NEWKer

Operation Manual

Single Channel AC Servo Driver

CHENGDU NEWKer CNC-TECHNOLOGY CO., LTD

Preface

The incorrect operation may lead to accident, please read the manual carefully before installation!

Note:

- New technique and software version will be added as time goes by, and some part of manual listed below may be amended at any time without prior notice.
- The warranty service will be invalid, If any changes in hardware or software of the product by users himself, from which NEWKer will not be responsible for any result leading.
- Please note and abide following warning mark:

means wrong operation may lead to grave consequence: Casualty or damage of products.

means wrong operation may lead to damaging of product or people.

means wrong operation may lead to malfunction of products or incorrect movements.

Safety Note

- There are 2 types power input including AC220V and AC380V, please note to check. And both type should connect with transformer, besides, AC380V driver also can be connect with reactor.
- Driver terminal UVW must correspond to motor terminal UVW.
- The driver design and manufacture is not for those system which will do harm to people.
- Protection should be taken into consideration while user design machine and install this product, in case of accident leading from incorrect operation.
- Driver should be power off for more than 5 minutes before disassembling it.
- The maintenance should be done by those who is professional.

- The broken and alarm malfunction driver can not be used anymore.
- Should be stored and transported according to requirements.
- The product transported should be well packed.
- Can not be impacted by external force.
- Avoid driver from vibration and concussion.
- Must be installed in cabinet with protection level.
- Must be installed in the environment without high electromagnetic interference.
- Must be in good heat dispersion.
- Avoid dust, corrosive gas, conductive object, liquid, inflammable and explosive material from driver.
- Do not power on and off driver frequently.
- After working for a period, driver may be heated, do not touch radiator or motor.

- When connect output signal with relay, must connect free-wheeling diode with two terminal of relay.

- The driver should match with motor.
- Rate torque of motor should be bigger than effectively continuous load torque.
- According to different motor, match 220V 20A, 30A, 50A driver or 380V 25A, 50A, 70A driver.

Content

Chapter 1 Summary

1.1 Production

NEWKer servo driver is a new generation full-digital AC servo driver designed and manufactured by NEWKer, adopting arithmetic unit with latest DSP (digital signal processor) technology and CPLD(programmable logical device) technique, and Intelligent power module, characterized by high respond speed, perfect protection, good reliability. Applied in such automatic field as cnc machine, automatic production line, and machine manufacturing,etc.

This servo driver is full digital ac servo driver, can fit incremental encoder motor or absolute encoder motor, featured with high integration level, small volume, it is a ideal servo system with advantages of power-saving and benefit-growth.

Compared with other model, it has following features:

- Matching 0.1kw-3.7kw motor with 220V input, 3.7kw-11kw with 380V input.
- Being able to switch among torque, speed, position, point-to-point position and hybrid type.
- torque, speed, position, and jogging control mode.
- Internal brake system, suiting needs in high payload application.
- Internal four-section positioning command, user can programme point-to-point positioning control.
- Motor encoder feedback signal to driver, combining half-closed loop control system with cnc controller.
- Speed ratio is 1:5000, ensuring stability from low to high torque.
- Maximum speed of motor can reach 6000r/min.
- Positioning accuracy ±0.01%.
- Updated space vector algorithm, generating higher torque and less noise.
- 300% overload capacity, bigger payload capacity.
- Voltage range: ~220V±20%, or ~380V±20%.
- Thorough protection: over current, over voltage, over heat and encoder malfunction.
- Parameter monitoring: motor speed, motor current, motor position, position offset, pulse unit, pulse frequency, linear speed, I/O point diagnosis, alarm history.

1.2 Driver specification

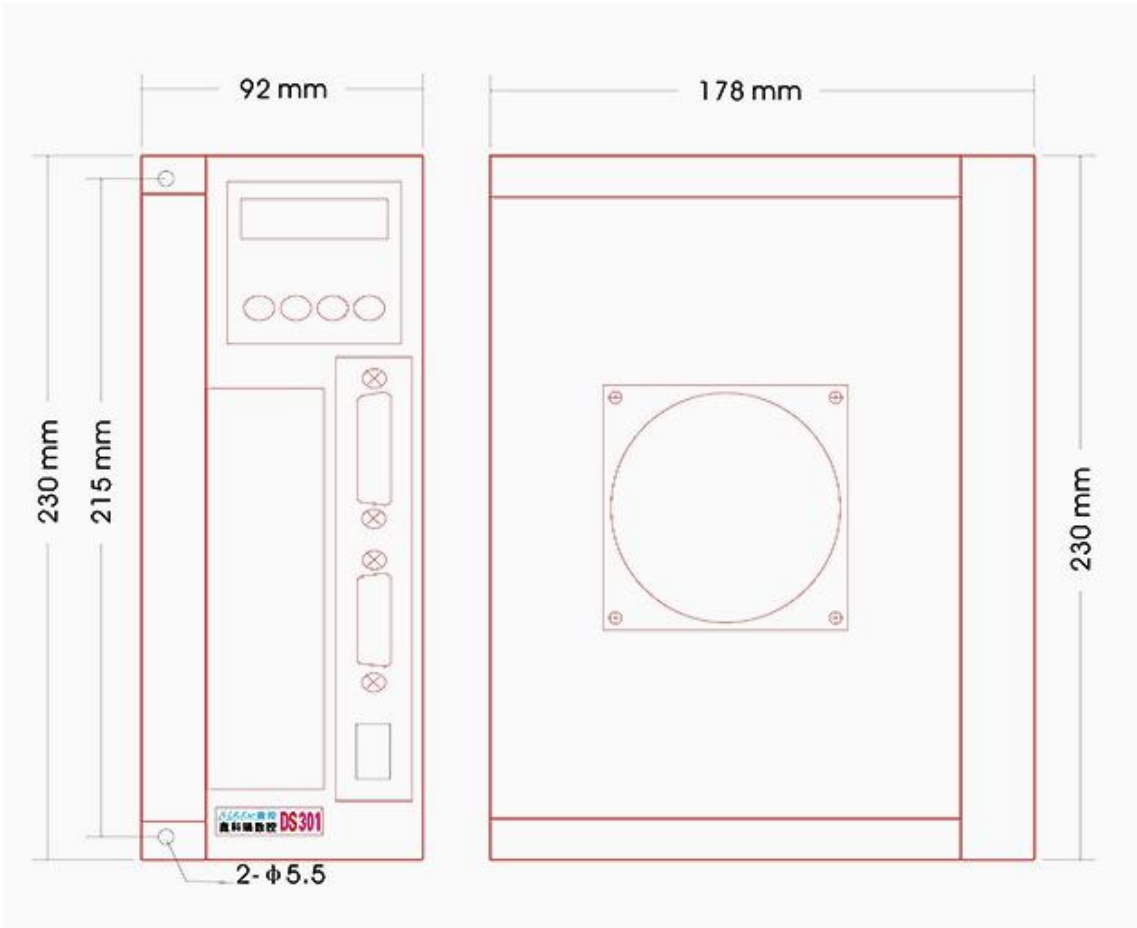
Input Voltage	AC220V -15%～+10%					
Current	20A	30A	50A	75A	100A	150A
Motor power	≤1.2KW	≤2.3KW	≤3.7KW	≤5.5KW	≤7.5KW	≤11KW
Input voltage	AC380V -15%～+10%					
Current	25A	50A	75A			
Motor power	≤3.7KW	≤7.5KW	≤11KW			
Temperature	Work：45℃ Storage：-40℃～55℃					
Humidity	40%~80%RH					
Atmosphere pressure	86-106kpa					
Control mode	①Position control ②JOG control ③Speed control ④Torque control ⑤Position&Speed control ⑥Internal pulse control ⑦Position&torque control					
Position command	①Pulse+Direction ②CW+CCW Pulse ③AB Orthogonal pulse ④Bus position					
Accuracy	0.01%					
Response frequency	≤200Hz					
Pulse frequency	≥500kHz					
Speed ratio	1：5000					
Regenerate brake	Internal					
Electronic gear ratio	1/30000～30000/1					
Overload capacity	≥300%					
Feedback pulse	Incremental: 2500p/r； Absolute： multiturn battery 33bit/39bit or single- turn17bit/23bit					
Parameter monitor	motor speed, motor current, motor torque, motor position, position offset, command pulse unit, pulse frequency, linear speed, I/O point diagnosis, alarm history.					
Protection	over current, over voltage, lower voltage, over load, tolerance exceeding, over heat, encoder malfunction, internal chip malfunction and module malfunction					

Chapter 2 Driver Installation

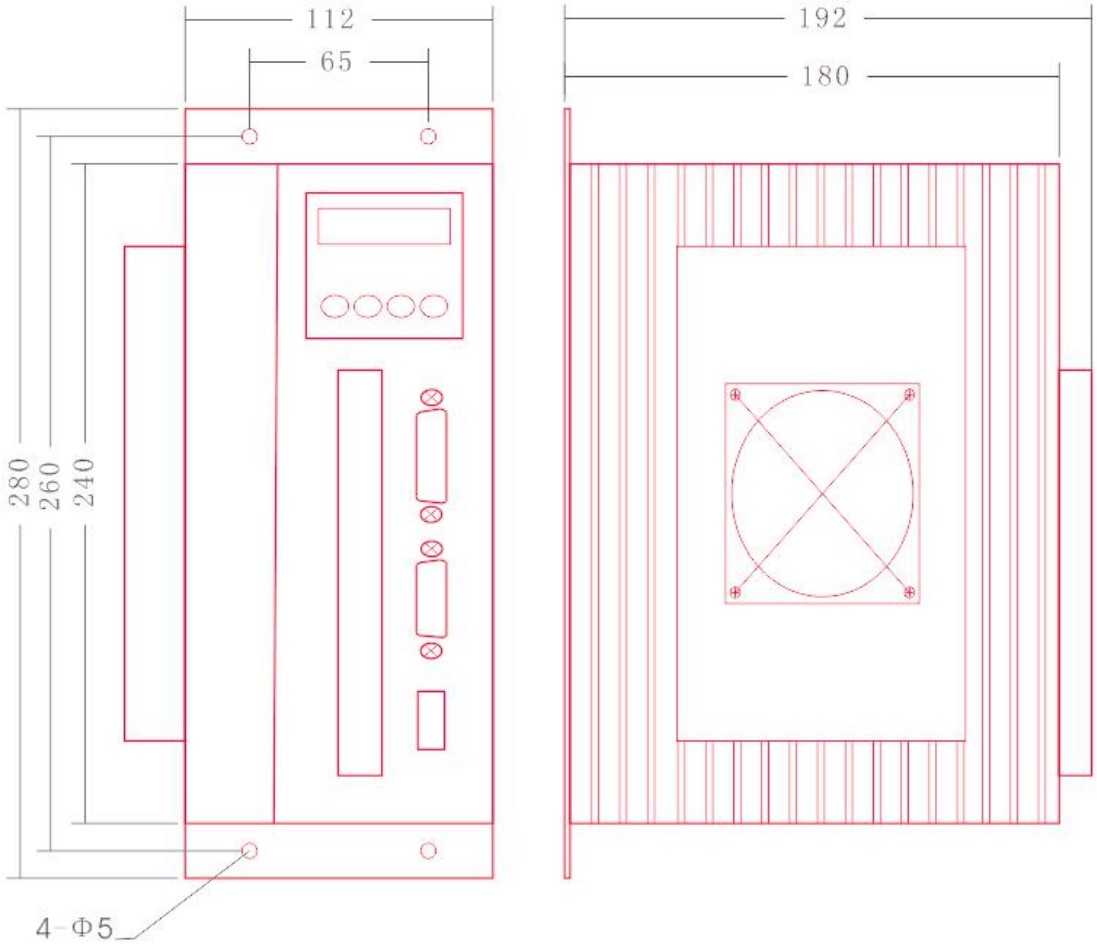
Attention

- Storage and installation of driver should meet the environment requirements.
- Driver should be protect from fire, and keep away from flammable material.
- Driver should be installed in electronic cabinet, prevent from dust, corrosive gas, conductive object, liquid and inflammable material.
- Driver and motor should avoid vibration, never strike it.
- Lighting stroke should be taken into consideration during installing servo driver.
- Do not drag motor cables, shaft and encoder.

2.1 Driver dimension



301/501 series driver dimension



503/753 series driver dimension

2.2 Installation environment

2.2.1 Electronic cabinet

Driver working life is directly relative to environment temperature. The heat generating from other parts in cabinet, and cooling system will influence temperature around driver, so when designing cabinet, cooling system and configuration of other part in cabinet should be taken into consideration, in order to ensure the temperature around driver is under 55°C, relative humidity is under 95%. long-term working temperature should be under 45°C.

2.2.2 Heat-producing device around driver

If diver works in high temperature condition, its working life will be reduced obviously, and possible to malfunction. So the temperature around driver should be kept under 55°C in the heat convection and heat radiation.

2.2.3 Vibration device around driver

Please take vibration-proof measures as possible, to make sure driver will not be influenced by vibration, and keep vibration under 0.5G(4.9m/s²).

