RA3P/A Servo Driver Commissioning manual

Version: V1.1



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Safety Precautions

To prevent personal injuries and property damages, the following statement is made for the precautions to be followed, and the extents of injury and damage that may occur due to incorrect use of this product are distinguished and described.

Danger 	This symbol indicates relevant contents that are [very likely to cause death or serious injury].
Notice 	This symbol indicates relevant contents that are [very likely to cause injury or property damage].

Please use the following graphic symbols to describe the precautions to be followed.

	This graphic symbol indicates non-implementable contents.
	This graphic symbol indicates contents which must be implemented.
 Danger	Please be sure to follow the instructions in the user manual.
 Warning	Do not touch the power terminal before the CHARGE indicator light is off and within 5 minutes after turning off the power, as there is a risk of electric shock.
 Notice	Do not touch the heat sink as there is a risk of burns.
	The ground wire must be connected to the terminal indicated with this symbol.

	Danger	Dangers that may be caused
	Do not use the product in areas with water, environments with corrosive or flammable gases, or near-flammable substances.	Fire, electric shock, fault, damage
	Do not place combustible materials around the motor, driver, regeneration resistor, and dynamic brake resistor.	
	Do not use the product in areas with intense vibration and impact.	Electric shock, injury and fire
	Do not use the wires that have been soaked in oil or water.	Electric shock, fault, damage
	Do not place it around heating elements such as heater or large winding resistor.	Fire, fault
	Do not connect the motor directly to a commercial power supply.	
	Do not carry out the wiring and equipment operation with the wet hands.	Electric shock, injury and fire
	Do not touch the keyway (if any) at the shaft end of the motor with bare hands.	Injury
	Do not come into contact with the rotating parts of the running motor.	Injury
	Do not touch the motor, driver heat sink, regenerative resistor, or dynamic brake resistor during operation.	Burns, part damage
	Do not put your hands inside the driver.	Electric shock, fault and fire
	Do not damage the wires or subject them to excessive external forces, heavy pressure or clamping.	Electric shock, fault, damage
	Install it at a place with a small amount of dust and free from water and oil, etc.	Electric shock, fire, fault, damage
	Install the motor, driver and regenerative resistor on the non-combustible materials such as metal.	Fire
	Wiring operations must be carried out by electrical engineering professionals.	Electric shock
	Please refer to the manual for correct wiring.	Electric shock, injury, fault, damage
	The cable shall be properly connected, and the energized parts shall be effectively insulated through insulation materials.	Electric shock, fire, fault
	The ground wires of the driver and motor must be grounded.	Electric shock
	In the event of an earthquake, make proper arrangements and installations to prevent fire and personal injury.	Injury, electric shock, fire, fault, damage
	Provide an emergency stop circuit to stop operation and switch off power in case of emergency.	
	Install overcurrent protection, high temperature prevention, emergency stop devices, and electric leakage circuit breaker.	Electric shock, injury and fire
	Relevant safety confirmation must be carried out after an earthquake occurs.	
	Carry out the movement, wiring and inspection for the driver after switching off the power and leaving it for more than the time displayed on the equipment body, and ensuring that there is no risk of electric shock.	Electric shock

	Notice	Dangers that may be caused
	Do not grab the cable or motor shaft during handling.	Injury
	Do not drop or invert the product during handling and operation setting.	Injury, fault
	Do not stand on the product and do not place heavy objects on it.	Electric shock, injury, fault, damage
	Do not place any obstacle around the motor, driver and peripheral equipment that hinders ventilation.	Burns, fire
	Do not use the product in areas directly exposed to sunlight.	Injury, fire
	Do not block the heat release hole and do not place foreign matters.	Electric shock, fire
	Do not subject the product to strong impact.	Fault
	Do not subject the motor shaft to the strong impact.	Fault
	Do not frequently turn on or off the main power supply of the driver.	Fault
	Do not use the electromagnetic contactor on the main power supply side to operate and stop the motor.	
	Do not make extreme gain adjustments or changes. Ensure the stability during operation and action.	Injury
	Do not use the built-in brake of the motor as a method for stopping the load during operation.	Injury, fault
	After the power outage ends and the power is restored, do not approach the machine to avoid accidents when restarting.	Injury
	Never modify, disassemble, or repair the product on your own.	Fire, electric shock, injury, fault
	Install the product properly according to the equipment body quality and rated output of the product.	Injury, fault
	Abide by the specified installation methods and direction.	
	The lifting eye bolts of the motor shall only be used for motor handling rather than the machine handling.	Injury, fault
	Ensure that the surrounding temperature of the motor and driver is within the range of operating temperature and humidity.	Injury, fault
	The distance between the driver and other machines inside the control cabinet shall be set to the specified distance.	
	Please abide by the voltage specified.	Electric shock, injury and fire
	Connect the brake control relay in series with the immediate stop circuit breaker relay.	Injury, fault
	Install the safety devices to prevent internal braking, gearbox idling and locking, and leakage of lubricating grease.	Injury, damage and stain
	The motor and driver shall be used according to the specified combination.	Fault, fire
	Fix the motor during the test run and ensure it operates properly before installing it onto the relevant machines.	Injury
	In case of an error, please resolve the cause of the error and ensure safety before restarting.	Injury
	When the drive has a fault, please switch off the power supply on the driver side.	Fire
	When the product is not used for a long period, the power must be switched off.	Injury

1 List of Functions

Function	Content
Control mode switching	Servo driver position/speed/torque mode switching
Position control mode	The servo drive operates in the position control mode
Speed control mode	The servo drive operates in the speed control mode
Torque control mode	The servo drive operates in the torque control mode

2 Detailed Descriptions of Functions

2.1 Control Mode Selection

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P000A	Control Mode Selection	0-6	1	1	Shutdown setting	Effective immediately

When setting the first and second control modes to 3, 4 and 5, you can switch through the control mode selection input (C-MODE1).

When the C-MODE1 is effective: select the first control mode.

When the C-MODE1 is ineffective: Select the second control mode.

When setting the composite (the first, second and third) control mode to 6, you can switch through the combination of control mode selection input (C-MODE1, C-MODE2).

When C-MODE1 is effective: Select the position control mode.

When C-MODE1 is ineffective and C-MODE2 is effective: Select the speed control mode.

When C-MODE1 is ineffective and C-MODE2 is ineffective: Select the torque control mode.

Table 2.1 Control Mode Selection Description

Set value	Mode description		
	The first mode	The second mode	The third mode
0	Speed	——	——
1	Position	——	——
2	Torque	——	——
3	Torque	Speed	——
4	Speed	Position	——
5	Torque	Position	——
6	Torque	Speed	Position

2.2 Position Mode

Associated Parameters

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0501	Position command source selection	0-1	1	0	Shutdown setting	Effective immediately

When selecting the position control mode, select the source of the position command:

0: Pulse command;

1: Multi-segment position command given.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0502	Command pulse form	0-3	1	0	Shutdown setting	Next power-on

In the position control mode, set the form of external command pulse:

0: Pulse train+direction (positive logic);

1: Pulse train+ direction (negative logic);

2: A phase +B phase orthogonal pulse (4 frequency multiplications);

3: CW (reverse pulse sequence)+CCW (forward pulse sequence)

Refer to Figure 7.7 for a detailed schematic diagram of pulse command.

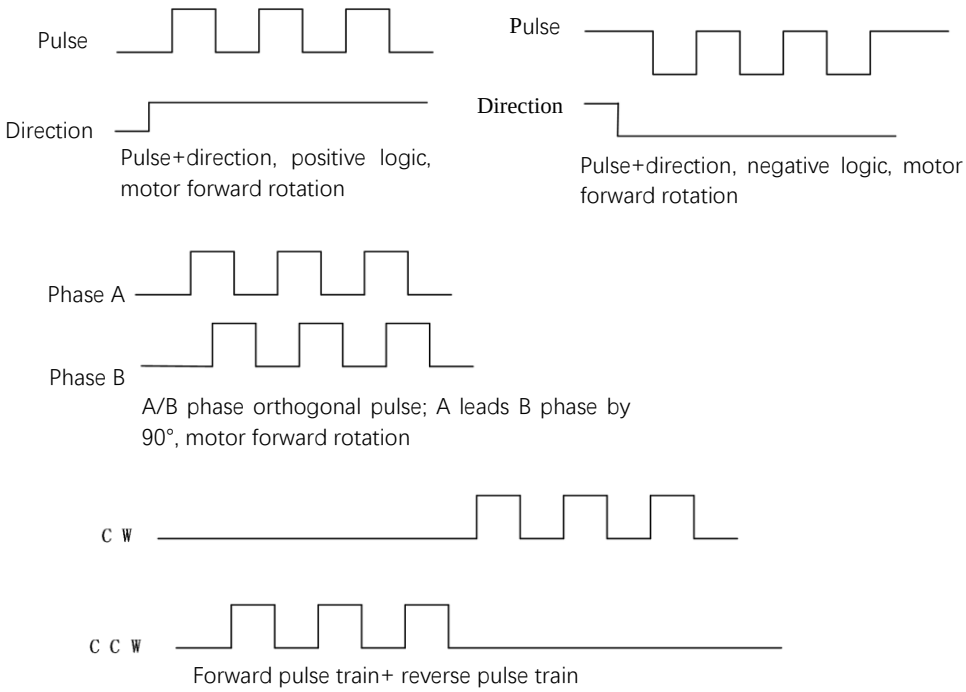


Figure 2.1 Position Command Pulse Output Form

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0503	Effective edge of command pulse	0-1	1	0	Setting at any time	Next power-on

When the position command is an external pulse, select the effective rising or falling edge of the pulse:

0: Falling edge effective;

1: Rising edge effective.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0505	Electronic gear ratio switching conditions	0-1	1	0	Shutdown setting	Effective immediately

The electronic gear switching function refers to the switching of two sets of electronic gears through DI input. When DI is ineffective, use the first set of electronic gears; when the DI is effective, use the second set of electronic gears (DI parameter: 9 GEAR-SEL electronic gear selection input).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0506	The number of command pulses per motor turn	0-1073741824	1P/Rev	0	Shutdown setting	Effective immediately

Set the number of required command pulses per motor turn.

When P0506=0, the electronic gear ratio parameters P0508/P050A/050C/050E and the electronic gear switching condition P0505 are effective;

When P0506 ≠ 0, the electronic gear ratio is equal to $\frac{\text{Encoder resolution}}{\text{P0506}}$, and the switching conditions for electronic gear ratio/electronic gear ratio 2/are ineffective. The encoder resolution is 2 ^ 23.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0508	Numerator of the first electronic gear	1-1073741824	1	8388608	Shutdown setting	Effective immediately

For the numerator of the first electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P050A	Denominator of the first electronic gear	1-1073741824	1	10000	Shutdown setting	Effective immediately

For the denominator of the first electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P050C	Numerator of the second electronic gear	1-1073741824	1	8388608	Shutdown setting	Effective immediately

For the numerator of the second electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P050E	Denominator of the second electronic gear	1-1073741824	1	10000	Shutdown setting	Effective immediately

For the denominator of the second electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0520	Positioning completion signal output condition	0-2	1	0	Setting at any time	Effective immediately

Set the output conditions for positioning completion and approaching signals, (DO parameter: 4-COIN position reaching output or 5-INP positioning approaching signal)

0: The absolute value of position deviation is less than P0521;

1: The absolute value of position deviation is less than P0521 and the position command is filtered to 0;

2: The absolute value of position deviation is less than P0521 and the position command is inputted as 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0521	Positioning completion value	1-65535	1	20	Setting at any time	Effective immediately

If the position deviation is less than this value, it is considered that the positioning is completed, and the DO output is activated (DO parameter: 4-COIN position reaching output).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0522	Positioning Approaching Value	1-65535	1	65535	Setting at any time	Effective immediately

If the position deviation is less than this value, it is considered that the positioning is close, and the DO output is activated (DO parameter: 5-INP positioning approaching signal).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0523	Excessive position deviation alarm value	1-1073741824	1	25165824	Setting at any time	Effective immediately

The position deviation alarm is an effective protection mechanism for the driver to perform position control; When the motor action does not match the command, abnormality can be detected to stop the motor from rotating;

Position deviation=position command - actual position (all in the encoder unit);

When the position deviation exceeds the "excessive position deviation alarm value", the driver will generate an alarm (alarm number 86.1), and the motor will stop rotating.

2.3 Speed Mode

Associated Parameters

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0601	Speed command selection	0-4	1	0	Shutdown setting	Effective immediately

Source of setting the speed command:
0-set speed command of parameter (P0604)
1-AI1 given speed command
2-AI2 given speed command
3- Internal multi-segment speed command
4-Communication given; speed command given by communication settings (P8912)

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0604	Given value of speed command	-10000/ 10000	r/min	100	Setting at any time	Effective immediately

When parameter P0601=0, the input speed is set by this value.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0606	DI jog speed value	0-10000	r/min	100	Read-only parameter	Effective immediately

When setting DI parameters (25 JOGCMD+forward jog input or 26 JOGCMD - reverse jog input), set the jog speed.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0608	Soft start acceleration time	0-65535	ms	0	Setting at any time	Effective immediately
Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0609	Soft start deceleration time	0-65535	ms	0	Setting at any time	Effective immediately

The soft start function refers to the specified acceleration and deceleration of the step speed command input, which is converted into a trapezoidal speed command, as shown in Figure 7.8.

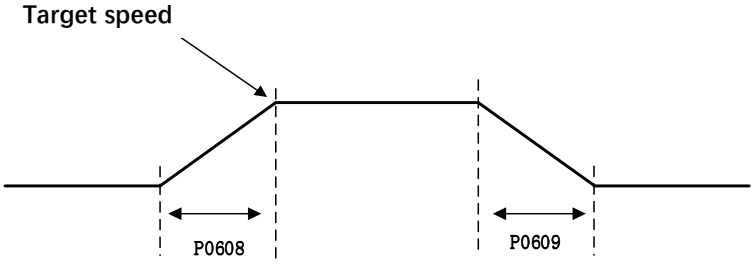


Figure 2.2 Soft Start Acceleration/Deceleration Time

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P060A	DI jog acceleration time	0-65535	ms	0	Setting at any time	Effective immediately

It is used to set the acceleration time for DI jog.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061A	Zero speed clamping level	0-10000	r/min	10	Setting at any time	Effective immediately

The zero speed clamping function refers to the locking of the motor shaft when the zero fixed signal (DI parameter: 8-ZCLAMP zero fixed enabling input) is effective and the speed command is less than P061A.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061B	Motor zero speed detection threshold	0-10000	r/min	10	Setting at any time	Effective immediately

If the absolute value of the motor speed is less than P61B, it is considered that the motor is stationary and outputs DO (DO parameter: 8-ZSP zero speed clamping detection signal, output signal).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061C	Rotation detection setting	0-1000	r/min	20	Setting at any time	Effective immediately

If the motor is rotating and the rotation speed is greater than P061C, it is considered that the motor is rotating (DO parameter: 9-TGON motor rotation output signal).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061D	The speed reaches the set value	10-10000	r/min	1000	Setting at any time	Effective immediately

When the absolute value of the motor speed is greater than P061D, a DO signal (DO parameter: 6-AT-SPEED speed reaching output) is outputted.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061F	Uniform speed setting	0-100	r/min	10	Setting at any time	Effective immediately

If the difference between the speed command and the motor speed is less than P061F, a DO signal (DO parameter: 7-V-COIN uniform speed output) is outputted.

2.4 Torque Mode

Associated Parameters

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0701	Torque command selection	0-3	1	0	Shut-down setting	Effective immediately

Torque command source:
0: Number given (P0704);
1: AI1 given torque;
2: AI2 given torque;
3: The communication is given by inputting speed commands through the communication method, with parameter P8914.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0704	Given value of torque command	-6000/6000	0.1%	0	Setting at any time	Effective immediately

When parameter P0701=0, the input torque is set through this value, and P0704=1000 represents the rated torque of the motor.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P070B	Speed limit setting	0-1	1	0	Setting at any time	Effective immediately

In the torque control mode, the motor will be controlled by the torque output, but the motor speed will not be controlled. If the input torque is greater than the mechanical load torque, the motor speed will be significantly increased. In this case, to protect the mechanical device, you need to limit the speed of the servo

motor. The speed limit setting in torque mode is as follows:

0: Internal speed limit (forward rotation P070D, reverse rotation P070E);

1: External analog input speed limit;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P070C	External speed limit - analog input	1-2	1	1	Setting at any time	Effective immediately

When P70B=1, you need to select the analog channel as the speed limit input:

1: Analog input channel 1 (AI1);

2: Analog input channel 2 (AI2);

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P070D	Internal forward speed limit value	0-10000	r/min	3000	Setting at any time	Effective immediately
P070E	Internal reverse speed limit value	0-10000	r/min	3000	Setting at any time	Effective immediately

When P070B=0, the above two parameters are used to set the speed limits in the torque mode.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P070F	Torque limit setting	0-2	1	0	Setting at any time	Effective immediately

0: Internal torque limit (P0711, P0712);

1: External torque limit (P0713, P0714);

2: Analog input torque limit;

3: External torque+analog input;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0710	Analog input torque limit	1-2	1	2	Setting at any time	Effective immediately

When P070F=2, select the analog channel as the torque limit input:

1: Analog input channel 1 (AI1);

2: Analog input channel 2 (AI2);

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0711	Internal forward torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately
P0712	Internal reverse torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately

When P070F=0, P0711 and P0712 serve as torque limits for forward/reverse rotation.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0713	External forward rotation torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately
P0714	External reverse rotation torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately

When P070F=1, torque limit is achieved through DI activation:

The DI parameter (14-P-ACL forward external torque limit input) is activated, and P0713 is used as the forward rotation torque limit;

The DI parameter (15-N-ACL reverse rotation external torque limit input) is activated, and P0714 is used as the reverse rotation torque limit;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

Parameter No.	Parameter name	Range of numeri-cal value	Unit	Factory default value	Setting method	Method to take effect
P0715	Torque reaching the reference value	0-6000	0.1%	0	Setting at any time	Effective immediately
P0718	Torque reaching the signal switching-on threshold	0-6000	0.1%	200	Setting at any time	Effective immediately
P0719	Torque reaching the signal switching-off threshold	0-6000	0.1%	100	Setting at any time	Effective immediately

The above three parameters are used to set whether the torque command is executed. When the actual torque command is within a certain range, DO will output an effective signal (DO parameter: 11-T-ARR torque command reaching signal). For detailed judgment logic, refer to Figure 2.4.

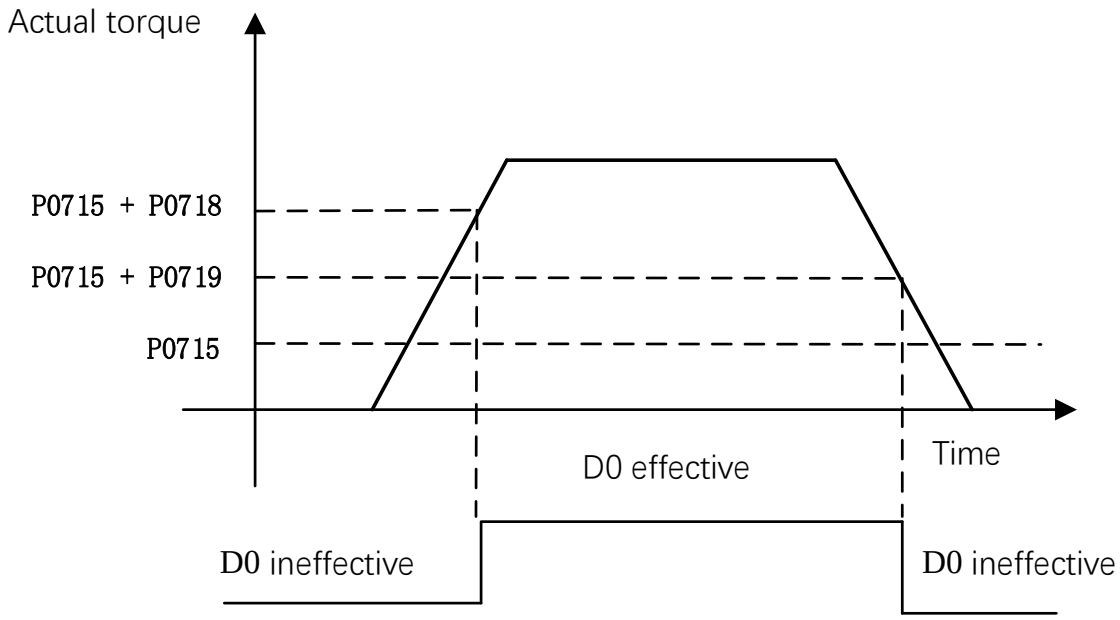


Figure 2.3 Torque Reaching Judgment Logic

2.5 Returning to Home Position

2.5.1 Introduction to Zeroing Function

The Raynen servo RA3A/P driver supports 35 zeroing modes defined in CIA402. For the zeroing design, please refer to the relevant documents of CIA402 (IEC61800-7-200/Ed1.0). For the specific zeroing mode action, you may refer to the introduction in Section 5.3.

2.5.2 Related Parameters

The prerequisite for zeroing is an enabling signal, and it is useless to only set the following signals.

Table 2.2 Related Parameters of Zeroing Function

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory de-fault value	
P1001	Zeroing parameter enabling (effective when P1003=1)	0-1	1	0: No action 1: Zeroing action enabled (effec-tive when P1003=1)	0	
P1002	Zeroing mode selection	1-35	1	Zeroing mode selection	1	
P1003	Zeroing start selection	0-1	0	0: DI terminal starts zeroing action 1: Set P1001=1 to start the zeroing action	0	
P1004	Power-on zeroed or not	0-1	1	0: Power-on does not trigger a zeroing action 1: Power-on triggers one zeroing	0	

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value	
				action		
P1005	Zeroing speed (high speed)	1-3000	rpm	Zeroing high speed setting	100	
P1006	Zeroing speed (low speed)	1-1000	rpm	Zeroing low speed setting	10	
P1007	Zeroing acceleration/ deceleration time	0-1000	ms	Zeroing acceleration/ deceleration time setting	1000	
P1008	Zeroing action timeout setting	0-65535	ms	Zeroing action timeout duration setting	50000	
P1009	Zeroing bias (lower bit)	0-0xFFFF	pulse	Zeroing action bias (lower 16 bits)	0	User unit
P100A	Zeroing bias (upper bit)	0-0xFFFF	pulse	Zeroing bias (upper 16 bits)	0	

Relevant DI function configuration:

Table 2.3 Zeroing Function Associated DI Setting

Parameter	Parameter name	Value setting	Unit	Factory default value	Setting method	Method to take effect
P0107	GDI-1 function allocation	4: Forward limit switch 5: Reverse limit switch 36: Home position switch 37: Zeroing action enabling	1	1	Setting at any time	Next power-on
P0109	GDI-2 function allocation			3	Setting at any time	Next power-on
P010B	GDI-3 function allocation			4	Setting at any time	Next power-on
P010D	GDI-4 function allocation			5	Setting at any time	Next power-on
P010F	GDI-5 function allocation			6	Setting at any time	Next power-on
P0115	HDI-1 function allocation			0	Setting at any time	Effective immediately
P0117	HDI-2 function allocation			0	Setting at any time	Effective immediately

Relevant DO function configuration:

Table 2.4 Zeroing Function Associated DO Setting

Parameter	Parameter name	Value setting	Unit	Factory default value	Setting method	Method to take effect
P0128	DO-1 function allocation	15: Zeroing action completion	1	1	Setting at any time	Effective immediately
P012A	DO-2 function allocation			2	Setting at any time	Effective immediately
P012C	DO-3 function allocation			3	Setting at any time	Effective immediately
P012E	DO-4 function allocation			4	Setting at any time	Effective immediately
P0130	DO-5 function allocation			0	Setting at any time	Effective immediately

2.5.3 Zeroing Mode Example

Take zeroing mode 1 as a routine

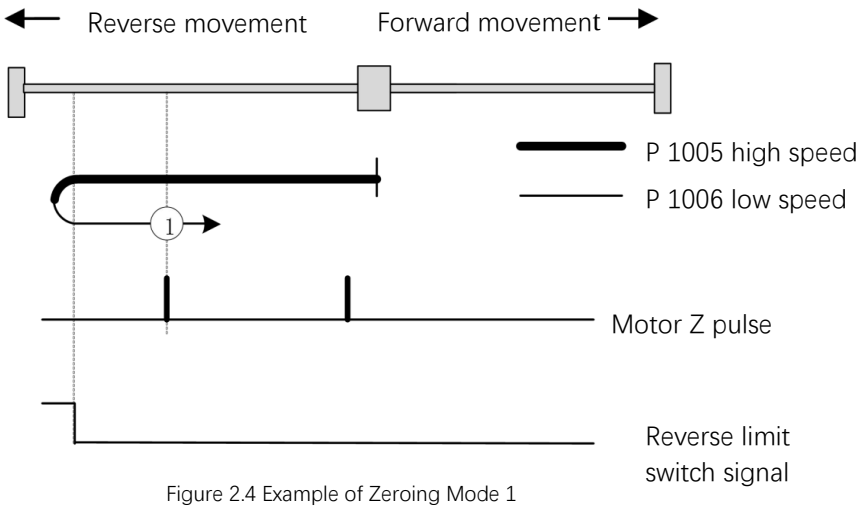


Figure 2.4 Example of Zeroing Mode 1

Operation procedure:

1) Set P1002=1, and the set zeroing mode is 1
2) Set P1003=0, and the DI terminal will start zeroing. Set:
   P0107=1 (GDI1 is the enabling signal)
   P010D=5 (GDI4 is the reverse rotation limit switch signal)
   P0113=37 (GDI7 is enabled for zeroing action)
   Set P0130=15 as DO5 output and zeroing will be outputted successfully.
3) After the effective electric level of GDI1 is connected externally, the excitation of the servo motor will be enabled.
4) When the GDI7 maintains an effective level externally, the zeroing action is effective and the motor will rotate reversely at the set high speed of P1005. The zeroing action is paused at the low electric level. When it becomes effective again, the zeroing action will be restarted.
5) When encountering an effective signal from the reverse limit switch during reverse movement, the motor will decelerate to 0 and rotate forward at the low speed set in P1006 to search for the motor Z signal.
6) After finding the first motor Z signal in the forward low-speed direction, it will stop and the zeroing action is completed. At this point, DO5 will output an effective level and maintain it until the next zeroing action starts.

2.5.4 Introduction to Zeroing Mode

The zeroing mode is set by the P1002 parameter. All zeroing modes are introduced below:

2.5.5 Zeroing Mode 1

Required DI signal: Reverse limit switch and motor encoder Z signal.
As shown in the diagram below, the reverse limit switch signal is ineffective at the start time, and it will start to move at a high speed reversely (P1005). When encountering the rising edge of the reverse limit switch, it will immediately de-celerate at the opposite direction. When moving forward at a low speed (P1006) , it will stop until it encounters the first Z signal.

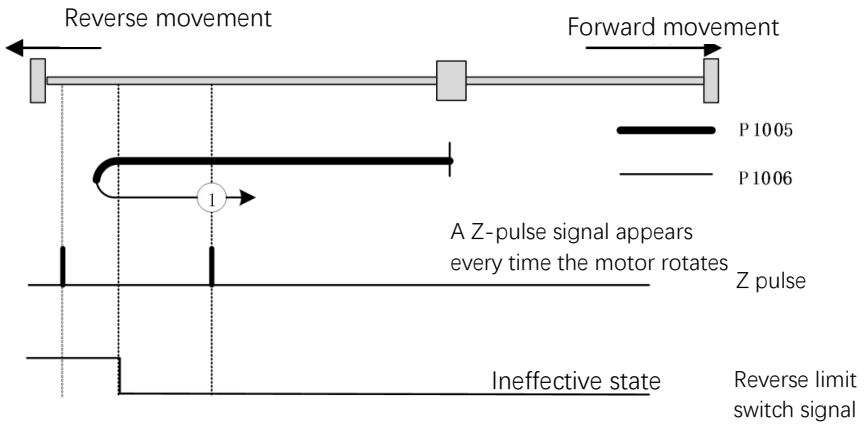


Figure 2.5 Zeroing Mode 1

2.5.6 Zeroing Mode 2

Required DI signal: forward limit switch and motor encoder Z signal.

As shown in the diagram below, the forward limit switch signal is ineffective at the start time, and it will start to move at a high speed forward (P1005). When encountering the rising edge of the forward limit switch, it will immediately decelerate at the opposite direction. When moving forward at a low speed (P1006) , it will stop until it encounters the first Z signal.

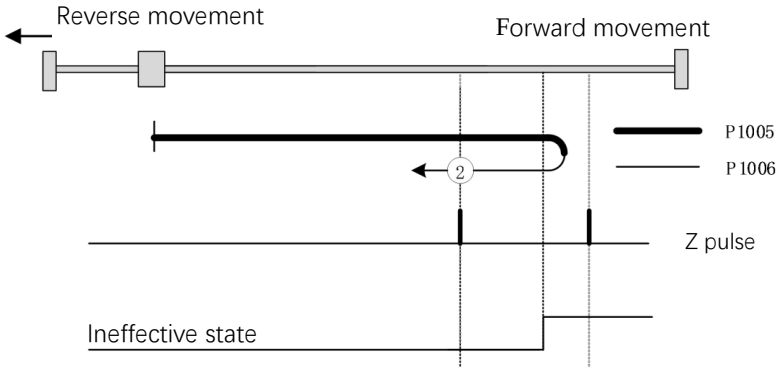


Figure 2.6 Zeroing Mode 2

2.5.7 Zeroing Mode 3 or 4

Required DI signal: Home position switch and motor encoder Z signal.

Zeroing Mode 3:

- The home position switch signal is ineffective at the start time, and it will start to move at a high speed forward (P1005). When encountering the rising edge of the forward limit switch, it will immediately decelerate at the opposite direction. When moving reversely at a low speed (P1006) , it will continue to move after encountering the home position switch falling edge and will stop until encountering the first Z signal.
- The home position switch signal is effective (equal to 1) at the start time, and it will move reversely at a low speed (P1006) and continue to move after encountering the falling edge of the home position switch. It will stop until encountering the first Z signal.

Zeroing Mode 4:

- The home position switch signal is effective (equal to 0) at the start time, and it will start to move at a low speed forward (P1006) and continue to move after encountering the rising edge of the home position switch. It will stop until encountering the first Z signal.
- The home position switch signal is effective (equal to 1) at the start time, and it will start to move at a high speed reversely (P1005). When encountering the falling edge of the home position switch, it will immediately decelerate and move forward at a low speed (P1006) . It will continue to move after encountering the home position switch rising edge and will stop until encountering the first Z signal.

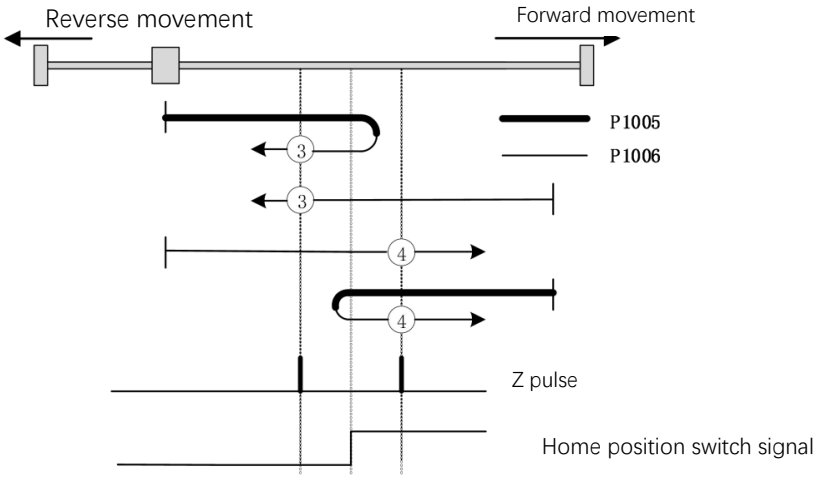


Figure 2.7 Zeroing Modes 3 and 4

2.5.8 Zeroing Mode 5 or 6

Zeroing Mode 5:

- The home position switch signal is effective (equal to 1) at the start time, and it will move forward at a low speed (P1006) and continue to move after encountering the falling edge of the home position switch. It will stop until encountering the first Z signal.
- The home position switch signal is ineffective (equal to 0) at the start time, and it will start to move at a high speed reversely (P1005). When encountering the rising edge of the home position switch, it will immediately decelerate and move reversely at a low speed (P1006). It will continue to move after encountering the home position switch falling edge and will stop until encountering the first Z signal.

Zeroing Mode 6:

- The home position switch signal is effective (equal to 1) at the start time, and it will move at a high speed forward (P1005). When encountering the falling edge of the home position switch, it will immediately decelerate and move reversely at a low speed (P1006) . It will continue to move after encountering the home position switch rising edge and will stop until encountering the first Z signal.
- The home position switch signal is effective (equal to 0) at the start time, and it will start to move at a low speed reversely (P1006) and continue to move after encountering the activated rising edge of the home position switch. It will stop until encountering the first Z signal.

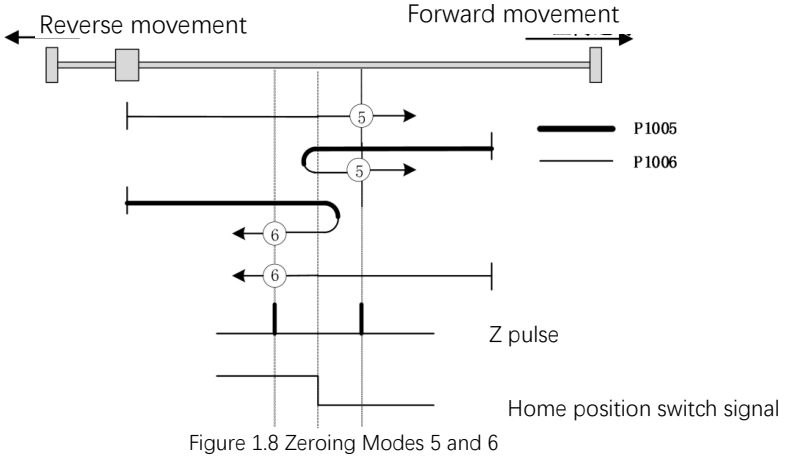


Figure 1.8 Zeroing Modes 5 and 6

2.5.9 Zeroing Modes 7 to 11

Zeroing Mode 7:

- The home position switch signal is ineffective (equal to 0) at the start time, and it will start to move at a high speed forward (P1005). When encountering the rising edge of the home position switch, it will immediately decelerate, move at the opposite direction and move reversely at a low speed (P1006). It will continue to move after encountering the home position switch falling edge and will stop until encountering the first Z signal.
- The home position switch signal is effective (equal to 1) at the start time, and it will move reversely at a low speed (P1006) and continue to move after encountering the falling edge of the home position switch. It will stop until encountering the first Z signal.
- The home position switch signal is ineffective (equal to 0) at the start time, and it will move at a high speed forward (P1005). When encountering the forward limit switch, it will immediately decelerate and move at the opposite direction. When moving reversely at a high speed (P1005) , it will move reversely at a low speed (P1006) after encountering the rising edge of the home position switch and will continue to move after encountering the home position switch falling edge and will stop until encountering the first Z signal.

