WISE Multi-axis Servo Drive User Manual

Version: 2020.1 1st Version
Author: Product Supporting Department

1. Basic Information

You can check the structure, the nameplate, equipment on opening the product package, learn about three control modes, specification and mounting of your servo drive.

- Structure
- Nameplate
- On Opening the Product Package
- Control Modes
- Specifications
- Mounting

1.1. Structure

The WISE multi-axis servo drive (Hereinafter referred as to the servo drive) consists of the following part:

- Drive part

  It can drive 4 servo motors and have the digital operation function.

  About its wiring, see Wiring of the Drive Part for details.

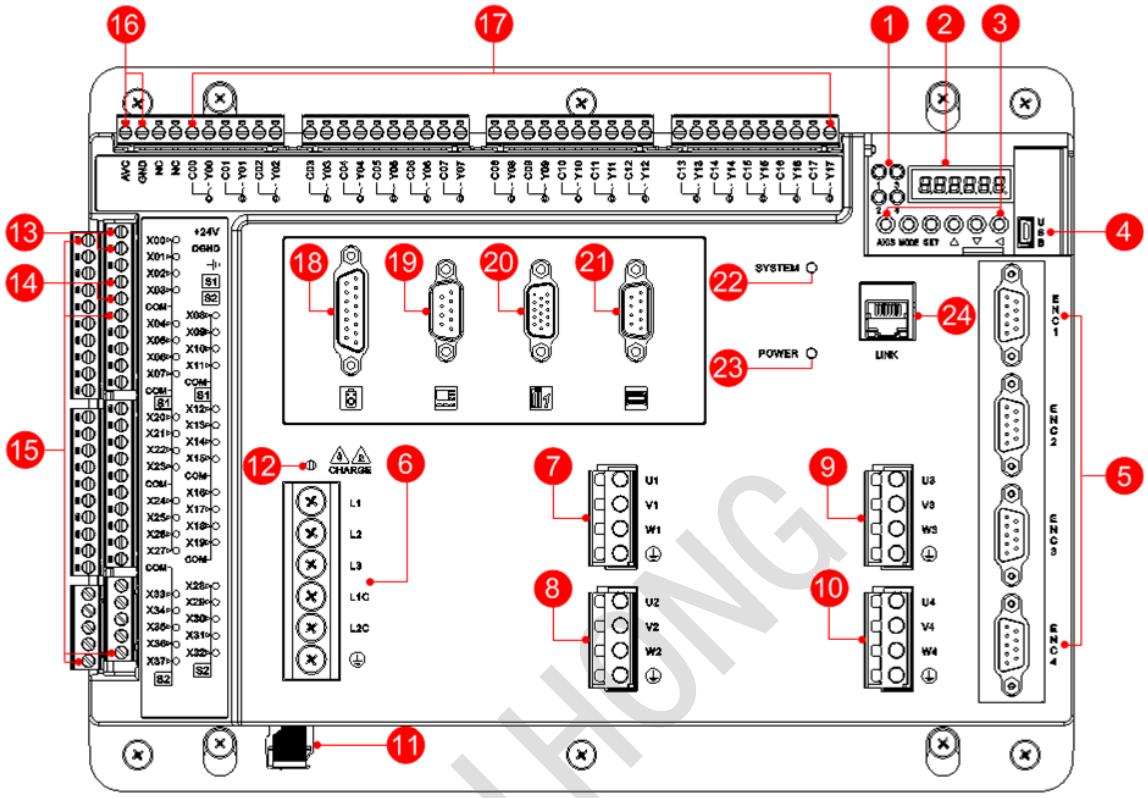
- Terminal board part

  18 general outputs, 38 general inputs and 1 analog output, 1 host interface, 1 pulse spindle interface, 1 six-axis handwheel interface, 1 extended I/O interface and 1 bus extended axis interface.

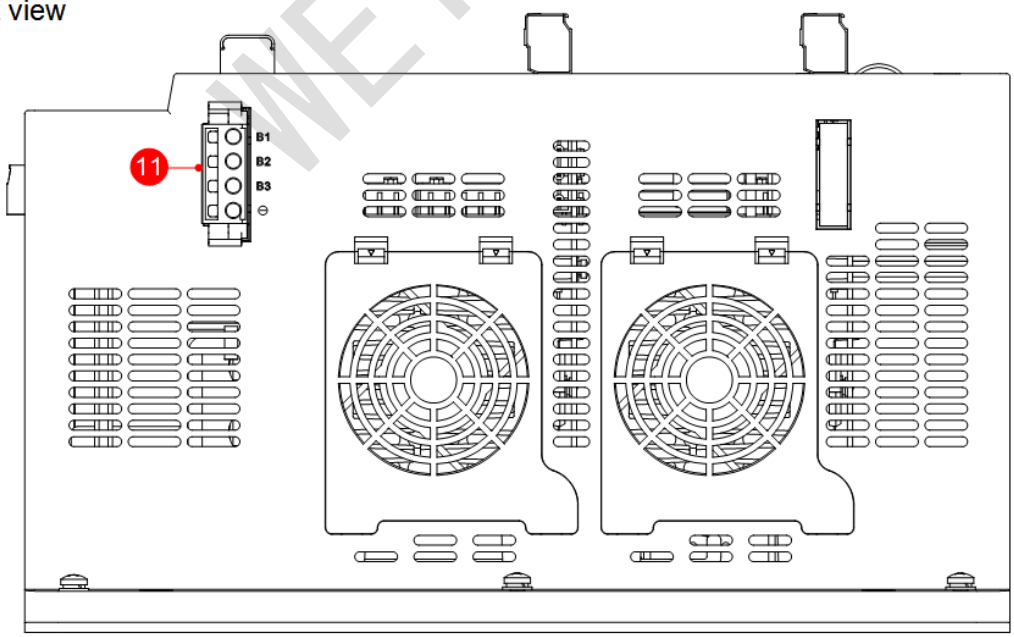
  About its wiring, see Wiring of the Terminal Board for details.

The diagram of the servo drive is as follows:

Top view



Front view



1. Indicator lights for each axis

   When the target axis is enabled, the corresponding light turns on.

   See Operation Panel for details.

2. Display: a 6-digit 7-segment LED display.

3. Operation buttons: including **AXIS** button, **MODE** button, **SET** button, ▲ button, ▼ button, ◀ button.

   See Operation Panel for details.

4. USB interface

   See Wiring of the USB Interface for details.

5. ENC1~4

   They are connected with the encoder of the motor.

   See Wiring of ENC1/ENC2/ENC3/ENC4 for details.

6. L1, L2, L3, L1C, L2C

   - L1, L2, L3: input terminals for the main circuit power.
   - L1C, L2C: input terminals for the control power.

   See Wiring of the Main Circuit for details.

7. U1, V1, W1, ⏚

   They are connected with the servo motor.

   ⏚ is the grounding terminal.

   See Wiring of the Main Circuit for details.

8. U2, V2, W2, ⏚

   They are connected with the servo motor.

   ⏚ is the grounding terminal.

   See Wiring of the Main Circuit for details.

9. U3, V3, W3, ⏚

   They are connected with the servo motor.

   ⏚ is the grounding terminal.

   See Wiring of the Main Circuit for details.

10. U4, V4, W4, ⏚

    They are connected with the servo motor.