2.2.4 Severe environment

The driver working in such severe environment as erosive gas, moist, metal powder, water and liquid, will malfunction easily. So please take protection measures when install the driver to make sure driver works in good condition .

2.2.4 Jamming device

If there is jamming device around driver, the cables of driver will be interfered, and may lead to wrong or incorrect movement. It is recommended to add noise filter or other anti-interfere design to make sure driver works normally. However, please attention that if with noise filter, leak current will raise, in order to terminate it, please install isolated transformer. Besides, the control signal cable of driver is easy to be interfered, so please take reasonable wiring method and shield means.

2.3 Installation environment

- Driver must be installed in electrical cabinet with good protection.
- Driver must be installed with certain direction and interval, also good cooling system.
- Do not install diver near inflammable material.

2.3.1 Installation environment

1) Protection:

The driver itself does not have protection structure, so it must be installed in well-protected cabinet. Keep away from erosive and inflammable gas, metal powder, water and liquid, conductive material.

2) Temperature

Environment Temperature：0～55℃, long-term working temperature: <45℃, relative humidity:<=95%.

3) Vibration and impact

Please take vibration-proof measures as possible, to make sure driver will not be influenced by vibration, and keep vibration under 0.5G(4.9m/s²), and can not put heavy pressure or impact on driver.

2.3.2 Installation method

1) Direction of installation： servo drive's installation direction must be upright.

2) Mounting: fasten 4pcs of M5 set crew on driver.

3) Cooling: natural cooling, and cabinet should be installed with cooling fans.

Caution

- Do not knock on motor or shaft in case of breaking encoder when disassemble belt or gear on shaft. Please use screw drawing device to disassemble it.
- Motor can not standard big load in both axial direction and radial direction.
- Please use lock washer to fasten motor in case of coming off.

Chapter 3 Wiring

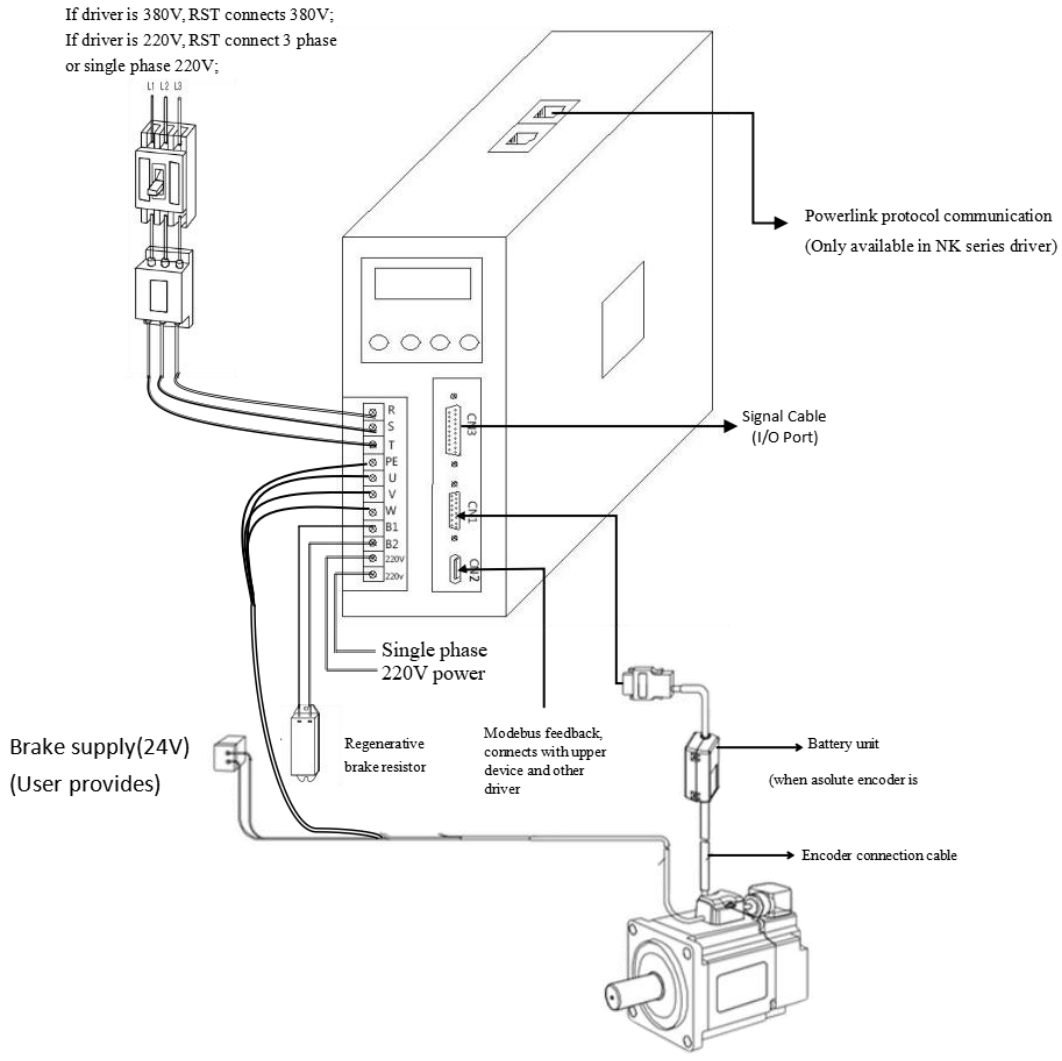
Warning

- The driver has two type input series, AC220V and AC380V, please note to check before connect power, and must connect with isolated transformer.
- Driver UVW terminal must connect with motor UVW accordingly.
- Protection should be taken into consideration while user design machine and install this product, in case of accident leading from incorrect operation.
- Driver and motor should be grounded.
- Do not disassemble the driver before powering off for 5 minutes.

3.1 Wiring instruction

The signal connection is relative to motor type and control mode.

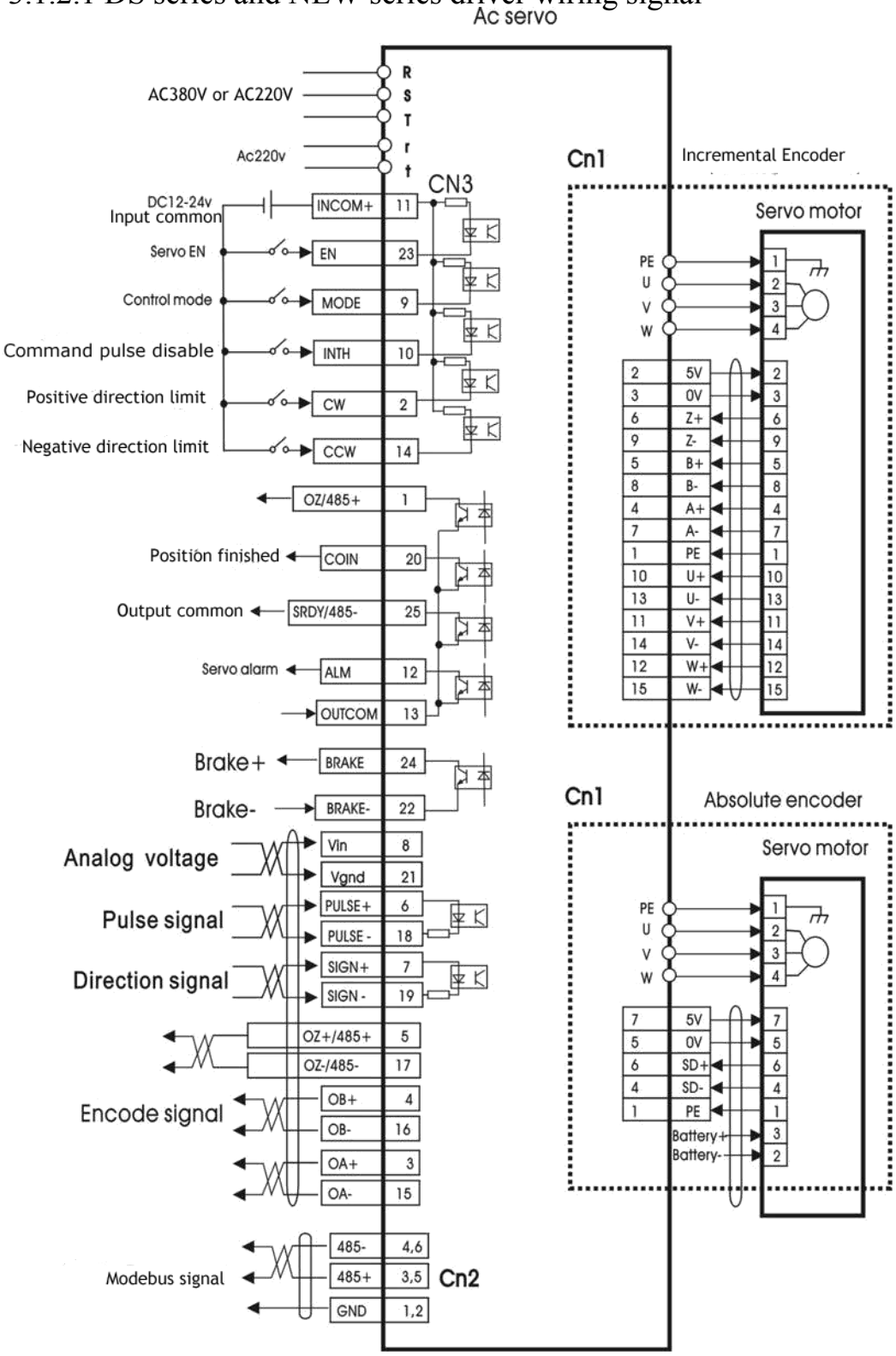
3.1.1 System wiring



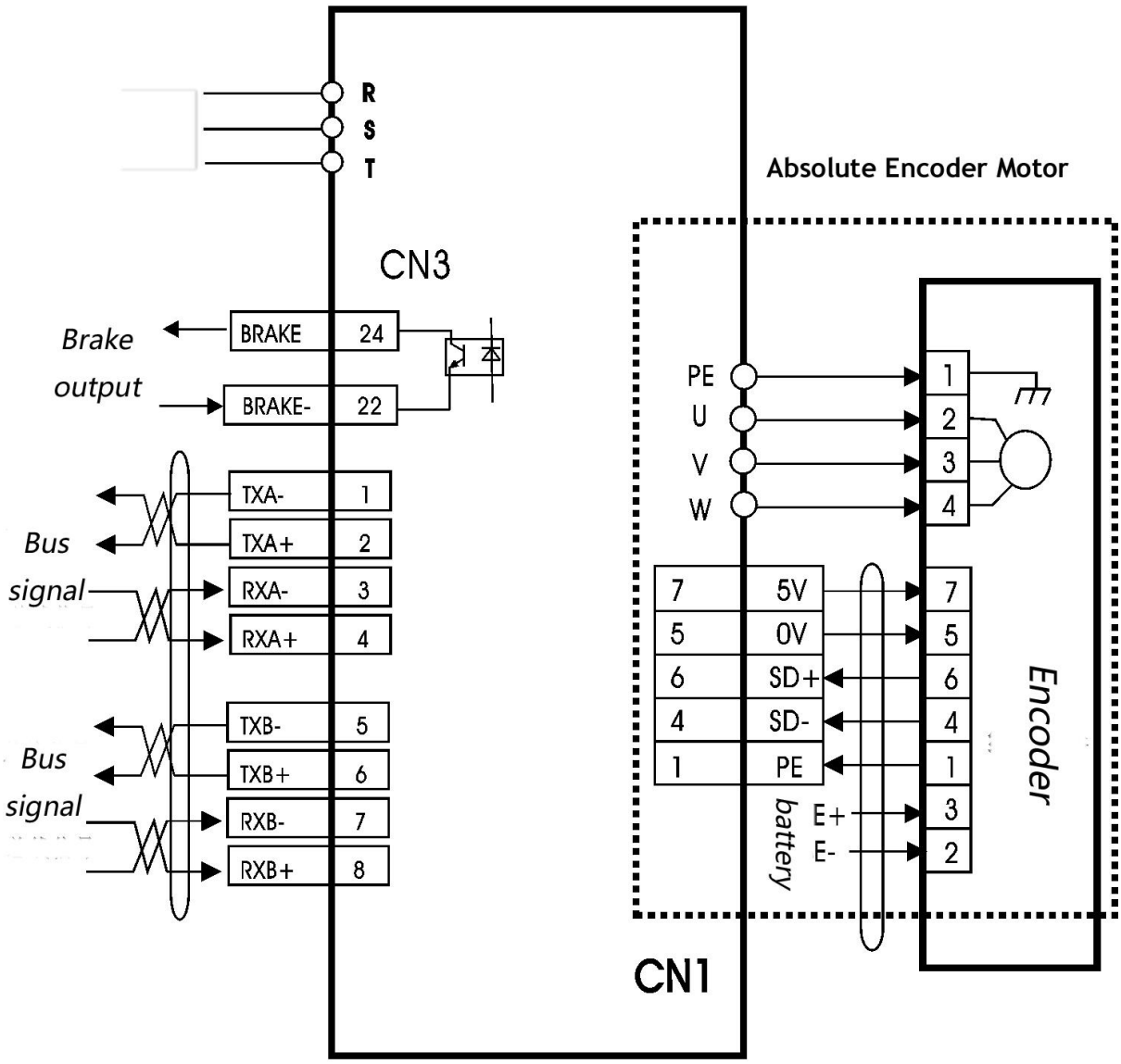
Note: 1. if driver is 220V voltage, power input is RST port, and it does not has B1B2 and 220V r/t ports.
2. only NEW series driver has CN2 port for Modbus communication.
3. only NK driver has Ethernet port for Powerlink communication.

