EL8-RS Series AC Servo Drive

User Manual

Foreword

Thank you for purchasing Leadshine EL8-RS series AC Servo drives. This manual will provide information on the EL8-RS series servo products regarding product safety & specifications, installations & wiring, tuning & problem diagnostics.

Please contact us at tech@leadshine.com if you need further technical support.

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 any customer's modification of product and the warranty of product will be canceled at the same time.

Safety Precautions

Please read the safety instructions carefully before using the products and pay attention to the safety signs.

Danger	Might incur death or serious injury
Caution	Might cause injury to operating personals or damage to equipment
Warning	Might cause damage to equipment
	High voltage. Might cause electrocution to personals in contact
	Hot surface. Do not touch
	Protective Earth

Safety instructions

Warning

✓ The design of the product is not to be used in mechanical system which may incur health hazard.
✓ Users should be aware of the product safety precautions during design and installations of the equipment to prevent any unwanted accident.

Upon receiving

Caution

✓ The use of damaged or faulty product(s) is prohibited.
✓ Please refer to item checklist. If the labels don't match, please do not install.

Transportation

Caution

- ✓ Please provide storage and transportation under protected conditions.
- ✓ Do not stack the products too high up to prevent toppling.
- ✓ The product should be packaged properly during transportation,
- ✓ Do not hold the product by the cable, motor shaft or encoder while transporting it.
- ✓ The product should be protected from external forces and shock.

Installation

Caution

Servo drive and Motor:

- ✓ Do not install around combustibles to prevent fire hazard.
- ✓ Avoid vibration and impact.
- ✓ Do not install products that are damaged or incomplete.

Servo drive:

- ✓ Please install in electrical cabinet with sufficient protection from outside elements.
- ✓ Reserve sufficient gap as per the installation guide.
- ✓ Make sure to have good heat sinking.
- ✓ Avoid dust, corrosive gas, conductive object or fluid and combustibles.

Servo Motor:

- ✓ Make sure installation is tight to prevent it from loosening.
- ✓ Prevent fluid from leaking into motor and encoder.
- ✓ Protect motor from impact to avoid damaging encoder.
- ✓ Motor shaft should not bear the load beyond the limits as specified.

Wiring

Warning

- ✓ Participate installation personals should have sufficient training in product installation safety.
- ✓ Please power off and wait for 10 minutes to make sure a full discharge of electricity.
- ✓ Servo drive and motor must be connected to ground.
- ✓ Connect the cables only after servo drive motor installed correctly
- ✓ Make sure the wires are properly managed and insulation layer is not torn to prevent electrocution.

Caution

- ✓ Wiring must be correctly connected to prevent damage to product(s)
- ✓ Servo motor U, V, W terminal should be connected correctly and NOT connected directly to an AC power supply.
- ✓ Capacitor, inductor or filter shouldn't be installed between servo motor and servo drive.
- ✓ Connecting wires or any non-heat resistant components should be put near to heat sink of the servo drive or motor.
- ✓ The flyback diode which is connected in parallel to output signal DC relay must not be connected in reverse.

Tuning and running

Caution

- ✓ Make sure the wirings of servo drive and servo motor are installed and fixed properly before powering on.
- ✓ On the first time tuning of the product, it is recommended to run unloaded until all the parameter settings are confirmed to prevent any damage to the product or machine.

Usage

Caution

- ✓ Please install an emergency stop button on machine to stop operation immediately if there is an accident.
- ✓ Please make sure machine is stopped before clearing an alarm.
- ✓ Servo drive must be matched with specified motor.
- ✓ Frequent restart of the servo system might incur damage to the product.
- ✓ Servo drive and motor will be hot to touch shortly after power off. Please be careful.
- ✓ Modification(s) to servo system is prohibited.

Error Handling

Warning

- ✓ Please wait for 5 minutes after powering off for the electricity to be fully discharged before uninstalling the cables.
- ✓ Participate maintenance personals should have sufficient training in maintenance and operation of this product series.

Caution

- ✓ Please handle the error before clearing an alarm.
- ✓ Keep away from machine after a restart upon alarm. Mechanical axis might suddenly move. Such hazard should be prevented during the utilization of the product.

Model Selection

Caution

- ✓ Rated torque of the servo motor should be higher than continuous designated torque when fully loaded.
- ✓ Load inertia ratio of the motor should be lower or equals to recommended value for specified models
- ✓ Servo drive must be matched with specified motor.

Warranty Information

Available for

Leadshine overseas warranty only covers Leadshine AC servo products that are obtained through **Leadshine certified sales channel outside of China**.

Warranty claim

- All Leadshine AC servo products (Servo drives and motors) overseas enjoy **18-month** warranty period.
- Due to unforeseen circumstances in different sales regions around the globe, we recommend users to seek technical support from directed sales channel as any warranty claim or repair services may be required.
- Please be informed that any maintenance/repair work that is outside of the warranty claim conditions might incur some charges and to be confirmed before product(s) is being sent in.
- The duration required for maintenance work to be done is to be confirmed after initial check-up but we reserve the right to prolong the repair duration if needed.
- Discontinued products within warranty period will be replaced with a product of similar specifications.

Steps to warranty claim

1. Visit Leadshine global site www.leadshine.com to look for local certified sales channel.
2. Contact designated sales channel to check if any fee might incur. May include repair fee, spare part cost or shipping cost.

Circumstances where warranty claim is not available

- Damage/Loss due to occurrence of natural or man-made disaster such as fire, flood or earthquake.
- Installation or wiring error
- If there is any modification done to the product
- Warranty label on products is torn or not existing
- Not a product bought from Leadshine certified global network of retailers/distributors.

Before warranty claim

- Please backup device parameters before any repair work/warranty claim. Leadshine and Leadshine certified retailers/distributors will not be held responsibilities for any data loss.
- If available, please send product back in original packaging or make sure it is well packaged to prevent any damage to the product during shipping.

Leadshine Technology Co.,Ltd. and its certified sales channel reserved the final right of the interpretation of the warranty information.

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Chapter 1 Introduction

1.1 Product Introduction

EL8-RS Series AC Servo Product is a whole new high-end AC servo drivers and motors product range that we have proudly developed at Leadshine Technology Co.,Ltd. This product series provides more in demand functionalities with better performance and safety assurance. Applicable in most high end usages.

EL8-RS Series AC Servo Drive comes with power rating from 450W up to 2000W which supports Modbus communication protocol. Using RS485 protocol, multi axis network of EL8-RS series servo drive can be realized and controlled from 1 single master device.

EL8-RS series AC Servo Drive is equipped with easy servo tuning (One-click Tuning/ Single Parameter Tuning), better auto gain adjustments, vibration suppression and many more. We have not only upgraded the existing functionalities but also added in new features such as Gantry synchronization, full closed loop control and black box. This AC servo drive series also comes with new AC servo motors with 23-bit optical/magnetic encoder which offers better accuracy and stability. This series also comes with Safe Torque Off with SIL3 grading.

First time user of the EL8-RS series servo products can refer to this manual for more information on this product that cannot be covered in this short introduction. For further technical support, please do contact us or any local Leadshine certified retailers on Contact Us page.

1.2 Model number structure

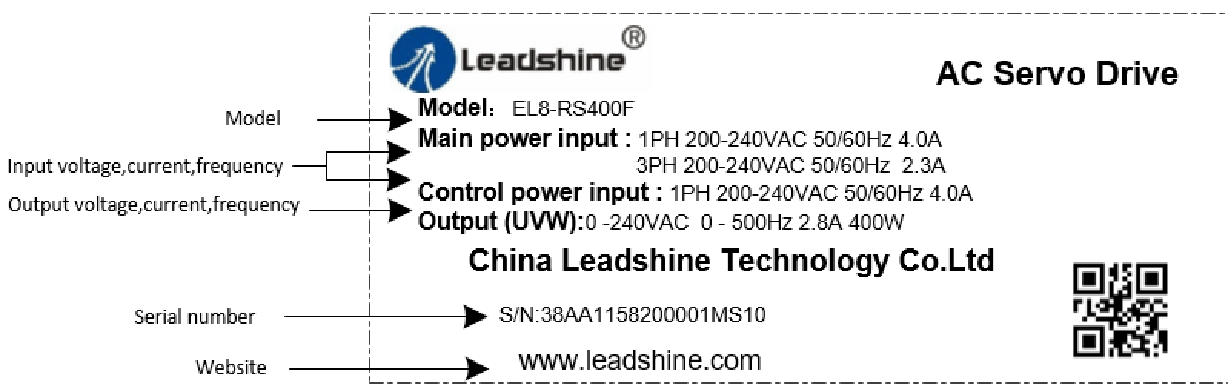
1.2.1 Servo Drive

EL8 - RS 400 F - □

① ② ③ ④ ⑤

No.	Description	
①	Series No.	EL8：EL8 AC Servo Drive Series
②	Communication protocol	RS：Pulse train + RS485 + Analogue EC：EtherCAT
③	Power Rating	400：400W 750：750W 1000:1000W 1500：1500W 2000: 2000W 3000: 3000W 4400: 4400W 5500: 5500W 7500: 7500W
④	Type	F: Full functions
⑤	Extra(customized)	Blank: Standard

Driver Label



1.2.2 Servo motor

ELM1 H - 0400 M A 60 F T - □

(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1)Series No.	
ELM1	ELM1 Series servo motor
ELM2	ELM2 Series servo motor

(2)Inertia Ratio	
L	Low
M	Medium
H	High

(3)Power Rating			
0050	50W	2000	2000W
0100	100W	2900	2900W
0200	200W	3000	3000W
0400	400W	4000	4000W
0750	750W	4400	4400W
0850	850W	5000	5000W
1000	1000W	5500	5500W
1300	1300W	7000	7000W
1500	1500W	7500	7500W
1800	1800W		

(4)Encoder Type	
L	23-bit optical multitum
M	23-bit magnetic multiturn

(5)Rated Speed	
A	3000rpm
B	2500rpm
C	2000rpm
D	1500rpm

(6)Frame Size	
40	40mm
60	60mm
80	80mm
100	100mm
130	130mm
180	180mm

(7)Motor Type	
E	With brake，oil seal
F	No brake，oil seal

(8)Voltage	
Blank	220VAC
T	380VAC

(9Motor Connector	
Blank	Direct Connector
H	Aviation Connector

1.3 Servo Drive Technical Specifications

EL8-RS Series Driver		EL8-RS400F	EL8-RS750F	EL8-RS1000F	EL8-RS1500F	EL8-RS2000F
Power Rating		400W	750W	1000W	1500W	2000W
Rated output current (A)		2.8	5.5	7.0	9.5	12
Maximum output current (A)		9.3	16.9	21.2	31.1	36
Continuous input current	Single phase	4	7.9	8.8	10.1	12.8
	three-phase	2.3	4.4	4.7	6.4	8.0
Control circuit power supply		1-Ph AC 200V-240V, -10% - +10%, 50/60Hz				
Main power supply		1-Ph/3-Ph AC 200V-240V,-10% - +10%, 50/60Hz				
Regenerative resistor	Resistance(Ω)	100			50	
	Power rating(W)	50			80	
Cooling method		Air-cooled	Fan-cooled			
Dimension H*L*W(mm)		150*150*43	150*160*55		168*183*80	

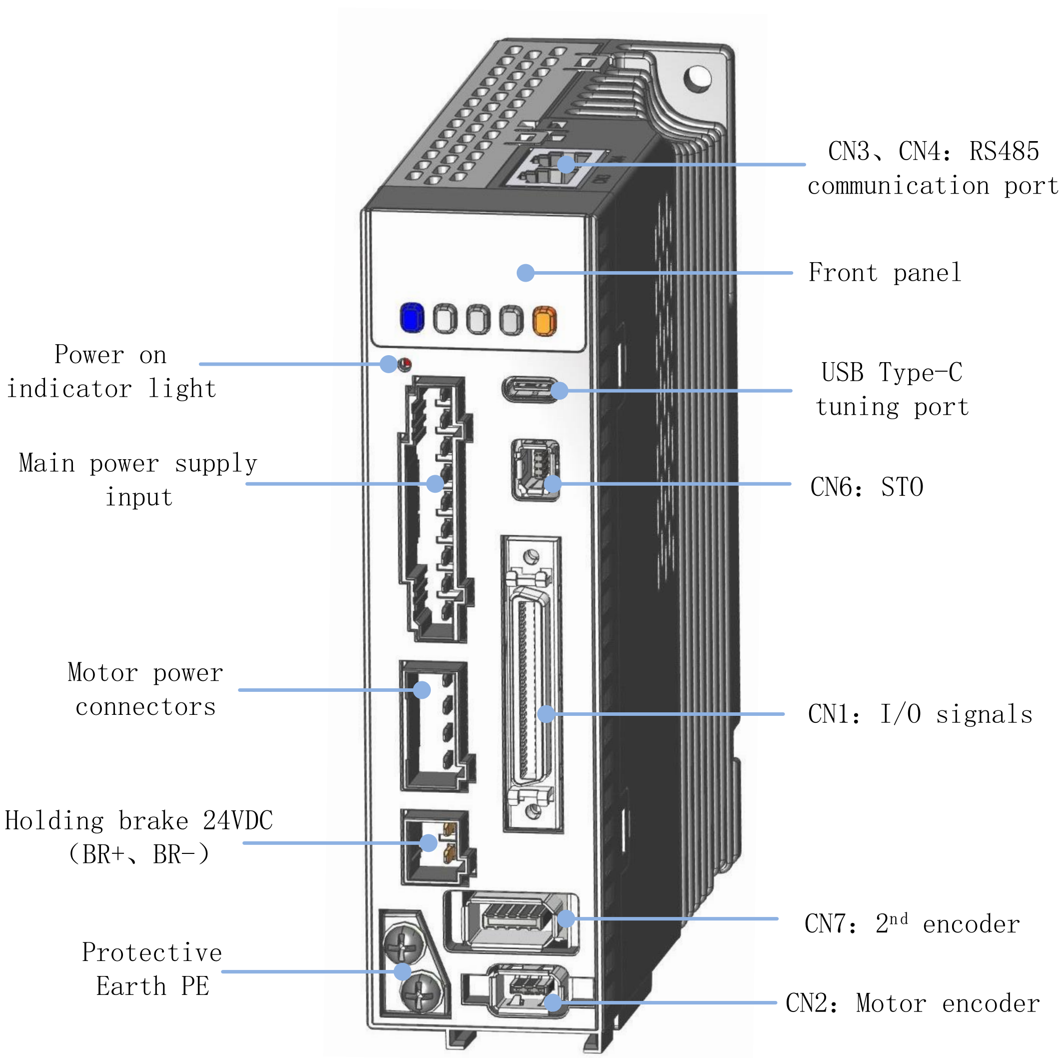
EL8-RS Series Driver		EL8-RS1000FT	EL8-RS1500FT	EL8-RS2000FT	EL8-RS3000FT	EL8-RS4400FT	EL8-RS5500FT	EL8-RS7500FT
Power Rating		1000	1500	2000	3000	4400	5500	7500
Rated output current (A)		3.5	5.4	8.4	12.0	16.5	20.8	25.7
Maximum output current (A)		10.6	14.9	20.0	24.8	38.9	51.6	63.6
Continuous input current	three-phase	2.4	3.6	5.6	8.0	11.6	15.8	20.8
Control circuit power supply		1-Ph AC 200V-240V, -10% - +10%, 50/60Hz						
Main power supply		3-Ph AC 200V-240V,-10% - +10%, 50/60Hz						
Regenerative resistor	Resistance(Ω)	50				35		
	Power rating(W)	80				100		
Cooling method		Fan-cooled						
Dimension H*L*W(mm)		168*183*80				250*230*89		

Ports	Descriptions
USB Type-C	Modify or read driver parameters without connecting to main power supply
Crossover Frequency Output	Supports phase A/B/Z differential crossover frequency output Supports phase Z open collector crossover frequency output
Low-speed pulse input	5V differential signal, 0-500kHz 24V differential signal, 0-200kHz
High-speed pulse input	5V differential signal, 0-4MHz
Analog Input	3 analog inputs（AI1/AI2/AI3）,-10V~+10V, Max. voltage: ±12V

Analog Output	2 analog outputs（AO1/AO2）, -10V~+10V
Digital Input	10 Digital Inputs (Supports common anode or cathode connection) 1. Servo enabled (SRV-ON) 2. Positive limit switch (POT) 3. Negative limit switch (NOT) 4. Gain switching (GAIN) 5. Emergency stop (E-Stop) 6. Deviation counter clearing (CL) 7. Control mode switching (C-MODE) 8. Torque limit switching (TL-SEL) 9. Vibration suppression 1(VS-SEL1) 10. Vibration suppression 2(VS-SEL2) 11. Command prohibition(INH) 12. Internal command velocity 1(INTSPD1) 13. Internal command velocity 2(INTSPD2) 14. Internal command velocity 3(INTSPD3) 15.Crossover frequency input(DIV1) 16. Zero speed clamp(ZEROSPD) 17.Velocity sign(VC-SIGN) 18.Torque sign(TC-SIGN) 19. Clear Alarm （A-CLR） *Under PR mode* 1. Path trigger (CTRG) 2. Home switch (HOME) 3. Emergency stop trigger(STP) 4. Path 0-3 (ADD0-ADD3) 5. Positive JOG (PJOG) 6. Negative JOG(NJOG) 7. Positive limit switch(PL) 8. Negative limit switch(NL) 9. Origin(ORG)
Digital Output	6 digital outputs（2 single ended, 4 double-ended） 1. Alarm (ALARM) 2. Servo ready (SRDY) 3. External brake off (BRK-OFF) 4. Positioning completed (INP1) 5. Velocity at arrival (AT-SPEED) 6. Zero speed position (ZSP) 7. Velocity coincidence (V-COIN) 8. Position command (P-CMD) 9. Velocity limit (V-LIMIT) 10. Velocity command (V-CMD) 11. Servo enabled (SRV-ST) 12. Positive limit switch(POT-OUT) 13. Negative limit switch (NOT-OUT) *Under PR mode* 1. Command completed (CMD-OK) 2. Path completed (PR-OK) 3. Homing done (HOME-OK)
Safe Torque Off (STO)	Available for all EL8-RS series servo drives
Encoder #2	
Holding brake	Internal holding brake. External relay not needed
Communication Port	Modbus protocol, RJ45 port
Control Mode	

Control		1. External pulse train position control 2. JOG control 3. Closed loop position control 4. Velocity control 5. Torque control 6. Hybrid control: Position-Torque/Position-Velocity/Velocity-Torque
Position	**Pulse frequency**	500kHz/4Mhz(5V differential input);200kHz(24V single-ended input)
	Electronic gear ratio	(1-8388608)/(1-8388608)
	Torque limit	*Please refer to parameter list*
Control Features		
Drive Mode		IGBT SVPWM sinusoidal wave drive
Feedback Method		Encoder: RS485 Protocol
Standardized Parameters		Quick tuning of servo driver parameters can be achieved through PC tuning tools.
Easy-to-use		One-click tuning, Single parameter tuning, Black box, Zero tracking control
Notch Filter		Mechanical resonance suppression. Supports up to 3 filters,50Hz~4000Hz
Vibration suppression		End vibration suppression
DI/DO settings		Digital inputs and outputs can be set accordingly
Alarm		Overcurrent. Overvoltage. Undervoltage. Overheat. Overload. Overtravel. Single-Phasing. Regenerative resistor error. Position deviation error. Encoder feedback error. Excessive braking rate. EEPROM error
Front Panel		5 push buttons, 8-segments display, 5 warning LEDs
Software		Driver tuning through **Motion Studio** Ver. 2.2.x. Parameters tuning in current loop, position loop, velocity loop; Modify I/O signal and motor parameters; Variables(velocity, position deviation, etc.) monitoring using step diagrams
Communication	**USB Type-C**	Modbus USB2.0 (No need to connect driver to power supply)
	Modbus	RJ45. Communication up to 32 axes to a host
Dynamic Brake		Internal dynamic brake
Position Comparison		42 position comparison outputs
Suitable Load Inertia		30 times smaller than motor inertia
Environmental requirements		
Temperature		Storage: -20-80℃ (Condensation free); Not more than 72 hours if stored in over 65℃ Installation: 0-55℃ (Not frozen); Lower performance at over 45℃
Humidity		Under 90%RH (Condensation free)
Altitude		Max. altitude of 2000m; 100% performance at 1000m or below. Performance decreases by 1% with every increase of 100m from 1000m.
Vibration		Less than 0.5G (4.9m/s2) 10-60Hz (non-continuous working)
IP ratings		IP20

1.4 Servo Drive Ports and Connectors

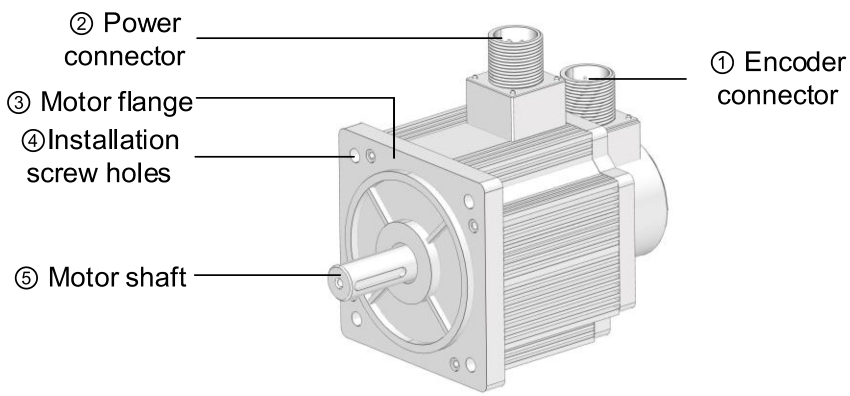


Front View of EL8-RS400F

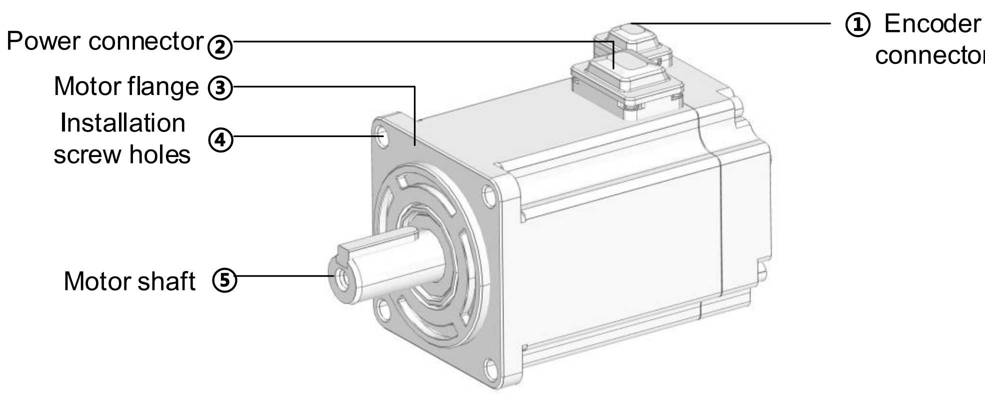
Parts & Connectors	Description
Front Panel	Including a LED display and 5 buttons. LED display is used to display servo driver status and parameter settings. 5 buttons： **M** ： *To switch between different modes and parameters* ◀ ： *Switch between value* ▲ ： *Switch between sub-menus/Increase* ▼ ： *Switch between sub-menus/Decrease* **S** **:** *Enter*
Type-C Data Port	Connect to computer for tuning of servo driver. Parameters of the servo driver can be modified without connecting to main power supply.
CN6 STO(Safety Torque Off)	STO connecters. Used for any application requiring STO functions.
CN1 I/O signal	I/O signal connection terminals(SCSI-50PIN)
CN2 Motor encoder	Connect to motor encoder
CN7 2nd encoder	Connect to external encoder
CN3 CN4 RS485 Communication Port	Connect to controller with RS485 interface
Holding Brake 24VDC	BR+/BR- brake terminals
Power-on indicator light	Lights up when servo driver is connected to main power supply. Please do not touch the power terminal immediately after power off as the capacitor might require some time to discharge.
Main power supply 220VAC	**L1C、L2C**： *Control circuit power supply(Single phase 220VAC)* **L1、L2、L3**： *Main power supply 220VAC* *Note：EL8 series supports 1P/3P 220VAC main power supply* **P+,B1,B2**: *Connect B1 and B2 to use internal regenerative resistor； If an external regenerative resistor is needed, connect it to P+ and B2， disconnect B1 and B2.*
Motor connectors	U,V,W Motor connector: Connect to U,V,W terminals on servo motor PE motor earth terminal: Connect to motor PE terminal
Protective Earth PE	Connect to PE of main power supply. For grounding

1.5 Motor ports and connectors

Motors with aviation connectors



Motors with direct connectors



Chapter 2 Installation & Wiring

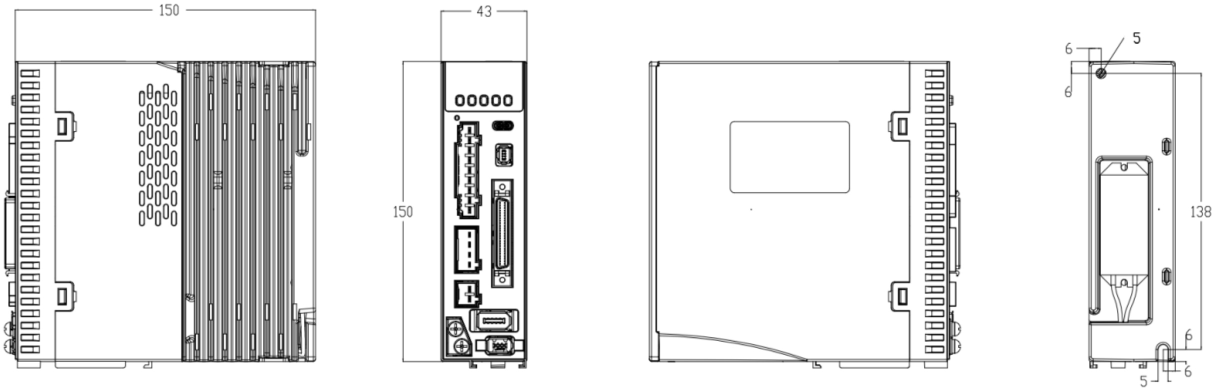
2.1 Servo Drive Installation

2.1.1 Servo drive installation environment

Temperature	Storage: -20-80℃ (Condensation free); Installation: 0-55℃ (Not frozen)
Humidity	Under 90%RH (Condensation free)
Altitude	Up to 1000m above sea level
Vibration	Less than 0.5G (4.9m/s2) 10-60Hz (non-continuous working)
Atmospheric	No corrosive gas, combustibles, dirt or dust.
IP ratings	IP20

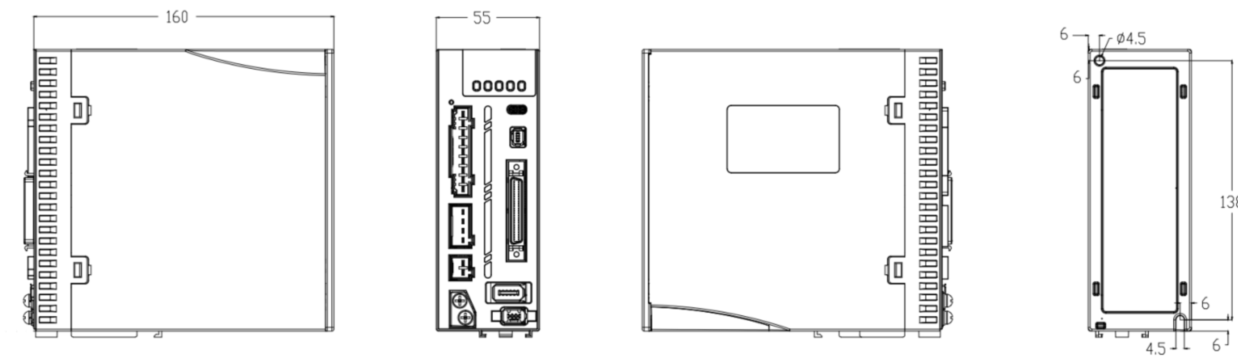
2.1.2 Servo drive dimension

Dimension 1: EL8-RS400F



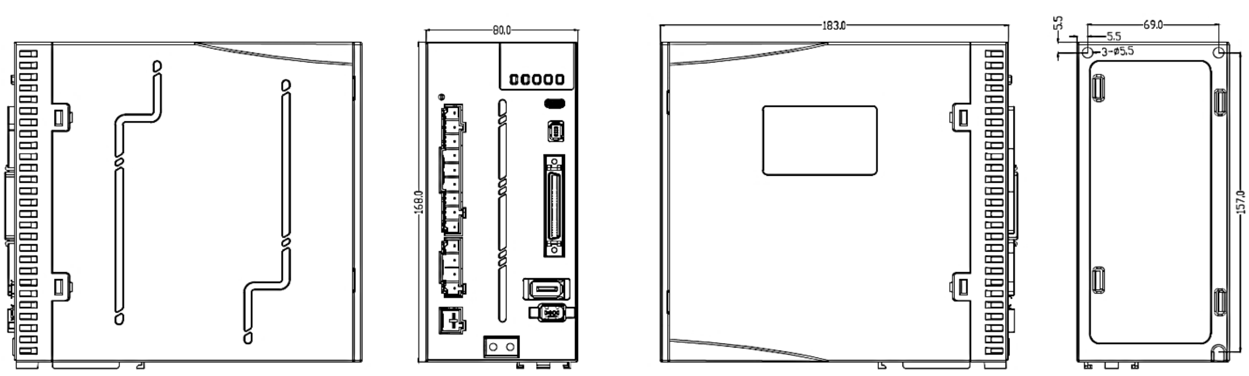
150mm x 150mm x 43mm

Dimension 2: EL8-RS750/1000F



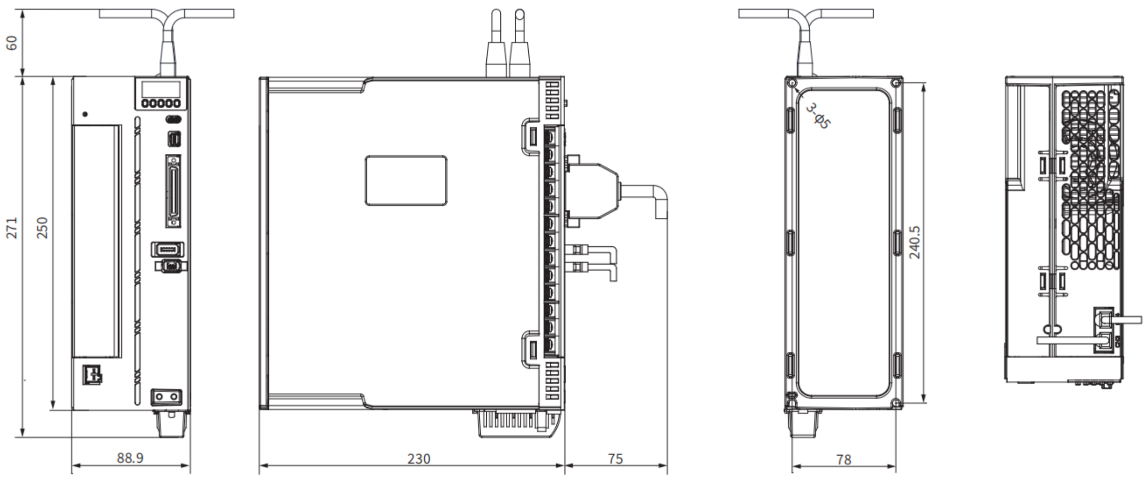
150mm x 160mm x 55mm

Dimension 3: EL8-RS1500/2000F EL8-RS1000T~ EL8-RS3000T



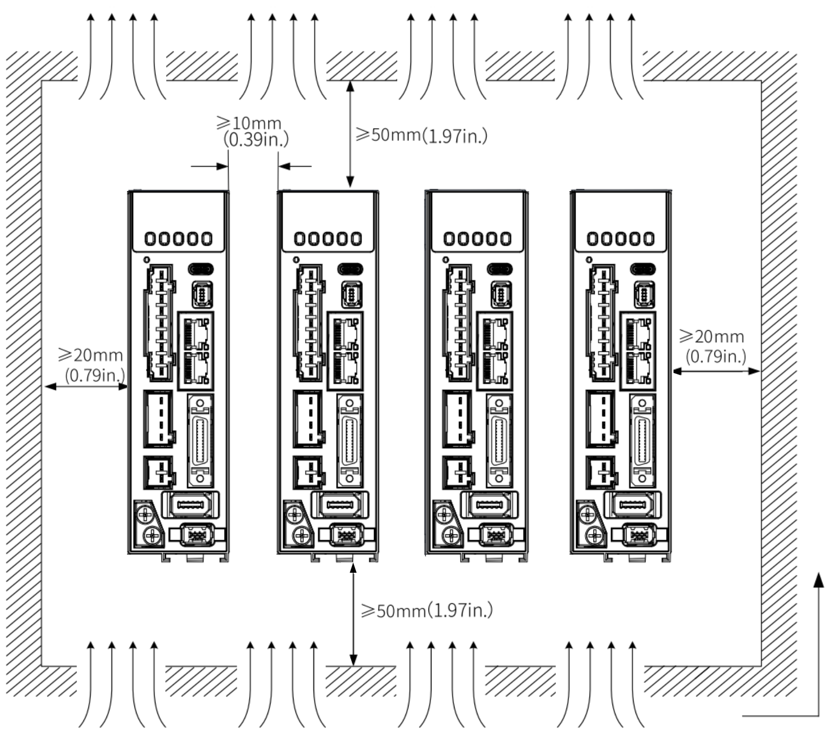
168mm x 183mm x 80mm

Dimension 4: EL8-RS4400T~ EL8-RS7500T



Space requirement for installation

In order to ensure efficient heat dissipation, please leave at least 10mm installation space in between drivers. If drivers need to be mounted compactly, please leave at 1mm of installation space. Please keep in mind that under such conditions, the drivers can only run at 75% of actual load rate.



- **Installation method**
  Please install the driver vertical to ground facing forward for better heat dissipation. Always install in rows and use heat insulation board to separate between rows.

Cooling fans are recommended for drivers to achieve optimal performance.

- **Grounding**
  PE terminals must be grounded to prevent electrocution hazard or electromagnetic interference.
- **Wiring**
  Please ensure there is no liquid around the wiring and connectors as liquid leakage may cause serious damage to the driver(s).
- **RJ45 port cover**
  Please cover unconnected RJ45 port(s) on top of the driver to prevent dust or liquid from damaging the ports.
- **Battery kit**
  If there is a need for battery kit, please remember to leave a room in the electrical cabinet for it.

2.2 Servo Motor Installation

2.2.1 Installation conditions

Installation conditions may affect the lifespan of a motor

- Please keep away from corrosive fluid and combustibles.
- If dusty working environment is unavoidable, please use motors with oil seal.
- Please keep away from heat source.
- If motor is used in enclosed environment without heat dissipation, motor lifespan will be short.
- Please check and clean the installation spot before installation.

2.2.2 Precautions during installation

Installation method

Install horizontal to ground

Make sure power cable and encoder cable is facing downwards to make sure fluid doesn’t leak into the ports.

Install vertical to ground

Please use a motor with oil seal when paired with a reducer to prevent reducer oil from leaking into the motor.

Oil- and waterproofing

- Do not submerge motor/cable under oil/water
- Please use a motor with oil seal when paired with a reducer to prevent reducer oil from leaking into the motor.
- If there is an unavoidable fluid leakage near the motor, please use motor with better IP ratings.
- Make sure power cable and encoder cable is facing downwards to make sure fluid doesn’t leak into the ports.
- Avoid the usage of motor in water/oil leaking prone environment.

Cable under stress

- Do not the bend the cable especially at each ends of the connectors.
- Make sure to not let the cables be too tight and under tremendous stress especially thinner cables such as signal cables.

Connectors

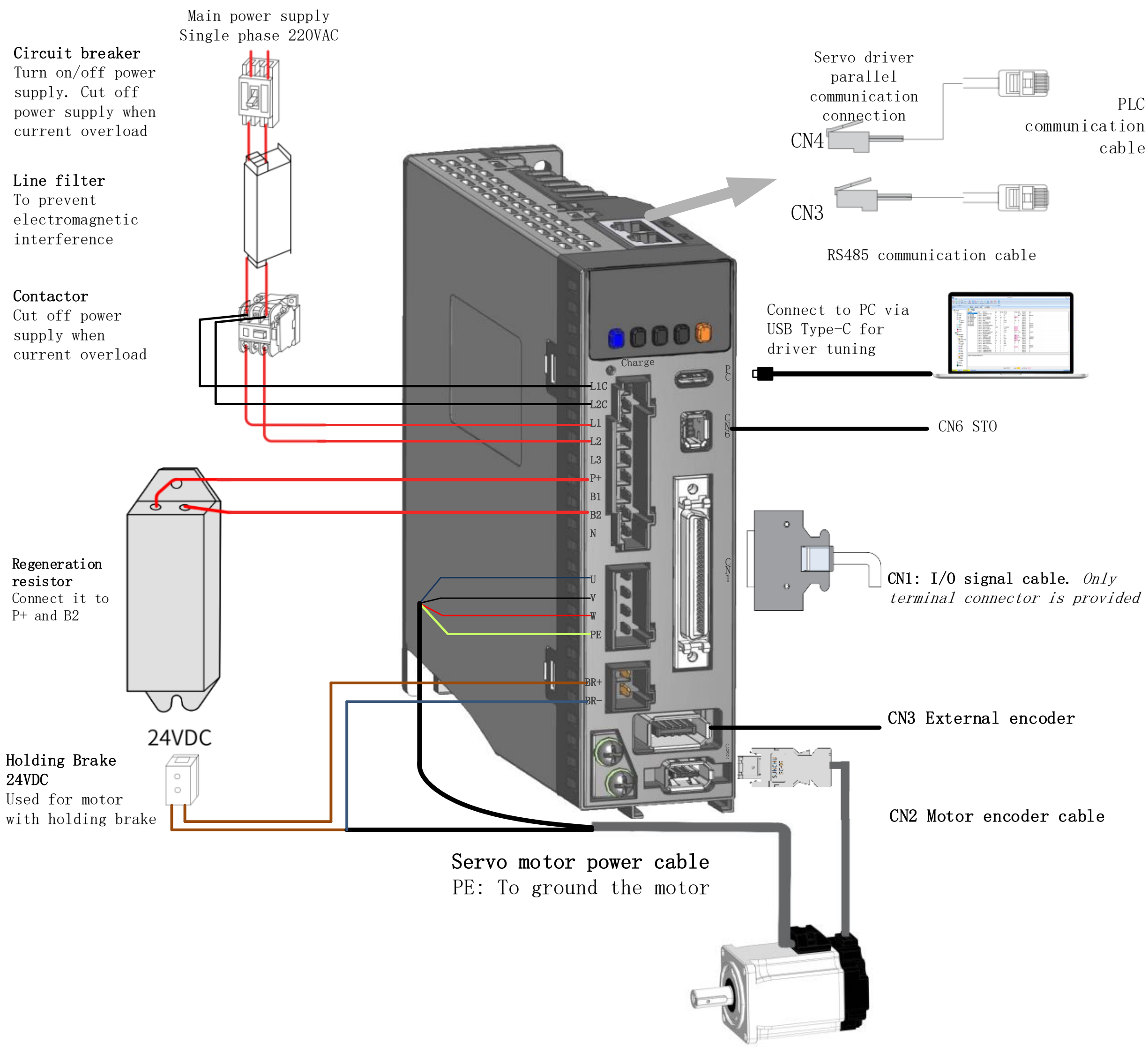
- Please to remove any conductive foreign objects from the connectors before installation
- The connectors are made of resin. May not withstand impact.
- Please hold the driver during transportation, not the cables.
- Leave enough “bend” on the connector cables to ensure less stress upon installation.

Encoder & coupling

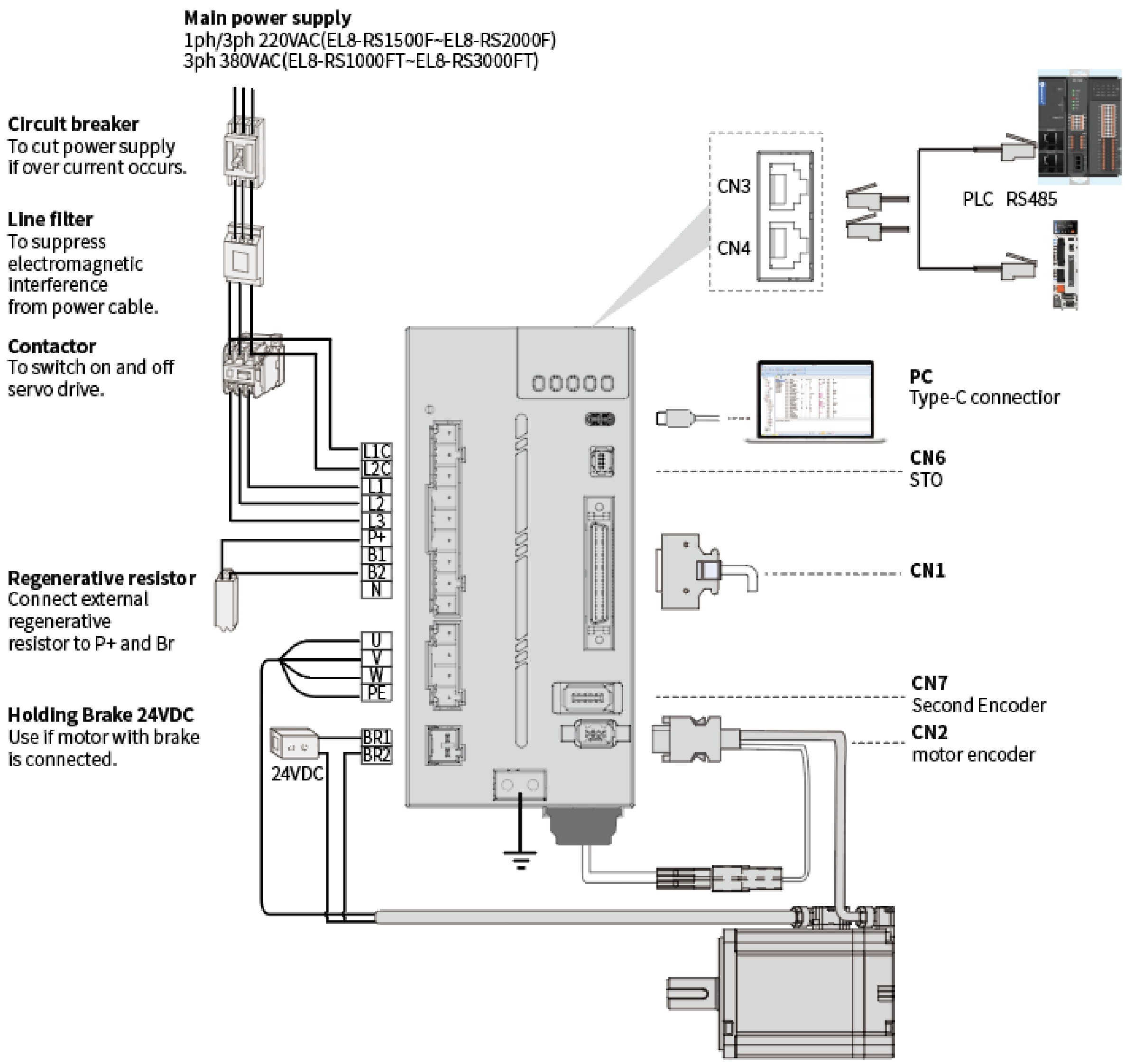
- During installation or removal of coupling, please do not hit the motor shaft with a hammer as it would cause damage to internal encoder.
- Please make sure to centralize the motor shaft and coupling, it might cause damage to motor or encoder due to vibration.
- Please make sure axial and radial load is within the limits specified as it might affect the lifespan of the motor or cause damage to it.

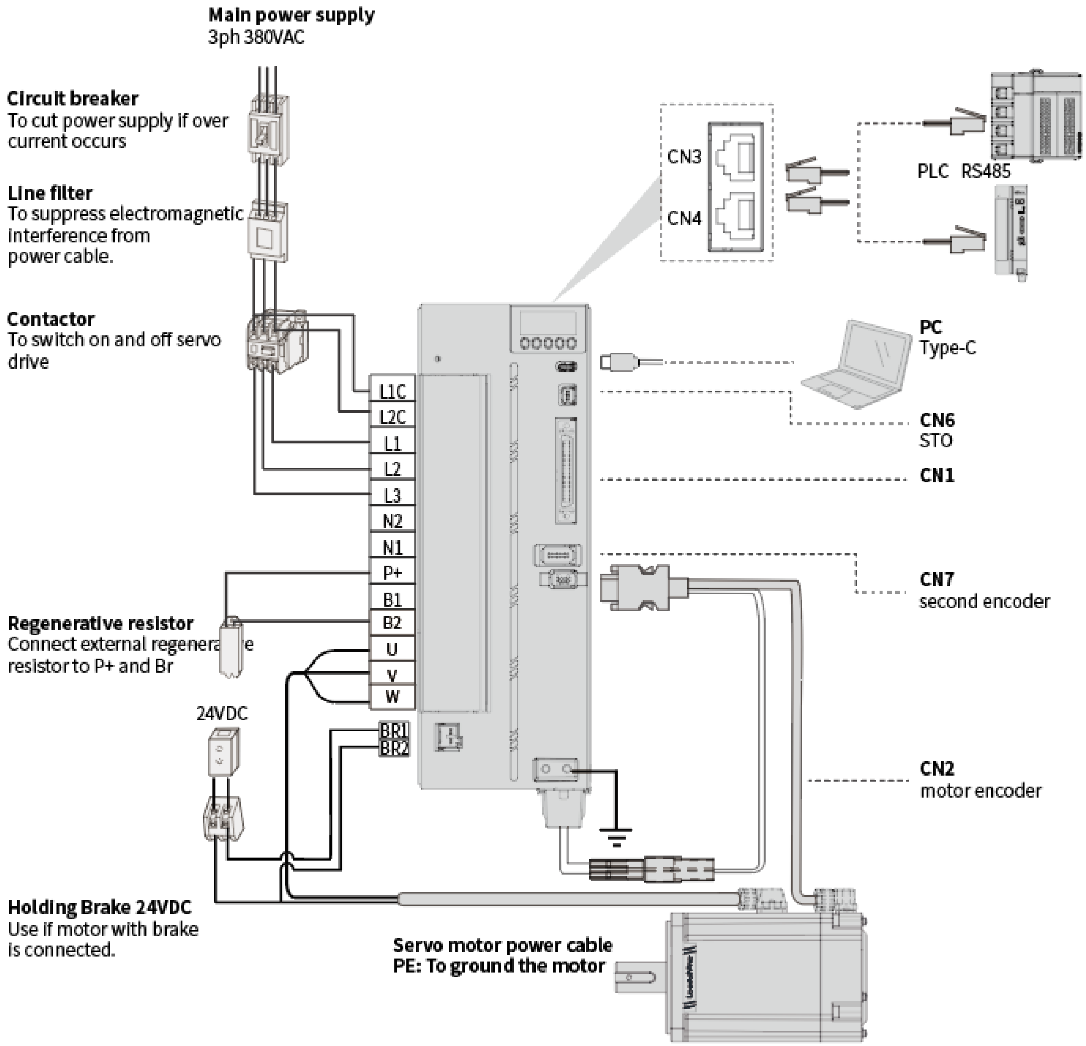
2.3 EL8-RS Wiring Diagram

EL8-RS 220VAC Wiring Diagram



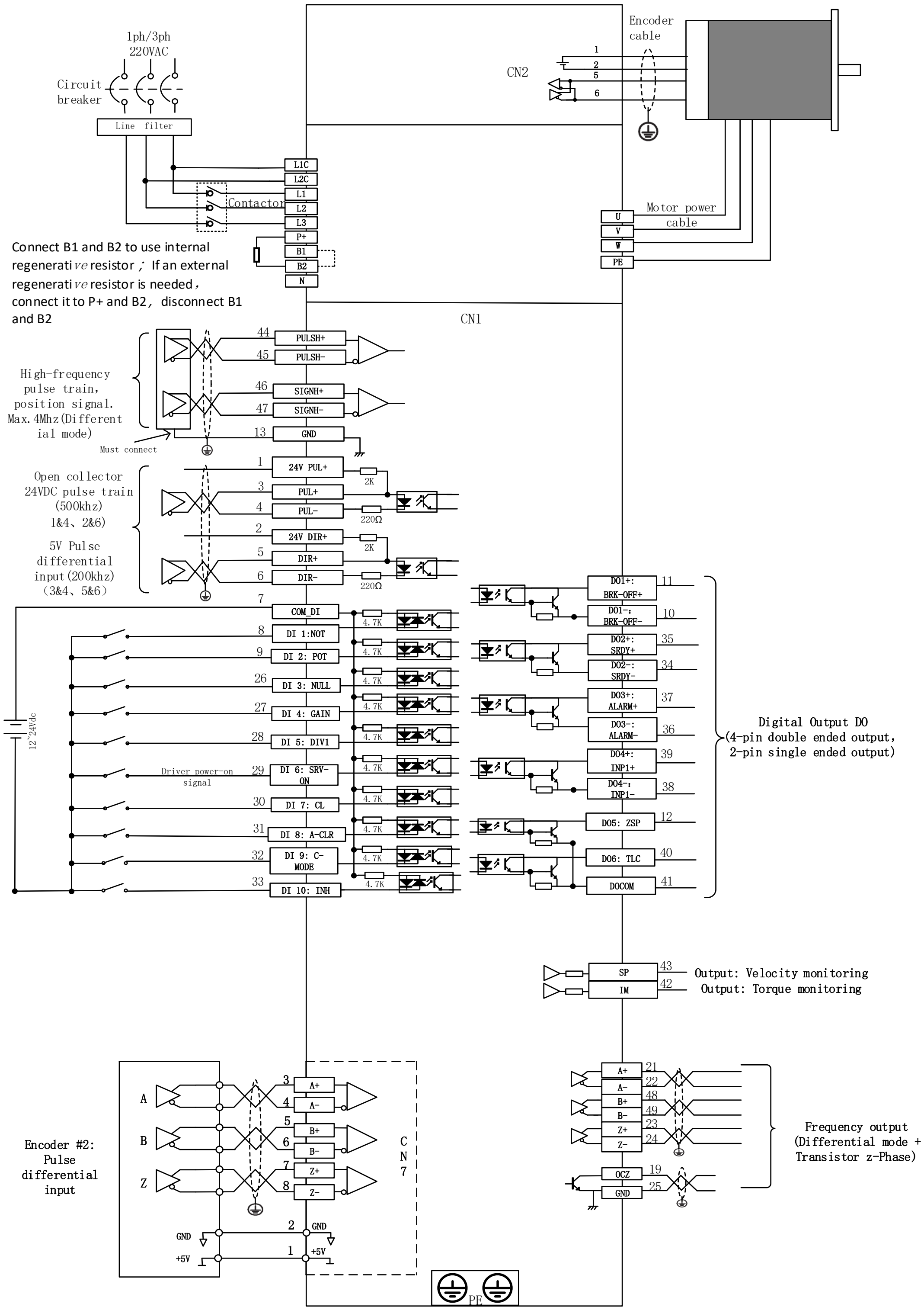
EL8-RS 400VAC Wiring Diagram




Main power supply
3ph 380VAC
Circuit breaker
To cut power supply if over current occurs
Line filter
To suppress electromagnetic interference from power cable.
Contactor
To switch on and off servo drive
L1C
L2C
L1
L2
L3
N2
N1
P+
B1
B2
U
V
W
BR1
BR2
Regenerative resistor
Connect external regenerative resistor to P+ and Br
24VDC
Holding Brake 24VDC
Use if motor with brake is connected.
Servo motor power cable
PE: To ground the motor
CN3
CN4
PLC RS485
PC
Type-C
CN6
STO
CN1
CN7
second encoder
CN2
motor encoder

2.3.1 Position control mode wiring diagram

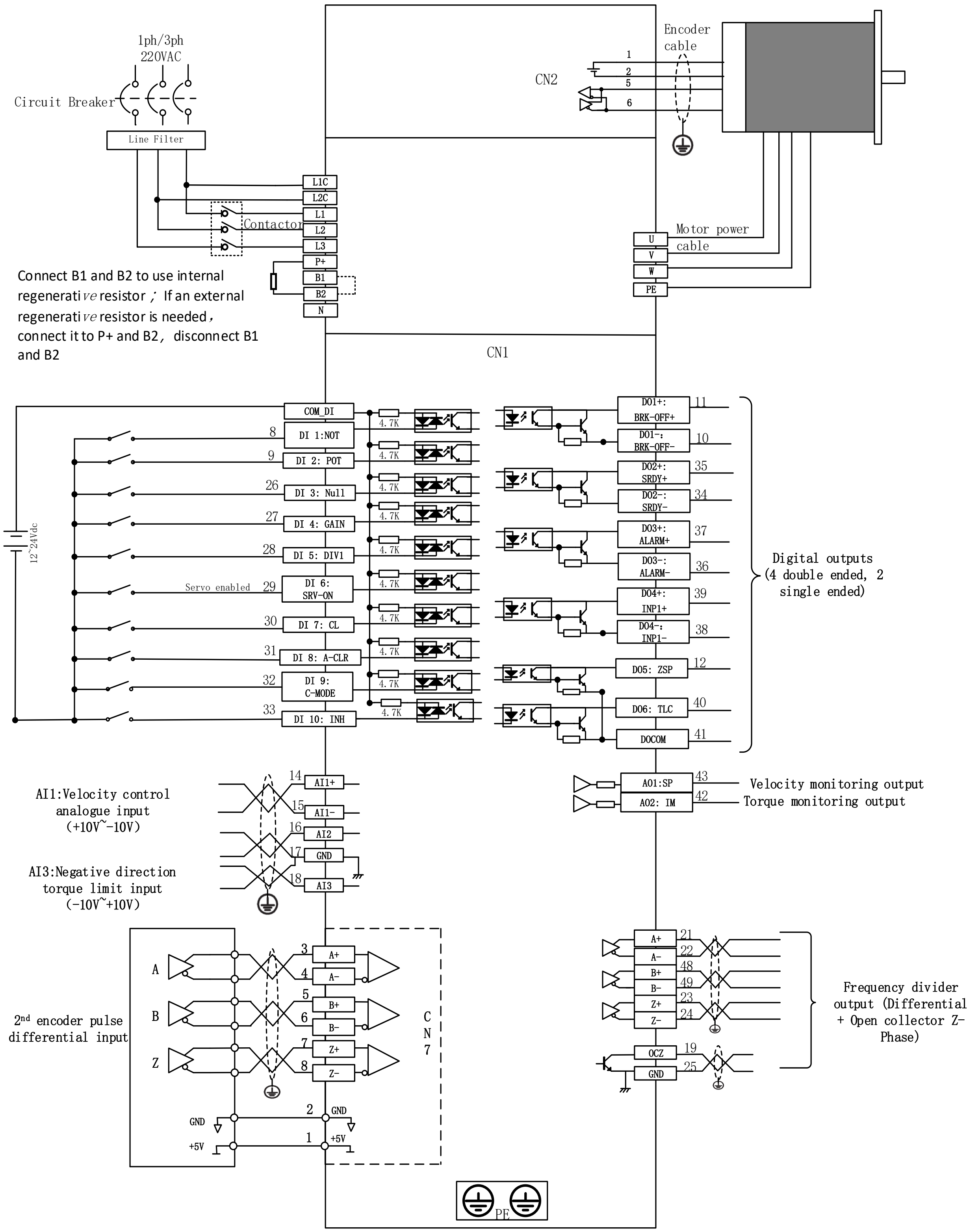
Position control mode + Full closed loop control wiring diagram



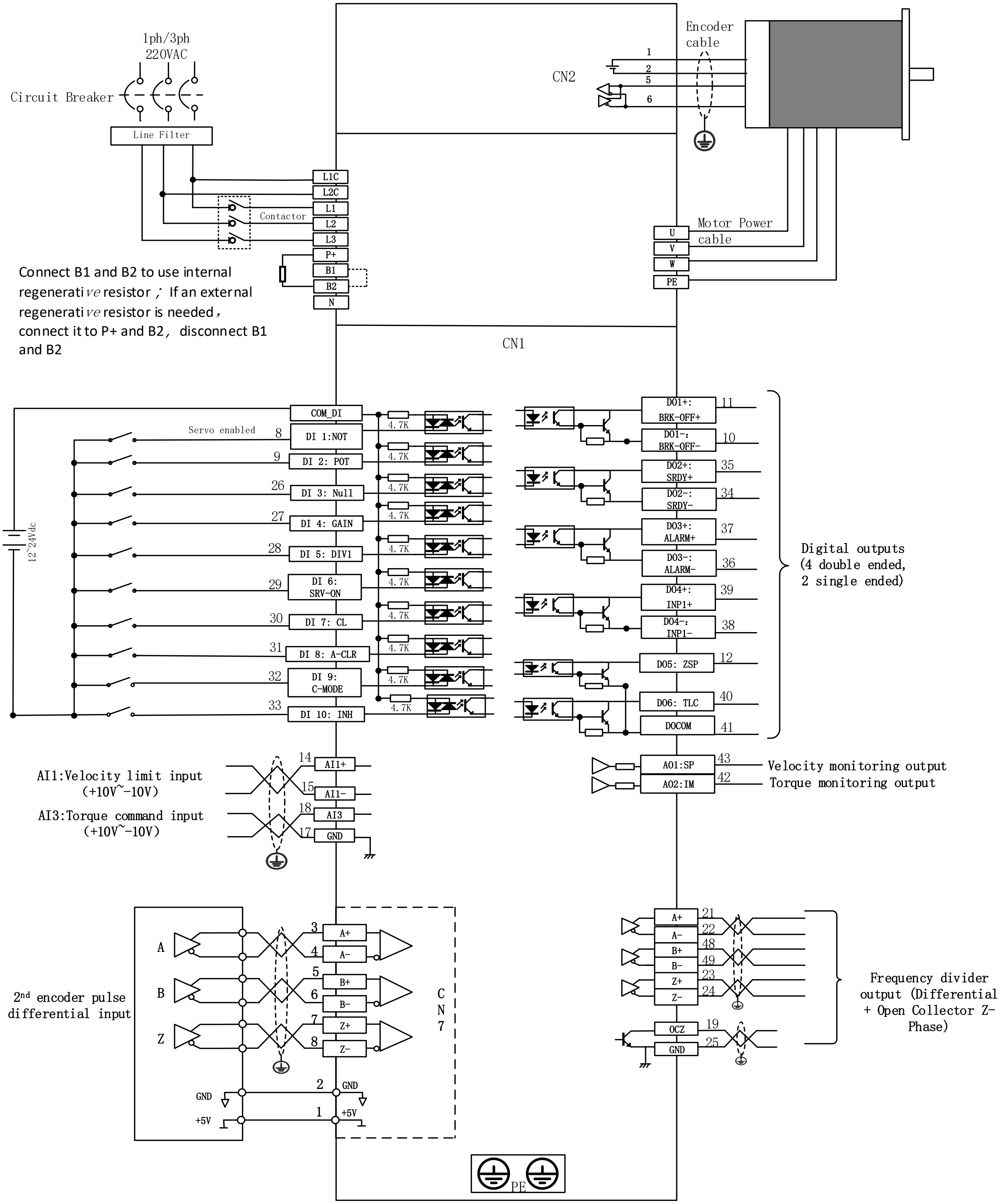
*Note: Please set **P00.05 to 1** when using high-frequency pulse train (max. 4 MHz)*

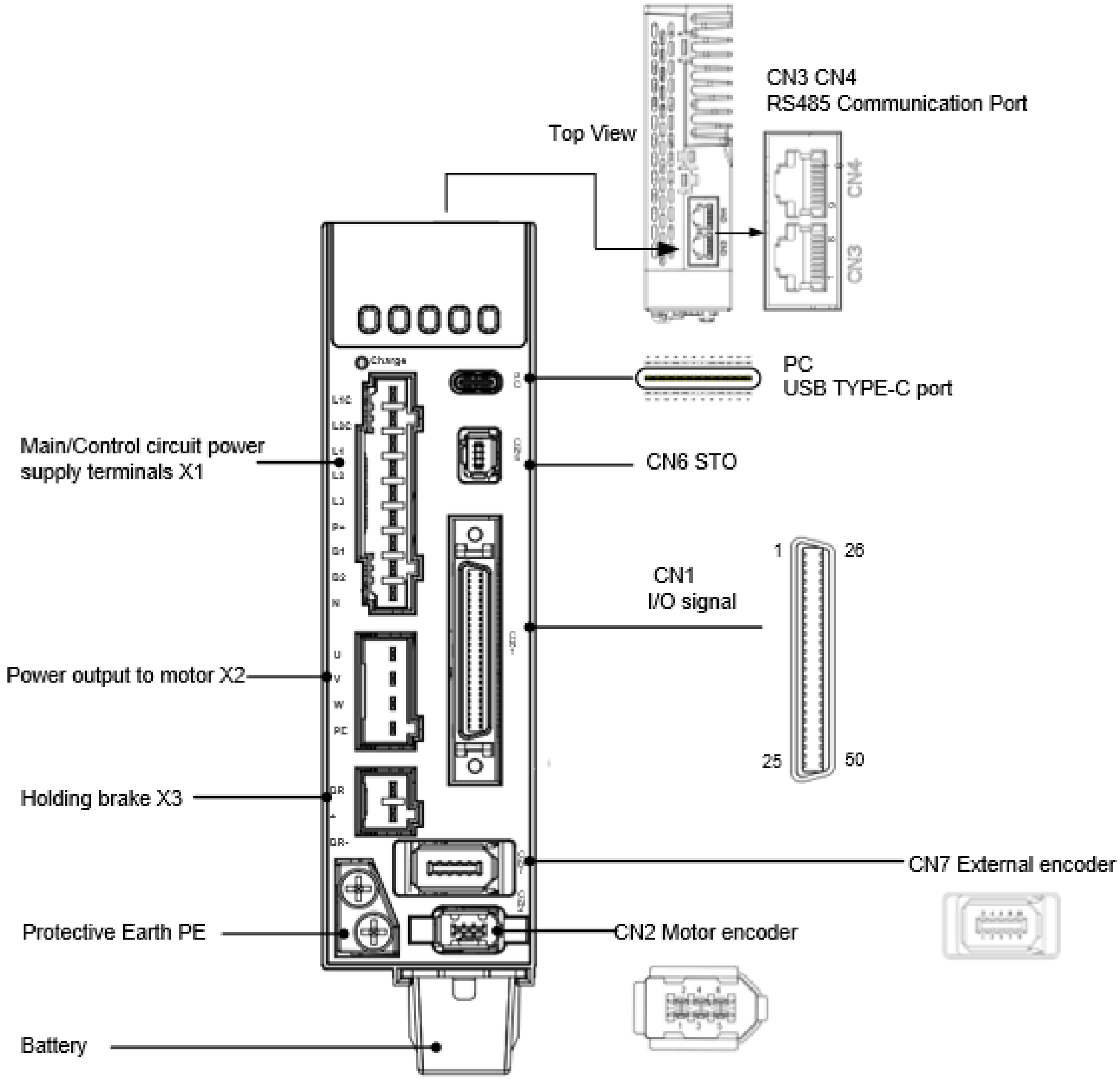
2.3.2 Velocity/Torque control mode wiring diagram

Velocity control mode wiring diagram



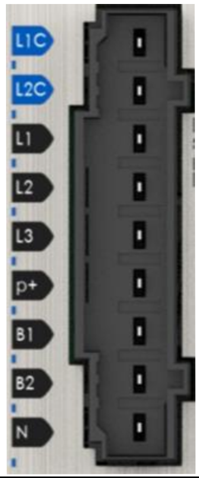
Torque control mode wiring diagram





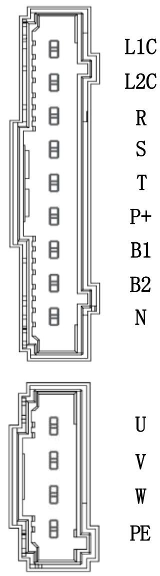
Connector	Label
CN1	I/O signal connector（50PIN）
CN2	Motor encoder feedback
CN3	RS485 Communication port
CN4	RS485 Communication port
CN6	STO Safety Torque Off port
CN7	External encoder feedback
X1	Main/Control circuit power supply
X2	Motor power supply
X3	Holding brake terminal
PC	USB type C port

2.5 X1 Main/Control Circuit Power Supply

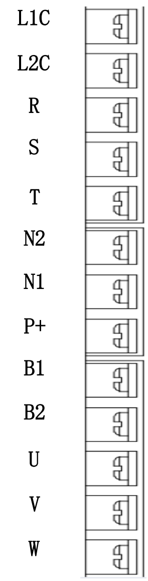


Pin	Label	Explanation	Remarks
L1C	Control circuit L1	Control circuit power supply. Single phase 220VAC	① Optional isolated switching power supply； ② Connecting to 380VAC will cause damage to driver； ③ Line filter is suggested in environment with strong interference； Use a fuseless circuit breaker to turn on/off power supply to driver.
L2C	Control circuit L2		
L1	Main power supply L1	Single phase 220VAC. Supports 1ph/3ph 220VAC,-10%～+10%,50/60Hz	
L2	Main power supply L2		
L3	Main power supply L3		
P +	DC Bus positive terminal	1. Internal DC bus positive terminal 2、External regenerative resistor P terminal	Connect B1 and B2 to use internal regenerative resistor If an external regenerative resistor is needed，connect it to P+ and B2，disconnect B1 and B2.
B1	Regenerative resistor terminal	Internal regenerative resistant drawing terminal	
B2	Regenerative resistor terminal	Internal IGBT transistor	
N	DC Bus negative terminal	Internal DC bus negative terminal	Please don’t connect to any cable

EL8-RS Series – 400V Models



Size C/D models



Size E models

Port	Pin	Functions	Remarks
X1	L1C	Control circuit: Single phase 380VAC, +10～-15%, 50/60Hz	① Optional isolation transformer ② In case of serious interference, it is recommended to connect a line filter to main power supply; *It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.*
	L2C		
	R	Main Power Supply: Three phase 380VAC, +10～-15%, 50/60Hz	
	S		
	T		
	P +	① Internal DC bus positive terminal ② External regenerative resistor P terminal	If an external regenerative resistor is required, please disconnect B1 and B2. Connect the external regenerative resistor to terminal P+ and B2.
	B1/B2	External regenerative resistor terminal	
	N	Internal DC bus negative terminal	Please do not connect
	N1		N1 and N2 are connected under normal circumstances. To suppress power supply high harmonics, please disconnected N1 and N2. Connect a DC reactor between N1 and N2.
	N2		
	U	Motor U terminal	Please ensure proper wire connection on motor.
	V	Motor V terminal	
	W	Motor W terminal	

	PE	Motor Protective Earth	Please ground PE of driver and motor together

2.5.1 Main power supply cable selection

Please connect to L1C/L2C (Control circuit) and L1/L2/L3 (Main power) to rated power supply voltage for the driver to operate under normal working condition. Driver will not function without both connected properly.

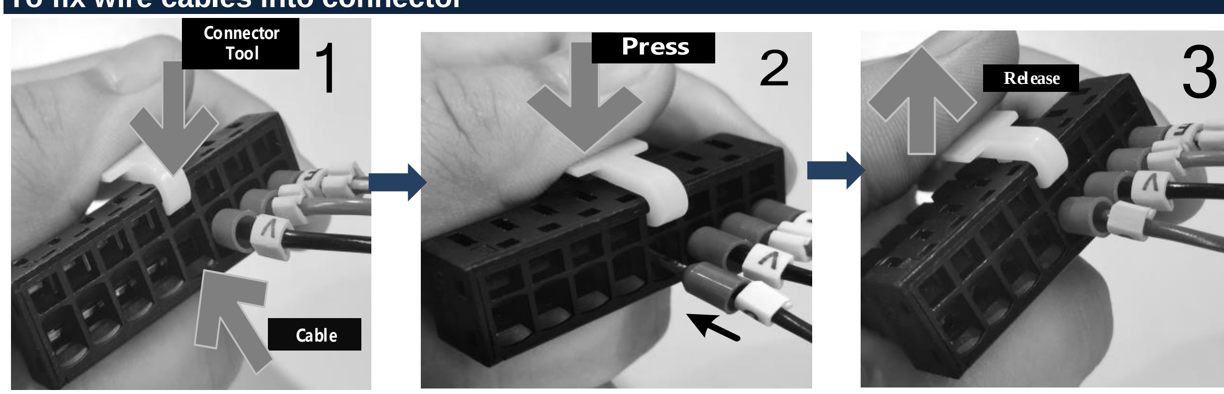
Main power supply wire gauge

Driver	Wire diameter (mm^2/AWG)			
	L1 L2 L3	P+ BR	U V W	PE
EL8-RS400F	1.3/AWG16	2.1/AWG14	0.52/AWG14	0.52/AWG14
EL8-RS750F	1.3/AWG16	2.1/AWG14	0.52/AWG14	0.52/AWG14
EL8-RS1000F	2.1/AWG14	2.1/AWG14	0.52/AWG14	0.52/AWG14
EL8-RS1500F	2.1/AWG14	2.1/AWG14	1.3/AWG16	1.3/AWG16
EL8-RS2000F	2.1/AWG14	2.1/AWG14	1.3/AWG16	1.3/AWG16
EL8-RS1000PT	1.3/AWG16	2.1/AWG14	1.3/AWG16	1.3/AWG16
EL8-RS1500PT	1.3/AWG16	2.1/AWG14	1.3/AWG16	1.3/AWG16
EL8-RS2000PT	2.1/AWG14	2.1/AWG14	1.3/AWG16	1.3/AWG16
EL8-RS3000PT	2.1/AWG14	2.1/AWG14	3.3/AWG12	3.3/AWG12
EL8-RS4400PT	2.1/AWG14	2.1/AWG14	3.3/AWG12	3.3/AWG12
EL8-RS5500PT	2.6/AWG13	2.6/AWG13	3.3/AWG12	3.3/AWG12
EL8-RS7500PT	4.2/AWG11	2.6/AWG13	3.3/AWG12	3.3/AWG12

**If 3-phase 220VAC is used, wire diameter could be smaller than the listed above.*

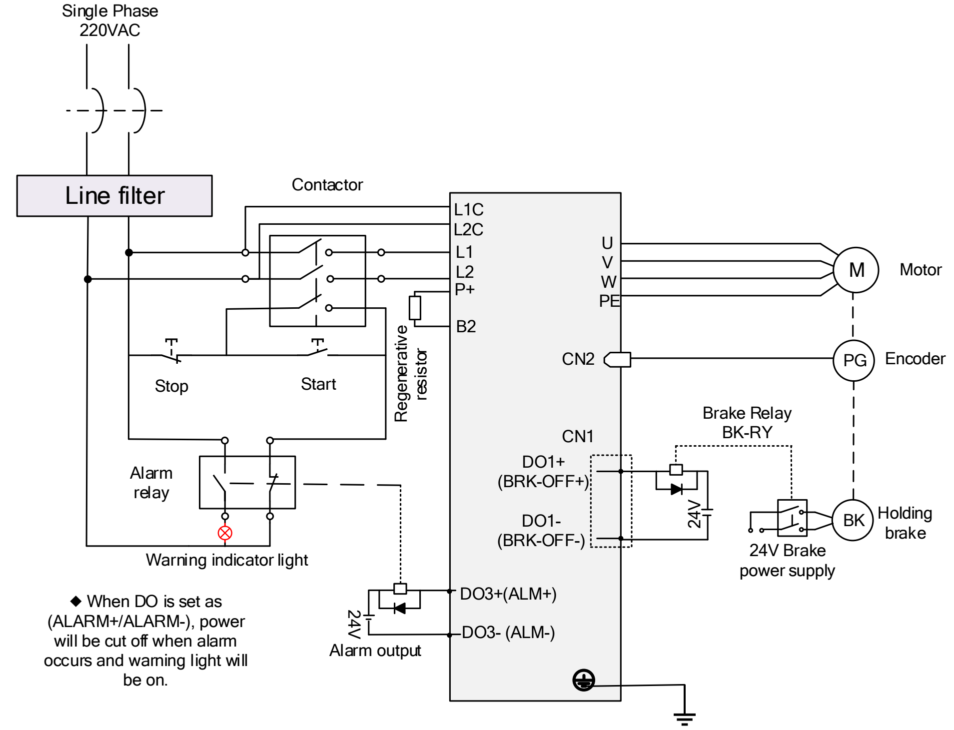
- Grounding: Grounding wire should be thicker. Ground PE terminal of servo drive and servo motor together with resistance <100 Ω.
- A 3-phase isolation transformer is recommended to lessen the risk of electrocution
- Connect a line filter to power supply to reduce electromagnetic interference.
- Please install a fuseless circuit breaker to cut off power supply in time when the driver fails.

To fix wire cables into connector

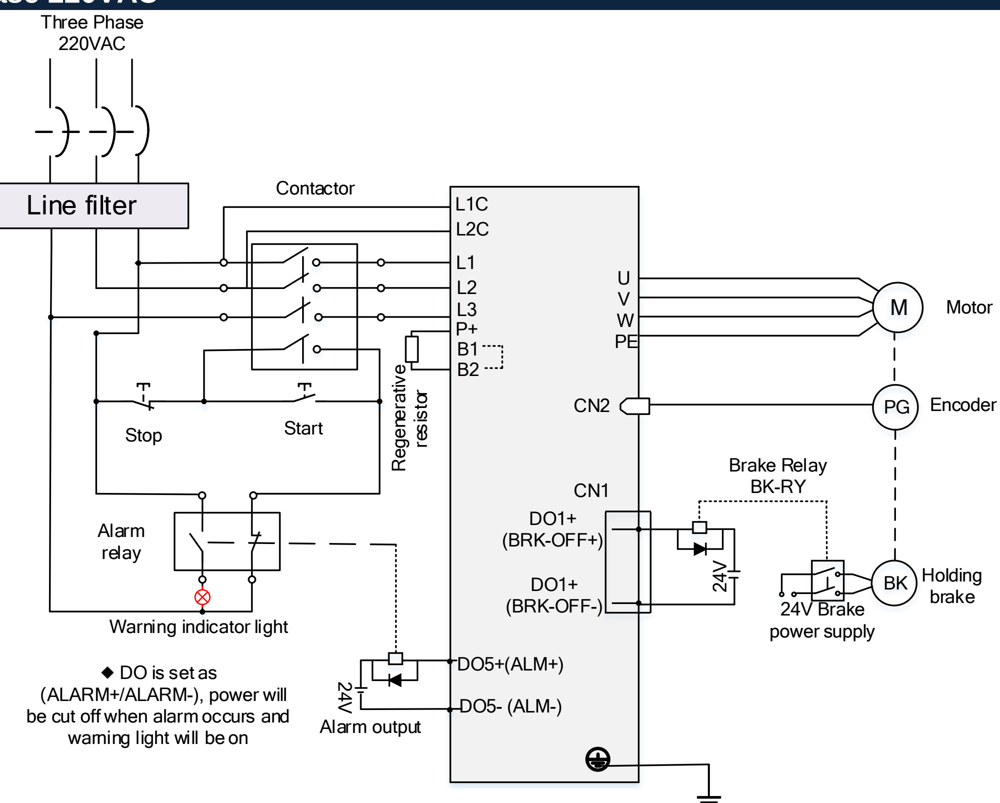


2.5.2 Single/Three phase power supply wiring diagram

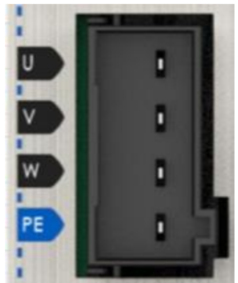
Single Phase 220VAC



Three Phase 220VAC

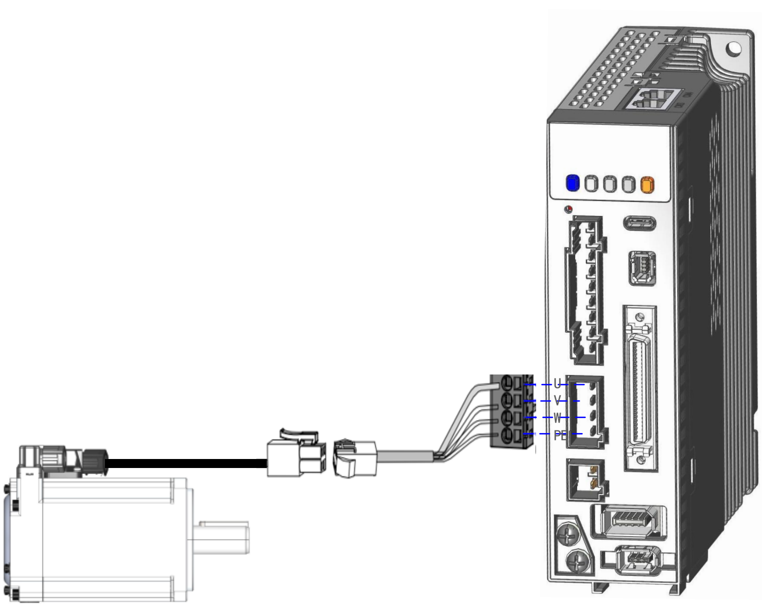


2.6 X2 Motor Power Supply



Pin	Label	Explanation	Remarks
U	U terminal	To motor U terminal	① Please make sure U, V, W terminals of driver and motor are correctly connected. ② Connect motor PE to driver PE and ground.
V	V terminal	To motor V terminal	
W	W terminal	To motor W terminal	
PE	PE	Motor frame	

2.6.1 Motor power cable selection （Port X2）



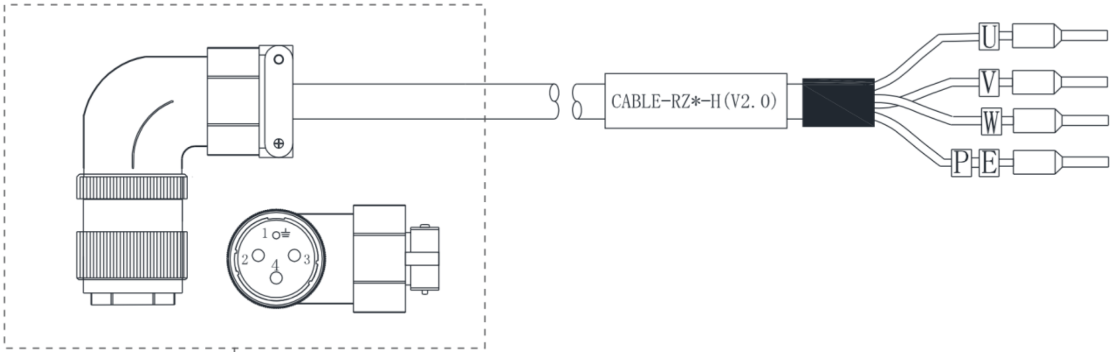
Example of motor power cable connection using an AMP electrical connector
Please connect the wires to corresponding terminals as labeled.

Motor winding power cable

- Wire length available: 1.5m, 3m and 5m
- Connectors type available: Aviation connectors, direct connectors (recommended)
- Please contact Leadshine sales team or any Leadshine certified local retailers for any customized needs.

**M*: Length of the cable*

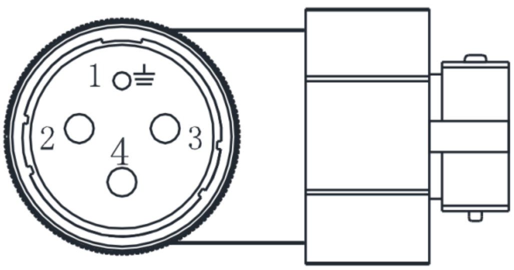
Aviation connector（Frame size 130）CABLE-RZ*H(V1.1/V2.0)



Motor side

Driver side

Motor cable pin

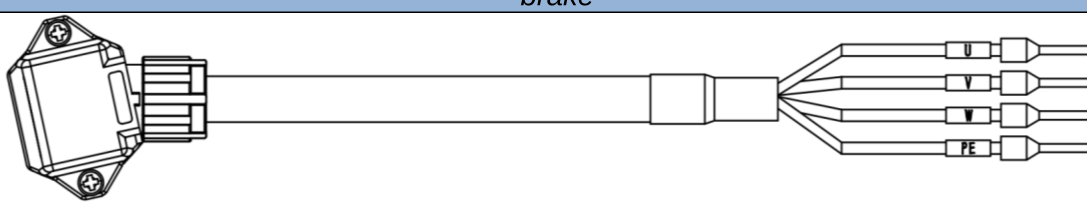


Motor side

Pins

Motor	Color	Driver
1	Red	U
3	Green	V
2	Black	W
4	Yellow	PE

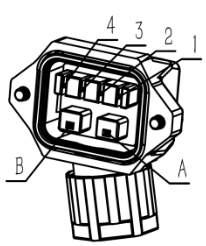
Direct connector(Frame size 80 or below）CABLE-RZH*M*-114-TS *without holding brake*



Motor side

Driver side

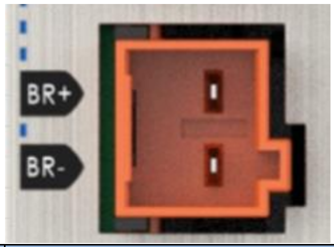
Driver cable pin



Pins

Motor	Color	Driver
1	Blue	U
2	Black	V
3	Red	W
4	Yellow-green	PE

2.7 X3 Holding Brake

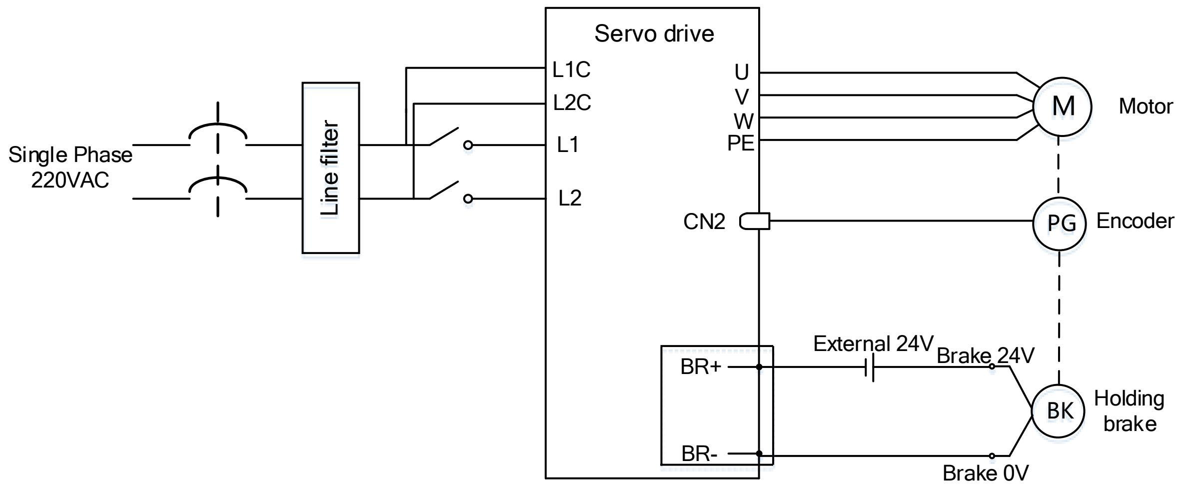


<table>
<tr><th>Pin</th><th>Label</th><th>Explanation</th><th>Remarks</th></tr>
<tr><td>BR+
（BR1）</td><td>Brake positive terminal</td><td>Connect to external power supply 24v negative terminal</td><td rowspan="2">No need of an external relay</td></tr>
<tr><td>BR-
(BR2)</td><td>Brake negative terminal</td><td>Connect to motor brake terminal 0V</td></tr>
</table>

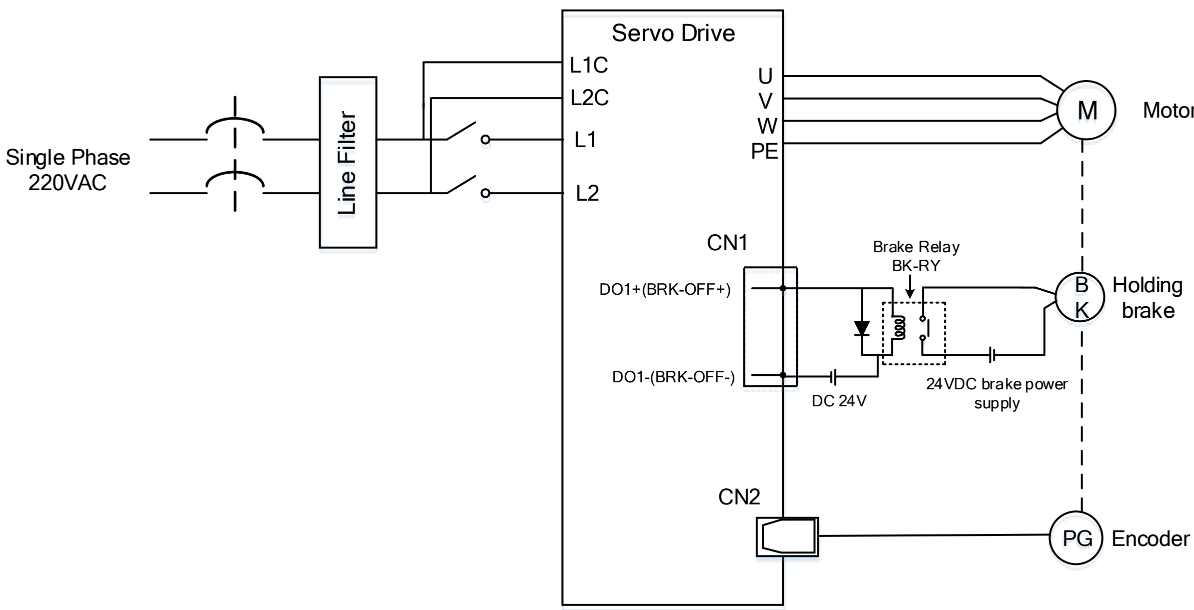
2.7.1 Holding brake wiring diagram

Holding brake is activated when servo drive is not powered on to prevent axis from moving due to gravitational pull or other external forces by locking the motor in place. Usually used on axis mounted vertically to the ground so that the load would not drop under gravitational force when the driver is powered off or when alarm occurs.
EL8 series servo drives support direct drive holding brake. Please connect BR+ and BR- to an external 24v power supply and motor brake terminal to control the holding brake. There is no need for an external relay.

1. Using internal holding brake output port X3 (Easy wiring, no need for an extra relay)

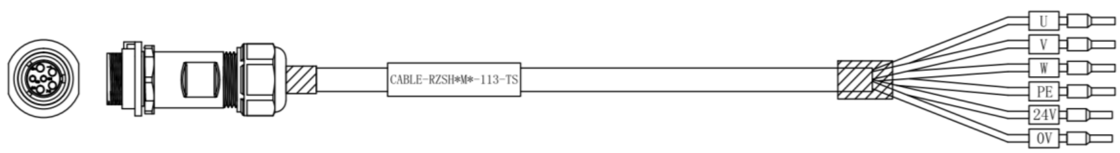


2.Connect to the DO(BRK+/BRK-)



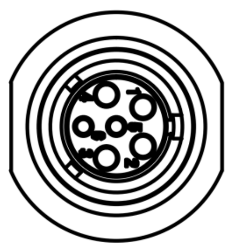
2.7.2 Cable selection for motor with holding brake

Aviation connector（Frame size 80 or below）CABLE-RZSH*M*-113-TS Winding cable with holding brake



Motor side Driver side

Motor cable pin

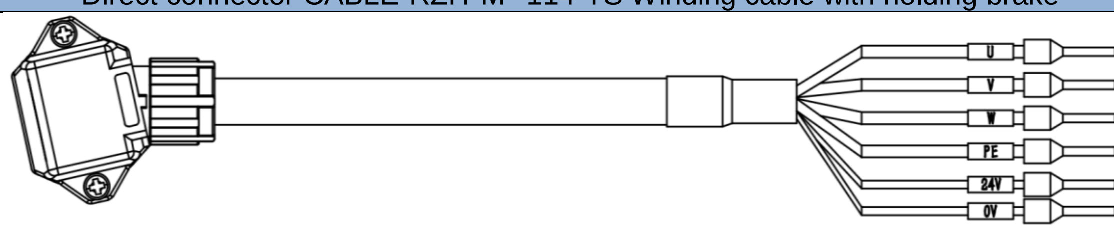


Motor side

Pins

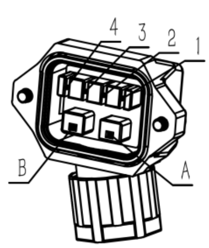
Motor	Color	Driver
1	Blue	U
2	Red	W
3	Black	V
4	Yellow-green	PE
5	Black	0V
6	Red	24V

Direct connector CABLE-RZH*M*-114-TS Winding cable with holding brake



Motor side Driver side

Motor cable pin



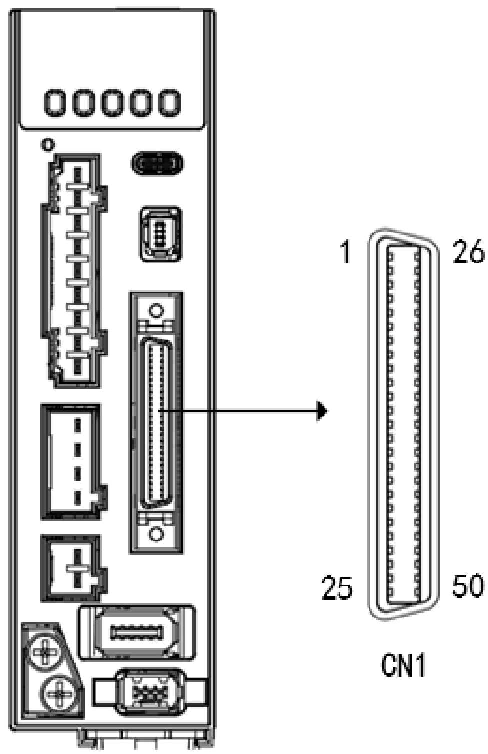
Pin

Motor	Color	Driver
1	Blue	U
2	Black	V
3	Red	W
4	Yellow-green	PE
A	Black	0V
B	Red	24V

- Mechanical noise might exist when motor with holding brake is in operation but it doesn't affect the functionality of the motor.
- When the holding brake circuit is closed (holding brake deactivated), there might be magnetic flux leakage. Please be aware to not use magnetic sensor around motor with holding brake.
- 24V operating voltage for the holding brake has to be ensured to maintain the functionality of the holding brake. Please consider the voltage dropped over lengthy motor cables due to increase in cable resistance.
- It is recommended to have an isolated switching power supply for the holding brake to prevent malfunctioning of the holding brake in case of voltage drop.

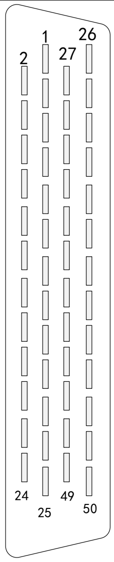
2.8 CN1 I/O Signal

EL8-RS series servo drives use SCSI 50-Pin connector.



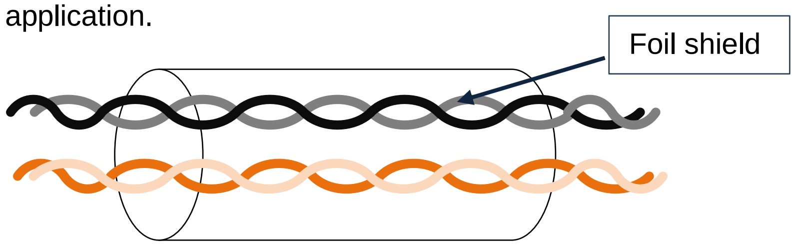
Note: It is recommended to use 24-26AWG cables for CN1

Port	Diagram	Pin	Signal	Label	Description
CN1		1	PUL+24	Pulse train	Low-frequency pulse train direction signal PUL+ & PUL-：5V differential （500KHz） DIR+ & DIR-：5V differential （500KHz） PUL+24 & PUL-：24V single ended (200KHz) DIR+24 & DIR-：24V single ended (200KHz)
		3	PUL+	Pulse train	
		4	PUL-	Pulse train	
		2	DIR+24	Pulse direction signal	
		5	DIR+	Pulse direction signal	
		6	DIR-	Pulse direction signal	
		44	PULSH+	High-frequency pulse train	4MHz High-frequency pulse train ,5V differential input
		45	PULSH-	High-frequency pulse train	
		46	SIGNH+	High-frequency direction signal	4MHz High-frequency pulse train,5V differential input

		47	SIGNH-	High-frequency direction signal	
		13	GND	GND	Internal ground
		7	DI-COM	Input	Common digital input
		8	DI1	NOT	Anti-clockwise motion disallowed
		9	DI2	POT	Clockwise motion disallowed
		26	DI3	Null	-
		27	DI4	GAIN	Gain switching
		28	DI5	DIV1	Command multiplier switching
		29	DI6	SRV-ON	Servo powers on
		30	DI7	CL	Set deviation counter to zero
		31	DI8	A-CLR	Clear alarm(s)
		32	DI9	C-MODE	Control mode switching
		33	DI10	INH	Signal inhibit
		11	DO1+	BRK-OFF+	Release external brake
		10	DO1-	BRK-OFF-	
		35	DO2+	SRDY+	Servo ready
		34	DO2-	SRDY-	
		37	DO3+	ALM+	Servo driver alarm
		36	DO3-	ALM-	
		39	DO4+	INP1+	Position reached feedback signal
		38	DO4-	INP1-	
		41	DOCOM	Output	Common digital output （Max.current:50mA,Max.voltage 30V）
		12	DO5	ZSP	Velocity zero
		40	DO6	TLC	Limited torque
		14	AI 1+	AI1	Velocity/Velocity limit(0～±10 V)
		15	GND	**Analog Ground**	Analog signal ground
		16	AI 2	AI2	Torque/Torque limit in clockwise direction(0～+10 V)
		17	GND	**Analog Ground**	Analog signal ground
		18	AI 3	AI3	Torque/Torque limit in anti-clockwise direction(–10～0 V)
		42	AO1	IM	Analog output signal monitoring 1 （Configurable）
		43	AO2	SP	Analog output signal monitoring 2 （Configurable）
		21	A+	Differential output	Encoder channel A pulse frequency
		22	A-	Differential output	
		48	B+	Differential output	Encoder channel B pulse frequency
		49	B-	Differential output	
		23	Z+	Differential output	Encoder channel Z pulse frequency
		24	Z-	Differential output	
		25	GND	GND	Internal ground
		19	OCZ	Channel Z output	Channel Z output (Open collector)
		20	GND	GND	Internal ground
		50	FG	FG	Shield grounding
		Frame		FG	Frame grounding

2.8.1 CN1 signal cable selection

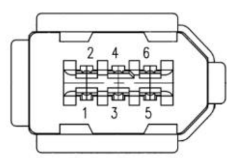
To ensure I/O signal to not be affected by electromagnetic interference, a **shielded cable** is recommended for this application.



Cables for different analogue signals should be using isolated shielded cable while cables for digital signals should be shielded twisted pair cable. Cables for CN1 connectors should be 24-28AWG in diameter.

- Please keep at least 30cm from main power supply/control circuit power cable (L1C/L2C/L1/L2/L3，U/V/W) to prevent electromagnetic interference of I/O signals.

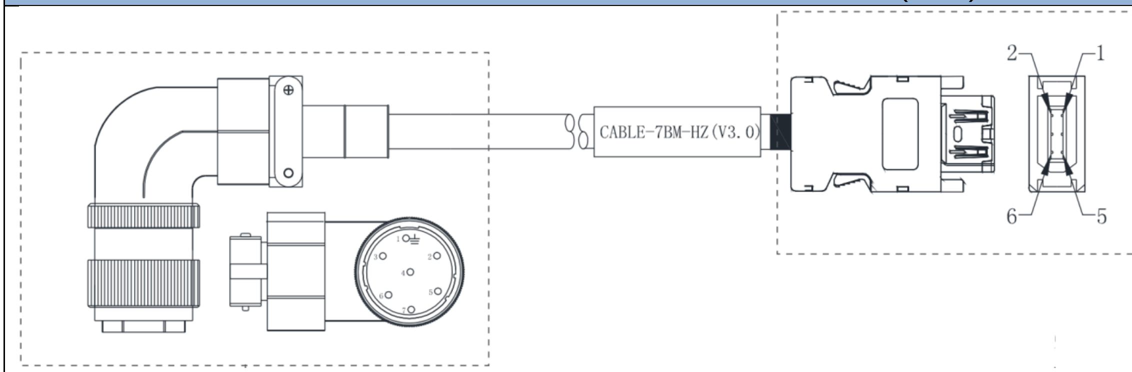
2.9 CN2 Motor Encoder



Port	Pin	Signal	Explanation
CN2	1	VCC5V	Power supply 5V
	2	GND	Power supply ground
	3	BAT+	Battery positive terminal
	4	BAT-	Battery negative terminal
	5	SD+	SSI Data+
	6	SD-	SSI Data-
	Frame	PE	Shield grounding

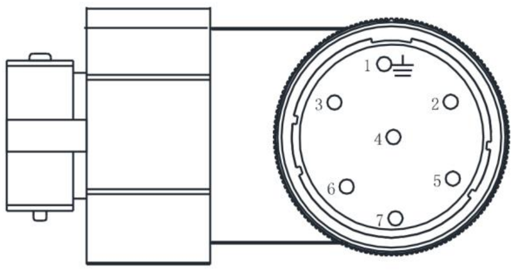
Motor encoder cable and connector selection

Aviation connector（Frame size 130）CABLE-7BM*HZ(V3.0)



Motor side　　Driver side

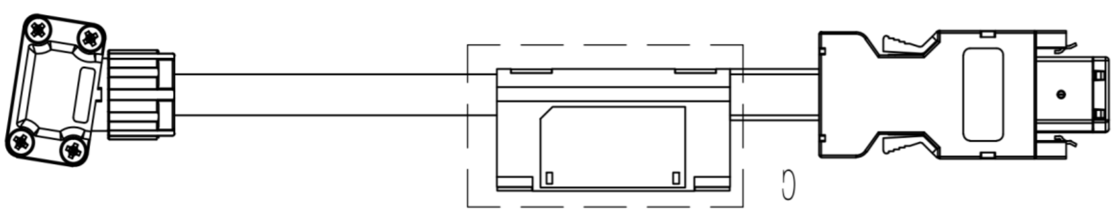
Motor cable pin	Pin



Motor side

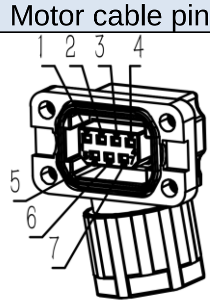
Motor	Driver	Signal
1	Frame	Shielded
2	1	+5V
3	2	0V
4	5	SD+
5	6	SD−
6	3	BAT+
7	4	BAT−

Direct connector(Frame size 80 or below）CABLE-BMH*M*-114-TS Incremental encoder



Motor side　　Driver side

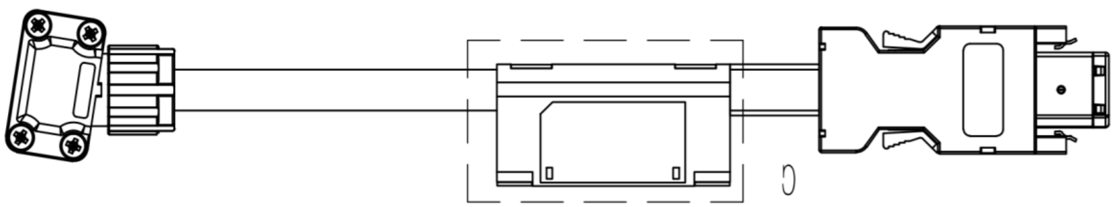
Motor cable pin	Pin



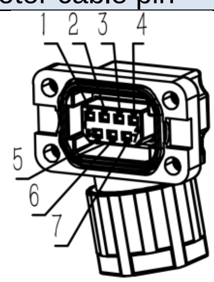
Motor side

Motor	Driver	Signal
1	Frame	Shielded
2	1	+5V
3	2	0V
4	5	SD+
5	6	SD-

Direct connector(Frame size 80 or below）CABLE-BMAH*M*-124-TS Absolute encoder



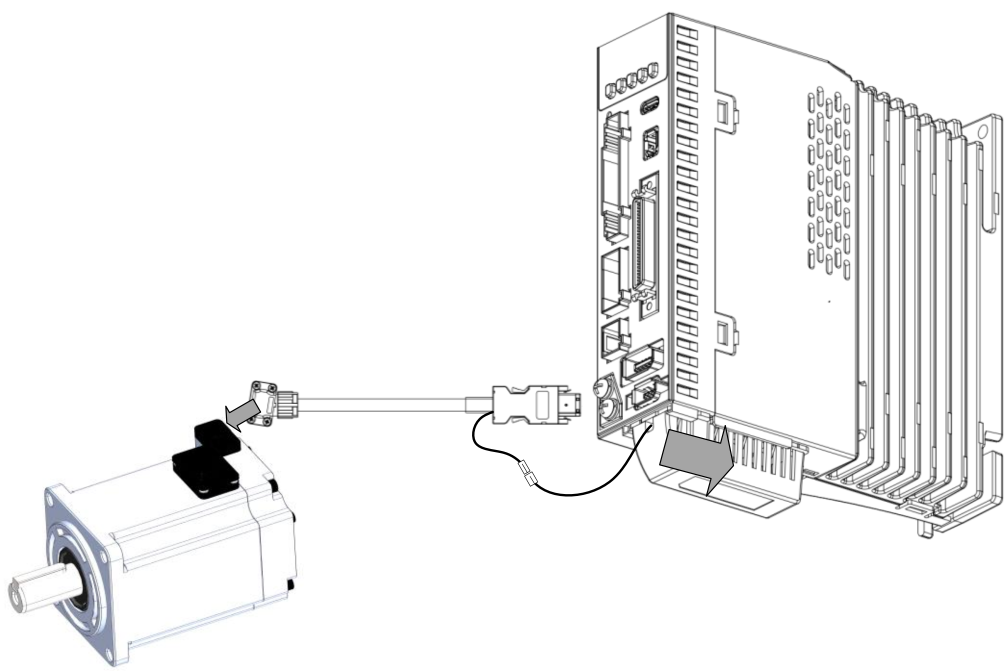
Motor side　　　　　　　　　　Driver side

Motor cable pin	Pin
 Motor side	see table below

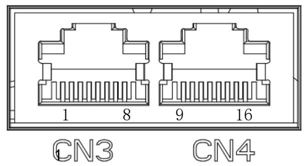
Motor	Driver	Signal
1	Frame	Shielded
2	1	+5V
3	2	0V
4	5	SD+
5	6	SD-
6	3	BAT+
7	4	BAT-

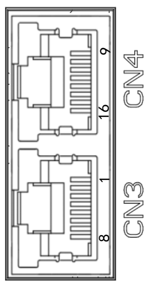
Battery box for absolute encoder

EL8-RS series servo drives come with battery kit installed on the driver or on the encoder cable.

