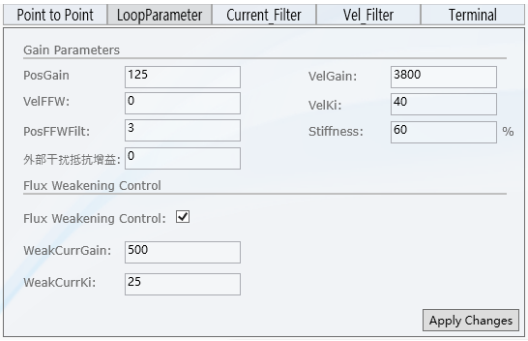
PTP motion parameter setting window is as shown in Figure below:



The acceleration, deceleration, velocity, smoothing and emergency stop deceleration are the motor motion parameters, which have been described in the previous section. You can view the detailed explanation in “Operation mode”.

- RepetitiveWait: The time between round-trip when executing PTP round-trip movement
- Target 1/Target 2: Two target points for PTPmotion; click“Get Pos 1” or “Get Pos 2” to reach the corresponding target point, or click “Go 1 Rep” or “Go 2 Rep” to repeat the motion between the two target points;

- Get Pos 1/ Get Pos 2: Click "Get Pos 1" or "Get Pos 2", and you can set the current motor position into "Go 1" or "Go 2";
- Relative Distance: The relative distance from the current position to the specified position; can not be used with "Go 1" and "Go 2" at the same time.
- Stop: current motion stops at set deceleration;
- Stop Repetitive: Stop after motion of this time finishes;
- Abort: The current motion stops at once;
- Motor Off: the current motion of motor stops by inertance and motor loosens.
- You can switch the units of the above parameters by modifying the value of "Unit Conversion" in "Parameter".



The parameters related to the stiffness of the driver can also be optimized in the PTP interface, as shown in the following figure:

Parameter	Setting range	Unit	Default setting	Take effect after restart	Control mode		
Position loop gain [PosGain]	1-300	-	125	No	**Position**	-	-
Velocity feedforward [PosFFW]	0-65536	-	0	No	**Position**	-	-
Velocity loop gain [VelGain]	0-1000000	-	250	No	**Position**	**Velocity**	-
Velocity loop integral [VelKi]	0-100000	-	10	No	**Position**	**Velocity**	-
Velocity feedforward	0-60	-	3	No	**Position**	-	-

filter constant [PosFFWFilt]							
Stiffness [Sitffness]	0-300	%	60	No	**Position**	-	-
External interference resistance gain [VelDST]	0-1024	0.001	0	No	**Position**	**Velocity**	-

Position loop gain: The gain value of the position commandin the position loop adjustment. The greater the value, the servo motor can reach the target position faster. However, this value should not be too large, otherwise vibration and noise will be produced to the motor. The setting range can be 0-300.

Velocity gain: The gain value of the velocity command in the velocity loop adjustment. The greater the value, the servo motor can reach the target position faster. However, this value should not be too large, otherwise vibration and noise will be produced to the motor. The setting range can be 0-1000000.

Velocity integral: The integral value of the velocity command during the velocity loop adjustment. When the velocity integral is increased, the velocity response time can be reduced and the velocity control error amount can be shortened. However, this value should not be too large, otherwise vibration and noise will be produced to the motor. The setting range can be 0-100000.

Velocity feedforward: The velocity feed forward setting value in the velocity loop adjustment. The setting range is 0~65536, 65536 corresponded to the velocity feed forward of 100%.

Velocity feedforward filter constant: By turning down this parameter, feed forward at a lower velocity can be smoother.

Stiffness: When the auto disturbance rejection mode is turned on, increasing this parameter can reduce the velocity response time.

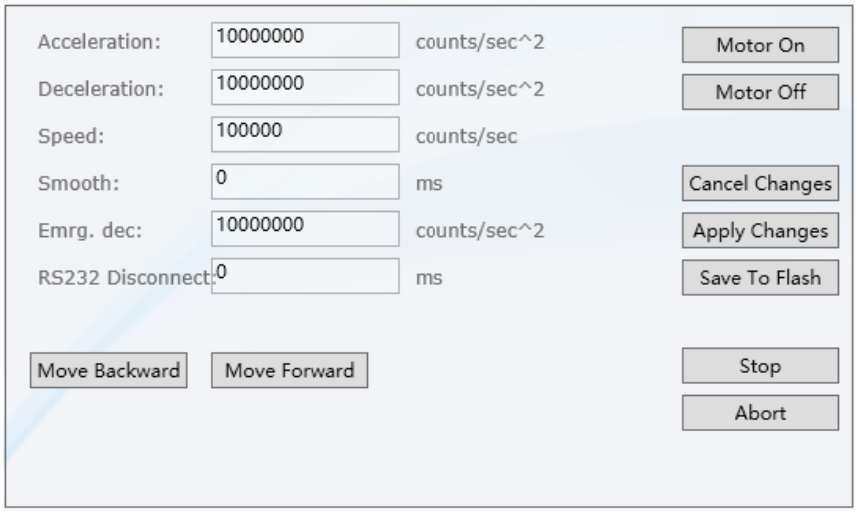
External disturbance resistance gain: Turning this parameter up would increases the damping of the velocity loop. In position mode: Lowering this parameter may reduce position overshoot; in velocity mode, increase of this parameter may reduce velocity overshoot.

4.9.2 JOG

JOG

JOG is a simple motion mode. When the relevant motion parameters are configured through the software, you can click “Forward” or “Reverse” to achieve the corresponding motor operation. When executing JOG motion mode, system will accelerate from the current position to the set velocity, and then maintain a state of uniform motion.

Click “Motion→JOG” to enter JOG motion mode setting interface, which is as shown below. Users can set in the reference of the relevant parameter meaning of “PTP”.

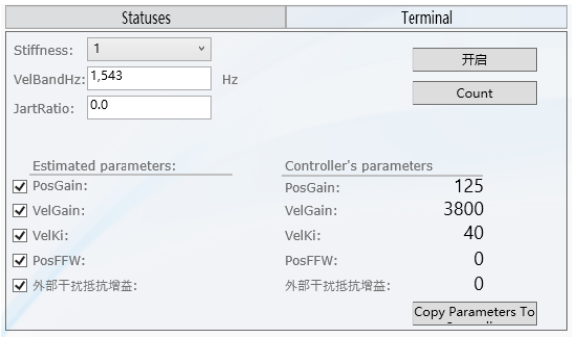


4.10 Advanced adjustment

4.10.1 Auto gain

Auto gain

QX PC Suite debugging software offers "auto gain" function, which simplifies the rigid debugging of servo motor. The "auto gain" interface is shown below.

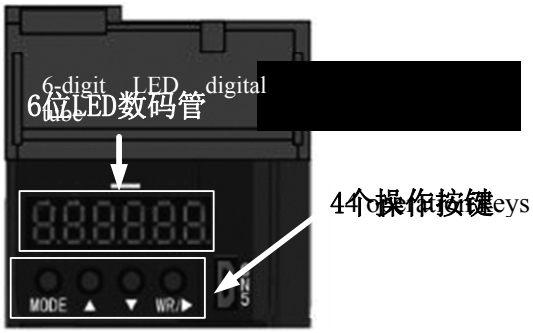


The auto gain debugging interface is as shown in the figure above. When automatic gain calculation is needed, you need to move the motor using PTP function and then click “ON”. The driver will calculate the “velocity loop bandwidth” and “inertia ratio” based on the currently set “low frequency stiffness”; the "low-frequency rigidity" can be modified during the calculation process. The greater the value, the stronger the stiffness of the motor, that is, the higher the response of the motor, but not too high, otherwise the motor will vibrate. After the “velocity loop bandwidth” and the “inertia ratio” change have been stabilized, the automatic training calculation can be stopped, after which the evaluation parameters can be "calculated" and the evaluation parameters can be "written" into the driver parameters.

Note: Please stop the motor when performing "write parameters".

5 Introduction to Keys on Digital Operation Panel

The digital operation panel of the QX servo driver is mainly composed of a digital display part and operation keys. Its structure is shown in the figure:



The function description for each component is shown in the following table:

Component	Specific operation	Function
Digital display	7-segment LED digital tube	Display monitor values, parameter values, etc. in 6 digits
Operation keys	**MODE**	1. Perform switching among five modes 2. Press and hold to set the value of high, medium and low bits.
		Addition and subtraction of values.
	WR/	1. Press the displacement cursor 2. Press and hold this key to enter or confirm the modified parameters

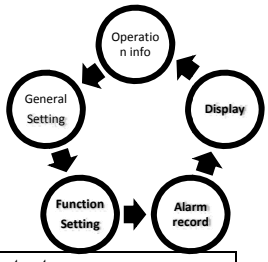
- **Press: Tap the key within 1 second**
- **Press and hold: release the key after pressing it for more than 3 seconds**

5.1 Operation mode

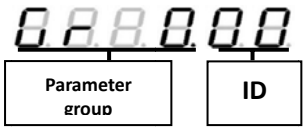
The digital operation panel allows status display, general parameter change and setting, motion, save parameters, view alarm record, monitoring value confirmation, etc.

5.1.1 Operation mode switching

Click the "MODE" key on the digital operation panel to switch among five operation modes. The switching sequence is as shown below:



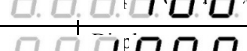
5.1.2 Contents of the mode

Operating mode name	Content
Operating status display 	● To display all power supplies, servo enable (Motoron), positive and negative limit and alarm status.
General parameter settings 	●The general parameters are divided into 4 groups based on functions: Gr0: Motor enable and power-on auto-enable settings Gr1: Basic control parameter settings Gr2: Stiffness adjustment and internal velocity settings Gr3: Parameter settings for brake and MODBUS with analog Gr4: Motor commutation related parameters Gr5: I/O configuration parameter settings
Function parameter 	●It executes the following functions: JOG operation, position clearing and save parameters to Flash
Alarm record display 	●It is used for the most recent alarm record query, and the data will be cleared after power off.
Monitor display 	● To monitor the velocity, velocity command, torque, torque command, auxiliary encoder position, external pulse, analog port input voltage, warning status, etc.

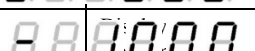
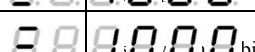
5.1.3 Display range

The form of data displayed by digital operation panel is as follows.

- 0-9999data

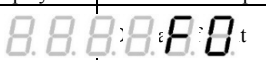
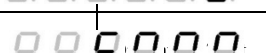
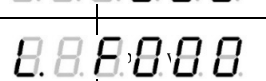
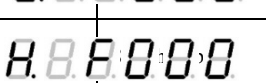
Display of digital operation panel	Display range of each digit bit
	0~9
	10~99
	100~999
	1000~9999

- 0~99999999data

Display of digital operation panel	Display range of each digit bit	
	bit	0~9999
	of	0~9999
	bit	0~9999

✓ The LEDs on the left indicate low, medium, and high bits. Press MODE for more than 3 seconds and then release it to switch.

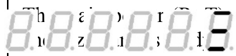
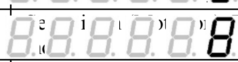
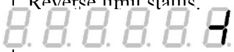
- Hexadecimal data

Digital operation panel display	Display range of each digit bit
	0~FF
	0~FFFF
	0000~FFFF (Bit31~Bit0)
	0000~FFFF (Bit63~Bit32)

➢ Digital tube displays corresponding content

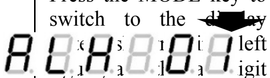
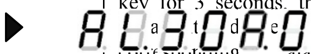
									
0	1	2	3	4	5	6	7	8	9
									
A	B	C	D	E	F	G	H	J	L
									
N	O	R	T	Y	F				

5.2 State display mode

Display code	Description
	Th[illegible] and control power (r, t) are [illegible] r operation.
	[illegible] Display "8" in rotating [illegible]
	Forward limit status.
	Reverse limit status.
	The alarm code is displayed when an alarm occurs.

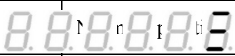
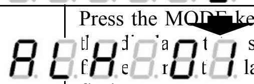
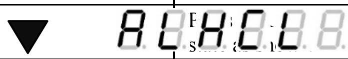
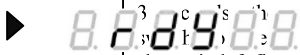
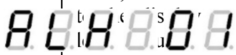
5.3 Alarm record viewing method

The alarm log can be viewed through the digital operation panel, but the alarm log will be cleared automatically after reboot.

Step	Operating key	Display code	Description
1			[illegible]
2	MODE		Press the MODE key to switch to the [illegible] left [illegible] igit “1” flashes.
3	WR/		Press and hold the WR key for 3 seconds, then [illegible] the corresponding alarm code.

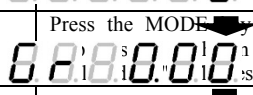
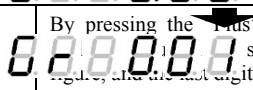
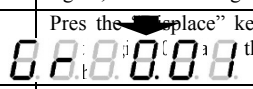
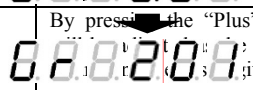
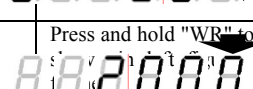
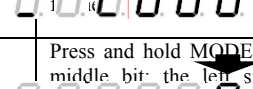
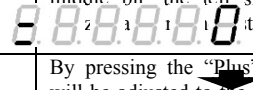
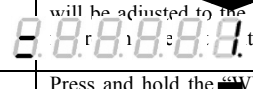
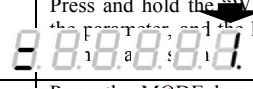
5.4 Alarm record clearing method

The alarm log can be cleared through digital operation panel, or can be cleared automatically after reboot.

Step	Operating key	Display code	Description
1			N[illegible] status
2	MODE		Press the MO[illegible]key to switch to t[illegible] shown in left f[illegible] last digit “1” flashes.
3			[illegible]witch to display s[illegible]ft figure
4	WR/		Press and hold the WR button for 3[illegible] release it and [illegible]splay state as shown in left figure.
5	WR/		Press and hold the WR button for 3[illegible] release it and [illegible]splay state as shown in left figure.
6			Then, it will automatically return t[illegible]te as shown in l[illegible]d the alarm information will then be cleared.

5.5 Parameter editing instructions

In the general parameter setting and function parameter setting editing mode, the internal parameters of the servo driver are changed according to actual needs. The change method will be explained, for example, changing 2000 as 12000 in the general parameter "velocity loop gain Gr2.01".

Step	Operating key	Display code	Description
1			
2	MODE		Press the MODE key to switch to the [illegible] in left figure, and [illegible]s at this time.
3	▲		By pressing the "Plus" key, the display [illegible] shown in the left [illegible]it "1" will flash.
4	WR/ ▶		Pres the "Replace" key and shift to the [illegible] the first digit "0"
5	▲		By pressing the "Plus" key, the display [illegible] state shown in left [illegible]it "2" flashes.
6	WR/ ▶		Press and hold "WR" to switch to the state [illegible] the last digit "0" [illegible]
7	MODE		Press and hold MODE to switch high to middle bit: the left side displays "two [illegible]t digit "0" flashes
8	▲		By pressing the "Plus" key, the display will be adjusted to the state shown in left [illegible]t "1" flashes.
9	WR/ ▶		Press and hold the "WR" key to confirm the parameter, and the last digit "1" stops [illegible]
10	MODE		[illegible] and switch to the [illegible]e

5.6 Parameter saving operation

After editing the relevant parameters, you need to save the parameters to the FLASH of the servo driver. Otherwise, the parameters modified after the restart will be restored back to the original parameters.

