Statement

Thank you for purchasing the servo drive SVD880/SVD810.Please read this user manual carefully before use to ensure the correct use of this product. The illustrations in this user manual are for convenience and may differ slightly from the product. Due to product upgrades or specification changes, and to improve the convenience of the user manual, the content of this user manual will be updated in a timely manner without prior notice. Please refer to the instructions provided on our website.

In addition, please place this instruction manual in a conspicuous place for easy reference.

NIETZ ELECTRIC CO.,LTD

Data version V2.4.26

2025-12

Safety precautions

Servo drives are precision power electronic products. For the safety of operators and mechanical equipment, please ensure that they are installed and debugged by professional motor engineer. Please carefully read the symbols as "danger" and "caution" in this manual. If you have any questions, please contact our agents,Our professional team will be happy to serve you.

Note precautions:

⚠ Danger

1. Be sure to ground correctly before using the driver
2. Be sure to cut off power when wiring
3. There is still residual voltage inside after cut off AC power, do not touch the internal circuit and components within 5 minutes after servo driver digital operation indicator light off.
4. Do not modify the servo drives by yourself
5. Be sure the driver terminal PE is correctly grounded
6. The servo drives cannot be used in application related to personal safety such as life-sustaining devices.

⚠ Warning

1. Do not make voltage withstand tests on the internal components of the servo drive, as the semiconductor devices used in the servo drive would be damaged by high voltage breakdown.
2. Do not operate any wiring terminals after the servo driver is connected to AC power
3. Installation, debugging, and repair of servo drives should be carried out by professional person.

4.

⚠ Note

1. After some functions of the servo drive are set, the motor may run immediately after the power supply is switch on or off
2. Select a suitable installation site to prevent high temperatures and direct sunlight, and avoid splashing of water droplets.
3. Prevent irrelevant operators from approaching the servo drive.

Warranty

1. The warranty of the product is 18 months. Within warranty, we offer free repair if any malfunction or damage occurs during normal use. For another agreement with warranty, refer to the contract signed.
2. Warranty scope only limit to servo driver.
3. Guarantee
   - The preliminary diagnosis of the fault is carried out by user, and the final diagnosis result is determined after inspection and confirmation by our team.
   - For quality problem, it is guaranteed to return and replace within 7 days after received, and replace within 15 days, maintenance within 18 months.
   - Within warranty, user request on-site service, if it is our quality problem, we offer free service, if the fault is caused by user, then user bear the on-site service charge.
4. For below situation, we should require service charge even if it is within warranty
   - Fault or damage caused by user's unsafe transportation, storage, and incorrect design, installation, wiring, debugging, etc.
   - Fault or damage caused by unauthorized disassembly, modification, maintenance, etc.
   - Fault or damage caused by flooding, fires, storms, lightning strikes, abnormal power grid voltage, and other natural disasters
   - Replace consumables and expired components
   - Other faults that not cause by our product
5. Exemption from liability

- Regardless of whether it is within the warranty period, all damages to your company or your company's users caused by the failure of our company's products, such as equipment, machinery, and electrical appliances, are not within the scope of compensation by our company.

Common symbols

- **Dual parameters function code representation：**

d_N_M

d indicates that the function code is a dual parameter function code；

M indicates first parameter；

N indicates second parameter；

- **Four-parameter function code representation：**

FDCBA

A indicates first parameter；

B indicates second parameter；

C indicates third parameter；

D indicates fourth parameter；

- **Mode description：**

P：Position control mode		**ALL**：All control mode
S：Speed control mode	Sr：Internal register speed control mode	
	Sz：Analog speed control mode	
T： Torque control mode	Tr：Internal register torque control mode	
	Tz：Analog torque control mode	

- **Function code unit description**

T：One control cycle，

$$T = \frac{1}{Fc}$$

Note：Fc is carrier frequency

Contents

Statement 1
Safety precautions 2
Warranty 4
Common symbols 6
Chapter 1 Introduction 11
1.1 Product confirmation 11
1.2 Model description..... 错误!未定义书签。
1.3 Specification 14
Chapter 2 Control and Wiring 18
2.1 Control circuit wiring diagram SVD880 Series 18
2.2 Installation and wiring.....20
2.3 Installation.....24
2.3.1 Install environment 24
2.3.2 Installation direction and space 24
2.4 Wiring 25
2.4.1 Main circuit wiring 1.Terminal names and functions 25
2.4.2 Servo motor encoder signal connect port 33
2.4.3 Control signal connector.....46
2.4.4 RS232 Communication connect port.....47
2.4.5 RS485 Communication port 47
2.4.6 Wiring diagram 48
Chapter 3 Operation panel and function code setting 53
3.1 Operation Panel 53
3.2 Operation panel using diagram 54
3.3 Monitoring Un 54

3.4 Function code Pn 57
Chapter 4 Function Code list.....59
4.1 Basic Operation Area 1 59
4.2 Basic Operation Area 2.....67
4.3 Gain adjustment area.....72
4.4 Position loop parameters.....75
4.5 Speed loop parameters 86
4.6 Torque ring parameters.....89
4.7 Input, Output and Other Control Parameters 92
4.8 Communication Area.....99
Chapter 5 Driver trial operation.....101
5.1 Servo status machine function 101
5.1.1. The driver are with below status 101
5.1.2.Status machine switchover diagram.....102
5.2 Servo control mode selection 104
5.3 Servo on running 105
5.4 Servo brake output 106
5.5 Servo running command setting.....109
5.5.1 Position loop position command setting.....109
5.5.2 Mainshaft specialize position command Pulse 111
5.5.3Electronic gear setting 112
5.5.4 Limit output function.....114
5.5.5 Speed loop speed command setting 115
5.5.6 Torque loop torque command setting 120
5.5.7 Internal multi-segment position command setting 123
5.5.8Home Return 128
Chapter 6 Digital input output terminal function 151
6.1 Input terminal.....151

6.1.1 Input terminal function setting.....151
6.2 Output terminal 156
6.2.1 Output terminal function setting 156
Chapter 7 Gain adjustment.....159
7.1 Speed loop gain adjustment 159
7.2 Position loop gain adjustment.....165
7.3 Torque loop gain adjustment.....167
Chapter 8 Communication function 169
8.1 RS232 Hardware connect of controller 169
8.2 RS232 Communication parameter of controller.....169
8.3 RS232 communication protocol.....169
8.3.1 Character structure 169
8.3.2 Data format.....169
8.4 RS485 Hardware connect of controller 173
8.5 RS485 Communication parameter of controller.....173
8.6 RS485 Communication Protocol 174
8.6.1 Character structure 174
8.6.2 Data format.....174
8.7 MODBUS CRC(Cyclical Redundancy Check) 178
8.8 Mechatrolink-III、Ethercat communication protocol related setting 180
8.8.1 MECHATROLINK-III communication protocol setting 180
8.8.2 Ethercat communication protocol setting.....180
Chapter 9 Fault and treatment measures.....193
9.1 Fault list.....193
9.2 Fault history record.....199

Chapter 1 Introduction

1.1 Product confirmation

Please note below info when you get the products:

- Is the product you get is the same as you ordered ? Please check the model of the nameplate
- Is there any damage to the product? Check whether there are any damages caused during transportation
- Is there any looseness in the screws?

Nameplate description as below：(Take the SVD880 series 400W EtherCAT bus as an example)

1.2 Model description

Driver model: (Take the 400W EtherCAT bus as an example)

SVD 880-0R4- □C 02

Identifying	Product
SVD	Servo Drive

Identifying	Series
880/810	Drive series

Identifying	Rated output
0R2	0.2KW
0R4	0.4KW
0R7	0.75KW
1R0	1KW
1R5	1.5KW
2R0	2.0KW
3R0	3KW
4R0	4KW
5R0	5KW
5R5	5.5KW
7R5	7.5KW
11	11KW
15	15KW

Identifying	Voltage
02	3 phase 220V
04	3 phase 380V

Identifying	Instruction Type
A	Pulse command given (including modbus RTU)
C	Absolute+EtherCAT
D	Absolute+ MechatrolinkIII
N	Absolute+CAN
P	Absolute+Profinet

Identifying	Encoder Type
Omit	Absolute valueTamagawa
A	ABZ type
B	BISSC Protocol
E	enData2.2 Protocol
H	Highperface Protocol
R	Resolver Protocol Encoder
S	Sin-Cos Protocol

Motor model：(Take the 400W optical encoder without brake motor as an example)

ZD M1-060 K L 013 30-5 E P

Identifying	Product
ZD	High performance
UD	Economic motor

Identifying	Encoder type
M1	Photoelectric
M2	Magnetic electric

Identifying	Flange
040	40
060	60
080	80
110	110
130	130
180	180
220	220

Identifying	Encoder type
N	Absolute 24-bit
K	Absolute 23-bit
K1	Absolute 23-bit Multi-turn Split
C	Absolute 17-bit
C1	Absolute 17-bit

Identifying	Phase/Voltage
L	3 phase 220V
S	3 phase 380V

Identifying	Waterproof/Oil
Y	With oil seal
W	Without oil seal
P	Waterproof & oil

Identifying	Brake
E	No brake
B	Brake

Identifying	Polar logarithm
4	4 pole
5	5 pole

Identifying	Rated rotate
30	3000r/min
20	2000r/min
15	1500r/min

Identifying	Rated torque
003	0.32N.m
006	0.6N.m
013	1.27N.m
024	2.39N.m
032	3.2N.m
054	5.4N.m
064	6.4N.m

1.3 Specification

<table>
<tr><td colspan="2">Driver model
SVD8□0-□R□-□0□</td><td>0R2</td><td>0R4</td><td>0R7</td><td>1R0</td><td>1R5</td><td>2R0</td><td>3R0</td><td>4R0</td><td>5R0</td><td>5R5</td><td>7R5</td><td>11</td></tr>
<tr><td rowspan="2">Input</td><td>Control circuit power</td><td colspan="11">Single phase AC200V～AC240V 50/60HZ</td><td>~</td></tr>
<tr><td>Main circuit power</td><td colspan="4">3 phase AC220V~AC240V 50/60Hz
L1、L2、L3 can connect with single phase 220V</td><td colspan="7">Three phase AC200V～AC240V 50/60HZ
Three phase AC360V～AC420V 50/60HZ
Input power 220V and 380V servo drive optional
Note：2.5KW above driver only allow to connect with three phase 220V, Connect to single phase need to derating15%~30% in use.</td><td>3 phase AC 360V~AC420V 50/60Hz</td></tr>
<tr><td rowspan="4">Output</td><td>Rated power</td><td colspan="4">Three phase AC：0-220V</td><td colspan="7">3 phase AC: 0~220V/3phase AC: 0~380V
Input power: 220V and 380V can be selected</td><td>3 phase AC: 0~380V</td></tr>
<tr><td rowspan="3">Rated current(A)</td><td rowspan="3">1.6</td><td rowspan="3">2.8</td><td rowspan="3">5</td><td rowspan="3">7.6</td><td colspan="6">220V</td><td rowspan="3">22</td><td rowspan="3">25</td></tr>
<tr><td>11</td><td>13</td><td>18</td><td>21</td><td>25</td><td>30</td></tr>
<tr><td colspan="6">380V</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>5.8</td><td>7.5</td><td>8.8</td><td>13</td><td>16</td><td>18</td></tr>
<tr><td>Rated power(KW)</td><td>0.2</td><td>0.4</td><td>0.75</td><td>1</td><td>1.5</td><td>2.0</td><td>3</td><td>4</td><td>5</td><td>5.5</td><td>7.5</td><td>11</td></tr>
<tr><td colspan="2">Driver model
SVD810-□R□-□0□</td><td>15</td><td>18.5</td><td>22</td><td>30</td><td>37</td><td>45</td><td>55</td><td>75</td><td>90</td><td>110</td><td>132</td><td>160</td></tr>
</table>

Input	Main circuit power supply	Three phase AC360V～AC420V 50/60HZ											
Output	Rated power	Three phase AC380V											
	Rated current	32	37	45	60	75	91	112	150	176	210	253	304
	Overload current (A) One minute	48	55.5	67.5	90	112.5	136.5	168	225	264	315	379.5	456
	Rated power	15	18.5	22	30	37	45	55	75	90	110	132	160
Environment condition	Temperature	Environment temperature 0°C～55°C(without condensing) Storage temperature -20°C～65°C（Maximum temperature 87°C 72 hours）											
	Humidity	Both using and storage need to keep below 90%RH （without condensing）											
	Altitude	Lower than 1000m											
	Vibration	Less than 5.88m/S²，10-60Hz(Can not continuous use under resonance frequency)											
Control mode		IGBT PWM type sine wave drive											
Encoder feedback		17Bit(131072 resolution) Absolute encoder 23Bit(8388608 resolution)Absolute encoder 24Bit(16777216 resolution)Absolute encoder 26Bit(67108864 resolution)Absolute encoder											
Communication		Supports EhterCAT protocol, MechatrolinkIII protocol, Profinet protocol, CAN											

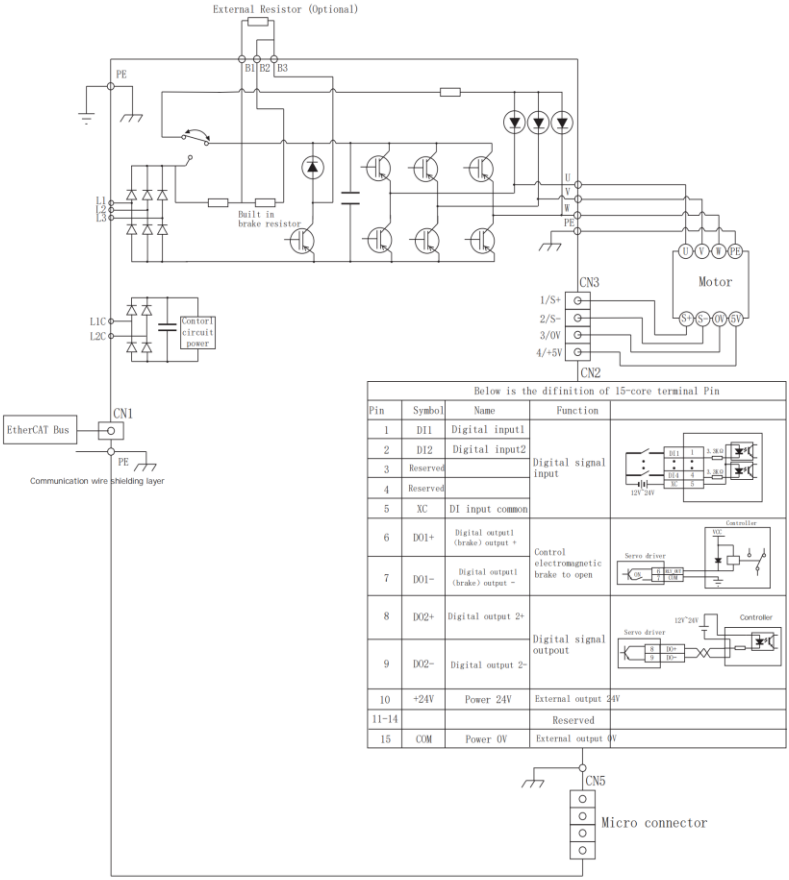
		protocol, modbus RTU
Operation panel		1、4 keys 2、LED light 5 bits 3、Power workable light 4、SON indicate light 5、Vector signal monitor output
Brake resistor		（0R4～11）built-in regenerative resistor (Can be external)
Dynamic brake		Built in
Position control	Signal input	SVD880 Support EhterCAT、MechatrolinkIII、Profinet, SVD810 support external pulse and EhterCAT
	Vibration suppression control	Support
Speed	Signal input	SVD880 Support EhterCAT、MechatrolinkIII、Profinet, SVD810 support external pulse and EhterCAT
	Zero speed dead zone	According to zero speed dead zone input
	Instantaneous velocity observer	Can be used
	Speed command filter	Can be used
Torque control	Signal input	SVD880 Support EhterCAT、MechatrolinkIII、Profinet, SVD810 support external pulse and EhterCAT
General	Hardware	Over voltage, under voltage, overload, over heat, over current,encoder fault

		Software	Position deviation too large, command pulse frequency division, EEPROM fault，ect
	Alarm data track		Refer to alarm data list

Chapter 2 Control and Wiring

2.1 Control circuit wiring diagram

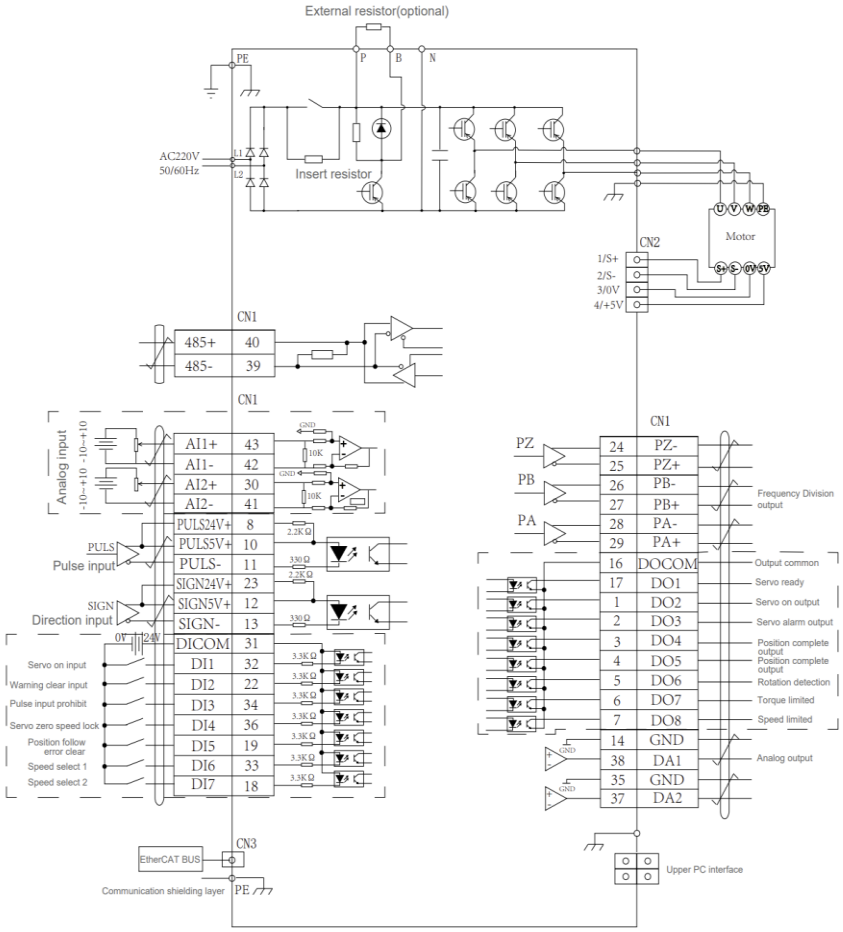
SVD880 Series



Below is the difinition of 15-core terminal Pin

Pin	Symbol	Name	Function	
1	DI1	Digital input1	Digital signal input	
2	DI2	Digital input2		
3	Reserved			
4	Reserved			
5	XC	DI input common		
6	DO1+	Digital output1 (brake) output +	Control electromagnetic brake to open	
7	DO1-	Digital output1 (brake) output -		
8	DO2+	Digital output 2+	Digital signal outpout	
9	DO2-	Digital output 2-		
10	+24V	Power 24V	External output 24V	
11-14			Reserved	
15	COM	Power 0V	External output 0V	

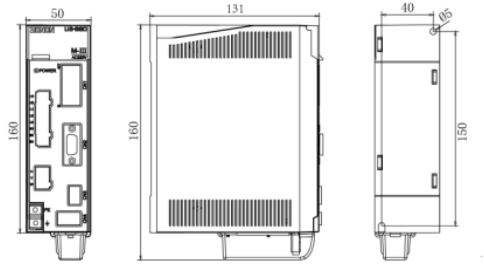
SVD810 Series



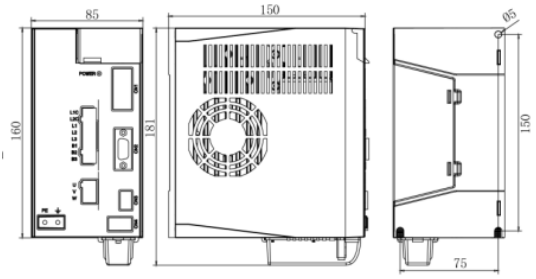
2.2 Installation and wiring

SVD880 Dimension

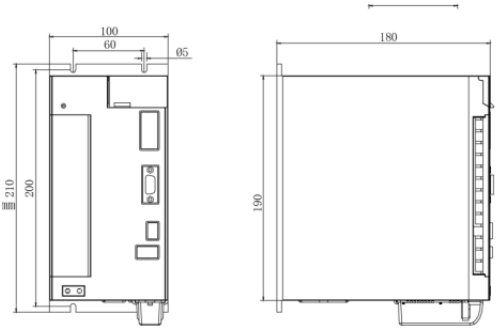
1KW and below: H X D X W =160×131×50mm



1.5KW-3.0KW : H X D X W =160×150×85mm

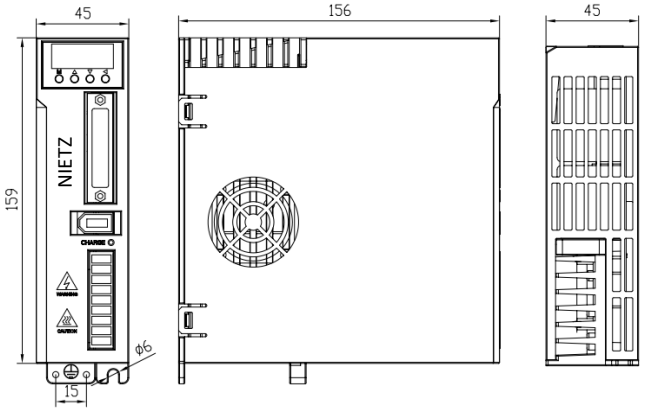


4KW-11KW : H X D X W =210×180×100mm

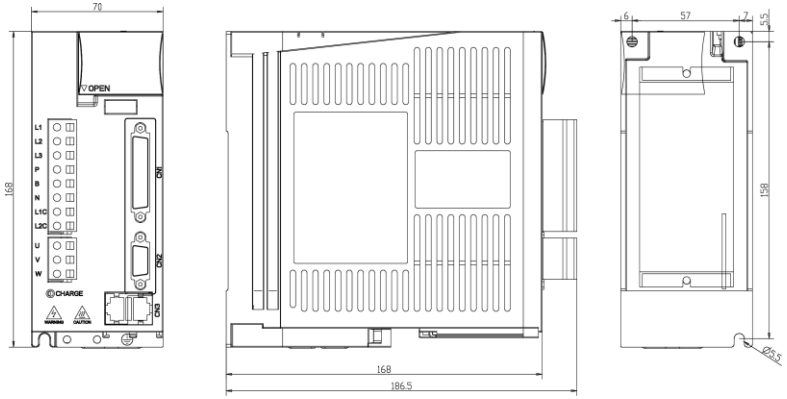


SVD810 Dimension

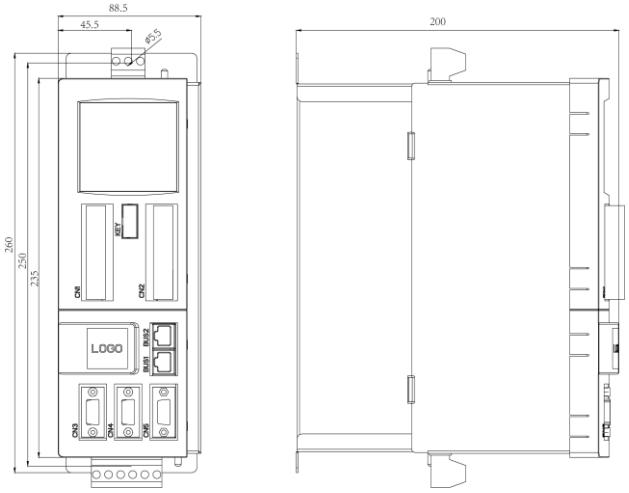
1KW and below: H X D X W =159×156×45mm



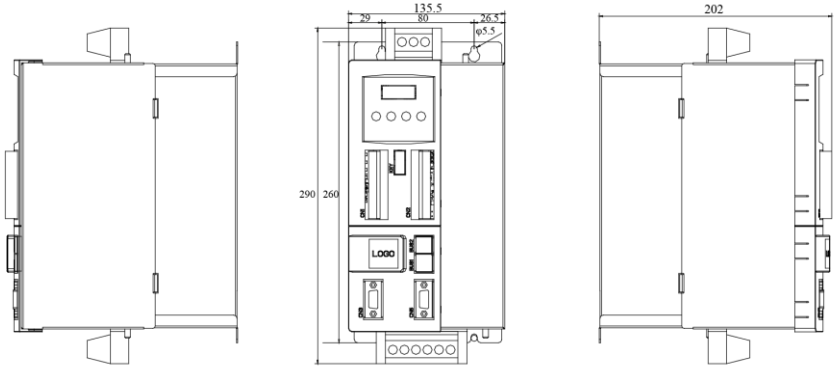
1.5KW-3.0KW : H X D X W =168×186.5×70mm

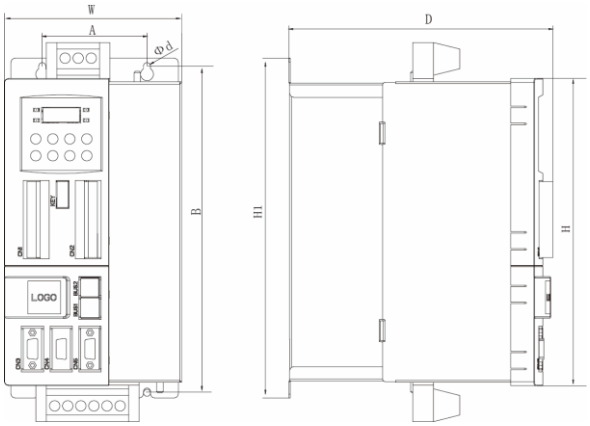


4.0KW-7.5KW : H X D X W =260×200×88.5mm



11KW-15KW : H X D X W =290×202×135.5mm





18.5KW-160KW : H X D X W =290×202×135.5mm

Driver Model	Dimensions（mm）				Installation Dimensions（mm）	
	W(Width)	H（High）	H1	D（Deep）	A*B	Φd
SVD810-18.5	193	235	260	222	132*250	5.5
SVD810-22						
SVD810-30	177	439	475	256	120*460	7
SVD810-37						
SVD810-45	239	579	615	308	160*600	9
SVD810-55						
SVD810-75	279	600	630	340	200*612	9
SVD810-90						
SVD810-110						
SVD810-132						

SVD810-160	305	845	880	450	200*838	11

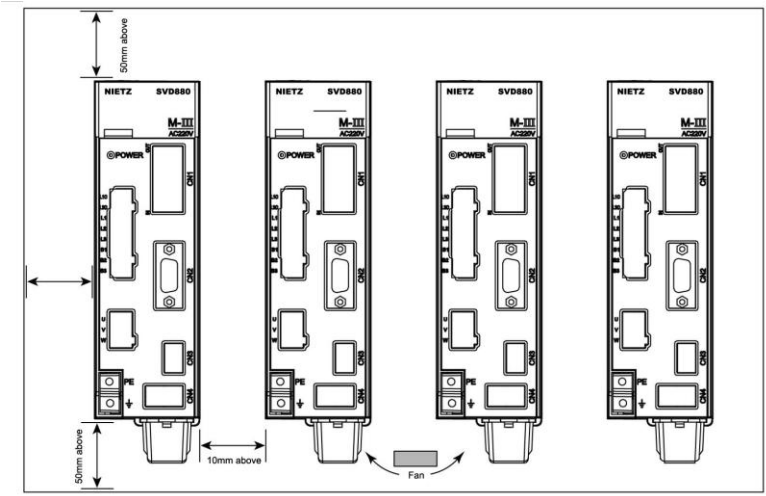
2.3 Installation

2.3.1 Install environment

1. Application with excellent ventilation, lower humidity and without dust；
2. Environment does not contain corrosive flammable gas；
3. Environment without vibration；
4. Avoid direct sunlight

2.3.2 Installation direction and space

1. The driver adopt natural cooling method, correct installation direction is vertical installation ；
2. Consider the temperature rising when install in cabinet, reserve enough space to achieve heat dissipation and cooling effects；
3. Do not drop debris into the driver when installation:
4. Use M5 screws to fix.