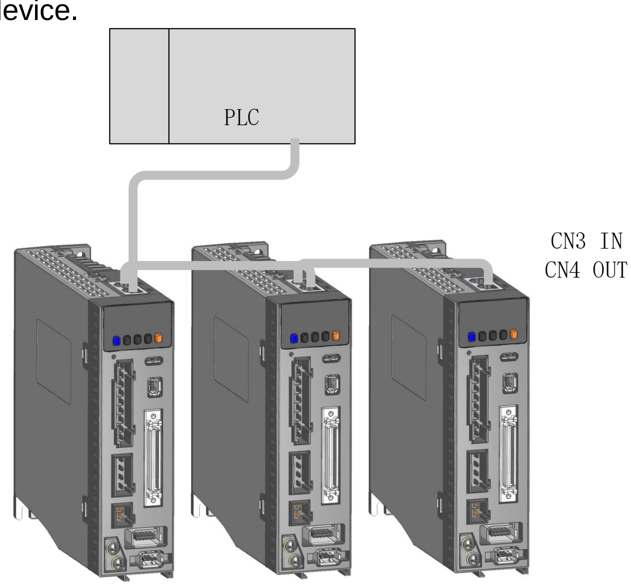


2.10 CN3/CN4 – RS485 Communication Port

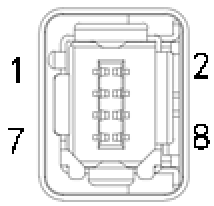


Port	Diagram	Pin	Signal	Description
CN3 CN4		1	422+	RS-422 Data Positive Terminal (Gantry Communication)
		2	422-	RS-422 Data Negetive Terminal (Gantry Communication)
		3	-	-
		4	485+	RS485 Data+
		5	485-	RS485 Data-
		6	5V	5V(50mA)
		7	-	-
		8	GND	GND
		Frame	PE	Shielding Grounding

EL8-RS series supports RS485 communication protocol which enables communication between single/multi axes and master device.



2.11 CN6 Safe Torque Off (STO) Port

Port	Pin	Signal	Description	Remarks
	1	24V	24v power supply	Connect to SF1 and SF2 when not in use. Do not use to supply power.
	2	0V	Reference ground	
	3	SF1-	Control signal 1 negative input	When SF1 = OFF or SF2 = OFF,STO is enabled.
	4	SF1+	Control signal 1 positive input	
	5	SF2 -	Control signal 2 negative input	
	6	SF2+	Control signal 2 positive input	
	7	EDM+	External monitoring device (EDM) with differential double ended output	When SF1 = OFF and SF2 = OFF,EDM = ON
	8	EDM-		

Introduction to Safe Torque Off (STO)

Function: Cut off motor current supply physically (through mechanical means)

STO module (CN6 connector) consists of 2 input channels. It cuts off the motor current supply by blocking of PWM control signal from the power module. When the motor current is cut off, the motor will still move under inertia and stops gradually.

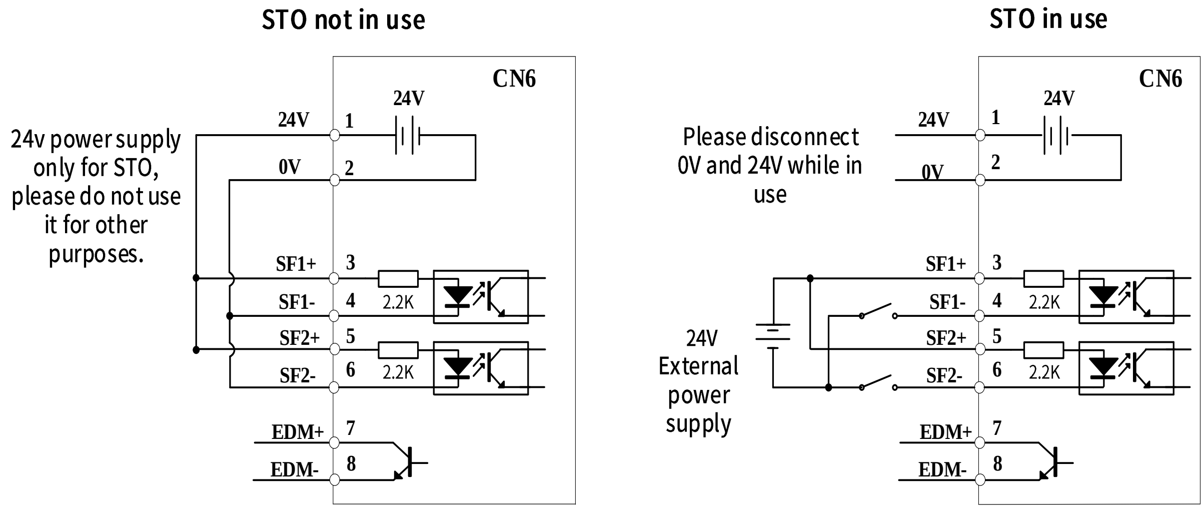
The STO function is set up ready to be used by factory default. Please remove STO connector if it is not needed.

STO functional principle

STO module cuts off the motor current supply and stops motor gradually by blocking of PWM control signal from the power module through 2 isolated circuits. When a STO error occurs, the actual status of STO can be determined by the EDM status feedback.

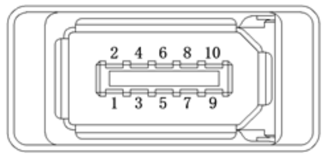
SF1 Input Status	SF2 Input Status	EDM Output Status	PWM control signal	Alarm code
ON	ON	OFF	Normal	-
ON	OFF	OFF	Blocked	Er 1c2
OFF	ON	OFF	Blocked	Er 1c1
OFF	OFF	ON	Blocked	Er 1c0

STO wiring diagram



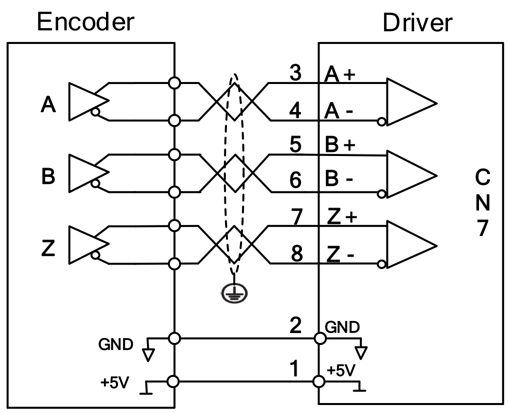
- *Please take precautions when enabling STO functions as servo drive will lose control over the motion of the motor. Motor might dropped under gravitational pull (vertically mounted load) or moved when external forces are applied to it. Alternatively, motor with holding brake can be chosen.*
- *STO is not meant to cut off the power supply of the servo drivers and motors completely. Please power off and wait for a few minutes before starting maintenance work.*
- *It is recommended to use an isolated power supply for STO signal input as any current leakage might cause STO malfunction.*
- *Please remove the shorting connector from the STO port and use the provided STO cable if the function is required.*

2.12 CN7 2nd Encoder (External)



Pin	Signal	Description
1	5V	Power supply 5V
2	GND	Power supply ground
3	A+	Phase A+ pulse input
4	A-	Phase A- pulse input
5	B+	Phase B+ pulse input
6	B-	Phase B- pulse input
7	Z+	Phase Z+ pulse input
8	Z-	Phase Z- pulse input
Frame	FG	Shield grounding

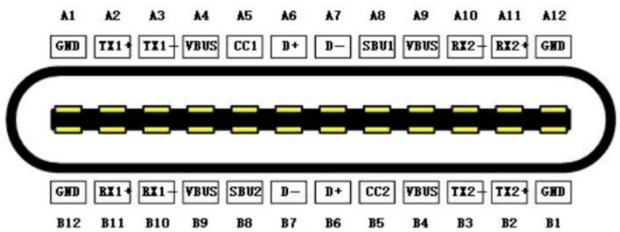
External encoder pulse input



- Please connect the encoder reference ground terminal to driver ground terminal. Recommended to use double winding cable with shielding foil, Connect the shielding foil to CN7 connector to reduce noise interference.
- External encoder input method: Differential input

2.13 USB Type-C Tuning Port

EL8-RS series servo drive can be connected to PC for performance tuning, data monitoring and parameters modifying using a **USB Type-C data cable**. Can be done without the servo drive connecting to main power supply.



Port	Pin	Signal	Description
USB Type-C	A4, B4,A9, B9	VCC 5V	Power supply positive terminal 5V
	A12,B12,A1,B1	GND	Power supply negative terminal
	A6,B6	D+	USB data positive terminal
	A7,B7	D-	USB data negative terminal
	Frame	USB_GND	Ground through capacitor

2.15 Regenerative resistor selection and connections

The use of regenerative resistor

When the motor opposes the direction of rotation as in deceleration or vertical axis escalation, part of the regenerative energy will be delivered back to the driver. This energy will first be stored in internal capacitors of the driver. When the energy stored in the capacitors reach the maximum capacity, a regenerative resistor is required the excessive energy to prevent over-voltage.

Selection of regenerative resistor

EL8-RS series servo drives are equipped with internal regenerative resistor. If an external resistor is needed, please refer to the table below.

Model no.	Internal regenerative resistor		Minimum allowable	
	Resistance(Ω)	Power rating(W)	Resistance(Ω)	Power rating(W)
EL8-RS400F	100	50	50	50
EL8-RS750F	100	50	40	50
EL8-RS1000F	50	75	30	50
EL8-RS1500F	50	80	30	75
EL8-RS2000F	50	80	30	100
EL8-RS1000T	50	80	100	100
EL8-RS1500T	50	80	60	100
EL8-RS2000T	50	80	40	100
EL8-RS3000T	50	80	40	100
EL8-RS4400T	35	100	35	100
EL8-RS5500T	35	100	25	100
EL8-RS7500T	35	100	25	100

Calculation of regenerative resistance under normal operation

Steps:

1. Determine if driver comes with a regenerative resistor. If not, please prepare a regenerative resistor with resistance value higher than might be required.
2. Monitor the load rate of the regenerative resistor using front panel (d14). Set the driver on high velocity back and forth motions with high acceleration/deceleration.
3.Please make sure to obtain the value under following conditions: Driver temperature < 60℃, d14<80(Won't trigger alarm), Regenerative resistor is not fuming, No overvoltage alarm(Err120).

Pb(Regenerative power rating) = Resistor power rating x Regenerative load rate (%)

Please choose a regenerative resistor with power rating Pr about **2-4 times the value of Pb** in considered of harsh working conditions and some 'headroom'.
If the calculated Pr value is less than internal resistor power rating, external resistor is not required.

$$R(\text{Max. required regenerative resistance}) = (380^2 - 370^2)/Pr$$

Problem diagnostics related to regenerative resistor:

➢ If driver temperature is high, reduce regenerative energy power rating or use an external regenerative resistor.

- If regenerative resistor is fuming, reduce regenerative energy power rating or use an external regenerative resistor with higher power rating.
- If d14 is overly large or increasing too fast, reduce regenerative energy power rating or use an external regenerative resistor with higher power rating.
- If driver overvoltage alarm (Er120) occurs, please use an external regenerative resistor with lower resistance or connect another resistor in parallel.

Please take following precautions before installing an external regenerative resistor.
1. Please set the correct resistance value in P00.16 and resistor power rating P00.17 for the external regenerative resistor.
2. Please ensure the resistance value is higher or equals to the recommended values in table 2-
3. Regenerative resistors are generally connected in series but they can also be connected in parallel to lower the total resistance.
3. Please provided enough cooling for the regenerative resistor as it can reach above 100℃ under continuous working conditions.
4. The min. resistance of the regenerative resistor is dependent on the IGBT of the regenerative resistor circuit. Please refer to the table above.

Theoretical selection of regenerative resistor

Without external loading torque, the need for an external regenerative resistor can be determined as the flow chart below

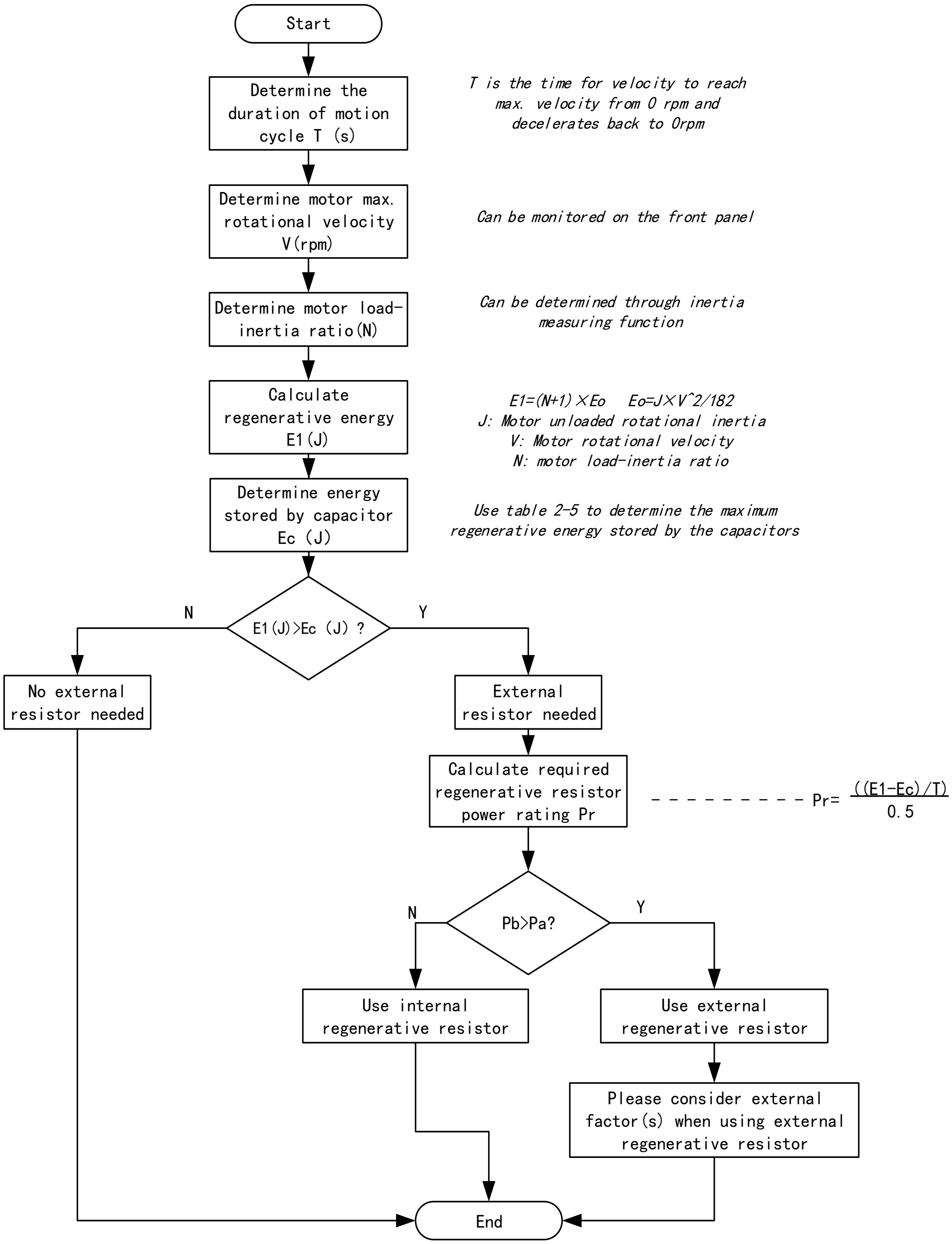
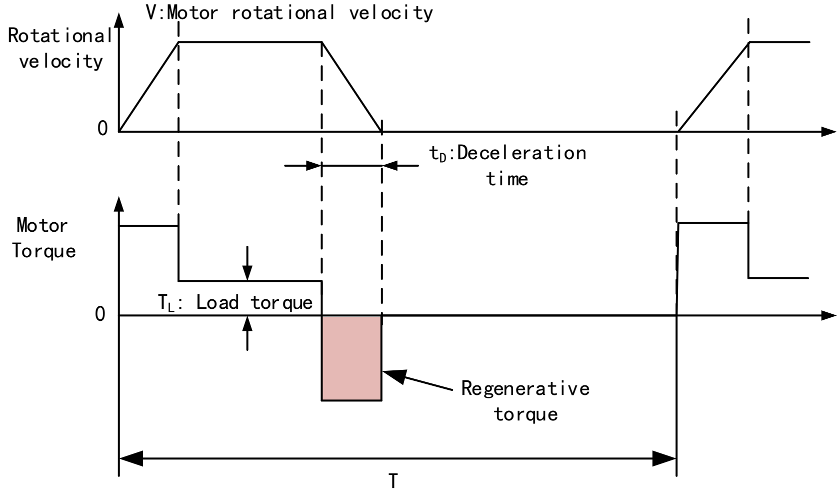


Diagram below shows the acceleration and deceleration cycle periods and the regenerative torque that occurs during the process.



Steps to calculate capacity of regenerative resistor

Steps	Calculation	Symbol	Formula
1	Servo system regenerative energy	E1	E1=(N+1)×J×V^2/182
2	Depleted energy from loss of load system during acceleration	E_L	E_L = (π/60) V×T_L×tD *If loss is not determined, please assume E_L = 0.*
3	Depleted energy due to motor coil resistance.	E_M	E_M=(U^2/R)×tD R= coil resistance, U = operating voltage *If R is not determined, please assume E_M = 0.*
4	Energy stored by internal DC capacitors	Ec	Please refer to table 2-5
5	Depleted energy due to regenerative resistance	E_K	E_K=E1-(EL+EM+EC), If loss is ignored, EK=E1-EC
6	Required power rating of regenerative resistor	Pr	Pr=E_K/(0.5×T)

Internal capacitor capacity and rotor inertia

EL8-RS Drivers	Servo motor	Rotor Inertia (× 10^{-4}kg.m^2)	Max. regenerative energy stored in capacitor Ec(J)
400W	ELM2H-0400LA60	0.56	13.47
750W	ELM2H-0750LA80	1.66	22.85
1000W	ELM2H-1000LA80	2.03	27.74
	ELM2H-0850LD130	12.5	
1500W	ELM2H-1300LD130	18.7	33.46
2000W	ELM2H-1800LD130	23.8	40.8

There are motors with low, medium and high inertia. Different motor models have different rotor inertia. Please refer to product catalogue for more information on rotor inertia.

Calculation examples:
Servo drive: EL8-RS750F, Servo Motor: ELM2H-0750LA80. When T = 2s, rotational velocity = 3000rpm, load inertia is 5 times of motor inertia.

EL8-RS Drivers	Servo motor	Rotor Inertia (× 10^{-4}kg.m^2)	Max. regenerative energy stored in capacitor Ec(J)
750W	ELM2H-0750LA80	1.66	22.85

Regenerative energy produced:

$$E1 = \frac{(N+1) \times J \times V^2}{182} = \frac{(5+1) \times 1.66 \times 3000^2}{182} = 49.3J$$

If E1<Ec, internal capacitors can't take in excessive regenerative energy, regenerative resistor is required.
Required regenerative resistor power rating Pr:

$$Pr = \frac{(E1 - Ec)}{0.5T} = \frac{49.3 - 22.85}{0.5 \times 2} = 26.45W$$

Hence, with the internal regenerative resistor Pa = 75W, Pr<Pa, no external regenerative resistor is required.

Let's assume if the load inertia is 15 times of motor inertia, Pr = 108.6W, Pr>Pa, external regenerative resistor is required. And to consider for harsh working environment,

Pr(external)=108.6/(1-40%)=181 W

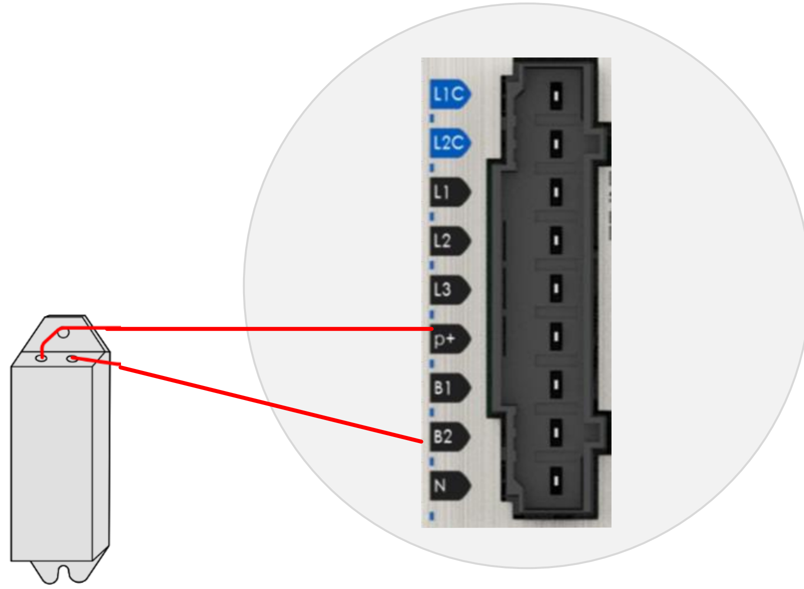
When selecting the resistance of the regenerative resistor, please be higher than the minimum value recommended in table 2-3 but lower than Rmax

Rmax =(380^2-370^2)/Pr=7500/108.6=69Ω

In conclusion, a regenerative resistor with resistance 40Ω - 70Ω and power rating 110W to 180W can be chosen.

Please take note that theoretical calculations of the regenerative resistance is not as accurate as calculations done under normal operation.

Regenerative resistor connection



- If B1 and B2 are connected, internal regenerative resistor is now functional; if an external regenerative resistor is required, please disconnect B1 and B2 and connect P+ to B1 to prevent overcurrent.
- Please do not connect external regenerative resistor directly to N or it might cause fire hazard.
- Please refer to the section above to select minimum allowable resistance for the external regenerative resistor or it might damage the driver.
- Please confirm P00.16 and P00.17 before using any regenerative resistor.
- Do not set the regenerative resistor near any flammable object.

2.16 I/O Signals

2.16.1 Pulse input circuit

When PLC or Motion Controller command pulse output circuits can be divided into 2 categories, namely differential output or open collector. Hence, on the side of servo drive, there are 2 types of command pulse input method as well: Differential drive input and open collector input.

Pulse input frequency:

1. High speed pulse input (4MHz)
2. Low speed pulse input (200kHz/500kHz)

Pulse input frequency can be set in P00.05.

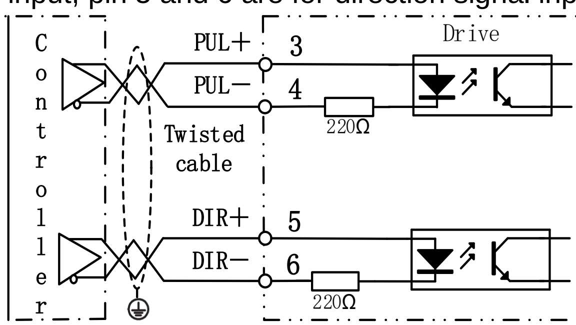
Pulse		Max. Frequency	Min pulse width(μs)
Low speed	Differential	500k	1
	Open collector（Single ended）	200k	2.5
High speed differential		4M	0.125

- *High-/low speed pulse cannot be used at the same time.*
- *If output pulse width is smaller than min pulse width, error might occur at pulse receiving end.*

5V differential drive input (Low Speed)

5V differential drive input (max. tolerable command input pulse frequency = 500kHz), input voltage of 3-6V with 50% duty ratio.

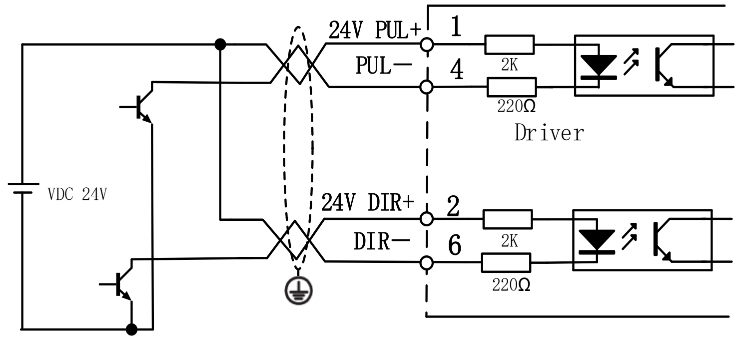
This input method will not be easily affected by noise with better delivery accuracy. Pin 3 and 4 of CN1 are for pulse signal input; pin 5 and 6 are for direction signal input.



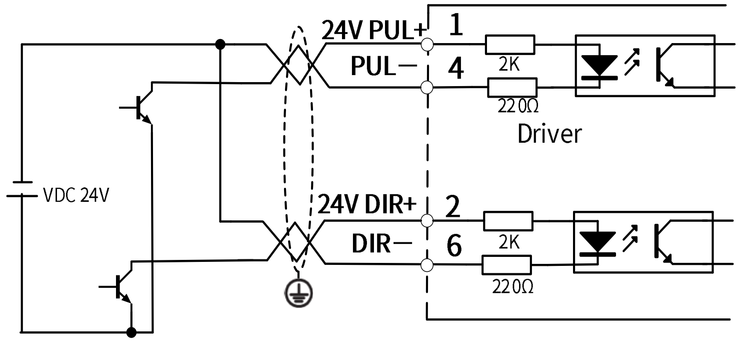
Single ended open collector drive input (Low Speed)

Max. tolerable command pulse input frequency under open collector = 200kHz. Input voltage of 12-24V with 50% duty ratio.

- Using 24V external power supply, driver internal includes current limitation equivalent to VDC value. By installing a resistor, driver's noise tolerance will be improved.
- Resistance of current limiting resistor = $\frac{\text{VDC}-1.5\text{V (Voltage drop)}}{\text{R (Current limiting)}+220\Omega}=10\text{mA}$. If VDC = 24V, resistance of current limiting resistor approximates 2kΩ. (Rough estimation)



24V single-ended drive mode of pulse input interface (NPN)

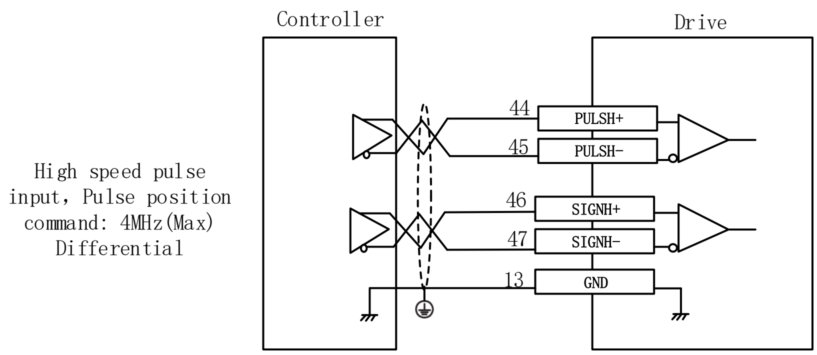


24V single-ended drive mode of pulse input interface (PNP)

- *5V differential drive method is recommended for accurate delivery of pulse data.*
- *EL8-RS series servo drive supports 5V differential drive and 24V single ended open collector drive, different connection pins for both methods.*
- *External power supply needs to be provided externally when using single ended open collector drive method. Please note that reversed polarity might cause damage to the servo drive.*

5V differential drive input (High Speed)

5V differential drive input (Max. tolerable command pulse input frequency: 500kHz). Due to high speed pulse input, it is highly recommended to use shielded cable and be isolated from power cable.



Please make sure that differential input is 5V or it might cause instability of input pulse.

- *Pulse lost during command pulse input*
- *Inversed pulse direction during direction command*
- *Please connect 5V signal to GND on driver to lower noise interference.*

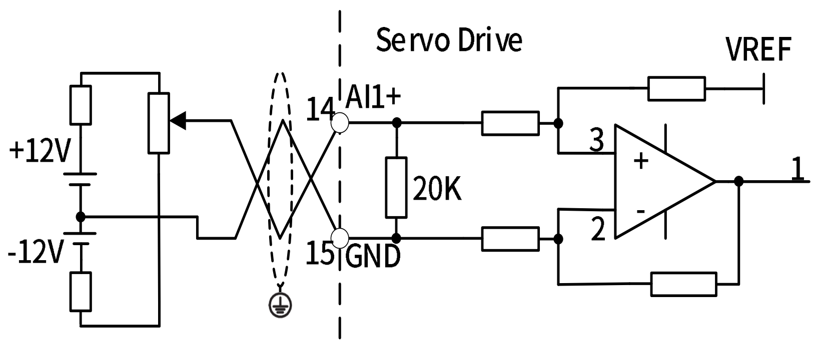
2.16.2 Analogue input circuit

Analogue input signal

EL8-RS series servo drives support 3 analogue input (1 differential, 2 single ended)

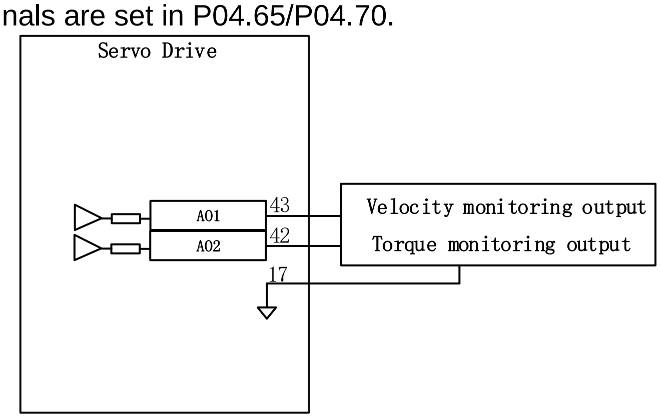
CN1 Pin	Signal	Description
14	AI1+	Analogue input 1, differential, Input voltage: ±10VDC, input resistance: 20KΩ
15	AGND	
16	AI2	Analogue input 2, single ended, Input voltage: ±10VDC, input resistance: 20KΩ
18	AI3	Analogue input 3, single ended, Input voltage: ±10VDC, input resistance: 20KΩ
17	AGND	Analogue GND

- AI1: Differential; AI2/AI3: Single ended
- Max tolerable input voltage for each AI is ±10VDC. If variable resistor (VR) or resistor (R) is used, please refer to the following circuit diagram.



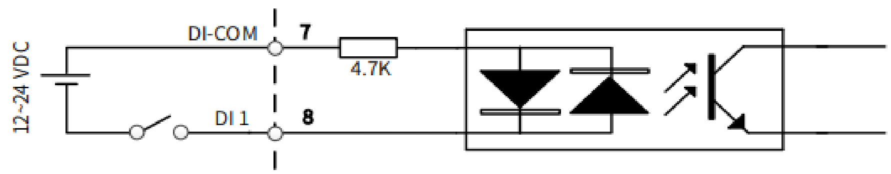
Analogue output signal

EL8-RS series servo drives support 2 analogue outputs, output voltage: ±10VDC. Corresponding signals are set in P04.65/P04.70.



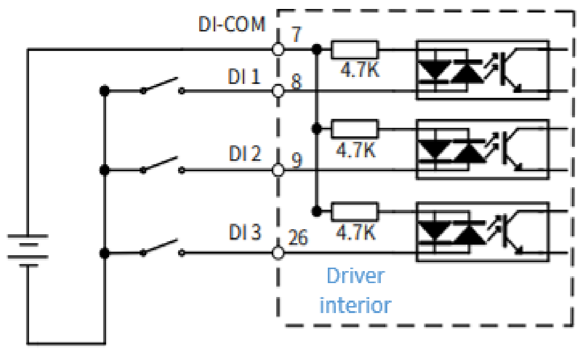
2.16.3 Digital Inputs

Using DI1 as an example (DI2-DI10 use the same input circuit). The internal circuit of common input is a bidirectional optocoupler which supports common anode and common cathode configurations. There are 2 types of outputs from master device: Relay output and Open Collector output as shown below.

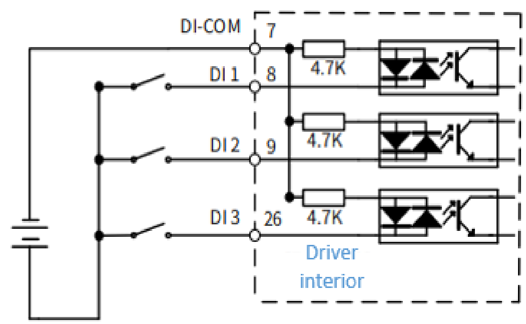


① Output from master device: Relay

Common anode:

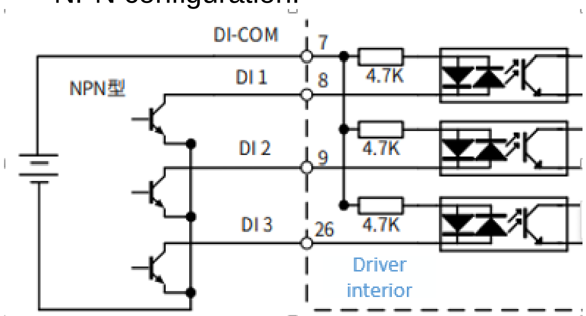


Common cathode:

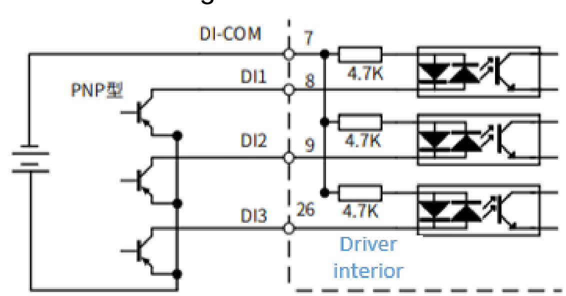


② Output from master device: Open Collector

NPN configuration:



PNP configuration:

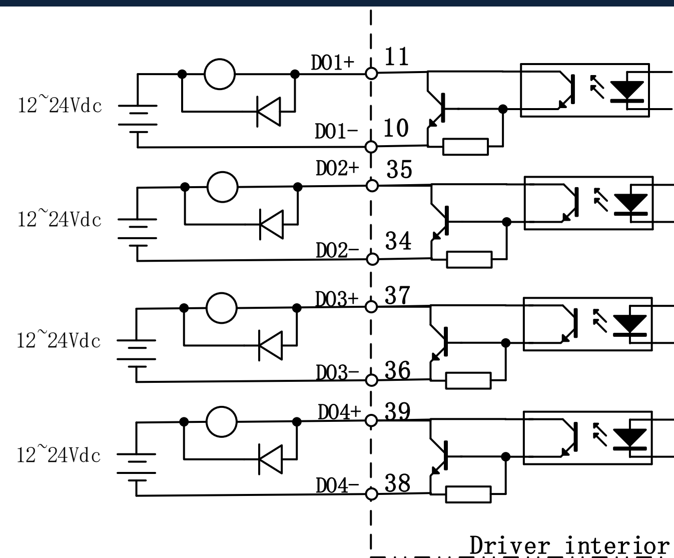


Please prepare switching power supply with output of 12-24VDC, current≥ 100mA;

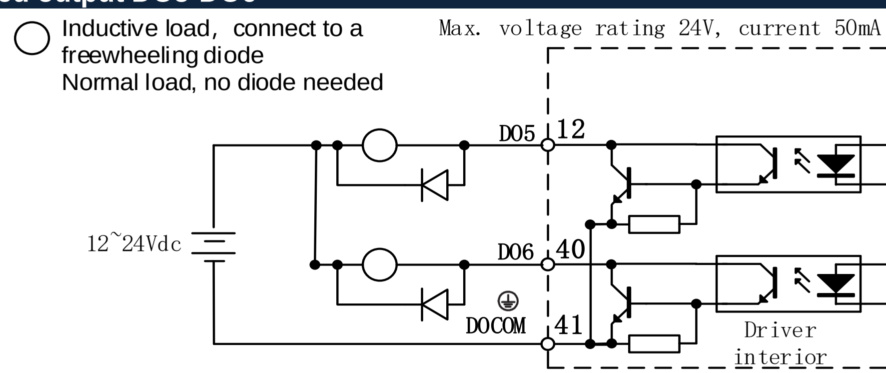
2.16.4 Digital Outputs

There are a total of 8 digital outputs with DO5/DO6 as single ended outputs. Both of these outputs are connected to COM of control signal source, which means both use the same control signal source. DO1-DO4 are double ended outputs. They can be connected to independent control signal source and reference ground can be different from other single ended output signals.

Double ended outputs DO1-DO4



Single ended output DO5-DO6



- External power supply needs to be provided. Reversed connection of power supply might cause damage to the driver.
- When output = open collector, max current 50mA, external power supply max voltage 25V. Hence, DO loads need to satisfy these conditions. If excessive or output connected directly to power supply, it might cause damage to the driver.
- If the load is an inductive load such as a relay, please install freewheeling diodes on both ends of the load in parallel. If the diode is connected in reverse, it might cause damage to the driver.
- Pin 12, 40 and 31: 2 single ended output. Pin 11, 10 and 35, 34, Pin 37,36 and 39,38 : double ended outputs.

2.16.5 Encoder frequency divider output circuit

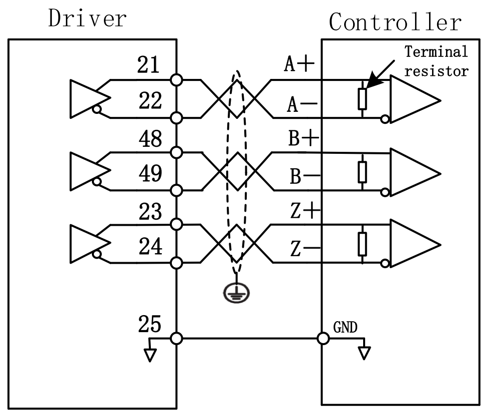
EL8-RS series frequency divider output: Differential and open collector

Pin	Label	Description	
21	A+	Motor encoder A-phase crossover frequency output	Differential, High≥2.5VDC, Low≤0.5VDC, Max current±20mA
22	A−		
48	B+	Motor encoder B-phase crossover frequency output	
49	B−		
23	Z+	Motor encoder Z-phase crossover frequency output	
24	Z−		
19	OCZ	Motor encoder Z-phase signal OC output	Only supports NPN type OC output
25	GND	Open collector signal ground	

Encoder frequency divider output (Differential)

Encoder signal after frequency division will go through differential driver to deliver differential output. Feedback signal will be provided if the master device is in position control mode. Please install a differential optocoupler receiving circuit to receive the signals.

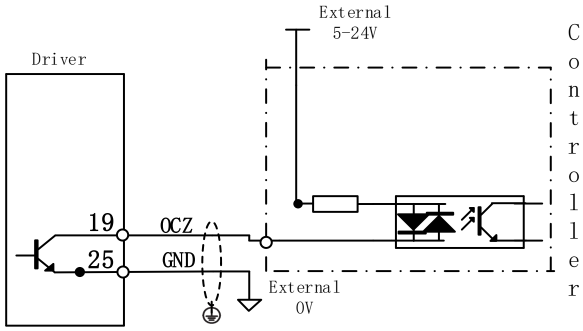
A terminal resistor must be installed between differential input circuits. Resistance of the resistor as per actual use.



If a differential receiving circuit instead an optocoupler is used on the controller side, please connect pin 30 (GND) to GND of differential receiving circuit.

Encoder frequency divider output (Open Collector)

Encoder signal after frequency division will be delivered through an open collector output.



Please connect driver frequency divider signal GND to GND of external power supply. Use shielded twisted pair cable to lower noise interference.

2.16.6 Set DI signals

CN1 PIN	Signal	Parameter	Default signal	Default status
7	DI-COM	-	Common input	
8	DI1	P04.00	NOT	NC OFF
9	DI2	P04.01	POT	NC OFF
26	DI3	P04.02	*Null*	NC OFF
27	DI4	P04.03	GAIN	NC OFF
28	DI5	P04.04	DIV1	NC OFF
29	DI6	P04.05	SRV-ON	NC OFF
30	DI7	P04.06	CL	NC OFF
31	DI8	P04.07	A-CLR	NC OFF
32	DI9	P04.08	C-MODE	NC OFF
33	DI10	P04.09	INH	NC OFF

NC: Signal NOT connected to DI-COM -> Invalid (OFF)
Signal connected to DI-COM -> Valid (ON)
NO: Signal NOT connected to DI-COM -> Valid (ON)
Signal connected to DI-COM -> Invalid (OFF)

Safety precautions
To stop motor if cable is disconnected, POT, NOT and E-STOP will be set as NO. Please make sure there is no safety issue if need to set to NC.
SRV-ON signal is recommended to set as NC. Please make sure there is no safety issue if need to set to NO.

Control DI settings

Signal S	Symbol	Value NO	Value NC
Invalid	—	0	-
Positive limit switch	POT	1	81
Negative limit switch	NOT	2	82
Servo enabled	SRV-ON	3	83
Clear alarm	A-CLR	4	-
Control mode switching	C-MODE	5	85
Gain switching	GAIN	6	86
Clear deviation count	CL	7	-
Command pulse prohibited	INH	8	88
Torque limit switching	TL-SEL	9	89
Command frequency divider/multiplier switching	DIV1	C	8C
Internal command velocity 1	INTSPD1	E	8E
Internal command velocity 2	INTSPD2	F	8F
Internal command velocity 3	INTSPD3	10	90
Internal command velocity 4	INTSPD4	31	B1
Zero speed clamp	ZEROSPD	11	91
Velocity command sign	VC-SIGN	12	92
Velocity command sign2	VC-SIGN2	4A	CA
Torque command sign	TC-SIGN	13	93
Forced alarm	E-STOP	14	94
Inertia ratio switching input	J-SEL	15	95
Gantry banning	GTRY	17	97
Vibration suppression 1	VS-SEL1	0A	8A
Vibration suppression 2	VS-SEL2	0B	8B

CN1 PIN	Input	Parameters
8	DI1	P04.00
9	DI2	P04.01
26	DI3	P04.02
27	DI4	P04.03
28	DI5	P04.04
29	DI6	P04.05
30	DI7	P04.06
31	DI8	P04.07
32	DI9	P04.08
33	DI10	P04.09

Please don’t set anything other than listed in table above.
Normally open (NO) : Valid when input = ON
Normally close (NC): Valid when input = OFF
Er210 might occur if same function is allocated to different channels at the same time

Servo enabled（SRV-ON）has to be allocated to enabled servo drive.

Inputs related to Pr-mode:

Signal	Symbol	Value NO	Value NC
Trigger command	CTRG	20	A0
Home	HOME	21	A1
Forced stop	STOP	22	A2

Signal	Symbol	Value NO	Value NC
Positive JOG	PJOG	23	A3
Negative JOG	NJOG	24	A4
Positive limit	PL	25	A5
Negative limit	NL	26	A6

Origin	ORG	27	A7
Path address 0	ADD0	28	A8
Path address 1	ADD1	29	A9
Path address 2	ADD2	2A	AA
Path address 3	ADD3	2B	AB

Note: CTRG, HOME are edge triggered, please make sure electronic bits last 1ms or above.

Configurable Input Signal

Label	Servo enabled			**Mode**	P	S	T
Signal	SRV-ON	**Default assignment**	29(DI6)	**I/O circuit**	2.16.3 Digital inputs		
	·Servo enabled (Motor ON/OFF control signal)						

Label	Positive position limit			**Mode**	P	S	T
Signal	POT	**Default assignment**	9(DI2)	**I/O circuit**	2.16.3 Digital inputs		
	To prevent axis from travelling in positive direction Signal valid when P05.04 is set. If P05.04 is set to any value besides 1, POT signal invalid when axis moves in positive direction.						
Label	Negative position limit			**Mode**	P	S	T
Signal	NOT	**Default assignment**	8(DI1)	**I/O circuit**	2.16.3 Digital inputs		
	To prevent axis from travelling in negative direction Signal valid when P05.04 is set. If P05.04 is set to any value besides 1, NOT signal invalid when axis moves in negative direction.						

Label	Clear deviation count			**Mode**	P		
Signal	CL	**Default assignment**	30(DI7)	**I/O circuit**	2.16.3 Digital inputs		
	To clear position deviation counter. Only clear once by default. Please modify on P05.17.						

Label	Clear alarm			**Mode**	P	S	T
Signal	A-CLR	**Default assignment**	31(DI8)	**I/O circuit**	2.16.3 Digital inputs		
	To clear alarm. Only some of the alarms can be cleared.						

Label	Command pulse prohibited			**Mode**	P		
Signal	INH	**Default assignment**	33(DI10)	**I/O circuit**	2.16.3 Digital inputs		
	Ignore position command pulse Please set in P05.18 when needed When INH input is valid, position command from controller will deviate from servo drive internal command after filtering, which might cause the loss of position info before INH input. Please reset before making any further action requiring position management.						

Label	Control mode switching			Mode	P	S	T
Signal	C-MODE	Default assignment	32(DI9)	I/O circuit	2.16.3 Digital inputs		
	When P00.01 = 3,4,5, control mode: hybrid mode, which is consists of 2 control modes. All control modes require this signal. Please set to a same logic when in position, velocity or torque mode to prevent error from occurring. When C-MODE is valid, select 2nd mode; when invalid, select 1st mode. Please do not enter any command 10ms before and after mode switching.						

Label	Command frequency divider/multiplier switching			Mode	P		
Signal	DIV1	Default assignment	28(DI5)	I/O circuit	2.16.3 Digital inputs		
	When DIV1 is valid, frequency divider/multiplier numerator and denominator switch to 2nd command frequency divider/multiplier numerator and denominator. When DIV1 input is valid, position command from controller will deviate from servo drive internal command after filtering, which might cause the loss of position info before DIV1 input. Please reset before making any further action requiring position management.						

Label	Vibration suppression 1			Mode	P		
Signal	VS-SEL1	Default assignment		I/O circuit	2.16.3 Digital inputs		
Label	Vibration suppression 2			Mode	P		
Signal	VS-SEL2	Default assignment		I/O circuit	2.16.3 Digital inputs		
	To switch frequency used in vibration suppression						

Label	Gain switching			Mode	P	S	T
Signal	GAIN	Default assignment	27(DI4)	I/O circuit	2.16.3 Digital inputs		
	To switch between 1st and 2nd gain						

Label	Torque limit switching			Mode	P	S	
Signal	TL-SEL	Default assignment		I/O circuit	2.16.3 Digital inputs		
	To switch between 1st and 2nd torque limit. Please refer to P05.21						

Value		Limit
【0】		Positive and negative torque limits: P00.13 First torque limit
1		Positive and negative torque limits: P05.22 Second torque limit
2	TL-SEL OFF	Positive torque limit: P00.13 First torque limit
	TL-SEL ON	Negative torque limit: P05.22 Second torque limit
3		Positive torque limit: AI 1 Negative torque limit: AI 2
4		Positive torque limit: P05.18 Torque limit analog A source selection Negative torque limit: P05.19 Torque limit analog B source selection
5		Positive torque limit: P00.13 First torque limit Negative torque limit: P05.22

			Second torque limit
	6		Positive torque limit: Minimum of P00.13 and P05.18 Negative torque limit: Minimum of P05.22 and P05.19
	7	TL-SEL OFF	Positive torque limit: P05.18 Torque limit analog A source selection; Negative torque limit: P05.19 Torque limit analog B source selection
		TL-SEL ON	Positive torque limit: P05.19 Torque limit analog B source selection; Negative torque limit: P05.18 Torque limit analog A source selection
	9	TL-SEL OFF	TL-SEL OFF: Positive torque limit: P05.18 Torque limit analog A source selection; Negative torque limit: P05.22 Second torque limit
		TL-SEL ON	TL-SEL ON: Positive torque limit: P05.22 Second torque limit; Negative torque limit: P05.19 Torque limit analog B source selection

Label	Zero speed clamp			**Mode**		S	
Signal	ZEROSPD	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	To set velocity command to 0 When in use, please set P03.15 ≠ 0.						

Label	Velocity command sign			**Mode**		S	
Signal	VC-SIGN	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	Sign of velocity command input in velocity control mode. Please refer to P03.01						

Label	Torque command sign			**Mode**			T
Signal	TC-SIGN	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	Sign of torque command input in torque control mode. Please refer to P03.18						

Value	Direction settings
【0】	Torque command input「Positive」→Positive direction、「Negative」→Negative direction
1	Use TC-SIGN ON/OFF status for torque direction OFF: *Positive direction* ON: *Negative direction*

Label	Internal command velocity 1			**Mode**		S	
Signal	INTSPD1	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
Label	Internal command velocity 2			**Mode**		S	
Signal	INTSPD2	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
Label	Internal command velocity 3			**Mode**		S	
Signal	INTSPD3	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		

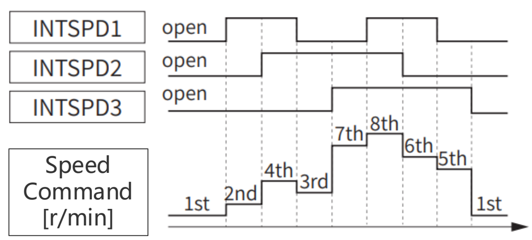
Label	Internal command velocity 4		Mode	S
Signal	INTSPD4	Default assignment	I/O circuit	2.16.3 Digital inputs

onnect to the right DI to control internal command velocity settings.

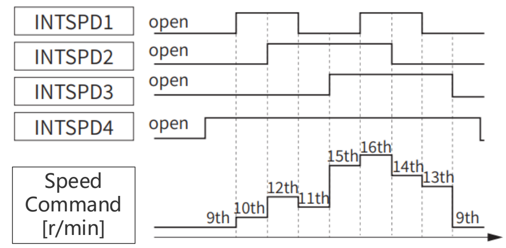
Value	Velocity settings
0	Analog Speed Command (SPR)
【1】	Internal velocity settings 1st – 8th speed（P03.04～P03.11 ）
2	Internal velocity settings 1st – 7rd speed（P03.04～P3.10），Analog Speed Command (SPR)
3	Internal velocity settings 1st – 16th speed（P03.04～P03.11，P03.36～P03.43）

Value	Internal Command velocity 1（INTSPD 1）	Internal command velocity 2（INTSPD2）	Internal command velocity 3（INTSPD3）	Internal command velocity 4（INTSPD4）	Velocity command
1	OFF	OFF	OFF	-	1st speed
	ON	OFF	OFF	-	2nd speed
	OFF	ON	OFF	-	3rd speed
	ON	ON	OFF	-	4th speed
	OFF	OFF	ON	-	5th speed
	ON	OFF	ON	-	6th speed
	OFF	ON	ON	-	7th speed
	ON	ON	ON	-	8th speed
2	OFF	OFF	OFF	-	1st speed
	ON	OFF	OFF	-	2nd speed
	OFF	ON	OFF	-	3rd speed
	ON	ON	OFF	-	4th speed
	OFF	OFF	ON	-	5th speed
	ON	OFF	ON	-	6th speed
	OFF	ON	ON	-	7th speed
	ON	ON	ON	-	Analog Speed Command
3	Similar to (P03.00=ON)			OFF	1st speed~8th speed
	OFF	OFF	OFF	ON	9th speed
	ON	OFF	OFF	ON	10th speed
	OFF	ON	OFF	ON	11th speed
	ON	ON	OFF	ON	12th speed
	OFF	OFF	ON	ON	13th speed
	ON	OFF	ON	ON	14th speed
	OFF	ON	ON	ON	15th speed
	ON	ON	ON	ON	16th speed

Please change internal command velocity as per diagram below as unexpected axis movement might occurs if 2 command velocities are changed at the same time



P03.00=1 / 2



P03.00=3

Signal input configurable only in PR mode

Label	Trigger command			**Mode**	**PR**
Signal	CTRG	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	Select path address ID through ADD0-3, then trigger PR path motion using CTRG Set rising edge/double edge trigger in P08.00.				

Label	Path address 0-3			**Mode**	**PR**
Signal	ADD0-3	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	IO combination trigger select path using ADD0~ADD3. Trigger mode is set in P08.26.				

ADD3	ADD2	ADD1	ADD0	Path selection
OFF	OFF	OFF	OFF	Path 0 (Non-action)
OFF	OFF	OFF	ON	Path1
OFF	OFF	ON	OFF	Path2
OFF	OFF	ON	ON	Path3
OFF	ON	OFF	OFF	Path4
OFF	ON	OFF	ON	Path5
OFF	ON	ON	OFF	Path6
OFF	ON	ON	ON	Path7
ON	OFF	OFF	OFF	Path8
ON	OFF	OFF	ON	Path9
ON	OFF	ON	OFF	Path10
ON	OFF	ON	ON	Path11
ON	ON	OFF	OFF	Path12
ON	ON	OFF	ON	Path13
ON	ON	ON	OFF	Path14
ON	ON	ON	ON	Path15

Label	Home			**Mode**	**PR**
Signal	HOME	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	Homing trigger, homing velocity and acceleration can be set in P08.15-P08.18				

Label	Forced stop			**Mode**	**PR**
Signal	STP	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	Emergency stop trigger in PR motion. Deceleration can be set in P08.23				

Label	Positive/Negative JOG			**Mode**	**PR**
Signal	PJOG/NJOG	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	To jog manually in PR mode				

Label	Positive/Negative limit			**Mode**	**PR**
Signal	PL/NL	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	PR mode positive/negative position limit				

Label	Origin			**Mode**	**PR**
Signal	ORG	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	Origin signal input				

2.16.7 Set DO signals

Default DO signal assignments

CN1 PIN	Label	Parameter	Assigned signal
11	DO1+	P04.10	External brake released BRK-OFF
10	DO1-		
35	DO2+	P04.11	Servo-Ready S-RDY
34	DO2-		
37	DO3+	P04.12	Alarm（ALARM）
36	DO3-		
39	DO4+	P04.13	Positioning completed INP1
38	DO4-		
12	DO5	P04.14	Zero speed clamp detection ZSP
40	DO6	P04.15	Torque limit signal TLC

Control signal output settings

Value		Signal	Symbol
NO	NC		
00	80	Invalid	—
01	81	Alarm	ALARM
02	82	Servo-Ready	SRDY
03	83	External brake released	BRK-OFF
04	84	Positioning completed	INP
05	85	At-speed	AT-SPPED
06	86	Torque limit signal	TLC
07	87	Zero speed clamp detection	ZSP
08	88	Velocity coincidence	V-COIN
12	92	Servo Status	SRV-ST
15	95	Positive limit valid	POT-OUT
16	96	Negative limit valid	NOT-OUT
0B	8B	Position command ON/OFF	P-CMD
0F	8F	Velocity command ON/OFF	V-CMD
0D	8D	Velocity limit signal	V-LIMIT
14	94	Position comparison	CMP-OUT

CN1 PIN	Output	Parameters
11	DO1+	P04.10
10	DO1-	
35	DO2+	P04.11
34	DO2-	
37	DO3+	P04.12
36	DO3-	
39	DO4+	P04.13
38	DO4-	
12	DO5	P04.14
40	DO6	P04.15

Same signal can be assigned to multiple different outputs.
Err212 might occur if output is allocated to signals other than listed in the table above.

Outputs related to PR-mode

Signal	Symbol	Value	
		NO	NC
Command completed	CMD-OK	20	A0
Path completed	PR-OK	21	A1
Homing done	HOME-OK	22	A2

Configurable DO signals

Label	Alarm			Mode	P	S	T
Signal	ALARM	Default assignment	(D03)	I/O circuit	2.16.3 Digital inputs		
	Signal output when driver alarm occurs						

Label	Servo Ready			Mode	P	S	T
Signal	S-RDY	Default assignment	(D02)	I/O circuit	2.16.3 Digital inputs		
	Signal output when servo is powered on						

Label	Positioning completed			Mode	P		
Signal	INP	Default assignment	(D04)	I/O circuit	2.16.3 Digital inputs		
	Signal output when positioning completed within set range						

Label	External brake released			Mode	P	S	T
Signal	BRK-OFF	Default assignment	(D01)	I/O circuit	2.16.3 Digital inputs		
	Signal valid to hold braking action						

Label	Velocity reached			Mode		S	T
Signal	AT-SPEED	Default assignment		I/O circuit	2.16.3 Digital inputs		
	Velocity reached signal						

Label	Torque limit signal			Mode	P	S	T
Signal	TLC	Default assignment	(D06)	I/O circuit	2.16.3 Digital inputs		
	Torque limiting signal						

Label	Zero speed clamp detection			Mode	P	S	T
Signal	ZSP	Default assignment	(D05)	I/O circuit	2.16.3 Digital inputs		
	Zero speed clamp activation signal						

Label	Velocity coincidence			Mode		S	T
Signal	V-COIN	Default assignment		I/O circuit	2.16.3 Digital inputs		
	Signal output when velocity coincides.						

Label	Servo Status			Mode	P	S	T
Signal	SRV-ST	Default assignment		I/O circuit	2.16.3 Digital inputs		

	Signal output when servo is enabled.						

Label	Positive limit valid			**Mode**		S	T
Signal	POT-OUT	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	Signal output when positive position limit signal valid.						

Label	Negative limit valid			**Mode**		S	T
Signal	NOT-OUT	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	Signal output when negative position limit signal valid						

Label	Position command ON/OFF			**Mode**	P		
Signal	P-CMD	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	Signal valid when position command ON						

Label	Velocity command ON/OFF			**Mode**		S	
Signal	V-CMD	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	Signal valid when velocity command ON in velocity control mode						
Label	Position comparison			**Mode**	P		
Signal	CMP-OUT	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs		
	When position comparison condition is satisfied, output according to selected method: Flip or pulse width output.						

DO signals configurable only in PR mode

Label	Command completed			**Mode**	PR
Signal	CMD-OK	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	PR command is delivered but axis not yet in position				

Label	Path completed			**Mode**	PR
Signal	PR-OK	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	PR command delivered and axis in position				
Label	Homing done			**Mode**	PR
Signal	HOME-OK	**Default assignment**		**I/O circuit**	2.16.3 Digital inputs
	PR motion homing done.				

2.17 Measures against electromagnetic interference

To reduce interference, please take the following measures:

- I/O signal cable > 3m; Encoder cable > 20m
- Use cable with larger diameter for grounding
  ①Grounding resistance > 100Ω
  ②When there are multiple drivers connected in parallel, PE terminal of the main power supply and ground terminal of servo drives must be connected to copper ground bar in the electrical cabinet and the copper ground bar needs to be connected to the metal frame of the cabinet.
- Please install a line filter on main power supply cable to prevent interference from radio

frequency.

- In order to prevent malfunctions caused by electromagnetic interference, please take following measures:

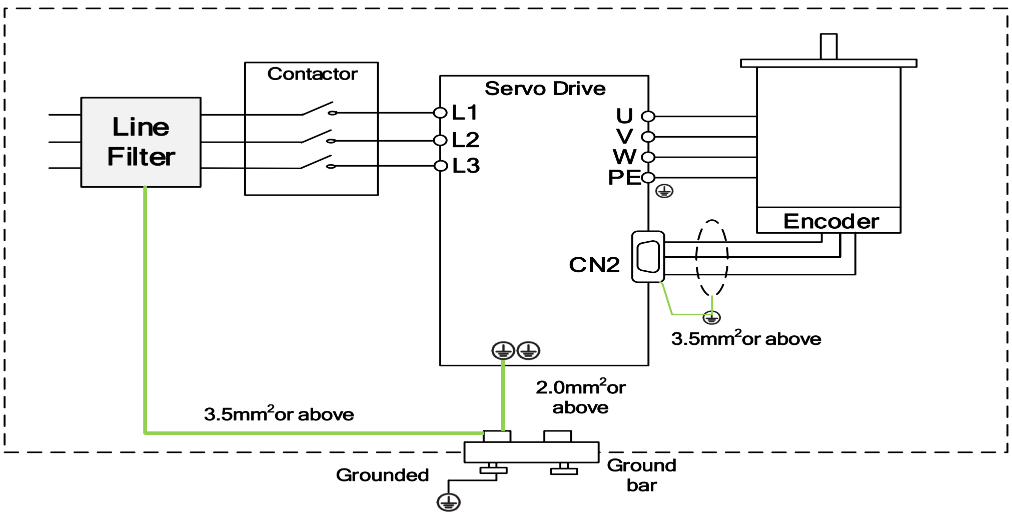
  ①Install master device and line filter close to the servo drive

  ②Install surge suppressor for relay and contactor

  ③Please separate signal/encoder cable from power cable with a space of at least 30cm

  ④Install a line filter for the main power supply if a device with high frequency generation such as a welding machine exists nearby

2.17.1 Grounding connection and other anti-interference wiring connections

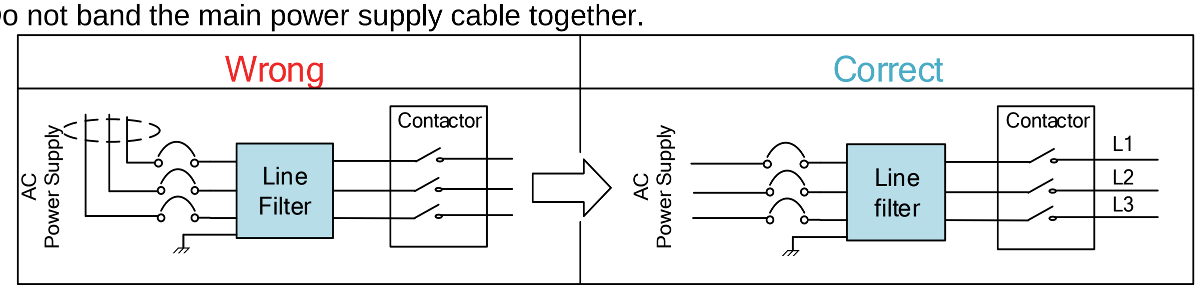


- Servo motor frame should be grounded. Please connect the PE terminal of servo motor and servo drive and ground them together to reduce interference.
- Ground both ends of the foil shield of encoder cable.

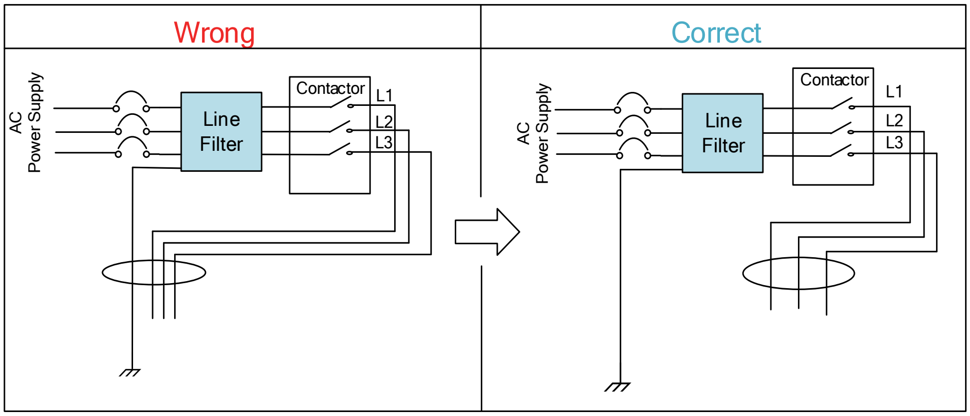
2.17.2 Using line filter

To reduce interference from main power supply cable and to prevent from affecting other sensitive components around the servo drive, please choose a line filter based on actual supply current. Please do be aware of the following mistake when installing a line filter.

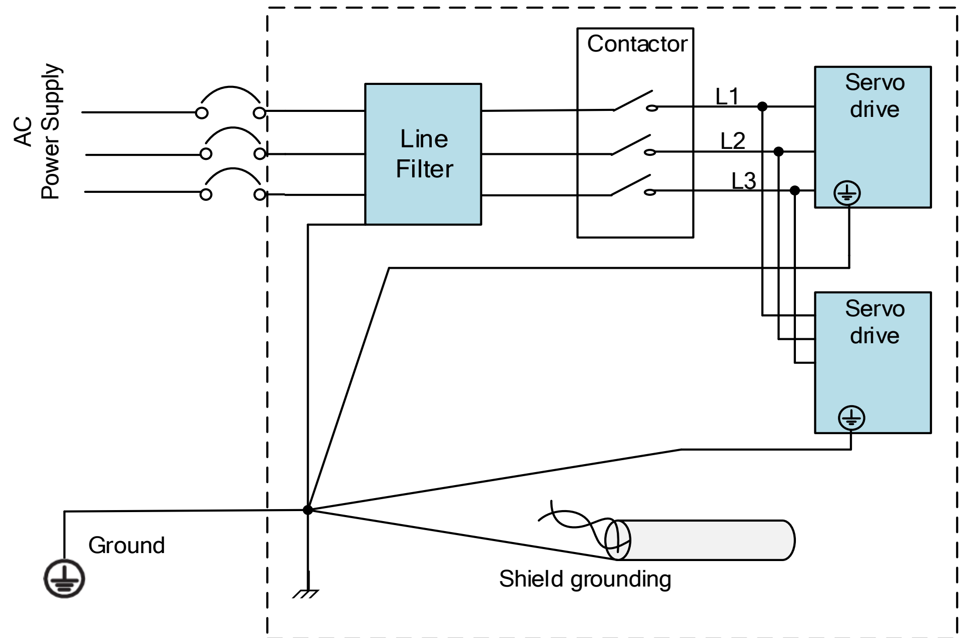
Do not band the main power supply cable together.



Separate the ground wire from the line filter and the main power supply cable.



Ground wires inside an electrical cabinet



Chapter 3 Parameter

3.1 Parameters list

P00.00
Classification code — Sub-code

Valid mode:
P: Valid in position control mode
S: Valid in velocity control mode
T: Valid in torque control mode
PR: Valid in PR control mode

Activation:
"O" – Restart driver for parameter changes to be valid
"—" – Valid immediately
"△" – Valid when axis stops
"●"- Valid after re-enabling

Valid mode:
"O" indicates that the parameter is valid in this mode
"-" indicates that the parameter is invalid in this mode.

[Class 0] Basic settings

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P00.00	Model-following bandwidth	1	△	O	—	—	16bit	R/W	0x0001
P00.01	Control Mode Settings	0	O	O	O	O	16bit	R/W	0x0003
P00.02	Real time Auto Gain Adjusting	0x1	—	O	O	O	16bit	R/W	0x0005
P00.03	Real time auto stiffness adjusting	11	—	O	O	O	16bit	R/W	0x0007
P00.04	Inertia ratio	250	—	O	O	O	16bit	R/W	0x0009
P00.05	Command pulse input selection	0	O	O	—	—	16bit	R/W	0x000B
P00.06	Command pulse polarity inversion	0	O	O	—	—	16bit	R/W	0x000D
P00.07	Command pulse input mode	3	O	O	—	—	16bit	R/W	0x000F
P00.08	command pulse count per revolution	10000	O	O	—	—	32bit	R/W	0x0010 0x0011
P00.09	1st command frequency divider/multiplier numerator	1	O	O	—	—	32bit	R/W	0x0012 0x0013
P00.10	1st command frequency divider/multiplier denominator	1	O	O	—	—	32bit	R/W	0x0014 0x0015
P00.11	Encoder output pulse count per revolution	5000	O	O	O	O	16bit	R/W	0x0017

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P00.12	Pulse output logic inversion	0	O	O	O	O	16bit	R/W	0x0019
P00.13	1st Torque Limit	350	—	O	O	O	16bit	R/W	0x001B
P00.14	Excessive position deviation	30	—	O	—	—	16bit	R/W	0x001D
P00.15	Absolute Encoder settings	0	O	O	O	O	16bit	R/W	0x001F
P00.16	Regenerative resistance	100	—	O	O	O	16bit	R/W	0x0021
P00.17	Regenerative resistor power rating	50	—	O	O	O	16bit	R/W	0x0023
P00.19	Friction compensation function settings	0	—	O	O	O	16bit	R/W	0x0027
P00.22	PR and P/S/T switching	0	—	O	O	O	16bit	R/W	0x002D
P00.25	Auxiliary function	0	—	O	O	O	16bit	R/W	0x0033
P00.26	Simulated I/O	0	—	O	O	O	16bit	R/W	0x0035
P00.30	Enable Full closed-loop function	0	—	O	O	O	16bit	R/W	0x0037
P00.31	External encoder type	0	O	O	O	O	16bit	R/W	0x0039
P00.32	External encoder direction	0	O	O	O	O	16bit	R/W	0x003B
P00.33	Excessive hybrid deviation	16000	O	O	—	—	16bit	R/W	0x0043
P00.34	Clear excess hybrid control deviation	0	O	O	—	—	16bit	R/W	0x0045
P00.35	External encoder frequency divider numerator	0	O	O	O	O	16bit	R/W	0x0047
P00.36	External encoder frequency divider denominator	10000	O	O	O	O	16bit	R/W	0x0049
P00.37	External encoder feedback pulse count per revolution	0	O	O	O	O	16bit	R/W	0x004B
P00.38	Z-signal pulse input source	0	—	O	O	O	16bit	R/W	0x004D
P00.39	PR Pulses per revolution	0	—	O	O	O	32bit	R/W	H:0x004E L:0x004F
P00.40	Mapping parameter 1	0x0	—	O	O	O	32bit	R/W *	H:0x0050 L:0x0051
P00.41	Mapping parameter 2	0x0	—	O	O	O	32bit	R/W *	H:0x0052 L:0x0053
P00.42	Mapping parameter 3	0x0	—	O	O	O	32bit	R/W *	H:0x0054 L:0x0055
P00.43	Mapping parameter 4	0x0	—	O	O	O	32bit	R/W *	H:0x0056 L:0x0057
P00.44	Mapping parameter 5	0x0	—	O	O	O	32bit	R/W *	H:0x0058 L:0x0059

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P00.45	Mapping parameter 6	0x0	—	O	O	O	32bit	R/W *	H:0x005A L:0x005B
P00.46	Mapping parameter 7	0x0	—	O	O	O	32bit	R/W *	H:0x005C L:0x005D
P00.47	Mapping parameter 8	0x0	—	O	O	O	32bit	R/W *	H:0x005E L:0x005F
P00.50	Mapping parameter 1 indicator	0x0	—	O	O	O	32bit	R/W	H:0x0064 L:0x0065
P00.51	Mapping parameter 2 indicator	0x0	—	O	O	O	32bit	R/W	H:0x0066 L:0x0067
P00.52	Mapping parameter 3 indicator	0x0	—	O	O	O	32bit	R/W	H:0x0068 L:0x0069
P00.53	Mapping parameter 4 indicator	0x0	—	O	O	O	32bit	R/W	H:0x006A L:0x006B
P00.54	Mapping parameter 5 indicator	0x0	—	O	O	O	32bit	R/W	H:0x006C L:0x006D
P00.55	Mapping parameter 6 indicator	0x0	—	O	O	O	32bit	R/W	H:0x006E L:0x006F
P00.56	Mapping parameter 7 indicator	0x0	—	O	O	O	32bit	R/W	H:0x0070 L:0x0071
P00.57	Mapping parameter 8 indicator	0x0	—	O	O	O	32bit	R/W	0x0072 0x0073

[Class 1] Gain adjustment

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P01.00	1st position loop gain	480	—	O	—	—	16bit	R/W	0x0101
P01.01	1st velocity loop gain	270	—	O	O	O	16bit	R/W	0x0103
P01.02	1st Integral Time Constant of Velocity Loop	210	—	O	O	O	16bit	R/W	0x0105
P01.03	1st velocity detection filter	15	—	O	O	O	16bit	R/W	0x0107
P01.04	1st Torque Filter Time Constant	84	—	O	O	O	16bit	R/W	0x0109
P01.05	2nd Position Loop Gain	570	—	O	—	—	16bit	R/W	0x010B

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P01.06	2nd velocity loop gain	270	—	O	O	O	16bit	R/W	0x010D
P01.07	2nd Integral Time Constant of Velocity Loop	10000	—	O	O	O	16bit	R/W	0x010F
P01.08	2nd velocity detection filter	15	—	O	O	O	16bit	R/W	0x0111
P01.09	2nd Torque Filter Time Constant	84	—	O	O	O	16bit	R/W	0x0113
P01.10	Velocity feed forward gain	300	—	O	—	—	16bit	R/W	0x0115
P01.11	Velocity feed forward filter time constant	50	—	O	—	—	16bit	R/W	0x0117
P01.12	Torque feed forward gain	0	—	O	O	—	16bit	R/W	0x0119
P01.13	Torque feed forward filter time constant	0	—	O	O	—	16bit	R/W	0x011B
P01.15	Position control gain switching mode	0	—	O	—	—	16bit	R/W	0x011F
P01.16	Position control gain switching delay	50	—	O	—	—	16bit	R/W	0x0121
P01.17	Position control gain switching level	50	—	O	—	—	16bit	R/W	0x0123
P01.18	Hysteresis at position control switching	33	—	O	—	—	16bit	R/W	0x0125
P01.19	Position control switching time	33	—	O	—	—	16bit	R/W	0x0127
P01.23	speed regulator-kr	100	—	—	O	—	16bit	R/W	0x012F
P01.34	Speed feedback filter level	1	—	O	O	—	16bit	R/W	0x0145
P01.35	Position command pulse filter time	8	O	O	—	—	16bit	R/W	0x0147
P01.36	Encoder feedback pulse digital filter setting	5	O	O	—	—	16bit	R/W	0x0149
P01.37	Special function register	0x0	—	O	O	O	16bit	R/W	0x014B
P01.38	Special function register 1	0x0	—	O	O	O	16bit	R/W	0x014D
P01.39	Special function register 2	0x40000	—	O	O	O	16bit	R/W	0x014F
P01.64	Second Q-axis current filter time constant	0	—	O	O	O	16bit	R/W	0x0181
P01.65	Second D-axis current filter time constant	0	—	O	O	O	16bit	R/W	0x0183
P01.66	Torque Filter Type Selection	0	•	O	O	O	16bit	R/W	0x0185

[Class 2] Vibration Suppression

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P02.00	Adaptive filtering mode settings	0	—	O	O	—	16bit	R/W	0x0201
P02.01	1st notch frequency	4000	—	O	O	O	16bit	R/W	0x0203
P02.02	1st notch width	4	—	O	O	O	16bit	R/W	0x0205
P02.03	1st notch depth	0	—	O	O	O	16bit	R/W	0x0207
P02.04	2nd notch frequency	4000	—	O	O	O	16bit	R/W	0x0209
P02.05	2nd notch width	4	—	O	O	O	16bit	R/W	0x020B

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P02.06	2nd notch depth	0	—	O	O	O	16bit	R/W	0x020D
P02.07	3rd notch frequency	4000	—	O	O	O	16bit	R/W	0x020F
P02.08	3rd notch width	4	—	O	O	O	16bit	R/W	0x0211
P02.09	3rd notch depth	0	—	O	O	O	16bit	R/W	0x0213
P02.14	1st damping frequency	0	—	O	—	—	16bit	R/W	0x021D
P02.16	2nd damping frequency	0	—	O	—	—	16bit	R/W	0x0221
P02.22	Position command smoothing filter	0	△	O	—	—	16bit	R/W	0x022D
P02.23	Position command FIR filter	0	△	O	—	—	16bit	R/W	0x022F
P02.31	5th resonant frequency	4000	—	O	O	O	16bit	R/W	0x023F
P02.32	5th resonant Q value	0	—	O	O	O	16bit	R/W	0x0241
P02.33	5th anti-resonant frequency	4000	—	O	O	O	16bit	R/W	0x0243
P02.34	5th anti-resonant Q value	0	—	O	O	O	16bit	R/W	0x0245
P02.35	6th resonant frequency	4000	—	O	O	O	16bit	R/W	0x0247
P02.36	6th resonant Q value	0	—	O	O	O	16bit	R/W	0x0249
P02.37	6th anti-resonant frequency	4000	—	O	O	O	16bit	R/W	0x024B
P02.38	6th anti-resonant Q value	0	—	O	O	O	16bit	R/W	0x024D
P02.48	Adjustment mode	0	—	O	O	O	16bit	R/W	0x0261
P02.50	MFC type	0	•	O	—	—	16bit	R/W	0x0265
P02.51	Velocity feedforward compensation coefficient	0	—	O	—	—	16bit	R/W	0x0267
P02.52	Torque feedforward compensation coefficient	0	—	O	O	—	16bit	R/W	0x0269
P02.53	Dynamic friction compensation coefficient	0	—	O	O	O	16bit	R/W	0x026B
P02.54	Overshoot time coefficient	0	—	O	O	O	16bit	R/W	0x026D
P02.55	Overshoot suppression gain	0	—	O	O	O	16bit	R/W	0x026F

[Class 3] Velocity / Torque Control

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P03.00	Velocity internal/external switching	1	—	—	O	—	16bit	R/W	0x0301
P03.01	Velocity command rotational direction selection	0	—	—	O	—	16bit	R/W	0x0303
P03.02	Velocity command input gain	500	—	—	O	O	16bit	R/W	0x0305
P03.03	Velocity command input inversion	0	—	—	O	—	16bit	R/W	0x0307
P03.04	1st speed of velocity setting	0	—	—	O	—	16bit	R/W	0x0309
P03.05	2nd speed of velocity setting	0	—	—	O	—	16bit	R/W	0x030B
P03.06	3rd speed of velocity setting	0	—	—	O	—	16bit	R/W	0x030D
P03.07	4th speed of velocity setting	0	—	—	O	—	16bit	R/W	0x030F
P03.08	5th speed of velocity setting	0	—	—	O	—	16bit	R/W	0x0311
P03.09	6th speed of velocity setting	0	—	—	O	—	16bit	R/W	0x0313
P03.10	7th speed of velocity setting	0	—	—	O	—	16bit	R/W	0x0315
P03.11	8th speed of velocity setting	0	—	—	O	—	16bit	R/W	0x0317

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P03.12	Acceleration time settings	100	—	—	O	—	16bit	R/W	0x0319
P03.13	Deceleration time settings	100	—	—	O	—	16bit	R/W	0x031B
P03.14	Sigmoid acceleration/deceleration settings	0	O	—	O	—	16bit	R/W	0x031D
P03.15	Zero speed clamp function selection	0	—	—	O	—	16bit	R/W	0x031F
P03.16	Zero speed clamp level	30	—	—	O	—	16bit	R/W	0x0321
P03.17	Torque internal/external switching	0	—	—	—	O	16bit	R/W	0x0323
P03.18	Torque command direction selection	0	—	—	—	O	16bit	R/W	0x0325
P03.19	Torque command input gain	30	—	—	—	O	16bit	R/W	0x0327
P03.20	Torque command input inversion	0	—	—	—	O	16bit	R/W	0x0329
P03.21	Velocity limit in torque mode	0	—	—	—	O	16bit	R/W	0x032B
P03.22	Torque command	0	—	O	O	O	16bit	R/W	0x032D
P03.23	Zero speed delay time in velocity mode	0	—	—	O	—	16bit	R/W	0x032F
P03.24	Maximum motor rotational speed	0	—	O	O	O	16bit	R/W	0x0331
P03.29	Speed limit analog input clamp voltage	0	—	—	—	O	16bit	R/W	0x033B
P03.30	Torque command analog input clamp voltage	0	—	—	—	O	16bit	R/W	0x033D
P03.31	Torque Command Analog Input Source Selection	2	—	O	O	O	16bit	R/W	0x033F
P03.48	Speed Limit Analog Input Source Selection	0	—	O	O	O	16bit	R/W	0x0361
P03.58	Speed regulation ratio 1	10	—	O	O	O	16bit	R/W	0x0375
P03.59	Speed regulation ratio 2	20	—	O	O	O	16bit	R/W	0x0377
P03.60	Speed regulation ratio 3	40	—	O	O	O	16bit	R/W	0x0379
P03.61	Speed regulation ratio 4	80	—	O	O	O	16bit	R/W	0x037A

[Class 4] I/O Monitoring Settings

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P04.00	Input selection DI1	0x3	—	O	O	O	16bit	R/W	0x0401
P04.01	Input selection DI2	0x1	—	O	O	O	16bit	R/W	0x0403
P04.02	Input selection DI3	0x2	—	O	O	O	16bit	R/W	0x0405
P04.03	Input selection DI4	0x6	—	O	O	O	16bit	R/W	0x0407
P04.04	Input selection DI5	0xC	—	O	O	O	16bit	R/W	0x0409
P04.05	Input selection DI6	0x7	—	O	O	O	16bit	R/W	0x040B
P04.06	Input selection DI7	0x4	—	O	O	O	16bit	R/W	0x040D
P04.07	Input selection DI8	0x5	—	O	O	O	16bit	R/W	0x040F
P04.08	Input selection DI9	0x8	—	O	O	O	16bit	R/W	0x0411
P04.09	Input selection DI10	0x0	—	O	O	O	16bit	R/W	0x0413
P04.10	Output selection DO1	0x3	—	O	O	O	16bit	R/W	0x0415
P04.11	Output selection DO2	0x2	—	O	O	O	16bit	R/W	0x0417

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P04.12	Output selection DO3	0x1	—	O	O	O	16bit	R/W	0x0419
P04.13	Output selection DO4	0x4	—	O	O	O	16bit	R/W	0x041B
P04.14	Output selection DO5	0x7	—	O	O	O	16bit	R/W	0x041D
P04.15	Output selection DO6	0x6	—	O	O	O	16bit	R/W	0x041F
P04.23	Analog input 1(AI-1) filter	0	—	—	O	O	16bit	R/W	0x042F
P04.24	Analog input 1(AI-1) overvoltage settings	0	—	—	O	O	16bit	R/W	0x0431
P04.26	Analog input 2(AI-2) filter	0	—	—	O	O	16bit	R/W	0x0435
P04.27	Analog input 2(AI-2) overvoltage settings	0	—	—	—	O	16bit	R/W	0x0437
P04.29	Analog input 3(AI-3) filter	1	—	O	—	—	16bit	R/W	0x043B
P04.30	Analog input 3(AI-3) overvoltage settings	0	—	O	—	—	16bit	R/W	0x043D
P04.31	Positioning complete range	50	—	O	O	O	16bit	R/W	0x043F
P04.32	Positioning complete output setting	50	—	—	O	—	16bit	R/W	0x0441
P04.33	INP positioning delay time	1000	—	—	O	—	16bit	R/W	0x0443
P04.34	Zero speed	150	—	O	O	O	16bit	R/W	0x0445
P04.35	Velocity coincidence range	0	—	O	O	O	16bit	R/W	0x0447
P04.36	Arrival velocity	30	—	O	O	O	16bit	R/W	0x0449
P04.37	Motor power-down delay time	150	—	O	O	O	16bit	R/W	0x044B
P04.38	brake release waiting time	0	—	O	O	O	16bit	R/W	0x044D
P04.39	Holding brake activation speed	30	—	O	O	O	16bit	R/W	0x044F
P04.43	Emergency stop function selection	0	—	O	O	O	16bit	R/W	0x0457
P04.48	Torque compensation delay time	0	—	O	O	O	16bit	R/W	0x0461
P04.62	Position/Speed/Torque Feedback Polarity Setting	0	—	O	O	O	16bit	R/W	0x047D
P04.64	AO1 output	0	—	O	O	O	16bit	R/W	0x0481
P04.65	AO1 signal	0x4	—	O	O	O	16bit	R/W	0x0483
P04.66	AO1 amplification	100	—	O	O	O	16bit	R/W	0x0485
P04.67	AO1 communication settings	0	—	O	O	O	16bit	R/W	0x0487
P04.68	AO1 offset	0	—	O	O	O	16bit	R/W	0x0489
P04.69	AO2 output	0	—	O	O	O	16bit	R/W	0x048B
P04.70	AO2 signal	0x1	—	O	O	O	16bit	R/W	0x048D
P04.71	AO2 amplification	100	—	O	O	O	16bit	R/W	0x048F
P04.72	AO2 communication settings	0	—	O	O	O	16bit	R/W	0x0491
P04.73	AO2 offset	0	—	O	O	O	16bit	R/W	0x0493
P04.74	Warning indicator light 1 signal	1	—	O	O	O	16bit	R/W	0x0495
P04.75	Warning indicator light 2 signal	2	—	O	O	O	16bit	R/W	0x0497
P04.76	Warning indicator light 3 signal	3	—	O	O	O	16bit	R/W	0x0499
P04.77	Warning indicator light 4 signal	4	—	O	O	O	16bit	R/W	0x049B
P04.78	Warning indicator light 5 signal	5	—	O	O	O	16bit	R/W	0x049D

[Class 5] Extension settings

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P05.00	2nd pulse count per revolution	10000	●	O	—	—	32bit	R/W	0x0500 0x0501
P05.01	2nd Command frequency divider/multiplier numerator	1	O	O	—	—	32bit	R/W	0x0502 0x0503
P05.02	2nd Command frequency divider/multiplier denominator	1	O	O	—	—	32bit	R/W	0x0504 0x0505
P05.04	Driver prohibition input settings	0	—	O	O	O	16bit	R/W	0x0509
P05.06	Servo-off mode	0	—	O	O	O	16bit	R/W	0x050D
P05.09	DC bus voltage undervoltage	50	—	O	O	O	16bit	R/W	0x0513
P05.10	Servo Alarm Timing Mode	0	O	O	O	O	16bit	R/W	0x0515
P05.11	Torque limit at alarm stop	0	—	O	O	O	16bit	R/W	0x0517
P05.12	Overload level setting	0	—	O	O	O	16bit	R/W	0x0519
P05.13	Overspeed level setting	0	—	O	O	O	16bit	R/W	0x051B
P05.15	I/O digital filter	10	—	O	O	O	16bit	R/W	0x051F
P05.17	Counter clearing input mode	0x13	—	O	—	—	16bit	R/W	0x0523
P05.18	Torque Limit Analog A Source Selection	0	—	O	O	O	16bit	R/W	0x0525
P05.19	Torque Limit Analog B Source Selection	0	—	O	O	O	16bit	R/W	0x0527
P05.20	Position unit settings	0	—	O	—	—	16bit	R/W	0x0529
P05.21	Torque limit selection	0	—	O	O	O	16bit	R/W	0x052B
P05.22	2nd torque limit	500	—	O	O	O	16bit	R/W	0x052D
P05.23	Positive torque warning threshold	0	—	O	O	O	16bit	R/W	0x052F
P05.24	Negative torque warning threshold	0	—	O	O	O	16bit	R/W	0x0531
P05.25	Analog 1 torque limit gain	30	—	O	O	O	16bit	R/W	0x0533
P05.26	Analog 2 torque limit gain	30	—	O	O	O	16bit	R/W	0x0535
P05.27	Analog 3 torque limit gain	30	—	O	O	O	16bit	R/W	0x0537
P05.28	LED initial status	34	O	O	O	O	16bit	R/W	0x0539
P05.29	RS485 communication mode	0x5	—	O	O	O	16bit	R/W	0x053B
P05.30	RS485 communication Baud rate	4	—	O	O	O	16bit	R/W	0x053D
P05.31	RS485 axis address	1	—	O	O	O	16bit	R/W	0x053F
P05.32	Max. command pulse input frequency	0	—	O	—	—	16bit	R/W	0x0541
P05.37	Torque saturation alarm detection time	500	—	O	O	O	16bit	R/W	0x0549
P05.40	D41 set value	0x30C	—	O	O	O	16bit	R/W	0x0551
P05.42	Frequency divider output – Z-signal polarity	0	O	O	O	O	16bit	R/W	0x0555
P05.43	Frequency divider output – Z-signal width	0	O	O	O	O	16bit	R/W	0x0557
P05.44	Frequency divider output source	0	O	O	O	O	16bit	R/W	0x0559
P05.45	External encoder overspeed feedback threshold	0	O	O	O	O	16bit	R/W	0x055D
P05.46	Vent overload level	0	O	O	O	O	16bit	R/W	0x055F
P05.58	Frequency Divider Output Delay Compensation	0	—	O	—	—	16bit	R/W	0x0575
P05.70	Velocity reaches hysteresis width	0	—	—	O	—	16bit	R/W	0x058D

[Class 6] Other Settings

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P06.01	Encoder zero position compensation	0	O	O	O	O	16bit	R/W	0x0603
P06.03	JOG trial run torque command	100	—	—	—	O	16bit	R/W	0x0607
P06.04	JOG trial run velocity command	50	—	O	O	O	16bit	R/W	0x0609
P06.05	Position 3rd gain valid time	0	—	O	—	—	16bit	R/W	0x060B
P06.06	Position 3rd gain scale factor	100	—	O	—	—	16bit	R/W	0x060D
P06.07	Torque command additional value	0	—	O	O	O	16bit	R/W	0x060F
P06.08	Positive direction torque compensation value	0	—	O	O	O	16bit	R/W	0x0611

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P06.09	Negative direction torque compensation value	0	—	O	O	O	16bit	R/W	0x0613
P06.10	Function extension setting	0	—	O	O	O	16bit	R/W	0x0615
P06.11	Current response settings	100	—	O	O	O	16bit	R/W	0x0617
P06.14	Max. time to stop after disabling	500	—	O	O	O	16bit	R/W	0x061D
P06.20	Trial run distance	10	—	O	—	—	16bit	R/W	0x0629
P06.21	Trial run waiting time	300	—	O	—	—	16bit	R/W	0x062B
P06.22	No. of trial run cycles	5	—	O	—	—	16bit	R/W	0x062D
P06.25	Trial run acceleration	200	—	O	O	—	16bit	R/W	0x0633
P06.28	Observer gain	0	—	O	O	O	16bit	R/W	0x0639
P06.29	Observer filter	0	—	O	O	O	16bit	R/W	0x063B
P06.56	Blocked rotor alarm torque threshold	300	—	O	O	O	16bit	R/W	0x0671
P06.57	Blocked rotor alarm delay time	400	—	O	O	O	16bit	R/W	0x0673
P06.59	Homing mode position threshold	8	—	O	O	O	16bit	R/W	0x0677
P06.61	Z signal holding time	10	—	O	O	O	16bit	R/W	0x067B
P06.63	Absolute multiturn data upper limit	0	O	O	O	O	16bit	R/W	0x067F

[Class 7] Factory Settings

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P07.15	Motor model	0x200	O	O	O	O	16bit	R/W	0x071F
P07.16	Encoder	-	O	O	O	O	16bit	R/W	0x0721
P07.54	External grating ruler precision	100	O	O	O	O	16bit	R/W	0x076D
P07.57	Motor Overheat Threshold	0	—	O	O	O	16bit	R/W	0x0773
P07.60	Encoder Communication Protocol	0	—	O	O	O	16bit	R/W	0x0779
P07.77	BISS-C encoder single turn	32	O	O	O	O	16bit	R/W	0x079B
P07.78	BISS-C encoder multi turn	100	O	O	O	O	16bit	R/W	0x079D
P07.79	BISS-C encoder communication rate	25	O	O	O	O	16bit	R/W	0x079F
P07.80	BISS-C encoder terminal polarity	0	O	O	O	O	16bit	R/W	0x0781
P07.83	Motor Zero Position Single Turn Position	0	O	O	O	O	16bit	R/W	0x0787

[Class 8] Pr-Control Parameters

Code	Label	Default	Activation	Valid mode			Communication mode		
				PR	S	T	Byte	Op.	485 Addr.
P08.00	PR Control	0	—	O	—	—	16bit	R/W	0x6000
P08.01	Path count	16	—	O	—	—	16bit	R/W	0x6001
P08.02	Control Operation		—	O	—	—	16bit	R/W	0x6002
P08.06	Software positive limit H	0		O			16bit	R/W	0x6006
P08.07	Software positive limit (L)	0	—	O	—	—	16bit	R/W	0x6007
P08.08	Software negative limit H	0	—	O	—	—	16bit	R/W	0x6008
P08.09	Software negative limit (L)	0	—	O	—	—	16bit	R/W	0x6009
P08.10	Homing mode	0	—	O	—	—	16bit	R/W	0x600A
P08.11	Zero position H	0	—	O	—	—	16bit	R/W	0x600B
P08.12	Zero position (L)	0	—	O	—	—	16bit	R/W	0x600C
P08.13	Home position off set H	0	—	O	—	—	16bit	R/W	0x600D
P08.14	Home position off set (L)	0		O	—	—	16bit	R/W	0x600E
P08.15	High homing velocity	200	—	O	—	—	16bit	R/W	0x600F
P08.16	Low homing velocity	50	—	O	—	—	16bit	R/W	0x6010
P08.17	Homing acceleration	100	—	O	—	—	16bit	R/W	0x6011
P08.18	Homing deceleration	100	—	O	—	—	16bit	R/W	0x6012
P08.19	Homing torque holding time	100	—	O	—	—	16bit	R/W	0x6013
P08.20	Homing torque	100	—	O	—	—	16bit	R/W	0x6014

Code	Label	Default	Activation	Valid mode			Communication mode		
				PR	S	T	Byte	Op.	485 Addr.
P08.21	Homing overtravel alarm range	0	—	O	—	—	16bit	R/W	0x6015
P08.22	Emergency stop at limit deceleration	10	—	O	—	—	16bit	R/W	0x6016
P08.23	STP emergency stop deceleration	50	—	O	—	—	16bit	R/W	0x6017
P08.24	I/O combination trigger mode	0	—	O	—	—	16bit	R/W	0x601A
P08.25	I/O combination filter	5	—	O	—	—	16bit	R/W	0x601B
P08.26	S-code current output value	0	—	O	—	—	16bit	R/W	0x601C
P08.27	PR warning	0	—	O	—	—	16bit	R/W	0x601D
P08.39	JOG velocity	100	—	O	—	—	16bit	R/W	0x6027
P08.40	JOG acceleration	100	—	O	—	—	16bit	R/W	0x6028
P08.41	JOG deceleration	100	—	O	—	—	16bit	R/W	0x6029
P08.42	Command position H	0	—	O	—	—	16bit	R/W	0x602A
P08.43	Command position（L）	0	—	O	—	—	16bit	R/W	0x602B
P08.44	Motor position H	0	—	O	—	—	16bit	R/W	0x602C
P08.45	Motor position（L）	0	—	O	—	—	16bit	R/W	0x602D
P08.46	Input I/O status	0	—	O	—	—	16bit	R/W	0x602E
P08.47	Output I/O status	0	—	O	—	—	16bit	R/W	0x602F
P08.48	Path 0 S-code	0	—	O	—	—	16bit	R/W	0x6030
P08.49	Path 1 S-code	0	—	O	—	—	16bit	R/W	0x6031
P08.50	Path 2 S-code	0	—	O	—	—	16bit	R/W	0x6032
P08.51	Path 3 S-code	0	—	O	—	—	16bit	R/W	0x6033
P08.52	Path 4 S-code	0	—	O	—	—	16bit	R/W	0x6034
P08.53	Path 5 S-code	0	—	O	—	—	16bit	R/W	0x6035
P08.54	Path 6 S-code	0	—	O	—	—	16bit	R/W	0x6036
P08.55	Path 7 S-code	0	—	O	—	—	16bit	R/W	0x6037
P08.56	Path 8 S-code	0	—	O	—	—	16bit	R/W	0x6038
P08.57	Path 9 S-code	0	—	O	—	—	16bit	R/W	0x6039
P08.58	Path 10 S-code	0	—	O	—	—	16bit	R/W	0x603A
P08.59	Path 11 S-code	0	—	O	—	—	16bit	R/W	0x603B
P08.60	Path 12 S-code	0	—	O	—	—	16bit	R/W	0x603C
P08.61	Path 13 S-code	0	—	O	—	—	16bit	R/W	0x603D
P08.62	Path 14 S-code	0	—	O	—	—	16bit	R/W	0x603E
P08.63	Path 15 S-code	0	—	O	—	—	16bit	R/W	0x603F

[Class 9] Pr-Control Path Parameters

Code	Label	Default	Activation	Valid mode			Communication mode		
				PR	S	T	Byte	Op.	485 Addr.
P09.00	PR0 mode	0	—	O	—	—	16bit	R/W	0x6200
P09.01	PR0 position H	0	—	O	—	—	16bit	R/W	0x6201
P09.02	PR0 position(L)	0	—	O	—	—	16bit	R/W	0x6202
P09.03	PR0 velocity	60		O	—	—	16bit	R/W	0x6203
P09.04	PR0 acceleration time	100	—	O	—	—	16bit	R/W	0x6204
P09.05	PR0 deceleration time	100	—	O	—	—	16bit	R/W	0x6205
P09.06	PR0 pause time	0	—	O	—	—	16bit	R/W	0x6206
P09.07	PR0 special parameter	0	—	O	—	—	16bit	R/W	0x6207
P09.08	PR1 mode	0	—	O	—	—	16bit	R/W	0x6208
P09.09	PR1 position H	0	—	O	—	—	16bit	R/W	0x6209
P09.10	PR1 position(L)	0	—	O	—	—	16bit	R/W	0x620A
P09.11	PR1 velocity	60	—	O	—	—	16bit	R/W	0x620B
P09.12	PR1 acceleration time	100	—	O	—	—	16bit	R/W	0x620C
P09.13	PR1 deceleration time	100	—	O	—	—	16bit	R/W	0x620D
P09.14	PR1 pause time	0	—	O	—	—	16bit	R/W	0x620E
P09.15	PR1 special parameter	0	—	O	—	—	16bit	R/W	0x620F
P09.16	PR2 mode	0	—	O	—	—	16bit	R/W	0x6210
P09.17	PR2 position H	0	—	O	—	—	16bit	R/W	0x6211

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P R	S	T	Byte	Op.	485 Addr.
P09.18	PR2 position(L)	0	—	O	—	—	16bit	R/W	0x6212
P09.19	PR2 velocity	60		O	—	—	16bit	R/W	0x6213
P09.20	PR2 acceleration time	100	—	O	—	—	16bit	R/W	0x6214
P09.21	PR2 deceleration time	100	—	O	—	—	16bit	R/W	0x6215
P09.22	PR2 pause time	0	—	O	—	—	16bit	R/W	0x6216
P09.23	PR2 special parameter	0	—	O	—	—	16bit	R/W	0x6217
P09.24	PR3 mode	0	—	O	—	—	16bit	R/W	0x6218
P09.25	PR3 position H	0	—	O	—	—	16bit	R/W	0x6219
P09.26	PR3 position(L)	0	—	O	—	—	16bit	R/W	0x621A
P09.27	PR3 velocity	60	—	O	—	—	16bit	R/W	0x621B
P09.28	PR3 acceleration time	100	—	O	—	—	16bit	R/W	0x621C
P09.29	PR3 deceleration time	100	—	O	—	—	16bit	R/W	0x621D
P09.30	PR3 pause time	0	—	O	—	—	16bit	R/W	0x621E
P09.31	PR3 special parameter	0	—	O	—	—	16bit	R/W	0x621F
P09.32	PR4 mode	0	—	O	—	—	16bit	R/W	0x6220
P09.33	PR4 position H	0	—	O	—	—	16bit	R/W	0x6221
P09.34	PR4 position(L)	0	—	O	—	—	16bit	R/W	0x6222
P09.35	PR4 velocity	60		O	—	—	16bit	R/W	0x6223
P09.36	PR4 acceleration time	100	—	O	—	—	16bit	R/W	0x6224
P09.37	PR4 deceleration time	100	—	O	—	—	16bit	R/W	0x6225
P09.38	PR4 pause time	0	—	O	—	—	16bit	R/W	0x6226
P09.39	PR4 special parameter	0	—	O	—	—	16bit	R/W	0x6227
P09.40	PR5 mode	0	—	O	—	—	16bit	R/W	0x6228
P09.41	PR5 position H	0	—	O	—	—	16bit	R/W	0x6229
P09.42	PR5 position(L)	0	—	O	—	—	16bit	R/W	0x622A
P09.43	PR5 velocity	60	—	O	—	—	16bit	R/W	0x622B
P09.44	PR5 acceleration time	100	—	O	—	—	16bit	R/W	0x622C
P09.45	PR5 deceleration time	100	—	O	—	—	16bit	R/W	0x622D
P09.46	PR5 pause time	0	—	O	—	—	16bit	R/W	0x622E
P09.47	PR5 special parameter	0	—	O	—	—	16bit	R	0x622F
P09.48	PR6 mode	0	—	O	—	—	16bit	R/W	0x6230
P09.49	PR6 position H	0	—	O	—	—	16bit	R/W	0x6231
P09.50	PR6 position(L)	0	—	O	—	—	16bit	R/W	0x6232
P09.51	PR6 velocity	60		O	—	—	16bit	R/W	0x6233
P09.52	PR6 acceleration time	100	—	O	—	—	16bit	R/W	0x6234
P09.53	PR6 deceleration time	100	—	O	—	—	16bit	R/W	0x6235
P09.54	PR6 pause time	0	—	O	—	—	16bit	R/W	0x6236
P09.55	PR6 special parameter	0	—	O	—	—	16bit	R/W	0x6237
P09.56	PR7 mode	0	—	O	—	—	16bit	R/W	0x6238
P09.57	PR7 position H	0	—	O	—	—	16bit	R/W	0x6239
P09.58	PR7 position(L)	0	—	O	—	—	16bit	R/W	0x623A
P09.59	PR7 velocity	60	—	O	—	—	16bit	R/W	0x623B
P09.60	PR7 acceleration time	100	—	O	—	—	16bit	R/W	0x623C
P09.61	PR7 deceleration time	100	—	O	—	—	16bit	R/W	0x623D
P09.62	PR7 pause time	0	—	O	—	—	16bit	R/W	0x623E
P09.63	PR7 special parameter	0	—	O	—	—	16bit	R/W	0x623F
P09.64	PR8 mode	0	—	O	—	—	16bit	R/W	0x6240
P09.65	PR8 position H	0	—	O	—	—	16bit	R/W	0x6241
P09.66	PR8 position(L)	0	—	O	—	—	16bit	R/W	0x6242
P09.67	PR8 velocity	60		O	—	—	16bit	R/W	0x6243
P09.68	PR8 acceleration time	100	—	O	—	—	16bit	R/W	0x6244
P09.69	PR8 deceleration time	100	—	O	—	—	16bit	R/W	0x6245
P09.70	PR8 pause time	0	—	O	—	—	16bit	R/W	0x6246
P09.71	PR8 special parameter	0	—	O	—	—	16bit	R/W	0x6247
P09.72	PR9 mode	0	—	O	—	—	16bit	R/W	0x6248
P09.73	PR9 position H	0	—	O	—	—	16bit	R/W	0x6249

Code	Label	Default	Activation	Valid mode			Communication mode		
				PR	S	T	Byte	Op.	485 Addr.
P09.74	PR9 position(L)	0	—	O	—	—	16bit	R/W	0x624A
P09.75	PR9 velocity	60	—	O	—	—	16bit	R/W	0x624B
P09.76	PR9 acceleration time	100	—	O	—	—	16bit	R/W	0x624C
P09.77	PR9 deceleration time	100	—	O	—	—	16bit	R/W	0x624D
P09.78	PR9 pause time	0	—	O	—	—	16bit	R/W	0x624E
P09.79	PR9 special parameter	0	—	O	—	—	16bit	R/W	0x624F
P09.80	PR10 mode	0	—	O	—	—	16bit	R/W	0x6250
P09.81	PR10 position H	0	—	O	—	—	16bit	R/W	0x6251
P09.82	PR10 position(L)	0	—	O	—	—	16bit	R/W	0x6252
P09.83	PR10 velocity	60		O	—	—	16bit	R/W	0x6253
P09.84	PR10 acceleration time	100	—	O	—	—	16bit	R/W	0x6254
P09.85	PR10 deceleration time	100	—	O	—	—	16bit	R/W	0x6255
P09.86	PR10 pause time	0	—	O	—	—	16bit	R/W	0x6256
P09.87	PR10 special parameter	0	—	O	—	—	16bit	R/W	0x6257
P09.88	PR11 mode	0	—	O	—	—	16bit	R/W	0x6258
P09.89	PR11 position H	0	—	O	—	—	16bit	R/W	0x6259
P09.90	PR11 position(L)	0	—	O	—	—	16bit	R/W	0x625A
P09.91	PR11 velocity	60	—	O	—	—	16bit	R/W	0x625B
P09.92	PR11 acceleration time	100	—	O	—	—	16bit	R/W	0x625C
P09.93	PR11 deceleration time	100	—	O	—	—	16bit	R/W	0x625D
P09.94	PR11 pause time	0	—	O	—	—	16bit	R/W	0x625E
P09.95	PR11 special parameter	0	—	O	—	—	16bit	R/W	0x625F
P09.96	PR12 mode	0	—	O	—	—	16bit	R/W	0x6260
P09.97	PR12 position H	0	—	O	—	—	16bit	R/W	0x6261
P09.98	PR12 position(L)	0	—	O	—	—	16bit	R/W	0x6262
P09.99	PR12 velocity	60		O	—	—	16bit	R/W	0x6263
P09.100	PR12 acceleration time	100	—	O	—	—	16bit	R/W	0x6264
P09.101	PR12 deceleration time	100	—	O	—	—	16bit	R/W	0x6265
P09.102	PR12 pause time	0	—	O	—	—	16bit	R/W	0x6266
P09.103	PR12 special parameter	0	—	O	—	—	16bit	R/W	0x6267
P09.104	PR13 mode	0	—	O	—	—	16bit	R/W	0x6268
P09.105	PR13 position H	0	—	O	—	—	16bit	R/W	0x6269
P09.106	PR13 position(L)	0	—	O	—	—	16bit	R/W	0x626A
P09.107	PR13 velocity	60	—	O	—	—	16bit	R/W	0x626B
P09.108	PR13 acceleration time	100	—	O	—	—	16bit	R/W	0x626C
P09.109	PR13 deceleration time	100	—	O	—	—	16bit	R/W	0x626D
P09.110	PR13 pause time	0	—	O	—	—	16bit	R/W	0x626E
P09.111	PR13 special parameter	0	—	O	—	—	16bit	R/W	0x626F
P09.112	PR14 mode	0	—	O	—	—	16bit	R/W	0x6270
P09.113	PR14 position H	0	—	O	—	—	16bit	R/W	0x6271
P09.114	PR14 position(L)	0	—	O	—	—	16bit	R/W	0x6272
P09.115	PR14 velocity	60		O	—	—	16bit	R/W	0x6273
P09.116	PR14 acceleration time	100	—	O	—	—	16bit	R/W	0x6274
P09.117	PR14 deceleration time	100	—	O	—	—	16bit	R/W	0x6275
P09.118	PR14 pause time	0	—	O	—	—	16bit	R/W	0x6276
P09.119	PR14 special parameter	0	—	O	—	—	16bit	R/W	0x6277
P09.120	PR15 mode	0	—	O	—	—	16bit	R/W	0x6278
P09.121	PR15 position H	0	—	O	—	—	16bit	R/W	0x6279
P09.122	PR15 position(L)	0	—	O	—	—	16bit	R/W	0x627A
P09.123	PR15 velocity	60	—	O	—	—	16bit	R/W	0x627B
P09.124	PR15 acceleration time	100	—	O	—	—	16bit	R/W	0x627C
P09.125	PR15 deceleration time	100	—	O	—	—	16bit	R/W	0x627D
P09.126	PR15 pause time	0	—	O	—	—	16bit	R/W	0x627E
P09.127	PR15 special parameter	0	—	O	—	—	16bit	R/W	0x627F

[Class C] Positon comparision

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P0C.00	Position comparison	0	—	O	O	O	16bit	R/W	0x2C01
P0C.01	Position comparison mode	0	—	O	O	O	16bit	R/W	0x2C03
P0C.02	Position comparison pulse output bandwidth	0	—	O	O	O	16bit	R/W	0x2C05
P0C.03	Position comparison output delay offset	0	—	O	O	O	16bit	R/W	0x2C07
P0C.04	Position comparison starting point	1	—	O	O	O	16bit	R/W	0x2C09
P0C.05	Position comparison end point	1	—	O	O	O	16bit	R/W	0x2C08
P0C.06	No. of cycles for N cycle comparison	1	—	O	O	O	16bit	R/W	0x2C0D
P0C.07	Position comparison – Set current position as origin	1	—	O	O	O	16bit	R/W	0x2C0F
P0C.08	Position comparison - offset to origin	1	—	O	O	O	16bit	R/W	0x2C11
P0C.20~61	Position comparison 1-42 target value	0	—	O	O	O	32bit	R/W	0x2C29~0x2C7B
P0C.70~90	Position Comparison 1~42 Attribute Values	0	—	O	—	—	32bit	R/W	0x2C8D~0x2C85

[Class D] Gantry parameter

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P0D.00	Gantry function settings	0	O	O	—	—	16bit	R/W	0x0D01
P0D.01	Gantry slave axis setting	0	●	O	—	—	16bit	R/W	0x0D03
P0D.02	Gantry feedback compensation gain	100	△	O	—	—	16bit	R/W	0x0D05
P0D.03	Gantry position synchronization deviation threshold	10000	—	O	—	—	32bit	R/W	0x0D06~0x0D07
P0D.04	Gantry torque deviation threshold	500	—	O	—	—	16bit	R/W	0x0D09
P0D.05	Gantry synchronization gain	0	△	O	—	—	16bit	R/W	0x0D0B
P0D.06	Gantry position synchronization gain	0	—	O	—	—	16bit	R/W	0x0D0D
P0D.07	Gantry velocity synchronization gain	0	—	O	—	—	16bit	R/W	0x0D0F
P0D.08	Gantry velocity synchronization integral	0	—	O	—	—	16bit	R/W	0x0D11
P0D.10	Gantry alignment mode	0	O	O	—	—	16bit	R/W	0x0D15
P0D.11	Gantry alignment offset	0	—	O	—	—	32bit	R/W	0x0D17
P0D.12	Gantry Origin Offset	10	●	O	—	O	32bit	R/W	H:0x2D18 L:0x2D19
P0D.13	Alignment Speed	0	—	O	—	O	32bit	R/W	H:0x2D1A L:0x2D1B
P0D.15	Offset Measurement	0	●	O	—	O	32bit	R/W	H:0x2D1E L:0x2D1F
P0D.16	Alignment Measurement Command	0	—	O	O	O	32bit	R/W	H:0x2D20 L:0x2D21
P0D.17	Offset Measurement Value	0	—	O	O	O	32bit	R/W	H:0x2D22 L:0x2D23
P0D.21	Gantry Command Type	0	O	O	O	O	16bit	R/W	0x2D2B

[Class 11] Driver parameter

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P11.00	MCU 1 Version	-	O	O	O	O	16bit	R	0x3101
P11.01	MCU 2 Version	-	O	O	O	O	16bit	R	0x3103

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
P11.02	FPGA Version	-	O	O	O	O	16bit	R	0x3105
P11.06	Drive Voltage Level	-	O	O	O	O	16bit	R	0x310D
P11.07	Drive Rated Power	-	O	O	O	O	16bit	R	0x310F
P11.08	Drive Rated Current	-	O	O	O	O	16bit	R	0x3111
P11.09	Drive Max. Current	-	O	O	O	O	16bit	R	0x3113
P11.16	Analog input 1 (AI1) zero drift setting	0	—	O	O	O	16bit	R/W	0x3121
P11.17	Analog input 2 (AI2) zero drift setting	0	—	O	O	O	16bit	R/W	0x3123
P11.18	Analog input 3 (AI3) zero drift setting	0	—	O	O	O	16bit	R/W	0x3125
P11.31	Bus voltage discharge control mode	0	—	O	O	O	16bit	R/W	0x313F

3.2 Parameters description

3.2.1 [Class 0] Basic Settings

P00.00	Label	Model-following/Zero tracking control		Valid mode(s)	P		
	Range	0-5000	Unit	0.1Hz	Default	1	
	Byte length	16bit	Attribute	R/W	485 address	0x0001	
	Valid	At stop					

Model-following bandwidth, also known as model-following control (MFC), is used to control the position loop to improve the responsiveness to commands, speed up positioning time and reduce following error. The effect is obvious especially in low and medium mechanical stiffness.