3.1.2 Standard wiring

3.1.2.1 DS series and NEW series driver wiring signal



3.1.2.2 NK series driver wiring signal



3.2 Cable

3.2.1 Power Cable

- Diameter of R,S,T,PE,U,V,W cable should be ≥1.5mm²(AWG14-16).
- Driver adopts JUT-2.5-4 cold-pressed terminal, make sure connect confirmed.
- Suggest to connect 3 phase isolate transformer, in order to prevent user. Suggest to install noise filter between electric supply and transformer, to reduce the interference.
- Please install NFB(no fuse breaker), in order that cut power supply if driver malfunction.

3.2.2 Signal control CN3, and feedback CN1 Cable

- Cable diameter: suggest to use twisted double-shield cable, diameter ≥0.12mm, shield layer need to connect with PE.
- Cable length: the length should be shorter as possible, control signal CN3 cable should not >3m, feedback signal CN1 should not >20m.
- Cabling: keep signal cable away from power and motor cable, in case of interference.
- Please add surge suppressor for inductance compensate(coil): DC coil anti-parallel connection with FWD(free-wheeling diode), DC coil parallel connects with CR(resistance-capacitance) to absorb loop.

3.3 Terminal function

3.3.1 Power terminal

Pin	Sign	Signal name	Function
1	R	Single-phase or three-phase AC220V	Servo Power
2	S		
3	T		
4	PE	Ground	Ground terminal
5	U	Servo motor output	Connect with UVW of motor
6	V		
7	W		
8	PE	Ground	Ground terminal

9	r	220V	Control power 220V 50HZ
10	t		

Note: AC220V driver is without 9th and 10th terminal.

3.3.2 I/O signal terminal CN3(25pin)

Pin	Sign	Signal	I/O	Function
1	OZ/485+	Encoder Z-/Modbus 485+	Output	Open-collector output, common terminal is OUTCOM(485+ signal in NEW series driver)
11	INCOM+	Input Power positive	Input	Positive terminal of input signal, used to drive photoelectric coupler, DC12-24V,≥100mA
23	EN	Servo enable	Input	Servo enable signal, 1)if P6=0, EN on means driver can work, and motor is powered; EN off means driver is closed, and motor is not powered, in free status 2) if P6=2, EN on means driver can work, and motor is powered; EN off means driver is closed, and motor is not powered, in free status 3) P6=1, close enable function. Note: 1. when switch EN off to EN on, motor should keep still. 2. after EN on, wait for at least 50ms before input command.
9	MODE	Control mode or function switch	Input	①Position/Speed/Torque control mode, if valid (P61=1 or 3), activate position control mode, P7=4 or 8 will set this function; ②Inner speed choosing, if valid input, activate Inner speed control mode 4(P26), P31=1 will set this function; ③Activate signal in Inner pulse mode, P44=1 or 2 will set this function; ④8 electronic gears in pulse control mode, P32=1 set this

				function.
10	INTH	Command pulse disable and Alarm clear	Input	①the disable terminal of pulse input in position mode and motor speed input in speed mode. P30=0, 1, 2 set this function. 0: invalid,not detect INTH; 1: detect INTH signal valid; 2: detect INTH signal valid, and clear afterpulse. ②when driver alarm, input INTH will clear alarm and reset servo. ③Inner speed switch, valid input activates inner speed 4(P26), P31=2 set this function ④when P20=3,P30=0, P31=0, INTH is home(orientation) input signal(unavailable in NK driver).
2	CW	Rotation forward limit	Input	①motor rotation forward limit input signal, P20=1 set this function, if P20=2, means no alarm, just stop motor. ②when P7=7, CW is motor forward jogging input signal. ③when P15=2, CW is motor forward rotating signal.
14	CCW	Rotation backward limit	Input	①motor rotation backward limit input signal, P20=1 set this function, if P20=2, means no alarm, just stop motor. ②when P7=7, CCW is motor backward jogging input signal. ③when P15=2, CCW is motor backward rotating signal.
13	OUTCOM	Output Common terminal	Output	Common terminal of output signal.used to drive photoelectric coupler, ≥200mA
25	SRDY/485-	Servo ready output/Modbus negative signal	Output	When servo is ready and no alarm, SRDY output is valid.(modbus negative

				signal in NEW series driver)
12	ALM	Servo alarm	Output	When driver is alarming, ALM is valid.
24	BRAKE+	Positive terminal of brake signal	Output	When servo work normally and motor is enabled, brake signal will output valid.
22	BRAKE-	negative terminal of brake signal	Output	
20	COIN-	Positioning finished	Output	①positioning finished status output, when position error is smaller than setting, output is valid. ②inner pulse running finished, output is valid. ③torque reaches percentage of P50, output is valid. ④when motor speed is zero(still), output is valid. P2 set this function.
6	PULSE+	Pulse signal +	Input	External position control command, P14 sets mode: 0: Pulse+Sign(pulse and direction); 1: CW+CCW(forward and backward control); 2: A+B (90° Orthogonal pulse)
18	PULSE-	Pulse signal -	Input	
7	SIGN+	Direction signal +	Input	
19	SIGN-	Direction signal -	Input	
8	Vin	Analog input	Input	External Speed or torque control command 0-±10V
21	Vgnd	Signal ground	Input	Ground of analog signal/RS485
5	OZ+	Encoder Z signal +	Output	Motor encoder Z signal output
17	OZ-	Encoder Z signal -	Output	
4	OB+	Encoder B signal +	Output	Motor encoder B signal output
16	OB-	Encoder B signal -	Output	
3	OA+	Encoder A signal +	Output	Motor encoder A signal output
15	OA-	Encoder A signal -	Output	

3.3.3 Incremental Encoder feedback terminal CN1(DB15)

The connection of DS series driver CN1

Pin	Sign	Signal	I/O	Function
2	VCC	Power +5V	Output	Power+5V
3	GND	Signal ground	Output	Signal ground
6	OZ+	Encoder Z+	Input	Z pulse +
9	OZ-	Encoder Z-	Input	Z pulse -
5	OB+	Encoder B+	Input	B pulse +
8	OB-	Encoder B-	Input	B pulse -
4	OA+	Encoder A+	Input	A pulse +
7	OA-	Encoder A-	Input	A pulse -
1	PE	Earth(ground)	Ground	System ground

10	OU+	Encoder U+	Input	U pulse +
13	OU-	Encoder U-	Input	U pulse -
11	OV+	Encoder V+	Input	V pulse +
14	OV-	Encoder V-	Input	V pulse -
12	OW+	Encoder W+	Input	W pulse +
15	OW-	Encoder W-	Input	W pulse -

3.3.4 Absolute Encoder feedback terminal CN1(DB15)

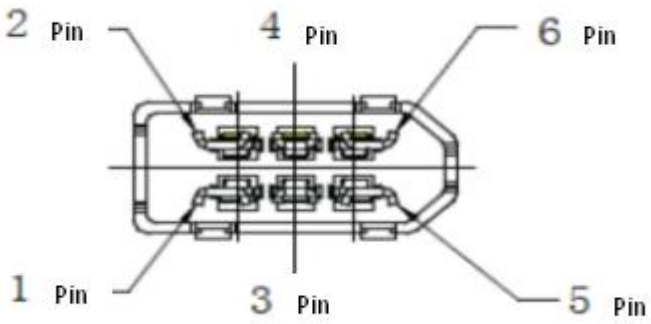
The connection of NEW/NK series driver CN1

Pin	Sign	Signal	I/O	Function
7	VCC	Power +5V	Output	Power+5V
5	GND	Signal ground	Output	Signal ground
6	SD+	SD+		Bus signal positive
5	SD-	SD-		Bus signal negative
3				
2				
1	PE	Eather(Ground)		System ground

3.3.5 RS485 bus signal terminal CN2 (only available in NEW series driver)

The connection of NEW series driver CN2

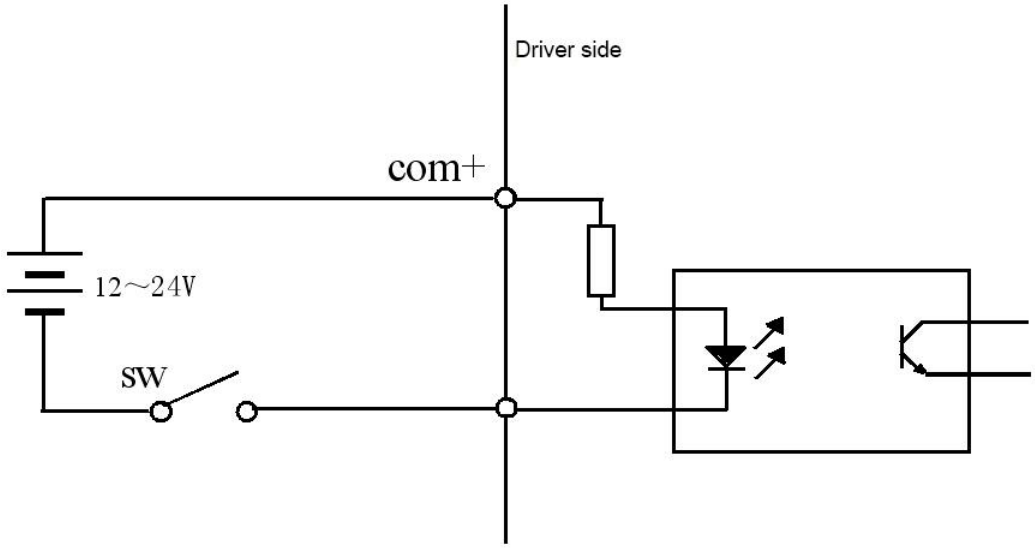
Pin	Sign	Signal	I/O	Function
1/2	GND	Signal ground	Output	Signal ground
3/5	485+	485+		Bus signal positive
4/6	485-	485-		Bus signal negative



View from plug

3.4 I/O interface principle

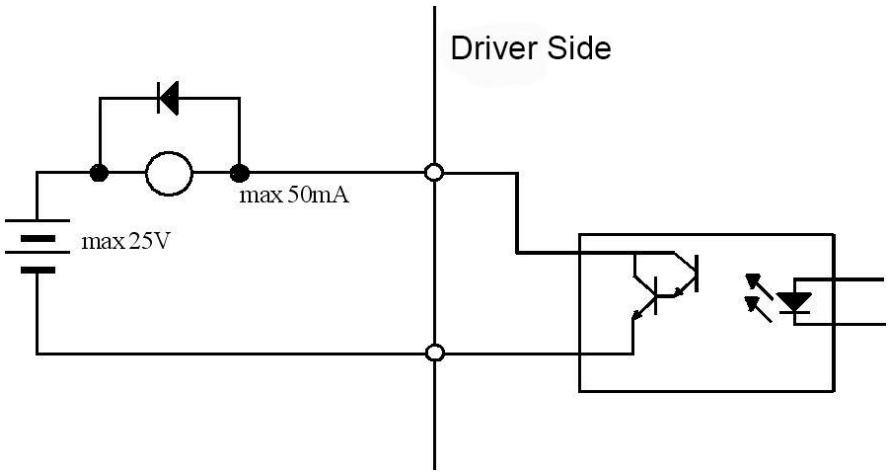
3.4.1 Input interface of switching value EN, CW, CCW, INTH, MODE



Switching value input connection

1) user offer power, DS12-24V, Current ≥100mA
2) Attention, if current polarity inverse connected, will lead to servo driver out of service.