    ⏚ is the grounding terminal.

    See Wiring of the Main Circuit for details.

11. B1, B2, B3, B1, ⊖

    B1, B2, B3: connection terminals for an external regenerative resistor.

    B1, ⊖**:** servo DC busbar terminals.

    See Wiring of the Regenerative Resistor and Wiring of the Main Circuit for details.

12. Power indicator light

    It is used to show whether the power is on.

13. +24V, DGND

    +24V: interface for the positive pole of the 24V power supply.

    DGND: interface for grounding.

    See Wiring of the Terminal Board for details.

14. S1, S2

    They are used to switch between the high level and low level.

    See Binary Input Signal for details.

15. X00~X37

    The general input ports.

    See Wiring of the Terminal Board for details.

16. AVC, GND

    The analog output ports.

    See Wiring of the Terminal Board for details.

17. Y00~Y17, C00~C17

    The general output ports.

    See Relay Output Signal for details.

18. Handwheel interface

    See Wiring of the Terminal Board for details.

19. Host interface

    See Wiring of the Terminal Board for details.

20. Interface for moving axes

    See Wiring of the Terminal Board for details.

21. Interface for extended terminal board

    See Wiring of the Terminal Board for details.

22. SYSTEM indicator light

    It is used to show the current system status.

23. POWER indicator light

    It is used to show whether the controller power is on.

24. LINK bus interface

    It is used for extended axes.

    See Wiring of the Terminal Board for details.

1.2. Nameplate

The diagram of the nameplate is as follows:

1. Model

WS	LM	-	A	A	A	A	3	M2	S	B	X	2
1-2	3-4		5	6	7	8	9	10-11	12	13	14	15
WISE Series	Model		Axis 1 Rated Power	Axis 2 Rated Power	Axis 3 Rated Power	Axis 4 Rated Power	Power Supply Voltage	Extended Bus Interface	Encoder Feedback	Motor Type	Port Specification	Special Specification

1-2

Symbol	Specification
WS	WISE Series

3-4

Symbol	Specification
LM	Multi-axis

5-8

Symbol	Specification
8	750W
A	1.0KW

9

Symbol	Specification
3	Three-phase 220V

10-11

Symbol	Specification
M2	MECHATROLINK-II Bus Communication Command

12

Symbol	Specification
S	Serial Communication Encoder

13

Symbol	Specification
B	Rotating Motor

14

Symbol	Specification
X	Lambda II

2. Input power specification

3. Control I/O power specification

4. Output power specification
5. Ambient temperature

1.3. On Opening the Product Package

After you open the product package, please check:

- Whether the model number marked on the nameplates of the servo drive corresponds to the order.
- Whether there is damage or scratch on the appearance.
- Whether screws are loose or fallen.
- Whether the following is fully-equipped:
  - One WISE multi-axis servo drive
  - One connector of the regenerative brake
  - Four motor connectors
  - Two auxiliary tools for wiring terminals
  - Four screws
  - **Optional:** Four encoder connectors and four encoder cables
  - **Optional:** Ten connectors (Two 5PIN connectors and eight 10PIN connectors) for I/O terminals of the controller.
  - **Optional:** One extended bus communication cable
  - **Optional:** One terminating resistor

1.4. Control Modes

There are three control modes, which can be selected by parameter **Pr001 Control mode setup**.

Modification to the parameter takes effect after powering on the servo drive again.

See the following for different control modes:

Pr001	Control Mode	Description
1	Position control	The servo drive receives the position command and makes the motor rotate to the target position. The position command of the servo drive (M2) is input through the internal communication instruction in the type of digital signal.
2	Velocity control	The servo drive receives the velocity command and makes the motor rotate to the target speed. The velocity command of the servo drive (M2) is input through the internal communication instruction in the type of digital signal.
3	Torque control	The servo drive receives the torque command and makes the motor rotate to the target torque. The torque command of the servo drive (M2) is input through the internal communication instruction in the type of digital signal.

1.5. Specifications

This part introduces basic specifications and the protection function of the servo drive.

1.5.1. Basic Specifications

Basic specifications of the servo drive include the following:

Main Circuit Power Supply	3-phase 200V ~240V $^{+10\%}_{-15\%}$, 50/60Hz
Control Circuit Power Supply	Single phase 200V ~240V $^{+10\%}_{-15\%}$, 50/60Hz
Control I/O Power Supply	24VDC ±10% 0.5A
Host Interface	Supporting PHOENIX communication
HW Interface	Supporting the six-axis handwheel
Extended Interface	Cascade extension, high-speed 485 interface, 10Mbps baud rate
Spindle Interface	Pulse train commands. Maximum pulse output frequency: 1MHz 1 analog output. Voltage range: 0~10V. Precision: 0.2V
General Interface	• 38 general digital inputs. Ports are configurable. Active high and low level • 18 general digital outputs
Link Interface	Supporting MECHATROLINK-II communication
Encoder Feedback	• 17-bit (resolution 131072) 7-wire serial absolute encoder • 20-bit (resolution 1048576) 5-wire serial incremental encoder • 23-bit (resolution 8388608) 7-wire serial absolute encoder • 24-bit (resolution 16777216) 7-wire serial absolute encoder
Insulation Resistance	AC 1500V or DC 2100V, withstand the voltage for 1 minute. Leakage current is 10mA at most
Ambient Temperature (Working)	0℃~+55℃ (No condensation and freezing)

Ambient Temperature (Storage)	-25℃~+70℃ (Max temperature guarantee: 80℃ for 72 hours, with humidity lower than 17%RH)

Protection Level/Cleanliness	• Protection level: IP20
	• Cleanliness: 2
	• Environment requirements:
	  ○ No corrosive gas or inflammable gas
	  ○ No splashing of water, oil or powder
	  ○ Little dust, powder, salt and iron powder

Ambient Humidity	5%~85% RH (No condensation and freezing)
Control Mode	SVPWM control mode
Command Mode	High-speed MECHATROLINK-II bus
Communication	Connecting with software iMotion in PC via the USB interface
Front Panel	6 buttons, 6-digit LED, 4 indicator lights
Regenerative Resistor	WSLM-AAAA and WSLM-8888 have the internal regenerative resistor and can be connected with the external one
Dynamic Brake	WSLM-AAAA and WSLM-8888 have the internal dynamic brake
Control Mode	Position control, velocity control, and torque control

1.5.2. Protection Function

Protection of the servo drive includes the following:

- Hardware protection

  Over-voltage, under-voltage, over-current, over-speed, over-load, over-load of the brake resistor, over-heat of the servo drive, encoder error, etc.

- Software protection

  Register error, initialization error, I/O allocation error, positional deviation excess, etc.