Value	Description
0	Disable model following/zero tracking control
1	Set bandwidth automatically
2~9	Reserved
10~5000	Manually set control bandwidth. 30~100 recommended for belt application

P00.01	Label	Control Mode Settings		Valid mode(s)	P	S	T
	Range	0~10	Unit	—	Default	0	
	Byte length	16bit	Attribute	R/W	485 address	0x0003	
	Valid	After restart					

Value	Description	
	1st mode	2nd mode
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position P00.22=0
		Velocity P00.22=1
		Torque P00.22=2
7~10	Reserved	

◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2st mode.
Please allow some time in between mode switching commands.
◆Please set P00.01 = 6 to switch to other modes from PR mod, then set 2nd mode using P00.22.

C-MODE is defaulted to Normally Open

P00.02	Label	Real time Auto Gain Adjusting			Valid mode(s)	P	S	T
	Range	0x0~0xFFF	Unit	—	Default	0x1		
	Byte length	16bit	Attribute	R/W	485 address	0x0005		
	Valid	Immediate						

Data bits	Category	Settings	Application
0x00_	Motion setting mode	Used to set motion setting mode, which can be selected according to the motion characteristics or setting requirements. Generally, it is recommended to select mode 1 with good generality when there is no special requirement, mode 2 when rapid positioning is needed If mode 1 and mode 2 cannot meet the requirements, please choose mode 0.	
		0:Manual	P00.03 invalid. Gain value must be adjusted manually and accordingly.
		1:Standard	P00.03 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. Gain switching is not used in this mode, suitable for applications with requirements for stability.
		2:Positioning	P00.03 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. This mode is suitable for applications requiring quick positioning. Not recommended for load mounted vertical to ground, or please compensate for the load using P06.07
0x0_0	Load type setting	Used to select the load type, choose according to load-inertia ratio and mechanical structure.	
		0: Rigid structure	This mode prioritizes system responsiveness. Use this mode when there is a relatively rigid structure with low load inertia. Typical application including directly connected high-precision gearbox, lead screw, gears, etc.
		1:High inertia	For applications with higher load inertia (10 times or above), gain settings take into account both machine stability and responsiveness. Not recommended to set stiffness above 15 for high load inertia.
		2: Flexible structure	This mode prioritizes system stability. Use this mode when there is low rigidity structure with high load inertia. Typical applications included belts and chains.
0x_00	reserved		

The setting type combination is a hexadecimal standard, as follows:

Setting type combination	Application type
0X000	Rigid structure + Manual
0X001	Rigid structure +Standard
0X002	Rigid structure +Positioning
0X010	High inertia + Manual
0X011	High inertia + Standard
0X012	High inertia + Positioning
0X020	Flexible structure + Manual
0X021	Flexible structure +Standard
0X022	Flexible structure +Positioning

P00.03	**Label**	Real time auto stiffness adjusting			**Valid mode(s)**	P	S	T
	Range	50 ~ 81	**Unit**	—	**Default**	68		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0007		
	Valid	Immediate						

Low → Mechanical stiffness → High

Low → Servo gain → High

81.80······························70.69.68·····························51.50

Low → Responsiveness → High

Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Recommend to set to around 68 with motor with high inertia.

P00.04	**Label**	Inertia ratio			**Valid mode(s)**	P	S	T
	Range	0~20000	**Unit**	%	**Default**	250		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0009		
	Valid	Immediate						

P00.04=(load inertia/motor rotational inertia)×100%

Set inertia ratio according to actual load inertia. When both are uniform, actual motor velocity loop responsiveness and gain settings will be consistent. If inertia ratio is greater than actual value, velocity loop gain settings will be higher and vice versa.
For motor with high inertia, P00.04 can be left unfilled but optimal setting of P00.04 could improve system performance

P00.05	**Label**	Command pulse input selection			**Valid mode(s)**	P		
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x000B		
	Valid	After restart						

Value	Description
【0】	Pulse input low speed channel (200/500kHz pulse input)
1	Pulse input high speed channel (4MHz pulse input)

Both channels cannot be used at the same time.
The setting of this parameter directly affects the setting of P01.35 (Pulse Filter Frequency).
Please set parameter P01.35 appropriately based on the setting of this parameter.

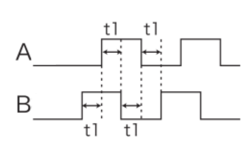
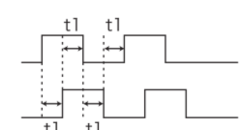
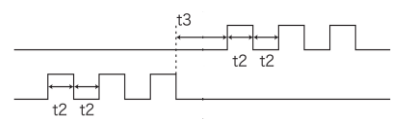
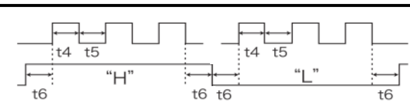
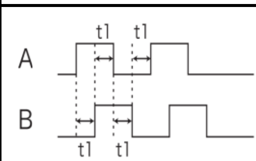
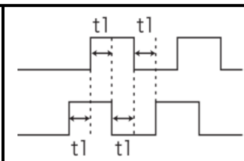
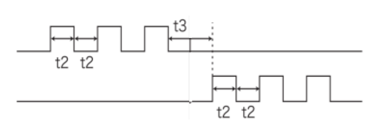
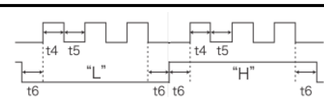
P00.06	Label	Command pulse polarity inversion			Valid mode(s)	P		PR
	Range	0~7	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x000D		
	Valid	After restart						

P00.06 and P00.07 respectively set the polarity of command input and the form of command pulse

input.
P00.06 only changes the motor movement direction, and the sign is not inverted.
When the speed mode is inverted or the torque mode is inverted, P03.03 and P03.20 will be masked.
0: Position command not inverted - Speed command not inverted - Torque command not inverted
1: Position command inverted - Speed command not inverted - Torque command not inverted
2: Position command not inverted - Speed command inverted - Torque command not inverted
3: Position command inverted - Speed command inverted - Torque command not inverted
4: Position command not inverted - Speed command not inverted - Torque command inverted
5: Position command inverted - Speed command not inverted - Torque command inverted
6: Position command not inverted - Speed command inverted - Torque command inverted
7: Position command inverted - Speed command inverted - Torque command inverted

<table>
<tr><td rowspan="4">P00.07</td><td>Label</td><td colspan="3">Command pulse input mode</td><td>Valid mode(s)</td><td>P</td><td></td><td></td></tr>
<tr><td>Range</td><td>0~3</td><td>Unit</td><td>—</td><td>Default</td><td colspan="3">3</td></tr>
<tr><td>Byte length</td><td>16bit</td><td>Attribute</td><td>R/W</td><td>485 address</td><td colspan="3">0x000F</td></tr>
<tr><td>Valid</td><td colspan="3">After restart</td><td></td><td colspan="3"></td></tr>
</table>

Command pulse input

<table>
<tr><th>Command Polarity inversion (P00.06)</th><th>Command pulse input mode settings (P00.07)</th><th>Command Pulse Mode</th><th>Positive signal</th><th>Negative signal</th></tr>
<tr><td rowspan="3">【0】</td><td>0
or
2</td><td>90°phase difference
2 phase pulse
（Phase A+ Phase B）</td><td></td><td></td></tr>
<tr><td>1</td><td>CW pulse sequence
＋
CCW pulse sequence</td><td colspan="2"></td></tr>
<tr><td>【3】</td><td>Pulse sequence
＋
Directional symbol</td><td colspan="2"></td></tr>
<tr><td rowspan="3">1</td><td>0
or
2</td><td>90°phase difference
2 phase pulse
（Phase A＋Phase B）</td><td></td><td></td></tr>
<tr><td>1</td><td>CW pulse sequence
＋
CCW pulse sequence</td><td colspan="2"></td></tr>
<tr><td>3</td><td>Pulse sequence
＋
Directional symbol</td><td colspan="2"></td></tr>
</table>

Command pulse input signal max. frequency and min. duration needed

Command pulse input interface		Max. Frequency	Min. duration needed（μ s）					
			t1	t2	t3	t4	t5	t6
Pulse sequence interface	Differential drive	500 kHz	2	1	1	1	1	1
	Open collector	200 kHz	5	2.5	2.5	2.5	2.5	2.5
	High speed differential drive	4Mhz	0.25	0.125	0.125	0.125	0.125	0.125

Please set >0.1μs for the duration between rising and falling edge of command pulse input signal.
1 revolution with 2500 pulses 2-phase pulse input when P00.07=0 or 2, P00.08 = 10000;
1 revolution with 10000 pulses 1-phase pulse input when P00.07=1 or 3, P00.08 = 10000

P00.08	Label	1st command pulse count per revolution			Valid mode(s)	P	S	T
	Range	0-67100864	Unit	PULSE	Default	10000		
	Byte length	32bit	Attribute	R/W	485 address	H: 0x0010 L: 0x0011		
	Valid	After restart						

Control will affected if value set is too low. Err1b1 might occur if value < 500.
(1) P00.08 valid when ≠ 0: Motor revolution = input pulse count / [P00.08 value]
(2) P00.08 invalid when = 0: P00.09 and P00.10 valid.

P00.09	Label	1st command frequency divider/multiplier numerator			Valid mode(s)	P		
	Range	1~2147483647	Unit	—	Default	1		
	Byte length	32bit	Attribute	R/W	485 address	H: 0x0012 L: 0x0013		
	Valid	After restart						

Valid when P00.08 = 0, please refer to description in P00.10.

P00.10	Label	1st command frequency divider/multiplier denominator			Valid mode(s)	P		
	Range	1~2147483647	Unit	—	Default	1		
	Byte length	32bit	Attribute	R/W	485 address	H: 0x0014 L: 0x0015		
	Valid	After restart						

1. Settings：
(1)Driver command pulse input count : X
(2)Encoder pulse count after frequency divider/multiplier: Y
(3)Encoder pulse count per revolution: Z
(4)Motor revolution: W
2. Calculation：
（1）X, Y
Y = X * P00.09 / P00.10
Please keep the value of P00.09 and P00.10 to be smaller than 2^{24} (16777216).
（2）Z
Motor with 23-bit motor： Z= 2^{23} = 8388608
（3）Y, Z, W
W = Y / Z
Performance cannot be guaranteed if frequency divider/multiplier ratio is set to extreme values. Err1b1 might occur if W < 500.

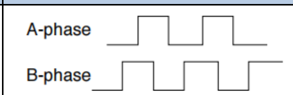
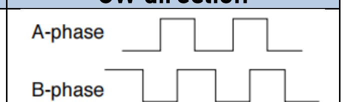
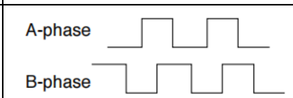
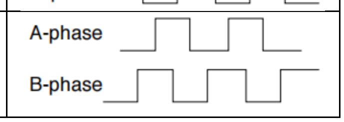
P00.11	**Label**	Encoder output pulse count per revolution			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~2097152	**Unit**	P/r	**Default**	2500		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0017		
	Valid	After restart						

Sets the number of divided output pulses.
Set the number of output pulses of phase A and phase B of the frequency division output terminal for one rotation of the motor as position feedback in the upper device.
Motor rotation 1 turn terminal output pulse resolution = P00.11 × 4.
When setting this parameter, it must meet: motor speed (revolution/second) x P00.11 (encoder output pulse number per revolution) ⩽ 1MHz. Otherwise alarm Er280

P00.12	**Label**	Pulse output logic inversion			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0019		
	Valid	After restart						

To set phase B logic and output source from encoder pulse output. To inverse B-Phase pulse logic and change the relation between Phase A and Phase B

Pulse output logic inversion

P00.12	Phase B logic	CCW direction	CW direction
[0]	Not inverted		
[1]	Inverted		

P00.13	**Label**	1st torque limit			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~500	**Unit**	%	**Default**	350		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x001B		
	Valid	Immediate						

1st torque limit is set according to ratio percentage of motor rated current. Do not exceed max driver output current.

Please refer to P05.21 on how to set torque limit.

P00.14	**Label**	Excessive position deviation			**Valid mode(s)**	**P**		
	Range	0~310	**Unit**	0.1rev	**Default**	30		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x001D		
	Valid	Immediate						

Please set threshold value for position deviation accordingly. Default factory setting = 30, Er180 will be triggered if positive deviation is in excess of 3 revolutions.

P00.15	Label	Absolute encoder settings			Valid mode(s)	P	S	T
	Range	0~15	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x001F		
	Valid	After restart						

Set the type of absolute encoder and how to use it.
0: Incremental mode: No power off position memory function. There is no restriction on the device load travelling range required.
1: Multi-turn linear mode: Enables multi-turn absolute function with position memory. It is used in the case where the travelling range of the equipment load is fixed and the data of the encoder will not be overflowed in multi-turns.
2: Multi-turn rotary mode: Enable multi-turn absolute value function, with position power off memory function, the actual feedback multi-turn data cycling back and forth between 0~(P06.63+1); used for the occasions where the load range of the equipment is not limited.
3: Single-turn absolute value mode: this mode is mainly used for equipment loads only need to remember the position of the motor within one turn. The initial position of the feedback after each power-on is the current position feedback calculated by the coordinate system after the last back to the original operation 6064. no need to carry out the back to the original operation.
5: Clear the multi-turn alarm. After normal clearing, it will change to the original multi-turn mode automatically, if it is still 5 after 3s, it will be processed according to 153 alarm.
9: Clear multiturn position and reset multiturn alarm. Automatically changes to original multiturn mode after normal clearing, if it is still 9 after 3s, then process according to 153 alarm.
Note: Use after mechanical zeroing, and only respond to clearing multiturn data under disable condition!
Other: Do not set.

P00.16	Label	Regenerative resistance			Valid mode(s)	P	S	T
	Range	25~500	Unit	Ohm	Default	100		
	Byte length	16bit	Attribute	R/W	485 address	0x0021		
	Valid	Immediate						

To set resistance value of regenerative resistor
P00.16 and P00.17set value determine alarm threshold of Er120.
If set value > actual regenerative resistance, Er120 occurrence might be delayed.

P00.17	Label	Regenerative resistor power rating			Valid mode(s)	P	S	T
	Range	20~5000	Unit	W	Default	50		
	Byte length	16bit	Attribute	R/W	485 address	0x0023		
	Valid	Immediate						

To set power rating of regenerative resistor. Please refer to table below

Model	Internal resistance(Ω)	Internal resistor power rating(W)
EL8-RS400F	100	50
EL8-RS750F	50	75
EL8-RS1000F	50	75

P00.16 and P00.17 determines the threshold value of Er120. Please set accordingly or it might trigger false alarm or damage to servo drive.
Note: If external regenerative resistor is used, please set according to its labeled power rating.

P00.19	Label	Friction compensation function settings			Valid mode(s)	P	S	T
	Range	0~1000	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0027		
	Valid	Immediate						

= 0, the default is 1; = X, indicating that the friction compensation slope is **(X plus one) per ten thousand**

P00.22	Label	PR and P/S/T switching			Valid mode(s)	P	S	T
	Range	0~2	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x002D		
	Valid	Immediate						

When P00.01 = 6(PR Mode), 2nd mode can be set on P00.22

P00.01	P00.22	Control mode
6	【0】	PR / Position
	1	PR / Velocity
	2	PR / Torque

P00.25	Label	Auxiliary function			Valid mode(s)	P	S	T
	Range	0~0xFFFF	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0033		
	Valid	Immediate						

Parameter	Auxiliary function
0x1111	Reset current alarm
0x1122	Reset record alarm
0x2211	Save parameter to EEPROM (not including PR)
0x2212	Save PR parameters
0x2222	Initialize parameter (not including motor parameters)
0x2233	All parameters restore to default
0x3322	Analog 2 self-learning zero point
0x3333	Analog 3 self-learning zero point
0X4001	JOG_P（once every 50ms）
0X4002	JOG_N（once every 50ms）
0x4411	Encoder auto correction to zero
0x6666	Software reset

Only for RS485 communication, please write corresponding parameters into P00.25
Do not use JOG_P and JOG_N in PR mode

P00.26	Label	Simulated I/O			Valid mode(s)	P	S	T
	Range	0~0xFFFF	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0035		
	Valid	Immediate						

Bit	Input
0	DI1
1	DI2
2	DI3
3	DI4
4	DI5
5	DI6
6	DI7
7	DI8
8	DI9
9	DI10

Only for RS485 communication. Simulated I/O is different from physical I/O which means inversion of current I/O status

P00.30	Label	Enable Full closed-loop function			Valid mode(s)	P	S	T
	Range	0~3	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0037		
	Valid	Immediate						

Value	Description
【0】	Close the full closed loop and do not recognize the direction
1	Enable Full closed-loop, do not recognize the direction
2	Close the full closed loop and recognize the direction
3	Enable Full closed-loop, recognize the direction

P00.31	Label	External encoder type			Valid mode(s)	P	S	T
	Range	0~3	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0039		
	Valid	After restart						

Value	Description
【0】	ABZ encoder
1~3	*Reserved for future upgrades.*

P00.32	Label	External encoder direction			Valid mode(s)	P	S	T
	Range	0~1	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x003B		
	Valid	After restart						

Value	Description
【0】	Default direction
1	Inversed direction

P00.33	Label	Excessive hybrid deviation			Valid mode(s)	P		
	Range	0~134217728	Unit	Command unit	Default	16000		
	Byte length	16bit	Attribute	R/W	485 address	0x0043		
	Valid	After restart						

To set the excessive hybrid deviation threshold value, please set accordingly. Use in full closed loop control. Factory default: 16000. Er180 might occur if position deviation during hybrid control exceeds 16000 pulse counts.
Er191 might occur if P00.33 set value is too low.

P00.34	Label	Clear excess hybrid control deviation			Valid mode(s)	P		
	Range	0~100	Unit	R	Default	0		

	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0045
	Valid	After restart				

To set condition to clear position deviation under hybrid control mode (Full closed loop)

Value	Description
【0】	OFF
1~100	Revolution count to clear hybrid control deviation

P00.35	**Label**	External encoder frequency divider numerator			**Valid mode(s)**	**P**	**S**	**T**
	Range	$0\sim2^{23}$	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0047		
	Valid	After restart						

To set frequency divider numerator for external encoder.

P00.36	**Label**	External encoder frequency divider denominator			**Valid mode(s)**	**P**	**S**	**T**
	Range	$1\sim2^{23}$	**Unit**	-	**Default**	10000		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0049		
	Valid	After restart						

To set frequency divider denominator for external encoder. When P00.37 = 0, External encoder feedback pulse count per revolution = P00.36.

P00.37	**Label**	External encoder feedback pulse count per revolution			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~2147483648	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x004B		
	Valid	After restart						

Value	Pulse count
【0】	P00.36
$1\sim2^{31}$	P00.37

P00.38	**Label**	Z-signal pulse input source			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~3	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x004D		
	Valid	Immediate						

Value	Bit 1 (Probe Z-signal)	Bit 0 (Homing Z-Signal)
【0】	Motor Z-signal	Motor Z-signal
1	Motor Z-signal	External encoder Z-signal
2	External encoder Z-signal	Motor Z-signal
3	External encoder Z-signal	External encoder Z-signal

P00.40 (Only for RS485)	**Label**	Mapping parameter 1			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H： 0x0050		
	Valid					L： 0x0051		

For user to set parameters unrelated by RS485 address quickly. Mapping parameter ID to be written is set on P00.50 by RS485. Data saved in P00.40 is parameter designated by P00.50.

Please refer to P00.57 for parameter settings.
Note: Range, unit and attribute of P00.40 is determined by P00.50 designated parameter.

P00.41 (Only for RS485)	**Label**	Mapping parameter 2			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H: 0x0052		
	Valid					L: 0x0053		
	Please refer to P00.40 for parameter description and P00.57 for parameter settings. *Note: Range, unit and attribute of P00.41 is determined by P00.51 designated parameter.*							

P00.42 (Only for RS485)	**Label**	Mapping parameter 3			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H: 0x0054		
	Valid					L： 0x0055		
	Please refer to P00.40 for parameter description and P00.57 for parameter settings. *Note: Range, unit and attribute of P00.42 is determined by P00.52 designated parameter.*							

P00.43 (Only for RS485)	**Label**	Mapping parameter 4			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H： 0x0056		
	Valid					L： 0x0057		
	Please refer to P00.40 for parameter description and P00.57 for parameter settings. *Note: Range, unit and attribute of P00.43 is determined by P00.53 designated parameter.*							

P00.44 (Only for RS485)	**Label**	Mapping parameter 5			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H： 0x0058		
	Valid					L： 0x0059		
	Please refer to P00.40 for parameter description and P00.57 for parameter settings. *Note: Range, unit and attribute of P00.44 is determined by P00.54 designated parameter.*							

P00.45 (Only for RS485)	**Label**	Mapping parameter 6			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H： 0x005A		
	Valid					L： 0x005B		
	Please refer to P00.40 for parameter description and P00.57 for parameter settings. *Note: Range, unit and attribute of P00.45 is determined by P00.55 designated parameter.*							

P00.46 (Only for RS485)	**Label**	Mapping parameter 7			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H： 0x005C		
	Valid					L： 0x005D		
	Please refer to P00.40 for parameter description and P00.57 for parameter settings. *Note: Range, unit and attribute of P00.46 is determined by P00.56 designated parameter.*							

P00.47 (Only for RS485)	**Label**	Mapping parameter 8			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**		**485 address**	H： 0x005E		
	Valid					L： 0x005F		
	Please refer to P00.40 for parameter description and P00.57 for parameter settings. *Note: Range, unit and attribute of P00.47 is determined by P00.57 designated parameter.*							

P00.50 (Only for RS485)	**Label**	Mapping parameter 1 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x0		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H： 0x0064		

	Valid	Immediate				L： 0x0065		
P00.51 (Only for RS485)	**Label**	Mapping parameter 2 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x00490049		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H： 0x0066		
	Valid	Immediate				L： 0x0067		
P00.52 (Only for RS485)	**Label**	Mapping parameter 3 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x00490049		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H： 0x0068		
	Valid	Immediate				L： 0x0069		
P00.53 (Only for RS485)	**Label**	Mapping parameter 4 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x00490049		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x006A		
	Valid	Immediate				L: 0x006B		
P00.54 (Only for RS485)	**Label**	Mapping parameter 5 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x00490049		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x006C		
	Valid	Immediate				L: 0x006D		
P00.55 (Only for RS485)	**Label**	Mapping parameter 6 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x00490049		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x006E		
	Valid	Immediate				L: 0x006F		
P00.56 (Only for RS485)	**Label**	Mapping parameter 7 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x00490049		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0070		
	Valid	Immediate				L: 0x0071		
P00.57 (Only for RS485)	**Label**	Mapping parameter 8 indicator			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**		**Default**	0x00490049		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0072		
	Valid	Immediate				L: 0x0073		

Set parameter to 0xABCDWXYZ
High bit parameter position(PH) and low bit parameter position(PL)settings format：
0xABCD & 0xWXYZ

4-bit value	Definition	4-bit value	Definition
CD	Parameter bias decimal	YZ	Parameter bias decimal
B	Parameter type hexadecimal	X	Parameter type hexadecimal
A	Unused	W	Unused

Description of corresponding parameter using Mapping Parameter 1 as example:
Mapping content is 32-bit wide, able to map 2 16-bit or 1 32-bit parameters：

P00.50 content as below：
(Mapping parameter 1 indicator：P00.50；Mapping parameter 1: P00.40)
P00.40 high bit corresponds to P00.50 high bit indicator (PH) value;

P00.40 low bit corresponds to P00.50 low bit indicator (PL) value;

1. When P00.50 PH≠PL, indicates that P00.40 contains 2 16-bit mapped values.
If P00.50=0x06200101; PH=0x0620,PL=0x0101; write 0x0005 0064 into P00.40; write 0x0005 into P06.20, write 0x0064 into P01.01;

2. When P00.50 PH=PL, indicates that P00.40 contains 1 32-bit mapped value.
If P00.50=0x01150115; PH=0x0115,PL=0x0115; write 0x00000001into P00.40; write 0x00000001 into P01.15;

Note: When a 32-bit address parameter is mapped, please write same address into high and low bit as shown above.

3.2.2 [Class 1] Gain adjustments

P01.00	**Label**	1st position loop gain			**Valid mode(s)**	**P**		
	Range	0～30000	**Unit**	0.1/s	**Default**	320		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0101		
	Valid	Immediate						
	Higher position loop gain value improves the responsiveness of the servo driver and lessens the positioning time. Position loop gain value shouldn't exceed responsiveness of the mechanical system and take in consideration velocity loop gain, if not it might cause vibration, mechanical noise and overtravel. As velocity loop gain is based on position loop gain, please set both values accordingly. Recommended range: 1.2≤P01.00/P01.01≤1.8							

P01.01	**Label**	1st velocity loop gain			**Valid mode(s)**	**P**	**S**	**T**
	Range	1～32767	**Unit**	0.1Hz	**Default**	180		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0103		
	Valid	Immediate						
	To determine the responsiveness of the velocity loop. If inertia ratio of P00.04 is uniform with actual inertia ratio, velocity loop responsiveness = P01.01. To increase position loop gain and improve responsiveness of the whole system, velocity loop gain must be set at higher value. Please notice that if the velocity loop gain is too high, it might cause vibration.							
P01.02	**Label**	1st Integral Time Constant of Velocity Loop			**Valid mode(s)**	**P**	**S**	**T**
	Range	1～10000	**Unit**	0.1ms	**Default**	310		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0105		
	Valid	Immediate						
	The lower the set value, the closer the lag error at stop to 0 but might cause vibration. If the value set is overly large, overshoot, delay of positioning time duration and lowered responsiveness might occur. Set 10000 to deactivate P01.02.							
P01.03	**Label**	1st velocity detection filter			**Valid mode(s)**	**P**	**S**	**T**
	Range	0～31	**Unit**	—	**Default**	15		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0107		
	Valid	Immediate						

This filter is a low pass filter. It blocks high frequencies which cause system instability from velocity feedback data. The higher the set value, lower frequencies will be blocked and velocity responsiveness will also be lowered. P01.03 needs to match velocity loop gain. Please refer to the following table.

Value	Velocity Detection Filter Cut-off Frequency(Hz)	Value	Velocity 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

P01.04	Label	1st Torque Filter Time Constant			Valid mode(s)	P	S	T
	Range	0～2500	Unit	0.01ms	Default	126		
	Byte length	16bit	Attribute	R/W	485 address	0x0109		
	Valid	Immediate						

To set torque command low-pass filter, add a filter delay time constant to torque command and filter out the high frequencies in the command.
Often used to reduce or eliminate some noise or vibration during motor operation, but it will reduce the responsiveness of current loop, resulting in undermining velocity loop and position loop control. P01.04 needs to match velocity loop gain.
Recommended range: 1,000,000/(2π×P01.04) ≥P01.01×4

For example: Velocity loop gain P01.01=180(0.1Hz) which is 18Hz. Time constant of torque filter should be P01.01≤221(0.01ms)
If mechanical vibration is due to servo driver, adjusting P01.04 might eliminate the vibration. The smaller the value, the better the responsiveness but also subjected to machine conditions. If the value is too large, it might lower the responsiveness of current loop.
With higher P01.01 value settings and no resonance, reduce P01.04 value;
With lower P01.01 value settings, increase P01.04 value to lower motor noise.

P01.05	Label	2nd Position Loop Gain			Valid mode(s)	P		
	Range	0～30000	Unit	0.1/s	Default	570		
	Byte length	16bit	Attribute	R/W	485 address	0x010B		
	Valid	Immediate						
P01.06	Label	2nd velocity loop gain			Valid mode(s)	P	S	T
	Range	1～32767	Unit	0.1Hz	Default	270		
	Byte length	16bit	Attribute	R/W	485 address	0x010D		
	Valid	Immediate						

P01.07	**Label**	2nd Integral Time Constant of Velocity Loop			**Valid mode(s)**	**P**	**S**	**T**
	Range	1～10000	**Unit**	0.1ms	**Default**	10000		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x010F		
	Valid	Immediate						
P01.08	**Label**	2nd velocity detection filter			**Valid mode(s)**	**P**	**S**	**T**
	Range	0～10000	**Unit**	—	**Default**	15		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0111		
	Valid	Immediate						
P01.09	**Label**	2nd Torque Filter Time Constant			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~2500	**Unit**	0.01ms	**Default**	126		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0113		
	Valid	Immediate						
	Position loop, velocity loop, velocity detection filter, torque command filter each have 2 pairs of gain or time constant (1st and 2nd).							
P01.10	**Label**	Velocity feed forward gain			**Valid mode(s)**	**P**		
	Range	0~1000	**Unit**	0.10%	**Default**	300		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0115		
	Valid	Immediate						
	Used for decreasing following error caused by low responsiveness of velocity loop. Might cause overshoot or increase in noise if set value is too high.							

P01.11	**Label**	Velocity feed forward filter time constant			**Valid mode(s)**	**P**		
	Range	0~6400	**Unit**	0.01ms	**Default**	50		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0117		
	Valid	Immediate						

Set velocity feed forward low pass filter to eliminate high or abnormal frequencies in velocity feed forward command. Often used when position command with low resolution or high electronic gear ration to smoothen velocity feed forward.
Position deviation under constant velocity can be lowered with higher velocity feed forward gain. Please to refer to the equation below.
Reduce P01.11 value to suppress velocity overshoot during deceleration; Increase P01.11 value to suppress noise or vibration due to long driver control cycle or position command uneven pulse frequency.

<Application>
Set P01.11 = 50（0.5ms）, improve feedforward effect by gradually increase P01.10. The equation below can be used to determine the position deviation due to velocity feedforward gain under constant velocity.

$$\text{Position deviation[Uint]}=\frac{Set\ velocity[\frac{Uint}{s}]}{Position\ loop\ gain[Hz]}\ x\ \frac{100-Velocity\ feed\ foward\ gain[\%]}{100}$$

P01.12	**Label**	Torque feed forward gain			**Valid mode(s)**	**P**	**S**	
	Range	0~1000	**Unit**	0.1Hz	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0119		
	Valid	Immediate						
	Before using torque feed forward, please set correct inertia ratio P00.04. By increasing torque feed forward gain, position deviation on constant acceleration/deceleration can be reduced to close to 0. Under ideal condition and trapezoidal speed profile, position deviation of the whole motion can be reduced to close to 0. In reality, perturbation torque							

will always exist, hence position deviation can never be 0.

P01.13	Label	Torque feed forward filter time constant			Valid mode(s)	P	S	
	Range	0~6400	Unit	0.01ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x011B		
	Valid	Immediate						

Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or precision.
Noise reduces if torque feed forward filter time constant is set higher but position deviation will increase at acceleration varied points.

<Application>

- Set P01.13 = 50ms, please increase torque forward gain gradually to enable torque feedforward.
- By increasing P01.13, noise will reduce but position deviation will become larger.

P01.15	Label	Position control gain switching mode			Valid mode(s)	P		
	Range	0～10	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x011F		
	Valid	Immediate						

In position control, set the conditions for gain switching to be valid.

Value	Condition	Gain switching condition
【0】	1st gain fixed	Fixed on using 1st gain(P01.00-P01.04)
1	2nd gain fixed	Fixed on using 2nd gain (P01.05-P01.09)
2	Gain switching input valid	· Gain switching input （GAIN）invalid: 1st gain. · Gain switching input （GAIN）valid: 2nd gain. **Default: 1st gain*
3	High command torque	Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1st gain when set torque command absolute value smaller than (level + hysteresis)[%]
4-9	Reserved	Reserved
10	Pending position command +actual velocity	Valid for position control. Switch to 2nd gain if position command ≠ 0 Switch to 1st gain if positional command = 0 throughout the duration of delay time and absolute value of actual velocity remains smaller than (level - hysteresis) (r/min)

*** Above 'level' and 'hysteresis' are in correspondence to P01.17 Position control gain switching level and P01.18 Hysteresis at position control switching.*

P01.16	Label	Position control gain switching delay	Valid mode(s)	P		
	Range	0~10000	Unit	0.1ms	Default	50
	Byte length	16bit	Attribute	R/w	485 address	0x0121
	Valid	Immediate				

Set the gain P01.15 to 2, 3, and 10. When switching from the first gain to the second gain, the time from detection trigger to actual gain switch

P01.17	**Label**	Position control gain switching level			**Valid mode(s)**	P		
	Range	0~20000	**Unit**	Mode dependent	**Default**	50		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0123		
	Valid	Immediate						

Set threshold value for gain switching to occur.
Unit is mode dependent.

Switching condition	Unit
Position	Encoder pulse count
Velocity	RPM
Torque	%

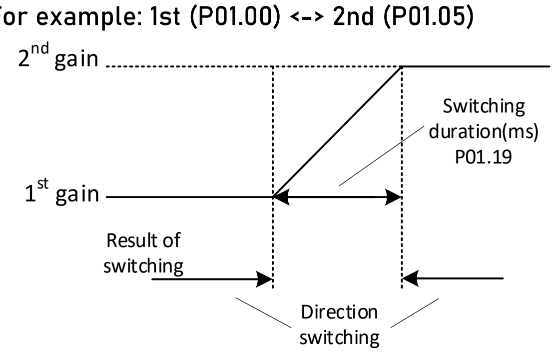
Please set level ≥ hysteresis

P01.18	**Label**	Hysteresis at position control switching			**Valid mode(s)**	P		
	Range	0~20000	**Unit**	Mode dependent	**Default**	33		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0125		
	Valid	Immediate						

To eliminate the instability of gain switching. Used in combination with P01.17 using the same unit.
If level< hysteresis, drive will set internally hysteresis = level.

P01.19	**Label**	Position control switching time			**Valid mode(s)**	P		
	Range	0~10000	**Unit**	0.1ms	**Default**	33		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0127		
	Valid	Immediate						

During position control, if 1st and 2nd gain difference is too large, to ease torque changes and vibration due to rapid changes in position loop gain, set suitable P01.19 value
For example: 1st (P01.00) <-> 2nd (P01.05)



P01.23	**Label**	speed regulator-kr			**Valid mode(s)**		S	
	Range	0~100	**Unit**	%	**Default**	100		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x012F		
	Valid	Immediate						

	Speed command adjustment coefficient, used to adjust the relationship between target value and feedback, and affect the response of the control system to errors							
P01.34	**Label**	Speed feedback filter level			**Valid mode(s)**	P	S	
	Range	1~8	**Unit**	-	**Default**	1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0145		
	Valid	Immediate						
	Set the speed feedback average filtering times, the greater the filtering times, the smaller the fluctuation, but the greater the delay.							

P01.35	**Label**	Position command pulse filter time			**Valid mode(s)**	P		
	Range	0~200	**Unit**	0.01us	**Default**	8		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0147		
	Valid	After restart						

To filter position setting pulse, getting rid of narrow pulse frequency with interference. Low-speed pulse input unit: 0.05us; High-speed pulse input unit: 0.01us.
If set value is overly large, it will affect the receiving of high frequency command pulse and wth high delay time.
P01.35 formula：

$$\text{Filter frequency} = \frac{1}{2 \times \text{P01.35} \times 0.05\text{us}} \times 1000000\text{Hz}$$

Example：P01.35=100, pulse frequency > 100KHz will be filtered;

P01.35	Filter frequency	P01.35	Filter frequency
0	*Null*	100	100kHz(500KHz)
8	1.25MHz(6.25MHz)	125	80kHz(400KHz)
10	1MHz（5MHz）	160	62.5kHz(312KHz)
20	500kHz(2.5MHz)	200	50kHz(250KHz)
50	200kHz(1MHz)		
80	125kHz(625KHz)		

P01.36	**Label**	External ABZ encoder filter time			**Valid mode(s)**	P
	Range	0~300	**Unit**	0.01us	**Default**	5
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0149
	Valid	After restart				
	To set filter time for external ABZ encoder					

P01.39	**Label**	Special function register 2			**Valid mode(s)**	P	T	S
	Range	0~0xFFFF FFFF	**Unit**	-	**Default**	0x40000		
	Byte length	32bit	**Attribute**	R/W	**485 address**	0x014F		
	Valid	Immediate						

Bit 0: Reserved

Bit 1: = 1: Enable full closed-loop function for test run; = 0: Disable

Bit 2: = 1: Enable hybrid position error clear function; = 0: Disable

Bit 3: Reserved

	Bit 4: = 1: Enable collision detection function; = 0: Disable Bit 5: = 1: Enable collision alarm (Err103) mask function; = 0: Disable Bit 6: Reserved Bit 7: Reserved Bit 8: = 1: Disable Hall error detection function; = 0: Enabled by default Bit 9: = 1: Disable Hall angle calibration function; = 0: Enabled by default Bit 10: Reserved Bit 11: Reserved Bit 12: Reserved Bit 13: Reserved Bit 14: Reserved Bit 15: = 1: Enable current self-tuning function; = 0: Disable Bit 16: = 1: Enable DC input; = 0: Disable Bit 17: = 1: Disable speed detection judgment for mode switching; = 0: Enable Bit 18: = 1: Disable absolute error calculation for position loop calculation; = 0: Enable (Reserved by Manufacturer) Bit 19: Reserved Bit 20: Reserved Bit 21: Reserved Bit 22: Reserved Bit 23: = 1: Disable speed control dead zone; = 0: Enable (Reserved by Manufacturer) Bit 24: Reserved Bit 25: Reserved

	Bit 26: = 1: Disable analog sampling filter; = 0: Enable (Reserved by Manufacturer)							
P01.64	**Label**	Second Q-axis current filter time constant			**Valid mode(s)**	**P**	**T**	**S**
	Range	0~2500	**Unit**	0.01ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0181		
	Valid	Immediate						
	The q-axis current low-pass filter time constant, the greater the setting value, the smaller the fluctuation, but the greater the delay							
P01.65	**Label**	D-axis current filter time constant			**Valid mode(s)**	**P**	**T**	**S**
	Range	0~2500	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0183		
	Valid	Immediate						
	The d-axis current low-pass filter time constant, the greater the setting value, the smaller the fluctuation, but the greater the delay							
P01.66	**Label**	Torque Filter Type Selection			**Valid mode(s)**	**P**	**T**	**S**
	Range	0~1	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0185		
	Valid	Immediate						
	0: Torque Filter Type is Second-Order Low-Pass Filter 1: Torque Filter Type is Low-Pass Filter							

3.2.3 [Class 2] Vibration suppression

P02.00	**Label**	Adaptive filtering mode settings			**Valid mode(s)**	**P**	**S**	
	Range	0~4	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0201		
	Valid	Immediate						

Value	Description	
0	Adaptive filter: invalid	Parameters related to 3rd notch filter remain unchanged
1	Adaptive filter: 1 filter valid for once.	1 adaptive filter becomes valid. 3rd notch filter related parameters updated accordingly. P02.00 switches automatically to 0 once updated.
2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3rd notch filter related parameters will keep updating accordingly.
3-4	Reserved	-

P02.01	**Label**	1st notch frequency			**Valid mode(s)**	**P**	**S**	**T**
	Range	50~4000	**Unit**	Hz	**Default**	4000		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0203		
	Valid	Immediate						
	Set center frequency of 1st torque command notch filter. Set P02.01 to 4000 to deactivate notch filter							
P02.02	**Label**	1st notch width			**Valid mode(s)**	**P**	**S**	**T**

	Range	0~20	**Unit**	—	**Default**	4
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0205
	Valid	Immediate				

Set notch bandwidth for 1st resonant notch filter.
Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P02.01 and P02.03, P02.02 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings

P02.03	**Label**	1st notch depth			**Valid mode(s)**	**P S T**
	Range	0~99	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0207
	Valid	Immediate				

Set notch depth for 1st resonant notch filter.
Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P02.01 and P02.02, P02.03 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings

P02.04	**Label**	2nd notch frequency			**Valid mode(s)**	**P S T**
	Range	50~4000	**Unit**	Hz	**Default**	4000
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0209
	Valid	Immediate				

Set center frequency of 2nd torque command notch filter.
Set P02.04 to 4000 to deactivate notch filter

P02.05	**Label**	2nd notch width			**Valid mode(s)**	**P S T**
	Range	0~20	**Unit**	—	**Default**	4
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x020B
	Valid	Immediate				

Set notch bandwidth for 2nd resonant notch filter.
Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P02.04 and P02.06, P02.05 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.

P02.06	**Label**	2nd notch depth			**Valid mode(s)**	**P S T**
	Range	0~99	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x020D
	Valid	Immediate				

Set notch depth for 1st resonant notch filter.
When P02.06 value is higher, notch depth becomes shallow, phase lag reduces. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P02.04 and P02.05, P02.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.

P02.07	**Label**	3rd notch frequency			**Valid mode(s)**	**P S T**
	Range	50~4000	**Unit**	Hz	**Default**	4000
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x020F
	Valid	Immediate				

Set center frequency of 3rd torque command notch filter.
Set P02.07 to 4000 to deactivate notch filter

P02.08	**Label**	3rd notch width			**Valid mode(s)**	**P S T**
	Range	0~20	**Unit**	—	**Default**	4
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0211
	Valid	Immediate				

Set notch depth for 3rd resonant notch filter.
When P02.06 value is higher, notch depth becomes shallow, phase lag reduces. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P02.04 and P02.05, P02.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.

P02.09	Label	3rd notch depth			Valid mode(s)	P	S	T
	Range	0~99	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0213		
	Valid	Immediate						

Set notch depth for 3rd resonant notch filter.
When P02.06 value is higher, notch depth becomes shallow, phase lag reduces. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with P02.04 and P02.05, P02.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.

P02.14	Label	1st damping frequency			Valid mode(s)	P		
	Range	0/10~2000	Unit	0.1Hz	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x021D		
	Valid	Immediate						

Set the first damping frequency to suppress the shaking at the end of the vibration. Please measure the vibration frequency at the end of the load and set it in 0.1[Hz].
Note: Suppresses sloshing at the end of the load. It is generally used to suppress the shaking of the elastic end of the load caused by the high deceleration impact when the motor is stopped. For the frequency within 100Hz shaking suppression effect is obvious. When in use, set this parameter to the frequency of shaking

Value	Description
0	Turn off the low frequency suppression function
10~2000	Set the damping frequency (0.1Hz in unit)

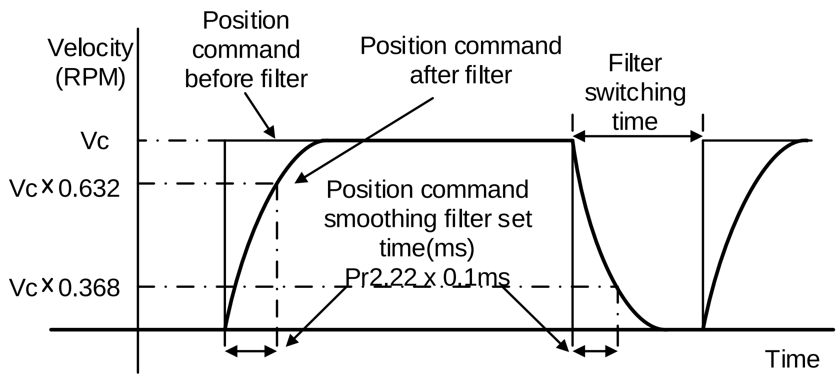
P02.16	Label	2nd damping frequency			Valid mode(s)	P		
	Range	0/10~2000	Unit	0.1Hz	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0221		
	Valid	Immediate						

Set the second damping frequency to suppress the shaking at the end of the vibration. Please measure the vibration frequency at the end of the load and set it in 0.1[Hz].
Note: Suppresses sloshing at the end of the load. It is generally used to suppress the shaking of the elastic end of the load caused by the high deceleration impact when the motor is stopped. For the frequency within 100Hz shaking suppression effect is obvious. When in use, set this parameter to the frequency of shaking

Value	Description
0	Turn off the low frequency suppression function
10~2000	Set the damping frequency (0.1Hz in unit)

P02.22	Label	Position command smoothing filter			Valid mode(s)	P		
	Range	0~32767	Unit	0.1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x022D		
	Valid	At stop						

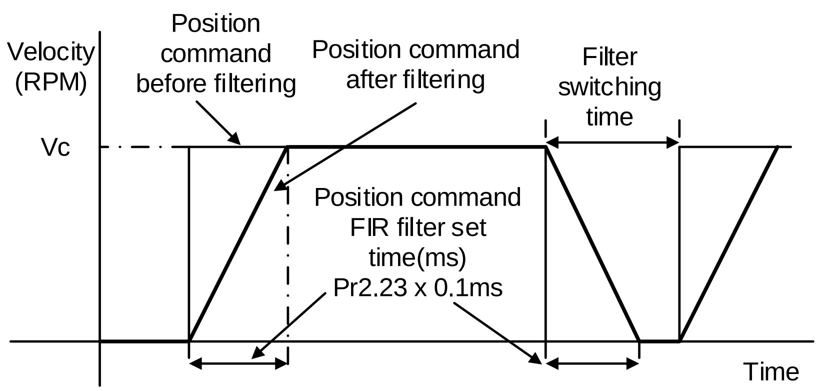
To set time constant of 1 time delay filter of position command.
To set time constant of 1 time delay filter, according to target velocity Vc square wave command as show below.



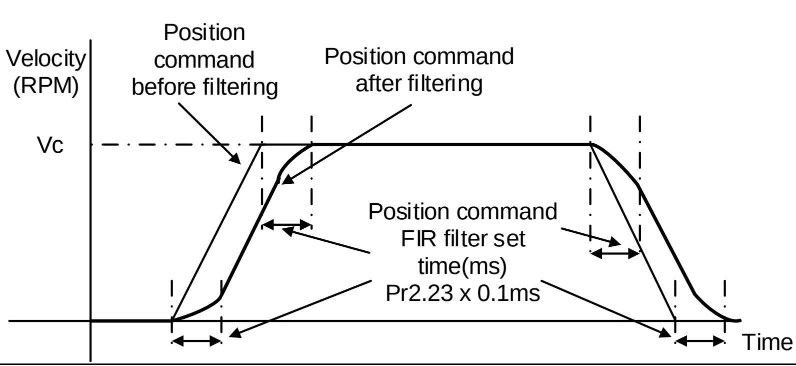
Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.22 is set too high, overall time will be lengthened.

P02.23	**Label**	Position command FIR filter			**Valid mode(s)**	**P**		
	Range	0~2500	**Unit**	0.1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x022F		
	Valid	At stop						

As shown below, when target velocity Vc square wave command reaches Vc, it becomes trapezoidal wave after filtering.



As shown below, when target velocity Vc trapezoidal command reaches Vc, it becomes S wave after filtering.



Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.23 is set too high, overall time will be lengthened.

Note: Please wait for command to stop and after filter idle time to modify P02.23.
Filter switching time = (P02.23 set value x 0.1ms + 0.25ms)

P02.48	**Label**	Adjustment mode			**Valid mode(s)**	P	S	T
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0261		
	Valid	Immediate						

Value	Description
【0】	Turn off automatic adjustments
1	Activate automatic adjustments, real time inertia measuring and vibration suppression. Inertia measuring deactivated after reaching 4 times in 5 minutes, triggering conditions: changes in mechanical stiffness.

P02.50	**Label**	MFC type			**Valid mode(s)**	P		
	Range	0~3	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0265		
	Valid	Re-enable						

Value	Description
【0】	Model following control
1	Zero tracking control
2	*3 inertia (future upgrade)*
3	*Path following (future upgrade)*

P02.51	**Label**	Velocity feedforward compensation coefficient			**Valid mode(s)**	P		
	Range	-10000~10000	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0267		
	Valid	Immediate						
	To compensate for velocity feedforward							

P02.52	**Label**	Torque feedforward compensation coefficient			**Valid mode(s)**	P	S	
	Range	-10000~10000	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0269		
	Valid	Immediate						
	To compensate for torque feedforward							

P02.53	**Label**	Dynamic friction compensation coefficient			**Valid mode(s)**	P	S	T
	Range	0~1000	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x026B		

	Valid	Immediate				

To set ratio of rated torque/rated rotational speed, to compensate for dynamic friction during motion and have better control over acceleration/deceleration.

Dynamic friction coefficient

$$= \left| \frac{\text{Torque(Rotational speed 1)} - \text{Torque(Rotational speed 2)}}{\text{Rotational speed 1} - \text{Rotational speed 2}} * \text{rated rotational speed} \right|$$

When there is an excess position deviation during acceleration/deceleration, please adjust P02.53 to reduce the deviation to 0.

P02.54	**Label**	Overshoot time coefficient			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10000	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x026D		
	Valid	Immediate						

To set overshoot time coefficient

P02.55	**Label**	Overshoot suppression gain			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10000	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x026F		
	Valid	Immediate						

Suppression improves with larger set value but might affect the performance of MFC. Please use with caution for any value above 100.

3.2.4 [Class 3] Velocity/Torque control

P03.00	**Label**	Velocity internal/external switching			**Valid mode(s)**	**S**
	Range	0~3	**Unit**	—	**Default**	1
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0301
	Valid	Immediate				

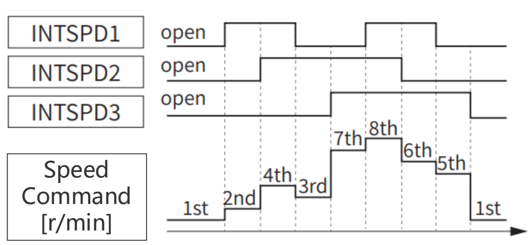
·Connect to the right DI to control internal command velocity settings.

Value	**Velocity settings**
0	Analog Speed Command (SPR)
【1】	Internal velocity settings 1st – 8th speed（P03.04～P03.11 ）
2	Internal velocity settings 1st – 7rd speed（P03.04～P3.10）, Analog Speed Command (SPR)
3	Internal velocity settings 1st – 16th speed（P03.04～P03.11, P03.36～P3.43）

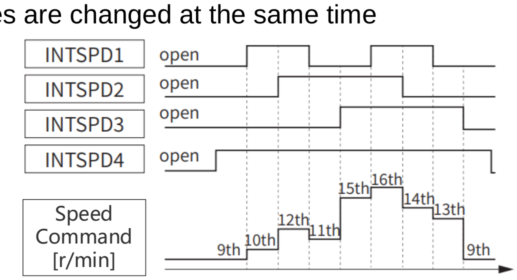
Value	Internal Command velocity 1 （INTSPD 1）	Internal command velocity 2 （INTSPD2 ）	Internal command velocity 3 （INTSPD3 ）	Internal command velocity 4 （INTSPD4 ）	Velocity command
1	OFF	OFF	OFF	-	1st speed
	ON	OFF	OFF	-	2nd speed

	OFF	ON	OFF	-	3rd speed
	ON	ON	OFF	-	4th speed
	OFF	OFF	ON	-	5th speed
	ON	OFF	ON	-	6th speed
	OFF	ON	ON	-	7th speed
	ON	ON	ON	-	8th speed
2	OFF	OFF	OFF	-	1st speed
	ON	OFF	OFF	-	2nd speed
	OFF	ON	OFF	-	3rd speed
	ON	ON	OFF	-	4th speed
	OFF	OFF	ON	-	5th speed
	ON	OFF	ON	-	6th speed
	OFF	ON	ON	-	7th speed
	ON	ON	ON	-	Analog Speed Command
3	Similar to (P03.00=ON)			OFF	1st speed~ 8th speed
	OFF	OFF	OFF	ON	9th speed
	ON	OFF	OFF	ON	10th speed
	OFF	ON	OFF	ON	11th speed
	ON	ON	OFF	ON	12th speed
	OFF	OFF	ON	ON	13th speed
	ON	OFF	ON	ON	14th speed
	OFF	ON	ON	ON	15th speed
	ON	ON	ON	ON	16th speed

Please change internal command velocity as per diagram below as unexpected axis movement might occurs if 2 command velocities are changed at the same time



P03.00=1 / 2



P03.00=3

P03.01	**Label**	Velocity command rotational direction selection			**Valid mode(s)**	**S**
	Range	0~2	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0303
	Valid	Immediate				

To set positive/negative direction of velocity command

Value	Velocity settings (Analog or internal velocity)	Velocity command sign selection (VC-SIGN)	Velocity command sign selection (VC-SIGN 2)	Velocity command direction	note
【0】	+	No effect	No effect	Positive	Direction determined by +/-
	—	No effect	No effect	Negative	Direction determined by VC-SIGN
1	No effect	OFF	No effect	Positive	The direction is determined by +/-, VC-SIGN and VC-SIGN2; 1.when the VC-SIGN and VC-SIGN2 are valid or invalid at the same time, the motor is stationary; 2. when the VC-SIGN is valid and the VC-SIGN2 is invalid, the speed command direction is the same as the speed setting value direction; 3. when the VC-SIGN is invalid and the VC-SIGN2 is valid, the speed command direction is opposite to the speed setting value direction
	No effect	ON	No effect	Negative	
2	+	ON	OFF	Positive	
		OFF	ON	Negative	
		ON	ON	STOP	
		OFF	OFF	STOP	
	-	ON	OFF	Negative	
		OFF	ON	Positive	
		ON	ON	STOP	
		OFF	OFF	STOP	

P03.02						
	Label	Velocity command input gain			**Valid mode(s)**	S
	Range	10~2000	**Unit**	(r/min)/V	**Default**	500
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0305
	Valid	Immediate				

To set gain changes from voltage added onto analog velocity command (SPR) to motor command velocity

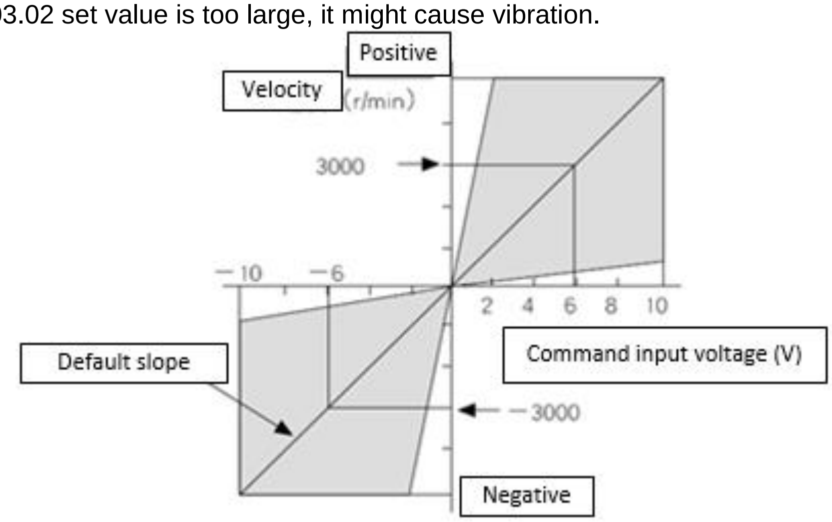
P03.02 sets command input voltage and rotational speed slope.

Factory default:

P03.02=500(r/min)/V.

Hence 6V input: 3000 r/min

1. Do not supply more than ±10V power for analog velocity command (SPR).
2. If P03.02 set value is too large, it might cause vibration.



P03.03	**Label**	Velocity command input inversion			**Valid mode(s)**	S
	Range	0~1	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0307
	Valid	Immediate				

To set voltage polarity of analog velocity command.

Only valid when P03.01 = 0. When P03.01 = 1, rotational direction is only related to VC-SIGN.

Value	Motor rotational direction	
【0】	Not inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」
1	Inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」

If there is an external position sensor with different polarity from P03.03, motor might undergo abnormal motion.

P03.04	**Label**	1st speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0309
	Valid	Immediate				
P03.05	**Label**	2nd speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x030B
	Valid	Immediate				
P03.06	**Label**	3rd speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x030D
	Valid	Immediate				

P03.07	**Label**	4th speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x030F
	Valid	Immediate				
P03.08	**Label**	5th speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0311
	Valid	Immediate				
P03.09	**Label**	6th speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0313
	Valid	Immediate				
P03.10	**Label**	7th speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0315
	Valid	Immediate				
P03.11	**Label**	8th speed of velocity setting			**Valid mode(s)**	S
	Range	-10000~10000	**Unit**	r/min	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0317
	Valid	Immediate				
To set internal velocity command 1st -8th speed						

P03.12	**Label**	Acceleration time settings			**Valid mode(s)**	S
	Range	0~10000	**Unit**	ms/ (1000rpm)	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0319
	Valid	Immediate				
P03.13	**Label**	Deceleration time settings			**Valid mode(s)**	S
	Range	0~10000	**Unit**	ms/ (1000rpm)	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x031B
	Valid	Immediate				

Set max acceleration/deceleration for velocity command.

If target velocity = *x* [rpm], max acceleration = *a* [unit: rpm/ms], acceleration time = *t* [ms]

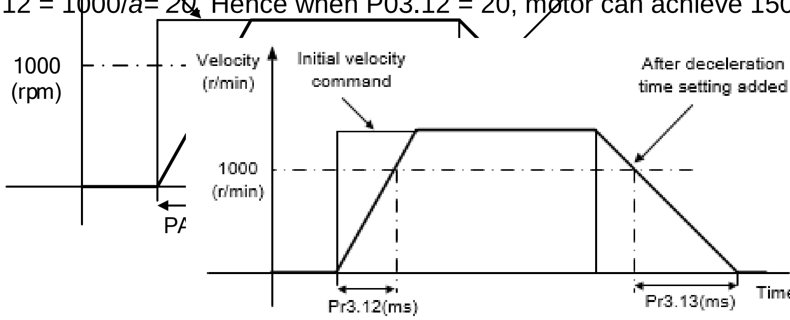
P03.12 = *1000/a*

P03.13 = *1000/a*

a = *x/t*

For example: If motor is to achieve 1500rpm in 30s, *a=1500/30=50rpm/ms*

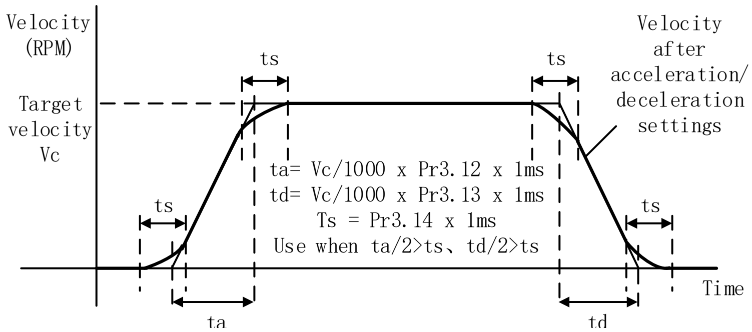
P03.12 = 1000/*a*= 20, Hence when P03.12 = 20, motor can achieve 1500rpm in 30s.



	Usually used when there is rapid acceleration or trapezoidal wave velocity command due to many different internal speed segments under velocity control mode which causes instable while motor in motion. *Under velocity control mode, 6083 and 6084 is limited by P03.12 and P03.13 correspondingly.*

P03.14	**Label**	Sigmoid acceleration/deceleration settings			**Valid mode(s)**	S
	Range	0~1000	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x031D
	Valid	After restart				

To set sigmoid acceleration and deceleration turning point in accordance to P03.12 and P03.13.



P03.15	**Label**	Zero speed clamp function selection			**Valid mode(s)**	S
	Range	0~3	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x031F
	Valid	Immediate				

Value	Zero speed clamp function
0	Invalid: zero speed clamp deactivated
1	Velocity command is forced to 0 when the zero speed clamp (ZEROSPD) input signal is valid.
2	Velocity command is forced to 0 when actual velocity is lower than P03.16.
3	Includes conditions from 1 and 2

P03.16	**Label**	Zero speed clamp level			**Valid mode(s)**	S
	Range	10~2000	**Unit**	r/min	**Default**	30
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0321
	Valid	Immediate				
	Valid when P03.15 = 2/3, velocity command is forced to 0 when actual velocity is lower than P03.16 and after static time set in P03.23.					

P03.17	**Label**	Torque internal/external switching			**Valid mode(s)**	T
	Range	0~3	**Unit**		**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0323
	Valid	Immediate				

Value	Torque command input	Velocity limit input
【0】	Analog input 3(AI 3)	P03.21 set value
1	Analog input 3(AI 3)	Analog input 1(AI 1)
2	P03.22 set value	P03.21 set value

P03.18	**Label**	Torque command direction selection			**Valid mode(s)**			T
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0325		
	Valid	Immediate						

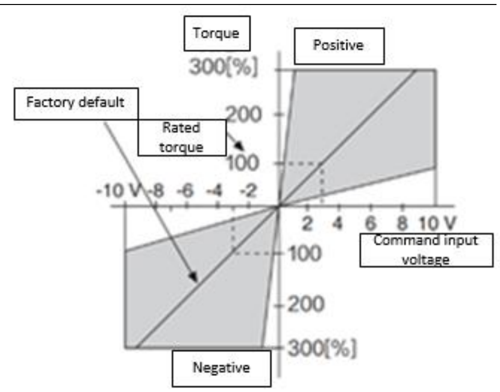
To set torque command positive/negative direction

Value	Direction settings
【0】	TC-SIGN ON/OFF has no effect on torque direction Torque command input「Positive」→Positive direction、 「Negative」→Negative direction
1	Use TC-SIGN ON/OFF status for torque direction OFF: *Positive direction* ON: *Negative direction*

P03.19	**Label**	Torque command input gain			**Valid mode(s)**			T
	Range	10~100	**Unit**	0.1V/100%	**Default**	30		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0327		
	Valid	Immediate						

To set gain changes from voltage added onto analog torque command (TRQR) to torque command (%)

·Unit: （0.1V/100%）。
·Set input voltage required for rated output torque.
·Default = 30，which is 3V/100%



P03.20	**Label**	Torque command input inversion			**Valid mode(s)**			T
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0329		
	Valid	Immediate						

To set voltage polarity of analog torque command.
Only valid when P03.18 = 0.

Value	Motor torque direction	
【0】	Not inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」
1	Inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」

P03.21	**Label**	Velocity limit in torque mode			**Valid mode(s)**		T
	Range	0~10000	**Unit**	r/min	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x032B	
	Valid	Immediate					

To set velocity limit in torque control mode. Only valid when P03.17 = 0 / 2.

P03.22	**Label**	Torque command			**Valid mode(s)**		T
	Range	-500~500	**Unit**	%	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x032D	
	Valid	Immediate					

To set torque limit in torque control mode. Only valid when P03.17 = 2.
Please refer to P03.17.

P03.23	**Label**	Zero speed delay time in velocity mode			**Valid mode(s)**	S	
	Range	0~2000	**Unit**	ms	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x032F	
	Valid	Immediate					

To set the time interval between axis reaches zero speed level and the moment it totally stops.
Used when axis crawls under velocity mode. Set 0 to deactivate this parameter.

P03.24	**Label**	Maximum motor rotational speed			**Valid mode(s)**	P	S	T
	Range	0~10000	**Unit**	r/min	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0331		
	Valid	Immediate						

To set maximum motor rotational speed but not higher than motor rated speed
If P03.24 = 0, maximum motor rotational speed = max. speed in motor parameter.

P03.29	**Label**	Speed limit analog input clamp voltage			**Valid mode(s)**		T
	Range	0~20000	**Unit**	mv	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x033B	
	Valid	Immediate					

Set the clamp voltage of analog 1. Only torque setting P03.17 is set to 1 mode when it takes effect.
For example: P03.17=1 When the voltage of analog 1 (AI1) is less than or equal to the set value, the speed is directly set to 0.

P03.30	**Label**	Torque command analog input clamp voltage	**Valid mode(s)**			T

	Range	0~20000	Unit	mv	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x033D		
	Valid	Immediate						
	Set the clamp voltage of analog 3. Only torque setting P03.17 is set to 1 mode when it takes effect. For example: P03.17=1 When the voltage of analog 3 (AI3) is less than or equal to the set value, the speed is directly set to 0.							
P03.31	Label	Torque Command Analog Input Source Selection			Valid mode(s)			T
	Range	0~3	Unit	-	Default	2		
	Byte length	16bit	Attribute	R/W	485 address	0x033F		
	Valid	Immediate						
	0: Select Analog Input 1 as the torque input 1: Select Analog Input 2 as the torque input 2: Select Analog Input 3 as the torque input							
P03.48	Label	Speed Limit Analog Input Source Selection			Valid mode(s)			T
	Range	0~4	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0361		
	Valid	Immediate						
	0: Use Analog Input 1 input voltage as the speed limit source 1: Use Analog Input 2 input voltage as the speed limit source 2: Use Analog Input 3 input voltage as the speed limit source Speed Limit Value = Analog Input Voltage × Speed Command Input Gain (P03.02).							
P03.58	Label	Speed regulation ratio 1			Valid mode(s)		S	
	Range	0~150	Unit	%	Default	10		
	Byte length	16bit	Attribute	R/W	485 address	H0x0374 L0x0375		
	Valid	Immediate						

To set speed regulation ratio for each input signal. If ratio is more than 150% in total, rotational speed of the motor will remain unchanged. If the rotational speed of the motor exceeds P03.24, then motor will rotate at maximum speed.
Speed regulation ratio = 100% if SPDREG signal is not valid.

Please refer to the following table as an example for users' required settings.
Assuming (1) P03.58-P03.61 = default
(2)Motor rated rotational speed = 2000rpm
(3) SPDREG input signal = ON

SPDREG1 P03.58	SPDREG2 P03.59	SPDREG3 P03.60	SPDREG4 P03.61	Ratio (%)	Actual speed (rpm)
OFF	OFF	OFF	OFF	0	0
ON	OFF	OFF	OFF	10	200
OFF	ON	OFF	OFF	20	400
OFF	OFF	ON	OFF	40	800
OFF	OFF	OFF	ON	80	1600
ON	ON	OFF	OFF	30	600
ON	ON	ON	OFF	70	1400

P03.59	Label	Speed regulation ratio 2	Valid mode(s)		S	

	Range	0~150	Unit	%	Default	20
	Byte length	16bit	Attribute	R/W	485 address	H0x0376 L0x0377
	Valid	Immediate				
	Same as P03.58					
P03.60	Label	Speed regulation ratio 3			Valid mode(s)	S
	Range	0~150	Unit	%	Default	40
	Byte length	16bit	Attribute	R/W	485 address	H0x0378 L0x0379
	Valid	Immediate				
	Same as P03.58					
P03.61	Label	Speed regulation ratio 4			Valid mode(s)	S
	Range	0~150	Unit	%	Default	80
	Byte length	16bit	Attribute	R/W	485 address	H0x037A L0x037B
	Valid	Immediate				
	Same as P03.58					

3.2.5 [Class 4]I/O Monitoring Settings

P04.00	Label	Input selection DI1			Valid mode(s)	P S T
	Range	0x00~0xFF	Unit	—	Default	0x2
	Byte length	16bit	Attribute	R/W	485 address	0x0401
	Valid	Immediate				

Please refer to the table below to set DI signals and table on the right for corresponding pin and parameters

Signal	Symbol	Value	
		NO	NC
Invalid	—	0	-
Positive limit switch	POT	1	81
Negative limit switch	NOT	2	82
Servo enabled	SRV-ON	3	83
Clear alarm	A-CLR	4	-
Control mode switching	C-MODE	5	85
Gain switching	GAIN	6	86
Clear deviation count	CL	7	-
Command pulse prohibited	INH	8	88
Torque limit switching	TL-SEL	9	89
Command frequency divider/multiplier switching	DIV1	C	8C
Internal command velocity 1	INTSPD1	E	8E
Internal command velocity 2	INTSPD2	F	8F
Internal command velocity 3	INTSPD3	10	90
Internal command velocity 4	INTSPD4	31	B1
Zero speed clamp	ZEROSPD	11	91
Velocity command sign	VC-SIGN	12	92
Velocity command sign2	VC-SIGN2	4A	CA
Torque command sign	TC-SIGN	13	93
Forced alarm	E-STOP	14	94
Inertia ratio switching input	J-SEL	15	95
Gantry banning	GTRY	17	97
Vibration suppression 1	VS-SEL1	0A	8A
Vibration suppression 2	VS-SEL2	0B	8B

CN1 PIN	Input	Parameters
8	DI1	P04.00
9	DI2	P04.01
26	DI3	P04.02
27	DI4	P04.03
28	DI5	P04.04
29	DI6	P04.05
30	DI7	P04.06
31	DI8	P04.07
32	DI9	P04.08
33	DI10	P04.09

Please don't set anything other than listed in table above.
Normally open (NO) : Valid when input = ON
Normally close (NC): Valid when input = OFF
Er210 might occur if same function is allocated to different channels at the same time

Servo enabled（SRV-ON）has to be allocated to enabled servo drive.
Inputs related to Pr-mode:

Signal	Symbol	Value	
		NO	NC
Trigger command	CTRG	20	A0
Home	HOME	21	A1
Forced stop	STP	22	A2

Signal	Symbol	Value	
		NO	NC
Positive JOG	PJOG	23	A3
Negative JOG	NJOG	24	A4
Positive limit	PL	25	A5
Negative limit	NL	26	A6
Origin	ORG	27	A7
Path address 0	ADD0	28	A8
Path address 1	ADD1	29	A9
Path address 2	ADD2	2A	AA
Path address 3	ADD3	2B	AB

Note: CTRG, HOME are edge triggered, please make sure electronic bits last 1ms or above.

P04.01	**Label**	Input selection DI2			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0403		
	Valid	Immediate						
P04.02	**Label**	Input selection DI3			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0405		
	Valid	Immediate						
P04.03	**Label**	Input selection DI4			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x6		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0407		
	Valid	Immediate						
P04.04	**Label**	Input selection DI5			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0xC		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0409		
	Valid	Immediate						
P04.05	**Label**	Input selection DI6			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x3		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x040B		
	Valid	Immediate						
P04.06	**Label**	Input selection DI7			**Valid mode(s)**	P	S	T

	Range	0x0~0xFF	**Unit**	—	**Default**	0x7		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x040D		
	Valid	Immediate						
P04.07	**Label**	Input selection DI8			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x4		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x040F		
	Valid	Immediate						
P04.08	**Label**	Input selection DI9			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x5		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0411		
	Valid	Immediate						
P04.09	**Label**	Input selection DI10			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x8		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0413		
	Valid	Immediate						

·DI2~DI10allocation is the same as DI1. Please refer to P04.00.

P04.10	**Label**	Output selection DO1			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x3		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0415		
	Valid	Immediate						

Please allocate DO as per table below. ALARM logic is the opposite of others

Value		Signal	Symbol
NO	NC		
00	80	Invalid	—
01	81	Alarm	ALARM
02	82	Servo-Ready	SRDY
03	83	External brake released	BRK-OFF
04	84	Positioning completed	INP
05	85	At-speed	AT-SPPED
06	86	Torque limit signal	TLC
07	87	Zero speed clamp detection	ZSP
08	88	Velocity coincidence	V-COIN
12	92	Servo Status	SRV-ST
15	95	Positive limit valid	POT-OUT
16	96	Negative limit valid	NOT-OUT
0B	8B	Position command ON/OFF	P-CMD
0F	8F	Velocity command ON/OFF	V-CMD
0D	8D	Velocity limit signal	V-LIMIT
14	94	Position comparison	CMP-OUT

CN1 PIN	Output	Parameters
11	DO1+	P04.10
10	DO1-	
35	DO2+	P04.11
34	DO2-	
37	DO3+	P04.12
36	DO3-	
39	DO4+	P04.13
38	DO4-	
12	DO5	P04.14
40	DO6	P04.15

Same signal can be assigned to multiple different outputs.

Normally open(NO)：Active low

Normally close(NC)：Active high

Err212 might occur if output is allocated to signals other than listed in the table above.

Outputs related to PR-mode

Signal	Symbol	Value	
		NO	NC
Command completed	CMD-OK	20	A0
Path completed	PR-OK	21	A1
Homing done	HOME-OK	22	A2

	Note: CMD-OK indicates PR command is sent by axis might not yet be in position. PR-OK indicates axis is in place.								
P04.11	**Label**	Output selection DO2			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x2		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0417		
	Valid	Immediate						
P04.12	**Label**	Output selection DO3			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0419		
	Valid	Immediate						
P04.13	**Label**	Output selection DO4			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x4		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x041B		
	Valid	Immediate						
P04.14	**Label**	Output selection DO5			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x7		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x041D		
	Valid	Immediate						
P04.15	**Label**	Output selection DO6			**Valid mode(s)**	P	S	T
	Range	0x0~0xFF	**Unit**	—	**Default**	0x6		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x041F		
	Valid	Immediate						
	DO2-DO6 is allocated by the same method as per DO1. Please refer to P04.10.							

P04.22	**Label**	Analog input 1(AI-1) Zero drift settings			**Valid mode(s)**		S	
	Range	-1860~1860	**Unit**	5.37mv	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x042D		
	Valid	Immediate						
	To set zero drift compensation value on analog input 1 voltage for zero drift correction.							
P04.23	**Label**	Analog input 1(AI-1) filter			**Valid mode(s)**		S	
	Range	0~6400	**Unit**	0.01ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x042F		
	Valid	Immediate						
	To set a delay filter time coefficient for AI1 input voltage. When filter time takes effect, input voltage will be smoothen.							
P04.24	**Label**	Analog input 1(AI-1) overvoltage settings			**Valid mode(s)**		S	
	Range	0~100	**Unit**	0.1V	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0431		
	Valid	Immediate						
	P04.24 is invalid when set to 0. Er270 might occur when the input voltage of AI1 is higher than the voltage after zero drift correction.							
P04.26	**Label**	Analog input 2(AI-2) overvoltage settings			**Valid mode(s)**	P	S	T
	Range	0~6400	**Unit**	0.01ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0435		

	Valid	Immediate						
	P04.24 is invalid when set to 0. Er270 might occur when the input voltage of AI2 is higher than the voltage after zero drift correction.							
P04.27	**Label**	Analog input 2(AI-2) overvoltage settings			**Valid mode(s)**	P	S	T
	Range	0~100	**Unit**	0.1V/uA	**Default**	100		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0437		
	Valid	Immediate						
	P04.24 is invalid when set to 0. Er270 might occur when the input voltage of AI2 is higher than the voltage after zero drift correction.							

P04.28	**Label**	Analog input 3(AI-3) Zero drift settings			**Valid mode(s)**			T
	Range	-1860~1860	**Unit**	5.37mv	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0439		
	Valid	Immediate						
	To set zero drift compensation value on analog input 3 voltage for zero drift correction.							
P04.29	**Label**	Analog input 3(AI-3) filter			有效模式			T
	Range	0~6400	**Unit**	0.01ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x043B		
	Valid	Immediate						
	To set a delay filter time coefficient for AI3 input voltage. When filter time takes effect, input voltage will be smoothen.							
P04.30	**Label**	Analog input 3(AI-3) overvoltage settings			**Valid mode(s)**			T
	Range	0~100	**Unit**	0.1V	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x043D		
	Valid	Immediate						
	P04.30 is invalid when set to 0. Er270 might occur when the input voltage of AI3 is higher than the voltage after zero drift correction.							

P04.31	**Label**	Positioning complete range			**Valid mode(s)**	P		
	Range	0～8388608	**Unit**	P05.20 set unit	**Default**	20		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x043F		
	Valid	Immediate						
	To set position deviation range of INP1 positioning completed output signal. INP1 output signal will be valid once position is complete within the range of deviation set. *Default unit: 0.00001rev. Can be set on P05.20 as command unit (pulse) or encoder unit (pulse)*							
P04.32	**Label**	Positioning complete output setting			**Valid mode(s)**	P		
	Range	0~4	**Unit**	—	**Default**	1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0441		
	Valid	Immediate						

To set conditions for INP1 output signal to be valid

Value	Positioning completed signal
0	Signal valid when the position deviation is smaller than P04.31
1	Signal valid when there is no position command and position deviation is smaller than P04.31
2	Signal valid when there is no position command, zero-speed clamp detection (ZSP) signal is ON and the positional deviation is smaller than P04.31
3	Signal valid when there is no position command and position deviation is smaller than P04.31. Signal ON when within the time set in P04.33 otherwise OFF.
4	When there is no command, position detection starts after the delay time set in P04.33. Signal valid when there is no position command and positional deviation is smaller than P04.31.

P04.33								
	Label	INP positioning delay time			Valid mode(s)	P		
	Range	0~15000	Unit	1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0443		
	Valid	Immediate						

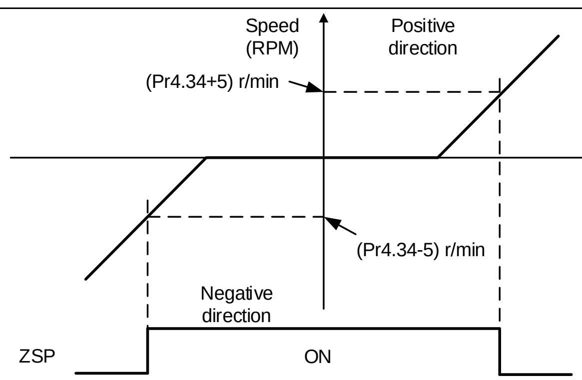
Valid when P04.32 = 3.

Set value	Positioning completed signal
0	Indefinite delay time, signal ON until next position command
1-15000	OFF within the time set; ON after time set. Switch OFF after receiving next position command.

P04.34								
	Label	Zero speed			Valid mode(s)	P	S	T
	Range	1~2000	Unit	r/min	Default	50		
	Byte length	16bit	Attribute	R/W	485 address	0x0445		
	Valid	Immediate						

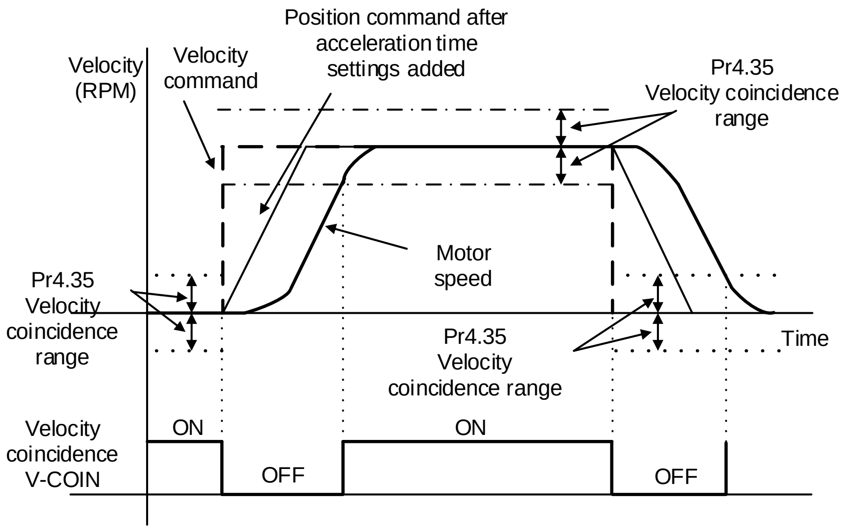
To set threshold value for zero speed clamp detection.
Zero speed clamp detection (ZSP) output signal valid when motor speed goes under the value set in P04.34

- Disregard the direction of rotation, valid for both directions.
- Hysteresis of 5RPM. Please refer to diagram on the right side.



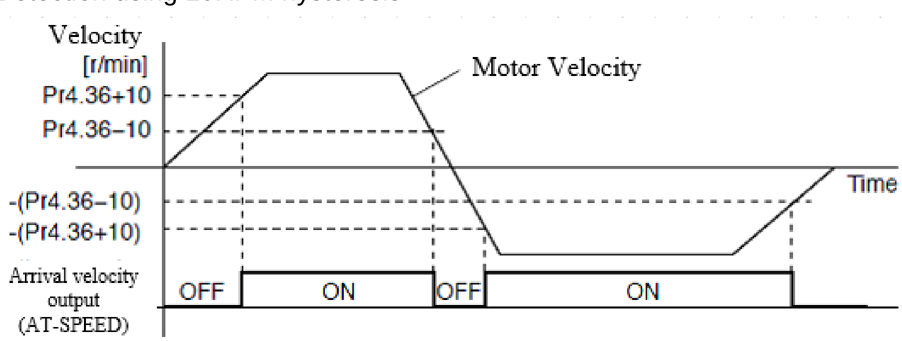
P04.35								
	Label	Velocity coincidence range			Valid mode(s)		S	
	Range	10~2000	Unit	r/min	Default	50		
	Byte length	16bit	Attribute	R/W	485 address	0x0447		
	Valid	Immediate						

	If the difference between velocity command and motor actual speed is below P04.35, Velocity coincidence (V-COIN) output signal valid. Due to 10RPM hysteresis: Velocity coincidence output OFF -> ON timing (P04.35 -10) r/min Velocity coincidence output ON -> OFF timing (P04.35 +10) r/min



P04.36	Label	Arrival velocity			Valid mode(s)	S
	Range	10~2000	Unit	r/min	Default	1000
	Byte length	16bit	Attribute	R/W	485 address	0x0449
	Valid	Immediate				

When motor velocity > P04.36, AT-speed output signal is valid.
Detection using 10RPM hysteresis.

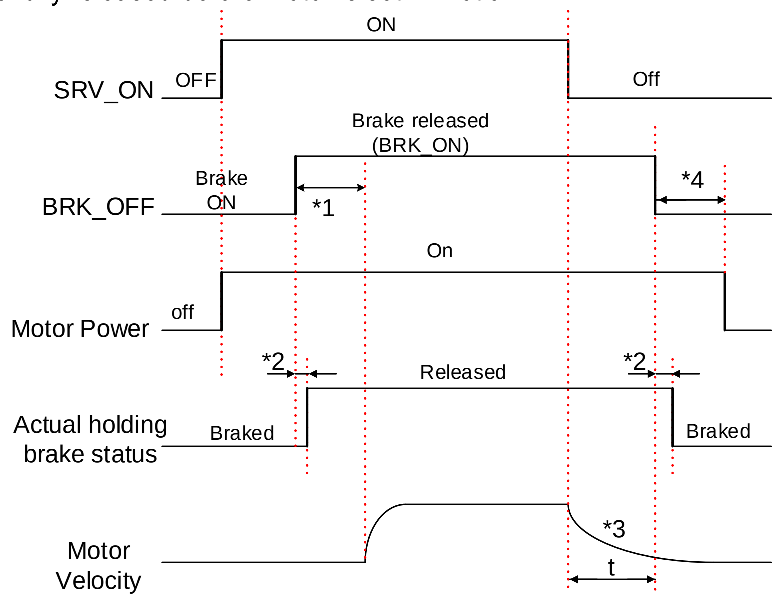


P04.37	Label	Motor power-off delay time			Valid mode(s)	P	S	T
	Range	0~3000	Unit	1ms	Default	150		
	Byte length	16bit	Attribute	R/W	485 address	0x044B		
	Valid	Immediate						

To set delay time for holding brake to be activated after motor power off to prevent axis from sliding.
When P05.06 = 0, SRV-ON signal is off, holding brake is activated (delay time is determined by P04.39 or P06.14). Motor powered-off once delay time set in P04.37 is due.

P04.38	Label	Holding brake release time			Valid mode(s)	P	S	T
	Range	0~3000	Unit	1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x044D		
	Valid	Immediate						

To set delay time for holding brake to be released after motor power on. Motor will remain at current position and input command is masked to allow holding brake to be fully released before motor is set in motion.



*1: Delay time set in P04.38
*2: Delay time from the moment BRK_OFF signal is given until actual holding brake is released or BRK_ON signal is given until actual holding brake is activated. It is dependent on the holding brake of the motor.
*3: Deceleration time is determined by P06.14 or if motor speed goes below P04.39, whichever comes first. BRK_OFF given after deceleration time.
*4: P04.37 set time value.

Delay time from the moment SRV_ON is given until BRK_OFF switch to BRK_ON, is less than 500ms.

P04.39	Label	Holding brake activation speed			Valid mode(s)	P	S	T
	Range	30~3000	Unit	r/min	Default	30		
	Byte length	16bit	Attribute	R/W	485 address	0x044F		
	Valid	Immediate						

To set the activation speed for which holding brake will be activated.

When SRV-OFF signal is given, motor decelerates, after it reaches below P04.39 and P06.14 is not yet reached, BRK_OFF is given.
BRK_OFF signal is determined by P06.14 or if motor speed goes below P04.39, whichever comes first.

Application:
1. After disabling axis, P06.14 has been reached but motor speed is still above P04.39, BRK_OFF signal given.
2. After disabling axis, P06.14 has not been reached but motor speed is below P04.39, BRK_OFF signal given.

Deceleration max duration: 2s. Servo disabled after 2s.

P04.43	**Label**	Emergency stop function			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0457		
	Valid	Immediate						

Value	Description.
【0】	Emergency stop is valid, servo driver will be forced to STOP and Err570 occurs.
1	When the forced alarm input E-STOP is active, the servo is forced to stop but does not generate an alarm.

P04.48	**Label**	Torque compensation delay time			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~3000	**Unit**	ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0461		
	Valid	Immediate						

Smooth the torque compensation. The larger the setting value, the slower the compensation, and the faster the compensation.

P04.62	**Label**	Position/Speed/Torque Feedback Polarity Setting			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x047D		
	Valid	Immediate						

Value	Description.
【0】	Feedback polarity is not reversed
1	feedback polarity reversal

P04.64	**Label**	AO1 output			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0481		
	Valid	Immediate						

Value	Description
【0】	Negative/Positive value: -10~10V
1	Absolute value output: 0~10V
Other	Reserved

P04.65	**Label**	AO1 signal			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0x7FFFFFFF	**Unit**	—	**Default**	0x4		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0483		
	Valid	Immediate						

Bit 0 – 15: AO signal source; Bit 16 – 31: DO extension channel

Bit0~Bit15	Signal source

0x0	-
0x1	Motor rotational speed（V/krpm）
0x2	Position command velocity（V/krpm）
0x3	Internal position command velocity（V/krpm）
0x4	Torque command（0.03V/0.01）
0x5	Position command deviation（mV/Command unit）
0x6	Position command deviation（mV/Encoder unit）
0x7	Analog 1（V/V）
0x8	Analog 2（V/V）
0x9	Analog 3（V/V）
0xA	Extension DO（0V/5V）
0xB	As per P04.67

Bit 16 – 31: Only available when AO signal source = 0xA

Bit16~Bit31	Channel
01h	Alarm output
02h	Servo ready
03h	External brake released
04h	Positioning completed
…	Please refer to P04.10 for other signal channels

P04.66	**Label**	AO1 amplification			**Valid mode(s)**	P	S	T
	Range	-10000~10000	**Unit**	0.01	**Default**	100		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0485		
	Valid	Immediate						

To set the amplification of AO1, actual voltage output = amplification x theoretical voltage

P04.67	**Label**	AO1 communication settings			**Valid mode(s)**	P	S	T
	Range	-10000~10000	**Unit**	mV	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0487		
	Valid	Immediate						

Available when A01 = 0xB

P04.68	**Label**	AO1 offset			**Valid mode(s)**	P	S	T
	Range	-10000~10000	**Unit**	mV	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0489		
	Valid	Immediate						

To set AO1 offset value.

P04.69	**Label**	AO2 output			**Valid mode(s)**	P	S	T
	Range	0~10	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x048B		
	Valid	Immediate						

Value	Description
【0】	Negative/Positive value: -10~10V
1	Absolute value output: 0~10V
Other	Reserved

P04.70	**Label**	AO2 signal			**Valid mode(s)**	P	S	T
	Range	0x0~0xFFFFFFFF	**Unit**	—	**Default**	0x1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x048D		
	Valid	Immediate						

Bit 0 – 15: AO signal source; Bit 16 – 31: DO extension channel

Bit0~Bit15	Signal source
0x0	-
0x1	Motor rotational speed（V/krpm）
0x2	Position command velocity（V/krpm）
0x3	Internal position command velocity（V/krpm）
0x4	Torque command（0.03V/0.01）
0x5	Position command deviation（mV/Command unit）
0x6	Position command deviation（mV/Encoder unit）
0x7	Analog 1（V/V）
0x8	Analog 2（V/V）
0x9	Analog 3（V/V）
0xA	Extension DO（0V/5V）
0xB	As per P04.72

Bit 16 – 31: Only available when AO signal source = 0xA

Bit16~Bit31	Channel
01h	Alarm output
02h	Servo ready
03h	External brake released
04h	Positioning completed
…	Please refer to P04.10 for other signal channels

P04.71	**Label**	AO2 amplification			**Valid mode(s)**	P	S	T
	Range	-10000~10000	**Unit**	0.01	**Default**	100		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x048F		
	Valid	Immediate						

To set the amplification of AO2, actual voltage output = amplification x theoretical voltage.

P04.72	**Label**	AO2 communication settings			**Valid mode(s)**	P	S	T
	Range	-10000~10000	**Unit**	mV	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0491		
	Valid	Immediate						

Available when AO2= 0xB

P04.73	**Label**	AO2 offset			**Valid mode(s)**	P	S	T
	Range	-10000~10000	**Unit**	mV	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0493		
	Valid	Immediate						

To set AO2 offset value.

P04.74	**Label**	Warning indicator light 1 signal			**Valid mode(s)**	P	S	T
	Range	0~100	**Unit**	-	**Default**	1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0495		
	Valid	Immediate						

To select warning signal for warning indicator light 1

Value	Signal
【0】	None
1	Negative limit
2	Battery low voltage
3	Overload
4	Torque limit
5	Positive limit

	other	*Reserved*						
	During normal operation, warning indicator light will be lighted in a cycle.							
P04.75	**Label**	Warning indicator light 2 signal			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	2		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0497		
	Valid	Immediate						
	To select warning signal for warning indicator light 2, as per table in P04.74							
P04.76	**Label**	Warning indicator light 3 signal			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	3		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0499		
	Valid	Immediate						
	To select warning signal for warning indicator light 3, as per table in P04.74							
P04.77	**Label**	Warning indicator light 4 signal			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	4		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x049B		
	Valid	Immediate						
	To select warning signal for warning indicator light 4, as per table in P04.74							
P04.78	**Label**	Warning indicator light 5 signal			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	5		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x049D		
	Valid	Immediate						
	To select warning signal for warning indicator light 5, as per table in P04.74							

3.2.6 [Class 5] Extension Settings

P05.00	**Label**	2nd pulse count per revolution			**Valid mode(s)**	**P**		
	Range	0-67108864	**Unit**	PULSE	**Default**	10000		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0500 L: 0x0501		
	Valid	After restart						
	Switch between P00.08 and P05.00 with DI signal DIV1. When switch to P05.00: （1）P05.00 valid when ≠ 0: Motor revolution = Input pulse count / [P05.00 set value] （2）P05.00 invalid when = 0: Actual position pulse count is according to P05.01 and P05.02. Switching with DIV1 signal only valid when servo drive is re-enabled.							

P05.01	**Label**	2nd Command frequency divider/multiplier numerator			**Valid mode(s)**	**P**		
	Range	1~1073741824	**Unit**	—	**Default**	1		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0502 L: 0x0503		
	Valid	After restart						
	To set command pulse input frequency division and multiplication numerator							
P05.02	**Label**	2nd Command frequency divider/multiplier denominator			**Valid mode(s)**	**P**		
	Range	1~1073741824	**Unit**	—	**Default**	1		

	Byte length	32bit	Attribute	R/W	485 address	H: 0x0504 L: 0x0505
	Valid	After restart				
	To set command pulse input frequency division and multiplication denominator. Please refer to P00.09 and P00.10. Switch using DIV1 signal.					

P05.04								
	Label	Driver prohibition input settings			Valid mode(s)	P	S	T
	Range	0/1/2	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0509		
	Valid	Immediate						

To set driver prohibition input (POT/NOT)

Value	Description
0	POT → Positive direction drive prohibited NOT → Negative direction drive prohibited
1	POT and NOT invalid
2	Any single sided input from POT or NOT might cause Er260

P05.06								
	Label	Servo-off mode			Valid mode(s)	P	S	T
	Range	0~5	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x050D		
	Valid	Immediate						

To set servo driver disable mode and status.

Value	Description	
	Mode	*Status*
0	Servo braking	Dynamic braking
1	Free stopping	Dynamic braking
2	Dynamic braking	Dynamic braking
3	Servo braking	Free-run
4	Free stopping	Free-run
5	Dynamic braking	Free-run

Servo braking: Stop servo axis quickly using braking torque
P05.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to P05.10

P05.09								
	Label	Main power-off detection time			Valid mode(s)	P	S	T
	Range	50~200	Unit	ms	Default	50		
	Byte length	16bit	Attribute	R/W	485 address	0x0513		
	Valid	Immediate						

To set delay time for detection of main power-off or low voltage supply.

P05.10								
	Label	Servo-off due to alarm mode			Valid mode(s)	P	S	T
	Range	0~2	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0515		
	Valid	After restart						

To set servo driver disable mode and status if alarm is triggered.
Alarm type 2:

Value	Explanation

	Mode	*Status*
0	Servo braking	Dynamic braking
1	Free stopping	Dynamic braking
2	Dynamic braking	Dynamic braking
3	Servo braking	Free-run
4	Free stopping	Free-run
5	Dynamic braking	Free-run

Alarm type 1:

Value	**Explanation**	
	Mode	*Status*
0	Dynamic braking	Dynamic braking
1		
2		
3	Servo braking	Free-run
4	Free stopping	Free-run
5	Dynamic braking	Free-run

P05.11	**Label**	Servo braking torque setting			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~500	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0517		
	Valid	Immediate						

To set torque limit for servo braking mode.
If P05.11 = 0, use torque limit as under normal situation.
Please note that if P05.11 set value is too low, emergency stop will take longer.

P05.12	**Label**	Overload level setting			有效模式	**P**	**S**	**T**
	Range	0~115	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0519		
	Valid	Immediate						

- When set to 0, overload level = 100%.
- Set to 0 under regular usage. Lowering overload level will cause motor to overload in shorter time.
- Er100 occurs when driver output current higher than motor rated current (overload)
  Er101 occurs when driver output current lower than motor rated current

P05.13	**Label**	Overspeed level settings			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10000	**Unit**	r/min	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x051B		
	Valid	Immediate						

If motor speed exceeds P05.13, Er1A0 might occur.
When P05.13 = 0, overspeed level = max. motor speed x 1.2

P05.15	**Label**	I/O digital filter			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~255	**Unit**	0.1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x051F		
	Valid	After restart						

Digital filtering of I/O input. Overly large value set will cause control delay.

P05.17	**Label**	Counter clearing input mode			**Valid mode(s)**	**P**		
	Range	0x0~0xFF	**Unit**	—	**Default**	0x13		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0523		

	Valid	Immediate				

High position: Set the clearing condition of the alarm clear zero input signal.
0= always clear (level clear)
1= only clear once (rising edge clear)

Low position: Set the deviation counter to zero the clearing condition of the input signal.
0/2/4= invalid 1= always clear (level clear)
3= only clear once (rising edge clear)

P05.18	Label	Torque Limit Analog A Source Selection			Valid mode(s)	P	S	T
	Range	0~3	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0525		
	Valid	After restart						
P05.19	Label	Torque Limit Analog B Source Selection			Valid mode(s)	P	S	T
	Range	0~3	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0527		
	Valid	After restart						

Value	Source selection
0	AI1
1	AI2
2	Reserved
3	Reserved

P05.20	Label	Position unit settings			Valid mode(s)	P		
	Range	0~2	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0529		
	Valid	Immediate						

Set unit for position related parameters

Value	Unit
0	Encoder unit
1	Command unit
2	0.0001rev

Command unit: Pulse from host (Affected by electronic gear ratio)
Encoder unit: Pulse from encoder (Related to encoder resolution)
P05.20 can only be modified when axis is disabled as it will clear position data

P05.21	Label	Torque limit selection			Valid mode(s)	P	S	T
	Range	0~9	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x052B		
	Valid	Immediate						

The torque limit can be limited by a direct set value or by an analog input.
Limit by directly setting the value Parameter
P00.13: First torque limit
P05.22: Second torque limit Limit by analog input Parameter
P05.18: Torque limit analog quantity A source selection
P05.19: Torque limit analog quantity B source selection

Value		Limit
【0】		Positive and negative torque limits: P00.13 First torque limit
1		Positive and negative torque limits: P05.22 Second torque limit
2	TL-SEL OFF	Positive torque limit: P00.13 First torque limit
	TL-SEL ON	Negative torque limit: P05.22 Second torque limit
3		Positive torque limit: AI 1 Negative torque limit: AI 2
4		Positive torque limit: P05.18 Torque limit analog A source selection Negative torque limit: P05.19 Torque limit analog B source selection
5		Positive torque limit: P00.13 First torque limit Negative torque limit: P05.22 Second torque limit
6		Positive torque limit: Minimum of P00.13 and P05.18 Negative torque limit: Minimum of P05.22 and P05.19
7	TL-SEL OFF	Positive torque limit: P05.18 Torque limit analog A source selection; Negative torque limit: P05.19 Torque limit analog B source selection
	TL-SEL ON	Positive torque limit: P05.19 Torque limit analog B source selection; Negative torque limit: P05.18 Torque limit analog A source selection
9	TL-SEL OFF	TL-SEL OFF: Positive torque limit: P05.18 Torque limit analog A source selection; Negative torque limit: P05.22 Second torque limit
	TL-SEL ON	TL-SEL ON: Positive torque limit: P05.22 Second torque limit; Negative torque limit: P05.19 Torque limit analog B source selection

P05.22	Label	2nd torque limit			Valid mode(s)	P	S	T
	Range	0~500	Unit	%	Default	300		

	Byte length	16bit	**Attribute**	R/W	**485 address**	0x052D		
	Valid	Immediate						
	P05.22 is limited by max. torque set in motor parameter.							