Step	Operating key	Display code	Description
1	MODE		Press the "MODE" button to adjust the [illegible] in left figure, and [illegible]s at this time.
2		▲	Press the "Plus" key to add the number to "2" [illegible] "2" flashes at this [illegible]
3	WR/	▶	Press and hold the "WR" key for 3 seconds, then release it to enter the [illegible] menu. The status "save" as shown in left is displayed.
4	WR/	▶	Press and hold the "WR" key for 3 [illegible] If the state in left [illegible] run" the driver and enter the parameter saving state
5			When the driver saves the parameters, it will automatically jump to the left [illegible] the parameters are [illegible] rvo driver at this time.

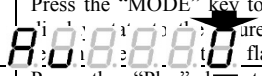
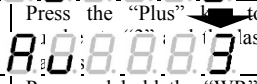
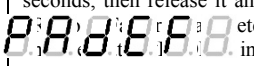
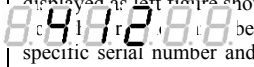
5.7 JOG mode operation instructions

The motor operation test can be performed in the JOGMotion mode using the digital operation panel. When using the JOG mode, the motor should be separated from the device to avoid the danger of collision. (Do not save parameters after performing JOG mode)

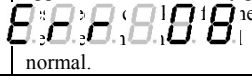
Step	Operating key	Display code	Description
1			[illegible]
2	**MODE**		Press the "MODE" key to adjust as shown [illegible] "0" flashes.
3	**WR/**	▶	[illegible] WR" key for 3 [illegible] and enter "JOG mode".
4	**WR/**	▶	Press and hold the "WR" key for 3 [illegible], and the servo is enabled at this time.
5		▲ ▼	Control motor forward and reverse by [illegible]

5.8 Operating instructions for restoring factoryparameters

After the parameter is garbled, you can restore the factory parameters of the driver by this way. When restoring the factory parameters, you need to ensure that the motor and the driver are properly connected.

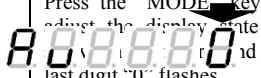
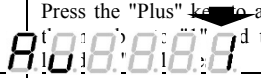
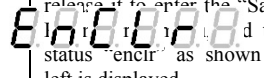
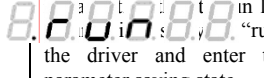
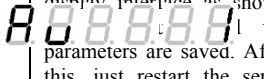
Step	Operating key	Display code	Description
1			
2	**MODE**		Press the “MODE” key to adjust the  ure shown in flashes.
3		▲	Press the “Plus” key to add the  last digit “3”
4	WR/	▶	Press and hold the “WR” key for 3 seconds, then release it and enter the  eters” menu, in left figure is then displayed.
5	WR/	▶	Press and hold the “WR” key for 3 seconds, then release it, and the factory parameters will be restored. The motor identification code corresponding to the motor will be displayed, and the status will be  displayed as left figure shows. between the specific serial number and the motor model, please refer to the Appendix "Correspondence Table of Motor Identification Codes". After the parameters are restored, please save these parameters.

After the “Restore to Factory Parameters” operation, the corresponding parameters in Gr 0.01 are also changed to the corresponding motor identification code.

			If the alarm shown on the left column  appears when the factory parameters are ne connection l the driver is normal.

5.9 Absolute encoder position clearing

When using an absolute encoder (with battery), if the battery voltage is low or the battery cable is disconnected, the encoder will judge the fault caused by low battery voltage. This fault is recorded inside the encoder. The battery after re-connection will not be reset automatically but needs to be cleared manually.

Step	Operating key	Display code	Description
1	MODE		Press the "MODE" key to adjust the display state as shown in left and the last digit "0" flashes.
2		▲ 	Press the "Plus" key to add the parameter "1" and the last digit "1" flashes.
3	WR/	▶ 	Press and hold the "WR" key for 3 seconds and then release it to enter the "Save parameters" and the status "encir" as shown in left is displayed.
4	WR/	▶ 	Press and hold the "WR" key for 3 seconds and release it in left status, "run" the driver and enter the parameter saving state
5			When the driver saves the parameters, it will automatically jump to the display interface as shown in left and the parameters are saved. After this, just restart the servo driver.

5.10 Description of operation mode parameters

5.10.1 General parameters

The general parameters are classified by Gr and entered in the following list in the order of ID.

☞ **Settings of Gr0 motor enable and power-on auto-enable**

ID	Variable	Parameter name	Control mode		
01	MotorID	Motor identification code	**Position**	**Velocity**	**Torque**
02	MotorON	Motor enable	**Position**	**Velocity**	**Torque**
03	AutoMotorON	Power-on auto enable	**Position**	**Velocity**	**Torque**

☞ **Gr1 basic control parameter setting**

ID	Variable	Parameter name	Control mode		
00	OperationMode	Operating mode	**Position**	**Velocity**	**Torque**
01	MotionMode	Sport mode	**Position**	**Velocity**	**Torque**
02	PDMode	Pulse mode	**Position**		
03	ModRevOn	Encoder revolution mode switch	**Position**	**Velocity**	**Torque**
04	EmulDir	Main encoder feedback frequency division direction	**Position**	**Velocity**	**Torque**
05	EmulRat	The numerator of main encoder feedback frequency division output	**Position**	**Velocity**	**Torque**
06	EmulRatDen	The denominator of main encoder feedback divider output	**Position**	**Velocity**	**Torque**
07	EncFilt	Main encoder digital filter	**Position**	**Velocity**	**Torque**
08	PDEncFilt	Digital filter of pulse direction encoder	**Position**		
09	PDFact	The numerator of electronic gear ratio	**Position**		
0A	PDFactDen	The denominator of electronic gear ratio	**Position**		
0B	PDEncDir	Pulse direction reversal	**Position**		
0C	PDFiltFact	Pulse direction direct mode filter	**Position**		
0D	CurrLimMode	Torque limit mode	**Position**	**Velocity**	**Torque**
0E	CurrLimFwd	Torque forward limit	**Position**	**Velocity**	**Torque**
0F	CurrLimRev	Torque reverse limit	**Position**	**Velocity**	**Torque**
10	ContCL	Rated motor current	**Position**	**Velocity**	**Torque**
11	PeakCL	Maximum motor current	**Position**	**Velocity**	**Torque**

☞ **Gr2 Rigidity adjustment and internal velocity setting**

ID	Variable	Parameter name	Control mode		
00	PosGain	Position loop gain	**Position**		
01	VelGain	Velocity loop gain	**Position**	**Velocity**	
02	VelKi	Velocity loop integral	**Position**	**Velocity**	
03	PosFFW	Position feed forward	**Position**		
04	Accel	Acceleration	**Position**	**Velocity**	**Torque**
05	Decel	Deceleration	**Position**	**Velocity**	**Torque**
06	Speed	Velocity	**Position**	**Velocity**	**Torque**
07	Jerk	Smoothness	**Position**	**Velocity**	**Torque**
08	Stiffness	Stiffness	**Position**	**Velocity**	
09	MultiSpeed1	Internal velocity setting 1st velocity		**Velocity**	
0A	MultiSpeed2	Internal velocity setting 2nd velocity		**Velocity**	
0B	MultiSpeed3	Internal velocity setting 3rd velocity		**Velocity**	
0C	MultiSpeed4	Internal velocity setting 4st velocity		**Velocity**	
0D	MultiSpeed5	Internal velocity setting 5st velocity		**Velocity**	
0E	MultiSpeed6	Internal velocity setting 6st velocity		**Velocity**	
0F	MultiSpeed7	Internal velocity setting 7st velocity		**Velocity**	
10	MultiSpeed8	Internal velocity setting 8st velocity		**Velocity**	
11	MultiSpeed9	Internal velocity setting 9st velocity		**Velocity**	
12	MultiSpeed10	Internal velocity setting 10st velocity		**Velocity**	
13	MultiSpeed11	Internal velocity setting 11st velocity		**Velocity**	
14	MultiSpeed12	Internal velocity setting 12st velocity		**Velocity**	
15	MultiSpeed13	Internal velocity setting 13st velocity		**Velocity**	
16	MultiSpeed14	Internal velocity setting 14st velocity		**Velocity**	
17	MultiSpeed15	Internal velocity setting 15st velocity		**Velocity**	
18	MultiSpeed16	Internal velocity setting 16st		**Velocity**	

		velocity			

☞ **Gr3 Related parameter settings of brake and MODBUSwith analog**

ID	Variable	Parameter name	Control mode		
00	BrkSpeed	Holding brake release velocity	**Position**	**Velocity**	**Torque**
01	BrkOnDly	Holding brake action delay time	**Position**	**Velocity**	**Torque**
02	BrkOffDly	Holding brake release delay time	**Position**	**Velocity**	**Torque**
03	ModbusAddr	MODBUS address	**Position**	**Velocity**	**Torque**
04	ModbusBaud	MODBUS baud rate	**Position**	**Velocity**	**Torque**
05	AInDB[3]	Analog 3 input dead zone		**Velocity**	**Torque**
06	AInGain[3]	Analog 3 input gain		**Velocity**	
07	AInOffSet[3]	Analog 3 input compensation		**Velocity**	
08	AInFilt[3]	Analog 3 input filter coefficient		**Velocity**	
09	AInputMode	Analog input source selection		**Velocity**	
0A	AInputValue	Internal analog voltage value		**Velocity**	**Torque**
0B	AinputDir	Analog input direction selection		**Velocity**	
0C	AInDB[5]	Analog 5 input dead zone			**Torque**
0D	AInGain[5]	Analog 5 input gain			**Torque**
0E	AInOffSet[5]	Analog 5 input compensation			**Torque**
0F	AInFilt[5]	Analog 5 input filter coefficient			**Torque**
10	ModbusDisTime	Modbus disconnection protection delay time	**Position**	**Velocity**	**Torque**

☞ **Gr4 Motor commutation related parameters**

ID	Variable	Parameter name	Control mode		
00	MotorType	Motor type	**Position**	**Velocity**	**Torque**
01	PolePrs	Pair of poles	**Position**	**Velocity**	**Torque**
02	AutoGJm	Moment of inertia	**Position**	**Velocity**	**Torque**
03	RatedTorque	Rated torque	**Position**	**Velocity**	**Torque**
04	RatedWm	Rotating speed	**Position**	**Velocity**	**Torque**
07	EncType	Encoder type	**Position**	**Velocity**	**Torque**
08	EncRes	Encoder resolution	**Position**	**Velocity**	**Torque**
09	EncDir	Encoder direction	**Position**	**Velocity**	**Torque**

0B	ComtMode[1]	Commutation mode	**Position**	**Velocity**	**Torque**
0C	ComtMode[3]	Commutation time	**Position**	**Velocity**	**Torque**
0D	ComtMode[2]	Commutation increment	**Position**	**Velocity**	**Torque**

☞ **Gr5 I/O configuration parameter settings**

ID	Variable	Parameter name	Control mode		
00	DInLog	Input logic (decimal value)	**Position**	**Velocity**	**Torque**
01	DInLog1	No. 1 input logic	**Position**	**Velocity**	**Torque**
02	DInLog2	No. 2 input logic	**Position**	**Velocity**	**Torque**
03	DInLog3	No. 3 input logic	**Position**	**Velocity**	**Torque**
04	DInLog4	No. 4 input logic	**Position**	**Velocity**	**Torque**
05	DInLog5	No. 5 input logic	**Position**	**Velocity**	**Torque**
06	DInLog6	No. 6 input logic	**Position**	**Velocity**	**Torque**
07	DInLog7	No. 7 input logic	**Position**	**Velocity**	**Torque**
08	DInLog8	No. 8 input logic	**Position**	**Velocity**	**Torque**
09	DInLog9	No. 9 input logic	**Position**	**Velocity**	**Torque**
0A	DInLog10	No. 10 input logic	**Position**	**Velocity**	**Torque**
10	DInFilt	Digital IO input filtering	**Position**	**Velocity**	**Torque**
11	DInMode1	Port 1 input function selection	**Position**	**Velocity**	**Torque**
12	DInMode2	Port 2 input function selection	**Position**	**Velocity**	**Torque**
13	DInMode3	Port 3 input function selection	**Position**	**Velocity**	**Torque**
14	DInMode4	Port 4 input function selection	**Position**	**Velocity**	**Torque**
15	DInMode5	Port 5 input function selection	**Position**	**Velocity**	**Torque**
16	DInMode6	Port 6 input function selection	**Position**	**Velocity**	**Torque**
17	DInMode7	Port 7 input function selection	**Position**	**Velocity**	**Torque**
18	DInMode8	Port 8 input function selection	**Position**	**Velocity**	**Torque**
19	DInMode9	Port 9 input function selection	**Position**	**Velocity**	**Torque**
1A	DInMode10	Port 10 input function selection	**Position**	**Velocity**	**Torque**
20	DOutLog	Outpot logic (decimal value)	**Position**	**Velocity**	**Torque**
21	DOutLog1	No.1 output logic (binary)	**Position**	**Velocity**	**Torque**
22	DOutLog2	No.2 output logic (binary)	**Position**	**Velocity**	**Torque**
23	DOutLog3	No.3 output logic (binary)	**Position**	**Velocity**	**Torque**
24	DOutLog4	No.4 output logic (binary)	**Position**	**Velocity**	**Torque**
25	DOutLog5	No.5 output logic (binary)	**Position**	**Velocity**	**Torque**

26	DOutLog6	No.6 output logic (binary)	**Position**	**Velocity**	**Torque**
27	DOutLog7	No.7 output logic (binary)	**Position**	**Velocity**	**Torque**
28	DOutLog8	No.8 output logic (binary)	**Position**	**Velocity**	**Torque**
29	DOutLog9	No.9 output logic (binary)	**Position**	**Velocity**	**Torque**
30	DoutPort	Output status	**Position**	**Velocity**	**Torque**
31	DOutMode1	Port 1 output function selection	**Position**	**Velocity**	**Torque**
32	DOutMode2	Port 2 output function selection	**Position**	**Velocity**	**Torque**
33	DOutMode3	Port 3 output function selection	**Position**	**Velocity**	**Torque**
34	DOutMode4	Port 4 output function selection	**Position**	**Velocity**	**Torque**
35	DOutMode5	Port 5 output function selection	**Position**	**Velocity**	**Torque**
36	DOutMode6	Port 6 output function selection	**Position**	**Velocity**	**Torque**
37	DOutMode7	Port 7 output function selection	**Position**	**Velocity**	**Torque**
38	DOutMode8	Port 8 output function selection	**Position**	**Velocity**	**Torque**
39	DOutMode9	Port 9 output function selection	**Position**	**Velocity**	**Torque**

5.10.2 Function descriptions of parameters

5.10.2.1 Gr0Motor enable and power-on auto-enable settings

Gr0	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
01	Motor identification code [MotorID]	0-9999	-	-	Yes
Parameter description	The initial parameters of the motor can be set by using the motor identification code. For the motor models corresponding to the motor identification codes, please refer to the Appendix "Correspondence Table of Motor Identification Code".				