Zeroing Mode 8:

- The home position switch signal is ineffective (equal to 0) at the start time. It will start to move at a high speed forward (P1005). When encountering the rising edge of the home position switch, it will immediately decelerate, move at the opposite direction and move reversely at a low speed (P1006). It will immediately decelerate and move at the opposite direction when encountering the falling edge of the home position switch. When it moves at a low speed forward (P1006), it will continue to move when encountering the rising edge of the home position switch and will stop until encountering the first Z signal.
- When the home position switch signal is effective (equal to 1) at the start time, it will move at a low speed reversely (P1006). When encountering the falling edge of the home position switch, it will move forward at a low speed (P1006) . It will continue to move after encountering the home position switch rising edge and will stop until encountering the first Z signal.
- When the home position switch signal is ineffective (equal to 0) at the start time, it will move at a high speed forward (P1005). When encountering the forward limit switch, it will immediately decelerate at the opposite direction. When moving reversely at a high speed (P1005) , it will move reversely at a low speed (P1006) after encountering the rising edge of the home position switch and will move immediately at a low speed (P1006) forward after encountering the home position switch falling edge. It will continue to move when encountering the rising edge of the home position and will stop until encountering the first Z signal.

Zeroing Mode 9:

- The home position switch signal is ineffective (equal to 0) at the start time. It will start to move at a high speed forward (P1005). When encountering the rising edge of the home position switch, it will immediately move forward at a low speed (P1006). It will immediately decelerate and move at the opposite direction when encountering the falling edge of the home position switch. When it moves at a low speed reversely (P1006), it will continue to move when encountering the rising edge of the home position switch and will stop until encountering the first Z signal.
- When the home position switch signal is effective (equal to 1) at the start time, it will move at a low speed forward (P1006). When encountering the falling edge of the home position switch, it will move reversely at a low speed (P1006). It will continue to move after encountering the home position switch rising edge and will stop until encountering the first Z signal.
- When the home position switch signal is ineffective (equal to 0) at the start time, it will move at a high speed forward (P1005). When encountering the forward limit switch, it will immediately decelerate at the opposite direction. When moving reversely at a high speed (P1005), it will move forward immediately at a low speed (P1006) after encountering the rising edge of the home position switch and will move immediately at a low speed (P1006) reversely after encountering the home position switch falling edge. It will continue to move when encountering the rising edge of the home position and will stop until encountering the first Z signal.

Zeroing Mode 10:

- The home position switch signal is ineffective (equal to 0) at the start time, and it will start to move at a high speed forward (P1005). When encountering the rising edge of the home position switch, it will immediately decelerate, and move forward at a low speed (P1006). It will continue to move after encountering the home position switch falling edge and will stop until encountering the first Z signal.
- The home position switch signal is effective (equal to 1) at the start time, and it will move forward at a low speed (P1006) and continue to move after encountering the falling edge of the home position switch. It will stop until encountering the first Z signal.
- The home position switch signal is ineffective (equal to 0) at the start time, and it will move at a high speed forward (P1005). When encountering the forward limit switch, it will immediately decelerate and move at the opposite direction. When moving reversely at a high speed (P1005), it will decelerate immediately and move forward at a low speed (P1006) after encountering the rising edge of the home position switch and will continue to move after encountering the home position switch falling edge and will stop until encountering the first Z signal.

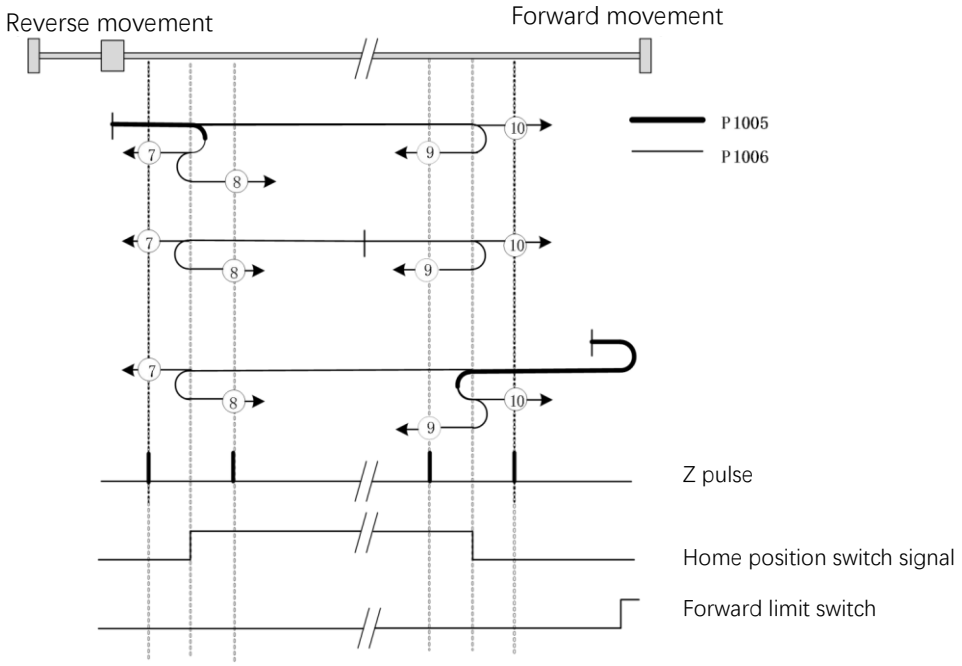


Figure 2.9 Zeroing Modes 7 to 10

2.5.10 Zeroing Modes 15/16/31/32

The zeroing modes 15/16/31/32 are reserved modes

2.5.11 Zeroing Modes 17 to 30

The zeroing modes 17 to 30 correspond similarly to zeroing modes1 to 14, except that there is no action to search for the Z signal in the zeroing actions of 17 to 30.

Example: when the zeroing modes 19 and 20 are compared with the zeroing modes 3 and 4, only the action of searching for the Z signal is omitted for modes 19 and 20.

Zeroing Mode 19:

- The home position switch signal is ineffective at the start time, and it will start to move at a high speed forward (P1005). When encountering the rising edge of the forward limit switch, it will immediately decelerate at the opposite direction. When moving reversely at a low speed (P1006) , it will stop until encountering the home position switch falling edge.

- The home position switch signal is effective (equal to 1) at the start time, and it will move reversely at a low speed (P1006) and will stop until encountering the falling edge of the home position switch.

Zeroing Mode 20:

- The home position switch signal is effective (equal to 0) at the start time, and it will start to move at a low speed forward (P1006) and will stop until encountering the rising edge of the home position switch.
- The home position switch signal is effective (equal to 1) at the start time, and it will start to move at a high speed reversely (P1005). When encountering the falling edge of the home position switch, it will immediately decelerate and move forward at a low speed (P1006) . It will stop until encountering the home position switch rising edge.

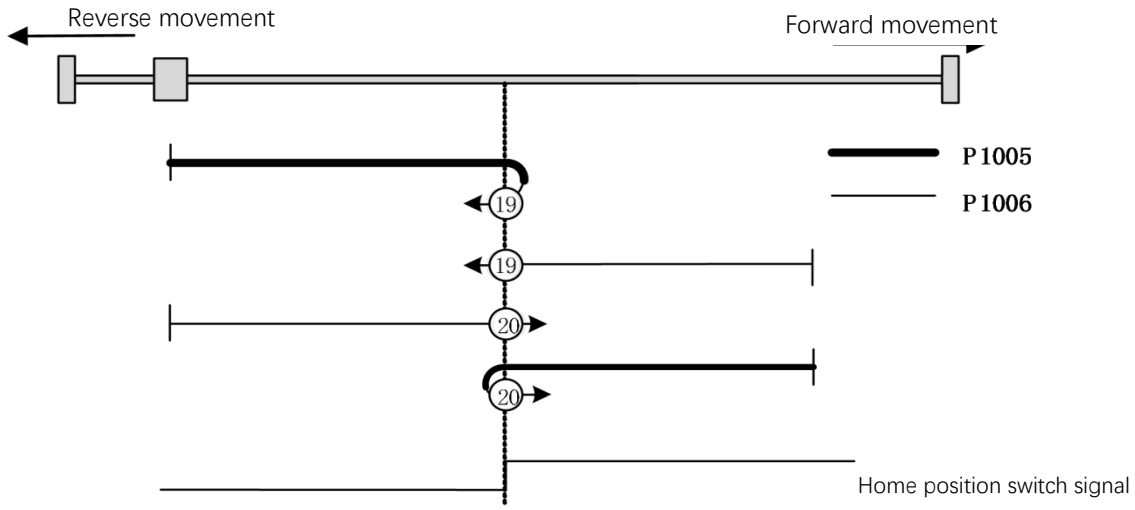


Figure 2.10 Zeroing Modes 19 and 20

2.5.12 Zeroing Modes 33 and 34

There is no home position switch or limit switch, and it simply rotates based on the current position to search for the nearest Z signal, which is the zero point.

- Zeroing mode 33: It moves reversely at a low speed (P1006), and will stop when encountering the first Z signal.
- Zeroing mode 34: It moves forward at a low speed (P1006), and will stop when encountering the first Z signal.

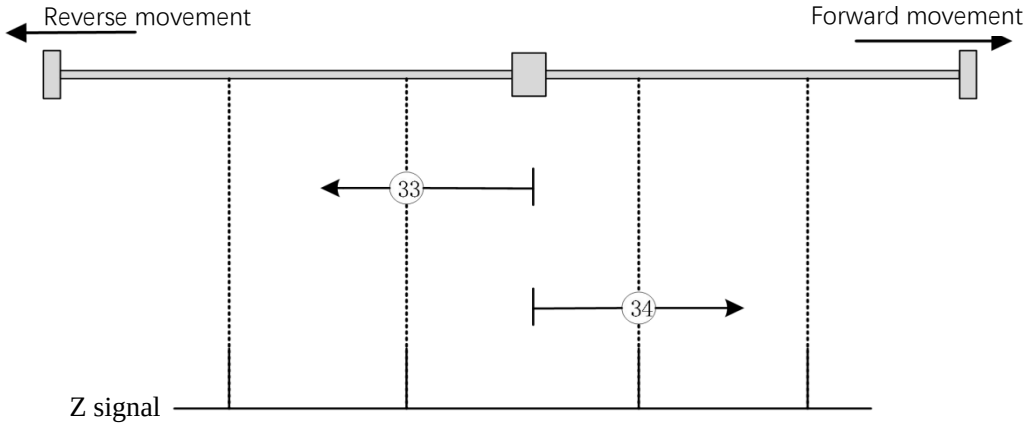


Figure 2.11 Zeroing Modes 33 and 34

2.5.13 Zeroing Mode 35

The DI does not need to be connected externally, and the current position is directly set to the zero position. When it returns to the zero position in this mode, the motor will not rotate, and the current actual position is equal to

the current value of the encoder (P100A+P1009).

3 Commissioning Tool

3.1 Introduction to Operation Panel

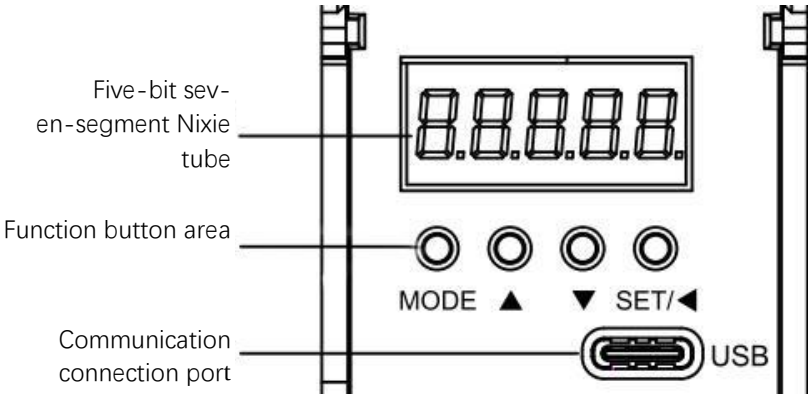


Figure 3.1 Panel Appearance Diagram

The RA3 servo driver panel consists of a display (5-bit 7-segment LED Nixie tube) and 4 function buttons. You can set various states, execute auxiliary functions, set relevant parameters, and monitor the servo actions through the panel operation device.

Table 3.1 Names and Operations of Panel Parts

Parameter name	Function	Action
Five-bit seven-segment Nixie tube	It is used to display the servo state, parameter values and set values	-
MODE	Switch modes, exit the current group code and exit the current parameter	Short press ≤ 0.8s
▲	Increase the numerical value of edited bit progressively	Short press ≤ 0.8s
	Increase the numerical value of edited bit continuously	Long press >0.8s
▼	Decrease the numerical value of edited bit progressively	Short press ≤ 0.8s
	Decrease the numerical value of edited bit continuously	Long press >0.8s
SET/◂	Short press=SHIFT: Move the edited bit (flashing)	Short press ≤ 0.8s
	Long press=SET: Enter the lower-level menu and set parameters	Long press >0.8s

3.2 Panel Display

Display Switching Method

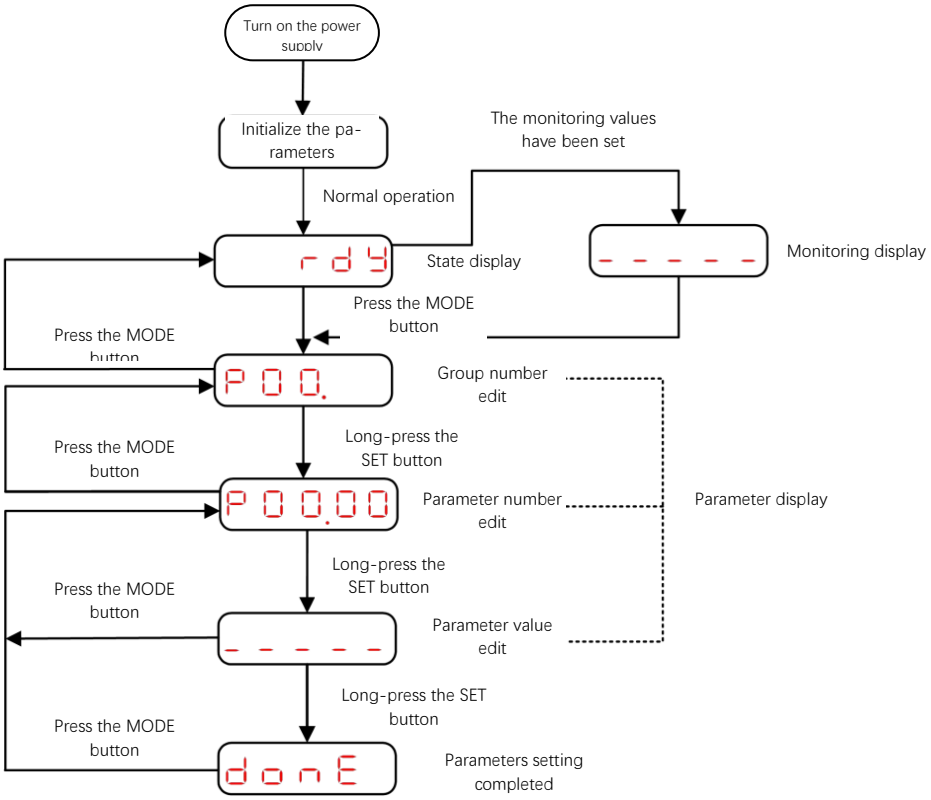


Figure 3.2 Schematic Diagram of State Switching Method

State Method

In the state display mode, the driver will update the current state on the Nixie tube. Figure 3.3 shows the internal state changes of the servo and the corresponding display of the Nixie tube after power-on.

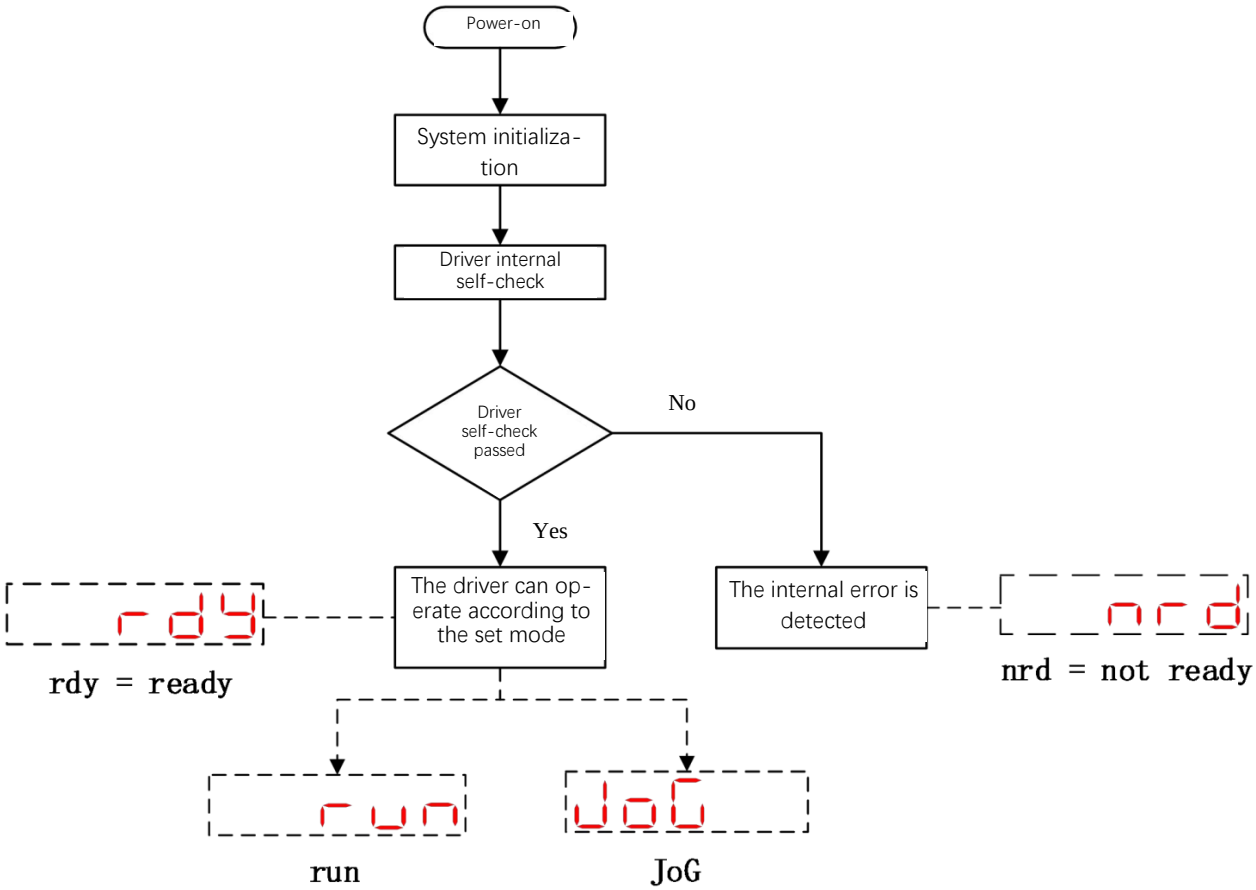
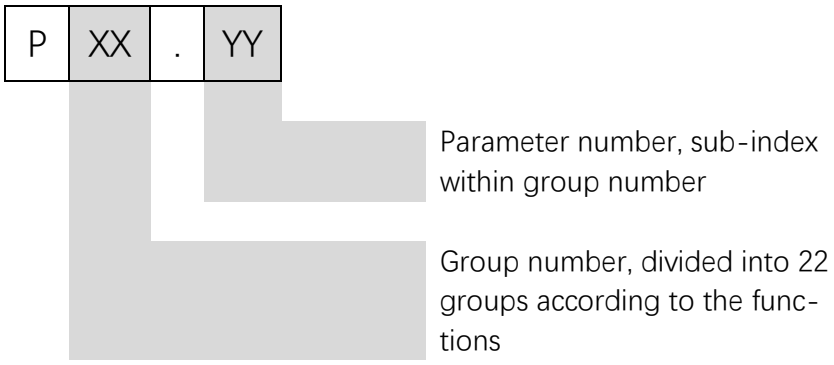


Figure 3.3 Servo State Displayed by Nixie tube

Parameter Number Display



Operation of Parameters Setting

Please modify the parameter settings with reference to "Figure 3.2 Schematic Diagram of State Switching Method". On the parameters setting interface, there is always a flashing bit on the Nixie tube, indicating that it is in an editable state. Short-press the SET button to switch between editing bits.

◆ Input and Display of Negative Number

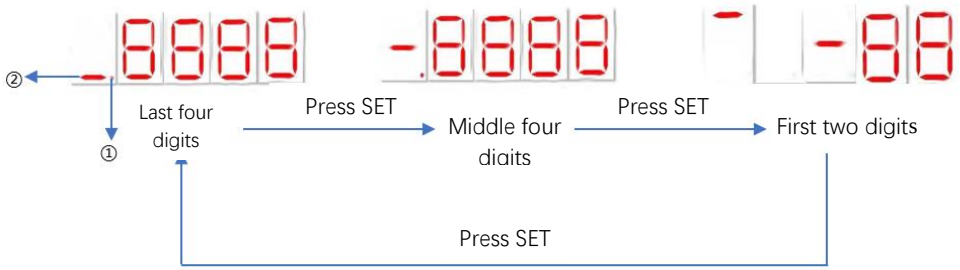
Example: For the parameter "P0604 speed command given value", long-press the SET button to enter the parameters editing interface. The setting method is as shown in the table below.

Table 3.2 Display of Positive/Negative Number on Nixie Tube

Display on Nixie tube	Explanation of parameter	Button operation method
1000	1000	Press the "UP/DOWN" button for numerical value modification, and press the "SET" button to switch the editable bits
-1000	-1000	Press the "UP/DOWN" button to modify the numerical value and press the "SET" button to switch the editable bits. When the Nixie tube displays "0000", press "DOWN" to input the negative numerical value

◆ Display of numerical value with more than 5 digits

The panel display can only display 5 digits, and can allow you to input up to 10 digits. Therefore, the set values for 6 digits or more are as shown below. (Assuming that you set: -88888888888).



Note: ①: Indicates a reverse value
② : Indicates the position of the

Figure 3.4 Display of Numbers with More than 5 Digits on Nixie Tube

◆ Display of Decimal Points

Table 3.3 Display of Decimal Points on Nixie tube

Display on Nixie tube	Numerical value	Explanation of parameter	Button operation method
002.00	2.00	Decimal number 2	None

The Nixie tube above shows the parameter P0139, indicating the actual time 2 ms. However, if the upper computer commissioning software is used to read this parameter, the value read is 200, and the unit of P0139 is 0.01ms. 200 x 0.01ms=2 ms.

◆ Display of Parameter with Unit of %

Table 3.4 Display of Parameter with Unit of % on Nixie Tube

Display on Nixie tube	Numerical value	Explanation of parameter	Button operation method
1.00	1.00	Decimal number 1	None

The Nixie tube above shows the parameter P0144, indicating the 1-time rated motor torque. However, if the upper computer commissioning software is used to read this parameter, the value read is 100, and the unit of P0144 is 1%. 100×1% = 1.

Monitoring display

If you need to monitor the state of parameter in the servo driver, there are two ways to choose from. Refer to Table 3.5.

Table 3.5 Two Forms of Monitoring Variable

Monitoring method	Operation method	Monitoring features
Monitoring multi-ple variables	Switch directly to the P09 parameter group through the parameters setting, and long-press the SET button according to the sub-index number to set the pa-rameters you want to monitor.	Every time you want to monitor variables, you need to set them; you can view any sub-index variable in the P09 group parameters at any time
Always monitoring a certain variable	Set the value in parameter P00.07 to be equal to the sub-index of group P09.	The variable state will always be displayed on the Nixie tube.

Monitoring multiple variables

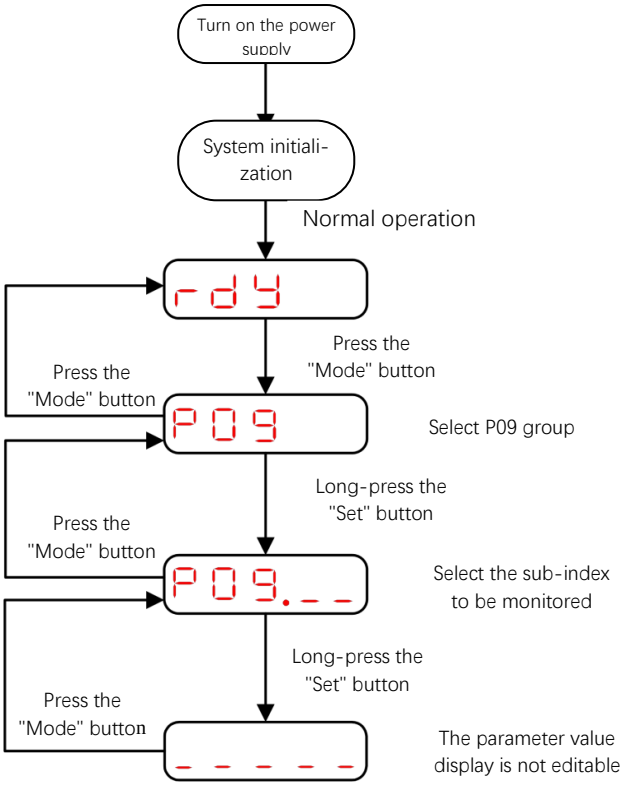


Figure 3.5 Flow Chart for Monitoring Multiple Variables

Notes:

- This monitoring method facilitates users to monitor multiple variables. For detailed data meanings in the P09 group, please refer to "Chapter 7 Detailed Description of Parameters";
- Switch the parameter number to monitor other variables;
- The parameter cannot be maintained after power outage, and the parameter needs to be reset.

Always Monitoring a Certain Variable

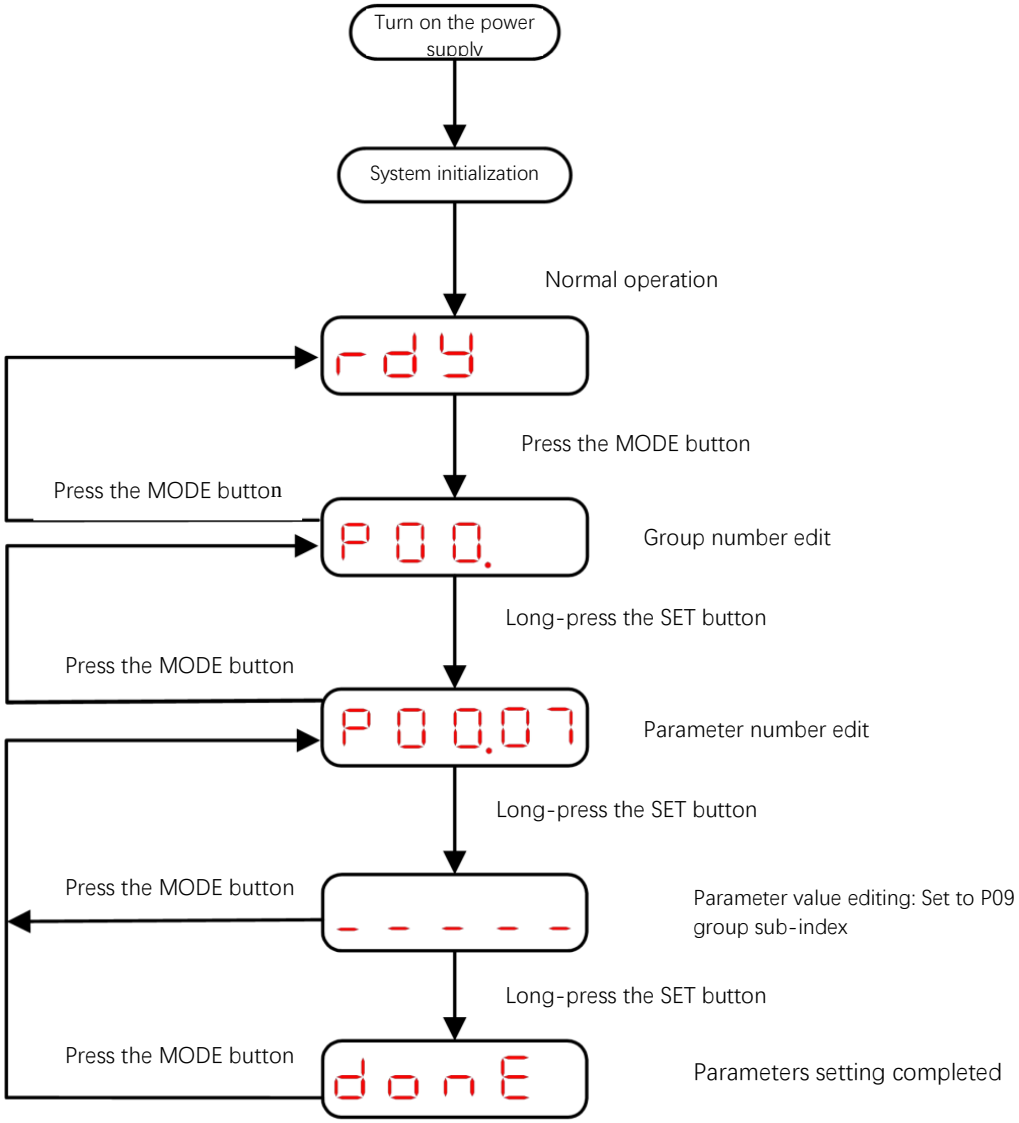


Figure 3.6 Flow Chart for Monitoring Multiple Variables

Notes:

- The value set for parameter P00.07 is a sub-index of the P09 group variable. For example, to monitor the "P09.04 Motor Speed", simply set the value of parameter P00.07 to 04;
- All monitored variables are in the P09 parameter group, and users can choose them according to their needs. Detailed parameters can be queried in Chapter 7;
- This function will be maintained even in case of power outage.

3.3 Commissioning Software

Our website (www.raynen.cn) provides free download and use of the backend software GQServo.

4 Operation

4.1 Jog Operation

⚠Before jog operation, please ensure that the motor is in a fixed state and that the rotation of the motor shaft will not cause any hazards!

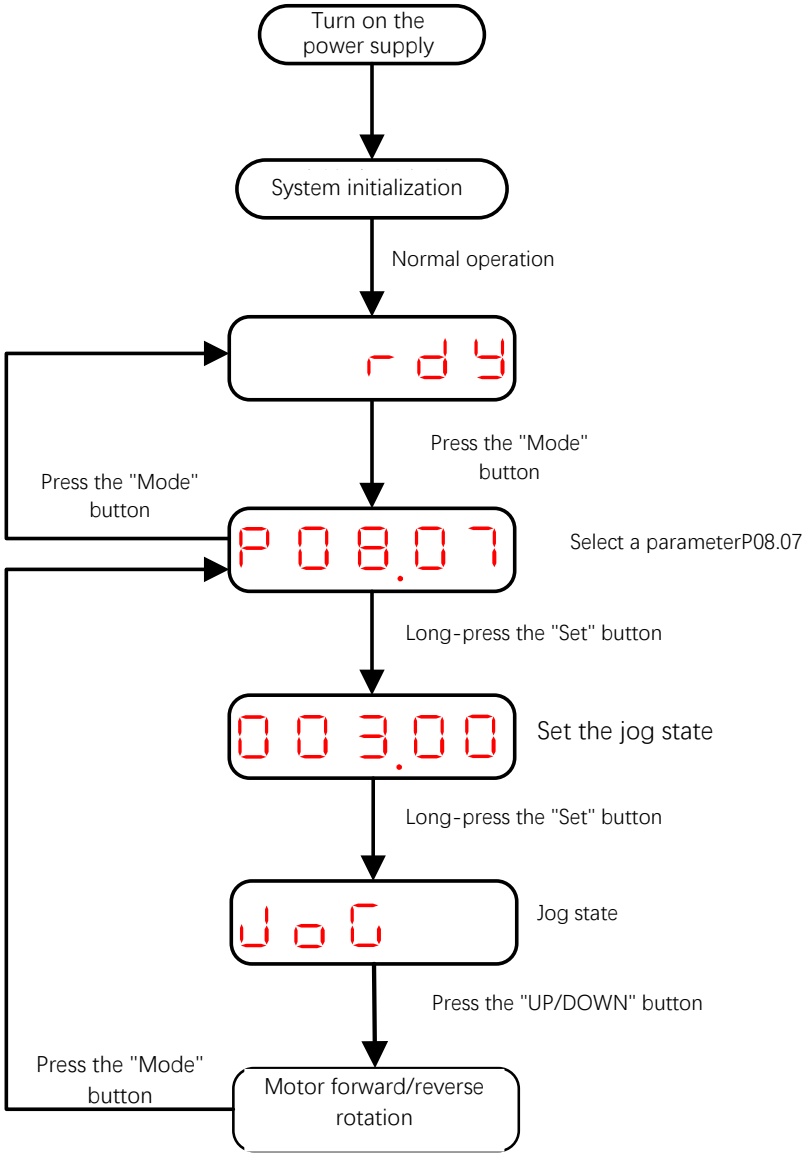


Figure 4.1 Motor Rotation Operation through Panel

Notes:

- Short-press the "UP/DOWN" button to achieve the motor shaft jog rotation;
- Long-press the "UP/DOWN" button to achieve the motor shaft continuous rotation;
- Release the "UP/DOWN" button to stop the motor from rotating immediately.

4.2 Rotation Direction Setting

Setting of motor shaft rotation direction:

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P000B	Rotation direction selection	0-1	1	0	Shutdown setting	Next power-on

Set the motor rotation direction:

0: The CCW direction is used as the forward rotation direction (A leads B);

1: The CW direction is used as the forward rotation direction (the reverse rotation mode, A lags behind B)

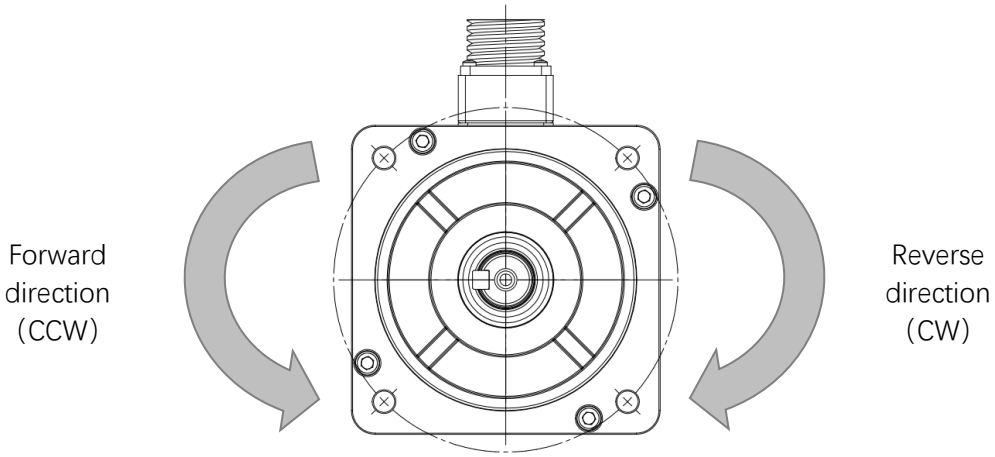


Figure 4.2 Motor Rotation Direction Setting

Set the direction of position/speed/torque command to change the direction of motor shaft rotation.