P05.23	**Label**	Positive torque warning threshold			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~300	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x052F		
	Valid	Immediate						
	Default = 0, which is 95%. Other values only valid when P05.21 = 5. If actual torque higher than threshold, TLC torque limit signal will be valid.							

P05.24	**Label**	Negative torque warning threshold			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~300	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0531		
	Valid	Immediate						
	Default = 0, which is 95%. Other values only valid when P05.21 = 5. If actual torque higher than threshold, TLC torque limit signal will be valid.							

P05.25	**Label**	Analog 1 torque limit gain			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	30		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0533		
	Valid	Immediate						
	Torque Limit Gain for Analog Input 1: 0.1V/100% Example: With the default value of 30, an analog input of 3V corresponds to a torque reference of 100%.							

P05.26	**Label**	Analog 2 torque limit gain			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	30		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0535		
	Valid	Immediate						
	Torque Limit Gain for Analog Input 2: 0.1V/100% Example: With the default value of 30, an analog input of 3V corresponds to a torque reference of 100%.							

P05.27	**Label**	Analog 3 torque limit gain			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	30		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0537		
	Valid	Immediate						
	Torque Limit Gain for Analog Input 3: 0.1V/100% Example: With the default value of 30, an analog input of 3V corresponds to a torque reference of 100%.							

P05.28	**Label**	LED initial status			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~50	**Unit**	—	**Default**	34		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0539		
	Valid	Immediate						

To set content display on front panel of the servo driver at servo driver power on.

Value	Status	Value	Status	Value	Status
0	Position deviation	14	Regenerative load rate	28	Software version
1	Motor speed	15	Overload rate	29	Internal usage
2	Position command deviation	16	Inertia load ratio	30	Encoder communication failure counts
3	Velocity control command	17	Cause(s) of non-rotation	31	Accumulated uptime
4	Actual feedback torque	18	No. of I/O changes	32	Internal usage
5	Feedback pulse sum	19	Internal usage	33	Driver temperature
6	Command pulse sum	20	Absolute encoder data	34	Servo status
7	Max. torque	21	Encoder single turn data	35	Internal usage
8	Position command frequency	22	Encoder multiturn data	43	External encoder Z-phase count
9	Control mode	23	485 receive frame	44	External encoder feedback pulse per revolution
10	I/O status	24	Encoder position deviation	45	External encoder direction
11	Analogue input	25	Internal usage	46	Current position comparison point
12	Alarm cause & history record	26	Internal usage	47	Analog output voltage
13	Warning ID	27	PN Voltage	49	Gantry Communication Status
				50	gantry synchronization error

P05.29	Label	RS485 communication mode			Valid mode(s)	P	S	T
	Range	0~31	Unit	—	Default	5		
	Byte length	16bit	Attribute	R/W	485 address	0x053B		
	Valid	After restart						

Value	Bit	Checksum	Stop
0	8	Even	2
1	8	Odd	2
2	8	Even	1
3	8	Odd	1
4	8	Null	1
【5】	8	Null	2

P05.30	Label	RS485 communication Baud rate			Valid mode(s)	P	S	T
	Range	0~13	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x053D		
	Valid	After restart						

Value	Baud rate
0	2400bps
1	4800bps
2	9600bps
3	19200bps

Value	Baud rate
【4】	38400bps
5	57600bps
6	115200bps

Baud rate tolerance: 2400～38400bps±0.5%, 57600～115200bps±2%

P05.31	Label	RS485 axis address			Valid mode(s)	P	S	T
	Range	0~127	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x053F		
	Valid	After restart						

When controller is connected to multiple axis and controller needs to identify the axis, P05.31 can be used to set the axis ID/address.
Please set to a max of 31 if the communication is between RS232 and RS485

P05.32	Label	Max. command pulse input frequency			Valid mode(s)	P		
	Range	0~8000	Unit	kHz	Default	4100		
	Byte length	16bit	Attribute	R/W	485 address	0x0541		
	Valid	Immediate						

Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds P05.32.

P05.35	Label	Front panel lock setting			Valid mode(s)	P	S	T
	Range	0~1	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0547		
	Valid	Immediate						

Value	Description
【0】	Front panel not lock
1	Only parameter modification through front panel is locked

P05.37	Label	Torque saturation alarm detection time			Valid mode(s)	P	S	T
	Range	0~5000	Unit	ms	Default	500		
	Byte length	16bit	Attribute	R/W	485 address	0x0549		
	Valid	Immediate						

To set the delay time for detection of torque over limit under torque homing mode.
Under homing mode, when torque exceeds limit and the time set in P05.37, TLC output signal will be valid.

P05.39	Label	3rd torque limit			Valid mode(s)	P	S	T
	Range	0~500	Unit	%	Default	80		
	Byte length	16bit	Attribute	R/W	485 address	0x0551		
	Valid	Immediate						

The torque limit value is used in the torque return to zero mode

P05.40	Label	D41 set value			Valid mode(s)	P	S	T
	Range	0x0~0xFFFFF	Unit	%	Default	0X30C		
	Byte length	16bit	Attribute	R/W	485 address	0x0553		
	Valid	Immediate						

Set object word monitored by D41, index (left 4 bits) + sub-index (right 1 bit), if monitoring 0x6092-01, set P05.40 to 0x60921.

P05.42	Label	Frequency divider output – Z-signal polarity	Valid mode(s)	P	S	T

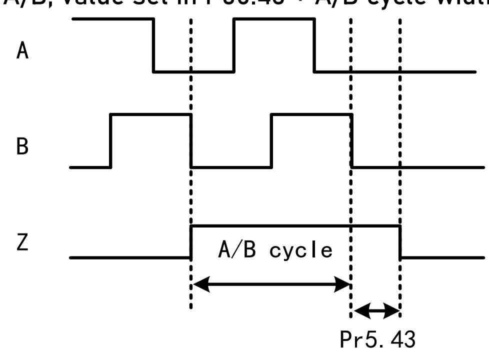
	Range	0~7	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0555
	Valid	Disabled				

Bit	Polarity	Description
Bit0	0 = Positive 1 = Negative	Z polarity setting of frequency divider output and position comparison
Bit1	0 = Positive 1 = Negative	Only valid in position comparison. Polarity setting when phase A frequency divider as position comparison output
Bit2	0 = Positive	Only valid in position comparison. Polarity setting when phase B frequency divider as position comparison output

P05.43	**Label**	Frequency divider output – Z-signal width			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~500	**Unit**	0.1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0557		
	Valid	After restart						

Value	Description
【0】	Z bandwidth equivalent to 1 cycle of A/B
1~500	Delay setting on top of A/B cycle width

When P05.43 = 0, width of frequency divider output Z-signal is equivalent to width of 1 cycle of A/B, value set in P05.43 + A/B cycle width = delay setting.



P05.44	**Label**	Frequency divider output source			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~4	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0559		
	Valid	After restart						

Value	Description
【0】	Position feedback of encoder #1(motor encoder)
1	Position feedback of encoder #2(external encoder)
2	Reserved
3	Pulse input command position synchronous output; position comparison not available in this mode
4	Frequency divider output prohibited

P05.45	**Label**	External encoder feedback overspeed threshold			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10000	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x055A		

	Valid	After restart						
	External encoder overspeed setting threshold							

P05.46	Label	Vent overload level			Valid mode(s)	P	S	T
	Range	0~115	Unit	%	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x055D		
	Valid	After restart						

Value	Description
【0】	Default level: 80%
1~115	Set vent overload level accordingly

P05.58	Label	Frequency division output delay compensation			Valid mode(s)	P		
	Range	-10000~10000	Unit	0.1us	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0575		
	Valid	After restart						
	Compensate the output delay caused by the frequency division output signal transmission, and the larger the setting value, the stronger the compensation effect.							

P05.70	Label	Velocity reaches hysteresis width			Valid mode(s)		S	
	Range	0~100	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x058D		
	Valid	Immediate						
	"The speed reaches the hysteresis ring width setting, that is, the hysteresis can be set Used with P04.35 parameters The timing of the output when the speed is consistent with OFF -> ON (P04.35-P05.70) Timing of ON->OFF (P04.35 P05.70)							

3.2.7 [Class 6] Other settings

P06.01	Label	Encoder zero position compensation			Valid mode(s)	P	S	T
	Range	0~360	Unit	Electrical angel	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0603		
	Valid	Power-off						
	Zero position compensation for encoder zero drift to avoid abnormality due to zero drift.							

P06.03	Label	JOG trial run torque command			Valid mode(s)			T
	Range	0~750	Unit	%	Default	100		
	Byte length	16bit	Attribute	R/W	485 address	0x0607		
	Valid	Immediate						
	To set torque for JOG trial run command.							
P06.04	Label	JOG trial run velocity command			Valid mode(s)	P	S	T
	Range	0~10000	Unit	r/min	Default	50		
	Byte length	16bit	Attribute	R/W	485 address	0x0609		
	Valid	Immediate						

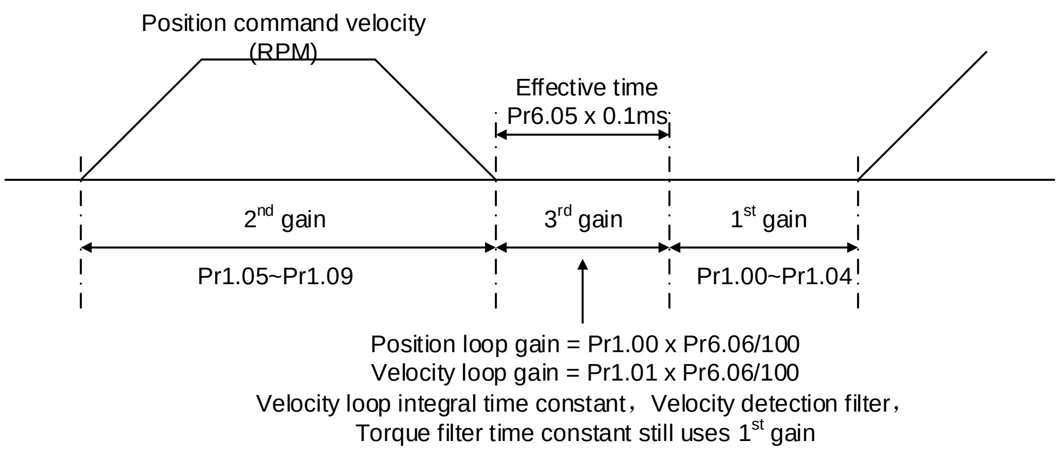
To set velocity for JOG trial run command.

P06.05	**Label**	Position 3^{rd} gain valid time			**Valid mode(s)**	**P**		
	Range	0~10000	**Unit**	0.1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060B		
	Valid	Immediate						

To set time for 3^{rd} gain to be valid
Only available in position mode
When not in use, set P06.05=0, P06.06=100

P06.06	**Label**	Position 3^{rd} gain scale factor			**Valid mode(s)**	**P**		
	Range	1~1000	**Unit**	%	**Default**	100		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060D		
	Valid	Immediate						

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



Above diagram is illustrated using P01.15 = 7.
3^{rd} gain= 1^{st} gain * P06.06/100
Only effective under position control mode. 3^{rd} gain valid when P06.05 ≠ 0. Set 3^{rd} gain value in P06.06. When 2^{nd} gain switches to 1^{st} gain, it will go through 3^{rd}, switching time is set in P01.19.

P06.07	**Label**	Torque command additional value			**Valid mode(s)**	**P**	**S**	**T**
	Range	-100~100	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060F		
	Valid	Immediate						

To set torque forward feed additional value of vertical axis.
Applicable for loaded vertical axis, compensate constant torque.
Application: When load move along vertical axis, pick any point from the whole motion and stop the load at that particular point with motor enabled but not rotating. Record output torque value from d04, use that value as torque command additional value (compensation value)

P06.08	**Label**	Positive direction torque compensation value			**Valid mode(s)**	**P**	**S**	**T**
	Range	-100~100	**Unit**	%	**Default**	0		

	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0611
	Valid	Immediate				

P06.09	**Label**	Negative direction torque compensation value			**Valid mode(s)**	**P S T**
	Range	-100~100	**Unit**	%	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0613
	Valid	Immediate				

Sets the feedforward torque overlay value for the torque command.
It aims to reduce the influence of friction on the operation effect in mechanical transmission, and different positive and negative compensation values are carried out according to the positive and negative directions of operation.
For example, when the motor speed is at a constant speed, monitor the value of the output torque of d04, the value of d04 is recorded as T1 when running in the forward direction, and the value of d04 is recorded as T2 when running in the negative direction.
then the friction torque Tf=| T1-T2|/2, the size of Tf is the setting value of P06.08 and P0 6.09.
Note: The positive and negative compensation directions are determined according to the actual position instructions, and the torque compensation value in the positive direction is set to positive (P06.08= Tf) and the friction compensation value in the negative direction is set to negative (P06.09=-Tf).

P06.10	**Label**	Function extension setting			**Valid mode(s)**	**P S T**
	Range	0x0~0xFFFF	**Unit**	-	**Default**	0X0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0615
	Valid	Immediate				

Bit4: Torque compensation is on
Bit13: PR homing offset setting function is enabled

P06.11	**Label**	Current response settings			**Valid mode(s)**	**P S T**
	Range	50~100	**Unit**	%	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0617
	Valid	Immediate				

To set driver current loop related effective value ratio.

P06.14	**Label**	Max. time to stop after disabling			**Valid mode(s)**	**P S T**
	Range	0~1000	**Unit**	ms	**Default**	500
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x061D
	Valid	Immediate				

To set the max. time allowed for the axis to stop on emergency stop or normal axis disabling.
After disabling axis, if motor speed is still higher than P04.39 but the time set in P06.14 is reached, BRK_ON given and holding brake activated.
BRK_ON given time is determined by P06.14 or when motor speed goes below P04.39, whichever comes first.

Applications:
1. After disabling axis, if motor speed is still higher than P04.39 but the time set in P06.14 is reached, BRK_ON given and holding brake activated.
2. After disabling axis, if motor speed is already lower than P04.39 but the time set in P06.14 is not yet reached, BRK_ON given and holding brake activated.

Dynamic brake will be provide the braking function if the function is activated for motors without holding brake.

P06.20	**Label**	Trial run distance			**Valid mode(s)**	P	
	Range	0~1200	**Unit**	0.1rev	**Default**	10	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0629	
	Valid	Immediate					
	JOG (Position control) : Distance travel of each motion.						

P06.21	**Label**	Trial run waiting time			**Valid mode(s)**	P	
	Range	0~30000	**Unit**	ms	**Default**	300	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x062B	
	Valid	Immediate					
	JOG (Position control) : Waiting time interval after each motion cycle						
P06.22	**Label**	No. of trial run cycles			**Valid mode(s)**	P	
	Range	0~32767	**Unit**	—	**Default**	5	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x062D	
	Valid	Immediate					
	JOG (Position control) : No. of cycles When P06.22=0, trial run goes into endless cycles.						
P06.25	**Label**	Trial run acceleration			**Valid mode(s)**	P	S
	Range	0~10000	**Unit**	ms	**Default**	200	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0633	
	Valid	Immediate					
	JOG commissioning acceleration and deceleration time from 0 to 1 m/s						
P06.28	**Label**	Observer gain			**Valid mode(s)**	P	S
	Range	0~32767	**Unit**	%	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0639	
	Valid	Immediate					
	0：Default stable gain 1：OFF x：(unit：%) Manual, related to motor, load and encoder						
P06.29	**Label**	Observer filter			**Valid mode(s)**	P	S
	Range	0~32767	**Unit**	μs	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x063B	
	Valid	Immediate					
	0：Default stable observer filter 1：OFF x：(unit：μs) Manual, related to motor, load and encoder						

P06.56	**Label**	Blocked rotor alarm torque threshold			**Valid mode(s)**	P	S
	Range	0~300	**Unit**	%	**Default**	300	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0671	
	Valid	Immediate					
	To set the torque threshold of blocked rotor to trigger alarm. (Alarm triggered if torque output% larger than threshold value & under 10rpm) If P06.56 = 0, blocked rotor alarm deactivated. If motor speed is 10rpm or above, Er102 won't be triggered.						
P06.57	**Label**	Blocked rotor alarm delay time			**Valid mode(s)**	P	S

	Range	1~10000	**Unit**	ms	**Default**	400
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0673
	Valid	Immediate				

To set delay time for blocked rotor alarm. Err102 won't be triggered if time doesn't exceed set time in P06.57.
Blocked rotor alarm is activated by default, alarm torque threshold = 300%, delay time = 400ms; speed threshold = 10rpm;

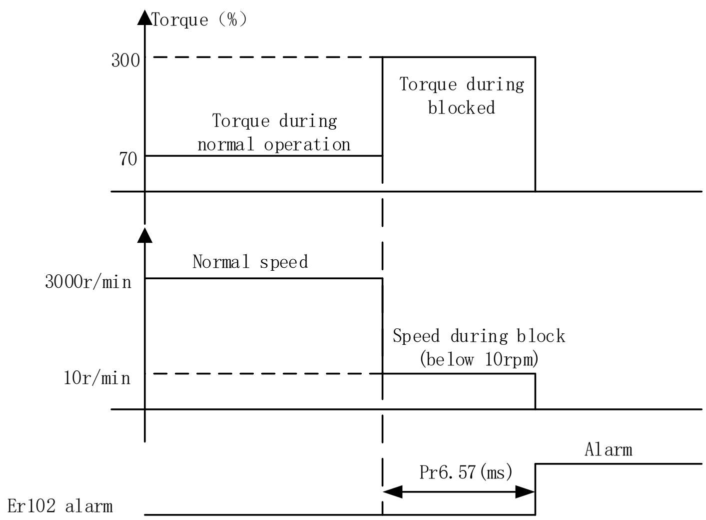


Diagram shows blocked rotor with speed under 10rpm

If the rotor is blocked but with speed over 10rpm, Er102 would not be triggered but Er100 might occur.

P06.59	**Label**	Home Mode In-position Threshold			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**	-	**Default**	8		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0677		
	Valid	After restart						

Used to set the home mode in-position threshold, which is compared with the relative position error. When the relative position error is within the threshold range, the judgment starts that the home position is in-position.

P06.61	**Label**	Z signal holding time			**Valid mode(s)**	**P**	**S**	**T**
	Range	1~1000	**Unit**	ms	**Default**	10		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x067B		
	Valid	After restart						

Sets the time for which the DO output Z signal is maintained.

P06.63	**Label**	Absolute multiturn data upper limit			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~32766	**Unit**	rev	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x067F		
	Valid	After restart						

Use P00.15 = 2 in rotational mode, Feedback position cycles between 0 and (P06.63+1) x encoder resolution.
Absolute multiturn data will be set to 0 if reaches upper limit.

P06.91	**Label**	Homing Mode In-position Delay Time			**Valid mode(s)**	**P**	**S**	**T**
	Range		**Unit**	rev	**Default**			
	Byte length	16bit	**Attribute**	R/W	**485 address**			

	Valid	After restart				
	Valid only in Incremental Mode. To prevent misjudgment of homing in-position when the motor is not yet stable (which would cause the zero position value to be non-zero), a Homing Delay setting is added on the driver side. When the relative position error is less than the Home Mode In-position Threshold (P06.59), the Homing In-position Signal starts to output only after this delay time elapses.					

3.2.8 [Class 7] Factory settings

**Please take precaution when modifying Class 7 parameters. Might cause driver errors*

P07.15	**Label**	Motor model			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFFFF	**Unit**	—	**Default**	0x200		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x071F		
	Valid	After restart						

Value	Description
0x100	Read from EEPROM
[0x200]	Read from Encoder

When P07.15 = 0x200(2xx):

Parameter	Label
P07.00	Current loop gain
P07.01	Current loop integral time
P07.05	No. of motor pole pairs
P07.06	Motor phase resistance
P07.07	Motor D/Q induction
P07.08	Motor back EMF coefficient
P07.09	Motor torque coefficient
P07.10	Motor rated rotational speed
P07.11	Motor max. rotational speed
P07.12	Motor rated current
P07.13	Motor rotor inertia
P07.14	Driver power rating
P07.16	Encoder
P07.17	Motor max. current
P07.18	Encoder index angle compensation

P07.16	**Label**	Encoder			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFFFFFFFF	**Unit**	—	**Default**	编码器决定		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0721		
	Valid	After restart						

Select encoder type; typically, the type is read directly from the encoder.
bit7: Encoder direction, =0: Forward direction, =1: Reverse direction
bit12~14: Encoder type
=0: ABZ incremental encoder
=1: RS485 master-slave communication
=2: BiSS-C encoder
=3: ABZ differential + single-ended Hall (UVW)
bit16: UV swap, =1: Swap, =0: Do not swap
bit17: VW swap, =1: Swap, =0: Do not swap
bit18: UW swap, =1: Swap, =0: Do not swap
bit19: HALL U inversion, =1: Invert, =0: Do not invert
bit20: HALL V inversion, =1: Invert, =0: Do not invert

P07.54	Label	Accuracy of external grating ruler			Valid mode(s)	P	S	T
	Range	0~1000000	Unit	nm	Default	100		
	Byte length	16bit	Attribute	R/W	485 address	0x076D		
	Valid	After restart						
	Select the accuracy of the external grating ruler, the unit is nm.							
P07.57	Label	Motor Overheat Threshold			Valid mode(s)	P	S	T
	Range	1~150	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0773		
	Valid	Immediate						
	The setting of the motor overtemperature threshold is valid only when the driver supports the temperature sensor.							
P07.60	Label	Encoder Communication Protocol			Valid mode(s)	P	S	T
	Range	0~32767	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0779		
	Valid	Immediate						
P07.77	Label	BISS-C encoder single turn			Valid mode(s)	P	S	T
	Range	0~32	Unit	-	Default	32		
	Byte length	16bit	Attribute	R/W	485 address	0x079B		
	Valid	After restart						
	Set the number of single turn bits of BISS-C encoder.							
P07.78	Label	BISS-C encoder multi turn			Valid mode(s)	P	S	T
	Range	0~16	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x079D		
	Valid	After restart						
	Set the number of multi turn bits of BISS-C encoder.							
P07.79	Label	BISS-C encoder communication rate			Valid mode(s)	P	S	T
	Range	0~100	Unit	0.1M Hz	Default	25		
	Byte length	16bit	Attribute	R/W	485 address	0x079F		
	Valid	After restart						
	Set the communication rate of BISS-C encoder.							
P07.80	Label	BISS-C encoder terminal polarity			Valid mode(s)	P	S	T
	Range	0x0~0x7FF	Unit	-	Default	0X0		
	Byte length	16bit	Attribute	R/W	485 address	0x0781		
	Valid	After restart						
	Bit0: CLK pin polarity Bit1: DATA pin polarity Bit2: CLK and DATA pin swap Bit3~Bit10: DATA pin filter time constant, unit: 0.01us							
P07.83	Label	Motor Zero Position Single Turn Position			Valid mode(s)	P	S	T

	Range	-2147483648 ~ 2147483647	**Unit**	-	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0787
	Valid	After restart				
	Set the position value of the electrical angle zero position for the BISS-C encoder.					

3.2.9 [Class 8] PR control parameters

P08.00	**Label**	PR Control			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6000

It is recommended to modify PR control parameters using Motion Studio.

Bit	3	2	1	0
Description	=1, absolute value memory =0, absolute value with no memory	=1, homing upon power on =0, no homing upon power on	=1, software position limit valid =0, software position limit not valid	=0, CTRG rising edge trigger =1, double edges trigger

If parameter modifications are done through the front panel or parameters list, please keep in mind that PR control parameters byte are decimal system.
For example: If Bit 3, 2, 1, 0 are to be set to 1 (1111). Conversion using decimal system, 1111 = 15, P08.00 is to be set to 15.

P08.01	**Label**	Path count			**Valid mode(s)**	**PR**
	Range	16	**Unit**	/	**Default**	16
	Byte length	16bit	**Attribute**	R	**485 address**	0X6001
	16 paths					
P08.02	**Label**	Control Operation			**Valid mode(s)**	**PR**
	Range	0x0 ~ 0xFFFF	**Unit**	/	**Default**	0x0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6002

Attributes of P08.02 functions are divided into Read/Write. P refers to positioning motion of *N* path. Please refer to the following table.

Attribute	Address	Description
Write	0x01P	*N* path positioning
Write	0x020	Reset
Write	0x021	Manually set currently position as 0 (Origin)
Write	0x040	Emergency stop
Read	0x000P	Positioning completed. Ready to receive new data
Read	0x01P, 0x020, 0x040	Yet to respond to command
Read	0x10P	Path motion undergoing
Read	0x200	Command completed. Waiting for positioning

P08.06	**Label**	Software positive limit H			**Valid mode(s)**	**PR**
	Range	0~ 65535	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6006
	High bit of software positive limit；(Only valid using 485 communication)					

P08.07	**Label**	Software positive limit (L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6007
	To set software positive limit position (32 bit base) Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P08.06 When software positive limit = 994817, 0x000F2E01(Hexadecimal) high16bit = 0x000F, hence P08.05 reading = 0x000F, controller = 15. R/W of high/low bit data is similar when using 485 communication.					
P08.08	**Label**	Software negative limit H			**Valid mode(s)**	**PR**
	Range	0~ 0x65535	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6008
	High bit of software negative limit；(Only valid using 485 communication)					
P08.09	**Label**	Software negative limit (L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6009
	To set software positive limit position. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P08.08.					

P08.10	**Label**	Homing mode			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X600A
	To set homing method in PR mode. It is recommended to modify PR control parameters using Motion Studio.					

Bit	8（Z-signal homing）	2-7（Homing mode）	1（Specific position after homing）	0（Homing direction）
Description	=1, homing with Z-signal =0, homing without Z-signal	=0 Limit homing =1 Origin homing =2 Single turn Z homing =3 Torque homing =8 Immediate homing	=1, Yes =0, No	=1, Forward =0, Reverse

P08.11	**Label**	Zero position H			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X600B
	High bit of zero position；(Only valid using 485 communication)					

P08.10	**Label**	Homing mode			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X600A

To set homing method in PR mode. It is recommended to modify PR control parameters using Motion Studio.

Bit	8（Z-signal homing）	2-7（Homing mode）	1（Specific position after homing）	0（Homing direction）
Description	=1, homing with Z-signal =0, homing without Z-signal	=0 Limit homing =1 Origin homing =2 Single turn Z homing =3 Torque homing =8 Immediate homing	=1, Yes =0, No	=1, Forward =0, Reverse

P08.11	**Label**	Zero position H			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X600B
	High bit of zero position;（Only valid using 485 communication)					

P08.12	**Label**	Zero position (L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	p	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X600C
	To set zero position. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P08.11.					
P08.13	**Label**	Home position offset H			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X600D
	High bit of home position offset;（Only valid using 485 communication)					
P08.14	**Label**	Home position offset (L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	p	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X600E
	To set home position offset. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P08.13.					
P08.15	**Label**	High homing velocity			**Valid mode(s)**	**PR**
	Range	1 ~ 6000	**Unit**	rpm	**Default**	200
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X600F
	To set high homing velocity in PR mode.					
P08.16	**Label**	Low homing velocity			**Valid mode(s)**	**PR**
	Range	1 ~ 6000	**Unit**	rpm	**Default**	50
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6010
	To set low homing velocity in PR mode.					

P08.17	**Label**	Homing acceleration			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6011

	To set homing acceleration time in PR mode, time needed for 0rpm to accelerate to 1000rpm					
P08.18	**Label**	Homing deceleration			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6012
	To set homing deceleration time in PR mode, time needed for 1000rpm to decelerate to 0rpm					
P08.19	**Label**	Homing torque holding time			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	ms	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6013
	To set homing torque holding time					
P08.20	**Label**	Homing torque			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	%	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6014
	To set homing torque					

P08.21	**Label**	Homing overtravel alarm range			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	0.1r	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6015
	To set homing overtravel alarm threshold.					

P08.22	**Label**	Emergency stop at limit deceleration			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	10
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6016
	To set position limit emergency stop deceleration.					
P08.23	**Label**	STP emergency stop deceleration			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	50
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6017
	To set STP emergency stop deceleration.					

P08.26	**Label**	I/O combination trigger mode			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X601A

Value	Description
【0】	Disable I/O combination trigger mode. Uses I/O CTRG signal edge trigger.
1	Enable I/O combination trigger. Valid when HOME-OK signal is valid.
2	Enable I/O combination trigger. HOME-OK signal not required.

IO combination trigger select path using ADD0~ADD3. Trigger mode is set in P08.26.

ADD3	ADD2	ADD1	ADD0	Path selection
OFF	OFF	OFF	OFF	Path 0 (Non-action)
OFF	OFF	OFF	ON	Path1
OFF	OFF	ON	OFF	Path2
OFF	OFF	ON	ON	Path3
OFF	ON	OFF	OFF	Path4
OFF	ON	OFF	ON	Path5
OFF	ON	ON	OFF	Path6
OFF	ON	ON	ON	Path7

ON	OFF	OFF	OFF	Path8
ON	OFF	OFF	ON	Path9
ON	OFF	ON	OFF	Path10
ON	OFF	ON	ON	Path11
ON	ON	OFF	OFF	Path12
ON	ON	OFF	ON	Path13
ON	ON	ON	OFF	Path14
ON	ON	ON	ON	Path15

P08.27	Label	I/O combination filter			Valid mode(s)	PR
	Range	0 ~ 10000	Unit	ms	Default	5
	Byte length	16bit	Attribute	R/W	485 address	0X601B

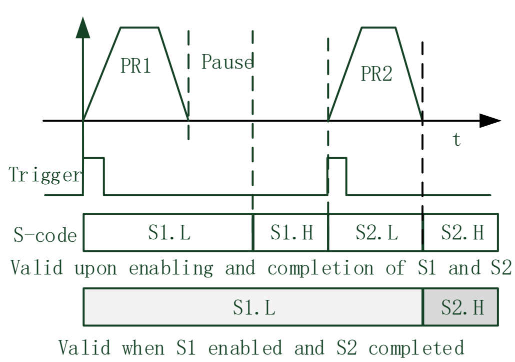
To set I/O combination filter time.

P08.28	Label	S-code current output value			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X601C

S-code（Status code）is the S-code of currently operating PR positioning data. Every PR path has a S-code setting.

S-code	Sx.H		Sx.L	
Bit	15	8-14	7	0-6
Description	S-code valid when completed. 0: Invalid, retain previous value 1: Valid	S-code upon completion	S-code valid upon activation 0: Invalid 1: Valid	S-code upon activation

Sequence diagram



S-code bit	bit0/8	bit1/9	bit2/10	bit3/11	bit4/12	bit5/13	Bit6/14
SDx	SD0	SD1	SD2	SD3	SD4	SD5	SD6

P08.29	Label	PR warning			Valid mode(s)	PR
	Range	0x0~0x20F	Unit	/	Default	0

	Byte length	16bit	Attribute	R/W	485 address	0X601D

Address	Warning
0	Reset new command automatically
0x100	Position limit error during homing
0x101	Emergency stop. Homing not completed
0x102	Homing overtravel alarm
0x20x	Position limit error on Path *N*

P08.39	Label	JOG velocity			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	rpm	Default	100
	Byte length	16bit	Attribute	R	485 address	0X6027
	Set JOG velocity in PR mode.					
P08.40	Label	JOG acceleration			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R	485 address	0X6028
	Set JOG acceleration in PR mode.					

P08.41	Label	JOG deceleration			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R	485 address	0X6029
	Set JOG deceleration in PR mode.					

P08.42	Label	Command position H			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	
	Byte length	16bit	Attribute	R	485 address	0X602A
	High bit of command position；(Only valid using 485 communication)					
P08.43	Label	Command position（L）			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	p	Default	
	Byte length	32bit	Attribute	R	485 address	0X602B
	To set PR-motion command position. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P08.42.					
P08.44	Label	Motor position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	/	Default	
	Byte length	16bit	Attribute	R	485 address	0X602C
	High bit of command position；(Only valid using 485 communication)					
P08.45	Label	Motor position（L）			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	p	Default	
	Byte length	32bit	Attribute	R	485 address	0X602D
	Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P08.44.					

P08.46	Label	Input I/O status	Valid mode(s)	PR

	Range	0 ~ 65535	**Unit**	/	**Default**	
	Byte length	16bit	**Attribute**	R	**485 address**	0X602E
	Input I/O status, displays in decimal system. Convert to binary system to determine which bit is valid.					
P08.47	**Label**	Output I/O status			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	
	Byte length	16bit	**Attribute**	R	**485 address**	0X602F
	Output I/O status, displays in decimal system. Convert to binary system to determine which bit is valid.					

P08.48	**Label**	Path 0 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6030
	Please refer to P08.28 for S-code setting.					

P08.49	**Label**	Path 1 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6031
	Please refer to P08.28 for S-code setting.					

P08.50	**Label**	Path 2 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6032
	Please refer to P08.28 for S-code setting.					

P08.51	**Label**	Path 3 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6033
	Please refer to P08.28 for S-code setting.					

P08.52	**Label**	Path 4 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6034
	Please refer to P08.28 for S-code setting.					

P08.53	**Label**	Path 5 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6035
	Please refer to P08.28 for S-code setting.					

P08.54	**Label**	Path 6 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6036
	Please refer to P08.28 for S-code setting.					

P08.55	**Label**	Path 7 S-code			**Valid mode(s)**	**PR**

	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6037
	Please refer to P08.28 for S-code setting.					

P08.56	**Label**	Path 8 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6038
	Please refer to P08.28 for S-code setting.					

P08.57	**Label**	Path 9 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6039
	Please refer to P08.28 for S-code setting.					

P08.58	**Label**	Path 10 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X603A
	Please refer to P08.28 for S-code setting.					

P08.59	**Label**	Path 11 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X603B
	Please refer to P08.28 for S-code setting.					

P08.60	**Label**	Path 12 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X603C
	Please refer to P08.28 for S-code setting.					

P08.61	**Label**	Path 13 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X603D
	Please refer to P08.28 for S-code setting.					

P08.62	**Label**	Path 14 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X603E
	Please refer to P08.28 for S-code setting.					

P08.63	**Label**	Path 15 S-code			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X603F
	Please refer to P08.28 for S-code setting.					

3.2.10 [Class 9] PR control path parameters

It is more convenient to set Class 9 parameters on Motion Studio

P09.00	Label	PR0 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6200

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.01	Label	PR0 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6201

High bit of Path 0 position；(Only valid using 485 communication)

P09.02	Label	PR0 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X6202

For Path 0 position, using 485 communication, only able to R/W low 16 bit.
R/W high 16 bit needs to be realized through P09.02.

P09.03	Label	PR0 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X6203

To set PR path 0 velocity.

P09.04	Label	PR0 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6204

To set PR path 0 acceleration time, time needed for 0rpm to accelerate to 1000rpm

P09.05	Label	PR0 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6205

To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm

P09.06	Label	PR0 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6206

To set pause time for PR path 0 from completion to next path

P09.07	Label	PR0 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X6207

Reserved

P09.08	**Label**	PR1 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6208

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.09	**Label**	PR1 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6209
	High bit of Path 1 position;(Only valid using 485 communication)					
P09.10	**Label**	PR1 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X620A
	For Path position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.09.					
P09.11	**Label**	PR1 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X620B
	To set PR path 1 velocity.					
P09.12	**Label**	PR1 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X620C
	To set PR path 1 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.13	**Label**	PR1 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X620D
	To set PR path 1 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.14	**Label**	PR1 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X620E
	To set pause time for PR path 2 from completion to next path					
P09.15	**Label**	PR1 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X620F
	Reserved					

P09.16	**Label**	PR2 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6210

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using！	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.17	**Label**	PR2 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6211

High bit of Path 2 position；(Only valid using 485 communication)

P09.18	**Label**	PR2 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6212

For Path 2 position, using 485 communication, only able to R/W low 16 bit.
R/W high 16 bit needs to be realized through P09.17.

P09.19	**Label**	PR2 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6213

To set PR path 2 velocity.

P09.20	**Label**	PR2 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6214

To set PR path 2 acceleration time, time needed for 0rpm to accelerate to 1000rpm

P09.21	**Label**	PR2 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6215

To set PR path 2 deceleration time, time needed for 1000rpm to decelerate to 0rpm

P09.22	**Label**	PR2 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6216

To set pause time for PR path 2 from completion to next path

P09.23	**Label**	PR2 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6217

Reserved

P09.24	**Label**	PR3 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6218

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.25	**Label**	PR3 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6219
	High bit of Path 3 position；(Only valid using 485 communication)					
P09.26	**Label**	PR3 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X621A
	For Path 3 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.25.					
P09.27	**Label**	PR3 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X621B
	To set PR path 3 velocity.					
P09.28	**Label**	PR3 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X621C
	To set PR path 3 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.29	**Label**	PR3 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X621D
	To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.30	**Label**	PR3 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X621E
	To set pause time for PR path 3 from completion to next path					
P09.31	**Label**	PR3 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X621F
	Reserved					

P09.32	**Label**	PR4 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6220

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.33	**Label**	PR4 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6221
	High bit of Path 0 position；(Only valid using 485 communication)					
P09.34	**Label**	PR4 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6222
	For Path 4 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.33.					
P09.35	**Label**	PR4 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6223
	To set PR path 4 velocity.					
P09.36	**Label**	PR0 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6224
	To set PR path 4 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.37	**Label**	PR4deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6225
	To set PR path 4 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.38	**Label**	PR4 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6226
	To set pause time for PR path 4 from completion to next path					
P09.39	**Label**	PR4 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6227
	Reserved					

P09.40	**Label**	PR5 mode				**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/		**Default**	0
	Byte length	16bit	**Attribute**	R/W		**485 address**	0X6228

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.41	**Label**	PR5 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6229
	High bit of Path 5 position；(Only valid using 485 communication)					
P09.42	**Label**	PR5 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X622A
	For Path 0 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.41.					
P09.43	**Label**	PR5 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X622B
	To set PR path 5 velocity.					
P09.44	**Label**	PR5 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X622C
	To set PR path 5 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.45	**Label**	PR5 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X622D
	To set PR path 5 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.46	**Label**	PR5 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X622E
	To set pause time for PR path 5 from completion to next path					
P09.47	**Label**	PR5 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X622F
	Reserved					

P09.48	**Label**	PR6 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6230

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.49	**Label**	PR6 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6231
	High bit of Path 6 position；(Only valid using 485 communication)					
P09.50	**Label**	PR6 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6232
	For Path 6 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.49.					
P09.51	**Label**	PR6 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6233
	To set PR path 6 velocity.					
P09.52	**Label**	PR6 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6234
	To set PR path 6 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.53	**Label**	PR6 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6235
	To set PR path 6 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.54	**Label**	PR6 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6236
	To set pause time for PR path 6 from completion to next path					
P09.55	**Label**	PR6 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6237
	Reserved					

P09.56	**Label**	PR7 mode				**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/		**Default**	0
	Byte length	16bit	**Attribute**	R/W		**485 address**	0X6238

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.57	**Label**	PR7 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6239
	High bit of Path 7 position；(Only valid using 485 communication)					
P09.58	**Label**	PR7 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X623A
	For Path 7 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.57.					
P09.59	**Label**	PR7 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X623B
	To set PR path 7 velocity.					
P09.60	**Label**	PR7 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X623C
	To set PR path 7 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.61	**Label**	PR0 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X623D
	To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.62	**Label**	PR7 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X623E
	To set pause time for PR path 7 from completion to next path					
P09.63	**Label**	PR7 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X623F
	Reserved					

P09.64	Label	PR8 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6240

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.65	Label	PR8 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6241

High bit of Path 0 position；(Only valid using 485 communication)

P09.66	Label	PR8 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X6242

For Path 8 position, using 485 communication, only able to R/W low 16 bit.
R/W high 16 bit needs to be realized through P09.65.

P09.67	Label	PR8 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X6243

To set PR path 8 velocity.

P09.68	Label	PR8 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6244

To set PR path 8 acceleration time, time needed for 0rpm to accelerate to 1000rpm

P09.69	Label	PR8 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6245

To set PR path 8 deceleration time, time needed for 1000rpm to decelerate to 0rpm

P09.70	Label	PR8 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6246

To set pause time for PR path 8 from completion to next path

P09.71	Label	PR8 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X6247

Reserved

P09.72	**Label**	PR9 mode				**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/		**Default**	0
	Byte length	16bit	**Attribute**	R/W		**485 address**	0X6248

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.73	**Label**	PR9 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6249
	High bit of Path 9 position；(Only valid using 485 communication)					
P09.74	**Label**	PR9 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X624A
	For Path 9 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.73.					
P09.75	**Label**	PR0 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X624B
	To set PR path 0 velocity.					
P09.76	**Label**	PR9 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X624C
	To set PR path 9 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.77	**Label**	PR9 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X624D
	To set PR path 9 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.78	**Label**	PR9 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X624E
	To set pause time for PR path 9 from completion to next path					
P09.79	**Label**	PR9 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X624F
	Reserved					

P09.80	**Label**	PR10 mode				**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/		**Default**	0
	Byte length	16bit	**Attribute**	R/W		**485 address**	0X6250

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.81	**Label**	PR10 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6251
	High bit of Path10 position；(Only valid using 485 communication)					
P09.82	**Label**	PR10 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6252
	For Path 10 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.81.					
P09.83	**Label**	PR10 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6253
	To set PR path 10 velocity.					
P09.84	**Label**	PR10 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6254
	To set PR path 10 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.85	**Label**	PR10 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6255
	To set PR path 10 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.86	**Label**	PR10 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6256
	To set pause time for PR path 10 from completion to next path					
P09.87	**Label**	PR10 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6257
	Reserved					

P09.88	Label	PR11 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6258

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.89	Label	PR11 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6259

High bit of Path 11 position；(Only valid using 485 communication)

P09.90	Label	PR11 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X625A

For Path 11 position, using 485 communication, only able to R/W low 16 bit.
R/W high 16 bit needs to be realized through P09.89.

P09.91	Label	PR11 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X625B

To set PR path 11 velocity.

P09.92	Label	PR11 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X625C

To set PR path 11 acceleration time, time needed for 0rpm to accelerate to 1000rpm

P09.93	Label	PR11 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X625D

To set PR path 11 deceleration time, time needed for 1000rpm to decelerate to 0rpm

P09.94	Label	PR11 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X625E

To set pause time for PR path 11 from completion to next path

P09.95	Label	PR11 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X625F

Reserved

P09.96	**Label**	PR12 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6260

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.97	**Label**	PR12 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6261
	High bit of Path 12 position；(Only valid using 485 communication)					
P09.98	**Label**	PR12 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6262
	For Path 12 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.97.					
P09.99	**Label**	PR12 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6263
	To set PR path 12 velocity.					
P09.100	**Label**	PR12 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6264
	To set PR path 12 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.101	**Label**	PR12 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6265
	To set PR path 12 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.102	**Label**	PR12 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6266
	To set pause time for PR path 12 from completion to next path					
P09.103	**Label**	PR12 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6267
	Reserved					

P09.104	Label	PR13 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6268

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.105	Label	PR13 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6269

High bit of Path 13 position；(Only valid using 485 communication)

P09.106	Label	PR13 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X626A

For Path 13 position, using 485 communication, only able to R/W low 16 bit.
R/W high 16 bit needs to be realized through P09.105.

P09.107	Label	PR13 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X626B

To set PR path 13 velocity.

P09.108	Label	PR13 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X626C

To set PR path 13 acceleration time, time needed for 0rpm to accelerate to 1000rpm

P09.109	Label	PR13 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X626D

To set PR path 13 deceleration time, time needed for 1000rpm to decelerate to 0rpm

P09.110	Label	PR13 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X626E

To set pause time for PR path 13 from completion to next path

P09.111	Label	PR13 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X626F

Reserved

P09.112	**Label**	PR14 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6270

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.113	**Label**	PR14 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6271
	High bit of Path 14 position；(Only valid using 485 communication)					
P09.114	**Label**	PR14 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X6272
	For Path 14 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.113.					
P09.115	**Label**	PR14 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6273
	To set PR path 14 velocity.					
P09.116	**Label**	PR14 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6274
	To set PR path 14 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.117	**Label**	PR14 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6275
	To set PR path 14 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.118	**Label**	PR14 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6276
	To set pause time for PR path 14 from completion to next path					
P09.119	**Label**	PR14 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X6277
	Reserved					

P09.120	**Label**	PR15 mode			**Valid mode(s)**	**PR**
	Range	0x0~0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6278

Bit	14	8-13	6-7	5	4	0-3
Definition	0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0-15: Jump to correspond path	0: absolute 1: correspond command 2: correspond motor	0: No overlap, indicates with SJ 1 Overlap, indicated with CJ	0: Can be Interrupt 1: Can't be Interrupt, indicates using !	0: null 1: Positioning 2: Velocity motion 3: Homing 4: Emergency stop Indicates using P/V/H/S

P09.121	**Label**	PR15 position H			**Valid mode(s)**	**PR**
	Range	0~ 0xFFFF	**Unit**	Pulse	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X6279
	High bit of Path 15 position；(Only valid using 485 communication)					
P09.122	**Label**	PR15 position(L)			**Valid mode(s)**	**PR**
	Range	-2147483648~ 2147483647	**Unit**	Pulse	**Default**	0
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X627A
	For Path 15 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through P09.121.					
P09.123	**Label**	PR15 velocity			**Valid mode(s)**	**PR**
	Range	-10000～10000	**Unit**	rpm	**Default**	60
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X627B
	To set PR path 15 velocity.					
P09.124	**Label**	PR15 acceleration time			**Valid mode(s)**	**PR**
	Range	1 ~ 32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X627C
	To set PR path 15 acceleration time, time needed for 0rpm to accelerate to 1000rpm					
P09.125	**Label**	PR15 deceleration time			**Valid mode(s)**	**PR**
	Range	1 ~32767	**Unit**	ms/Krpm	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X627D
	To set PR path 15 deceleration time, time needed for 1000rpm to decelerate to 0rpm					
P09.126	**Label**	PR15 pause time			**Valid mode(s)**	**PR**
	Range	0 ~ 32767	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X627E
	To set pause time for PR path 15 from completion to next path					
P09.127	**Label**	PR15 special parameter			**Valid mode(s)**	**PR**
	Range	0 ~ 65535	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R	**485 address**	0X627F
	Reserved					

3.2.11 [Class C] Positional comparison

P0C.00	Label	Position comparison			Valid mode(s)	P	S	T
	Range	0 ~ 3	Unit	/	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C01		

Set Value	Description
【0】	Disable
1	Enable （Rising edge）

P0C.01	Label	Position comparison mode			Valid mode(s)	P	S	T
	Range	0 ~ 255	Unit	/	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C03		

Set value	Description
【0】	Sequence comparison mode for absolute positions
1	Sequence comparison mode of relative position
128	Reciprocating comparison mode of absolute position
129	Reciprocating comparison mode of relative position

P0C.02	Label	Position comparison pulse output width			Valid mode(s)	P		
	Range	1 ~ 4095	Unit	0.1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C05		

Set the pulse width of the output signal when the position comparison point is reached, in milliseconds (ms).

P0C.03	Label	Position comparison output delay time compensation			Valid mode(s)	P		
	Range	-10000 ~ 10000	Unit	0.1us	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C07		

Set the delay compensation for position comparison output. Compensate for the delay caused by DO/frequency division output circuits

P0C.04	Label	Position comparison starting point			Valid mode(s)	P		
	Range	1~42	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C09		

To set the starting point of position comparison.

P0C.05	Label	Position comparison end point			Valid mode(s)	P		
	Range	1~42	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C0B		

To set the ending point of position comparison.

P0C.06	Label	No. of cycle for N cycles comparison			Valid mode(s)	P		
	Range	1~60000	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C0D		

Set the number of position comparison cycles. Setting it to 0 is for infinite cycle comparison;

P0C.07	Label	Position comparison – set current position as origin			Valid mode(s)	P		
	Range	0~1	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C0F		

Set Value	Description
【0】	Disable
1	Enable （Rising edge）

Set origin for position comparison, set current position as origin at rising edge.

P0C.08	**Label**	Position comparison – Offset to origin			**Valid mode(s)**	**P**		
	Range	-2147483648 ~2147483647	**Unit**	/	**Default**	1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X2C11		
	Set the number of position comparison cycles. Setting it to 0 is for infinite cycle comparison;							
P0C.20~ P0C.61	**Label**	Position comparison 1-42 target value			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648 ~2147483647	**Unit**	/	**Default**	0		
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X2C28~0X2C7B		
	Set the target values of position comparison points 1 to 42; when reaching the position of the comparison point, determine the position comparison output according to the attribute values of position comparison points 1 to 42.							
P0C.70~ P0C.90	**Label**	Position comparison 1 & 2 attributes value			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~0xFFFFFFFF	**Unit**	/	**Default**	0		
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X2C8D~0X2CB5		

Bit	Position comparison 1
0	Positive traversal comparison. 0=OFF,1=ON
1	Negative traversal comparison. 0=OFF,1=ON
2~5	Reserved
6	Output property settings： =0：Pulse mode =1：Flipping mode
7	DO1
8	DO2
9	DO3
10~12	Reserved
13	Frequency divider Phase A output
14	Frequency divider Phase B output
15	Frequency divider Phase Z output

bit0 ~ 15 are position comparison point 1 attributes

Bit	Position comparison 2
16	Positive traversal comparison. 0=OFF,1=ON
17	Negative traversal comparison. 0=OFF,1=ON
18~21	Reserved
22	Output property settings： =0：Pulse mode =1：Flipping mode
23	DO1
24	DO2
25	DO3
26~28	Reserved
29	Frequency divider Phase A output
30	Frequency divider Phase B output
31	Frequency divider Phase Z output

bit16 ~ 31 are position comparison point 2 attributes:

3.2.12 [Class D] Gantry parameters

P0D.00	Label	Gantry function settings			Valid mode(s)	P	S	T
	Range	0~15	Unit	/	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2D01		

Bit	Set Value	Description
0	0	Enable gantry function
	1	Disable gantry function
1	0	Slave axis
	1	Master axis
2*	0	Disable PWM synchronization
	1	Enable PWM synchronization
3	0	Enable parameter synchronization from master axis
	1	Disable parameter synchronization from master axis

Set 3, gantry Master axis effective

set 5, gantry slave axis effective

P0D.01	Label	Gantry slave axis setting			Valid mode(s)	P	S	T
	Range	0~1	Unit	/	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2D03		

Set Value	Description
0	Torque command synchronization
1	Position command synchronization

P0D.02	Label	Gantry feedback compensation gain			Valid mode(s)	P	S	T
	Range	0~300	Unit	/	Default	100		
	Byte length	16bit	Attribute	R/W	485 address	0X2D05		

To set gantry synchronization feedback compensation gain. Only valid under position command synchronization mode.

Gain Value	Description
0	Gain = 0%. Center position gain, min. torque deviation, max. position deviation
100	*Default.* Gain=100%. Balance between torque and position deviation
1-100	Low gantry stiffness. Reduce torque deviation during operation
100-300	High gantry flexibility. Reduce position deviation during operation

P0D.03	Label	Gantry position synchronization deviation threshold			Valid mode(s)	P	S	T
	Range	0~67108864	Unit	PULSE	Default	10000		
	Byte length	32bit	Attribute	R/W	485 address	H:0X2D06 L:0X2D07		

0: Disable position synchronization deviation alarm

P0D.04	Label	Gantry torque deviation threshold			Valid mode(s)	P	S	T
	Range	0~7500	Unit	0.1%	Default	500		
	Byte length	16bit	Attribute	R/W	485 address	0X2D09		

0: Disable position synchronization deviation alarm

P0D.05	Label	Gantry adjustment gain 2			Valid mode(s)	P	S	T
	Range	0~1000	Unit	/	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2D0B		

To synchronize controller parameter, suppression torque deviation between 2 axes. Only valid under position

	command synchronization mode. 0: Disable torque deviation suppression 1~1000: Torque deviation suppression is better when higher P0D.05 set value but it will cause reduction in gain limit for velocity control. Usually applies in gantry structure with high stiffness. If velocity control gain needs to be set higher, P0D.05 must be overly large. Torque deviation suppression can be used in together with P06.73.								
P0D.06	**Label**	Gantry position synchronization gain			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~32767	**Unit**	/	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X2D0D		
P0D.07	**Label**	Gantry velocity synchronization gain			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~32767	**Unit**	/	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X2D0F		
P0D.08	**Label**	Gantry velocity synchronization integral			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~32767	**Unit**	/	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X2D11		
P0D.10	**Label**	Homing method			**Valid mode(s)**	**P**		**T**
	Range	0~1			**Unit**	/	**Default**	0
	Byte length	16bit			**Attribute**	R/W	**485 address**	0X2D15
	0: Unilateral homing 1: Bilateral homing							
P0D.11	**Label**	Gantry Alignment Mode			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~4	**Unit**	/	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X2D17		
	0: enable alignment: take the enable time position as the alignment point (equivalent to no alignment); 1: power-on alignment: the above power-on time position is the alignment point; 2: origin offset alignment: align according to the master-slave origin offset; 3: origin offset alignment (power-on default alignment): the above power-on time is the alignment point before returning to zero, and align with the origin offset after returning to zero; 4: origin Offset Alignment (Absolute Value Encoder): Used for absolute value encoder. By default, zero clearing has been completed.							
P0D.12	**Label**	Gantry Original point offset			**Valid mode(s)**	**P**		**T**
	Range	-2147483648 ~2147483647	**Unit**	/	**Default**	0		
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X2D18~0X2D19		
	Encoder unit: under the condition of ensuring alignment, move the gantry beam from the axis origin to the spindle origin, during which the increment of the spindle feedback position is the origin offset.							
P0D.13	**Label**	Alignment speed			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~100	**Unit**		**Default**	0		
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X2D1A~0X2D1B		
	Set master-slave axis alignment speed							
P0D.15	**Label**	Offset Measurement mode			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~3	**Unit**	/	**Default**	0		

	Byte length	32bit	**Attribute**	R/W	**485 address**	0X2D1E~0X2D1F		
	0: None 1: Current position aligned 3: Realign							
P0D.16	**Label**	Align Measurement Commands			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Unit**	/	**Default**	0		
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X2D20~0X2D21		
	0: None 1: Start measurement							
P0D.17	**Label**	Offset Measurement value			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Unit**	/	**Default**	0		
	Byte length	32bit	**Attribute**	R/W	**485 address**	0X2D22~0X2D23		
	Read the offset measurement value after the bilateral zero return is completed.							
P0D.21	**Label**	Gantry Command Type			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~1	**Unit**	/	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X2D2B		
	0: Drive Synchronization 1: Master Synchronization							

3.2.13 [Class 11] Driver parameter

P11.00	**Label**	MCU1 version number			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Unit**	/	**Default**	-		
	Byte length	16bit	**Attribute**	R	**485 address**	0X3101		
	MCU1 version number.							

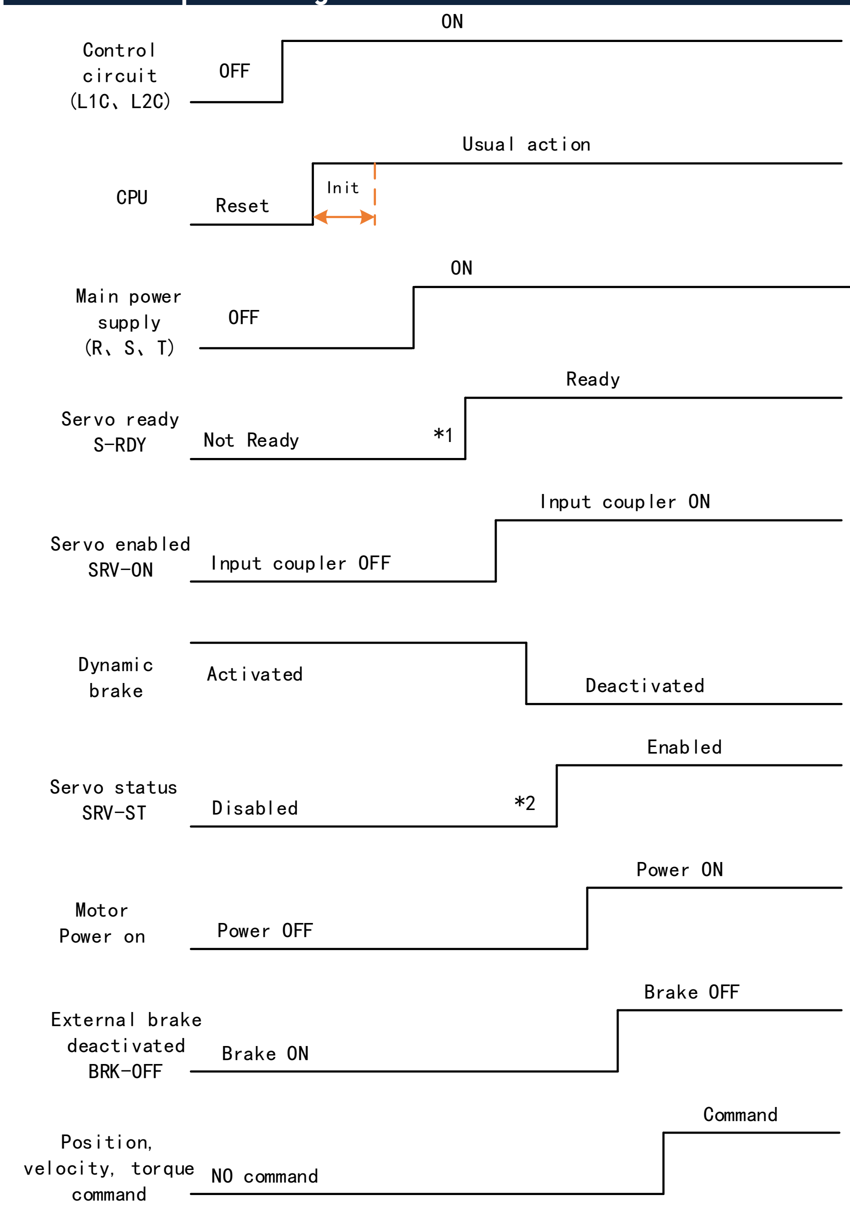
P11.01	**Label**	MCU2 version number			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Unit**	/	**Default**	-		
	Byte length	16bit	**Attribute**	R	**485 address**	0X3103		
	MCU2 version number.							
P11.02	**Label**	FPGA version number			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Unit**	/	**Default**	-		
	Byte length	16bit	**Attribute**	R	**485 address**	0X3105		
	FPGA version number							
P11.06	**Label**	Driver voltage level			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Default**	V	**Default**	-		
	Byte length	16bit	**Attribute**	R	**485 address**	0X310D		
	Driver voltage level							
P11.07	**Label**	Driver rated power			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Default**	W	**Default**	-		
	Byte length	16bit	**Attribute**	R	**485 address**	0X310F		
	Driver rated power							
P11.08	**Label**	Driver rated current			**Valid mode(s)**	**P**	**S**	**T**

	Range	-2147483648~2147483647	**Default**	0.01 A	**Default**	-			
	Byte length	16bit	**Attribute**	R	**485 address**	0X3111			
	Driver rating current								
P11.09	**Label**	Driver Maximum current			**Valid mode(s)**	**P**	**S**	**T**
	Range	-2147483648~2147483647	**Default**	0.01 A	**Default**	-			
	Byte length	16bit	**Attribute**	R	**485 address**	0X3113			
	Driver Maximum current								
P11.16	**Label**	Analog Input 1(AI1) Zero Drift Setting			**Valid mode(s)**	**P**	**S**	**T**
	Range	-32767 ~ 32767	**Unit**	mV	**Default**	0			
	Byte length	16bit	**Attribute**	R/w	**485 address**	0X3121			
	Sets the compensation value for the zero drift adjustment added to the analog input 1 voltage, the zero drift calibration function.								
P11.17	**Label**	Analog Input 1(AI2 Zero Drift Setting			**Valid mode(s)**	**P**	**S**	**T**
	Range	-32767 ~ 32767	**Unit**	mV	**Default**	0			
	Byte length	16bit	**Attribute**	R/w	**485 address**	0X3123			
	Sets the compensation value for the zero drift adjustment added to the analog input 2 voltage, the zero drift calibration function.								
P11.18	**Label**	Analog Input 1(AI3 Zero Drift Setting			**Valid mode(s)**	**P**	**S**	**T**
	Range	-32767 ~ 32767	**Unit**	mV	**Default**	0			
	Byte length	16bit	**Attribute**	R/w	**485 address**	0X3125			
	Sets the compensation value for the zero drift adjustment added to the analog input 3 voltage, the zero drift calibration function.								
P11.31	**Label**	Bus voltage discharge control mode			**Valid mode(s)**	**P**	**S**	**T**
	Range	0-1	**Unit**	-	**Default**	0			
	Byte length	16bit	**Attribute**	R/w	**485 address**	0X313F			
	Set discharge mode: 0: use discharge resistor 1: do not use discharge resistor (absorb regenerative energy by capacitor)								

Chapter 4 Servo Drive Operation

4.1 Servo enabled

Power on sequence diagram



Please enter servo status, position, velocity, torque command as sequence diagram above.

*** 1. S-RDY signal is given after CPU initialization and main power supply powered on.*

2. SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet.

4.2 Servo stop

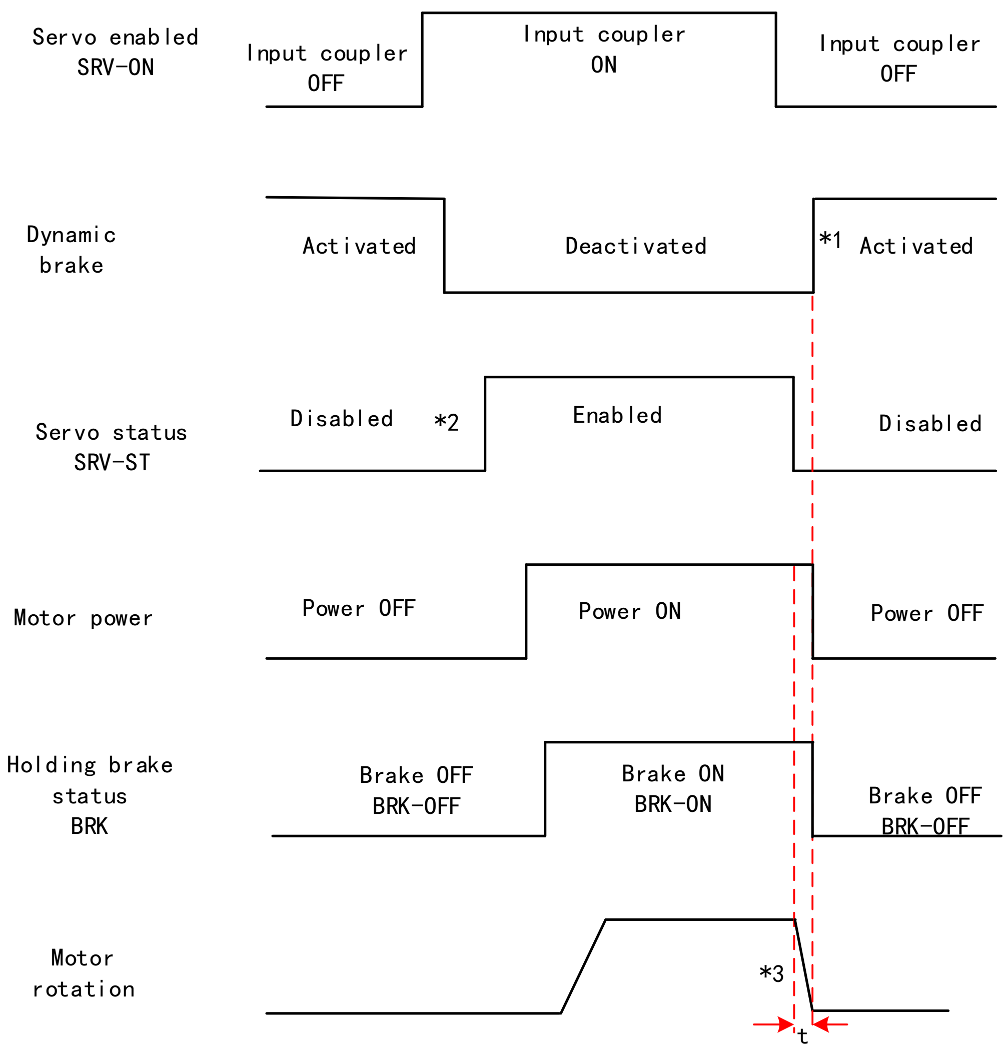
Servo stopping are of 3 different methods: Servo braking method, free stopping method, dynamic braking method.

Stopping method	Description	Details
Servo braking	Servo driver delivers braking torque in opposite direction	Quick stopping but mechanical impact might exist
Free stopping	Motor power cut off. Free to move until velocity = 0. Affected inertia, friction and other factors	Smooth deceleration, low mechanical impact but slow stopping
Dynamic braking	Brake activated when in motion	Quick stopping but mechanical impact might exist

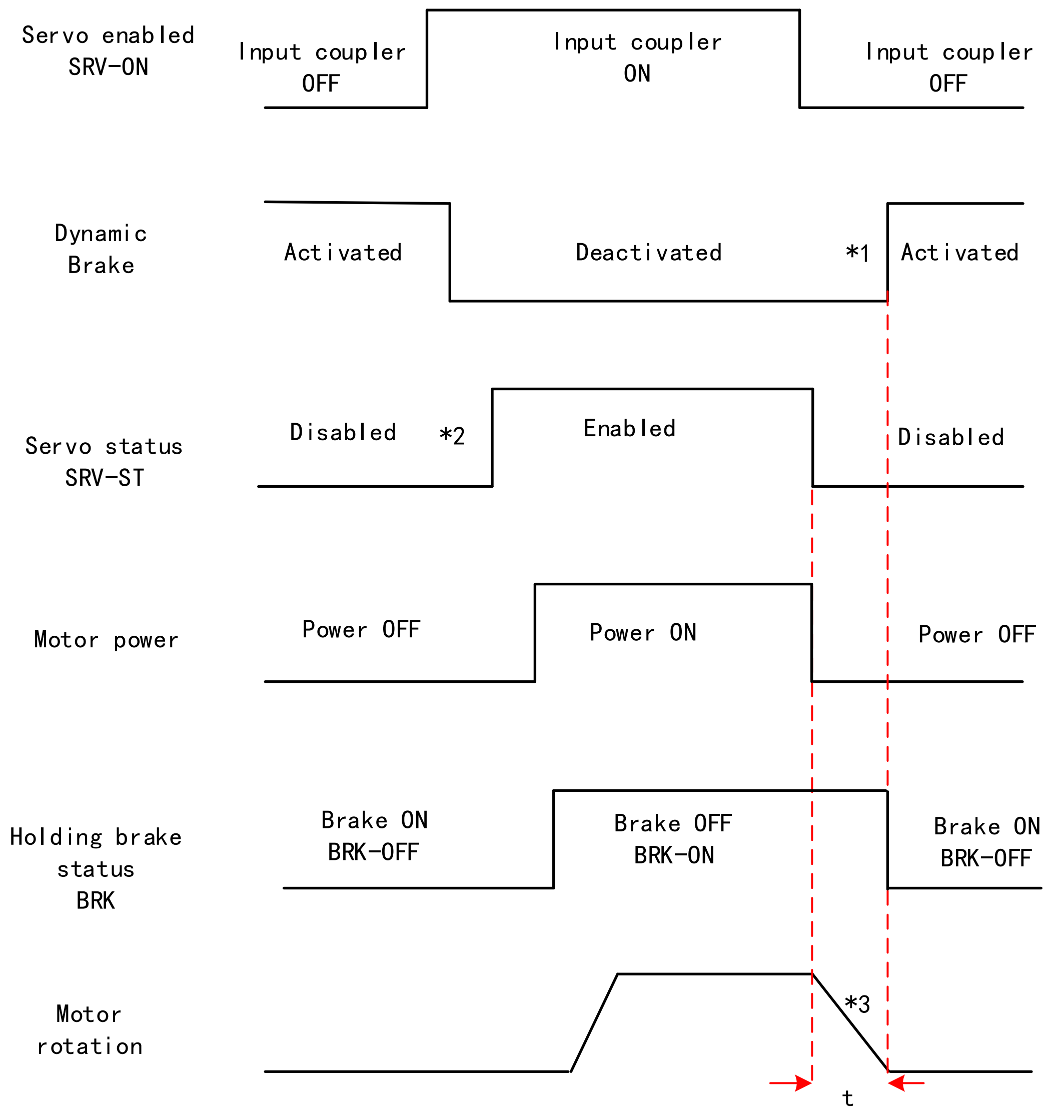
Stopping status	Status after stopped
Free running	Motor is powered off, rotor is free to rotate
Dynamic braking	Motor is powered off, rotor is not free to rotate
Holding brake stopping	Motor axis is locked, cannot rotate freely

Motor stopping（Servo disabled） - Sequence Diagram

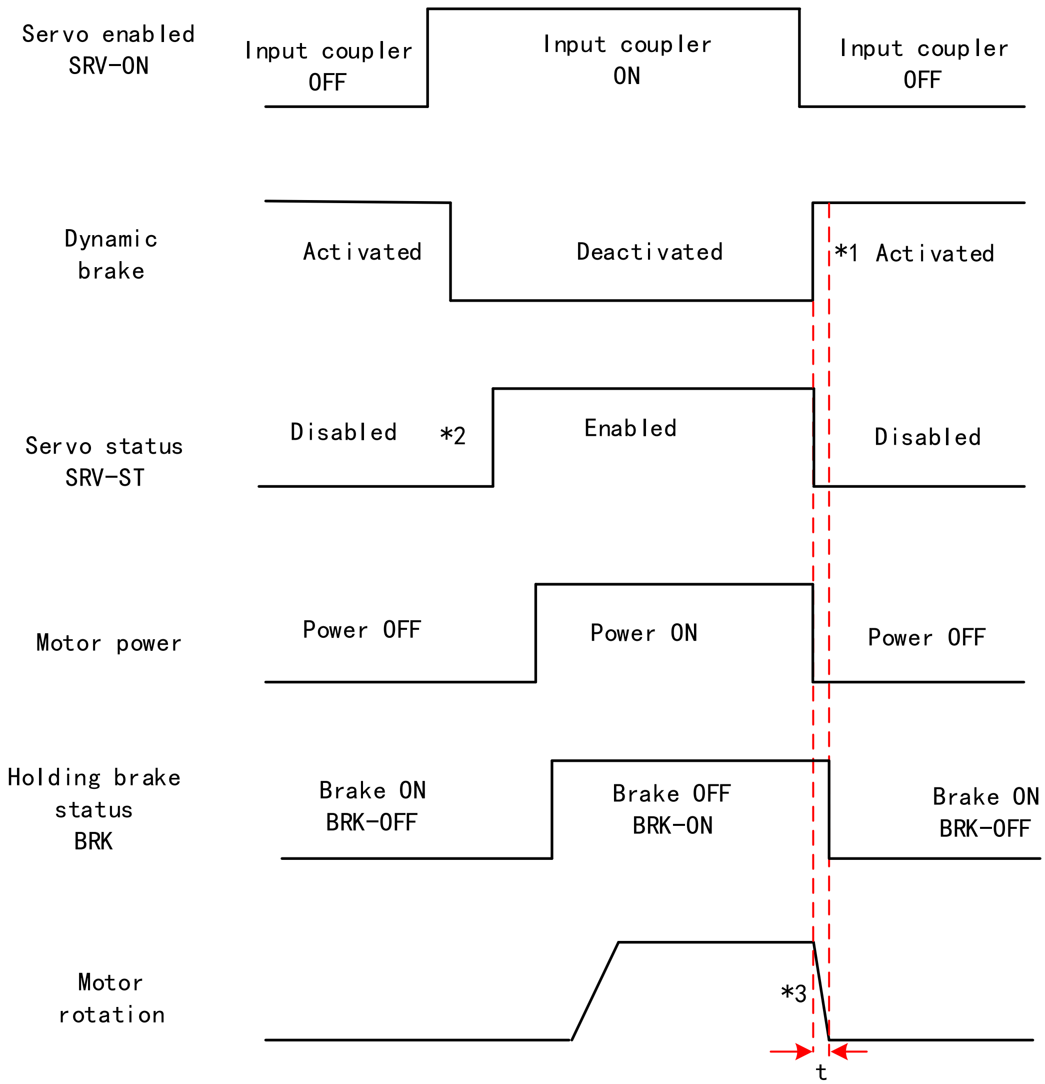
Servo braking method. Status after stopping: Dynamic braking (P05.06 = 1)



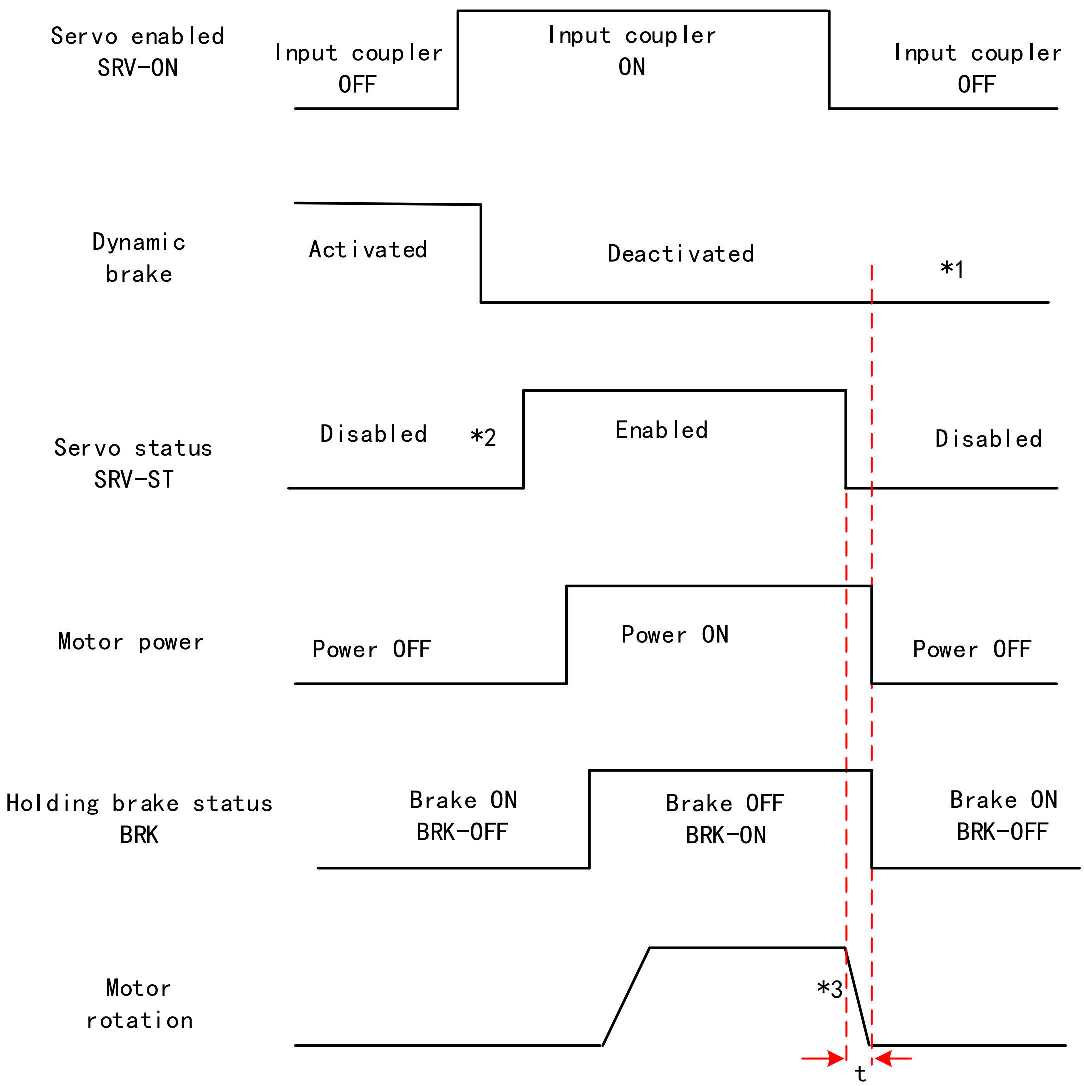
Free stopping method. Status after stopping: Dynamic braking (P05.06 = 1)



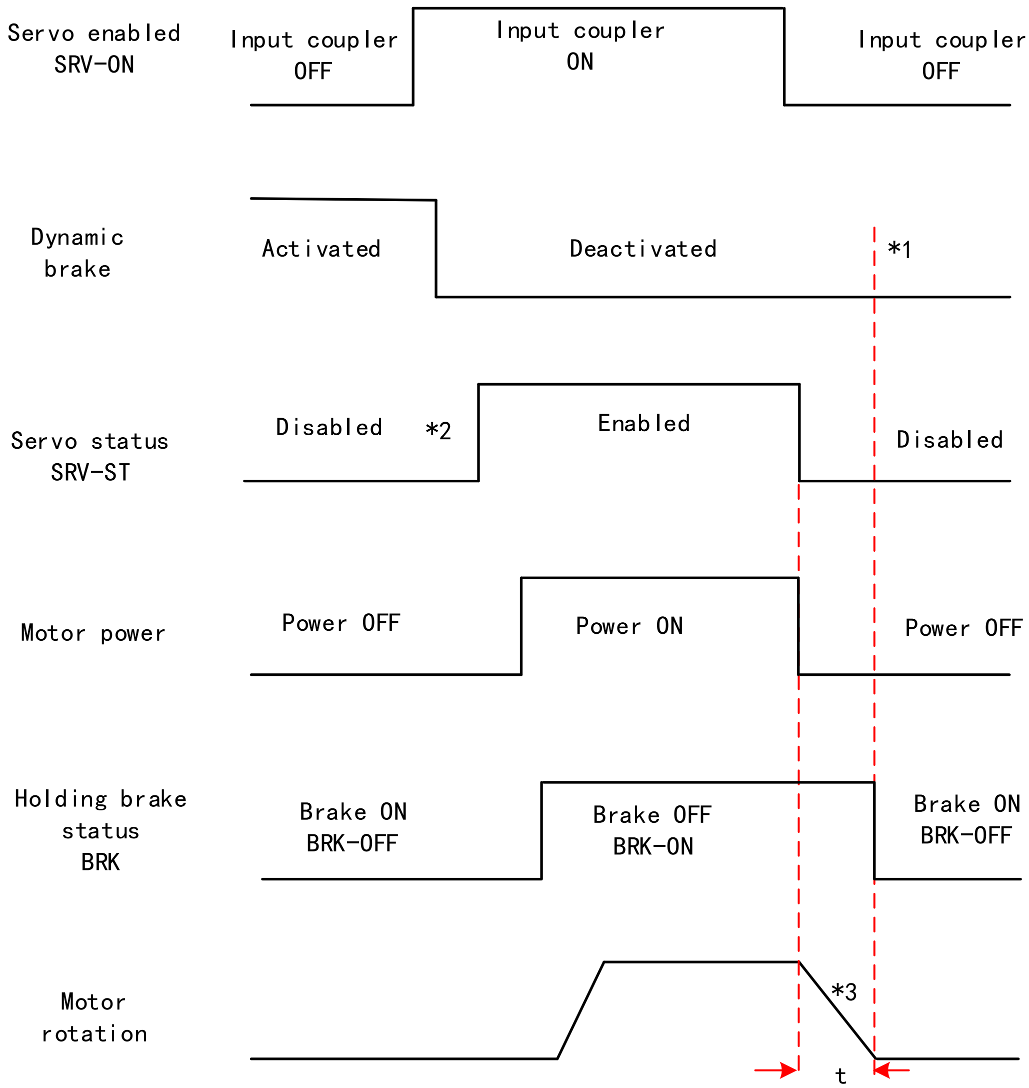
Dynamic braking method. Status after stopping: Dynamic braking (P05.06 = 2)



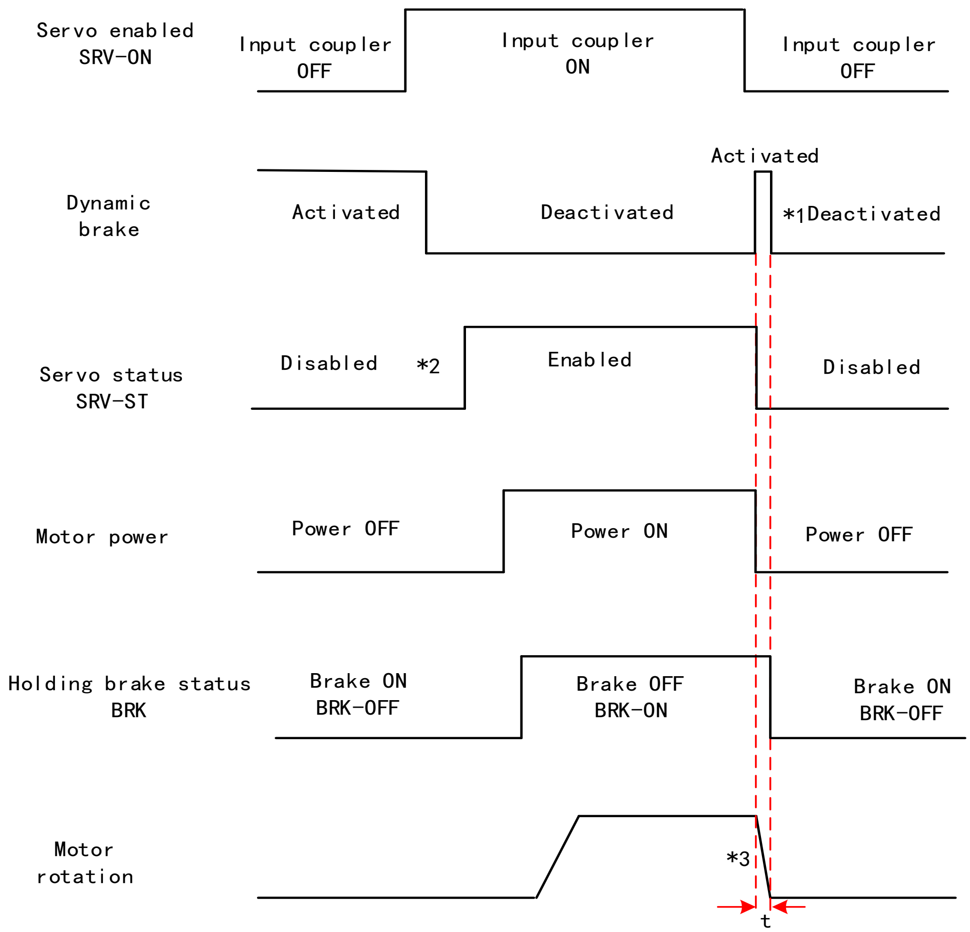
Servo stopping method. Status after stopping: Free running (P05.06 = 3)



Free stopping method. Status after stopping: Free running (P05.06 = 4)



Dynamic braking method. Status after stopping: Free running (P05.06 = 5)



*** 1. Status after stopping is as defined in P05.06.*

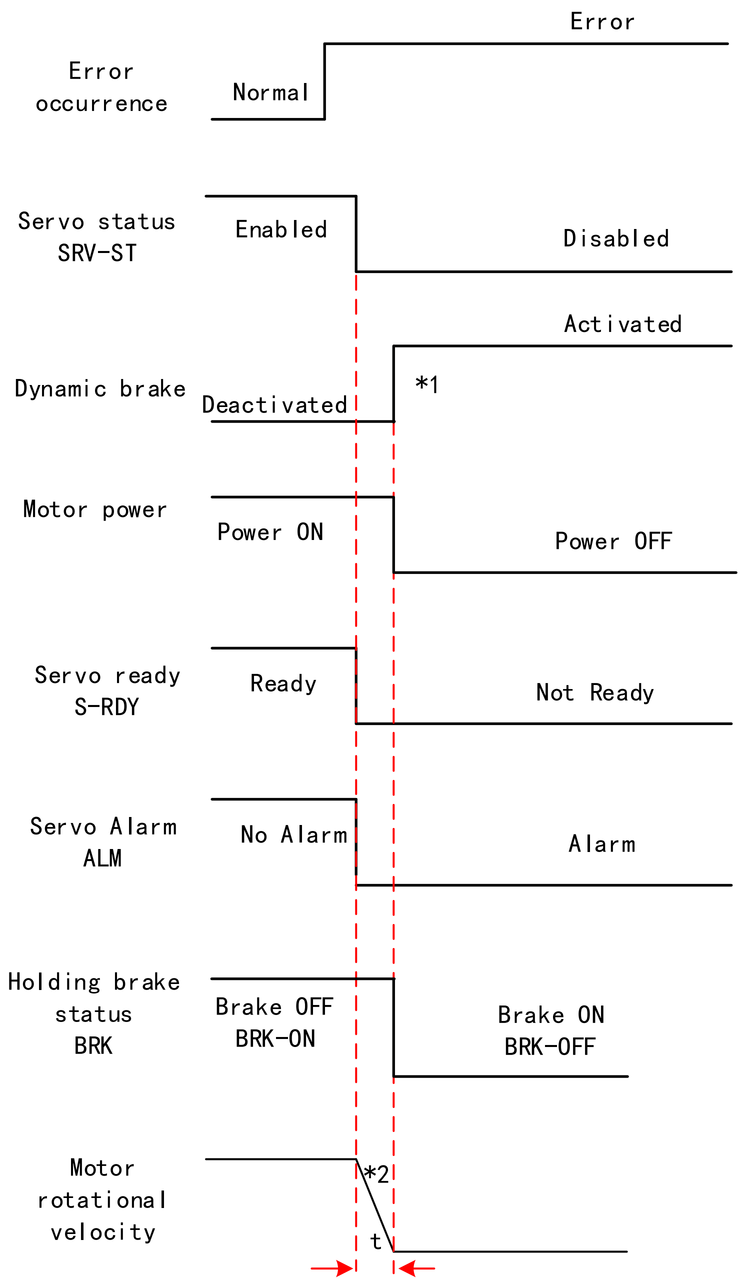
2. SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet.

3. Servo stopping method is as defined in P05.06; braking torque in opposite direction to decelerate the motor is as defined in P05.11. Deceleration time t is determined by whichever comes first between time set in P06.14 and time needed for motor to drop below velocity set in P04.39. After deceleration time t, dynamic braking will be off and holding brake signal will be set to OFF (Holding brake is activated. Although BRK-OFF signal is valid, actual activation of holding brake is dependent on whether the motor comes with holding brake).

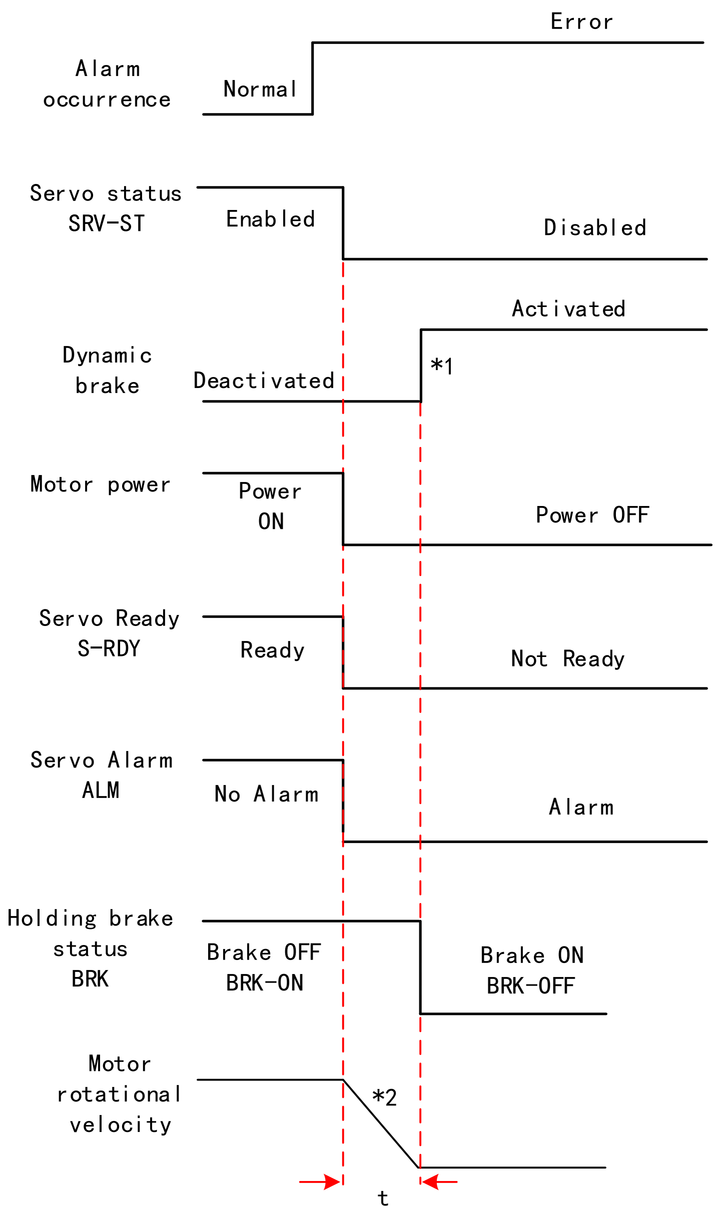
4. BRK-ON signal doesn't indicate the activation of holding brake but the validation of the signal. Holding brake is not applied when BRK-ON signal is valid. Same idea goes for BRK-OFF signal.

Stopping when alarm occurs – Sequence Diagram

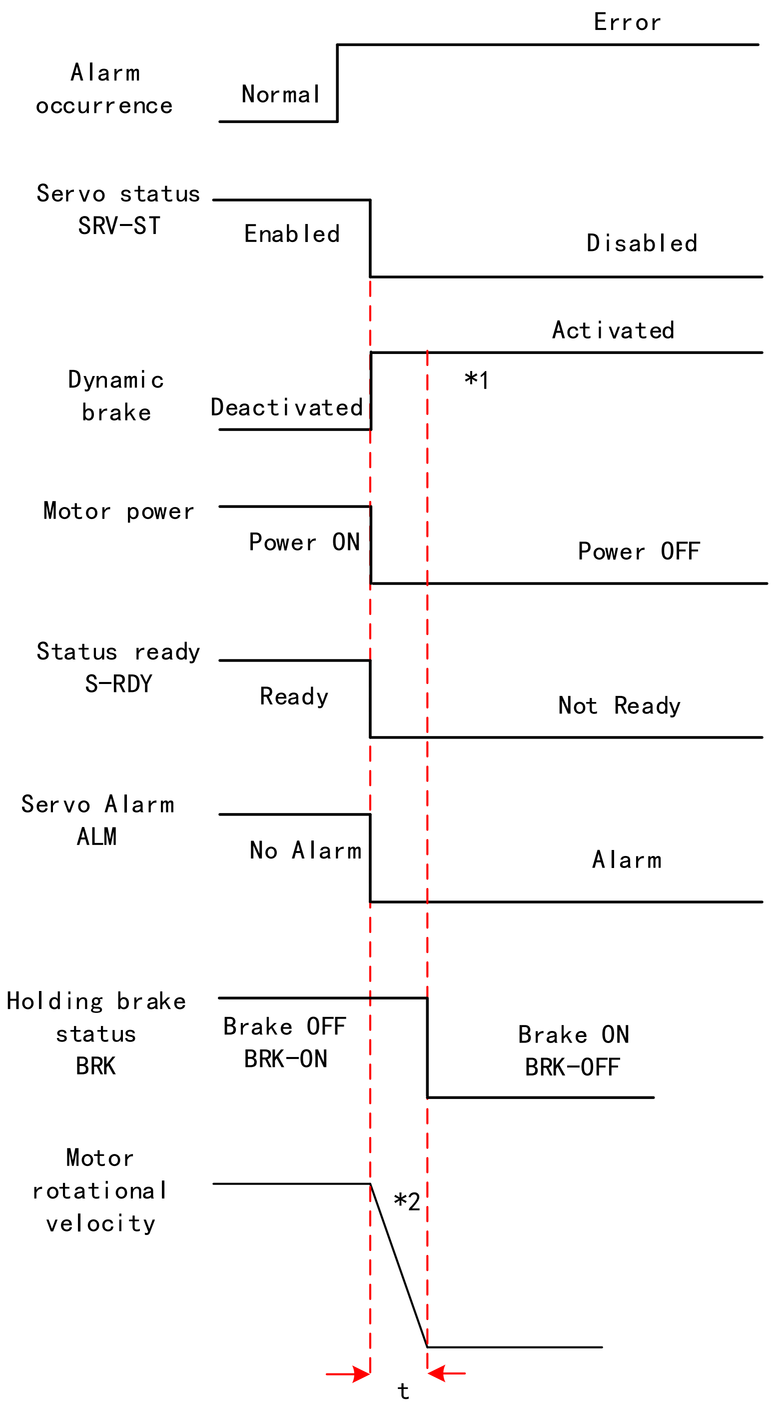
Servo braking method. Status after stopping: Dynamic braking



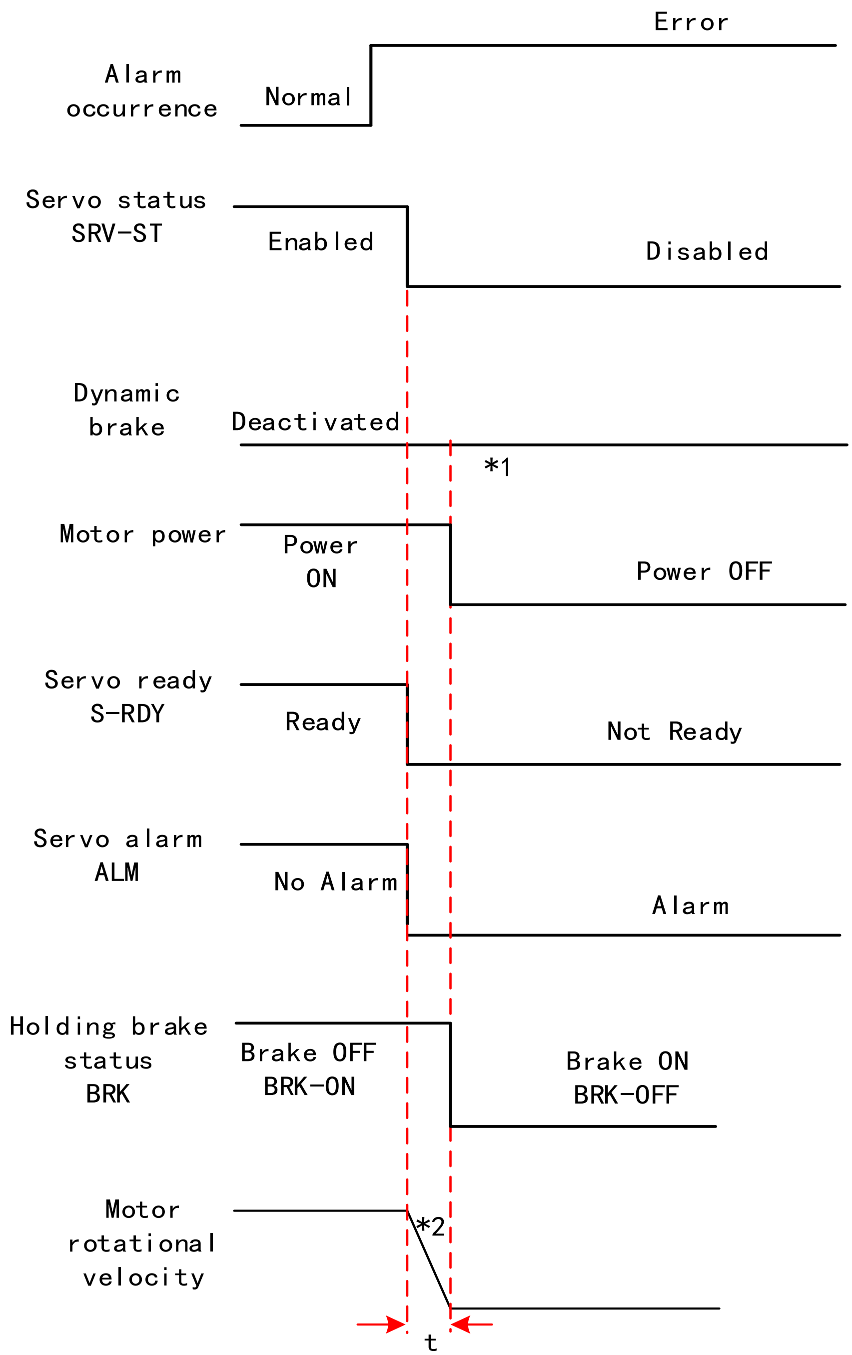
Free stopping method. Status after stopping: Dynamic braking



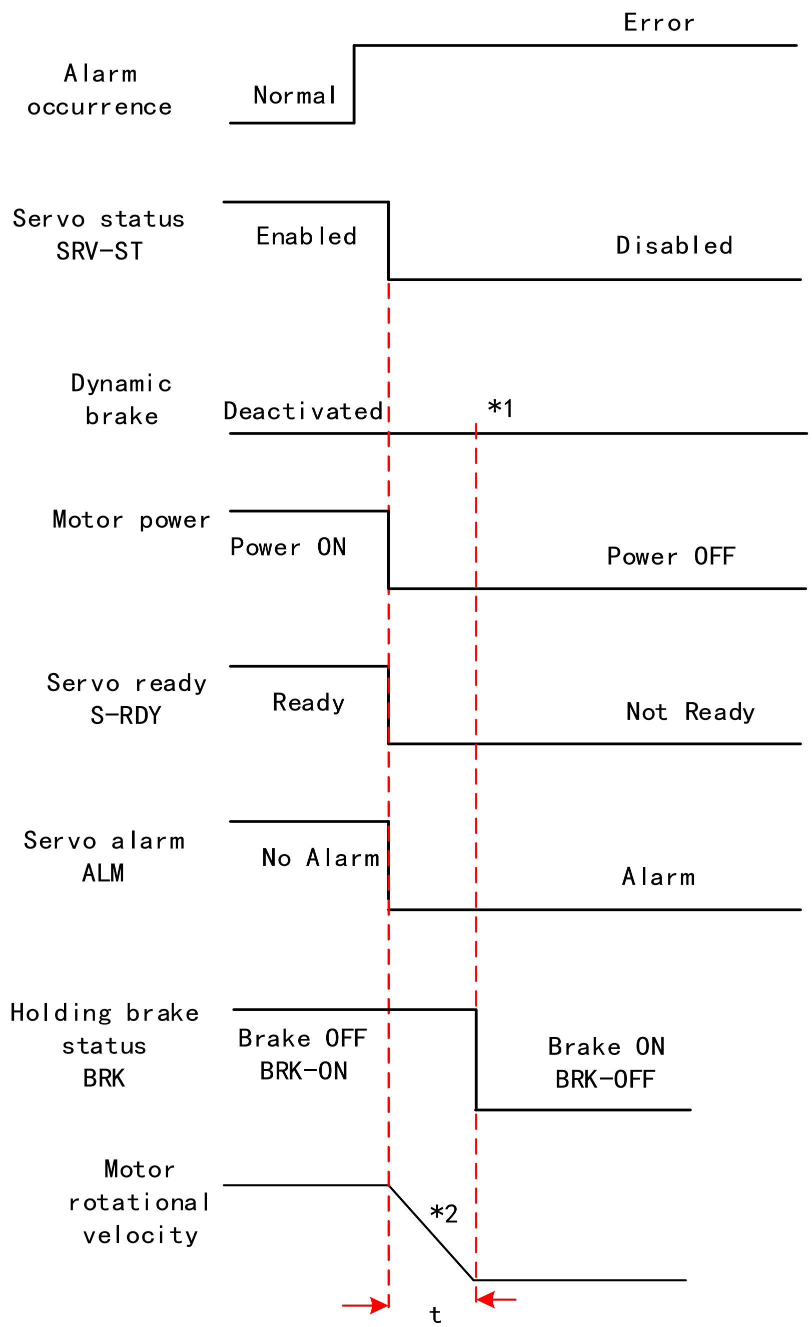
Dynamic braking method. Status after stopping: Dynamic braking



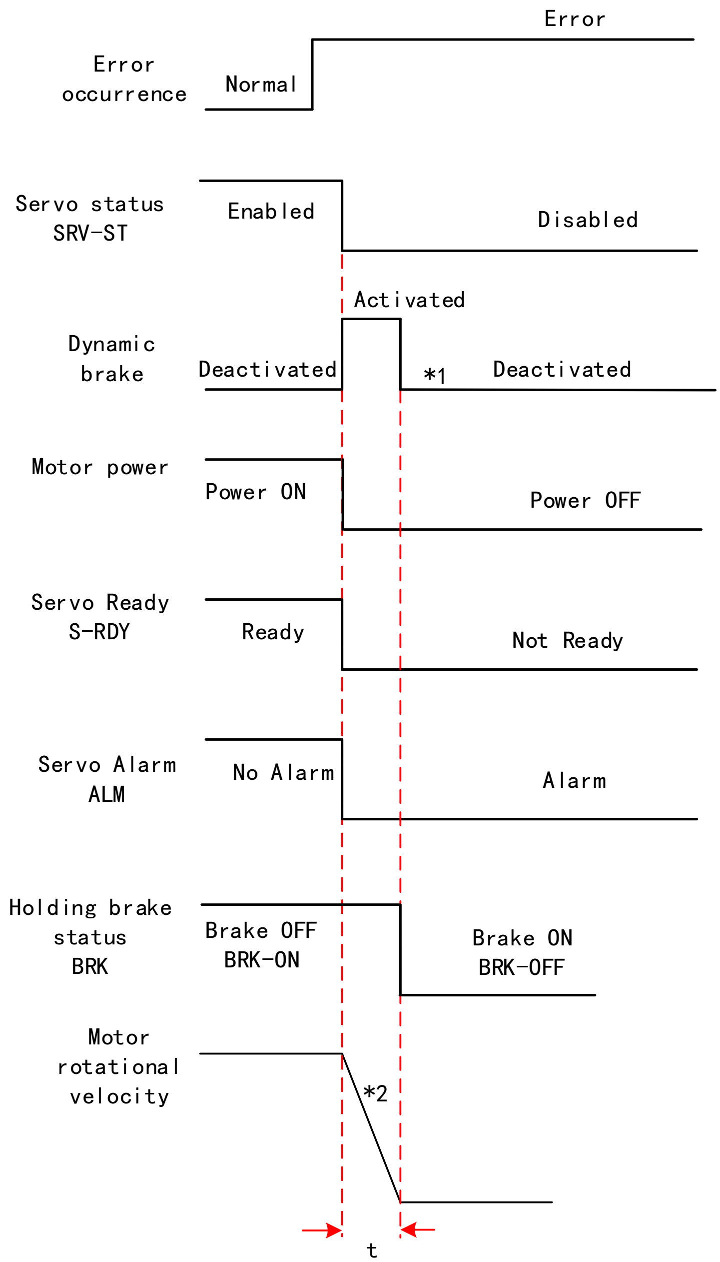
Servo braking method. Status after stopping: Free running



Free stopping method. Status after stopping: Free running



Dynamic braking. Status after stopping: Free running

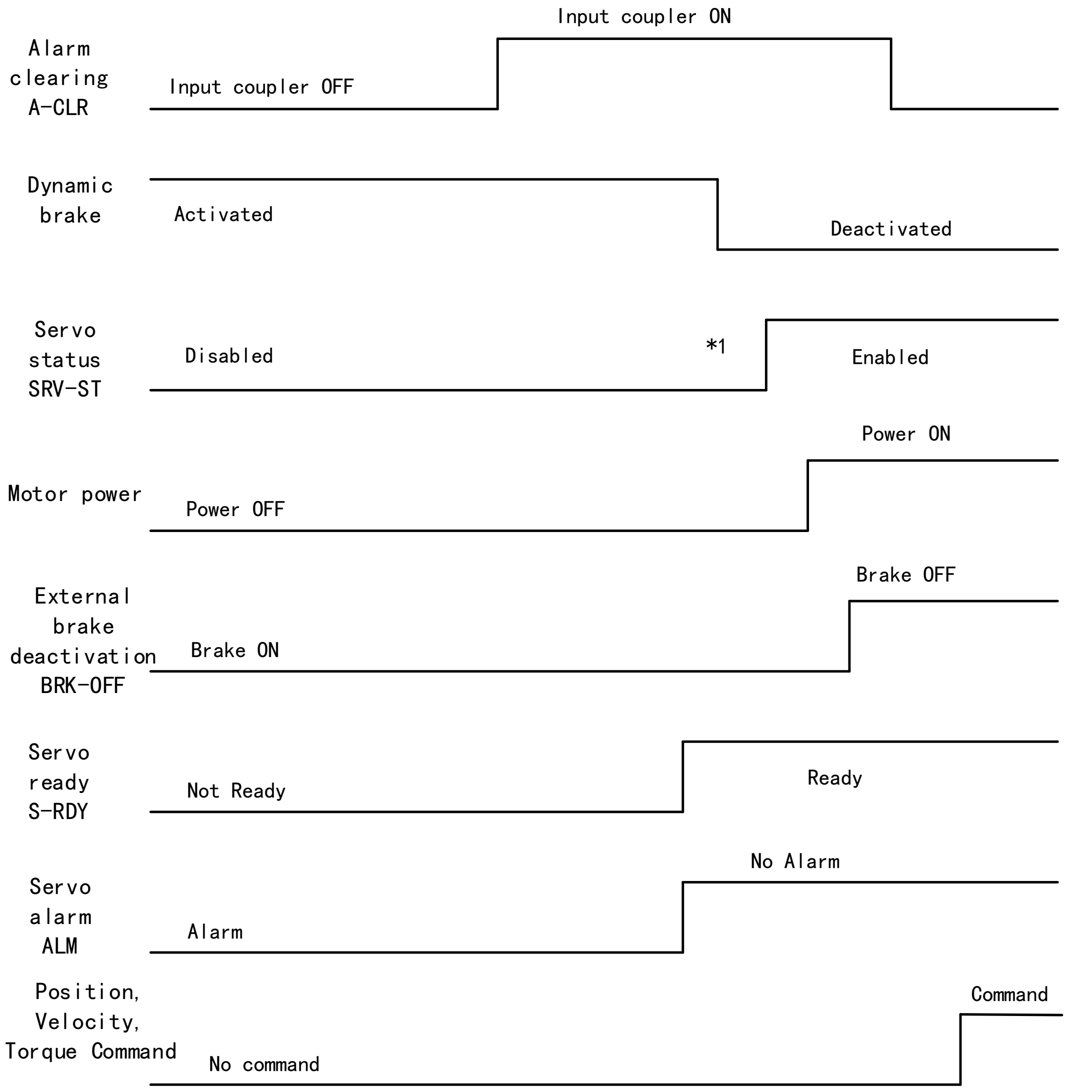


*** 1. Status after stopping is as defined in P05.10.*

2. Servo stopping method is as defined in P05.10. Deceleration time t is determined by whichever comes first between time set in P06.14 and time needed for motor to drop below velocity set in P04.39. After deceleration time t, dynamic braking will be off and holding brake signal will be set to OFF (Holding brake is activated. Although BRK-OFF signal is valid, actual activation of holding brake is dependent on whether the motor comes with holding brake).

