



# EL7-RS Series AC Servo Drive

## User Manual



## Foreword

Thank you for purchasing Leadshine EL7-RS series AC Servo drives. This manual will provide information on the EL7-RS series servo products regarding product safety & specifications, installations & wiring, tuning & problem diagnostics.







*Please contact us at [tech@leadshine.com](mailto: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.

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

### Safety instructions



- ✓ 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



- ✓ 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](http://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

EL7-RS Series AC Servo Product is a whole new midrange AC servo drivers and motors product range that we have proudly developed at Leadshine Technology Co.,Ltd. This product series provides more in demanded functionalities and control. While designing this AC servo drive series with cost concerns in mind, this product series doesn't compromise in term of performance and functions.

EL7-RS Series AC Servo Drive comes with power rating from 400W up to 7500W which supports Modbus communication protocol in addition to analogue and pulse + direction input control. Using RS485 protocol, multi axis network of EL7-RS series servo drive can be realized and controlled from 1 single master device.

EL7-RS series AC Servo Drive is equipped with easy servo tuning (One-click Tuning/ Single Parameter Tuning), Zero Tracking Control (ZTC), vibration suppression and many more. This AC servo drive series also comes with new AC servo motors with 23-bit optical/magnetic encoder which offers better accuracy and stability.

First time user of the EL7-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.

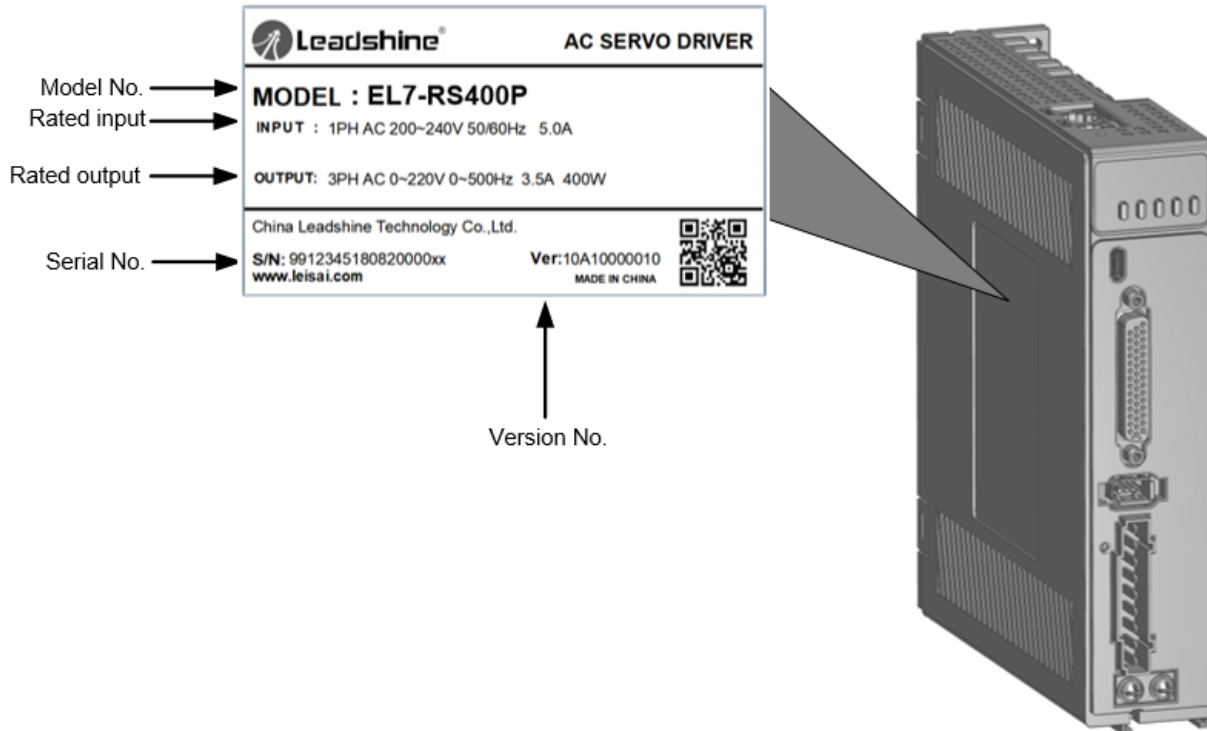
## 1.2 Model number structure

### 1.2.1 Servo Drive

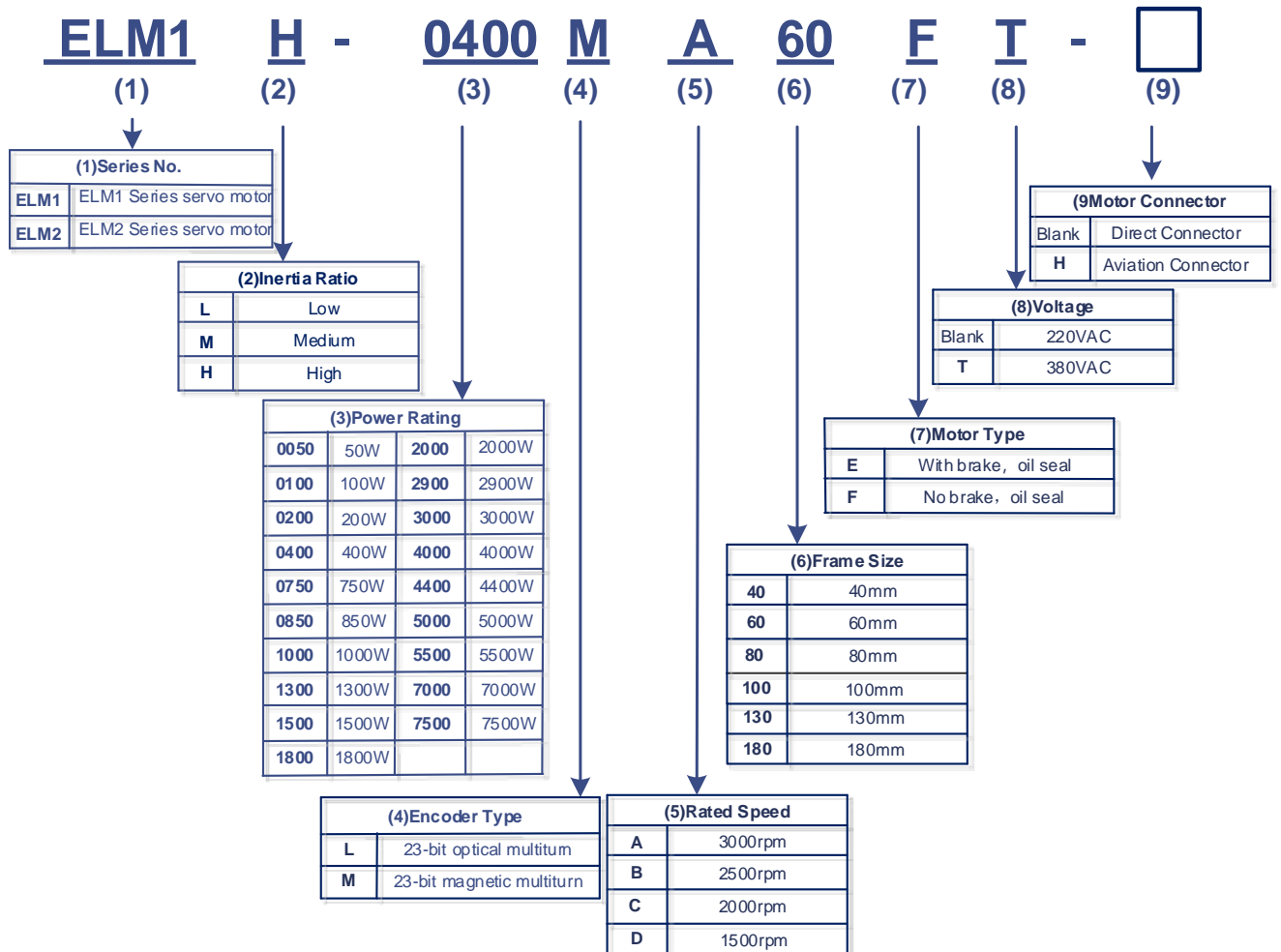


No.	Description	
①	Series No.	EL7: EL7 AC Servo Drive Series
②	Communication protocol	RS: Pulse train + RS485 + Analogue EC: EtherCAT
③	Power Rating	400: 400W    750: 750W    1000: 1000W 1500: 1500W    2000: 2000W    3000: 3000W 4400: 4400W    5500: 5500W    7500: 7500W
④	Type	P: Full functions without STO F: Full functions with STO
⑤	Input Voltage	Blank: 220VAC T:400VAC

#### Driver Label



## 1.2.2 Servo motor



## 1.3 Servo Drive Technical Specifications

### EL7-RS 220V Models

EL7-RSP Series Driver	EL7-RS400P	EL7-RS750P	EL7-RS1000P	EL7-RS1500P	EL7-RS2000P
<b>Power Rating</b>	400W	750W	1000W	1500W	2000W
<b>Rated Current (Arms)</b>	3.5	5.5	7.0	9.5	12
<b>Peak Current (Arms)</b>	9.5	16.6	18.7	31.1	36
<b>Control circuit power supply</b>	1-Ph AC 200V-240V, -10% - +10%, 50/60Hz				
<b>Main power supply</b>					
<b>Cooling method</b>	Air-cooled	Fan-cooled			
<b>Dimension H*L*W(mm)</b>	175*156*40	175*156*50		175*156*80	

### EL7-RS 400V Models

EL7-RSFT series	EL7-RS750FT	EL7-RS1000FT	EL7-RS1500FT	EL7-RS2000FT	EL7-RS3000FT	EL7-RS4400FT	EL7-RS5500FT	EL7-RS7500FT
<b>Rated Power(W)</b>	750	1000	1500	2000	3000	4400	5500	7500
<b>Rated Current (Arms)</b>	2.7	3.5	5.4	8.4	11.9	16.5	20.8	25.7
<b>Peak Current (Arms)</b>	8.6	10.6	14.9	24.8	33.2	38.9	51.6	33.6
<b>Size (mm)</b>	55*175*179			80*175*179		89*250*230		
<b>Main Power Supply</b>	Three phase AC 380V~440V, -15%~+10%, 50/60Hz							
<b>Control Circuit Power Supply</b>	Single phase AC 380V~440V, -15%~+10%, 50/60Hz							

Port	Descriptions
<b>USB Type-C Tuning</b>	Modify or read driver parameters without connecting to main power supply
<b>Low-speed pulse input</b>	5V differential signal, 0-500kHz 24V single ended signal, 0-200kHz
<b>High-speed pulse input</b>	5V differential signal, 0-4MHz
<b>Crossover Frequency Output</b>	Supports phase A/B/Z differential crossover frequency output Supports phase Z open collector crossover frequency output
<b>Analog Input</b>	2 analog inputs (AI1/AI2) , -10V~+10V, Max. voltage: ±12V
<b>Analog Output</b>	1 analog output (AO1) , -10V~+10V
<b>Digital Input</b>	8 Digital Inputs (Supports common anode or cathode connection) DI1~DI8 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)

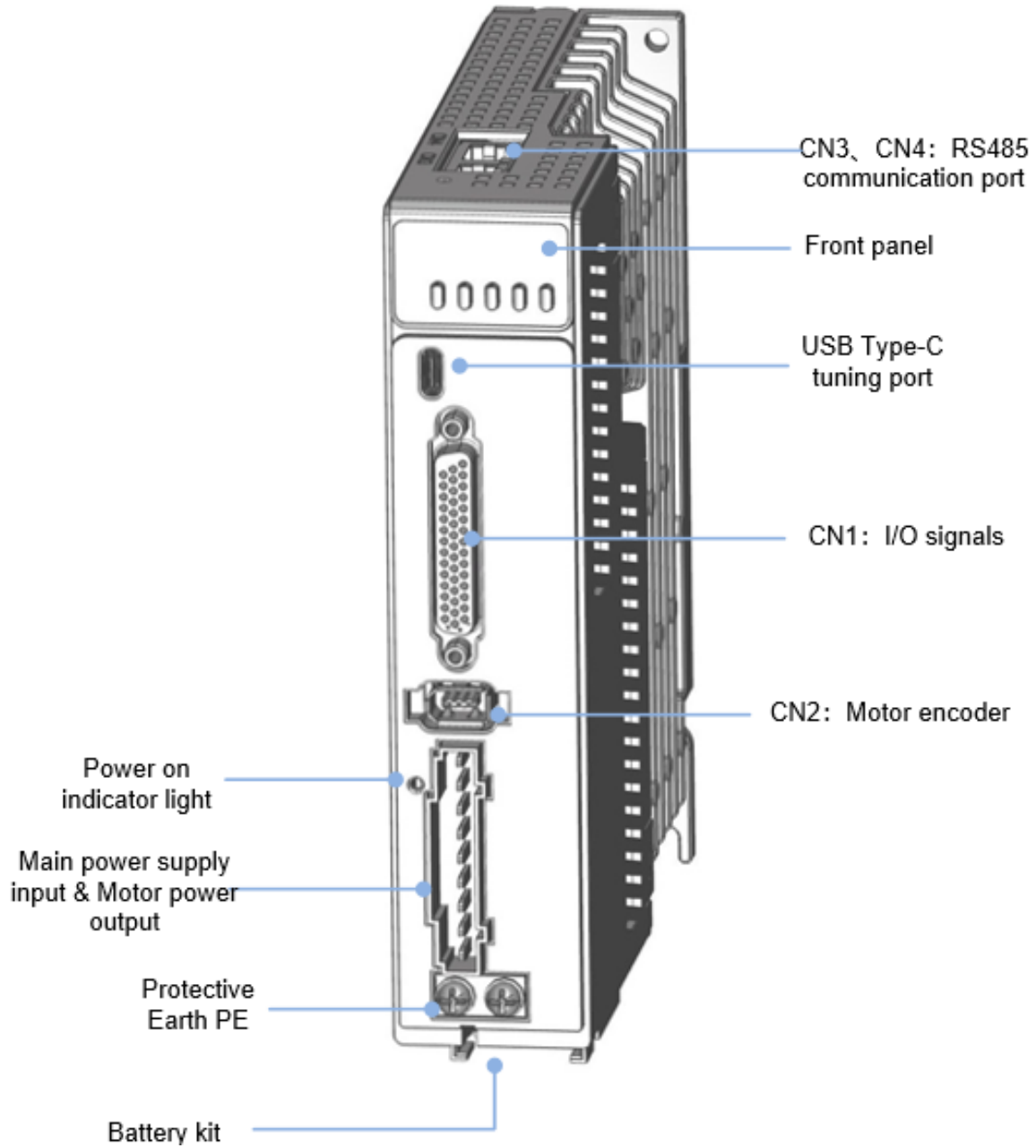
	18. Torque sign (TC-SIGN) 19. Clear Alarm (A-CLR) 20. Speed Regulation (SPDREG) <i>Under PR mode</i> 1. Path trigger (CTRG) 2. Home switch (HOME) 3. Emergency stop trigger (STP) 4. Path 0-3 (ADD0-ADD3) 5. Positive JOG (PJOG) 6. Negative JOG (NJOG) 7. Positive limit switch (PL) 8. Negative limit switch (NL) 9. Origin (ORG)	
<b>Digital Output</b>	5 digital outputs (double-ended) DO1~DO5 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) <i>Under PR mode</i> 1. Command completed (CMD-OK) 2. Path completed (PR-OK) 3. Homing done (HOME-OK)	
<b>Communication Port</b>	RS485 communication, Modbus RTU protocol (RJ45 port)	
<b>Control Mode</b>		
<b>Control</b>	1. External pulse train position control 2. JOG control 3. Velocity control 4. Torque control 5. Hybrid control: Position-Torque/Position-Velocity/Velocity-Torque	
<b>Position</b>	<b>Pulse frequency</b>	<ul style="list-style-type: none"> <li>• 4MHz (5V differential input)</li> <li>• 500kHz (5V differential input)</li> <li>• 200kHz (24V single-ended input)</li> </ul>
	<b>Electronic gear ratio</b>	(1~8388608) / (1~8388608)
	<b>Torque limit</b>	<i>Please refer to parameter settings</i>
<b>Control Features</b>		
<b>Drive Mode</b>	IGBT SVPWM sinusoidal wave drive	
<b>Feedback Method</b>	Encoder: RS485 Protocol	
<b>Standardized Parameters</b>	Quick tuning of servo driver parameters can be achieved through PC tuning tools.	
<b>Easy-to-use</b>	One-click tuning, Single parameter tuning, Black box, Zero tracking control	
<b>Notch Filter</b>	Mechanical resonance suppression. Supports up to 3 filters, 50Hz~4000Hz	

<b>Vibration suppression</b>	End vibration suppression	
<b>DI/DO settings</b>	Digital inputs and outputs are user-configurable	
<b>Alarm</b>	Overcurrent. Overvoltage. Undervoltage. Overheat. Overload. Overtravel. Single-Phasing. Regenerative resistor error. Position deviation error. Encoder feedback error. Excessive braking rate. EEPROM error	
<b>Front Panel</b>	5 push buttons, 8-segments display	
<b>Software</b>	Driver tuning through <b>Motion Studio</b> 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'	
<b>Communication</b>	<b>USB Type-C</b>	Modbus USB2.0 (No need to connect driver to power supply)
	<b>Modbus</b>	RS485 communication, Modbus RTU protocol (RJ45 port). Communication up to 32 axes to a host.
<b>Dynamic Brake</b>	Internal dynamic brake	
<b>Black Box</b>	Set triggering conditions and analyze the data from black box. Used for error solving	
<b>Suitable Load Inertia</b>	30 times smaller than motor inertia	
<b>Environmental requirements</b>		
<b>Temperature</b>	Storage: -20-80°C (Condensation free); Not < 72 hours if stored in over 65°C Installation: 0-55°C (Not frozen); Lower performance at over 45°C	
<b>Humidity</b>	Under 90%RH (Condensation free)	
<b>Altitude</b>	Max. altitude of 2000m; 100% performance at 1000m or below. Performance decreases by 1% with every increase of 100m from 1000m.	
<b>Vibration</b>	Less than 0.5G (4.9m/s <sup>2</sup> ) 10-60Hz (non-continuous working)	
<b>IP ratings</b>	IP20	

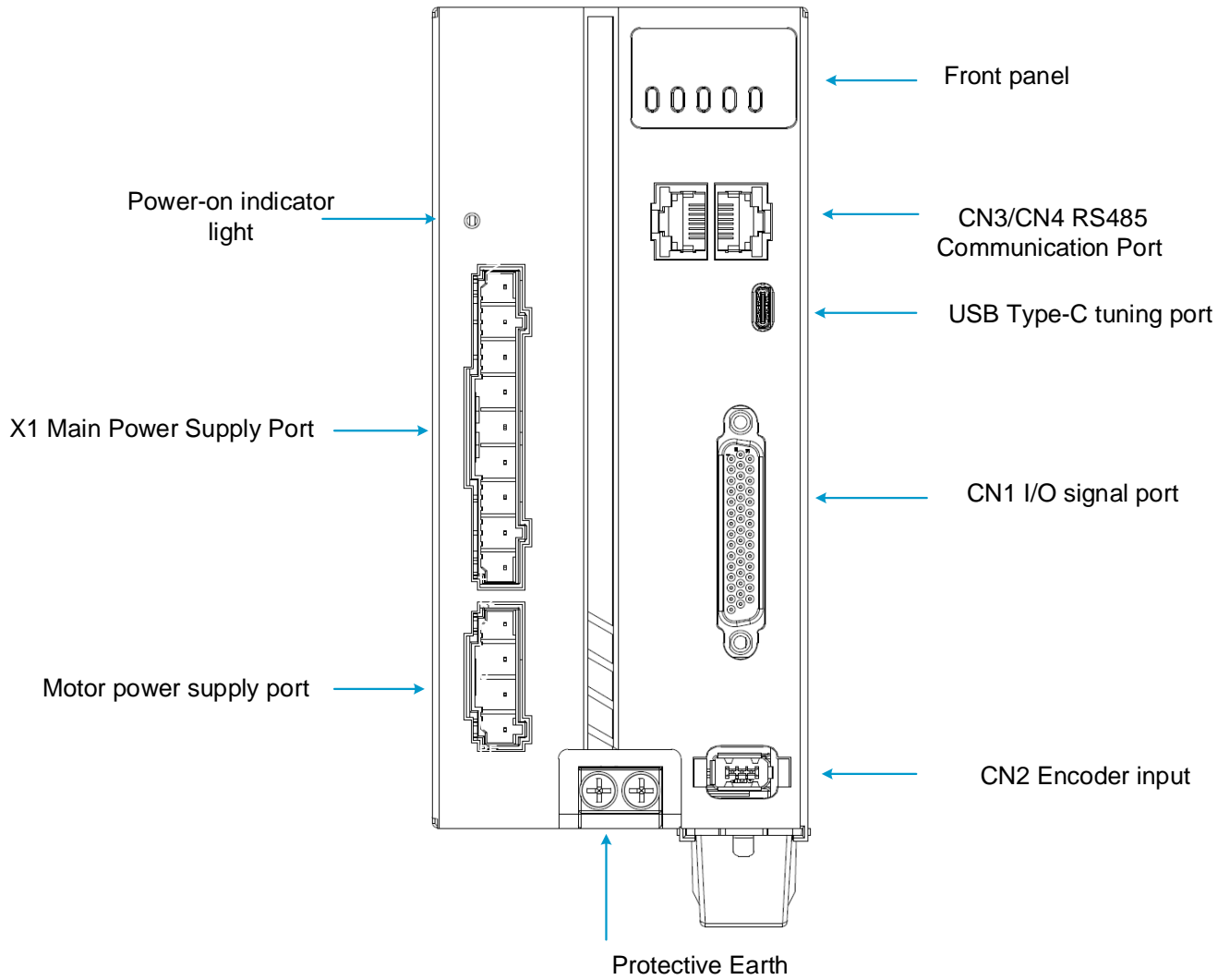
## 1.4 Servo Drive Ports and Connectors

EL7-RS Series Servo Drive

220V Models



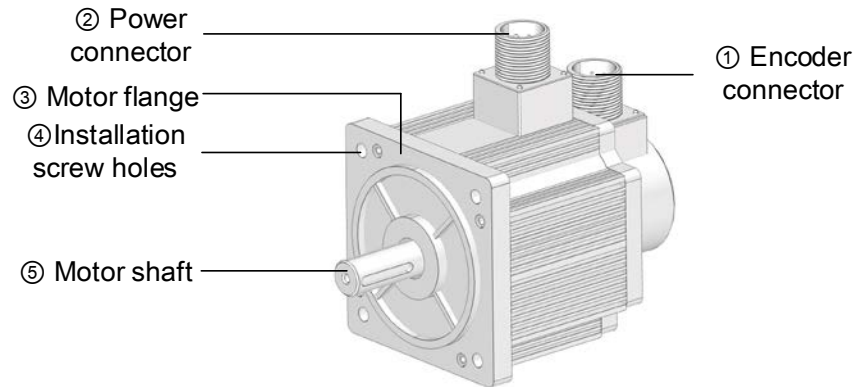




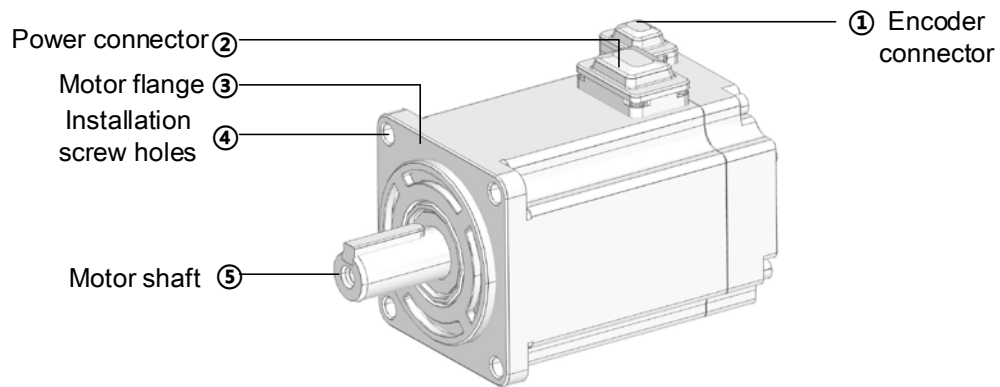
Parts & Connectors	Description
Front Panel	Including a LED display and 5 buttons. LED display is used to display servo drive status and parameter settings. 5 buttons: <b>M</b> : <i>To switch between different modes and parameters</i> ◀ : <i>Switch between value</i> ▲ : <i>Switch between sub-menus/Increase</i> ▼ : <i>Switch between sub-menus/Decrease</i> <b>S</b> : <i>Enter</i>
USB Type-C Tuning Port	Connect to computer for tuning of servo drive. Parameters of the servo drive can be modified without connecting to main power supply.
CN1 I/O signal	Probe input signal & other I/O signals terminals
CN3/CN4 RS485 communication port	Connect to master device or next/previous slave station
CN2 Encoder	Connect to motor encoder
Power-on indicator light	Lights up when servo drive is connected to main power supply. <i>Please do not touch the power terminal immediately after power off as the capacitor might require some time to discharge.</i>
<b>EL7-RS 220V models</b>	
L1, L2	Main power supply 220VAC
P+, Br	Connect to regenerative resistor
P+, N	Common DC bus terminals for multiple drivers
U, V, W	Motor connector: Connect to U,V,W power terminals on servo motor
PE	PE motor earth terminal: Connect to motor PE terminal
<b>EL7-RS 400V models</b>	
L1C, L2C	Control circuit power supply input – 1ph 400VAC
R, S, T	Main power supply input – 3ph 400VAC
P+	DC bus positive terminal. Connect to regenerative resistor
B1, B2	Please short connect B1 and B2 when using internal regenerative resistor. If external regenerative resistor is required, remove the short connector between B1 and B2, connect the external regenerative resistor to P+ and B2.
N	DC bus negative terminal. Do not connect.
N1, N2 (4.4/5.5/7.5kW models)	N1 and N2 are short connected. Connect N1 and N2 after removing short connector to a DC reactor to suppress electrical current high harmonics.
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

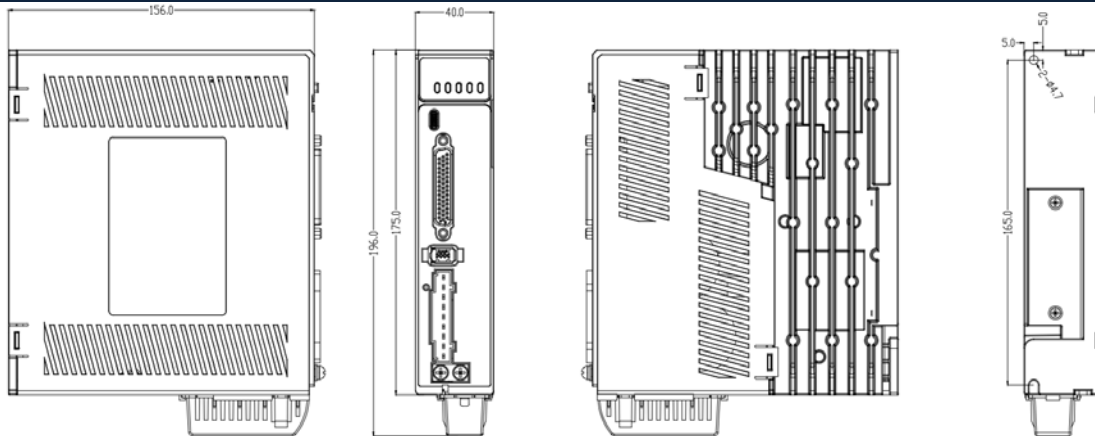
### 2.1 Servo Drive Installation

#### 2.1.1 Servo drive installation environment

<b>Temperature</b>	Storage: -20-80°C (Condensation free); Installation: 0-55°C (Not frozen)
<b>Humidity</b>	Under 90%RH (Condensation free)
<b>Altitude</b>	Up to 1000m above sea level
<b>Vibration</b>	Less than 0.5G (4.9m/s <sup>2</sup> ) 10-60Hz (non-continuous working)
<b>Atmospheric</b>	No corrosive gas, combustibles, dirt or dust.
<b>IP ratings</b>	IP20

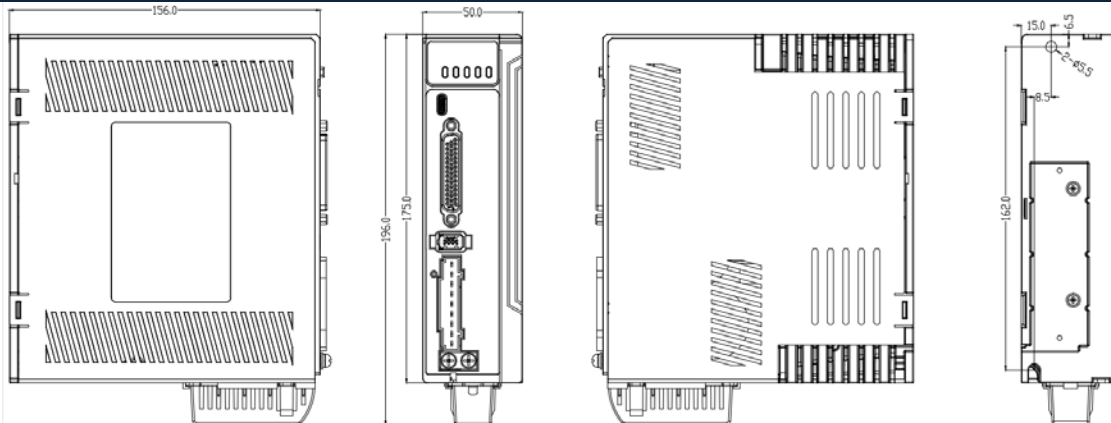
#### 2.1.2 Servo drive dimension

##### Dimension 1: EL7-RS400P

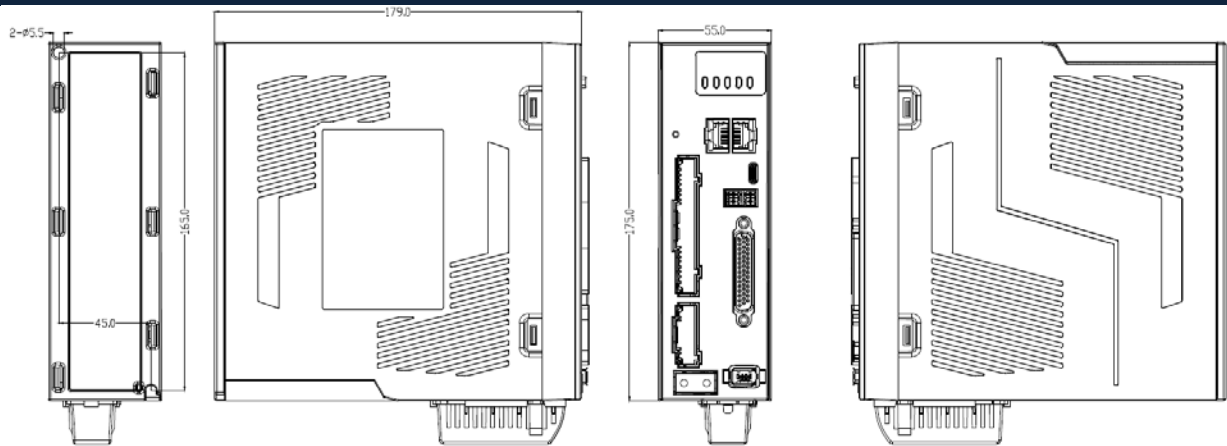


175mm x 156mm x 40mm

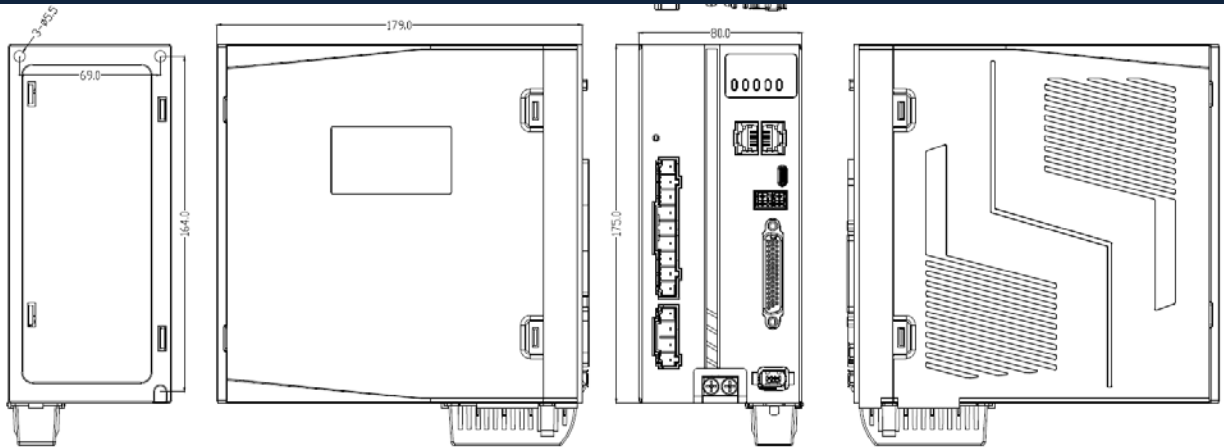
##### Dimension 2: EL7-RS750/1000P



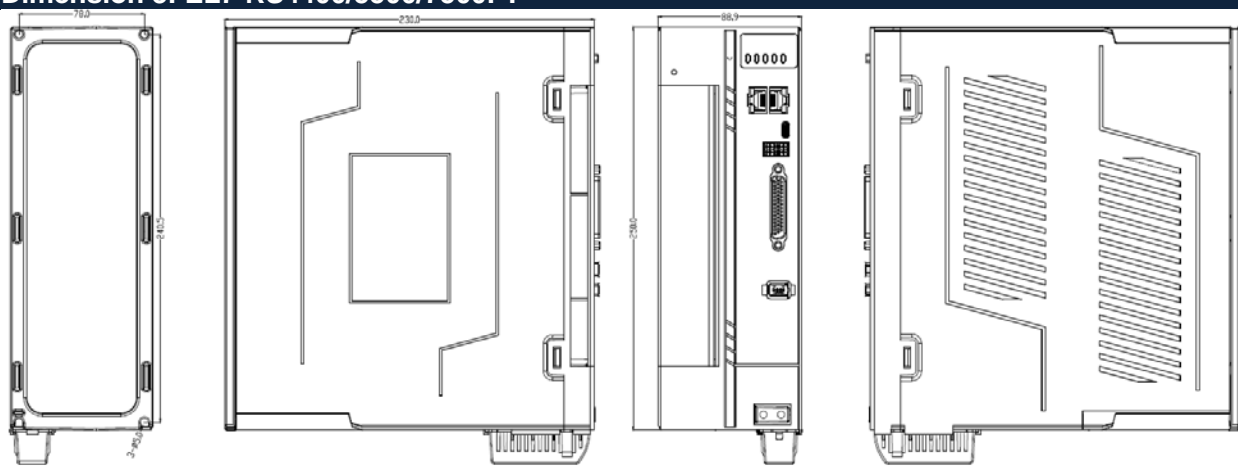
175mm x 156mm x 50mm

**Dimension 3: EL7-RS750/1000/1500FT**


175mm x 179mm x 55mm

**Dimension 3: EL7-RS2000/3000FT / EL7-RS1500/2000P**


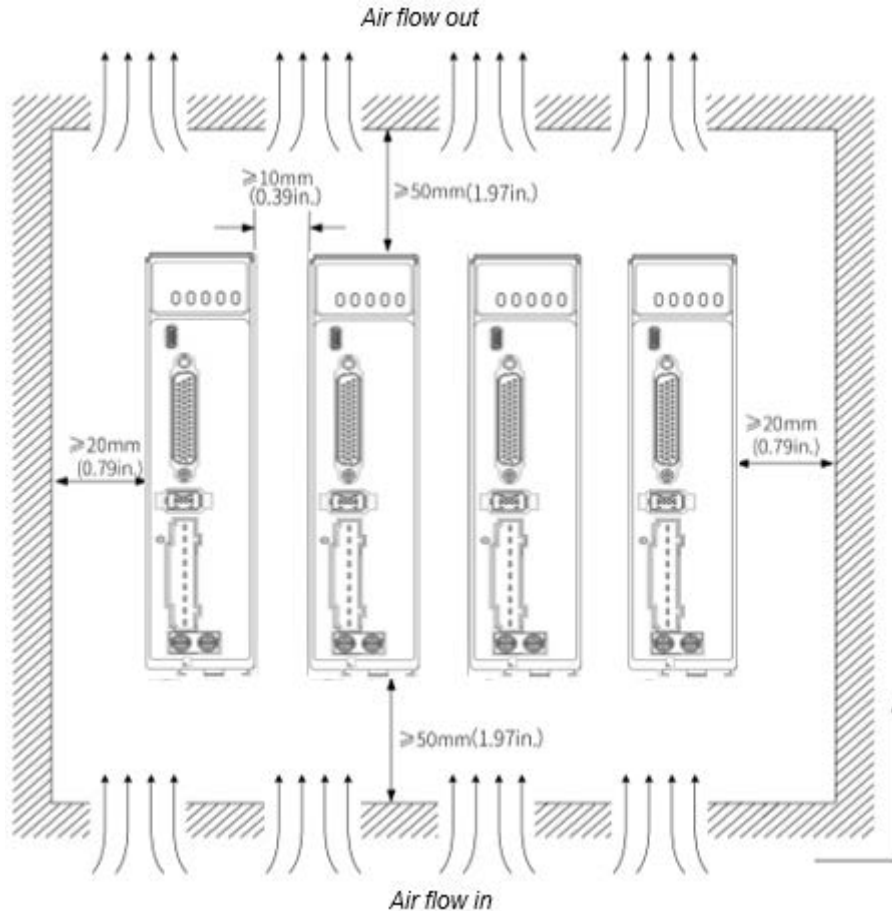
175mm x 179mm x 85mm

**Dimension 3: EL7-RS4400/5500/7500FT**


250mm x 230mm x 89mm

### 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 least 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

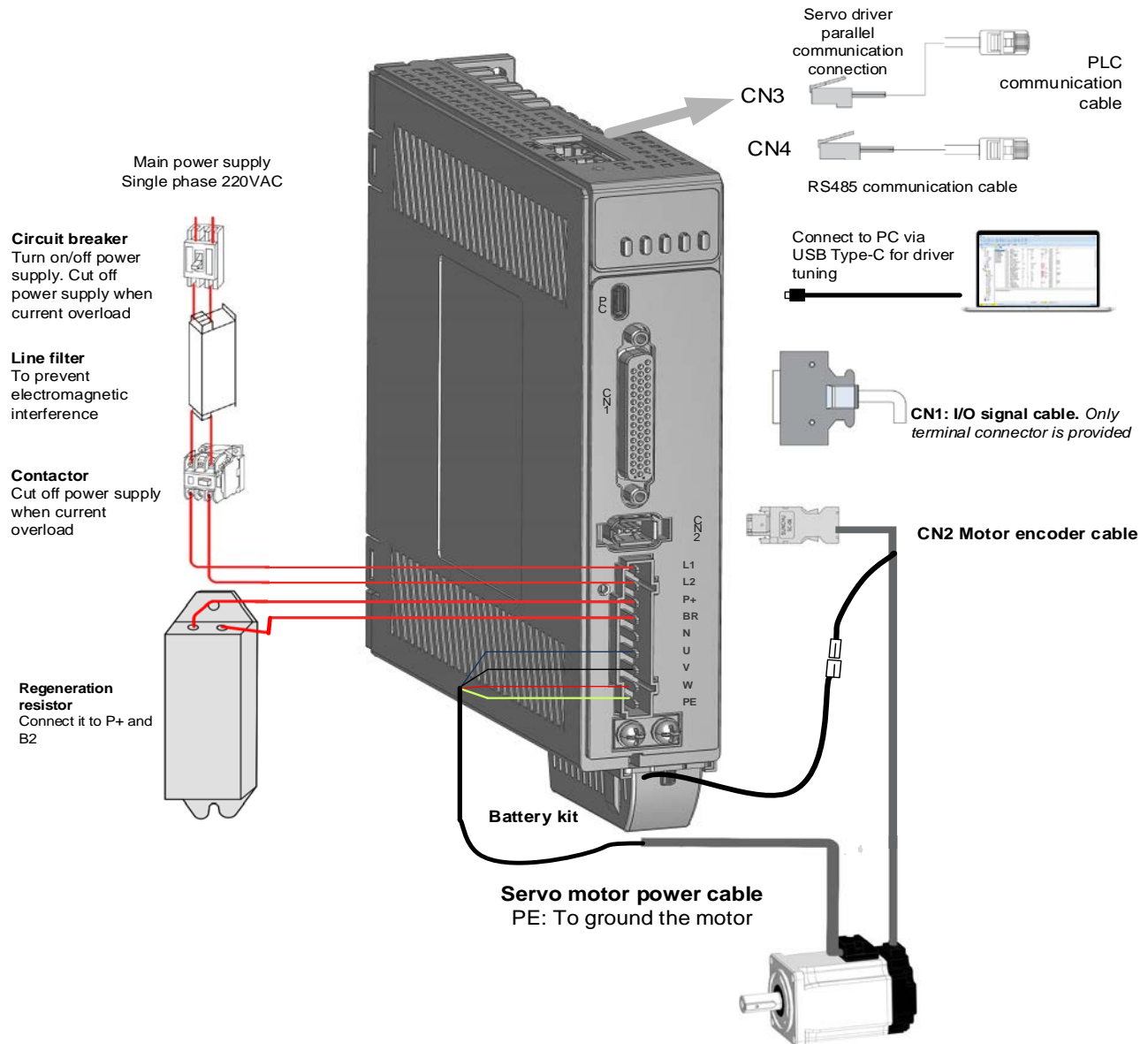
- Please to remove any conductive foreign objects from the connectors before installation
- The connectors are made of resin. May not withstand impact.
- Please hold the driver during transportation, not the cables.
- Leave enough "bend" on the connector cables to ensure less stress upon installation.

#### 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 EL7-RS Wiring Diagram

### EL7-RS 220VAC Wiring Diagram

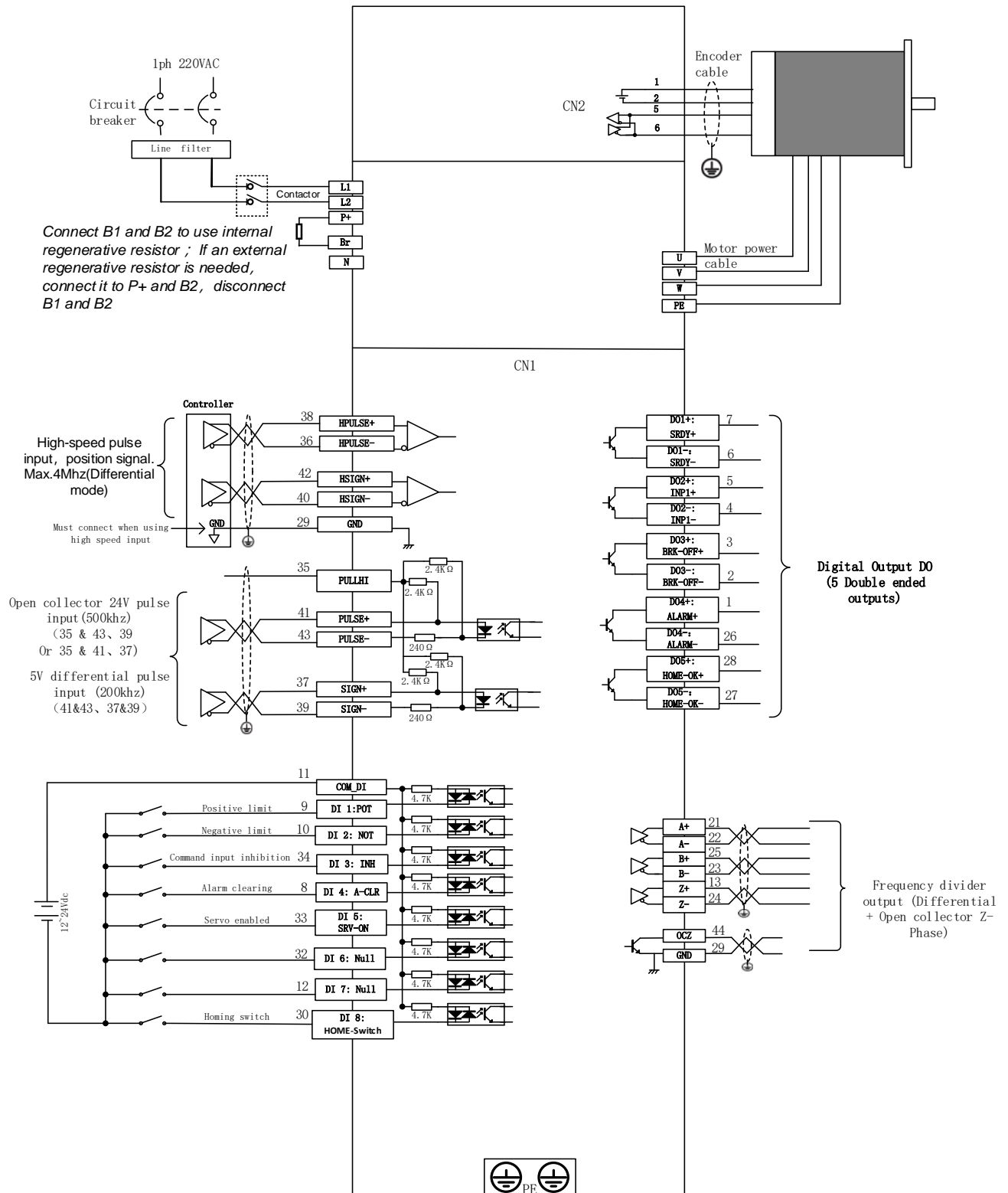


- EL7-RS series servo drive supports single phase and three phase 220VAC. Only driver with power rating above 1500W supports three phase 220VAC.
- Please use a circuit breaker for the main power supply to prevent damage to the product or machine.
- Please do not use a contactor in connection to servo motor as it may not withstand a sudden surge of operating voltage.
- Please take note of the capacity when connect to a 24VDC switching power supply, especially if power supply is shared between multiple components. Insufficient supply current will cause failure in holding brake functions.



## 2.3.1 Position Control Mode Wiring Diagram

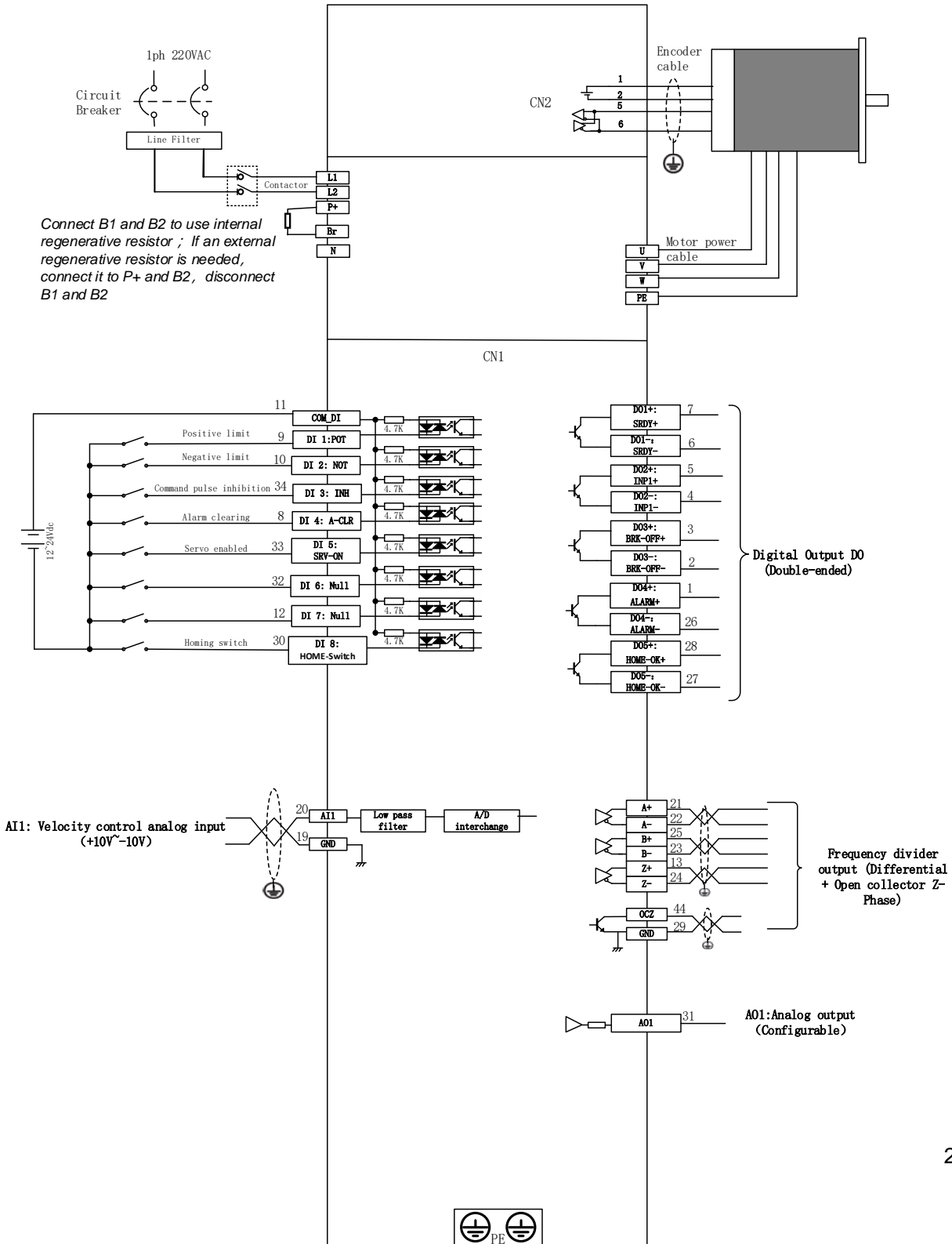
### Position control mode wiring diagram

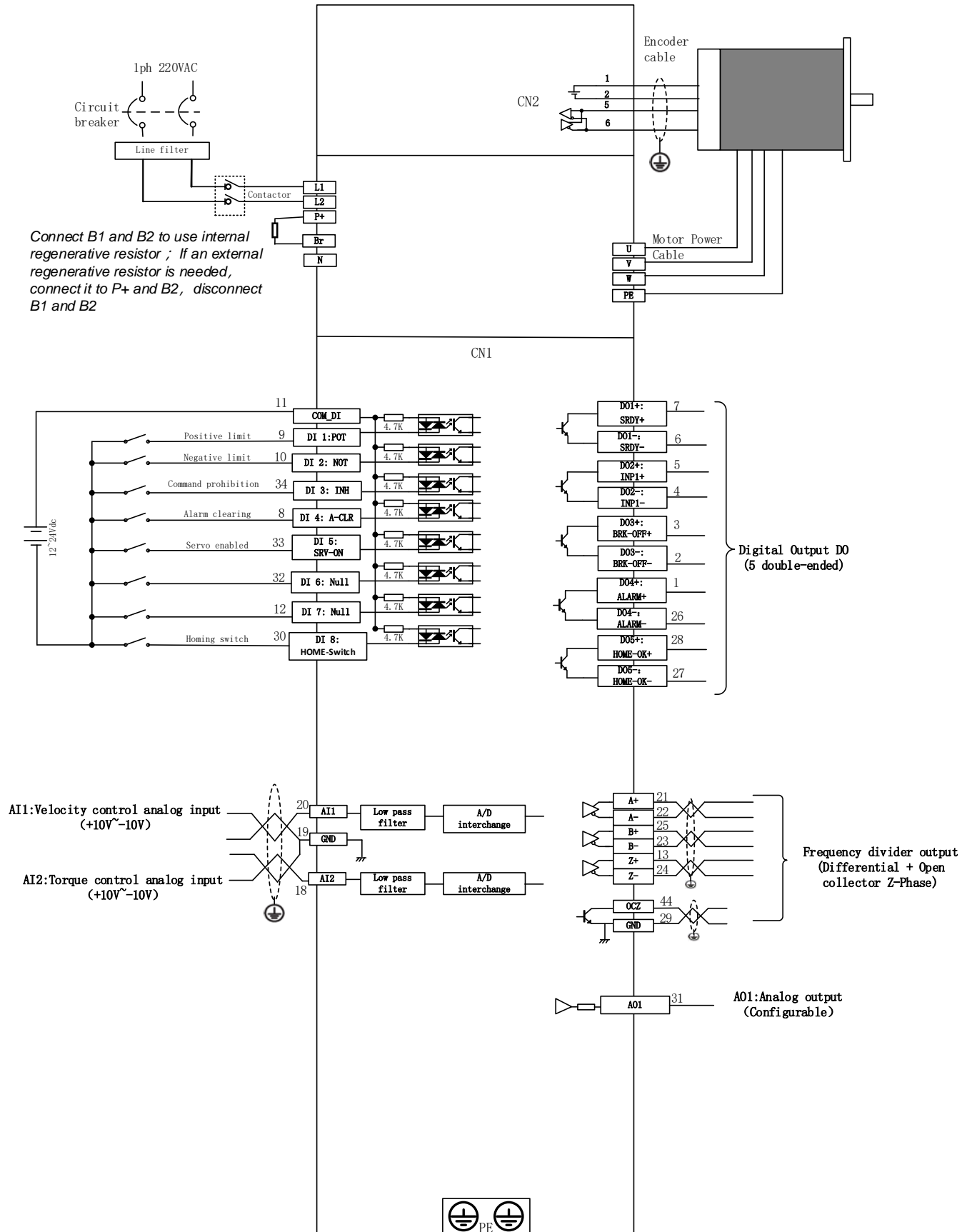


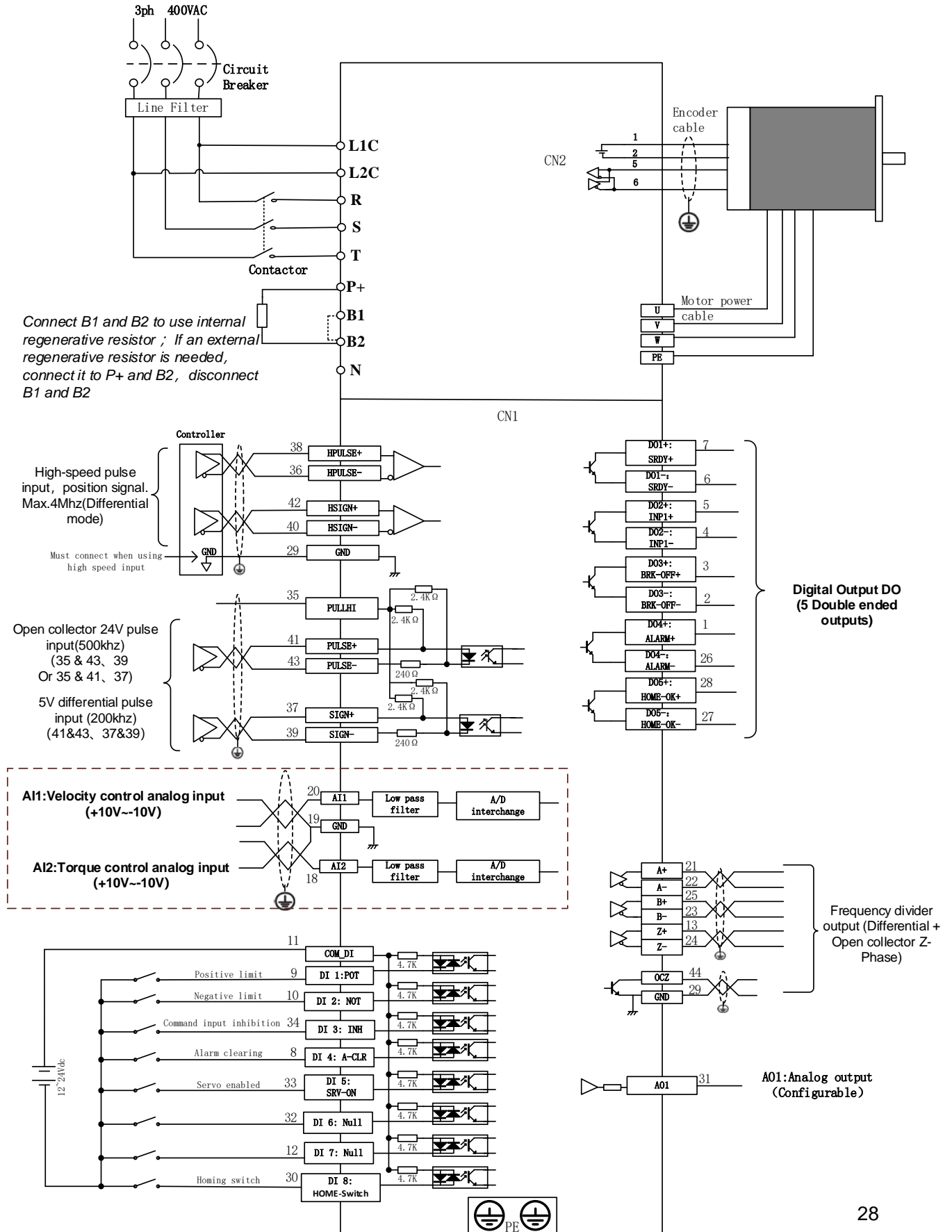
Note: Please set Pr0.05 to 1 when using high speed pulse command (max. 4 MHz)

## 2.3.2 Velocity/Torque Control Mode Wiring Diagram

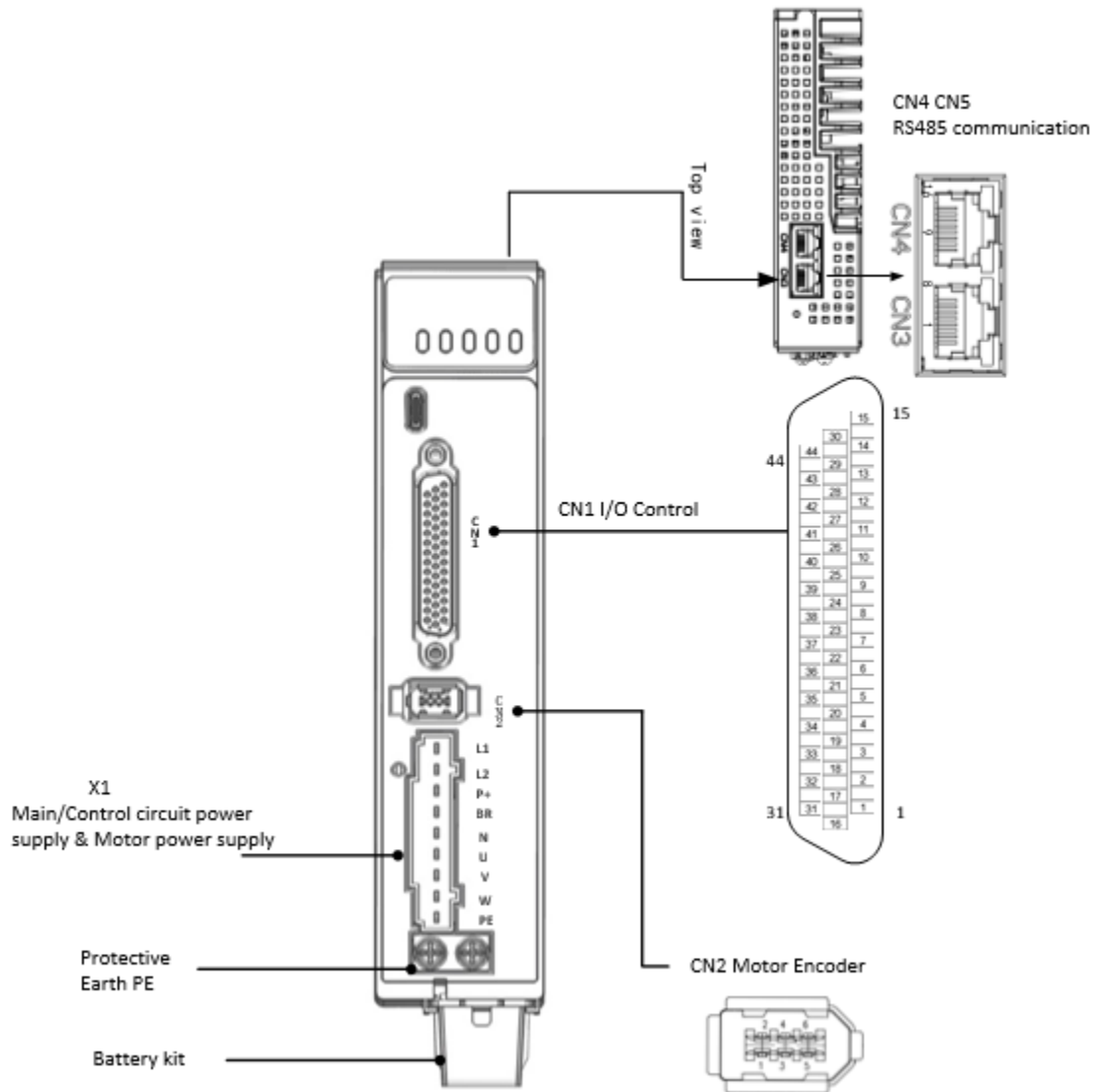
### Velocity control mode wiring diagram



**Torque control mode wiring diagram**


**EL7-RSPT(3ph 400VAC drives) wiring diagram**


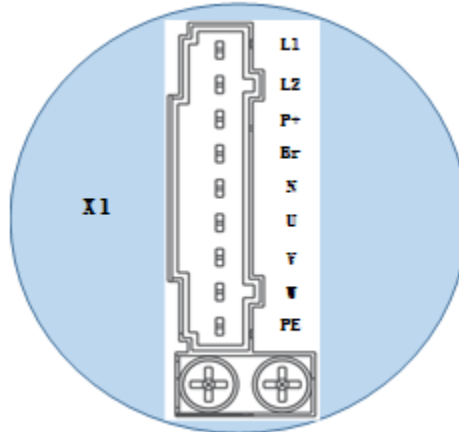
## 2.4 Servo Drive Ports



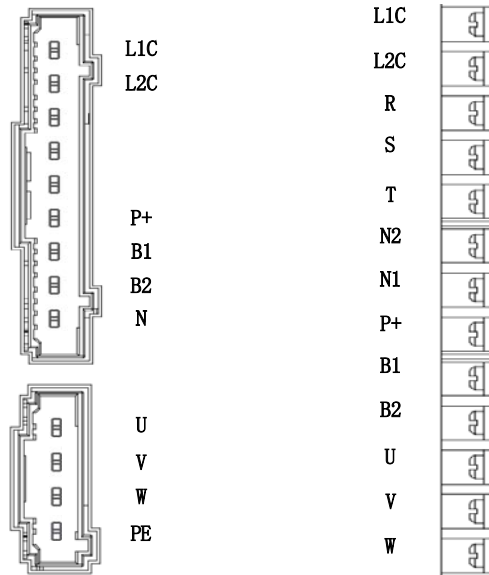
Connector	Label
CN1	I/O signal connector (DB 44PIN)
CN2	Motor encoder feedback
CN3	RS485 Communication port
CN4	RS485 Communication port
X1	Main circuit power supply/ Motor power output
PC	USB type C tuning port
PE	Protective Earth for grounding

## 2.5 X1 Main power supply

### EL7-RS Series – 220V Models



Port	Pin	Functions	Remarks
X1	L1	Single phase 220VAC, +10~- 15%, 50/60Hz	① Optional isolation transformer ② Do not connect to 400VAC directly to prevent damage to driver. ③ In case of serious interference, it is recommended to connect a line filter to main power supply; <i>It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.</i>
	L2		
	P+	① Internal DC bus positive terminal ② External regenerative resistor P terminal	Please refer to 2.10 Regenerative resistor selection and connections
	Br	External regenerative resistor terminal	
	N		Please do not connect
	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	

**EL7-RS Series – 400V 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; <i>It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.</i>
	L2C		
	R	Main Power Supply: Three phase 380VAC, +10 ~ -15%, 50/60Hz	
	S		
	T		
	P +	③ Internal DC bus positive terminal ④ 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

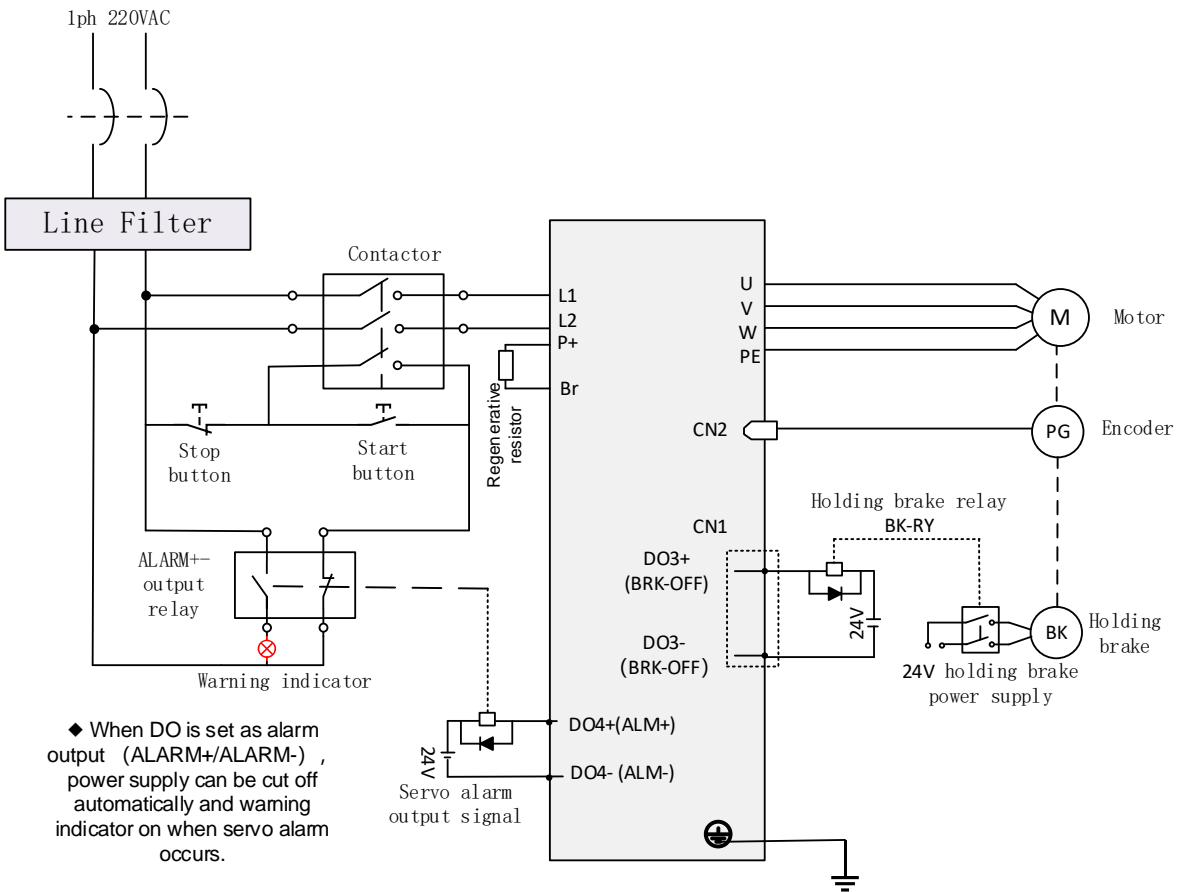
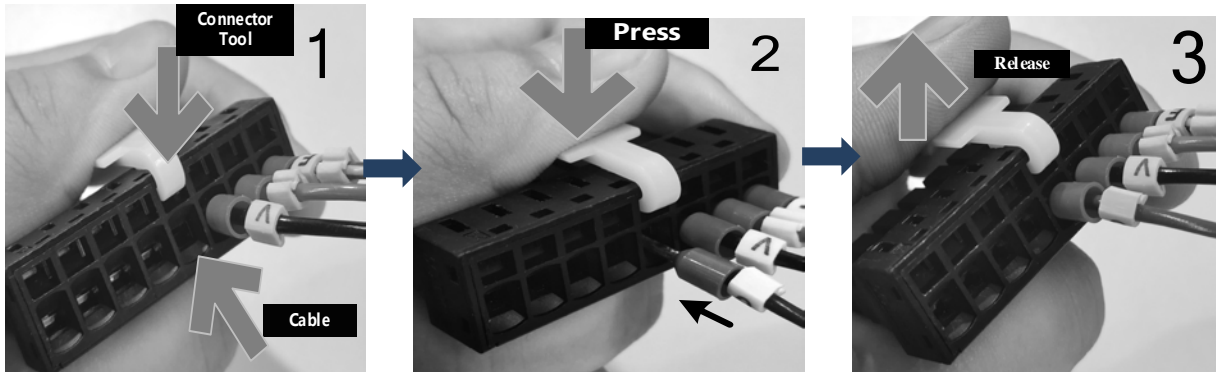
### Main Power Supply Cable

- **Wire diameter:** Wire diameter differs according to the power rating of the servo drives. Please refer to the table below.

Driver	Wire diameter (mm <sup>2</sup> /AWG)			
	L1 L2/R S T	P+ BR	U V W	PE
EL7-RS400P	0.81/AWG18	2.1/AWG14	1.3/AWG16	2.1/AWG14
EL7-RS750P	0.81/AWG18	2.1/AWG14	1.3/AWG16	2.1/AWG14
EL7-RS1000P	0.81/AWG18	2.1/AWG14	2.1/AWG14	2.1/AWG14
EL7-RS750PT	1.3/AWG16	2.1/AWG14	1.3/AWG16	2.1/AWG14
EL7-RS1000PT	2.1/AWG14	2.1/AWG14	2.1/AWG14	2.1/AWG14
EL7-RS1500PT	2.1/AWG14	2.1/AWG14	2.1/AWG14	2.1/AWG14
EL7-RS2000PT	2*0.75/AWG18	1.5/AWG16	3*1.5/AWG16	1.5/AWG16
EL7-RS3000PT	2*0.75/AWG16	1.5/AWG16	3*1.5/AWG16	1.5/AWG16
EL7-RS4400PT	2*0.75/AWG16	4.0/AWG12	3*4.0/AWG12	4.0/AWG12
EL7-RS5500PT	2*0.75/AWG14	4.0/AWG12	3*4.0/AWG12	4.0/AWG12
EL7-RS7500PT	2*0.75/AWG12	4.0/AWG12	3*4.0/AWG12	4.0/AWG12

- **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.



**Wiring diagram for models using single phase 220VAC 400/750/1000W**

**To fix wire cables into connector**


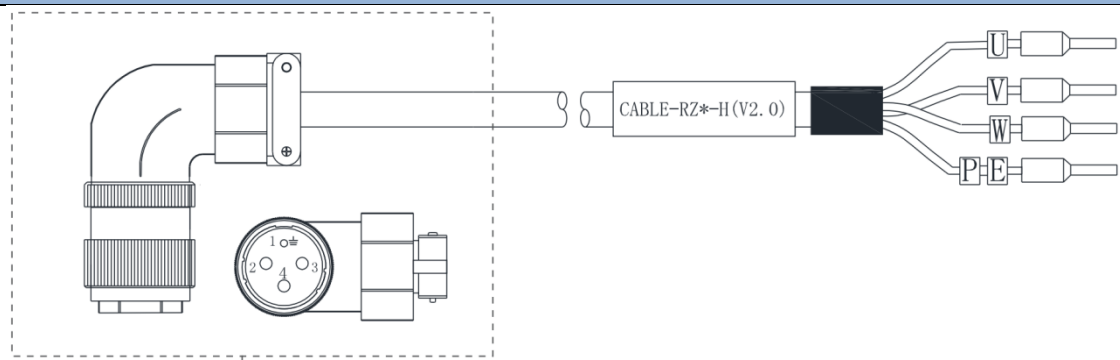
## 2.5.2 Motor Power Supply Cable Selection (Without Brake)

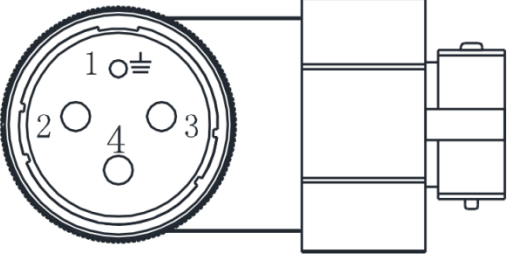
### Motor winding power cable

- 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.

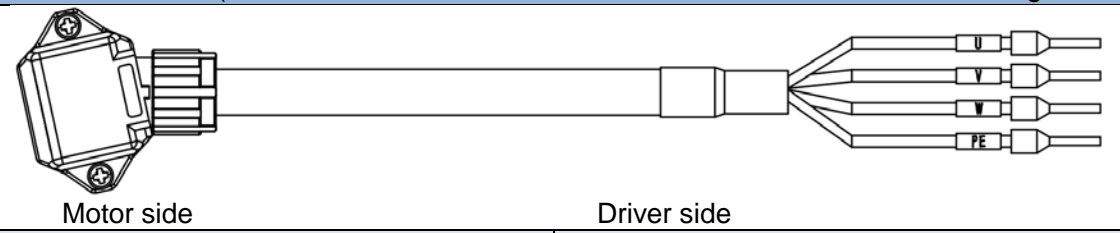
\*M\*: Length of the cable

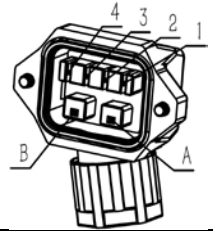
Aviation connector (Frame size 130) CABLE-RZ\*H(V1.1/V2.0)



Motor side	Driver side															
Motor cable pin	Pins															
 <p style="text-align: center;">Motor side</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Motor</th> <th>Color</th> <th>Driver</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Red</td> <td style="text-align: center;">U</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">Green</td> <td style="text-align: center;">V</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Black</td> <td style="text-align: center;">W</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">Yellow</td> <td style="text-align: center;">PE</td> </tr> </tbody> </table>	Motor	Color	Driver	1	Red	U	3	Green	V	2	Black	W	4	Yellow	PE
Motor	Color	Driver														
1	Red	U														
3	Green	V														
2	Black	W														
4	Yellow	PE														

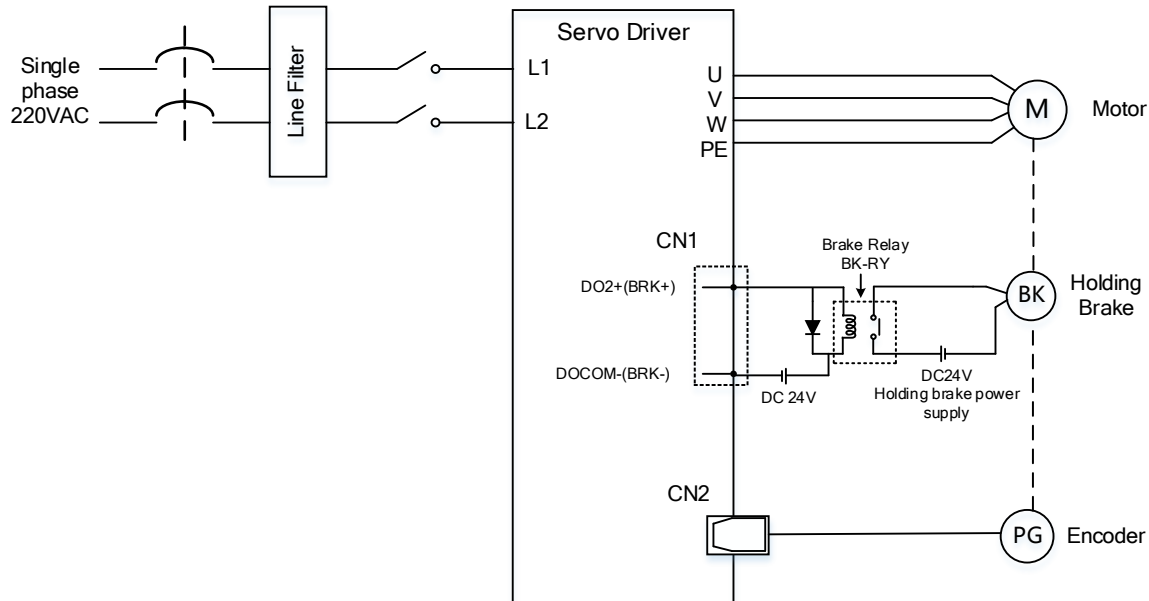
Direct connector(Frame size 80 or below) CABLE-RZH\*M\*-114-TS *without holding brake*



Motor side	Driver side															
Driver cable pin	Pins															
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Motor</th> <th>Color</th> <th>Driver</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Blue</td> <td style="text-align: center;">U</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Black</td> <td style="text-align: center;">V</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">Red</td> <td style="text-align: center;">W</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">Yellow- green</td> <td style="text-align: center;">PE</td> </tr> </tbody> </table>	Motor	Color	Driver	1	Blue	U	2	Black	V	3	Red	W	4	Yellow- green	PE
Motor	Color	Driver														
1	Blue	U														
2	Black	V														
3	Red	W														
4	Yellow- green	PE														

### 2.5.3 Holding Brake Wiring Diagram

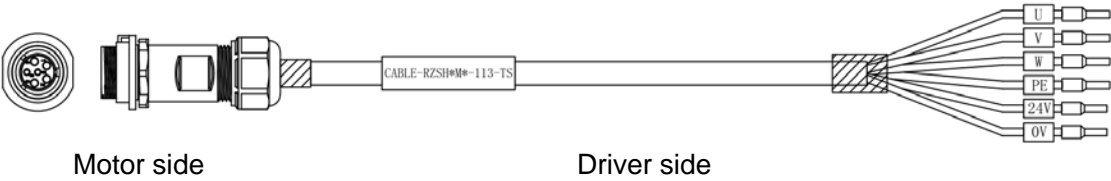
Holding brake is activated when servo drive is not powered on to prevent axis from moving due to gravitational pull or other external forces by locking the motor in place. Usually used on axis mounted vertically to the ground so that the load would not drop under gravitational force when the driver is powered off or when alarm occurs.



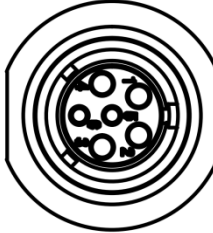
*Holding brake wiring diagram*

### 2.5.4 Motor Power Supply Cable (With Holding Brake)

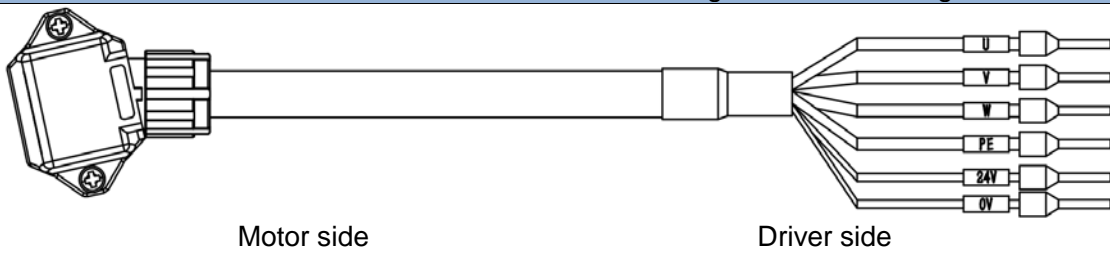
Aviation connector (Frame size 80 or below) CABLE-RZSH\*M\*-113-TS Winding cable with holding brake



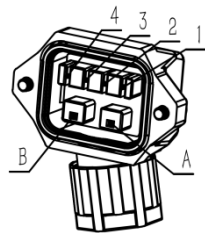
Motor side Driver side

Motor cable pin	Pins																					
 Motor side	<table border="1" style="border-collapse: collapse;"> <thead> <tr> <th>Motor</th> <th>Color</th> <th>Driver</th> </tr> </thead> <tbody> <tr><td>1</td><td>Blue</td><td>U</td></tr> <tr><td>2</td><td>Red</td><td>W</td></tr> <tr><td>3</td><td>Black</td><td>V</td></tr> <tr><td>4</td><td>Yellow-green</td><td>PE</td></tr> <tr><td>5</td><td>Black</td><td>0V</td></tr> <tr><td>6</td><td>Red</td><td>24V</td></tr> </tbody> </table>	Motor	Color	Driver	1	Blue	U	2	Red	W	3	Black	V	4	Yellow-green	PE	5	Black	0V	6	Red	24V
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5	Black	0V																				
6	Red	24V																				

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



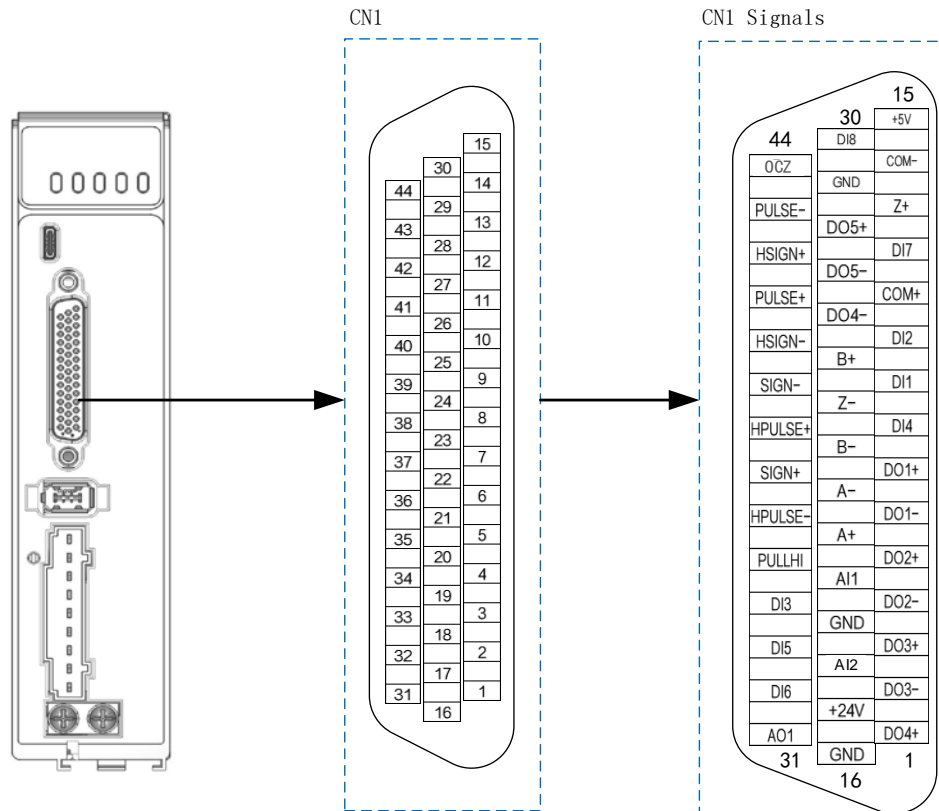
Motor side Driver side

Motor cable pin	Pin																					
	<table border="1" style="border-collapse: collapse;"> <thead> <tr> <th>Motor</th> <th>Color</th> <th>Driver</th> </tr> </thead> <tbody> <tr><td>1</td><td>Blue</td><td>U</td></tr> <tr><td>2</td><td>Black</td><td>V</td></tr> <tr><td>3</td><td>Red</td><td>W</td></tr> <tr><td>4</td><td>Yellow-green</td><td>PE</td></tr> <tr><td>A</td><td>Black</td><td>0V</td></tr> <tr><td>B</td><td>Red</td><td>24V</td></tr> </tbody> </table>	Motor	Color	Driver	1	Blue	U	2	Black	V	3	Red	W	4	Yellow-green	PE	A	Black	0V	B	Red	24V
Motor	Color	Driver																				
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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.

