OSD-H-*-P Series AC Servo Drive

User Manual

Foreword

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

Please contact us at info@optimusdrive.ru 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

Warning

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

Upon receiving

Caution

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

Transportation

Caution

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

Installation

Caution

Servo drive and Motor:

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

Servo drive:

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

Servo Motor:

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

Wiring

Warning

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

Caution

- ✓ Wiring must be correctly connected to prevent damage to product(s)
- ✓ Servo motor U, V, W terminal should be connected correctly and NOT connected directly to an AC power supply.
- ✓ Capacitor, inductor or filter shouldn't be installed between servo motor and servo drive.
- ✓ Connecting wires or any non-heat resistant components should not 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

Optimus Drive warranty only covers Optimus Drive AC servo products that are obtained through **Optimus Drive certified sales channel**.

Warranty claim

- All Optimus Drive 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 Optimus Drive global site www.OptimusDrive.ru 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 Optimus Drive certified global network of retailers/distributors.

Before warranty claim

- Please backup device parameters before any repair work/warranty claim. Optimus Drive and Optimus Drive 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.

Optimus Drive LLC. 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

OSD-H Series AC Servo Product is a whole new midrange AC servo drivers and motors product range that we have proudly developed at Optimus Drive LLC. 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.

OSD-H-*-P Series AC Servo Drive comes with power rating from 400W up to 22000W which supports Modbus communication protocol in addition to analogue and pulse + direction input control. Using RS485 protocol, multi axis network of OSD-H series servo drive can be realized and controlled from 1 single master device.

OSD-H 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 OSD-H 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 Optimus Drive certified retailers on Contact Us page.

1.2. Model number structure

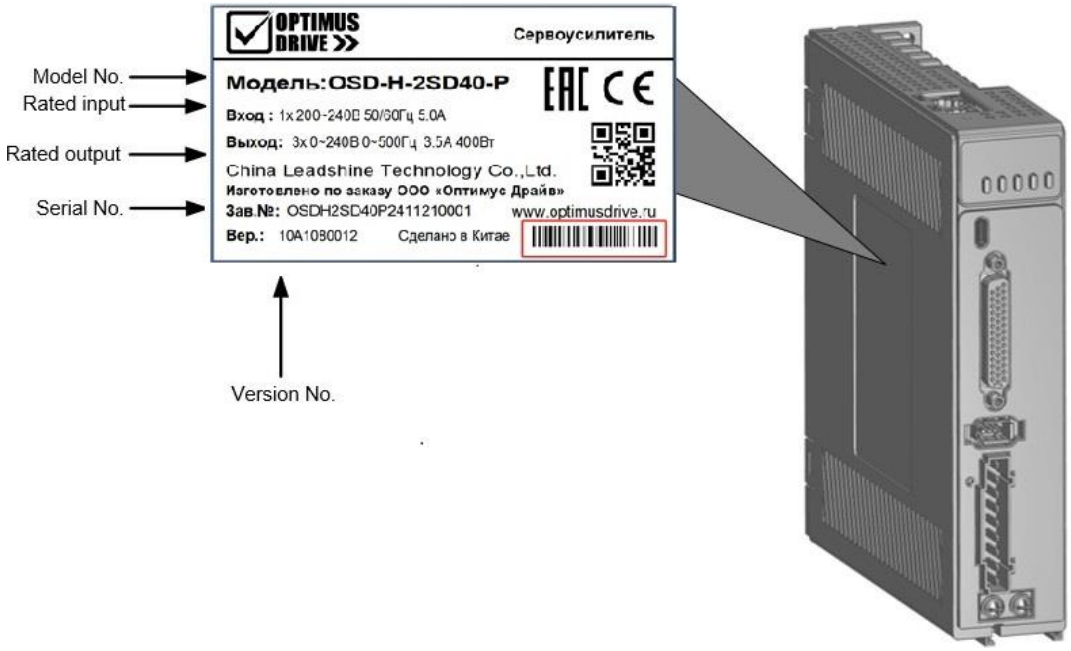
1.2.1. Servo Drive

OSD-H - 2S 2D0 P

① ② ③ ④

No.	Description	
①	Series No.	OSD-H AC Servo Drive Series
②	Input Voltage	2S: 220VAC 4T:400VAC
③	Power Rating	D40：400 W D75：750 W 1D0：1000 W 1D5：1500 W 2D0：2 kW 3D0：3 kW 4D4：4,4 kW 5D5：5,5 kW 7D5：7,5kW
④	Communication protocol	P：Pulse train + RS485 + Analogue, E：EtherCAT

Driver Label



1.2.2. Servo motor

OSM 080 - 102 C 3 N M 310 M1

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

Motor Type	
OSM	Optimus Servo Motor

(2) Flange size	
040	40 mm
060	60 mm
130	130 mm
180	180 mm
200	200 mm

(3)Power Rating			
101	100W	202	2000W
201	200W	292	2900W
401	400W	302	3000W
751	750W	402	4000W
102	1000W	442	4400W
851	850W	502	5000W
132	1300W	552	5500W
152	1500W	752	7500W
182	1800W		

(4) Rated Speed	
A	1000 rpm
B	2000 rpm
C	3000 rpm
H	1500 rpm
E	2500 rpm

(5) Nominal voltage	
2	220 VAC
3	400 VAC

(6) Brake option	
N	No Brake
B	With brake

(7) Encoder type	
L	21 bit optical single turn encoder
M	23 bit optical multi-turn encoder

(8) additional options XYZ		
X	3	Standard housing
	A	Protected housing
Y	0	without shaft seal
	1	With shaft seal
Z	0	Standard version
	***	Special options

(9) Motor series	
M1	M1 series
M2	M2 series

1.3. Servo Drive Technical Specifications

OSD-H 220V Models

OSD-H Series Driver	OSD-H-2SD40*	OSD-H-2SD75*	OSD-H-2S1D0*	OSD-H-2S1D5*	OSD-H-2S2D0*
Power Rating	400W	750W	1000W	1500W	2000W
Rated Current (Arms)	3.5	5.5	7.0	9.5	12
Peak Current (Arms)	9.5	16.6	18.7	31.1	36
Control circuit power supply Main power supply	1-Ph AC 200V-240V, -10% - +10%, 50/60Hz				
Cooling method	Air-cooled	Fan-cooled			
Dimension H*L*W(mm)	175*156*40	175*156*50		175*156*80	

OSD-H 400V Models

OSD-HFT series	OSD-H-4TD75*	OSD-H-4T1D0*	OSD-H-4T1D5*	OSD-H-4T2D0*	OSD-H-4T3D0*	OSD-H-4T4D4*	OSD-H-4T5D5*	OSD-H-4T7D5*
Rated Power(W)	750	1000	1500	2000	3000	4400	5500	7500
Rated Current (Arms)	2.7	3.5	5.4	8.4	11.9	16.5	20.8	25.7
Peak Current (Arms)	8.6	10.6	14.9	24.8	33.2	38.9	51.6	33.6
Size (mm)	55*175*179			80*175*179		89*250*230		
Main Power Supply	Three phase AC 380V~440V, -15%~+10%, 50/60Hz							
Control Circuit Power Supply	Single phase AC 380V~440V, -15%~+10%, 50/60Hz							

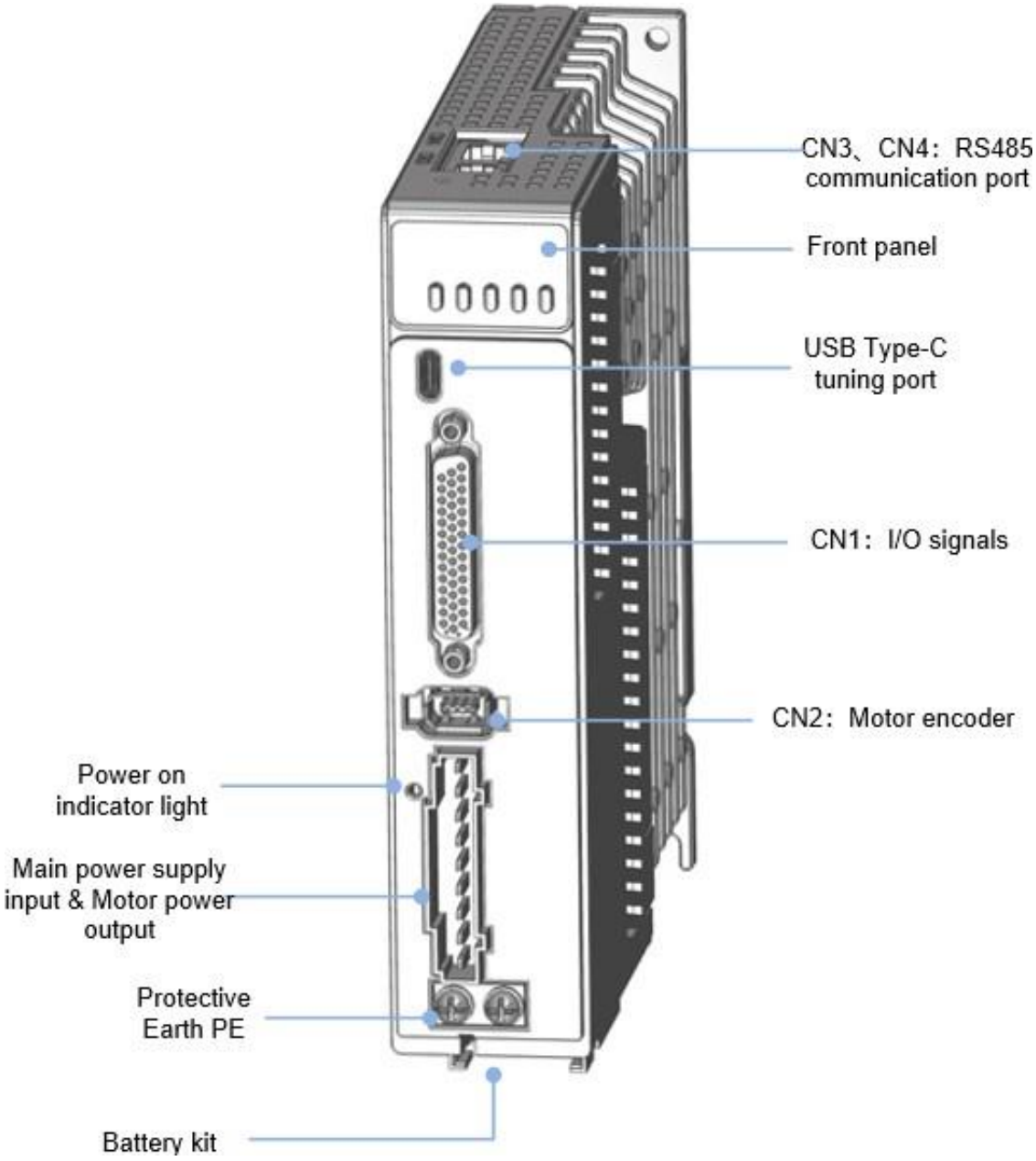
Port	Descriptions
USB Type-C Tuning	Modify or read driver parameters without connecting to main power supply
Low-speed pulse input	5V differential signal, 0-500kHz 24V single ended signal, 0-200kHz
High-speed pulse input	5V differential signal, 0-4MHz
Crossover Frequency Output	Supports phase A/B/Z differential crossover frequency output Supports phase Z open collector crossover frequency output
Analog Input	2 analog inputs（AI1/AI2）,-10V~+10V, Max. voltage: ±12V
Analog Output	1 analog output（AO1）, -10V~+10V
Digital Input	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) *Under PR mode* 1. Path trigger (CTRG) 2. Home switch (HOME) 3. Emergency stop trigger(STP) 4. Path 0-3 (ADD0-ADD3) 5. Positive JOG (PJOG) 6. Negative JOG(NJOG) 7. Positive limit switch(PL) 8. Negative limit switch(NL) 9. Origin(ORG)
Digital Output		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) *Under PR mode* 1. Command completed (CMD-OK) 2. Path completed (PR-OK) 3. Homing done (HOME-OK)
Communication Port		RS485 communication, Modbus RTU protocol (RJ45 port)
Control Mode		
Control		1. External pulse train position control 2. JOG control 3. Velocity control 4. Torque control 5. Hybrid control: Position-Torque/Position-Velocity/Velocity-Torque
Position	**Pulse frequency**	• 4MHz (5V differential input) • 500kHz (5V differential input) • 200kHz (24V single-ended input)
	Electronic gear ratio	(1～8388608) / (1～8388608)
	Torque limit	*Please refer to parameter settings*
Control Features		
Drive Mode		IGBT SVPWM sinusoidal wave drive
Feedback Method		Encoder: RS485 Protocol
Standardized Parameters		Quick tuning of servo driver parameters can be achieved through PC tuning tools.
Easy-to-use		One-click tuning, Single parameter tuning, Black box, Zero tracking control
Notch Filter		Mechanical resonance suppression. Supports up to 3 filters,50Hz~4000Hz

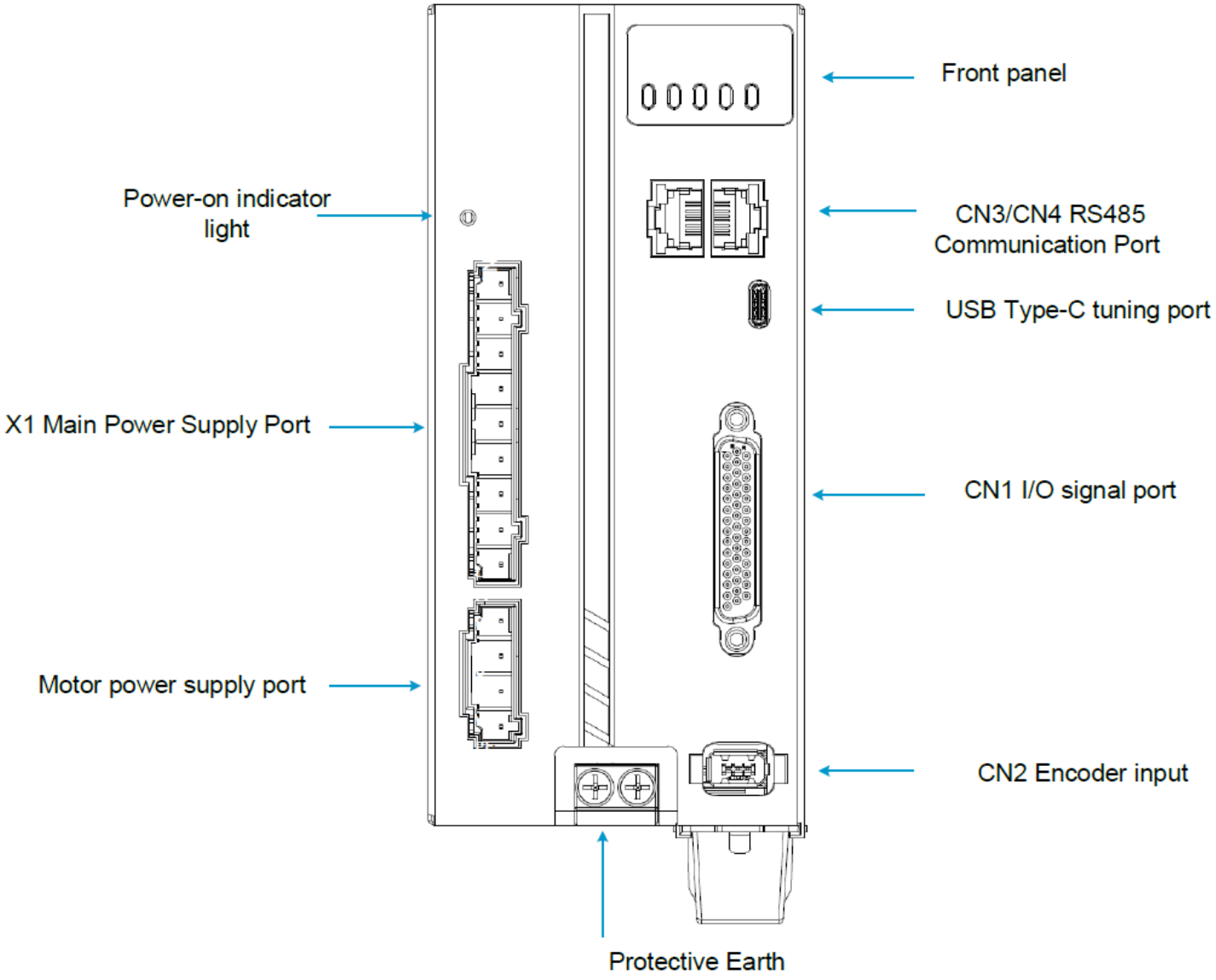
Vibration suppression	End vibration suppression	
DI/DO settings	Digital inputs and outputs are user-configurable	
Alarm	Overcurrent. Overvoltage. Undervoltage. Overheat. Overload. Overtravel. Single-Phasing. Regenerative resistor error. Position deviation error. Encoder feedback error. Excessive braking rate. EEPROM error	
Front Panel	5 push buttons, 8-segments display	
Software	Driver tuning through **Motion Studio** Ver. 2.2.x. Parameters tuning in current loop, position loop, velocity loop; Modify I/O signal and motor parameters; Variables(velocity, position deviation, etc.) monitoring using step diagrams'	
Communication	**USB Type-C**	Modbus USB2.0 (No need to connect driver to power supply)
	Modbus	RS485 communication, Modbus RTU protocol (RJ45 port). Communication up to 32 axes to a host.
Dynamic Brake	Internal dynamic brake	
Black Box	Set triggering conditions and analyze the data from black box. Used for error solving	
Suitable Load Inertia	30 times smaller than motor inertia	
Environmental requirements		
Temperature	Storage: -20-80℃ (Condensation free); Not < 72 hours if stored in over 65℃ Installation: 0-55℃ (Not frozen); Lower performance at over 45℃	
Humidity	Under 90%RH (Condensation free)	
Altitude	Max. altitude of 2000m; 100% performance at 1000m or below. Performance decreases by 1% with every increase of 100m from 1000m.	
Vibration	Less than 0.5G (4.9m/s2) 10-60Hz (non-continuous working)	
IP ratings	IP20	

1.4. Servo Drive Ports and Connectors

OSD-H Series Servo Drive **220V Models**



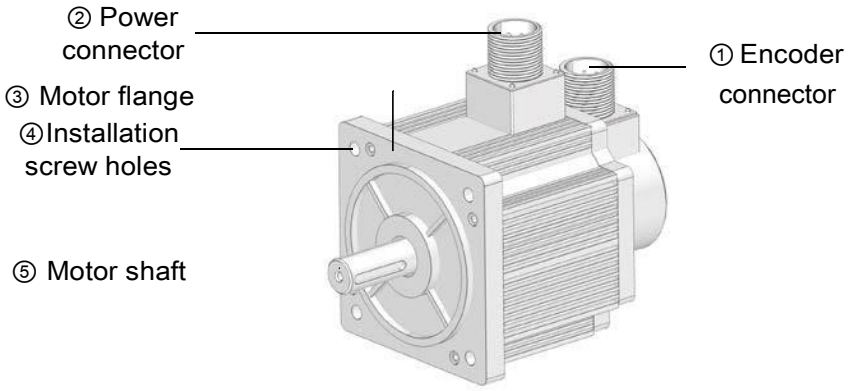
OSD-H Series Servo Drive **400V Models**



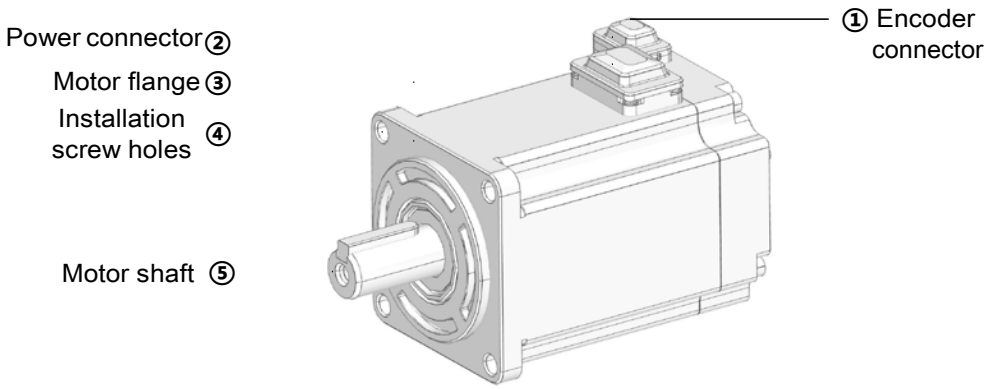
Parts & Connectors	Description
Front Panel	Including a LED display and 5 buttons. LED display is used to display servo drive status and parameter settings. 5 buttons: M : *To switch between different modes and parameters* ◀ : *Switch between value* ▲ : *Switch between sub-menus/Increase* ▼ : *Switch between sub-menus/Decrease* S : *Enter*
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. *Please do not touch the power terminal immediately after power off as the capacitor might require some time to discharge.*
OSD-H 220V models	
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
OSD-H 400V models	
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

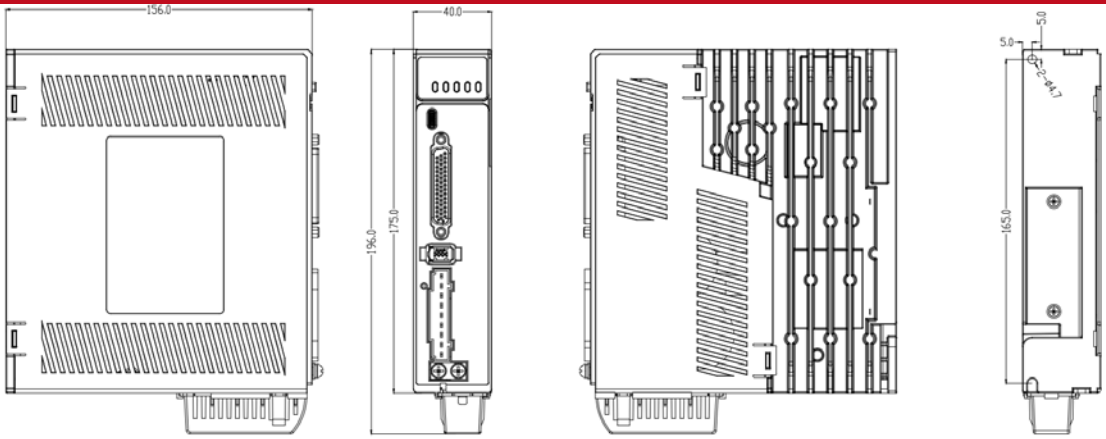
2.1 Servo Drive Installation

2.1.1 Servo drive installation environment

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

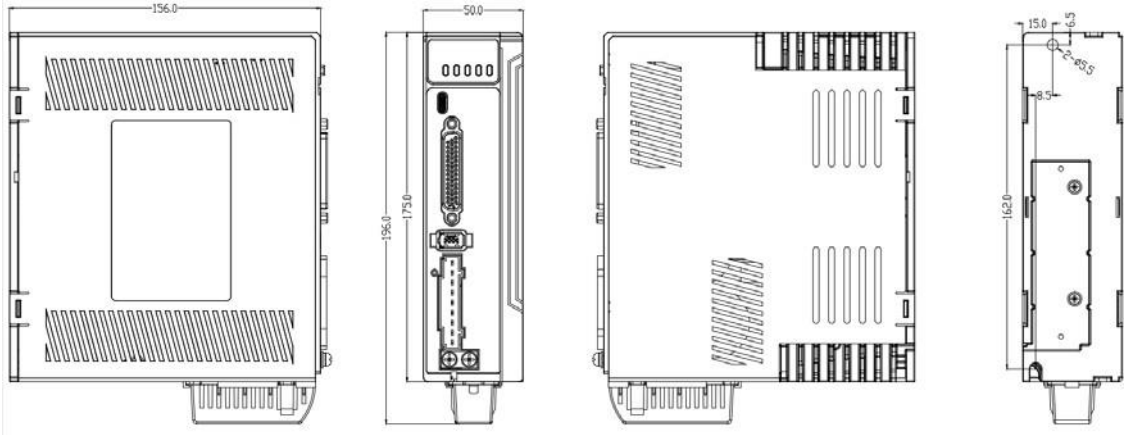
2.1.2 Servo drive dimension

Dimension 1: OSD-H-2SD40



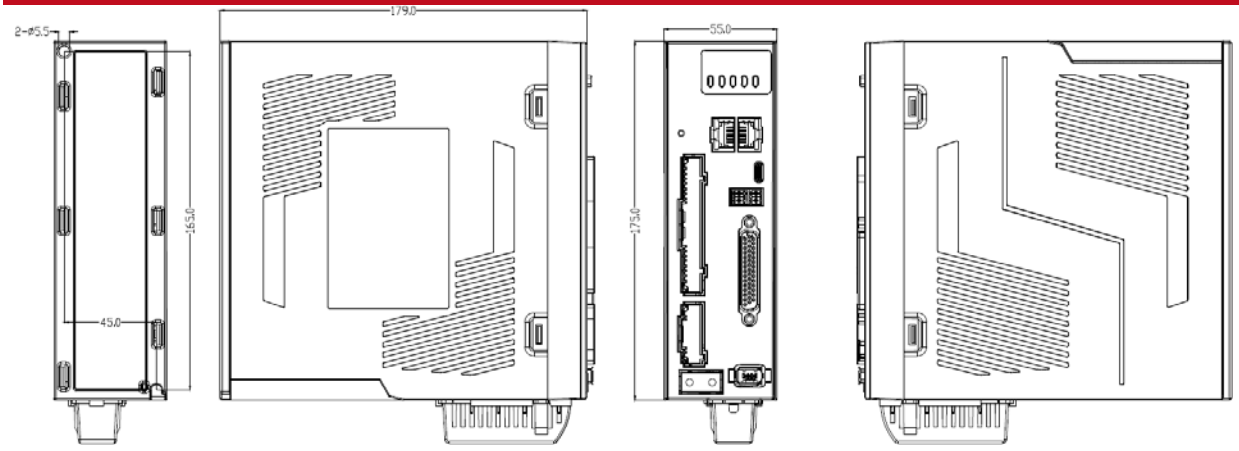
175mm x 156mm x 40mm

Dimension 2: OSD-H-2SD75/1D0/1D5



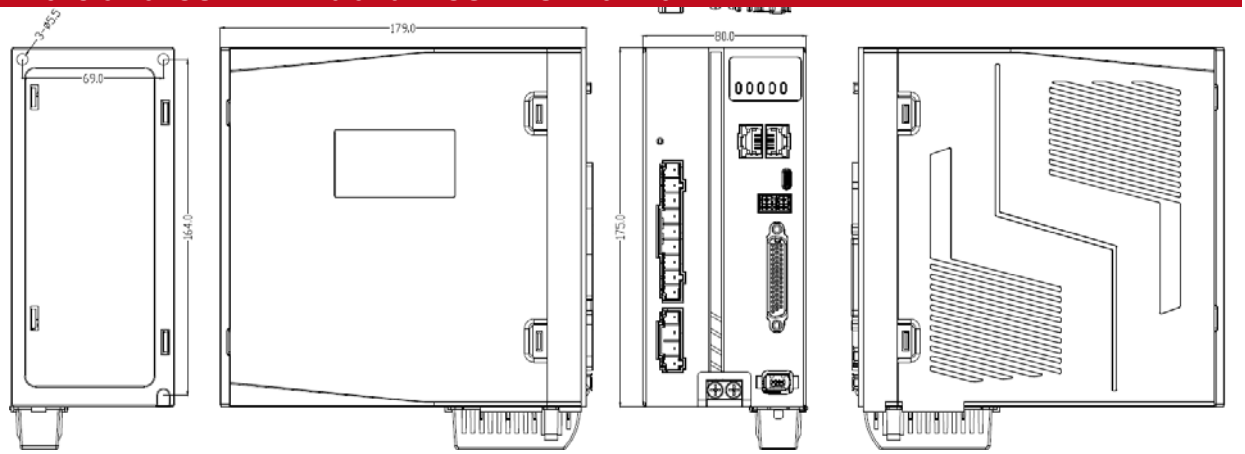
175mm x 156mm x 50mm

Dimension 3: OSD-H 4T D75/1D0/1D5



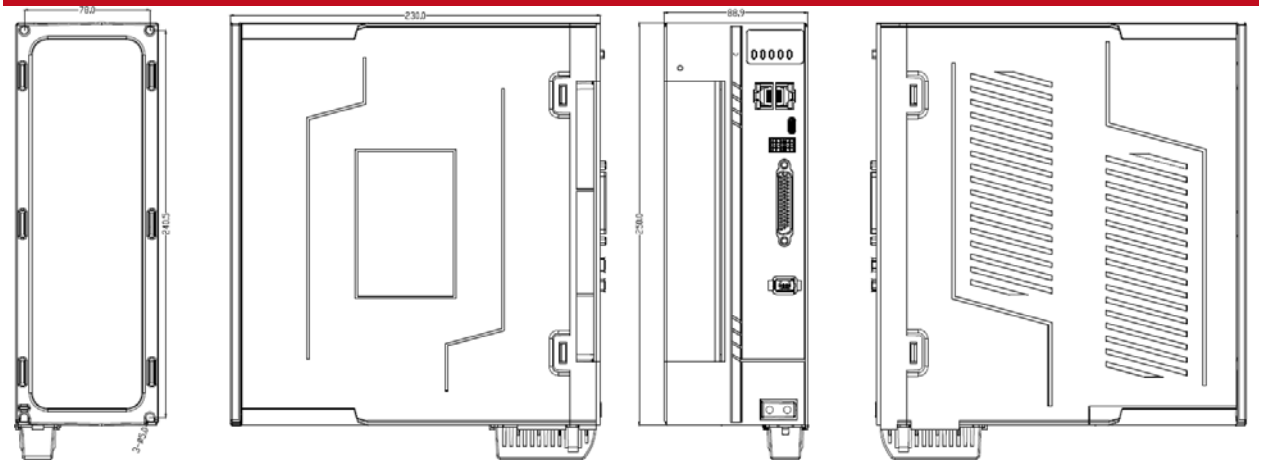
175mm x 179mm x 55mm

Dimension 3: OSD- 4T 2D0/3D0 - OSD- 2S 1D5/2D5



175mm x 179mm x 85mm

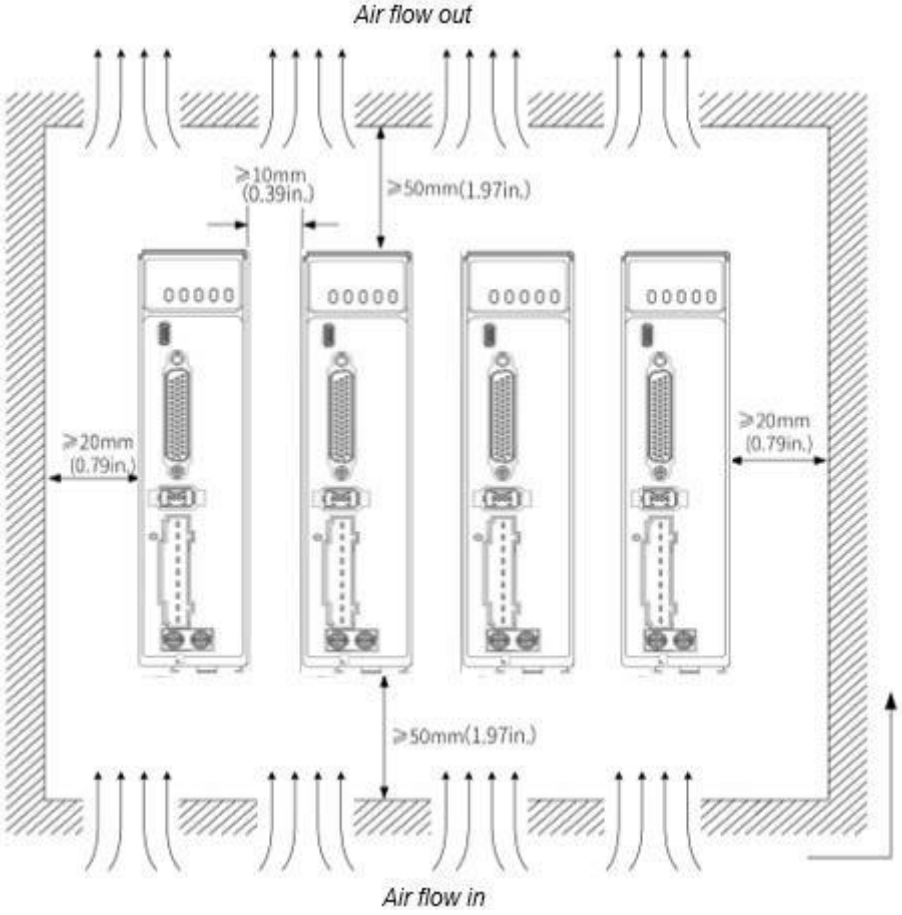
Dimension 3: OSD- 4T 4D4/5D5/7D5



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 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

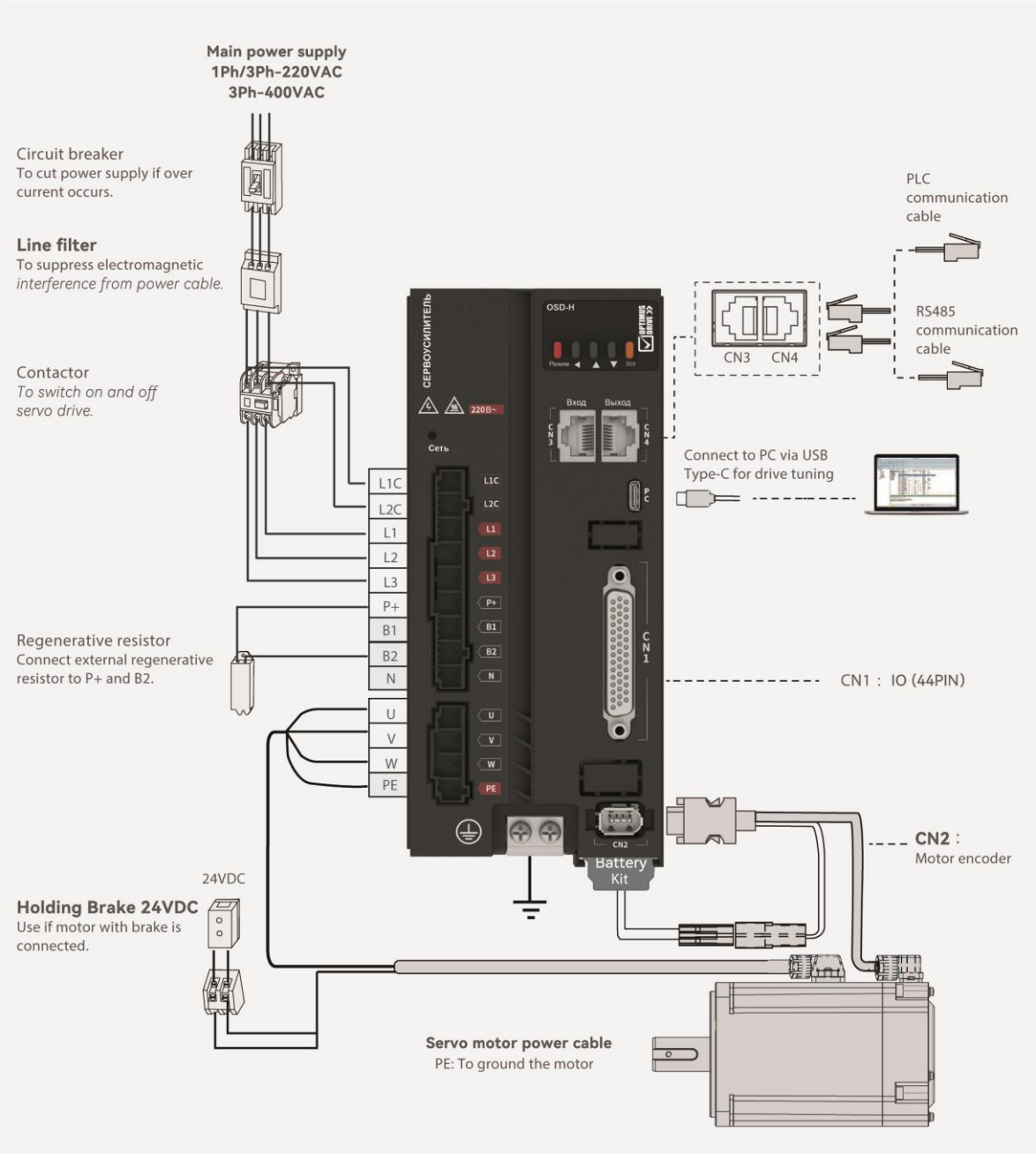
- Please to remove any conductive foreign objects from the connectors before installation
- The connectors are made of resin. May not withstand impact.
- Please hold the driver during transportation, not the cables.
- Leave enough "bend" on the connector cables to ensure less stress upon installation.

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 OSD-H Wiring Diagram

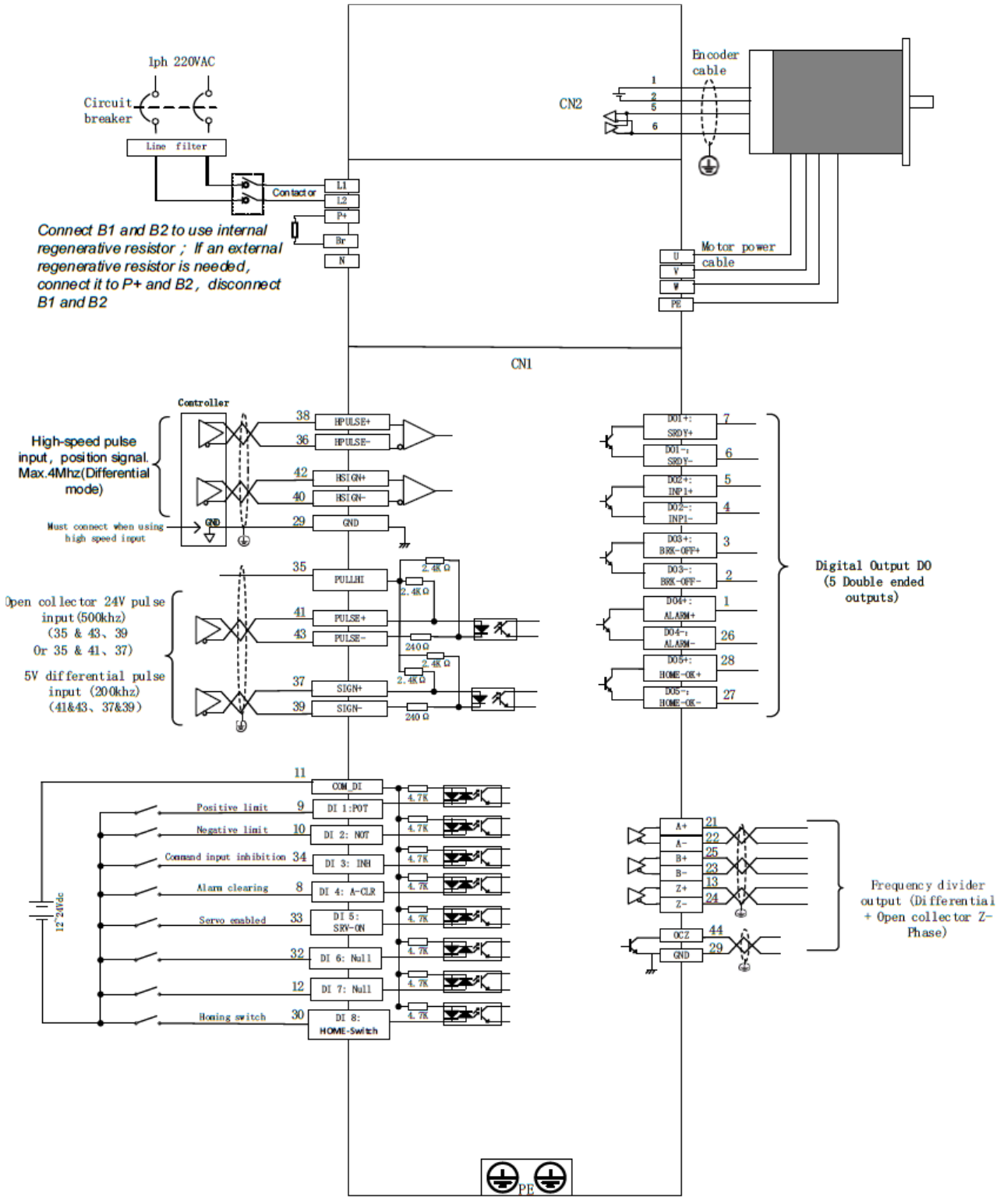
Common connection scheme for OSD-H-P below



- OSD-H 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

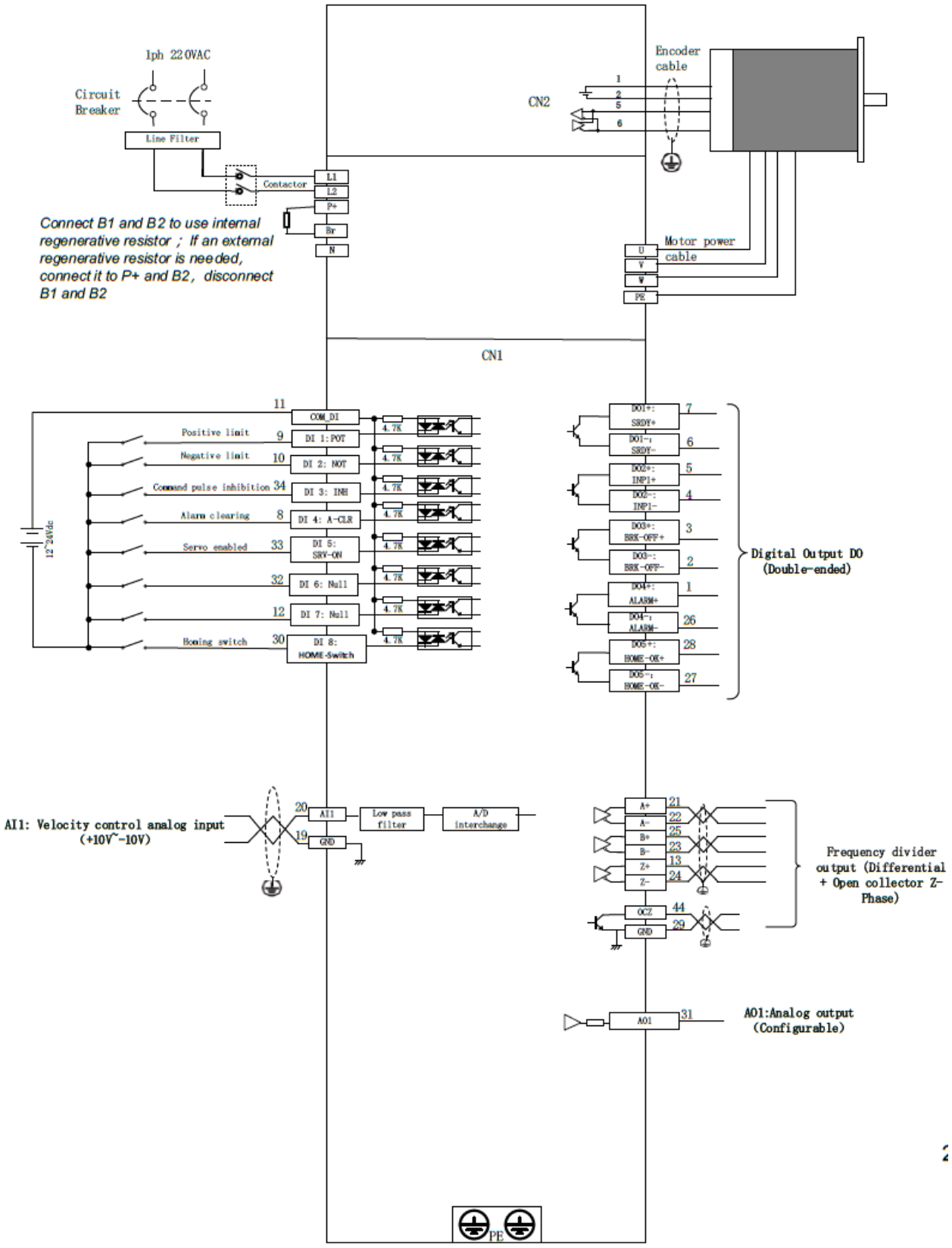
Position control mode wiring diagram



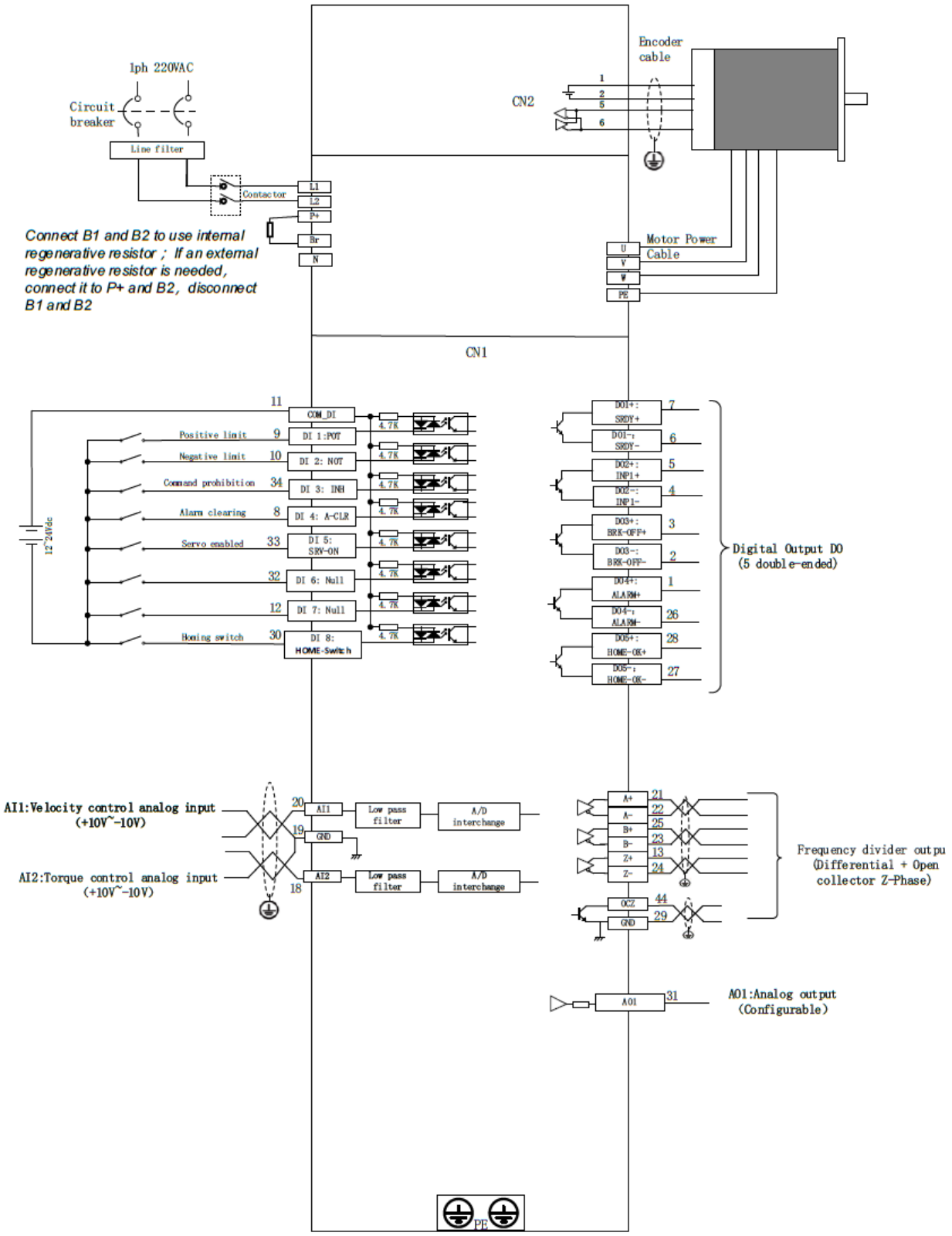
*Note: Please set **Pr0.05 to 1** when using high speed pulse command (max. 4 MHz)*

2.3.2 Velocity/Torque Control Mode Wiring Diagram

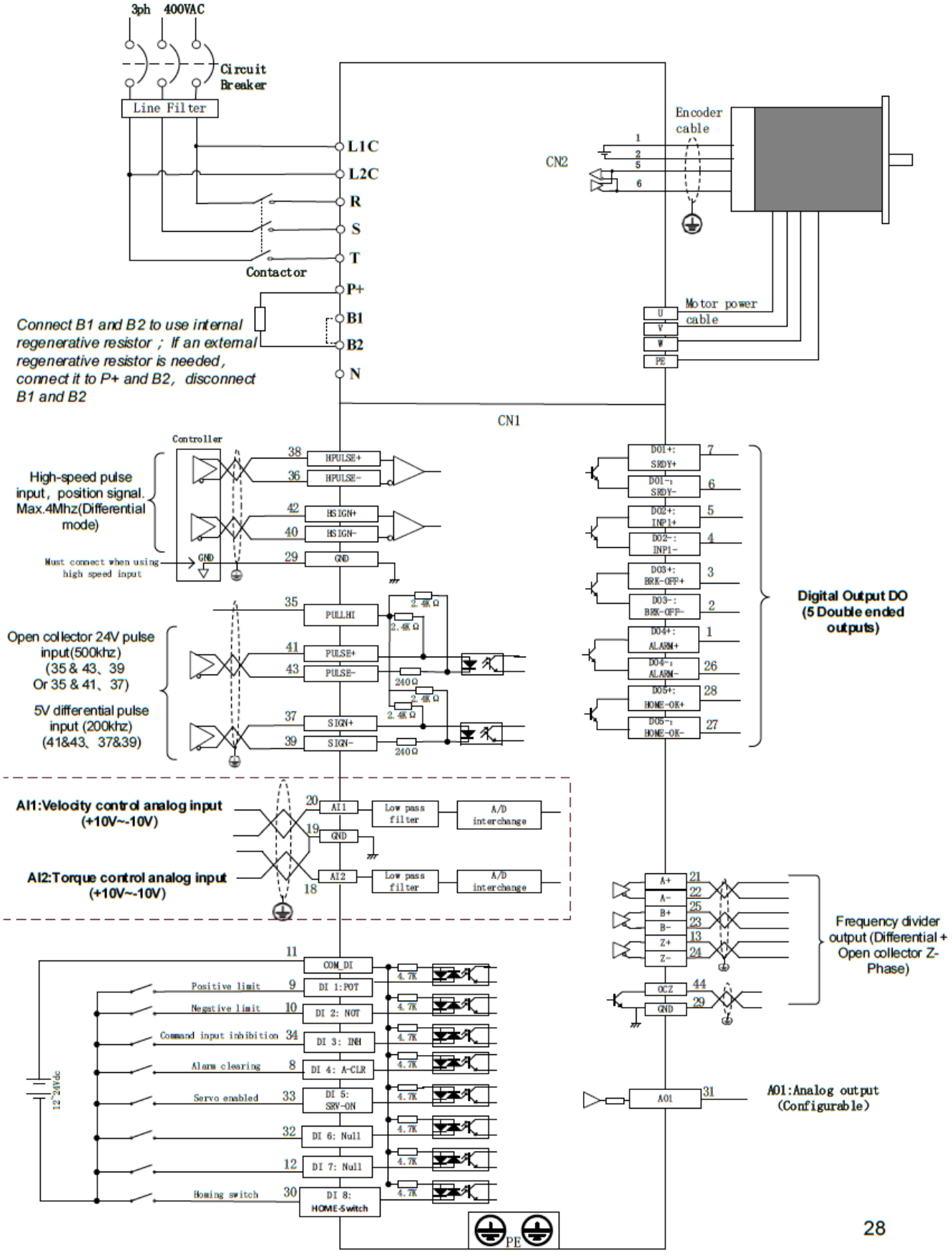
Velocity control mode wiring diagram



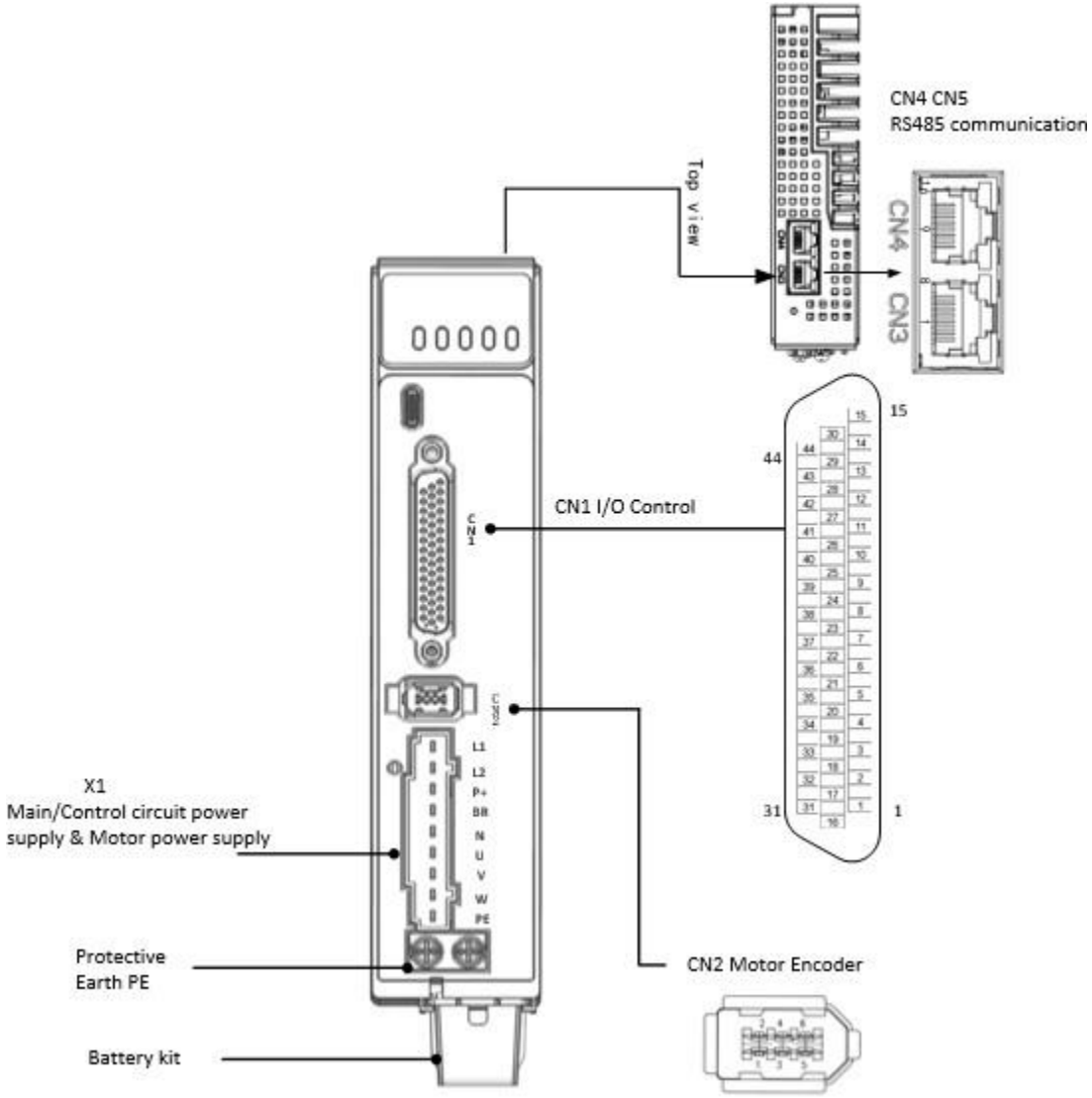
Torque control mode wiring diagram



OSD-H (3ph 400VAC drives) wiring diagram



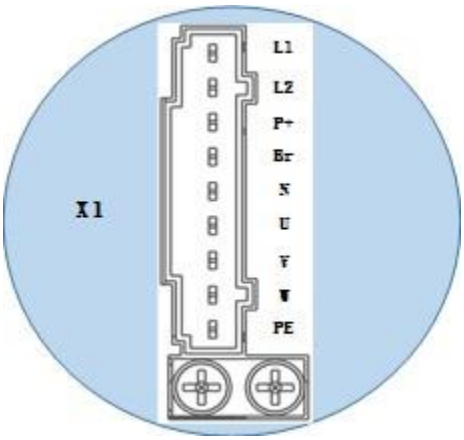
2.4 Servo Drive Ports



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

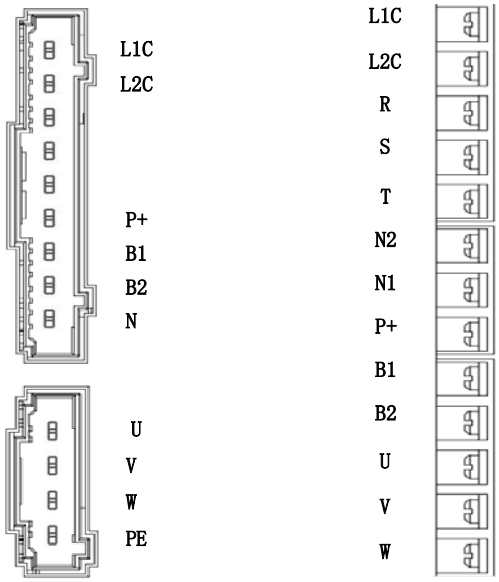
2.5 X1 Main power supply

OSD-H 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; *It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.*
	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

OSD-H 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; *It is recommended to install a fuseless circuit breaker to cut off power supply in time when the driver fails.*
	L2C		
	R	Main Power Supply: Three phase 380VAC, +10 ~ -15%, 50/60Hz	
	S		
	T		
	P +	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

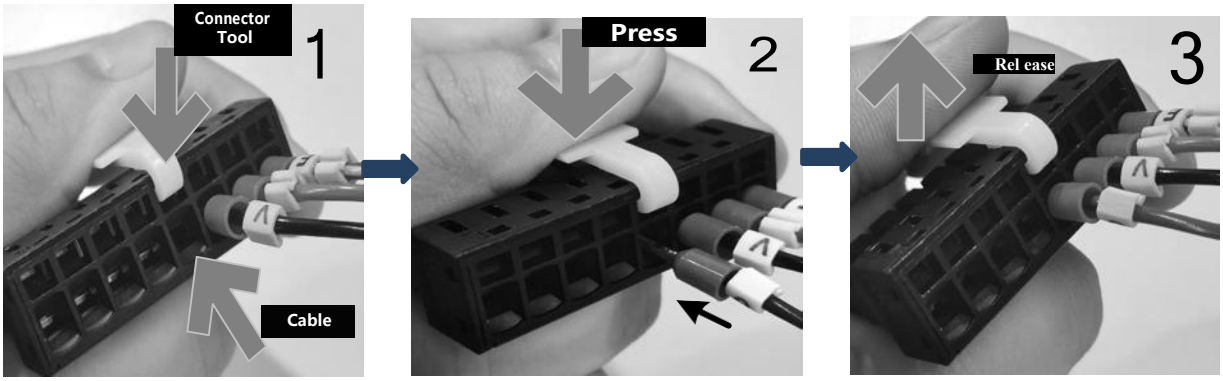
- Wire diameter: Wire diameter differs according to the power rating of the servo drives. Please refer to the table below.

Driver	Wire diameter (mm^2/AWG)			
	L1 L2/R S T	P+ BR	U V W	PE
OSD-2SD40-*	1.3/AWG16	2.1/AWG14	0.52/AWG14	0.52/AWG14
OSD-2SD75-*	1.3/AWG16	2.1/AWG14	0.52/AWG14	0.52/AWG14
OSD-2S1D0-*	1.3/AWG16	2.1/AWG14	0.52/AWG14	0.52/AWG14
OSD-2S1D5-*	2.1/AWG14	2.1/AWG14	1.3/AWG16	1.3/AWG16
OSD-4TD75-*	1.3/AWG16	2.1/AWG14	0.52/AWG14	0.52/AWG14
OSD-4T1D0-*	1.3/AWG16	2.1/AWG14	1.3/AWG16	1.3/AWG16
OSD-4T1D5-*	1.3/AWG16	2.1/AWG14	1.3/AWG16	1.3/AWG16
OSD-4T2D0-*	2.1/AWG14	2.1/AWG14	1.3/AWG16	1.3/AWG16
OSD-4T3D0-*	2.1/AWG14	2.1/AWG14	3.3/AWG12	3.3/AWG12
OSD-4T4D4-*	2.1/AWG14	2.1/AWG14	3.3/AWG12	3.3/AWG12
OSD-4T5D5-*	2.6/AWG13	2.6/AWG13	3.3/AWG12	3.3/AWG12
OSD-4T7D5-*	4.2/AWG11	2.6/AWG13	3.3/AWG12	3.3/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.

To fix wire cables into connector

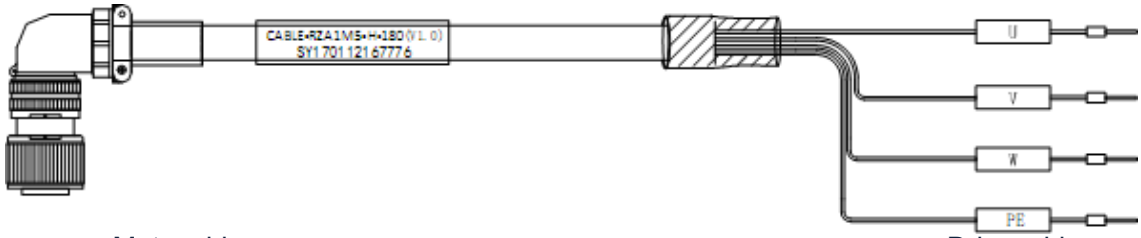
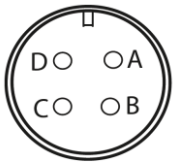


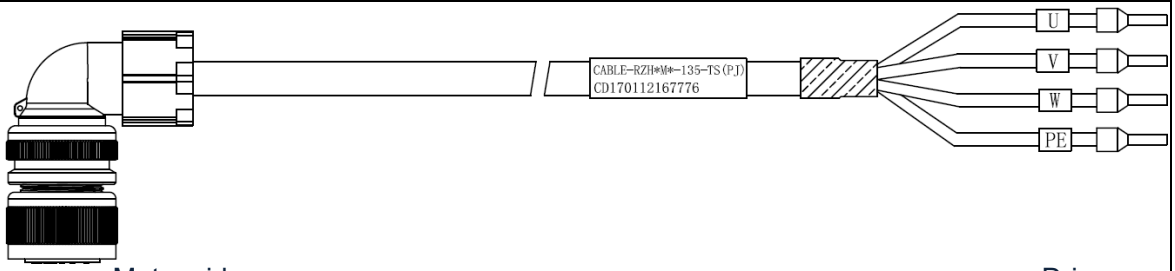
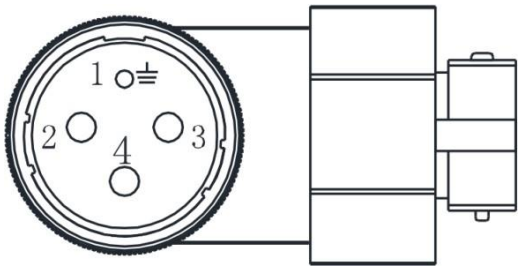
2.5.2 Motor Power Supply Cable Selection (Without Brake)

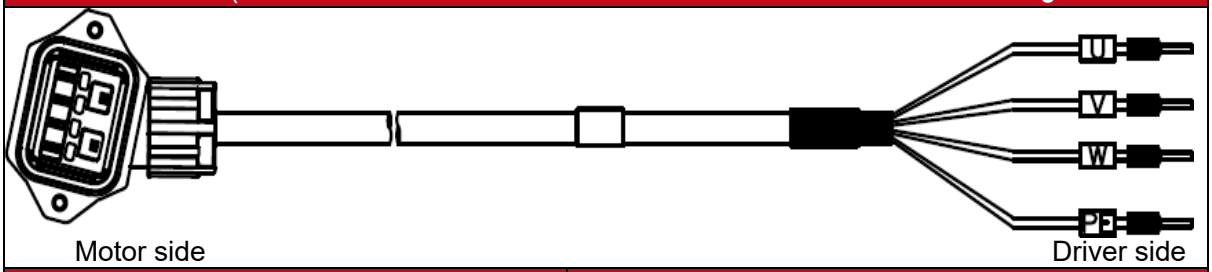
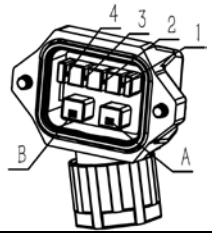
Motor winding power cable

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

**M*: Length of the cable*

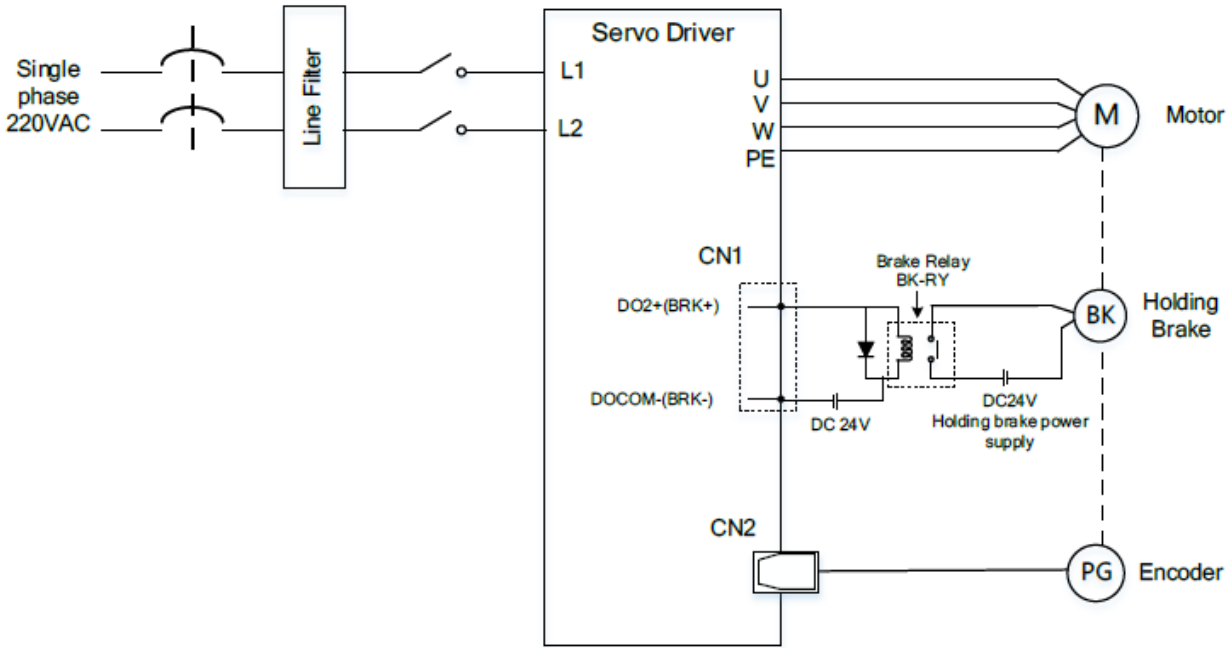
Aviation connector Frame size 180）CABLE-RZA*M*-H-180(V1.0)	
 Motor side　　Driver side	
Motor cable pin	**Pins**
 Motor side	Motor / Color / Driver A / Blue / U B / Black / V C / Red / W D / Yellow/Green / PE

Aviation connector（Frame size 130）CABLE-RZH*M*-135-TS	
 Motor side side　　Driver	
Motor cable pin	**Pins**
 Motor side	Motor / Color / Driver 1 / Red / U 3 / Green / V 2 / Black / W 4 / Yellow / PE

Direct connector(Frame size 80 or below）CABLE-RZH*M*-114-TS *without holding brake*	
 Motor side Driver side	
Driver cable pin	**Pins**
	Motor / Color / Driver 1 / Blue / U 2 / Black / V 3 / Red / W 4 / Yellow- green / PE

2.5.3 Holding Brake Wiring Diagram

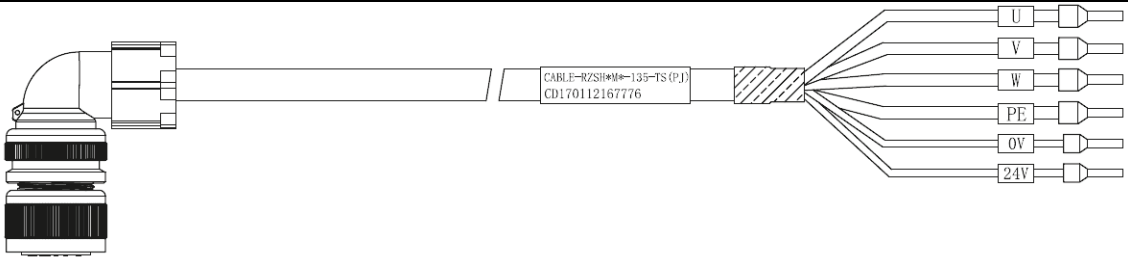
Holding brake is activated when servo drive is not powered on to prevent axis from moving due to gravitational pull or other external forces by locking the motor in place. Usually used on axis mounted vertically to the ground so that the load would not drop under gravitational force when the driver is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



Holding brake wiring diagram

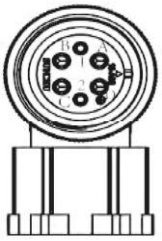
2.5.4 Motor Power Supply Cable (With Holding Brake)

Aviation connector（Frame size 130 ）CABLE-RZSH*M*-135-TS Winding cable with holding brake

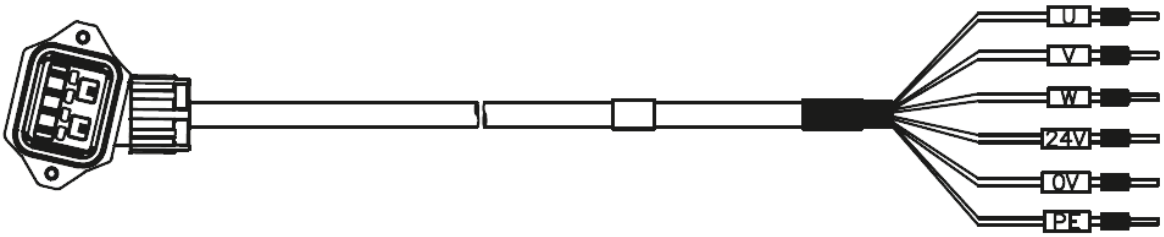
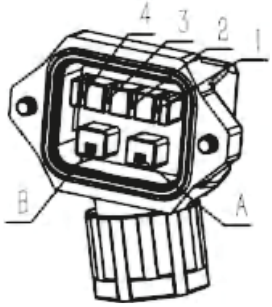


Motor side side

Driver

Motor cable pin	Pins		
	Motor	Color	Drive
	A	Blue	U
	B	Black	V
	C	Red	W
	D	Yellow- green	PE
	1	Black	0V

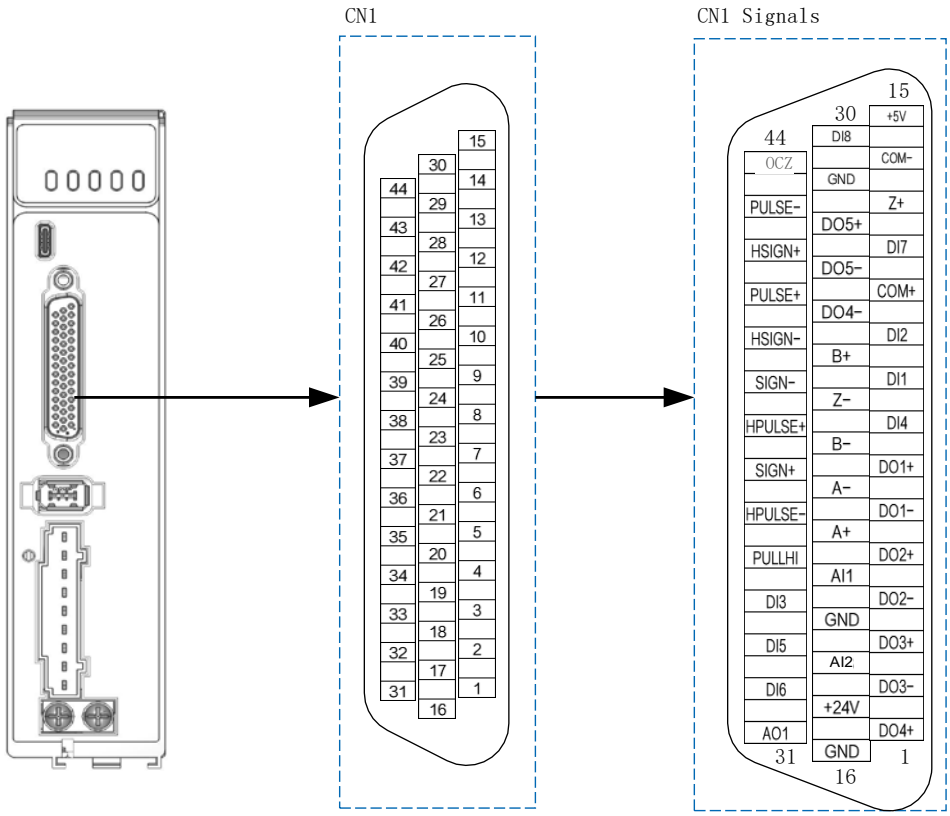
Motor side	2	Red	24V

Aviation connector（Frame size 80 and below ）CABLE-RZSH*M*-114-TS Winding cable with holding brake			
 Motor side side Driver			
Motor cable pin	Pi ns		
 Motor side	Motor	Color	Drive
	1	Blue	U
	2	Black	V
	3	Red	W
	4	Yellow- green	PE
	A	Black	0V
	B	Red	24V

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

2.6 CN1 I/O Control Signal

OSD-H Series Servo Drive uses DB 44-Pin connector.