3. BRK-ON signal doesn't indicate the activation of holding brake but the invalidation of the signal. Holding brake is not applied when BRK-ON signal is valid. Same idea goes for BRK-OFF signal.

Alarm clearing - Sequence diagram

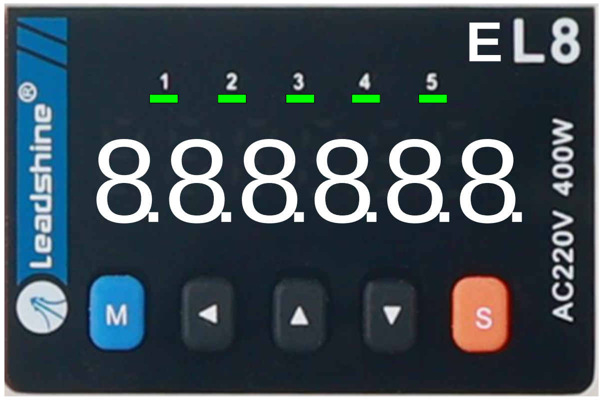


*** 1.SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet*

2. BRK-OFF signal doesn't indicate the deactivation of holding brake but the invalidation of the signal. Holding brake is applied when BRK-OFF signal is invalid.

4.3 Front Panel

Servo Drive front panel consists of 5 push buttons , a 8-segments display and 5 green LED as warning indicators. Can be used for displaying of status, alarms, functions, parameters setting and auxiliary functions.



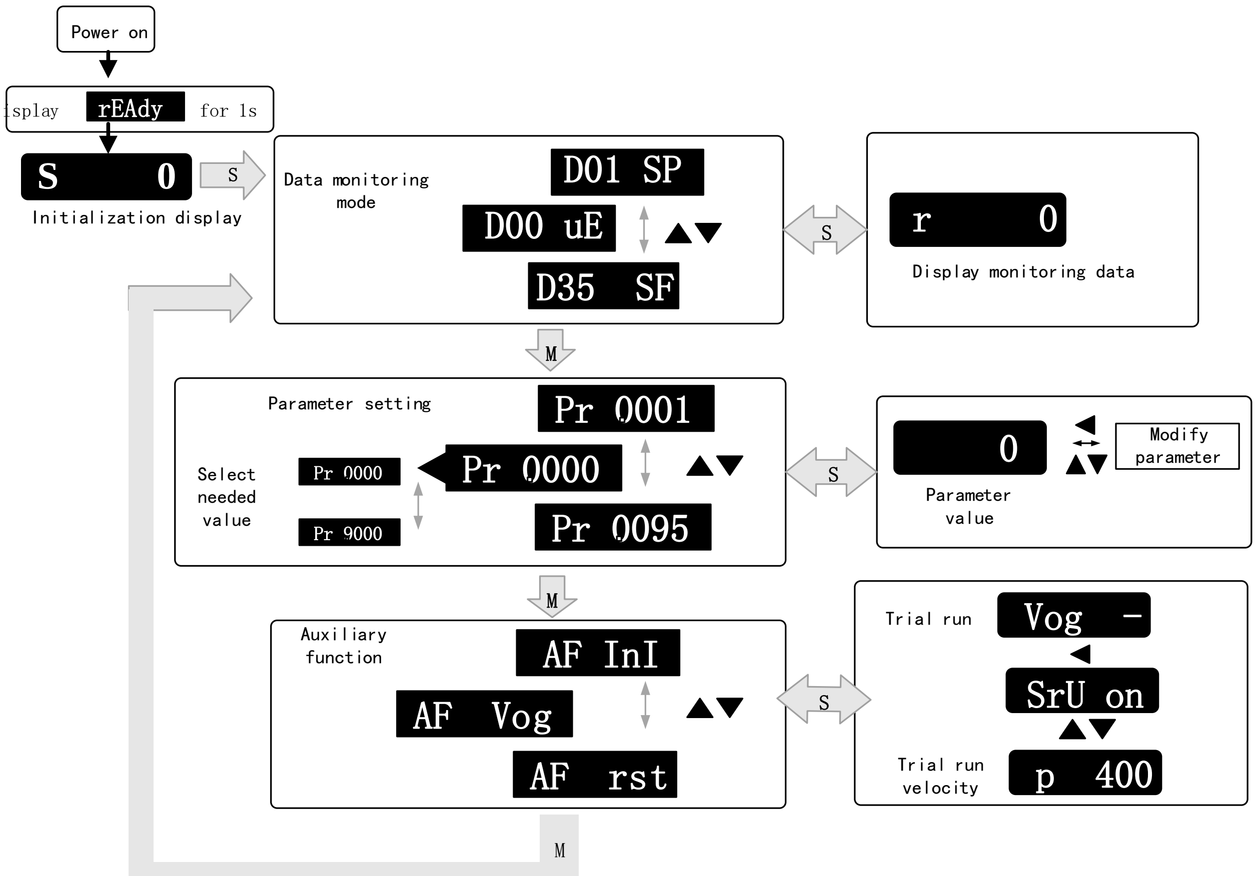
Front panel

Buttons and functions

Label	Symbol	Function
Display	/	Consists of 5 push buttons , a 8-segments display and 5 green LED as warning indicators
Mode	M	To switch between 3 modes: 1. Data monitoring mode : To monitor changes of motion data values 2. Parameters setting mode : To set parameters 3. Auxiliary functions mode: To operate common functions, such as trial run, alarm clearing
Enter	S	To enter or confirm
Up	▲	To switch between sub-menus / Increase
Down	▼	To switch between sub-menus / Decrease
Left	◀	To switch between values

4.4 Panel Display and Operation

4.4.1 Panel Operation



Flow diagram of panel operation

(1) rEAdY will be displayed for about 1 second after driver is powered on. Then, automatically enters data monitoring mode and displays initial data value. Otherwise, alarm code will be displayed if error occurs.

(2) Press **M** key to switch between modes.

Data monitoring mode → Parameters setting mode → Auxiliary functions mode

Alarm code will be displayed regardless of any mode if alarm occurs. Press **M** to switch to other modes.

(3) Press ▲ or ▼ to select the type of parameters in data monitoring mode. Press **S** to confirm.

(4) Press ◀ to select current segment in parameters settings mode. Press ▲ or ▼ to increase/decrease the value of segment. Press **S** to confirm the modified value(s) and save the parameters.

Front Panel Locking

To prevent any misuse of the front panel, it can be locked. Limitations when locked are as shown below.

Mode	Limitation
Data monitoring	Not limited
Parameters setting	Parameters can only be read, not modified.
Auxiliary functions	Not limited

To lock and unlock the front panel

	Front Panel	Motion Studio
Lock	①Set P05.35 = 1. ②Restart driver. ③Front panel is now locked.	
Unlock	① Please refer to auxiliary function AF UnL ② Front panel is now unlocked.	① Set P05.35 = 0. ② Front panel is now unlocked.

4.4.2 Data Monitoring Mode

EL8 series servo driver offers the function to monitor different types of data in data monitoring mode. After entering this mode, press **S** to monitor any data that starts with d. Press **S** again to get back to data monitoring mode and **M** to switch to any other modes.

Data list in data monitoring mode

No.	Label	Descriptions	Display	Unit	Data Format (x = numerical value)
0	d00uE	Position command deviation	d00uE	pulse	"xxxx"
1	d01SP	Motor velocity	d01SP	r/min	"r xxxx" – Motor actual velocity "F xxxx" – External encoder feedback velocity
2	d02CS	Position control command velocity	d02CS	r/min	"xxxx"
3	d03Cu	Velocity control command velocity	d03Cu	r/min	"xxxx"
4	d04tr	Actual feedback torque	d04tr	%	"xxxx"
5	d05nP	Feedback pulse sum	d05nP	pulse	"xxxx"
6	d06cP	Command pulse sum	d06CP	pulse	"xxxx"
7	d07	Maximum torque during motion	d07	/	"d xxxx" – Max torque % "V xxxx"– Average load

					ratio
8	d08FP	Internal command position sum	d08FP	pulse	"xxxx"
9	d09cn	Control mode	d09Cn	/	Position: "Ct PoS" Velocity: "Ct SPd " Torque: "Ct trq"
10	d10Io	I/O signal status	d10 Io	/	-
11	d11Ai	Analog input	d11Ai	V	-
12	d12Er	Alarm cause and record	d12Er	/	"Er xxx" Alarm code
13	d13rn	Warning	d13rn	/	"H xxx" Warning code
14	d14r9	Regeneration load factor	d14r9	%	"xxx"
15	d15oL	Overload factor	d15oL	%	"L xxx" – Motor overload % "d xxx" – Driver overload %
16	d16Jr	Inertia ratio	d16Jr	%	"xxx"
17	d17ch	Motor not running cause	d17Ch	/	"CP xxx" Error code
18	d18ic	No. of changes in I/O signals	d18ic	/	"xxx"
19	d19	Internal use	d19	/	" xxxx"
20	d20Ab	CSP position command sum	d20Ab	pulse	" xxxx"
21	d21AE	Single turn encoder data	d21AE	pulse	"A xxxx" – motor encoder single turn data "F xxxx" – external encoder single turn data
22	d22rE	Multiturn encoder data	d22rE	r	" xxxx"
23	d23 id	485 received frame	d23id	/	"id xxx" "Fr xxx"
24	d24PE	Position deviation	d24PE	Unit	"A xxxx" – Position deviation "F xxxx" – Full closed loop deviation (Command unit) "H xxxx" - Full closed loop deviation (Encoder unit)
25	d25PF	Motor electrical angle	d25PF	pulse	" xxxx"
26	d26hy	Motor mechanical angle	d26hy	pulse	" xxxx"
27	d27 Pn	Voltage across PN	d27Pn	V	" xxxx"
28	d28 no	Software version	d28no	/	"d xxx Servo software" "F xx Communication software" "p xxx Servo power rating" "C xx CPLD software"
29	d29AS	Internal usage	d29AS	/	"A xxxx" "F xxxx" – external encoder serial no.
30	d30NS	No. of times of encoder communication error	d30sE	/	"A xxxx" – Motor encoder communication error

					count “F xxxx” – External encoder communication error count
31	d31 tE	Accumulated uptime	d31tE	/	“ xxxx”
32	d32Au	Automatic motor identification	d32Au	/	“r xxx Motor no.” “E xxx Servo no.”
33	d33At	Driver temperature	d33At	℃	“d xxx” – driver temperature “C xxx” – MCU temperature
34	d34	Servo status	d34	/	“xxx”
35	d35 SF	Internal usage	d35SF	/	“xxxxxx”
43	d43	External encoder Z-Phase counter	D43	/	“xxxxxx”
44	d44	External encoder pulse count per revolution	D44	pulse	“xxxxxx”
45	d45	External encoder direction	D45	/	“xxxxxx”
46	d46	Position compared to current position	D46	/	“xxxxxx”

Description of data monitoring function

When using the front panel to monitor data, data is divided in low/high bit and positive/negative.

. 2 .   608850

High bit: 1st and 2nd values on the right has two decimal points
Low bit: 1st and 2nd values on the right has no decimal point.

. . 50   50

Positive: 1st and 2nd values on the left has no decimal point.
Negative: 1st and 2nd values on the left has two decimal points

1. d00uE Position command deviation

Shows high bit and low bit of position deviation

.. 8 0

Position command deviation

Positive: 1st and 2nd values on the left has no decimal point.
Negative: 1st and 2nd values on the left has two decimal points

Press ◀ to switch between low and high bit
Example : Position command deviation=260885

. 2 .   608850

High bit: 1st and 2nd values on the right has two decimal points
Low bit: 1st and 2nd values on the right has no decimal point.

2. d01SP Motor velocity, d02CS Position control command velocity, d03CU Velocity control command velocity, d04 tr Actual torque feedback

d04 tr reflects actual current.

D01 sp → S → r 400 Motor actual velocity (r/min) F 20 External encoder feedback velocity (mm/s)

Press ▲

D02 Cs → S → 400 Command velocity under position control (r/min)

D03 CU → S → 400 Command velocity under velocity control (r/min)

D04 tr → S → 4 Actual torque feedback (‰)

3. d05nP Feedback pulse sum d06CP Command pulse sum

Feedback pulse sum(Encoder feedback pulse)

D05 np → S → 10016

Feedback pulse sum (unit)

Press ◀ to switch between high/low bit
Example: Feedback pulse sum=2100160

. 2 .　　100160

High bit　　Low bit

Command pulse sum (Command pulse)

D06 Cp → S → 100160

Command pulse sum (unit)

Press ◀ to switch between high/low bit
Example: Command pulse sum=210017

.　　100170

High bit　　Low bit

4. d07 Maximum torque during motion

D07 → S → D 7　　Maximum torque during motion (%)

▲▼

V 7　　Average load ratio (%)

5. d08FP Internal command pulse sum

D08 Fp → S → 20

Internal command pulse sum (pulse)

6. d09Cn Control mode

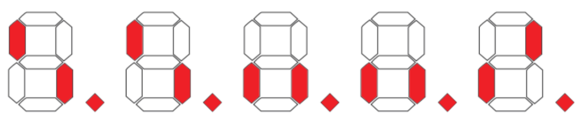
D09 Cn ⇨ S

Ct pos	Position control mode
Ct spd	Velocity control mode
Ct trq	Torque control mode

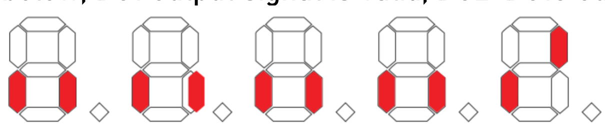
7. d10Io I/O signal status

When the top half of the digital tube is lighted, the signal is valid; when the bottom half of the digital tube is lighted, the signal is not valid. Decimal points represent I/O status, input when lighted, output when not lighted.

- **Input:** From low to high bit(Right to left) DI1,DI2....DI10. Decimal point is lighted to represent input signals.
  In the example below, DI1, DI8 and DI10 input signal is valid; DI2-DI7, DI9 input signal is invalid.



- **Output:** From low to high bit(Right to left) DO1,DO2....DO10. Decimal point is not lighted to represent output signals.
  In the example below, DO1 output signal is valid; DO2-DO10 output signal is invalid.



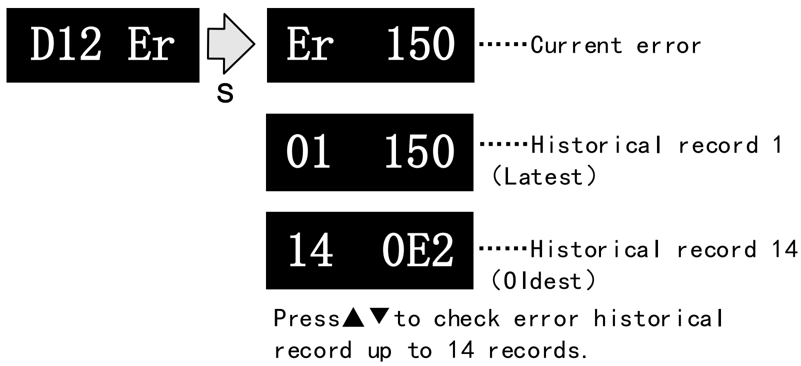
8. d11Ai Analog input

D11 Ai ⇨ S

_ 2 0	Analog input 1 (Unit: 0.001V)
▲▼	
- 2 0	Analog input 2 (Unit: 0.001V)
▲▼	
_ 2 0	Analog input 3 (Unit: 0.001V)

3 analog inputs can be monitored through d11. Left most bar at the top: 1st analog input; at the middle: 2nd analog input; at the bottom 3rd analog input. Points on 4th and 5th value means negative value.

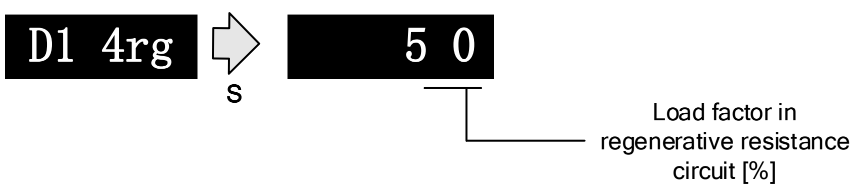
9. d12Er Alarm cause and historical record



Please refer to the alarm list table in chapter 9 for alarms that can be recorded.

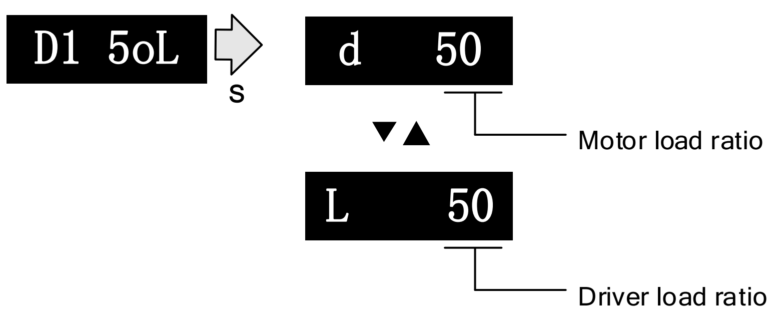
10. d14rg Regenerative load factor d15oL Overload factor

Regenerative load factor（Er120 might occur, if the value increases indefinitely）

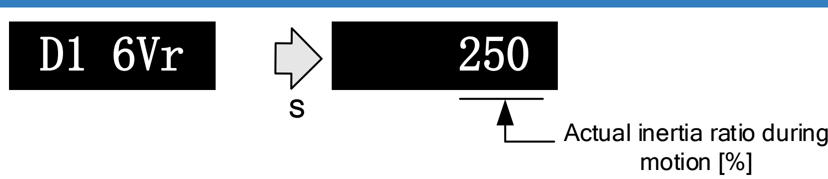


Overload factor（Er100 might occur, if d increases indefinitely

Er101 might occur, if L increases indefinitely）

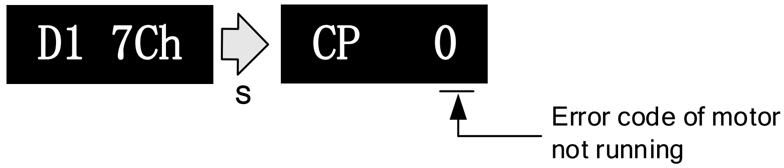


11、d16Vr Inertia ratio



Use auxiliary function **AF_GL** or Motion studio to measure the inertia ratio. The result will be shown on **D1 6Vr**, hold M to write the value in P00.04.

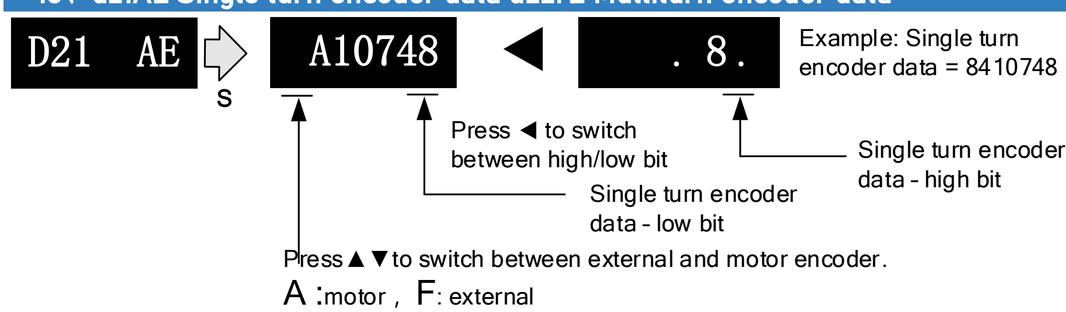
12、d17Ch Motor not running cause



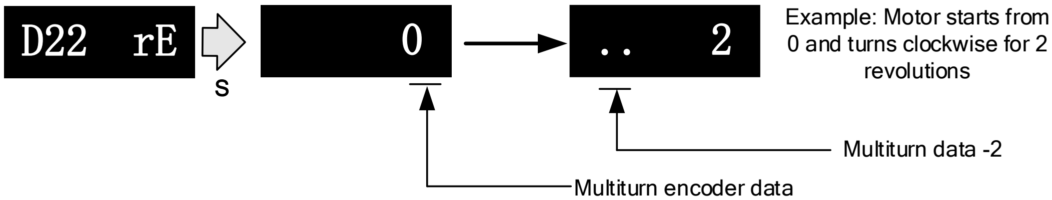
"d17Ch" Motor No Running Cause - Codes & Descriptions

Display Code	Description	Content
CP 0	Normal	
CP 1	DC bus undervoltage	Check if DC bus voltage is too low on D27
CP 2	No SRV-ON signal	Servo-ON input (SRV-ON) is not connected to COM-
CP 3	POT/NOT input valid	P05.04 = 0, POT is in open circuit, velocity command is in positive direction NOT is in open circuit, velocity command is in negative direction
CP 4	Driver alarm	/
CP 5	Relay not clicked	Check input voltage
CP 6	Pulse input prohibited(INH)	P05.18=0
CP 7	Position command too low	No command or too low
CP 8	CL valid	P05.17=0, deviation counter connected to COM-
CP 9	Zero speed clamp valid	P03.15 = 1, Zero speed clamp input is open

13、d21AE Single turn encoder data d22rE Multiturn encoder data

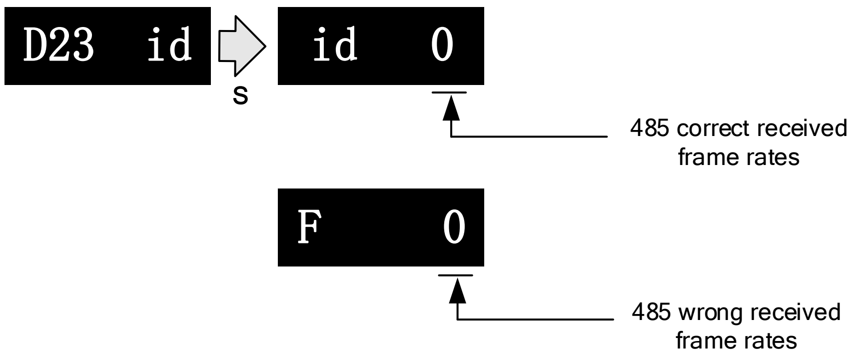


For 23-bit encoder, single turn encoder data = 0~8388607.Each value corresponds to certain position in a single revolution of the rotor, clockwise motion as negative, counter clockwise motion as positive. When counter clockwise single turn data > 8388607, multiturn data +1, clockwise single turn data < 0, multiturn data -1.

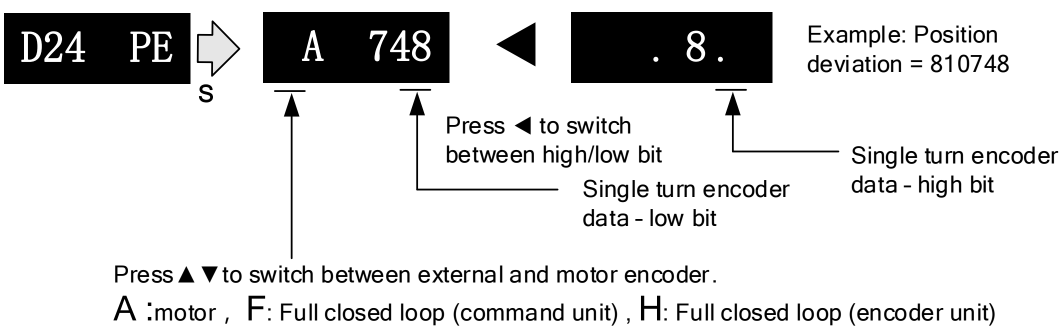


Multiturn encoder data range:-32768~+32767, As no. of revolution goes over range,32767 will jump to -32768、 -32767(counter clockwise)； -32768 will jump to 32767、 32766 (clockwise)

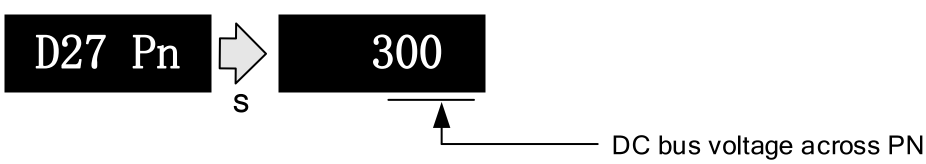
14.d23id 485 received frame



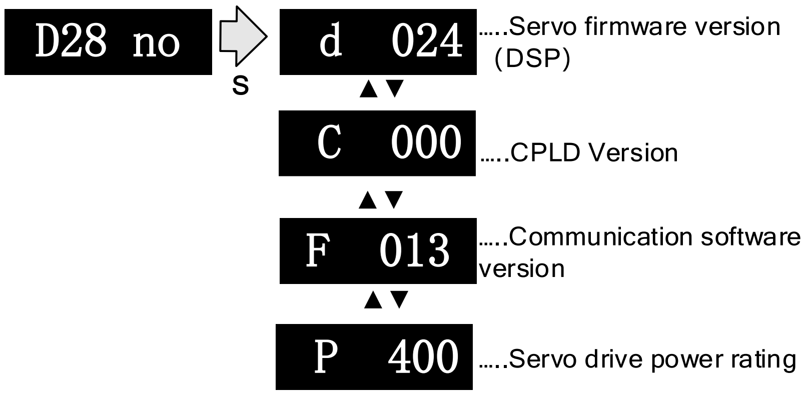
15. d24PE Position deviation



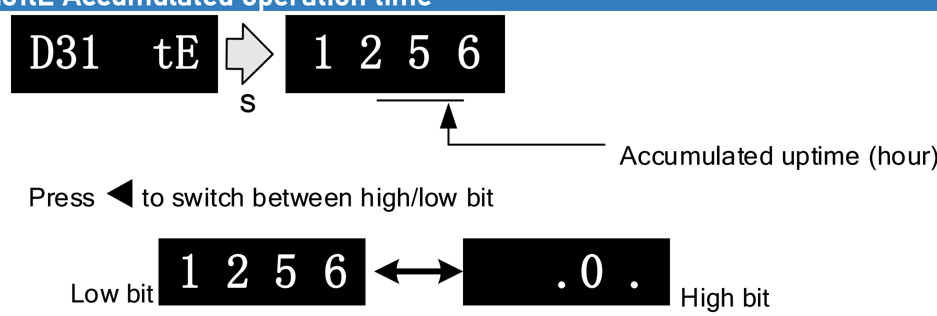
15. d27Pn DC bus voltage



16. d28no Software version

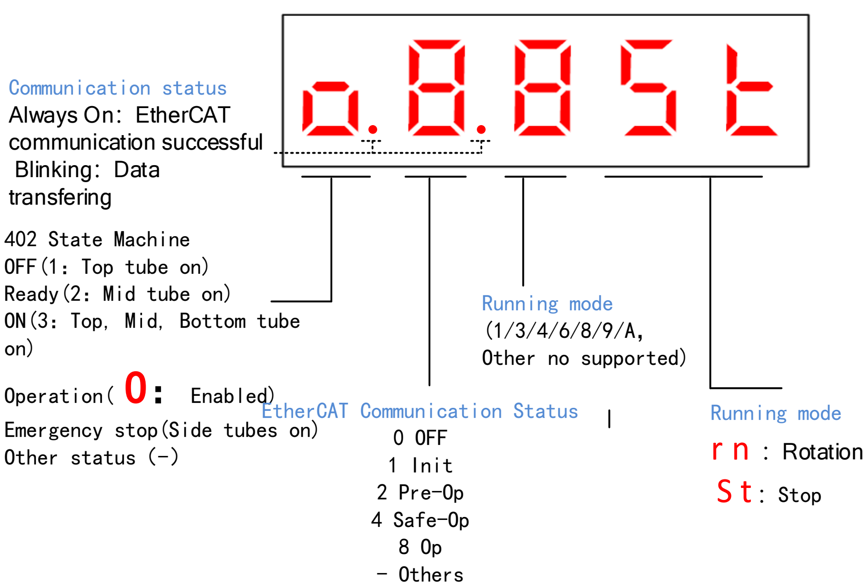


17. d31tE Accumulated operation time



18. d34 Servo driver status display

Driver status: 402 state machine, EtherCAT communication, running mode, running



Display setting at power on

- Default setting for initialization display settings at power on is d34,if any other display is required, please set on P05.28.

Please refer to P05.28 for any display content required on the front panel during initialization

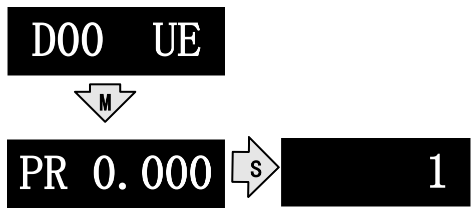
P05.28	Label	LED initial status			Valid mode(s)	P	S	T
	Range	0~35	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0539		
	Valid	Immediate						

To set content display on front panel of the servo driver at servo driver power on.

Value	Status	Value	Status	Value	Status
0	Position deviation	14	Regenerative load rate	28	Software version
1	Motor speed	15	Overload rate	29	Internal usage
2	Position command deviation	16	Inertia load ratio	30	Encoder communication failure counts
3	Velocity control command	17	Cause(s) of non-rotation	31	Accumulated uptime
4	Actual feedback torque	18	No. of I/O changes	32	Internal usage
5	Feedback pulse sum	19	Internal usage	33	Driver temperature
6	Command pulse sum	20	Absolute encoder data	34	Servo status
7	Max. torque	21	Encoder single turn data	35	Internal usage
8	Position command frequency	22	Encoder multiturn data	43	External encoder Z-phase count
9	Control mode	23	485 receive frame	44	External encoder feedback pulse per revolution
10	I/O status	24	Encoder position deviation	45	External encoder direction
11	Analogue input	25	Internal usage	46	Current position comparison point
12	Alarm cause & history record	26	Internal usage		
13	Warning ID	27	PN Voltage		

4.5 Parameters saving

Save using driver's front panel

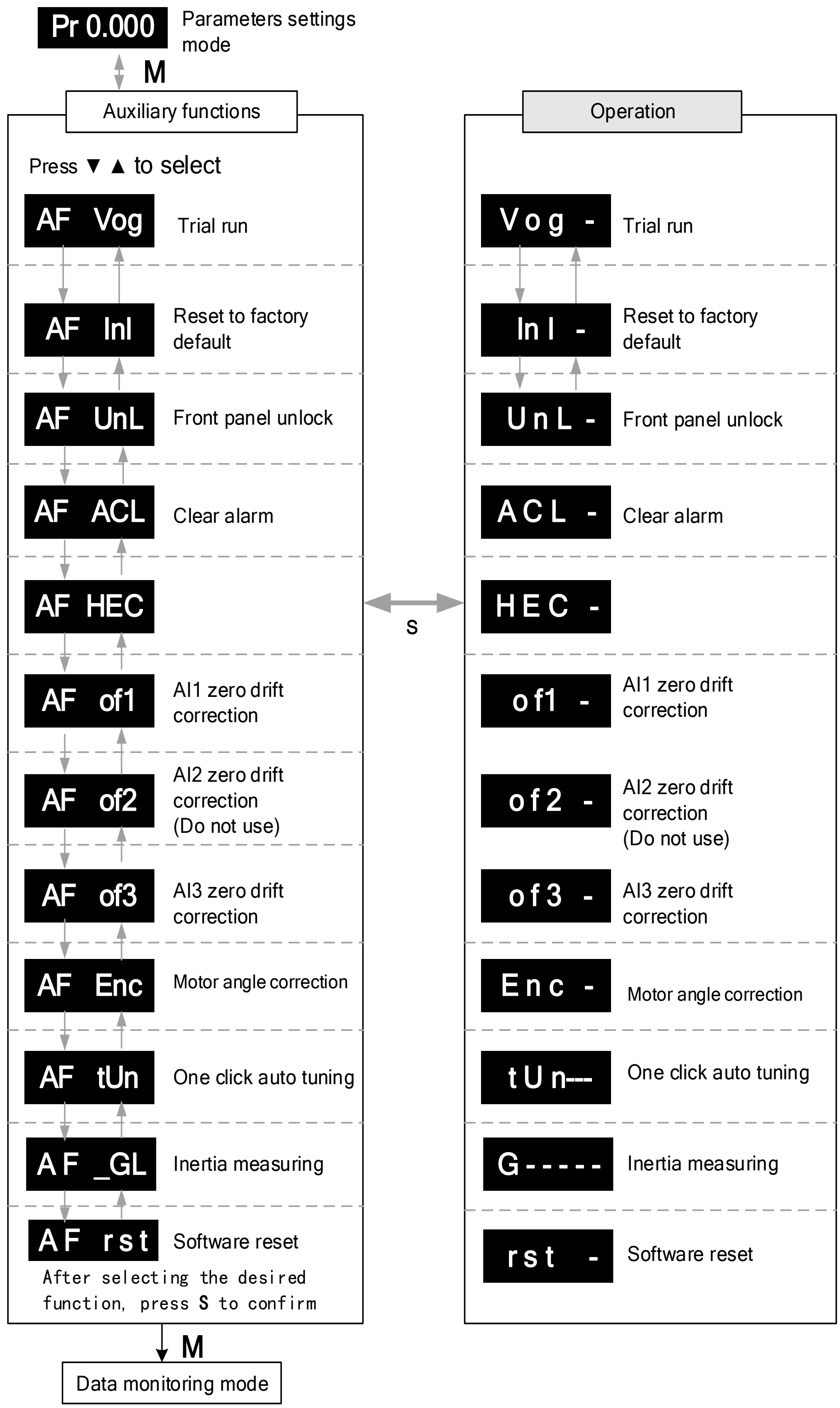


Increase/decrease value using ▲ ▼, press **S** to select the parameters to be modified

Select value using ◀

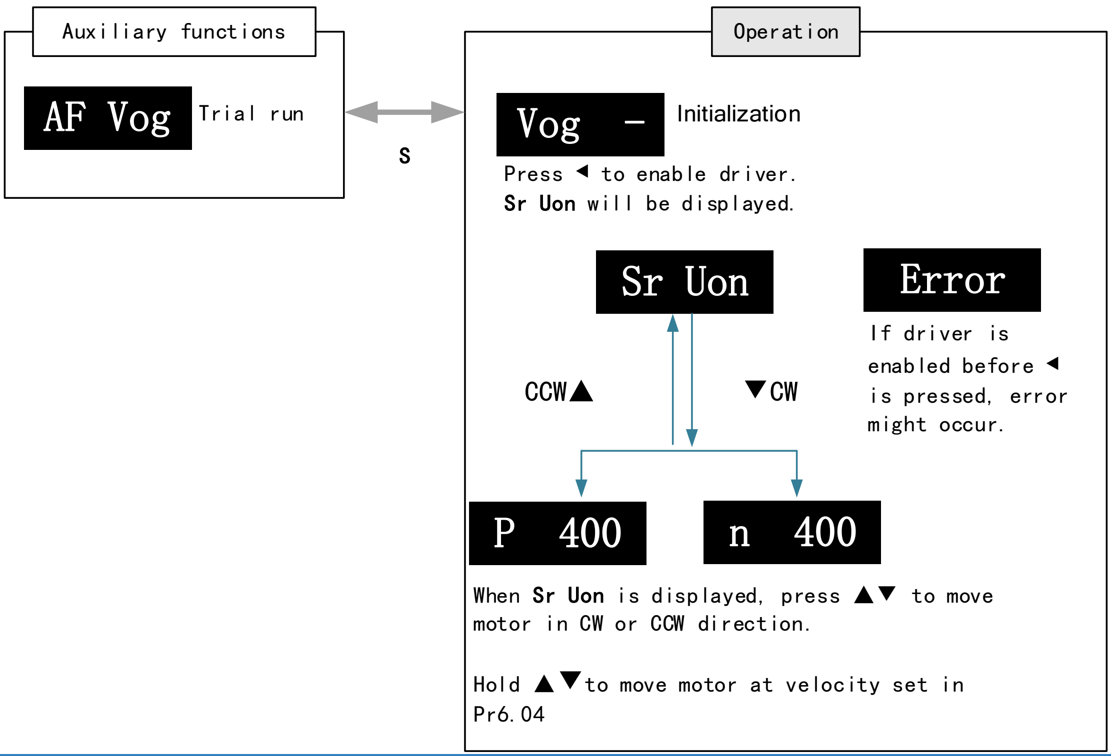
After modifying the selected parameter to desired values, press **S** to confirm and save the changes. If the parameter is modified but user does not want to save the changes, press **M** to exit without saving. Some parameter modifications will only take effect after the driver is restarted.

4.6 Auxiliary function



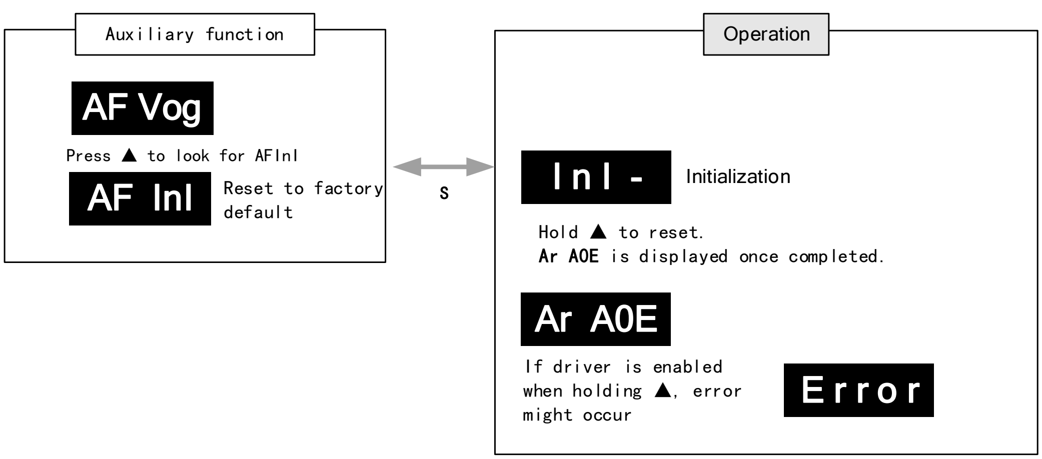
AF Vog Trial run

- Please disable servo driver before performing any trial run.
- Please don't modify gain related parameters during trial run to prevent any occurrence of mechanical vibrations.
- Only use trial run when P00.01 set to 0, 1, 6.
- Please check P06.04 (JOG velocity) and P06.25 (JOG acceleration) before running.
- Press **S** to exit trial run.

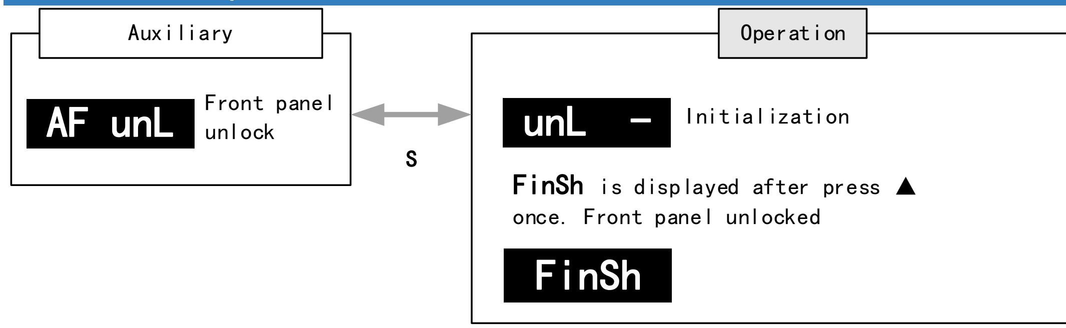


AF Inl Reset to factory default

To reset parameters settings to factory default. Can be used to reset parameters using auxiliary function on front panel or using object dictionary.

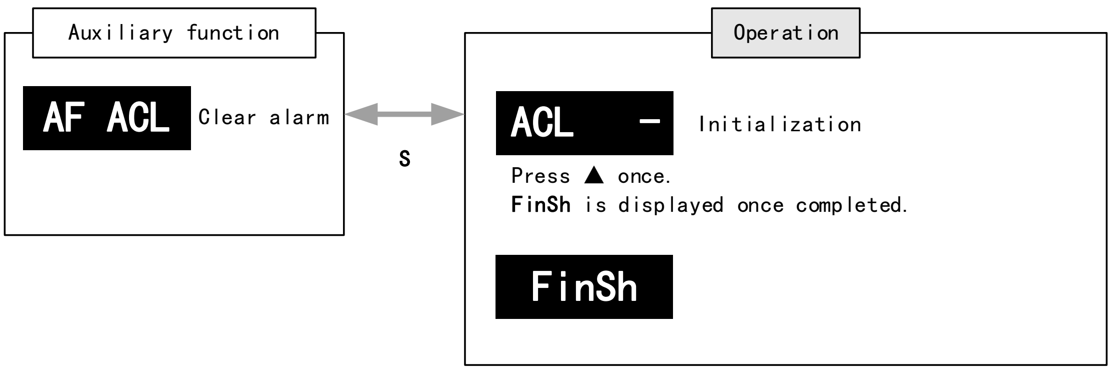


AF unL Front panel unlock



AF ACL Clear alarm

Alarm can be cleared using this auxiliary function but before that, the error needs to be solved and driver needs to be restarted.

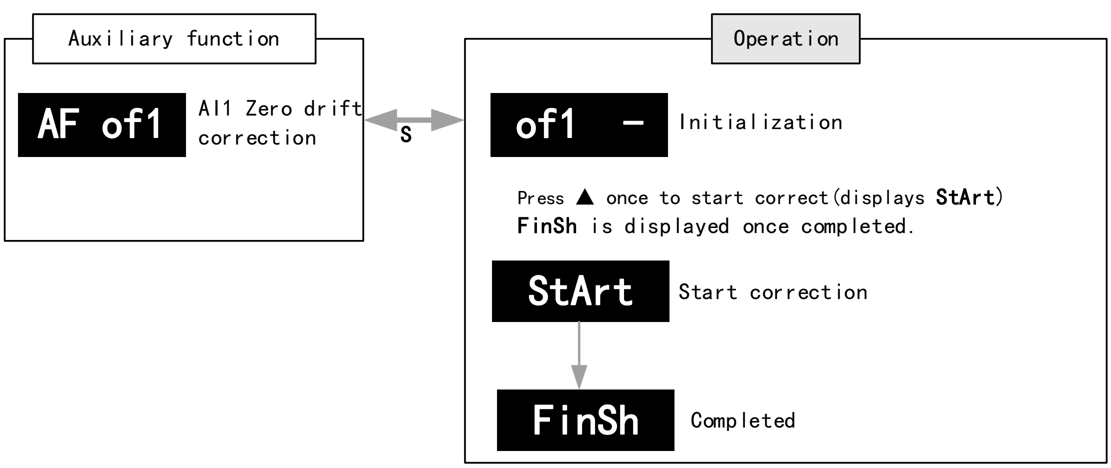


For alarms that can be cleared using this function, please refer to table in Chapter 9.

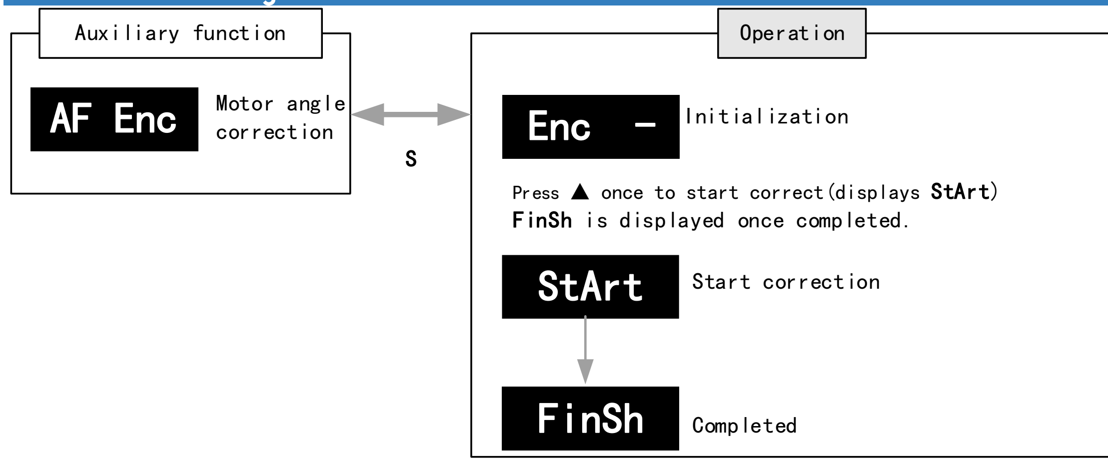
AF of1 - AF of3 Analog input AI1-3 zero drift correction

Auto adjustment of analog input zero drift settings

Analog input	Parameter (Zero drift settings)
AI1	P04.22
AI2	P04.25
AI3	P04.28

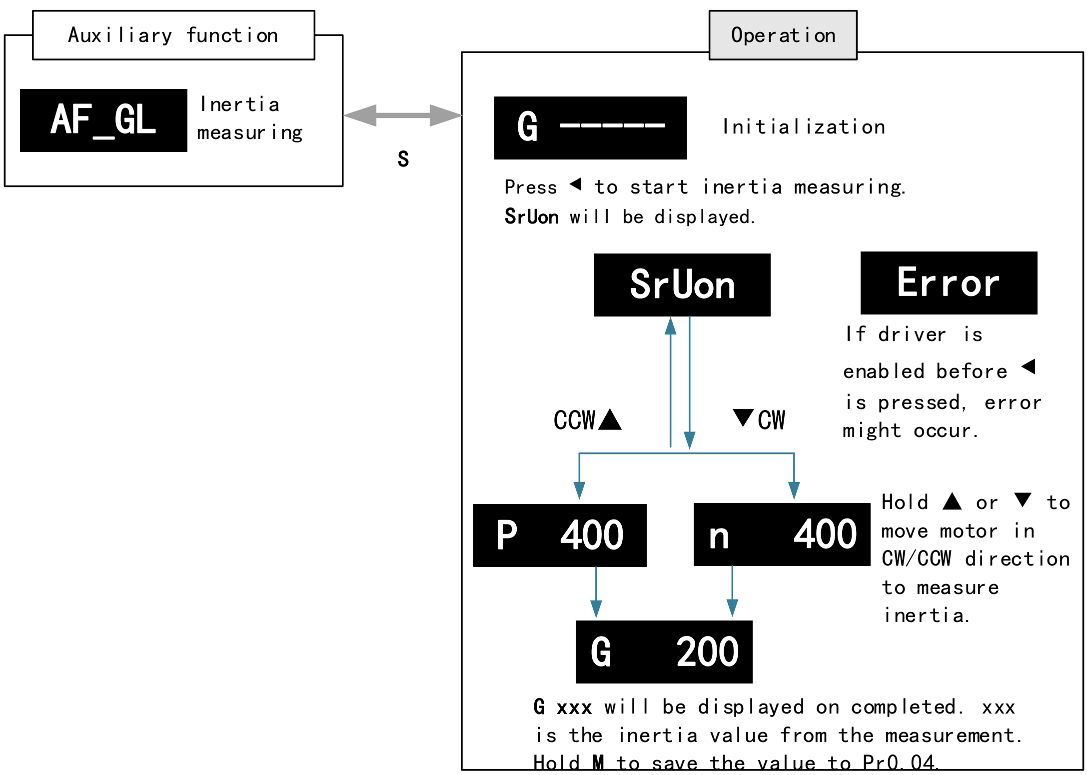


AF Enc Motor angle correction



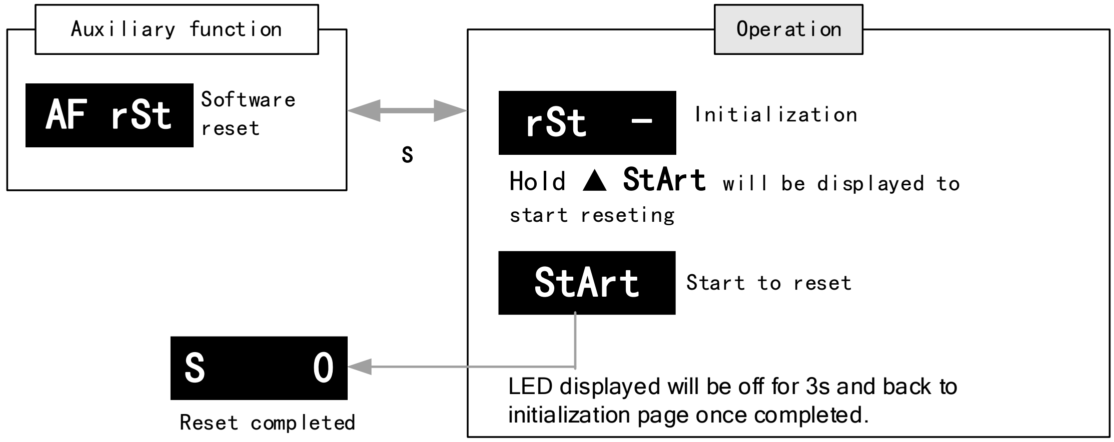
AF_GL Inertia measuring

Please make sure: 1. Velocity < 300RPM, average velocity duration < 50ms
2. Acceleration/Deceleration time < 500ms
Press **S** to exit and disable the driver once completed.



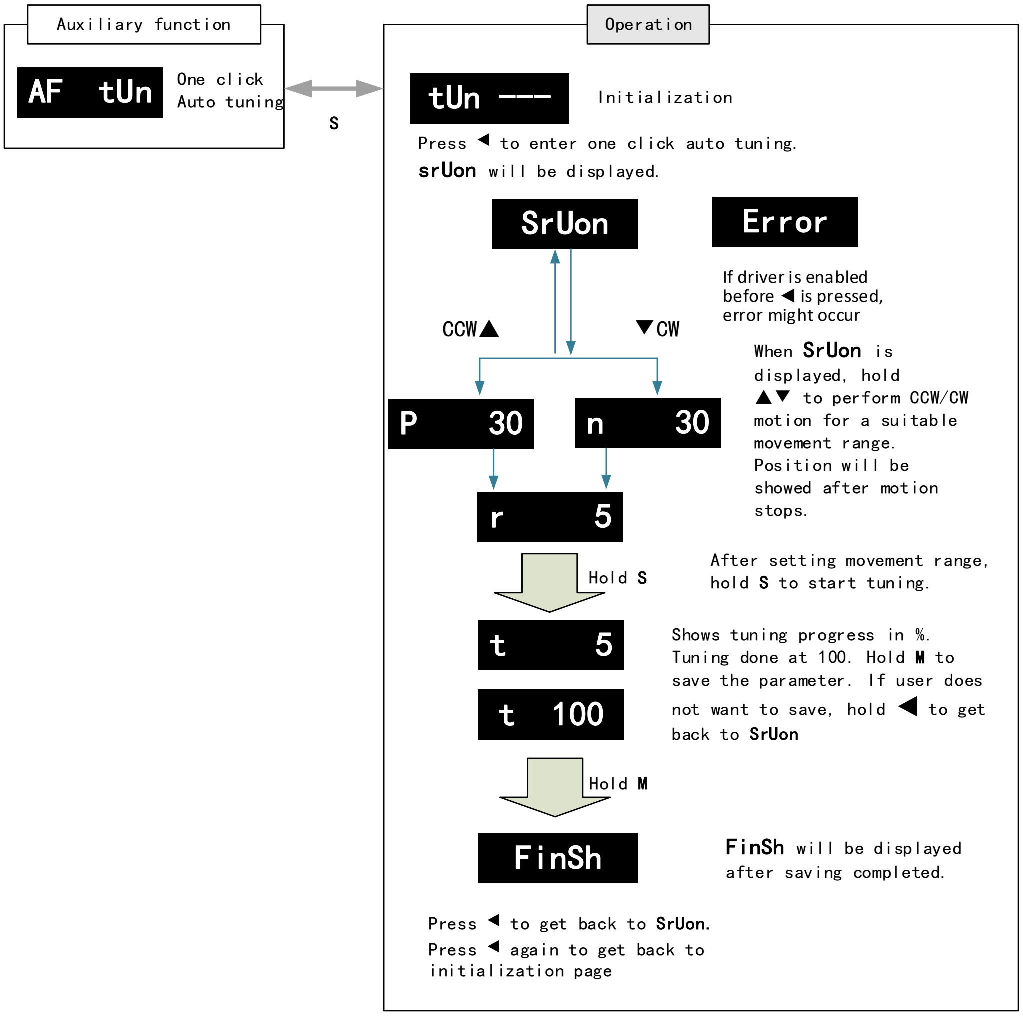
AF rSt Software reset

Software reset is used mainly on parameters modification that takes effect only after driver restart.



AF_tun One click auto tuning

One click auto tuning can be applied by operating the front panel. Set simple movement range and movement range has to be more than 0.5 motor revolution.



4.7 Front panel warning indicator

Warning indicator light status

1. Servo powered on but disabled: All 5 LEDs off
2. Servo powered on and enabled: All 5 LEDs lighted in cycles.
3. Warning status: All 5 LEDs lighted in accordance to assigned signals. Please refer to the table below.

<table>
<tr><th>Warning indicator</th><th>Parameter</th><th>Assignment</th></tr>
<tr><td>LED 1</td><td>P04.74</td><td rowspan="5"><table><tr><th>Set value</th><th>Signal</th></tr><tr><td>[0]</td><td>Null</td></tr><tr><td>1</td><td>Negative limit switch</td></tr><tr><td>2</td><td>Battery low voltage</td></tr><tr><td>3</td><td>Overload</td></tr><tr><td>4</td><td>Torque limit</td></tr><tr><td>5</td><td>Positive limit switch</td></tr></table></td></tr>
<tr><td>LED 2</td><td>P04.75</td></tr>
<tr><td>LED 3</td><td>P04.76</td></tr>
<tr><td>LED 4</td><td>P04.77</td></tr>
<tr><td>LED 5</td><td>P04.78</td></tr>
</table>

4.8 Get Started with Driver Operation

4.7.1 Checklist before operation

No.	Description
Power supply	
1	The voltage of main and control circuit power supply is within rated values.
2	Power supply polarity is rightly connected.
Wiring	
1	Power supply input is rightly connected.
2	Driver's power output UVW matches UVW terminals on the main circuit.
3	No short circuit of driver's input and output UVW terminals.
4	Signal cables are correctly and well connected.
5	Drivers and motors are connected to ground
6	All cables under stress within recommended range.
7	No foreign conductive objects inside/outside the driver.
Mechanical	
1	Driver and external holding brake are not place near combustibles.
2	Installations of driver, motor and axis is fastened.
3	Movement of motors and mechanical axes are not obstructed.

4.7.2 Power On

Connect 220V power supply into main power supply R, S, T terminals and 220V power supply into control circuit power supply L1C, L2C. After power on, light indicator will light up and front panel will display **rEAdY**, then LED initial status will be displayed. Driver is ready for operation if no alarm occurs.

4.7.3 Trial Run

Servo drive must be disabled before performing trial run. For safety precautions, please JOG under minimal velocity.

Related Parameters

No.	Parameters	Label	Set value	Unit
1	P00.01	Control mode settings	0、1、6	/
2	P06.04	JOG trial run command velocity	User defined	r/min
3	P06.25	Trial run acc-/deceleration time	User defined	ms/1000rpm

- *Please make sure the mechanical axis is within the range of motion and travelled distance should not be too long to avoid collision.*
- *Set optimal velocity and acceleration for trial run (not too high!)*
- *Do not modify any gain related parameters during motion to avoid vibration.*

Please refer to "Section 4.5 AF_Vog Trial Run" for detailed explanations on how to perform trial run using front panel operation. Or refer to Motion Studio user manual for details guide on how to perform trial run using Motion Studio.

Chapter 5 Control Mode

Control modes for EL8-RSF series AC servo drives can be divided into 3 categories: Position control mode, Velocity control mode and Torque control mode. RS models also come with a hybrid control mode which is a combination of any 2 modes which are above.

- Position control mode determines position through pulse count. External input pulse frequency determines rotational speed, mainly through motion controller, control card (5V pulse), PLC (24V pulse). Due to the ability of position control mode to control velocity and position tightly, it is usually use in positioning devices. It is the most widely used control mode for servo drives.
- Velocity control mode controls rotational speed through digital I/O or communication command settings. Mainly use in application where speed stability is required.
- Torque control mode is used in applications where forced applied on production material is restricted, mainly winding or scrolling devices. For example, coil winding machines or optical fiber cable production. Torque settings change according to the coil winding diameter as to maintain stable force output throughout the process.

To set control mode								
P00.01	**Label**	Control Mode Settings			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0003		
	Valid	After restart						

Value	Description	
	1st mode	**2nd mode**
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position P00.22=1
		Velocity P00.22=1
		Torque P00.22=2
7~10	Reserved	

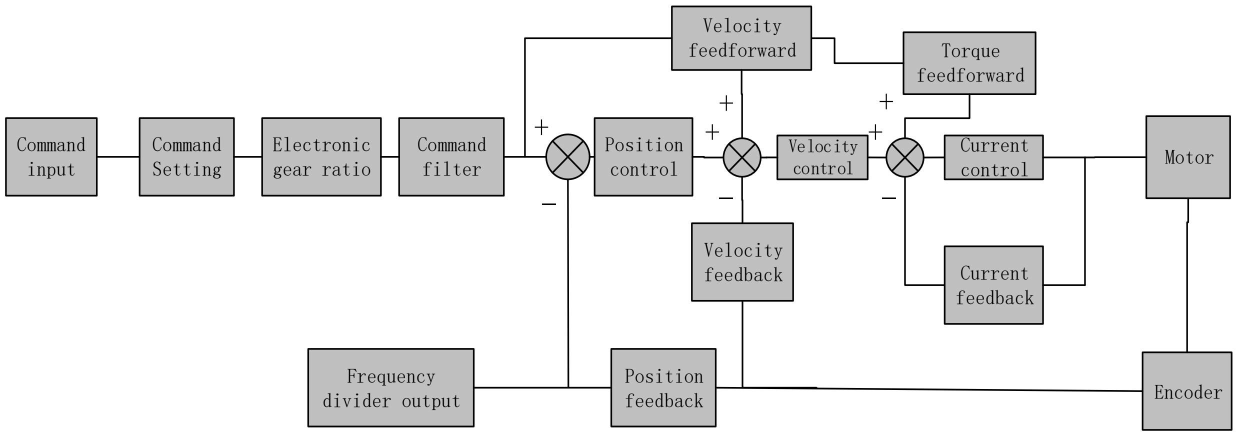
◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2st mode.
Please allow some time in between mode switching commands.

◆Please set P00.01 = 6 to switch to other modes from PR mod, then set 2nd mode using P00.22.

C-MODE is defaulted to Normally Open

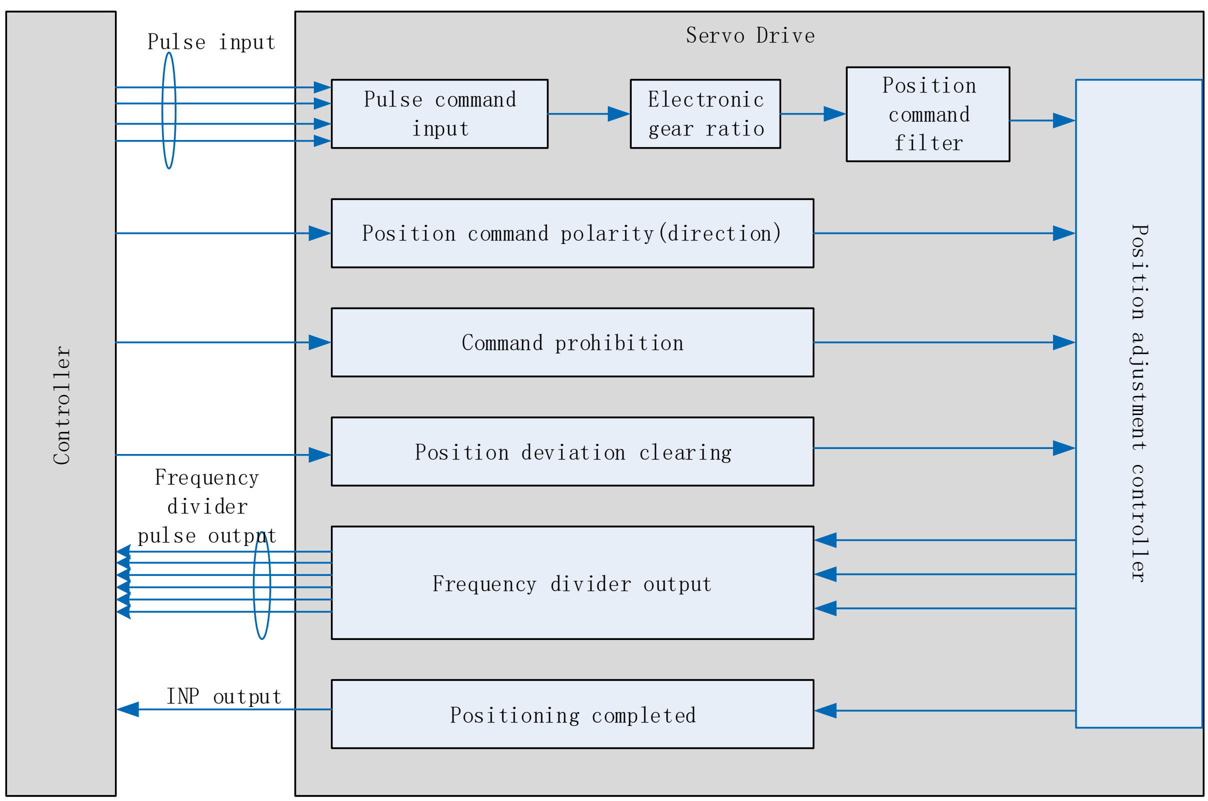
5.1 Position control

Position control determines rotational speed by frequency of external input pulse and angle of rotation through pulse count using 5V pulse from motion controller, control card or 24V pulse for PLC. Applies where precise positioning is required.



Set P00.01 = 0 to activate position control mode.

Please set related servo parameters according with the following diagram.



5.1.1 Pulse input and direction settings

Position command (pulse) input method:

1. A and B phase pulse
2. Positive/Negative direction pulse
3. Pulse count + symbol

Set pulse mode, rotational direction and max. pulse input frequency according to actual need

<table>
<tr><td rowspan="9">Position Command</td><td>41</td><td>PULSE+</td><td>Low-speed pulse command input</td><td rowspan="5">Low-Speed Pulse Command Input Modes
• Differential input (5V)
• Open collector (24V)

Low-speed pulse/direction command input methods:
• PULSE+ and PULSE-: 5V differential input (200kHz)
• SIGN+ and SIGN-: 5V differential input (200kHz)
• PULLH and PULSE-: 24V single-ended input (200kHz)
• PULLH and SIGN-: 24V single-ended input (200kHz)</td></tr>
<tr><td>43</td><td>PULSE-</td><td>Low-speed pulse command input</td></tr>
<tr><td>37</td><td>SIGN+</td><td>Low-speed direction command input</td></tr>
<tr><td>39</td><td>SIGN-</td><td>Low-speed direction command input</td></tr>
<tr><td>35</td><td>PULLH</td><td>Open-collector 24V input common terminal</td></tr>
<tr><td>38</td><td>HPULSE+</td><td>High-speed pulse command input</td><td rowspan="2">• 4MHz high-speed pulse command input: 5V differential input</td></tr>
<tr><td>36</td><td>HPULSE-</td><td>High-speed pulse command input</td></tr>
<tr><td>42</td><td>HSIGN+</td><td>High-speed direction command input</td><td rowspan="2">• 4MHz high-speed direction command input: 5V differential input</td></tr>
<tr><td>40</td><td>HSIGN-</td><td>High-speed direction command input</td></tr>
<tr><td>COM</td><td>17</td><td>+24V</td><td>Internal 24V power supply</td><td>• Voltage range: +20~28V</td></tr>
</table>

	14	COM-		• Maximum output current: 200mA • Warning: Prohibited to use as a shared power supply.

P00.05	**Label**	Command pulse input selection			**Valid mode(s)**	**P**
	Range	0~1	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x000B
	Valid	After restart				

Value	Description
【0】	Pulse input low speed channel (200/500kHz pulse input)
1	Pulse input high speed channel (4MHz pulse input)

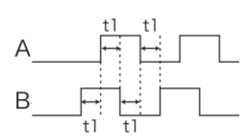
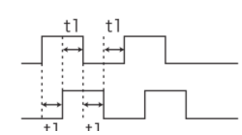
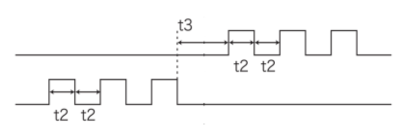
Both channels cannot be used at the same time.

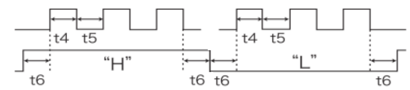
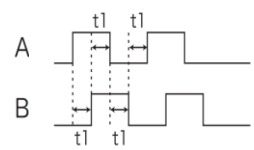
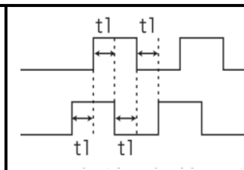
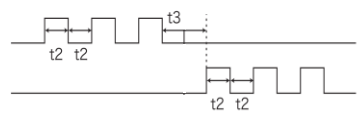
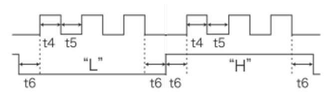
P00.06	**Label**	Command pulse polarity inversion			**Valid mode(s)**	**P**
	Range	0~1	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x000D
	Valid	After restart				

P00.06 and P00.07 set command pulse input inversion and mode correspondingly.

P00.07	**Label**	Command pulse input mode			**Valid mode(s)**	**P**
	Range	0~3	**Unit**	—	**Default**	3
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x000F
	Valid	After restart				

Command pulse input

Command Polarity inversion (P00.06)	Command pulse input mode settings (P00.07)	Command Pulse Mode	Positive signal	Negative signal
【0】	0 *or* 2	90°phase difference 2 phase pulse （Phase A+ Phase B）		
	1	CW pulse sequence ＋ CCW pulse sequence		

	【3】	Pulse sequence ＋ Directional symbol	
1	0 *or* 2	90°phase difference 2 phase pulse （Phase A＋Phase B）	 
	1	CW pulse sequence ＋ CCW pulse sequence	
	3	Pulse sequence ＋ Directional symbol	

Command pulse input signal max. frequency and min. duration needed

Command pulse input interface		Max. Frequency	Min. duration needed（μ s）					
			t1	t2	t3	t4	t5	t6
Pulse sequence interface	Differential drive	500 kHz	2	1	1	1	1	1
	Open collector	200 kHz	5	2.5	2.5	2.5	2.5	2.5
	High speed differential drive	4Mhz	0.25	0.125	0.125	0.125	0.125	0.125

Please set >0.1μs for the duration between rising and falling edge of command pulse input signal.
1 revolution with 2500 pulses 2-phase pulse input when P00.07=0 or 2, P00.08 = 10000;
1 revolution with 10000 pulses 1-phase pulse input when P00.07=1 or 3, P00.08 = 10000

P05.32	**Label**	Max. command pulse input frequency		**Valid mode(s)**	**P**		
	Range	0~8000	**Unit**	kHz	**Default**	4100	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0541	
	Valid	Immediate					
	Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds P05.32.						

5.1.2 Electronic Gear Ratio

To realize correspondent motor rotational angle to arbitrarily set input command input by multiplying pulse command input from controller and coefficient of frequency divider/multiplier. Motor might not reach target velocity due to insufficient pulse output from controller. This function can be used to solve this issue by increasing pulse command frequency.

1. When P00.08 = 0, P00.09 and P00.10 will be valid. Other than that, P00.08 set value will be valid.
2. EL8-RSF series supports 2 independent sets of electronic gear ratio. The 2 sets can be switch by delivering a command frequency divider/multiplier input DIV1. Both sets of electronic gear ratio is set up using P00.08, P00.09 and P00.10; P05.00, P05.01 and P05.02.

P00.08	**Label**	1st command pulse count per revolution			**Valid mode(s)**	**P**	**S**	**T**
	Range	0-67100864	**Unit**	PULSE	**Default**	10000		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0010 L: 0x0011		
	Valid	After restart						
	Control will affected if value set is too low. Err1b1 might occur if value < 500. (1) P00.08 valid when ≠ 0: Motor revolution = input pulse count / [P00.08 value] (2) P00.08 invalid when = 0: P00.09 and P00.10 valid.							
P00.09	**Label**	1st command frequency divider/multiplier numerator			**Valid mode(s)**	**P**		
	Range	1~2147483647	**Unit**	—	**Default**	1		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0012 L: 0x0013		
	Valid	After restart						
	Valid when P00.08 = 0, please refer to description in P00.10.							
P00.10	**Label**	1st command frequency divider/multiplier denominator			**Valid mode(s)**	**P**		
	Range	1~2147483647	**Unit**	—	**Default**	1		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0014 L: 0x0015		
	Valid	After restart						
	1. Settings： (1)Driver command pulse input count : X (2)Encoder pulse count after frequency divider/multiplier: Y (3)Encoder pulse count per revolution: Z (4)Motor revolution: W 2. Calculation： （1）X, Y Y = X * P00.09 / P00.10 Please keep the value of P00.09 and P00.10 to be smaller than 2^{24} (16777216). （2）Z Motor with 23-bit motor： Z= 2^{23} = 8388608 （3）Y, Z, W W = Y / Z *Performance cannot be guaranteed if frequency divider/multiplier ratio is set to extreme values. Err1b1 might occur if W < 500.*							

5.1.3 Position command filter

Position command filter is to filter position command after electronic gear ratio frequency dividing/multiplying. Including position command smoothing filter and position command FIR filter.

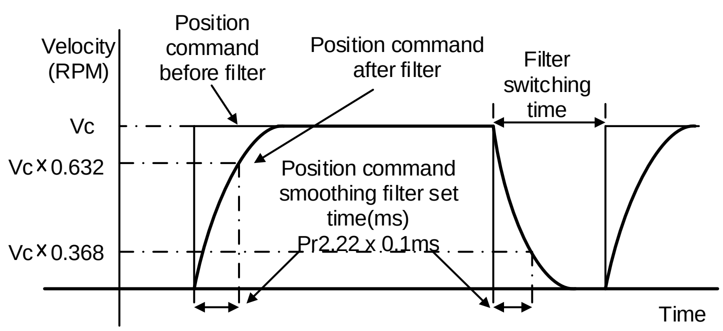
Position command filter should be added for the following cases:

1. Position command pulse from controller has not yet to undergo acceleration/deceleration (with steep acceleration/deceleration).
2. Low command pulse frequency
3. Electronic gear ratio = 10 times or above

Position command filter can smoothen position command and motor rotation will be more stable

P02.22	**Label**	Position command smoothing filter			**Valid mode(s)**	P		
	Range	0~32767	**Unit**	0.1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x022D		
	Valid	At stop						

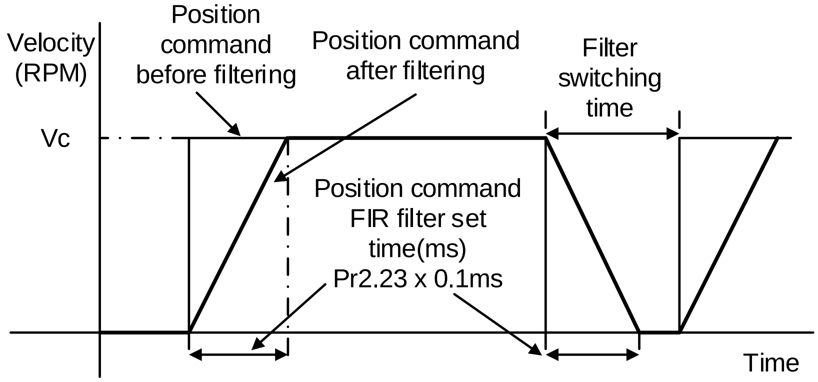
To set time constant of 1 time delay filter of position command.
To set time constant of 1 time delay filter, according to target velocity Vc square wave command as show below.



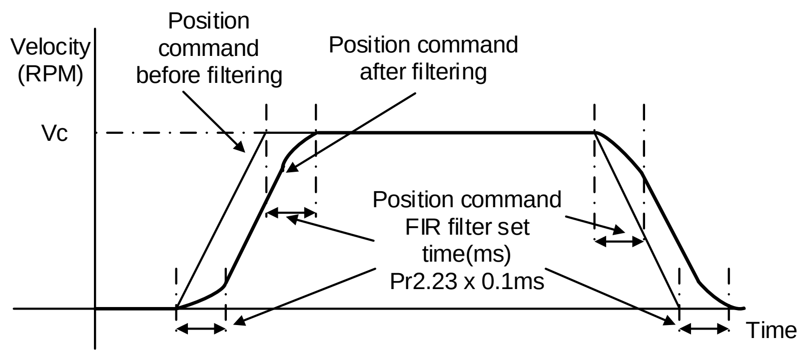
Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.22 is set too high, overall time will be lengthened.

P02.23	Label	Position command FIR filter			Valid mode(s)	P		
	Range	0~2500	Unit	0.1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x022F		
	Valid	At stop						

As shown below, when target velocity Vc square wave command reaches Vc, it becomes trapezoidal wave after filtering.



As shown below, when target velocity Vc trapezoidal command reaches Vc, it becomes S wave after filtering.



Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If P02.23 is set too high, overall time will be lengthened.

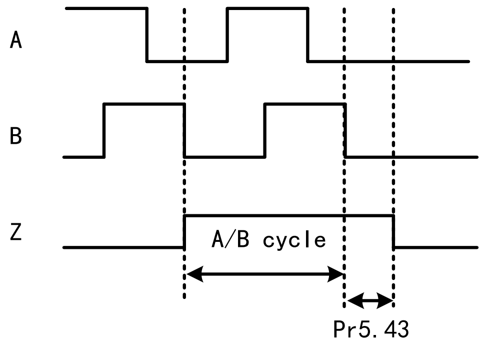
Note: Please wait for command to stop and after filter idle time to modify P02.23.
Filter switching time = (P02.23 set value x 0.1ms + 0.25ms)

5.1.4 Frequency divider output

Frequency divider output indicates position command pulse or encoder feedback position pulse which is A and B phase pulse output.
Frequency divider output delivers motor encoder or external encoder position feedback to controller using ABZ phase pulses

***Encoder Z-signal width ≥ 62.5ms, or equivalent to an A/B signal cycle. If frequency divider output Z-signal width has to be widen, set through P05.43.*
**When P05.43 = 0, frequency divider Z-signal width is similar to width of single A/B cycle.*
If P05.43 = 1~500, set delay based on A/B cycle width.

Value	Description
【0】	Z bandwidth equivalent to 1 cycle of A/B
1~500	Delay setting on top of A/B cycle width



Related parameters

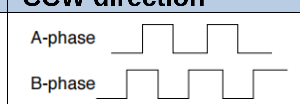
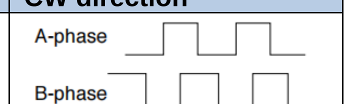
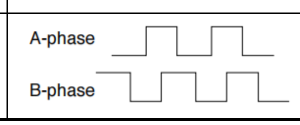
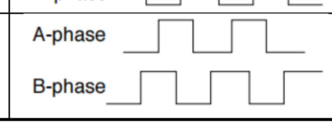
P00.11	Label	Encoder output pulse count per revolution			Valid mode(s)	P	S	T
	Range	1~32767	Unit	P/r	Default	2500		
	Byte length	16bit	Attribute	R/W	485 address	0x0017		
	Valid	After restart						

If P00.11 = 1000, encoder differential output signal per revolution = 4000 pulses

P00.12	Label	Pulse output logic inversion			Valid mode(s)	P	S	T
	Range	0~1	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0019		
	Valid	After restart						

To set phase B logic and output source from encoder pulse output. To inverse B-Phase pulse logic and change the relation between Phase A and Phase B

Pulse output logic inversion

P00.12	Phase B logic	CCW direction	CW direction
[0]	Not inverted		
[1]	Inverted		

P05.42	Label	Frequency divider output – Z-signal polarity			Valid mode(s)	P	S	T
	Range	0~7	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0555		
	Valid	Disabled						

Bit	Polarity	Description
Bit0	0 = Positive 1 = Negative	Z polarity setting of frequency divider output and position comparison
Bit1	0 = Positive 1 = Negative	Only valid in position comparison. Polarity setting when phase A frequency divider as position comparison output
Bit2	0 = Positive	Only valid in position comparison. Polarity setting when phase B frequency divider as position comparison output

P05.44	Label	Frequency divider output source			Valid mode(s)	P	S	T
	Range	0~4	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0559		
	Valid	After restart						

Value	Description
【0】	Position feedback of encoder #1(motor encoder)
1	Position feedback of encoder #2(external encoder)
2	Reserved
3	Pulse input command position synchronous output; position comparison not available in this mode
4	Frequency divider output prohibited

5.1.5 Positioning completed INP signal output

INP signal output will be valid when position deviation is within the range when positioning is completed. Set unit in P05.20.

P04.31	Label	Positioning complete range			Valid mode(s)	P		
	Range	0～10000	Unit	P05.21 set unit	Default	20		
	Byte length	16bit	Attribute	R/W	485 address	0x043F		
	Valid	Immediate						

To set position deviation range of INP1 positioning completed output signal. INP1 output signal will be valid once position is complete within the range of deviation set.
Default unit: 0.00001rev. Can be set on P05.21 as command unit (pulse) or encoder unit (pulse)

P04.32	Label	Positioning complete output setting			Valid mode(s)	P		
	Range	0~4	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0441		
	Valid	Immediate						

To set conditions for INP1 output signal to be valid

Value	Positioning completed signal
0	Signal valid when the position deviation is smaller than P04.31
1	Signal valid when there is no position command and position deviation is smaller than P04.31
2	Signal valid when there is no position command, zero-speed clamp detection (ZSP) signal is ON and the positional deviation is smaller than P04.31
3	Signal valid when there is no position command and position deviation is smaller than P04.31. Signal ON when within the time set in P04.33 otherwise OFF.
4	When there is no command, position detection starts after the delay time set in P04.33. Signal valid when there is no position command and positional deviation is smaller than P04.31.

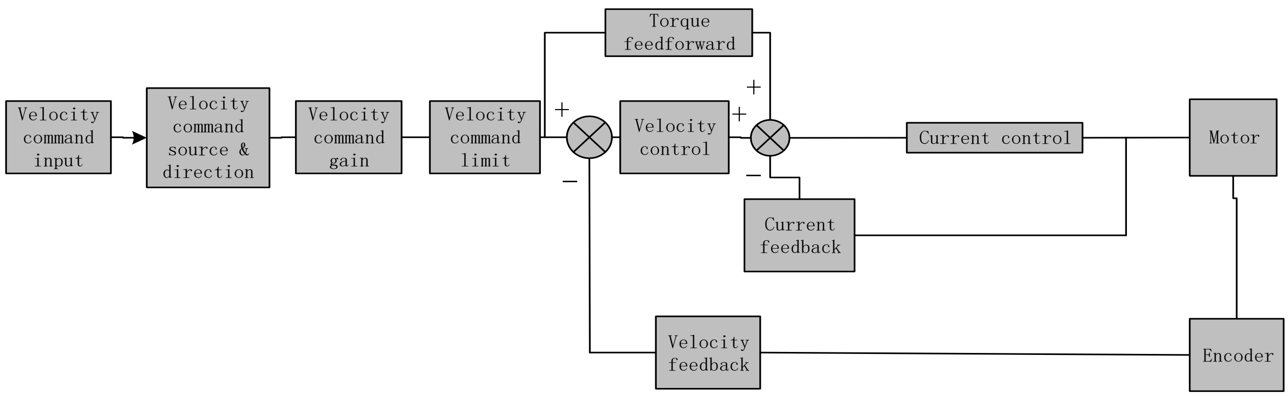
P04.33	**Label**	INP positioning delay time			**Valid mode(s)**	P		
	Range	0~15000	**Unit**	1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0443		
	Valid	Immediate						

Valid when P04.32 = 3.

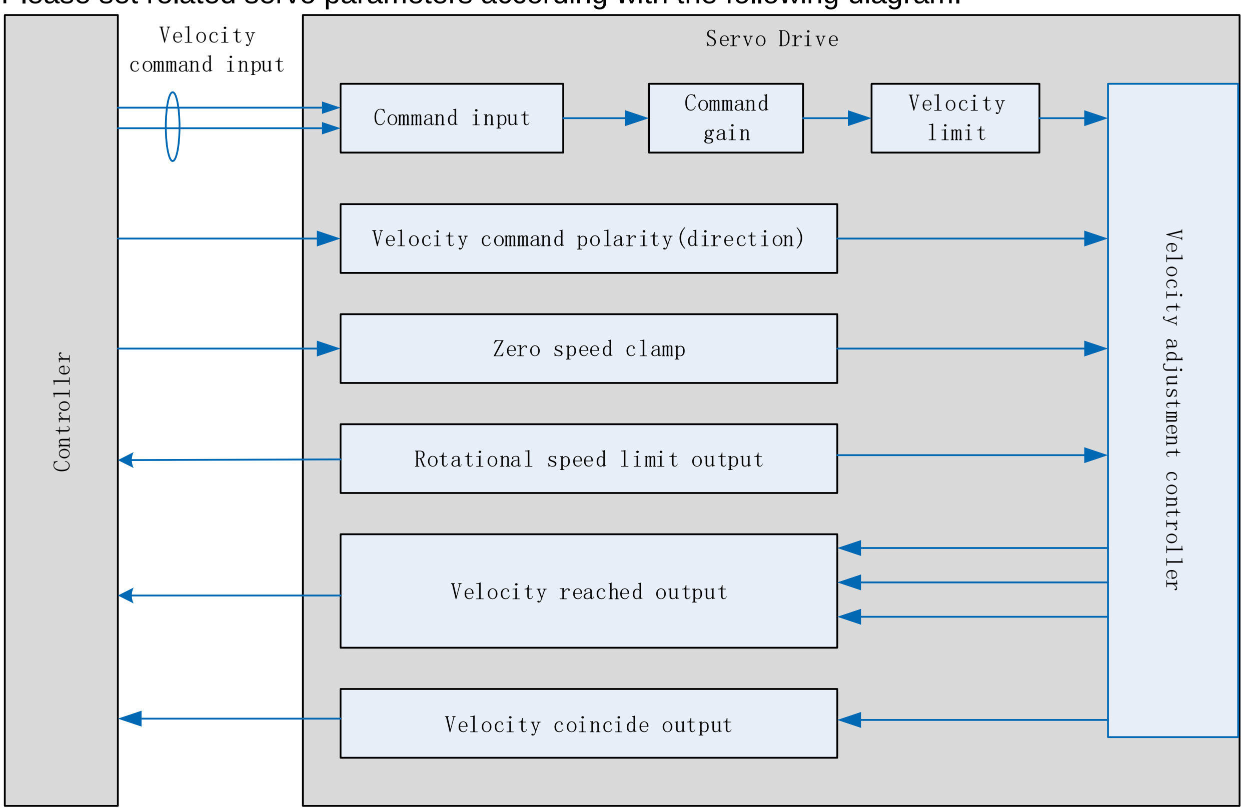
Set value	Positioning completed signal
0	Indefinite delay time, signal ON until next position command
1-15000	OFF within the time set; ON after time set. Switch OFF after receiving next position command.

5.2 Velocity control mode

Velocity mode precisely controls motor rotational speed/direction using analog velocity command or internal related parameters. There are 4 types of velocity control modes for EL8-RSF series AC Servo Drives: Analog control, internal velocity 4 speeds, internal velocity 8 speeds and analog + internal velocity control.
Set P00.01 = 1 to activate velocity control mode.

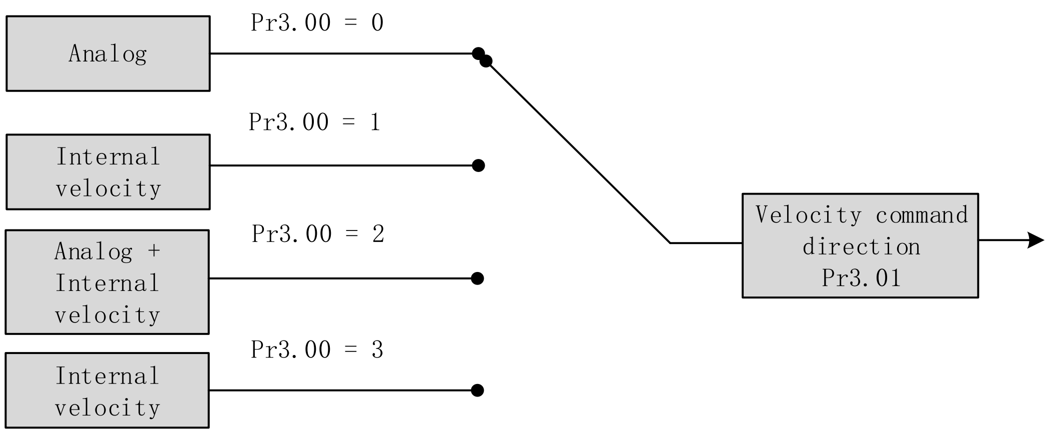


Please set related servo parameters according with the following diagram.



5.2.1 Velocity command input control

Set velocity control mode in P03.00



P03.00	Label	Velocity internal/external switching			Valid mode(s)	S
	Range	0~3	Unit	—	Default	1
	Byte length	16bit	Attribute	R/W	485 address	0x0301
	Valid	Immediate				

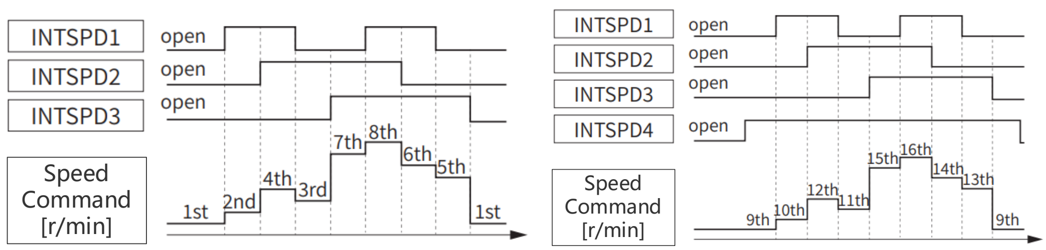
·Connect to the right DI to control internal command velocity settings.

Value	Velocity settings
0	Analog Speed Command (SPR)
【1】	Internal velocity settings 1st – 8th speed（P03.04～P03.11 ）
2	Internal velocity settings 1st – 7rd speed（P03.04～P3.10）， Analog Speed Command (SPR)
3	Internal velocity settings 1st – 16th speed（P03.04～P03.11, P03.36～P3.43）

Value	Internal Command velocity 1 （INTSPD 1）	Internal command velocity 2 （INTSPD2 ）	Internal command velocity 3 （INTSPD3 ）	Internal command velocity 4 （INTSPD4 ）	Velocity command
1	OFF	OFF	OFF	-	1st speed
	ON	OFF	OFF	-	2nd speed
	OFF	ON	OFF	-	3rd speed
	ON	ON	OFF	-	4th speed
	OFF	OFF	ON	-	5th speed
	ON	OFF	ON	-	6th speed
	OFF	ON	ON	-	7th speed
	ON	ON	ON	-	8th speed
2	OFF	OFF	OFF	-	1st speed
	ON	OFF	OFF	-	2nd speed
	OFF	ON	OFF	-	3rd speed
	ON	ON	OFF	-	4th speed

	OFF	OFF	ON	-	5^{th} speed
	ON	OFF	ON	-	6^{th} speed
	OFF	ON	ON	-	7^{th} speed
	ON	ON	ON	-	Analog Speed Command
3	Similar to (P03.00=ON)			OFF	1^{st} speed~ 8^{th} speed
	OFF	OFF	OFF	ON	9^{th} speed
	ON	OFF	OFF	ON	10^{th} speed
	OFF	ON	OFF	ON	11^{th} speed
	ON	ON	OFF	ON	12^{th} speed
	OFF	OFF	ON	ON	13^{th} speed
	ON	OFF	ON	ON	14^{th} speed
	OFF	ON	ON	ON	15^{th} speed
	ON	ON	ON	ON	16^{th} speed

Please change internal command velocity as per diagram below as unexpected axis movement might occurs if 2 command velocities are changed at the same time



P03.00=1 / 2 P03.00=3

Velocity command direction settings

Switch velocity command direction using I/O. Assign VC-SIGN to corresponding DI terminal, velocity command direction will be in accordance to DI signal.

P03.01	**Label**	Velocity command rotational direction selection			**Valid mode(s)**	S
	Range	0~1	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0303
	Valid	Immediate				

To set positive/negative direction of velocity command

Value	Velocity settings（Analog or internal velocity）	Velocity command sign selection（VC-SIGN ）	Velocity command direction
【0】	＋	No effect	Positive
	－	No effect	Negative
1	No effect	OFF	Positive
	No effect	ON	Negative

Velocity command input inversion

Set Analog-Velocity command (SPR) voltage polarity

P03.03	**Label**	Velocity command input inversion			**Valid mode(s)**	S
	Range	0~1	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0307
	Valid	Immediate				

To set voltage polarity of analog velocity command.
Only valid when P03.01 = 0. When P03.01 = 1, rotational direction is only related to VC-SIGN.

Value	Motor rotational direction	
【0】	Not inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」
1	Inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」

If there is an external position sensor with different polarity from P03.03, motor might undergo abnormal motion.

Velocity command input gain

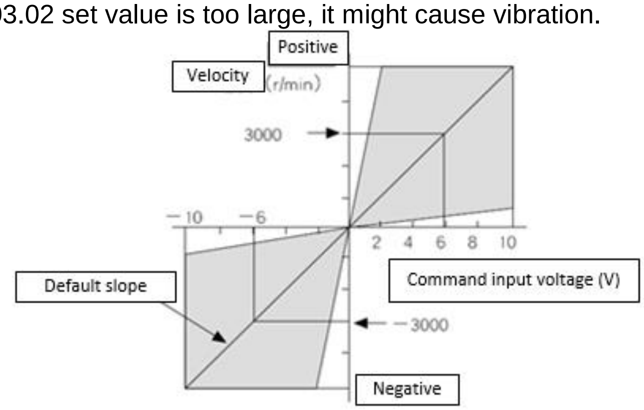
Set Analog-Velocity command (SPR) voltage to motor velocity command switching gain

P03.02	**Label**	Velocity command input gain			**Valid mode(s)**	S
	Range	10~2000	**Unit**	(r/min)/V	**Default**	500
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0305
	Valid	Immediate				

To set gain changes from voltage added onto analog velocity command (SPR) to motor command velocity

P03.02 sets command input voltage and rotational speed slope.
Factory default:
P03.02=500(r/min)/V.
Hence 6V input: 3000 r/min

1. Do not supply more than ±10V power for analog velocity command (SPR).
2. If P03.02 set value is too large, it might cause vibration.



5.2.2 Velocity command acceleration/deceleration

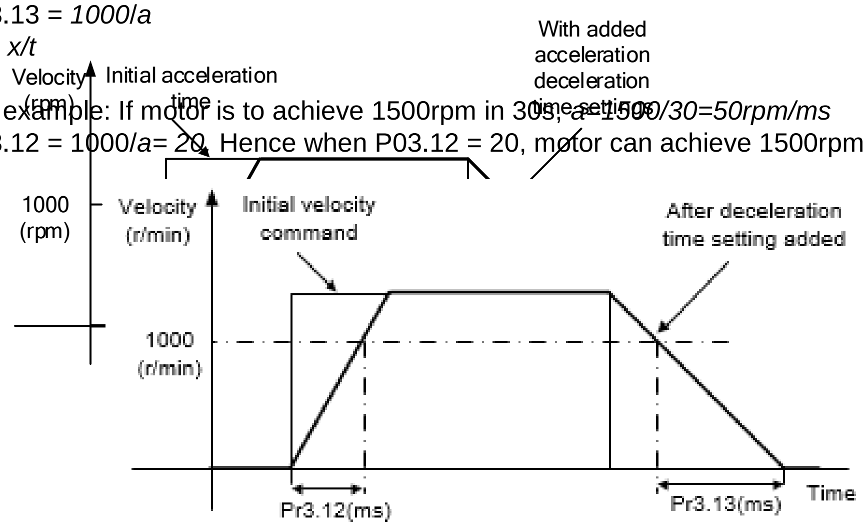
Acceleration/Deceleration is added onto velocity command input to control velocity. This function is valid when entering step-like velocity command or internal velocity settings is used to realize motor soft start. Use Sigmoid acceleration/deceleration to reduce vibration and impact due to changes in velocity.

P03.12	**Label**	Acceleration time settings			**Valid mode(s)**	S
	Range	0~10000	**Unit**	ms/ (1000rpm)	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0319
	Valid	Immediate				
P03.13	**Label**	Deceleration time settings			**Valid mode(s)**	S
	Range	0~10000	**Unit**	ms/ (1000rpm)	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x031B
	Valid	Immediate				

Set max acceleration/deceleration for velocity command.

If target velocity = *x* [rpm], max acceleration = *a* [unit: rpm/ms], acceleration time = *t* [ms]
P03.12 = *1000/a*
P03.13 = *1000/a*
a = x/t

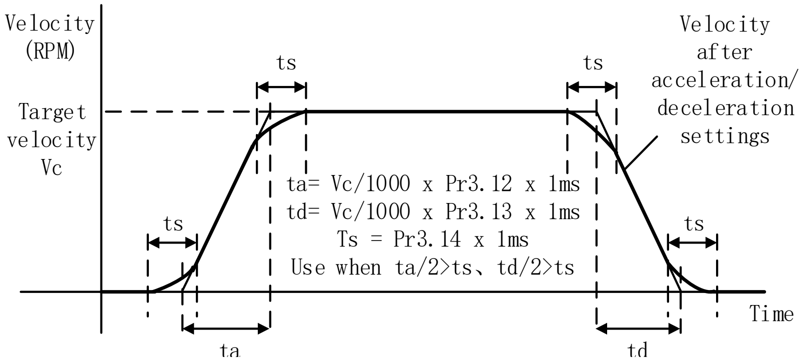
For example: If motor is to achieve 1500rpm in 30s, *a=1500/30=50rpm/ms*
P03.12 = 1000/*a*= 20, Hence when P03.12 = 20, motor can achieve 1500rpm in 30s.



Usually used when there is rapid acceleration or trapezoidal wave velocity command due to many different internal speed segments under velocity control mode which causes instable while motor in motion.
Under velocity control mode, 6083 and 6084 is limited by P03.12 and P03.13 correspondingly.

P03.14	**Label**	Sigmoid acceleration/deceleration settings			**Valid mode(s)**	S
	Range	0~1000	**Unit**	ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x031D
	Valid	After restart				

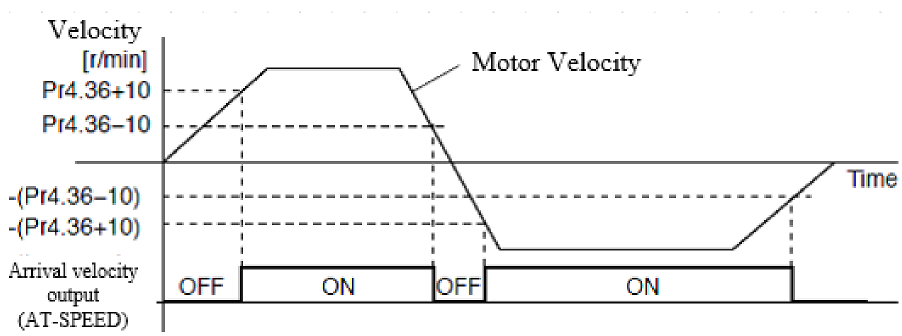
To set sigmoid acceleration and deceleration turning point in accordance to P03.12 and P03.13.



5.2.3 Velocity reached signal AT-SPEED output

Velocity reached signal AT-SPEED output will be valid when motor velocity reached set speed in P04.36. This output function can be assigned through I/O configurations, please refer to P04.10. When velocity matches set conditions, assigned I/O terminal will be ON, signal will be valid.

P04.36	**Label**	Arrival velocity			**Valid mode(s)**	S
	Range	10~2000	**Unit**	r/min	**Default**	1000
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0449
	Valid	Immediate				
	When motor velocity > P04.36, AT-speed output signal is valid. Detection using 10RPM hysteresis.					



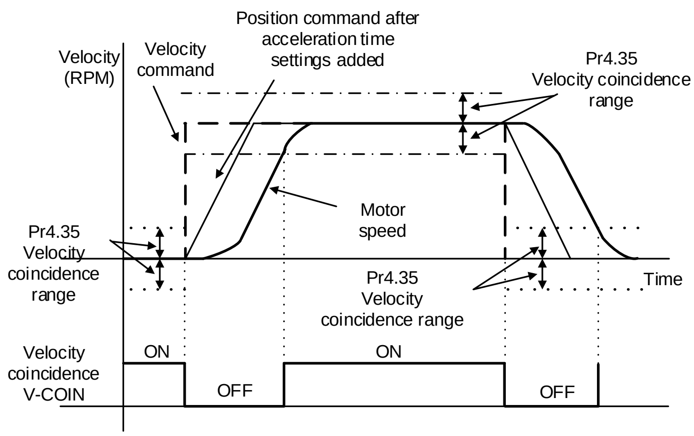
5.2.4 Velocity coincidence V-COIN signal output

V-COIN signal output will be valid when velocity command (before acceleration/deceleration) coincides with motor velocity. Velocity is considered to be coincided if the difference between velocity command before acceleration/deceleration from servo drive and motor velocity is within the value set in P04.35. This output function can be assigned through I/O configurations, please refer to P04.10. When velocity matches set conditions, assigned I/O terminal will be ON, signal will be valid.
In Position signal in PV mode is in synchronization with V-COIN signal.

P04.35	**Label**	Velocity coincidence range			**Valid mode(s)**	S
	Range	10~2000	**Unit**	r/min	**Default**	50
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0447
	Valid	Immediate				

If the difference between velocity command and motor actual speed is below P04.35, Velocity coincidence (V-COIN) output signal valid.

Due to 10RPM hysteresis:
Velocity coincidence output OFF -> ON timing (P04.35 -10) r/min
Velocity coincidence output ON -> OFF timing (P04.35 +10) r/min



5.2.5 Zero Speed Clamp

Forced set velocity command to 0 using zero speed clamp to avoid servo axis from crawling at low velocity.
This input function can be assigned through I/O configurations, please refer to P04.00.