In order to enable the cooling fan to have low wind resistance and effectively dissipate heat, please install it according to the recommended distance.

2.4 Wiring

2.4.1 Main circuit wiring

1.Terminal names and functions

(1). (SVD880_0.2KW-3.0KW) 220V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
Input	L1C、L2C	Control power input terminal	Connect single phase AC 220V to input power. Supply power to servo control circuit
	L1、L2、L3	Main circuit power input terminal	Connect three phase AC 220V input power,Supply power to servo main circuit
Brake resistor	B1、B2、B3	External, built in brake resistor connecting terminal	Driver built in brake resistor between B2 and B3. If the capacitor of the built in resistor is not enough, install external brake resistor between B1 and B3. It need to disconnect the built in resistor(B2 and B3 disconnect).
Output	U、V、W	Servo motor connect terminal	Connect to servo motor's U、V、W
	PE(M4 screw bolt)	Ground terminal	Connect to motor PE

(2). SVD880_1.5KW-3.0KW) 380V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
Input	L1C、L2C	Control power input terminal	Connect single phase AC 220V to input power. Supply power to servo control circuit
	L1、L2、L3	Main circuit power input terminal	Connect three phase AC 380V input power
Brake resistor	B1、B2、B3	External, built in brake resistor connecting terminal	. If the capacitor of the built in resistor is not enough, install external brake resistor between B1 and B3. It need to disconnect the built in resistor(B2 and B3 disconnect).
Output	U、V、W	Servo motor connect terminal	Connect to servo motor's U、V、W
	PE(M4 screw bolt)	Ground terminal	Connect to motor PE

(3). (SVD880_4.0KW-5.5KW) 220V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
Input	L1C、L2C	Control power input terminal	Connect single phase AC 220V to input power. Supply power to servo control circuit
	L1、L2、L3	Main circuit power input terminal	Connect three phase AC 220V input power,Supply power to servo main circuit

	N	DC bus -	Connect to external brake unit (Take care when wiring special function terminal)
	P+	DC bus+	P+,N as DC power input
Brake resistor	P+、B1、B2	External, built in brake resistor connecting terminal	Driver built in brake resistor between B1 and B2. If the capacitor of the built in resistor is not enough, install external brake resistor between P+ and B2. It need to disconnect the built in resistor(B1 and B2 disconnect).
Output	U、V、W	Servo motor connect terminal	Connect to servo motor's U、V、W
	PE(M4 screw bolt)	Ground terminal	Connect to motor PE

(4). (SVD880_4.0KW-11KW) 380V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
Input	L1C、L2C	Control power input terminal	Connect single phase AC 220V to input power. Supply power to servo control circuit
	L1、L2、L3	Main circuit power input terminal	Connect three phase AC 380V input power,Supply power to servo main circuit
	N	DC bus -	Connect to external brake unit (Take care when wiring special function terminal)

	P+	DC bus+	P+,N as DC power input
Brake resistor	P+、B1、B2	External, built in brake resistor connecting terminal	Driver built in brake resistor between B1 and B2. If the capacitor of the built in resistor is not enough, install external brake resistor between P+ and B2. It need to disconnect the built in resistor(B1 and B2 disconnect).
Output	U、V、W	Servo motor connect terminal	Connect to servo motor's U、V、W
	PE(M4 screw bolt)	Ground terminal	Connect to motor PE

(5). (SVD810_0.2KW-1.0KW) 220V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
Input	L1、L2	Control power input terminal	Connect single phase AC 220V to input power.
	P	DC bus +	Servo built in brake resistor, It must disconnect between B and P as default, if the capacitor is not enough, connect external brake resistor between B and P
	B	External brake resistor connecting terminal	
	N	DC bus -	Take care when wiring special function terminal
	U、V、W	Servo motor connect	Connect to servo motor's U、V、

Output		terminal	W
	PE	Ground terminal	Connect to motor PE

(6). (SVD810_1.5KW) 220V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
Input	L1、L2	Control power input terminal	Connect single phase AC 220V to input power. Supply power to servo control circuit
	L1、L2、L3	Main circuit power input terminal	Connect three phase AC 220V input power,Supply power to servo main circuit
	P	DC bus +	If the capacitor is not enough, connect external brake resistor between B and P
	B	External brake resistor connecting terminal	
	N	DC bus -	Take care when wiring special function terminal
Output	U、V、W	Servo motor connect terminal	Connect to servo motor's U、V、W
	PE(M4 screw bolt)	Ground terminal	Connect to motor PE

(7). (SVD810_1.5KW-3.0KW) 380V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
	L1、L2	Control power input terminal	Connect single phase AC 220V to input power. Supply power to servo control circuit(L1,L2,L3

Input			as 380V input, L1,L2 could be no connect)
	L1、L2、L3	Main circuit power input terminal	Connect three phase AC 220V input power,Supply power to servo main circuit
	P	DC bus +	Servo built in brake resistor, It must disconnect between B and P as default, if the capacitor is not enough, connect external brake resistor between B and P
	B	External brake resistor connecting terminal	
	N	DC bus -	Take care when wiring special function terminal
Output	U、V、W	Servo motor connect terminal	Connect to servo motor's U、V、W
	PE	Ground terminal	Connect to motor PE

(8). (SVD810_4KW-15KW) 380V Terminals of main circuit ：

Module type	Terminal symbol	Name	Function
Input	R、S、T	Main circuit power input terminal	Connect three phase AC 220V input power,Supply power to servo main circuit
Output	(+)	DC bus +	The drive has no built-in brake resistor. Connect an external brake resistor between (+) and PB.
	PB	External brake resistor connecting terminal	
	(-)	DC bus -	Take care when wiring special function terminal

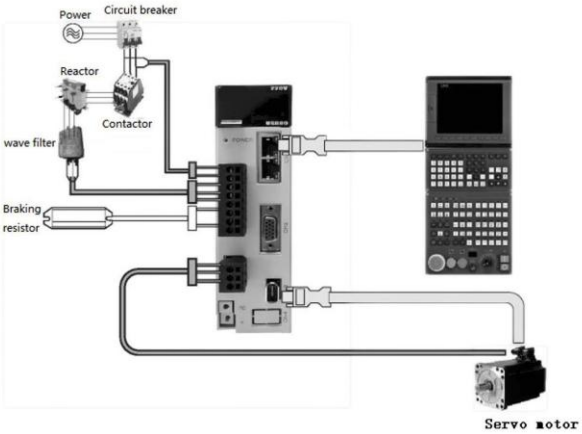
	U、V、W	Servo motor connect terminal	Connect to servo motor's U、V、W
	PE	Ground terminal	Connect to motor PE

2. External brake resistor selection

Servo driver			Built in brake resistor		External brake resistor	
Power（Kw）	Voltage（V）	Model	Resistance（Ω）	Power（w）	Minimum resistance（Ω）	Power（W）
0.2	220	SVD810 /SVD880-	50	50	10	100
0.4	220	SVD810 /SVD880-	50	50	10	100
0.75	220	SVD810 /SVD880-	50	50	10	200
1	220	SVD810 /SVD880-	50	50	10	200
1.5	220	SVD810 /SVD880-	50	50	10	400
3	220	SVD810 /SVD880-	20	100	10	500
4	220	SVD810 /SVD880-	20	100	10	800
5	220	SVD810 /SVD880-	20	100	10	1000
5.5	220	SVD810 /SVD880-	20	100	10	1000
7.5	380	SVD810 /SVD880-	20	100	10	1500
11	380	SVD810 /SVD880-11-			10	2000
15	380	SVD810/SVD880-15-			10	2000
18.5	380	SVD810/SVD880-			10	3000
22	380	SVD810/SVD880-22-			10	4KW
30	380	US810-30-□04			10	6KW
37	380	US810-37-□04			10	6KW
45	380	US810-45-□04			10	8KW
55	380	US810-55-□04			10	8KW
75	380	US810-75-□04			10	15KW

Servo driver			Built in brake resistor		External brake resistor	
Power（Kw）	Voltage（V）	Model	Resistance（Ω）	Power（w）	Minimum resistance（Ω）	Power（W）
90	380	US810-90-□04			10	9KW*2
110	380	US810-110-□04			10	11KW*2
132	380	US810-132-□04			10	13KW*2
160	380	US810-160-□04			10	16KW*2

3. Wiring example

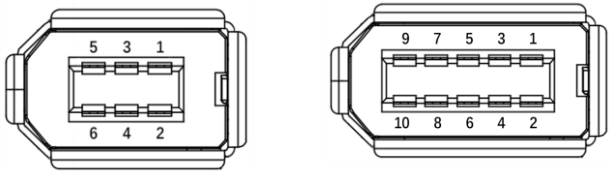


N**ote:** Due to the coaxial connection between the motor and encoder, do not strike when install a pulley or coupling at the motor shaft end. Otherwise, encoder may damage.(This situation is not covered by the warranty!)

2.4.2 Servo motor encoder signal connect port

1.Schematic diagram of servo motor encoder signal interface.

Suitable for model SVD880 full power, SVD810 below 1KW



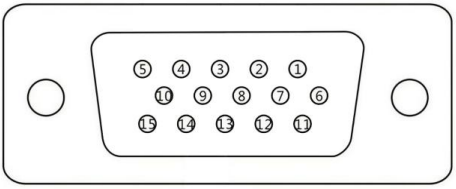
SVD810(CN2)/SVD880(CN3)SM6P Servo motor encoder signal,pin name and function of connect port.

Pin	Signal name	Description	Introduction
1	SD+	Encoder signal +	Suit for RS-485 bus protocol, maximum frequency is 10MHz。
2	SD-	Encoder signal -	
3	GND	Encoder power -	DC5V，power supply current is 500mA,voltage fluctuation±200mV
4	+5V	Encoder power +	
5-6		Reserved	

SVD880(CN4)/SM10P Secondary encoder signal,pin name and function of connect port.

Pin	Signal name	Description	Introduction
1	DATA+	BISS or EnData signal +	
2	DATA-	BISS or EnData signal -	
3	GND	Encoder power 0V	
4	+5V	Encoder power 5V+	
5	MA+	BISS or EnData clock (CLK) signal +	
6	MA-	BISS or EnData clock (CLK) signal -	
7-10		Reserved	

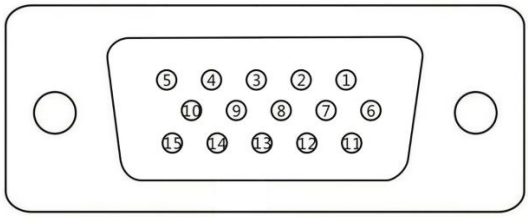
SVD810(CN2) Servo motor encoder signal connect port diagram **(SVD810 1.5KW -3.0kW)**



Pin	Signal name	Description	Instruction
1		Reserved	Suit for RS-485 bus protocol, maximum frequency is 10MHz. DC5V，power supply current is 500mA,voltage fluctuation±200mVD
2	SD+	Encoder signal +	
3	Z+	Encoder signal Z +	
4	B+	Encoder signal B +	
5	A+	Encoder signal A +	
6		Reserved	
7	SD-	Encoder signal -	
8	Z-	Encoder signal Z -	
9	B-	Encoder signal B -	
10	A-	Encoder signal A-	
11		Reserved	
12		Reserved	
13	+5V	Encoder power +	
14	GND	Encoder power -	
15		Reserved	

SVD810(CN3) Servo motor encoder signal connect port diagram

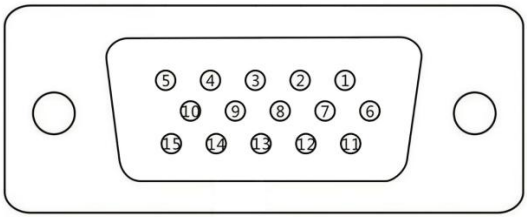
(SVD810 4.0KW -15kW)



Pin	Signal name	Description	Instruction
1	PGV+	Magnetic pole signal V+	Incremental encoder wiring DC5V power supply, current 500mA, voltage fluctuation ±200mV
2	PGU+	Magnetic pole signal U+	
3	PGZ+	Differential signal Z+	
4	PGB+	Differential signal B+	
5	PGA+	Differential signal A+	
6	PGV-	Magnetic pole signal V-	
7	PGU-	Magnetic pole signal U-	
8	PGZ-	Differential signal Z-	
9	PGB-	Differential signal B-	
10	PGA-	Differential signal A-	
11	PGW-	Magnetic pole signal W+	
12	PGW+	Magnetic pole signal W-	
13	+5V	5V power supply	
14	GND	Common ground	
15		Reserved	

引脚	符号	描述	说明
2	SD+	Encoder signal +	Absolute encoder wiring DC5V power supply, current 500mA, voltage fluctuation ±200mV
7	SD-	Encoder signal -	
13	+5V	Encoder power +	
14	GND	Encoder power -	

2.Servo digital input and output SVD880 (CN2) interface diagram.
Fits model SVD880 full power.

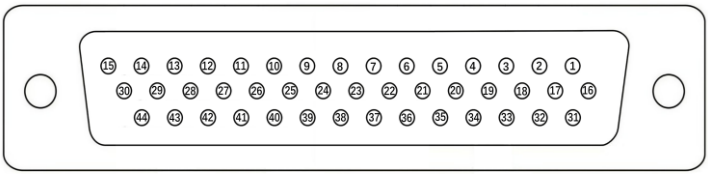


SVD880 Servo digital signal Input/Output (CN2) ,pin name and function of connect port.

Pin	Signal name	Description	Introduction
1	DI1	Analog input 1	The digital input terminal withstands a voltage of 12 to 30 V and can be configured as PNP or NPN input. Its function can be programmed through the function code. For details, please refer to Chapter 4
2	DI2	Analog input 2	
3	DI3	Analog input 3	
4	DI4	Analog input 4	
5	XC	Analog input common	
6	DO1+	Analog output 1+	Digital output terminal, with a voltage range of 12V to 30V, a maximum output current of 1A, can directly drive the relay. Its function can be programmed
7	DO1-	Analog output 1-	
8	DO2+	Analog output 2+	

Pin	Signal name	Description	Introduction
9	DO2-	Analog output 2-	through the function code, please refer to Chapter 4 for details
10	+24V	Power supply output +24V	Output 24V, Maximum current is 300mA
11-14		Reserved	
15	COM	Power supply output 0V	

SVD810 Servo digital signal Input/Output (CN1) connect port diagram
Suitable for model SVD810 0.2KW-3.0KW.



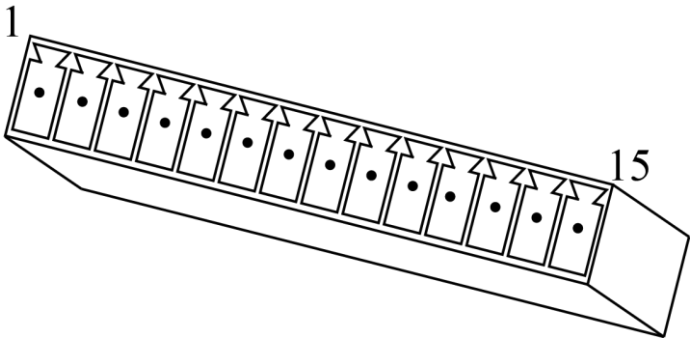
Servo digital signal Input/Output (CN1) ,pin name and function of connect port.

Pin	Signal name	Description	Instruction
16	DOCOM	Digital output common	Connect to external power supply 0V
17	DO1	Digital output terminal 1	NPN type output, Maximum Voltage 30V, Maximum Output Current 1A, can connect drive relay directly. The function can
1	DO2	Digital output terminal 2	
2	DO3	Digital output terminal 3	
3	DO4	Digital output terminal 4	
4	DO5	Digital output terminal 5	

5	DO6	Digital output terminal 6	be set through function code, refer to chapter 4
6	DO7	Digital output terminal 7	
7	DO8	Digital output terminal 8	
8	PULS24V+	24V pulse input +	External pulse signal input, Support 24V or 5V input, wiring according to need
23	SIGN24V+	24V direction input +	
10	PULS5V+	Pulse input +	
11	PULS-	Pulse input -	
12	SIGN5V+	Direction input +	
13	SIGN-	Direction input -	
31	DICOM	Digital input common	Connect external 24V or 0V
32	DI1	Digital input terminal 1	Configurable PNP or NPN Input, Maximum Voltage 30V,The function can be set through function code, refer to chapter 4
22	DI2	Digital input terminal 2	
34	DI3	Digital input terminal 3	
36	DI4	Digital input terminal 4	
19	DI5	Digital input terminal 5	
33	DI6	Digital input terminal 6	
18	DI7	Digital input terminal 7	
24	PZ-	Frequency Division Output Z Phase -	Pulse frequency division output
25	PZ+	Frequency Division Output Z Phase +	
26	PB-	Frequency Division Output B	

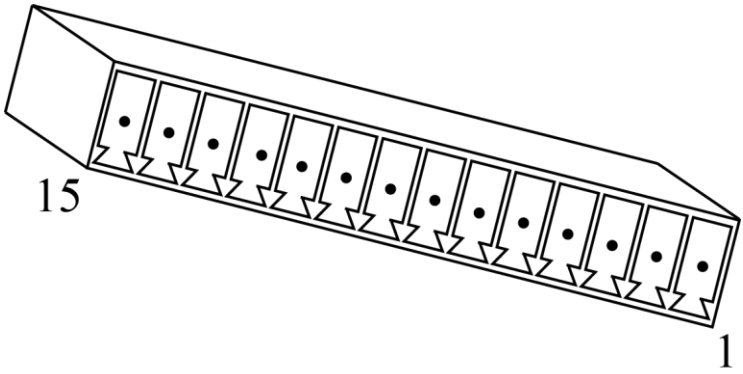
		Phase -	
27	PB+	Frequency Division Output B Phase +	
28	PA-	Frequency Division Output A Phase -	
29	PA+	Frequency Division Output A Phase +	
43	AI1+	Input analog 1+	AI1: Speed limit AI2: Torque limit Input analog: 2 input range：-10V～10V
42	AI1-	Input analog 1-	
30	AI2+	Input analog 2+	
41	AI2-	Input analog 2-	
38	DA1	Output analog 1	Output analog：2, output range ： -10V～10V
37	DA2	Output analog 2	
14	GND	Output analog GND	
35	GND	Output analog GND	
44	GND	GND	
39	RS485-	485 communication wiring -	Built in net suitable resistor
40	RS485+	485 communication wiring +	
9、15	/	Reserved	
20 、21	/		

SVD810 servo digital input and output SVD810 (CN1) interface diagram
Suitable for models SVD810 4.0KW-15KW.



Pin	Signal name	Description	Pin	Signal name	Description
1	COM-	Internal 24V power supply ground	2	DI1	Digital signal 1 input
3	DI2	Digital signal 2 input	4	DI3	Digital signal 3 input
5	DI4	Digital signal 4 input	6	DI5	Digital signal 5 input
7	DI6	Digital signal 6 input	8	DI7	Digital signal 7 input
9	DI8	Digital signal 8 input	10	COM-	Internal 24V power supply ground
11	COM+	External 24V power input common terminal	12	+24V	Internal 24V power output+
13	AI1	Analog 1 input	14	GND	Common ground
15	AI2	Analog 2 input			

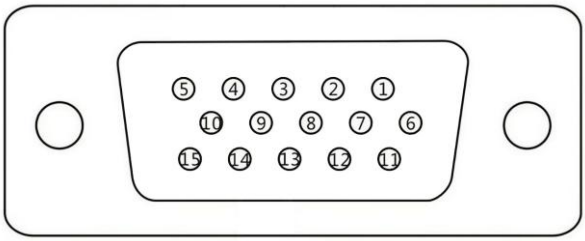
SVD810 servo digital input and output SVD810 (CN2) interface diagram
Suitable for models SVD810 4.0KW-15KW.



Pin	Signal name	Description	Pin	Signal name	Description
1	SIGN+	Command symbol input 5V+	2	SIGN-	Command symbol input-
3	SIGNH+	Command symbol input 24V+	4	PULSE +	Command pulse input 5V+
5	PULSE-	Command pulse input-	6	PULSE H+	Command pulse input 24V+
7	RSCOM	485 communication ground	8	RS-	Communication 485-
9	RS+	Communication 485+	10	DO5	Digital signal 5 output-
11	DO4	Digital signal 4 output	12	DO3	Digital signal 3 output-
13	DO2	Digital signal 2 output	14	DO1	Digital signal 1 output-
15	DO-	Digital signal common terminal			

SVD810 (CN5) frequency division output interface diagram

Suitable for SVD810 4.0KW-15KW.

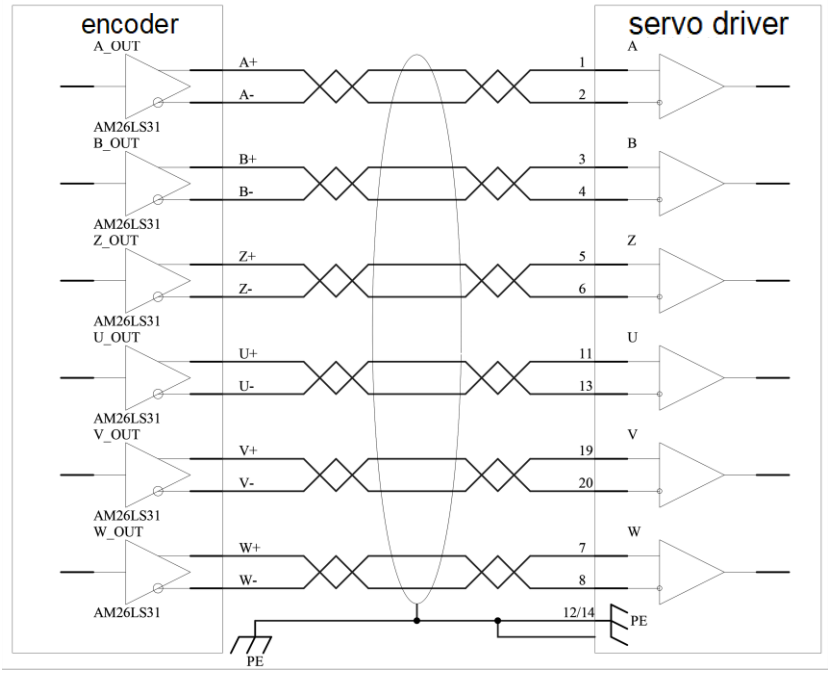


Pins	Symbol	Describe	Pins	Symbol	Describe
1	PE	Shield ground	2	CGND	CAN communication reference ground
3	CANL	CANL	4	CANH	CANH
5	GND	Analog output reference ground	6	DA2	Analog output 2
7	DA1	Analog output 1	8	PZO-	PG frequency division output Z signal -
9	PBO--	PG frequency division output B signal-	10	PAO-	PG frequency division output A signal -
11	GND	Pulse output reference ground	12	Reserved	-
13	PZO+	PG frequency division output Z signal+	14	PBO+	PG frequency division output B signal +
15	PAO+	PG frequency division output A signal			

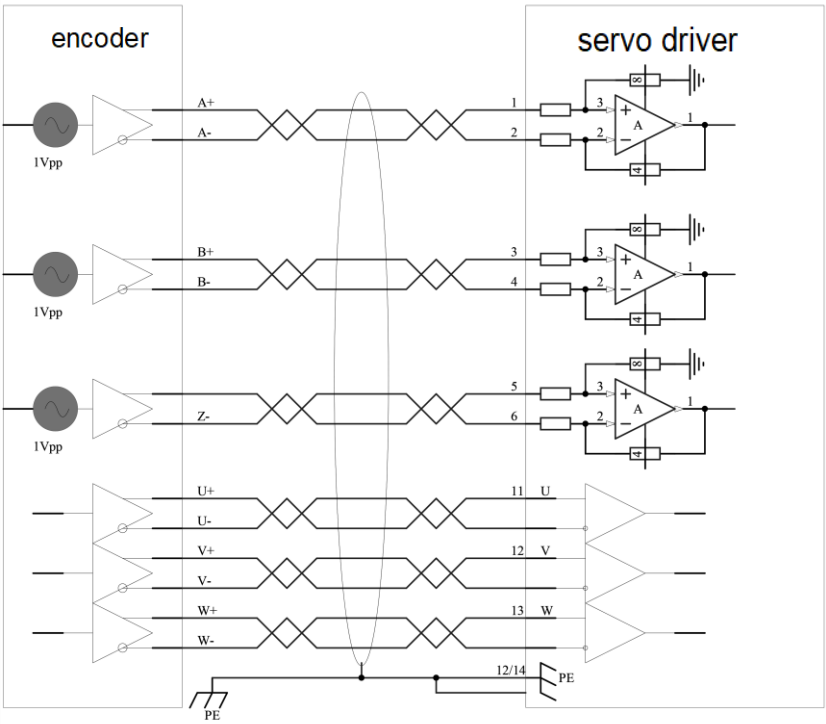
3.Encoder wiring example

The driver support AB pulse encoder, 1Vpp Sine-cosine encoder, RS485 bus encoder ect.

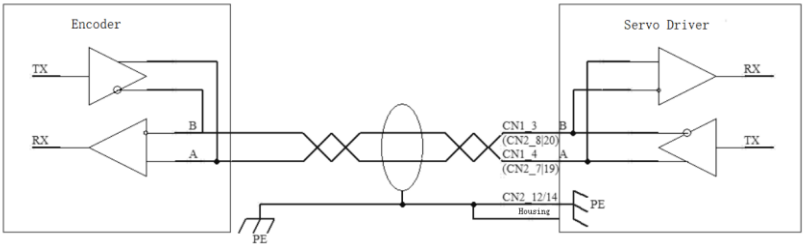
a. AB pulse encoder wiring diagram：



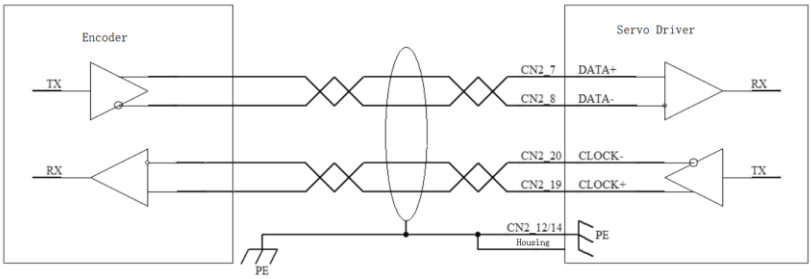
b. 1Vpp Sine-cosine encoder wiring diagram：



c. RS485 bus encoder wiring diagram：



d. RS422 bus encoder wiring diagram：

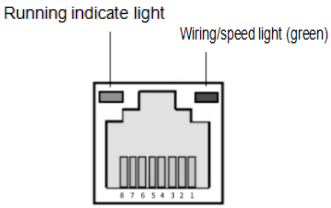


2.4.3 Control signal connector

1. Control signal connect port SVD880(CN1)/SVD810(CN3) as below

Connect port support kinds of computer port, MECHATROLINK-III bus connect port, Ethercat bus connect port.