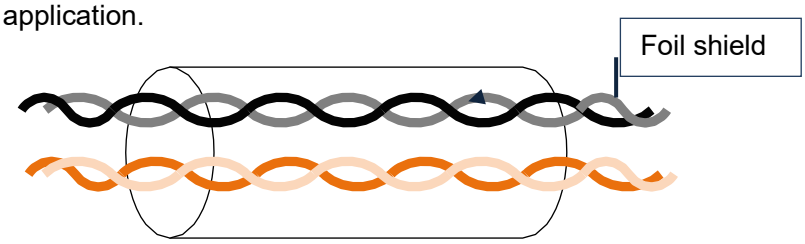
Note: It is recommended to use 24-26AWG cables for CN1

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) Low speed pulse and direction command input mode： PULSE+ & PULSE-：5V Differential （500KHz） SIGN+ & SIGN-：5V Differential （500KHz） PULLHI & PULSE-：24V Single ended (200KHz) PULLHI & SIGN-：24V Single ended (200KHz)
	43	PULSE-	Low speed pulse command input	
	37	SIGN+	Low speed direction command input	
	39	SIGN-	Low speed direction command input	
	35	PULLHI	Open collector 24V common input	
	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	
Common	17	+24V	Internal 24V power supply	24V internal power supply, range 20V~28V. Max. output current 200mA
	14	COM-		
Digital inputs and outputs	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	*Null*	-
	12	DI7	*Null*	-
	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-	
Analog input and output	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
Frequency divider output	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)
Common	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

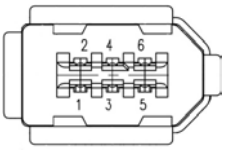
To ensure I/O signal to not be affected by electromagnetic interference, a **shielded cable** is recommended for this application.



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.

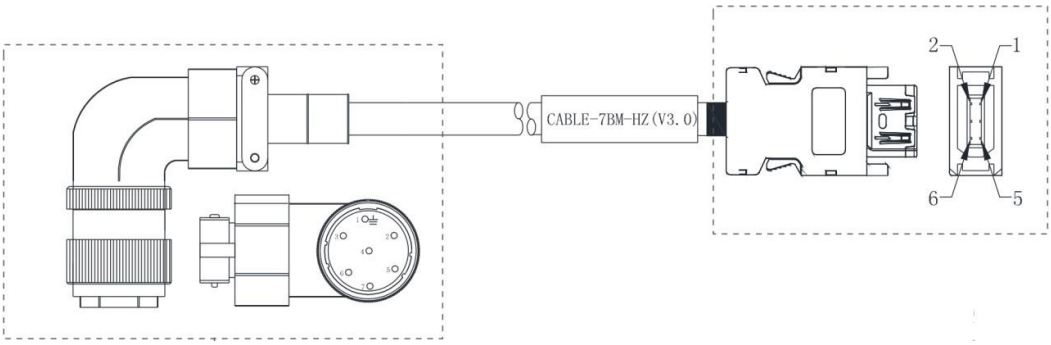
2.7 CN2 Motor Encoder



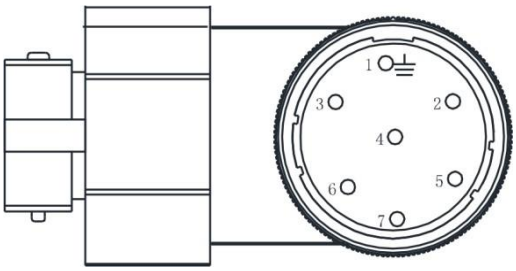
Port	Pin	Signal	Explanation
CN2	1	VCC5V	Power supply 5V
	2	GND	Power supply ground
	3	BAT+	Battery positive terminal
	4	BAT-	Battery negative terminal
	5	SD+	SSI Data+
	6	SD-	SSI Data-
	Frame	PE	Shield grounding

Motor encoder cable and connector selection

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

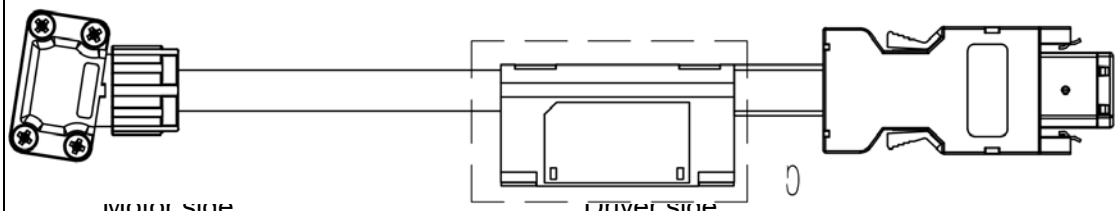


Motor side　　Drive side

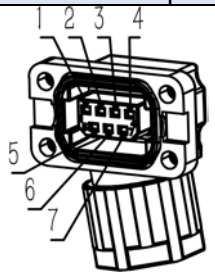
Motor cable pin	Pin		
	Motor	Drive	Signal
	1	Frame	Shield
	2	1	+5V
	3	2	0V
	4	5	SD+
	5	6	SD-
	6	3	BAT+
	7	4	BAT-

Motor side

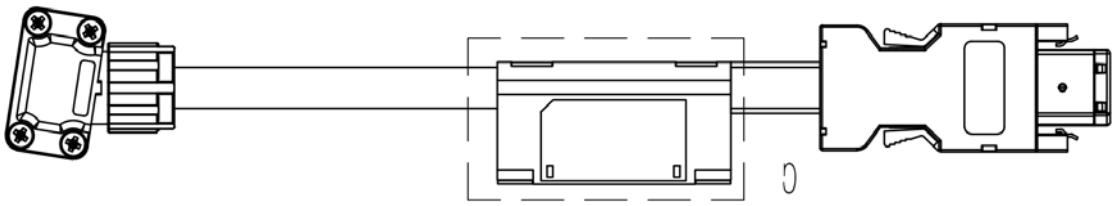
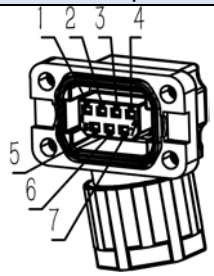
Direct connector(Frame size 80 or below）CABLE-BMH*M*-114-TS Incremental encoder



Motor side　　Driver side

Motor cable pin	Pin		
	Motor	Drive	Signal
	1	Frame	Shield
	2	1	+5V
	3	2	0V
	4	5	SD+
	5	6	SD-

Motor side

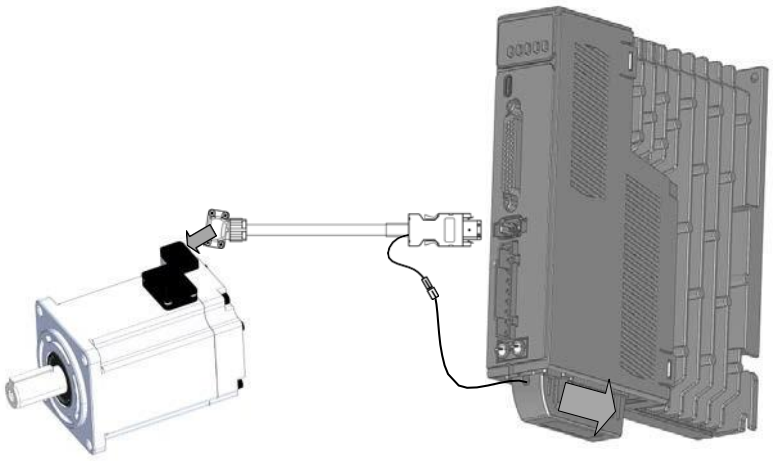
Direct connector(Frame size 80 or below）CABLE-BMAH*M*-124-TS Absolute encoder	
 Motor side Driver side	
Motor cable pin	Pin
 Motor side	

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

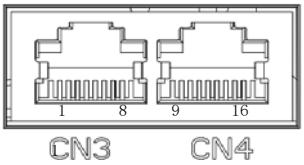
a) Please ground cable shield foil to drive to prevent servo error alarm
b) Please use a double winded shielded cable and make sure to be as short as possible.
c) Please separate CN1 cable from power cables with a minimum gap of 30cm.

Battery kit installation

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

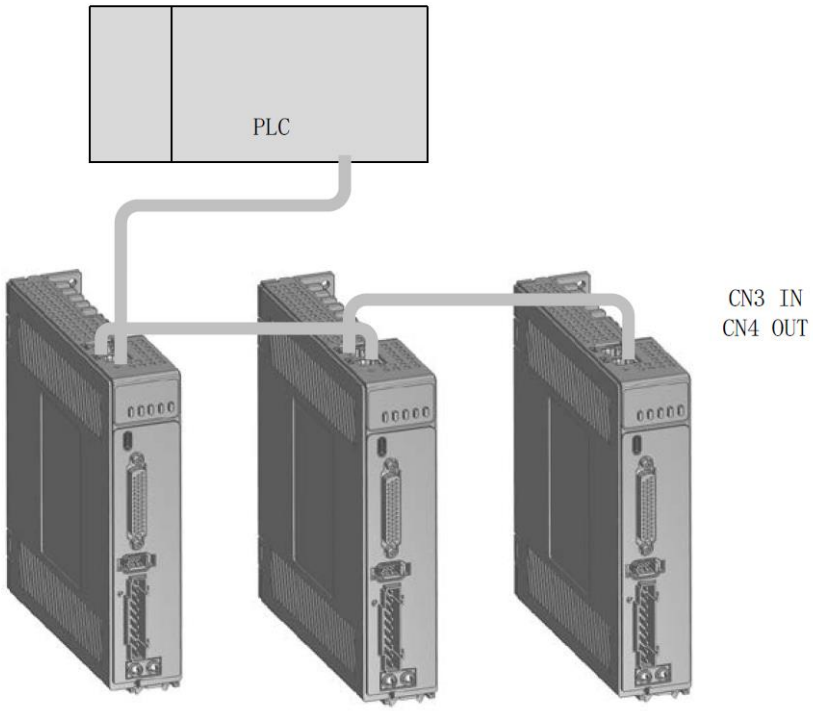


2.8 CN3/CN4 – RS485 Communication Port



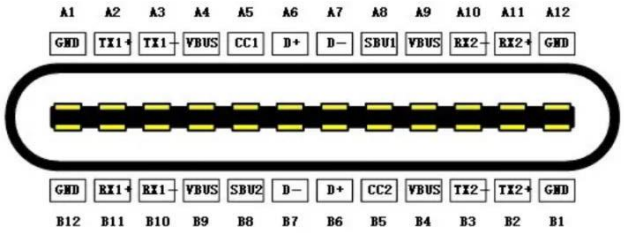
Port	Pin	Signal	Description
CN3 CN4	1，9	RDO+	RS485 Differential signal+
	2，10	RDO -	RS485 Differential signal-
	3，11	GND	Ground（RS485）
	4，12	TXD+	RS485 Differential signal+
	5，13	TXD-	RS485 Differential signal-
	6	VCC5V	Reserved，5V positive（50mA）
	7，15	GND	Ground
	8，16	/	/
	Frame	PE	Shield grounding

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



2.9 USB Type-C Tuning Port

OSD-H 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

2.10Regenerative 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

OSD-H 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)
OSD-2SD40	100	50	50	50
OSD-2SD75	50	75	40	50
OSD-2S1D0	50	100	30	100
OSD-4TD75	100	100	100	100
OSD-4T 1D0	100	100	100	100
OSD-4T 1D5	100	100	100	100
OSD-4T 2D0	50	100	40	100
OSD-4T 3D0	50	100	40	100
OSD-4T 4D4	35	100	35	100
OSD-4T 5D5	35	100	25	100
OSD-4T 7D5	35	100	25	100

Calculation of regenerative resistance under normal operation

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

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

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

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

Problem diagnostics related to regenerative resistor:

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

Please take following precautions before installing an external regenerative resistor.
1. Please set the correct resistance value in 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℃ under continuous working conditions.
4. The min. resistance of the regenerative resistor is dependent on the IGBT of the regenerative resistor circuit. Please refer to the table above.

Theoretical selection of regenerative resistor

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

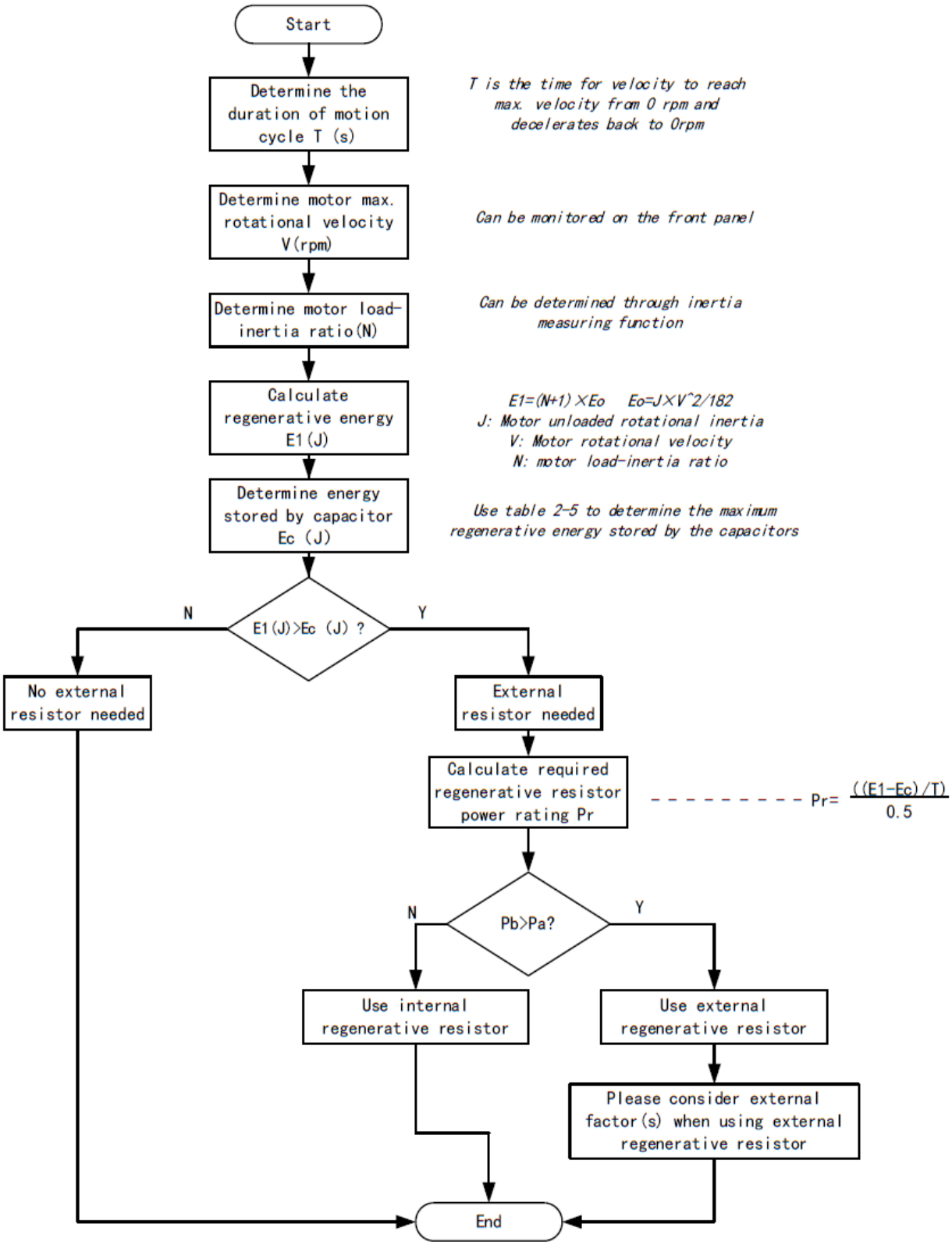
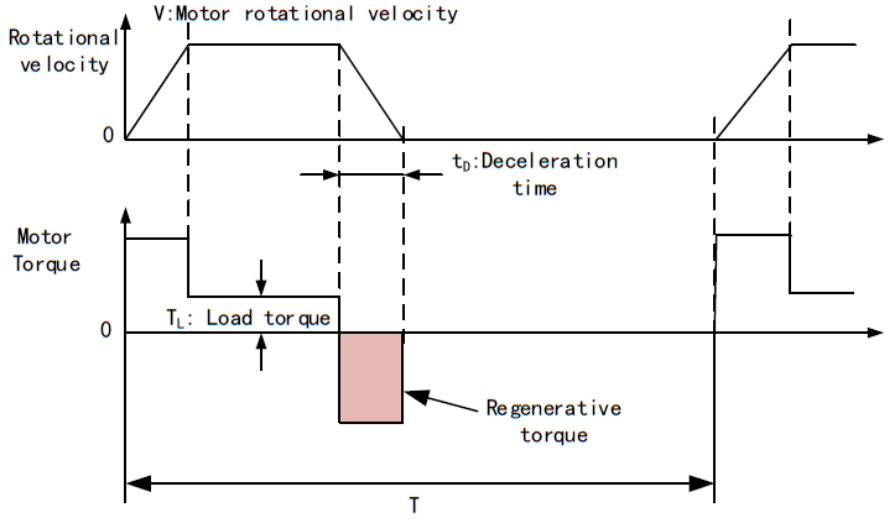


Diagram below shows the acceleration and deceleration cycle periods and the regenerative torque that occurs during the process.



Steps to calculate capacity of regenerative resistor

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

Internal capacitor capacity and rotor inertia

OSD-H Drivers	Servo motor	Rotor Inertia ($\times10^{-4}$kg.m^2)	Max. regenerative energy stored in capacitor Ec(J)
400W	OSM-060401C-2NM310-M2	0.58	13.47
750W	OSM-080751C-2NM310-M2	1.66	22.85
1000W	OSM-080102C-2NM310-M2	1.79	27.74

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: OSD-H- 2SD75, Servo Motor: OSM-080751C-2NM310-M2. When T = 2s, rotational velocity = 3000rpm, load inertia is 5 times of motor inertia.

OSD-H Drivers	Servo motor	Rotor Inertia (× 10^{-4}kg.m^2)	Max. regenerative energy stored in capacitor Ec(J)
750W	OSM-080751C-2NM310-M2	1.66	22.85

Regenerative energy produced:

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

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

Required regenerative resistor power rating Pr:

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

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

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

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

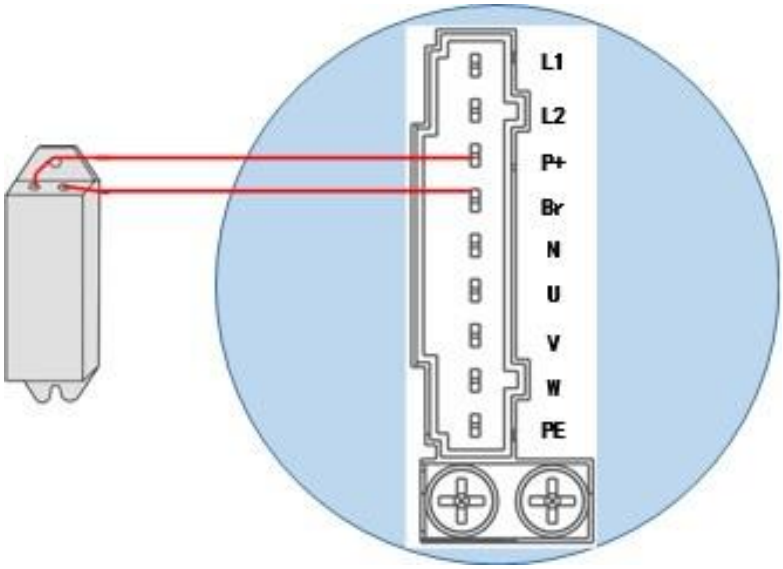
When selecting the resistance of the regenerative resistor, please be higher than the minimum value recommended in table 2-3 but lower than Rmax

Rmax =(380^2-370^2)/Pr=7500/108.6=69Ω

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

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

Regenerative resistor connection



- If B1 and B2 are connected, internal regenerative resistor is now functional; if an external regenerative resistor is required, please disconnect B1 and B2 and connect P+ to B1 to prevent overcurrent.
- Please do not connect external regenerative resistor directly to N or it might cause fire hazard.
- Please refer to the section above to select minimum allowable resistance for the external regenerative resistor or it might damage the driver.
- Please confirm Pr0.16 and Pr0.17 before using any regenerative resistor.
- Do not set the regenerative resistor near any flammable object.

2.11I/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)**

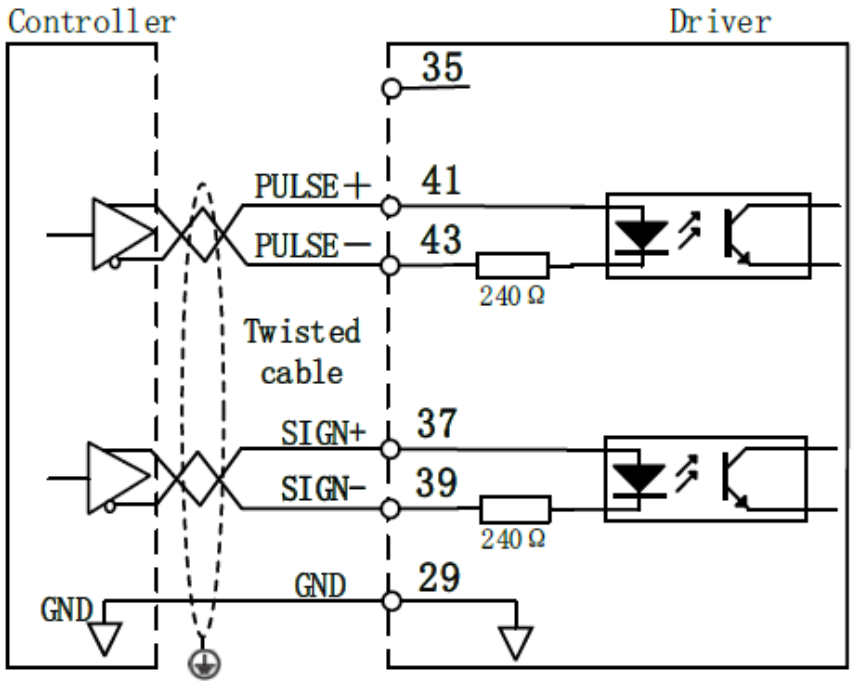
Pulse input frequency can be set in Pr0.05.

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.

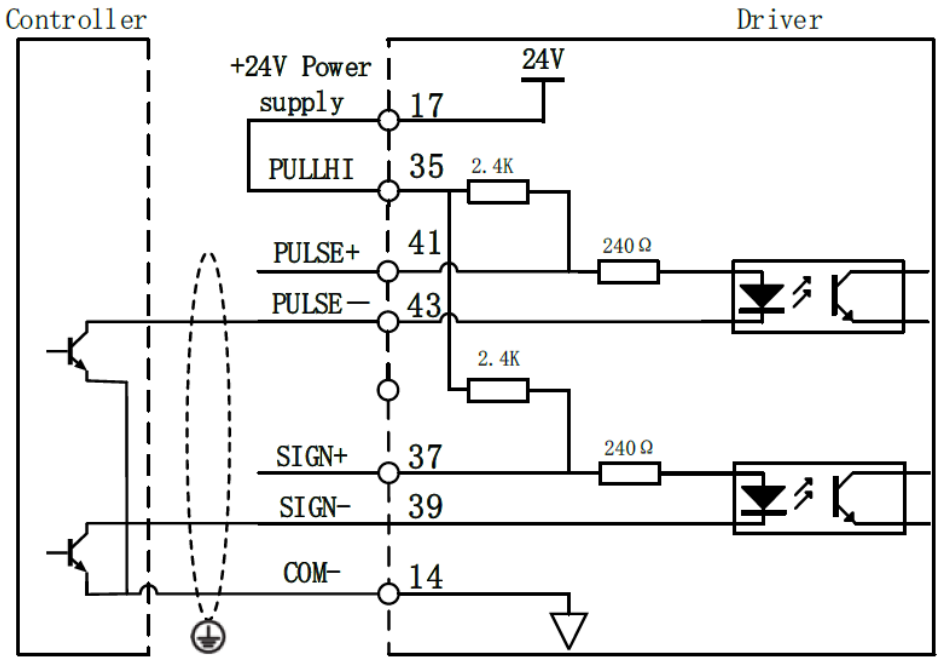


Single ended open collector drive input (Low Speed)

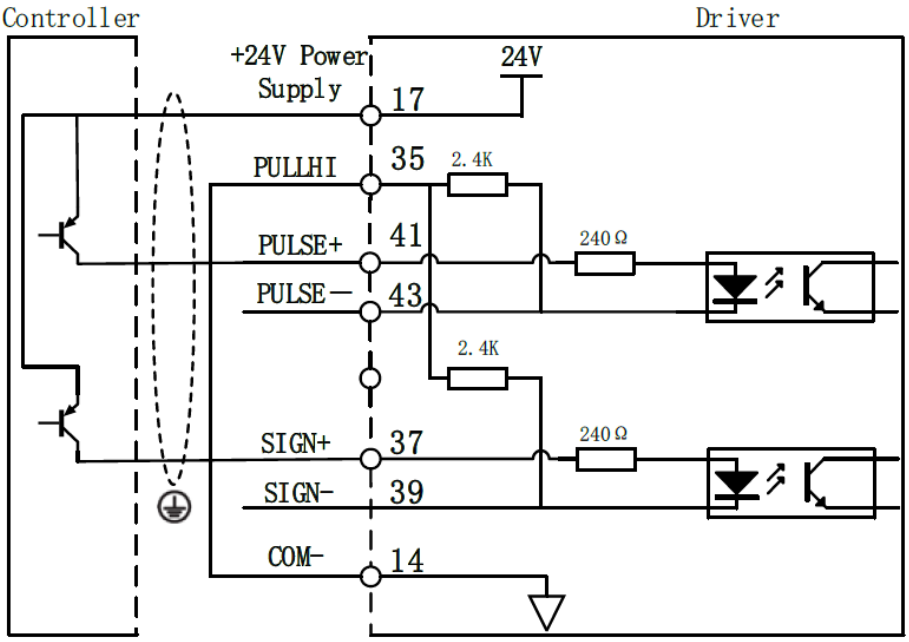
Max. tolerable command pulse input frequency under open collector = 200kHz. Input voltage of 12-24V with 50% duty ratio.

- Using driver internal 24V power supply

1. When pulse input comes from NPN type device:

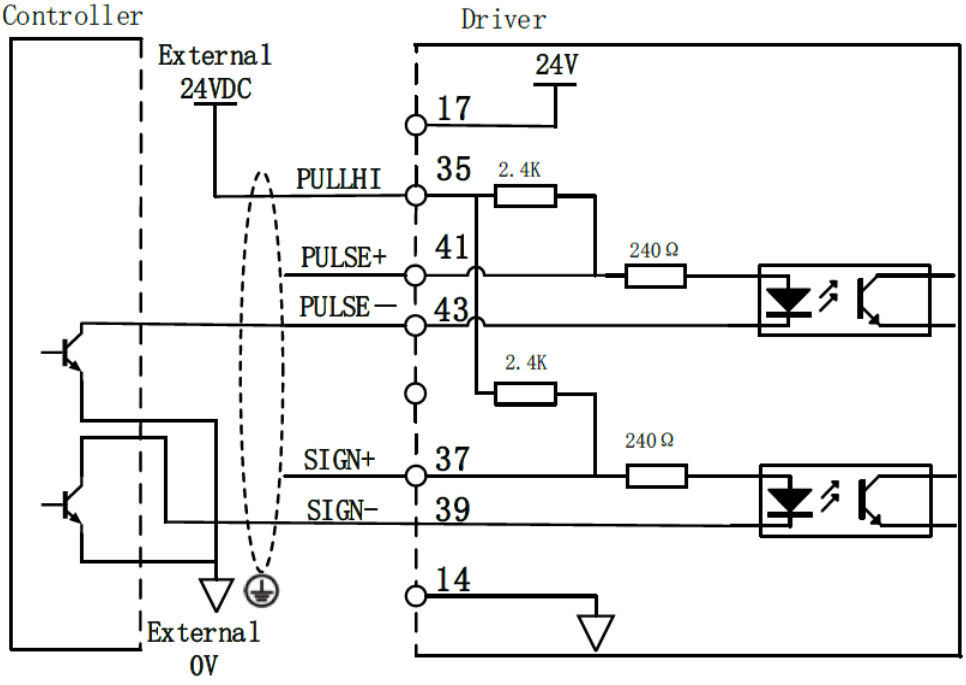


2. When pulse input comes from PNP type device:

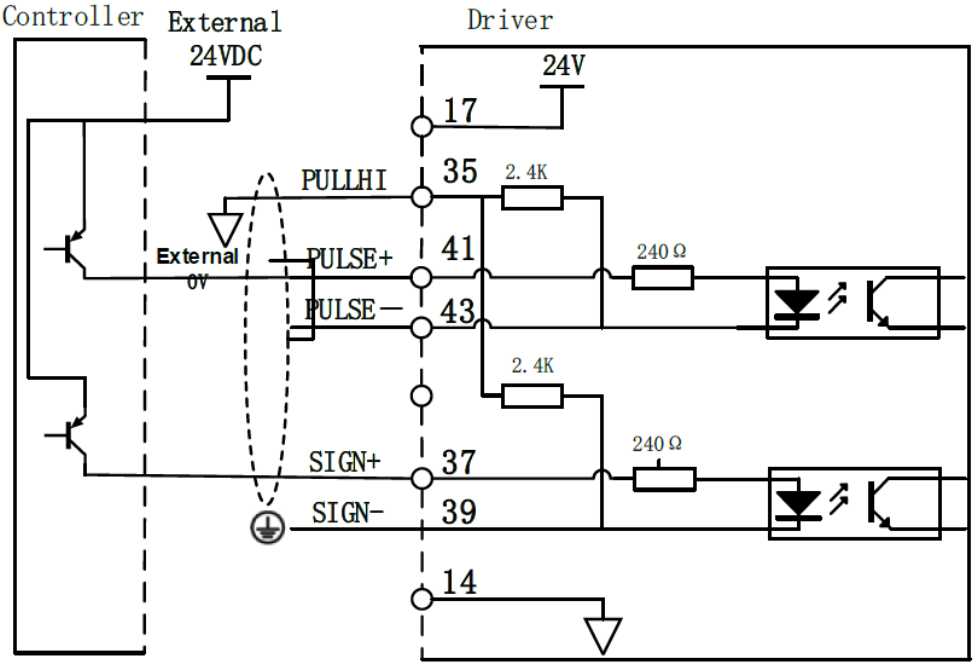


- **Using external power supply**
  Method 1: Using driver internal resistor (Recommended)

3. When pulse input comes from NPN type device:

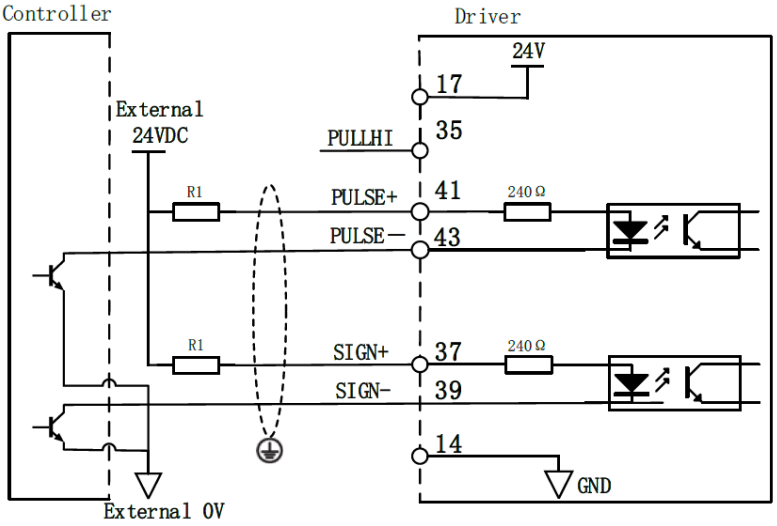


4. When pulse input comes from PNP type device:

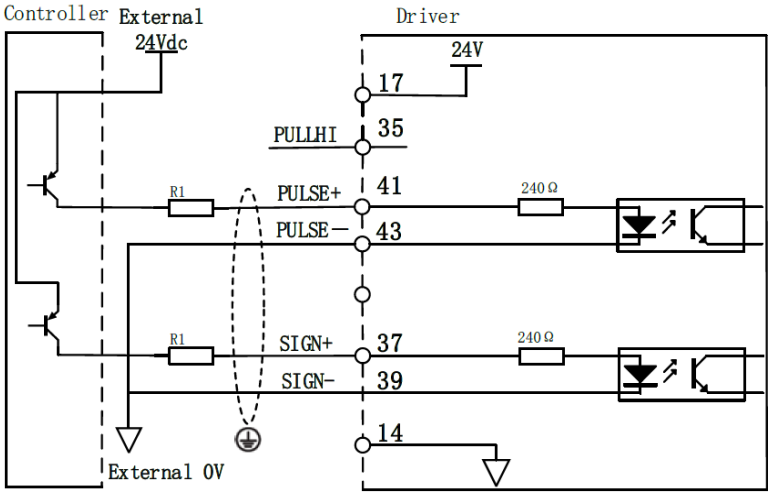


Method 2: Using external resistor

5. When pulse input comes from NPN type device:



6. When pulse input comes from PNP type device:



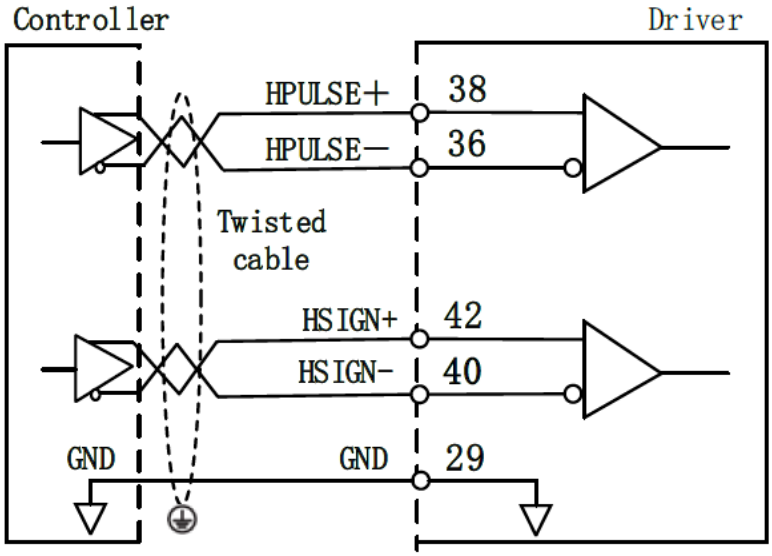
- Using 24V external power supply, driver internal includes current limitation equivalent to VDC value. By installing a resistor, driver's noise tolerance will be improved.
- Resistance of current limiting resistor = $\frac{\text{VDC}-1.5\text{V(Voltage drop)}}{\text{R1(Current limiting)}+220\,\Omega}=10\text{mA}$. 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.*
- *OSD-H 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

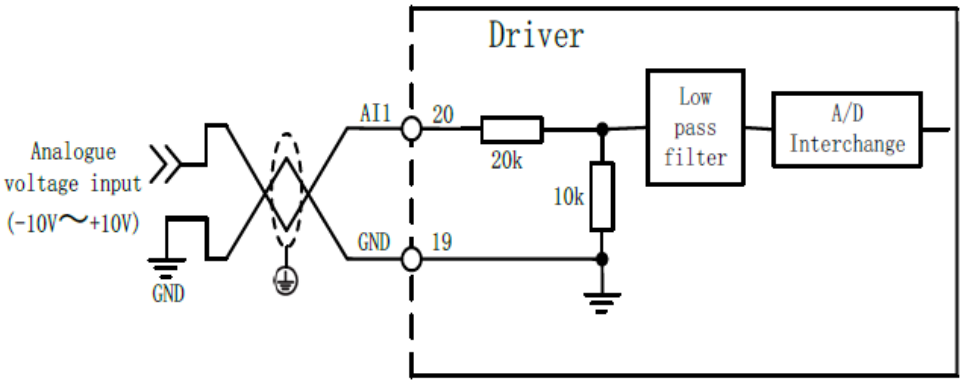
Analogue input signal

OSD-H series servo drives support 2 analogue inputs and 1 analogue output.

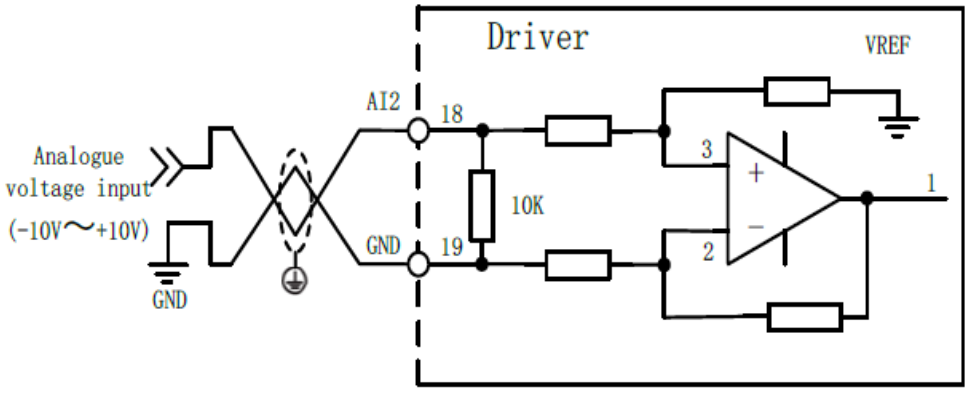
CN1 Pin	Pin Label	Description
15	AO1	Analogue output 1: Single-ended Input voltage: ±10VDC, input resistance: 20KΩ
16	GND	Power supply ground
18	AI2	Analogue input 2: Differential Input voltage: ±10VDC, Input Resistance: 10KΩ
19	GND	Analogue I/O common ground
20	AI1	Analogue input 1: Single-ended Input voltage: ±10VDC, Input Resistance: 10KΩ
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 = ±12VDC

Analogue input 1 AI1 wiring diagram



Analogue input 2 AI2 wiring diagram

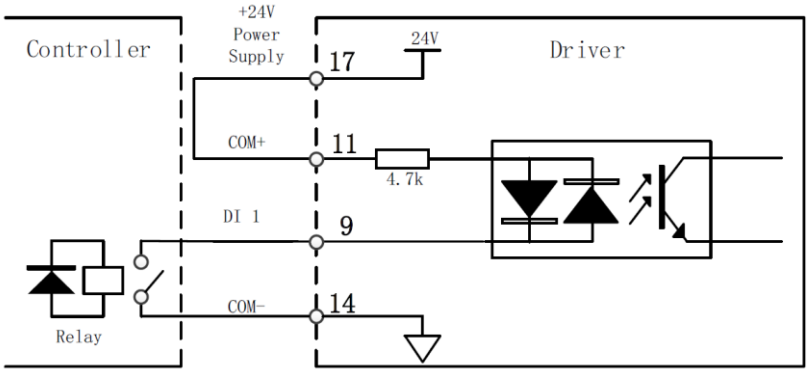


2.11.3 Digital Input Circuit

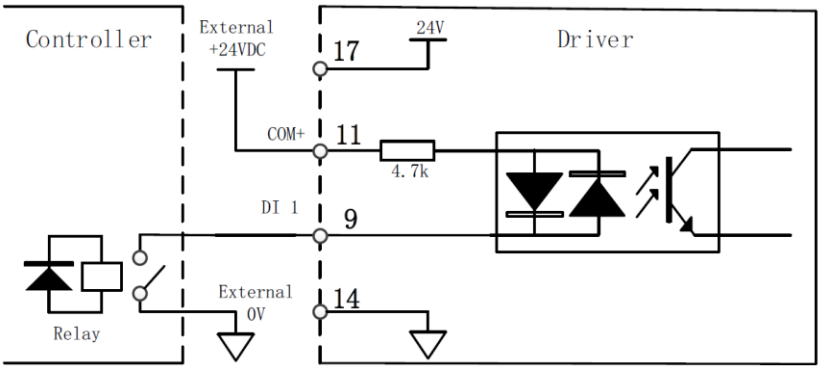
Using DI1 as an example (DI2-DI8 use the same input circuit). The internal circuit of common input is a bidirectional optocoupler which supports common anode and common cathode configurations. There are 2 types of outputs from master device: Relay output and Open Collector output as shown below.

- Relay output:

3. Using internal 24V power supply



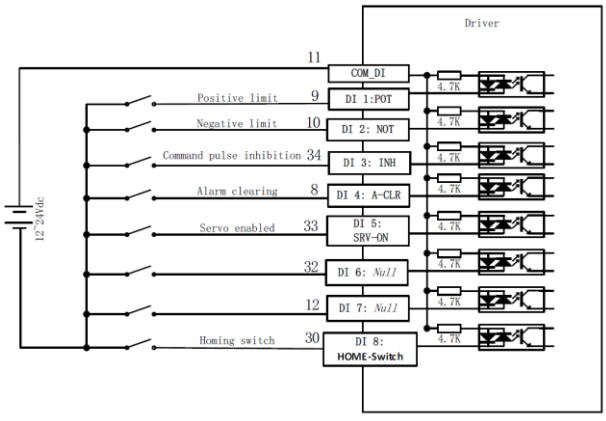
4. Using external power supply



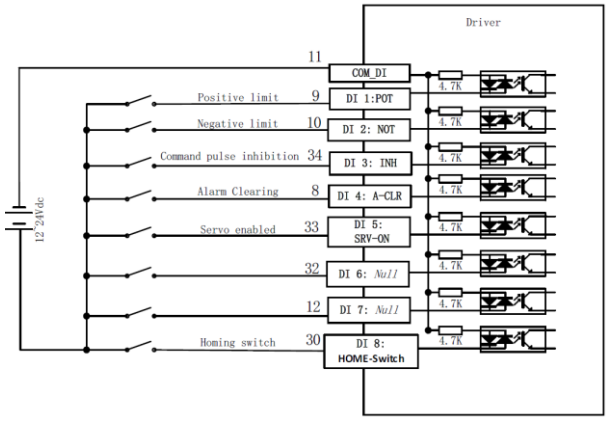
**Please connect to a flyback diode when using relay input to prevent damage to DO terminal.*

OSD-H Series AC Servo Drive supports both common anode and cathode connection:

Common Cathode:

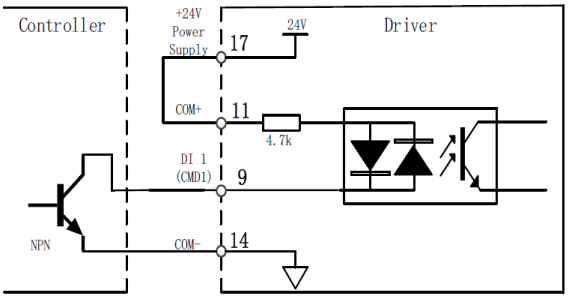


Common Anode:

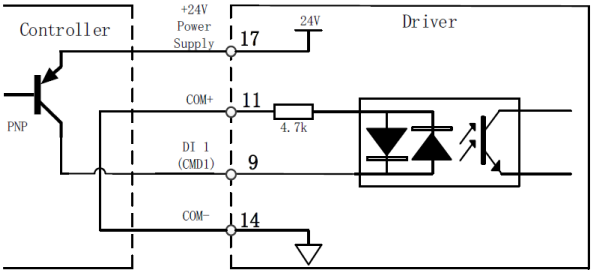


Open collector output

Common Anode (Internal power supply)



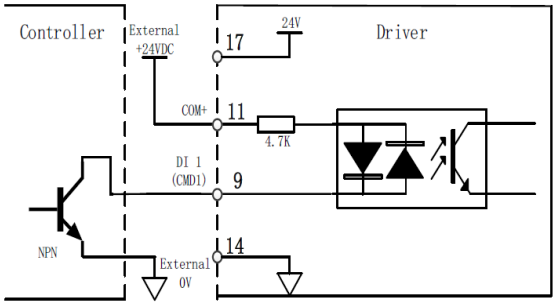
Common Cathode (Internal power supply)



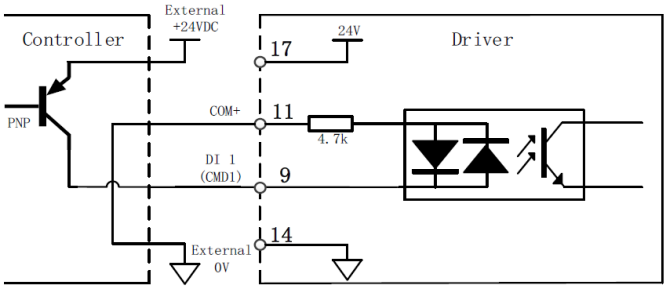
** Please prepare switching power supply with output of 12-24VDC, current≥ 100mA;*

■ **Using open collector output**

Common Anode (External power supply)

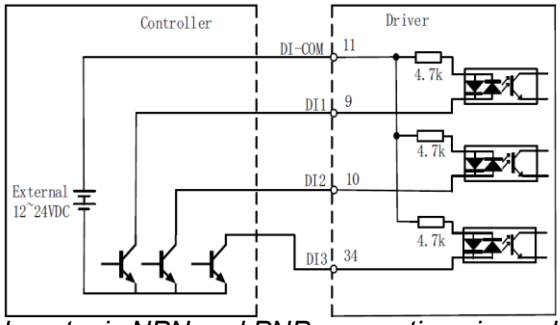


Common Cathode (External power supply)

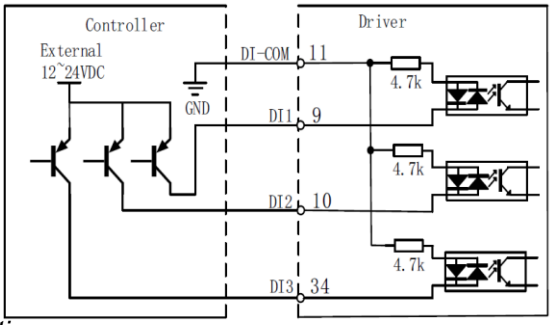


■ **Using transistor output**

NPN:



PNP:



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

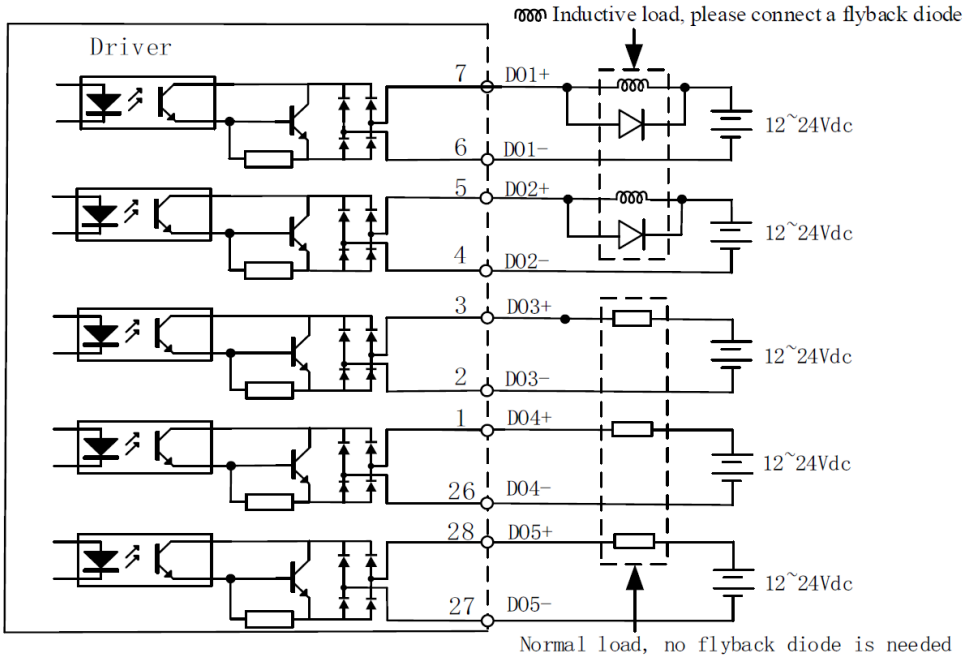
DI1-DI8 Default Signal Assignment

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

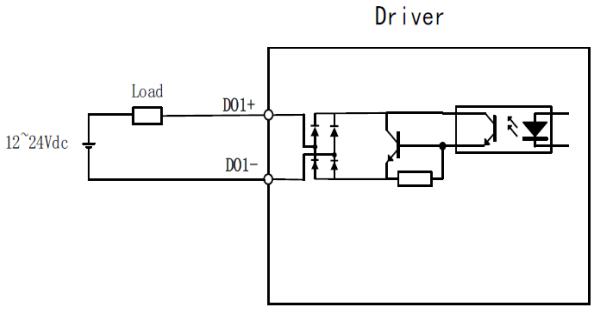
2.11.4 Digital Output Circuit

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.

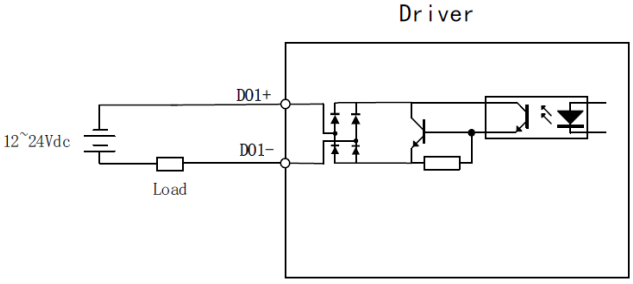
Double ended outputs DO1-DO5 (Supports both NPN & PNP)



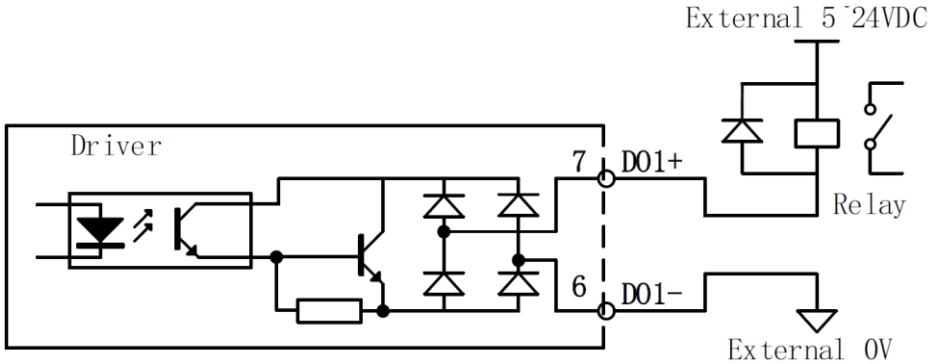
NPN:



PNP:

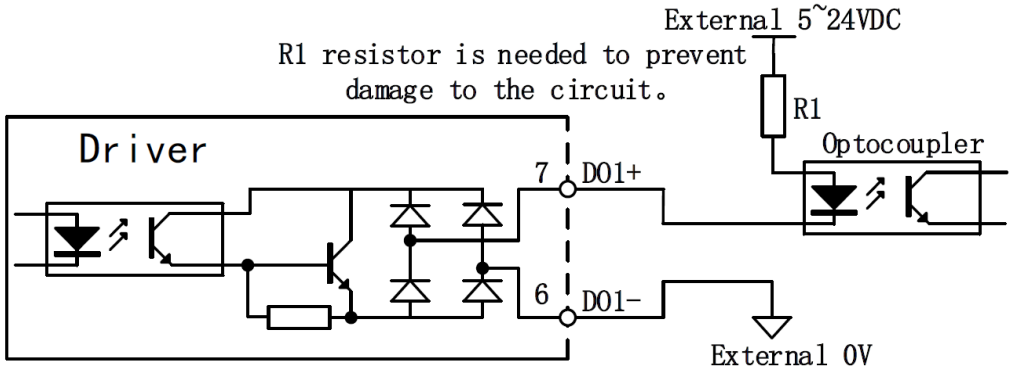


Relay:



**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	

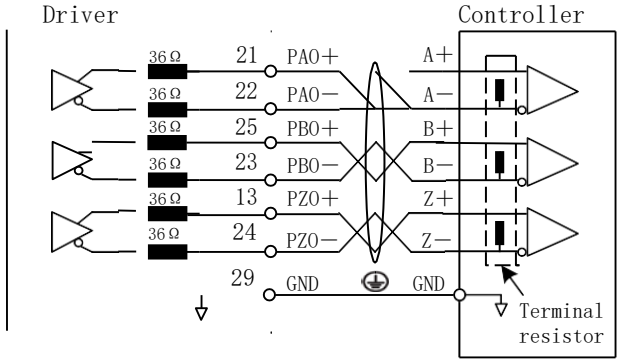
2.11.5 Encoder frequency divider output circuit

OSD-H series supports 2 kinds of frequency divider output: Differential and open collector.

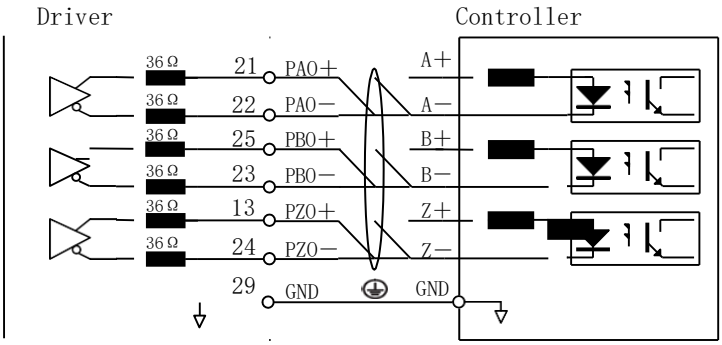
Pin	Signal	Description	
21	PAO＋	Motor encoder A phase frequency divider output	Differential, High＞=2.5VDC， Low<=0.5VDC， Max current output±20mA。
22	PAO－		
25	PBO＋	Motor encoder B phase frequency divider output	
23	PBO－		
13	PZO＋	Motor encoder Z phase frequency divider output	
24	PZO－		
44	PZ-OUT	Motor 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.



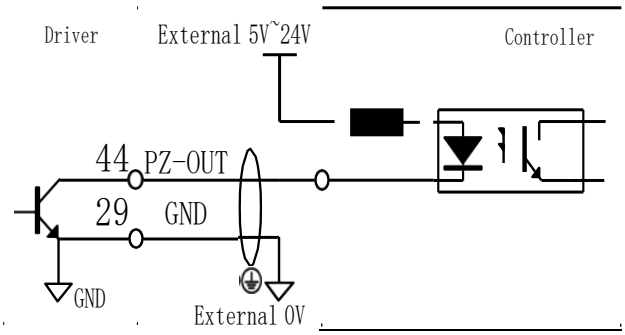
Using an optocoupler receiving circuit:



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.

2.12DI 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	P	S	T
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	P	S	T
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	P	S	T
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	P		
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	P	S	T
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	P		
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	P	S	T
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 2nd mode; when invalid, select 1st mode. Please do not enter any command 10ms before and after mode switching.						

Label	Command frequency divider/multiplier switching			Mode	P		
Signal	DIV1	Default assignment		I/O circuit	2.11.3 Digital inputs		
	When DIV1 is valid, frequency divider/multiplier numerator and denominator switch to 2nd command frequency divider/multiplier numerator and denominator. When DIV1 input is valid, position command from controller will deviate from servo drive internal command after filtering, which might cause the loss of position info before DIV1 input. Please reset before making any further action requiring position management.						

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

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

Label	Torque limit switching			Mode	P	S	
Signal	TL-SEL	Default assignment		I/O circuit	2.11.3 Digital inputs		

To switch between 1st and 2nd torque limit. Please refer to Pr5.21

Value		Limit
【0】		1st torque limit Pr0.13
1		2nd torque limitPr5.22
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

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

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

Label	Torque command sign			Mode			T
Signal	TC-SIGN	Default assignment		I/O circuit	2.11.3 Digital inputs		

Sign of torque command input in torque control mode. Please refer to Pr3.18

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

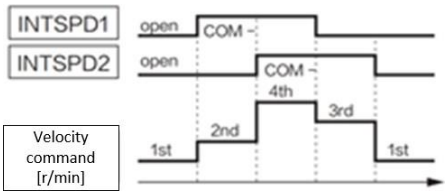
Label	Internal command velocity 1			**Mode**	**S**
Signal	INTSPD1	**Default assignment**		**I/O circuit**	2.11.3 Digital inputs
Label	Internal command velocity 2			**Mode**	**S**
Signal	INTSPD2	**Default assignment**		**I/O circuit**	2.11.3 Digital inputs
Label	Internal command velocity 3			**Mode**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

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

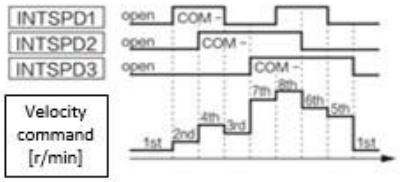
0	Analog - Velocity command（SPR）
【1】	Internal velocity settings 1st – 4th speed（Pr3.04～Pr3.07）
2	Internal velocity settings 1st – 3rd speed（Pr3.04～P3.06）、Analog velocity command（SPR）
3	Internal velocity settings 1st – 8th speed（Pr3.00～Pr3.11）

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



Pr3.00=1 / 2



Pr3.00=3

Signal input configurable only in PR mode

Label	Trigger command			Mode	PR
Signal	CTRG	Default assignment		I/O circuit	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
Signal	ADD0-3	Default assignment		I/O circuit	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
Signal	HOME	Default assignment		I/O circuit	2.11.3 Digital inputs
	Homing trigger, homing velocity and acceleration can be set in Pr8.15-Pr8.18				

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

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

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

2.13DO 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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.14Measures against electromagnetic interference

To reduce interference, please take the following measures:

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

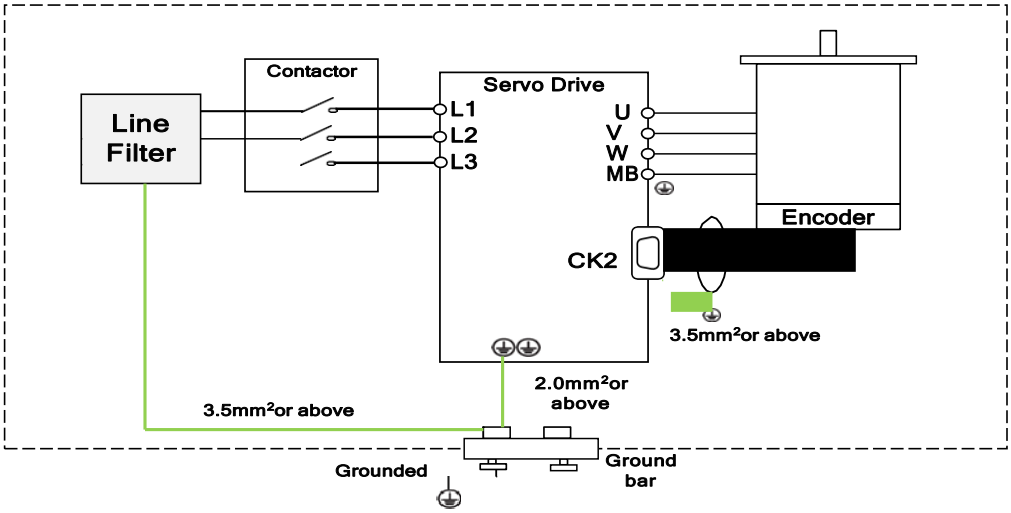
  ①Install master device and line filter close to the servo drive

  ②Install surge suppressor for relay and contactor

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

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

2.14.1 Grounding connection and other anti-interference wiring connections

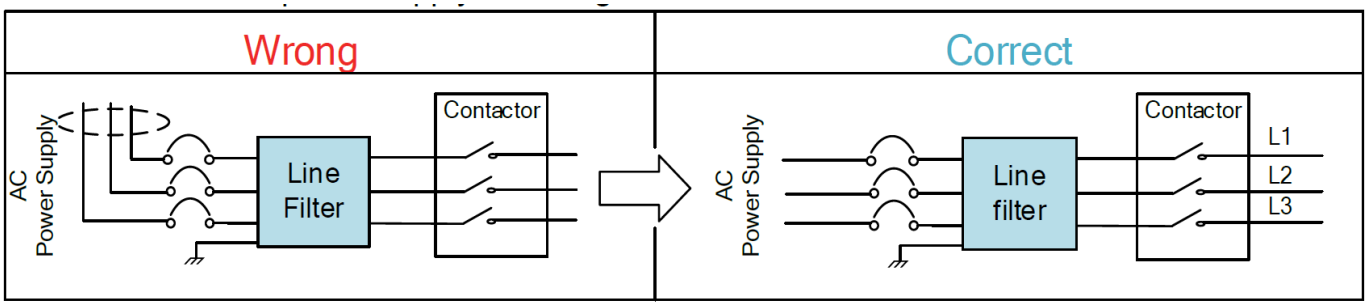


- Servo motor frame should be grounded. Please connect the PE terminal of servo motor and servo drive and ground them together to reduce interference.
- Ground both ends of the foil shield of encoder cable.

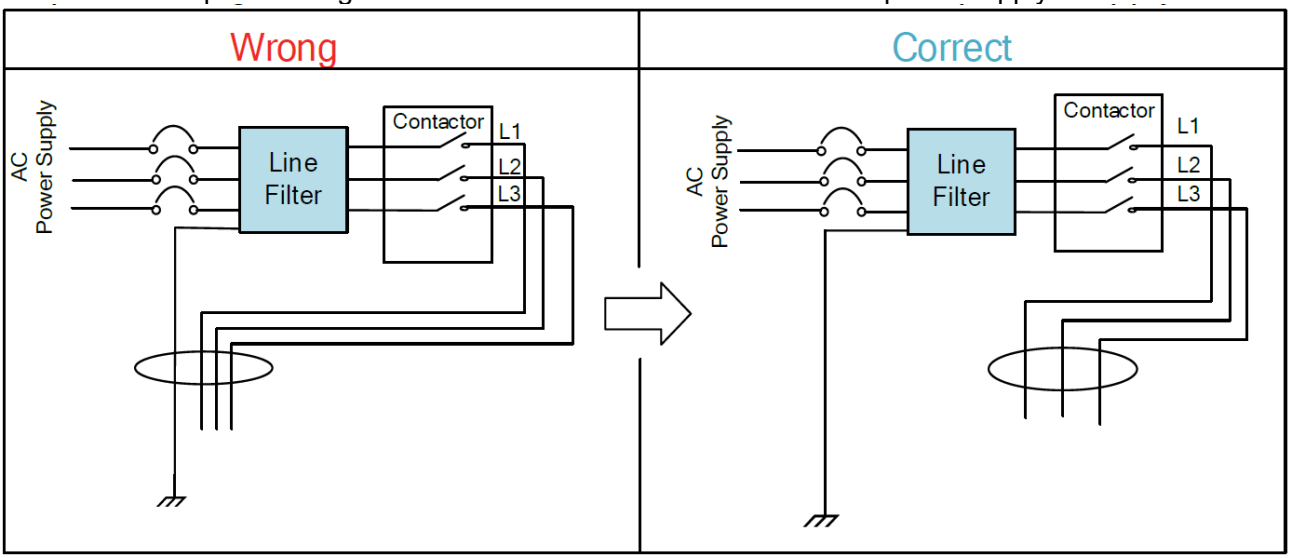
2.14.2 Using line filter

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.

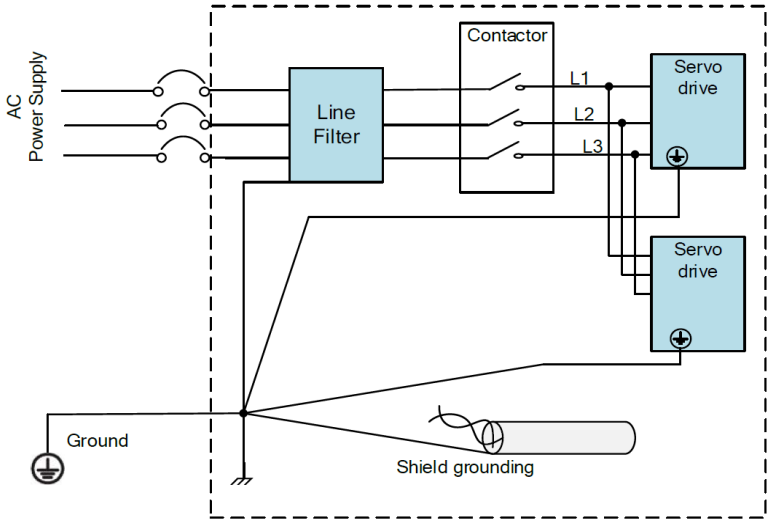
Do not band the main power supply cable together.



