User Manual for L7 Servo

Introduction

Thanks for purchasing Leadshine L7-series AC servo drivers, this instruction manual provides knowledge and attention for using this driver.

Incorrect operation may cause unexpected accident, please read this manual carefully before using product.

- ✧ We reserve the right to modify equipment and documentation without prior notice.
- ✧ We won't undertake any responsibility with customer's any modification of product, and the warranty of product will be cancel at the same time.

icates that the error use may damage product and equipment.

Safety Items

EL5 Series servo drive, should be mounted in cover type control box during operating. The mounting of drive, wiring and motor should be under the regulations of EN 61800-5-1.
Safety items indicate a potential for personal injury or equipment damage if the recommended precautions and safe operating practices are not followed.
The following safety-alert symbols are used on the drive and in the documentation:

	Indicates great possibility of death or serious injury
	Indicates something that must be done.
	Indicates something that must not be done.
	Indicates dangerous voltage.
	Indicates do not touch hot heat sink when power on.
	Protective Earth

Safety precautions

Warning

- The design and manufacture of product doesn't use in mechanic and system which have a threat to operator.
- The safety protection must be provided in design and manufacture when using this product to prevent incorrect operation or abnormal accident.

Acceptance

Caution

- The product which is damaged or have fault is forbidden to use.

Transportation

Caution

- The storage and transportation must be in normal condition.
- Don't stack too high, prevent falling.
- The product should be packaged properly in transportation,
- Don't hold the product by the cable, motor shaft or encoder while transporting it.
- The product can't undertake external force and shock.

Installation

Caution

Servo Driver and Servo Motor:

- Don't install them on inflammable substance or near it to preventing fire hazard.
- Avoid vibration, prohibit direct impact.
- Don't install the product while the product is damaged or incomplete.

Servo Driver:

- Must install in control cabinet with sufficient safeguarding grade.
- Must reserve sufficient gap with the other equipment.
- Must keep good cooling condition.
- Avoid dust, corrosive gas, conducting object, fluid and inflammable ,explosive object from invading.

Servo Motor:

- Installation must be steady, prevent drop from vibrating.
- Prevent fluid from invading to damage motor and encoder.
- Prohibit knocking the motor and shaft, avoid damaging encoder.
- The motor shaft can't bear the load beyond the limits.

Wiring

Warning

- The workers of participation in wiring or checking must possess sufficient ability do this job.
- The wiring and check must be going with power off after five minutes
- Ground the earth terminal of the motor and driver without fail.
- The wiring should be connected after servo driver and servo motor installed correctly
- After correctly connecting cables, insulate the live parts with insulator.

Caution

- The wiring must be connected correctly and steadily, otherwise servo motor may run incorrectly, or damage the equipment .
- Servo motor U, V, W terminal should be connected correctly , it is forbidden to connect them directly to AC power.
- We mustn't connect capacitors ,inductors or filters between servo motor and servo driver .
- The wire and temperature-resistant object must not be close to radiator of servo driver and motor.
- The freewheel diode which connect in parallel to output signal DC relay mustn't connect reversely.

Debugging and running

Caution

- Make sure the servo driver and servo motor installed properly before power on, fixed steadily, power voltage and wiring correctly.
- The first time of debugging should be run without loaded, debugging with load can be done after confirming parameter setting correctly, to prevent mechanical damage because of error operation.

Using

Caution

- Install a emergency stop protection circuit externally, the protection can stop running immediately to prevent accident happened and the power can be cut off immediately.
- The run signal must be cut off before resetting alarm signal, just to prevent restarting suddenly.
- The servo driver must be matched with specified motor.
- Don't power on and off servo system frequently, just to prevent equipment damaged.
- Forbidden to modify servo system.

Fault Processing

Warning

- The high voltage also will contain in several minutes even if the servo driver is powered off, please don't touch terminal strip or separate the wiring.
- The workers of participation in wiring or checking must possess sufficient ability do this job.

Caution

- The reason of fault must be figured out after alarm occurs, reset alarm signal before restart.
- Keep away from machine, because of restart suddenly if the driver is powered on again after momentary interruption(the design of the machine should be assured to avoid danger when restart occurs)

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Chapter 1 Introduction

1.1 Product Introduction

Talent feature:

◆Width ratio, constant torque

Speed ratio :1:5000, stable torque features from low speed to high speed

◆High-speed, high-precision

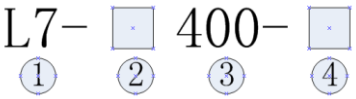
The maximum speed of the servo motor up to 5000rpm, rotation positioning accuracy up to $1/2^{23}$r.

◆Simple, flexible to control

By modifying the parameters of the servo system, the operating characteristics make the appropriate setting to suit different requirements.

1.2 Inspection of product

1. **You must check the following thing before using the products :**
   a. Check if the product is damaged or not during transportation.
   b. Check if the servo driver & motor are complete or not.
   c. Check the packing list if the accessories are complete or not
2. **Type meaning**
   a. L7 series servo driver



NO	Details	
①	Series Num	L7：7th servo driver
②	Command source	Reserved：Stand version RS：RS485 EC：EtherCAT
③	Power	200:200W 400：400W 750：750W 1000：1000W 1500：1500W
④	Customize Num	

ACM2 - 060 02 L 2 H1 - E17□ - S25 -□□
(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1).系列名称 4位

ACM2: 雷赛交流伺服电机系列标识，第2代

(2).机座尺寸 3位

040: 40mm **060:** 60mm **080:** 80mm **110:** 110mm **130:** 130mm **180:** 180mm

(3).功率大小 2位

标识	01	02	04	06	08	09	10	13	15	18	20	25	30
功率【KW】	0.1	0.2	0.4	0.6	0.75	0.85	1	1.3	1.5	1.8	2	2.5	3

(4).惯量类型 1位

L:小惯量 **M**：中惯量 **H:**大惯量

(5).电压等级 1位

1：110Vac **2**：220Vac **3**：380Vac

(6).电机形态 2位(表格仅示例，接插件形式分别用数字表示，详见下表)

注：第2位中， 1：塑插型 2：小航插型(防水型)

符号		出轴形式		抱闸器		油封		连接器	
		圆轴	带键	有	无	有	无	塑插型	航插型
A	1	●		●		●		●	
B	2	●			●	●			●
C	3	●		●			●		
D	1	●			●		●	●	
E	1		●	●		●		●	
F	2		●		●	●			●
G	3		●	●			●		
H	1		●		●		●	●	

(7).编码器类型 3-4位

字段1 (编码器类型)	具体释义	字段2 (分辨率)	具体释义	字段3 (单圈/多圈)	具体释义
E	光电编码器	17	17位分辨率	S	单圈编码器
		23	23位分辨率	缺省	多圈编码器
M	磁编码器	17	17位分辨率	S	单圈编码器
		23	23位分辨率	缺省	多圈编码器

(8).转速标识 3位

*S30:3000rpm(缺省) **S25:2500rpm** **S20:2000rpm** **S15:1500rpm** ...

***(9).派生型号 1-2位**

Chapter 2 Product Specification

Notice
Servo driver must be matched with relevant servo motor, this manual describes Leadshine EL5 series servo motor.

2.1 Driver Technical Specification

Table 2.1 Driver Specification

Parameter	L7-**400	L7-**0750	L7-**1000	L7-**1500	L7-**2000
Rated output power	400W	750W	1KW	1.5KW	2KW
Rated output current	2	3.7	5	7.5	10.5
Max output current	8.5	16	22	25	30
Main power	Single phase or three phase 220V -15%~+10% 50/60HZ				
Control power	Single phase 220V -15%~+10%				
Control mode	IGBT SVPWM sinusoidal wave control				
Feedback mode	2500P/R incremental encoder/5000line/17-bit absolute encoder/23bit abosolute encoder				
Input pulse	0-500kHZ,5V differential input				
Adjust speed ratio	3000:1				
Position bandwidth	200HZ				
Electronic gear ratio	1~32767/1~32767				
Analog input	-10~10Vdc,input resistance 20KΩ, no isolation				
Velocity bandwidth	500HZ				
Input signal	DI：9 inputs（Support common + and common - two wiring modes） Servo enable, over-travel inhibition, gain switching, command pulse inhibition, speed zero clamp, deviation counter clear, alarm clear				
Output signal	DO：6 outputs（4 single-ended，2 differential） Alarm output, servo-ready, at-speed, zero-detection, velocity coincidence				
Encoder signal output	A phase, B phase, Z phase, long-distance drive mode output				
Alarm function	Over-voltage, under-voltage, over-current, over-load, encoder error, position deviation error, brake alarm, limit alarm, over-speed error etc.				
Operation and display	jog, trapezoidal wave test, each parameter and input output signal can be modified and saved, six-bit LED to display rotational speed, current, position deviation, driver type version and address ID value etc.				
Debug software	Can adjust the parameters of current loop, velocity loop, position loop , and change the value of input and output signals and the parameter of motor and save the values to the files which can be downloaded and uploaded, monitor the waveform of velocity and position in the ladder.				
Communication interface	USB：Based on Modbus protocol (according to USB2.0 specification) RS485				
Brake mode	Built-in brake 50Ω/50W				
Adapt load inertia	Less than 5 times motor inertia				
weight	About 1.5-3Kg				
environment	Environment	Avoid dust, oil fog and corrosive gases			
	Ambient Temp	0 to +40℃ .			
	Humidity	40% RH to 90%RH, no condensation			
	Vibration	5.9 m/s^2 MAX			
	Storage Temperature	-20~80℃			
	Installation	Vertical installation			

2.2 Accessory selection

1. motor cable

2. encoder cable
3. brake cable (if necessary)
4. software configuration cable
5. control signal terminal CN1 (44 pin)
6. control signal shell CN1

Chapter 3 Installation

3.1 Storage and Installation Circumstance

Table 3.1 Servo Driver, Servo Motor Storage Circumstance Requirement

Item	L7 series driver	servo motor
Temperature	-20-80℃	-25-70℃
Humility	Under 90%RH (free from condensation)	Under 80%RH(free from condensation)
Atmospheric environment	Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust	Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust
Altitude	Lower than 1000m	Lower than 2500m
Vibration	Less than 0.5G (4.9m/s^2) 10-60Hz (non-continuous working)	
Protection level	IP00(no protection)	IP54

Table 3.2 Servo Driver, Servo Motor Installation Circumstance Requirement

Item	L7 series driver	servo motor
Temperature	0-55℃	-25-40℃
Humility	Under 90%RH(free from condensation)	Under 90%RH(free from condensation)
Atmospheric environment	Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust	Indoor(no exposure)no corrosive gas or flammable gas, no oil or dust
Altitude	Lower than 1000m	Lower than 2500m
Vibration	Less than 0.5G (4.9m/s^2) 10-60Hz (non-continuous working)	
Protection level	IP00(no protection)	IP54

3.2 Servo Driver Installation

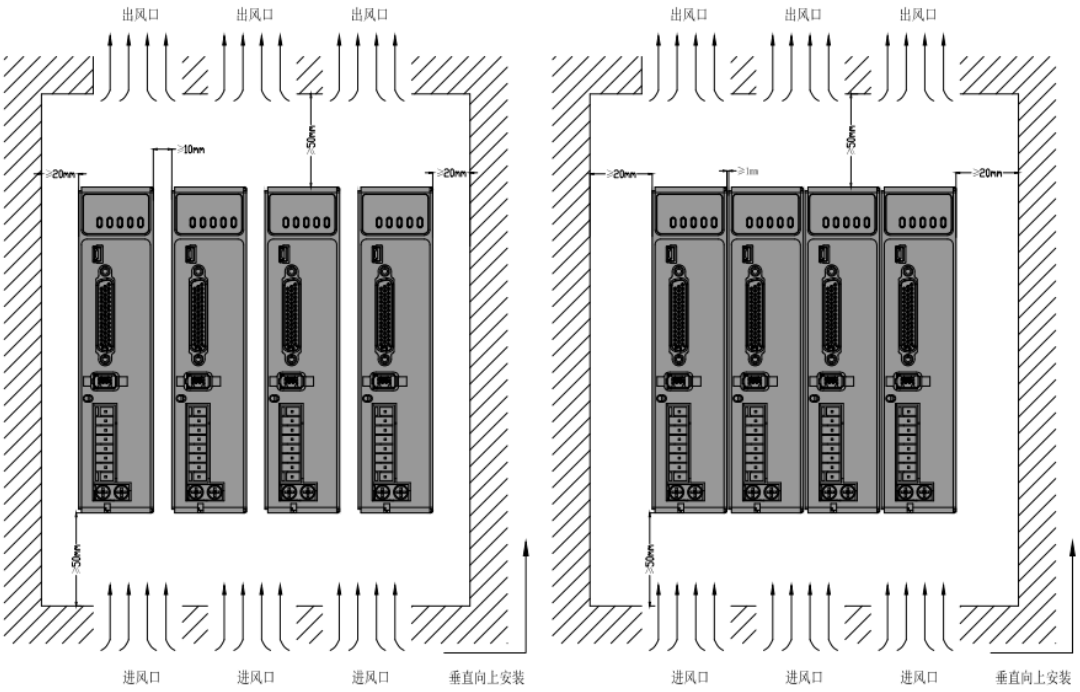
Notice
● Must install in control cabinet with sufficient safeguarding grade.
● Must install with specified direction and intervals, and ensure good cooling condition.
● Don’t install them on inflammable substance or near it to prevent fire hazard.

Install in vertical position ,and reserve enough space around the servo driver for ventilation.

The user may install the product in the mode of bottom plate installation or panel installation, and the installation direction is perpendicular to the installation face. In order to ensure good heat dissipation conditions, at least 10MM of installation space should be set aside in the actual installation.

When mounting drives compactly, consider installation tolerances and leave at least 1MM between each two drives. Use it below 75% of the actual load rate.

Here is the installation diagram:



3.3 Servo Motor Installation

Notice
● Don’t hold the product by the cable, motor shaft or encoder while transporting it. ● No knocking motor shaft or encoders, prevent motor by vibration or shock. ● The motor shaft can’t bear the load beyond the limits. ● Motor shaft does not bear the axial load, radial load, otherwise you may damage the motor. ● Use a flexible with high stiffness designed exclusively for servo application in order to make a radial thrust caused by micro misalignment smaller than the permissible value. ● Install must be steady, prevent drop from vibrating.

Chapter 4 Wiring

Warning

- The workers of participation in wiring or checking must possess sufficient ability do this job.
- The wiring and check must be going with power off after five minutes.

Caution

- Ground the earth terminal of the motor and driver without fail.
- The wiring should be connected after servo driver and servo motor installed correctly

4.1 Wiring

4.1.1 Wire Gauge

(1)Power supply terminal TB

● Diameter:

Table 4.1 Power wiring specification

Driver	Wire diameter (mm^2/AWG)			
	r、t	P+、BR	U、V、W	PE
L7-400	0.81/AWG18	2.1/AWG14	1.3/AWG16	2.1/AWG14
L7-750	0.81/AWG18	2.1/AWG14	1.3/AWG16	2.1/AWG14
L7-1000	0.81/AWG18	2.1/AWG14	2.1/AWG14	2.1/AWG14

● Grounding: The grounding wire should be as thick as possible, drive servo motor the PE terminal point ground, ground resistance <100 Ω.

●Use noise filter to remove external noise from the power lines and reduce an effect of the noise generated by the servo driver.

● Install fuse (NFB) promptly to cut off the external power supply if driver error occurs.

(2) The control signal CN1 feedback signal CN2

● Diameter: shielded cable (twisting shield cable is better), the diameter ≥ 0.14mm^2 (AWG24-26), the shield should be connected to FG terminal.

● Length of line: cable length should be as short as possible and control CN1 cable is no more than 3 meters, the CN2 cable length of the feedback signal is no more than 20 meters.

● Wiring: be away from the wiring of power line, to prevent interference input.

●Install a surge absorbing element for the relevant inductive element (coil),: DC coil should be in parallel connection with freewheeling diode reversely; AC coil should be in parallel connection with RC snubber circuit.

（3）Regenerative resister

When the torque of the motor is opposite to the direction of rotation (common scenarios such as deceleration, vertical axis descent, etc.), energy will feedback from the load to the driver. At this time, the energy feedback is first received by the capacitor in the driver, which makes the voltage of the capacitor rise. When it rises to a certain voltage value, the excess energy needs to be consumed by the regenerative resistance

The recommended regenerative resistance specifications for the L7 series are as follows：

Table 4.2 Regenerative resistance specification sheet

Driver	Built-in resister value (Ω)	Built-in resister power (W)

L7-400	100	50
L7-750	50	50
L7-1000	50	100

Method for determining regenerative resistance specification

- Firstly, use the built-in resistance of the driver to run for a long time to see if it can meet the requirements: ensure that the driver temperature d33<60℃, the braking circuit does not alarm (Regeneration load factor d14<80), and the driver does not report overvoltage error
- If the driver temperature is high, try to reduce the regenerative energy power, or external resistance of the same specification (in this case, cancel the built-in resistance).
- If the brake resistance burns out, try to reduce the regenerative energy power, or put an external resistance of the same specification or even more power (in this case, cancel the built-in resistance).
- If d14 is too large or accumulates too fast, it means that the regenerative energy is too large, and the built-in resistance cannot consume the generated energy, the regenerative energy power will be reduced, or the external resistance with higher resistance value or power will be reduced.
- If an overvoltage error is reported by the driver, the regenerative energy power is reduced, or a resistance with a smaller external resistance, or a parallel resistance.

Attention

- Match the colors of the motor lead wires to those of the corresponding motor output terminals (U.V.W)
- Never start nor stop the servo motor with this magnetic contactor.
- Cable must be fixed steadily, avoid closing to radiator and motor to prevent reducing the properties of heat insulation

4.1.2 Position Control Mode

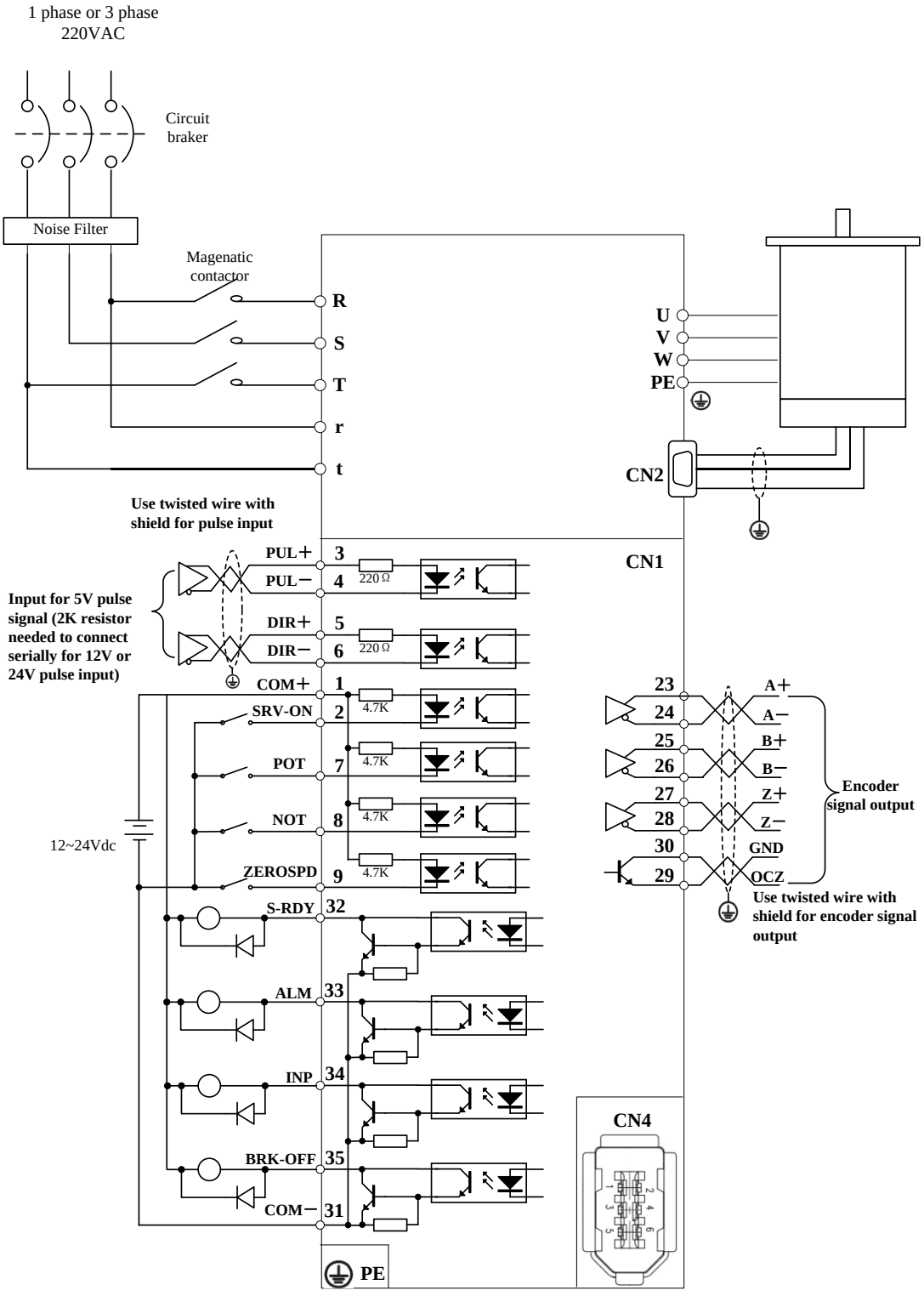


Figure 4-1 Positional Control Mode Wiring

4.1.3 Torque /Velocity Control Mode

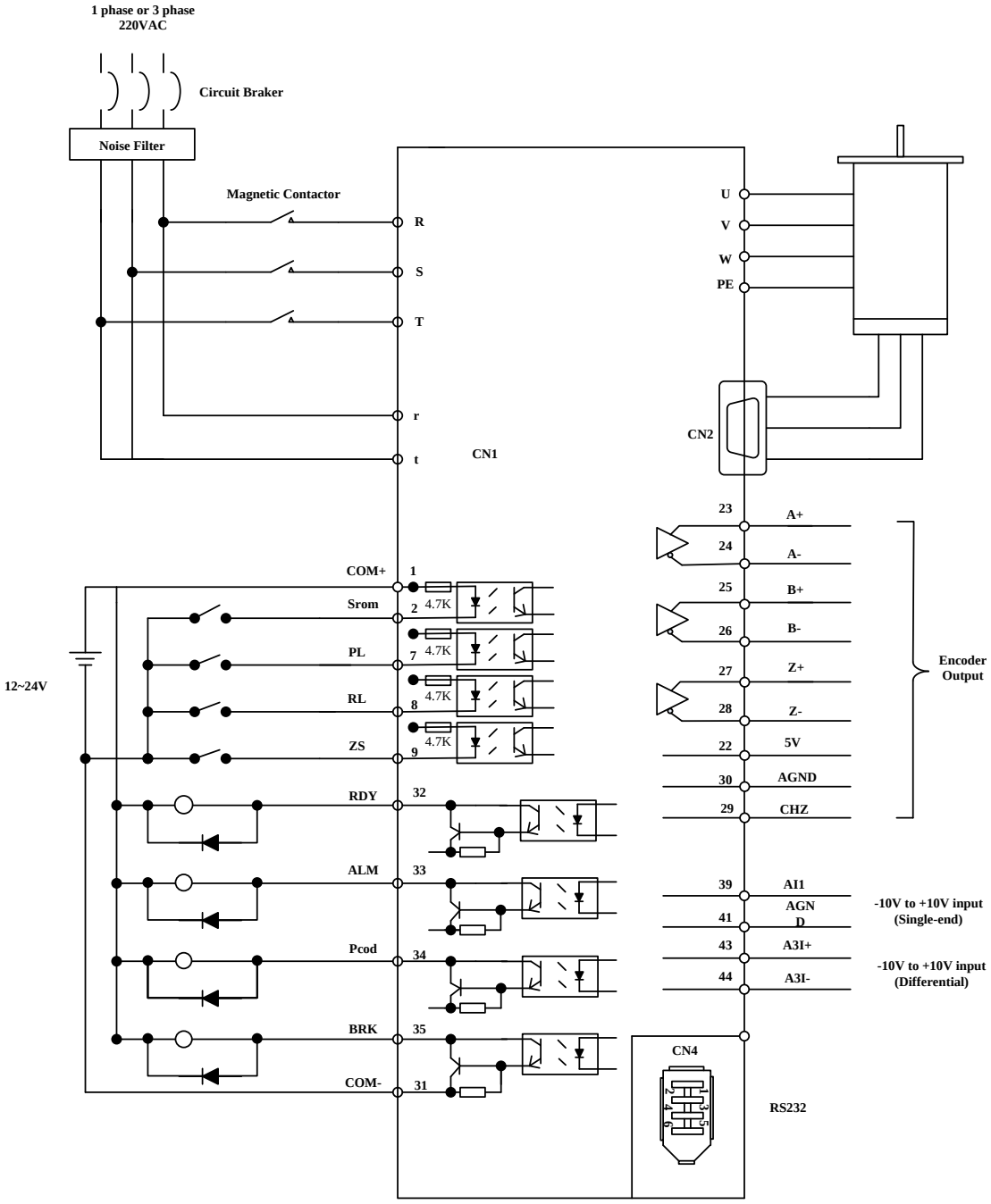


Figure 4-2 Torque/Velocity Control Mode Wiring

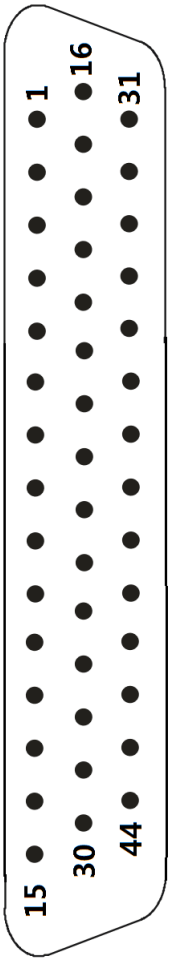
4.2 Driver Terminals Function

Table 4.3 Functions of driver port

Port	Function
CN1	Control Signal Port
CN2	Encoder Input Port
CN3	USB Communication Port
CN4	RS232、RS485 Communication Port
CN5	RS232、RS485 Communication Port
X1	Power Port

4.2.1 Control Signal Port-CN1 Terminal

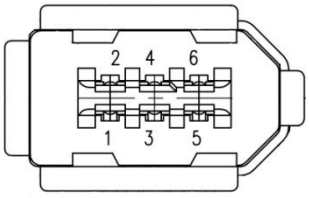
Table 4.4 Signal Explanation of Control Signal Port-CN1

Port		Pin	Signal	I/O	Name	Explanation
CN1		1	COM_SI	input	Digital input common terminal, Com+/Com-， 12VDC~24VDC	Two-way digital input with common terminal, function can be configured. 12VDC ~ 24VDC
		2	SI1	input	Digital input 1	
		7	SI2	input	Digital input 2	
		8	SI3	input	Digital input 3	
		9	SI4	input	Digital input 4	
		10	SI5	input	Digital input 5	
		11	SI6	input	Digital input 6	
		12	SI7	input	Digital input 7	
		13	SI8	input	Digital input 8	
		14	SI9	input	Digital input 9	
		31	COM - _SO	output	Digital output common- terminal	Low resistor output in default . OC, the maximum voltage/current is no more than 30V, 50mA . Recommend the voltage : 12 V-24V. Current :10mA
		33	SO1 +	output	Digital output 1	
		32	SO2 +	output	Digital output 2	
		34	SO3 +	output	Digital output 3	
		35	SO4 +	output	Digital output 4	
		18	SO5 +	output	Differential Digital output 5	Differential Digital output，the maximum voltage/current is no more than 30V, 50mA . Recommend the voltage : 12 V-24V. Current :10mA
		19	SO5 -	output		
		20	SO6-	output	Differential Digital output 6	
		21	SO6 +	output		
		23	A +	output	Differential output terminal of motor encoder A phase	Differential output, High >= 2.5vdc, low <= 0.5vdc, maximum current ±20mA
		24	A -	output		
		25	B +	output	Differential output terminal of motor encoder B phase	
		26	B -	output		
		27	Z +	output	Differential output terminal of	

		28	Z -	output	motor encoder Z phase	
		36	OCA	output	OC output terminal of motor encoder A phase	
		37	OCB	output	OC output terminal of motor encoder B phase	
		29	OCZ	output	OC output terminal of motor encoder Z phase	
		30	GND	output	OC output GND terminal of motor encoder	
		3	PUL +	input	Pulse input， PUL+ and PUL-：5V differential input PUL+_24 and PUL-：24V differential input	
		4	PUL -	input		
		16	PUL + _24	input		
		5	DIR +	input	Direction input， DIR+ and DIR-：5V differential input DIR+_24 and DIR-：24V differential input	
		6	DIR -	input		
		17	DIR + _24	input		
		39	AI1+	input	Analog input 1, voltage input range : 10VDC~10VDC , input resistor 20KΩ	
		40	AI1-	input		
		41	AGND	input		
		43	AI3 +	input	Analog input 3, voltage input range : 10VDC~10VDC , input resistor 20KΩ	
		44	AI3 -	input		
		15、22、38、40、42	NC	/	Not connection	
		Shell	FG		Shield ground	

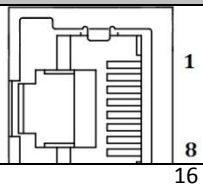
4.2.2 Encoder Input Port-CN2 Terminal

Table 4.5 Encoder Input Port-CN2 Terminal Signal Explain

Port		Pin	Signal
CN2		1	VCC5V
		2	GND
		3	BAT+
		4	BAT-
		5	SD+
		6	SD-
			PE

4.2.3 RS232/RS48 Communication Port

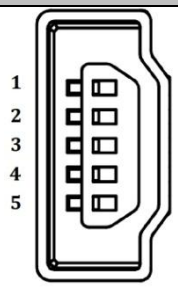
Table 4.6 signal explanation of driver interconnection interface-CN3

Port		Pin	Signal
CN4 CN5		1，9	RDO+
		2，10	RDO-
		3，11	/

		4，12	TXD
		5，13	RXD
		6，14	VCC5V
		7，15	GND
		8，16	/
		连接器外壳	PE

4.2.4 USB Communication Port

Table 4.7 USB Communication Port -CN5

Port		Pin	Signal
CN3		1	VCC5V
		2	D+
		3	D-
		4	
		5	GND
			USB_GND

4.2.5 Power Port

Table 4.8 Main Power Input Port-X1

Port	Pin	Signal	Detail
X1	L1	For single phase 220V	For single phase 220V，+15～-15%，50/60Hz
	L2	For single phase 220V	
Notes	① Isolation transformer can be used for power supply; ② Do not access the 380VAC power supply, or it will cause serious damage to the drive; ③ In the case of serious interference, it is recommended to use noise filter for power supply; ④ It is recommended to install a non-fusible circuit breaker to cut off external power supply in time when the driver fails.		
Port	**Pin**	**Signal**	**Detail**
X1	P +	Dc bus + terminal	① Driver Dc bus + terminal ② External regenerative resistor P terminal
	Br	External regenerative resistor terminal	External regenerative resistor terminal
Notes	When using external resistors, the values of resistance and power are selected as follows：		

Driver	Resistor（Ω）	Power（W）
L7-400	≥ 40	100

Port	Pin	Signal	Detail
X1	U	U	3 phase motor power input

	V	V	
	W	W	
	PE	PE	Frame ground
Notes	① Connect the driver to the ground end (PE) of the motor and connect it to the earth		

4.3 I/O Interface Principle

4.3.1 Switch Input Interface

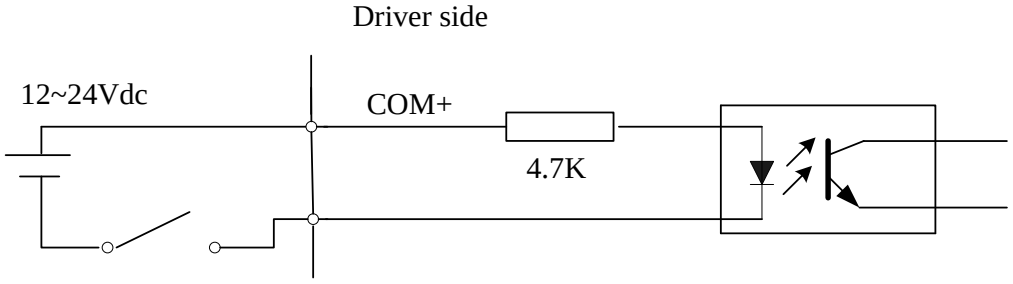


Figure 4-3 Switch Input Interface

⑴The user provide power supply, DC 12-24V, current≥100mA
⑵**Notice:** if current polar connect reversely, servo driver doesn't run.

Pr4.00*	Input selection SI1	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.01*	Input selection SI2	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.02*	Input selection SI3	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.03*	Input selection SI4	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.04*	Input selection SI5	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.05*	Input selection SI6	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.06*	Input selection SI7	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.07*	Input selection SI8	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.08*	Input selection SI9	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T

S Set SI1 input function allocation.
This parameter use 16 binary system to set up the values, as following :
00- - - - * * h: position control
00- - * * - - h: velocity control
00* * - - - - h: torque control
Please at [**] partition set up function number
For the function number, please refer to the following Figure.

Signal name	**symbol**	**Set value**	
		a-contact	**b- contact**

Invalid	-	00h	Do not setup
Positive direction over-travel inhibition input	POT	01h	81h
negative direction over-travel inhibition input	NOT	02h	82h
Servo-ON input	SRV-ON	03h	83h
Alarm clear input	A-CLR	04h	Do not setup
Control mode switching input	C-MODE	05h	85h
Gain switching input	GAIN	06h	86h
Deviation counter clear input	CL	07h	Do not setup
Command pulse inhibition input	INH	08h	88h
Electronic gear switching input 1	DIV1	0Ch	8Ch
Electronic gear switching input 2	DIV2	0Dh	8Dh
Selection 1 input of internal command speed	INTSPD1	0Eh	8Eh
Selection 2 input of internal command speed	INTSPD2	0Fh	8Fh
Selection 3 input of internal command speed	INTSPD3	10h	90h
Speed zero clamp input	ZEROSPD	11h	91h
Speed command sign input	VC-SIGN	12h	92h
Torque command sign input	TC-SIGN	13h	93h
Forced alarm input	E-STOP	14h	94h

Note:

1. a-contact means input signal comes from external controller or component ,for example: PLC .
2. b-contact means input signal comes from driver internally.
3. Don't setup to a value other than that specified in the table .
4. Don't assign specific function to 2 or more signals. Duplicated assignment will cause Err21.0 I/F input multiple assignment error 1or Err21.1 I/F input multiple assignment error 2.

Pr related input setup as below:

Input			
Signal name	symbol	Set value	
		Normal open	Normal close
Trigger command	CTRG	20h	A0h
Homing signal	HOME	21h	A1h
Forced stop	STP	22h	A2h
Forward direction JOG	JOG+	23h	A3h
Opposite direction JOG	JOG-	24h	A4h
Forward limit	PL	25h	A5h
Reverse limit	NL	26h	A6h
Homing signal	ORG	27h	A7h
Road strength address 0	ADD0	28h	A8h
Road strength address 1	ADD1	29h	A9h
Road strength address 2	ADD2	2ah	Aah
Road strength address 3	ADD3	2bh	Abh
Torque switching	TC-SEL	09h	89h

NOTE: CTRG,HOME is edge triggered, but the valid level must be last more than 1ms.