Connect port diagram as below：



2. Control signal connect port,pin name and function of connect port.

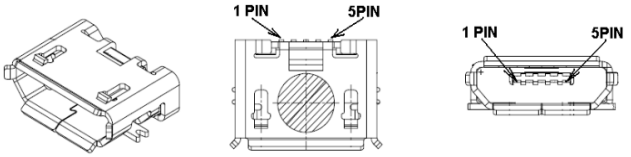
MECHATROLINK-III bus connect port and Ethercat bus connect port definition:

Connect port number	Pin number	Symbol	Analog connect port function	Introduction
RJ1 RJ2	1	TD+	Bus communication sending signal+	422 communication protocol

Connect port number	Pin number	Symbol	Analog connect port function	Introduction
	2	TD-	Bus communication sending signal-	
	3	RD+	Bus communication receiving signal+	
	6	RD-	Bus communication receiving signal-	
	8	PE	Shielded ground	

2.4.4 RS232 Communication connect port

1. RS232 Communication SVD880(CN5) connect port wiring diagram



2. RS232 signal connect port SVD880(CN5), pin name and function

Pin number	Function	Symbol
1	Power + disabled	+5V
2	Data receiving	RXD
3	Data sending	TXD
4		Reserved
5	Power-	GND

2.4.5 RS485 Communication port

1. **RS485 communication port diagram**

Check Servo digital input/output SVD810(CN1) diagram

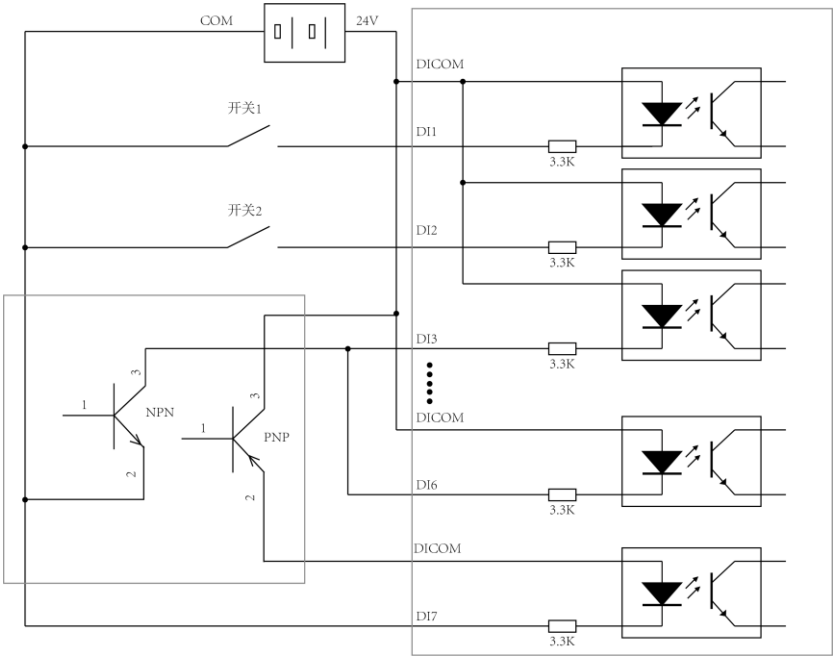
2. **RS485 signal port SVD810(CN1) pin name and function**

Pin number	Function	Symbol
39	485 communication wiring -	RS485-
40	485 communication wiring +	RS485+

2.4.6 Wiring diagram

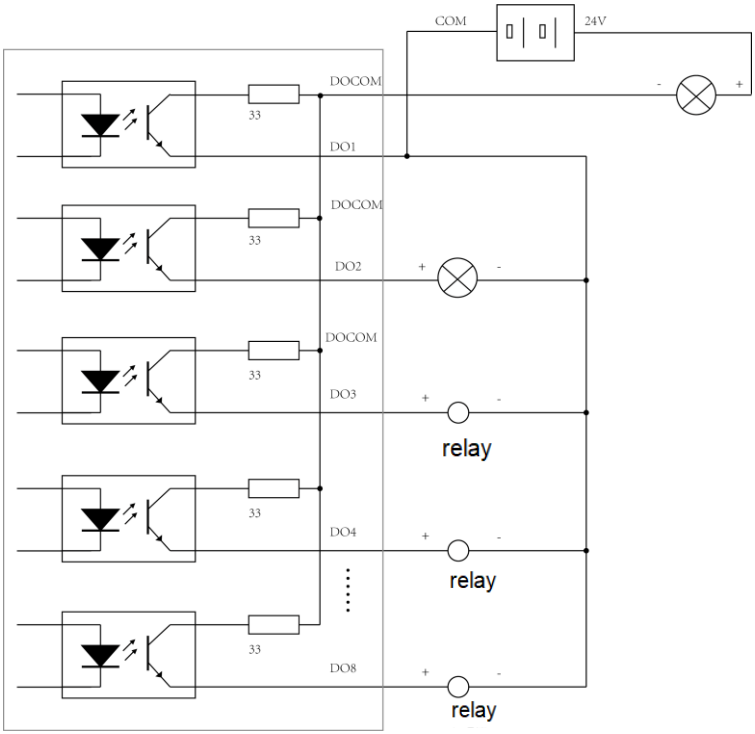
1.Analog input circuit

The US880 driver has an internal 24V power output, while the US810 does not. It is recommended to use an external power supply for the digital input power supply. The US880 driver is equipped with 2 digital input terminals as standard, while the US810 driver is equipped with 7 digital input terminals DI1 to DI7, a total of 7 digital input terminals, using NPN connection. To ensure that the voltage at the input terminal is between 12V and 30V during operation. Its function can be set through function code programming, please refer to Chapter 4 for details.



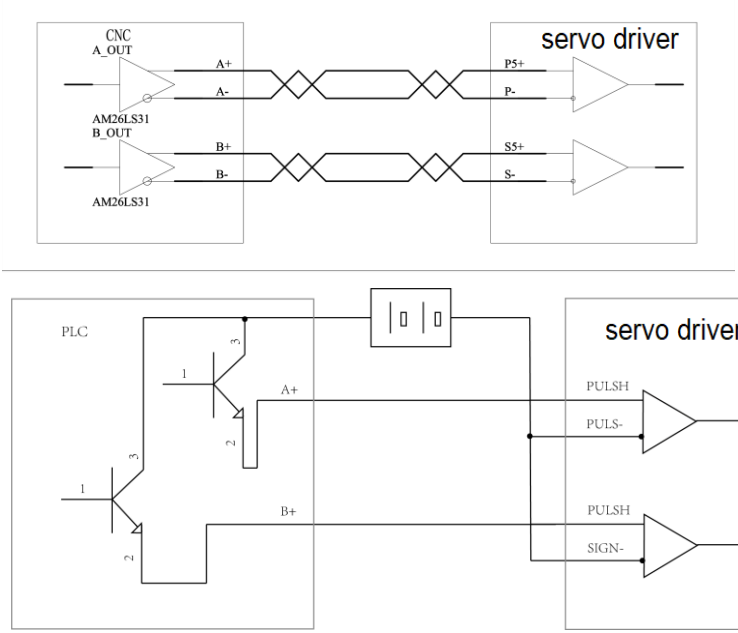
2.Analog output circuit

The digital output can withstand a voltage range of 12 to 30 VDC, with a maximum output current of 1A, and can directly drive relays. The US880 bus-type driver comes standard with 2 digital outputs DO1 and DO2, and the US810 pulse-type driver comes standard with 8 digital outputs DO1 to DO8. The functions can be set through function code programming. For details, please refer to Chapter 4.



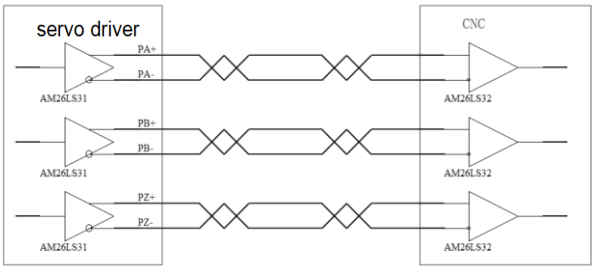
3.Pulse signal input circuit

The input form is differential input. The maximum input frequency is 1M for differential input. Two levels of 24V and 5V are provided. 24V level input is generally used in PLC control systems, and the input frequency is low. Bus-type servos are not equipped with input terminals!



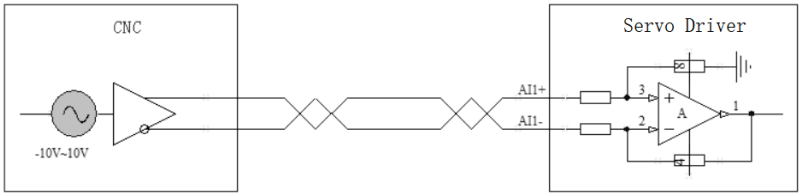
4.Pulse simulation output circuit

Differential output, output voltage is 5V, maximum output current is 20mA, match for 120Ω resistor in receiving end. Bus type servo is not equipped with simulation output terminal!



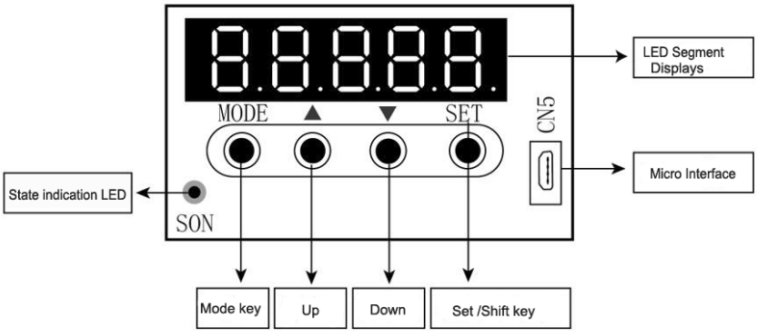
5.Analog input circuit

Differential input, input voltage range is -10V～+10V，input impedance is about 10KΩ. Bus-type servo do not with the function.



Chapter 3 Operation panel and function code setting

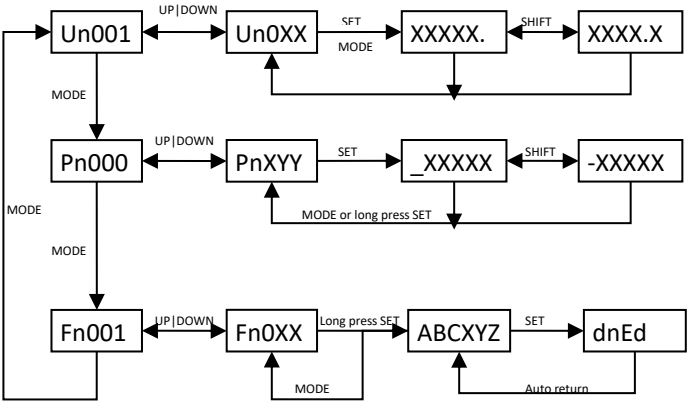
3.1 Operation Panel



Key's name and function

Symbol	Name	Function
8.	5 digit nixie	Display data and identifiers, if the data exceed 5 digit,press shift key to switch high/low bit
MODE	Mode key	1. Press the key to switch among Un、Pn、Fn 2. If under data display or function execution area, exit Un, Pn and Fn.
UP	Up key	1. Modify data numbers for each zone 2. Modify data value, long press to quick modify data value
DOWN	Down key	
SET/SHIFT	Set /Shift key	Press this button can move the selected bit(blinking) to left a bit. Enter data display zone or function execution, confirm the modify data.
CN5 terminal	Micro USB	Connect adjust software and hardware update connect port

3.2 Operation panel using diagram



3.3 Monitoring Un

Monitoring driver's running parameters.

1. Monitor content as below:

Monitoring No	Content	Monitoring No	Content
Un001	Setting pulse (pulse) After gear ratio	Un002	Feedback pulse(pulse)
Un003	Pulse error(pulse)	Un004	Setting speed(r/min)
Un005	Feedback speed(r/min)	Un006	Setting torque(%)
Un007	Feedback torque(%)	Un008	Output current(0.01A)
Un009	PN voltage(v)	Un010	Input analog channel 1(10mV)

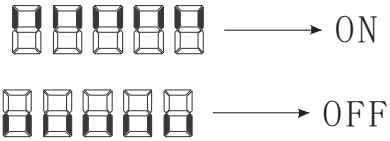
Monitoring No	Content	Monitoring No	Content
Un011	Input analog channel 2(10mV)	Un012	DI terminal state
Un013	DO terminal state	Un014	L1C,L2C control voltage
Un-15	Driver heat sink temperature(℃)	Un016	Motor temperature(℃)
Un-17	Current angle of electronic cam(optional)	Un018	Encoder A/B/Z/U/V/W level state
Un-19	Electrical angle of the motor	Un020	
Un021	Fault code	Un022	Single circle data of absolute encoder
Un023	Multi-circle data of absolute encoder	Un024	Auto-tuning forward rotate inertia
Un025	Auto-tuning reserve rotate inertia	Un026	Auto-tuning rotate inertial percentage(%)
Un027	MIII bus initial state	Un028	communication state
Un036	Mechanical position	Un037	Relative Position
Un039	Operation status display (rdy/run)	Un032	Bus servo operation mode 8: Position mode 9: Speed mode
Un040	Setting pulse(pulse)		

Un28 (CPU1 working status) description

Type	Bit31~24	Bit23~16	Bit15~0
MIII	CPU1 working breathing light	Communication initialization status 0x06：Hardware initialization completed, waiting for communication packets 0x20：The communication packet detection is completed and enter into the normal working mode	CPU1 Alarm 0：No warning 1： MIII Bus initialization alarm 2：MIII disconnect alarm Others: Look for technical support
EtherCAT	CPU1 working breathing light	OP status 1：Initialization 2：PreOP 3：safeOP 4：OP	Bus status machine 0x0001：Not ready 0x0002：No allow power on 0x0004：Servo ready 0x0008：Servo enable, not allow running 0x0010：Running allow 0x0020：Quick stop 0x0040：Error 0x0080：Error state

2. Monitoring content check

a） Monitoring No. As Un012，Un013 content represents the closed and disconnected status of the terminal （not include logic）：



b） Monitoring value as 32 bit with symbol number, display lower 5 bits and upper 5 bits, switch loop display by shift key. The highest decimal point illuminated indicates a negative number, otherwise it is a positive number. Such as monitor content is -12345678。

Lower 5 bits	4.|5|6|7|8.
Upper 5 bits	0.|0|1|2.|3

3.4 Function code Pn

View and modify function code in Pn. Set steps as below：

1. Switch to PnXXX through MODE.
2. Get the function code needed by UP and DOWN.
3. Press the SET key enter into function code value, shift to the modify data bit through SHIFT, modify the value by UP and DOWN.
4. Long press SET to save the function code value, display dnEd and auto return to PnXXX. Or directly press MODE discard modify and back to PnXXX.

Function code list

Function no.	Function	Function no.	Function
Fn001	JOG	Fn007	Force output terminal status
Fn002	Check history fault	Fn008	Reserved
Fn003	Clear fault alarm Eclr0 disabled Eclr1 Clear current alarm Eclr2 Clear history alarm	Fn009	Reserved
		Fn010	Reserved
		Fn011	Reserved
		Fn012	Reserved
Fn004	STY0:No operation STY1：UVW Magnetic Dwell Angle Learning STY2:Z phase Magnetic Dwell Angle Learning STY3:Locked electrical 0° STY4: Phase sequence learning	Fn013	Operate encoder EEPROM Enc00: No function Enc01: Read encoder EEPROM data Enc02: Write encoder EEPROM data Enc03: Clear encoder multi-turn data and multi-turn fault Enc04: Clear encoder fault
Fn005	Software restart		
Fn006	Pdft3: Parameter Initialization Pdft4: Parameter Initialization (Include factory parameters)	Fn014	Reserved

Chapter 4 Function Code list

4.1 Basic Operation Area 1

Dual parameter：dYYXX；Four-parameter：FDCBA

Code	Description	Default	Lower limit	Upper limit	Unit
Pn008	Rate voltage of the motor	Model dependent	1	440	V
Pn009	Rate power of the motor	Model dependent	1	65535	0.01KW
Pn010	Rate current of the motor	Model dependent	1	65535	0.01A
Pn011	Rated torque of the motor	Model dependent	0	65535	0.01N.M
Pn012	Maximum torque of the motor	Model dependent	1	65535	0.01N.M
Pn013	Rated speed of the motor	Model dependent	1	65535	RPM
Pn014	Maximum speed of the motor	Model dependent	1	65535	RPM
Pn015	Rotor inertia	Model dependent	1	65535	0.01Kg.cm^2
Pn016	Number of pole-pairs	Model dependent	1	65535	

Code	Description	Default	Lower limit	Upper limit	Unit
Pn017	Stator resistance	Model dependent	1	65535	0.001Ω
Pn018	Q-axis inductor	Model dependent	1	65535	0.01mH
Pn019	D-axis inductance	Model dependent	1	65535	0.01mH
Pn020	Antipotential	Model dependent	1	65535	0.01V/Krpm
Pn021	Torque time constant	Model dependent	1	65535	0.01Nm/Arm
Pn022	Electric time constant	Model dependent	1	65535	0.01.ms
Pn023	Mechanical time constant	Model dependent	1	65535	0.01ms
Pn026	Magnetic pitch	Model dependent	0	16777216	
Pn028	Encoder type 0: Incremental 2: Tama River Absolute or Ruiying: The encoder plug comes in brown and brown-black variants, with the green body being the Tama River encoder; the yellow variant has a semi-encapsulated body (with exposed	Model dependent	0	6	

Code	Description	Default	Lower limit	Upper limit	Unit
	circuit board) and is the Ruiying encoder. 3: BISSC 5: Nikon Absolute: Available in purple, with the black body. 6: 1Vpp sine/cosine analog encoder, where 1Vpp indicates a peak-to-peak analog signal of 1V, and the sine analog signal leads the cosine signal by 90°.				
Pn029	Encoder properties	Model dependent			
Pn030	First encoder resolution or line count: The definition of Pn028 varies according to the definition of Pn030. Pn028 = 0, 2, 3, 5. Pn030 = encoder resolution. For example, a 2500-line encoder should be set to 10000; a 17-bit encoder to 131072; a 23-bit encoder to 8388608; and a 24-bit encoder to 16777216. Pn028 = 6 encoder line count. For example, a 18000-line Heidemann circular grating should	Model dependent	0	16777216	

Code	Description	Default	Lower limit	Upper limit	Unit
	be set to 18000, and the system will automatically multiply by 4.				
Pn045	(FDCBA) A = 0~4 The order of magnitude of Pn015 0 = Pn015×1 1 = Pn015×10 2 = Pn015×100 3 = Pn015×1000 4 = Pn015×10000 B = 0~4 The magnitude of Pn017~Pn019 C = 0~4 The magnitude of Pn020 D = 0~2 The magnitude of Pn110 0 = Unit of current correction coefficient 0.01A 1 = Unit of current correction coefficient 0.1A 2 = Unit of current correction coefficient 1A				
Pn100	Software version	Model dependent	0	65535	
Pn101	FPGA software version	Model dependent	0	65535	
Pn102	Driver number	Model dependent	0	10000	

Code	Description	Default	Lower limit	Upper limit	Unit
Pn103	Rated voltage	Model dependent	1	440	V
Pn104	Rated current	Model dependent	1	65535	0.01A
Pn105	Maximum current	Model dependent	1	65535	0.01A
Pn106	Current sampling direction setting (double parameters)	Model dependent	D00	D13	
Pn107 DYYXX	Speed sampling filter depth XX=control board type selection 0: single board control board; 1: dual board 1.5KW~3KW control board 4: 5KW and above control board YY=whether to start hardware matching judgment 0: match hardware and software settings, if not match, alarm ER1.60 ER1.61 1: do not match hardware and software settings	D 0 0	D 0 0	D 1 15	
Pn108	Speed sampling mode	0	0	1	
Pn109	Thermometer	1	0	1	
Pn110	Current channel proportional coefficient	Model dependent	1	65535	

Code	Description	Default	Lower limit	Upper limit	Unit
Pn111	Bus voltage detection compensation value	Model dependent	1	65535	
Pn112	Control voltage sampling coefficient	680	1	65535	
Pn113	Small current amplification coefficient	51	0	160	0.1
Pn114	Carrier frequency	20000	2000	20000	Hz
Pn115	Speed loop carrier frequency	3	1	32	
Pn116	Position loop carrier frequency	8	1	32	
Pn117	Speed sampling filter depth 0: No filtering, sampling frequency 16K 1: 2 times smoothing filter 2: 4 times 3: 8 times	0	0	3	
Pn118	Current filter depth	2	0	2	
Pn119	Torque loop proportional gain	1500	100	10000	Hz
Pn120	Torque loop integral gain	1000	1	65535	0.01ms
Pn121	Excitation loop proportional gain	1500	1	10000	Hz
Pn122	Excitation loop integral gain	1000	1	65535	0.01ms
Pn123	Dead zone compensation	0	0	240	
Pn124	Voltage of over voltage	395	1	1000	V
Pn125	Over voltage filter	10	0	65535	0.1s
Pn126	Voltage of under voltage	220	1	1000	V
Pn127	Under voltage filter	10	0	65535	0.1s
Pn128	Motor overload coefficient	100	50	200	
Pn129	Driver over current coefficient	100	20	100	

Code	Description	Default	Lower limit	Upper limit	Unit
Pn130	Position error alarm switch	0	0	1	
Pn131	Alarm function selection(FDCBA) A=Under voltage alarm switch 0: Close 1: Open B=Hardware over current(Er108) selection 0: Open 1: Close C=ESP function alarm selection 0: Close 1: Open D=Reserved	F0001	F0000	F1111	
Pn132	Whether to clear alarm after recovery of under voltage or over voltage	0	0	1	
Pn133	Input terminal filter time 0: No filter 1-9: Input terminal filter depth Filter time=(1-9)*2ms	0	0	9	
Pn135	Voltage compensation selection FDCBA A=AVR function effective selection 0: Disabled 1: Enabled	F0010	F0000	F0011	

Code	Description	Default	Lower limit	Upper limit	Unit
	B=Voltage compensation function enabled 0: Enabled 1: Disabled C=Voltage compensation basis selection 0: Given current 1: Feedback current D=Reserved				
Pn145	Password	0	0	65535	
Pn146	Password setting	0	0	65535	
Pn147	Open factory password	0	0	65535	
Pn150	Board type: Pulse board 3，MIII bus control board 4，Ether cat bus control board	Model dependent	0	5	

4.2 Basic Operation Area 2

Code	Description	Default	Lower limit	Upper limit	Unit
Pn200	Control mode selection 1: Position control mode 2: Speed control mode 4: Torque control mode 6: Position control mode-Speed control mode 7: Position control mode-Torque control mode 8: Speed control mode-Torque control mode 9: VVVF control mode	1	0	15	
Pn201	Motor running direction setting 0: Forward 1: Reverse	0	0	1	
Pn202	Servo enable type select 0: Register control enable 1: Enable terminal control 2: Direction terminal enable 3: Power on auto enable	0	0	3	
Pn203	Register servo on enable 0：Servo disable 1：Servo enable	0	0	1	
Pn204	Servo stop mode selection (dual parameter)	D00	D00	D22	

	Lower bit, servo off and warning stop ; Upper bit, servo exceed range stop				
Pn205	Parking mode (FDCBA) A=0-3 The parking mode when the control word 0x6040 has 15-》2 B=0-3 (Baoyuan system sets this item) The parking mode when the control word 0x6040 has 15-》6 C=0-3 The parking mode when the control word 0x6040 has 15-》7 D=0-3 The parking mode when an error state is found 0: directly disable 1: slow deceleration stop, the stop deceleration is set by Pn516, and then disable 2: fast deceleration stop, the stop deceleration is set by Pn518, and then disable 3: deceleration stop with maximum torque, and then disable	F0000	F0000	F3333	

	Note: pn516 and Pn518 are both decelerations, and the set value takes effect immediately.				
Pn206	Power on auto enable delay	20	0	65535	0.1s
Pn207	Control mode switch delay	100	0	65535	ms
Pn208	Forward limit enable	0	0	1	
Pn209	Reverse limit enable	0	0	1	
Pn210	Dynamic brake time	100	0	65535	ms
Pn212	Bleeding resistor resistance	0	0	0	Ω
Pn213	Bleeding resistor power	0	0	0	KW
Pn214	Bleeding voltage	375	100	1000	V
Pn215	Bleeding duty ratio	50	0	100	%
Pn216	Delay in opening the brake command after the servo command is turned on	10	0	65535	ms
Pn217	Delay time of servo OFF after brake closed--stop	1000	0	65535	ms
Pn218	Delay time of servo OFF after brake closed--revolve	1000	0	65535	ms
Pn219	Speed --revolve when brake closed	100	0	6000	rpm
Pn222	Stall over temperature protection delay time	200	10	65535	ms
Pn223	Phase loss protection filter time	100	10	5000	Ms
Pn225	Inverter module over-temperature selection (FDCBA) A=0-1 module over-temperature alarm selection	F1001	F0000	F1111	

	0: Off 1: On B=motor over-temperature alarm selection 0: Off 1: On C=fan operation mode 0=power on operation 1=enable operation D=blocked rotor over-temperature alarm selection 0: Off 1: On				
Pn226	Motor stall protection effective selection (FDCBA) A=0-1 stall effective selection 0: invalid 1: valid B=Is phase loss protection effective? 0: invalid 1: valid After setting effective, if phase is missing, the driver alarms Er1.15 C=Is main power failure protection effective? 0: invalid 1: valid After this function is turned on, alarm Er1.16 is issued, and forced discharge is performed at the same time to achieve rapid power failure	F0001	F0000	F1111	

	D=reserved				
Pn227	Motor stall protection detection threshold Motor stall protection detection time	50	0	100	rpm
Pn228	Motor stall protection detection threshold Motor stall protection detection time	200	10	1000	ms
Pn229	Motor overspeed level setting 0: Overspeed level is 1.2 times the maximum speed 1-20000: Overspeed value is the actual setting value	0	0	20000	rpm
Pn230	Battery fault alarm selection	1	0	1	
Pn231	0: Off 1: On	1	0	1	
Pn233	Battery alarm alarm selection	0	0	1	
Pn235	0: Off 1: On	0	0	5	
Pn236	No initial phase operation mode	0	0	65535	
Pn242	Self-learning function selection	45	0	300	%

4.3 Gain adjustment area

Code	Description	Default	Lower limit	Upper limit	Unit
Pn300	Speed control gain 1	1000	10	20000	0.1Hz
Pn301	Speed integral time constant	2000	15	50000	0.01ms
Pn302	Position control proportional gain1	750	10	20000	0.1/s
Pn303	Rotate inertia ratio	100	0	20000	%
Pn304	Speed control gain 2	500	10	20000	0.1Hz
Pn305	Speed integral time constant	2000	15	50000	0.1/s
Pn306	Position control proportional gain 2	750	10	20000	0.1/s
Pn307	Speed feedforward ratio	0	0	100	%
Pn308	Speed feedforward filter time constant	0	0	6400	0.01ms
Pn309	Torque feedforward gain	0	0	100	%
Pn310	Torque feedforward filter time	0	0	6400	0.01ms
Pn311	Rigidity level	7	0	21	
Pn312	Real-time automatic adjustment (rigidity, inertia) 0: Do not enable automatic adjustment 1: Automatically adjust rigidity according to Pn311 (rigidity table). Related parameters Pn300~Pn302, Pn304~Pn306	0	0	6	

	2: Positioning control. Automatically adjust rigidity according to Pn311 (rigidity table), and self-learn the moment of inertia. Determine whether the inertia ratio is adjusted in real time according to the setting of Pn530. Automatically set Pn315=0x0091 to enable gain switching mode 5: Self-learning of moment of inertia, and update the learned inertia ratio to the Pn303 parameter at medium speed. If the mechanical vibration is large, please stop self-learning immediately 6: Self-learning of moment of inertia, no update				
Pn313	Inertia ratio self-learning mode	0	0	4	
Pn315	Gain switchover type	0	0	13141	
Pn316	Gain switchover condition（pulse error）	10000	0	60000	
Pn317	Gain switchover condition (speed command/feedback speed)	0	0	5000	rpm
Pn318	Gain switchover condition (speed command/feedback speed)	0	0	5000	rpm
Pn319	Gain switchover condition (torque command)	0	0	300	%
Pn320	Gain switchover condition (torque command)	0	0	300	%
Pn321	P/PI condition(pulse error)	0	0	60000	

Pn322	P/PI condition(speed command/feedback speed)	0	0	5000	rpm
Pn323	P/PI condition(torque command)	0	0	300	%
Pn324	Gain switchover delay	6	0	60000	ms
Pn329	Position integration time constant	c			
Pn330	Motor response frequency test function enabled	0	0	10	
Pn331	Viscous friction torque compensation	0	0	1000	0.1%
Pn332	Gravity friction torque compensation	0	0	1000	0.1%
Pn333	Forward friction torque compensation	0	0	1000	
Pn334	Reverse friction torque compensation	0	0	1000	0.1%
Pn335	Friction compensation speed	2	0	100	rpm
Pn345	Magnetic field weakening control enable	0	0	1	
Pn346	Magnetic field weakening control voltage usage frequency	90	99	1	%
Pn347	Magnetic field weakening control bandwidth	20	1	100	Hz
Pn348	Magnetic field weakening control maximum current	50	1	100	%
Pn349	Magnetic field weakening proportional gain	0	1	100	0.1%