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

Pr 0 . 0 0
Classification code
Sub-code

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

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

[Class 0] Basic settings

Code	Label	Default	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr0.00	Model-following bandwidth	1	△	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	1st command pulse count per revolution	10000	O	O	—	—	32bit	R/W	0x0010 0x0011
Pr0.09	1st command frequency divider/multiplier numerator	1	O	O	—	—	32bit	R/W	0x0012 0x0013
Pr0.10	1st 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	1st 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	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr0.17	Regenerative resistor power rating	50	—	O	O	O	16bit	R/W	0x0023
Pr0.22	PR and P/S/T switching	0	—	O	O	O	16bit	R/W	0x002D
Pr0.25	Auxiliary function	0	—	O	O	O	16bit	R/W	0x0033
Pr0.26	Simulated I/O	0	—	O	O	O	16bit	R/W	0x0035
Pr0.30	Encoder feedback mode	0	—	O	O	O	16bit	R/W	0x0037
Pr0.33	Excessive hybrid deviation	16000	O	O			16bit	R/W	0x0043
Pr0.34	Clear excess hybrid control deviation	0	O	O			16bit	R/W	0x0045
Pr0.40	Mapping parameter 1	0x0	—	O	O	O	32bit	R/W *	0x0050 0x0051
Pr0.41	Mapping parameter 2	0x0	—	O	O	O	32bit	R/W *	0x0052 0x0053
Pr0.42	Mapping parameter 3	0x0	—	O	O	O	32bit	R/W *	0x0054 0x0055
Pr0.43	Mapping parameter 4	0x0	—	O	O	O	32bit	R/W *	0x0056 0x0057
Pr0.44	Mapping parameter 5	0x0	—	O	O	O	32bit	R/W *	0x0058 0x0059
Pr0.45	Mapping parameter 6	0x0	—	O	O	O	32bit	R/W *	0x005A 0x005b
Pr0.46	Mapping parameter 7	0x0	—	O	O	O	32bit	R/W *	0x005C 0x005d
Pr0.47	Mapping parameter 8	0x0	—	O	O	O	32bit	R/W *	0x005E 0x005F
Pr0.50	Mapping parameter 1 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x0064 0x0065
Pr0.51	Mapping parameter 2 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x0066 0x0067
Pr0.52	Mapping parameter 3 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x0068 0x0069
Pr0.53	Mapping parameter 4 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x006A 0x006B
Pr0.54	Mapping parameter 5 indicator	0x0049 0049	—	O	O	O	32bit	R/W	0x006C 0x006D

Code	Label	Default	Activation	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	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr1.00	1st position loop gain	320	—	O	—	—	16bit	R/W	0x0101
Pr1.01	1st velocity loop gain	180	—	O	O	O	16bit	R/W	0x0103
Pr1.02	1st Integral Time Constant of Velocity Loop	310	—	O	O	O	16bit	R/W	0x0105
Pr1.03	1st velocity detection filter	15	—	O	O	O	16bit	R/W	0x0107
Pr1.04	1st Torque Filter Time Constant	126	—	O	O	O	16bit	R/W	0x0109
Pr1.05	2nd Position Loop Gain	380	—	O	—	—	16bit	R/W	0x010B
Pr1.06	2nd velocity loop gain	180	—	O	O	O	16bit	R/W	0x010D
Pr1.07	2nd Integral Time Constant of Velocity Loop	10000	—	O	O	O	16bit	R/W	0x010F
Pr1.08	2nd velocity detection filter	15	—	O	O	O	16bit	R/W	0x0111
Pr1.09	2nd 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	Activation	Valid mode			Communication mode		
				P	S	T	Byte	Op.	485 Addr.
Pr2.00	Adaptive filtering mode settings	0	—	O	O	—	16bit	R/W	0x0201
Pr2.01	1st notch frequency	4000	—	O	O	O	16bit	R/W	0x0203
Pr2.02	1st notch width	4	—	O	O	O	16bit	R/W	0x0205
Pr2.03	1st notch depth	0	—	O	O	O	16bit	R/W	0x0207
Pr2.04	2nd notch frequency	4000	—	O	O	O	16bit	R/W	0x0209
Pr2.05	2nd notch width	4	—	O	O	O	16bit	R/W	0x020B
Pr2.06	2nd notch depth	0	—	O	O	O	16bit	R/W	0x020D
Pr2.07	3rd notch frequency	4000	—	O	O	O	16bit	R/W	0x020F
Pr2.08	3rd notch width	4	—	O	O	O	16bit	R/W	0x0211
Pr2.09	3rd notch depth	0	—	O	O	O	16bit	R/W	0x0213
Pr2.14	1st damping frequency	0	—	O	—	—	16bit	R/W	0x021D
Pr2.16	2nd damping frequency	0	—	O	—	—	16bit	R/W	0x0221
Pr2.22	Position command smoothing filter	0	△	O	—	—	16bit	R/W	0x022D
Pr2.23	Position command FIR filter	0	△	O	—	—	16bit	R/W	0x022F
Pr2.48	Adjustment mode	0	—	O	O	O	16bit	R/W	0x0261
Pr2.50	MFC type	0	•	O	—	—	16bit	R/W	0x0265
Pr2.51	Velocity feedforward compensation coefficient	0	—	O	—	—	16bit	R/W	0x0267
Pr2.52	Torque feedforward compensation coefficient	0	—	O	O	—	16bit	R/W	0x0269
Pr2.53	Dynamic friction compensation coefficient	0	—	O	O	O	16bit	R/W	0x026B
Pr2.54	Overshoot time coefficient	0	—	O	O	O	16bit	R/W	0x026D
Pr2.55	Overshoot suppression gain	0	—	O	O	O	16bit	R/W	0x026F

[Class 3] Velocity / Torque Control

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

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

[Class 4] I/O Monitoring Settings

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

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

[Class 5] Extension settings

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

[Class 6] Other Settings

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

[Class B] Status Parameters

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

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

[Class 8] Pr-Control Parameters

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

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

[Class 9] Pr-Control Path Parameters

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

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

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

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

◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2st mode.
Please allow some time in between mode switching commands.
◆Please set Pr0.01 = 6 to switch to other modes from PR mod, then set 2nd 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	0x0~0xFFF	Unit	—	Default	0x1		
	Byte length	16bit	Attribute	R/W	485 address	0x0005		
	Valid	Immediate						

Data bits	Category	Settings	Application
0x00_	Motion setting mode	Used to set motion setting mode, which can be selected according to the motion characteristics or setting requirements. Generally, it is recommended to select mode 1 with good generality when there is no special requirement, mode 2 when rapid positioning is needed If mode 1 and mode 2 cannot meet the requirements, please choose mode 0.	
		0:Manual	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						

Low ⟶ Mechanical stiffness ⟶ High

Low ⟶ Servo gain ⟶ High

81.80·····70.69.68·····51.50

Low ⟶ Responsiveness ⟶ High

Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Recommend to set to around 15 with motor with high inertia.

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						

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

Set inertia ratio according to actual load inertia. When both are uniform, actual motor velocity loop responsiveness and gain settings will be consistent. If inertia ratio is greater than actual value, velocity loop gain settings will be higher and vice versa.
For motor with high inertia, Pr0.04 can be left unfilled but optimal setting of Pr0.04 could improve system performance

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

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

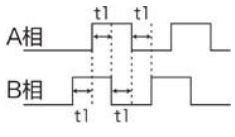
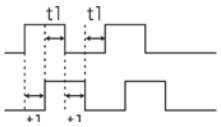
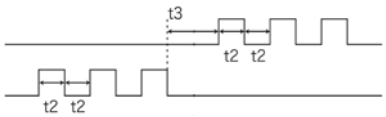
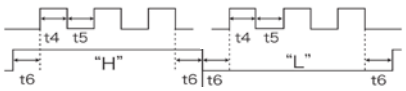
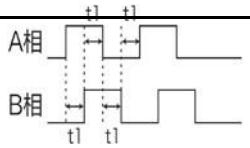
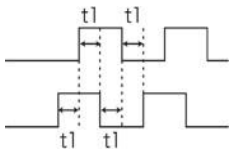
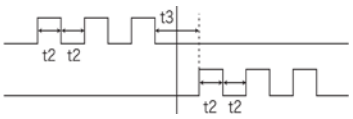
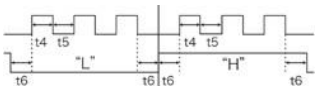
Both channels cannot be used at the same time.

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

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

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

Command pulse input

Command Polarity inversion (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（μ□s）					
			t1	t2	t3	t4	t5	t6
Pulse sequence interface	Differential drive	500 kHz	2	1	1	1	1	1
	Open collector	200 kHz	5	2.5	2.5	2.5	2.5	2.5
	High speed differential drive	4Mhz	0.25	0.125	0.125	0.125	0.125	0.125

Please set >0.1μs for the duration between rising and falling edge of command pulse input signal.
1 revolution with 2500 pulses 2-phase pulse input when 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

Pr0.08	Label	1st command pulse count per revolution			Valid mode(s)	P	S	T
	Range	0-67100864	Unit	PULSE	Default	10000		
	Byte length	32bit	Attribute	R/W	485 address	H: 0x0010 L: 0x0011		
	Valid	After restart						

Control will affected if value set is too low. Err1b1 might occur if value < 500.
(1) 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.

Pr0.09	Label	1st command frequency divider/multiplier numerator			Valid mode(s)	P		
	Range	1~2147483647	Unit	—	Default	1		
	Byte length	32bit	Attribute	R/W	485 address	H: 0x0012 L: 0x0013		
	Valid	After restart						

Valid when Pr0.08 = 0, please refer to description in Pr0.10.

Pr0.10	Label	1st command frequency divider/multiplier denominator			Valid mode(s)	P		
	Range	1~2147483647	Unit	—	Default	1		
	Byte length	32bit	Attribute	R/W	485 address	H: 0x0014 L: 0x0015		
	Valid	After restart						

1. Settings：
(1) Driver command pulse input count : X
(2) Encoder pulse count after frequency divider/multiplier: Y
(3)Encoder pulse count per revolution: Z
(4)Motor revolution: W
2. Calculation：
（1）X, Y
Y = X * 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.

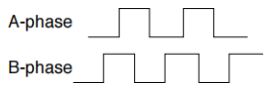
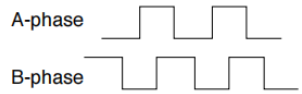
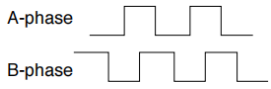
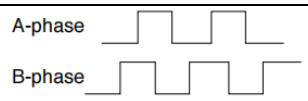
Pr0.11	Label	Encoder output pulse count per revolution			Valid mode(s)	P	S	T
	Range	1~32767	Unit	P/r	Default	2500		
	Byte length	16bit	Attribute	R/W	485 address	0x0017		
	Valid	After restart						

If Pr0.11 = 1000, encoder differential output signal per revolution = 4000 pulses

Pr0.12	Label	Pulse output logic inversion			Valid mode(s)	P	S	T
	Range	0~1	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0019		
	Valid	After restart						

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

Pulse output logic inversion

Pr0.12	Phase B logic	CCW direction	CW direction
[0]	Not inverted		
[1]	Inverted		

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

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

Please refer to Pr5.21 on how to set torque limit.

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

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

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 Pr0.17set 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)
OSD-2SD40	100	50
OSD-2SD75	50	75
OSD-2S1D0	50	100
OSD-4TD75	100	100
OSD-4T1D0	100	100
OSD-4T1D5	100	100
OSD-4T2D0	50	100
OSD-4T3D0	50	100
OSD-4T4D4	35	100
OSD-4T5D5	35	100
OSD-4T7D5	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.

Pr0.22	Label	PR and P/S/T switching			Valid mode(s)	P	S	T
	Range	0~2	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x002D		
	Valid	Immediate						

Pr0.01	Pr0.22	Control mode
6	【0】	PR / Position
	1	PR / Velocity
	2	PR / Torque

Pr0.25	Label	Auxiliary function			Valid mode(s)	P	S	T
	Range	0~0xFFFF	Unit	-	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0033		
	Valid	Immediate						

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

Only for RS485 communication, please write corresponding parameters into Pr0.25
Do not use JOG_P and JOG_N in PR mode

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

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

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

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

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

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

Pr0.57 (Only for RS485)	Label	Mapping parameter 8 indicator			Valid mode(s)	P	S	T
	Range	0~0xFFFFFFFF	Unit		Default	0x00490049		
	Byte length	32bit	Attribute	R/W	485 address	H: 0x0072		
	Valid	Immediate				L: 0x0073		

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

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

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

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 0x00000001into Pr0.40; write 0x00000001 into Pr1.15;

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

3.2.2 [Class 1] Gain adjustments

Pr1.00	Label	1st position loop gain			Valid mode(s)	P		
	Range	0～30000	Unit	0.1/s	Default	320		
	Byte length	16bit	Attribute	R/W	485 address	0x0101		
	Valid	Immediate						

Higher position loop gain value improves the responsiveness of the servo driver and lessens the positioning time.
Position loop gain value shouldn't exceed responsiveness of the mechanical system and take in consideration velocity loop gain, if not it might cause vibration, mechanical noise and overtravel.
As velocity loop gain is based on position loop gain, please set both values accordingly.
Recommended range: 1.2≤Pr1.00/Pr1.01≤1.8

Pr1.01	Label	1st velocity loop gain			Valid mode(s)	P	S	T
	Range	1～32767	Unit	0.1Hz	Default	180		
	Byte length	16bit	Attribute	R/W	485 address	0x0103		
	Valid	Immediate						

To determine the responsiveness of the velocity loop. If inertia ratio of 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.

Pr1.02	Label	1st Integral Time Constant of Velocity Loop			Valid mode(s)	P	S	T
	Range	1～10000	Unit	0.1ms	Default	310		
	Byte length	16bit	Attribute	R/W	485 address	0x0105		
	Valid	Immediate						

The lower the set value, the closer the lag error at stop to 0 but might cause vibration. If the value set is overly large, overshoot, delay of positioning time duration and lowered responsiveness might occur.
Set 10000 to deactivate Pr1.02.

Pr1.03	Label	1st velocity detection filter			Valid mode(s)	P	S	T
	Range	0～31	Unit	—	Default	15		
	Byte length	16bit	Attribute	R/W	485 address	0x0107		
	Valid	Immediate						

This filter is a low pass filter. It blocks high frequencies which cause system instability from velocity feedback data. The higher the set value, lower frequencies will be blocked and velocity responsiveness will also be lowered. Pr1.03 needs to match velocity loop gain. Please refer to the following table.

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

Pr1.04	Label	1st Torque Filter Time Constant			Valid mode(s)	P	S	T
	Range	0～2500	Unit	0.01ms	Default	126		
	Byte length	16bit	Attribute	R/W	485 address	0x0109		
	Valid	Immediate						
	To set torque command low-pass filter, add a filter delay time constant to torque command and filter out the high frequencies in the command. Often used to reduce or eliminate some noise or vibration during motor operation, but it will reduce the responsiveness of current loop, resulting in undermining velocity loop and position loop control. Pr1.04 needs to match velocity loop gain. Recommended range: 1,000,000/(2π×Pr1.04) ≥Pr1.01×4 For example: Velocity loop gain Pr1.01=180(0.1Hz) which is 18Hz. Time constant of torque filter should be Pr1.01≤221(0.01ms) 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.							

Pr1.05	Label	2nd Position Loop Gain			Valid mode(s)	P		
	Range	0～30000	Unit	0.1/s	Default	380		
	Byte length	16bit	Attribute	R/W	485 address	0x010B		
	Valid	Immediate						
Pr1.06	Label	2nd velocity loop gain			Valid mode(s)	P	S	T
	Range	1～32767	Unit	0.1Hz	Default	180		
	Byte length	16bit	Attribute	R/W	485 address	0x010D		
	Valid	Immediate						
Pr1.07	Label	2nd Integral Time Constant of Velocity Loop			Valid mode(s)	P	S	T
	Range	1～10000	Unit	0.1ms	Default	10000		
	Byte length	16bit	Attribute	R/W	485 address	0x010F		
	Valid	Immediate						
Pr1.08	Label	2nd velocity detection filter			Valid mode(s)	P	S	T
	Range	0～31	Unit	—	Default	15		
	Byte length	16bit	Attribute	R/W	485 address	0x0111		
	Valid	Immediate						
Pr1.09	Label	2nd Torque Filter Time Constant			Valid mode(s)	P	S	T
	Range	0~2500	Unit	0.01ms	Default	126		
	Byte length	16bit	Attribute	R/W	485 address	0x0113		
	Valid	Immediate						
	Position loop, velocity loop, velocity detection filter, torque command filter each have 2 pairs of gain or time constant (1st and 2nd).							
Pr1.10	Label	Velocity feed forward gain			Valid mode(s)	P		
	Range	0~1000	Unit	0.10%	Default	300		
	Byte length	16bit	Attribute	R/W	485 address	0x0115		
	Valid	Immediate						
	Used for decreasing following error caused by low responsiveness of velocity loop. Might cause overshoot or increase in noise if set value is too high.							

Pr1.11	Label	Velocity feed forward filter time constant			Valid mode(s)	P		
	Range	0~6400	Unit	0.01ms	Default	50		
	Byte length	16bit	Attribute	R/W	485 address	0x0117		
	Valid	Immediate						

Set velocity feed forward low pass filter to eliminate high or abnormal frequencies in velocity feed forward command. Often used when position command with low resolution or high electronic gear ration to smoothen velocity feed forward.
Position deviation under constant velocity can be lowered with higher velocity feed forward gain. Please to refer to the equation below.
Reduce 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.

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

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.

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

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

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

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

Value	Condition	Gain switching condition
【0】	1st gain fixed	Fixed on using 1st gain(Pr1.00-Pr1.04)
1	2nd gain fixed	Fixed on using 2nd gain (Pr1.05-Pr1.09)
2	Gain switching input valid	· Gain switching input （GAIN）invalid: 1st gain. · Gain switching input （GAIN）valid: 2nd gain. **Default: 1st gain*
3	High command torque	Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1st gain when set torque command absolute value smaller than (level + hysteresis)[%]
4-9	Reserved	Reserved
10	Pending position command +actual velocity	Valid for position control. Switch to 2nd gain if position command ≠ 0 Switch to 1st gain if positional command = 0 throughout the duration of delay time and absolute value of actual velocity remains smaller than (level - hysteresis) (r/min)

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

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

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

Switching condition	Unit
Position	Encoder pulse count
Velocity	RPM
Torque	%

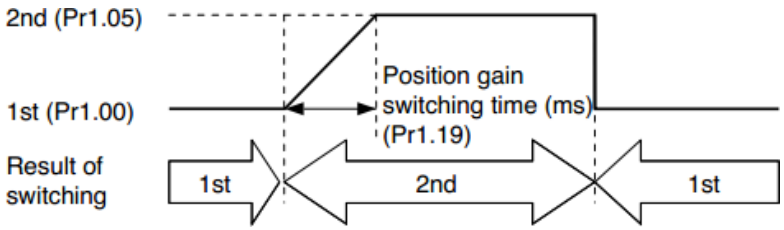
Please set level ≥ hysteresis

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

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

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

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



Pr1.35	Label	Position command pulse filter time			Valid mode(s)	P		
	Range	0~200	Unit	0.01us	Default	8		
	Byte length	16bit	Attribute	R/W	485 address	0x0147		
	Valid	After restart						

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

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)		

3.2.3 [Class 2] Vibration suppression

Pr2.00	Label	Adaptive filtering mode settings			Valid mode(s)	P	S	
	Range	0~4	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0201		
	Valid	Immediate						

Value	Description	
0	Adaptive filter: invalid	Parameters related to 3rd notch filter remain unchanged
1	Adaptive filter: 1 filter valid for once.	1 adaptive filter becomes valid. 3rd notch filter related parameters updated accordingly. Pr2.00 switches automatically to 0 once updated.
2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3rd notch filter related parameters will keep updating accordingly.
3-4	Reserved	-

Pr2.01	Label	1st notch frequency			Valid mode(s)	P	S	T
	Range	50~4000	Unit	Hz	Default	4000		
	Byte length	16bit	Attribute	R/W	485 address	0x0203		
	Valid	Immediate						
	Set center frequency of 1st torque command notch filter. Set Pr2.01 to 4000 to deactivate notch filter							
Pr2.02	Label	1st notch width			Valid mode(s)	P	S	T
	Range	0~20	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x0205		
	Valid	Immediate						
	Set notch bandwidth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.03, Pr2.02 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings							
Pr2.03	Label	1st notch depth			Valid mode(s)	P	S	T
	Range	0~99	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0207		
	Valid	Immediate						
	Set notch depth for 1st resonant notch filter. Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.02, Pr2.03 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings							

Pr2.04	Label	2nd notch frequency			Valid mode(s)	P	S	T
	Range	50~4000	Unit	Hz	Default	4000		
	Byte length	16bit	Attribute	R/W	485 address	0x0209		
	Valid	Immediate						

Set center frequency of 2nd torque command notch filter.
Set Pr2.04 to 4000 to deactivate notch filter

Pr2.05	Label	2nd notch width			Valid mode(s)	P	S	T
	Range	0~20	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x020B		
	Valid	Immediate						

Set notch bandwidth for 2nd resonant notch filter.
Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.04 and Pr2.06, Pr2.05 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.

Pr2.06	Label	2nd notch depth			Valid mode(s)	P	S	T
	Range	0~99	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x020D		
	Valid	Immediate						

Set notch depth for 1st resonant notch filter.
When 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.

Pr2.07	Label	3rd notch frequency			Valid mode(s)	P	S	T
	Range	50~4000	Unit	Hz	Default	4000		
	Byte length	16bit	Attribute	R/W	485 address	0x020F		
	Valid	Immediate						

Set center frequency of 3rd torque command notch filter.
Set Pr2.07 to 4000 to deactivate notch filter

Pr2.08	Label	3rd notch width			Valid mode(s)	P	S	T
	Range	0~20	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x0211		
	Valid	Immediate						

Set notch depth for 3rd resonant notch filter.
When 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.

Pr2.09	Label	3rd notch depth			Valid mode(s)	P	S	T
	Range	0~99	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0213		
	Valid	Immediate						

Set notch depth for 3rd resonant notch filter.
When 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.

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

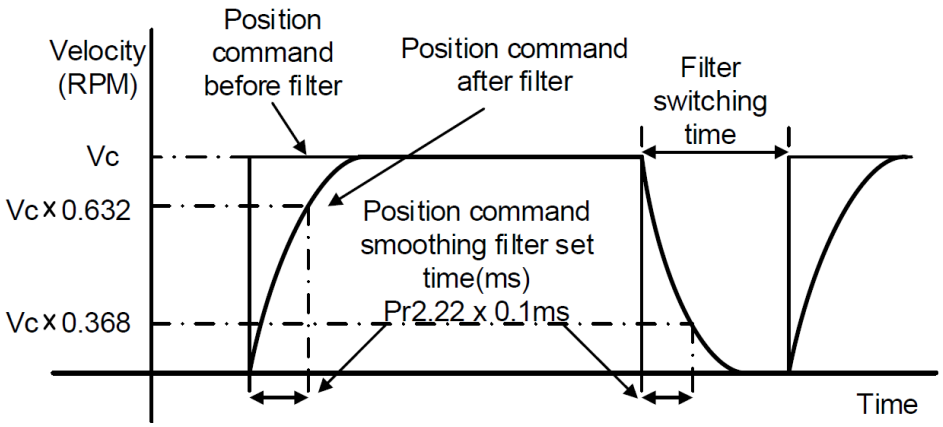
Set Pr2.16 to 0 to deactivate this parameter.
To suppress wobble at load end. Often used when wobble of flexible structure due to high deceleration upon stopping. Especially effective for wobble with frequencies under 100Hz. Set Pr2.15 to wobble frequency (wobble frequency can be determined using tracing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

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

Set 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)

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

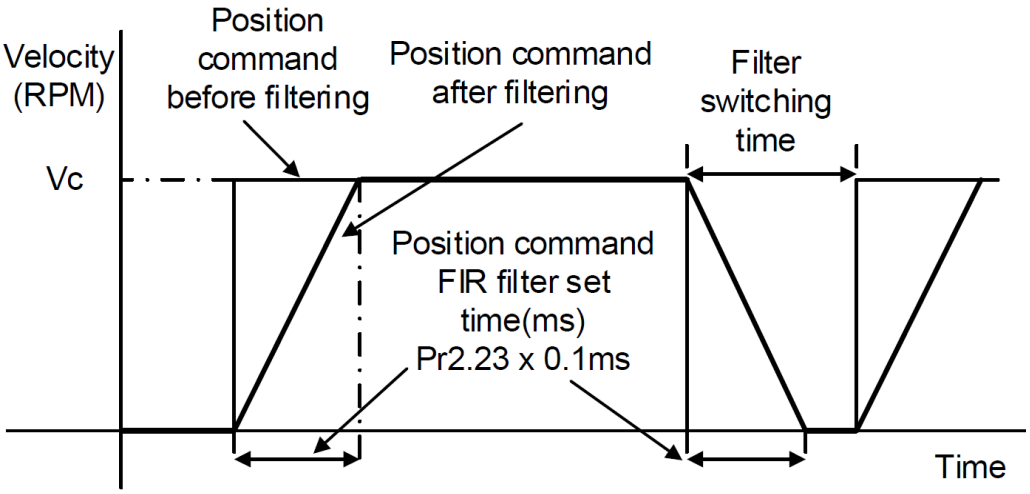
To set time constant of 1 time delay filter of position command.
To set time constant of 1 time delay filter, according to target velocity Vc square wave command as show below.



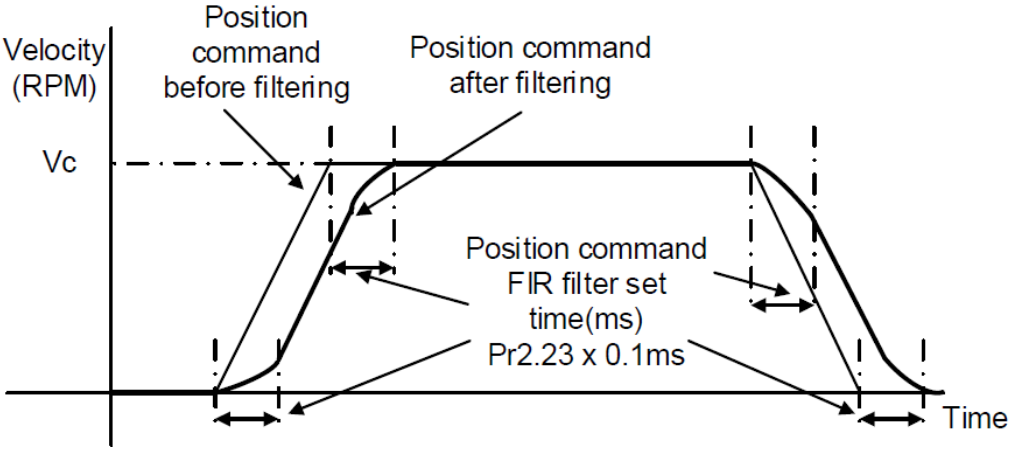
Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If Pr2.22 is set too high, overall time will be lengthened.

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

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



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



Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If 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)

Pr2.48	Label	Adjustment mode			Valid mode(s)	P	S	T
	Range	0~1	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0261		
	Valid	Immediate						

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

Pr2.50	Label	MFC type			Valid mode(s)	P		
	Range	0~3	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0265		
	Valid	Re-enable						

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

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

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

Pr2.53	Label	Dynamic friction compensation coefficient			Valid mode(s)	P	S	T
	Range	0~1000	Unit	%	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x026B		
	Valid	Immediate						

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

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

When there is an excess position deviation during acceleration/deceleration, please adjust Pr2.53 to reduce the deviation to 0.

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

To set overshoot time coefficient

Pr2.55	Label	Overshoot suppression gain			Valid mode(s)	P	S	T
	Range	0~10000	Unit	%	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x026F		
	Valid	Immediate						

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

3.2.4 [Class 3] Velocity/Torque control

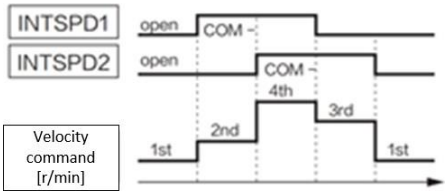
Pr3.00	Label	Velocity internal/external switching			Valid mode(s)	S
	Range	0~3	Unit	—	Default	1
	Byte length	16bit	Attribute	R/W	485 address	0x0301
	Valid	Immediate				

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

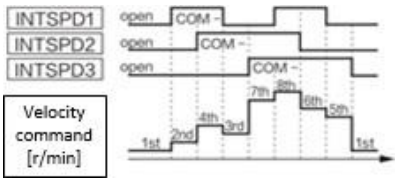
Value	Velocity settings
0	Analog - Velocity command（SPR）
【1】	Internal velocity settings 1st – 4th speed（Pr3.04～Pr3.07）
2	Internal velocity settings 1st – 3rd speed（Pr3.04～P3.06）、Analog velocity command（SPR）
3	Internal velocity settings 1st – 8th speed（Pr3.00～Pr3.11）

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



Pr3.00=1 / 2



Pr3.00=3

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

To set positive/negative direction of velocity command

Value	Velocity settings（Analog or internal velocity）	Velocity command sign selection（VC-□SIGN□）	Velocity command direction
【0】	＋	No effect	Positive
	—	No effect	Negative
1	No effect	OFF	Positive
	No effect	□ON	Negative

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

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

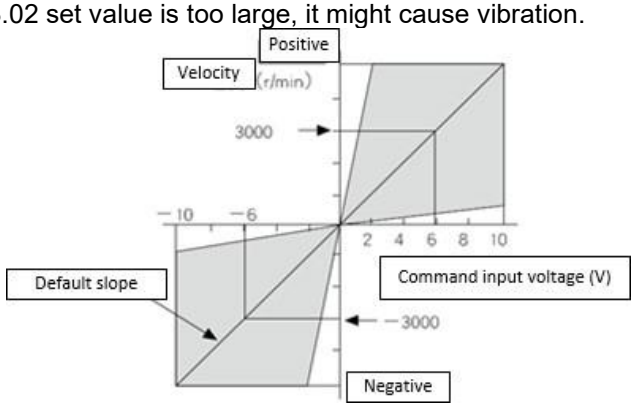
Pr3.02 sets command input voltage and rotational speed slope.

Factory default:

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

Hence 6V input: 3000 r/min

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



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

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

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

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

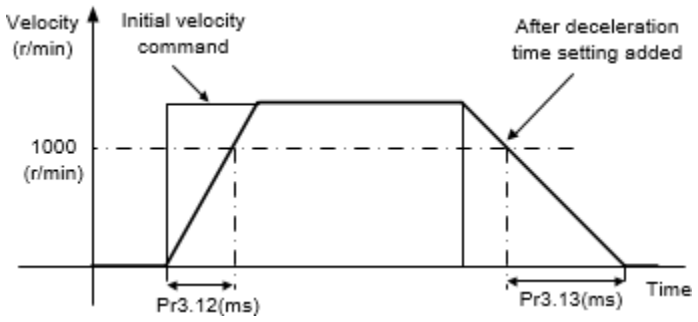
To set internal velocity command 1st -8th speed

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

Set max acceleration/deceleration for velocity command.

If target velocity = *x* [rpm], max acceleration = *a* [unit: rpm/ms], acceleration time = *t* [ms]
Pr3.12 = *1000/a*
Pr3.13 = *1000/a*
a = x/t

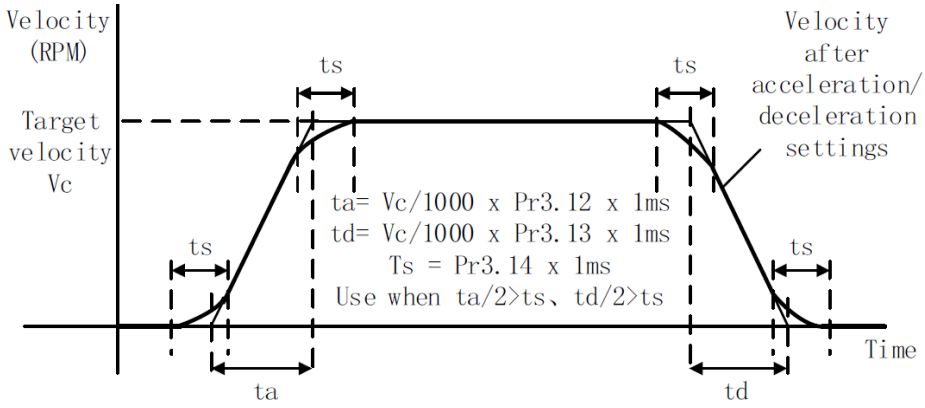
For example: If motor is to achieve 1500rpm in 30s, *a=1500/30=50rpm/ms*
Pr3.12 = 1000/*a= 20.* Hence when Pr3.12 = 20, motor can achieve 1500rpm in 30s.



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.

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

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



Pr3.15	Label	Zero speed clamp function selection			Valid mode(s)	S
	Range	0~3	Unit	—	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0x031F
	Valid	Immediate				

Value	Zero speed clamp function
0	Invalid: zero speed clamp deactivated
1	Velocity command is forced to 0 when the zero speed clamp (ZEROSPD) input signal is valid.
2	Velocity command is forced to 0 when actual velocity is lower than Pr3.16.
3	Includes conditions from 1 and 2

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

Valid when 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.

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
【0】	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

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					

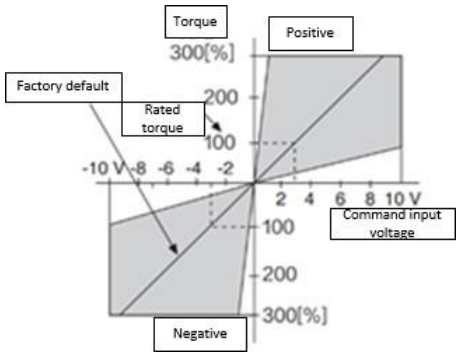
To set torque command positive/negative direction

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

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

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

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



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

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

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

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

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

Pr3.23	Label	Zero speed delay time in velocity mode			Valid mode(s)		S	
	Range	0~2000	Unit	ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x032F		
	Valid	Immediate						
	To set the time interval between axis reaches zero speed level and the moment it totally stops. Used when axis crawls under velocity mode. Set 0 to deactivate this parameter.							

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.							

Pr3.29	Label	Analog 1 clamping voltage			Valid mode(s)			T
	Range	0~20000	Unit	mv	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x033B		
	Valid	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.							
Pr3.30	Label	Analog 3 clamping voltage			Valid mode(s)			T
	Range	0~20000	Unit	mv	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x033D		
	Valid	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.							

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

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

3.2.5 [Class 4] I/O Monitoring Settings

Pr4.00	Label	Input selection DI1	Valid mode(s)	P	S	T
	Range	0x00~0xFF	Unit	—	Default	0x2
	Byte length	16bit	Attribute	R/W	485 address	0x0401
	Valid	Immediate				

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

Signal	Symbol	Value	
		NO	NC
Invalid	—	0	-
Positive limit switch	POT	1	81
Negative limit switch	NOT	2	82
Servo enabled	SRV-ON	3	83
Clear alarm	A-CLR	4	-
Control mode switching	C-MODE	5	85
Gain switching	GAIN	6	86
Clear deviation count	CL	7	-
Command pulse prohibited	INH	8	88
Torque limit switching	TL-SEL	9	89
Command frequency divider/multiplier switching	DIV1	C	8C
Internal command velocity 1	INTSPD1	E	8E
Internal command velocity 2	INTSPD2	F	8F
Internal command velocity 3	INTSPD3	10	90
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	**Label**	Input selection DI2			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFF	**Unit**	—	**Default**	0x1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0403		
	Valid	Immediate						
Pr4.02	**Label**	Input selection DI3			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFF	**Unit**	—	**Default**	0x0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0405		
	Valid	Immediate						
Pr4.03	**Label**	Input selection DI4			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFF	**Unit**	—	**Default**	0x6		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0407		
	Valid	Immediate						
Pr4.04	**Label**	Input selection DI5			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFF	**Unit**	—	**Default**	0xC		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0409		
	Valid	Immediate						
Pr4.05	**Label**	Input selection DI6			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFF	**Unit**	—	**Default**	0x3		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x040B		
	Valid	Immediate						
Pr4.06	**Label**	Input selection DI7			**Valid mode(s)**	**P**	**S**	**T**
	Range	0x0~0xFF	**Unit**	—	**Default**	0x7		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x040D		
	Valid	Immediate						

Pr4.07	Label	Input selection DI8			Valid mode(s)	P	S	T
	Range	0x0~0xFF	Unit	—	Default	0x4		
	Byte length	16bit	Attribute	R/W	485 address	0x040F		
	Valid	Immediate						
DI2~DI8allocation is the same as DI1. Please refer to Pr4.00.								

Pr4.10	Label	Output selection DO1			Valid mode(s)	P	S	T
	Range	0x0~0xFF	Unit	—	Default	0x3		
	Byte length	16bit	Attribute	R/W	485 address	0x0415		
	Valid	Immediate						

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

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

CN1 PIN	Output	Parameters
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.

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

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

Pr4.22	**Label**	Analog input 1(AI-1) Zero drift settings			**Valid mode(s)**	**S**
	Range	-1860~1860	**Unit**	5.37mv	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x042D
	Valid	Immediate				
To set zero drift compensation value on analog input 1 voltage for zero drift correction.						
Pr4.23	**Label**	Analog input 1(AI-1) filter			**Valid mode(s)**	**S**
	Range	0~6400	**Unit**	0.01ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x042F
	Valid	Immediate				
To set a delay filter time coefficient for AI1 input voltage. When filter time takes effect, input voltage will be smoothen.						
Pr4.24	**Label**	Analog input 1(AI-1) overvoltage settings			**Valid mode(s)**	**S**
	Range	0~100	**Unit**	0.1V	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0431
	Valid	Immediate				
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	**Label**	Analog input 3(AI-3) Zero drift settings			**Valid mode(s)**	**T**
	Range	-1860~1860	**Unit**	5.37mv	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0439
	Valid	Immediate				
To set zero drift compensation value on analog input 3 voltage for zero drift correction.						
Pr4.29	**Label**	Analog input 3(AI-3) filter			**Valid mode(s)**	**T**
	Range	0~6400	**Unit**	0.01ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x043B
	Valid	Immediate				
To set a delay filter time coefficient for AI3 input voltage. When filter time takes effect, input voltage will be smoothen.						

Pr4.30	Label	Analog input 3(AI-3) overvoltage settings			Valid mode(s)			T
	Range	0~100	Unit	0.1V	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x043D		
	Valid	Immediate						
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.								

Pr4.31	Label	Positioning complete range			Valid mode(s)	P		
	Range	0～10000	Unit	Pr5.21 set unit	Default	20		
	Byte length	16bit	Attribute	R/W	485 address	0x043F		
	Valid	Immediate						

To set position deviation range of INP1 positioning completed output signal. INP1 output signal will be valid once position is complete within the range of deviation set.
Default unit: 0.00001rev. Can be set on Pr5.21 as command unit (pulse) or encoder unit (pulse)

Pr4.32	Label	Positioning complete output setting			Valid mode(s)	P		
	Range	0~4	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0441		
	Valid	Immediate						

To set conditions for INP1 output signal to be valid

Value	Positioning completed signal
0	Signal valid when the position deviation is smaller than 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.

Pr4.33	Label	INP positioning delay time			Valid mode(s)	P		
	Range	0~15000	Unit	1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0443		
	Valid	Immediate						

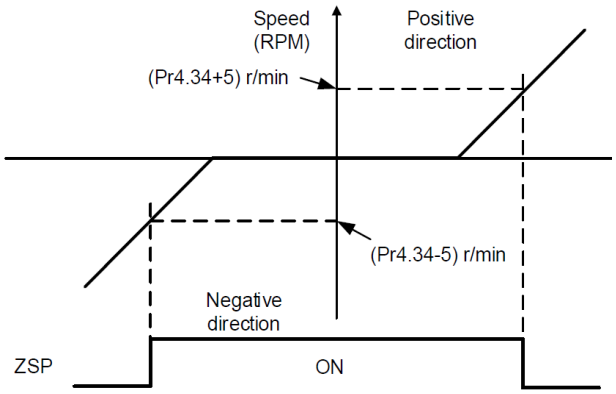
Valid when Pr4.32 = 3.

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

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

To set threshold value for zero speed clamp detection.
Zero speed clamp detection (ZSP) output signal valid when motor speed goes under the value set in Pr4.34

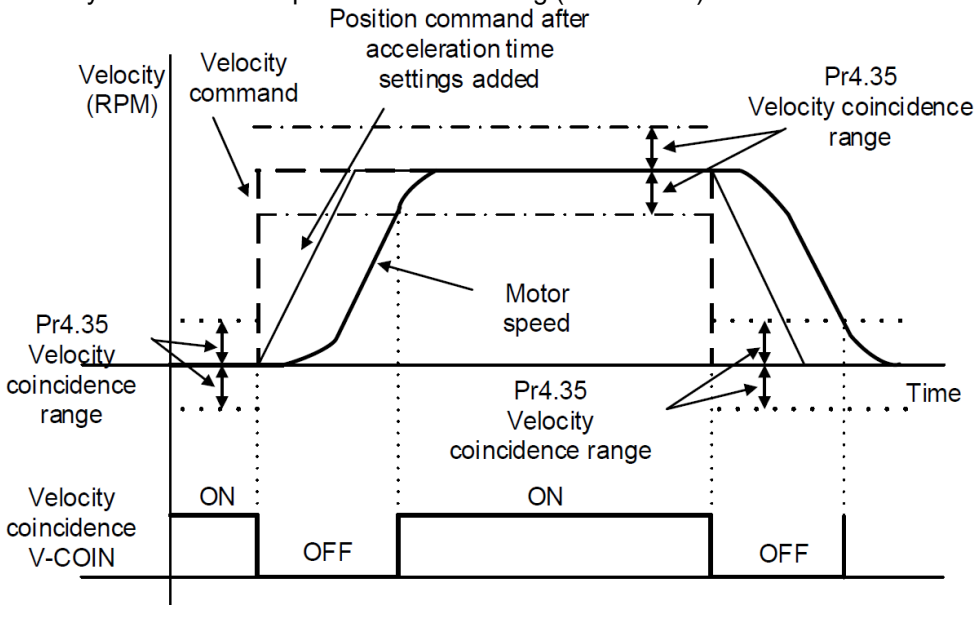
- Disregard the direction of rotation, valid for both directions.
- Hysteresis of 5RPM. Please refer to diagram on the right side.



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

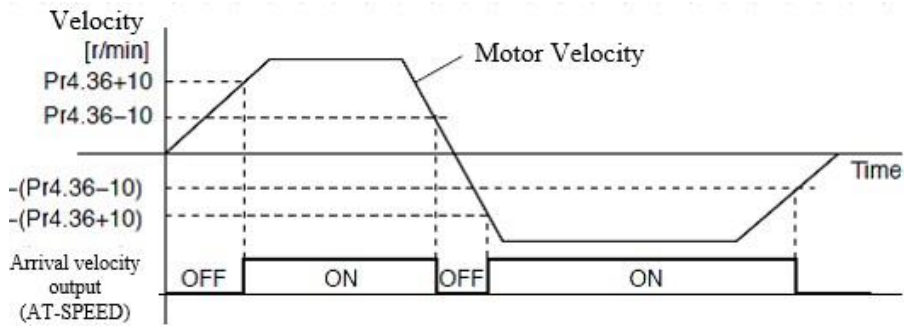
If the difference between velocity command and motor actual speed is below Pr4.35, Velocity coincidence (V-COIN) output signal valid.

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



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

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

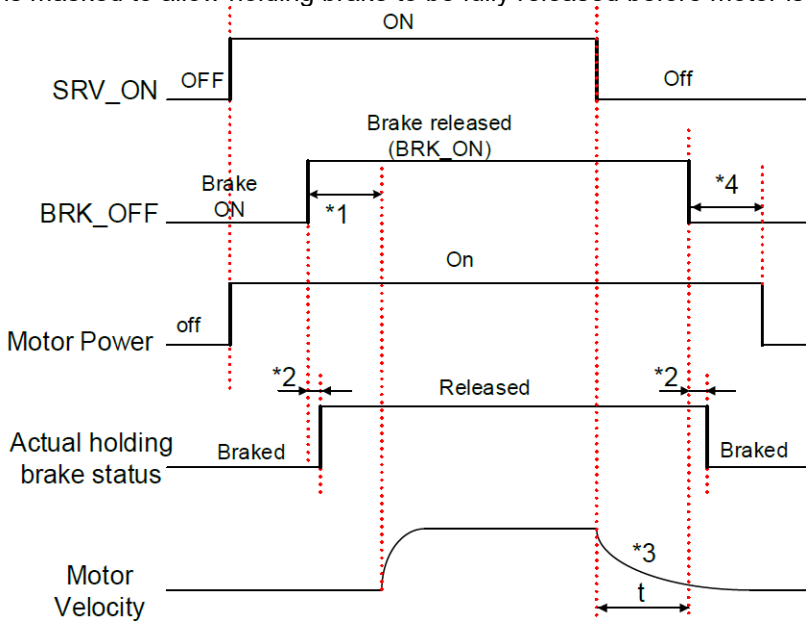


Pr4.37	Label	Motor power-off delay time			Valid mode(s)	P	S	T
	Range	0~3000	Unit	1ms	Default	150		
	Byte length	16bit	Attribute	R/W	485 address	0x044B		
	Valid	Immediate						

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.

Pr4.38	Label	Holding brake release time			Valid mode(s)	P	S	T
	Range	0~3000	Unit	1ms	Default	00		
	Byte length	16bit	Attribute	R/W	485 address	0x044D		
	Valid	Immediate						

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



*1: Delay time set in 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.

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

Value	Description.
【0】	Emergency stop is valid, servo driver will be forced to STOP and Err570 occurs.
1	Emergency stop is invalid, servo driver will not be forced to STOP. Servo can be enabled once E-STOP signal is cleared.

Pr4.64	Label	AO1 output			Valid mode(s)	P	S	T
	Range	0~10	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0481		
	Valid	Immediate						

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

Pr4.65	Label	AO1 signal			Valid mode(s)	P	S	T
	Range	0x0~0x7FFFFFFF	Unit	—	Default	0x4		
	Byte length	16bit	Attribute	R/W	485 address	0x0483		
	Valid	Immediate						

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

Bit0~Bit15	Signal source
0x0	-
0x1	Motor rotational speed（V/krpm）
0x2	Position command velocity（V/krpm）
0x3	Internal position command velocity（V/krpm）
0x4	Torque command（0.03V/0.01）
0x5	Position command deviation（mV/Command unit）
0x6	Position command deviation（mV/Encoder unit）
0x7	Analog 1（V/V）
0x8	Analog 2（V/V）
0x9	Analog 3（V/V）
0xA	Extension DO（0V/5V）
0xB	As per Pr4.67

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

Bit16~Bit31	Channel
01h	Alarm output
02h	Servo ready
03h	External brake released
04h	Positioning completed
…	Please refer to Pr4.10 for other signal channels

Pr4.66	Label	AO1 amplification			Valid mode(s)	P	S	T
	Range	-10000~10000	Unit	0.01	Default	100		
	Byte length	16bit	Attribute	R/W	485 address	0x0485		
	Valid	Immediate						

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

Pr4.67	Label	AO1 communication settings			Valid mode(s)	P	S	T
	Range	-10000~10000	Unit	mV	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0487		
	Valid	Immediate						

Available when AO1 = 0xB

Pr4.68	Label	AO1 offset			Valid mode(s)	P	S	T
	Range	-10000~10000	Unit	mV	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0489		
	Valid	Immediate						

To set AO1 offset value.

3.2.6 [Class 5] Extension Settings

Pr5.00								
	Label	2nd pulse count per revolution			**Valid mode(s)**	**P**		
	Range	0-67108864	**Unit**	PULSE	**Default**	10000		
	Byte length	32bit	**Attribute**	R/W	**485 address**	H: 0x0500 L: 0x0501		
	Valid	After restart						
Switch between 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.								

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

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

Pr5.04								
	Label	Driver prohibition input settings			**Valid mode(s)**	**P**	**S**	**T**
	Range	0/1/2	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0509		
	Valid	Immediate						

To set driver prohibition input (POT/NOT)

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

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.

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

Servo braking: Stop servo axis quickly using braking torque
Pr5.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to Pr5.10

Pr5.09	Label	Main power-off detection time			Valid mode(s)	P	S	T
	Range	50~200	Unit	ms	Default	50		
	Byte length	16bit	Attribute	R/W	485 address	0x0513		
	Valid	Immediate						

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

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:

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

Alarm type 1:

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

Pr5.11	Label	Servo braking torque setting			Valid mode(s)	P	S	T
	Range	0~500	Unit	%	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0517		
	Valid	Immediate						

To set torque limit for servo braking mode.
If 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.

Pr5.12	Label	Overload level setting			Valid mode(s)	P	S	T
	Range	0~115	Unit	%	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0519		
	Valid	Immediate						

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

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

Pr5.15	Label	I/O digital filter			Valid mode(s)	P	S	T
	Range	0~255	Unit	0.1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x051F		
	Valid	After restart						

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

Pr5.17	Label	Counter clearing input mode			Valid mode(s)	P		
	Range	0~4	Unit	—	Default	3		
	Byte length	16bit	Attribute	R/W	485 address	0x0523		
	Valid	Immediate						

To set the clearing conditions for deviation counter clearing input signal.

Value	Condition
0/2/4	Invalid
1	Always clear
3	Clear only once (Rising edge trigger)

Pr5.20	Label	Position unit settings			Valid mode(s)	P		
	Range	0~2	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0529		
	Valid	Immediate						

Set unit for position related parameters

Value	Unit
0	Encoder unit
1	Command unit
2	0.0001rev

Command unit: Pulse from host (Affected by electronic gear ratio)
Encoder unit: Pulse from encoder (Related to encoder resolution)
Pr5.20 can only be modified when axis is disabled as it will clear position data

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

Value		Limit
【0】		1st torque limit Pr0.13
1		2nd torque limitPr5.22
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

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

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

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

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

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

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

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

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

Value	Status	Value	Status	Value	Status
0	Position deviation	14	Regenerative load rate	28	Software version
1	Motor speed	15	Overload rate	29	Internal usage
2	Position command deviation	16	Inertia load ratio	30	Encoder communication failure counts
3	Velocity control command	17	Cause(s) of non-rotation	31	Accumulated uptime
4	Actual feedback torque	18	No. of I/O changes	32	Internal usage
5	Feedback pulse sum	19	Internal usage	33	Driver temperature
6	Command pulse sum	20	Absolute encoder data	34	Servo status
7	Max. torque	21	Encoder single turn data	35	Internal usage
8	Position command frequency	22	Encoder multiturn data		
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		

Pr5.29	Label	RS485 communication mode			Valid mode(s)	P	S	T
	Range	0~255	Unit	—	Default	5		
	Byte length	16bit	Attribute	R/W	485 address	0x053B		
	Valid	After restart						

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

Pr5.30	Label	RS485 communication Baud rate			Valid mode(s)	P	S	T
	Range	0~15	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x053D		
	Valid	After restart						

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

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

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

Pr5.31	Label	RS485 axis address			Valid mode(s)	P	S	T
	Range	0~127	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x053F		
	Valid	After restart						

When controller is connected to multiple axis and controller needs to identify the axis, 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

Pr5.32	Label	Max. command pulse input frequency			Valid mode(s)	P		
	Range	0~8000	Unit	kHz	Default	4100		
	Byte length	16bit	Attribute	R/W	485 address	0x0541		
	Valid	Immediate						

Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds Pr5.32.

Pr5.35	Label	Front panel lock setting			Valid mode(s)	P	S	T
	Range	0~1	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0547		
	Valid	Immediate						

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

Pr5.37	Label	Torque saturation alarm detection time			Valid mode(s)	P	S	T
	Range	0~5000	Unit	ms	Default	500		
	Byte length	16bit	Attribute	R/W	485 address	0x0549		
	Valid	Immediate						

To set the delay time for detection of torque over limit under torque homing mode.
Under homing mode, when torque exceeds limit and the time set in Pr5.37, TLC output signal will be valid.

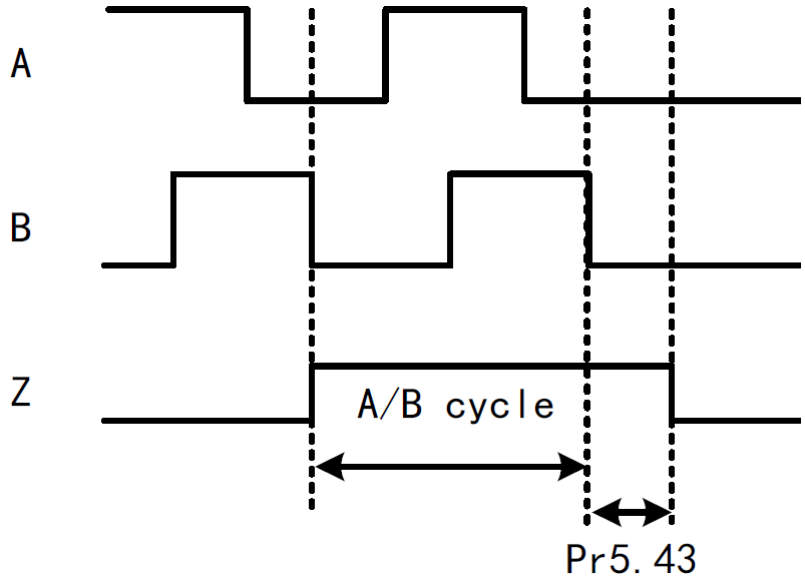
Pr5.42	Label	Frequency divider output – Z-signal polarity			Valid mode(s)	P	S	T
	Range	0~7	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0555		
	Valid	Disabled						

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

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

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

When 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.



Pr5.44	Label	Frequency divider output source			Valid mode(s)	P	S	T
	Range	0~4	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0559		
	Valid	After restart						

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

Pr5.46	Label	Vent overload level			Valid mode(s)	P	S	T
	Range	0~115	Unit	%	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x055D		
	Valid	After restart						

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

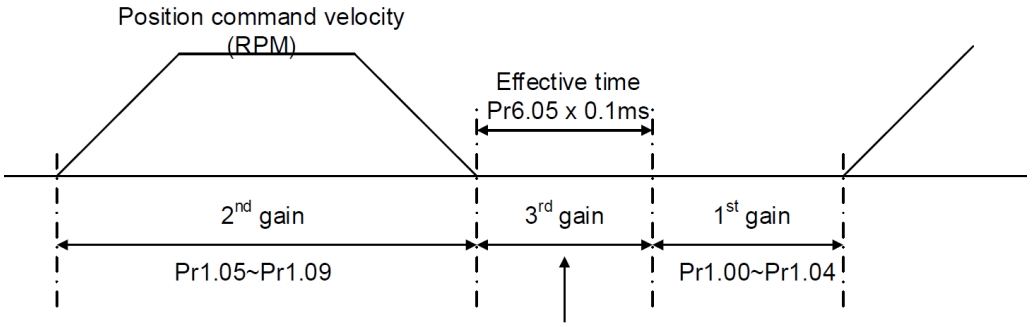
3.2.7 [Class 6] Other settings

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

Pr6.03	Label	JOG trial run torque command			Valid mode(s)			T
	Range	0~350	Unit	%	Default	350		
	Byte length	16bit	Attribute	R/W	485 address	0x0607		
	Valid	Immediate						
To set torque for JOG trial run command.								
Pr6.04	Label	JOG trial run velocity command			Valid mode(s)	P	S	T
	Range	0~10000	Unit	r/min	Default	30		
	Byte length	16bit	Attribute	R/W	485 address	0x0609		
	Valid	Immediate						
To set velocity for JOG trial run command.								

Pr6.05	Label	Position 3rd gain valid time			Valid mode(s)	P		
	Range	0~10000	Unit	0.1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x060B		
	Valid	Immediate						
To set time for 3rd gain to be valid Only available in position mode When not in use, set Pr6.05=0, Pr6.06=100								
Pr6.06	Label	Position 3rd gain scale factor			Valid mode(s)	P		
	Range	50~1000	Unit	100%	Default	100		
	Byte length	16bit	Attribute	R/W	485 address	0x060D		
	Valid	Immediate						

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



Position loop gain = Pr1.00 x Pr6.06/100
Velocity loop gain = Pr1.01 x Pr6.06/100
Velocity loop integral time constant，Velocity detection filter，
Torque filter time constant still uses 1st gain

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

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 Pr6.08/Pr6.09 = $T_f = \frac{\lvert T1 - T2 \rvert}{2}$ *Positive/Negative compensation corresponds to actual position feedback.* *Positive torque compensation value = +(Pr6.08=+T_f)* *Negative torque compensation value = -(Pr6.08=+T_f)* *Pr6.08 =x, Pr6.09=y; friction compensation value = |x-y|/2*						

Pr6.11							
	Label	Current response settings			**Valid mode(s)**	**P**	**S** / **T**
	Range	50~100	**Unit**	%	**Default**	100	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0617	
	Valid	Immediate					
	To set driver current loop related effective value ratio.						

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						

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.

Applications:
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.
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.

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

Pr6.20	Label	Trial run distance			Valid mode(s)	P		
	Range	0~1200	Unit	0.1rev	Default	10		
	Byte length	16bit	Attribute	R/W	485 address	0x0629		
	Valid	Immediate						

JOG (Position control) : Distance travel of each motion.

Pr6.21	Label	Trial run waiting time			Valid mode(s)	P		
	Range	0~10000	Unit	ms	Default	300		
	Byte length	16bit	Attribute	R/W	485 address	0x062B		
	Valid	Immediate						

JOG (Position control) : Waiting time interval after each motion cycle

Pr6.22	Label	No. of trial run cycles			Valid mode(s)	P		
	Range	0~10000	Unit	—	Default	5		
	Byte length	16bit	Attribute	R/W	485 address	0x062D		
	Valid	Immediate						

JOG (Position control) : No. of cycles
When Pr6.22, trial run goes into endless cycles.

Pr6.25	Label	Trial run acceleration			Valid mode(s)	P	S	
	Range	0~10000	Unit	ms	Default	200		
	Byte length	16bit	Attribute	R/W	485 address	0x0633		
	Valid	Immediate						

To set the acceleration/deceleration time for JOG command between 0 rpm to 1000 rpm

Pr6.28	Label	Observer gain			Valid mode(s)	P	S
	Range	0~32767	Unit	%	Default	0	
	Byte length	16bit	Attribute	R/W	485 address	0x0639	
	Valid	Immediate					
0：Default stable gain 1：OFF x：(unit：%) Manual, related to motor, load and encoder							
Pr6.29	**Label**	Observer filter			**Valid mode(s)**	**P**	**S**
	Range	0~32767	**Unit**	μs	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x063B	
	Valid	Immediate					
0：Default stable observer filter 1：OFF x：(unit：μs) Manual, related to motor, load and encoder							

Pr6.56	Label	Blocked rotor alarm torque threshold			Valid mode(s)	P	S
	Range	0~300	Unit	%	Default	300	
	Byte length	16bit	Attribute	R/W	485 address	0x0671	
	Valid	Immediate					
To set the torque threshold of blocked rotor to trigger alarm. (Alarm triggered if torque output% larger than threshold value & under 10rpm) If Pr6.56 = 0, blocked rotor alarm deactivated. If motor speed is 10rpm or above, Er102 won't be triggered.							
Pr6.57	**Label**	Blocked rotor alarm delay time			**Valid mode(s)**	**P**	**S**
	Range	1~10000	**Unit**	ms	**Default**	400	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0673	
	Valid	Immediate					

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

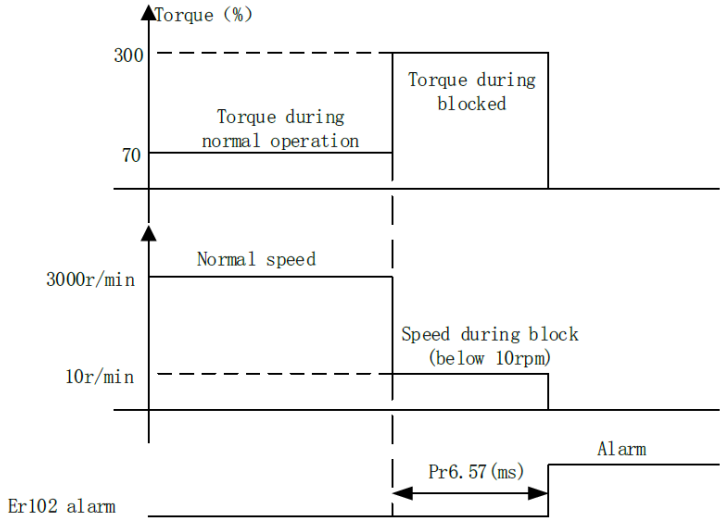


Diagram shows blocked rotor with speed under 10rpm

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

Pr6.63	Label	Absolute multiturn data upper limit			Valid mode(s)	P	S	T
	Range	0~32766	Unit	rev	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x067F		
	Valid	After restart						
	Use 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*

Pr7.15	Label	Motor model			Valid mode(s)	P	S	T
	Range	0x0~0x7FFF	Unit	—	Default	0x200		
	Byte length	16bit	Attribute	R/W	485 address	0x071F		
	Valid	After restart						

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

When Pr7.15 = 0x200(2xx):

Parameter	Label
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

Pr7.16	Label	Encoder			Valid mode(s)	P	S	T
	Range	0x0~0x200	Unit	—	Default	编码器决定		
	Byte length	16bit	Attribute	R/W	485 address	0x0721		
	Valid	After restart						

To select encoder type. Typically, encoder specifications are automatically read.

0x0	17-bit encoder
0x7	23-bit encoder

3.2.9 [Class B] Status Parameters

PrB.00	Label	Software version 1（DSP）			Valid mode(s)	P	S	T
	Range	/	Unit	/	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B00		
	Show DSP software version info.							
PrB.01	Label	Software version 2（CPLD）			Valid mode(s)	P	S	T
	Range	/	Unit	/	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B01		
	Show software version info.							
PrB.02	Label	Software version 3（Others）			Valid mode(s)	P	S	T
	Range	/	Unit	/	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B02		
	Show software version info.							

PrB.03	Label	Current alarm			Valid mode(s)	P	S	T
	Range	/	Unit	/	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B03		
	Show current alarm							

PrB.04	Label	Motor not rotating cause			Valid mode(s)	P	S	T
	Range	/	Unit	/	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B04		
	Show cause of motor not rotating							

PrB.05	Label	Driver operation status			Valid mode(s)	P	S	T
	Range	/	Unit	/	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B05		

Bit	Status	Description
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

PrB.06	Label	Motor speed (Before filter)			Valid mode(s)	P	S	T
	Range	/	Unit	rpm	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B06		
	Motor actual speed							

PrB.07	Label	Motor torque			Valid mode(s)	P	S	T
	Range	/	Unit	%	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B07		
	The percentage of motor actual torque and rated torque							

PrB.08	Label	Motor current			Valid mode(s)	P	S	T
	Range	/	Unit	0.01A	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B08		
	Motor actual current							

PrB.09	Label	Motor speed (After filter)			Valid mode(s)	P	S	T
	Range	/	Unit	rpm	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B09		
	Motor speed after motor actual speed filtering							

PrB.10	Label	DC bus voltage			Valid mode(s)	P	S	T
	Range	/	Unit	V	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B0A		
	Driver DC bus actual voltage							

PrB.11	Label	Driver temperature			Valid mode(s)	P	S	T
	Range	/	Unit	°C	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B0B		
	Actual driver temperature							

PrB.12	Label	External analog 1			Valid mode(s)	P	S	T
	Range	/	Unit	0.01V	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B0C		
	Driver analog input 1							

PrB.13	Label	External analog 2			Valid mode(s)	P	S	T
	Range	/	Unit	0.01V	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B0D		
	Driver analog input 2							

PrB.14	Label	External analog 3			Valid mode(s)	P	S	T
	Range	/	Unit	0.01V	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B0E		
	Driver analog input 3							

PrB.15	Label	Motor overload rate			Valid mode(s)	P	S	T
	Range	/	Unit	%	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B0F		
	Motor overload rate							

PrB.16	Label	Vent overload rate			Valid mode(s)	P	S	T
	Range	/	Unit	%	Default	/		
	Byte length	16bit	Attribute	R	485 address	0x0B10		
	Vent overload rate							

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

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

PrB.20	Label	Command position (Command unit)			Valid mode(s)	P		
	Range	/	Unit	P	Default	/		
	Byte length	32bit	Attribute	R	485 address	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.							

PrB.21	Label	Motor position (Command unit)			Valid mode(s)	P		
	Range	/	Unit	P	Default	/		
	Byte length	32bit	Attribute	R	485 address	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.							

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

PrB.23	Label	Command position (Encoder unit)			Valid mode(s)	P		
	Range	/	Unit	P	Default	/		
	Byte length	32bit	Attribute	R	485 address	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.							

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

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

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

3.2.10 [Class 8] PR control parameters

Pr8.00	Label	PR Control			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6000

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

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

If parameter modifications are done through the front panel or parameters list, please keep in mind that PR control parameters byte are decimal system.
For example: If Bit 3, 2, 1, 0 are to be set to 1 (1111). Conversion using decimal system, 1111 = 15, Pr8.00 is to be set to 15.

Pr8.01	Label	Path count			Valid mode(s)	PR
	Range	16	Unit	/	Default	16
	Byte length	16bit	Attribute	R	485 address	0X6001

16 paths

Pr8.02	Label	Control Operation			Valid mode(s)	PR
	Range	0x0 ~ 0xFFFF	Unit	/	Default	0x0
	Byte length	16bit	Attribute	R/W	485 address	0X6002

Attributes of Pr8.02 functions are divided into Read/Write. P refers to positioning motion of *N* path. Please refer to the following table.

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

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

Pr8.07	Label	Software positive limit (L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X6007
	To set software positive limit position (32 bit base) Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through 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.					

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

Pr8.09	Label	Software negative limit (L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X6009
	To set software positive limit position. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr8.08.					

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.

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

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

Pr8.12	Label	Zero position (L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	p	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X600C
	To set zero position. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr8.11.					
Pr8.13	Label	Home position offset H			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X600D
	High bit of home position offset；(Only valid using 485 communication)					
Pr8.14	Label	Home position offset (L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	p	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X600E
	To set home position offset. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr8.13.					
Pr8.15	Label	High homing velocity			Valid mode(s)	PR
	Range	1 ~ 6000	Unit	rpm	Default	200
	Byte length	16bit	Attribute	R/W	485 address	0X600F
	To set high homing velocity in PR mode.					
Pr8.16	Label	Low homing velocity			Valid mode(s)	PR
	Range	1 ~ 6000	Unit	rpm	Default	50
	Byte length	16bit	Attribute	R/W	485 address	0X6010
	To set low homing velocity in PR mode.					
Pr8.17	Label	Homing acceleration			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6011
	To set homing acceleration time in PR mode, time needed for 0rpm to accelerate to 1000rpm					
Pr8.18	Label	Homing deceleration			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6012
	To set homing deceleration time in PR mode, time needed for 1000rpm to decelerate to 0rpm					
Pr8.19	Label	Homing torque holding time			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	ms	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6013
	To set homing torque holding time					
Pr8.20	Label	Homing torque			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	%	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6014
	To set homing torque					

Pr8.21	Label	Homing overtravel alarm range			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	0.1r	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6015
	To set homing overtravel alarm threshold.					

Pr8.22	Label	Emergency stop at limit deceleration			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	10
	Byte length	16bit	Attribute	R/W	485 address	0X6016
	To set position limit emergency stop deceleration.					

Pr8.23	Label	STP emergency stop deceleration			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	50
	Byte length	16bit	Attribute	R/W	485 address	0X6017
	To set STP emergency stop deceleration.					

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

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

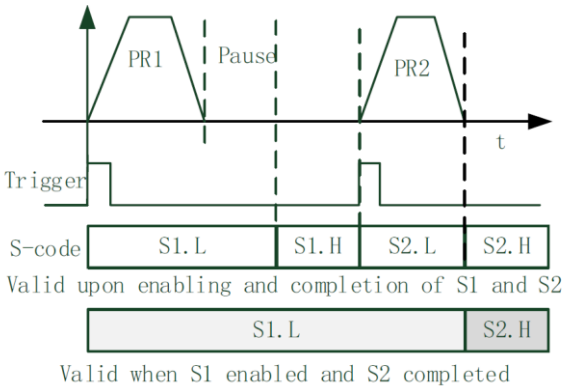
Pr8.27	Label	I/O combination filter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	ms	Default	5
	Byte length	16bit	Attribute	R/W	485 address	0X601B
	To set I/O combination filter time.					

Pr8.28	Label	S-code current output value			Valid mode(s)	P R
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X601C

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

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

Sequence diagram



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

Pr8.29	Label	PR warning			Valid mode(s)	P R
	Range	0x0~0x20F	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X601D

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

Pr8.39	Label	JOG velocity			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	rpm	Default	100
	Byte length	16bit	Attribute	R	485 address	0X6027
	Set JOG velocity in PR mode.					
Pr8.40	Label	JOG acceleration			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R	485 address	0X6028
	Set JOG acceleration in PR mode.					

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

Pr8.42	Label	Command position H			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	
	Byte length	16bit	Attribute	R	485 address	0X602A
	High bit of command position；(Only valid using 485 communication)					
Pr8.43	Label	Command position（L）			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	p	Default	
	Byte length	32bit	Attribute	R	485 address	0X602B
	To set PR-motion command position. Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr8.42.					
Pr8.44	Label	Motor position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	/	Default	
	Byte length	16bit	Attribute	R	485 address	0X602C
	High bit of command position；(Only valid using 485 communication)					
Pr8.45	Label	Motor position（L）			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	p	Default	
	Byte length	32bit	Attribute	R	485 address	0X602D
	Using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr8.44.					

Pr8.46	Label	Input I/O status			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	
	Byte length	16bit	Attribute	R	485 address	0X602E
	Input I/O status, displays in decimal system. Convert to binary system to determine which bit is valid.					
Pr8.47	Label	Output I/O status			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	
	Byte length	16bit	Attribute	R	485 address	0X602F
	Output I/O status, displays in decimal system. Convert to binary system to determine which bit is valid.					

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.2.11 [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					

Pr9.08	Label	PR1 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6208

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

Pr9.09	Label	PR1 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6209
	High bit of Path 1 position；(Only valid using 485 communication)					

Pr9.10	Label	PR1 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X620A
	For Path position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.09.					

Pr9.11	Label	PR1 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X620B
	To set PR path 1 velocity.					

Pr9.12	Label	PR1 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X620C
	To set PR path 1 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

Pr9.13	Label	PR1 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X620D
	To set PR path 1 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.14	Label	PR1 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X620E
	To set pause time for PR path 2 from completion to next path					

Pr9.15	Label	PR1 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X620F
	Reserved					

Pr9.16	Label	PR2 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6210

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

Pr9.17	Label	PR2 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6211
	High bit of Path 2 position；(Only valid using 485 communication)					

Pr9.18	Label	PR2 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X6212
	For Path 2 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.17.					

Pr9.19	Label	PR2 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X6213
	To set PR path 2 velocity.					

Pr9.20	Label	PR2 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6214
	To set PR path 2 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

Pr9.21	Label	PR2 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6215
	To set PR path 2 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.22	Label	PR2 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6216
	To set pause time for PR path 2 from completion to next path					

Pr9.23	Label	PR2 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X6217
	Reserved					

Pr9.24	Label	PR3 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6218

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

Pr9.25	Label	PR3 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6219
	High bit of Path 3 position；(Only valid using 485 communication)					

Pr9.26	Label	PR3 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X621A
	For Path 3 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.25.					

Pr9.27	Label	PR3 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X621B
	To set PR path 3 velocity.					

Pr9.28	Label	PR3 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X621C
	To set PR path 3 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

Pr9.29	Label	PR3 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X621D
	To set PR path 0 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.30	Label	PR3 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X621E
	To set pause time for PR path 3 from completion to next path					

Pr9.31	Label	PR3 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X621F
	Reserved					

Pr9.32	Label	PR4 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6220

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

Pr9.33	Label	PR4 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6221
	High bit of Path 0 position；(Only valid using 485 communication)					

Pr9.34	Label	PR4 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X6222
	For Path 4 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.33.					

Pr9.35	Label	PR4 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X6223
	To set PR path 4 velocity.					

Pr9.36	Label	PR0 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6224
	To set PR path 4 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

Pr9.37	Label	PR4deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6225
	To set PR path 4 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.38	Label	PR4 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6226
	To set pause time for PR path 4 from completion to next path					

Pr9.39	Label	PR4 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X6227
	Reserved					

Pr9.40	Label	PR5 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6228

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

Pr9.41	Label	PR5 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6229
	High bit of Path 5 position；(Only valid using 485 communication)					

Pr9.42	Label	PR5 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X622A
	For Path 0 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.41.					