3.4.2 output interface of switching value SRDY, ALM, BRAKE, COIN, OZ

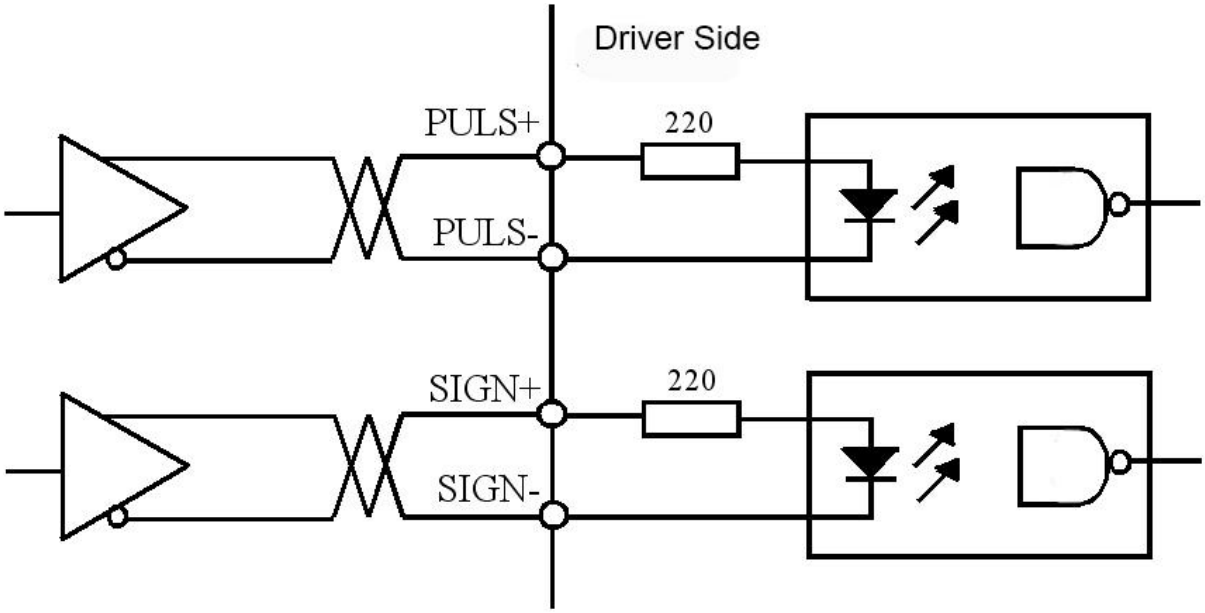


1) Attention, if current polarity inverse connected, will lead to malfunction of driver.

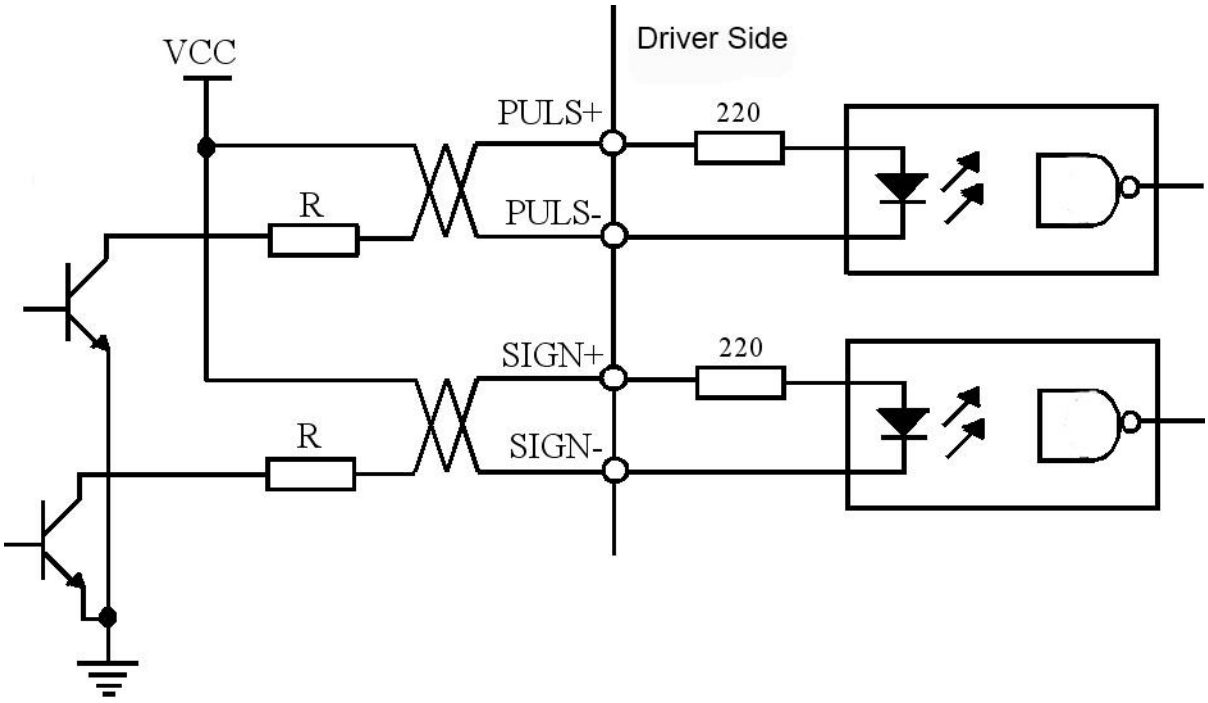
2) it is open-collector output, the max current of OZ, SRDY, COIN and ALM signal is 20mA, the max current of BRAKE signal is 50mA, so BRAKE signal can connect external relay directly, while OZ, SRDY, COIN and ALM signal cannot. The max voltage of external power supply is 25V, therefor load of switching signal must be under this limit. If over the limit or connect driver with power supply directly, will lead to malfunction of driver.

3) if load is such inductive objects as relay, it is necessary to connect antiparallel freewheel diode between both sides of load. If diodes connected inverse, will lead to malfunction of driver.

3.4.3 Input interface of pulse signal



Differential drive mode in pulse input interface



Single-ended drive mode in pulse input interface

1) in order to transfer pulse data correctly, suggest to use differential driver mode;

2) under differential mode, adopt AM26LS31、MC3487 so similar driver like RS422;

3) single-ended mode will lower movement frequency. According to pulse input circuit, and condition that driver current is 10-15mA, 25V max voltage of external power supply, to define value of resistance R.

Experience data: VCC＝24V, R＝1.3～2k;VCC＝12V, R＝510～820Ω;

VCC＝5V, R＝82～120Ω.

4) under single-ended mode, user offer external power. And attention that if current polarity inverse connected, will lead to malfunction of driver.

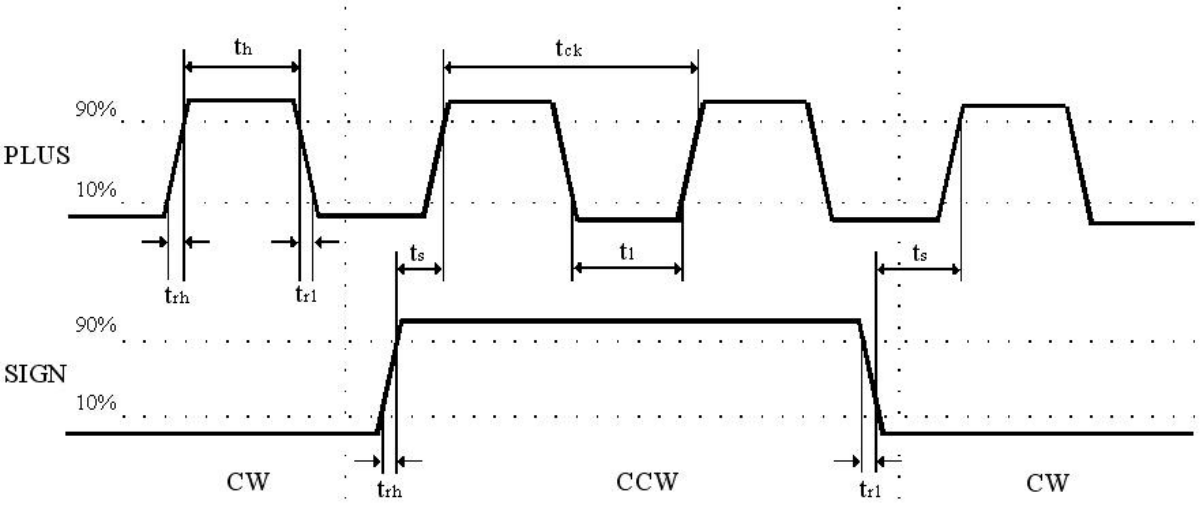
5) Pulse input mode is as follow diagram, pulse frequency should be ≤500kHz.

Pulse Input Mode

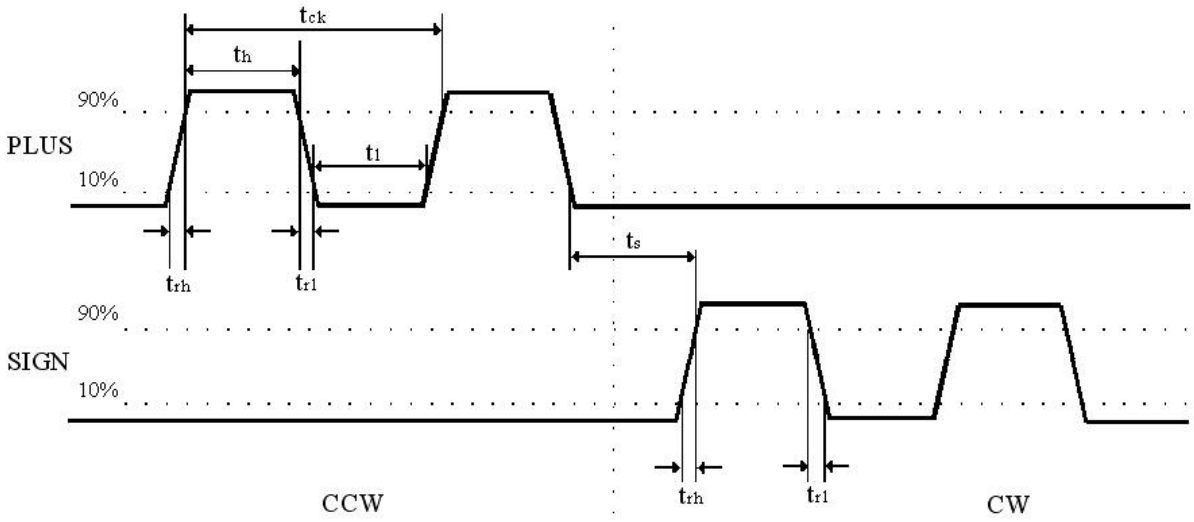
Pulse Command	CW	CCW	P14 Value
Pulse+Sign	PULS SIGN		0 Pulse+Sign
CCW Pulse CW Pulse	PULS SIGN		1 CW+CCW Pulse
A+B Pulse	PULS SIGN		2 A+B90° Orthogonal pulse

Pulse input sequence parameter

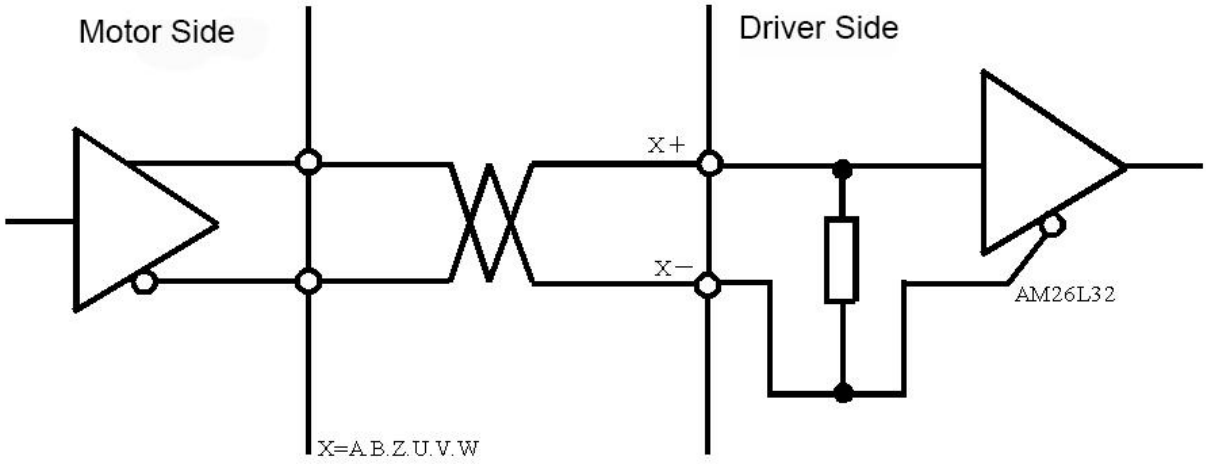
Parameter	Differential	Single-end
tck	>2uS	>5uS
th	>1uS	>2.5uS
tl	>1uS	>2.5uS
trh	<0.2uS	<0.3uS
trl	<0.2uS	<0.3uS
ts	>1uS	>2.5uS
tqck	>8uS	>10uS
tqh	>4uS	>5uS
tql	>4uS	>5Us
tqrh	<0.2uS	<0.3uS
tqrl	<0.2uS	<0.3Us
tqs	>1uS	>2.5Us



PULS+SIGN input interface sequence(pulse frequency≤ 500kHz)



CW+CCW pulse input interface sequence(pulse frequency≤ 500kHz)



Servo motor optical encoder input interface

Chapter 4 Parameter


Caution

- The operator should learn about parameters meaning, wrong setting will lead to malfunction of driver and casualty.
- Suggest to adjust parameter when motor is still.