4.4 Position loop parameters

Code	Description	Default	Lower limit	Upper limit	Unit
Pn400	Position loop command selection Pn150=0 (Pn400 parameter is valid) Pn200=1 (Pn400 parameter can be selected as 0, 1, 2, 3) 0 Internal register given position; 1 External pulse given position 2 Spindle position control 3 Internal use Pn150=3 (Pn400 parameter is invalid) MIII communication given; Pn150=4 (Pn400 parameter is invalid) EtherCAT communication given;	0	0	6	
Pn401	External pulse command form (FDCBA) **A: Pulse setting mode**: 0: AB orthogonal pulse (4 times frequency) 1: Pulse + direction (falling edge count) 2: Forward pulse + reverse pulse (falling edge count) 3: AB orthogonal pulse 2 times frequency 4: Pulse + direction 2 times frequency	F0300	F0000	F1317	

	5: Forward pulse + reverse pulse (2 times frequency) 6: Pulse + direction (rising edge count) 7: Forward pulse + reverse pulse (rising edge count) B: **Pulse setting logic:** 0: positive logic; 1: negative logic **C: Pulse setting filter:** 0: 10M; 1: 5M; 2: 2.5M; 3: 1M; **D: spare**				
Pn402	Setting pulse filter time constant	0	0	65535	0.1 ms
Pn403	Frequency division output logic (FDCBA) **A: Frequency division output logic** 0: Positive logic; 1: Negative logic **B: z signal output logic** 0: Positive logic; 1: Negative logic **C: z signal source selection** 0: Simulation Z signal output 1: Hardware Z signal output **D: Frequency division output selection** 0: Off 1: On 2: When the pulse is given, the frequency division output is turned on, and when the pulse is not given, the frequency division output is not turned on	F1000	F0000	F2111	

Pn404	Frequency division coefficient	10000	0	8088608	
Pn406	Electric gear ratio numerator	1	1	1073741824	
Pn408	Electronic gear ratio denominator	1	1	1073741824	
Pn410	Given pulse number per pulse	0	0	1073741824	
Pn412	Zero offset	0	-2147483648	2147483648	
Pn414	PZ output width setting	1000	100	32768	
Pn415	Internal position JOG speed	100	1	500	rpm
Pn416	Internal position running speed	300	1	10000	rpm
Pn417	Frequency division output delay Frequency division output off delay in frequency division output mode 2 Set the delay time to turn off the frequency division output when there is no pulse setting	1000	0	65535	ms
Pn418	Internal register position function 1: Start running (0x0001) 2: Stop running (0x0002) 16: Enter zero return mode and run (0x0010) 17: Exit zero return mode (0x0011) 256: Forward JOG (0x0100) 257: Reverse JOG (0x0101) 512: Set zero (0x0200)	0	0	65535	

	513: Set minimum soft limit (0x0201) 514：Set maximum soft limit (0x0202)				
Pn420	Software limit function selection (FDCBA) A: Output to output terminal after exceeding the soft limit 0: Off; 1: Output to output terminal B: Whether to alarm after exceeding the soft limit 0: Off; 1: Alarm C: Whether to stop after exceeding the soft limit 0: Continue to run; 1: Stop D: Standby	F0000	F0000	F1111	
Pn421	Parameter storage After setting to 1, Pn422, Pn424, Pn426 are stored in EEPROM.	0	0	1	
Pn422	Software limit minimum value	0	-2147483648	2147483648	
Pn424	Software limit maximum value	0	-2147483648	2147483648	
Pn426	Relative position zero offset	0	-2147483648	2147483648	

Pn428	Position limit origin range	100	-2147483648	2147483648	
Pn430	Mechanical position once cycle pulse It is valid when the internal register has multiple segments.	0	0	2147483648	PPS
Pn432	Return to zero mode 1: Reverse return to zero, the deceleration point is the negative limit switch, the origin is the motor Z signal 2: Forward return to zero, the deceleration point is the positive limit switch, the origin is the motor Z signal 3-4 Forward return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal. 5-6 Reverse return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal. 7-10: Forward return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal. 11-14: Reverse return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal. 15-16: Reserved	0	0	42	

	17: Reverse return to zero, the deceleration point and the origin are the negative limit switch. 18: Forward return to zero, the deceleration point and the origin are the positive limit switch. 19-20: Forward return to zero, the deceleration point and the origin are the origin switch. 21-22: Reverse return to zero, the deceleration point and the origin are the origin switch. 23-26: Positive return to zero, deceleration point and origin are the origin switch, and the limit is the positive limit switch. 27-30: Reverse return to zero, deceleration point and origin are the origin switch, and the limit is the negative limit switch. 31-32: Reserved 33: Single-turn reverse return to zero, the origin is the motor Z signal. 34: Single-turn positive return to zero, the origin is the motor Z signal 35: Take the current position as the origin 40: Absolute value return to zero				

	41: Forward torque return to zero 42: Reverse torque return to zero For detailed instructions, please refer to Chapter 5.5.8 (page 87)				
Pn433	Return to zero at high speed	100	0	1000	rpm
Pn434	Return to zero at low speed	20	0	1000	rpm
Pn437	Push-type zero return torque limit	150	0	3000	0.1 %
Pn438	Push-type zero return delay time	100	0	65535	Ms
Pn439	Zero return function selection (FDCBA) A: Whether to move the offset after zero return is completed 0: Do not move; 1: Move B: Whether to automatically exit the zero return mode after zero return is completed 0: Do not exit; 1: Exit C: Reserved D: Reserved	F0000	F0000	F0011	
Pn440	Register position operation mode 0: Invalid 1: Single operation 2: Cycle operation 3: DI switching 4: Sequential operation, no delay 5: Axis control operation, only position 1 is valid	5	0	10	

	6: DI switching (with operation command)				
Pn441	The internal register operate segments number	1	1	8	
Pn442	Position command type 0: Absolute 1: Incremental	0	0	1	
Pn450	Reserved				
Pn451	Maximum speed of register position 1	100	0	30000	Rpm
Pn452	Position of register position 1	10000	-2147483648	2147483647	Pulse
Pn454	Acceleration and deceleration time of register position 1	100	0	65535	Ms
Pn455	Delay waiting time after register position 1 positioning is completed	100	0	65535	Ms
Pn456	Reserved				
Pn457	Maximum speed of register position 2	100	0	30000	Rpm
Pn458	Position of register position 2	100000	-2147483648	2147483647	Pulse
Pn460	Acceleration and deceleration time of register position 2	100	0	65535	Ms
Pn461	Delay waiting time after register position 2 positioning is completed	100	0	65535	Ms
Pn462	Reserved				

Pn463	Maximum speed of register position 3	100	0	30000	Rpm
Pn464	Position of register position 3	100000	-2147483648	2147483647	Pulse
Pn466	Acceleration and deceleration time of register position 3	100	0	65535	Ms
Pn467	Delay waiting time after register position 3 positioning is completed	100	0	65535	Ms
Pn468	Reserved				
Pn469	Maximum speed of register position 4	100	0	30000	Rpm
Pn470	Position of register position 4	100000	-2147483648	2147483647	Pulse
Pn472	Acceleration and deceleration time of register position 4	100	0	65535	Ms
Pn473	Delay waiting time after register position 4 positioning is completed	100	0	65535	Ms
Pn474	Reserved				
Pn475	Maximum speed of register position 5	100	0	30000	Rpm
Pn476	Position of register position 5	100000	-2147483648	2147483647	Pulse
Pn478	Acceleration and deceleration time of register position 5	100	0	65535	Ms

Pn479	Delay waiting time after register position 5 positioning is completed	100	0	65535	Ms
Pn480	Reserved				
Pn481	Maximum speed of register position 6	100	0	30000	Rpm
Pn482	Position of register position 6	100000	-2147483648	2147483647	Pulse
Pn484	Acceleration and deceleration time of register position 6	100	0	65535	Ms
Pn485	Delay waiting time after register position 6 positioning is completed	100	0	65535	Ms
Pn486	Reserved				
Pn487	Maximum speed of register position 7	100	0	30000	Rpm
Pn488	Position of register position 7	100000	-2147483648	2147483647	Pulse
Pn490	Acceleration and deceleration time of register position 7	100	0	65535	Ms
Pn491	Delay waiting time after register position 7 positioning is completed	100	0	65535	Ms
Pn492	Reserved				
Pn493	Maximum speed of register position 8	100	0	30000	Rpm
Pn494	Position of register position 8	100000	-2147483648	2147483647	Pulse

Pn496	Acceleration and deceleration time of register position 8	100	0	65535	Ms
Pn497	Delay waiting time after register position 8 positioning is completed	100	0	65535	Ms

4.5 Speed loop parameters

Code	Description	Default	Lower limit	Upper limit	Unit
Pn500	Speed command selection Pn150=0 (Pn500 parameter is valid) Pn200=2 (Pn500 parameter can be selected as 0, 1, 2, 3) 0: Internal register speed 1 (Pn502) 1: Internal register speed 1 and 2 automatically cycle 2: Select the given speed through the speed function terminal 3: Give speed through the analog interface Pn150=3 (Pn500 parameter is invalid) MIII bus given speed Pn150=4 (Pn500 parameter is invalid) EtherCAT bus given speed	0	0	10	
Pn501	Jog speed	100	0	9000	rpm
Pn502	Internal set speed 1	100	-9000	9000	rpm
Pn503	Internal set speed 2	200	-9000	9000	rpm
Pn504	Internal set speed 3	300	-9000	9000	rpm
Pn506	Speed tracking function enable	0	0	1	

Pn507	Speed feedback filter time constant	0	0	65535	0.01 ms
Pn508	Speed setting filter time constant	0	0	65535	0.1m s
Pn509	Speed setting filter time constant(stop)	0	0	65535	0.1m s
Pn511	Speed acceleration time	300	0	65535	ms
Pn512	Speed deceleration time	300	0	65535	ms
Pn515	Torque limit mode selection 0: Torque limit value given by internal register 1: Torque limit value given by external torque terminal 2: Torque limit value given by analog interface	0	0	2	
Pn516	Deceleration stop deceleration	1000	0	16777216	PPS 2
Pn517	Pulse torque time	0	0	1	10ms
Pn518	Emergency stop deceleration	1000	0	16777216	PPS 2
Pn520	Auto emergency acc/dec function	0	0	1	
Pn521	Auto rapid acc/dec delay	100	0	65535	s
Pn522	Direction of internal speed 1	0	0	1	
Pn523	Direction of internal speed 2	0	0	1	
Pn526	Feedback speed command unit selection: 0-4 0: PPS = pulses per second 1: PPM = pulses per minute	3	0	4	

	2: %, percentage of rated speed 3: rpm. Speed per minute 4: Maximum speed corresponds to 0x0000000				
Pn530	Rotate inertia identify selection: 0：Do not identify 1：Identify	0	0	4	
Pn531	Rotate inertia identify speed	1000	200	3000	rpm
Pn532	Rotate inertia identify acc/dec time	200	0	1000	ms
Pn533	Rotate inertia identify delay time	50	0	1000	0.1s
Pn534	Rotate inertia identify effective Adjust acc/dec time	0	0	0	
Pn535	Rotate inertia identify search for jog speed of left/right stroke	100	0	1000	rpm

4.6 Torque ring parameters

Code	Description	Default	Lower limit	Upper limit	Unit
Pn600	Torque command source **Pn150=0 (Pn600 parameter is valid)** **Pn200=4 (Pn600 parameter can be selected as 0, 1, 2)** 0: Internal register torque 1 (Pn601) 1: Select the given torque through the torque function terminal 2: Give torque through the analog interface **Pn150=3 (Pn600 parameter is invalid)** MIII bus given torque **Pn150=4 (Pn600 parameter is invalid)** EtherCAT bus given torque	0	0	10	
Pn601	Internal torque setting 1	100	-3000	3000	0.1%
Pn602	Internal torque setting 2	200	-3000	3000	0.1%
Pn603	Internal torque setting 3	300	-3000	3000	0.1%
Pn604	Forward side torque limit	3000	0	5000	0.1%
Pn605	Reverse side torque limit	3000	0	5000	0.1%
Pn606	Forward side external torque limit	3000	0	5000	0.1%
Pn607	Reverse side external torque limit	3000	0	5000	0.1%
Pn610	Torque command slide time constant	100	0	1000	0.1ms

Pn611	Speed limit selection during torque control PN150=4 setting is invalid (speed limit comes from the smaller value of the object dictionary 0X607F instruction maximum speed and 0X6080 maximum speed) PN150=0 setting is valid 0: Speed limit source PN620 1: Speed limit comes from terminal selection	0	0	1	
Pn613	Emergency stop torque	50	0	250	0.1%
Pn614	Feedback torque command unit 0: 0.1% (EtherCAT) 1: 1% (M3) 2: Nm	0	0	2	%
Pn620	Speed limitation in torque mode	3000	0	6000	rpm
Pn630	vvvf control mode 0：No torque boost control 1：With torque boost control 2：Auto torque boost control	0	0	2	
Pn631	Test current	0	0	5000	
Pn632	Output frequency	5000	0	60000	0.01 Hz
Pn633	Output voltage	220	0	440	V
Pn634	Output angle	0	0	3600	0.1°
Pn635	Rated motor frequency	5000	0	60000	0.01 Hz

Pn636	Manual slip compensation	0	0	100	1%
Pn637	Manual torque compensation way 0：No compensation 1：Linear torque compensation 2：Curve torque compensation 3：Customize torque compensation	0	0	3	
Pn638	Linear compensation	100	100	500	1%
Pn639	Curve compensation	0	0	7	
Pn640	Customize frequency 1	100	0	60000	0.01 Hz
Pn641	Customize voltage 1	4	0	100	1%
Pn642	Customize frequency 2	500	0	60000	0.01 Hz
Pn643	Customize voltage 2	13	0	100	1%
Pn644	Customize frequency 3	1000	0	60000	0.01 Hz
Pn645	Customize voltage 3	24	0	100	1%
Pn646	Customize frequency 4	2000	0	60000	0.01 Hz
Pn647	Customize voltage 4	45	0	100	1%
Pn648	Customize frequency 5	3000	0	60000	0.01 Hz
Pn649	Customize voltage 5	63	0	100	1%
Pn650	Customize frequency 6	4000	0	60000	0.01 Hz
Pn651	Customize voltage 6	81	0	100	1%
Pn652	Voltage corresponding to knee frequency	100	0	100	1%

4.7 Input, Output and Other Control Parameters

<table>
<tr><th>Code</th><th>Description</th><th>Default</th><th>Lower limit</th><th>Upper limit</th><th>Unit</th></tr>
<tr><td>Pn700</td><td>Digital input terminal DI1 function selection(DYYXX)
XX: Input terminal function selection
<table>
<tr><td>0</td><td>No function</td></tr>
<tr><td>1</td><td>Servo on</td></tr>
<tr><td>2</td><td>Forward prohibit(forward limit)</td></tr>
<tr><td>3</td><td>Reverse prohibit(forward limit)</td></tr>
<tr><td>4</td><td>(ESP)External emergency stop</td></tr>
<tr><td>5</td><td>Proportional control | Proportional integral control switch</td></tr>
<tr><td>6</td><td>Forward external torque limit</td></tr>
<tr><td>7</td><td>Reverse external torque limit</td></tr>
<tr><td>8</td><td>Warning clear</td></tr>
<tr><td>9</td><td>Position error clear</td></tr>
<tr><td>10</td><td>Prohibit pulse command input</td></tr>
</table></td><td>D01</td><td>D00</td><td>D163</td><td></td></tr>
</table>

	11	Servo lock(Zero speed clamping)				
	12	Internal setting speed selection 1				
	13	Internal setting speed selection 2				
	14	Internal setting speed direction				
	15	Control mode switch				
	16	Internal setting torque 1				
	17	Internal setting torque 2				
	18	Gain switch				
	19	Pulse enable method				
	20	Ratio selection 1				
	21	Ratio selection 2				
	22	Ratio selection 3				
	23	Forward start				
	24	Reverse start				
	25	Home signal				
	26	External probe input 1				
	27	External probe input 2				
	28	Internal position start operation				
	29	Start return to zero				
	30	Internal position stop operation				
	YY: Input terminal logic 0：Positive logic					

<table>
<tr><td></td><td>1：Negative logic</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pn701</td><td>Digital input terminal DI2 function selection(DYYXX)</td><td>D 0 8</td><td>D 0 0</td><td>D 1 63</td><td></td></tr>
<tr><td>Pn702</td><td>Digital input terminal DI3 function selection(DYYXX)</td><td>D 0 10</td><td>D 0 0</td><td>D 1 63</td><td></td></tr>
<tr><td>Pn703</td><td>Digital input terminal DI4 function selection(DYYXX)</td><td>D 0 11</td><td>D 0 0</td><td>D 1 63</td><td></td></tr>
<tr><td>Pn704</td><td>Digital input terminal DI5 function selection(DYYXX)</td><td>D 0 9</td><td>D 0 0</td><td>D 1 63</td><td></td></tr>
<tr><td>Pn705</td><td>Digital input terminal DI6 function selection(DYYXX)</td><td>D 0 12</td><td>D 0 0</td><td>D 1 63</td><td></td></tr>
<tr><td>Pn706</td><td>Digital input terminal DI7 function selection(DYYXX)</td><td>D 0 13</td><td>D 0 0</td><td>D 1 63</td><td></td></tr>
<tr><td>Pn707</td><td>Digital input terminal DI8 function selection(DYYXX)</td><td>D 0 0</td><td>D 0 0</td><td>D 1 63</td><td></td></tr>
<tr><td>Pn710</td><td>Digital output terminal DO1 function selection(DYYXX)
XX: Output terminal function selection
<table><tr><td>0</td><td>Servo ready</td></tr><tr><td>1</td><td>Servo on enable</td></tr><tr><td>2</td><td>Warning</td></tr><tr><td>3</td><td>Stop signal</td></tr><tr><td>4</td><td>Positioning completed</td></tr><tr><td>5</td><td>Speed reached</td></tr><tr><td>6</td><td>Rotate detection</td></tr><tr><td>7</td><td>Torque reached</td></tr><tr><td>8</td><td>Torque limiting</td></tr></table></td><td>D00</td><td>D00</td><td>D1.63</td><td></td></tr>
</table>

	<table><tr><td>9</td><td>Speed limiting</td></tr><tr><td>10</td><td>Position error pre-warning</td></tr><tr><td>11</td><td>Electromagnetic brake</td></tr><tr><td>19</td><td>Minimum limit output</td></tr><tr><td>20</td><td>Maximum limit output</td></tr><tr><td>21</td><td>Origin position output</td></tr></table> YY: Output terminal logic 0：Positive logic 1：Negative logic				
Pn711	Digital output terminal DO2 function selection (DYYXX)	D 0 2	D 0 0	D 1 63	
Pn712	Digital output terminal DO3function selection (DYYXX)	D 0 4	D 0 0	D 1 63	
Pn713	Digital output terminal DO4 function selection(DYYXX)	D 0 6	D 0 0	D 1 63	
Pn714	Digital output terminal DO5 function selection(DYYXX)	D 0 8	D 0 0	D 1 63	
Pn715	Digital output terminal DO6 function selection(DYYXX)	D 0 9	D 0 0	D 1 63	
Pn716	Digital output terminal DO7 function selection(DYYXX)	D 0 10	D 0 0	D 1 63	
Pn717	Digital output terminal DO8 function selection(DYYXX)	D 0 18	D 0 0	D 1 63	
Pn720	Over speed function enable selection	0	0	1	
Pn721	Over speed filter time constant	0	10	9000	0.1s

Pn722	Speed reached signal detection width	10	0	9000	
Pn723	Speed detection value	5	0	9000	
Pn724	Zero servo enabled	0	0	1	
Pn725	Zero servo speed	5	0	1000	
Pn730	Position reached width	5	0	65535	P
Pn731	Position error pre-warning pulse number	20	0	65535	KP
Pn732	Position error warning pulse number	40	0	65535	KP
Pn733	Origin positioning range	5	0	65535	
Pn734	Positioning approach range	50	0	65535	
Pn737	Torque reached width	5	0	300	0.1%
Pn740	Analog 1 selection	0	0	4	
Pn741	Analog 1 corresponding gain	10000	0	65535	
Pn744	Analog 1 offset	0	0	16777216	
Pn746	Analog 1 dead zone	0	-50000	50000	1mV
Pn748	Analog 1 filter time constant	10	0	65535	0.1ms
Pn750	Analog 2 selection	0	0	4	
Pn751	Analog 2 corresponding gain	10000	0	65535	
Pn754	Analog 2 offset	0	-50000	50000	
Pn756	Analog 2 dead zone	0	-16777216	16777216	1mV
Pn758	Analog 2 filter time constant	10	0	65535	0.1ms

Pn761	Input analog zero offset auto-tuning		0	1	
Pn770	Analog 1 output function selection 1: Motor speed 1V/1000rpm 2: Speed command 1V/1000rpm 3: Torque command 1V/100% torque 4: Load rate 1V/100% torque 5: Position deviation 0.001V/1 command unit 6: Position amplifier deviation 0.001V/1 command unit 7: Position command speed 5V/rated speed	0	0	32	
Pn771	Analog output 1 gain	100	-10000		%
Pn772	Analog output 1 offset	434	-10000		mV
Pn775	Analog 2 output function selection	0	0	32	
Pn776	Analog output 2 gain	100	-10000		%
Pn777	Analog output 2 offset	434	-10000		mV
Pn790	Input terminal internal forced opening	0	0	1	
Pn791	Input terminal internal forced setting	0	0	256	
Pn792	Output terminal internal forced opening	0	0	1	
Pn793	Output terminal internal forced setting	0	0	256	

4.8 Communication Area

Code	Description	Default	Lower limit	Upper limit	Unit
Pn800	232 communication address	1	0	255	
Pn801	232 communication checksum 0: No checksum 1: Odd checksum 2: Even checksum	0	0	2	
Pn802	232 Communication baud rate 0：1200；1：2400；2：4800； 3：9600；4：19200；5：38400； 6：57600；7：115200	3	0	7	
Pn805	Channel 1 monitor selection	1	0	65535	
Pn806	Channel 2 monitor selection	2	0	65535	
Pn807	Channel 3 monitor selection	3	0	65535	
Pn808	Channel 4 monitor selection	4	0	65535	
Pn809	232 communication mode 0: Modbus RTU mode 1: Oscilloscope mode	0	0	1	
Pn810	TOG_CH	0	0	10	
Pn811	TOG_TYPE	0	0	10	
Pn812	TOG_WAY	0	0	10	
Pn813	TOG_EDGE	0	0	10	
Pn814	TOG_LEVEL	0	0	65535	
Pn815	SAMPL_T	0	0	65535	
Pn816	Channel 1 proportional value	10000	0	60000	
Pn817	Channel 2 proportional value	10000	0	60000	
Pn818	Channel 3 proportional value	10000	0	60000	

Pn819	Channel 4 proportional value	10000	0	60000	
Pn820	Channel 1 data type	1	0	9	
Pn821	Channel 2 data type	0	0	9	
Pn822	Channel 3 data type	0	0	9	
Pn823	Channel 4 data type	0	0	9	
Pn830	MII Communication station number	1	1	64	
Pn840	MIII Communication station number	1	1	65535	
Pn850	485 communication address (1-247)	1	1	247	
Pn851	485 communication mode 0: RTU mode 1: Ascll (No support)	0	0	0	
Pn852	485 communication check 0: No checksum 1: Odd checksum 2: Even checksum	0	0	2	
Pn853	485 communication baud rate 0：9600；1：19200；2：38400；3：57600；4：115200	2	0	4	

Chapter 5 Driver trial operation

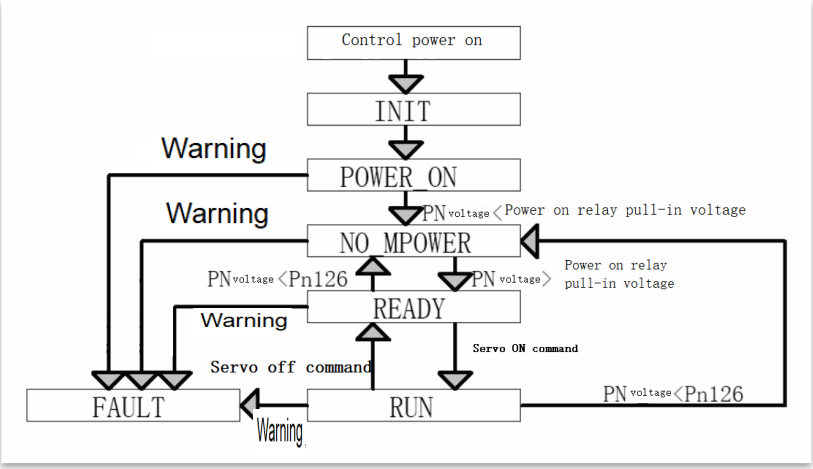
5.1 Servo status machine function

5.1.1. The driver are with below status

Status code	Status name	Status identify	Function description
0	Initialization	INIT	Enter the status when control stable,under the status, all driver internal parameters are initialized. After initialization completed, enter into POWER-ON status.
1	Initialization completed	POWER_ON	Initialization is complete, and the control circuit is powered on successfully. There is no alarm during initialization. If the bus voltage is less than the undervoltage value, it enters the NO_MPOWER state, and the status POWER_LED flashes; if the bus voltage is higher than the charging relay pull-in value, it enters the READY state, and the status POWER_LED goes out. An alarm occurs during initialization, and it enters the FAULT state. The status POWER_LED flashes, and the five-digit digital tube displays the alarm code.
2	Main power not on	NO_MPOWER	The drive system has no alarm, the bus voltage is lower than the undervoltage value, and the status POWER_LED flashes. The bus voltage rises to the charging relay closure value and enters the READY state.

3	Ready	READY	The bus voltage is normal, the status POWER_LED is always on, and the drive system is ready. In the current state, the servo motor is not powered and is waiting for the driver enable command.
4	Motor running	RUN	The servo enable command is received, the motor is powered on, and if there is a run command, the motor rotates. Status SON_LED is always on
5	Driver fault	FAULT	Status LED blinking, servo on disabled, 5 digit nixie display fault code

5.1.2.Status machine switchover diagram



5.2 Servo control mode selection

Servo control mode selection through Pn200 setting

<table>
<tr><td>Pn200</td><td>Servo control mode selection
<table>
<tr><td>Pn200</td><td>DI_MODE_CHG</td><td>Control mode</td></tr>
<tr><td>1</td><td>XX</td><td>Position control mode</td></tr>
<tr><td>2</td><td>XX</td><td>Speed control mode</td></tr>
<tr><td>3</td><td>XX</td><td>Torque control mode</td></tr>
<tr><td>4</td><td>XX</td><td>Register torque control mode</td></tr>
<tr><td>5</td><td>XX</td><td>Analog torque control mode</td></tr>
<tr><td rowspan="2">6</td><td>OFF</td><td>Position control mode</td></tr>
<tr><td>ON</td><td>Analog speed control mode</td></tr>
<tr><td rowspan="2">7</td><td>OFF</td><td>Position control mode</td></tr>
<tr><td>ON</td><td>Analog torque control mode</td></tr>
<tr><td rowspan="2">8</td><td>OFF</td><td>Analog torque control mode</td></tr>
<tr><td>ON</td><td>Analog speed control mode</td></tr>
<tr><td>9</td><td>XX</td><td>VVVF control mode， mainly use in Asynchronous machine operation and debugging</td></tr>
</table>
Note: If Pn150 is set to 4 and Ethercat bus control is used, this function code is invalid and the servo control mode is controlled by the host system.</td></tr>
</table>

5.3 Servo on running

The selection of servo on mode is determined by function code Pn202.