Pr9.43	Label	PR5 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X622B
	To set PR path 5 velocity.					

Pr9.44	Label	PR5 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X622C
	To set PR path 5 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

Pr9.45	Label	PR5 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X622D
	To set PR path 5 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.46	Label	PR5 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X622E
	To set pause time for PR path 5 from completion to next path					

Pr9.47	Label	PR5 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X622F
	Reserved					

Pr9.48	Label	PR6 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6230

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

Pr9.49	Label	PR6 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6231
	High bit of Path 6 position；(Only valid using 485 communication)					

Pr9.50	Label	PR6 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X6232
	For Path 6 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.49.					

Pr9.51	Label	PR6 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X6233
	To set PR path 6 velocity.					

Pr9.52	Label	PR6 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6234
	To set PR path 6 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

Pr9.53	Label	PR6 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X6235
	To set PR path 6 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.54	Label	PR6 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6236
	To set pause time for PR path 6 from completion to next path					

Pr9.55	Label	PR6 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	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

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

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

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					

Pr9.104	Label	PR13 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6268

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

Pr9.105	Label	PR13 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6269
	High bit of Path 13 position；(Only valid using 485 communication)					

Pr9.106	Label	PR13 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X626A
	For Path 13 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.105.					

Pr9.107	Label	PR13 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X626B
	To set PR path 13 velocity.					

Pr9.108	Label	PR13 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X626C
	To set PR path 13 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

Pr9.109	Label	PR13 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X626D
	To set PR path 13 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.110	Label	PR13 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X626E
	To set pause time for PR path 13 from completion to next path					

Pr9.111	Label	PR13 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	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

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

Pr9.113	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					

Pr9.120	Label	PR15 mode			Valid mode(s)	PR
	Range	0x0~0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6278

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

Pr9.121	Label	PR15 position H			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	Pulse	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X6279
	High bit of Path 15 position；(Only valid using 485 communication)					

Pr9.122	Label	PR15 position(L)			Valid mode(s)	PR
	Range	-2147483648~ 2147483647	Unit	Pulse	Default	0
	Byte length	32bit	Attribute	R/W	485 address	0X627A
	For Path 15 position, using 485 communication, only able to R/W low 16 bit. R/W high 16 bit needs to be realized through Pr9.121.					

Pr9.123	Label	PR15 velocity			Valid mode(s)	PR
	Range	-10000～10000	Unit	rpm	Default	60
	Byte length	16bit	Attribute	R/W	485 address	0X627B
	To set PR path 15 velocity.					

Pr9.124	Label	PR15 acceleration time			Valid mode(s)	PR
	Range	1 ~ 32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X627C
	To set PR path 15 acceleration time, time needed for 0rpm to accelerate to 1000rpm					

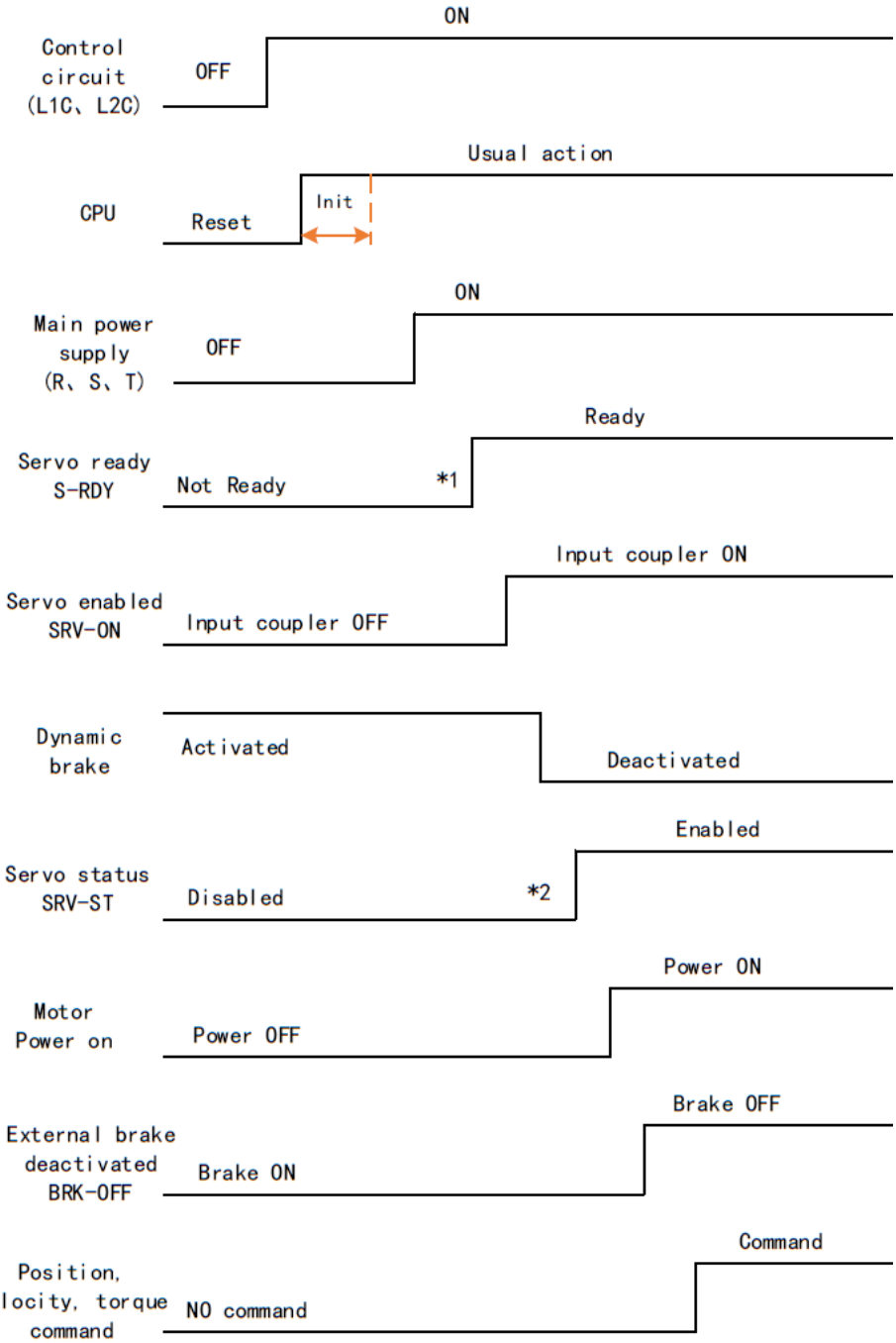
Pr9.125	Label	PR15 deceleration time			Valid mode(s)	PR
	Range	1 ~32767	Unit	ms/Krpm	Default	100
	Byte length	16bit	Attribute	R/W	485 address	0X627D
	To set PR path 15 deceleration time, time needed for 1000rpm to decelerate to 0rpm					

Pr9.126	Label	PR15 pause time			Valid mode(s)	PR
	Range	0 ~ 32767	Unit	ms	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X627E
	To set pause time for PR path 15 from completion to next path					

Pr9.127	Label	PR15 special parameter			Valid mode(s)	PR
	Range	0 ~ 65535	Unit	/	Default	0
	Byte length	16bit	Attribute	R	485 address	0X627F
	Reserved					

Chapter 4 Servo Drive Operation

4.1 Servo enabled



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

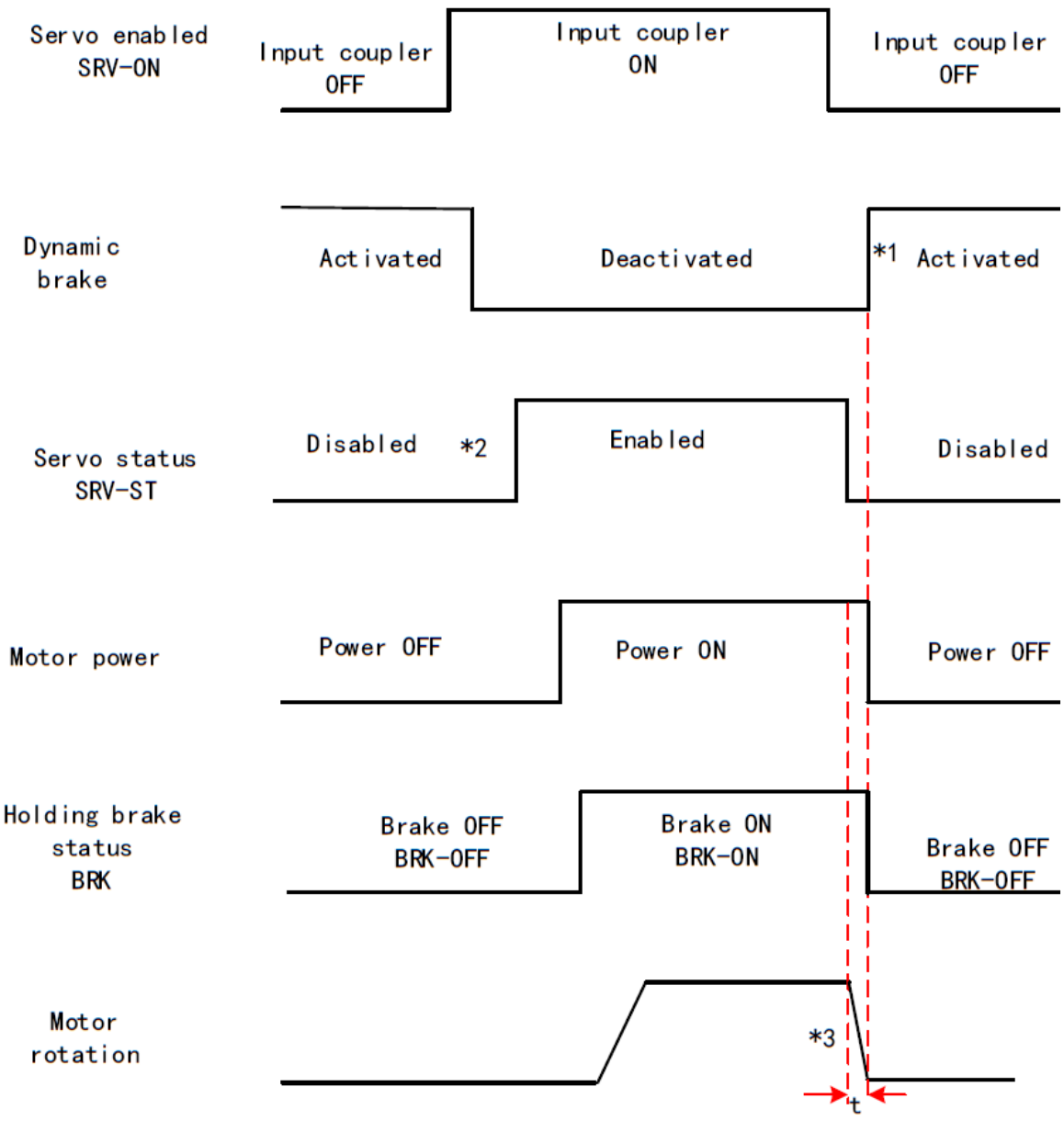
Servo stopping are of 3 different methods: Servo braking method, free stopping method, dynamic braking method.

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

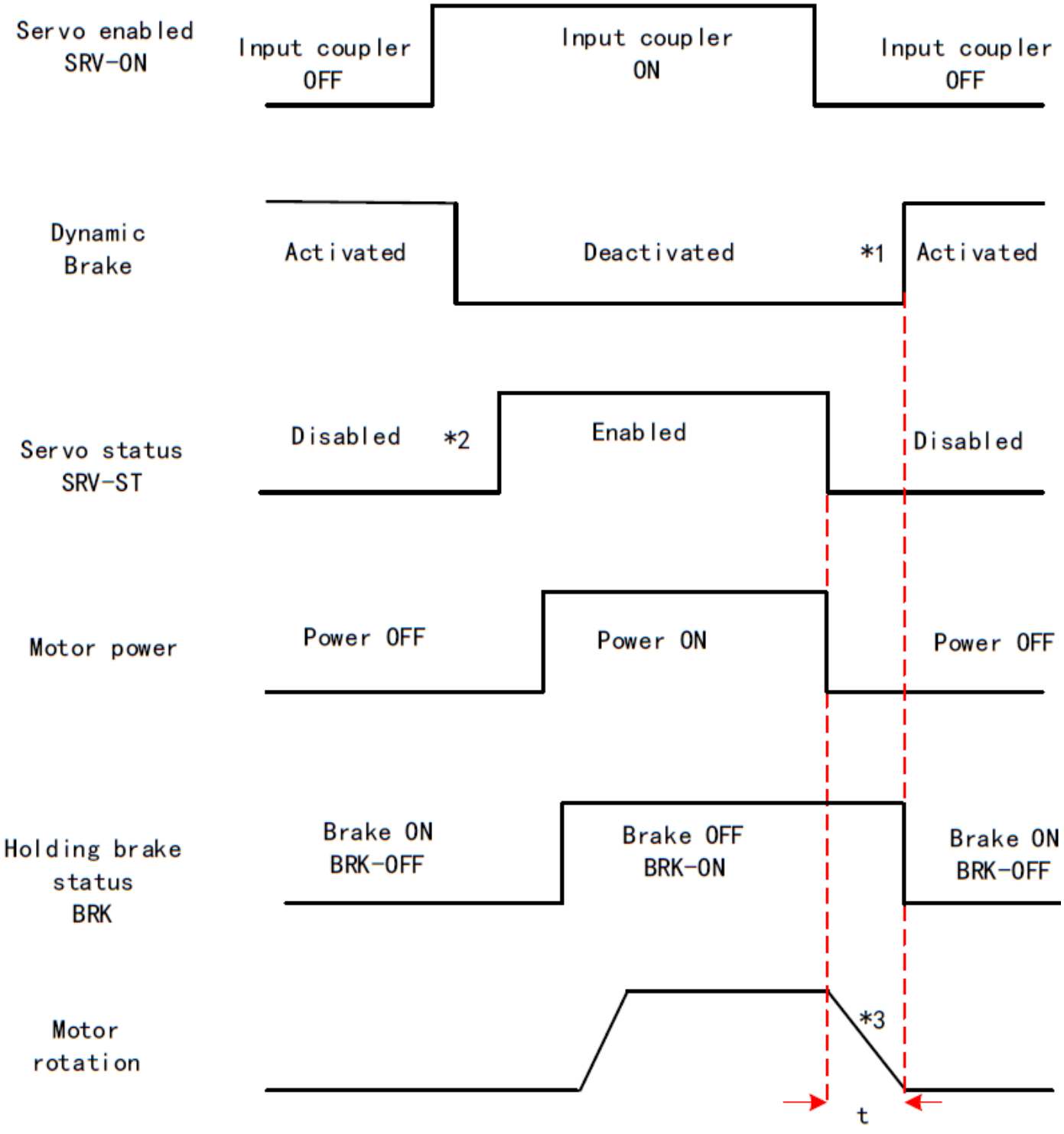
Stopping status	Status after stopped
Free running	Motor is powered off, rotor is free to rotate
Dynamic braking	Motor is powered off, rotor is not free to rotate
Holding brake stopping	Motor axis is locked, cannot rotate freely

Motor stopping（Servo disabled）- Sequence Diagram

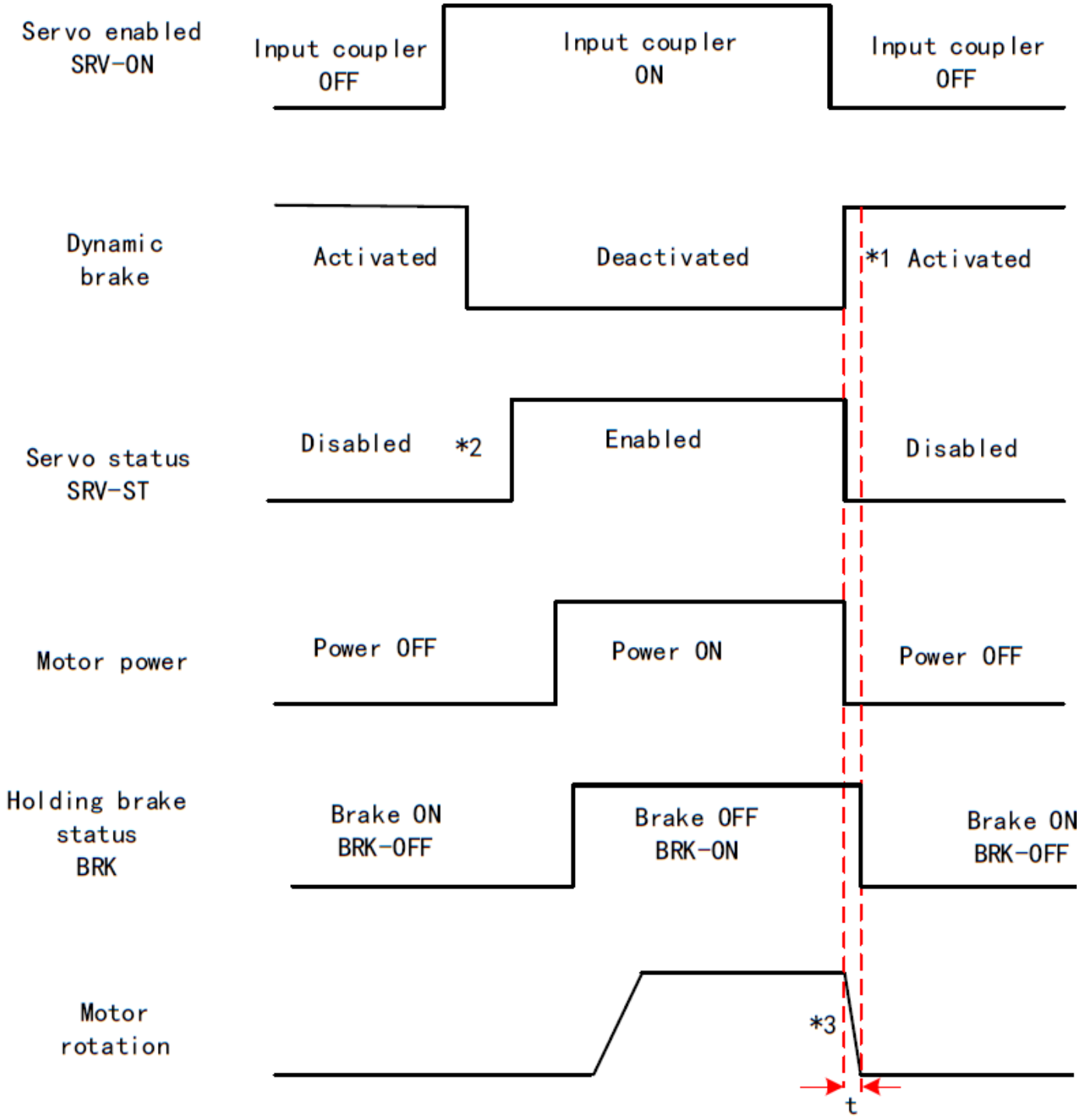
Servo braking method. Status after stopping: Dynamic braking


Servo enabled
SRV-ON
Input coupler
OFF
Input coupler
ON
Input coupler
OFF
Dynamic
brake
Activated
Deactivated
*1 Activated
Servo status
SRV-ST
Disabled
*2
Enabled
Disabled
Motor power
Power OFF
Power ON
Power OFF
Holding brake
status
BRK
Brake OFF
BRK-OFF
Brake ON
BRK-ON
Brake OFF
BRK-OFF
Motor
rotation
*3
t

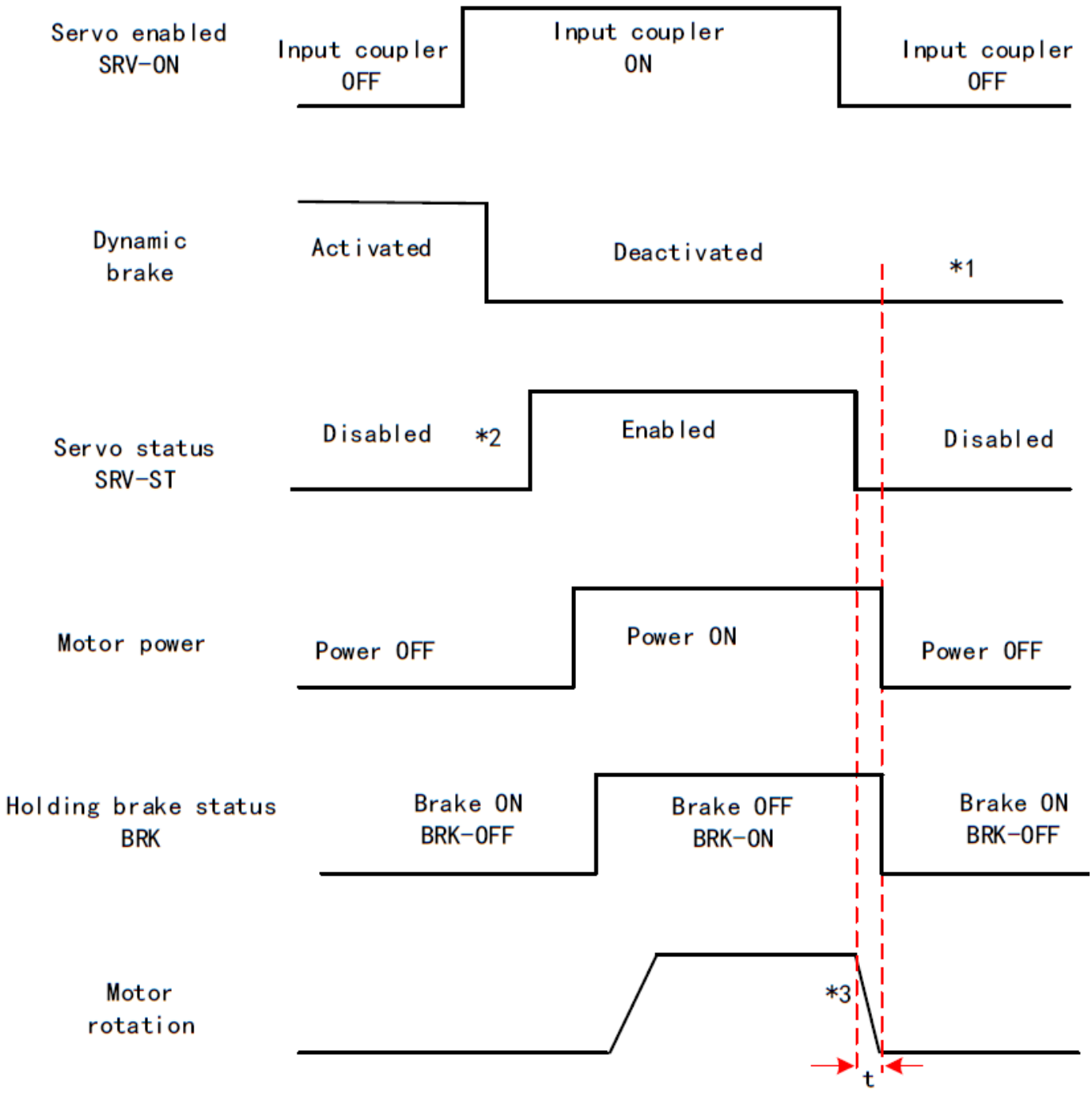
Free stopping method. Status after stopping: Dynamic braking



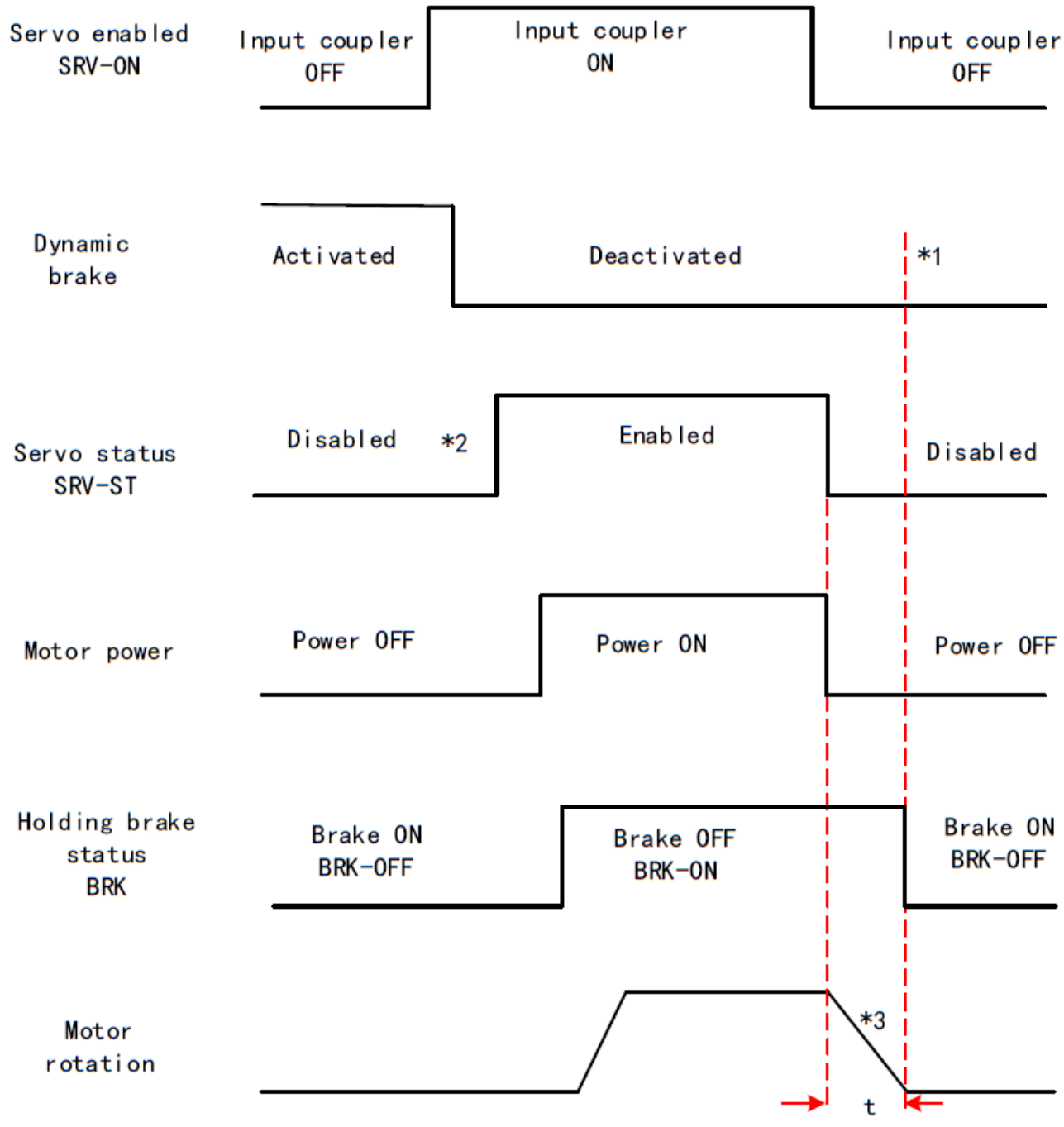
Dynamic braking method. Status after stopping: Dynamic braking



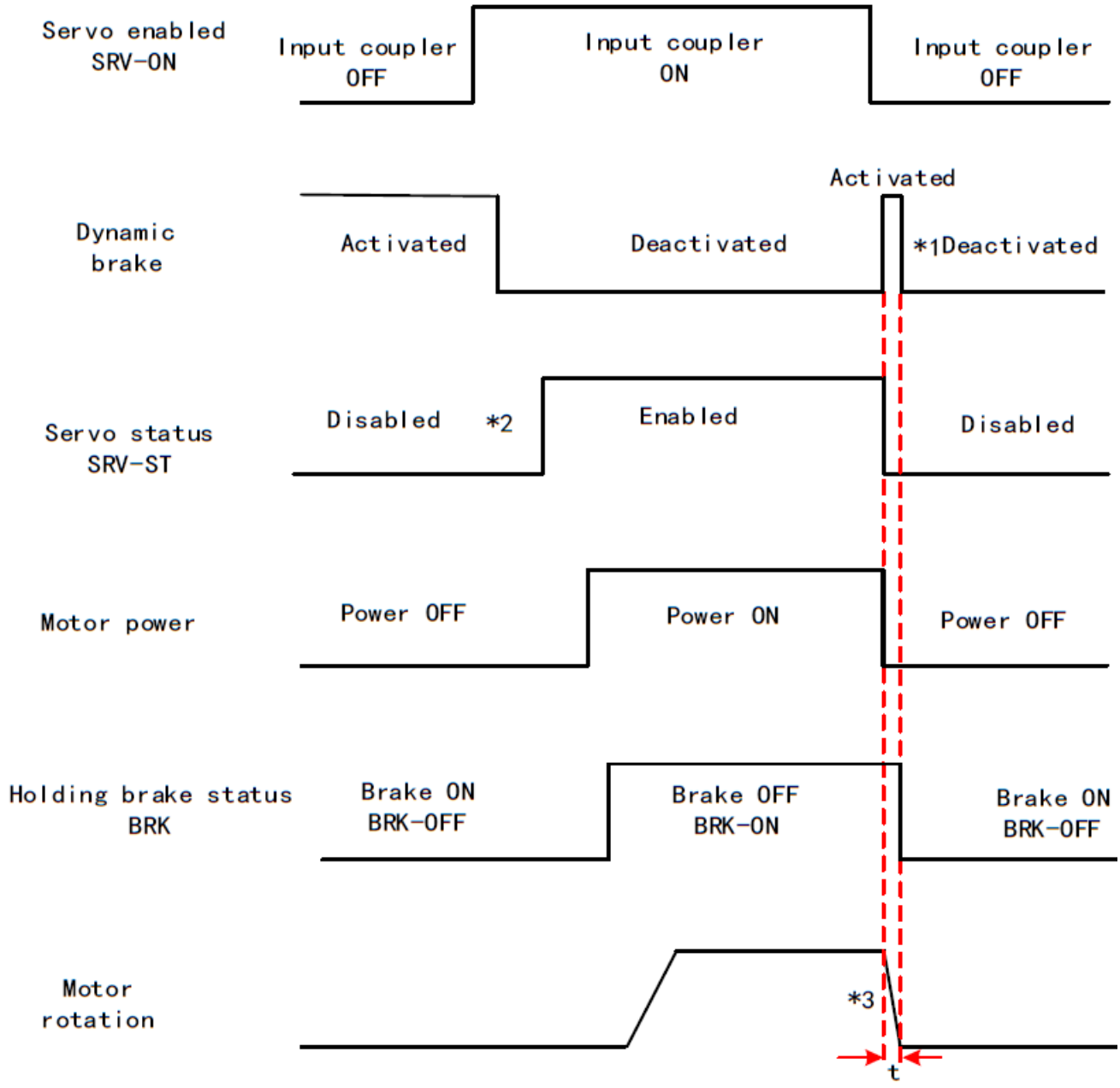
Servo stopping method. Status after stopping: Free running



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.*

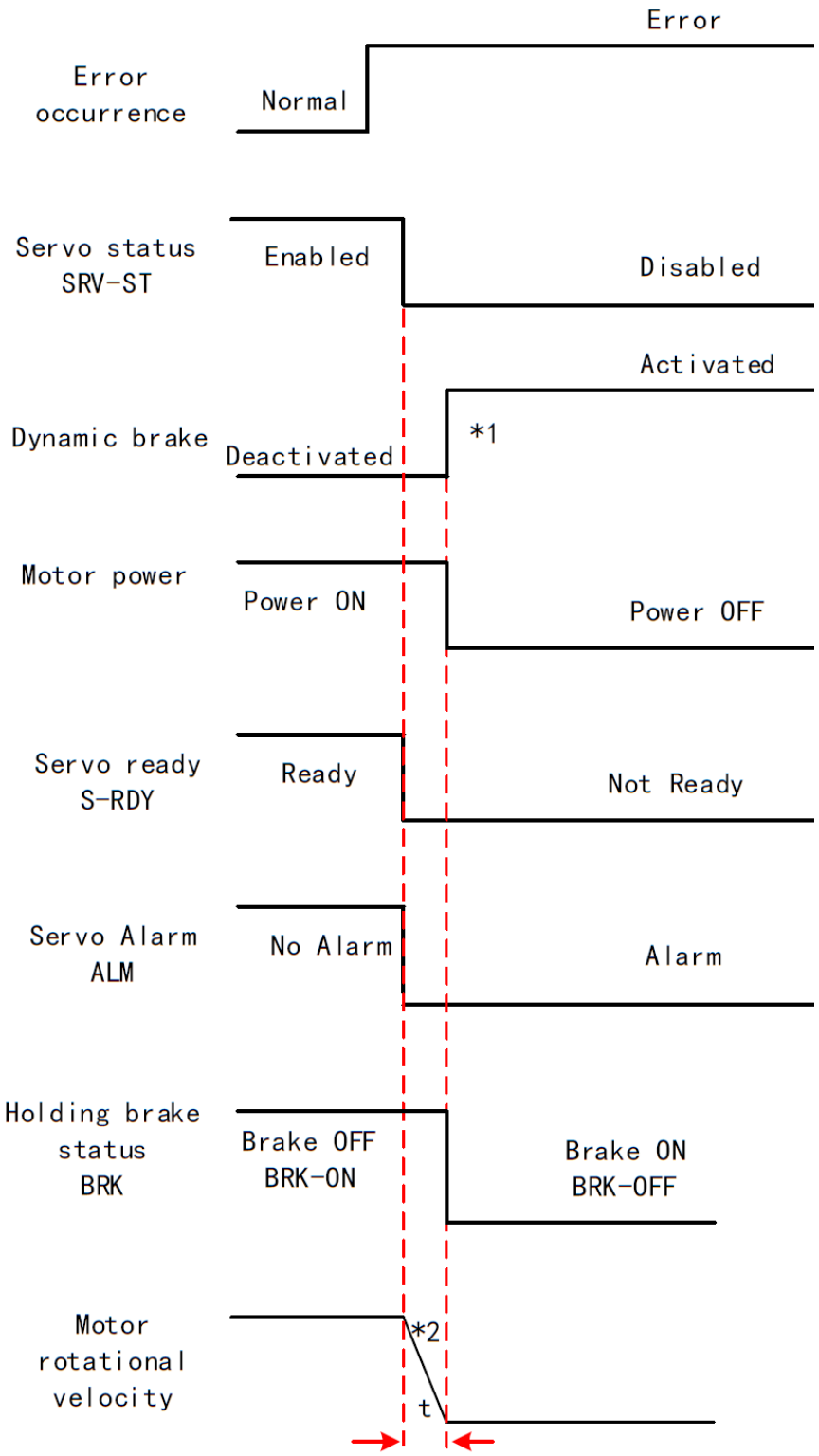
2. SRV-ST signal is received when servo driver is enabled. Command input is not allowed yet.

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).

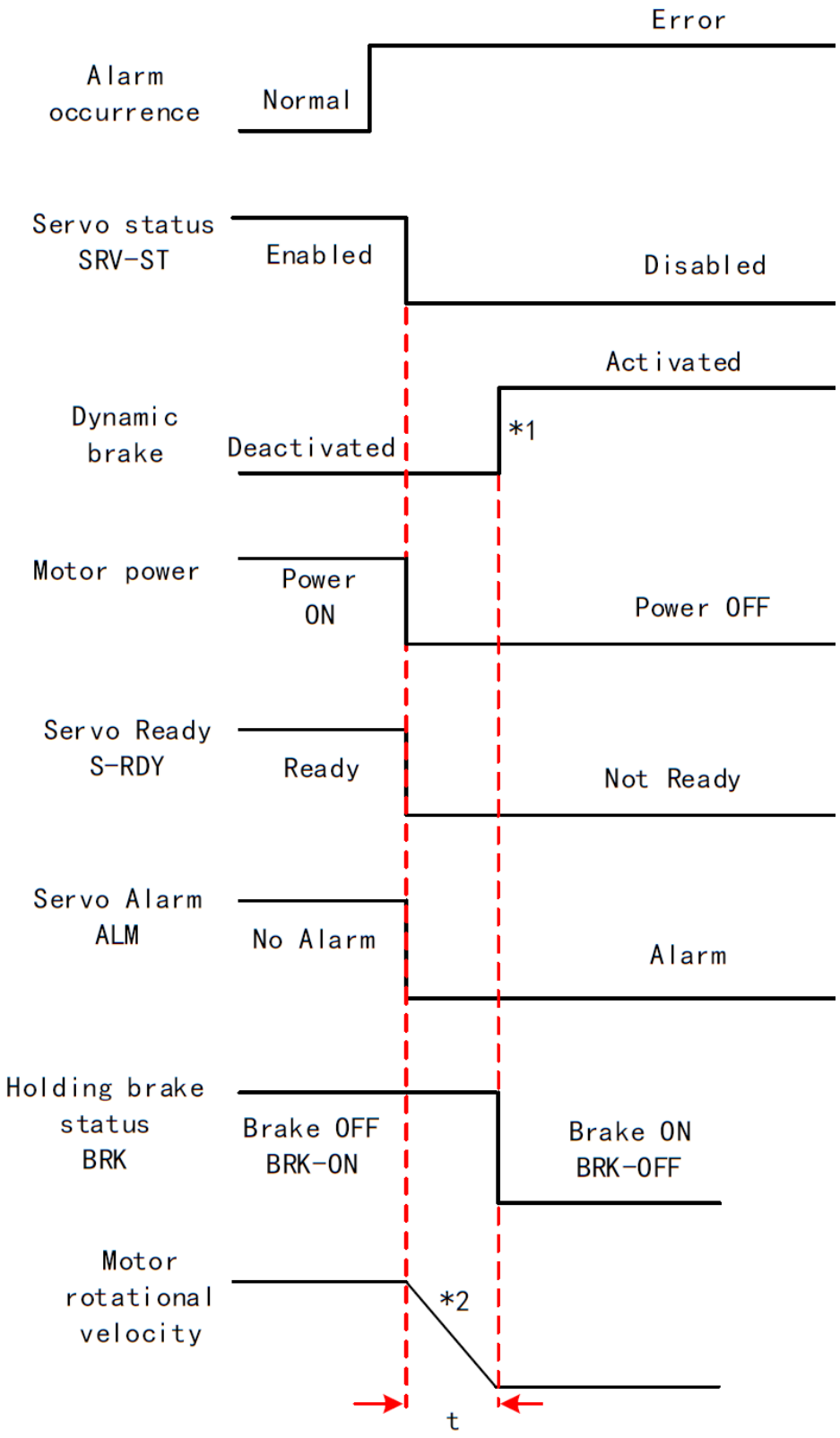
4. BRK-ON signal doesn't indicate the activation of holding brake but the validation of the signal. Holding brake is not applied when BRK-ON signal is valid. Same idea goes for BRK-OFF signal.

Stopping when alarm occurs – Sequence Diagram

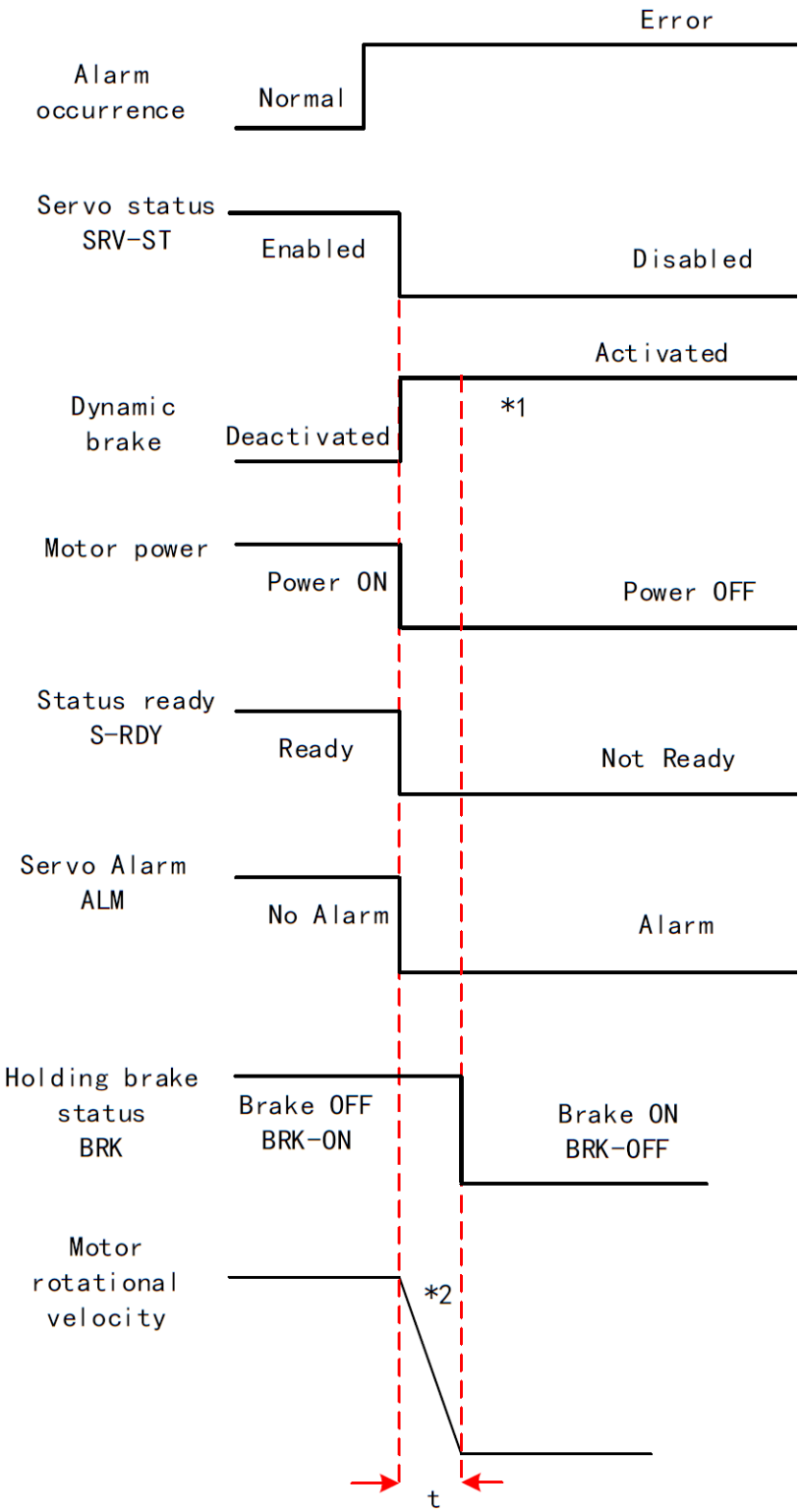
Servo braking method. Status after stopping: Dynamic braking



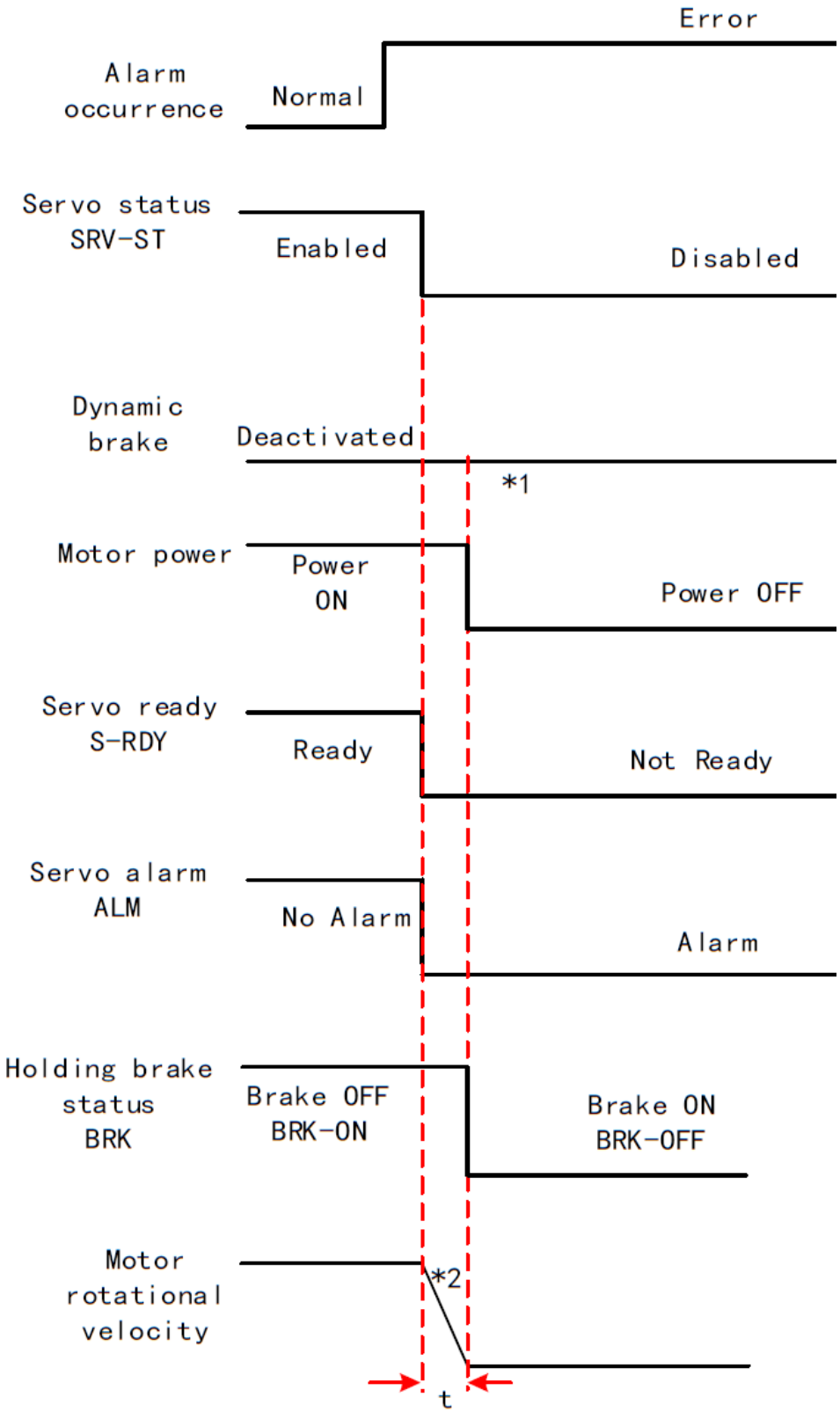
Free stopping method. Status after stopping: Dynamic braking



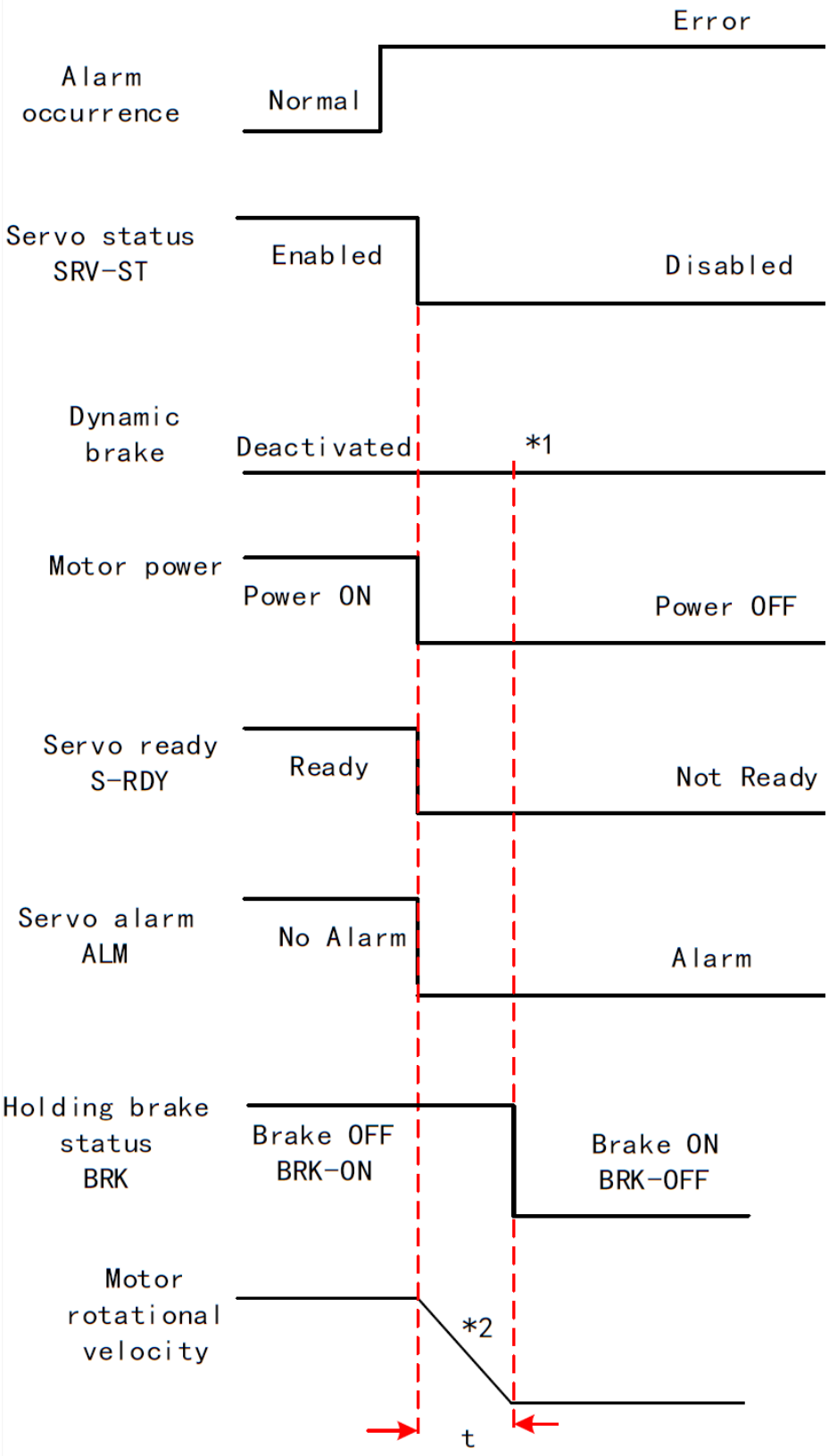
Dynamic braking method. Status after stopping: Dynamic braking



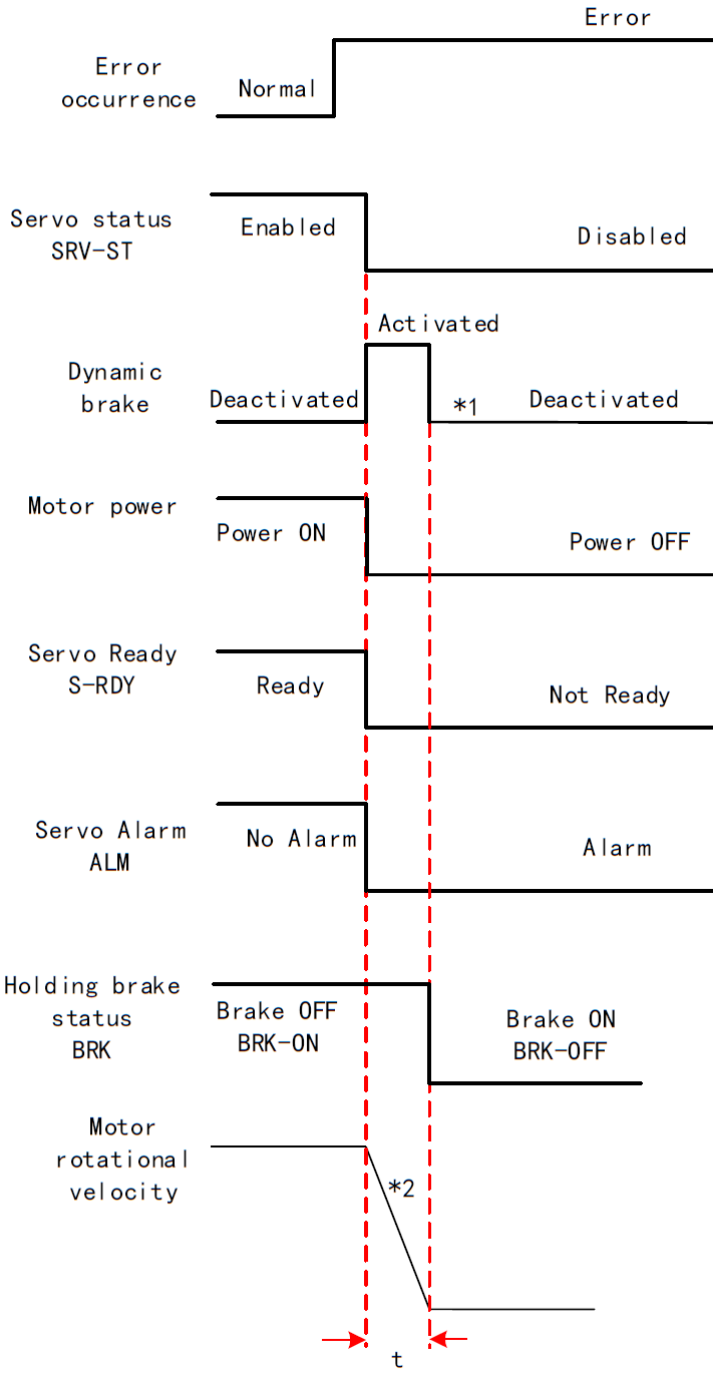
Servo braking method. Status after stopping: Free moving



Free stopping method. Status after stopping: Free moving



Dynamic braking. Status after stopping: Free moving

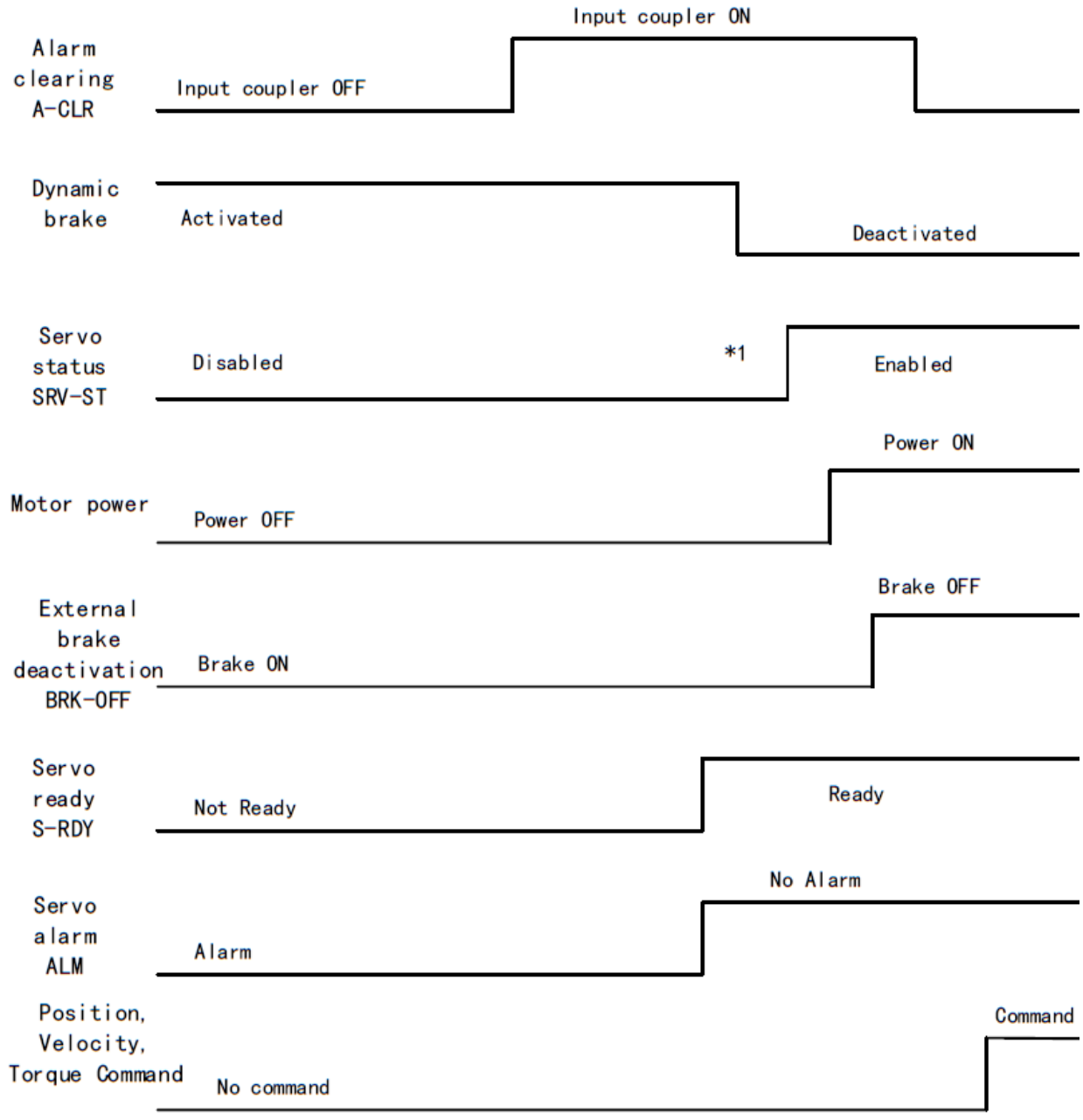


** *1. Status after stopping is as defined in Pr5.10.*

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.

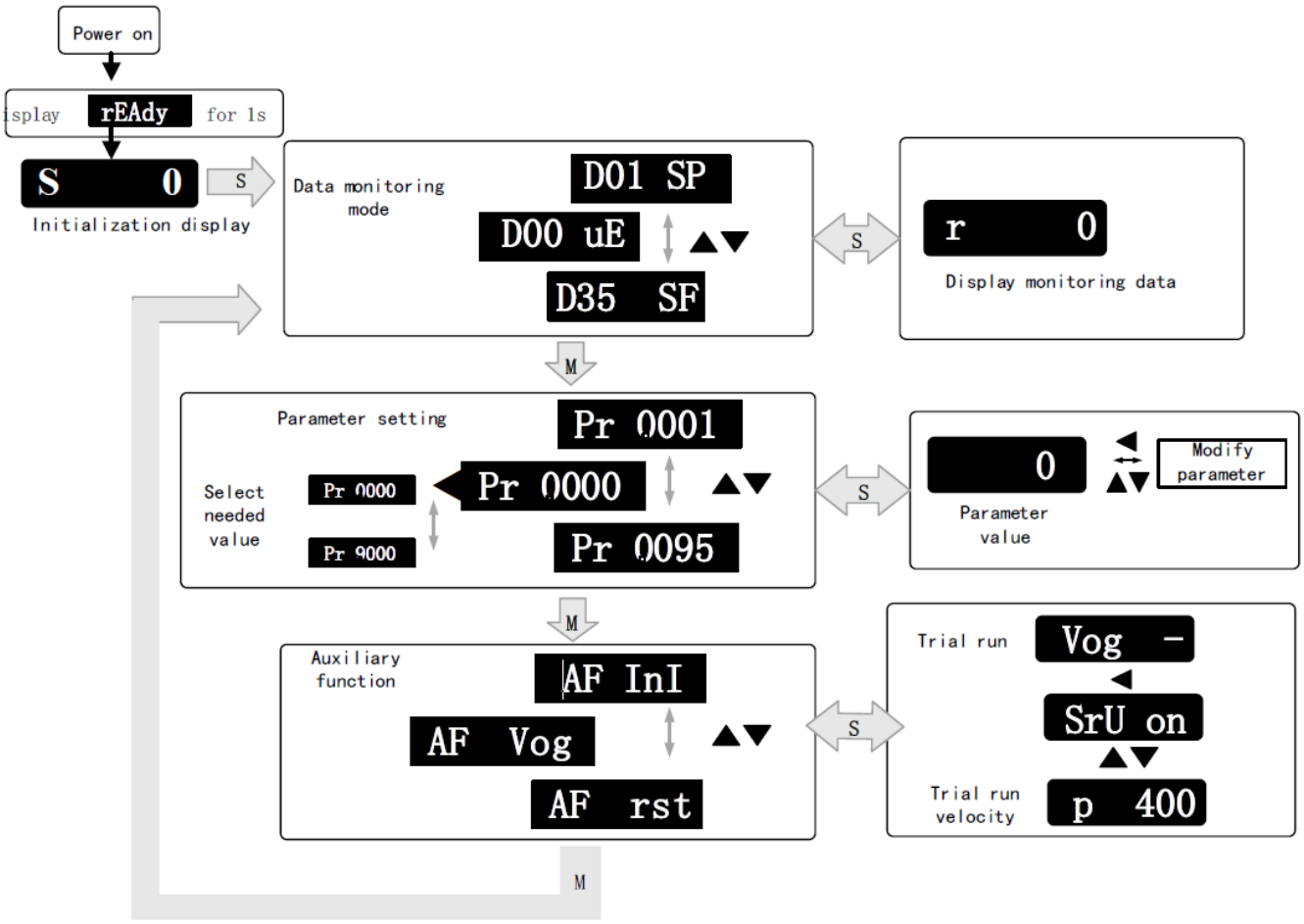
Front panel

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	①Set Pr5.35 = 1. ②Restart driver. ③Front panel is now locked.	
Unlock	① Please refer to auxiliary function **AFUnL** ② Front panel is now unlocked.	① Set Pr5.35 = 0. ② Front panel is now unlocked.

4.4.2 Data Monitoring Mode

OSD-H series servo driver offers the function to monitor different types of data in data monitoring mode. After entering this mode, press S to monitor any data that starts with **d**. Press S again to get back to data monitoring mode and M to switch to any other modes.

Data list in data monitoring mode

No.	Label	Descriptions	Display	Unit	Data Format (x = numerical value)
0	d00uE	Position command deviation	d00uE	pulse	"xxxx"
1	d01SP	Motor velocity	d01SP	r/min	"r xxxx" – Motor actual velocity
2	d02CS	Position control command velocity	d02CS	r/min	"xxxx"
3	d03Cu	Velocity control command velocity	d03Cu	r/min	"xxxx"
4	d04tr	Actual feedback torque	d04tr	%	"xxxx"
5	d05nP	Feedback pulse sum	d05nP	pulse	"xxxx"
6	d06cP	Command pulse sum	d06CP	pulse	"xxxx"
7	d07	Maximum torque during motion	d07	/	"d xxxx" – Max torque % "V xxxx"- Average load ratio

8	d08FP	Internal command position sum	d08FP	pulse	"xxxx"
9	d09cn	Control mode	d09Cn	/	Position: "Ct PoS" Velocity: "Ct SPd " Torque: "Ct trq"
10	d10Io	I/O signal status	d10 Io	/	-
11	d11Ai	Analog input	d11Ai	V	-
12	d12Er	Alarm cause and record	d12Er	/	"Er xxx" Alarm code
13	d13rn	Warning	d13rn	/	"H xxx" Warning code
14	d14r9	Regeneration load factor	d14r9	%	"xxx"
15	d15oL	Overload factor	d15oL	%	"L xxx" – Motor overload % "d xxx" – Driver overload %
16	d16Jr	Inertia ratio	d16Jr	%	"xxx"
17	d17ch	Motor not running cause	d17Ch	/	"CP xxx" Error code
18	d18ic	No. of changes in I/O signals	d18ic	/	"xxx"
19	d19	Internal use	d19	/	" xxxx"
20	d20Ab	CSP position command sum	d20Ab	pulse	" xxxx"
21	d21AE	Single turn encoder data	d21AE	pulse	"A xxxx" – motor encoder single turn data [redacted]
22	d22rE	Multiturn encoder data	d22rE	r	" xxxx"
23	d23 id	485 received frame	d23id	/	"id xxx" "Fr xxx"
24	d24PE	Position deviation	d24PE	Unit	"A xxxx" – Position deviation "F xxxx" – Full closed loop deviation (Command unit) "H xxxx" - Full closed loop deviation (Encoder unit)
25	d25PF	Motor electrical angle	d25PF	pulse	" xxxx"
26	d26hy	Motor mechanical angle	d26hy	pulse	" xxxx"
27	d27 Pn	Voltage across PN	d27Pn	V	" xxxx"
28	d28 no	Software version	d28no	/	"d xxx Servo software" "F xx Communication software" "p xxx Servo power rating" "C xx CPLD software"
29	d29AS	Internal usage	d29AS	/	
30	d30NS	No. of times of encoder communication error	d30sE	/	"A xxxx" – Motor encoder communication error count
31	d31 tE	Accumulated uptime	d31tE	/	" xxxx"
32	d32Au	Automatic motor identification	d32Au	/	"r xxx Motor no." "E xxx Servo no."

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

Description of data monitoring function

When using the front panel to monitor data, data is divided in low/high bit and positive/negative.

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

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

1. d00uE Position command deviation

Shows high bit and low bit of position deviation

Position command deviation

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

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

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

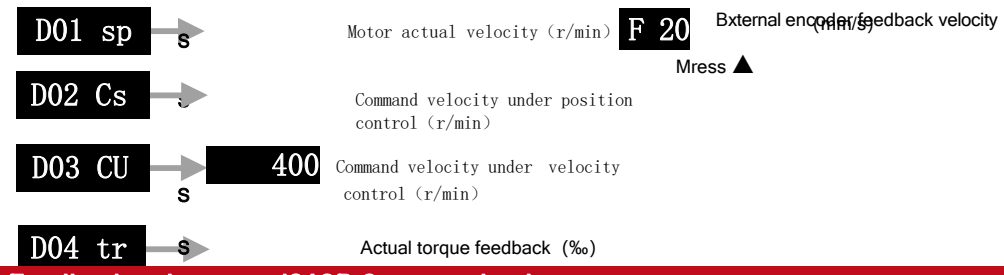
2. d01SP Motor velocity, d02CS Position control command velocity, d03CU Velocity control command velocity, d04 tr Actual torque feedback

d04 tr reflects actual current.

r 400

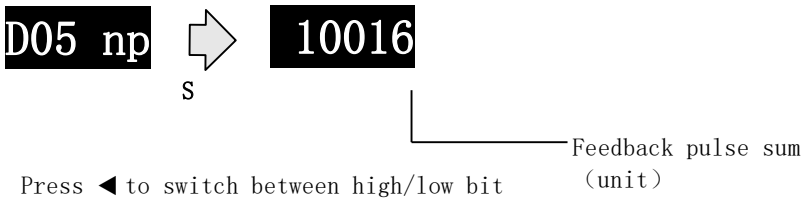
400

4



d05nP Feedback pulse sum d06CP Command pulse sum

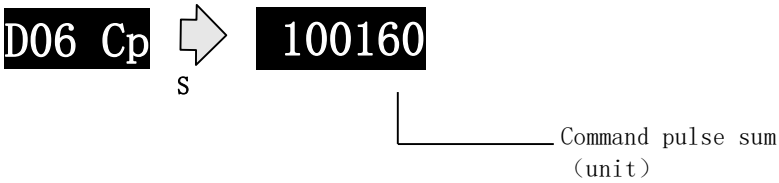
Feedback pulse sum(Encoder feedback pulse)



Press ◀ to switch between high/low bit
Example: Feedback pulse sum=2100160

High bit Low bit

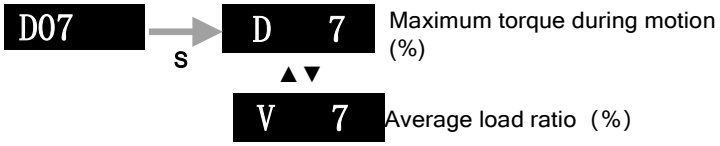
Command pulse sum (Command pulse)



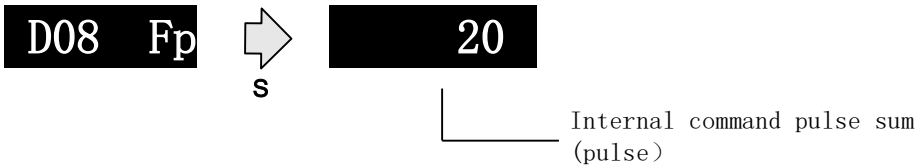
Press ◀ to switch between high/low bit
Example: Command pulse sum=210017

High bit Low bit

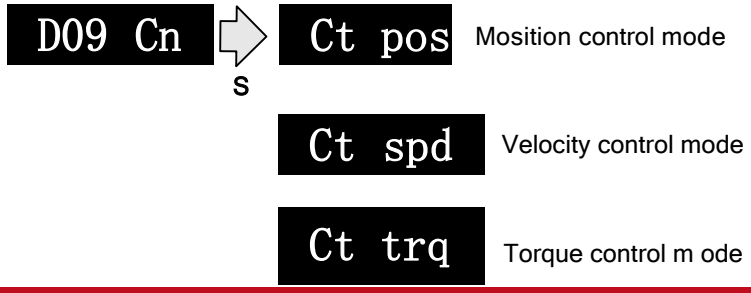
4. d07 Maximum torque during motion



5. d08FP Internal command pulse sum



6. d09Cn Control mode

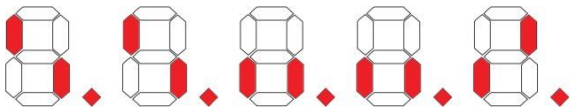


7. d10Io I/O signal status

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.

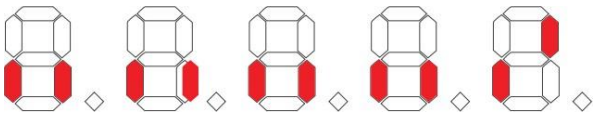
■ Input: From low to high bit(Right to left) DI1,DI2….DI10. Decimal point is lighted to represent input signals.

In the example below, DI1, DI8 and DI10 input signal is valid; DI2-DI7, DI9 input signal is invalid.

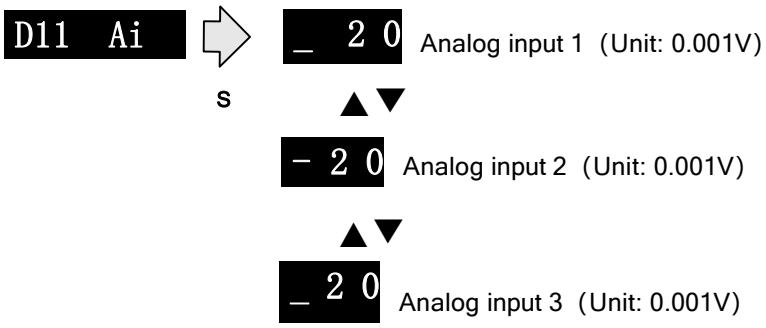


■ Output: From low to high bit(Right to left) DO1,DO2….DO10. Decimal point is not lighted to represent output signals.

In the example below, DO1 output signal is valid; DO2-DO10 output signal is invalid.