- Error protection history

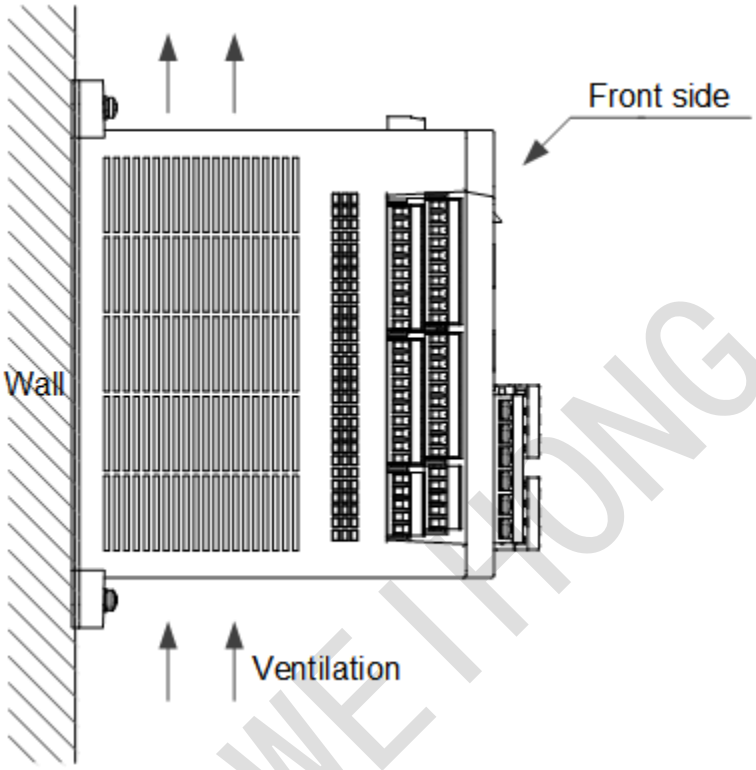
  Up to 14 errors, including the latest 3 errors can be traced.

1.6. Mounting

This part introduces how to install servo drives in the control box.

To install the servo drives, do the following:

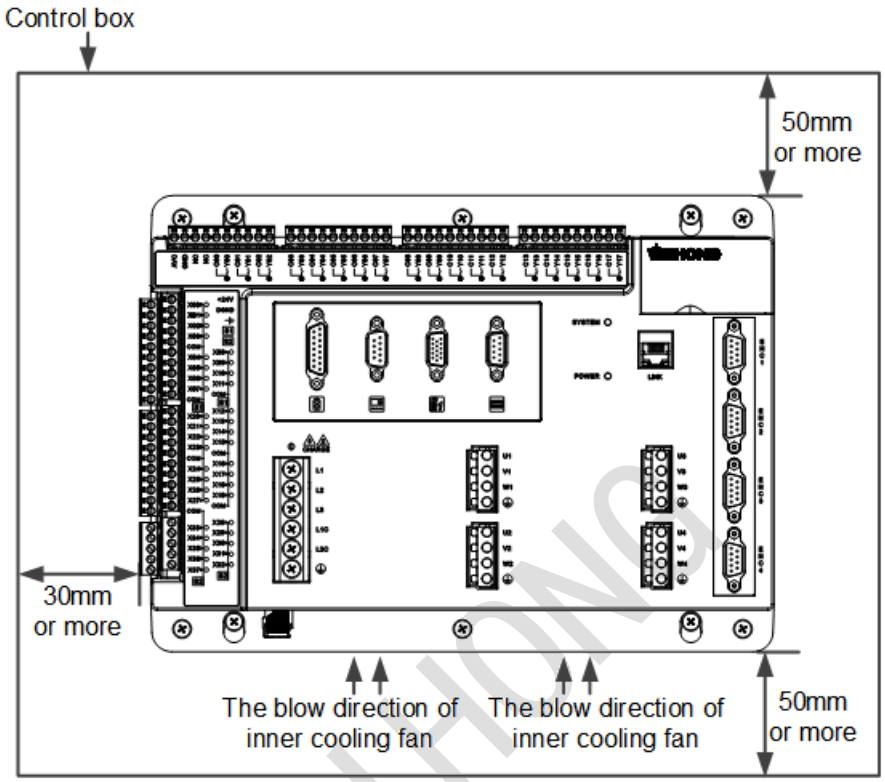
1. Keep the front panel face to the operator and install the servo drive perpendicularly to the wall:



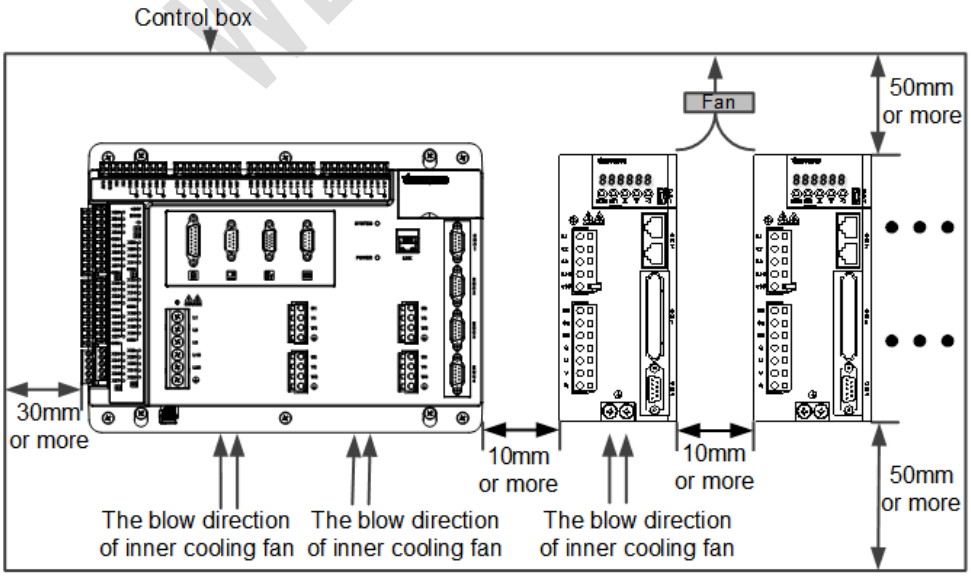
2. Secure the servo drive on the wall via mounting holes, and cool it by cooling fans or nature convection.

3. To place one servo drive or more in the control box, do one of the following:

- When only one multi-axis servo drive is placed in the control box:



- When one multi-axis servo drive and several single-axis servo drives are placed in the control box:

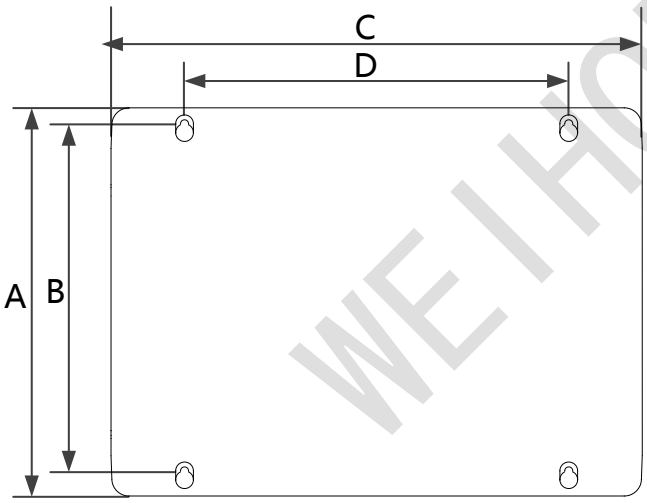


To cool the servo drives when one multi-axis servo drive and several single-axis servo drives are placed in the control box, ensure the following:

- The space between the servo drives is at least 10mm and the space above or below a servo drive is at least 50mm, and cooling fans are installed above the servo drives.
- To avoid high ambient temperature at part and maintain even temperature inside the control box, ensure environment in the control box meets the following requirements:
  - Ambient temperature: 0℃~+55℃ (no condensation and freezing).
  - Humidity: 5%~85% RH (no freezing or frost).
  - Ambient temperature for long-term reliability: ≤45℃.