## 2.6 CN1 I/O Control Signal

EL7-RS Series Servo Drive uses DB 44-Pin connector.



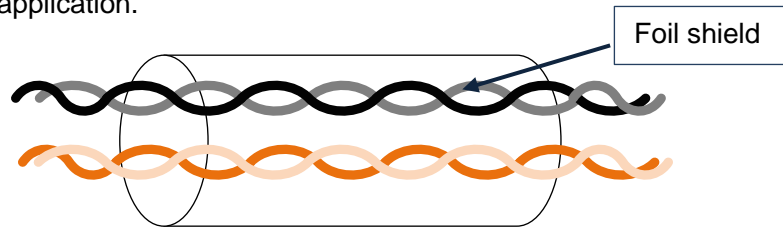
Note: It is recommended to use 24-26AWG cables for CN1

Function	Pin	Signal	Label	Description
Position command	41	PULSE+	Low speed pulse command input	Low speed pulse command input mode: • Differential (5V) • Single ended (24V)
	43	PULSE-	Low speed pulse command input	Low speed pulse and direction command input mode :
	37	SIGN+	Low speed direction command input	PULSE+ & PULSE-: 5V Differential (500KHz)
	39	SIGN-	Low speed direction command input	SIGN+ & SIGN- : 5V Differential (500KHz)
	35	PULLHI	Open collector 24V common input	PULLHI & PULSE-: 24V Single ended (200KHz) PULLHI & SIGN- : 24V Single ended (200KHz)
	38	HPULSE+	High speed pulse command input	4MHz High speed pulse command input ,

	36	HPULSE-	High speed pulse command input	5V differential input
	42	HSIGN+	High speed direction command input	4MHz High speed direction command input , 5V differential input
	40	HSIGN-	High speed direction command input	
<b>Common</b>	17	+24V	Internal 24V power supply	24V internal power supply, range 20V~28V. Max. output current 200mA
	14	COM-		
<b>Digital inputs and outputs</b>	11	COM+	Common DI	Common DI
	9	DI1	POT	Positive limit
	10	DI2	NOT	Negative limit
	34	DI3	INH	Command pulse inhibition
	8	DI4	A-CLR	Alarm clearing
	33	DI5	SRV-ON	Servo enabled
	32	DI6	<i>Null</i>	-
	12	DI7	<i>Null</i>	-
	30	DI8	HOME-Switch	Homing switch (sensor)
	7	DO1+	SRDY+	Servo ready signal output
	6	DO1-	SRDY-	
	5	DO2+	INP1+	Positioning done signal output
	4	DO2-	INP1-	
	3	DO3+	BRK-OFF+	Holding brake output
	2	DO3-	BRK-OFF-	
	1	DO4+	ALARM+	Alarm output
	26	DO4-	ALARM-	
	28	DO5+	HOME-OK+	Homing done signal output
	27	DO5-	HOME-OK-	
<b>Analog input and output</b>	20	AI1	AI1	Velocity command or limit input(0~±10 V)
	18	AI2	AI2	Torque command or limit input (0~+10 V)
	31	AO1	AO1	Analogue output – Status monitoring
	19	GND	GND	Analogue ground
<b>Frequency divider output</b>	21	A+	Encoder A phase frequency divider output	Differential output, A/B phase quadrature frequency divided pulse output signal
	22	A-		
	25	B+	Encoder B phase frequency divider output	
	23	B-		
	13	Z+	Encoder Z phase frequency divider output	Differential output, motor Z phase signal output
	24	Z-		
	44	OCZ	Z-phase open collector output	Channel Z output (Open collector)
	29	GND	Z-phase open collector output signal ground	Channel Z output ground (Open collector)
<b>Common</b>	15	+5V	Internal 5V power supply	5V internal power supply. Max. output current 200mA
	16	GND		
	Fram		FG	Frame grounding

### 2.6.1 CN1 control signal cable selection

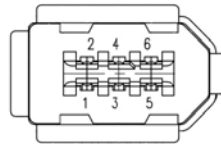
To ensure I/O signal to not be affected by electromagnetic interference, a **shielded cable** is recommended for this application.



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.

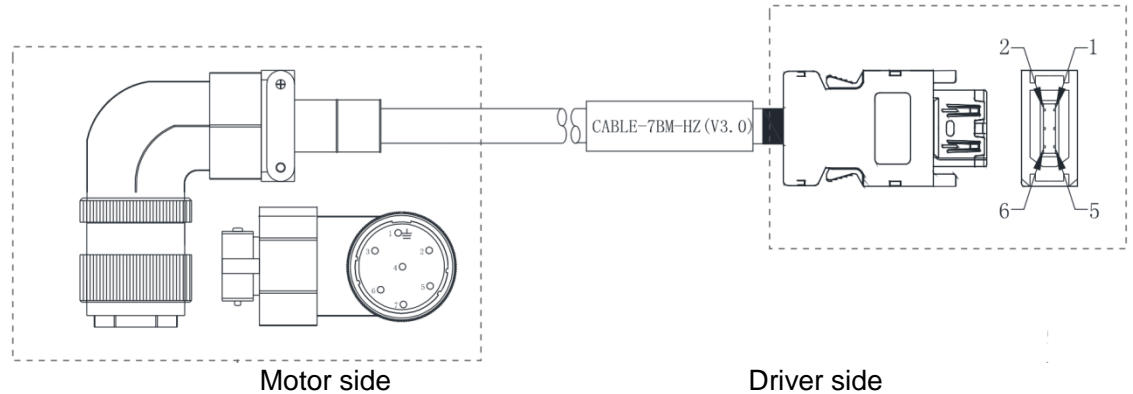
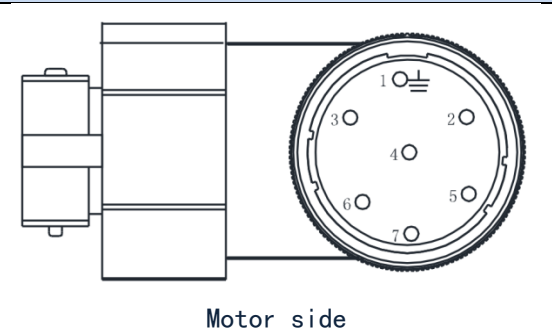
- Please keep at least 30cm from main power supply/control circuit power cable (L1C/L2C/L1/L2/L3, U/V/W) to prevent electromagnetic interference of I/O signals.

## 2.7 CN2 Motor Encoder

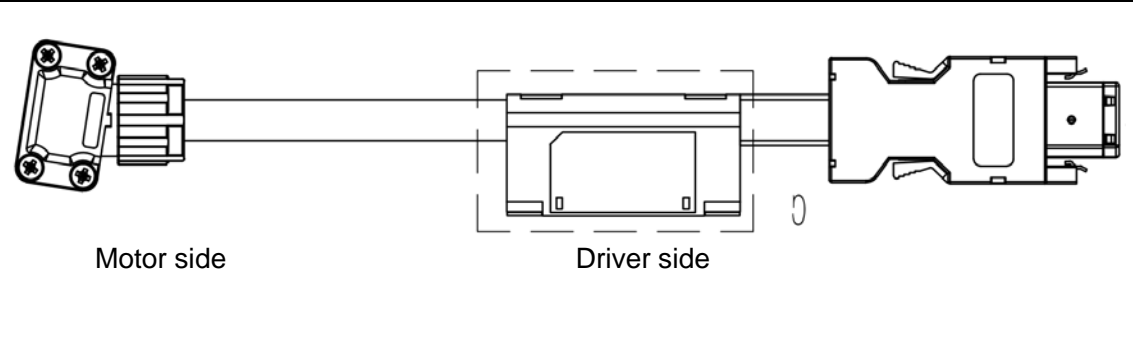
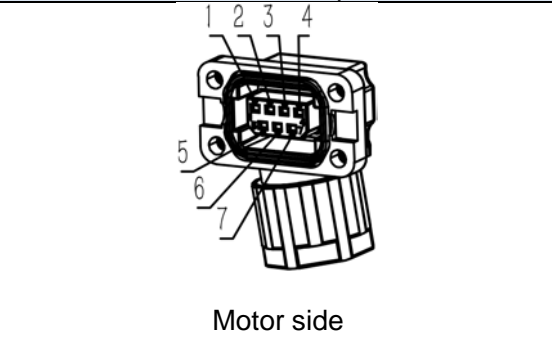


Port	Pin	Signal	Explanation
CN2	1	VCC5V	Power supply 5V
	2	GND	Power supply ground
	3	BAT+	Battery positive terminal
	4	BAT-	Battery negative terminal
	5	SD+	SSI Data+
	6	SD-	SSI Data-
	Frame	PE	Shield grounding

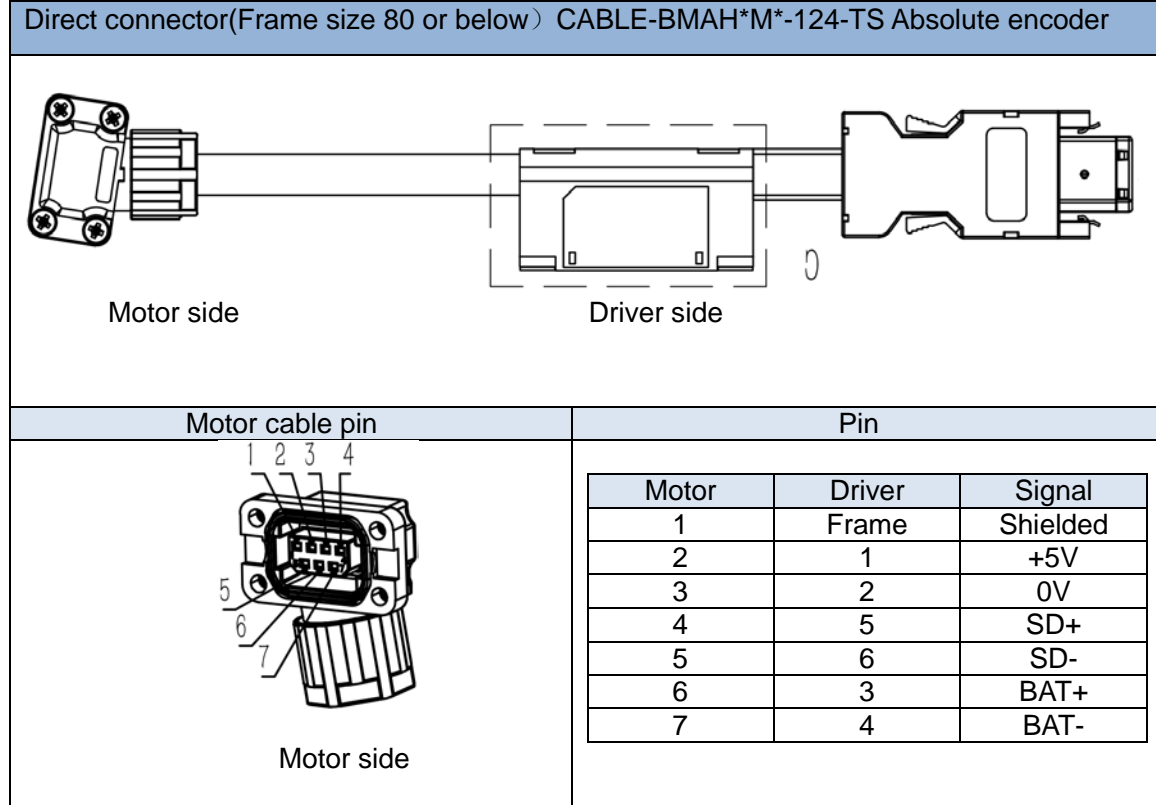


**Motor encoder cable and connector selection**
**Aviation connector (Frame size 130) CABLE-7BM\*HZ(V3.0)**

**Motor cable pin**

**Pin**

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 cable pin**

**Pin**

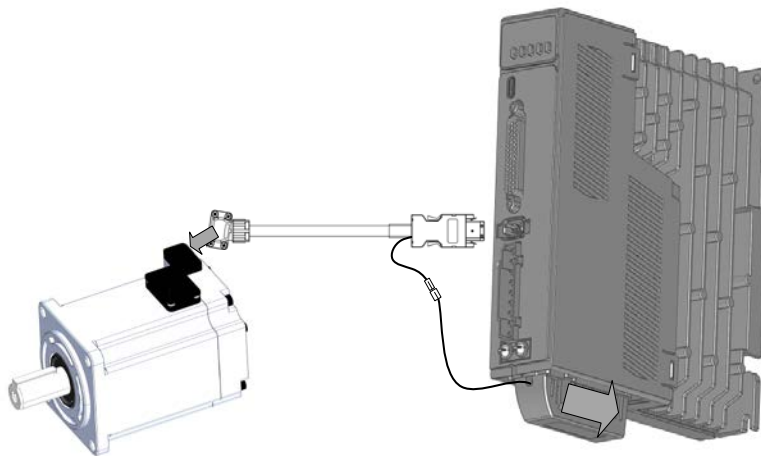
Motor	Driver	Signal
1	Frame	Shielded
2	1	+5V
3	2	0V
4	5	SD+
5	6	SD-



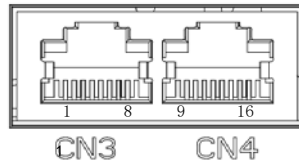
- a) Please ground cable shield foil to drive to prevent servo error alarm
- b) Please use a double wined shielded cable and make sure to be as short as possible.
- c) Please separate CN1 cable from power cables with a minimum gap of 30cm.

### Battery kit installation

Please install the battery kit as the following diagram if our Leadshine direct connector motor doesn't come with an online battery kit.

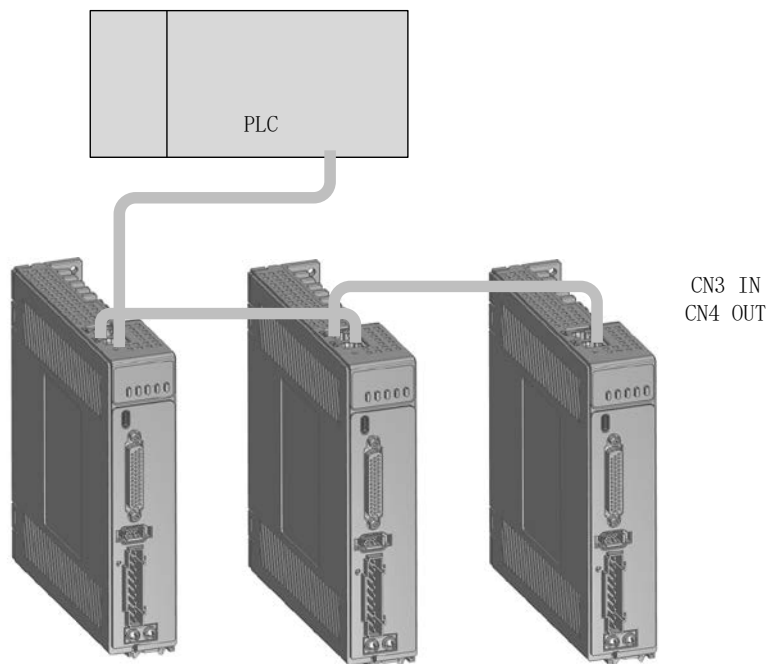


## 2.8 CN3/CN4 – RS485 Communication Port



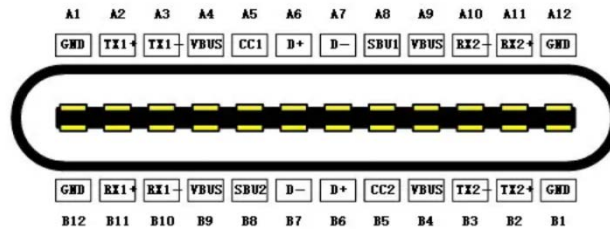
Port	Pin	Signal	Description
CN3 CN4	1, 9	RDO+	RS485 Differential signal+
	2, 10	RDO -	RS485 Differential signal-
	3, 11	GND	Ground (RS485)
	4, 12	TXD+	RS485 Differential signal+
	5, 13	TXD-	RS485 Differential signal-
	6	VCC5V	Reserved, 5V positive (50mA)
	7, 15	GND	Ground
	8, 16	/	/
	Frame	PE	Shield grounding

EL7-RS series supports RS485 communication protocol which enables communication between single/multi axes and master device.



## 2.9 USB Type-C Tuning Port

EL7-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

## 2.10 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

EL7-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 resistance (Ω)	Internal resistor power rating (W)	Minimum resistance (Ω)	Minimum power rating (W)
EL7-RS400P	100	50	50	50
EL7-RS750P	50	75	40	50
EL7 -RS1000P	50	100	30	100
EL7-RS750PT	100	100	100	100
EL7-RS1000PT	100	100	100	100
EL7-RS1500PT	100	100	100	100
EL7-RS2000PT	50	100	40	100
EL7-RS3000PT	50	100	40	100
EL7-RS4400PT	35	100	35	100
EL7-RS5500PT	35	100	25	100
EL7-RS7500PT	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°C, d14 < 80 (Won't trigger alarm), Regenerative resistor is not fuming, No overvoltage alarm (Err120).

$$P_b(\text{Regenerative power rating}) = \text{Resistor power rating} \times \text{Regenerative load rate (\%)}$$

Please choose a regenerative resistor with power rating  $P_r$  about **2-4 times the value of  $P_b$**  in considered of harsh working conditions and some 'headroom'.

If the calculated  $P_r$  value is less than internal resistor power rating, external resistor is not required.

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

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 Pr0.16 and resistor power rating Pr0.17 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°C 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

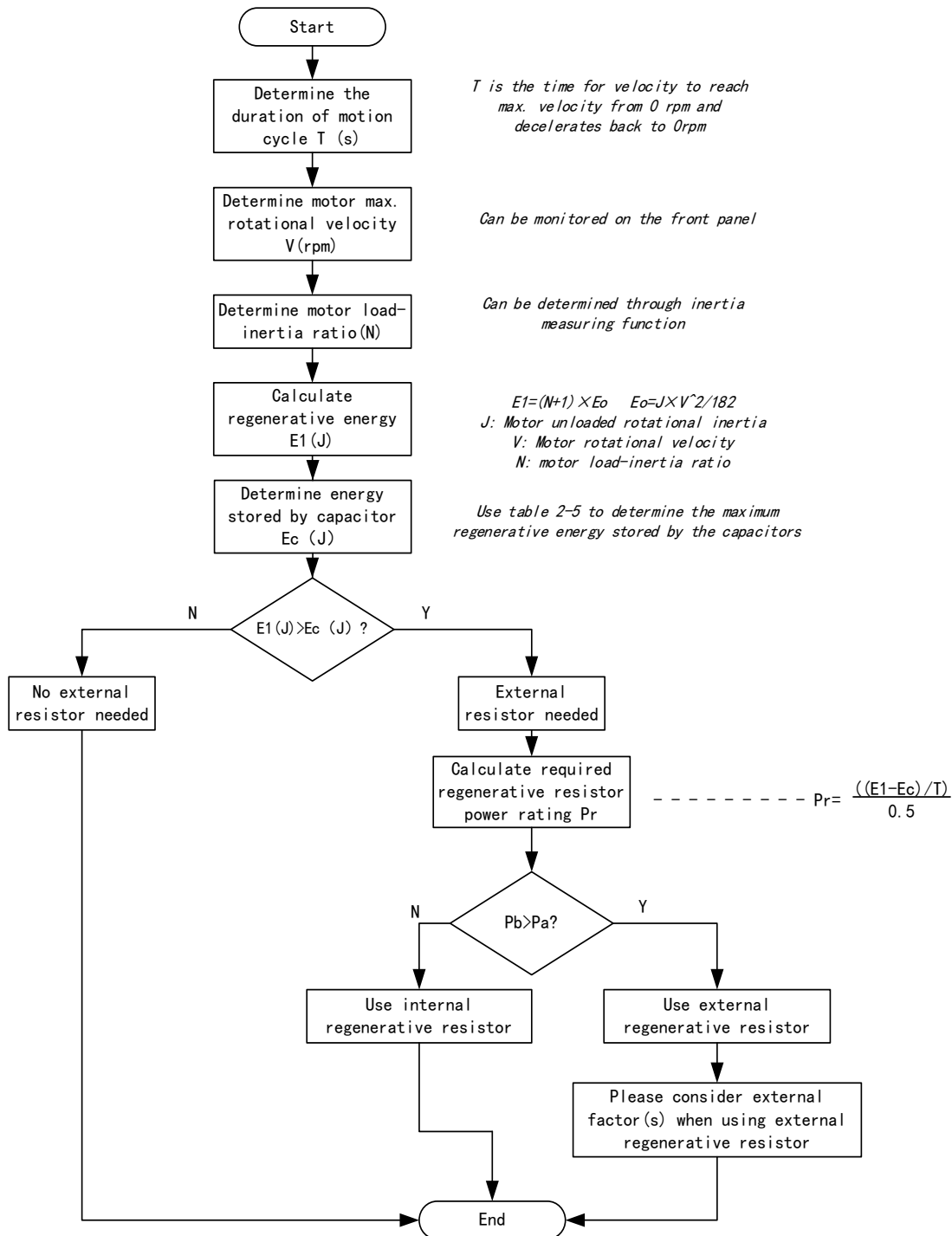
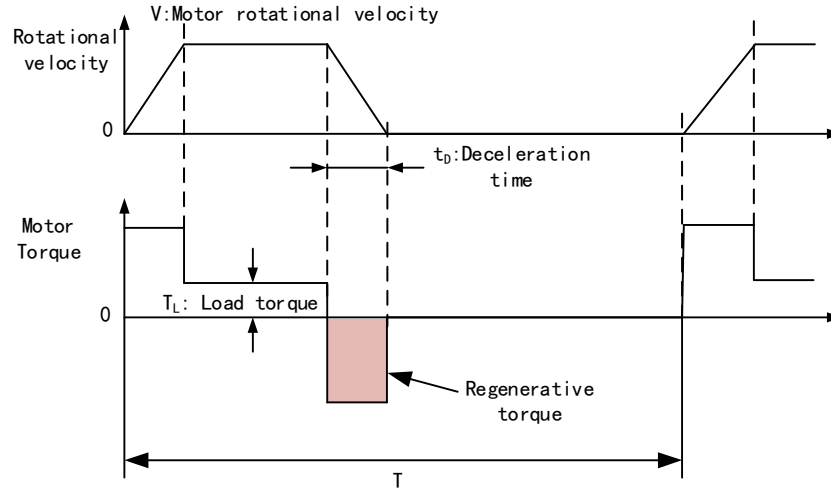


Diagram below shows the acceleration and deceleration cycle periods and the regenerative torque that occurs during the process.



### Steps to calculate capacity of regenerative resistor

Steps	Calculation	Symbol	Formula
1	Servo system regenerative energy	E <sub>1</sub>	$E_1 = (N+1) \times J \times V^2 / 182$
2	Depleted energy from loss of load system during acceleration	E <sub>L</sub>	$E_L = (\pi/60) V \times T_L \times t_D$ If loss is not determined, please assume $E_L = 0$ .
3	Depleted energy due to motor coil resistance.	E <sub>M</sub>	$E_M = (U^2/R) \times t_D$ R = coil resistance, U = operating voltage If R is not determined, please assume $E_M = 0$ .
4	Energy stored by internal DC capacitors	E <sub>c</sub>	Please refer to table 2-5
5	Depleted energy due to regenerative resistance	E <sub>K</sub>	$E_K = E_1 - (E_L + E_M + E_C)$ , If loss is ignored, $E_K = E_1 - E_C$
6	Required power rating of regenerative resistor	P <sub>r</sub>	$P_r = E_K / (0.5 \times T)$

### Internal capacitor capacity and rotor inertia

EL7-RS Drivers	Servo motor	Rotor Inertia ( $\times 10^{-4} \text{kg.m}^2$ )	Max. regenerative energy stored in capacitor E <sub>c</sub> (J)
400W	ELM2H-0400LA60	0.58	13.47
750W	ELM2H-0750LA80	1.66	22.85
1000W	ELM2M-1000LB80	1.79	27.74
	ELM2M-1000LB130	8.5	

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: EL7-RS750P, Servo Motor: ELM2H-0750LA80. When T = 2s, rotational velocity = 3000rpm, load inertia is 5 times of motor inertia.

EL7-RS Drivers	Servo motor	Rotor Inertia ( $\times 10^{-4}\text{kg.m}^2$ )	Max. regenerative energy stored in capacitor $E_c(\text{J})$
750W	ELM2H-0750LA80	1.66	22.85

Regenerative energy produced:

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

If  $E1 < E_c$ , internal capacitors can't take in excessive regenerative energy, regenerative resistor is required.

Required regenerative resistor power rating  $P_r$ :

$$P_r = \frac{(E1 - E_c)}{0.5T} = \frac{49.3 - 22.85}{0.5 \times 2} = 26.45\text{W}$$

Hence, with the internal regenerative resistor  $P_a = 75\text{W}$ ,  $P_r < P_a$ , no external regenerative resistor is required.

Let's assume if the load inertia is 15 times of motor inertia,  $P_r = 108.6\text{W}$ ,  $P_r > P_a$ , external regenerative resistor is required. And to consider for harsh working environment,

$$P_r(\text{external}) = 108.6 / (1 - 40\%) = 181\text{ W}$$

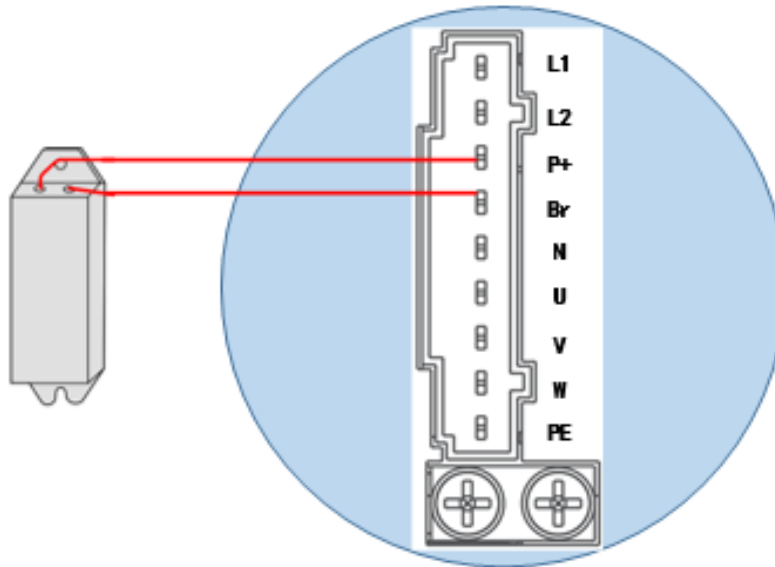
When selecting the resistance of the regenerative resistor, please be higher than the minimum value recommended in table 2-3 but lower than  $R_{\text{max}}$

$$R_{\text{max}} = (380^2 - 370^2) / P_r = 7500 / 108.6 = 69\Omega$$

In conclusion, a regenerative resistor with resistance  $40\Omega - 70\Omega$  and power rating  $110\text{W}$  to  $180\text{W}$  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 Pr0.16 and Pr0.17 before using any regenerative resistor.
- Do not set the regenerative resistor near any flammable object.

## 2.11 I/O Signals

### 2.11.1 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 Pr0.05.

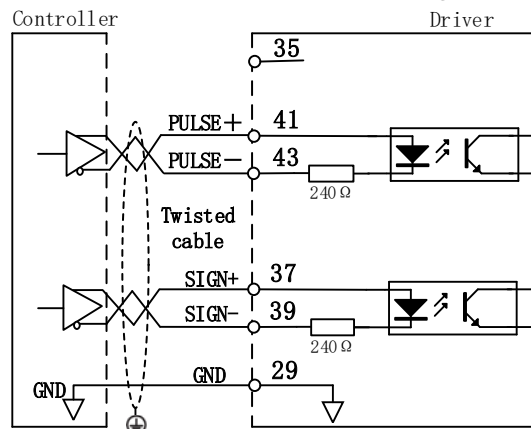
Pulse		Max. Frequency	Min pulse width(μs)
Low speed	Differential	500k	1
	Open collector (Single ended)	200k	2.5
High speed differential		4M	0.125

- *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 47 and 43 of CN1 are for pulse signal input; pin 37 and 39 are for direction signal input.

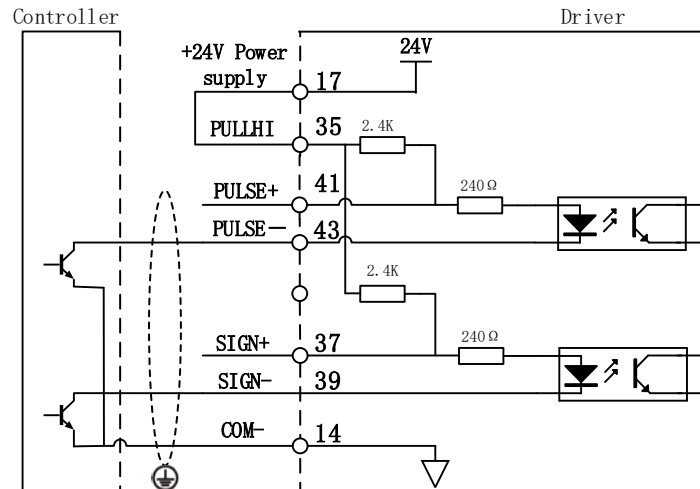


### Single ended open collector drive input (Low Speed)

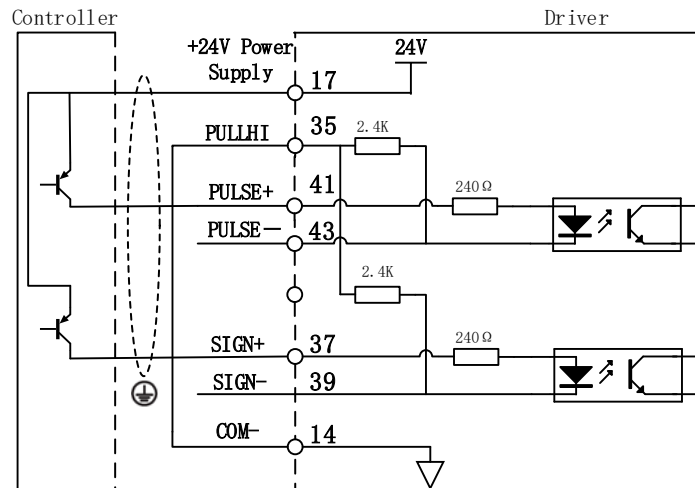
Max. tolerable command pulse input frequency under open collector = 200kHz. Input voltage of 12-24V with 50% duty ratio.

- **Using driver internal 24V power supply**

1. When pulse input comes from NPN type device:

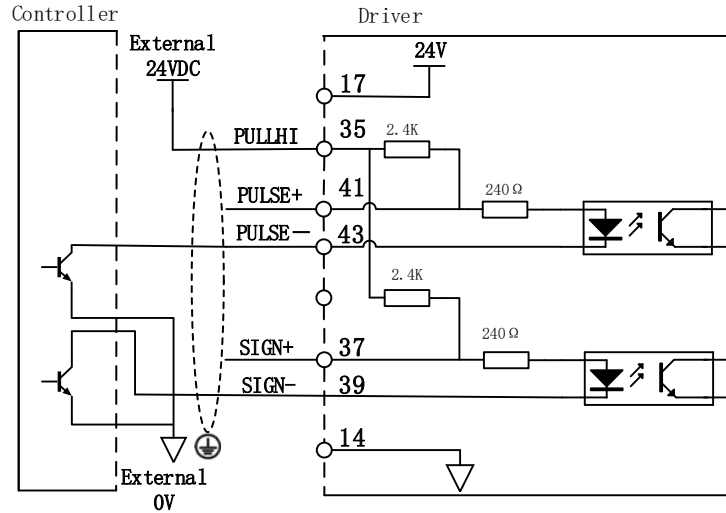


2. When pulse input comes from PNP type device:

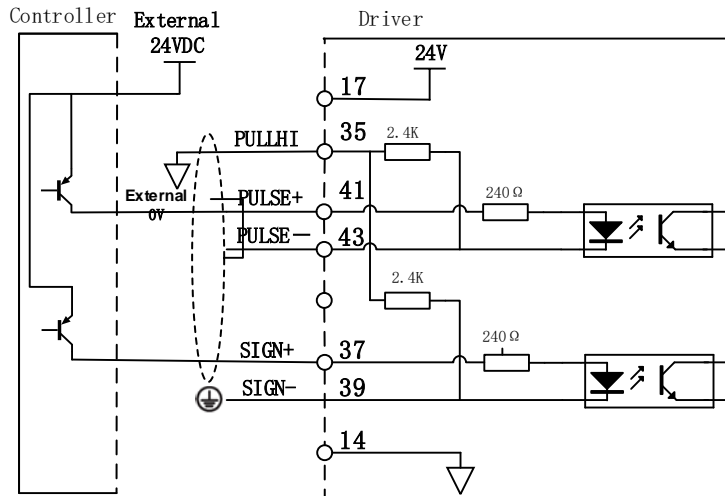


- Using external power supply  
**Method 1: Using driver internal resistor (Recommended)**

3. When pulse input comes from NPN type device:

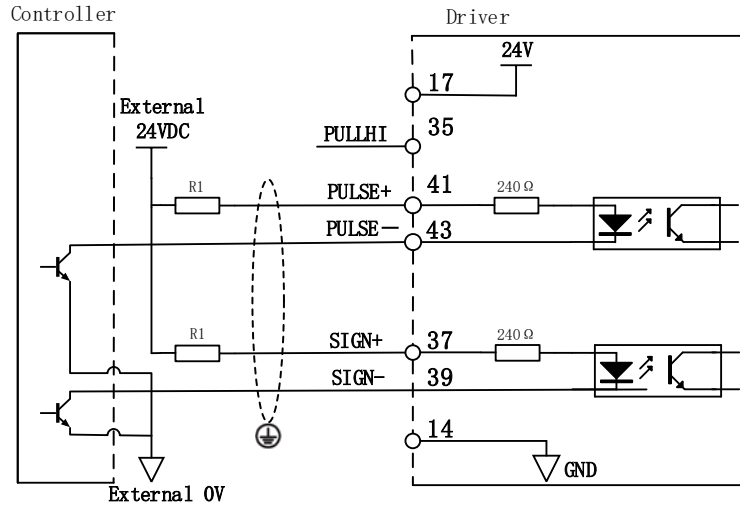


4. When pulse input comes from PNP type device:

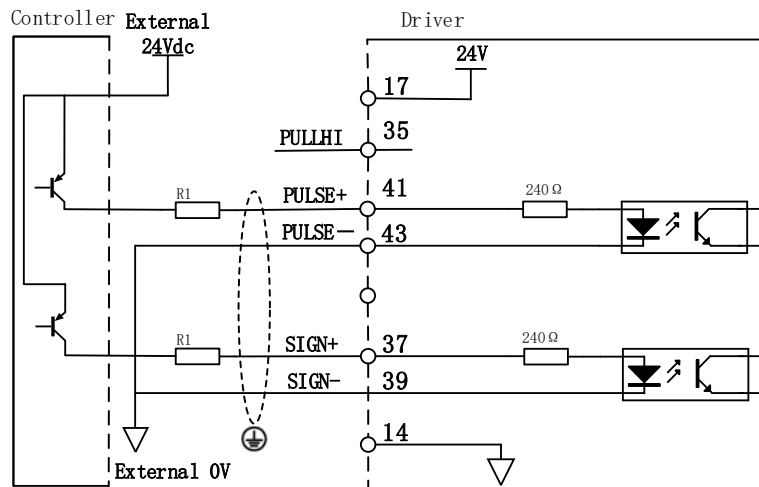


**Method 2: Using external resistor**

## 5. When pulse input comes from NPN type device:



## 6. When pulse input comes from PNP type device:



- 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.

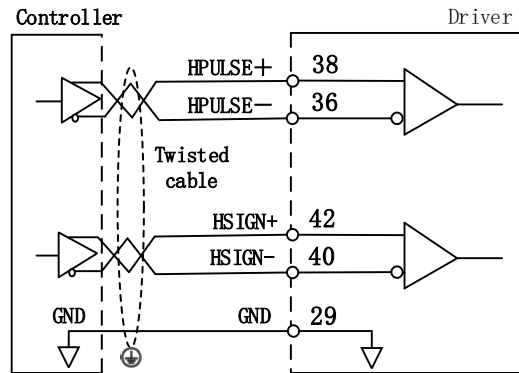
- Resistance of current limiting resistor =  $\frac{VDC - 1.5V (\text{Voltage drop})}{I_{limit} + 220\Omega} = 10mA$ . If VDC = 24V, resistance of current limiting resistor approximates 2kΩ. (Rough estimation)

Vcc Voltage	R1 Resistance	R1 Power rating
24V	2.4kΩ	1/2 W
12V	1.5kΩ	1/2 W

- 5V differential drive method is recommended for accurate delivery of pulse data.
- EL7-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.

## 2.11.2 Analogue input/output circuit

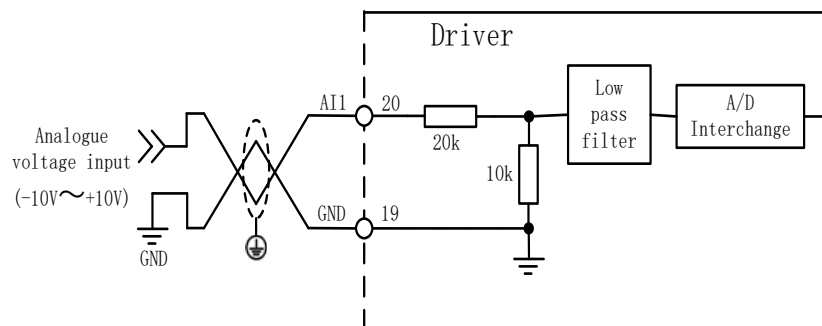
### Analogue input signal

EL7-RS series servo drives support 2 analogue inputs and 1 analogue output.

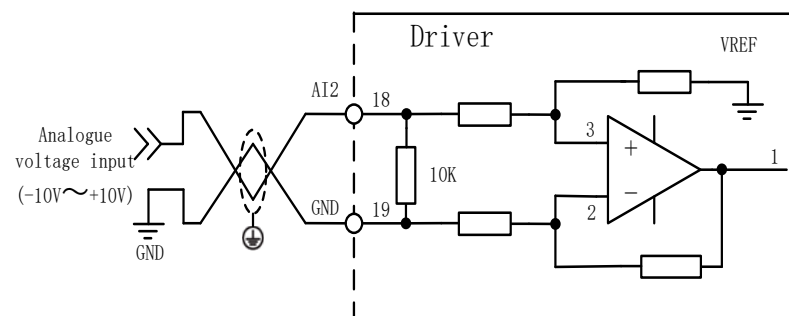
CN1 Pin	Pin Label	Description
15	AO1	Analogue output 1: Single-ended Input voltage: $\pm 10\text{VDC}$ , input resistance: $20\text{K}\Omega$
16	GND	Power supply ground
18	AI2	Analogue input 2: Differential Input voltage: $\pm 10\text{VDC}$ , Input Resistance: $10\text{K}\Omega$
19	GND	Analogue I/O common ground
20	AI1	Analogue input 1: Single-ended Input voltage: $\pm 10\text{VDC}$ , Input Resistance: $10\text{K}\Omega$
Frame	PE	Protective earth

- There are 2 analogue inputs: AI1 and AI2. AI1 uses single ended input while AI2 uses differential input
- AI1 and AI2 are both voltage analogue inputs with resolution of 12-bit.
- AI1 uses specific calculations to increase sampling precision.
- Both analogue inputs max. voltage input =  $\pm 12\text{VDC}$

#### Analogue input 1 AI1 wiring diagram



#### Analogue input 2 AI2 wiring diagram

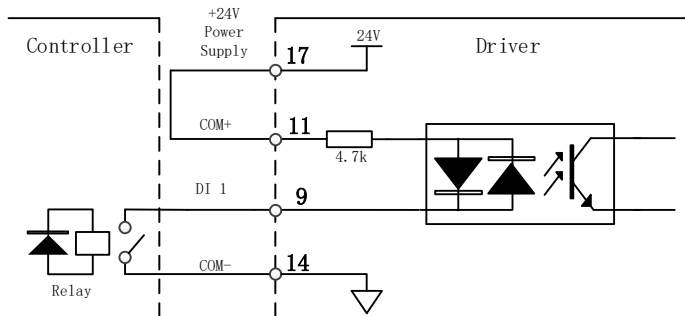


### 2.11.3 Digital Input Circuit

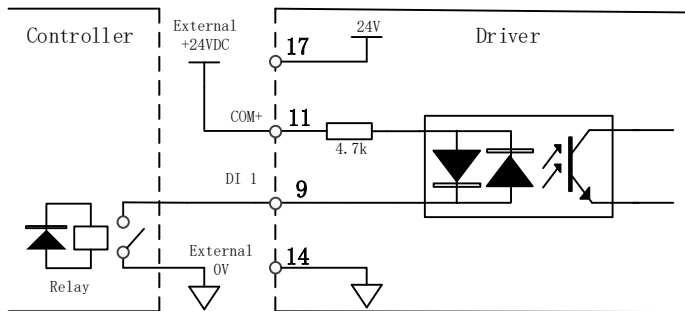
Using DI1 as an example (DI2-DI8 use the same input circuit). The internal circuit of common input is a bidirectional optocoupler which supports common anode and common cathode configurations. There are 2 types of outputs from master device: Relay output and Open Collector output as shown below.

■ Relay output:

1. Using internal 24V power supply



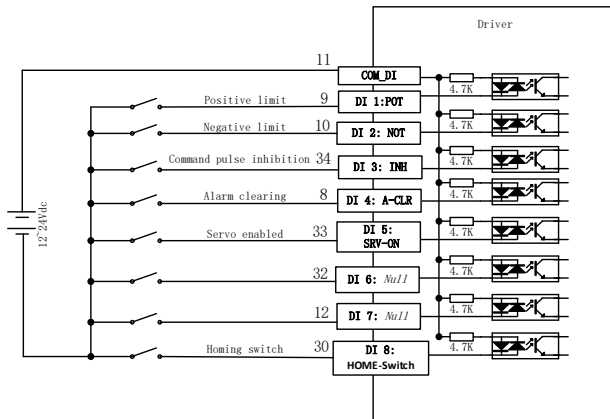
2. Using external power supply



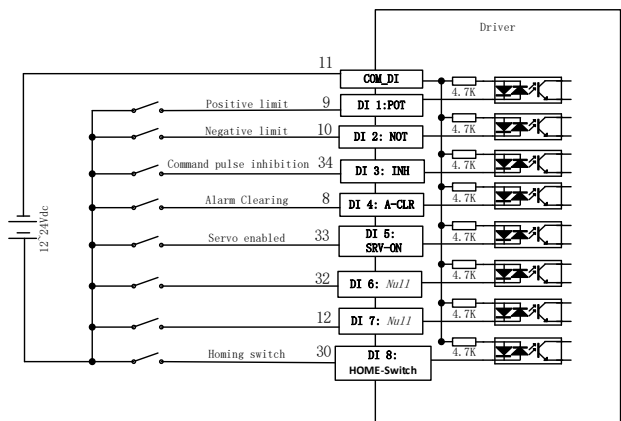
*\*Please connect to a flyback diode when using relay input to prevent damage to DO terminal.*

EL7-RS Series AC Servo Drive supports both common anode and cathode connection:

**Common Cathode:**

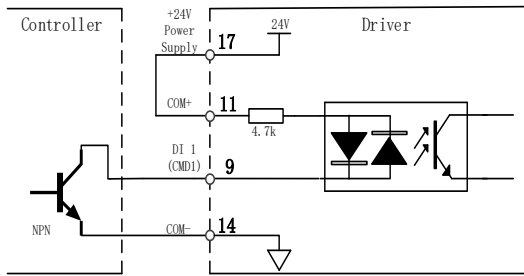


**Common Anode:**

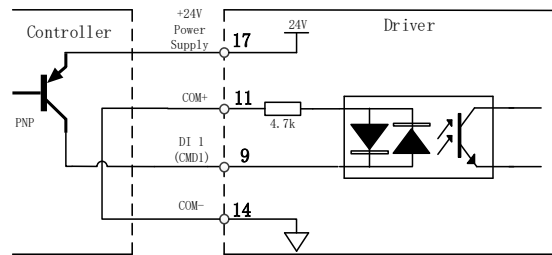




### Open collector output Common Anode (Internal power supply)



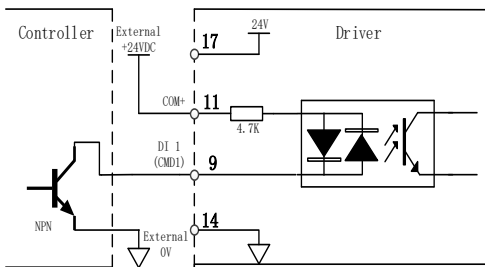
### Common Cathode (Internal power supply)



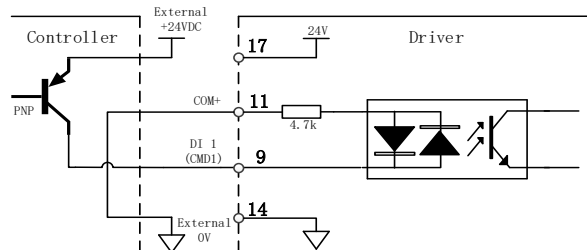
\* Please prepare switching power supply with output of 12-24VDC, current  $\geq 100\text{mA}$ ;

#### ■ Using open collector output

##### Common Anode (External power supply)

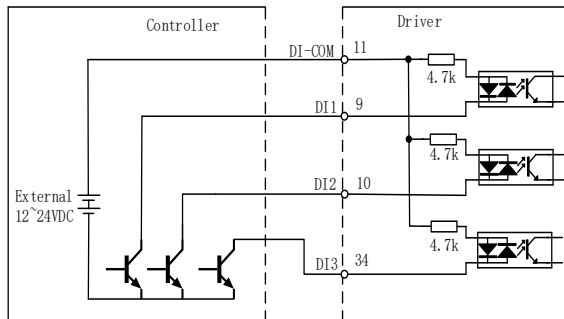


##### Common Cathode (External power supply)

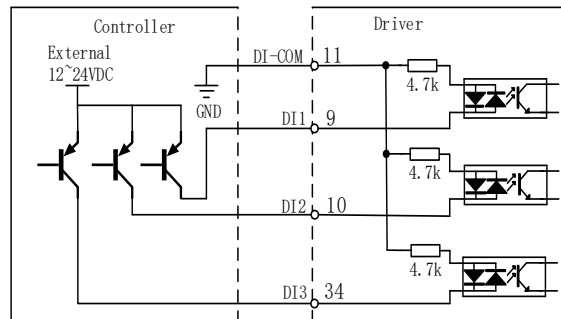


#### ■ Using transistor output

##### NPN:



##### PNP:



\*Please do not mix NPN and PNP connections in applications

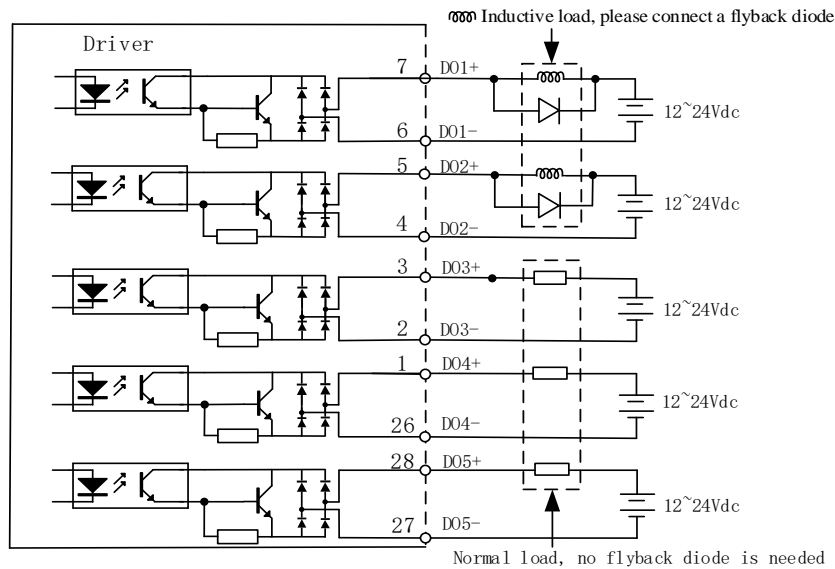
#### DI1-DI8 Default Signal Assignment

Signal	Default	Pin	Description	
Digital Input	DI1	POT	9	Positive limit
	DI2	NOT	10	Negative limit
	DI3	INH	34	Command pulse inhibition
	DI4	A-CLR	8	Alarm clearing
	DI5	SRV-ON	33	Servo enabled
	DI6	-	32	-
	DI7	-	12	-
	DI8	ORG	30	Homing switch(Only in PR mode)
+24V		17	Internal 24V power supply, Voltage range+20~28V,Max current output 200mA	
COM-		14		
COM+		11		Common DI

## 2.11.4 Digital Output Circuit

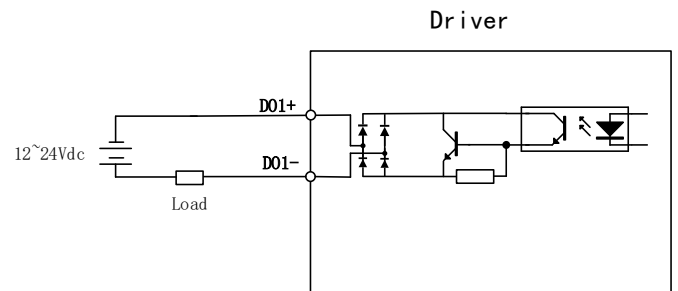
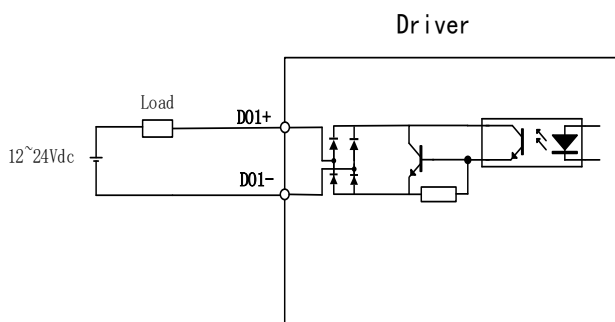
There are 5 digital outputs. DO1-DO5 are all double ended outputs. Can be connected to independent control signal power supply and reference ground is different from single ended output signals.

### Double ended outputs DO1-DO5 (Supports both NPN & PNP)

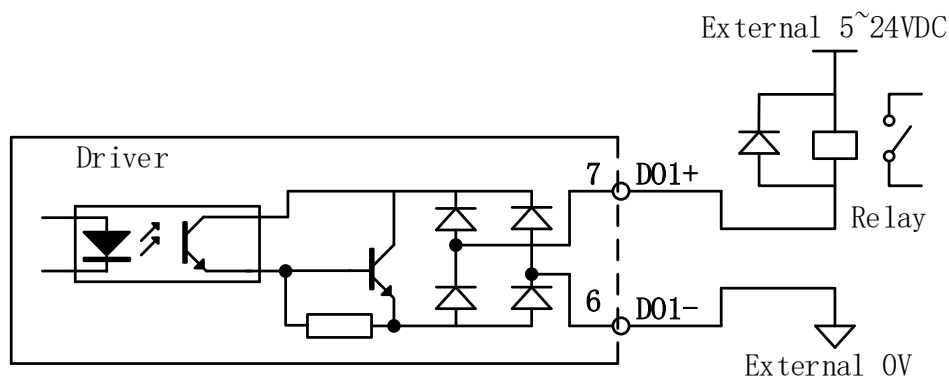


NPN:

PNP:

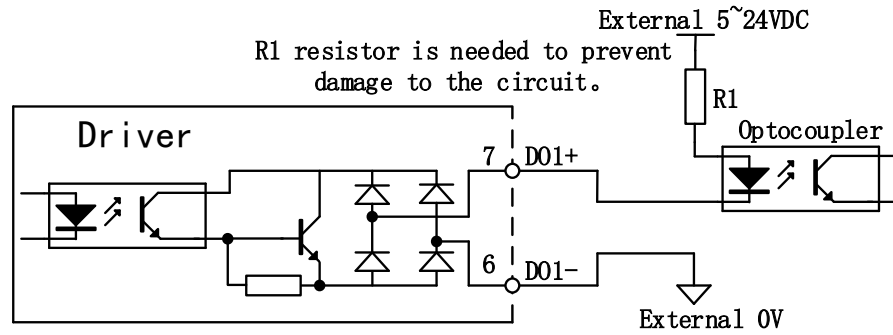


Relay:



*\*Please connect to a flyback diode when using relay input to prevent damage to DO terminal.*

Optocoupler:



\*For servo drive internal optocoupler output circuit: Max. Voltage: 30VDC, Max. Current:50mA

- 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.

#### DO1-DO5 Default Signal Assignment

	Signal	Default	Pin	Description
Digital Output	DO1+	SRDY+	7	Servo Ready
	DO1-	SRDY-	6	
	DO2+	INP+	5	Positioning completed
	DO2-	INP-	4	
	DO3+	BRK- OFF+	3	External brake released
	DO3-	BRK-OFF-	2	
	DO4+	ALARM+	1	Alarm
	DO4-	ALARM-	26	
	DO5+	WARN1+	28	Warning
	DO5-	WARN1-	27	

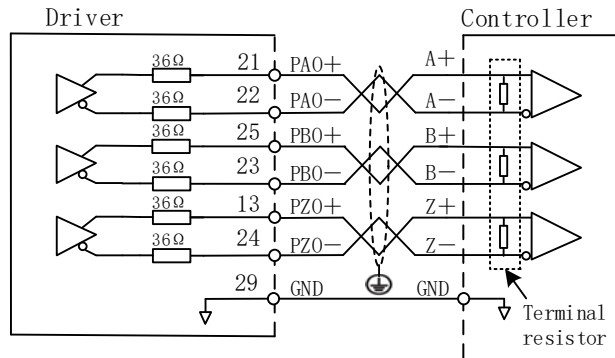
## 2.11.5 Encoder frequency divider output circuit

EL7-RS series supports 2 kinds of frequency divider output: Differential and open collector.

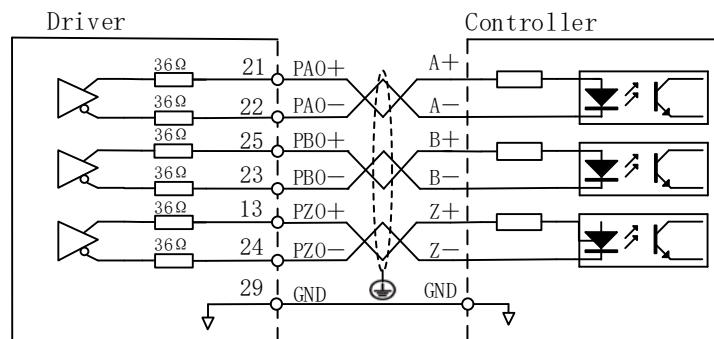
Pin	Signal	Description	
21	PAO+	Motor encoder A phase frequency divider output	Differential, High $\geq 2.5\text{VDC}$ , Low $\leq 0.5\text{VDC}$ , Max current output $\pm 20\text{mA}$ .
22	PAO-		
25	PBO+	Motor encoder B phase frequency divider output	
23	PBO-		
13	PZO+	Motor encoder Z phase frequency divider output	
24	PZO-		
44	PZ-OUT	Motor encoder Z phase OC signal output	
29	GND	Reference ground	
15	+5V	Internal 5V power supply, Max current output 200mA	
16	GND		
Frame	PE	-	

### 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.



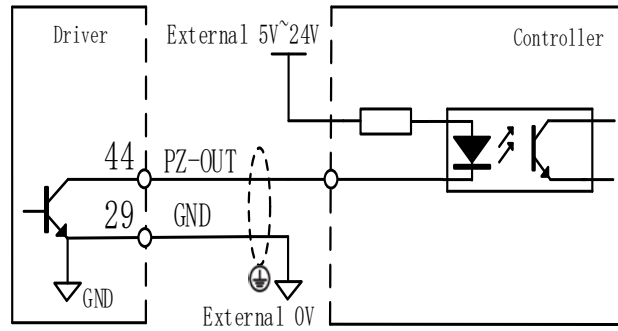
Using an optocoupler receiving circuit:



If a differential receiving circuit instead an optocoupler is used on the controller side, please connect pin 29 (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.*

## 2.12 DI Signals Settings

CN1 PIN	Signal	Parameter	Default signal	Default status
11	DI-COM	-	Common input	
9	DI1	Pr4.00	POT	NC OFF
10	DI2	Pr4.01	NOT	NC OFF
34	DI3	Pr4.02	INH	NC OFF
8	DI4	Pr4.03	A-CLR	NC OFF
33	DI5	Pr4.04	SRV-ON	NC OFF
32	DI6	Pr4.05	-	NC OFF
12	DI7	Pr4.06	-	NC OFF
30	DI8	Pr4.07	ORG	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	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
Zero speed clamp	ZEROSPD	11	91
Velocity command sign	VC-SIGN	12	92
Torque command sign	TC-SIGN	13	93
Forced alarm	E-STOP	14	94
Vibration suppression 1	VS-SEL1	0A	8A
Vibration suppression 2	VS-SEL2	0B	8B
Speed regulation valid	SPDREG	4B	CB
Speed regulation ratio 1	SPDREG1	4C	CC
Speed regulation ratio 2	SPDREG2	4D	CD
Speed regulation ratio 3	SPDREG3	4E	CE
Speed regulation ratio 4	SPDREG4	4F	CF

CN1 PIN	Input	Parameters
9	DI1	Pr4.00
10	DI2	Pr4.01
34	DI3	Pr4.02
8	DI4	Pr4.03
33	DI5	Pr4.04
32	DI6	Pr4.05
12	DI7	Pr4.06
30	DI8	Pr4.07

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
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	<b>P</b>	<b>S</b>	<b>T</b>
Signal	SRV-ON	Default assignment	33(DI5)	I/O circuit	2.11.3 Digital inputs		
.Servo enabled (Motor ON/OFF control signal)							

Label	Positive position limit			Mode	<b>P</b>	<b>S</b>	<b>T</b>
Signal	POT	Default assignment	9(DI1)	I/O circuit	2.11.3 Digital inputs		
To prevent axis from travelling in positive direction Signal valid when Pr5.04 is set. If Pr5.04 is set to any value besides 1, POT signal invalid when axis moves in positive direction.							
Label	Negative position limit			Mode	<b>P</b>	<b>S</b>	<b>T</b>
Signal	NOT	Default assignment	10(DI2)	I/O circuit	2.11.3 Digital inputs		
To prevent axis from travelling in negative direction Signal valid when Pr5.04 is set. If Pr5.04 is set to any value besides 1, NOT signal invalid when axis moves in negative direction.							

Label	Clear deviation count			Mode	<b>P</b>		
Signal	CL	Default assignment		I/O circuit	2.11.3 Digital inputs		
To clear position deviation counter. Only clear once by default. Please modify on Pr5.17.							

Label	Clear alarm			Mode	<b>P</b>	<b>S</b>	<b>T</b>
Signal	A-CLR	Default assignment	8(DI4)	I/O circuit	2.11.3 Digital inputs		
To clear alarm. Only some of the alarms can be cleared.							

Label	Command pulse prohibited			Mode	<b>P</b>		
Signal	INH	Default assignment	34(DI3)	I/O circuit	2.11.3 Digital inputs		
Ignore position command pulse Please set in Pr5.18 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	<b>P</b>	<b>S</b>	<b>T</b>
Signal	C-MODE	Default assignment		I/O circuit	2.11.3 Digital inputs		
When Pr0.01 = 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 2 <sup>nd</sup> mode; when invalid, select 1 <sup>st</sup> mode. Please do not enter any command 10ms before and after mode switching.							



<b>Label</b>	Command frequency divider/multiplier switching		<b>Mode</b>	<b>P</b>		
<b>Signal</b>	DIV1	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
When DIV1 is valid, frequency divider/multiplier numerator and denominator switch to 2 <sup>nd</sup> 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.						

<b>Label</b>	Vibration suppression 1		<b>Mode</b>	<b>P</b>		
<b>Signal</b>	VS-SEL1	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
<b>Label</b>	Vibration suppression 2		<b>Mode</b>	<b>P</b>		
<b>Signal</b>	VS-SEL2	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
To switch frequency used in vibration suppression						

<b>Label</b>	Gain switching		<b>Mode</b>	<b>P</b>	<b>S</b>	<b>T</b>
<b>Signal</b>	GAIN	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
To switch between 1 <sup>st</sup> and 2 <sup>nd</sup> gain						

<b>Label</b>	Torque limit switching		<b>Mode</b>	<b>P</b>	<b>S</b>	
<b>Signal</b>	TL-SEL	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
To switch between 1 <sup>st</sup> and 2 <sup>nd</sup> torque limit. Please refer to Pr5.21						
		<b>Value</b>	<b>Limit</b>			
		<b>[0]</b>	1 <sup>st</sup> torque limit Pr0.13			
		1	2 <sup>nd</sup> torque limit Pr5.22			
		2	TL-SEL OFF	Pr0.13		
			TL-SEL ON	Pr5.22		
		3~4	Reserved			
		5	Pr0.13 → Positive torque limit Pr5.22 → Negative torque limit			

<b>Label</b>	Zero speed clamp		<b>Mode</b>		<b>S</b>	
<b>Signal</b>	ZEROSPD	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
To set velocity command to 0 When in use, please set Pr3.15 ≠ 0.						

<b>Label</b>	Velocity command sign		<b>Mode</b>		<b>S</b>	
<b>Signal</b>	VC-SIGN	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
Sign of velocity command input in velocity control mode. Please refer to Pr3.01						

<b>Label</b>	Torque command sign		<b>Mode</b>			<b>T</b>
<b>Signal</b>	TC-SIGN	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
Sign of torque command input in torque control mode. Please refer to Pr3.18						
		<b>Value</b>	<b>Direction settings</b>			
		<b>[0]</b>	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			

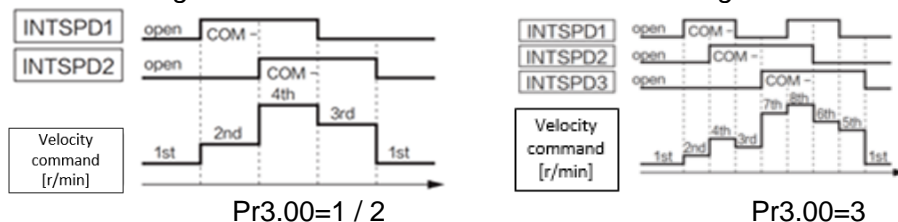
<b>Label</b>	Internal command velocity 1		<b>Mode</b>	<b>S</b>
<b>Signal</b>	INTSPD1	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
<b>Label</b>	Internal command velocity 2		<b>Mode</b>	<b>S</b>
<b>Signal</b>	INTSPD2	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
<b>Label</b>	Internal command velocity 3		<b>Mode</b>	<b>S</b>
<b>Signal</b>	INTSPD3	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs

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

Value	Velocity settings
0	Analog - Velocity command (SPR)
<b>【1】</b>	Internal velocity settings 1 <sup>st</sup> - 4 <sup>th</sup> speed (Pr3.04~Pr3.07)
2	Internal velocity settings 1 <sup>st</sup> - 3 <sup>rd</sup> speed (Pr3.04~P3.06)、Analog velocity command (SPR)
3	Internal velocity settings 1 <sup>st</sup> - 8 <sup>th</sup> speed (Pr3.00~Pr3.11)

Value	Internal command velocity 1 (INTSPD□1)	Internal command velocity 2 (INTSPD2)	Internal command velocity 3 (INTSPD3)	Velocity command
1	OFF	OFF	No effect	1 <sup>st</sup> speed
	ON	OFF		2 <sup>nd</sup> speed
	OFF	ON		3 <sup>rd</sup> speed
	ON	ON		4 <sup>th</sup> speed
2	OFF	OFF	No effect	1 <sup>st</sup> speed
	ON	OFF		2 <sup>nd</sup> speed
	OFF	ON		3 <sup>rd</sup> speed
	ON	ON		Simulated speed
3	Similar to Pr3.00=1		OFF	1 <sup>st</sup> - 4 <sup>th</sup> speed
	OFF	OFF	ON	5 <sup>th</sup> speed
	ON	OFF	ON	6 <sup>th</sup> speed
	OFF	ON	ON	7 <sup>th</sup> speed
	ON	ON	ON	8 <sup>th</sup> 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.



**Signal input configurable only in PR mode**

Label	Trigger command		Mode	PR
<b>Signal</b>	CTRG	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
Select path address ID through ADD0-3, then trigger PR path motion using CTRG Set rising edge/double edge trigger in Pr8.00.				

Label	Path address 0-3				Mode	PR
<b>Signal</b>	ADD0-3	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.3 Digital inputs	
IO combination trigger select path using ADD0~ADD3. Trigger mode is set in Pr8.26.						
	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
<b>Signal</b>	HOME	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
Homing trigger, homing velocity and acceleration can be set in Pr8.15-Pr8.18				

Label	Forced stop		Mode	PR
<b>Signal</b>	STP	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
Emergency stop trigger in PR motion. Deceleration can be set in Pr8.23				

Label	Positive/Negative JOG		Mode	PR
<b>Signal</b>	PJOG/NJOG	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
To jog manually in PR mode				
Label	Positive/Negative limit		Mode	PR
<b>Signal</b>	PL/NL	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
PR mode positive/negative position limit				

Label	Origin		Mode	PR
<b>Signal</b>	ORG	<b>Default assignment</b>	<b>I/O circuit</b>	2.11.3 Digital inputs
Origin signal input				

## 2.13 DO Signals Settings

CN1 PIN	Label	Parameter	Assigned signal
7	DO1+	Pr4.10	Servo-Ready S-RDY
6	DO1-		
5	DO2+	Pr4.11	Positioning completed INP1
4	DO2-		
3	DO3+	Pr4.12	External brake released BRK-OFF
2	DO3-		
1	DO4+	Pr4.13	Alarm (ALARM)
26	DO4-		
27	DO5+	Pr4.14	Homing done (HOME-OK)
28	DO5-		

### 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
7	DO1+	Pr4.10
6	DO1-	
5	DO2+	Pr4.11
4	DO2-	
3	DO3+	Pr4.12
2	DO3-	
1	DO4+	Pr4.13
26	DO4-	
27	DO5+	Pr4.14
28	DO5-	

*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**

<b>Label</b>	Alarm			<b>Mode</b>	<b>P</b>	<b>S</b>	<b>T</b>
<b>Signal</b>	ALARM	<b>Default assignment</b>	(D04)	<b>I/O circuit</b>	2.11.4 Digital inputs		
Signal output when driver alarm occurs							

<b>Label</b>	Servo Ready			<b>Mode</b>	<b>P</b>	<b>S</b>	<b>T</b>
<b>Signal</b>	S-RDY	<b>Default assignment</b>	(D01)	<b>I/O circuit</b>	2.11.4 Digital inputs		
Signal output when servo is powered on							

<b>Label</b>	Positioning completed			<b>Mode</b>	<b>P</b>		
<b>Signal</b>	INP	<b>Default assignment</b>	(D02)	<b>I/O circuit</b>	2.11.4 Digital inputs		
Signal output when positioning completed within set range							

<b>Label</b>	External brake released			<b>Mode</b>	<b>P</b>	<b>S</b>	<b>T</b>
<b>Signal</b>	BRK-OFF	<b>Default assignment</b>	(D03)	<b>I/O circuit</b>	2.11.4 Digital inputs		
Signal valid to hold braking action							

<b>Label</b>	Velocity reached			<b>Mode</b>		<b>S</b>	<b>T</b>
<b>Signal</b>	AT-SPEED	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs		
Velocity reached signal							

<b>Label</b>	Torque limit signal			<b>Mode</b>	<b>P</b>	<b>S</b>	<b>T</b>
<b>Signal</b>	TLC	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs		
Torque limiting signal							

<b>Label</b>	Zero speed clamp detection			<b>Mode</b>	<b>P</b>	<b>S</b>	<b>T</b>
<b>Signal</b>	ZSP	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs		
Zero speed clamp activation signal							

<b>Label</b>	Velocity coincidence			<b>Mode</b>		<b>S</b>	<b>T</b>
<b>Signal</b>	V-COIN	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs		
Signal output when velocity coincides.							

<b>Label</b>	Servo Status			<b>Mode</b>	<b>P</b>	<b>S</b>	<b>T</b>
<b>Signal</b>	SRV-ST	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs		
Signal output when servo is enabled.							

<b>Label</b>	Positive limit valid			<b>Mode</b>		<b>S</b>	<b>T</b>
<b>Signal</b>	POT-OUT	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs		
Signal output when positive position limit signal valid.							

<b>Label</b>	Negative limit valid		<b>Mode</b>		<b>S</b>	<b>T</b>
<b>Signal</b>	NOT-OUT	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs	
Signal output when negative position limit signal valid						

<b>Label</b>	Position command ON/OFF		<b>Mode</b>	<b>P</b>		
<b>Signal</b>	P-CMD	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs	
Signal valid when position command ON						

<b>Label</b>	Velocity command ON/OFF		<b>Mode</b>		<b>S</b>	
<b>Signal</b>	V-CMD	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs	
Signal valid when velocity command ON in velocity control mode						

<b>Label</b>	Position comparison		<b>Mode</b>	<b>P</b>		
<b>Signal</b>	CMP-OUT	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 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

<b>Label</b>	Command completed		<b>Mode</b>	<b>PR</b>		
<b>Signal</b>	CMD-OK	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs	
PR command is delivered but axis not yet in position						

<b>Label</b>	Path completed		<b>Mode</b>	<b>PR</b>		
<b>Signal</b>	PR-OK	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs	
PR command delivered and axis in position						

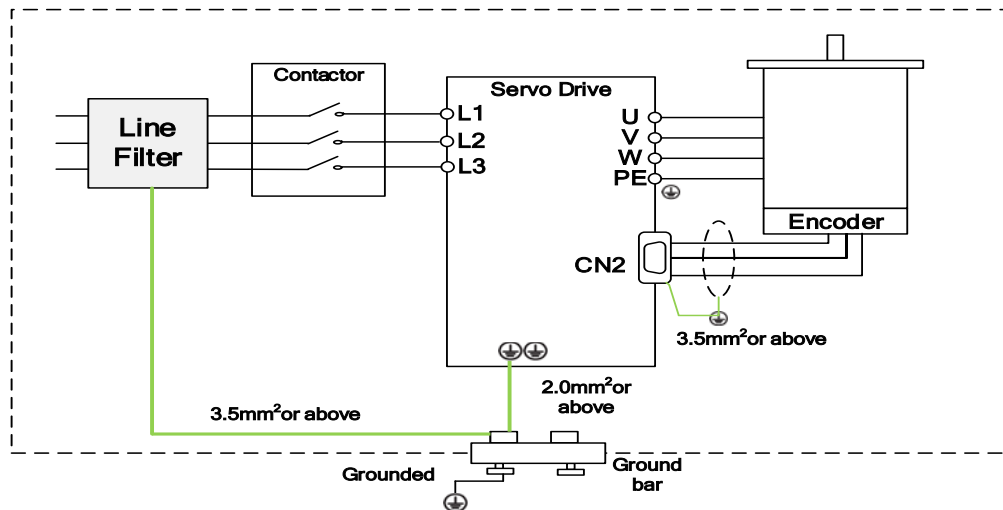
<b>Label</b>	Homing done		<b>Mode</b>	<b>PR</b>		
<b>Signal</b>	HOME-OK	<b>Default assignment</b>		<b>I/O circuit</b>	2.11.4 Digital inputs	
PR motion homing done.						

## 2.14 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
  - ① Grounding resistance > 100Ω
  - ② When 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:
  - ① Install master device and line filter close to the servo drive
  - ② Install surge suppressor for relay and contactor
  - ③ Please separate signal/encoder cable from power cable with a space of at least 30cm
  - ④ Install a line filter for the main power supply if a device with high frequency generation such as a welding machine exists nearby

### 2.14.1 Grounding connection and other anti-interference wiring connections

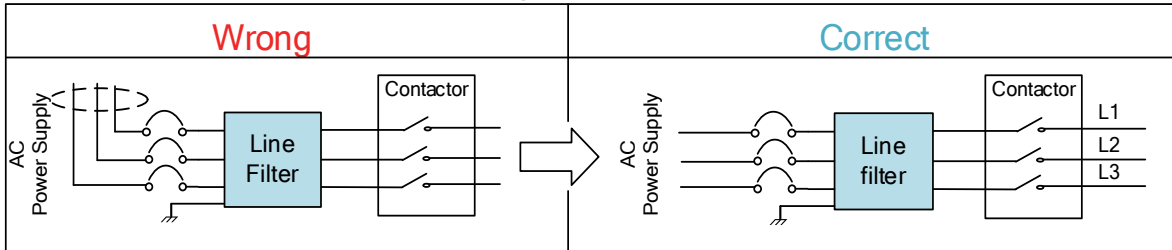


- Servo motor frame should be grounded. Please connect the PE terminal of servo motor and servo drive and ground them together to reduce interference.
- Ground both ends of the foil shield of encoder cable.

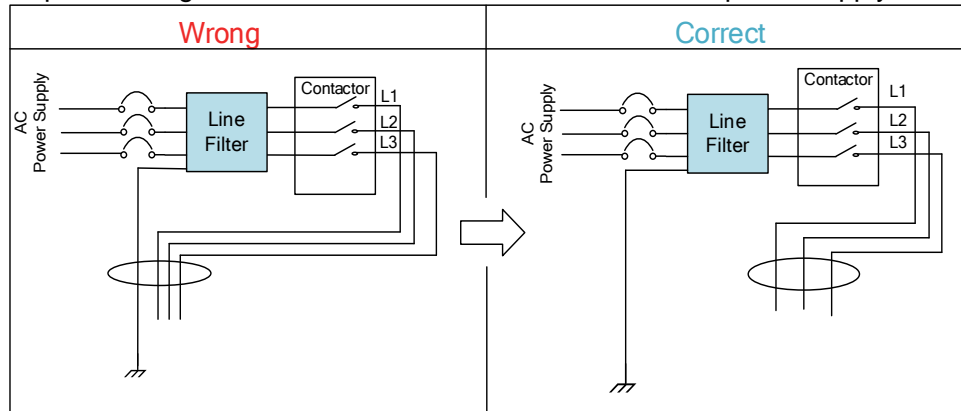
## 2.14.2 Using line filter

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.

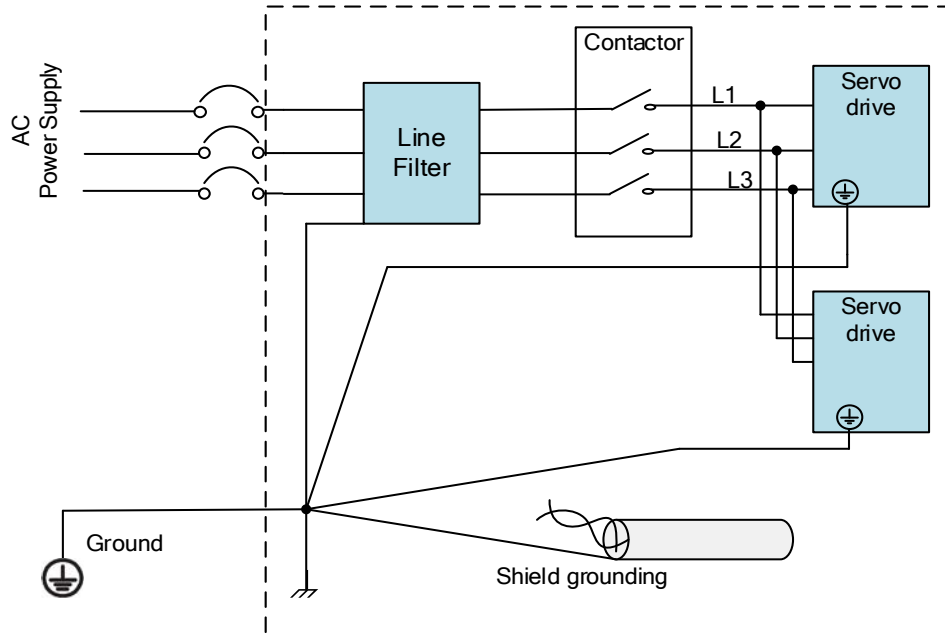
Do not band the main power supply cable together.