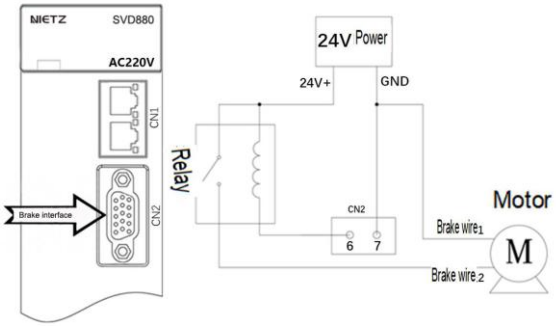
<table>
<tr><td></td><td>Servo on mode selection</td></tr>
<tr><td>Pn202</td><td>0：Internal enable, set by Pn203(Servo on register).
0：Driver exit RUN status, motor power not on.
1：Driver enter into RUN status, motor power on locked, waiting for run command
1：Terminal enable, DI terminal control driver enable via servo on DI_OFF: Driver exit RUN status, motor power not on.
DI_ON: Driver enter into RUN status, motor power on locked, waiting for run command.
2：Direction terminal enable, DI terminal enable signal via forward start or reverse start. Generally used in mainshaft control
3: The servo is powered on and enabled. After the servo is powered on, the drive is automatically controlled to enable.
<table>
<tr><td>Reverse start DI terminal</td><td>Servo status</td><td>Command direction</td></tr>
<tr><td>OFF</td><td>READY</td><td>NULL</td></tr>
<tr><td>OFF</td><td>RUN</td><td>Forward</td></tr>
<tr><td>ON</td><td>RUN</td><td>Reverse</td></tr>
<tr><td>ON</td><td>RUN</td><td>Forward</td></tr>
</table>
</td></tr>
</table>

When set Pn202=3, open power on auto enable function. Driver enter into READY status， with delay setting of Pn206, driver auto set Pn203=1, servo enter RUN status.

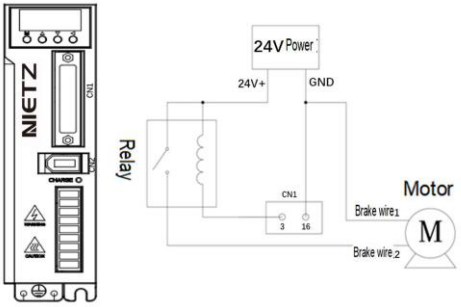
5.4 Servo brake output

When the servo is not enabled, the servo motor may be displaced due to external force. To prevent this undesirable situation, the motor can be mechanically held by an electromagnetic brake. All DO output interfaces can directly drive 24V relays. It is recommended to use an external power supply and use the normally open contact of the relay to control the electromagnetic brake, which effectively prevents the DO terminal from outputting insufficient power and burning the internal circuit. The recommended wiring circuit is as follows:

SVD880 Electromagnetic Brake Wiring Example:



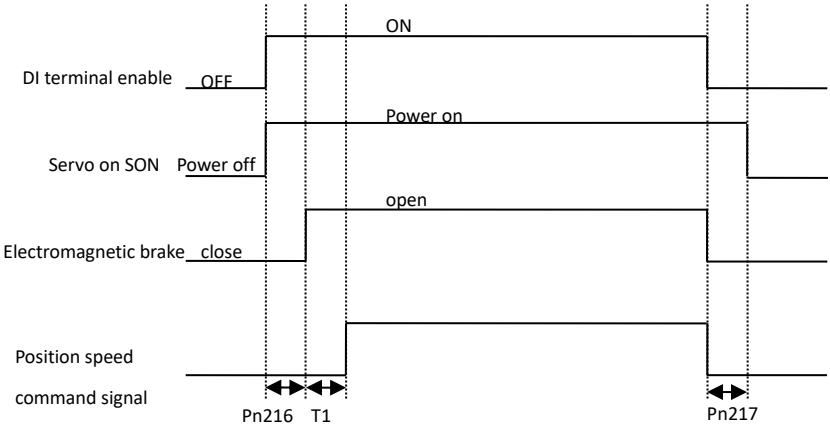
SVD810 Electromagnetic Brake Wiring Example:



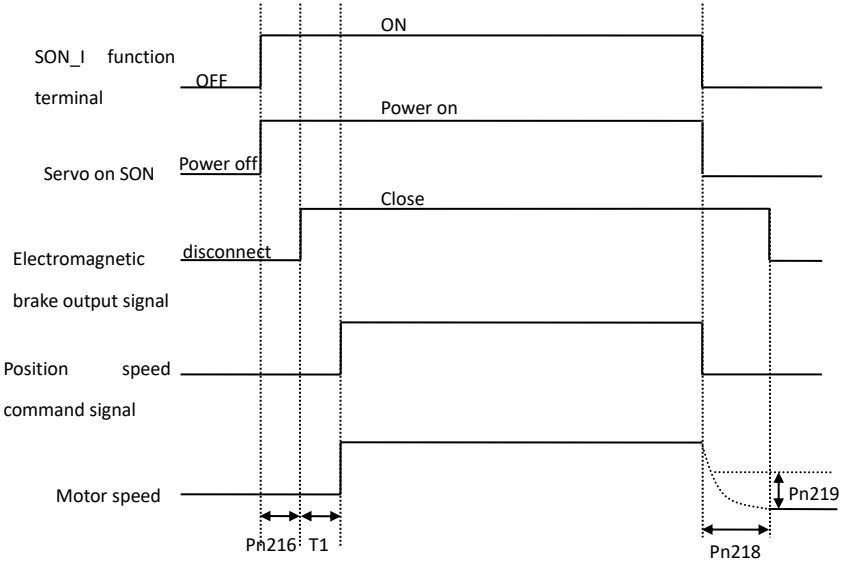
After the servo enable command is sent, the driver immediately enters the RUN state, the motor is powered on and locked, and no speed command is received. After the delay time of Pn216 (delay of brake command opening after servo command ON), the electromagnetic brake opens. To ensure that the electromagnetic brake is fully opened, a delay of T1 (10ms~1s) is required before the driver is allowed to receive speed commands.

After the drive receives the servo de-enable command, the electromagnetic brake is immediately closed, and speed commands are not allowed to be received at this time. When the motor is stopped, after the delay time of Pn217, the motor is powered off and the driver enters the READY state. The delay time of Pn217 is because the electromagnetic brake has a mechanical action delay, which can ensure that the electromagnetic brake truly locks the motor to prevent misoperation. If the driver receives the servo disable command while the motor is still running, the driver decides whether to immediately remove the motor enable state according to Pn204 (servo stop mode selection): Pn204.XX=0 or 1, the motor is disabled, and then after the delay of Pn219 (delay time of servo OFF after brake command is closed_rotation) or the motor speed drops below Pn219 (speed_rotation when brake command is closed), the electromagnetic brake is closed to lock the motor shaft.

When motor stop brake work sequence diagram：



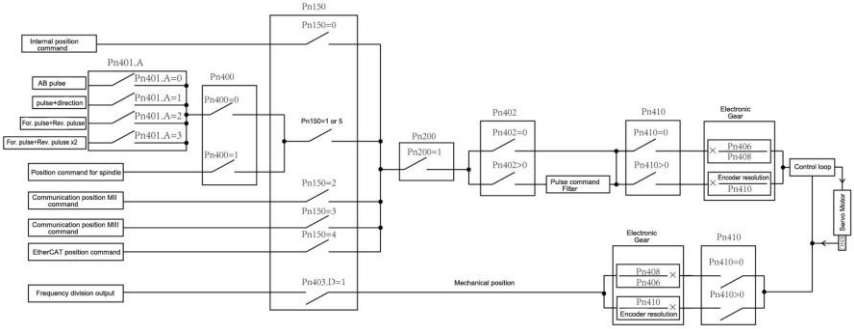
When motor running brake work sequence diagram：



5.5 Servo running command setting

5.5.1 Position loop position command setting

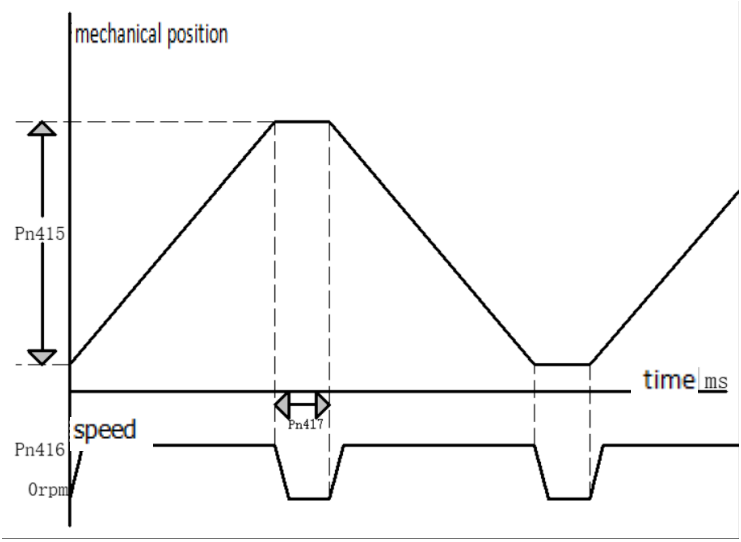
1.Position loop position command setting



2.Internal position command setting

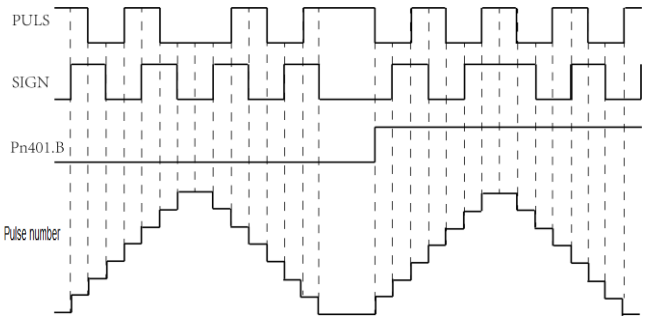
Internal position command is a command of PLC, driver control the motor to position at a command speed (Pn416) from the current mechanical position to the command incremental position (Pn415), then delay (Pn417), and reposition to the starting mechanical position, and reciprocating.

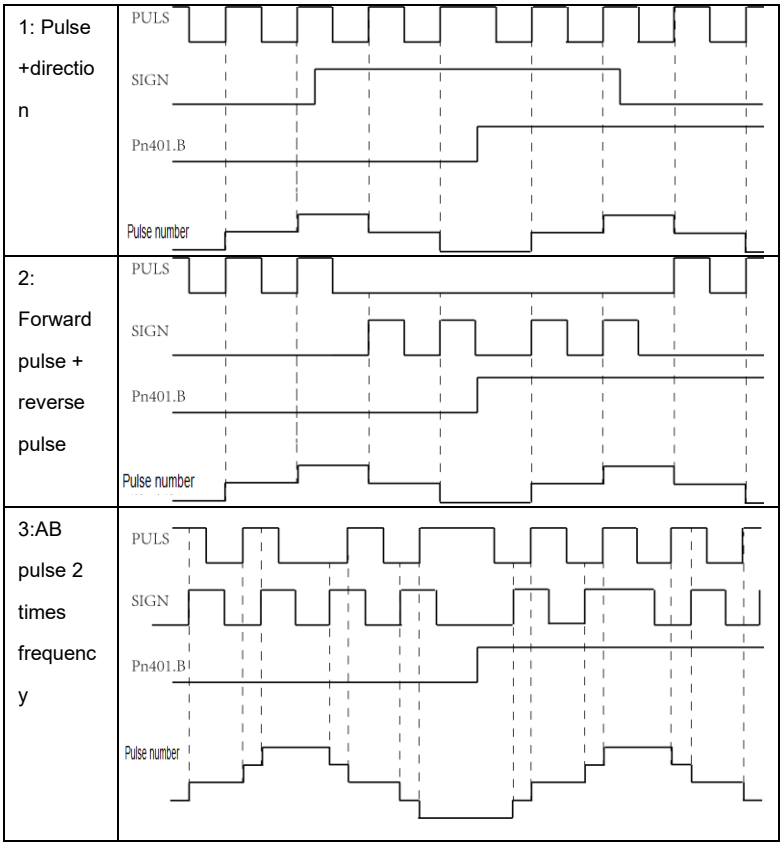
Pn415	Internal position jog speed
	Set the jog speed of the drive in position mode in rpm
Pn416	Internal position running speed
	Sets the speed at which the driver sends pulses



3.Pulse command selection

Select pulse as position command setting, set the format of pulse command by Pn401.A, set pulse command logic by Pn401.B.

Pn401.A	Pulse command format
0:AB pulse 4times frequenc y	



5.5.2 Mainshaft specialize position command Pulse

The servo spindle will switch between speed mode and position mode. The control mode is switched by the state of the input function terminal (DI_MODE_CHG). When the DI_MODE_CHG state is ON, the servo spindle enters the position control mode. The servo spindle dedicated position command will select the pulse command or the zero speed lock command (servo spindle accurate stop) to control the motor. The switch is made through the input function terminal (DI_BACK0).

DI_BACK0	Command source
ON	Zero speed locked, driver positioning to mechanical zero point with command speed(PnE04), and offset specialize position (PnE02), locked in the position.
OFF	Pulse command, refer to above

Zero speed locked function code as below：

PnE01	Zero speed locked command mechanical zero point type selection
	1：Mainshaft motor encoder signal Z； 2：External encoder signal Z； 3：Approach switch； 4：Absolute
PnE02	Zero speed locked command offset
	Set the benchmark as the pulse current of one revolution position of the motor encoder
PnE04	Zero speed locked command position speed

5.5.3Electronic gear setting

Proportional relationship between electronic gear setting position command and motor rotate position. Such as input position command 10000 pulses, motor rotate one circle, one revolution of motor encoder pulse is 8388608，then electronic gear should set

$$\frac{\text{Numerator}}{\text{Denominator}} = \frac{8388608}{10000}$$

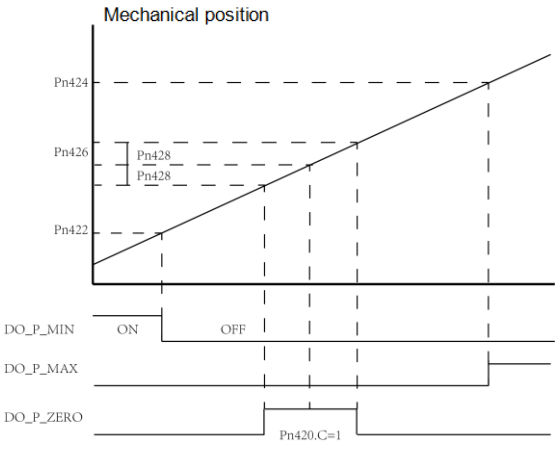
There are two ways to set the electronic gear. Directly set Pn410 (the number of command pulses for the motor to rotate one circle) = 10000. At this time, Pn406 and Pn408 are invalid. You can also set Pn406 (numerator of the electronic gear) = 8388608, Pn408 (denominator of the electronic gear) =

10000. At this time, Pn410 should be set to 0. When setting Pn406 and Pn408, you can reduce the set value, Pn406 = 524288, Pn408 = 625, but no decimals are allowed.

5.5.4 Limit output function

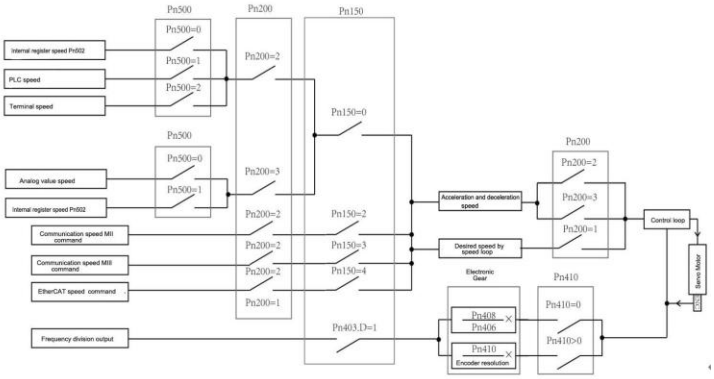
Motor encoder select absolute encoder, set current mechanical left right limit by encoder absolute position, to avoid collision by malfunction.

Pn420	Limit function selection(FDCBA)
	A: Output to output terminal after exceeding soft limit 0, invalid; 1, output to output terminal
	B: Whether the servo alarms after reaching the limit position 0, off; 1, drive alarm
	C, whether to stop running after exceeding the soft limit 0: continue running 1, stop running
	D：Reserved
Pn421	Parameter storage
	After setting to 1, Pn422 and Pn424 are stored in EEPROM. After setting the soft limit, it must be stored, otherwise it will be invalid.
Pn422	Limit minimum
	The minimum value of the limit function is valid when Pn420.A=1. When the mechanical position is less than this value, the DO_P_MIN output terminal is ON. If Pn420.B=1, the drive alarm Er1.40 is triggered.
Pn424	Limit maximum
	The minimum value of the limit function is valid when Pn420.A=1. When the mechanical position > this value, the DO_P_MAX output terminal is ON. If Pn420.B=1, the drive alarm Er1.41.
Pn426	Relative position zero point offset
Pn428	Position limit origin range

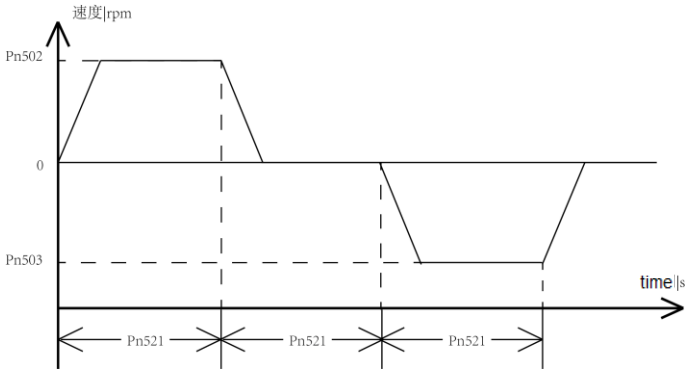


5.5.5 Speed loop speed command setting

1.When set to PLC speed, the driver cycles running between Pn502 speed and Pn503 speed. Pn502 is forward speed value，Pn503 is reverse speed value, running time set by Pn521(auto acc/dec delay). Running process as below



speed



2.When set to terminal speed, driver select running speed according to speed function terminal, as below time

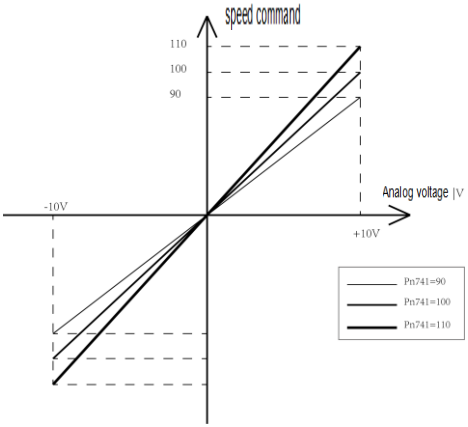
DI_SPD1	DI_SPD2	DI_SPD_DIR	Speed value
OFF	OFF	XX	0
ON	OFF	OFF	Pn502
OFF	ON	OFF	Pn503
ON	ON	OFF	Pn503
ON	OFF	ON	-Pn502
OFF	ON	ON	-Pn503
ON	ON	ON	-Pn503

3.When set to analog speed, driver running the speed set by analog channel voltage

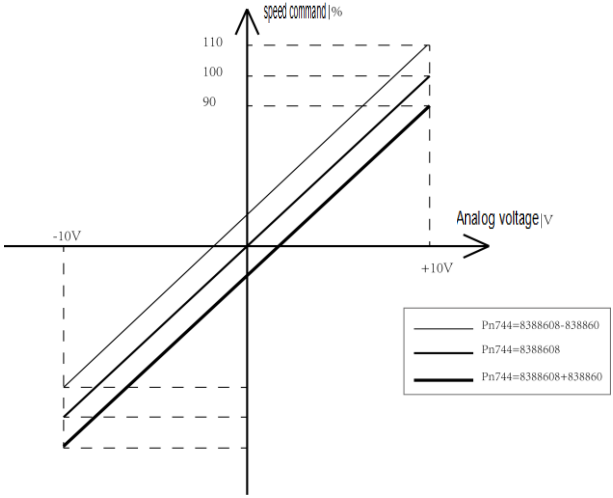
	Analog speed command channel selection
Pn740	0：Analog speed command keep as 0 1：Analog speed command get from analog channel 1, its hardware connect port are pin 42,43 of CN1 2：Analog speed command get from analog channel 2, its hardware

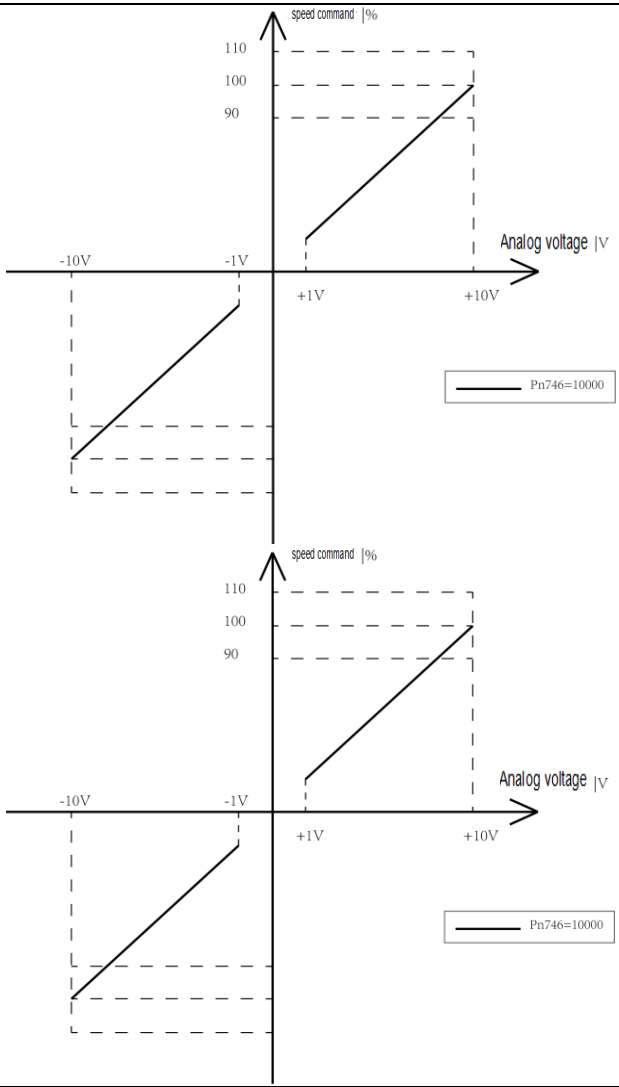
	connect port are pin 30, 41 of CN1

Analog channel voltage range is -10V~+10V，Pn741 set as 10V voltage corresponding to percentage of rated speed. The relationship between voltage and speed command as below:



Pn744	Analog speed command offset
	When speed command is 0, analog channel input offset of voltage.. Default as 8388608，corresponding input voltage value as 0V. For example, If want 1V corresponding to speed command 0，Set $$Pn741 = \frac{16777216 \times 1V}{10V \times 2} + 8388608$$ In condition of servo disabled, set Pn761=1，restart driver, driver will auto get analog voltage value, and calculate speed command offset.

	The relationship between analog offset and speed command as below： 
Pn746	Analog speed command dead zone(0.1mV)
	After zero drift compensation (setting Pn744), set this value, and the driver will maintain in the range of voltage, keep output speed command of 0. The relationship between analog dead zone and speed command as below:：



Pn748	Analog speed command filter time constant (0.1ms)
	Set the first-order inertial filtering coefficient of the analog speed

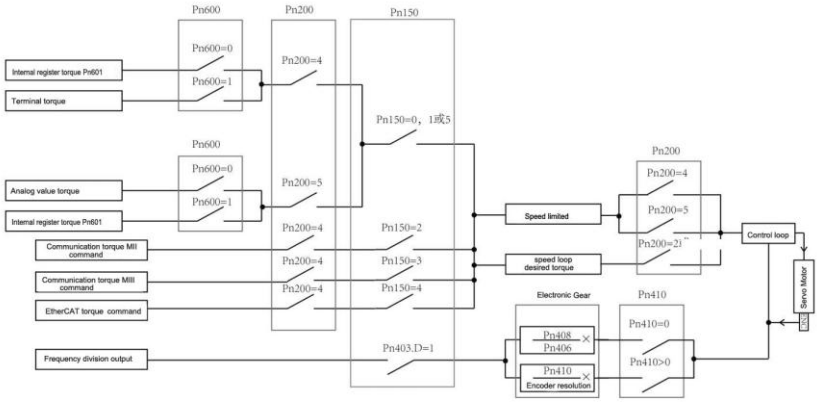
	command to 0, without filtering; The larger the set value, the smoother the speed command, but the slower the response to the input analog

4.Torque limit in speed mode

The torque limit command source is set by Pn515. If the torque limit value exceeds the maximum torque (Pn012 motor maximum torque), the torque is limited to the maximum torque, otherwise the torque is limited to within the torque limit value

Pn515	DI_TQ _LF	DI_TQ_ LR	Forward torque limit value	Reverse torque limit value
0	X	X	Pn604	Pn605
1	ON	OFF	Pn606	Maximum torque
1	OFF	ON	Maximum torque	Pn607
1	ON	ON	Pn606	Pn607
2	X	X	Analog torque	Analog torque

5.5.6 Torque loop torque command setting



1. Terminal torque

DI_TRQ1	DI_TRQ2	DI_SPD_DIR	Speed value
OFF	OFF	XX	0
ON	OFF	OFF	Pn601
OFF	ON	OFF	Pn602
ON	ON	OFF	Pn603
ON	OFF	ON	-Pn601
OFF	ON	ON	-Pn602
ON	ON	ON	-Pn603

2. Analog torque

When set to analog torque, the drive selects the analog channel voltage as the torque reference value to run.

Pn750	Analog torque command channel selection
	0：Analog torque command keep to 0 1：Analog torque command get from analog channel 1, its hardware connect port are pin 42,43 of CN1 2：Analog torque command get from analog channel 2, its hardware connect port are pin 30,41 of CN1

Analog channel voltage range is -10V~+10V，Pn751 set 10V, voltage corresponding to percentage of rated torque. Refer to the setting of analog speed command.

Pn754	Analog torque command offset
Pn756	Analog torque command dead zone (0.1mV)
Pn758	Analog torque command filter time constant (0.1ms)

5.5.7 Internal multi-segment position command setting

When Pn200=1 ， Pn400=0, and Pn150=0, the servo runs in the internal register position control mode.

Internal register position control is an operation control based on the setting of each internal position. The driver provides 8 internal positions, namely internal register position 1-> internal register position 8. The function code can set the operation mode, maximum speed, position, acceleration and deceleration time and delay time after positioning for each position.

Internal register position control uses relative position as the coordinate system reference. The mechanical position (see Un-36) is the actual feedback position of the encoder, and the relative position (see Un-37) is the feedback position based on the zero point. The relationship between the two is as follows:

Relative position = mechanical position – Pn426 (relative position zero point offset)

Realize the internal register position control function by changing the Pn418 parameter

Detailed description

Code	Description	Default	Lower limit	Upper limit	Unit
Pn418	Internal register position control function 1：Start running（0x0001） 2：Stop running（0x0002） 16：Zero return running（0x0010） 256：Forward JOG（0x0100） 257：Reverse JOG（0x0101） 512：Set zero（0x0200） 513：Set minimum software limit（0x0201） 514：Set maximum software limit（0x0202）	0	0	65535	

1 (0x0001): Start running. Start running each segment register position

according to the setting mode of Pn440

2 (0x0002): Stop running.

16 (0x0010): Return to zero operation. Start the zero return operation according to the zero return mode set by Pn432

256 (0x0100) and 257 (0x0101): Jog. It operates at Pn415 (jogging speed) and is not restricted by the software limit. Please operate with caution to prevent collision. To exit JOG, you can set Pn418=2

512 (0x0200): Set zero. Set the current mechanical position as the zero of the relative position, that is, Pn426 (relative position zero offset) = mechanical position. The setting will not save Pn426 to EEPROM and will be lost after powering on again. If you want to save, you need to set Pn421 to 1 and perform the storage operation.

513 (0x0201): Set the minimum software limit. Set the current relative position to the minimum software limit, that is, Pn422 (minimum software limit) = current relative position. The setting will not save Pn422 to EEPROM and will be lost after powering on again. If you want to save, you need to set Pn421 to 1 and perform the storage operation.

514 (0x0202): Set the maximum software limit. Set the current relative position to the maximum software limit, that is, Pn424 (maximum software limit) = current relative position. The setting will not save Pn424 to EEPROM and will be lost after powering on again. If you want to save, you need to set Pn421 to 1 and perform the storage operation.