Installation Dimension

The installation dimension of the servo drive is as follows:

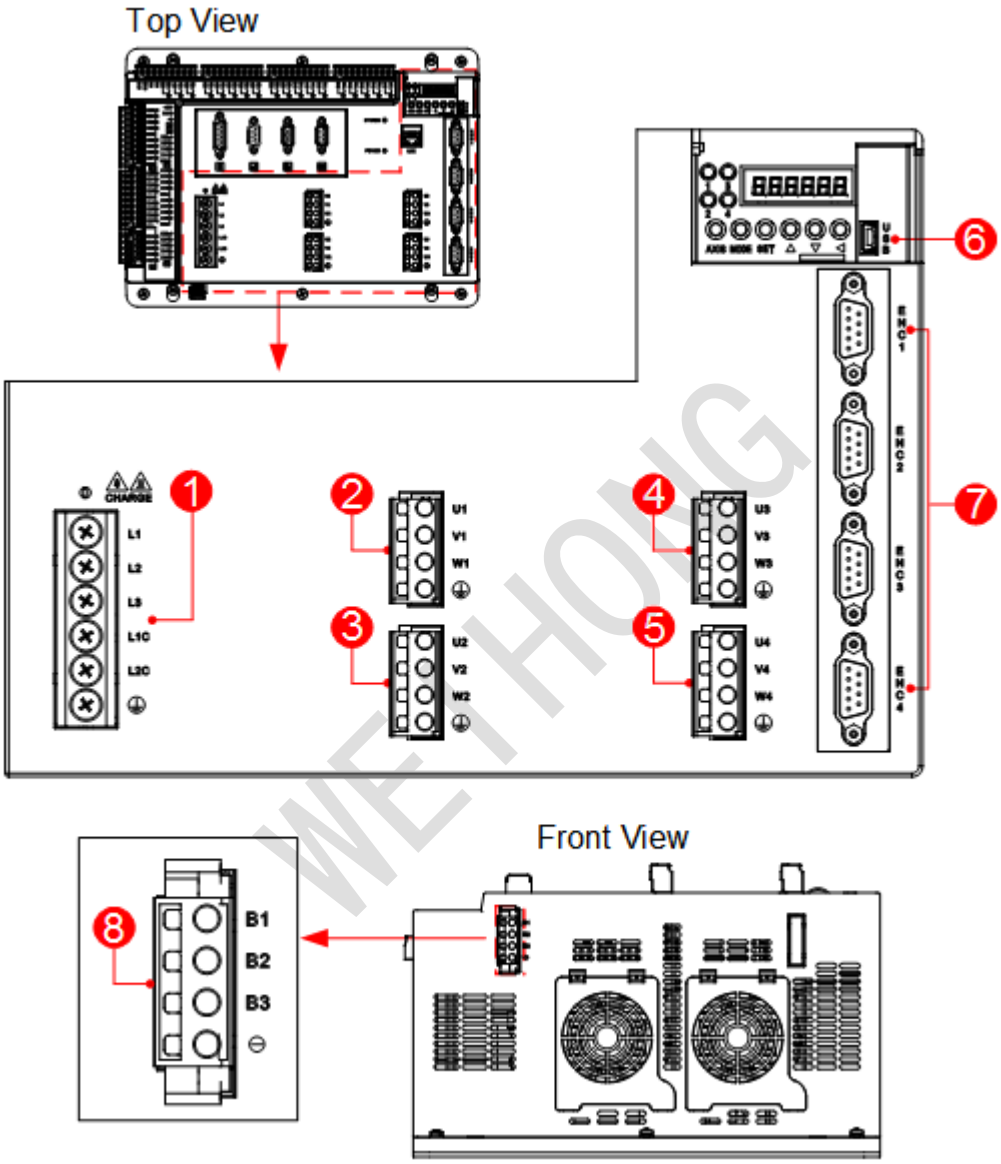


Dimension				Screw Size	Screw No.
A	B	C	D		
200	196	300	220	M4	4

2. Wiring of the Drive Part

This part introduces the wiring about the drive part.

The diagram is as follows:



- 1~5, 8: Main circuit

  See Wiring of the Main Circuit for details.

- 6: USB interface

  See Wiring of the USB Interface for details.

- 7: ENC1~4

  See Wiring of ENC1/ENC2/ENC3/ENC4 for details.

- 8: B1, B2, B3, ⊖

  See Wiring of the Regenerative Resistor for details.

2.1. Wiring of the Main Circuit

This part introduces the wiring of the main circuit from the following aspects:

- Terminals
- Cables
- Specifications

About wiring the main circuit, note the following:

– Before wiring, power off and take off the transparent cover of the servo drive.

– After wiring, power off and install the cover back.

2.1.1. Terminals

Terminals of the main circuit are as follows:

1. Input terminals for the main circuit power: L1, L2, L3

   – They are connected to 3-phase voltage.
   – Voltage specification: 200V~240V $^{+10\%}_{-15\%}$, 50/60Hz.

2. Input terminals for the control power: L1C, L2C

   – They are connected to single phase voltage.
   – Voltage specification: 200V~240V $^{+10\%}_{-15\%}$, 50/60Hz.

3. Connection terminals for the servo motor: U1, V1, W1

   They are connected with a servo motor whose encoder is connected to ENC1.

4. Connection terminals for the servo motor: U2, V2, W2

   They are connected with a servo motor whose encoder is connected to ENC2.

5. Connection terminals for the servo motor: U3, V3, W3

   They are connected with a servo motor whose encoder is connected to ENC3.

6. Connection terminals for the servo motor: U4, V4, W4

   They are connected with a servo motor whose encoder is connected to ENC4.

7. PE grounding terminal: ⏚

   It is the grounding point of AC and motor power cables. There are 5 PE grounding terminals in the main circuit.

8. Connection terminals for an external regenerative resistor: B1, B2, B3

   When the capacity of the internal regenerative resistor is inadequate, you can make circuit between B2 and B3 open by removing the wire between B2 and B3, and connect an external regenerative resistor (optional part) between B1 and B2. It is short-circuited between B2 and B3 by default.

9. Servo DC busbar terminals: B1, ⊖

   To share the voltage of the busbar, connect the servo DC busbar terminals of multiple servo drives when they are connected in parallel.

2.1.2. Cables

This part introduces the cables of the main circuit from the following aspects:

- Cautions
- Types of Cables
- Specifications

2.1.2.1. Cautions

Cautions about cables are as follows:

- Allowable temperature: 40℃, which is the specification for rated current flowing through 3 wires.
- Use electrical wires of 600V or more withstand voltage for the main circuit.
- Take the attenuation coefficient of allowable current into consideration during binding wires and putting them into PVC tubes or metal tubes.
- Thermal aging of PVC wires is relatively quick, that is, PVC wires cannot be used any longer in a short time. Use heat-resistant wires when ambient temperature is very high.