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

Classification code  $\overbrace{\text{Pr0.00}}^{\text{Pr0.00}}$  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

“Δ” – Valid when axis stops

“●” – Valid after re-enabling

### [Class 0] Basic settings

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr0.00	Model-following bandwidth	1	Δ	O	—	—	16bit	R/W	0x0001
Pr0.01	Control Mode Settings	0	O	O	O	O	16bit	R/W	0x0003
Pr0.02	Real time Auto Gain Adjusting	0x1	—	O	O	O	16bit	R/W	0x0005
Pr0.03	Real time auto stiffness adjusting	11	—	O	O	O	16bit	R/W	0x0007
Pr0.04	Inertia ratio	250	—	O	O	O	16bit	R/W	0x0009
Pr0.05	Command pulse input selection	0	O	O	—	—	16bit	R/W	0x000B
Pr0.06	Command pulse polarity inversion	0	O	O	—	—	16bit	R/W	0x000D
Pr0.07	Command pulse input mode	3	O	O	—	—	16bit	R/W	0x000F
Pr0.08	1 <sup>st</sup> command pulse count per revolution	10000	O	O	—	—	32bit	R/W	0x0010 0x0011
Pr0.09	1 <sup>st</sup> command frequency divider/multiplier numerator	1	O	O	—	—	32bit	R/W	0x0012 0x0013
Pr0.10	1 <sup>st</sup> command frequency divider/multiplier denominator	1	O	O	—	—	32bit	R/W	0x0014 0x0015
Pr0.11	Encoder output pulse count per revolution	2500	O	O	O	O	16bit	R/W	0x0017
Pr0.12	Pulse output logic inversion	0	O	O	O	O	16bit	R/W	0x0019
Pr0.13	1 <sup>st</sup> Torque Limit	350	—	O	O	O	16bit	R/W	0x001B
Pr0.14	Excessive position deviation	30	—	O	—	—	16bit	R/W	0x001D
Pr0.15	Absolute Encoder settings	0	O	O	O	O	16bit	R/W	0x001F
Pr0.16	Regenerative resistance	100	—	O	O	O	16bit	R/W	0x0021

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr0.17	Regenerative resistor power rating	50	—	0	0	0	16bit	R/W	0x0023
Pr0.22	PR and P/S/T switching	0	—	0	0	0	16bit	R/W	0x002D
Pr0.25	Auxiliary function	0	—	0	0	0	16bit	R/W	0x0033
Pr0.26	Simulated I/O	0	—	0	0	0	16bit	R/W	0x0035
Pr0.30	Encoder feedback mode	0	—	0	0	0	16bit	R/W	0x0037
Pr0.31	External encoder type	0	0	0	0	0	16bit	R/W	0x0039
Pr0.32	External encoder direction	0	0	0	0	0	16bit	R/W	0x003B
Pr0.33	Excessive hybrid deviation	16000	0	0			16bit	R/W	0x0043
Pr0.34	Clear excess hybrid control deviation	0	0	0			16bit	R/W	0x0045
Pr0.35	External encoder frequency divider numerator	0	0	0	0	0	16bit	R/W	0x0047
Pr0.36	External encoder frequency divider denominator	10000	0	0	0	0	16bit	R/W	0x0049
Pr0.37	External encoder feedback pulse count per revolution	0	0	0	0	0	16bit	R/W	0x004B
Pr0.38	Z-signal pulse input source	0	—	0	0	0	16bit	R/W	0x004D
Pr0.40	Mapping parameter 1	0x0	—	0	0	0	32bit	R/W *	0x0050 0x0051
Pr0.41	Mapping parameter 2	0x0	—	0	0	0	32bit	R/W *	0x0052 0x0053
Pr0.42	Mapping parameter 3	0x0	—	0	0	0	32bit	R/W *	0x0054 0x0055
Pr0.43	Mapping parameter 4	0x0	—	0	0	0	32bit	R/W *	0x0056 0x0057
Pr0.44	Mapping parameter 5	0x0	—	0	0	0	32bit	R/W *	0x0058 0x0059
Pr0.45	Mapping parameter 6	0x0	—	0	0	0	32bit	R/W *	0x005A 0x005b
Pr0.46	Mapping parameter 7	0x0	—	0	0	0	32bit	R/W *	0x005C 0x005d
Pr0.47	Mapping parameter 8	0x0	—	0	0	0	32bit	R/W *	0x005E 0x005F
Pr0.50	Mapping parameter 1 indicator	0x0049 0049	—	0	0	0	32bit	R/W	0x0064 0x0065
Pr0.51	Mapping parameter 2 indicator	0x0049 0049	—	0	0	0	32bit	R/W	0x0066 0x0067
Pr0.52	Mapping parameter 3 indicator	0x0049 0049	—	0	0	0	32bit	R/W	0x0068 0x0069
Pr0.53	Mapping parameter 4 indicator	0x0049 0049	—	0	0	0	32bit	R/W	0x006A 0x006B
Pr0.54	Mapping parameter 5 indicator	0x0049 0049	—	0	0	0	32bit	R/W	0x006C 0x006D

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr0.55	Mapping parameter 6 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x006E 0x007F
Pr0.56	Mapping parameter 7 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x0070 0x0071
Pr0.57	Mapping parameter 8 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x0072 0x0073

**[Class 1] Gain adjustment**

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr1.00	1 <sup>st</sup> position loop gain	320	—	O	—	—	16bit	R/W	0x0101
Pr1.01	1 <sup>st</sup> velocity loop gain	180	—	O	O	O	16bit	R/W	0x0103
Pr1.02	1 <sup>st</sup> Integral Time Constant of Velocity Loop	310	—	O	O	O	16bit	R/W	0x0105
Pr1.03	1 <sup>st</sup> velocity detection filter	15	—	O	O	O	16bit	R/W	0x0107
Pr1.04	1 <sup>st</sup> Torque Filter Time Constant	126	—	O	O	O	16bit	R/W	0x0109
Pr1.05	2 <sup>nd</sup> Position Loop Gain	380	—	O	—	—	16bit	R/W	0x010B
Pr1.06	2 <sup>nd</sup> velocity loop gain	180	—	O	O	O	16bit	R/W	0x010D
Pr1.07	2 <sup>nd</sup> Integral Time Constant of Velocity Loop	10000	—	O	O	O	16bit	R/W	0x010F
Pr1.08	2 <sup>nd</sup> velocity detection filter	15	—	O	O	O	16bit	R/W	0x0111
Pr1.09	2 <sup>nd</sup> Torque Filter Time Constant	126	—	O	O	O	16bit	R/W	0x0113
Pr1.10	Velocity feed forward gain	300	—	O	—	—	16bit	R/W	0x0115
Pr1.11	Velocity feed forward filter time constant	50	—	O	—	—	16bit	R/W	0x0117
Pr1.12	Torque feed forward gain	0	—	O	O	—	16bit	R/W	0x0119
Pr1.13	Torque feed forward filter time constant	0	—	O	O	—	16bit	R/W	0x011B
Pr1.15	Position control gain switching mode	0	—	O	—	—	16bit	R/W	0x011F
Pr1.17	Position control gain switching level	50	—	O	—	—	16bit	R/W	0x0123
Pr1.18	Hysteresis at position control switching	33	—	O	—	—	16bit	R/W	0x0125
Pr1.19	Position control switching time	33	—	O	—	—	16bit	R/W	0x0127
Pr1.35	Position command pulse filter time	8	O	O	—	—	16bit	R/W	0x0147
Pr1.39	Special function register 2	0	—	O	O	O	16bit	R/W	0x014F

**[Class 2] Vibration Suppression**

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr2.00	Adaptive filtering mode settings	0	—	0	0	—	16bit	R/W	0x0201
Pr2.01	1 <sup>st</sup> notch frequency	4000	—	0	0	0	16bit	R/W	0x0203
Pr2.02	1 <sup>st</sup> notch width	4	—	0	0	0	16bit	R/W	0x0205
Pr2.03	1 <sup>st</sup> notch depth	0	—	0	0	0	16bit	R/W	0x0207
Pr2.04	2 <sup>nd</sup> notch frequency	4000	—	0	0	0	16bit	R/W	0x0209
Pr2.05	2 <sup>nd</sup> notch width	4	—	0	0	0	16bit	R/W	0x020B
Pr2.06	2 <sup>nd</sup> notch depth	0	—	0	0	0	16bit	R/W	0x020D
Pr2.07	3 <sup>rd</sup> notch frequency	4000	—	0	0	0	16bit	R/W	0x020F
Pr2.08	3 <sup>rd</sup> notch width	4	—	0	0	0	16bit	R/W	0x0211
Pr2.09	3 <sup>rd</sup> notch depth	0	—	0	0	0	16bit	R/W	0x0213
Pr2.14	1 <sup>st</sup> damping frequency	0	—	0	—	—	16bit	R/W	0x021D
Pr2.16	2 <sup>nd</sup> damping frequency	0	—	0	—	—	16bit	R/W	0x0221
Pr2.22	Position command smoothing filter	0	△	0	—	—	16bit	R/W	0x022D
Pr2.23	Position command FIR filter	0	△	0	—	—	16bit	R/W	0x022F
Pr2.48	Adjustment mode	0	—	0	0	0	16bit	R/W	0x0261
Pr2.50	MFC type	0	●	0	—	—	16bit	R/W	0x0265
Pr2.51	Velocity feedforward compensation coefficient	0	—	0	—	—	16bit	R/W	0x0267
Pr2.52	Torque feedforward compensation coefficient	0	—	0	0	—	16bit	R/W	0x0269
Pr2.53	Dynamic friction compensation coefficient	0	—	0	0	0	16bit	R/W	0x026B
Pr2.54	Overshoot time coefficient	0	—	0	0	0	16bit	R/W	0x026D
Pr2.55	Overshoot suppression gain	0	—	0	0	0	16bit	R/W	0x026F

**[Class 3] Velocity / Torque Control**

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr3.00	Velocity internal/external switching	1	—	—	0	—	16bit	R/W	0x0301
Pr3.01	Velocity command rotational direction selection	0	—	—	0	—	16bit	R/W	0x0303
Pr3.02	Velocity command input gain	500	—	—	0	0	16bit	R/W	0x0305
Pr3.03	Velocity command input inversion	0	—	—	0	—	16bit	R/W	0x0307
Pr3.04	1st speed of velocity setting	0	—	—	0	—	16bit	R/W	0x0309
Pr3.05	2nd speed of velocity setting	0	—	—	0	—	16bit	R/W	0x030B
Pr3.06	3rd speed of velocity setting	0	—	—	0	—	16bit	R/W	0x030D
Pr3.07	4th speed of velocity setting	0	—	—	0	—	16bit	R/W	0x030F
Pr3.08	5th speed of velocity setting	0	—	—	0	—	16bit	R/W	0x0311
Pr3.09	6th speed of velocity setting	0	—	—	0	—	16bit	R/W	0x0313
Pr3.10	7th speed of velocity setting	0	—	—	0	—	16bit	R/W	0x0315
Pr3.11	8th speed of velocity setting	0	—	—	0	—	16bit	R/W	0x0317
Pr3.12	Acceleration time settings	100	—	—	0	—	16bit	R/W	0x0319
Pr3.13	Deceleration time settings	100	—	—	0	—	16bit	R/W	0x031B

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr3.14	Sigmoid acceleration/deceleration settings	0	0	—	0	—	16bit	R/W	0x031D
Pr3.15	Zero speed clamp function selection	0	—	—	0	—	16bit	R/W	0x031F
Pr3.16	Zero speed clamp level	30	—	—	0	—	16bit	R/W	0x0321
Pr3.17	Torque internal/external switching	0	—	—	—	0	16bit	R/W	0x0323
Pr3.18	Torque command direction selection	0	—	—	—	0	16bit	R/W	0x0325
Pr3.19	Torque command input gain	30	—	—	—	0	16bit	R/W	0x0327
Pr3.20	Torque command input inversion	0	—	—	—	0	16bit	R/W	0x0329
Pr3.21	Velocity limit in torque mode	0	—	—	—	0	16bit	R/W	0x032B
Pr3.22	Torque command	0	—	0	0	0	16bit	R/W	0x032D
Pr3.23	Zero speed delay time in velocity mode	0	—	—	0	—	16bit	R/W	0x032F
Pr3.24	Maximum motor rotational speed	0	—	0	0	0	16bit	R/W	0x0331
Pr3.29	Analog 1 clamping voltage	0	—	—	—	0	16bit	R/W	0x033B
Pr3.30	Analog 3 clamping voltage	0	—	—	—	0	16bit	R/W	0x033D
Pr3.58	Speed Regulation Ratio 1	10		0		0	16bit	R/W	0x0374 0x0375
Pr3.59	Speed Regulation Ratio 2	20		0		0	16bit	R/W	0x0376 0x0377
Pr3.60	Speed Regulation Ratio 3	40		0		0	16bit	R/W	0x0378 0x0379
Pr3.61	Speed Regulation Ratio 4	80		0		0	16bit	R/W	0x037A 0x037B

#### [Class 4] I/O Monitoring Settings

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr4.00	Input selection DI1	0x1	—	0	0	0	16bit	R/W	0x0401
Pr4.01	Input selection DI2	0x2	—	0	0	0	16bit	R/W	0x0403
Pr4.02	Input selection DI3	0x8	—	0	0	0	16bit	R/W	0x0405
Pr4.03	Input selection DI4	0x4	—	0	0	0	16bit	R/W	0x0407
Pr4.04	Input selection DI5	0x3	—	0	0	0	16bit	R/W	0x0409
Pr4.05	Input selection DI6	0x0	—	0	0	0	16bit	R/W	0x040B
Pr4.06	Input selection DI7	0x0	—	0	0	0	16bit	R/W	0x040D
Pr4.07	Input selection DI8	0x27	—	0	0	0	16bit	R/W	0x040F
Pr4.10	Output selection DO1	0x2	—	0	0	0	16bit	R/W	0x0415
Pr4.11	Output selection DO2	0x4	—	0	0	0	16bit	R/W	0x0417
Pr4.12	Output selection DO3	0x3	—	0	0	0	16bit	R/W	0x0419
Pr4.13	Output selection DO4	0x1	—	0	0	0	16bit	R/W	0x041B
Pr4.14	Output selection DO5	0x22	—	0	0	0	16bit	R/W	0x041D
Pr4.22	Analog input 1(AI-1) Zero drift settings	0	—	—	0	0	16bit	R/W	0x042D
Pr4.23	Analog input 1(AI-1) filter	0	—	—	0	0	16bit	R/W	0x042F
Pr4.24	Analog input 1(AI-1) overvoltage settings	0	—	—	0	0	16bit	R/W	0x0431
Pr4.28	Analog input 3(AI-3) Zero drift settings	20	—	0	—	—	16bit	R/W	0x043F
Pr4.29	Analog input 3(AI-3) filter	1	—	0	—	—	16bit	R/W	0x0441
Pr4.30	Analog input 3(AI-3) overvoltage	0	—	0	—	—	16bit	R/W	0x0443

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
	settings								
Pr4.31	Positioning complete range	50	—	0	0	0	16bit	R/W	0x0445
Pr4.32	Positioning complete output setting	50	—	—	0	—	16bit	R/W	0x0447
Pr4.33	INP positioning delay time	1000	—	—	0	—	16bit	R/W	0x0449
Pr4.34	Zero speed	150	—	0	0	0	16bit	R/W	0x044B
Pr4.35	Velocity coincidence range	0	—	0	0	0	16bit	R/W	0x044D
Pr4.36	Arrival velocity	30	—	0	0	0	16bit	R/W	0x044F
Pr4.43	Emergency stop function	0	—	0	0	0	16bit	R/W	0x0457
Pr4.64	AO1 output	0	—	0	0	0	16bit	R/W	0x0481
Pr4.65	AO1 signal	0x4	—	0	0	0	16bit	R/W	0x0483
Pr4.66	AO1 amplification	100	—	0	0	0	16bit	R/W	0x0485
Pr4.67	AO1 communication settings	0	—	0	0	0	16bit	R/W	0x0487
Pr4.68	AO1 offset	0	—	0	0	0	16bit	R/W	0x0489

### [Class 5] Extension settings

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr5.00	2nd pulse count per revolution	10000	0	0	—	—	32bit	R/W	0x0500 0x0501
Pr5.01	2nd Command frequency divider/multiplier numerator	1	0	0	—	—	32bit	R/W	0x0502 0x0503
Pr5.02	2nd Command frequency divider/multiplier denominator	1	0	0	—	—	32bit	R/W	0x0504 0x0505
Pr5.04	Driver prohibition input settings	0	—	0	0	0	16bit	R/W	0x0509
Pr5.06	Servo-off mode	0	—	0	0	0	16bit	R/W	0x050D
Pr5.08	DC bus voltage undervoltage	50	—	0	0	0	16bit	R/W	0x0513
Pr5.09	Main power-off detection time	0	0	0	0	0	16bit	R/W	0x0515
Pr5.10	Servo-off due to alarm mode	0	—	0	0	0	16bit	R/W	0x0517
Pr5.11	Servo braking torque setting	0	—	0	0	0	16bit	R/W	0x0519
Pr5.12	Overload level setting	0	—	0	0	0	16bit	R/W	0x051B
Pr5.15	I/O digital filter	0	0	0	0	0	16bit	R/W	0x051F
Pr5.17	Counter clearing input mode	3	—	0	—	—	16bit	R/W	0x0523
Pr5.20	Position unit settings	1	—	0	—	—	16bit	R/W	0x0529
Pr5.21	Torque limit selection	0	—	0	0	0	16bit	R/W	0x052B
Pr5.22	2nd torque limit	300	—	0	0	0	16bit	R/W	0x052D
Pr5.23	Positive torque warning threshold	0	—	0	0	0	16bit	R/W	0x052F
Pr5.24	Negative torque warning threshold	0	—	0	0	0	16bit	R/W	0x0531
Pr5.28	LED initial status	1	—	0	0	0	16bit	R/W	0x0539
Pr5.29	RS485 communication mode	0x5	—	0	0	0	16bit	R/W	0x053B
Pr5.30	RS485 communication Baud rate	4	—	0	0	0	16bit	R/W	0x053D
Pr5.31	RS485 axis address	1	—	0	0	0	16bit	R/W	0x053F
Pr5.32	Max. command pulse input frequency	0	—	0	—	—	16bit	R/W	0x0541
Pr5.35	Front panel lock setting	0	—	0	0	0	16bit	R/W	0x0547
Pr5.37	Torque saturation alarm detection time	500	—	0	0	0	16bit	R/W	0x0549

**[Class 6] Other Settings**

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr6.01	Encoder zero position compensation	0	0	0	0	0	16bit	R/W	0x0603
Pr6.03	JOG trial run torque command	350	—	—	—	0	16bit	R/W	0x0607
Pr6.04	JOG trial run velocity command	30	—	0	0	0	16bit	R/W	0x0609
Pr6.05	Position 3rd gain valid time	0	—	0	—	—	16bit	R/W	0x060B
Pr6.06	Position 3rd gain scale factor	100	—	0	—	—	16bit	R/W	0x060D
Pr6.07	Torque command additional value	0	—	0	0	0	16bit	R/W	0x060F
Pr6.08	Positive direction torque compensation value	0	—	0	0	0	16bit	R/W	0x0611
Pr6.09	Negative direction torque compensation value	0	—	0	0	0	16bit	R/W	0x0613
Pr6.11	Current response settings	100	—	0	0	0	16bit	R/W	0x0617
Pr6.14	Max. time to stop after disabling	500	—	0	0	0	16bit	R/W	0x061D
Pr6.20	Trial run distance	10	—	0	—	—	16bit	R/W	0x0629
Pr6.21	Trial run waiting time	300	—	0	—	—	16bit	R/W	0x062B
Pr6.22	No. of trial run cycles	5	—	0	—	—	16bit	R/W	0x062D
Pr6.25	Trial run acceleration	200	—	0	0	—	16bit	R/W	0x0633
Pr6.28	Observer gain	0	—	0	0	0	16bit	R/W	0x0639
Pr6.29	Observer filter	0	—	0	0	0	16bit	R/W	0x063B
Pr6.56	Blocked rotor alarm torque threshold	300	—	0	0	0	16bit	R/W	0x0671
Pr6.57	Blocked rotor alarm delay time	400	—	0	0	0	16bit	R/W	0x0673
Pr6.63	Absolute multiturn data upper limit	0	0	0	0	0	16bit	R/W	0x067F

**[Class B] Status Parameters**

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
PrB.00	Software version 1 (DSP)	/	—	0	0	0	16bit	R	0x0B00
PrB.01	Software version 2 (CPLD)	/	—	0	0	0	16bit	R	0x0B01
PrB.02	Software version 3 (Others)	/	—	0	0	0	16bit	R	0x0B02
PrB.03	Current alarm	/	—	0	0	0	16bit	R	0x0B03
PrB.04	Motor not rotating cause	/	—	0	0	0	16bit	R	0x0B04
PrB.05	Driver operation status	/	—	0	0	0	16bit	R	0x0B05
PrB.06	Motor speed (Before filter)	/	—	0	0	0	16bit	R	0x0B06
PrB.07	Motor torque	/	—	0	0	0	16bit	R	0x0B07
PrB.08	Motor current	/	—	0	0	0	16bit	R	0x0B08
PrB.09	Motor speed (After filter)	/	—	0	0	0	16bit	R	0x0B09
PrB.10	DC bus voltage	/	—	0	0	0	16bit	R	0x0B0A
PrB.11	Driver temperature	/	—	0	0	0	16bit	R	0x0B0B
PrB.12	External analog 1	/	—	0	0	0	16bit	R	0x0B0C
PrB.13	External analog 2	/	—	0	0	0	16bit	R	0x0B0D
PrB.14	External analog 3	/	—	0	0	0	16bit	R	0x0B0E
PrB.15	Motor overload rate	/	—	0	0	0	16bit	R	0x0B0F
PrB.16	Vent overload rate	/	—	0	0	0	16bit	R	0x0B10
PrB.17	Physical I/O input status	/	—	0	0	0	16bit	R	0x0B11
PrB.18	Physical I/O output status	/	—	0	0	0	16bit	R	0x0B12
PrB.20	Command position (Command unit)	/	—	0	0	0	32bit	R	0x0B14 0x0B15
PrB.21	Motor position (Command unit)	/	—	0	-	-	32bit	R	0x0B16 0x0B17
PrB.22	Position deviation (Command unit)	/	—	0	0	0	32bit	R	0x0B18 0x0B19
PrB.23	Command position (Encoder unit)	/	—	0	0	0	32bit	R	0x0B1A 0x0B1B
PrB.24	Motor position (Encoder unit)	/	—	0	-	-	32bit	R	0x0B1C



Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
									0x0B1D
PrB.25	Position deviation (Encoder unit)	/	—	0	0	0	32bit	R	0x0B1E 0x0B1F
PrB.26	Rotational encoder position feedback	/	—	0	-	-	32bit	R	0x0B20 0x0B21

**[Class 8] Pr-Control Parameters**

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P R	S	T	Byte	Op.	485 Addr.
Pr8.00	PR Control	0	—	0	—	—	16bit	R/W	0x6000
Pr8.01	Path count	16	—	0	—	—	16bit	R/W	0x6001
Pr8.02	Control Operation		—	0	—	—	16bit	R/W	0x6002
Pr8.06	Software positive limit H	0	—	0			16bit	R/W	0x6006
Pr8.07	Software positive limit (L)	0	—	0	—	—	16bit	R/W	0x6007
Pr8.08	Software negative limit H	0	—	0	—	—	16bit	R/W	0x6008
Pr8.09	Software negative limit (L)	0	—	0	—	—	16bit	R/W	0x6009
Pr8.10	Homing mode	0	—	0	—	—	16bit	R/W	0x600A
Pr8.11	Zero position H	0	—	0	—	—	16bit	R/W	0x600B
Pr8.12	Zero position (L)	0	—	0	—	—	16bit	R/W	0x600C
Pr8.13	Home position off set H	0	—	0	—	—	16bit	R/W	0x600D
Pr8.14	Home position off set (L)	0	—	0	—	—	16bit	R/W	0x600E
Pr8.15	High homing velocity	200	—	0	—	—	16bit	R/W	0x600F
Pr8.16	Low homing velocity	50	—	0	—	—	16bit	R/W	0x6010
Pr8.17	Homing acceleration	100	—	0	—	—	16bit	R/W	0x6011
Pr8.18	Homing deceleration	100	—	0	—	—	16bit	R/W	0x6012
Pr8.19	Homing torque holding time	100	—	0	—	—	16bit	R/W	0x6013
Pr8.20	Homing torque	100	—	0	—	—	16bit	R/W	0x6014
Pr8.21	Homing overtravel alarm range	0	—	0	—	—	16bit	R/W	0x6015
Pr8.22	Emergency stop at limit deceleration	10	—	0	—	—	16bit	R/W	0x6016
Pr8.23	STP emergency stop deceleration	50	—	0	—	—	16bit	R/W	0x6017
Pr8.24	I/O combination trigger mode	0	—	0	—	—	16bit	R/W	0x601A
Pr8.25	I/O combination filter	5	—	0	—	—	16bit	R/W	0x601B
Pr8.26	S-code current output value	0	—	0	—	—	16bit	R/W	0x601C
Pr8.27	PR warning	0	—	0	—	—	16bit	R/W	0x601D
Pr8.39	JOG velocity	100	—	0	—	—	16bit	R/W	0x6027
Pr8.40	JOG acceleration	100	—	0	—	—	16bit	R/W	0x6028
Pr8.41	JOG deceleration	100	—	0	—	—	16bit	R/W	0x6029
Pr8.42	Command position H	0	—	0	—	—	16bit	R/W	0x602A
Pr8.43	Command position (L)	0	—	0	—	—	16bit	R/W	0x602B
Pr8.44	Motor position H	0	—	0	—	—	16bit	R/W	0x602C
Pr8.45	Motor position (L)	0	—	0	—	—	16bit	R/W	0x602D
Pr8.46	Input I/O status	0	—	0	—	—	16bit	R/W	0x602E
Pr8.47	Output I/O status	0	—	0	—	—	16bit	R/W	0x602F
Pr8.48	Path 0 S-code	0	—	0	—	—	16bit	R/W	0x6030
Pr8.49	Path 1 S-code	0	—	0	—	—	16bit	R/W	0x6031
Pr8.50	Path 2 S-code	0	—	0	—	—	16bit	R/W	0x6032
Pr8.51	Path 3 S-code	0	—	0	—	—	16bit	R/W	0x6033
Pr8.52	Path 4 S-code	0	—	0	—	—	16bit	R/W	0x6034
Pr8.53	Path 5 S-code	0	—	0	—	—	16bit	R/W	0x6035
Pr8.54	Path 6 S-code	0	—	0	—	—	16bit	R/W	0x6036
Pr8.55	Path 7 S-code	0	—	0	—	—	16bit	R/W	0x6037
Pr8.56	Path 8 S-code	0	—	0	—	—	16bit	R/W	0x6038
Pr8.57	Path 9 S-code	0	—	0	—	—	16bit	R/W	0x6039
Pr8.58	Path 10 S-code	0	—	0	—	—	16bit	R/W	0x603A



Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P R	S	T	Byte	Op.	485 Addr.
Pr8.59	Path 11 S-code	0	—	0	—	—	16bit	R/W	0x603B
Pr8.60	Path 12 S-code	0	—	0	—	—	16bit	R/W	0x603C
Pr8.61	Path 13 S-code	0	—	0	—	—	16bit	R/W	0x603D
Pr8.62	Path 14 S-code	0	—	0	—	—	16bit	R/W	0x603E
Pr8.63	Path 15 S-code	0	—	0	—	—	16bit	R/W	0x603F

**[Class 9] Pr-Control Path Parameters**

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P R	S	T	Byte	Op.	485 Addr.
Pr9.00	PR0 mode	0	—	0	—	—	16bit	R/W	0x6200
Pr9.01	PR0 position H	0	—	0	—	—	16bit	R/W	0x6201
Pr9.02	PR0 position(L)	0	—	0	—	—	16bit	R/W	0x6202
Pr9.03	PR0 velocity	60	—	0	—	—	16bit	R/W	0x6203
Pr9.04	PR0 acceleration time	100	—	0	—	—	16bit	R/W	0x6204
Pr9.05	PR0 deceleration time	100	—	0	—	—	16bit	R/W	0x6205
Pr9.06	PR0 pause time	0	—	0	—	—	16bit	R/W	0x6206
Pr9.07	PR0 special parameter	0	—	0	—	—	16bit	R/W	0x6207
Pr9.08	PR1 mode	0	—	0	—	—	16bit	R/W	0x6208
Pr9.09	PR1 position H	0	—	0	—	—	16bit	R/W	0x6209
Pr9.10	PR1 position(L)	0	—	0	—	—	16bit	R/W	0x620A
Pr9.11	PR1 velocity	60	—	0	—	—	16bit	R/W	0x620B
Pr9.12	PR1 acceleration time	100	—	0	—	—	16bit	R/W	0x620C
Pr9.13	PR1 deceleration time	100	—	0	—	—	16bit	R/W	0x620D
Pr9.14	PR1 pause time	0	—	0	—	—	16bit	R/W	0x620E
Pr9.15	PR1 special parameter	0	—	0	—	—	16bit	R/W	0x620F
Pr9.16	PR2 mode	0	—	0	—	—	16bit	R/W	0x6210
Pr9.17	PR2 position H	0	—	0	—	—	16bit	R/W	0x6211
Pr9.18	PR2 position(L)	0	—	0	—	—	16bit	R/W	0x6212
Pr9.19	PR2 velocity	60	—	0	—	—	16bit	R/W	0x6213
Pr9.20	PR2 acceleration time	100	—	0	—	—	16bit	R/W	0x6214
Pr9.21	PR2 deceleration time	100	—	0	—	—	16bit	R/W	0x6215
Pr9.22	PR2 pause time	0	—	0	—	—	16bit	R/W	0x6216
Pr9.23	PR2 special parameter	0	—	0	—	—	16bit	R/W	0x6217
Pr9.24	PR3 mode	0	—	0	—	—	16bit	R/W	0x6218
Pr9.25	PR3 position H	0	—	0	—	—	16bit	R/W	0x6219
Pr9.26	PR3 position(L)	0	—	0	—	—	16bit	R/W	0x621A
Pr9.27	PR3 velocity	60	—	0	—	—	16bit	R/W	0x621B
Pr9.28	PR3 acceleration time	100	—	0	—	—	16bit	R/W	0x621C
Pr9.29	PR3 deceleration time	100	—	0	—	—	16bit	R/W	0x621D
Pr9.30	PR3 pause time	0	—	0	—	—	16bit	R/W	0x621E
Pr9.31	PR3 special parameter	0	—	0	—	—	16bit	R/W	0x621F
Pr9.32	PR4 mode	0	—	0	—	—	16bit	R/W	0x6220
Pr9.33	PR4 position H	0	—	0	—	—	16bit	R/W	0x6221
Pr9.34	PR4 position(L)	0	—	0	—	—	16bit	R/W	0x6222
Pr9.35	PR4 velocity	60	—	0	—	—	16bit	R/W	0x6223
Pr9.36	PR4 acceleration time	100	—	0	—	—	16bit	R/W	0x6224
Pr9.37	PR4 deceleration time	100	—	0	—	—	16bit	R/W	0x6225
Pr9.38	PR4 pause time	0	—	0	—	—	16bit	R/W	0x6226
Pr9.39	PR4 special parameter	0	—	0	—	—	16bit	R/W	0x6227
Pr9.40	PR5 mode	0	—	0	—	—	16bit	R/W	0x6228
Pr9.41	PR5 position H	0	—	0	—	—	16bit	R/W	0x6229
Pr9.42	PR5 position(L)	0	—	0	—	—	16bit	R/W	0x622A
Pr9.43	PR5 velocity	60	—	0	—	—	16bit	R/W	0x622B
Pr9.44	PR5 acceleration time	100	—	0	—	—	16bit	R/W	0x622C
Pr9.45	PR5 deceleration time	100	—	0	—	—	16bit	R/W	0x622D

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P R	S	T	Byte	Op.	485 Addr.
Pr9.46	PR5 pause time	0	—	0	—	—	16bit	R/W	0x622E
Pr9.47	PR5 special parameter	0	—	0	—	—	16bit	R	0x622F
Pr9.48	PR6 mode	0	—	0	—	—	16bit	R/W	0x6230
Pr9.49	PR6 position H	0	—	0	—	—	16bit	R/W	0x6231
Pr9.50	PR6 position(L)	0	—	0	—	—	16bit	R/W	0x6232
Pr9.51	PR6 velocity	60	—	0	—	—	16bit	R/W	0x6233
Pr9.52	PR6 acceleration time	100	—	0	—	—	16bit	R/W	0x6234
Pr9.53	PR6 deceleration time	100	—	0	—	—	16bit	R/W	0x6235
Pr9.54	PR6 pause time	0	—	0	—	—	16bit	R/W	0x6236
Pr9.55	PR6 special parameter	0	—	0	—	—	16bit	R/W	0x6237
Pr9.56	PR7 mode	0	—	0	—	—	16bit	R/W	0x6238
Pr9.57	PR7 position H	0	—	0	—	—	16bit	R/W	0x6239
Pr9.58	PR7 position(L)	0	—	0	—	—	16bit	R/W	0x623A
Pr9.59	PR7 velocity	60	—	0	—	—	16bit	R/W	0x623B
Pr9.60	PR7 acceleration time	100	—	0	—	—	16bit	R/W	0x623C
Pr9.61	PR7 deceleration time	100	—	0	—	—	16bit	R/W	0x623D
Pr9.62	PR7 pause time	0	—	0	—	—	16bit	R/W	0x623E
Pr9.63	PR7 special parameter	0	—	0	—	—	16bit	R/W	0x623F
Pr9.64	PR8 mode	0	—	0	—	—	16bit	R/W	0x6240
Pr9.65	PR8 position H	0	—	0	—	—	16bit	R/W	0x6241
Pr9.66	PR8 position(L)	0	—	0	—	—	16bit	R/W	0x6242
Pr9.67	PR8 velocity	60	—	0	—	—	16bit	R/W	0x6243
Pr9.68	PR8 acceleration time	100	—	0	—	—	16bit	R/W	0x6244
Pr9.69	PR8 deceleration time	100	—	0	—	—	16bit	R/W	0x6245
Pr9.70	PR8 pause time	0	—	0	—	—	16bit	R/W	0x6246
Pr9.71	PR8 special parameter	0	—	0	—	—	16bit	R/W	0x6247
Pr9.72	PR9 mode	0	—	0	—	—	16bit	R/W	0x6248
Pr9.73	PR9 position H	0	—	0	—	—	16bit	R/W	0x6249
Pr9.74	PR9 position(L)	0	—	0	—	—	16bit	R/W	0x624A
Pr9.75	PR9 velocity	60	—	0	—	—	16bit	R/W	0x624B
Pr9.76	PR9 acceleration time	100	—	0	—	—	16bit	R/W	0x624C
Pr9.77	PR9 deceleration time	100	—	0	—	—	16bit	R/W	0x624D
Pr9.78	PR9 pause time	0	—	0	—	—	16bit	R/W	0x624E
Pr9.79	PR9 special parameter	0	—	0	—	—	16bit	R/W	0x624F
Pr9.80	PR10 mode	0	—	0	—	—	16bit	R/W	0x6250
Pr9.81	PR10 position H	0	—	0	—	—	16bit	R/W	0x6251
Pr9.82	PR10 position(L)	0	—	0	—	—	16bit	R/W	0x6252
Pr9.83	PR10 velocity	60	—	0	—	—	16bit	R/W	0x6253
Pr9.84	PR10 acceleration time	100	—	0	—	—	16bit	R/W	0x6254
Pr9.85	PR10 deceleration time	100	—	0	—	—	16bit	R/W	0x6255
Pr9.86	PR10 pause time	0	—	0	—	—	16bit	R/W	0x6256
Pr9.87	PR10 special parameter	0	—	0	—	—	16bit	R/W	0x6257
Pr9.88	PR11 mode	0	—	0	—	—	16bit	R/W	0x6258
Pr9.89	PR11 position H	0	—	0	—	—	16bit	R/W	0x6259
Pr9.90	PR11 position(L)	0	—	0	—	—	16bit	R/W	0x625A
Pr9.91	PR11 velocity	60	—	0	—	—	16bit	R/W	0x625B
Pr9.92	PR11 acceleration time	100	—	0	—	—	16bit	R/W	0x625C
Pr9.93	PR11 deceleration time	100	—	0	—	—	16bit	R/W	0x625D
Pr9.94	PR11 pause time	0	—	0	—	—	16bit	R/W	0x625E
Pr9.95	PR11 special parameter	0	—	0	—	—	16bit	R/W	0x625F
Pr9.96	PR12 mode	0	—	0	—	—	16bit	R/W	0x6260
Pr9.97	PR12 position H	0	—	0	—	—	16bit	R/W	0x6261
Pr9.98	PR12 position(L)	0	—	0	—	—	16bit	R/W	0x6262
Pr9.99	PR12 velocity	60	—	0	—	—	16bit	R/W	0x6263
Pr9.100	PR12 acceleration time	100	—	0	—	—	16bit	R/W	0x6264
Pr9.101	PR12 deceleration time	100	—	0	—	—	16bit	R/W	0x6265

Code	Label	Default	Activ ation	Valid mode			Communication mode		
				P R	S	T	Byte	Op.	485 Addr.
Pr9.102	PR12 pause time	0	—	0	—	—	16bit	R/W	0x6266
Pr9.103	PR12 special parameter	0	—	0	—	—	16bit	R/W	0x6267
Pr9.104	PR13 mode	0	—	0	—	—	16bit	R/W	0x6268
Pr9.105	PR13 position H	0	—	0	—	—	16bit	R/W	0x6269
Pr9.106	PR13 position(L)	0	—	0	—	—	16bit	R/W	0x626A
Pr9.107	PR13 velocity	60	—	0	—	—	16bit	R/W	0x626B
Pr9.108	PR13 acceleration time	100	—	0	—	—	16bit	R/W	0x626C
Pr9.109	PR13 deceleration time	100	—	0	—	—	16bit	R/W	0x626D
Pr9.110	PR13 pause time	0	—	0	—	—	16bit	R/W	0x626E
Pr9.111	PR13 special parameter	0	—	0	—	—	16bit	R/W	0x626F
Pr9.112	PR14 mode	0	—	0	—	—	16bit	R/W	0x6270
Pr9.113	PR14 position H	0	—	0	—	—	16bit	R/W	0x6271
Pr9.114	PR14 position(L)	0	—	0	—	—	16bit	R/W	0x6272
Pr9.115	PR14 velocity	60	—	0	—	—	16bit	R/W	0x6273
Pr9.116	PR14 acceleration time	100	—	0	—	—	16bit	R/W	0x6274
Pr9.117	PR14 deceleration time	100	—	0	—	—	16bit	R/W	0x6275
Pr9.118	PR14 pause time	0	—	0	—	—	16bit	R/W	0x6276
Pr9.119	PR14 special parameter	0	—	0	—	—	16bit	R/W	0x6277
Pr9.120	PR15 mode	0	—	0	—	—	16bit	R/W	0x6278
Pr9.121	PR15 position H	0	—	0	—	—	16bit	R/W	0x6279
Pr9.122	PR15 position(L)	0	—	0	—	—	16bit	R/W	0x627A
Pr9.123	PR15 velocity	60	—	0	—	—	16bit	R/W	0x627B
Pr9.124	PR15 acceleration time	100	—	0	—	—	16bit	R/W	0x627C
Pr9.125	PR15 deceleration time	100	—	0	—	—	16bit	R/W	0x627D
Pr9.126	PR15 pause time	0	—	0	—	—	16bit	R/W	0x627E
Pr9.127	PR15 special parameter	0	—	0	—	—	16bit	R/W	0x627F

## 3.2 Parameters description

### 3.2.1 [Class 0] Basic Settings

Pr0.00	Label	Model-following/Zero tracking control			Valid mode(s)	P		
	Range	0-2000	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. Use mainly to tune MFC or ZTC bandwidth.								
<b>Value</b>		<b>Description</b>						
0		Disable model following/zero tracking control						
1		Set bandwidth automatically						
2~9		Reserved						
10~2000		Manually set control bandwidth. 30~100 recommended for belt application						

Pr0.01	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	
	1 <sup>st</sup> mode	2 <sup>nd</sup> mode
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position Pr0.22=1
		Velocity Pr0.22=1
		Torque Pr0.22=2
7~10	Reserved	

◆When 3, 4, 5, 6 combination hybrid mode, 1<sup>st</sup> and 2<sup>nd</sup> mode can be chosen accordingly with control mode switching input (C-MODE).  
 C-MODE: Invalid, select 1<sup>st</sup> mode.  
 C-MODE: Valid, select 2<sup>st</sup> mode.  
 Please allow some time in between mode switching commands.  
 ◆Please set Pr0.01 = 6 to switch to other modes from PR mod, then set 2<sup>nd</sup> mode using Pr0.22.  
*C-MODE is defaulted to Normally Open*

Pr0.02	Label	Real time Auto Gain Adjusting			Valid mode(s)	P	S	T
	Range	0x0~0xFF F	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	Pr0.03 invalid. Gain value must be adjusted manually and accordingly.
		1:Standard	Pr0.03 valid. Quick gain adjusting can be achieved by changing Pr0.03 stiffness value. Gain switching is not used in this mode, suitable for applications with requirements for stability.
		2:Positioning	Pr0.03 valid. Quick gain adjusting can be achieved by changing Pr0.03 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 Pr6.07

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

Pr0.03	Label	Real time auto stiffness adjusting			Valid mode(s)	P	S	T
	Range	0 ~ 31	Unit	—	Default	11		
	Byte length	16bit	Attribute	R/W	485 address	0x0007		
	Valid	Immediate						
<p style="text-align: center;">                     Low → Mechanical stiffness → High                      Low → Servo gain → High  <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px 0;">                         81.80.....70.69.68.....51.50                     </div>                      Low → Responsiveness → High                 </p> <p>Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Recommend to set to around 15 with motor with high inertia.</p>								

<b>Pr0.04</b>	<b>Label</b>	Inertia ratio			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~20000	<b>Unit</b>	%	<b>Default</b>	250		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0009		
	<b>Valid</b>	Immediate						

$$\text{Pr0.04} = (\text{load inertia} / \text{motor rotational inertia}) \times 100\%$$

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, Pr0.04 can be left unfilled but optimal setting of Pr0.04 could improve system performance

<b>Pr0.05</b>	<b>Label</b>	Command pulse input selection			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x000B		
	<b>Valid</b>	After restart						

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

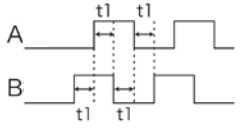
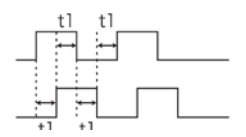
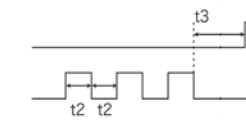
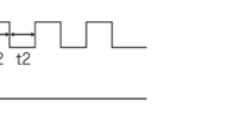
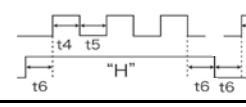
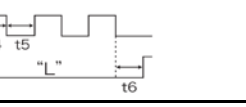
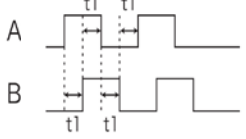
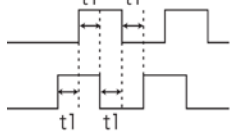
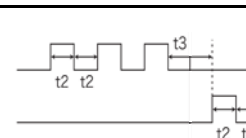
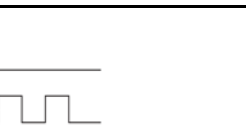
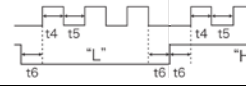

*Both channels cannot be used at the same time.*

<b>Pr0.06</b>	<b>Label</b>	Command pulse polarity inversion			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x000D		
	<b>Valid</b>	After restart						

Pr0.06 and Pr0.07 set command pulse input inversion and mode correspondingly.

<b>Pr0.07</b>	<b>Label</b>	Command pulse input mode		<b>Valid mode(s)</b>	<b>P</b>
	<b>Range</b>	0~3	<b>Unit</b>	—	<b>Default</b>
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>
	<b>Valid</b>	After restart			0x000F

**Command pulse input**

Command Polarity inversion (Pr0.06)	Command pulse input mode settings (Pr0.07)	Command Pulse Mode	Positive signal	Negative signal
<b>【0】</b>	0 or 2	90° phase difference 2 phase pulse (Phase A+ Phase B)		
	1	CW pulse sequence + CCW pulse sequence		
	<b>【3】</b>	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 (μs)					
			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

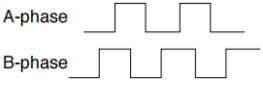
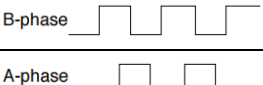


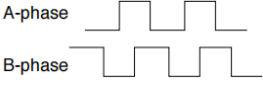
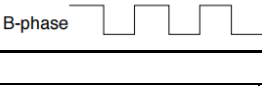

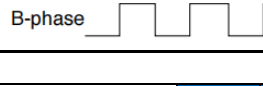
Please set >0.1μs for the duration between rising and falling edge of command pulse input signal.

1 revolution with 2500 pulses 2-phase pulse input when Pr0.07=0 or 2, Pr0.08 = 10000;

1 revolution with 10000 pulses 1-phase pulse input when Pr0.07=1 or 3, Pr0.08 = 10000

<b>Pr0.08</b>	<b>Label</b>	1st command pulse count per revolution			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0-67100864	<b>Unit</b>	PULSE	<b>Default</b>	10000		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0010 L: 0x0011		
	<b>Valid</b>	After restart						
Control will affected if value set is too low. Err1b1 might occur if value < 500. (1) Pr0.08 valid when $\neq 0$ : Motor revolution = input pulse count / [Pr0.08 value] (2) Pr0.08 invalid when = 0: Pr0.09 and Pr0.10 valid.								
<b>Pr0.09</b>	<b>Label</b>	1st command frequency divider/multiplier numerator			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	1~2147483647	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0012 L: 0x0013		
	<b>Valid</b>	After restart						
Valid when Pr0.08 = 0, please refer to description in Pr0.10.								
<b>Pr0.10</b>	<b>Label</b>	1st command frequency divider/multiplier denominator			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	1~2147483647	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0014 L: 0x0015		
	<b>Valid</b>	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 $Y = X * Pr0.09 / Pr0.10$ Please keep the value of Pr0.09 and Pr0.10 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 $W < 500$ .								
<b>Pr0.11</b>	<b>Label</b>	Encoder output pulse count per revolution			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	1~32767	<b>Unit</b>	P/r	<b>Default</b>	2500		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0017		
	<b>Valid</b>	After restart						
If Pr0.11 = 1000, encoder differential output signal per revolution = 4000 pulses								



<b>Pr0.12</b>	<b>Label</b>	Pulse output logic inversion			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0019		
	<b>Valid</b>	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								
<b>Pulse output logic inversion</b>								
	<b>Pr0.12</b>	<b>Phase B logic</b>	<b>CCW direction</b>		<b>CW direction</b>			
	[0]	Not inverted	A-phase  B-phase 		A-phase  B-phase 			
	[1]	Inverted	A-phase  B-phase 		A-phase  B-phase 			

<b>Pr0.13</b>	<b>Label</b>	1 <sup>st</sup> torque limit			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~500	<b>Unit</b>	%	<b>Default</b>	350		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x001B		
	<b>Valid</b>	Immediate						
1 <sup>st</sup> torque limit is set according to ratio percentage of motor rated current. Do not exceed max driver output current.								
Please refer to Pr5.21 on how to set torque limit.								

<b>Pr0.14</b>	<b>Label</b>	Excessive position deviation			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~310	<b>Unit</b>	0.1rev	<b>Default</b>	30		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x001D		
	<b>Valid</b>	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.								

Pr0.15	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						
Value	Mode	Description						
【0】	Incremental	Doesn't retain position data on power off. Unlimited travel distance.						
1	Multiturn absolute linear	Retrain position data on power off. For applications with fixed travel distance and no multiturn data overflow.						
2	Multiturn absolute rotary	Retrain position data on power off. Actual data feedback in between 0-(Pr6.63+1). Unlimited travel distance.						
3	Single turn absolute	Used when travel distance is within 1 revolution of the encoder. Data overflow will trigger alarm.						
5	Multi turn absolute	Clear multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 5 after 3s, please solve according to Er153.						
9		Clear multiturn position, reset multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 9 after 3s, please solve according to Er153. Please disable axis before setting to 9 and home the axis before using.						
Others		Do not use!						

Pr0.16	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  
 Pr0.16 and Pr0.17 set value determine alarm threshold of Er120.  
 If set value > actual regenerative resistance, Er120 occurrence might be delayed.

Pr0.17	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 no.	Internal resistance (Ω)	Internal resistor power rating (W)
EL7-RS400P	100	50
EL7-RS750P	50	75
EL7-RS1000P	50	100
EL7-RS750PT	100	100
EL7-RS1000PT	100	100
EL7-RS1500PT	100	100
EL7-RS2000PT	50	100
EL7-RS3000PT	50	100
EL7-RS4400PT	35	100
EL7-RS5500PT	35	100
EL7-RS7500PT	35	100

Pr0.16 and Pr0.17 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.*

<b>Pr0.22</b>	<b>Label</b>	PR and P/S/T switching			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~2	<b>Unit</b>	-	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x002D		
	<b>Valid</b>	Immediate						
When Pr0.01 = 6(PR Mode), 2 <sup>nd</sup> mode can be set on Pr0.22								
		<b>Pr0.01</b>	<b>Pr0.22</b>	<b>Control mode</b>				
		6	<b>【0】</b>	PR / Position				
			1	PR / Velocity				
			2	PR / Torque				

<b>Pr0.25</b>	<b>Label</b>	Auxiliary function			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFF	<b>Unit</b>	-	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0033		
	<b>Valid</b>	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 Pr0.25  
Do not use JOG\_P and JOG\_N  
in PR mode

<b>Pr0.26</b>	<b>Label</b>	Simulated I/O			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFF	<b>Unit</b>	-	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0035		
	<b>Valid</b>	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

<b>Pr0.40</b> (Only for RS485)	<b>Label</b>	Mapping parameter 1			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x0050		
	<b>Valid</b>					L: 0x0051		
<p>For user to set parameters unrelated by RS485 address quickly. Mapping parameter ID to be written is set on Pr0.50 by RS485. Data saved in Pr0.40 is parameter designated by Pr0.50.</p> <p>Please refer to Pr0.57 for parameter settings.</p> <p><i>Note: Range, unit and attribute of Pr0.40 is determined by Pr0.50 designated parameter.</i></p>								
<b>Pr0.41</b> (Only for RS485)	<b>Label</b>	Mapping parameter 2			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x0052		
	<b>Valid</b>					L: 0x0053		
<p>Please refer to Pr0.40 for parameter description and Pr0.57 for parameter settings.</p> <p><i>Note: Range, unit and attribute of Pr0.41 is determined by Pr0.51 designated parameter.</i></p>								
<b>Pr0.42</b> (Only for RS485)	<b>Label</b>	Mapping parameter 3			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x0054		
	<b>Valid</b>					L: 0x0055		
<p>Please refer to Pr0.40 for parameter description and Pr0.57 for parameter settings.</p> <p><i>Note: Range, unit and attribute of Pr0.42 is determined by Pr0.52 designated parameter.</i></p>								
<b>Pr0.43</b> (Only for RS485)	<b>Label</b>	Mapping parameter 4			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x0056		
	<b>Valid</b>					L: 0x0057		
<p>Please refer to Pr0.40 for parameter description and Pr0.57 for parameter settings.</p> <p><i>Note: Range, unit and attribute of Pr0.43 is determined by Pr0.53 designated parameter.</i></p>								
<b>Pr0.44</b> (Only for RS485)	<b>Label</b>	Mapping parameter 5			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x0058		
	<b>Valid</b>					L: 0x0059		
<p>Please refer to Pr0.40 for parameter description and Pr0.57 for parameter settings.</p> <p><i>Note: Range, unit and attribute of Pr0.44 is determined by Pr0.54 designated parameter.</i></p>								
<b>Pr0.45</b> (Only for RS485)	<b>Label</b>	Mapping parameter 6			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x005A		
	<b>Valid</b>					L: 0x005B		
<p>Please refer to Pr0.40 for parameter description and Pr0.57 for parameter settings.</p> <p><i>Note: Range, unit and attribute of Pr0.45 is determined by Pr0.55 designated parameter.</i></p>								
<b>Pr0.46</b> (Only for RS485)	<b>Label</b>	Mapping parameter 7			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x005C		
	<b>Valid</b>					L: 0x005D		
<p>Please refer to Pr0.40 for parameter description and Pr0.57 for parameter settings.</p> <p><i>Note: Range, unit and attribute of Pr0.46 is determined by Pr0.56 designated parameter.</i></p>								

<b>Pr0.47 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 8			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>		<b>Unit</b>		<b>Default</b>	0		
	<b>Byte length</b>	32bit	<b>Attribute</b>		<b>485 address</b>	H: 0x005E		
	<b>Valid</b>					L: 0x005F		
Please refer to Pr0.40 for parameter description and Pr0.57 for parameter settings. <i>Note: Range, unit and attribute of Pr0.47 is determined by Pr0.57 designated parameter.</i>								

<b>Pr0.50 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 1 indicator			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFFFFFF F	<b>Unit</b>		<b>Default</b>	0x00490049		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0064		
	<b>Valid</b>	Immediate				L: 0x0065		
<b>Pr0.51 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 2 indicator			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFFFFFF F	<b>Unit</b>		<b>Default</b>	0x00490049		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0066		
	<b>Valid</b>	Immediate				L: 0x0067		
<b>Pr0.52 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 3 indicator			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFFFFFF F	<b>Unit</b>		<b>Default</b>	0x00490049		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0068		
	<b>Valid</b>	Immediate				L: 0x0069		
<b>Pr0.53 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 4 indicator			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFFFFFF F	<b>Unit</b>		<b>Default</b>	0x00490049		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x006A		
	<b>Valid</b>	Immediate				L: 0x006B		
<b>Pr0.54 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 5 indicator			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFFFFFF F	<b>Unit</b>		<b>Default</b>	0x00490049		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x006C		
	<b>Valid</b>	Immediate				L: 0x006D		
<b>Pr0.55 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 6 indicator			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFFFFFF F	<b>Unit</b>		<b>Default</b>	0x00490049		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x006E		
	<b>Valid</b>	Immediate				L: 0x006F		
<b>Pr0.56 (Only for RS485)</b>	<b>Label</b>	Mapping parameter 7 indicator			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~0xFFFFFFFF F	<b>Unit</b>		<b>Default</b>	0x00490049		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0070		
	<b>Valid</b>	Immediate				L: 0x0071		

Pr0.57 (Only for RS485)	Label	Mapping parameter 8 indicator			Valid mode(s)	P	S	T
	Range	0~0xFFFFFFFF F	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								
<b>4-bit value</b>		<b>Definition</b>		<b>4-bit value</b>		<b>Definition</b>		
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:								
Pr0.50 content as below: (Mapping parameter 1 indicator: Pr0.50; Mapping parameter 1: Pr0.40) Pr0.40 high bit corresponds to Pr0.50 high bit indicator (PH) value; Pr0.40 low bit corresponds to Pr0.50 low bit indicator (PL) value;								
1. When Pr0.50 PH≠PL, indicates that Pr0.40 contains 2 16-bit mapped values. If Pr0.50=0x06200101; PH=0x0620,PL=0x0101; write 0x0005 0064 into Pr0.40; write 0x0005 into Pr6.20, write 0x0064 into Pr1.01;								
2. When Pr0.50 PH=PL, indicates that Pr0.40 contains 1 32-bit mapped value. If Pr0.50=0x01150115; PH=0x0115,PL=0x0115; write 0x00000001 into Pr0.40; write 0x00000001 into Pr1.15;								
<i>Note: When a 32-bit address parameter is mapped, please write same address into high and low bit as shown above.</i>								

### 3.2.2 [Class 1] Gain adjustments

Pr1.00	Label	1 <sup>st</sup> 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: $1.2 \leq \text{Pr1.00}/\text{Pr1.01} \leq 1.8$								

<b>Pr1.01</b>	<b>Label</b>	1 <sup>st</sup> velocity loop gain			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																																																																				
	<b>Range</b>	1~32767	<b>Unit</b>	0.1Hz	<b>Default</b>	180																																																																						
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0103																																																																						
	<b>Valid</b>	Immediate																																																																										
To determine the responsiveness of the velocity loop. If inertia ratio of Pr0.04 is uniform with actual inertia ratio, velocity loop responsiveness = Pr1.01. 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.																																																																												
<b>Pr1.02</b>	<b>Label</b>	1 <sup>st</sup> Integral Time Constant of Velocity Loop			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																																																																				
	<b>Range</b>	1~10000	<b>Unit</b>	0.1ms	<b>Default</b>	310																																																																						
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0105																																																																						
	<b>Valid</b>	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 Pr1.02.																																																																												
<b>Pr1.03</b>	<b>Label</b>	1 <sup>st</sup> velocity detection filter			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																																																																				
	<b>Range</b>	0~31	<b>Unit</b>	—	<b>Default</b>	15																																																																						
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0107																																																																						
	<b>Valid</b>	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. Pr1.03 needs to match velocity loop gain. Please refer to the following table.																																																																												
<table border="1"> <thead> <tr> <th>Value</th> <th>Velocity Detection Filter Cut-off Frequency(Hz)</th> <th>Value</th> <th>Velocity Detection Filter Cut-off Frequency(Hz)</th> </tr> </thead> <tbody> <tr><td>0</td><td>2500</td><td>16</td><td>750</td></tr> <tr><td>1</td><td>2250</td><td>17</td><td>700</td></tr> <tr><td>2</td><td>2100</td><td>18</td><td>650</td></tr> <tr><td>3</td><td>2000</td><td>19</td><td>600</td></tr> <tr><td>4</td><td>1800</td><td>20</td><td>550</td></tr> <tr><td>5</td><td>1600</td><td>21</td><td>500</td></tr> <tr><td>6</td><td>1500</td><td>22</td><td>450</td></tr> <tr><td>7</td><td>1400</td><td>23</td><td>400</td></tr> <tr><td>8</td><td>1300</td><td>24</td><td>350</td></tr> <tr><td>9</td><td>1200</td><td>25</td><td>300</td></tr> <tr><td>10</td><td>1100</td><td>26</td><td>250</td></tr> <tr><td>11</td><td>1000</td><td>27</td><td>200</td></tr> <tr><td>12</td><td>950</td><td>28</td><td>175</td></tr> <tr><td>13</td><td>900</td><td>29</td><td>150</td></tr> <tr><td>14</td><td>850</td><td>30</td><td>125</td></tr> <tr><td>【15】</td><td>800</td><td>31</td><td>100</td></tr> </tbody> </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
Value	Velocity Detection Filter Cut-off Frequency(Hz)	Value	Velocity Detection Filter Cut-off Frequency(Hz)																																																																									
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<b>Pr1.04</b>	<b>Label</b>	1 <sup>st</sup> Torque Filter Time Constant			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~2500	<b>Unit</b>	0.01ms	<b>Default</b>	126		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0109		
	<b>Valid</b>	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. Pr1.04 needs to match velocity loop gain.

Recommended range:  $1,000,000/(2\pi \times \text{Pr1.04}) \geq \text{Pr1.01} \times 4$

For example: Velocity loop gain Pr1.01=180(0.1Hz) which is 18Hz. Time constant of torque filter should be  $\text{Pr1.01} \leq 221(0.01\text{ms})$

If mechanical vibration is due to servo driver, adjusting Pr1.04 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 Pr1.01 value settings and no resonance, reduce Pr1.04 value;

With lower Pr1.01 value settings, increase Pr1.04 value to lower motor noise.

<b>Pr1.05</b>	<b>Label</b>	2 <sup>nd</sup> Position Loop Gain			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~30000	<b>Unit</b>	0.1/s	<b>Default</b>	380		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x010B		
	<b>Valid</b>	Immediate						

<b>Pr1.06</b>	<b>Label</b>	2 <sup>nd</sup> velocity loop gain			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	1~32767	<b>Unit</b>	0.1Hz	<b>Default</b>	180		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x010D		
	<b>Valid</b>	Immediate						

<b>Pr1.07</b>	<b>Label</b>	2 <sup>nd</sup> Integral Time Constant of Velocity Loop			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	1~10000	<b>Unit</b>	0.1ms	<b>Default</b>	10000		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x010F		
	<b>Valid</b>	Immediate						

<b>Pr1.08</b>	<b>Label</b>	2 <sup>nd</sup> velocity detection filter			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~31	<b>Unit</b>	—	<b>Default</b>	15		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0111		
	<b>Valid</b>	Immediate						

<b>Pr1.09</b>	<b>Label</b>	2 <sup>nd</sup> Torque Filter Time Constant			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~2500	<b>Unit</b>	0.01ms	<b>Default</b>	126		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0113		
	<b>Valid</b>	Immediate						

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

<b>Pr1.10</b>	<b>Label</b>	Velocity feed forward gain			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~1000	<b>Unit</b>	0.10%	<b>Default</b>	300		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0115		
	<b>Valid</b>	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.

<b>Pr1.11</b>	<b>Label</b>	Velocity feed forward filter time constant			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~6400	<b>Unit</b>	0.01ms	<b>Default</b>	50		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0117		
	<b>Valid</b>	Immediate						
<p>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.</p> <p>Reduce Pr1.11 value to suppress velocity overshoot during deceleration; Increase Pr1.11 value to suppress noise or vibration due to long driver control cycle or position command uneven pulse frequency.</p> <p><b>&lt;Application&gt;</b>                      Set Pr1.11 = 50 (0.5ms) , improve feedforward effect by gradually increase Pr1.10. The equation below can be used to determine the position deviation due to velocity feedforward gain under constant velocity.</p> $\text{Position deviation[Uint]} = \frac{\text{Set velocity}[\frac{\text{Uint}}{\text{s}}]}{\text{Position loop gain[Hz]}} \times \frac{100 - \text{Velocity feed forward gain}[\%]}{100}$								
<b>Pr1.12</b>	<b>Label</b>	Torque feed forward gain			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	
	<b>Range</b>	0~1000	<b>Unit</b>	0.1%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0119		
	<b>Valid</b>	Immediate						
<p>Before using torque feed forward, please set correct inertia ratio Pr0.04. 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.</p>								
<b>Pr1.13</b>	<b>Label</b>	Torque feed forward filter time constant			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	
	<b>Range</b>	0~6400	<b>Unit</b>	0.01ms	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x011B		
	<b>Valid</b>	Immediate						
<p>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.</p> <p><b>&lt;Application&gt;</b></p> <ul style="list-style-type: none"> <li>Set Pr1.13 = 50ms, please increase torque forward gain gradually to enable torque feedforward.</li> <li>By increasing Pr1.13, noise will reduce but position deviation will become larger.</li> </ul>								

<b>Pr1.15</b>	<b>Label</b>	Position control gain switching mode			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~10	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x011F		
	<b>Valid</b>	Immediate						

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

Value	Condition	Gain switching condition
<b>【0】</b>	1 <sup>st</sup> gain fixed	Fixed on using 1 <sup>st</sup> gain(Pr1.00-Pr1.04)
1	2 <sup>nd</sup> gain fixed	Fixed on using 2 <sup>nd</sup> gain (Pr1.05-Pr1.09)
2	Gain switching input valid	· Gain switching input (GAIN) invalid: 1 <sup>st</sup> gain. · Gain switching input (GAIN) valid: 2 <sup>nd</sup> gain. <i>*Default: 1<sup>st</sup> gain</i>
3	High command torque	Switch to 2 <sup>nd</sup> gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1 <sup>st</sup> 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 2 <sup>nd</sup> gain if position command $\neq 0$ Switch to 1 <sup>st</sup> gain if positional command = 0 throughout the duration of delay time and absolute value of actual velocity remains smaller than (level - hysteresis) (r/min)

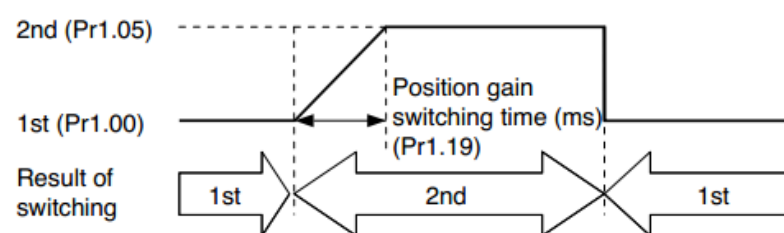
**\*\* Above 'level' and 'hysteresis' are in correspondence to Pr1.17 Position control gain switching level and Pr1.18 Hysteresis at position control switching.**

<b>Pr1.17</b>	<b>Label</b>	Position control gain switching level			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~20000	<b>Unit</b>	Mode dependent	<b>Default</b>	50		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0123		
	<b>Valid</b>	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  $\geq$  hysteresis*

<b>Pr1.18</b>	<b>Label</b>	Hysteresis at position control switching			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~20000	<b>Unit</b>	Mode dependent	<b>Default</b>	33		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0125		
	<b>Valid</b>	Immediate						
To eliminate the instability of gain switching. Used in combination with Pr1.17 using the same unit. If level < hysteresis, drive will set internally hysteresis = level.								
<b>Pr1.19</b>	<b>Label</b>	Position control switching time			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~10000	<b>Unit</b>	0.1ms	<b>Default</b>	33		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0127		
	<b>Valid</b>	Immediate						
During position control, if 1 <sup>st</sup> and 2 <sup>nd</sup> gain difference is too large, to ease torque changes and vibration due to rapid changes in position loop gain, set suitable Pr1.19 value For example: 1st (Pr1.00) <-> 2nd (Pr1.05)								
								

<b>Pr1.35</b>	<b>Label</b>	Position command pulse filter time			<b>Valid mode(s)</b>	<b>P</b>																														
	<b>Range</b>	0~200	<b>Unit</b>	0.01us	<b>Default</b>	8																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0147																														
	<b>Valid</b>	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 with high delay time. Pr1.35 formula:																																				
$\text{Filter frequency} = \frac{1}{2 \times \text{Pr1.35} \times 0.05\text{us}} \times 1000000\text{Hz}$																																				
Example: Pr1.35=100, pulse frequency > 100KHz will be filtered;																																				
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Pr1.35</th> <th>Filter frequency</th> <th>Pr1.35</th> <th>Filter frequency</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Null</td> <td>100</td> <td>100kHz(500KHz)</td> </tr> <tr> <td>8</td> <td>1.25MHz(6.25MHz)</td> <td>125</td> <td>80kHz(400KHz)</td> </tr> <tr> <td>10</td> <td>1MHz (5MHz)</td> <td>160</td> <td>62.5kHz(312KHz)</td> </tr> <tr> <td>20</td> <td>500kHz(2.5MHz)</td> <td>200</td> <td>50kHz(250KHz)</td> </tr> <tr> <td>50</td> <td>200kHz(1MHz)</td> <td></td> <td></td> </tr> <tr> <td>80</td> <td>125kHz(625KHz)</td> <td></td> <td></td> </tr> </tbody> </table>									Pr1.35	Filter frequency	Pr1.35	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)		
Pr1.35	Filter frequency	Pr1.35	Filter frequency																																	
0	Null	100	100kHz(500KHz)																																	
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50	200kHz(1MHz)																																			
80	125kHz(625KHz)																																			

### 3.2.3 [Class 2] Vibration suppression

<b>Pr2.00</b>	<b>Label</b>	Adaptive filtering mode settings			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>																
	<b>Range</b>	0~4	<b>Unit</b>	—	<b>Default</b>	0																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0201																	
	<b>Valid</b>	Immediate																					
<table border="1"> <thead> <tr> <th>Value</th> <th colspan="2">Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Adaptive filter: invalid</td> <td>Parameters related to 3<sup>rd</sup> notch filter remain unchanged</td> </tr> <tr> <td>1</td> <td>Adaptive filter: 1 filter valid for once.</td> <td>1 adaptive filter becomes valid. 3<sup>rd</sup> notch filter related parameters updated accordingly. Pr2.00 switches automatically to 0 once updated.</td> </tr> <tr> <td>2</td> <td>Adaptive filter: 1 filter remains valid</td> <td>1 adaptive filter becomes valid. 3<sup>rd</sup> notch filter related parameters will keep updating accordingly.</td> </tr> <tr> <td>3-4</td> <td>Reserved</td> <td>-</td> </tr> </tbody> </table>									Value	Description		0	Adaptive filter: invalid	Parameters related to 3 <sup>rd</sup> notch filter remain unchanged	1	Adaptive filter: 1 filter valid for once.	1 adaptive filter becomes valid. 3 <sup>rd</sup> notch filter related parameters updated accordingly. Pr2.00 switches automatically to 0 once updated.	2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3 <sup>rd</sup> notch filter related parameters will keep updating accordingly.	3-4	Reserved	-
Value	Description																						
0	Adaptive filter: invalid	Parameters related to 3 <sup>rd</sup> notch filter remain unchanged																					
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2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3 <sup>rd</sup> notch filter related parameters will keep updating accordingly.																					
3-4	Reserved	-																					
<b>Pr2.01</b>	<b>Label</b>	1 <sup>st</sup> notch frequency			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	50~4000	<b>Unit</b>	Hz	<b>Default</b>	4000																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0203																	
	<b>Valid</b>	Immediate																					
Set center frequency of 1 <sup>st</sup> torque command notch filter. Set Pr2.01 to 4000 to deactivate notch filter																							
<b>Pr2.02</b>	<b>Label</b>	1 <sup>st</sup> notch width			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	0~20	<b>Unit</b>	—	<b>Default</b>	4																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0205																	
	<b>Valid</b>	Immediate																					
Set notch bandwidth for 1 <sup>st</sup> resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.03, Pr2.02 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings																							
<b>Pr2.03</b>	<b>Label</b>	1 <sup>st</sup> notch depth			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	0~99	<b>Unit</b>	—	<b>Default</b>	0																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0207																	
	<b>Valid</b>	Immediate																					
Set notch depth for 1 <sup>st</sup> resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.02, Pr2.03 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings																							

<b>Pr2.04</b>	<b>Label</b>	2 <sup>nd</sup> notch frequency			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	50~4000	<b>Unit</b>	Hz	<b>Default</b>	4000		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0209		
	<b>Valid</b>	Immediate						
Set center frequency of 2 <sup>nd</sup> torque command notch filter. Set Pr2.04 to 4000 to deactivate notch filter								
<b>Pr2.05</b>	<b>Label</b>	2 <sup>nd</sup> notch width			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~20	<b>Unit</b>	—	<b>Default</b>	4		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x020B		
	<b>Valid</b>	Immediate						
Set notch bandwidth for 2 <sup>nd</sup> resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.04 and Pr2.06, Pr2.05 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								
<b>Pr2.06</b>	<b>Label</b>	2 <sup>nd</sup> notch depth			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~99	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x020D		
	<b>Valid</b>	Immediate						
Set notch depth for 1 <sup>st</sup> resonant notch filter. When Pr2.06 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 Pr2.04 and Pr2.05, Pr2.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								
<b>Pr2.07</b>	<b>Label</b>	3 <sup>rd</sup> notch frequency			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	50~4000	<b>Unit</b>	Hz	<b>Default</b>	4000		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x020F		
	<b>Valid</b>	Immediate						
Set center frequency of 3 <sup>rd</sup> torque command notch filter. Set Pr2.07 to 4000 to deactivate notch filter								
<b>Pr2.08</b>	<b>Label</b>	3 <sup>rd</sup> notch width			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~20	<b>Unit</b>	—	<b>Default</b>	4		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0211		
	<b>Valid</b>	Immediate						
Set notch depth for 3 <sup>rd</sup> resonant notch filter. When Pr2.06 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 Pr2.04 and Pr2.05, Pr2.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								
<b>Pr2.09</b>	<b>Label</b>	3 <sup>rd</sup> notch depth			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~99	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0213		
	<b>Valid</b>	Immediate						
Set notch depth for 3 <sup>rd</sup> resonant notch filter. When Pr2.06 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 Pr2.04 and Pr2.05, Pr2.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								

<b>Pr2.14</b>	<b>Label</b>	1 <sup>st</sup> damping frequency			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0/10~2000	<b>Unit</b>	0.1Hz	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x021D	
	<b>Valid</b>	Immediate					

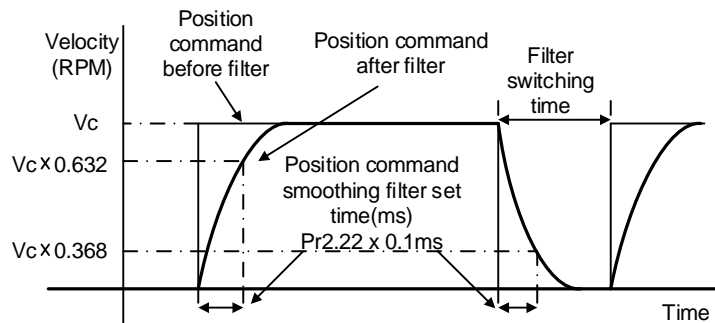
Set Pr2.16 to 0 to deactivate this parameter.  
 To suppress wobble at load end. Often used when wobble of flexible structure due to high deceleration upon stopping. Especially effective for wobble with frequencies under 100Hz. Set Pr2.15 to wobble frequency (wobble frequency can be determined using tracing function of Motion Studio)

<b>Pr2.16</b>	<b>Label</b>	2 <sup>nd</sup> damping frequency			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0/10~2000	<b>Unit</b>	0.1Hz	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0221	
	<b>Valid</b>	Immediate					

Set Pr2.16 to 0 to deactivate this parameter.  
 To suppress wobble at load end. Often used when wobble of flexible structure due to high deceleration upon stopping. Especially effective for wobble with frequencies under 100Hz. Set Pr2.16 to wobble frequency (wobble frequency can be determined using tracing function of Motion Studio)

<b>r2.22</b>	<b>Label</b>	Position command smoothing filter			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~32767	<b>Unit</b>	0.1ms	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x022D	
	<b>Valid</b>	At stop					

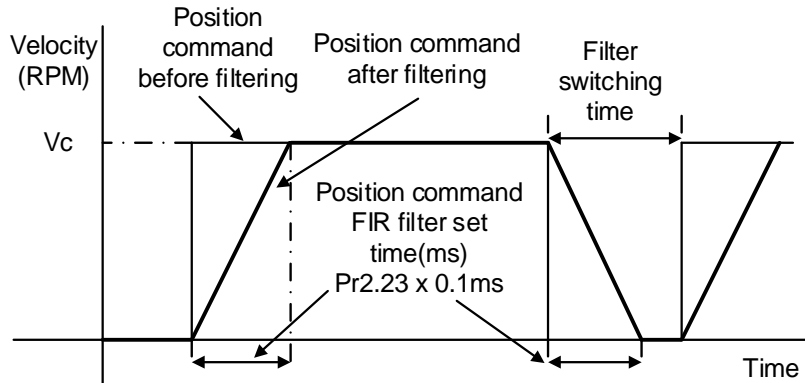
To set time constant of 1 time delay filter of position command.  
 To set time constant of 1 time delay filter, according to target velocity  $V_c$  square wave command as show below.



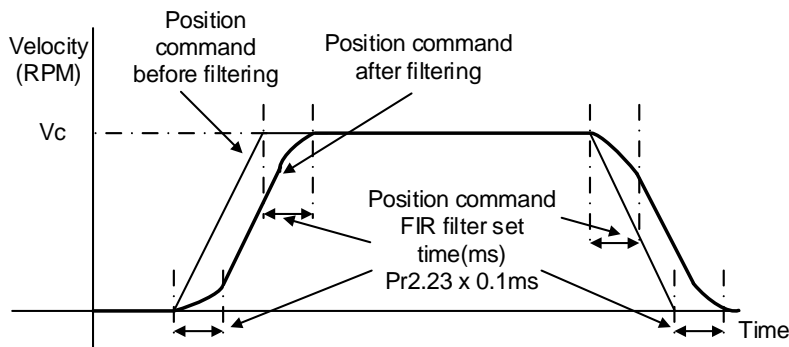
Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If Pr2.22 is set too high, overall time will be lengthened.

<b>Pr2.23</b>	<b>Label</b>	Position command FIR filter			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~2500	<b>Unit</b>	0.1ms	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x022F	
	<b>Valid</b>	At stop					

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



As shown below, when target velocity  $V_c$  trapezoidal command reaches  $V_c$ , 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 Pr2.23 is set too high, overall time will be lengthened.

*Note: Please wait for command to stop and after filter idle time to modify Pr2.23.*

$$\text{Filter switching time} = (\text{Pr2.23 set value} \times 0.1\text{ms} + 0.25\text{ms})$$



<b>Pr2.48</b>	<b>Label</b>	Adjustment mode			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>						
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0								
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0261								
	<b>Valid</b>	Immediate												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 15%;">Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>【0】</b></td> <td>Turn off automatic adjustments</td> </tr> <tr> <td style="text-align: center;">1</td> <td>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.</td> </tr> </tbody> </table>									Value	Description	<b>【0】</b>	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.
Value	Description													
<b>【0】</b>	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.													

<b>Pr2.50</b>	<b>Label</b>	MFC type			<b>Valid mode(s)</b>	<b>P</b>												
	<b>Range</b>	0~3	<b>Unit</b>	—	<b>Default</b>	0												
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0265												
	<b>Valid</b>	Re-enable																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 15%;">Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>【0】</b></td> <td>Model following control</td> </tr> <tr> <td style="text-align: center;">1</td> <td>Zero tracking control</td> </tr> <tr> <td style="text-align: center;">2</td> <td><i>3 inertia (future upgrade)</i></td> </tr> <tr> <td style="text-align: center;">3</td> <td><i>Path following (future upgrade)</i></td> </tr> </tbody> </table>									Value	Description	<b>【0】</b>	Model following control	1	Zero tracking control	2	<i>3 inertia (future upgrade)</i>	3	<i>Path following (future upgrade)</i>
Value	Description																	
<b>【0】</b>	Model following control																	
1	Zero tracking control																	
2	<i>3 inertia (future upgrade)</i>																	
3	<i>Path following (future upgrade)</i>																	

<b>Pr2.51</b>	<b>Label</b>	Velocity feedforward compensation coefficient			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	-10000~10000	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0267		
	<b>Valid</b>	Immediate						
To compensate for velocity feedforward								

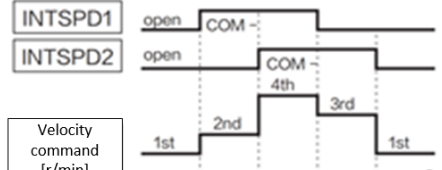
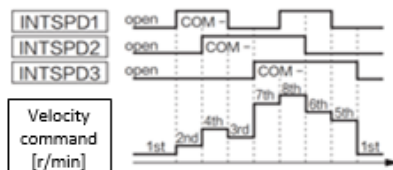
<b>Pr2.52</b>	<b>Label</b>	Torque feedforward compensation coefficient			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	
	<b>Range</b>	-10000~10000	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0269		
	<b>Valid</b>	Immediate						
To compensate for torque feedforward								

<b>Pr2.53</b>	<b>Label</b>	Dynamic friction compensation coefficient			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~1000	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x026B		
	<b>Valid</b>	Immediate						
<p>To set ratio of rated torque/rated rotational speed, to compensate for dynamic friction during motion and have better control over acceleration/deceleration.</p> <p><b>Dynamic friction coefficient</b></p> $= \left  \frac{\text{Torque}(\text{Rotational speed 1}) - \text{Torque}(\text{Rotational speed 2})}{\text{Rotational speed 1} - \text{Rotational speed 2}} * \text{rated rotational speed} \right $ <p>When there is an excess position deviation during acceleration/deceleration, please adjust Pr2.53 to reduce the deviation to 0.</p>								

<b>Pr2.54</b>	<b>Label</b>	Overshoot time coefficient			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x026D		
	<b>Valid</b>	Immediate						
To set overshoot time coefficient								

<b>Pr2.55</b>	<b>Label</b>	Overshoot suppression gain			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x026F		
	<b>Valid</b>	Immediate						
<p>Suppression improves with larger set value but might affect the performance of MFC. Please use with caution for any value above 100.</p>								

### 3.2.4 [Class 3] Velocity/Torque control

Pr3.00	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.						
<b>Value</b>		<b>Velocity settings</b>				
0		Analog - Velocity command (SPR)				
【1】		Internal velocity settings 1 <sup>st</sup> – 4 <sup>th</sup> speed (Pr3.04~Pr3.07)				
2		Internal velocity settings 1 <sup>st</sup> – 3 <sup>rd</sup> speed (Pr3.04~P3.06)、Analog velocity command (SPR)				
3		Internal velocity settings 1 <sup>st</sup> – 8 <sup>th</sup> speed (Pr3.00~Pr3.11)				
Value	Internal command velocity 1 (INTSPD□1)	Internal command velocity 2 (INTSPD2)	Internal command velocity 3 (INTSPD3)	Velocity command		
1	OFF	OFF	No effect	1 <sup>st</sup> speed		
	ON	OFF		2 <sup>nd</sup> speed		
	OFF	ON		3 <sup>rd</sup> speed		
	ON	ON		4 <sup>th</sup> speed		
2	OFF	OFF	No effect	1 <sup>st</sup> speed		
	ON	OFF		2 <sup>nd</sup> speed		
	OFF	ON		3 <sup>rd</sup> speed		
	ON	ON		Simulated speed		
3	Similar to Pr3.00=1		OFF	1 <sup>st</sup> – 4 <sup>th</sup> speed		
	OFF	OFF	ON	5 <sup>th</sup> speed		
	ON	OFF	ON	6 <sup>th</sup> speed		
	OFF	ON	ON	7 <sup>th</sup> speed		
	ON	ON	ON	8 <sup>th</sup> speed		
<p>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.</p>						
						
Pr3.00=1 / 2		Pr3.00=3				

<b>Pr3.01</b>	<b>Label</b>	Velocity command rotational direction selection			<b>Valid mode(s)</b>	S
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0303
	<b>Valid</b>	Immediate				

To set positive/negative direction of velocity command

Value	Velocity settings (Analog or internal velocity)	Velocity command sign selection (VC- <input type="checkbox"/> SIGN <input type="checkbox"/> )	Velocity command direction
<b>【0】</b>	+	No effect	Positive
	-	No effect	Negative
1	No effect	OFF	Positive
	No effect	<input type="checkbox"/> ON	Negative

<b>Pr3.02</b>	<b>Label</b>	Velocity command input gain			<b>Valid mode(s)</b>	S
	<b>Range</b>	10~2000	<b>Unit</b>	(r/min)/V	<b>Default</b>	500
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0305
	<b>Valid</b>	Immediate				

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

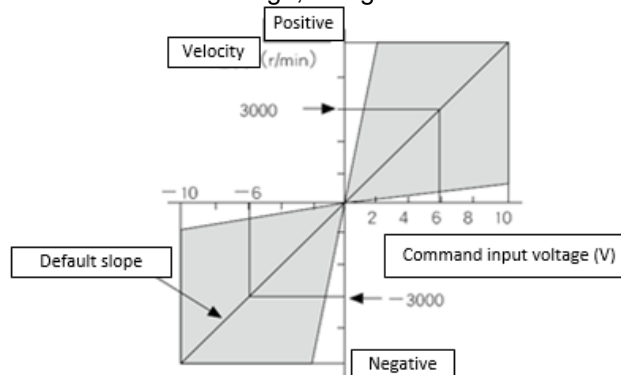
Pr3.02 sets command input voltage and rotational speed slope.

Factory default:

Pr3.02=500(r/min)/V.

Hence 6V input: 3000 r/min

1. Do not supply more than  $\pm 10V$  power for analog velocity command (SPR).
2. If Pr3.02 set value is too large, it might cause vibration.



Pr3.03	<b>Label</b>	Velocity command input inversion			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0307
	<b>Valid</b>	Immediate				

To set voltage polarity of analog velocity command.  
 Only valid when Pr3.01 = 0. When Pr3.01 = 1, rotational direction is only related to VC-SIGN.

Value	Motor rotational direction	
<b>【0】</b>	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 Pr3.03, motor might undergo abnormal motion.

Pr3.04	<b>Label</b>	1st speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0309
	<b>Valid</b>	Immediate				
Pr3.05	<b>Label</b>	2nd speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x030B
	<b>Valid</b>	Immediate				
Pr3.06	<b>Label</b>	3rd speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x030D
	<b>Valid</b>	Immediate				
Pr3.07	<b>Label</b>	4th speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x030F
	<b>Valid</b>	Immediate				
Pr3.08	<b>Label</b>	5th speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0311
	<b>Valid</b>	Immediate				
Pr3.09	<b>Label</b>	6th speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0313
	<b>Valid</b>	Immediate				
Pr3.10	<b>Label</b>	7th speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0315
	<b>Valid</b>	Immediate				
Pr3.11	<b>Label</b>	8th speed of velocity setting			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	r/min	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0317
	<b>Valid</b>	Immediate				
To set internal velocity command 1 <sup>st</sup> -8 <sup>th</sup> speed						

<b>Pr3.12</b>	<b>Label</b>	Acceleration time settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~10000	<b>Unit</b>	ms/ (1000rpm)	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0319
	<b>Valid</b>	Immediate				
<b>Pr3.13</b>	<b>Label</b>	Deceleration time settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~10000	<b>Unit</b>	ms/ (1000rpm)	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x031B
	<b>Valid</b>	Immediate				

Set max acceleration/deceleration for velocity command.

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

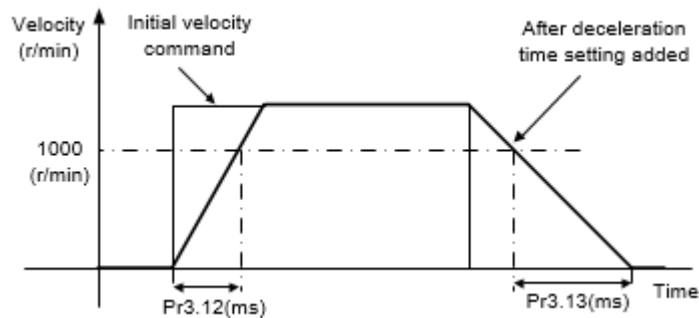
$$\text{Pr3.12} = 1000/a$$

$$\text{Pr3.13} = 1000/a$$

$$a = x/t$$

For example: If motor is to achieve 1500rpm in 30s,  $a=1500/30=50\text{rpm/ms}$

Pr3.12 =  $1000/a=20$ . Hence when Pr3.12 = 20, motor can achieve 1500rpm in 30s.

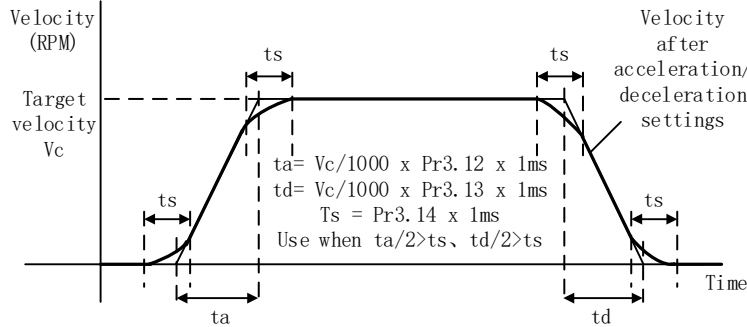


Usually used when there is rapid acceleration or trapezoidal wave velocity command due to many different internal speed segments under velocity control mode which causes instable while motor in motion.

*Under velocity control mode, 6083 and 6084 is limited by Pr3.12 and Pr3.13 correspondingly.*

<b>Pr3.14</b>	<b>Label</b>	Sigmoid acceleration/deceleration settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~1000	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x031D
	<b>Valid</b>	After restart				

To set sigmoid acceleration and deceleration turning point in accordance to Pr3.12 and Pr3.13.



<b>Pr3.15</b>	<b>Label</b>	Zero speed clamp function selection			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~3	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x031F
	<b>Valid</b>	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 Pr3.16.
3	Includes conditions from 1 and 2

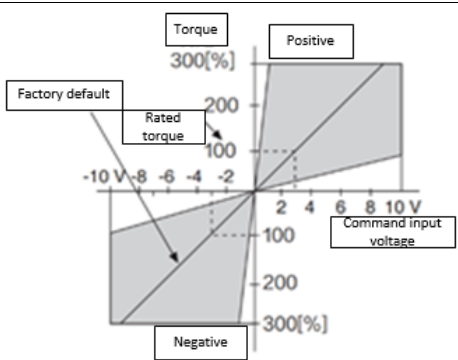
<b>Pr3.16</b>	<b>Label</b>	Zero speed clamp level			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	10~2000	<b>Unit</b>	r/min	<b>Default</b>	30
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0321
	<b>Valid</b>	Immediate				

Valid when Pr3.15 = 2/3, velocity command is forced to 0 when actual velocity is lower than Pr3.16 and after static time set in Pr3.23.

<b>Pr3.17</b>	<b>Label</b>	Torque internal/external switching			<b>Valid mode(s)</b>	<b>T</b>
	<b>Range</b>	0~3	<b>Unit</b>		<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0323
	<b>Valid</b>	Immediate				

Value	Torque command input	Velocity limit input
<b>【0】</b>	Analog input 3(AI 3)	Pr3.21 set value
1	Analog input 3(AI 3)	Analog input 1(AI 1)
2	Pr3.22 set value	Pr3.21 set value

<b>Pr3.18</b>	<b>Label</b>	Torque command direction selection		<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0325
	<b>Valid</b>	Immediate				
To set torque command positive/negative direction						
		<b>Value</b>	<b>Direction settings</b>			
		<b>【0】</b>	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: <i>Positive direction</i> ON: <i>Negative direction</i>			

<b>Pr3.19</b>	<b>Label</b>	Torque command input gain		<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	10~100	<b>Unit</b>	0.1V/100%	<b>Default</b>	30
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0327
	<b>Valid</b>	Immediate				
To set gain changes from voltage added onto analog torque command (TRQR) to torque command (%)						
<ul style="list-style-type: none"> <li>·Unit: (0.1V/100%)。</li> <li>·Set input voltage required for rated output torque.</li> <li>·Default = 30, which is 3V/100%</li> </ul>						
						

<b>Pr3.20</b>	<b>Label</b>	Torque command input inversion		<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0329
	<b>Valid</b>	Immediate				
To set voltage polarity of analog torque command. Only valid when Pr3.18 = 0.						
		<b>Value</b>	<b>Motor torque direction</b>			
		<b>【0】</b>	Not inversed	「Positive voltage」 → 「Positive direction」 「Negative voltage」 → 「Negative direction」		
		1	Inversed	「Positive voltage」 → 「Positive direction」 「Negative voltage」 → 「Negative direction」		



<b>Pr3.21</b>	<b>Label</b>	Velocity limit in torque mode			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	r/min	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x032B	
	<b>Valid</b>	Immediate					
To set velocity limit in torque control mode. Only valid when Pr3.17 = 0 / 2.							