Gr0	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
02	Motor enable [MotorON]	0-1	-	0	No
Parameter description	0: Off The motor is in the shaft loosening state 1: On The motor is in the shaft locking state				

Gr0	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
03	Power-on auto enable [AutoMotorON]	0-1	-	0	Yes
Parameter description	0: Off The motor is in the shaft looseningstate after the servo driver power is turned on. 1: On The motor is in the shaft locking state after the servo driver power is turned on.				

5.10.2.2 Gr1 Basic control parameter settings

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
00	Operation mode [OperationMode]	1-3	-	3	No
Parameter description	1: Current mode 2: Velocity mode 3: Position mode				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
01	Motion mode [MotionMode]	0-4	-	3	No
Parameter description	0: JOG mode 1: PTP (one-way) mode 2: PTP (reciprocating) mode 3: External pulse (direct mode) 4: External pulse (contour mode)				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
02	Pulse mode [PDMode]	1-7	-	1	No
Parameter description	1: Pulse direction (differential) 2: Double pulse (differential) 3: AB orthogonal (differential) 5: Pulse direction (optocoupler) 6: Double pulse (optocoupler) 7: AB orthogonal (optocoupler)				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
03	Encoder revolution mode switch [ModRevOn]	0-1	-	0	No

Parameter description	0: Off 1: On Note: It needs to be turned on when the motor runs in one direction

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
04	Main encoder feedback frequency division direction [EmulDir]	0-1	-	0	Yes
Parameter description	Change the direction of the main encoder frequency dividing output 0: forward 1: reverse				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
05	The numerator of main encoder feedback frequency division output [EmulRat]	1-65535	-	1	Yes
06	The denominator of main encoder feedback frequency division output [EmulRatDen]	1-65535	-	1	yes
Parameter description	● For the servo driver of B version: The encoder feedback output ratio determines the ratio of the main encoder input to the encoder analog output, and divides the frequency for encoder output pulse (the A- and B-phase pulses are output by the CN1 port after frequency division). If the ratio is 2, it means two divided-frequency. When it is 3, it means three divided-frequency, and so on. If it is set to 0 or 1, it means one divided-frequency. Thecalculation formula of the frequency division output numerator/denominator B: EmulRat; A: EmulRatDen; PG: Encoder resolution; P: The number of pulses required for the motor to rotate a revolution;				

	$\frac{B}{A}=\frac{P}{PG}$ Encoder resolution: The 2500-line encoder is 2500×4=10000; 17Bit encoder is =131072; 20Bit encoder is =1048576; ● For the servo driver of BPro version: Set EmulRat (Gr 1.05) to the number of pulses required for frequency division by one revolution of the motor.

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
07	Main encoder digital filter [EncFilt]	1-255	-	15	No
Parameter description	It is used for feedback of interference filter sent by motor encoder. The greater the value, the stronger the filtering performance, but the greater the value, the lower the frequency of the feedback from the encoder.				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
08	Digital filter of pulse direction encoder [PDEncFilt]	0-15	-	3	No

Parameter description

It is used for pulse receiving interference filtering. The larger the value, but in this case, the lower the frequency of the received pulse.

The maximum pulse receiving frequency for each filter level is as follows:

Level	Freq. (KHZ)	Level	Freq. (KHZ)	Level	Freq. (KHZ)	Level	Freq. (KHZ)
0	2500	4	950	8	550	12	360
1	2000	5	810	9	500	13	340
2	1500	6	700	10	450	14	320
3	1000	7	620	11	400	15	300

Gr1	Content				
	Parameter	**Setting range**	**Unit**	**Default setting**	**Take effect after restart**
09	Electronic gear ratio numerator [PDFact]	1-16777215	-	No	**Position**
0A	Electronic gear ratio numerator [PDFactDen]	1-16777215	-	No	**Position**

ParameterDescription

Electronic gear ratio calculation formula:

β: instruction unit (the so-called instruction unit refers to the minimum position unit in which the load is moved)

PG: Encoder resolution

P: The amount of movement of the load shaft by one revolution

$\frac{m}{n}$: reduction ratio

$$\frac{PDFact}{PDFactDen} = \frac{PG}{\frac{P}{\beta}} \times \frac{m}{n}$$

Encoder resolution:

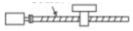
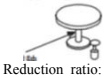
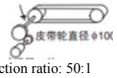
2500-line encoder: 2500×4=10000

17Bit encoder:2^{17}=131072

20Bit encoder: 2^{20}=1048576

24Bit encoder:2^{24}=16777216

Example of electronic gear ratio setting

Content	**Mechanical structure**		
	Ball screw rod	**Disc**	**Pulley**
	Instruction unit: 0.001mm Load shaft  Ball screw pitch: 6mm	Instruction unit: 0.01°  Reduction ratio: 100:1 Load shaft	Instruction unit: 0.005mm  Reduction ratio: 50:1 Pulleydiameter: Φ100mm
Encoder resolution	2500lines	17Bit	24Bit
Mechanical structure specifications	Screw pitch: 6mm	Rotation angle: 360°	Pulley circumference:314mm
Instruction unit	0.001mm	0.01°	0.005mm
Reduction ratio	1:1	100:1	50:1
Electronic gear ratio	$\frac{10000}{6000} \times \frac{1}{1} = \frac{5}{3}$	$\frac{131072}{36000} \times \frac{100}{1} = \frac{16384}{45}$	$\frac{1048576}{62800} \times \frac{50}{1} = \frac{131072}{157}$
Parameter	PDFact: 5	PDFact: 16384	PDFact: 131072
	PDFactDen: 3	PDFactDen: 45	PDFactDen: 157

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0B	Pulse direction reversal [PDEncDir]	0-1	-	0	No
Parameter description	When the direction in which the motor runs is inconsistent with the actual pulse output direction, select 1 to reverse the direction. This function is valid only for external pulse control. 0: No 1: Yes				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0C	Pulse direction direct mode filter [PDFiltFact]	1-64	-	6	No
Parameter description	It is used for trajectory smoothing in direct mode. The higher the level, the smoother the trajectory, but the longer the lag time.				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0D	Torque limit mode [CurrLimMode]	0-3	-	0	No
0E	Torque forward limit [CurrLimFwd]	0-50000	mA	20000	No
0F	Torque reverse limit [CurrLimRev]	0-50000	mA	20000	No
Parameter description	1. When 0D is set to 0, the torque limit function is disabled, and the 0E and 0F parameters are invalid. 2. When the OD is set to 3, the torque limit function is enabled, and the 0E and 0F parameters are valid. This parameter is used for torque limit. When these functions are enabled, the driver will not output a force higher than the set value.				

Gr1	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
10	Rated Motor Current [ContCL]	0-50000	A	Set according to the actual situation of the motor	No
11	The Maximum Motor Current [PeakCL]	0-50000	A	Set according to the actual situation of the motor	No
Parameter description	Set the corresponding value according to the actual situation of the motor.				

5.10.2.3 Gr2 stiffness adjustment and internal velocity setting

Gr2	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
00	Position Loop Gain [PosGain]	0-32768	-	50	No
Parameter description	The larger the value, the faster the servo motor reaches the target velocity, but an oscillation will be caused if it is too large.				

Gr2	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
01	VelocityLoop Gain [VelGain]	0-1000000	-	200	No
Parameter description	The larger the value, the faster the servo motor reaches the target velocity, but an oscillation will be caused if it is too large.				

Gr2	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
02	VelocityLoop Integral [VelKi]	0-100000	-	30	No
Parameter description	The larger the value, the faster the servo motor reaches the target velocity, but an oscillation will be caused if it is too large. This parameter shall be used together with VelGai.				

Gr2	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
03	Position Feed Forward [PosFFW]	0-65535	-	0	No

Parameter description	Increase the position response. The greater the value, the faster the position response. The noise is generated when this value is too great.

Gr2	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
04	Acceleration [Accel]	0-10000	ms	0	No
05	Deceleration [Decel]	0-10000	ms	0	No
06	Velocity [Velocity]	0-6000	r/min	0	No
07	Smoothness [Jerk]	0-9	-	0	No
Parameter description	For JOG mode and contour mode When MotionMode (Gr 1.01) = 0, enter the JOG mode, and the above four parameters are used when operating in the JOG mode. When MotionMode (Gr 1.01) = 4, enter the contour mode. At this time, when the external pulse is acceleration, deceleration and the velocity are lower than the set value, the servo motor uses the external pulse acceleration and deceleration and velocity; when the acceleration, deceleration and the velocity of external pulse are greater than the set value, the servo motor uses the acceleration, deceleration and velocity of the set value.				

Gr2	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
08	Stiffness [Sitffness]	0-300	%	60	No
Parameter description	The larger the value, the faster the servo motor reaches the target velocity, but an oscillation will be caused if it is too large. This parameter shall be used together with VelGai.				

<table>
<tr><td rowspan="2">Gr2</td><td colspan="5">Content</td></tr>
<tr><td>Parameter name</td><td>Setting range</td><td>Unit</td><td>Default setting</td><td>Take effect after restart</td></tr>
<tr><td>09</td><td>Internal VelocitySetting 1st Velocity [MultiVelocity1]</td><td>-6000-6000</td><td>r/min</td><td>0</td><td>No</td></tr>
<tr><td>Parameter description</td><td colspan="5">When using the internal multi-segment speed function, set the [OperationMode] to 2-velocity mode, and set the analog input source selection [AInputMode] to 2-internal multi-segment speed setting, and set the input I/O function to follows: 12-Internal multi-segment speed 1,13-internal multi-segment speed 2.14-internal multi-segment speed 3, and 15-internal multi-segment speed 4. The correspondence between each segment of velocity and the input I/O signal is shown in the following table. OFF means that there is no signal input on the port, and ON means that there's signal input at such port.
<table>
<tr><td>Velocity command selection</td><td>Internal multi-segment speed 1</td><td>Internal multi-segment speed 2</td><td>Internal multi-segment speed 3</td><td>Internal multi-segment speed 4</td></tr>
<tr><td>1st speed</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
</table></td></tr>
</table>

5.10.2.4 Gr3 related parameters setting of brake and MODBUS with analog

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
00	Holding brake release speed [BrkVelocity]	0-3000	P/S	0	No
01	Holding brake action delay time [BrkOnDly]	0-50000	ms	0	No
02	Holding brake release delay time [BrkOffDly]	0-50000	ms	0	No
Parameter description	BrkVelocity: Turns off the brake output when the motor running velocity is lower than the set value. BrkOnDly: Turns on the brake output when the servo is energized and enable the delay time. BrkOffDly: When the servo enable is required to be turned off, turn off the brake output first, and then turn off the servo enable after the delay time is set.				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
03	MODBUSaddress [ModbusAddr]	1-99	-	1	No
04	MODBUS baud rate [ModbusBaud]	1-4	-	1	No
Parameter description	ModbusBaud is set with following levels: 1. 9600Hz 2. 19200Hz 3.38400Hz 4.115200Hz				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
05	MODBUSaddress [ModbusAddr]	1-99	-	1	No
06	MODBUS baud rate [ModbusBaud]	1-4	-	1	No
Parameter description	Set the ModbusBaud in following levels: 1. 9600 2. 19200 3.38400 4.115200				

Gr3	Content

	Parameter name	Setting range	Unit	Default setting	Take effect after restart
05	Analog 3 input dead zone [AInDB[3]]	0 - 2147483647	mv	0	No
Parameter description	Velocity mode input dead zone Set the dead zone range so that the motor stops when the input analog is in the dead zone. When the external input voltage is within a certain range, the actual voltage at the driver port input is 0. For example, if the dead zone settingis 50mV, and when the external input voltage is -50~50mV, the input voltage at driver port is 0; when the external input voltage is60mV, the input voltage at driver port is 60 − 50 = 10 mV				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
06	Analog 3 input gain [AInGain[3]]	1 - 2147483647	1/65536	1	No
Parameter description	Velocity mode input gain Gain is used to amplify a given analog quantity to achieve the desired target velocity				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
07	Analog 3 input compensation [AInOffSet[3]]	0 - 2147483647	mv	0	No
Parameter description	The velocity mode input compensation analog input port itself may have a certain offset voltage, so it is necessary to superimpose the corresponding offset amount on the input voltage signal, so that the actual voltage at the internal input port of the driver is equal to the external input voltage. For example, when the external input voltage is 0, the actual internal input voltage of the driver is -47mV. In this case, the user needs to set the offset to 47 mV.				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
08	Analog 3 input filter coefficient [AInFilt[3]]	1 - 65536	1/65536	65536	No

Parameter description	Velocity mode input filter coefficient The external input analog voltage is subjected to first-order filtering processing to smooth the analog quantity control; The smaller the setting value, the higher the smoothness, but in this case, the motor response will become lower.

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
09	Analog input source selection [AInputMode]	0 - 2	-	0	No
Parameter description	To switch between internal analog and external analog 0: Use external analog 1: Use internal analog 2: Internal multi-segment speed setting				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0A	Internal analog voltage value [AInputValue]	0 - 12000	mv	10000	No
Parameter description	Internal analog input value Enabled when Gr 3.09 is set to 1.				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0B	Analog input direction selection [AInputDir]	0 - 1	-	0	No
Parameter description	0: Forward 1: Reverse				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0C	Analog 5 input dead zone [AInDB[5]]	0 - 2147483647	mv	0	No

Parameter description	Torque mode input dead zone Set the deadzone range so that the motor stops when the input analog is in the dead zone. When the external input voltage is within a certain range, the actual voltage at the driver port input is 0. For example, if the dead zone setting is 50mV, and when the external input voltage is -50~50mV, the input voltage at driver port is 0; when the external input voltage is 60mV, the input voltage at driver port is 60 − 50 = 10 mV

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0D	Analog 5 input gain [AInGain[5]]	1 - 2147483647	1/65536	1	No
Parameter description	Torque mode input gain Gain is used to amplify a given analog quantity to achieve the desired target velocity				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0E	Analog 5 input compensation [AInOffSet[5]]	0 - 2147483647	mv	0	No
Parameter description	The torque mode input compensation analog input port itself may have a certain offset voltage, so it is necessary to superimpose the corresponding offset amount on the input voltage signal, so that the actual voltage at the internal input port of the driver is equal to the external input voltage. For example, when the external input voltage is 0, the actual internal input voltage of the driver is -47mV. In this case, the user needs to set the offset to 47 mV.				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0F	Analog 5 input filter coefficient [AInFilt[5]]	1 - 65536	1/65536	65536	No
Parameter description	Torque mode input filter coefficient The external input analog voltage is subjected to first-order filtering processing to smooth the analog quantity control; The smaller the setting value, the higher the smoothness, but in this case, the motor response will become lower.				