I/O input digital filtering

Pr5.15*	I/F reading filter	Range	unit	default	Related control mode		
		0-255	0.1ms	0	P	S	T
I/O input digital filtering; higher setup will arise control delay.							

4.3.2 Switch Output Interface

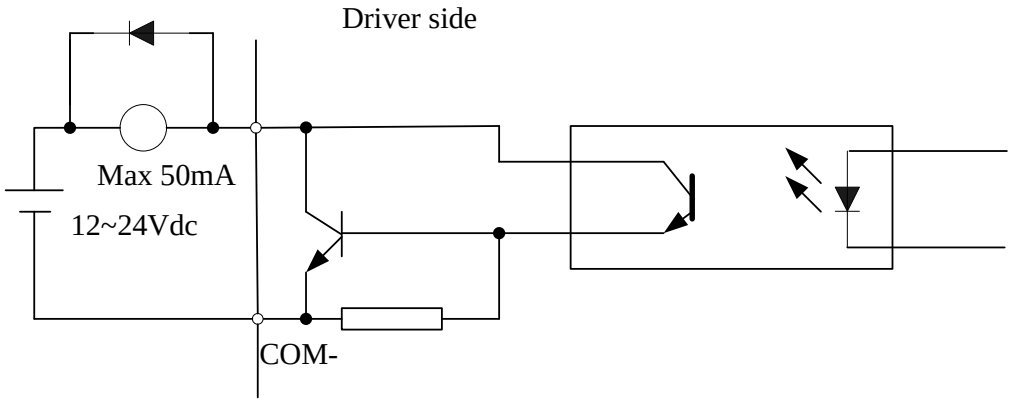


Figure 4.4 Switch Output Interface

(1) The user provide the external power supply . However, if current polarity connects reversely, servo driver is damaged.
(2) The output of the form is open-collector, the maximum voltage is 25V, and maximum current is 50mA. Therefore, the load of switch output signal must match the requirements. If you exceed the requirements or output directly connected with the power supply, the servo drive is damaged.
(3) If the load is inductive loads relays, etc., there must be anti-parallel freewheeling diode across the load. If the freewheeling diode is connected reversely, the servo drive is damaged.
(4) 32、33、34、35、31 Pin：Single-ended output;
18、19 Pin ， 20、21 Pin：Differencial output.

Pr4.10*	Output selection SO1	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.11*	Output selection SO2	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.12*	Output selection SO3	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.13*	Output selection SO4	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.14*	Output selection SO5	Range	unit	default	Related control mode		
		0-00FFFFFFh			P	S	T
Pr4.15*	Output selection SO6	Range	unit	default	Related control mode		
		0-00FFFFFFh			P	S	T

Assign functions to SO1 outputs.
This parameter use 16 binary system do setup, as following :
00- - - - * * h: position control
00- - * * - - h: velocity control
00* * - - - - h: torque control
Please at [**] partition set up function number.
For the function number, please refer to the following Figure.

Signal name	symbol	Setup value
Invalid	-	00h
Alarm output	Alm	01h
Servo-Ready output	S-RDY	02h
Eternal brake release signal	BRK-OFF	03h
Positioning complete output	INP	04h
At-speed output	AT-SPPED	05h
Zero-speed detection output	ZSP	07h

Velocity coincidence output	V-COIN	08h
Positional command ON/OFF output	P-CMD	0Bh
Speed command ON/OFF output	V-CMD	0Fh

Pr related output setup as below;

output			
Signal name	symbol	Set value	
		Normal open	Normal close
Command complete	CMD-OK	20h	A0h
Road strength address	MC-OK	21h	A1h
Homing finish	HOME-OK	22h	A2h
Torque limit	TQL	06h	86h

Note: CMD-OK indicates PR command sent complete, but the motor may not in-position.
MC-OK indicates command complete and the motor in-position.
*1 Pay attention to the front panel display is hexadecimal.

4.3.3 Pulse Input Interface

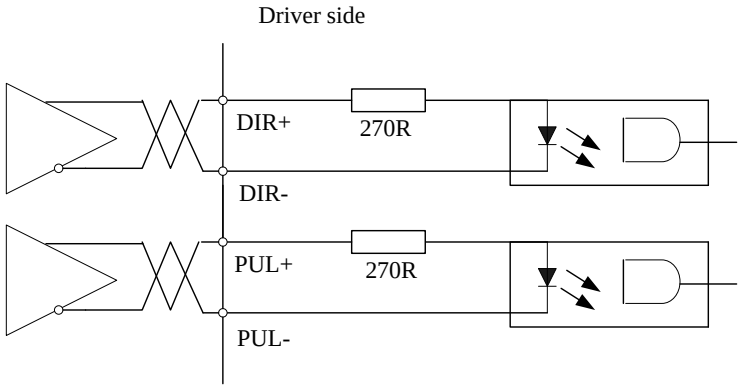
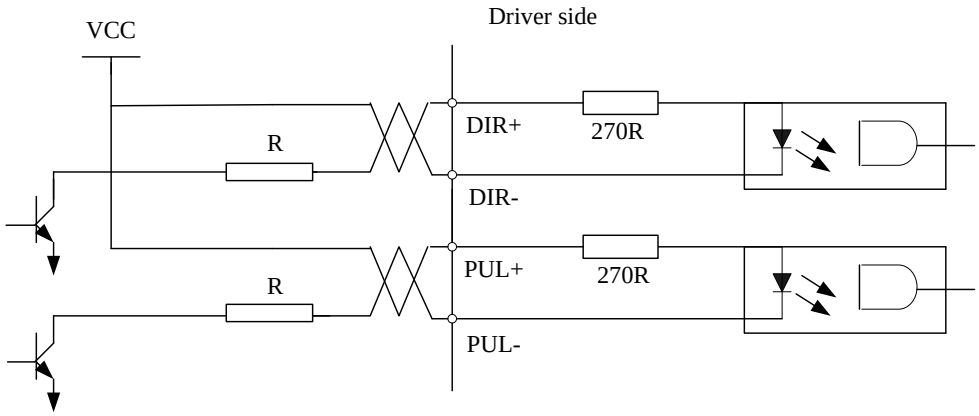


Figure 4-6 Pulse Input Interface Differential Drive Mode

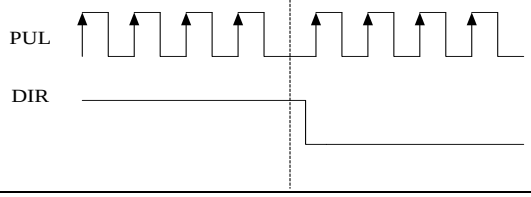


Vcc =12V, R = 1K, 0.25W; Vcc =24V, R = 2K, 0.25W

Figure 4-5 Pulse Input Interface Single Terminal Drive Mode

(1) In order to transmit pulse data properly , we recommend using the differential drive mode.
(2) The differential drive mode, AM26LS31, MC3487 or similar RS422 line drive.
(3) Using of single-ended drive will cause reduction of the operation frequency. The value of the resistance R depends on pulse input circuit and the external voltage,while drive current should be at the range of 10 - 15mA and the maximum voltage is no more than 25V .
Recommendation:
VCC = 24V, R = 1.3 to 2KΩ;
VCC = 12V, R = 510 ~ 820Ω;
VCC = 5V, R = 82 ~~ 120Ω.
(4) The user provide external power supply for single-ended drive. However, if current polarity connect reversely, servo driver is damaged.
(5) The form of pulse input is the following form 4.7 below, while the arrows indicates the count .

Table 4.9 Pulse Input Form

Pulse command form	CCW	CW	Parameter setting value
Pulse symbol			Pulse + direction

The form of pulse input timing parameter is the following form 3.8 below. The 4 times pulse frequency ≤ 500kH if 2-phase input form is used.

Table 4.10 the parameters of pulse input time sequence

parameter	Differential drive input	Single-ended drive input
t_{ck}	＞2μs	＞5μs
t_h	＞1μs	＞2.5μs
t_l	＞1μs	＞2.5μs
t_{rh}	＜0.2μs	＜0.3μs
t_{rl}	＜0.2μs	＜0.3μs
t_s	＞1μs	＞2.5μs
t_{qck}	＞8μs	＞10μs
t_{qh}	＞4μs	＞5μs
t_{ql}	＞4μs	＞5μs
t_{qrh}	＜0.2μs	＜0.3μs
t_{qrl}	＜0.2μs	＜0.3μs
t_{qs}	＞1μs	＞2.5μs

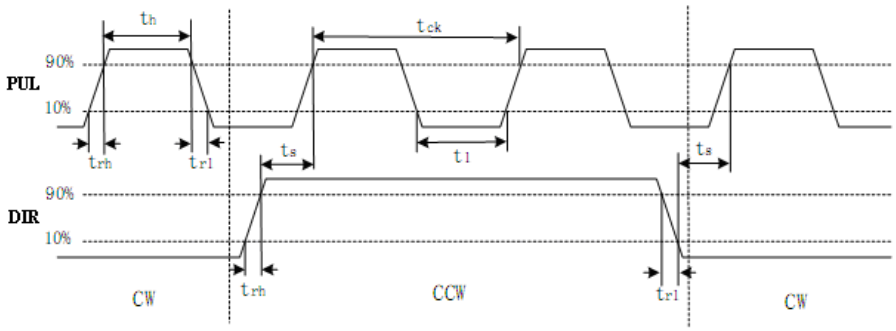
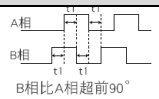
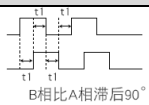


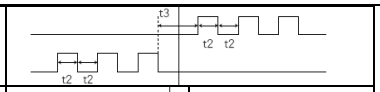
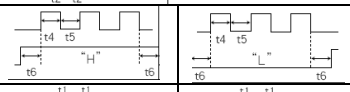
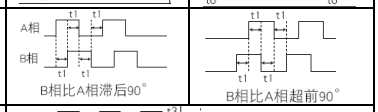
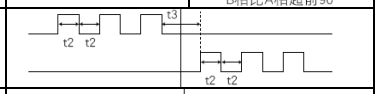
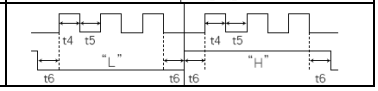
Figure 4.6 pulse + direction input interface timing (the maximum of pulse frequency : 500KHZ)

Pr0.06*	Command Pulse Rotational Direction Setup	Range	unit	default	Related control mode		
		0 -1	-	0	P		

Set command pulse input rotate direction, command pulse input type

Pr0.07*	Command Pulse Input Mode Setup	Range	unit	default	Related control mode		
		0 -3	-	3	P		

Pr0.06	Pr0.07	Command Pulse Format	Signal	Positive Direction Command	Negative Direction Command
0	0 or 2	90 phase difference 2-phase pulse(A phase +B phase)	Pulse sign		

	1	Positive direction pulse + negative direction pulse	Pulse sign	
	3	Pulse + sign	Pulse sign	
1	0 or 2	90 phase difference 2 phase pulse(A phase +B phase)	Pulse sign	
	1	Positive direction pulse + negative direction pulse	Pulse sign	
	3	Pulse + sign	Pulse sign	

Command pulse input signal allow largest frequency and smallest time width

PULS/SIGN Signal Input I/F		Permissible Max. Input Frequency	Smallest Time Width					
			t1	t2	t3	t4	t5	t6
Pulse series interface	Long distance interface	500kpps	2	1	1	1	1	1
	Open-collector output	200kpps	5	2.5	2.5	2.5	2.5	2.5

4.3.4 Analog Value Input Interface

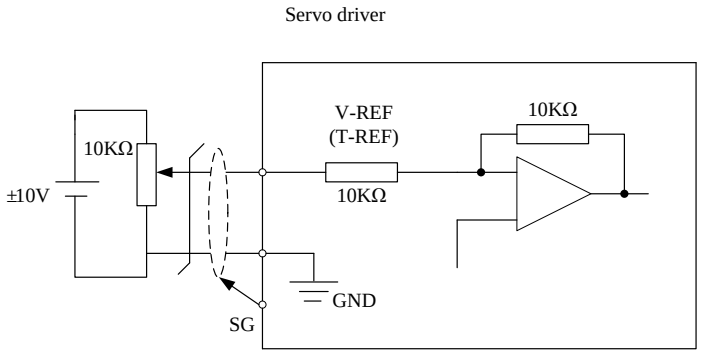


Figure 4-7 Analog AI1 Input Interface

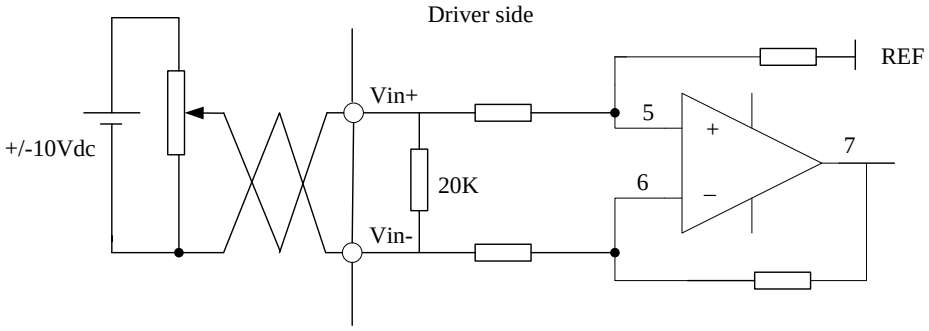


Figure 4-8 Analog AI3 Input Interface

4.3.5 Servo Motor Encoder Input Interface

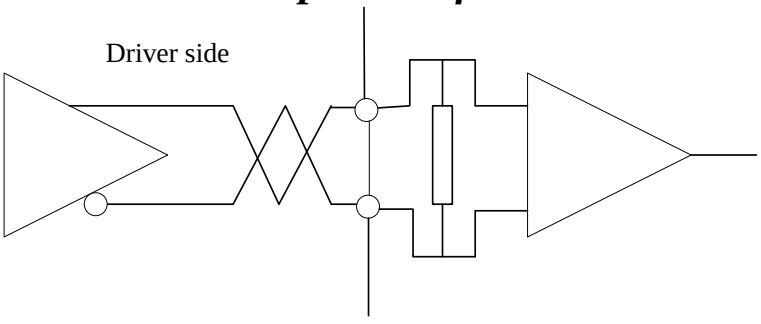


Figure 4-9 Servo Motor optical-electrical Encoder Input Interface

Chapter 5 Parameter

5.1 Parameter List

Notes: The parameters like PA_001*, which contain' *' means that the new value of this parameters will vaild after power is restarted !

Mode			Parameter Number		Name	Panel Display
P	S	T	Classify	Number		
P	S	T	【Class 0】Basic setting	00	MFC function	PA_000
P	S	T		01	control mode setup	PA_001*
P	S	T		02	real-time auto-gain tuning	PA_002
P	S	T		03	selection of machine stiffness at real-time auto-gain tuning	PA_003
P	S	T		04	Inertia ratio	PA_004
P				06	command pulse rotational direction setup	PA_006*
P				07	command pulse input mode setup	PA_007*
				08	Command pulse per one motor revolution	PA_008*
P				09	1st numerator of electronic gear	PA_009
P				10	denominator of electronic gear	PA_010
P	S	T		11	output pulse counts per one motor revolution	PA_011*
P	S	T		12	reversal of pulse output logic	PA_012*
P	S	T		13	1st torque limit	PA_013
P				14	position deviation excess setup	PA_014
P	S	T		15	Absolute encoder setup	PA_015
P	S	T		16	External regenerative discharge resistor setup	PA_016*
P	S	T		17	External regenerative discharge power value	PA_017*
P			【Class 1】Gain Adjust	00	1st gain of position loop	PA_100
P	S	T		01	1st gain of velocity loop	PA_101
P	S	T		02	1st time constant of velocity loop integration	PA_102
P	S	T		03	1st filter of velocity detection	PA_103
P	S	T		04	1st time constant of torque filter	PA_104
P				05	2nd gain of position loop	PA_105
P	S	T		06	2nd gain of velocity loop	PA_106
P	S	T		07	2nd time constant of velocity loop integration	PA_107
P	S	T		08	2nd filter of velocity detection	PA_108
P	S	T		09	2nd time constant of torque filter	PA_109
P				10	Velocity feed forward gain	PA_110
P				11	Velocity feed forward filter	PA_111
P	S			12	Torque feed forward gain	PA_112
P	S			13	Torque feed forward filter	PA_113
P	S	T		14	2nd gain setup	PA_114
P				15	Control switching mode	PA_115
P				17	Control switching level	PA_117
P				18	Control switch hysteresis	PA_118
P				19	Gain switching time	PA_119
P				35	Positional command filter setup	PA_135*
P	S	T		36	Encoder feedback pulse digital filter setup	PA_136*
P	S	T		37	Special register	PA_137
P	S		【Class 2】Vibration Restrain	00	adaptive filter mode setup	PA_200
P	S	T		01	1st notch frequency	PA_201
P	S	T		02	1st notch width selection	PA_202

P	S	T	**Function**	03	1st notch depth selection	PA_203
P	S	T		04	2nd notch frequency	PA_204
P	S	T		05	2nd notch width selection	PA_205
P	S	T		06	2nd notch depth selection	PA_206
P	S	T		07	3rd notch frequency	PA_207
P	S	T		08	3rd notch width selection	PA_208
P	S	T		09	3rd notch depth selection	PA_209
P				14	1st damping frequency	PA_214
P				15	1st damping filter setup	PA_215
P				16	2nd damping frequency	PA_216
P				17	2nd damping filter setup	PA_217
P				22	Positional command smooth filter	PA_222*
P				23	Positional command FIR filter	PA_223*
	S		【Class 3】 **Speed, Torque Control**	00	Velocity setup internal/external switching	PA_300
	S			01	Speed command rotational direction selection	PA_301
	S	T		02	Speed command input gain	PA_302
	S			03	Speed command reversal input	PA_303
	S			04	1st speed setup	PA_304
	S			05	2nd speed setup	PA_305
	S			06	3rd speed setup	PA_306
	S			07	4th speed setup	PA_307
	S			08	5th speed setup	PA_308
	S			09	6th speed setup	PA_309
	S			10	7th speed setup	PA_310
	S			11	8th speed setup	PA_311
	S			12	time setup acceleration	PA_312
	S			13	time setup deceleration	PA_313
	S			14	Sigmoid acceleration/deceleration time setup	PA_314*
				15	Speed zero-clamp function selection	PA_315
	S	T		16	Speed zero-clamp level	PA_316
				17	Torque command selection	PA_317
		T		18	Torque command direction selection	PA_318
		T		19	Torque command input gain	PA_319
		T		20	Torque command input reversal	PA_320
		T		21	Speed limit value 1	PA_321
				22	2nd torque limit	PA_322
P	S	T		24	maximum speed of motor rotation	PA_324
P	S	T		28	Synchronous parameter setting of gantry	PA_328
P	S	T	【Class 4】 **I/F Monitor Setting**	00	input selection SI1	PA_400*
P	S	T		01	input selection SI2	PA_401*
P	S	T		02	input selection SI3	PA_402*
P	S	T		03	input selection SI4	PA_403*
P	S	T		04	input selection SI5	PA_404*
P	S	T		05	input selection SI6	PA_405*
P	S	T		06	input selection SI7	PA_406*
P	S	T		07	input selection SI8	PA_407*
P	S	T		08	input selection SI9	PA_408*
P	S	T		09	input selection SI10	PA_409*
P	S	T		10	output selection SO1	PA_410*
P	S	T		11	output selection SO2	PA_411*
P	S	T		12	output selection SO3	PA_412*
P	S	T		13	output selection SO4	PA_413*

P	S	T		14	output selection SO5	PA_414*
P	S	T		15	output selection SO6	PA_415*
	S	T		22	Analog input 1(AI 1) offset setup	PA_422
	S	T		23	Analog input 1(AI 1) filter	PA_423
	S	T		24	Analog input 1(AI 1) over-voltage setup	PA_424
	S	T		28	Analog input 3(AI 3) offset setup	PA_428
	S	T		29	Analog input 3(AI 3) filter	PA_429
		T		30	Analog input 3(AI 3) over-voltage setup	PA_430
P				31	Positioning complete range	PA_431
P				32	Positioning complete output setup	PA_432
P				33	INP hold time	PA_433
P	S	T		34	Zero-speed	PA_434
	S			35	Speed coincidence range	PA_435
	S			36	At-speed	PA_436
P	S	T		37	Mechanical brake action at stalling setup	PA_437
P	S	T		38	Mechanical brake action at running setup	PA_438
P	S	T		39	Brake action at running setup	PA_439
P	S	T		43	E-stop function active	PA_443
P	S	T		44	Input selection SI11	PA_444
P	S	T		45	Input selection SI12	PA_445
P	S	T		46	Input selection SI13	PA_446
P	S	T		47	Input selection SI14	PA_447
P			【Class 5】 Extended Setup	00	2nd numerator of electronic gear	PA_500
P				01	3rd numerator of electronic gear	PA_501
P				02	4th numerator of electronic gear	PA_502
P	S	T		03	Denominator of pulse output division	PA_503*
P	S	T		04	Drive inhibit input setup	PA_504
P	S	T		06	Sequence at servo-off	PA_506
P	S	T		08	Main power off LV trip selection	PA_508
P	S	T		09	Main power off detection time	PA_509
				10	Dynamic braking mode	PA_510*
P	S	T		11	Torque setup for emergency stop	PA_511
P	S	T		12	Over-load level setup	PA_512
P	S	T		13	Over-speed level setup	PA_513
P	S	T		15	I/F reading filter	PA_515*
P				17	Counter clear up input mode	PA_517
P				18	Invalidation of command pulse inhibit input	PA_518
P				20	Position setup unit select	PA_520*
P	S	T		21	Selection of torque limit	PA_521
P	S	T		22	2nd torque limit	PA_522
				23	Torque limit switching setup 1	PA_523
				24	Torque limit switching setup 2	PA_524
P	S	T		28	LED initial status	PA_528*
P	S	T		29	RS485 mode selection	PA_529*
P	S	T		30	RS485 baud rate setup	PA_530*
P	S	T		31	RS485 slave axis address	PA_531*
P				32	Command pulse input maximum setup	PA_532
P	S	T		34	Upper monitor communication port select	PA_534
P	S	T		35	Front panel lock setup	PA_535
P	S	T		36	Password for opening group 7 parameter	PA_536
P	S	T	【Class 6】 Special	01	Encoder zero position compensation	PA_601*
P	S	T		03	JOG trial run command torque	PA_603

P			Setup	04	JOG trial run command speed	PA_604
p				05	Position 3rd gain valid time	PA_605
p				06	Position 3rd gain scale factor	PA_606
P	S	T		07	Torque command additional value	PA_607
P	S	T		08	Positive direction torque compensation value	PA_608
P	S	T		09	Negative direction torque compensation value	PA_609
P	S	T		13	2nd inertia ratio	PA_613
P	S	T		14	Emergency stop time at alarm	PA_614
P				20	distance of trial running	PA_620
P				21	waiting time of trial running	PA_621
P				22	cycling times of trial running	PA_622
P	S			25	Acceleration of trial running	PA_6.25
P	S			26	Mode of trial running	PA_6.26
P	S	T	【Class 7】	19	Weak magnetic current	PA_719

5.2 Parameter Function

Here is the explanation of parameters ,you can check them or modify the value using software Protuner or the front panel of driver.

5.2.1【Class 0】Basic Setting

Pr0.00	Mode loop gain	Range	unit	default	Related control mode		
		0 -2000	0.1Hz	0	P	S	T

Set up the bandwidth of MFC , it is similar to the response bandwidth

Setup value	Meaning
0	Disable the function.
1	Enable the function , set the bandwidth automatically , recommended for most application .
2-10	Forbidden and reserved .
11-20000	Set the bandwidth manually , 1.1Hz – 2000Hz

MFC is used to enhance the performance of dynamic tracing for input command , make positioning faster , cut down the tracking error , run more smooth and steady . It is very useful for multi-axis synchronous movement and interpolation, the performance will be better.

The main way to use this function :

a. Choose the right control mode : Pr001 = 0
b. Set up the inertia of ratio : Pr004
c. Set up the rigidity : Pr003
d. Set up the Pr000 :
   1) If no multi-axis synchronous movement , set Pr000 as 1 or more than 10 ;
   2) If multi-axis synchronous movement needed , set Pr000 as the same for all the axes .
   3) If Pr000 is more than 10 , start with 100 , or 150 , 200 , 250 , …. .

Caution:

1. Set up the right control mode , the right inertia of ratio and rigidity firstly .
2. Don't change the value of Pr000 when the motor is running , otherwise vibration occurs
3. Set up a small value from the beginning if using it in manual mode , smaller value means running more smooth and steady , while bigger one means faster positioning

Pr0.01*	Control Mode Setup	Range	unit	default	Related control mode

		0 -10	-	0	P	S	T

Set using control mode

Setup value	Content	
	1st mode	2nd mode
0	Position	-
1	Velocity	-
2	Torque	-
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	Pr-Mode	
7~10	Reaserved	

When you set up the combination mode of 3.4.5, you can select either the 1st or the 2nd with control mode switching input(C-MODE).
When C-MODE is open, the 1st mode will be selected.
When C-MODE is shorted, the 2nd mode will be selected.

Pr0.02	Real-time Auto-gain Tuning	Range	unit	default	Related control mode		
		0 -2	-	0	P	S	T

You can set up the action mode of the real-time auto-gain tuning.

Setup value	mode	Varying degree of load inertia in motion
0	invalid	Real-time auto-gain tuning function is disabled.
1	standard	Basic mode. do not use unbalanced load, friction compensation or gain switching
2	positioning	Main application is positioning. it is recommended to use this mode on equipment without unbalanced horizontal axis, ball screw driving equipment with low friction, etc.

Caution: If pr0.02=1 or 2 , you can't modify the values of pr1.01 – pr1.13, the values of them depend on the real-time auto-gain tuning ,all of them are set by the driver itself.

Pr0.03	selection of machine stiffness at real time auto gain tuning	Range	unit	default	Related control mode		
		0 -31	-	11	P	S	T

You can set up response while the real-time auto-gain tuning is valid.

Low ⟶ Machine stiffness ⟶ High

Low ⟶ Servo gain ⟶ High

0.1·····11.12.13·····30.31

Low ⟶ Response ⟶ High

Notice: Higher the setup value, higher the velocity response and servo stiffness will be obtained. However, when increasing the value, check the resulting operation to avoid oscillation or vibration. Control gain is updated while the motor is stopped. If the motor can't be stopped due to excessively low gain or continuous application of one-way direction command ,any change made to Pr0.03 is not used for update. If the changed stiffness setting is made valid after the motor stopped, abnormal sound or oscillation will be generated. To prevent this problem, stop the motor after changing the stiffness setting and check that the changed setting is enabled.

Pr0.04	Inertia ratio	Range	unit	default	Related control mode		
		0 -10000	%	250	P	S	T

You can set up the ratio of the load inertia against the rotor(of the motor)inertia.

Pr0.04=(load inertia/rotate inertia)×100%

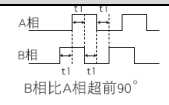
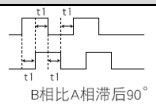
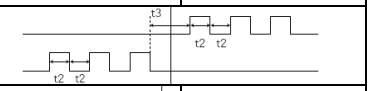
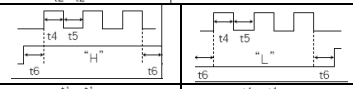
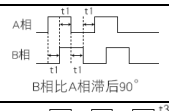
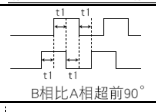
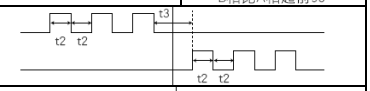
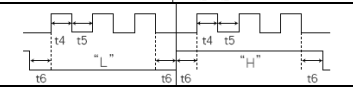
Notice:

If the inertia ratio is correctly set, the setup unit of Pr1.01 and Pr1.06 becomes (Hz). When the inertia ratio of Pr0.04 is larger than the actual value, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr0.04 is smaller than the actual value, the setup unit of the velocity loop gain becomes smaller.

Pr0.06*	Command Pulse Rotational Direction Setup	Range	unit	default	Related control mode		
		0 -1	-	0	P		

Set command pulse input rotate direction, command pulse input type

Pr0.07*	Command Pulse Input Mode Setup	Range	unit	default	Related control mode		
		0 -3	-	3	P		

Pr0.06	Pr0.07	Command Pulse Format	Signal	Positive Direction Command	Negative Direction Command
0	0 or 2	90 phase difference 2-phase pulse(A phase +B phase)	Pulse sign		
	1	Positive direction pulse + negative direction pulse	Pulse sign		
	3	Pulse + sign	Pulse sign		
1	0 or 2	90 phase difference 2 phase pulse(A phase +B phase)	Pulse sign		
	1	Positive direction pulse + negative direction pulse	Pulse sign		
	3	Pulse + sign	Pulse sign		

Command pulse input signal allow largest frequency and smallest time width

PULS/SIGN Signal Input I/F		Permissible Max. Input Frequency	Smallest Time Width					
			t1	t2	t3	t4	t5	t6
Pulse series interface	Long distance interface	500kpps	2	1	1	1	1	1
	Open-collector output	200kpps	5	2.5	2.5	2.5	2.5	2.5

Pr0.08	Command pulse counts per one motor revolution	Range	unit	default	Related control mode		
		0-8388 608	pulse	0	P	S	T

Set the command pulse that causes single turn of the motor shaft.

1) If pr008 ≠ 0 , the actual turns = pulse number / Pr008

2) If pr008 = 0 , Pr009 1st numerator of electronic gear and Pr0.10 Denominator of electronic Gear become valid.

Pr0.09	1st numerator of electronic gear	Range	unit	default	Related control mode		
		1-10737 41824	-	1	P		

Set the numerator of division/multiplication operation made according to the command pulse input.

Pr0.10	denominator of electronic gear	Range	unit	default	Related control mode		
		1-10737 41824	-	1	P		

Set the denominator of division/multiplication operation made according to the command pulse input.

Pr0.09	Pr0.10	Command division/multiplication operation
1-32767	1-32767	Command pulse input → 【Pr0.09 set value】 / 【Pr0.10 set value】 → position command

1、Settings:

(1)The driver input command pulse number is X

(2)The pulse number of encoder after frequency division and frequency doubling is Y

(3)The number of pulses per revolution of the motor encoder is Z

(4)Number of turns of motor is W

2、Calculations:

(1)Y=X* Pr0.09 / Pr0.10

(2)17Bit encoder: Z=2^17 = 131072

23Bit encoder: Z=2^23 = 8388608

Pr0.11*	Output pulse counts per one motor revolution	Range	unit	default	Related control mode		
		1-2500	P/r	2500	P	S	T

Set the numerator of division/multiplication operation made according to the command pulse input.

Pr5.03*	denominator of pulse output division	Range	unit	default	Related control mode		
		1-2500	-	2500	P	S	T

Combination of Pr0.11 Output pulse counts per one motor revolution and Pr5.03 Denominator of pulse output division

Pr0.11	Pr5.03	Pulse output process
1-2500	1-2500	encoder pulse → 【Pr0.11set value】 / 【Pr5.03 set value】 → output pulse

Pulse output resolution after dividing double frequency 4 times

$$\text{Pulse output resolution} = \text{encoder} \times 4 \times \frac{\text{Pr0.11(pulse output divide frequency molecule)}}{\text{Pr5.03(pulse output divide frequency denominator)}}$$

Pr0.12*	reversal of pulse output logic	Range	unit	default	Related control mode		
		0 -1	-	0	P	S	T

You can set up the B phase logic and the output source of the pulse output. With this parameter, you can reverse the phase relation between the A-phase pulse and B-phase pulse by reversing the B-phase logic.

< reversal of pulse output logic >

Pr0.12	B-phase Logic	CCW Direction Rotation	CW Direction Rotation
0	Non-Reversal	A phase B phase	A phase B phase
1	Reversal	A phase B phase	A phase B phase

Pr0.13	1st Torque Limit	Range	unit	default	Related control mode		
		0 -500	%	300	P	S	T

You can set up the limit value of the motor output torque, as motor rate current %, the value can't exceed the maximum of output current.

Pr0.14	Position Deviation Excess Setup	Range	unit	default	Related control mode		
		0 -500	0.1 rev	200	P		

Set excess range of positional deviation by the command unit(default).Setting the value too small will cause Err18.0 (position deviation excess detection)

Pr0.15	Absolute Encoder Setup	Range	unit	default	Related control mode		
		0 -15	0.1 rev	0	P	S	T

Bit description;

Bit	Description
Bit0	0:close absolute value 1: open absolute value
Bit1	Default : 0,do not use
Bit2	0: no action 1: clean up absolute alarm, automatically become 0 when clean success
Bit3	0： no action 1： multi-turn position, clean up and reset automatically become 0 after success
Bit4-15	Default 0,do not use

How to use:

0: close multi-turn absolute function, multi-turn position invalid;

1: open multi-turn absolute function;

5: clean multi-turn alarm, and open multi-turn absolute function. It will become 1 when normal clearance, if it's still 5 after 3seconds, please deal with according to 153 alarm processing.

9: multi-turn zero clearing and reset multi-turn alarm, open multi-turn absolute function. It will become 1 when normal clearance, if it's still 9 after 3seconds, please deal with according to 153 alarm processing. Please remember to do mechanical homing.

Pr0.16	External regenerative resistance	Range	unit	default	Related control mode		
		10-50	Ω	50	P	S	T
Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current.							
Pr0.17	External regenerative resistor power value	Range	unit	default	Related control mode		
		0 -10000	W	50	P	S	T
Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current.							

5.2.2【Class 1】Gain Adjust

Pr1.00	1st gain of position loop	Range	unit	default	Related control mode		
		0 -30000	0.1/s	320	P		
You can determine the response of the positional control system. Higher the gain of position loop you set, faster the positioning time you can obtain. Note that too high setup may cause oscillation.							
Pr1.01	1st gain of velocity loop	Range	unit	default	Related control mode		
		0 -32767	0.1Hz	180	P	S	T
You can determine the response of the velocity loop. In order to increase the response of overall servo system by setting high position loop gain, you need higher setup of this velocity loop gain as well. However, too high setup may cause oscillation.							

Pr1.02	1st Time Constant of Velocity Loop Integration	Range	unit	default	Related control mode		
		0 -10000	0.1ms	310	P	S	T
You can set up the integration time constant of velocity loop, Smaller the set up, faster you can dog-in deviation at stall to 0.The integration will be maintained by setting to"9999".The integration effect will be lost by setting to"10000".							
Pr1.03	1st Filter of Velocity Detection	Range	unit	default	Related control mode		
		0 -31	-	15	P	S	T

You can set up the time constant of the low pass filter (LPF) after the speed detection, in 32 steps (0 to 31).Higher the setup, larger the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow.

You can set the filter parameters through the loop gain, referring to the following table:

Set Value	Speed Detection Filter Cut-off Frequency(Hz)	Set Value	Speed Detection Filter Cut-off Frequency(Hz)
0	2500	16	750
1	2250	17	700
2	2100	18	650
3	2000	19	600
4	1800	20	550
5	1600	21	500
6	1500	22	450
7	1400	23	400
8	1300	24	350
9	1200	25	300
10	1100	26	250
11	1000	27	200
12	950	28	175
13	900	29	150
14	850	30	125
15	800	31	100

		Range	unit	default	Related control mode
Pr1.04	2nd Time Constant of torque filter	0 -2500	0.01ms	126	P S T
Pr1.05	2nd gain of position loop	0 -30000	0.1/s	380	P
Pr1.06	2nd gain of velocity loop	0 -32767	0.1Hz	180	P S T
Pr1.07	2nd Time Constant of Velocity Loop Integration	0 -10000	0.1ms	10000	P S T
Pr1.08	2nd Filter of Velocity Detection	0 -31	-	15	P S T
Pr1.09	2nd Time Constant of torque filter	0 -2500	0.01ms	126	P S T

Position loop, velocity loop, velocity detection filter, torque command filter have their 2 pairs of gain or time constant(1st and 2nd).