<b>Pr3.22</b>	<b>Label</b>	Torque command			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~300	<b>Unit</b>	%	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x032D	
	<b>Valid</b>	Immediate					
To set torque limit in torque control mode. Only valid when Pr3.17 = 2. Please refer to Pr3.17.							

<b>Pr3.23</b>	<b>Label</b>	Zero speed delay time in velocity mode			<b>Valid mode(s)</b>		<b>S</b>
	<b>Range</b>	0~2000	<b>Unit</b>	ms	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x032F	
	<b>Valid</b>	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.							

<b>Pr3.24</b>	<b>Label</b>	Maximum motor rotational speed			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	r/min	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0331		
	<b>Valid</b>	Immediate						
To set maximum motor rotational speed but not higher than motor rated speed If Pr3.24 = 0, maximum motor rotational speed = max. speed in motor parameter.								

<b>Pr3.29</b>	<b>Label</b>	Analog 1 clamping voltage			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~20000	<b>Unit</b>	mv	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x033B	
	<b>Valid</b>	Immediate					
Only valid when Pr3.17 = 1. When Pr3.17=1, velocity is set to 0 if analog 1 voltage is below Pr3.29 set value.							

<b>Pr3.30</b>	<b>Label</b>	Analog 3 clamping voltage			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~20000	<b>Unit</b>	mv	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x033D	
	<b>Valid</b>	Immediate					
Only valid when Pr3.17 = 1 / 0. When Pr3.17=1 / 0, velocity is set to 0 if analog 1 voltage is below Pr3.30 set value.							

<b>Pr3.58</b>	<b>Label</b>	Speed regulation ratio 1			<b>Valid mode(s)</b>		<b>S</b>
	<b>Range</b>	0~150	<b>Unit</b>	%	<b>Default</b>	10	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	H0x0374 L0x0375	
	<b>Valid</b>	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 Pr3.24, 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) Pr3.58-Pr3.61 = default  
 (2) Motor rated rotational speed = 2000rpm  
 (3) SPDREG input signal = ON

SPDREG1 Pr3.58	SPDREG2 Pr3.59	SPDREG3 Pr3.60	SPDREG4 Pr3.61	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

<b>Pr3.59</b>	<b>Label</b>	Speed regulation ratio 2		<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~150	<b>Unit</b>	%	<b>Default</b>
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>
	<b>Valid</b>	Immediate			
Same as Pr3.58					
<b>Pr3.60</b>	<b>Label</b>	Speed regulation ratio 3		<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~150	<b>Unit</b>	%	<b>Default</b>
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>
	<b>Valid</b>	Immediate			
Same as Pr3.58					
<b>Pr3.61</b>	<b>Label</b>	Speed regulation ratio 4		<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~150	<b>Unit</b>	%	<b>Default</b>
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>
	<b>Valid</b>	Immediate			
Same as Pr3.58					

### 3.2.5 [Class 4] I/O Monitoring Settings

<b>Pr4.00</b>	<b>Label</b>	Input selection DI1	<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x00~0xFF	<b>Unit</b>	—	<b>Default</b>	<b>0x2</b>
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	<b>0x0401</b>
	<b>Valid</b>	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
Zero speed clamp	ZEROSPD	11	91
Velocity command sign	VC-SIGN	12	92
Torque command sign	TC-SIGN	13	93
Forced alarm	E-STOP	14	94
Vibration suppression 1	VS-SEL1	0A	8A
Vibration suppression 2	VS-SEL2	0B	8B
Speed regulation valid	SPDREG	4B	CB
Speed regulation ratio 1	SPDREG1	4C	CC
Speed regulation ratio 2	SPDREG2	4D	CD
Speed regulation ratio 3	SPDREG3	4E	CE
Speed regulation ratio 4	SPDREG4	4F	CF

CN1 PIN	Input	Parameters
8	DI1	Pr4.00
9	DI2	Pr4.01
26	DI3	Pr4.02
27	DI4	Pr4.03
28	DI5	Pr4.04
29	DI6	Pr4.05
30	DI7	Pr4.06
31	DI8	Pr4.07

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.

Pr4.01	<b>Label</b>	Input selection DI2			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x1		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0403		
	<b>Valid</b>	Immediate						
Pr4.02	<b>Label</b>	Input selection DI3			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0405		
	<b>Valid</b>	Immediate						
Pr4.03	<b>Label</b>	Input selection DI4			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x6		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0407		
	<b>Valid</b>	Immediate						
Pr4.04	<b>Label</b>	Input selection DI5			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0xC		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0409		
	<b>Valid</b>	Immediate						
Pr4.05	<b>Label</b>	Input selection DI6			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x3		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x040B		
	<b>Valid</b>	Immediate						
Pr4.06	<b>Label</b>	Input selection DI7			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x7		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x040D		
	<b>Valid</b>	Immediate						

<b>Pr4.07</b>	<b>Label</b>	Input selection DI8			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x4		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x040F		
	<b>Valid</b>	Immediate						

DI2~DI8allocation is the same as DI1. Please refer to Pr4.00.

<b>Pr4.10</b>	<b>Label</b>	Output selection DO1			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x3		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0415		
	<b>Valid</b>	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
7	DO1+	Pr4.10
6	DO1-	
5	DO2+	Pr4.11
4	DO2-	
3	DO3+	Pr4.12
2	DO3-	
1	DO4+	Pr4.13
26	DO4-	
27	DO5+	Pr4.14
28	DO5-	

*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.*

<b>Pr4.11</b>	<b>Label</b>	Output selection DO2			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x2		

	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0417
	<b>Valid</b>	Immediate				
Pr4.12	<b>Label</b>	Output selection DO3			<b>Valid mode(s)</b>	<b>P</b> <b>S</b> <b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x1
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0419
	<b>Valid</b>	Immediate				
Pr4.13	<b>Label</b>	Output selection DO4			<b>Valid mode(s)</b>	<b>P</b> <b>S</b> <b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x4
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x041B
	<b>Valid</b>	Immediate				
Pr4.14	<b>Label</b>	Output selection DO5			<b>Valid mode(s)</b>	<b>P</b> <b>S</b> <b>T</b>
	<b>Range</b>	0x0~0xFF	<b>Unit</b>	—	<b>Default</b>	0x7
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x041D
	<b>Valid</b>	Immediate				
DO2-DO5 is allocated by the same method as per DO1. Please refer to Pr4.10.						

Pr4.22	<b>Label</b>	Analog input 1(AI-1) Zero drift settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	-1860~1860	<b>Unit</b>	5.37mv	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x042D
	<b>Valid</b>	Immediate				
To set zero drift compensation value on analog input 1 voltage for zero drift correction.						
Pr4.23	<b>Label</b>	Analog input 1(AI-1) filter			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~6400	<b>Unit</b>	0.01ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x042F
	<b>Valid</b>	Immediate				
To set a delay filter time coefficient for AI1 input voltage. When filter time takes effect, input voltage will be smoothen.						
Pr4.24	<b>Label</b>	Analog input 1(AI-1) overvoltage settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~100	<b>Unit</b>	0.1V	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0431
	<b>Valid</b>	Immediate				
Pr4.24 is invalid when set to 0. Er270 might occur when the input voltage of AI1 is higher than the voltage after zero drift correction.						

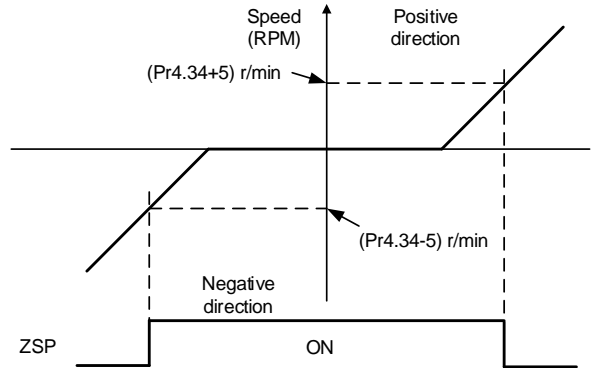
Pr4.28	<b>Label</b>	Analog input 3(AI-3) Zero drift settings			<b>Valid mode(s)</b>	<b>T</b>
	<b>Range</b>	-1860~1860	<b>Unit</b>	5.37mv	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0439
	<b>Valid</b>	Immediate				
To set zero drift compensation value on analog input 3 voltage for zero drift correction.						
Pr4.29	<b>Label</b>	Analog input 3(AI-3) filter			<b>Valid mode(s)</b>	<b>T</b>
	<b>Range</b>	0~6400	<b>Unit</b>	0.01ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x043B
	<b>Valid</b>	Immediate				
To set a delay filter time coefficient for AI3 input voltage. When filter time takes effect, input voltage will be smoothen.						

<b>Pr4.30</b>	<b>Label</b>	Analog input 3(AI-3) overvoltage settings			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~100	<b>Unit</b>	0.1V	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x043D	
	<b>Valid</b>	Immediate					
Pr4.30 is invalid when set to 0. Er270 might occur when the input voltage of AI3 is higher than the voltage after zero drift correction.							
<b>Pr4.31</b>	<b>Label</b>	Positioning complete range			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~10000	<b>Unit</b>	Pr5.21 set unit	<b>Default</b>	20	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x043F	
	<b>Valid</b>	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. <i>Default unit: 0.00001rev. Can be set on Pr5.21 as command unit (pulse) or encoder unit (pulse)</i>							
<b>Pr4.32</b>	<b>Label</b>	Positioning complete output setting			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~4	<b>Unit</b>	—	<b>Default</b>	1	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0441	
	<b>Valid</b>	Immediate					
To set conditions for INP1 output signal to be valid							
		<b>Value</b>	<b>Positioning completed signal</b>				
		0	Signal valid when the position deviation is smaller than Pr4.31				
		1	Signal valid when there is no position command and position deviation is smaller than Pr4.31				
		2	Signal valid when there is no position command, zero-speed clamp detection (ZSP) signal is ON and the positional deviation is smaller than Pr4.31				
		3	Signal valid when there is no position command and position deviation is smaller than Pr4.31. Signal ON when within the time set in Pr4.33 otherwise OFF.				
		4	When there is no command, position detection starts after the delay time set in Pr4.33. Signal valid when there is no position command and positional deviation is smaller than Pr4.31.				
<b>Pr4.33</b>	<b>Label</b>	INP positioning delay time			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~15000	<b>Unit</b>	1ms	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0443	
	<b>Valid</b>	Immediate					
Valid when Pr4.32 = 3.							
		<b>Set value</b>	<b>Positioning completed signal</b>				
		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.				

<b>Pr4.34</b>	<b>Label</b>	Zero speed			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	1~2000	<b>Unit</b>	r/min	<b>Default</b>	50		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0445		
	<b>Valid</b>	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 Pr4.34

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



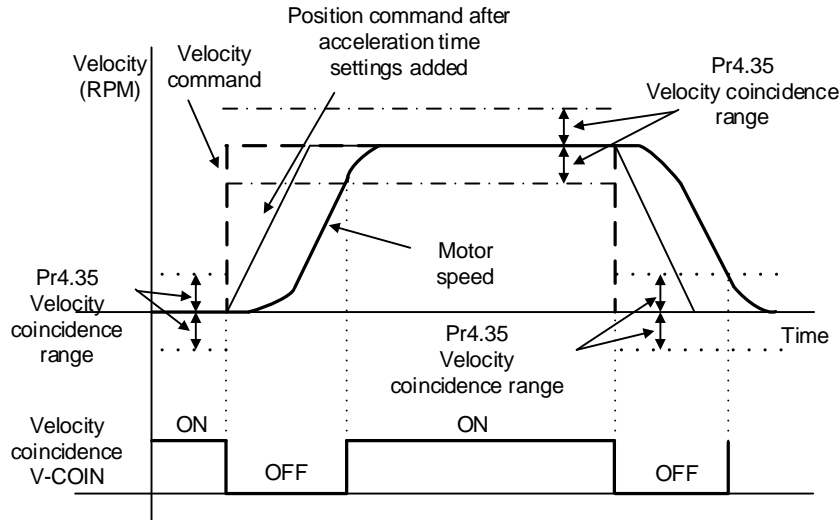
<b>Pr4.35</b>	<b>Label</b>	Velocity coincidence range			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	10~2000	<b>Unit</b>	r/min	<b>Default</b>	50
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0447
	<b>Valid</b>	Immediate				

If the difference between velocity command and motor actual speed is below Pr4.35, Velocity coincidence (V-COIN) output signal valid.

Due to 10RPM hysteresis:

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

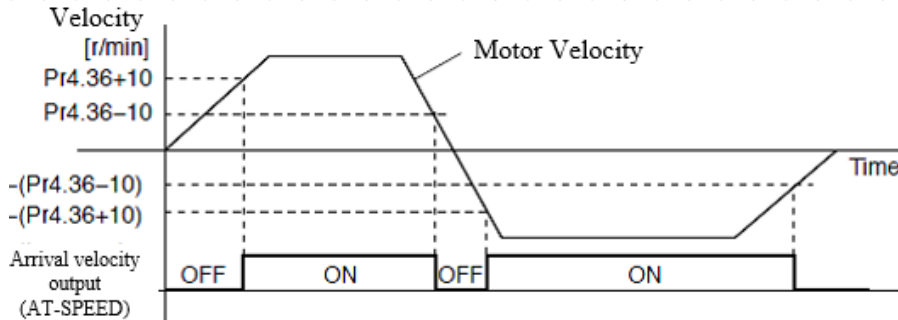
Velocity coincidence output ON -> OFF timing (Pr4.35 +10) r/min





<b>Pr4.36</b>	<b>Label</b>	Target velocity			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	10~2000	<b>Unit</b>	r/min	<b>Default</b>	1000
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0449
	<b>Valid</b>	Immediate				

When motor velocity > Pr4.36, AT-speed output signal is valid.  
Detection using 10RPM hysteresis.



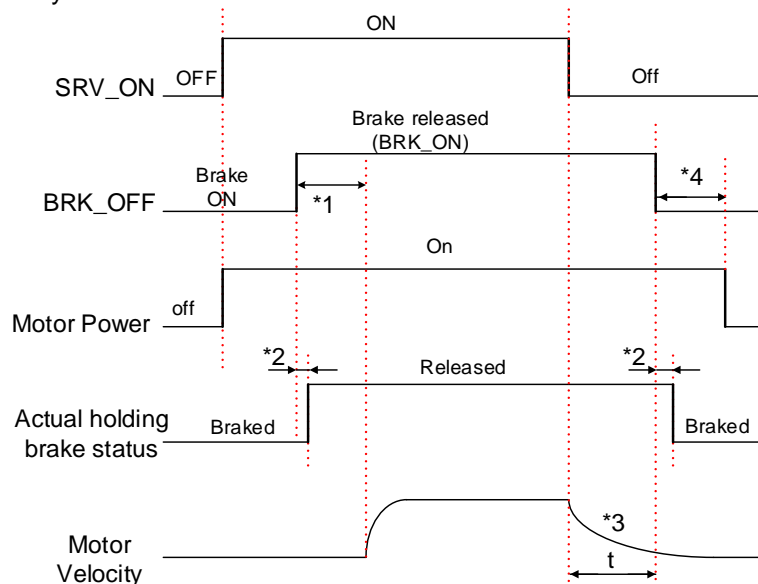
<b>Pr4.37</b>	<b>Label</b>	Motor power-off delay time			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~3000	<b>Unit</b>	1ms	<b>Default</b>	150		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x044B		
	<b>Valid</b>	Immediate						

To set delay time for holding brake to be activated after motor power off to prevent axis from sliding.

When Pr5.06 = 0, SRV-ON signal is off, holding brake is activated (delay time is determined by Pr4.39 or Pr6.14). Motor powered-off once delay time set in Pr4.37 is due.

<b>Pr4.38</b>	<b>Label</b>	Holding brake release time			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~3000	<b>Unit</b>	1ms	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x044D		
	<b>Valid</b>	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 Pr4.38  
 \*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 Pr6.14 or if motor speed goes below Pr4.39, whichever comes first. BRK\_OFF given after deceleration time.  
 \*4: Pr4.37 set time value.

*Delay time from the moment SRV\_ON is given until BRK\_OFF switch to BRK\_ON, is less than 500ms.*

<b>Pr4.39</b>	<b>Label</b>	Holding brake activation speed			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	30~3000	<b>Unit</b>	r/min	<b>Default</b>	30		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x044F		
	<b>Valid</b>	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 Pr4.39 and Pr6.14 is not yet reached, BRK\_OFF is given.

BRK\_OFF signal is determined by Pr6.14 or if motor speed goes below Pr4.39, whichever comes first.

Application:

1. After disabling axis, Pr6.14 has been reached but motor speed is still above Pr4.39, BRK\_OFF signal given.
2. After disabling axis, Pr6.14 has not been reached but motor speed is below Pr4.39, BRK\_OFF signal given.

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

<b>Pr4.43</b>	<b>Label</b>	Emergency stop function			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0457		
	<b>Valid</b>	Immediate						

Value	Description.
<b>【0】</b>	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.

<b>Pr4.64</b>	<b>Label</b>	AO1 output			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~10	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0481		
	<b>Valid</b>	Immediate						
	<b>Value</b>	<b>Description</b>						
	<b>【0】</b>	Negative/Positive value: -10~10V						
	1	Absolute value output: 0~10V						
	Other	Reserved						
<b>Pr4.65</b>	<b>Label</b>	AO1 signal			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0x7FFFFFFF	<b>Unit</b>	—	<b>Default</b>	0x4		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0483		
	<b>Valid</b>	Immediate						
Bit 0 – 15: AO signal source; Bit 16 – 31: DO extension channel								
	<b>Bit0~Bit15</b>		<b>Signal source</b>					
	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 Pr4.67					
Bit 16 – 31: Only available when AO signal source = 0xA								
	<b>Bit16~Bit31</b>		<b>Channel</b>					
	01h		Alarm output					
	02h		Servo ready					
	03h		External brake released					
	04h		Positioning completed					
	...		Please refer to Pr4.10 for other signal channels					
<b>Pr4.66</b>	<b>Label</b>	AO1 amplification			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	0.01	<b>Default</b>	100		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0485		
	<b>Valid</b>	Immediate						
To set the amplification of AO1, actual voltage output = amplification x theoretical voltage								
<b>Pr4.67</b>	<b>Label</b>	AO1 communication settings			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	mV	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0487		
	<b>Valid</b>	Immediate						
Available when AO1 = 0xB								
<b>Pr4.68</b>	<b>Label</b>	AO1 offset			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	mV	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0489		
	<b>Valid</b>	Immediate						
To set AO1 offset value.								

### 3.2.6 [Class 5] Extension Settings

<b>Pr5.00</b>	<b>Label</b>	2 <sup>nd</sup> pulse count per revolution			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0-67108864	<b>Unit</b>	PULSE	<b>Default</b>	10000		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0500 L: 0x0501		
	<b>Valid</b>	After restart						
Switch between Pr0.08 and Pr5.00 with DI signal DIV1. When switch to Pr5.00: (1) Pr5.00 valid when ≠ 0: Motor revolution = Input pulse count / [Pr5.00 set value] (2) Pr5.00 invalid when = 0: Actual position pulse count is according to Pr5.01 and Pr5.02. Switching with DIV1 signal only valid when servo drive is re-enabled.								

<b>Pr5.01</b>	<b>Label</b>	2 <sup>nd</sup> Command frequency divider/multiplier numerator			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	1~1073741824	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0502 L: 0x0503		
	<b>Valid</b>	After restart						
To set command pulse input frequency division and multiplication numerator								

<b>Pr5.02</b>	<b>Label</b>	2 <sup>nd</sup> Command frequency divider/multiplier denominator			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	1~1073741824	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0504 L: 0x0505		
	<b>Valid</b>	After restart						
To set command pulse input frequency division and multiplication denominator. Please refer to Pr0.09 and Pr0.10. Switch using DIV1 signal.								

<b>Pr5.04</b>	<b>Label</b>	Driver prohibition input settings			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0/1/2	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0509		
	<b>Valid</b>	Immediate						
To set driver prohibition input (POT/NOT)								
		<b>Value</b>	<b>Description</b>					
		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					

<b>Pr5.06</b>	<b>Label</b>	Servo-off mode			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																							
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0																									
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x050D																									
	<b>Valid</b>	Immediate																													
To set servo driver disable mode and status.																															
		<table border="1"> <thead> <tr> <th rowspan="2">Value</th> <th colspan="2">Description</th> </tr> <tr> <th>Mode</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Servo braking</td> <td>Dynamic braking</td> </tr> <tr> <td>1</td> <td>Free stopping</td> <td>Dynamic braking</td> </tr> <tr> <td>2</td> <td>Dynamic braking</td> <td>Dynamic braking</td> </tr> <tr> <td>3</td> <td>Servo braking</td> <td>Free-run</td> </tr> <tr> <td>4</td> <td>Free stopping</td> <td>Free-run</td> </tr> <tr> <td>5</td> <td>Dynamic braking</td> <td>Free-run</td> </tr> </tbody> </table>							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
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3	Servo braking	Free-run																													
4	Free stopping	Free-run																													
5	Dynamic braking	Free-run																													
<p><i>Servo braking: Stop servo axis quickly using braking torque</i>                  Pr5.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to Pr5.10</p>																															

<b>Pr5.09</b>	<b>Label</b>	Main power-off detection time			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	50~200	<b>Unit</b>	ms	<b>Default</b>	50		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0513		
	<b>Valid</b>	Immediate						
To set delay time for detection of main power-off or low voltage supply.								

<b>Pr5.10</b>	<b>Label</b>	Servo-off due to alarm mode			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																							
	<b>Range</b>	0~2	<b>Unit</b>	—	<b>Default</b>	0																									
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0515																									
	<b>Valid</b>	After restart																													
To set servo driver disable mode and status if alarm is triggered.																															
Alarm type 2:																															
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<b>Pr5.11</b>	<b>Label</b>	Servo braking torque setting			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~500	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0517		
	<b>Valid</b>	Immediate						
To set torque limit for servo braking mode. If Pr5.11 = 0, use torque limit as under normal situation. Please note that if Pr5.11 set value is too low, emergency stop will take longer.								

<b>Pr5.12</b>	<b>Label</b>	Overload level setting			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~115	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0519		
	<b>Valid</b>	Immediate						
<ul style="list-style-type: none"> <li>• When set to 0, overload level = 100%.</li> <li>• Set to 0 under regular usage. Lowering overload level will cause motor to overload in shorter time.</li> <li>• Er100 occurs when driver output current higher than motor rated current (overload)</li> <li>• Er101 occurs when driver output current lower than motor rated current</li> </ul>								

<b>Pr5.13</b>	<b>Label</b>	Overspeed level settings			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	r/min	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x051B		
	<b>Valid</b>	Immediate						
If motor speed exceeds Pr5.13, Er1A0 might occur. When Pr5.13 = 0, overspeed level = max. motor speed x 1.2								

<b>Pr5.15</b>	<b>Label</b>	I/O digital filter			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~255	<b>Unit</b>	0.1ms	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x051F		
	<b>Valid</b>	After restart						
Digital filtering of I/O input. Overly large value set will cause control delay.								

<b>Pr5.17</b>	<b>Label</b>	Counter clearing input mode			<b>Valid mode(s)</b>	<b>P</b>										
	<b>Range</b>	0~4	<b>Unit</b>	—	<b>Default</b>	3										
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0523										
	<b>Valid</b>	Immediate														
To set the clearing conditions for deviation counter clearing input signal. <table border="1" style="margin-left: 20px; width: 100%;"> <thead> <tr> <th style="background-color: #d9e1f2;">Value</th> <th style="background-color: #d9e1f2;">Condition</th> </tr> </thead> <tbody> <tr> <td>0/2/4</td> <td>Invalid</td> </tr> <tr> <td>1</td> <td>Always clear</td> </tr> <tr> <td>3</td> <td>Clear only once (Rising edge trigger)</td> </tr> </tbody> </table>									Value	Condition	0/2/4	Invalid	1	Always clear	3	Clear only once (Rising edge trigger)
Value	Condition															
0/2/4	Invalid															
1	Always clear															
3	Clear only once (Rising edge trigger)															

<b>Pr5.20</b>	<b>Label</b>	Position unit settings			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~2	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0529		
	<b>Valid</b>	Immediate						
Set unit for position related parameters								
		<b>Value</b>	<b>Unit</b>					
		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) Pr5.20 can only be modified when axis is disabled as it will clear position data								

<b>Pr5.21</b>	<b>Label</b>	Torque limit selection			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~6	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x052B		
	<b>Valid</b>	Immediate						
		<b>Value</b>	<b>Limit</b>					
		<b>【0】</b>	1 <sup>st</sup> torque limit Pr0.13					
		1	2 <sup>nd</sup> torque limit Pr5.22					
		2	TL-SEL OFF		Pr0.13			
			TL-SEL ON		Pr5.22			
		3~4	Reserved					
		5	Pr0.13 → Positive torque limit Pr5.22 → Negative torque limit					

<b>Pr5.22</b>	<b>Label</b>	2 <sup>nd</sup> torque limit			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~500	<b>Unit</b>	%	<b>Default</b>	300		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x052D		
	<b>Valid</b>	Immediate						

Pr5.22 is limited by max. torque set in motor parameter.

<b>Pr5.23</b>	<b>Label</b>	Positive torque warning threshold			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~300	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x052F		
	<b>Valid</b>	Immediate						

Default = 0, which is 95%. Other values only valid when Pr5.21 = 5.  
If actual torque higher than threshold, TLC torque limit signal will be valid.

<b>Pr5.24</b>	<b>Label</b>	Negative torque warning threshold			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~300	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0531		
	<b>Valid</b>	Immediate						

Default = 0, which is 95%. Other values only valid when Pr5.21 = 5.  
If actual torque higher than threshold, TLC torque limit signal will be valid.

<b>Pr5.28</b>	<b>Label</b>	LED initial status			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~35	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0539		
	<b>Valid</b>	Immediate						

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

Val	Status	Val	Status	Val	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 surr	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		
9	Control mode	23	485 receive frame		
10	I/O status	24	Encoder position deviation		
11	Analogue input	25	Internal usage		
12	Alarm cause & history record	26	Internal usage		
13	Warning ID	27	PN Voltage		



<b>Pr5.29</b>	<b>Label</b>	RS485 communication mode			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																												
	<b>Range</b>	0~255	<b>Unit</b>	—	<b>Default</b>	5																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x053B																														
	<b>Valid</b>	After restart																																		
<table border="1"> <thead> <tr> <th>Value</th> <th>Bit</th> <th>Checksum</th> <th>Stop</th> </tr> </thead> <tbody> <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><b>【5】</b></td> <td>8</td> <td>Null</td> <td>2</td> </tr> </tbody> </table>									Value	Bit	Checksum	Stop	0	8	Even	2	1	8	Odd	2	2	8	Even	1	3	8	Odd	1	4	8	Null	1	<b>【5】</b>	8	Null	2
Value	Bit	Checksum	Stop																																	
0	8	Even	2																																	
1	8	Odd	2																																	
2	8	Even	1																																	
3	8	Odd	1																																	
4	8	Null	1																																	
<b>【5】</b>	8	Null	2																																	
<b>Pr5.30</b>	<b>Label</b>	RS485 communication Baud rate			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																												
	<b>Range</b>	0~15	<b>Unit</b>	—	<b>Default</b>	4																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x053D																														
	<b>Valid</b>	After restart																																		
<table border="1"> <thead> <tr> <th>Value</th> <th>Baud rate</th> <th>Value</th> <th>Baud rate</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2400bps</td> <td><b>【4】</b></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> </tbody> </table> <p>Baud rate tolerance: 2400~38400bps ± 0.5%, 57600~115200bps ± 2%</p>									Value	Baud rate	Value	Baud rate	0	2400bps	<b>【4】</b>	38400bps	1	4800bps	5	57600bps	2	9600bps	6	115200bps	3	19200bps										
Value	Baud rate	Value	Baud rate																																	
0	2400bps	<b>【4】</b>	38400bps																																	
1	4800bps	5	57600bps																																	
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3	19200bps																																			
<b>Pr5.31</b>	<b>Label</b>	RS485 axis address			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																												
	<b>Range</b>	0~127	<b>Unit</b>	—	<b>Default</b>	1																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x053F																														
	<b>Valid</b>	After restart																																		
<p>When controller is connected to multiple axis and controller needs to identify the axis, Pr5.31 can be used to set the axis ID/address. Please set to a max of 31 if the communication is between RS232 and RS485</p>																																				
<b>Pr5.32</b>	<b>Label</b>	Max. command pulse input frequency			<b>Valid mode(s)</b>	<b>P</b>																														
	<b>Range</b>	0~8000	<b>Unit</b>	kHz	<b>Default</b>	4100																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0541																														
	<b>Valid</b>	Immediate																																		
<p>Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds Pr5.32.</p>																																				
<b>Pr5.35</b>	<b>Label</b>	Front panel lock setting			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																												
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0547																														
	<b>Valid</b>	Immediate																																		
<table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td><b>【0】</b></td> <td>Front panel not lock</td> </tr> <tr> <td>1</td> <td>Only parameter modification through front panel is locked</td> </tr> </tbody> </table>									Value	Description	<b>【0】</b>	Front panel not lock	1	Only parameter modification through front panel is locked																						
Value	Description																																			
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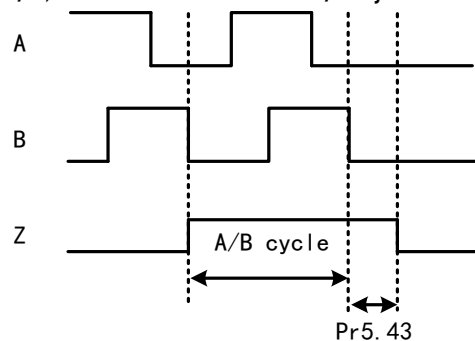
<b>Pr5.37</b>	<b>Label</b>	Torque saturation alarm detection time			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~5000	<b>Unit</b>	ms	<b>Default</b>	500		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0549		
	<b>Valid</b>	Immediate						
To set the delay time for detection of torque over limit under torque homing mode. Under homing mode, when torque exceeds limit and the time set in Pr5.37, TLC output signal will be valid.								

<b>Pr5.42</b>	<b>Label</b>	Frequency divider output – Z-signal polarity			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~7	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0555		
	<b>Valid</b>	Disabled						
		<b>Bit</b>	<b>Polarity</b>	<b>Description</b>				
		Bit0	0 = Positive	Z polarity setting of frequency divider output and position comparison				
			1 = Negative					
		Bit1	0 = Positive	Only valid in position comparison. Polarity setting when phase A frequency divider as position comparison output				
			1 = Negative					
		Bit2	0 = Positive	Only valid in position comparison. Polarity setting when phase B frequency divider as position comparison output				

<b>Pr5.43</b>	<b>Label</b>	Frequency divider output – Z-signal width			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~500	<b>Unit</b>	μs	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0557		
	<b>Valid</b>	After restart						

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

When Pr5.43 = 0, width of frequency divider output Z-signal is equivalent to width of 1 cycle of A/B, value set in Pr5.43 + A/B cycle width = delay setting.



<b>Pr5.44</b>	<b>Label</b>	Frequency divider output source			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>												
	<b>Range</b>	0~4	<b>Unit</b>	—	<b>Default</b>	0														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0559														
	<b>Valid</b>	After restart																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 15%;">Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td><b>【0】</b></td> <td>Position feedback of encoder #1(motor encoder)</td> </tr> <tr> <td>1</td> <td>Position feedback of encoder #2(external encoder)</td> </tr> <tr> <td>2</td> <td>Reserved</td> </tr> <tr> <td>3</td> <td>Pulse input command position synchronous output; position comparison not available in this mode</td> </tr> <tr> <td>4</td> <td>Frequency divider output prohibited</td> </tr> </tbody> </table>									Value	Description	<b>【0】</b>	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
Value	Description																			
<b>【0】</b>	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																			
<b>Pr5.46</b>	<b>Label</b>	Vent overload level			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>												
	<b>Range</b>	0~115	<b>Unit</b>	%	<b>Default</b>	0														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x055D														
	<b>Valid</b>	After restart																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 15%;">Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td><b>【0】</b></td> <td>Default level: 80%</td> </tr> <tr> <td>1~115</td> <td>Set vent overload level accordingly</td> </tr> </tbody> </table>									Value	Description	<b>【0】</b>	Default level: 80%	1~115	Set vent overload level accordingly						
Value	Description																			
<b>【0】</b>	Default level: 80%																			
1~115	Set vent overload level accordingly																			

### 3.2.7 [Class 6] Other settings

<b>Pr6.01</b>	<b>Label</b>	Encoder zero position compensation			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~360	<b>Unit</b>	Electrical angel	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0603		
	<b>Valid</b>	Power-off						
Zero position compensation for encoder zero drift to avoid abnormality due to zero drift.								

<b>Pr6.03</b>	<b>Label</b>	JOG trial run torque command			<b>Valid mode(s)</b>			<b>T</b>
	<b>Range</b>	0~350	<b>Unit</b>	%	<b>Default</b>	350		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0607		
	<b>Valid</b>	Immediate						
To set torque for JOG trial run command.								

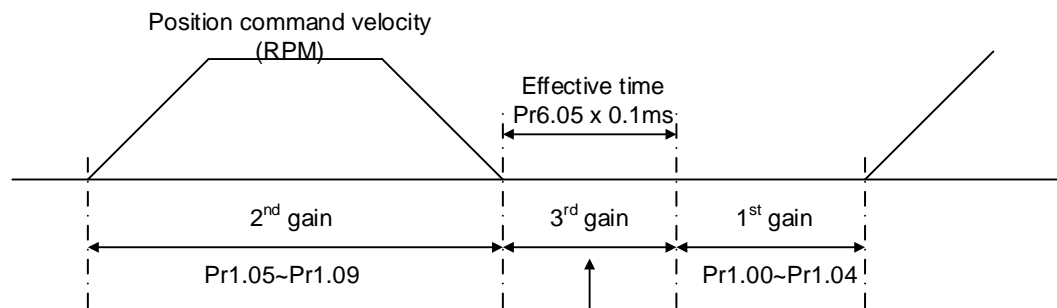
<b>Pr6.04</b>	<b>Label</b>	JOG trial run velocity command			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	r/min	<b>Default</b>	30		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0609		
	<b>Valid</b>	Immediate						
To set velocity for JOG trial run command.								

<b>Pr6.05</b>	<b>Label</b>	Position 3 <sup>rd</sup> gain valid time			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~10000	<b>Unit</b>	0.1ms	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x060B		
	<b>Valid</b>	Immediate						

To set time for 3<sup>rd</sup> gain to be valid  
 Only available in position mode  
 When not in use, set Pr6.05=0, Pr6.06=100

<b>Pr6.06</b>	<b>Label</b>	Position 3 <sup>rd</sup> gain scale factor			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	50~1000	<b>Unit</b>	100%	<b>Default</b>	100		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x060D		
	<b>Valid</b>	Immediate						

Set up the 3<sup>rd</sup> gain by multiplying factor of the 1<sup>st</sup> gain



Position loop gain =  $Pr1.00 \times Pr6.06/100$   
 Velocity loop gain =  $Pr1.01 \times Pr6.06/100$   
 Velocity loop integral time constant, Velocity detection filter,  
 Torque filter time constant still uses 1<sup>st</sup> gain

Above diagram is illustrated using Pr1.15 = 7.  
 $3^{\text{rd}} \text{ gain} = 1^{\text{st}} \text{ gain} * \text{Pr6.06}/100$   
 Only effective under position control mode.  $3^{\text{rd}}$  gain valid when Pr6.05  $\neq$  0. Set  $3^{\text{rd}}$  gain value in Pr6.06. When  $2^{\text{nd}}$  gain switches to  $1^{\text{st}}$  gain, it will go through  $3^{\text{rd}}$ , switching time is set in Pr1.19.

<b>Pr6.07</b>	<b>Label</b>	Torque command additional value			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	-100~100	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x060F		
	<b>Valid</b>	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)

<b>Pr6.08</b>	<b>Label</b>	Positive direction torque compensation value			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	-100~100	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0611		
	<b>Valid</b>	Immediate						

<b>Pr6.09</b>	<b>Label</b>	Negative direction torque compensation value			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	-100~100	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0613		
	<b>Valid</b>	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 = T<sub>1</sub>;

Torque value in negative direction = T<sub>2</sub>

$$\text{Pr6.08/Pr6.09} = T_f = \frac{|T_1 - T_2|}{2}$$

*Positive/Negative compensation corresponds to actual position feedback.*

*Positive torque compensation value = +(Pr6.08=+T<sub>f</sub>)*

*Negative torque compensation value = -(Pr6.08=+T<sub>f</sub>)*

*Pr6.08 =x, Pr6.09=y; friction compensation value = |x-y|/2*

<b>Pr6.11</b>	<b>Label</b>	Current response settings			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	50~100	<b>Unit</b>	%	<b>Default</b>	100		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0617		
	<b>Valid</b>	Immediate						

To set driver current loop related effective value ratio.

<b>Pr6.14</b>	<b>Label</b>	Max. time to stop after disabling			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~1000	<b>Unit</b>	ms	<b>Default</b>	500		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x061D		
	<b>Valid</b>	Immediate						
<p>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 Pr4.39 but the time set in Pr6.14 is reached, BRK_ON given and holding brake activated. BRK_ON given time is determined by Pr6.14 or when motor speed goes below Pr4.39, whichever comes first.</p> <p>Applications:</p> <ol style="list-style-type: none"> <li>1. After disabling axis, if motor speed is still higher than Pr4.39 but the time set in Pr6.14 is reached, BRK_ON given and holding brake activated.</li> <li>2. After disabling axis, if motor speed is already lower than Pr4.39 but the time set in Pr6.14 is not yet reached, BRK_ON given and holding brake activated.</li> </ol> <p>Dynamic brake will be provide the braking function if the function is activated for motors without holding brake.</p>								

<b>Pr6.20</b>	<b>Label</b>	Trial run distance			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~1200	<b>Unit</b>	0.1rev	<b>Default</b>	10		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0629		
	<b>Valid</b>	Immediate						
JOG (Position control) : Distance travel of each motion.								
<b>Pr6.21</b>	<b>Label</b>	Trial run waiting time			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~10000	<b>Unit</b>	ms	<b>Default</b>	300		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x062B		
	<b>Valid</b>	Immediate						
JOG (Position control) : Waiting time interval after each motion cycle								
<b>Pr6.22</b>	<b>Label</b>	No. of trial run cycles			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~10000	<b>Unit</b>	—	<b>Default</b>	5		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x062D		
	<b>Valid</b>	Immediate						
JOG (Position control) : No. of cycles When Pr6.22, trial run goes into endless cycles.								
<b>Pr6.25</b>	<b>Label</b>	Trial run acceleration			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	
	<b>Range</b>	0~10000	<b>Unit</b>	ms	<b>Default</b>	200		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0633		
	<b>Valid</b>	Immediate						
To set the acceleration/deceleration time for JOG command between 0 rpm to 1000 rpm								

<b>Pr6.28</b>	<b>Label</b>	Observer gain			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>
	<b>Range</b>	0~32767	<b>Unit</b>	%	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0639	
	<b>Valid</b>	Immediate					

0: Default stable gain 1: OFF  
 x: (unit: %) Manual, related to motor, load and encoder

<b>Pr6.29</b>	<b>Label</b>	Observer filter			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>
	<b>Range</b>	0~32767	<b>Unit</b>	μs	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x063B	
	<b>Valid</b>	Immediate					

0: Default stable observer filter 1: OFF  
 x: (unit: μs) Manual, related to motor, load and encoder

<b>Pr6.56</b>	<b>Label</b>	Blocked rotor alarm torque threshold			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>
	<b>Range</b>	0~300	<b>Unit</b>	%	<b>Default</b>	300	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0671	
	<b>Valid</b>	Immediate					

To set the torque threshold of blocked rotor to trigger alarm. (Alarm triggered if torque output% larger than threshold value & under 10rpm)  
 If Pr6.56 = 0, blocked rotor alarm deactivated.  
 If motor speed is 10rpm or above, Er102 won't be triggered.

<b>Pr6.57</b>	<b>Label</b>	Blocked rotor alarm delay time			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>
	<b>Range</b>	1~10000	<b>Unit</b>	ms	<b>Default</b>	400	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0673	
	<b>Valid</b>	Immediate					

To set delay time for blocked rotor alarm. Err102 won't be triggered if time doesn't exceed set time in Pr6.57.  
 Blocked rotor alarm is activated by default, alarm torque threshold = 300%, delay time = 400ms; speed threshold = 10rpm;

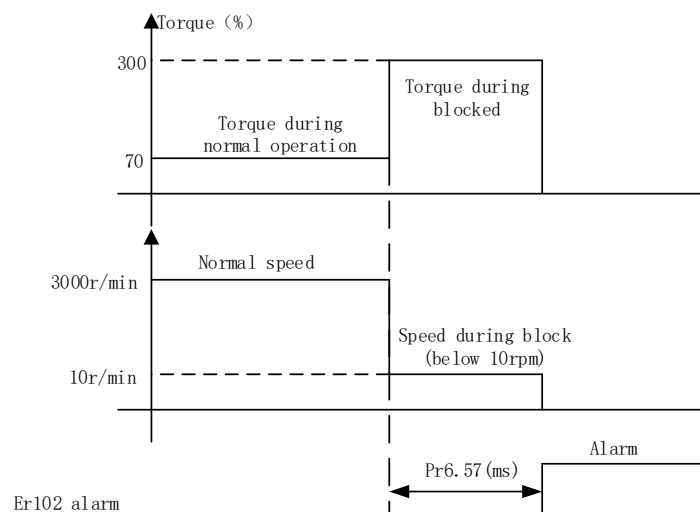


Diagram shows blocked rotor with speed under 10rpm

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

<b>Pr6.63</b>	<b>Label</b>	Absolute multiturn data upper limit			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~32766	<b>Unit</b>	rev	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x067F		
	<b>Valid</b>	After restart						
Use Pr0.15 = 2 in rotational mode, Feedback position cycles between 0 and (Pr6.63+1) x encoder resolution. Absolute multiturn data will be set to 0 if reaches upper limit.								

### 3.2.8 [Class 7] Factory settings

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

<b>Pr7.15</b>	<b>Label</b>	Motor model			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0x7FFF	<b>Unit</b>	—	<b>Default</b>	0x200		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x071F		
	<b>Valid</b>	After restart						
		<b>Value</b>	<b>Description</b>					
		0x100	Read from EEPROM					
		[0x200]	Read from Encoder					
When Pr7.15 = 0x200(2xx):								
		<b>Parameter</b>	<b>Label</b>					
		Pr7.00	Current loop gain					
		Pr7.01	Current loop integral time					
		Pr7.05	No. of motor pole pairs					
		Pr7.06	Motor phase resistance					
		Pr7.07	Motor D/Q induction					
		Pr7.08	Motor back EMF coefficient					
		Pr7.09	Motor torque coefficient					
		Pr7.10	Motor rated rotational speed					
		Pr7.11	Motor max. rotational speed					
		Pr7.12	Motor rated current					
		Pr7.13	Motor rotor inertia					
		Pr7.14	Driver power rating					
		Pr7.16	Encoder					
		Pr7.17	Motor max. current					
		Pr7.18	Encoder index angle compensation					
<b>Pr7.16</b>	<b>Label</b>	Encoder			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x0~0x200	<b>Unit</b>	—	<b>Default</b>	编码器决定		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0721		
	<b>Valid</b>	After restart						
To select encoder type. Typically, encoder specifications are automatically read.								
		<b>Value</b>	<b>Description</b>					
		0x0	17-bit encoder					
		0x7	23-bit encoder					



<b>Pr7.54</b>	<b>Label</b>	External grating ruler precision			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	1~1000000	<b>Unit</b>	nm	<b>Default</b>	100		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x076D		
	<b>Valid</b>	After restart						
To select external grating ruler precision								

### 3.2.8 [Class B] Status Parameters

<b>PrB.00</b>	<b>Label</b>	Software version 1 (DSP)			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B00		
Show DSP software version info.								
<b>PrB.01</b>	<b>Label</b>	Software version 2 (CPLD)			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B01		
Show software version info.								
<b>PrB.02</b>	<b>Label</b>	Software version 3 (Others)			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B02		
Show software version info.								
<b>PrB.03</b>	<b>Label</b>	Current alarm			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B03		
Show current alarm								
<b>PrB.04</b>	<b>Label</b>	Motor not rotating cause			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B04		
Show cause of motor not rotating								
<b>PrB.05</b>	<b>Label</b>	Driver operation status			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B05		
	<b>Bit</b>	<b>Status</b>	<b>Description</b>					
	0	RDY	Servo is ready					
	1	RUN	Servo is running					
	2	ERR	Driver error					
	3	HOME_OK	Homing completed					
	4	INP	In position					
	5	AT-SPEED	Velocity reached					
	6~15		Reserved					
<b>PrB.06</b>	<b>Label</b>	Motor speed (Before filter)			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	rpm	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B06		
Motor actual speed								

<b>PrB.07</b>	<b>Label</b>	Motor torque			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	%	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B07		
The percentage of motor actual torque and rated torque								
<b>PrB.08</b>	<b>Label</b>	Motor current			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	0.01A	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B08		
Motor actual current								
<b>PrB.09</b>	<b>Label</b>	Motor speed (After filter)			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	rpm	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B09		
Motor speed after motor actual speed filtering								
<b>PrB.10</b>	<b>Label</b>	DC bus voltage			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	V	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B0A		
Driver DC bus actual voltage								
<b>PrB.11</b>	<b>Label</b>	Driver temperature			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	°C	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B0B		
Actual driver temperature								
<b>PrB.12</b>	<b>Label</b>	External analog 1			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	0.01V	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B0C		
Driver analog input 1								
<b>PrB.13</b>	<b>Label</b>	External analog 2			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	0.01V	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B0D		
Driver analog input 2								
<b>PrB.14</b>	<b>Label</b>	External analog 3			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	0.01V	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B0E		
Driver analog input 3								
<b>PrB.15</b>	<b>Label</b>	Motor overload rate			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	%	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B0F		
Motor overload rate								
<b>PrB.16</b>	<b>Label</b>	Vent overload rate			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	%	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B10		
Vent overload rate								

<b>PrB.17</b>	<b>Label</b>	Physical I/O input status			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B04		
Driver physical I/O input bit0 corresponds to DI1, bit1 to DI2 and so on; Bitn=1, DI <sub>n+1</sub> high level signal input; Bitn=0, DI <sub>n+1</sub> low level signal input								

<b>PrB.18</b>	<b>Label</b>	Cause of motor not rotating			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	/	<b>Unit</b>	/	<b>Default</b>	/		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0x0B04		
Driver physical I/O output bit0 corresponds to DO1, bit1 to DO2 and so on; Bitn=1, DO <sub>n+1</sub> high level signal output; Bitn=0 indicates DO <sub>n+1</sub> low level signal output								

<b>PrB.20</b>	<b>Label</b>	Command position (Command unit)			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	/	<b>Unit</b>	P	<b>Default</b>	/		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	H: 0x0B14 L: 0x0B15		
Driver receives command pulse count. Driver command unit: 10000 pulses/rev, Encoder unit: 8388608 pulses/rev. If driver receives 8388608 pulses, 10000P will be shown.								

<b>PrB.21</b>	<b>Label</b>	Motor position (Command unit)			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	/	<b>Unit</b>	P	<b>Default</b>	/		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	H: 0x0B16 L: 0x0B17		
Motor position feedback. Driver command unit: 10000 pulses/rev, Encoder unit: 8388608 pulses/rev. If driver receives 8388608 pulses, 10000P will be shown.								

<b>PrB.22</b>	<b>Label</b>	Position deviation (Command unit)			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	/	<b>Unit</b>	P	<b>Default</b>	/		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	H: 0x0B18 L: 0x0B19		
Shows position deviation. Please refer to PrB.20.								

<b>PrB.23</b>	<b>Label</b>	Command position (Encoder unit)			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	/	<b>Unit</b>	P	<b>Default</b>	/		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	H: 0x0B1A L: 0x0B1B		
Driver receives command pulse count. Driver command unit: 10000 pulses/rev, Encoder unit: 8388608 pulses/rev. If driver receives 10000 pulses, 8388608 pulses will be shown.								

<b>PrB.24</b>	<b>Label</b>	Motor position (Encoder unit)			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	/	<b>Unit</b>	P	<b>Default</b>	/		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	H: 0x0B1C L: 0x0B1D		
Driver receives motor encoder feedback pulses								

<b>PrB.25</b>	<b>Label</b>	Position deviation (Encoder unit)			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	/	<b>Unit</b>	P	<b>Default</b>	/		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	H: 0x0B1E L: 0x0B1F		
Shows position deviation. Please refer to PrB.23.								

<b>PrB.26</b>	<b>Label</b>	Rotational encoder position feedback (Command unit)			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	/	<b>Unit</b>	P	<b>Default</b>	/		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	H: 0x0B20 L: 0x0B21		
Motor position under rotary mode. Please refer to PrB.21								

### 3.2.9 [Class 8] PR control parameters

<b>Pr8.00</b>	<b>Label</b>	PR Control			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6000
It is recommended to modify PR control parameters using Motion Studio.						
	<b>Bit</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	
	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, Pr8.00 is to be set to 15.						

<b>Pr8.01</b>	<b>Label</b>	Path count			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	16	<b>Unit</b>	/	<b>Default</b>	16
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6001
16 paths						
<b>Pr8.02</b>	<b>Label</b>	Control Operation			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0 ~ 0xFFFF	<b>Unit</b>	/	<b>Default</b>	0x0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6002
Attributes of Pr8.02 functions are divided into Read/Write. P refers to positioning motion of <i>N</i> path. Please refer to the following table.						
	<b>Attribute</b>	<b>Address</b>	<b>Description</b>			
	Write	0x01P	<i>N</i> 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			

<b>Pr8.06</b>	<b>Label</b>	Software positive limit H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 65535	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6006
High bit of software positive limit; (Only valid using 485 communication)						

<b>Pr8.07</b>	<b>Label</b>	Software positive limit (L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr8.06 When software positive limit = 994817, 0x000F2E01(Hexadecimal) high16bit = 0x000F, hence Pr8.05 reading = 0x000F, controller = 15. R/W of high/low bit data is similar when using 485 communication.						

<b>Pr8.08</b>	<b>Label</b>	Software negative limit H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0x65535	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6008
High bit of software negative limit; (Only valid using 485 communication)						

<b>Pr8.09</b>	<b>Label</b>	Software negative limit (L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr8.08.						

<b>Pr8.10</b>	<b>Label</b>	Homing mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X600A
To set homing method in PR mode. It is recommended to modify PR control parameters using Motion Studio.						
	<b>Bit</b>	8 (Z-signal homing)	2-7 (Homing mode)		1 (Specific position after homing)	0 (Homing direction)
	<b>Description</b>	=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

<b>Pr8.11</b>	<b>Label</b>	Zero position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X600B
High bit of zero position; (Only valid using 485 communication)						

Pr8.12	<b>Label</b>	Zero position (L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	p	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr8.11.						
Pr8.13	<b>Label</b>	Home position offset H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X600D
High bit of home position offset; (Only valid using 485 communication)						
Pr8.14	<b>Label</b>	Home position offset (L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	p	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr8.13.						
Pr8.15	<b>Label</b>	High homing velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 6000	<b>Unit</b>	rpm	<b>Default</b>	200
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X600F
To set high homing velocity in PR mode.						
Pr8.16	<b>Label</b>	Low homing velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 6000	<b>Unit</b>	rpm	<b>Default</b>	50
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6010
To set low homing velocity in PR mode.						
Pr8.17	<b>Label</b>	Homing acceleration			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6011
To set homing acceleration time in PR mode, time needed for 0rpm to accelerate to 1000rpm						
Pr8.18	<b>Label</b>	Homing deceleration			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6012
To set homing deceleration time in PR mode, time needed for 1000rpm to decelerate to 0rpm						
Pr8.19	<b>Label</b>	Homing torque holding time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	ms	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6013
To set homing torque holding time						
Pr8.20	<b>Label</b>	Homing torque			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	%	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6014
To set homing torque						
Pr8.21	<b>Label</b>	Homing overtravel alarm range			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	0.1r	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6015
To set homing overtravel alarm threshold.						

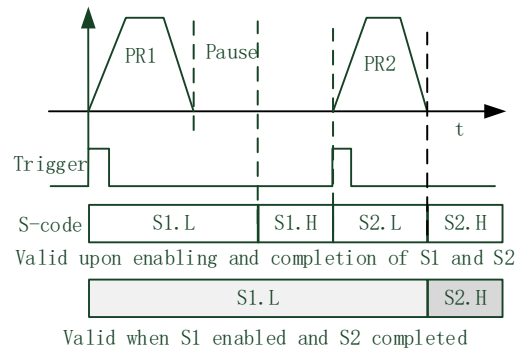
<b>Pr8.22</b>	<b>Label</b>	Emergency stop at limit deceleration			<b>Valid mode(s)</b>	<b>PR</b>																																																																																													
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	10																																																																																													
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6016																																																																																													
To set position limit emergency stop deceleration.																																																																																																			
<b>Pr8.23</b>	<b>Label</b>	STP emergency stop deceleration			<b>Valid mode(s)</b>	<b>PR</b>																																																																																													
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	50																																																																																													
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6017																																																																																													
To set STP emergency stop deceleration.																																																																																																			
<b>Pr8.26</b>	<b>Label</b>	I/O combination trigger mode			<b>Valid mode(s)</b>	<b>PR</b>																																																																																													
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0																																																																																													
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X601A																																																																																													
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ON	ON	ON	ON	Path15																																																																																															
<b>Pr8.27</b>	<b>Label</b>	I/O combination filter			<b>Valid mode(s)</b>	<b>PR</b>																																																																																													
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	ms	<b>Default</b>	5																																																																																													
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X601B																																																																																													
To set I/O combination filter time.																																																																																																			

<b>Pr8.28</b>	<b>Label</b>	S-code current output value			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	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

<b>Pr8.29</b>	<b>Label</b>	PR warning			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0x20F	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	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

<b>Pr8.39</b>	<b>Label</b>	JOG velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	rpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6027

Set JOG velocity in PR mode.

<b>Pr8.40</b>	<b>Label</b>	JOG acceleration			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6028

Set JOG acceleration in PR mode.



<b>Pr8.41</b>	<b>Label</b>	JOG deceleration			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6029
Set JOG deceleration in PR mode.						

<b>Pr8.42</b>	<b>Label</b>	Command position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X602A
High bit of command position; (Only valid using 485 communication)						

<b>Pr8.43</b>	<b>Label</b>	Command position (L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	p	<b>Default</b>	
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	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 Pr8.42.

<b>Pr8.44</b>	<b>Label</b>	Motor position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	/	<b>Default</b>	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X602C
High bit of command position; (Only valid using 485 communication)						

<b>Pr8.45</b>	<b>Label</b>	Motor position (L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	p	<b>Default</b>	
	<b>Byte length</b>	32bit	<b>Attribute</b>	R	<b>485 address</b>	0X602D

Using 485 communication, only able to R/W low 16 bit.  
R/W high 16 bit needs to be realized through Pr8.44.

<b>Pr8.46</b>	<b>Label</b>	Input I/O status			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X602E

Input I/O status, displays in decimal system. Convert to binary system to determine which bit is valid.

<b>Pr8.47</b>	<b>Label</b>	Output I/O status			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X602F

Output I/O status, displays in decimal system. Convert to binary system to determine which bit is valid.

<b>Pr8.48</b>	<b>Label</b>	Path 0 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6030
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.49</b>	<b>Label</b>	Path 1 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6031
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.50</b>	<b>Label</b>	Path 2 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6032
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.51</b>	<b>Label</b>	Path 3 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6033
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.52</b>	<b>Label</b>	Path 4 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6034
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.53</b>	<b>Label</b>	Path 5 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6035
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.54</b>	<b>Label</b>	Path 6 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6036
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.55</b>	<b>Label</b>	Path 7 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6037
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.56</b>	<b>Label</b>	Path 8 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6038
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.57</b>	<b>Label</b>	Path 9 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6039
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.58</b>	<b>Label</b>	Path 10 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X603A
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.59</b>	<b>Label</b>	Path 11 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X603B
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.60</b>	<b>Label</b>	Path 12 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X603C
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.61</b>	<b>Label</b>	Path 13 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X603D
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.62</b>	<b>Label</b>	Path 14 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X603E
Please refer to Pr8.28 for S-code setting.						

<b>Pr8.63</b>	<b>Label</b>	Path 15 S-code			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X603F
Please refer to Pr8.28 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*

Pr9.00	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
Pr9.01	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)						
Pr9.02	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 Pr9.02.						
Pr9.03	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.						
Pr9.04	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						
Pr9.05	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						
Pr9.06	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						
Pr9.07	Label	PR0 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X6207
Reserved						

<b>Pr9.08</b>	<b>Label</b>	PR1 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6208
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.09</b>	<b>Label</b>	PR1 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6209
High bit of Path 1 position; (Only valid using 485 communication)						
<b>Pr9.10</b>	<b>Label</b>	PR1 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.09.						
<b>Pr9.11</b>	<b>Label</b>	PR1 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X620B
To set PR path 1 velocity.						
<b>Pr9.12</b>	<b>Label</b>	PR1 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X620C
To set PR path 1 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.13</b>	<b>Label</b>	PR1 deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X620D
To set PR path 1 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.14</b>	<b>Label</b>	PR1 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X620E
To set pause time for PR path 2 from completion to next path						
<b>Pr9.15</b>	<b>Label</b>	PR1 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X620F
Reserved						

<b>Pr9.16</b>	<b>Label</b>	PR2 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6210
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.17</b>	<b>Label</b>	PR2 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6211
High bit of Path 2 position; (Only valid using 485 communication)						
<b>Pr9.18</b>	<b>Label</b>	PR2 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.17.						
<b>Pr9.19</b>	<b>Label</b>	PR2 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6213
To set PR path 2 velocity.						
<b>Pr9.20</b>	<b>Label</b>	PR2 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6214
To set PR path 2 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.21</b>	<b>Label</b>	PR2 deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6215
To set PR path 2 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.22</b>	<b>Label</b>	PR2 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6216
To set pause time for PR path 2 from completion to next path						
<b>Pr9.23</b>	<b>Label</b>	PR2 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6217
Reserved						

<b>Pr9.24</b>	<b>Label</b>	PR3 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6218
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.25</b>	<b>Label</b>	PR3 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6219
High bit of Path 3 position; (Only valid using 485 communication)						
<b>Pr9.26</b>	<b>Label</b>	PR3 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.25.						
<b>Pr9.27</b>	<b>Label</b>	PR3 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X621B
To set PR path 3 velocity.						
<b>Pr9.28</b>	<b>Label</b>	PR3 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X621C
To set PR path 3 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.29</b>	<b>Label</b>	PR3 deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X621D
To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.30</b>	<b>Label</b>	PR3 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X621E
To set pause time for PR path 3 from completion to next path						
<b>Pr9.31</b>	<b>Label</b>	PR3 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X621F
Reserved						

<b>Pr9.32</b>	<b>Label</b>	PR4 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6220
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.33</b>	<b>Label</b>	PR4 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6221
High bit of Path 0 position; (Only valid using 485 communication)						
<b>Pr9.34</b>	<b>Label</b>	PR4 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.33.						
<b>Pr9.35</b>	<b>Label</b>	PR4 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6223
To set PR path 4 velocity.						
<b>Pr9.36</b>	<b>Label</b>	PR0 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6224
To set PR path 4 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.37</b>	<b>Label</b>	PR4deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6225
To set PR path 4 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.38</b>	<b>Label</b>	PR4 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6226
To set pause time for PR path 4 from completion to next path						
<b>Pr9.39</b>	<b>Label</b>	PR4 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6227
Reserved						



<b>Pr9.40</b>	<b>Label</b>	PR5 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6228
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.41</b>	<b>Label</b>	PR5 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6229
High bit of Path 5 position: (Only valid using 485 communication)						
<b>Pr9.42</b>	<b>Label</b>	PR5 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.41.						
<b>Pr9.43</b>	<b>Label</b>	PR5 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X622B
To set PR path 5 velocity.						
<b>Pr9.44</b>	<b>Label</b>	PR5 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X622C
To set PR path 5 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.45</b>	<b>Label</b>	PR5 deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X622D
To set PR path 5 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.46</b>	<b>Label</b>	PR5 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X622E
To set pause time for PR path 5 from completion to next path						
<b>Pr9.47</b>	<b>Label</b>	PR5 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X622F
Reserved						

<b>Pr9.48</b>	<b>Label</b>	PR6 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6230
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.49</b>	<b>Label</b>	PR6 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6231
High bit of Path 6 position; (Only valid using 485 communication)						
<b>Pr9.50</b>	<b>Label</b>	PR6 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.49.						
<b>Pr9.51</b>	<b>Label</b>	PR6 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6233
To set PR path 6 velocity.						
<b>Pr9.52</b>	<b>Label</b>	PR6 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6234
To set PR path 6 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.53</b>	<b>Label</b>	PR6 deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6235
To set PR path 6 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.54</b>	<b>Label</b>	PR6 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6236
To set pause time for PR path 6 from completion to next path						
<b>Pr9.55</b>	<b>Label</b>	PR6 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X6237
Reserved						

Pr9.56	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
Pr9.57	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)						
Pr9.58	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 Pr9.57.						
Pr9.59	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.						
Pr9.60	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						
Pr9.61	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						
Pr9.62	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						
Pr9.63	Label	PR7 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X623F
Reserved						

Pr9.64	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
Pr9.65	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)						
Pr9.66	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 Pr9.65.						
Pr9.67	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.						
Pr9.68	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						
Pr9.69	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						
Pr9.70	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						
Pr9.71	Label	PR8 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X6247
Reserved						

Pr9.72	Label	PR9 mode			Valid mode(s)	PR														
	Range	0x0~0xFFFF	Unit	/	Default	0														
	Byte length	16bit	Attribute	R/W	485 address	0X6248														
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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														
Pr9.73	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)																				
Pr9.74	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 Pr9.73.																				
Pr9.75	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.																				
Pr9.76	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																				
Pr9.77	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																				
Pr9.78	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																				
Pr9.79	Label	PR9 special parameter			Valid mode(s)	PR														
	Range	0 ~ 65535	Unit	/	Default	0														
	Byte length	16bit	Attribute	R	485 address	0X624F														
Reserved																				

Pr9.80	Label	PR10 mode			Valid mode(s)	PR														
	Range	0x0~0xFFFF	Unit	/	Default	0														
	Byte length	16bit	Attribute	R/W	485 address	0X6250														
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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														
Pr9.81	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)																				
Pr9.82	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 Pr9.81.																				
Pr9.83	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.																				
Pr9.84	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																				
Pr9.85	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																				
Pr9.86	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																				
Pr9.87	Label	PR10 special parameter			Valid mode(s)	PR														
	Range	0 ~ 65535	Unit	/	Default	0														
	Byte length	16bit	Attribute	R	485 address	0X6257														
Reserved																				

Pr9.88	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
Pr9.89	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)						
Pr9.90	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 Pr9.89.						
Pr9.91	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.						
Pr9.92	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						
Pr9.93	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						
Pr9.94	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						
Pr9.95	Label	PR11 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X625F
Reserved						



Pr9.96	Label	PR12 mode			Valid mode(s)	PR														
	Range	0x0~0xFFFF	Unit	/	Default	0														
	Byte length	16bit	Attribute	R/W	485 address	0X6260														
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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														
Pr9.97	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)																				
Pr9.98	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 Pr9.97.																				
Pr9.99	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.																				
Pr9.100	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																				
Pr9.101	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																				
Pr9.102	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																				
Pr9.103	Label	PR12 special parameter			Valid mode(s)	PR														
	Range	0 ~ 65535	Unit	/	Default	0														
	Byte length	16bit	Attribute	R	485 address	0X6267														
Reserved																				



<b>Pr9.104</b>	<b>Label</b>	PR13 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6268
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.105</b>	<b>Label</b>	PR13 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6269
High bit of Path 13 position; (Only valid using 485 communication)						
<b>Pr9.106</b>	<b>Label</b>	PR13 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.105.						
<b>Pr9.107</b>	<b>Label</b>	PR13 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X626B
To set PR path 13 velocity.						
<b>Pr9.108</b>	<b>Label</b>	PR13 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X626C
To set PR path 13 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.109</b>	<b>Label</b>	PR13 deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X626D
To set PR path 13 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.110</b>	<b>Label</b>	PR13 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X626E
To set pause time for PR path 13 from completion to next path						
<b>Pr9.111</b>	<b>Label</b>	PR13 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X626F
Reserved						

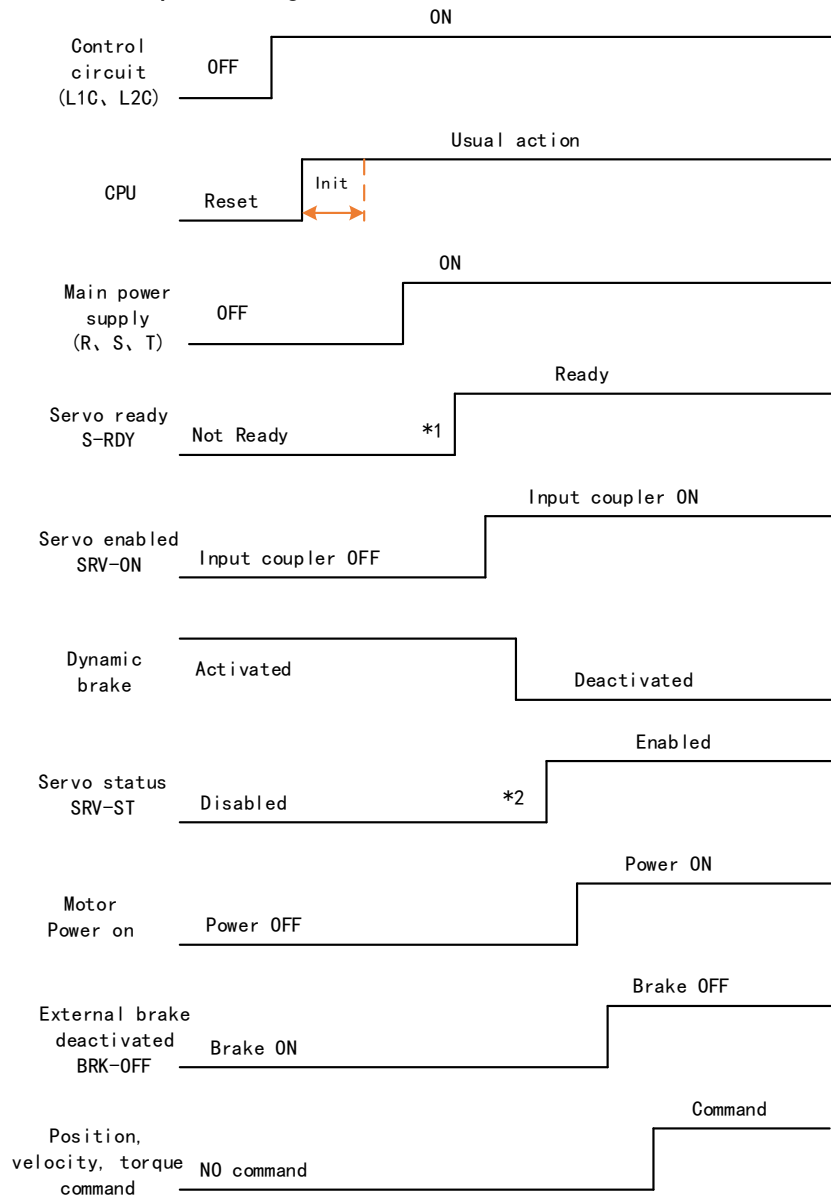
Pr9.112	Label	PR14 mode			Valid mode(s)	PR														
	Range	0x0~0xFFFF	Unit	/	Default	0														
	Byte length	16bit	Attribute	R/W	485 address	0X6270														
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Bit	14	8-13	6-7	5	4	0-3														
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Pr9.113	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)																				
Pr9.114	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 Pr9.113.																				
Pr9.115	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.																				
Pr9.116	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																				
Pr9.117	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																				
Pr9.118	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																				
Pr9.119	Label	PR14 special parameter			Valid mode(s)	PR														
	Range	0 ~ 65535	Unit	/	Default	0														
	Byte length	16bit	Attribute	R	485 address	0X6277														
Reserved																				

<b>Pr9.120</b>	<b>Label</b>	PR15 mode			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0x0~0xFFFF	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6278
<b>Bit</b>	14	8-13	6-7	5	4	0-3
<b>Definition</b>	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
<b>Pr9.121</b>	<b>Label</b>	PR15 position H			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0~ 0xFFFF	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X6279
High bit of Path 15 position; (Only valid using 485 communication)						
<b>Pr9.122</b>	<b>Label</b>	PR15 position(L)			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-2147483648~ 2147483647	<b>Unit</b>	Pulse	<b>Default</b>	0
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	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 Pr9.121.						
<b>Pr9.123</b>	<b>Label</b>	PR15 velocity			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	-10000~10000	<b>Unit</b>	rpm	<b>Default</b>	60
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X627B
To set PR path 15 velocity.						
<b>Pr9.124</b>	<b>Label</b>	PR15 acceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~ 32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X627C
To set PR path 15 acceleration time, time needed for 0rpm to accelerate to 1000rpm						
<b>Pr9.125</b>	<b>Label</b>	PR15 deceleration time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	1 ~32767	<b>Unit</b>	ms/Krpm	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X627D
To set PR path 15 deceleration time, time needed for 1000rpm to decelerate to 0rpm						
<b>Pr9.126</b>	<b>Label</b>	PR15 pause time			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 32767	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0X627E
To set pause time for PR path 15 from completion to next path						
<b>Pr9.127</b>	<b>Label</b>	PR15 special parameter			<b>Valid mode(s)</b>	<b>PR</b>
	<b>Range</b>	0 ~ 65535	<b>Unit</b>	/	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R	<b>485 address</b>	0X627F
Reserved						

# 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

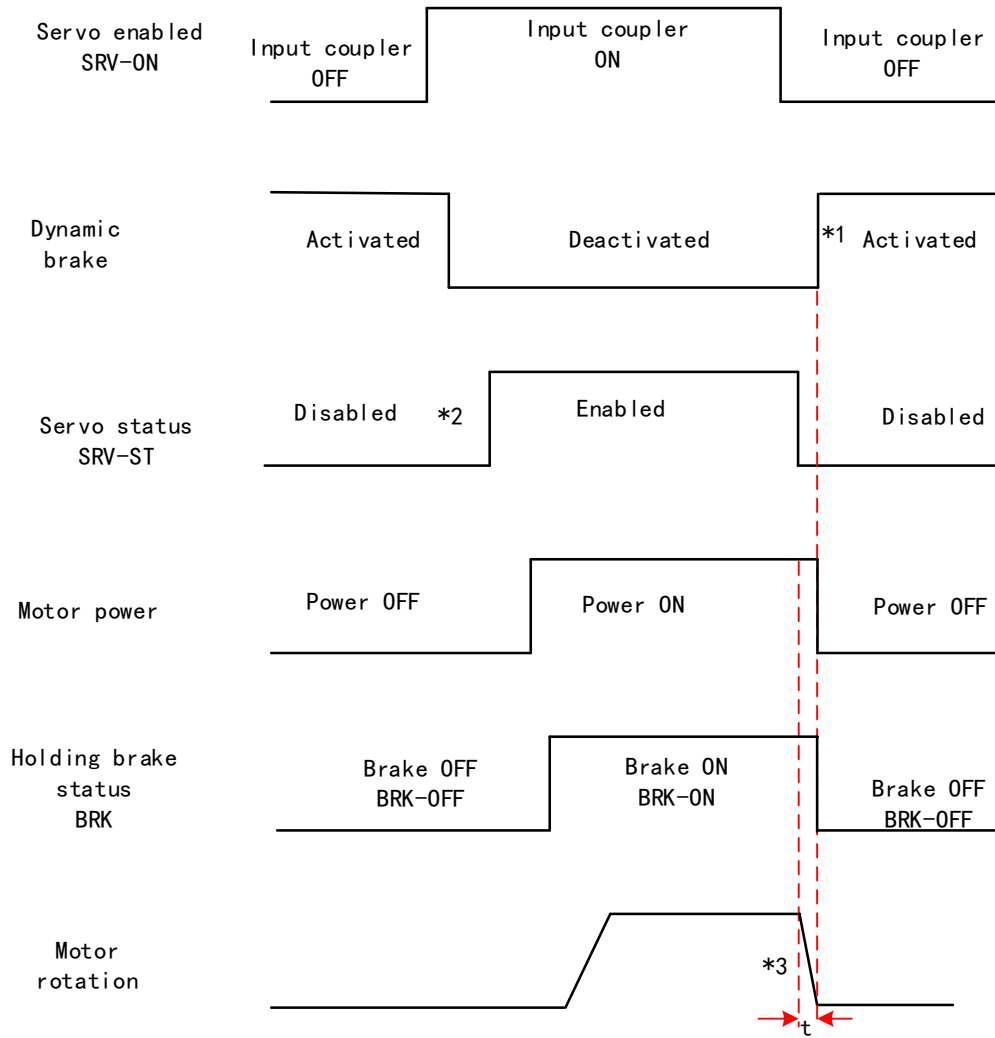
Servo stopping are of 3 different methods: Servo braking method, free stopping method, dynamic braking method.