Gr3	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
10	Modbus disconnection protection delay time [ModbusDisTime]	-	ms	0	No
Parameter description	When the RS485 communication disconnection time is greater than the set time, the servo driver Modbus sends disconnection alarm				

5.10.2.5 Gr4 Related parameters for motor commutation

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
00	Motor type [MotorType]	3-5	-	0	Yes
Parameter description	The type of servo motor used must be the same as the type of current servo motor. 3 Linear Motor 4 Rotary motor 5 DDR motor				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
01	Pair of poles [PolePrs]	1-20	-	5	Yes
Parameter description	Each set of coils of magnetic phase 3 AC motors will generate N and S poles, and the number of magnetic poles per phase of each motor is the number of poles. Since the magnetic poles appear in pairs, the motor can be divided into 2, 4, 6, 8 ... poles. Set by referring to the model and specifications of the used motor.				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
02	Moment of inertia [AutoGJm]	-	kg.m^2	1	Yes
Parameter description	Rotor inertia of motor The setting value is 16777216=1kg.m^2, that is, if the rotor inertia of the motor is $0.66 \times 10^{-4}\ kg \cdot m^2$, the setting value should be 0.000066×16777216= 1107.				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
03	Rated torque [RatedTorque]	-	N.m	1	Yes
Parameter description	The rated torque of the motor.				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
04	Rated velocity [RatedWm]	0-6000	rpm	3000	Yes
Parameter description	The rated velocity of the motor.				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
07	Encoder type [EncType]	1-24	-	24	Yes

Parameter description

Please select this option according to the type of actual motor encoder

Para. value	Encoder type	Para. value	Encoder type
1	Incremental	13	Tamagawa, 17-bit single-turn, absolute (without battery)
2	BISS protocol 32 subdivision	14	Taikin, incremental 17-bit
3	BISS protocol 64 subdivision	15	Nikon, 17-bit multi-turn, absolute
4	BISS protocol 128 subdivision	16	Panasonic, 23-bit multi-turn, absolute (multi-turn)
5	Nikon absolute, 17-bit	17	Incremental ABZ_ ,with Hall
6	Panasonic incremental (20-digit or 2500-line)	18	Nikon, 20-bit, single-turn, absolute
7	Panasonic, 17-bit, single-turn, absolute (without battery)	19	Nikon, 20-bit, multi-turn, absolute (with battery)
8	Panasonic, 17-bit, multi-turn, absolute (with battery)	20	Tamagawa, 23-bit, single-turn, absolute
9	Retained	21	Tamagawa, 23-bit, single-turn, absolute (with battery)
10	Tamagawa, 17-bit multi-turn, absolute (with battery)	22	Panasonic, 23-bit. absolute
11	Retained	23	Nikon, 24-bit, single-turn,
12	Tamagawa, 17-bit,incremental	24	Nikon, 24-bit, multi-turn,

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
08	Encoder resolution [EncRes]	1000-16777216	counts	16777216	Yes
Parameter description	The number of pulses output by the encoder when the rotary motor rotates one revolution. Rotary motor: N-bit encoder,pair of poles =2^N, For example, the resolution of a 24-bit encoder is:2^{24}=16777216; The 2500-line incremental motor is:2500*4 (multiplier)=10000				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
09	Encoder direction [EncDir]	0-1	-	0	Yes
Parameter description	Change the direction of the main encoder output. When set it to 1, the encoder reading is negated. 0:Forward 1: Reverse				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0B	Commutation mode [ComtMode[1]]	0-3	-	2	Yes
Parameter description	0-jump to zero phase 2-absolute encoder preset angle 3-incremental encoder (with Hall)				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0C	Commutation time [ComtMode[3]]	0-5000	ms	1500	Yes
Parameter description	Determine the size of the current used for commutation. Do not set too large to prevent the running current from being too high. The default setting is 1500ms.				

Gr4	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
0D	Commutation increment [ComtMode[2]]	0-5000	ms	1500	Yes
Parameter description	Determine the time elapsed for the commutation. It is defaulted as 4;				

5.10.2.6 Gr5 I/O configuration parameter settings

Gr5	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
00	Output logic [DInlog]	0-255	-	0	No
01	No.1 output logic [DInlog1]	0-1	-	0	No
02	No.2 output logic [DInlog2]	0-1	-	0	No
03	No.3 output logic [DInlog3]	0-1	-	0	No
04	No.4 output logic [DInlog4]	0-1	-	0	No
05	No.5 output logic [DInlog5]	0-1	-	0	No
06	No.6 output logic [DInlog6]	0-1	-	0	No
07	No.7 output logic [DInlog7]	0-1	-	0	No
08	No.8 output logic [DInlog8]	0-1	-	0	No
09	No.9 output logic [DInlog9]	0-1	-	0	No
Parameter description	Set the logic of each input port. The relationship between each parameter is as follows:				

D0	D1	D2	D3	D4
DInlog 1	DInlog 2	DInlog3	DInlog 4	DInlog 5
D5	D6	D7	D8	
DInlog 6	DInlog 7	DInlog8	DInlog 9	

$$\text{DInlog} = \text{D0} \times 2^0 + D1 \times 2^1 + D2 \times 2^2 + D3 \times 2^3 + D4 \times 2^4 + D5 \times 2^5 + D6 \times 2^6 + D7 \times 2^7 + D8 \times 2^8$$

Gr5	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
10	Digital input filter [DInFilt]	0-2000	ms	0	No
Parameter description	Perform the time filtering to the digital input signal. The larger the value, the better the filtering effect, but it will also delay the input signal.				

Gr5	Content

	Parameter name	Setting range	Unit	Default setting	Take effect after restart
11	Port 1 input function selection [DInMode1]	0-31	-	0	No
12	Port 2 input function selection [DInMode2]	0-31	-	0	No
13	Port 3 input function selection [DInMode3]	0-31	-	0	No
14	Port 4 input function selection [DInMode4]	0-31	-	0	No
15	Port 5 input function selection [DInMode5]	0-31	-	0	No
16	Port 6 input function selection [DInMode6]	0-31	-	0	No
17	Port 7 input function selection [DInMode7]	0-31	-	0	No
18	Port 8 input function selection [DInMode8]	0-31	-	0	No
19	Port 9 input function selection [DInMode9]	0-31	-	0	No

Parameter description

No.	Function name	No.	Function name
1	IDE	17	Velocity/torque mode switching
2	Enable + motor operation	18	Position/torque mode switching
5	Terminate operation	20	Fully -closed loop function
6	(pulse clear)	21	Homing mode
7	Zero clamp speed	22	IO control trigger signal
8	Fault reset	23	Control bit 0
9	Emergency stop	24	Control bit 1
10	Reverse limit	25	Control bit 2
11	Forward limit	26	Control bit 3
12	Torque limit	27	Control bit 4
13	Internal multi-segment speed 1	28	Rising edge stop/falling edge operation
14	Internal multi-segment speed 2	29	Motor enable
15	Internal multi-segment speed 3	30	Origin switch
16	Internal multi-segment speed 4	31	Enable error compensation

[Note] For function descriptions, see "I/O function descriptions" for details

Gr5	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
20	Output logic [DOutlog]	0-255	-	0	No
21	No.1 output logic [DOutlog1]	0-1	-	0	No
22	No.2 output logic [DOutlog2]	0-1	-	0	No
23	No.3 output logic [DOutlog3]	0-1	-	0	No
24	No.4 output logic [DOutlog4]	0-1	-	0	No
25	No.5 output logic [DOutlog5]	0-1	-	0	No
26	No.6 output logic [DOutlog6]	0-1	-	0	No
27	No.7 output logic [DOutlog7]	0-1	-	0	No
28	No.8 output logic [DOutlog8]	0-1	-	0	No
29	No.9 output logic [DOutlog9]	0-1	-	0	No

Parameter description

Set the logic of each input port. The relationship between each parameter is as follows:

D0	D1	D2	D3	D4
DOutlog1	DOutlog2	DOutlog3	DOutlog4	DOutlog5
D5	D6	D7	D8	
DOutlog6	DOutlog7	DOutlog8	DOutlog9	

$$\mathrm{DOutlog} = \mathrm{D0} \times 2^0 + D1 \times 2^1 + D2 \times 2^2 + D3 \times 2^3 + D4 \times 2^4 + D5 \times 2^5 + D6 \times 2^6 + D7 \times 2^7 + D8 \times 2^8$$

<table>
<tr><td rowspan="2">Gr5</td><td colspan="5">Content</td></tr>
<tr><td>Parameter name</td><td>Setting range</td><td>Unit</td><td>Default setting</td><td>Take effect after restart</td></tr>
<tr><td>30</td><td>Output status [DOutPort]</td><td>0-255</td><td>-</td><td>-</td><td>No</td></tr>
<tr><td>Parameter description</td><td colspan="5">To display the input status of each input port:
<table>
<tr><td>D0</td><td>D1</td><td>D2</td><td>D3</td><td>D4</td></tr>
<tr><td>Out1</td><td>Out2</td><td>Out3</td><td>Out4</td><td>Out5</td></tr>
<tr><td>D5</td><td>D6</td><td>D7</td><td>D8</td><td></td></tr>
<tr><td>Out6</td><td>Out7</td><td>Out8</td><td>Out9</td><td></td></tr>
</table>
This bit is set as 1 when an input port input is valid, otherwise it is set to 0.
$\mathrm{DOutPort} = \mathrm{D0} \times 2^0 + D1 \times 2^1 + D2 \times 2^2 + D3 \times 2^3 + D4 \times 2^4 + D5 \times 2^5 + D6 \times 2^6 + D7 \times 2^7 + D8 \times 2^8$</td></tr>
</table>

Gr5	Content				
	Parameter name	Setting range	Unit	Default setting	Take effect after restart
31	Port 1 output function selection [DOutMode1]	0-25	-	0	No
32	Port 2 output function selection [DOutMode2]	0-25	-	0	No
33	Port 3 output function selection [DOutMode3]	0-25	-	0	No
34	Port 4 output function selection [DOutMode4]	0-25	-	0	No
35	Port 5 output function selection [DOutMode5]	0-25	-	0	No

Parameter description

No.	Function name	No.	Function name
0	No function	17	Torque arrival output
1	Servo ready	18	Velocity arrival output
2	Motor enable	19	Low velocity output
8	Positioning completed	20	Homing completion signal
9	Alarm output	21	Station detection output 0
10	Encoder Z phase output	22	Station detection output 1
12	Forward or reverse limit is activated	23	Station detection output 2
13	Software limit exceeded	24	Station detection output 3
14	Regenerative braking is activated	25	Station detection output 4
16	Motor brake is activated		

[Note] For the function description, please see the Appendix "I/O function descriptions"

5.10.3 Monitor display

The real-time data of the corresponding servo driver parameters can be monitored by operating the different IDs of the monitor display Ob. The specific ID correspondence is shown in the following table.

Obmonitor display			
ID	**Variable**	**Parameter name**	**Description**
0	ParaType	Parameter sequence	Decimal display
1	PwrTemp	Driver temperature	Decimal display (℃)
2	DInPort	General-purpose input IO	
3	DOutPort	General-purpose output IO	
4	VBus	Bus voltage	Decimal display (mV)
5	Vel	Velocity	Decimal display (r/min)
6	MotorCurr	Torque	Decimal display (A)
7	CurrRef	Torque command	Decimal display (A)
8	Pos	Motor encoder position	Decimal display (puls)
9	AuxPos	Auxiliary encoder position	Decimal display (puls)
0A	PDPos	External pulse	Decimal display (puls)
0B	AInPort[3]	Analog input voltage	Decimal display (mV)
0C	PDVel	Command pulse frequency	Decimal display (Hz)
0D	MotionState	Driver status	Decimal display
0E	AInPort[5]	Analog input voltage	Decimal display(mV)
0F		Load rate	Decimal display (%)
20	Identity[3]	Hardware version number	Decimal display
21	Identity[4]	Firmware version number	Decimal display
22	Identity[5]	FPGA version number	Decimal display
23	MotorID	Motor identification code	Decimal display, for QXS series motors only

5.10.4 Function parameters

By operating the function parameter Au,JOGMotion can be realized, the encoder position can be reset, and the parameters can be saved to the flash and so on. The correspondence of the specific ID to the relevant parameters is shown in the following table.

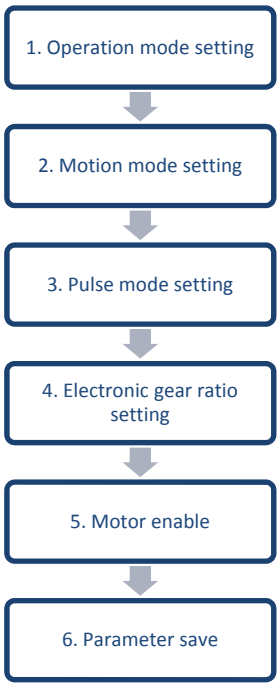
	ID	**Parameter name**	**Operating instructions**
Au	**00**	**JOGmode**	**See Section 7.7 "JOG mode"**
	01	**Encoder position reset**	**See Section 7.8 "Absolute encoder position reset"**
	02	**Save parameters to flash**	**See Section 7.6 "Parameter saving"**

5.11 Example of servo parameter settings

☞ **Debug environment settings**

The servo parameter can be set by taking following as examples QXSS-06040EB011 servo motor, the upper computer is of position control mode, pulse + direction control; the motor running acceleration and deceleration are controlled by the upper computer; the number of pulses per revolution of the upper computer is 10,000, and the connected pulse line is an optocoupler channel (14-PU+, 13-PU-, 16-DR+, 17-DR-), and the internal enabling is required.

According to the introduction to Group1.09 (the numerator of electronic gear ratio) and Group1.0A (the denominator of electronic gear ratio), the electronic gear ratio is calculated to be 8192/625.

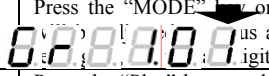
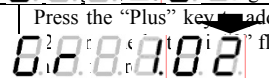
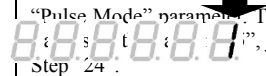
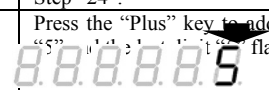
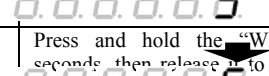
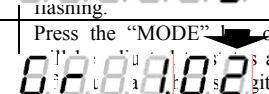
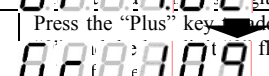
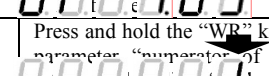
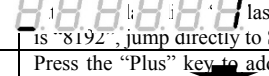
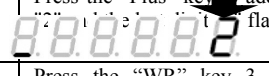
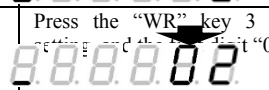
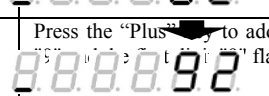
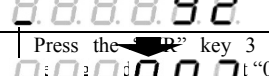


☞ **Step to debug**

Debug the servo with the digital operation panel by following six steps:

☞ **The operation steps are as follows:**

Step	Operating key	Display code	Description
1			
2	**MODE**		Press the "MODE" key twice to adjust the figure, and the last
3	**WR/**	▶	Press the "WR" key once to set the shift, shes.
4		▲	Press the "Plus" key to adjust the display gure, the first digit de) at this mode.
5	**WR/**	▶	Press and hold the "WR" key and enter the "Working Mode" parameter, the last digit s "3", skip to Step 12.
6		▲	Press the "Plus" key to add the number to flashes.
7	**WR/**	▶	Press and hold the "WR" key for 3 seconds, then release it to confirm the set st digit "3" stops flashing at this time.
8	**MODE**		Press the "MODE" key once, the display igure in left shows, shes.
9	**WR/**	▶	Press the "WR" key once to set the shift, shes.
10		▲	Press the "Plus" key to add the number to flashes, as shown in
11	**WR/**	▶	Press and hold the "WR" key and enter the "Sport Mode" parameter, the last digit "0" "3", skip to Step 18.
12		▲	Press the "Plus" key to add the number to "3" flashes.
13	**WR/**	▶	Press and hold the "WR" key for 3 seconds, then release it to confirm the set st digit "3" stops flashing at this time.