2.1.2.2. Types of Cables

Types of cables are as follows:

- IV
  - Name: 600V PVC wire
  - Allowable temperature of conductor: 60℃
- HIV
  - Name: special heat-resistant PVC wire
  - Allowable temperature of conductor: 75℃

Relationship between the wire diameter and allowable current when 3 wires are used is as follows (Values in the table are the reference specifications of the 600V special heat-resistant PVC wire and the maximum specifications in real practice):

AWG Specification	Nominal Cross Sectional Area (mm^2)	Constitution (wires/mm^2)	Resistance of Conductor (Ω/Km)	Allowable Current under Different Ambient Temperature (A)		
				30℃	40℃	50℃
20	0.5	19/0.18	39.5	6.6	5.6	4.5
19	0.75	30/0.18	26.0	8.8	7.0	5.5
18	0.9	37/0.18	24.4	9.0	7.7	6.0
16	1.25	50/0.18	15.6	12.0	11.0	8.5
14	2.0	7/0.6	9.53	23	20	16
13	2.63	52/0.254	7.1	28	24	20
12	3.5	7/0.8	5.41	33	29	24
10	5.5	7/1.0	3.47	43	38	31
8	8.0	7/1.2	2.41	55	49	40
6	14.0	7/1.6	1.35	79	70	57

2.1.2.3. Specifications

Cable specifications of all terminals when input terminals (L1, L2, L3) for the main circuit power are connected with 3-phase / single phase voltage are as follows:

Power	External Terminal Name	Symbol	Specification	
			8888	AAAA
Single phase/3-phase 200V	Main circuit power input terminal	L1, L2, L3	2.0mm² (AWG14)	2.5mm² (AWG12)
	Control power input terminal	L1C, L2C	1.25mm² (AWG16)	
	Motor connection terminal	U, V, W	1.25mm² (AWG16)	2.0mm² (AWG14)
	External regenerative resistor connection terminal	B1, B2	1.25mm² (AWG16)	
	Grounding terminal	⏚	3.5mm² (AWG12) or more	

2.1.3. Wiring Specifications

This part introduces specifications for wiring from the following aspects:

- Cautions
- Items Related to Wiring
- Power-Control Input Setup

2.1.3.1. Cautions

Cautions about wiring are as follows:

- Use a transformer to convert into 3-phase 200V power supply, and use a circuit breaker (QF) or fuse to prevent the servo drive from mis-contact with peripheral components.
- No internal grounding protection circuit is enabled for the servo drive. To build up a safe system, equip the servo drive with an electric leakage circuit breaker with over-load and short protection.
- Do not frequently turn on/off the power. Relatively large amount of charging current occurs when power is on because the power component has capacitor. Thus, frequently turning on/off power leads to decreased performance of main circuit components.

2.1.3.2. Items Related to Wiring

During wiring, do the following:

- When designing or arranging the system, shorten the cable.
- In main circuit wiring, note the following:
  - Twisted-pair shield wires or standard shield wires are required for I/O signal cables or encoder cables.
  - Maximum length for I/O signal cables is 3m, and maximum length for encoder cables is 20m.
- In ground connection, note the following:
  - It is recommended to use bold wires (3.5mm^2 or more) for ground connection.
  - It is recommended to use ground cables with resistance less than 100Ω.
  - It MUST be single point grounding.
  - If the servo motor is insulated from mechanical parts, it is required to directly ground the motor.
- Do not bend or pull the cable too tight.

2.1.3.3. Power-Control Input Setup

During setting power-control input, note the following:

- After “Servo alarm” signal feeds out, the main circuit power should keep off.
- The power specification of used parts should match with the input power specification.
- During connecting control power and main circuit power, you should turn them on at the same time, or turn on the main circuit power after control power is turned on for 1s. Similarly, you should cut them off at the same time or cut off the main circuit power after control power is turned off.

2.2. Wiring of the USB Interface

The USB interface is used to connect the servo drive and the iMotion software in the PC.

You can conduct operations, including monitoring, parameter editing, waveform acquiring, warning or pin checking and other operations via the iMotion software in the PC.

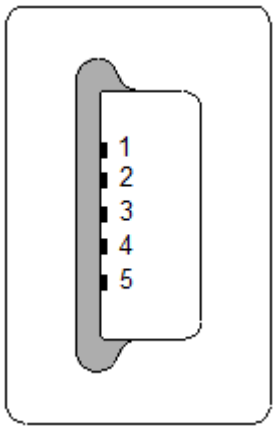
To get iMotion software, you can contact the manufacturer or download from Weihong official website.

This part introduces the wiring of USB interface from the following aspects:

- Port Definition
- Cable

2.2.1. Port Definition

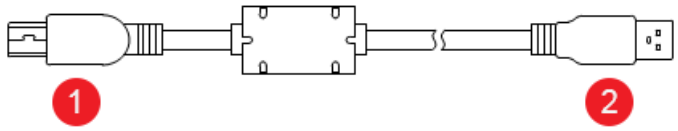
The terminals of CN1 are as follows:



Pin No.	Signal	Description
1	+5V	Power supply +5V
2	Data -	Data -
3	Data +	Data +
4	—	—
5	GND	Ground

2.2.2. Cable

The cable of CN1 is as follows:



1. Drive side
2. PC side

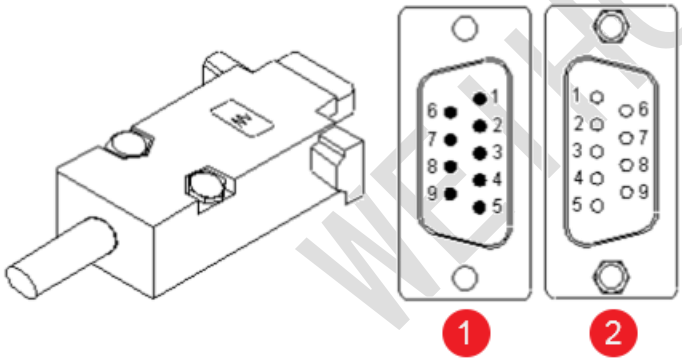
2.3. Wiring of ENC1/ENC2/ENC3/ENC4

ENC1/ ENC2/ ENC3/ENC4 interface is used to connect the servo drive and the servo motor. And servo drives support the servo motor whose encoder is serial 17-bit/20-bit/23-bit/24-bit communication.

ENC1 interface, ENC2 interface, ENC3 interface and ENC4 interface are the same.

2.3.1. Port Definition

The diagram is as follows:



①: Pin

②: Hole

The definition of pins is as follows:

Pin No.	Signal	Description
1	PS	Signal +
2	/PS	Signal -
3	BAT+	Battery +
4	BAT-	Battery -
5	SO1(BRK-OFF)	-
6	-	-