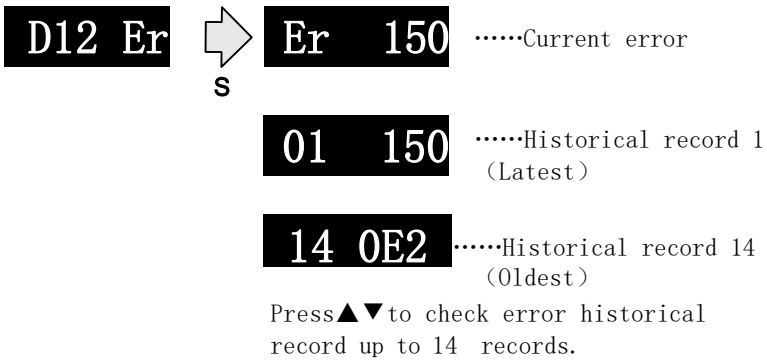


8. d11Ai Analog input



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

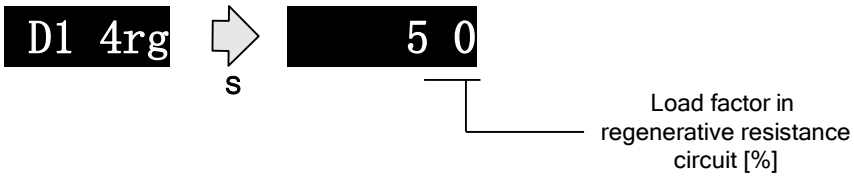
9. d12Er Alarm cause and historical record



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

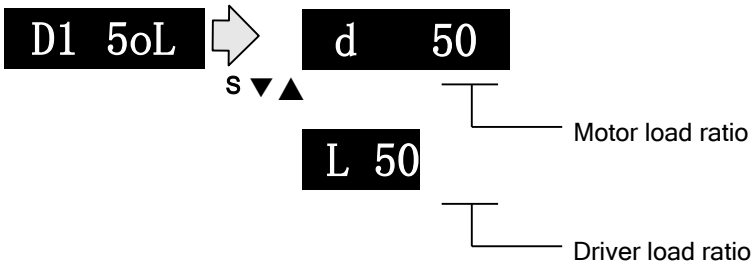
10. d14rg Regenerative load factor d15oL Overload factor

Regenerative load factor（Er120 might occur, if the value increases indefinitely）

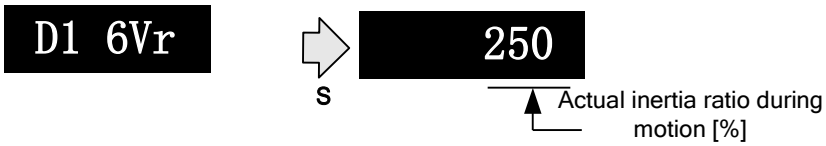


Overload factor（Er100 might occur, if d increases indefinitely

Er101 might occur, if L increases indefinitely）

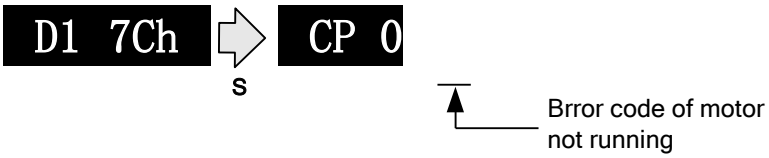


11、d16Jr Inertia ratio



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.

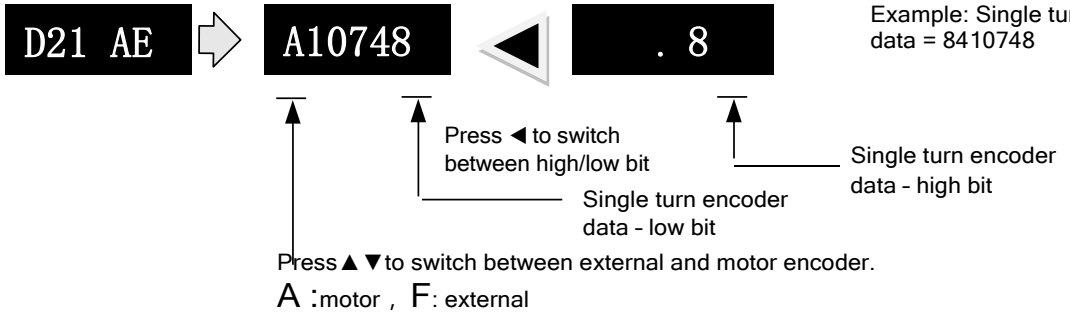
12、d17Ch Motor not running cause



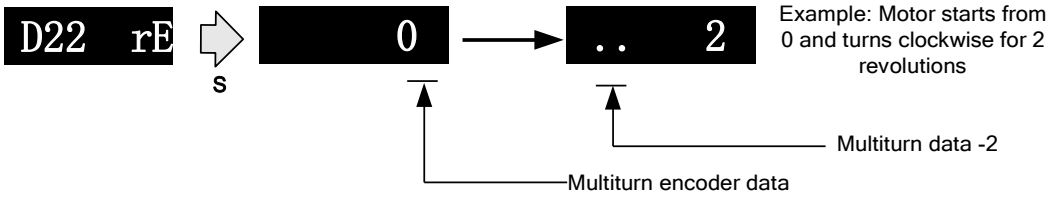
"d17Ch" Motor No Running Cause - Codes & Descriptions

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

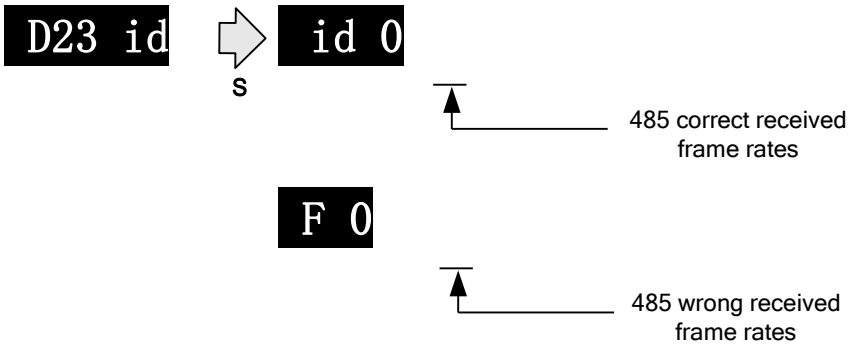


For 23-bit encoder, single turn encoder data = 0~8388607.Each value corresponds to certain position in a single revolution of the rotor, clockwise motion as negative, counter clockwise motion as positive. When counter clockwise single turn data > 8388607, multiturn data +1, clockwise single turn data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

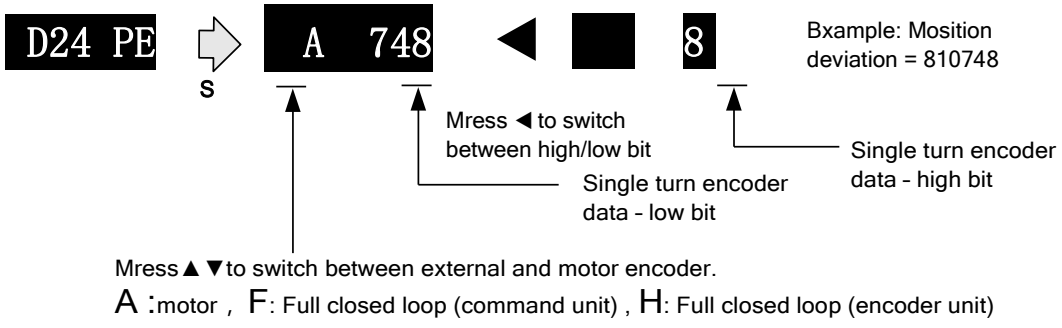


Multiturn encoder data range:-32768~+32767, As no. of revolution goes over range,32767 will jump to -32768、 -32767(counter clockwise)； -32768 will jump to 32767、 32766 (clockwise)

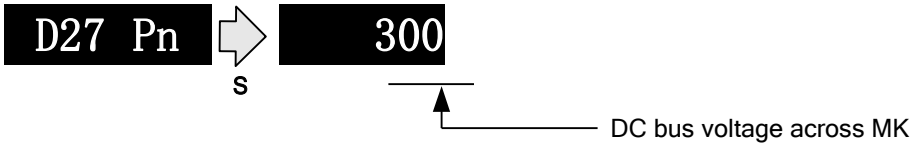
14.d23id 485 received frame



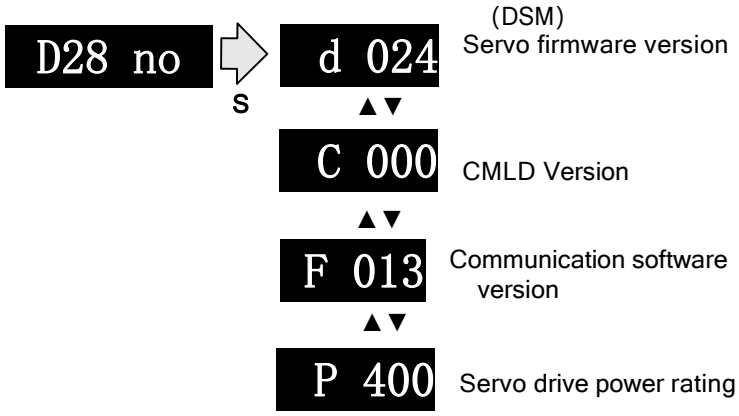
15. d24PE Position deviation



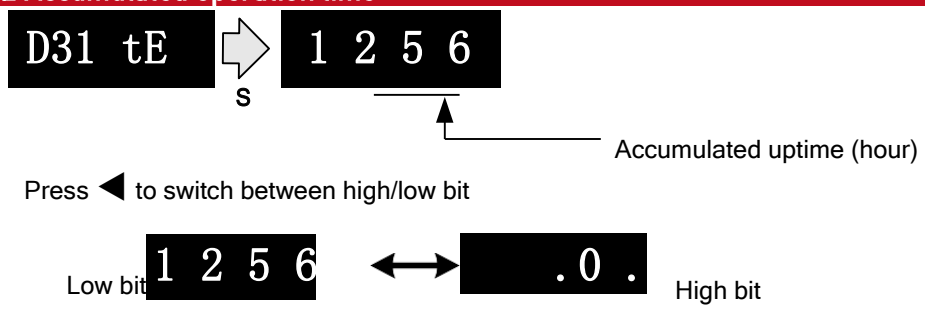
16. d27Pn DC bus voltage



17. d28no Software version

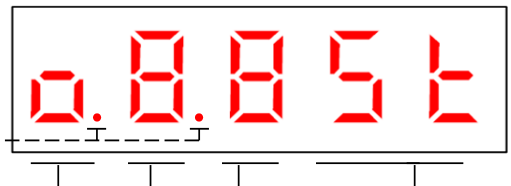


17. d31tE Accumulated operation time



18. d34 Servo driver status display

Driver status: 402 state machine, EtherCAT communication, running mode, running



402 State Machine
OFF(1： Top tube on)
Ready (2： Mid tube on)
ON (3： Top, Mid, Bottom tube on)
Operation(0 Enabled)
Emergency stop(Side tubes on)
Other status （-）

Running mode
(1/3/4/6/8/9/A, Other no supported)

EtherCAT Communication Status
Status0 OFF
1 Init
2 Pre-Op
4 Safe-Op
8 Op
- Others

Running mode
r n： Rotation
S t： Stop

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

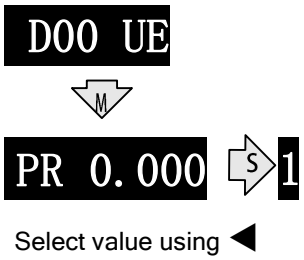
Pr5.28	Label	LED initial status			Valid mode(s)	P	S	T
	Range	0~35	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0539		
	Valid	Immediate						

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

Value	Status	Value	Status	Value	Status
0	Position deviation	14	Regenerative load rate	28	Software version
1	Motor speed	15	Overload rate	29	Internal usage
2	Position command deviation	16	Inertia load ratio	30	Encoder communication failure counts
3	Velocity control command	17	Cause(s) of non-rotation	31	Accumulated uptime
4	Actual feedback torque	18	No. of I/O changes	32	Internal usage
5	Feedback pulse sum	19	Internal usage	33	Driver temperature
6	Command pulse sum	20	Absolute encoder data	34	Servo status
7	Max. torque	21	Encoder single turn data	35	Internal usage
8	Position command frequency	22	Encoder multiturn data		
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		

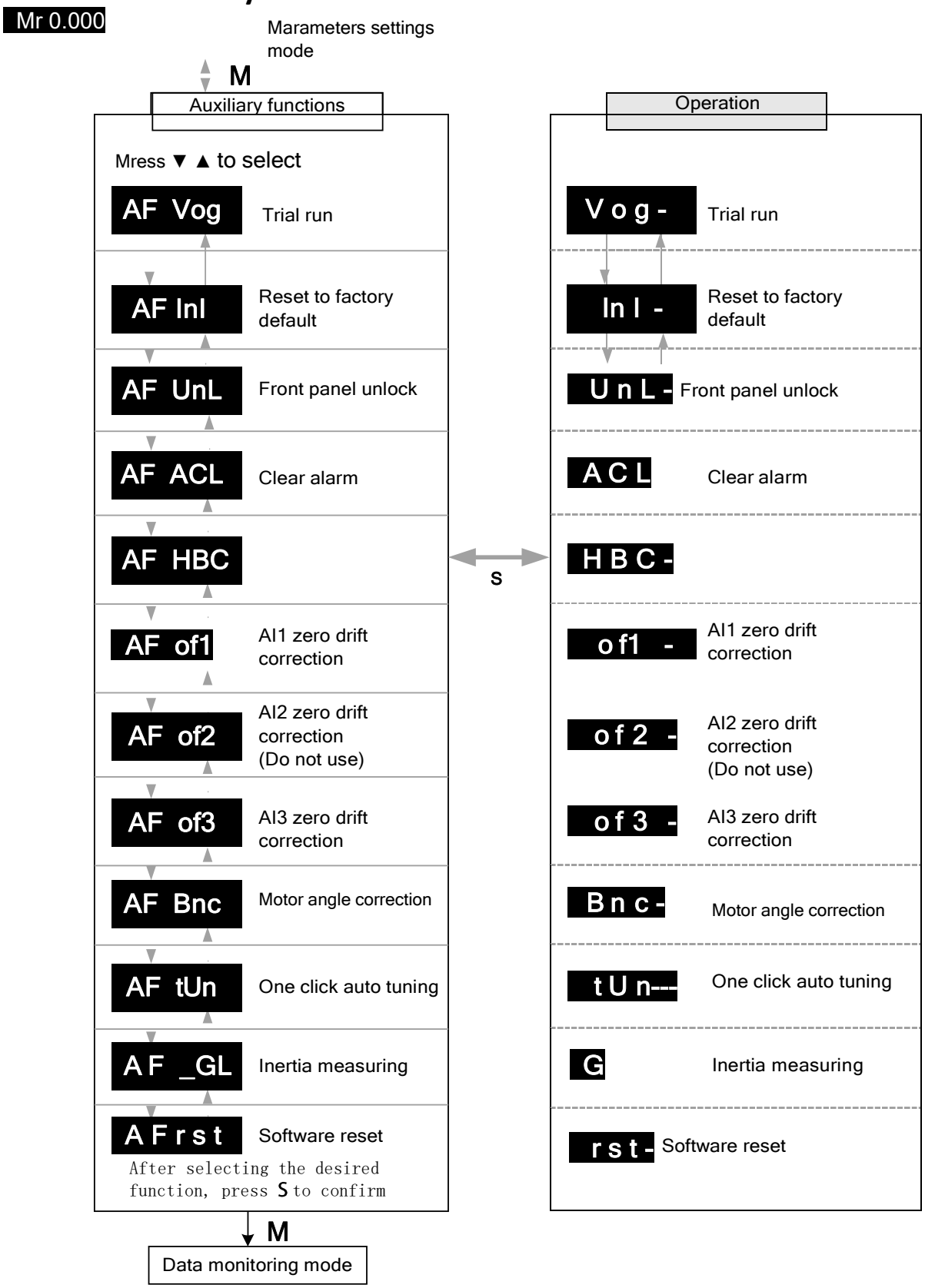
4.5 Parameters saving

Save using driver's front panel



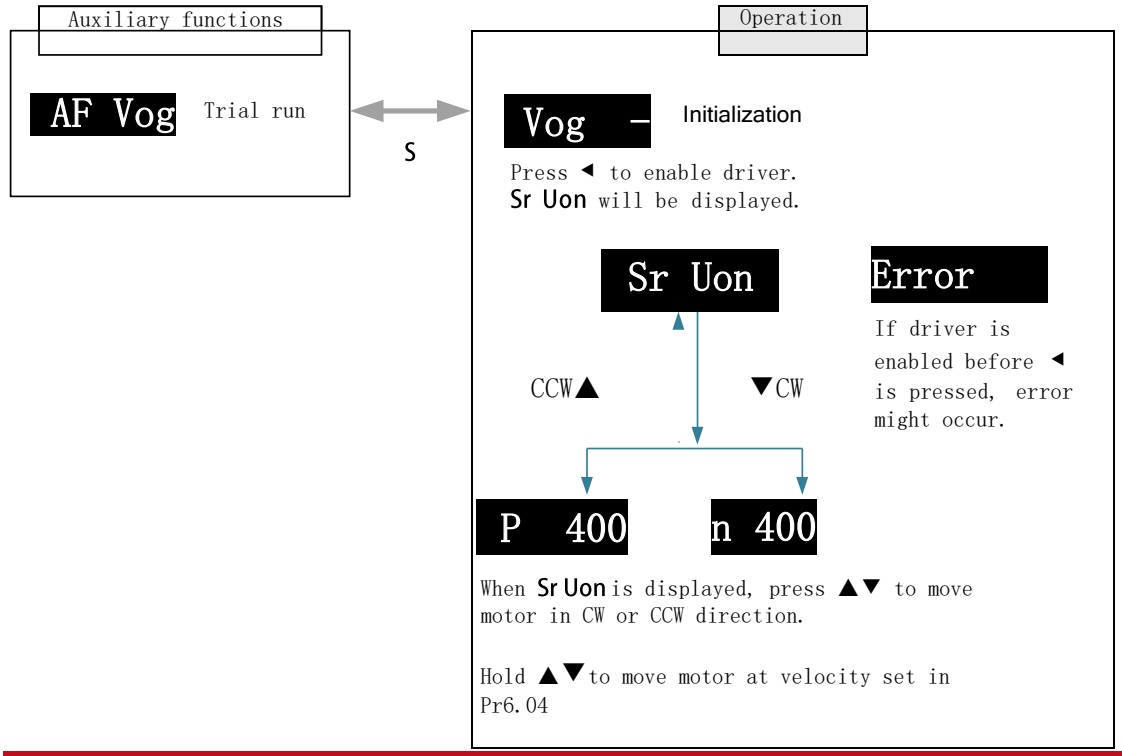
After modifying the selected parameter to desired values, press S to confirm and save the changes. If the parameter is modified but user does not want to save the changes, press M to exit without saving. Some parameter modifications will only take effect after the driver is restarted.

4.6 Auxiliary function



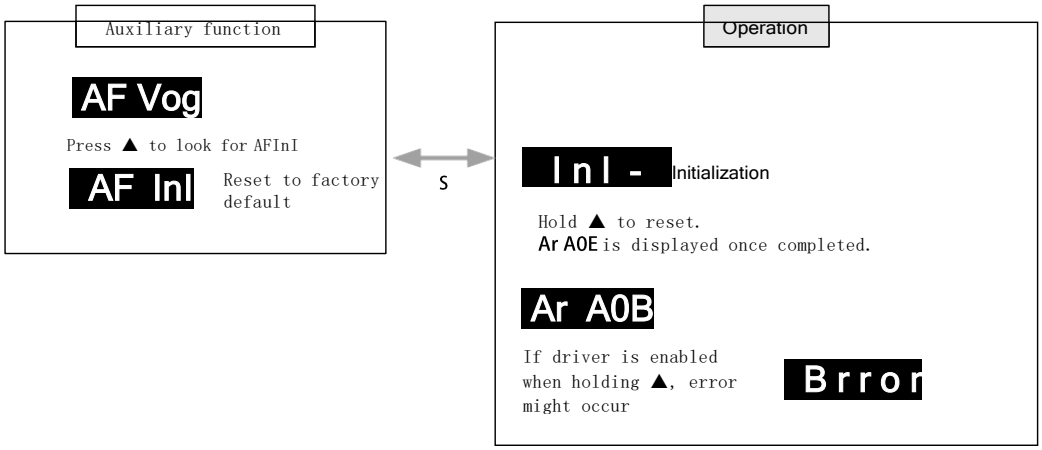
AF Vog Trial run

- 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.

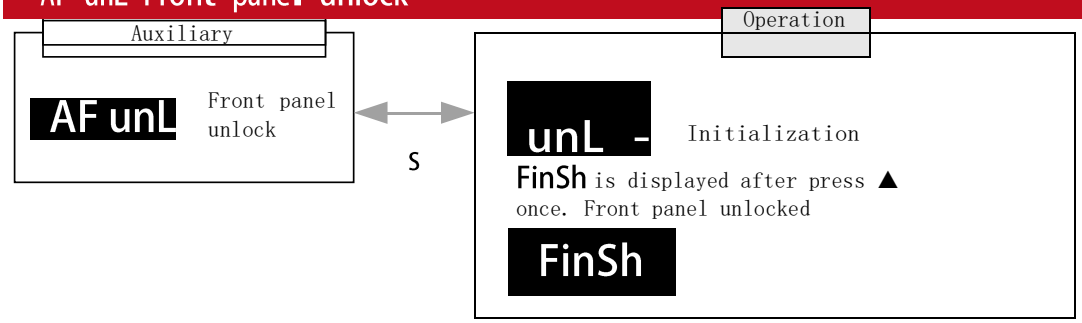


AF Inl Reset to factory default

To reset parameters settings to factory default. Can be used to reset parameters using auxiliary function on front panel or using object dictionary.

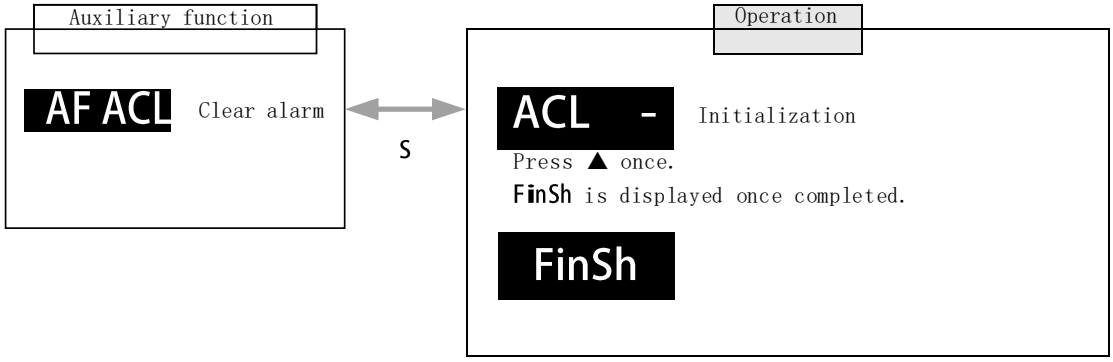


AF unL Front panel unlock



AF ACL Clear alarm

Alarm can be cleared using this auxiliary function but before that, the error needs to be solved and driver needs to be restarted.

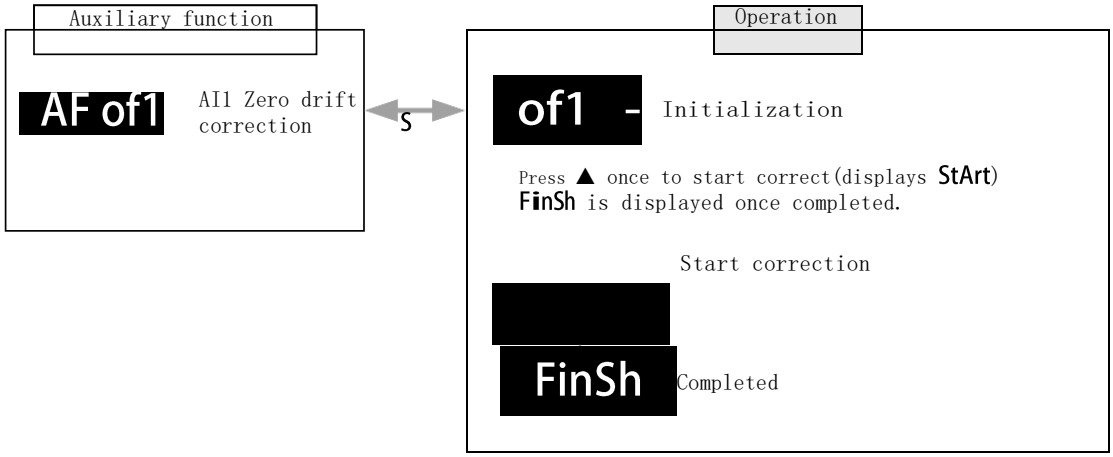


For alarms that can be cleared using this function, please refer to table in Chapter 8.

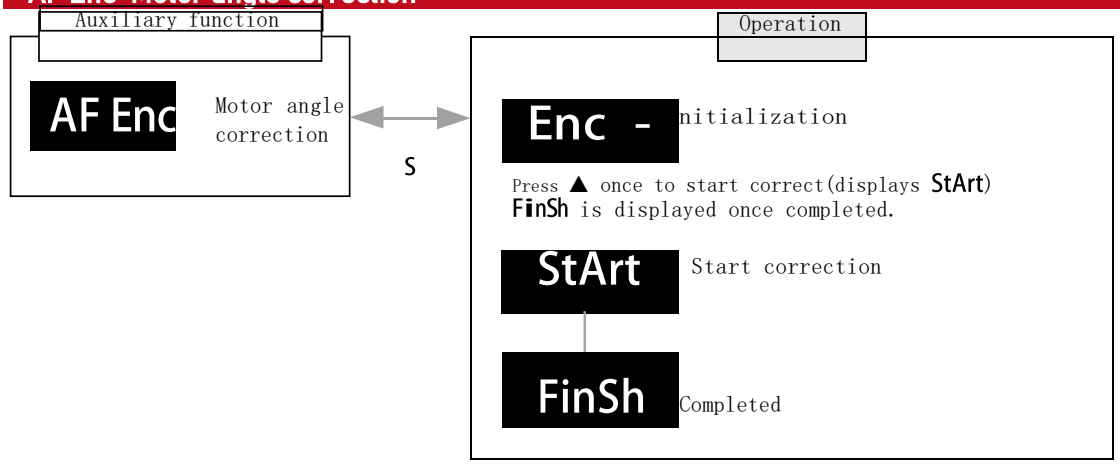
AF of1 – AF of3 Analog input AI1-3 zero drift correction

Auto adjustment of analog input zero drift settings

Analog input	Parameter (Zero drift settings)
AI1	Pr4.22
AI2	Pr4.25
AI3	Pr4.28

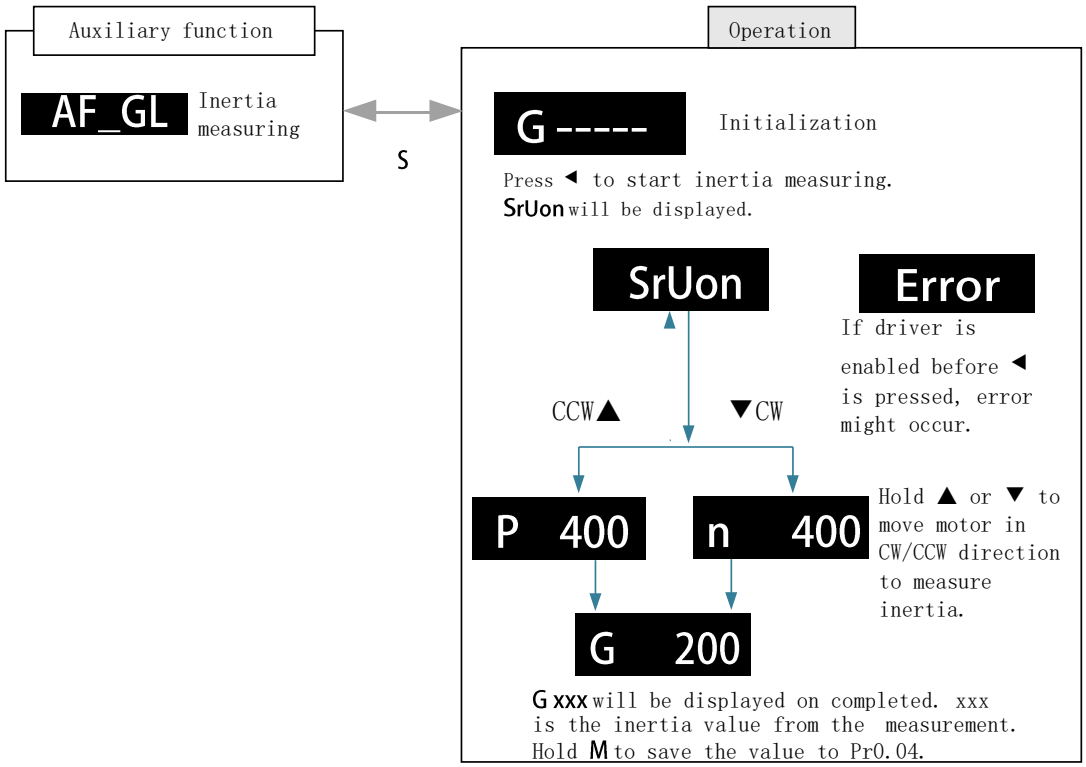


AF Enc Motor angle correction



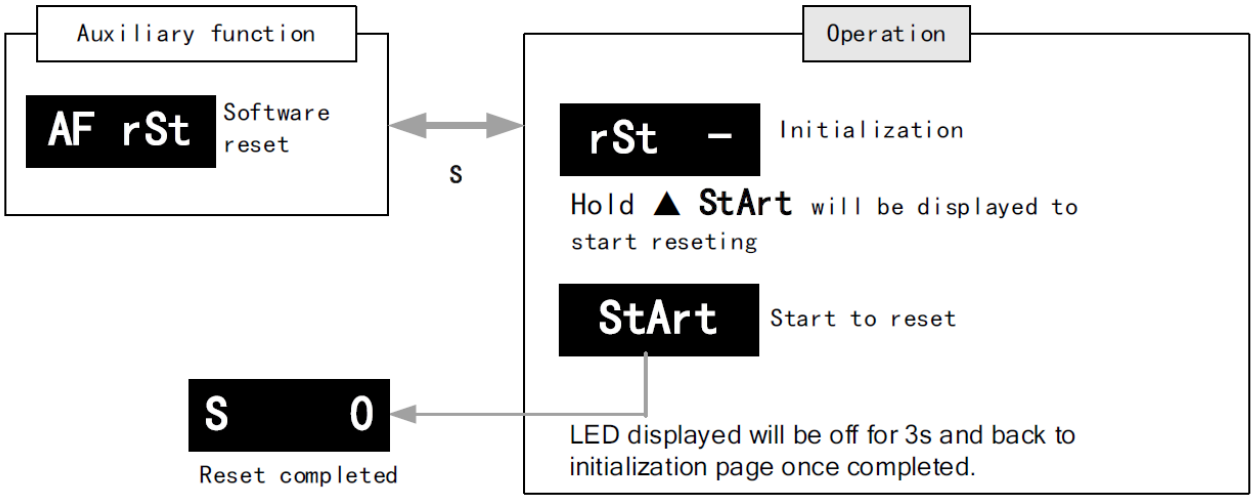
AF_GL Inertia measuring

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.



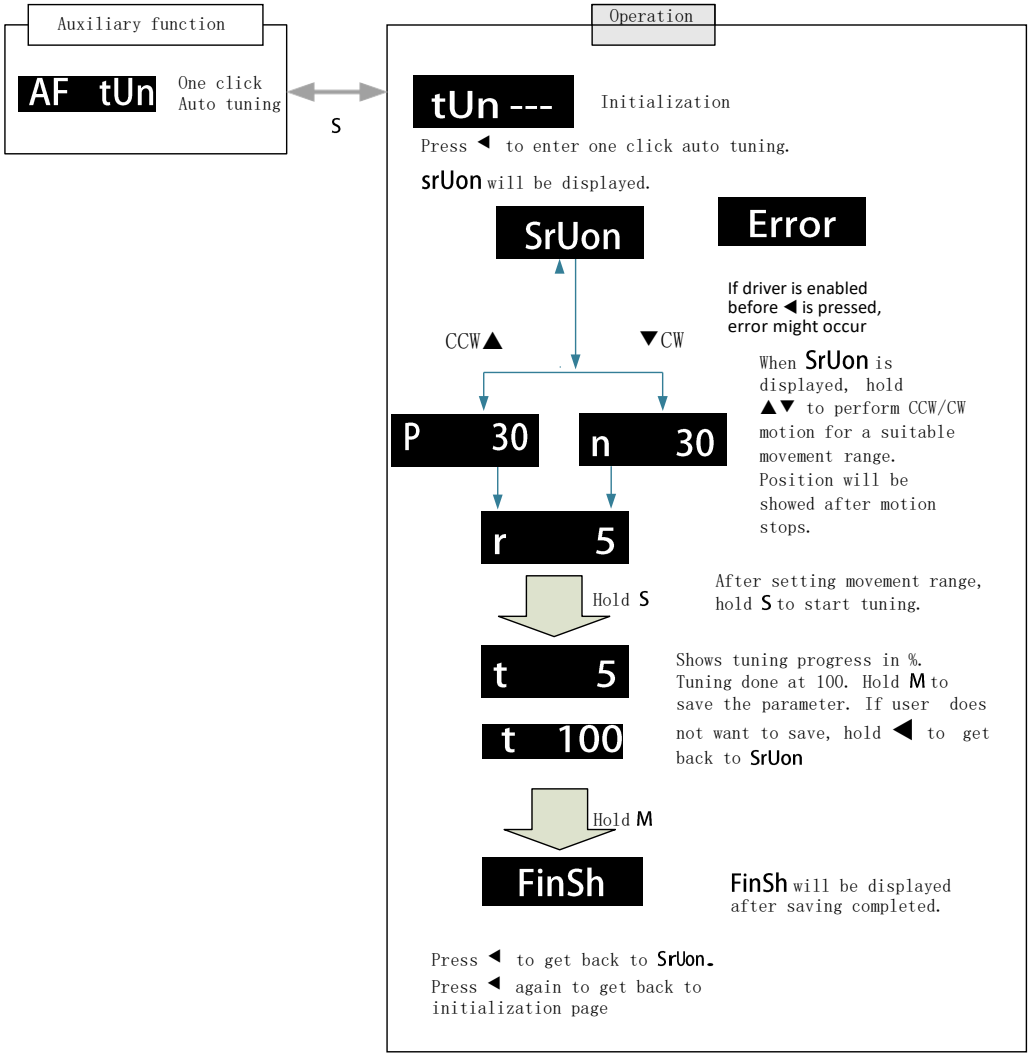
AF rSt Software reset

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 OSD-HP 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	
	1st mode	2nd mode
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position Pr0.22=1
		Velocity Pr0.22=1
		Torque Pr0.22=2
7~10	Reserved	

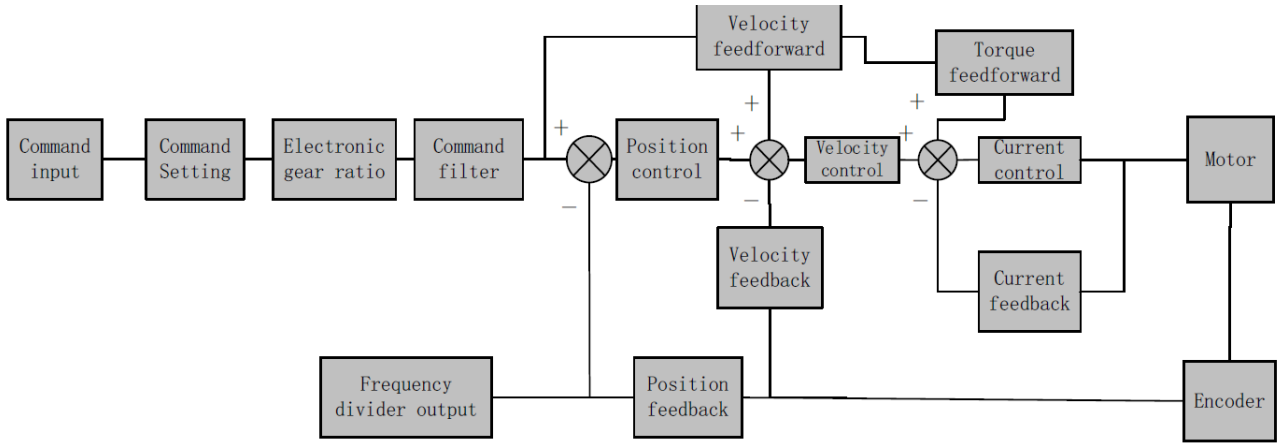
◆When 3, 4, 5, 6 combination hybrid mode, 1st and 2nd mode can be chosen accordingly with control mode switching input (C-MODE).
C-MODE: Invalid, select 1st mode.
C-MODE: Valid, select 2st mode.
Please allow some time in between mode switching commands.

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

C-MODE is defaulted to Normally Open

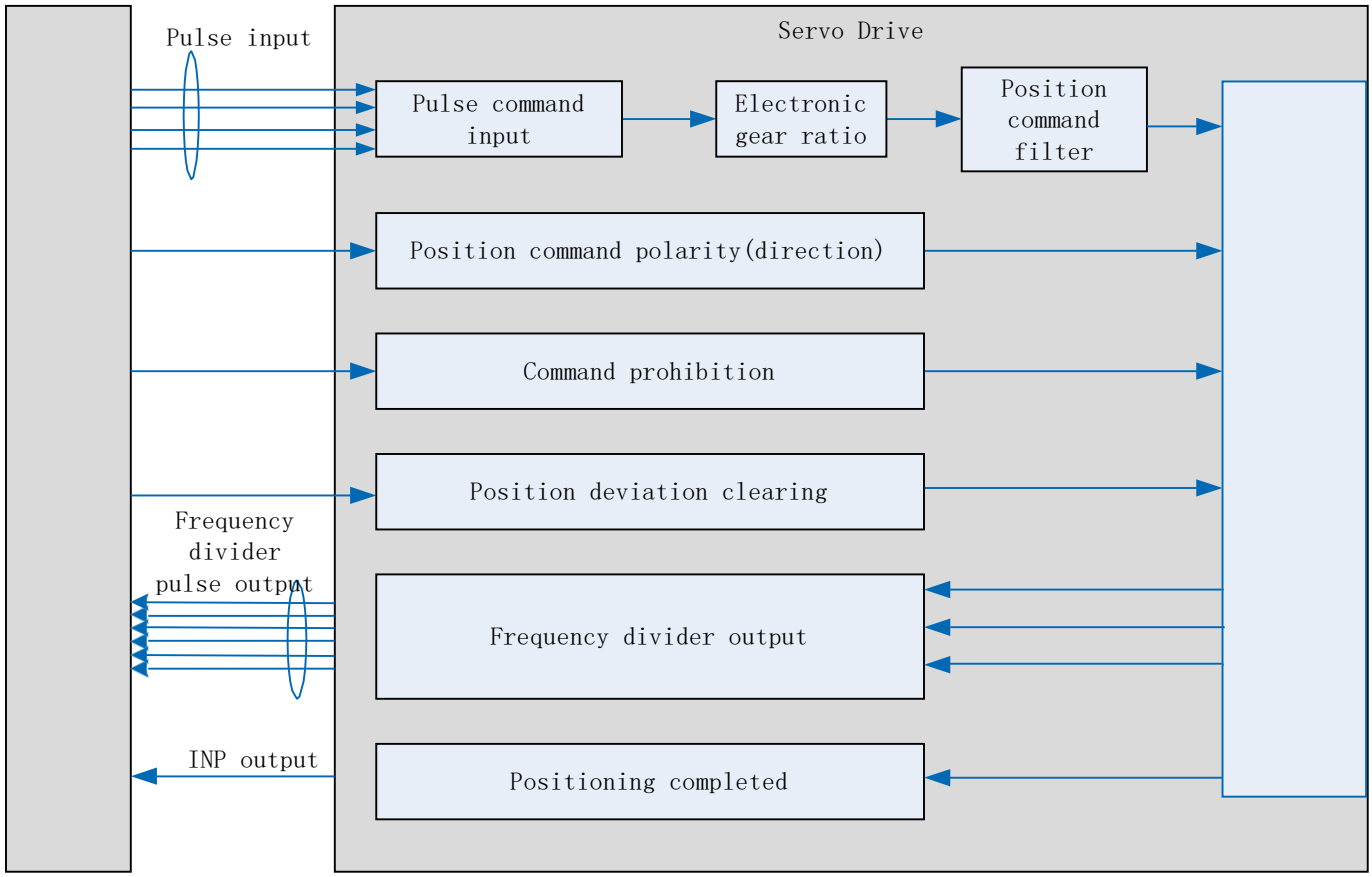
5.1 Position control

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-：24Vsingle ended input (200KHz)
3	PUL+		
4	PUL-		
2	DIR+24	Direction command input	
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-		

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

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

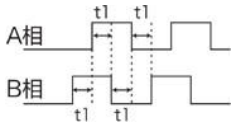
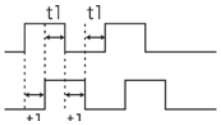
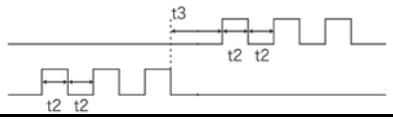
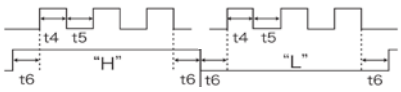
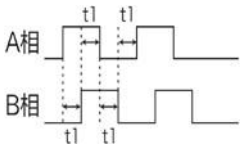
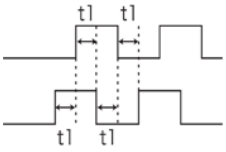
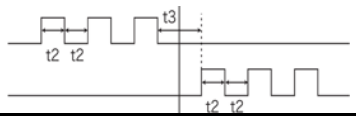
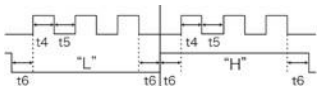
Both channels cannot be used at the same time.

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

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

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

Command pulse input

Command Polarity inversion (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（μ□s）					
			t1	t2	t3	t4	t5	t6
Pulse sequence interface	Differential drive	500 kHz	2	1	1	1	1	1
	Open collector	200 kHz	5	2.5	2.5	2.5	2.5	2.5
	High speed differential drive	4Mhz	0.25	0.125	0.125	0.125	0.125	0.125

Please set >0.1μs for the duration between rising and falling edge of command pulse input signal.
1 revolution with 2500 pulses 2-phase pulse input when 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	Label	Max. command pulse input frequency			Valid mode(s)	P		
	Range	0~8000	Unit	kHz	Default	4100		
	Byte length	16bit	Attribute	R/W	485 address	0x0541		
	Valid	Immediate						
	Please set the max. frequency required for command pulse input. Er1B0 will occur, if command pulse input frequency exceeds 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. OSD-H 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.

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

1. Settings：
(1) Driver command pulse input count : X
(2) Encoder pulse count after frequency divider/multiplier: Y
(3)Encoder pulse count per revolution: Z
(4)Motor revolution: W
2. Calculation：
（1） X, Y
Y = X * 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.

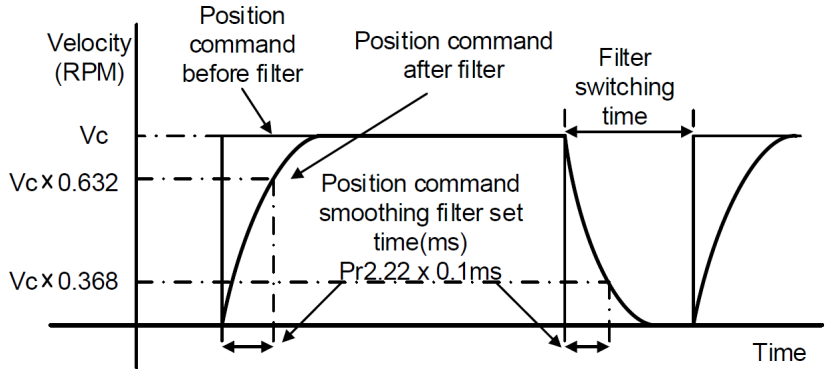
Position command filter should be added for the following cases:

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

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

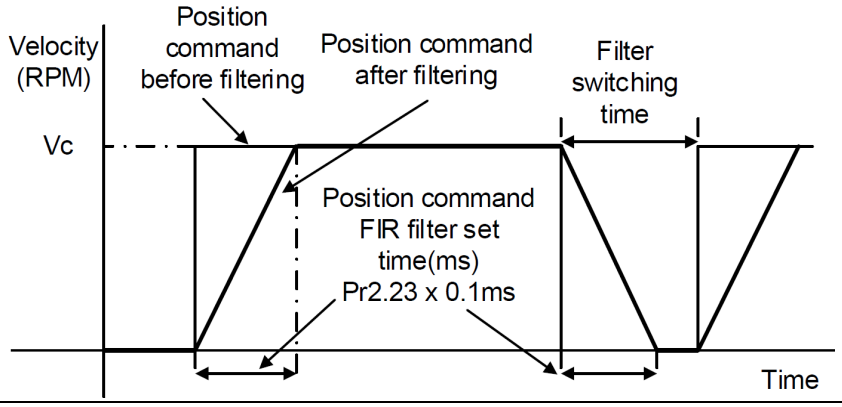
To set time constant of 1 time delay filter of position command.
To set time constant of 1 time delay filter, according to target velocity Vc square wave command as show below.



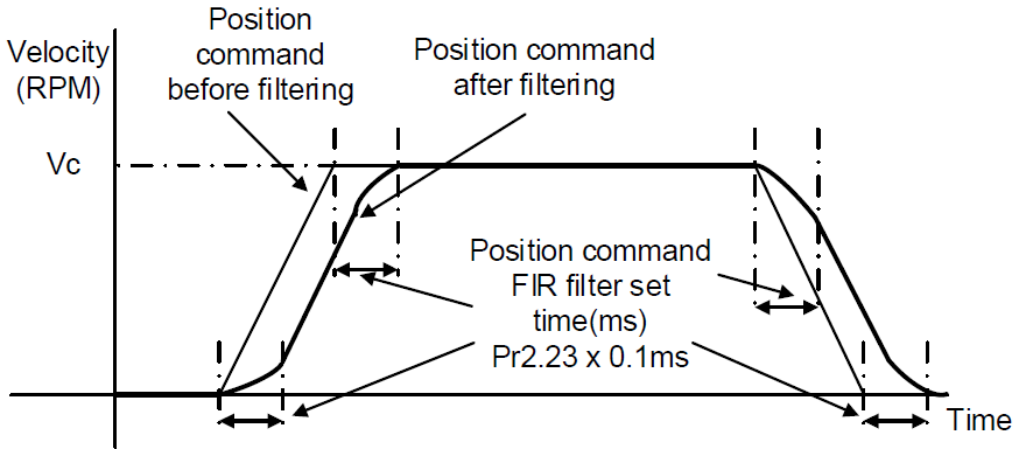
Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If Pr2.22 is set too high, overall time will be lengthened.

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

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



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



Usually applied when there is rather sharp acceleration which might cause motor overshoot or undershoot. To smoothen command signal, reduces impact to machines and eliminate vibration. If Pr2.23 is set too high, overall time will be lengthened.

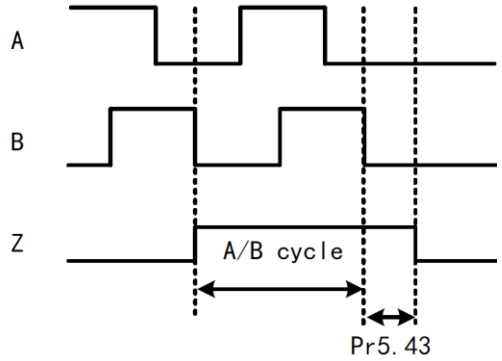
Note: Please wait for command to stop and after filter idle time to modify Pr2.23.
Filter switching time = (Pr2.23 set value x 0.1ms + 0.25ms)

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.

***Encoder Z-signal width ≥ 62.5ms, or equivalent to an A/B signal cycle. If frequency divider output Z-signal width has to be widen, set through 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
【0】	Z bandwidth equivalent to 1 cycle of A/B
1~500	Delay setting on top of A/B cycle width

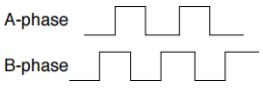
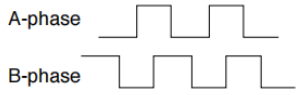
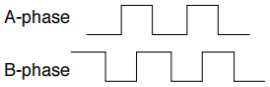
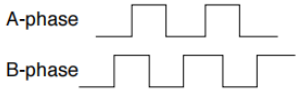


Related parameters

Pr0.11	**Label**	Encoder output pulse count per revolution			**Valid mode(s)**	**P**	**S**	**T**
	Range	1~32767	**Unit**	P/r	**Default**	2500		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0017		
	Valid	After restart						
	If Pr0.11 = 1000, encoder differential output signal per revolution = 4000 pulses							
Pr0.12	**Label**	Pulse output logic inversion			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~1	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0019		
	Valid	After restart						

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

Pulse output logic inversion

Pr0.12	Phase B logic	CCW direction	CW direction
[0]	Not inverted		
[1]	Inverted		

Pr5.42	**Label**	Frequency divider output – Z-signal polarity			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~7	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0555		
	Valid	Disabled						

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

Pr5.44	**Label**	Frequency divider output source			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~4	**Unit**	—	**Default**	0		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0559		
	Valid	After restart						

Value	Description
【0】	Position feedback of encoder #1(motor encoder)
1	Reserved
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.

Pr4.31	Label	Positioning complete range			Valid mode(s)	P		
	Range	0～10000	Unit	Pr5.21 set unit	Default	20		
	Byte length	16bit	Attribute	R/W	485 address	0x043F		
	Valid	Immediate						

To set position deviation range of INP1 positioning completed output signal. INP1 output signal will be valid once position is complete within the range of deviation set.
Default unit: 0.00001rev. Can be set on Pr5.21 as command unit (pulse) or encoder unit (pulse)

Pr4.32	Label	Positioning complete output setting			Valid mode(s)	P		
	Range	0~4	Unit	—	Default	1		
	Byte length	16bit	Attribute	R/W	485 address	0x0441		
	Valid	Immediate						

To set conditions for INP1 output signal to be valid

Value	Positioning completed signal
0	Signal valid when the position deviation is smaller than 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.

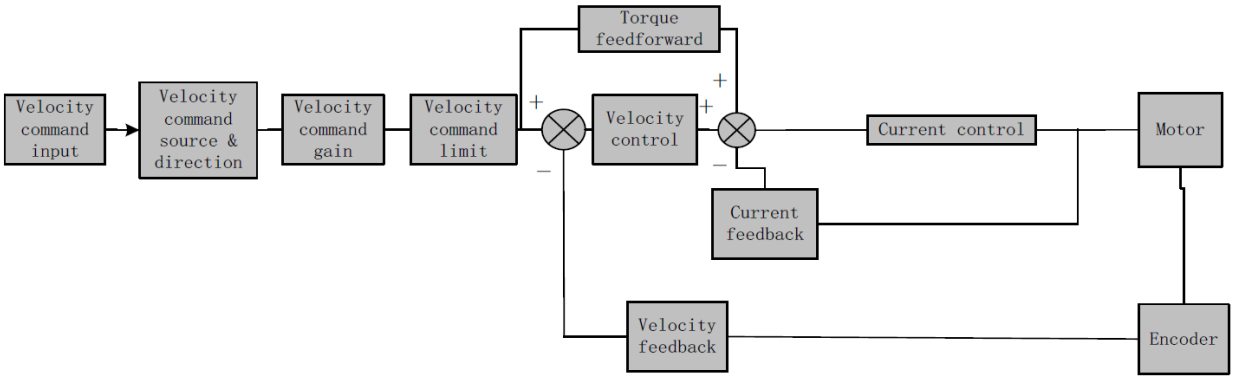
Pr4.33	Label	INP positioning delay time			Valid mode(s)	P		
	Range	0~15000	Unit	1ms	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0443		
	Valid	Immediate						

Valid when Pr4.32 = 3.

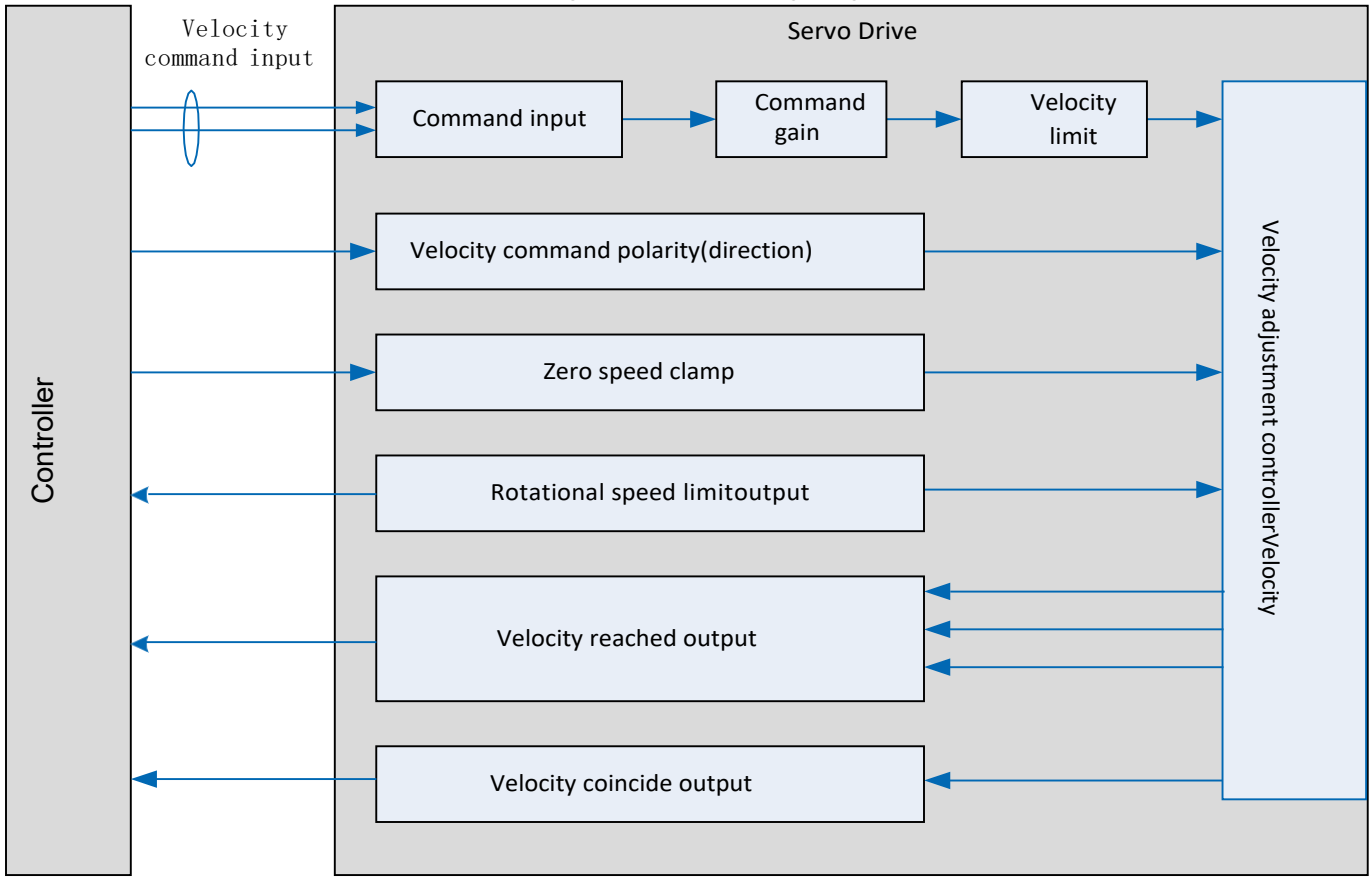
Set value	Positioning completed signal
0	Indefinite delay time, signal ON until next position command
1-15000	OFF within the time set; ON after time set. Switch OFF after receiving next position command.

5.2 Velocity control mode

Velocity mode precisely controls motor rotational speed/direction using analog velocity command or internal related parameters. There are 4 types of velocity control modes for OSD-HP 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.

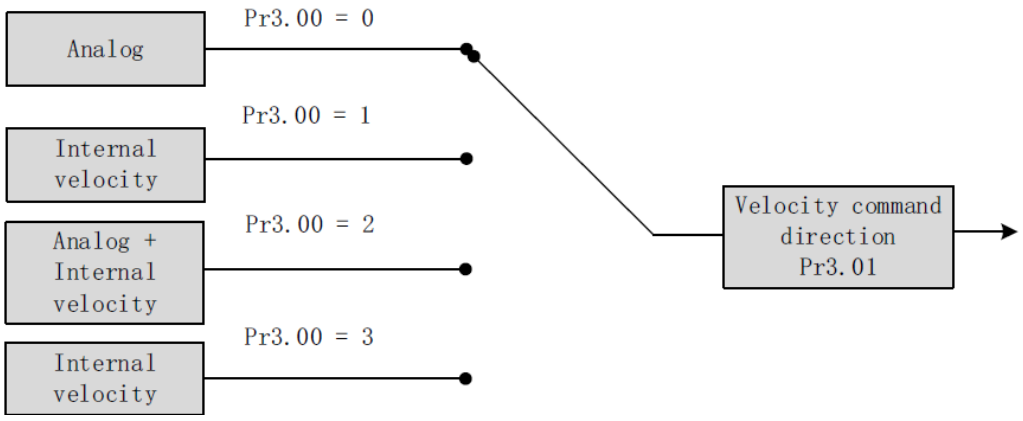


Please set related servo parameters according with the following diagram.



5.2.1 Velocity command input control

Set velocity control mode in Pr3.00



Pr3.00						
	Label	Velocity internal/external switching			**Valid mode(s)**	S
	Range	0~3	**Unit**	—	**Default**	1
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0301
	Valid	Immediate				

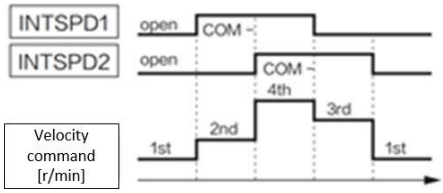
Connect to the right DI to control internal command velocity settings.

Value	Velocity settings
0	Analog - Velocity command（SPR）
[1]	Internal velocity settings 1st – 4th speed（Pr3.04～Pr3.07）
2	Internal velocity settings 1st – 3rd speed（Pr3.04～P3.06）、Analog velocity command（SPR）
3	Internal velocity settings 1st – 8th speed（Pr3.00～Pr3.11）

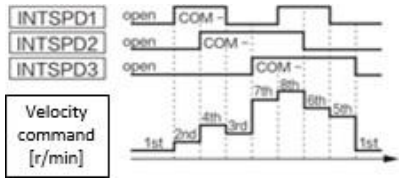
Value	Internal command velocity 1（INTSPD□1）	Internal command velocity 2（INTSPD2）	Internal command velocity 3（INTSPD3）	Velocity command
1	OFF	OFF	No effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		4th speed
2	OFF	OFF	No effect	1st speed
	ON	OFF		2nd speed
	OFF	ON		3rd speed
	ON	ON		Simulated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



Pr3.00=1 / 2



Pr3.00=3

Velocity command direction settings

Switch velocity command direction using I/O. Assign VC-SIGN to corresponding DI terminal, velocity command direction will be in accordance to DI signal.

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

To set positive/negative direction of velocity command

Value	Velocity settings（Analog or internal velocity）	Velocity command sign selection（VC-□SIGN□）	Velocity command direction
【0】	＋	No effect	Positive
	－	No effect	Negative
1	No effect	OFF	Positive
	No effect	□ON	Negative

Velocity command input inversion

Set Analog-Velocity command (SPR) voltage polarity

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

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

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

Velocity command input gain

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

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

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

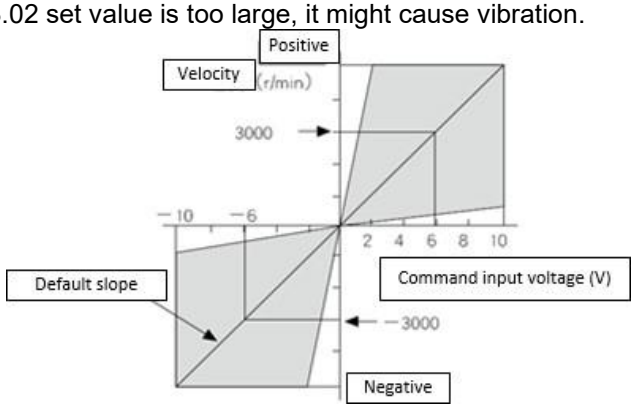
Pr3.02 sets command input voltage and rotational speed slope.

Factory default:

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

Hence 6V input: 3000 r/min

1. Do not supply more than ±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.

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

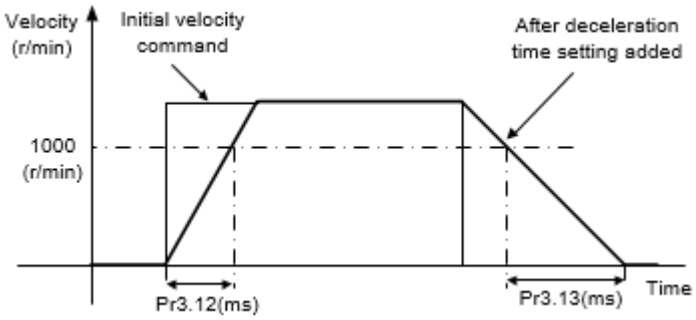
Set max acceleration/deceleration for velocity command.

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

Pr3.12 = *1000/a*

Pr3.13 = *1000/a*

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

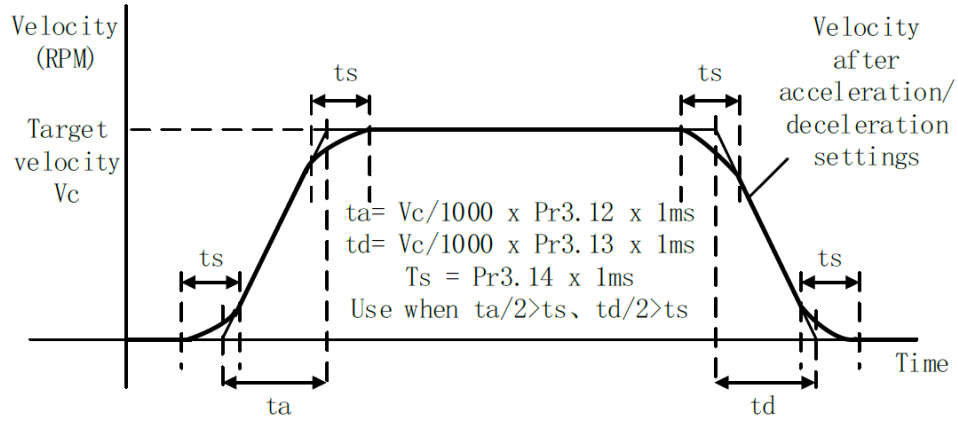


Usually used when there is rapid acceleration or trapezoidal wave velocity command due to many different internal speed segments under velocity control mode which causes instable while motor in motion.

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

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

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

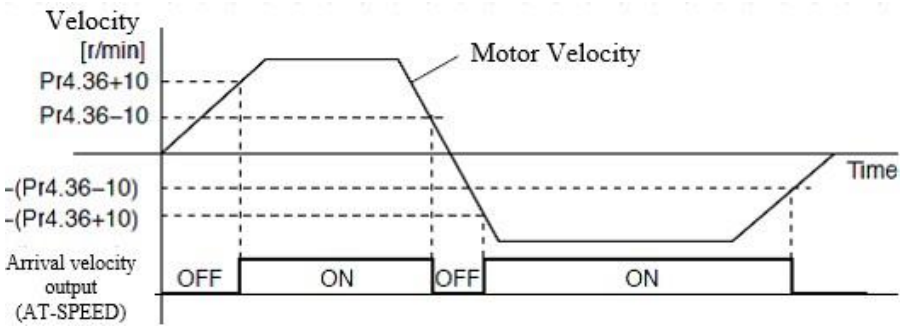


5.2.3 Velocity reached signal AT-SPEED output

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.

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

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

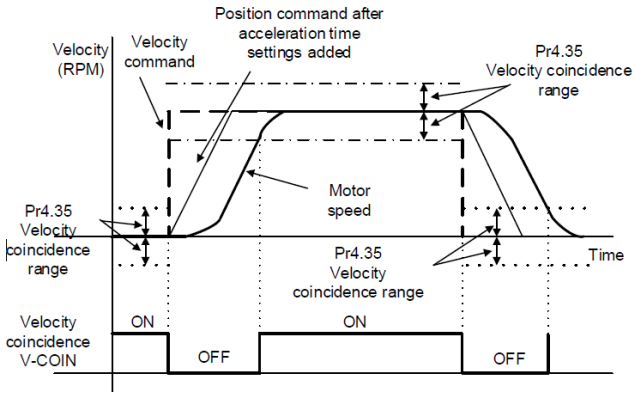


5.2.4 Velocity coincidence V-COIN signal output

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.

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

If the difference between velocity command and motor actual speed is below 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.

Pr3.15	Label	Zero speed clamp function selection			Valid mode(s)	S
	Range	0~3	Unit	—	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0x031F
	Valid	Immediate				

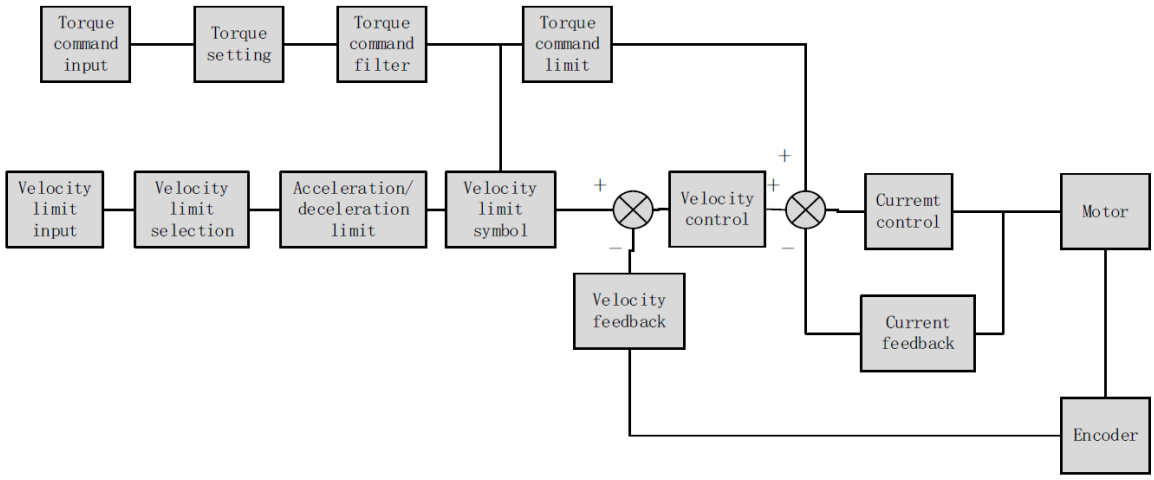
Value	Zero speed clamp function
0	Invalid: zero speed clamp deactivated
1	Velocity command is forced to 0 when the zero speed clamp (ZEROSPD) input signal is valid.
2	Velocity command is forced to 0 when actual velocity is lower than Pr3.16.
3	Includes conditions from 1 and 2

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

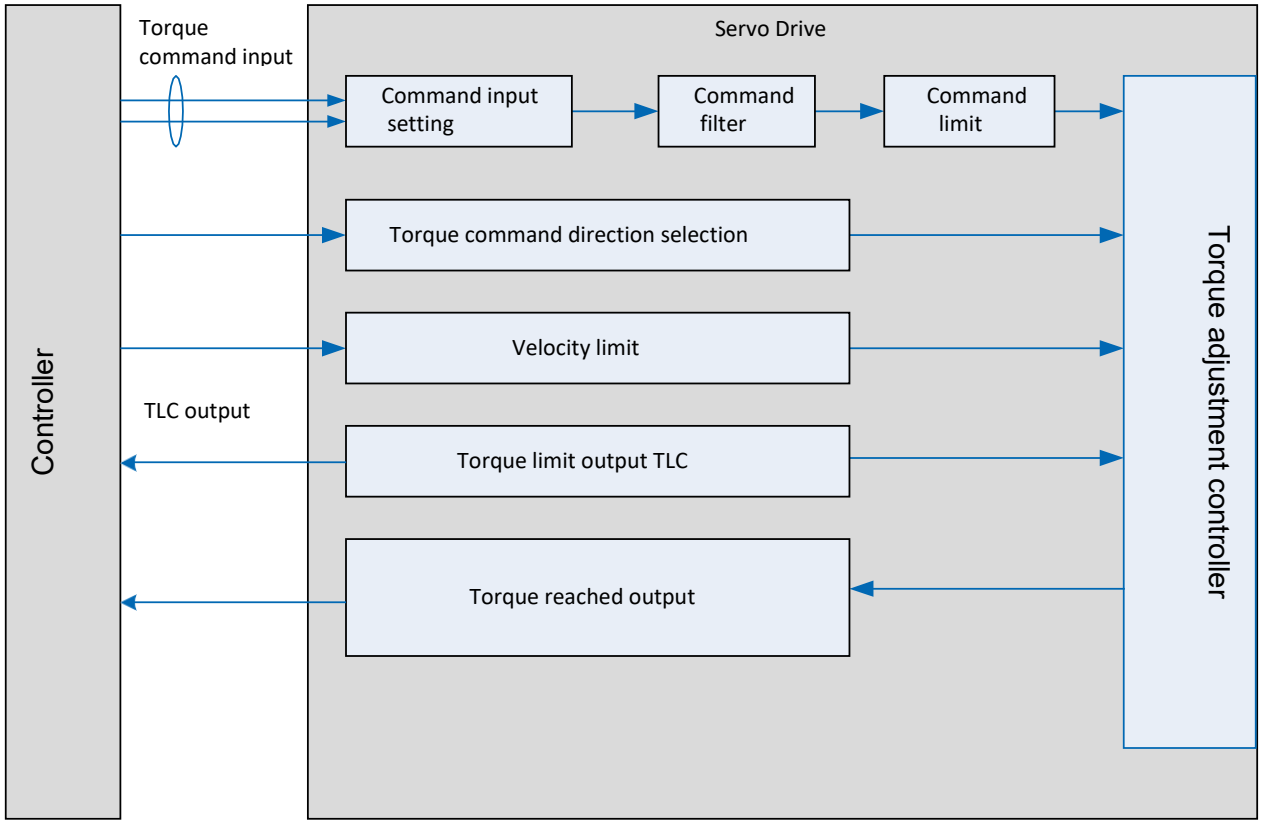
Valid when Pr3.15 = 2/3, velocity command is forced to 0 when actual velocity is lower than Pr3.16 and after static time set in Pr3.23.