When setting PN418 to run, first enable the servo.

The software limit is disabled by factory default. If you need to set it, please set Pn420.C=1.

Code	Description	Default	Lower limit	Upper limit	Unit
Pn420	Software limit function selection (FDCBA) A: After exceeding the software limit, output to the output terminal. 0: Close 1: Output to the output terminal B:Whether to alarm after exceeding the soft limit 0: Close 1: Alarm C ： Whether to stop after exceeding the soft limit 0：Continue to running 1: Stop D: Reserved	F0000	F0000	F0111	
Pn421	Parameter storage After setting to 1, Pn422, Pn424, Pn426 are stored in EEPROM.	0	0	1	
Pn422	Software limit minimum value	0	-2147483648	2147483647	
Pn424	Software limit maximum value	0	-2147483648	2147483647	
Pn426	Relative position zero offset	0	-2147483648	2147483647	
Code	Description	Default	Lower limit	Upper limit	Unit
Pn430	Number of pulses per mechanical position	10000	0	2147483647	PPS

Code	Description	Default	Lower limit	Upper limit	Unit
	Set the number of pulses sent by the motor for one revolution. When the mechanical structure reduction ratio is 1:1, Pn410 needs to be set to the value of Pn430.				
Pn432	Zero return method 0~35: Other zero return methods 40: Pn433 (zero return high speed) directly return to the relative position zero	40	0	50	
Pn433	Return to zero at high speed	100	0	1000	Rpm
Pn434	Return to zero at low speed	20	0	1000	Rpm
Pn440	Register position operating mode 0: Invalid 1:Single run 2: Loop operation 3:DI switching 4: Sequential operation, no delay 5: Axis control operation, only position 1 is valid	5	0	10	

1: Single operation, Pn418=1, runs from segment 1 to the number of segments set by Pn441, and then enters the stop state. To run again, you need to reset Pn418=1. and then position again.

2: Circular operation, Pn418=1, runs from segment 1 to the number of segments set by Pn441, then enters segment 1 again and runs to the number

of segments set by Pn441, and runs in a loop. Set Pn418=2 to stop running

3: DI switching, select segment operation according to the status of DI terminal.

DI(Internal given speed direction)	DI(Internal given speed selection 2)	DI(Internal given speed selection1)	
Pn70X=14	Pn70X=13	Pn70X=12	Terminal function setting value
0	0	0	Internal register position 1
0	0	1	Internal register position 2
0	1	0	Internal register position 3
0	1	1	Internal register position 4
1	0	0	Internal register position 5
1	0	1	Internal register position 6
1	1	0	Internal register position 7
1	1	1	Internal register position 8

4: Sequential operation, no delay. Pn418=1, runs from segment 1 to the number of segments set by Pn441, and then enters the stop state. To run again, you need to reset Pn418=1. When switching between segments, there will be no more delay and waiting.

5: Axis control operation, only position 1 is valid. After Pn418=1, positioning of segment 1 is executed. The set position of segment 1 changes and the motor is immediately positioned to the new position.

For the position, speed, acceleration and deceleration, and waiting time of each segment of the internal register, please refer to page 50 of the manual to set the corresponding parameter number correctly.

6: The internal position start, stop, and return to zero can be controlled through the terminals. All use rising edge wake-up control of terminal status.

For function definition, please refer to page 58 of input terminal parameters.

5.5.8Home Return

The home return function refers to the function in position control mode, when the servo is enabled, the servo motor will actively find the zero point according to the selected home return method to complete the positioning. By selecting the home return method (Pn432), the home return signal (positive limit switch, negative limit switch, home switch, motor Z signal) can be clearly established. The different home return positions are clearly indicated in the figure below. The number in a circle indicates the code for selecting this home return mode. The direction of movement is also further indicated. The home return method can be set using the home return method (Pn432).

Before modifying the home return parameters, first set the Pn430 and Pn526 parameters and re-power on, otherwise the home return is invalid or abnormal.

In the home return sequence diagram shown below, the encoder count increases as the axis position moves to the right, with the minimum position on the left and the maximum position on the right. This method clearly describes the precise sequence of the home return operation.

After the origin return is completed, the relative position (Un-37) will be assigned a value of "0".

Relative position = Un-36 (mechanical position) - Pn426 (relative position zero offset)

During the origin return operation, other position instructions will not be executed. The servo drive will execute other position instructions only after the origin return operation is completed. After the origin return is completed, the servo drive outputs a return completion signal. The host computer determines

that the origin return is completed through this signal.

Origin return supports return to zero through the etherCAT bus. The return to zero setting can be changed by changing the object dictionary 0x6098, 0x6099, and 0x609A through SDO. These object dictionaries are not recommended to be changed using PDO. The modified value of 0x6098 is written to Pn432; the modified value of 0x6099.01 is written to Pn433, and the modified value of 0x6099.02 is written to Pn434.

Before returning to the origin, please ensure that the trigger signal is correctly connected to the input terminal (positive limit switch, negative limit switch, origin switch) and the input terminal function code is correctly set.

The following is the setting of the origin return trigger signal:

Trigger signal	Trigger signal input terminal (optional)	Parameter setting (Pn70X = D YY XX, YY selects logic, XX selects function)	Definition of object dictionary 0x60FD in EtherCAT communication
Positive limit	DI1～DI4	Pn70X=D 0 2	0x60FD.bit1
Negative limit	DI1～DI4	Pn70X=D 0 3	0x60FD.bit0
Home switch	DI1～DI4	Pn70X=D 0 25	0x60FD.bit2
Motor Z signal	No setup required		0x60FD.bit5

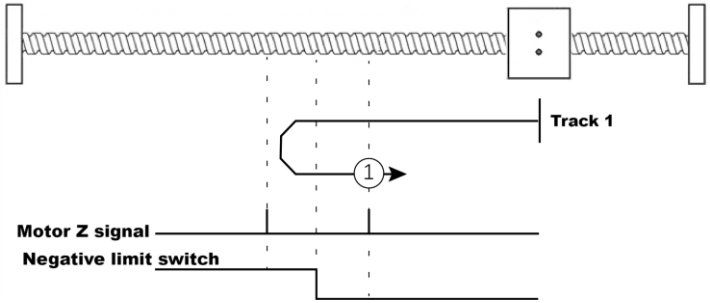
Zero return	Trigger signal	Illustrate

method (Pn432)		
1	Negative limit switch, motor Z signal	Return to zero on negative limit switch and motor Z signal
2	Positive limit switch, motor Z signal	Return to zero on positive limit switch and motor Z signal
3-4	Origin switch, motor Z signal	Return to zero on positive origin switch and motor Z signal
5-6	Origin switch, motor Z signal	Return to zero on negative origin switch and motor Z signal
7-10	Origin switch, motor Z signal, positive limit switch	Return to zero on origin switch, motor Z signal and positive limit switch
11-14	Origin switch, motor Z signal, negative limit switch	Return to zero on the origin switch, motor Z signal and negative limit switch
17	Origin switch	Return to zero on the negative limit switch
18	Origin switch	Return to zero on the positive limit switch
19-20	Origin switch	Return to zero on the positive origin switch
21-22	Origin switch	Return to zero on the negative origin switch
23-26	Origin switch, positive limit switch	Return to zero on the origin switch and positive limit switch
27-30	Origin switch, negative limit switch	Return to zero on the origin switch and negative limit switch
33-34	Motor Z signal	Return to zero on the motor Z signal in a single turn
35	Origin signal	Positioning at the current position as the origin

40	Pn418=512 (set origin) requires Pn421=1 to save	Return to zero by absolute value
41-42	Motor Z signal	Return to zero on the motor Z signal and torque

Description of origin return

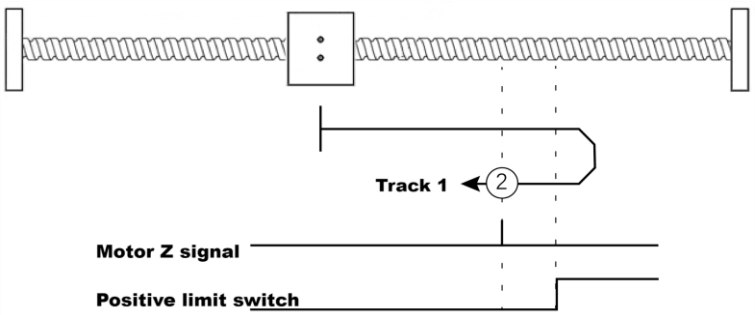
◆ **Reverse return to zero, the deceleration point is the negative limit switch, and the origin is the motor Z signal.**



➢

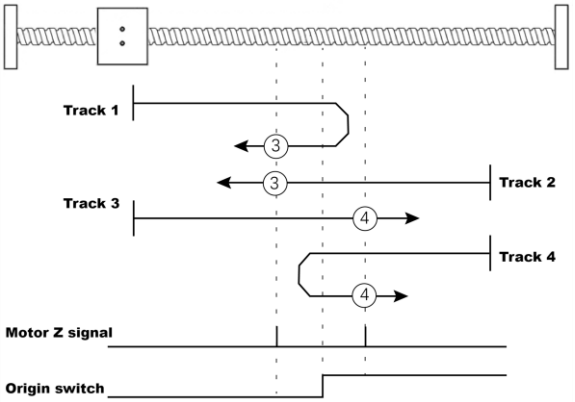
Track 1: At the beginning of the return to zero operation, the negative limit switch is invalid, and the motor runs in the reverse direction. When the negative limit switch is valid, it reverses and runs forward at a low speed to return to zero. The origin is the first Z signal detected when the negative limit switch changes from valid to invalid.

◆ **Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the motor Z signal.**



- Trace 1: When the return-to-zero operation starts, the forward limit switch is invalid, and the motor runs forward at the return-to-zero high speed. When the forward limit switch is valid, the motor reverses and runs in the reverse direction at the return-to-zero low speed. The origin is the first Z signal detected when the forward limit switch changes from valid to invalid.

◆ **Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the motor Z signal.**

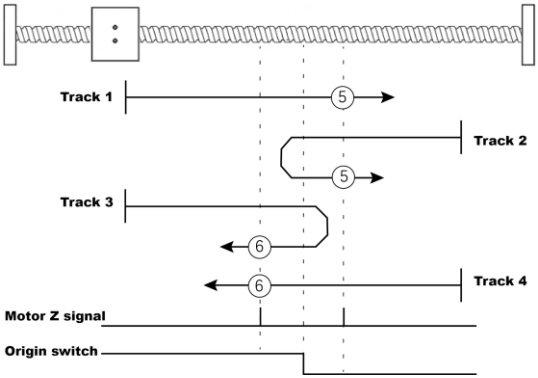


- Track 1: At the beginning of the return to zero operation, the origin switch is invalid, the motor runs forward at the return to zero high speed, and

reverses to the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

- Track 2: At the beginning of the return to zero operation, the origin switch is valid, the motor runs in the reverse direction at the return to zero high speed, and continues to run in the reverse direction at the return to zero low speed when the origin switch is invalid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.
- Track 3: At the beginning of the return to zero operation, the origin switch is invalid, the motor runs forward at the return to zero high speed, and continues to run in the reverse direction at the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from invalid to valid.
- Track 4: At the beginning of the return to zero operation, the origin switch is valid, the motor runs in the reverse direction, and reverses to the return to zero low speed when the origin switch is invalid. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

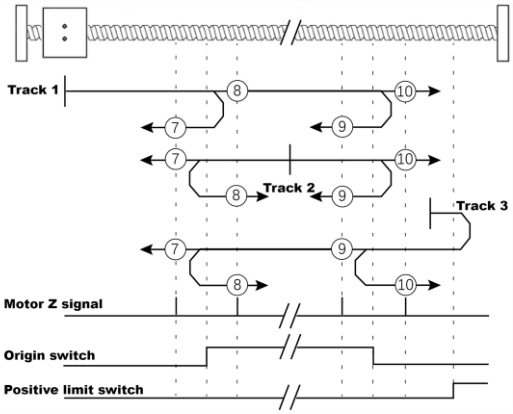
◆ **Reverse return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal.**



- Track 1: When the return to zero operation starts, the origin switch is valid, the motor runs forward at the return to zero high speed, and continues to run forward at the return to zero low speed when the origin switch is invalid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.
- Track 2: When the return to zero operation starts, the origin switch is invalid, the motor runs in the reverse direction at the return to zero high speed, and reverses to run forward at the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.
- Track 3: When the return to zero operation starts, the origin switch is valid, the motor runs forward at the return to zero high speed, and reverses to run reversely at the return to zero low speed when the origin switch is invalid. The origin is the first Z signal detected when the origin switch changes from invalid to valid.
- Track 4: When the return to zero operation starts, the origin switch is invalid, the motor runs in the reverse direction at the return to zero high

speed, and continues to run reversely at the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

◆ **Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the motor Z signal.**



➢ Track 1: The origin switch is invalid and the forward limit switch is invalid at the beginning of the return to zero operation

Return to zero mode 7 The motor runs forward at the return to zero high speed, and reverses to the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

Return to zero mode 8 The motor runs forward at the return to zero high speed, and continues to run forward at the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

Return to zero mode 9 The motor runs forward at the return to zero high speed, and reverses to the return to zero low speed when the falling edge of the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from

invalid to valid.

Return to zero mode 10, the motor runs forward at the return to zero high speed, and continues to run forward at the return to zero low speed when the falling edge of the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

- Track 2: When the return to zero operation starts, the origin switch is valid and the forward limit switch is invalid.

  Return to zero mode 7 The motor runs in reverse at the return to zero high speed, and continues to run in reverse at the return to zero low speed when the origin switch is invalid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

  Return to zero mode 8 The motor runs in reverse at the return to zero high speed, reverses when the origin switch is invalid and runs forward at the return to zero low speed, and the origin is the first Z signal detected when the origin switch changes from invalid to valid.

  Return to zero mode 9 The motor runs in forward at the return to zero high speed, reverses when the origin switch is invalid and runs in reverse at the return to zero low speed, and the origin is the first Z signal detected when the origin switch changes from invalid to valid.

  Return to zero mode 10 The motor runs in forward at the return to zero high speed, and continues to run forward at the return to zero low speed when the origin switch is invalid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

- Track 3: The origin switch is invalid and the positive limit switch is invalid at the beginning of the return to zero operation

  Return to zero mode 7 The motor runs forward at the return to zero high speed, reverses when the positive limit switch is valid, and continues to run in the reverse direction at the return to zero low speed when the falling edge of the origin switch is

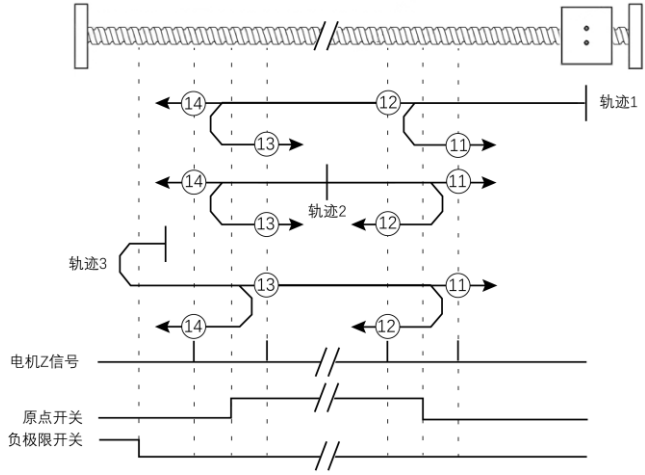
valid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

Return to zero mode 8 The motor runs forward at the return to zero high speed, reverses when the positive limit switch is valid, reverses and runs forward at the return to zero low speed when the falling edge of the origin switch, and the origin is the first Z signal detected when the origin switch changes from invalid to valid.

Return to zero mode 9 The motor runs forward at the return to zero high speed, reverses when the positive limit switch is valid, and continues to run in the reverse direction at the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

Return to zero mode 10 The motor runs forward at the return to zero high speed, reverses when the positive limit switch is valid, reverses and runs forward at the return to zero low speed when the origin switch is valid, and the origin is the first Z signal detected when the origin switch changes from valid to invalid.

◆ **Reverse return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal.**



- Track 1: The origin switch is invalid and the negative limit switch is invalid at the beginning of the return to zero operation

  Return to zero mode 11 The motor runs in reverse at the return to zero high speed, and the origin switch is reversed to run forward at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

  Return to zero mode 12 The motor runs in reverse at the return to zero high speed, and continues to run in reverse at the return to zero low speed when the origin switch is valid. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

  Return to zero mode 13 The motor runs in reverse at the return to zero high speed, and the falling edge of the origin switch is reversed to run forward at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

  Return to zero mode 14 The motor runs in reverse at the return to zero high speed, and continues to run in reverse at the return to zero low

speed when the origin switch drops and is valid. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

- Track 2: When the return to zero operation starts, the origin switch is valid and the negative limit switch is invalid

  Return to zero mode 11 The motor runs forward at the return to zero high speed. When the origin switch is invalid, it continues to run forward at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

  Return to zero mode 12 The motor runs forward at the return to zero high speed. When the origin switch is invalid, it reverses and runs reversely at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

  Return to zero mode 13 The motor runs reversely at the return to zero high speed. When the origin switch is invalid, it reverses and runs forward at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

  Return to zero mode 14 The motor runs forward at the return to zero high speed. When the origin switch is invalid, it continues to run forward at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

- Track 3: The origin switch is invalid and the negative limit switch is invalid at the beginning of the return to zero operation

  Return to zero mode 11 The motor runs in reverse at the return to zero high speed, the negative limit switch is reversed effectively, and the falling edge of the origin switch is valid. It continues to run forward at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

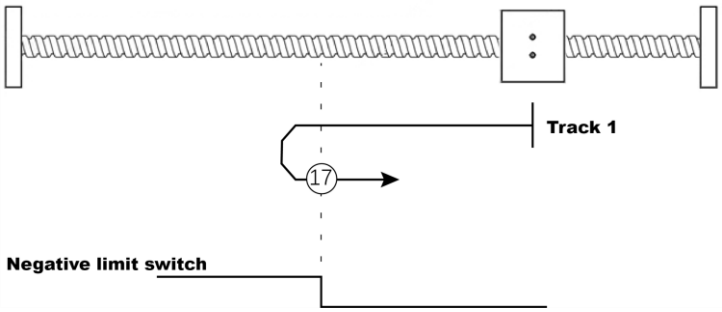
  Return to zero mode 12 The motor runs in reverse at the return to zero

high speed, the negative limit switch is reversed effectively, and the falling edge of the origin switch is reversed to reverse at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

Return to zero mode 13 The motor runs in reverse at the return to zero high speed, the negative limit switch is reversed effectively, and the origin switch is valid. It continues to run forward at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from invalid to valid.

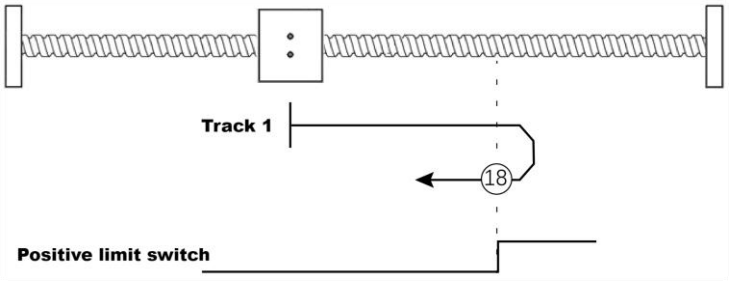
Return to zero mode 14 The motor runs in reverse at the return to zero high speed, the negative limit switch is reversed effectively, and the origin switch is reversed when the origin switch is valid. It runs in reverse at the return to zero low speed. The origin is the first Z signal detected when the origin switch changes from valid to invalid.

◆ **Reverse return to zero, the deceleration point and the origin are negative limit switches.**



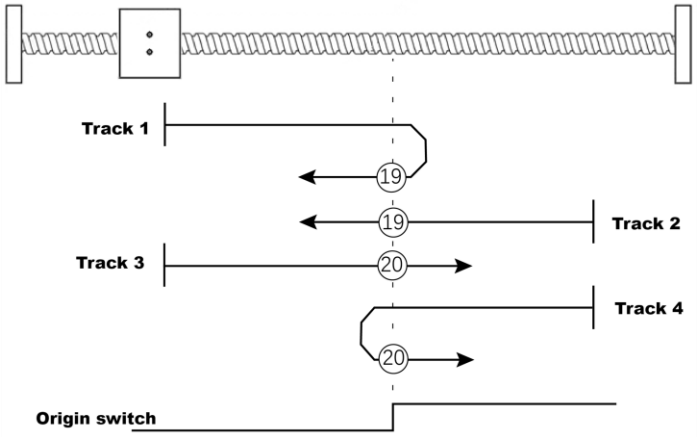
➢ Trace 1: The negative limit switch is invalid at the beginning of the return to zero operation, and the motor runs in the reverse direction at the return to zero high speed, with the origin being the negative limit switch.

◆ **Forward return to zero, the deceleration point and origin are the positive limit switches.**



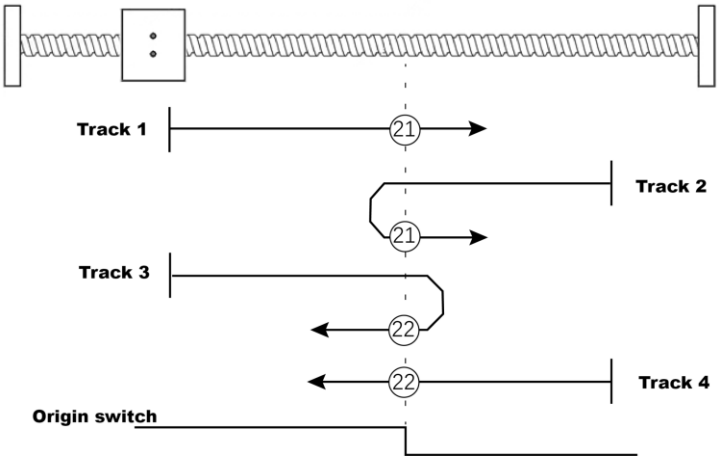
➢ Trace 1: When the return-to-zero operation starts, the positive limit switch is invalid, the motor runs forward at the return-to-zero high speed, and the origin is the positive limit switch.

◆ **Return to zero in the positive direction, the deceleration point and the origin are the origin switch.**



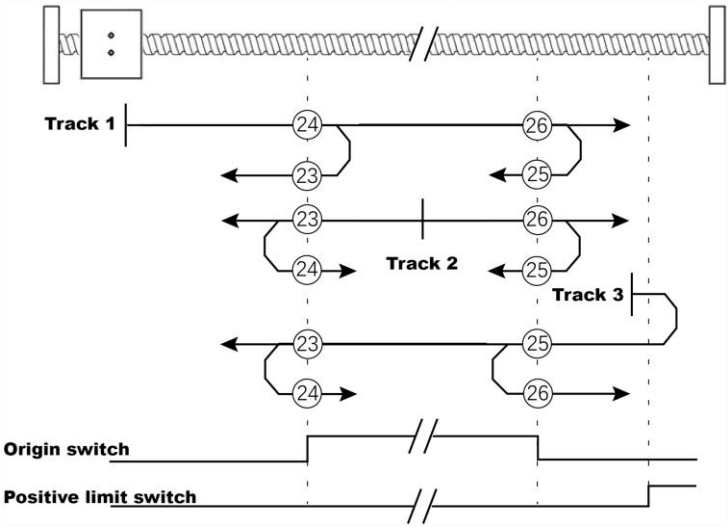
- Track 1: The origin switch is invalid at the start of the return to zero operation, the motor runs forward at the return to zero high speed, and the origin is the origin switch.
- Track 2: The origin switch is valid at the start of the return to zero operation, the motor runs reverse at the return to zero high speed, and the origin is the origin switch.
- Track 3: The origin switch is invalid at the start of the return to zero operation, the motor runs forward at the return to zero high speed, and the origin is the origin switch.
- Track 4: The origin switch is valid at the start of the return to zero operation, the motor runs reverse at the return to zero high speed, and the origin is the origin switch.

◆ **Reverse return to zero, deceleration point and origin are the origin switch.**



- Track 1: When the return to zero operation starts, the origin switch is valid, the motor runs forward at the return to zero high speed, and the origin is the origin switch.
- Track 2: When the return to zero operation starts, the origin switch is invalid, the motor runs reverse at the return to zero high speed, and the origin is the origin switch.
- Track 3: When the return to zero operation starts, the origin switch is valid, the motor runs forward at the return to zero high speed, and the origin is the origin switch.
- Track 4: When the return to zero operation starts, the origin switch is invalid, the motor runs reverse at the return to zero high speed, and the origin is the origin switch.

◆ **Return to zero in the positive direction, the deceleration point and the origin are the origin switch, and the limit is the positive limit switch.**



➢ Track 1: At the beginning of the return to zero operation, the origin switch is invalid and the forward limit switch is invalid

Return to zero mode 23 The motor runs forward at the return to zero high speed, and reverses to the return to zero low speed when the origin switch is valid, and the origin is the origin switch.

Return to zero mode 24 The motor runs forward at the return to zero high speed, and continues to run forward at the return to zero low speed when the origin switch is valid, and the origin is the origin switch.

Return to zero mode 25 The motor runs forward at the return to zero high speed, and reverses to the return to zero low speed when the falling edge of the origin switch is valid, and the origin is the origin switch.

Return to zero mode 26 The motor runs forward at the return to zero

high speed, and continues to run forward at the return to zero low speed when the falling edge of the origin switch is valid, and the origin is the origin switch.

- Track 2: At the beginning of the return to zero operation, the origin switch is valid and the forward limit switch is invalid

  Return to zero mode 23 The motor runs reversely at the return to zero high speed, and continues to run reversely at the return to zero low speed when the origin switch is invalid, and the origin is the origin switch.

  In zero return mode 24, the motor runs in reverse at zero return high speed, and reverses when the origin switch is invalid and runs forward at zero return low speed. The origin is the origin switch.

  In zero return mode 25, the motor runs in forward at zero return high speed, and reverses when the origin switch is invalid and runs in reverse at zero return low speed. The origin is the origin switch.

  In zero return mode 26, the motor runs in forward at zero return high speed, and continues to run forward at zero return low speed when the origin switch is invalid, and the origin is the origin switch.

- Track 3: The origin switch is invalid and the forward limit switch is invalid at the beginning of the zero return operation

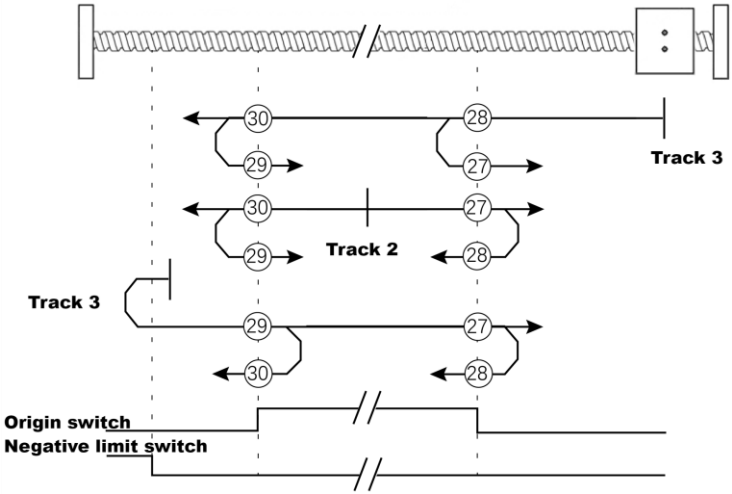
  In zero return mode 23, the motor runs in forward at zero return high speed, reverses when the forward limit switch is valid, and continues to run in reverse at zero return low speed when the origin switch falls, and the origin is the origin switch.

  In zero return mode 24, the motor runs in forward at zero return high speed, reverses when the forward limit switch is valid, and reverses when the origin switch falls and runs forward at zero return low speed. The origin is the origin switch.

Home mode 25 The motor runs forward at home high speed, reverses when the forward limit switch is effective, and continues to run in the reverse direction at home low speed when the origin switch is effective. The origin is the origin switch.

Home mode 26 The motor runs forward at home high speed, reverses when the forward limit switch is effective, reverses when the origin switch is effective, and runs forward at home low speed, and the origin is the origin switch.