Step	Operating key	Display code	Description
14	**MODE**		Press the "MODE" key once, the display  as shown in the digit "1" flashes.
15		▲	Press the "Plus" key to add the number to  flashes, as shown
16	**WR/**	▶	Press and hold the "WR" key and enter the "Pulse Mode" parameter. The last digit "1"  ", jump directly to Step "24".
17		▲	Press the "Plus" key to add the number to  flashes.
18	**WR/**	▶	Press and hold the "WR" key for 3 seconds, then release it to confirm the set  digit "5" stops flashing.
19	**MODE**		Press the "MODE" key once,the display  as shown in the digit "2" flashes.
20		▲	Press the "Plus" key to add the number to  flashes, as shown
21	**WR/**	▶	Press and hold the "WR" key and enter the parameter "numerator of electronic gear  flashes. If the value is "8192", jump directly to Step "34".
22		▲	Press the "Plus" key to add the number to  flashes.
23	**WR/**	▶	Press the "WR" key 3 times for shift  digit "0" flashes.
24		▲	Press the "Plus" key to add the number to  flashes.
25	**WR/**	▶	Press the "WR" key 3 times for shift  digit "0" flashes.
26		▲	Press the "Plus" key to add the number to  flashes.

Step	Operating key	Display code	Description
27	WR/	▶	Press the "WR" key 3 times for shift [illegible] "0" flashes.
28		▲	Press the "Plus" key to add the number to [illegible] flashes.
29	WR/	▶	Press and hold the "WR" key for 3 seconds [illegible] release it to confirm the set [illegible] digit "8" stops flashing.
30	MODE		Press the "MODE" key once, the display [illegible] is as shown in the [illegible] digit "9" flashes.
31		▲	Press the "Plus" key to add the number to [illegible] "A" flashes, as
32	WR/	▶	Press and hold the "WR" key and enter the [illegible] of electronic gear [illegible] ashes. If the value is 625 , jump directly to Step "43".
33		▲	Press the "Plus" key to add the number to "5" [illegible].
34	WR/	▶	Press the "WR" key 3 times for shift [illegible] "0" flashes.
35		▲	Press the "Plus" key to add the number to [illegible] flashes.
36	WR/	▶	Press the "WR" key 3 times for shift [illegible] "0" flashes.
37		▲	Press the "Plus" key to add the number to [illegible] flashes.
38	WR/	▶	Press and hold the "WR" key for 3 seconds [illegible] release it to confirm the set [illegible] digit "6" stops flashing.
39	MODE		Press the "MODE" key once, the display will [illegible] shown in the left [illegible] A" flashes.

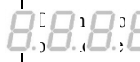
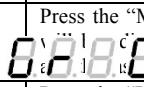
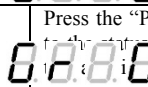
Step	Operating key	Display code	Description
40		▼	Press the "Minus" key to minus the number to "3" flashes.
41	**WR/**	▶	Press the "WR" key once for shift setting, and
42		▼	Press the "Minus" key to minus the number to "0" flashes.
43	**WR/**	▶	Press and hold the "WR" key and enter the parameter "Power-on auto enable", and the the number is "1",
44		▼	Press the "Plus" key to add the number to "1" flashes.
45	**WR/**	▶	Press and hold the "WR" key for 3 seconds, then release it to confirm the set digit "1" stops flashing.
46	**MODE**		Press the "MODE" key once, the display will shown in the left "0" flashes.
47	MODE		Press the "MODE" key once, the display will shown in the left flashes.
48		▲	Press the "Plus" key to add the number to "2" flashes.
49	**WR/**	▶	Press and hold the "WR" key for 3 seconds, then release it and enter the "Save status is as shown in
50	**WR/**	▶	Press and hold the "WR" key for 3 seconds and release it. If the state in left column is over and enter the parameter saving state
51			When the driver saves the parameters, it will automatically return to the left display meters are saved. After this, just restart the servo driver.

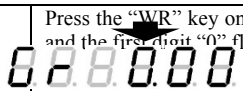
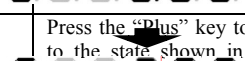
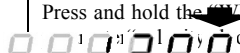
5.12 How to modify the servo gain

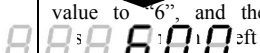
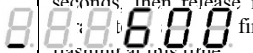
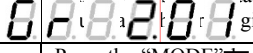
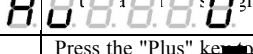
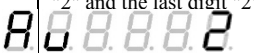
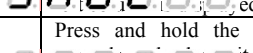
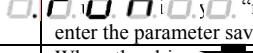
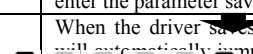
When the motor may need different servo gain under the different load operation conditions, the servo gain (position loop gain, velocity loop gain, velocity loop integral) needs to be adjusted accordingly. The approximate adjustment principle of servo gain is shown in the following table:

Motor running	Detailed description	Adjustment gain method
Motor overshoot	After the motor reaches the target position, it rushes out of the target position and then stops after returning to it.	Reduce position loop gain and velocity loop gain If the motor runs fast and the load slowness is larger, the velocity loop integral needs to be reduced.
	After the motor reaches the target position, it oscillates back and forth	Reduce velocity loop gain and velocity loop integral
There's noise in motor	There's noise during the motor running	First, reduce the velocity loop integral. If the velocity loop integral does not eliminate the noise within 10, you need to reduce the velocity loop gain.
	The motor is noisy when it stops.	Reduce position loop gain
Motor running in a lagged manner	The motor moves to the right position in a very slow velocity when it is about to reach the target position.	Increase position loop gain
	The motor does not run at the velocity required by the command.	Increase velocity loop gain Increase velocity loop integral (when the effect is not obvious after increasing the velocity loop gain)

We can explain the way how to modify the servo gain by changing the velocity loop gain (Gr 2.01) 1200 to 600 as an example.

Step	Operating key	Display code	Description
1			 n status, servo is ".
2	MODE		Press the "MODE" key once, the display  left figure shows, "0" flashes.
3		▲	Press the "Plus" key to adjust the display  in left column, and s.

4	WR/	▶	Press the "WR" key once for shift setting, and the first digit "0" flashes. 
5		▲	Press the "Plus" key to adjust the display to the state shown in left, and the first 
6	WR/	▶	Press and hold the "WR" key to enter the  op gain", and the hes at this time.

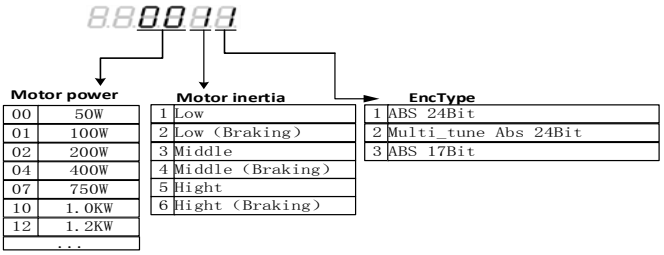
Step	Operating key	Display code	Description
7	WR/	▶	Press the "WR" key twice to perform the  and the second digit "2"
8		▼	Press the "Minus" key to decrease the value to "6", and the first digit "6"  eft figure
9	**WR/**	▶	Press and hold the "WR" key for 3 seconds, then release it, confirm the set  first digit "6" stops flashing at this time.
10	**MODE**		Press the "MODE" key once, the display will be adjusted to state as shown in left  git "2" flashes.
11	**MODE**		Press the "MODE" key once, the display will be adjusted to state as shown in left  git "0" flashes.
12		▲	Press the "Plus" key to add the number to "2" and the last digit "2" flashes. 
13	**WR/**	▶	Press and hold the "WR" key for 3 seconds, then release it and enter the  nction. If the state in  ed, "save" it.
14	**WR/**	▶	Press and hold the "WR" key for 3  it. If the state in left  "run" the driver and enter the parameter saving state
15			When the driver saves the parameters, it  mp to the left display 

			interface, and the parameters are saved. After this, just restart the servo driver.

5.13 Confirmation of driver motor parameter information

The digital panel of QXM series servo driver allows for querying the current parameter information. Through the digital panel, you may view or call the factory parameters of our released motors.

The motor identification code is a four-digit decimal number. The meaning of the corresponding digit of the serial number is as follows:



00	50W
01	100W
02	200W
04	400W
07	750W
10	1.0KW
12	1.2KW
...	

1	Low
2	Low (Braking)
3	Middle
4	Middle (Braking)
5	Hight
6	Hight (Braking)

1	ABS 24Bit
2	Multi_tune Abs 24Bit
3	ABS 17Bit

The operating steps to view the current parameter serial number can be as follows:

Note: Please refer to the appendix “Motor Identification Code Correspondence Table” for the identification code corresponding to the specific motor.

Step	Operating key	Display code	Description
1			
2	**MODE**		Press the MODE key once to switch to the state displayed in left column, and the digit “0” flashes.
3	**INC**		Press the INC key to adjust the [illegible] left, and the [illegible]
4	**ENTER**		Press and hold the “WR” key for 3 seconds and then release it. The digital tube displays the information shown in left column. [illegible] ition of the [illegible] 50W low inertia 24bit absolute value single turn (without brake) can then be obtained.

6 Alarm Fault Handling

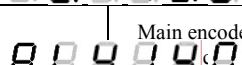
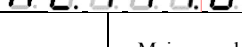
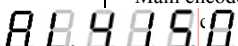
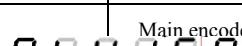
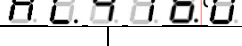
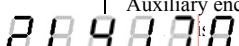
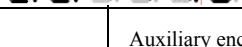
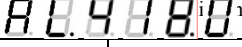
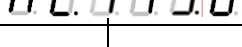
6.1 Alarm code list

No.	Hex alarm code		Alarm description
	Decimal alarm code	Hex alarm code	
1	1001	AL3E90 	arm
2	1003	AL3EB0 	connected
3	1006	AL3EE0 	nected
4	1007	AL3EF0 	
5	1008	AL3F00 	igh
6	1009	AL3F10 	w
7	1010	AL3F20 	Internal power voltage of the
8	1011	AL3F30 	Internal power voltage of the
9	1013	AL3F50 	o high
10	1014	AL3F60	Phase B current too high

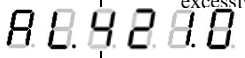
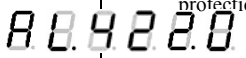
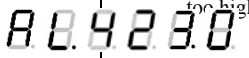
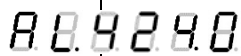
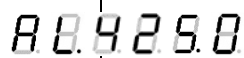
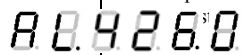
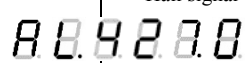
No.	Hex alarm code		Alarm description
	Decimal alarm code	Hex alarm code	

11	1015	AL3F70	Phase C current too high
12	1018	AL3FA0	IPM temperature too high
13	1019	AL3FB0	Velocity too high
14	1020	AL3FC0	Position error overrun
15	1026	AL4020	Auxiliary encoder not connected
16	1027	AL4030	IPM fault
17	1028	AL4040	Main encoder not supported
18	1019	AL4050	Auxiliary encoder not supported
19	1032	AL4080	Trajectory shaping is prohibited in the revolution mode
20	1035	AL40B0	Main encoder disconnected
21	1036	AL40C0	Motor reference current too high
22	1042	AL4120	Backup battery low voltage alarm

No.	Hex alarm code		Alarm description
	Decimal alarm code	Hex alarm code	

23	1043	AL4130 	Encoder data CRC check error
24	1044	AL4140 	Main encoder phase A connected
25	1045	AL4150 	Main encoder phase B connected
26	1046	AL4160 	Main encoder phase Z connected
27	1047	AL4170 	Auxiliary encoder phase connected
28	1048	AL4180 	Auxiliary encoder phase connected
29	1049	AL4190 	Auxiliary encoder phase connected
35	1050	AL41A0 	tor overload
30	1051	AL41B0 	MODBUS disconnection protection
31	1052	AL41C0 	IDE program error
32	1053	AL41D0 	Homing program error

No.	Hex alarm code		Alarm description
	Decimal alarm code	Hex alarm code	
33	1054	AL41E0 	Jog mode commutation error

34	1057	AL4210 	Pulse input speed too excessive
35	1058	AL4220 	RS232 disconnection protection
36	1059	AL4230 	Motor PTC temperature too high
37	1060	AL4240 	DSP data abnormal
38	1061	AL4250 	I2t overload
39	1062	AL4260 	Motor phase sequence error
40	1063	AL4270 	Hall signal wrong

6.2 Reason and handling of fault alarm

The following table lists the causes and handling of the fault alarm. If the fault still can’t be cleared, please contact our technical department.