		Range	unit	default	Related control mode
Pr1.10	Velocity feed forward gain	0 -1000	0.1%	300	P

Multiply the velocity control command calculated according to the internal positional command by the ratio of this parameter and add the result to the speed command resulting from the positional control process.

		Range	unit	default	Related control mode
Pr1.11	Velocity feed forward filter	0 -6400	0.01ms	50	P

Set the time constant of 1st delay filter which affects the input of speed feed forward.
(usage example of velocity feed forward)
The velocity feed forward will become effective as the velocity feed forward gain is gradually increased with the speed feed forward filter set at approx.50 (0.5ms). The positional deviation during operation at a constant speed is reduced as shown in the equation below in proportion to the value of velocity feed forward gain.
Position deviation [unit of command]=command speed [unit of command /s]/position loop gain[1/s] ×(100-speed feed forward gain[%]/100

		Range	unit	default	Related control mode
Pr1.12	Torque feed forward gain	0 -1000	0.1%	0	P S

- Multiply the torque control command calculated according to the velocity control command by the ratio of this parameter and add the result to the torque command resulting from the velocity control process.
- To use torque feed forward, correctly set ratio of inertia. Set the inertia ratio that can be calculated from the machine specification to Pr0.04 inertia ratio.
- Positional deviation at a constant acceleration/deceleration can be minimized close to 0 by increasing the torque forward gain .this means that positional deviation can be maintained at near 0 over entire operation range while driving in trapezoidal speed pattern under ideal condition where disturbance torque is not active.

		Range	unit	default	Related control mode
Pr1.13	Torque feed forward filter	0 -6400	0.01ms	0	P S

Set up the time constant of 1st delay filter which affects the input of torque feed forward.
zero positional deviation is impossible in actual situation because of disturbance torque. as with the velocity feed forward, large torque feed forward filter time constant decreases the operating noise

but increases positional deviation at acceleration change point.

Pr1.14	2nd gain setup	Range	unit	default	Related control mode		
		0 -1	-	1	P	S	T

Setup value	Gain selection / switching
0	1st gain is fixed at a value, by using the gain switching input (GAIN), change the velocity loop operation from PI to P GAIN input off, PI operation GAIN input on, P operation Remark: the above description applies when the logical setting of GAIN input is a-contact. ON/OFF of photo-coupler is reversed when b-contact.
1	Enable gain switching of the 1st gain(Pr0.00—Pr1.04), and 2nd gain (Pr1.05—Pr1.09)

Pr1.15	Mode of position control switching	Range	unit	default	Related control mode		
		0 -10	-	0	P		

Setting value	Switching condition	Gain switching condition
0	Fixed to 1st gain	Fixed to the 1st gain (Pr1.00-Pr1.04)
1	Fixed to 2nd gain	Fixed to the 2nd gain (Pr1.05-Pr1.09)
2	with gain switching input	● 1st gain when the gain switching input is open. ● 2nd gain when the gain switching input is connected to com- . ✧ If no input signal is allocated to the gain switching input, the 1st gain is fixed.
3	Torque command is large	● Shift to the 2nd gain when the absolute value of the torque command exceeded (level + hysteresis)[%]previously with the 1st gain. ● Return to the 1st gain when the absolute value of the torque command was kept below (level + hysteresis) [%]previously during delay time with the 2nd gain.
4	reserve	reserve
5	Speed command is large	● Valid for position and speed controls. ● Shift to the 2nd gain when the absolute value of the speed command exceeded (level + hysteresis)[r/min]previously with the 1st gain. ● Return to the 1st gain when the absolute value of the speed command was kept below (level + hysteresis) [r/min] previously during delay time with the 2nd gain.
6	Position deviation is large	● Valid for position control. ● Shift to the 2nd gain when the absolute value of the positional deviation exceeded (level + hysteresis)[pulse] previously with the 1st gain. ● Return to the 1st gain when the absolute value of the positional deviation was kept below (level + hysteresis)[r/min]previously during delay time with the 2nd gain. ✧ Unit of level and hysteresis [pulse] is set as the encoder resolution for positional control.
7	position command exists	● Valid for position control. ● Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. ● Return to the 1st gain when the positional command was kept

		0 previously during delay time with the 2nd gain.
8	Not in positioning complete	● Valid for position control. ● Shift to the 2nd gain when the positioning was not completed previously with the 1st gain. ● Return to the 1st gain when the positioning was kept in completed condition previously during delay time with the 2nd gain.
9	Actual speed is large	● Valid for position control. ● Shift to the 2nd gain when the absolute value of the actual speed exceeded (level + hysteresis) (r/min) previously with the 1st gain. ● Return to the 1st gain when the absolute value of the actual speed was kept below (level - hysteresis) (r/min) previously during delay time with the 2nd gain.
10	Have position command +actual speed	● Valid for position control. ● Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. ● Return to the 1st gain when the positional command was kept at 0 during the delay time and the absolute value of actual speed was kept below (level - hysteresis) (r/min) previously with the 2nd gain.

In position control mode, setup Pr1.15=3,5,6,9,10;
In speed control mode, setup Pr1.15=3,5,9;

Pr1.17	Level of position control switching	Range	unit	default	Related control mode		
		0 -20000	Mode dependent	50	P		

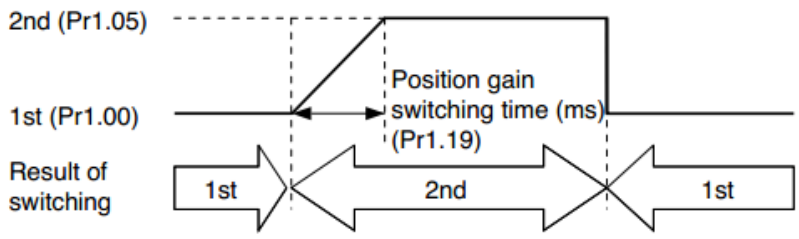
Unit of setting varies with switching mode.
switching condition: position :encoder pulse number ; speed : r/min ; torque : % .
Notice: set the level equal to or higher than the hysteresis.

Pr1.18	Hysteresis at position control switching	Range	unit	default	Related control mode		
		0 -20000	Mode dependent	33	P		

Combining Pr1.17(control switching level)setup
Notice: when level< hysteresis, the hysteresis is internally adjusted so that it is equal to level.

Pr1.19	position gain switching time	Range	unit	default	Related control mode		
		0 -10000	0.1ms	33	P		

For position controlling: if the difference between 1st gain and 2nd gain is large, the increasing rate of position loop gain can be limited by this parameter.
<Position gain switching time>
Notice: when using position control, position loop gain rapidly changes, causing torque change and vibration. By adjusting Pr1.19 position gain switching time, increasing rate of the position loop gain can be decreased and variation level can be reduced.
Example: 1st (pr1.00) <-> 2nd (Pr1.05)



Pr1.35*	positional command filter setup	Range	unit	default	Related control mode		
		0 -200	0.05us	0	P		
Do filtering for positional command pulse, eliminate the interference of the narrow pulse, over-large setup will influence the input of high frequency positional command pulse, and make more time-delayed.							
Pr1.36*	pulse digital filter of encoder feedback setup	Range	unit	default	Related control mode		
		0 -10000	0.05ms	33	P		
Do filtering for pulse of encoder feedback, eliminate the interference of the narrow pulse, over-large setup will influence the performance of motor in large speed, and influence the control performance of motor causing by large time-delayed.							

Pr1.37	Special register	Range	unit	default	Related control mode		
		0 -32767	-	0	P	S	T
Under binary, these bits in register are used for some function operation. Bit2=1, shield the speed out of control alarm (1A1) Bit4=1, shield the over-load alarm 100,101 Bit6=1, shield the excessive vibration alarm 190 Bit7=1, shield the braking resistor over-load alarm 120 Bit9=1, shield the lacking of phase alarm0dl (other bits are forbidden to use, default 0)							

5.2.3【Class 2】Vibration Suppression

Pr2.00	Adaptive filter mode setup	Range	unit	default	Related control mode		
		0 -4	-	0	P	S	

Set up the resonance frequency to be estimated by the adaptive filter and the special the operation after estimation.

Setup value	content	
0	Adaptive filter: invalid	Parameters related to the 3rd and 4th notch filter hold the current value.
1	Adaptive filter,1 filter is valid, one time	One adaptive filter is valid, parameters related to the 3rd notch filter will be updated based on adaptive performance. After updated, Pr2.00 returns to 0, stop self-adaptation.
2	Adaptive filter, 1 filter is valid, It will be valid all the time	One adaptive filter is valid, parameters related to the 3rd notch filter will be updated all the time based on adaptive performance.
3-4	Not use	Non-professional forbidded to use

Pr2.01	1st notch frequency	Range	unit	default	Related control mode		
		50 -2000	HZ	2000	P	S	T
Set the center frequency of the 1st notch filter Notice: the notch filter function will be invalidated by setting up this parameter to "2000".							
Pr2.02	1st notch width selection	Range	unit	default	Related control mode		
		0 -20	-	2	P	S	T

Set the width of notch at the center frequency of the 1st notch filter.
Notice: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

		Range	unit	default	Related control mode		
Pr2.03	1st notch depth selection	0 -99	-	0	P	S	T

Set the depth of notch at the center frequency of the 1st notch filter.
Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

		Range	unit	default	Related control mode		
Pr2.04	2nd notch frequency	50 -2000	HZ	2000	P	S	T

Set the center frequency of the 2nd notch filter
Notice: the notch filter function will be invalidated by setting up this parameter to "2000".

		Range	unit	default	Related control mode		
Pr2.05	2nd notch width selection	0 -20	-	2	P	S	T

Set the width of notch at the center frequency of the 2nd notch filter.
Notice: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

		Range	unit	default	Related control mode		
Pr2.06	2nd notch depth selection	0 -99	-	0	P	S	T

Set the depth of notch at the center frequency of the 2nd notch filter.
Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.

		Range	unit	default	Related control mode		
Pr2.07	3rd notch frequency	50 -2000	Hz	2000	P	S	T

Set the center frequency of the 3rd notch filter
Notice: the notch filter function will be invalidated by setting up this parameter to "2000".
Setup invalid after opening self-adaptation function.

		Range	unit	default	Related control mode		
Pr2.08	3rd notch width selection	0 -20	-	2	P	S	T

Set the width of notch at the center frequency of the 3rd notch filter.
Notice: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.
Setup invalid after opening self-adaptation function.

		Range	unit	default	Related control mode		
Pr2.09	3rd notch depth selection	0 -99	-	0	P	S	T

Set the depth of notch at the center frequency of the 3rd notch filter.
Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.
Setup invalid after opening self-adaptation function.

		Range	unit	default	Related control mode		
Pr2.14*	1st damping frequency	10 -2000	0.1Hz	0	P		

0: close
Setup damping frequency, to suppress vibration at the load edge.

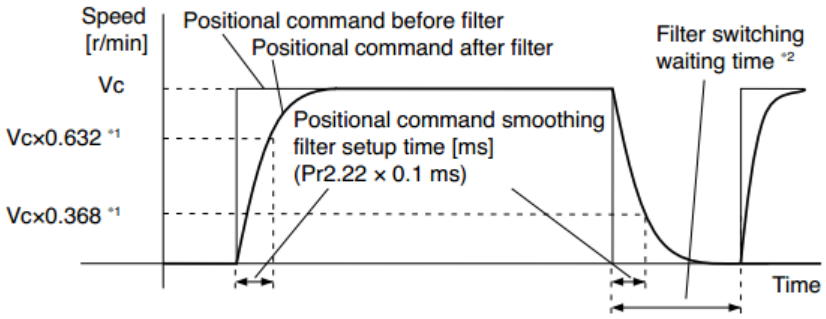
		Range	unit	default	Related
Pr2.16*	1nd damping frequency				

					control mode		
		10 -2000	0.1Hz	0	P		

0: close
Setup damping frequency, to suppress vibration at the load edge.

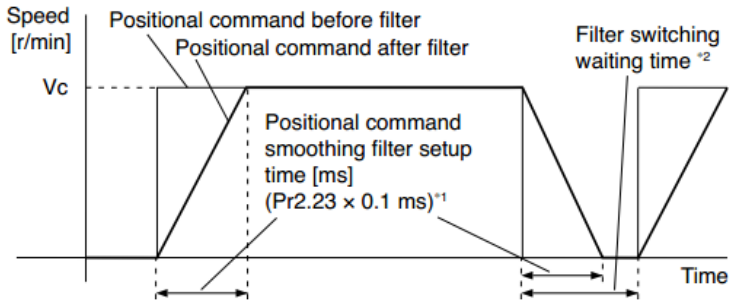
Pr2.22	positional command smoothing filter	Range	unit	default	Related control mode		
		0 -32767	0.1ms	0	P		

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied ,set up the time constant of the 1st delay filter as shown in the figure below.



Pr2.23	positional command FIR filter	Range	unit	default	Related control mode		
		0 -10000	0.1ms	0	P		

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied , set up the Vc arrival time as shown in the figure below.



Note: For parameters which No. have a suffix of "*",changed contents will be validated when you turn on the control power.

5.2.4【Class 3】Velocity/ Torque Control

Pr3.00	Speed setup, Internal /External switching	Range	unit	default	Related control mode		
		0 -3	-	0		S	

This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.

Setup value	Speed setup method
0	Analog speed command(SPR)
1	Internal speed command 1st to 4th speed(PR3.04-PR3.07)
2	Internal speed command 1st to 3rd speed (PR3.04-PR3.06), Analog speed command(SPR)
3	Internal speed command 1st to 8th speed (PR3.04-PR3.11)

<relationship between Pr3.00 Internal/External switching speed setup and the internal command speed selection 1-3 and speed command to be selected>

Setup value	selection 1 of internal command speed(INTSPD1)	selection 2 of internal command speed (INTSPD2)	selection 3 of internal command speed (INTSPD3)	selection of Speed command
1	OFF	OFF	NO effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		4th speed
2	OFF	OFF	NO effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		Analog speed command
3	The same as [Pr3.00=1]		OFF	1st to 4th speed
	OFF	OFF	ON	5th speed
	ON	OFF	ON	6th speed
	OFF	ON	ON	7th speed

Pr3.01	Speed command rotational direction selection	Range	unit	default	Related control mode
		0 -1	-	0	S

Select the Positive /Negative direction specifying method

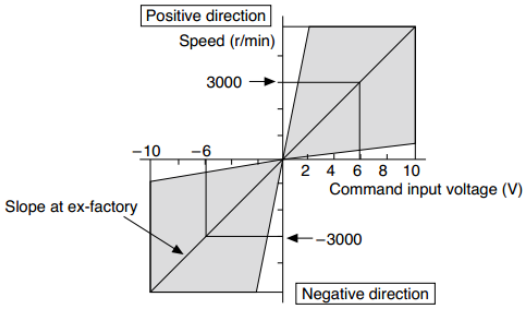
Setup value	Select speed command sign (1st to 8th speed)	Speed command direction (VC-SIGN)	Position command direction
0	+	No effect	Positive direction
	-	No effect	Negative direction
1	Sign has no effect	OFF	Positive direction
	Sign has no effect	ON	Negative direction

Pr3.02	Input gain of speed command	Range	unit	default	Related control mode
		10 -2000	(r/min)/v	500	S T

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
You can set up "slope" of relation between the command input voltage and motor speed, with Pr3.02. Default is set to Pr3.02=500(r/min)/V, hence input of 6V becomes 3000r/min.

Notice:

1. Do not apply more than ±10V to the speed command input(SPR).
2. When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
3. Pay an extra attention to oscillation caused by larger setup of Pr3.02.



Pr3.03	Reversal of speed command input	Range	unit	default	Related control mode
		0 -1	-	0	S

Specify the polarity of the voltage applied to the analog speed command (SPR).

Setup value	**Motor rotating direction**

0	Non-reversal	[+ voltage] →[+ direction] [- voltage] → [-direction]
1	reversal	[+ voltage] →[- direction] [- voltage] → [+direction]

Caution: When you compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

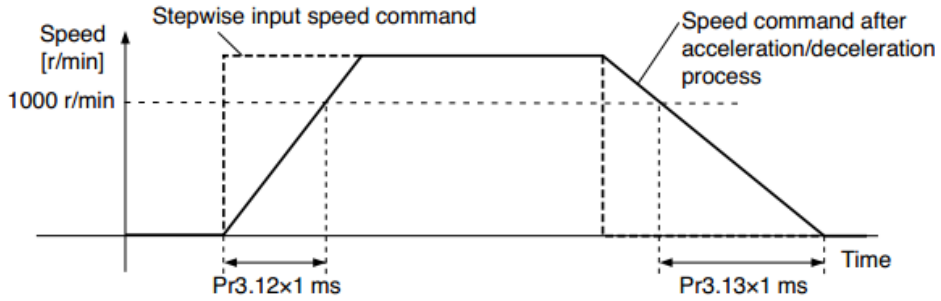
		Range	unit	default	Related control mode
Pr3.04	1st speed of speed setup	-20000 -20000	r/min	0	S
Pr3.05	2nd speed of speed setup	-20000 -20000	r/min	0	S
Pr3.06	3rd speed of speed setup	-20000 -20000	r/min	0	S
Pr3.07	4th speed of speed setup	-20000 -20000	r/min	0	S
Pr3.08	5th speed of speed setup	-20000 -20000	r/min	0	S
Pr3.09	6th speed of speed setup	-20000 -20000	r/min	0	S
Pr3.10	7th speed of speed setup	-20000 -20000	r/min	0	S
Pr3.11	8th speed of speed setup	-20000 -20000	r/min	0	S

Set up internal command speeds, 1st to 8th

		Range	unit	default	Related control mode
Pr3.12	time setup acceleration	0 -10000	Ms(1000r/min)	100	S
Pr3.13	time setup deceleration	0 -10000	Ms(1000r/min)	100	S

Set up acceleration/deceleration processing time in response to the speed command input.
Set the time required for the speed command(stepwise input)to reach 1000r/min to Pr3.12 Acceleration time setup. Also set the time required for the speed command to reach from 1000r/min to 0 r/min, to Pr3.13 Deceleration time setup.
Assuming that the target value of the speed command is Vc(r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

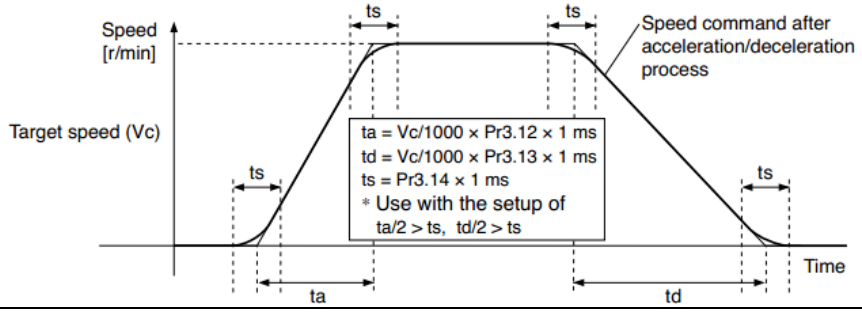
Acceleration time (ms)=Vc/1000 *Pr3.12 *1ms
Deceleration time (ms)=Vc/1000 *Pr3.13 *1ms



		Range	unit	default	Related control mode
Pr3.14	Sigmoid acceleration/deceleration time				

	setup	0 -1000	ms	0		S	

Set S-curve time for acceleration/deceleration process when the speed command is applied. According to Pr3.12 Acceleration time setup and Pr3.13 Deceleration time setup, set up sigmoid time with time width centering the inflection point of acceleration/deceleration.



Pr3.15	Speed zero-clamp function selection	Range	unit	default	Related control mode		
		0 -3	-	0		S	

1. If Pr3.15=0, the function of zero clamp is forbidden. It means the motor rotates with actual velocity which is controlled by the analog voltage input 1 even if the velocity is less than 10 rpm. The motor runs no matter what the value of Pr3.16 is. The actual velocity is controlled by external the analog voltage input .
2. If Pr3.15=1 and the input signal of Zero Speed is available in the same time, the function of zero clamp works. It means motor will stop rotating in servo-on condition no matter what the velocity of motor is, and motor stop rotating no matter what the value of Pr3.16 is.
3. If Pr3.15=2 , the function of zero clamp belongs to the value of Pr3.16. If the actual velocity is less than the value of Pr3.16, the motor will stop rotating in servo-on condition.

Pr3.16	Speed zero-clamp level	Range	unit	default	Related control mode		
		0 -20000	r/min	30		S	

When analog speed given value under speed control mode less than zero speed clamp level setup, speed command will set to 0 strongly.

Pr3.17	Selection of torque command	Range	unit	default	Related control mode		
		0/1/2/3	-	0			T

Setup value	Torque command input	Velocity limit input
0	Analog input 3	Parameter value (P3.21)
1	Analog input 3	Analog input 1 for Speed limit
2	Parameter value (P3.22)	Parameter value (P3.21)
3	Analog input 3	Speed limit 0

Pr3.18	Torque command direction selection	Range	unit	default	Related control mode
Pr3.19	Torque command input gain	Range	unit	default	Related control mode

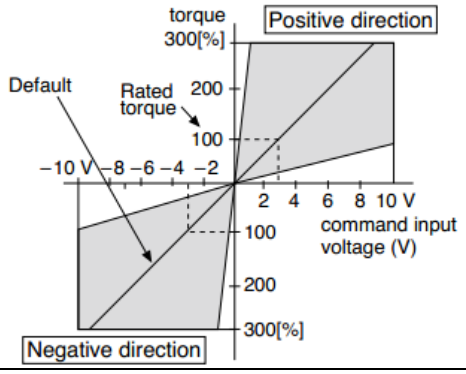
Select the direction positive/negative direction of torque command

Setup value	designation
0	Specify the direction with the sign of torque command Torque command input[+] → positive direction, [-] → negative direction
1	Specify the direction with torque command sign(TC-SIGN). OFF: positive direction ON: negative direction

		0 -1	-	500			T

Based on the voltage (V) applied to the analog torque command (TRQR),set up the conversion gain to torque command(%) .

- Unit of the setup value is [0.1V/100%] and set up input voltage necessary to produce the rated torque.
- Default setup of 30 represents 3V/100%



Pr3.20	Torque command input reversal	Range	unit	default	Related control mode		
		0 -1	-	0			T

Set up the polarity of the voltage applied to the analog torque command(TRQR).

Setup value	Direction of motor output torque	
0	Non-reversal	[+ voltage] → [+ direction] [- voltage] → [-direction]
1	reversal	[+ voltage] → [- direction] [- voltage] → [+direction]

Pr3.21	Speed limit value 1	Range	unit	default	Related control mode		
		0 -20000	r/min	0			T

Set up the speed limit used for torque controlling.
During the torque controlling, the speed set by the speed limit value cannot be exceeded.

Pr3.22	Torque command	Range	unit	default	Related control mode		
		0 -300	%	0	P	S	T

Set up the speed limit used for torque controlling.
During the torque controlling, the speed set by the speed limit value cannot be exceeded.

Pr3.24*	Motor rotate maximum speed limit	Range	unit	default	Related control mode		
		0 -6000	r/min	3000	P	S	T

Set up motor running max rotate speed, but can't be exceeded motor allowed max rotate speed.

Note: For parameters which No. have a suffix of "*",changed contents will be validated when you turn on the control power.

5.2.5【Class 4】I/F Monitor Setting

Pr4.00*	Input selection SI1	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.01*	Input selection SI2	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.02*	Input selection SI3	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.03*	Input selection SI4	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.04*	Input selection SI5	Range	unit	default	Related		

					control mode
		0-00FFFFFFh	-		P S T
Pr4.05*	Input selection SI6	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.06*	Input selection SI7	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.07*	Input selection SI8	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T
Pr4.08*	Input selection SI9	Range	unit	default	Related control mode
		0-00FFFFFFh	-		P S T

S Set SI1 input function allocation.

This parameter use 16 binary system to set up the values, as following :

00- - - - * * h: position control

00- - * * - - h: velocity control

00* * - - - - h: torque control

Please at [**] partition set up function number

For the function number, please refer to the following Figure.

Signal name	**symbol**	**Set value**	
		a-contact	**b- contact**
Invalid	-	00h	Do not setup
Positive direction over-travel inhibition input	POT	01h	81h
negative direction over-travel inhibition input	NOT	02h	82h
Servo-ON input	SRV-ON	03h	83h
Alarm clear input	A-CLR	04h	Do not setup
Control mode switching input	C-MODE	05h	85h
Gain switching input	GAIN	06h	86h
Deviation counter clear input	CL	07h	Do not setup
Command pulse inhibition input	INH	08h	88h
Electronic gear switching input 1	DIV1	0Ch	8Ch
Electronic gear switching input 2	DIV2	0Dh	8Dh
Selection 1 input of internal command speed	INTSPD1	0Eh	8Eh
Selection 2 input of internal command speed	INTSPD2	0Fh	8Fh
Selection 3 input of internal command speed	INTSPD3	10h	90h
Speed zero clamp input	ZEROSPD	11h	91h
Speed command sign input	VC-SIGN	12h	92h
Torque command sign input	TC-SIGN	13h	93h
Forced alarm input	E-STOP	14h	94h

Note:

5. a-contact means input signal comes from external controller or component ,for example: PLC .
6. b-contact means input signal comes from driver internally.
7. Don't setup to a value other than that specified in the table .
8. Don't assign specific function to 2 or more signals. Duplicated assignment will cause Err21.0 I/F input multiple assignment error 1or Err21.1 I/F input multiple assignment error 2.

Pr related input setup as below:

Input			
Signal name	symbol	Set value	
		Normal open	Normal close
Trigger command	CTRG	20h	A0h
Homing signal	HOME	21h	A1h
Forced stop	STP	22h	A2h
Forward direction JOG	JOG+	23h	A3h
Opposite direction JOG	JOG-	24h	A4h
Forward limit	PL	25h	A5h

Reverse limit	NL	26h	A6h
Homing signal	ORG	27h	A7h
Road strength address 0	ADD0	28h	A8h
Road strength address 1	ADD1	29h	A9h
Road strength address 2	ADD2	2ah	Aah
Road strength address 3	ADD3	2bh	Abh
Torque switching	TC-SEL	09h	89h

NOTE: CTRG,HOME is edge triggered, but the valid level must be last more than 1ms.

Pr4.10*	Output selection SO1	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.11*	Output selection SO2	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.12*	Output selection SO3	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.13*	Output selection SO4	Range	unit	default	Related control mode		
		0-00FFFFFFh	-		P	S	T
Pr4.14*	Output selection SO5	Range	unit	default	Related control mode		
		0-00FFFFFFh			P	S	T
Pr4.15*	Output selection SO6	Range	unit	default	Related control mode		
		0-00FFFFFFh			P	S	T

Assign functions to SO1 outputs.
This parameter use 16 binary system do setup, as following :
00- - - - * * h: position control
00- - * * - - h: velocity control
00* * - - - - h: torque control
Please at [**] partition set up function number.
For the function number, please refer to the following Figure.

Signal name	**symbol**	**Setup value**
Invalid	-	00h
Alarm output	Alm	01h
Servo-Ready output	S-RDY	02h
Eternal brake release signal	BRK-OFF	03h
Positioning complete output	INP	04h
At-speed output	AT-SPPED	05h
Zero-speed detection output	ZSP	07h
Velocity coincidence output	V-COIN	08h
Positional command ON/OFF output	P-CMD	0Bh
Speed command ON/OFF output	V-CMD	0Fh

Pr related output setup as below;

output			
Signal name	symbol	Set value	
		Normal open	Normal close
Command complete	CMD-OK	20h	A0h
Road strength address	MC-OK	21h	A1h
Homing finish	HOME-OK	22h	A2h
Torque limit	TQL	06h	86h

Note: CMD-OK indicates PR command sent complete, but the motor may not in-position.
MC-OK indicates command complete and the motor in-position.

*1 Pay attention to the front panel display is hexadecimal.

Pr4.22	Analog input 1 (AI1) offset setup	Range	unit	default	Related control mode
		-5578 -5578	-	0	S

Set up the offset correction value applied to the voltage fed to the analog input 1.

Pr4.23	Analog input 1 (AI1) filter	Range	unit	default	Related control mode
		0-6400	0.01ms	0	S

Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 1.

Pr4.24	Analog input 1 (AI1) over -voltage setup	Range	unit	default	Related control mode
		0-100	0.1v	0	S

Set up the excessive level of the input voltage of analog input 1 by using the voltage associated with offset.

Pr4.28	Analog input 3 (AI3) offset setup	Range	unit	default	Related control mode
		0 -1	-	500	T

Set up the offset correction value applied to the voltage fed to the analog input 3.

Pr4.29	Analog input 3 (AI3) filter	Range	unit	default	Related control mode
		0 -1	-	500	T

Set up the time constant of 1st delay filter that determines the lag time behind the voltage applied to the analog input 3.

Pr4.30	Analog input 3 (AI3) overvoltage setup	Range	unit	default	Related control mode
		0 -1	-	500	T

Set up the excessive level of the input voltage of analog input 3 by using the voltage associated with offset.

Pr4.31	Positioning complete range	Range	unit	default	Related control mode
		0 -10000	Encoder unit	10	P

Set up the timing of positional deviation at which the positioning complete signal (INP1) is output.

Pr4.32	Positioning complete range	Range	unit	default	Related control mode
		0 -3	command unit	10	P

Select the condition to output the positioning complete signal (INP1).

Setup value	Action of positioning complete signal
0	The signal will turn on when the positional deviation is smaller than Pr4.31 [positioning complete range].
1	The signal will turn on when there is no position command and position deviation is smaller than Pr4.31 [positioning complete range].

2	The signal will turn on when there is no position command, the zero-speed detection signal is ON and the positional deviation is smaller than Pr4.31 [positioning complete range].
3	The signal will turn on when there is no position command and the positional deviation is smaller than Pr4.31 [positioning complete range].Then holds "ON" states until the next position command is entered. Subsequently, ON state is maintained until Pr4.33 INP hold time has elapsed. After the hold time, INP output will be turned ON/OFF according to the coming positional command or condition of the positional deviation.

Pr4.33	INP hold time	Range	unit	default	Related control mode		
		0-30000	1ms	0	P		

Set up the hold time when Pr 4.32 positioning complete output setup=3.

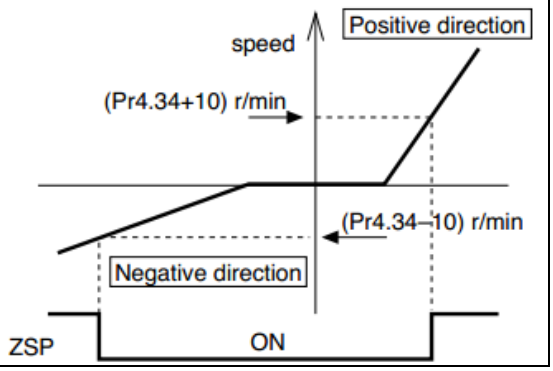
Setup value	State of Positioning complete signal
0	The hold time is maintained definitely, keeping ON state until next positional command is received.
1-30000	ON state is maintained for setup time (ms)but switched to OFF state as the positional command is received during hold time.

Pr4.34	Zero-speed	Range	unit	default	Related control mode		
		10 -20000	r/min	50	P	S	T

You can set up the timing to feed out the zero-speed detection output signal(ZSP or TCL) in rotate speed (r/min).

The zero-speed detection signal(ZSP) will be fed out when the motor speed falls below the setup of this parameter, Pr4.34

- the setup of pr4.34 is valid for both positive and negative direction regardless of the motor rotating direction.
- There is hysteresis of 10[r/min].



Pr4.35	Speed coincidence range	Range	unit	default	Related control mode		
		10 -20000	r/min	50		S	

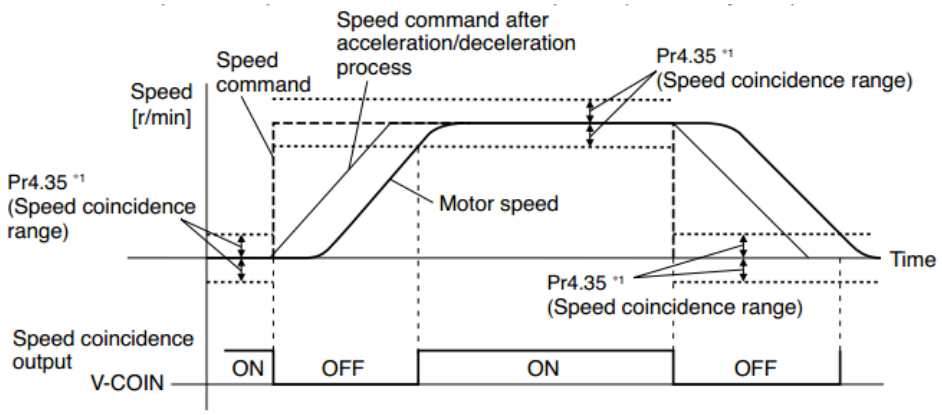
Set the speed coincidence (V-COIN) output detection timing.

Output the speed coincidence (V-COIN) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter.

Because the speed coincidence detection is associated with 10 r/min hysteresis, actual detection range is as shown below.

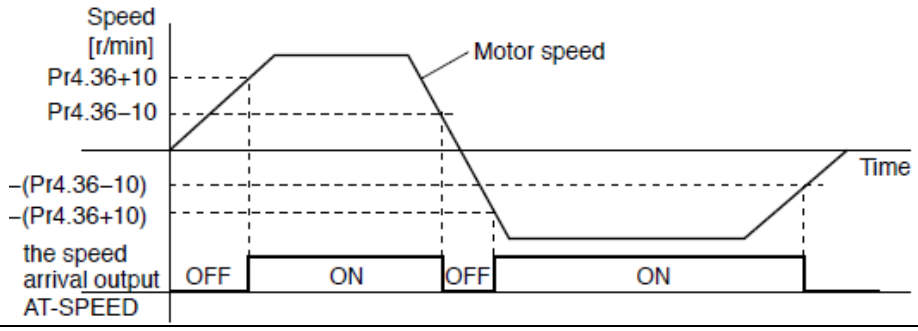
Speed coincidence output OFF -> ON timing (Pr4.35 -10) r/min

Speed coincidence output ON -> OFF timing (Pr4.35 +10) r/min



Pr4.36	At-speed(Speed arrival)	Range	unit	default	Related control mode		
		10-20000	r/min	1000		S	

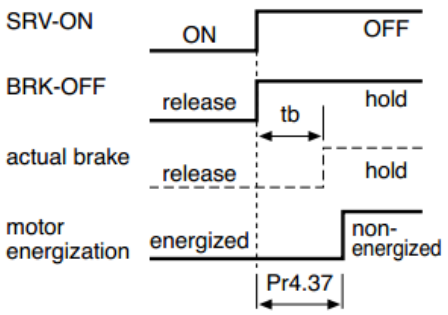
Set the detection timing of the speed arrival output (AT-SPEED).
When the motor speed exceeds this setup value, the speed arrive output (AT-SPEED) is output.
Detection is associated with 10r/min hysteresis .