- **Reverse return to zero, the deceleration point and origin are the origin switch, and the limit is the negative limit switch.**



- Track 1: At the beginning of the return to zero operation, the origin switch is invalid and the negative limit switch is invalid

  Return to zero mode 27 The motor runs in reverse at the return to zero high speed, and the origin switch is reversed to run forward at the return

to zero low speed. The origin is the origin switch.

Return to zero mode 28 The motor runs in reverse at the return to zero high speed, and continues to run in reverse at the return to zero low speed when the origin switch is valid. The origin is the origin switch.

Return to zero mode 29 The motor runs in reverse at the return to zero high speed, and the falling edge of the origin switch is reversed to run forward at the return to zero low speed. The origin is the origin switch.

Return to zero mode 30 The motor runs in reverse at the return to zero high speed, and continues to run in reverse at the return to zero low speed when the origin switch is valid. The origin is the origin switch.

- Track 2: At the beginning of the return to zero operation, the origin switch is valid and the negative limit switch is invalid

  Return to zero mode 27 The motor runs in forward at the return to zero high speed, and continues to run forward at the return to zero low speed when the origin switch is invalid. The origin is the origin switch.

  Return to zero mode 28: The motor runs forward at return to zero high speed, reverses when the origin switch is invalid, and runs reversely at return to zero low speed, and the origin is the origin switch.

  Return to zero mode 29: The motor runs reversely at return to zero high speed, reverses when the origin switch is invalid, and runs forward at return to zero low speed, and the origin is the origin switch.

  Return to zero mode 30: The motor runs forward at return to zero high speed, and continues to run forward at return to zero low speed when the origin switch is invalid, and the origin is the origin switch.

- Track 3: The origin switch is invalid and the negative limit switch is invalid at the beginning of the return to zero operation

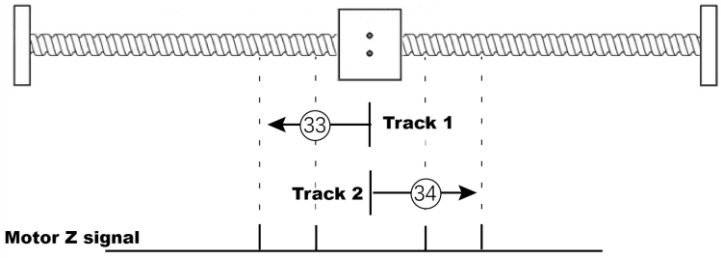
  Return to zero mode 27: The motor runs reversely at return to zero high speed, reverses when the negative limit switch is valid, and continues to

run forward at return to zero low speed when the falling edge of the origin switch is valid, and the origin is the origin switch.

Return to zero mode 28: The motor runs reversely at return to zero high speed, reverses when the negative limit switch is valid, and reverses when the falling edge of the origin switch is valid, and runs reversely at return to zero low speed, and the origin is the origin switch.

Home mode 29 The motor runs in reverse at home high speed, reverses when the negative limit switch is effective, and continues to run forward at home low speed when the origin switch is effective. The origin is the origin switch. Home mode 30 The motor runs in reverse at home high speed, reverses when the negative limit switch is effective, reverses when the origin switch is effective, and runs in reverse at home low speed, and the origin is the origin switch.

◆ **Single-turn zero return, the origin is the Z signal.**



- Track 1: Return to zero mode 33 The motor returns to zero in the reverse direction, and the origin is the motor Z signal.
- Track 2: Return to zero mode 34 The motor returns to zero in the forward direction, and the origin is the motor Z signal.

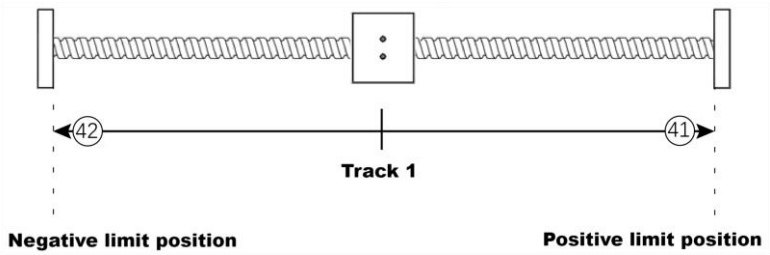
◆ **Current position is the origin**

Return to zero mode 35, take the current position as the origin.

◆ **The absolute value returns to zero.**

Zero return mode 40 returns to the relative position zero point directly with Pn433 (zero return high speed)

◆ **The torque returns to zero and the deceleration point origin is the mechanical limit position.**



- Trace 1: Zero return mode 41 The motor returns to zero in the positive direction at the zero return low speed (pn434). When it reaches the positive mechanical limit position, the torque reaches the set value (Pn437) and delays the time of Pn438. When the speed is zero, the current position is the origin.

  Zero return mode 42 The motor returns to zero in the reverse direction at the zero return low speed (pn434). When it reaches the negative

mechanical limit position, the torque reaches the set value (Pn437) and delays the time of Pn438. When the speed is zero, the current position is the origin

Chapter 6 Digital input output terminal function

6.1 Input terminal

6.1.1 Input terminal function setting

The distribution of digital input terminals is as follows:

Pn150	SVD880(CN2)	SVD810(CN1)
0: Pulse type		Default as 4 (Can select 7)
3: M3	2	
4: EtherCAT	2	2

Digital input terminal function setting, Pn700~Pn709 set each input terminal function and logic, input format is dYYXX

XX：Input terminal function setting，input terminal function can not be repeated, otherwise the terminal is invalid.

YY：Input terminal logic set，0，Positive logic；1，Negative logic.

XX Each function as below：

DI function setting (function code setting format = DYYXX. Function code number Pn700.XX~Pn707.XX)		
Function Number	Function Name	Description (H means the input is valid; L means the input is invalid)
0	No function	
1	Servo enabled	Input is on when Pn202=1. Level control. H=servo enable; L=servo disable.
2	Forward prohibited	★This function is only valid in position control mode. ★When Pn208=1, the forward limit input is turned on; when

	(forward limit)	Pn209=1, the reverse limit input is turned on. ★After the input is valid, the servo action is determined by Pn204.C Pn204.C = 0, servo is disabled Pn204.C = 1, servo is not enabled. When the forward limit is valid, the motor does not receive the forward command, and the reverse command is not affected; when the reverse limit is valid, the motor does not receive the reverse command, and the forward command is not affected.
3	Reverse prohibited (reverse limit)	
4	(ESP) External emergency stop	H=Emergency stop is valid. If the motor is in running state, the enable will be removed and the servo will enter the ready state. However, if Pn131.C=1, the servo drive will alarm Er107 and enter the alarm state.
5	Proportional control| Proportional integral control switch	
6	Forward external torque limit	★This input function is valid in position mode, speed mode, and torque mode ★The input function is enabled when Pn515=1. ★When the forward external torque limit function is valid, the forward torque is limited to Pn606; when it is invalid, the forward torque is limited to the maximum torque. ★When the reverse external torque limit function is valid, the reverse torque is limited to Pn607; when it is invalid, the reverse torque is limited to the maximum torque.
7	Reverse external torque limit	
8	Alarm clear	When the input is valid, the current alarm is cleared.

<table>
<tr><td>9</td><td>Position error clear</td><td></td></tr>
<tr><td>10</td><td>Prohibit pulse command input</td><td>★This input function is effective in position mode.
★When the input is valid, the position setting command is no longer received.</td></tr>
<tr><td>11</td><td>Servo lock (zero speed clamp)</td><td></td></tr>
<tr><td>12</td><td>Internal given speed selection 1</td><td rowspan="3">★In position control mode, it is valid when Pn400=0 (position control mode selects internal register position control) and Pn440=3 (register position operation mode selects DI switching mode).
<table>
<tr><th>Speed direction</th><th>Speed 2</th><th>Speed 1</th><th>Register position s number</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Register position 1 (Pn45</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Register position 2 (Pn45</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Register position 3 (Pn46</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Register position 4 (Pn47</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Register position 5 (Pn47</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Register position 6 (Pn48</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Register position 7 (Pn48</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Register position 8 (Pn49</td></tr>
</table>
★In speed control mode, it is effective when Pn500=2 (speed comes from terminal setting).
<table>
<tr><th>Speed 2</th><th>Speed 1</th><th>Speed reference source</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>Internally set speed 1 (Pn502)</td></tr>
<tr><td>1</td><td>0</td><td>Internally set speed 2 (Pn503)</td></tr>
<tr><td>1</td><td>1</td><td>Internally set speed 3 (Pn504)</td></tr>
</table></td></tr>
<tr><td>13</td><td>Internal given speed selection 2</td></tr>
<tr><td>14</td><td>Internal given speed direction</td></tr>
</table>

<table>
<tr><td></td><td></td><td colspan="3">When the speed direction input function is valid, the given speed is forward; when it is invalid, the given speed is reverse.
★In torque control mode, it is valid when Pn611 (speed limit source selection) = 1.</td></tr>
<tr><td></td><td></td><td>Speed 2</td><td>Speed 1</td><td>Speed reference source</td></tr>
<tr><td></td><td></td><td>0</td><td>0</td><td>Speed limit comes from internal register Pn502</td></tr>
<tr><td></td><td></td><td>0</td><td>1</td><td>Speed limit comes from internal register Pn502</td></tr>
<tr><td></td><td></td><td>1</td><td>0</td><td>Speed limit comes from internal register Pn503</td></tr>
<tr><td></td><td></td><td>1</td><td>1</td><td>Speed limit comes from internal register Pn504</td></tr>
<tr><td></td><td></td><td colspan="3">The speed direction input function is invalid.</td></tr>
<tr><td>15</td><td>Control mode switching</td><td colspan="3"></td></tr>
<tr><td>16</td><td>Internal given torque 1</td><td colspan="3">★Only valid in torque control mode
★Valid when Pn600=1</td></tr>
<tr><td>17</td><td>Internal given torque 2</td><td>Torque 2</td><td>Torque 1</td><td>Torque setting source</td></tr>
<tr><td></td><td></td><td>0</td><td>0</td><td>0</td></tr>
<tr><td></td><td></td><td>0</td><td>1</td><td>The given torque comes from the internal register Pn601</td></tr>
<tr><td></td><td></td><td>1</td><td>0</td><td>The given torque comes from the internal register Pn602</td></tr>
<tr><td></td><td></td><td>1</td><td>1</td><td>The given torque comes from the internal register Pn603</td></tr>
<tr><td>18</td><td>Gain switching</td><td colspan="3">★Only valid in position control and speed control mode
★Open when Pn315.A=1 and Pn315.B=2</td></tr>
</table>

		When input function is valid, select gain group 2; when input function is invalid, select gain group 1
19	Pulse enable mode	
20	Multiplier selection 1	
21	Multiplier selection 2	
22	Multiplier selection 3	
23	Forward start	★Only valid in speed mode ★Function is enabled when Pn202=2 ★Forward start input function is valid, motor is enabled, when there is a speed command, the motor rotates forward; invalid, the motor is disabled. ★Reverse start input function is valid, motor is enabled, when there is a speed command, the motor rotates reversely; invalid, the motor is disabled. ★Forward start and reverse start are valid at the same time, motor is enabled, when there is a speed command, the motor rotates forward; invalid, the motor is disabled.
24	Reverse start	
25	Origin signal	★Effective in homing mode, Pn200=1, enter homing mode through bus or Pn418=16 or start the homing input terminal function.
26	External probe input 1	★Effective when bus control (Pn150=3 or 4)
27	External probe input 2	
28	Register	★Effective in position control mode

	position start operation	★Function is enabled when Pn400=0 ★Rising edge is effective, the motor starts running according to the set internal register setting mode, and automatically enters the stop state after execution. If you need to start again, you need to generate a rising edge pulse signal.
29	Start return to zero	★Effective in position control mode ★Rising edge is effective
30	Register position stop operation	★Effective in position control mode ★Function is enabled when Pn400=0 ★Rising edge is effective, the motor stops in the internal register setting mode.

6.2 Output terminal

6.2.1 Output terminal function setting

The distribution of digital output terminals is as follows:

Pn150	SVD880(CN2)	SVD810(CN1)
0: Pulse type		Default as 4 (Can select 8)
3:M3	2	
4:EtherCAT	2	2

Pn710~Pn719 set each output terminals function and logic, input format is dYYXX

XX：Output terminal function setting

YY：Output terminal logic setting，0，Positive logic；1，Negative logic

XX each function as below：

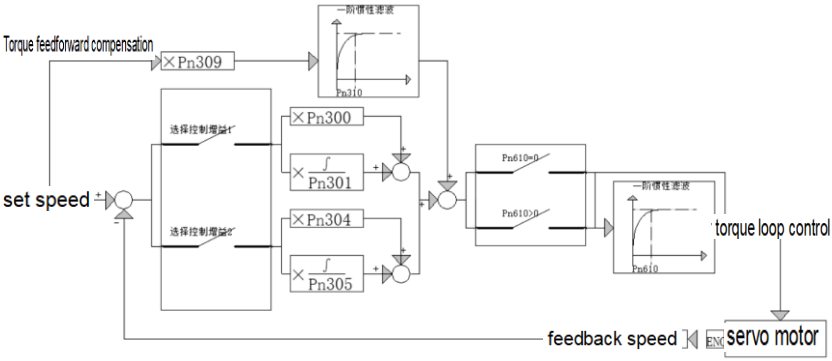
DO function setting (function code setting format = DYYXX. Function code number Pn710.XX~Pn717.XX)		
Function Number	Function Name	Description (H means the output is valid; L means the output is invalid)
0	Servo ready	H = Servo drive is ready L = Servo drive has not been initialized or has an alarm
1	Servo enabled	H = Servo drive is enabled L = Servo drive is not enabled
2	Alarm	H = Servo drive has an alarm L = Servo drive has no alarm
3	Stop signal	
4	Positioning completed	★Valid in position mode, uncertain in other modes H=motor reaches given position, |given position - feedback position|<Pn730 (pulse) L=motor is positioning, |given position - feedback position|>=Pn730 (pulse)
5	Speed reached	
6	Zero speed state output	★Valid in all modes H=motor is at zero speed, |feedback speed|<Pn723 L=motor is rotating, |feedback speed|>Pn723
7	Torque reached	
8	Torque limited	★ Valid in all modes H = given torque reaches the maximum torque limit L = given torque does not reach the maximum torque limit
9	Speed limited	

10	Position error pre-alarm	★Effective in position mode H=|Pulse error| > Pn731(0.1r) L= |Pulse error| < Pn731(0.1r)
11	Electromagnetic brake	★ Valid in all modes H = electromagnetic brake open L = electromagnetic brake closed
12	Motor z signal output	★Valid in all modes H=Motor position is not on Z signal L=Motor position is on Z signal
18	Return to zero completed output	★Effective in position mode H=zero return completed, always H until zero return is started again, the output changes to L L=zero return in progress
19	Minimum limit output	
20	Maximum limit output	
21	Origin position output	

Chapter 7 Gain adjustment

7.1 Speed loop gain adjustment

1. Speed loop control gain diagram



2. Gain switchover function

Driver built in two group control gain parameters, switchover according to different application.

Item	Gain group 1	Gain group 2
Speed loop proportional gain	300	304
Speed loop integral time constant	301	305
Position loop proportional gain	302	306

Gain switchover mode set depend on Pn315

Pn315	Gain switchover mode FDCBA			
	A,Gain group switchover condition			
	Pn315.A	Switch by	Gain group 1	Gain group 2
	0	Terminal switchover	DI_GAIN_SEL=OFF	DI_GAIN_SEL=ON
	1	Pulse error	Pulse error< Pn316	Pulse error≥Pn316

2	Set speed	Set speed<Pn317	Set speed≥Pn317
3	Feedback speed	Feedback speed<Pn317	Feedback speed ≥Pn317
4	Set torque	Set torque<Pn319	Set torque≥Pn319
5	Feedback torque	Feedback torque<Pn319	Feedback torque≥Pn319

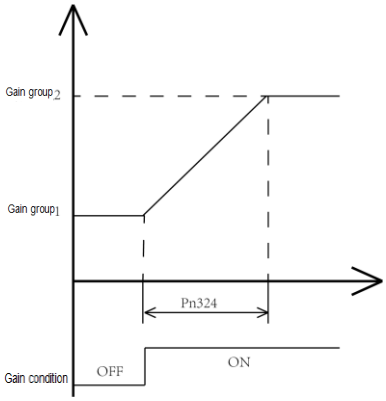
B,PI/P Switchover condition

Pn315.B	Switch by	PI control	P control
0	Terminal switchover	DI_GAIN_SEL=OFF	DI_GAIN_SEL=ON
1	Pulse error	Pulse error< Pn321	Pulse error≥Pn321
2	Set speed	Set speed<Pn322	Set speed≥Pn322
3	Feedback speed	Feedback speed<Pn322	Feedback speed≥Pn322
4	Set torque	Set torque<Pn323	Set torque≥Pn323
5	Feedback torque	Feedback torque<Pn323	Feedback torque≥Pn323

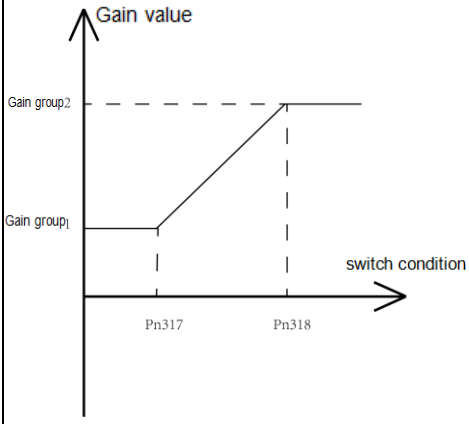
C, Gain group switchover invalid

0：Gain group not switch，select gain group 1 as control gain

1 or 2: Gain group single condition switching, the switching condition is determined by Pn315.A



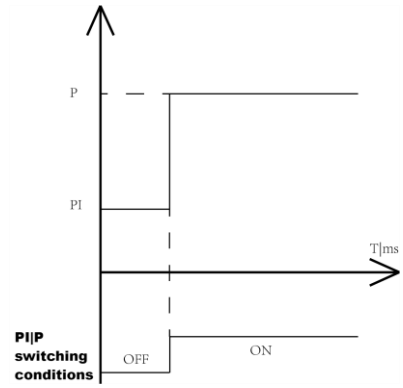
3：Gain group dual condition switching



D: PI/P switchover valid

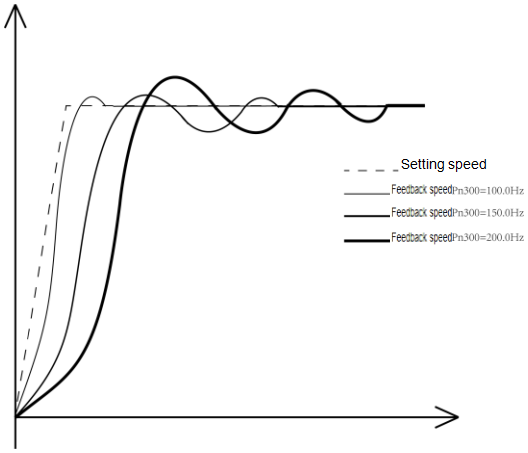
0: PI/P no switch, select PI control

1: PI/P switch, switch condition depend on Pn315.B

	
Pn316	Gain switchover condition (Pulse error)
	Pn315.C=1 or 2，Pn315.A=1 valid，Control gain by switching the gain group based on this threshold. If the pulse error< Pn316, select gain group 1; If the pulse error is ≥ Pn316, select gain group 2
Pn317	Gain switchover condition(speed command/feedback speed)(rpm)
Pn318	Gain switchover condition 2(speed command/feedback speed)(rpm)
	Set Pn315.C=3 valid，Feedback speed<Pn317, gain group select 1；Feedback speed≥Pn318，gain group select 2；Pn317≤Feedback speed<Pn318, $$\text{Gain} = \text{Pn317} + \text{Feedback speed} \times \frac{\text{gain group2} - \text{gain group1}}{Pn318 - Pn317}$$
Pn319	Gain switchover condition(torque command)(%)
Pn320	Gain switchover condition 2(torque command)(%)
Pn321	P/PI condition(Pulse error)
Pn322	P/PI condition(Speed command/feedback speed)(rpm)
Pn323	P/PI condition(Torque command)(%)
Pn324	Gain switchover delay
	Pn315.C=1 or 2，Pn315.A=1 valid，set gain group changing speed

3. Gain adjustment detail description

Speed loop P(Pn300|Pn304) adjust control rigidity. The larger the value, the faster the speed response, the smaller the overshoot, and the smaller the fluctuation during stable speed operation. However, if this value exceeds the mechanical response frequency, it may cause the adjustment fail to converge, lead the mechanical vibration.



The speed loop I (Pn301 | Pn305) is an integral time constant to eliminate static errors. The smaller the value, the greater the integral gain, and the faster the response. However, the overshoot will increase, the adjustment time will be extended, and excessive overshoot will cause steady-state oscillation.

Torque feedforward compensation is to improve the response of feedback speed. The larger the set value, the faster the speed response, but it is easy to cause oscillation. To eliminate oscillations, first-order inertial filtering is applied to torque feedforward compensation, and the filtering time is set by Pn310. If Pn309 is 0, torque feedforward compensation is no longer effective.

4. Moment of inertia self-learning function

Pn530	Rotate inertial auto-tuning function mode selection

	0: Only online learning is performed, and the value of Pn302 is not updated. 1: Slow self-learning. The value of Pn302 is changed at a low speed according to the learned moment of inertia. 2: Medium self-learning. The value of Pn302 is changed at a medium speed according to the learned moment of inertia. 3: Fast self-learning. The value of Pn302 is changed at a high speed according to the learned moment of inertia.

Rotate inertial auto-tuning should meet below condition：

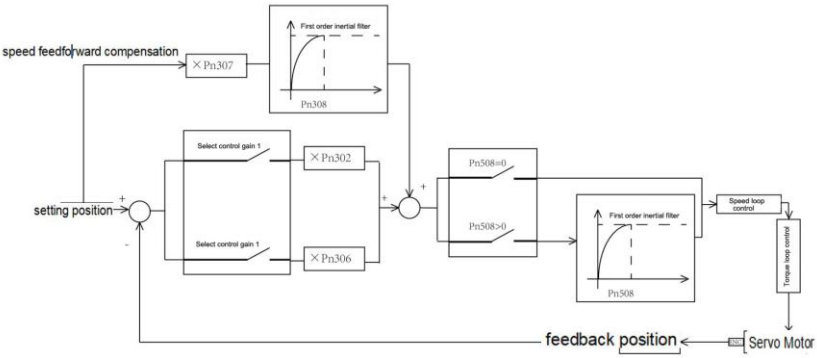
1. Motor forward reverse running, minimum speed not less than 100rpm。
2. Motor acc/dec time not less than 200ms/1000rpm
3. If in the process of rotate inertial auto-tuning, make sure limit switch is valid
4. Motor running speed should be smooth.

After start the auto-tuning function, the learned rotate inertia can be viewed in the Un area

Un-24	Forward rotate inertial learned value(0.01kg.cm2)
Un-25	Reverse rotate inertial learned value(0.01kg.cm2)
Un-26	Rotate inertial learned average(%),The learned result is percentage of the rotate inertial of the motor

7.2 Position loop gain adjustment

1. Position gain adjustment diagram



2. Relate function code

Pn302	Position loop proportional gain 1
	This parameter is used to adjust the following performance of the set pulse and feedback pulse. The larger the set value, the smaller the following error of the given pulse and feedback pulse, and the faster the response. However, if the set value is too large, exceeding the vibration frequency of the mechanical system can cause vibration. This value can be increased without mechanical vibration as much as possible, and when increase this value, the proportional gain of the speed loop should be increased to prevent insufficient gain of the speed loop from causing the response of the speed loop to lag behind the changes in the position loop, cause vibration. When reduce this value, the proportional gain of the speed loop should also be reduced to prevent overshoot of the speed loop from causing vibration. For the high mechanical vibration frequency of the screw or rack, the value is higher when the load is on these mechanical structures; When the load is a belt or chain, this value is also lower because their mechanical vibration frequency is lower.

Pn306	Position loop proportional gain 2
	When switchover condition is met, take the gain as position loop proportional gain.
Pn307	Speed feedforward compensation proportional gain
	The parameter is to reduce static pulse error, improve dynamic response
Pn308	Speed feedforward compensation filter time constant
	Perform first-order inertial filtering on velocity feedforward compensation. The larger the set value, the slower the feedforward compensation response

3. Position loop dual gain switching function

Pn315(FDCBA)	A = Switch Gain Enable	B = Gain switching mode	C=PI/P switching enable	D=PI/P switching mode
0	Switching is invalid	Fixed gain 1	Switching is invalid	NULL
1	Switching is invalid	Fixed gain 2	Switching is invalid	NULL
2	NULL	Terminal switch	NULL	NULL
3	NULL	NULL	NULL	NULL
9	NULL	Position command + feedback speed	NULL	NULL

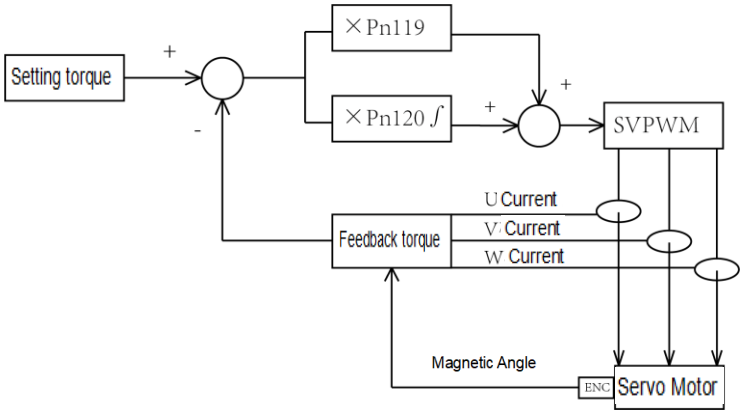
When Pn315.B=9, the functions are as follows:

Gain group 2: with position command given

Gain group 1: without position command given, and the feedback speed is less than the speed of Pn317, after the delay of Pn324 on the basis of meeting the above conditions, enter gain group 1

7.3 Torque loop gain adjustment

1. Torque loop gain adjustment diagram



Torque loop control gain parameters

Pn119	Torque loop proportional gain
	The larger the setting value, the faster the torque response and the smaller the following error between the given torque and the feedback torque. However, if the setting value exceeds the motor response frequency, the output torque will oscillate and the motor noise will increase.
Pn120	Torque loop integral gain: used to eliminate static error

2. Weak field control

Weak field control is used for the embedded permanent magnet synchronous motors, which improves the operating speed of the motor when the back EMF of the motor is saturated

Pn345	Weak field function valid
	0：No 1：Use weak field control
Pn346	Voltage use ratio
	The larger the set value, the weaker the magnetic current will decrease at the

	same speed. The recommended maximum setting is 98%.
Pn347	Weak field control gain
	The larger the set value, the faster the weak field response, but will easy lead to vibration
Pn348	Maximum current of weak field control, The value is the percentage of maximum torque.
Pn349	Factory debugging, please set to 1

Chapter 8 Communication function

8.1 RS232 Hardware connect of controller

SVD880/SVD810 driver supports the serial communication function of RS232, and the communication protocol is MODBUS RTU protocol. It provides PC communication software to assist in debugging. Wiring please refer to the chapter 2.4.4.

8.2 RS232 Communication parameter of controller

<table>
<tr><td rowspan="2">Pn800</td><td colspan="9">Communication address (0-247,0 is broadcast address)</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td rowspan="2">Pn801</td><td colspan="9">RS232 Communication odd/even parity bit</td></tr>
<tr><td colspan="9">0，No check；1，Odd parity check；2，Even parity check</td></tr>
<tr><td rowspan="4">Pn802</td><td colspan="9">RS232 communication baud rate</td></tr>
<tr><td colspan="9">Set communication speed ratio</td></tr>
<tr><td>Set value</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Baud rate</td><td>1200</td><td>2400</td><td>4800</td><td>9600</td><td>19200</td><td>38400</td><td>57600</td><td>115200</td></tr>
</table>

8.3 RS232 communication protocol

8.3.1 Character structure

RTU mode：11 bit structure. Structure Format as below：

Check way (d1-03)	Starting bit	Data bit	Check bit	Stop bit
0(No check)	1	8	0	2
1(Odd parity check)	1	8	1	1
2(Even-parity check)	1	8	1	1

8.3.2 Data format

1.RTU mode：

STX	ADR	CMD	DAT	LRC	END

Start Flag T	Communication address	Communication command	Data 1	Data 2	..	Data n	Check code	End flag T

Note: T is the stationary time period, which depends on the communication baud rate. Set t=the time of sending 1 byte data ,T=4t。

2.Data format description：

Format of data DAT is depend on communication command CMD.