Alarm code	Alarm content	Cause	Verification method	Treatment measures
AL3E90	**Emergency stop alarm**	Emergency stop signal is valid	Check if the emergency stop function of input port is on Check if the emergency stop has input	Confirm I/O configuration parameters Confirm that the signal is valid in I/O configuration
AL3EB0	**Main encoder not connected**	Motor encoder is not connected to the EN1 port	Check the connection of motor encoder	Connect the motor encoder cable to EN1 port
		Incorrect motor encoder wiring	Check the pin definitions for the motor encoder	Connect the motor encoder according to the correct definition
		Main encoder setting does not match the actual model of the motor encoder	Check the settings of main encoder	Change to correct encoder type through the host computer debugging software
AL3EE0	**Hall input not connected**	Rotary motor encoder is not connected to the EN1 port	Check the connection of motor encoder	Re-connect the line properly
		The Hall input port of the linear motor is not properly connected to the EN2 port	Check the Hall input connection mode	Re-connect the line properly
		Motor encoder cable does not match the actual motor encoder	Check the wiring of the motor encoder pins	Connect the motor encoder according to the correct definition
		Main encoder setting does not match the actual model of the motor encoder	Check the settings of main encoder	Change to correct encoder type through the host computer debugging software
		The commutation mode is set to incremental with Hall for a motor without Hall	Check the commutation mode	Change to correct commutation mode through the host computer debugging software
AL3EF0	**Motor stall**	Overload	Re-measure the load	Replace with motor or driverof appropriate capacity

		Motor shaft is jammed	Check the motor of mechanical structure is stuck	Repair the mechanical structure
AL3F00	**Bus voltage too high**	Main input voltage is too high	Check input AC voltage	Ensure that the input voltage is AC 200V-230V
		The motor decelerates too fast and the braking resistor size is too small	Confirm motor deceleration and brake resistor specifications	Choose the right braking resistor
		Internal circuit of driver is abnormal		Replace the driver

Alarm code	Alarm content	Cause	Verification method	Treatment measures
AL3F10	**Bus voltage too low**	Main power input voltage is too low	Check input AC voltage	Ensure that the input voltage is AC 200V-230V
		Internal circuit of the driver is defective		Replace the driver
AL3F20	**The internal power supply voltage of the driver is too high**	Main power input voltage is too high	Check input AC voltage	Ensure that the input voltage is AC 200V-230V
		The internal circuit of the driver is defective		Replace the driver
AL3F50	Phase A current is too high	Poor contact between the driver and UVW wiring of the motor	Check the wiring of motor power line	Install the motor power line firmly
		Motor encoder feedback problem	Check if the motor encoder feedback is interrupted during operation	Check if the encoder cable is in good condition Add magnetic ring for anti-interference
AL3F60	Phase B current is too high	Poor contact between the driver and UVW wiring of the motor	Check the wiring of motor power line	Install the motor power line firmly
		Motor encoder feedback problem	Check if the motor encoder feedback is interrupted during operation	Check if the encoder cable is in good condition Add magnetic ring for anti-interference
AL3F70	Phase C current is too high	Poor contact between the driver and UVW wiring of the motor	Check the wiring of motor power line	Install the motor power line firmly
		Motor encoder feedback problem	Check if the motor encoder feedback is interrupted during operation	Check if the encoder cable is in good condition Add magnetic ring for anti-interference
AL3FA0	IPM temperature	The operating	Check the ambient	Please stop

	too high	temperature of the driver is too high	operating temperature of the driver	immediately and disconnect the power
AL3FB0	**Velocity too high**	Velocity exceeds the maximum velocity limit		Reduce motor velocity
AL3FC0	Position error exceeds limit	Acceleration / deceleration setting is too high	Check the control command acceleration / deceleration	Reduce the acceleration /deceleration
		Improper servo parameter setting (position loop gain)	Check position loop gain	Re-adjust the gain of position loop
		Poor contact between the driver and UVW wiring of the motor	Check motor power line	Install the power line properly
		Internal circuit problem of the driver / motor encoder	Check the motor encoder line	Install the motor encoder line in the correct way
Alarm code	Alarm content	Cause	Verification method	Treatment measures
AL4020	**Auxiliary encoder not connected**	Auxiliary encoder is not connected to the EN2 port	Check the connection of motor encoder	Connect the auxiliary encoder cable to EN2 port
		Incorrect auxiliary encoder wiring	Check the pin definitions for the motor encoder	Connect the auxiliary encoderaccording to the correct definition
		Auxiliary encoder setting does not match the actual model of the motor encoder	Check the settings of auxiliary encoder	Change to correct encoder type through the host computer debugging software
AL4030	**IPMalarm**	Power module of the driver is overheated		Stop immediately and wait for it cooling down
		Internal circuit of driver is abnormal		Replace the driver
		Open phase or short circuit of driverand UVW of the motor	Check the wiring of motor power lines	Install the power line properly Replace the motor
AL4040	**Main encoder not supported**	Servo and motor do not match	Confirm that the encoder type of the servo setting is compatible with the motor model.	Perform a restore factory parameter operation
		Poor connection between servo and motor	Check wiring	Connect the cable correctly
AL4050	**Auxiliary encoder not supported**	Servo is compatible with the auxiliary encoder	Check if the auxiliary encoder type of the servo setting is the same	Set the servo parameters correctly

			as the auxiliary encoder that is actually connected.	
		Poor connection between driver and auxiliary encoder	Check wiring	Connect the cable correctly
AL4080	**Trajectory shaping is prohibited in the revolution mode**	Trajectory shaping is turned on while the rotation mode is turned on.	Check parameters	Rotary mode and trajectory shaping cannot be turned on simultaneously
AL40B0	**Main power supply is disconnected**	Main power input disconnected	Check the input power cord of the main power source	Connect the cable correctly
AL40C0	**Motor reference current too high**	Motor encoder wiring error	Check the motor encoder line	Install the motor encoder line in the correct way
		Wrong sequence of phase U, V and W of motor	Check motor power lines	Install the power line properly
		Motor electrical angle incorrect	Check if the angle deviation of the motor after commutationis less than 10	Re-adjustcommutation
AL4120	Backup battery low voltage alarm	Absolute motor installed for the first time		Perform a battery alarm clearing operation
		The battery cable is disconnected or the battery runs out.	Check battery wiring and voltage (3.5V)	Correct wiring Battery replacement
Alarm code	Alarm content	Cause	Verification method	Treatment measures
AL4130	Encoder data CRC check error	Incorrect wiring of the motor encoder	Check the motor encoder line	Install the motor encoder line in the correct way
		Incorrect wiring of the motor encoder	Check the motor encoder line	Install the motor encoder line in the correct way
AL4140	**Main encoder phase A disconnected**	Motor encoder line phase A disconnected	Check phase A wiring of motor encoder	Re-connect the line properly
		Main encoder setting does not match the actual model of the motor encoder	Check the settings of main encoder	Change to correct encoder type
AL4150	**Main encoder phase B disconnected**	Motor encoder line phase B disconnected	Check phase A wiring of motor encoder	Re-connect the line properly
		Main encoder setting does not match the	Check the settings of main encoder	Change to correct encoder type

		actual model of the motor encoder		
AL4160	**Main encoder phase Z disconnected**	Motor encoder line phase Z disconnected	Check phase A wiring of motor encoder	Re-connect the line properly
		Main encoder setting does not match the actual model of the motor encoder	Check the settings of main encoder	Change to correct encoder type
AL4170	**Auxiliary encoder phase A disconnected**	Auxiliary encoder line phase A disconnected	Check phase A wiring of auxiliary encoder	Re-connect the line properly
		Auxiliary encoder setting does not match the actual model of the motor encoder	Check the settings of auxiliary encoder	Change to correct encoder type through the host computer debugging software
AL4180	**Auxiliary encoder phase B disconnected**	Auxiliary encoder line phase B disconnected	Check phase B wiring of auxiliary encoder	Re-connect the line properly
		Auxiliary encoder setting does not match the actual model of the motor encoder	Check the settings of auxiliary encoder	Change to correct encoder type through the host computer debugging software
AL4190	**Auxiliary encoder phase Z disconnected**	Auxiliary encoder line phase Z disconnected	Check phase Z wiring of auxiliary encoder	Re-connect the line properly
		Auxiliary encoder setting does not match the actual model of the motor encoder	Check the settings of auxiliary encoder	Change to correct encoder type through the host computer debugging software
AL41A0	**Braking resistor overload**	Brake resistor specification is too small or the damping resistor is not connected		Replace the appropriate specifications
AL41B0	**MODBUS disconnection protection**	CN2/CN3 line disconnected	Check RS485 wiring	Reconnect the cable properly
AL41C0	**IDE program error**	Program is incorrect in user programming	Check the IDE program	Modify the IDE program
AL41D0	**Homing program error**	Auto homing error	Check HomingStat parameter	Processaccording to HomingStat
Alarm code	Alarm content	Cause	Verification method	Treatment measures
AL41E0	**Jog mode commutation error**	Poor encoder wiring	Check the encoder cable	Connect the motor encoder cable
		The motor power line isn't connected properly and is shorted to the housing	Check the wiring of each pin of the motor power line	Connect the motor power line properly

AL4210	**Pulse input speed is too excessive**	External command pulse input is too large	Check the external command pulse input frequency	Reduce the external command pulse frequency
AL4220	**RS232 disconnection protection**	Communication is disconnected when control servo actions using QX PC Suite debugging software to	Check the debugging cable	Reconnect the servo driver
AL4230	**PTC temperature of motor is too high**	Motor temperature is too high	Confirm motor temperature	Power off, and wait for the motor to cool before using
AL4240	**DSPdata is abnormal**	Appears when downloading parameters	It is normal if it appears when downloading parameters	Restart the driver
		Internal exception of driver		Replace the driver
AL4250	**I2toverload**	Motor overload	Check if the motor is stuck or the force applied not enough	Check the machine or replace the motor with a higher torque
AL4260	**Motor phase sequence test error**	Poor encoder wiring	Check the encoder line	Connect the motor encoder cable
		The motor power line isn't connected properly and is shorted to the housing	Check the wiring of each pin of the motor power line	Connect the motor encoder line properly
AL4270	**Hall signal is wrong**	Poor Hall signal connection	Check Hall cable	Make sure the signal cable is connected correctly

6.3 Causes of failure and treatment measures determined through motor action and state

The causes of failure and treatment measures determined through motor action and state are as follows

Fault content	Cause	Verification method	Treatment measures
Power is turned on but the servo motor is not working	Control power is not connected	Check if the digital tube has display Measure the voltage between terminals of control power supply	Check if the control power supply is connected correctly, and if the input power is AC190V-230V
	Main power is not connected	Measure the voltage between terminals of main power supply	Check if the control power supply is connected correctly, and if the input power is AC190V-230V
	The driver did not receive an external control command	Confirm whether the operation mode matches the type of command being controlled:	1. Pulse command control selects the position mode 2. Analog control selects velocity mode or current mode
		Check if the pulse mode matches the external pulse type	1. Select 1: Pulse direction (differential) 2: Double pulse (differential) 3: AB orthogonal (differential),if the pulse line is connected with Pin 26, 27, 28 and 29 2. Select 5: Pulse direction (optocoupler) 6: Double pulse (optocoupler) 7: AB orthogonal (optocoupler),if the pulse line is connected with Pin 13, 14, 15 and 16
		Confirm whether the external command is issued	Measure external command voltage: 1. Measure whether the analog command has a corresponding voltage output. 2. The pulse command can measure whether there is a voltage change of DC3.5V or above and DC1.2V or less when the command is issued and not issued.
	No servo enable command for the servo	Confirm whether the servo enable signal is accessed	1. Confirm whether the CN1 wiring is wrong. 2. Determine the servo enable signal and 24V+ for the presence of DC24V voltage.
		Confirm whether the auto enable parameter is turned on after power-on when the servo enable signal is not connected.	Confirm if GR0.03 is 1

Fault content	Cause	Verification method	Treatment measures
Power is turned on but the servo motor is not working (Continued)	Positive /negative limit input signal remains OFF	Check the positive /negative limit input signals	Set the positive /negative limit input signals to ON
	Velocity and position mode switching and the current and position mode switching input signals are incompatible with the external control command mode	Confirm the input signals for the velocity and position mode switching and current and position mode switching	For the velocity and position mode switching, and current and position mode switching, confirm that it is velocity (current) mode when the input signal ON, and the position mode when it is OFF; and confirm whether current signal status matches current external control command
	Motor parameter sequence does not match the motor model	Check the motor model and motor parameter number	Query "8.QX Pulse Driver Motor Parameter File List" and check if motor model matches parameter number
The signal is inactive immediately after the instantaneous operation of servo motor	Motor power line wiring error	Check the wiring	The phase sequence of the motor power line needs to be consistent with the driver
	Encoder line wiring error	Check the wiring	The encoder line needs to be consistent with the driver's pin definition
The servo motor runs automatically without issuing a command	Command pulse interference	Eliminate the interference	1. Increase the parameter of "pulse direction encoder digital filter" 2. Connect the 1uF monolithic capacitor between pulses + and – in parallel 3. Add a magnetic ring on the command pulse line.
	There's offset and deviation for analog	Adjust the deviation parameter	1. Adjust the scope of the "dead zone" 2. Adjust the "compensation" parameter
Motor lag	Velocity loop gain (GR2.01) setting is too small	Confirm the setting of velocity loop gain (Gr2.01)	Increase the velocity loop gain (Gr2.01)
	Position loop gain (Gr2.00) setting is too small	Confirm the setting of position loop gain (Gr2.00)	Increase the position loop gain (Gr2.00)
	Velocity loop integral (Gr2.02)setting is too small	Confirm the setting of velocity loop integral (Gr2.02)	Increase the velocity loop integral (Gr2.02)

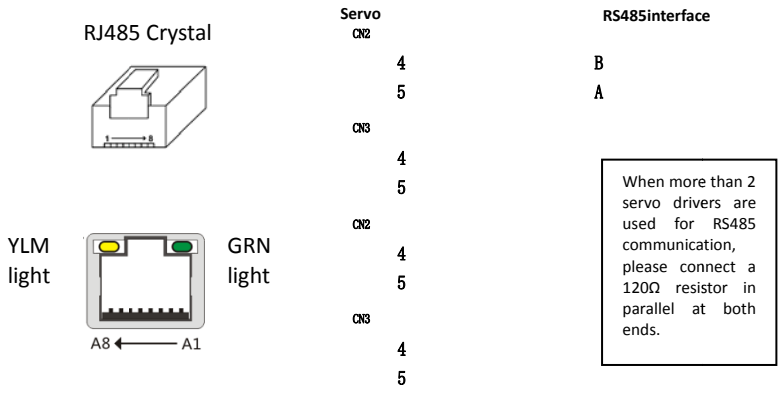
Fault content	Cause	Verification method	Treatment measures
Servo motor emits abnormal sound	Poor mechanical installation	Check if the Rotary motor is concentric with the coupling Confirm the balance of the mechanical installation	Adjust the mechanical installation
	Bearing failure	Check for sound and vibration near the bearing	Replace if there is any exception
	Mechanical vibration source	Check for foreign matter near the bearing and damage or deformation	Repair machinery part
		Check VEL [1], velref waveform for mechanical resonance	1. Eliminate mechanical resonance over 100HZ-600HZ through notch filter 2. Reduce the velocity loop gain and velocity loop integral
	Noise interference as the encoder cable is too long	Confirm the length of encoder cable	Set the length of the encoder cable to less than 20M
Velocity overshoot as start and stop is too large	Velocity loop gain(Gr2.01) setting is too big	Confirm the setting of velocity loop gain (Gr2.01)	Reduce the velocity loop gain (Gr2.01)
	Position loop gain (Gr2.00)setting is too big	Confirm the setting of position loop gain (Gr2.00)	Reduce the position loop gain (Gr2.00)
	Velocity loop integral (Gr2.02)setting is too big	Confirm the setting of velocity loop integral (Gr2.02)	Reduce the velocity loop integral (Gr2.02)
Position deviation (no alarm occurred)	Machinery and servo motor coupling failure	Check the machinery and servo coupling for slip and dislocation	Fix the coupling of machinery and servo motor
	Interference to command pulse signal line	Eliminate interference Increase filtering	1. Increase the parameter of "pulse direction encoder digital filter" 2. Connect the 1uF monolithic capacitor between pulses + and – in parallel 3. Add a magnetic ring on the command pulse line.