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

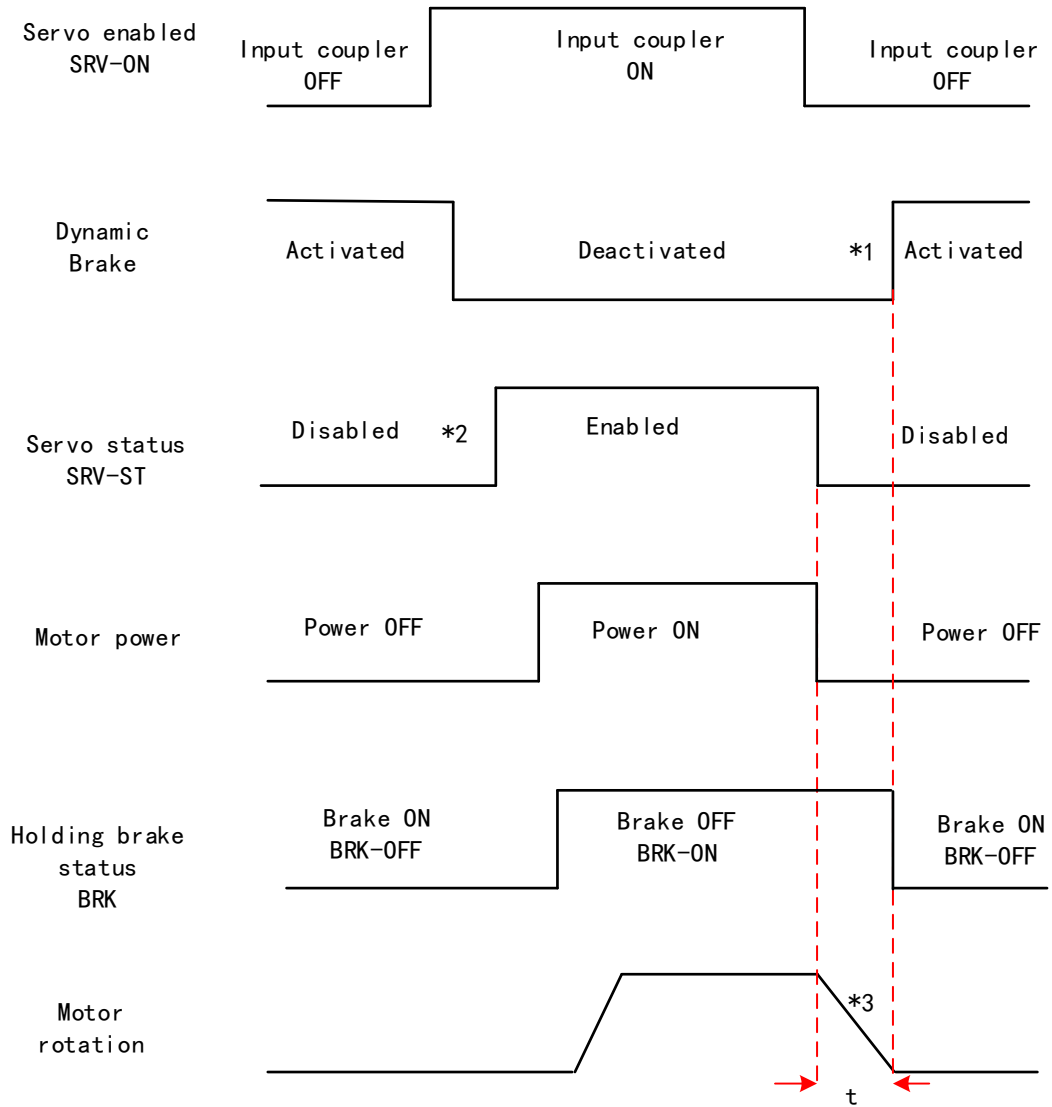
Stopping status	Status after stopped
Free running	Motor is powered off, rotor is free to rotate
Dynamic braking	Motor is powered off, rotor is not free to rotate
Holding brake stopping	Motor axis is locked, cannot rotate freely

**Motor stopping (Servo disabled) - Sequence Diagram**

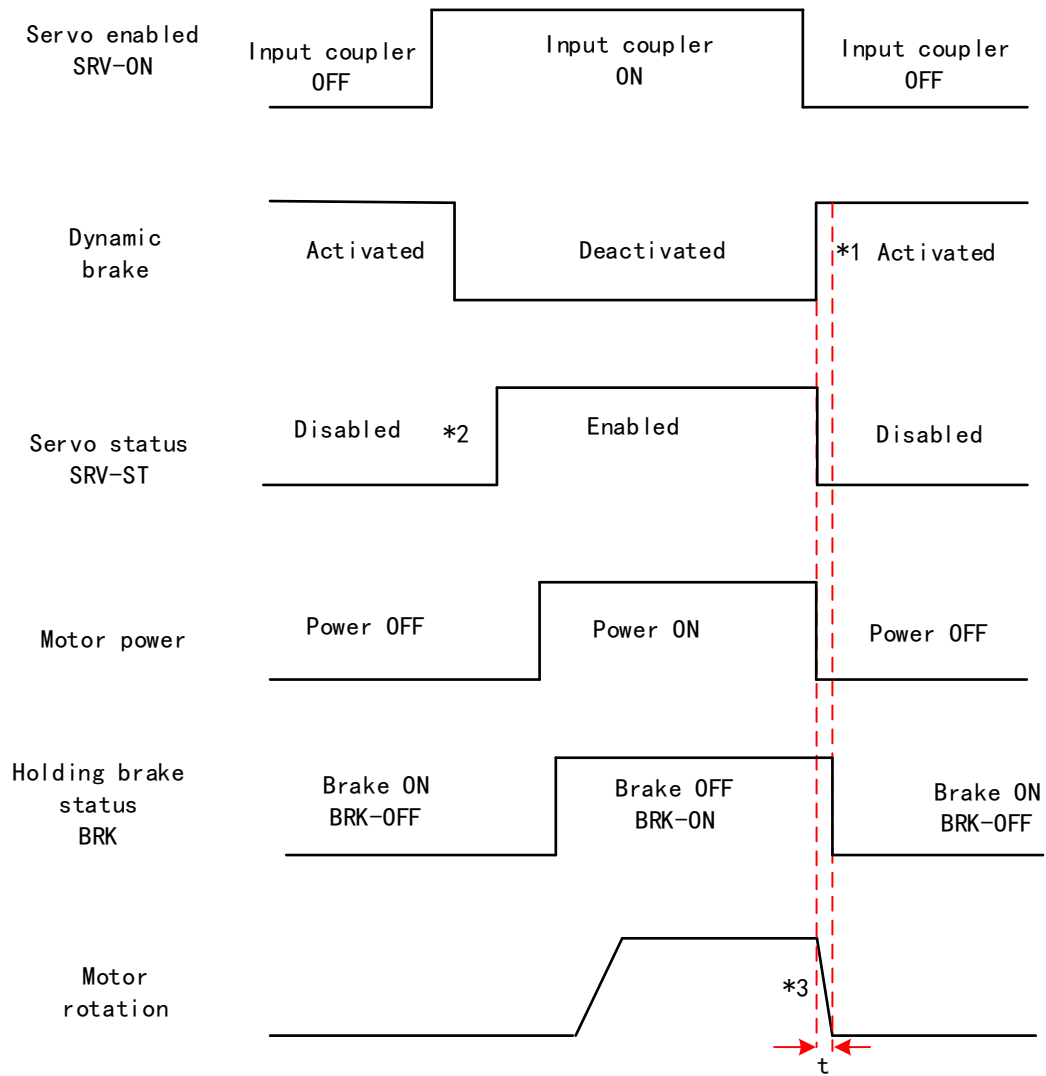
Servo braking method. Status after stopping: Dynamic braking



## Free stopping method. Status after stopping: Dynamic braking

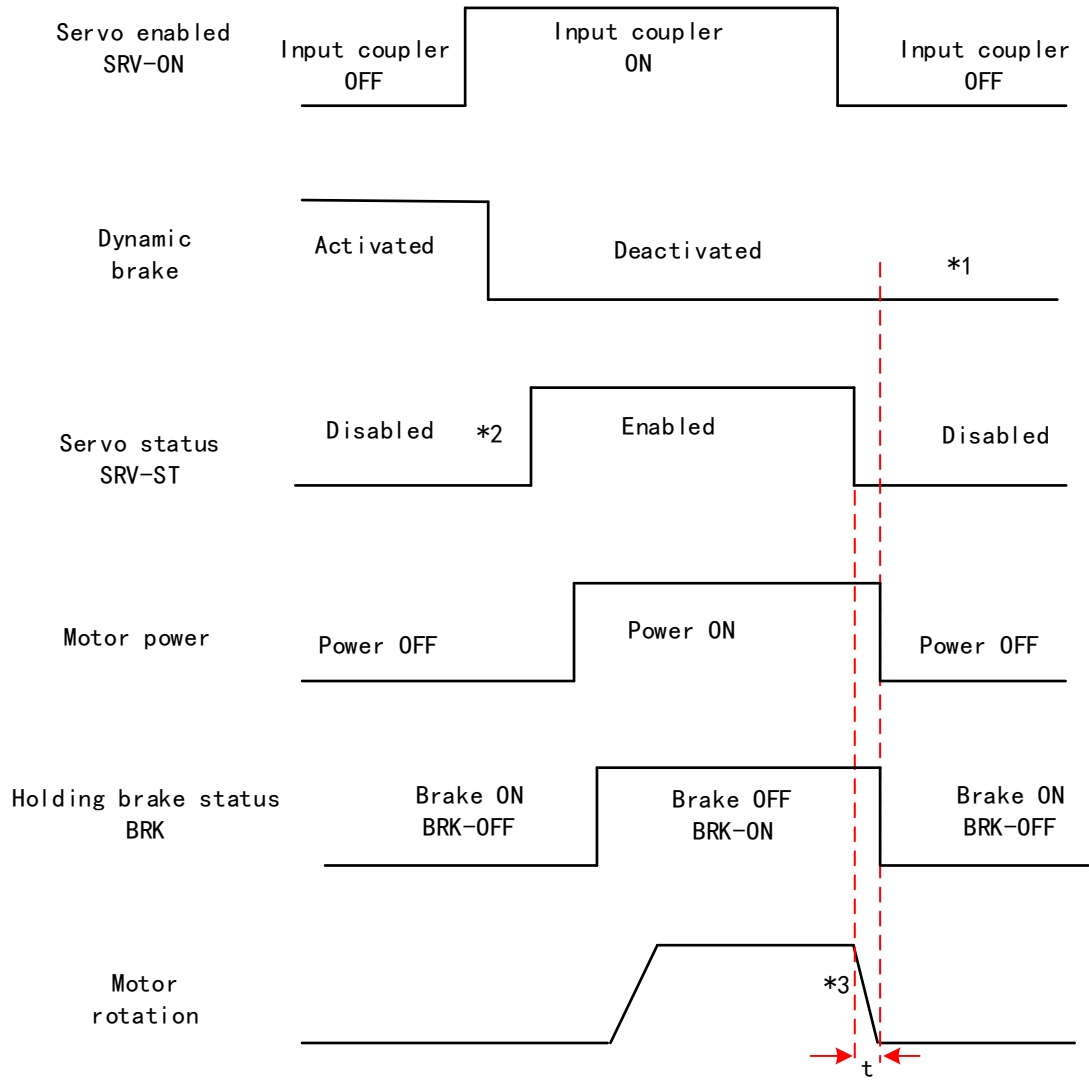


## Dynamic braking method. Status after stopping: Dynamic braking

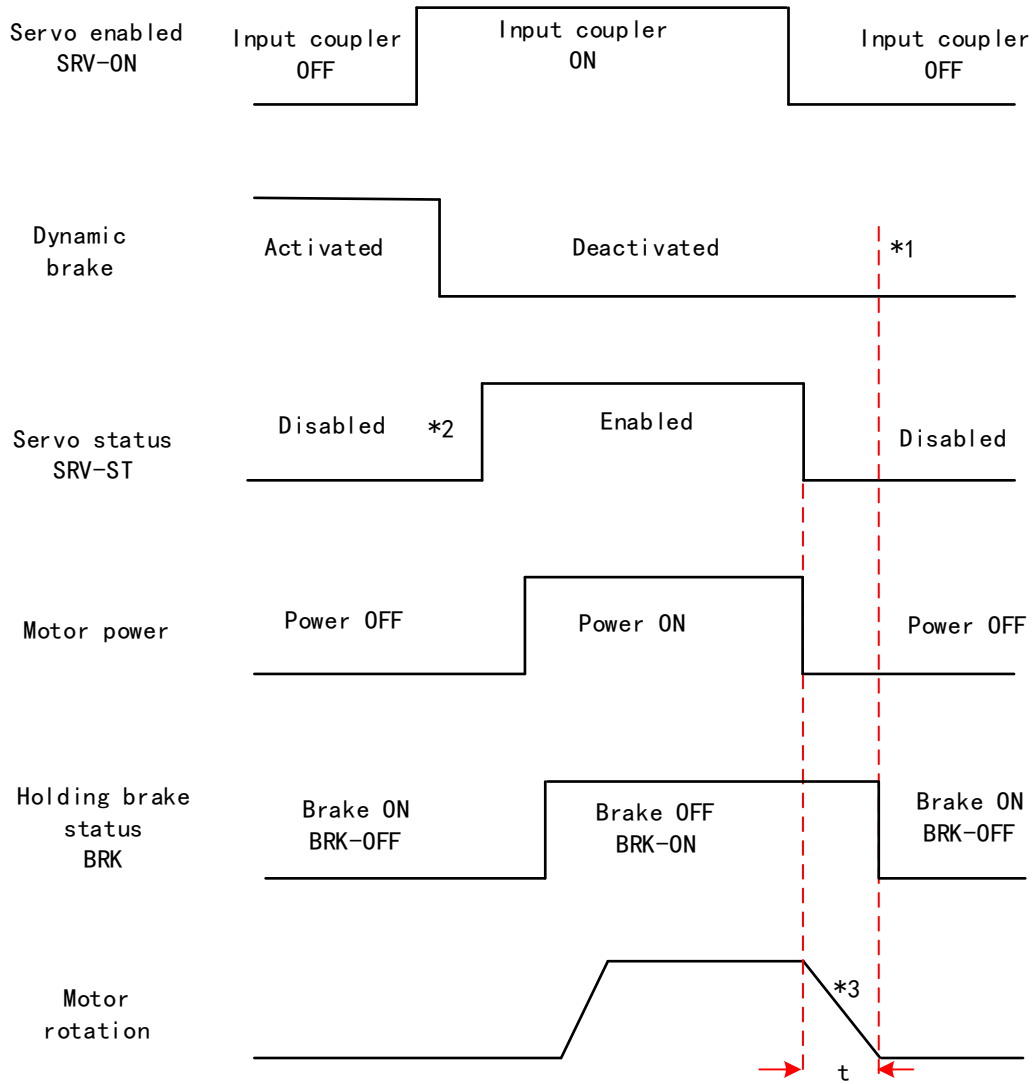




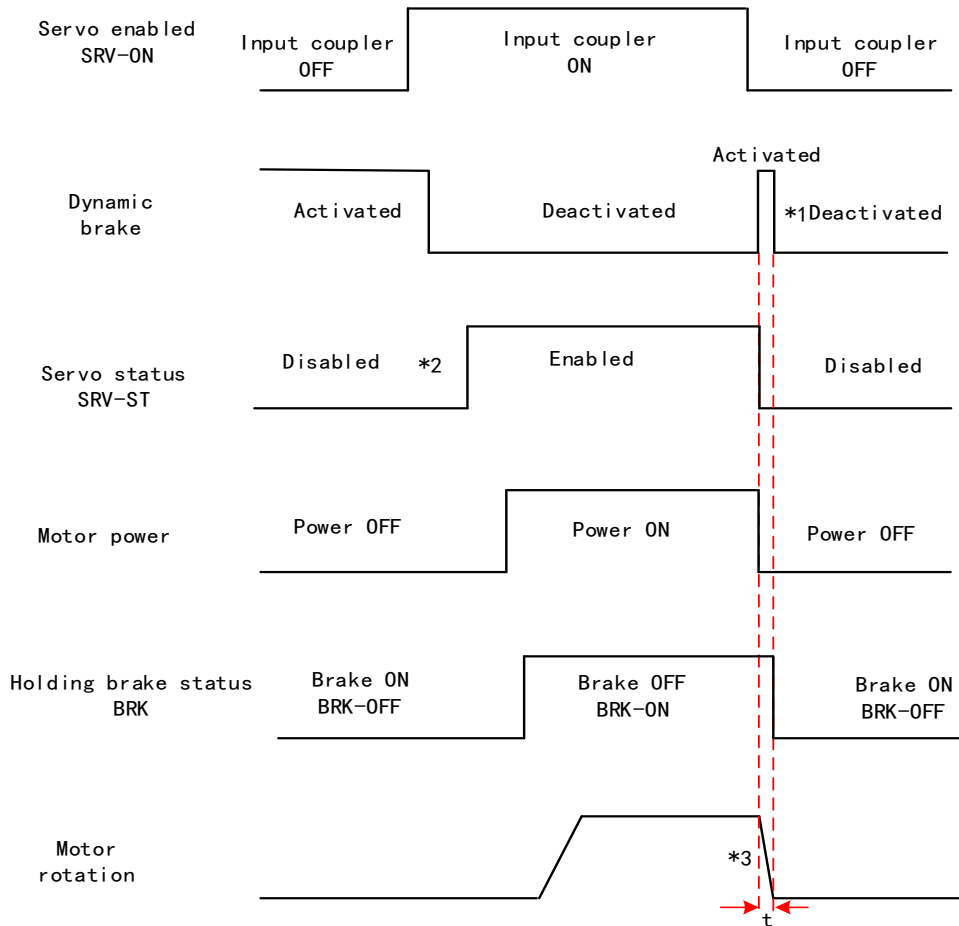
## Servo stopping method. Status after stopping: Free running



## Free stopping method. Status after stopping: Free running



## Dynamic braking method. Status after stopping: Free running



**\*\*1.** Status after stopping is as defined in Pr5.06.

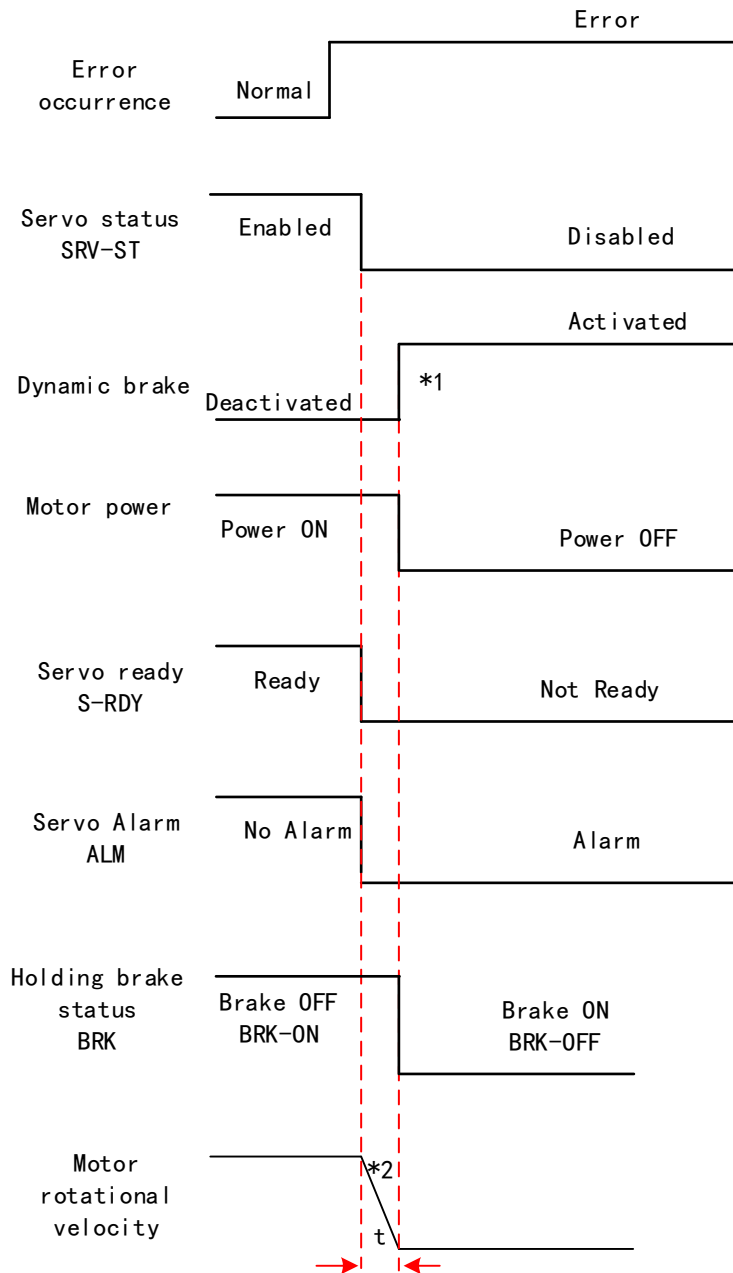
**2.** SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet.

**3.** Servo stopping method is as defined in Pr5.06; braking torque in opposite direction to decelerate the motor is as defined in Pr5.11. Deceleration time  $t$  is determined by whichever comes first between time set in Pr6.14 and time needed for motor to drop below velocity set in Pr4.39. 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).

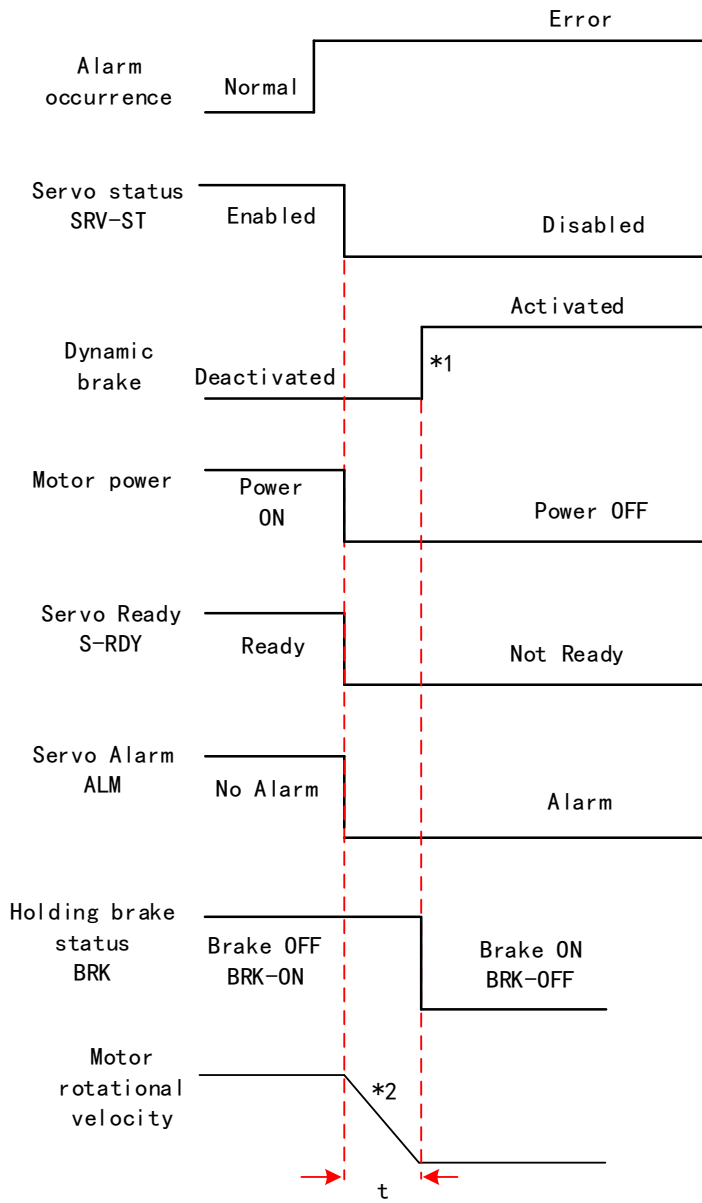
**4.** BRK-ON signal doesn't indicate the activation of holding brake but the validation of the signal. Holding brake is not applied when BRK-ON signal is valid. Same idea goes for BRK-OFF signal.

**Stopping when alarm occurs – Sequence Diagram**

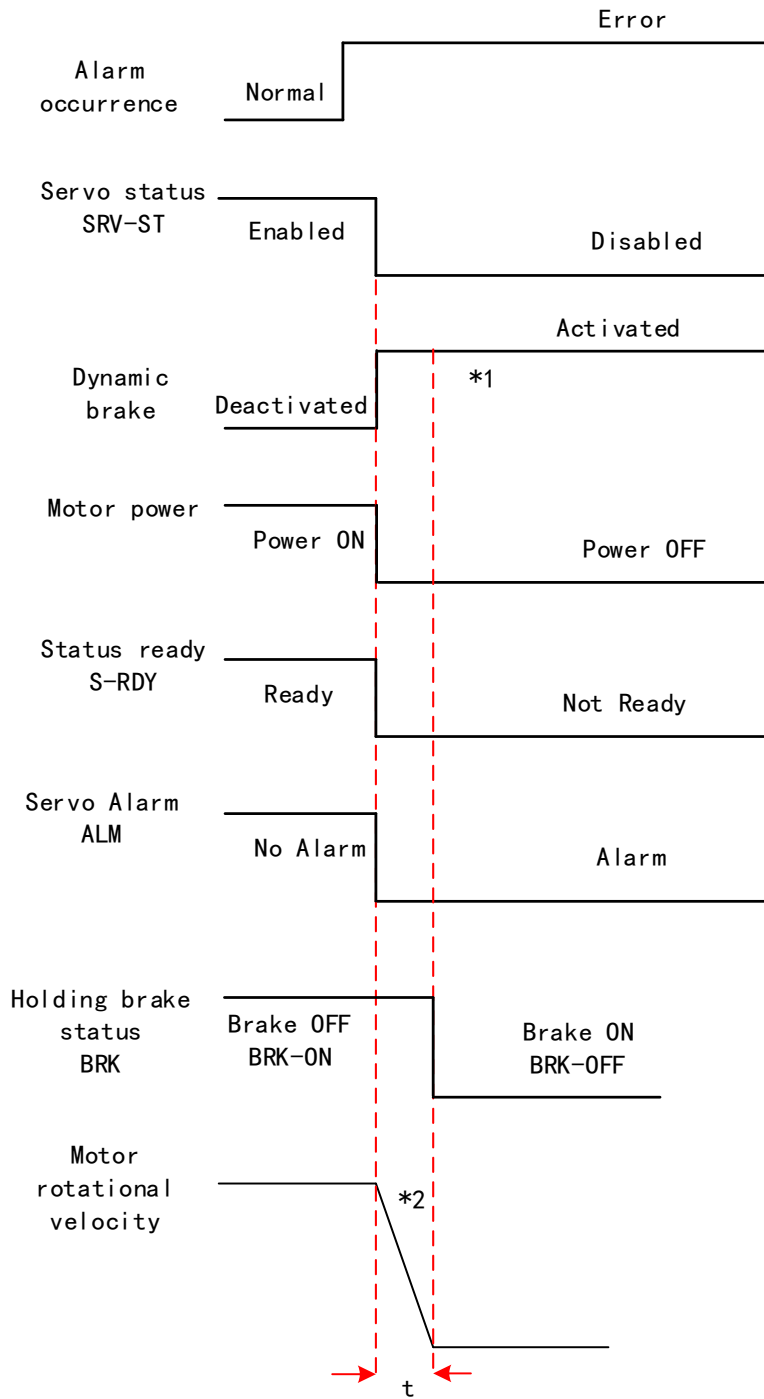
Servo braking method. Status after stopping: Dynamic braking



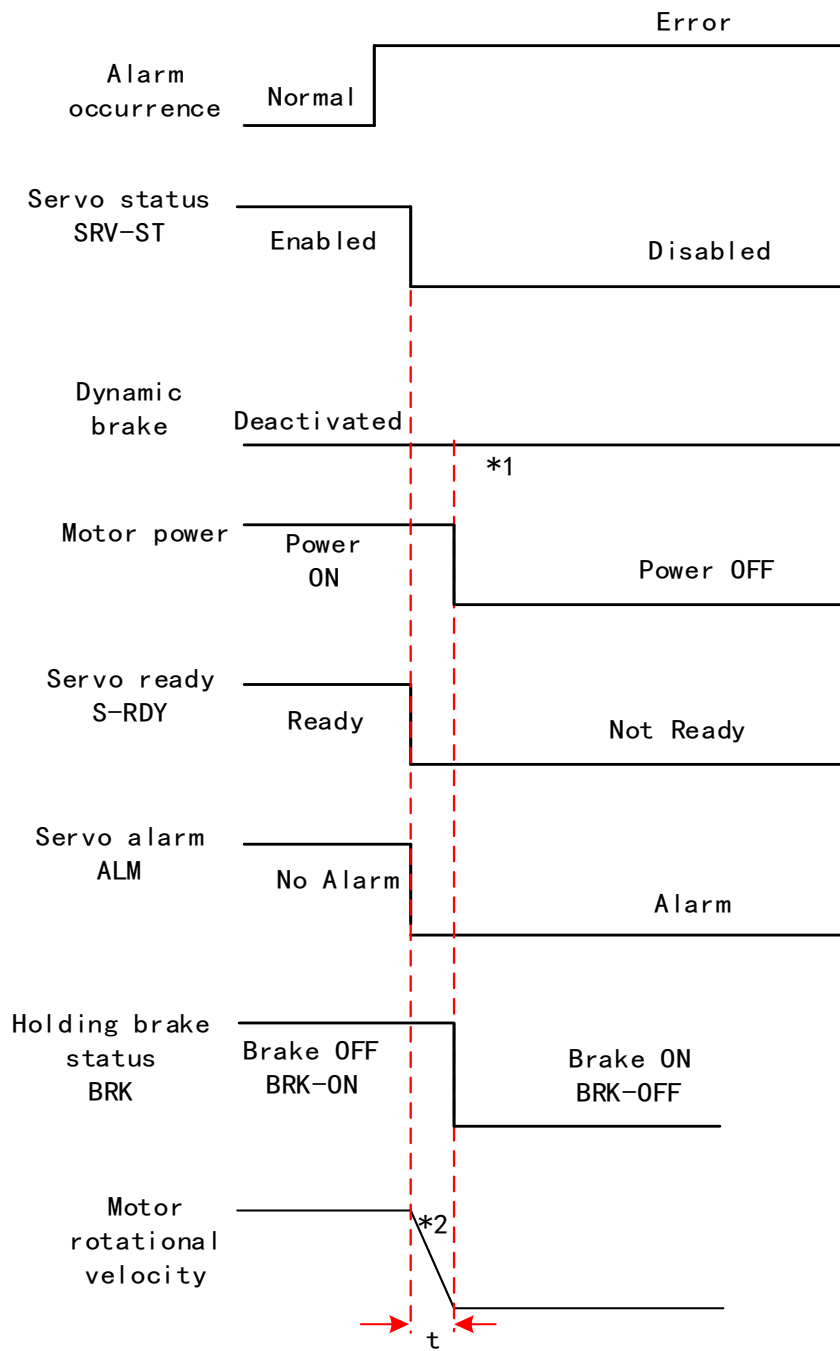
## Free stopping method. Status after stopping: Dynamic braking



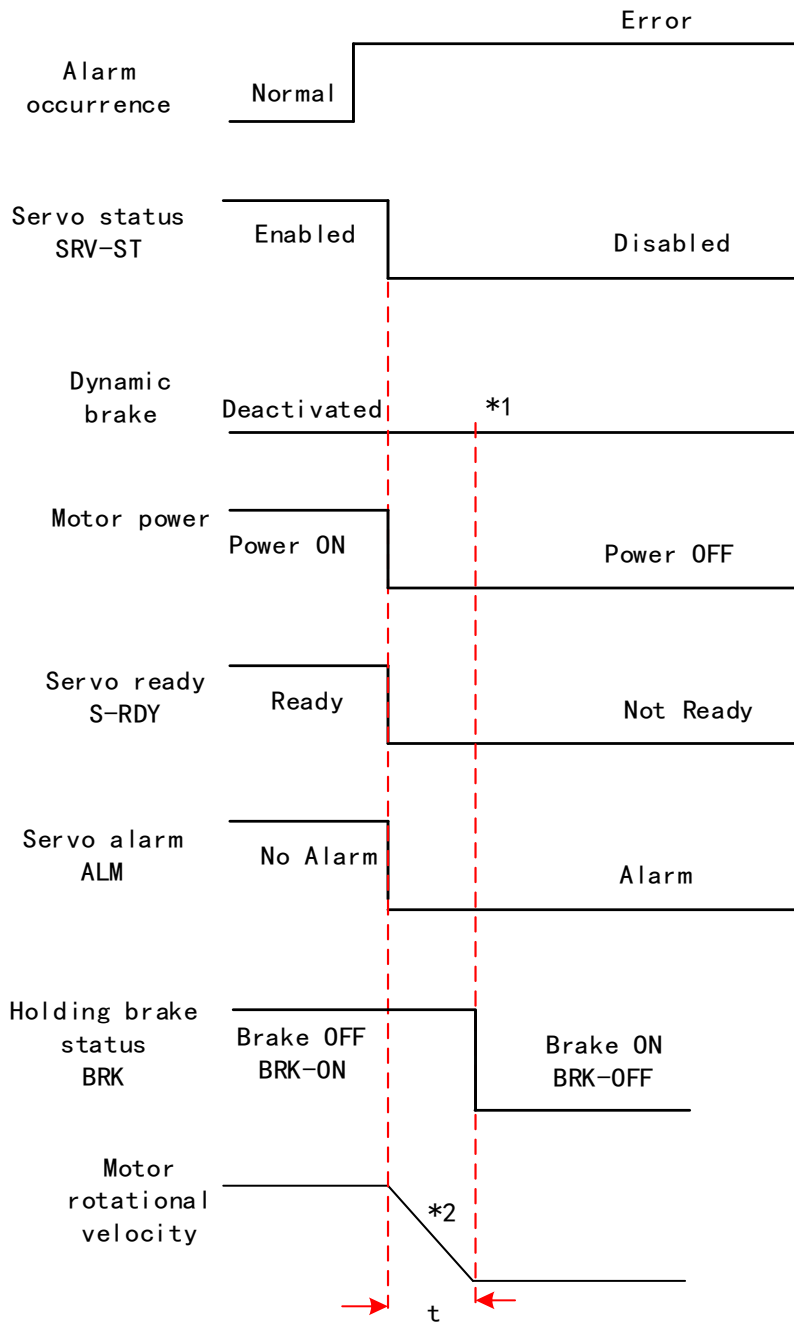
## Dynamic braking method. Status after stopping: Dynamic braking



## Servo braking method. Status after stopping: Free moving

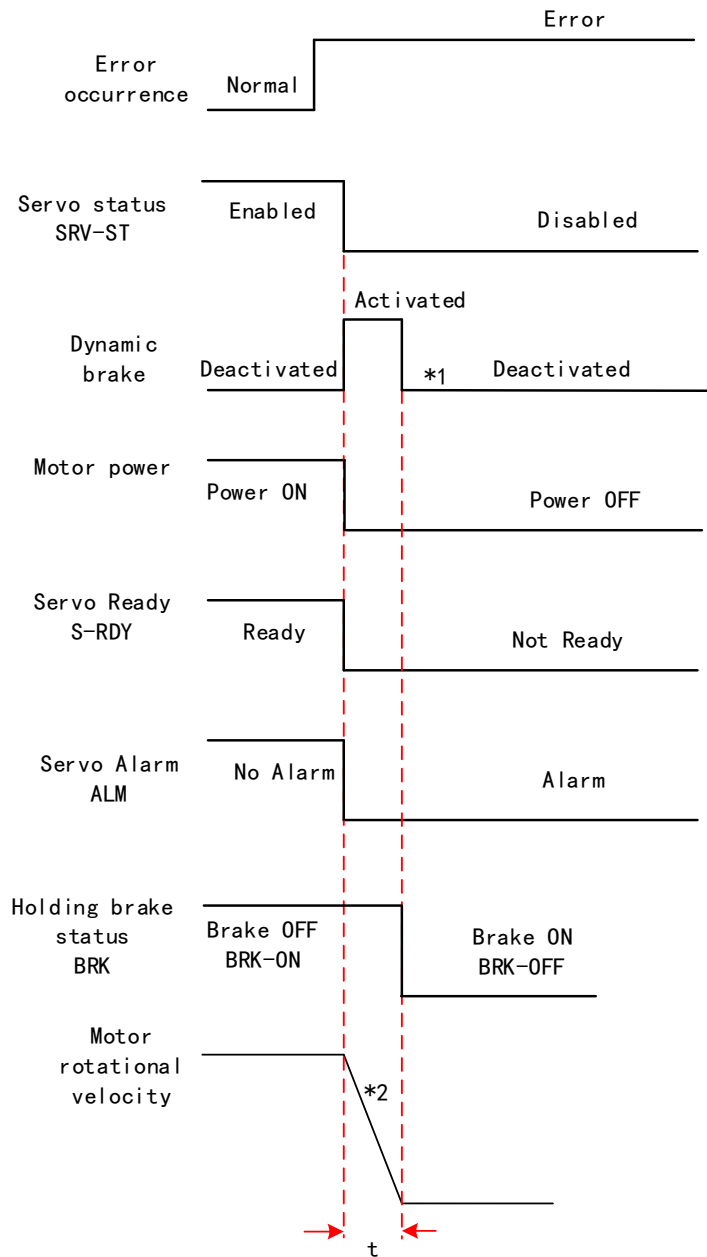


## Free stopping method. Status after stopping: Free moving





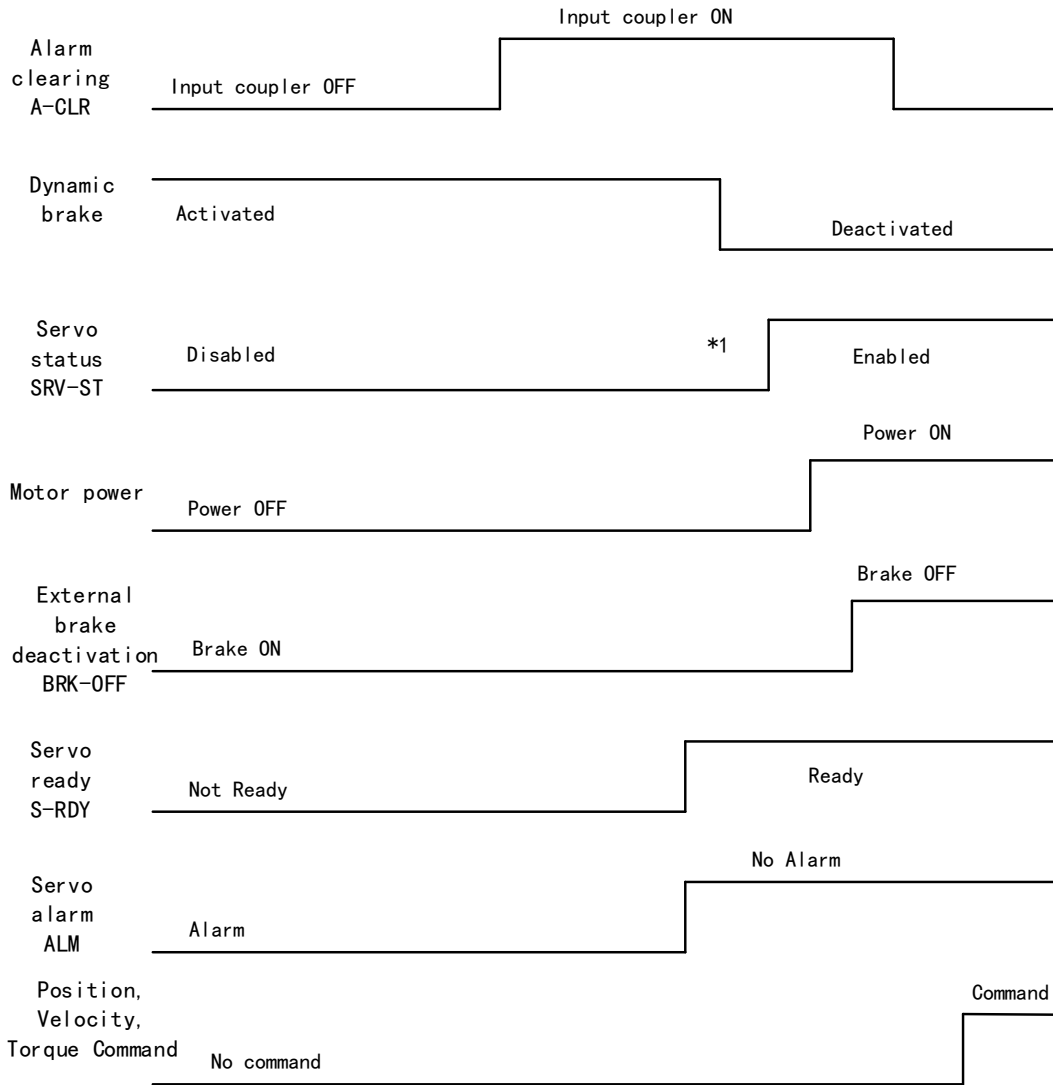
## Dynamic braking. Status after stopping: Free moving



**\*\*1.** Status after stopping is as defined in Pr5.10.

**2.** Servo stopping method is as defined in Pr5.10. Deceleration time  $t$  is determined by whichever comes first between time set in Pr6.14 and time needed for motor to drop below velocity set in Pr4.39. 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 and a 8-segments display

. Can be used for displaying of status, alarms, functions, parameters setting and auxiliary functions.



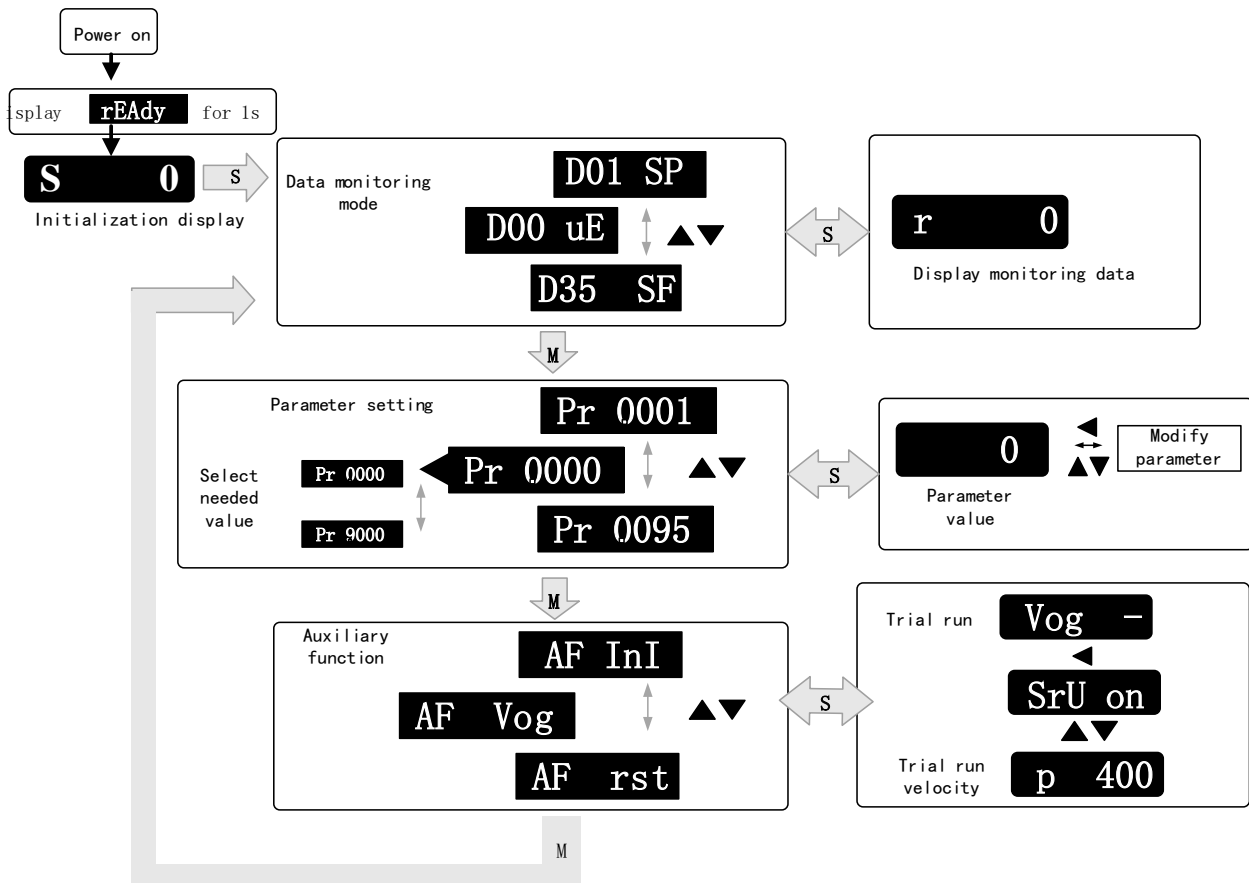
Front panel

Buttons and functions

Label	Symbol	Function
Display	/	Consists of 5 push buttons and a 8-segments display
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	① Set Pr5.35 = 1. ② Restart driver. ③ Front panel is now locked.	
Unlock	① Please refer to auxiliary function <b>A F U n L</b> ② Front panel is now unlocked.	① Set Pr5.35 = 0. ② Front panel is now unlocked.

### 4.4.2 Data Monitoring Mode

EL7 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	<b>d00uE</b>	pulse	"xxxx"
1	d01SP	Motor velocity	<b>d01SP</b>	r/min	"r xxxx" - Motor actual velocity "F xxxx" - External encoder feedback velocity
2	d02CS	Position control command velocity	<b>d02CS</b>	r/min	"xxxx"
3	d03Cu	Velocity control command velocity	<b>d03Cu</b>	r/min	"xxxx"
4	d04tr	Actual feedback torque	<b>d04tr</b>	%	"xxxx"
5	d05nP	Feedback pulse sum	<b>d05nP</b>	pulse	"xxxx"
6	d06cP	Command pulse sum	<b>d06cP</b>	pulse	"xxxx"
7	d07	Maximum torque during motion	<b>d07</b>	/	"d xxxx" - Max torque % "V xxxx" - Average load ratio

8	d08FP	Internal command position sum	<b>d08FP</b>	pulse	"xxxx"
9	d09cn	Control mode	<b>d09Cn</b>	/	Position: " <b>Ct PoS</b> " Velocity: " <b>Ct SPd</b> " Torque: " <b>Ct trq</b> "
10	d10Io	I/O signal status	<b>d10Io</b>	/	-
11	d11Ai	Analog input	<b>d11Ai</b>	V	-
12	d12Er	Alarm cause and record	<b>d12Er</b>	/	" <b>Er xxx</b> " Alarm code
13	d13rn	Warning	<b>d13rn</b>	/	" <b>H xxx</b> " Warning code
14	d14r9	Regeneration load factor	<b>d14r9</b>	%	"xxx"
15	d15oL	Overload factor	<b>d15oL</b>	%	" <b>L xxx</b> " - Motor overload % " <b>d xxx</b> " - Driver overload %
16	d16Jr	Inertia ratio	<b>d16Jr</b>	%	"xxx"
17	d17ch	Motor not running cause	<b>d17Ch</b>	/	" <b>CP xxx</b> " Error code
18	d18ic	No. of changes in I/O signals	<b>d18ic</b>	/	"xxx"
19	d19	Internal use	<b>d19</b>	/	"xxxx"
20	d20Ab	CSP position command sum	<b>d20Ab</b>	pulse	"xxxx"
21	d21AE	Single turn encoder data	<b>d21AE</b>	pulse	" <b>A xxxx</b> " - motor encoder single turn data " <b>F xxxxx</b> " - external encoder single turn data
22	d22rE	Multiturn encoder data	<b>d22rE</b>	r	"xxxx"
23	d23 id	485 received frame	<b>d23id</b>	/	"id xxx" "Fr xxx"
24	d24PE	Position deviation	<b>d24PE</b>	Unit	" <b>A xxxx</b> " - Position deviation " <b>F xxxxx</b> " - Full closed loop deviation (Command unit) " <b>H xxxxx</b> " - Full closed loop deviation (Encoder unit)
25	d25PF	Motor electrical angle	<b>d25PF</b>	pulse	"xxxx"
26	d26hy	Motor mechanical angle	<b>d26hy</b>	pulse	"xxxx"
27	d27 Pn	Voltage across PN	<b>d27Pn</b>	V	"xxxx"
28	d28 no	Software version	<b>d28no</b>	/	"d xxx Servo software" "F xx Communication software" "p xxx Servo power rating" "C xx CPLD software"
29	d29AS	Internal usage	<b>d29AS</b>	/	" <b>A xxxx</b> " " <b>F xxxxx</b> " - external encoder serial no.
30	d30NS	No. of times of encoder communication error	<b>d30sE</b>	/	" <b>A xxxx</b> " - Motor encoder communication error count " <b>F xxxxx</b> " - External encoder communication error count
31	d31 tE	Accumulated uptime	<b>d31tE</b>	/	"xxxx"
32	d32Au	Automatic motor identification	<b>d32Au</b>	/	"r xxx Motor no." "E xxx Servo no."

33	d33At	Driver temperature	d33At	°C	"d xxx" – driver temperature "C xxx" – MCU temperature
34	d34	Servo status	d34	/	"xxx"
35	d35 SF	Internal usage	d35SF	/	"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 .

High bit: 1<sup>st</sup> and 2<sup>nd</sup> values on the right has two decimal points  
Low bit: 1<sup>st</sup> and 2<sup>nd</sup> values on the right has no decimal point.

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. .50

Positive: 1<sup>st</sup> and 2<sup>nd</sup> values on the left has no decimal point.  
Negative: 1<sup>st</sup> and 2<sup>nd</sup> values on the left has two decimal points

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### 1. d00uE Position command deviation

Shows high bit and low bit of position deviation

.. 8 0

Position command deviation

Positive: 1<sup>st</sup> and 2<sup>nd</sup> values on the left has no decimal point.  
Negative: 1<sup>st</sup> and 2<sup>nd</sup> values on the left has two decimal points

Press ◀ to switch between low and high bit  
Example : Position command deviation=260885

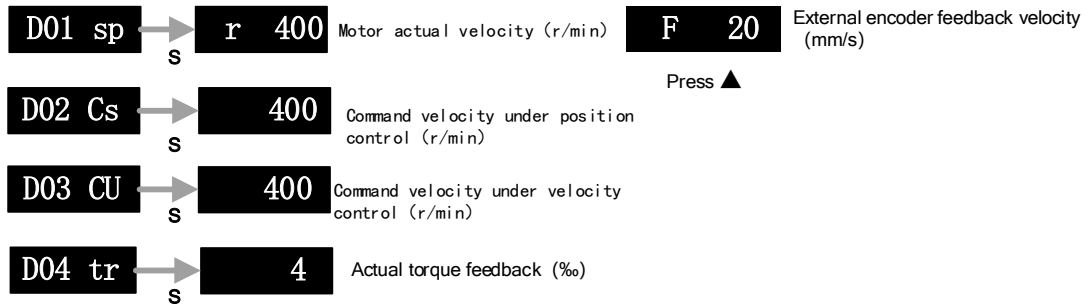
. 2 .

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High bit: 1<sup>st</sup> and 2<sup>nd</sup> values on the right has two decimal points  
Low bit: 1<sup>st</sup> and 2<sup>nd</sup> values on the right has no decimal point.

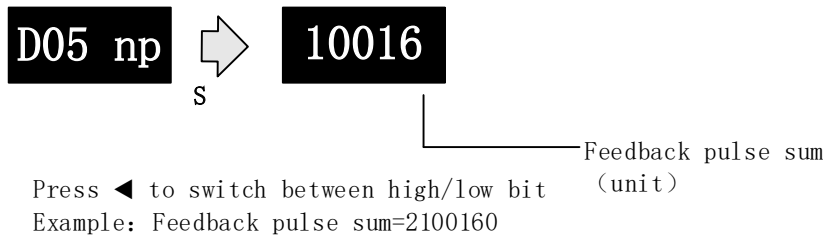
## 2. d01SP Motor velocity, d02CS Position control command velocity, d03CU Velocity control command velocity, d04 tr Actual torque feedback

**d04 tr** reflects actual current.

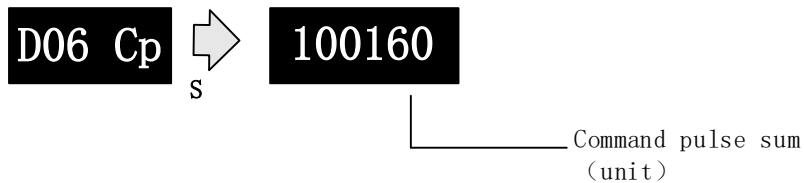


## 3. d05nP Feedback pulse sum d06CP Command pulse sum

Feedback pulse sum(Encoder feedback pulse)



Command pulse sum (Command pulse)



Press ◀ to switch between high/low bit  
Example: Command pulse sum=210017

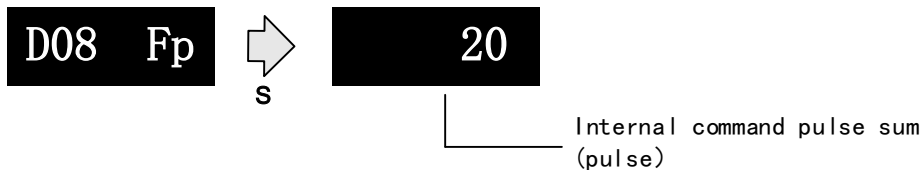




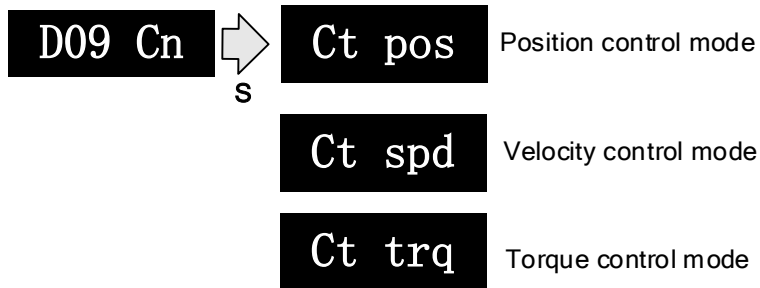
#### 4. d07 Maximum torque during motion



#### 5. d08FP Internal command pulse sum



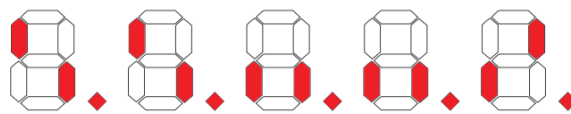
#### 6. d09Cn Control mode



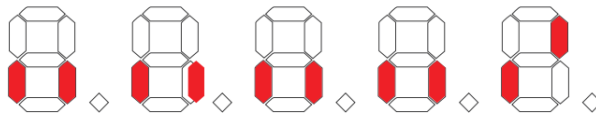
#### 7. d10Io I/O signal status

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.

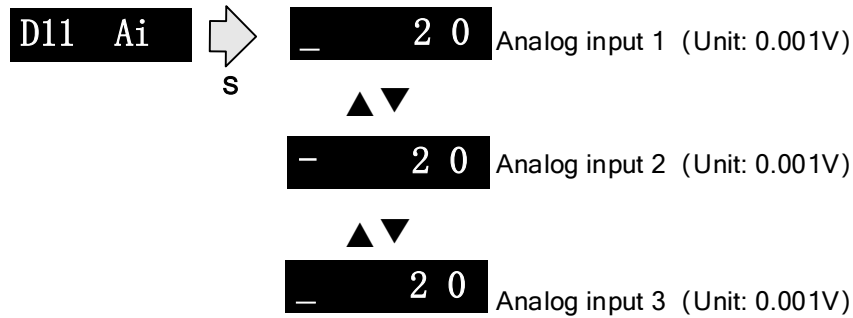
- Input:** From low to high bit(Right to left) DI1,DI2...DI10. Decimal point is lighted to represent input signals.  
 In the example below, DI1, DI8 and DI10 input signal is valid; DI2-DI7, DI9 input signal is invalid.



- Output:** From low to high bit(Right to left) D01,D02...D010. Decimal point is not lighted to represent output signals.  
 In the example below, D01 output signal is valid; D02-D010 output signal is invalid.

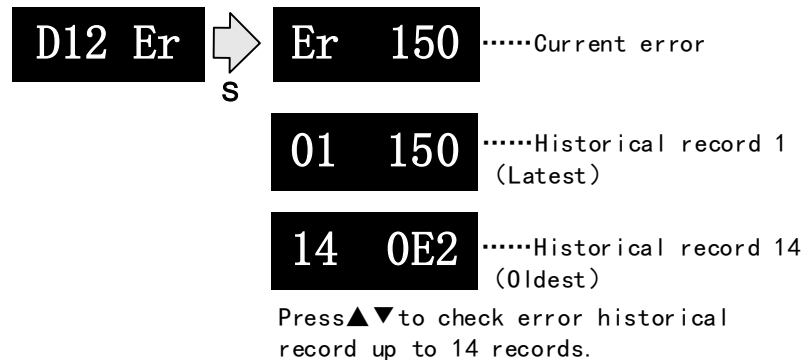


### 8. d11Ai Analog input



3 analog inputs can be monitored through d11. Left most bar at the top: 1<sup>st</sup> analog input; at the middle: 2<sup>nd</sup> analog input; at the bottom 3<sup>rd</sup> analog input. Points on 4<sup>th</sup> and 5<sup>th</sup> value means negative value.

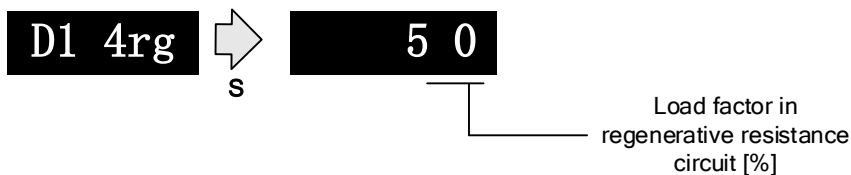
### 9. d12Er Alarm cause and historical record



Please refer to the alarm list table in chapter 9 for alarms that can be recorded.

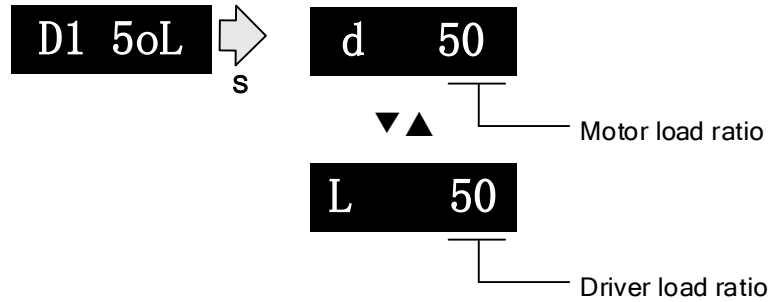
### 10. d14rg Regenerative load factor d15oL Overload factor

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)

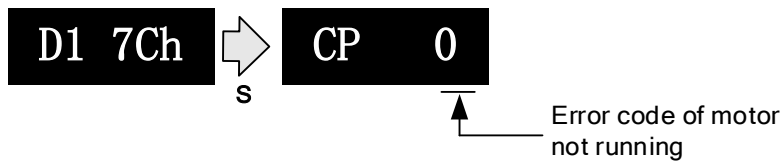


### 11、d16Jr Inertia ratio



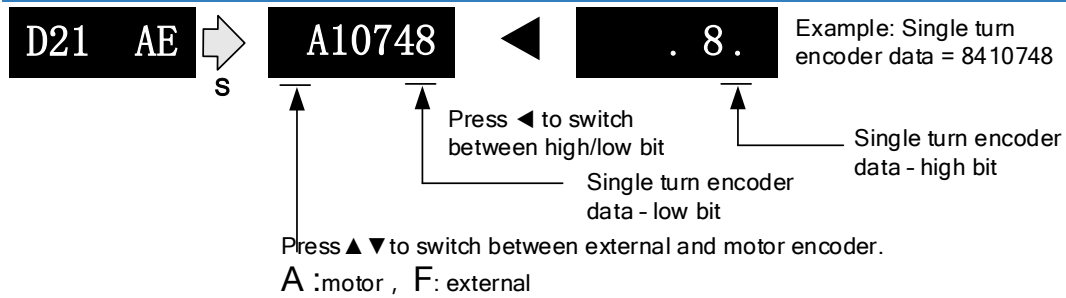
Use auxiliary function **AF\_GL** or Motion studio to measure the inertia ratio. The result will be shown on **D1 6Vr**, hold M to write the value in Pr0.04.

### 12、d17Ch Motor not running cause

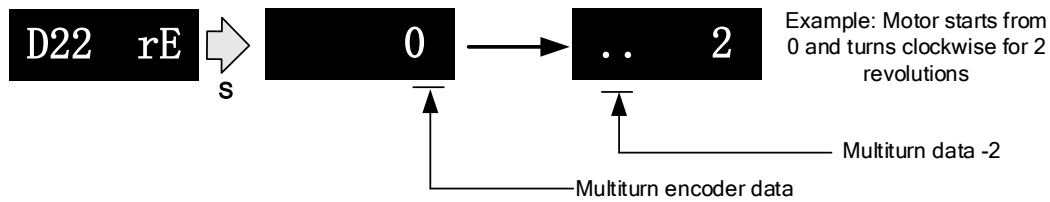


**“d17Ch” Motor No Running Cause - Codes & Descriptions**

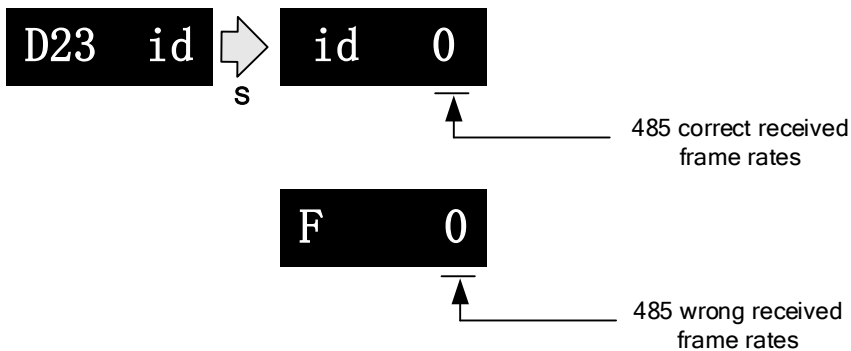
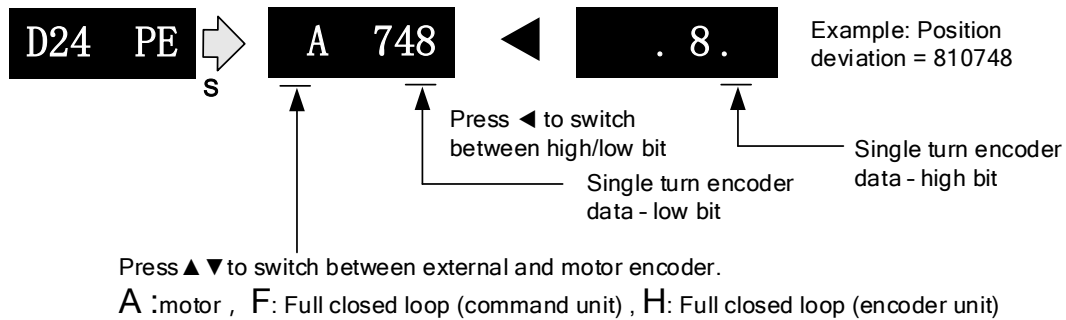
Display Code	Description	Content
CP 0	Normal	
CP 1	DC bus undervoltage	Check if DC bus voltage is too low on D27
CP 2	No SRV-ON signal	Servo-ON input (SRV-ON) is not connected to COM-
CP 3	POT/NOT input valid	Pr5.04 = 0, POT is in open circuit, velocity command is in positive direction NOT is in open 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)	Pr5.18=0
CP 7	Position command too low	No command or too low
CP 8	CL valid	Pr5.17=0, deviation counter connected to COM-
CP 9	Zero speed clamp valid	Pr3.15 = 1, Zero speed clamp input is open

**13. d21AE Single turn encoder data d22rE Multiturn encoder data**


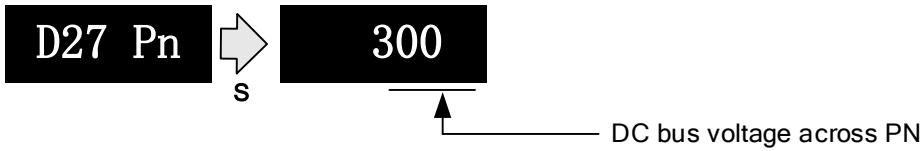
For 23-bit encoder, single turn encoder data = 0~8388607. Each value corresponds to certain position in a single revolution of the rotor, clockwise motion as negative, counter clockwise motion as positive. When counter clockwise single turn data > 8388607, multiturn data +1, clockwise single turn data < 0, multiturn data -1.



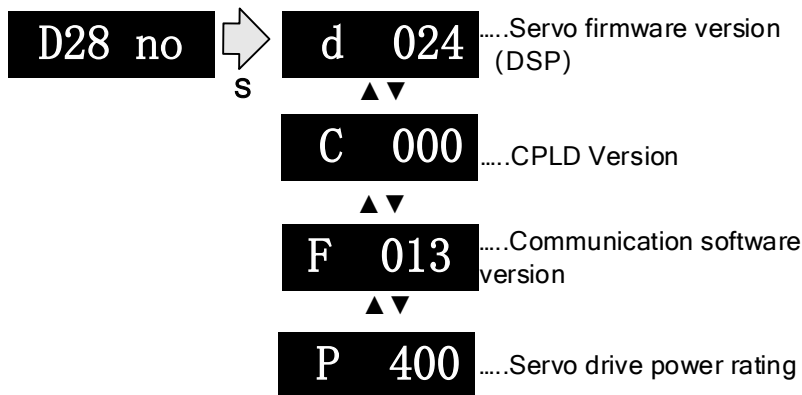
Multiturn encoder data range: -32768~+32767, As no. of revolution goes over range, 32767 will jump to -32768, -32767 (counter clockwise); -32768 will jump to 32767, 32766 (clockwise)

**14.d23id 485 received frame**

**15. d24PE Position deviation**


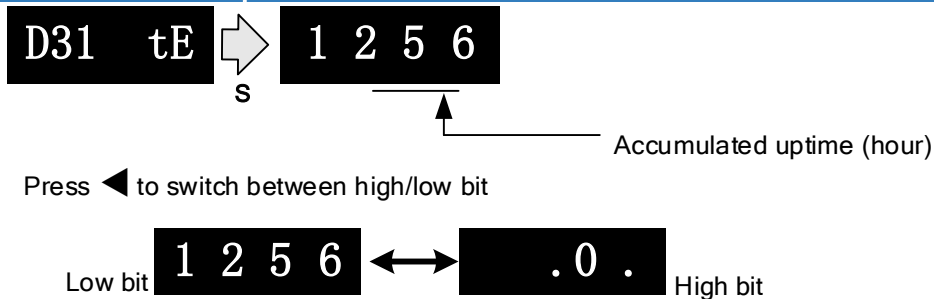
### 15. d27Pn DC bus voltage



### 16. d28no Software version

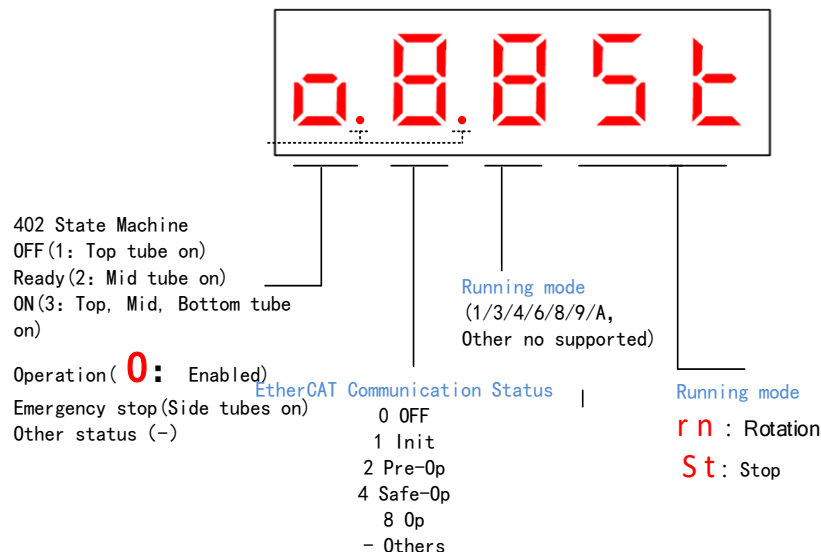


### 17. d31tE Accumulated operation time



### 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 Pr5.28.

Please refer to Pr5.28 for any display content required on the front panel during initialization

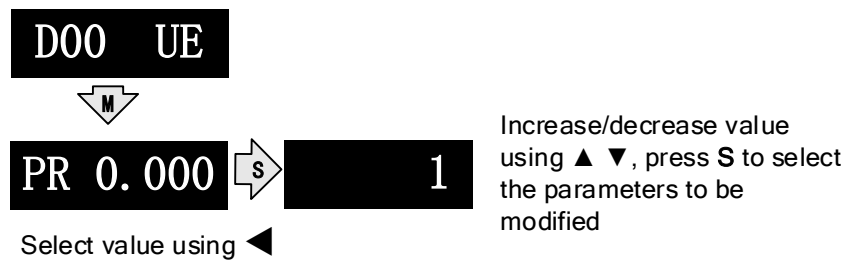
<b>Pr5.28</b>	<b>Label</b>	LED initial status			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~35	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0539		
	<b>Valid</b>	Immediate						

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		
9	Control mode	23	485 receive frame		
10	I/O status	24	Encoder position deviation		
11	Analogue input	25	Internal usage		
12	Alarm cause & history record	26	Internal usage		
13	Warning ID	27	PN Voltage		

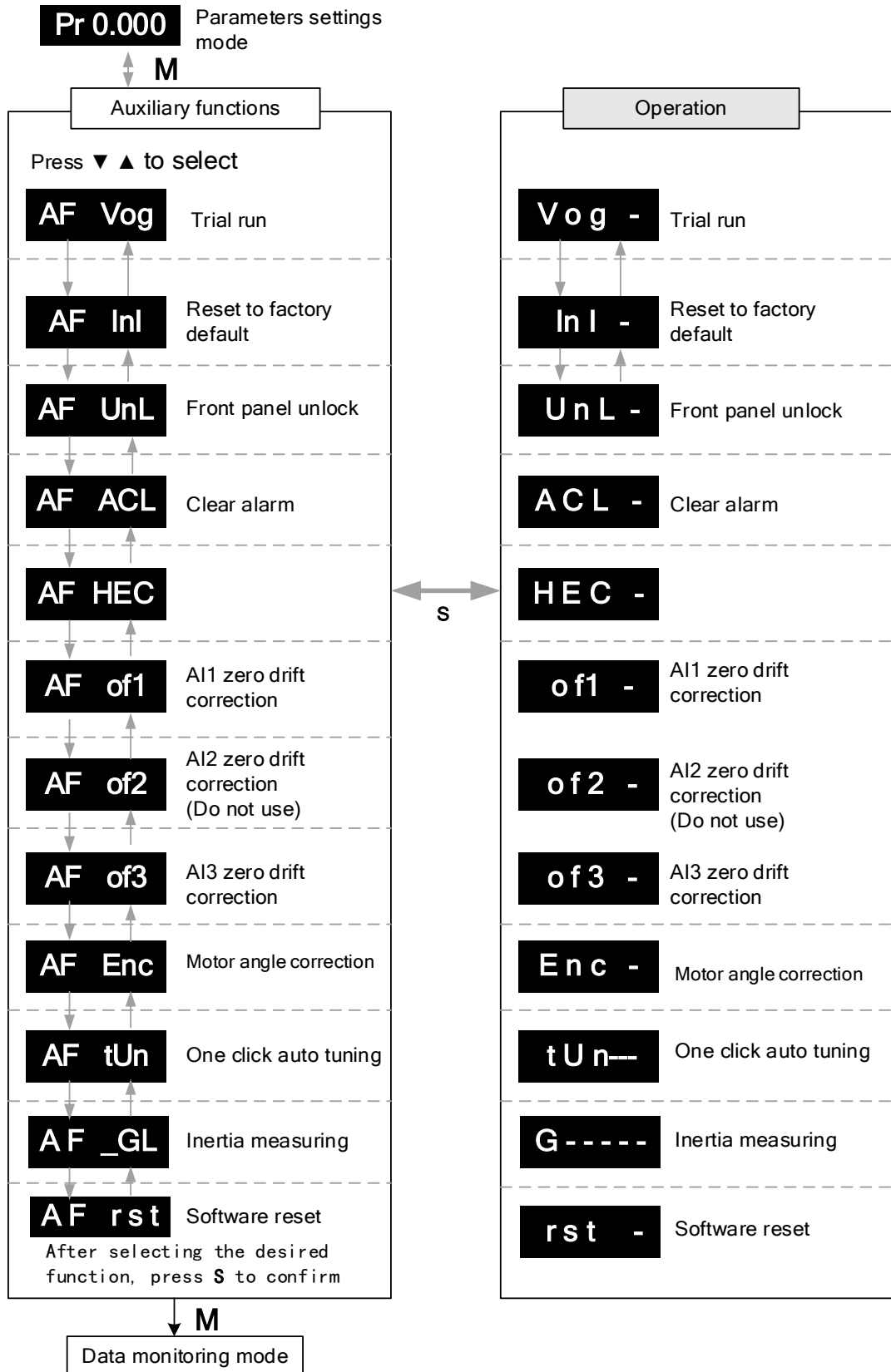
## 4.5 Parameters saving

Save using driver's front panel



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.

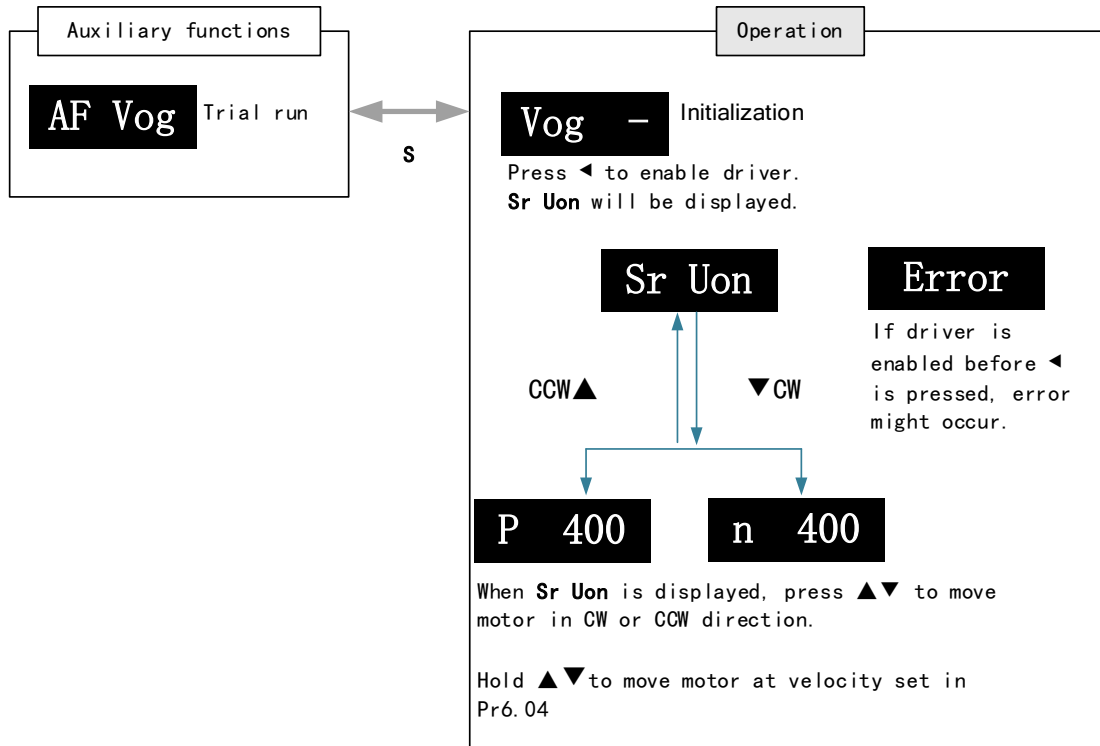
## 4.6 Auxiliary function





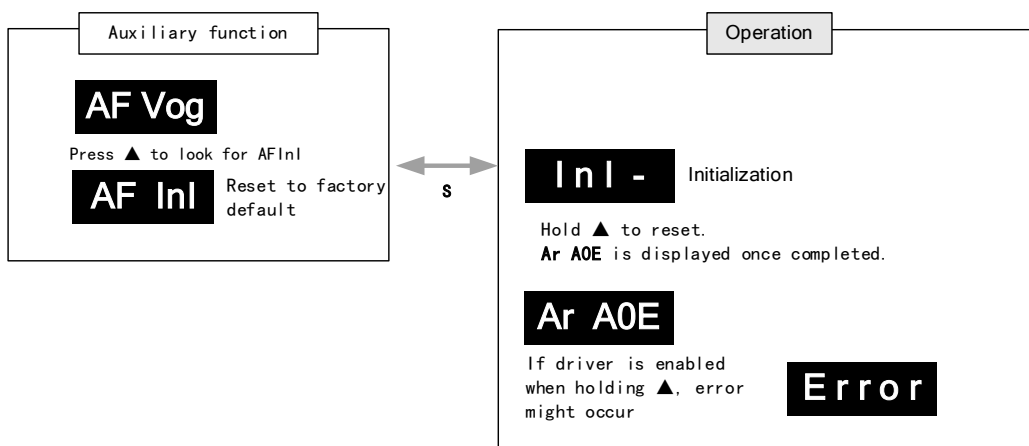
### AF Vog Trial run

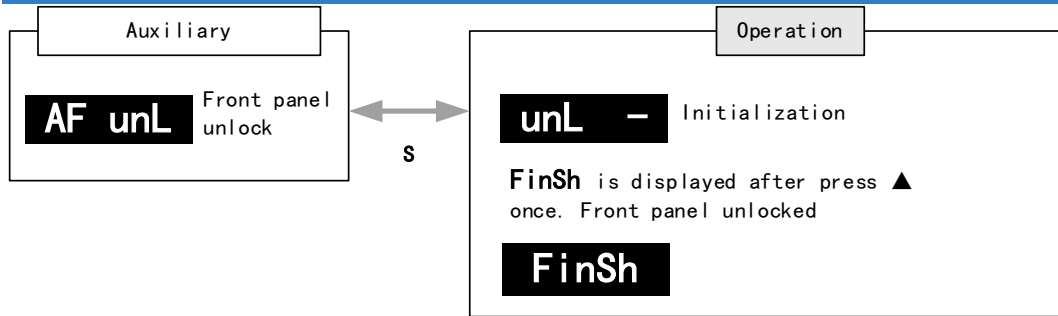
- Please disable servo driver before performing any trial run.
- Please don't modify gain related parameters during trial run to prevent any occurrence of mechanical vibrations.
- Only use trial run when Pr0.01 set to 0, 1, 6.
- Please check Pr6.04 (JOG velocity) and Pr6.25 (JOG acceleration) before running.
- Press **S** to exit trial run.



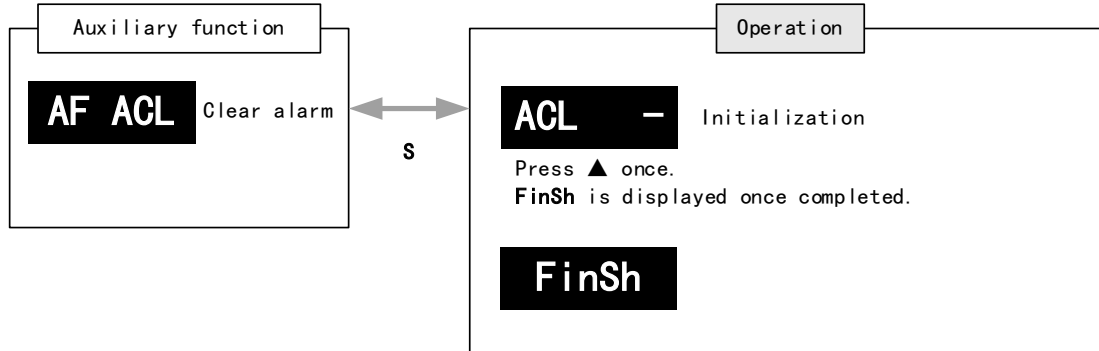
### AF InI Reset to factory default

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.

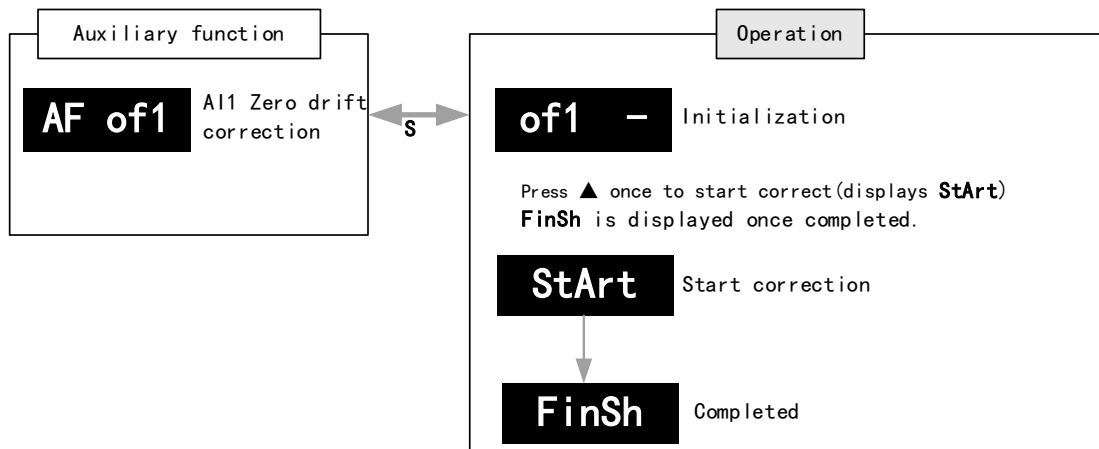


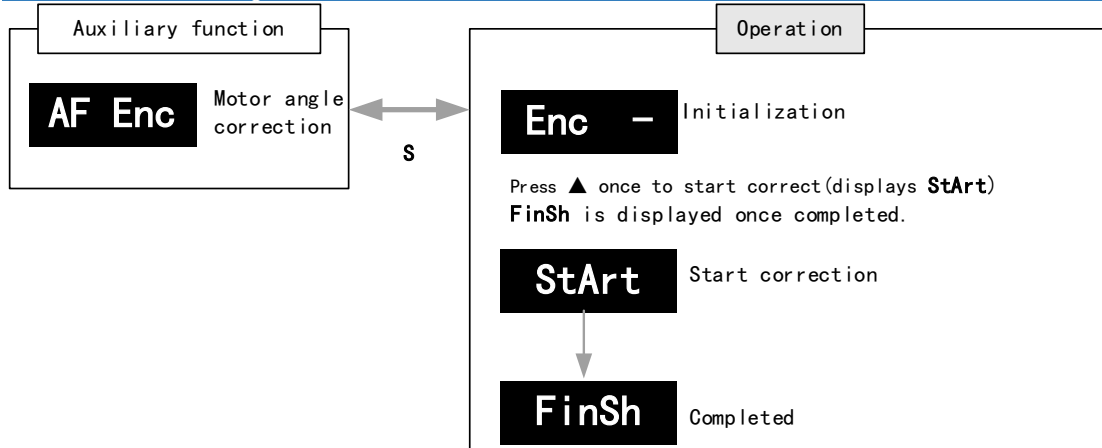
For alarms that can be cleared using this function, please refer to table in Chapter 8.

**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	Pr4.22
AI2	Pr4.25
AI3	Pr4.28

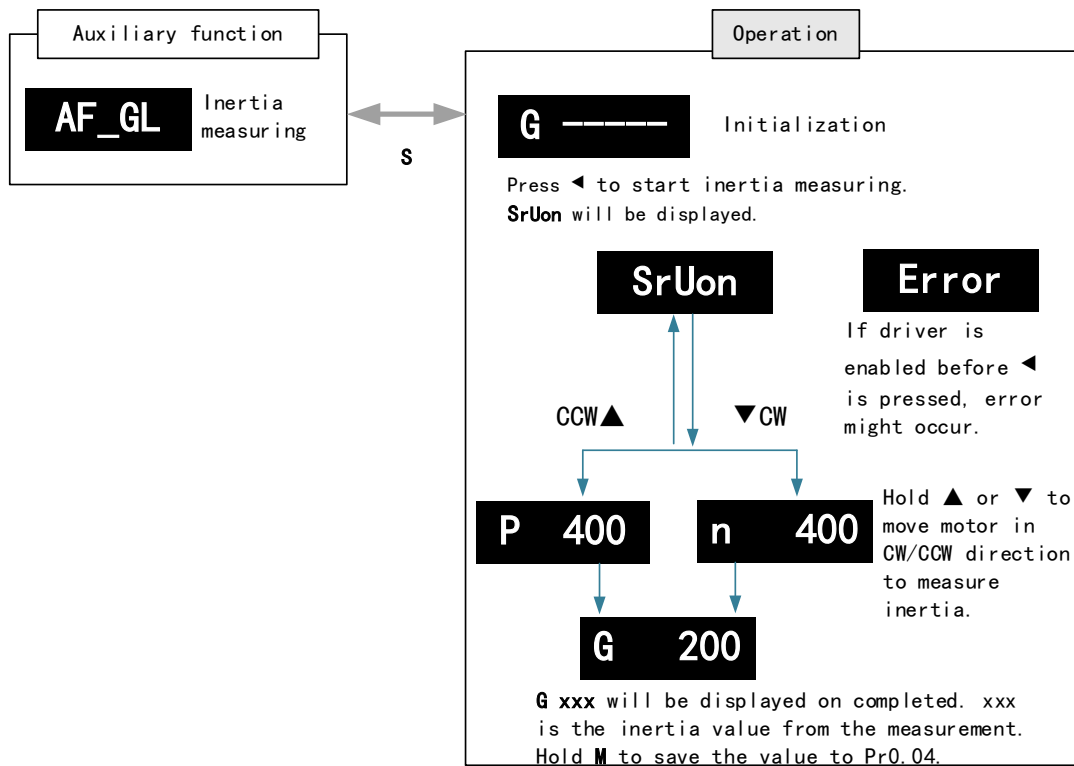


**AF Enc Motor angle correction**

**AF\_GL Inertia measuring**

Please make sure: 1. Velocity < 300RPM, average velocity duration < 50ms

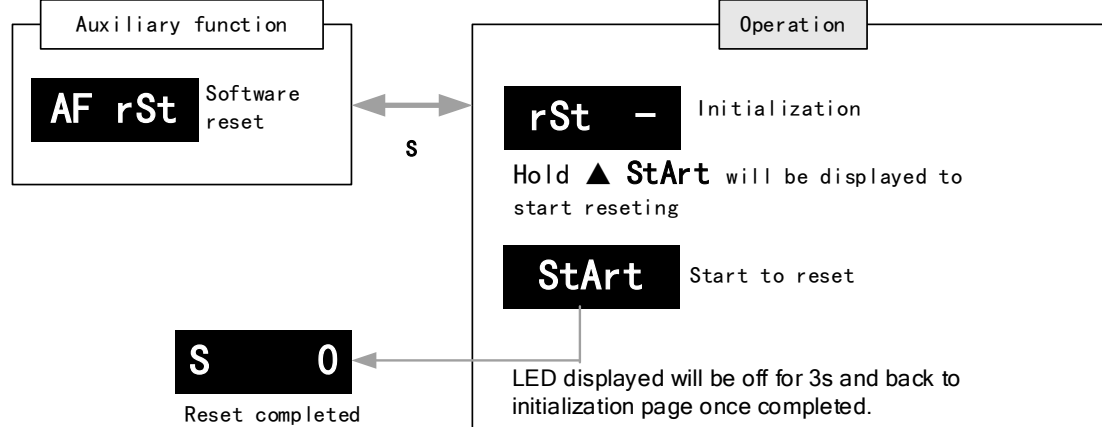
2. Acceleration/Deceleration time < 500ms

Press **S** to exit and disable the driver once completed.



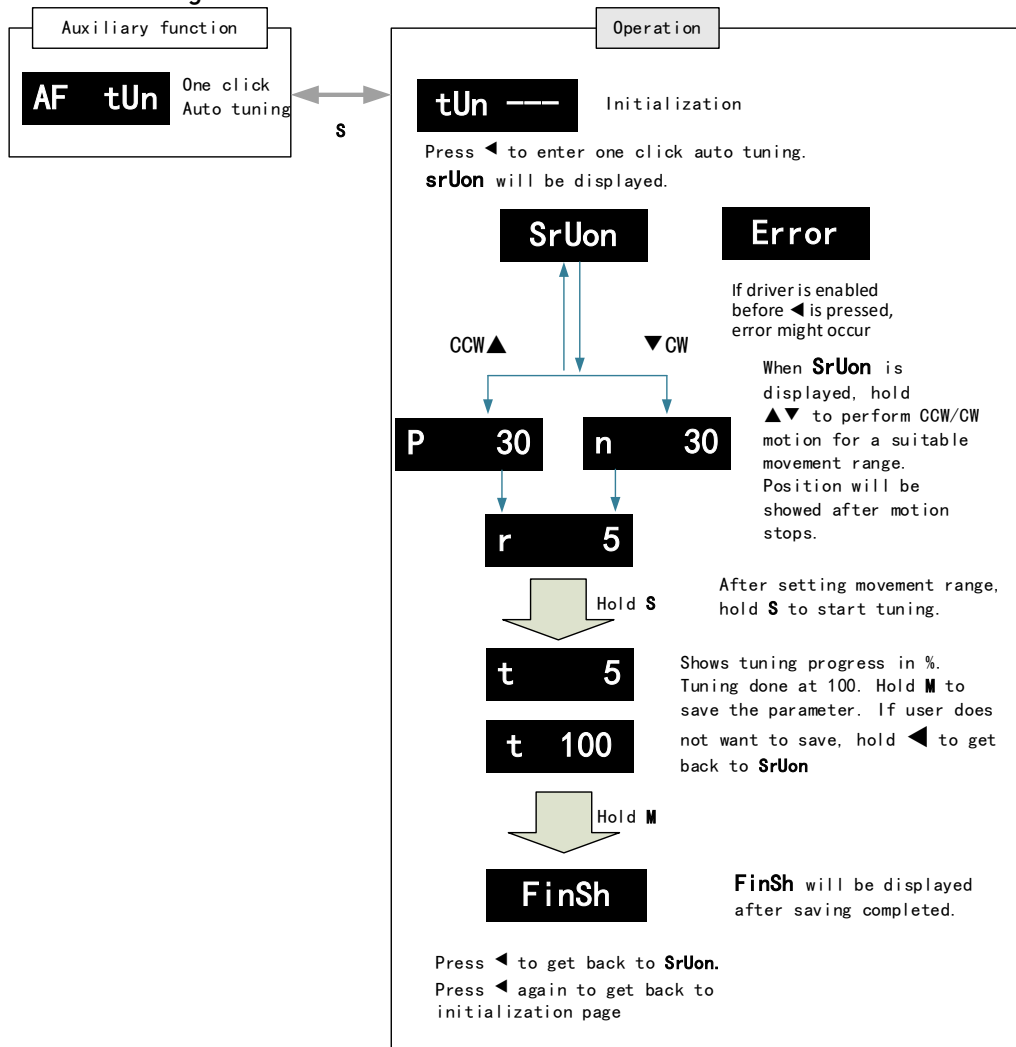
### AF rSt Software reset

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 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	Pr0.01	Control mode settings	0、1、6	/
2	Pr6.04	JOG trial run command velocity	User defined	r/min
3	Pr6.25	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 4.6 AF\_Vog Trial Run” for detailed explanations on how to perform trial run using front panel operation

## Chapter 5 Control Mode

Control modes for EL7-RSP 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

Pr0.01 *	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	
	1 <sup>st</sup> mode	2 <sup>nd</sup> mode
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position Pr0.22=1
		Velocity Pr0.22=1
		Torque Pr0.22=2
7~10	Reserved	

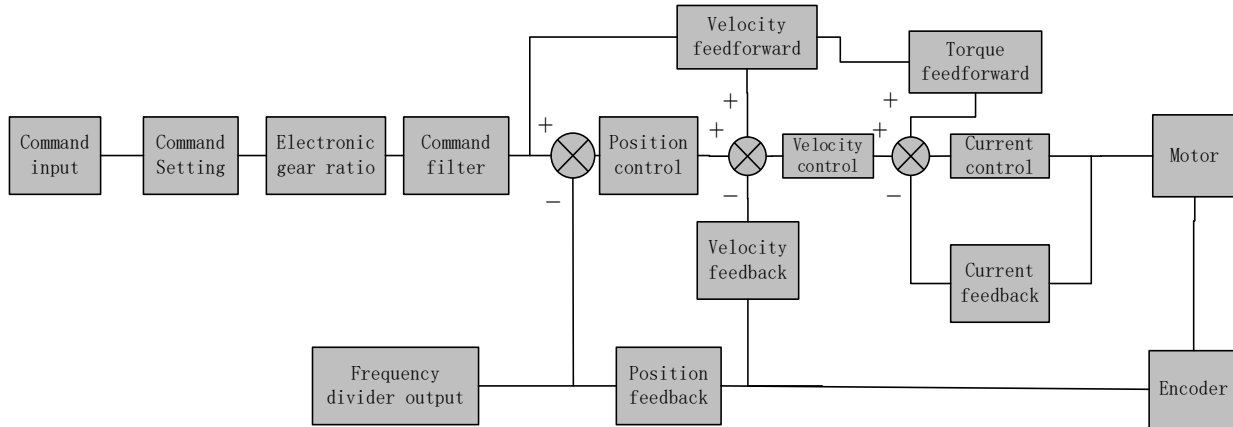
◆When 3, 4, 5, 6 combination hybrid mode, 1<sup>st</sup> and 2<sup>nd</sup> mode can be chosen accordingly with control mode switching input (C-MODE).  
 C-MODE: Invalid, select 1<sup>st</sup> mode.  
 C-MODE: Valid, select 2<sup>st</sup> mode.  
 Please allow some time in between mode switching commands.