P03.15	**Label**	Zero speed clamp function selection			**Valid mode(s)**	S
	Range	0~3	**Unit**	—	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x031F
	Valid	Immediate				

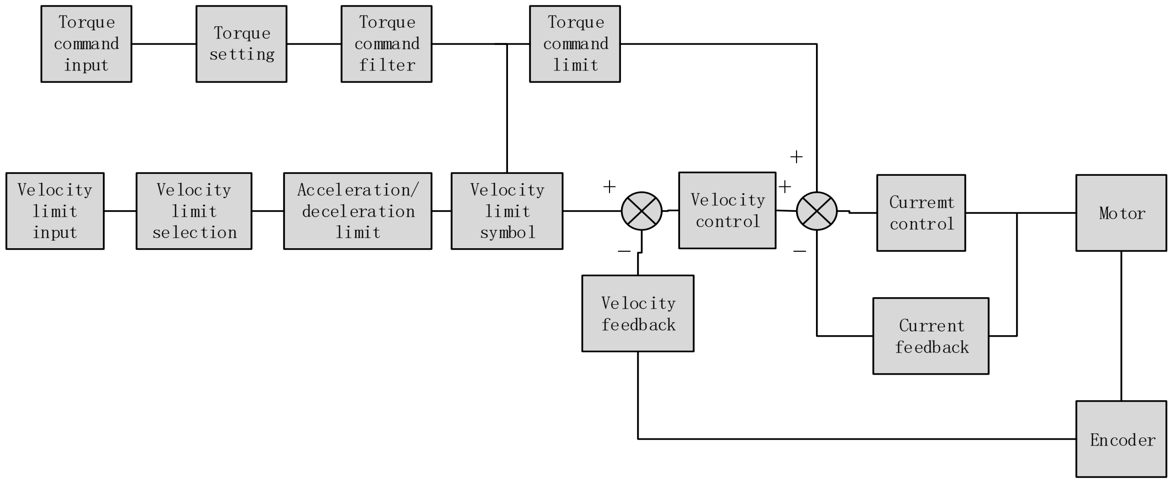
Value	Zero speed clamp function
0	Invalid: zero speed clamp deactivated
1	Velocity command is forced to 0 when the zero speed clamp (ZEROSPD) input signal is valid.
2	Velocity command is forced to 0 when actual velocity is lower than P03.16.
3	Includes conditions from 1 and 2

P03.16	**Label**	Zero speed clamp level			**Valid mode(s)**	S
	Range	10~2000	**Unit**	r/min	**Default**	30
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0321
	Valid	Immediate				

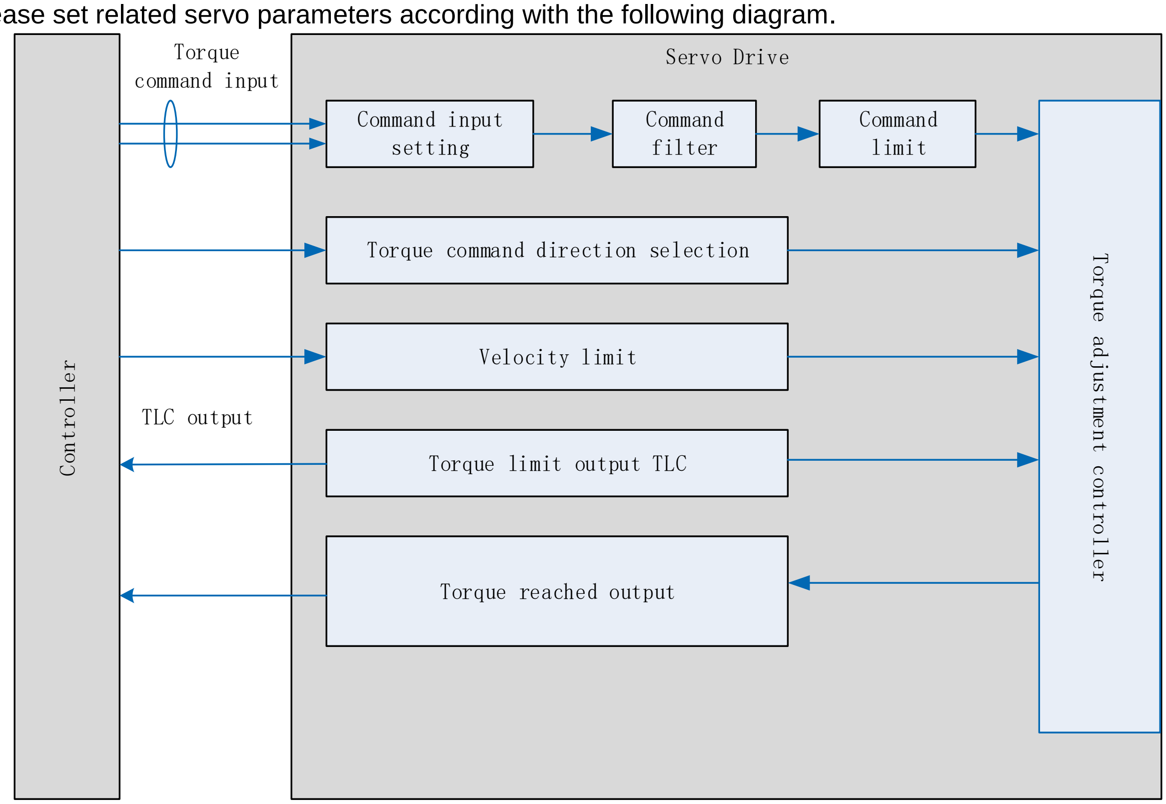
Valid when P03.15 = 2/3, velocity command is forced to 0 when actual velocity is lower than P03.16 and after static time set in P03.23.

5.3 Torque control

Torque control mode is to the size of motor asserted torque through external analogue input or directly from set value internally. This control mode is applicable where torque is the main control and limiting factor.



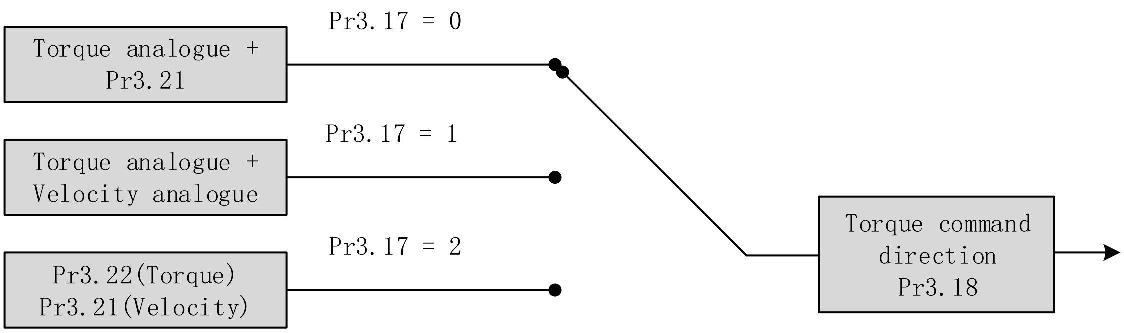
Using Motion Studio or front panel on servo drive, set P00.01 = 2 to activate torque control mode. Please set related servo parameters according with the following diagram.



5.3.1 Torque command input control

Torque control mode settings

Torque control mode includes 3 control modes as shown below. Set torque control mode in P03.17.



P03.17	Label	Torque internal/external switching			Valid mode(s)			T
	Range	0~3	Unit		Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0323		
	Valid	Immediate						

Value	Torque command input	Velocity limit input
【0】	Analog input 3(AI 3)	P03.21 set value
1	Analog input 3(AI 3)	Analog input 1(AI 1)
2	P03.22 set value	P03.21 set value

Torque command direction settings

To switch velocity command direction through DI. Assign TC-SIGN signal to corresponding DI terminal and determine velocity command direction through digital input signal.

P03.18	Label	Torque command direction selection			Valid mode(s)			T
	Range	0~1	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0325		
	Valid	Immediate						

To set torque command positive/negative direction

Value	Direction settings
【0】	TC-SIGN ON/OFF has no effect on torque direction Torque command input「Positive」→Positive direction、 「Negative」→Negative direction
1	Use TC-SIGN ON/OFF status for torque direction OFF: *Positive direction* ON: *Negative direction*

Torque command input inversion

To set the voltage polarity added onto analogue torque command (TRQR)

P03.20	**Label**	Torque command input inversion			**Valid mode(s)**				T
	Range	0~1	**Unit**	—	**Default**	0			
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0329			
	Valid	Immediate							

To set voltage polarity of analog torque command.
Only valid when P03.18 = 0.

Value	Motor torque direction	
【0】	Not inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」
1	Inversed	「Positive voltage」→「Positive direction」 「Negative voltage」→「Negative direction」

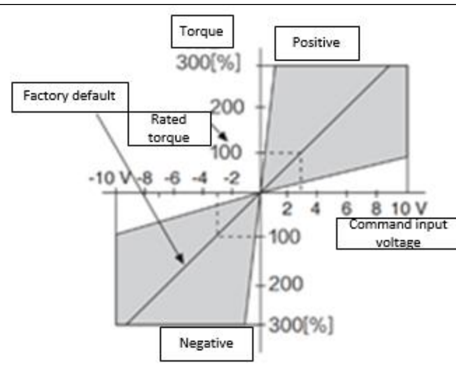
Torque command input gain

To set voltage added on to switching gain of motor torque command from analog torque command(TRQR)

P03.19	**Label**	Torque command input gain			**Valid mode(s)**				T
	Range	10~100	**Unit**	0.1V/100%	**Default**	30			
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0327			
	Valid	Immediate							

To set gain changes from voltage added onto analog torque command (TRQR) to torque command (%)

·Unit: （0.1V/100%）。
·Set input voltage required for rated output torque.
·Default = 30，which is 3V/100%



5.3.2 Torque velocity limit

To set velocity limit in torque mode for safety reasons.

P03.21	**Label**	Velocity limit in torque mode			**Valid mode(s)**				T
	Range	0~10000	**Unit**	r/min	**Default**	0			
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x032B			
	Valid	Immediate							

To set velocity limit in torque control mode. Only valid when P03.17 = 0 / 2.

P03.22	**Label**	Torque command			**Valid mode(s)**				T
	Range	0~300	**Unit**	%	**Default**	0			
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x032D			
	Valid	Immediate							

To set torque limit in torque control mode. Only valid when P03.17 = 2.
Please refer to P03.17.

5.3.3 Torque limit (TL-SEL)

This input function can be assigned through I/O configurations, please refer to P04.00.
To set torque limiting method.

P05.21	Label	Torque limit selection			Valid mode(s)	P	S	T
	Range	0~9	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x052B		
	Valid	Immediate						

Value		Limit
【0】		Positive and negative torque limits: P00.13 First torque limit
1		Positive and negative torque limits: P05.22 Second torque limit
2	TL-SEL OFF	Positive torque limit: P00.13 First torque limit
	TL-SEL ON	Negative torque limit: P05.22 Second torque limit
3		Positive torque limit: AI 1 Negative torque limit: AI 2
4		Positive torque limit: P05.18 Torque limit analog A source selection Negative torque limit: P05.19 Torque limit analog B source selection
5		Positive torque limit: P00.13 First torque limit Negative torque limit: P05.22 Second torque limit
6		Positive torque limit: Minimum of P00.13 and P05.18 Negative torque limit: Minimum of P05.22 and P05.19
7	TL-SEL OFF	Positive torque limit: P05.18 Torque limit analog A source selection; Negative torque limit: P05.19 Torque limit analog B source selection
	TL-SEL ON	Positive torque limit: P05.19 Torque limit analog B source selection; Negative torque limit: P05.18 Torque limit analog A source selection
9	TL-SEL OFF	TL-SEL OFF: Positive torque limit: P05.18 Torque limit analog A source selection; Negative torque limit: P05.22 Second torque limit
	TL-SEL ON	TL-SEL ON: Positive torque limit: P05.22 Second torque limit; Negative torque limit: P05.19 Torque limit analog B source selection

P05.22	**Label**	2nd torque limit			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~500	**Unit**	%	**Default**	300		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x052D		
	Valid	Immediate						
	P05.22 is limited by max. torque set in motor parameter.							

P00.13	**Label**	1st torque limit			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~500	**Unit**	%	**Default**	350		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x001B		
	Valid	Immediate						
	1st torque limit is set according to ratio percentage of motor rated current. Do not exceed max driver output current. Please refer to P05.21 on how to set torque limit.							

5.4 Hybrid Control Mode

Hybrid control mode is for servo drive to be able to switch between different modes during operation. Hybrid control mode consists of the 3 listed below:

- Position-velocity mode
- Position-torque mode
- Velocity-torque mode

Set P00.01 to select the hybrid control mode needed through Motion Studio or servo drive front panel.

P00.01	Label	Control Mode Settings			Valid mode(s)	P	S	T
	Range	0~10	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0003		
	Valid	After restart						

Value	Description	
	1st mode	2nd mode
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position P00.22=1
		Velocity P00.22=1
		Torque P00.22=2
7~10	Reserved	

◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2st mode.
Please allow some time in between mode switching commands.

◆Please set P00.01 = 6 to switch to other modes from PR mod, then set 2nd mode using P00.22.

C-MODE is defaulted to Normally Open

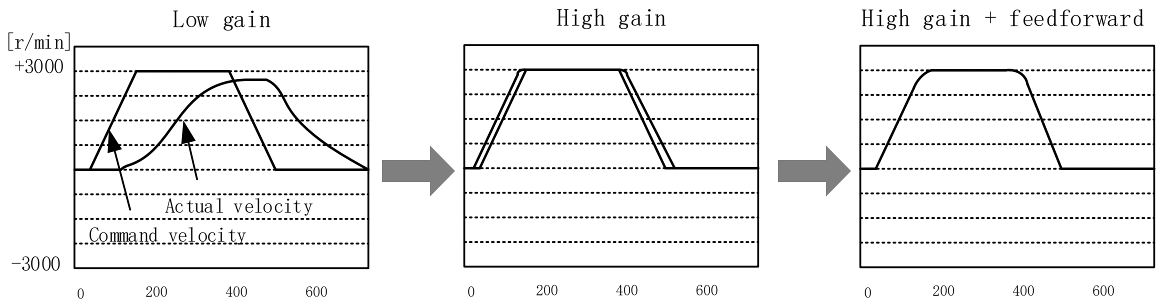
When P00.01 = 3/4/5, please set assign C-MODE mode switching signal to one of the DI terminal and make sure the logic is valid.

Signal	Set value	Label	Description		
			P00.01	C-MODE	Control mode
C-MODE	0x5	Control mode switching	3	Invalid	Position mode
				Valid	Velocity mode
			4	Invalid	Position mode
				Valid	Torque mode
			5	Invalid	Velocity mode
				Valid	Torque mode

Chapter 6 Application Case

6.1 Gain Adjustment

In order for servo driver to execute commands from master device without delay and to optimize machine performance, gain adjustment has to be done yet.

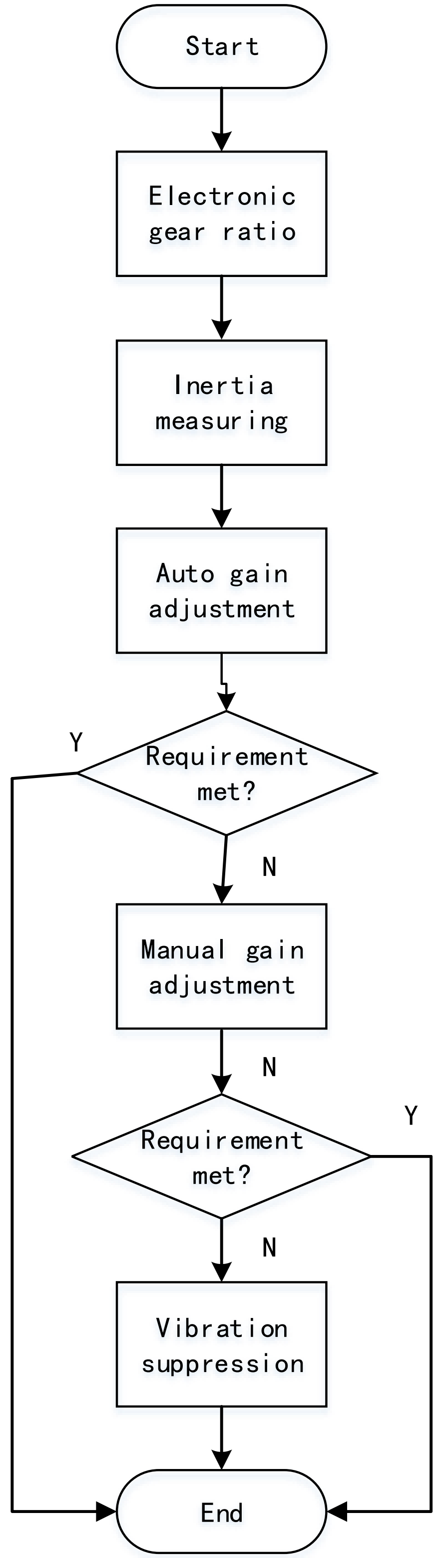


Position loop gain: 320 (0.1/s)
Velocity loop gain: 180 (0.1Hz)
Velocity loop integral time constant: 31ms

Position loop gain: 900 (0.1/s)
Velocity loop gain: 500 (0.1Hz)
Velocity loop integral time constant: 31ms

Position loop gain: 900 (0.1/s)
Velocity loop gain: 500 (0.1Hz)
Velocity loop integral time constant: 31ms

Servo driver gain adjustment is done in combination with a few other parameters (Inertia ratio, Position loop gain, Velocity loop gain and Filters settings). These parameters will have an effect on each other so it always advisable to tune each parameter according in order to achieve optimal machine performance. Please refer to the steps below



Gain adjustment flow chart

Steps	Functions	Explanation
Inertia ratio identification	Online	Motor moves with command from controller, servo driver will automatically calculate load-inertia ratio
	Offline	Using servo driver inertia determining function, servo driver can automatically calculate load-inertia ratio
Auto gain adjustment	Auto gain adjustment	Real time determining of mechanical load, gain value is set accordingly. 1. One-click tuning (Can be realized using Motion Studio. Auto tuning of gain and inertia according to actual data) 2. Real time auto adjustment (Set by selecting mechanical stiffness level, related gain parameters will be automatically adjusted accordingly)
Manual gain adjustment	Basic gain	On top of auto gain adjustment, manually adjust related parameters so that machine can have better responsiveness and following
	Basic steps	1. Gain related parameters tuning under position mode 2. Gain related parameters tuning under velocity mode 3. Gain related parameters tuning under torque mode
	Gain switching	Gain switching through internal data or external signal. Lower vibration at stop, shorten tuning time, improve command following.
	Model following control	Improve responsiveness, shorten positioning time (Only available in position mode)
	Command pulse filter	Set filter for position, velocity and torque command pulse.
	Gain feedforward	Enable feedforward function to improve following behavior
	Friction compensation	Reduce the effect of mechanical friction
	3rd gain switching	Base on usual gain switching function. Can be set to switch gain at stopping and reduce positioning time.
Vibration suppression	Mechanical resonance	Using notch filtering function to suppress mechanical resonance.
	End vibration suppression	To suppress low frequency vibration of mechanical end

6.2 Inertia ratio identification function

Inertia ratio = Total mechanical load rotational inertia / Motor rotational inertia

Inertia ratio is an important parameter. Setting a suitable value can help with the precise tuning of the servo system. Inertia ratio can be set manually and also be determined automatically through servo driver

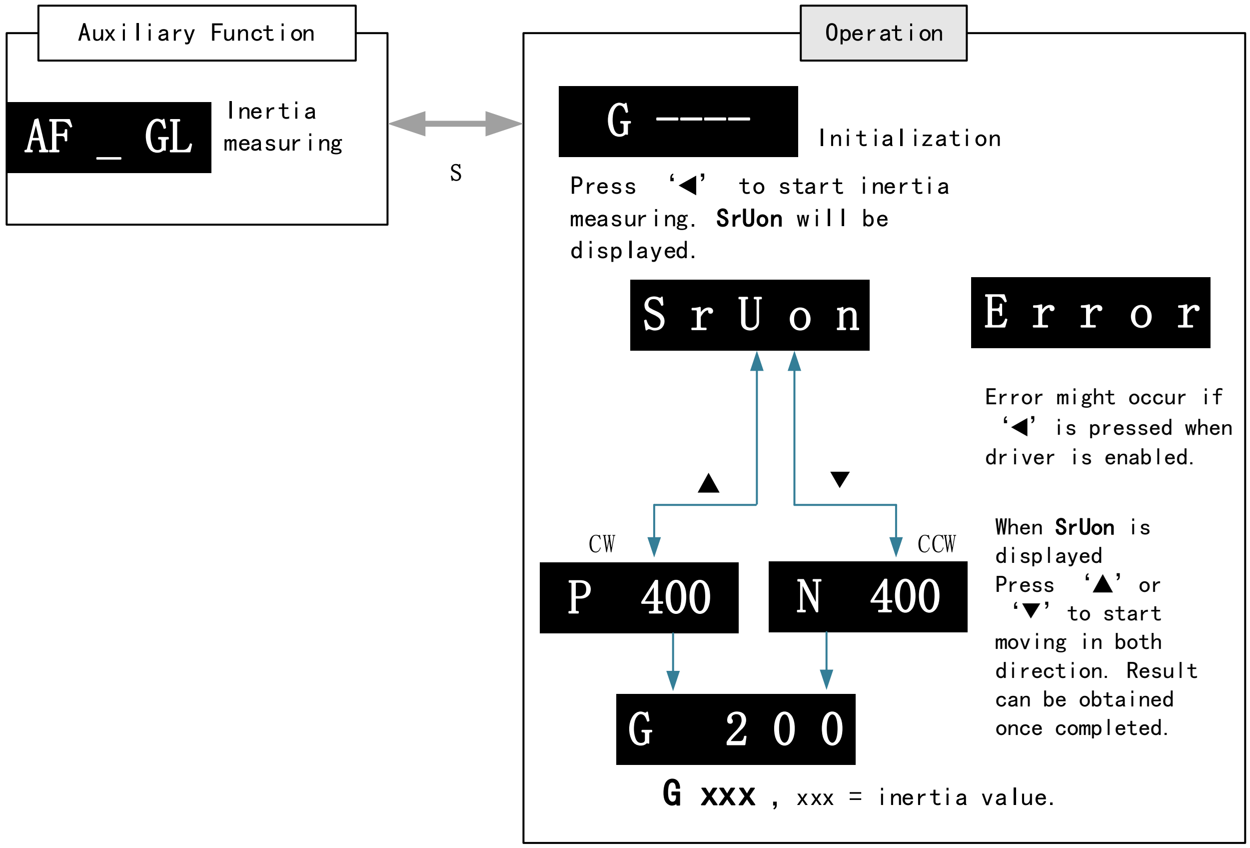
To make sure accurate inertia ratio identification

1. Max rotational velocity at 400rpm
2. Acceleration/deceleration time above 100ms
3. Stable load torque without large variation.

Online inertia determination
Enable motor using controller. Let motor run at above 400rpm, make sure there are acceleration, constant velocity and deceleration phase during the whole run. Cycle through 2-3 times to calculate load-inertia ratio. Result can be found on the front panel d16 or through Motion Studio system monitoring page. Enter the calculated value into P00.04 and save.

Offline inertia determination
Can be achieved through driver front panel or on Motion Studio
Please make sure: 1. Servo driver is disabled.
2. Axis is within safe and allowed range and limit switch is not triggered to prevent axis from over travelling.

Auxiliary function to determine inertia on front panel



Steps:

1、Set the trial run velocity **P06.04**. Value set shouldn't be too large, please keep it at around **400 r/min**.

2、Enter **AF_GL** for auxiliary function – Inertia ratio determination into front panel

3、Press S once to enter. "**G---**" will be displayed on the front panel.

4、Press ◀ once to display "**StUon**"

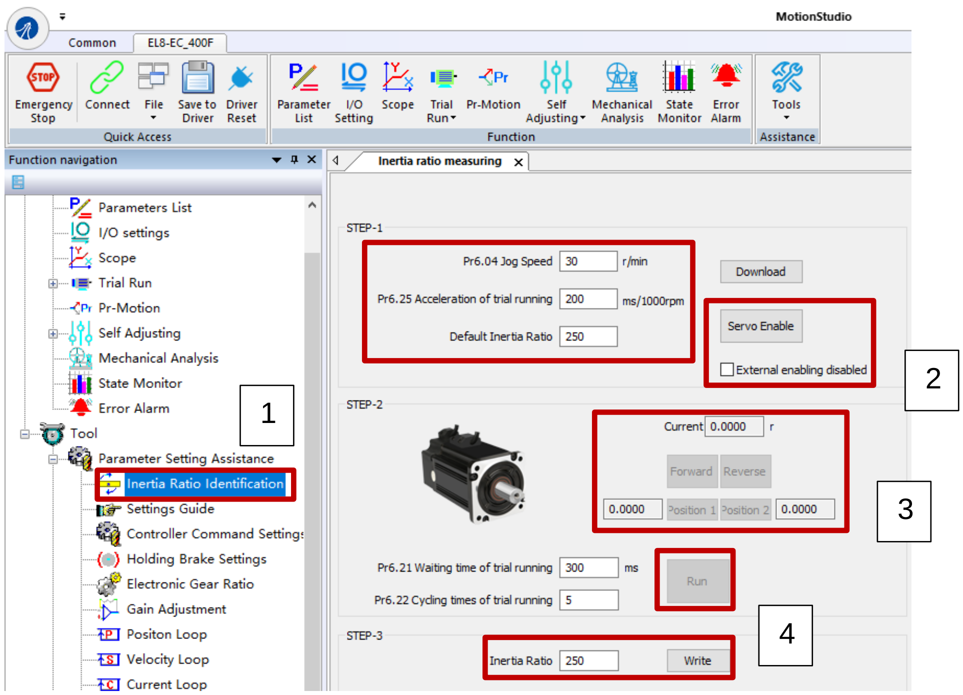
5、Press ▲ or ▼ once to start to calculate the inertia.

6、After the calculation is done, G **xxx** will be displayed and **xxx** is the value of inertia calculated.

7、Write the corresponding value into P00.04. Please refer to for parameter saving on servo driver.

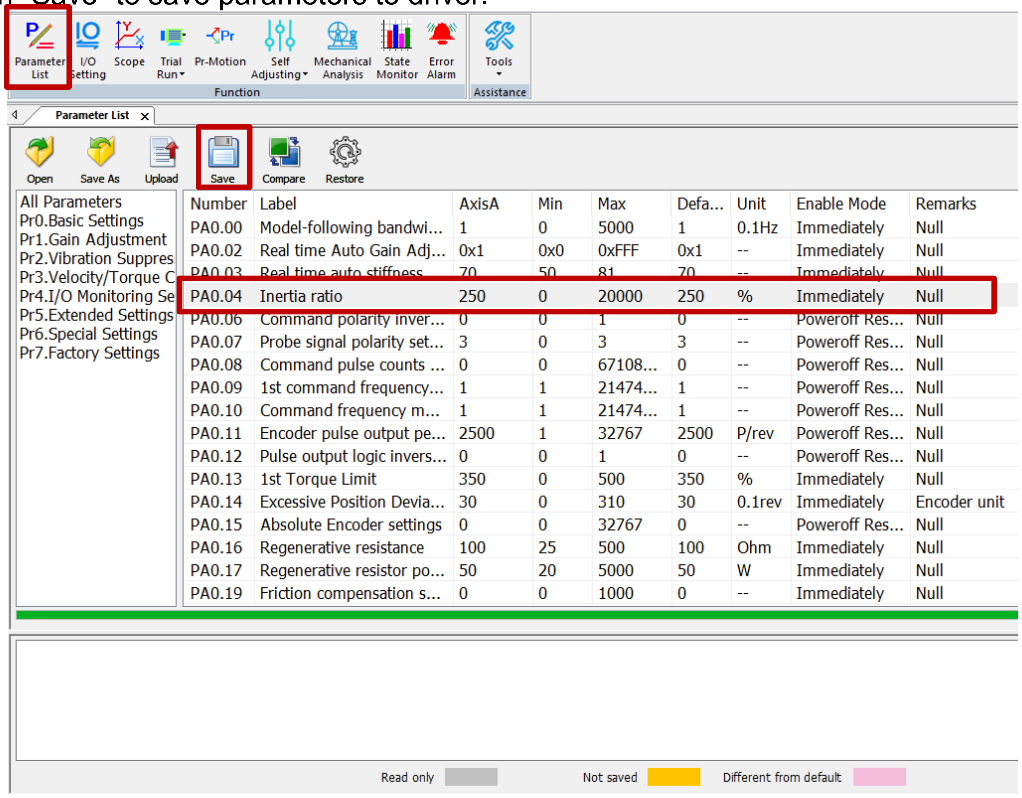
Inertia measuring using Motion Studio

1. Start Motion Studio and maneuver to inertia ratio identification page under performance tuning. Set trial run velocity P06.04 and acc-/deceleration time P06.25, click on ‘Upload’ to upload parameters to servo driver.
2. Tick “Prohibit external enabling” and click on “servo on”.
3. Click and hold “CCW” to start the motor. Current position will show motor cycles of revolution. Click on POS 1 to save current position as starting point. Click and hold “CW” to start the motor again. Click on POS 2 to save current position as ending point.
4. Set the waiting time between each cycle in P06.21 and no. of cycles in P06.22. Click on ‘Run’ and motor will run according to the parameters set.



5. After the calculation is done, inertia ratio will be calculated automatically and click on ‘write’ to enter the calculated value into P00.04.

6. Click on “Parameter List” to enter parameters management to check or modify P00.04. Then, click on “Save” to save parameters to driver.



Please take note:
1. Trial run velocity and distance should be optimal to prevent any axis from bumping into objects.
2. It is recommended to move only in 1 direction for vertically mounted axis. Take precaution before moving the axis.
3. For applications with higher frictional drag, please set a minimal travel distance.

P00.04	Label	Inertia ratio			Valid mode(s)	P	S	T
	Range	0~20000	Unit	%	Default	250		
	Byte length	16bit	Attribute	R/W	485 address	0x0009		
	Valid	Immediate						

P00.04=(load inertia/motor rotational inertia)×100%

Set inertia ratio according to actual load inertia. When both are uniform, actual motor velocity loop responsiveness and gain settings will be consistent. If inertia ratio is greater than actual value, velocity loop gain settings will be higher and vice versa.
For motor with high inertia, P00.04 can be left unfilled but optimal setting of P00.04 could improve system performance

Common issues

Error	Cause	Solution
Inertia measuring failure	Loose load connection	Check for mechanical failure
	Measuring distance is too short	Increase measuring distance
	Belt load	Please pre-set an inertia ratio when using a belt to prevent jolt due to low inertia.

6.3 Easy Tuning

6.3.1 Single parameter tuning

Set a mechanical stiffness level and the driver will automatically tune the parameters accordingly, including inertia measuring and vibration suppression to fulfill responsiveness and stability needs. At same time, more advanced functions can be applied, for example: Command pulse filter, low frequency vibration suppression, etc.
Recommended for applications where inertia changes is minute. Single parameter tuning is more complicated to set up compared to one-click tuning. Use single parameter tuning when one-click tuning doesn't fulfill the needs.

	Recommended application scenarios
Control mode	Suitable in position mode or EtherCAT mode (Not applicable in other modes)
Others	➢ Servo ON (SRV-ON) status ➢ Set suitable position/torque limit so that motor can run normally ➢ Use trial run or any external controller to make sure no clash of axes

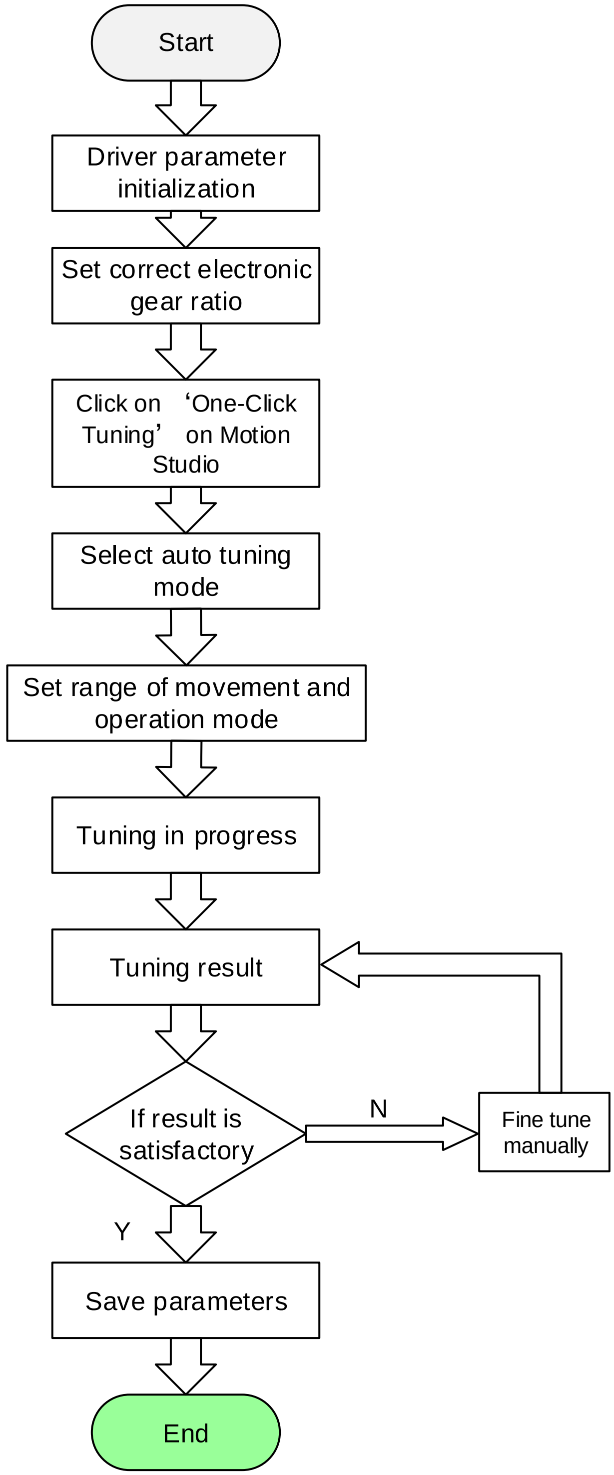
	Factors affecting single parameter tuning
Load inertia	➢ External load smaller or 30 times larger than rotor inertia ➢ Inertia measuring might fail upon changes in load inertia ➢ Load torque changes drastically
Load	➢ Mechanical stiffness is too low ➢ Existence of gear backlash or any other non-linear factors ➢ Complicated mechanical load structure
Motion	➢ Low speed, no more than 300[r/min]. ➢ Acceleration/deceleration time too long, more than = 600ms ➢ Speed > 300r/min, acceleration/deceleration time < 600ms but travelling time duration < 50ms.

6.3.2 One-click Tuning

This function is able to automatically tune the most optimal gain parameters for the specific applications after the axis is in operation and learning. Corresponding paths and responsiveness level need to be set before using this function. Please refer to the flow chart below. Parameter will be saved to parameters file and can be used on similar axes.
Recommended for applications where inertia changes is minute.

	Recommended application scenarios
Control mode	Suitable in position mode or EtherCAT mode (Not applicable in other modes)
Others	➢ Make sure servo drive can't be enabled externally or any external command that can rotate the motor. Set range of movement, velocity and acceleration/deceleration time for one-click tuning. ➢ Prohibit external command. Make sure there is no obstacle within the range of movement of the axis and motor can rotate freely.

	Factors affecting one-click tuning
Load inertia	➢ External load smaller or 30 times larger than rotor inertia ➢ Drastic changes in load inertia during motion. *Under heavy load (more than 30 times inertia), please make sure of safety*
Load	➢ Mechanical load is loosely connected. ➢ Existence of gear backlash or any other non-linear factors ➢ Complicated mechanical load structure
Motion	➢ Range of movement is too short or too long which cost the time to be overdue. ➢ Not smaller than 0.5R



One-click tuning flow diagram

6.4 Auto gain adjustment

This function will measure real time mechanical properties and set gain values in accordance to mechanical stiffness. Can be used in any control mode

Conditions to implement	
Control mode	Please refer to P00.02 for detailed explanations. Auto gain adjustment is different for each control mode.
Other	・Servo driver needs to be enabled ・Set up input signals such as deviation counter clearing and command input; Torque limit and other motion control parameters to enable motor to move normally without obstacles.

Under certain conditions, external factors might affect automatic gain adjustment functions. If the conditions as listed exist or unfavorable, please disable the automatic gain adjustment function.

Affecting conditions	
Load inertia	・If inertia is less than 3 times or over 30 times of rotor inertia. ・Changes in load inertia
Load	・Very low mechanical stiffness ・If gear backlash is a non-linear property
Motion	・Velocity less than 100r/min or continuously in low velocity mode ・Acc-/deceleration to 2000r/min within 1s. 。 ・Acc-/deceleration torque lower than eccentric load, frictional torque. ・Velocity < 100r/min, acc-/deceleration to 2000r/min within 1s but not longer than 50ms

To enable automatic gain adjustment:
Disable the servo driver.
Set P00.02 = 0x01/0x11 or 0x02/0x12. Then, set P00.03
Servo enabled. Run motion as normal to start measuring load properties. Related parameters will be automatically set.
Increase motor responsiveness by increasing P00.03. Please check if there is any vibration before setting P00.03 to max. value.
Save the parameters.

Please take note:
- Please stop the motor before modifying any parameter. P00.02 only takes effect after saving modified parameter values into EEPROM and restarting the driver.
- After enabling the servo driver for the first time or when increasing P00.03, mechanical noise or vibration might occur for the first run, it is normal. If it persists, please set P00.03 to lower value.

Parameters that change in accordance to real time gain adjustment

There are 2 types of auto gain adjustment methods:
Standard mode (P00.02 = 0x__1): Basic mode, prioritizing on stability, gain switching is disabled. Actual gain auto adjustment as accordance to P00.03.
Gain related parameters that change as shown below.

Parameter	Label	Remarks
P01.00	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
P01.01	1st velocity loop gain	
P01.02	1st velocity integral time constant	
P01.03	1st velocity detection filter	
P01.04	1st torque filter	

Gain related that doesn't change

Parameter	Label	Reference value	Remarks
P01.10	Velocity feedforward gain constant	300（0.1%）	Doesn't change according to changes in stiffness

Positioning mode (P00.02=0x2): Prioritizing positioning. Usually applies on horizontal axis without variable load, ball screws with lower friction, gain switching enabled. Stiffness level of 2nd position loop gain is 1 level higher than 1st position.

No.	Parameters	Label	Remarks
1	P01.00	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
2	P01.01	1st velocity loop gain	
3	P01.02	1st velocity integral time constant	
4	P01.03	1st velocity detection filter	
5	P01.04	1st torque filter	
6	P01.05	2nd position loop gain	
7	P01.06	2nd velocity loop gain	
8	P01.07	2nd velocity integral time constant	
9	P01.08	2nd velocity detection filter	
10	P01.09	2nd torque filter	

If auto gain adjustment is valid, the parameters listed above can't be manually modified. Only when P00.02 = 0x00 or 0x10, can the gain related parameters be modified manually.

Gain related parameters that don't change with the real time gain adjustment

Parameter	Label	Reference value
P01.10	Velocity feedforward gain constant	1000ms
P01.11	Velocity feedforward filter time constant	30%
P01.12	Torque feedforward gain	0.50ms
P01.13	Torque feedforward filter time constant	0
P01.15	Position control gain switching mode	0
P01.17	Position control switching level	10
P01.18	Position control switching hysteresis	50
P01.19	Position gain switching time	33

Types of mechanical load

Please select mechanical load according to load-inertia ratio and mechanical structures:

Load types	Description
0x00_ : Rigid structure	When load is **rigid** with relatively **low inertia**. Gain adjustments prioritize **system responsiveness**. Structures including high precision reducer, lead screws, mechanical gears, etc.
0x01_ : High inertia	**High load inertia** (10 times or above). Gain adjustments prioritize **operation stability and responsiveness**. Recommended mechanical stiffness level **not more than 15**.
0x02_ : Flexible structure	When load is **flexible** with relatively **high inertia**. Gain adjustments prioritize **operation stability**. Structures including long transportation belt or chain.

Structures with high inertia can have better performance if inertia ratio is set accurately.

P00.02	**Label**	Real time Auto Gain Adjusting			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFFF	**Unit**	—	**Default**	0x1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0005		
	Valid	Immediate						

Data bits	Category	Settings	Application
0x00_	Motion setting mode	Used to set motion setting mode, which can be selected according to the motion characteristics or setting requirements. Generally, it is recommended to select mode 1 with good generality when there is no special requirement, mode 2 when rapid positioning is needed If mode 1 and mode 2 cannot meet the requirements, please choose mode 0.	
		0:Manual	P00.03 invalid. Gain value must be adjusted manually and accordingly.
		1:Standard	P00.03 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. Gain switching is not used in this mode, suitable for applications with requirements for stability.

		2:Positioning	P00.03 valid. Quick gain adjusting can be achieved by changing P00.03 stiffness value. This mode is suitable for applications requiring quick positioning. Not recommended for load mounted vertical to ground, or please compensate for the load using P06.07
0x0_0	Load type setting	Used to select the load type, choose according to load-inertia ratio and mechanical structure.	
		0: Rigid structure	This mode prioritizes system responsiveness. Use this mode when there is a relatively rigid structure with low load inertia. Typical application including directly connected high-precision gearbox, lead screw, gears, etc.
		1:High inertia	For applications with higher load inertia (10 times or above), gain settings take into account both machine stability and responsiveness. Not recommended to set stiffness above 15 for high load inertia.
		2: Flexible structure	This mode prioritizes system stability. Use this mode when there is low rigidity structure with high load inertia. Typical applications included belts and chains.
0x_00	reserved		

The setting type combination is a hexadecimal standard, as follows:

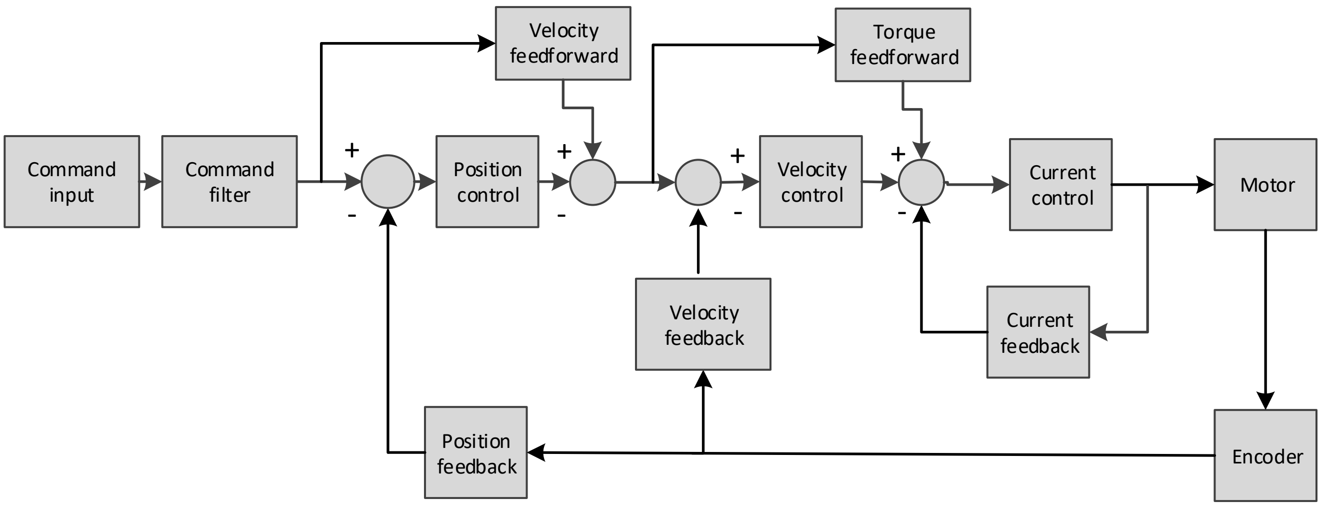
Setting type combination	Application type
0X000	Rigid structure + Manual
0X001	Rigid structure +Standard
0X002	Rigid structure +Positioning
0X010	High inertia + Manual
0X011	High inertia + Standard
0X012	High inertia + Positioning
0X020	Flexible structure + Manual
0X021	Flexible structure +Standard
0X022	Flexible structure +Positioning

Gain parameters settings table

Stiffness	1st gain				2nd gain			
	P01.00	P01.01	P01.02	P01.04	P01.05	P01.06	P01.07	P01.09
	Position loop gain (0.1/s)	Velocity loop gain (Hz)	Velocity loop integral time constant （0.1ms）	Torque filter (0.01ms)	Position loop gain (0.1/s)	Velocity loop gain (Hz)	Velocity loop integral time constant （0.1ms）	Torque filter (0.01ms)
81	20	15	3700	1500	25	15	10000	1500
80	25	20	2800	1100	30	20	10000	1100
79	30	25	2200	900	40	25	10000	900
78	40	30	1900	800	45	30	10000	800
77	45	35	1600	600	55	35	10000	600
76	55	45	1200	500	70	45	10000	500
75	75	60	900	400	95	60	10000	400
74	95	75	700	300	120	75	10000	300
73	115	90	600	300	140	90	10000	300
72	140	110	500	200	175	110	10000	200
71	175	140	400	200	220	140	10000	200
70	320	180	310	126	380	180	10000	126
69	390	220	250	103	460	220	10000	103
68	480	270	210	84	570	270	10000	84
67	630	350	160	65	730	350	10000	65
66	720	400	140	57	840	400	10000	57
65	900	500	120	45	1050	500	10000	45
64	1080	600	110	38	1260	600	10000	38
63	1350	750	90	30	1570	750	10000	30
62	1620	900	80	25	1880	900	10000	25
61	2060	1150	70	20	2410	1150	10000	20
60	2510	1400	60	16	2930	1400	10000	16
59	3050	1700	50	13	3560	1700	10000	13
58	3770	2100	40	11	4400	2100	10000	11
57	4490	2500	40	9	5240	2500	10000	9
56	5000	2800	35	8	5900	2800	10000	8
55	5600	3100	30	7	6500	3100	10000	7
54	6100	3400	30	7	7100	3400	10000	7
53	6600	3700	25	6	7700	3700	10000	6
52	7200	4000	25	6	8400	4000	10000	6
51	8100	4500	20	5	9400	4500	10000	5
50	9000	5000	20	5	10500	5000	10000	5

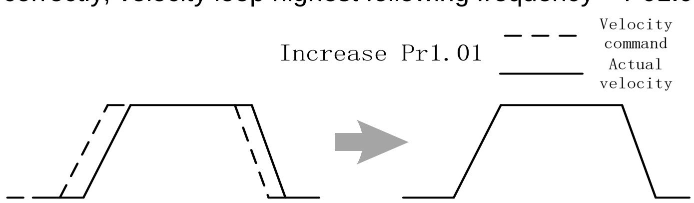
6.5 Manual gain adjustment

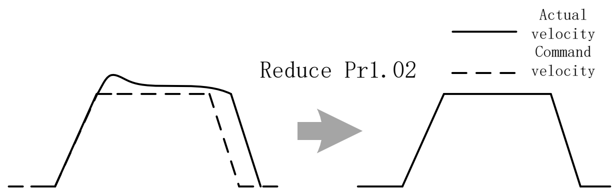
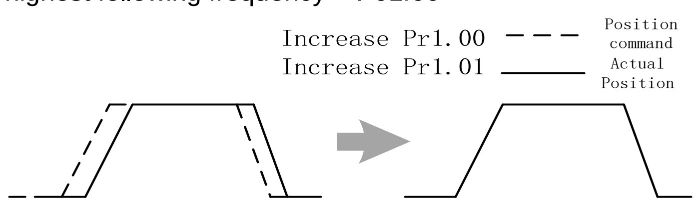
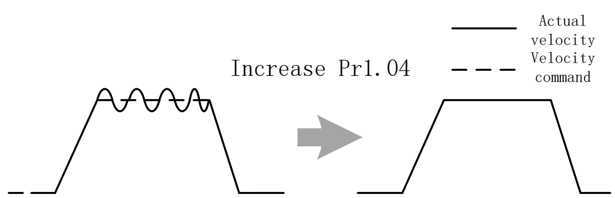
Due to limitation of load conditions, automatic gain adjustment might not achieve expected performance. Control can be improved through manual gain adjustment
The servo system is made up of 3 control loops. From outer to inner: position loop, velocity loop, current loop as shown in the diagram below.



Inner control loop demands higher responsiveness. In order to avoid system instability, please tune in accordance to this principle. Current loop gain usually satisfies the responsiveness demand without tuning. When gain adjustment is done under position control mode, in order to keep the system stabile, position and velocity loop gain have to be increased at the same time to make sure the responsiveness of the position loop is lower than velocity loop.

Steps to tuning (Position and velocity control)

Step	Parameter	Label	Tuning method
1	P01.01	Velocity loop gain	Determine if velocity loop is able to follow the changes in velocity command at highest frequency. If P00.04 is set correctly, velocity loop highest following frequency = P01.01  Increase P01.01 provided there is no noise or vibration to reduce positioning time, better velocity stability and following. Reduce P01.01 if there is mechanical noise. Set up vibration suppression if there is mechanical vibration.

Step	Parameter	Label	Tuning method
2	P01.02	Velocity loop integral time constant	To eliminate velocity loop deviation  Velocity loop integral time constant (ms) = 4000 /（2*π*Velocity loop gain(Hz)） Reduce P01.02 to reduce positioning time. Mechanical vibration might occur if set value is too low; Velocity loop deviation can't be zeroed if set value is too high. Reduce P01.02 to increase systemic stiffness, reduce deviation, provided that there is no resonance or noise in the system. If load-inertia ratio is high or resonance exists in mechanical system, increase P01.02.
3	P01.00	Position loop gain	Determine if position loop is able to follow the changes in position command at highest frequency. Position loop highest following frequency = P01.00  Increase P01.00 to reduce position following deviation, reduce positioning time provided that there is no resonance or noise in the system. If P01.00 is set too high, it might cause trembling in the mechanical system or positioning overshoot
4	P01.04	1st torque filter time constant	Eliminate high frequency noise, suppress mechanical resonance.  System response improves with lower set value but there is mechanical limitations；High frequency resonance suppression improves with higher set value but it might cause reduction in response bandwidth and phase margin, resulting in system turbulence. Torque filtering frequency is 4 times higher than velocity loop max following frequency: 1000000/(2π×P01.04)≥P01.01×4 For example, when P01.01=180（0.1 Hz）, P01.04 should satisfy： P01.01≤221（0.01ms）

1. If vibration occurs with increasing P01.01, please modify P01.04 to suppress vibration.
2. If the parameters are set too high, it might cause current loop response to reduce.
3. To suppress vibration at stop, increase P01.01 and decrease P01.04.
4. Decrease P01.04 if motor vibrates too much at rest.
5. P01.04 cannot be set to overly high value as it might cause control system instability because the torque loop response is much higher than velocity loop.

For servo gain, if any one of the parameters is changed, please modify other gain related parameters accordingly. Make sure to the change at around 5% and follow the rules as below.

1. Increase responsiveness
   a) Reduce torque command filter time
   b) Increase velocity loop gain
   c) Decrease velocity loop integral time
   d) Increase position loop gain

2. Decrease responsiveness, prevent vibration and over shoot
   a) Reduce position loop gain
   b) Increase velocity loop integral time
   c) Reduce velocity loop gain
   d) Increase torque filter time

6.5.1 Parameters adjustment under different control modes

Under different control mode, parameters adjustment has to be adjusted in this order:
“Inertia measuring” -> “Auto gain adjustment”->” Manual gain adjustments”

Position control mode

Set load-inertia ratio P00.04 after inertia determination.

No.	Parameter	Label
1	P01.00	1st position loop gain
2	P01.01	1st velocity loop gain
3	P01.02	1st velocity integral time constant
4	P01.03	1st velocity detection filter
5	P01.04	1st torque filter time constant
6	P01.05	2nd position loop gain
7	P01.06	2nd velocity loop gain
8	P01.07	2nd velocity integral time constant
9	P01.08	2nd velocity detection filter
10	P01.09	2nd torque filter time constant
11	P01.10	Velocity feedforward gain constant
12	P01.11	Velocity feedforward filter time constant
13	P01.12	Torque feedforward gain
14	P01.13	Torque feedforward filter time constant
15	P01.15	Position control gain switching mode
16	P01.17	Position control switching level
17	P01.18	Position control switching hysteresis
18	P01.19	Position gain switching time

1st and 2nd gain initial values are obtained by automatic gain adjustment

No.	Parameter	Label
1	P01.00	1st position loop gain
2	P01.01	1st velocity loop gain
3	P01.02	1st velocity integral time constant
4	P01.03	1st velocity detection filter
5	P01.04	1st torque filter time constant
6	P01.05	2nd position loop gain
7	P01.06	2nd velocity loop gain
8	P01.07	2nd velocity integral time constant
9	P01.08	2nd velocity detection filter
10	P01.09	2nd torque filter time constant

Manually adjusted gain parameters

No.	Parameter	Label
1	P01.00	1st position loop gain
2	P01.01	1st velocity loop gain
3	P01.02	1st velocity integral time constant
4	P01.04	1st torque filter time constant
5	P01.10	Velocity feedforward gain constant
6	P01.11	Velocity feedforward filter time constant

Velocity control mode

Velocity control mode parameters adjustment is pretty similar to position control mode. Except for position loop gain P01.00 and P01.05, velocity feedforward gain (P01.10)

Torque control mode

Parameters adjustment for torque control mode has to be differentiate into 2 conditions:

1. When actual velocity reaches velocity limit, adjustment will be as per velocity control mode. Motor will switch from torque control to velocity limit as velocity control.
2. When actual velocity doesn't reach velocity limit yet, Except for position loop gain, velocity loop gain and feedforward gain, parameter adjustments as per velocity control mode.

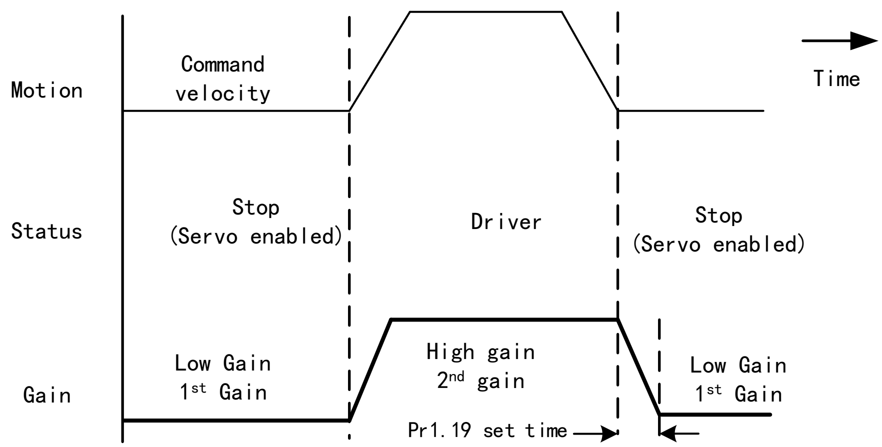
If there is no velocity limit and control is through torque command, please deactivate torque and notch filter, set velocity limit to max. value and increase velocity loop gain to as high as possible.

6.5.2 Gain switching

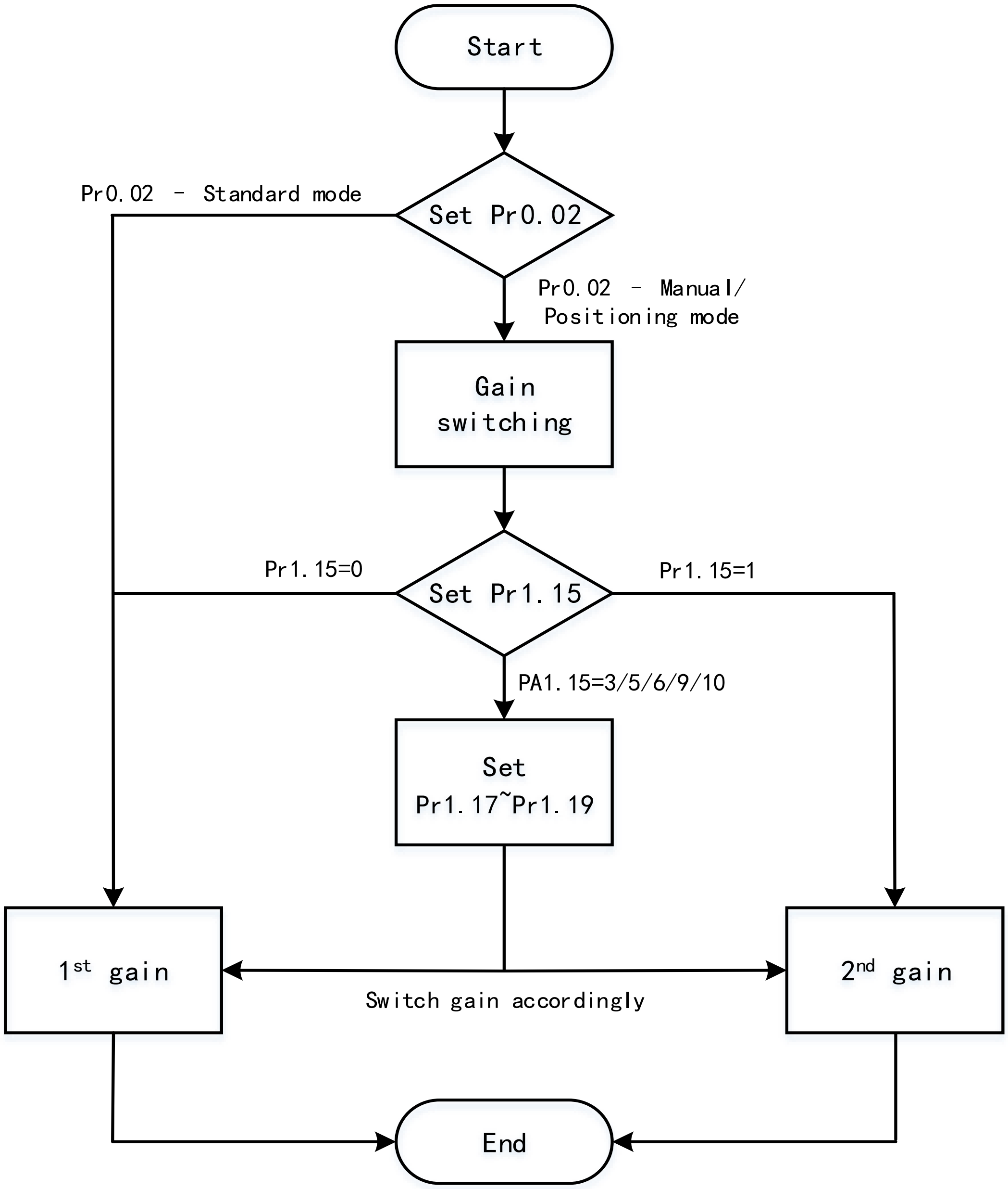
Gain switching function can be triggered internally in servo driver. Only valid under position or velocity control mode. Following effects can be realized by gain switching:

1. Switch to lower gain when motor stops to suppress vibration
2. Switch to higher gain when motor is moving at a low velocity to shorten positioning time
3. Switch to higher gain when motor is moving at a high velocity to improve command following behavior.

Diagram below shows gain switching when motor stops.



1st gain (P01.00-P01.04) and 2nd gain (P01.05-P01.09) switching can be realized through manual and positioning mode. Switching condition is set through P01.15. Gain switching is invalid under standard mode.

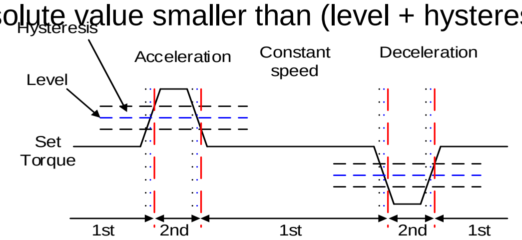
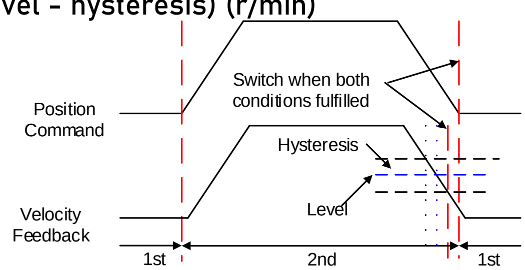


Related parameters on gain switching

No.	Parameter	Label	Remarks
1	P01.15	Position control gain switching mode	In position control, set P01.15=3、5、6、9、10. In velocity control, set P01.15=3、5、9
2	P01.17	Position control level switching	Please set P01.17≥P01.18
3	P01.18	Position control hysteresis switching	If P01.17＜P01.18, driver will set P01.17＝P01.18
4	P01.19	Position gain time switching	

P01.15	Label	Position control gain switching mode			Valid mode(s)	P		
	Range	0～10	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x011F		
	Valid	Immediate						

In position control, set the conditions for gain switching to be valid.

Value	Condition	Gain switching condition
【0】	1st gain fixed	Fixed on using 1st gain(P01.00-P01.04)
1	2nd gain fixed	Fixed on using 2nd gain (P01.05-P01.09)
2	Gain switching input valid	· Gain switching input （GAIN）invalid: 1st gain. · Gain switching input （GAIN）valid: 2nd gain. *Default: 1st gain*
3	High command torque	Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1st gain when set torque command absolute value smaller than (level + hysteresis)[%] 
4-9	Reserved	Reserved
10	Pending position command +actual velocity	Valid for position control. Switch to 2nd gain if position command ≠ 0 Switch to 1st gain if positional command = 0 throughout the duration of delay time and absolute value of actual velocity remains smaller than (level - hysteresis) (r/min) 

*** Above 'level' and 'hysteresis' are in correspondence to P01.17 Position control gain switching level and P01.18 Hysteresis at position control switching.*

P01.17	**Label**	Position control gain switching level			**Valid mode(s)**	**P**		
	Range	0~20000	**Unit**	Mode dependent	**Default**	50		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0123		
	Valid	Immediate						

Set threshold value for gain switching to occur.
Unit is mode dependent.

Switching condition	Unit
Position	Encoder pulse count
Velocity	RPM
Torque	%

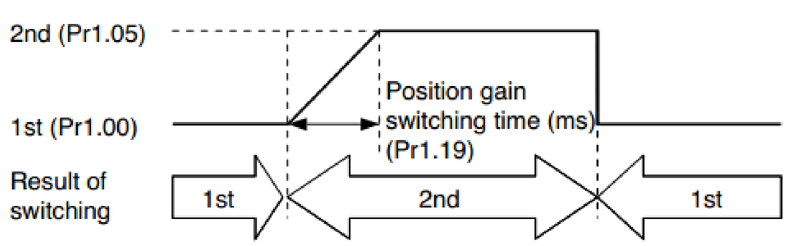
Please set level ≥ hysteresis

P01.18	**Label**	Hysteresis at position control switching			**Valid mode(s)**	**P**		
	Range	0~20000	**Unit**	Mode dependent	**Default**	33		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0125		
	Valid	Immediate						

To eliminate the instability of gain switching. Used in combination with P01.17 using the same unit.
If level< hysteresis, drive will set internally hysteresis = level.

P01.19	**Label**	Position control switching time			**Valid mode(s)**	**P**		
	Range	0~10000	**Unit**	0.1ms	**Default**	33		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0127		
	Valid	Immediate						

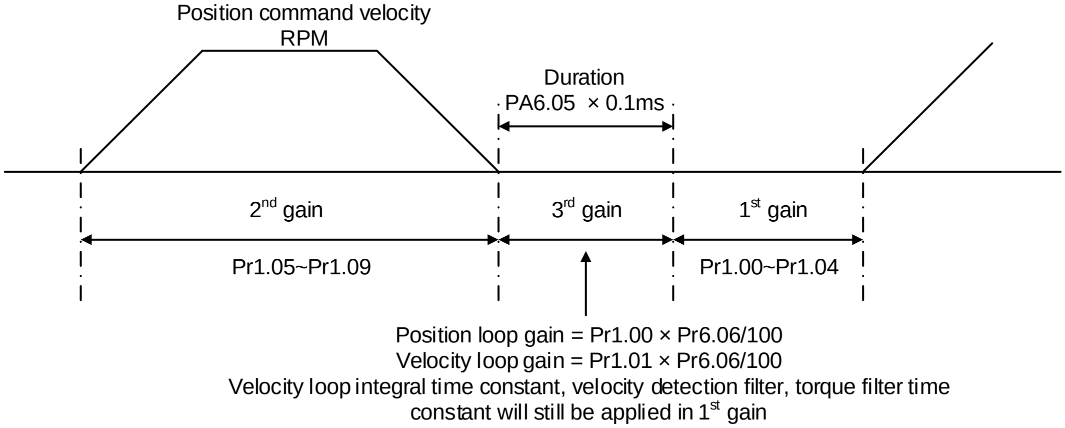
During position control, if 1st and 2nd gain difference is too large, to ease torque changes and vibration due to rapid changes in position loop gain, set suitable P01.19 value
For example: 1st (pr1.00) <-> 2nd (P01.05)



6.5.3 3rd gain switching

Besides switching between 1st and 2nd gain, a 3rd gain switching is added to set gain at the moment of stopping to reduce positioning time.
Only available under position mode and P06.05 ≠ 0, set P06.06 for 3rd gain value. When 2nd gain switches to 1st gain, it has to go through 3rd gain, switching time is set in P01.19.

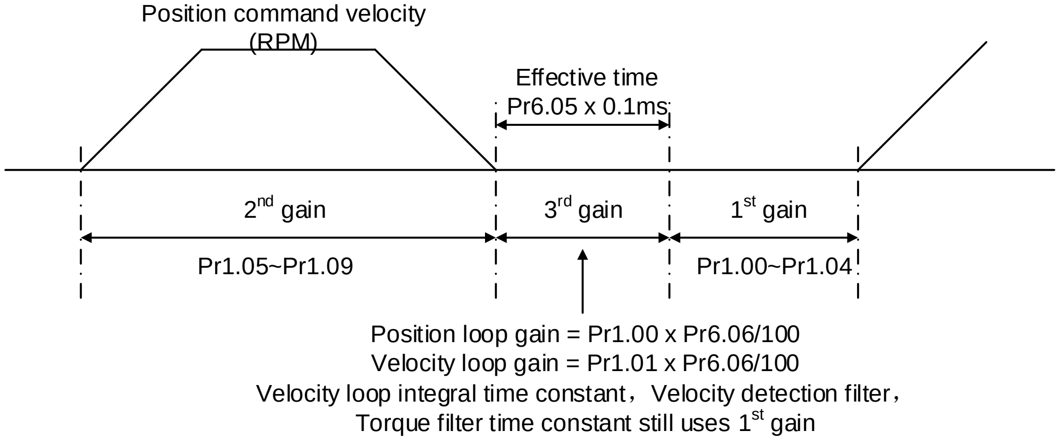
Diagram below shows when P01.15 = 7.



Related parameters

P06.05	**Label**	Position 3rd gain valid time			**Valid mode(s)**	**P**		
	Range	0~10000	**Unit**	0.1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060B		
	Valid	Immediate						
	To set time for 3rd gain to be valid Only available in position mode When not in use, set P06.05=0, P06.06=100							
P06.06	**Label**	Position 3rd gain scale factor			**Valid mode(s)**	**P**		
	Range	50~1000	**Unit**	100%	**Default**	100		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060D		
	Valid	Immediate						

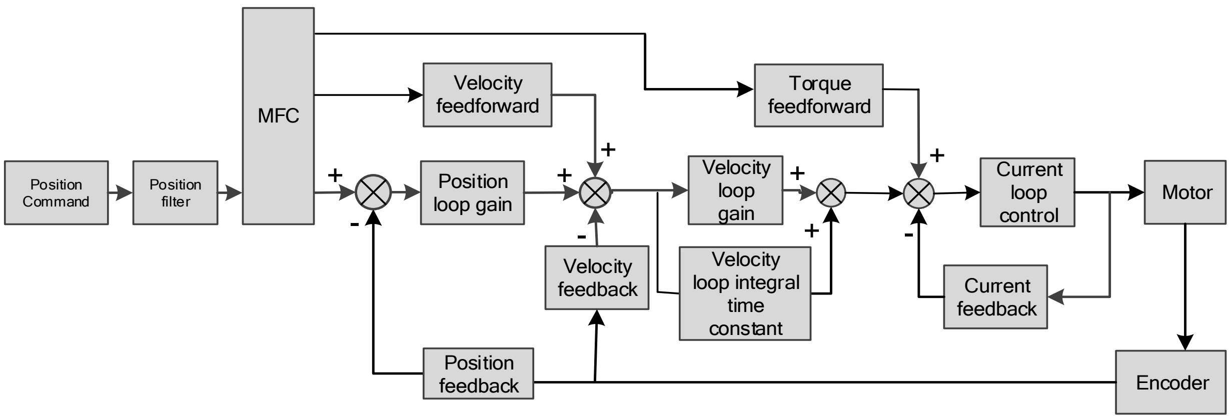
Set up the 3rd gain by multiplying factor of the 1st gain



Above diagram is illustrated using P01.15 = 7.
3rd gain= 1st gain * P06.06/100
Only effective under position control mode. 3rd gain valid when P06.05 ≠ 0. Set 3rd gain value in P06.06. When 2nd gain switches to 1st gain, it will go through 3rd, switching time is set in P01.19.

6.6 Model following control

Model following control is a type of closed loop control system. First, an ideal model is constructed and acts as a reference for actual model in a closed loop control. Model following control can be treated as a control mode with 2 flexibilities: Model reference can be used to improve command responsiveness and closed loop control used to increase responsiveness of the system towards interference. They don't affect each other.
Model following control can be used in position loop control to increase responsiveness to commands, reduce positioning time and following error. This function is only available in position control mode.



To adjust model following control

1. Automatic adjustment
   Set model following bandwidth P00.00 = 1 for automatic adjustment. Now, P00.00 = P01.01, model following bandwidth is adjusted automatically according to different velocity loop gain.
3. Manual adjustment
   Please used manual adjustment if
   - Automatic adjustment is not satisfactory.
   - Responsiveness needs further improvement in comparison with automatic adjustment.
   - There is a need to set servo gain or model following control parameters manually.

Steps to manually adjust

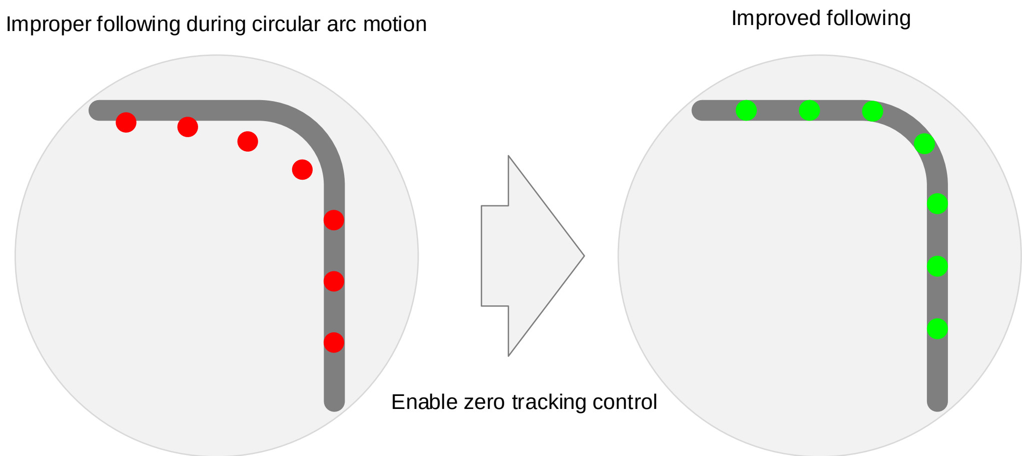
Step	Content
1	Set up vibration suppression.
2	Set up the right inertia ratio.
3	Manually adjust gain.
4	Increase P00.00 provided that there is no overshoot and vibration. Usually P00.00 ≥ P01.01 is recommended.

Model following bandwidth determines the responsiveness of the servo system. Increase the value set will increase responsiveness and reduce positioning time. Overshoot can be prevented if it is set at a lower value but responsiveness will be lowered. Model following bandwidth shouldn't be too large for mechanical structure with lower stiffness, excessive position deviation alarm might occur under high velocity.

6.7 Zero tracking control

Zero tracking control (ZTC) is able to realize a zero position deviation during acceleration/deceleration. This function increase multi axis precision and master-slave following.
Recommended application:

1. Multi axis



2. Master-slave following

Used when driving axis sends frequency divider signal to lead following axis to improve the following control.

- *ZTC only available under position control mode.*
- *ZTC can only be enabled when P00.00 is valid.*
- *Model following control (MFC) and Zero Tracking Control (ZTC) cannot be used together at the same time.*

Zero tracking control can achieve better performance with the following limiting factors.

	Limiting factors
Electronic gear ratio	Electronic gear ratio should be lower to prevent current noise.
Mechanical structure	Better structural rigidity to prevent vibration.
Motion	1. Command acceleration should be continuously low to prevent deviation change during drastic changes in acceleration. 2. Callback or overtravel might exist in positioning; sigmoid signal command might improve the problem.

Related parameters

Parameter	Label	Description
P02.50	Model following control	0：Model following control - Default 1：Zero tracking control
P02.53	Dynamic friction compensation coefficient	Range: 0-1000, unit: 0.1% Unit：Changes in torque with the effect of friction on rotational speed. Only valid when MFC is activated
P00.00	Model following bandwidth	If P00.00 = 0, MFC and ZTC is deactivated. When P02.50 = 1 (Zero tracking control), higher

		bandwidth will improve following performance but noise will be higher.
Set the following parameters to default		
P02.51	Velocity feedforward compensation coefficient	Default value = 0 for zero tracking control.
P02.52	Torque feedforward compensation coefficient	
P02.54	Overtravel time constant	
P02.55	Overtravel suppression gain	

6.8 Feedforward gain

In position control or full closed loop control, velocity feedforward is calculated by comparing the velocity control command calculated internally and velocity command calculated from position feedback. Comparing to control only using feedbacks, this will reduce position deviation and increase responsiveness. Besides, by comparing the torque needed during motion from velocity control command in comparison with velocity feedback, torque feedback can be calculated to improve system responsiveness.

Servo drive uses 2 kinds of feedforward gain: Velocity feedforward and torque feedforward.
Velocity feedforward can be used in position control mode. By using it, it can reduce position deviation during constant velocity and increase responsiveness to velocity command.
In position control mode, using feedforward gain, able to reduce position deviation during constant acceleration/deceleration and increase responsiveness to torque command.
In velocity control mode, using feedforward gain, able to reduce velocity deviation during constant velocity and increase responsiveness to torque command.

Velocity feedforward

Velocity feedforward can be used in position control mode. When the function is enabled, it can increase velocity responsiveness, reduce position deviation during constant velocity.

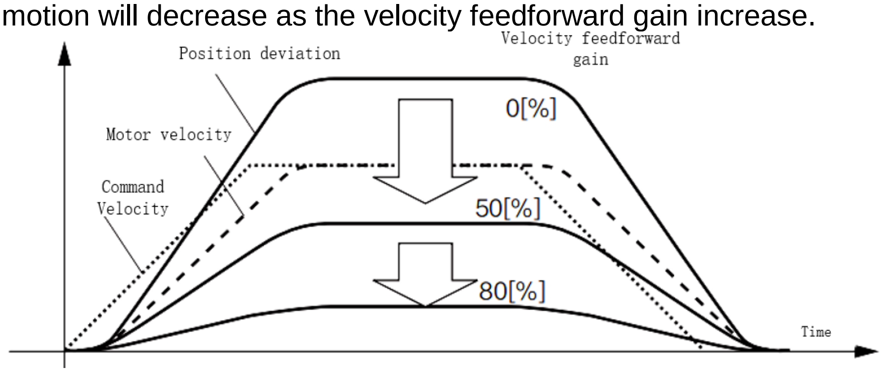
P01.10	**Label**	Velocity feed forward gain			**Valid mode(s)**	**P**		
	Range	0~1000	**Unit**	0.10%	**Default**	300		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0115		
	Valid	Immediate						
	Used for decreasing following error caused by low responsiveness of velocity loop. Might cause overshoot or increase in noise if set value is too high.							
P01.11	**Label**	Velocity feed forward filter time constant			**Valid mode(s)**	**P**		
	Range	0~6400	**Unit**	0.01ms	**Default**	50		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0117		
	Valid	Immediate						

Set velocity feed forward low pass filter to eliminate high or abnormal frequencies in velocity feed forward command. Often used when position command with low resolution or high electronic gear ration to smoothen velocity feed forward.
Position deviation under constant velocity can be lowered with higher velocity feed forward gain. Please to refer to the equation below.
Reduce P01.11 value to suppress velocity overshoot during deceleration;
Increase P01.11 value to suppress noise or vibration due to long driver control cycle or position command uneven pulse frequency.

<Application>
Set P01.11 = 50（0.5ms）, improve feedforward effect by gradually increase P01.10. The equation below can be used to determine the position deviation due to velocity feedforward gain under constant velocity.

$$\text{Position deviation[Uint]=} \frac{Set\ velocity[\frac{Uint}{s}]}{Position\ loop\ gain[Hz]} \times \frac{100 - Velocity\ feed\ foward\ gain[\%]}{100}$$

Velocity feedforward application
Set P01.11 to around 50 (0.5ms), then tune P01.10 from 0 to bigger values until the velocity feedforward achieves better performance. Under constant velocity, the position deviation in a motion will decrease as the velocity feedforward gain increase.



Steps to tuning:
1. Increase P01.10 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing P01.11, velocity feedforward would be more effective and vice versa. P01.10 and P01.11 need to be tuned to a balance.
3. If mechanical noise exists under normal working conditions, please increase P01.11 or use position command filter (1 time delay/ FIR smoothing filter)

Torque feedforward

Position control mode: Torque feedforward can increase the responsiveness of torque command, decrease position deviation during constant acc-/deceleration.
Velocity control mode: Torque feedforward can increase the responsiveness of torque command, decrease velocity deviation during constant velocity.

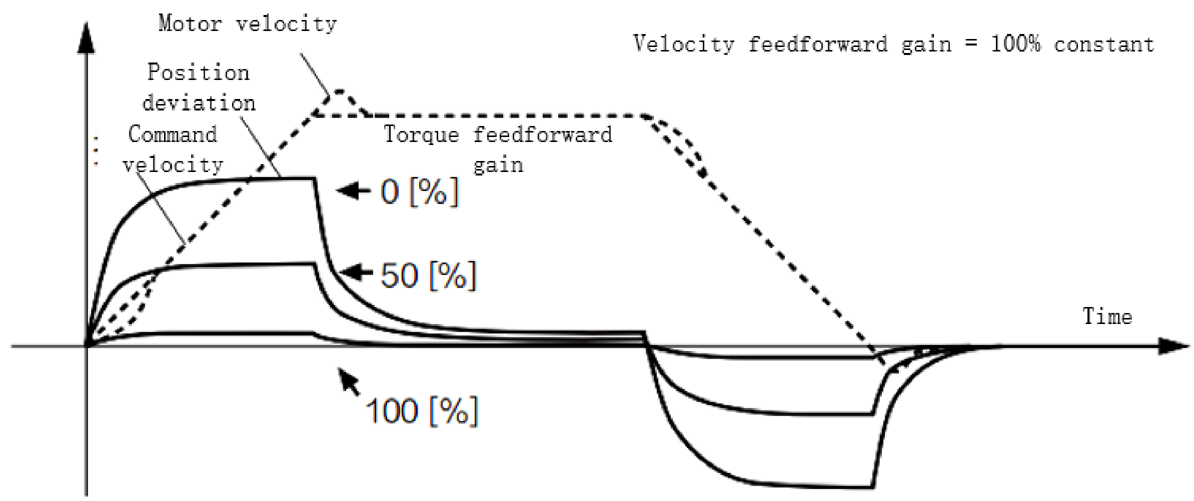
P01.12	**Label**	Torque feed forward gain			**Valid mode(s)**	**P**	**S**	
	Range	0~1000	**Unit**	0.1%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0119		
	Valid	Immediate						

	Before using torque feed forward, please set correct inertia ratio P00.04. By increasing torque feed forward gain, position deviation on constant acceleration/deceleration can be reduced to close to 0. Under ideal condition and trapezoidal speed profile, position deviation of the whole motion can be reduced to close to 0. In reality, perturbation torque will always exist, hence position deviation can never be 0.

P01.13	**Label**	Torque feed forward filter time constant			**Valid mode(s)**	**P**	**S**	
	Range	0~6400	**Unit**	0.01ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x011B		
	Valid	Immediate						
	Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or precision. Noise reduces if torque feed forward filter time constant is set higher but position deviation will increase at acceleration varied points. **<Application>** ・ Set P01.13 = 50ms, please increase torque forward gain gradually to enable torque feedforward. ・By increasing P01.13, noise will reduce but position deviation will become larger.							

Torque feedforward application

Set P01.13 to around 50 (0.5ms), then tune P01.10 from 0 to bigger values until torque feedforward achieves better performance. Under constant acc-/deceleration, the position deviation in a motion will decrease as the velocity feedforward gain increase.

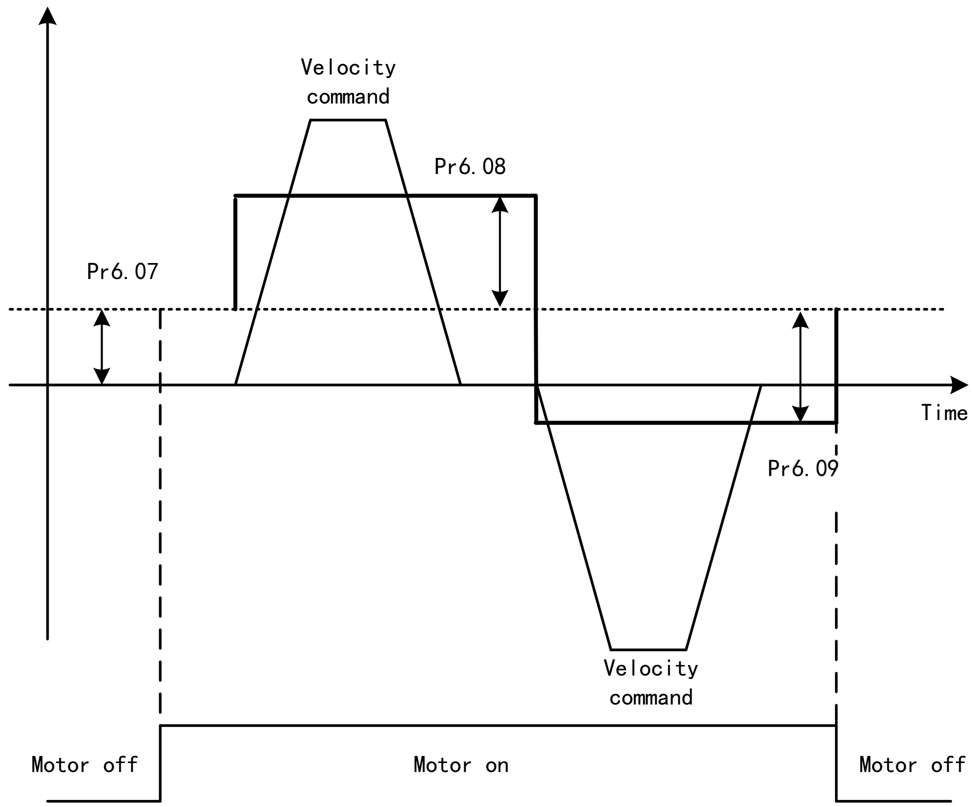


Steps to tuning:

1. Increase P01.12 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing P01.13, torque feedforward would be more effective and vice versa. P01.12 and P01.13 need to be tuned to a balance and reduce noise.

6.9 Friction compensation function

This function is to compensation for changes in load to reduce the effect of friction in motion. The compensation value is directional.



Vertically loaded axis: A constant eccentric load torque is applied on the motor. By adjusting P06.07, positioning deviation due to different motional direction can be reduced.
Belt-driven axis: Due to large radial load with dynamic frictional torque. Positioning time delay and deviation can be reduced by adjusting P06.08 and P06.09.

P06.07	**Label**	Torque command additional value			**Valid mode(s)**	**P**	**S**	**T**
	Range	-100~100	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060F		
	Valid	Immediate						
	To set torque forward feed additional value of vertical axis. Applicable for loaded vertical axis, compensate constant torque. Application: When load move along vertical axis, pick any point from the whole motion and stop the load at that particular point with motor enabled but not rotating. Record output torque value from d04, use that value as torque command additional value (compensation value)							

P06.08	**Label**	Positive direction torque compensation value			**Valid mode(s)**	**P**	**S**	**T**
	Range	-100~100	**Unit**	%	**Default**	0		

	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0611		
	Valid	Immediate						
P06.09	**Label**	Negative direction torque compensation value			**Valid mode(s)**	**P**	**S**	**T**
	Range	-100~100	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0613		
	Valid	Immediate						

To reduce the effect of mechanical friction in the movement(s) of the axis. Compensation values can be set according to needs for both rotational directions.

Applications:
1. When motor is at constant speed, d04 will deliver torque values.
Torque value in positive direction = T1;
Torque value in negative direction = T2

P06.08/P06.09 = $\frac{|T1-T2|}{2}$

Positive/Negative compensation corresponds to actual position feedback.
Positive torque compensation value = +(P06.08=+T_f)
Negative torque compensation value = -(P06.08=+T_f)
P06.08 =x, P06.09=y; friction compensation value = |x-y|/2

6.10 Safety Functions

Max. motor rotational speed limitation

Motor rotational speed limits can be set on P03.24. If command speed is 1500r/min, but P03.24 is set to 1000r/min, motor rotational speed will only go up to 1000r/min.
Motor overspeed threshold value can be set in P05.13, if the rotational speed is exceeded during operation, Er1A0 might occur.

P03.24	**Label**	Maximum motor rotational speed			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10000	**Unit**	r/min	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0331		
	Valid	Immediate						

To set maximum motor rotational speed but not higher than motor rated speed
If P03.24 = 0, maximum motor rotational speed = max. speed in motor parameter.

P05.13	**Label**	Overspeed level settings			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~10000	**Unit**	r/min	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x051B		
	Valid	Immediate						

If motor speed exceeds P05.13, Er1A0 might occur.
When P05.13 = 0, overspeed level = max. motor speed x 1.2

Max. duration for motor to stop after disabling

Set max time duration for motor to stop after disabling. If the time taken for motor to stop exceeds the duration set in P06.14 and motor speed is still higher than P04.39, holding brake will be activated. If motor doesn't have holding brake, dynamic braking will be activated to force stop the motor.

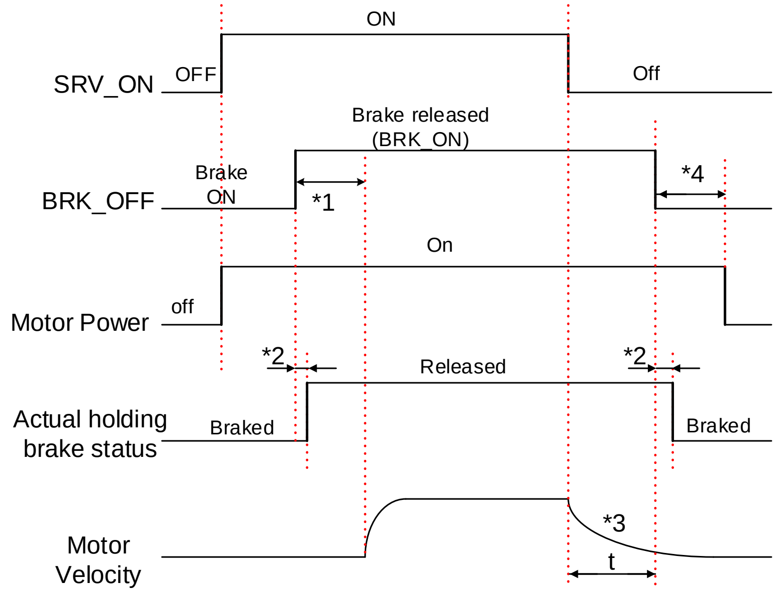
P06.14	**Label**	Max. time to stop after disabling			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~1000	**Unit**	ms	**Default**	500		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x061D		
	Valid	Immediate						
	To set the max. time allowed for the axis to stop on emergency stop or normal axis disabling. After disabling axis, if motor speed is still higher than P04.39 but the time set in P06.14 is reached, BRK_ON given and holding brake activated. BRK_ON given time is determined by P06.14 or when motor speed goes below P04.39, whichever comes first. Applications: 1. After disabling axis, if motor speed is still higher than P04.39 but the time set in P06.14 is reached, BRK_ON given and holding brake activated. 2. After disabling axis, if motor speed is already lower than P04.39 but the time set in P06.14 is not yet reached, BRK_ON given and holding brake activated. Dynamic brake will be provide the braking function if the function is activated for motors without holding brake.							

External brake deactivation output signal BRK-OFF

Please refer to P04.11 to set up the I/O output function parameters. When enabled and timing conditions are fulfilled, the set I/O output will deliver ON signal.

P04.37	**Label**	Motor power-off delay time			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~3000	**Unit**	1ms	**Default**	150		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x044B		
	Valid	Immediate						
	To set delay time for holding brake to be activated after motor power off to prevent axis from sliding. When P05.06 = 0, SRV-ON signal is off, holding brake is activated (delay time is determined by P04.39 or P06.14). Motor powered-off once delay time set in P04.37 is due.							
P04.38	**Label**	Holding brake release time			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~3000	**Unit**	1ms	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x044D		
	Valid	Immediate						
	To set delay time for holding brake to be released after motor power on.							

Motor will remain at current position and input command is masked to allow holding brake to be fully released before motor is set in motion.



*1: Delay time set in P04.38
*2: Delay time from the moment BRK_OFF signal is given until actual holding brake is released or BRK_ON signal is given until actual holding brake is activated. It is dependent on the holding brake of the motor.
*3: Deceleration time is determined by P06.14 or if motor speed goes below P04.39, whichever comes first. BRK_OFF given after deceleration time.
*4: P04.37 set time value.

Delay time from the moment SRV_ON is given until BRK_OFF switch to BRK_ON, is less than 500ms.

P04.39	**Label**	Holding brake activation speed			**Valid mode(s)**	**P**	**S**	**T**
	Range	30~3000	**Unit**	r/min	**Default**	30		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x044F		
	Valid	Immediate						

To set the activation speed for which holding brake will be activated.

When SRV-OFF signal is given, motor decelerates, after it reaches below P04.39 and P06.14 is not yet reached, BRK_OFF is given.
BRK_OFF signal is determined by P06.14 or if motor speed goes below P04.39, whichever comes first.

Application:
1. After disabling axis, P06.14 has been reached but motor speed is still above P04.39, BRK_OFF signal given.
2. After disabling axis, P06.14 has not been reached but motor speed is below P04.39, BRK_OFF signal given.

Deceleration max duration: 2s. Servo disabled after 2s.

Servo stopping mode

P05.06	Label	Servo-off mode			Valid mode(s)	P	S	T
	Range	0~1	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x050D		
	Valid	Immediate						

To set servo driver disable mode and status.

Value	Description	
	Mode	*Status*
0	Servo braking	Dynamic braking
1	Free stopping	Dynamic braking
2	Dynamic braking	Dynamic braking
3	Servo braking	Free-run
4	Free stopping	Free-run
5	Dynamic braking	Free-run

Servo braking: Stop servo axis quickly using braking torque
P05.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to P05.10

P05.10	Label	Servo-off due to alarm mode			Valid mode(s)	P	S	T
	Range	0~2	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0515		
	Valid	After restart						

To set servo driver disable mode and status if alarm is triggered.
Alarm type 2:

Value	Explanation	
	Mode	*Status*
0	Servo braking	Dynamic braking
1	Free stopping	Dynamic braking
2	Dynamic braking	Dynamic braking
3	Servo braking	Free-run
4	Free stopping	Free-run
5	Dynamic braking	Free-run

Alarm type 1:

Value	Explanation	
	Mode	*Status*
0	Dynamic braking	Dynamic braking
1		
2		
3	Servo braking	Free-run
4	Free stopping	Free-run
5	Dynamic braking	Free-run

Emergency stop function

Emergency stop is used when an alarm occurs or a servo prohibition signal is received when servo driver is enabled.

Method 1: Set up P04.43 to enable the function

P04.43	**Label**	Emergency stop function			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0457		
	Valid	Immediate						

Value	Description.
【0】	Emergency stop is valid, servo driver will be forced to STOP and Err570 occurs.
1	Emergency stop is invalid, servo driver will not be forced to STOP. Servo can be enabled once E-STOP signal is cleared.

P05.04	**Label**	Driver prohibition input settings			**Valid mode(s)**	**P**	**S**	**T**
	Range	0/1/2	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0509		
	Valid	Immediate						

To set driver prohibition input (POT/NOT)

Value	Description
0	POT → Positive direction drive prohibited NOT → Negative direction drive prohibited
1	POT and NOT invalid
2	Any single sided input from POT or NOT might cause Er260

Method 2: Using 605Ah object dictionary through master device to activate this function.

P05.11	**Label**	Servo braking torque setting			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~500	**Unit**	%	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0517		
	Valid	Immediate						

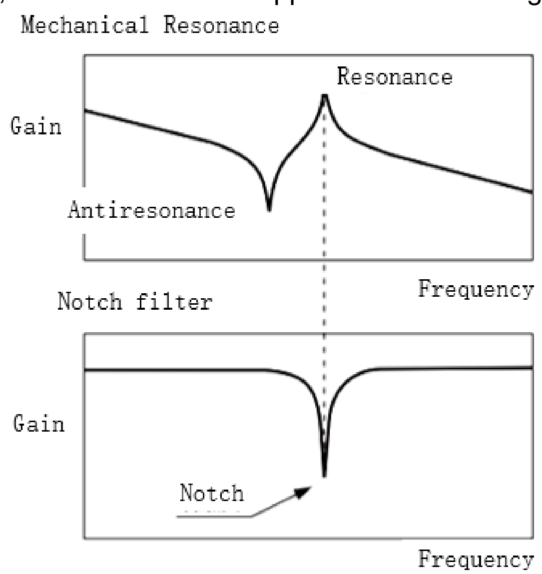
To set torque limit for servo braking mode.
If P05.11 = 0, use torque limit as under normal situation.
Please note that if P05.11 set value is too low, emergency stop will take longer.

6.11 Vibration Suppression

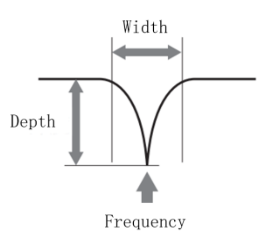
6.11.1 Mechanical resonance suppression

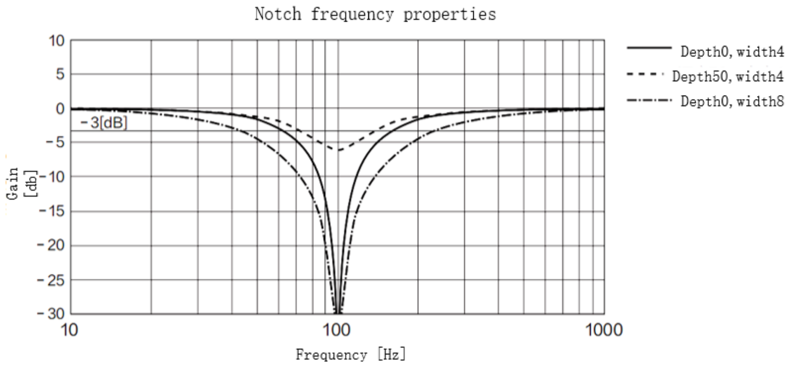
Mechanical system has certain resonance frequencies. When servo gain is increased, resonance might occur at around mechanical resonant frequencies, preventing gain value from increasing. In such situation, notch filter can be used to suppress resonance to set higher gains or lower vibration.
To suppress mechanical resonance:

1. Torque command filter time constant
   Set filter time constant to reduce gain at around resonant frequencies
   Torque command filter blocked frequencies（Hz） fc=1/ [2π×PA1.04(0.01ms)×0.00001）]
2. Notch filter
   Notch filter suppress mechanical resonance by reducing gain at certain frequencies. When notch filter is correctly set, resonance can be suppressed and servo gain can be increased.



- Notch filter bandwidth
  Center frequency of the notch filter, frequency bandwidth with reduction of -3dB.
- Notch filter depth
  The ratio between input and output of center frequency.
  When depth = 0, center frequency output is totally off and when depth = 100,
  Hence when notch filter depth is set at lower value, the depth is higher and better at suppressing mechanical resonance but it might cause system instability.





If the analytic result from mechanical properties analysis tool doesn't show any obvious peak but vibration did occur, it might not be due to mechanical resonance, it may be that servo gain has reached its limit. This kind of vibration can't be suppressed by using notch filter, only by reducing gain and torque command filter time.

To use notch filter

Automatic notch filter

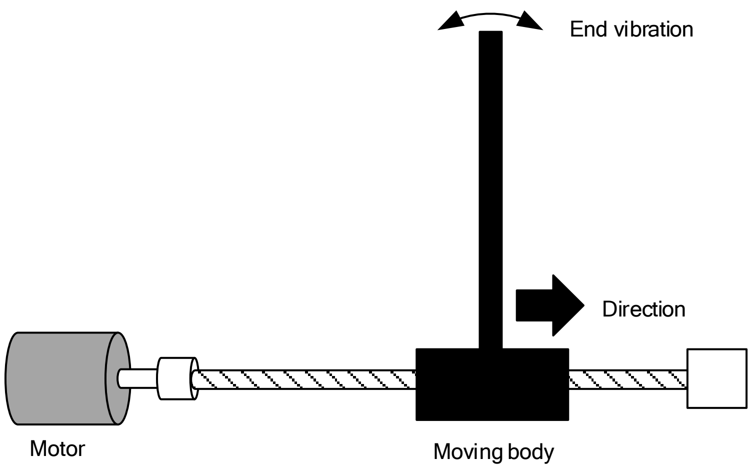
1. Set P02.00 = 1 for auto notch filter adjustment
2. If P00.03 stiffness increases, 3rd group of notch filter (P02.07/P02.08/P02.09) updates automatically when driver is enabled. P02.00 = 0, auto adjustments stop.
   If resonance is suppressed, it means self-adjusting notch filter is working. If resonance occurs when mechanical stiffness increases, please use manual notch filter, set filter frequency to actual resonant frequency.

Manual notch filter

There are 2 ways to use manual notch filter.

1. After enabling self-adjusting notch filter, set the values from 3rd group of filters to 1st group of notch filter (P02.01/P02.02/P02.03), see if resonance is suppressed. If there is other resonance, set P02.00 = 1, then set the values from 3rd group of filters to 2nd group of notch filter (P02.04/P02.05/P02.06)
2. Get resonant frequency, notch filter bandwidth and depth and set it into the corresponding parameters through Motion Studio.

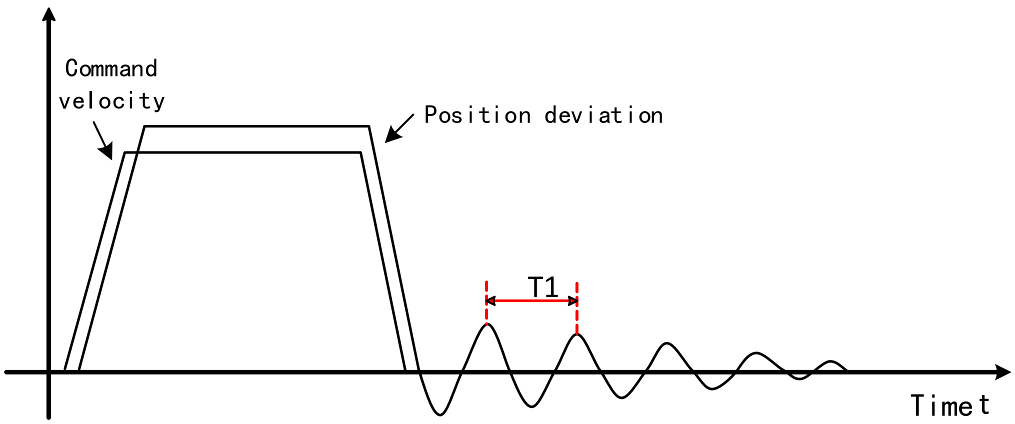
6.11.2 End vibration suppression



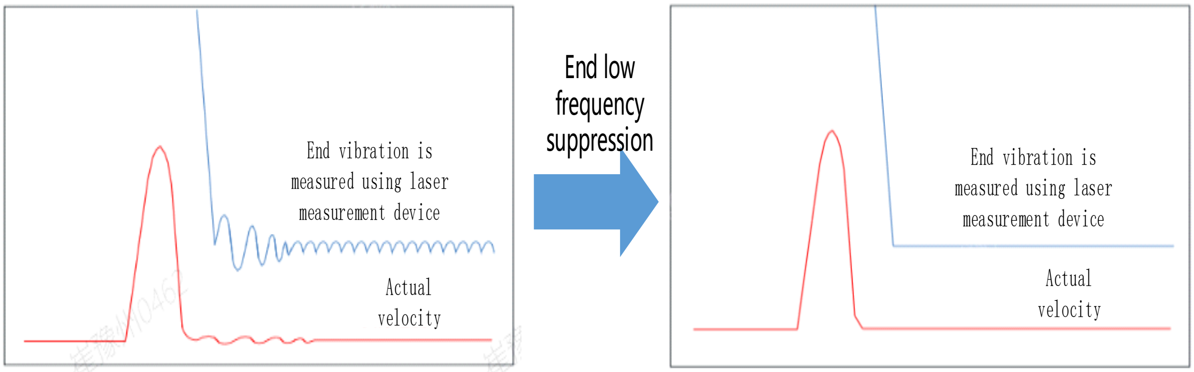
If the mechanical has an end that is long and heavy, it might cause end vibration at emergency stop and affect the positioning. Usually happens on long armed axis with loose end. The frequency is usually within 100Hz which is lower than mechanical resonant frequencies. It is called low-frequency resonance which can be prevented by applying low frequency suppression function.

<u>To apply low frequency suppression</u>

1. Trace current/ position deviation waveform when motion stops.
2. Measure the vibration cycle T1 of current waveform.
3. Convert T1 into low frequency resonance by F1 = 1/T1
4. Write F1 into P02.14
5. If some other low frequency resonance occurs, please repeat step 1-3 and write F2 into P02.16.