7 Function description of RS485 modbus

The QX series servo driver supports reading (writing) some parameters of the servo driver via RS485 modbus (please refer to Appendix “11.2 Correspondence Table of Modbus Communication Addresses and Parameter Variables” for the support parameters). It also supports RTU communication mode, and CRC check of CRC-16/Modbus X16+X15+X2+1 as well.

7.1 RS485wiring diagram

RS485 communication interface CN2/CN3				
Pin No.	**Signal name**	**Control mode**		
4	RS485B	**Position**	**Velocity**	**Torque**
5	RS485A			



1. RS485 is primarily used for MODBUS communication, and can carry out PTP communication of multiple servo drivers.
2. When multiple servos are connected in parallel, connect the terminal resistors in parallel on the RS485A and RS485B of the first servo and the last servo.
3. RS485 communication cannot be used in communication with the debugging software.

7.2 RTU packet format

1) The input format of the 06 (write into a single) command is as follows:

Output	Device address	Command	Write the high 8-bit of address	Write the low 8-bit of address
	01-FF	06	00	00-1F
	High 8-bit of lower data	Low 8-bit of lower data	Low 8-bit of CRC checker	High 8-bit of CRC checker
	00	01or 00	CRCL	CRCH
Return	If the input data is correct, the returning data and the output data are the same;			

Example: Modify the motion mode of the servo driver to 3
0x0002 motionmode motion mode
The input format is as follows:

01	06	00	02	00	03	68	0B
Device address	Command	Write the high 8-bit of address	Write the low 8-bit of address	High 8-bit of lower data	Low 8-bit of lower data	Low 8-bit of CRC checker	High 8-bit of CRC checker

The correct returning can be:

01	06	00	02	00	03	68	0B
Device address	Command	Write the high 8-bit of address	Write the low 8-bit of address	High 8-bit of lower data	Low 8-bit of lower data	Low 8-bit of CRC checker	High 8-bit of CRC checker

2)The input format of the (read holding register) 03 command is as follows:

Output	Device address	Command	Start address high 8-bit	Start address low 8-bit	Read the number of IO ports		CRClow 8-bit		CRChigh 8-bit
	01-FF	03	00	00-1F	0001-0020		CRCL		CRCH
Returning	Device address	Command	The number of returning bytes	Data 1	Data 2	Data 2	DataN	CRClow 8-bit	CRChigh 8-bit
	01-FF	03	Read IO numberX2	0001or 0000	0001or 0000	0001or 0000	0001or 0000	CRCL	CRCH

Example: Reading the position information of a multi-turn absolute encoder

0x0074	absposH	The multi-turn absolute position of multi-turn absolute encoder (high bit)	R
0x0075	absposL	The multi-turn absolute position of multi-turn absolute encoder (low bit)	R

When reading the values of absposH and absposL at the same time

The input format is as follows:

01	03	00	74	0002	84	11
Device address	Command	Start address high 8-bit	Start address low 8-bit	Read the number of IO ports	CRC low 8-bit	CRC high 8-bit

The correct returning can be:

01	03	04	00	01	C9	F9	3A	D1
Device address	Command	The number of returning bytes	Data 1	Data 2	Data 2	Data N	CRClow 8-bit	CRChigh 8-bit

Data 1 to N are the sum of multi-turn absolute encoders.

8 Maintenance and Inspection

Please perform a periodical maintenance and inspection to the driver and motor so as to use safely and easily.

◆Notice of maintenance and inspection

◆Inspection item and period

The routine inspection and periodical inspection should be done as per follow requirements:

Type	Inspection period	Inspection item
Routine inspection	Routine	● Check use temperature, humidity, dust, foreign matter, etc. ● Check to see if there is abnormal vibration and noise ● Check to see if power voltage is normal ● Check to see if there is foreign odor ● Check to see if there is fiber thread stick to the vent opening ●Check the clean state of front of driver and connector. ● Check to see if wire is damaged ● Check to see if connecting part of the device and equipment is loose or if pin and body are separated ● Check to see if there is any foreign matter in loading
Peri odical inspection	1 year	● Check to see if fastening position become loose ● Check to see if there is any over-heat trace ● Check to see if terminal block is damaged ● Check to see if fastening position of terminal block becomes loose

9 Appendix

9.1 External regenerative resistor

When the motor decelerates or stops normally, the energy generated by the brake will be fed back through the inverter circuit to the DC bus, which is absorbed by the built-in or external

regenerative resistor. This energy-saving braking method is called “regenerative braking”.

QX##02N#-#~QX##06N#-# series drivers are not equipped with built-in regenerative resistors but support external regenerative resistors.

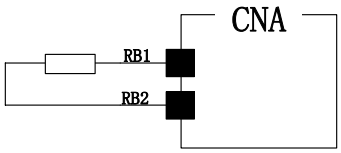
9.1.1 Selecting capacity of external regenerative resistor

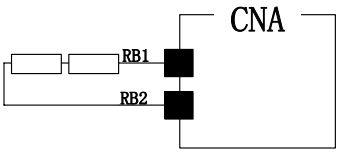
Drive model	Motor instantaneous velocity	≦3000 r/min	>3000 r/min	≦3000 r/min	>3000 r/min	≦3000 r/min	>3000 r/min
	Deceleration time	≦100ms	≦ 100ms	100ms-200ms	100ms-200ms	>200ms	>200ms
QXMP02N#-#	Capacity of external regenerative resistor	Not required	50Ω 60W	Not required	50Ω 60W	Not required	50Ω 60W
QXMP04N#-#		Not required	50Ω 120W	Not required	50Ω 120W	Not required	50Ω 120W
QXMP05N#-#		50Ω 60W	50Ω 120W	50Ω 60W	50Ω 120W	Not required	50Ω 120W
QXMP06N#-#		50Ω 60W	50Ω 120W	50Ω 60W	50Ω 120W	Not required	50Ω 120W
QXMP10N#-#		Built-in	30Ω 750W	Not required	30Ω 470W	Built-in	30Ω 470W
QXMP15N#-#		Built-in	20Ω 1KW	Not required	20Ω 1KW	Built-in	20Ω 1KW

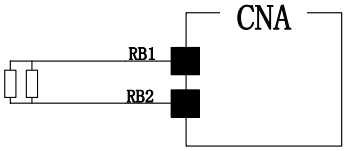
[Note]

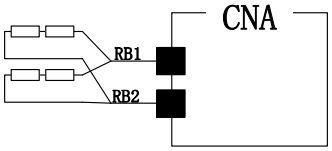
1. The resistance values of external regenerative resistors in the table need to be configured in accordance with the requirements, and the power can be greater than but mustn’t be lower than the value in the table.
2. External regenerative resistors should be purchased separately.
3. The specifications of the external regenerative resistor in the table are tested based on the external input voltage AC220V. When the voltage is greater than AC220V, please amplify the resistor power accordingly.

9.1.2 Connection of external regenerative resistor

<table>
<tr><td>Connection of 1 resistor</td><td>Series connection of 2 resistors</td></tr>
<tr><td> 

✓ This connection is used when one resistor can meet the adaptation requirements</td><td> 

✓ This connection is used when one resistor can't meet the adaptation requirements
✓ The resistors are connected in series, the resistance increases and the power decreases</td></tr>
<tr><td>Association of 2 resistors</td><td>Series connection and association of 4 resistors</td></tr>
<tr><td> 

✓ This connection is used when one resistor can't meet the adaptation requirements
✓ The resistors are associated, the resistance decreases and the power increases</td><td> 

✓ This connection is used when two resistors can't meet the adaptation requirements</td></tr>
</table>

[Note]

1. The connection line must be flame-retardant cable or cable with fire-resistant treatment, and wiring shouldn't be exposed to external regeneration resistor;
2. The length of connection line should be less than 2m;
3. Regenerative resistor should be installed on metal or a material that is resistant to high temperature and easy to dissipate heat.

9.2 Correspondence table of Modbus communication address and parameter variables

Basic parameters				
Address	Variable	Parameter name	Attribute	Description
0x0000	OperationMode	Operation mode	R/W	1. Torque mode; 2. Velocity mode; 3. Position mode;
0x0001	ControlMode	Control mode	R/W	
0x0002	MotionMode	Motion mode	R/W	0. JOG mode; 1. PTP mode (one-way); 2. PTP mode (two-way); 3. Indirect mode; 4. Contour mode;
0x0003	PolePrs	Pair of poles	R/W	
0x0004	EncType	Encoder type	R/W	
0x0005	EncResH	Encoder pulse number (high bit)	R/W	
0x0006	EncResL	Encoder pulse number (low bit)	R/W	
0x0007	EncFilt	Encoder filter coefficient	R/W	
0x0008	PDMode	Pulse mode (PD/CWCCW/AB)	R/W	1. Pulse + direction (differential); 2, double pulse (differential); 5. Pulse + direction (optocoupler); 6. Double pulse (optocoupler);
0x0009	PDFactH	Pulse gear ratio (numerator) (high bit)	R/W	
0x000A	PDFactL	Pulse gear ratio (numerator) (low bit)	R/W	
0x000B	PDFactDenH	Pulse gear ratio (denominator) (high bit)	R/W	
0x000C	PDFactDenL	Pulse gear ratio (denominator) (low bit)	R/W	

0x000D	RegenOn	Brake resistor turn-on voltage	R/W	Unit (V)
0x000F	RegenOff	Braking resistor turn-off voltage	R/W	Unit (V)
0x0011	BrkOnDly	Brake open delay	R/W	Unit (ms)
0x0012	BrkOffDly	Brake off delay	R/W	Unit (ms)
0x0013	BrkSpeedH	Brake velocity threshold (high bit)	R/W	Unit (unit/s)

Basic parameters				
Address	Variable	Parameter name	Attribute	Description
0x0014	BrkSpeedL	Brake velocity threshold (low bit)	R/W	Unit (unit/s)
0x0015	ModbusAddr	Modbus address	R/W	
0x0016	ModbusBaud	Modbus baud rate	R/W	Baudrate setting: 1.9600Hz 2.19200Hz 3.38400Hz 4.115200Hz
0x0017	ModbusDisTime	Modbus disconnection delay protection time	R/W	Unit (ms)
0x001D	PosGain	Position loop gain	R/W	
0x001E	AccFFW	Acceleration feedforward	R/W	
0x001F	PosFFW	Position feedforward	R/W	
0x0020	VelGain	Velocity loop gain	R/W	
0x0021	VelKi	Velocity loop integral	R/W	
0x0022	CurrGain	Current loop gain	R/W	
0x0023	CurrKi	Current loop integral	R/W	
0x0024	Stiffness	Stiffness	R/W	
0x002E	AbsTrgtH	Absolute position of the target (high bit)	R/W	
0x002F	AbsTrgtL	Absolute position of the target (low bit)	R/W	

0x0030	RelTrgtH	Relative position of the target (high bit)	R/W	
0x0031	RelTrgtL	Relative position of the target (low bit)	R/W	
0x0032	SpeedH	Velocity setting (high bit)	R/W	
0x0033	SpeedL	Velocity setting (low bit)	R/W	
0x0034	AccelH	Acceleration (high bit)	R/W	
0x0035	AccelL	Acceleration (low bit)	R/W	
0x0036	DecelH	Deceleration (high bit)	R/W	
0x0037	DecelL	Deceleration (low bit)	R/W	
0x0038	EmrgDecH	Emergency stop deceleration (high bit)	R/W	

Control Parameters				
Address	Variable	Parameter name	Attribute	Description
		Emergency stop deceleration (low bit)		
		Smooth fillet factor		
		Repeat wait time (high bit)		
		Repeat wait time (low bit)		
		Absolute position highest bit		ABSPOS= AbsPosHH<<48bit+ AbsPosLH<<32bit + AbsPosHL<<16bit+ AbsPosLL (with Symbol)
		Absolute position second-highest bit		
		Absolute position second-lowest bit		
		Absolute position lowest bit		
		Error code		
		Operating status		
		Operation sign		
		Location arrival status		
		Pulse position (high bit)		
		Pulse position (low bit)		
		Position given (high bit)		

		Position given (low bit)		
		Position feedback (high bit)		
		Position feedback (low bit)		
		Position error (high bit)		
		Position error (low bit)		
		Auxiliary encoder position (high bit)		
		Auxiliary encoder position (low bit)		
		Pulse velocity (high bit)		
		Pulse velocity (low bit)		

State Parameters				
Addres	Variable	Parameter name	Attrib	Description
		Velocity given (high bit)		
		Velocity given (low bit)		
		Current velocity (high bit)		
		Current velocity (low bit)		
		Current reference (high bit)		
		Current reference (low bit)		
		Motor current (high bit)		
		Motor current (low bit)		
		Bus voltage		Unit (V)
		Radiator temperature		
		Position reach accuracy setting		
		Position reach time setting		
		Drive model		
		Hardware version		
		DSP software version		
		FPGA version		

		Single-turn absolute position (high bit)		
		Single-turn absolute position (low bit)		
		The number of turns		

I/OParameters				
Address	Variable	Parameter name	Attrib	Description
		Input port status		
		Input port logic		
		Input port 1 function		
		Input port 2 function		
		Input port 3 function		
		Input port 4 function		
		Input port 5 function		
		Input port 6 function		
		Input port 7 function		
		Input port 8 function		
		Output port status		
		Output port logic		
		Output port 1 function		
		Output port 2 function		
		Output port 3 function		
		Output port 4 function		
		Output port 5 function		
		Output port 6 function		
		Output port 7 function		
		Output port 8 function		
		Velocity/torque analog input port status		
		Analog dead zone (velocity mode)		
		Analog offset (velocity mode)		

		Analog gain (velocity mode)		
		Analog filter coefficient (velocity mode)		

I/OParameters				
Addres	Variable	Parameter name	Attribu	Description
		Internal/external analog control switching		
		Internal analog value		
		Velocity/torque analog input port status		
		Analog dead band (torque mode)		
		Analog offset (torque mode)		
		Analog gain (torque mode)		
		Analog filter coefficient (torque mode)		
		Analog control direction (velocity mode / torque mode)		

Control Command				
Addres	Variable	Parameter name	Attribu	Description
		Motor enable off	Comm	The command will work by writing any data to the address
		Motor enable	Comm	
		Start operation	Comm	
		Stop operation	Comm	
		Emergency stop	Comm	
		Stop repeatedmotion	Comm	
		Set the current position value	Comm	
		Clear fault	Comm	
		Save parameter	Comm	