Pr4.37	Mechanical brake action at stalling setup	Range	unit	default	Related control mode		
		0 -10000	1ms	0	P	S	T

Motor brake delay time setup, mainly used to prevent servo on “galloping “phenomenon.
Set up the time from when the brake release signal(BRK-OFF) turns off to when the motor is de-energized (servo-free),when the motor turns to servo-off while the motor is at stall

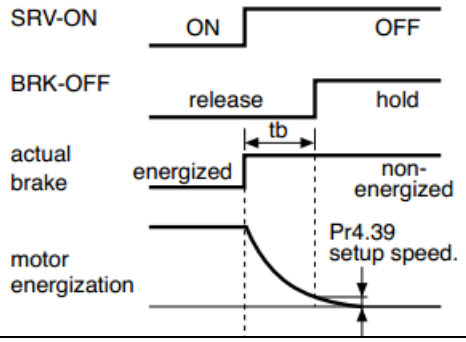
- Set up to prevent a micro-travel/drop of the motor (work) due to the action delay time(tb) of the brake.
- After setting up Pr4.37>=tb, then compose the sequence so as the driver turns to servo-off after the brake is actually activated.



Pr4.38	Mechanical brake action at running setup	Range	unit	default	Related control mode		
		0 -10000	1ms	0	P	S	T

Mechanical brake start delay time setup, mainly used to prevent servo off "galloping "phenomenon. Set up time from when detecting the off of servo-on input signal(SRV-ON)is to when external brake release signal(BRK-OFF)turns off, while the motor turns to servo off during the motor in motion.

- Set up to prevent the brake deterioration due to the motor running.
- At servo-OFF during the motor is running , tb of the right fig will be a shorter one of either Pr4.38 setup time, or time lapse till the motor speed falls below Pr4.39 setup speed.



Pr4.39	Brake release speed setup	Range	unit	default	Related control mode		
		30 -3000	1ms	30	P	S	T

When servo off, rotate speed less than this setup vale, and mechanical brake start delay time arrive, motor lost power.

5.2.6【Class 5】Extended Setup

Pr5.00	2nd numerator of electronic gear	Range	unit	default	Related control mode		
		1-32767	-	1	P	S	T
Pr5.01	3rd numerator of electronic gear	Range	unit	default	Related control mode		
		1-32767	-	1	P	S	T
Pr5.02	4th numerator of electronic gear	Range	unit	default	Related control mode		
		1-32767	-	1	P	S	T
Pr5.03*	Denominator of pulse output division	Range	unit	default	Related control mode		
		1-2500	-	2500	P	S	T

According to the command pulse input , set the 2nd to 4th numerator of electronic gear

DIV1	DIV2	numerator of electronic gear	denominator of electronic gear
OFF	OFF	Pr0.09	Pr5.03
ON	OFF	Pr5.00	Pr5.03
OFF	ON	Pr5.01	Pr5.03
ON	ON	Pr5.02	Pr5.03

For details, refer to Pr0.11 .

Pr5.04	Over-travel inhibit input setup	Range	unit	default	Related control mode		
		0/1/2	1ms	0	P	S	T

0: positive and negative limit effective, no alarm output;
1: positive and negative limit effective invalid;
2: positive and negative limit effective, alarm output;

Pr5.06	Sequence at servo-off	Range	unit	default	Related control mode		
		0-1	-	0	P	S	T

Specify the status during deceleration and after stop, after servo-off.

Setup value	during deceleration	After stop
0	emergency	Free-run
1	Free-run	Free-run

Pr5.08	LV trip selection at main power OFF	Range	unit	default	Related control mode		
		0-1	-	0	P	S	T

You can select whether or not to activate Err0d.0 (main power under-voltage protection)function while the main shutoff continues for the setup of Pr5.09(The main power-OFF detection time).

Setup value	Action of main power low voltage protection
0	When the main power is shut off during Servo-On,Err0d.0 will not be triggered and the driver turns to Servo-OFF. The driver returns to Servo-On again after the main power resumption.
1	When the main power is shut off during Servo-On, the driver will trip due to Err0d.0

Caution: Err0d.0(main power under-voltage protection) is trigged when setup of Pr5.09 is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff , regardless of the Pr5.08 setup.

Pr5.09*	The main power-OFF detection time	Range	unit	default	Related control mode		
		70-2000	1ms	70	P	S	T

You can set up the time to detect the shutoff while the main power is kept shut off continuously. The main power off detection is invalid when you set up this to 2000.

Pr5.11*	Torque setup for emergency stop	Range	unit	default	Related control mode		
		0-500	%	0	P	S	T

Set up the torque limit at emergency stop

When setup value is 0, the torque limit for normal operation is applied.

Pr5.12	Over-load level setup	Range	unit	default	Related control mode		
		0-115	%	0	P	S	T

You can set up over-load level. The overload level becomes 115% by setting up this value to 0.

Use this with 0 setup in normal operation, set up other value only when you need to low this over-load level.

The setup value of this parameter is limited by 115% of the motor rating.

Pr5.13	Over-speed level setup	Range	unit	default	Related control mode		
		0-20000	r/min	0	P	S	T

If the motor speed exceeds this setup value, Err1A.0 [over-speed protect] occurs.
The over-speed level becomes 1.2 times of the motor max, speed by setting up this to 0.

Pr5.15*	I/F reading filter	Range	unit	default	Related control mode		
		0-255	0.1ms	0	P	S	T

I/O input digital filtering; higher setup will arise control delay.

Pr5.17	Counter clear input mode	Range	unit	default	Related control mode		
		0-4	--	3	P		

Set up the clearing conditions of the counter clear input signal

Setup value	Clear condition
0/2/4	invalid
1	Always clear
3	Only clear one time

.

Pr5.18	Invalidation of command pulse inhibit input	Range	unit	default	Related control mode		
		0-1	--	1	P		

Set up the clearing conditions of the counter clear input signal

Setup value	Clear condition
0	valid
1	invalid

.

Pr5.20	Position setup unit select	Range	unit	default	Related control mode		
		0-2	-	0	P		

Specify the unit to determine the range of positioning complete and excessive positional deviation

Setup value	unit
0	Encoder unit
1	Command unit
2	Standard 2500-line unit

Pr5.21	Selection of torque limit	Range	unit	default	Related control mode		
		0-2	--	0	P	S	T

Set up the torque limiting method;

Setup value		Limiting value
0		PR0.13
1		PR5.22
2	TL-SEL off	PR0.13
	TL-SEL on	PR5.22

Pr5.22	2nd torque limit	Range	unit	default	Related control mode		
		0-500	%	300	P	S	T

Set up the 2nd limit value of the motor torque output

The value of the parameter is limited to the maximum torque of the applicable motor.

Pr5.28*	LED initial status	Range	unit	default	Related control mode		
		0-35	-	1	P	S	T

You can select the type of data to be displayed on the front panel LED (7-segment) at the initial status after power-on.

Setup value	content	Setup value	content	Setup value	content
0	Positional command deviation	10	I/O signal status	27	Voltage across PN [V]
1	Motor speed	11	Analog input value	28	Software version
2	Positional command speed	12	Error factor and reference of history	29	Driver serial number
3	Velocity control command	16	Inertia ratio	30	Motor serial number
4	Torque command	17	Factor of no-motor running	31	Accumulated operation time
5	Feedback pulse sum	23	Communication axis address	33	Temperature information
6	Command pulse sum	24	Encoder positional deviation[encoder unit]	36	Safety condition monitor
9	Control mode				

Pr5.29*	baud rate setup of RS232 communication	Range	unit	default	Related control mode		
		0-6	-	5	P	S	T

You can set up the communication speed of RS232.

Pr5.30*	baud rate setup of RS485 communication	Range	unit	default	Related control mode		
		0-6	-	2	P	S	T

You can set up the communication speed of RS485.

Set value	Baud rate	Set value	Baud rate
0	2400bps	4	38400bps
1	4800bps	5	57600bps
2	9600bps	6	115200bps
3	19200bps		

Baud rate error is 2400-38400bps ±5% ,57600-115200bps ±2%

Pr5.31*	RS485 slave axis address	Range	unit	default	Related control mode		
		0-127	-	1	P	S	T

During communication with the host (e.g. PC) to control multiple shafts, the shaft being accessed by the host should be identified.
Notice: when using RS232/RS485, the maximum valid value is 31.

Pr5.32	Command pulse input maximum setup	Range	unit	default	Related control mode		
		0--4000	-KHZ	0	P		

Set the maximum number of pulses to be used as command pulse input, if the number of the input pulse exceeds the setup value ,ERR1B0 command pulse input frequency error protection occurs.

Pr5.34	Controller communication port select	Range	unit	default	Related control mode		
		0,1	-	0	P	S	T

0: controller communication by RS232
1: controller communication by RS485

Pr5.35*	Front panel lock setup	Range	unit	default	Related control mode		
		0-1	-	0	P	S	T

Lock the operation on the front panel.

Setup value	content
0	No limit on the front panel operation
1	Lock the operation on the front panel

Pr5.36	7th setting parameters open	Range	unit	default	Related control mode		
		0,102	-	0	P	S	T

7th setting parameters open.

Setup value	content
0	
102	Open 7th setting parameters modification authority.

5.2.7【Class 6】Special Setup

Pr6.03	JOG trial run command torque	Range	unit	default	Related control mode		
		0 -100	%	0			T

You can set up the command speed used for JOG trial run (torque control).

Pr6.04	JOG trial run command speed	Range	unit	default	Related control mode		
		0-500	r/min	300	P	S	T

You can set up the command speed used for JOG trial run (velocity control).

Pr6.05	Position 3rd gain multiplication	Range	unit	default	Related control mode		
		0--1000	0.1ms	0	P		

Set up the time at which 3rd gain becomes valid.
When not using this parameter, set PR6.05=0, PR6.06=100
This is valid for only position control/full-closed control.

Pr6.06	Position 3rd gain valid time	Range	unit	default	Related control mode		
		0--1000	0.1ms	0	P		

Set up the 3rd gain by multiplying factor of the 1st gain

3rd gain= 1st gain * PR6.06/100

Pr6.07	JOG trial run command speed	Range	unit	default	Related control mode

		-100-100	%	0	P	S	T
Pr6.08	JOG trial run command speed	Range	unit	default	Related control mode		
		-100-100	%	0	P	S	T
Pr6.09	JOG trial run command speed	Range	unit	default	Related control mode		
		-100-100	%	0	P	S	T
This three parameters may apply feed forward torque superposition directly to torque command.							

Pr6.13	2nd inertia ratio	Range	unit	default	Related control mode		
		0-1000	%	0	P	S	T
Set up 2nd inertia ratio Set up the ratio of the load inertia against the rotor of the motor ratio. PR6.13= (load inertia/ rotor inertia) * 100 【%】							

Pr6.14	Emergency stop time at alarm	Range	unit	default	Related control mode		
		0-1000	1ms	200	P	S	T
Set up the time allowed to complete emergency stop in an alarm condition, exceeding this time puts this system in alarm state.							
Pr6.20	Trial run distance	Range	unit	default	Related control mode		
		0-200	0.1rev	10	P		
The distance of running each time in JOG run(position control)							

Pr6.21	Trial run waiting time	Range	unit	default	Related control mode		
		0-30000	Ms	1000	P		
The waiting time after running each time in JOG run(position control)							
Pr6.22	Trial run cycle times	Range	unit	default	Related control mode		
		0-32767	-	10	P		
The cycling times of JOG run(position control)							

Pr6.25	Acceleration of trial running	Range	unit	default	Related control mode		
		0-32767	-	10	P		
Acceleration of trial running							
Pr6.26	Mode of trial running	Range	unit	default	Related control mode		
		0-32767	-	10	P		
Mode of trial running							

Pr7.19	Weak magnetic current	Range	unit	default	Related control mode		
		0-100	%	0	P	S	T
0: automatic operation Manual operation, do not set if you are not professional, to avoid motor demagnetization.							

Chapter 6 Alarm and Processing

6.1 Alarm List

Protection function is activated when an error occurs, the driver will stop the rotation of servo motor, and the front panel will automatically display the corresponding fault error code. The history of the error can be viewed on data monitoring mode. error logging submenu displays like:“d12Er”.

The error code displays like:

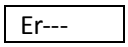


Figure 6-1 Panel Alarm Display

Table 6.1 Error Code List

Error code		content	Attribute		
Main	Sub		history	Immediate stop	Can be cleared
09	0~F	FPGA communication error	●		
0A	0~1	Current detection circuit error	●		
	2、4	Analog input circuit error	●		
	3	Power line（U、V、W）not connected	●		
	5	DC bus circuit error	●		
	6	Temperature detection circuit error	●		
0b	0	Control power under-voltage	●		
0c	0	DC bus over-voltage	●		●
0d	0	DC bus under-voltage	●		●
	2	Power line（U、V、W）not connected			●
0E	0	Over-current	●		
	1	over -current of intelligent power module(IPM)	●		
0F	0	Driver over-heat	●	●	
10	0	Motor over-load	●		●
	1	Driver over-load	●		●
12	0	Resistor discharged circuit overload	●	●	
	1	Brake error	●		
15	0	Encoder wiring error	●		
	1	Encoder data error	●		
	2	Encoder initial position error	●		
	3	Encoder battery low-voltage error	●		●
17	0	Encoder data error	●	●	

	1	Motor parameter error			
18	0	Too large position pulse deviation	•	•	•
	1	Too large velocity deviation	•	•	•
19	0	Vibration is too large	•	•	•
1A	0	Over-speed 1	•	•	•
	1	Speed out of control	•		•
21	0	I/F input interface allocation error	•		•
	1	I/F input interface function set error	•		•
	2	I/F output interface function set error	•		•
24	0	CRC verification error when EEPROM parameter saved			
26	0	Positive/negative over-range input valid	•	•	•
51	0	Compulsory alarm input valid	•	•	

Save: save this error history record
Emergency: error, driver will stop immediately
May remove: may through SI input/panel/software ACH Series remove alarm

6.2 Alarm Processing Method

When appear error, please clear error reason, renew power on

Error code	Main	Extra	**Display:** "Er 090" -- "Er 09F"
	09	0~F	**Content:** FPGA communication error

Cause	Confirmation	Solution
r,t terminal under-voltage	Check r,t terminal voltage	Make sure voltage of r.t terminal in proper range
Driver internal fault	/	replace the driver with a new one

Error code	Main	Extra	**Display:** "Er 0A0" -- "Er 0A1"
	0A	0~1	**Content:** current detection circuit error

Cause	Confirmation	Solution
Wiring error of motor output U,V,W terminal	Check wiring of motor output U,V,W terminal	Make sure motor U,V,W terminal wiring correctly
Main voltage R,S,T terminal voltage whether over-low	Check main voltage R,S,T terminal voltage	Make sure voltage of R,S,T terminal in proper range
Driver inner fault	/	replace the driver with a new one

Error code	Main	Extra	**Display:** "Er 0A2"、"Er 0A4"
	0A	2、4	**Content:** analog input circuit error

Cause	Confirmation	Solution
Analog input Wiring error	Check wiring of analog input	Make sure analog input wiring correctly
Driver inner fault	/	replace the driver with a new one

Error code	Main	Extra	Display: "Er 0A3"
	0A	3	Content: Power line（U、V、W）not connected

Cause	Confirmation	Solution
Power line（U、V、W）not connected	Check wiring of U、V、W	Make sure U、V、W wiring correctly
Motor inner fault	/	replace the motor with a new one

Error code	Main	Extra	Display: "Er 0A5"
	0A	5	Content: DC bus circuit error

Cause	Confirmation	Solution
Main voltage R,S,T terminal under-voltage	Check R,S,T terminal voltage	Make sure voltage of R,S,T terminal in proper range
Driver inner fault	/	replace the driver with a new one

Error code	Main	Extra	Display: "Er 0A6"
	0A	6	Content: temperature detection circuit error

Cause	Confirmation	Solution
r,t terminal under-voltage	Check r,t terminal voltage	Make sure voltage of r,t terminal in proper range
Driver inner fault	/	replace the driver with a new one

Error code	Main	Extra	Display: "Er 0b0"
	0b	0	Content: control power under-voltage

Cause	Confirmation	Solution
r,t terminal under-voltage	Check r,t terminal voltage	Make sure voltage of r,t terminal in proper range
Driver inner fault	/	replace the driver with a new one

Error code	Main	Extr	Display: "Er 0c0"
	0c	0	Content: DC bus over-voltage

Cause	Confirmation	Solution
Main power R,S,T terminal over-voltage	Check R,S,T terminal voltage	decrease R,S,T terminal Voltage
Inner brake circuit damaged	/	replace the driver with a new one
Driver inner fault	/	replace the driver with a new one

Error code	Main	Extra	Display: "Er 0d0"
	0d	0	Content: DC bus under-voltage

Cause	Confirmation	Solution
Main power L1,L2 terminal under-voltage	Check R,S,T terminal voltage	increase L1,L2 terminal Voltage
Driver inner fault	/	replace the driver with a new one

Error code	Main	Extra	Display: "Er 0E0"
	0E	0	Content: over-current

Cause	Confirmation	Solution
Short of driver output wire	Short of driver output wire, whether short circuit to PG ground or not	Assure driver output wire no short circuit, assure motor no damage
Abnormal wiring of motor	Check motor wiring order	Adjust motor wiring sequence
Short of IGBT module	Cut off driver output wiring, make srv_on available and drive motor, check whether over-current exists	replace the driver with a new one
abnormal setting of control parameter	Modify the parameter	Adjust parameter to proper range
abnormal setting of control command	Check control command whether command changes too violently or not	Adjust control command: open filter function

Error code	Main	Extra	Display: "Er 0E1"
	0E	1	Content: IPM over-current

Cause	Confirmation	Solution
Short of driver output wire	Short of driver output wire, whether short circuit to PG ground or not	Assure driver output wire no short circuit, assure motor no damage
Abnormal wiring of motor	Check motor wiring order	Adjust motor wiring sequence
Short of IGBT module	Cut off driver output wiring, make srv_on available and drive motor, check whether over-current exists or not	replace the driver with a new one
Short of IGBT module	/	replace the driver with a new one
abnormal setting of control parameter	Modify the parameter	Adjust parameter to proper range
abnormal setting of control command	Check control command whether command changes too violently or not	Adjust control command: open filter function

Error code	Main	Extra	Display: "Er 0F0"
	0F	0	Content: driver over-heat

Cause	Confirmation	Solution
the temperature of power module have exceeded upper limit	Check driver radiator whether the temperature is too high or not	Strengthen cooling conditions, promote the capacity of driver and motor, enlarge acceleration/deceleration time, reduce load

Error code	Main	Extr	Display: "Er 100"
	10	0	Content: motor over-load

Cause	Confirmation	Solution
Load is too heavy	Check actual load if the value of parameter exceed maximum or not	Decrease load, adjust limit parameter
Oscillation of machine	Check the machine if oscillation exists or not	Modify the parameter of control loop; enlarge acceleration/deceleration time
wiring error of motor	Check wiring if error occurs or not, if line breaks or not	Adjust wiring or replace encoder/motor for a new one
electromagnetic	Check brake terminal voltage	Cut off brake

brake engaged		

Error code	Main	Extra	**Display:** “Er 101”
	10	1	**Content:** Driver over-load

Cause	Confirmation	Solution
wiring error of motor power line	Check U、V、W wiring if error occurs or not, if line breaks or not	Check U、V、W wiring if error occurs or not, if line breaks or not
Motor dosen’t match the driver	Driver over-current	Motor current exceed driver current

Error code	Main	Extra	**Display:** “Er 120”
	12	0	**Content:** Resistance discharge circuit over-load

Cause	Confirmation	Solution
Regenerative energy has exceeded the capacity of regenerative resistor .	Check the speed if it is too high. Check the load if it is too large or not.	lower motor rotational speed; decrease load inertia ,increase external regenerative resistor, improve the capacity of the driver and motor
Resistance discharge circuit damage	/	Increase external regenerative resistor, replace the driver with a new one

Error code	Main	Extra	**Display:** “Er 121”
	12	1	**Content:** braking error

Cause	Confirmation	Solution
Braking circuit damage	Braking resistor short circuit	Change a new braking resistor
	Braking IGBT damaged	Repair IGBT

Error code	Main	Extra	**Display:** “Er 150”
	15	0	**Content:** encoder line breaked

Cause	Confirmation	Solution
Encoder line disconnected	check wiring if it steady or not	Make encoder wiring steady
Encoder wiring error	Check encoder wiring if it is correct or not	Reconnect encoder wiring
Encoder damaged	/	replace the motor with a new one
Encoder measuring circuit damaged	/	replace the driver with a new one

Error code	Main	Extra	**Display:** “Er 151”
	15	1	**Content:** encoder data error

Cause	Confirmation	Solution
Encoder data error	Check for interference	Anti-interference treatment

Error code	Main	Extr	**Display:** “Er 152”
	15	2	**Content:** initialized position of encoder error

Cause	Confirmation	Solution

Communication data abnormal	Check encoder power voltage if it is DC5V ± 5% or not; check encoder cable and shielded line if it is damaged or not; check encoder cable whether it is intertwined with other power wire or not	Ensure power voltage of encoder normally, ensure encoder cable and shielded line well with FG ground, ensure encoder cable separated with other power wire
Encoder damaged	/	replace the motor with a new one
Encoder measuring circuit damaged	/	replace the driver with a new one

Error code	Main	Extr	**Display:** "Er 153"
	15	3	**Content:** encoder battery under voltage

Cause	Confirmation	Solution
Multi-turn absolute encoder power off	Check battery	Change a battery
	/Check motor	Motor damaged, replace the motor with a new one
	/Clear drive alarm	Clear alarm after changing battery

Error code	Main	Extra	**Display:** "Er 170"
	17	0	**Content:** encoder data error

Cause	Confirmation	Solution
Communication data abnormal	Check encoder power voltage if it is DC5V ± 5% or not ; check encoder cable and shielded line if it is damaged or not; check encoder cable whether it is intertwined with other power wire or not	Ensure power voltage of encoder normally, ensure encoder cable and shielded line well with FG ground, ensure encoder cable separated with other power wire
Encoder damaged	/	replace the motor with a new one
Encoder measuring circuit damaged	/	replace the driver with a new one

Error code	Main	Extra	**Display:** "Er 171"
	17	1	**Content:** motor parameters error

Cause	Confirmation	Solution
Motor parameters error		Input motor parameters to match with driver or replace the motor with a new one

Error code	Main	Extra	**Display:** "Er 180"
	18	0	**Content:** position error over-large error

Cause	Confirmation	Solution
Unreasonable set of position error parameter	Check parameter PA_014 value if it is too small or not	Enlarge the value of PA_014
Gain set is too small	Check parameter PA_100, PA_105 value if it is too small or not	Enlarge the value of PA_100, PA_105
Torque limit is too small	Check parameter PA_013, PA_522 value whether too small or not	Enlarge the value of PA_103, PA_522
Outside load is too large	Check acceleration/ deceleration time if it is too small or not , check motor rotational speed if it is too big or not ; check load if	Increase acceleration/ deceleration time decrease speed, decrease load

	it is too large or not	

Error code	Main	Extra	**Display:** "Er 181"
	18	1	**Content:** velocity error over-large error

Cause	Confirmation	Solution
The deviation of inner position command velocity is too large with actual speed	Check the value of PA_602 if it is too small or not	Enlarge the value of PA_602, or set the value to 0, make position deviation over-large detection invalid
The acceleration/ decelerate time Inner position command velocity is too small	Check the value of PA_312, PA_313 if it is too small or not	Enlarge the value of PA_312, PA_313. adjust gain of velocity control, improve trace performance.

Error code	Main	Extra	**Display:** "Er 190"
	19	0	**Content:** motor vibration

Cause	Confirmation	Solution
Current vibration	Current vibration	Cut down the value of Pr003. Pr004
Stiffness is too strong	Stiffness is too strong	

Error code	Main	Extra	**Display:** "Er 1A0"
	1A	0	**Content:** over-speed 1

Cause	Confirmation	Solution
Motor speed has exceeded the first speed limit (PA_321)	Check speed command if it is too large or not; check the voltage of analog speed command if it is too large or not; check the value of PA_321 if it is too small or not; check input frequency and division frequency coefficient of command pulse if it is proper or not; check encoder if the wiring is correct or not	Adjust the value of input speed command, enlarge the value PA_321 value, modify command pulse input frequency and division frequency coefficient, assure encoder wiring correctly

Error code	Main	Extra	**Display:** "Er 1A1"
	1A	1	**Content:** speed out of control

Cause	Confirmation	Solution
Control maladjustment	UVW wrong connection	
Encoder error	Monitor D30 count increasing	Anti-interference treatment or change motor
Special application	The rotation direction of the motor is opposite with motor force direction.	The special assessment of practical application, set 0 to 4 for PA137 to shield ERR1A1 alarm.

Error code	Main	Extra	**Display:** "Er 1b0"
	1b	0	**Content:** input pulse format incorrect or out of frequency

Cause	Confirmation	Solution
The input pulse frequency is too high	Too high pulse frequency	To decrease pulse input frequency, less than 500K

Error code	Main	Extra	Display: "Er 161"
	16	1	**Content:** incorrect electronic gear ratio

Cause	Confirmation	Solution
Out of range	Numerator denominator is zero, or setting values out of range	Reduce the number of pulses per revolution

Error code	Main	Extra	Display: "Er 210"
	21	0	**Content:** I/F input interface allocation error

Cause	Confirmation	Solution
The input signal are assigned with two or more functions.	Check the value of PA_400, PA_401, PA_402,PA_403,PA_404 if it is proper or not	Assure the value of PA_400, PA_401, PA_402, PA_403, PA_404 set correctly
The input signal aren't assigned with any functions.	Check the value of PA_400, PA_401,PA_402,PA_403,PA_404 if it is proper or not	Assure parameter PA_400, PA_401, PA_402,PA_403,PA_404 set correctly

Error code	Main	Extra	Display: "Er 211"
	21	1	**Content:** I/F input interface function set error

Cause	Confirmation	Solution
Signal allocation error	Check the value of PA_400, PA_401, PA_402,PA_403,PA_404 if it is proper or not	Assure the value of PA_400, PA_401, PA_402, PA_403, PA_404 set correctly

Error code	Main	Extra	Display: "Er 212"
	21	2	**Content:** I/F input interface function set error

Cause	Confirmation	Solution
The input signal are assigned with two or more functions.	Check the value of PA_410, PA_411, PA_412, PA_413, if it is proper or not	Assure the value of PA_410, PA_411, PA_412,PA_413 set correctly
The input signal aren't assigned with any functions.	Check the value of PA_410, PA_411, PA_412, PA_413, if it is proper or not	Assure the value of PA_410, PA_411,PA_412,PA_413 set correctly

Error code	Main	Extra	Display: "Er 240"
	24	0	**Content:** CRC verification error when EEPROM parameter is saved

Cause	Confirmation	Solution
r,t terminal under-voltage	Check r,t terminal voltage	Assure r,t terminal voltage in proper range
Driver is damaged	save the parameters for several times	replace the driver with a new one
The setting of driver maybe default setting which isn't	Check the setting of driver if it is suitable for your motor	Download the suitable project file to driver for motor

suitable for motor .		

Error code	Main	Extra	Display: "Er 260"
	26	0	**Content:** positive negative over-travel input valid

Cause	Confirmation	Solution
positive /negative over-travelling input signal has been conducted	Check the state of positive negative over-travel input signal	/

Error code	Main	Extra	Display: "Er 270~ Er 272"
	27	0~2	**Content**: analog input out of range

Cause	Confirmation	Solution
Analog input out of range		Try to adjust analog input within limited range

Error code	Main	Extra	Display: " Er 570"
	57	0	**Content**: forced alarm input valid

Cause	Confirmation	Solution
Forced-alarm input signal has been conducted	Check forced-alarm input signal	Assure input signal wiring correctly

6.3 Alarm clear

For alarm can be cleared:

1、Use auxiliary function "AF_ACL"

a. Press M to select auxiliary function

b. Press SET to enter into "AF_ACL"

c. Press and hold ◀ to clear the alarm

2、Set IO input function as Alarm clear input " (A-CLR)", refer to switch input interface connection to clear the alarm

For alarm can not be cleared:

1、 Restart the power-supply to clear the alarm.

Chapter 7 Display and Operation

7.1 Introduction

The operation interface of servo driver consists of six LED nixie tubes and five key , which are used for servo driver's status display and parameter setting. The inter face layout is as follows :

Figure 7-1 front panel

Table 7.1 The name and function of keys

Name	Key	Function
Display	/	There are 6 LED nixie tubes to display monitor value, parameter value and set value
Key of mode switch	**M**	Press this key to switch among 4 mode: 1.data monitor mode 2.parameter setting mode 3.auxiliary function mode 4.EEPROM written mode
Confirming key	**SET**	Entrance for submenu, confirming input
Up key	▲	Press this key to increase the set value of current flash bit
Down key	▼	Press this key to decrease the set value of current flash bit
Left key	◄	Press this key to shift to the next digit on the left

7.2 Panel Display and Operation

7.2.1 Panel Operation Flow Figure

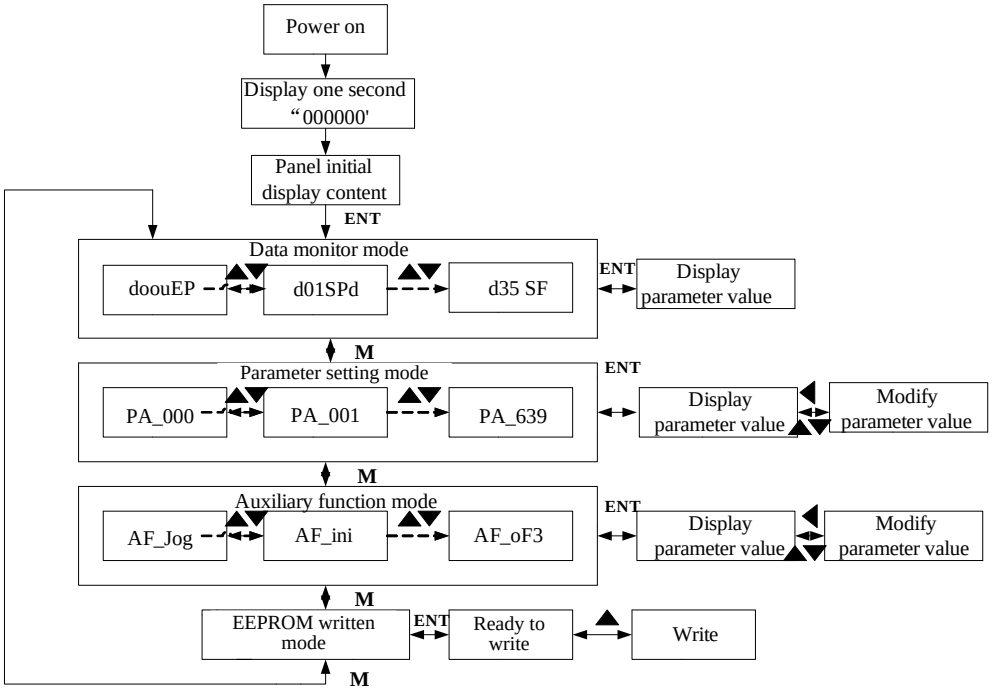


Figure 7-2 the flow diagram of panel operation

(1) The front panel display rEAdY for about one second firstly after turning on the power of the driver. Then if no abnormal alarm occurs, monitor mode is displayed with the value of initial parameter ; otherwise, abnormal alarm code is displayed.

(2) Press M key to switch the data monitor mode → parameter setting mode → auxiliary function mode → EEPROM written mode.

(3) If new abnormal alarm occurs, the abnormal alarm will be displayed immediately in abnormal mode no matter what the current mode is, press M key to switch to the other mode.

(4) In data monitor mode, press ▲ or ▼ to select the type of monitor parameter; Press ENT to enter the parameter type , then press ◀ to display the high 4 bits "H" or low 4 bits "L" of some parameter values.

(5) In parameter setting mode, press ◀ to select current editing bit of parameter No, press ▲ or ▼ to change current editing bit of parameters No. Press ENT key to enter the parameter setting mode of corresponding parameters No. Press ◀ to select current bit of parameter value when editing it, press ▲ or ▼ to change the value of the bit. Press ENT to save it and switch to the interface of parameter No.

7.2.2 Driver Operating Data Monitor

Table 7.2 Function List of Driver Monitor

Serial Number	Name	Specification	Display	Unit	Data Format (x, y is numerical value)
0	d00uE	Positional command deviation	d00uE	pulse	Low-bit "L xxxx" High-bit "H xxxx"
1	d01SP	Motor speed	d01SP	r/min	"r xxxx"
2	d02cS	Positional command speed	d02cS	r/min	"r xxxx"

3	d03cu	Velocity control command	d03Cu	r/min	“r xxxx”
4	d04tr	Torque command	d04tr	%	“r xxxx”
5	d05nP	Feedback pulse sum	d05nP	pulse	Low-bit “L xxxx” High-bit”H xxxx”
6	d06cP	Command pulse sum	d06CP	pulse	Low-bit “L xxxx” High -bit”H xxxx”
7	d07	/	d07	/	“ xxxx”
8	d08FP	External scale feedback pulse sum	d08FP	pulse	Low-bit “L xxxx” High -bit”H xxxx”
9	d09cn	Control mode	d09Cn	/	Position:“PoScn” Speed:”SPdcn” Torque:”trqcn” Composite mode” cnt”
10	d10Io	I/O signal status	d10 Io	/	Refer instructions for details
11	d11Ai	Analog input value	d11Ai	v	“x yyyy” x:AI1 A,AI2 b,AI3 c yyyy:value
12	d12Er	Error factor and reference of history	d12Er	/	“Er xxx”
13	d13 rn	Alarm display	d13rn	/	“m xxx”
14	d14 r9	Regeneration load factor	d14r9	%	“rg xxx”
15	d15 oL	Over-load factor	d15oL	%	“oL xxx”
16	d16Jr	Inertia ratio	d16Jr	%	“J xxx”
17	d17ch	Factor of no-motor running	d17Ch	/	“cP xxx”
18	d18ic	No. of changes in I/O signals	d18ic	/	“n xxx”
19	d19	/	d19	/	“ xxxx”
20	d20Ab	Absolute encoder data	d20Ab	pulse	Low-bit “L xxxx” High-bit”H xxxx”
21	d21AE	Absolute external scale position	d21AE	pulse	Low-bit “L xxxx” High -bit”H xxxx”
22	d22rE	No of Encoder/external scale communication errors monitor	d22rE	times	“n xxx”
23	d23 id	Communication axis address	d23id	/	“id xxx” “Fr xxx”
24	d24PE	Encoder positional deviation(encoder unit)	d24PE	pulse	Low-bit “L xxxx” High -bit”H xxxx”
25	d25PF	Encoder scale deviation (external scale unit)	d25PF	pulse	Low-bit “L xxxx” High -bit”H xxxx”
26	d26hy	hybrid deviation (command unit)	d26hY	pulse	Low-bit “L xxxx” High -bit”H xxxx”
27	d27 Pn	Voltage across PN [V]	d27Pn	V	“u xxx”
28	d28 no	Software version	d28no	/	“d xxx” “F xxx” “P xxx”
29	d29AS	Driver serial number	d29AS	/	“n xxx”
30	d30NS	Motor serial number	d30SE	/	Low-bit “L xxxx” High -bit”H xxxx”
31	d31 tE	Accumulated operation time	d31tE	/	Low-bit “L xxxx” High -bit”H xxxx”
32	d32Au	Automatic motor identification	d32Au	/	“r xxx”

33	d33At	Driver temperature	d33At	℃	“th xxx”
34	d34	/	d34	/	“t xxx”
35	d35 SF	Safety condition monitor	d35SF	/	“xxxxxx”

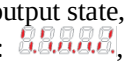
Instructions:

1、d01SP Motor speed

Driver display s 0 after power on, in disable state. While in enable state, display r 0. Motor speed display
r xxx. So users can distinguish in disable state or in enable state by display s 0 or r 0 .