7	+5V	Power supply +5V
8	⏚	Ground
9	SO1+(BRK-OFF)	-

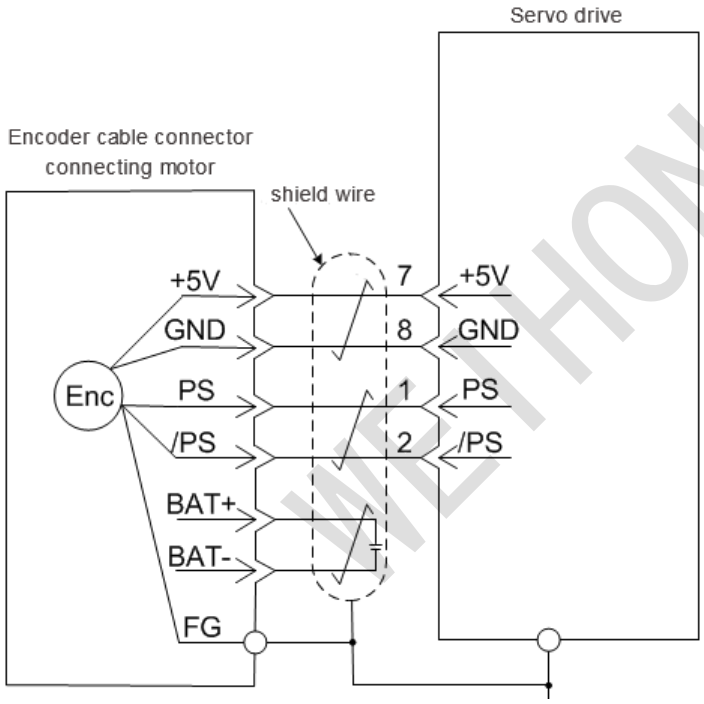
2.3.2. Wiring Specifications

The wiring specifications differ in the motor type:

- Wiring Specification of Motors with Absolute Encoders
- Wiring Specification of Motors with Incremental Encoders

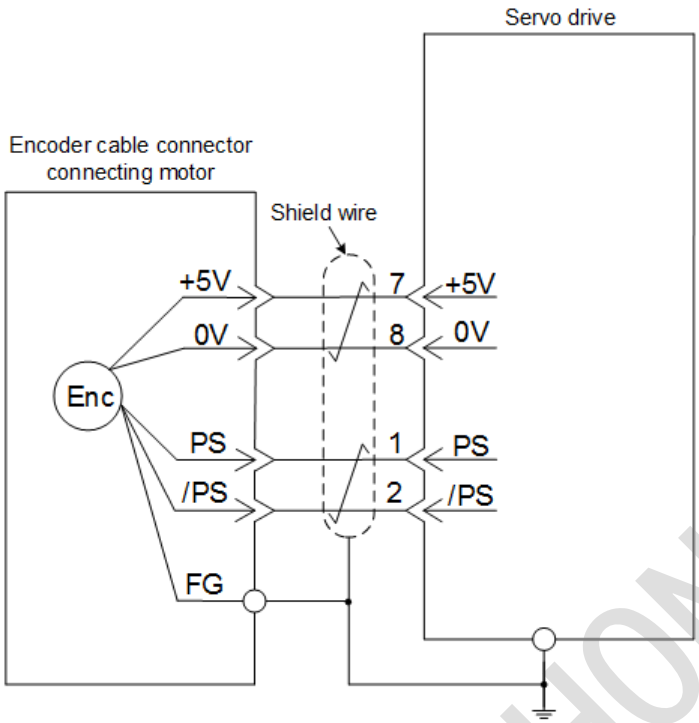
2.3.2.1. Wiring Specification of Motors with Absolute Encoders

The wiring specification of motors with absolute encoders is as follows:



2.3.2.2. Wiring Specification of Motors with Incremental Encoders

The wiring specification of motors with incremental encoders is as follows:



2.3.3. Wiring of Encoder Cables

Wiring of encoder cables differs in the motors brand:

- For encoder cables matching WISE MA/MB/MN/ME series motors, see Wiring Diagrams for the Servo Drives and WISE MA/MB/MN/ME Motors for details.
- For encoder cables matching Panasonic A5/A6 series motors, see Wiring Diagrams for the Servo Drives and Panasonic A5/A6 Motors for details.

2.4. Wiring of the Regenerative Resistor

When the directions of motor torque and rotation are opposite, the motor will change from rotating status to regenerating status. Regenerative energy will be fed back to the DC circuit, after rectified by a diode. Because the energy in the DC circuit cannot be fed back to power grid, and can only be absorbed by the capacitor of the servo drive, charges in capacitor will accumulate to pump voltage and the DC voltage will rise.

In this case, the energy can only be consumed by the regenerative resistor. Otherwise, the parts of the servo drive will be damaged due to the high DC voltage.

You can choose the internal regenerative resistor or the external one via setting parameter **Pr016 External regenerative resistor setup**. And the internal regenerative resistor does not need to be connected.

When an external regenerative resistor is used, remove the wire between B2 and B3, connect the external regenerative resistor between terminals B1 and B2 and set **Pr016 External regenerative resistor setup** to **1**.

Please confirm that the regenerative resistor is not mis-wired, or it will result in machine damage or fire hazard.

Rated Content

- **Specifications of the regenerative resistor**

  Check parameter **Pr017 Load factor of external regenerative resistor selection** for the recommended specification of the external regenerative resistor.

  – Internal regenerative resistor

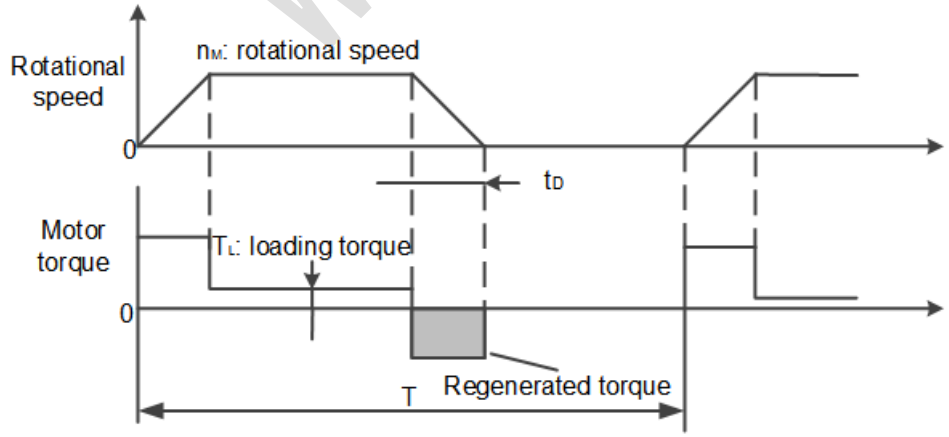
Drive Model	Resistance (Ω)	Power Pr(W)
WSLM-AAAA	15	150
WSLM-8888	15	150

  – External regenerative resistor

Drive Model	Min. Allowable Resistance (Ω)	Min. Allowable Power (W)
WSLM-AAAA	10	800
WSLM-8888	10	600

- **Capacitance calculation of a regenerative resistor**

  The diagram of motor run cycle is as follows:



When the motor accelerates or decelerates according to the cycle shown above, the capacitance of a regenerative resistor can be calculated in the following steps:

1. Calculate rotation energy of the servo system(E_s).

   $$E_s = \frac{1}{2} * J * \left(Spd * \frac{\pi}{30}\right)^2 = J * Spd^2/182(J)$$

   $J = J_M + J_L$

   J_M: Rotational inertia of servo motor(kg•m^2)

   J_L: Rotational inertia of motor axis load(kg•m^2)

   ω: Angular speed of servo motor(rad/s)

   Spd: Rotational speed of servo motor(r/min)

2. Calculate energy consumed by the load system during deceleration(E_L).

   $$E_L = \frac{\pi}{60} * Spd * T_L * t_D$$

   T_L: Load torque(N•m)

   t_D: Deceleration stop time(s)

3. Calculate energy consumed by the coil resistor of the servo motor(E_M).

   It can be neglected.