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.



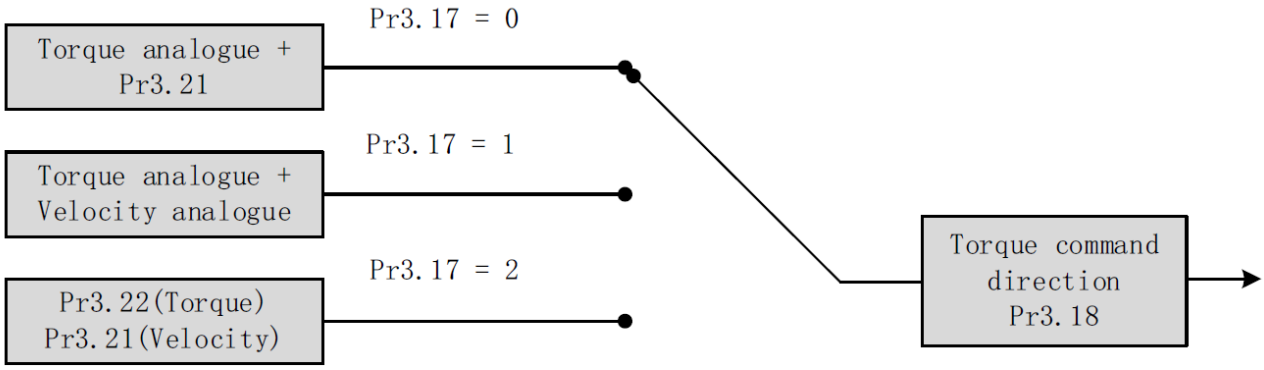
Using Motion Studio or front panel on servo drive, set Pr0.01 = 2 to activate torque control mode. Please set related servo parameters according with the following diagram.



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

Torque command input inversion

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

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

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

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

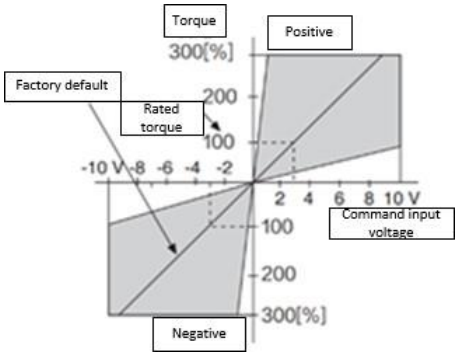
Torque command input gain

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

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

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

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



5.3.2 Torque velocity limit

To set velocity limit in torque mode for safety reasons.

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

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

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

Value		Limit
【0】		1st torque limit Pr0.13
1		2nd torque limitPr5.22
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

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

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

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

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

Please refer to 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	
	1st mode	2nd mode
【0】	Position	—
1	Velocity	—
2	Torque	—
3	Position	Velocity
4	Position	Torque
5	Velocity	Torque
6	PR internal command control	Position Pr0.22=1
		Velocity Pr0.22=1
		Torque Pr0.22=2
7~10	Reserved	

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

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

C-MODE is defaulted to Normally Open

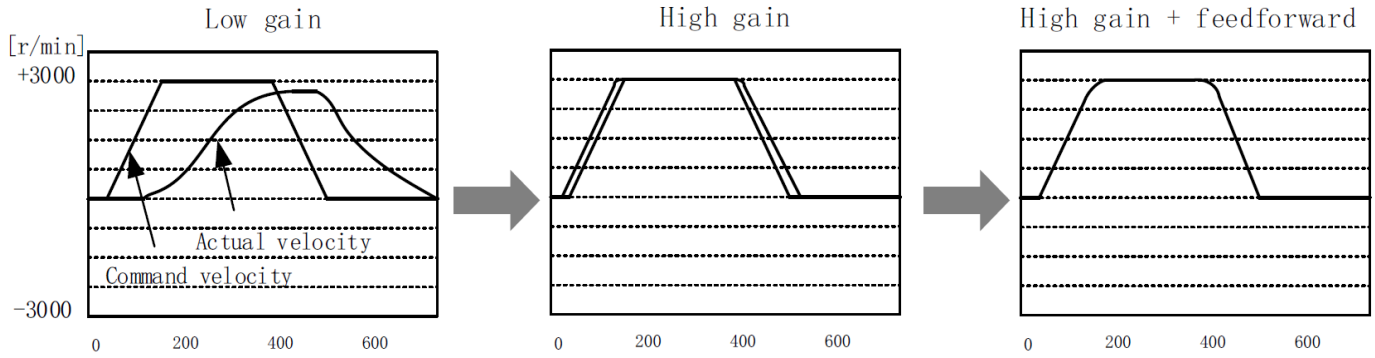
When Pr0.01 = 3/4/5, please set assign C-MODE mode switching signal to one of the DI terminal and make sure the logic is valid.

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.

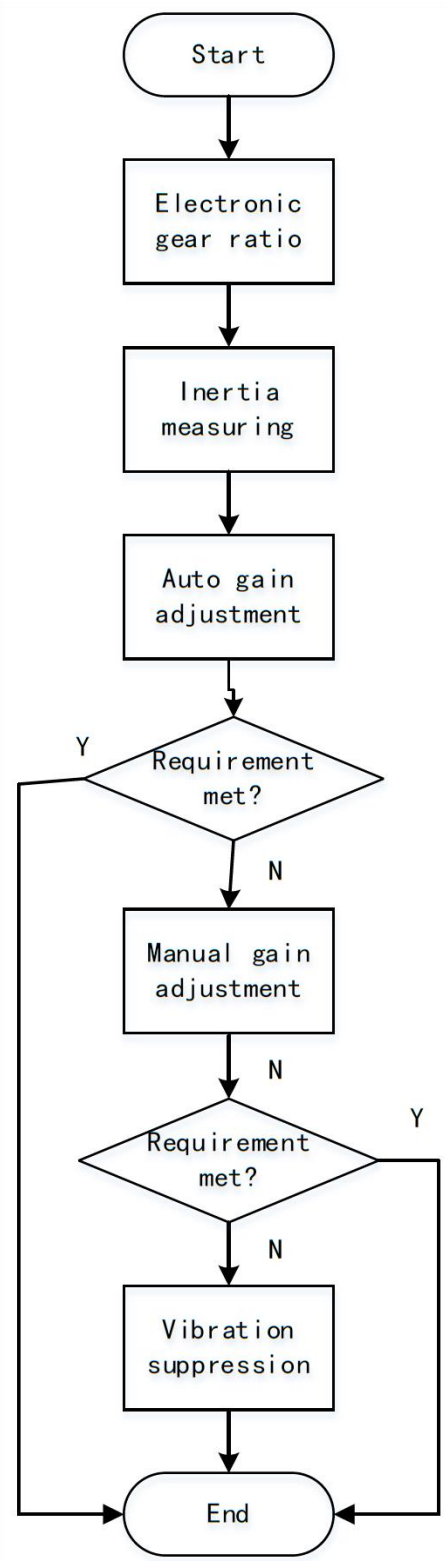


Position loop gain: 320 (0.1/s)
Velocity loop gain: 180 (0.1Hz)
Velocity loop integral time constant: 31ms

Position loop gain: 900 (0.1/s)
Velocity loop gain: 500 (0.1Hz)
Velocity loop integral time constant: 31ms

Position loop gain: 320 (0.1/s)
Velocity loop gain: 500 (0.1Hz)
Velocity loop integral time constant: 31ms

Servo driver gain adjustment is done in combination with a few other parameters (Inertia ratio, Position loop gain, Velocity loop gain and Filters settings). These parameters will have an effect on each other so it always advisable to tune each parameter according in order to achieve optimal machine performance. Please refer to the steps below



Gain Adjustment Flow 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. 1. One-click tuning (Can be realized using Motion Studio. Auto tuning of gain and inertia according to actual data) 2. Real time auto adjustment (Set by selecting mechanical stiffness level, related gain parameters will be automatically adjusted accordingly)
Manual gain adjustment	Basic gain	On top of auto gain adjustment, manually adjust related parameters so that machine can have better responsiveness and following
	Basic steps	1. Gain related parameters tuning under position mode 2. Gain related parameters tuning under velocity mode 3. Gain related parameters tuning under torque mode
	Gain switching	Gain switching through internal data or external signal. Lower vibration at stop, shorten tuning time, improve command following.
	Model following control	Improve responsiveness, shorten positioning time (Only available in position mode)
	Command pulse filter	Set filter for position, velocity and torque command pulse.
	Gain feedforward	Enable feedforward function to improve following behavior
	Friction compensation	Reduce the effect of mechanical friction
	3rd gain switching	Base on usual gain switching function. Can be set to switch gain at stopping and reduce positioning time.
Vibration suppression	Mechanical resonance	Using notch filtering function to suppress mechanical resonance.
	End vibration suppression	To suppress low frequency vibration of mechanical end

6.2 Inertia ratio identification function

Inertia ratio = Total mechanical load rotational inertia / Motor rotational inertia

Inertia ratio is an important parameter. Setting a suitable value can help with the precise tuning of the servo system. Inertia ratio can be set manually and also be determined automatically through servo driver

To make sure accurate inertia ratio identification

6.2.1 Max rotational velocity at 400rpm

6.2.2 Acceleration/deceleration time above 100ms

6.2.3 Stable load torque without large variation.

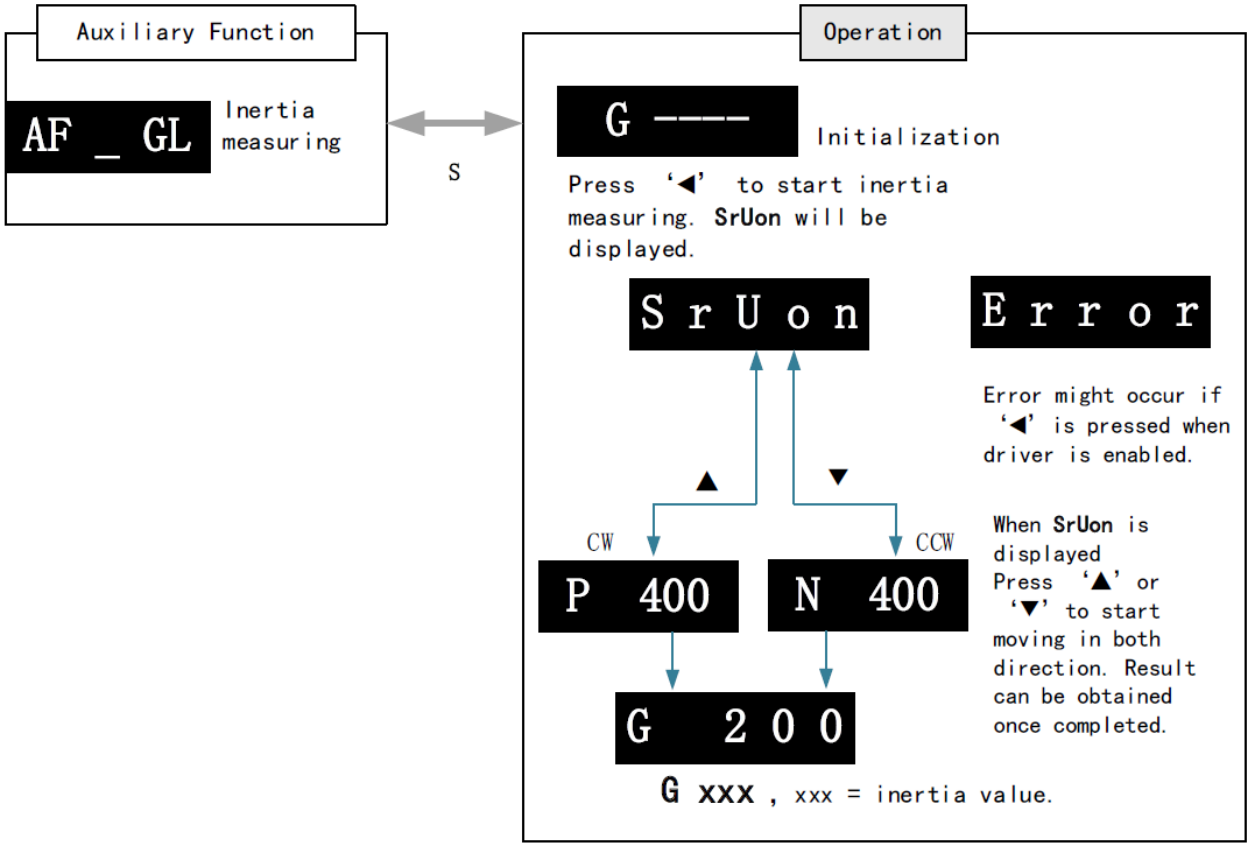
Online inertia determination

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**"

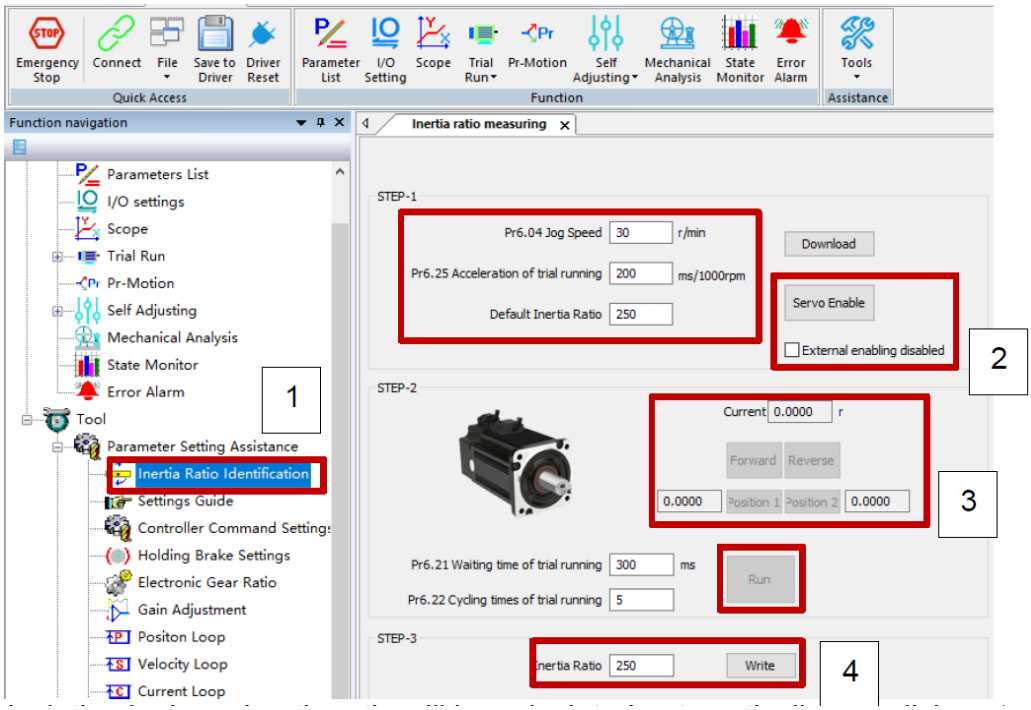
5、Press ▲ or ▼ once to start to calculate the inertia.

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.

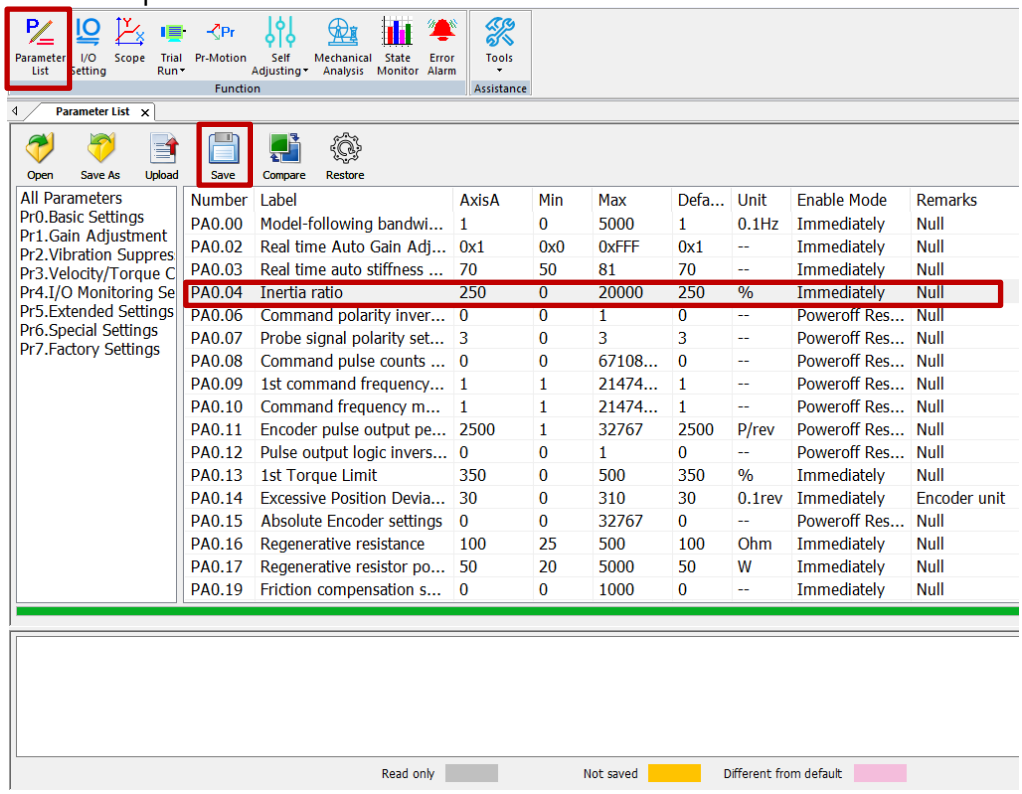
Inertia measuring using Motion Studio

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.



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						

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

Set inertia ratio according to actual load inertia. When both are uniform, actual motor velocity loop responsiveness and gain settings will be consistent. If inertia ratio is greater than actual value, velocity loop gain settings will be higher and vice versa. For motor with high inertia, 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	➢ Servo ON (SRV-ON) status ➢ Set suitable position/torque limit so that motor can run normally ➢ Use trial run or any external controller to make sure no clash of axes

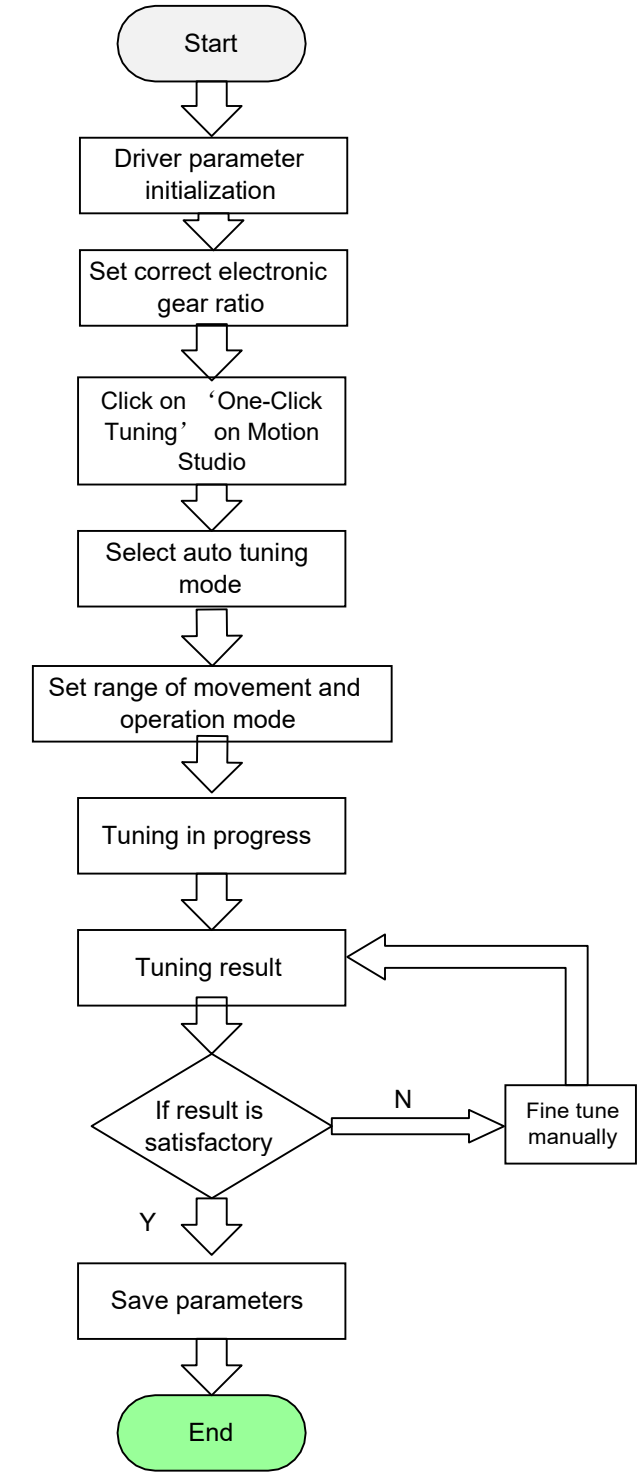
	Factors affecting single parameter tuning
Load inertia	➢ External load smaller or 30 times larger than rotor inertia ➢ Inertia measuring might fail upon changes in load inertia ➢ Load torque changes drastically
Load	➢ Mechanical stiffness is too low ➢ Existence of gear backlash or any other non-linear factors ➢ Complicated mechanical load structure
Motion	➢ Low speed, no more than 300[r/min]. ➢ Acceleration/deceleration time too long, more than = 600ms ➢ Speed > 300r/min, acceleration/deceleration time < 600ms but travelling time duration < 50ms.

6.3.2 One-click Tuning

This function is able to automatically tune the most optimal gain parameters for the specific applications after the axis is in operation and learning. Corresponding paths and responsiveness level need to be set before using this function. Please refer to the flow chart below. Parameter will be saved to parameters file and can be used on similar axes.
Recommended for applications where inertia changes is minute.

	Recommended application scenarios
Control mode	Suitable in position mode or EtherCAT mode (Not applicable in other modes)
Others	➢ Make sure servo drive can't be enabled externally or any external command that can rotate the motor. Set range of movement, velocity and acceleration/deceleration time for one-click tuning. ➢ Prohibit external command. Make sure there is no obstacle within the range of movement of the axis and motor can rotate freely.

	Factors affecting one-click tuning
Load inertia	➢ External load smaller or 30 times larger than rotor inertia ➢ Drastic changes in load inertia during motion. *Under heavy load (more than 30 times inertia), please make sure of safety*
Load	➢ Mechanical load is loosely connected. ➢ Existence of gear backlash or any other non-linear factors ➢ Complicated mechanical load structure
Motion	➢ Range of movement is too short or too long which cost the time to be overdue. ➢ Not smaller than 0.5R



One-click tuning flow diagram

6.4 Auto gain adjustment

This function will measure real time mechanical properties and set gain values in accordance to mechanical stiffness. Can be used in any control mode

Conditions to implement	
Control mode	Please refer to Pr0.02 for detailed explanations. Auto gain adjustment is different for each control mode.
Other	- Servo driver needs to be enabled · Set up input signals such as deviation counter clearing and command input; Torque limit and other motion control parameters to enable motor to move normally without obstacles.

Under certain conditions, external factors might affect automatic gain adjustment functions. If the conditions as listed exist or unfavorable, please disable the automatic gain adjustment function.

Affecting conditions	
Load inertia	- If inertia is less than 3 times or over 20 times of rotor inertia. - Changes in load inertia
Load	- Very low mechanical stiffness - If gear backlash is a non-linear property
Motion	- Velocity less than 100r/min or continuously in low velocity mode - Acc-/deceleration to 2000r/min within 1s. 。 - Acc-/deceleration torque lower than eccentric load, frictional torque. · Velocity < 100r/min, acc-/deceleration to 2000r/min within 1s but not longer than 50ms

To enable automatic gain adjustment:

6.4.1 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	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
Pr1.01	1st velocity loop gain	
Pr1.02	1st velocity integral time constant	
Pr1.03	1st velocity detection filter	
Pr1.04	1st 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 2nd position loop gain is 1 level higher than 1st position.

No.	Parameters	Label	Remarks
1	Pr1.00	1st position loop gain	When stiffness setting is valid, parameters will be updated to match stiffness value
2	Pr1.01	1st velocity loop gain	
3	Pr1.02	1st velocity integral time constant	
4	Pr1.03	1st velocity detection filter	
5	Pr1.04	1st torque filter	
6	Pr1.05	2nd position loop gain	
7	Pr1.06	2nd velocity loop gain	
8	Pr1.07	2nd velocity integral time constant	
9	Pr1.08	2nd velocity detection filter	
10	Pr1.09	2nd 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
0x00_ : Rigid structure	When load is **rigid** with relatively **low inertia**. Gain adjustments prioritize **system responsiveness**. Structures including high precision reducer, lead screws, mechanical gears, etc.
0x01_ : High inertia	**High load inertia** (10 times or above). Gain adjustments prioritize **operation stability and responsiveness**. Recommended mechanical stiffness level **not more than 15**.
0x02_ : Flexible structure	When load is **flexible** with relatively **high inertia**. Gain adjustments prioritize **operation stability**. Structures including long transportation belt or chain.

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

Pr0.02	Label	Real time Auto Gain Adjusting			Valid mode(s)	P	S	T
	Range	0x0~0xFF	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						

Low ⟶ Mechanical stiffness ⟶ High

Low ⟶ Servo gain ⟶ High

81.80·····70.69.68·····51.50

Low ⟶ Responsiveness ⟶ High

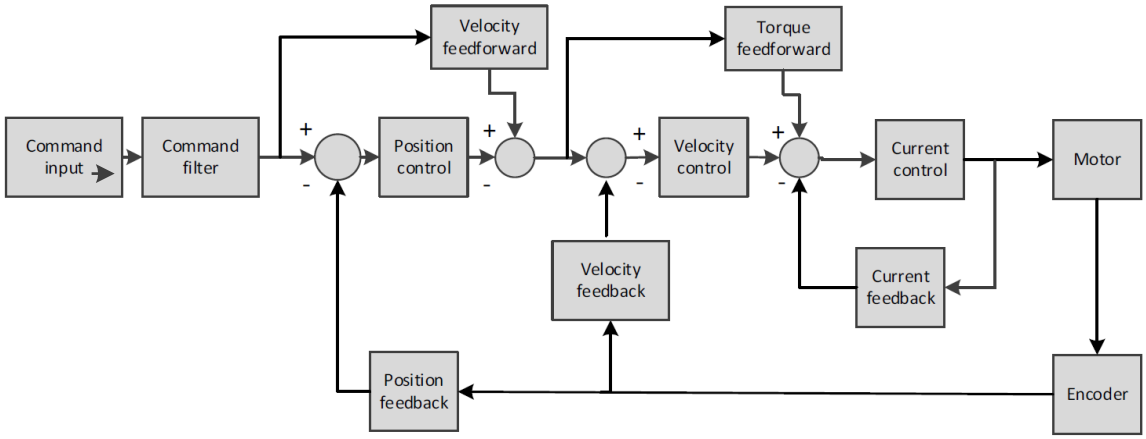
Lower values ensure better system responsiveness and mechanical stiffness but machine vibration might occur, please set accordingly. Recommend to set to around 15 with motor with high inertia.

Gain parameters settings table

Stiffness	1st gain				2nd 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

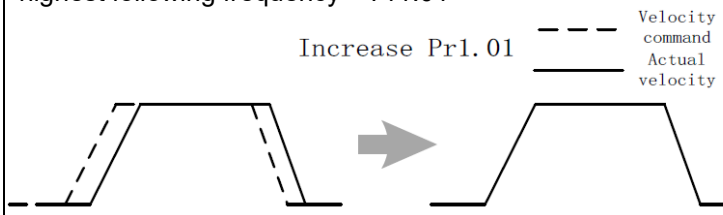
6.5 Manual gain adjustment

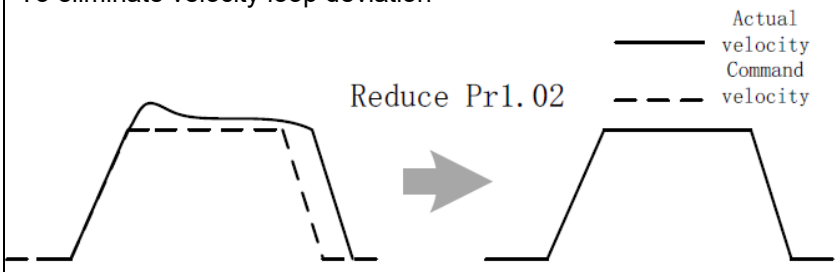
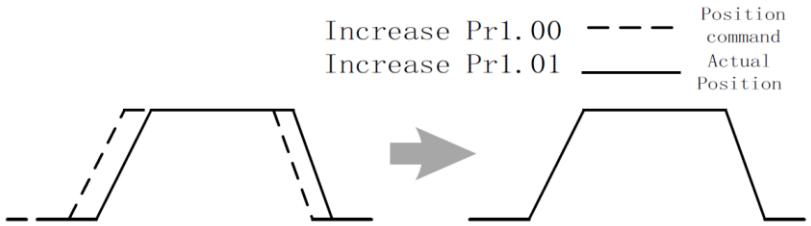
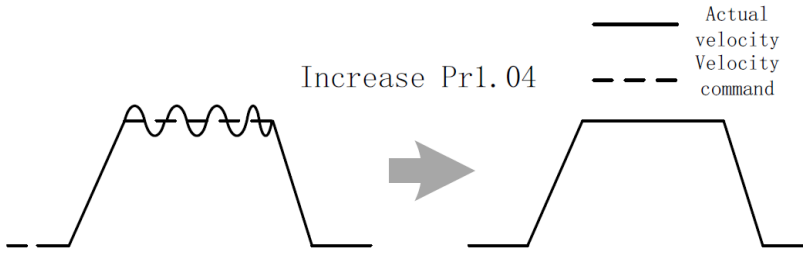
Due to limitation of load conditions, automatic gain adjustment might not achieve expected performance. Control can be improved through manual gain adjustment
The servo system is made up of 3 control loops. From outer to inner: position loop, velocity loop, current loop as shown in the diagram below.



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 stabile, position and velocity loop gain have to be increased at the same time to make sure the responsiveness of the position loop is lower than velocity loop.

Steps to tuning (Position and velocity control)

Step	Parameter	Label	Tuning method
1	Pr1.01	Velocity loop gain	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  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.

Step	Parameter	Label	Tuning method
2	Pr1.02	Velocity loop integral time constant	To eliminate velocity loop deviation  Velocity loop integral time constant (ms) = 4000 / (2*π*Velocity loop gain(Hz)) Reduce 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.
3	Pr1.00	Position loop gain	Determine if position loop is able to follow the changes in position command at highest frequency. Position loop highest following frequency = Pr1.00  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
4	Pr1.04	1st torque filter time const ant	Eliminate high frequency noise, suppress mechanical resonance.  System response improves with lower set value but there is a mechanical limitation High frequency resonance suppression improves with higher set value but it might cause reduction in response bandwidth and phase margin, resulting in system turbulence. Torque filtering frequency is 4 times higher than velocity loop max following frequency: 1000000/(2π×Pr1.04)≥Pr1.01×4 For example, when Pr1.01=180（0.1 Hz）, Pr1.04 should satisfy： Pr1.01≤221（0.01ms）

- *If vibration occurs with increasing Pr1.01, please modify Pr1.04 to suppress vibration.*
- *If the parameters are set too high, it might cause current loop response to reduce.*
- *To suppress vibration at stop, increase Pr1.01 and decrease Pr1.04.*
- *Decrease Pr1.04 if motor vibrates too much at rest.*
- *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	1st position loop gain
2	Pr1.01	1st velocity loop gain
3	Pr1.02	1st velocity integral time constant
4	Pr1.03	1st velocity detection filter
5	Pr1.04	1st torque filter time constant
6	Pr1.05	2nd position loop gain
7	Pr1.06	2nd velocity loop gain
8	Pr1.07	2nd velocity integral time constant
9	Pr1.08	2nd velocity detection filter
10	Pr1.09	2nd 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

1st and 2nd gain initial values are obtained by automatic gain adjustment

No.	Parameter	Label
1	Pr1.00	1st position loop gain

2	Pr1.01	1st velocity loop gain
3	Pr1.02	1st velocity integral time constant
4	Pr1.03	1st velocity detection filter
5	Pr1.04	1st torque filter time constant
6	Pr1.05	2nd position loop gain
7	Pr1.06	2nd velocity loop gain
8	Pr1.07	2nd velocity integral time constant
9	Pr1.08	2nd velocity detection filter
10	Pr1.09	2nd torque filter time constant

Manually adjusted gain parameters

No.	Parameter	Label
1	Pr1.00	1st position loop gain
2	Pr1.01	1st velocity loop gain
3	Pr1.02	1st velocity integral time constant
4	Pr1.04	1st 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.

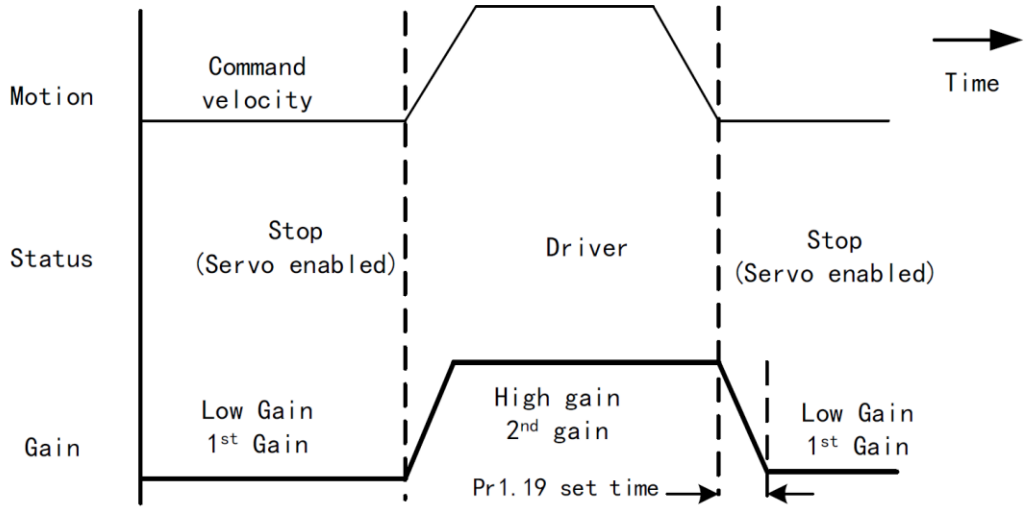
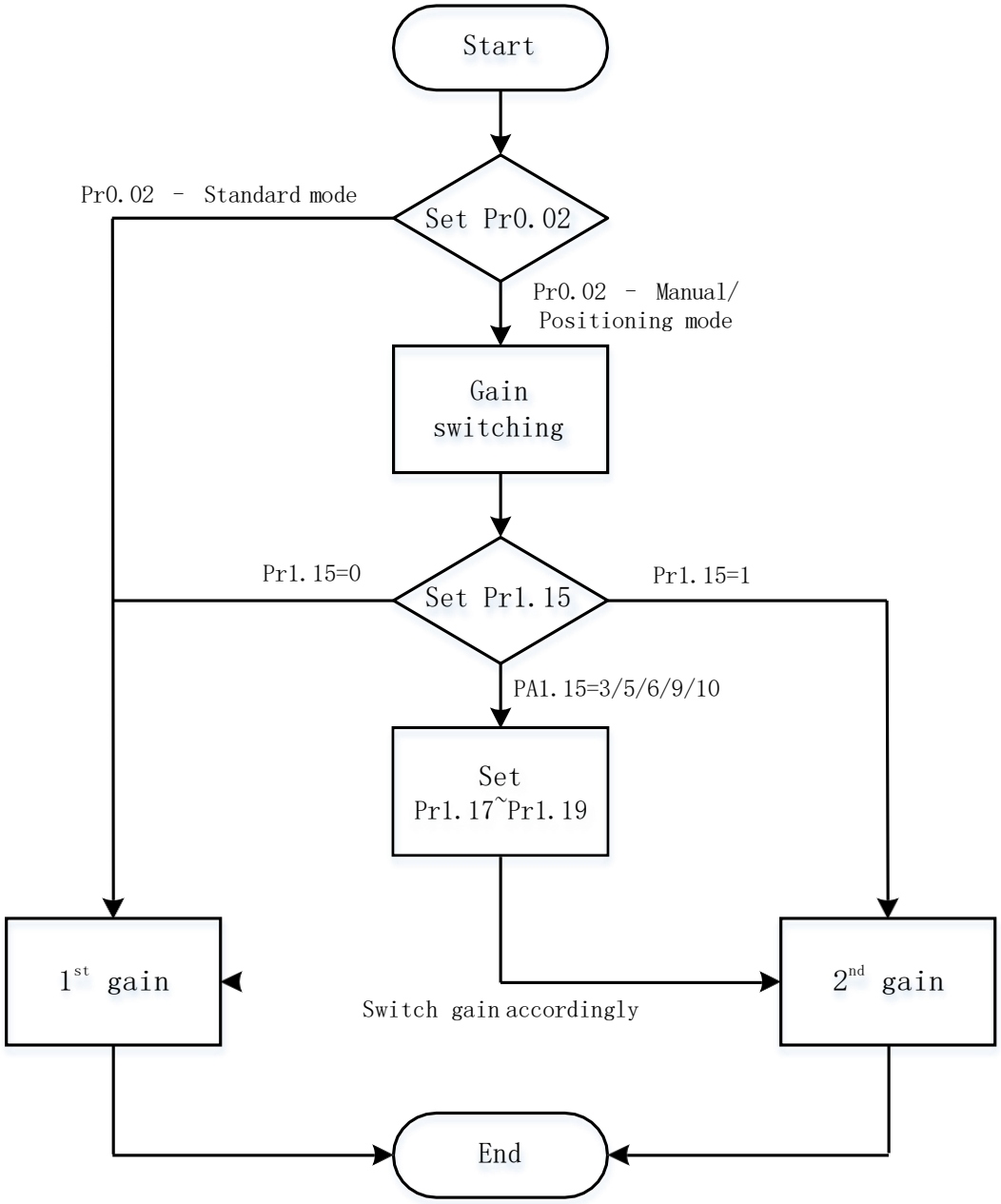


Diagram below shows gain switching when motor stops.

1st gain (Pr1.00-Pr1.04) and 2nd 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.

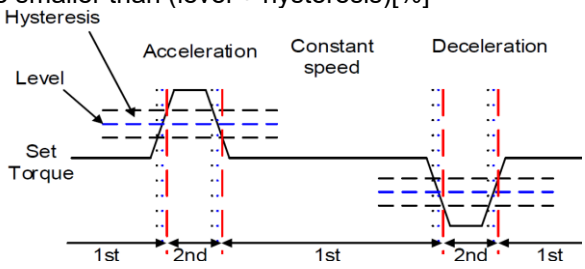
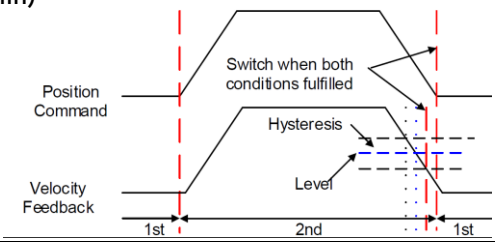


Related parameters on gain switching

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

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

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

Value	Condition	Gain switching condition
【0】	1st gain fixed	Fixed on using 1st gain(Pr1.00-Pr1.04)
1	2nd gain fixed	Fixed on using 2nd gain (Pr1.05-Pr1.09)
2	Gain switching input valid	· Gain switching input （GAIN）invalid: 1st gain. · Gain switching input （GAIN）valid: 2nd gain. **Default: 1st gain*
3	High command torque	Switch to 2nd gain when set torque command absolute value larger than (level + hysteresis)[%] Switch to 1st gain when set torque command absolute value smaller than (level + hysteresis)[%] 
4-9	Reserved	Reserved
10	Pending position command +actual velocity	Valid for position control. Switch to 2nd gain if position command ≠ 0 Switch to 1st gain if positional command = 0 throughout the duration of delay time and absolute value of actual velocity remains smaller than (level - hysteresis) (r/min) 

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

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

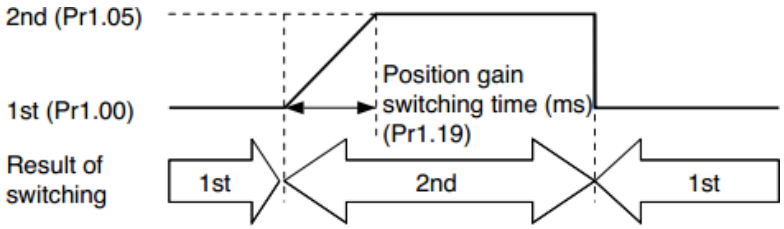
Set threshold value for gain switching to occur.

Switching condition	Unit
Position	Encoder pulse count
Velocity	RPM
Torque	%

Unit is mode dependent.

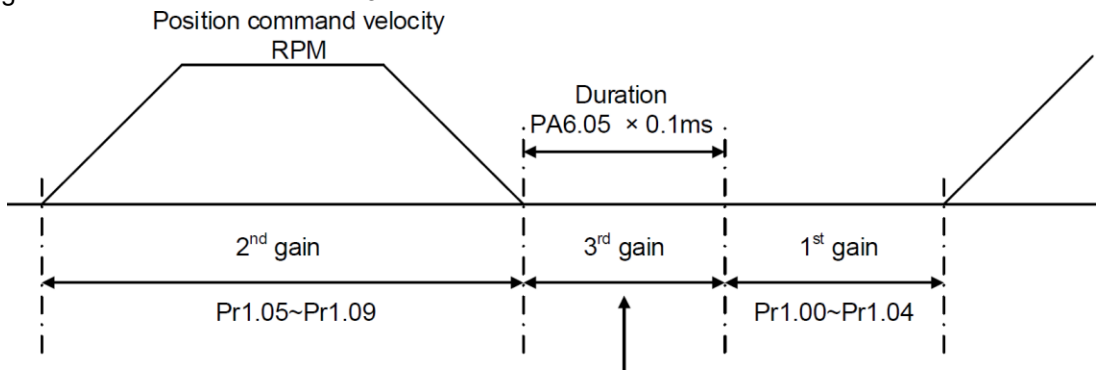
Please set level ≥ hysteresis

Pr1.18	**Label**	Hysteresis at position control switching			**Valid mode(s)**	**P**	
	Range	0~20000	**Unit**	Mode dependent	**Default**	33	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0125	
	Valid	Immediate					
	To eliminate the instability of gain switching. Used in combination with Pr1.17 using the same unit. If level< hysteresis, drive will set internally hysteresis = level.						
Pr1.19	**Label**	Position control switching time			**Valid mode(s)**	**P**	
	Range	0~10000	**Unit**	0.1ms	**Default**	33	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0127	
	Valid	Immediate					
	During position control, if 1st and 2nd gain difference is too large, to ease torque changes and vibration due to rapid changes in position loop gain, set suitable Pr1.19 value For example: 1st (pr1.00) <-> 2nd (Pr1.05)						



6.5.3 3rd gain switching

Besides switching between 1st and 2nd gain, a 3rd gain switching is added to set gain at the moment of stopping to reduce positioning time.
Only available under position mode and Pr6.05 ≠ 0, set Pr6.06 for 3rd gain value. When 2nd gain switches to 1st gain, it has to go through 3rd gain, switching time is set in Pr1.19.
Diagram below shows when Pr1.15 = 7.

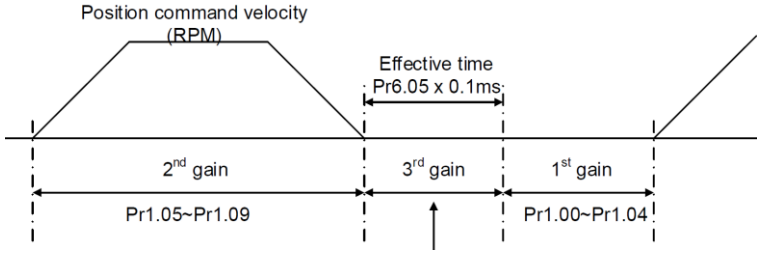


Position loop gain = Pr1.00 × Pr6.06/100 Velocity loop gain = Pr1.01 × Pr6.06/100
Velocity loop integral time constant, velocity detection filter, torque filter time constant will still be applied in 1st gain

Related parameters

Pr6.05	**Label**	Position 3rd gain valid time			**Valid mode(s)**	**P**
	Range	0~10000	**Unit**	0.1ms	**Default**	0
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060B
	Valid	Immediate				
	To set time for 3rd gain to be valid Only available in position mode When not in use, set Pr6.05=0, Pr6.06=100					
Pr6.06	**Label**	Position 3rd gain scale factor			**Valid mode(s)**	**P**
	Range	50~1000	**Unit**	100%	**Default**	100
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x060D
	Valid	Immediate				

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

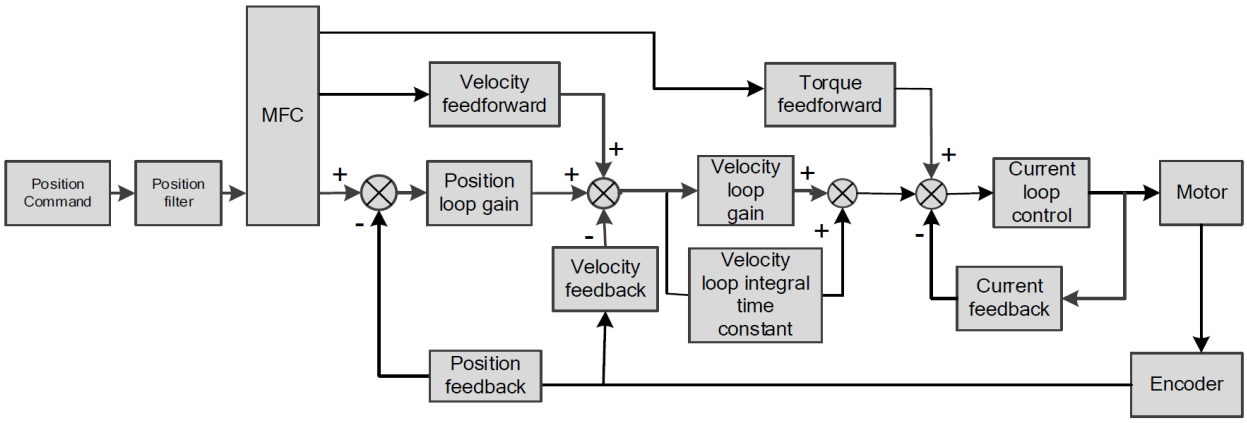


Position loop gain = Pr1.00 x Pr6.06/100

Velocity loop gain = Pr1.01 x Pr6.06/100
Velocity loop integral time constant, Velocity detection filter,Torque filter time constant still uses 1st gain
Above diagram is illustrated using Pr1.15 = 7. 3rd gain= 1st gain * Pr6.06/100
Only effective under position control mode. 3rd gain valid when Pr6.05 ≠ 0. Set 3rd gain value in Pr6.06.
When 2nd gain switches to 1st gain, it will go through 3rd, 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

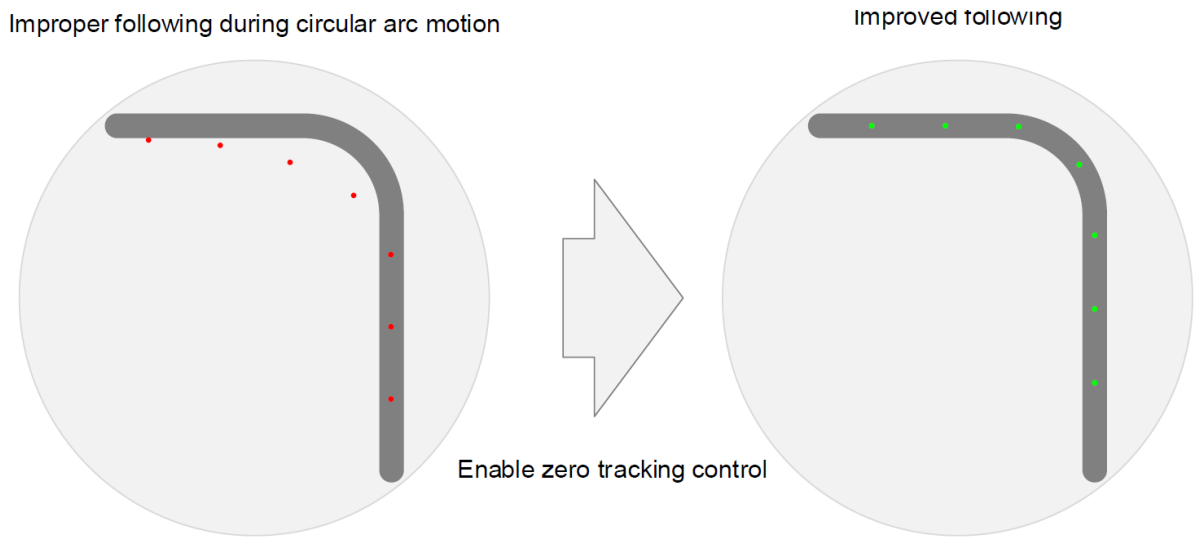
Step	Content
1	Set up vibration suppression.
2	Set up the right inertia ratio.
3	Manually adjust gain.
4	Increase Pr0.00 provided that there is no overshoot and vibration. Usually Pr0.00 ≥ Pr1.01 is recommended.

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**



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 over travel 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.

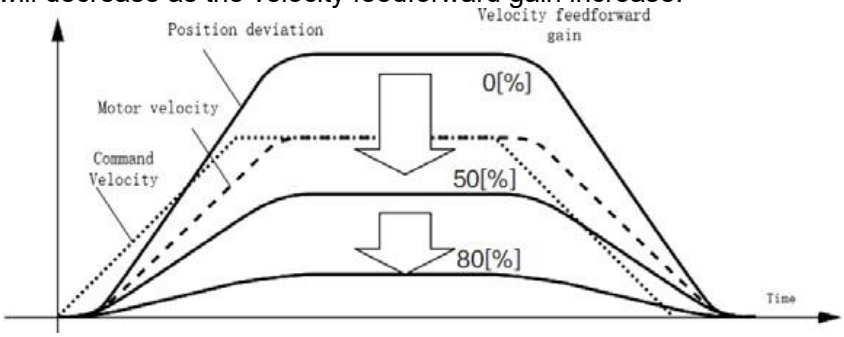
Pr1.10	**Label**	Velocity feed forward gain			**Valid mode(s)**	**P**	
	Range	0~1000	**Unit**	0.10%	**Default**	300	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0115	
	Valid	Immediate					
	Used for decreasing following error caused by low responsiveness of velocity loop. Might cause overshoot or increase in noise if set value is too high.						
Pr1.11	**Label**	Velocity feed forward filter time constant			**Valid mode(s)**	**P**	
	Range	0~6400	**Unit**	0.01ms	**Default**	50	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x0117	
	Valid	Immediate					

Set velocity feed forward low pass filter to eliminate high or abnormal frequencies in velocity feed forward command. Often used when position command with low resolution or high electronic gear ration to smoothen velocity feed forward.
Position deviation under constant velocity can be lowered with higher velocity feed forward gain. Please to refer to the equation below.
Reduce 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.

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

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.



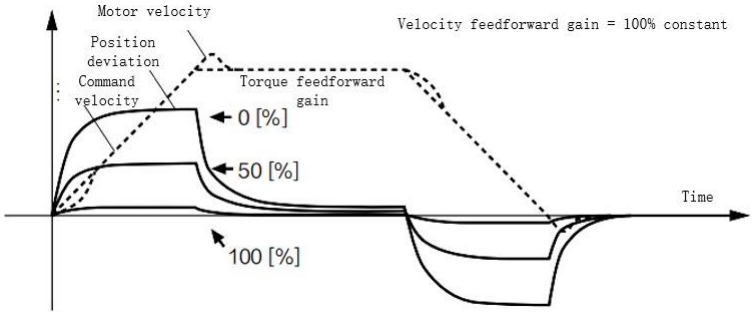
Steps to tuning:
1. Increase Pr1.10 to increase responsiveness but velocity overshoot might occur during acc-/deceleration.
2. By reducing Pr1.11, velocity feedforward would be more effective and vice versa. Pr1.10 and Pr1.11 need to be tuned to a balance.
3. If mechanical noise exists under normal working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

6.8.2 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.						
Pr1.13	**Label**	Torque feed forward filter time constant			**Valid mode(s)**	**P**	**S**
	Range	0~6400	**Unit**	0.01ms	**Default**	0	
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x011B	
	Valid	Immediate					
	Low pass filter to eliminate abnormal or high frequencies in torque feed forward command. Usually used when encoder has lower resolution or precision. Noise reduces if torque feed forward filter time constant is set higher but position deviation will increase at acceleration varied points. **<Application>** - Set 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.						

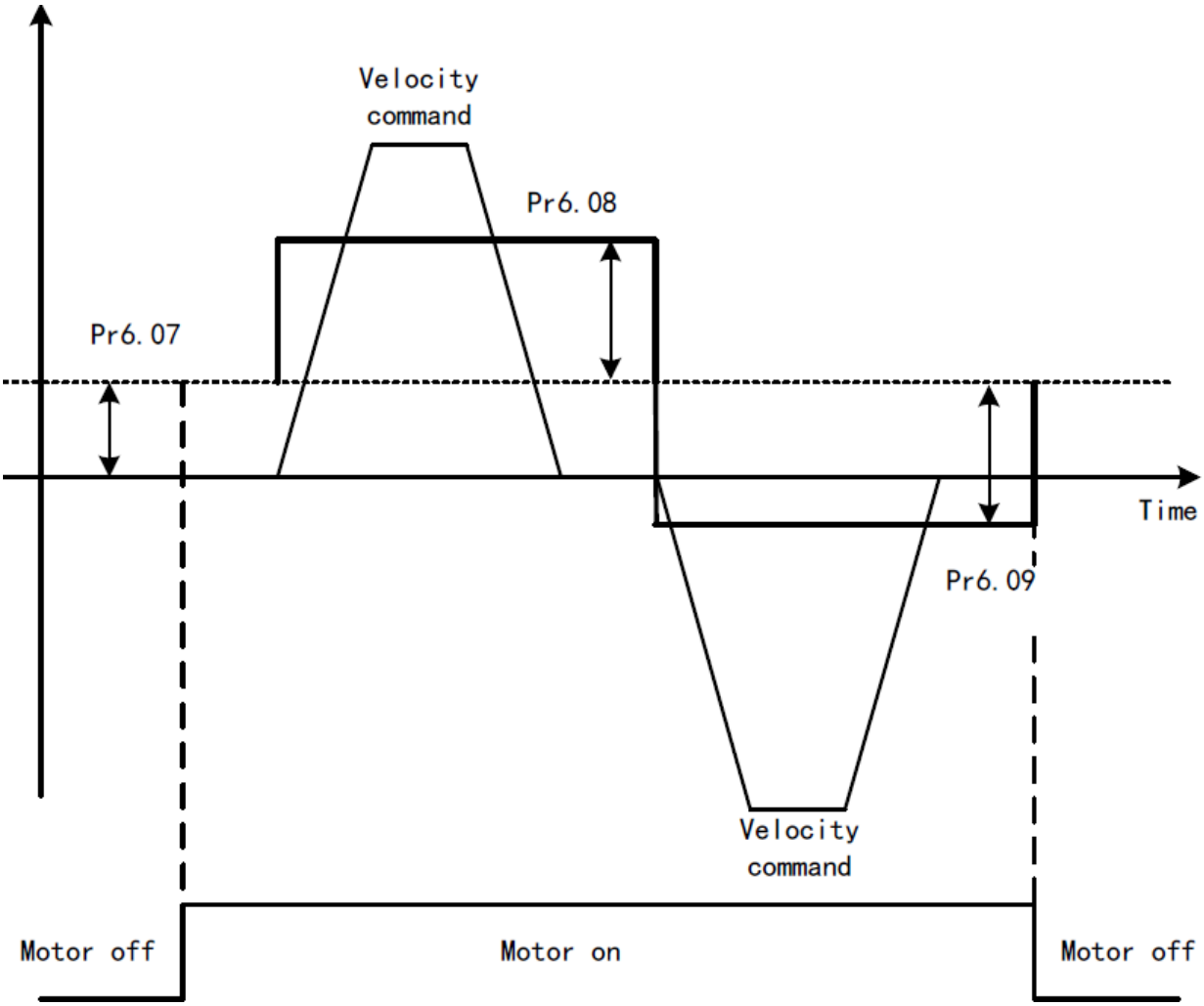
Torque feedforward application
Set Pr1.13 to around 50 (0.5ms), then tune Pr1.10 from 0 to bigger values until torque feedforward achieves better performance. Under constant acc-/deceleration, the position deviation in a motion will decrease as the velocity feedforward gain increase.



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

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

Positive/Negative compensation corresponds to actual position feedback.
Positive torque compensation value = +(Pr6.08=+T_f)
Negative torque compensation value = -(Pr6.08=+T_f)
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

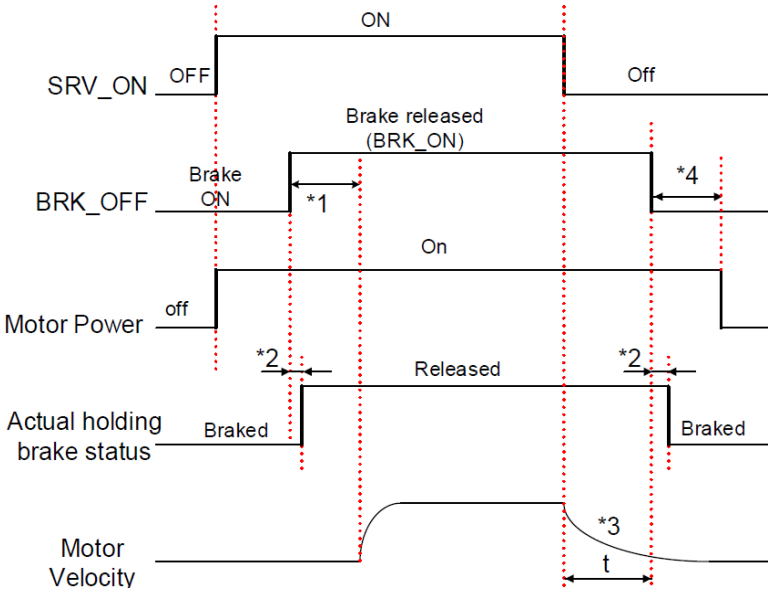
Set max time duration for motor to stop after disabling. If the time taken for motor to stop exceeds the duration set in Pr6.14 and motor speed is still higher than Pr4.39, holding brake will be activated. If motor doesn't have holding brake, dynamic braking will be activated to force stop the motor.

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

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						
	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.							
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						
	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.

Pr4.39	Label	Holding brake activation speed			Valid mode(s)	P	S	T
	Range	30~3000	Unit	r/min	Default	3(		
	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.

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

Servo braking: Stop servo axis quickly using braking torque
Pr5.06 only effective for stopping under normal circumstances. For stopping on alarm occurrence but refer to Pr5.10

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:

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

Alarm type 1:

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

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

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

Value	Description.
【0】	Emergency stop is valid, servo driver will be forced to STOP and Err570 occurs.
1	Emergency stop is invalid, servo driver will not be forced to STOP. Servo can be enabled once E-STOP signal is cleared.

Pr5.04	Label	Driver prohibition input settings			Valid mode(s)	P	S	T
	Range	0/1/2	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0509		
	Valid	Immediate						

To set driver prohibition input (POT/NOT)

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

Method 2: Using 605Ah object dictionary through master device to activate this function.

Pr5.11	Label	Servo braking torque setting			Valid mode(s)	P	S	T
	Range	0~500	Unit	%	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0517		
	Valid	Immediate						

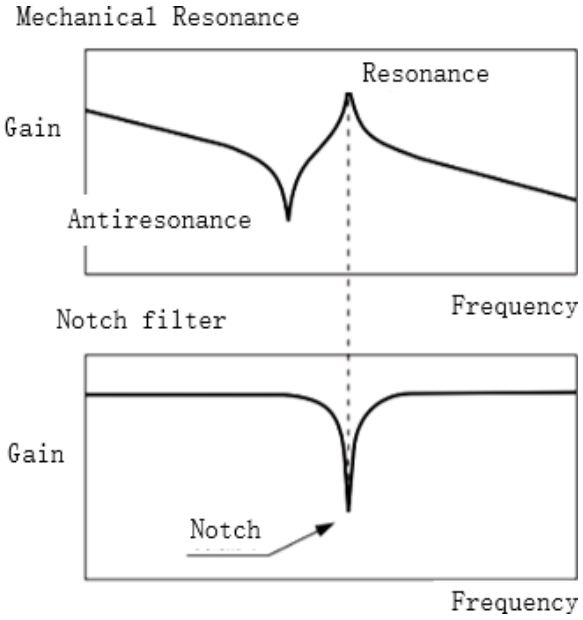
To set torque limit for servo braking mode.
If Pr5.11 = 0, use torque limit as under normal situation.
Please note that if Pr5.11 set value is too low, emergency stop will take longer.

6.11 Vibration Suppression

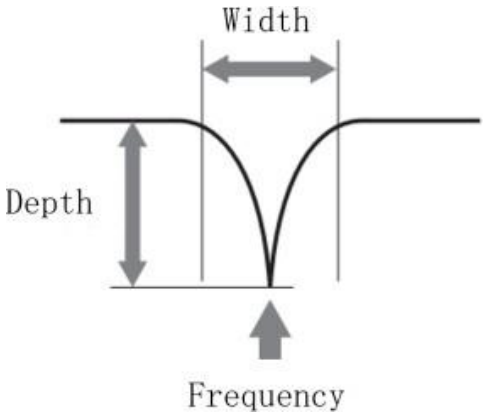
6.11.1 Mechanical resonance suppression

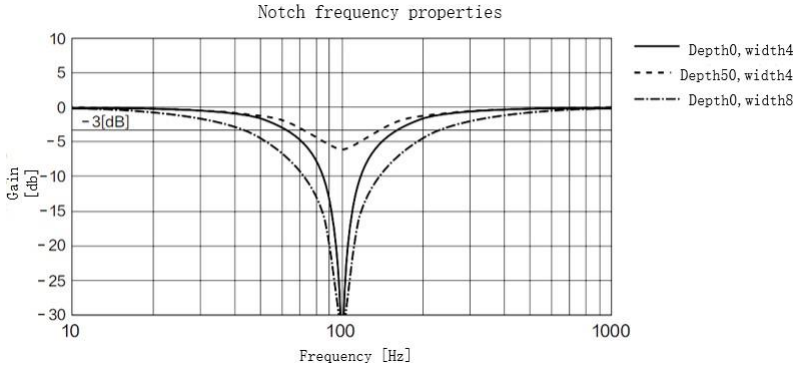
Mechanical system has certain resonance frequencies. When servo gain is increased, resonance might occur at around mechanical resonant frequencies, preventing gain value from increasing. In such situation, notch filter can be used to suppress resonance to set higher gains or lower vibration.
To suppress 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） fc=1/ [2π×Pr1.04(0.01ms)×0.00001）]
2. Notch filter
   Notch filter suppress mechanical resonance by reducing gain at certain frequencies. When notch filter is correctly set, resonance can be suppressed and servo gain can be increased.



- Notch filter bandwidth
  Center frequency of the notch filter, frequency bandwidth with reduction of -3dB.
- Notch filter depth
  The ratio between input and output of center frequency.
  When depth = 0, center frequency output is totally off and when depth = 100,
  Hence when notch filter depth is set at lower value, the depth is higher and better at suppressing mechanical resonance but it might cause system instability.





If the analytic result from mechanical properties analysis tool doesn't show any obvious peak but vibration did occur, it might not be due to mechanical resonance, it may be that servo gain has reached its limit. This kind of vibration can't be suppressed by using notch filter, only by reducing gain and torque command filter time.

To use notch filter

Automatic notch filter

1. Set Pr2.00 = 1 for auto notch filter adjustment
2. If Pr0.03 stiffness increases, 3rd 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 3rd group of filters to 1st 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 3rd group of filters to 2nd 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.

Pr2.00	Label	Adaptive filtering mode settings			Valid mode(s)	P	S	
	Range	0~4	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0201		
	Valid	Immediate						

Value	Description	
0	Adaptive filter: invalid	Parameters related to 3rd notch filter remain unchanged
1	Adaptive filter: 1 filter valid for once.	1 adaptive filter becomes valid. 3rd notch filter related parameters updated accordingly. Pr2.00 switches automatically to 0 once updated.
2	Adaptive filter: 1 filter remains valid	1 adaptive filter becomes valid. 3rd notch filter related parameters will keep updating accordingly.
3-4	Reserved	-

Pr2.01	Label	1st notch frequency			Valid mode(s)	P	S	T
	Range	50~4000	Unit	Hz	Default	4000		
	Byte length	16bit	Attribute	R/W	485 address	0x0203		
	Valid	Immediate						

Set center frequency of 1st torque command notch filter.
Set Pr2.01 to 4000 to deactivate notch filter

Pr2.02	Label	1st notch width			Valid mode(s)	P	S	T
	Range	0~20	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x0205		
	Valid	Immediate						

Set notch bandwidth for 1st resonant notch filter.
Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.03, Pr2.02 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings

Pr2.03	Label	1st notch depth			Valid mode(s)	P	S	T
	Range	0~99	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0207		
	Valid	Immediate						

Set notch depth for 1st resonant notch filter.
Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.01 and Pr2.02, Pr2.03 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings

Pr2.04	Label	2nd notch frequency			Valid mode(s)	P	S	T
	Range	50~4000	Unit	Hz	Default	4000		
	Byte length	16bit	Attribute	R/W	485 address	0x0209		
	Valid	Immediate						

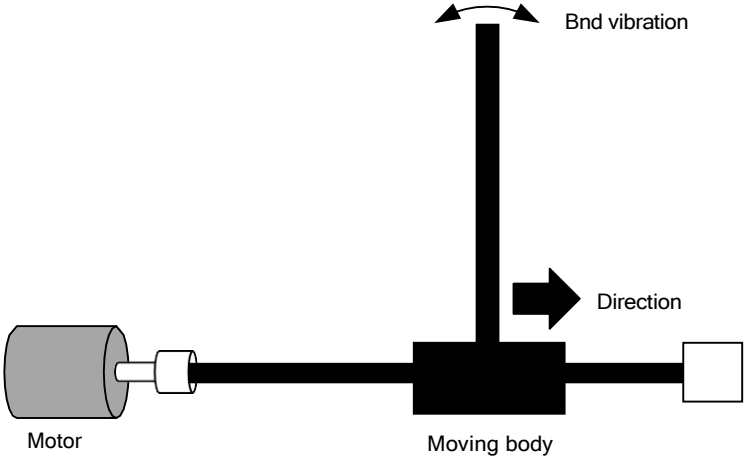
Set center frequency of 2nd torque command notch filter.
Set Pr2.04 to 4000 to deactivate notch filter

Pr2.05	Label	2nd notch width			Valid mode(s)	P	S	T
	Range	0~20	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x020B		
	Valid	Immediate						

Set notch bandwidth for 2nd resonant notch filter.
Under normal circumstances, please use factory default settings. If resonance is under control, in combination with Pr2.04 and Pr2.06, Pr2.05 can be reduced to improve current loop responsiveness which allows higher mechanical stiffness settings.

Pr2.06	Label	2nd notch depth			Valid mode(s)	P	S	T
	Range	0~99	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x020D		
	Valid	Immediate						
Set notch depth for 1st resonant notch filter. When 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.								
Pr2.07	Label	3rd notch frequency			Valid mode(s)	P	S	T
	Range	50~4000	Unit	Hz	Default	4000		
	Byte length	16bit	Attribute	R/W	485 address	0x020F		
	Valid	Immediate						
Set center frequency of 3rd torque command notch filter. Set Pr2.07 to 4000 to deactivate notch filter								
Pr2.08	Label	3rd notch width			Valid mode(s)	P	S	T
	Range	0~20	Unit	—	Default	4		
	Byte length	16bit	Attribute	R/W	485 address	0x0211		
	Valid	Immediate						
Set notch depth for 3rd resonant notch filter. When 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.								
Pr2.09	Label	3rd notch depth			Valid mode(s)	P	S	T
	Range	0~99	Unit	—	Default	0		
	Byte length	16bit	Attribute	R/W	485 address	0x0213		
	Valid	Immediate						
Set notch depth for 3rd resonant notch filter. When 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.								