2、d10 Io I/O signal status

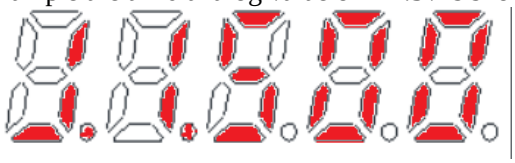
The upper half of the nixie tube is valid, the lower half is invalid, the decimal point represents the input and output state, lit represents the input, not bright represents the output

Input:  , from low to high, the order is SI1, SI2…SI10. The next figue represents SI1、SI8、SI10 input are valid, other inputs are invalid.

Output:  , from low to high, the order is SO1, SO2…SO10. The next figue represents SO1 output are valid, other inputs are invalid.

3、d11Ai Analog input value

d11Ai is used to monitor the state of the three channels of simulation. The horizontal line on the leftmost digital tube represents which channel of simulation, specifically, the horizontal line above represents the first channel of simulation, the horizontal line in the middle represents the second channel of simulation, and the horizontal line below represents the third channel of simulation. The analog display unit is 0.001V, and the fourth and fifth decimal places on the right represent negative signs. Analog monitoring switch by up and down keys. Example the third analog value of -11.5v is shown as follows:



4、Parameter high and low bit, positive and negative Numbers.

The highest and lowest digits of data and the signs are shown as follows. The first and second decimal points on the right are bright, indicating the data of high order. The two decimal points are not lit, indicating the data of low order. The fourth and fifth decimal places on the right indicate negative Numbers, otherwise positive Numbers

Users can choose to set the initial display state of power supply to any of the above:

Pr5.28*	LED initial status	Range	unit	default	Related control mode		
		0-36	-	1	P	S	T

You can select the type of data to be displayed on the front panel LED (7-segment) at the initial status after power-on.

Setup value	content	Setup value	content	Setup value	content
0	Positional command deviation	10	I/O signal status	27	Voltage across PN [V]
1	Motor speed	11	Analog input value	28	Software version

2	Positional command speed	12	Error factor and reference of history	29	Driver serial number
3	Velocity control command	16	Inertia ratio	30	Motor serial number
4	Torque command	17	Factor of no-motor running	31	Accumulated operation time
5	Feedback pulse sum	23	Communication axis address	33	Temperature information
6	Command pulse sum	24	Encoder positional deviation[encoder unit]	36	Safety condition monitor
9	Control mode				

Table 7.3 "d17 ch" Motor No Rotate Reason Code Definition

Code	Display Code	Specification	Content
0	cP 0	Working normally	
1	cP 1	DC bus under-voltage	/
2	cP 2	No entry of Srv-On input	The Servo-ON input (SRV-ON) is not connected to COM-
3	cP 3	POT/NOT input is valid	PA_504=0,POT is open , speed command is positive direction NOT is open , speed command is negative direction
4	cP 4	Driver fault	/
5	cP 5	The relay inside the driver isn't closed	/
6	cP 6	Pulse input prohibited (INH)	PA_518=0,INH is open
8	cP 8	CL is valid	PA_517=0,deviation counter clear is connected to COM-
9	cP 9	speed zero-clamp is valid	PA_315=1, speed zero-clamp is open

7.2.3 Auxiliary Function

Table 7.4 setting interface System parameter

No	Name	Specification	Display Code	Operation Flow
0	AFjog	Trial run	AFJoG	Please refer to the chapter of"trial run"
1	AFInI	Initialization of parameter	AFInI	1. press SET to enter operation, display "InI -"。 2.press ▲ once to display "InI---", indicated initialization; after finishing it, display"FinSh"。
2	AFunL	Release of front panel lock	AFunL	1. press SET to enter operation, display "unL -"。 2. press ▲button one time , display "FinSh",indicated unlock the panel successfully
3	AFAcL	Alarm clear	AFAcL	1. press SET to enter operation, display"AcL -"。 2. press ▲once , display "FinSh", indicated alarm clear successfully
4	AFoF1	A1 automatic offset adjustment	AFoF1	1.press SET to enter operation, display

				“oF1 -”。 2.press ▲once , display “StArt”, indication start correct, then display“FinSh”indicated correction finished。
5	AFoF2	A2 automatic offset adjustment	AFoF2	1.press SET to enter operation, display “oF2 -”。 2.press ▲once , display “StArt”, indicated start to correct the offset, then display“FinSh”indicated that correction finished。
6	AFoF3	A3 automatic offset adjustment	AFoF3	1.press SET to enter operation, display “oF3 -”。 2.press ▲once , display “StArt”, indicated start to correct the offset, then display“FinSh”indicated correction finished。
7	AFEnc	Motor Angle correction	AFEnc	1、 Press SET once to enter operation, display “Enc -” 2、 press ▲once , display “StArt”, indicated start to correct the angle, then display“FinSh”indicated correction finished
8	AF tUn	Reserved	AFtUn	
9	AF_GL	Inertia ratio identification	AF_GL	1、 Press SET once to enter operation, display “G---” 2、 Press ◀once， display “StUon” 3、 Press ▲， motor running， indicated start to identification 4、 Finishing， display G xxx， xxx indicated Inertia ratio value
10	AFrSt	Soft reset	AFrSt	1、 Press SET once to enter operation, display “rSt -” 2、 Press ▲ and hold on， display “StArt” Then， finished

Table 7.5 The Locked panel conditions

Mode	The Locked panel conditions
Monitor mode	No limitation: all monitored data can be checked.
Parameter set up mode	No parameter can be changed but setting can be checked.
Auxiliary function mode	Cannot be run except for” release of front panel lock”
EEPROM writing mode	No limitation

7.2.4 Saving parameter

Operation procedure:

1. press M to select EEPROM writing mode, display “EESEt”;

2. Press ENT to enter into writing mode operation:

3. Press and hold ▲, display LED from" EP -" to" EP--", then it become" EP---", finally it become" StArt", indicated EEPROM writing operation have been began;

4. "Error08" means that writing is unsuccessful， while "End5tA" show that the writing is successful; Follow steps 3 and 4 to repeat the operation; the drive may be damaged if repeat of several times still fails. The driver need to repair.

5. The driver need to power off and restart again if writing is successful .

NOTE: Don't turn off the power if EEPROM writing operation goes on, otherwise it may cause a writing wrong data; If this happens, please reset all the parameters ,then do EEPROM writing operation again.

7.2.6 Abnormal Alarm

The front panel will automatically enter the abnormal alarm display mode if driver error occurs while it displays the corresponding error code. Please refer to Chapter 6 of alarm processing about the detail of error code.

7.3 Trial Run

Attention

- Ground the earth terminal of the motor and driver without fail. the PE terminal of driver must be reliably connected with the grounding terminal of equipment.
- The driver power need with isolation transformer and power filter in order to guarantee the security and anti-jamming capability.
- Check the wiring to make sure correctness before power on.
- Install a emergency stop protection circuit externally, the protection can stop running immediately to prevent accident happened and the power can be cut off immediately.
- If drive alarm occurs, the cause of alarm should be excluded and Svon signal must be invalid before restarting the driver.
- The high voltage also will contain in several minutes even if the servo driver is powered off, please don't touch terminal strip or separate the wiring.
-

Note: there are two kinds of trial run : trial run without load and trial run with load . The user need to test the driver without load for safety first.

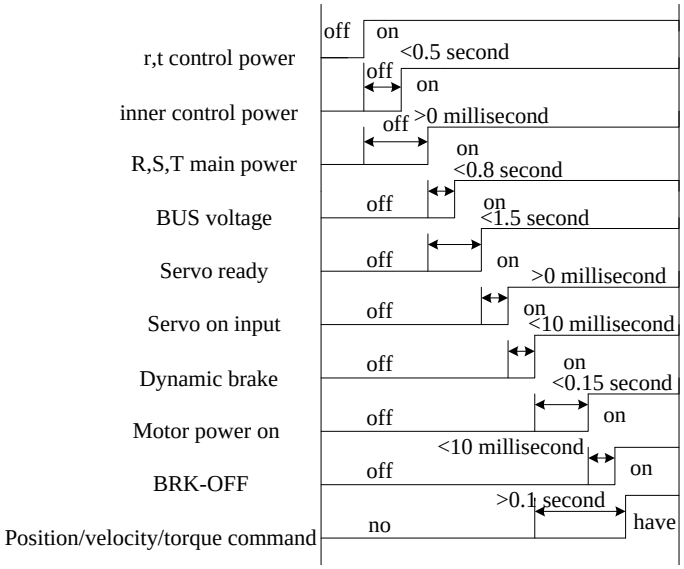
7.3.1 Inspection Before trial Run

Table7.6 inspection Item Before Run

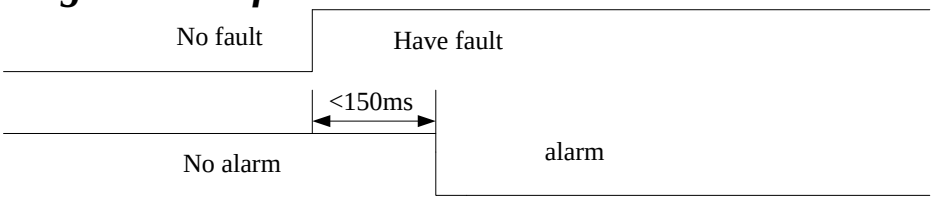
No	Item	Content
1	Inspection on wiring	1. Ensure the following terminals are properly wired and securely connected : the input power terminals, motor output power terminal ,encoder input terminal CN2, control signal terminal CN1, communication terminal CN4(it is unnecessary to connect CN1 andCN4 in Jog run mode) 2.short among power input lines and motor output lines are forbidden , and no short connected with PG ground.
2	Confirmation of power supply	1. The range of control power input r, t must be in the rated range. 2. The range of the main power input R, S, T must be in the rated range. 3. Single phase 220VAC input is sufficient if the power of driver is no more 1.5kw .
3	Fixing of position	the motor and driver must be firmly fixed
4	Inspection without load	the motor shaft must not be with a mechanical load.
5	Inspection on	1, all of the control switch must be placed in OFF state.

	control signal	2, servo enable input Srv_on must be in OFF state.

7.3.2 Timing chart on power-up



7.3.3 Timing chart on fault

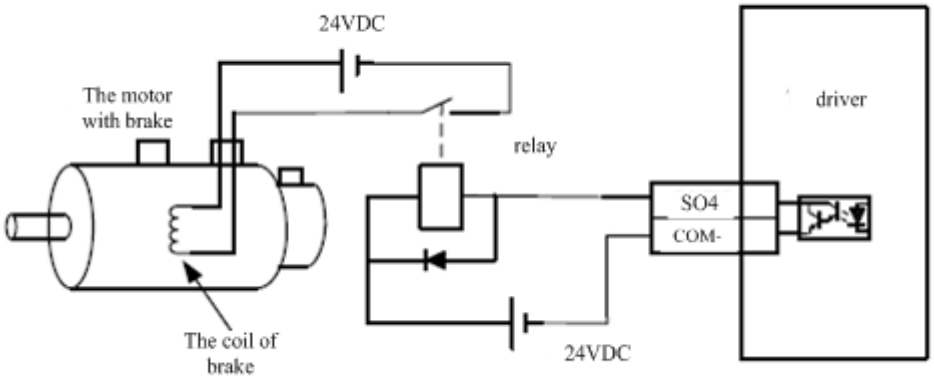


7.3.4 holding brake

In applications where the motor drives the vertical axis, this brake would be used to hold and prevent the work (moving load) from falling gravity while the power to the servo is shut off .

Never use this for "Brake" purpose to stop the load in motion.
Use this built-in brake for "holding" purpose only. That is to hold the stalling status.

For the brake release timing at power-on ,or braking timing at servo-off/servo-alarm while the motor is in motion ,refer to chapter 7.1.2 timing chart on power-up.
You can follow the diagram about the wiring below :



About the wire of brake ,there should be an 24VDC for brake, the brake will be loosed with the 24VDC input, and the driver give an output signal to control the connection or disconnection of the 24VDC , pin 31 and pin 35 of CN1 is the control signal , and it is forbidden to connect these signal directly for the power of 24VDC , it will destroy the hardware of servo driver.

And if you connect the pin31 and pin35 for controlling the brake , just make sure the setting value of Pr4.13. The default is 00000303h , if the driver works in torque mode , this value should be changed to 00030303h .

7.3.5 Trial Run Jog Control

After installation and connection is completed , check the following items before turning on the power:

Wiring ? (especially power input and motor output)
Short or grounded ?
Loose connection ?
Unstable mounting ?
Separation from the mechanical system ?

It is unnecessary to connect control signal terminal CN1 and communication terminal CN4 in Jog run mode. It is recommended that motor runs at low speed for safety, while the speed depends on the parameters below:
there are two different modes : **speed JOG mode** and **location JOG mode.**

Table 7.7 Parameter Setup of Velocity JOG

No	parameter	name	Set value	unit
1	PA_001	Control mode setting	1	/
2	PA_312	Acceleration time setup	User-specified	millisecond
3	PA_313	Deceleration time setup	User-specified	millisecond
4	PA_314	Sigmoid acceleration/deceleration time setup	User-specified	millisecond
5	PA_604	JOG trial run command speed	User-specified	rpm

Table 7.8 Parameter Setup of Position JOG

No	parameter	name	value	unit
1	PA_001	Control mode setting	0	/
2	PA_312	Acceleration time setup	User-specified	millisecond
3	PA_313	Deceleration time setup	User-specified	millisecond
4	PA_314	Sigmoid acceleration/deceleration time setup	0	millisecond
5	PA_604	JOG trial run command speed	User-specified	rpm
6	PA_620	distance of trial running	User-specified	0.1 rotation
7	PA_621	waiting time of trial running	User-specified	millisecond
8	PA_622	cycling times of trial running	User-specified	times

◆JOG trial run operation process

1. set all parameters above corresponding to velocity JOG or position JOG ;

2. Enter EEPROM writing mode, and save the value of modified parameters ;

3. The driver need to restart after the value is written successfully;

4. Enter auxiliary function mode, and go to "AF JoG "sub-menu;

5. Press ENT once, and display JoG - ";

6. Press once, and display " Sruon " if no exception occurs; press once again if " Error " occurs, it should display " Sruon "; If " Error " still occurs, please switch to data monitoring mode " diAG "sub-menu, find the cause why motor doesn't rotate, fix the trouble and try again;

7. In position JOG mode, the motor will rotate directly; if motor doesn't rotate, switch to data monitoring mode diAG "sub-menu, find the cause why motor doesn't rotate, fix the trouble and try again;

In speed JOG mode, press once, the motor rotates once (hold will make motor rotating to value of

PA_604); press once, the motor rotates once (hold will make motor rotating to value of PA_ 604); if motor doesn't rotate, switch to data monitoring mode d17 Ch "sub-menu, find the cause why motor doesn't rotate, fix the trouble and try again;
8. Press SET will exit JOG control in JOG run mode.

Chapter 8 Application Case

Operation Mode Selection

L7 series AC servo drives support the position, speed, torque three basic modes of operation, and can switch freely between the three basic modes of operation by switch or modify parameters.

Table 8.1 Parameter setup of Operation Mode Selection

No	Mode	Parameter	Specification
1	Position mode	PA_001=0	The position control is performed based on the positional command (pulse train) from the host controller or the command set in the servo driver.
2	Velocity mode	PA_001=1	The velocity control is performed according to the analog speed command from the host controller or the speed command set in the servo driver.
3	Torque mode	PA_001=2	The torque control is performed according to the torque command specified in the form of analog voltage or the command set in the servo driver.
4	1st mode: position mode 2nd mode: speed mode	PA_001=3	The control mode is switched through external input.
5	1st mode: position mode 2nd Mode: torque mode	PA_001=4	The control mode is switched through external input.
6	1st mode: speed mode 2nd Mode: torque mode	PA_001=5	The control mode is switched through external input.

The step of changing the operation mode:
1, Switch the driver to Servo Off status.
2, Modify the corresponding parameters of control mode to EEPROM.
Turn off/on the power to make the new mode works after setup completed.

8.1 Position Control

Notice : You must do inspection before position control test run.

Table 8.2 Parameter Setup of Position Control

No	parameter	name	input	value	unit
1	PA_001	control mode setup	/	0	/
2	PA_006	command pulse rotational direction setup		0	
3	PA_007	command pulse input mode setup		0~3	
4	PA_008	Command pulse per one motor revolution		User-specified	Pulse
5	PA_009	1st numerator of electronic gear		1	
6	PA_010	denominator of electronic gear		1	
7	PA_312	Acceleration time setup	/	User-specified	millisecond
8	PA_313	Deceleration time setup	/	User-specified	millisecond
9	PA_314	Sigmoid acceleration/deceleration time setup	/	User-specified	millisecond
10	PA_518	Command pulse prohibit input invalidation	/	1	/
11	PA_400	SI1 input select	Srv_on	Hex:0003	/

◆ Wiring Diagram

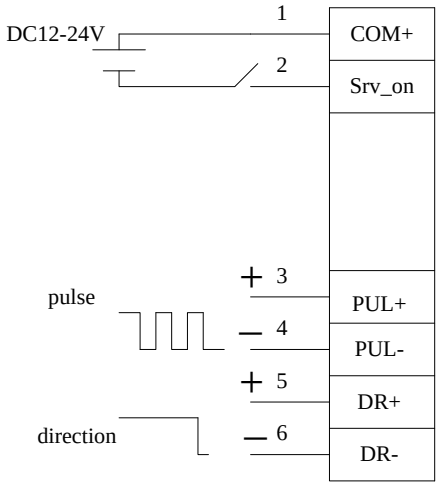


Figure 8-1 Control Terminal CN1 Signal Wiring in Position Control Mode

◆Operation Steps

1. connect terminal CN1.
2. Enter the power (DC12V to 24V) to control signal (the COM_SI + and SI1).
3. Enter the power to the driver.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the driver)
5. Connect the Srv_on input to bring the driver to servo-on status and energize the motor.
6. Enter low-frequency pulse and direction signal to run the motor at low speed.
7. Check the motor rotational speed at monitor mode whether, ("d0 1SP "),
   Rotational speed is as per the setup or not, and
   The motor stops by stopping the command (pulse) or not
   If the motor does not run correctly, refer to the Factor of No-Motor running in data monitor mode ("d1 7Ch ").

The driver is widely used for precise positioning in position control mode.

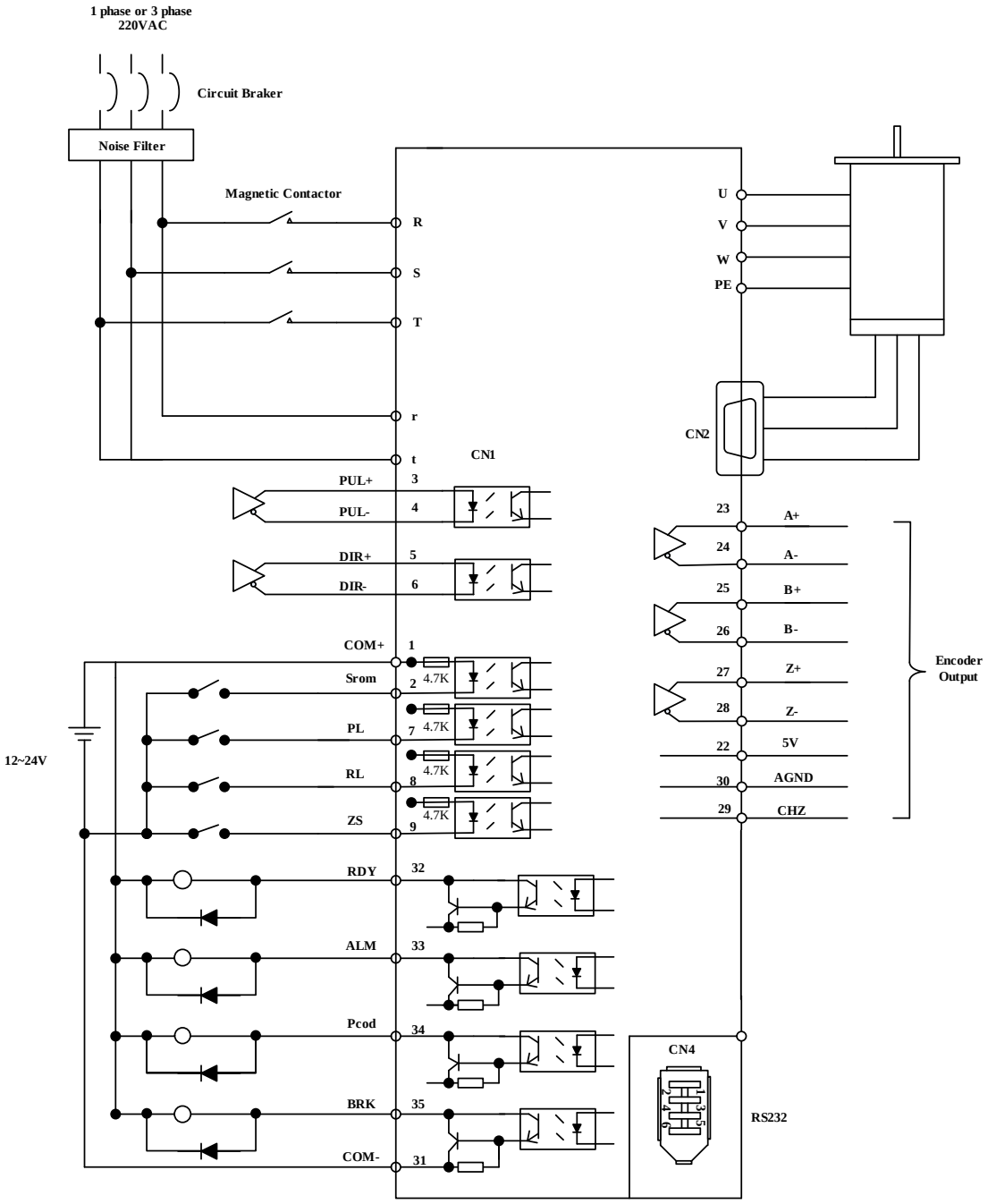


Figure 8-2 Position Mode Typical Wiring Diagram

Note: Single phase 220VAC input is sufficient if the power of driver is no more than 1.5kw .

Corresponding parameters setup of position control mode

8.1.1 Process of command pulse input

The positional commands of the following 3 types (pulse train) are available.

◆A, B phase pulse

◆Positive direction pulse/negative direction pulse

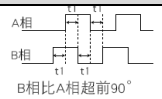
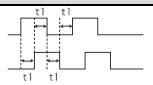
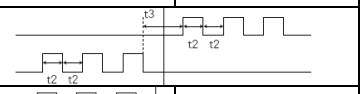
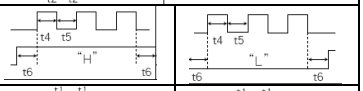
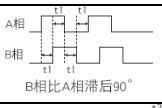
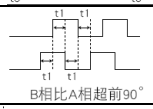
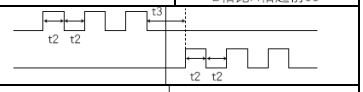
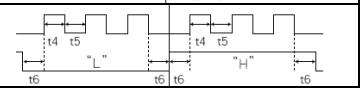
◆Pulse + sign

Please set the pulse configuration and pulse counting method based on the specification and configuration of installation of the host controller.

Pr0.06*	Command Pulse Rotational Direction Setup	Range	unit	default	Related control mode		
		0 -1	-	0	P		

Set command pulse input rotate direction, command pulse input type

Pr0.07*	Command Pulse Input Mode Setup	Range	unit	default	Related control mode		
		0 -3	-	3	P		

Pr0.06	Pr0.07	Command Pulse Format	Signal	Positive Direction Command	Negative Direction Command
0	0 or 2	90 phase difference 2-phase pulse(A phase +B phase)	Pulse sign		
	1	Positive direction pulse + negative direction pulse	Pulse sign		
	3	Pulse + sign	Pulse sign		
1	0 or 2	90 phase difference 2 phase pulse(A phase +B phase)	Pulse sign		
	1	Positive direction pulse + negative direction pulse	Pulse sign		
	3	Pulse + sign	Pulse sign		

Command pulse input signal allow largest frequency and smallest time width

PULS/SIGN Signal Input I/F		Permissible Max. Input Frequency	Smallest Time Width					
			t1	t2	t3	t4	t5	t6
Pulse series interface	Long distance interface	500kpps	2	1	1	1	1	1
	Open-collector output	200kpps	5	2.5	2.5	2.5	2.5	2.5

8.1.2 Electronic gear function

The function multiplies the input pulse command from the host controller by the predetermined dividing or multiplying factor and applies the result to the position control section as the positional command. By using this function, desired motor rotations or movement distance per unit input command pulse can be set.

Pr0.08	Command pulse counts per one motor revolution	Range	unit	default	Related control mode		
		0-8388608	pulse	0	P	S	T

Set the command pulse that causes single turn of the motor shaft.
1) If pr008 ≠ 0 , the actual turns = pulse number / Pr008
2) If pr008 = 0 , Pr009 1st numerator of electronic gear and Pr0.10 Denominator of electronic Gear become valid.

Pr0.09	1st numerator of electronic gear	Range	unit	default	Related control mode		
		1-10737 41824	-	1	P		

Set the numerator of division/multiplication operation made according to the command pulse input.

Pr0.10	denominator of electronic gear	Range	unit	default	Related control mode		
		1-10737 41824	-	1	P		

Set the denominator of division/multiplication operation made according to the command pulse input.

Pr0.09	Pr0.10	Command division/multiplication operation
1-32767	1-32767	Command pulse input → 【Pr0.09 set value】 / 【Pr0.10 set value】 → position command

1、Settings:
(1)The driver input command pulse number is X
(2)The pulse number of encoder after frequency division and frequency doubling is Y
(3)The number of pulses per revolution of the motor encoder is Z
(4)Number of turns of motor is W

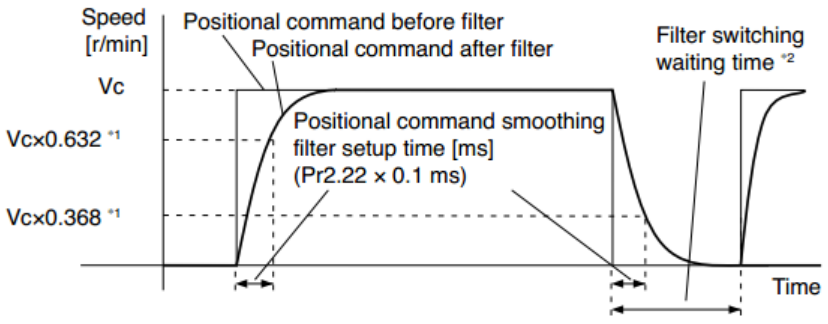
2、Calculations:
(1)Y=X* Pr0.09 / Pr0.10
(2)17Bit encoder: Z=2^17 = 131072
23Bit encoder: Z=2^23 = 8388608

8.1.3 Position command filter

To make the positional command divided or multiplied by the electronic gear smooth, set the command filter.

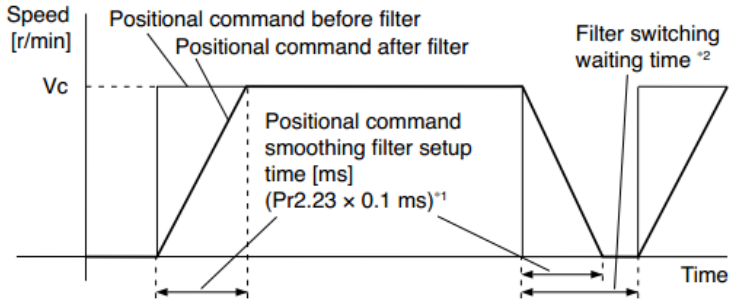
Pr2.22	positional command smoothing filter	Range	unit	default	Related control mode		
		0 -32767	0.1ms	0	P		

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied ,set up the time constant of the 1st delay filter as shown in the figure below.



Pr2.23	positional command FIR filter	Range	unit	default	Related control mode		
		0 -10000	0.1ms	0	P		

- Set up the time constant of the1st delay filter in response to the positional command.
- When a square wave command for the target speed Vc is applied , set up the Vc arrival time as shown in the figure below.



8.1.4 Motor encoder pulse output

The information on the amount of movement can be sent to the host controller in the form of A and B phase pulses from the servo driver.

Pr0.11*	Output pulse counts per one motor revolution	Range	unit	default	Related control mode		
		1-2500	P/r	2500	P	S	T

Set the numerator of division/multiplication operation made according to the command pulse input.

Pr5.03*	denominator of pulse output division	Range	unit	default	Related control mode		
		1-2500	-	2500	P	S	T

Combination of Pr0.11 Output pulse counts per one motor revolution and Pr5.03 Denominator of pulse output division

Pr0.11	Pr5.03	Pulse output process
1-2500	1-2500	encoder pulse → 【Pr0.11set value】 / 【Pr5.03 set value】 → output pulse

Pulse output resolution after dividing double frequency 4 times

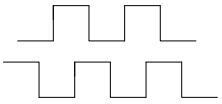
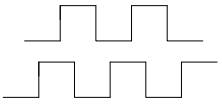
$$\text{Pulse output resolution} = \text{encoder} \times 4 \times \frac{\text{Pr0.11(pulse output divide frequency molecule)}}{\text{Pr5.03(pulse output divide frequency denominator)}}$$

Pr0.12*	reversal of pulse output logic	Range	unit	default	Related control mode		
		0 -1	-	0	P	S	T

You can set up the B phase logic and the output source of the pulse output. With this parameter, you can reverse the phase relation between the A-phase pulse and B-phase pulse by reversing the B-phase logic.

< reversal of pulse output logic >

Pr0.12	B-phase Logic	CCW Direction Rotation	CW Direction Rotation
0	Non-Reversal	A phase B phase	A phase B phase

1	Reversal	A phase B phase 	A phase B phase 

8.1.5 Position complete output (INP)

The completion of positioning can be verified by the positioning complete output (INP).When the absolute value of the positional deviation counter at the position control is equal to or below the positioning complete
Range by the parameter, the output is ON. Presence and absence of positional command can be specified as one of judgment conditions.

Pr4.31	Positioning complete range	Range	unit	default	Related control mode
		0 -10000	Encoder unit	10	P

Set up the timing of positional deviation at which the positioning complete signal (INP1) is output.

Pr4.32	Positioning complete range	Range	unit	default	Related control mode
		0 -3	command unit	10	P

Select the condition to output the positioning complete signal (INP1).

Setup value	Action of positioning complete signal
0	The signal will turn on when the positional deviation is smaller than Pr4.31 [positioning complete range].
1	The signal will turn on when there is no position command and position deviation is smaller than Pr4.31 [positioning complete range].
2	The signal will turn on when there is no position command, the zero-speed detection signal is ON and the positional deviation is smaller than Pr4.31 [positioning complete range].
3	The signal will turn on when there is no position command and the positional deviation is smaller than Pr4.31 [positioning complete range].Then holds "ON" states until the next position command is entered. Subsequently, ON state is maintained until Pr4.33 INP hold time has elapsed. After the hold time, INP output will be turned ON/OFF according to the coming positional command or condition of the positional deviation.

Pr4.33	INP hold time	Range	unit	default	Related control mode
		0-30000	1ms	0	P

Set up the hold time when Pr 4.32 positioning complete output setup=3.

Setup value	State of Positioning complete signal
0	The hold time is maintained definitely, keeping ON state until next positional command is received.
1-30000	ON state is maintained for setup time (ms)but switched to OFF state as the positional command is received during hold time.

And the output port should be assigned for "INP", for details of these parameters, refer to PA_410 – PA415.

Other setup for SI/SO function

For details of SI input function, refer to PA_400 – PA409.
For details of SO output function, refer to PA_410 – PA415.

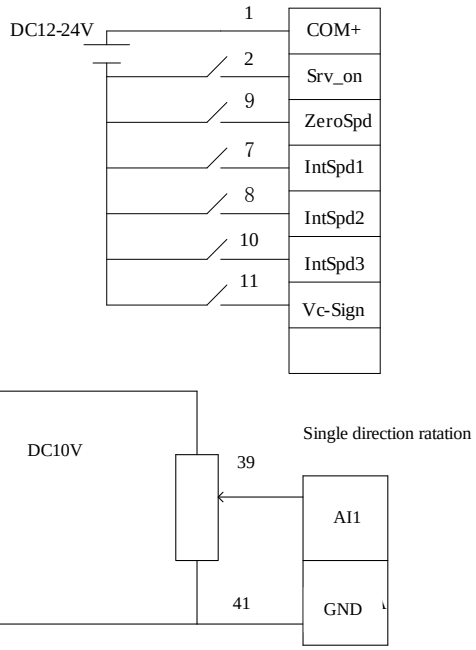
8.2 Velocity Control

Notice : You must do inspection before velocity control test run.

Table 8.3 Parameter Setup of Velocity Control

No	Parameter	Name	input	Setup value	Unit
1	PA_001	Control mode setup	/	1	/
2	PA_312	Acceleration time setup	/	User-specified	millisecond
3	PA_313	Deceleration time setup	/	User-specified	millisecond
4	PA_314	Sigmoid acceleration/deceleration time setup	/	User-specified	millisecond
5	PA_315	Zero speed clamping function select	/	1	/
6	PA_300	Velocity setup internal and external switching	/	User-specified	/
7	PA_301	Speed Command direction selection	/	User-specified	/
8	PA_302	Speed command input gain	/	User-specified	Rpm/V
9	PA_303	Speed setting input reversal	/	User-specified	/
10	PA_422	Analog input I(AI1) offset setup	/	User-specified	0.359mv
11	PA_423	Analog input I(AI1) filter	/	User-specified	0.01ms
12	PA_400	SI1 input selection	Srv_on	hex:0300	/
13	PA_401	SI2 input selection	ZeroSpd	hex:1100	/
14	PA_402	SI3 input selection	IntSpd1	hex:0E00	/
15	PA_403	SI4 input selection	IntSpd2	hex:0F00	/
16	PA_404	SI5 input selection	IntSpd3	hex:1000	/
17	PA_405	SI6 input selection	Vc-Sign	hex:1200	/

◆Wiring Diagram



◆Operation steps

1. connect terminal CN1.
2. Enter the power (DC12V to 24V) to control signal (the COM_SI + and SI1).
3. Enter the power to the driver.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the driver)

5.Connect the Srv_on input to bring the driver to servo-on status and energize the motor.
6. apply DC voltage between velocity command input ,AI1 and AGND, and gradually increase from 0V to confirm the motor runs.
7. Check the motor rotational speed at monitor mode , ("d01SP ")
Whether rotational speed is as per the setup or not, and
Whether the motor stops with zero command or not
If the motor does rotate at a micro speed with command voltage of 0.
8. When you want to change the rotational speed and direction, set up the following parameters again.
Pr3.00. Pr3.01. Pr3.03
If the motor does not run correctly, refer to the Factor of No-Motor running in data monitor mode ("d17Ch ").