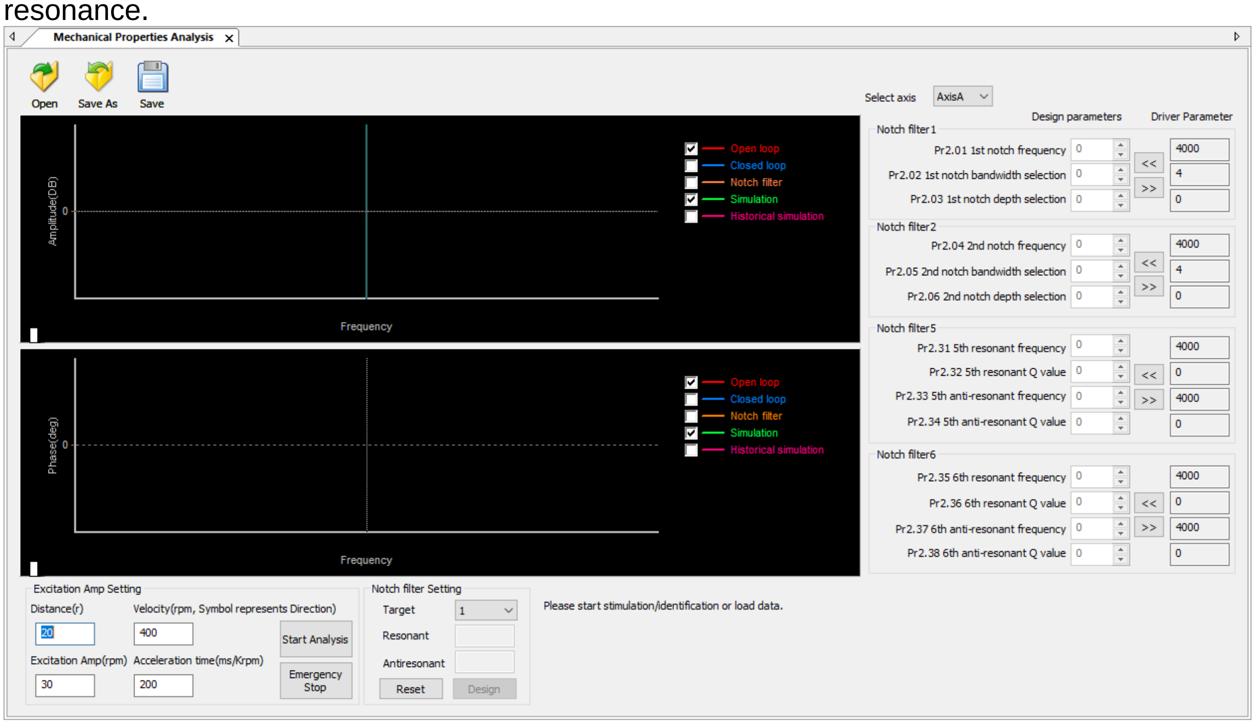


The result of suppressing low frequency resonance



6.12 Mechanical properties analysis

To determine mechanical and set up notch filter parameters to suppress vibration caused by resonance.



To avoid strong vibration, please first set lower excitation amplitude. However, if the set value is too low, data waveform will include some degree of distortion.
If vibration occurs during tests which can't be reduce through lowering electrical current excitation, it might be due to excessive gain. Please lower velocity gain and set notch filter as accordance from the mechanical properties analysis. Or might be due to inertia settings (P00.04) is too large, please use optimal inertia ratio value.

6.13 Position comparison

Position comparison is achieved by using instantaneous position data in comparison with preset position in position parameters. When the condition(s) is fulfilled, a pulse width configurable DO signal or ABZ/OCZ signal through frequency divider will be delivered. This function is operated in CPLD, without communication delay between processors hence it is suitable for application where high velocity motion is required.

Position comparison		Description
Output trigger	Output	6 DO or frequency divider ABZ/OCZ signal
	Logic	DO output valid as set in P04.10-P04.15
		ABZ/OCZ output valid as set in P05.42
		Output mode：Pulse / Flip
	Pulse width	P0C.02 set pulse width
	Delay compensation	P0C.03 compensate for hardware delay
Comparison source	Motor enclosed	Supported
	Closed loop ABZ encoder	Supported
Comparison value	Points of comparison	42 points
Comparison attribute	Comparison method	Comparison ON/OFF for positive/negative crossover
		Set comparison output

When the position comparison output function is needed, the corresponding DO needs to be configured as the CMP-OUT position comparison output signal or the frequency division ABZ needs to be allocated as the position comparison function.

Related parameters

P0C.00	Label	Position comparison			Valid mode(s)	P	S	T
	Range	0 ~ 3	Unit	/	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C01		

Set Value	Description
【0】	Disable
1	Enable （Rising edge）

P0C.01	Label	Position comparison mode			Valid mode(s)	P	S	T
	Range	0 ~ 255	Unit	/	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C03		

Set value	Description
【0】	Sequence comparison mode for absolute positions
1	Sequence comparison mode of relative position
128	Reciprocating comparison mode of absolute position
129	Reciprocating comparison mode of relative position

P0C.02	Label	Position comparison pulse output width			Valid mode(s)	P		
	Range	1 ~ 4095	Unit	0.1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C05		

Set the pulse width of the output signal when the position comparison point is reached, in milliseconds (ms).

P0C.03	Label	Position comparison output delay time			Valid mode(s)	P		

		compensation						
	Range	-10000 ~ 10000	Unit	0.1us	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0X2C07		
Set the delay compensation for position comparison output. Compensate for the delay caused by DO/frequency division output circuits								
P0C.04	Label	Position comparison starting point			Valid mode(s)	P		
	Range	1~42	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C09		
To set the starting point of position comparison.								
P0C.05	Label	Position comparison end point			Valid mode(s)	P		
	Range	1~42	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C0B		
To set the ending point of position comparison.								
P0C.06	Label	No. of cycle for N cycles comparison			Valid mode(s)	P		
	Range	1~60000	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C0D		
Set the number of position comparison cycles. Setting it to 0 is for infinite cycle comparison;								
P0C.07	Label	Position comparison – set current position as origin			Valid mode(s)	P		
	Range	0~1	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C0F		

Set Value	Description
【0】	Disable
1	Enable （Rising edge）

Set origin for position comparison, set current position as origin at rising edge.

P0C.08	Label	Position comparison – Offset to origin			Valid mode(s)	P		
	Range	-2147483648 ~2147483647	Unit	/	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0X2C11		
Set the number of position comparison cycles. Setting it to 0 is for infinite cycle comparison;								
P0C.20~ P0C.61	Label	Position comparison 1-42 target value			Valid mode(s)	P	S	T
	Range	-2147483648 ~2147483647	Unit	/	Default	0		
	Byte length	32bit	Attribute	R/W	485 address	0X2C28~0X2C7B		
Set the target values of position comparison points 1 to 42; when reaching the position of the comparison point, determine the position comparison output according to the attribute values of position comparison points 1 to 42.								
P0C.70~ P0C.90	Label	Position comparison 1 & 2 attributes value			Valid mode(s)	P	S	T
	Range	0~0xFFFFFFFF	Unit	/	Default	0		
	Byte length	32bit	Attribute	R/W	485 address	0X2C8D~0X2CB5		

Bit	Position comparison 1
0	Positive traversal comparison. 0=OFF,1=ON
1	Negative traversal comparison. 0=OFF,1=ON
2~5	Reserved
6	Output property settings： =0：Pulse mode =1：Flipping mode
7	DO1

8	DO2
9	DO3
10~12	Reserved
13	Frequency divider Phase A output
14	Frequency divider Phase B output
15	Frequency divider Phase Z output

bit0 ~ 15 are position comparison point 1 attributes

Bit	Position comparison 2
16	Positive traversal comparison. 0=OFF,1=ON
17	Negative traversal comparison. 0=OFF,1=ON
18~21	Reserved
22	Output property settings： =0：Pulse mode =1：Flipping mode
23	DO1
24	DO2
25	DO3
26~28	Reserved
29	Frequency divider Phase A output
30	Frequency divider Phase B output
31	Frequency divider Phase Z output

bit16 ~ 31 are position comparison point 2 attributes:

Working principle

- **Enable position comparison P0C.00**

  Position comparison function enabled when **P0C.00** is set to 1. Comparison status will be updated as position comparison starting point. When **P0C.00** is set to 0, position comparison ends and status clears.

- **Coordinate Mode**

  1. **Absolute position**

  The value of the set comparison point is the absolute position, and the comparison point is output when the value meets the condition and reaches the set absolute position.

  2. **Relative position**

  The set comparison point is the relative position of the previous comparison point, and the comparison point is output when the condition is met and the set relative position is reached.

- **Comparison mode**

  1. Sequence comparison

  In the sequence comparison mode, the comparison point trigger can only be triggered in sequence according to the set comparison sequence ("positive crossing" or "negative crossing" cannot be set). When the number of comparison cycles reaches the set value (P0C.06), the comparison enable will be automatically closed. Only when the comparison enable switch is detected to be turned on again, the comparison function will be enabled again. After comparing a point, P0C.10 real-time position feedback is linearly accumulated on the basis of the previous comparison point and will not be cleared automatically.

  2. Reciprocating comparison

  In the reciprocating comparison mode, the trigger mode can be set to "positive crossing or negative crossing". When the number of comparison cycles reaches the set value (P0C.06), the comparison enable will automatically turn off. Only when the comparison enable switch is re-detected to be turned on, the comparison function will be re-enabled. After comparing a point, P0C.10 real-time position feedback is linearly accumulated on the basis of the previous comparison point and will not be cleared automatically.

- **Absolute position sequence comparison mode**

  In the absolute position sequence comparison mode, when the comparison of the termination comparison point is completed, the comparison enable is automatically closed and the current comparison value is set to zero. The compare function is re-enabled only if the compare enable switch is re-detected to be on. The real-time position feedback in the single comparison mode is absolute. After each comparison point, POC.10 real-time position feedback is linearly accumulated on the basis of the previous comparison point and will not be cleared automatically.

- **Position comparison output width P0C.02**

  When the position comparison condition is met, the DO/frequency division output effective level signal is output, and the width of the effective level can be set by POC. 02 position comparison pulse output width, ranging from 1 to 4095 × 0.1ms. During the DO output is valid, the comparison logic is suspended and the comparison operation will not be performed, so please keep the running time between the two target points greater than the width of the DO output

- **Position comparison target position**

  42 target positions. Target position value and its corresponding attributes can be set in P0C.20~P0C.90.

- **Position comparison starting point P0C.04**

  Indicates the first comparison point. For example, if P0C.04 is set to 5, position comparison will start from 5^{th} target position.

- **Position comparison end point P0C.05**

  Indicates the last comparison point. For example, if P0C.05 is set to 7, position comparison will stop at 7^{th} target position.

- **Position comparison – Offset to origin P0C.08**

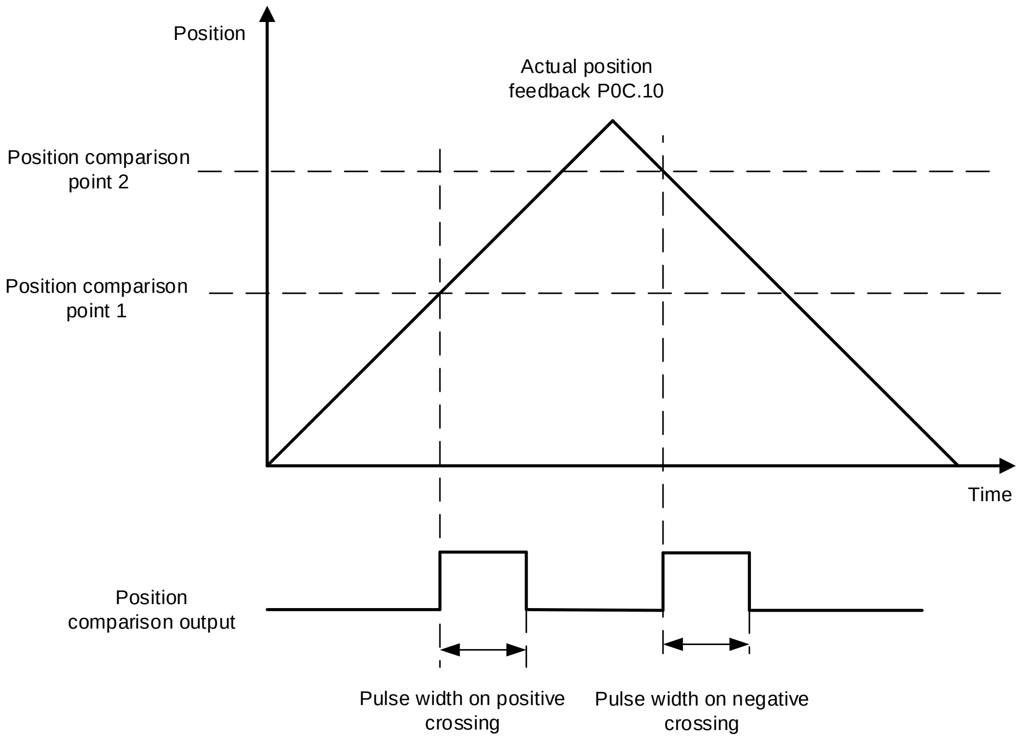
  When P0C.07 is triggered, P0C.10 actual position will automatically be set as P0C.08 offset value.

Applying position comparison

When the position passes through the target position comparison point, the output condition of the output attribute of the comparison point is satisfied, and the output width of the output port is the width pulse set by POC. 02.

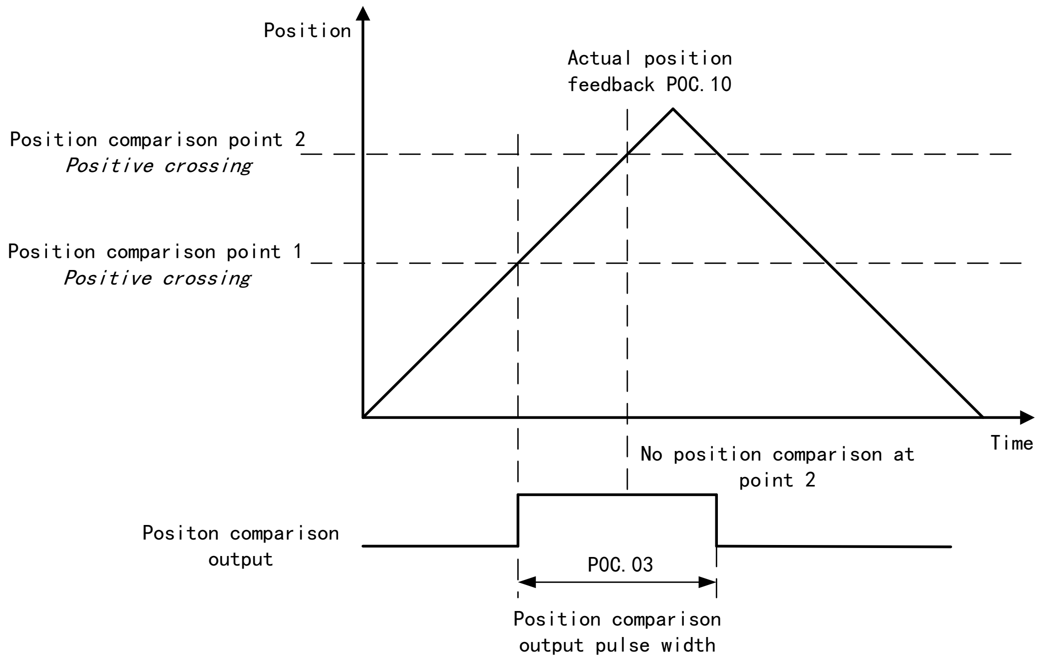
When the position comparison point attribute is set to pass through the comparison output in the forward direction, when the position feedback changes from small to large, the comparison output port will output the position comparison signal; if the position feedback changes from large to small, it will pass through the comparison point in the reverse direction, and the comparison output will not be performed.

For example, the comparison point 1 in the figure below is set to forward traversal comparison, and the comparison point 2 is set to reverse traversal comparison. When the comparison point 2 in forward traversal position is set, no comparison output will be performed..

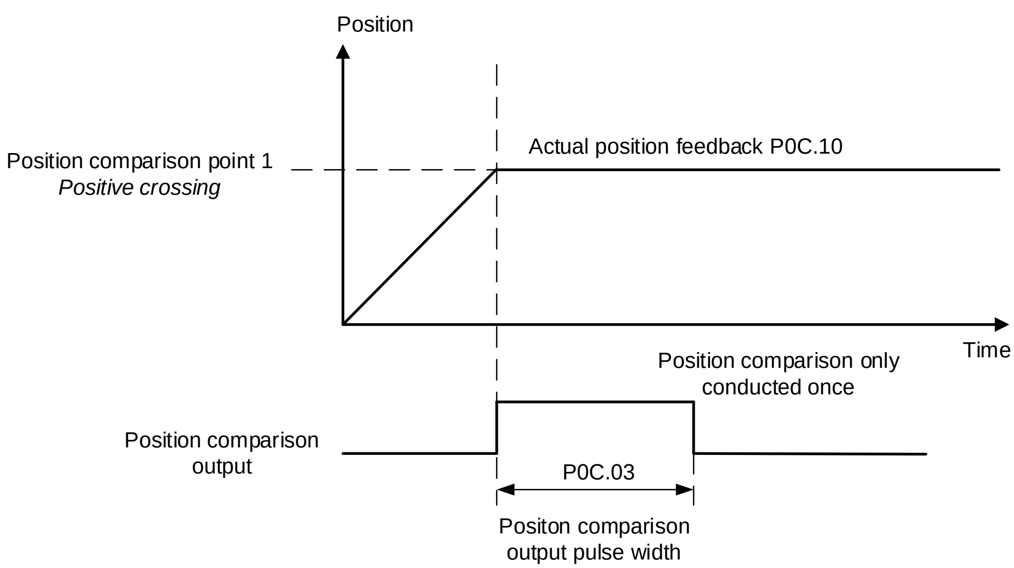


When setting multiple position comparison values, the comparison operation will not be performed during the valid period of the position comparison output port, so please keep the running time between the two target position comparison points greater than the width of the pulse output.

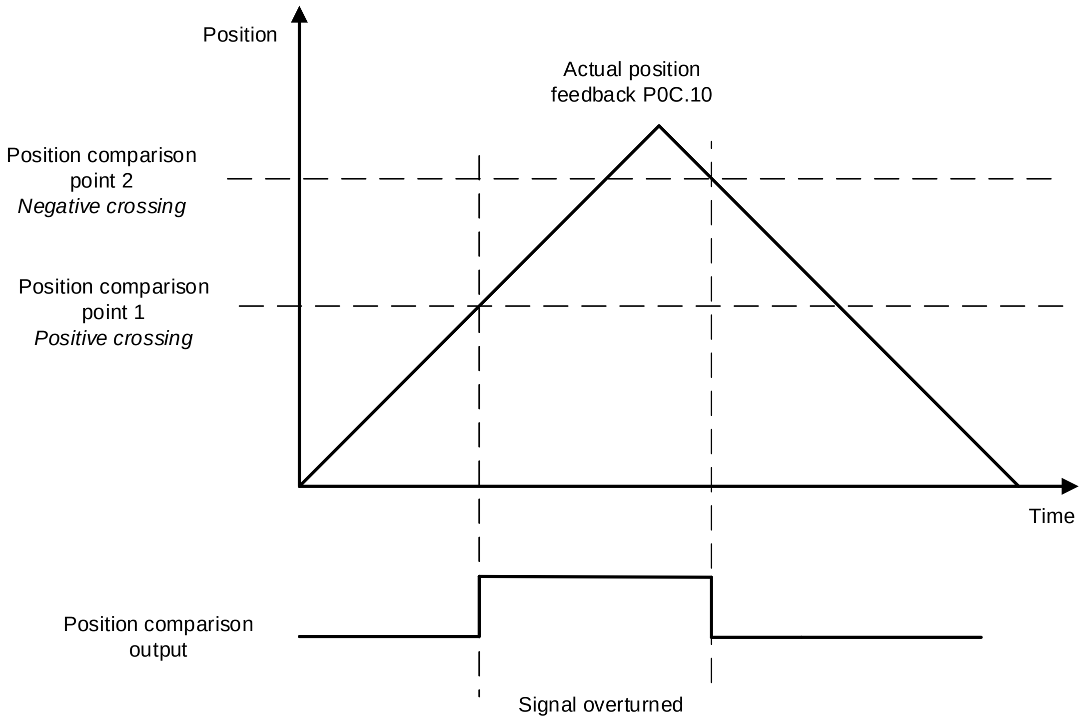
The following figure shows that the running time between the comparison points of the two target positions is less than the pulse output width, which leads to the reverse crossing of the target point, and no comparison operation is performed.



In the case of stopping at the same position as the position comparison value, as in the case of passing, only one pulse is output.



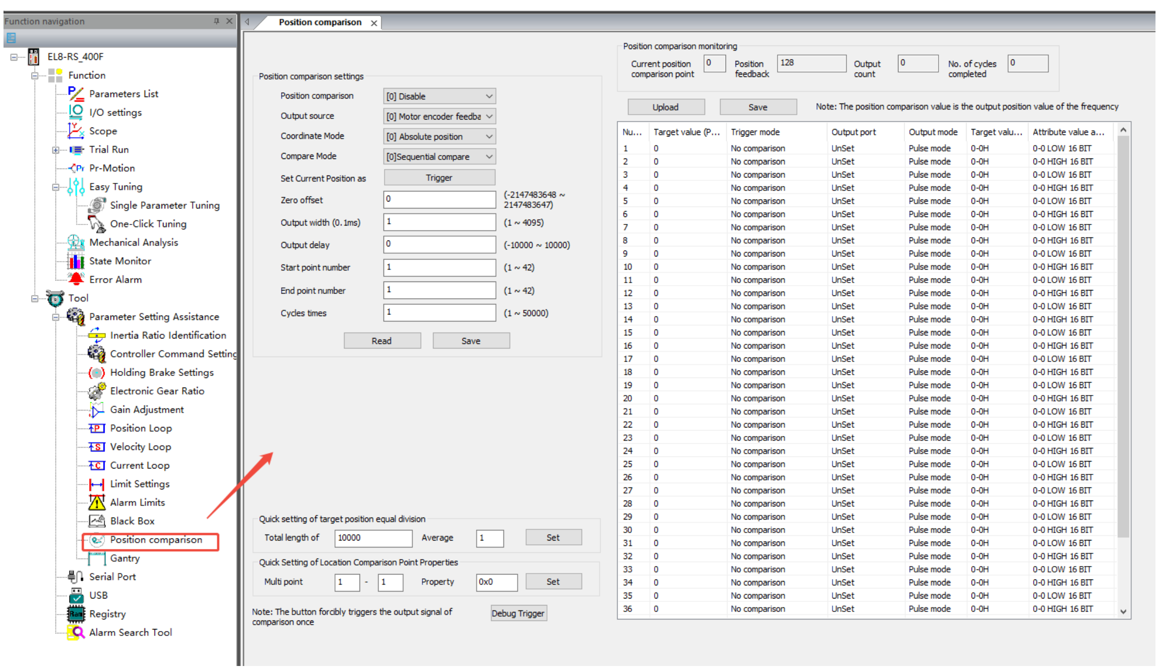
When the output mode is configured as the flip mode, when the position comparison point is reached and the output condition is met, the configured output port changes from the output setting width to the level flip.



MotionStudio2 Quick Configuration Interface

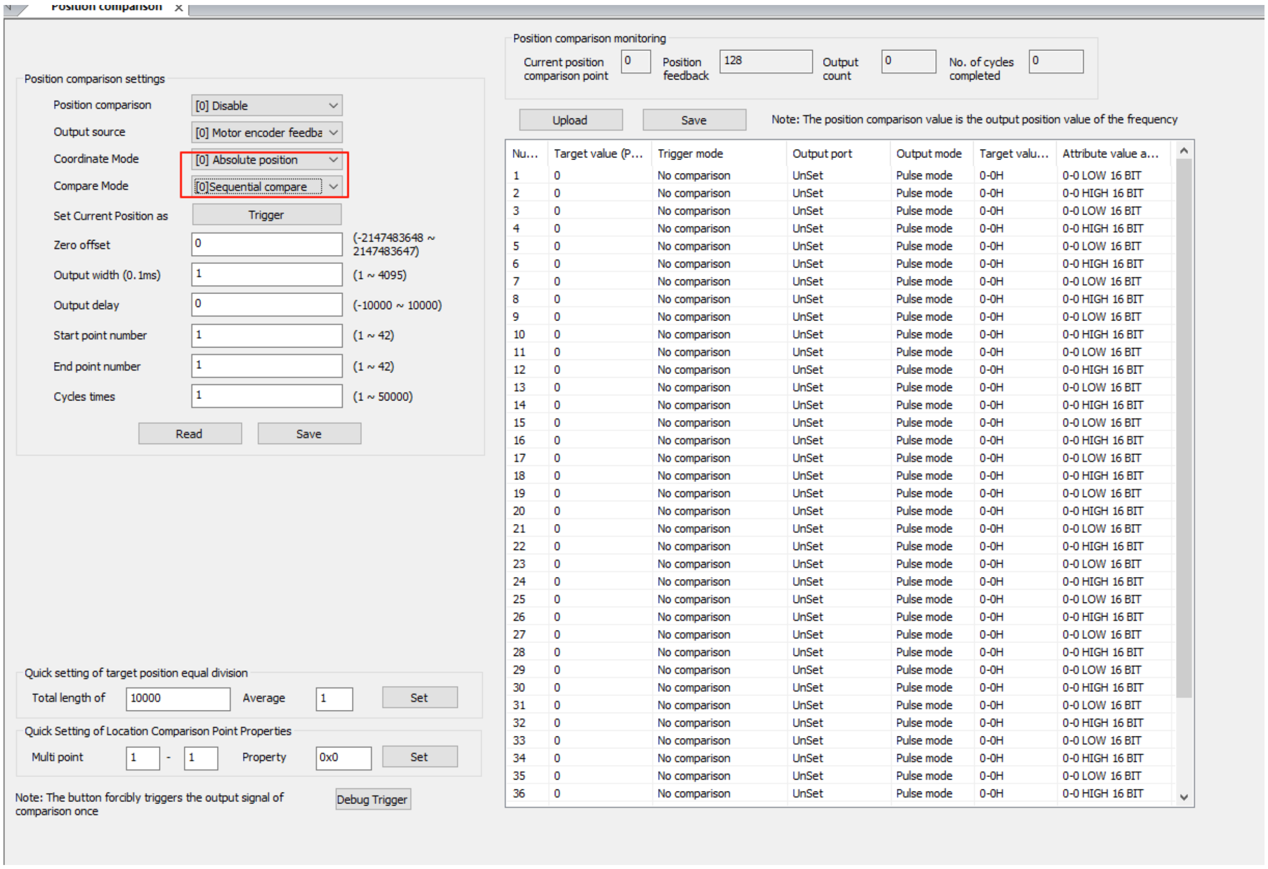
For faster configuration of the debug position compare output, the L8 series drives support the position compare function in the MotionStudio2 for configuration.

Select the location comparison function and double click to open:



- **Sequence comparison mode for absolute positions**

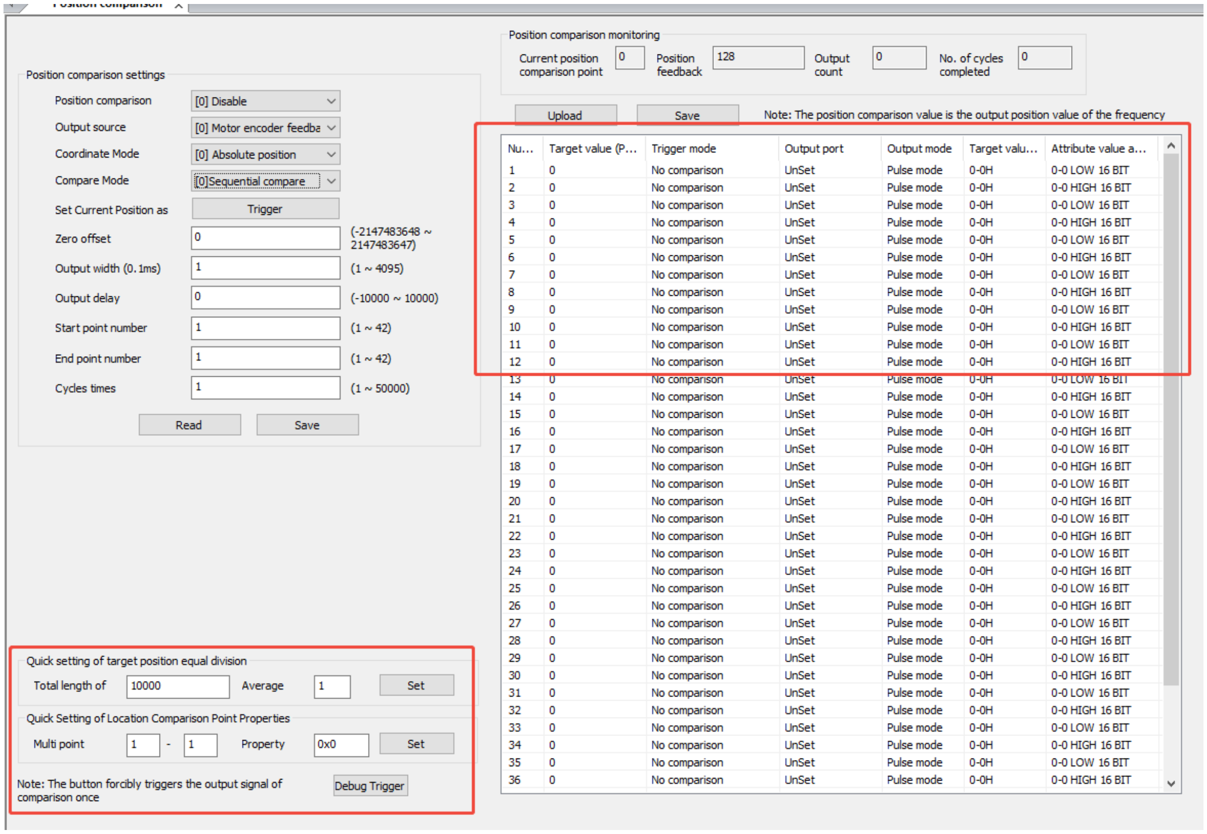
1. Set the position comparison mode to 0-absolute position sequence comparison mode, and configure the output pulse width, comparison start and end points and other parameters.



2. The target position parameter setting, the comparison target position value can be set in the table on the right. If the actual working condition is equidistant, the target position can be set quickly by dividing the target position, and the target position can be set by setting the total running length and the average number of points.

   Comparison point N Target position = N * (total length of position/average points)

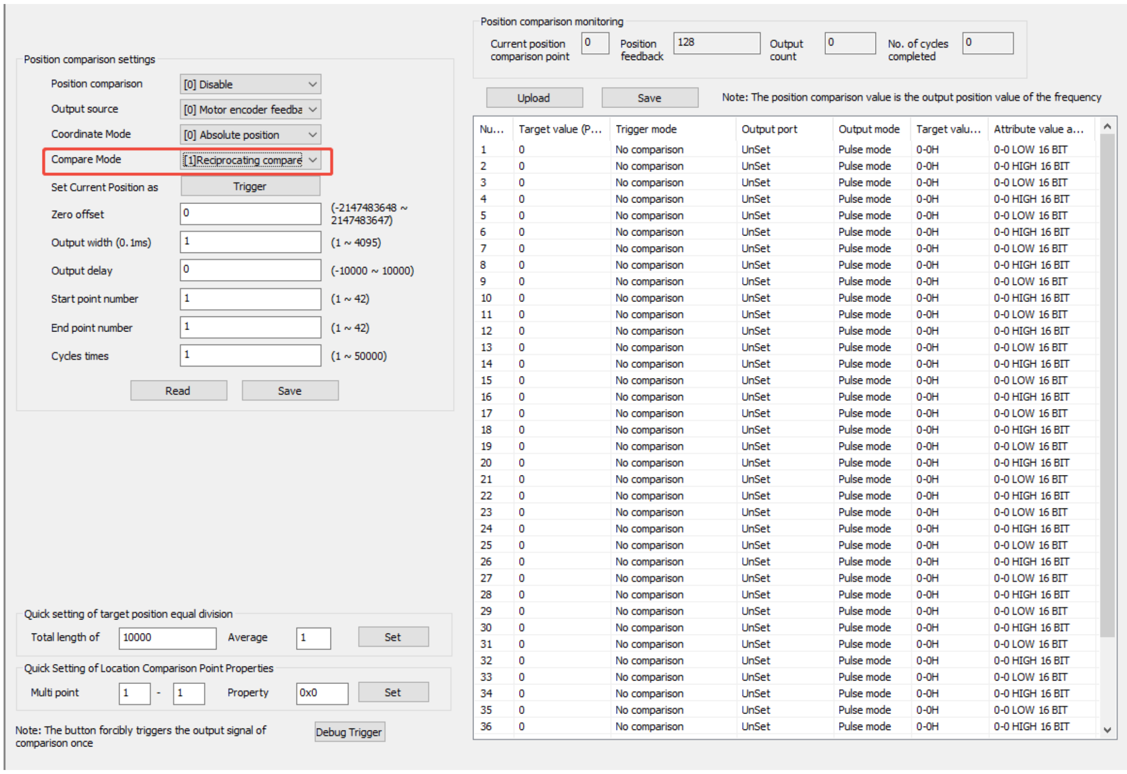
   Properties can also be configured through Quick Settings.



3. When the position comparison enable changes from 0 to 1 (the rising edge enables the position comparison output function), the current position comparison point changes from 0 to the position comparison starting point. At this time, the starting point is 1, and the first target position value is compared. After the position feedback reaches the first target position value, the current position comparison point changes to the next point, and so on.

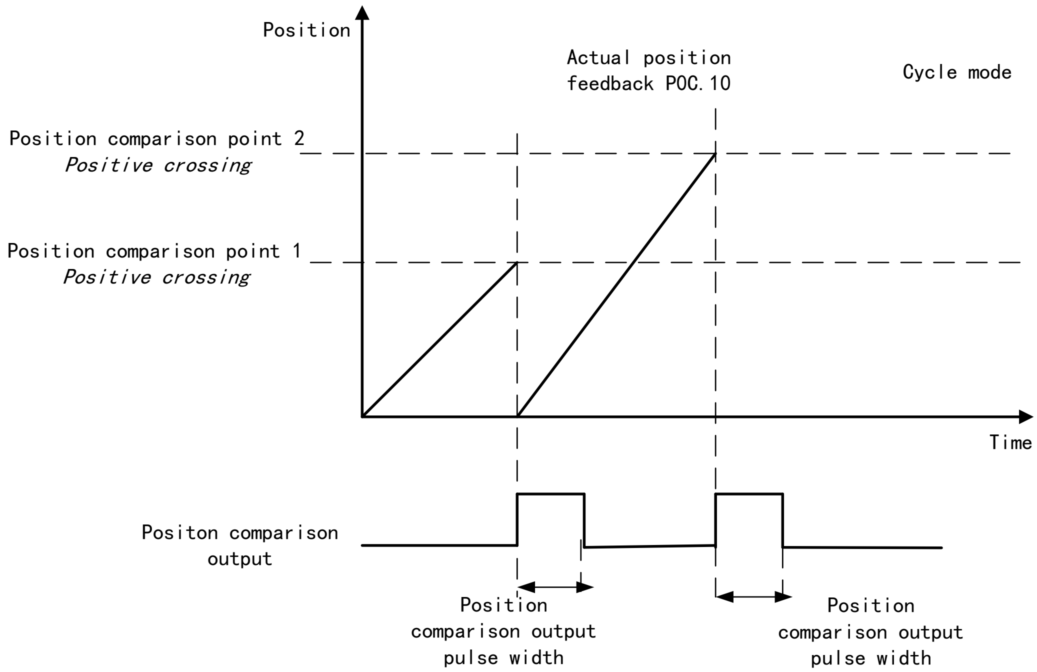
- **Reciprocating comparison mode for absolute position**

1. Set the position comparison mode to the reciprocating comparison mode of absolute position.



2. The target position parameter is set, and the comparison target position value can be set in the table on the right. At this time, the fast setting can set the running distance of two adjacent points and set the number of cycle points. The target position can be set by setting the running length and the average number of points equally. After the average number of points is set, the target values of the first to n comparison points are updated to the value of the total length of the positions at equal intervals.

3. When the position comparison enable changes from 0 to 1 (the rising edge enables the position comparison output function), the current comparison point changes from 0 to the comparison initial point, and the first target position value is compared. When the position feedback reaches the first target position value, the current comparison point becomes the next comparison point, and the position feedback starts from zero, and so on. As shown in the following figure:



Note:
It is necessary to ensure that the direction of crossing the set point during the first operation is consistent with the set direction to ensure the normal use of the function.
When setting the serial comparison mode, the comparison point position value is set to be consistent with the direction of the trigger mode.

6.14 Black box

Black box is a function which allows users to set conditions or data to be captured whenever error occurs. The data will be recorded by black box at the moment of error occurrence and automatically saved. Thus, through Motion Studio, user can analyze cause of the problem with the aid of black box data.
Black box is deactivated by default. It is user configurable to choose whether to overwrite current data or when to overwrite the data in black box.

6.15 Full closed loop control

Full closed loop control utilizes external position sensor (i.e. grading ruler) to get an actual position feedback to implement position control. This control can compensate for lead screw tolerance and any changes due to temperature.
Parameters setting needs to make sure a smooth axis motion profile. No overtravel or abnormal noise at stopping.

Full closed-loop setting steps:

1. **Set external encoder**
   External encoder type can be set accordingly in P00.31. At the moment, only ABZ incremental encoder is supported.

Parameter	Label	Range	Description
P00.31	External encoder type	0~3	=0：ABZ incremental encoder =1：Communication incremental encoder =2：Communication absolute incremental encoder (Tamagawa protocol) =3：BISS-C

2. **Set direction of external encoder**
   Please make sure the direction of the external encoder is the same as the motor encoder to prevent motor runaway.
   a) Enter position JOG mode. Jog the motor in the same direction at low velocity. Monitor if the feedback value of d21 absolute encoder single turn position and d21_1 external encoder are changing in the same trend. If they are not the same, inverse the setting of P00.32.
   b) The feedback value of d21 and d21_1 can be verified by pushing the axis and monitoring the trend of the changes. Please make sure the servo axis is disabled.
   c) Use trial run to set up a reciprocating motion. Max velocity > 200rpm. If d49 = 1 after several cycles of motion, set P00.32 to 1; d48 External encoder feedback pulse count per revolution.
3. **Set external encoder feedback pulse count**
   When P00.37 = 0, set external encoder feedback pulse count per revolution in P00.36. If the lead size of lead screw and encoder accuracy are known, please calculate using the formula below and enter the result into P00.36.

$$\mathrm{P00.36} = \frac{\text{Lead size of lead screw (mm)}}{\text{Encoder accuracy } \left(\frac{\mu\text{m}}{\text{pulse}}\right)}$$

23-bit encoder resolution = 8388608 pulses
Please make sure the parameters are set correctly to avoid excessive position deviation especially after long range motion. This may trigger excessive hybrid control deviation error alarm.

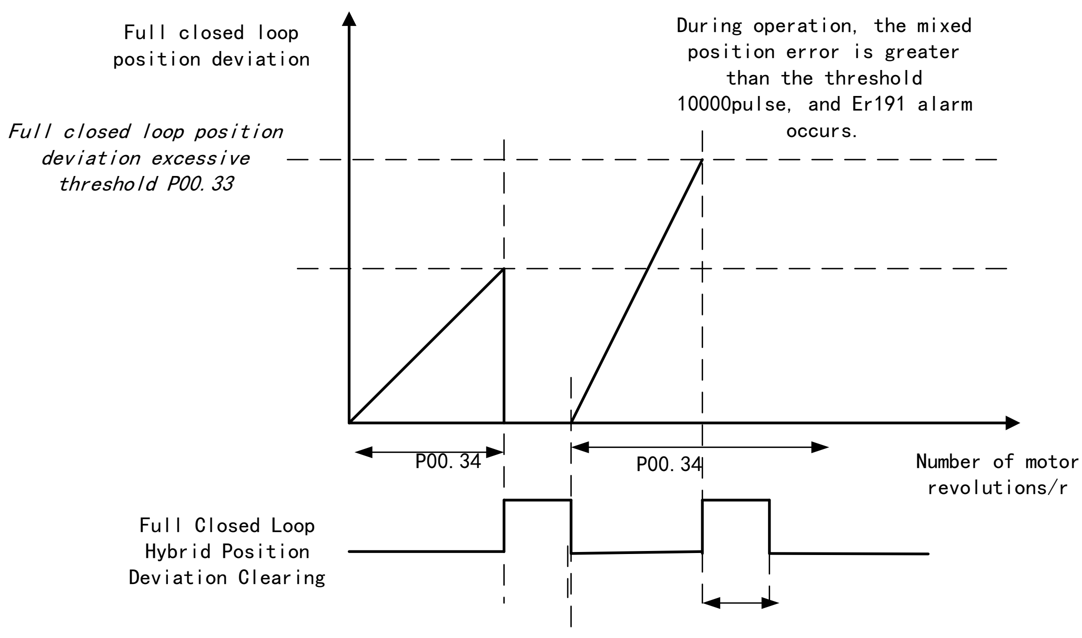
Parameter	Label	Range	Description
P00.35	External encoder frequency divider numerator	$0\sim2^{23}$	To set external encoder frequency divider numerator When P00.35 = 0, numerator = resolution of encoder
P00.36	External encoder frequency divider denominator	$1\sim2^{23}$	To set external encoder frequency divider denominator
P00.37	External encoder feedback pulse count per	0~2147483648	When P00.37 = 0, P00.36 set value = external encoder feedback pulse count per revolution.

	revolution		

4. **Set alarm threshold**
   - Excessive hybrid deviation (P00.33)
     To set alarm threshold value for the position deviation between motor actual position and external encoder actual position. Er191 might occur if position deviation exceeds alarm threshold value.
   - Clear hybrid control deviation (P00.34)
     Use to set the condition to clear hybrid control deviation (Only in full closed loop control mode)

Set value	Description
【0】	OFF
1~100	Revolution count to clear hybrid control deviation

Example: Let P00.34 be 10, and P00.33=10000.



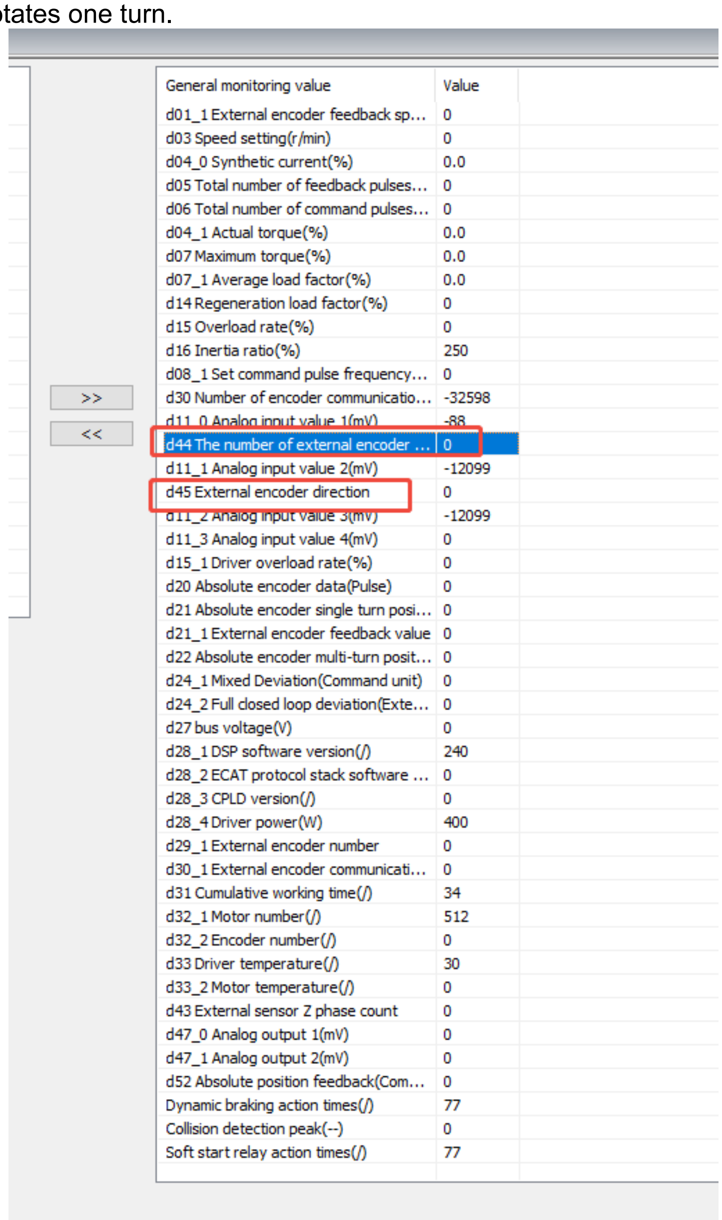
5. **Set encoder feedback mode**
   P00.30 Set 1 to enable full closed loop mode. The full closed loop mode needs to be in the P00.01 = 0 position control mode to open.

Parameter	Label	Range	Description
P00.30	Encoder feedback mode	0~3	= 0: do not open the full closed loop, do not identify the direction = 1: open the full closed loop, do not identify the direction = 2: do not open the full closed loop, identify the direction

			= 3: open the full closed loop, identify the direction

Confirm external encoder orientation

Confirmation method: Use the test run for reciprocating motion, the maximum speed is greater than 200rpm, observe the values of d44 and d45 after multiple reciprocating runs, if d45=1, P00.32 needs to be set to 1, d44 is the estimated number of feedback pulses of the external encoder when the motor rotates one turn.



General monitoring value	Value
d01_1 External encoder feedback sp...	0
d03 Speed setting(r/min)	0
d04_0 Synthetic current(%)	0.0
d05 Total number of feedback pulses...	0
d06 Total number of command pulses...	0
d04_1 Actual torque(%)	0.0
d07 Maximum torque(%)	0.0
d07_1 Average load factor(%)	0.0
d14 Regeneration load factor(%)	0
d15 Overload rate(%)	0
d16 Inertia ratio(%)	250
d08_1 Set command pulse frequency...	0
d30 Number of encoder communicatio...	-32598
d11_0 Analog input value 1(mV)	-88
d44 The number of external encoder ...	0
d11_1 Analog input value 2(mV)	-12099
d45 External encoder direction	0
d11_2 Analog input value 3(mV)	-12099
d11_3 Analog input value 4(mV)	0
d15_1 Driver overload rate(%)	0
d20 Absolute encoder data(Pulse)	0
d21 Absolute encoder single turn posi...	0
d21_1 External encoder feedback value	0
d22 Absolute encoder multi-turn posit...	0
d24_1 Mixed Deviation(Command unit)	0
d24_2 Full closed loop deviation(Exte...	0
d27 bus voltage(V)	0
d28_1 DSP software version(/)	240
d28_2 ECAT protocol stack software ...	0
d28_3 CPLD version(/)	0
d28_4 Driver power(W)	400
d29_1 External encoder number	0
d30_1 External encoder communicati...	0
d31 Cumulative working time(/)	34
d32_1 Motor number(/)	512
d32_2 Encoder number(/)	0
d33 Driver temperature(/)	30
d33_2 Motor temperature(/)	0
d43 External sensor Z phase count	0
d47_0 Analog output 1(mV)	0
d47_1 Analog output 2(mV)	0
d52 Absolute position feedback(Com...	0
Dynamic braking action times(/)	77
Collision detection peak(--)	0
Soft start relay action times(/)	77

Related parameters:

P00.30	**Label**	Enable Full closed-loop function			**Valid mode(s)**	P	S	T
	Range	0~3	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0037		
	Valid	Immediate						

Value	Description
【0】	Close the full closed loop and do not recognize the direction
1	Enable Full closed-loop, do not recognize the direction
2	Close the full closed loop and recognize the direction
3	Enable Full closed-loop, recognize the direction

P00.31	**Label**	External encoder type			**Valid mode(s)**	P	S	T
	Range	0~3	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0039		
	Valid	After restart						

Value	Description
【0】	ABZ encoder
1~3	*Reserved for future upgrades.*

P00.32	**Label**	External encoder direction			**Valid mode(s)**	P	S	T
	Range	0~1	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x003B		
	Valid	After restart						

Value	Description
【0】	Default direction
1	Inversed direction

P00.33	**Label**	Excessive hybrid deviation			**Valid mode(s)**	P		
	Range	0~134217728	**Unit**	Command unit	**Default**	16000		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0043		
	Valid	After restart						

To set the excessive hybrid deviation threshold value, please set accordingly. Use in full closed loop control. Factory default: 16000. Er180 might occur if position deviation during hybrid control exceeds 16000 pulse counts.
Er191 might occur if P00.33 set value is too low.

P00.34	**Label**	Clear excess hybrid control deviation			**Valid mode(s)**	P		
	Range	0~100	**Unit**	R	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0045		
	Valid	After restart						

To set condition to clear position deviation under hybrid control mode (Full closed loop)

Value	Description
【0】	OFF
1~100	Revolution count to clear hybrid control deviation

P00.35	**Label**	External encoder frequency divider numerator			**Valid mode(s)**	P	S	T
	Range	$0\sim2^{23}$	**Unit**	-	**Default**	0		

	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0047		
	Valid	After restart						

To set frequency divider numerator for external encoder.

P00.36	**Label**	External encoder frequency divider denominator			**Valid mode(s)**	**P**	**S**	**T**
	Range	$1\sim2^{23}$	**Unit**	-	**Default**	10000		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0049		
	Valid	After restart						

To set frequency divider denominator for external encoder. When P00.37 = 0, External encoder feedback pulse count per revolution = P00.36.

P00.37	**Label**	External encoder feedback pulse count per revolution			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~2147483648	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x004B		
	Valid	After restart						

Value	Pulse count
【0】	P00.36
$1\sim2^{31}$	P00.37

P00.38	**Label**	Z-signal pulse input source			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~3	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x004D		
	Valid	Immediate						

Value	Bit 1 (Probe Z-signal)	Bit 0 (Homing Z-Signal)
【0】	Motor Z-signal	Motor Z-signal
1	Motor Z-signal	External encoder Z-signal
2	External encoder Z-signal	Motor Z-signal
3	External encoder Z-signal	External encoder Z-signal

P01.39	**Label**	Special function register 2			**Valid mode(s)**	**P**	**T**	**S**
	Range	0~0xFFFF	**Unit**	-	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x014F		
	Valid	Immediate						

Value	Description
【0】	Reserved
1	=1, activate full closed loop during trial run
2	=1, hybrid position deviation clearing

P05.44	**Label**	Frequency divider output source			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~4	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0559		
	Valid	After restart						

Value	Description
【0】	Position feedback of encoder #1(motor encoder)
1	Position feedback of encoder #2(external encoder)
2	Reserved
3	Pulse input command position synchronous output; position comparison not available in this mode
4	Frequency divider output prohibited

6.16 Multiturn absolute encoder

Multiturn absolute encoder records the position and the revolution counts of the motor. When driver is powered-off, multiturn absolute encoder will backed up the data using battery and after powering on, the data will be used to calculated absolute mechanical position and there is no need for a mechanical homing process. Use widely in robotic arms and CNC machines.

If it is the first time using the encoder, please home the mechanical axis and initialize the absolute position of the encoder to zero. Set up a homing point and only home when there is an alarm. Please stop the axis before reading any position data to prevent inaccuracy.

6.16.1 Parameters setting

<table>
<tr><td rowspan="4">P00.15</td><td>Label</td><td colspan="3">Absolute encoder settings</td><td>Valid mode(s)</td><td>P</td><td>S</td><td>T</td></tr>
<tr><td>Range</td><td>0~15</td><td>Unit</td><td>-</td><td>Default</td><td colspan="3">0</td></tr>
<tr><td>Byte length</td><td>16bit</td><td>Attribute</td><td>R/W</td><td>485 address</td><td colspan="3">0x001F</td></tr>
<tr><td>Valid</td><td colspan="2">After restart</td><td></td><td></td><td colspan="3"></td></tr>
<tr><td colspan="9">Set the type of absolute encoder and how to use it.
0: Incremental mode: No power off position memory function. There is no restriction on the device load travelling range required.
1: Multi-turn linear mode: Enables multi-turn absolute function with position memory. It is used in the case where the travelling range of the equipment load is fixed and the data of the encoder will not be overflowed in multi-turns.
2: Multi-turn rotary mode: Enable multi-turn absolute value function, with position power off memory function, the actual feedback multi-turn data cycling back and forth between 0~(P06.63+1); used for the occasions where the load range of the equipment is not limited.
3: Single-turn absolute value mode: this mode is mainly used for equipment loads only need to remember the position of the motor within one turn. The initial position of the feedback after each power-on is the current position feedback calculated by the coordinate system after the last back to the original operation 6064. no need to carry out the back to the original operation.
5: Clear the multi-turn alarm. After normal clearing, it will change to the original multi-turn mode automatically, if it is still 5 after 3s, it will be processed according to 153 alarm.
9: Clear multiturn position and reset multiturn alarm. Automatically changes to original multiturn mode after normal clearing, if it is still 9 after 3s, then process according to 153 alarm.</td></tr>
</table>

Note: Use after mechanical zeroing, and only respond to clearing multiturn data under disable condition! Other: Do not set.

6.16.2 Read absolute position

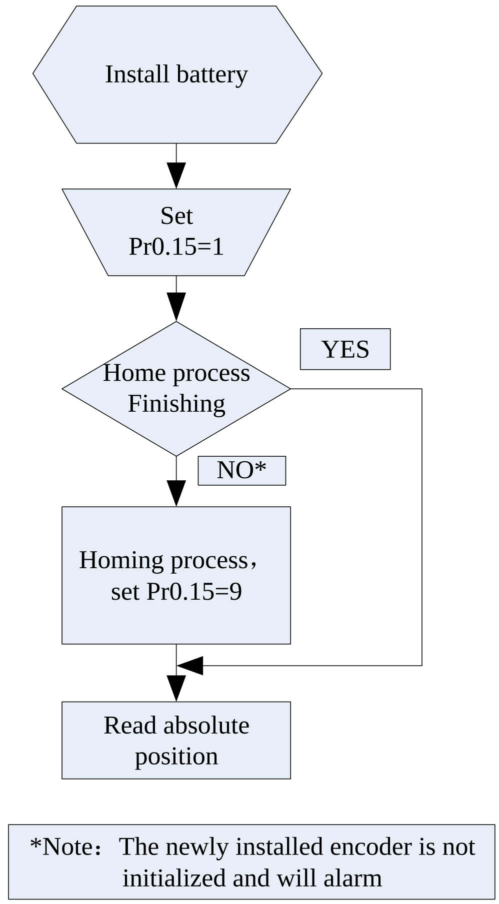
1、Steps：

1) First, select a motor with multiturn absolute encoder, install battery and confirm whether the driver version supports the specific motor;

2) Set P00.15 = 1. If it is the first time of installation, Err153 will occur because battery is newly installed and position data is invalid. Please home the axis and initialize the absolute position of the encoder to zero.

3) When absolute homing point is set and there is no fault with the battery, the alarm will be cleared

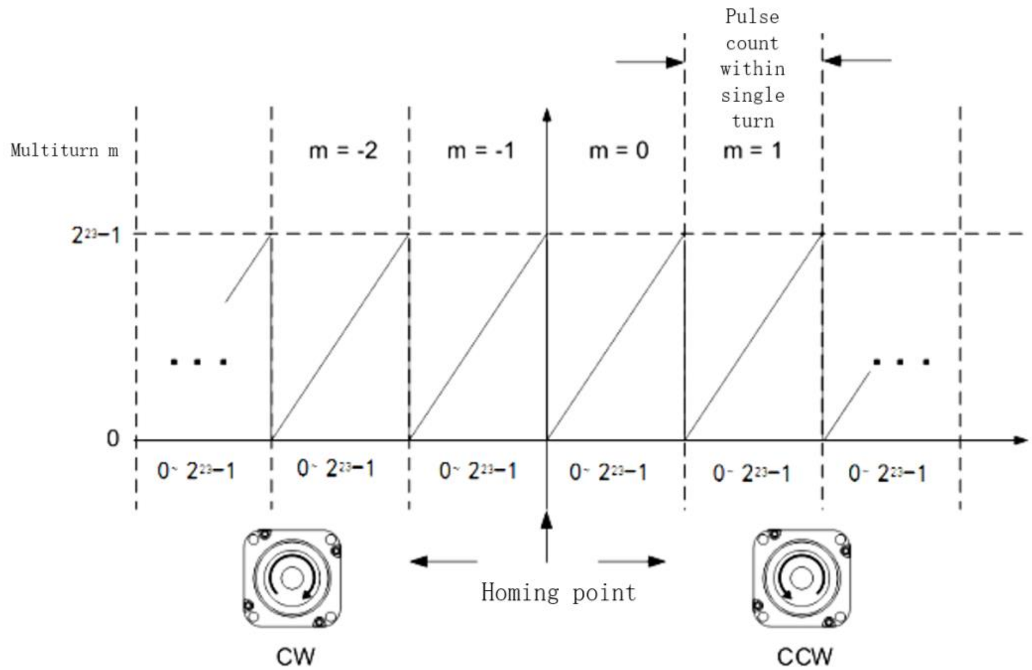
4) Finally, the user can read the absolute position. Position won’t be lost even if the driver is powered off.



2、Read absolute position

When the rotor turns in clockwise direction, the revolution count will be negative; turns in counter clockwise direction, the count will be positive. No. of revolutions will be from -32767 to +32767. If the count number reaches +32767 in counter clockwise direction, the count will revert back to -32768, -32767 and vice versa for clockwise direction.

As for position data, it depends on the precision of the encoder. For 17 bit = 0-131071, 23 bit = 0-8388607



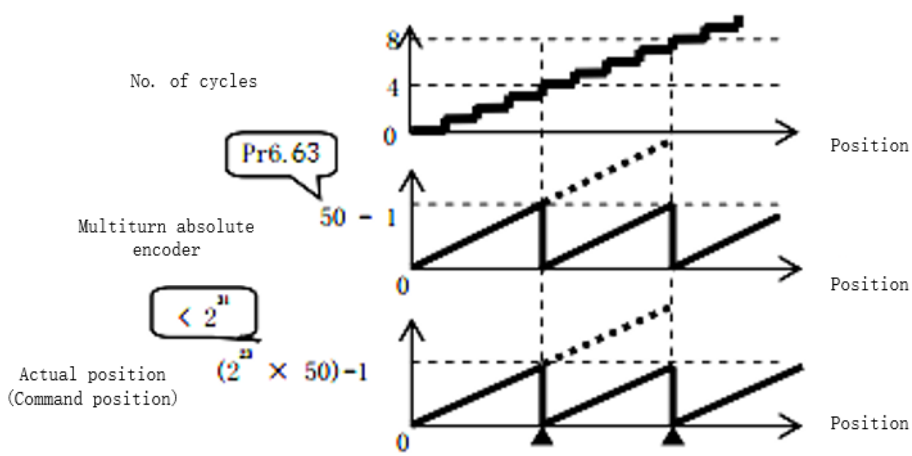
Read data from 485 address object dictionary
Please read data only when the motor is fully stopped or it might cause calculation errors.
Please repeat this step for at least twice to make sure the result is uniform.

Multiturn linear mode(P00.15 = 1)

Multiturn absolute with memory of position at power off. Use this mode when travel distance is constant, encoder multiturn data would not overflow.
In this mode, encoder data ranges from -32768~32767. If the value either of the limits, Er157 might occur. Set 9 in P00.15 to clear multiturn data and home the axis.

Multiturn rotational mode

For absolute encoder, multiturn rotational mode (P00.15 = 2, P06.63 set to multiturn upper limit) is added on top of incremental mode and multiturn linear mode. Actual feedback multiturn data is always between 0 – [P06.63 + 1], regardless of the direction of rotation. There is no limit to no. of rotation and no data overflow.



Single turn absolute mode

Use this mode when the travel distance of the axis is within a single turn of the rotor.

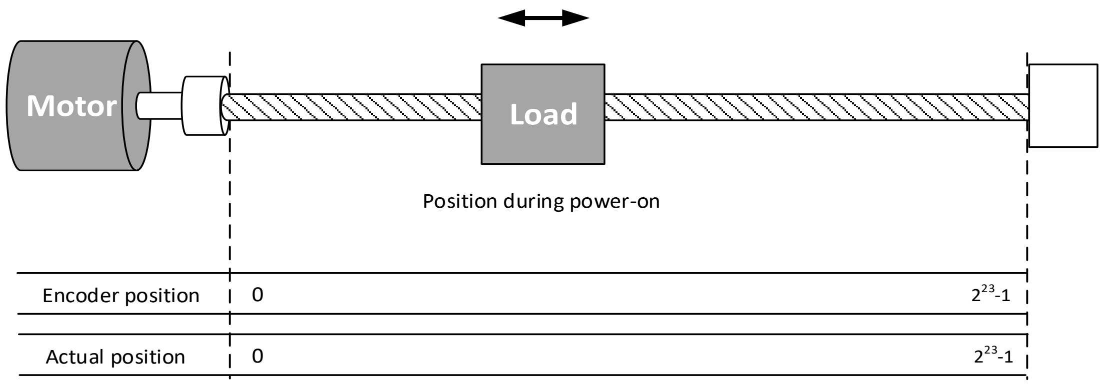
1. Target position input range – EtherCAT

When using 23-bit absolute encoder, under single turn absolute mode, electronic gear ratio =1:1

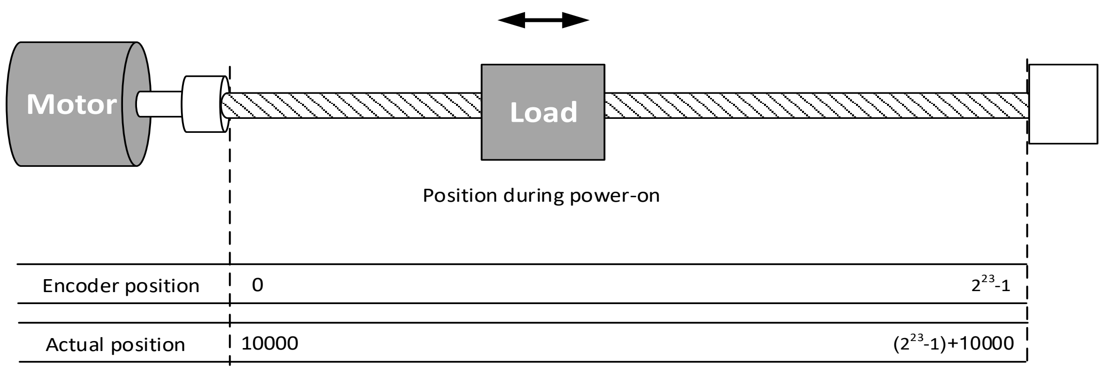
Homing point offset 607Ch = 0, target position range = 0 – [2^{23}-1]

Axis is homed, target position range = 607Ch – [2^{23}-1+607Ch]

When electronic gear ratio = 1:1, 607Ch = 0:



When electronic gear ratio = 1:1, 607Ch = 10000:



3、Clear multiturn position

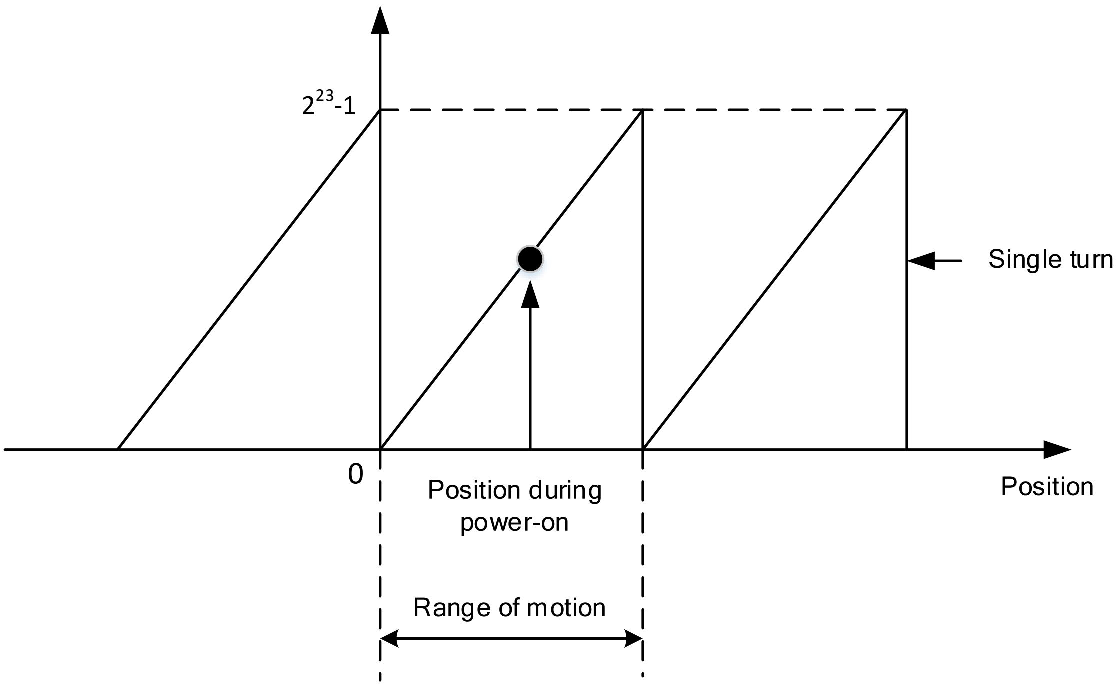
Before clearing multiturn position, axis needs to be homed. After clearing multiturn position, revolution count = 0 but absolute position remains unchanged and Err153 alarm will be cleared.

Please make sure the homing point is within the range of 1 revolution of the rotor. Installation and setup of the homing point can be set with the use of auxiliary function D21 on the front panel.

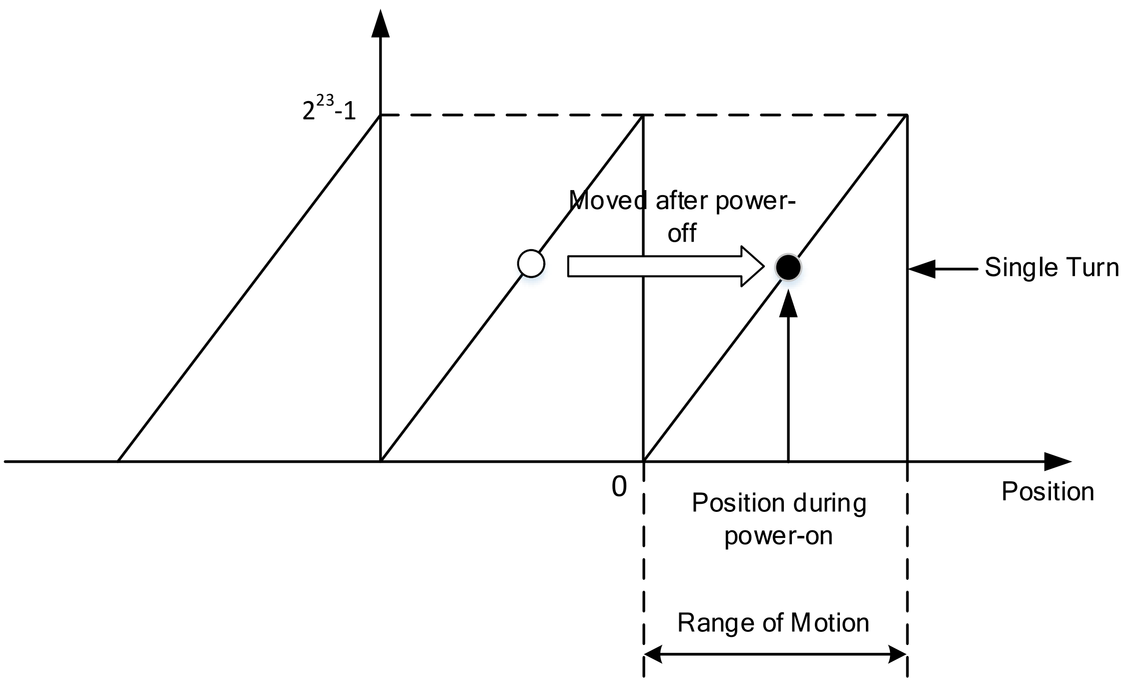
By setting P00.15 to 9, multiturn position will be cleared.

Please take notice of motor position during power on. Range of motion of a motor depends on the position of the motor during power on (23-bit absolute encoder as example).

If the motor position is as shown below during power on. The range of motion of the motor is within the range of a single turn of the motor from motor position during power on.



If power is turned off at position as shown below and power on when motor reaches the position below. Motor range of motion changes as shown below.

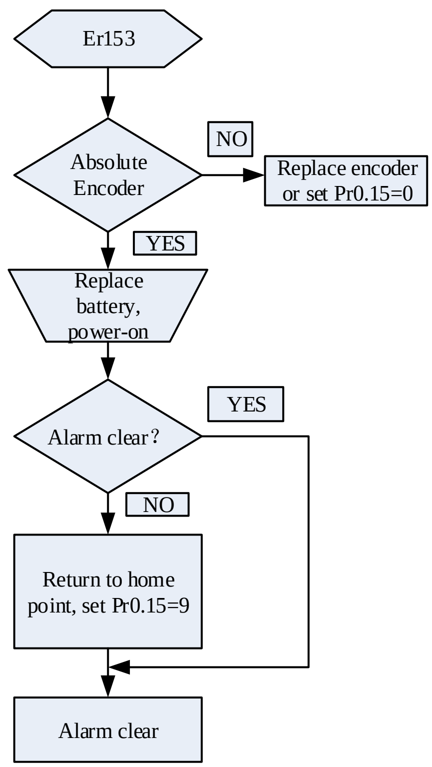


6.16.3 Absolute Encoder Related Alarm

The alarm can determine if absolute value encoder is valid. If battery power is low, not a motor with absolute encoder, encoder error etc. occurs, user can find out about the error from alarm output or on the front panel. Controller will stop any operation until alarm is cleared.

Alarm output:
Err153 will be shown on front panel or by I/O ALM signal and from controller.

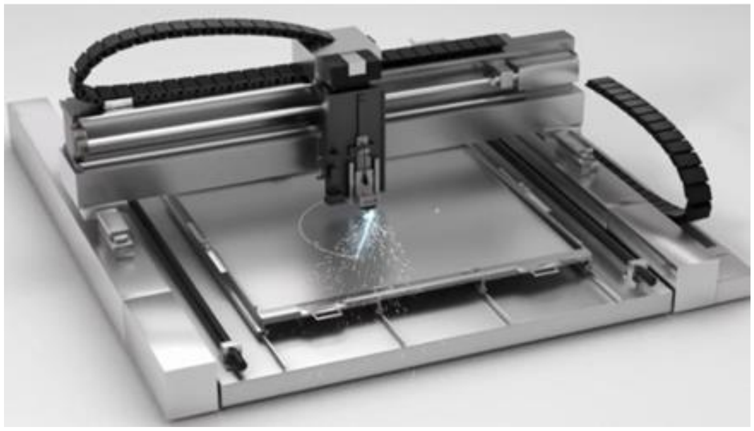
Err153 might occur,
（1）If absolute encoder is used for the first time and due to installation of new batteries Axis needs to be homed and multiturn data needs to be cleared.
（2）If battery voltage is lower than 3.2v. Replace battery and restart the motor.
（3）If battery voltage is lower than 2.5v or battery power was cut off. Replacing the battery won't clear the alarm. Axis needs to be homed and multiturn data needs to be cleared.
4、Alarm processing flow chart



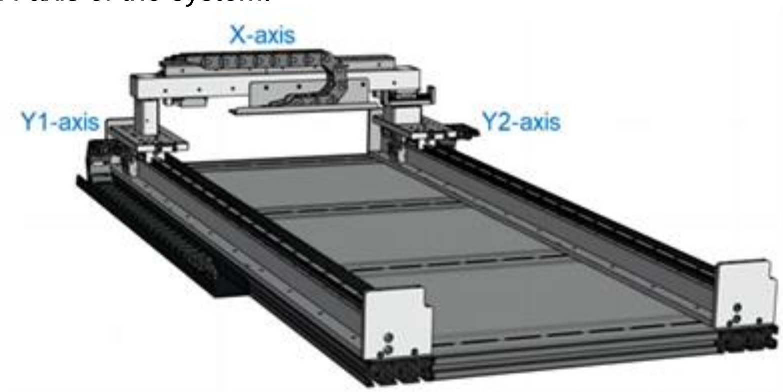
Battery kit
In multiturn absolute mode, Er153 might occur upon first time installation. P00.15 needs to be set to 0 to reset error and clear multiturn data.
When battery supply voltage < 3.0V, ArA03 might occur. Change battery as per steps below:
1.Power on driver (Make sure axis is disabled)
2.Change battery
3.Servo drive will reset warning automatically.

6.16.4 Gantry Functional Applications

The gantry function is used to achieve two-axis synchronisation. Equipment with a gantry synchronisation structure requires two motors to be driven bilaterally to ensure synchronisation.



The gantry system uses two parallel axes (Y1 and Y2) to control a single linear axis. This axis is orthogonal to the X-axis of the system.



In order to improve the synchronisation of the two axes, it is necessary to adopt the synchronous mode, which is completely completed by the servo drive to control the gantry synchronously, and the upper computer only does simple open-loop position control and logic control.

Gantry function: - To achieve two-axis alignment and two-axis synchronous tracking function of the equipment, the drive will be synchronous control by itself, without the need for complex control of the host computer.

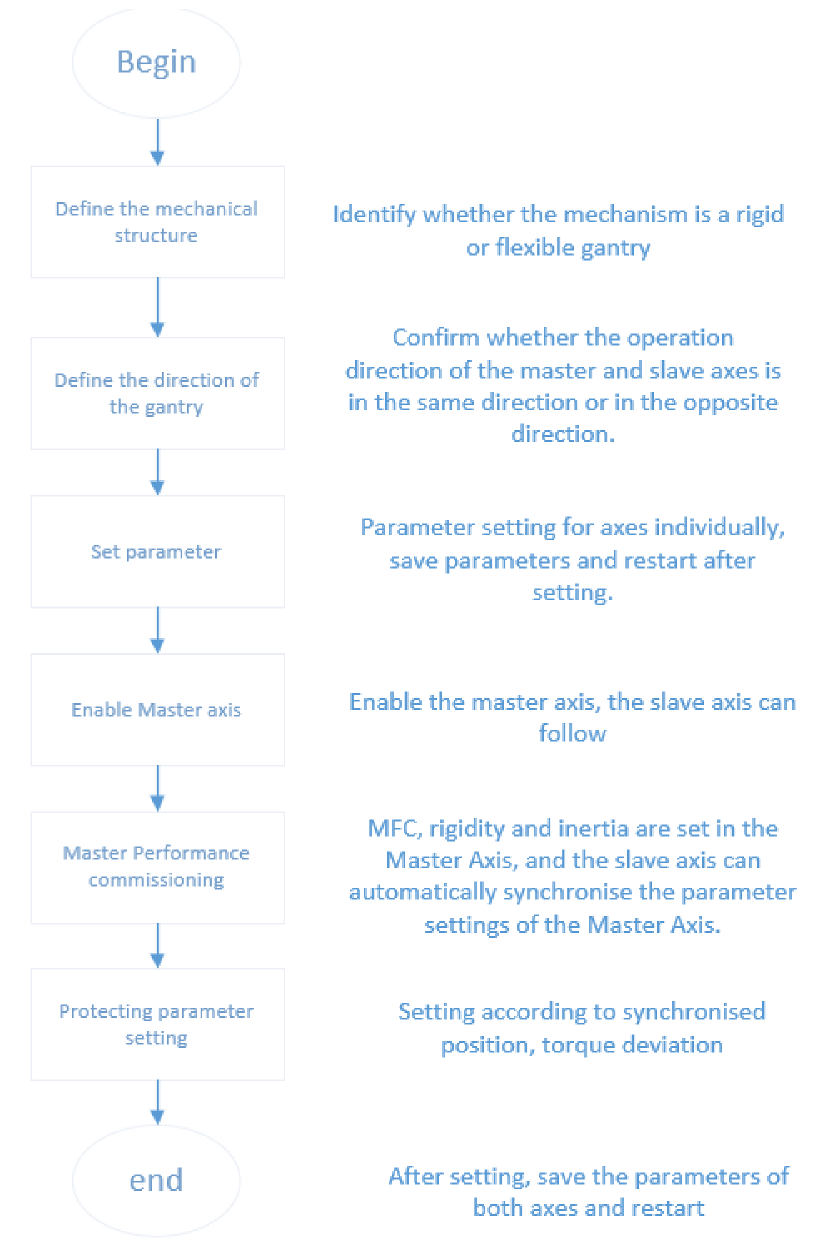
1. When the position deviation exceeds the set permissible value, a warning will be issued to stop the system operation;
2. Suitable for semiconductor, welding and cutting equipment, glass processing, large-scale planer need to keep two axes synchronous with the application process, etc.

Related parameters

parameter	name	description
P00.01	Control mode	Set to position mode
P00.06	Command polarity inversion	Default is 0; sets the positive direction of motor rotation. When the gantry function is on: Master axis: set the polarity of command pulse input, matching with PA0.07 Slave axis: set the relationship between the positive direction of rotation and the positive direction of master axis rotation, 0 is the same as the positive direction of the master axis, 1 is the opposite of the positive direction of the master axis. Note: Wrong setting of this parameter will cause the gantry to report error or even damage the mechanical structure!
P0D.00	Gantry settings	Default is 0, no gantry function is turned on. Bit0: Gantry function switch, 0 off, 1 on Bit1: master-slave axis switch, 0 for slave axis, 1 for master axis Bit2: PWM synchronisation switch, 0 off synchronisation, 1 on synchronisation (master axis needs to turn off synchronisation, slave axis needs to turn on synchronisation) Bit3=0: synchronisation; Bit3=1: no synchronisation
P0D.01	Gantry slave axis command settings	Default 0; 0: Torque (moment) command synchronisatio 1: Position command synchronisation
P0D.02	Gantry feedback compensation gain	Default 100; Range 0-300 Gantry Sync Feedback Compensation Gain Setting. Valid only in position command sync mode. 0: Equivalent to centre position feedback with minimum moment deviation and maximum position deviation; 100: Default value, gain 100%, balance moment and position deviation. 1-100: the rigid gantry is adjusted down, which can reduce the moment deviation during the movement. 100-300: the flexible gantry is adjusted larger, which can reduce the position deviation during the movement.
P0D.03	Gantry synchronization position deviation threshold value	Unit: Pulse 0: Shield position synchronisation deviation alarm
P0D.04	Gantry synchronization torque deviation threshold value	Unit: 0.1% 0: Shield position synchronisation deviation alarm
P0D.05	Gantry synchronization gain	Default 0; Suppresses torque deviation in both axes; valid only in position command synchronisation mode. 0: Suppression of torque deviation is switched off; 1-1000: The higher the value, the better the torque deviation suppression effect, but it will cause the limit gain of speed ring to decrease. It can be used in conjunction with PA6.73 to suppress torque deviation.

P0D.06	Gantry synchronization position gain	Default: 0; Setting range 0~32767
P0D.07	Gantry synchronization velocity gain	Default: 0; Setting range 0~32767
P0D.08	Gantry synchronization velocity integral	Default: 0; Setting range 0~32767

Comissioning steps:



Commissioning details:

1.Define the mechanical structure:

In case of flexible gantry, recommend to set the parameter slave axis command mode PAD.01=1;
In case of rigid gantry, recommend to set the parameter slave axis command mode PAD.01 = 0.

1. Define the direction of the gantry

method	description
Hand-push confirmation (for smaller mechanism)	1. Connect the master Axis host computer, collect the ‘unfiltered speed feedback’, and push the gantry in a certain direction. 2.Connect the slave Axis host computer, collect ‘unfiltered speed feedback’, push the gantry in the same direction as master Axis. 3. If the positive and negative sign of the speed collected from both axes is the same, it means that the encoder direction of both axes is the same, and the gantry direction is the same. 4. If the positive and negative sign of the speed collected from both axes is opposite, it means that the encoder direction of two axes is reversed, and the gantry direction is reversed.
Trial run confirmation (for larger mechanism)	1. Disconnect the power cable of one axis, disable the DB status, trial run in a certain mechanical direction, and collect the waveform of ‘unfiltered speed feedback’. Repeat the above steps and collect waveforms of two axes respectively. 2. If the positive and negative sign of the speed collected from both axes is the same, then the gantry direction is the same direction; if the positive and negative sign is opposite, then it means the gantry direction is reversed.

2. Set parameter- Configure the master axis and slave axis motor parameters separately.

code	name	Master axis setting	Slave axis setting	Vaild condition
P00. 06	Command pulse polarity in version	As user need	Set the gantry direction according to the gantry direction confirmed in the second step. 0: Same gantry direction 1: Reverse gantry direction	Restart
P0D. 00	Gantry function settings	3: Some parameters of the slave axis need to be synchronised with the Master axis control bits	1: No parameter synchronisation 5: partial parameter synchronisation	Restart
P0D. 01	Gantry slave axis setting	Rigid gantry mode, set to 0. Flexible gantry mode, set to 1.	The same as master axis	re-enabling
P0D. 03	Gantry position synchroniz ation deviation threshold	By default, it should not be set too large at the beginning of commissioning Do not set to 0. Otherwise, it may damage the mechanical structure.	The same as master axis	immediat ely
P0D. 04	Gantry torque deviation th reshold	The same as P0D.03	The same as master axis	immediat ely

3. After enabling the master axis, the slave axis will be enabled automatically.
4. Master Performance commissioning
5. Protection parameter setting

Set P0D.03 and P0D.04 according to the synchronisation error and torque deviation during operation and control requirements.

Observe the maximum values of ‘Synchronous position error’ and ‘Synchronous torque error’ of the oscilloscope channel during operation. Recommended setting is 2 times the maximum value.

Error Codes and Monitoring Parameters:

code	description
Er250	Gantry deviation error
Er251	Gantry communication error
Er252	Gantry Slave Axis disable
Er253	Excessive deviation of gantry synchronising torque
Er254	Gantry synchronisation mode is in non-position control mode
Er255	Gantry Alignment Alarm
Ar15	Gantry Slave Axis disable: the slave axis is disable after Master axis is enable.for more than 2S , Alarm output.
Ar16	Gantry Slave Axis Alarm
Ar17	Gantry Slave Axis Emergency Stop Signal Effective
Ar18	Gantry slave axis limit effective
Ar19	Gantry slave axis PWM synchronisation alarms
Ar1A	Gantry communication error frequency is too high
Ar1B	Incorrect setting of gantry-related parameters

Monitor Parameters:

Oscilloscope Channels	description
0x300	Slave axis feedback speed
0x301	Slave feedback position
0x302	Slave Axis torque
0x303	Slave axis position error
0x304	centre position
0x305	Synchronous position error
0x306	centre speed
0x307	Synchronous torque error
0x308	Synchronous speed error

Handling of common problems

1. Inertia ratio set too small, motor keeps vibrating

Solution: Increase the inertia ratio manually

2. Single-axis operation is normal, two axes can not be synchronous operation, drive start-up reported overload or blocking faults

Solution:Check that the single axes are running in the same direction:

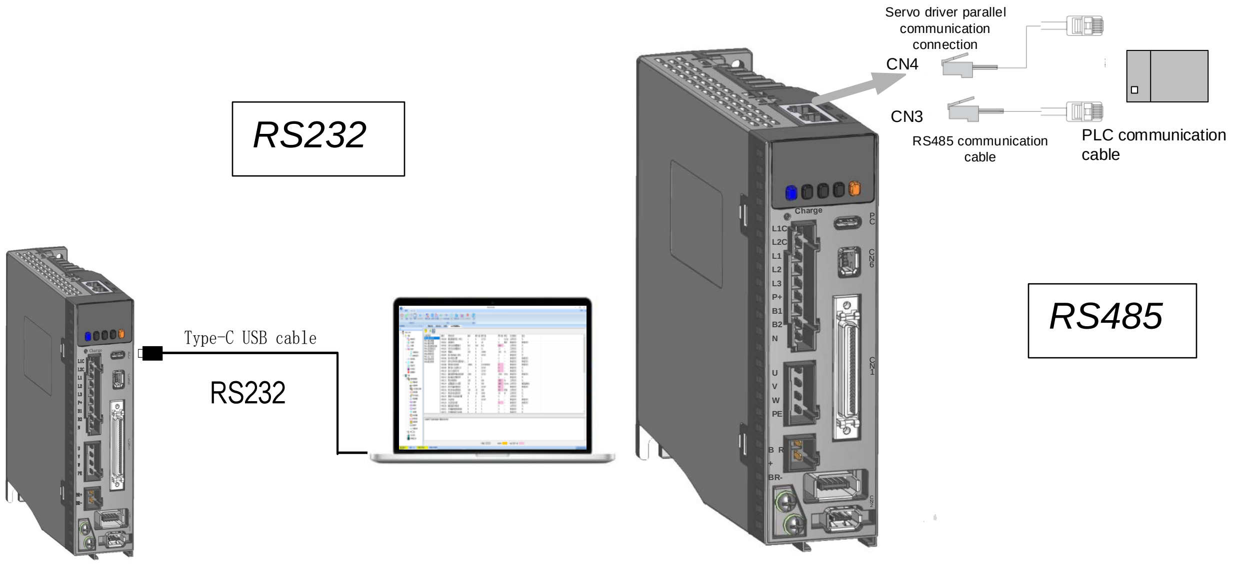
(1)Check whether the running direction of single axis is the same;

(2)If the master axis P00.06 has been set to 1, the slave axis P00.06 must be set to zero. In the synchronous mode, the slave axis P00.06 means that the direction of the received master axis command is reversed.

Chapter 7 Modbus communication

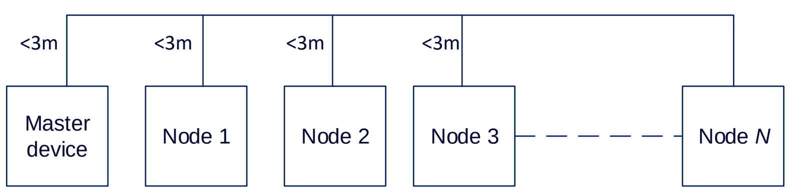
There are 2 types of Modbus communication on EL8-RS series servo drives: RS485 and RS232. RS232 is used for point-to-point communication connecting the driver to PC through a USB type-C cable for tuning using Motion Studio. RS485 can be set to communicate with multiple slave devices as a single master. Network control of the drivers can be achieved through CN3/CN4 ports.

7.1 RS232 and RS485 Connection Diagram.



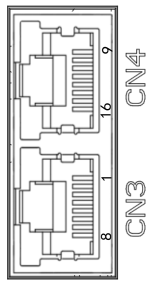
RS485 network of multiple servo drives

If there is a need to connect multiple EL8-RS series servo drives together, it is recommended to connect the drivers in series and no longer than 3 meters of LAN cable between each nodes (drivers) as shown below.



- *Keep the connection cable between each node as short as possible. Not longer than 3m.*
- *Install a terminal resistor each end. Recommended resistance: 120 Ohm.*
- *Please use shielded twisted pair connection cables.*
- *Connect to reference ground of the driver.*
- *Connect shielded foil of the cables to Protective Earth PE terminal.*
- *Please separate them from power cable or any cable with strong interference.*

7.2 RS485 communication port

Port	Diagram	Pin	Signal	Description
CN3 CN4		1	422+	RS-422 Data Positive Terminal (Gantry Communication)
		2	422-	RS-422 Data Negetive Terminal (Gantry Communication)
		3	-	-
		4	485+	RS485 Data+
		5	485-	RS485 Data-
		6	5V	5V
		7	-	
		8	GND	GND
		Frame	PE	Shielding Grounding

7.2.1 Communication parameters and settings

Parameters related to RS485 communication

P05.29	Label	RS485 communication mode			Valid mode(s)	P	S	T
	Range	0~255	Unit	—	Default	5		
	Byte length	16bit	Attribute	R/W	485 address	0x053B		
	Valid	After restart						

Value	Bit	Checksum	Stop
0	8	Even	2
1	8	Odd	2
2	8	Even	1
3	8	Odd	1
4	8	Null	1
【5】	8	Null	2

P05.30	Label	RS485 communication Baud rate			Valid mode(s)	P	S	T
	Range	0~15	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x053D		
	Valid	After restart						

Value	Baud rate
0	2400bps
1	4800bps
2	9600bps
3	19200bps

Value	Baud rate
【4】	38400bps
5	57600bps
6	115200bps

Baud rate tolerance: 2400～38400bps±0.5%, 57600～115200bps±2%

P05.31	Label	RS485 axis address			Valid mode(s)	P	S	T
	Range	0~127	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x053F		
	Valid	After restart						
	When controller is connected to multiple axis and controller needs to identify the axis, P05.31 can be used to set the axis ID/address. Please set to a max of 31 if the communication is between RS232 and RS485							

7.3 Modbus Protocol

EL8-RS series servo drives contain 16-bit and 32-bit parameters. The parameters supports read and write functions in the Modbus-RTU protocol with function codes as listed in the table below.

Operation	Function code
Read 16/32 bit parameters	0x03
Write 16 bit parameters	0x06
Write 32 bit parameters	0x10

Parameters class 0 – 7 are 32 bits data but mostly only applicable up to 16 bit. To make it convenient for users to read the data, any byte length written in the parameters list only shows that the data is using 16 bit lower level data but it is actually a 32 bit data.

Using P00.00 as an example, the 485 address shows 0x0001. It is actually high 0x0000 and low 0x0001 data.

P00.00	Label	Model-following/Zero tracking control			Valid mode(s)	P		
	Range	0-5000	Unit	0.1Hz	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0001		
	Valid	At stop						
	Model-following bandwidth, also known as model-following control (MFC), is used to control the position loop to improve the responsiveness to commands, speed up positioning time and reduce following error. The effect is obvious especially in low and medium mechanical stiffness.							

Value	Description
0	Disable model following/zero tracking control
1	Set bandwidth automatically
2~9	Reserved
10~5000	Manually set control bandwidth. 30~100 recommended for belt application

7.3.1 Read Data 0x03

Read Data function code 0x03 can be used to read 1 – 100 16-bit data. For example, from servo drive to slave as 1 and reading 2 data. (H: High 8-bit, L: Low 8-bit)

No.	Request frame data（Master->Slave）			Reply frame data（Slave->Master）		
1	ID	Slave	0x01	ID	Slave	0x01
2	FC	Function code	0x03	FC	Function code	0x03
3	ADDR	Starting address	H	NUM	Data count（byte）	0x00(H)
4			L			0x04(L)

5	**NUM**	Data count（word）	0x00(H)	**DATA1**	Data 1	H
6			0x02(L)			L
7	**CRC**	Checksum	L	**DATA2**	Data 2	H
8			H			L
9				**CRC**	Checksum	L
10						H

Request frame and reply frame should have the same set of data as shown below.

Send	01 06 00 01 00 01 19 CA
Receive	01 06 00 01 00 01 19 CA

Send Frame: Request Frame. Master device writes a 1-Word (16 bit) data (0x0001) into slave servo drive with ID no. 1 (Address 0x0001).
Receive Frame: Reply frame. Master device writes value in slave servo drive with ID no.1 successfully and gets the same frame data back.

7.3.2 Write multiple data 0x10

Function code 0x10 is to write multiple 16-bit data into servo drive. For example, from servo drive to slave as 1 and reading 2 data. (H: High 8-bit, L: Low 8-bit).

No.	Request frame data（Master->Slave）			Reply frame data（Slave->Master）		
1	**ID**	Slave	0x01	**ID**	Slave	0x01
2	**FC**	Function code	0x03	**FC**	Function code	0x03
3	**ADDR**	Starting address	H	**ADDR**	Address	H
4			L			L
5	**NUM1**	Data count（word）	0x00(H)	**NUM**	Data count（word）	H
6			0x02(L)			L
7	**NUM2**	Data count（Byte）	0x04 (2*NUM1)	**CRC**	Checksum	L H
8	**DATA1**	Data 1	H			
9			L			
10	**DATA2**	Data 2	H			
11			L			
12	**CRC**	Checksum	L			
13			H			

Servo parameters are 32-bit with high 16-bit at the front and low 16-bit at the back. 2 continuous communication addresses will be distributed starting with even number (High 16-bit uses even number address, low 16-bit uses odd number address. Word byte frame word is also with high 8-bit at the front and low 8-bit at the back.
32-bit data written from starting address 0x0000 (Servo driver with axis address 01):

Send	01 10 00 00 00 02 04 00 00 00 00 F3 AF
Receive	01 10 00 00 00 02 41 C8

Send Frame: Request Frame. Master device writes a 2 Word (16 bit), 4 bytes data (0x0000 0000) into slave servo drive with ID no. 1 (Address 0x0000). 11-byte CRC value is 0xAFF3 before frame sending.
Receive Frame: Reply frame. Master device writes a 2 Word value into slave servo drive with ID no. 1 (Address 0x0000). 6-byte CRC value is 0xC841 before frame sending.
7.3.3 Reply error
When driver receives request frame data format with error, driver will feedback error reply data frame to master device.

No.	Error reply frame data (Slave->Master)		
1	**ID**	Slave ID	0~31
2	**FC**	Function code	(0x03/0x06/0x10)+0x80
3	**Error code**	Address	0x01/0x02/0x03
4	**CRC**	Checksum	L
5			H

Error code table:

Error code	Description
0x01	Function code error
0x02	Address error
0x03	Data error, i.e. written data over limit
0x08	CRC checksum error

Communication data:

Receive frame: Slave servo drive's reply frame. Request frame data CRC from master device, servo drive will not respond to current request.

[Send]01 11 00 04 00 02 04 01 00 00 00 F3 A0

[Receive]01 91 01 4C 56

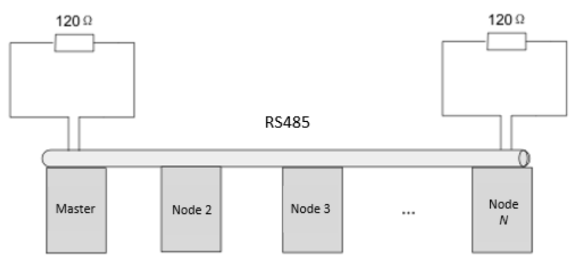
Receive frame: Slave servo drive's reply frame. Request frame data function from master device error or slave station does not support this function, unable to respond to current request.

[Send]01 11 00 04 00 02 04 01 00 00 00 A2 65

[Receive]01 91 01 8C 50

7.4 Frequently occurred issues and solutions with RS485 communication.

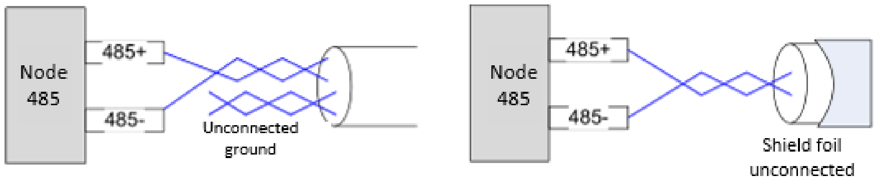
Terminal resistor



Terminal resistor is to be connected at the start and end of the device network. Recommended resistance of the terminal resistor: 120 Ohm. Measure the resistance within the network using a multimeter and refer to the table below.

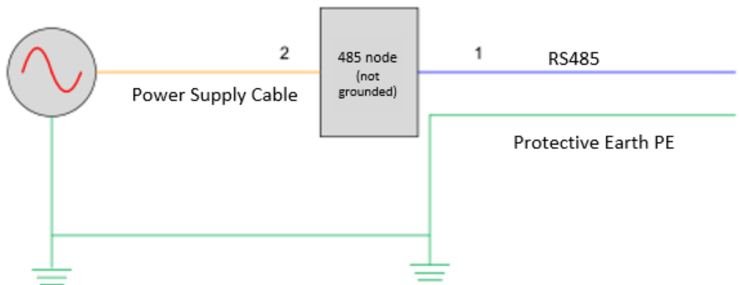
Measured resistance (Ohm) **Normal: 60 Ohm**	Description
0	Short circuit
Much lower than 60	Might be other resistor within the network; incorrect terminal resistor is used
Much higher than 60	Might be due to damaged/faulty node communication port

Incorrect wiring connection

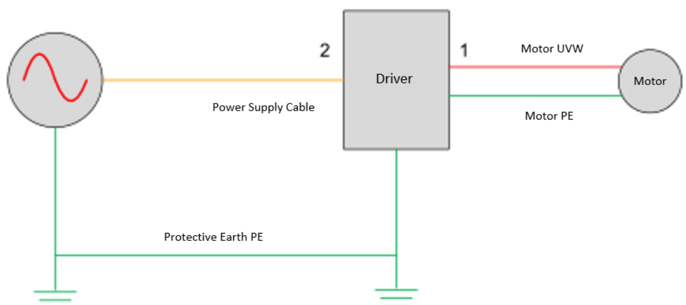


Please make sure RS485 communication connection is normal using a multimeter. Then, make sure the reference ground is corrected connected. If there is not no reference ground, please leave it unconnected. Same goes for cable shield foil.

Signal interference



External interference: Magnetic ring can be intertwined within cable 1 and 2 to prevent external interference.

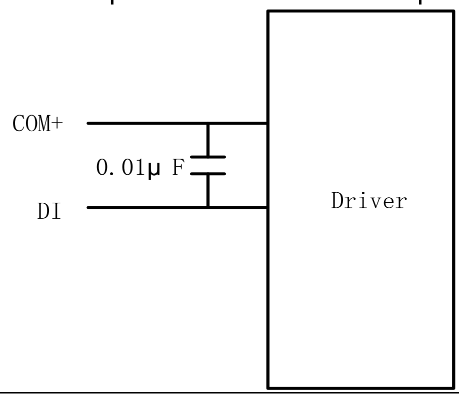


Driver interference: If interference occurs within the driver, please intertwine magnetic rings on cable 1 and 2. Please loop UVW cables around the magnetic ring for at least 3 rounds. Do not loop PE wire into the magnetic ring.

Step-by-step problem solving

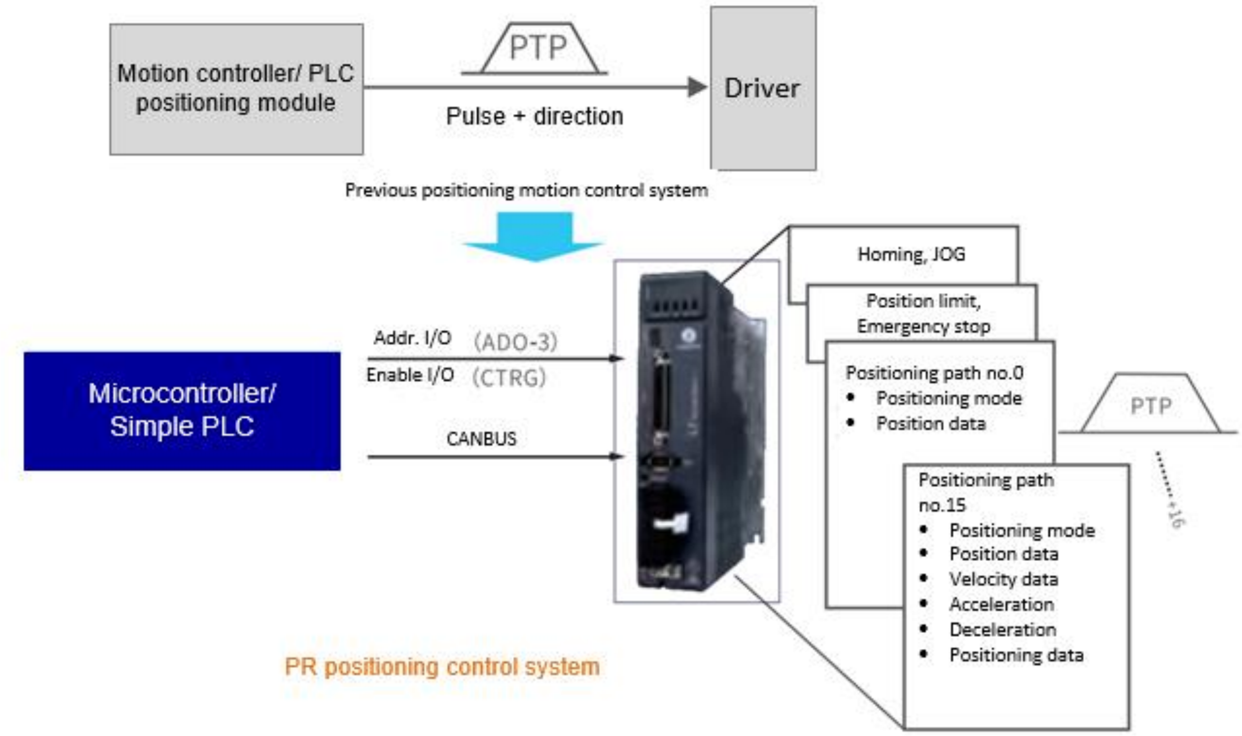
1: Verify if communication parameters setting are correct (ID not repeated, uniform Baud rate and data format);
2: If terminal resistor used is correct;
3: If wiring connection is correct;
4: Verify grounding and PE connection;
5: Communication cables should be separated from power cables.

Servo drives are devices of good anti-interference. However, during installation, interference still might occur due to wiring and grounding issues. Please refer to the table below if such problems persist.

Steps	Solutions
1	Use shielded wire cable for I/O signals, connect shield foil to PE.
2	Connect motor PE to PE terminals on drivers, connect driver PE to PE terminals of electrical network.
3	Ground master device and servo drives together.
4	Loop UVW motor power cable around magnetic ring for 2-3 times.
5	Loop signal cable around magnetic ring for 1-2 times.
6	Use shielded cable for power cables. Connect shield foil to ground.
7	Connect a capacitance filter onto DI input. Max capacitance: 0.1 μF 

Chapter 8 PR Functions

PR function is a control module in servo drive that controls single axis motion using PRocedure program. Main single axis motion control functions included homing, path, position limit and emergency stop. Using PR functions can save the resources on the main controller.



Please set P00.01 = 6 when using PR functions. All position unit: 10000 Pulse/r

8.1 PR functions introduction

Function	Description
Homing	Driver seeks origin signal through homing to determine zero point of the mechanical motion coordination system 1. Homing mode configurable. Can be chosen between position limit signal homing, origin signal homing and manually set home; 2. Homing direction configurable; 3. Specific position can be set after homing completed; 4. Homing velocity, acceleration and deceleration configurable. 5. High homing velocity to locate origin and low homing velocity to look for Z-signal
JOG	Forward/Reverse JOG through I/O control. Used for tuning. 1. JOG direction: forward JOG, reverse JOG 2. JOG velocity and acceleration configurable
Position limit	Prevent mechanical damage by limiting the range of motion 1. Positive/Negative position limit input through I/O 2. Software position limit 3. Position limit deceleration configurable
Emergency stop	Emergency stop input signal through I/O. To stop any operating motion
Path motion	Select path ID through IO（ADD0-3）, then trigger path motion through enable IO（CTRG）；or directly through I/O combination mode；path motion can be controlled directly through 485 communication as well 1. Path motion includes positioning, velocity and homing modes. 2. I/O trigger includes rising edge, double edges trigger 3. Supports continuous positioning； 4. Max. 16 paths； 5. Configurable position, velocity and acceleration/deceleration； 6. Pause time/ timer configurable
485 communication	PR parameter R/W through 485 communication. Control PR functions such as homing, JOG, path motion, emergency stop, etc.

8.2 Control parameters

All PR motion related parameters including trigger, status output, limits, emergency stop, JOG, homing, etc.