Allocate the following parameters to DI:

- ◆10-P-DIR position command direction input; only effective in the position mode
- ◆11-V-DIR speed command direction input; only effective in the speed mode
- ◆12-T-DIR torque command direction input; only effective in the torque mode

When DI is activated, the motion command will be inverted to change the direction of motor shaft rotation.

4.3 Brake Resistor Setting

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0029	Regenerative Brake Method	0-3	1	0	Shutdown setting	Effective immediately

During the deceleration and brake process of the servo motor, energy will be transferred from the load end to the DC bus. If the feedback energy is too large, the brake resistor needs to release this part of the energy. Otherwise, the driver may alarm or be damaged.

Table 4.1 Description of Regenerative Brake Method

Set value	Regenerative Brake Method	Description
0	Using the internal resistor	The overload protection action for the regenerative brake resistor is made based on the power and resistance value of the internal resistor.
1	Using the external resistor	The overload protection action for the regenerative brake resistor is made based on the power and resistance value of the external resistor.
2	Reserved	——
3	None	The regenerative brake resistor is not used, and all of the regenerative electric power is processed through the built-in capacitor.

⚠The brake method varies under different powers. Please refer to the specific specifications of the driver to set this parameter. Internal and external brake resistors cannot be used simultaneously. Please pay attention to the correct hardware wiring and refer to the RA3 hardware manual. When using an external re-

generative discharge resistor, be sure to set up the external protection such as temperature fuse. When using the internal regenerative resistor, do not set the values other than 0. Do not touch the external regenerative resistor. Due to the high temperature of the external resistor, please pay attention to safety during use to avoid burns.

4.4 Brake Sticking Setting

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0022	Opening the Stuck Brake Sticking- Command Receiving Delay Time	0-500	ms	100	Setting at any time	Effective immediately

Please open the stuck brake and wait for the delay time (P0022) set for receiving the command before outputting the command from the upper device to the servo unit

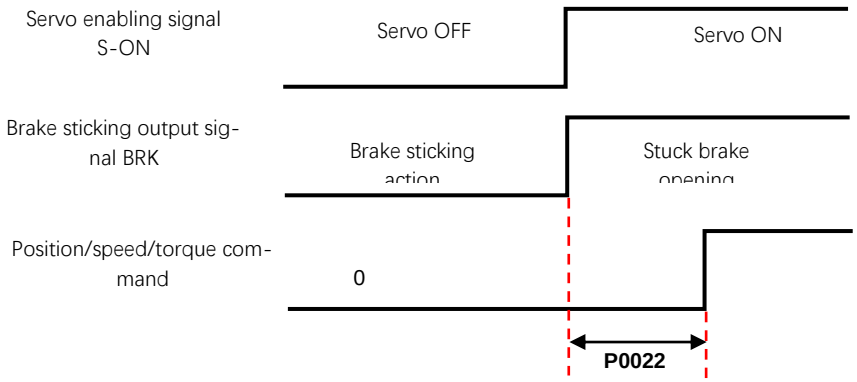


Figure 4.3 Opening the Stuck Brake Sticking- Command Receiving Delay Time

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0023	Brake Sticking Action during Stop-Servo OFF Delay Time	1-1000	ms	100	Setting at any time	Effective immediately

When the servo motor stops, the BRK signal will also be OFF if the servo ON input (S-ON) signal is OFF. By setting the servo OFF delay time (P0023), the BRK signal can be changed from OFF to the actual time when the motor is not powered on.

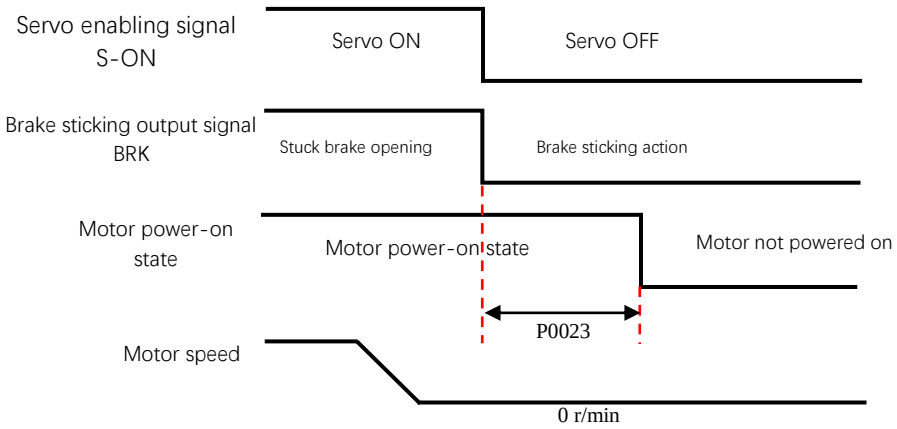


Figure 4.4 Brake Sticking Action during Stop- Servo OFF Delay Time

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P0024	Brake Sticking Action during Operation- Servo OFF Delay Time	1-1000	ms	300	Setting at any time	Effective immediately

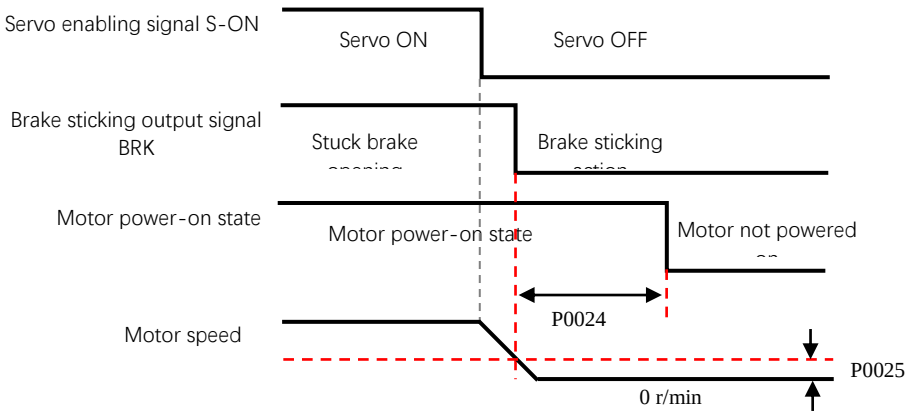


Figure 4.5 Brake Sticking Action during Operation- Servo OFF Delay Time

If the servo ON input (S-ON) signal is OFF when the servo motor is running, the BRK signal will be OFF when the motor speed is less than the output speed value of the brake sticking action (P0025). By setting the servo OFF delay time (P0024), the BRK signal can be changed from OFF to the actual time when the motor is not powered on.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0025	Brake sticking action speed value	0-3000	r/min	20	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002A	Heat dissipation coefficient of regenerative resistor	10-100	1	50	Shutdown setting	Effective immediately

Adjust the heat dissipation coefficient of the regenerative resistor based on the heat dissipation state of the external regenerative resistor. If you use an internal regenerative resistor, please set it to the factory value.

Table 4.2 Description of Dissipation Coefficient of Regenerative Resistor Heat

Heat dissipation speed of regenerative resistor	Heat dissipation coefficient of regenerative resistor
High	Large
↓	↓
Low	Small

When you use the natural cooling method (natural convectional cooling): it is recommended to set it to below 30%.

When you use the air forced cooling method: it is recommended to set it to below 50%.

⚠Please set the heat dissipation coefficient of the regenerative resistor according to the actual heat dissipation state to avoid abnormal heating of the regenerative discharge resistor due to improper setting, which may cause burnout. When using an external regenerative discharge resistor, be sure to set up the external protection such as temperature fuse. The regenerative discharge resistor may have abnormal heating, leading to burnout, which is unrelated to the effectiveness/ineffectiveness of overload protection for regenerative discharge resistor.

	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002E	Resistance value of external regenerative resistor	1-1000	Ω	50	Shutdown setting	Effective immediately

Please set this value according to the brake resistor nameplate.

When selecting an external regenerative resistor, please check whether the capacity is appropriate. Otherwise, it may cause personal injury and fire.

	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002F	Capacity of external regenerative resistor	1-65535	W	40	Shutdown setting	Effective immediately

Please set this value according to the brake resistor nameplate.

When selecting an external regenerative resistor, please check whether the capacity is appropriate. Otherwise, it may cause personal injury and fire.

4.5 Shutdown setting

The motor stop method is described as follows:

There are 5 motor stop methods as follows:

Motor stop method	Description
Dynamic brake (DB) stop	Short-circuit the electrical circuit of the servo motor to emergency-stop the servo motor.
Free running stop	It stops naturally due to friction during motor rotation.
Zero speed stop	Set the speed command to "0" to emergency-stop the servo motor.
Ramp stop	Stop the servo motor according to the set ramp stop deceleration time (P0021).
Emergency stop torque stop	It decelerates to stop according to the emergency stop torque.

There are three states after the motor stops:

State after the motor stop	Description
Dynamic brake (DB) state	The state in which the servo motor stops after causing a short circuit in the electrical circuit.
Free running state	The state where the servo unit does not control the servo motor (the mechanical action occurs when the force is applied from the load side).
Zero fixed state	Stop state of position command bit "0" (the current stop position is maintained).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001B	Servo OFF stop mode	0-5	1	0	Shutdown setting	Effective immediately

The motor stop method at the servo OFF state is selected through P001B.

Set value	Description	
	Servo motor stop method	State after the servo stop
0	Dynamic brake (DB)	Dynamic brake (DB)
1	Zero speed	
2	Ramp stop	
3	Free running	Free running
4	Zero speed	
5	Ramp stop	

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001C	Overrun prevention stop method	0-4	1	1	Shutdown setting	Effective immediately

The motor stop method when the servo overrun prevention function is activated is selected through P001C.

Set value	Description

	Servo motor stop method	State after the servo stop
0	Free running	Servo OFF stop mode
1	Zero speed	
2		Zero position fixing
3	Ramp stop	Servo OFF stop mode
4		Zero position fixing

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001D	Type 1 fault alarm stop method	0-2	1	0	Shutdown setting	Effective immediately

The method for stopping the motor when the servo has type 1 fault alarm is selected through P001D.

Set value	Description	
	Servo motor stop method	State after the servo stop
0	Free running	Free running
1	Dynamic brake (DB)	
2		Dynamic brake (DB)

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001E	Type 2 fault alarm stop method	0-9	1	0	Shutdown setting	Effective immediately

The method for stopping the motor when the servo has type 2 fault alarm is selected through P001E.

Set value	Description	
	Servo motor stop method	State after the servo stop
0	Dynamic brake (DB)	Dynamic brake (DB)
1	Zero speed	
2	Ramp stop	
3	Reserved	
4	Emergency stop torque	Dynamic brake (DB)
5	Free running	Free running
6	Zero speed	
7	Ramp stop	
8	Reserved	
9	Emergency stop torque	Free running

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001F	Stop speed threshold	10-10000	r/min	100	Shutdown setting	Effective immediately

The threshold for switching between deceleration and stop states during the servo stop. If it is greater than the set value of P001F, it is considered to be decelerating. If it is less than the set value of P001F, it is considered that the motor has stopped.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0020	Emergency stop torque	0-6000	0.1%	1000	Shutdown setting	Effective immediately

Use the set torque of the emergency stop torque P0020 as the maximum value to decelerate the servo motor. The set factory value of 1000 indicates the rated torque of the motor.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0021	Ramp stop deceleration time	0-65536	ms	100	Shutdown setting	Effective immediately

When the driver stops and the stop mode is set to ramp stop mode, the time from the starting moment of equipment stop to the motor speed of 0.

5 Adjustment

5.1 Automatic Gain Adjustment

The automatic gain adjustment refers to automatically setting the relevant gain parameter value for the servo by setting the parameter P0202 rigidity level. This function can meet the requirements for most occasions. Refer to Table 5.1 for relevant parameters of automatic gain adjustment.

Table 5.1 Relevant Parameters of Automatic Gain Adjustment

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P0201	Adjustment mode selection	0-4	1	0=Automatic gain adjustment function ineffective; the parameters are manually set; 1=Standard mode; the mode that the rigid meter automatically adjusts the gain parameters without using the gain switching, and the stability is emphasized; 2= Positioning mode; the mode that the rigid meter automatically adjusts the gain parameters with using the gain switching additionally, and the positioning is emphasized. Others are reserved.	0
P0202	Rigidity level selection	0-31	1	The smaller the value, the smaller the gain of the associated parameter.	12
P0203	Gain at the first position loop	0-20000	0.1/s	The smaller the value, the smaller the gain of the position loop.	400
P0204	Gain at the first speed loop	1-20000	0.1Hz	The smaller the value, the smaller the gain of the speed loop.	250
P0205	Integral time constant of the first speed loop	10-50000	0.01ms	The smaller the value, the more significant the integration effect.	3200
P0206	Filtering time constant of the first torque	0-3000	0.01ms	The larger the value, the more significant the filtering effect.	80
P0207	Gain at the second position loop	0-20000	0.1/s	The smaller the value, the smaller the gain of the position loop.	640
P0208	Gain at the second speed loop	1-20000	0.1Hz	The smaller the value, the smaller the gain of the speed loop.	400
P0209	Integral time constant of the second speed loop	10-50000	0.01ms	The smaller the value, the more significant the integration effect.	2000
P020A	Filtering time constant of the second torque	0-3000	0.01ms	The larger the value, the more significant the filtering effect.	80

Basic Process Flow Chart of Automatic Gain Adjustment:

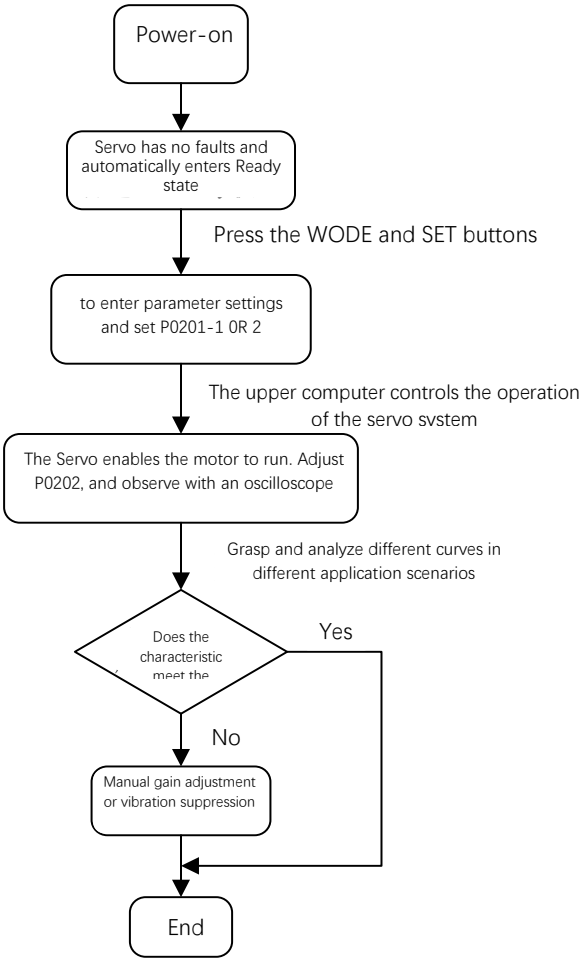


Figure 5.1 Automatic Gain Adjustment Process Flow Chart

The higher the value of the rigidity level (parameter P0202), the stronger the rigidity is. The stronger the rigidity is, the faster the servo shall be. If the rigidity is too strong, it may cause vibration and noise in the servo motor or mechanical system. In this case, please immediately reduce the gain or stop the machine to avoid damage to the motor encoder or mechanical system.

During the automatic gain adjustment, you need to continuously capture the response curve of the servo through the commissioning software or oscilloscope, and observe and analyze whether the characteristics of the servo can meet customer needs.

The automatic gain adjustment is available in two modes, which are suitable for different situations. The detailed description is as follows.

- The parameter P0201 =1 represents the standard mode; the mode that the rigid meter automatically adjusts the gain parameters without using the gain switching, and the stability is emphasized. During the operation of the servo, if the rigidity level (parameter P0202) is modified, the servo will automatically update the gain parameters (P203/P204/P205/P206) in real time, without re-enabling or powering off and restarting. It is generally applicable to the position mode, speed mode, or torque mode with low positioning requirements.
- The parameter P0201 = 2 represents the positioning mode; the mode that the rigid meter automatically adjusts the gain parameters with using the gain switching additionally, and the positioning is emphasized. After you select this mode and set the rigidity level (parameter P0202), the second gain parameter (P207/P208/P209/P20A) will be automatically updated real-timely based on the updated parameters in mode 1. The rigidity of the second gain will be greater than that of the first mode by default. It is generally applicable to the position control mode with high position requirements. If this adjustment method is selected in the speed mode or torque mode, the effect is the same as P0201=1.

When you use this mode, the gain switching function will be automatically turned on due to the presence of two groups of gain parameters, and the relevant parameters for gain switching will be set to fixed values, as shown in Table 5.2.

Table 5.2 Positioning Mode, Gain Switching Parameter Set to Fixed Value

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P0210	Gain switching method selection	0-1	1	1=Switched according to the conditions set in P0211	1
P0211	Trigger conditions for gain switching	0-10	1	10= Position command provided + actual speed	0
P0212	Gain switching delay time	0-10000	0.1ms	It is set to 5ms in the positioning mode	50
P0213	Gain switching level	0-20000	1	Set to 50 in the positioning mode	50
P0214	Gain switching hysteresis	0-20000	1	Set to 30 in the positioning mode	30
P0215	Position gain switching time	0-10000.	0.1ms	Set to 2 ms in the positioning mode	20

5.2 Manual Gain Adjustment

Manual gain adjustment refers to manually adjusting some parameters based on the parameters obtained from automatic gain adjustment in order to improve servo performance and meet user needs, when the automatic gain adjustment cannot meet customer needs. Refer to Table 5.3 for the main adjustment parameters.

Table 5.3 Adjustable Parameters for Manual Gain Adjustment

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P0201	Adjustment mode selection	0-4	1	0 switch off the automatic gain adjustment, set manually	0
P0203	Gain at the first position loop	0-20000	0.1/s	The smaller the value, the smaller the gain of the position loop	400
P0204	Gain at the first speed loop	1-20000	0.1Hz	The smaller the value, the smaller the gain of the speed loop	250
P0205	Integral time constant of the first speed loop	10-50000	0.01ms	The smaller the value, the more significant the integration effect	3200
P0206	Filtering time constant of the first torque	0-3000	0.01ms	The larger the value, the more significant the filtering effect	80

The principles for adjusting the parameters are with reference to the following description:

◆ Principle for Adjusting the Gain of Position or Speed Loop

The adjustment of gain is to improve the following characteristics of the system, as shown in Figure 5.2. The larger the value of gain adjustment, the faster the actual curve can follow the speed curve. At a result, the response characteristics of the servo will be accelerated. However, if the gain adjustment is too large, it may cause vibration of the servo motor or mechanical system and produce noise. In this case, please immediately reduce the gain or stop the machine.

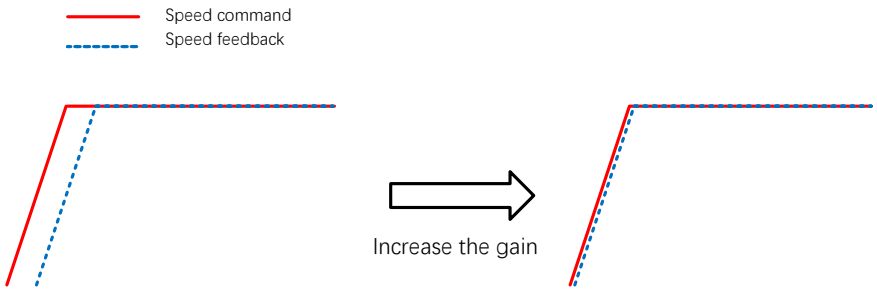


Figure 5.2 Effect Diagram of Gain Regulator

◆ Principle of Speed Loop Integral Time Adjustment

The integration process is to eliminate the system bias. The smaller the value, the more significant the integration effect is.

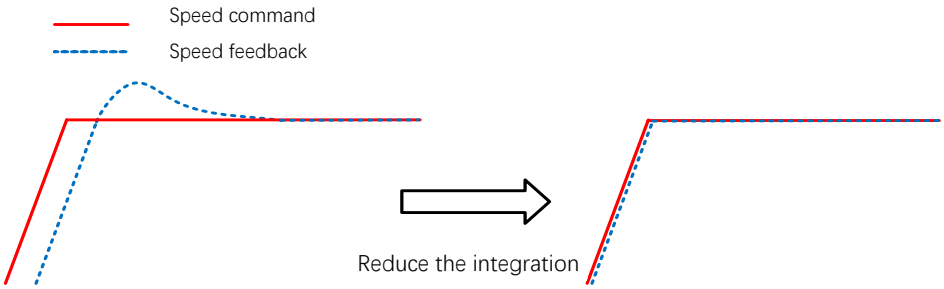


Figure 5.3 Effect Diagram of Integral Time Regulator

◆ Principle of Torque Filtering Adjustment

The torque filter time parameter; the smaller the value, the better the high-frequency part of the command is filtered, achieving the effect of eliminating high-frequency noise and suppressing mechanical vibration. However, it shall be noted that the factory default value can already meet the needs of most situations. If the value is set too large, it will cause slow strain in the current loop response.

5.3 Gain Function Switching

By using internal data or external signals for gain switching, you can enable the servo system to use different gains in different motion states, resulting in the following effects:

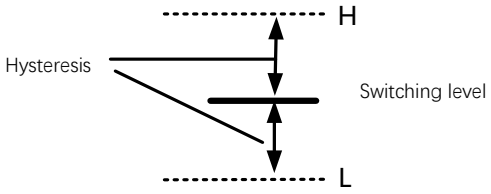
- ◆ Reduce the gain during stop (servo lock) and suppress vibration.
- ◆ Increase the gain during stop (when stable) and shorten the positioning time.
- ◆ Improve the gain during operation and enhance the command following characteristic.
- ◆ Switch the gain with the external signal based on the equipment state.

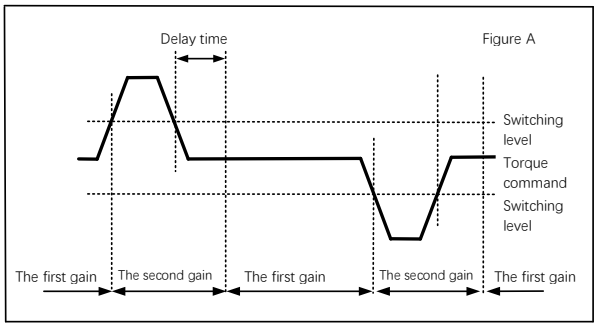
Instructions for Setting Gain Switching Conditions:

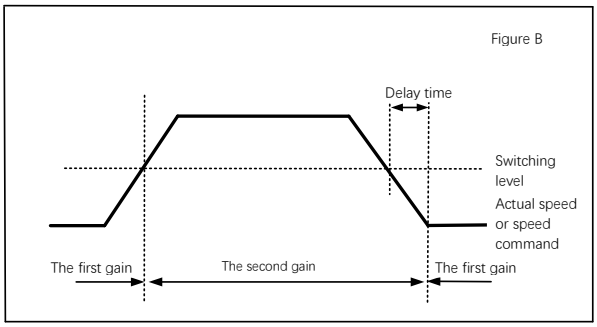
The gain switching is effective only in the position control mode and speed control mode. （ o: This parameter is effective, -: This parameter is ineffective)

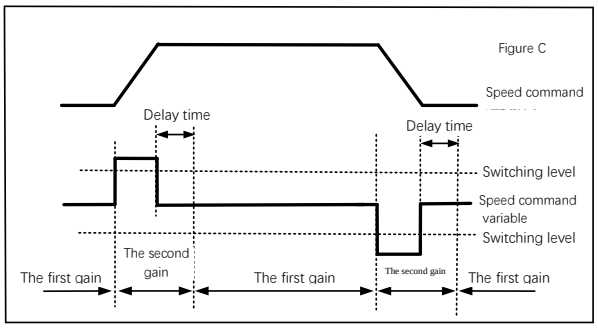
Setting Gain Switching Conditions *1 (P/PI switching conditions)				Set parameters		
				P0212*2	P0213	P0214
P0210	P0211	The condition for switching to the second gain	Figure	Delay time	Switching level	Hysteresis*7
1	0	Fixed at the first gain		-	-	-
	1	Gain switching terminal input		-	-	-
	2	Torque command	A	o	o%	o%
	3	Speed command	B	o	o	o
	4	Speed command variation	C	o	o(10r/min/s)*3	o(10r/min/s)*3
	5	Reserved		-	-	-
	6	Position deviation	D	o	o(pulse)*4	o(pulse)*4
	7	Position command provided	E	o	-	-
	8	Positioning end signal	F	o	-	-
	9	Actual speed	B	o	o(r/min)	o(r/min)
	10	Position command provided + actual speed*5	G	o	o(r/min)	o(r/min)
0	-	Gain switching effective, P/PI switching effective*6		-	-	-

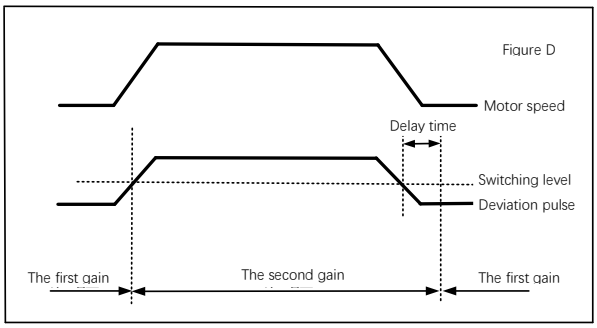
- ◆ The parameter P0215 position gain switching time is effective during the position gain switching.
- ◆ The delay time P0212 is only effective when the second gain returns to the first gain.
- ◆ The minimum unit of speed command variation is 10r/min within 1 second.
- ◆ Motor encoder unit or full loop encoder input unit.
- ◆ When P0211=10, please refer to Figure G for delay time, switching level and hysteresis.
- ◆ At this point, the gain is fixed to the first gain, but you can use external terminal/P-CON to achieve P/PI action switching for the the speed loop.
- ◆ The relationship between switching hysteresis and switching level is as follows:

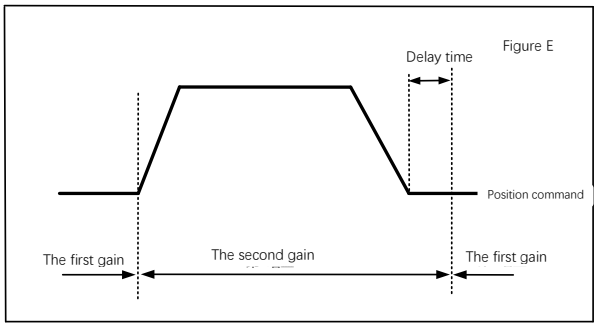


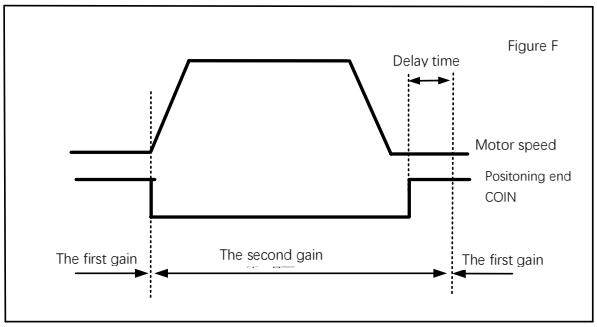

Figure A
Delay time
Switching level
Torque command
Switching level
The first gain
The second gain
The first gain
The second gain
The first gain

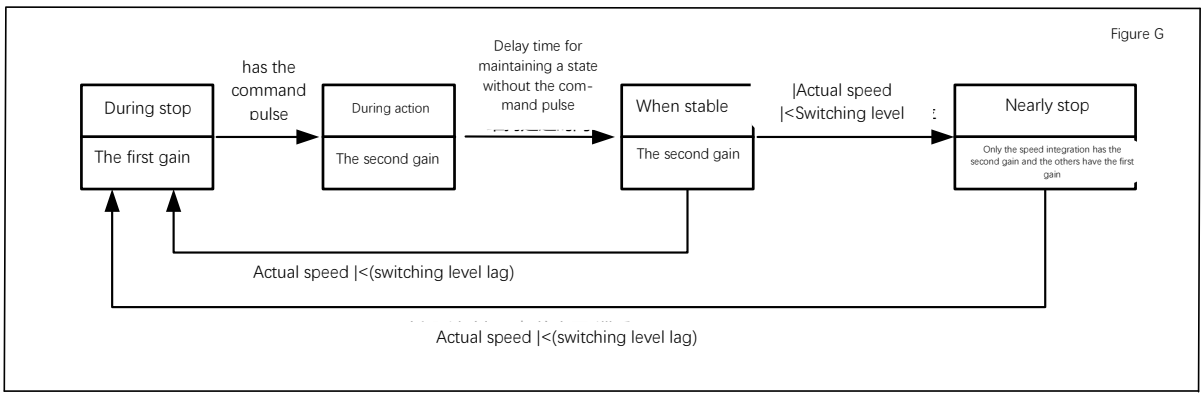

Figure B
Delay time
Switching level
Actual speed or speed command
The first gain
The second gain
The first gain


Figure C
Speed command
Delay time
Delay time
Switching level
Speed command variable
Switching level
The first gain
The second gain
The first gain
The second gain
The first gain


Figure D
Motor speed
Delay time
Switching level
Deviation pulse
The first gain
The second gain
The first gain


Figure E
Delay time
Position command
The first gain
The second gain
The first gain


Figure F
Delay time
Motor speed
Positoning end COIN
The first gain
The second gain
The first gain


Figure G
During stop
The first gain
has the command pulse
During action
The second gain
Delay time for maintaining a state without the command pulse
When stable
The second gain
|Actual speed |<Switching level
Nearly stop
Only the speed integration has the second gain and the others have the first gain
Actual speed |<(switching level lag)
Actual speed |<(switching level lag)

5.4 Inertia Identification

Related Parameters

Table 5.4 Relevant Parameters for Inertia Identification

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P0230	Load inertia ratio	0-12000	0.01	Set the rotational inertia ratio between the motor and the load	100
P0231	Automatic load identification mode	0-3	1	Not enabled	0
P0232	Inertia identification mode	0-1	1	1 = JOG mode	1
P0233	Maximum speed of inertia identification	100-1000	r/min	Maximum speed of motor during identification	500
P0234	Acceleration of inertia identification	20-800	ms	Motor acceleration time during identification	100

P0230 load inertia ratio is the final result obtained from inertia identification, interpreted as the ratio of the rotational inertia of the mechanical load to the rotational inertia of the motor. In the selection segment of servo motor, the priority shall be given to this value, especially for situations with high dynamic response requirements, such as high-speed reciprocating motion and precise positioning requirements. Otherwise, it cannot meet the design requirements no matter how the servo system is debugged. To obtain the accurate inertia ratio, the RA3 series servo provides the function of manual inertia identification.

Manual Inertia Identification

After setting the parameters of Table 5.4, enter the parameters setting interface of P080C to perform manual inertia identification.

The operation process flow chart of the manual inertia identification is shown in Figure 5.4.

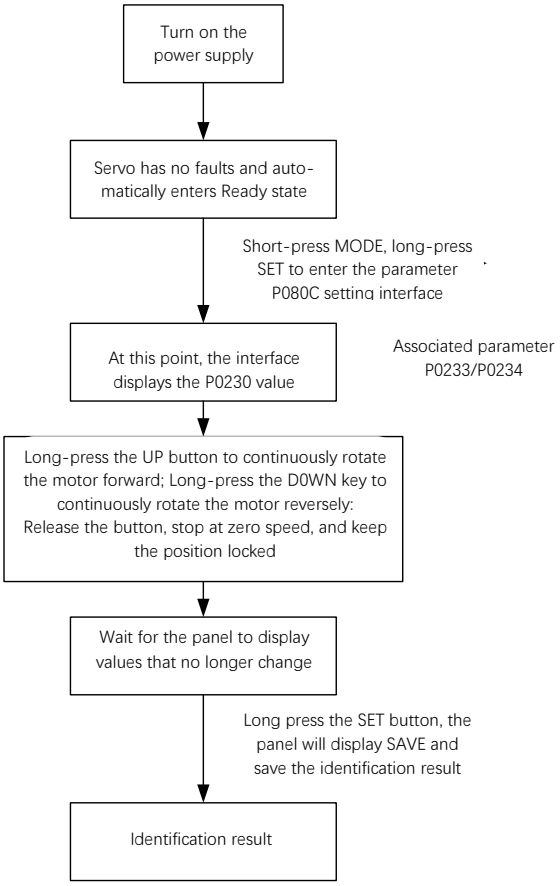


Figure 5.4 Basic Process Flow Chart of Offline Identification

- During the inertia identification, the motor will rotate forward/reversely. Please pay attention to

safety precautions: whether the motor is firmly fixed, whether the mechanical load allows rotation, and whether the motor rotation will cause the mechanical device to exceed the limit;

- Parameter P0236 can read the number of turns of the motor shaft;
- You need to pay attention to the limit of mechanical device in the JOG mode;
- If the motor speed rises slowly during the identification, resulting in unsuccessful identification, you can try to increase the value of parameter P0202;
- The offline identification is provided with different speed curves and associated parameters, as shown in Figure 5.5.

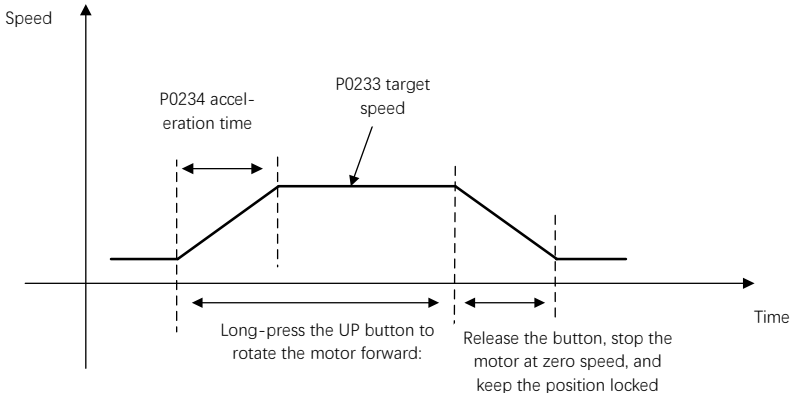


Figure 5.5 Offline Identification Using JOG Mode (Taking Forward Rotation as an Example)

5.5 Feedforward Function

You can improve the following characteristic of the servo system by increasing the gain and rigidity level. However, when it is not possible to increase the gain continuously due to various reasons, and a fixed following error is found in the practical analysis, and such error is not accepted in many fields. At this point, the feedforward control can be adopted, which can achieve the same effect as increasing the gain without increasing the position or speed loop gain. In RA3 servo, feedforward control includes speed feedforward and torque feedforward. You can use the feedforward control to reduce command deviation, improve responsiveness, and improve the following accuracy of the servo system.