The driver is widely used for accuracy speed control in velocity control mode.
You can control the speed according to the analog speed command from the host controller or the speed command set in servo driver.

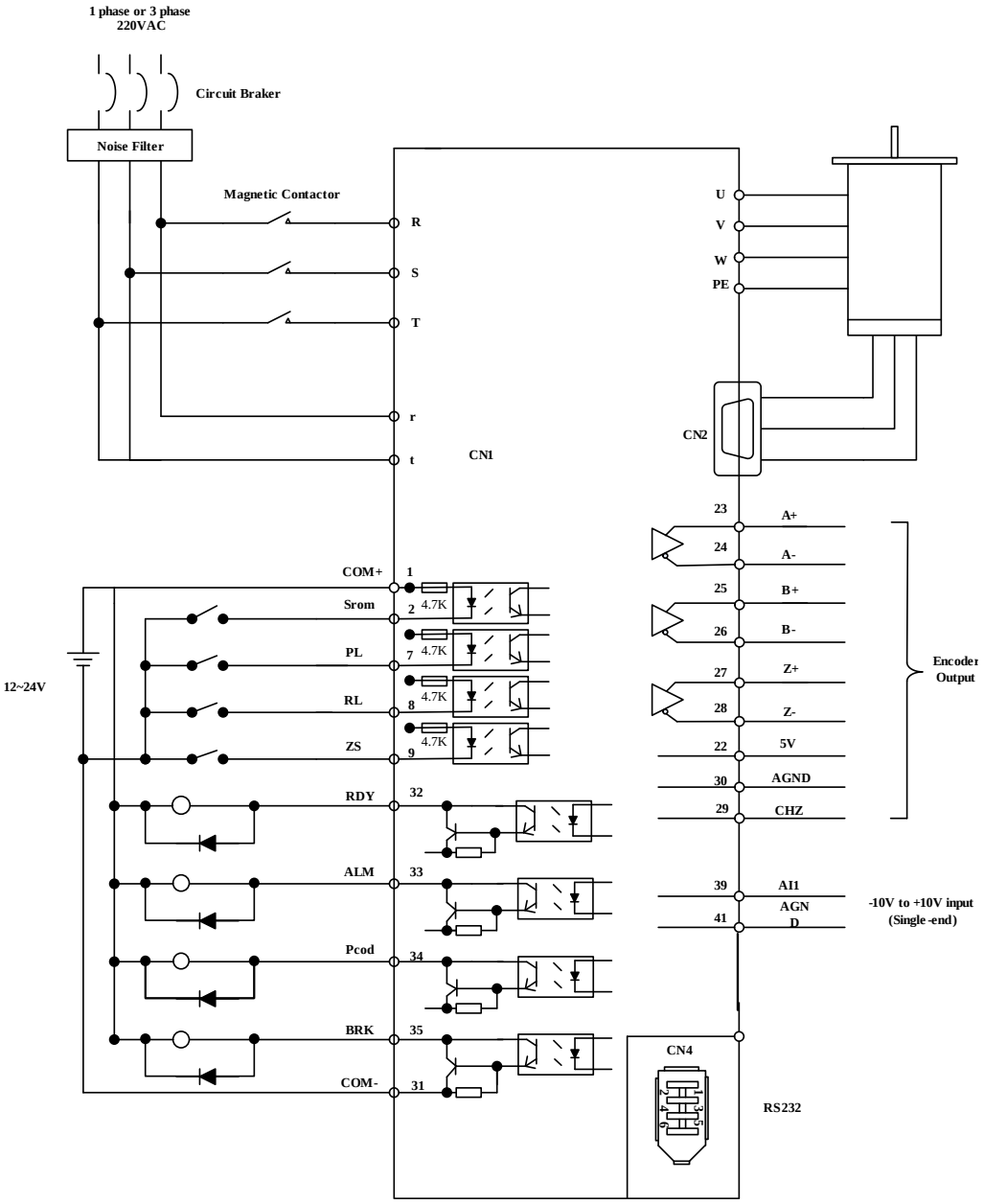


Figure 8-3 Velocity Mode Typical Wiring Diagram

Relevant parameters setup of velocity control mode

8.2.1 Velocity control by analog speed command

The analog speed command input voltage is converted to equivalent digital speed command. You can set the filter to eliminate noise or adjust the offset.

Pr3.00	Speed setup, Internal /External switching	Range	unit	default	Related control mode
		0 -3	-	0	S

This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.

Setup value	Speed setup method
0	Analog speed command(SPR)
1	Internal speed command 1st to 4th speed(PR3.04-PR3.07)
2	Internal speed command 1st to 3rd speed (PR3.04-PR3.06), Analog speed command(SPR)
3	Internal speed command 1st to 8th speed (PR3.04-PR3.11)

<relationship between Pr3.00 Internal/External switching speed setup and the internal command speed selection 1-3 and speed command to be selected>

Setup value	selection 1 of internal command speed(INTSPD1)	selection 2 of internal command speed (INTSPD2)	selection 3 of internal command speed (INTSPD3)	selection of Speed command
1	OFF	OFF	NO effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		4th speed
2	OFF	OFF	NO effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		Analog speed command
3	The same as [Pr3.00=1]		OFF	1st to 4th speed
	OFF	OFF	ON	5th speed
	ON	OFF	ON	6th speed
	OFF	ON	ON	7th speed

Pr3.01	Speed command rotational direction selection	Range	unit	default	Related control mode
		0 -1	-	0	S

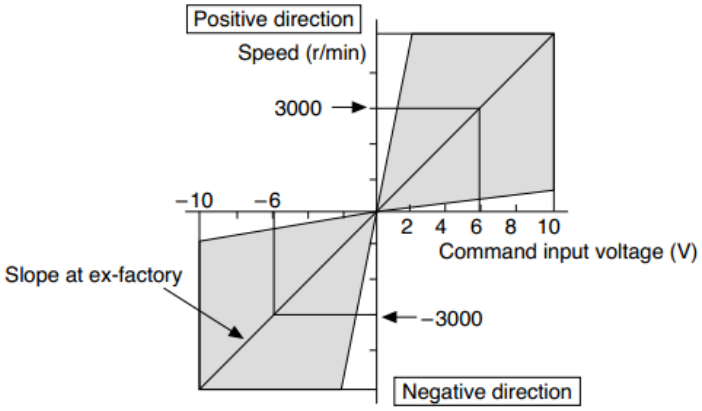
Select the Positive /Negative direction specifying method

Setup value	Select speed command sign (1st to 8th speed)	Speed command direction (VC-SIGN)	Position command direction
0	+	No effect	Positive direction
	-	No effect	Negative direction
1	Sign has no effect	OFF	Positive direction
	Sign has no effect	ON	Negative direction

Pr3.02	Input gain of speed command	Range	unit	default	Related control mode
		10 -2000	(r/min)/v	500	S T

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
You can set up "slope" of relation between the command input voltage and motor speed, with Pr3.02.
Default is set to Pr3.02=500(r/min)/V, hence input of 6V becomes 3000r/min.
Notice:

1. Do not apply more than ±10V to the speed command input(SPR).
2. When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
3. Pay an extra attention to oscillation caused by larger setup of Pr3.02.



Pr3.03	Reversal of speed command input	Range	unit	default	Related control mode
		0 -1	-	0	S

Specify the polarity of the voltage applied to the analog speed command (SPR).

Setup value	Motor rotating direction	
0	Non-reversal	[+ voltage] →[+ direction] [- voltage] → [-direction]
1	reversal	[+ voltage] →[- direction] [- voltage] → [+direction]

Caution: When you compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

8.2.2 Velocity control by internal speed command

You can control the speed by using the internal speed command set to the parameter. By using the internal speed command selection 1,2,3(INTSPD 1,2,3), you can select best appropriate one

Pr3.00	Speed setup, Internal /External switching	Range	unit	default	Related control mode
		0 -3	-	0	S

This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.

Setup value	Speed setup method
0	Analog speed command(SPR)
1	Internal speed command 1st to 4th speed(PR3.04-PR3.07)
2	Internal speed command 1st to 3rd speed (PR3.04-PR3.06), Analog speed command(SPR)
3	Internal speed command 1st to 8th speed (PR3.04-PR3.11)

<relationship between Pr3.00 Internal/External switching speed setup and the internal command speed selection 1-3 and speed command to be selected>

Setup value	selection 1 of internal command speed(INTSPD1)	selection 2 of internal command speed (INTSPD2)	selection 3 of internal command speed (INTSPD3)	selection of Speed command
1	OFF	OFF	NO effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		4th speed
2	OFF	OFF	NO effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		Analog speed

				command
3	The same as [Pr3.00=1]		OFF	1st to 4th speed
	OFF	OFF	ON	5th speed
	ON	OFF	ON	6th speed
	OFF	ON	ON	7th speed

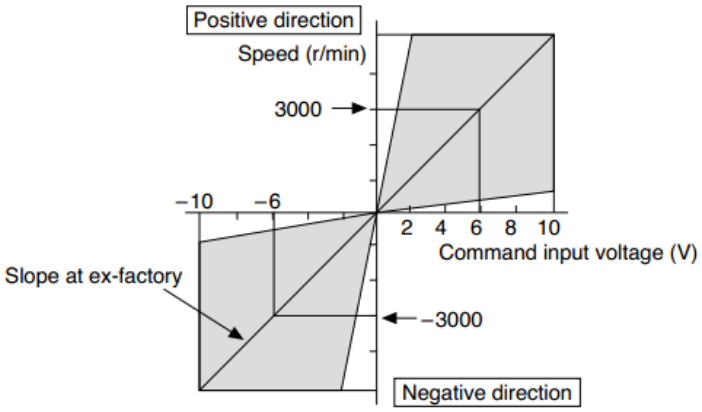
Pr3.01	Speed command rotational direction selection	Range	unit	default	Related control mode
		0 -1	-	0	S

Select the Positive /Negative direction specifying method

Setup value	Select speed command sign (1st to 8th speed)	Speed command direction (VC-SIGN)	Position command direction
0	+	No effect	Positive direction
	-	No effect	Negative direction
1	Sign has no effect	OFF	Positive direction
	Sign has no effect	ON	Negative direction

Pr3.02	Input gain of speed command	Range	unit	default	Related control mode
		10 -2000	(r/min)/v	500	S T

Based on the voltage applied to the analog speed command (SPR), set up the conversion gain to motor command speed.
You can set up "slope" of relation between the command input voltage and motor speed, with Pr3.02. Default is set to Pr3.02=500(r/min)/V, hence input of 6V becomes 3000r/min.
Notice:
1. Do not apply more than ±10V to the speed command input(SPR).
2. When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
3. Pay an extra attention to oscillation caused by larger setup of Pr3.02.



Pr3.03	Reversal of speed command input	Range	unit	default	Related control mode
		0 -1	-	0	S

Specify the polarity of the voltage applied to the analog speed command (SPR).

Setup value	Motor rotating direction	
0	Non-reversal	[+ voltage] → [+ direction] [- voltage] → [-direction]
1	reversal	[+ voltage] → [- direction] [- voltage] → [+direction]

Caution: When you compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

Pr3.04	1st speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S

Pr3.05	2nd speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S
Pr3.06	3rd speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S
Pr3.07	4th speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S
Pr3.08	5th speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S
Pr3.09	6th speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S
Pr3.10	7th speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S
Pr3.11	8th speed of speed setup	Range	unit	default	Related control mode
		-20000 -20000	r/min	0	S
Set up internal command speeds, 1st to 8th					

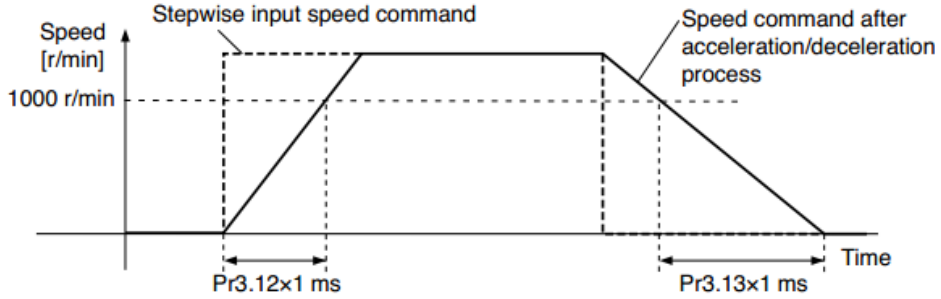
8.2.3 Speed command acceleration and deceleration function

On the basis of speed command input, acceleration and deceleration are added as internal speed commands to control the speed. This function can be used when entering the ladder-like speed command and internal speed setting. In addition, the acceleration and deceleration function can also be used when the vibration is reduced by the change of acceleration

Pr3.12	time setup acceleration	Range	unit	default	Related control mode
		0 -10000	Ms(1000r/min)	100	S
Pr3.13	time setup deceleration	Range	unit	default	Related control mode
		0 -10000	Ms(1000r/min)	100	S

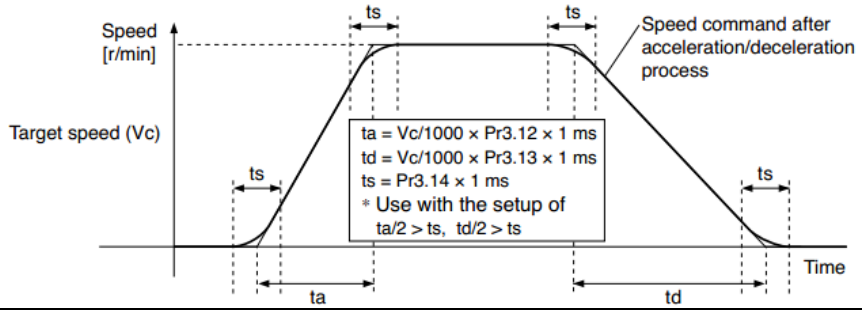
Set up acceleration/deceleration processing time in response to the speed command input.
Set the time required for the speed command(stepwise input)to reach 1000r/min to Pr3.12 Acceleration time setup. Also set the time required for the speed command to reach from 1000r/min to 0 r/min, to Pr3.13 Deceleration time setup.
Assuming that the target value of the speed command is Vc(r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

Acceleration time (ms)=Vc/1000 *Pr3.12 *1ms
Deceleration time (ms)=Vc/1000 *Pr3.13 *1ms



Pr3.14	Sigmoid acceleration/deceleration time setup	Range	unit	default	Related control mode
		0 -1000	ms	0	S

Set S-curve time for acceleration/deceleration process when the speed command is applied.
According to Pr3.12 Acceleration time setup and Pr3.13 Deceleration time setup, set up sigmoid time with time width centering the inflection point of acceleration/deceleration.



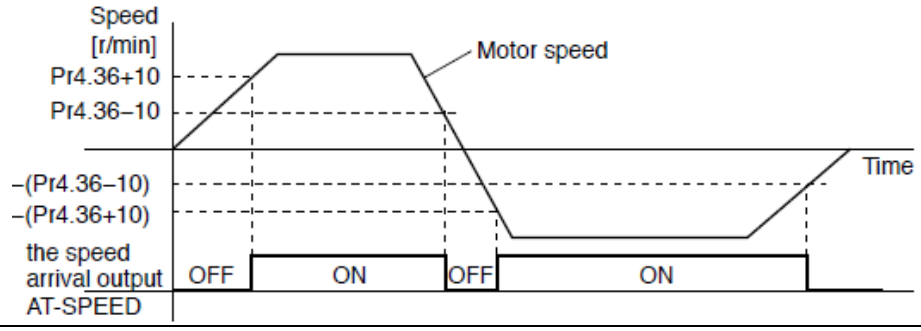
8.2.4 Attained Speed signal AT-SPEED output

When the motor speed reaches the speed set by the parameter PA_436 (setting of arrival speed), the output speed reaches the output (AT-SPEED) signal.

This function can be configured by IO output function parameters, as described in IO Pr4.10 parameters. When the speed meets the set conditions, the set corresponding output IO port can output ON.

Pr4.36	At-speed(Speed arrival)	Range	unit	default	Related control mode
		10-20000	r/min	1000	S

Set the detection timing of the speed arrival output (AT-SPEED).
When the motor speed exceeds this setup value, the speed arrive output (AT-SPEED) is output.
Detection is associated with 10r/min hysteresis .



8.2.5 Speed coincidence output (V-COIN)

When the speed command (before acceleration and deceleration processing) is consistent with the motor speed, the output speed is consistent (V-COIN). If the difference between the speed command and the motor speed before acceleration and deceleration processing in the driver is within the parameter PA_435 (setting the same speed range), it is judged to be consistent.

This function can be configured by IO output function parameters, as described in IO Pr4.10 parameters. When the speed difference meets the setting conditions, the corresponding output IO port set can output ON.

Among them, the in place signal of PV mode is synchronized with the v-coin signal

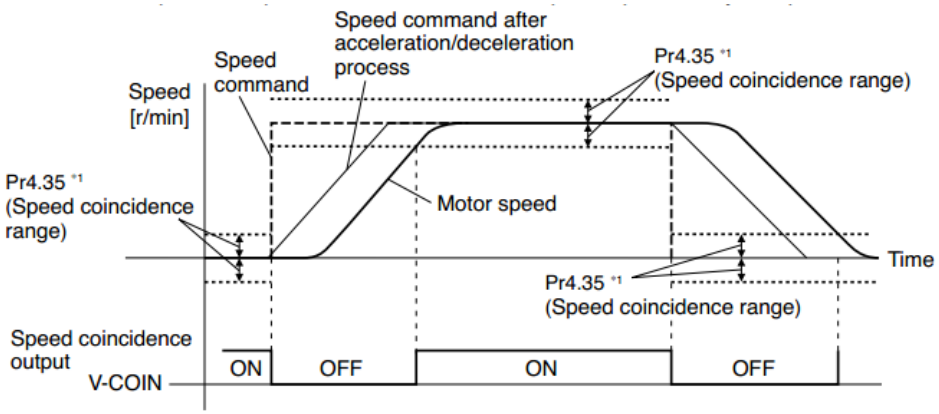
Pr4.35	Speed coincidence range	Range	unit	default	Related control mode
		10 -20000	r/min	50	S

Set the speed coincidence (V-COIN) output detection timing.
Output the speed coincidence (V-COIN) when the difference between the speed command and the motor speed is equal to or smaller than the speed specified by this parameter.

Because the speed coincidence detection is associated with 10 r/min hysteresis, actual detection range is as shown below.

Speed coincidence output OFF -> ON timing (Pr4.35 -10) r/min

Speed coincidence output ON -> OFF timing (Pr4.35 +10) r/min



8.2.6 Speed zero clamp (ZEROSPD)

You can forcibly set the speed command to 0 by using the speed zero clamp input.

Pr3.15	Speed zero-clamp function selection	Range	unit	default	Related control mode
		0 -3	-	0	S

1. If Pr3.15=0, the function of zero clamp is forbidden. It means the motor rotates with actual velocity which is controlled by the analog voltage input 1 even if the velocity is less than 10 rpm. The motor runs no matter what the value of Pr3.16 is. The actual velocity is controlled by external the analog voltage input .
2. If Pr3.15=1 and the input signal of Zero Speed is available in the same time, the function of zero clamp works. It means motor will stop rotating in servo-on condition no matter what the velocity of motor is, and motor stop rotating no matter what the value of Pr3.16 is.
3. If Pr3.15=2 , the function of zero clamp belongs to the value of Pr3.16. If the actual velocity is less than the value of Pr3.16, the motor will stop rotating in servo-on condition.

Pr3.16	Speed zero-clamp level	Range	unit	default	Related control mode
		0 -20000	r/min	30	S

When analog speed given value under speed control mode less than zero speed clamp level setup, speed command will set to 0 strongly.

Other setup for SI/SO function

For details of SI input function, refer to PA_400 – PA409.

For details of SO output function, refer to PA_410 – PA415.

8.3 Torque Control

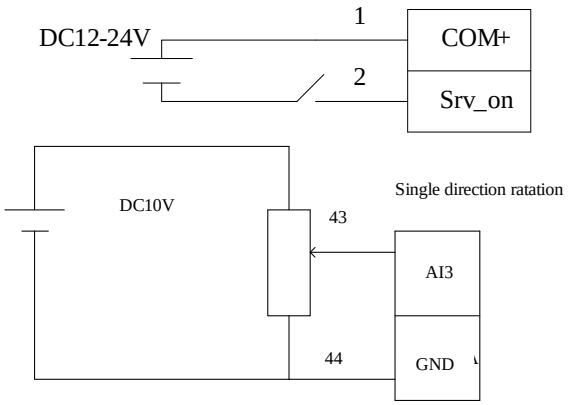
Notice : You must do inspection before torque control test run.

Table 8.6 Parameter Setup of Torque Control

No	Parameter	Name	input	Setup value	Unit
1	PA_001	Control mode setup	/	2	/
2	PA_312	Acceleration time setup	/	User-specified	millisecond
3	PA_313	Deceleration time setup	/	User-specified	millisecond
4	PA_314	Sigmoid acceleration/deceleration time setup	/	User-specified	millisecond
5	PA_315	Zero-clamp function selection	/	0	/

6	PA_317	Torque setup internal/external switching	/	0	/
7	PA_319	Torque command direction input gain	/	User-specified	0.1V/100%
8	PA_320	Torque setup input reversal	/	User-specified	/
9	PA_321	Speed limit value 1	/	User-specified	R/min
10	PA_400	SI1 input selection	Srv_on	hex:030000	/
11	PA_428	Analog input 3(AI3) offset setup	/	User-specified	0.359mv
12	PA_429	Analog input 3(AI3) filter	/	User-specified	0.01ms

◆Wiring Diagram



◆**Operation Steps**

1. connect terminal CN1.
2. Enter the power (DC12V to 24V) to control signal (the COM_SI + and SI1).
3. Enter the power to the driver.
4. Confirm the value of the parameters, and write to the EEPROM and turn off/on the power (of the driver)
5.Connect the Srv_on input to bring the driver to servo-on status and energize the motor.
6. apply DC voltage between torque command input ,AI1 and AGND, and gradually increase from 0V to confirm the motor runs.
7. Check the motor torque at monitor mode ("d04tr "), Whether actual torque is as per the setup or not
8. When you want to change the torque magnitude, direction and velocity limit value against the command voltage, set up the following parameters : Pr3.19. Pr3.20. Pr3.21

If the motor does not run correctly, refer to the Factor of No-Motor running in data monitor mode ("d17Ch ").

The torque control is performed according to the torque command specified in the form of analog voltage. For controlling the torque, the speed limit input is required in addition to the torque command to maintain the motor speed within the speed limit.

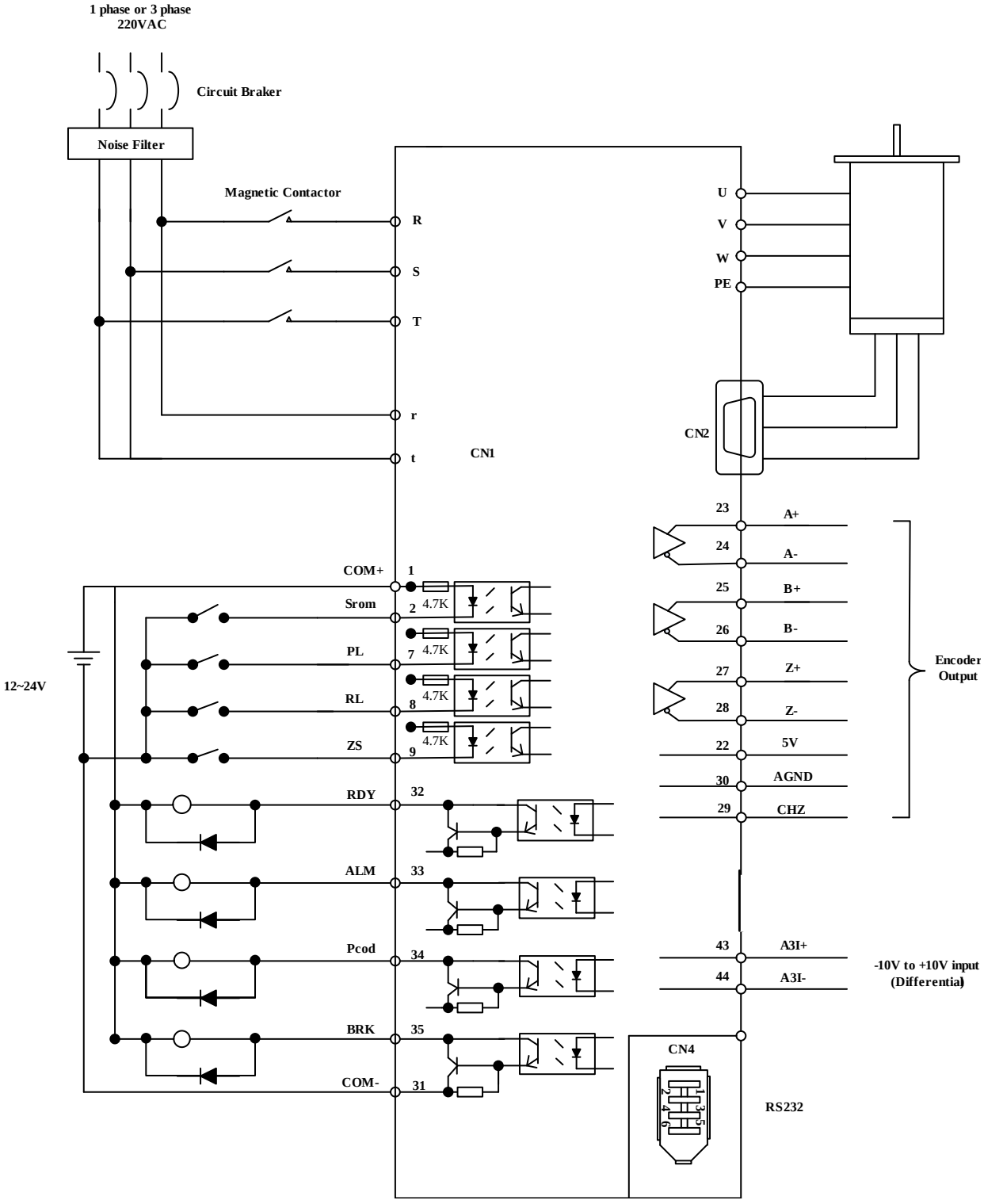


Figure 8-4 Torque Mode Typical External Wiring Diagram

Relevant parameters setup of torque control mode

8.3.1 Analog torque command input

The analog torque command input voltage is converted to equivalent digital torque command. You can set the filter to eliminate noise or adjust the offset.

Pr3.17	Selection of torque command	Range	unit	default	Related control mode		
		0/1/2/3	-	0			T

Setup value	Torque command input	Velocity limit input
0	Analog input 3	Parameter value (P3.21)
1	Analog input 3	Analog input 1 for Speed limit
2	Parameter value (P3.22)	Parameter value (P3.21)
3	Analog input 3	Speed limit 0

Pr3.18	Torque command direction selection	Range	unit	default	Related control mode		
		0 -1	-	0			T

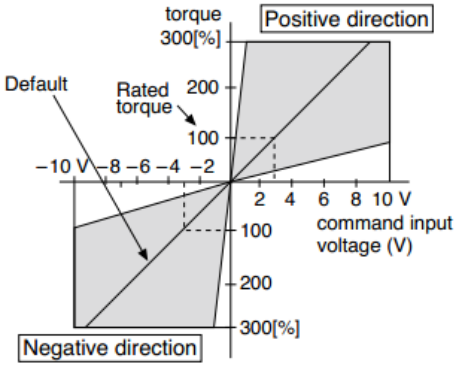
Select the direction positive/negative direction of torque command

Setup value	designation
0	Specify the direction with the sign of torque command Torque command input[+] → positive direction, [-] → negative direction
1	Specify the direction with torque command sign(TC-SIGN). OFF: positive direction ON: negative direction

Pr3.19	Torque command input gain	Range	unit	default	Related control mode		
		0 -1	-	500			T

Based on the voltage (V) applied to the analog torque command (TRQR),set up the conversion gain to torque command(%) .

- Unit of the setup value is [0.1V/100%] and set up input voltage necessary to produce the rated torque.
- Default setup of 30 represents 3V/100%



Pr3.20	Torque command input reversal	Range	unit	default	Related control mode		
		0 -1	-	0			T

Set up the polarity of the voltage applied to the analog torque command(TRQR).

Setup value	Direction of motor output torque	
0	Non-reversal	[+ voltage] →[+ direction] [- voltage] → [-direction]
1	reversal	[+ voltage] →[- direction] [- voltage] → [+direction]

8.3.2 Torque limit function

The speed limit is one of protective functions used during torque control.
This function regulates the motor speed so that it doesn't exceed the speed limit while the torque is controlled.

Pr3.20	Torque command input reversal	Range	unit	default	Related control mode		
		0 -1	-	0			T

Set up the polarity of the voltage applied to the analog torque command(TRQR).

Setup value	Direction of motor output torque	
0	Non-reversal	[+ voltage] →[+ direction] [- voltage] → [-direction]
1	reversal	[+ voltage] →[- direction] [- voltage] → [+direction]

Pr3.21	Speed limit value 1	Range	unit	default	Related control mode		
		0 -20000	r/min	0			T

Set up the speed limit used for torque controlling.
During the torque controlling, the speed set by the speed limit value cannot be exceeded.

Other setup for SI/SO function

For details of SI input function, refer to PA_400 – PA409.

For details of SO output function, refer to PA_410 – PA415.

8.4 Inertia ratio identification

Pr0.04	Inertia ratio	Range	unit	default	Related control mode		
		0 -10000	%	250	P	S	T

You can set up the ratio of the load inertia against the rotor(of the motor)inertia.

Pr0.04=(load inertia/rotate inertia)×100%

Notice:

If the inertia ratio is correctly set, the setup unit of Pr1.01 and Pr1.06 becomes (Hz). When the inertia ratio of Pr0.04 is larger than the actual value, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr0.04 is smaller than the actual value, the setup unit of the velocity loop gain becomes smaller.

8.4.1 On-line inertia ratio identification

The motor is operated by the controller, and the motor speed is above 400rmp. The running stroke has obvious acceleration, uniform speed and deceleration process, and the load inertia ratio can be tested by running 2-3 times continuously. The inertia ratio of the test is viewed through panel d16. Write the corresponding panel value minus 100 into PA004.

8.4.2 Off-line inertia ratio identification

Pre-conditions： 1、servo disable. 2、Positive limit and negative limit invalid

Steps:

1、Set the trial running speed PA604, and the setting of PA604 should not be too large

2、Enter auxiliary inertia ratio identification function on the drive panel, AF_GL

3、Press ENT once to enter operation， display "G---"

4、Press ◀ once， display "StUon"

5、Press ▲ once， motor start running to identification

6、After finishing， display G XXX, which represents the measured inertia ratio value

7、Write the corresponding panel value minus 100 into PA004.

8.5 Vibration Suppression

Specific resonance frequency can be obtained from PC upper computer software according to waveform monitoring, and filter frequency can be set to effectively suppress the oscillation ripple of a certain frequency in the current instruction.

The width of the notch is the ratio of the frequency of the notch center at a depth of 0 to the frequency range width of the attenuation rate of -3db.

The depth of the trap is: when the set value is 0, the input of the center frequency is completely disconnected; When the set value is 100, it represents the ratio of input and output that are completely passed

Pr2.00	Adaptive filter mode setup	Range	unit	default	Related control mode		
		0 -4	-	0	P	S	

Set up the resonance frequency to be estimated by the adaptive filter and the special the operation after estimation.

Setup value	content	
0	Adaptive filter: invalid	Parameters related to the 3rd and 4th notch filter hold the current value.
1	Adaptive filter,1 filter is valid, one time	One adaptive filter is valid, parameters related to the 3rd notch filter will be updated based on adaptive performance. After updated, Pr2.00 returns to 0, stop self-adaptation.
2	Adaptive filter, 1 filter is valid, It will be valid all the time	One adaptive filter is valid, parameters related to the 3rd notch filter will be updated all the time based on adaptive performance.
3-4	Not use	Non-professional forbidded to use

Pr2.01	1st notch frequency	Range	unit	default	Related control mode		
		50 -2000	HZ	2000	P	S	T
Set the center frequency of the 1st notch filter Notice: the notch filter function will be invalidated by setting up this parameter to "2000".							
Pr2.02	1st notch width selection	Range	unit	default	Related control mode		
		0 -20	-	2	P	S	T
Set the width of notch at the center frequency of the 1st notch filter. Notice: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.							
Pr2.03	1st notch depth selection	Range	unit	default	Related control mode		
		0 -99	-	0	P	S	T
Set the depth of notch at the center frequency of the 1st notch filter. Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.							
Pr2.04	2nd notch frequency	Range	unit	default	Related control mode		
		50 -2000	HZ	2000	P	S	T
Set the center frequency of the 2nd notch filter Notice: the notch filter function will be invalidated by setting up this parameter to "2000".							
Pr2.05	2nd notch width selection	Range	unit	default	Related control mode		
		0 -20	-	2	P	S	T
Set the width of notch at the center frequency of the 2nd notch filter. Notice: Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.							
Pr2.06	2nd notch depth selection	Range	unit	default	Related control mode		
		0 -99	-	0	P	S	T
Set the depth of notch at the center frequency of the 2nd notch filter. Notice: Higher the setup, shallower the notch depth and smaller the phase delay you can obtain.							

Check the current command waveform on the upper computer. When the increase of rigidity causes the current command to produce the oscillation motor to scream, obtain its oscillation frequency from the waveform, and set the frequency to the notch frequency to debug the width and depth：

The notch width is described as follows：

notch width	notch width / notch frequency	notch width	notch width / notch frequency	notch width	notch width / notch frequency

0	0.50	7	1.68	14	5.66
1	0.59	8	2.00	15	6.73
2	0.71	9	2.38	16	8.00
3	0.84	10	2.83	17	9.51
4	1.00	11	3.36	18	11.31
5	1.19	12	4.00	19	13.45
6	1.41	13	4.76	20	16.00

The notch depth is described as follows：

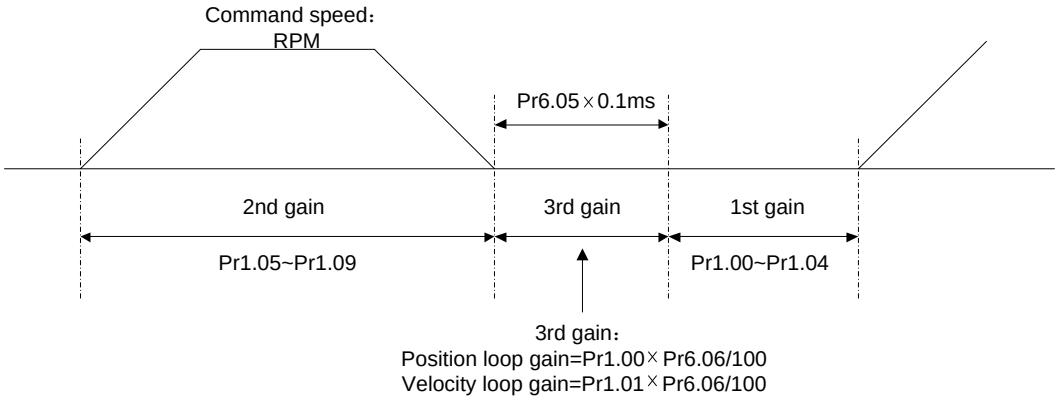
notch depth	输入输出比	notch depth	输入输出比	notch depth	输入输出比
0	0.00	8	0.08	40	0.40
1	0.01	9	0.09	45	0.45
2	0.02	10	0.10	50	0.50
3	0.03	15	0.15	60	0.60
4	0.04	20	0.20	70	0.70
5	0.05	25	0.25	80	0.80
6	0.06	30	0.30	90	0.90
7	0.07	35	0.35	100	1.00

8.6 Third gain switching

In addition to the conventional switch between the first and second gain, add the third gain switch function to shorten the positioning and setting time.