Parameter No.	Parameter Name	Function	Range	Default
P0	Software Version	Read only, can not be modified.		
P1	Parameter password	①in case of misoperation parameter changing, once password is set, need to input password each time before parameter modification. Default password is 1. ②when password is 9999, no need to input password each time before parameter modification. ③no need to input password if modify P3 only. ④if forget password, please contact supplier. ⑤if P1=12345, alarm history will be cleared.	1~9999	1
P2	COIN output mode	0: output COIN signal when positioning is finished, and position error is lower than set; 1: output COIN signal when motor positions done and stop. if pulse input, COIN is invalid; 2: output COIN signal after running inner pulse; 3: output COIN signal when torque reaches P50 value; 4: output COIN signal when motor speed ≥ P53, output BRAKE signal when motor speed ≤ P50; 5: output COIN signal when motor is zero speed(keep still).	0~5	0
P3	Default monitor	0: Motor rotation speed (r/min)(communication address: 283);	0~17	0

	display	1: Motor current(A)(communication address: 284); 2: Motor torque(NM)(communication address: 435); 3: Motor position(pulse); 4: Counter deviation(pulse); 5: Low 4 bit of pulse count(pulse); 6: High 4 bit of pulse count (*1000pulse); 7: Linear speed(mm/min); 8: Input pulse frequency(kHz); 9: Input port status; 10: Output port status; 11: Alarm number; 12: No display(except for alarm); 15: Encoder signal-turn low 16 bit (1) display 0~±32767 (2) communication value 0~65536 (3) communication address 90 (907 if P52=11) 16: Encoder signal-turn high 16 bit (1) display 0~1 (2) single-turn value=low 16 bit value + this value*65536 (3) communication address 91 (906 if P52=11) 17: Encoder multi-turn low 16 bit (1) display 0~±32767 (2) communication value 0~65536 (3) multi-turn value=this value*131072 (4) communication address 90 (907 if P52=11)		
P4	Driver model	Read only		
P5	Current loop filtering constant	①set current loop filtering constant; ②noise will grow up as the vale raise; ③when connect with small motor, P5 should be smaller. ④when load inertia is big, if motor vibrates, user can increase P5; ⑤note: bus type controller is controlled by P44.	1~300	36
P6	External EN signal instruction	Used to set if EN signal control motor status. 0: Valid, if EN input signal is effective, motor will be enabled; 1: Invalid, not detect EN input, once driver power on, motor will be enabled; 2: Valid, if EN input signal is ineffective, motor will be enabled.	0~2	1
P7	Control Mode	0: Position control mode, external input pulse signal, pulse+sign; 1: JOG mode, controlled by button; 2: Speed control mode, external input	0~13	0

		0~±10V controls speed; 3: Torque control, external input 0~±10V controls torque; 4: Position and Speed control mode, when P61=1 or 3, switch between Position mode and Speed mode by status of MODE signal; 5: Four-part inner pulse control mode; 6: Position control mode, external EN,INTH,CW,CCW signal and pulse(if P46,P47,P48,P49 value mantissa is 1, it means continue movement, if 0, means jogging movement); 7: External CW,CCW signal jogging mode; 8: Position and torque control mode, when P61=1 or 3, switch between Position mode and torque mode by status of MODE signal; 9: Inner speed control mode; 10: Inner speed control mode, and if torque reaches P50, motor stops; 11: Four-part inner position control mode; 12: Inner speed control mode, and forward/backward speed is limited; 13: For-part inner speed control mode.		
P8	Current loop proportional gain	①Used to set Current loop proportional gain; ②the bigger value is, the faster current gain is; ③when motor squeals or vibrates, please increase P8; ④when connect small motor and it becomes heated, decrease P8; Special function: if P8 value mantissa is 1, When motor stops, it will be half-current locked, lock coefficient defined by P59.	1~600	430
P9	Speed loop proportional gain	①Used to set speed loop proportional gain; ②the bigger value means means higher gain and stronger rigidity, but motor is easier to noise; ③P8 should increase as load grows; ④the bigger value is better if without noise.	1~400	80
P10	Position control position loop feedforward	①used to set position loop feedforward gain; ②the bigger value means means higher gain and stronger rigidity, but motor is	1~400	100

	gain	easier to vibrate; ③P10 value should decrease as load grows; ④the bigger value is better if without vibration. Special function: when motor is still(no pulse input), P59 can replace P8(P59≠100 valid).		
P11	Position loop proportional gain	①used to set position loop proportional gain; ②smaller value means motor is more smooth, but rigidity is less; ③the bigger P11 value is, the faster positioning speed is, the stronger rigidity becomes, and following counting deviation is smaller, but motor is easier to vibrate or overshoot; ④the bigger value is better if without vibration and overshoot.	1~8000	110
P12	Numerator of position command pulse division	①motor pulse unit per revolution =10000* P12/P13; ②electronic gear G = P12/P13 1/30000<G<30000.	1~30000	1
P13	Denominator of position command pulse division		1~30000	1
P14	Input pulse Mode	0: Pulse+Sign; 1: CW+CCW; 2: A+B, 90° Orthogonal pulse	0~2	0
P15	Direction reverse	0: not reverse direction; 1: reverse direction; 2: In speed control mode and torque control mode, the rotary direction is controlled by CW,CCW signal, instead of sign of input voltage.	0~2	0
P16	Overload alarm percentage	Driver will alarm ERO-10 when load is over motor rate torque*P16 percentage.	1~300%	200
P17	Position tolerance value	When deviation counting is smaller than or equal to P17, it means positioning is finished.	0~30000	2
P18	Detection range of positioning over tolerance	When deviation counting is bigger than P18, it will alarm position over tolerance.	0~30000	30000
P19	Positioning over tolerance alarm	0: Positioning over tolerance alarm valid; 1: Positioning over tolerance alarm invalid.	0~1	0
P20	Driver limit signal	0: invalid, not detect CW, CCW signal; 1: detect CW,CCW signal, CW input	0~3	0

	CW,CCW	effective, motor limits in forward direction. CCW input effective, motor limits in backward direction, and also alarm; 2: detect CW, CCW signal, if effective, motor stops only, but no alarm; 3: motor back zero, if INTH is effective, motor orients at zero position.		
P21	Motor rate current	The motor rate current Note: it is controlled by P32 in NK series driver	1~800 *0.1A	100
P22	Motor rate torque	The motor rate torque Note: it is controlled by P33 in NK series driver	1~800 *0.1Nm	100
P23	Inner speed 1	①JOG control speed; ②the max speed in torque control mode; ③speed selection in inner pulse control mode; ④speed when INTH is valid(pulse); ⑤motor orientation speed;	0~±6000 r/min	10
P24	Inner speed 2	①max speed in speed control mode; ②speed selection in inner pulse control mode.	0~±6000 r/min	100
P25	Inner speed 3	speed selection in inner pulse control mode.	0~±6000 r/min; if P7=11, 0~± 32000	200
P26	Inner speed 4	①JOG control speed, when P31=1 or 2; ②max speed in speed control mode, when P31=1 or 2; ③speed selection in inner pulse control mode.	0~±6000 r/min; if P7=11, 0~± 32000	500
P27	Motor max speed	Motor max speed	0~6000r /min	3600
P28	Zero point offset of analog voltage input	Used to set 0V voltage adjust in speed control mode and torque control mode; Set as “12345” to do zero set automatically, but it need to be saved manually.	0~±4000	0
P29	Torque gain constant in torque control mode; Dead-time voltage constant in speed control mode	①Torque control: torque gain constant, bigger value means bigger torque; ②speed control: when input analog voltage < P29, motor will keep still; ③motor orientation offset when INTH is effective.	1~10000	30
P30	Input signal INTH mode	0: invalid, not detect INTH signal; 1: valid, if INTH is effective, not clear	0~3	0

<table>
<tr><td></td><td></td><td>afterpulse;
2: valid, if INTH is effective or if P2=3 and when torque reach P50,output COIN, then clear afterpulse;
3: invalid, if INTH is ineffective, not clear afterpulse.</td><td></td><td></td></tr>
<tr><td>P31</td><td>Input detection of inner speed 4 mode</td><td>0: invalid, not detect MODE, INTH input;
1: valid, detect MODE signal input;
2: valid, detect MODE signal input.</td><td>0~2</td><td>0</td></tr>
<tr><td>P32</td><td>Detection mode of pulse division numerator 2</td><td>0: invalid;
1: valid, 8 class electronic gear:
<table>
<tr><th>Numerator</th><th>Gain</th><th>MODE</th><th>CW</th><th>CCW</th></tr>
<tr><td>P12</td><td>P11</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>P33</td><td>P43</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>P24</td><td>P44</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>P25</td><td>P45</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>P26</td><td>P46</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>P40</td><td>P47</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>P41</td><td>P48</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>P42</td><td>P49</td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td>0~1</td><td>0</td></tr>
<tr><td>P33</td><td>Numerator 2 of position command pulse division</td><td>When P32=1, position mode selection (P12,P33, P24-P26, P40-P42), calculation method is the same as P12;
position gain selection (P11, P43-P49).</td><td>1~30000</td><td>1</td></tr>
<tr><td>P34</td><td>Zero offset of motor encoder</td><td>Changes according to motor specification, details refer to debugging section.</td><td>1~10000 /P35</td><td>2360</td></tr>
<tr><td>P35</td><td>Pole pairs of motor</td><td>Changes according to motor specification, details refer to motor catalog.</td><td>2~5</td><td>4</td></tr>
<tr><td>P36</td><td>Acceleration time constant in position control mode</td><td>The bigger value it is, the shorter acceleration time is, and the faster positioning speed.</td><td>0~30000</td><td>1000</td></tr>
<tr><td>P37</td><td>Deceleration time constant in position control mode</td><td>The bigger value it is, the shorter deceleration time is, and the faster portioning speed.</td><td>0~30000</td><td>1000</td></tr>
<tr><td>P38</td><td>Acceleration time constant in JOG, speed, torque control mode</td><td>The bigger value it is, the shorter acceleration time is, and the faster respond speed.</td><td>0~32000 ; if P7=11, 0~± 32000</td><td>30</td></tr>
<tr><td>P39</td><td>Deceleration time constant in JOG, speed, torque control mode</td><td>The bigger value it is, the shorter deceleration time is, and the faster respond speed.</td><td>0~32000 ; if P7=11, 0~± 32000</td><td>30</td></tr>
<tr><td>P40</td><td>Inner pulse number 1</td><td>The 1st part pulse number in inner pulse control mode.</td><td>0~± 32000</td><td>10000</td></tr>
<tr><td>P41</td><td>Inner pulse number 2</td><td>The 2nd part pulse number in inner pulse control mode.</td><td>0~± 32000</td><td>10000</td></tr>
<tr><td>P42</td><td>Inner pulse</td><td>The 3rd part pulse number in inner pulse</td><td>0~±</td><td>10000</td></tr>
</table>

	number 3	control mode.	32000	
P43	Inner pulse number 4	The 4th part pulse number in inner pulse control mode.	0~± 32000	10000
P44	Inner pulse control selection	0: auto run mode, run automatically when power on; 1: single-block running by MODE input signal; 2: continuous running by MODE input signal.	0~2	0
P45	Inner pulse control direction	Hex code: ①D0=0 means 1st part is backward direction, D0=1 means 1st part is forward direction; ②D1=0 means 2nd part is backward direction, D1=1 means 2nd part is forward direction; ③D2=0 means 3rd part is backward direction, D2=1 means 3rd part is forward direction; ④D3=0 means 4th part is backward direction, D3=1 means 4th part is forward dirction;	0~15; if P7=11, 0~± 32000	5
P46	Inner time 1	①Pause time after running 1st part; ②if P7=6, the increased pulse number each time when EN signal is valid once.	0~32000 ms; if P7=11, 0~± 32000	500
P47	Inner time 2	①Pause time after running 2nd part; ②if P7=6, the decreased pulse number each time when INTH signal is valid once.	0~32000 ms; if P7=11, 0~± 32000	500
P48	Inner time 3	Pause time after running 3rd part;	0~32000 ms; if P7=11, 0~± 32000	500
P49	Inner time 4	Pause time after running 4th part;	0~32000 ms; if P7=11, 0~± 32000	500
P50	Torque control percentage	When torque control reach P50, output COIN signal	0~100%	100
P51	Encoder alarm	0: valid, detect encoder alarm; 1: invalid, not detect encoder alarm.	0~1	0
P52	Alarm history display	0: display current alarm number; 1~10: display last 10 times alarm number, if P1=12345, alarm history will be cleared.	0~11	0