Parameter	Label	Description	485 Addr.
P08.00	PR Control	PR control functions Bit 0：=0，CTRG rising edge trigger =1，double edges trigger ; Bit 1：=1，software position limit valid， =0，software position limit not valid; Bit 2：=1，homing upon power on , =0，no homing upon power on Bit 3：=1，absolute value memory， =0，absolute value with no memory，	0X6000
P08.01	Path count	16 paths	0X6001
P08.02	Control Operation	--	0X6002
P08.06	Software positive limit H	High 16-bit of software positive limit	0X6006
P08.07	Software positive limit L	Software positive limit（Only able to read low 16-bit using 485 communication）	0X6007
P08.08	Software negative limit H	High 16-bit of software negative limit	0X6008
P08.09	Software negative limit L	Software negative limit（Only able to read low 16-bit using 485 communication）	0X6009
P08.10	Homing mode	Homing method in PR mode Bit 0：Homing direction =0 ：Reverse； =1： Forward Bit 1：Specific position after homing =0：No； =1：Yes Bit2~7：Homing mode =0：Position limit homing =1：Origin homing =2：Single turn Z homing =3：Torque homing =8：Immediate homing Bit 8： =1: Homing with Z-signal = 0: Homing without Z-signal *Single turn Z homing is homing method within 1 revolution, has nothing to do with Bit 8 Z-signal.*	0X600A
P08.11	Zero position H	High 16-bit of zero position	0X600B
P08.12	Zero position L	Zero position（Only able to read low 16-bit using 485 communication）	0X600C
P08.13	Home position offset H	High 16-bit of home position offset	0X600D
P08.14	Home position offset L	Home position offset（Only able to read low 16-bit	0X600E

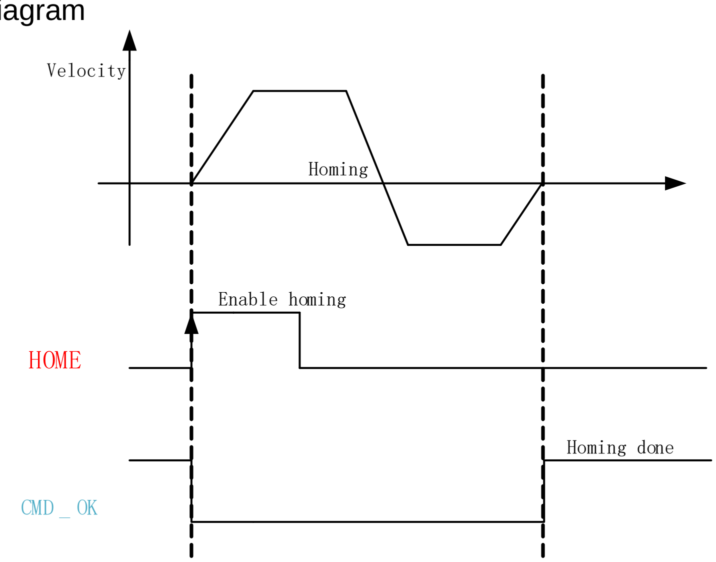
		using 485 communication）	
P08.15	High homing velocity	Set high homing velocity	0X600F
P08.16	Low homing velocity	Set low homing velocity	0X6010
P08.17	Homing acceleration	Set homing acceleration	0X6011
P08.18	Homing deceleration	Set homing deceleration	0X6012
P08.19	Homing torque holding time	Set homing torque holding time	0X6013
P08.20	Homing torque	Set homing torque value	0X6014
P08.21	Homing overtravel alarm range	Set homing overtravel alarm threshold, set to 0 to deactivate the alarm	0X6015
P08.22	Emergency stop at limit deceleration	Set position limit emergency stop deceleration	0X6016
P08.23	STP emergency stop deceleration	Set STP emergency stop deceleration	0X6017
P08.26	I/O combination trigger mode	0：Disable I/O combination trigger mode. Uses I/O CTRG signal edge trigger. 1：Enable I/O combination trigger. Valid when HOME-OK signal is valid. 2：Enable I/O combination trigger. HOME-OK signal not required.	0X601A
P08.27	I/O combination filter	Set I/O combination filter time	0X601B
P08.28	S-code current output value	Display S-code output	0X601C
P08.29	PR warning	=0：Reset new command automatically； =0x100；Position limit error during homing =0x101；Emergency stop. Homing not completed； =0x20x；Position limit error on Path *N*	0X601D
P08.39	JOG velocity	Set JOG velocity	0X6027
P08.40	JOG acceleration	Set JOG acceleration	0X6028
P08.41	JOG deceleration	Set JOG deceleration	0X6029
P08.42	Command position H	High 16- bit of command position	0X602A
P08.43	Command position L	Command position （Only able to read low 16-bit using 485 communication）	0X602B
P08.44	Motor position H	High 16- bit of motor position	0X602C
P08.45	Motor position L	Motor position（Only able to read low 16-bit using 485 communication）	0X602D
P08.46	Input	Input status	0X602E
P08.47	Output	Output status	0X602F
P08.48 - P08.63	S-code setting	Path *N* S-code output settings	0x6030 ~ 0x603F

8.3 PR Motion

8.3.1 Homing

Homing is divided into 5 methods according to home signal: Single turn Z-phase homing, position limit homing, origin homing, torque homing, manually set home. Position limit homing, origin homing and torque homing can be with or without Z-signal. Homing can be triggered upon power on or using I/O after servo enabled.

Homing sequence diagram



1. **HOME**: Homing trigger signal. When HOME is valid, homing will be done according to set homing method.
2. **CMD_OK**: Command completed signal. Invalid when command is being carried out, valid when command is done.
3. Please refer to P08.10 to set homing methods and other homing mode related settings. It is recommended to use Motion Studio to modify the control parameters in PR mode.

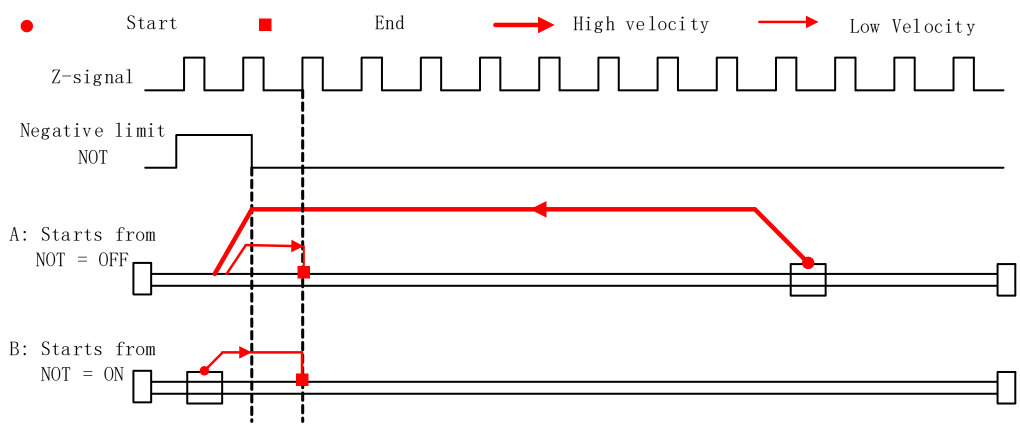
P08.10	**Label**	Homing mode			**Valid mode(s)**	PR
	Range	0~ 0xFFFF	**Unit**	/	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0X600A

To set homing method in PR mode. It is recommended to modify PR control parameters using Motion Studio.

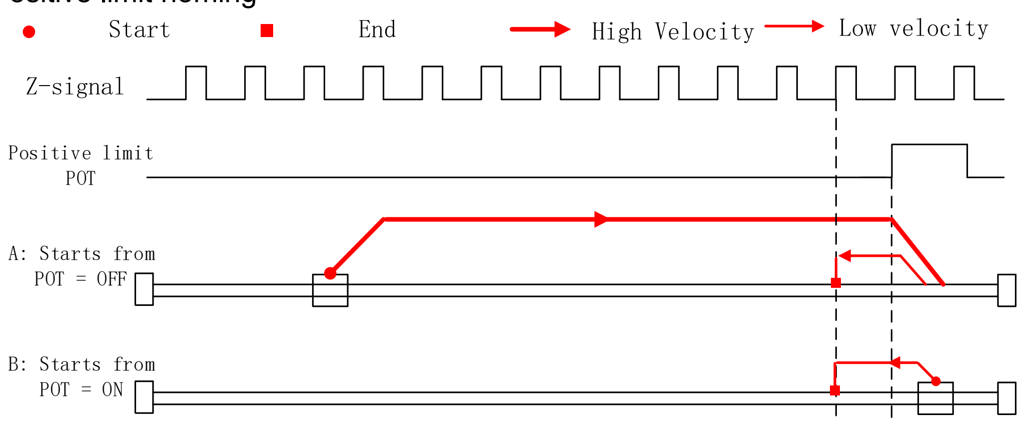
Bit	8（Z-signal homing）	2-7（Homing mode）	1（Specific position after homing）	0（Homing direction）
Description	=1, homing with Z-signal =0, homing without Z-signal	=0 Limit homing =1 Origin homing =2 Single turn Z homing =3 Torque homing =8 Immediate homing	=1, Yes =0, No	=1, Forward =0, Reverse

Position limit, origin and torque homing with Z-signal

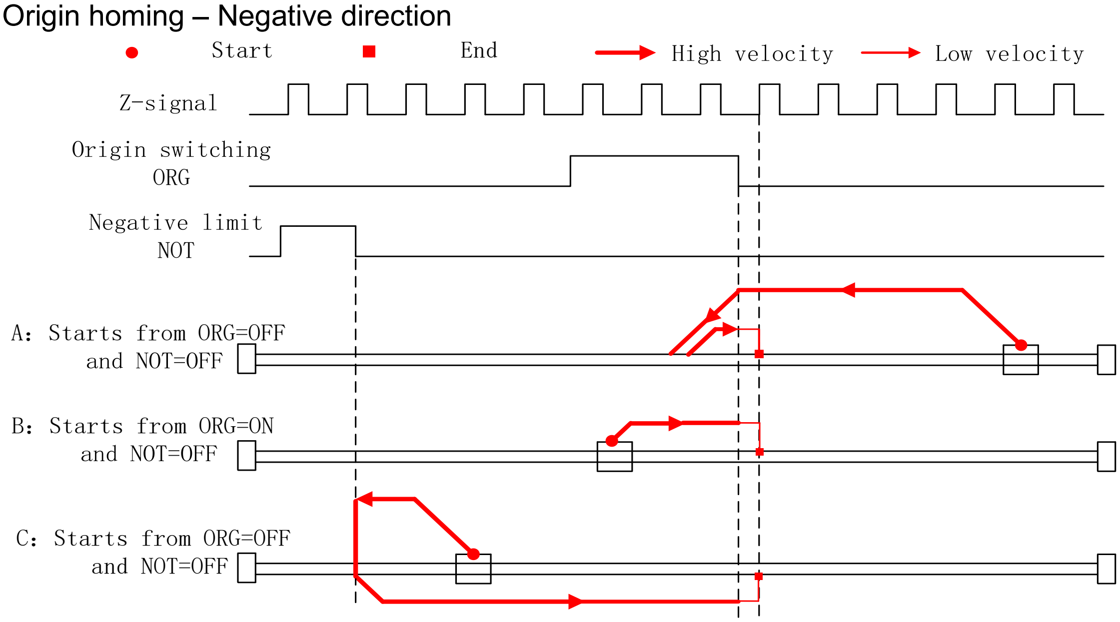
1. Negative limit homing



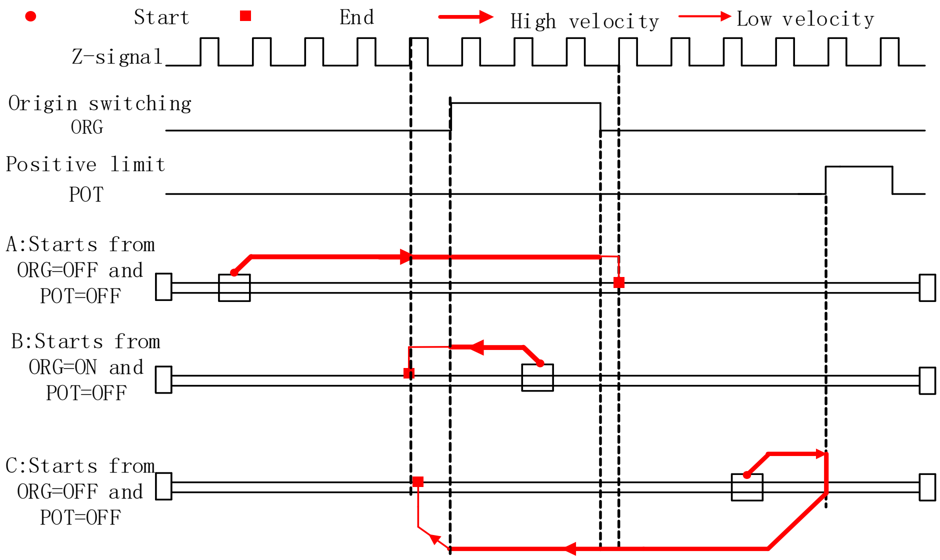
2. Positive limit homing



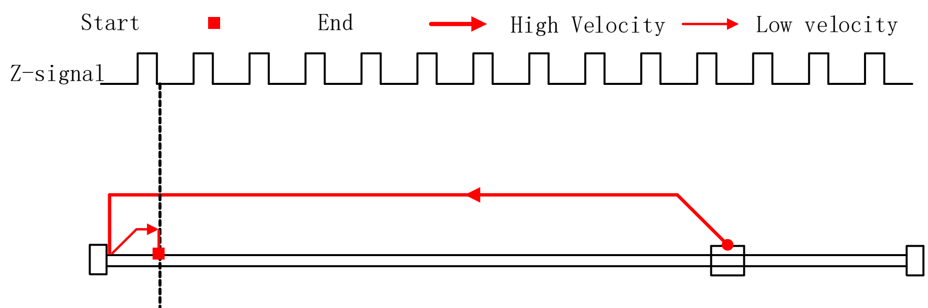
3. Origin homing – Negative direction



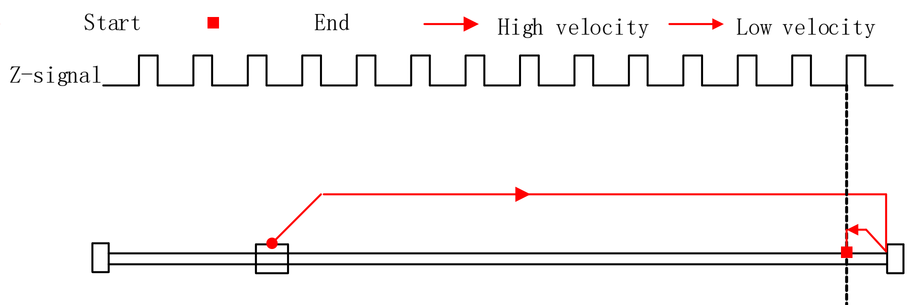
4. Origin homing – Positive direction



5. Torque homing – Negative direction



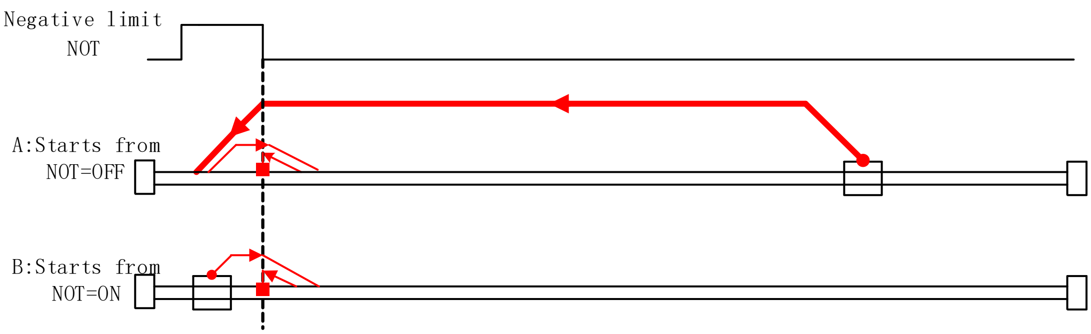
6. Torque homing – Positive direction



Position limit, origin, Z-signal, torque and manual set home (Homing with single condition)

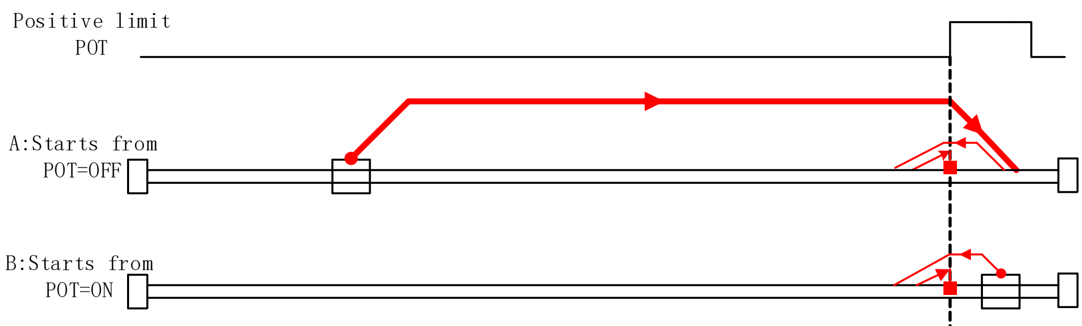
1. Negative limit homing

Start End High velocity Low velocity



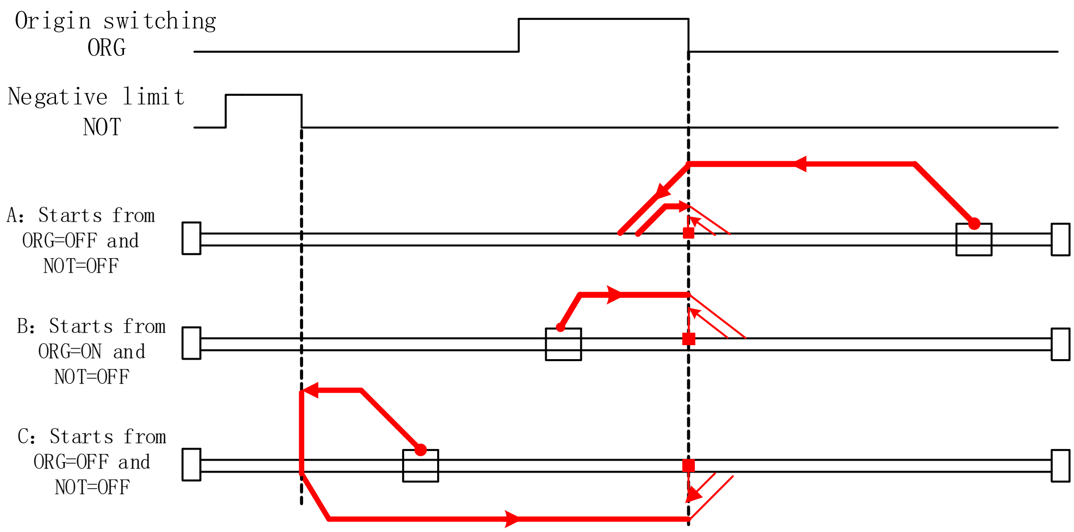
2. Positive limit homing

Start End High velocity Low velocity

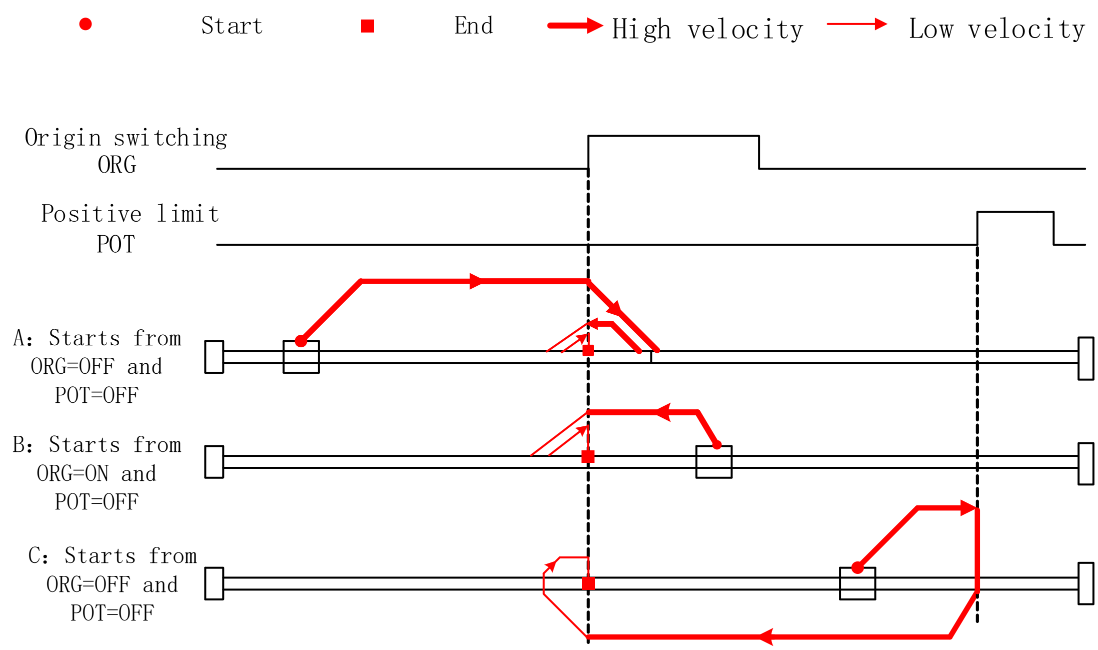


3. Origin homing – Negative direction

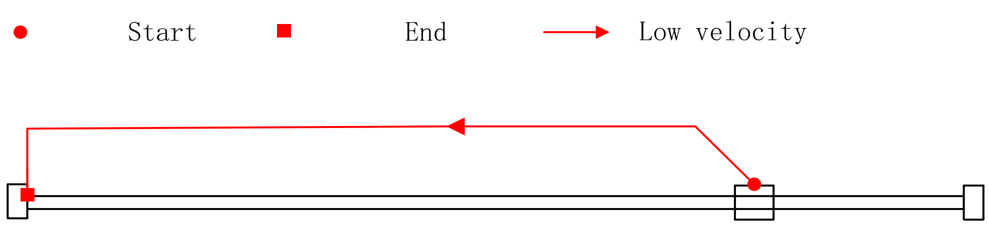
Start End High velocity Low velocity



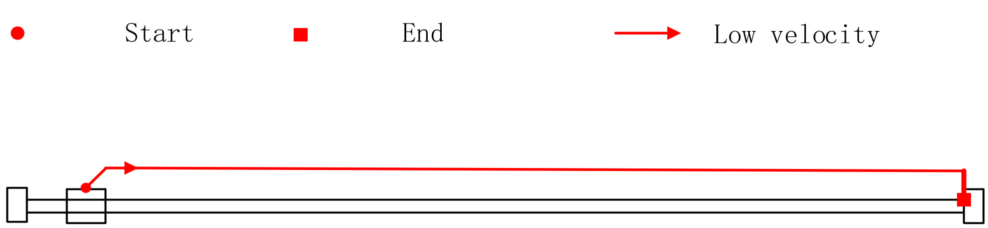
4. Origin homing – Positive direction



5. Torque homing – Negative direction

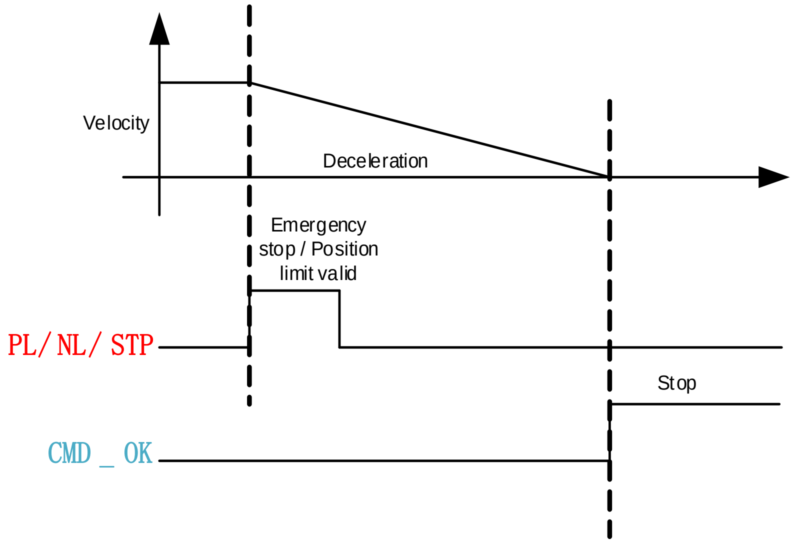


6. Torque homing – Positive direction



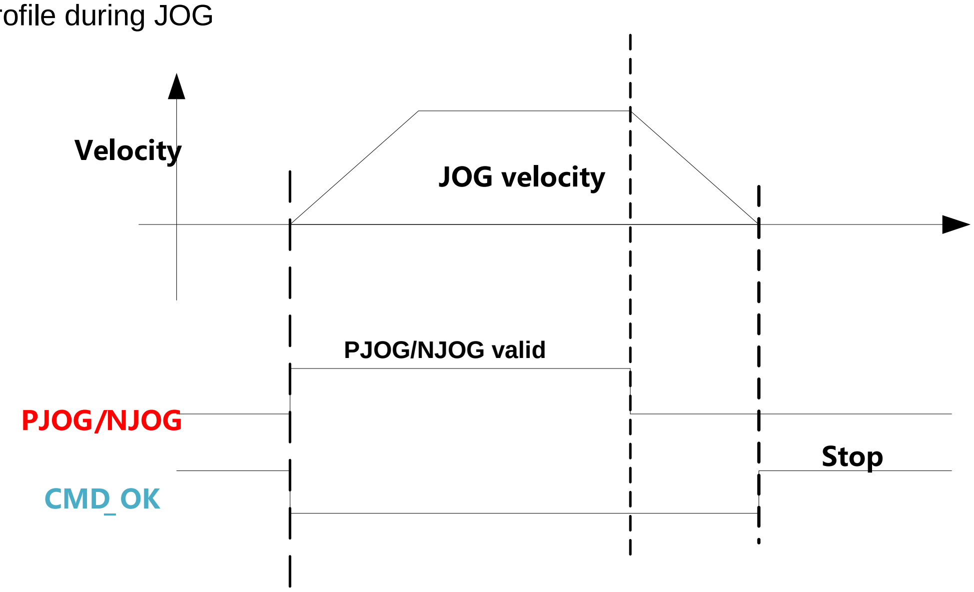
8.3.2 Position limit and emergency stop

For safety concerns, PR mode is designed to trigger emergency stop when position limit or emergency stop signal is valid. Please refer to the sequence diagram below.



8.3.3 JOG

JOG is used to make tuning more convenient. Please refer to the sequence diagram below for motion profile during JOG



8.3.4 Path motion

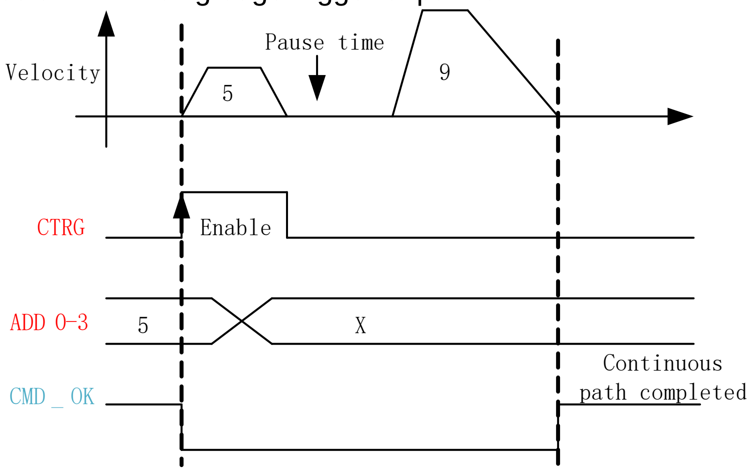
Path motion: Segmented, continuous, interrupted. Path positioning: Position, velocity, homing. PR path is to a total of 16 paths. Every path can be set with motion type, positioning mode, velocity, acceleration, deceleration and pause time independently.

Parameter	Label	Description	485 addr.
P09.00	PR mode	Attribute of PR path is determined by its mode. Bit 0-3：type ： 0: null 1: Positioning 2: Velocity 3: Homing 4: Emergency stop *Indicates using P/V/H/S* Bit 4: 0: Can be Interrupted 1: Can't be Interrupted, indicates using ! Bit 5: OVLP: 0: No overlap, indicates with SJ 1: Overlap, indicated with CJ Bit 6-7: 0: absolute 1: relative command 2: relative motor *Corresponding to ABS/INC/REL* Bit8-13： 0-15: Jump to corresponding path *Indicates using SJ0x or CJ0x* Bit 14： JUMP: 0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0X6200
P09.01	PR position H	High 16-bit of PR path position	0X6201
P09.02	PR position L	PR position（Only able to read low 16-bit using 485 communication）	0X6202
P09.03	Velocity	Velocity, rpm	0X6203
P09.04	Acceleration time	Unit ms/1000rpm	0X6204
P09.05	Deceleration time	Unit ms/1000rpm	0X6205
P09.06	Pause time	Pause time after command completed	0X6206
P09.07	Special parameter	Mapped to P08.02	0X6207
P09.08 ~ P09.127		8 parameters for each path. Please refer to Class 9 parameter in Chapter 3	

Path motion

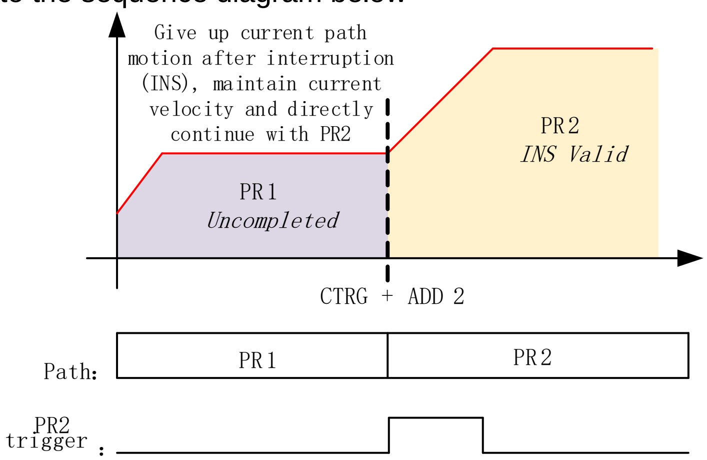
Segmented trigger

CTRG rising edge/double edges trigger (P08.00) a segmented motion. Please refer to the sequence diagram below with rising edge trigger of path 5.



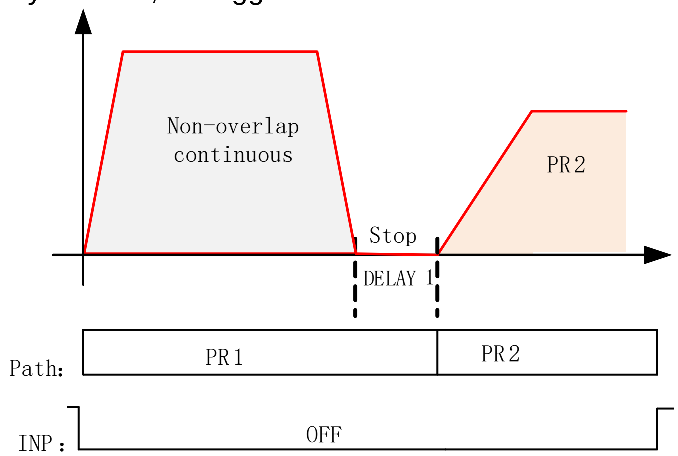
Multi-path interrupted motion

In multi-path motion, path motion that is triggered later will interrupt path motion that has already started. Please refer to the sequence diagram below



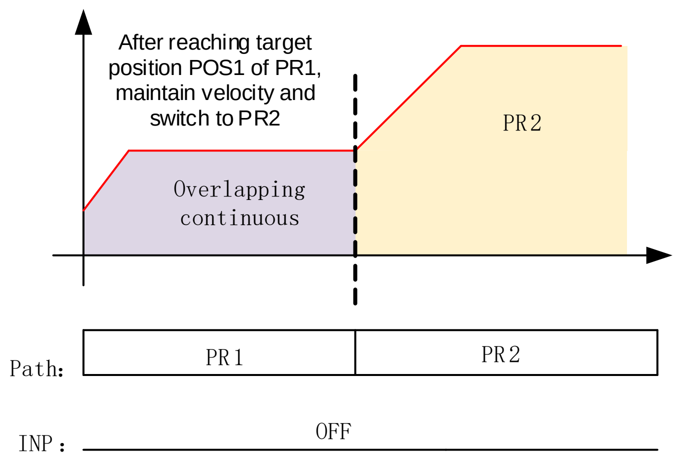
Non-overlap continuous motion

Path motion continues by another, no trigger needed for the next one to start.



Overlapping continuous motion

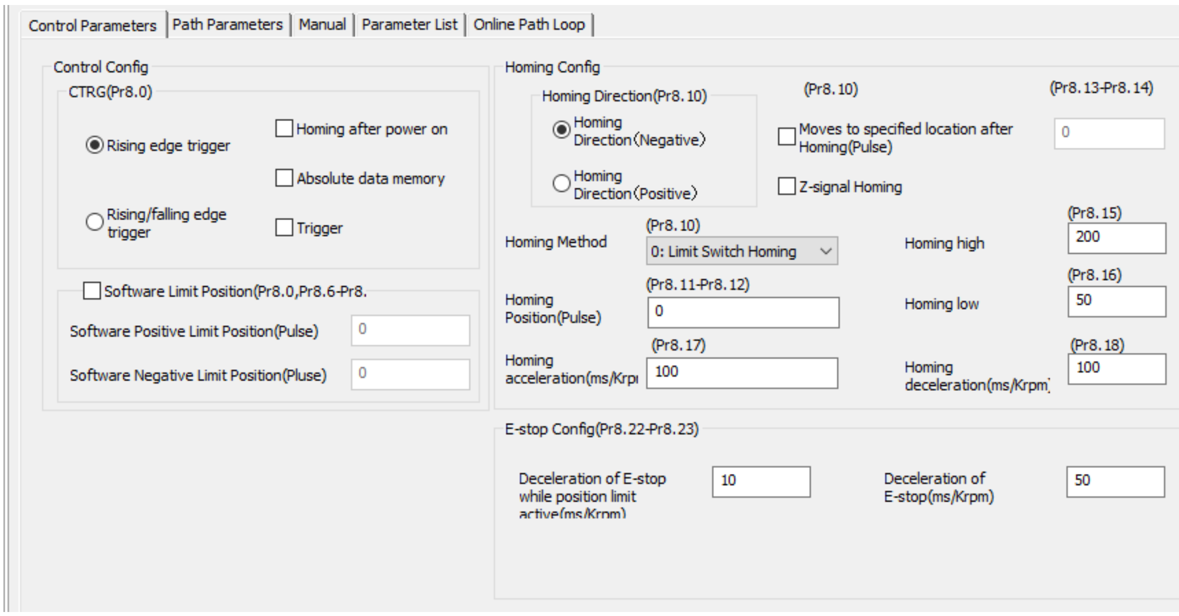
Path motion starts immediate after the previous path motion is completed without deceleration or trigger in between.



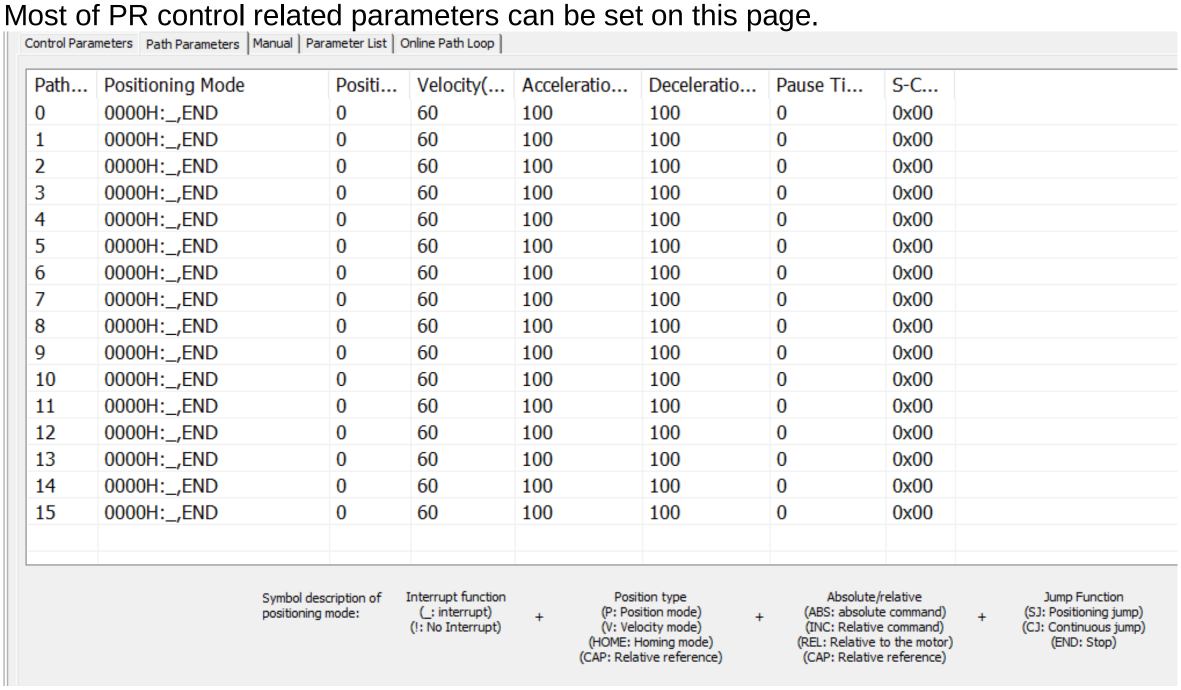
8.4 PR Control

8.4.1 PR module in Motion Studio

Using Pr-Motion function in Motion Studio 2, PR parameters can be set including trigger settings, software position limit, JOG, homing, emergency stop, etc. Manual triggering of homing, path motion or emergency stop can also be triggered on this interface.

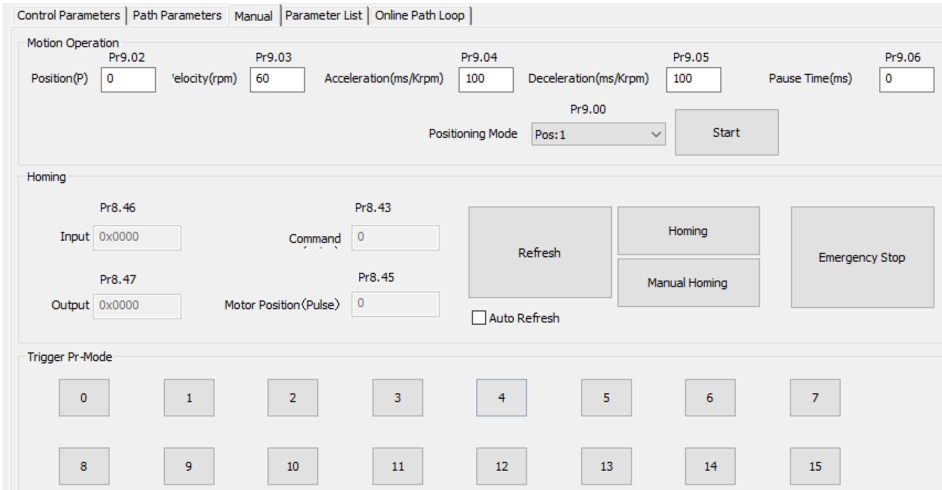


Most of PR control related parameters can be set on this page.

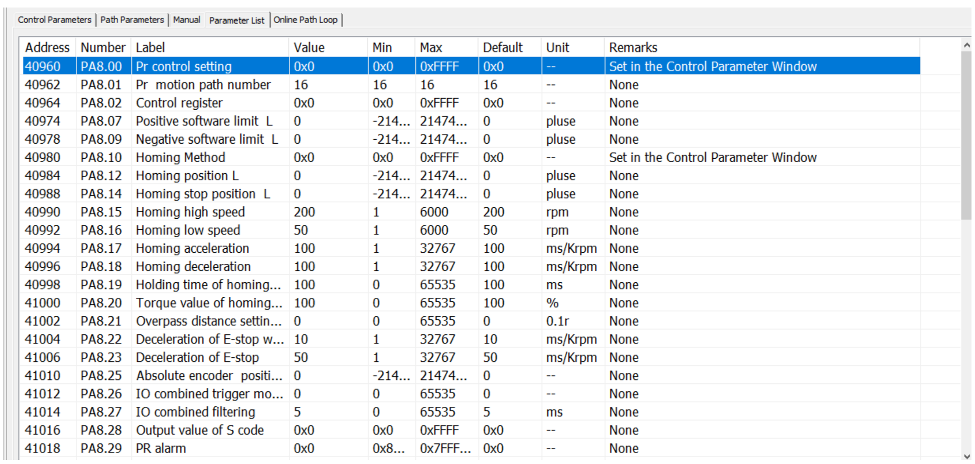


Path...	Positioning Mode	Positi...	Velocity(...	Acceleratio...	Deceleratio...	Pause Ti...	S-C...
0	0000H:_,END	0	60	100	100	0	0x00
1	0000H:_,END	0	60	100	100	0	0x00
2	0000H:_,END	0	60	100	100	0	0x00
3	0000H:_,END	0	60	100	100	0	0x00
4	0000H:_,END	0	60	100	100	0	0x00
5	0000H:_,END	0	60	100	100	0	0x00
6	0000H:_,END	0	60	100	100	0	0x00
7	0000H:_,END	0	60	100	100	0	0x00
8	0000H:_,END	0	60	100	100	0	0x00
9	0000H:_,END	0	60	100	100	0	0x00
10	0000H:_,END	0	60	100	100	0	0x00
11	0000H:_,END	0	60	100	100	0	0x00
12	0000H:_,END	0	60	100	100	0	0x00
13	0000H:_,END	0	60	100	100	0	0x00
14	0000H:_,END	0	60	100	100	0	0x00
15	0000H:_,END	0	60	100	100	0	0x00

All class 9 parameters for 0-15 paths can be found here once connected to a servo drive that supports PR mode.



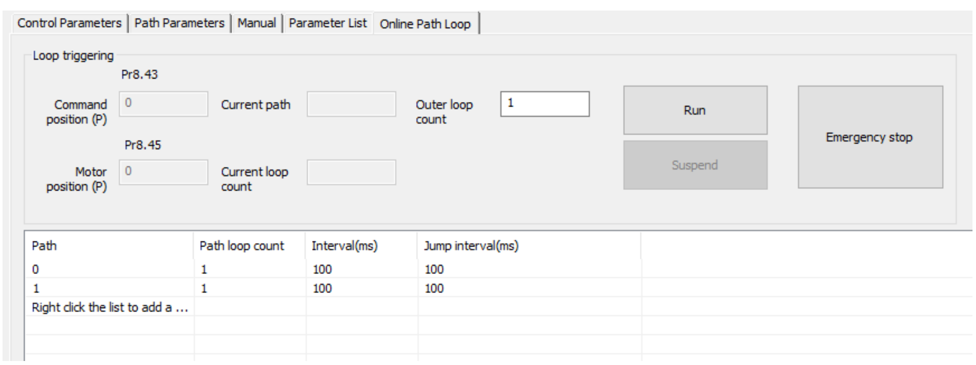
Manual control of servo drive in PR mode can be done in this page.



Control Parameters | Path Parameters | Manual | Parameter List | Online Path Loop

Address	Number	Label	Value	Min	Max	Default	Unit	Remarks
40960	PA8.00	Pr control setting	0x0	0x0	0xFFFF	0x0	--	Set in the Control Parameter Window
40962	PA8.01	Pr motion path number	16	16	16	16	--	None
40964	PA8.02	Control register	0x0	0x0	0xFFFF	0x0	--	None
40974	PA8.07	Positive software limit L	0	-214...	21474...	0	pluse	None
40978	PA8.09	Negative software limit L	0	-214...	21474...	0	pluse	None
40980	PA8.10	Homing Method	0x0	0x0	0xFFFF	0x0	--	Set in the Control Parameter Window
40984	PA8.12	Homing position L	0	-214...	21474...	0	pluse	None
40988	PA8.14	Homing stop position L	0	-214...	21474...	0	pluse	None
40990	PA8.15	Homing high speed	200	1	6000	200	rpm	None
40992	PA8.16	Homing low speed	50	1	6000	50	rpm	None
40994	PA8.17	Homing acceleration	100	1	32767	100	ms/Krpm	None
40996	PA8.18	Homing deceleration	100	1	32767	100	ms/Krpm	None
40998	PA8.19	Holding time of homing...	100	0	65535	100	ms	None
41000	PA8.20	Torque value of homing...	100	0	65535	100	%	None
41002	PA8.21	Overpass distance settin...	0	0	65535	0	0.1r	None
41004	PA8.22	Deceleration of E-stop w...	10	1	32767	10	ms/Krpm	None
41006	PA8.23	Deceleration of E-stop	50	1	32767	50	ms/Krpm	None
41010	PA8.25	Absolute encoder positi...	0	-214...	21474...	0	--	None
41012	PA8.26	IO combined trigger mo...	0	0	65535	0	--	None
41014	PA8.27	IO combined filtering	5	0	65535	5	ms	None
41016	PA8.28	Output value of S code	0x0	0x0	0xFFFF	0x0	--	None
41018	PA8.29	PR alarm	0x0	0x8...	0x7FFF...	0x0	--	None

All PR mode and control parameters can be found on this list for convenience of tuning



To run PR mode in a loop

8.4.2 Physical I/O

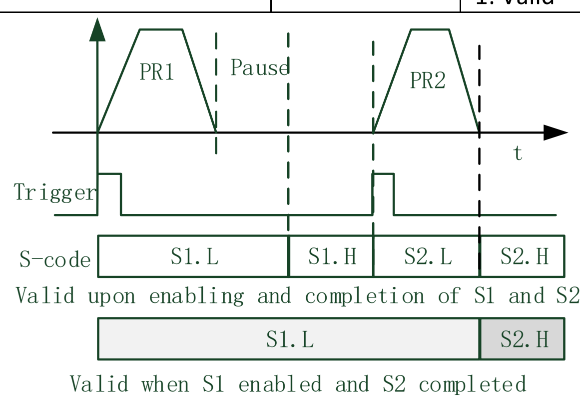
Path motion, feedback status, etc can be triggered through I/O in PR mode. Please refer to the table below for I/O assignments in PR mode.

Input				Output			
Label	Signal	Value		Label	Signal	Value	
		NO	NC			NO	NC
Command trigger	CTRG	20h	A0h	Command completed	CMD_OK	20h	A0h
Homing	HOME	21h	A1h	Path completed	PR_OK	21h	A1h
Forced emergency stop	STP	22h	A2h	Homing completed	HOME_OK	22h	A2h
Positive JOG	PJOG	23h	A3h	S-code 0	SD0	23h	A3h
Negative JOG	NJOG	24h	A4h	S-code 1	SD1	24h	A4h
Positive position limit	PL	25h	A5h	S-code 2	SD2	25h	A5h
Negative position limit	NL	26h	A6h	S-code 3	SD3	26h	A6h
Origin	ORG	27h	A7h	S-code 4	SD4	27h	A7h
Path address 0	ADD0	28h	A8h	S-code 5	SD5	28h	A8h
Path address 1	ADD1	29h	A9h	S-code 6	SD6	29h	A9h
Path address 2	ADD2	2ah	Aah	PR warning	PRWAR	2Ah	AAh
Path address 3	ADD3	2bh	Abh				
Torque switching	TC-SEL	09h	89h				

S-code

S-code（Status code）is the S-code of currently operating PR positioning data.
Every PR path has a S-code setting.

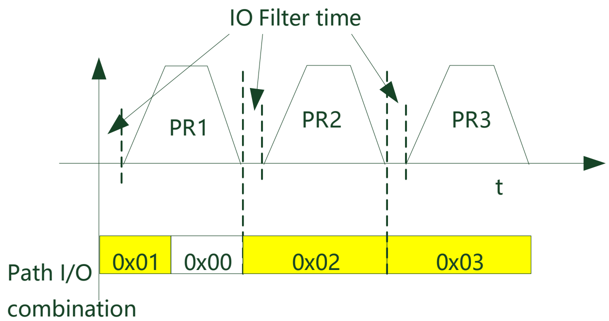
S-code	Sx.H		Sx.L	
Bit	15	8-14	7	0-6
Description	S-code valid when completed. 0: Invalid, retain previous value 1: Valid	S-code upon completion	S-code valid upon activation 0: Invalid 1: Valid	S-code upon activation



S-code bit	bit0/8	bit1/9	bit2/10	bit3/11	bit4/12	bit5/13	Bit6/14
SDx	SD0	SD1	SD2	SD3	SD4	SD5	SD6

I/O trigger

Path motion trigger: Edge trigger/combination trigger(P08.26). Edge trigger is triggering path combination motion using I/O. I/O combination trigger uses electrical level as trigger rather than signal edge. No valid motion for path 0 and I/O combination triggers motion once after I/O filter when converted to non-zero paths.



***Path combination 0 is invalid because I/O combination x>0->x can be triggered for multiple times when using incremental position.*
**In I/O combination trigger mode 2, path motion will be triggered upon servo drive power on if I/O combination not set to 0. Please be careful.*

P08.26	Label	I/O combination trigger mode			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X601A

Value	Description
【0】	Disable I/O combination trigger mode. Uses I/O CTRG signal edge trigger.
1	Enable I/O combination trigger. Valid when HOME-OK signal is valid.
2	Enable I/O combination trigger. HOME-OK signal not required.

IO combination trigger select path using ADD0~ADD3. Trigger mode is set in P08.26.

ADD3	ADD2	ADD1	ADD0	Path selection
OFF	OFF	OFF	OFF	Path 0 (Non-action)
OFF	OFF	OFF	ON	Path1
OFF	OFF	ON	OFF	Path2
OFF	OFF	ON	ON	Path3
OFF	ON	OFF	OFF	Path4
OFF	ON	OFF	ON	Path5
OFF	ON	ON	OFF	Path6
OFF	ON	ON	ON	Path7
ON	OFF	OFF	OFF	Path8
ON	OFF	OFF	ON	Path9
ON	OFF	ON	OFF	Path10
ON	OFF	ON	ON	Path11
ON	ON	OFF	OFF	Path12
ON	ON	OFF	ON	Path13
ON	ON	ON	OFF	Path14
ON	ON	ON	ON	Path15

8.4.3 485 communication

485 communication can be used to achieve the same functions as with I/O, modifying PR related parameters and trigger path motions. Through this communication protocol, controlling of multiple axes can be realized, saving wiring works with flexibility in the system. 485 communication includes 2 kinds of mode: Fixed trigger and immediate trigger.

485 communication parameters

<table>
<tr><th>Parameter</th><th>Label</th><th>Description</th></tr>
<tr><td>P05.29</td><td>Communication mode</td><td>485 communication mode data
<table>
<tr><th>Value</th><th>Bit</th><th>Checksum</th><th>Stop</th></tr>
<tr><td>0</td><td>8</td><td>Even</td><td>2</td></tr>
<tr><td>1</td><td>8</td><td>Odd</td><td>2</td></tr>
<tr><td>2</td><td>8</td><td>Even</td><td>1</td></tr>
<tr><td>3</td><td>8</td><td>Odd</td><td>1</td></tr>
<tr><td>4</td><td>8</td><td>Null</td><td>1</td></tr>
<tr><td>【5】</td><td>8</td><td>Null</td><td>2</td></tr>
</table></td></tr>
<tr><td>P05.30</td><td>Baud rate</td><td>To set communication speed of RS485 communication
<table>
<tr><th>Value</th><th>Baud rate</th><th>Value</th><th>Baud rate</th></tr>
<tr><td>0</td><td>2400bps</td><td>【4】</td><td>38400bps</td></tr>
<tr><td>1</td><td>4800bps</td><td>5</td><td>57600bps</td></tr>
<tr><td>2</td><td>9600bps</td><td>6</td><td>115200bps</td></tr>
<tr><td>3</td><td>19200bps</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>P05.31</td><td>ID</td><td>Modbus slave ID address</td></tr>
<tr><td>P08.02</td><td>PR trigger</td><td>
<table>
<tr><th>Attribute</th><th>Index</th><th>Description</th></tr>
<tr><td>Write</td><td>0x01P</td><td>N path positioning</td></tr>
<tr><td>Write</td><td>0x020</td><td>Reset</td></tr>
<tr><td>Write</td><td>0x021</td><td>Manually set currently position as 0 (Origin)</td></tr>
<tr><td>Write</td><td>0x040</td><td>Emergency stop</td></tr>
<tr><td>Read</td><td>0x000P</td><td>Positioning completed. Ready to receive new data</td></tr>
<tr><td>Read</td><td>0x01P,
0x020,
0x040</td><td>Yet to respond to command</td></tr>
<tr><td>Read</td><td>0x10P</td><td>Path motion undergoing</td></tr>
<tr><td>Read</td><td>0x200</td><td>Command completed. Waiting for positioning</td></tr>
</table></td></tr>
</table>

PR mode communication address:
Class 8 parameters: 0x6000+(Param-ID-800). For example P08.06: 0x6000+(806-800)=0x6006
Class 9 parameters: 0x6200+(Param-ID-900). For example P09.06: 0x6200+(906-900)=0x6206

8.4.4 Path trigger

Fixed trigger

Fixed triggering method is to set all 16 paths homing and other settings, then through P08.02 (trigger register to replace CTRG and HOME) to enable path. Recommended for simple applications with fixed motions.

Steps:
1. Set homing and path attributes using Motion Studio. Power on driver for parameters to be valid.
2. Write corresponding command into 0x6002(P08.02) to realize required motions.

Attribute	Index	Description
Write	0x01P	*N* path positioning
Write	0x020	Reset
Write	0x021	Manually set currently position as 0 (Origin)
Write	0x040	Emergency stop
Read	0x000P	Positioning completed. Ready to receive new data
Read	0x01P, 0x020, 0x040	Yet to respond to command
Read	0x10P	Path motion undergoing
Read	0x200	Command completed. Waiting for positioning

Immediate trigger

Immediate trigger is more flexible while fixed triggering is restricted by 16 paths position. Path motion is triggered immediately once path is written. Motions such as position, velocity or homing are realized through data frame.
This triggering method uses PR0 with 8 datum from which P09.07 mapped into P08.02. When 0x10 is written into P08.02, it will trigger PR0 motion immediately.
Steps:
1. Set homing and path attributes using Motion Studio. (Homing parameters must be set) Power on driver for parameters to be valid.
2. Control specific path using P08.02.
3. Realize path motion by writing into P09.00 – P09.07 with P09.07 = 0x10

Master device request frame byte data

No.	Data	Description	Value
1	ID	Slave ID	1~127
2	FC	Function code	0x10
3	ADDR	Address	0x62
4	ADDR	Address	0x00
5~6	NUM1	Data count（Word）	0x0008
7	NUM2	Data count（BytE）	0x10
8-9	P09.00	Mode	XXXX
10-11	P09.01	Position high bit	XXXX
12-13	P09.02	Position low bit	XXXX
14-15	P09.03	Velocity	XXXX
16-17	P09.04	Acceleration	XXXX

18-19	P09.05	Deceleration	XXXX
20-21	P09.06	Delay time	XXXX
22-23	P09.07	Trigger control	0x0010
24	CRC	Checksum Lo	
25		Checksum Hi	

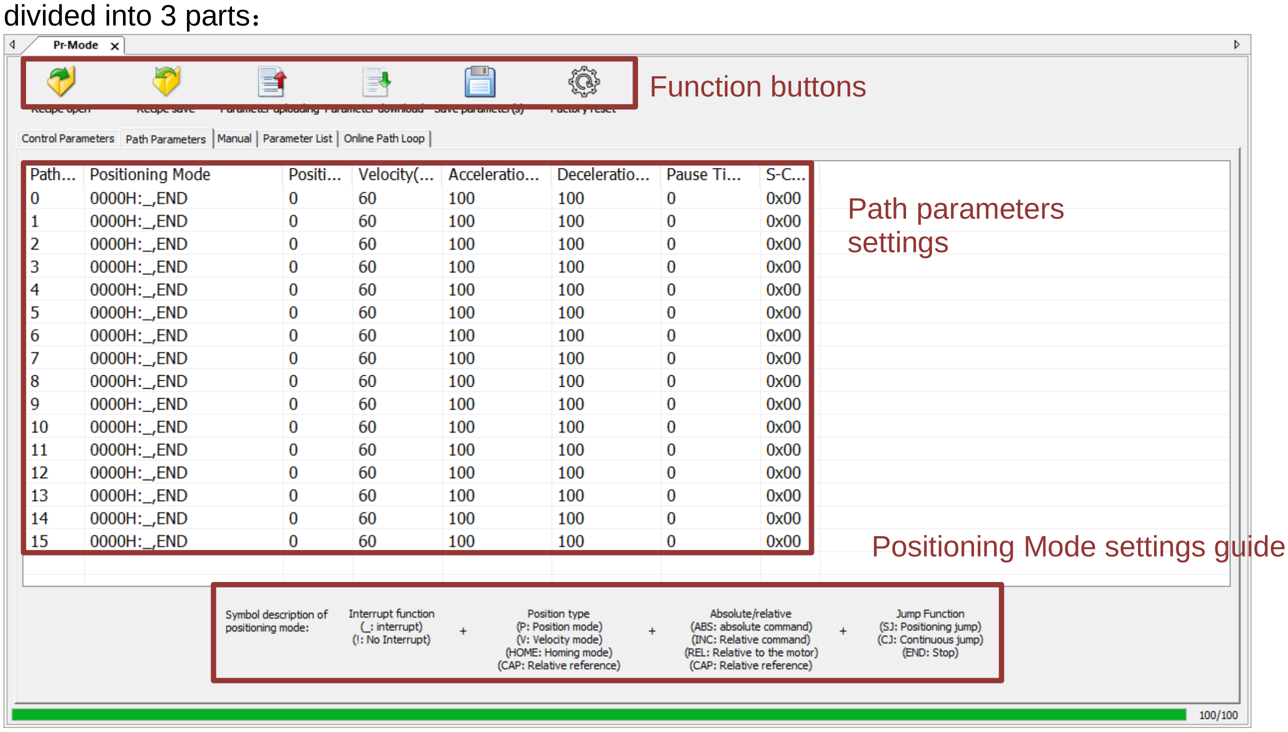
Slave response frame byte data

No.	Data	Description	Value
1	ID	Slave ID	1~127
2	FC	Function code	0x10
3	ADDR	Address	0x62
4	ADDR	Address	0x00
5	NUM	Data count（Word）	0x08
6	CRC	Checksum Lo	0xXX
7		Checksum Hi	0xXX

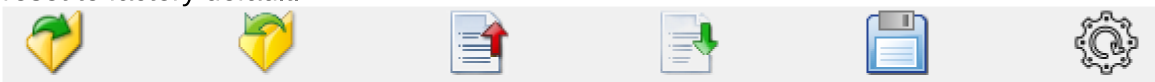
8.5 PR motion

8.5.1 Trigger using physical I/O

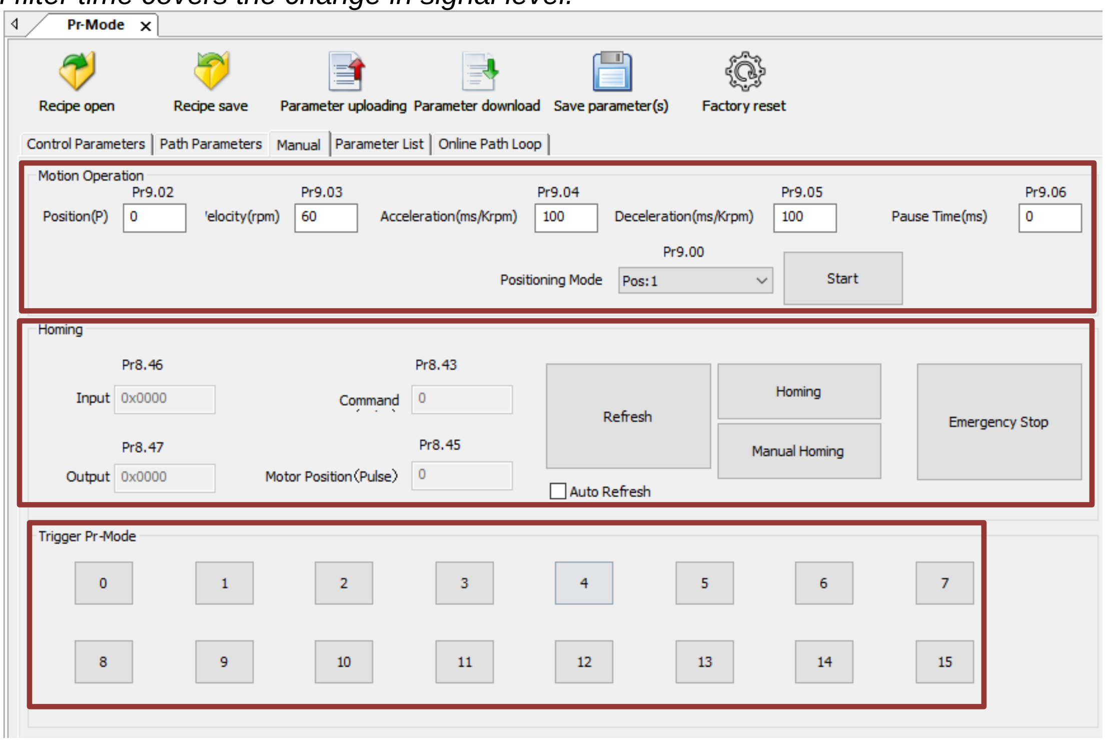
1. Set up servo drive parameter such as P00.01 = 6. Required PR I/Os are set in P04.00-P04.15
2. Set up PR control parameters such as trigger, homing, emergency stop, velocity, etc as shown below
3. Set PR path parameter such as motion type, S-code, etc as shown below. The interface is divided into 3 parts：



Function buttons: Upload, download parameters to/from drives, save parameter, backup and reset to factory default.



Parameters: Set PR path related parameters here
Descriptions: Short explanation on each PR path motion types
Remember to upload parameters to drive and save to drive after parameters setup.
4. Set up homing, trigger, I/O in PR mode as shown below:
***Please select required path when using edge trigger. Make sure the corresponding path is chosen in I/O path selection*
**Please set up I/O combination filter time when using I/O combination trigger. Make sure I/O signal filter time covers the change in signal level.*



This page is divided into 3 parts:
Motion Operation: To set up parameters for Path 0. Click on “Start” and parameters will be automatically uploaded to driver
Homing: I/O and position display; Homing and emergency stop button
Trigger Pr-Mode: To trigger operation of any of the 16 PR paths.

8.5.2 Control using 485 communication

485 communication data frame format

Byte(x)	0	1	2	3	4	5	6	7
Definition	ID	Function code	Addr. High 8-bit	Addr. Low 8-bit	Data High 8-bit	Data Low 8-bit	CRC checksum Low 8-bit	CRC checksum High 8-bit

Please refer to Modbus communication in Chapter 7 to use Word function code writing. The request and respond frame data format is similar.

1. Set PR0 to travel to absolute position = 200000 (10000 pulse/rev)

No.	485 communication data frame	Description
1	01 06 62 00 00 01 57 B2	Set PR0 mode as absolute position
2	01 06 62 01 00 03 87 B3	Set PR0 position high bit
3	01 06 62 02 0D 40 32 D2	Set PR0 position low bit
4	01 06 62 03 02 58 66 E8	Set PR0 velocity
5	01 06 62 04 00 32 56 66	Set PR0 acceleration
6	01 06 62 05 00 32 07 A6	Set PR0 deceleration
7	01 06 60 02 00 10 37 C6	Trigger PR0 motion
8	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

2. Set PR0 to travel relative distance = 10000 (10000 pulse/rev)

No.	485 communication data frame	Description
1	01 06 62 00 00 41 56 42	Set PR0 mode as relative position
2	01 06 62 01 00 00 C7 B2	Set PR0 position high bit
3	01 06 62 02 27 10 2D 8E	Set PR0 position low bit
4	01 06 62 03 02 58 66 E8	Set PR0 velocity
5	01 06 62 04 00 32 56 66	Set PR0 acceleration
6	01 06 62 05 00 32 07 A6	Set PR0 deceleration
7	01 06 60 02 00 10 37 C6	Trigger PR0 motion
8	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

3. Set PR0 as velocity mode with velocity = 600rpm

No.	485 communication data frame	Description
1	01 06 62 00 00 02 17 B3	Set PR0 as velocity mode
2	01 06 62 03 02 58 66 E8	Set PR0 velocity
3	01 06 62 04 00 32 56 66	Set PR0 acceleration
4	01 06 62 05 00 32 07 A6	Set PR0 deceleration
5	01 06 60 02 00 10 37 C6	Trigger PR0 motion
6	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

4. Set PR1 to travel to absolute position = 200000 (10000 pulse/rev)

No.	485 communication data frame	Description
1	01 06 62 08 00 01 D6 70	Set PR1 mode
2	01 06 62 09 FF FC 07 C1	Set PR1 position high bit
3	01 06 62 0A F2 C0 F3 40	Set PR1 position low bit
4	01 06 62 0B 02 58 E7 2A	Set PR1 velocity
5	01 06 62 0C 00 32 D7 A4	Set PR1 acceleration
6	01 06 62 0D 00 32 86 64	Set PR1 deceleration
7	01 06 60 02 00 11 F6 06	Trigger PR1 motion
8	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

5. Set PR1 as velocity mode with velocity = 300rpm

No.	485 communication data frame	Description
1	01 06 62 08 00 02 96 71	Set PR1 as velocity mode
2	01 06 62 0B 01 2C E7 FD	Set PR1 velocity
3	01 06 60 02 00 11 F6 06	Set PR1 acceleration
4	01 06 62 0C 00 32 D7 A4	Set PR1 deceleration
5	01 06 62 0D 00 32 86 64	Trigger PR1 motion
6	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

6. Homing

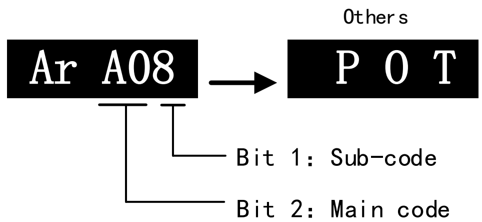
No.	485 communication data frame	Description
1	01 06 60 0A 00 00 B7 C8	Set homing method
2	01 06 60 0F 00 64 A6 22	Set high homing velocity
3	01 06 60 10 00 1E 16 07	Set low homing velocity
4	01 06 60 02 00 20 37 D2	Trigger homing
5	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

Chapter 9 Warning and Alarm

9.1 Servo drive warning

When warning occurs, driver will set protective function but **motor won't stop moving**. Error code will be displayed on the front panel.

Example of warning code:



Warning Code		Content
Main	Code	
A0	1	Overload warning
	2	Regeneration energy overload warning(**85% of the regeneration threshold**)
	3	Absolute encoder **battery voltage low (<3.1V)**. Valid when P00.15 is set to 1.
	4	Change the parameter to a non-real time valid warning
	7	Low temperature warning **(< 20℃)**
	8	Positive limit switch valid. **POT** blinking on front panel
	9	Negative limit switch valid. **NOT** blinking on front panel
	A	Positive and negative limit switch valid. **PNOT** blinking on front panel
	B	Current position is beyond software positive limit. **SPOT** blinking on front panel
	C	Current position is beyond software negative limit. **NPOT** blinking on front panel
	D	Current position is beyond software negative, positive limit. **SPNOT** blinking on front panel
	E	Parameters reset to factory default. Restart needed
A	10	Software limit setting error
	11	PR Software limit setting error
	15	Gantry communication error
	16	Gantry mating shaft alarm
	17	Emergency stop signal of gantry mating shaft is effective
	18	Gantry mating Shaft Limit Effective
	19	Gantry slave axis synchronization timeout
	1A	High error rate of gantry communication
	20	Undervoltage alarm

9.2 Servo drive alarm

When alarm occurs, driver will set protective function and **motor stops moving**. Error code will be displayed on the front panel. Alarm history record can also be viewed in data monitoring mode, with the alarm log sub-menu displaying "d12Er".

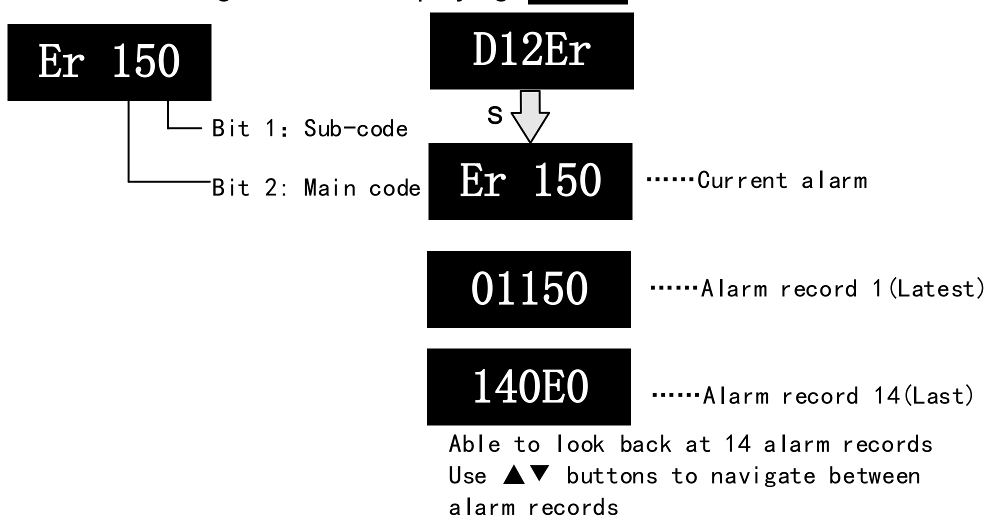


Table 9.1 Error Code List

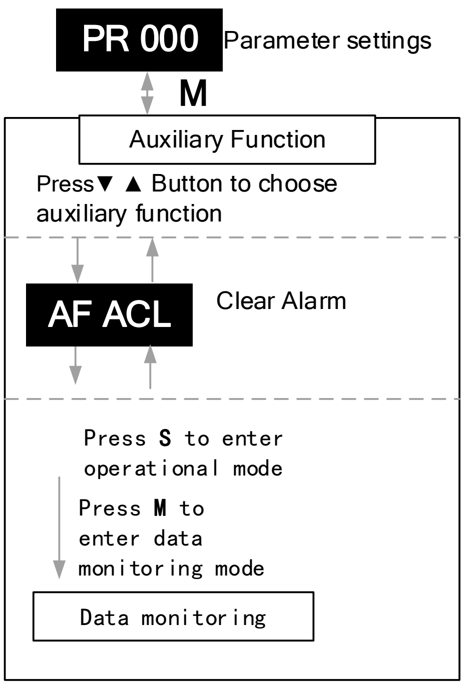
Error code		Content	Attribute		
Main	Sub		Save	Type	Clearable
09	0	FPGA communication error	●	2	
0A	0~1	Circuit current detection error	●	2	
	2 , 4	Analog input error	●	2	
	3	Motor power cable not connected	●	1	
	5	DC bus error	●	2	
	6	Temperature measuring error	●	2	
0b	0	Control circuit power supply voltage too low		2	
	1	Control circuit power supply voltage too high		2	●
0c	0	DC bus overvoltage	●	1	●
0d	0	DC bus undervoltage	●	1	●
	1	Single phasing of main power supply	●	2	
	2	No main power supply detected		2	
0E	0	Overcurrent	●	1	
	1	Intelligent Power Module (IPM) overcurrent	●	1	
	2	Power output to motor shorted to ground	●	1	
	4	Phase overcurrent	●	1	
0F	0	Driver overheated	●	2	
10	0	Motor overloaded	●	1	●

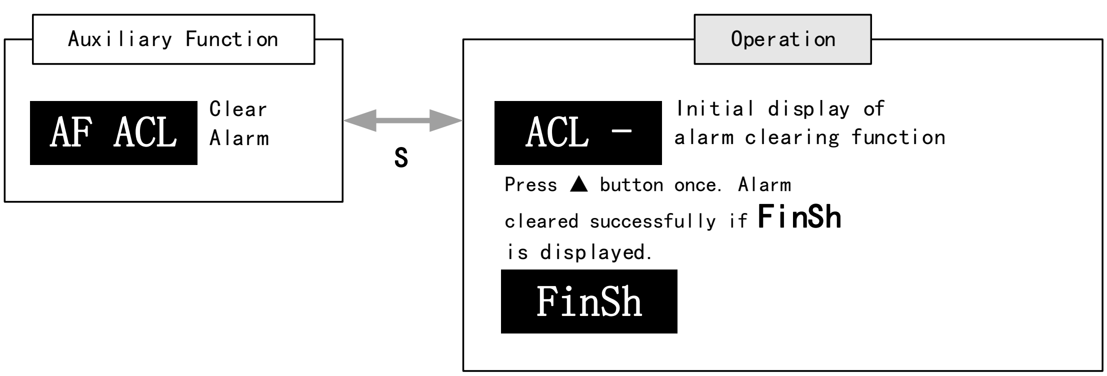
	1	Driver overloaded	●	1	●
	2	Motor rotor blocked	●	1	●
11	0	Relay error			
	1	Fan error			
12	0	Regenerative resistor overvoltage	●	2	
	1	Holding brake error	●	1	
	2	Regenerative resistor value too low	●	2	
15	0	Encoder disconnected	●	1	
	1	Encoder communication error	●	1	
	2	Encoder initial position error	●	1	
	3	Multiturn encoder error	●	2	
	4	Encoder parameter settings error	●	2	
	5	Encoder data overflow	●	2	●
	6	Encoder overheated	●	2	●
	7	Encoder counter error	●	2	●
	A	Encoder phase A error			
	B	Encoder phase B error			
	C	Encoder phase Z error			
	D	Encoder phase UVW error			
16	0	Phase-seeking failure			
	1	Phase-seeking failure (motor not stationary before phase-seeking)			
	2	Phase-seeking failure (phase sequence error)			
	3	Phase-seeking failure (motor blocking)			
	4	Phase-seeking failure (angle compensation too large)			
	5	Phase-seeking failure (overtime)			
	6	Phase-seeking failure (phase-seeking required before enabling)			
17	0	Encoder data error	●	1	
	1	Encoder parameter initialization error	●	1	
18	0	Excessive position deviation	●	2	●
	1	Excessive velocity deviation	●	2	●
19	0	Motor vibration too strong	●	2	●
	1	Excessive hybrid position deviation	●	1	●
1A	0	Overspeed of motor	●	2	●
	1	Velocity out of control	●	1	●
	2	Overspeed of the second encoder			
1b	0	Bus input signal dithering	●	2	●
	1	Incorrect electronic gear ratio	●	2	●
	2	Encoder single-turn data overflow			
	3	External encoder frequency divider parameter error	●	1	
	4	Excessive synchronous position command	●	2	●
	5	Pulse and direction input disconnected			
1c	0	Both STO failed	●	1	

	1	1st STO failed	●	1	
	2	2nd STO failed	●	1	
	3	STO power supply 3.3v anomaly		2	
	4	STO power supply 5.0v anomaly		2	
	5~8	Faulty STO internal optocoupler, inverter		2	
21	0	I/O input interface assignment error	●	2	
	1	I/O input interface function assignment error	●	2	
	2	I/O output interface function assignment error	●	2	
24	0	CRC correction during EEPROM parameter saving		2	
	1	I2C communication status error		2	
	2	Error r/w alarm history record		2	
	3	Error r/w diagnostic data		2	
	4	Error r/w 402 parameters		2	
	5	Error r/w communication parameters		2	
25	0	Gantry deviation error	●	1	
	1	Gantry communication error	●	1	
	2	slave axis disable	●	●	●
	3	Excessive deviation of gantry synchronising torque	●	●	●
	4	Gantry synchronisation mode is in non-position control mode	●	●	●
	5	Gantry Alignment Failure	●		
26	0	Positive/Negative position limit triggered under non-homing mode	●	2	●
27	0	Analog 1 input overrun limit	●	2	●
	1	Analog 2 input overrun limit	●	2	●
	2	Analog 3 input overrun limit	●	2	●
28	0	Frequency division output pulse frequency too high	●	2	●
29	0	Control mode not match under full closed loop mode	●	1	
	1	Encoder mode not match under full closed loop mode	●	1	
55	0	External ABZ encoder disconnected	●	1	
	1	External ABZ encoder Phase A disconnected	●	1	
	2	External ABZ encoder Phase B disconnected	●	1	
	3	External ABZ encoder Phase Z disconnected	●	1	
57	0	Forced alarm input valid(E-stop)	●	2	●
5F	0	Motor model no. detection error		2	
	1	Driver power module detection error		2	
60	0	Main loop interrupted timeout		2	
	1	Velocity loop interrupted timeout		2	
70	0	Encryption error		2	
73	B	Excessive number of DC interruptions lost			
D0	0	The number of recognised encoder lines does not correspond to the set value.			

	1	Inconsistent recognised Hall signals with settings			
	2	The number of identified polar pairs is not equal to the setting			
	3	Encoder parameter recognition error			
89	0	Homing error		2	●
92	0	External encoder parameter initialization error	●	1	

Save: Save error messages to alarm history.
Type: The type 1 and type 2 fault stop mode can be set via P05.10 [Sequence at alarm].
Clearable: Clearable alarm by operating the front panel and use auxiliary function **AFACL** as below. Besides clearable alarms, please first solve the error and restart the servo driver to clear alarm.





9.3 Alarm Handling

***When error occurs, please solve accordingly. Then, restart. If the solutions described don't work, please consider replacing the driver.*

Error code	Main	Sub	**Display:** "Er 090"--"Er 09F"	
	09	0~F	**Content:** FPGA communication error	
Cause			Diagnosis	Solution
L1, L2 terminal voltage too low			Verify L1, L2 terminal voltage	Make sure L1, L2 terminal voltage is within recommended range

Error code	Main	Sub	**Display:** "Er 0A0"--"Er 0A1"	
	0A	0~1	**Content:** Circuit current detection error	
Cause			Diagnosis	Solution
Motor power cable wiring error			Verify motor power cable wiring	Make sure U,V,W terminal wired properly
Main power supply undervoltage			Verify L1,L2,L3 terminal voltage	Increase main power supply voltage

Error code	Main	Sub	**Display:** "Er 0A2" / "Er 0A4"	
	0A	2 / 4	**Content:** Analog input error	
Cause			Diagnosis	Solution
Analog input wiring error			Verify analog input wiring	Make sure of analog input wiring connection

Error code	Main	Sub	**Display:** "Er 0A3"	
	0A	3	**Content:** Motor power cable not connected	
Cause			Diagnosis	Solution
Motor power cable not connected			Verify motor power cable wiring	Measure **resistance values between U, V, W terminals**, make sure the values are almost equal. If not, might be due to damaged motor or motor winding open circuit.
Motor fault			/	Replace motor

Error code	Main	Sub	**Display:** "Er 0A5"	
	0A	5	**Content:** DC Bus error	
Cause			Diagnosis	Solution

L1, L2 terminal voltage too low	Verify L1, L2 terminal voltage. Check if power on indicator light on servo drive is on and d27 DC bus voltage.	Make sure L1, L2 terminal voltage is within recommended range

Error code	Main	Sub	**Display:** “Er 0A6”
	0A	6	**Content:** Temperature measuring error
Cause		Diagnosis	Solution
L1, L2 terminal voltage too low		Verify L1, L2 terminal voltage	Make sure L1, L2 terminal voltage is within recommended range

Error code	Main	Sub	**Display:** “Er 0b0”
	0b	0	**Content:** Control circuit power supply voltage too low
Cause		Diagnosis	Solution
Control circuit power supply voltage too low		Verify L1C, L2C terminal voltage; check if wiring connection is tight	Increase L1C, L2C terminal voltage; Tighten L1C, L2C terminal connection
Power supply under capacity		/	Increase power supply capacity for L1C, L2C terminals

Error code	Main	Sub	**Display:** “Er 0b1”
	0b	1	**Content:** Control circuit power supply abnormal
Cause		Diagnosis	Solution
USB power supply too low		Verify if USB cable is properly connected and not damaged.	Replace USB Type-C cable

Error code	Main	Sub	**Display:** “Er 0c0”
	0c	0	**Content:** DC bus overvoltage
Cause		Diagnosis	Solution
Main power supply overvoltage		Verify L1,L2,L3 terminal voltage	Decrease main power supply voltage
Acceleration/deceleration time too short		Verify if the time is actually too short	Increase the duration time or change to a regenerative resistor with higher resistance.
Regenerative brake parameter anomaly		Verify P07.32/P07.33	Modify vent overload parameter
Inner brake circuit damaged		/	Replace driver

Error code	Main	Sub	**Display:** "Er 0d0"
	0d	0	**Content**: DC bus undervoltage

Cause	Diagnosis	Solution
Main power supply undervoltage	Verify L1,L2,L3 terminal voltage	Increase main power supply voltage
L1C, L2C connected when USB cable is connected	Control circuit power on before driver initialization. Alarm might occur.	Please disconnect the USB cable before powering on control circuit.

Error code	Main	Sub	**Display:** "Er 0d1"
	0d	1	**Content**: Single phasing of main power supply

Cause	Diagnosis	Solution
Main power supply undervoltage	Verify L1,L2,L3 terminal voltage	Increase main power supply voltage
Main power supply wiring error	Loose connection of L1, L2, L3	Secure connections

Error code	Main	Sub	**Display:** "Er 0d2"
	0d	2	**Content**: No main power supply detected

Cause	Diagnosis	Solution
No main power supply	Verify L1,L2,L3 terminal voltage	1. Increase main power supply voltage 2. Secure connections

Error code	Main	Sub	**Display:** "Er 0E0"
	0E	0	**Content:** Overcurrent

Cause	Diagnosis	Solution
Driver power output short circuit	Verify if there is short circuit between UVW terminals, or shorted to PG.	1. Make sure there is no circuit. 2. Make sure motor is not damaged
Motor wiring error	Verify motor wiring	Reconnect motor wiring
IGBT module short circuit	Disconnect motor output cable. Then, enable servo driver to check for overcurrent	Replace driver
Control parameter anomaly	Verify if parameter exceeds recommended range	Set parameter within recommended range.
Control command anomaly	Verify if command motion is too acute	Modify control command; use filter

Error code	Main	Sub	**Display:** "Er 0E1"
	0E	1	**Content**: Intelligent Power Module (IPM) overcurrent

Cause	Diagnosis	Solution
Driver power output short circuit	Verify if there is short circuit between UVW terminals, or shorted to PG.	1. Make sure there is no circuit. 2. Make sure motor is not damaged

Motor wiring error	Verify motor wiring	Reconnect motor wiring
IGBT module short circuit	Disconnect motor output cable. Then, enable servo driver to check for overcurrent	Replace driver
IGBT module undervoltage	/	Replace driver
Control parameter anomaly	Verify if parameter exceeds recommended range	Set parameter within recommended range.
Control command anomaly	Verify if command motion is too acute	Modify control command; use filter

Error code	Main	Sub	**Display:** "Er 0E2"
	0E	2	**Content**: Power output to motor shorted to ground

Cause	Diagnosis	Solution
Driver U, V, W terminals shorted to ground	Disconnect motor power cable and check for short circuit between driver UVW and PE	1. Reconnect wiring. 2. Change motor power cable.
Motor shorted to ground	Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is in the range of MegaOhm (MΩ)	Replace motor

Error code	Main	Sub	**Display:** "Er 0E4"
	0E	2	**Content**: Phase overcurrent

Cause	Diagnosis	Solution
Driver U, V, W terminals shorted to ground	Disconnect motor power cable and check for short circuit between driver UVW and PE	1. Reconnect wiring. 2. Change motor power cable.
Motor shorted to ground	Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is equal and if there is short circuit	Replace motor

Error code	Main	Sub	**Display:** "Er 0F0"
	0F	0	**Content**: Driver overheated

Cause	Diagnosis	Solution
Temperature of power module exceeded upper limit	Measure the temperature of driver radiator.	1. Improve cooling condition. Please check installation guide; 2. Replace driver and motor with higher power rating; 3. Increase duration time for acceleration and deceleration; 4. Decrease load

Error code	Main	Sub	**Display:** "Er 100"
	10	0	**Content:** Motor overloaded

Cause	Diagnosis	Solution
Load too heavy	Verify if actual load exceeds maximum value allowed	1. Decrease load 2. Adjust limit values
Strong mechanical vibration	Look for mechanical vibration from machine system	1. Adjust gain value of control loop 2. Increase duration time for acceleration and deceleration
Motor or encoder cable wiring error	Verify motor and encoder wiring	1. Reconnect wiring 2. Replace motor and encoder cable
Holding brake engaged	Verify holding brake terminal voltage	Cut off holding brake

Error code	Main	Sub	**Display:** "Er 101"
	10	1	**Content:** Driver overloaded

Cause	Diagnosis	Solution
Motor power cable wiring error	UVW terminals wiring error	Make sure motor power cable wiring connection is correct
Motor not matched	Motor current is too high	Motor rated current is higher than driver rated current. Please change to a driver with higher rated current.

Error code	Main	Sub	**Display:** "Er 102"
	10	2	**Content:** Motor rotor blocked

Cause	Diagnosis	Solution
Motor rotor blocked	Look for mechanical blockages	Check the machinery
Motor rotor blocking time threshold value too low	Verify value of P06.57	Adjust value of P06.57

Error code	Main	Sub	**Display:** "Er 120"
	12	0	**Content:** Regenerative resistor overvoltage

Cause	Diagnosis	Solution
Regenerative energy exceeded capacity of regenerative resistor	1. Verify if velocity is too high 2. Verify if load is too large	1. Decrease motor rotational velocity; 2. Decrease load inertia; 3. Add an external regenerative resistor;
Power supply voltage too high	1. Verify if power supply voltage is within the rated range. 2. Interval regenerative resistor value is too low	1. Decrease power supply voltage 2. Increase regeneration resistance value(add external regenerative resistor)
Unstable power supply voltage	Verify if power supply voltage is stable	Add a surge suppressor to main power supply.

Regenerative energy discharge circuit damaged	/	1. Add an external regenerative resistor; 2. Replace driver

Error code	Main	Sub	Display: "Er 121"
	12	1	**Content:** Holding brake error

Cause	Diagnosis	Solution
Holding brake circuit damaged	Regenerative resistor disconnected	Replace regenerative resistor
	Holding brake IGBT damaged	Replace driver

Error code	Main	Sub	Display: "Er 122"
	12	2	**Content:** Regenerative resistor value too low

Cause	Diagnosis	Solution
External regenerative resistor value is less than the minimum value allowed by the drive	/	Replace the regenerative resistor with the right resistance value which meets the specification of the driver

Error code	Main	Sub	Display: "Er 150"
	15	0	**Content:** Encoder disconnected

Cause	Diagnosis	Solution
Encoder cable disconnected	Verify encoder cable connection	Make sure encoder cable properly connected
Encoder cable wiring error	Verify if encoder wiring is correct	Reconnect encoder wiring
Encoder damaged	/	Replace motor
Encoder measuring circuit damaged	/	Replace driver

Error code	Main	Sub	Display: "Er 151"
	15	1	**Content:** Encoder communication error

Cause	Diagnosis	Solution
Encoder wire shielding layer is missing	Verify if encoder cable has shielding layer	Replace with standard encoder cable
Encoder cable wiring error	Verify if encoder wiring is correct	Reconnect encoder wiring
Encoder damaged	/	Replace motor

Error code	Main	Sub	Display: "Er 152"
	15	2	**Content:** Encoder initial position error

Cause	Diagnosis	Solution
Communication data abnormal	1. Verify if encoder power supply voltage is DC5V±5% ; 2. Verify if encoder cable and shielded	1. Make sure encoder power supply voltage is stable 2. Make sure encoder cable is not

	layer is not damaged; 3. Verify if encoder cable is close to high-powered power supply cable	damaged. 3. Make sure encoder cable shielded layer is grounded to frame 4. Make sure encoder cable is away from high-powered power supply cable
Encoder damaged	/	Replace motor
Encoder measuring circuit damaged	/	Replace driver

Error code	Main	Sub	**Display:** "Er 153"
	15	3	**Content:** Multiturn encoder error

Cause	Diagnosis	Solution
Initial use	Origin calibration not performed	Perform origin positioning and multiturn position initialization, calibrate the origin of coordinate system.
Encoder without multiturn absolute function used	Verify if encoder has multiturn absolute function	1. Replace the motor with a multiturn absolute encoder. 2. Set P00.15 = 0 to deactivate multiturn absolute function.
Low battery power	Replace battery and restart driver to clear alarm	Replace battery
Battery has no power or has been dismantled	Alarm not cleared after replacing battery and restart	Absolute position lost. Return to origin and perform multiturn initialization, calibrate the origin of coordinate system

Error code	Main	Sub	**Display:** "Er 154"
	15	4	**Content:** Encoder parameter settings error

Cause	Diagnosis	Solution
Absolute encoder mode is incorrectly set.	Verify if encoder has multi-turn absolute value function.	Modify absolute encoder mode settings

Error code	Main	Sub	**Display:** "Er 155"
	15	5	**Content:** Encoder data overflow

Cause	Diagnosis	Solution
Encoder data overflow	Verify if encoder is not damaged	Initialize multiturn data
Absolute value applications, motor rotates in one direction	Verify if encoder is not damaged	Adjust absolute value application mode, set to turntable mode

Error code	Main	Sub	**Display:** "Er 156"
	15	6	**Content:** Encoder overheated

Cause	Diagnosis	Solution
The encoder temperature is too high.	Verify if motor temperature is too high	Reduce encoder temperature.

Error code	Main	Sub	Display: "Er 157"
	15	7	**Content:** Encoder counter error

Cause	Diagnosis	Solution
Encoder data overflow	Verify if encoder is not damaged	Initialize multiturn data
Absolute value applications, motor rotates in one direction	Verify if encoder is not damaged	Adjust absolute value application mode, set to turntable mode

Error code	Main	Sub	Display: "Er 170"
	17	0	**Content:** Encoder data error

Cause	Diagnosis	Solution
Communication data abnormal	1. Verify if encoder power supply voltage is DC5V±5% ; 2. Verify if encoder cable and shielded layer is not damaged; 3. Verify if encoder cable is close to high-powered power supply cable	1. Make sure encoder power supply voltage is stable 2. Make sure encoder cable is not damaged. 3. Make sure encoder cable shielded layer is grounded to frame 4. Make sure encoder cable is away from high-powered power supply cable
Encoder damaged	/	Replace motor
Encoder measuring circuit damaged	/	Replace driver

Error code	Main	Sub	Display: "Er 171"
	17	1	**Content:** Encoder parameter initialization error

Cause	Diagnosis	Solution
Driver and motor not matched	Verify driver and motor models.	Replace with matching driver and motor
Error while getting parameters from encoder	1. Verify if encoder cable is standard. 2. Verify if encoder has no peeled insulator, broken connection or improper contact.	Use standard encoder cable, verify the connection of both sides of driver and motor, change encoder cable if necessary

Error code	Main	Sub	Display: "Er 180"
	18	0	**Content:** Excessive position deviation

Cause	Diagnosis	Solution
Improper position deviation settings	Verify if value of Pr_014 is too low	Increase value of Pr_014
Position gain setting too low	Verify if values of P01.00 & P01.05 are too low	Increase values of P01.00 & P01.05
Torque limit too low	Verify if values of P00.13 & P05.22 are too low	Increase values of P00.13 & P05.22

Excessive external load	1. Verify if acceleration and deceleration duration time is too low. 2. Verify if rotational velocity is too high 3. Verify if load is too large	1. Increase duration time for acceleration and deceleration 2. Decrease rotational velocity 3. Decrease load

Error code	Main	Sub	**Display:** "Er 181"
	18	1	**Content:** Excessive velocity deviation

Cause	Diagnosis	Solution
Deviation between set velocity and actual velocity is too great	Verify if value of P06.02 is too low	1. Increase value of P06.02; 2. Set P06.02 to 0, position error detection off.
Acceleration and deceleration duration time for set velocity is too low	Verify if value of P03.12 and P03.13 are too low	1. Increase value of P03.12, P03.13; 2. Adjust velocity gain to reduce velocity lag error

Error code	Main	Sub	**Display:** "Er 190"
	19	0	**Content:** Vibration too strong

Cause	Diagnosis	Solution
Resonance	Mechanical stiffness is too high, resonance occurs	Reduce mechanical stiffness or use filter
Current loop gain too large	Verify current loop gain value	Reduce current loop gain

Error code	Main	Sub	**Display:** "Er 191"
	19	1	**Content:** Excessive hybrid position deviation

Cause	Diagnosis	Solution
Driver UVW terminal output single phasing or wiring error	Verify if UVW terminal wiring connection is right	Make sure UVW terminals are correctly connected to UVW of motor; change motor power cable.
Motor rotor blocked	Look for mechanical blockages	Check the machinery
Driver stiffness too low	Verify if position loop and velocity loop gain is too low	Increase position loop and velocity loop gain
Full closed loop position deviation (**Deviation between external encoder feedback position and motor feedback position**) exceeds P00.33	Verify if P00.33 is set too low	Increase P00.33 set value accordingly but please aware that doing so might cause the position deviation to be higher.

Error code	Main	Sub	**Display:** "Er 1A0"
	1A	0	**Content:** Overspeed

Cause	Diagnosis	Solution

Motor velocity exceeded first speed limit (P03.21)	1. Verify if velocity command is too high; 2. Verify if simulated velocity command voltage is too high; 3. Verify if parameter value of P03.21 is too low; 4. Verify if input frequency and division frequency coefficient of pulse train is proper; 5. Verify if encoder is wired correctly	1. Adjust velocity input command; 2. Increase P03.21 value; 3. Adjust pulse train input frequency and division frequency coefficient; 4. Verify encoder wiring;

Error code	Main	Sub	**Display:** "Er 1A1"
	1A	1	**Content:** Velocity out of control

Cause	Diagnosis	Solution
Motor velocity out of control, Excessive velocity error	Verify encoder phase sequence; Verify if UVW cable is connected to the right terminal	Reconnect UVW if wrongly connected. If still remains unsolved, please contact technical support.

Error code	Main	Sub	**Display:** "Er 1b0"
	1b	0	**Content:** Bus input signal dithering

Cause	Diagnosis	Solution
Controller synchronization dithering	/	Increase alarm threshold value

Error code	Main	Sub	**Display:** "Er 1b1"
	1b	1	**Content:** Incorrect electronic gear ratio

Cause	Diagnosis	Solution
Values out of range	Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

Error code	Main	Sub	**Display:** "Er 1b3"
	1b	3	**Content:** External encoder frequency divider parameter error

Cause	Diagnosis	Solution
Values out of range	Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

Error code	Main	Sub	**Display:** "Er 1b4"
	1b	4	**Content:** Excessive synchronous position mode command

Cause	Diagnosis	Solution
Values out of range	Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

Error code	Main	Sub	Display: "Er 1c0"
	1c	0	**Content:** Both STO failed

Cause	Diagnosis	Solution
Both STO input signals valid	Verify if STO power supply is normal	Verify 24V STO power supply and power cable connection
	Disconnect switch connected to STO	Close switch

Error code	Main	Sub	Display: "Er 1c1"
	1c	1	**Content:** 1st STO failed

Cause	Diagnosis	Solution
1st STO input signal valid	Verify if STO power supply is normal	Verify 24V STO power supply and power cable connection
	Disconnect switch connected to STO	Close switch

Error code	Main	Sub	Display: "Er 1c2"
	1c	2	**Content:** 2nd STO failed

Cause	Diagnosis	Solution
2nd STO input signal valid	Verify if STO power supply is normal	Verify 24V STO power supply and power cable connection
	Disconnect switch connected to STO	Close switch

Error code	Main	Sub	Display: "Er 210"
	21	0	**Content:** I/O input interface assignment error

Cause	Diagnosis	Solution
Input signal assigned with two or more functions.	Verify values of P04.00-P04.09, P04.44-4.47	Set proper values for P04.00-P04.09, P04.44-4.47

Error code	Main	Sub	Display: "Er 211"
	21	1	**Content:** I/O input interface function assignment error

Cause	Diagnosis	Solution
Input signal assignment error	Verify values of P04.00-P04.09, P04.44-4.47	Set proper values for P04.00-P04.09, P04.44-4.47

Error code	Main	Sub	Display: "Er 212"
	21	2	**Content:** I/O output interface function assignment error

Cause	Diagnosis	Solution
Input signal assigned with two or more functions.	Verify values of P04.10-P04.15	Set proper values for P04.10-P04.15
Input signal not assigned	Verify values of P04.10-P04.15	Set proper values for P04.10-P04.15

Error code	Main	Sub	**Display:** "Er 240"
	24	0	**Content:** CRC correction error during EEPROM parameter saving

Cause	Diagnosis	Solution
L1, L2 terminal voltage too low	Verify if L1, L2 terminal voltage too low	Make sure L1, L2 terminal voltage is within recommended range
Parameter saving anomaly	Save parameter again and restart	Save parameter again

Error code	Main	Sub	**Display:** "Er 250"
	25	0	**Content:** Gantry deviation error

Cause	Diagnosis	Solution
Excessive Gantry drivers deviation	Verify if both drivers share the same set of parameters	Unify the parameters of both drivers
	Verify if control cable of the drivers are properly connected	Connect control cable properly
	Verify if gantry communication cable is connected properly	Connect communication cable properly

Error code	Main	Sub	**Display:** "Er 251"
	25	1	**Content:** Gantry communication error

Cause	Diagnosis	Solution
Gantry communication data error	Verify if gantry communication cable is connected properly	Connect communication cable properly

Error code	Main	Sub	**Display:** "Er 252"
	25	2	**Content:** Gantry Slave Axis disable

Cause	Diagnosis	Solution
In the case of no error, the master axis is enabled for 2s and the slave axis is still not enabled	caused by communication interference	Check the state of slave axis

Error code	Main	Sub	**Display:** "Er 253"
	25	3	**Content:** Excessive deviation of gantry synchronising torque

Cause	Diagnosis	Solution
When enabled, the gantry synchronous torque deviation exceeds the gantry torque deviation threshold and is greater than 5ms, the alarm will be activated.	Check the gantry torque deviation threshold parameter whether is set appropriately	Ensure that the gantry torque deviation threshold setting parameters are appropriate

Error code	Main	Sub	**Display:** "Er 254"
	25	4	**Content:** Gantry synchronisation mode is in non-position control mode

Cause	Diagnosis	Solution
Gantry synchronisation	Check the mode that Gantry is	Adjust the parameter

not in position mode, alarm 254			currently in	
Error code	Main	Sub	**Display:** "Er 255"	
	25	5	**Content:** Gantry Alignment Alarm	
Cause			Diagnosis	Solution
Receive the command, more than 200ms later, the gantry alignment failed to complete properly, alarm			Check whether the gantry alignment enable and servo enable timing is normal; after the end of the gantry alignment action, the position error is not within the end range of positioning	Servo enable, connect the gantry alignment enable timing; set reasonable parameters to ensure that the spindle movement distance and gantry alignment offset deviation is within the positioning end range

Error code	Main	Sub	**Display:** "Er 260"	
	26	0	**Content:** Positive/Negative position limit triggered under non-homing mode	
Cause			Diagnosis	Solution
Positive/negative position limit triggered			Verify position limit signal	Confirmation of wiring and parameter settings

Error code	Main	Sub	**Display:** "Er 270" -- "Er 272"	
	27	0~2	**Error description:** Analog input 1-3 out of range	
Cause			Diagnosis	Solution
Analog value out of range			Verify if analog input value is out of range	Adjust analog input voltage

Error code	Main	Sub	**Display:** "Er 280"	
	28	0	**Error description:** Output pulse frequency too high	
Cause			Diagnosis	Solution
Frequency divided pulse output exceeds 1MHz			Verify if motor rotational speed and the number of frequency divided pulse output are too high	Reduce the number of frequency divided pulse output or reduce rotational speed
Error code	Main	Sub	**Display:** "Er 290"	
	29	0	**Error description:** Control mode not match in full closed loop mode	
Cause			Diagnosis	Solution
Control mode is not position mode when full closed loop mode is on			Verify if P00.01 is set to 0	Make sure P00.01 is set to 0 – Position mode
Error code	Main	Sub	**Display:** "Er 291"	
	29	1	**Error description:** Encoder mode not match in full closed loop mode	
Cause			Diagnosis	Solution
Encoder mode not match in full closed loop			Only ABZ encoder is supported for the moment being	For external ABZ encoder, please set P00.31 = 0.

mode		

Error code	Main	Sub	**Display:** "Er 550" -- "Er 553"	
	55	0~3	**Error description:** Encoder mode not match in full closed loop mode	
Cause			Diagnosis	Solution
Er550: External ABZ encoder disconnected Er551: External encoder Phase A disconnected Er552: External encoder Phase B disconnected Er553: External encoder Phase Z disconnected			Verify if encoder cable is connected properly	1. Make sure encoder cable connection is tight 2. Change encoder cable 3. External encoder cable needs to be shielded

Error code	Main	Sub	**Display:** " Er 570"	
	57	0	**Error description:** Forced alarm input valid	
Cause			Diagnosis	Solution
Forced alarm input signal occurred			Verify forced alarm input signal	Verify if the input wiring connection is correct

Error code	Main	Sub	**Display:** "Er 5F0"	
	5F	0	**Content:** Motor model no. detection error	
Cause			Diagnosis	Solution
Automatically detected motor doesn't match set motor			/	Please contact our technical support

Error code	Main	Sub	**Display:** "Er 5F1"	
	5F	1	**Error description:** Driver power module detection error	
Cause			Diagnosis	Solution
Driver power rating not within range.			Restart driver	Please contact our technical support

Err or co	Main	Sub	**Display:** "Er 600"	
	60	0	**Error description:** Main loop interrupted timeout	
Cause			Diagnosis	Solution
The motor control loop calculation			Check for interference from devices releasing	Ground driver and motor to reduce interference

time overflow	electromagnetic field	
	Restart driver	Replace driver

Err or co	Main	Sub	**Display:** "Er 601"
	60	1	**Error description:** Velocity loop interrupted timeout

Cause	Diagnosis	Solution
Motor control loop calculation time overflow	Verify if encoder connection is and that the encoder cable is too not long (more than 20 meters)	Replace encoder cable if necessary
	Restart driver	Replace the drive with a new one

Err or co	Main	Sub	**Display:** "Er 700"
	70	0	**Error description:** Encryption error

Cause	Diagnosis	Solution
Encryption error during initialization upon power-on.	Restart driver	Please contact our technical support

Err or co	Main	Sub	**Display:** "Er 890"
	89	0	**Error description:** Homing error

Cause	Diagnosis	Solution
1. Excess homing velocity 2. Homing mode is different from given signal 3. Sensor signal edge inconsistent	1. Verify if homing velocity is too high 2. Verify if homing mode is set correctly 3. Verify if sensor signal edge is consistent	1. Set an optimal homing velocity 2. Make sure sensor signal edge is consistent.
Inconsistent origin status	1. Homing acceleration/ deceleration is set too low 2. Electronic gear ratio is low which causes acceleration/ deceleration to be too low	1. If electronic gear ratio cannot be changed, please set a suitable 609A. 2. Increase electronic gear ratio

Err or co	Main	Sub	**Display:** "Er 920"
	92	0	**Error description:** External encoder parameter initialization error

Cause	Diagnosis	Solution
Encoder parameter P00.37 setting error	Verify if P00.37 set value is out of range	Modify P00.37 set value, please use default value and see if the error still persists.

9.4 Alarm clearing

9.4.1 Servo Drive Alarm

For alarm can be cleared，There are 3 method.

Method 1：

1、By setting bit 7 of 6040h to 1, switches state machine from fault to initialization completion , No fault(Switch on disabled).

Method 2：

Use auxiliary function “AF_ACL”

1、Press M to select auxiliary function , Press SET to enter into “AF_ACL” , Press and hold to clear the alarm

Method 3：

Set IO input function as Alarm clear input “ (A-CLR)”，refer to switch input interface connection to clear the alarm.

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