Pr6.05	Position 3rd gain multiplication	Range	unit	default	Related control mode		
		0--1000	0.1ms	0	P		
Set up the time at which 3rd gain becomes valid. When not using this parameter, set PR6.05=0, PR6.06=100 This is valid for only position control/full-closed control.							
Pr6.06	Position 3rd gain valid time	Range	unit	default	Related control mode		
		0--1000	0.1ms	0	P		
Set up the 3rd gain by multiplying factor of the 1st gain 3rd gain= 1st gain * PR6.06/100							

This function is only effective for position control. When Pr6.06 is set to non-0 value, the third gain function will be turned on. Pr6.05 is set to specify the value of the third gain. When switching from the second gain to the first gain, there will be a transition from the third gain. The switching time is set as Pr1.19. Take Pr1.15=7(with or without position instruction as the first and second gain of conditional switching) as an example to illustrate the figure below:



8.7 Friction torque compensation

Pr6.07	JOG trial run command speed	Range	unit	default	Related control mode		
		-100-100	%	0	P	S	T
Pr6.08	JOG trial run command speed	Range	unit	default	Related control mode		
		-100-100	%	0	P	S	T
Pr6.09	JOG trial run command speed	Range	unit	default	Related control mode		
		-100-100	%	0	P	S	T
This three parameters may apply feed forward torque superposition directly to torque command.							

8.8 Regenerative resister setting

When the torque of the motor is opposite to the direction of rotation (common scenarios such as deceleration, vertical axis descent, etc.), energy will feedback from the load to the driver. At this time, the energy feedback is first received by the capacitor in the driver, which makes the voltage of the capacitor rise. When it rises to a certain voltage value, the excess energy needs to be consumed by the regenerative resistance

Pr0.16	External regenerative resistance	Range	unit	default	Related control mode		
		10-50	Ω	50	P	S	T
Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current.							
Pr0.17	External regenerative resistor power value	Range	unit	default	Related control mode		
		0 -10000	W	50	P	S	T
Set Pr.0.16 and Pr.0.17 to confirm the threshold value of the discharge loop to give alarm for over current.							

8.9 Security Features

8.9.1 Speed limit

Pr3.24*	Motor rotate maximum speed limit	Range	unit	default	Related control mode		
		0 -6000	r/min	3000	P	S	T
Set up motor running max rotate speed, but can't be exceeded motor allowed max rotate speed.							

8.9.2 Torque limit (TL-SEL)

Pr5.21	Selection of torque limit	Range	unit	default	Related control mode		
		0-2	--	0	P	S	T

Set up the torque limiting method;

Setup value		Limiting value
0		PR0.13
1		PR5.22
2	TL-SEL off	PR0.13
	TL-SEL on	PR5.22

Pr5.22	2nd torque limit	Range	unit	default	Related control mode		
		0-500	%	300	P	S	T

Set up the 2nd limit value of the motor torque output

The value of the parameter is limited to the maximum torque of the applicable motor.

Pr0.13	1st Torque Limit	Range	unit	default	Related control mode		
		0 -500	%	300	P	S	T

You can set up the limit value of the motor output torque, as motor rate current %, the value can't exceed the maximum of output current.

8.10 Multi-turn absolute encoder

The absolute encoder remember position, When the absolute encoder is used for the first time, it needs to move to the home position, and clear the absolute position value of multiple turns through the driver to set the home position. It is unnecessary to return to zero in the future (except for the absolute encoder alarm and other situations). It is recommended that the motor is stationary when reading the position to prevent dynamic data jump.

8.10.1 Parameters setting

Pr0.15	Absolute Encoder Setup	Range	unit	default	Related control mode		
		0 -15	0.1 rev	0	P	S	T

Bit description;

Bit	Description
Bit0	0: close absolute value 1: open absolute value
Bit1	Default : 0,do not use
Bit2	0: no action 1: clean up absolute alarm, automatically become 0 when clean success
Bit3	0: no action 1: multi-turn position, clean up and reset automatically become 0 after success
Bit4-15	Default 0,do not use

How to use:
0: close multi-turn absolute function, multi-turn position invalid;
1: open multi-turn absolute function;
5: clean multi-turn alarm, and open multi-turn absolute function. It will become 1 when normal clearance, if it's still 5 after 3seconds, please deal with according to 153 alarm processing.
9: multi-turn zero clearing and reset multi-turn alarm, open multi-turn absolute function. It will become 1 when normal clearance, if it's still 9 after 3seconds, please deal with according to 153 alarm processing. Please remember to do mechanical homing.

8.10.2 Read absolute position

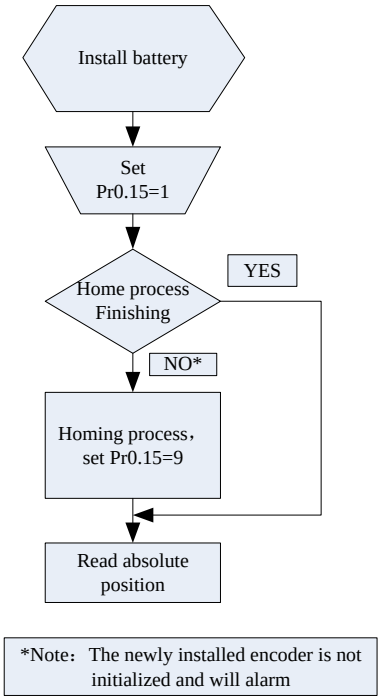
1、Steps：

（1）Firstly, select the multi-turns absolute encoder motor, install the battery, and confirm whether the driver version supports multi-turns absolute encoder motor;

（2）Set Pr0.15=1 to open absolute encoder. If it is the first time of installation, the driver will alarm Err153. The reason is that the multi-turn position is invalid due to the newly installed battery of the motor. At this time, it is necessary to return to the home position of the machine and perform the multi-turn position reset operation (see multi-turn position reset).

（3）When the absolute value origin is set and there is no battery fault, the alarm will be cancelled

（4）Finally, the user can read the absolute position, even if the power off the position will not lost.



2、Read absolute position

The absolute encoder counting mode is that when the motor rotates clockwise, the number of turns is defined as negative, while motor rotates counterclockwise the number of turns is defined as positive. The maximum rotation number is -32768 to +32767. After the number of turns is out of range, if the number of turns is 32767 counterclockwise, it will reverse to -32768, -32767... ; If the number of turns clockwise -32768, it will reverse to 32767, 32766...

Absolute encoder read mode: read 6064h data object

3、Clear absolute position

Before clear absolute position, the machine needs to return to the home point. After clear absolute position, the absolute position =0, the single-turn position remains unchanged, and the absolute value of the encoder is cleared to alarm

Set Pr0.15=9: multi-turn zero clearing and reset multi-turn alarm, open multi-turn absolute function. It will become 1 when normal clearance, if it’s still 9 after 3seconds, please deal with according to 153 alarm processing. Please remember to do mechanical homing.

8.10.3 Alarm

1、Introductions

The multi-turns absolute encoder alarm function can determine whether the absolute encoder is valid or not, such as battery under voltage or power failure, encoder fault, etc., users can judge the absolute

encoder alarm through bus alarm output, IO alarm output, and driver operation panel alarm. At this time, the controller should stop operation immediately, and the absolute motion operation can only be carried out after the alarm is eliminated

2、Alarm output

Absolute encoder alarm can be displayed by the panel Err153, IO output alarm signal, or read alarm information by communication

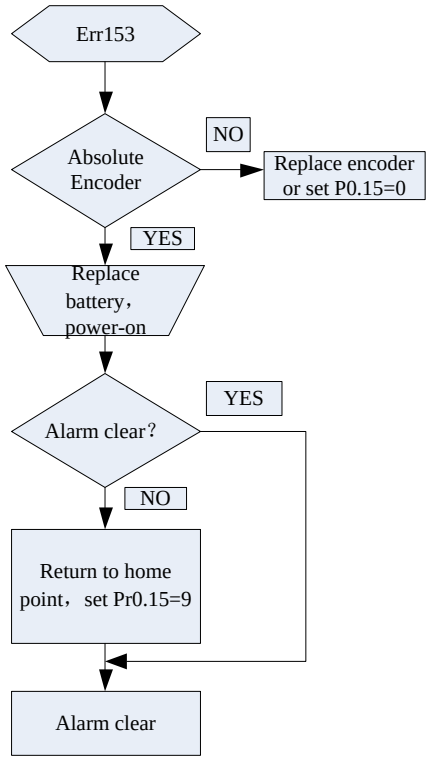
3、The driver sends an absolute encoder alarm Err153, the main situation is as follows:

（1）When the absolute encoder is used for the first time, absolute encoder alarm will be generated due to the new battery of the motor. At this time, it is necessary to return to the home point and perform multi-turn zero clearing operation

（2）When the battery under voltage is lower than 3.2v, absolute encoder alarm will be generated by the driver. At this time, the alarm will be automatically eliminated after the battery is recharged by replacing the battery

（3）When the battery voltage is lower than 2.5v, or the battery has a power failure, the absolute encoder alarm will be generated. Even if the battery is replaced, the alarm cannot be eliminated. At this time, the return to the home point and multi-turn zero clearing operation should be performed

5、Alarm processing flow chart



8.11 Other functions

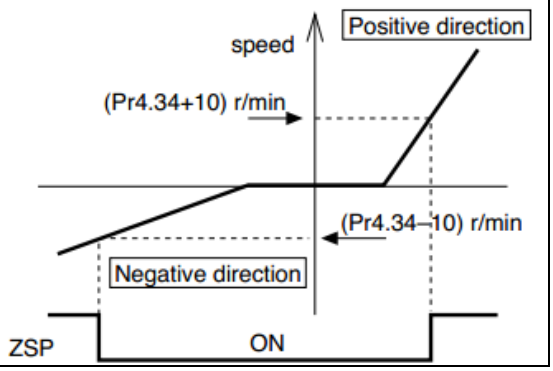
8.11.1 Zero speed output（ZSP）

This function can be configured by IO output function parameters, as described in IO Pr4.10 parameters. When the enabling and time meet the setting conditions, the corresponding output IO port set can output ON

		Range	unit	default	Related control mode		
Pr4.34	Zero-speed	10 -20000	r/min	50	P	S	T

You can set up the timing to feed out the zero-speed detection output signal(ZSP or TCL) in rotate speed (r/min).
The zero-speed detection signal(ZSP) will be fed out when the motor speed falls below the setup of this parameter, Pr4.34

- the setup of pr4.34 is valid for both positive and negative direction regardless of the motor rotating direction.
- There is hysteresis of 10[r/min].



8.11.2 Position deviation cleared（CL）

This function can be configured by IO input function parameters, as described in IO Pr4.00 parameters.

Pr5.17	Counter clear input mode	Range	unit	default	Related control mode
		0-4	--	3	P

Set up the clearing conditions of the counter clear input signal

Setup value	Clear condition
0/2/4	invalid
1	Always clear
3	Only clear one time

.

8.11.3 Position setup unit select

Pr5.20	Position setup unit select	Range	unit	default	Related control mode
		0-2	-	0	P

Specify the unit to determine the range of positioning complete and excessive positional deviation

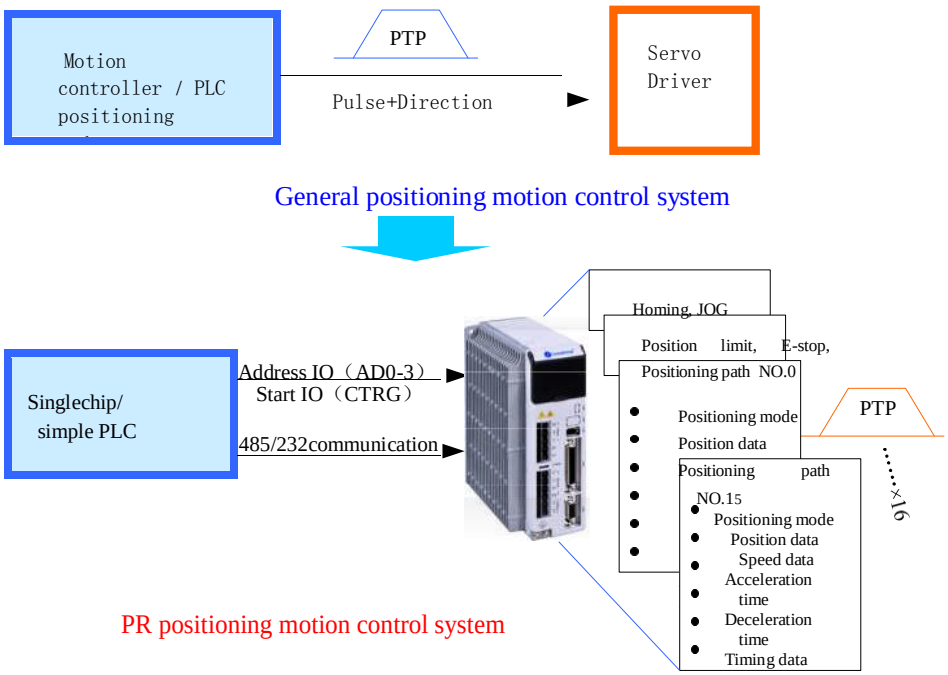
Setup value	unit
0	Encoder unit
1	Command unit
2	Standard 2500-line unit

`

Chapter 9 Pr-Mode function

9.1 Overview

PR is uniaxial motion control function which is controlled by procedure software. Mainly uniaxial motion command control, save the motion control function of the controller.



9.1.1 Main function

Main function as below：

PR function	Specification
Homing	Through homing, the drive can find the home signal， So the coordinate system zero of mechanical motion is determined □ Limit signal homing, home signal homing, and manual homing selectable, Homing direction settable □ Home shift position settable. □ Can be positioned to the specified location after homing □ Homing acceleration and deceleration settable **Remark：Cannot input external pulse during homing!!**
JOG	Realize positive/negative point move by I/O, for debugging

	□ Positive point move □ Negative point move □ JOG speed and acceleration selectable
Position limit	Protect device by limiting move range ● Positive and negative signal input by IO ● Software position limit setting ● Position limit deceleration settable **Remark：Software position limit effective after homing accomplish.**
E-stop	Input E-stop signal through I/O，stop positioning operation.
Positioning	Select location path number by positioning address IO(AD0-3), Then start the location path operation by activate I/O(CTRG) ● Contains the positioning mode, speed mode and homing mode. ● IO rising edge double edge trigger start. ● Support continuous positioning ● Maximum 16 segment ● Position, speed, acceleration settable ● Pause/timing time settable **Remark： Double edge trigger only effective for CTRG !**
485 control	Use 485 communication to manipulate above PR working

Remark：（1）Under PR control mode, all places adopt unit: 10000P/r .

（2）PR only effective under PR position control mode, P0.01=6.

9.1.2 Installation wiring

IO terminal wiring and parameter configuration：Newly added IO of PR on the base of standard IO

Relevant parameters：

Parameter	Name	Specification
P400-P407	SI input selection	Specific of the 8 input terminals' function distribution，refer to functional allocation table.
P410-P415	SO output selection	Specific of the 6 output terminals' function distribution，refer to functional allocation table.

IO terminal functional allocation table：

Input				Output			
Signal name	**Symbol**	**set value**		**signal name**	**Symbol**	**set value**	
		Normally open	**Normally close**			**Normally open**	**Normally close**
Trigger command	CTRG	20h	A0h	Accomplish commands	CMD_OK	20h	A0h
Homing signal	HOME	21h	A1h	Accomplish path	MC_OK	21h	A1h
Forced to stop	STP	22h	A2h	Accomplish homing	HOME_OK	22h	A2h
Positive JOG	JOG+	23h	A3h	Torque limit	TQL	06h	86h

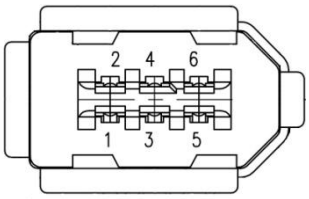
Negative JOG	JOG-	24h	A4h				
Forward limit	PL	25h	A5h				
Reverse limit	NL	26h	A6h				
Home signal	ORG	27h	A7h				
Path address_0	ADD0	28h	A8h				
Path address_1	ADD1	29h	A9h				
Path address_2	ADD2	2ah	Aah				
Path address_3	ADD3	2bh	Abh				
Torque switch	TC-SEL	09h	89h				

Remark：CMD_OK means PR instruction is sent， maybe motor is not yet in place.

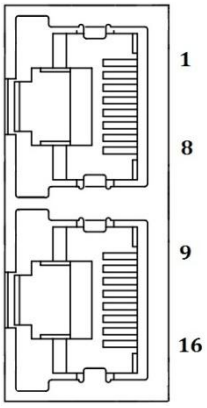
MC_OK means PR instruction is sent and motor is in place.

CTRG、HOME is edge trigging, but effective level need to last more than 1ms.

232 terminal connection diagram：

Port		Pin	Signal
CN2		1	VCC5V
		2	GND
		3	BAT+
		4	BAT-
		5	SD+
		6	SD-
			PE

485 terminal connection diagram：

Port		Pin	Signal
CN4 CN5		1，9	RDO+
		2，10	RDO-
		3，11	/
		4，12	TXD
		5，13	RXD
		6，14	VCC5V
		7，15	GND
		8，16	/
			PE

9.2 Parameter

PR parameters contain 8th and 9th parameters, 8th parameters is e-stop and control parameters, 9th parameters is store path table.

9.2.1 8th sort parameters specification

No.	Name	Data	Range	Default Value	Definition
P8.0	PR control setting	hex	0-3	0	PR's global control function Bit0：CTRG rising edge trigger / double edge trigger， 0/1 Bit1：Software limit effectively，0invalid /1valid Bit2：Homing after power on ,0 invalid /1valid
P8.1	PR path section number	16	16	0	Fixed 16 section
P8.2	Control register input	hex	0	0	Write 0x1P，P section locate 16-31 Write 0x20，homing Write 0x21，manual zero point setting Write 0x40，e-stop，Pinsignificance64 Read 0x00P，indicate positioning finished， can receive new data Read 0x10P， In operation Read 0x20P，In positioning
P8.3	Reserved	16	0	0	
P8.4	Reserved	16	0	0	
P8.5	Reserved	16	0	0	
P8.6	Positive software limit H	32	(+-2^31)	0x7FFF	Positive software limit +high16bit, during homing，software limit invalid.
P8.7	Positive software limit			0XFFFF	Positive software limit +low16bit,
P8.8	Negative software limit H	32	(+-2^31)	0x8000	Negative software limit -high16bit, The precision of software limit is 0.1 round
P8.9	Negative software limit			0	Negative software limit - low16bit
P8.10	Homing mode	hex		0	Homing mode, Bit0：homing reverse, 0reverse/1forward Bit1：Whether back to zero after homing, 0 No /1Yes Bit2-7：Homing mode
P8.11	Zero position H	32	(+-2^31)	0	Zero signal on coordinate axis. Such as take positive limit as homing signal but take negative limit as absolute position 0, then zero position is the distance between positive/negative limit.
P8.12	Zero position L			0	
P8.13	Homing stop positionH	32	(+-2^31)	0	After homing，motor stop after move to appointed position. If homing mode bit1 enable. Then moving to the absolute position after homing.
P8.14	Homing stop position L			0	
P8.15	Homing high speed	16	1-6000	200	Homing high speed

P8.16	Homing low speed	16	1-6000	50	Homing creeping speed
P8.17	Homing acceleration	16	1-32767	100	Homing acceleration
P8.18	Homing deceleration	16	1-32767	100	Homing deceleration
P8.19	Reserved			0	
P8.20	Reserved			0	
P8.21	Reserved			0	
P8.22	Position limit e-stop speed	16	1-32767	10	E-stop deceleration, when the limit is encountered
P8.23	STP e-stop speed	16	1-32767	50	E-stop speed, when the STOP signal is encountered
P8.24	Reserved	16	0	0	
P8.25	Reserved	16	0	0	
P8.26	Reserved	16	0	0	
P8.27	Reserved	16	0	0	
P8.28	Reserved	16	0	0	
P8.29	Reserved	16	0	0	
P8.30	Reserved	16	0	0	
P8.31	Reserved	16	0	0	
P8.32	Reserved	16	0	0	
P8.33	Reserved	16	0	0	
P8.34	Reserved	16	0	0	
P8.35	Reserved	16	0	0	
P8.36	Reserved	16	0	0	
P8.37	Reserved	16	0	0	
P8.38	Reserved	16	0	0	
P8.39	Reserved	16	0	0	

P8.40	Reserved	16	0	0	
P8.41	Reserved	16	0	0	
Pr8.42	Command position H	Read only 32	0	0	The current position of commands reset to zero after homing
Pr8.43	Command position L	Read only	0	0	
Pr8.44	Motor position H	Read only 32	0	0	Motor real position reset to zero after homing
Pr8.45	Motor position L	Read only	0	0	

9.2.2 9th sort parameters specification

No.	Name	Data type	Range	Default value	Definition
P9.0	PR1Mode	hex		0	PR path mode, determine the action according to type property Bit0-3：TYPE , 0 No Action /1 location positioning /2 speed running /3 homing, use P/V/H to express Bit4:INS,0 do no interrupt / 1interrupt, Use ！ to express interrupt , _ express interrupt （**Currently, they are all interrupt**） Bit5:OVLP，0do not overlap /1overlap, Use SJ to express no, overlap jump, use CJ to express overlap jump, （right now no） Bit6-7:0absolute/1relative instruction/2 relative to the motor/3opposite reference value, ABS/INC/REL/CAP（ right now only ABS、INC、REL） Bit8-13：0-15Jump to the corresponding path，Use SJ0x or CJ0x to express. bit14：JUMP，0 No jump，1 jump , No jump use END to express, jump use SJ or CJ。 （SJstop and jumpCJcontinueand jump）

P9.1	PR1 position H	16	(+-2^31)	0	The position parameter of the path, refer to PR motion type for specific meaning.
P9.2	PR1 position L	16		0	Position parameter low 16bit
P9.3	PR1speed	16	0+-6000	0	The position parameter of the path, refer to PR motion type for specific meaning.
P9.4	PR1 acceleration	16	1-32767	100	The position parameter of the path, refer to PR motion type for specific meaning.
P9.5	PR 1 Deceleration	16	1-32767	100	The position parameter of the path, refer to PR motion type for specific meaning.
P9.6	PR 1 Pause time	16	0-32767)	0	The pause of path, delay time parameter etc. Refer to PR motion type for specific meaning.
P9.7	PR 1 Reserved	16	0	0	PR 0 path is mapped toP8.02 parameters Used to trigger actions. Other paths standby is invalid.
P9.8-15	PR2	As above	As above	As above	As above
P9.16-23	PR3				
P9.24-31	PR4				
P9.32-39	PR5				
P9.40	PR6				
P9.48	PR7				
P9.56	PR8				
P9.64	PR9				
P9.72	PR10				
P9.80	PR11				
P9.88	PR12				
P9.96	PR13				
P9.104	PR14				
P9.112-119	PR15				
P9.120-127	PR16				

9.3 IO Operation mode

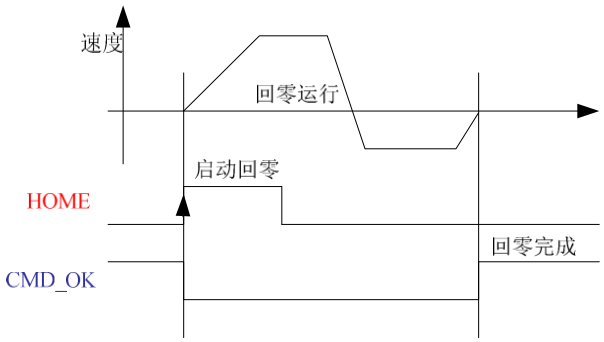
IO Can realize homing, path trigger, limit stop, and other functions.

9.3.1 Homing

Homing include zero point homing and manual homing. At the same time also includes first time power on active homing.

Relevant parameter：

Parameter	Name	Specification
P8.00	PR control setting	PR's global control function Bit0：CTRG Rising edge trigger / Double edge trigger，0/1 Bit1： software limit is valid，0 invalid/1 valid Bit2：homing after power on，0 invalid/1 valid
P810	Homing mode	Bit0：Homing direction，0 reverse/1 forward Bit1：whether move to specific position after homing, 0 No/1 Yes Bit2-7：Homing mode =0，Position limit homing =1，Zero point homing =2，Z phase homing （Need hardware support, not available at present） =8 Manual homing, The other is prohibited to use!
P811-P812	Zero point position	Zero point position on the coordinate axes P811 for high 16bit，P812 for low 16bit.
P813-P814	Homing jump position	Motor move to the specified location and stop after homing. If homing mode bit1 enable, then move to the absolute position after homing. P813 for high 16bit，P814 for low 16bit.
P815	Homing high speed	First speed of homing, unit: rpm.
P816	Homing low speed	Second speed of homing, unit: rpm.
P817	Homing acceleration time	Homing acceleration, unit: ms/1000rpm
P818	Homing deceleration time	Homing deceleration, unit: ms/1000rpm



Remark：Homing also be done by positioning function, only need to set the path to be homing mode.

CMD_OK and MC_OK Both of them can be used to represent action is complete，after the signal effective, there will have a delay within 1 ms.

9.3.2 Trigger path

Positioning path can make single segment running, also can make continuous running, configurable. There are three types of positioning path：Position location type, Speed running type and homing type, for flexible use.

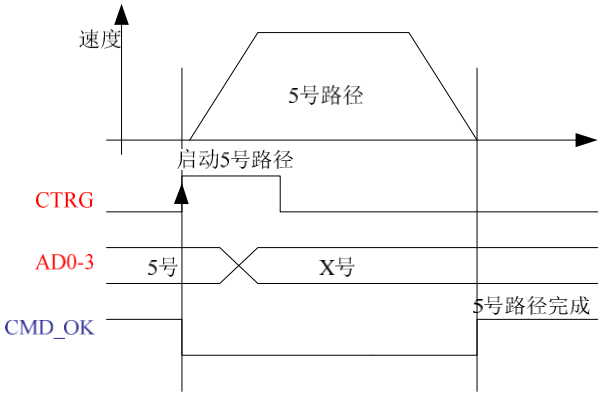
A total of 16PR path, each path set movement type alone, position method, speed, deceleration and pause time, etc. relevant parameters：

Parameters	Name	Specification
P900	Motion mode path 0	The model of the PR pat, to determine the action property according to motion mode Bit0-3：TYPE: 0 No Action /1 position addressing /2 speed running/3 homing Bit4: INS,0 do not interrupt /1 interrupt （All interrupt now） Bit5: OVLP，0 do not overlap /1 overlap（Null） Bit6-7: 0 absolute position /1 relative instruction /2 Relative to the motor Bit8-13： 0-15 Jump to the corresponding path Bit14： JUMP: 0 do not jump /1 jump

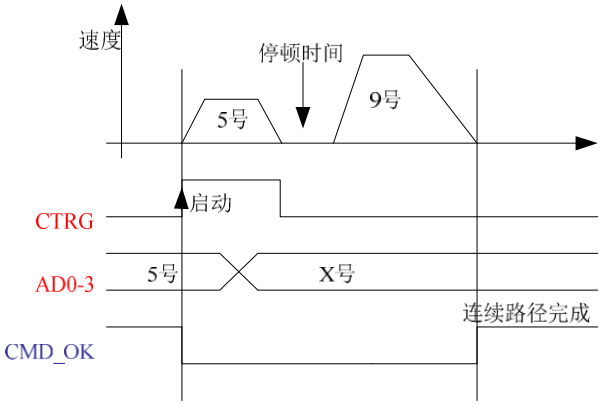
P901-P902	Position	P901 for high 16bit，P902 for low 16bit.
P903	Speed	running speed, rpm
P904	Acceleration time	Unit: ms/1000rpm
P905	Deceleration time	Unit: ms/1000rpm

P906	Pause time	Pause time after Instruction stop
P907	Special Parameters	Path 0 mapped to P802 directly， Other reserved
And so on		Each path occupy eight parameters and so on

Time sequence

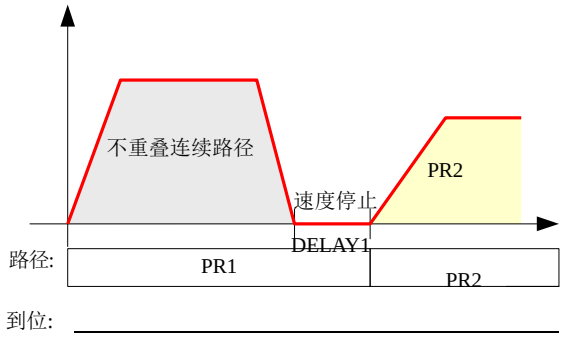


Single segment running:

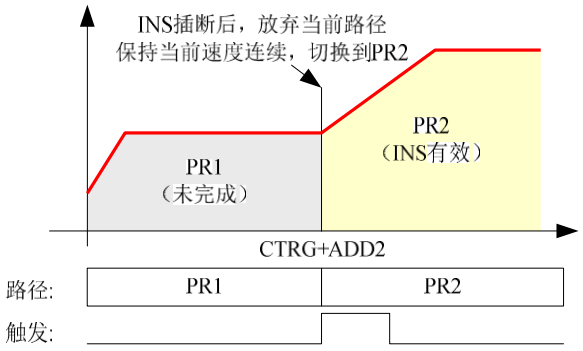


Continuous operation

P9.00bit5 is 0, continuous path does not overlap



Interrupt function can be understood as a path's priority. Interrupt valid path, can suspend or drop current path under the trigger, run the path directly. Similar to the interrupt priority level of functions. To set it in the path set parameters.



9.3.3 Position limit, JOG and E-stop function.

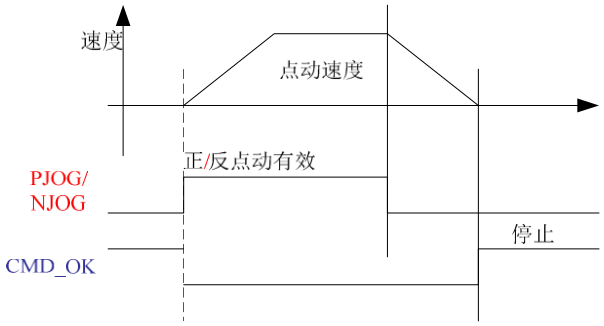
Relevant parameters

Parameters	Name	Specification
P800	PR Control parameter	Bit1： Software limit is valid
P806-P807	Positive limit	Software limit positive position
P808-P809	Negative limit	Software limit negative position
P822	Position limit E-stop time	Acceleration deceleration after position limit
P823	E-stop time	Acceleration deceleration after E-stop
P312	JOG Acceleration time	Unit: ms/1000rpm
P313	JOG Deceleration time	Unit: ms/1000rpm
P604	JOG speed	Unit: rpm
SI	Input terminal	Forced E-stop / STP / 22h Forward JOG / JOG+ / 23h

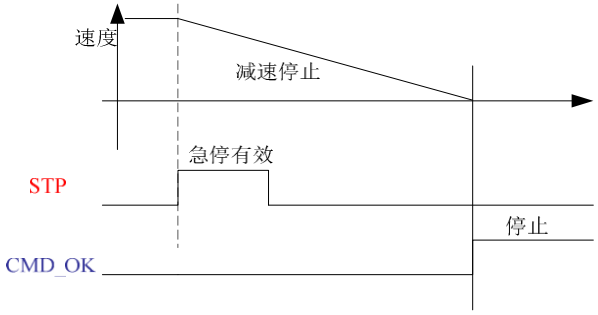
		ReverseJOG	JOG-	24h
		Forward position limit	PL	25h
		Reverse position limit	NL	26h

1、JOG

Manual point move function



2、Position limit and E-stop, apply to safe stop and so on condition.



9.4 Communication control mode

Communication control mode can realize same function as IO operation, Can flexible modify parameters and trigger action to run, can control more than one operation by field bus, save the wiring and good flexibility. Communications control includes two modes:Fixed trigger mode and immediately trigger mode.