◆Please set Pr0.01 = 6 to switch to other modes from PR mod, then set 2<sup>nd</sup> mode using Pr0.22.

*C-MODE is defaulted to Normally Open*

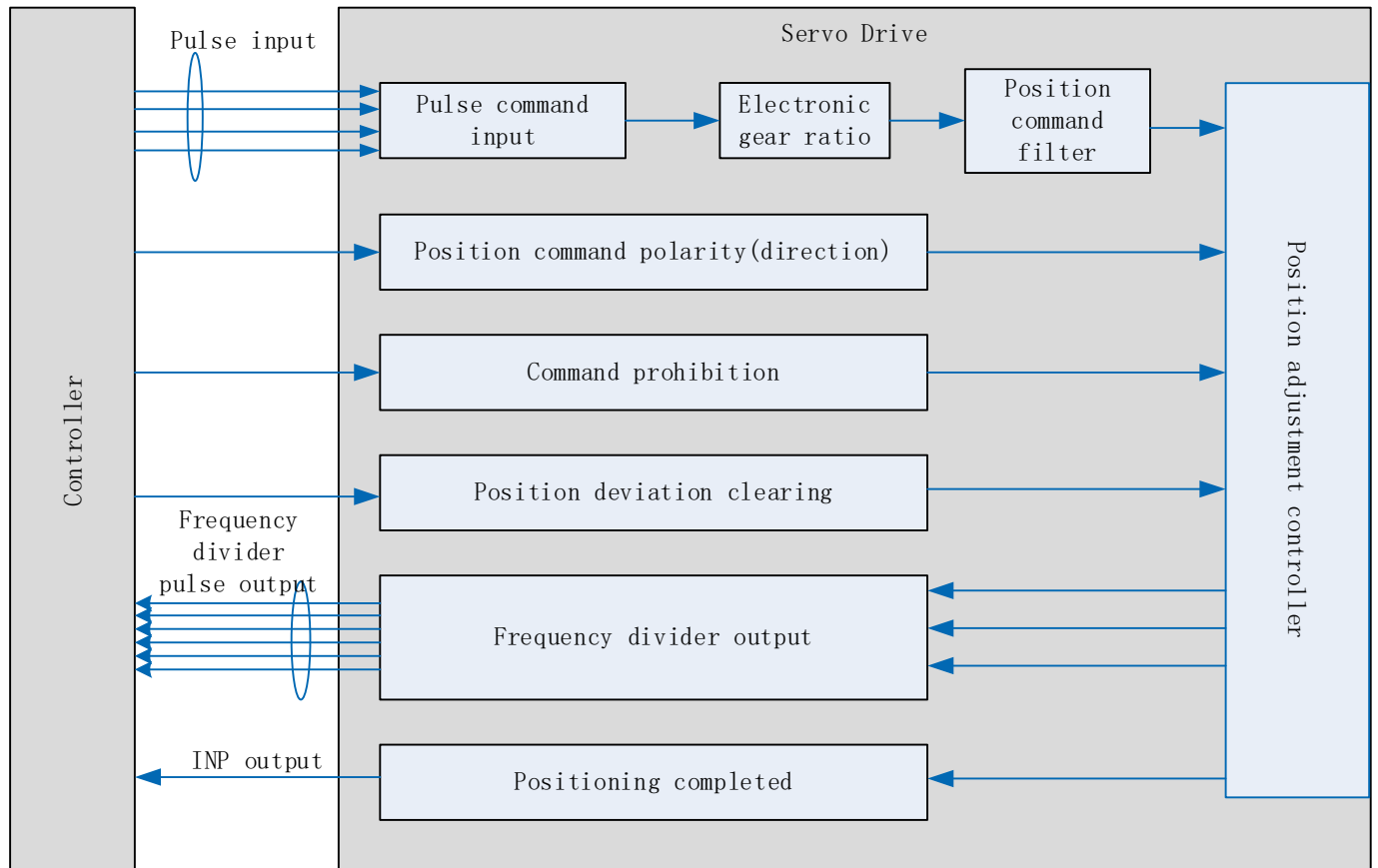
## 5.1 Position control

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 Pr0.01 = 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

CN1 Pin	Label	Definition	Description
1	PUL+24	Pulse command input	Low speed pulse direction command input: PUL+ / PUL-: 5V differential input (500KHz) DIR+ / DIR-: 5V differential input (500KHz) PUL+24 / PUL-: 24V single ended input (200KHz) DIR+24 / DIR-: 24V single ended input (200KHz)
3	PUL+		
4	PUL-		
2	DIR+24	Direction command input	Low speed pulse direction command input: PUL+ / PUL-: 5V differential input (500KHz) DIR+ / DIR-: 5V differential input (500KHz) PUL+24 / PUL-: 24V single ended input (200KHz) DIR+24 / DIR-: 24V single ended input (200KHz)
5	DIR+		
6	DIR-		
44	PULSH+	High speed pulse command input	4MHz high speed pulse command input : 5V differential input
45	PULSH-		
46	SIGNH+	High speed direction command input	4MHz high speed direction command input : 5V differential input
47	SIGNH-		

<b>Pr0.05</b>	<b>Label</b>	Command pulse input selection			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x000B		
	<b>Valid</b>	After restart						

Value	Description
<b>【0】</b>	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.*

<b>Pr0.06</b>	<b>Label</b>	Command pulse polarity inversion			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x000D		
	<b>Valid</b>	After restart						

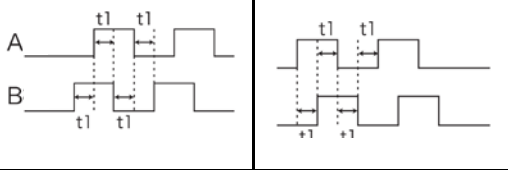
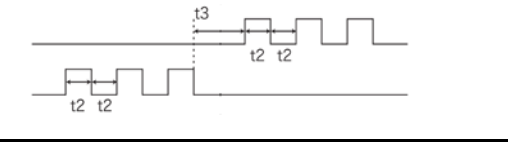
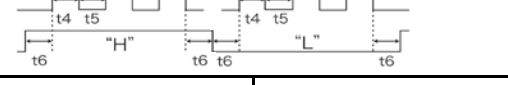
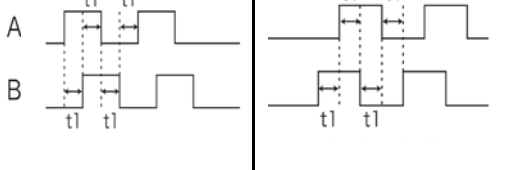
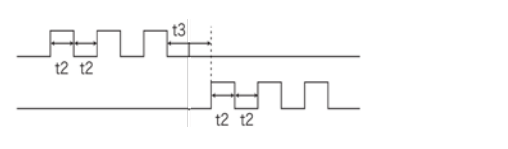
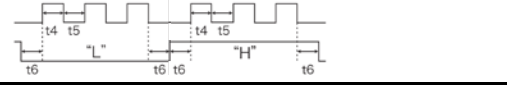
Pr0.06 and Pr0.07 set command pulse input inversion and mode correspondingly.

<b>Pr0.07</b>	<b>Label</b>	Command pulse input mode			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~3	<b>Unit</b>	—	<b>Default</b>	3		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x000F		
	<b>Valid</b>	After restart						

#### Command pulse input

Command Polarity inversion (Pr0.06)	Command pulse input mode settings (Pr0.07)	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 (μs)					
			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 Pr0.07=0 or 2, Pr0.08 = 10000;

1 revolution with 10000 pulses 1-phase pulse input when Pr0.07=1 or 3, Pr0.08 = 10000

Pr5.32	<b>Label</b>	Max. command pulse input frequency		<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~8000	<b>Unit</b>	kHz	<b>Default</b>	4100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0541
	<b>Valid</b>	Immediate				
Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds Pr5.32.						

## 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 Pr0.08 = 0, Pr0.09 and Pr0.10 will be valid. Other than that, Pr0.08 set value will be valid.
2. EL7-RS 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 Pr0.08, Pr0.09 and Pr0.10; Pr5.00, Pr5.01 and Pr5.02.

<b>Pr0.08</b>	<b>Label</b>	1st command pulse count per revolution			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0-67100864	<b>Unit</b>	PULSE	<b>Default</b>	10000		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0010 L: 0x0011		
	<b>Valid</b>	After restart						
Control will affected if value set is too low. Err1b1 might occur if value < 500. (1) Pr0.08 valid when ≠ 0: Motor revolution = input pulse count / [Pr0.08 value] (2) Pr0.08 invalid when = 0: Pr0.09 and Pr0.10 valid.								
<b>Pr0.09</b>	<b>Label</b>	1st command frequency divider/multiplier numerator			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	1~2147483647	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0012 L: 0x0013		
	<b>Valid</b>	After restart						
Valid when Pr0.08 = 0, please refer to description in Pr0.10.								
<b>Pr0.10</b>	<b>Label</b>	1st command frequency divider/multiplier denominator			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	1~2147483647	<b>Unit</b>	—	<b>Default</b>	1		
	<b>Byte length</b>	32bit	<b>Attribute</b>	R/W	<b>485 address</b>	H: 0x0014 L: 0x0015		
	<b>Valid</b>	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 $Y = X * Pr0.09 / Pr0.10$ Please keep the value of Pr0.09 and Pr0.10 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:

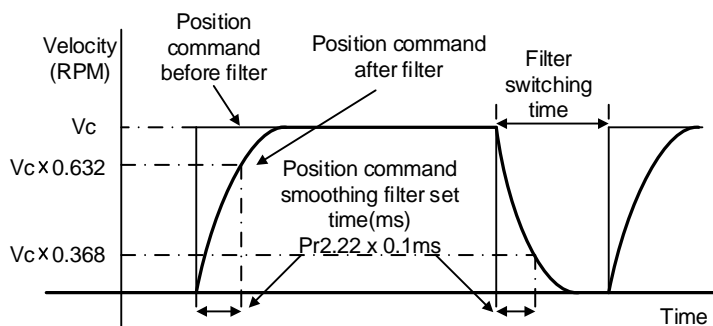
1. Position command pulse from controller has not yet to undergo acceleration/deceleration (with steep acceleration/deceleration).
2. Low command pulse frequency
3. Electronic gear ratio = 10 times or above

Position command filter can smoothen position command and motor rotation will be more stable

<b>Pr2.22</b>	<b>Label</b>	Position command smoothing filter		<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~32767	<b>Unit</b>	0.1ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x022D
	<b>Valid</b>	At stop				

To set time constant of 1 time delay filter of position command.

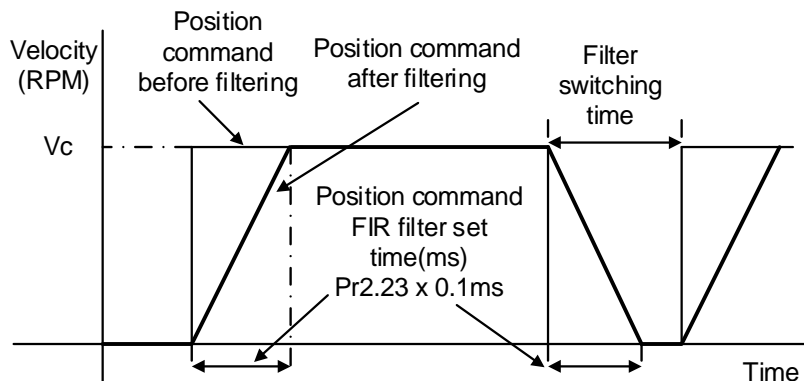
To set time constant of 1 time delay filter, according to target velocity  $V_c$  square wave command as show below.



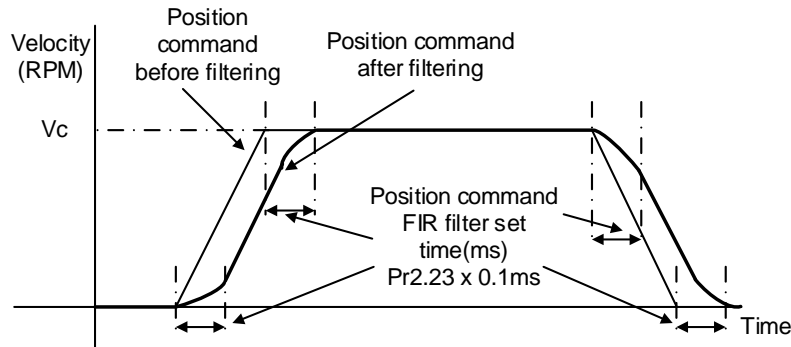
Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If Pr2.22 is set too high, overall time will be lengthened.

<b>Pr2.23</b>	<b>Label</b>	Position command FIR filter		<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~2500	<b>Unit</b>	0.1ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x022F
	<b>Valid</b>	At stop				

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



As shown below, when target velocity  $V_c$  trapezoidal command reaches  $V_c$ , 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 Pr2.23 is set too high, overall time will be lengthened.

*Note: Please wait for command to stop and after filter idle time to modify Pr2.23.  
Filter switching time = (Pr2.23 set value x 0.1ms + 0.25ms)*

### 5.1.4 Frequency divider output

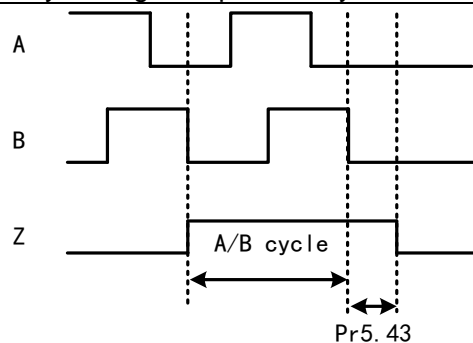
Frequency divider output indicates position command pulse or encoder feedback position pulse which is A and B phase pulse output.

Frequency divider output delivers motor encoder or external encoder position feedback to controller using ABZ phase pulses

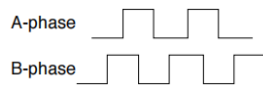
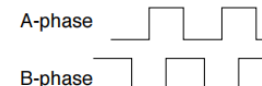
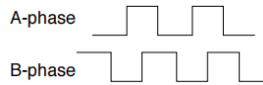

**\*\*Encoder Z-signal width  $\geq 62.5ms$ , or equivalent to an A/B signal cycle. If frequency divider output Z-signal width has to be widen, set through Pr5.43.**

**\*When Pr5.43 = 0, frequency divider Z-signal width is similar to width of single A/B cycle.  
If Pr5.43 = 1~500, set delay based on A/B cycle width.**

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



**Related parameters**

<b>Pr0.11</b>	<b>Label</b>	Encoder output pulse count per revolution			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	1~32767	<b>Unit</b>	P/r	<b>Default</b>	2500		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0017		
	<b>Valid</b>	After restart						
If Pr0.11 = 1000, encoder differential output signal per revolution = 4000 pulses								
<b>Pr0.12</b>	<b>Label</b>	Pulse output logic inversion			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0019		
	<b>Valid</b>	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 <b>Pulse output logic inversion</b>								
	<b>Pr0.12</b>	<b>Phase B logic</b>	<b>CCW direction</b>	<b>CW direction</b>				
	[0]	Not inverted	A-phase  B-phase	A-phase  B-phase				
	[1]	Inverted	A-phase  B-phase	A-phase  B-phase				
<b>Pr5.42</b>	<b>Label</b>	Frequency divider output – Z-signal polarity			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~7	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0555		
	<b>Valid</b>	Disabled						
	<b>Bit</b>	<b>Polarity</b>	<b>Description</b>					
	Bit0	0 = Positive	Z polarity setting of frequency divider output and position comparison					
		1 = Negative						
	Bit1	0 = Positive	Only valid in position comparison. Polarity setting when phase A frequency divider as position comparison output					
		1 = Negative						
	Bit2	0 = Positive	Only valid in position comparison. Polarity setting when phase B frequency divider as position comparison output					
<b>Pr5.44</b>	<b>Label</b>	Frequency divider output source			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~4	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0559		
	<b>Valid</b>	After restart						
	<b>Value</b>	<b>Description</b>						
	<b>【0】</b>	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

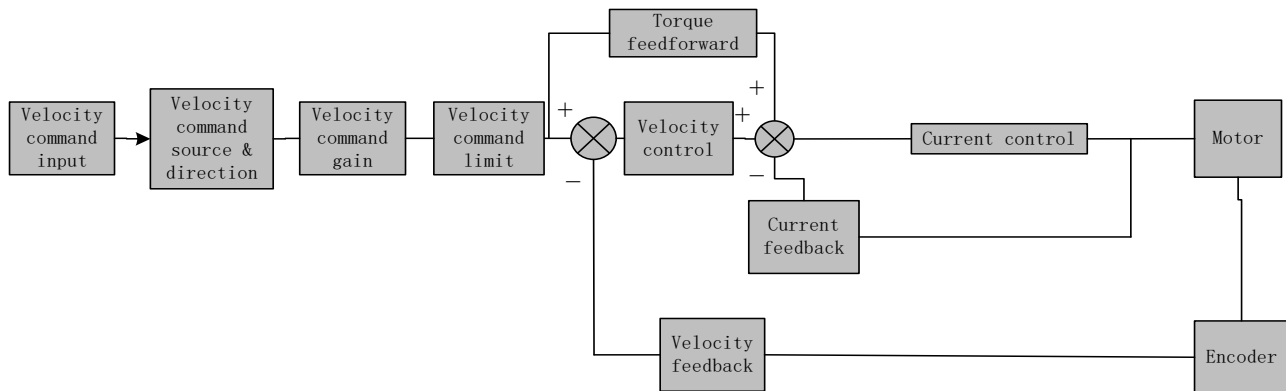
INP signal output will be valid when position deviation is within the range when positioning is completed. Set unit in Pr5.20.

<b>Pr4.31</b>	<b>Label</b>	Positioning complete range			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~10000	<b>Unit</b>	Pr5.21 set unit	<b>Default</b>	20	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x043F	
	<b>Valid</b>	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. <i>Default unit: 0.00001rev. Can be set on Pr5.21 as command unit (pulse) or encoder unit (pulse)</i>							
<b>Pr4.32</b>	<b>Label</b>	Positioning complete output setting			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~4	<b>Unit</b>	—	<b>Default</b>	1	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0441	
	<b>Valid</b>	Immediate					
To set conditions for INP1 output signal to be valid							
		<b>Value</b>	<b>Positioning completed signal</b>				
		0	Signal valid when the position deviation is smaller than Pr4.31				
		1	Signal valid when there is no position command and position deviation is smaller than Pr4.31				
		2	Signal valid when there is no position command, zero-speed clamp detection (ZSP) signal is ON and the positional deviation is smaller than Pr4.31				
		3	Signal valid when there is no position command and position deviation is smaller than Pr4.31. Signal ON when within the time set in Pr4.33 otherwise OFF.				
		4	When there is no command, position detection starts after the delay time set in Pr4.33. Signal valid when there is no position command and positional deviation is smaller than Pr4.31.				
<b>Pr4.33</b>	<b>Label</b>	INP positioning delay time			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0~15000	<b>Unit</b>	1ms	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0443	
	<b>Valid</b>	Immediate					
Valid when Pr4.32 = 3.							
		<b>Set value</b>	<b>Positioning completed signal</b>				
		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.				

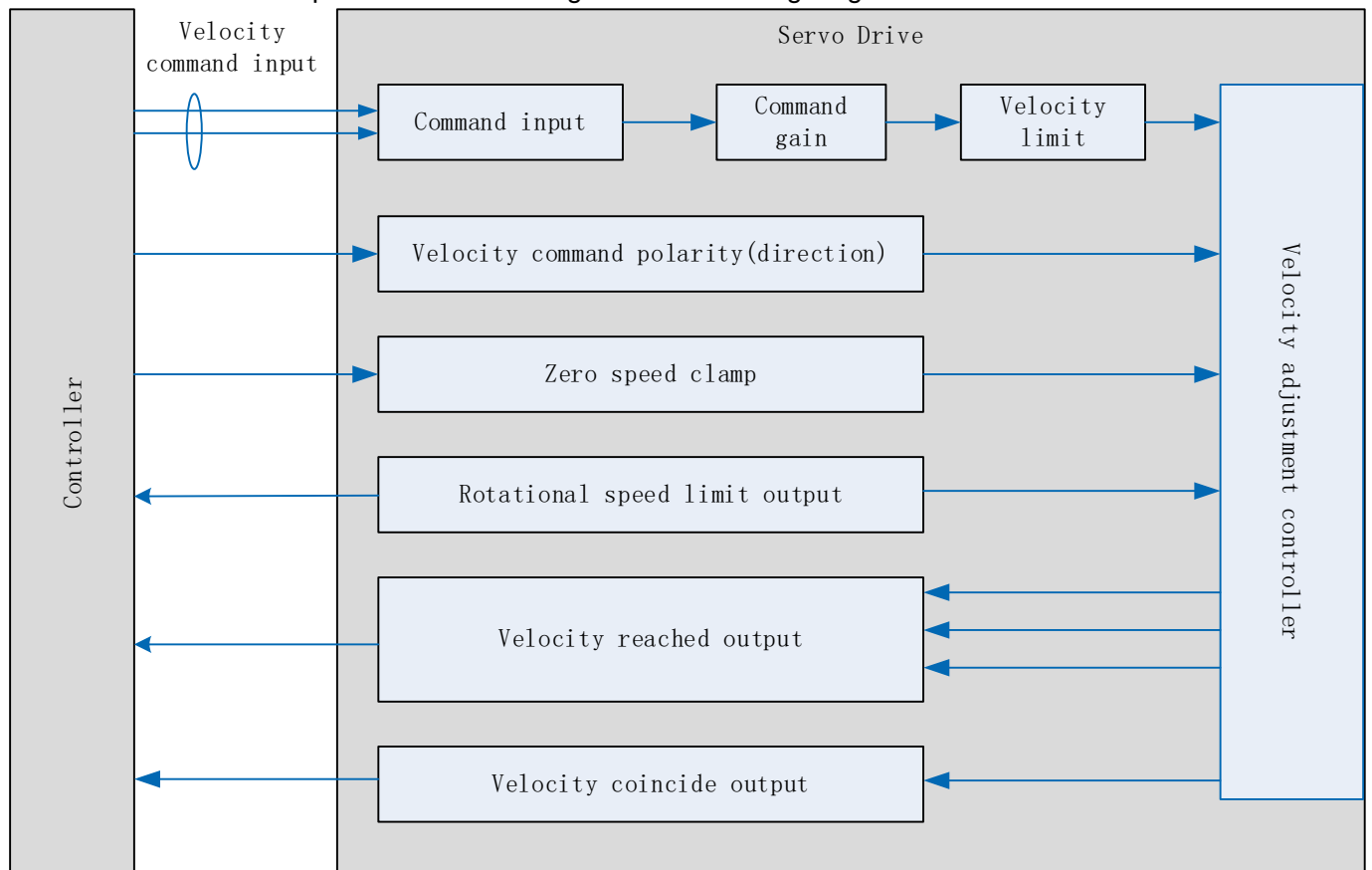
## 5.2 Velocity control mode

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 EL7-RSP series AC Servo Drives: Analog control, internal velocity 4 speeds, internal velocity 8 speeds and analog + internal velocity control.

Set Pr0.01 = 1 to activate velocity control mode.

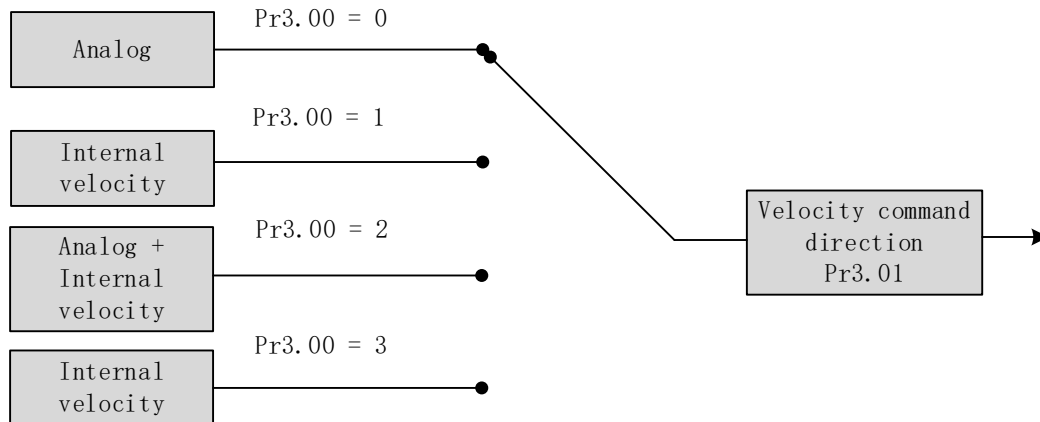


Please set related servo parameters according with the following diagram.



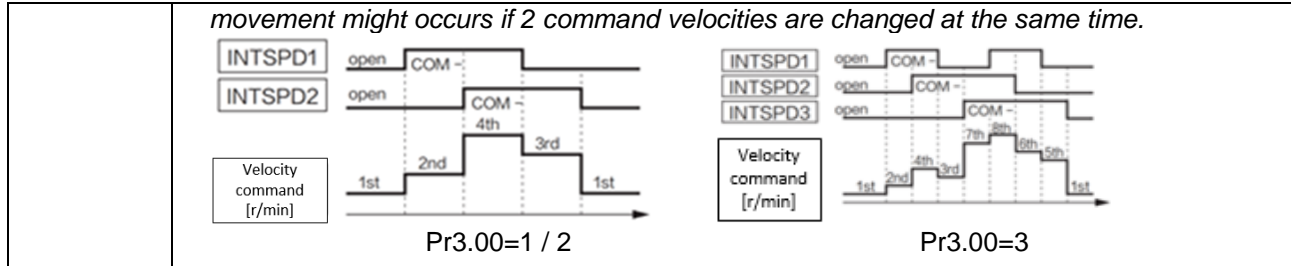
## 5.2.1 Velocity command input control

Set velocity control mode in Pr3.00



Pr3.00	Label	Velocity internal/external switching		Valid mode(s)	<b>S</b>	
	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.						
<b>Value</b>		<b>Velocity settings</b>				
0		Analog - Velocity command (SPR)				
<b>【1】</b>		Internal velocity settings 1 <sup>st</sup> – 4 <sup>th</sup> speed (Pr3.04~Pr3.07)				
2		Internal velocity settings 1 <sup>st</sup> – 3 <sup>rd</sup> speed (Pr3.04~P3.06)、Analog velocity command (SPR)				
3		Internal velocity settings 1 <sup>st</sup> – 8 <sup>th</sup> speed (Pr3.00~Pr3.11)				
Value	Internal command velocity 1 (INTSPD□1)	Internal command velocity 2 (INTSPD2)	Internal command velocity 3 (INTSPD3)	Velocity command		
1	OFF	OFF	No effect	1 <sup>st</sup> speed		
	ON	OFF		2 <sup>nd</sup> speed		
	OFF	ON		3 <sup>rd</sup> speed		
	ON	ON		4 <sup>th</sup> speed		
2	OFF	OFF	No effect	1 <sup>st</sup> speed		
	ON	OFF		2 <sup>nd</sup> speed		
	OFF	ON		3 <sup>rd</sup> speed		
	ON	ON		Simulated speed		
3	Similar to Pr3.00=1		OFF	1 <sup>st</sup> – 4 <sup>th</sup> speed		
	OFF	OFF	ON	5 <sup>th</sup> speed		
	ON	OFF	ON	6 <sup>th</sup> speed		
	OFF	ON	ON	7 <sup>th</sup> speed		
	ON	ON	ON	8 <sup>th</sup> speed		
<i>Please change internal command velocity as per diagram below as unexpected axis</i>						





### 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.

<b>Pr3.01</b>	<b>Label</b>	Velocity command rotational direction selection			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0303
	<b>Valid</b>	Immediate				

To set positive/negative direction of velocity command

Value	Velocity settings (Analog or internal velocity)	Velocity command sign selection (VC- <input type="checkbox"/> SIGN <input type="checkbox"/> )	Velocity command direction
<b>【0】</b>	+	No effect	Positive
	-	No effect	Negative
1	No effect	OFF	Positive
	No effect	<input type="checkbox"/> ON	Negative

### Velocity command input inversion

Set Analog-Velocity command (SPR) voltage polarity

<b>Pr3.03</b>	<b>Label</b>	Velocity command input inversion			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0307
	<b>Valid</b>	Immediate				

To set voltage polarity of analog velocity command.

Only valid when Pr3.01 = 0. When Pr3.01 = 1, rotational direction is only related to VC-SIGN.

Value	Motor rotational direction	
<b>【0】</b>	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 Pr3.03, motor might undergo abnormal motion.

## Velocity command input gain

Set Analog-Velocity command (SPR) voltage to motor velocity command switching gain

<b>Pr3.02</b>	<b>Label</b>	Velocity command input gain			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	10~2000	<b>Unit</b>	(r/min)/V	<b>Default</b>	500
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0305
	<b>Valid</b>	Immediate				

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

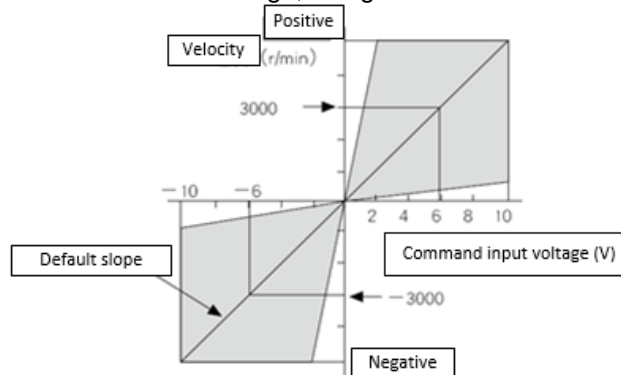
Pr3.02 sets command input voltage and rotational speed slope.

Factory default:

Pr3.02=500(r/min)/V.

Hence 6V input: 3000 r/min

1. Do not supply more than  $\pm 10V$  power for analog velocity command (SPR).
2. If Pr3.02 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.

<b>Pr3.12</b>	<b>Label</b>	Acceleration time settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~10000	<b>Unit</b>	ms/ (1000rpm)	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0319
	<b>Valid</b>	Immediate				
<b>Pr3.13</b>	<b>Label</b>	Deceleration time settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~10000	<b>Unit</b>	ms/ (1000rpm)	<b>Default</b>	100
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x031B
	<b>Valid</b>	Immediate				

Set max acceleration/deceleration for velocity command.

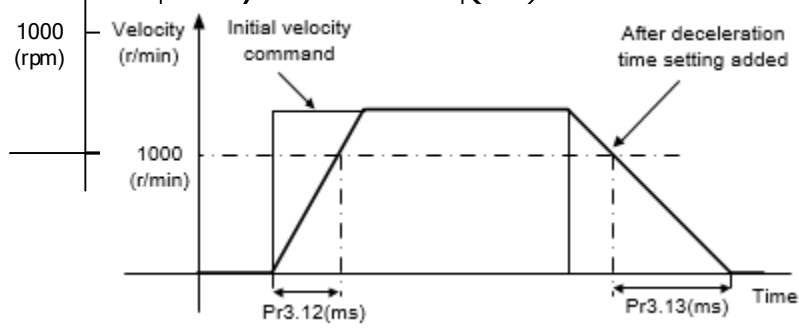
If target velocity =  $x$  [rpm], max acceleration =  $a$  [unit: rpm/ms], acceleration time =  $t$  [ms]

Pr3.12 =  $1000/a$

Pr3.13 =  $1000/a$

$a = x/t$   
 Velocity (rpm) vs Time graph showing initial acceleration and deceleration phases.

For example: If motor is to achieve 1500rpm in 30s,  $a = 1500/30 = 50 \text{ rpm/ms}$   
 $\text{Pr3.12} = 1000/a = 20$ . Hence when  $\text{Pr3.12} = 20$ , motor can achieve 1500rpm in 30s.

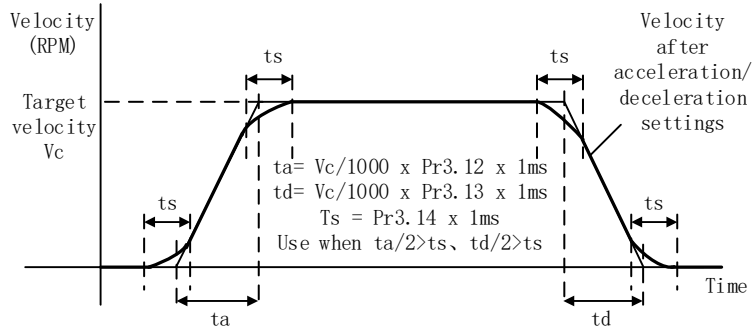


Usually used when there is rapid acceleration or trapezoidal wave velocity command due to many different internal speed segments under velocity control mode which causes instable while motor in motion.

*Under velocity control mode, 6083 and 6084 is limited by Pr3.12 and Pr3.13 correspondingly.*

<b>Pr3.14</b>	<b>Label</b>	Sigmoid acceleration/deceleration settings			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~1000	<b>Unit</b>	ms	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x031D
	<b>Valid</b>	After restart				

To set sigmoid acceleration and deceleration turning point in accordance to Pr3.12 and Pr3.13.

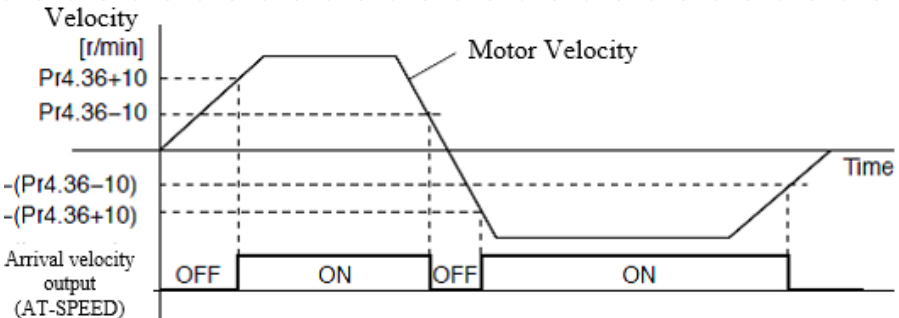


### 5.2.3 Velocity reached signal AT-SPEED output

Velocity reached signal AT-SPEED output will be valid when motor velocity reached set speed in Pr4.36. This output function can be assigned through I/O configurations, please refer to Pr4.10. When velocity matches set conditions, assigned I/O terminal will be ON, signal will be valid.

<b>Pr4.36</b>	<b>Label</b>	Arrival velocity			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	10~2000	<b>Unit</b>	r/min	<b>Default</b>	1000
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0449
	<b>Valid</b>	Immediate				

When motor velocity > Pr4.36, AT-speed output signal is valid.  
Detection using 10RPM hysteresis.



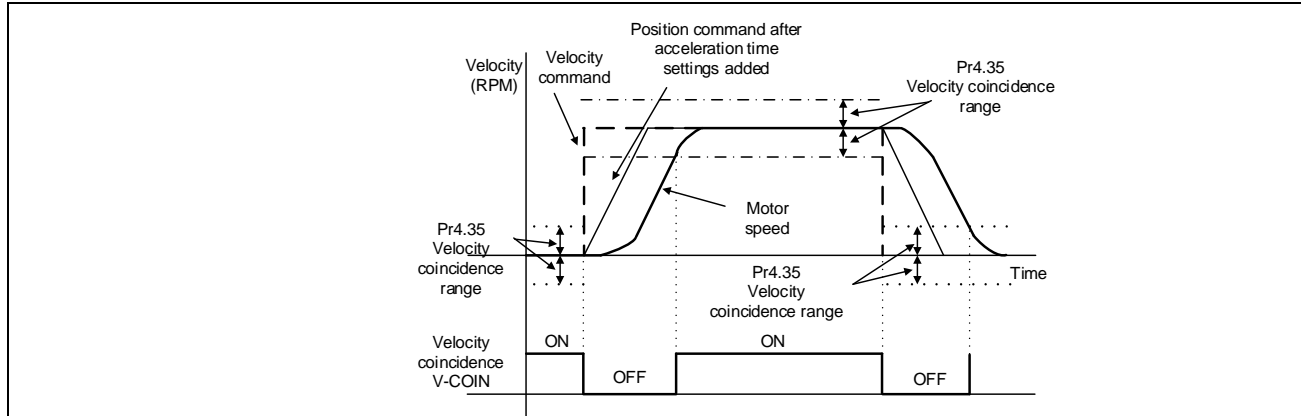
### 5.2.4 Velocity coincidence V-COIN signal output

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 Pr4.35. This output function can be assigned through I/O configurations, please refer to Pr4.10. 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.

<b>Pr4.35</b>	<b>Label</b>	Velocity coincidence range			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	10~2000	<b>Unit</b>	r/min	<b>Default</b>	50
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0447
	<b>Valid</b>	Immediate				

If the difference between velocity command and motor actual speed is below Pr4.35, Velocity coincidence (V-COIN) output signal valid.

Due to 10RPM hysteresis:  
Velocity coincidence output OFF -> ON timing (Pr4.35 -10) r/min  
Velocity coincidence output ON -> OFF timing (Pr4.35 +10) r/min



### 5.2.5 Zero Speed Clamp

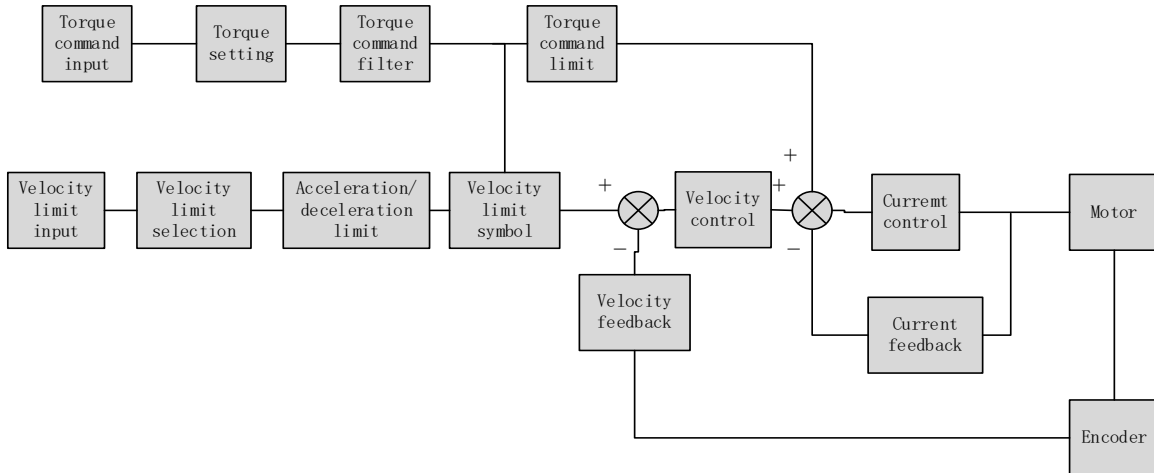
Forced set velocity command to 0 using zero speed clamp to avoid servo axis from crawling at low velocity.

This input function can be assigned through I/O configurations, please refer to Pr4.00.

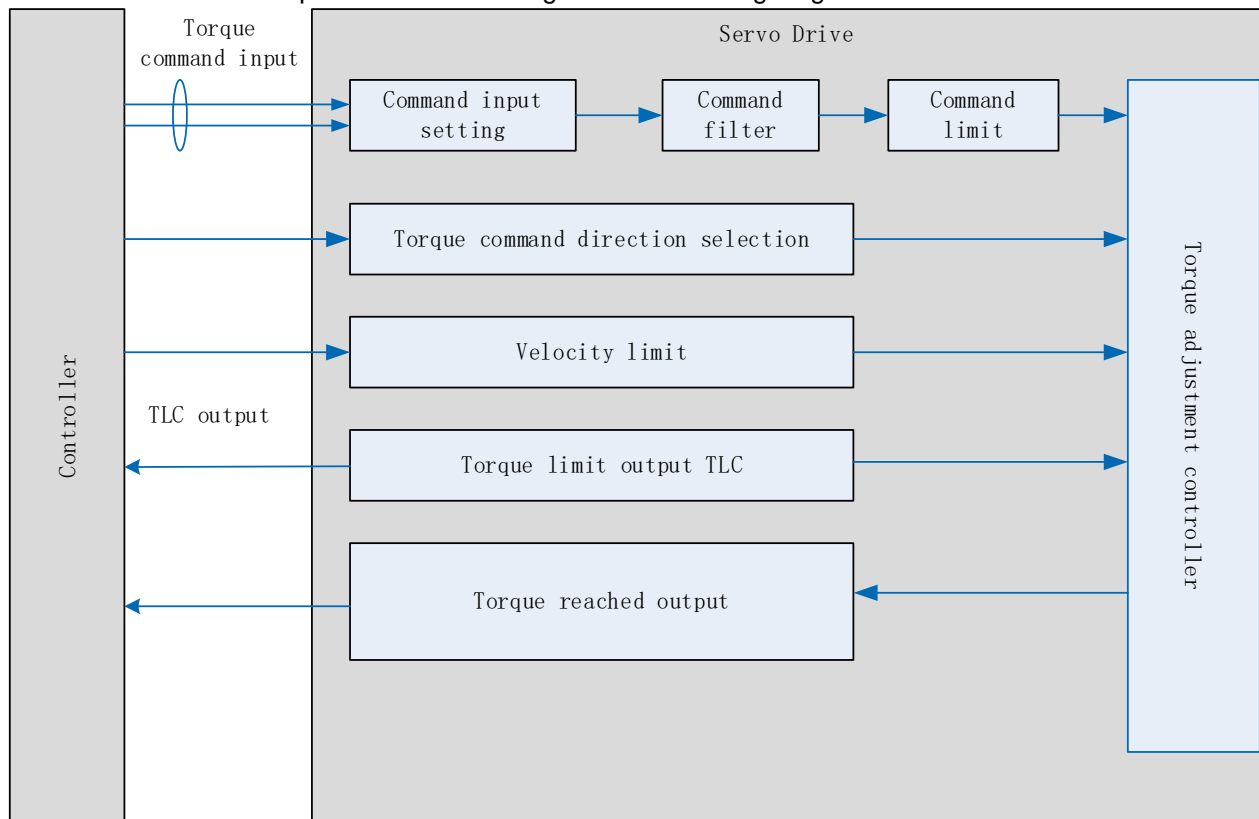
<b>Pr3.15</b>	<b>Label</b>	Zero speed clamp function selection			<b>Valid mode(s)</b>	S
	<b>Range</b>	0~3	<b>Unit</b>	—	<b>Default</b>	0
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x031F
	<b>Valid</b>	Immediate				
		Value	Zero speed clamp function			
		0	Invalid: zero speed clamp 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 Pr3.16.			
		3	Includes conditions from 1 and 2			
<b>Pr3.16</b>	<b>Label</b>	Zero speed clamp level			<b>Valid mode(s)</b>	S
	<b>Range</b>	10~2000	<b>Unit</b>	r/min	<b>Default</b>	30
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0321
	<b>Valid</b>	Immediate				
Valid when Pr3.15 = 2/3, velocity command is forced to 0 when actual velocity is lower than Pr3.16 and after static time set in Pr3.23.						

## 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.



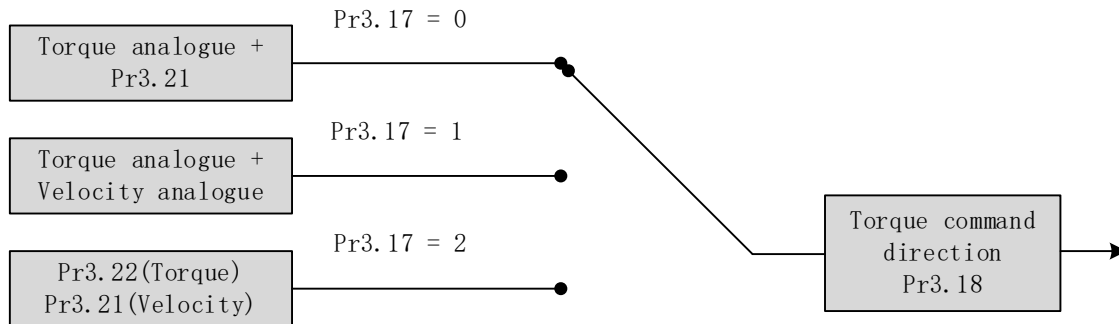
Using Motion Studio or front panel on servo drive, set Pr0.01 = 2 to activate torque control mode. Please set related servo parameters according with the following diagram.



### 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 Pr3.17.



Pr3.17	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				
	<b>【0】</b>	Analog input 3(AI 3)	Pr3.21 set value				
	1	Analog input 3(AI 3)	Analog input 1(AI 1)				
	2	Pr3.22 set value	Pr3.21 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.

Pr3.18	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						
	<b>【0】</b>	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: <i>Positive direction</i> ON: <i>Negative direction</i>						

### Torque command input inversion

To set the voltage polarity added onto analogue torque command (TRQR)

<b>Pr3.20</b>	<b>Label</b>	Torque command input inversion			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0329	
	<b>Valid</b>	Immediate					

To set voltage polarity of analog torque command.  
Only valid when Pr3.18 = 0.

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

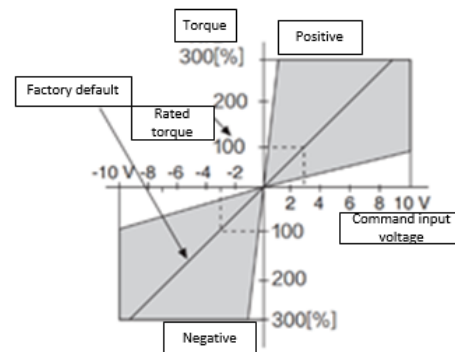
### Torque command input gain

To set voltage added on to switching gain of motor torque command from analog torque command(TRQR)

<b>Pr3.19</b>	<b>Label</b>	Torque command input gain			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	10~100	<b>Unit</b>	0.1V/100%	<b>Default</b>	30	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0327	
	<b>Valid</b>	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.

<b>Pr3.21</b>	<b>Label</b>	Velocity limit in torque mode			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	r/min	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x032B	
	<b>Valid</b>	Immediate					

To set velocity limit in torque control mode. Only valid when Pr3.17 = 0 / 2.

<b>Pr3.22</b>	<b>Label</b>	Torque command			<b>Valid mode(s)</b>		<b>T</b>
	<b>Range</b>	0~300	<b>Unit</b>	%	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x032D	
	<b>Valid</b>	Immediate					

To set torque limit in torque control mode. Only valid when Pr3.17 = 2.  
Please refer to Pr3.17.



### 5.3.3 Torque limit (TL-SEL)

This input function can be assigned through I/O configurations, please refer to Pr4.00.  
To set torque limiting method.

<b>Pr5.21</b>	<b>Label</b>	Torque limit selection			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~6	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x052B		
	<b>Valid</b>	Immediate						

Value		Limit
<b>【0】</b>		1 <sup>st</sup> torque limit Pr0.13
1		2 <sup>nd</sup> torque limit Pr5.22
2	TL-SEL OFF	Pr0.13
	TL-SEL ON	Pr5.22
3~4		Reserved
5		Pr0.13 → Positive torque limit Pr5.22 → Negative torque limit

<b>Pr5.22</b>	<b>Label</b>	2 <sup>nd</sup> torque limit			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~500	<b>Unit</b>	%	<b>Default</b>	300		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x052D		
	<b>Valid</b>	Immediate						

Pr5.22 is limited by max. torque set in motor parameter.

<b>Pr0.13</b>	<b>Label</b>	1 <sup>st</sup> torque limit			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~500	<b>Unit</b>	%	<b>Default</b>	350		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x001B		
	<b>Valid</b>	Immediate						

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

Please refer to Pr5.21 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 Pr0.01 to select the hybrid control mode needed through Motion Studio or servo drive front panel.

Pr0.01	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	
	1 <sup>st</sup> mode	2 <sup>nd</sup> mode
<b>[0]</b>	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position Pr0.22=1
		Velocity Pr0.22=1
		Torque Pr0.22=2
7~10	Reserved	

◆ When 3, 4, 5, 6 combination hybrid mode, 1<sup>st</sup> and 2<sup>nd</sup> mode can be chosen accordingly with control mode switching input (C-MODE).  
 C-MODE: Invalid, select 1<sup>st</sup> mode.  
 C-MODE: Valid, select 2<sup>st</sup> mode.  
 Please allow some time in between mode switching commands.

◆ Please set Pr0.01 = 6 to switch to other modes from PR mod, then set 2<sup>nd</sup> mode using Pr0.22.

*C-MODE is defaulted to Normally Open*

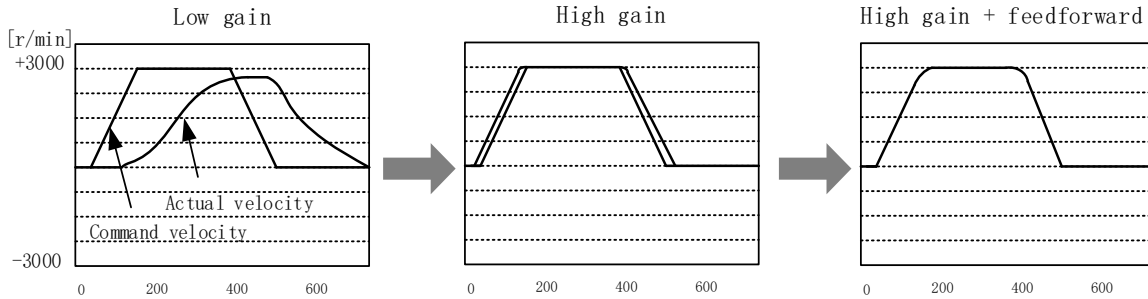
When Pr0.01 = 3/4/5, please set assign C-MODE mode switching signal to one of the DI terminal and make sure the logic is valid.

Signal	Set value	Label	Description		
			Pr0.01	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

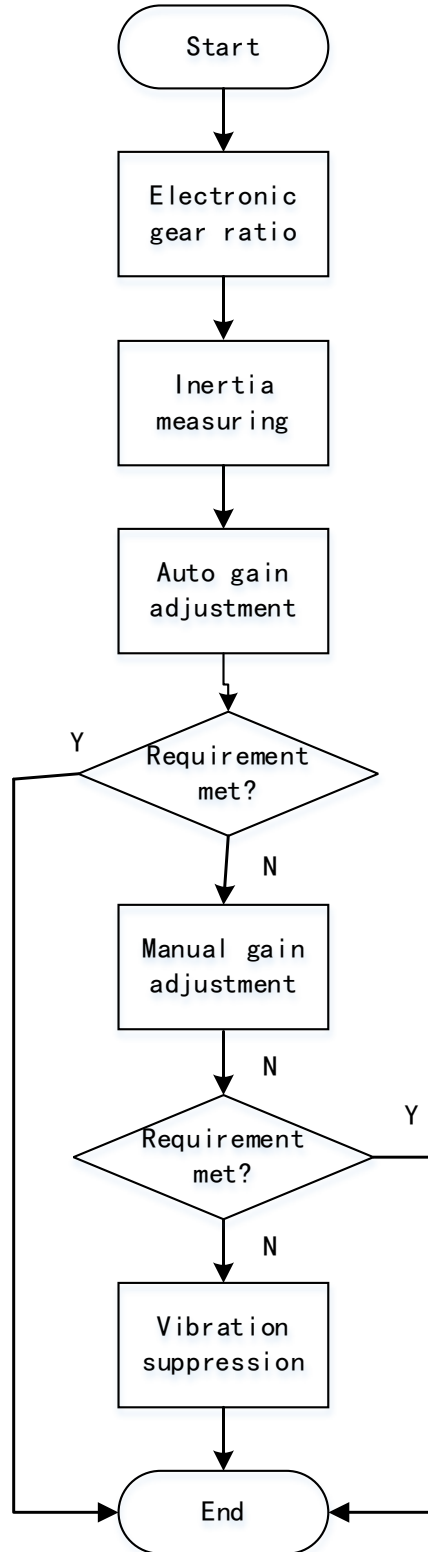
### 6.1 Gain Adjustment

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.



<b>Position loop gain:</b> 320 (0.1/s)	<b>Position loop gain:</b> 900 (0.1/s)	<b>Position loop gain:</b> 900 (0.1/s)
<b>Velocity loop gain:</b> 180 (0.1Hz)	<b>Velocity loop gain:</b> 500 (0.1Hz)	<b>Velocity loop gain:</b> 500 (0.1Hz)
<b>Velocity loop integral time constant:</b> 31ms	<b>Velocity loop integral time constant:</b> 31ms	<b>Velocity loop integral time constant:</b> 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 is always advisable to tune each parameter according in order to achieve optimal machine performance. Please refer to the steps below



**Gain Adjustment Flow Diagram**

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. <ol style="list-style-type: none"> <li>One-click tuning (Can be realized using Motion Studio. Auto tuning of gain and inertia according to actual data)</li> <li>Real time auto adjustment (Set by selecting mechanical stiffness level, related gain parameters will be automatically adjusted accordingly)</li> </ol>
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	<ol style="list-style-type: none"> <li>Gain related parameters tuning under position mode</li> <li>Gain related parameters tuning under velocity mode</li> <li>Gain related parameters tuning under torque mode</li> </ol>
	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
	3 <sup>rd</sup> 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 Pr0.04 and save.

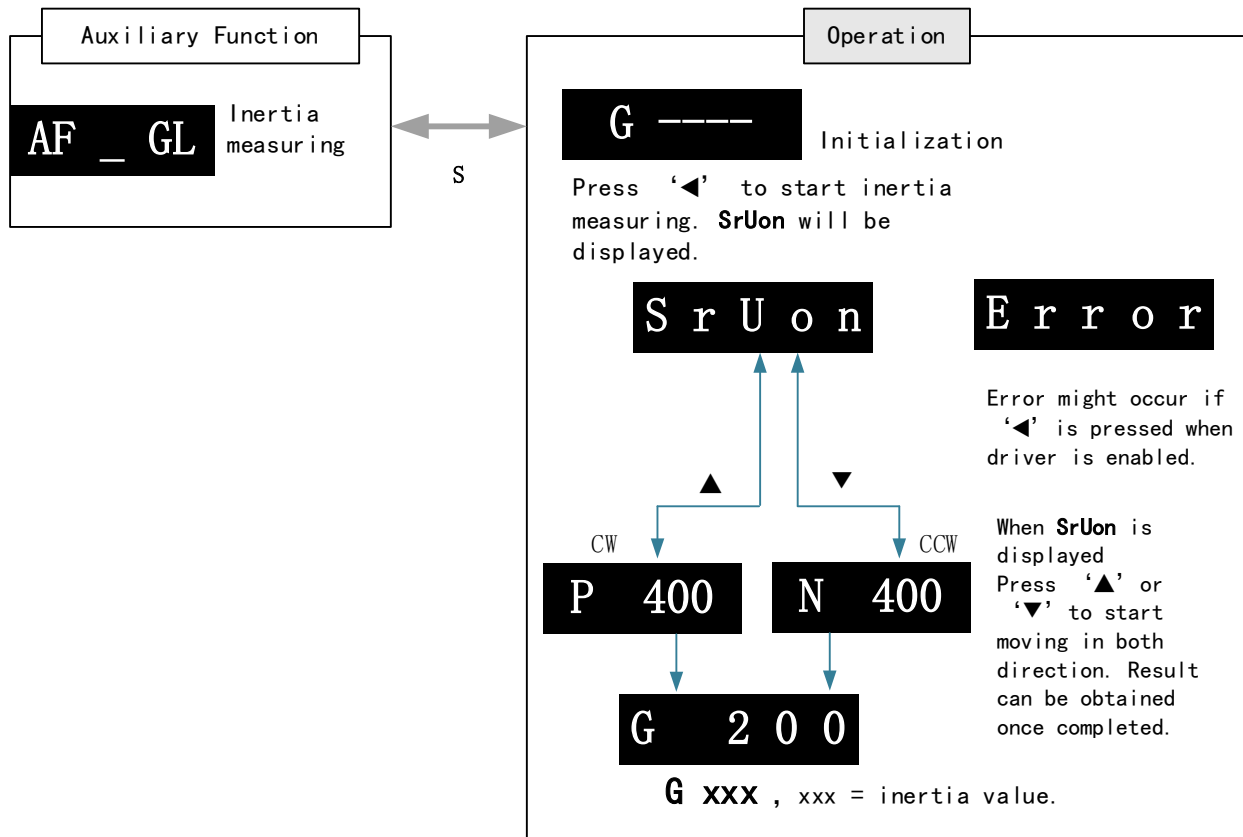
### Offline inertia determination

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

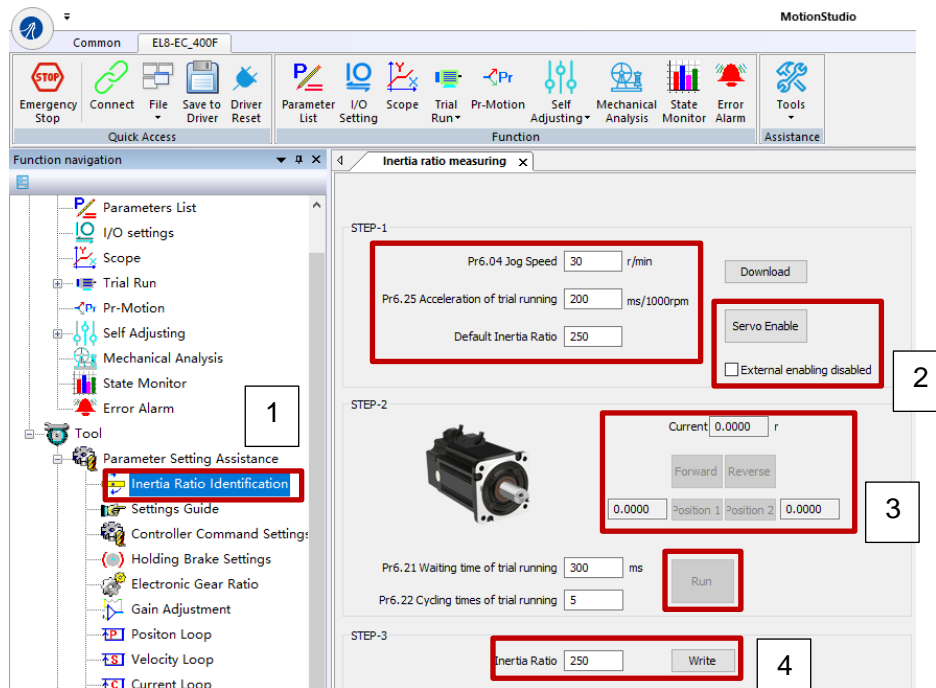


**Steps:**

- 1、 Set the trial run velocity **Pr6.04**. 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 **Pr0.04**. Please refer to for parameter saving on servo driver.

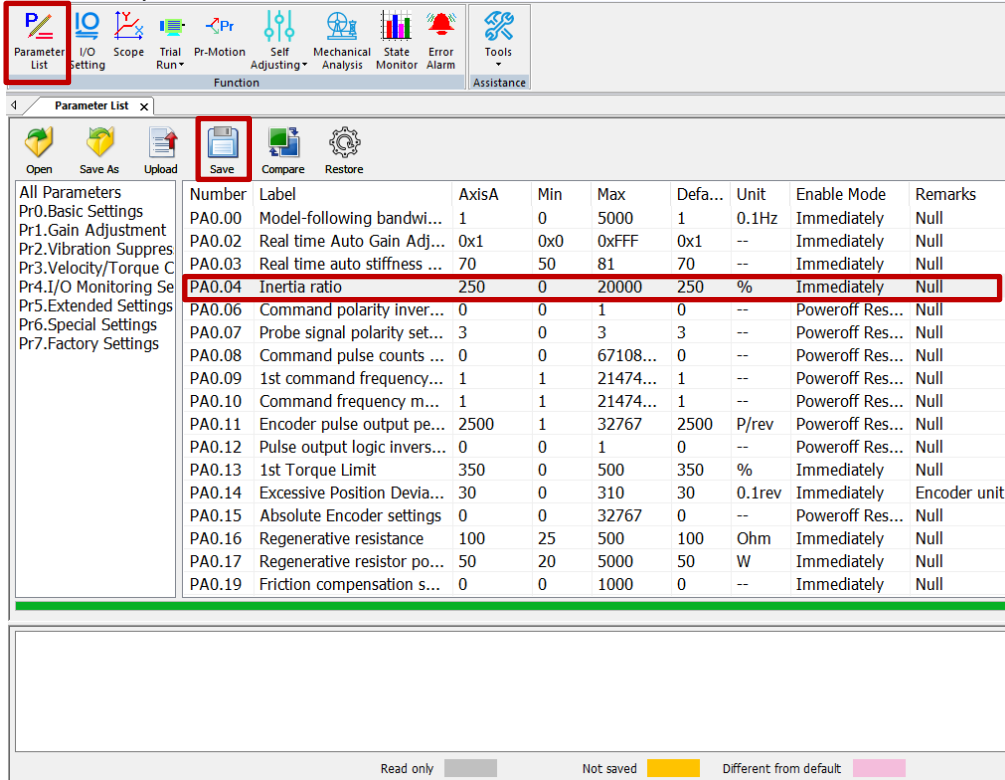
### Inertia measuring using Motion Studio

1. Start Motion Studio and maneuver to inertia ratio identification page under performance tuning. Set trial run velocity **Pr6.04** and acc-/deceleration time **Pr6.25**, 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 **Pr6.21** and no. of cycles in **Pr6.22**. 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 **Pr0.04**.

6. Click on “Parameter List” to enter parameters management to check or modify Pr0.04. Then, click on “Save” to save parameters to driver.



Number	Label	AxisA	Min	Max	Defa...	Unit	Enable Mode	Remarks
PA0.00	Model-following bandwi...	1	0	5000	1	0.1Hz	Immediately	Null
PA0.02	Real time Auto Gain Adj...	0x1	0x0	0xFF	0x1	--	Immediately	Null
PA0.03	Real time auto stiffness ...	70	50	81	70	--	Immediately	Null
PA0.04	Inertia ratio	250	0	20000	250	%	Immediately	Null
PA0.06	Command polarity inver...	0	0	1	0	--	Poweroff Res...	Null
PA0.07	Probe signal polarity set...	3	0	3	3	--	Poweroff Res...	Null
PA0.08	Command pulse counts ...	0	0	67108...	0	--	Poweroff Res...	Null
PA0.09	1st command frequency...	1	1	21474...	1	--	Poweroff Res...	Null
PA0.10	Command frequency m...	1	1	21474...	1	--	Poweroff Res...	Null
PA0.11	Encoder pulse output pe...	2500	1	32767	2500	P/rev	Poweroff Res...	Null
PA0.12	Pulse output logic inver...	0	0	1	0	--	Poweroff Res...	Null
PA0.13	1st Torque Limit	350	0	500	350	%	Immediately	Null
PA0.14	Excessive Position Devia...	30	0	310	30	0.1rev	Immediately	Encoder unit
PA0.15	Absolute Encoder settings	0	0	32767	0	--	Poweroff Res...	Null
PA0.16	Regenerative resistance	100	25	500	100	Ohm	Immediately	Null
PA0.17	Regenerative resistor po...	50	20	5000	50	W	Immediately	Null
PA0.19	Friction compensation s...	0	0	1000	0	--	Immediately	Null

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.

Pr0.04	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						

$$\text{Pr0.04} = (\text{load inertia} / \text{motor rotational inertia}) \times 100\%$$

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, Pr0.04 can be left unfilled but optimal setting of Pr0.04 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	<ul style="list-style-type: none"> <li>➤ Servo ON (SRV-ON) status</li> <li>➤ Set suitable position/torque limit so that motor can run normally</li> <li>➤ Use trial run or any external controller to make sure no clash of axes</li> </ul>

	Factors affecting single parameter tuning
Load inertia	<ul style="list-style-type: none"> <li>➤ External load smaller or 30 times larger than rotor inertia</li> <li>➤ Inertia measuring might fail upon changes in load inertia</li> <li>➤ Load torque changes drastically</li> </ul>
Load	<ul style="list-style-type: none"> <li>➤ Mechanical stiffness is too low</li> <li>➤ Existence of gear backlash or any other non-linear factors</li> <li>➤ Complicated mechanical load structure</li> </ul>
Motion	<ul style="list-style-type: none"> <li>➤ Low speed, no more than 300[r/min].</li> <li>➤ Acceleration/deceleration time too long, more than = 600ms</li> <li>➤ Speed &gt; 300r/min, acceleration/deceleration time &lt; 600ms but travelling time duration &lt; 50ms.</li> </ul>

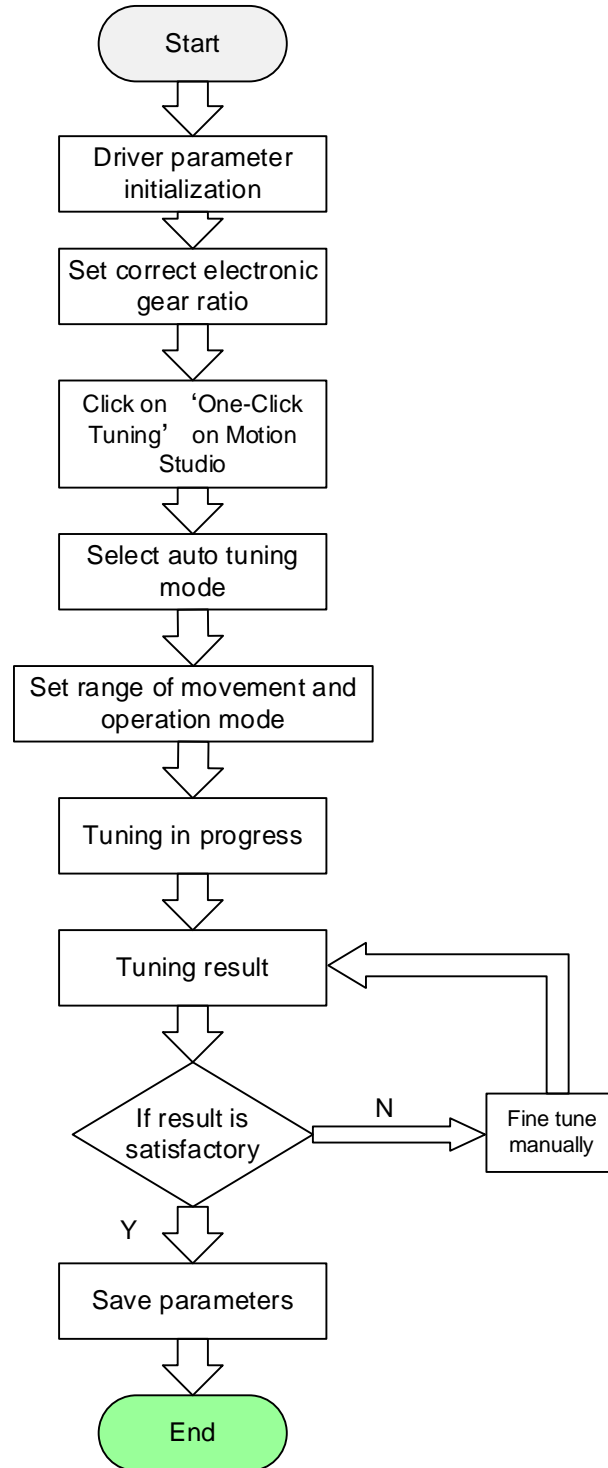
### 6.3.2 One-click Tuning

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	<ul style="list-style-type: none"> <li>➤ 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.</li> <li>➤ Prohibit external command. Make sure there is no obstacle within the range of movement of the axis and motor can rotate freely.</li> </ul>

Factors affecting one-click tuning	
Load inertia	<ul style="list-style-type: none"> <li>➤ External load smaller or 30 times larger than rotor inertia</li> <li>➤ Drastic changes in load inertia during motion.</li> </ul> <p><i>Under heavy load (more than 30 times inertia), please make sure of safety</i></p>
Load	<ul style="list-style-type: none"> <li>➤ Mechanical load is loosely connected.</li> <li>➤ Existence of gear backlash or any other non-linear factors</li> <li>➤ Complicated mechanical load structure</li> </ul>
Motion	<ul style="list-style-type: none"> <li>➤ Range of movement is too short or too long which cost the time to be overdue.</li> <li>➤ Not smaller than 0.5R</li> </ul>

**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 Pr0.02 for detailed explanations. Auto gain adjustment is different for each control mode.
Other	<ul style="list-style-type: none"> <li>· Servo driver needs to be enabled</li> <li>· 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.</li> </ul>

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	<ul style="list-style-type: none"> <li>· If inertia is less than 3 times or over 20 times of rotor inertia.</li> <li>· Changes in load inertia</li> </ul>
Load	<ul style="list-style-type: none"> <li>· Very low mechanical stiffness</li> <li>· If gear backlash is a non-linear property</li> </ul>
Motion	<ul style="list-style-type: none"> <li>· Velocity less than 100r/min or continuously in low velocity mode</li> <li>· Acc-/deceleration to 2000r/min within 1s. ◦</li> <li>· Acc-/deceleration torque lower than eccentric load, frictional torque.</li> <li>· Velocity &lt; 100r/min, acc-/deceleration to 2000r/min within 1s but not longer than 50ms</li> </ul>

### To enable automatic gain adjustment:

1. Disable the servo driver.
2. Set Pr0.02 = 0x01/0x11 or 0x02/0x12. Then, set Pr0.03
3. Servo enabled. Run motion as normal to start measuring load properties. Related parameters will be automatically set.
4. Increase motor responsiveness by increasing Pr0.03. Please check if there is any vibration before setting Pr0.03 to max. value.
5. Save the parameters.

### Please take note:

- Please stop the motor before modifying any parameter. Pr0.02 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 Pr0.03, mechanical noise or vibration might occur for the first run, it is normal. If it persists, please set Pr0.03 to lower value.

## Parameters that change in accordance to real time gain adjustment

There are 2 types of auto gain adjustment methods:

- **Standard mode** (Pr0.02 = 0x\_\_1): Basic mode, prioritizing on stability, gain switching is disabled. Actual gain auto adjustment as accordance to Pr0.03.

Gain related parameters that change as shown below.

Parameter	Label	Remarks
Pr1.00	1 <sup>st</sup> position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
Pr1.01	1 <sup>st</sup> velocity loop gain	
Pr1.02	1 <sup>st</sup> velocity integral time constant	
Pr1.03	1 <sup>st</sup> velocity detection filter	
Pr1.04	1 <sup>st</sup> torque filter	

Gain related that doesn't change

Parameter	Label	Reference value	Remarks
Pr1.10	Velocity feedforward gain constant	300 (0.1%)	Doesn't change according to changes in stiffness

- **Positioning mode** (Pr0.02=0x2): Prioritizing positioning. Usually applies on horizontal axis without variable load, ball screws with lower friction, gain switching enabled. Stiffness level of 2<sup>nd</sup> position loop gain is 1 level higher than 1<sup>st</sup> position.

No.	Parameters	Label	Remarks
1	Pr1.00	1 <sup>st</sup> position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
2	Pr1.01	1 <sup>st</sup> velocity loop gain	
3	Pr1.02	1 <sup>st</sup> velocity integral time constant	
4	Pr1.03	1 <sup>st</sup> velocity detection filter	
5	Pr1.04	1 <sup>st</sup> torque filter	
6	Pr1.05	2 <sup>nd</sup> position loop gain	
7	Pr1.06	2 <sup>nd</sup> velocity loop gain	
8	Pr1.07	2 <sup>nd</sup> velocity integral time constant	
9	Pr1.08	2 <sup>nd</sup> velocity detection filter	
10	Pr1.09	2 <sup>nd</sup> torque filter	

If auto gain adjustment is valid, the parameters listed above can't be manually modified. Only when Pr0.02 = 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
Pr1.10	Velocity feedforward gain constant	1000ms
Pr1.11	Velocity feedforward filter time constant	30%
Pr1.12	Torque feedforward gain	0.50ms
Pr1.13	Torque feedforward filter time constant	0
Pr1.15	Position control gain switching mode	0
Pr1.17	Position control switching level	10
Pr1.18	Position control switching hysteresis	50
Pr1.19	Position gain switching time	33

**Types of mechanical load**

Please select mechanical load according to load-inertia ratio and mechanical structures:

Load types	Description
<b>0x00_</b> : Rigid structure	When load is <b>rigid</b> with relatively <b>low inertia</b> . Gain adjustments prioritize <b>system responsiveness</b> . Structures including high precision reducer, lead screws, mechanical gears, etc.
<b>0x01_</b> : High inertia	<b>High load inertia</b> (10 times or above). Gain adjustments prioritize <b>operation stability and responsiveness</b> . Recommended mechanical stiffness level <b>not more than 15</b> .
<b>0x02_</b> : Flexible structure	When load is <b>flexible</b> with relatively <b>high inertia</b> . Gain adjustments prioritize <b>operation stability</b> . Structures including long transportation belt or chain.

*Structures with high inertia can have better performance if inertia ratio is set accurately.*

Pr0.02	Label	Real time Auto Gain Adjusting			Valid mode(s)	P	S	T
	Range	0x0~0xF FF	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	Pr0.03 invalid. Gain value must be adjusted manually and accordingly.					
		1:Standard	Pr0.03 valid. Quick gain adjusting can be achieved by changing Pr0.03 stiffness value. Gain switching is not used in this mode, suitable for applications with requirements for stability.					
		2:Positioning	Pr0.03 valid. Quick gain adjusting can be achieved by changing Pr0.03 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 Pr6.07					

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

Pr0.03	Label	Real time auto stiffness adjusting			Valid mode(s)	P	S	T
	Range	0 ~ 31	Unit	—	Default	11		
	Byte length	16bit	Attribute	R/W	485 address	0x0007		
	Valid	Immediate						
<p style="text-align: center;">                     Low ———▶ Mechanical stiffness ———▶ High                      Low ———▶ Servo gain ———▶ High  <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px 0;">                         81.80.....70.69.68.....51.50                     </div>                      Low ———▶ Responsiveness ———▶ High                 </p> <p>Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Recommend to set to around 15 with motor with high inertia.</p>								

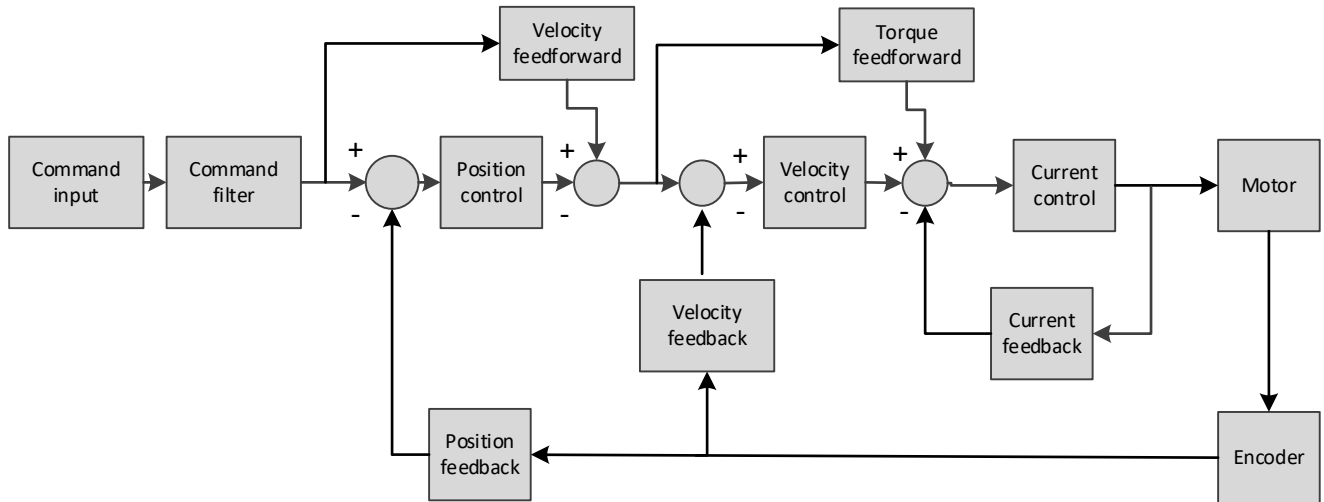
**Gain parameters settings table**

Stiffness	1 <sup>st</sup> gain				2 <sup>nd</sup> gain			
	Pr1.00	Pr1.01	Pr1.02	Pr1.04	Pr1.05	Pr1.06	Pr1.07	Pr1.09
	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



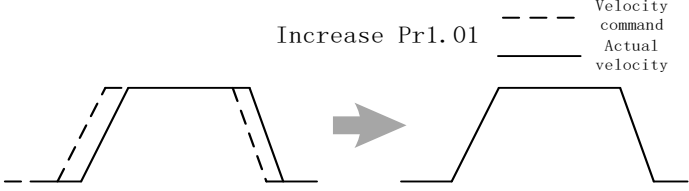
## 6.5 Manual gain adjustment

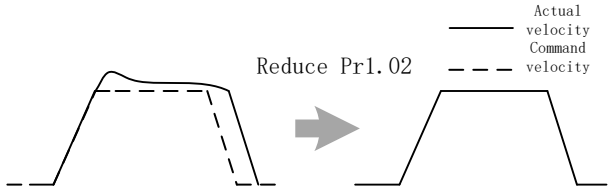
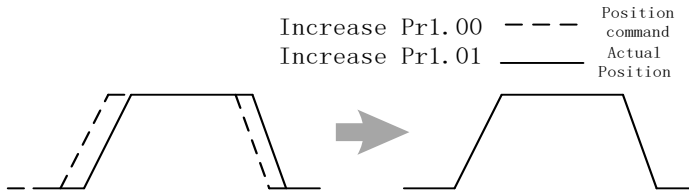
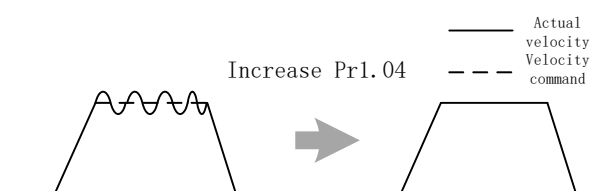
Due to limitation of load conditions, automatic gain adjustment might not achieve expected performance. Control can be improved through manual gain adjustment  
 The servo system is made up of 3 control loops. From outer to inner: position loop, velocity loop, current loop as shown in the diagram below.



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 stable, 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	Pr1.01	Velocity loop gain	<p>Determine if velocity loop is able to follow the changes in velocity command at highest frequency. If Pr0.04 is set correctly, velocity loop highest following frequency = Pr1.01</p>  <p>Increase Pr1.01</p> <p>--- Velocity command                  ——— Actual velocity</p> <p>Increase Pr1.01 provided there is no noise or vibration to reduce positioning time, better velocity stability and following. Reduce Pr1.01 if there is mechanical noise. Set up vibration suppression if there is mechanical vibration.</p>

Step	Parameter	Label	Tuning method
2	Pr1.02	Velocity loop integral time constant	<p>To eliminate velocity loop deviation</p>  <p>Velocity loop integral time constant (ms) = <math>4000 / (2 * \pi * \text{Velocity loop gain(Hz)})</math></p> <p>Reduce Pr1.02 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 Pr1.02 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 Pr1.02.</p>
3	Pr1.00	Position loop gain	<p>Determine if position loop is able to follow the changes in position command at highest frequency. Position loop highest following frequency = Pr1.00</p>  <p>Increase Pr1.00 to reduce position following deviation, reduce positioning time provided that there is no resonance or noise in the system. If Pr1.00 is set too high, it might cause trembling in the mechanical system or positioning overshoot</p>
4	Pr1.04	1 <sup>st</sup> torque filter time constant	<p>Eliminate high frequency noise, suppress mechanical resonance.</p>  <p>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.</p> <p>Torque filtering frequency is 4 times higher than velocity loop max following frequency:  <math>1000000 / (2\pi * \text{Pr1.04}) \geq \text{Pr1.01} * 4</math></p> <p>For example, when Pr1.01=180 (0.1 Hz) , Pr1.04 should satisfy: <math>\text{Pr1.04} \leq 221</math> (0.01ms)</p>

1. If vibration occurs with increasing Pr1.01, please modify Pr1.04 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 Pr1.01 and decrease Pr1.04.
4. Decrease Pr1.04 if motor vibrates too much at rest.
5. Pr1.04 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 Pr0.04 after inertia determination.

No.	Parameter	Label
1	Pr1.00	1 <sup>st</sup> position loop gain
2	Pr1.01	1 <sup>st</sup> velocity loop gain
3	Pr1.02	1 <sup>st</sup> velocity integral time constant
4	Pr1.03	1 <sup>st</sup> velocity detection filter
5	Pr1.04	1 <sup>st</sup> torque filter time constant
6	Pr1.05	2 <sup>nd</sup> position loop gain
7	Pr1.06	2 <sup>nd</sup> velocity loop gain
8	Pr1.07	2 <sup>nd</sup> velocity integral time constant
9	Pr1.08	2 <sup>nd</sup> velocity detection filter
10	Pr1.09	2 <sup>nd</sup> torque filter time constant
11	Pr1.10	Velocity feedforward gain constant
12	Pr1.11	Velocity feedforward filter time constant
13	Pr1.12	Torque feedforward gain
14	Pr1.13	Torque feedforward filter time constant
15	Pr1.15	Position control gain switching mode
16	Pr1.17	Position control switching level
17	Pr1.18	Position control switching hysteresis
18	Pr1.19	Position gain switching time

1<sup>st</sup> and 2<sup>nd</sup> gain initial values are obtained by automatic gain adjustment

No.	Parameter	Label
1	Pr1.00	1 <sup>st</sup> position loop gain
2	Pr1.01	1 <sup>st</sup> velocity loop gain
3	Pr1.02	1 <sup>st</sup> velocity integral time constant
4	Pr1.03	1 <sup>st</sup> velocity detection filter
5	Pr1.04	1 <sup>st</sup> torque filter time constant
6	Pr1.05	2 <sup>nd</sup> position loop gain
7	Pr1.06	2 <sup>nd</sup> velocity loop gain
8	Pr1.07	2 <sup>nd</sup> velocity integral time constant
9	Pr1.08	2 <sup>nd</sup> velocity detection filter
10	Pr1.09	2 <sup>nd</sup> torque filter time constant

Manually adjusted gain parameters

No.	Parameter	Label
1	Pr1.00	1 <sup>st</sup> position loop gain
2	Pr1.01	1 <sup>st</sup> velocity loop gain
3	Pr1.02	1 <sup>st</sup> velocity integral time constant
4	Pr1.04	1 <sup>st</sup> torque filter time constant
5	Pr1.10	Velocity feedforward gain constant
6	Pr1.11	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 Pr1.00 and Pr1.05, velocity feedforward gain (Pr1.10)

### 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.

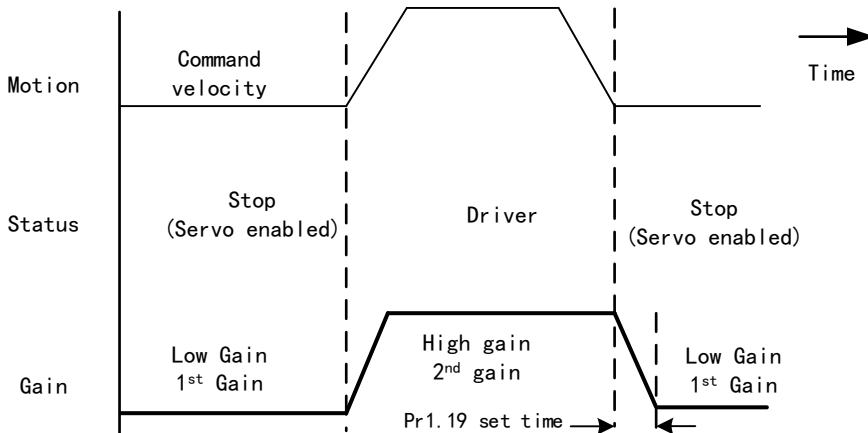
If there is no velocity limit and control is through torque command, please deactivate torque and notch filter, set velocity limit to max. value and increase velocity loop gain to as high as possible.