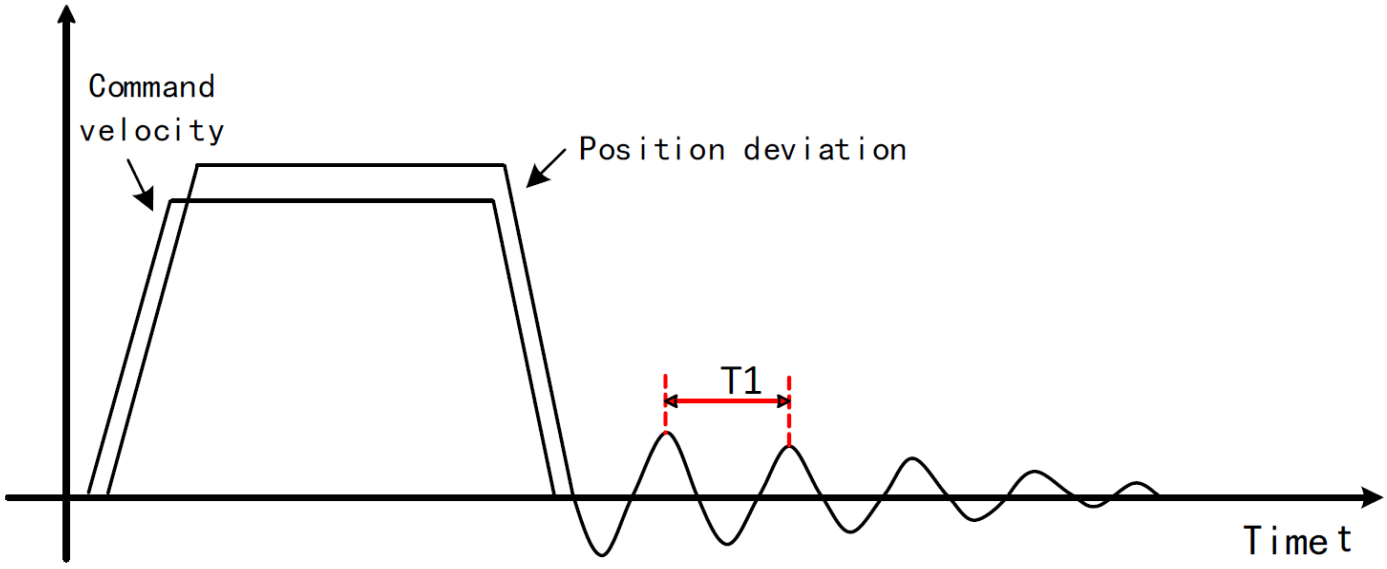
6.11.2 End vibration suppression



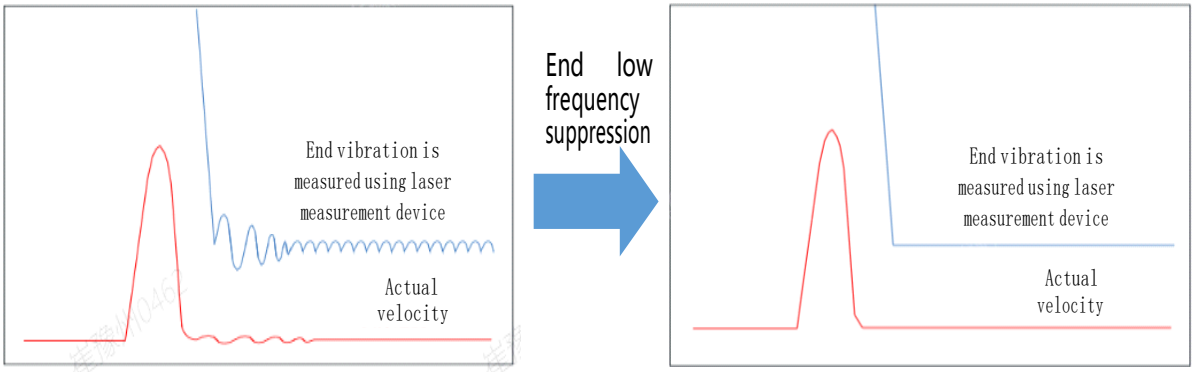
If the mechanical has an end that is long and heavy, it might cause end vibration at emergency stop and affect the positioning. Usually happens on long armed axis with loose end. The frequency is usually within 100Hz which is lower than mechanical resonant frequencies. It is called low-frequency resonance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

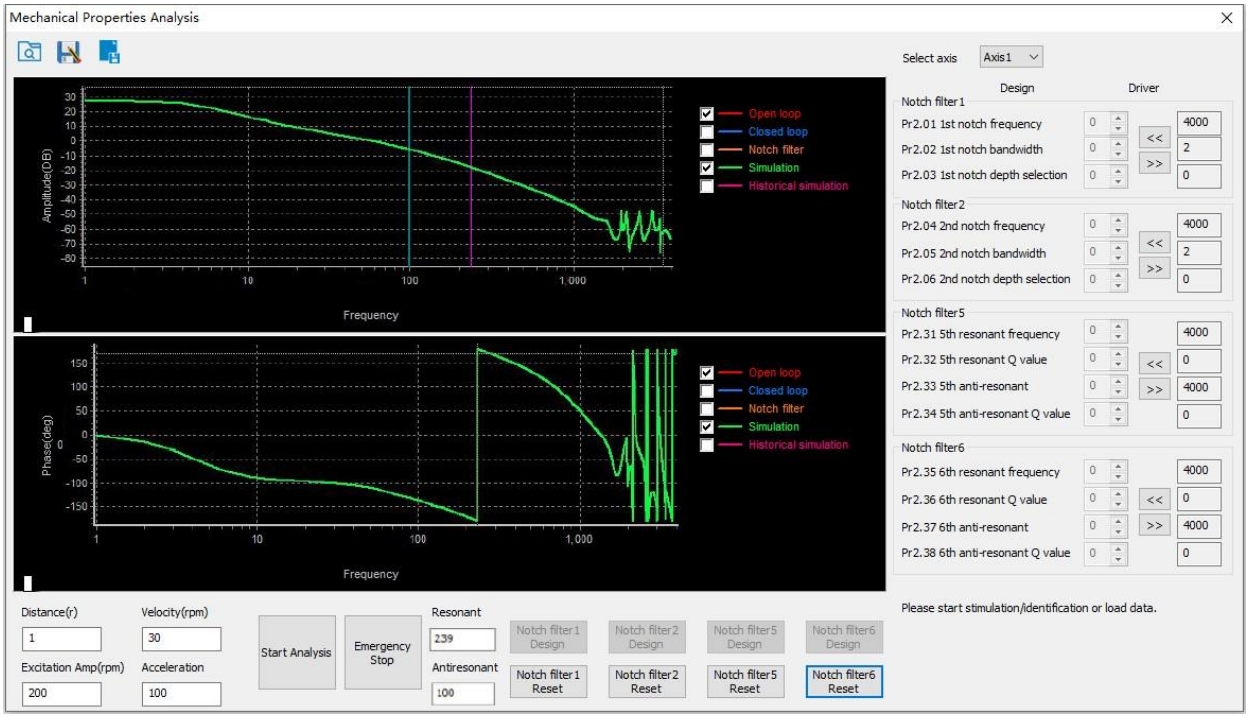


The result of suppressing low frequency resonance



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.

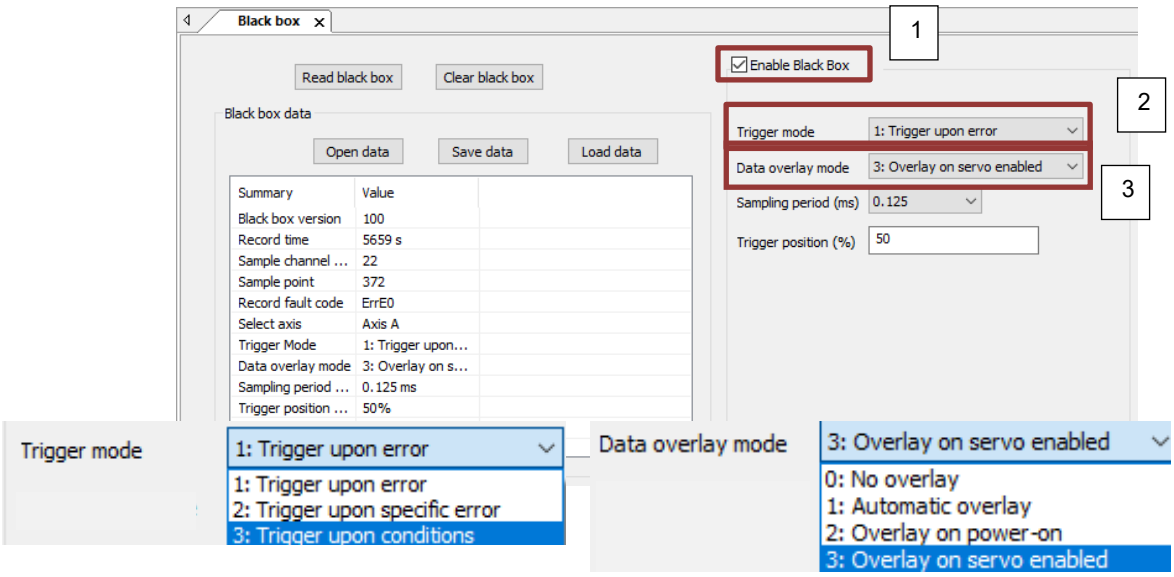
If vibration occurs during tests which can't be reduce through lowering electrical current excitation, it might be due to excessive gain. Please lower velocity gain and set notch filter as accordance from the mechanical properties analysis. Or might be due to inertia settings (Pr0.04) is too large, please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

6.12 Black box

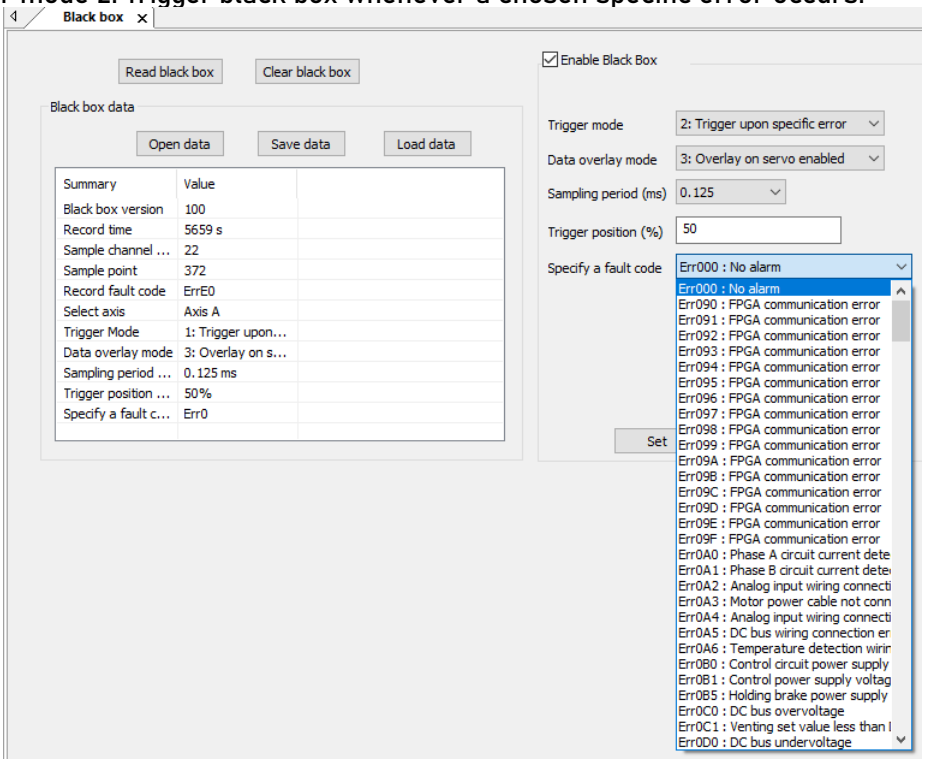
Black box is a function which allows users to set conditions or data to be captured whenever error occurs. The data will be recorded by black box at the moment of error occurrence and automatically saved. Thus, through Motion Studio, user can analyze cause of the problem with the aid of black box data.
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

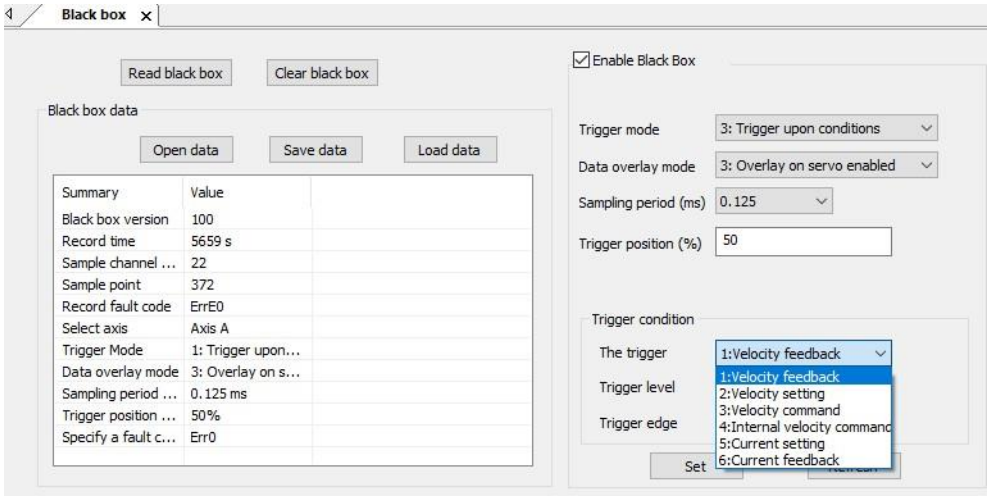
Click on "Black Box" under "Tool" to enter Black box setup. There 3 methods to trigger black box function: 1. Random error, 2. Specific error, 3. Conditions triggering. Choose trigger method as accordance to needs. Please pay attention to Data Overlay Mode and choose the option needed before start.



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



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.



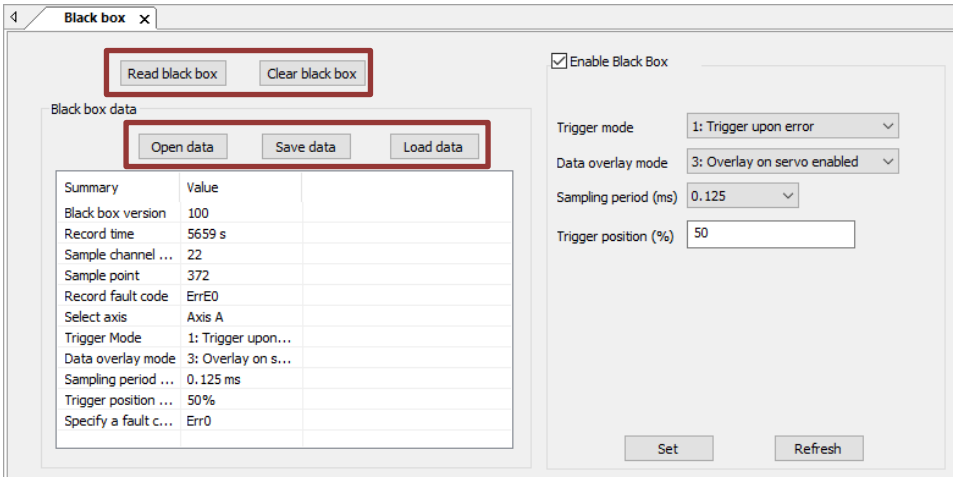
Data overlay mode: To select how and when black box data is overlaid. 0: Do not overlay data (Black box will only preserve the data of the first trigger). 1: Always overlay (Black box data will be overlaid every time). 2: Overlay upon powered on (Data overlaid occurs when servo drive is powered on) 3: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

Sampling period (ms): The lower the set value, the more precise the samples are but sampling time will be shorter.

Trigger position (%): Set the position of trigger within the sampling period.

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.



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						

【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

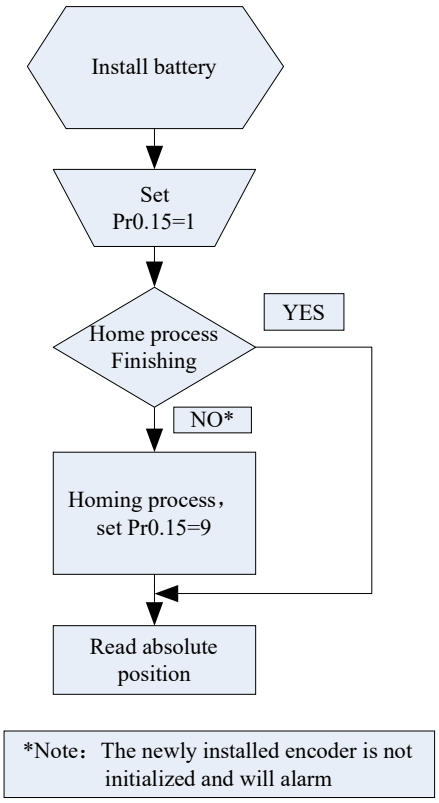
1、Steps：

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

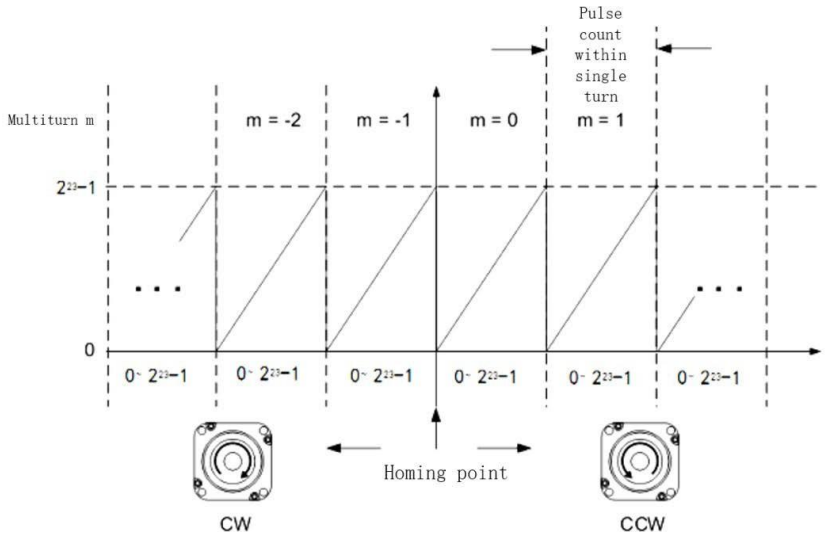
4) Finally, the user can read the absolute position. Position won't be lost even if the driver is powered off.



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

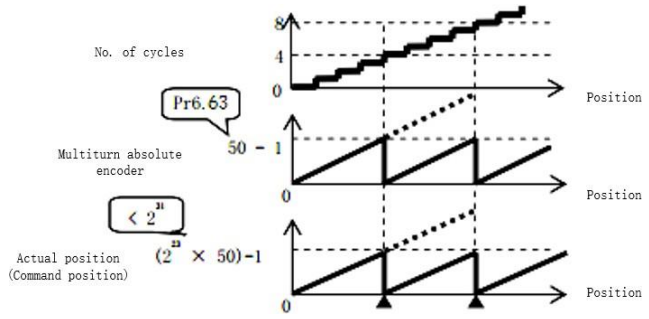
Please read data only when the motor is fully stopped or it might cause calculation errors. Please repeat this step for at least twice to make sure the result is uniform.

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

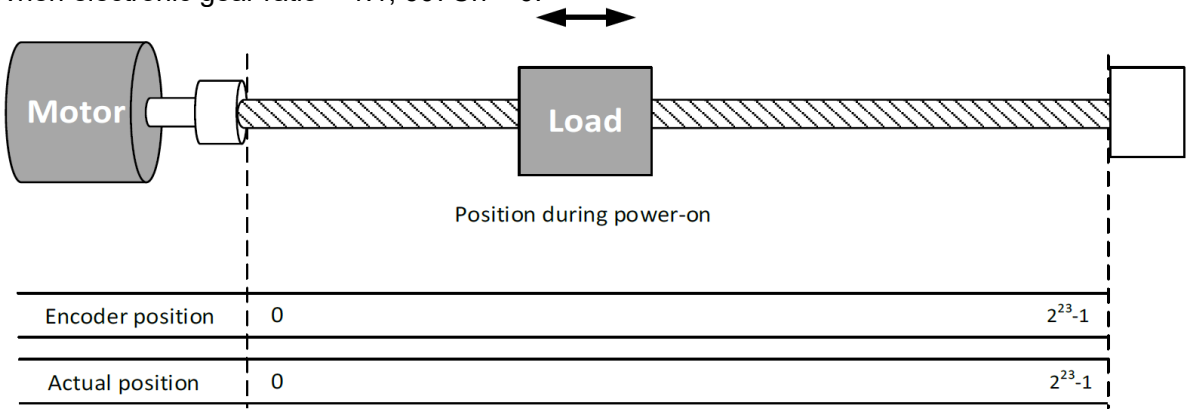
For absolute encoder, multiturn rotational mode (Pr0.15 = 2, Pr6.63 set to multiturn upper limit) is added on top of incremental mode and multiturn linear mode. Actual feedback multiturn data is always between 0 – [Pr6.63 + 1], regardless of the direction of rotation. There is no limit to no. of rotation and no data overflow.



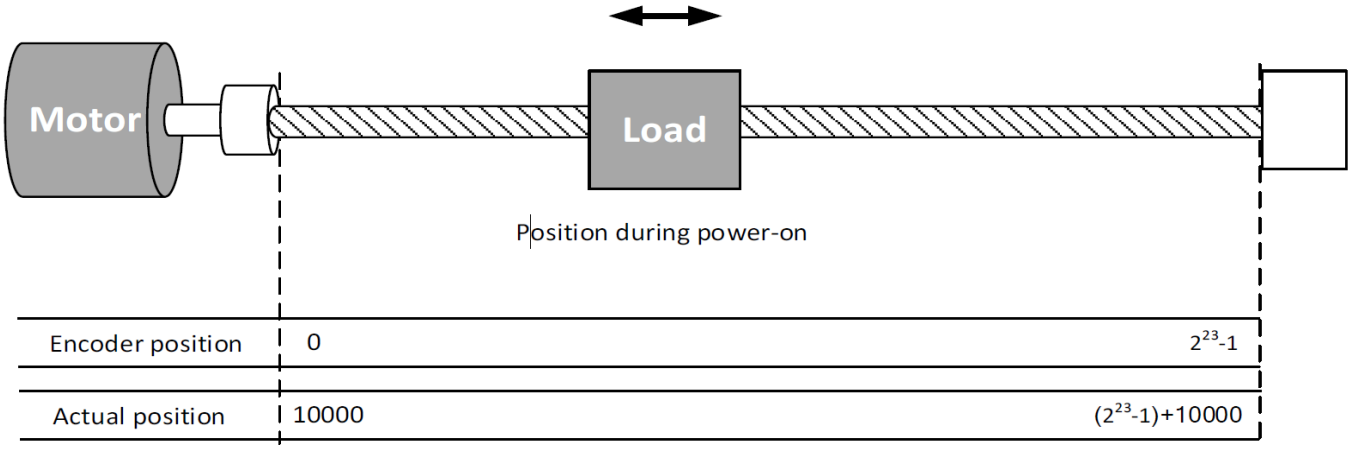
Single turn absolute mode

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

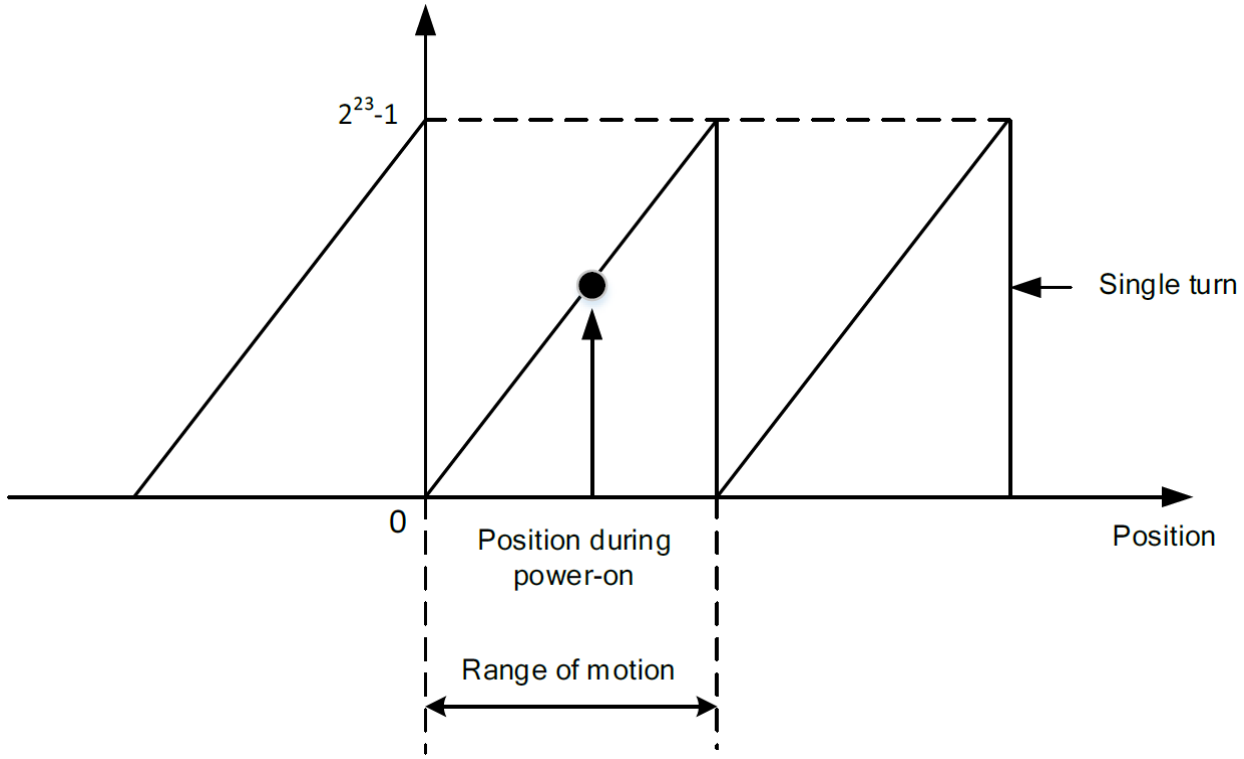
Before clearing multiturn position, axis needs to be homed. After clearing multiturn position, revolution count = 0 but absolute position remains unchanged and Err153 alarm will be cleared.

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.

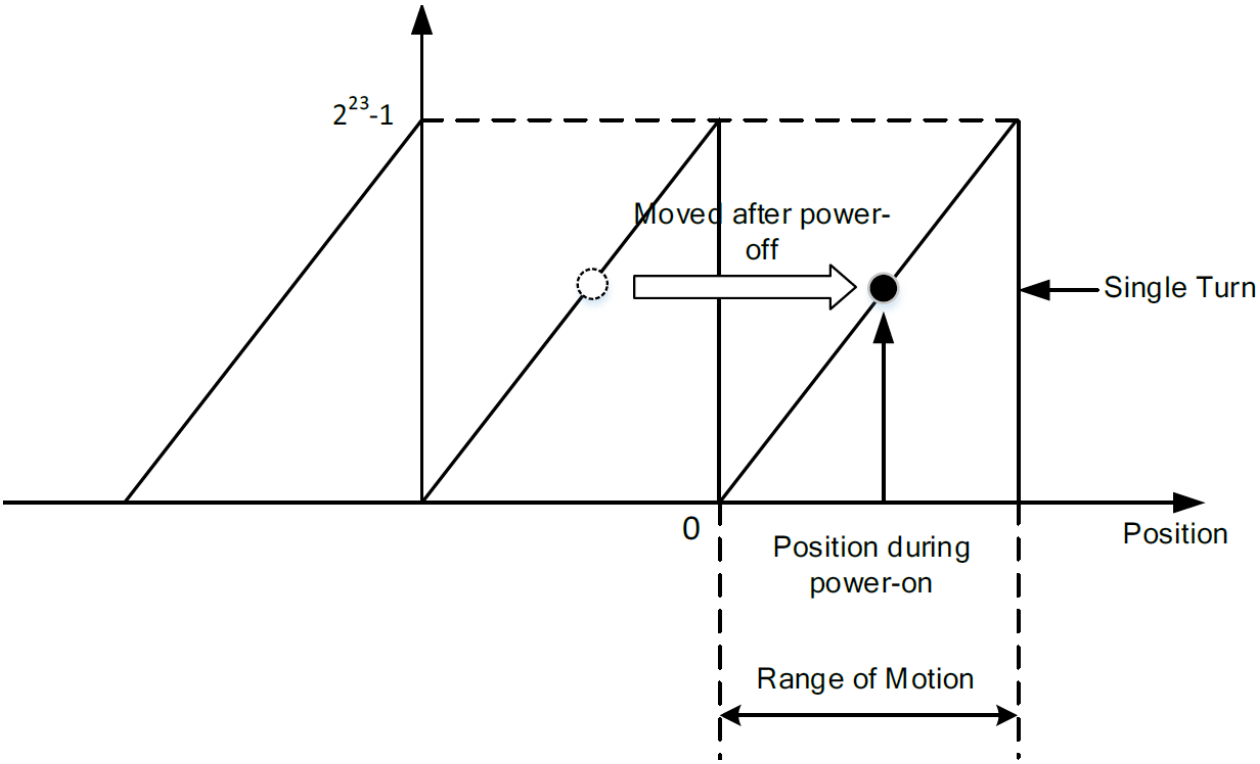
By setting Pr0.15 to 9, multiturn position will be cleared.

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.

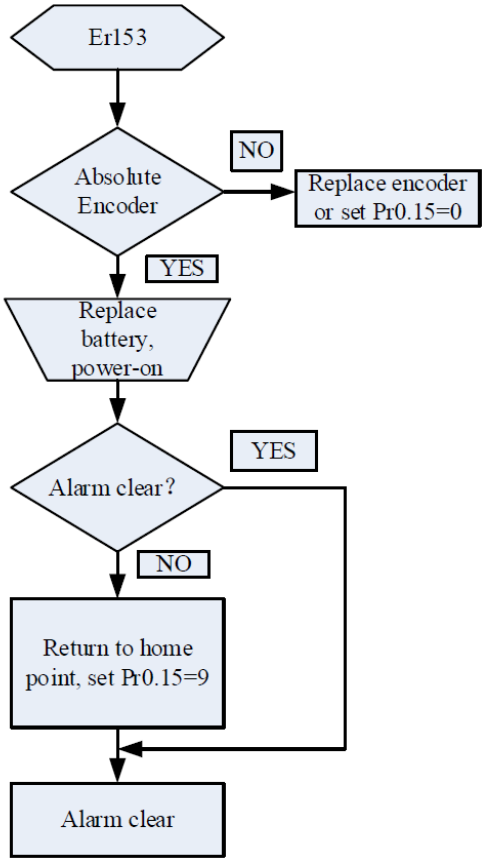
Alarm output:
Err153 will be shown on front panel or by I/O ALM signal and from controller.
Err153 might occur,

（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.

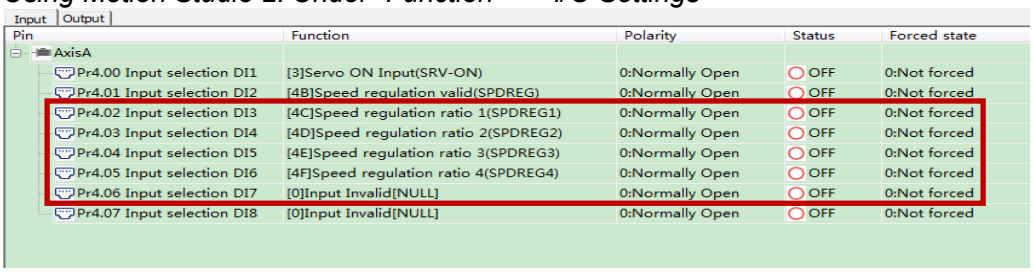
6.14 Motor Speed Regulation

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"



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

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

Pr3.59	Label	Speed regulation ratio 2			Valid mode(s)	S
	Range	0~150	Unit	%	Default	20
	Byte length	16bit	Attribute	R/W	485 address	H0x0376 L0x0377
	Valid	Immediate				

Same as Pr3.58

Pr3.60	Label	Speed regulation ratio 3			Valid mode(s)	S
	Range	0~150	Unit	%	Default	40
	Byte length	16bit	Attribute	R/W	485 address	H0x0378 L0x0379
	Valid	Immediate				

Same as Pr3.58

Pr3.61	Label	Speed regulation ratio 4			Valid mode(s)	S
	Range	0~150	Unit	%	Default	80
	Byte length	16bit	Attribute	R/W	485 address	H0x037A L0x037B
	Valid	Immediate				

Same as Pr3.58

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.

	Label	Input selection DI1	Valid mode(s)	P	S	T

Pr4.00	Range	0x00~0xFF	Unit	—	Default	0x2
	Byte length	16bit	Attribute	R/W	485 address	0x0401
	Valid	Immediate				

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

Signal	Symbol	Value	
		NO	NC
Invalid	—	0	-
Positive limit switch	POT	1	81
Negative limit switch	NOT	2	82
Servo enabled	SRV-ON	3	83
Clear alarm	A-CLR	4	-
Control mode switching	C-MODE	5	85
Gain switching	GAIN	6	86
Clear deviation count	CL	7	-
Command pulse prohibited	INH	8	88
Torque limit switching	TL-SEL	9	89
Command frequency divider/multiplier switching	DIV1	C	8C
Internal command velocity 1	INTSPD1	E	8E
Internal command velocity 2	INTSPD2	F	8F
Internal command velocity 3	INTSPD3	10	90
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

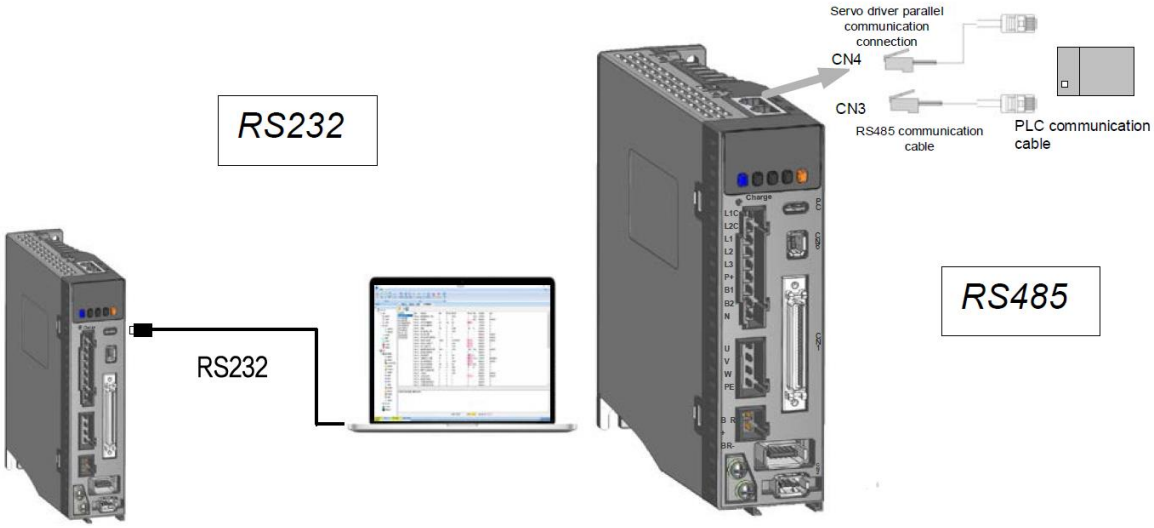
Please don't set anything other than listed in table above.
Normally open (NO) : Valid when input = ON
Normally close (NC): Valid when input = OFF
Er210 might occur if same function is allocated to different channels at the same time
Servo enable（SRV-ON）has to be allocated to enabled servo drive.
Inputs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

Chapter 7 Modbus communication

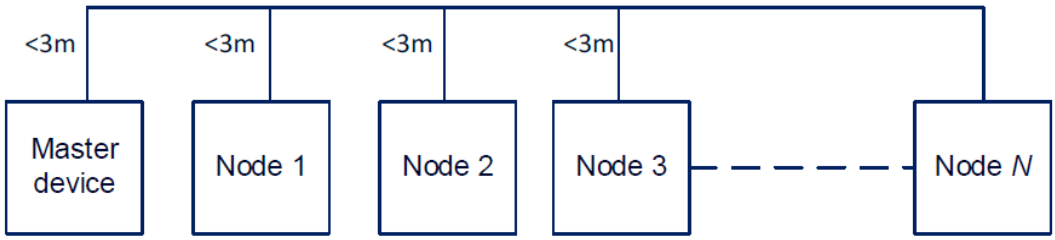
There are 2 types of Modbus communication on OSD-HP series servo drives: RS485 and RS232. RS232 is used for point-to-point communication connecting the driver to PC through a USB type-C cable for tuning using Motion Studio. RS485 can be set to communicate with multiple slave devices as a single master. Network control of the drivers can be achieved through CN3/CN4 ports.

7.1 RS232 and RS485 Connection Diagram.



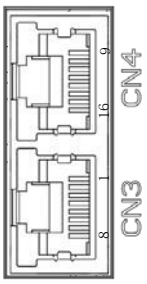
RS485 network of multiple servo drives

If there is a need to connect multiple OSD-H-*-P 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

Pr5.29	**Label**	RS485 communication mode			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~255	**Unit**	—	**Default**	5		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x053B		
	Valid	After restart						

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

Pr5.30	**Label**	RS485 communication Baud rate			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~15	**Unit**	—	**Default**	4		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x053D		
	Valid	After restart						

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

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

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

Pr5.31	**Label**	RS485 axis address			**Valid mode(s)**	**P**	**S**	**T**
	Range	0~127	**Unit**	—	**Default**	1		
	Byte length	16bit	**Attribute**	R/W	**485 address**	0x053F		
	Valid	After restart						

When controller is connected to multiple axis and controller needs to identify the axis, 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

7.3 Modbus Protocol

OSD-HP 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.

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					

7.3.1 Read Data 0x03

Read Data function code 0x03 can be used to read 1 – 100 16-bit data. For example, from servo drive to slave as 1 and reading 2 data. (H: High 8-bit, L: Low 8-bit)

No.	Request frame data（Master->Slave）				Reply frame data（Slave->Master）		
1	**ID**	Slave	0x01		**ID**	Slave	0x01
2	**FC**	Function code	0x03		**FC**	Function code	0x03
3	**ADDR**	Starting address	H		**NUM**	Data count（byte）	0x00(H)
4			L				0x04(L)
5	**NUM**	Data count（word）	0x00(H)		**DATA1**	Data 1	H
6			0x02(L)				L
7	**CRC**	Checksum	L		**DATA2**	Data 2	H
8			H				L
9					**CRC**	Checksum	L
10							H

Request frame and reply frame should have the same set of data as shown below.

Send	01 06 00 01 00 01 19 CA
Receive	01 06 00 01 00 01 19 CA

Send Frame: Request Frame. Master device writes a 1-Word (16 bit) data (0x0001) into slave servo drive with ID no. 1 (Address 0x0001).
Receive Frame: Reply frame. Master device writes value in slave servo drive with ID no.1 successfully and gets the same frame data back.

7.3.2 Write multiple data 0x10

Function code 0x10 is to write multiple 16-bit data into servo drive. For example, from servo drive to slave as 1 and reading 2 data. (H: High 8-bit, L: Low 8-bit).

No.	Request frame data（Master->Slave）				Reply frame data（Slave->Master）		
1	**ID**	Slave	0x01		**ID**	Slave	0x01
2	**FC**	Function code	0x03		**FC**	Function code	0x03
3	**ADDR**	Starting address	H		**ADDR**	Address	H
4			L				L
5	**NUM1**	Data count（word）	0x00(H)		**NUM**	Data count（word）	H
6			0x02(L)				L
7	**NUM2**	Data count（Byte）	0x04 (2*NUM1)		**CRC**	Checksum	L
							H
8	**DATA1**	Data 1	H				
9			L				
10	**DATA2**	Data 2	H				
11			L				
12	**CRC**	Checksum	L				
13			H				

Servo parameters are 32-bit with high 16-bit at the front and low 16-bit at the back. 2 continuous communication addresses will be distributed starting with even number (High 16-bit uses even number address, low 16-bit uses odd number address. Word byte frame word is also with high 8-bit at the front and low 8-bit at the back.

32-bit data written from starting address 0x0000 (Servo driver with axis address 01):

Send	01 10 00 00 00 02 04 00 00 00 00 F3 AF
Receive	01 10 00 00 00 02 41 C8

Send Frame: Request Frame. Master device writes a 2 Word (16 bit), 4 bytes data (0x0000 0000) into slave servo drive with ID no. 1 (Address 0x0000). 11-byte CRC value is 0xAFF3 before frame sending.
Receive Frame: Reply frame. Master device writes a 2 Word value into slave servo drive with ID no. 1 (Address 0x0000). 6-byte CRC value is 0xC841 before frame sending.

7.3.3 Reply error

When driver receives request frame data format with error, driver will feedback error reply data frame to master device.

No.	Error reply frame data (Slave->Master)		
1	**ID**	Slave ID	0~31
2	**FC**	Function code	(0x03/0x06/0x10)+0x80
3	**Error code**	Address	0x01/0x02/0x03
4	**CRC**	Checksum	L
5			H

Error code table:

Error code	Description
0x01	Function code error
0x02	Address error
0x03	Data error, i.e. written data over limit
0x08	CRC checksum error

Communication data:

Receive frame: Slave servo drive's reply frame. Request frame data CRC from master device, servo drive will not respond to current request.

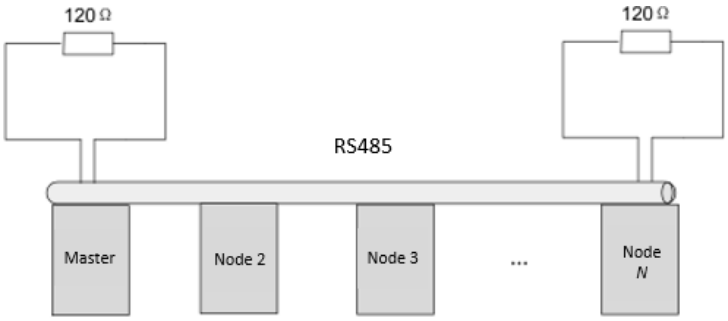
```
[Send]01 11 00 04 00 02 04 01 00 00 00 F3 A0
[Receive]01 91 01 4C 56
```

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

```
[Send]01 11 00 04 00 02 04 01 00 00 00 A2 65
[Receive]01 91 01 8C 50
```

7.4 Frequently occurred issues and solutions with RS485 communication.

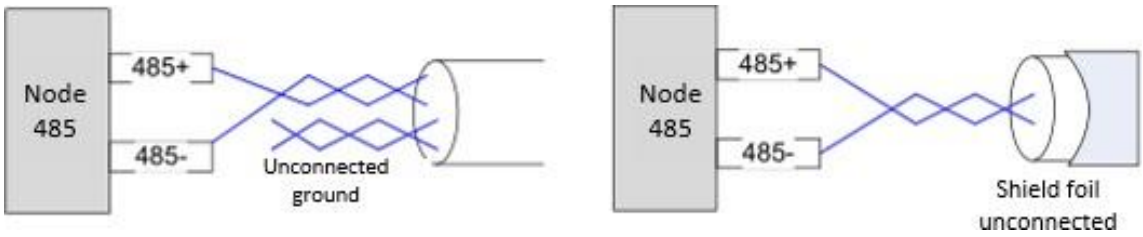
Terminal resistor



Terminal resistor is to be connected at the start and end of the device network. Recommended resistance of the terminal resistor: 120 Ohm. Measure the resistance within the network using a multimeter and refer to the table below.

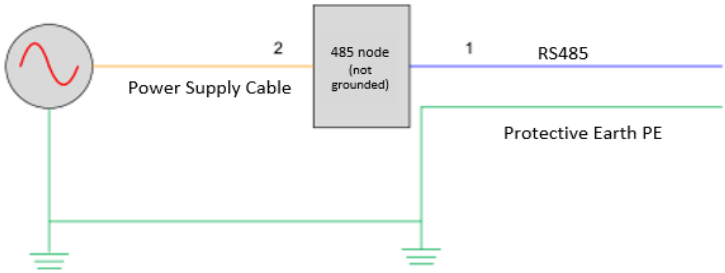
Measured resistance (Ohm) **Normal: 60 Ohm**	Description
0	Short circuit
Much lower than 60	Might be other resistor within the network; incorrect terminal resistor is used
Much higher than 60	Might be due to damaged/faulty node communication port

Incorrect wiring connection

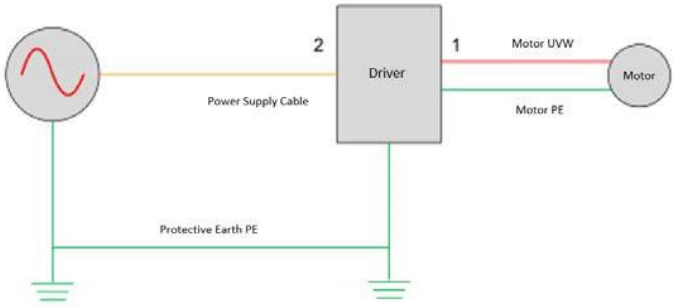


Please make sure RS485 communication connection is normal using a multimeter. Then, make sure the reference ground is corrected connected. If there is not no reference ground, please leave it unconnected. Same goes for cable shield foil.

Signal interference



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

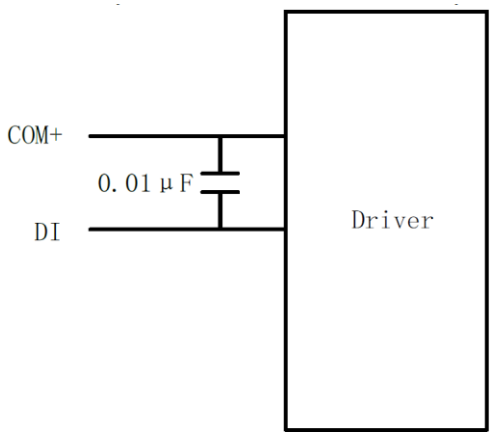


Driver interference: If interference occurs within the driver, please intertwine magnetic rings on cable 1 and 2. Please loop UVW cables around the magnetic ring for at least 3 rounds. Do not loop PE wire into the magnetic ring.

Step-by-step problem solving

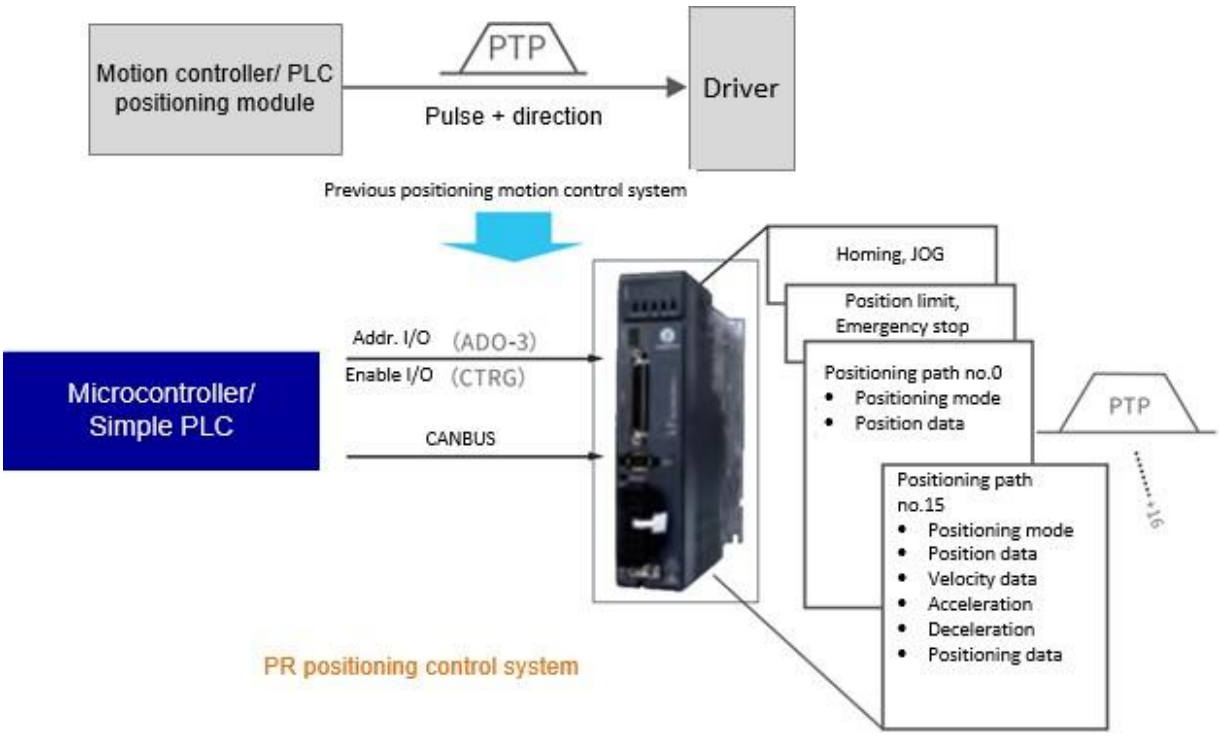
1: Verify if communication parameters setting are correct (ID not repeated, uniform Baud rate and data format);
2: If terminal resistor used is correct;
3: If wiring connection is correct;
4: Verify grounding and PE connection;
5: Communication cables should be separated from power cables.

Servo drives are devices of good anti-interference. However, during installation, interference still might occur due to wiring and grounding issues. Please refer to the table below if such problems persist.

Steps	Solutions
1	Use shielded wire cable for I/O signals, connect shield foil to PE.
2	Connect motor PE to PE terminals on drivers, connect driver PE to PE terminals of electrical network.
3	Ground master device and servo drives together.
4	Loop UVW motor power cable around magnetic ring for 2-3 times.
5	Loop signal cable around magnetic ring for 1-2 times.
6	Use shielded cable for power cables. Connect shield foil to ground.
7	Connect a capacitance filter onto DI input. Max capacitance: 0.1 μF 

Chapter 8 PR Functions

PR function is a control module in servo drive that controls single axis motion using PRocedure program. Main single axis motion control functions included homing, path, position limit and emergency stop. Using PR functions can save the resources on the main controller.



Please set 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 1. Homing mode configurable. Can be chosen between position limit signal homing, origin signal homing and manually set home; 2. Homing direction configurable; 3. Specific position can be set after homing completed; 4. Homing velocity, acceleration and deceleration configurable. 5. High homing velocity to locate origin and low homing velocity to look for Z-signal
JOG	Forward/Reverse JOG through I/O control. Used for tuning. 1. JOG direction: forward JOG, reverse JOG 2. JOG velocity and acceleration configurable
Position limit	Prevent mechanical damage by limiting the range of motion 1. Positive/Negative position limit input through I/O 2. Software position limit 3. Position limit deceleration configurable
Emergency stop	Emergency stop input signal through I/O. To stop any operating motion
Path motion	Select path ID through IO（ADD0-3）, then trigger path motion through enable IO（CTRG）; or directly through I/O combination mode; path motion can be controlled directly through 485 communication as well 1. Path motion includes positioning, velocity and homing modes. 2. I/O trigger includes rising edge, double edges trigger 3. Supports continuous positioning; 4. Max. 16 paths; 5. Configurable position, velocity and acceleration/deceleration; 6. Pause time/ timer configurable
485 communication	PR parameter R/W through 485 communication. Control PR functions such as homing, JOG, path motion, emergency stop, etc.

8.2 Control parameters

All PR motion related parameters including trigger, status output, limits, emergency stop, JOG, homing, etc.

Parameter	Label	Description	485 Addr.
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 *Single turn Z homing is homing method within 1 revolution, has nothing to do with Bit 8 Z-signal.*	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

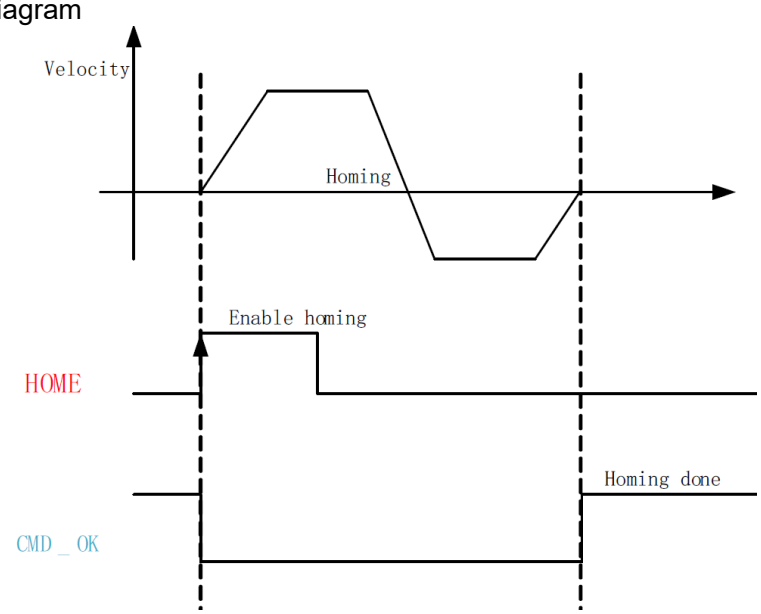
Pr8.16	Low homing velocity	Set low homing velocity	0X6010
Pr8.17	Homing acceleration	Set homing acceleration	0X6011
Pr8.18	Homing deceleration	Set homing deceleration	0X6012
Pr8.19	Homing torque holding time	Set homing torque holding time	0X6013
Pr8.20	Homing torque	Set homing torque value	0X6014
Pr8.21	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 *N*	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 *N* S-code output settings	0x6030 ~ 0x603F

8.3 PR Motion

8.3.1 Homing

Homing is divided into 5 methods according to home signal: Single turn Z-phase homing, position limit homing, origin homing, torque homing, manually set home. Position limit homing, origin homing and torque homing can be with or without Z-signal. Homing can be triggered upon power on or using I/O after servo enabled.

Homing sequence diagram



1. **HOME**: Homing trigger signal. When HOME is valid, homing will be done according to set homing method.
2. **CMD_OK**: Command completed signal. Invalid when command is being carried out, valid when command is done.
3. Please refer to 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.

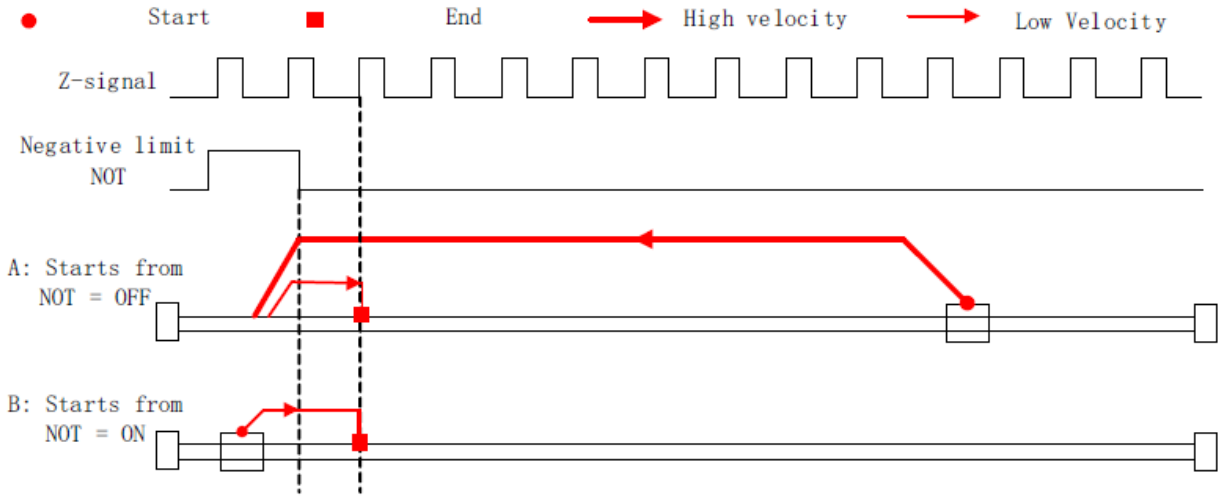
Pr8.10	Label	Homing mode			Valid mode(s)	PR
	Range	0~ 0xFFFF	Unit	/	Default	0
	Byte length	16bit	Attribute	R/W	485 address	0X600A

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

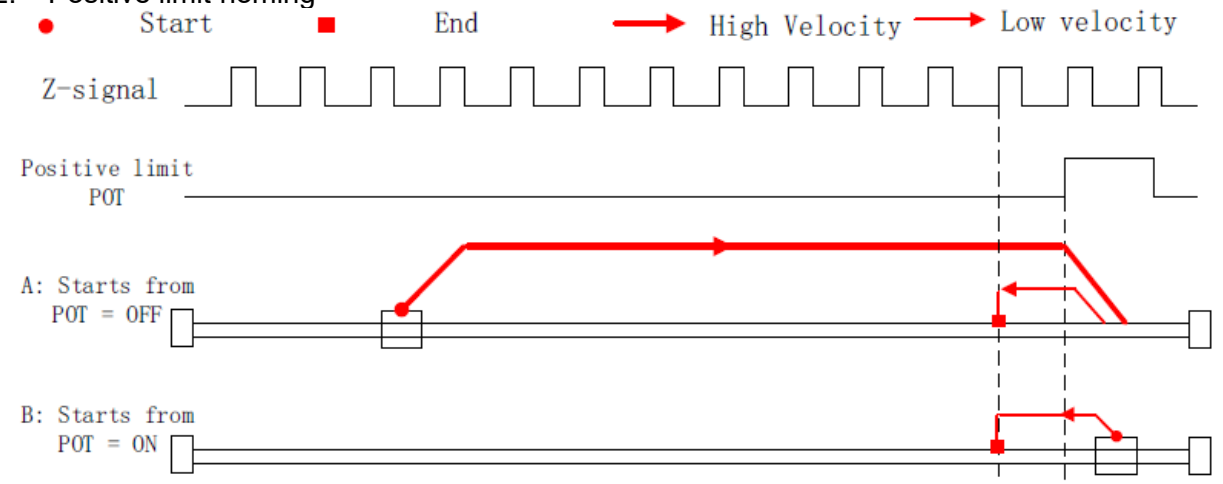
Bit	8（Z-signal homing）	2-7（Homing mode）	1（Specific position after homing）	0（Homing direction）
Description	=1, homing with Z-signal =0, homing without Z-signal	=0 Limit homing =1 Origin homing =2 Single turn Z homing =3 Torque homing =8 Immediate	=1, Yes =0, No	=1, Forward =0, Reverse

Position limit, origin and torque homing with Z-signal

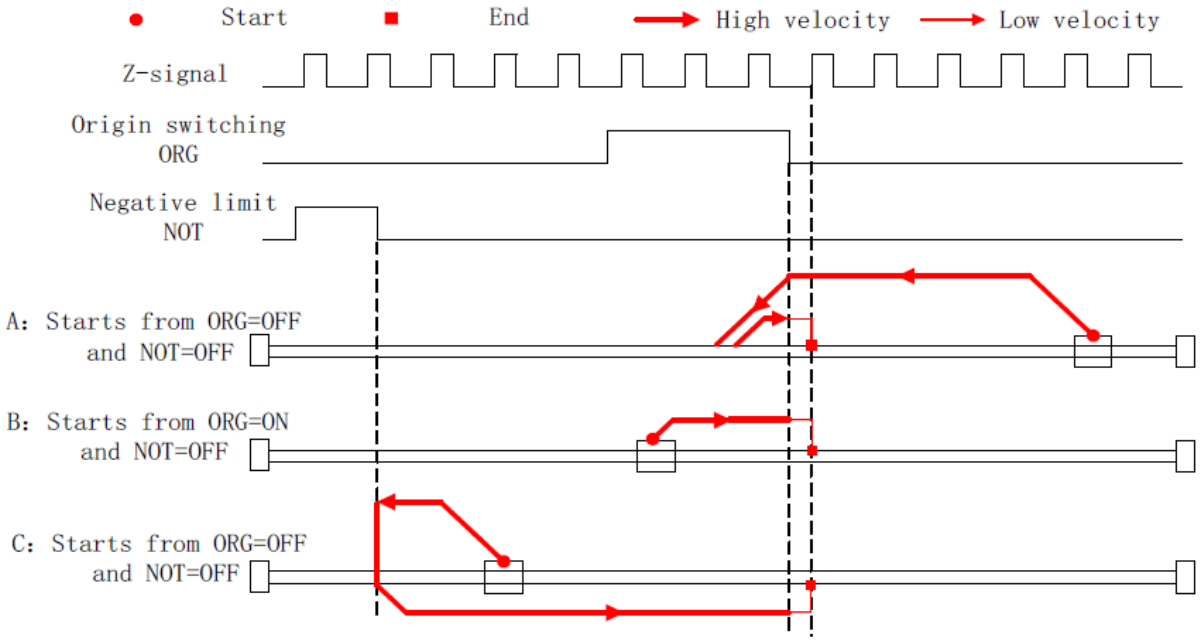
1. Negative limit homing



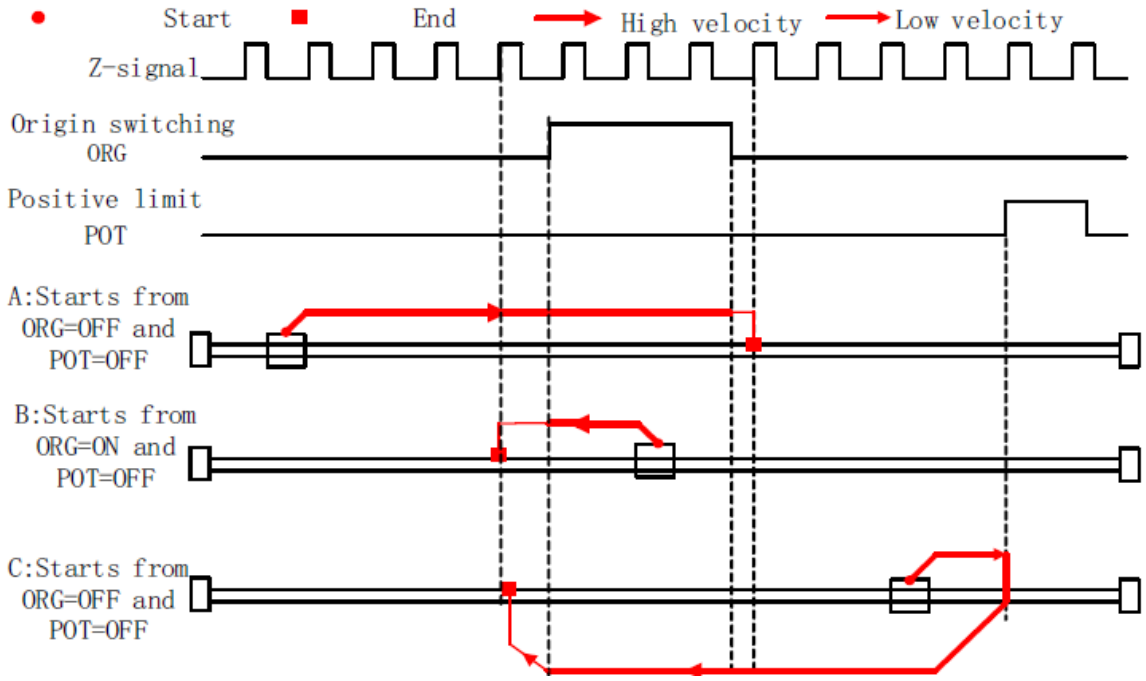
2. Positive limit homing



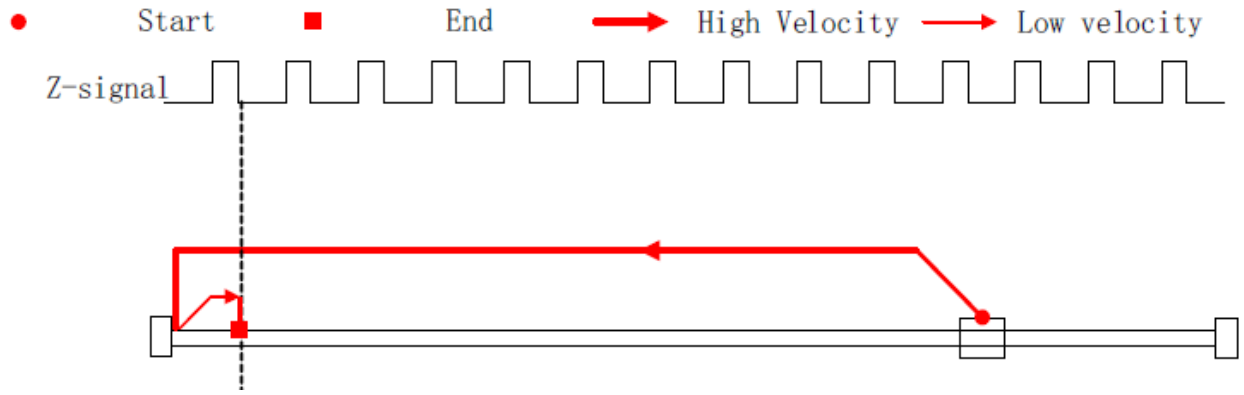
3. Origin homing – Negative direction



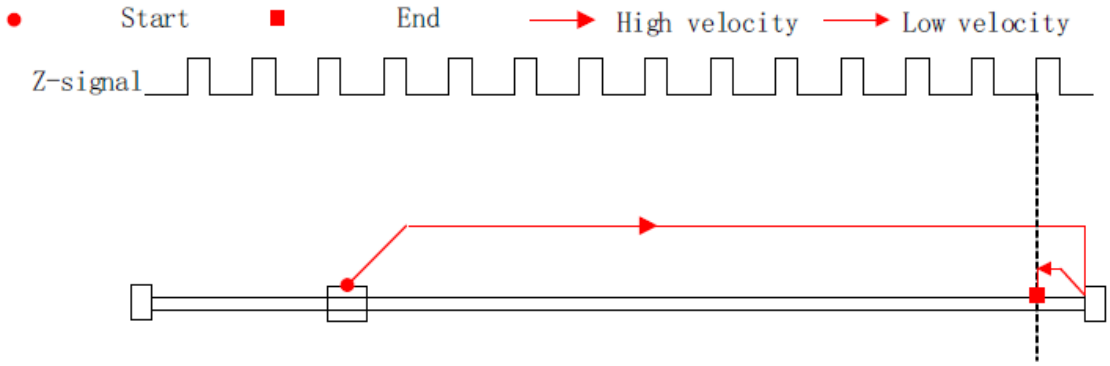
4. Origin homing – Positive direction



5. Torque homing – Negative direction

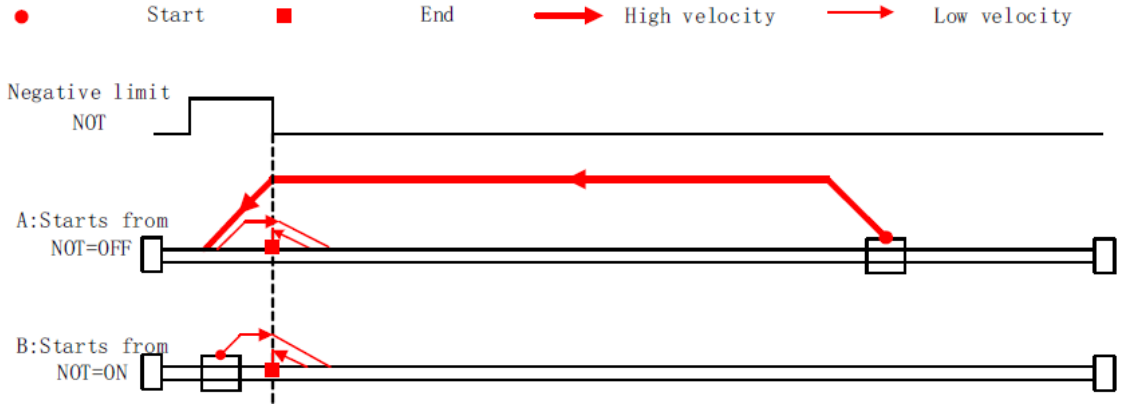


6. Torque homing – Positive direction

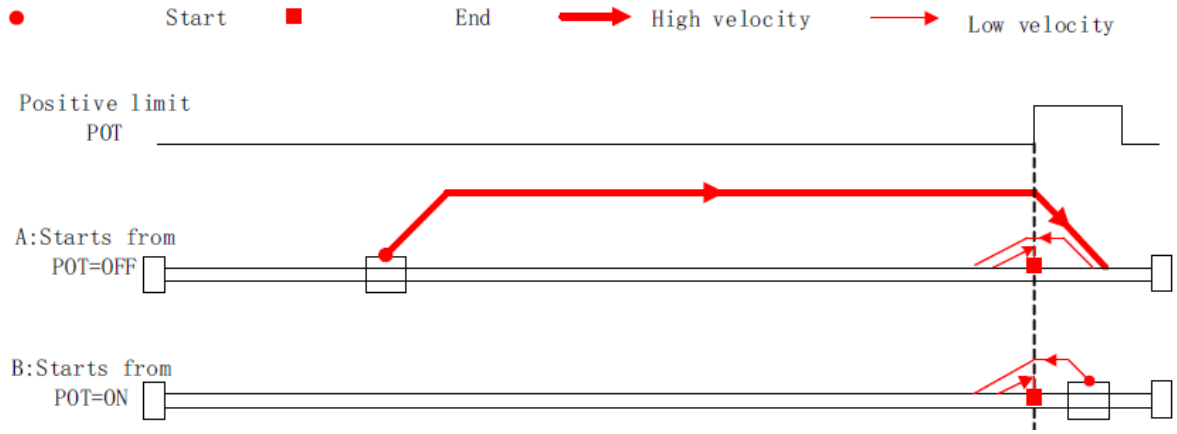


Position limit, origin, Z-signal, torque and manual set home (Homing with single condition)