9.4.1 parameters setting

Parameters	Name	Specification
Pr0.01	Control Mode Setup	Set Pr0.01=6 for Pr-Mode
Pr4.00	SI1 Input selection	Set 383 for internal SERVO-ON
Pr5.29	Communication mode	RS485 Communication mode selection，set 21 to select Modbus protocol. Don't need to change. For ELD2 485 communication , no need to change 21 to 53 For ELD5 485 communication , no need to change 21 to 53 For EL5 485 communication , need to change 21 to 53 For L7 485 communication , need to change 21 to 53

<table>
<tr><td>Pr5.30</td><td>Communication band rate</td><td>
<table>
<tr><th>Setting value</th><th>Baud rate</th></tr>
<tr><td>0</td><td>2400bps</td></tr>
<tr><td>1</td><td>4800bps</td></tr>
<tr><td>2</td><td>9600bps</td></tr>
<tr><td>3</td><td>19200bps</td></tr>
</table>
<table>
<tr><th>Setting value</th><th>Baud rate</th></tr>
<tr><td>4</td><td>38400bps</td></tr>
<tr><td>5</td><td>57600bps</td></tr>
<tr><td>6</td><td>115200bps</td></tr>
</table>
Baud rate deviation is 2400~38400bps ±5%, 57600~115200bps ±2%
</td></tr>
<tr><td>Pr5.31</td><td>Device No.</td><td>Modbus sub-station address number.</td></tr>
<tr><td>Pr8.02</td><td>PR trigger</td><td>（16bit，485 address..0x6002）
Write 0x01P，P section positioning Write
0x020，homing
Write 0x021，The current location manually set to zero.
Write 0x040，e-stop
Read 0x000p，means positioning completed, can receive new data .
Read 0x01P、0x020、0x040 Means still no responding to commands.
Read 0x10P， means path is running.
Read 0x200 means instructions completed and wait for positioning.</td></tr>
</table>

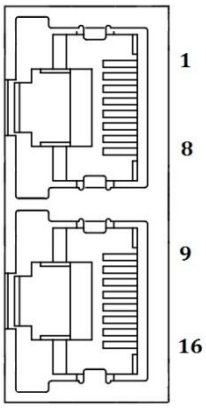
Communication address mapping of PR-MODE

485 address	Parameter	Name	Specification
0x6000	Pr8.00	PRcontrol setup	HEX
0x6002	Pr8.02	PRcontrol register	HEX
0x6006	Pr8.06	Positive software limit H	Pulse
0x6007	Pr8.07	Positive software limit L	Pulse
0x6008	Pr8.08	Negative software limit H	Pulse
0x6009	Pr8.09	Negative software limit L	Pulse
0x600a	Pr8.10	Homing mode	HEX
0x600b	Pr8.11	Zero position H	Pulse
0x600c	Pr8.12	Zero position L	Pulse
0x600d	Pr8.13	Homing stop position H	Pulse
0x600e	Pr8.14	Homing stop position L	Pulse
0x600f	Pr8.15	High speed homing	r/min
0x6010	Pr8.16	Low speed homing	r/min
0x6011	Pr8.17	Homing acceleration	ms/Krpm
0x6012	Pr8.18	Homing deceleration	ms/Krpm
0x6016	Pr8.22	Position limit e-stop speed	r/min
0x6017	Pr8.23	STP e-stop speed	r/min
0x602a	Pr8.42	Command positionH	Read only
0x602b	Pr8.43	Command positionL	Read only
0x602c	Pr8.44	Motor position H	Read only
0x602d	Pr8.45	Motor position L	Read only
0x602e	Pr8.46	Input IO status	Read only
0x602f	Pr8.47	Output IO status	Read only
	Pr9.00~Pr9.07	PR0 parameters	
0x6200	Pr9.00	PR0 mode	HEX
0x6201	Pr9.01	PR0 position H	Pulse
0x6202	Pr9.02	PR0 position L	Pulse

0x6203	Pr9.03	PR0 speed	r/min
0x6204	Pr9.04	PR0 acceleration	ms/Krpm
0x6205	Pr9.05	PR0 deceleration	ms/Krpm
0x6206	Pr9.06	PR0 pause time	ms
0x6207	Pr9.07	PR0 trigger	
0x6208~0x620f	Pr9.08~Pr9.15	PR1 parameters	
	The same with Pr9.00~Pr9.07		
0x6210~0x6217	Pr9.16~Pr9.23	PR2 parameters	
	The same with Pr9.00~Pr9.07		
0x6218~0x621f	Pr9.24~Pr9.31	PR3 parameters	
	The same with Pr9.00~Pr9.07		
0x6220~0x6227	Pr9.32~Pr9.39	PR4 parameters	
	The same with Pr9.00~Pr9.07		
0x6228~0x622f	Pr9.40~Pr9.47	PR5 parameters	
	The same with Pr9.00~Pr9.07		
0x6230~0x6237	Pr9.48~Pr9.55	PR6 parameters	
	The same with Pr9.00~Pr9.07		
0x6238~0x623f	Pr9.56~Pr9.63	PR7 parameters	
	The same with Pr9.00~Pr9.07		
0x6240~0x6247	Pr9.64~Pr9.71	PR8 parameters	
	The same with Pr9.00~Pr9.07		
0x6248~0x624f	Pr9.72~Pr9.79	PR9 parameters	
	The same with Pr9.00~Pr9.07		
0x6250~0x6257	Pr9.80~Pr9.87	PR10 parameters	
	The same with Pr9.00~Pr9.07		
0x6258~0x625f	Pr9.88~Pr9.95	PR11 parameters	
	The same with Pr9.00~Pr9.07		
0x6260~0x6267	Pr9.96~Pr9.103	PR12 parameters	
	The same with Pr9.00~Pr9.07		
0x6268~0x626f	P9.104~Pr9.111	PR13 parameters	
	The same with Pr9.00~Pr9.07		
0x6270~0x6277	Pr9.112-Pr119	PR14 parameters	
	The same with Pr9.00~Pr9.07		
0x6278~0x627f	Pr9.120-Pr127	PR15 parameters	
	The same with Pr9.00~Pr9.07		

9.4.2 485 communication Installation wiring

Bus connecror

Port		Pin	Signal
CN4 CN5		1，9	RDO+
		2，10	RDO-
		3，11	/
		4，12	TXD
		5，13	RXD
		6，14	VCC5V
		7，15	GND
		8，16	/
		连接器外壳	PE

Do not use CN3 communication port ， that is for parameters setting only

9.4.3 Fixed trigger mode

Fixed trigger mode is to config no more than 16 segments homing and path. Then, replace CTRG and HOME with P8.02(trigger register) to start the operation path. This mode apply to fixed motion and simple operation system.

As below procedure：

1. Firstly, config homing and path 0~ path 15 which need to run, can transmit parameter configuration temporarily after power on, also can configured to save with upper computer.
2. Enable drive.
3. Implement choice and start of actions by write corresponding instructions into 0x6002 (P8.02) .
   Write 0x01P, P segment positioning (write 0x010 to run path 0, write 0x013 to run path 3)
   Write 0x020,homing
   Write 0x021, current position manual set to zero.
   Write 0x040, E-stop.
   Read 0x000p, means positioning accomplished, can receive new data
   Read 0x01P, 0x020, 0x040 means still does not response to instructions.
   Read 0x10P, means path is running.
   Read 0x200, means instruction accomplished and wait for positioning.

Set path 0 parameters as the table show , path 1~path15 parameters are the same as path0

Parameters	Name	Specification
P900	Motion mode path 0	The model of the PR pat, to determine the action property according to motion mode Bit0-3：TYPE: 0 No Action /1 position addressing /2 speed running/3 homing Bit4: INS,0 do not interrupt /1 interrupt （All interrupt now） Bit5: OVLP，0 do not overlap /1 overlap（Null） Bit6-7: 0 absolute position /1 relative instruction /2 Relative to the motor Bit8-13： 0-15 Jump to the corresponding path Bit14： JUMP: 0 do not jump /1 jump
P901-P902	Position	P901 for high 16bit，P902 for low 16bit.

P903	Speed	running speed, rpm
P904	Acceleration time	Unit: ms/1000rpm
P905	Deceleration time	Unit: ms/1000rpm
P906	Pause time	Pause time after Instruction stop
P907	Special Parameters	Path 0 mapped to Pr8.02 directly，Other reserved
And so on		Each path occupy eight parameters and so on

Set path 1~ path15 as same as path0 .
Implement choice and start of actions by write corresponding instructions into 0x6002 (P8.02) , to chose which path to run .

9.4.4 Immediately trigger method

Fixed trigger is limited by 16 segment position, but immediately trigger method is flexible. It is written to the current path at each time, at the same time trigger the operation of this path. Realize position, speed , homing and such actions by a data frame.

This method adopt PR0 to implement, PR0 has 8 data in total, the last data P9.07 of it will mapped to P8.02, write in 0x10 can trigger PR0 operation immediately, realize data trigger running immediately.

Operating steps:

1. Firstly, configure homing and path which need to run, can power on and send parameter configuration temporarily, also can configure and save with upper computer. (homing must be configured)
2. Enable drive.
3. Operate fixed path by P8.02
4. Or write in immediate data by P9.00-9.07, and P9.07=0x10, implement immediately running path 0.

For example：

Order	**sending orders （Master->Slave）**				**return command (Slave->Master）**		
1	**ID**	Sub-station No.	0~31		**ID**	Sub-station No.	0~31
2	**FC**	Function code	0x10		**FC**	Function code	0x10
3	**ADDR**	Address	0x62		**ADDR**	Address	0x62
4			0x00				0x00
5	**NUM1**	Data quantity Word	0x00		**NUM**	Actually written data quantity	0x00
6			0x08				0x08
7	**NUM2**	Data quantity Byte	0x10		**CRC**	check code	Lo
							Hi
8-9	**P9.00**	Mode	XXXX				
10-11	**P9.01**	High position	XXXX				

12-13	**P9.02**	Low position	XXXX			
14-15	**P9.03**	Speed	XXXX			
16-17	**P9.04**	Acceleration	XXXX			
18-19	**P9.05**	Deceleration	XXXX			
20-21	**P9.06**	Delay time	XXXX			
22-23	**P9.07**	Trigger control	0x0010			
24	**CRC**	Check code	Lo			
25			Hi			

Please refer to parameter specification for specific data setting.

9.4.5 Test Pr-Mode with Serial debugging assistant

Disconnect and close the debugging software，Test PR mode with Serial debugging assistant software
PR mode communication trigger function description

9.4.5.1 Fixed trigger mode

Fixed trigger mode is to configure no more than 16 segments homing and path. Then, replace CTRG and HOME with P8.02 (trigger register) to start the operation path. This mode apply to fixed motion and simple operation system.

As below procedure：

1. Firstly, configure homing and path 0~ path 15 which need to run, can transmit parameter configuration temporarily after power on, also can configured to save with upper computer.
2. Enable drive.
3. Implement choice and start of actions by write corresponding instructions into 0x6002 (P8.02) .
   Write 0x01P, P segment positioning (write 0x010 to run path 0, write 0x013 to run path 3)
   Write 0x020,Homing
   Write 0x021, current position manual set to zero.
   Write 0x040, E-stop.
   Read 0x000p, means positioning accomplished, can receive new data
   Read 0x01P, 0x020, 0x040 means still does not response to instructions.
   Read 0x10P, means path is running.
   Read 0x200, means instruction accomplished and wait for positioning.

9.4.5.2 Immediately trigger method

Fixed trigger is limited by 16 segment position, but immediately trigger method is flexible. It is written to the current path at each time, at the same time trigger the operation of this path. Realize position, speed , homing and such actions by a data frame.

This method adopt PR0 to implement, PR0 has 8 data in total, the last data P9.07 of it will mapped to P8.02, write in 0x10 can trigger PR0 operation immediately, realize data trigger running immediately.

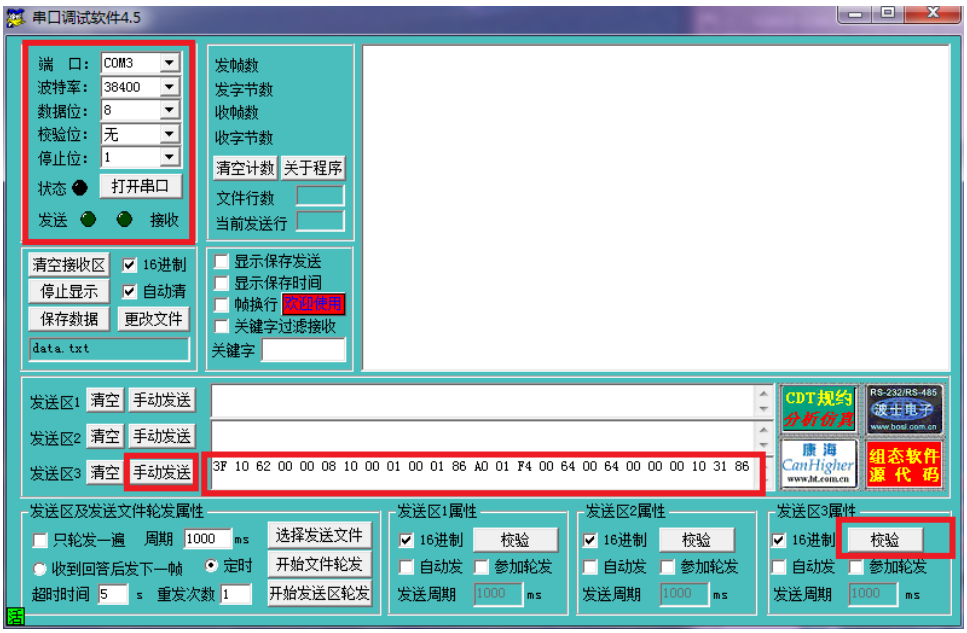
Operating steps:

1. Firstly, configure homing and path which need to run, can power on and send parameter configuration temporarily, also can configure and save with upper computer. (homing must be configured)
2. Enable drive.
3. Operate fixed path by P8.02
4. Or write in immediate data by P9.00-9.07, and P9.07=0x10, implement immediately running path 0.

Demonstrate with immediately trigger method
An example of MODBUS communication frame format operation is shown below:

Order	sending orders （Master->Slave）				return command (Slave->Master）		
1	**ID**	Sub-station No.	0~31		**ID**	Sub-station No.	0~31
2	**FC**	Function code	0x10		**FC**	Function code	0x10
3	**ADDR**	Address	0x62		**ADDR**	Address	0x62
4			0x00				0x00
5	**NUM1**	Data quantity Word	0x00		**NUM**	Actually written data quantity	0x00
6			0x08				0x08
7	**NUM2**	Data quantity Byte	0x10		**CRC**	Check code	Lo
							Hi
8-9	**P9.00**	Mode	XXXX				
10-11	**P9.01**	High position	XXXX				
12-13	**P9.02**	Low position	XXXX				
14-15	**P9.03**	Speed	XXXX				
16-17	**P9.04**	Acceleration	XXXX				
18-19	**P9.05**	Deceleration	XXXX				
20-21	**P9.06**	Delay time	XXXX				
22-23	**P9.07**	Trigger control	0x0010				
24	**CRC**	Check code	Lo				
25			Hi				

Open the serial debugging software



Set the correct communication format, the baud rate must be 38400, and the status light is red when the serial port is opened successfully

Fill in the data frame format in the sending area (according to relevant motion commands), and the last two bit bit data are CRC check codes, Instead of entering directly, click the check button of the corresponding send area to generate automatically, which is shown in figure 31 86

Absolute position: 3F 10 62 00 00 08 10 00 01 00 01 86 A0 01 F4 00 64 00 64 00 00 00 10 31 86

3F slave ID 63

10 function code, write multi data

Example for writing 2 data as blow:

FC=0x10 write multi data

NO	Send				Recieve		
1	**ID**	Slave ID	0~31		**ID**	Slave ID	0~31
2	**FC**	Function	0x10		**FC**	Function	0x10
3	**ADDR**	Address	Hi		**ADDR**	Address	Hi
4			Lo				Lo
5	**NUM1**	Data quantity Word	Hi		**NUM**	Actually written data quantity	Hi
6			Lo				Lo
7	**NUM2**	Data quantity Byte	2* NUM1		**CRC**	check code	Lo
							Hi
8	**DATA1**	DATA1	Hi				
9			Lo				
10	**DATA2**	DATA2	Hi				
11			Lo				
12	**CRC**	check code	Lo				
13			Hi				

62 00 first address mapped to Pr9.00

00 08 8 consecutive operating addresses from 62 00 to 62 07，mapped to Pr9.00~Pr9.07
10 Hexadecimal data of the number of data，8 register，each address data is divided into high and low bits， 8*2=16
00 01 data written down to the first addresses of 6200 mapped to Pr9.00
Motion Model，Absolute positioning mode
00 01 86 A0 data written down to the second and third addresses of 6201 mapped to Pr9.01；6202 mapped to Pr9.02
Hexadecimal data of position=100000plus. All positions in PR mode are in units of 10000P/r，therefore, 00 01 86 A0 represents ten turns of motor rotation
01 F4 data written down to the fourth addresses of 6203 mapped to Pr9.03
Hexadecimal data of Speed=500r/min
00 64 data written down to the five addresses of 6204 mapped to Pr9.04
Hexadecimal data of acceleration time=100ms
00 64 data written down to the six addresses of 6205 mapped to Pr9.05
Hexadecimal data of deceleration time=100ms
00 00 data written down to the seven addresses of 6206 mapped to Pr9.06
Hexadecimal data of the delay time=0ms
00 10 data written down to the eight addresses of 6207 mapped to Pr9.07 ， to trigger the action，
Immediately trigger method（1P，Immediately trigger path-P，The sample Pr9.00~9.07 is the positioning related data of path-0）
31 86 the verification code, do not have to directly input, click the corresponding send area verification button automatically generated
The final analysis is as follows: speed is 500r/min, acceleration and deceleration time is 100ms, and the position of absolute positioning is 10 rotation

3F 10 62 00 00 08 10 00 01 00 00 00 00 01 F4 00 64 00 64 00 00 00 10 3B 73
The final analysis was performed at a speed of 500r/min, acceleration and deceleration time of 100ms, and the position of absolute positioning 0 rotation was taken

Homing: 3F 06 60 02 00 21 33 0C（Back to origin high-speed, low-speed, and back to zero mode can be set in the eighth set of parameters, using default values this time）
Caution：In Pr mode, the origin induction switch is connected to the driver, which is different from the impulse control. Limited by conditions, only the current position can be demonstrated to the customer：Write 0x021，The current location manually set to zero.。
The frame format function is：
3F slave ID 63
06 function code，write single data

NO	Send				Recieve		
1	ID	Slave ID	0~31		ID	Slave ID	0~31
2	FC	Function	0x06		FC	Function	0x06
3	ADDR	Address	Hi		ADDR	Address	Hi
4			Lo				Lo
5	DATA	Data quantity Word	Hi		DATA	Actually written data quantity	Hi
6			Lo				Lo
7	CRC	check code	Lo		CRC	check code	Lo
8			Hi				Hi

60 02 register address，mapped to Pr8.02

00 21 the data write into the register，Write 0x021，The current location manually set to zero.
Write 0x01P，P section positioning
Write 0x020，homing
Write 0x021，The current location manually set to zero.
Write 0x040，e-stop
33 0C the verification code, do not have to directly input, click the corresponding send area verification button automatically generated

After the current position is set to zero manually, you can click absolute positioning again to send it manually, indicating that the current position is set to zero manually

JOG is IO input, there is no communication control method, you can push users to write relative positioning data in real time, and trigger inching motion immediately instead.

Speed： 3F 10 62 00 00 08 10 00 02 00 00 00 00 03 E8 00 64 00 64 00 00 00 10 41 78

3F slave ID 63
10 function code，write multi data
62 00 first address mapped to Pr9.00
00 08 8 consecutive operating addresses from 62 00 to 62 07，mapped to Pr9.00~Pr9.07
10 Hexadecimal data of the number of data，8 register，each address data is divided into high and low bits， 8*2=16
00 02 data written down to the first addresses of 6200 mapped to Pr9.00
Motion Model，Speed mode
00 00 00 00 data written down to the second and third addresses of 6201 mapped to Pr9.01；6202 mapped to Pr9.02.Hexadecimal data of position=0plus. All positions in PR mode are in units of 10000P/r，therefore, 00 00 00 00 represents 0 turns of motor rotation in Speed mode
03 E8 data written down to the fourth addresses of 6203 mapped to Pr9.03
Hexadecimal data of Speed=1000r/min
00 64 data written down to the five addresses of 6204 mapped to Pr9.04
Hexadecimal data of acceleration time=100ms
00 64 data written down to the six addresses of 6205 mapped to Pr9.05
Hexadecimal data of deceleration time=100ms
00 00 data written down to the seven addresses of 6206 mapped to Pr9.06
Hexadecimal data of the delay time=0ms
00 10 data written down to the eight addresses of 6207 mapped to Pr9.07 ， to trigger the action，Immediately trigger method（1P，Immediately trigger path-P，The sample Pr9.00~9.07 is the positioning related data of path-0）
41 78 the verification code, do not have to directly input, click the corresponding send area verification button automatically generated
The final analysis is as follows: speed=1000r/min, acceleration and deceleration time is 100ms, Speed mode

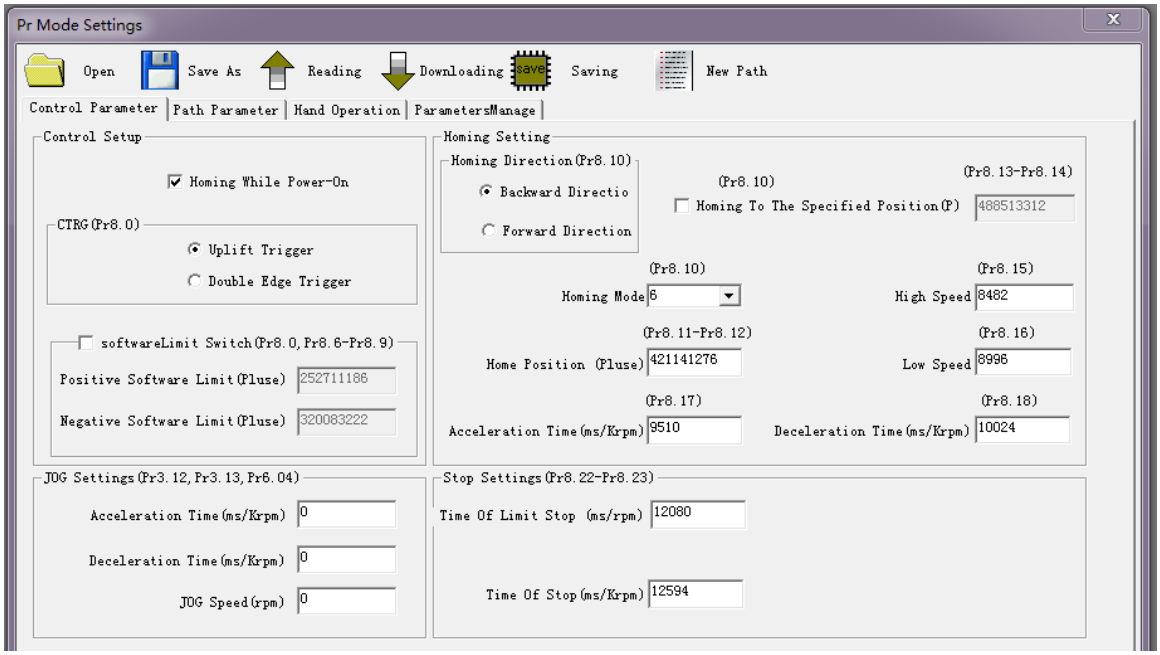
9.5 Upper computer operation

Upper computer is used for drive parameter setting and save, steps for debugging is:

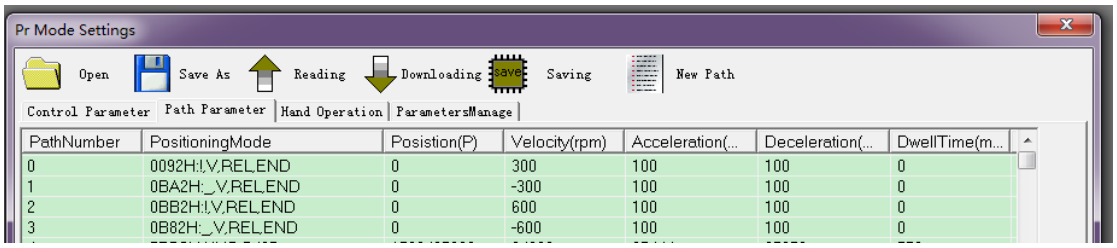
1. Three-loop control parameters. According to the position mode debugging method.

2. Set the work mode to be PR mode（Pr0.01=0），Internal SERVO-enabled （Pr4.00=383），set the distribution of IO register P4.0-P4.13) Confirm the running direction and so on.

3. Setting up the PR basic control parameters through upper computer's "PRmode" interface.
Include: trigger setting, software limit, JOG function, homing function, e-stop function and so on.



4. Setting up the PR positioning path parameters through upper computer's "PR mode" interface, include:



For the convenience of the positioning model expressing, use mnemonic symbol to express, su ch as:

_P , ABS , SJ1 means that path is position addressing, position value is absolute position, jump to No.1 path with delay, and can not interrupt running.

!V , ABS , SJ1 means that path is speed running, jump to No.1 path with delay, and can interrupt running.

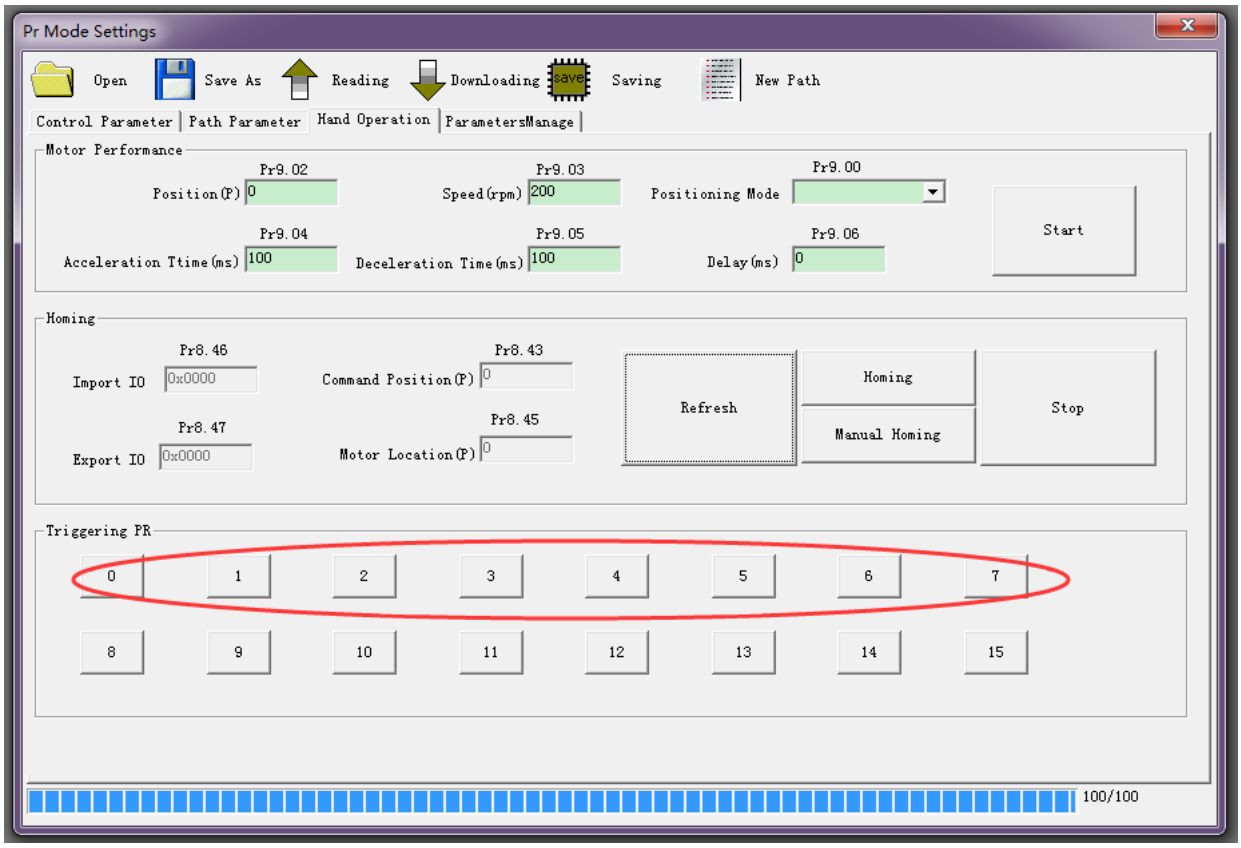
_HOME means that path is homing movement.

_END means that path is E-stop.

5. Test run

After confirming that the parameters are set correctly, the test begins. The interface is shown below

Click the number marked red in the figure and click start to run according to the speed in the path parameter configuration diagram. Click the corresponding number and click to run at the configured speed. If not, check that the parameters are set correctly



PR-mode manual operation diagram

9.6 RS485 Parameter address

Parameter	Address （decimalism）	Address（HEX）	Data Width
Pr0.00~Pr0.24	0~24	0x0~0x18	16 bit data
Pr1.00~Pr1.39	25~64	0x19~0x40	
Pr2.00~Pr2.29	65~94	0x41~0x5E	
Pr3.00~Pr3.29	95~124	0x5F~0xD6	
Pr4.00~Pr4.49	125~174	0x7D~0xFE	
Pr5.00~Pr5.39	175~214	0xAF~0xD6	
Pr6.00~Pr6.39	215~254	0xD7~0xFE	
Pr7.00~Pr7.91	255~349	0xFF~0x15D	
Pr8.00~Pr8.49	24576~24625	0x6000~0x6031	
Pr9.00~Pr9.127	25088~25215	0x6200~0x627F	

Status monitoring

Sort	Name	Address	Operation	Unit	Specification
status monitoring	U phase current	0x187	R	0.1A	
	V phase current	0x188	R	0.1A	
	Status monitoring pointer 1	0x191	R/W	--	Refer to specification2
	Status monitoring pointer 2	0x192	R/W	--	
	Status monitoring	0x193	R/W	--	

	pointer 3				
	Status monitoring pointer 4	0x194	R/W	--	
	Virtue input 1	0x197	R/W	--	
	Virtue input 2	0x198	R/W	--	
	Servo status	0x1F0	R	--	
	Virtue output	0x1F1	R	--	
	Status monitoring data 1	0x1F3	R	--	
	Status monitoring data 2	0x1F4	R	--	
	Status monitoring data 3	0x1F5	R	--	
	Status monitoring data 4	0x1F6	R	--	

Specification 2：

（2-15）Status monitoring：status monitoring X pointer：0x191~0x194，status monitoring X Data：0x1F3~0x1F6；X=1,2,3,4。

Status monitoring X data and status monitoring X pointer one-to-one correspondence. Status monitoringX data feedback status monitoring.

X pointer points to the data. The corresponding data of status monitoring X pointer are as below:

Pointer value	Name	Unit	Specification
0x03	Position deviation	pulse	
0x41	Speed feedback	r/min	
0x42	Speed deviation	r/min	
0x140	DC bus voltage	0.01V	
0x180	Analog input 1	0.01V	
0x200	SI1 Input port status	--	=1:High level；=0：Low level
0x201	SI2 Input port status	--	=1:High level；=0：Low level
0x202	SI3 Input port status	--	=1:High level；=0：Low level
0x203	SI4 Input port status	--	=1:High level；=0：Low level
0x204	SI5 Input port status	--	=1:High level；=0：Low level
0x205	SI6 Input port status	--	=1:High level；=0：Low level
0x206	SO1Output port status	--	=1:High level；=0：Low level
0x207	SO2 Output port status	--	=1:High level；=0：Low level
0x208	SO3 Output port status	--	=1:High level；=0：Low level
0x209	SO4 Output port status	--	=1:High level；=0：Low level

（2-2）Virture INPU T1：0x197

Bit	Name	Symbol	Operatio	Specification
[0]	Positive overtravel	POT	R/W	=1：valid ； =0：invalid
[1]	Negative overtravel	NOT	R/W	=1：valid ； =0：invalid
[2]	Servo enable	SRV-ON	R/W	=1：valid ； =0：invalid
[3]	Clear alarm	A-CLR	R/W	=1：valid ； =0：invalid
[4]	Reserved	--	--	--
[5]	Reserved	--	--	--
[6]	Position error clear	CL	R/W	=1：valid ； =0：invalid
[7]	Command pulse input is prohibited	INH	R/W	=1：valid ； =0：invalid
[8]	Reserved	--	--	--
[9]	Reserved	--	--	--
[10]	Reserved	--	--	--
[11]	Electronic gear selection 1	DIV1	R/W	=1：valid ； =0：invalid
[12]	Electronic gear selection 2	DIV2	R/W	=1：valid ； =0：invalid
[13]	Internal instruction speed choice 1	INTSPD1	R/W	=1：valid ； =0：invalid
[14]	Internal instruction speed choice 2	INTSPD2	R/W	=1：valid ； =0：invalid
[15]	Internal instruction speed choice 3	INTSPD3	R/W	=1：valid ； =0：invalid

（2-3）Virtual INPUT2：0x198

Bit	Name	Symbol	Operatio	Specification
[0]	Zero speed clamping	ZEROSPD	R/W	=1：valid ； =0：invalid
[1]	Torque instruction symbols	VC-SIGN	R/W	=1：valid ； =0：invalid
[2]	Torque instruction symbols	TC-SIGN	R/W	=1：valid ； =0：invalid
[3]	Forced alarm	E-STOP	R/W	=1：valid ； =0：invalid
[4]	Reserved	--	--	--
[5]	Position error clear	CL-LAST	R/W	=1：valid ； =0：invalid

[6]~[1	Reserved	Reserved	--	--

（2-4）Servo status：0x1F0

Bit	Name	Symbol	Operati	Specification
[0]	Reserved	Reserved	--	--
[1]	Servo enable	SRV-ON	R	=1：valid ； =0：invalid
[2]	Servo error	SRV-ERR	R	=1：valid ； =0：invalid
[3]~[	Reserved	Reserved	--	--

（2-5）Virtual OUTPUT：0x1F1

Bit	Name	Symbol	Operatio	Specification
[0]	Servo ready	SRDY	R	=1：valid ； =0：invalid
[1]	Reserved	--	--	--
[2]	Positioning completed	INP	R	=1：valid ； =0：invalid
[3]	Speed reach	ATSPD	R	=1：valid ； =0：invalid
[4]	Torque limit signals effective	TLC	R	=1：valid ； =0：invalid
[5]	zero-speed	ZSP	R	=1：valid ； =0： invalid
[6]	Velocity Matching	VCOIN	R	=1：valid ； =0：invalid
[7]	Reserved	--	--	--
[8]	Reserved	--	--	--
[9]	Position command have output or not	PCMD	R	=1：valid ； =0：invalid
[10]	Reserved	--	--	--
[11]	Reserved	--	--	--
[12]	Reserved	--	--	--
[13]	Speed command have output or not	VCMD	R	=1：valid ； =0：invalid
[14]	alarm signal	ALARM	R	=1：valid ； =0：invalid
[15]	Reserved	Reserved	--	--

（3）Alarm signal

Sort	Name	Address	Operation	Unit	Specification
Alarm signal	Servo error alarm	0x1f2	R	--	Refer to explain 3

Explain3

Alarm signal define：ADD 0x1f2			
The value of the bit [11:0](HEX). High 4 bit [15:12] must be shielded	Alarm List	The value of the bit [11:0](HEX). High 4 bit [15:12] must be shielded	Alarm List
0x000	No Alarm	0x190	excessive vibration
0x0E1/0x0E0	over-current	0x150	encoder line breaked
0x100	over-load	0x151/0x170	encoder data error
0x180	position error over-large error	0x152	initialized position of encoder error
0x1A0	over-speed	0x240	CRC verification error when EEPROM parameter is saved
0x1A1	motor speed out of control	0x570	
0x0D0	DC bus under-voltage	0x120	Resistance discharge circuit over-load
0x0C0	DC bus over-voltage	0x153	encoder battery error
0x171/0x172	encoder parameters read error	0x210/0x211/0x212	I/F input interface allocation error
Other values	Refer to user manual		

（4）Auxiliary function

Sort	Name	Address	Operation	Unit	Specification
Auxiliary function	Control word	0x19A	W	/	Refer to explain 4
	Status word	0x1E7	R	/	

Explain4

Auxiliary function operation procedure： Start the related functions by transmit control word, estimate completion by querying status word

State word back to initial status automatically after been read. Auxiliary function as below.

Address	Control word	Auxiliary function
0x19A	0x4444	Download default parameters（Except the motor parameters）
	0x5555	Save parameters
	0x7777	Remove the alarm (can only clear purgeable alarm）
	0x7788	Clear historical alarm

Address	Control word	Specification
0x1F7	0x5555	OK
	others	null

Chapter 10 Order Guidance

10.1 Capacity Selection

To determine the capacity of servo system, we must consider the inertia of load, torque of load, the positioning accuracy, the requirement of the highest speed, consider the selection according to the following steps:

1) Calculate Inertia of Load and Torque

You can refer to relative information to calculate inertia of load, torque of load, acceleration/deceleration torque as the next step basis.

2) Identify Mechanical Gear Ratio

According to the maximum speed and the highest speed of the motor ,you can calculate the maximum of mechanical reduction ratio, by using it and minimum of motor turning unit ,to calculate if they can meet the requirements of the smallest position unit or not. If the positional precision is high, you can increase the mechanical reduction ratio or select motor with higher capacity.

3) Calculate Inertia and Torque.

Convert mechanical reduction ratio of the load inertia and load torque to the motor shaft, while the result shall be not 5 times more than motor inertia. If the requirements can't be matched, you can increase the mechanical reduction ratio (the actual maximum speed reducing) or select larger capacity motor.

10.2 Electronic Gear Ratio

In position control mode, the actual speed = command pulse velocity× G ×mechanical reduction ratio.
In position control mode, the actual load minimum displacement = minimum command pulse travel ×G ×mechanical reduction ratio.
【Note 】If the electronic gear ratio of G is not 1, gear ratio division may have the remainder, then there will be position deviation existed, the maximum deviation is the minimum of rotation (minimum resolution).