## 6.5.2 Gain switching

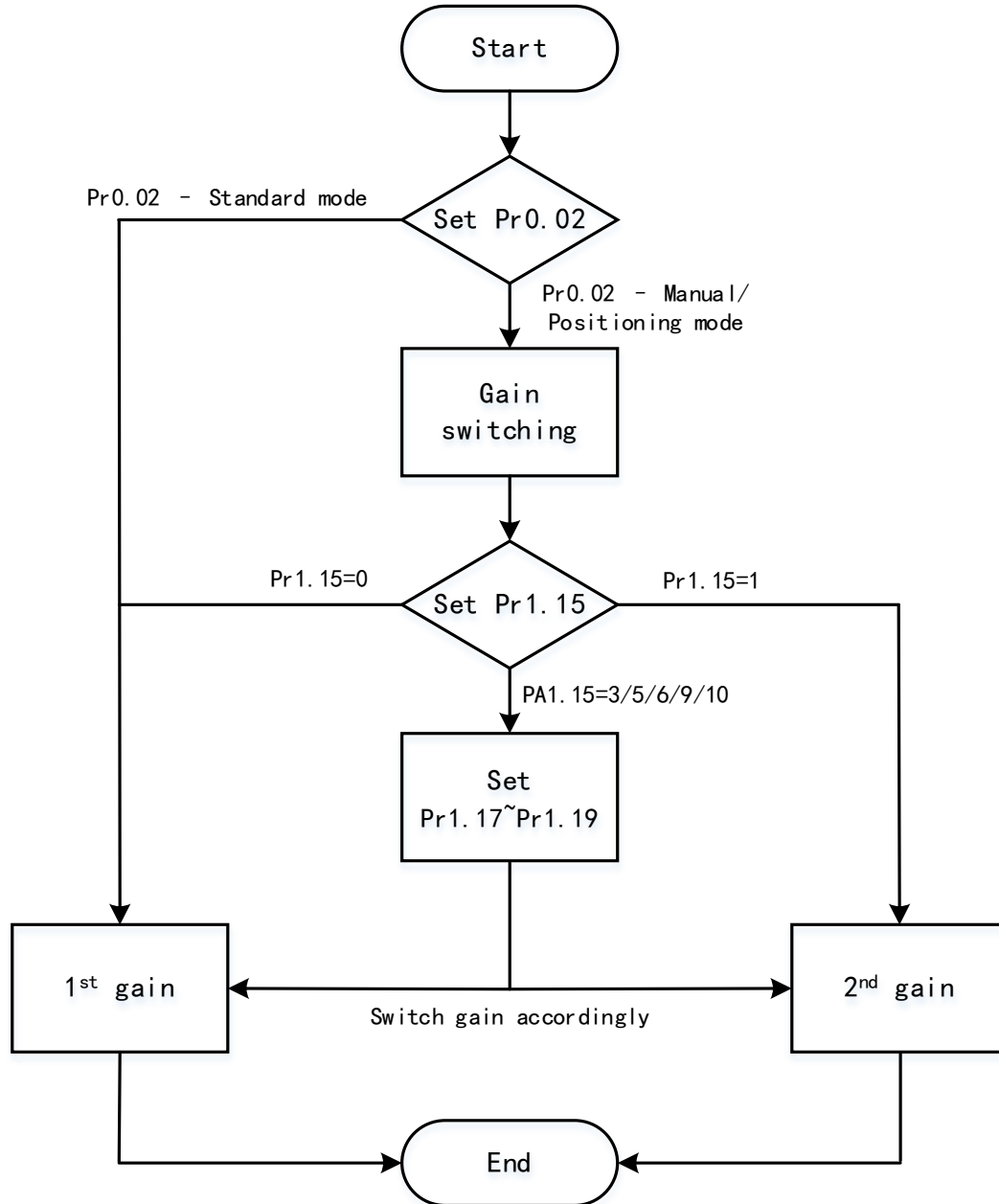
Gain switching function can be triggered internally in servo driver. Only valid under position or velocity control mode. Following effects can be realized by gain switching:

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.



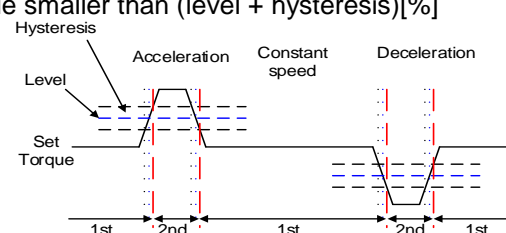
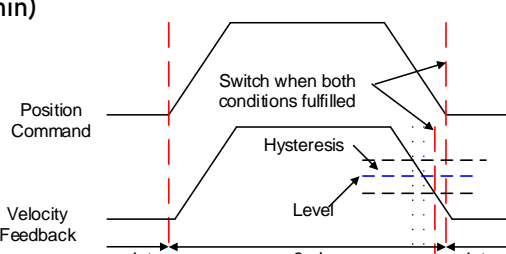
1<sup>st</sup> gain (Pr1.00-Pr1.04) and 2<sup>nd</sup> gain (Pr1.05-Pr1.09) switching can be realized through manual and positioning mode. Switching condition is set through Pr1.15. Gain switching is invalid under standard mode.


**Related parameters on gain switching**

No.	Parameter	Label	Remarks
1	Pr1.15	Position control gain switching mode	In position control, set Pr1.15=3、5、6、9、10. In velocity control, set Pr1.15=3、5、9
2	Pr1.17	Position control level switching	Please set Pr1.17≥Pr1.18
3	Pr1.18	Position control hysteresis switching	If Pr1.17<Pr1.18, driver will set Pr1.17 = Pr1.18
4	Pr1.19	Position gain time switching	As shown below

<b>Pr1.15</b>	<b>Label</b>	Position control gain switching mode	<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~10	<b>Unit</b>	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x011F
	<b>Valid</b>	Immediate				

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

Value	Condition	Gain switching condition
<b>【0】</b>	1 <sup>st</sup> gain fixed	Fixed on using 1 <sup>st</sup> gain(Pr1.00-Pr1.04)
1	2 <sup>nd</sup> gain fixed	Fixed on using 2 <sup>nd</sup> gain (Pr1.05-Pr1.09)
2	Gain switching input valid	<ul style="list-style-type: none"> <li>Gain switching input (GAIN) invalid: 1<sup>st</sup> gain.</li> <li>Gain switching input (GAIN) valid: 2<sup>nd</sup> gain.</li> <li><i>*Default: 1<sup>st</sup> gain</i></li> </ul>
3	High command torque	Switch to 2 <sup>nd</sup> gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1 <sup>st</sup> 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 2 <sup>nd</sup> gain if position command $\neq 0$ Switch to 1 <sup>st</sup> 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 Pr1.17 Position control gain switching level and Pr1.18 Hysteresis at position control switching.**

<b>Pr1.17</b>	<b>Label</b>	Position control gain switching level	<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~20000	<b>Unit</b>	Mode dependent	<b>Default</b>	50
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0123
	<b>Valid</b>	Immediate				

Set threshold value for gain switching to occur.

Unit is mode dependent.

Switching condition	Unit
Position	Encoder pulse count
Velocity	RPM
Torque	%

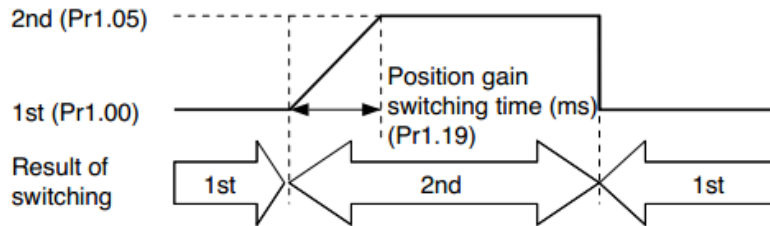
*Please set level  $\geq$  hysteresis*

<b>Pr1.18</b>	<b>Label</b>	Hysteresis at position control switching			<b>Valid mode(s)</b>	P		
	<b>Range</b>	0~20000	<b>Unit</b>	Mode dependent	<b>Default</b>	33		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0125		
	<b>Valid</b>	Immediate						

To eliminate the instability of gain switching. Used in combination with Pr1.17 using the same unit.  
If level < hysteresis, drive will set internally hysteresis = level.

<b>Pr1.19</b>	<b>Label</b>	Position control switching time			<b>Valid mode(s)</b>	P		
	<b>Range</b>	0~10000	<b>Unit</b>	0.1ms	<b>Default</b>	33		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0127		
	<b>Valid</b>	Immediate						

During position control, if 1<sup>st</sup> and 2<sup>nd</sup> gain difference is too large, to ease torque changes and vibration due to rapid changes in position loop gain, set suitable Pr1.19 value  
For example: 1st (pr1.00) <-> 2nd (Pr1.05)



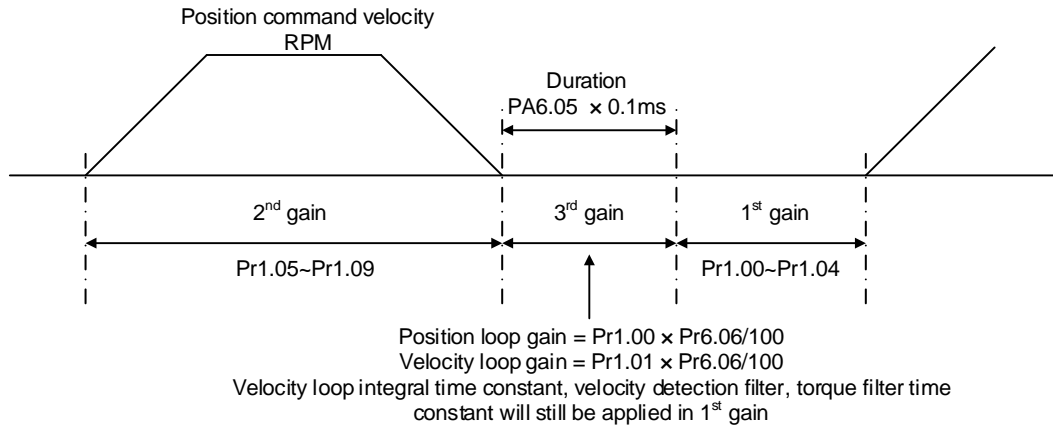


### 6.5.3 3<sup>rd</sup> gain switching

Besides switching between 1<sup>st</sup> and 2<sup>nd</sup> gain, a 3<sup>rd</sup> gain switching is added to set gain at the moment of stopping to reduce positioning time.

Only available under position mode and Pr6.05 ≠ 0, set Pr6.06 for 3<sup>rd</sup> gain value. When 2<sup>nd</sup> gain switches to 1<sup>st</sup> gain, it has to go through 3<sup>rd</sup> gain, switching time is set in Pr1.19.

Diagram below shows when Pr1.15 = 7.



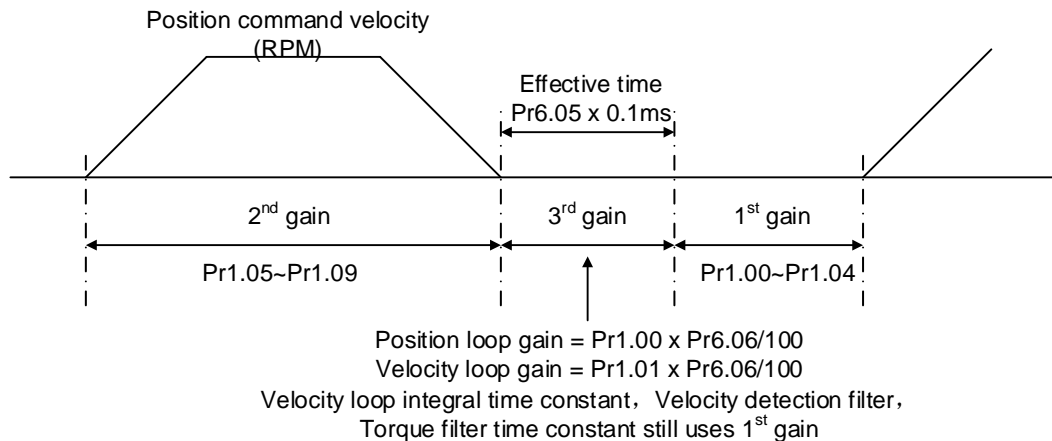
#### Related parameters

<b>Pr6.05</b>	<b>Label</b>	Position 3 <sup>rd</sup> gain valid time			<b>Valid mode(s)</b>	P	
	<b>Range</b>	0~10000	<b>Unit</b>	0.1ms	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x060B	
	<b>Valid</b>	Immediate					

To set time for 3<sup>rd</sup> gain to be valid  
 Only available in position mode  
 When not in use, set Pr6.05=0, Pr6.06=100

<b>Pr6.06</b>	<b>Label</b>	Position 3 <sup>rd</sup> gain scale factor			<b>Valid mode(s)</b>	P	
	<b>Range</b>	50~1000	<b>Unit</b>	100%	<b>Default</b>	100	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x060D	
	<b>Valid</b>	Immediate					

Set up the 3<sup>rd</sup> gain by multiplying factor of the 1<sup>st</sup> gain

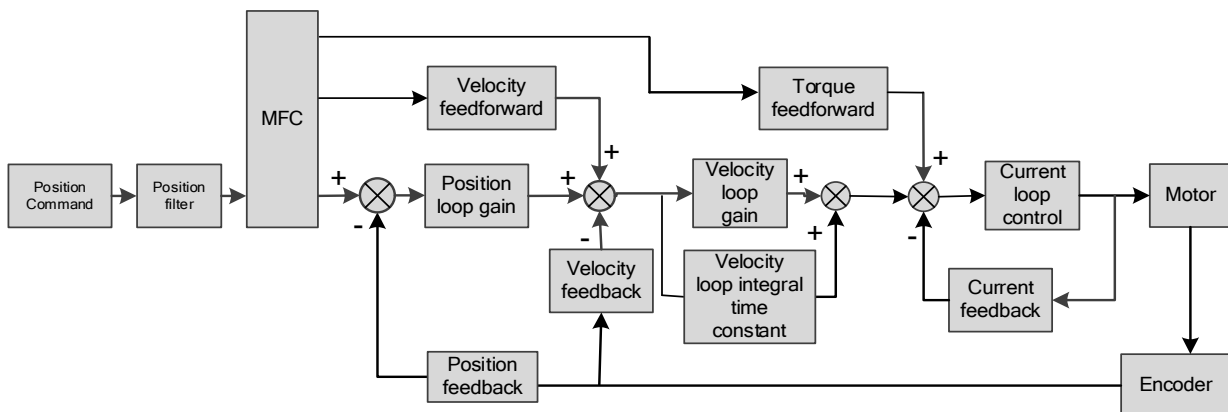


Above diagram is illustrated using  $Pr1.15 = 7$ .  
 $3^{rd} \text{ gain} = 1^{st} \text{ gain} * Pr6.06/100$   
 Only effective under position control mode.  $3^{rd}$  gain valid when  $Pr6.05 \neq 0$ . Set  $3^{rd}$  gain value in  $Pr6.06$ . When  $2^{nd}$  gain switches to  $1^{st}$  gain, it will go through  $3^{rd}$ , switching time is set in  $Pr1.19$ .

## 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  $Pr0.00 = 1$  for automatic adjustment. Now,  $Pr0.00 = Pr1.01$ , 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 $Pr0.00$ provided that there is no overshoot and vibration. Usually $Pr0.00 \geq Pr1.01$ 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.

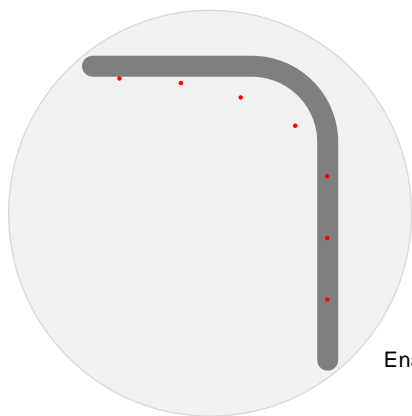
## 6.7 Zero tracking control

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.

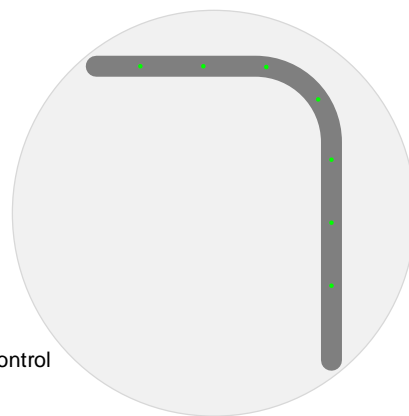
Recommended application:

### 1. Multi axis

Improper following during circular arc motion



Improved following



Enable zero tracking control

### 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 Pr0.00 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
Pr2.50	Model following control	0: Model following control - Default 1: Zero tracking control
Pr2.53	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
Pr0.00	Model following bandwidth	If Pr0.00 = 0, MFC and ZTC is deactivated. When Pr2.50 = 1 (Zero tracking control), higher bandwidth will improve following performance but noise will be higher.
Set the following parameters to default		
Pr2.51	Velocity feedforward compensation coefficient	Default value = 0 for zero tracking control.
Pr2.52	Torque feedforward compensation coefficient	
Pr2.54	Overtravel time constant	
Pr2.55	Overtravel suppression gain	

## 6.8 Feedforward gain

In position 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.

### 6.8.1 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.

<b>Pr1.10</b>	<b>Label</b>	Velocity feed forward gain			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~1000	<b>Unit</b>	0.10%	<b>Default</b>	300		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0115		
	<b>Valid</b>	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.								
<b>Pr1.11</b>	<b>Label</b>	Velocity feed forward filter time constant			<b>Valid mode(s)</b>	<b>P</b>		
	<b>Range</b>	0~6400	<b>Unit</b>	0.01ms	<b>Default</b>	50		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0117		
	<b>Valid</b>	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 ratio 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 Pr1.11 value to suppress velocity overshoot during deceleration; Increase Pr1.11 value to suppress noise or vibration due to long driver control cycle or position command uneven pulse frequency.

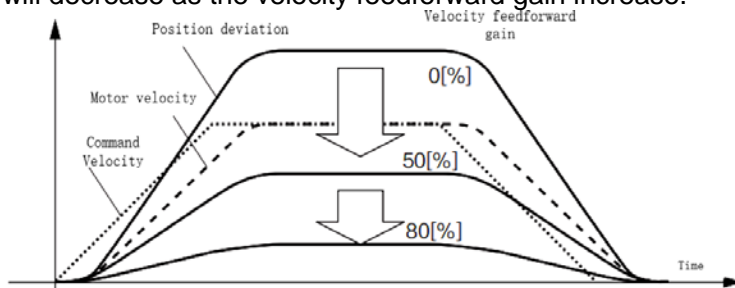
#### <Application>

Set Pr1.11 = 50 (0.5ms) , improve feedforward effect by gradually increase Pr1.10. The equation below can be used to determine the position deviation due to velocity feedforward gain under constant velocity.

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

### Velocity feedforward application

Set Pr1.11 to around 50 (0.5ms), then tune Pr1.10 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 Pr1.10 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing Pr1.11, velocity feedforward would be more effective and vice versa. Pr1.10 and Pr1.11 need to be tuned to a balance.
3. If mechanical noise exists under normal working conditions, please increase Pr1.11 or use position command filter (1 time delay/ FIR smoothing filter)

### 6.6.2 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.

Pr1.12	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 Pr0.04. 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.

<b>Pr1.13</b>	<b>Label</b>	Torque feed forward filter time constant			<b>Valid mode(s)</b>	P	S
	<b>Range</b>	0~6400	<b>Unit</b>	0.01ms	<b>Default</b>	0	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x011B	
	<b>Valid</b>	Immediate					

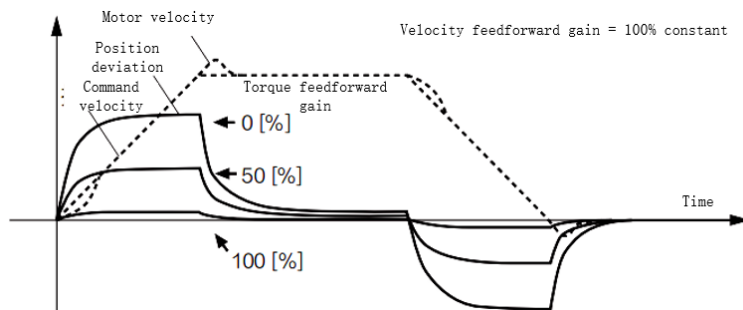
Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or precision. Noise reduces if torque feed forward filter time constant is set higher but position deviation will increase at acceleration varied points.

**<Application>**

- Set Pr1.13 = 50ms, please increase torque forward gain gradually to enable torque feedforward.
- By increasing Pr1.13, noise will reduce but position deviation will become larger.

### Torque feedforward application

Set Pr1.13 to around 50 (0.5ms), then tune Pr1.10 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.

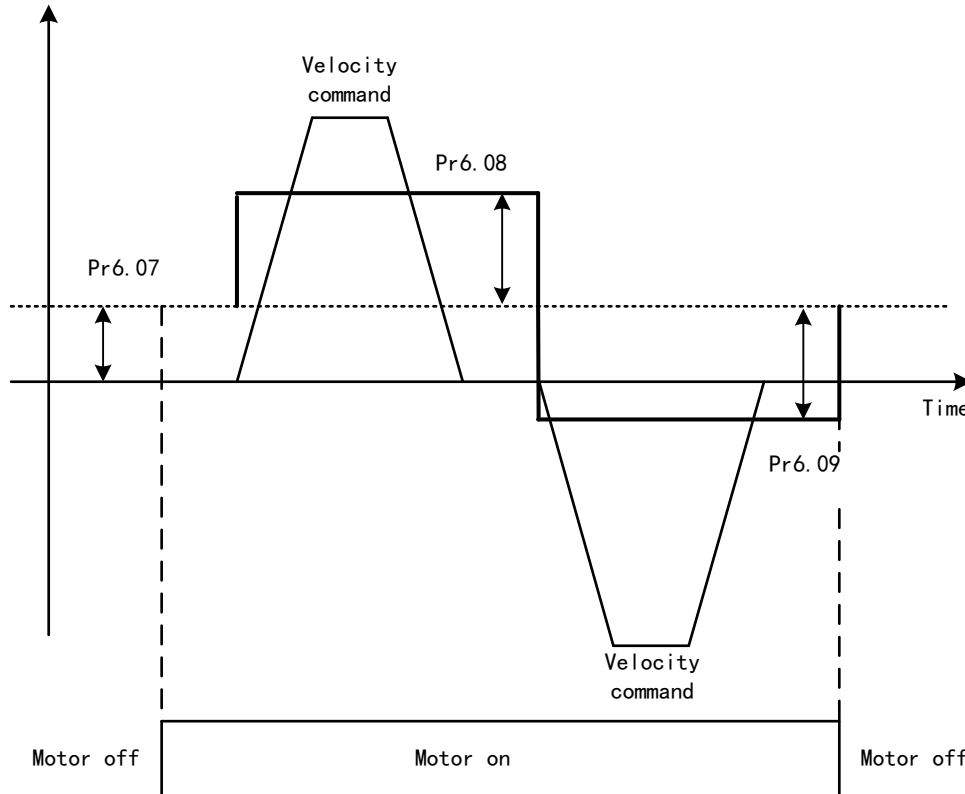


### Steps to tuning:

3. Increase Pr1.12 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
4. By reducing Pr1.13, torque feedforward would be more effective and vice versa. Pr1.12 and Pr1.13 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 Pr6.07, 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 Pr6.08 and Pr6.09.

Pr6.07	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)								
Pr6.08	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						

Pr6.09	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

$$\text{Pr6.08/Pr6.09} = T_f \frac{|T1 - T2|}{2}$$

*Positive/Negative compensation corresponds to actual position feedback.  
 Positive torque compensation value = +(Pr6.08=+T<sub>f</sub>)  
 Negative torque compensation value = -(Pr6.08=+T<sub>f</sub>)  
 Pr6.08 = x, Pr6.09 = y; friction compensation value = |x-y|/2*

## 6.10 Safety Functions

### 6.10.1 Max. motor rotational speed limitation

Motor rotational speed limits can be set on Pr3.24. If command speed is 1500r/min, but Pr3.24 is set to 1000r/min, motor rotational speed will only go up to 1000r/min.

Motor overspeed threshold value can be set in Pr5.13, if the rotational speed is exceeded during operation, Er1A0 might occur.

Pr3.24	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 Pr3.24 = 0, maximum motor rotational speed = max. speed in motor parameter.

Pr5.13	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 Pr5.13, Er1A0 might occur.  
 When Pr5.13 = 0, overspeed level = max. motor speed x 1.2



### 6.10.2 Max. duration for motor to stop after disabling

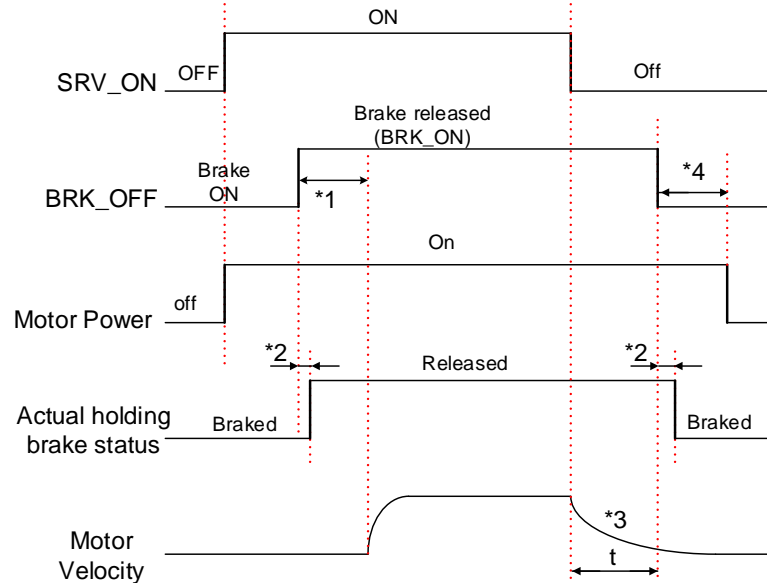
Set max time duration for motor to stop after disabling. If the time taken for motor to stop exceeds the duration set in Pr6.14 and motor speed is still higher than Pr4.39, holding brake will be activated. If motor doesn't have holding brake, dynamic braking will be activated to force stop the motor.

Pr6.14	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						
<p>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 Pr4.39 but the time set in Pr6.14 is reached, BRK_ON given and holding brake activated.                      BRK_ON given time is determined by Pr6.14 or when motor speed goes below Pr4.39, whichever comes first.</p> <p>Applications:</p> <ol style="list-style-type: none"> <li>1. After disabling axis, if motor speed is still higher than Pr4.39 but the time set in Pr6.14 is reached, BRK_ON given and holding brake activated.</li> <li>2. After disabling axis, if motor speed is already lower than Pr4.39 but the time set in Pr6.14 is not yet reached, BRK_ON given and holding brake activated.</li> </ol> <p>Dynamic brake will be provide the braking function if the function is activated for motors without holding brake.</p>								

### 6.10.3 External brake deactivation output signal BRK-OFF

Please refer to Pr4.11 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.

Pr4.37	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						
<p>To set delay time for holding brake to be activated after motor power off to prevent axis from sliding.                      When Pr5.06 = 0, SRV-ON signal is off, holding brake is activated (delay time is determined by Pr4.39 or Pr6.14). Motor powered-off once delay time set in Pr4.37 is due.</p>								
Pr4.38	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						
<p>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.</p>								



\*1: Delay time set in Pr4.38

\*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 Pr6.14 or if motor speed goes below Pr4.39, whichever comes first. BRK\_OFF given after deceleration time.

\*4: Pr4.37 set time value.

*Delay time from the moment SRV\_ON is given until BRK\_OFF switch to BRK\_ON, is less than 500ms.*

Pr4.39	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 Pr4.39 and Pr6.14 is not yet reached, BRK\_OFF is given.

BRK\_OFF signal is determined by Pr6.14 or if motor speed goes below Pr4.39, whichever comes first.

Application:

1. After disabling axis, Pr6.14 has been reached but motor speed is still above Pr4.39, BRK\_OFF signal given.
2. After disabling axis, Pr6.14 has not been reached but motor speed is below Pr4.39, BRK\_OFF signal given.

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

### 6.10.4 Servo stopping mode

Pr5.06	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.																															
<table border="1"> <thead> <tr> <th rowspan="2">Value</th> <th colspan="2">Description</th> </tr> <tr> <th>Mode</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Servo braking</td> <td>Dynamic braking</td> </tr> <tr> <td>1</td> <td>Free stopping</td> <td>Dynamic braking</td> </tr> <tr> <td>2</td> <td>Dynamic braking</td> <td>Dynamic braking</td> </tr> <tr> <td>3</td> <td>Servo braking</td> <td>Free-run</td> </tr> <tr> <td>4</td> <td>Free stopping</td> <td>Free-run</td> </tr> <tr> <td>5</td> <td>Dynamic braking</td> <td>Free-run</td> </tr> </tbody> </table> <p><i>Servo braking: Stop servo axis quickly using braking torque Pr5.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to Pr5.10</i></p>									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
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3	Servo braking	Free-run																													
4	Free stopping	Free-run																													
5	Dynamic braking	Free-run																													
Pr5.10	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:																															
<table border="1"> <thead> <tr> <th rowspan="2">Value</th> <th colspan="2">Explanation</th> </tr> <tr> <th>Mode</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Servo braking</td> <td>Dynamic braking</td> </tr> <tr> <td>1</td> <td>Free stopping</td> <td>Dynamic braking</td> </tr> <tr> <td>2</td> <td>Dynamic braking</td> <td>Dynamic braking</td> </tr> <tr> <td>3</td> <td>Servo braking</td> <td>Free-run</td> </tr> <tr> <td>4</td> <td>Free stopping</td> <td>Free-run</td> </tr> <tr> <td>5</td> <td>Dynamic braking</td> <td>Free-run</td> </tr> </tbody> </table>									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
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Alarm type 1:																															
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1																															
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3	Servo braking	Free-run																													
4	Free stopping	Free-run																													
5	Dynamic braking	Free-run																													

## 6.10.5 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 Pr4.43 to enable the function

<b>Pr4.43</b>	<b>Label</b>	Emergency stop function			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>								
	<b>Range</b>	0~1	<b>Unit</b>	—	<b>Default</b>	0										
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0457										
	<b>Valid</b>	Immediate														
<table border="1"> <thead> <tr> <th>Value</th> <th>Description.</th> </tr> </thead> <tbody> <tr> <td><b>【0】</b></td> <td>Emergency stop is valid, servo driver will be forced to STOP and Err570 occurs.</td> </tr> <tr> <td>1</td> <td>Emergency stop is invalid, servo driver will not be forced to STOP. Servo can be enabled once E-STOP signal is cleared.</td> </tr> </tbody> </table>									Value	Description.	<b>【0】</b>	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.		
Value	Description.															
<b>【0】</b>	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.															
<b>Pr5.04</b>	<b>Label</b>	Driver prohibition input settings			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>								
	<b>Range</b>	0/1/2	<b>Unit</b>	—	<b>Default</b>	0										
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0509										
	<b>Valid</b>	Immediate														
To set driver prohibition input (POT/NOT) <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>POT → Positive direction drive prohibited NOT → Negative direction drive prohibited</td> </tr> <tr> <td>1</td> <td>POT and NOT invalid</td> </tr> <tr> <td>2</td> <td>Any single sided input from POT or NOT might cause Er260</td> </tr> </tbody> </table>									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
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.

<b>Pr5.11</b>	<b>Label</b>	Servo braking torque setting			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~500	<b>Unit</b>	%	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0517		
	<b>Valid</b>	Immediate						
To set torque limit for servo braking mode. If Pr5.11 = 0, use torque limit as under normal situation. Please note that if Pr5.11 set value is too low, emergency stop will take longer.								

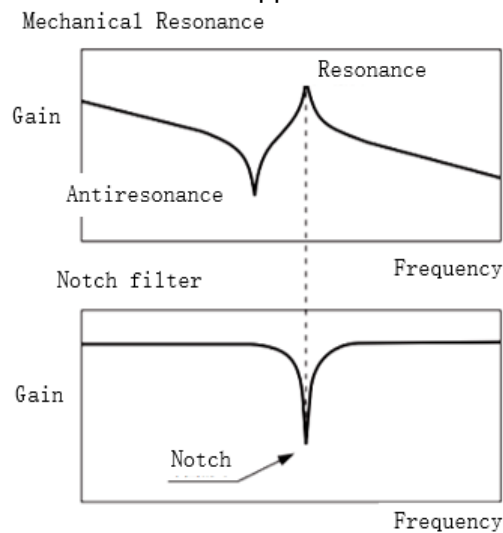
## 6.11 Vibration Suppression

### 6.11.1 Mechanical resonance suppression

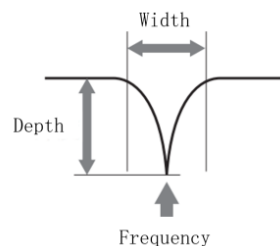
Mechanical system has certain resonance frequencies. When servo gain is increased, resonance might occur at around mechanical resonant frequencies, preventing gain value from increasing. In such situation, notch filter can be used to suppress resonance to set higher gains or lower vibration.

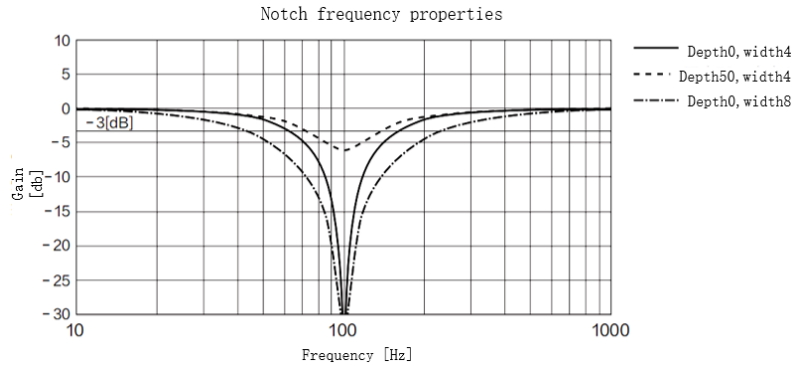
To suppress mechanical resonance:

1. Torque command filter time constant  
Set filter time constant to reduce gain at around resonant frequencies  
Torque command filter blocked frequencies (Hz)  $f_c = 1 / [2\pi \times Pr1.04(0.01ms) \times 0.00001]$
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 Pr2.00 = 1 for auto notch filter adjustment
2. If Pr0.03 stiffness increases, 3<sup>rd</sup> group of notch filter (Pr2.07/Pr2.08/Pr2.09) updates automatically when driver is enabled. Pr2.00 = 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.

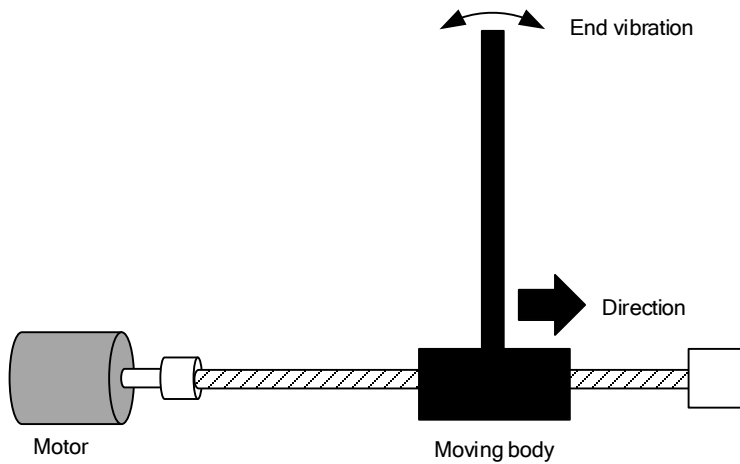
1. After enabling self-adjusting notch filter, set the values from 3<sup>rd</sup> group of filters to 1<sup>st</sup> group of notch filter (Pr2.01/Pr2.02/Pr2.03), see if resonance is suppressed. If there is other resonance, set Pr2.00 = 1, then set the values from 3<sup>rd</sup> group of filters to 2<sup>nd</sup> group of notch filter (Pr2.04/Pr2.05/Pr2.06)
2. Get resonant frequency, notch filter bandwidth and depth and set it into the corresponding parameters through Motion Studio.

<b>Pr2.00</b>	<b>Label</b>	Adaptive filtering mode settings			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>																
	<b>Range</b>	0~4	<b>Unit</b>	—	<b>Default</b>	0																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0201																	
	<b>Valid</b>	Immediate																					
<table border="1"> <thead> <tr> <th>Value</th> <th colspan="2">Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Adaptive filter: invalid</td> <td>Parameters related to 3<sup>rd</sup> notch filter remain unchanged</td> </tr> <tr> <td>1</td> <td>Adaptive filter: 1 filter valid for once.</td> <td>1 adaptive filter becomes valid. 3<sup>rd</sup> notch filter related parameters updated accordingly. Pr2.00 switches automatically to 0 once updated.</td> </tr> <tr> <td>2</td> <td>Adaptive filter: 1 filter remains valid</td> <td>1 adaptive filter becomes valid. 3<sup>rd</sup> notch filter related parameters will keep updating accordingly.</td> </tr> <tr> <td>3-4</td> <td>Reserved</td> <td>-</td> </tr> </tbody> </table>									Value	Description		0	Adaptive filter: invalid	Parameters related to 3 <sup>rd</sup> notch filter remain unchanged	1	Adaptive filter: 1 filter valid for once.	1 adaptive filter becomes valid. 3 <sup>rd</sup> notch filter related parameters updated accordingly. Pr2.00 switches automatically to 0 once updated.	2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3 <sup>rd</sup> notch filter related parameters will keep updating accordingly.	3-4	Reserved	-
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<b>Pr2.01</b>	<b>Label</b>	1 <sup>st</sup> notch frequency			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	50~4000	<b>Unit</b>	Hz	<b>Default</b>	4000																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0203																	
	<b>Valid</b>	Immediate																					
Set center frequency of 1 <sup>st</sup> torque command notch filter. Set Pr2.01 to 4000 to deactivate notch filter																							
<b>Pr2.02</b>	<b>Label</b>	1 <sup>st</sup> notch width			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	0~20	<b>Unit</b>	—	<b>Default</b>	4																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0205																	
	<b>Valid</b>	Immediate																					
Set notch bandwidth for 1 <sup>st</sup> resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.03, Pr2.02 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings																							
<b>Pr2.03</b>	<b>Label</b>	1 <sup>st</sup> notch depth			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	0~99	<b>Unit</b>	—	<b>Default</b>	0																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0207																	
	<b>Valid</b>	Immediate																					
Set notch depth for 1 <sup>st</sup> resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.02, Pr2.03 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings																							
<b>Pr2.04</b>	<b>Label</b>	2 <sup>nd</sup> notch frequency			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	50~4000	<b>Unit</b>	Hz	<b>Default</b>	4000																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0209																	
	<b>Valid</b>	Immediate																					
Set center frequency of 2 <sup>nd</sup> torque command notch filter. Set Pr2.04 to 4000 to deactivate notch filter																							
<b>Pr2.05</b>	<b>Label</b>	2 <sup>nd</sup> notch width			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>															
	<b>Range</b>	0~20	<b>Unit</b>	—	<b>Default</b>	4																	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x020B																	
	<b>Valid</b>	Immediate																					

Set notch bandwidth for 2 <sup>nd</sup> resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.04 and Pr2.06, Pr2.05 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								
<b>Pr2.06</b>	<b>Label</b>	2 <sup>nd</sup> notch depth			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~99	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x020D		
	<b>Valid</b>	Immediate						
Set notch depth for 1 <sup>st</sup> resonant notch filter. When Pr2.06 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 Pr2.04 and Pr2.05, Pr2.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								
<b>Pr2.07</b>	<b>Label</b>	3 <sup>rd</sup> notch frequency			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	50~4000	<b>Unit</b>	Hz	<b>Default</b>	4000		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x020F		
	<b>Valid</b>	Immediate						
Set center frequency of 3 <sup>rd</sup> torque command notch filter. Set Pr2.07 to 4000 to deactivate notch filter								
<b>Pr2.08</b>	<b>Label</b>	3 <sup>rd</sup> notch width			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~20	<b>Unit</b>	—	<b>Default</b>	4		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0211		
	<b>Valid</b>	Immediate						
Set notch depth for 3 <sup>rd</sup> resonant notch filter. When Pr2.06 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 Pr2.04 and Pr2.05, Pr2.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								
<b>Pr2.09</b>	<b>Label</b>	3 <sup>rd</sup> notch depth			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~99	<b>Unit</b>	—	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0213		
	<b>Valid</b>	Immediate						
Set notch depth for 3 <sup>rd</sup> resonant notch filter. When Pr2.06 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 Pr2.04 and Pr2.05, Pr2.06 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.								



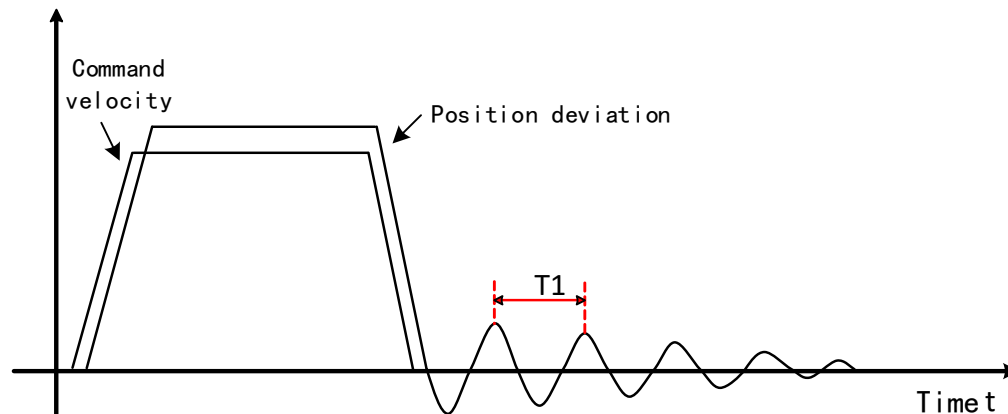
### 6.11.2 End vibration suppression



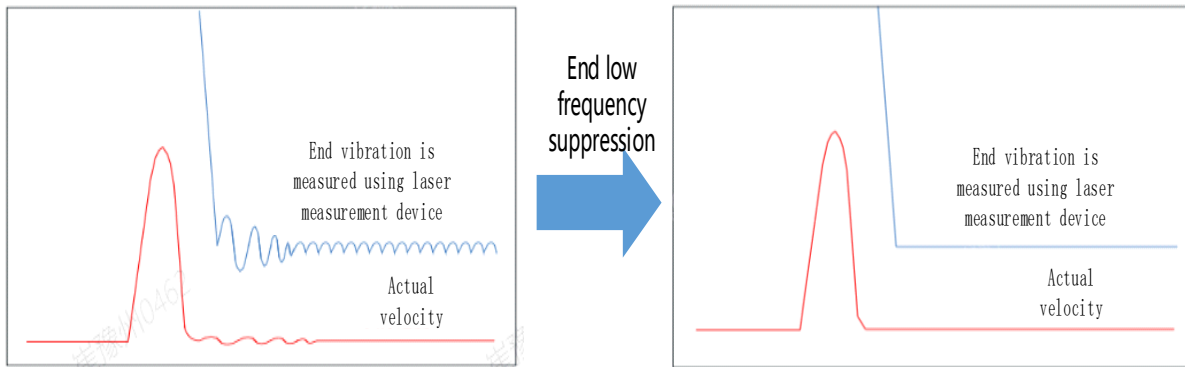
If the mechanical has an end that is long and heavy, it might cause end vibration at emergency stop and affect the positioning. Usually happens on long armed axis with loose end. The frequency is usually within 100Hz which is lower than mechanical resonant frequencies. It is called low-frequency resonance which can be prevented by applying low frequency suppression function.

#### To apply low frequency suppression

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 Pr2.14
5. If some other low frequency resonance occurs, please repeat step 1-3 and write  $F2$  into Pr2.16.

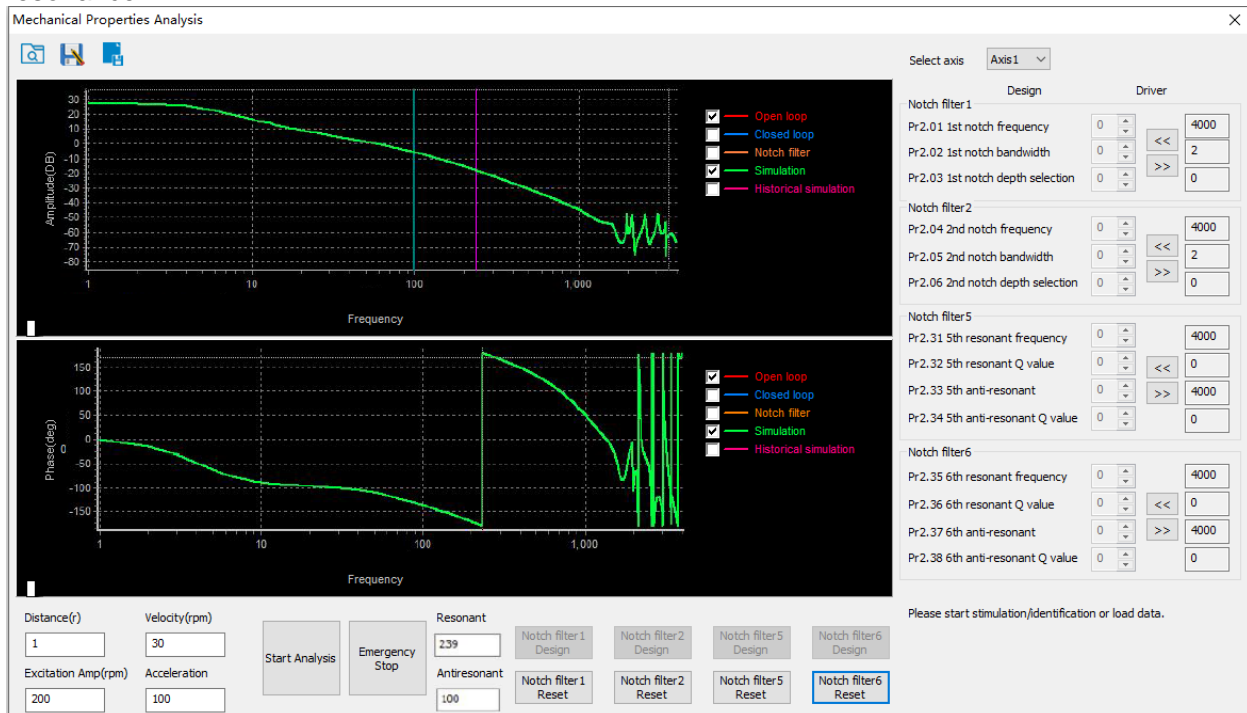


The result of suppressing low frequency resonance



### 6.11.3 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.

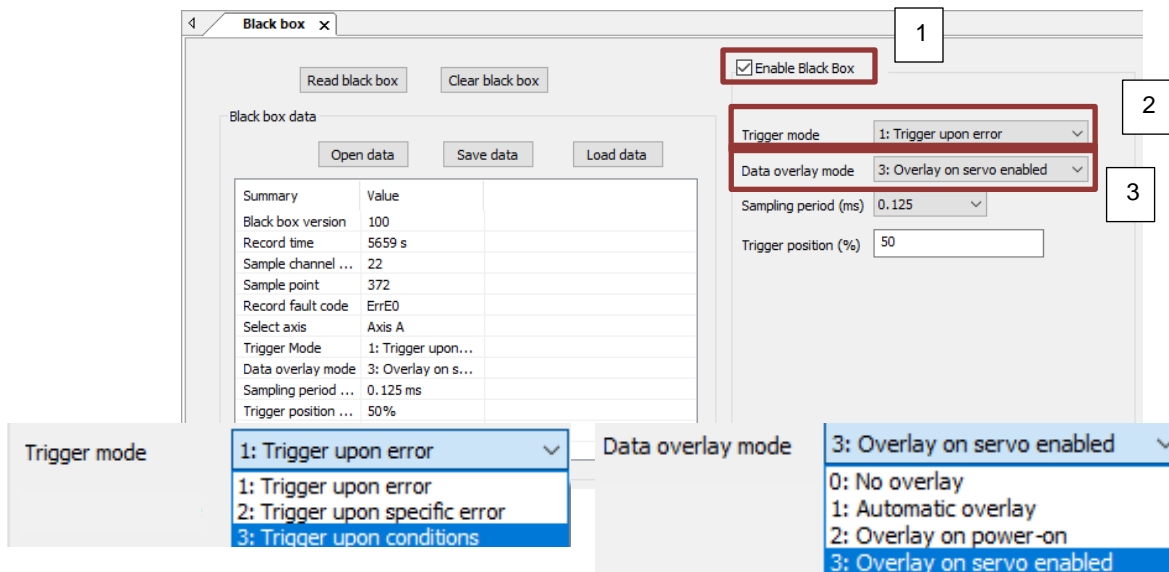
If vibration occurs during tests which can't be reduce through lowering electrical current excitation, it might be due to excessive gain. Please lower velocity gain and set notch filter as accordance from the mechanical properties analysis. Or might be due to inertia settings (Pr0.04) is too large, please use optimal inertia ratio value.

## 6.12 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.

### Setting Up Black Box

1. Click on "Black Box" under "Tool" to enter Black box setup. There 3 methods to trigger black box function: 1. Random error, 2. Specific error, 3. Conditions triggering. Choose trigger method as accordance to needs. Please pay attention to Data Overlay Mode and choose the option needed before start.

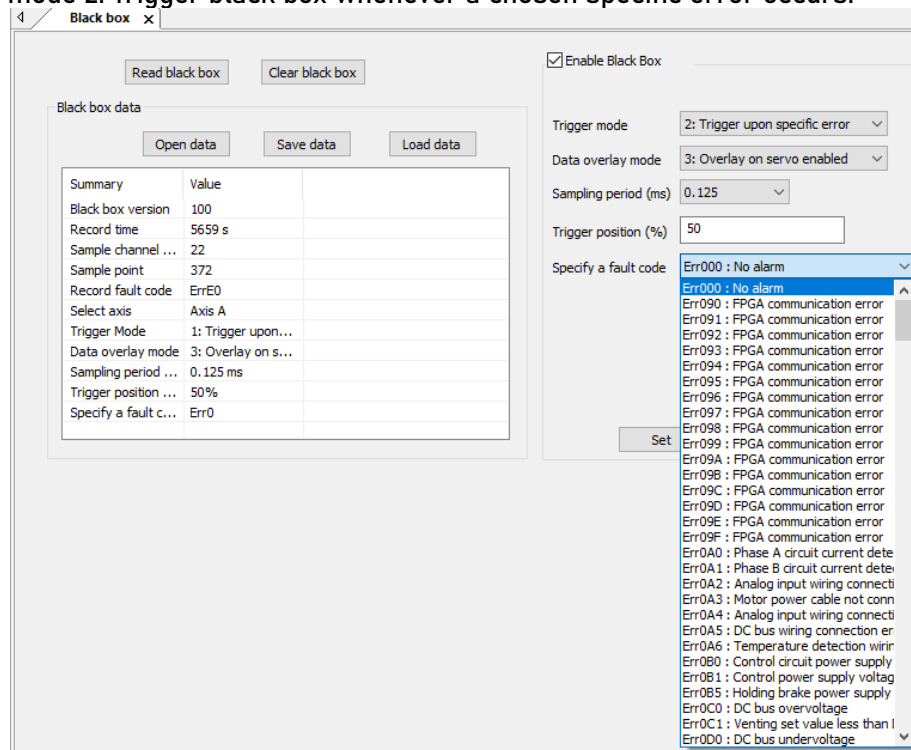


The screenshot shows the 'Black box' configuration window. Key elements include:

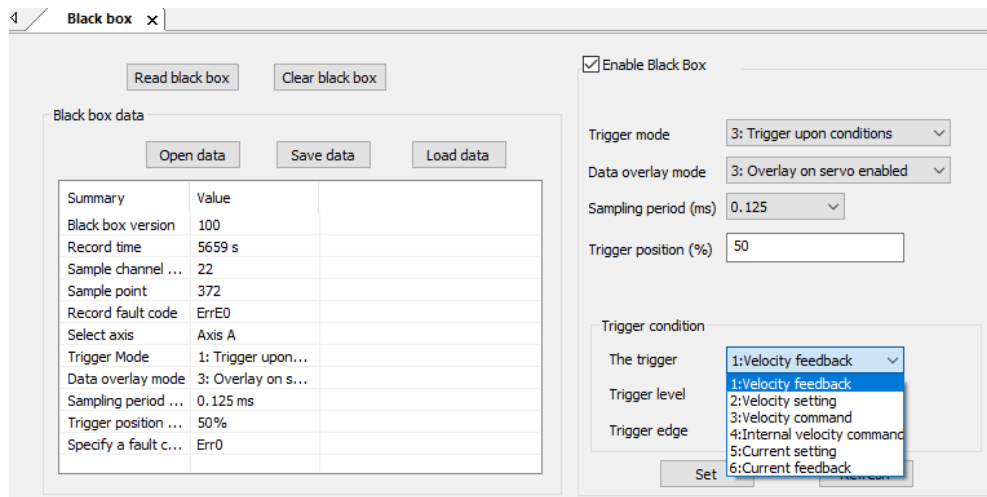
- Enable Black Box:** A checked checkbox, highlighted with a red box and the number 1.
- Trigger mode:** A dropdown menu set to '1: Trigger upon error', highlighted with a red box and the number 2.
- Data overlay mode:** A dropdown menu set to '3: Overlay on servo enabled', highlighted with a red box and the number 3.
- Other settings:** 'Sampling period (ms)' is set to 0.125, and 'Trigger position (%)' is set to 50.
- Summary Table:**

Summary	Value
Black box version	100
Record time	5659 s
Sample channel ...	22
Sample point	372
Record fault code	ErrE0
Select axis	Axis A
Trigger Mode	1: Trigger upon...
Data overlay mode	3: Overlay on s...
Sampling period ...	0.125 ms
Trigger position ...	50%

2. Trigger mode 2: Trigger black box whenever a chosen specific error occurs.



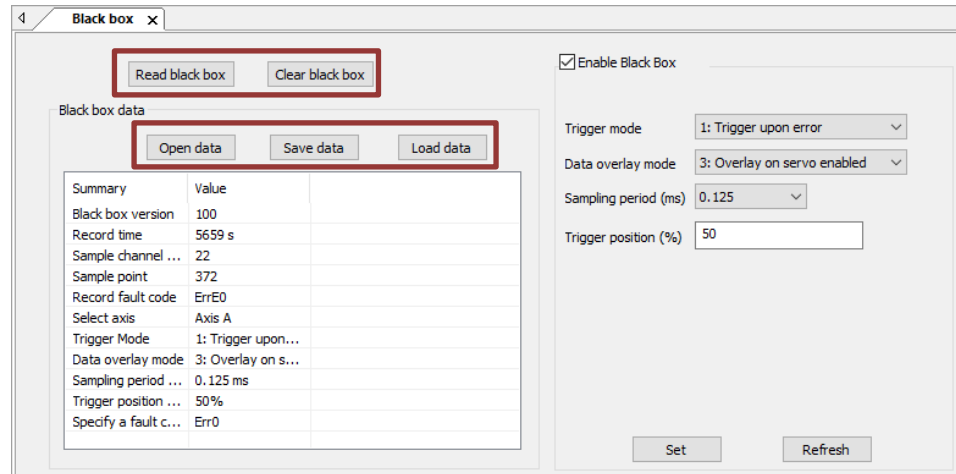
3. Trigger mode 3: Conditions for black box functions to be triggered can set. Set the source, level and edge of the trigger as shown below.



4. Data overlay mode: To select how and when black box data is overlaid. 0: Do not overlay data (Black box will only preserve the data of the first trigger). 1: Always overlay (Black box data will be overlaid every time). 2: Overlay upon powered on (Data overlaid occurs when servo drive is powered on) 3: Overlay when enabled (Data overlaid occurs when servo drive is enabled).

5. Sampling period (ms): The lower the set value, the more precise the samples are but sampling time will be shorter.
6. Trigger position (%): Set the position of trigger within the sampling period.
7. Click on "Set" to save the settings to driver.

Data recorded in Black Box can be read and cleared. The data can also be saved and read by anyone from this function interface for further analysis.



Black box data

Summary	Value
Black box version	100
Record time	5659 s
Sample channel ...	22
Sample point	372
Record fault code	ErrE0
Select axis	Axis A
Trigger Mode	1: Trigger upon...
Data overlay mode	3: Overlay on s...
Sampling period ...	0.125 ms
Trigger position ...	50%
Specify a fault c...	Err0

Enable Black Box

Trigger mode: 1: Trigger upon error

Data overlay mode: 3: Overlay on servo enabled

Sampling period (ms): 0.125

Trigger position (%): 50

Set Refresh

## 6.13 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.

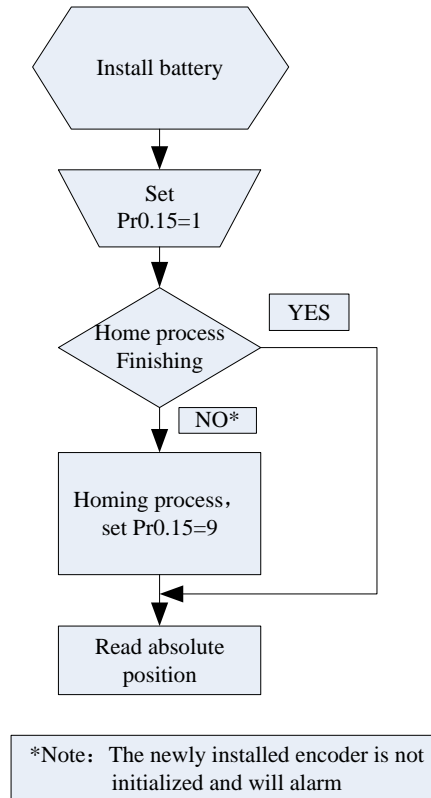
### 6.13.1 Parameters setting

Pr0.15	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						
Value	Mode	Description						
【0】	Incremental	Doesn't retain position data on power off. Unlimited travel distance.						
1	Multiturn absolute linear	Retrain position data on power off. For applications with fixed travel distance and no multiturn data overflow.						
2	Multiturn absolute rotary	Retrain position data on power off. Actual data feedback in between 0-(Pr6.63+1). Unlimited travel distance.						
3	Single turn absolute	Used when travel distance is within 1 revolution of the encoder. Data overflow will trigger alarm.						
5	Multi turn absolute	Clear multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 5 after 3s, please solve according to Er153.						
9		Clear multiturn position, reset multiturn alarm and activate multiturn absolute function. Will switch to multiturn mode once alarm cleared, if remains at 9 after 3s, please solve according to Er153. Please disable axis before setting to 9 and home the axis before using.						
Others		Do not use!						

### 6.13.2 Read absolute position

#### 1、Steps:

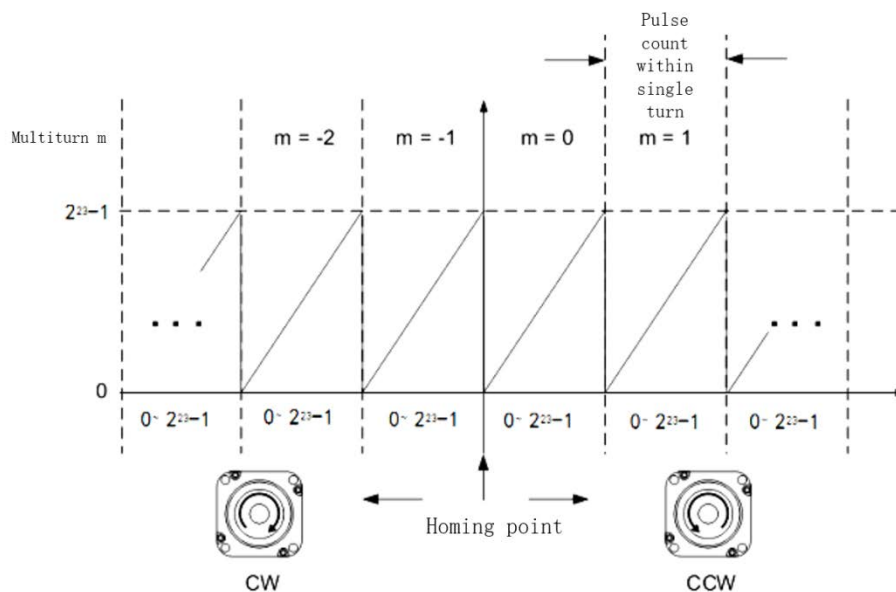
- 1) First, select a motor with multiturn absolute encoder, install battery and confirm whether the driver version supports the specific motor;
- 2) Set Pr0.15 = 1. If it is the first time of installation, Err153 will occur because battery is newly installed and position data is invalid. Please home 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 6064h 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.

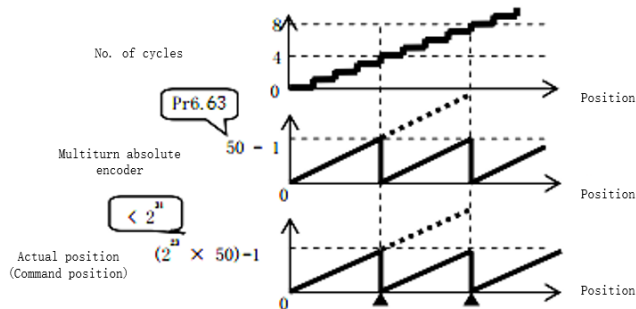
### Multiturn linear mode(Pr0.15 = 1)

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 Pr0.15 to clear multiturn data and home the axis.

### Multiturn rotational mode

For absolute encoder, multiturn rotational mode (Pr0.15 = 2, Pr6.63 set to multiturn upper limit) is added on top of incremental mode and multiturn linear mode. Actual feedback multiturn data is always between  $0 - [Pr6.63 + 1]$ , 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.

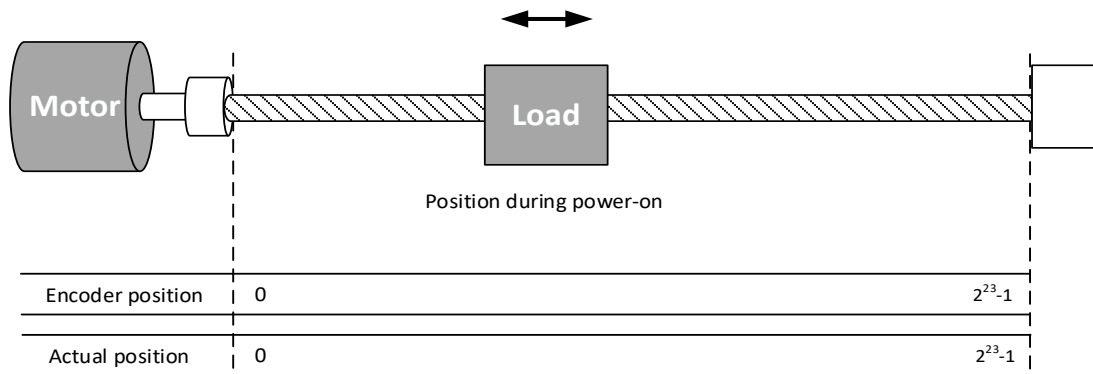
1. Target position input range – EtherCAT

When using 23-bit absolute encoder, under single turn absolute mode, electronic gear ratio = 1:1

Homing point offset 607Ch = 0, target position range =  $0 - [2^{23} - 1]$

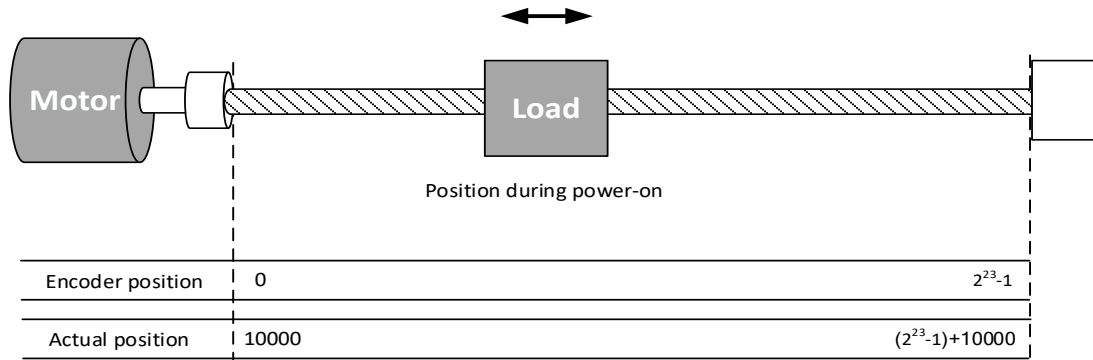
Axis is homed, target position range =  $607Ch - [2^{23} - 1 + 607Ch]$

When electronic gear ratio = 1:1, 607Ch = 0:



When electronic gear ratio = 1:1, 607Ch = 10000:





### 3、Clear multiturn position

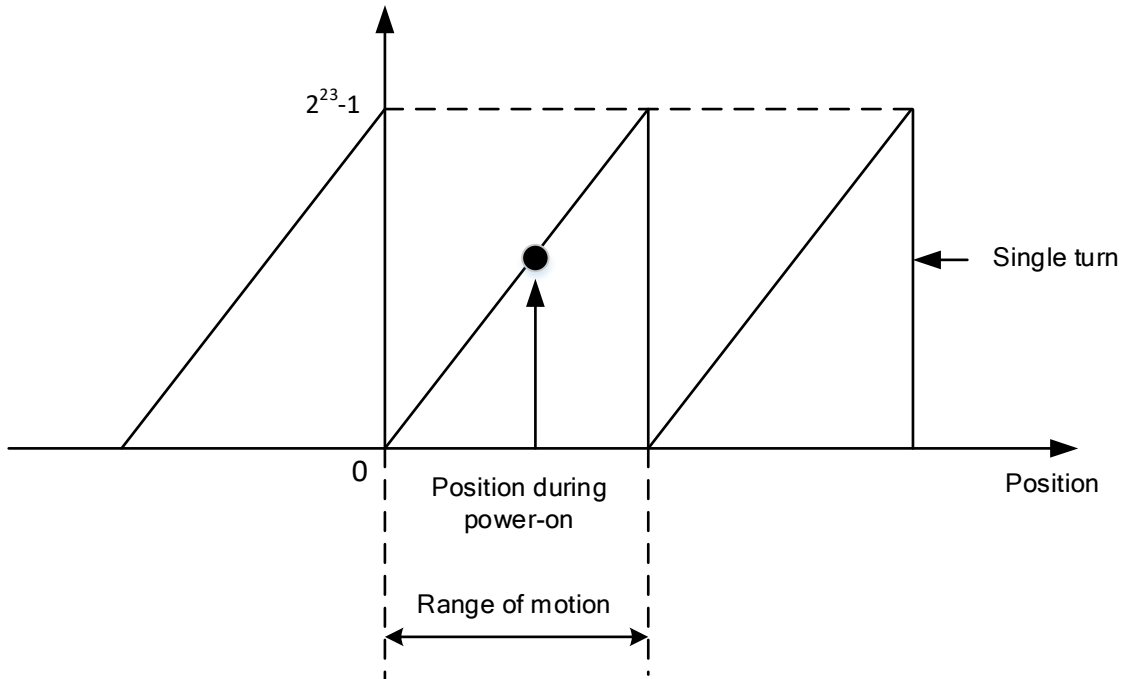
Before clearing multiturn position, axis needs to be homed. After clearing multiturn position, revolution count = 0 but absolute position remains unchanged and Err153 alarm will be cleared.

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.

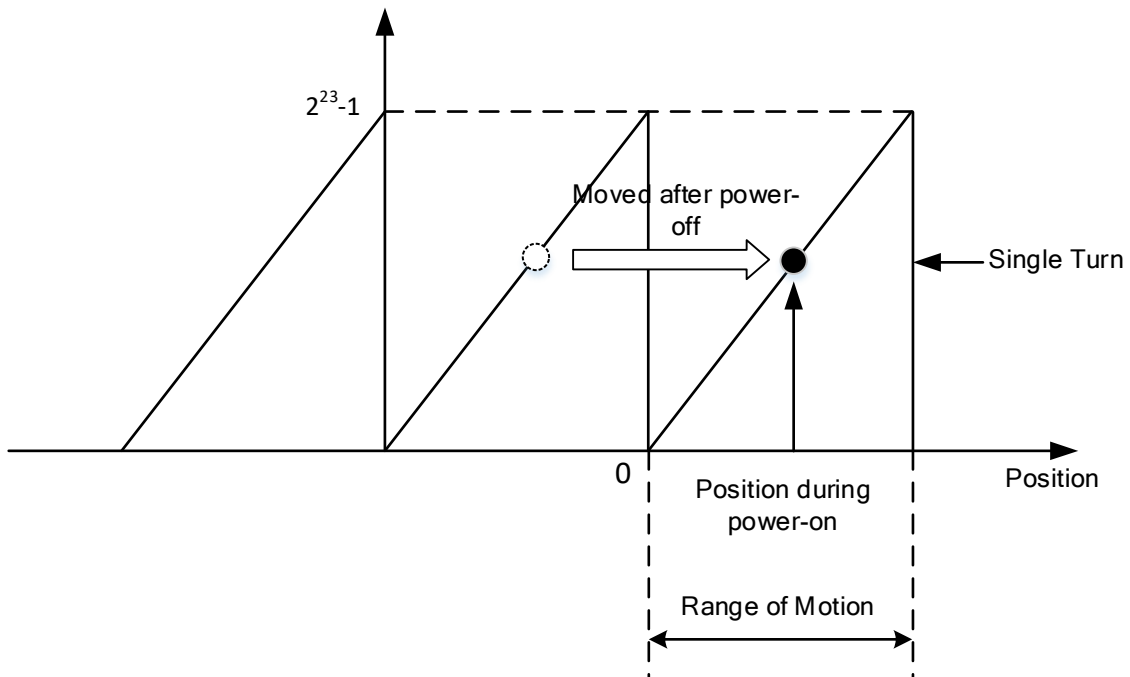
By setting Pr0.15 to 9, multiturn position will be cleared.

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.



### 6.13.3 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.

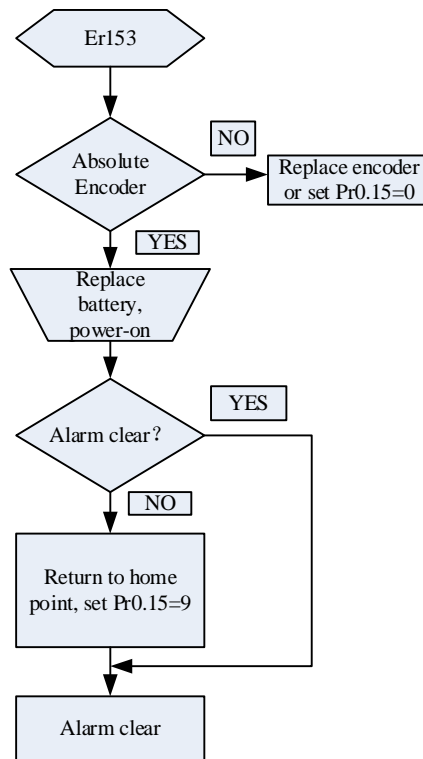
Err153 might occur,

(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. Pr0.15 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.

## 6.14 Motor Speed Regulation

This is a motor speed regulator to control motor rotational speed using I/O input signals. For example, if the input voltage = -10 ~ 10VDC and rotational speed of the motor corresponds to -2000 to 2000rpm. When SPDREG = ON, motor speed regulation can be controlled using SPDREG 1 – 4. If the speed regulation ratio is set to be 20%, then -10~10VDC input voltage will correspond to -400 to 400rpm (-2000\*20%~2000\*20%rpm). Please be minded that this is only applicable under velocity control mode.

### 6.14.1 Set up motor speed regulation

1. Assign I/O signals using Motion Studio 2 or using the front panel.

*Using Motion Studio 2: Under “Function” -> “I/O Settings”*

Pin	Function	Polarity	Status	Forced state
Pr4.00 Input selection DI1	[3]Servo ON Input(SRV-ON)	0:Normally Open	<input type="radio"/> OFF	0:Not forced
Pr4.01 Input selection DI2	[4B]Speed regulation valid(SPDREG)	0:Normally Open	<input type="radio"/> OFF	0:Not forced
Pr4.02 Input selection DI3	[4C]Speed regulation ratio 1(SPDREG1)	0:Normally Open	<input type="radio"/> OFF	0:Not forced
Pr4.03 Input selection DI4	[4D]Speed regulation ratio 2(SPDREG2)	0:Normally Open	<input type="radio"/> OFF	0:Not forced
Pr4.04 Input selection DI5	[4E]Speed regulation ratio 3(SPDREG3)	0:Normally Open	<input type="radio"/> OFF	0:Not forced
Pr4.05 Input selection DI6	[4F]Speed regulation ratio 4(SPDREG4)	0:Normally Open	<input type="radio"/> OFF	0:Not forced
Pr4.06 Input selection DI7	[0]Input Invalid[NULL]	0:Normally Open	<input type="radio"/> OFF	0:Not forced
Pr4.07 Input selection DI8	[0]Input Invalid[NULL]	0:Normally Open	<input type="radio"/> OFF	0:Not forced

*Using front panel: Please refer to Chapter 4 section 4.5 for detailed instructions on how to assign I/O signals using the front panel.*

Assign SPDREG to enable motor speed regulator and SPDREG1-4 to control motor rotational speed as per desired from 0%-150%. Please make sure that the control wirings are wired to the right pins on CN1.

2. Make sure the control mode used for the servo drive is velocity control mode (Pr0.01=1/3/5/6). Set up Pr3.58-Pr3.61 as per required.

Keep in mind that max ratio in total should not exceed 150%, if total exceeds 150%, motor rotational speed will remain unchanged. Motor rotational speed will be running at max. speed set in Pr3.24 if exceeds max speed.

**Related parameters**

Pr0.01	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	
	1 <sup>st</sup> mode	2 <sup>nd</sup> mode
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position Pr0.22=1
		Velocity Pr0.22=1
		Torque Pr0.22=2
7~10	Reserved	

◆When 3, 4, 5, 6 combination hybrid mode, 1<sup>st</sup> and 2<sup>nd</sup> mode can be chosen accordingly with control mode switching input (C-MODE).  
 C-MODE: Invalid, select 1<sup>st</sup> mode.  
 C-MODE: Valid, select 2<sup>st</sup> mode.  
 Please allow some time in between mode switching commands.

◆Please set Pr0.01 = 6 to switch to other modes from PR mod, then set 2<sup>nd</sup> mode using Pr0.22.

*C-MODE is defaulted to Normally Open*

Pr3.58	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 Pr3.24, 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) Pr3.58-Pr3.61 = default  
 (2) Motor rated rotational speed = 2000rpm  
 (3) SPDREG input signal = ON

SPDREG1 Pr3.58	SPDREG2 Pr3.59	SPDREG3 Pr3.60	SPDREG4 Pr3.61	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

<b>Pr3.59</b>	<b>Label</b>	Speed regulation ratio 2			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~150	<b>Unit</b>	%	<b>Default</b>	20
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	H0x0376 L0x0377
	<b>Valid</b>	Immediate				
Same as Pr3.58						
<b>Pr3.60</b>	<b>Label</b>	Speed regulation ratio 3			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~150	<b>Unit</b>	%	<b>Default</b>	40
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	H0x0378 L0x0379
	<b>Valid</b>	Immediate				
Same as Pr3.58						
<b>Pr3.61</b>	<b>Label</b>	Speed regulation ratio 4			<b>Valid mode(s)</b>	<b>S</b>
	<b>Range</b>	0~150	<b>Unit</b>	%	<b>Default</b>	80
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	H0x037A L0x037B
	<b>Valid</b>	Immediate				
Same as Pr3.58						

<b>Pr3.24</b>	<b>Label</b>	Maximum motor rotational speed			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0~10000	<b>Unit</b>	r/min	<b>Default</b>	0		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0331		
	<b>Valid</b>	Immediate						
To set maximum motor rotational speed but not higher than motor rated speed If Pr3.24 = 0, maximum motor rotational speed = max. speed in motor parameter.								

<b>Pr4.00</b>	<b>Label</b>	Input selection DI1			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>
	<b>Range</b>	0x00~0xFF	<b>Unit</b>	—	<b>Default</b>	0x2		
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0401		
	<b>Valid</b>	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
Zero speed clamp	ZEROSPD	11	91
Velocity command sign	VC-SIGN	12	92

CN1 PIN	Input	Parameters
8	DI1	Pr4.00
9	DI2	Pr4.01
26	DI3	Pr4.02
27	DI4	Pr4.03
28	DI5	Pr4.04
29	DI6	Pr4.05
30	DI7	Pr4.06
31	DI8	Pr4.07

Torque command sign	TC-SIGN	13	93
Forced alarm	E-STOP	14	94
Vibration suppression 1	VS-SEL1	0A	8A
Vibration suppression 2	VS-SEL2	0B	8B
Speed regulation valid	SPDREG	4B	CB
Speed regulation ratio 1	SPDREG1	4C	CC
Speed regulation ratio 2	SPDREG2	4D	CD
Speed regulation ratio 3	SPDREG3	4E	CE
Speed regulation ratio 4	SPDREG4	4F	CF

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

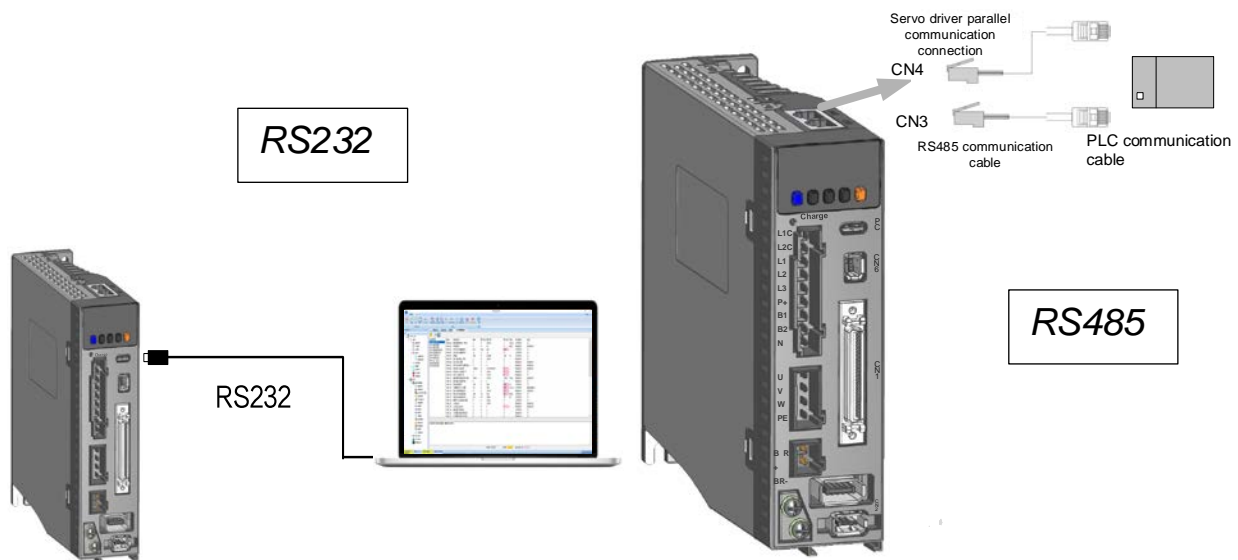
Signal	Symbol	Value	
		NO	NC
Positive JOG	PJOG	23	A3
Negative JOG	NJOG	24	A4
Positive limit	PL	25	A5
Negative limit	NL	26	A6
Origin	ORG	27	A7
Path address 0	ADD0	28	A8
Path address 1	ADD1	29	A9
Path address 2	ADD2	2A	AA
Path address 3	ADD3	2B	AB

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

## Chapter 7 Modbus communication

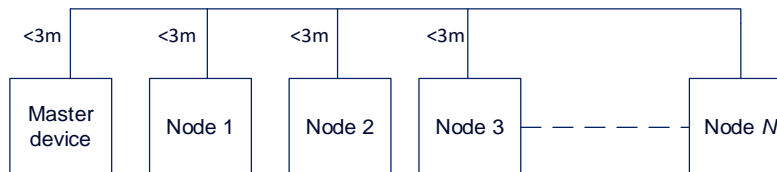
There are 2 types of Modbus communication on EL7-RSP series servo drives: RS485 and RS232. RS232 is used for point-to-point communication connecting the driver to PC through a USB type-C cable for tuning using Motion Studio. RS485 can be set to communicate with multiple slave devices as a single master. 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

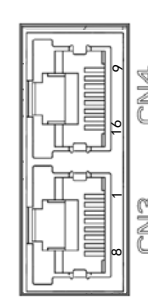
If there is a need to connect multiple EL8-RS series servo drives together, it is recommended to connect the drivers in series and no longer than 3 meters of LAN cable between each nodes (drivers) as shown below.