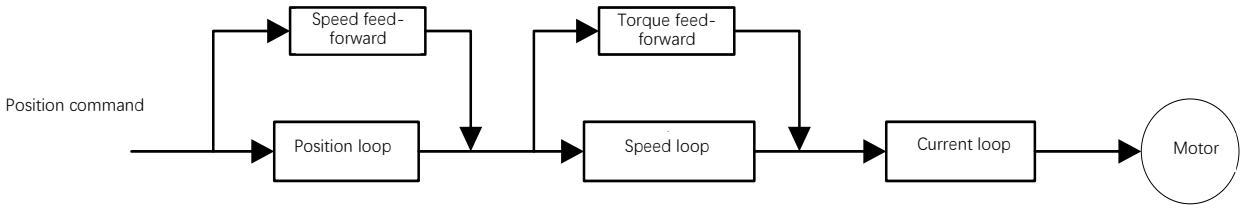


Figure 5.6 Structure Diagram of Feedforward Control

Refer to Figure 5.7 for the control effect to be achieved for the feedforward control.

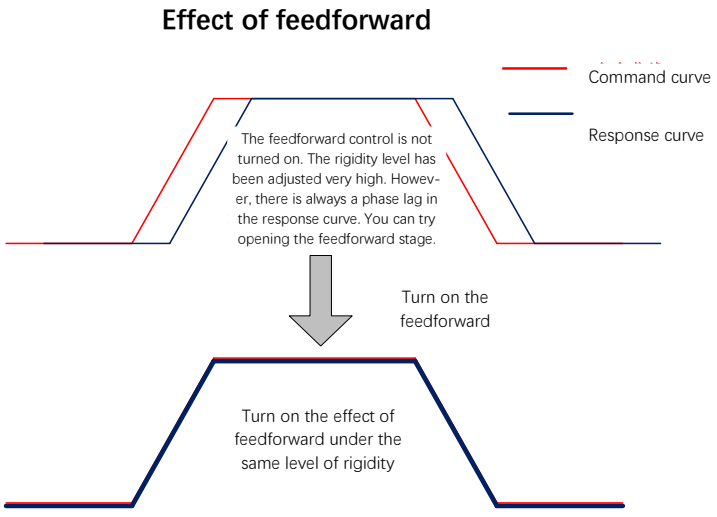


Figure 5.7 Response Effect of Feedforward Control

Speed Feedforward Control

The relevant parameters of speed feedforward are as shown in Table 5.5.

Table 5.5 Relevant Parameters of Speed Feedforward

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P021F	Speed feedforward method selection	0-1	1	0= No speed feedforward; 1= Internal speed feedforward;	0
P0220	Speed feedforward gain	0-1000	0.10%	Improve the response and enhance the following characteristic	0
P0221	Speed feedforward filter time constant	0-6400	0.01ms	Suppress the steady-state errors and reduce the positioning errors	0

Torque Feedforward Control

The relevant parameters of torque feedforward are as shown in Table 5.6.

Table 5.6 Relevant Parameters of Torque Feedforward

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P0222	Torque feedforward method selection	0-1	1	0= No torque feedforward; 1= Internal torque feedforward;	0
P0223	Torque feedforward gain	0-2000	0.10%	Improve the response and enhance the following characteristic	0
P0224	Torque feedforward filtering time constant	0-6400	0.01ms	Suppress the steady-state errors and reduce the positioning errors	0

5.6 Suppression of Mechanical Resonance

In the equipment, a series of intermediate transmission links are required from the output of the motor to the final load. Due to mechanical rigidity, the transmission system can be approximated as a linear link and an elastic link, and the frequency of the elastic link part is often a combination of multiple frequencies, to increases the order of the system. In this case, in the output part of the transmission link, some inputs will be suppressed and some outputs will be amplified, and the amplified part is commonly known as "resonance". These resonances all have a certain resonance frequency. When the servo gain increases, resonance may occur near the mechanical resonance frequency, causing the system gain to fail to increase continuously. increase. There are two main methods to suppress the mechanical resonance:

Torque Command Filter:

The torque filter has been already switched on by default in the servo system, with the factory default setting value of 80, which can be adjusted appropriately according to Table 5.7.

Table 5.7 Torque Command Filtering

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P0206	Filtering time constant of the first torque	0-3000	0.01ms	The part above the cutoff frequency will attenuate	80
P021A	Filtering time constant of the second torque	0-3000	0.01ms	The part above the cutoff frequency will attenuate	80

Note: For the working timing of the two torque filters, please refer to the gain switching conditions in Section 6.4. As the gain is switched, the torque filters will be also switched.

Notch Filter:

During the operation of mechanical equipment, the friction, impact, or unbalanced forces between components cause resonance and noise, resulting in the failure to improve the system response. At this point, we need to use a notch filter to suppress such resonance, so as to increase the system gain and meet the system response requirements.

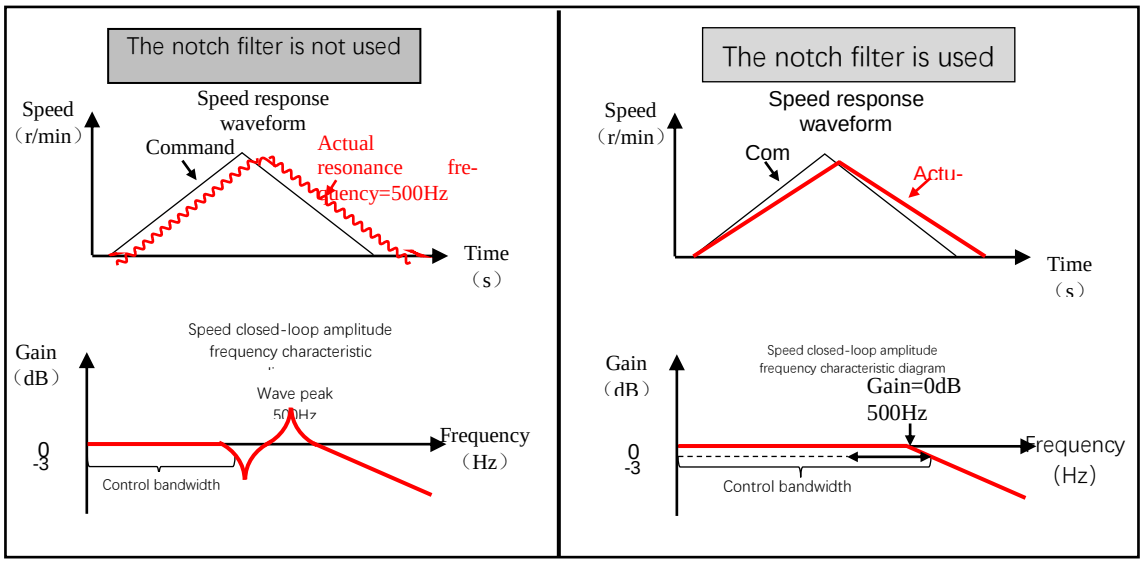


Figure 5.8 Notch Filter Effect

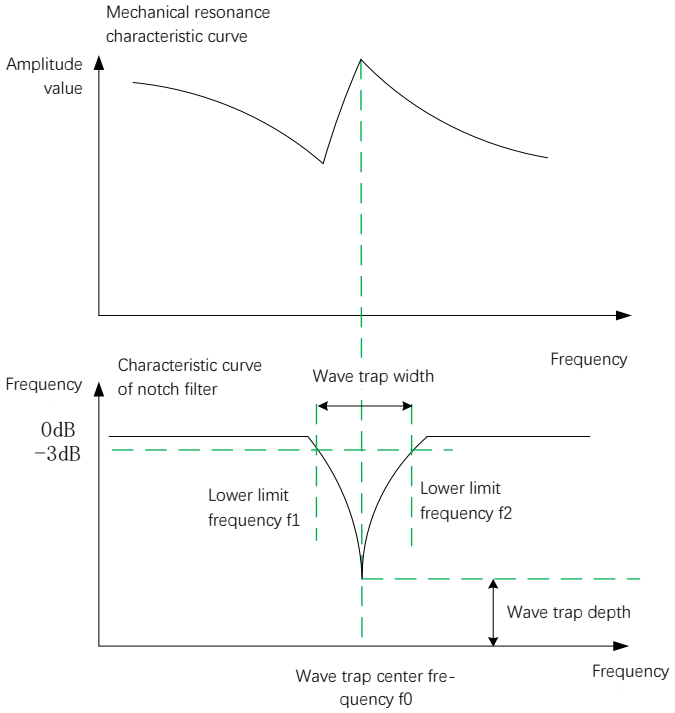


Figure 5.9 Characteristic Diagram of Notch Filter

As shown in Figure 5.9, the characteristics of a notch filter have three key parameters: notch center frequency, notch width, and notch depth.

- Notch filter frequency: The center frequency of the notch filter is measured in Hz.
- Notch width: the ratio of center frequency to gain attenuation -3dB bandwidth when the depth of the notch is 0.
- Notch depth: When set to 0, the input of the center frequency is completely cut off. When set to 100, it will pass through completely.

Working mechanism of notch filter:

The RA3 column servo has four groups of notch filters, with the first and second groups being manually set, and the third and fourth groups being manually/automatically set. By setting the parameter P0301, you can select different notch modes, as shown in Tables 5.8 and 5.9.

Table 5.8 Working Mechanism for Four Groups of Notch Filter

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0301	Resonance suppression method selection	0-4	1	0	Setting at any time	Effective immediately

Set the number of resonant frequencies estimated by the notch filter and the action after estimation

Table 5.9 Function Description of Notch Filter

Set value	Content	
0	Automatic filter: ineffective	The parameters of the 3rd and 4th notch filters remain unchanged.
1	Automatic filter: 1 effective	The parameters of the third notch filter are updated based on the resonance detection results.
2	Automatic filter: 2 effective	The parameters of the third and fourth notch filters are updated based on the resonance detection results.
3	Resonance frequency test mode	Only the resonance frequency is detected and displayed
4	Automatic filter results clearing	The third and fourth notch filters are restored to their factory values.

Automatic Notch Filter:

With the automatic notch filter, the equipment can automatically control the notch filter parameters (center frequency, width, depth) corresponding to different resonance points.

Table 5.10 Automatic Notch Filter Parameters Configuration

Notch filter type	Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value
Automatic	P0309	The third notch filter frequency	50-8000	Hz	8000
	P030A	The third notch filter width	0-20	1	2
	P030B	The third notch filter depth	0-99	%	0
	P030C	The fourth notch filter frequency	50-8000	Hz	8000
	P030D	The fourth notch filter width	0-20	1	2
	P030E	The fourth notch filter depth	0-99	%	0

Working Process of Automatic Notch Filter:

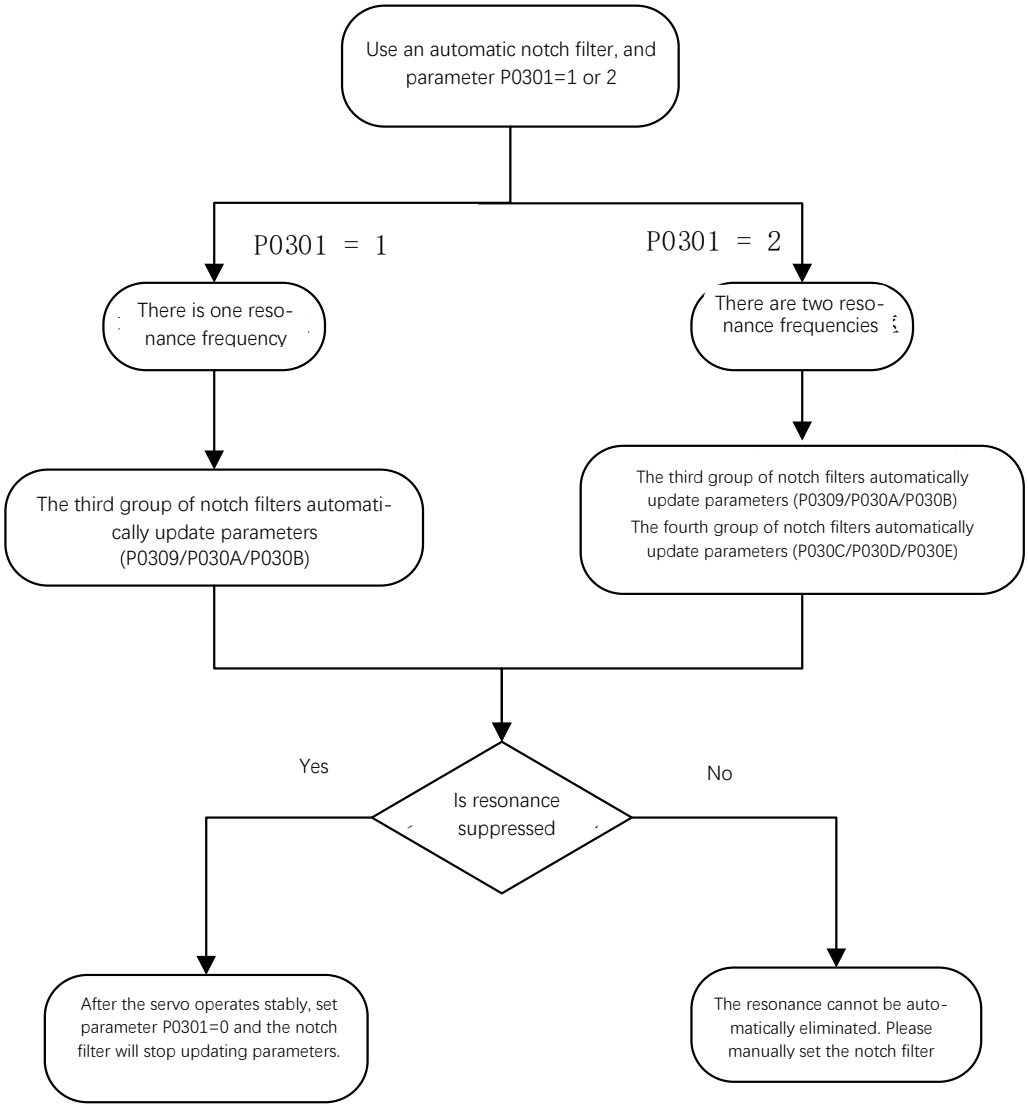


Figure 5.10 Setting Process of Automatic Notch Filter

- After the automatic notch filter is switched on, the parameters of the third or fourth group of notch filters will be automatically updated;
- After the resonance is suppressed, please set P0301 to 0, and the notch filter parameters will be saved and no longer updated;
- If the detected resonance frequency number exceeds 2 or the automatic notch filter cannot eliminate the resonance, please use a manual notch filter and set the parameter P0301=0. Use the manual notch filter to manually set the parameters of the automatic notch filter;
- The default frequency of the notch filter is 8 KHz. At this point, the notch filter is ineffective.

Manual Configuration of Notch Filter:

- Method 1: Enable the built-in "Mechanical Characteristic Analysis" function in the accompanying PC commissioning software "ServoOperator". Set parameters and measurement conditions such as excitation signal and noise reduction level. Manually configure the resonance frequency into the notch filter parameters based on the measurement results. At this point, it shall be noted that P0301 is set to manually configure the notch filter, and the width and depth parameters of the notch filter need to be inputted in the meantime;
- Method 2: Use the parameter P0301=3 to enable the servo to automatically detect the resonance frequency. The user reads the resonance frequency through parameter P0302, and then inputs the resonance frequency obtained from P0302 into the notch filter.

Table 5.11 Manual Notch Filter Parameters Configuration

Notch filter type	Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value
Manual	P0303	The first notch filter frequency	50-8000	Hz	8000
	P0304	The first notch filter width	0-20	1	2
	P0305	The first notch filter depth	0-99	%	0
	P0306	The second notch filter frequency	50-8000	Hz	8000
	P0307	The second notch filter width	0-20	1	2
	P0308	The second notch filter depth	0-99	%	0
Manual or automatic	P0309	The third notch filter frequency	50-8000	Hz	8000
	P030A	The third notch filter width	0-20	1	2
	P030B	The third notch filter depth	0-99	%	0
	P030C	The fourth notch filter frequency	50-8000	Hz	8000
	P030D	The fourth notch filter width	0-20	1	2
	P030E	The fourth notch filter depth	0-99	%	0

5.7 Vibration Control

When there are spring elements at the end of the mechanical device or the mechanical rigidity is low, vibration is prone to occur, which may lead to an increase in the system position setting time and reduce the system response. The RA3 column servo can use a damping filter to improve this phenomenon.

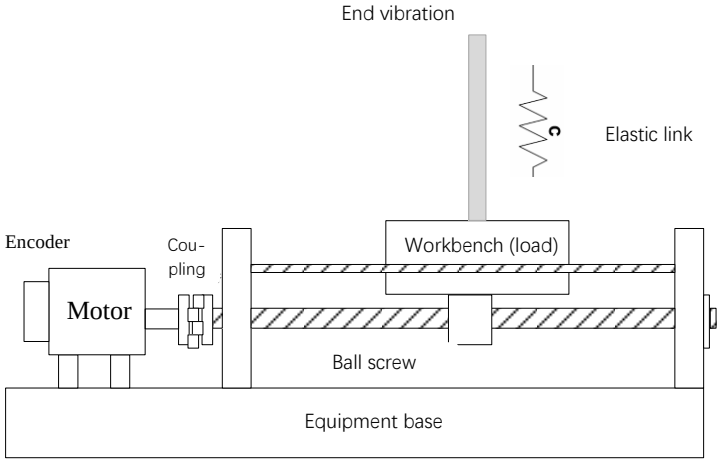


Figure 5.11 End Vibration Diagram

The end vibration can be measured through the measuring devices such as laser displacement measuring

device. If there is no measuring device available, the "oscilloscope" function in the PC commissioning software "ServoOperator" can also be used to read the internal position deviation waveform to determine the vibration frequency, as shown in Figure 5.13.

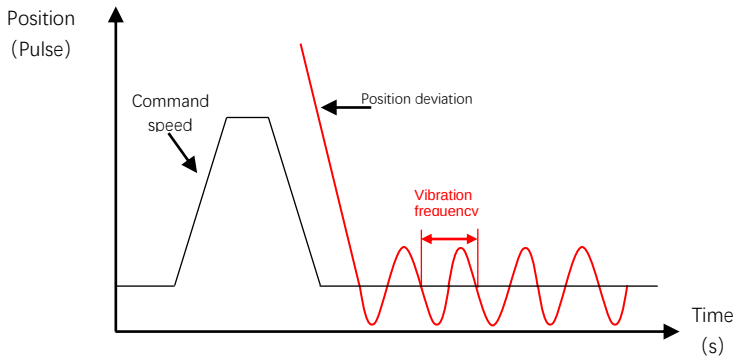


Figure 5.12 Schematic Diagram of Position Deviation Waveform

Refer to Table 5.12 for relevant parameters of vibration filter.

Table 5.12 Relevant Parameters for Low-frequency Resonance Suppression

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Function selection
P032A	Vibration frequency	10-1000	0.1Hz	1000	Vibration frequency
P032B	Notch frequency ratio	12-30	0.1	12	Frequency ratio of damping filter
P032C	Notch width level	0-10	1	2	Damping filter width level

5.8 Full Closed-loop Function

Full closed-loop system refers to a system that uses an external displacement sensor to feed back mechanical position information to the servo unit by utilizing the mechanical position of the controlled object. Due to the direct feedback on the actual mechanical position, high-precision positioning can be achieved. However, a full closed-loop system may also have unstable positioning and even vibration due to mechanical clearance and other reasons.

The system composition is as shown in the figure below:

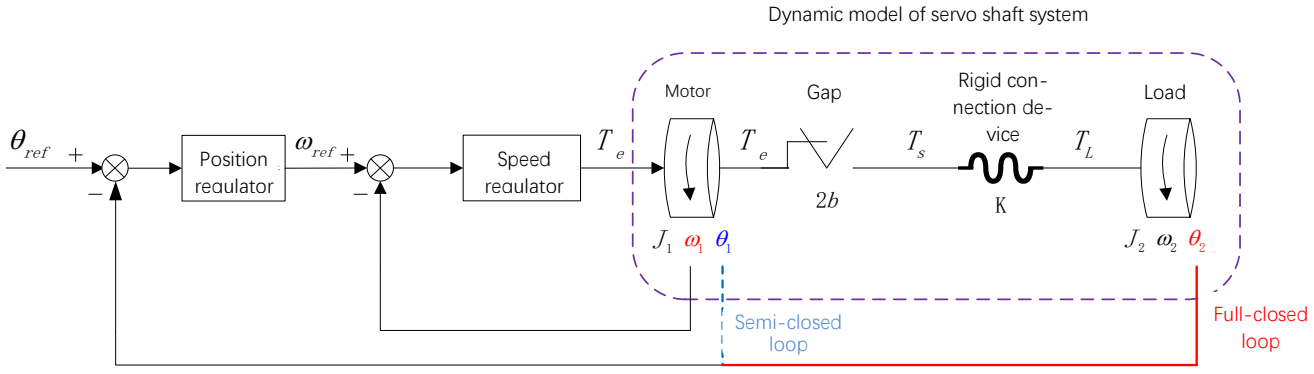


Figure 5.13 Schematic Diagram of Full-closed Loop System Composition

When starting the servo unit, firstly check whether the action is normal through semi-closed loop control, and then check whether the action is normal through the full-closed loop control.

The procedure for starting the full closed-loop control is as shown in the figure below.

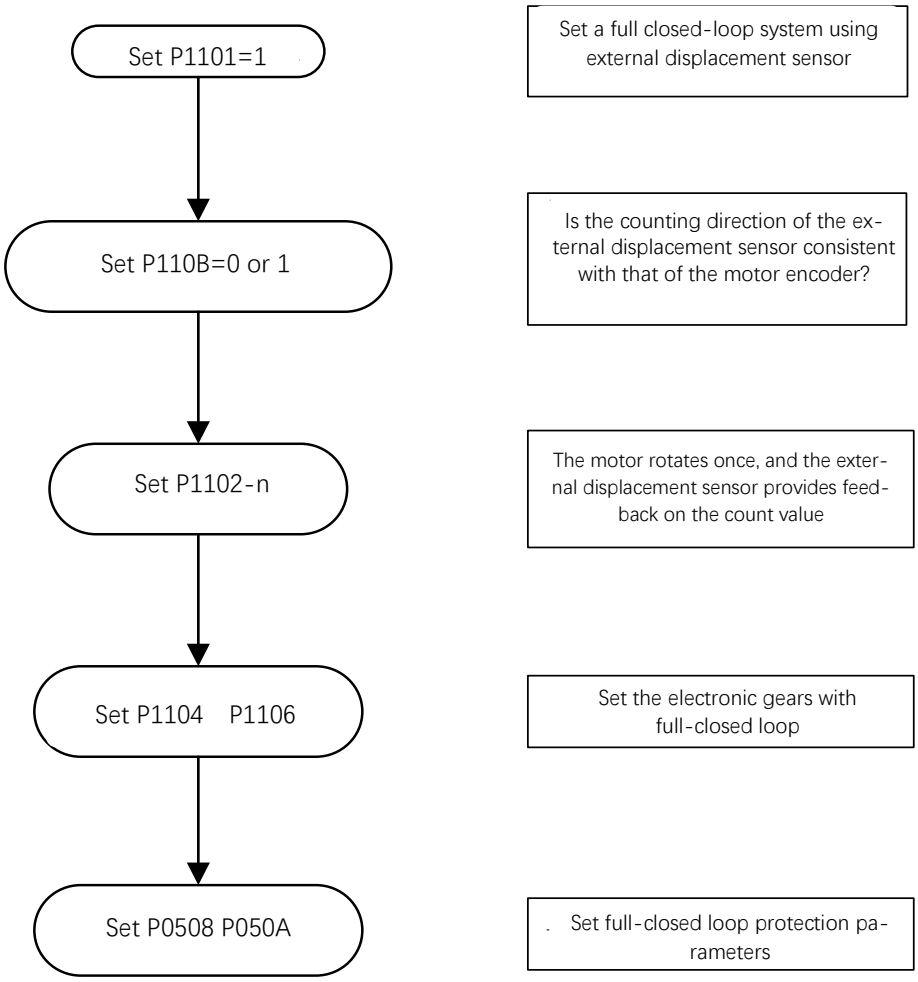


Figure 5.14 Procedure for Starting Full Closed-Loop System

Refer to Table 5.13 for relevant parameters of full closed-loop system.

Table 5.13 Relevant Parameters of Full Closed-loop System

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1101	Full closed-loop control mode selection	0-1	-	0	Shutdown setting	Effective immediately
P1102	Total pulse count of the external displacement sensor corresponding to one turn of the motor	0-1073741824	-	10000	Shutdown setting	Next power-on
P1104	Excessive mixing deviation setting	0-1073741824	-	1000	Setting at any time	Effective immediately
P1106	Mixing deviation zero setting	0-100	-	1	Setting at any time	Effective immediately
P1107	Full closed-loop position mixing deviation counter	-1073741824/ 1073741824	-	0	Display	
P1109	External displacement sensor feedback pulse counter	-1073741824/ 1073741824	-	0	Display	
P110B	Counting direction of external displacement sensor	0-1	1	0	Shutdown setting	Effective immediately

The setting of the full closed-loop electronic gear can be with reference to: P050A represents the number of pulses of a motor rotating by one turn; P0508 is equal to the number of pulses fed back by the external encoder when the motor rotates by one turn.

5.9 Torque Limit

Torque limit refers to the capability to limit the output torque of a motor. The torque limit is effective in any control mode, and the parameters associated with the torque limit are described in Table 5.14.

Table 5.14 Parameters Related to Torque Limit Function

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P070F	Torque limit setting	0-2	1	It is used to set the source of torque limit: 0: Internal torque limit (P0711, P0712); 1: External torque limit (P0713, P0714); 2: Analog input torque limit; 3: External torque+analog input;	0
P0710	Analog input torque limit	1-2	1	Select the analog channel as the torque limit input: 1: Analog input channel 1 (AI1); 2: Analog input channel 2 (AI2);	2
P0711	Internal forward torque limit value	0-6000	0.1%	The maximum forward rotation torque of the motor when set to internal torque limit.	3000
P0712	Internal reverse torque limit value	0-6000	0.1%	The maximum torque for motor reverse rotation when set to the internal torque limit.	3000
P0713	External forward rotation torque limit value	0-6000	0.1%	The maximum forward rotation torque of the motor when set to the external torque limit; The external forward rotation torque limit function needs to be activated through DI; DI parameters (14-P-ACL forward rotation external torque limit input)	3000
P0714	External reverse rotation torque limit value	0-6000	0.1%	The maximum reverse rotation torque of the motor when set to the external torque limit; The external reverse rotation torque limit function needs to be activated through DI; DI parameters (15-N-ACL reverse rotation external torque limit input)	3000

Note: Regardless of the torque limit method, the maximum output torque of the motor is always less than the maximum motor torque (the maximum motor torque depends on the motor parameters).

Internal Torque Limit

When you set the parameter P070F=0, the motor output torque is always less than the values of parameters P0711 and P0712. This limit method does not require external DI activation and is always effective.

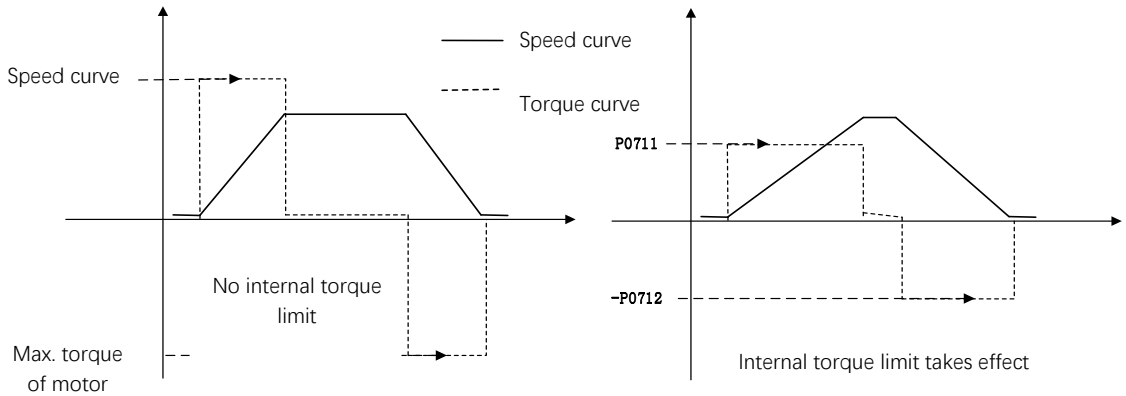


Figure 5.15 Internal Torque Limit Function

The same position for the driver is planned at the main control equipment. The impact of the internal torque limit function switching-on and switching-off on the actual operation of the motor is as described in Figure 5.16:

- The left half of the operating curve does not limit the motor output torque. During acceleration and deceleration, the motor can output the maximum torque, and the acceleration/deceleration time is relatively short;
- On the contrary, the output torque of the right half is limited by P0711 and P0712, and the maximum output torque of the motor is less than P0711 and P0712, resulting in a relatively long acceleration and deceleration time.

External Torque Limit

When parameter P070F=1, the torque limit function is activated through external DI to achieve the maximum torque limit. The maximum torque value is less than P0713 and P0714, and the associated DI parameters are (14-P-ACL forward rotation external torque limit input/15-N-ACL reverse rotation external torque limit input).

- DI parameter 14-P-ACL is activated, and the maximum forward rotation torque of the motor is less than P0713;
- The DI parameter 15-N-ACL is activated, and the absolute maximum torque of the motor reverse is less than P0714.

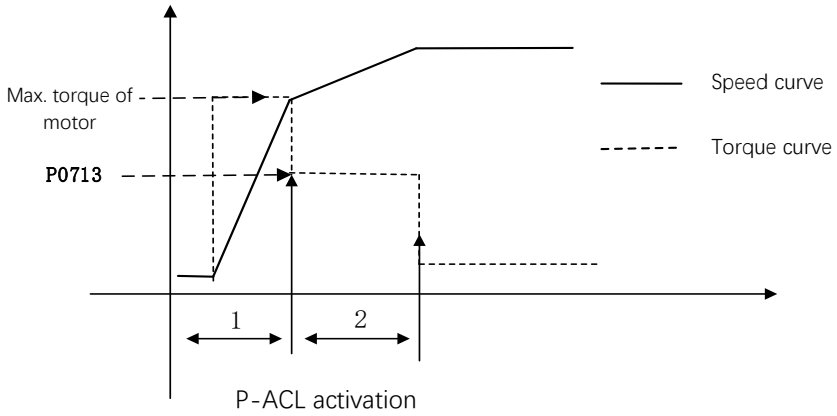


Figure 5.16 Internal Torque Limit Function

When P070F is equal to 1 and P-ACL is not activated, the operation curve is as shown in the first-segment operation curve in Figure 5.16. At this time, the motor acceleration is fast (the slope of the first-segment speed curve is large), and the motor outputs the maximum torque; after P-ACL is activated, the maximum output torque of the motor is immediately limited to P0713, and the motor acceleration slows down (the slope of the second-segment speed curve decreases). On the contrary, the N-ACL will be activated.

Analog input torque limit

When P070F=2, the analog input port AI1 or AI2 will input the torque limit value (P0710 selection). At this point, the maximum torque changes with the analog input, as shown in Figure 5.17. The maximum torque limit value changes real-timely with the analog input of AI, but does not exceed the maximum torque value of the motor in the motor parameters.

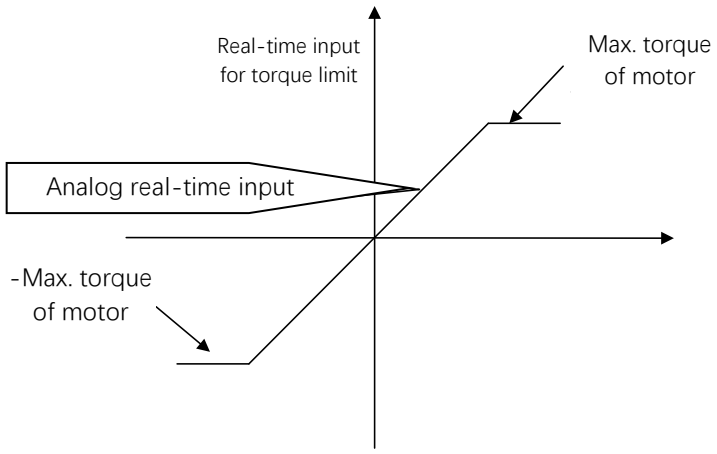


Figure 5.17 Internal Torque Limit Function

External Torque Limit+Analog Input Torque Limit

Meanwhile, the control method that both DI input signals and analog input voltage signals are used for maximum torque limitation. As shown in Figure 5.18, the maximum forward rotation torque limit value: The external forward torque limit control signal is activated, i.e., the DI parameter (14-P-ACL forward rotation external torque limit input) activates the parameter P0713, and the torque limit values of analog quantities are inputted real-timely. At this time, the smaller value of the two is taken as the maximum forward rotation torque limit. The principle of maximum reverse rotation torque limit is similar.

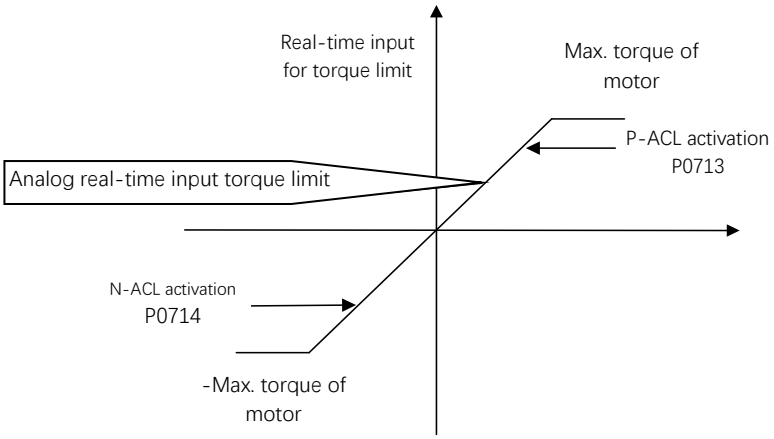


Figure 5.18 Combination of External Torque Limit and Analog Quantity Input Limit

6 Troubleshooting

When the servo unit has an abnormality, the Nixie tube on the panel will flash and display a fault code, as shown in Figure 6.1.

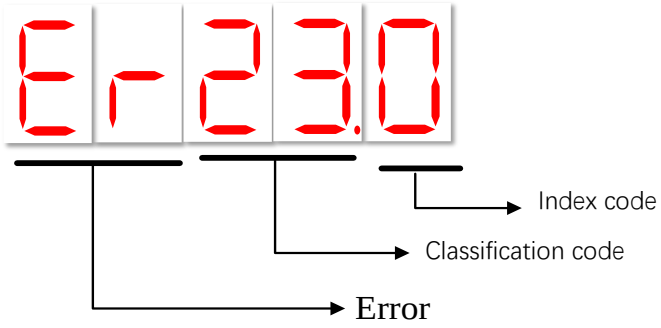


Figure 6.1 Display of Servo Nixie Tube Fault State

- In the fault display mode, press the "SET" button to stop the Nixie tube from flashing, then press the "MODE" button to switch to the parameter display mode.
- You can set the panel to not display warning messages through parameter P00.06;
- If multiple faults occur simultaneously, the panel will display the fault code at highest fault level (non-resettable fault) by default;
- If the fault/error type allows resetting (referring to the table in Section 6.2 to check whether the resetting option is allowed), the fault can be reset through DI setting parameters (2-ALM-RST reset alarm input) or parameter P0805;
- not all faults can be reset. Please eliminate the cause of the fault and ensure safety before resetting;
- The incorrect fault reset method may cause servo misoperation and personal injury. Please carefully evaluate during the design phase.