4. Calculate absorbable energy by the servo unit(E_C).

   Energy handled by a single internal capacitor is as follows:

Drive Model	Power (W)	Absorbable Regenerated Energy (J)
WSLM-AAAA	4000	123
WSLM-8888	3000	92

5. Calculate energy consumed by the regenerative resistor(E_K)

   $$E_K = E_s - (E_L + E_M + E_C)$$

6. Calculate necessary capacitance W of the regenerative resistor(W_K)

   $W_K = E_k / (0.3 * T)$

   W_k: Necessary capacity of regenerative resistor(W)

   0.3: the load ratio of a regenerative resistor is 30%

Note: In the actual calculation, the energy consumed by load system can be neglected. You can calculate the necessary capacitance of servo system only by the rotation energy (Es).

Example 1

For WSLM-AAAA (4kW) servo system, with each axis braked and 400% inertia ratio, to calculate the capacitance of the regenerative resistor, do the following:

1. Calculate rotational energy:

   $$E_s = 4 * J * \frac{Spd^2}{182} = 455J$$

2. Calculate rotational energy:

   The absorbed energy by an internal capacitor is about 123J. It proves that the rotation energy cannot be completely absorbed by an internal capacitor. Therefore, the remaining part needs to be consumed by an external resistor.

   The energy needing to be consumed by the regenerative resistor is: 455-123=332J

3. Assuming that the acceleration and deceleration cycle of motor is 1s, the capacitance of the regenerative resistor is as follows:

   $$W_K = \frac{E_K}{(0.3 * T)} = 1106W$$

W_K is greater than 150W, the capacitance of the internal brake resistor. Therefore, using an internal brake resistor is not enough. An external brake resistor is needed and the recommended power of external brake resistor is 1200W.

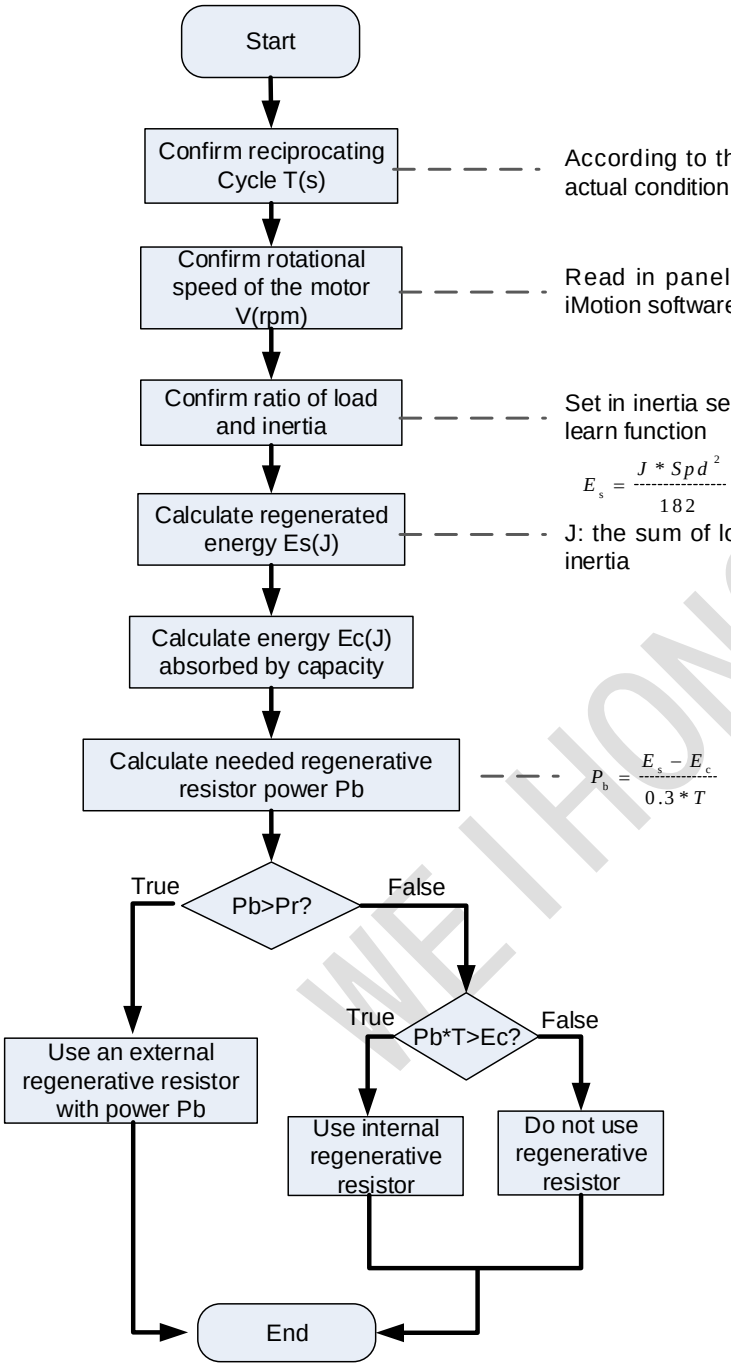
Example 2

If the inertia ratio is changed from 400% to 250%, two of the axes are braked but the other items remain the same, the needed resistor power is as follows:

$$W_K = \frac{E_K}{(0.3 * T)} = 120W$$

W_K is less than that can be handled by an internal resistor. Therefore, using an internal brake resistor is enough.