Register address definition ：

Parameter area	Start address	Offset	For example	Operation
Pn area	0x3B2C	2	Pn300 address=0x3B2C+2*300	Read-write
Un area	0x493C	4	Un-08 address=0x493C+4*(8-1)	Read-only
Fn area	0x4874	2	Fn=05 address=0x4874+4*(5-1)	Write-only

（1） Communication command 03H：Read the value of register

Read the value of function code Pn300，address is 0x3D84,host request：

Address	Function code	Register address (2Byte)	Register number(2Byte)	CRC check (2Byte)
01	03	0x3D84	0x0001	

Driver normal response：（Value of Pn300 is 300）

Address	Function code	Register bytes (2Byte)	Register 1 value (2Byte)	……	CRC check (2Byte)
01	03	0x0002	0x01F4	More register data	

Driver response command for communication fault：

Address	Function code	Error code	CRC check (2Byte)
01	86	0x01	

（2） Communication command 06H：Set value of register

Set value of driver Pn300 to 1000，Pn300 corresponding address is 0x3D84，data format as below：

Address	Function code	Address (2Byte)	Refer value (2Byte)	CRC check (2Byte)
01	06	0x3D84	0x03E8	

Driver normal response：

Address	Function code	Address (2Byte)	Refer value (2Byte)	CRC check (2Byte)
01	06	0x3D84	0x03E8	

Driver response command for communication error：

Address	Function code	Error code	CRC check (2Byte)
01	86	0x01	

（3） Communication command 10H：set value of various register

Set Pn410 of driver as 8388608，upper PC send command

Address	Function code	Address(2Byte)	Register number(2Byte)	Bytes	Register value	CRC check (2Byte)
01	10	0x3E60	0x0002	4	0x00800000	

Driver receive command correctly and response

Address	Function code	Address(2Byte)	Register number (2Byte)	CRC check (2Byte)
01	10	0x3E60	0x0002	

Driver response command for communication error or command error

Address	Function code	Error code	CRC check (2Byte)
01	90	0x01	

（4） Communication error code description

Data	Description	
01	Illegal function code	
02	Illegal data address	
03	Illegal data	
04	Reserved	
05	Slave equipment fault	
06	Check fault	
07	Data address exceed limit	
08	Password not open	The setting register value error
09	Set data over limit	
0A	Not allow modify when running	
0B	Write EEPROM error	

（5） Fn command description

Address（16-bit binary）	Data	Function
0x4874	0001H	Enter JOG mode and servo on
	0002H	Forward JOG
	0003H	Reverse JOG
	0004H	Servo stop rotate
	0005H	Servo exit enable,and exit JOG mode
0x4878	0001H	Clear fault
0x487C	0001H	Software reset
0x4880	8001H	Force output terminal 1 valid
	8002H	Force output terminal 2 valid
	8004H	Force output terminal 3 valid

Address（16-bit binary）	Data	Function
	8008H	Force output terminal 4 valid
	……	……
	8XXXH	Enter force output terminal mode,each bit of the low byte corresponds to force output state
	0XXXH	Exit force output terminal mode

8.4 RS485 Hardware connect of controller

SVD810 driver supports RS485 serial communication function. The communication protocol is MODBUS RTU protocol. The wiring definition is as follows

Pin		Symbol	Description	Introduction
CN1	39	RS485-	485 communication cable terminal -	The driver built with a network matching resistor, so no need additional half-duplex communication
	40	RS485 +	485 communication cable terminal +	

8.5 RS485 Communication parameter of controller

After the communication function parameters are set, the driver needs to be powered on again to be effective.

Pn850	Communication address(1-247)
	Set communication address, default as 1, When multiple slave stations are used in cascade, the addresses of multiple slave stations cannot be repeated.
Pn851	Communication mode
	Support to set to 0, that is RTU mode

Pn852	Communication odd/even parity bit
	0，No check；1，Odd parity check；2，Even parity check
Pn853	Communication baud rate （0~7）
	Set communication rate (bps) default as 2 0=9600 1=19200 2=38400 3=57600 4=119200 其他=38400

8.6 RS485 Communication Protocol

8.6.1 Character structure

RTU mode：11 bit structure. Structure Format as below：

Check way (Pn852)	Starting bit	Data bit	Check bit	Stop bit
0(No check)	1	8	0	2
1(Odd parity check)	1	8	1	1
2(Even-parity check)	1	8	1	1

8.6.2 Data format

1.RTU mode：

STX	ADR	CMD	DAT				CRC	END
Start Flag T	Communication address	Communication command	Data 1	Data 2	..	Data n	Check code	End flag T
	8 bit	8 bit	8 bit	8 bit	8 bit	8 bit	16 bit	

Note: A. T is the quiescent time period, default as 3ms.

B. Maximum length of the data format is 60, it will alarm if exceed

2. Register definition：

Parameter	Start	Bytes	For example	Operation

area	address			
Pn area	0	2	The function code address is the communication address. If you want to read and write register Pn300, its register address is 0x012C	Read-write
Fn area	1700	2	Fn-01 address=1701(0x06A5) Fn-02 address=1702(0x06A6) …… Fn-13 address=1713(0x06B1)	Write-only
Un area	1800	4	Un-01 address=1800(0x0708) Un-02 address=1801(0x0709) Un-03 address=1802(0x070A) …… Un-40 address=1839(0x072F)	Read-only

3. Data format description：

Format of data DAT is depend on communication command CMD.

Register address definition

(1) Communication command 03H：Read the value of register

Read the value of function code Pn300，address is 0x3D84,host request：

Address	Function code	Register address (2Byte)	Register number(2Byte)	CRC check (2Byte)
01	03	0x012C	0x0001	

Driver normal response：（Value of Pn300 is 300）

Address	Function code	Register bytes (2Byte)	Register 1 value (2Byte)	……	CRC check

					(2Byte)
01	03	0x0002	0x01F4	More register data	

Driver response command for communication fault：

Address	Function code	Error code	CRC check (2Byte)
01	86	0x01	

Note: Each address in the Un area corresponds to 4 bytes, and the number of registers must be set to 0x0002 to read the correct value.

Some function codes in the Pn area are 32bit, and the number of registers must be set to 0x0002 when reading, such as Pn410.

(2) Communication command 06H：Set value of register

Set value of driver Pn300 to 1000，Pn300 corresponding address is 0x012C，data format as below：

Address	Function code	Address (2Byte)	Refer value (2Byte)	CRC check (2Byte)
01	06	0x012C	0x03E8	

Driver normal response：

Address	Function code	Address (2Byte)	Refer value (2Byte)	CRC check (2Byte)
01	06	0x012C	0x03E8	

Driver response command for communication error：

Address	Function code	Error code	CRC check (2Byte)
01	86	0x01	

(3) Communication command 10H：set value of various register

Set Pn410 of driver as 8388608，upper PC send command

Address	Function code	Address(2Byte)	Register number(2By	Bytes	Register value	CRC check

			te)			(2Byte)
01	10	0x019A	0x0002	4	0x00800000	

Driver receive command correctly and response

Address	Function code	Address(2 Byte)	Register number (2Byte)	CRC check (2Byte)
01	10	0x019A	0x0002	

Driver response command for communication error or command error

Address	Function code	Error code	CRC check (2Byte)
01	90	0x01	

(4) Communication error code description

Data	Description	
01	Illegal function code	
02	Illegal data address	
03	Illegal data	
04	Reserved	
05	Slave equipment fault	
06	Check fault	
07	Data address exceed limit	
08	Password not open	The setting register value error
09	Set data over limit	
0A	Not allow modify when running	
0B	Write EEPROM error	

(5) Fn command description

Address (decimal)	Data	Function
1701	0001H	Enter JOG mode and servo on
	0002H	Forward JOG
	0003H	Reverse JOG
	0004H	Servo stop rotate
	0005H	Servo exit enable,and exit JOG mode
1702	No support	Write any data will return to fault code 0x02
1703	0001H	Clear fault
1705	0001H	Software reset
1707	8001H	Force output terminal 1 valid
	8002H	Force output terminal 2 valid
	8004H	Force output terminal 3 valid
	8008H	Force output terminal 4 valid
	……	……
	8XXXH	Enter force output terminal mode,each bit of the low byte corresponds to force output state
	0XXXH	Exit force output terminal mode
1713	0001H	Read encoder EEPROM
	0002H	Write encoder EEPROM
	0003H	Clear encoder multi-turn data and alarm
	0004H	Clear encoder alarm

8.7 MODBUS CRC(Cyclical Redundancy Check)

CRC verification method: Redundant cyclic code (CRC) contains 2 bytes, that is, 16 bits of binary. The CRC code is calculated by the sending

device and placed at the end of the transmitted information. The receiving device recalculates the CRC code of the received information and compares whether the calculated CRC code matches the received one. If the two do not match, it indicates an error. The calculation method of the CRC code is to first preset the 16-bit register to all 1. Then gradually process each 8-bit data information. When calculating the CRC code, only 8 data bits are used, the start bit and the stop bit, and the parity bit if there is a parity bit, are not involved in the CRC code calculation. When calculating the CRC code, the 8-bit data is XORed with the data in the register, and the result is shifted one byte to the lower position, and the highest bit is filled with 0. Then check the lowest bit. If the lowest bit is 1, the content of the register is XORed with the preset number. If the lowest bit is 0, no XOR operation is performed. This process is repeated 8 times. After the 8th shift, the next 8 bits are XORed with the current content of the register, and the process is repeated 8 times as above. When all data information is processed, the final register content is the CRC code value. The data in the CRC code is sent and received with the low byte first..

The CRC code calculation steps:

1. Preset 16 bit register to hexadecimal FFFF (all are 1).The register is CRC register.

2. The first 8-bit data are separate and dissimilar or the low bit of the 16-bit CRC register and place the result in the CRC register.

3. Move the contents of the register to the right one bit (towards the low bit), fill the highest bit with 0, and check the least bit.

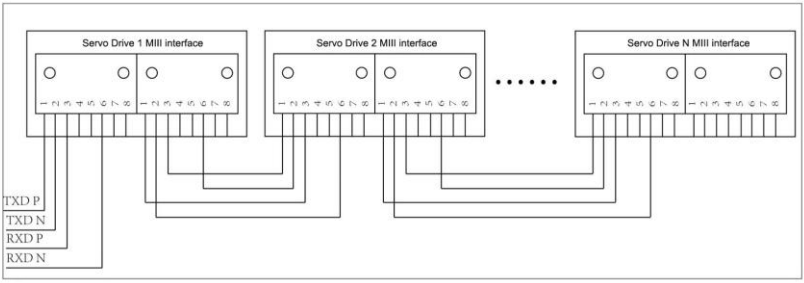
4. If the least bit is 0: repeat step 3 (move again); If the least bit is 1: CRC register XOR with polynomial A001 (1010 0000 0000 0001);

5. Repeat steps 3 and 4 until moved 8 times to the right, so that the entire 8-bit data has been processed; Repeat steps 2 to 5 for the next

8-bit data processing; The final CRC register is the CRC code

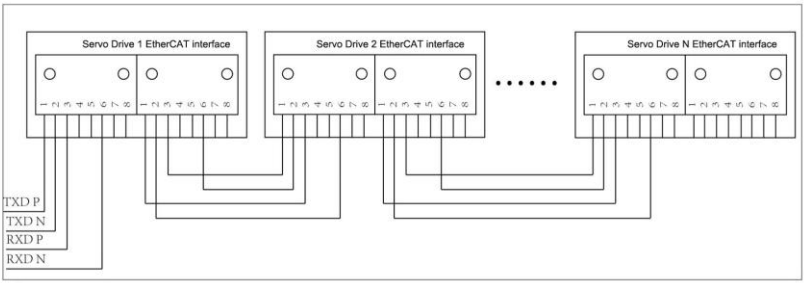
8.8 Mechatrolink-III、Ethercat communication protocol related setting

8.8.1 MECHATROLINK-III communication protocol setting



Pn840	MIII Communication station number
	This protocol support up to 62 slave stations. Please set the value between 1 ~62.
Pn841	MIII communication fault code

8.8.2 Ethercat communication protocol setting



Note：No need to set Ethercat communication station number,Be sure the network cable entering from the lower port of SVD880(CN1)/SVD810(CN3) and outputting from the upper port!

1. EtherCAT introduction

EtherCAT is an industrial Ethernet technology based on the standard Ethernet physical layer, it is more suitable for industrial control scenarios compared to traditional Ethernet protocols. It meet the requirements of small data volume but high real-time reliability and also with simple and flexible networking.

EtherCAT equipment has master station and slave station. The master station category includes CNC control systems, PLCs, etc., while the slave station category includes servo controllers, IO, etc. Normal network cables can be connected to the master and slave stations. For the environmental impact of industrial sites, generally select category 5 and above network cables.

The SVD880-C02 servo belongs to the slave category, and current support application protocol is CoE (EtherCAT based CAN application protocol). The master station need to configure SVD880-C02 as a DS402 type.

2. PDO data object

The real-time data in the control data is transmitted through PDO (Process Data Object) by synchronization managers 2 and 3 respectively. In PDO, the master station sends out slave station receive called RxPDO or Output, and the slave

station sends out master station receive, called TxPDO or Input. After the EtherCAT data frame is sent from the master station, it is sequentially transmitted from the first slave station to the last slave station. During this process, each slave station exchanges data with the data frame, and then sends it back from the last slave station to the master station

Configure TxPDO mapping table for synchronization manager 2 (0x1C13), which can be mapped to 0x1A00~0x1A02

TxPDO support below objects

Index number	Name	English name
0x6041	Status word	Status Word
0x6064	Actual position	Actual Position
0x606C	Actual speed	Actual Velocity
0x6077	Actual torque	Torque Actual Value
0x6011	Operation mode display	Mode Of Operation Display
0x603F	Alarm code	Error Code
0x60B9	Probe status	Touch Probe Status
0x60BA	Probe position 1	Touch Probe 1 Position Value
0x60BC	Probe position 2	Touch Probe 2 Position Value

TxPDO mapping table as below

Index	Sub-Index	Default	Setting range
1A00	0	5	0~9
CSV |CSP mode	1	0x60410010	
	2	0x60640020	
	3	0x606C0020	
	4	0x60770010	
	5	0x60610008	

	……		
1A01	0	3	0~9
CSP mode	1	0x60410010	
	2	0x60640020	
	3	0x60770010	
	……		
1A02	0	2	0~9
CSV mode	1	0x60410010	
	2	0x606C0020	
	……		

RxPDO support below objects

Index	Name	English Name
0x6040	Control word	Control Word
0x607A	Target position	Target Position
0x60FF	Target speed	Target Velocity
0x6060	Operation mode	Mode Of Operation
0X6061	Current control mode	
0x60B8	Probe function control	Touch Probe Function

RxPDO mapping table as below

Index	Sub-index	Default	Setting range
1600	0	4	0~9
CSV |CSP mode	1	0x60400010	
	2	0x607A0020	
	3	0x60FF0020	
	4	0x60600008	
	……		
1601	0	2	0~9
CSP mode	1	0x60400010	
	2	0x607A0020	
	……		
1602	0	2	0~9
CSV mode	1	0x60400010	
	2	0x60FF0020	
	……		

Note : Above PDO default to mandatory allocation，Sync management 0x1C12 default selection 0x1600 、0x1C13 default selection 0x1A00，0x1600~1602 and 0x1A00~0x1A02 both can be configured through the upper system.

3.SDO data object

SDO data is transmitted by synchronization managers 0 and 1 through mailboxes and is mainly used to transmit data that does not require high real-time performance, such as parameter configuration.

Index number (hex)	Data Types	Number of sub-indexes	Access Rights	Name	English name
603F	UINT16	0	RO	Error code	Error Code
6040	UINT16	0	RW	Control word	Control Word
6041	UINT16	0	RO	Status word	Status Word
6060	INT8	0	RW	Operation mode	Modes of Operation
6061	INT8	0	RO	Operation mode display	Modes of Operation Display
6064	INT32	0	RO	Actual position	Position Actual Value
606C	INT32	0	RO	Actual speed	Velocity Actual Value
6077	INT16	0	RO	Actual torque	Torque Actual Value
607A	INT32	0	RW	Target position	Target Position
60FF	INT32	0	RW	Target speed	Target Velocity
6502	UINT32	0	RO	Supported modes	Supported Drive Modes
60FB	RECORD	3	RW	Position control parameters	Position Control Parameters
60F9	ARRAY	2	RW	Speed control parameters	Velocity Control Parameters
60F6	RECORD	5	RW	Torque control	Torque Control Parameters

				parameters	

The sub indexes of the RECORD type description

Index(HEX)	Sub-index No	Data type	Access permission	Name	Minimum value	Maximum value
60FB	0	UINT8	RO	Index number	-	-
60FB	1	UINT32	RW	Position control gain	100	10000
60FB	2	UINT32	RW	Rigidity level setting	1	20
60FB	3	UINT32	RW	Inertial ratio setting	0	1500
60F9	0	UINT8	RO	Index number	-	-
60F9	1	UINT16	RW	Speed control gain	100	10000
60F9	2	UINT16	RW	Speed control integral time constant	100	10000
60F6	0	UINT8	RO	Index number	-	-
60F6	1	UINT32	RW	Torque command gain	10	5000
60F6	2	UINT32	RW	Torque command integral time constant	10	5000
60F6	3	UINT32	RW	Friction compensation positive torque percentage	0	200
60F6	4	UINT32	RW	Friction	0	200

				compensation negative torque percentage		
60F6	5	UINT32	RW	Friction compensation speed	0	1000

Index (hex)	Data type	Sub-index No.	Access permission	Name	Minimum value	Maximum value	Default value
2000	UINT32	0	RW	Control mode	0	22	1
2001	UINT32	0	RW	Servo enable way	0	6	6
2002	UINT32	0	RW	Motor forward	0	1	0
2003	UINT32	0	RW	Dynamic brake time (ms)	100	50000	300
2004	UINT32	0	RW	Discharge resistance value (Ω)	20	1000	50
2005	UINT32	0	RW	Discharge resistor power (W)	1	30000	50
2006	UINT32	0	RW	Delay time__stop after brake command close servo OFF(ms)	0	60000	100
2007	UINT32	0	RW	Delay time__rotate after brake command close servo OFF(ms	0	60000	100
2008	UINT32	0	RW	Speed__rotate when brake command close (RPM)	0	600	100
2009	UINT32	0	RW	Electronic gear	1	99999	1

				molecule			
200A	UINT32	0	RW	Electronic gear denominator	1	99999	1
200B	UINT32	0	RW	Position reached width (1pulse)	0	65535	5
200C	UINT32	0	RW	Position error pre-warning pulse number (1% turn)	0	10000	100
200D	UINT32	0	RW	Position error warning pulse number(1% turn)	0	10000	200

EtherCAT bus communication also supports the following control modes (Un032 monitors the current control mode):

0x06: home mode

0x08: CSP position control mode

0x09: CSV speed control mode

0x0A: CST torque control mode

Control mode (Un032)	Related Object Dictionary	Illustrate
0x06 home	0x6098	Zero return mode
	0x6099.01	Zero return high speed: speed before touching the zero switch: unit/s
	0x6099.02	Zero return low speed: speed after touching the zero switch: unit/s
	0x609A	Zero return acceleration time: unit/s2

0x08 CSP	0x607A	Position control command: unit
	0x6064	Current position: unit
	0x60E0	Forward torque limit: 0.1%.
	0x60E1	Reverse torque limit: 0.1%.
0x09 CSV	0x60FF	Speed control command: unit
	0x606C	Current speed: unit
	0x60E0	Forward torque limit: 0.1%. Pn515 setting 2 is valid
	0x60E1	Reverse torque limit: 0.1%. Pn515 setting 2 is valid
0x0A CST	0x6071	Torque control command: 0.1%.
	Ox6077	Current torque: 0.1%
	0x607F	Speed limit: speed unit.
	0x6080	Maximum speed: rpm. This object dictionary is not supported for the time being

4.Alarm code list

The alarm code is uploaded to the master station device through 0x603F

Error code(HEX)	Servo display	Description
2220	Er.101	Current too large protection
3210	Er.103	Bus voltage too high
3220	Er.104	Bus voltage too low
4210	Er.105	Overheat protection
8A80	Er.107	External emergency stop protection
5410	Er.108	Inverter unit protection
8611	Er.111	Position error too large
8A81	Er.112	Forward/Reverse prohibit at the same time
8400	Er.113	Speed exceed protection
7380	Er.210	Encoder communication fault
7381	Er.212	Encoder communication overtime
7382	Er.213	Encoder parameter read error
7383	Er.220	Encoder error overspeed
7384	Er.221	Encoder error FS
7385	Er.222	Encoder error count fault
7386	Er.223	Encoder error OF
7387	Er.224	Encoder error overheat
7388	Er.225	Encoder error multi-circle fault
7389	Er.226	Encoder error battery fault
738A	Er.227	Encoder error battery warning
738B	Er.228	Encoder error OTHER
5210	Er.114	Current sensor fault

Chapter 9 Fault and treatment measures

9.1 Fault list

Fault code	Description	Possible Causes and solutions
Er0.20	Main board FPGA error	Looking for technical support
Er0.30	Servo internal fault	Looking for technical support
Er0.40	EEPROM initialization fault	Parameter register initialization failed
Er1.01	Over current	1, Acceleration time too short 2, Motor cable U,V,W wiring error 3, Encoder initialization fault 4, Pn105 setting value too small, increase Pn105 value 5,The torque limit of driver is too large, check the value of Pn604 and Pn605 6,Servo motor fault, change servo motor
Er1.02	Motor overload	1,Motor cable U,V,W wiring error or encoder wiring error 2, The setting of motor parameters in the driver is different from the actual motor parameters 3, Motor stall or the load suddenly change 4, Load problem, Change the load 5, The brake do not release when

Fault code	Description	Possible Causes and solutions
		running 6, Input voltage abnormal
Er1.03	Bus over voltage	1,Check the 3phase input voltage of the power 2, Release resistor fault 3, Setting too low for the over voltage 4, Deceleration time is too short
Er1.04	Bus under voltage	1,Check three phase of the power and output bus voltage 2, Release unit fault 3, Setting too high for the under voltage
Er1.05	Driver overheat	1,Fan fault, change fan 2,Load too large, increase cooling or change to higher power driver 3, Environment temperature too high 4, Release unit fault or release power set too large 5, Driver install improper
Er1.06	Motor overheat	1,Motor fan fault 2,Motor power not enough, change to higher power motor 3,Motor temperature sensor damage
Er1.07	External emergency stop	DI terminal ESP effective 1,Input terminal function setting

Fault code	Description	Possible Causes and solutions
		error, check the setting value of Pn700~Pn709 2, Eliminating external faults, Release ESP terminal effective
Er1.08	Output short circuit	Module pass-through protection IPM fault UVW phase short circuit or ground short circuit Check motor U,V,W,PE wiring, and check whether the motor insulation is good
Er1.09	Inverter unit drive fault	The drive signal of the inverter unit is blocked
Er1.10	Control power fault	Control power input voltage is too low or control circuit fault
Er1.11	Position pulse error too large	1, U,V,W 3 phase wiring fault 2, Upper PC given speed exceed motor maximum speed 3, Load problem 4, Motor abnormal
Er1.12	Forward and reverse signal abnormal prohibit	Forward limit switch and reverse limit switch effect at the same time 1, Check whether the hardware limit wiring is correct. 2, Check whether the hardware limit parameters of Pn700~Pn709 are

Fault code	Description	Possible Causes and solutions
		correct. 3, Pn208=0 shields the forward hardware limit; Pn209=0 shields the reverse hardware limit.
Er1.13	Speed too high	1,Position pulse command frequency is too high 2, Motor U,V,W wiring error or encoder wiring error 3, Speed loop gain setting too large
Er1.14	Current detection initialization error warning	Output current detection sensor fault, looking for technical support
Er1.15	Output phase loss	Driver fault
Er1.20	Pn parameter detection exceed limit warning	1, Motor parameters setting error 2, Gain parameters setting error 3, The magnetic declination setting exceeds the limit. Please check the following function codes: Pn015,Pn300,Pn301,Pn302,Pn303, Pn026,Pn030
Er1.21	Frequency division parameter setting error	1.The output frequency may exceed 500K due to the frequency division parameter setting value. Check whether the settings of Pn406, Pn408 and Pn410 are correct. 2. Set Pn403.D=0 to turn off the hardware frequency division

Fault code	Description	Possible Causes and solutions
		output function
Er1.30	Hardware detection error	Looking for technical support
Er1.40	Position exceed limit warning	1,Check whether the settings of Pn422,Pn424 are correct, Pn422<Pn424 2, Check mechanical position
Er1.60	Software settings do not match hardware	Software settings do not match hardware Set Pn107 parameters correctly
Er1.61	Software settings do not match hardware	Software settings do not match hardware Set Pn107 parameters correctly
Er1.70	Motor stall alarm	The machine is stuck, check the machine.
Er1.71	Motor stall alarm	1: The encoder initial position acquisition failed to update the motor angle. 2: The motor phase sequence wiring error caused the motor to stall, check the UVW wiring.
Er2.01	First encoder module error	The first encoder does not support this encoder type
Er2.02	Second encoder module error	The second encoder does not support this encoder type
Er2.10	Encoder continuously fail to detect position data warning	Er2.XX fault codes are all Tamagawa communication encoder faults

Fault code	Description	Possible Causes and solutions
Er2.11	Encoder response data verification error	1,Check encoder shielding and solder joints 2,Rewrite encoder EEPROM motor parameter data 3，Check whether the motor parameters written to the encoder are correct 4,Check whether the setting value of Pn028，Pn029，Pn030，Pn038，and Pn044 are correct 5,ERP39: Battery error clear failed, if restart can not clear the fault, set Pn230,Pn231 to 0, close and restart, set Pn230, Pn231 to 1 again.
Er2.12	Encoder disconnect warning	
Er2.13	Encoder write EEPROM Fault	
Er2.14	Encoder read EEPROM fault	
Er2.15	Encoder response data check fault	
Er2.16	Encoder command sending overflow fault	
Er2.17	Encoder communication module fault	
Er2.18	Encoder EEPROM doesn't find motor parameter fault	
Er2.19	Encoder communication data verification error	
Er2.1A		
Er2.1B		
Er2.1C	Encoder sending command not match	
Er2.1D	Encoder initialization communication abnormal	
Er2.20	Over-speed fault was detected inside the encoder	There is warning inside the encoder 1. Execute the operation of clearing the encoder warning, and then reset the driver
Er2.21	Encoder detected absolute data anomaly	
Er2.22	Encoder internal position data calculation fault	
Er2.23	Encoder detect count exceed	
Er2.24	Over-temperature fault was detected inside the encoder.	
Er2.25	Encoder detect multi-turn exceed	
Er2.26	Encoder battery under voltage warning	Battery voltage too low Replace the battery, clear the

Fault code	Description	Possible Causes and solutions
		encoder warning and multi-turn data, and pay attention to the mechanical zero position.
Er2.27	Encoder battery under voltage warning	The battery voltage is lower than 3.2V, replace the battery
Er2.28	The encoder detected other errors	There is waning inside the encoder 1. Execute the operation of clearing the encoder warning, and then reset the drive
Er2.29	Encoder detect CRC check error	1, Check the encoder cable and shield. Replace the encoder cable. 2, Check whether the ground cable is in good condition
Er4.01	Bus communication disconnect	1, Bus communication is interfered. 2, The network cable is disconnected
Er4.02	Bus communication module detection fault	Check whether the setting of Pn150 matches the drive model.
Er4.10	Bus communication other warning	Looking for technical support

9.2 Fault history record

Fault records can be queried through functional area Fn002. 1-xxx are the latest fault records. Adjust the up and down keys to view the last 10 fault records. Fault history can be cleared through function parameter Fn003