6.1 List of Alarms and Faults

The list of alarms lists the alarm contents, alarm types, and alarm reset availability in the order of alarm codes.

6.1.1 Shutdown Methods in the Event of Different Types of Alarm

For the method of stopping the motor when an alarm occurs, please refer to the stop setting in Section 4.5.

6.1.2 Alarm Reset

Yes: The alarm can be cleared by resetting the alarm. But alarm factors still exist, the alarm cannot be released.

No.: The alarm cannot be released.

Alarm code			Content	Attribute	
Classification code		Index code		Alarm type	Alarm Reset
2	3	0	IPM module overcurrent	Fault 1	No
2	3	1	U phase overcurrent	Fault 1	No
2	3	2	V phase overcurrent	Fault 1	No
2	3	5	Regenerative resistor short circuit	Fault 1	No
2	3	6	Excessively small regenerative resistance	Warning	Yes
3	1	0	Control power failure	Fault 1	No
3	1	1	Power phase loss	Warning	Yes
3	2	0	DC bus overvoltage	Fault 1	Yes
3	2	1	Regenerative overload	Warning	Yes
3	2	4	DC bus undervoltage	Fault 1	Yes
3	2	7	Driver overload	Fault 1	Yes
3	2	8	Motor overload	Fault 2	Yes

Alarm code			Content	Attribute	
3	2	9	Motor overload warning	Warning	Yes
3	2	A	Driver motor power mismatching	Warning	Yes
4	3	0	IPM module overtemperature	Fault 2	Yes
4	3	5	Fan fault	Warning	Yes
5	1	0	Soft start relay fault	Fault 1	No
5	2	0	Phase current sensor fault	Fault 1	No
5	2	3	Excessively large analog input voltage	Fault 1	No
5	2	4	Analog input converter fault	Fault 1	No
5	2	5	Excessively large analog input zero drift	Warning	Yes
5	5	0	Write driver EEPROM timeout	Fault 1	No
5	5	1	Read driver EEPROM timeout	Fault 1	No
5	5	2	Drive EEPROM read/write data quantity exceeds limit	Warning	Yes
5	5	6	Read and write encoder EEPROM failure	Fault 1	No
5	5	7	Fail to write the magnetic pole identification results to the encoder EEPROM	Fault 2	Yes
6	3	0	Factory parameter initialization failed	Fault 1	Yes
6	3	1	User parameter initialization failed	Fault 1	Yes
6	3	2	Abnormal parameter value	Fault 2	Yes
6	3	3	Parameter changes that require reconnecting the power supply	Warning	Yes
6	3	7	Check character data verification error in the encoder EEPROM	Fault 2	Yes
7	1	0	Locked rotor	Fault 2	Yes
7	1	1	Motor cable breakage warning	Warning	Yes
7	1	2	Motor UVW wiring error	Fault 1	No
7	3	0	Absolute value encoder multi-turn count abnormality	Fault 2	Yes
7	3	1	Encoder battery failure	Fault 2	Yes
7	3	2	Encoder single turn count error	Fault 2	Yes
7	3	3	Encoder battery alarm	Warning	Yes
7	3	4	Encoder overheating	Warning	Yes
7	4	0	Processor abnormality 1	Fault 1	No
7	4	1	Processor abnormality 2	Fault 1	No
7	4	2	Processor abnormality 3	Fault 1	No
7	4	3	Processor abnormality 4	Fault 1	No
7	5	0	Encoder timeout	Fault 1	No
7	5	1	Encoder count increment abnormality	Fault 2	Yes
7	5	2	Encoder communication error 1	Fault 1	No
7	5	3	Encoder communication error 2	Fault 1	No
8	4	0	Overspeed	Fault 1	Yes
8	4	1	Speeding	Fault 1	No
8	5	0	Forward overrun warning	Warning	Yes
8	5	1	Reverse overrun warning	Warning	Yes
8	5	2	Absolute value encoder multi-turn count overflow	Fault 2	Yes
8	5	3	Abnormal setting of position limit value	Fault 2	Yes
8	6	1	Excessive position deviation	Fault 2	Yes
8	6	2	Command pulse frequency abnormality	Fault 2	Yes
8	6	3	Abnormal command position input	Fault 2	Yes
8	6	4	Electronic gear ratio setting overlimit	Fault 2	Yes
F	1	0	Product combination abnormality	Fault 1	No
F	1	1	Motor recognition failure	Fault 1	No
F	1	2	Motor code or encoder type setting error	Fault 1	No
F	1	5	Emergency stop	Warning	Yes
F	1	6	Motor angle search failure	Fault 1	Yes
F	1	7	Resonance frequency search failure	Fault 2	Yes
F	2	0	Encoder abnormality warning	Warning	Yes

Alarm code			Content	Attribute	
F	2	1	Frequency division pulse output setting abnormality warning	Warning	Yes
F	2	2	Frequency division pulse output overspeed	Fault 2	Yes
F	2	5	DI function configuration abnormality	Fault 1	Yes
F	2	6	DO function configuration abnormality	Fault 1	Yes
F	2	7	Servo ON command ineffective fault	Fault 2	Yes
F	4	1	Abnormal setting of home position reset function	Warning	Yes
F	4	2	Home position reset failure	Warning	Yes
F	4	6	Excessive error in full closed-loop position control	Fault 2	Yes
F	4	7	Full closed-loop function setting abnormality	Fault 2	Yes
F	4	A	STO abnormality	Fault 1	No

6.2 Troubleshooting Methods

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
Er23.6 Excessively small regenerative resistance	When an external brake resistor is used, the resistance value is less than the minimum value allowed by the driver (P002E factory value).	Measure the resistance value of the external brake resistor and check whether it is less than the factory value of P002E.	Ensure that the external brake resistance value of the driver is greater than the minimum allowable value of the driver, and write this value into parameter P002E.
Er31.1 Power phase loss	Poor wiring of three-phase wires.	Check the power supply wiring.	Check whether there is any problem with the power wiring.
	Three-phase power supply imbalance.	Measure the voltage of each phase of the three-phase power supply.	Correct the imbalance of the power supply.
	A single-phase power supply is inputted without inputting the single-phase AC power supply.	Check the power supply and parameter settings.	Set the correct power input and parameters.
Er32.1 Regenerative overload	The power supply voltage exceeds the specification range.	Measure the supply voltage.	Set the power supply voltage within the specified range.
	Insufficient external regenerative resistor value or regenerative resistor capacity, or in a continuous regeneration state.	Check the operating conditions and capacity again.	Change the regenerative resistance value and regenerative resistor capacity. Adjust the operating conditions again.
	The resistance value (P002E) or capacity (P002F) of the external regenerative resistor is set to be less than the actual value of the external regenerative resistor.	The external regenerative resistance is too large and check whether the regenerative resistance value is correct.	Change it to the correct resistance value and capacity.
Er32.9 Motor overload warning	The motor has exceeded the overload protection characteristic during operation.	Check the overload characteristics and operation command of the motor.	Re-explore the load and operating conditions. Or reconsider the motor capacity.
	Due to the mechanical factors, the motor is not driven, resulting in excessive load during operation.	Check the operation command and motor speed.	Improve mechanical factors.
Er32.A Driver motor power mismatching	Driver power mismatches the motor power	The driver is connected to a motor with a mismatching power (a large motor pulling a small driver or small motor pulling a large driver)	Select the correct motor with matching power according to the selection manual
Er43.5 Fan fault	The fan inside the servo unit stops rotating.	Check whether there is any foreign object stuck inside the fan.	An alarm still occurs after foreign objects are removed.

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
			Please replace the servo driver.
Er52.5 Excessively large analog input zero drift	AI analog input wiring error.	Check whether the wiring is correct with reference to the wiring diagram.	Refer to the wiring diagram to ensure that the wiring is correct.
	There is interference in the AI analog input signal.	Improve the noise environment such as wiring and settings, and check whether the action is effective.	Take actions to prevent noise, such as correctly wiring FG, shortening cable length and using twisted pair cables. Increase the AI analog filtering time constant (P0139 P013E).
	Drive unit fault.	Reconnect the power supply to the servo unit without connecting external terminals. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er55.2 Drive EEPROM read/write data quantity exceeds limit	Lots of parameters are modified very frequently, and the parameters are stored in EEPROM (P0005 = 1).	Check whether the upper computer system frequently and quickly modifies parameters.	Before performing write operations on the upper computer, set P0005 to 0 for parameters that do not need to be stored in EEPROM.
Er63.3 Parameter changes that require re-connecting the power supply	The modified parameters can take effect only after the equipment is re-powered on.	Check whether any parameters that will take effect only after re-power-on are modified.	Re-power on.
Er71.1 Motor cable breakage warning	The driver UVW output cable is detached and damaged.	Check whether the cable interface is loose or damaged.	Reconnect the motor cables or replace the cables.
Er73.3 Encoder battery alarm	The battery voltage is less than the specified value (3.0V).	Measure the battery voltage.	Replace the battery.
Er73.4 Encoder overheating	The ambient temperature of the servo motor is too high.	Measure the ambient temperature of the servo motor.	Adjust the ambient temperature of the servo motor to be less than 40 °C.
	The servo motor operates at a load exceeding the rated value.	Check the load by accumulating the load rate.	Adjust the load of the servo motor to be within the rated value before operating.
Er85.0 Forward overrun warning	The forward operation disabling function is effective.	Check whether the input terminal function is configured with a forward overrun disabling function, as the forward overrun switch is effective in this case when the motor is running at the forward direction.	It operates reversely until the forward overrun switch is ineffective.
Er85.1 Reverse overrun warning	The reverse operation disabling function is effective.	Check whether the input terminal function is configured with a reverse overrun disabling function, as the reverse overrun switch is effective in this case when the motor is running at the reverse direction.	Make it operate forward until the reverse overrun switch is ineffective.
ErF1.5 Emergency stop	The DI emergency stop signal is effective.	Check whether the DI function is set to emergency stop and whether the emergency stop signal is effective.	After confirming safe operation, release the emergency stop signal.
ErF2.0 Encoder ab-	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs,	Replace the servo motor.

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
normality warning		it may be caused by the encoder fault.	
ErF2.1 Frequency division pulse output setting abnormality warning	Too large number of encoder division pulses (P0016, P0017) is set.	Check whether the number of frequency division pulses (P0016, P0017) of the encoder is greater than the encoder resolution/4.	Correctly adjust the set parameters (P0016, P0017).
ErF4.1 Abnormal setting of home position reset mode	The incorrect home position reset mode is selected.	Check whether the home position reset mode setting is appropriate.	Correctly set the home position reset mode value.
ErF4.2 Home position reset failure	An abnormality occurs during the home position reset action.	Please check whether the settings of various sensors are abnormal.	Check the sensor setting.

6.3 Troubleshooting Methods

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
Er23.0 IPM module overcurrent	Main circuit cable wiring error or poor contact.	Check whether the wiring is correct.	Modify the wiring.
	The main circuit cable has an internal short circuit or the grounding short circuit has occurred.	Check whether there is a short circuit between the UVW phases of the cable and between the UVW and ground wire.	The cable may has a short circuit. Replace the cable.
	There is a short circuit or grounding short circuit inside the servo motor.	Check whether there is a short circuit between the UVW phases of the motor terminal and between the UVW and ground wire.	It may be caused by the servo motor fault. Replace the servo motor.
	There is a short circuit or grounding short circuit inside the servo unit.	Check whether there is a short circuit between the UVW phases of the servo motor connection terminal of the servo unit and between the UVW and ground wire.	It may be caused by the servo unit fault. Replace the servo unit.
	Regenerative resistor wiring error or poor contact.	Check whether the wiring is correct.	Modify the wiring.
	Too small resistance value of servo unit.	Check the use frequency of the regenerative resistor.	Change the regenerative resistance value to a value above the minimum allowable resistance value of the servo unit.
	Misoperation caused by noise.	Improve the noise environment such as wiring and settings, and check whether the action is effective.	Take actions to prevent noise, such as correctly wiring FG. In addition, please use the FG wire with the same size as the main circuit wire of the servo unit.
Er23.1 U phase overcurrent	Main circuit cable wiring error or poor contact.	Check whether the wiring is correct.	Modify the wiring.
	The main circuit cable has an internal short circuit or the grounding short circuit has occurred.	Check whether there is a short circuit between the UVW phases of the cable and between the UVW and ground wire.	The cable may has a short circuit. Replace the cable.
	There is a short circuit or grounding short circuit inside the servo motor.	Check whether there is a short circuit between the UVW phases of the motor terminal and between the UVW and ground wire.	It may be caused by the servo motor fault. Replace the servo motor.
	There is a short circuit or grounding short circuit inside the servo unit.	Check whether there is a short circuit between the UVW phases of the servo motor connection terminal of the servo unit and between the UVW and ground wire.	It may be caused by the servo unit fault. Replace the servo unit.
	The time synchronization between pulse input and servo switching-on or the pulse input is too fast.	Check whether the command input is earlier than the servo enabling	After the servo is enabled, input the command again.
		Check whether the command acceleration and deceleration time is too fast.	Give a command to increase the acceleration and deceleration time.
Er23.2V phase overcurrent	Same as Er23.1.	Same as Er23.1.	Same as Er23.1.
Er23.5	The wiring of the external	Check the wiring of the external regen-	Connect the external regenera-

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
Regenerative resistor short circuit	regenerative resistor is poor, detached, or disconnected.	erative resistor.	tive resistor correctly.
	The regenerative drive transistor of the driver is faulty.	-	Replace the servo driver.
Er31.0 Control power failure	The control power supply operates abnormally.	Check whether the control power supply voltage has an instantaneous power outage.	Replace the power supply and ensure that the supply voltage operates normally.
		Check whether the specifications of the control power supply voltage meet the requirements.	
	Poor connection between control cable and driver.	Check whether there is any poor contact in the connection of the control wire and cable.	Reconnect the control cable or replace the cable.
Er32.0 DC bus overvoltage	The power supply voltage exceeds the specification range.	Measure the supply voltage.	Adjust the supply voltage to be within the product specification range.
	The power supply is in an unstable state or has been affected by lightning strike.	Measure the supply voltage.	Improve the power condition, set up the surge suppressor and then reconnect the servo unit power supply.
	Acceleration and deceleration are performed when the AC power supply voltage exceeds the specification range.	Check the power supply voltage and the speed and torque during operation.	Adjust the AC supply voltage to be within the product specification range.
	The external regenerative resistance value is higher than the operating condition.	Check operating conditions and regenerative resistance values.	Re-discuss the regenerative resistance value considering the operating conditions and load.
	Make the equipment operate in a state above the allowable rotational inertia ratio or mass ratio.	Ensure that the rotational inertia ratio or mass ratio is within the allowable range.	Increase the deceleration time, or reduce the load.
Er32.4 DC bus undervoltage	The power supply voltage is lower than the specification range.	Measure the supply voltage.	Adjust the power supply voltage to the normal range.
	The supply voltage drops in the operation.	Measure the supply voltage.	Increase the power capacity.
Er32.7 Driver overload	Excessive load of driver.	Check whether the average load rate P0928 is higher than 80%.	Re-select the driver and select the driver with larger power.
	The poor gain adjustment leads to vibration and swinging action.	Check whether there is any vibration or abnormal noise in the motor.	Re-adjust the parameters.
	The machine is subjected to the collision, and the machine suddenly becomes heavy and twisted.	Check whether the mechanical action state is abnormal.	Eliminate the mechanical abnormalities and reduce the load.
	The brake is not opened and the motor acts.	Measure the brake terminal voltage.	Open the brake.
Er32.8 Motor overload	The motor has exceeded the overload protection characteristic during	Check the overload characteristics and operation command of the motor.	Re-explore the load and operating conditions. Or reconsider the motor capacity.

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
	operation.		
	Due to the mechanical factors, the motor is not driven, resulting in excessive load during operation.	Check the operation command and motor speed.	Improve mechanical factors.
Er43.0 IPM module overtemperature	Too high ambient temperature.	Measure ambient temperature with a thermometer. Or set up the environmental monitoring through the servo unit to check the operation status.	Improve the setting conditions of the servo unit and reduce the ambient temperature.
	Operate the equipment after resetting the overload alarm multiple times by turning off the power.	Use the alarm display to check whether an overload alarm has occurred.	Reset method for changing the alarm
	Excessive load of driver.	Check whether the average load rate P0928 is higher than 80%.	Re-select the driver and select the driver with larger power.
	The poor gain adjustment leads to vibration and swinging action.	Check whether there is any vibration or abnormal noise in the motor.	Re-adjust the parameters.
	The machine is subjected to the collision, and the machine suddenly becomes heavy and twisted.	Check whether the mechanical action state is abnormal.	Eliminate the mechanical abnormalities and reduce the load.
	The brake is not opened and the motor acts.	Measure the brake terminal voltage.	Open the brake.
Er51.0 Soft start relay fault	Servo unit fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er52.0 Phase current sensor fault	Servo unit fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er52.3 Excessively large analog input voltage	The AI analog input voltage is too high.	Measure the actual input voltage and check whether the AI voltage sampling values (P0923 and P0924) are higher than 11V	Adjust the AI analog input voltage to be less than 11V.
	AI analog input wiring error.	Check whether the wiring is correct with reference to the wiring diagram.	Refer to the wiring diagram to ensure that the wiring is correct.
	There is interference in the AI analog input signal.	Improve the noise environment such as wiring and settings, and check whether the action is effective.	Take actions to prevent noise, such as correctly wiring FG, shortening cable length and using the shielded cables and twisted pair cables.
			Increase the AI analog filtering time constant (P0139 P013E).
Er52.4 Analog input converter fault	There is interference in the AI analog input signal.	Improve the noise environment such as wiring and settings, and check whether the action is effective.	Take actions to prevent noise, such as correctly wiring FG, shortening cable length and using the shielded cables and twisted pair cables.
	Servo unit fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er55.0 Write driver	Drive unit fault.	It may be caused by the fault of servo unit when the alarm still occurs after the	Replace the servo unit.

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
EEPROM timeout		power supply of the servo unit is re-connected and the parameter is changed.	
Er55.1 Read driver EEPROM timeout	Drive unit fault.	It may be caused by the fault of servo unit when the alarm still occurs during the parameters reading after the power supply of the servo unit is re-connected.	Replace the servo unit.
Er55.6 Read and write encoder EEPROM failure	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.
	Encoder cable abnormality.	Check whether the encoder cable is damaged and whether the cable interface is loose.	Replace the encoder cable or re-connect the cable.
Er55.7 Fail to write the magnetic pole identification results to the encoder EEPROM	Encoder fault.	Reconnect the power supply to the servo unit. Perform the magnetic pole identification. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.
	Encoder cable abnormality.	Check whether the encoder cable is damaged and whether the cable interface is loose.	Replace the encoder cable or re-connect the cable.
Er63.0 Factory parameter initialization failed	Control the power supply abnormality, which may cause the driver to fail to read the parameters.	Check whether the control power supply voltage has an instantaneous power outage.	Replace the power supply and ensure that the supply voltage operates normally.
		Check whether the specifications of the control power supply voltage meet the requirements.	
	Driver firmware update.	Check whether the drive firmware has been updated.	Initialize the parameters.
	Drive unit fault.	When an alarm still occurs after parameter initialization, it may be caused by the fault of the servo unit.	Replace the servo unit.
Er63.1 User parameter initialization failed	Control the power supply abnormality, which may cause the driver to fail to read the parameters.	Check whether the control power supply voltage has an instantaneous power outage.	Replace the power supply and ensure that the supply voltage operates normally.
		Check whether the specifications of the control power supply voltage meet the requirements.	
	Driver firmware update.	Check whether the drive firmware has been updated.	Initialize the parameters.
	Drive unit fault.	When an alarm still occurs after parameter initialization, it may be caused by the fault of the servo unit.	Replace the servo unit.
Er63.2 Abnormal parameter value	Beyond the parameters setting range.	Check the setting range of the changed parameters.	Set the changed parameters to values within the set range.
	Driver firmware update.	Check whether the drive firmware has been updated.	Initialize the parameters.
	Drive unit fault.	When an alarm still occurs after parameter initialization, it may be caused by the fault of the servo unit.	Replace the servo unit.
Er63.7 Check character data verification error in the encoder EEPROM	The driver mismatches the motor.	Check whether the driver matches the motor based on the nameplates.	Replace the matching driver or motor.
	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
	Encoder cable abnormality.	Check whether the encoder cable is damaged and whether the cable interface is loose.	Replace the encoder cable or re-connect the cable.
Er71.0 Locked rotor	The motor is locked due to the mechanical cause.	Check whether the mechanical load is too large or whether there is a collision with the mechanical structure.	Re-select the driver and select the driver with larger power.
			Improve mechanical factors.
	Abnormal connection of the driver UVW output cable or encoder cable.	Use jog operation without load and check the wiring.	Connect the cables correctly or replace the cables.
Er71.2 Motor UVW wiring error	Motor UVW cable sequence connection error.	Ensure that the driver UVW wiring terminals correspond to the motor UVW cable phase sequence one to one.	Connect the motor UVW cable correctly.
Er73.0 Absolute value encoder multi-turn count abnormality	The first power-on of multi-turn absolute encoder	Check whether the multi-turn absolute encoder is powered on for the first time.	Absolute value encoder multi-turn data reset (P0804 set to 2)
	The encoder has an abnormality.	The encoder may be faulty when the power supply with the re-connected servo unit still has an alarm after the absolute value encoder multi-turn data is reset (P0804 set to 2)	Replace the servo motor.
Er73.1 Encoder battery alarm	The first power-on of multi-turn absolute encoder	Check whether the multi-turn absolute encoder is powered on for the first time.	Absolute value encoder multi-turn data reset (P0804 set to 2)
	Poor or disconnected battery connection.	Check the battery connection.	Connect the battery correctly.
	The battery voltage is less than the specified value (3.0V).	Measure the battery voltage.	Replace the battery.
Er73.2 Encoder single turn count error	Check whether the encoder cable is clamped, the cladding is damaged, and the signal wire is interfered with.	Check the state of the encoder cable and connector.	Check whether there is any problem with the laying of the encoder cable.
	Check whether the encoder cable is tied together with or too close to the high-current wire.	Check the setting state of the cable for encoder.	Lay the encoder cable in a location that will not be subjected to surge voltage.
	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.
Er74.0 Processor abnormality 1	Servo unit fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er74.1 Processor abnormality 2	Servo unit fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er74.2 Processor abnormality 3	Servo unit fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er74.3 Processor abnormality 4	Servo unit fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the faulty servo unit.	Replace the servo unit.
Er75.0 Encoder timeout	Check whether the encoder cable is clamped, the cladding is damaged,	Check the state of the encoder cable and connector.	Check whether there is any problem with the laying of the encoder cable.

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
	and the signal wire is interfered with.		
	Check whether the encoder cable is tied together with or too close to the high-current wire.	Check the setting state of the cable for encoder.	Lay the encoder cable in a location that will not be subjected to surge voltage.
	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.
Er75.1 Encoder count increment abnormality	Check whether the encoder cable is clamped, the cladding is damaged, and the signal wire is interfered with.	Check the state of the encoder cable and connector.	Check whether there is any problem with the laying of the encoder cable.
	Check whether the encoder cable is tied together with or too close to the high-current wire.	Check the setting state of the cable for encoder.	Lay the encoder cable in a location that will not be subjected to surge voltage.
	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.
Er75.2 Encoder communication error 1	Check whether the encoder cable is clamped, the cladding is damaged, and the signal wire is interfered with.	Check the state of the encoder cable and connector.	Check whether there is any problem with the laying of the encoder cable.
	Check whether the encoder cable is tied together with or too close to the high-current wire.	Check the setting state of the cable for encoder.	Lay the encoder cable in a location that will not be subjected to surge voltage.
	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.
Er75.3 Encoder communication error 2	Check whether the encoder cable is clamped, the cladding is damaged, and the signal wire is interfered with.	Check the state of the encoder cable and connector.	Check whether there is any problem with the laying of the encoder cable.
	Check whether the encoder cable is tied together with or too close to the high-current wire.	Check the setting state of the cable for encoder.	Lay the encoder cable in a location that will not be subjected to surge voltage.
	Encoder fault.	Reconnect the power supply to the servo unit. When the alarm still occurs, it may be caused by the encoder fault.	Replace the servo motor.
Er84.0 Overspeed	Incorrect U, V, and W phase sequence of the motor wiring.	Check the wiring of the servo motor.	Check whether there is any problem with the motor wiring.
	The command input value exceeds the speed limit.	Check the input command.	Reduce the command value. Or adjust the gain.
	The motor speed exceeds the maximum speed.	Check the waveform of the motor speed.	Reduce the speed command input gain and adjust the servo gain. Or adjust the operating conditions.

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
Er84.1 Speeding	Incorrect U, V, and W phase sequence of the motor wiring.	Check the wiring of the servo motor.	Check whether there is any problem with the motor wiring.
	The initial magnetic pole angle value of the motor is incorrect.	After the magnetic pole angle is re-identified, the alarm is eliminated.	Perform the pole angle identification again.
Er85.2 Absolute value encoder multi-turn count overflow	The multi-turn count value of the encoder exceeds the specified value.	-	Absolute value encoder multi-turn data reset (P0804 set to 1).
Er85.3 Abnormal setting of position limit value	The software location limit value is not set correctly. (Object dictionary: 607D)	Check whether the values of object dictionary 607D001 and 607D002 are appropriate.	Correctly set the values of the object dictionaries 607D001 and 607D002.
Er86.1 Excessive position deviation	The U, V, and W wiring of the servo motor is incorrect.	Check the wiring of the main circuit cable of the servo motor.	Check whether there are any poor contact problems with the motor cable or encoder cable.
	The gain of the servo unit is relatively low.	Check whether the gain of the servo unit is too low.	Improve the servo gain through automatic adjustment (no upper command) function, etc.
	The frequency of position command pulses is relatively high.	Try to reduce the command pulse before operating.	Reduce the frequency of position command pulse or command acceleration, or adjust the electronic gear ratio.
	The acceleration of the position command is too high.	Try to reduce the command acceleration before operating.	Add the smoothing function for the position command acceleration and deceleration time parameter (P0320).
	Compared with the operating conditions, the alarm value (P0523) for excessive position deviation is low.	Check whether the alarm value (P0523) of the excessive position deviation is appropriate.	Set the value of parameter P0523 correctly.
Er86.2 Position pulse command abnormality 1	The pulse command frequency is greater than the maximum command pulse frequency setting value (P9131).	Check whether the set maximum command pulse frequency is appropriate.	Set the value of parameter P9131 correctly.
Er86.3 Position command input abnormality	Position command value input abnormality (in modes of CSP, PP and IP)	Check whether the target position value is appropriate.	Set the value of position command correctly.
Er86.4 Electronic gear ratio setting overlimit	Too small electronic gear ratio parameters (P0508, P050A, P050C and P050E) are set.	Check whether the electronic gear ratio (numerator) (P0508)/electronic gear ratio (denominator) (P050A) is less than the encoder resolution/ 10^7. Check whether the electronic gear ratio 2 (numerator) (P050C)/electronic gear ratio 2 (denominator) (P050E) is less than the encoder resolution/10^7.	Correctly adjust the set parameter values (P0508, P050A, P050C and P050E).
	Too large electronic gear ratio parameters (P0508, P050A, P050C and P050E) are set.	Check whether the electronic gear ratio (numerator) (P0508)/electronic gear ratio (denominator) (P050A) is larger than the encoder resolution/ 2.5.	Correctly adjust the set parameter values (P0508, P050A, P050C and P050E).

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
		Check whether the electronic gear ratio 2 (numerator) (P050C)/electronic gear ratio 2 (denominator) (P050E) is less than the encoder resolution/2.5.	
ErF1.0 Product combination abnormality	The power board model of the drive cannot be recognized.	Check whether the series model of the driver power board matches the control board.	Replace the control board and power board that match the driver series model.
	Poor connection between the driver power board and control board.	Check whether the connectors of the driver power board and control board are connected correctly	Reconnect the control board and power board.
	Driver fault.	-	Replace the driver.
ErF1.1 Motor recognition failure	The driver mismatches the motor.	Check whether the driver matches the motor based on the nameplates.	Replace with a matching servo motor.
	Encoder fault.	-	Replace the servo motor.
ErF1.2 Motor code or encoder type setting error.	The motor code (P9001) or encoder type (P9026) is set incorrectly.	Check whether the servo motor matches based on the nameplates.	Set the motor code (P9001) or encoder type (P9026) correctly.
ErF1.6 Motor angle search failure	The motor shaft vibrates due to the mechanical cause.	Ensure that there must be no load connection during angle search.	Ensure that the motor shaft is unloaded.
ErF1.7 Resonance frequency search failure	Due to excessive load, resonance frequency search fails.	Check whether the driver current reaches saturation during resonance frequency search.	Please turn off the self-adaptive notch filter
	The resonance frequency search fails due to the too fast command acceleration and deceleration.		
ErF2.2 Frequency division pulse output overspeed	The output frequency of the frequency division pulse is too high, exceeding the limit value (1MHz).	Check whether the output frequency of the frequency division pulse is too high, exceeding the limit value (1MHz).	Correctly adjust the set parameters (P0016, P0017).
	The motor speed is too high, and the output frequency of the division pulse exceeds the limit value.	Check the output setting of the frequency division pulse and the motor speed.	Reduce the motor speed
ErF2.5 DI function configuration abnormality	Repeated configuration of DI function.	Check whether the same function has been repeatedly configured for multiple DI terminals during DI function configuration.	Ensure that each DI function is assigned to one DI terminal.
ErF2.6 DO function configuration abnormality	Repeated configuration of DO function.	Check whether the same function has been repeatedly configured for multiple DO terminals during DO function configuration.	Ensure that each DO function is assigned to one DO terminal.
ErF2.7 Servo ON command ineffective fault	When the auxiliary function is used to enable the servo driver, the external DI terminal servo ON signal is effective.	Check the servo ON signal status of the external DI terminal when using the auxiliary function.	Set the servo ON function of the external DI terminal to be ineffective.
ErF4.6 Excessive error in full closed-loop position control	The U, V, and W wiring of the servo motor is incorrect.	Check the wiring of the main circuit cable of the servo motor.	Check whether there are any poor contact problems with the motor cable or encoder cable.
	The gain of the servo unit	Check whether the gain of the servo unit	Improve the servo gain through

Alarm code Alarm content	Cause	Inspection method	Troubleshooting method
	is relatively low.	is too low.	automatic adjustment (no upper command) function, etc.
	The frequency of position command pulses is relatively high.	Try to reduce the command pulse before operating.	Reduce the frequency of position command pulse or command acceleration, or adjust the electronic gear ratio.
	The acceleration of the position command is too high.	Try to reduce the command acceleration before operating.	Add the smoothing function for the position command acceleration and deceleration time parameter (P0320).
	Compared with the operating conditions, the alarm value (P1104) for excessive mixing deviation is low.	Check whether the alarm value (P1104) of the excessive mixing deviation is appropriate.	Set the value of parameter P1104 correctly.
ErF4.7 Full closed-loop function setting abnormality	Both the interruption fixed length function and the full closed-loop function are switched on simultaneously.	Please check whether both the interruption fixed length function and the full closed-loop function are switched on simultaneously.	Please turn off the full loop function when the interruption fixed length function is switched on.
ErF4. ASTO abnormality	Poor connection between servo unit and safety optional module	Check the servo unit and safety optional module connection.	Connect the safety optional module correctly.
	Fault of safety optional module.	-	Replace the safety optional module.

7 Modbus Communication

The MODBUS interface (CN2 port) of the Raynen RA3 series servo adopts the standard Modbus RTU communication protocol and can communicate with upper computers (such as PLC controller and PC) to achieve centralized monitoring of multiple servos. The Modbus protocol of this servo currently only supports RTU transmission and is mainly used for reading and writing general parameters or monitoring the state of servo driver. If you need to use a motion control bus, please refer to the RA3E product application manual and the RA3C product application manual.

7.1 Precautions for Use

MODBUS Connection Diagram

- Please refer to the RA3 hardware manual for the definition of CN2 interface pins;
- Try to shorten the cable length between sites as far as possible, and the maximum length shall not exceed 15 meters;
- Twisted pair cables must be used as the cables; if the shielded cables are used, it is recommended to connect both ends of the shielding layer to PE at the same time, without hanging in the air;
- The RS-485 bus shall be laid out separately from power cables or interference wires such as U, V and W phases, or they shall be vertically crossed to avoid parallel wiring;
- RS-485 can be used to connect 32 drivers simultaneously. If more drivers need to be connected, please install a 485 repeater. In this case, you can expand up to 127 drivers;
- RS485 communication shall be used. If the upper computer only supports RS-232, please use an RS232/RS-485 converter;
- If multiple drivers need to be connected, it is recommended to use the topology as shown in the figure below, which does not support the ring or star network;

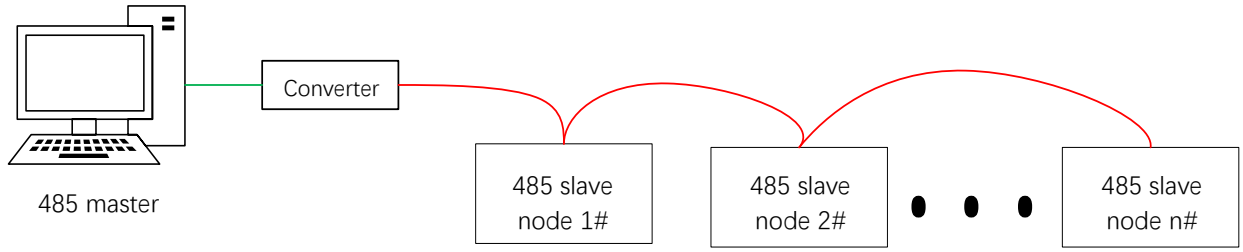


Figure 7.1 Recommended RS-485 Network Topological Structure

- If the signal reception at the end of the bus is poor, a terminal resistor of 120 ohms can be added. Do not add intermediate equipment. Otherwise, it will increase line loss and reduce the number of equipment connections;

Transmission Distance/Rate

Table 6.1 Transmission Distance of RS485

SN	Communication rate	Transmission distance	Cable specification
1	57600bps	< 200 m	24AWG
2	19200bps	< 1200 m	26AWG

Note: The transmission distance of RS-485 is closely related to communication speed, cable material, and on-site electromagnetic interference.

Bus Interference

Generally, ordinary twisted pair cables are sufficient. If there is high noise on site, it is recommended to use shielded twisted pair cables with both grounded ends of the shielding layer.