P53	Delay time of brake	The delay time between motor power on/off and output BRK signal.	0~30000 ms	200
P54	Percentage of analog voltage input	Input voltage=Vin*P54/100	0-500%; if P7=11, 0~± 32000	100
P55	Modbus baud rate and data format	4800, 9600, 14400, 19200,3840x10, 5670x10; Data format: RTU; 1) Mantissa=0: 1start+8data+1odd+1stop; 2) Mantissa=1:1start+8data+1even+1stop.		19200
P56	Station number	1-8 corresponds to XYZABCXsYs	1~255	1
P57	Encoder line number	1) Incremental encoder line number: 1024, 1000, 2000, 2048, 2500, 3000, 5000, 6000; 2) Absolute encoder resolution: if single turn, without battery. 0: 17bit single turn; 23: 23 bit single turn; 2500: 17 bit multi turn; 2523: 23 bit multi turn.		2500
P58	Encoder type	0: with U,V,W signal cable; 1: Without U,V,W signal cable (cable-saving encoder).	0~1	0
P59	Speed loop feedforward gain in speed control	1. speed control mode: like P10 ①used to set speed feedforward gain; ②the bigger value is, the higher gain is, the stronger rigidity is, but easier to vibrate; ③the value should decrease as load grows; ④the bigger value is better if without vibration. 2. if P8 mantissa≠1, P7=0, 5, 11 position control: keep still(no pulse input) in position control, just lie P10(when P59≠100, valid) 3. if P8 mantissa=1, half current lock coefficient when motor stops.	1~800	100
P60	Torque percentage of still motor	The torque output percentage when motor keeps still, the smaller value is, the smaller torque outputs.	0~100%	100
P61	ALM alarm signal output mode	0: normally open, when MODE signal is valid, switch into position control mode; 1: normally close, when MODE signal is valid, switch into position control mode; 2: normally open, when MODE signal is invalid, switch into position control mode;	0~3	0

		3: normally close, when MODE signal is invalid, switch into position control mode;		

Caution

- Suggest to adjust parameter when motor keep still.
- All parameter setting(except for P34) can be done through pressing “Enter”, not need to restart driver. But if user want to save the parameter setting, the parameter writing operation is necessary.
- After powering off driver, must wait for more that 30 seconds before power on again.
- When driver is used in cnc machine, and without connection with NEWKer cnc controller, P12 and P13 can be set as follows:

$$\frac{P12}{P13} = \frac{\text{machine reduction ratio} \times \text{controller pulse equivalent} \times 10000}{\text{ballscrew pitch(mm)}}$$

Note: pulse equivalent of general cnc controller is 0.001mm.

Chapter 5 Display and Parameter operation

5.1 Driver display

Servo driver panel includes 6pcs of LED digital display, 4 buttons. Digital display is used showing status and parameters of servo driver; buttons are used to read and modify driver parameter.

The normal display of driver includes following 12 types:

1) Motor speed: P3=0, unit:r/min

2) Motor current:P3=1, unit: A

3) Motor torque: P3=2, unit:NM

4) Motor position: P3=3, unit:pulse

5) Position deviation: P3=4, unit: pulse

6) Input pulse low 4 bit: P3=5, unit:pulse

7) Input pulse high 4 bit: P3=6, unit:×1000pulse

8) Motor linear speed: P3=7, unit:mm/min

0.001mm per pulse input

9) Input pulse frequency: P3=8, unit:kHz

10) Input port status: P3=9,

Display number is hex code:

D0=1 means EN input is valid;

D1=1 means INTH input is valid;

D3=1 means MODE input is valid;

D5=1 means CW input is valid;

D6=1 means CCW input is valid;

11) Output port status: P3=10

Display number is hex code:

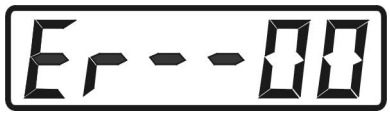
D0=1 means SRDY output is valid;

D1=1 means ALM output is valid;

D2=1 means BRAKE output is valid;

D3=1 means COIN output is valid;

12) Motor alarm display: P3=11,



Set P52 to display last 10 times alarm number,

if P1=12345, alarm history will be cleared.

13) No display(except for alarm), P3=12.

5.2 Button operation

The buttons contain "↑", "↓", "**Mode**", "**Enter**", used to read and set parameter.

"↑": parameter number or value increase, or motor rotates forward in JOG mode.

"↓": parameter number or value decrease, or motor rotates backward in JOG mode

"**Mode**": function switch, or current cursor move left.

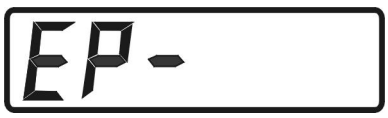
"**Enter**": function enter, or value input enter.

In normal display, press "**Mode**" to switch among ①"Parameter", ② "Parameter write", ③ "Parameter initialize".

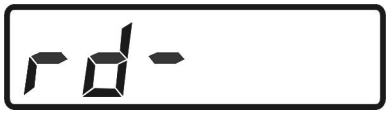
During switch, press "↑" to back monitoring display.

①"Parameter": P1~P56

② "Parameter write":



③ "Parameter initialize"



Attention

- Before input driver password, user only can enter into ①"Parameter" read, input password and modify P3.

5.3 Parameter setting

5.3.1 Parameter choose

1) under normal display, press "Mode" Button to enter into ①"Parameter"

2) press "↑" or "↓" to switch parameter number, press "Enter".

3) press "↑" to increase 1, or "↓" to decrease 1, press "Mode", cursor will move left, press "Enter" to confirm or enter setting.

Attention

- Enter into P1, it just show 0, namely no show password.
- Before input password, all parameter setting is invalid, and going to back monitor display.

5.3.2 Password input and modify

Every time when power on driver, it is necessary to input password before modify parameter, namely set P1 parameter, default value is 1.

Before modifying password, user need to input original password. If user forgets password, please contact supplier.

When set P1=9999, it will be unnecessary to input password after next time power on.

5.3.3 Parameter writing

In monitoring display, press "Mode" switch into "Parameter writing" mode.

If user want to save the parameter, need to do parameter writing operation. After switch into Parameter writing mode, press “Enter” for 3~5 seconds, parameter will be written into inner EERPROM, after finishing writing, display will show:

5.3.4 Parameter initialize

In monitoring display, press “Mode” to switch into “Parameter initialize” status.

When user need to set driver parameter back to default value, please press “Enter” for 3~5 seconds, display will show “End”. then all parameter except for password will be set as default value, but still did not write into EEPROM, please do parameter writing(5.3.3) again. Press “Enter” back to monitor display.

Attention

P1, P34, P35 parameter can not be initialized.

Chapter 6 Debug

- Driver and motor should connect with earth, PE terminal should be grounded..
- Driver power should be supplied by isolated transformer, in order to make sure safety and anti-jamming capability.
- Only after make sure correct connection, can power on driver.
- If driver alarms, make sure trouble removal before power on driver again.
- After power off driver and motor, do not touch them within 5 minutes, in case of electric shock.
- After running for a period, driver and motor may be heated, careful of burns.

6.1 Sequence diagram

6.1.1 Power connection

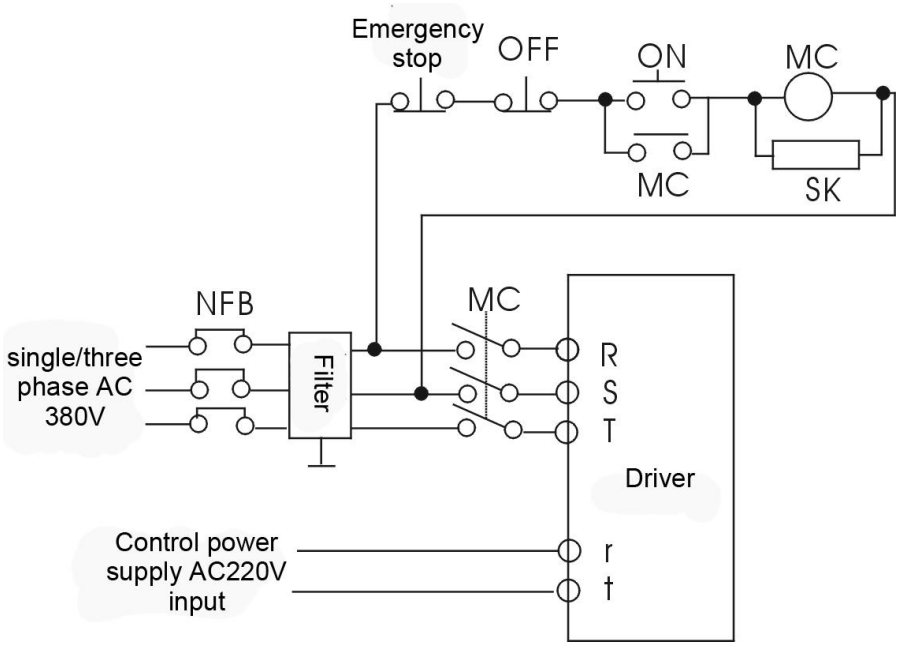
Power connection refers to diagram 7-1, and connect power as following steps:

1) connect power into main circuit power input terminal(R,S,T) through electromagnetic contractor;

2) delay for 1.5 seconds after power on, Servo ready signal(SRDY) is on, now driver is ready to receive enable signal(EN), if detect EN valid, driver output is effective, motor is under excitation and powers on. If detect EN invalid or alarm on, close motor excitation, motor is in free status.

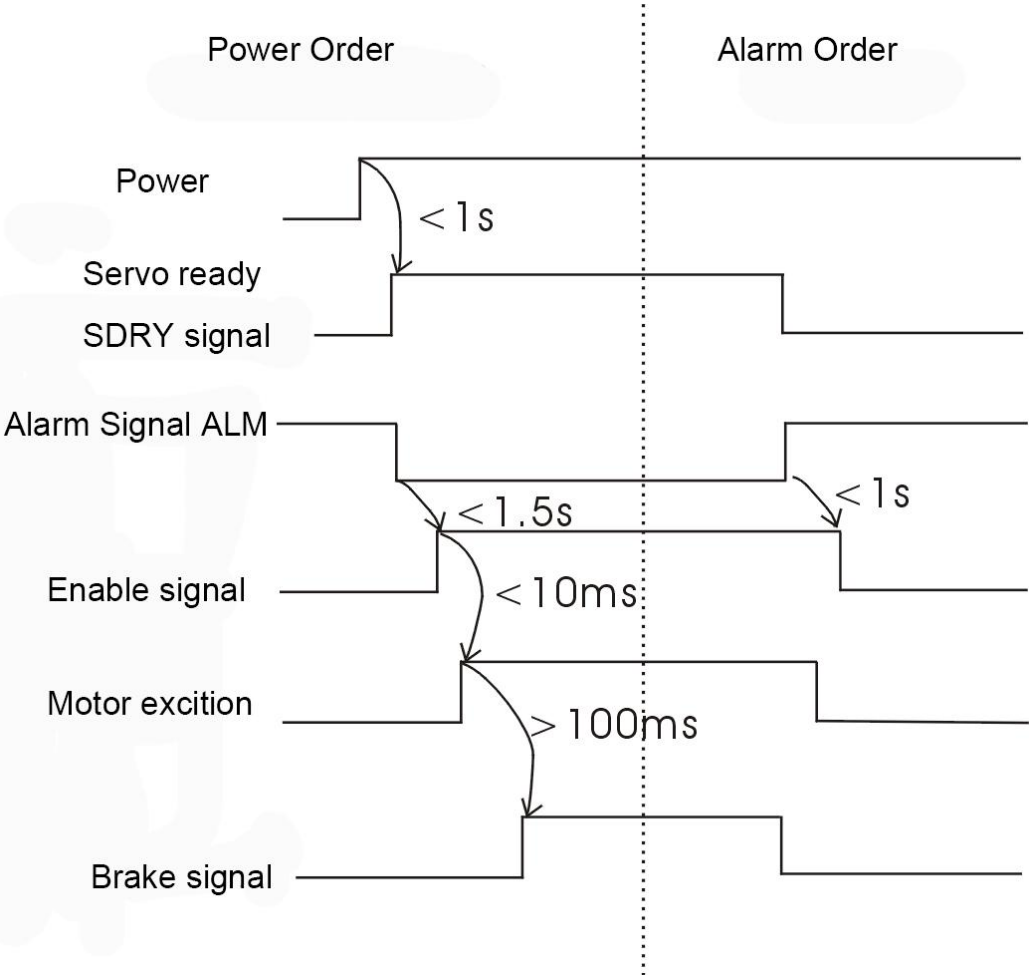
3) when servo enable and power are switched on together, motor excitation will be on in 1.5 seconds.

4) frequently power on and off, may damage soft start circuit and energy consumption braking circuit, the frequency of switching on and off should be limited 5 times within 1 hour, under 30 times every day. If driver or motor malfunctioned because of over heat, please wait for 30 minutes to cool it before power on again.