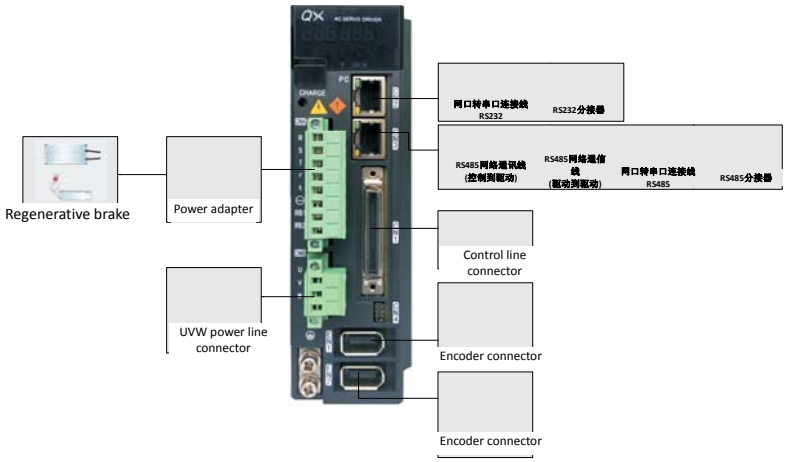
Protection Parameters				
Addres	Variable	Parameter name	Attrib	Description
		Continuous current (high bit)		
		Continuous current (low bit)		
		Peak current (high bit)		
		Peak current (low bit)		
		Peak current protection time		
		Maximum velocity (high bit)		
		Maximum velocity (low bit)		
		Maximum position error (high bit)		
		Maximum position error (low bit)		
		Positive limit position (high bit)		
		Positive limit position (low bit)		
		Reverse limit position (high bit)		
		Reverse limit position (low bit)		
		Maximum phase current (high bit)		
		Maximum phase current (low bit)		
		Locked-rotor current (high bit)		
		Locked-rotor current (low bit)		
		Locked-rotorvelocity (high bit)		
		Locked-rotorvelocity (low bit)		
		Locked-rotor time		
		Minimum bus voltage		Unit (V)
		Maximum bus voltage		Unit (V)
		Radiator temperature protection value		
		Maximum operating velocity in torque mode (high bit)		
		Maximum operating velocity in torque mode (low bit)		

Debug and IDE parameters				
Addres	Variable	Parameter name	Attribu	Description
		By using the reserved parameters of IDE programming, it can be used as a data register		Data length 32bit

Homing and point control parameters				
Address	Variable	Parameter name	Attribute	Description
		Homing executing state		
		Homingmode selection		
		Homing application selection		
		Homing acceleration high-bit		
		Homing acceleration low-bit		
		1st homing velocity high-bit		
		1st homing velocity low-bit		
		2nd homing velocity high-bit		
		2nd homing velocitylow-bit		
		Homing deviation positon high-bit		
		Homing deviation positonlow-bit		
		Homing switch		0: Close 1: Open
		Relative to absolute control switch		0:Relative position control 1: Absolute position control 2: Non-IO point control
		Absolute position mode		0: Forward 1: Reverse 2: Principle of proximity

9.3 Parts list of driver

List of QXM-B/QXL-B/QXR-B Driver Accessories



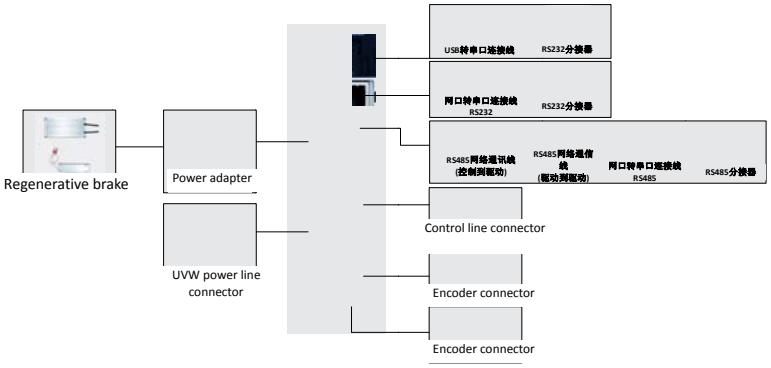
网口转串口连接线 R5232	Network port to serial port cable RS232
R5232 分接器	R5232 demultiplexer
RS485 网络通讯线 (控制到驱动)	RS485 network communication line (control to driver)
RS485 网络通讯线 (驱动到驱动)	RS485 network communication line (driver to driver)

Classification	Name	Model	Specification	Corresponding port	Figure
Plug	Encoder connector	E59A2110001	SM-10P 10-bit, Double layer, split type	EN1 EN2	
	Power connector	E5901208102	2EDGKM-5.08-08P 8-bit, single layer, bentpin, green	CNA	

	Control wire connector	E63AG502101	MY11-50T, Male, 50-pin, half gold, pin spacing: 1.27mm	CN1	
	UVW power line connector	E5901203103	3-bit, single layer, female pin spacing 5.08 (threaded female),	CNB	

Classification	Name	Model	Specification	Corresponding port	Figure
QX PC Suitedebugging software debugging line	RS232 demultiplexer	L1315200002	UT-880 1M	CN2 CN3	
	Network port to serial port cable RS232	L011029M8P2	0.5M	CN2 CN3	
RS485 and PC communication line	RS485 demultiplexer	L1315200001	UT-890,1M	CN2 CN3	
	Network port to serial port cable RS485	L01011019	0.5M	CN2 CN3	
RS485 communication line	RS485 network communication line (control to drive)	L08011011	1.5M	CN2 CN3	
	RS485network communication line (drive to drive)	-	0.2M	CN2 CN3	
Others	Battery	E31A3V60002	Lithium battery, **3.6V, 1200mAh**	-	-
	Regenerative braking	Select as required	-	-	-

List of QXM-A2 Driver Accessories



Classification	Name	Model	Specification	Corresponding port	Figure
Plug	Encoder connector	E29017012	10 cores, terminal pitch 0.8mm, overall black, wire-to-board	X5	
	Encoder connector	E29011025	6 cores, terminal pitch 2.56mm, overall grey, wire-to-board	X6	
	Power connector	E29011029	5-digit, foot spacing 5.08mm, of forward direction type, X key control, male, gold plated	XA	
	Control wire connector	E63AG502101	MY11-50T, male, 50 pins, half gold, foot spacing: 1.27mm	X4	

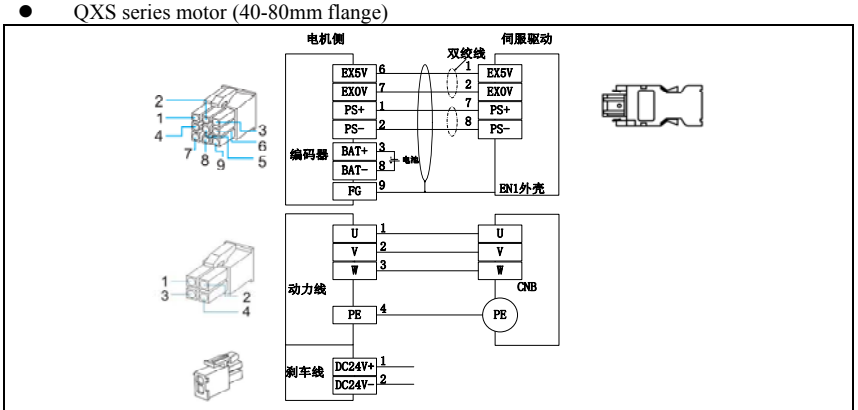
	UVW power line connector	E29011028	6 digit, foot spacing 5.08mm, of forward direction type,, X key controlled, male, gold plated	XB	

Classification	Name	Model	Specification	Corresponding port	Figure
QXPCSuite debugging software debugging line	RS232demultiplexer	L1315200002	UT-880 1M	X2A X2B	
	USB to serial port cable	L01011020	Data transmission lineADT-D9MmimiUSB	X1	
	Network port to serial port cable RS232	L011029M8P2	0.5M	X2A X2B	
RS485 and PC communication line	RS485 demultiplexer	L1315200001	UT-890, 1M	X2A X2B	
	Network port to serial port cable RS485	L01011019	0.5M	X2A X2B	
RS485communication line	RS485 network communication line (drive to drive)	L08011011	1.5M	X2A X2B	
	RS485network communication line (control to drive)	-	0.2M	X2A X2B	

Others	Battery	E31A3V60002	Lithium battery, **3.6V, 1200mAh**	-	-
	Regenerative braking	Select as required	-	-	-

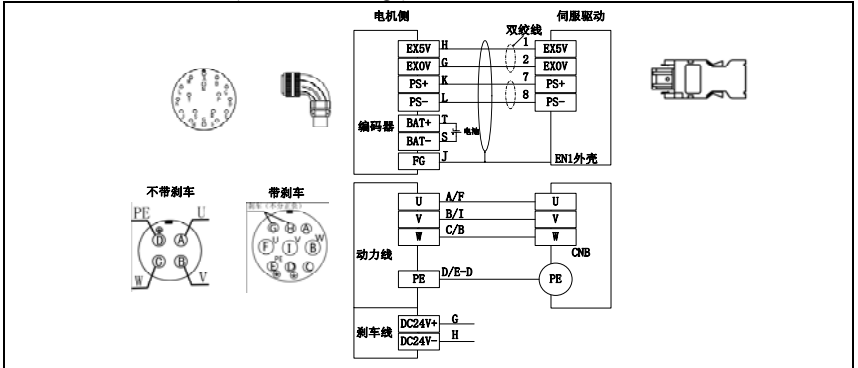
9.4 Type driver and motor wiring diagram

- QXS series motor (40-80mm flange)



[Note]The absolute encoder battery is connected between the 3pin and 8pin on the motor side (as shown in the figure)

- QXS series motor (130-180mm flange)



[Note]The absolute encoder battery is connected between the T-pin and S-pin on the motor side (as shown in figure)

9.5 Correspondence Table of Motor Identification Code

Driver Model	Motor Model	ID	Driver Model	Motor Model	ID
QXMP01NA-B	QXSS-04010EA0	0112	QXMP04NA-B	QXSH-06040EA0	0452
QXMP01NA-B	QXSS-04010EA1	0122	QXMP04NA-B	QXSH-06040EA1	0462
QXMP01NA-B	QXSS-04010EB0	0113	QXMP04NA-B	QXSH-06040EB0	0453
QXMP01NA-B	QXSS-04010EB1	0123	QXMP04NA-B	QXSH-06040EB1	0463
QXMP01NA-B	QXSS-04010EI0	0111	QXMP04NA-B	QXSH-06040EI0	0451
QXMP01NA-B	QXSS-04010EI1	0121	QXMP04NA-B	QXSH-06040EI1	0461
QXMP02NA-B	QXSS-06020EA0	0212	QXMP05NA-B	QXSH-08075EA0	0752
QXMP02NA-B	QXSS-06020EA1	0222	QXMP05NA-B	QXSH-08075EA1	0762
QXMP02NA-B	QXSS-06020EB0	0213	QXMP05NA-B	QXSH-08075EB0	0753
QXMP02NA-B	QXSS-06020EB1	0223	QXMP05NA-B	QXSH-08075EB1	0763
QXMP02NA-B	QXSS-06020EI0	0211	QXMP05NA-B	QXSH-08075EI0	0751
QXMP02NA-B	QXSS-06020EI1	0221	QXMP05NA-B	QXSH-08075EI1	0761
QXMP04NA-B	QXSS-06040EA0	0412	QXMP06NA-B	QXSH-08100EA0	1052
QXMP04NA-B	QXSS-06040EA1	0422	QXMP06NA-B	QXSH-08100EA1	1062
QXMP04NA-B	QXSS-06040EB0	0413	QXMP06NA-B	QXSH-08100EB0	1053
QXMP04NA-B	QXSS-06040EB1	0423	QXMP06NA-B	QXSH-08100EB1	1063
QXMP04NA-B	QXSS-06040EI0	0411	QXMP06NA-B	QXSH-08100EI0	1051
QXMP04NA-B	QXSS-06040EI1	0421	QXMP06NA-B	QXSH-08100EI1	1061
QXMP06NA-B	QXSS-08075CA0	0812	QXMP06NA-B	QXSH-13085BA0	0952
QXMP06NA-B	QXSS-08075CB0	0813	QXMP06NA-B	QXSH-13085BA1	0962
QXMP06NA-B	QXSS-08075CI0	0811	QXMP06NA-B	QXSH-13085BB0	0953
QXMP06NA-B	QXSS-08075EA0	0712	QXMP06NA-B	QXSH-13085BB1	0963
QXMP06NA-B	QXSS-08075EA1	0722	QXMP06NA-B	QXSH-13100CA0	1152
QXMP06NA-B	QXSS-08075EB0	0713	QXMP06NA-B	QXSH-13100CA1	1162
QXMP06NA-B	QXSS-08075EB1	0723	QXMP06NA-B	QXSH-13100CB0	1153
QXMP06NA-B	QXSS-08075EI0	0711	QXMP06NA-B	QXSH-13100CB1	1163
QXMP06NA-B	QXSS-08075EI1	0721	QXMP02NA-B	QXSH-06020EB1	0263
QXMP02NA-B	QXSH-06020EA0	0252	QXMP02NA-B	QXSH-06020EI0	0251
QXMP02NA-B	QXSH-06020EA1	0262	QXMP02NA-B	QXSH-06020EI1	0261
QXMP02NA-B	QXSH-06020EB0	0253			

Driver Model	Motor Model	ID	Driver Model	Motor Model	ID
QXMP10NA-B	QXSH-13130BA0	1352	QXMP15NA-B	QXSH-13380CA0	3852
QXMP10NA-B	QXSH-13130BA1	1362	QXMP15NA-B	QXSH-13380CA1	3862
QXMP10NA-B	QXSH-13130BB0	1353	QXMP15NA-B	QXSH-13380CB0	3853
QXMP10NA-B	QXSH-13130BB1	1363	QXMP15NA-B	QXSH-13380CB1	3863
QXMP10NA-B	QXSH-13150CA0	1552	QXMP15NA-B	QXSM-13200CB0	2033
QXMP10NA-B	QXSH-13150CA1	1562	QXMP15NA-B	QXSM-13200CB1	2043
QXMP10NA-B	QXSH-13150CB0	1553	QXMP15NA-B	QXSM-13200CA0	2032
QXMP10NA-B	QXSH-13150CB1	1563	QXMP15NA-B	QXSM-13200CA1	2042
QXMP10NA-B	QXSM-13150CA0	1532	QXMP15NA-B	QXSH-18270BB0	2753
QXMP10NA-B	QXSM-13150CA1	1542	QXMP15NA-B	QXSH-18270BA0	2752
QXMP10NA-B	QXSM-13150CB0	1533	QXMP15NA-B	QXSH-18300BB0	3053
QXMP10NA-B	QXSM-13150CB1	1543	QXMP15NA-B	QXSH-18300BA0	3052
QXMP10NA-B	QXSS-08100EA0	1012	QXMP15NA-B	QXSM-13230BB0	2343
QXMP10NA-B	QXSS-08100EA1	1022	QXMP15NA-B	QXSM-13230BA0	2342
QXMP10NA-B	QXSS-08100EB0	1013	QXMP10NA-B	QXSS-08100EI1	1021
QXMP10NA-B	QXSS-08100EB1	1023	QXMP10NA-B	QXSM-13260DB0	2633
QXMP10NA-B	QXSS-08100EI0	1011	QXMP10NA-B	QXSM-13260DA0	2632