7.2 Parameters Setting

Table 7.1 Modbus Communication Related Parameters

Parameter No.	Parameter name	Range of numeri-cal value	Unit	Function	Factory default value
P8001	Slave device shaft address	0-65535	1	Se the address of driver	1
P8002	Communication baud rate	0-2400 1-4800 2-9600 3-19200 4-38400 5-57600 6-115200	bit/s	Set the communication rate between the driver and the upper computer	5
P8003	Parity checking method	0- No check bit, 2 stop bits 1-Even parity check, 1 stop bit 2- Odd parity check, 1 stop bit 3- No check, 1 stop bit	-	Set the verification method for communication between the driver and the upper computer	0
P8005	Slave response delay	0-5000	1	After receiving the command, the servo will respond to the upper computer after a delay of P8005 from the slave	1
P8006	32-bit data transmission order	0-1	1	0-Higher 16 bits in front, lower 16 bits at the back 1-Lower 16 bits in front, higher 16 bits at the back	1

Parameter No.	Parameter name	Range of numerical value	Unit	Function	Factory default value
P0005	Modbus communication write EEPROM enabling	0-1	1	0-Not saved into the EEPROM; 1-Real-timely updated to EEPROM	1

- Parameter P0005 needs to be set in conjunction with data attributes. If the data of the variable changes frequently, it is not recommended to save it to EEPROM. Otherwise, frequent reading of and writing into EEPROM may cause damage to EEPROM and driver;
- When multiple drives are networked, each driver can only have a unique address, and the address setting starts from 1;
- The communication rate of the driver shall be consistent with that of the upper computer. Otherwise, it will be impossible to carry out communication;

The data frame structures for different verification methods are as follows:

(1-8-2 format, no check)

Start bit	0	1	2	3	4	5	6	7	Stop bit	Stop bit

(1-8-2 format, odd parity check)

Start bit	0	1	2	3	4	5	6	7	Odd parity check	Stop bit

(1-8-2 format, even parity check)

Start bit	0	1	2	3	4	5	6	7	Even parity check	Stop bit

7.3 Communication Protocol

Modbus is a standard communication protocol widely used in industrial controllers. Through this protocol, controllers from different manufacturers can be connected to industrial networks to achieve data exchange. The Modbus communication adopts a master-slave mode, where there is one master device and up to 32 slave devices in a network. In each question and answer loop, the master node can only allow accessing one of the slave nodes. When the master node issues data to the slave node (reads the slave node data), all slave nodes will accept and determine whether the issued commands belong to the master node. For the node address queried, you needs to upload the data within the specified time limit. The remaining nodes will not respond.

There are two communication modes for Modbus protocol: ASCII mode and RTU (remote terminal unit) mode. Our RA3 series servo drivers currently only support RTU mode.

7.3.1 Communication Data Structure in RTU Mode

Table 7.2 Data Frame Structure of Modbus RTU Mode

Start	Idle time greater than or equal to 3.5 characters, start of frame
Address	The communication address is inputted in hexadecimal. If the node number is 20, input 14 (hexadecimal with a data length of 1 Byte.
Function Code	The function code of Modbus (0x03 0x06 0x10) has a data length of 1 Byte.
Data(0)	Data content, data length 2n (Byte), with the maximum length of 8Byte.
Data(1)	
……	
Data(n-1)	
CRC Check Low	CRC check code is 8 low bits.
CRC Check High	CRC check code is 8 high bits.
End	Idle time greater than or equal to 3.5 characters, end of frame

7.3.2 Description of Modbus Function Codes

Table 7.3 Function Codes for Modbus Reading and Writing Data

Function code	Achieved function
0x03	Reading operation, with the data length of 2 Bytes or 4Bytes
0x06	Writing operation, with the data length of 2Bytes
0x10	Writing operation, with the data length of 4Bytes

7.3.3 Communication Examples of 3 Function Codes

Example of Reading 2-Byte Data for 0x03:

Table 7.4 Reading 2-Byte Data in RTU Mode

Upper computer reads 2-Byte data		The analysis is as follows:	Servo response data	
Address	01H	Read address: 0920H; Read data: 0x0C6C = 3180 indicates the read parameter: P0920 = 3180 i.e., the DC bus voltage is 318V	Address	01H
Function code	03H		Function code	03H
Address of initial data	09H (high bytes)		Number of read bytes	02H
	20H (low bytes)		Content of initial address	0CH (high bytes)
Data length (calculated in Word)	00H (high bytes)			
	01H (low bytes)			6CH (low bytes)
CRC Check Low	86H		CRC Check Low	86H
CRC Check High	5CH		CRC Check High	5CH

Example of Writing 2-Byte Data to the Servo for 0x06:

Table 7.5 Writing 2-Byte Data in RTU Mode

Upper computer writes 2-Byte data		The analysis is as follows:	Servo response data	
Address	01H	Write the data target address: 0704H; Data: 0x0190 =400 Indicates setting the parameter P0704 = 400 i.e., setting the target torque 40%	Address	01H
Function code	06H		Function code	06H
Address of initial data	07H (high bytes)		Address of initial data	07H (high bytes)
	04H (low bytes)			04H (low bytes)
Data content	01H (high bytes)		Data content	01H (high bytes)
	90H (low bytes)			90H (low bytes)
CRC Check Low	C8H		CRC Check Low	C8H
CRC Check High	83H		CRC Check High	83H

7.3.4 Error Response Frame

Table 7.7 RTU Mode Error Data Frame

Start	Idle time greater than or equal to 3.5 characters, start of frame
Address	The communication address is inputted in hexadecimal. If the node number is 20, input 14 (hexadecimal with a data length of 1 Byte
Function Code	Modbus function code+0x80
Data[0]~[3]	Error code
CRC Check Low	CRC check code is 8 low bits.
CRC Check High	CRC check code is 8 high bits.
End	Idle time greater than or equal to 3.5 characters, end of frame

The error codes for the Modbus communication protocol are shown in the table below:

Table 7.8 Error Codes of RTU Error Data Frame

Error code	Error analysis
0x0001	Function code error
0x0002	Data address error
0x0003	Data error
0x0004	Servo fault

7.3.5 Modbus CRC Checking

When the upper computer and servo driver adopt the Modbus communication protocol, the same

CRC checking method must be followed. Otherwise, the CRC checking error will occur and the communication cannot be smooth. You can check it by setting the parameters.

8 Detailed Descriptions of Functions

Table 8.1 List of RA3 Series Servo Parameters

Parameter group category	Parameter group	Function category
General parameter group	P00	Basic configuration
	P01	I/O terminal configuration
	P02	Gain adjustment
	P03	Vibration inhibiting
	P04	Extended control
	P05	Position control mode
	P06	Speed control mode
	P07	Torque control mode
	P08	Auxiliary function operation
	P09	Operating state display
Special function	P10	Returning to Home Position
	P11	Full Closed-loop Function
	P12	Multi-segment speed function
	P13	Multi-segment position function
	P14	Operating state display
Communication parameter	P80	Modbus protocol

8.1 Group P00- Basic Configuration

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0007	LED initial state display	0-99	1	50	Setting at any time	Effective immediately

Set the value in parameter P00.07 to be equal to the sub-index of group P09 to make the Nixie tube always display a certain specific variable.

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P000A	Control Mode Selection	0-6	1	1	Shutdown setting	Effective immediately

Set the servo control mode. The detailed definitions of numerical values are as described in Table 8.2:

When setting the first and second control modes to 3, 4 and 5, you can switch through the control mode selection input (C-MODE1).
When the C-MODE1 is effective: select the first control mode.
When the C-MODE1 is ineffective: Select the second control mode.

When setting the composite (the first, second and third) control mode to 6, you can switch through the combination of control mode selection input (C-MODE1, C-MODE2).
When C-MODE1 is effective: Select the position control mode.
When C-MODE1 is ineffective and C-MODE2 is effective: Select the speed control mode.
When C-MODE1 is ineffective and C-MODE2 is ineffective: Select the torque control mode.

Table 8.2 Control Mode Selection Description

Set value	Mode description		
	The first mode	The second mode	The third mode
0	Speed	——	——
1	Position	——	——
2	Torque	——	——

3	Torque	Speed	——
4	Speed	Position	——
5	Torque	Position	——
6	Torque	Speed	Position

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P000B	Rotation direction selection	0-1	1	0	Shutdown setting	Next power-on

Set the motor rotation direction:

0: The CCW direction is used as the forward rotation direction (A leads B);

1: The CW direction is used as the forward rotation direction (the reverse rotation mode, A lags behind B).

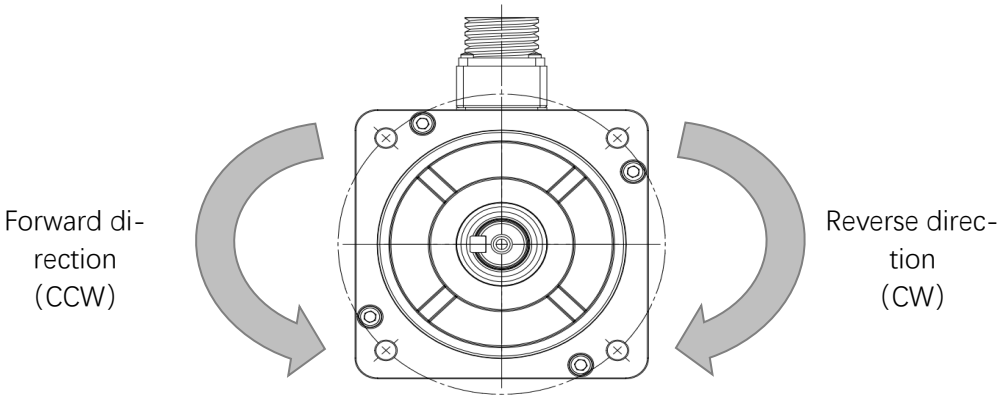


Figure 8.1 Motor Rotation Direction Setting

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P000C	Absolute position type	0-1	1	0	Shutdown setting	Next power-on

Set absolute position type for position mode:

0: When you use the single turn absolute type, it cannot remember the absolute position after power failure and needs to search for the home position again;

1: When you use the multi-turn absolute type, it can maintain the position after power failure and it will alarm in case of multi-turn overflow (please set the correct motor encoder type);

Note: ErF1.2 Er73.0 Er73.1 is a normal phenomenon when the multi-turn absolute motor is first connected to the driver and powered on. Please release the alarm according to the troubleshooting methods.

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0012	Pulse output logic reversal	0-1	1	0	Shutdown setting	Next power-on

Set the pulse phase relationship of the output pulse port:

0: The CCW direction is used as the forward rotation direction (A leads B);

1: The CW direction is used as the forward rotation direction (the reverse rotation mode, A lags behind B)

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0013	Z-pulse output polarity selection	0-1	1	1	Shutdown setting	Next power-on

Set the output electric level of the Z pulse at the pulse output port:

0: Positive polarity output (Z pulse is at the high electric level);

1: Negative polarity output (Z pulse is at the low electric level).

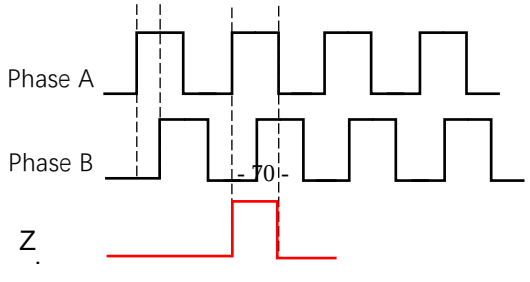


Figure 8.2 Pulse Output Port Characteristic Settings

For detailed information on parameters P0012 and P0013, please refer to Figure 7.2. A leads phase B by 90°, and the Z pulse output is at a high electric level.

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0016	Number of frequency division pulses of encoder	0-2147483647	1Pulse/ Rev	2500	Shut-down setting	Next power-on

Set the number of pulses outputted by the pulse output port when the motor rotates 1 turn.
For example, when parameter P0011 is equal to 0 and parameter P0016 is set to 2500, the actual number of pulses outputted by the pulse port is 10000. If parameter P0011 is set to another value, P0016 is ineffective.

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001B	Servo OFF stop mode	0-5	1	0	Shut-down setting	Effective immediately

The motor stop method at the servo OFF state is selected through P001B.

Set value	Description	
	Servo motor stop method	State after the servo stop
0	Dynamic brake (DB)	Dynamic brake (DB)
1	Zero speed	
2	Ramp stop	
3	Free running	Free running
4	Zero speed	
5	Ramp stop	

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001C	Overrun stop method	0-4	1	1	Shutdown setting	Effective immediately

The motor stop method when the servo overrun prevention function is activated is selected through P001C.

Set value	Description	
	Servo motor stop method	State after the servo stop
0	Free running	Servo OFF stop mode
1	Zero speed	
2		Zero position fixing
3	Ramp stop	Servo OFF stop mode
4		Zero position fixing

Parameter group	Parameter name	Range of numerical	Unit	Factory default value	Setting method	Method to take effect
P001D	Type 1 fault alarm stop method	0-2	1	0	Shut-down setting	Effective immediately

The method for stopping the motor when the servo has type 1 fault alarm is selected through P001D.

Set value	Description	
	Servo motor stop method	State after the servo stop
0	Free running	Free running
1	Dynamic brake (DB)	

2		Dynamic brake (DB)

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001E	Type 2 fault alarm stop method	0-9	1	0	Shut-down setting	Effective immediately

The method for stopping the motor when the servo has type 2 fault alarm is selected through P001E.

Set value	Description	
	Servo motor stop method	State after the servo stop
0	Dynamic brake (DB)	Dynamic brake (DB)
1	Zero speed	
2	Ramp stop	
3	Reserved	
4	Emergency stop torque	Dynamic brake (DB)
5	Free running	Free running
6	Zero speed	
7	Ramp stop	
8	Reserved	
9	Emergency stop torque	Free running

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P001F	Stop switching speed threshold	10-10000	r/min	100	Shut-down setting	Effective immediately

The threshold for deceleration and stop during the servo stop. If it is greater than 100r/min, it is considered to be decelerating. If it is less than 100r/min, it is considered that the motor has stopped.

Parameter group	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0020	Emergency stop torque	0-6000	0.1%	1000	Shut-down setting	Effective immediately

In the emergency stop state, the factory value of 1000 indicates that the motor output torque is 1 multiplied by the rated torque of the motor (1000* 0.1%=1).

The parameter for DI needs to be set to "2-EMG-S emergency stop input". When DI is activated, the motor is in the emergency stop process.

	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0021	Ramp stop deceleration time	0-65535	ms	100	Shutdown setting	Effective immediately

When the driver stops and the stop mode is set to ramp stop mode, the time from the starting moment of equipment stop to the motor speed of 0.

	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0022	Opening the Stuck Brake Sticking-Command Receiving Delay Time	0-500	ms	100	Setting at any time	Effective immediately

Please open the stuck brake and wait for the delay time (P0022) set for receiving the command before outputting the command from the upper device to the servo unit

	Parameter name	Range of nu-	Unit	Factory de-	Setting meth-	Method to take

		merical value		fault value	od	effect
P0023	Brake Sticking Action during Stop- Servo OFF Delay Time	1-1000	ms	100	Setting at any time	Effective immediately

When the servo motor stops, the BRK signal will also be OFF if the servo ON input (S-ON) signal is OFF. By setting the servo OFF delay time (P0023), the BRK signal can be changed from OFF to the actual time when the motor is not powered on.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0024	Brake Sticking Action during Operation- Servo OFF Delay Time	1-1000	ms	300	Setting at any time	Effective immediately

If the servo ON input (S-ON) signal is OFF when the servo motor is running, the BRK signal will be OFF when the motor speed is less than the output speed value of the brake sticking action (P0025). By setting the servo OFF delay time (P0024), the BRK signal can be changed from OFF to the actual time when the motor is not powered on.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0025	Brake sticking action speed value	0-3000	r/min	20	Setting at any time	Effective immediately

When the holding brake logic is handled during the operation of the motor, the motor is considered as stationary when the speed is less than this value.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0029	Regenerative Brake Method	0-3	1	0	Shutdown setting	Effective immediately

During the deceleration and brake process of the servo motor, energy will be transferred from the load end to the DC bus. If the feedback energy is too large, the brake resistor needs to release this part of the energy. Otherwise, the driver may alarm or be damaged.

Table 8.3 Description of Regenerative Brake Method

Set value	Regenerative Brake Method	Description
0	Using the internal resistor	The overload protection action for the regenerative brake resistor is made based on the power and resistance value of the internal resistor.
1	Using the external resistor	The overload protection action for the regenerative brake resistor is made based on the power and resistance value of the external resistor.
2	Reserved	——
3	None	The regenerative brake resistor is not used, and all of the regenerative electric power is processed through the built-in capacitor.

The brake method varies under different powers. Please refer to the specific specifications of the driver to set this parameter. Internal and external brake resistors cannot be used simultaneously. Please pay attention to the correct hardware wiring.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002A	Heat dissipation coefficient of regenerative resistor	10-100	1	50	Shutdown setting	Effective immediately

Adjust the heat dissipation coefficient of the regenerative resistor based on the heat dissipation state of the external regenerative resistor. If you use an internal regenerative resistor, please set it to the factory value.

Table 8.4 Description of Dissipation Coefficient of Regenerative Resistor Heat

Heat dissipation speed of regenerative resistor	Heat dissipation coefficient of regenerative resistor
High	Large
↓	↓
Low	Small

When you use the natural cooling method (natural convectional cooling): it is recommended to set it to below 30%.

When you use the air forced cooling method: it is recommended to set it to below 50%.

Please set the heat dissipation coefficient of the regenerative resistor according to the actual heat dissipation state to avoid abnormal heating of the regenerative discharge resistor due to improper setting, which may cause burnout. When using an external regenerative discharge resistor, be sure to set up the external protection such as temperature fuse. The regenerative discharge resistor may have abnormal heating, leading to burnout, which is unrelated to the effectiveness/ineffectiveness of overload protection for regenerative discharge resistor.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002C	Internal regenerative resistance value	1-1000	Ω	50	Only displayed	Effective immediately

The default value is maintained and cannot be modified.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002D	Capacity of internal regenerative resistor	1-65535	W	50	Only displayed	Effective immediately

The default value is maintained and cannot be modified.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002E	Resistance value of external regenerative resistor	1-1000	Ω	50	Shutdown setting	Effective immediately

Please set this value according to the brake resistor nameplate.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P002F	Capacity of external regenerative resistor	1-65535	W	40	Shutdown setting	Effective immediately

Please set this value according to the brake resistor nameplate.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0030	Single-phase/three-phase selection	0-1	1	0	Setting at any time	Effective immediately

Set according to the nameplate of driver.

0: Single-phase input

1: Three-phase input

8.2 Group P01- I/O Terminal Configuration

The hardware configuration of this servo drive includes 9 circuits of digital input interface (DI) and 5 circuits of digital output interface (DO). The functions and logical effective electric level of each interface can be set through relevant parameters. Please refer to the following instructions.

8.2.1 DI Function Selection

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P0107	GDI-1 function allocation	0-37 (Please refer to the table below for details)	1	1	Setting at any time	Next power-on
P0109	GDI-2 function allocation			3	Setting at any time	Next power-on
P010B	GDI-3 function allocation			4	Setting at any time	Next power-on
P010D	GDI-4 function allocation			5	Setting at any time	Next power-on
P010F	GDI-5 function allocation			6	Setting at any time	Next power-on
P0115	HDI-1 function allocation			0	Setting at any time	Effective immediately
P0117	HDI-2 function allocation			0	Setting at any time	Effective immediately

Refer to the Table Below for the Parameters Setting and Functions Selection:

Table 8.5 Allocatable Functions of DI

Input signal	Input signal name	Set value of DI
-	No definition	0
S-ON	Servo enabling input	1
EMG-S	Emergency stop input	2
ALM-RST	Reset alarm input	3
P-OT	Forward drive input inhibiting	4
N-OT	Reverse drive input inhibiting	5
INHIBIT	Command pulse input inhibiting	6
CL	Deviation counter clear input	7
ZCLAMP	Zero position fixed enabling input	8
GEAR-SEL	Electronic gear selection input	9
P-DIR	Position command direction input	10
V-DIR	Speed command direction input	11
T-DIR	Torque command direction input	12
TL-SEL	Torque limit switching input	13
P-ACL	Forward rotation external torque limit input	14
N-ACL	Reverse rotation external torque limit input	15
P-CON	Proportional action switching input	16
C-MODE1	Mode switch M1 input	17
C-MODE2	Mode switch M2 input	18
PMUL-EN	Internal multi-segment position enabling input	19
DIR-SEL	Multi-segment motion command direction switching input	20
CMD1	Multi-segment motion command switching CMD1 input	21
CMD2	Multi-segment motion command switching CMD2 input	22
CMD3	Multi-segment motion command switching CMD3 input	23
CMD4	Multi-segment motion command switching CMD4 input	24
JOGCMD+	Forward jog input	25
JOGCMD-	Reverse jog input	26
	Home position switch	36
	Zeroing action enabling	37

8.2.2 Effective Logic Level Setting of DI Input Terminal

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0108	GDI-1 logic level	0: Low level effective 1: High level effective 2: Reserved 3: Reserved	1	0	Setting at any time	Effective immediately
P010A	GDI-2 logic level			0	Setting at any time	Effective immediately
P010C	GDI-3 logic level			0	Setting at any time	Effective immediately
P010E	GDI-4 logic level			0	Setting at any time	Effective immediately
P0110	GDI-5 logic level			0	Setting at any time	Effective immediately
P0116	HDI-1 logic level			0	Setting at any time	Effective immediately
P0118	HDI-2 logic level			0	Setting at any time	Effective immediately

8.2.3 Function Selection of DO Output Terminal

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0127	DO terminal signal source selection	0-31	1	0	Shut-down setting	Effective immediately

Set whether the logic output of the DO1-DO5 terminal is controlled by the driver or set by communication. P0127 is displayed in decimal by default. If a bit is 1 after it is converted to binary system, it indicates that the logic of that bit is set by communication. For example, if P0127=8 (decimal)=1000 (binary), then bit 3 is controlled by the communication modification parameter P8911, and the remaining bits are controlled by the servo driver.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0128	DO-1 function allocation	0-13 (Please refer to Table 7.6 for details)	1	1	Setting at any time	Effective immediately
P012A	DO-2 function allocation		1	2	Setting at any time	Effective immediately
P012C	DO-3 function allocation		1	3	Setting at any time	Effective immediately
P012E	DO-4 function allocation		1	4	Setting at any time	Effective immediately
P0130	DO-5 function allocation		1	0	Setting at any time	Effective immediately

Set relevant functions for the DO output terminal with reference to Table 8.6.

Table 8.6 Allocatable Functions of DO

Output signal	Output signal name	Set value of DI
-	No definition	0
S-RDY	Servo ready to output	1
ALM	Alarm output	2
BRK	External brake signal	3
COIN	Position reaching output	4
INP	Position approaching signal	5
AT-SPEED	Speed reaching output	6
V-COIN	Uniform speed output	7
ZSP	Zero speed clamping detection signal	8
TGON	Motor rotation output signal	9
V-LIMIT	Speed limiting output	10

T-ARR	Torque command reaching signal	11
TLC	Torque limiting signal output	12
WARN	Alarm output	13

8.2.4 Effective Logic Level Setting of DO Input Terminal

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0129	DO-1 logic level	0: When the logic is effective, Output optocoupler is switched on; 1: When the logic is effective, Output optocoupler is switched off;	1	0	Setting at any time	Effective immediately
P012B	DO-2 logic level		1	0	Setting at any time	Effective immediately
P012D	DO-3 logic level		1	0	Setting at any time	Effective immediately
P012F	DO-4 logic level		1	0	Setting at any time	Effective immediately
P0131	DO-5 logic level		1	0	Setting at any time	Effective immediately

8.2.5 AI Analog Function

The hardware configuration of this servo drive includes 2 analog input ports.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0138	AI1 median filter enabling	0-1	1	0	Setting at any time	Effective immedi-ately
P0139	AI1 filtering time constant	0-65535	0.01ms	200	Setting at any time	Effective immedi-ately
P013A	AI1 bias set value	-5000/5000	1mV	0	Setting at any time	Effective immedi-ately
P013B	AI1 zero drift set value	-5000/5000	0.1mV	0	Setting at any time	Effective immedi-ately
P013C	AI1 dead zone set value	0-10000	0.1mV	100	Setting at any time	Effective immedi-ately
P013D	AI2 median filter enabling	0-1	1	0	Setting at any time	Effective immedi-ately
P013E	AI2 filtering time constant	0-65535	0.01ms	200	Setting at any time	Effective immedi-ately
P013F	AI2 bias set value	-5000/5000	1mV	0	Setting at any time	Effective immedi-ately
P0140	AI2 zero drift set value	-5000/5000	0.1mV	0	Setting at any time	Effective immedi-ately
P0141	AI2 dead zone set value	0-10000	0.1mV	100	Setting at any time	Effective immedi-ately

Parameter No.	Parameter name	Range of nu-merical value	Unit	Factory default value	Setting method	Method to take effect
P0142	AI speed calibration factor	0-10000	r/min	3000	Shutdown setting	Effective immedi-ately

It is used to set the motor output speed when the analog input is 10V.

Parameter No.	Parameter name	Range of numeri-cal value	Unit	Factory default value	Setting method	Method to take effect
P0144	AI torque calibra-tion factor	0-800	1%	100	Shutdown setting	Effective immedi-ately

It is used to set the motor output torque when the analog input is 10V. The factory value 100 multiplied by the unit 0.01 indicates 1 x motor rated torque.

8.3 Group P02- Gain Adjustment

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0201	Adjustment mode selection	0-2	1	0	Setting at any time	Effective immediately

Method for setting the gain adjustment:
0: Manually adjust the gain parameter, P0202 (rigidity level selection) is ineffective;
1: Standard mode: P0202 automatically adjusts the first group of gain parameters;
2: Positioning mode: P0202 automatically adjusts the first and second groups of gain parameters, and switch on the automatic gain switching function;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0202	Rigidity level selection	0-31	1	12	Setting at any time	Effective immediately

It is used to set the rigidity of the servo. The larger the value, the higher the servo rigidity and the better the dynamic characteristic. After you select the rigidity level, the servo driver will automatically update the gain parameter (the updating method is determined by parameter P0201).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0203	Gain at the first position loop	0-20000	0.1/s	400	Setting at any time	Effective immediately

This parameter is used to set the proportional element of the position ring. If parameter P0201 is set to 1 or 2, this parameter will be automatically updated after the rigidity level is set in parameter P0202; if parameter P0201 is set to 0, it needs to be manually adjusted. For the specific adjustment principle, please refer to the manual gain adjustment in Section 5.2.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0204	Gain at the first speed loop	1-20000	0.1Hz	250	Setting at any time	Effective immediately

This parameter is used to set the proportional element of the position ring. If parameter P0201 is set to 1 or 2, this parameter will be automatically updated after the rigidity level is set in parameter P0202;
if parameter P0201 is set to 0, it needs to be manually adjusted. For the specific adjustment principle, please refer to the manual gain adjustment in Section 5.2.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0205	Integral time constant of the first speed loop	10-50000	0.01ms	3200	Setting at any time	Effective immediately

This parameter is used to set the integration element of the position ring. If parameter P0201 is set to 1 or 2, this parameter will be automatically updated after the rigidity level is set in parameter P0202;
if parameter P0201 is set to 0, it needs to be manually adjusted. For the specific adjustment principle, please refer to the manual gain adjustment in Section 5.2.
The smaller the value set, the stronger the integration effect, which can make the steady-state error approach 0 faster.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0206	Filtering time constant of the first torque	0-3000	0.01ms	80	Setting at any time	Effective immediately

This parameter is used to set the command low-pass filtering of internal torque. If parameter P0201 is set to 1 or 2, this parameter will be automatically updated after the rigidity level is set in parameter P0202; if parameter P0201 is set to 0, it needs to be manually adjusted. The torque command will be smoother after filtering, which can significantly reduce noise or vibration. The larger the value is set, the more significant the filtering effect, and the smoother the processed curve is, but it will affect the response characteristic of the system. Please refer to Figure 7.3 for the filtering effect.

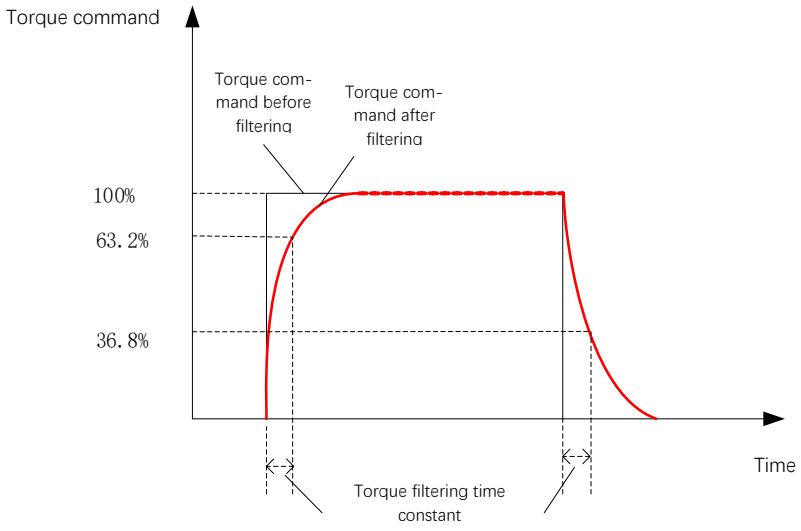


Figure 8.3 Torque Command Filtering Effect

The parameters P0203 to P0206 are related parameters for the first group gain, and the parameter types for the second group gain are similar. If the second group gain parameters are manually set, the commissioning method principle is also similar. Please refer to Table 7.7. However, the value of the second group gain will be larger than that of the first group by default.

Table 8.7 Relevant Parameters of the Second Group Gain

Parameter No.	Parameter name	Parameter No.	Parameter name
P0203	Gain at the first position loop	P0207	Gain at the second position loop
P0204	Gain at the first speed loop	P0208	Gain at the second speed loop
P0205	Integral time constant of the first speed loop	P0209	Integral time constant of the second speed loop
P0206	Filtering time constant of the first torque	P020A	Filtering time constant of the second torque

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0210	Gain switching method selection	0-1	1	1	Setting at any time	Effective immediately

The parameters that can be set for gain switching are described as follows:

0: Fixed at the 1st gain, but the speed loop can be switched between proportional or proportional integral control (P/PI) actions using the external input terminal/P-CON.

1: Switching with the gain according to the conditions of P0211.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0211	Gain switching condition selection	0-10	1	0	Setting at any time	Effective immediately

If the gain switching function is enabled, set the conditions for gain switching according to parameter P0211.

0: Fixed at the first gain;

1: Gain switching terminal input;

2: Torque command;

3: Speed command;

4: Speed command variation;

5: Reserved;
6: Position deviation;
7: Position command provided;
8: Positioning end signal;
9: Actual speed
10: Position command provided + actual speed
Please refer to the relevant contents of gain switching function in section 5.3 for the gain switching method.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0212	Switching delay time	0-10000	0.1ms	50	Setting at any time	Effective immediately
P0213	Switching level	0-20000	1	50	Setting at any time	Effective immediately
P0214	Switching hysteresis	0-20000	1	30	Setting at any time	Effective immediately

Switching Delay Time:
When switching from the first gain to the second gain, immediately switch to the second gain after meeting the conditions for gain switching;
When switching back from the second gain to the first gain, switch to the first gain after a delay time (set at P0212) after triggering the gain switch.
Switching level and hysteresis: The switching level and hysteresis jointly determine the criteria for triggering the switching action.
Note: When the switching level setting is less than the hysteresis, the switching level will be set to be equal to the hysteresis.
(For specific actions on gain switching, please refer to 5.3 Gain Switching Function).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0215	Position gain switching time	0-10000	0.1ms	20	Setting at any time	Effective immediately

When there is a significant difference between the gain of the first position loop and the gain of the second position loop during the position control, in order to reduce the torque and vibration caused by the sharp change in position loop gain during gain switching, this parameter can be set to make the gain of the first position transit in a slope form to the gain of the second position.

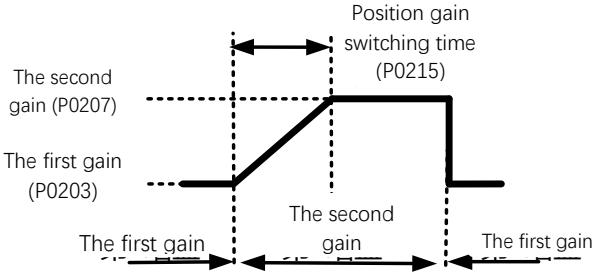


Figure 8.4 Position Gain Switching Time

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P021E	PDFF gain	0-1000	0.1%	1000	Setting at any time	Effective immediately

It is used to set the control method of speed loop.
The factory value 1000 indicates that the speed loop adopts PI control and has fast dynamic response;
If it is set to 0, it means that the speed loop is controlled by PDF, with a slower dynamic response and no

overshoot;
By adjusting P021E, you can make the speed loop have fast responsiveness without increasing speed feedback overshoot.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P021F	Speed feedforward method selection	0-1	1	0	Shut-down setting	Effective immediately

You may select an appropriate speed feedforward in the position control mode to improve the response characteristic of the position loop and reduce position deviation, as shown in Figure 7.4.
0: No speed feedforward;
1: Internal speed feedforward;

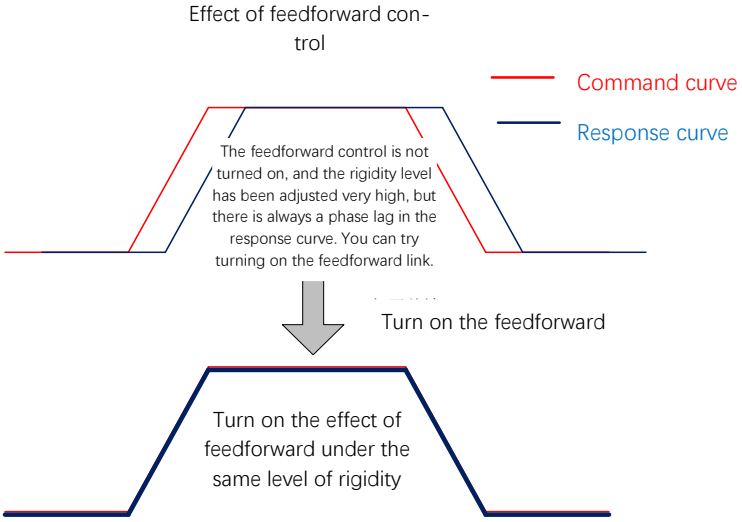


Figure 8.5 Feedforward Control Effect

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0220	Speed feedforward gain	0-1000	0.1%	0	Setting at any time	Effective immediately

Multiply the selected speed feedforward signal by P0220 in the position control mode to obtain the speed feedforward value, which is used as part of the speed command.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0221	Speed feedforward filter time constant	0-6400	0.01ms	0	Setting at any time	Effective immediately

Set the filtering time constant required for speed feedforward input.
Under the condition of a certain time constant for velocity feedforward filtering, gradually increase the speed feedforward gain to make the speed feedforward function effective. Increase the feedforward gain of the rotational speed to achieve the near-zero position error during the constant acceleration and deceleration process.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0222	Torque feedforward method selection	0-1	1	0	Setting at any time	Effective immediately

You may use the torque feedforward control to improve the response of torque command and improve the control accuracy.