Power connection diagram 7-1

6.1.2 Power sequence diagram

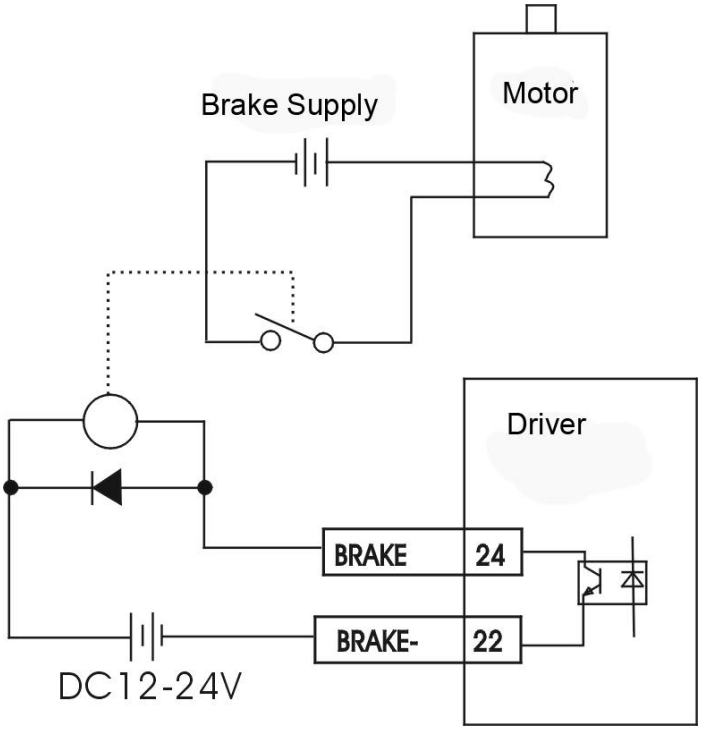


6.2 Brake connection

Mechanical brake is used to lock the vertical or slant platform which connects with motor, preventing it from dropping off for gravity after power off. The brake function requires the motor with brake.

Driver BRAKE signal controls intermediate reply which is used to control brake supply(offered by user). when driver powers on and motor excitation, BRAKE signal will be on after the delay time defined by P53. if power off or servo alarms, BRAKE signal will be off automatically, and cut off motor excitation after delay time by P53.

When connect BRAKE signal, please make sure capacity of brake supply, and must connect free-wheeling diode as surge absorber, as following picture:



6.3 Running

6.3.1 Checking before running

After connection, please check following items before powering on:

- **Are power terminals connected well? Is input voltage correct?**
- **Is power cable or motor cable is short circuited or grounded?**
- **Is control signal terminal connected well? Are power polarity and sie correct?**
- **Are driver and motor fixed well?**
- **Does motor shaft connect without load?**

- **Check if P21(rate current) and P22(rate torque) corresponds to configuration on motor label**

6.3.2 JOG control mode

When driver parameter P7=1, P7=7, driver is in JOG control mode.

When P7=7, motor rotary direction is controlled by CW, CCW signal, instead of button "↑", "↓".

When P7=1, press "↑", motor will rotate forward, release button, motor will stop. Speed is set by P23 and P31, when P31=1 or 2, speed selection is defined by MODE/INTH input signal, if MODE/INTH is valid, speed is set by P26.

When P7=1, press "↓", motor will rotate backward, release button, motor will stop. Speed is set by P23 and P31, when P31=1 or 2, speed selection is defined by MODE/INTH input signal, if MODE/INTH is valid, speed is set by P26.

Acceleration time constant in JOG mode can be adjusted by P38; Deceleration time constant in JOG mode can be adjusted by P39.

6.3.3 Position control mode

When P7=0, or P7=4 and MODE is invalid, driver is in position control mode. The speed is controlled by input pulse frequency, running direction is set by input direction and P15, input pulse mode is set by P14.

When P30=1 or 2, and INTH signal is valid, the position control mode is disabled.

When P32=0, electronic gear is defined by P12 and P13.

When P32=1, driver has dynamic electronic gear.

Note:

Motor orientation control: when P20=3, P30=0, P31=0, INTH is motor orientation input signal(must be pulse signal), P32 is motor orientation speed, direction is defined by P45-D0, P29 is motor orientation offset, when P2=2, output COIN signal.

Acceleration time constant in position control mode can be adjusted by P36; Deceleration time constant in position control mode can be adjusted by P37.

6.3.4 Speed control mode

When P7=2, or P7=4 and MODE is valid, driver is in position control mode.The max speed is defined by P24 and P31, when P31=1 or 2, max speed depends on status of MODE/INTH signal, if MODE/INTH is valid, the max speed is defined by P26. Th max speed refers to running speed when input 10V voltage.

Running speed is defined by voltage of Vin1, input voltage=Vin×P54/100, P54 is input voltage percentage; direction is defined by Vin1 sign and P15, when P15=2, direction is defined by CW and CCW signal, CW means rotates forward, CCW means rotates backward.

Zero drift in speed control mode can be adjusted by P28, adjust P28 to make sure speed is zero when input 0V.

Acceleration time constant in speed control mode can be adjusted by P38; Deceleration time constant in speed control mode can be adjusted by P39.

Note:

when P7=4, if switching between position and speed control by MODE signal, it should delayed for 10ms before command sending.

6.3.5 Torque control mode

When P7=3, or P7=8 and MODE signal is invalid, driver is in torque control mode. Torque is controlled by Vin1 input voltage. Direction is defined by Vin1 sign and P15, if P15=2, direction is controlled by CW,CCW signal, CW means forward rotary torque, CCW means backward rotary torque. The max torque refers to torque when input voltage is 10V, max speed is defined by P23.

P21 is motor rate torque, P22 is motor rate torque.

Zero drift in torque control mode can be adjusted by 28, adjust P28 to make sure output torque is zero when input 0V.

Torque can be do gain compensation adjustment through P29, bigger value means bigger torque output.

Acceleration time constant in torque control mode can be adjusted by P38; Deceleration time constant in torque control mode can be adjusted by P39.

When torque output reaches percentage(P50) of rate torque(P22), driver output COIN signal. COIN is pulse signal, width is 10ns. When P2=3 or P7=3/8, COIN is torque reach output(P50).

Note:

1. In torque control mode, P21 and P22 must accord to motor parameter;

2. when P7=8, during switch mode through MODE signal, should delay for 10ms before send command.

Parameter setting steps:

1. set P21, P22 according to motor parameter on motor label;

2. set P23, the max speed when input 10V;

3. motor without load, input 10V analog voltage, and adjust P28 to make motor speed the same as P23 setting;

4. motor with load, input 10V analog voltage, adjust P29 to make motor torque output is the same as P22 setting.

5. set P50 to make driver output COIN signal when torque output reaches P50.

6. during motor rotation, if motor vibrates, bigger motor need to reduce P29 value, little motor need to increase P29 value.

Experience setting: 7.7NM/2.3KW motor P29=250 approximately;

1.3NM/400W motor P29=1000 approximately.

Also can adjust P38, P39(the bigger motor it is, the bigger value parameter is).

6.3.6 Four-part inner pulse control mode

When P7=5, driver is in four-part inner pulse control mode. This function is applied to fixed-length processing in automation.

The control method is defined by P44:

P44=0, servo starts with auto loop.

P44=1, if input valid MODE signal, servo will start with single step;

P44=2, if input valid MODE signal, servo will start with auto loop.

If input valid INTH signal, the current part will pause, input INTH again, current part will quit, if input MODE signal, continue current part.

After start automatically, driver will do loop from the first part to the fourth part, as following chart:

Program part	Pulse number	Speed	Pause number after running pulse	Direction(defined by P45 hex code)	Output COIN or not after pulse running out
1st part	P40	P23	P46	D0=1, rotates CW	When P2=2, output COIN
2nd part	P41	P24	P47	D1=1, rotates CW	
3rd part	P42	P25	P48	D2=1, rotates CW	
4th part	P43	P26	P49	D3=1, rotates CW	

Attention

The width by inner pulse control= pulse number×electron gear G.

6.3.7 Servo motor home, four-part inner position control mode

When P7=11, driver is inner position control mode. This function is applied to fixed-length processing in automation. When input MODE valid, driver starts, direction is defined

by input pulse sign. Pause when input valid INTH, then quit current part input INTH(wait for above 0.5s after last INTH input) again, if input MODE signal, then continue current part. As following chart(0 means invalid, 1 means valid):

CCW	CW	MODE	Pulse Number	Motor speed
0	0	1	Home fuction	P23
0	1	1	P41	P24
1	0	1	P42	P25
1	1	1	P43	P26

The width by inner position control= pulse number×electron gear G.

6.3.8 Four-part inner speed control mode

hen P7=13, driver is inner speed control mode. When input MODE valid, driver starts, direction is defined by input pulse sign. As following chart(0 means invalid, 1 means valid):

CCW	CW	MODE	Motor speed
0	0	1	P23
0	1	1	P24
1	0	1	P25
1	1	1	P26

6.3.9 Inner speed control mode

When P7=9, driver is in inner speed control mode.

When input MODE signal(electric level signal), motor starts, input INTH signal(normal closed), motor stops(when P30=1 or 2, motor stops immediately). speed is defined by CW,CCW signal, as following chart:

MODE	INTH	CW	CCW	Motor speed
	0			0
1	1	0	0	P23 (max speed when Vin=10V)
1	1	0	1	P24
1	1	1	0	P25
1	1	1	1	P26

6.3.10 Inner speed control mode and stops when torque reach

When P7=10, driver is in inner speed control mode and when torque reaches P50, motor stops. Speed is controlled by CW and CCW signal.

MODE	CCW	CW	Motor speed
1	0	0	P23
1	0	1	P24
1	1	0	P25
1	1	1	P26

6.3.11 Inner speed control mode and left/right limit

When P7=12, driver is in inner speed control mode, and motor stops at left/right limit. During movement, if torque reaches P50, motor stops or rotates reverse, MODE signal is start button. As following chart:

INTH	Motor direction	Detect signal stop	Motor speed
1	P23 direction	CW	P23
0	P24 direction	CCW	P24

6.3.12 External signal JOG control mode

When P7=7, driver is in external CW,CCW signal JOG mode.

When CW signal is valid, motor rotate CW, if CW off, then motor stops. Speed is controlled by P23, P31, when P31=1 or 2, speed depends on MODE/INTH input signal, if MODE/INTH is valid, speed is controlled by P26.

When CCW signal is valid, motor rotate CCW, if CCW off, then motor stops. Speed is controlled by P23, P31, when P31=1 or 2, speed depends on MODE/INTH input signal, if MODE/INTH is valid, speed is controlled by P26.

Acceleration constant is controlled by P38; decelleration constant is controlled by P39. this control mode is simillar with JOG mode, but controlled by external signal instead of button.

6.4 Debug

- Mistaken parameter setting may cause driver malfunction, please check parameter validity before start driver.
- Suppose to do debug without load before debug with load.

6.4.1 Motor encoder zero position setting

When motor zero position offset, it is necessary to correct it, method is as following:

Open motor rear cover, set driver parameter P7=1, P3=1 to show motor current, rotate motor CW, CCW through JOG mode(speed from low to high), adjust motor encoder, to make the motor positive and negative current are the same and the lowest when motor is in max speed.

In case of over current alarm, speed can be adjusted from low to high step by step.

6.4.2 Servo motor encoder zero position debug

The encoder zero position in different brand motor may be different, parameter P34 is used to match encoder home position.

Set driver parameter P7=1, P3=1 to show motor current, rotate motor CW, CCW through JOG mode(speed from low to high), adjust P34, to make the motor positive and negative current are the same and the lowest when motor is in max speed.

Every time when P34 is changed, must do writing operation and restart driver.

In case of over current alarm, speed can be adjusted from low to high step by step.

6.4.3 Rigidity and gain adjustment

Speed loop proportional gain parameter P9: the bigger value means means higher gain and stronger rigidity, but motor is easier to noise; the bigger value is better if without noise.

Current loop proportional gain P8: the bigger value means the faster current gain; when motor vibrates, please increase P8; when connect small motor and it becomes heated, please decrease P8; Unless higher requirement, please do not change P8.

Position loop proportional gain P11: smaller value means motor is more smooth, but rigidity is less;the bigger P11 value is, the faster positioning speed is, the stronger rigidity becomes, and following counting deviation is smaller, but motor is easier to vibrate or overshoot;the bigger value is better if without vibration and overshoot.

Position control position loop feedforward gain P10:the bigger value means means higher gain and stronger rigidity, but motor is easier to vibrate; P10 value should decrease as load grows; the bigger value is better if without vibration.

Speed loop feedforward gain in speed control P59: the bigger value is, the higher gain is, the stronger rigidity is, but easier to vibrate; the value should decrease as load grows; the bigger value is better if without vibration.