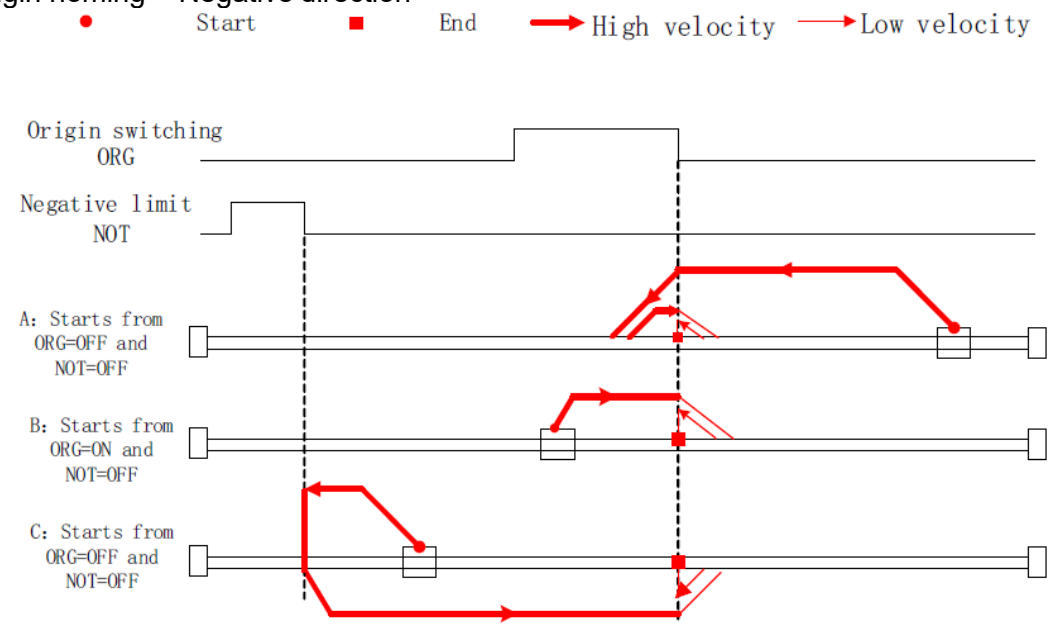
1. Negative limit homing



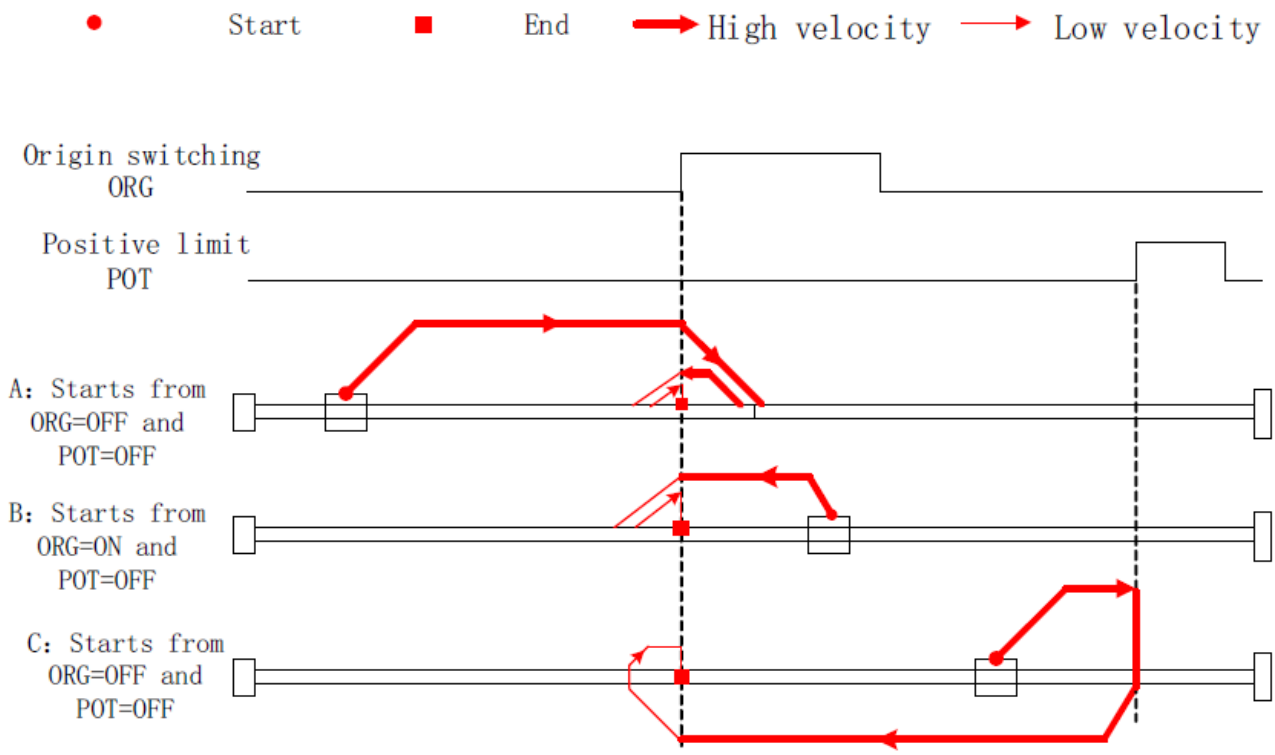
2. Positive limit homing



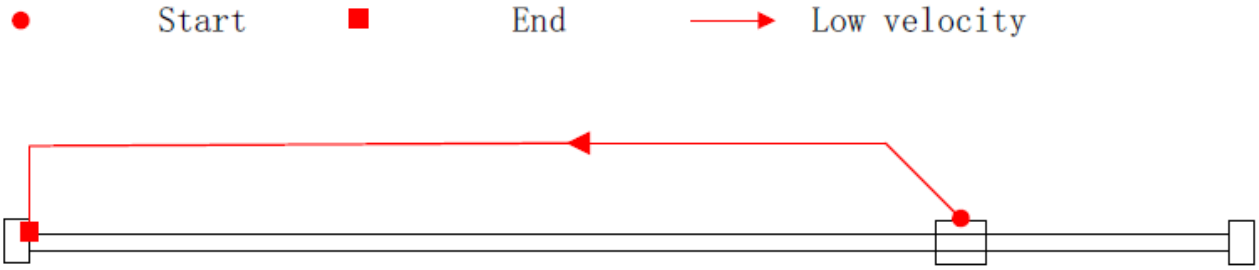
3. Origin homing – Negative direction



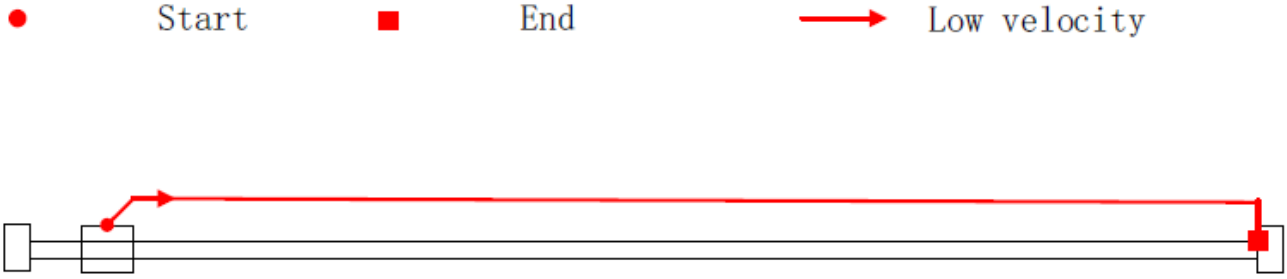
4. Origin homing – Positive direction



5. Torque homing – Negative direction

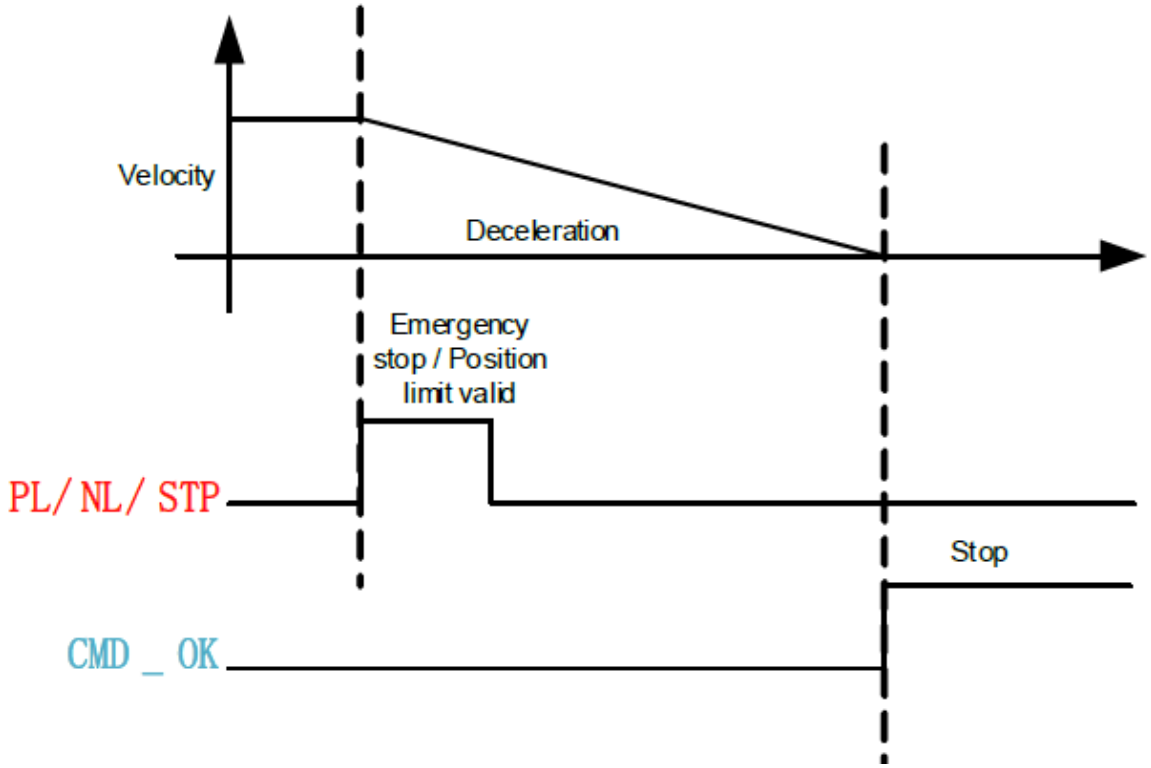


6. Torque homing – Positive direction



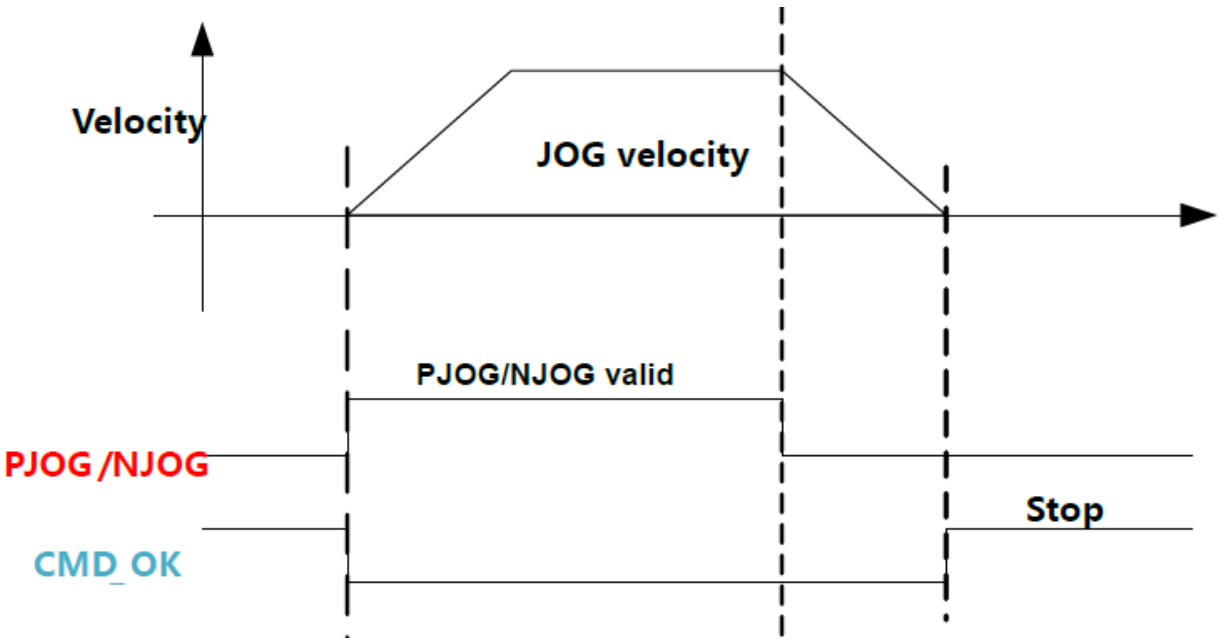
8.3.2 Position limit and emergency stop

For safety concerns, PR mode is designed to trigger emergency stop when position limit or emergency stop signal is valid. Please refer to the sequence diagram below.



8.3.3 JOG

JOG is used to make tuning more convenient. Please refer to the sequence diagram below for motion profile during JOG

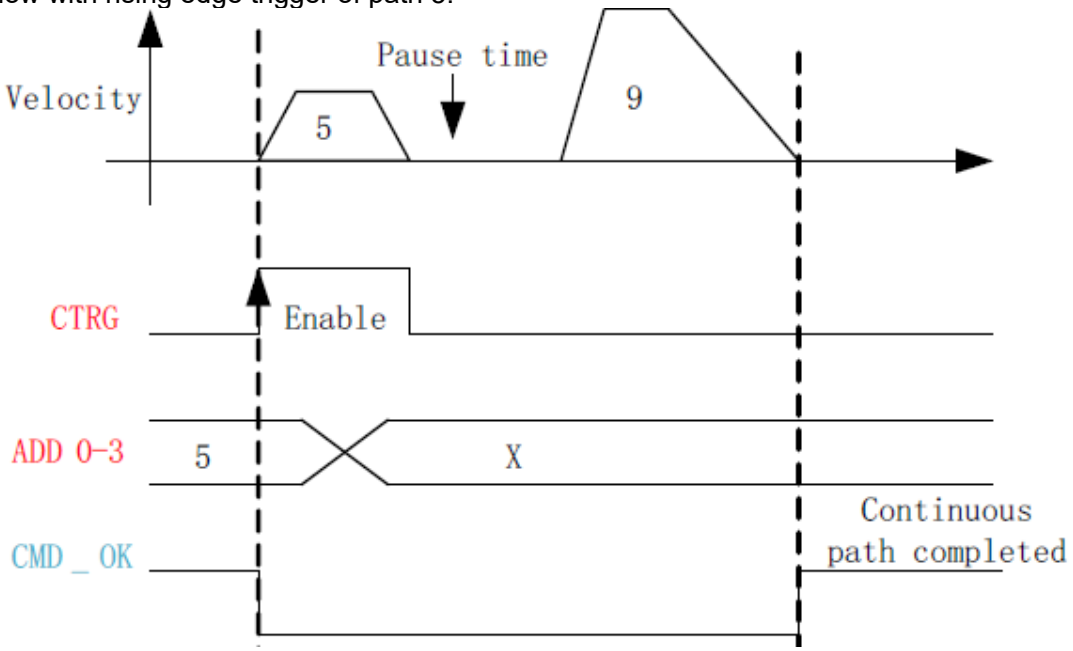


Path motion: Segmented, continuous, interrupted. Path positioning: Position, velocity, homing.
PR path is to a total of 16 paths. Every path can be set with motion type, positioning mode, velocity, acceleration, deceleration and pause time independently.

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 *Indicates using P/V/H/S* Bit 4: 0: Can be Interrupted 1: Can't be Interrupted, indicates using ! Bit 5: OVLP: 0: No overlap, indicates with SJ 1: Overlap, indicated with CJ Bit 6-7: 0: absolute 1: relative command 2: relative motor *Corresponding to ABS/INC/REL* Bit8-13： 0-15: Jump to corresponding path *Indicates using SJ0x or CJ0x* Bit 14： JUMP: 0: No Jump, indicates with END 1: Jump. Jump to SJ or CJ	0X6200
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	

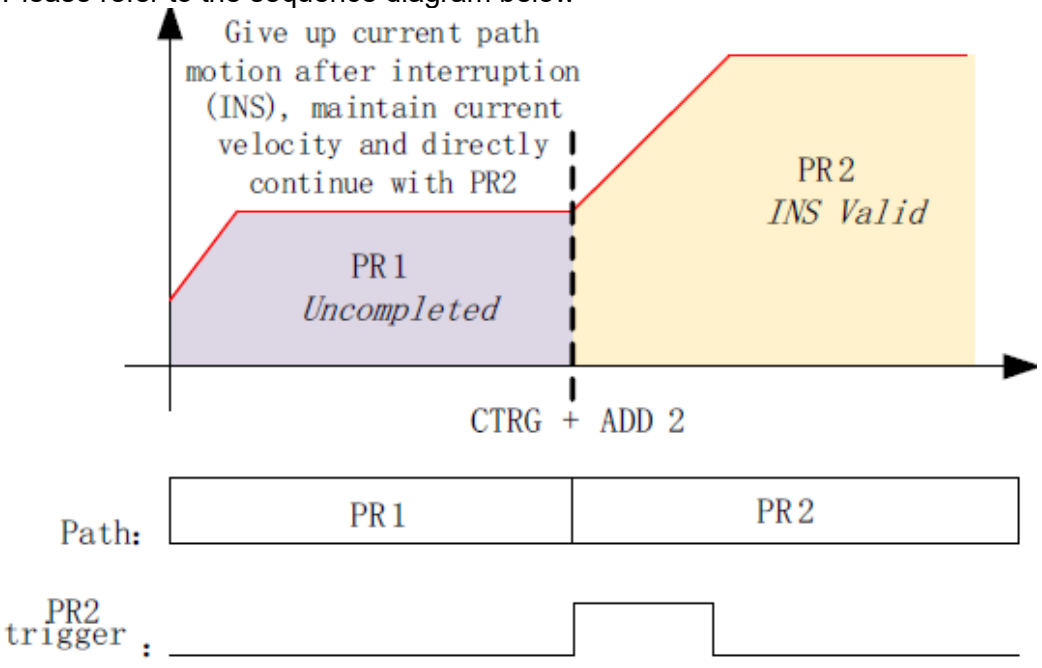
Segmented trigger

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.



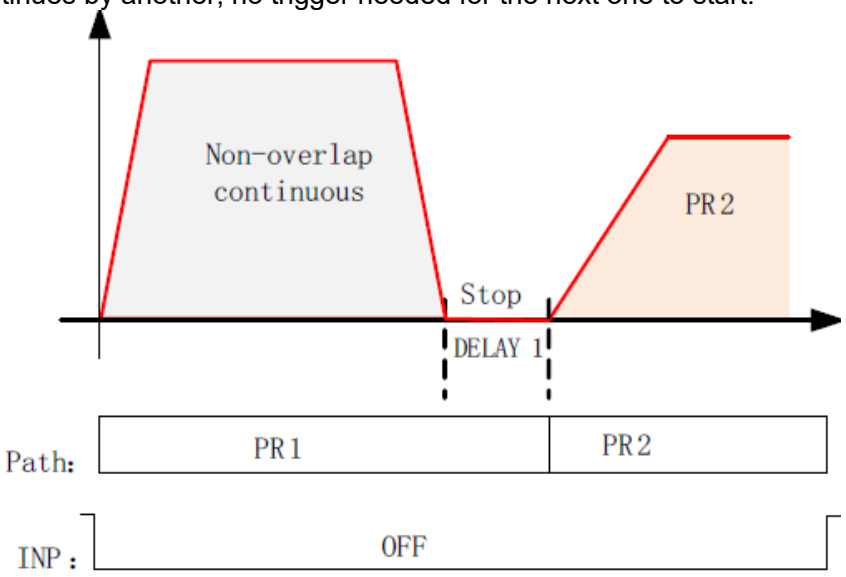
Multi-path interrupted motion

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



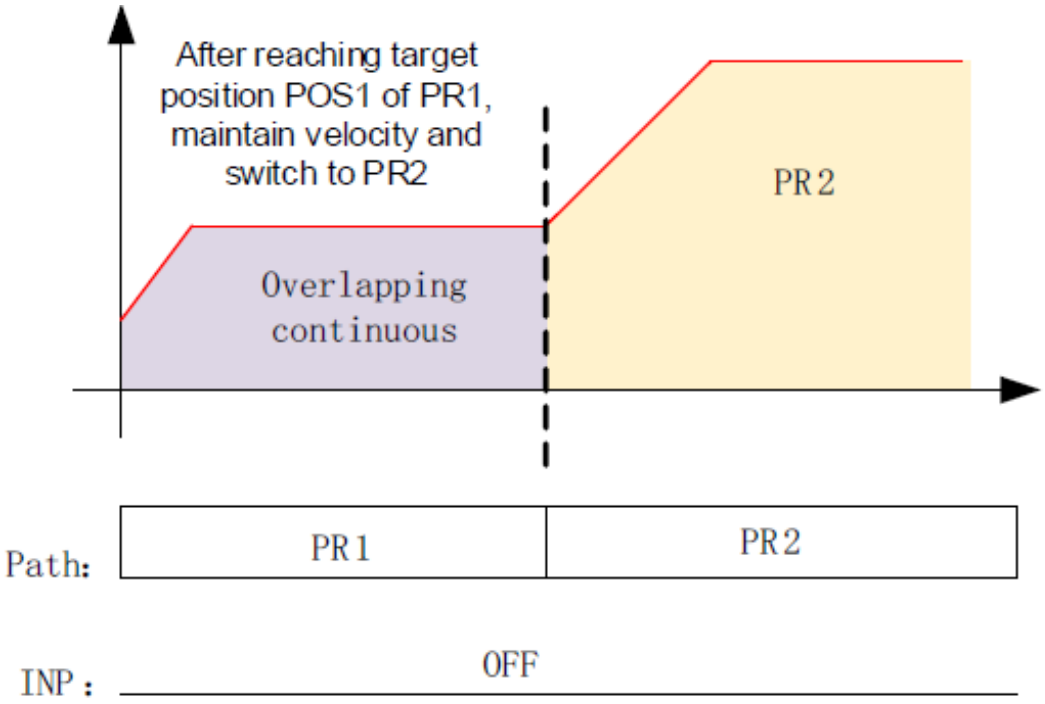
Non-overlap continuous motion

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



Overlapping continuous motion

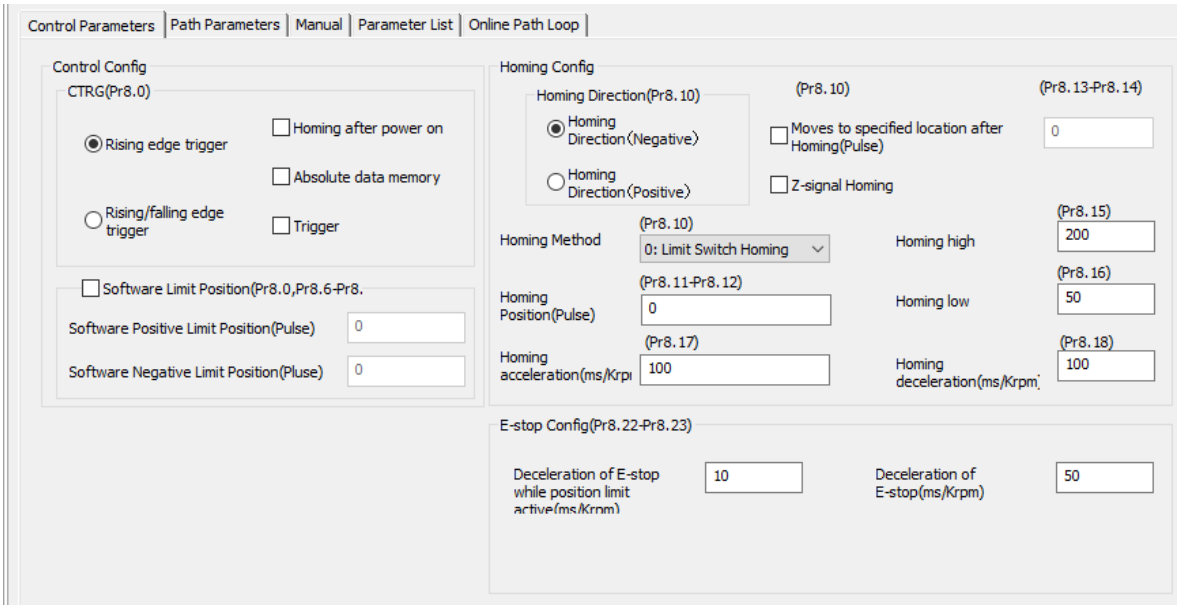
Path motion starts immediate after the previous path motion is completed without deceleration or trigger in between.



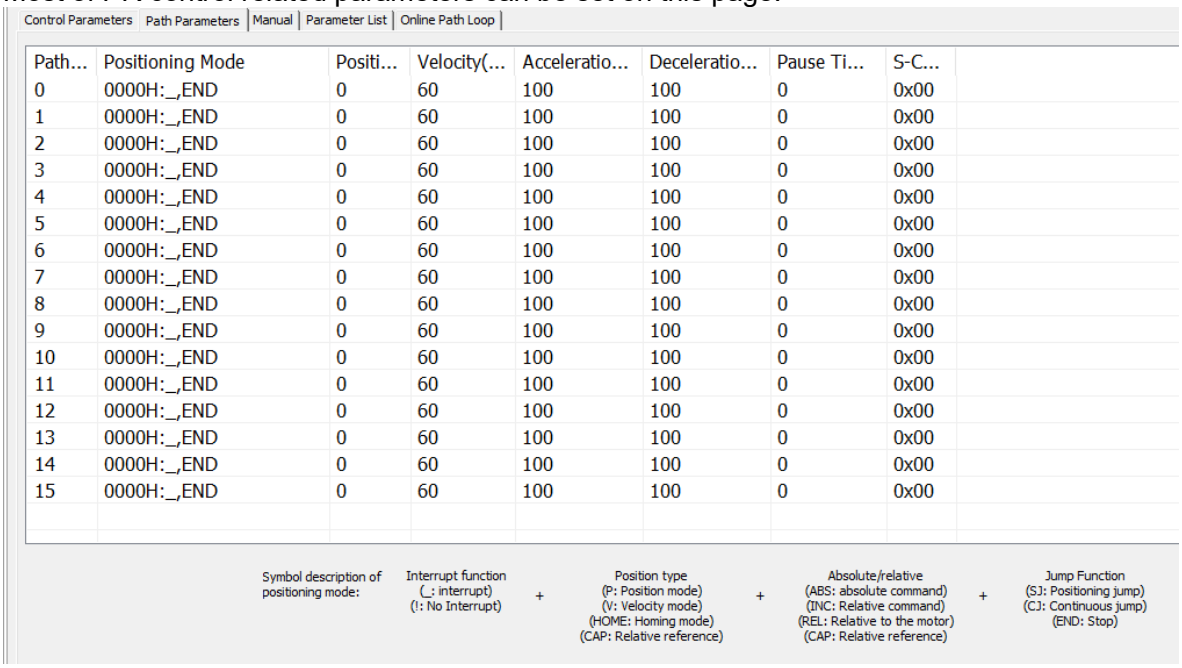
8.4 PR Control

8.4.1 PR module in Optimus tuning software

Using Pr-Motion function in Optimus tuning software, 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.

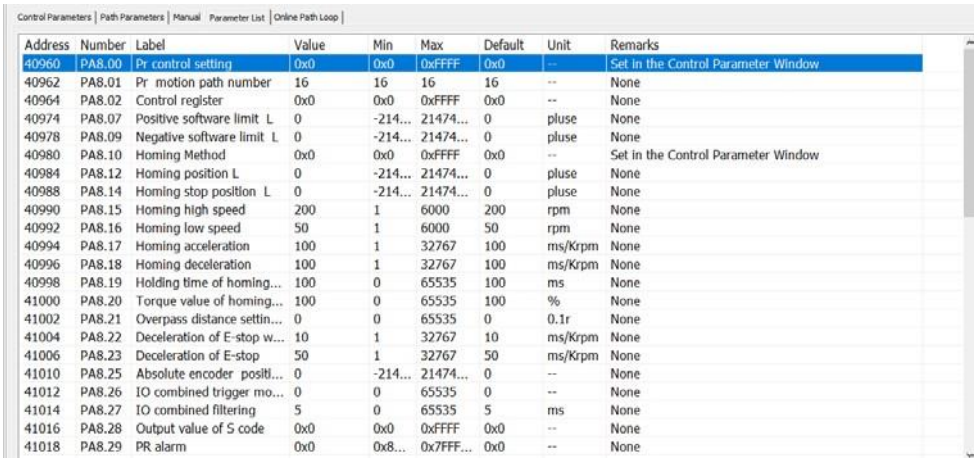


Most of PR control related parameters can be set on this page.



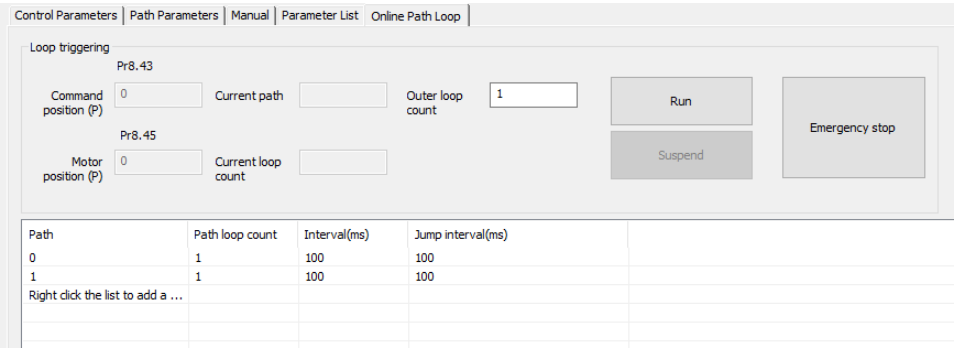
All class 9 parameters for 0-15 paths can be found here once connected to a servo drive that supports PR mode.

Manual control of servo drive in PR mode can be done in this page.



Address	Number	Label	Value	Min	Max	Default	Unit	Remarks
40960	PA8.00	Pr control setting	0x0	0x0	0xFFFF	0x0	--	Set in the Control Parameter Window
40962	PA8.01	Pr motion path number	16	16	16	16	--	None
40964	PA8.02	Control register	0x0	0x0	0xFFFF	0x0	--	None
40974	PA8.07	Positive software limit L	0	-214...	21474...	0	pluse	None
40978	PA8.09	Negative software limit L	0	-214...	21474...	0	pluse	None
40980	PA8.10	Homing Method	0x0	0x0	0xFFFF	0x0	--	Set in the Control Parameter Window
40984	PA8.12	Homing position L	0	-214...	21474...	0	pluse	None
40988	PA8.14	Homing stop position L	0	-214...	21474...	0	pluse	None
40990	PA8.15	Homing high speed	200	1	6000	200	rpm	None
40992	PA8.16	Homing low speed	50	1	6000	50	rpm	None
40994	PA8.17	Homing acceleration	100	1	32767	100	ms/Krpm	None
40996	PA8.18	Homing deceleration	100	1	32767	100	ms/Krpm	None
40998	PA8.19	Holding time of homing...	100	0	65535	100	ms	None
41000	PA8.20	Torque value of homing...	100	0	65535	100	%	None
41002	PA8.21	Overpass distance settin...	0	0	65535	0	0.1r	None
41004	PA8.22	Deceleration of E-stop w...	10	1	32767	10	ms/Krpm	None
41006	PA8.23	Deceleration of E-stop	50	1	32767	50	ms/Krpm	None
41010	PA8.25	Absolute encoder positi...	0	-214...	21474...	0	--	None
41012	PA8.26	IO combined trigger mo...	0	0	65535	0	--	None
41014	PA8.27	IO combined filtering	5	0	65535	5	ms	None
41016	PA8.28	Output value of S code	0x0	0x0	0xFFFF	0x0	--	None
41018	PA8.29	PR alarm	0x0	0x8...	0x7FFF...	0x0	--	None

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



To run PR mode in a loop

8.4.2 Physical I/O

Path motion, feedback status, etc can be triggered through I/O in PR mode. Please refer to the table below for I/O assignments in PR mode.

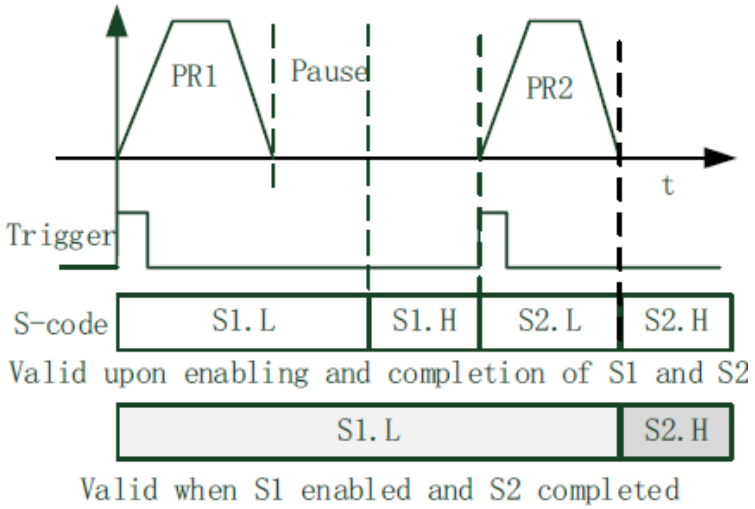
Input				Output			
Label	Signal	Value		Label	Signal	Value	
		NO	NC			NO	NC
Command trigger	CTRG	20h	A0h	Command completed	CMD_OK	20h	A0h
Homing	HOME	21h	A1h	Path completed	PR_OK	21h	A1h
Forced emergency stop	STP	22h	A2h	Homing completed	HOME_OK	22h	A2h
Positive JOG	PJOG	23h	A3h	S-code 0	SD0	23h	A3h
Negative JOG	NJOG	24h	A4h	S-code 1	SD1	24h	A4h

Positive position limit	PL	25h	A5h	S-code 2	SD2	25h	A5h
Negative position limit	NL	26h	A6h	S-code 3	SD3	26h	A6h
Origin	ORG	27h	A7h	S-code 4	SD4	27h	A7h
Path address 0	ADD0	28h	A8h	S-code 5	SD5	28h	A8h
Path address 1	ADD1	29h	A9h	S-code 6	SD6	29h	A9h
Path address 2	ADD2	2ah	Aah	PR warning	PRWAR	2Ah	AAh
Path address 3	ADD3	2bh	Abh				
Torque switching	TC-SEL	09h	89h				

S-code

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

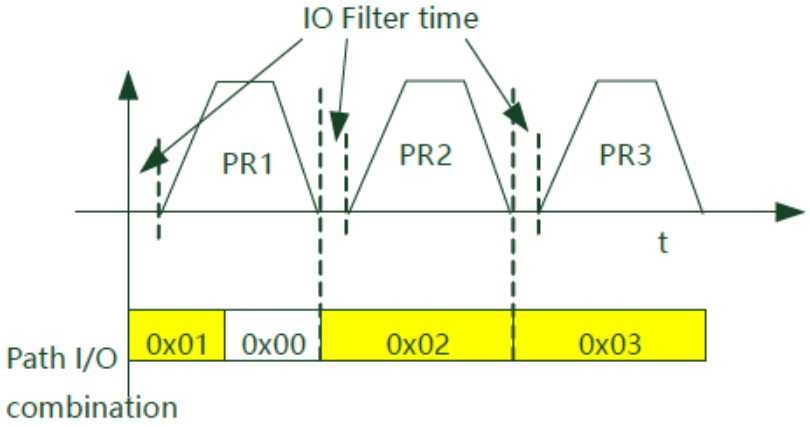
S-code	Sx.H		Sx.L	
Bit	15	8-14	7	0-6
Description	S-code valid when completed. 0: Invalid, retain previous value 1: Valid	S-code upon completion	S-code valid upon activation 0: Invalid 1: Valid	S-code upon activation



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

I/O trigger

Path motion trigger: Edge trigger/combination trigger(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->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
【0】	Disable I/O combination trigger mode. Uses I/O CTRG signal edge trigger.
1	Enable I/O combination trigger. Valid when HOME-OK signal is valid.
2	Enable I/O combination trigger. HOME-OK signal not required.

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

<table>
<tr><th>Parameter</th><th>Label</th><th>Description</th></tr>
<tr><td>Pr5.29</td><td>Communication mode</td><td>485 communication mode data
<table>
<tr><th>Value</th><th>Bit</th><th>Checksum</th><th>Stop</th></tr>
<tr><td>0</td><td>8</td><td>Even</td><td>2</td></tr>
<tr><td>1</td><td>8</td><td>Odd</td><td>2</td></tr>
<tr><td>2</td><td>8</td><td>Even</td><td>1</td></tr>
<tr><td>3</td><td>8</td><td>Odd</td><td>1</td></tr>
<tr><td>4</td><td>8</td><td>Null</td><td>1</td></tr>
<tr><td>【5】</td><td>8</td><td>Null</td><td>2</td></tr>
</table></td></tr>
<tr><td>Pr5.30</td><td>Baud rate</td><td>To set communication speed of RS485 communication
<table>
<tr><th>Value</th><th>Baud rate</th><th>Value</th><th>Baud rate</th></tr>
<tr><td>0</td><td>2400bps</td><td>【4】</td><td>38400bps</td></tr>
<tr><td>1</td><td>4800bps</td><td>5</td><td>57600bps</td></tr>
<tr><td>2</td><td>9600bps</td><td>6</td><td>115200bps</td></tr>
<tr><td>3</td><td>19200bps</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Pr5.31</td><td>ID</td><td>Modbus slave ID address</td></tr>
<tr><td>Pr8.02</td><td>PR trigger</td><td>
<table>
<tr><th>Attribute</th><th>Index</th><th>Description</th></tr>
<tr><td>Write</td><td>0x01P</td><td>N path positioning</td></tr>
<tr><td>Write</td><td>0x020</td><td>Reset</td></tr>
<tr><td>Write</td><td>0x021</td><td>Manually set currently position as 0 (Origin)</td></tr>
<tr><td>Write</td><td>0x040</td><td>Emergency stop</td></tr>
<tr><td>Read</td><td>0x000P</td><td>Positioning completed. Ready to receive new data</td></tr>
<tr><td>Read</td><td>0x01P,
0x020,
0x040</td><td>Yet to respond to command</td></tr>
<tr><td>Read</td><td>0x10P</td><td>Path motion undergoing</td></tr>
<tr><td>Read</td><td>0x200</td><td>Command completed. Waiting for positioning</td></tr>
</table></td></tr>
</table>

PR mode communication address:
Class 8 parameters: 0x6000+(Param-ID-800). For example Pr8.06: 0x6000+(806-800)=0x6006
Class 9 parameters: 0x6200+(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	

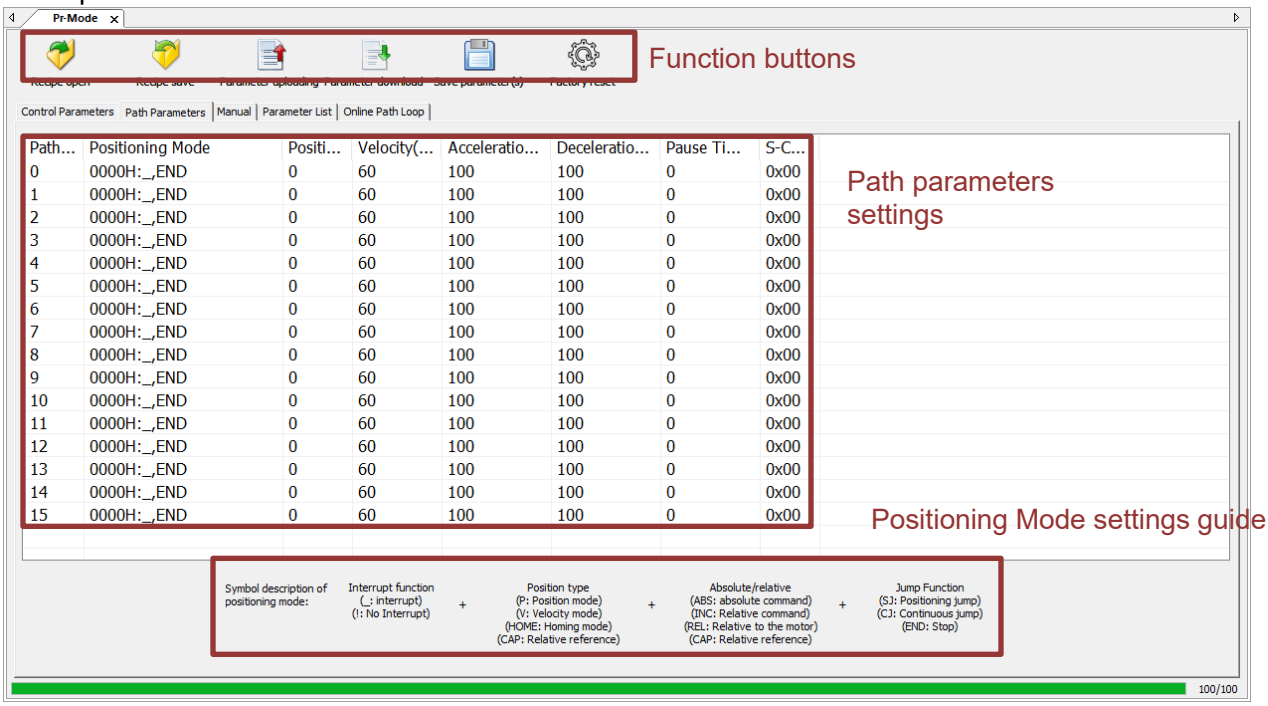
Slave response frame byte data

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

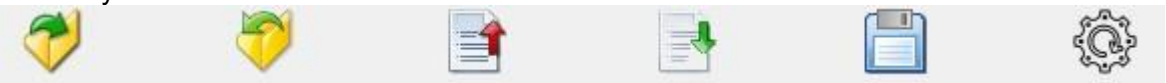
8.5.1 Trigger using physical I/O

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：

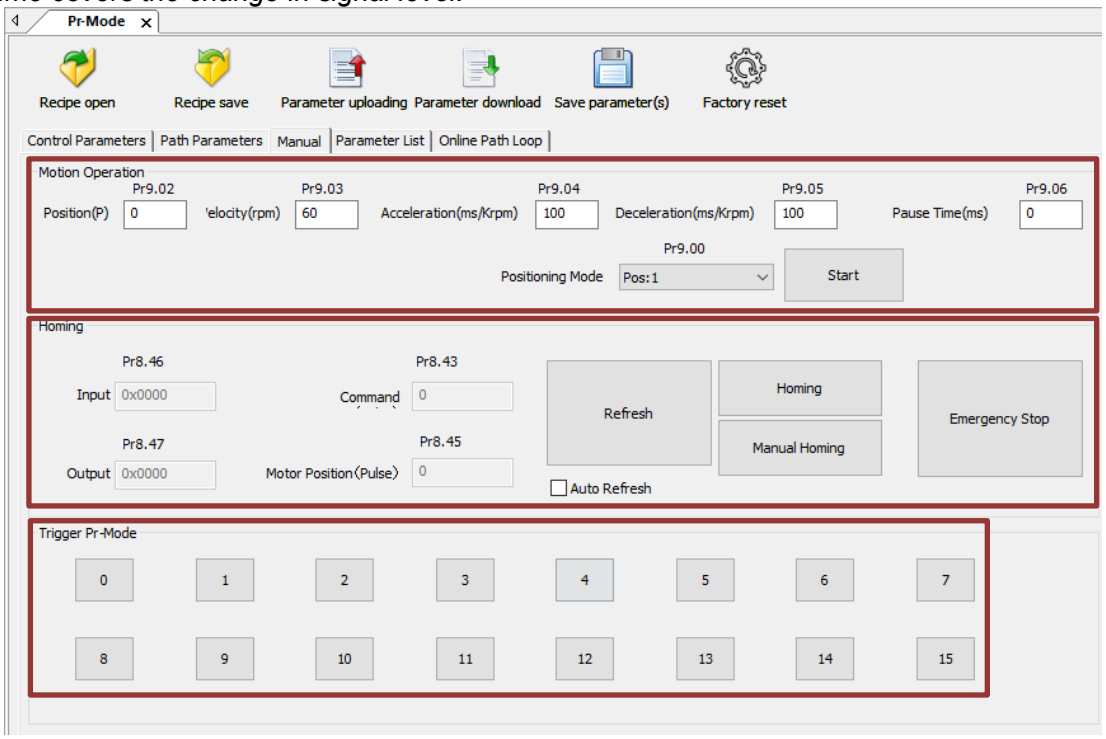


Path...	Positioning Mode	Positi...	Velocity(...	Acceleratio...	Deceleratio...	Pause Ti...	S-C...
0	0000H:_,END	0	60	100	100	0	0x00
1	0000H:_,END	0	60	100	100	0	0x00
2	0000H:_,END	0	60	100	100	0	0x00
3	0000H:_,END	0	60	100	100	0	0x00
4	0000H:_,END	0	60	100	100	0	0x00
5	0000H:_,END	0	60	100	100	0	0x00
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

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



Parameters: Set PR path related parameters here
Descriptions: Short explanation on each PR path motion types
Remember to upload parameters to drive and save to drive after parameters setup.
4. Set up homing, trigger, I/O in PR mode as shown below:
***Please select required path when using edge trigger. Make sure the corresponding path is chosen in I/O path selection*
**Please set up I/O combination filter time when using I/O combination trigger. Make sure I/O signal filter time covers the change in signal level.*



This page is divided into 3 parts:
Motion Operation: To set up parameters for Path 0. Click on “Start” and parameters will be automatically uploaded to driver
Homing: I/O and position display; Homing and emergency stop button
Trigger Pr-Mode: To trigger operation of any of the 16 PR paths.

8.5.2 Control using 485 communication

485 communication data frame format

Byte(x)	0	1	2	3	4	5	6	7
Definition	ID	Function code	Addr. High 8-bit	Addr. Low 8-bit	Data High 8-bit	Data Low 8-bit	CRC checksum Low 8-bit	CRC checksum High 8-bit

Please refer to Modbus communication in Chapter 7 to use Word function code writing. The request and respond frame data format is similar.

1. Set PR0 to travel to absolute position = 200000 (10000 pulse/rev)

No.	485 communication data frame	Description
1	01 06 62 00 00 01 57 B2	Set PR0 mode as absolute position
2	01 06 62 01 00 03 87 B3	Set PR0 position high bit
3	01 06 62 02 0D 40 32 D2	Set PR0 position low bit
4	01 06 62 03 02 58 66 E8	Set PR0 velocity
5	01 06 62 04 00 32 56 66	Set PR0 acceleration
6	01 06 62 05 00 32 07 A6	Set PR0 deceleration
7	01 06 60 02 00 10 37 C6	Trigger PR0 motion
8	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

2. Set PR0 to travel relative distance = 10000 (10000 pulse/rev)

No.	485 communication data frame	Description
1	01 06 62 00 00 41 56 42	Set PR0 mode as relative position
2	01 06 62 01 00 00 C7 B2	Set PR0 position high bit
3	01 06 62 02 27 10 2D 8E	Set PR0 position low bit
4	01 06 62 03 02 58 66 E8	Set PR0 velocity
5	01 06 62 04 00 32 56 66	Set PR0 acceleration
6	01 06 62 05 00 32 07 A6	Set PR0 deceleration
7	01 06 60 02 00 10 37 C6	Trigger PR0 motion
8	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

3. Set PR0 as velocity mode with velocity = 600rpm

No.	485 communication data frame	Description
1	01 06 62 00 00 02 17 B3	Set PR0 as velocity mode
2	01 06 62 03 02 58 66 E8	Set PR0 velocity
3	01 06 62 04 00 32 56 66	Set PR0 acceleration
4	01 06 62 05 00 32 07 A6	Set PR0 deceleration
5	01 06 60 02 00 10 37 C6	Trigger PR0 motion
6	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

4. Set PR1 to travel to absolute position = 200000 (10000 pulse/rev)

No.	485 communication data frame	Description
1	01 06 62 08 00 01 D6 70	Set PR1 mode
2	01 06 62 09 FF FC 07 C1	Set PR1 position high bit
3	01 06 62 0A F2 C0 F3 40	Set PR1 position low bit
4	01 06 62 0B 02 58 E7 2A	Set PR1 velocity
5	01 06 62 0C 00 32 D7 A4	Set PR1 acceleration
6	01 06 62 0D 00 32 86 64	Set PR1 deceleration
7	01 06 60 02 00 11 F6 06	Trigger PR1 motion
8	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

5. Set PR1 as velocity mode with velocity = 300rpm

No.	485 communication data frame	Description
1	01 06 62 08 00 02 96 71	Set PR1 as velocity mode
2	01 06 62 0B 01 2C E7 FD	Set PR1 velocity
3	01 06 60 02 00 11 F6 06	Set PR1 acceleration
4	01 06 62 0C 00 32 D7 A4	Set PR1 deceleration
5	01 06 62 0D 00 32 86 64	Trigger PR1 motion
6	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

6. Homing

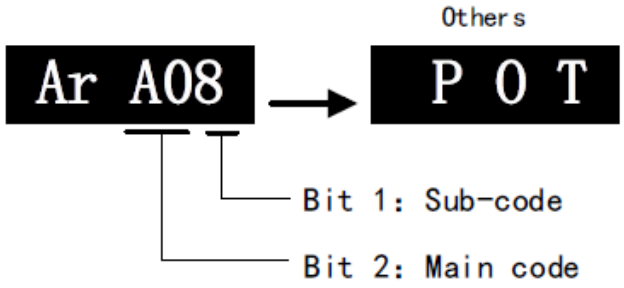
No.	485 communication data frame	Description
1	01 06 60 0A 00 00 B7 C8	Set homing method
2	01 06 60 0F 00 64 A6 22	Set high homing velocity
3	01 06 60 10 00 1E 16 07	Set low homing velocity
4	01 06 60 02 00 20 37 D2	Trigger homing
5	01 06 60 02 00 40 37 FA	Send Emergency stop datagram when required

Chapter 9 Warning and Alarm

9.1 Servo drive warning

When warning occurs, driver will set protective function but **motor won't stop moving**. Error code will be displayed on the front panel.

Example of warning code:



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

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".

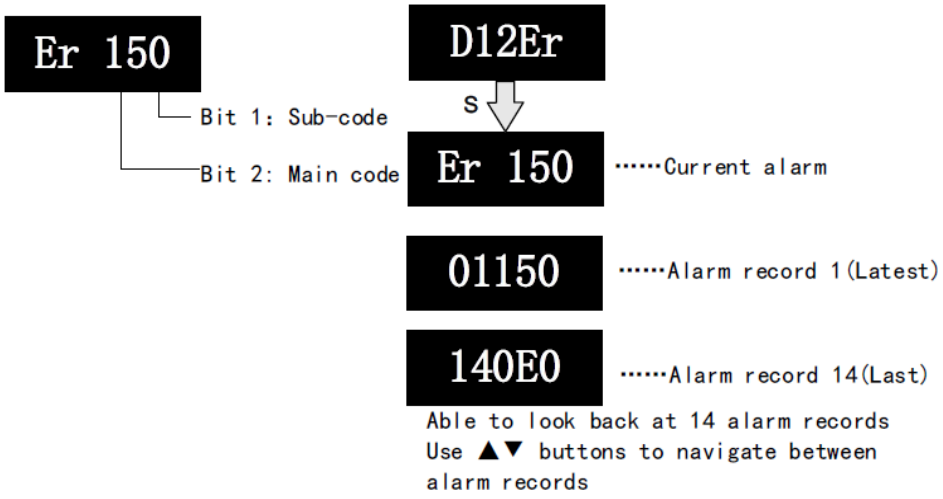
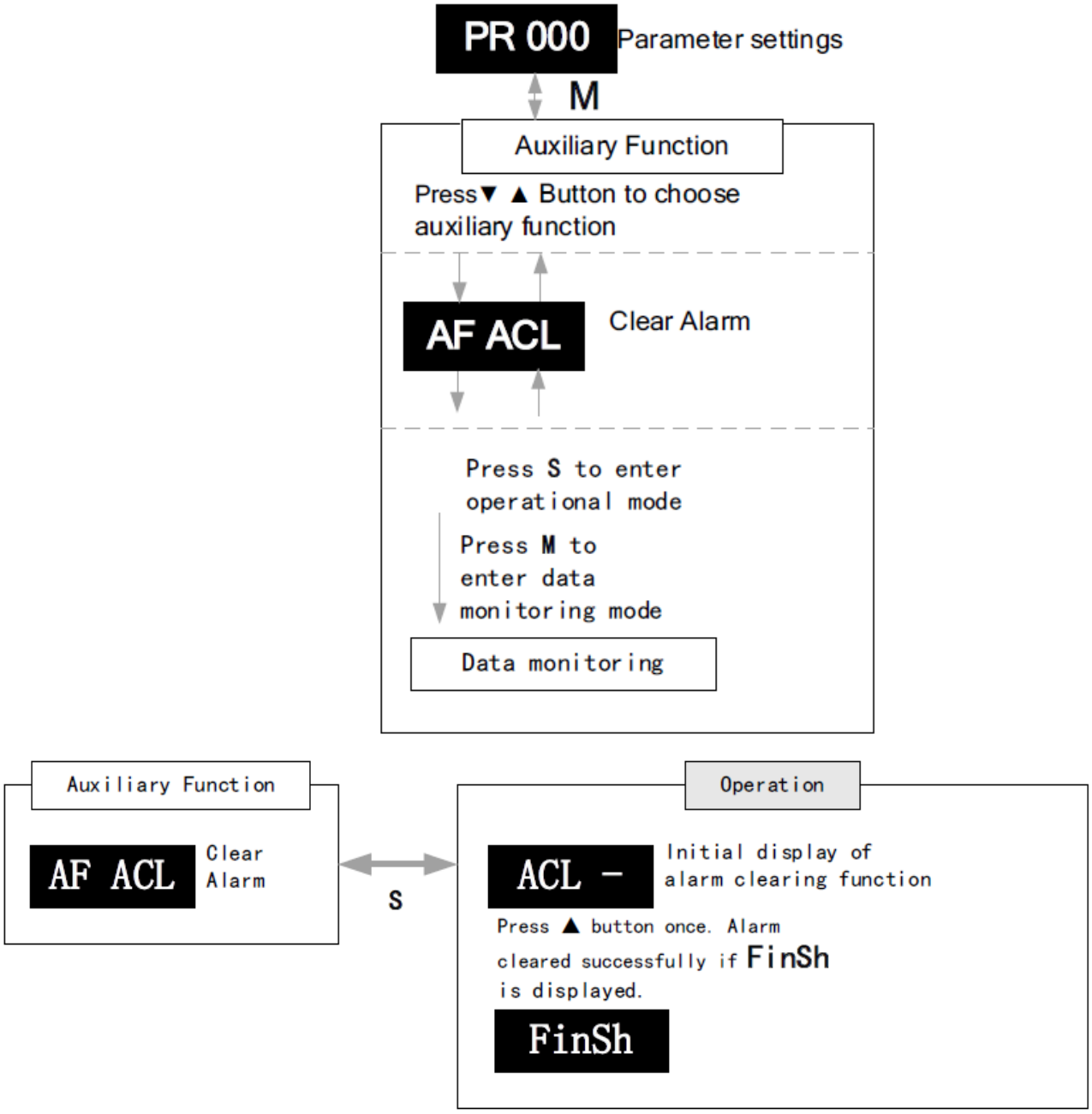


Table 9.1 Error Code List

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	●
	7	Encoder counter error	●	2	●
17	0	Encoder data error	●	1	
	1	Encoder parameter initialization error	●	1	
18	0	Excessive position deviation	●	2	●
	1	Excessive velocity deviation	●	2	●
19	0	Motor vibration too strong	●	2	●
	1	Excessive hybrid position deviation	●	1	●
1A	0	Overspeed	●	2	●
	1	Velocity out of control	●	1	●
1b	0	Bus input signal dithering	●	2	●
	1	Incorrect electronic gear ratio	●	2	●
	4	Excessive synchronous position command	●	2	●
21	0	I/O input interface assignment error	●	2	
	1	I/O input interface function assignment error	●	2	
	2	I/O output interface function assignment error	●	2	
24	0	CRC correction during EEPROM parameter saving		2	
	1	I2C communication status error		2	
	2	Error r/w alarm history record		2	
	3	Error r/w diagnostic data		2	
	4	Error r/w 402 parameters		2	
	5	Error r/w communication parameters		2	
25	0	Gantry deviation error	●	1	
	1	Gantry communication error	●	1	
26	0	Positive/Negative position limit triggered under non-homing mode	●	2	●
27	0	Analog 1 input overrun limit	●	2	●
	1	Analog 2 input overrun limit	●	2	●
	2	Analog 3 input overrun limit	●	2	●
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.*

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

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

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

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

Error code	Main	Sub	**Display:** "Er 0A5"	
	0A	5	**Content:** DC Bus error	
Cause			Diagnosis	Solution
L1, L2 terminal voltage too low			Verify L1, L2 terminal voltage. Check if power on indicator light on servo drive is on and d27 DC bus voltage.	Make sure L1, L2 terminal voltage is within recommended range

Error code	Main	Sub	Display: "Er 0A6"
	0A	6	**Content:** Temperature measuring error

Cause	Diagnosis	Solution
L1, L2 terminal voltage too low	Verify L1, L2 terminal voltage	Make sure L1, L2 terminal voltage is within recommended range

Error code	Main	Sub	Display: "Er 0b0"
	0b	0	**Content:** Control circuit power supply voltage too low

Cause	Diagnosis	Solution
Control circuit power supply voltage too low	Verify L1C, L2C terminal voltage; check if wiring connection is tight	Increase L1C, L2C terminal voltage; Tighten L1C, L2C terminal connection
Power supply under capacity	/	Increase power supply capacity for L1C, L2C terminals

Error code	Main	Sub	Display: "Er 0b1"
	0b	1	**Content:** Control circuit power supply abnormal

Cause	Diagnosis	Solution
USB power supply too low	Verify if USB cable is properly connected and not damaged.	Replace USB Type-C cable

Error code	Main	Sub	Display: "Er 0c0"
	0c	0	**Content:** DC bus overvoltage

Cause	Diagnosis	Solution
Main power supply overvoltage	Verify L1,L2,L3 terminal voltage	Decrease main power supply voltage
Acceleration/deceleration time too short	Verify if the time is actually too short	Increase the duration time or change to a regenerative resistor with higher resistance.
Regenerative brake parameter anomaly	Verify Pr7.32/Pr7.33	Modify vent overload parameter
Inner brake circuit damaged	/	Replace driver

Error code	Main	Sub	Display: "Er 0d0"
	0d	0	**Content**: DC bus undervoltage

Cause	Diagnosis	Solution
Main power supply undervoltage	Verify L1,L2,L3 terminal voltage	Increase main power supply voltage
L1C, L2C connected when USB cable is connected	Control circuit power on before driver initialization. Alarm might occur.	Please disconnect the USB cable before powering on control circuit.

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

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

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

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

Error code	Main	Sub	Display: "Er 0E2"
	0E	2	**Content**: Power output to motor shorted to ground
Cause			Diagnosis	Solution
Driver U, V, W terminals shorted to ground			Disconnect motor power cable and check for short circuit between driver UVW and PE	1. Reconnect wiring. 2. Change motor power cable.
Motor shorted to ground			Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is in the range of MegaOhm (MΩ)	Replace motor

Error code	Main	Sub	Display: "Er 0E4"
	0E	2	**Content**: Phase overcurrent
Cause			Diagnosis	Solution
Driver U, V, W terminals shorted to ground			Disconnect motor power cable and check for short circuit between driver UVW and PE	1. Reconnect wiring. 2. Change motor power cable.
Motor shorted to ground			Connect motor power cable to driver power output. Verify if resistance value of UVW to PE is equal and if there is short circuit	Replace motor

Error code	Main	Sub	Display: "Er 0F0"
	0F	0	**Content**: Driver overheated
Cause			Diagnosis	Solution
Temperature of power module exceeded upper limit			Measure the temperature of driver radiator.	1. Improve cooling condition. Please check installation guide; 2. Replace driver and motor with higher power rating; 3. Increase duration time for acceleration and deceleration; 4. Decrease load

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

Error code	Main	Sub	Display: "Er 101"
	10	1	**Content:** Driver overloaded

Cause	Diagnosis	Solution
Motor power cable wiring error	UVW terminals wiring error	Make sure motor power cable wiring connection is correct
Motor not matched	Motor current is too high	Motor rated current is higher than driver rated current. Please change to a driver with higher rated current.

Error code	Main	Sub	Display: "Er 102"
	10	2	**Content:** Motor rotor blocked

Cause	Diagnosis	Solution
Motor rotor blocked	Look for mechanical blockages	Check the machinery
Motor rotor blocking time threshold value too low	Verify value of Pr6.57	Adjust value of Pr6.57

Error code	Main	Sub	Display: "Er 120"	
	12	0	**Content:** Regenerative resistor overvoltage	
Cause			Diagnosis	Solution
Regenerative energy exceeded capacity of regenerative resistor			1. Verify if velocity is too high 2. Verify if load is too large	1. Decrease motor rotational velocity; 2. Decrease load inertia; 3. Add an external regenerative resistor;
Power supply voltage too high			1. Verify if power supply voltage is within the rated range. 2. Interval regenerative resistor value is too low	1. Decrease power supply voltage 2. Increase regeneration resistance value(add external regenerative resistor)
Unstable power supply voltage			Verify if power supply voltage is stable	Add a surge suppressor to main power supply.
Regenerative energy discharge circuit damaged			/	1. Add an external regenerative resistor; 2. Replace driver

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

Error code	Main	Sub	Display: "Er 122"
	12	2	**Content:** Regenerative resistor value too low

Cause	Diagnosis	Solution
External regenerative resistor value is less than the minimum value allowed by the drive	/	Replace the regenerative resistor with the right resistance value which meets the specification of the driver

Error code	Main	Sub	Display: "Er 150"
	15	0	**Content:** Encoder disconnected

Cause	Diagnosis	Solution
Encoder cable disconnected	Verify encoder cable connection	Make sure encoder cable properly connected
Encoder cable wiring error	Verify if encoder wiring is correct	Reconnect encoder wiring
Encoder damaged	/	Replace motor
Encoder measuring circuit damaged	/	Replace driver

Error code	Main	Sub	Display: "Er 151"
	15	1	**Content:** Encoder communication error

Cause	Diagnosis	Solution
Encoder wire shielding layer is missing	Verify if encoder cable has shielding layer	Replace with standard encoder cable
Encoder cable wiring error	Verify if encoder wiring is correct	Reconnect encoder wiring
Encoder damaged	/	Replace motor

Error code	Main	Sub	Display: "Er 152"
	15	2	**Content:** Encoder initial position error

Cause	Diagnosis	Solution
Communication data abnormal	1. Verify if encoder power supply voltage is DC5V ± 5% ; 2. Verify if encoder cable and shielded 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 153"	
	15	3	**Content:** Multiturn encoder error	
Cause			Diagnosis	Solution
Initial use			Origin calibration not performed	Perform origin positioning and multiturn position initialization, calibrate the origin of coordinate system.
Encoder without multiturn absolute function used			Verify if encoder has multiturn absolute function	1. Replace the motor with a multiturn absolute encoder. 2. Set 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

Error code	Main	Sub	Display: "Er 154"	
	15	4	**Content:** Encoder parameter settings error	
Cause			Diagnosis	Solution
Absolute encoder mode is incorrectly set.			Verify if encoder has multi-turn absolute value function.	Modify absolute encoder mode settings

Error code	Main	Sub	Display: "Er 155"	
	15	5	**Content:** Encoder data overflow	
Cause			Diagnosis	Solution
Encoder data overflow			Verify if encoder is not damaged	Initialize multiturn data
Absolute value applications, motor rotates in one direction			Verify if encoder is not damaged	Adjust absolute value application mode, set to turntable mode

Error code	Main	Sub	Display: "Er 156"	
	15	6	**Content:** Encoder overheated	
Cause			Diagnosis	Solution
The encoder temperature is too high.			Verify if motor temperature is too high	Reduce encoder temperature.

Error code	Main	Sub	Display: "Er 157"	
	15	7	**Content:** Encoder counter error	
Cause			Diagnosis	Solution
Encoder data overflow			Verify if encoder is not damaged	Initialize multiturn data
Absolute value applications, motor rotates in one direction			Verify if encoder is not damaged	Adjust absolute value application mode, set to turntable mode

Error code	Main	Sub	Display: "Er 170"
	17	0	**Content:** Encoder data error

Cause	Diagnosis	Solution
Communication data abnormal	1. Verify if encoder power supply voltage is DC5V ± 5% ; 2. Verify if encoder cable and shielded layer is not damaged; 3. Verify if encoder cable is close to high-powered power supply cable	1. Make sure encoder power supply voltage is stable 2. Make sure encoder cable is not damaged. 3. Make sure encoder cable shielded layer is grounded to frame 4. Make sure encoder cable is away from high-powered power supply cable
Encoder damaged	/	Replace motor
Encoder measuring circuit damaged	/	Replace driver

Error code	Main	Sub	Display: "Er 171"
	17	1	**Content:** Encoder parameter initialization error

Cause	Diagnosis	Solution
Driver and motor not matched	Verify driver and motor models.	Replace with matching driver and motor
Error while getting parameters from encoder	1. Verify if encoder cable is standard. 2. Verify if encoder has no peeled insulator, broken connection or improper contact.	Use standard encoder cable, verify the connection of both sides of driver and motor, change encoder cable if necessary

Error code	Main	Sub	Display: "Er 180"
	18	0	**Content:** Excessive position deviation

Cause	Diagnosis	Solution
Improper position deviation settings	Verify if value of Pr_014 is too low	Increase value of Pr_014
Position gain setting too low	Verify if values of 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

Error code	Main	Sub	Display: "Er 181"
	18	1	**Content:** Excessive velocity deviation

Cause	Diagnosis	Solution
Deviation between set velocity and actual velocity is too great	Verify if value of 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

Error code	Main	Sub	Display: "Er 190"
	19	0	**Content:** Vibration too strong

Cause	Diagnosis	Solution
Resonance	Mechanical stiffness is too high, resonance occurs	Reduce mechanical stiffness or use filter
Current loop gain too large	Verify current loop gain value	Reduce current loop gain

Error code	Main	Sub	Display: "Er 191"
	19	1	**Content:** Excessive hybrid position deviation

Cause	Diagnosis	Solution
Driver UVW terminal output single phasing or wiring error	Verify if UVW terminal wiring connection is right	Make sure UVW terminals are correctly connected to UVW of motor; change motor power cable.
Motor rotor blocked	Look for mechanical blockages	Check the machinery
Driver stiffness too low	Verify if position loop and velocity loop gain is too low	Increase position loop and velocity loop gain

Error code	Main	Sub	Display: "Er 1A0"
	1A	0	**Content:** Overspeed

Cause	Diagnosis	Solution
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;

Error code	Main	Sub	Display: "Er 1A1"
	1A	1	**Content:** Velocity out of control

Cause	Diagnosis	Solution
Motor velocity out of control, Excessive velocity error	Verify encoder phase sequence; Verify if UVW cable is connected to the right terminal	Reconnect UVW if wrongly connected. If still remains unsolved, please contact technical support.

Error code	Main	Sub	Display: "Er 1b0"
	1b	0	**Content:** Bus input signal dithering

Cause	Diagnosis	Solution
Controller synchronization dithering	/	Increase alarm threshold value

Error code	Main	Sub	Display: "Er 1b1"
	1b	1	**Content:** Incorrect electronic gear ratio

Cause	Diagnosis	Solution
Values out of range	Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

Error code	Main	Sub	Display: "Er 1b4"
	1b	4	**Content:** Excessive synchronous position mode command

Cause	Diagnosis	Solution
Values out of range	Numerator or denominator is zero/Set values out of range	Reduce number of pulses per revolution

Error code	Main	Sub	Display: "Er 210"
	21	0	**Content:** I/O input interface assignment error

Cause	Diagnosis	Solution
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

Error code	Main	Sub	Display: "Er 211"
	21	1	**Content:** I/O input interface function assignment error

Cause	Diagnosis	Solution
Input signal assignment error	Verify values of Pr4.00-Pr4.09, Pr4.44-4.47	Set proper values for Pr4.00-Pr4.09, Pr4.44-4.47

Error code	Main	Sub	Display: "Er 212"
	21	2	**Content:** I/O output interface function assignment error

Cause	Diagnosis	Solution
Input signal assigned with two or more functions.	Verify values of 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

Error code	Main	Sub	Display: "Er 240"
	24	0	**Content:** CRC correction error during EEPROM parameter saving

Cause	Diagnosis	Solution
L1, L2 terminal voltage too low	Verify if L1, L2 terminal voltage too low	Make sure L1, L2 terminal voltage is within recommended range
Parameter saving anomaly	Save parameter again and restart	Save parameter again

Error code	Main	Sub	Display: "Er 260"
	26	0	**Content:** Positive/Negative position limit triggered under non-homing

Cause	Diagnosis	Solution
Positive/negative position limit triggered	Verify position limit signal	/

Error code	Main	Sub	Display: "Er 270" -- "Er 272"
	27	0~2	**Error description:** Analog input 1-3 out of range

Cause	Diagnosis	Solution
Analog value out of range	Verify if analog input value is out of range	Adjust analog input voltage

Error code	Main	Sub	Display: "Er 280"
	28	0	**Error description:** Output pulse frequency too high

Cause	Diagnosis	Solution
Frequency divided pulse output exceeds 1MHz	Verify if motor rotational speed and the number of frequency divided pulse output are too high	Reduce the number of frequency divided pulse output or reduce rotational speed

Error code	Main	Sub	Display: “ Er 570”	
	57	0	**Error description:** Forced alarm input valid	
Cause			Diagnosis	Solution
Forced alarm input signal occurred			Verify forced alarm input signal	Verify if the input wiring connection is correct

Error code	Main	Sub	Display: “Er 5F0”	
	5F	0	**Content:** Motor model no. detection error	
Cause			Diagnosis	Solution
Automatically detected motor doesn’t match set motor			/	Please contact our technical support

Error code	Main	Sub	Display: “Er 5F1”	
	5F	1	**Error description:** Driver power module detection error	
Cause			Diagnosis	Solution
Driver power rating not within range.			Restart driver	Please contact our technical support

Error code	Main	Sub	Display: “Er 600”	
	60	0	**Error description:** Main loop interrupted timeout	
Cause			Diagnosis	Solution
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

Error code	Main	Sub	Display: “Er 601”	
	60	1	**Error description:** Velocity loop interrupted timeout	
Cause			Diagnosis	Solution
Motor control loop calculation time overflow			Verify if encoder connection is and that the encoder cable is too not long (more than 20 meters)	Replace encoder cable if necessary
			Restart driver	Replace the drive with a new one

Error code	Main Extra	Sub	Display: “Er 700”	
	70	0	**Error description:** Encryption error	
Cause			Diagnosis	Solution
Encryption error during initialization upon power-on.			Restart driver	Please contact our technical support

Error code	Main	Sub	Display: "Er 890"	
	89	0	**Error description:** Homing error	
Cause			Diagnosis	Solution
1. Excess homing velocity 2. Homing mode is different from given signal 3. Sensor signal edge inconsistent			1. Verify if homing velocity is too high 2. Verify if homing mode is set correctly 3. Verify if sensor signal edge is consistent	1. Set an optimal homing velocity 2. Make sure sensor signal edge is consistent.
Inconsistent origin status			1. Homing acceleration/ deceleration is set too low 2. Electronic gear ratio is low which causes acceleration/ deceleration to be too low	1. If electronic gear ratio cannot be changed, please set a suitable 609A. 2. Increase electronic gear ratio

9.4 Alarm clearing

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.