0: No torque feedforward;
1: Internal torque feedforward.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0223	Torque feedforward gain	0-2000	0.1%	0	Setting at any time	Effective immediately

Multiply the selected torque feedforward signal by P0223 in the non-torque control mode to obtain the torque feedforward value, which is used as part of the torque command.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0224	Torque feedforward filtering time constant	0-6400	0.01ms	0	Setting at any time	Effective immediately

Set the filtering time constant required for the torque feedforward input.
Gradually increase the torque feedforward gain under the condition of a certain time constant for torque feedforward filtering to make the torque feedforward function effective. Increase the feedforward gain of the torque to achieve the near-zero position error during the constant acceleration and deceleration process.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0230	Load inertia ratio	0-12000	1%	100	Setting at any time	Effective immediately

The calculation formula for load inertia ratio is as follows. If the actual load inertia can be accurately calculated, P0230 can be directly set. If the load inertia cannot be accurately calculated, please operate P08C through the servo panel button to achieve the automatic learning of load inertia. If the motor optical axis runs without any load, then P0230=0. If the mechanical load inertia and the motor rotational inertia are the same, then P0230=100.

$$\text{Load inertia ratio} = \frac{\text{Load inertia}}{\text{Motor inertia}}$$

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0232	Manual inertia identification mode	0-1	1	1	Shutdown setting	Effective immediately

If the load inertia ratio cannot be obtained, offline inertia identification function can be used. The offline identification function refers to the function of identifying inertia by controlling the motor rotation through the operation panel of the servo driver without the help of external devices. The detailed operation process can be found in Section 5.4.
1: JOG mode; hold the "UP" button to keep the motor always rotating forward, and hold the "Down" button to keep the motor always rotating reversely.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0233	Maximum speed of inertia identification	100-1000	r/min	500	Shutdown setting	Effective immediately

The maximum speed of the motor during manual inertia identification process. Please set the maximum speed reasonably based on the load. The higher the speed is, the more accurate the identification result is.

	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P0234	Acceleration of inertia identification	20-800	1ms	100	Shutdown setting	Effective immediately

It refers to the time taken for the motor speed to accelerate from 0 r/min to P0233 maximum speed.

Please note whether the number of motor turns exceeds the mechanical limit to ensure personal and equipment safety; when the JOG mode is used for inertia identification, you shall note whether it exceeds the mechanical limit.

8.4 Group P03- Vibration Inhibiting

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0301	Resonance suppression method selection	0-4	1	0	Setting at any time	Effective immediately

Set the number of resonant frequencies estimated by the notch filter and the action after estimation

Set value	Content	
0	Automatic filter: ineffective	The parameters of the 3rd and 4th notch filters remain unchanged.
1	Automatic filter: 1 effective	The parameters of the third notch filter are updated based on the resonance detection results.
2	Automatic filter: 2 effective	The parameters of the third and fourth notch filters are updated based on the resonance detection results.
3	Resonance frequency test mode	Only the resonance frequency is detected and displayed
4	Automatic filter results clearing	The third and fourth notch filters are restored to their factory values.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0302	Resonance frequency detection value	0-8000	Hz	0	Only displayed	Effective immediately

The mechanical resonance frequency is detected. The value will be updated when parameter P0301=3.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0303	The first notch filter frequency	50-8000	Hz	8000	Setting at any time	Effective immediately

Set the resonant frequency of the first notch filter. When this parameter is set to "8000", the first notch filter function is ineffective.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0304	The first notch filter width	0-20	1	2	Setting at any time	Effective immediately

Set the width of the first notch filter. When it is set to a larger value, the width of the notch also increases. The factory values are used generally.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0305	The first notch filter depth	0-99	%	0	Setting at any time	Effective immediately

Set the notch depth of the first notch filter. As the set value increases, the depth of the notch becomes smaller and the phase lag decreases.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0306	The second notch filter frequency	50-8000	Hz	8000	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0307	The second notch filter width	0-20	1	2	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0308	The second notch filter depth	0-99	%	0	Setting at any time	Effective immediately

Refer to the setting of the first group of notch filters for the setting of the second group.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0309	The third notch filter frequency	50-8000	Hz	8000	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P030A	The third notch filter width	0-20	1	2	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P030B	The third notch filter depth	0-99	%	0	Setting at any time	Effective immediately

Refer to the setting of the first group of notch filters for the setting of the third group.

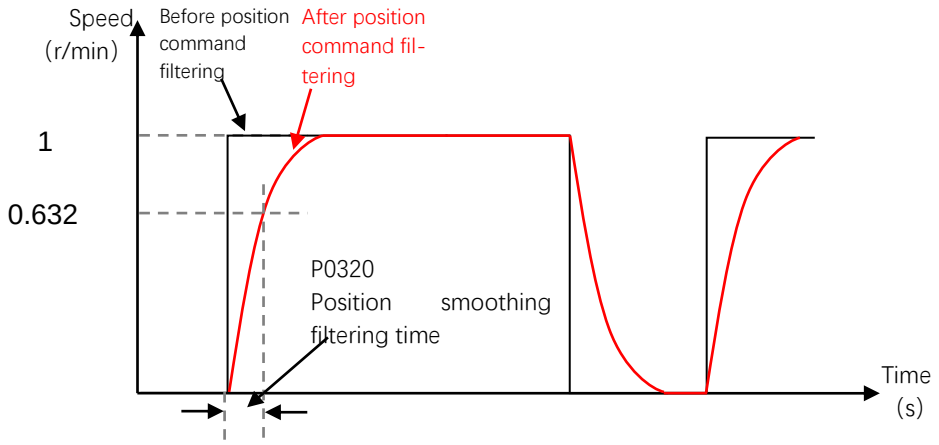
Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P030C	The fourth notch filter frequency	50-8000	Hz	8000	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P030D	The fourth notch filter width	0-20	1	2	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P030E	The fourth notch filter depth	0-99	%	0	Setting at any time	Effective immediately

Refer to the setting of the first group of notch filters for the setting of the fourth group.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0320	Position smoothing filtering time constant	0-65535	0.1ms	0	Shutdown setting	Effective immediately



This parameter is used to process the position commands with a first-order low-pass filter. If the inputted position command is in step type or is smoothed, the filtering time can be set to smooth the position command, as shown in Figure 7.5. However, as indicated in the figure, if the filtering time is too long, it will cause response delay.

Figure 8.6 Smooth Filtering Effect of Position Command

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0321	Position FIR filtering time constant	0-1000	0.1ms	0	Shutdown setting	Effective immediately

This parameter is also used to perform FIR filtering on position command and set the filtering time constant. Please refer to Figure 7.6 for the filtering effect.

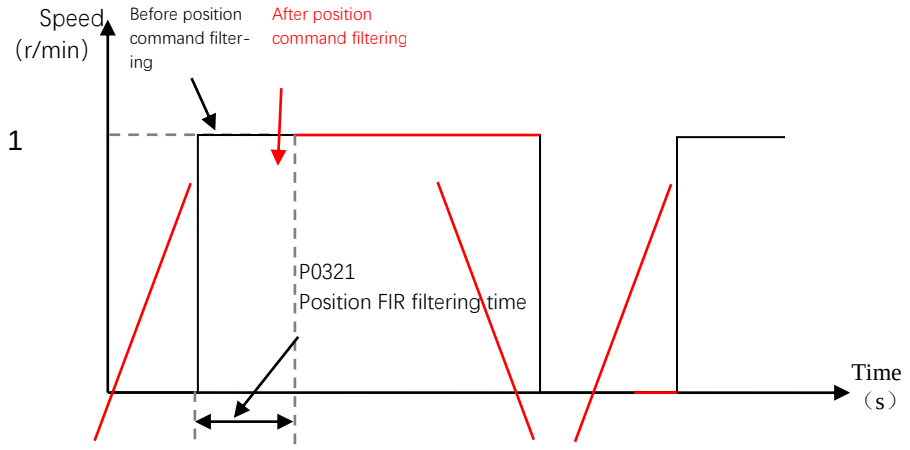


Figure 8.7 FIR Filtering Effect of Position Command

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P032A	LF vibration frequency	0-1000	0.1Hz	1000	Setting at any time	Effective immediately

It is used to set the low-frequency vibration frequency

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P032B	Damping notch frequency ratio	12-30	0.1	12	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P032C	Damping notch width level	0-10	1	2	Setting at any time	Effective immediately

8.5 Group 04- Extended Control

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0401	Speed observer selection	0-65535	1	0	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0402	Speed observer bandwidth	0-65535	Hz	8000	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0410	Disturbance observer selection	0-1	1	0	Setting at any time	Effective immediately

It is used to turn on/off the disturbance observer

0: Off;

1: Turn on the disturbance observer , and improve the torque disturbance resistance.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0411	Disturbance observer gain	-1000/1000	0.1%	0	Setting at any time	Effective immediately

Set the gain size of disturbance torque compensation in the non-torque control mode.

The disturbance torque compensation can suppress the influence of external disturbance torque on speed. For example, when a sudden load is applied, the speed will drop. The larger the value of P0411 is, the stronger the capability to resist external torque disturbance is, which means the speed drop will be smaller. However, you may cause vibration and noise by setting it too large, and it needs to be used together with P0412.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0412	Disturbance observer time constant	0-2500	0.01ms	0	Setting at any time	Effective immediately

Set the filter time constant for disturbance torque compensation in the non-torque control mode.

The disturbance torque compensation for parameter P0412 acts as a low-pass filter, which means that the larger the time is set, the slower the disturbance torque compensation will take effect.

At the beginning, setting P0412 as a larger value and setting P0411 as a smaller value also has a certain effect; gradually reducing the set value of P0412 can significantly improve the suppression of the influence of external disturbance torque on speed, but may generate vibration and noise.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0420	Constant load compensation value	-1000/1000	0.1%	0	Setting at any time	Effective immediately

Compensation for constant torque:

0: Not compensated;

1: Compensated based on the position command;

2: Compensated based on the speed command;

3: Compensated based on the torque command.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P0421	Forward friction compensation value	-1000/1000	0.1%	0	Setting at any time	Effective immediately

It is used to set friction compensation when the motor is rotating forward.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0422	Reverse friction compensation value	-1000/ 1000	0.1%	0	Setting at any time	Effective immediately

It is used to set friction compensation when the motor rotates reversely.

8.6 Group 05- Position Control Mode

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0501	Position command source selection	0-1	1	0	Shutdown setting	Effective immediately

When selecting the position control mode, select the source of the position command:

0: Pulse command;

1: Multi-segment position command given.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0502	Command pulse form	0-3	1	0	Shutdown setting	Next power-on

In the position control mode, set the form of external command pulse:

0: Pulse train+direction (positive logic);

1: Pulse train+direction (negative logic);

2: A phase+B phase orthogonal pulse (4 frequency multiplications);

3: CW (reverse pulse sequence)+CCW (forward pulse sequence)

Refer to Figure 8.8 for a detailed schematic diagram of pulse command.

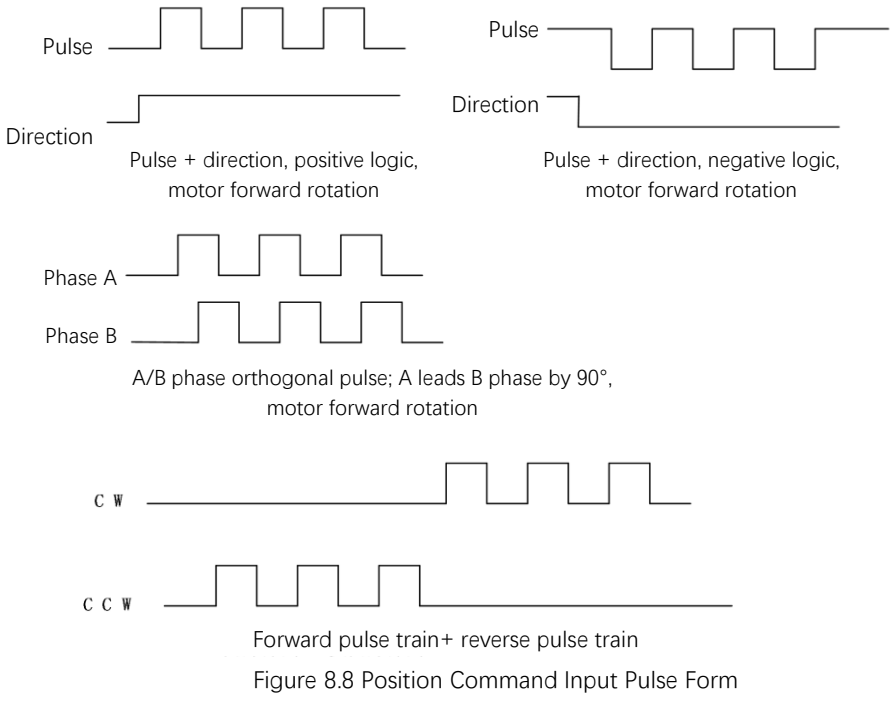


Figure 8.8 Position Command Input Pulse Form

Parameter	Parameter name	Range of nu-	Unit	Factory de-	Setting	Method to

No.		merical value		fault value	method	take effect
P0503	Effective edge of command pulse	0-1	1	0	Setting at any time	Next power-on

When the position command is an external pulse, select the effective rising or falling edge of the pulse:
0: Falling edge effective;
1: Rising edge effective.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0504	Pulse command filtering time	0-255	25 nanoseconds	10	Shutdown setting	Next power-on

When the position command is an external pulse, set the pulse command filtering time constant in unit of 25 nanoseconds, with a default value of 10, which represents 0.25 microseconds.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0505	Electronic gear ratio switching conditions	0-1	1	0	Shutdown setting	Effective immediately

The electronic gear switching function refers to the switching of two sets of electronic gears through DI input. When DI is ineffective, use the first set of electronic gears; when the DI is effective, use the second set of electronic gears (DI parameter: 9 GEAR-SEL electronic gear selection input).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0506	The number of command pulses per motor turn	0-1073741824	1P/Rev	0	Shutdown setting	Effective immediately

Set the number of required command pulses per motor turn.

When P0506=0, the electronic gear ratio parameters P0508/P050A/050C/050E and the electronic gear switching condition P0505 are effective;

When P0506 $\neq$ 0, the electronic gear ratio is equal to $\frac{\text{Encoder resolution}}{\text{P0506}}$, and the switching conditions for electronic gear ratio 1 and electronic gear ratio 2 are ineffective. The encoder resolution is 2 ^23.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0508	Numerator of the first electronic gear	1-1073741824	1	8388608	Shutdown setting	Effective immediately

For the numerator of the first electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P050A	Denominator of the first electronic gear	1-1073741824	1	10000	Shutdown setting	Effective immediately

For the denominator of the first electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P050C	Numerator of the second electronic gear	1-1073741824	1	8388608	Shutdown setting	Effective immediately

For the numerator of the second electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P050E	Denominator of the second electronic gear	1-1073741824	1	10000	Shutdown setting	Effective immediately

For the denominator of the second electronic gear, the effective condition is parameter P0506 = 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P0520	Positioning completion signal output condition	0-2	1	0	Setting at any time	Effective immediately

Set the output conditions for positioning completion and approaching signals, (DO parameter: 4-COIN position reaching output or 5-INP positioning approaching signal)

0: The absolute value of position deviation is less than P0521;

1: The absolute value of position deviation is less than P0521 and the position command is filtered to 0;

2: The absolute value of position deviation is less than P0521 and the position command is inputted as 0.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0521	Positioning completion value	1-65535	1	20	Setting at any time	Effective immediately

If the position deviation is less than this value, it is considered that the positioning is completed, and the DO output is activated (DO parameter: 4-COIN position reaching output).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0522	Positioning Approaching Value	1-65535	1	65535	Setting at any time	Effective immediately

If the position deviation is less than this value, it is considered that the positioning is close, and the DO output is activated (DO parameter: 5-INP positioning approaching signal).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0523	Excessive position deviation alarm value	1-1073741824	1	25165824	Setting at any time	Effective immediately

The position deviation alarm is an effective protection mechanism for the driver to perform position control;

When the motor action does not match the command, abnormality can be detected to stop the motor from rotating;

Position deviation=position command - actual position (all in the encoder unit);

When the position deviation exceeds the "excessive position deviation alarm value", the driver will generate an alarm (alarm number 86.1), and the motor will stop rotating.

8.7 Group P06- Speed Control Mode

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0601	Speed command selection	0-4	1	0	Shutdown setting	Effective immediately

Source of setting the speed command:

0-set speed command of parameter (P0604)

1-AI1 given speed command

2-AI2 given speed command

3- Internal multi-segment speed command

4-Communication given; speed command given by communication settings (P8912)

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0604	Given value of speed command	-10000/ 10000	r/min	100	Setting at any time	Effective immediately

When parameter P0601=0, the input speed is set by this value.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0606	DI jog speed value	0-10000	r/min	100	Read-only parameter	Effective immediately

When setting DI parameters (25 JOGCMD+forward jog input or 26 JOGCMD - reverse jog input), set the jog speed.

Parameter	Parameter name	Range of numeri-	Unit	Factory de-	Setting	Method to

No.		cal value		fault value	method	take effect
P0608	Soft start acceleration time	0-65535	ms	0	Setting at any time	Effective immediately
P0609	Soft start deceleration time	0-65535	ms	0	Setting at any time	Effective immediately

The soft start function refers to the specified acceleration and deceleration of the step speed command input, which is converted into a trapezoidal speed command, as shown in Figure 8.9.

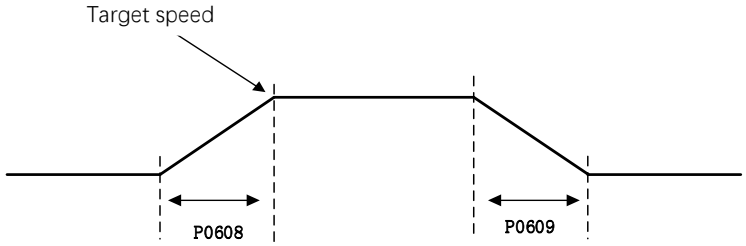


Figure 8.9 Soft Start Acceleration/Deceleration Time

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P060A	DI jog acceleration/ deceleration time	0-65535	ms	0	Setting at any time	Effective immediately

It is used to set the acceleration/deceleration time for DI jog.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0610	Maximum speed limit amplitude	0-10000	r/min	10	Setting at any time	Effective immediately

If the multi-segment speed acceleration/deceleration time (P1204-P120B) has a value set to zero when you use the internal multi-segment speed function, it indicates zero acceleration/deceleration time. At this time, P0610 is used to calculate the planned acceleration/deceleration.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0612	Forward rotation speed limit amplitude	0-10000	r/min	10	Setting at any time	Effective immediately

Limit the maximum forward rotation speed, TBD.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0614	Reverse rotation speed limit amplitude	0-10000	r/min	10	Setting at any time	Effective immediately

Limit the maximum reverse rotation speed, TBD.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061A	Zero speed clamping level	0-10000	r/min	10	Setting at any time	Effective immediately

The zero speed clamping function refers to the locking of the motor shaft when the zero fixed signal (DI parameter: 8-ZCLAMP zero fixed enabling input) is effective and the speed command is less than P061A.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061B	Motor zero speed detection threshold	0-10000	r/min	10	Setting at any time	Effective immediately

If the absolute value of the motor speed is less than P61B, it is considered that the motor is stationary and outputs DO (DO parameter: 8-ZSP zero speed clamping detection signal, output signal).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061C	Rotation detection setting	0-1000	r/min	20	Setting at any time	Effective immediately

If the motor is rotating and the rotation speed is greater than P061C, it is considered that the motor is rotating (DO parameter: 9-TGON motor rotation output signal).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061D	The speed reaches the set value	10-10000	r/min	1000	Setting at any time	Effective immediately

When the absolute value of the motor speed is greater than P061D, a DO signal (DO parameter: 6-AT-SPEED speed reaching output) is outputted.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P061F	Uniform speed setting	0-100	r/min	10	Setting at any time	Effective immediately

If the difference between the speed command and the motor speed is less than P061F, a DO signal (DO parameter: 7-V-COIN uniform speed output) is outputted.

8.8 Group 07-Torque Control Mode

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0701	Torque command selection	0-3	1	0	Shutdown setting	Effective immediately

Torque command source:
0: Number given (P0704);
1: AI1 given torque;
2: AI2 given torque;
3: The communication is given by inputting speed commands through the communication method, with parameter P8914.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0704	Given value of torque command	-6000/6000	0.1%	0	Setting at any time	Effective immediately

When parameter P0701=0, the input torque is set through this value, and P0704=1000 represents the rated torque of the motor.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P070B	Speed limit setting	0-1	1	0	Setting at any time	Effective immediately

In the torque control mode, the motor will be controlled by the torque output, but the motor speed will not be controlled. If the input torque is greater than the mechanical load torque, the motor speed will be significantly increased. In this case, to protect the mechanical device, the speed of the servo motor needs to be limited. The speed limit setting in torque mode is as follows:
0: Internal speed limit (forward rotation P070D, reverse rotation P070E);
1: External analog input speed limit;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P070C	External speed limit - analog input	1-2	1	1	Setting at any time	Effective immediately

When P70B=1, you need to select the analog channel as the speed limit input:
1: Analog input channel 1 (AI1);
2: Analog input channel 2 (AI2);

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P070D	Internal forward speed limit value	0-10000	r/min	3000	Setting at any time	Effective immediately
P070E	Internal reverse speed limit value	0-10000	r/min	3000	Setting at any time	Effective immediately

When P070B=0, the above two parameters are used to set the speed limits in the torque mode.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P070F	Torque limit setting	0-2	1	0	Setting at any time	Effective immediately

Set the source of torque limit:
0: Internal torque limit (P0711, P0712);
1: External torque limit (P0713, P0714);
2: Analog input torque limit;
3: External torque+analog input;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0710	Analog input torque limit	1-2	1	2	Setting at any time	Effective immediately

When P070F=2, select the analog channel as the torque limit input:
1: Analog input channel 1 (AI1);
2: Analog input channel 2 (AI2);

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0711	Internal forward torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately
P0712	Internal reverse torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately

When P070F=0, P0711 and P0712 serve as torque limits for forward/reverse rotation.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0713	External forward rotation torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately
P0714	External reverse rotation torque limit value	0-6000	0.1%	3000	Setting at any time	Effective immediately

When P070F=1, torque limit is achieved through DI activation:
The DI parameter (14-P-ACL forward external torque limit input) is activated, and P0713 is used as the forward rotation torque limit;
The DI parameter (15-N-ACL reverse rotation external torque limit input) is activated, and P0714 is used as the reverse rotation torque limit;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0715	Torque reaching the reference value	0-6000	0.1%	0	Setting at any time	Effective immediately
P0718	Torque reaching the signal switching-on threshold	0-6000	0.1%	200	Setting at any time	Effective immediately
P0719	Torque reaching the signal switching-off threshold	0-6000	0.1%	100	Setting at any time	Effective immediately

The above three parameters are used to set whether the torque command is executed. When the actual torque command is within a certain range, DO will output an effective signal (DO parameter: 11-T-ARR torque command reaching signal). For detailed judgment logic, refer to Figure 8.10.

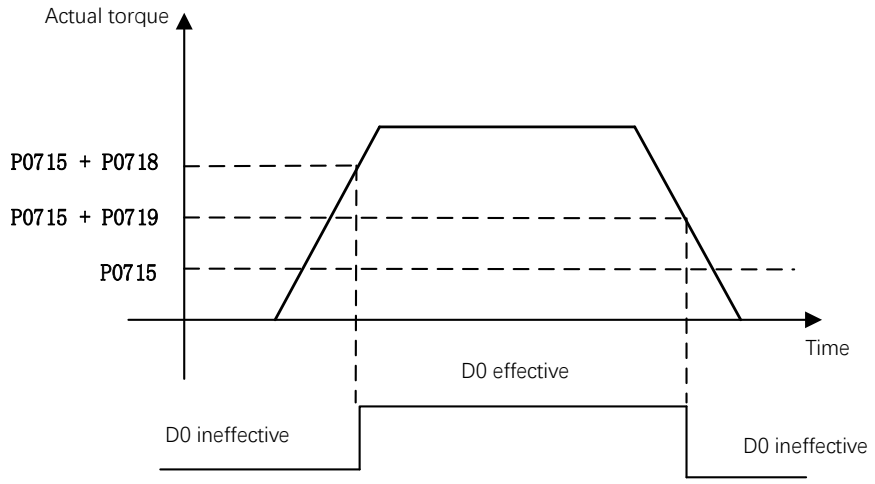


Figure 8.8 Torque Reaching Judgment Logic

8.9 Group P08- Auxiliary Function Operation

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0802	Initialize the parameters	0-2	1	0	Shutdown setting	Effective immediately

It is used to reset parameters to factory settings or clear fault records:
0: No operation;
1: Restore parameters to factory settings (except for groups P90 and P91 parameters);
2: Clear the last 10 fault and warning codes.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0803	Reading and writing encoder ROM	0-3	1	0	Shutdown setting	Effective immediately

For encoder ROM reading and writing operations, please consult the manufacturer before operation. Otherwise, it may cause equipment damage:
0: No operation;
1: Write ROM; write data from the driver to the encoder ROM;
2: Read ROM; read data from the encoder, and save it in the driver.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0804	Absolute value encoder multi-turn data reset	0-3	1	0	Shutdown setting	Effective immediately

You can achieve the following functions by setting P0804:
0: No operation;
1: Fault reset;
2: Multi-turn zeroing and fault reset;
Note: After the multi-turn data is reset, the absolute position of the encoder will change. Please pay attention to the mechanical home position.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0805	Alarm clearing	0-1	1	0	Shutdown setting	Effective immediately

Alarm reset operation:
0: No operation;
1: Fault reset.

Please refer to Section 6 for the types of faults in the alarm reset operation. Please perform this operation when the servo is not running to avoid misoperation after servo reset.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0806	Emergency stop	0-1	1	0	Setting at any time	Effective immediately

You can use this function code to perform an emergency stop regardless of the servo in any mode:
0: No any operation;
1: Emergency stop operation; for the stop action, and motor state after equipment stop, refer to the setting of parameter P001B.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0807	Speed JOG enabling	0-65535	1	0	Setting at any time	Effective immediately

Carry out the servo jog operation through the panel. The servo driver can enter the speed jog mode only when it is at the non-enabled state and there is no alarm. Refer to Section 4.1 for the specific operation.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0809	Motor magnetic pole identification enabling	0-2	1	0	Shutdown setting	Effective immediately

Through the panel operation of motor magnetic pole identification, operation can only be carried out when the servo is not in an enabled state and there is no fault.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P080C	Manual Inertia Identification enabling	0-65	1	0	Setting at any time	Effective immediately

To achieve the manual inertia identification through panel operation, it needs to be in a non-enabled state. Refer to section 6.1.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P080E	AI zero bias self-calibration enabling	0-2	1	0	Shutdown setting	Effective immediately

Set whether to automatically correct AI input channel zero drift.
0: No operation;
1: AI1 channel calibration (associated parameter P013B);
1: AI2 channel calibration (associated parameter P0140).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P080F	DI/DO mandatory setting	0-3	1	0	Setting at any time	Effective immediately

Set whether to automatically correct AI input channel zero drift.
0: No operation;
1: DI set mandatorily, DO not set mandatorily;
2: DO set mandatorily, DI not set mandatorily;
3: DI and DO set mandatorily.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0810	DI mandatory setting value	0-511	1	0	Setting at any time	Effective immediately

When P080F is equal to 1 or 3, P0810 is effective and is displayed in hexadecimal by default. If a bit is 1 after it is converted into binary system, it indicates that the DI of that bit is effective. For example, if P0810=8

(decimal)=1000 (binary), then the fourth DI input is effective.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0811	DO mandatory setting value	0-31	1	0	Setting at any time	Effective immediately

When P080F is equal to 2 or 3, P0811 is effective and is displayed in hexadecimal by default. If a bit is 1 after it is converted into binary system, it indicates that the DI of that bit is effective. For example, if P0811=8 (decimal)=1000 (binary), then the fourth DO output is effective.

8.10 Group P09-Operating State Display

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0901	Torque command	-32767-32767	0.1%	0	Only displayed	Effective immediately

It displays the current input torque, and 1000 represents the rated torque of the motor.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0902	Speed command	-32767-32767	r/min	0	Only displayed	Effective immediately

It displays the current speed command with an accuracy of 1r/min.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0904	Motor speed	-32767-32767	r/min	0	Only displayed	Effective immediately

It displays the actual speed of motor. The accuracy is 1r/min.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0906	Motor speed (0.1r/min)	-2147483647/ 2147483647	0.1r/min	0	Only displayed	Effective immediately

It displays the actual speed of motor. The accuracy is 0.1r/min.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0908	Command pulse speed	-32767-32767	r/min	0	Only displayed	Effective immediately

The speed value corresponding to the position command during each position control cycle.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P090A	Position command counter	-2147483647/ 2147483647	1	0	Only displayed	Effective immediately

In the position control mode, the number of position commands issued by the upper computer can be directly read (without filtering, frequency division, doubling, electronic gear processing).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P090E	Absolute position counter (Encoder unit)	-2147483647/ 2147483647	1	0	Only displayed	Effective immediately

The position pulse counter fed back by the encoder in any mode.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P0912	Position deviation counter (Encoder unit)	-2147483647/ 2147483647	1	0	Only dis-played	Effective immediately

It displays the position deviation value after electronic gear processing in any mode.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory de-fault value	Setting method	Method to take effect
P0914	Position following error (command unit)	-2147483647/ 2147483647	1	0	Only dis-played	Effective immediately

It displays the position deviation value (command unit) after electronic gear processing in the position mode.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory de-fault value	Setting method	Method to take effect
P091A	Absolute value encoder single-turn data	0-2147483647	1	0	Only dis-played	Effective immediately
P091C	Absolute value encoder multi-turn data	0-65535	1	0	Only dis-played	Effective immediately

The above two pieces of data are used to display the absolute position value of the encoder:
For a single-turn encoder, only P091A has data and P091C has no data;
For a multi-turn absolute value encoder, the current position of the encoder is P091A+ P091C*8388608.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory de-fault value	Setting method	Method to take effect
P091D	Motor electric angle	0-65535	0.1°	0	Only dis-played	Effective immediately

It is used to display the current electric angle of motor rotor.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P091E	Phase current effective value	0-65535	0.01A	0	Only dis-played	Effective immediately

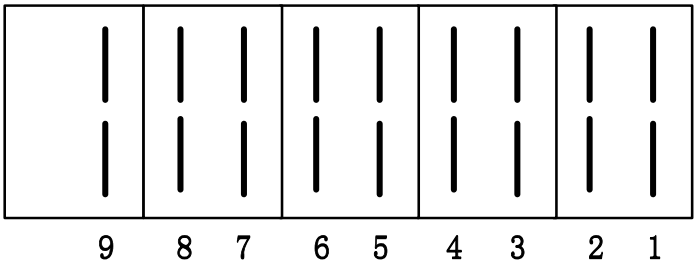
Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0920	DC bus voltage	0-65535	0.1V	0	Only dis-played	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0923	AI1 voltage sampling value	-32767-32767	mV	0	Only dis-played	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0924	AI2 voltage sampling value	-32767-32767	mV	0	Only dis-played	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0925	DI terminal state	0-65535	1	0	Only dis-played	Effective immediately

Display the assigned DI signal in the LED Nixie tube on the panel, corresponding to the 9 DI input signals of the RS2 driver.



Up: OFF

Down: ON

Figure 8.9 DI State Nixie Tube Display

When the upper segment of the Nixie tube is illuminated, the input signal is OFF (switched off internally, high-level state);

When the lower segment of the Nixie tube is illuminated, the input signal is ON (switched on internally, low-level state);

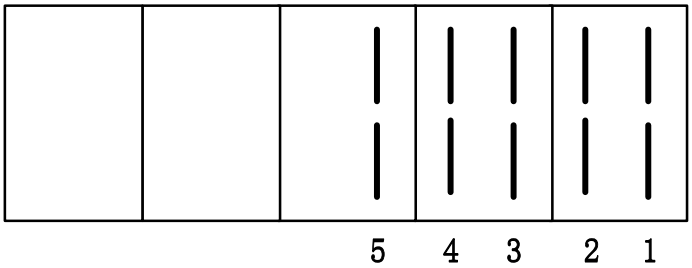
If you need to use a DI port as a control signal, you shall first set the parameters of the DI port; select the appropriate logic level for DI based on the actual control situation (for example, when the DI port does not need to be wired, the logic level can be set to be at a high level).

Example:

- DI1 port is not wired to control the servo enabling. The parameters to be set are: P0107=1-S-ON servo enabling input, P0108=1- indicating the the effective high level. After setting, the servo driver will immediately enter the enabled state.
- DI1 port needs to be wired to control servo enabling. The parameters to be set are: P0107=1-S-ON servo enabling input, P0108=0- indicating effective low level. At this time, as long as DI1 is wired with reference to RA3 hardware manual, the servo driver enabling control can be achieved.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0926	DO terminal state	0-65535	1	0	Only dis-played	Effective immediately

Display the function assigned by DO in the LED Nixie tube on the panel, corresponding to the 5 DO output signals of the RS2 driver:



Up: OFF

Down: ON

Figure 8.10 DO State Nixie Tube Display

When the upper segment of the Nixie tube is illuminated, the output signal is OFF (switched off internally, high-level state);

When the lower segment of the Nixie tube is illuminated, the output signal is ON (switched on internally, low-level state);

Example:

- Parameter settings for DO1 port: P0128="1-R-RDY servo ready", P0129=0- indicating the output of L low level when effective. When the drive is in the Ready state, Pin 6 and Pin 7 are in the on state and the DO1 state is consistent with Figure 8.12; when the driver is in the Error state, Pin 6 and Pin 7 are in the off state;
- Parameters setting for DO1 port: P0128="1-R-RDY servo ready", P0129=1- indicating the output of H high level when effective. When the drive is in the Ready state, Pin 6 and Pin 7 are in the off state; when the driver is in the Error state, Pin 6 and Pin 7 are in the on state, and the DO1 state is consistent with Figure 8.12;

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0928	Average load rate	0-8000	0.1%	0	Only dis-played	Effective im-mediately

Parameter No.	Parameter name	Range of nu-merical value	Unit	Factory default val-ue	Setting method	Method to take effect
P0929	Servo total power-on time	0-4294967295	0.1S	0	Only dis-played	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P092B	Servo running state	0-65535	1	0	Only displayed	Effective immediately

This numerical value is used to monitor the current operating state of the servo driver, and the specific relationship between the numerical value and the servo state is as follows:

Numerical value of P092B	Servo state	Explanation
0	Not Ready	The servo does not meet the running conditions
1	Ready	The servo has been ready and can enter the enabled state
2	Run	The servo has enabled
3	Error	The servo has a fault

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0931	Current alarm code	0-65535	1	0	Only displayed	Effective immediately

Display the current alarm code. For example, the data read is 1874 (decimal)=0x752 (hexadecimal), indicating an error of 75.2. You can refer to the list of faults in Section 6.3 to view the relevant alarm codes.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0933	Current abnormal parameter address	0-65535	1	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0935	Alarm record index No.	0-9	1	0	Only displayed	Effective immediately
P0936	Selected recorded alarm code	0-65535	1	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0937	Selected alarm timestamp	0-4294967295	Second	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P0939	Motor speed during the selected alarm	-32767-32767	r/min	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P093B	U-phase current during the selected alarm	-32767-32767	1	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P093C	V-phase current during the selected alarm	-32767-32767	1	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P093D	Bus voltage during the selected alarm	0-65535	1	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P093E	DI state during the selected alarm	0-65535	1	0	Only displayed	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P093C	DO state during the selected alarm	0-65535	1	0	Only displayed	Effective immediately

Parameters P0935 to P093C are used to read historical fault records, as well as historical fault moments and key driver information records: n (0-9) is inputted into P0935, and the the data from P0936 to P093C is read to comprehensively determine the possible cause of the fault.