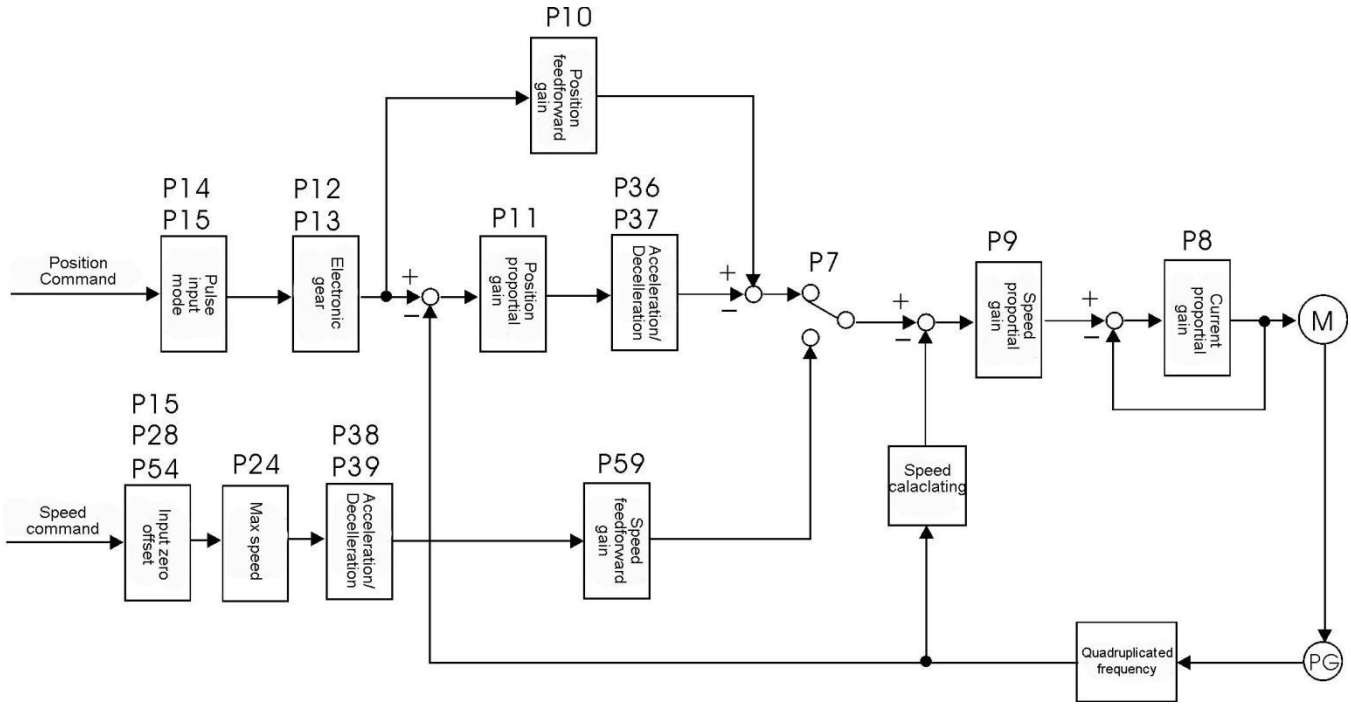
Attention:

1. if motor squeals or noise, please increase P8 value incrementally;

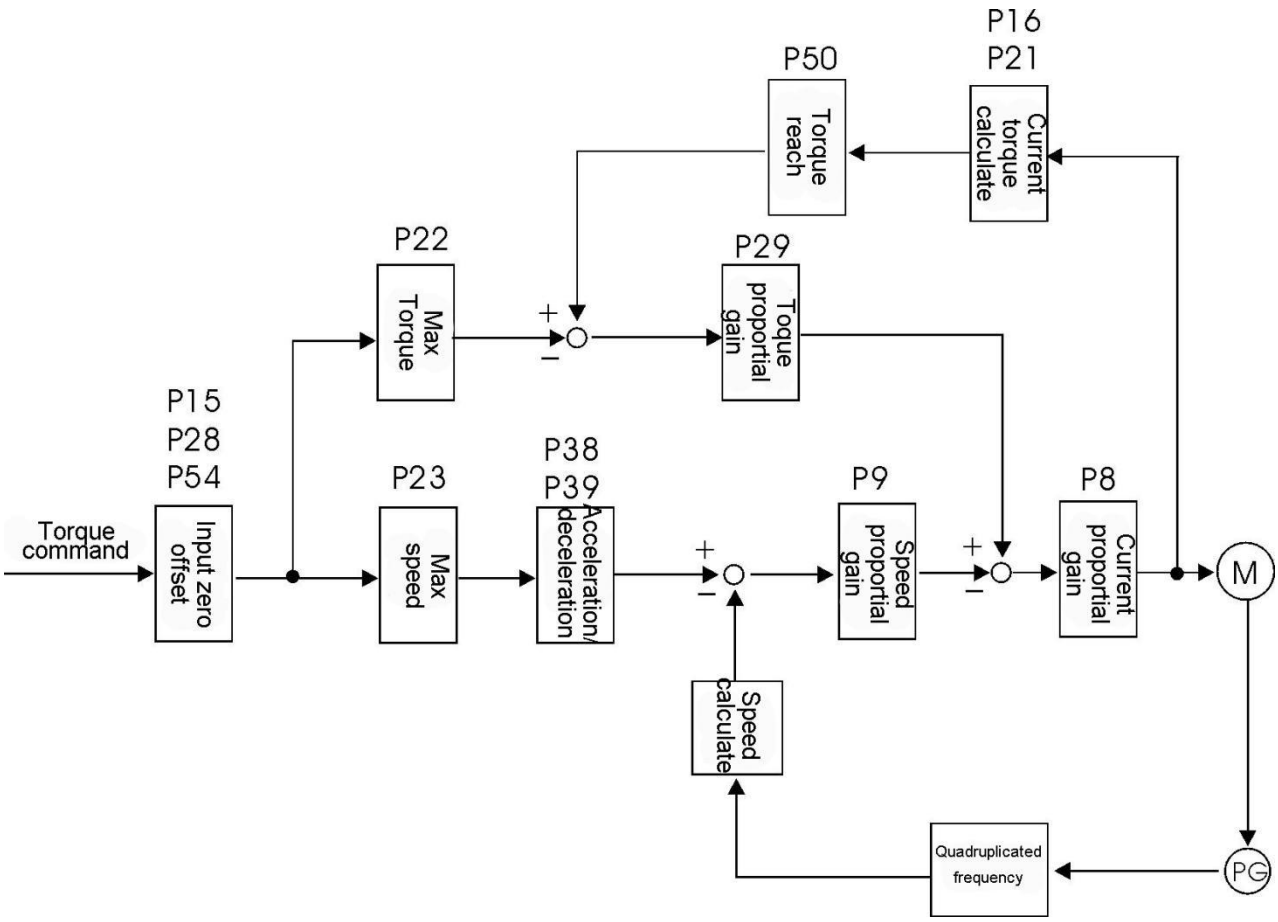
2. when motor connects with ballscrew and squeals, please decrease P9 value incrementally.

3. when connects ballscrew, and motor vibrates, please decrease P10 value incrementally. And if vibration is severe, while decreasing P10 does not work, please decrease P11.

6.4.4 Basic parameter setting diagram



Position, Speed control diagram



Torque control diagram

6.4.5 Position resolution and Electronic gear

Position resolution(one unit pulse travel) depends on motor per turn travel and pulse feedback Pt of encoder per turn, as following formula:

$$\Delta 1 = \frac{\Delta s}{P_t}$$

Δ1: 1 unit pulse travel(mm);

ΔS: servo motor travel per turn(mm/turn);

Pt: feedback pulse of encoder per turn(pulse/turn)

Besides, there is quadruplicated frequency circuit in driver, so

Pt=4×C

C is encoder line number. In NEWker driver, C=2500 lines per turn, then Pt=10000 unit pule per turn.

Command pulse needs to multiply electronic gear G before converting into position control pulse, so one unit command pulse travel is:

$$\Delta 1^{*} = \frac{\Delta S}{Pt} \times G$$

$$G = \frac{\text{Command pulse numberator}}{\text{Command pulse denominator}}$$

When the driver is used in cnc machine, parameter P12 and P13 is as following:

$$\frac{P12}{P13} = \frac{\text{machine reduction ratio} \times \text{controller pulse equivalent} \times 10000}{\text{ballscrew pitch(mm)}}$$

Normally, cnc controller pulse equivalent is 0.001mm.

6.4.6 Servo start and stop character debug

Start and stop character means acceleration and deceleration time, depending on load inertia, stop frequency, and performance of servo driver with motor. Frequent start and stop, short acceleration and deceleration time, big load inertia will heat driver and motor up, lead to overload alarm, therefore used need to adjust parameter according to real situation.

1) load inertia and start/stop frequency

For high start/stop frequency application, user need to confirm if it is within limit. The frequency varies along motor type, capacity, load inertia, motor speed differ. If load inertia is M times than motor inertia, allowed motor start/top frequency and advised acceleration are as following:

M times of load inertia	Allowed frequency
M≦3	>100 times/minute; acceleration time constant≦500
M≦5	60~100 times/minute; acceleration time constant≦150
M>5	<60 times/minute; acceleration time constant≦50

2) Servo motor

Various motors start/stop frequency and acceleration time differs according to load condition, running time, load rate, condition temperature etc, please refer to motor manual and real condition to adjust parameter, in case of overheat alarm or work life decrease.

3) Adjustment

Normally, the load inertia should be within the value which is 5 times than motor rate inertia. If used in big load inertia always, it is easier that main circuit is over voltage or brake malfunction during deceleration, then solution is as follows:

- Increase acceleration and deceleration time, it can be set bigger, and decrease incrementally to suitable value.
- Decrease inner torque limit, and current limit value.
- Decrease motor max speed.
- Exchange bigger power, higher inertia motor.

Chapter 7 Alarm

- After power off driver and motor, do not touch them within 5 minutes, in case of electric shock.
- After alarm, please do not use driver before fault is solved.
- During alarm happens, driver will display ER0-xx and flicker, xx is alarm code.
- Set P52, P3=11 to check alarm history, in order to analyse source.
- After alarm, driver parameter still can be checked or modified.

Alarm Code List

Alarm Code	Alarm Information	Causes
ER0-00	Normal	
ER0-01	Motor overspeed	1) Encoder cable connection is wrong; 2) Encoder is broken; 3) Encoder cable is too long, voltage supply to encoder is too low; 4) Motor sun speed is too fast; 5) Input pulse frequency is too high; 6) Electronic gear is too big; 7) Servo system is not stable and causes overshoot; 8) Circuit board is broken
ER0-02	Main circuit power Overvoltage	1) Power voltage is too high (Over+20%); 2) Brake resistor cable is cut off; 3) Inner regenerative brake transistor is broken; 4) Inner regenerative brake loop capacity is too small; 5) Circuit board is broken.

ER0-03	Main circuit voltage low or Driver overheat	1) Power voltage is tool low (lower than -20%); 2) Temporary interruption over 200mS; 3) Power start circuit loop fault; 4) Circuit board is broken; 5) Driver is overheated;
ER0-04	Out of tolerance	1) Mechanical part is chucked; 2) Input pulse frequency is too high; 3) Encoder zero position changes; 4) Encoder cable connection fault; 5) Position loop gain P11 is too small; 6) Torque is not enough; 7) P18 value is too small; 8) P19=1 will hide this alarm;
ER0-05	Driver overheat	1) Condition temperature is too high; 2) Cooling fan is broken; 3) Temperature sensor is broken; 4) Motor current is too big; 5) Inner regenerative brake transistor is broken; 6) Inner regenerative brake loop capacity is too small; 7) Circuit board is broken.
ER0-06	Driver writing EEPROM storage fault	Chip U19 is broken, need to changing.
ER0-07	CW motor positive limit	Reach positive limit switch, set P20=0 to hide the function or rotate motor in reversed direction(increase P17), when

		P0=2, it will not alarm
	NK driver FPGA chip is broken	U30 chip is broken, need to changing
ER0-08	CCW motor negative limit	Reach negative limit switch, set P20=0 to hide the function or rotate motor in reversed direction(increase P17), when P0=2, it will not alarm
ER0-09	Encoder fault	1) Encoder is broken; 2) Encoder cable is cut off; 3) P51=1 will hide this alarm; 4) Encoder cable is too long, voltage supply to encoder is too low; 5) Absolute encoder: communication fault, overspeed, connection cable fault;
ER0-10	Motor overload	When load is over rate torque×P16 percentage, driver alarm ER0-10;
ER0-11	Module fault	1) Current is too big; 2) Voltage is too low; 3) Motor isolation is broken; 4) Gain parameter setting is incorrect; 5) Overload; 6) Temperature is too high; 7) Module is broken; 8) Driver is interfered; 9) Motor cable UVW are short circuit;
ER0-12	Over current	1) Motor cable UVW are short circuit; 2) Bad grounding; 3) Motor isolation is broken;

		4) Overload; 5) Over 300% rate current for above 100ms; 6) Continually over 30% rate current for above 15s; 7) Gain parameter setting is incorrect, decrease P8 value to reduce current loop gain; 8) Circuit board is broken;
ER0-13	Driver discharge fault	1) Power voltage is too high; 2) Power discharge loop circuit fault; 3) Circuit board is broken;
ER0-15	Absolute encoder battery fault	1) Battery voltage is low(the battery voltage is 3.6V, capacity is 7500mAH, when battery voltage is lower than 3.2V, driver will alarm), please exchange battery.(must exchange battery during driver powering on, otherwise the multiturn data will lose!!!) 2) Battery connection cable poor contact; 3) When P57=0, ER0-15 will be hidden.

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