- 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, 9	RDO+	RS485 Differential signal+
		2, 10	RDO -	RS485 Differential signal-
		3, 11	GND	Ground (RS485)
		4, 12	TXD+	RS485 Differential signal+
		5, 13	TXD-	RS485 Differential signal-
		6	VCC5V	Reserved, 5V positive (50mA)
		7, 15	GND	Ground
		8, 16	/	/
		Frame	PE	Shield grounding

### Parameters related to RS485 communication

<b>Pr5.29</b>	<b>Label</b>	RS485 communication mode			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																												
	<b>Range</b>	0~255	<b>Unit</b>	—	<b>Default</b>	5																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x053B																														
	<b>Valid</b>	After restart																																		
<table border="1"> <thead> <tr> <th>Value</th> <th>Bit</th> <th>Checksum</th> <th>Stop</th> </tr> </thead> <tbody> <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><b>【5】</b></td> <td>8</td> <td>Null</td> <td>2</td> </tr> </tbody> </table>									Value	Bit	Checksum	Stop	0	8	Even	2	1	8	Odd	2	2	8	Even	1	3	8	Odd	1	4	8	Null	1	<b>【5】</b>	8	Null	2
Value	Bit	Checksum	Stop																																	
0	8	Even	2																																	
1	8	Odd	2																																	
2	8	Even	1																																	
3	8	Odd	1																																	
4	8	Null	1																																	
<b>【5】</b>	8	Null	2																																	
<b>Pr5.30</b>	<b>Label</b>	RS485 communication Baud rate			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																												
	<b>Range</b>	0~15	<b>Unit</b>	—	<b>Default</b>	4																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x053D																														
	<b>Valid</b>	After restart																																		
<table border="1"> <thead> <tr> <th>Value</th> <th>Baud rate</th> <th>Value</th> <th>Baud rate</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2400bps</td> <td><b>【4】</b></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> </tbody> </table> <p>Baud rate tolerance: 2400~38400bps±0.5%, 57600~115200bps±2%</p>									Value	Baud rate	Value	Baud rate	0	2400bps	<b>【4】</b>	38400bps	1	4800bps	5	57600bps	2	9600bps	6	115200bps	3	19200bps										
Value	Baud rate	Value	Baud rate																																	
0	2400bps	<b>【4】</b>	38400bps																																	
1	4800bps	5	57600bps																																	
2	9600bps	6	115200bps																																	
3	19200bps																																			
<b>Pr5.31</b>	<b>Label</b>	RS485 axis address			<b>Valid mode(s)</b>	<b>P</b>	<b>S</b>	<b>T</b>																												
	<b>Range</b>	0~127	<b>Unit</b>	—	<b>Default</b>	1																														
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x053F																														
	<b>Valid</b>	After restart																																		
<p>When controller is connected to multiple axis and controller needs to identify the axis, Pr5.31 can be used to set the axis ID/address. Please set to a max of 31 if the communication is between RS232 and RS485</p>																																				

## 7.3 Modbus Protocol

EL7-RSP 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 Pr0.00 as an example, the 485 address shows 0x0001. It is actually high 0x0000 and low 0x0001 data.

<b>Pr0.00</b>	<b>Label</b>	Model-following/Zero tracking control			<b>Valid mode(s)</b>	<b>P</b>	
	<b>Range</b>	0-2000	<b>Unit</b>	0.1Hz	<b>Default</b>	1	
	<b>Byte length</b>	16bit	<b>Attribute</b>	R/W	<b>485 address</b>	0x0001	
	<b>Valid</b>	At stop					

### 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	<b>ID</b>	Slave	0x01	<b>ID</b>	Slave	0x01
2	<b>FC</b>	Function code	0x03	<b>FC</b>	Function code	0x03
3	<b>ADDR</b>	Starting address	H	<b>NUM</b>	Data count (byte)	0x00(H)
4			L			0x04(L)
5	<b>NUM</b>	Data count (word)	0x00(H)	<b>DATA1</b>	Data 1	H
6			0x02(L)			L
7	<b>CRC</b>	Checksum	L	<b>DATA2</b>	Data 2	H
8			H			L
9				<b>CRC</b>	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).

Request frame data (Master->Slave)				Reply frame data (Slave->Master)		
1	<b>ID</b>	Slave	0x01	<b>ID</b>	Slave	0x01
2	<b>FC</b>	Function code	0x03	<b>FC</b>	Function code	0x03
3	<b>ADDR</b>	Starting address	H	<b>ADDR</b>	Address	H
4			L			L
5	<b>NUM1</b>	Data count (word)	0x00(H)	<b>NUM</b>	Data count (word)	H
6			0x02(L)			L
7	<b>NUM2</b>	Data count (Byte)	0x04 (2*NUM1)	<b>CRC</b>	Checksum	L
8	<b>DATA1</b>	Data 1	H			H
9			L			
10	<b>DATA2</b>	Data 2	H			
11			L			
12	<b>CRC</b>	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	<b>ID</b>	Slave ID	0~31
2	<b>FC</b>	Function code	(0x03/0x06/0x10)+0x80
3	<b>Error code</b>	Address	0x01/0x02/0x03
4	<b>CRC</b>	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

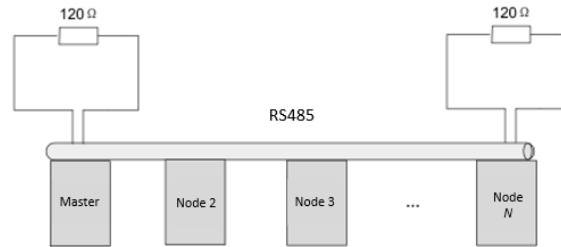
**Receive frame:** Slave servo drive's reply frame. Request frame data function from master device error or slave station does not support this function, unable to respond to current request.

[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.

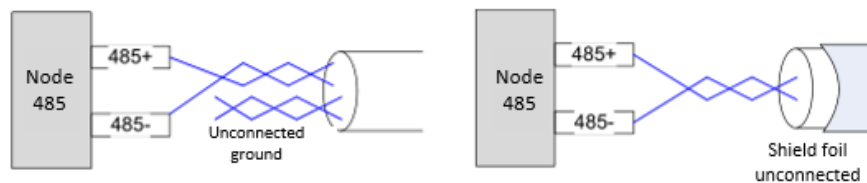
### Terminal resistor



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.

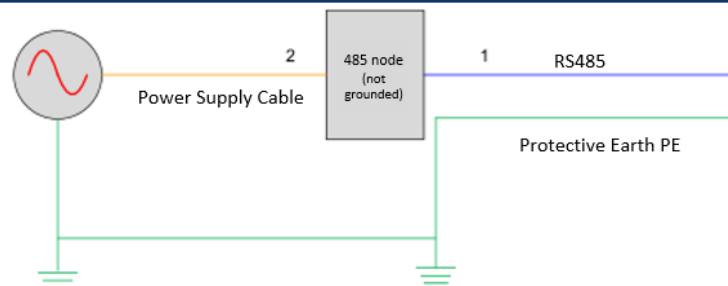
Measured resistance (Ohm)	Normal: 60 Ohm	Description
0		Short circuit
Much lower than 60		Might be other resistor within the network; incorrect terminal resistor is used
Much higher than 60		Might be due to damaged/faulty node communication port

### Incorrect wiring connection

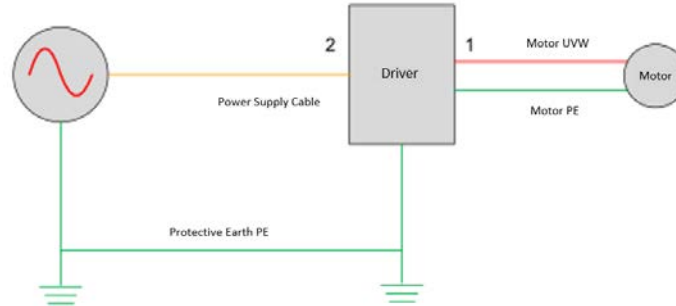


Please make sure RS485 communication connection is normal using a multimeter. Then, make sure the reference ground is corrected connected. If there is not no reference ground, please leave it unconnected. Same goes for cable shield foil.

### Signal interference



**External interference:** Magnetic ring can be intertwined within cable 1 and 2 to prevent external interference.

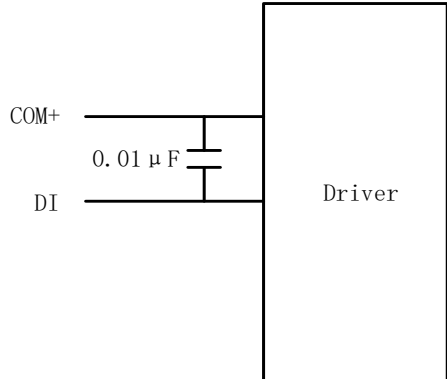


**Driver interference:** If interference occurs within the driver, please intertwine magnetic rings on cable 1 and 2. Please loop UVW cables around the magnetic ring for at least 3 rounds. Do not loop PE wire into the magnetic ring.

### Step-by-step problem solving

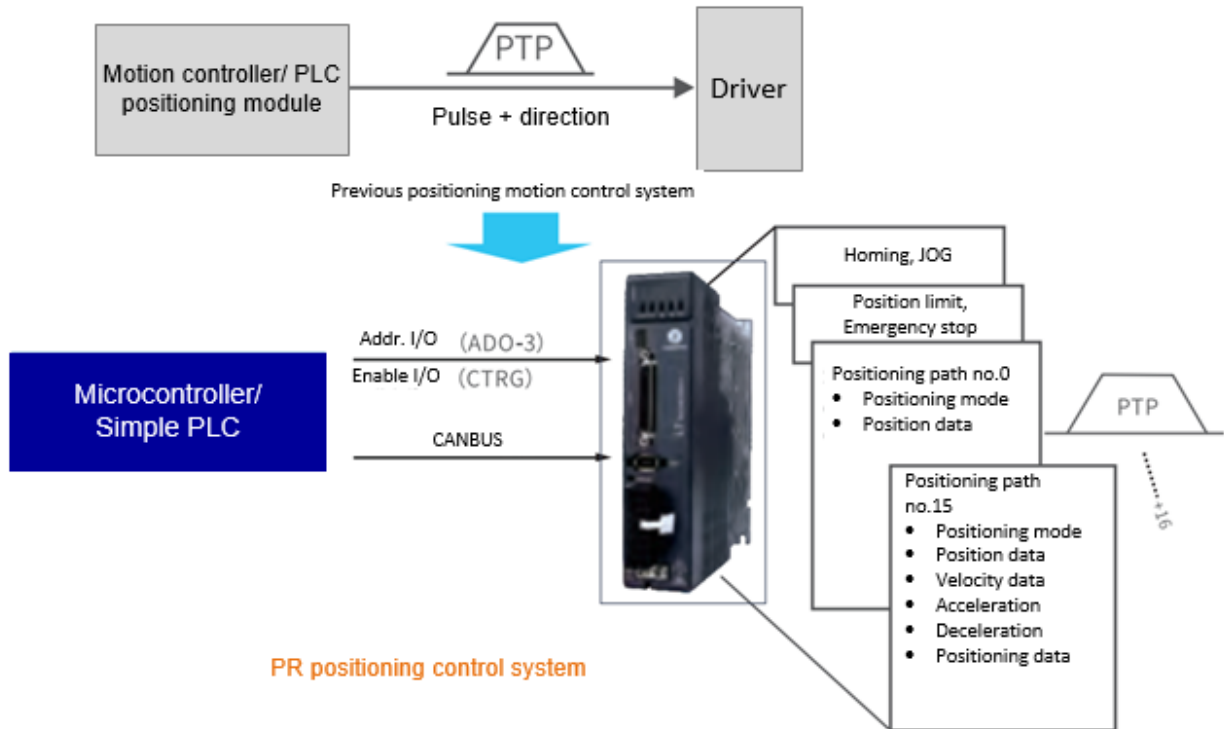
- 1: Verify if communication parameters setting are correct (ID not repeated, uniform Baud rate and data format);
- 2: If terminal resistor used is correct;
- 3: If wiring connection is correct;
- 4: Verify grounding and PE connection;
- 5: Communication cables should be separated from power cables.

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 $\mu$ F 

## Chapter 8 PR Functions

PR function is a control module in servo drive that controls single axis motion using PProcedure 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 Pr0.01 = 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 <ol style="list-style-type: none"> <li>1. Homing mode configurable. Can be chosen between position limit signal homing, origin signal homing and manually set home;</li> <li>2. Homing direction configurable;</li> <li>3. Specific position can be set after homing completed;</li> <li>4. Homing velocity, acceleration and deceleration configurable.</li> <li>5. High homing velocity to locate origin and low homing velocity to look for Z-signal</li> </ol>
JOG	Forward/Reverse JOG through I/O control. Used for tuning. <ol style="list-style-type: none"> <li>1. JOG direction: forward JOG, reverse JOG</li> <li>2. JOG velocity and acceleration configurable</li> </ol>
Position limit	Prevent mechanical damage by limiting the range of motion <ol style="list-style-type: none"> <li>1. Positive/Negative position limit input through I/O</li> <li>2. Software position limit</li> <li>3. Position limit deceleration configurable</li> </ol>
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 <ol style="list-style-type: none"> <li>1. Path motion includes positioning, velocity and homing modes.</li> <li>2. I/O trigger includes rising edge, double edges trigger</li> <li>3. Supports continuous positioning;</li> <li>4. Max. 16 paths;</li> <li>5. Configurable position, velocity and acceleration/deceleration;</li> <li>6. Pause time/ timer configurable</li> </ol>
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.
Pr8.00	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
Pr8.01	Path count	16 paths	0X6001
Pr8.02	Control Operation	--	0X6002
Pr8.06	Software positive limit H	High 16-bit of software positive limit	0X6006
Pr8.07	Software positive limit L	Software positive limit (Only able to read low 16-bit using 485 communication)	0X6007
Pr8.08	Software negative limit H	High 16-bit of software negative limit	0X6008
Pr8.09	Software negative limit L	Software negative limit (Only able to read low 16-bit using 485 communication)	0X6009
Pr8.10	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  <i>Single turn Z homing is homing method within 1 revolution, has nothing to do with Bit 8 Z-signal.</i>	0X600A
Pr8.11	Zero position H	High 16-bit of zero position	0X600B
Pr8.12	Zero position L	Zero position (Only able to read low 16-bit using 485 communication)	0X600C
Pr8.13	Home position offset H	High 16-bit of home position offset	0X600D
Pr8.14	Home position offset L	Home position offset (Only able to read low 16-bit using 485 communication)	0X600E
Pr8.15	High homing velocity	Set high homing velocity	0X600F

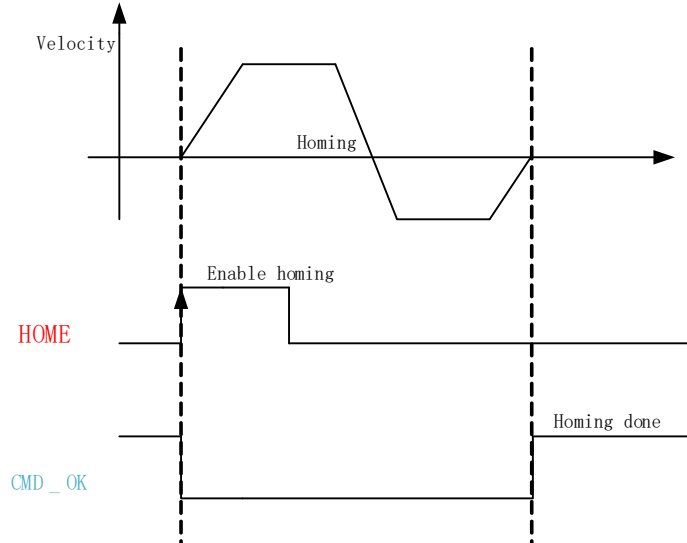
Pr8.16	Low homing velocity	Set low homing velocity	0X6010
Pr8.17	Homing acceleration	Set homing acceleration	0X6011
Pr8.18	Homing deceleration	Set homing deceleration	0X6012
Pr8.19	Homing torque holding time	Set homing torque holding time	0X6013
Pr8.20	Homing torque	Set homing torque value	0X6014
Pr8.21	Homing overtravel alarm range	Set homing overtravel alarm threshold, set to 0 to deactivate the alarm	0X6015
Pr8.22	Emergency stop at limit deceleration	Set position limit emergency stop deceleration	0X6016
Pr8.23	STP emergency stop deceleration	Set STP emergency stop deceleration	0X6017
Pr8.26	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
Pr8.27	I/O combination filter	Set I/O combination filter time	0X601B
Pr8.28	S-code current output value	Display S-code output	0X601C
Pr8.29	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 <i>N</i>	0X601D
Pr8.39	JOG velocity	Set JOG velocity	0X6027
Pr8.40	JOG acceleration	Set JOG acceleration	0X6028
Pr8.41	JOG deceleration	Set JOG deceleration	0X6029
Pr8.42	Command position H	High 16- bit of command position	0X602A
Pr8.43	Command position L	Command position (Only able to read low 16-bit using 485 communication)	0X602B
Pr8.44	Motor position H	High 16- bit of motor position	0X602C
Pr8.45	Motor position L	Motor position (Only able to read low 16-bit using 485 communication)	0X602D
Pr8.46	Input	Input status	0X602E
Pr8.47	Output	Output status	0X602F
Pr8.48 - Pr8.63	S-code setting	Path <i>N</i> 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

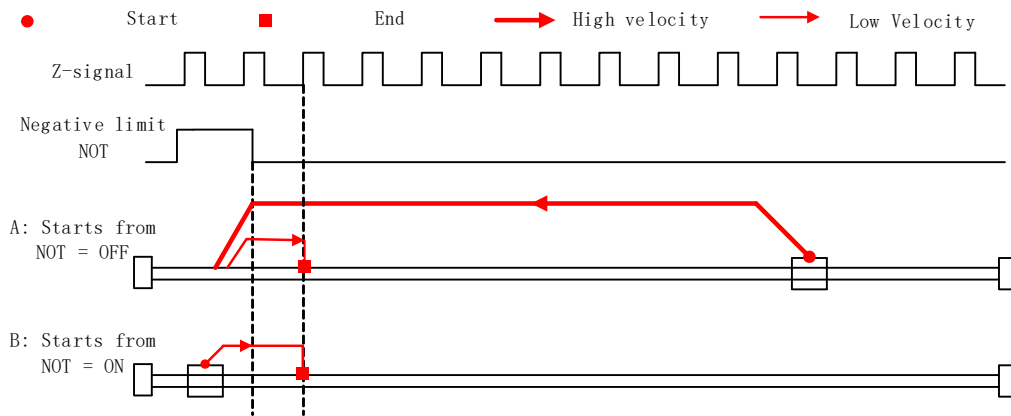


1. **HOME**: Homing trigger signal. When HOME is valid, homing will be done according to set homing method.
2. **CMD\_OK**: Command completed signal. Invalid when command is being carried out, valid when command is done.
3. Please refer to Pr8.10 to set homing methods and other homing mode related settings. It is recommended to use Motion Studio to modify the control parameters in PR mode.

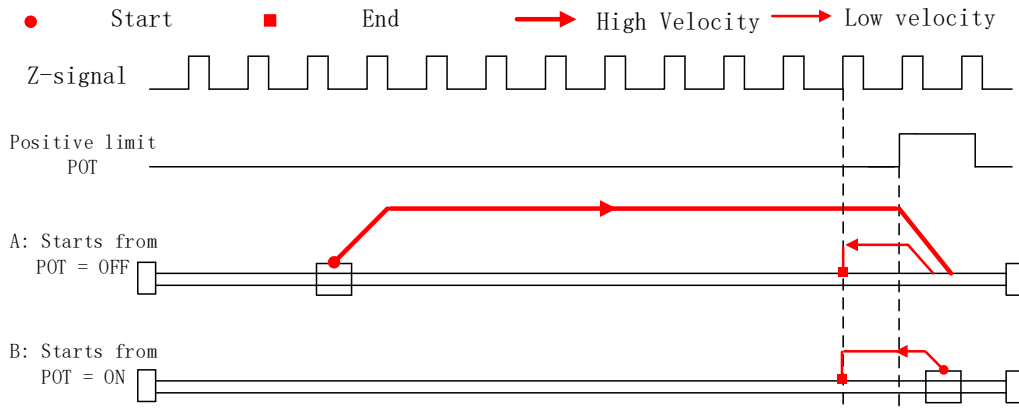
Pr8.10	Label	Homing mode			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X600A
To set homing method in PR mode. It is recommended to modify PR control parameters using Motion Studio.						
<b>Bit</b>	8 (Z-signal homing)	2-7 (Homing mode)	1 (Specific position after homing)	0 (Homing direction)		
<b>Description</b>	=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

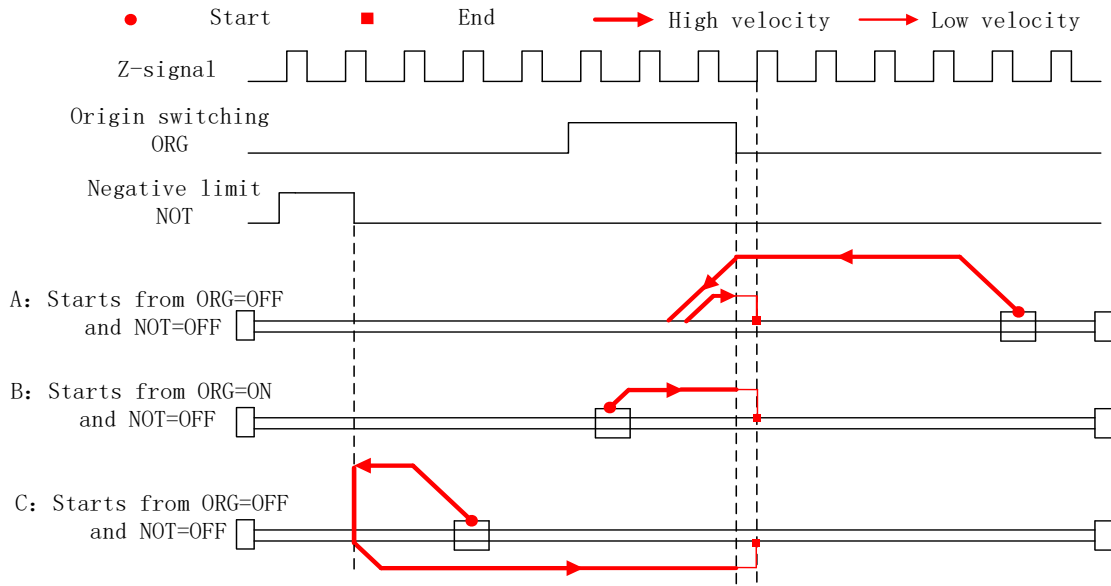
### 1. Negative limit homing



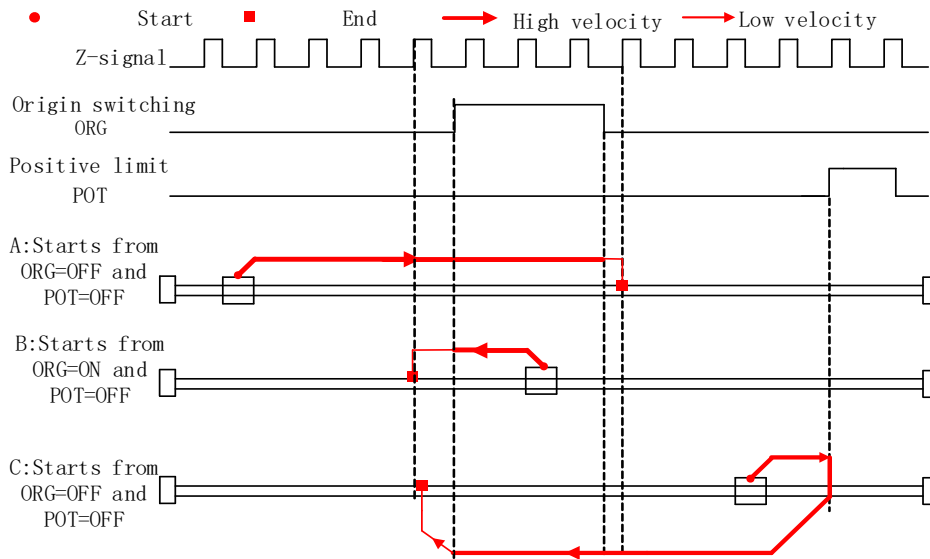
### 2. Positive limit homing



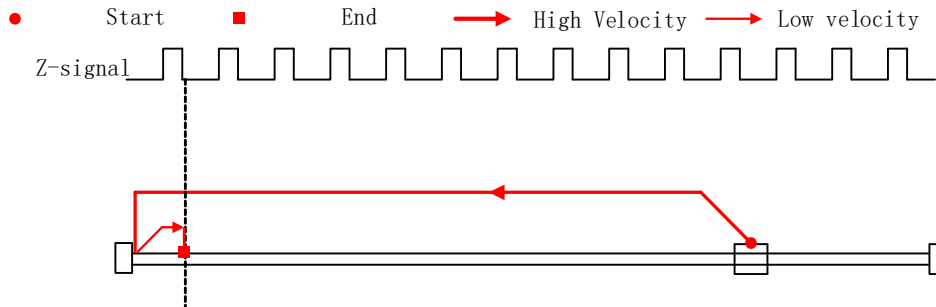
### 3. Origin homing – Negative direction



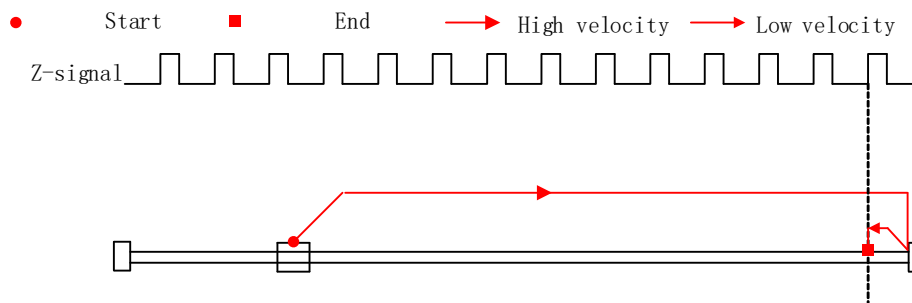
#### 4. Origin homing – Positive direction



#### 5. Torque homing – Negative direction



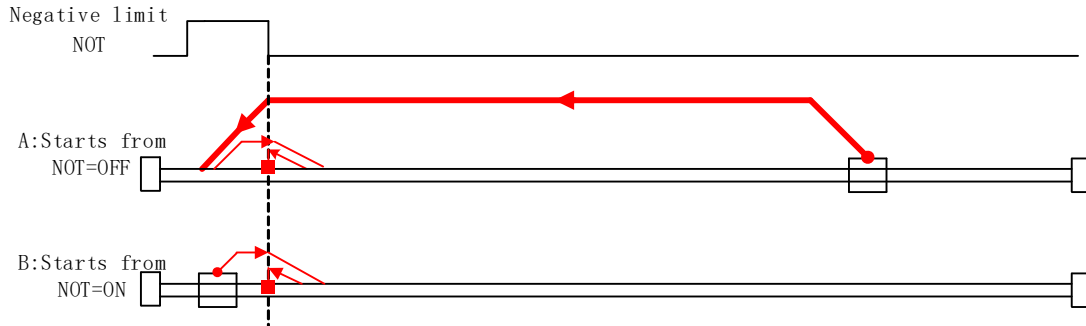
#### 6. Torque homing – Positive direction



## Position limit, origin, Z-signal, torque and manual set home (Homing with single condition)

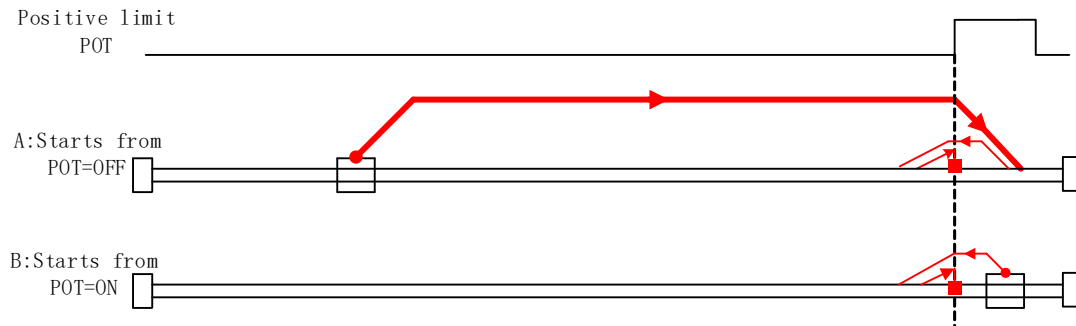
### 1. Negative limit homing

● Start    ■ End    → High velocity    → Low velocity



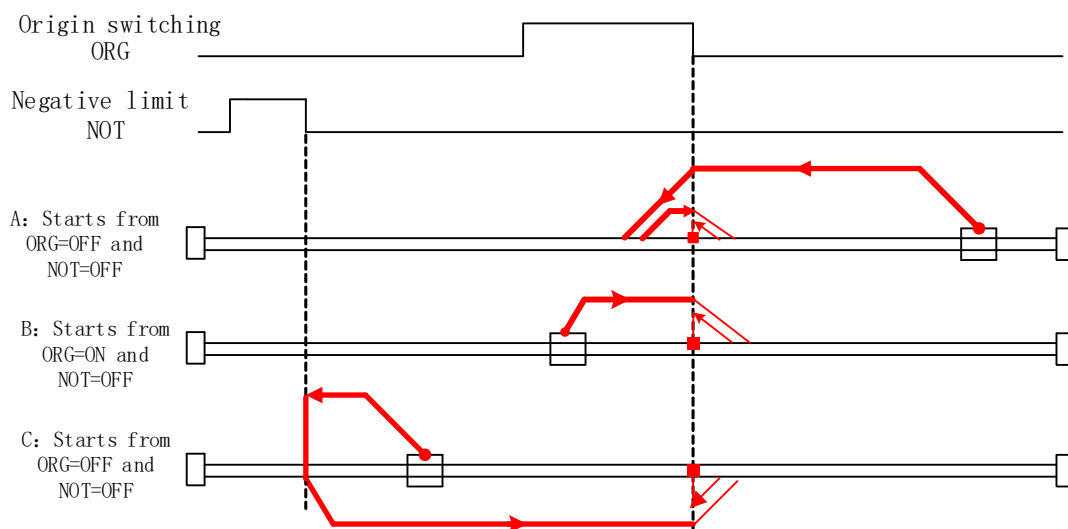
### 2. Positive limit homing

● Start    ■ End    → High velocity    → Low velocity



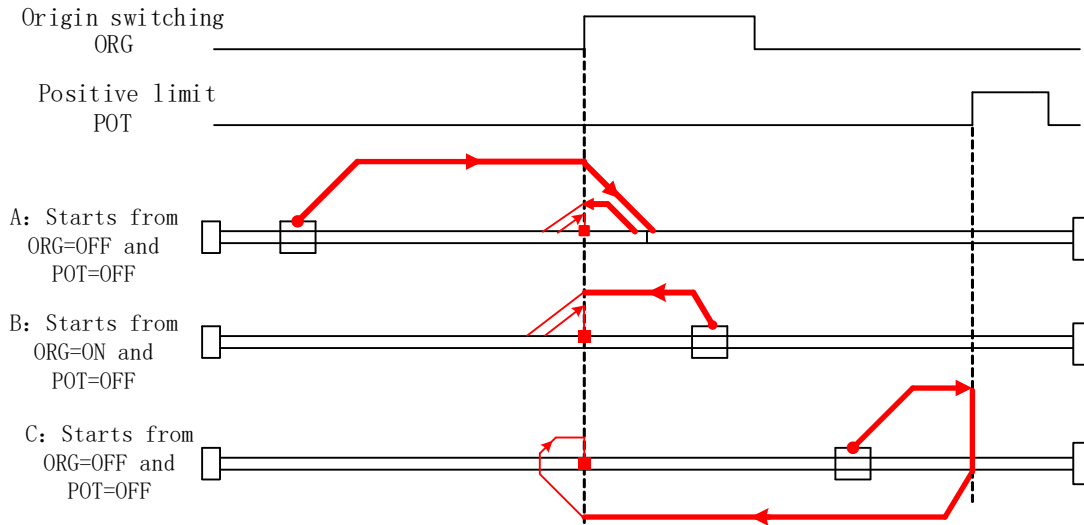
### 3. Origin homing – Negative direction

● Start    ■ End    → High velocity    → Low velocity




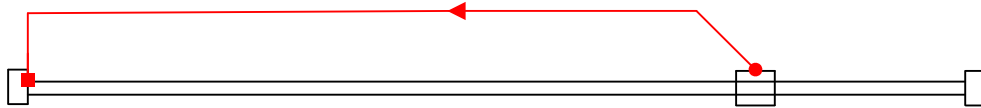
#### 4. Origin homing – Positive direction

● Start    ■ End     High velocity     Low velocity




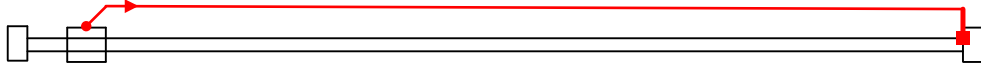
#### 5. Torque homing – Negative direction

● Start    ■ End     Low velocity



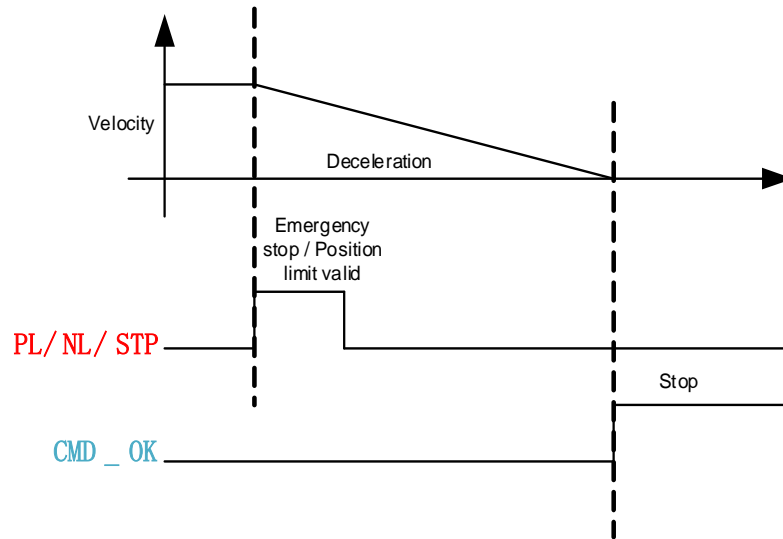
#### 6. Torque homing – Positive direction

● Start    ■ End     Low velocity



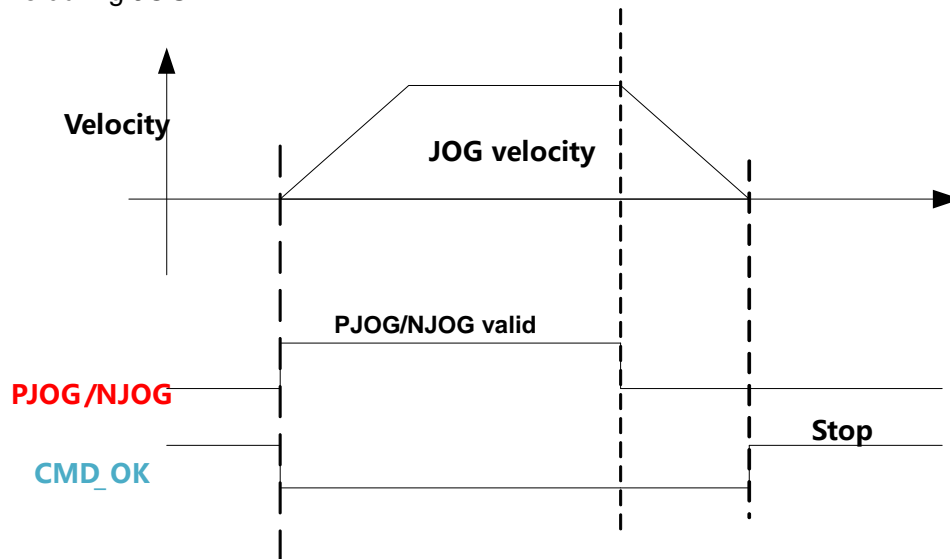
### 8.3.2 Position limit and emergency stop

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





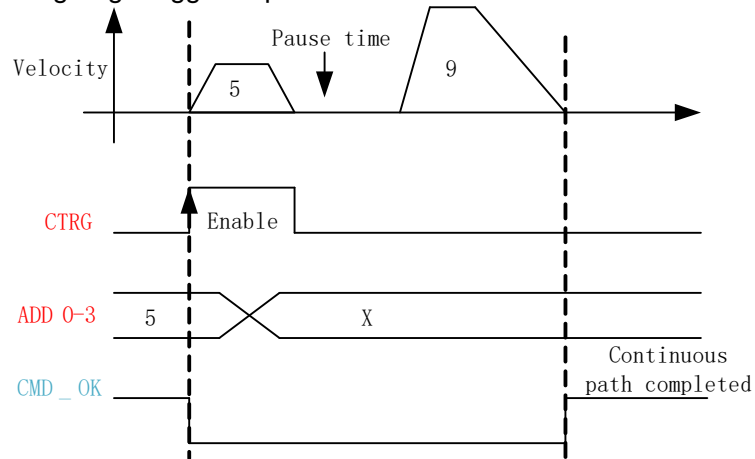
### 8.3.4 Path motion

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.
Pr9.00	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 <i>Indicates using P/V/H/S</i> Bit 4: 0: Can be Interrupted 1: Can't be Interrupted, indicates using ! Bit 5: OVL P: 0: No overlap, indicates with SJ 1: Overlap, indicated with CJ Bit 6-7: 0: absolute 1: relative command 2: relative motor <i>Corresponding to ABS/INC/REL</i> Bit8-13: 0-15: Jump to corresponding path <i>Indicates using SJ0x or CJ0x</i> Bit 14: JUMP: 0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0X6200
Pr9.01	PR position H	High 16-bit of PR path position	0X6201
Pr9.02	PR position L	PR position (Only able to read low 16-bit using 485 communication)	0X6202
Pr9.03	Velocity	Velocity, rpm	0X6203
Pr9.04	Acceleration time	Unit ms/1000rpm	0X6204
Pr9.05	Deceleration time	Unit ms/1000rpm	0X6205
Pr9.06	Pause time	Pause time after command completed	0X6206
Pr9.07	Special parameter	Mapped to Pr8.02	0X6207
Pr9.08 ~ Pr9.127		8 parameters for each path. Please refer to Class 9 parameter in Chapter 3	

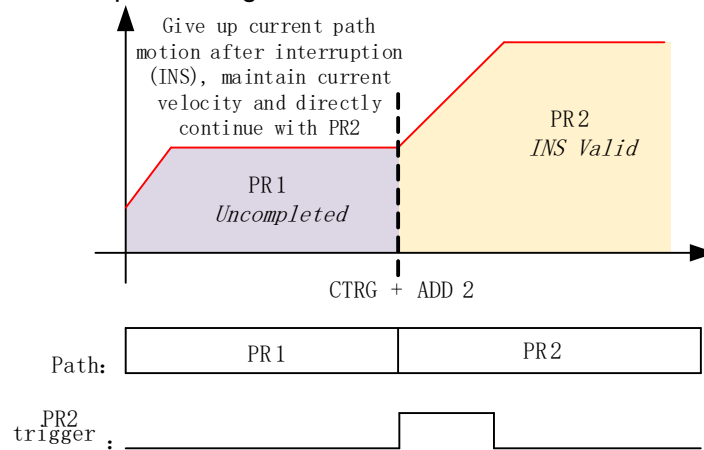
### Segmented trigger

CTRG rising edge/double edges trigger (Pr8.00) a segmented motion. Please refer to the sequence diagram below with rising edge trigger of path 5.



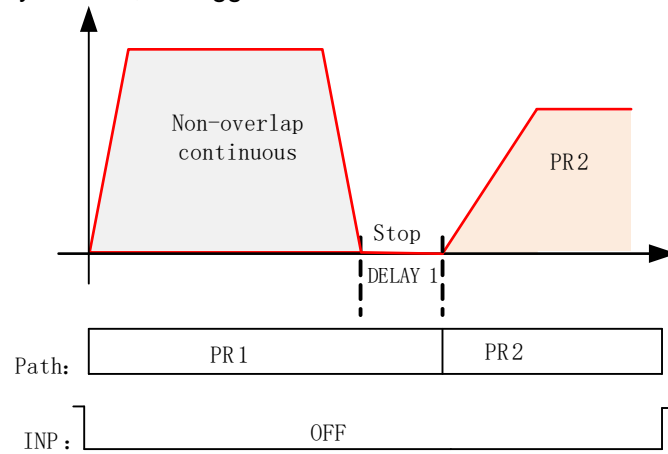
### Multi-path interrupted motion

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



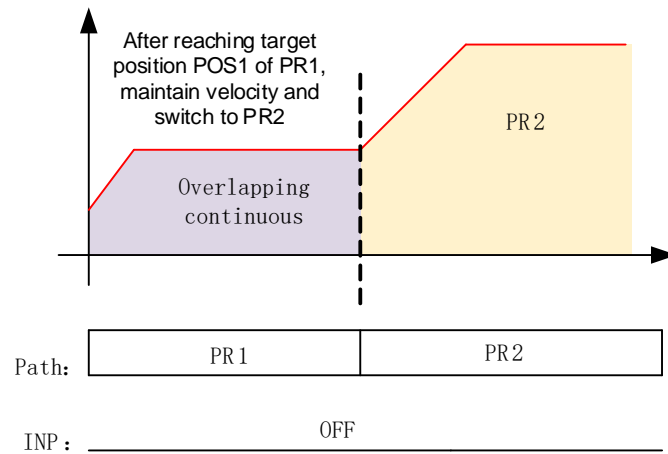
### Non-overlap continuous motion

Path motion continues by another, no trigger needed for the next one to start.



### Overlapping continuous motion

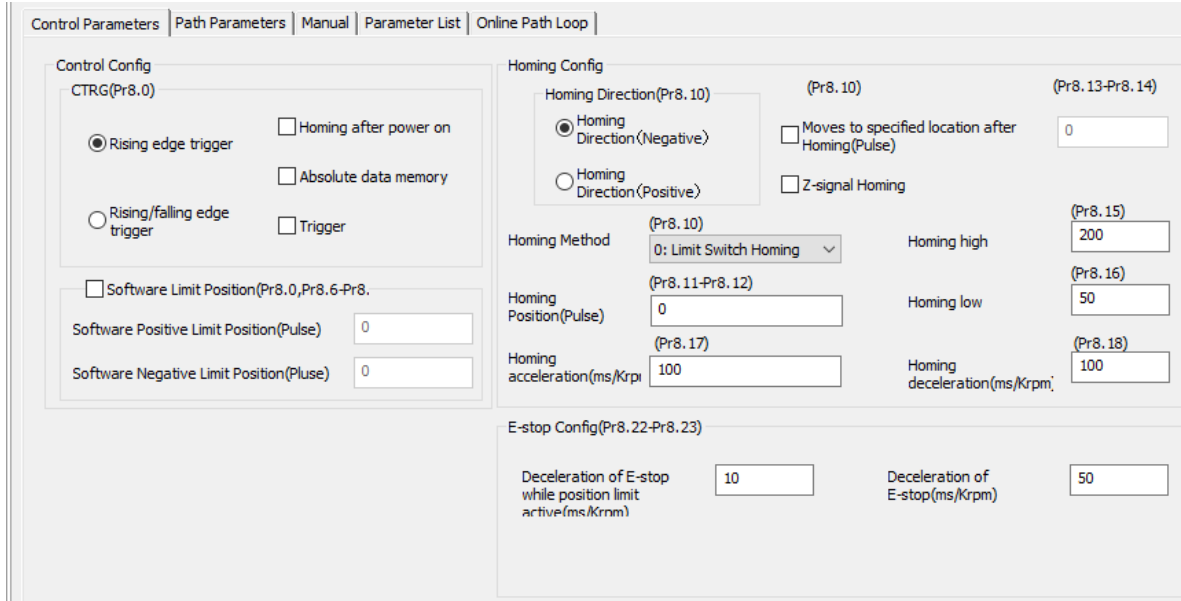
Path motion starts immediate after the previous path motion is completed without deceleration or trigger in between.



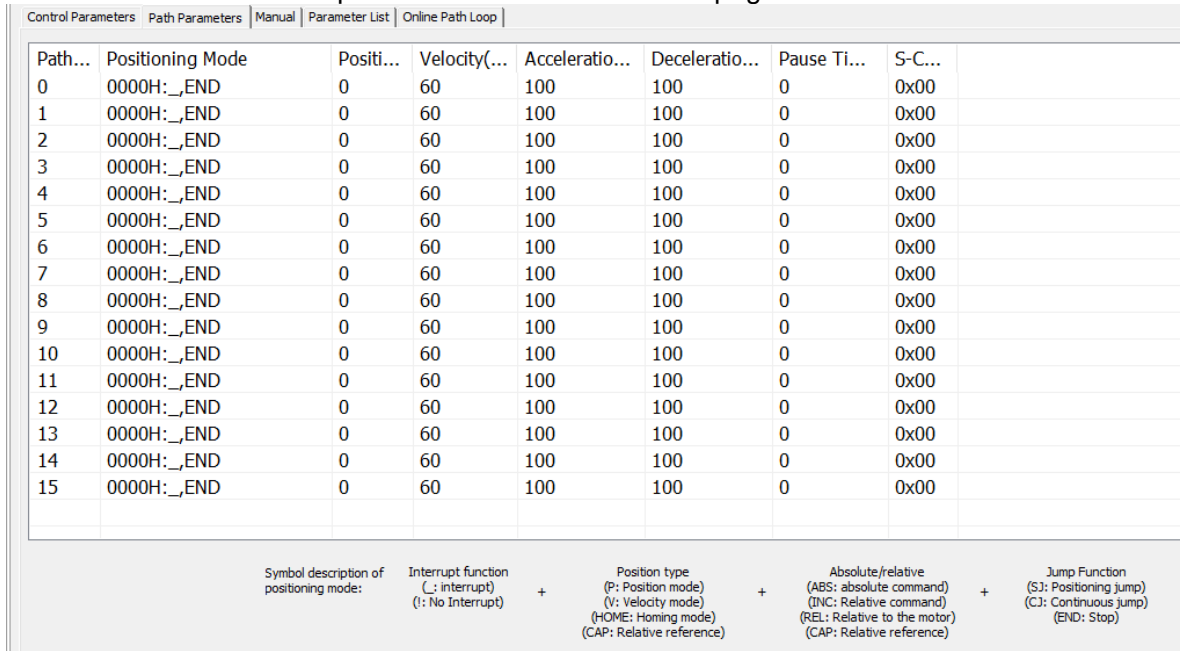
## 8.4 PR Control

### 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

Symbol description of positioning mode: Interrupt function (.: interrupt) (!: No Interrupt) + Position type (P: Position mode) (V: Velocity mode) (HOME: Homing mode) (CAP: Relative reference) + Absolute/relative (ABS: absolute command) (INC: Relative command) (REL: Relative to the motor) (CAP: Relative reference) + Jump Function (SJ: Positioning jump) (CJ: Continuous jump) (END: Stop)

All class 9 parameters for 0-15 paths can be found here once connected to a servo drive that supports PR mode.

Control Parameters | Path Parameters | Manual | Parameter List | Online Path Loop

Motion Operation

Pr9.02 Position(P)  'velocity(rpm) Pr9.03  Acceleration(ms/Krpm) Pr9.04  Deceleration(ms/Krpm) Pr9.05  Pause Time(ms) Pr9.06

Pr9.00 Positioning Mode

Homing

Pr8.46 Input  Pr8.43 Command

Pr8.47 Output  Pr8.45 Motor Position(Pulse)   Auto Refresh

Trigger 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	PAS.00	Pr control setting	0x0	0x0	0xFFFF	0x0	--	Set in the Control Parameter Window
40962	PAS.01	Pr motion path number	16	16	16	16	--	None
40964	PAS.02	Control register	0x0	0x0	0xFFFF	0x0	--	None
40974	PAS.07	Positive software limit L	0	-214...	21474...	0	pluse	None
40978	PAS.09	Negative software limit L	0	-214...	21474...	0	pluse	None
40980	PAS.10	Homing Method	0x0	0x0	0xFFFF	0x0	--	Set in the Control Parameter Window
40984	PAS.12	Homing position L	0	-214...	21474...	0	pluse	None
40988	PAS.14	Homing stop position L	0	-214...	21474...	0	pluse	None
40990	PAS.15	Homing high speed	200	1	6000	200	rpm	None
40992	PAS.16	Homing low speed	50	1	6000	50	rpm	None
40994	PAS.17	Homing acceleration	100	1	32767	100	ms/Krpm	None
40996	PAS.18	Homing deceleration	100	1	32767	100	ms/Krpm	None
40998	PAS.19	Holding time of homing...	100	0	65535	100	ms	None
41000	PAS.20	Torque value of homing...	100	0	65535	100	%	None
41002	PAS.21	Overpass distance settin...	0	0	65535	0	0.1r	None
41004	PAS.22	Deceleration of E-stop w...	10	1	32767	10	ms/Krpm	None
41006	PAS.23	Deceleration of E-stop	50	1	32767	50	ms/Krpm	None
41010	PAS.25	Absolute encoder positl...	0	-214...	21474...	0	--	None
41012	PAS.26	IO combined trigger mo...	0	0	65535	0	--	None
41014	PAS.27	IO combined filtering	5	0	65535	5	ms	None
41016	PAS.28	Output value of S code	0x0	0x0	0xFFFF	0x0	--	None
41018	PAS.29	PR alarm	0x0	0x8...	0x7FFF...	0x0	--	None

All PR mode and control parameters can be found on this list for convenience of tuning

Control Parameters | Path Parameters | Manual | Parameter List | Online Path Loop

Loop triggering

Pr8.43 Command position (P)  Current path  Outer loop count

Pr8.45 Motor position (P)  Current loop count

Path	Path loop count	Interval(ms)	Jump interval(ms)
0	1	100	100
1	1	100	100

Right click the list to add a ...

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.

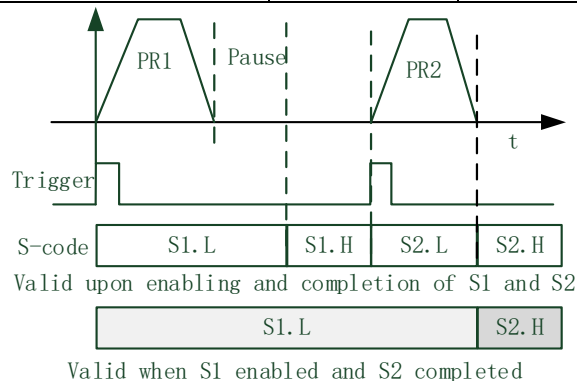
Input				Output			
Label	Signal	Value		Label	Signal	Value	
		NO	NC			NO	NC
Command trigger	CTRG	20h	A0h	Command completed	CMD_OK	20h	A0h
Homing	HOME	21h	A1h	Path completed	PR_OK	21h	A1h
Forced emergency stop	STP	22h	A2h	Homing completed	HOME_OK	22h	A2h
Positive JOG	PJOG	23h	A3h	S-code 0	SD0	23h	A3h
Negative 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.

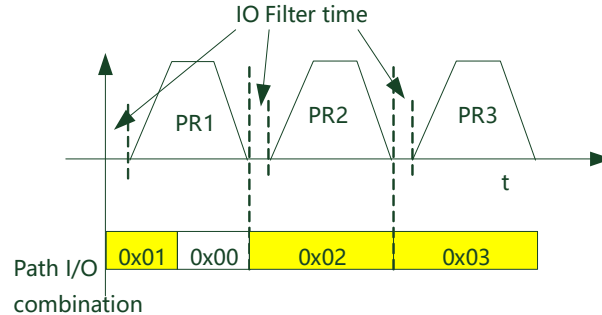
S-code	Sx.H	Sx.L
Bit	15	8-14
Description	S-code valid when completed. 0: Invalid, retain previous value 1: Valid	S-code upon completion
		S-code valid upon activation 0: Invalid 1: Valid
		S-code upon activation



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(Pr8.26). 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  $x>0 \rightarrow x$  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.*

Pr8.26	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				
	<b>【0】</b>	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 Pr8.26.					
	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

Parameter	Label	Description																												
Pr5.29	Communication mode	485 communication mode data																												
		<table border="1"> <thead> <tr> <th>Value</th> <th>Bit</th> <th>Checksum</th> <th>Stop</th> </tr> </thead> <tbody> <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><b>【5】</b></td> <td>8</td> <td>Null</td> <td>2</td> </tr> </tbody> </table>	Value	Bit	Checksum	Stop	0	8	Even	2	1	8	Odd	2	2	8	Even	1	3	8	Odd	1	4	8	Null	1	<b>【5】</b>	8	Null	2
		Value	Bit	Checksum	Stop																									
		0	8	Even	2																									
		1	8	Odd	2																									
		2	8	Even	1																									
		3	8	Odd	1																									
4	8	Null	1																											
<b>【5】</b>	8	Null	2																											
Pr5.30	Baud rate	To set communication speed of RS485 communication																												
		<table border="1"> <thead> <tr> <th>Value</th> <th>Baud rate</th> <th>Value</th> <th>Baud rate</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2400bps</td> <td><b>【4】</b></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> </tbody> </table>	Value	Baud rate	Value	Baud rate	0	2400bps	<b>【4】</b>	38400bps	1	4800bps	5	57600bps	2	9600bps	6	115200bps	3	19200bps										
		Value	Baud rate	Value	Baud rate																									
		0	2400bps	<b>【4】</b>	38400bps																									
		1	4800bps	5	57600bps																									
2	9600bps	6	115200bps																											
3	19200bps																													
Pr5.31	ID	Modbus slave ID address																												
Pr8.02	PR trigger	<table border="1"> <thead> <tr> <th>Attribute</th> <th>Index</th> <th>Description</th> </tr> </thead> <tbody> <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> </tbody> </table>	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	
		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																												

PR mode communication address:

Class 8 parameters:  $0x6000 + (\text{Param-ID} - 800)$ . For example Pr8.06:  $0x6000 + (806 - 800) = 0x6006$

Class 9 parameters:  $0x6200 + (\text{Param-ID} - 900)$ . For example Pr9.06:  $0x6200 + (906 - 900) = 0x6206$



## 8.4.4 Path trigger

### Fixed trigger

Fixed triggering method is to set all 16 paths homing and other settings, then through Pr8.02 (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(Pr8.02) 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 Pr9.07 mapped into Pr8.02. When 0x10 is written into Pr8.02, 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 Pr8.02.
3. Realize path motion by writing into Pr9.00 – Pr9.07 with Pr9.07 = 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	Pr9.00	Mode	XXXX
10-11	Pr9.01	Position high bit	XXXX
12-13	Pr9.02	Position low bit	XXXX

14-15	Pr9.03	Velocity	XXXX
16-17	Pr9.04	Acceleration	XXXX
18-19	Pr9.05	Deceleration	XXXX
20-21	Pr9.06	Delay time	XXXX
22-23	Pr9.07	Trigger control	0x0010
24	CRC	Checksum Lo	
25		Checksum Hi	

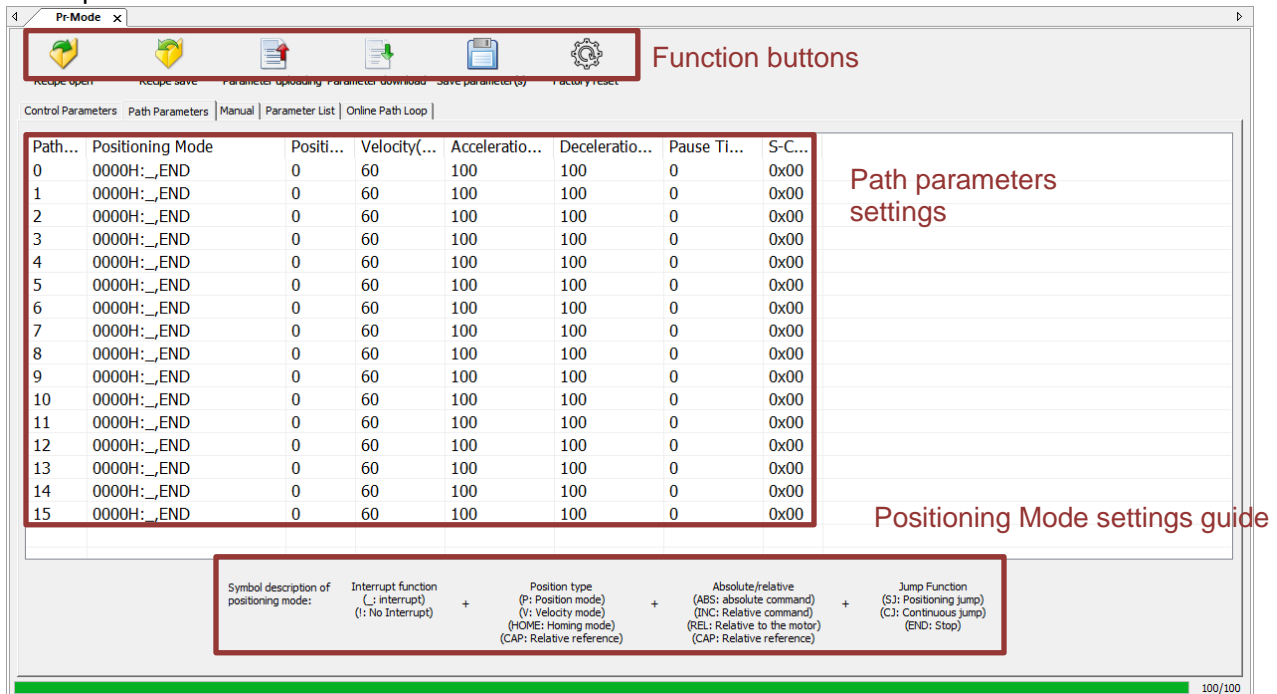
### Slave response frame byte data

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 Pr0.01 = 6. Required PR I/Os are set in Pr4.00-Pr4.15
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:



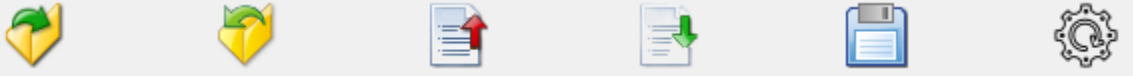
The screenshot shows the 'Pr-Mode' software interface. At the top, there is a toolbar with icons for 'Recipe open', 'Recipe save', 'Parameter uploading', 'Parameter download', 'Save parameter(s)', and 'Factory reset'. Below the toolbar, there are tabs for 'Control Parameters', 'Path Parameters', 'Manual', 'Parameter List', and 'Online Path Loop'. The main area displays a table of path parameters:

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

At the bottom, there is a legend for the 'Symbol description of positioning mode':

Symbol description of positioning mode: Interrupt function ( \_: interrupt (!: No Interrupt) ) + Position type (P: Position mode) (V: Velocity mode) (HOM: Homing mode) (CAP: Relative reference) + Absolute/relative (ABS: absolute command) (INC: Relative command) (REL: Relative to the motor) (CAP: Relative reference) + Jump Function (SJ: Positioning jump) (CJ: Continuous jump) (END: Stop)

**Function buttons:** Upload, download parameters to/from drives, save parameter, backup and reset to factory default.



**Parameters:** Set PR path related parameters here

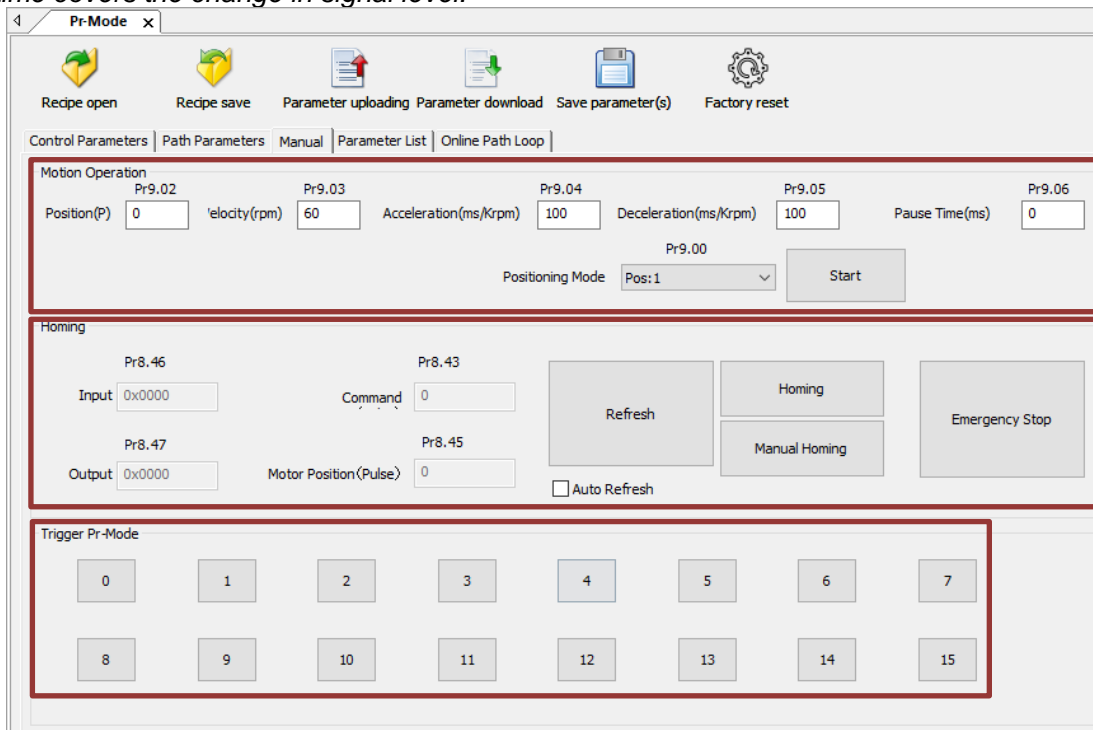
**Descriptions:** Short explanation on each PR path motion types

*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

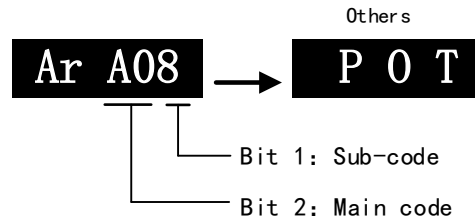
No.	485 communication data frame	Description
1	01 06 60 0A 00 00 B7 C8	Set homing method
2	01 06 60 0F 00 64 A6 22	Set high homing velocity
3	01 06 60 10 00 1E 16 07	Set low homing velocity
4	01 06 60 02 00 20 37 D2	Trigger homing
5	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

## 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.

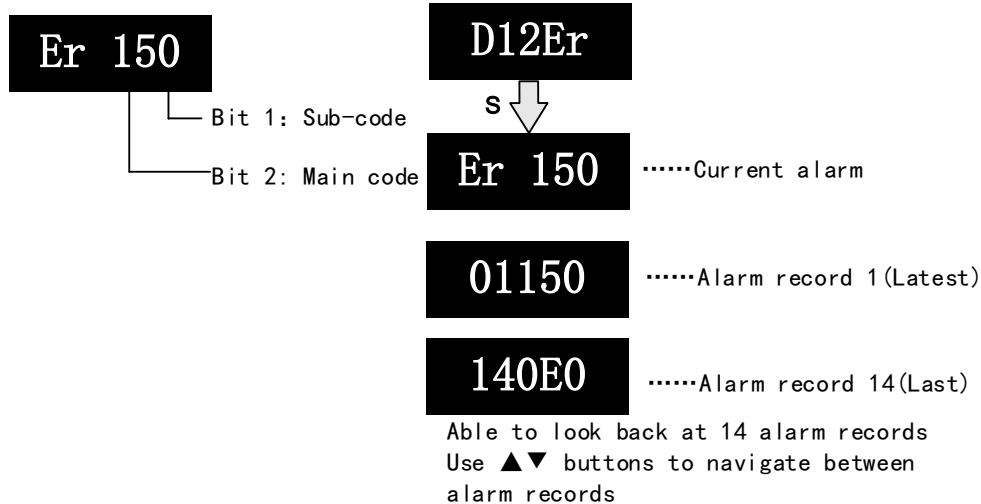
Example of warning code:



Warning Code		Content
Main	Code	
A0	1	Overload warning
	2	Regeneration energy overload warning( <b>85% of the regeneration threshold</b> )
	3	Absolute encoder <b>battery voltage low (&lt;3.1V)</b> . Valid when Pr0.15 is set to 1.
	4	Change the parameter to a non-real time valid warning
	7	Low temperature warning ( < 20°C)
	8	Positive limit switch valid. <b>POT</b> blinking on front panel
	9	Negative limit switch valid. <b>NOT</b> blinking on front panel
	A	Positive and negative limit switch valid. <b>PNOT</b> blinking on front panel
	B	Current position is beyond software positive limit. <b>SPOT</b> blinking on front panel
	C	Current position is beyond software negative limit. <b>NPOT</b> blinking on front panel
	D	Current position is beyond software negative, positive limit. <b>SPNOT</b> blinking on front panel
	E	Parameters reset to factory default. Restart needed

## 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~F	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	●
12	0	Regenerative resistor overvoltage	●	2	
	1	Holding brake error	●	1	
	2	Regenerative resistor value too low	●	2	

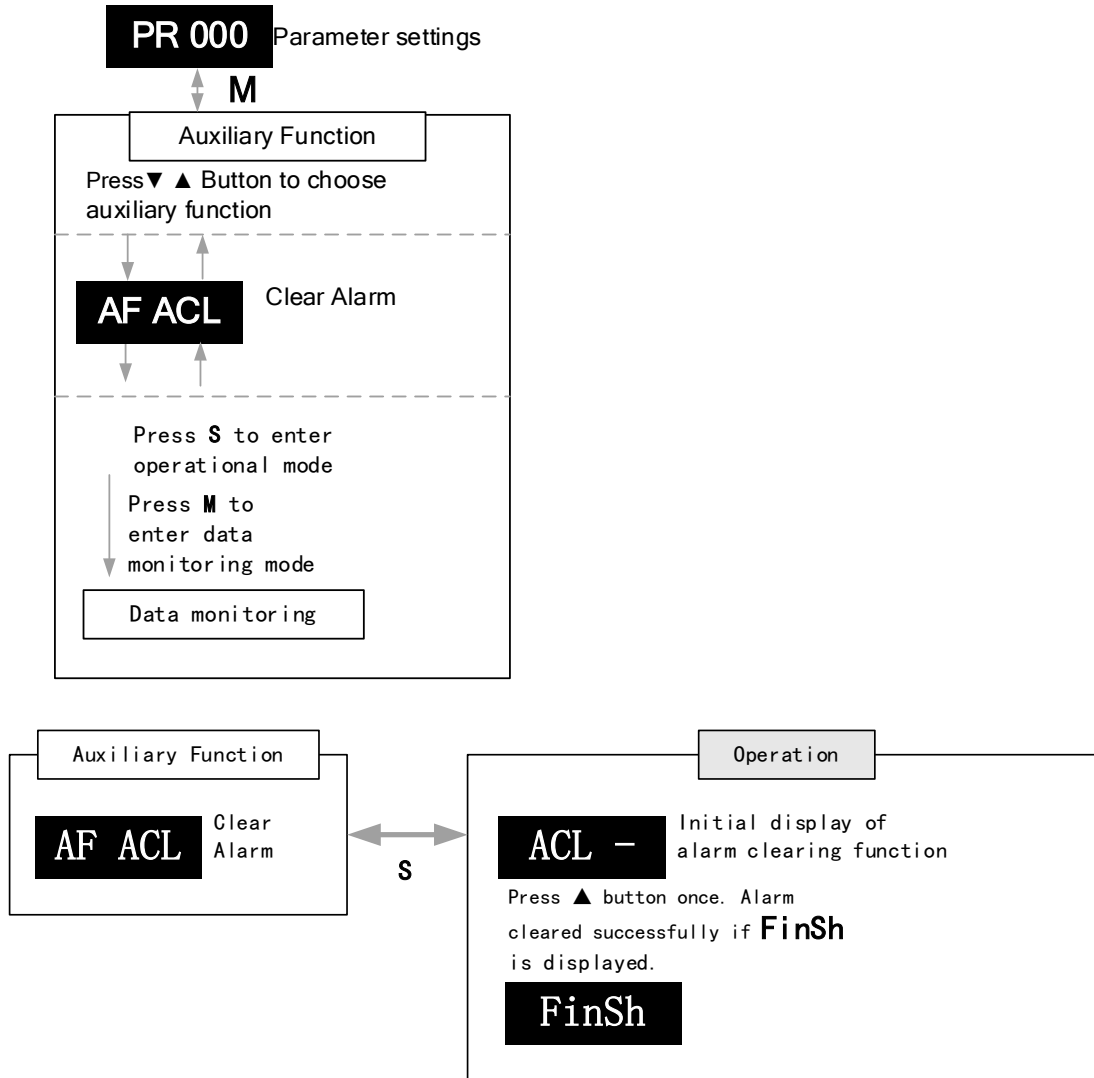
15	0	Encoder disconnected	●	1	
	1	Encoder communication error	●	1	
	2	Encoder initial position error	●	1	
	3	Multiturn encoder error	●	2	
	4	Encoder parameter settings error	●	2	
	5	Encoder data overflow	●	2	●
	6	Encoder overheated	●	2	●
17	7	Encoder counter error	●	2	●
	0	Encoder data error	●	1	
18	1	Encoder parameter initialization error	●	1	
	0	Excessive position deviation	●	2	●
19	1	Excessive velocity deviation	●	2	●
	0	Motor vibration too strong	●	2	●
1A	1	Excessive hybrid position deviation	●	1	●
	0	Overspeed	●	2	●
1b	1	Velocity out of control	●	1	●
	0	Bus input signal dithering	●	2	●
	1	Incorrect electronic gear ratio	●	2	●
	3	External encoder frequency divider parameter error	●	1	
21	4	Excessive synchronous position command	●	2	●
	0	I/O input interface assignment error	●	2	
	1	I/O input interface function assignment error	●	2	
24	2	I/O output interface function assignment error	●	2	
	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	
25	5	Error r/w communication parameters		2	
	0	Gantry deviation error	●	1	
26	1	Gantry communication error	●	1	
	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	●
29	0	Control mode not match under full closed loop mode	●	1	
	1	Encoder mode not match under full closed loop mode	●	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	
89	0	Homing error		2	●



**Save:** Save error messages to alarm history.

**Type:** The type 1 and type 2 fault stop mode can be set via Pr5.10 [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.*

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 090"--"Er 09F"
	09	0~F	<b>Content:</b> FPGA communication error
<b>Cause</b>			<b>Diagnosis</b>
L1, L2 terminal voltage too low			Verify L1, L2 terminal voltage
			<b>Solution</b>
			Make sure L1, L2 terminal voltage is within recommended range

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0A0"--"Er 0A1"
	0A	0~1	<b>Content:</b> Circuit current detection error
<b>Cause</b>			<b>Diagnosis</b>
Motor power cable wiring error			Verify motor power cable wiring
Main power supply undervoltage			Verify L1,L2,L3 terminal voltage
			<b>Solution</b>
			Make sure U,V,W terminal wired properly
			Increase main power supply voltage

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0A2" / "Er 0A4"
	0A	2 / 4	<b>Content:</b> Analog input error
<b>Cause</b>			<b>Diagnosis</b>
Analog input wiring error			Verify analog input wiring
			<b>Solution</b>
			Make sure of analog input wiring connection

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0A3"
	0A	3	<b>Content:</b> Motor power cable not connected
<b>Cause</b>			<b>Diagnosis</b>
Motor power cable not connected			Verify motor power cable wiring
Motor fault			/
			<b>Solution</b>
			Measure <b>resistance values between U, V, W terminals</b> , make sure the values are almost equal. If not, might be due to damaged motor or motor winding open circuit.
			Replace motor

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0A5"
	0A	5	<b>Content:</b> DC Bus error
<b>Cause</b>			<b>Diagnosis</b>
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.
			<b>Solution</b>
			Make sure L1, L2 terminal voltage is within recommended range

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0A6"
	0A	6	<b>Content:</b> Temperature measuring error
<b>Cause</b>			<b>Diagnosis</b>
L1, L2 terminal voltage too low			Verify L1, L2 terminal voltage
			<b>Solution</b>
			Make sure L1, L2 terminal voltage is within recommended range

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0b0"
	0b	0	<b>Content:</b> Control circuit power supply voltage too low
<b>Cause</b>			<b>Diagnosis</b>
Control circuit power supply voltage too low			Verify L1C, L2C terminal voltage; check if wiring connection is tight
Power supply under capacity			/
			<b>Solution</b>
			Increase L1C, L2C terminal voltage; Tighten L1C, L2C terminal connection
			Increase power supply capacity for L1C, L2C terminals

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0b1"
	0b	1	<b>Content:</b> Control circuit power supply abnormal
<b>Cause</b>			<b>Diagnosis</b>
USB power supply too low			Verify if USB cable is properly connected and not damaged.
			<b>Solution</b>
			Replace USB Type-C cable

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0c0"
	0c	0	<b>Content:</b> DC bus overvoltage
<b>Cause</b>			<b>Diagnosis</b>
Main power supply overvoltage			Verify L1,L2,L3 terminal voltage
Acceleration/deceleration time too short			Verify if the time is actually too short
Regenerative brake parameter anomaly			Verify Pr7.32/Pr7.33
Inner brake circuit damaged			/
			<b>Solution</b>
			Decrease main power supply voltage
			Increase the duration time or change to a regenerative resistor with higher resistance.
			Modify vent overload parameter
			Replace driver

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0d0"
	0d	0	<b>Content:</b> DC bus undervoltage
<b>Cause</b>			<b>Diagnosis</b>
Main power supply undervoltage			Verify L1,L2,L3 terminal voltage
L1C, L2C connected when USB cable is connected			Control circuit power on before driver initialization. Alarm might occur.
			<b>Solution</b>
			Increase main power supply voltage
			Please disconnect the USB cable before powering on control circuit.

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0d1"
	0d	1	<b>Content:</b> Single phasing of main power supply
<b>Cause</b>			<b>Diagnosis</b>
Main power supply undervoltage			Verify L1,L2,L3 terminal voltage
Main power supply wiring error			Loose connection of L1, L2, L3
			<b>Solution</b>
			Increase main power supply voltage
			Secure connections

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0d2"
	0d	2	<b>Content:</b> No main power supply detected
<b>Cause</b>			<b>Diagnosis</b>
No main power supply			Verify L1,L2,L3 terminal voltage
			<b>Solution</b>
			1. Increase main power supply voltage
			2. Secure connections

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0E0"
	0E	0	<b>Content:</b> Overcurrent
<b>Cause</b>			<b>Diagnosis</b>
Driver power output short circuit			Verify if there is short circuit between UVW terminals, or shorted to PG.
Motor wiring error			Verify motor wiring
IGBT module short circuit			Disconnect motor output cable. Then, enable servo driver to check for overcurrent
Control parameter anomaly			Verify if parameter exceeds recommended range
Control command anomaly			Verify if command motion is too acute
			<b>Solution</b>
			1. Make sure there is no circuit.
			2. Make sure motor is not damaged
			Reconnect motor wiring
			Replace driver
			Set parameter within recommended range.
			Modify control command; use filter

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0E1"
	0E	1	<b>Content:</b> Intelligent Power Module (IPM) overcurrent
<b>Cause</b>			<b>Diagnosis</b>
Driver power output short circuit			Verify if there is short circuit between UVW terminals, or shorted to PG.
Motor wiring error			Verify motor wiring
IGBT module short circuit			Disconnect motor output cable. Then, enable servo driver to check for overcurrent
IGBT module undervoltage			/
Control parameter anomaly			Verify if parameter exceeds recommended range
Control command anomaly			Verify if command motion is too acute
			<b>Solution</b>
			1. Make sure there is no circuit.
			2. Make sure motor is not damaged
			Reconnect motor wiring
			Replace driver
			Replace driver
			Set parameter within recommended range.
			Modify control command; use filter

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0E2"
	0E	2	<b>Content:</b> Power output to motor shorted to ground
<b>Cause</b>			<b>Diagnosis</b>
Driver U, V, W terminals shorted to ground			Disconnect motor power cable and check for short circuit between driver UVW and PE
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)
			<b>Solution</b>
			1. Reconnect wiring. 2. Change motor power cable.
			Replace motor

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0E4"
	0E	2	<b>Content:</b> Phase overcurrent
<b>Cause</b>			<b>Diagnosis</b>
Driver U, V, W terminals shorted to ground			Disconnect motor power cable and check for short circuit between driver UVW and PE
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
			<b>Solution</b>
			1. Reconnect wiring. 2. Change motor power cable.
			Replace motor

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 0F0"
	0F	0	<b>Content:</b> Driver overheated
<b>Cause</b>			<b>Diagnosis</b>
Temperature of power module exceeded upper limit			Measure the temperature of driver radiator.
			<b>Solution</b>
			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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 100"
	10	0	<b>Content:</b> Motor overloaded
<b>Cause</b>			<b>Diagnosis</b>
Load too heavy			Verify if actual load exceeds maximum value allowed
Strong mechanical vibration			Look for mechanical vibration from machine system
Motor or encoder cable wiring error			Verify motor and encoder wiring
Holding brake engaged			Verify holding brake terminal voltage
			<b>Solution</b>
			1. Decrease load 2. Adjust limit values
			1. Adjust gain value of control loop 2. Increase duration time for acceleration and deceleration
			1. Reconnect wiring 2. Replace motor and encoder cable
			Cut off holding brake

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 101"
	10	1	<b>Content:</b> Driver overloaded
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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.

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 102"
	10	2	<b>Content:</b> Motor rotor blocked
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Motor rotor blocked		Look for mechanical blockages	Check the machinery
Motor rotor blocking time threshold value too low		Verify value of Pr6.57	Adjust value of Pr6.57

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 120"
	12	0	<b>Content:</b> Regenerative resistor overvoltage
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 121"
	12	1	<b>Content:</b> Holding brake error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Holding brake circuit damaged		Regenerative resistor disconnected	Replace regenerative resistor
		Holding brake IGBT damaged	Replace driver

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 122"
	12	2	<b>Content:</b> Regenerative resistor value too low
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 150"
	15	0	<b>Content:</b> Encoder disconnected
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 151"
	15	1	<b>Content:</b> Encoder communication error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 152"
	15	2	<b>Content:</b> Encoder initial position error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Communication data abnormal		1. Verify if encoder power supply voltage is $DC5V \pm 5\%$ ; 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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 153"
	15	3	<b>Content:</b> Multiturn encoder error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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 Pr0.15 = 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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 154"
	15	4	<b>Content:</b> Encoder parameter settings error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Absolute encoder mode is incorrectly set.		Verify if encoder has multi-turn absolute value function.	Modify absolute encoder mode settings

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 155"
	15	5	<b>Content:</b> Encoder data overflow
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 156"
	15	6	<b>Content:</b> Encoder overheated
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
The encoder temperature is too high.		Verify if motor temperature is too high	Reduce encoder temperature.

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 157"
	15	7	<b>Content:</b> Encoder counter error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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 $DC5V \pm 5\%$ ; 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 Pr1.00 & Pr1.05 are too low	Increase values of Pr1.00 & Pr1.05
Torque limit too low		Verify if values of Pr0.13 & Pr5.22 are too low	Increase values of Pr0.13 & Pr5.22
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 181"
	18	1	<b>Content:</b> Excessive velocity deviation
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Deviation between set velocity and actual velocity is too great		Verify if value of Pr6.02 is too low	1. Increase value of Pr6.02; 2. Set Pr6.02 to 0, position error detection off.
Acceleration and deceleration duration time for set velocity is too low		Verify if value of Pr3.12 and Pr3.13 are too low	1. Increase value of Pr3.12, Pr3.13; 2. Adjust velocity gain to reduce velocity lag error

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 190"
	19	0	<b>Content:</b> Vibration too strong
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 191"
	19	1	<b>Content:</b> Excessive hybrid position deviation
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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 ( <b>Deviation between external encoder feedback position and motor feedback position</b> ) exceeds Pr0.33		Verify if Pr0.33 is set too low	Increase Pr0.33 set value accordingly but please aware that doing so might cause the position deviation to be higher.

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 1A0"
	1A	0	<b>Content:</b> Overspeed
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Motor velocity exceeded first speed limit (Pr3.21)		1. Verify if velocity command is too high; 2. Verify if simulated velocity command voltage is too high; 3. Verify if parameter value of Pr3.21 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 Pr3.21 value; 3. Adjust pulse train input frequency and division frequency coefficient; 4. Verify encoder wiring;

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 1A1"
	1A	1	<b>Content:</b> Velocity out of control
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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.

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 1b0"
	1b	0	<b>Content:</b> Bus input signal dithering
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Controller synchronization dithering		/	Increase alarm threshold value

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 1b1"
	1b	1	<b>Content:</b> Incorrect electronic gear ratio
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Values out of range		Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 1b3"
	1b	3	<b>Content:</b> External encoder frequency divider parameter error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Values out of range		Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 1b4"
	1b	4	<b>Content:</b> Excessive synchronous position mode command
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Values out of range		Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 210"
	21	0	<b>Content:</b> I/O input interface assignment error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Input signal assigned with two or more functions.		Verify values of Pr4.00-Pr4.09, Pr4.44-4.47	Set proper values for Pr4.00-Pr4.09, Pr4.44-4.47

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 211"
	21	1	<b>Content:</b> I/O input interface function assignment error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Input signal assignment error		Verify values of Pr4.00-Pr4.09, Pr4.44-4.47	Set proper values for Pr4.00-Pr4.09, Pr4.44-4.47

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 212"
	21	2	<b>Content:</b> I/O output interface function assignment error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Input signal assigned with two or more functions.		Verify values of Pr4.10-Pr4.15	Set proper values for Pr4.10-Pr4.15
Input signal not assigned		Verify values of Pr4.10-Pr4.15	Set proper values for Pr4.10-Pr4.15

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 240"
	24	0	<b>Content:</b> CRC correction error during EEPROM parameter saving
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 260"
	26	0	<b>Content:</b> Positive/Negative position limit triggered under non-homing mode
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Positive/negative position limit triggered		Verify position limit signal	/

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 270" -- "Er 272"
	27	0~2	<b>Error description:</b> Analog input 1-3 out of range
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Analog value out of range		Verify if analog input value is out of range	Adjust analog input voltage

<b>Error code</b>	Main	Sub	<b>Display:</b> "Er 280"
	28	0	<b>Error description:</b> Output pulse frequency too high
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> “Er 570”
	57	0	<b>Error description:</b> Forced alarm input valid
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Forced alarm input signal occurred		Verify forced alarm input signal	Verify if the input wiring connection is correct

<b>Error code</b>	Main	Sub	<b>Display:</b> “Er 5F0”
	5F	0	<b>Content:</b> Motor model no. detection error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Automatically detected motor doesn't match set motor		/	Please contact our technical support

<b>Error code</b>	Main	Sub	<b>Display:</b> “Er 5F1”
	5F	1	<b>Error description:</b> Driver power module detection error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Driver power rating not within range.		Restart driver	Please contact our technical support

<b>Error code</b>	Main	Sub	<b>Display:</b> “Er 600”
	60	0	<b>Error description:</b> Main loop interrupted timeout
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
The motor control loop calculation time overflow		Check for interference from devices releasing electromagnetic field	Ground driver and motor to reduce interference
		Restart driver	Replace driver

<b>Error code</b>	Main	Sub	<b>Display:</b> “Er 601”
	60	1	<b>Error description:</b> Velocity loop interrupted timeout
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
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

<b>Error code</b>	Main	Sub	<b>Display:</b> “Er 700”
	Extra 70	0	<b>Error description:</b> Encryption error
<b>Cause</b>		<b>Diagnosis</b>	<b>Solution</b>
Encryption error during initialization upon power-on.		Restart driver	Please contact our technical support

Error code	Main	Sub	Display: "Er 890"
		89	0
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

## 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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