8.11 Group 10- Returning to Home Position

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1001	Zeroing parameter enabling (effective when P1003=1)	0-1	1	0	Shutdown setting	Next power-on

0: No action

1: Zeroing action enabled (effective when P1003=1)

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1002	Zeroing mode selection	1-35	1	1	Shutdown setting	Next power-on

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1003	Zeroing start selection	0-1	1	0	Shutdown setting	Next power-on

0: DI terminal starts zeroing action

1: Set P1001=1 to start the zeroing action

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1004	Power-on zeroed or not	0-1	1	0	Shutdown setting	Next power-on

0: Power-on does not trigger a zeroing action

1: Power-on triggers one zeroing action

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1005	Zeroing speed (high speed)	1-3000	r/min	100	Shutdown setting	Next power-on

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1006	Zeroing speed (low speed)	1-1000	r/min	10	Shutdown setting	Next power-on

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1007	Zeroing acceleration/ deceleration time	0-1000	ms	1000	Shutdown setting	Next power-on

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1008	Zeroing action timeout setting	0-65535	ms	50000	Shutdown setting	Next power-on

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1009	Zeroing deviation	-2147483647/ 2147483647	1	0	Shutdown setting	Next power-on

8.12 Group P11-Full Closed-loop Function

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1101	Full closed-loop control mode selection	0-1		0	Shutdown setting	Next power-on

Set the source of encoder feedback signal during the full closed-loop control.
0: Internal encoder feedback; the position feedback signal comes from the built-in encoder of servo motor.
1: External encoder feedback; the position feedback signal comes from a full closed-loop external encoder, and the first group of electronic gear ratio is used.

Note: When the full closed-loop function is used and the position command source is internal position command, the speed setting unit is specific to the internal encoder. Please pay attention to the conversion before setting the speed value. Otherwise, it will cause operation errors.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1102	Total count of full closed-loop positions corresponding to one turn of the motor	0-1073741824	External encoder unit	10000	Shutdown setting	Next power-on

Set the number of feedback pulses from the external encoder when the servo motor rotates one turn. By using this parameter, the relationship between the number of feedback pulses from the external encoder and the internal encoder can be established.
Note: Be sure to set P1102 correctly. Otherwise, it may cause a fault of excessive deviation in the full closed-loop position after the servo operates.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1104	Excessive mixing deviation setting	0-1073741824	External encoder unit	1000	Setting at any time	Effective immediately

The threshold for the absolute value of position deviation in the event of a fault due to a large closed-loop position deviation.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1106	Mixing deviation zero setting	0-100	Number of turns	1	Setting at any time	Effective immediately

Set the number of turns of the motor to clear a full closed-loop position mixing deviation when the driver is operating. The number of motor turns is reflected by the internal encoder feedback pulse number P090E.
0: Set to 0 to always clear position mixing deviation;
1-100: Within n turns of the servo motor, the position mixing deviation is always smaller than P1104. At the nth turn, the fully closed position mixing deviation is cleared, and the mixing deviation and number of motor turns is counted again from 0;
If the servo motor rotates within n turns and the position deviation exceeds P1104, the mixing deviation of the fully closed position will be immediately cleared. If an external encoder feedback is used, a fault of excessive position deviation in the full closed loop will occur.

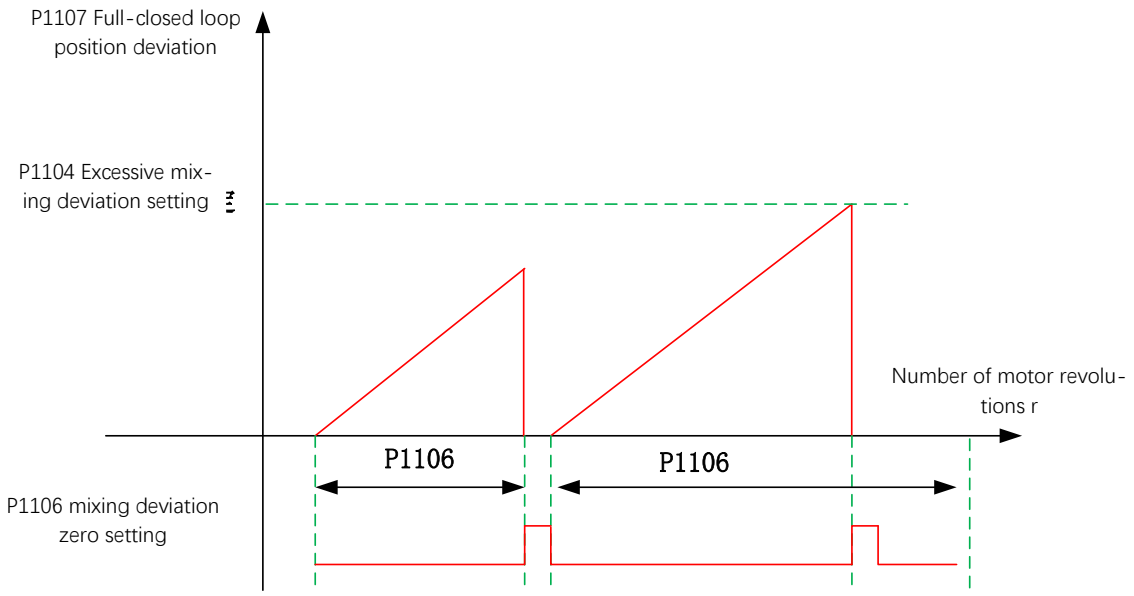


Figure 8.11 Logic for Clearing Position Deviation of Full Closed Loop Function

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1107	Full closed-loop position deviation counter	-1073741824/ 1073741824	External encoder unit	0	Display	

Statistically display the absolute value of position deviation and external encoder unit under the full closed-loop control.

Full closed-loop position deviation=external encoder absolute position feedback - internal encoder absolute position feedback converted value

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1109	External displacement sensor feedback pulse counter	-1073741824/ 1073741824	External encoder unit	0	Display	

Count and display the number of external encoder feedback pulses (external encoder unit after electronic gear ratio).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P110B	Using method of external encoder	0-1	1	0	Shutdown setting	Effective immediately

Set the feedback pulse count direction of internal and external encoders during the motor rotation under the full closed-loop function.

0- Take the CCW direction as the forward rotation direction; during the rotation of the motor, the counting direction of the internal encoder pulse feedback counter (P090E) and the external encoder pulse feedback counter (P1109) are the same.

1- Take the CW direction as the forward rotation direction. During the rotation of the motor, the counting direction of the internal encoder pulse feedback counter (P090E) and the external encoder pulse feedback counter (P1109) is opposite.

Note: This parameter must be set correctly. Otherwise, it may cause a speeding accident.

8.13 Group 12- Multi-segment Speed Function

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1201	Multi-segment speed function mode selection	0-2	1	1	Shut-down setting	Effective immediately

When the speed command source P0601=4, the speed command is a multi-segment speed. Set the multi-segment speed Operation mode:

Table 8.8 Multi-segment Speed Operation Mode Setting

Set value	Operation mode	Detailed explanation
0	Stop after single operation ends	1) The equipment stops after running for one turn. The number of running segments is set by P1202. 2) The segment number is switched by auto increment. 3) The running time at each segment of speed can be set independently. 4) The acceleration /deceleration time 1/2/3/4 can be independently set as the acceleration /deceleration time at each segment.
1	Cyclic operation	1) The initial segment number of each cycle is 1 during the cyclic operation. The operating segment number is set by P1202. 2) The segment number is switched by auto increment. 3) The running time at each segment of speed can be set independently. 4) The acceleration /deceleration time 1/2/3/4 can be independently set as the acceleration /deceleration time at each segment.
2	DI switching operation	1) Switched through the external DI. 2) The segment number is decided by the terminal state of the DI (CMD4/3/2/1) function. 3) The acceleration /deceleration time 1/2/3/4 can be independently set as the acceleration /deceleration time at each segment.

Note: When running at each segment of speed, you must ensure that the servo is enabled effectively. Otherwise, the driver will immediately stop in the servo OFF mode.

After the speed reaches the set speed value, the speed reaching signal is effective.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1202	Speed segment number selection	1-16	1	16	Shutdown setting	Effective immediately

Set the total segments number of the speed command. Different speeds and running time can be set for different segments, and there are four sets of acceleration and deceleration time to choose from.

- In the DI switching operation mode (P1201=2), set the four DI terminals to CMD4/3/2/1, and switch the segment number by controlling the DI level logic through the upper computer. When CMD4/3/2/1=0000, select segment number 1; When CMD4/3/2/1=0001, select segment number 2, and so forth; when CMD4/3/2/1=1111, the segment number is selected as 16.
- In single or cyclic operation mode (P1201=0/1), the segment number automatically increases and switches, and the maximum number of segments shall not exceed P1202:1, 2... P1202.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1203	Running time unit selection	0-1	1	0	Shutdown setting	Effective immediately

0: sec

1: min

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1204	Acceleration time 1	0-65535	ms	10	Shut-down setting	Effective immediately
P1205	Deceleration time 1	0-65535	ms	10	Shut-down	Effective immediately

Parameter No.	Parameter name	Range of numeri-cal value	Unit	Factory default value	Setting method	Method to take effect
					setting	
P1206	Acceleration time 2	0-65535	ms	50	Shut-down setting	Effective imme-diately
P1207	Deceleration time 2	0-65535	ms	50	Shut-down setting	Effective imme-diately
P1208	Acceleration time 3	0-65535	ms	100	Shut-down setting	Effective imme-diately
P1209	Deceleration time 3	0-65535	ms	100	Shut-down setting	Effective imme-diately
P120A	Acceleration time 4	0-65535	ms	150	Shut-down setting	Effective imme-diately
P120B	Deceleration time 4	0-65535	ms	150	Shut-down setting	Effective imme-diately

You can select the acceleration and deceleration time by setting the acceleration and deceleration time for each segment (P120E/P1211... P1238/P123B).

Acceleration time: The time for the motor to uniformly accelerate from 0 r/min to 1000 r/min.

Deceleration time: The time for the motor to uniformly decelerate from 1000 r/min to 0 r/min.

The setting of acceleration and deceleration time in actual operation can be calculated with the following formula:

Actual acceleration /deceleration time= $\frac{|V2-V1|}{1000}$ *Acceleration/deceleration time

Parameter No.	Parameter name	Range of nu-merical value	Unit	Factory default value	Setting method	Method to take effect
P120C	Segment 1 speed command	-10000/ 10000	r/min	0	Shutdown setting	Effective immediately
P120D	Segment 1 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P120E	Segment 1 acceleration/ de-celeration time	0-4	1	0	Shutdown setting	Effective immediately
P120F	Segment 2 speed command	-10000/ 10000	r/min	100	Shutdown setting	Effective immediately
P1210	Segment 2 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1211	Segment 2 acceleration/ de-celeration time	0-4	1	0	Shutdown setting	Effective immediately
P1212	Segment 3 speed command	-10000/ 10000	r/min	300	Shutdown setting	Effective immediately
P1213	Segment 3 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1214	Segment 3 acceleration/ de-celeration time	0-4	1	0	Shutdown setting	Effective immediately
P1215	Segment 4 speed command	-10000/ 10000	r/min	500	Shutdown setting	Effective immediately
P1216	Segment 4 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1217	Segment 4 acceleration/ de-celeration time	0-4	1	0	Shutdown setting	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1218	Segment 5 speed command	-10000/ 10000	r/min	700	Shutdown setting	Effective immediately
P1219	Segment 5 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P121A	Segment 5 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P121B	Segment 6 speed command	-10000/ 10000	r/min	900	Shutdown setting	Effective immediately
P121C	Segment 6 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P121D	Segment 6 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P121E	Segment 7 speed command	-10000/ 10000	r/min	600	Shutdown setting	Effective immediately
P121F	Segment 7 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1220	Segment 7 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P1221	Segment 8 speed command	-10000/ 10000	r/min	300	Shutdown setting	Effective immediately
P1222	Segment 8 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1223	Segment 8 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P1224	Segment 9 speed command	-10000/ 10000	r/min	100	Shutdown setting	Effective immediately
P1225	Segment 9 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1226	Segment 9 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P1227	Segment 10 speed command	-10000/ 10000	r/min	-100	Shutdown setting	Effective immediately
P1228	Segment 10 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1229	Segment 10 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P122A	Segment 11 speed command	-10000/ 10000	r/min	-300	Shutdown setting	Effective immediately
P122B	Segment 11 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P122C	Segment 11 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P122D	Segment 12 speed command	-10000/ 10000	r/min	-500	Shutdown setting	Effective immediately
P122E	Segment 12 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P122F	Segment 12 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P1230	Segment 13 speed command	-10000/ 10000	r/min	-700	Shutdown setting	Effective immediately
P1231	Segment 13 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1232	Segment 13 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P1233	Segment 14 speed command	-10000/ 10000	r/min	-900	Shutdown setting	Effective immediately
P1234	Segment 14 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1235	Segment 14 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P1236	Segment 15 speed command	-10000/ 10000	r/min	-600	Shutdown setting	Effective immediately
P1237	Segment 15 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P1238	Segment 15 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately
P1239	Segment 16 speed command	-10000/ 10000	r/min	-300	Shutdown setting	Effective immediately
P123A	Segment 16 speed running time	0-65535	0.1s(min)	50	Shutdown setting	Effective immediately
P123B	Segment 16 acceleration/ deceleration time	0-4	1	0	Shutdown setting	Effective immediately

The running time of the segment n speed command: refers to the variable speed time from the previous-segment speed command to the current-segment speed command+the constant speed running time of current segment. If the running time is 0, the driver will automatically skip the current-segment speed. In DI switching operation mode (P1201=2), the external DI state determines the running segment number, and the equipment will continue to run within the current-segment speed and will not be controlled by the commanded running time.

Segment n acceleration/ deceleration time:

Table 8.9 Acceleration and Deceleration Time for Each Speed Segment can be Set to the Following Values

Set value	Acceleration/ deceleration time	Corresponding parameter of acceleration time	Corresponding parameter of deceleration time
0	Zero acceleration/ deceleration time	0	0
1	Acceleration/ deceleration time 1	P1204	P1205
2	Acceleration/ deceleration time 2	P1206	P1207
3	Acceleration/ deceleration time 3	P1208	P1209
4	Acceleration/ deceleration time 4	P120A	P120B

Example:

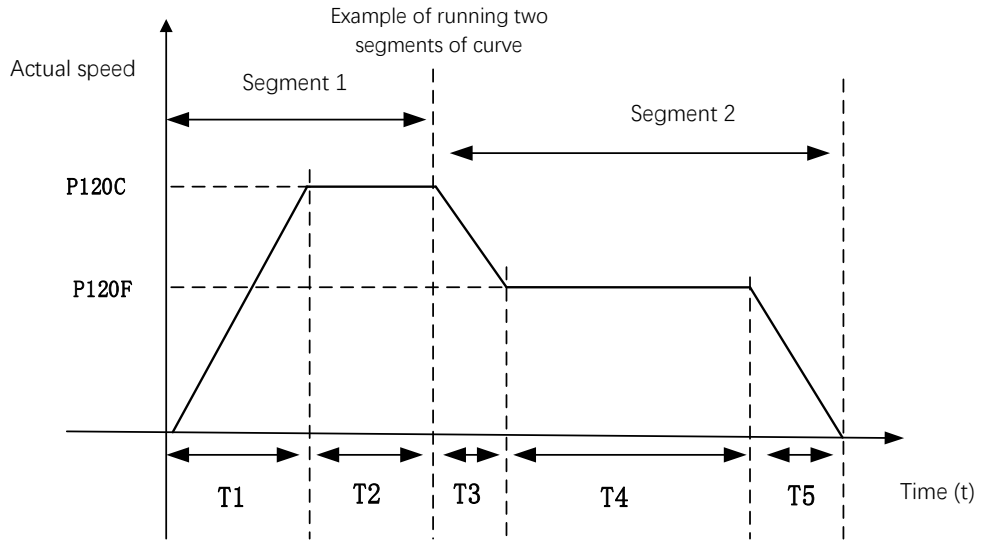


Figure 8.12 Example of Multi-segment Speed Curve

- Segment 1 speed curve running time: T1+T2;
- Segment 2 speed curve running time: T3+T4;
- Segment 1 speed curve acceleration/ deceleration time is T1;

- Segment 2 speed curve acceleration time is T3 and the deceleration time is T5;
- If a certain DO configuration parameter: 7-V-COIN is outputted at the same speed during the T2 and T4 time frames, then the DO is effective;
- If the running time of a certain segment speed curve is set to 0, the curve will not be executed;
- If the switching method of the speed curve is DI switching, and the state of DI does not change, the current-segment speed curve will be continuously executed without being limited by the running time.

8.14 Group 13- Multi-segment Position Function

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1301	Multi-segment position function mode selection	0-3	1	1	Shut-down setting	Effective immediately

Position control mode; if the multi-segment position parameter P0501=2 is selected, the multi-segment position function will be activated. The optional operation mode for multi-segment position:

0: Equipment stop after a single operation (the segment number is selected for P1302);

1: Cyclic operation (the segment number is selected for P1302);

2: DI switching operation (DI selection);

3: Sequential operation (the segment number is selected for P1302).

Notes:

- When using the multi-segment position function, you need to set a DI parameter to "19-PMUL-EN internal multi-segment position enabling input";
- During multi-segment operation, you need to ensure that the servo enabling signal is effective. Otherwise, the machine will be shut down according to the servo OFF mode set in P001B;
- During the multi-segment position operation, the servo enabling signal exists. However, if the multi-segment position enabling signal of DI is turned off, the servo will stop executing the remaining position command and immediately stop (except for DI switching operation mode). The multi-segment position enabling signal will be re-switched on, and the operation segment number will be determined by the setting of P1303.
- During the single operation, cyclic operation and sequential operation, the multi-segment position enabling signal is a level signal;
- During the DI switching operation, the multi-segment position enabling signal is the edge signal, and the equipment only stops after executing such segment.
- During the DI switching operation, firstly turn off the multi-segment position enabling signal when switching the segment number. Then, configure CMD1~4 to the corresponding segment number, and finally restore the multi-segment position enabling signal to execute the target segment number.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1302	Displacement end segment number selection	1-16	1	1	Shut-down setting	Effective immediately

Set the total number of segments for the position command, and each-segment position can be freely set.

- When P1301 = 2, set the four DI terminals to CMD4/3/2/1, and switch the segment number by controlling the DI level logic through the upper computer. When CMD4/3/2/1=0000, select segment number 1; When CMD4/3/2/1=0001, select segment number 2, and so forth; when CMD4/3/2/1=1111, the segment number is selected as 16.
- When P1301 ≠ 2, the segment number at multi-segment positions will automatically increase, and the maximum number of segments shall not exceed the setting of P302: 1, 2... P1302.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1303	Operation recovery handling method	0-1	1	0	Shut-down setting	Effective immediately

When the operation at the multi-segment position function is paused(e.g., the multi-segment position enabling signal of DI is disconnected) and is recovered, the segment number for restart can be set:
0: The equipment continuously runs according to the remaining position commands; for example, when the operation is paused, the equipment will execute until the 4th segment. During recovery, the operation will start from the 5th segment
1: The equipment re-runs from segment 1. The equipment will re-start executing the command regardless of the state before pause.
Once paused during the operation of multi-segment positions, the position command that has not been completed in this segment will be discarded.

The Explanation of the Case When P1303=0 is as Follows:

Set P1302=5, and the equipment will run until the segment 4. However, when segment 4 is not completed, i.e., there is still some remaining amount left. Use DIx (which maps to the internal multi-segment position enabling signal of 19-PMUL-EN) to disconnect the multi-segment position enabling signal, and then restore it. The executed multi-segment positions are as shown in the table below.

Parameter No.	P1305=0 (Relative displacement command)	P1305=1 (absolute displacement command)
P1303=0 (remaining position command executed continuously)	From the segment 5	The remaining amount of segment 4 is continuously executed

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1304	Waiting time unit	0-1	1	0	Shutdown setting	Effective immediately

Set the time unit of multi-segment position function:
0: ms;
1: s.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1305	Command type selection	0-1	1	0	Shutdown setting	Effective immediately

Select the relative position or absolute position to execute the position command at the multi-segment position:
0: Relative position command;
1: Absolute position command.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1306	cyclic mode selection	0-16	1	0	Shutdown setting	Effective immediately

When P1301=1 and the equipment runs cyclically at multi-segment position, set the segment number to start after running one cycle:
0: No cyclic operation; number of segments set for P1302 in case of operating once.
1-16: Cyclic operation; the segment number at which the cycle starts after the first cycle of operation; please note to match P1302.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P1307	Segment 1 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1309	Segment 1 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P130A	Segment 1 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately

P130B	Segment 1 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately

Parameter set for segment 1 position; you can refer to Figure 8.13:

Displacement: The movement position of segment 1 (command unit); the shaded area of the figure.

Displacement speed: The maximum speed during the execution of the first position command. Please consider the acceleration and deceleration time;

Acceleration/deceleration time: The time it takes for the motor shaft to accelerate from 0 r/min to P1309;

Waiting time: The time for waiting the next-segment position to start after the completion of the first-segment position.

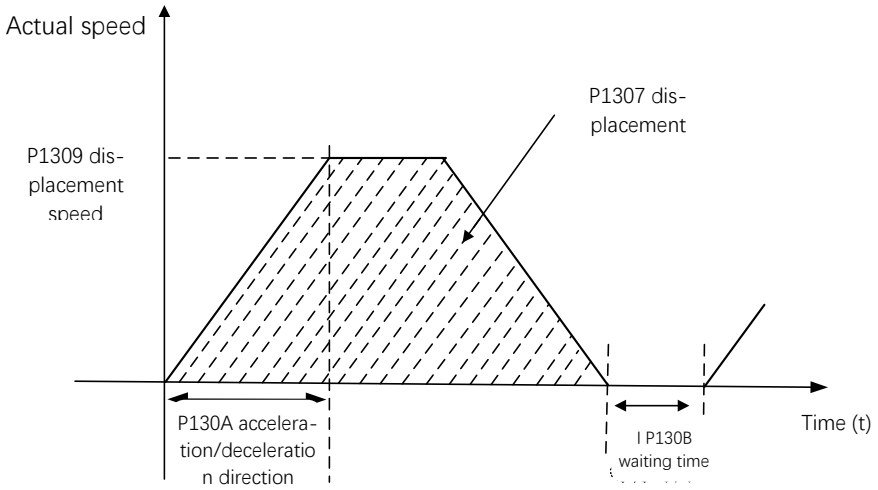


Figure 8.13 Position Command Parameter at Each Segment

Note: The waiting time is ineffective for both sequential operation (P1301=3) and DI switching mode (P1301=2).

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P130C	Segment 2 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P130E	Segment 2 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P130F	Segment 2 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1310	Segment 2 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1311	Segment 3 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1313	Segment 3 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1314	Segment 3 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1315	Segment 3 displacement completion waiting time	1-10000	ms(s)	10	Setting at any time	Effective immediately
P1316	Segment 4 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1318	Segment 4 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1319	Segment 4 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P131A	Segment 4 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P131B	Segment 5 displacement	-1073741824/	Command	10000	Setting at	Effective

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
		1073741824	unit		any time	immediately
P131D	Segment 5 displacement command	1-10000	r/min	200	Setting at any time	Effective immediately
P131E	Segment 5 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P131F	Segment 5 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1320	Segment 6 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1322	Segment 6 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1323	Segment 6 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1324	Segment 6 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1325	Segment 7 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1327	Segment 7 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1328	Segment 7 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1329	Segment 7 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P132A	Segment 8 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P132C	Segment 8 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P132D	Segment 8 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P132E	Segment 8 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P132F	Segment 9 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1331	Segment 9 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1332	Segment 9 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1333	Segment 9 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1334	Segment 10 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1336	Segment 10 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1337	Segment 10 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1338	Segment 10 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1339	Segment 11 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P133B	Segment 11 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P133C	Segment 11 displacement	0-65535	ms(s)	10	Setting at	Effective

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
	acceleration/ deceleration time				any time	immediately
P133D	Segment 11 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P133E	Segment 12 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1340	Segment 12 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1341	Segment 12 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1342	Segment 12 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1343	Segment 13 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1345	Segment 13 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1346	Segment 13 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1347	Segment 13 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1348	Segment 14 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P134A	Segment 14 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P134B	Segment 14 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P134C	Segment 14 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P134D	Segment 15 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P134F	Segment 15 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1350	Segment 15 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1351	Segment 15 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately
P1352	Segment 16 displacement	-1073741824/ 1073741824	Command unit	10000	Setting at any time	Effective immediately
P1354	Segment 16 displacement speed	1-10000	r/min	200	Setting at any time	Effective immediately
P1355	Segment 16 displacement acceleration/ deceleration time	0-65535	ms(s)	10	Setting at any time	Effective immediately
P1356	Segment 16 displacement completion waiting time	0-10000	ms(s)	10	Setting at any time	Effective immediately

8.15 Group P80- Modbus Protocol

Parameter No.	Parameter name	Range of nu-	Unit	Factory default	Setting	Method to

		merical value		value	method	take effect
P8001	Slave device shaft address	1-255	1	1	Setting at any time	Effective immediately

When RS-485 communication is used, only one unique address can be set for each servo driver. If the address is repeated, it will cause communication to fail to function properly. When the address is set to 0, it will be used as the broadcast address, and the 485 master station will access all slave nodes.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8002	Communication baud rate	0-6	bps	5	Setting at any time	Effective immediately

Set the communication rate with the same one as the upper computer. Otherwise, the equipment will fail to communicate:

0-2400;
1-4800;
2-9600;
3-19200;
4-38400;
5-57600;
6-115200

Note: Unit bps (bit/second),1Kb= 1024b, Mb= 1024 Kb .

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8003	Parity checking method	0-3	1	0	Setting at any time	Effective immediately

When the communication between the driver and the upper computer is set, the data verification method shall be the same. Otherwise, the communication cannot be achieved:

0- No check, 2 stop bits
1-Even parity check, 1 stop bit
2- Odd parity check, 1 stop bit
3- No check, 1 stop bit

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8004	Communication error type	0-65535	1	0	Only displayed, read	Effective immediately

In the event of a communication fault, the servo panel will display a fault code (displayed in hexadecimal), and the explanations of the relevant fault codes can be found in the table below:

Table 1 Modbus Communication Error Fault Codes

Error code	Error analysis
0x0001	Command code error
0x0002	Data address error
0x0003	Data error
0x0004	Servo fault

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8005	Slave response delay	0-5000	ms	1	Setting at any time	Effective immediately

After receiving the command from the upper computer, the servo will delay for a period of time to respond to the upper computer.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8006	32-bit data transmission order	0-1	1	1	Setting at any time	Effective immediately

For Modbus communication, the transmission format for 32-bit data is:

0- Higher 16 bits in front, lower 16 bits at the back;
1- Lower 16 bits in front, higher 16 bits at the back.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P800C	Virtual ID terminal enabling	0-1	1	0	Shutdown setting	Effective immediately

Set whether to use the VDI (Virtual-Digital-Input) terminal:
0- Disabled:
1- Enabled.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P800D	VDI power-on default value	0-65535	1	0	Setting at any time	Effective immediately

Set the default value of VDI after power-on.

Refer to Figure 8.14 for the using of VDI.

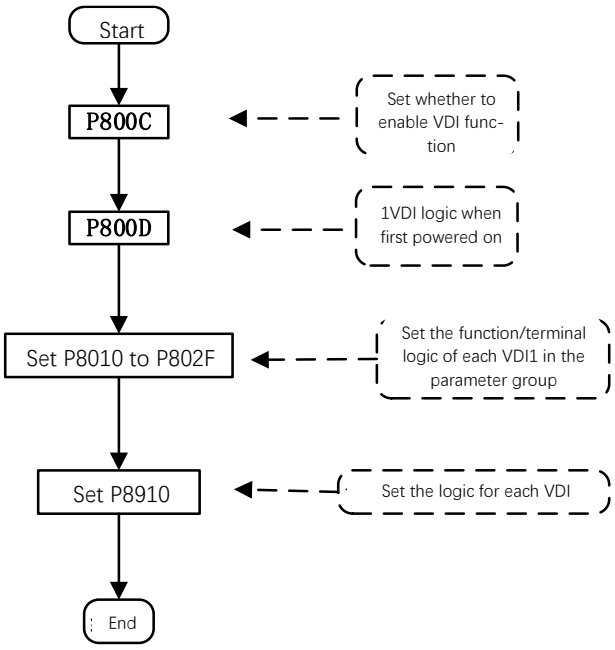


Figure 8.14 VDI Setting Logic

Notes:

- After the logic setting parameters P080D and P8910 of VDI are converted to binary numbers, it indicates that the logic of VDI (n) is 1 if bit (n)=1.
- Please note that the function code assigned by VDI cannot be duplicated with the actual function code assigned by DI.

The functional allocation of VDI is consistent with that of normal DI.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8010	VDI 1 function allocation	0-26	1	0	Setting at any time	Effective immediately
P8012	VDI 2 function allocation	0-26	1	0	Setting at any time	Effective immediately
P8014	VDI 3 function allocation	0-26	1	0	Setting at any time	Effective immediately
P8016	VDI 4 function allocation	0-26	1	0	Setting at any time	Effective immediately
P8018	VDI 5 function allocation	0-26	1	0	Setting at any time	Effective immediately
P801A	VDI 6 function allocation	0-26	1	0	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P801C	VDI 7 function allocation	0-26	1	0	Setting at any time	Effective immediately
P801E	VDI 8 function allocation	0-26	1	0	Setting at any time	Effective immediately

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P800E	Virtual DO terminal enabling	0-1	1	0	Shutdown setting	Effective immediately

Set whether to use the VDO (Virtual-Digital-Output) terminal:
0: Disabled;
1: Enabled.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P800F	VDO power-on default value	0-65535	1	0	Shutdown setting	Effective immediately

Set VDO function, with a default value of 0 indicating no allocation of DO function and virtual level value.
Refer to Figure 8.15 for the using of VDO.

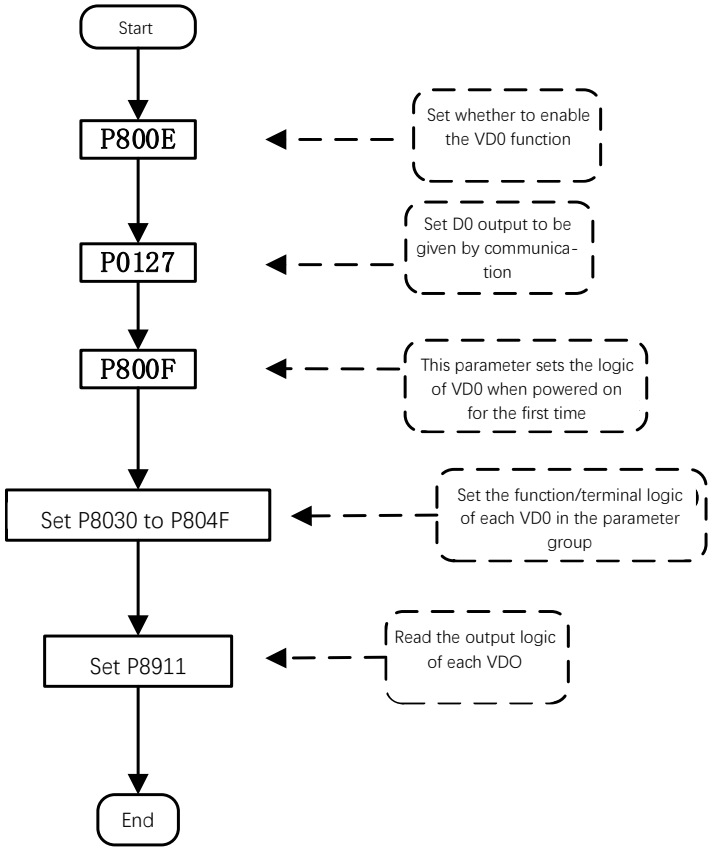


Figure 8.15 VDO Setting Logic

Notes:

- After the logic setting parameters P080F and P8911 of VDO are converted to binary numbers, it indicates that the logic of VDO(n) is 1 if bit (n)=1.
- If bit (n)=0, it means that the VDO (n) logic is 0.

The functional allocation of VDO is consistent with that of normal DO.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect

P8030	VDO 1 function allocation	0-13	1	0	Setting at any time	Effective immediately
P8032	VDO 2 function allocation	0-13	1	0	Setting at any time	Effective immediately
P8034	VDO 3 function allocation	0-13	1	0	Setting at any time	Effective immediately
P8013	VDO 4 function allocation	0-13	1	0	Setting at any time	Effective immediately
P8038	VDO 5 function allocation	0-13	1	0	Setting at any time	Effective immediately
P803A	VDO 6 function allocation	0-13	1	0	Setting at any time	Effective immediately
P803C	VDO 7 function allocation	0-13	1	0	Setting at any time	Effective immediately
P803E	VDO 8 function allocation	0-13	1	0	Setting at any time	Effective immediately

8.16 Group P89- Communication with Upper Computer

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8910	Set the virtual DI signal	0-65535	1	0	Setting at any time	Effective immediately

It is used for the communication DI control. You can change the DI state by setting the value of P8910. P8910 is displayed in decimal. After you convert to binary system, it indicates that the VDI (n+1) logic is 1 if bit (n)=1.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8911	Set the virtual DO signal	0-31	1	0	Setting at any time	Effective immediately

It is used for the communication DO control. You can change the DO state by setting the value of P8911. If bit (n)=1, it means that the VDO (n+1) logic is

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8912	Speed command	-10000/ 10000	1 r/min	0	Setting at any time	Effective immediately

When the speed command source is 4 (P0601=4) in the speed control mode, the speed command is set by P8912.

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P8914	Torque command	-6000/ 6000	0.1%	0	Setting at any time	Effective immediately

When the speed command source is 3 (P0701 = 3) in the torque control mode, the speed command is set by P8914.

8.17 Group P90- Motor Parameters

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P9001	Motor code	0-65535	1	0	Shutdown setting	Effective immediately

Table 8.11 Code Definitions for MA3 Series Motors

220V				380V			
Motor power (kW)	Motor code (P9001)	Motor power (kW)	Motor code (P9001)	Motor power (kW)	Motor code (P9001)	Motor power (kW)	Motor code (P9001)

0.2	10110	1.3	10101	0.85	10121	2.3	10141
0.4	10120	1.5	10101	1	10121	2.9	10102
0.75	10130	1.8	10111	1.3	10131	3	10102
0.85	10140	2	10111	1.5	10131	4.4	10112
1	10140			1.8	10141	5.5	10122
				2	10141	7.5	10132

Parameter No.	Parameter name	Range of numerical value	Unit	Factory default value	Setting method	Method to take effect
P9026	Encoder type	0-65535	1	0	Shutdown setting	Effective im-mediately

Encoder type:

Encoder type	Encoder type description	Encoder type code (P9026)
A0	Single turn absolute 17-bit magnetic encoder	11170
A1	Multi-turn absolute 17-bit magnetic encoder	11171
E0	Single turn absolute 17-bit optical encoder	11230
E1	Multi-turn absolute 17-bit optical encoder	11231