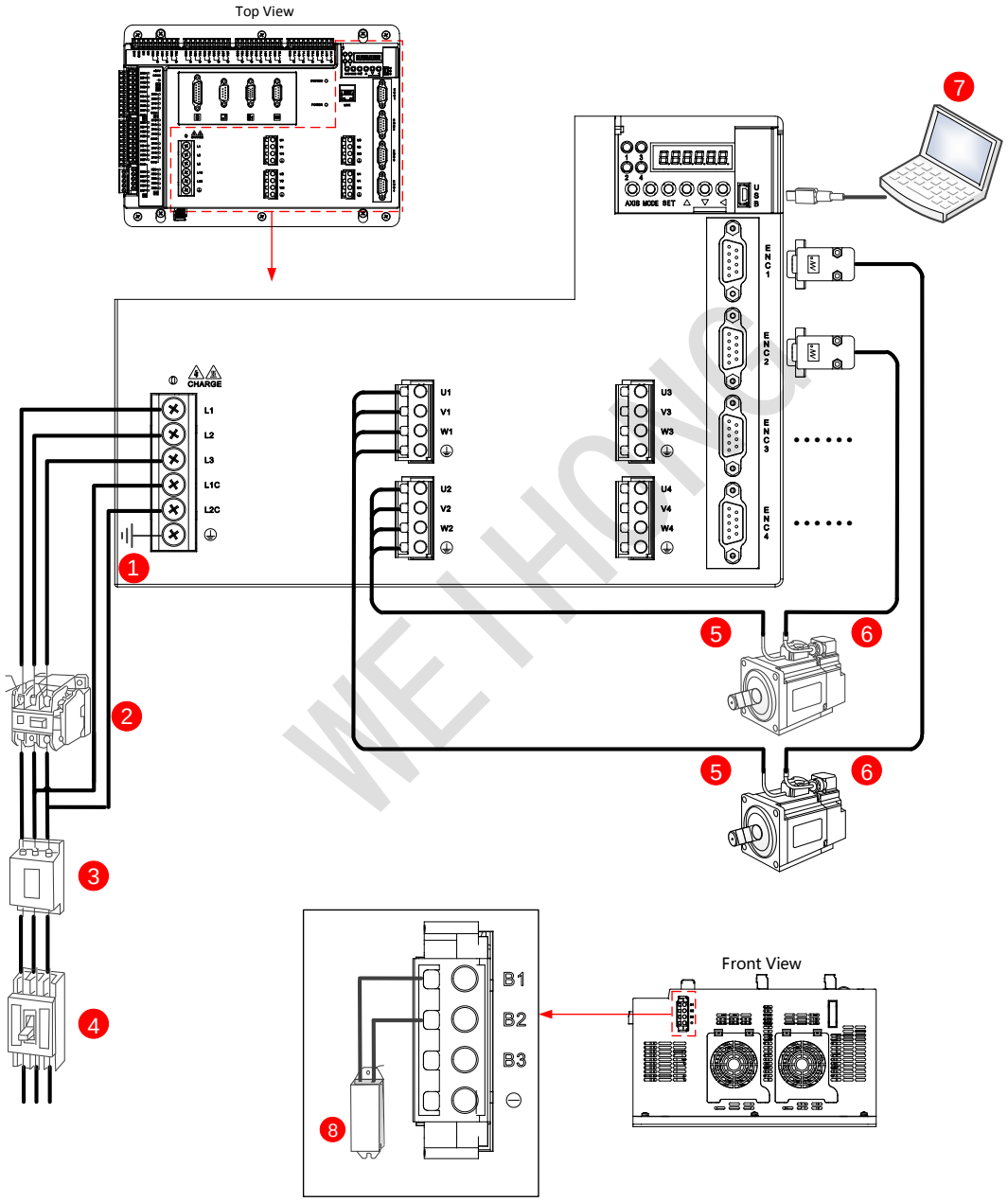
- Model Selection



2.5. Overall Wiring

This part introduces the diagram of overall wiring about the part of the servo drive. Before wiring, please connect it with a transformer, converting to 3-phase power supply.

The diagram is as follows:



1. Ground
2. Magnetic contactor

   It is used to turn on or off the servo drive. Please install a surge suppressor on the magnetic contactor.

   Note: Never start or stop the servo motor with this magnetic contactor.
3. Noise filter

   It is used to prevent the power wire from external noise and eliminate noise disturbance from the servo drive.
4. Circuit breaker

   It is used to protect the power wire by shutting off the circuit when over-current is detected.
5. Encoder cable
6. Power cable
7. PC

   It supports the iMotion software.
8. Regenerative resistor

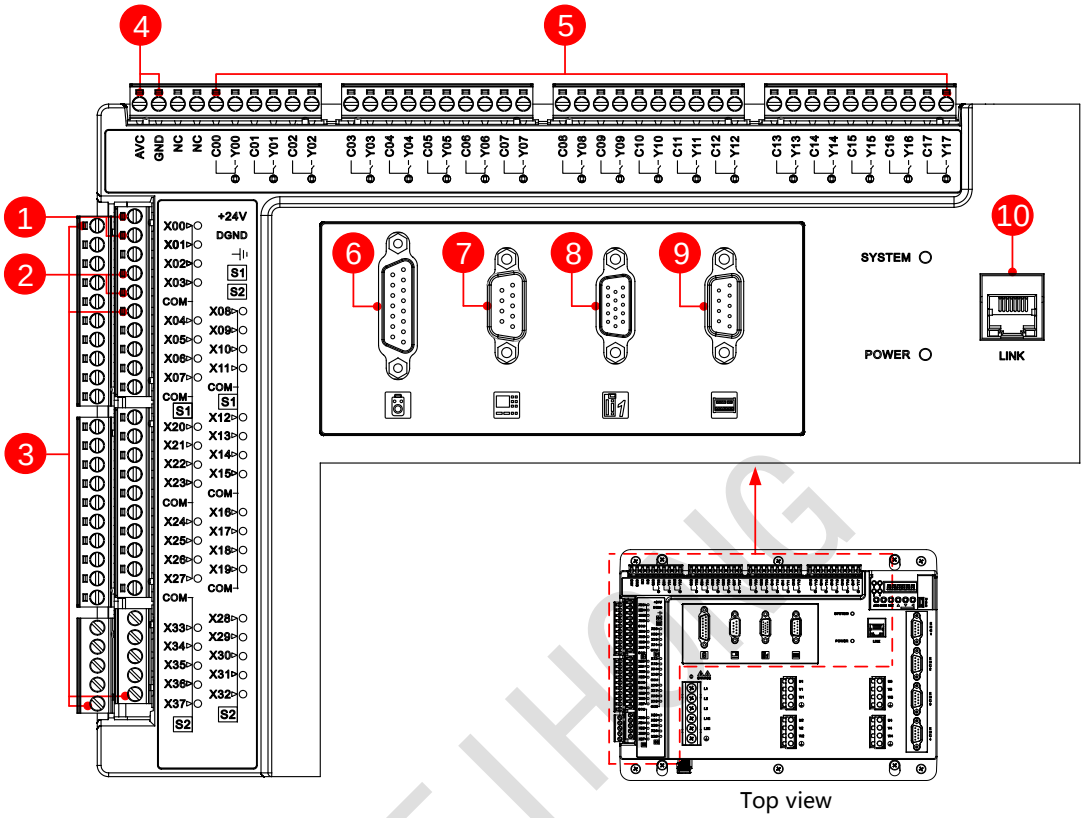
   It is installed on non-combustible substance such as metal.

   When an external regenerative resistor is used, external protection such as over-temperature protection must be provided.

   Over-temperature protection fuse and thermostat are installed in the regenerative resistor.

3. Wiring of the Terminal Board

This part introduces the wiring about the terminal board part.



1. 24V power supply interface

   Its rated power supply is 24V±10%. It has anti-reverse connection protection.

2. High-low switching interface

   It is used to switch between the high level and low level.

3. General input ports

   They include X00 ~ X37. They adopt a two-way photo-coupler. They are compatible with the PNP switch and NPN switch and they are configurable.

4. Analog output port

   - Analog voltage: 0 ~ 10V
   - Precision: 0.2V

5. General output ports

   They include Y00 ~ Y17, and among them, C00 ~ C17 belong the general ports.

   - Type: relay contact output interface
   - Drive capacity: AC 250V/5A

6. Handwheel interface

   It is connected with a handwheel (supporting the 6-axis handwheel).

   See Wiring of the Handwheel Interface for details.

7. Host interface

   It is connected with NC65C, PM95A, integrated CNC systems, etc. It adopts the serial communication, high-speed 485 interface and 10Mbps baud rate, and supports the Phoenix communication.

8. Interface for moving axes

   It is connected with a servo drive. It supports the incremental encoder.

   It adopts pulse control mode (Pulse + Direction) and supports a decimal pulse number (Minimum pulse: 1/128 unit pulse). And maximum pulse output frequency is 1MHz.

   See Interface Wiring for Moving Axes for details.

9. Interface for extended terminal board

   It is used for the cascade and adopts the serial communication, high-speed 485 interface and 10Mbps baud rate.

   See Interface Wiring for Extended Board for details.

10. LINK bus interface

    It is connected with expansion bus and supports the M-II bus system.

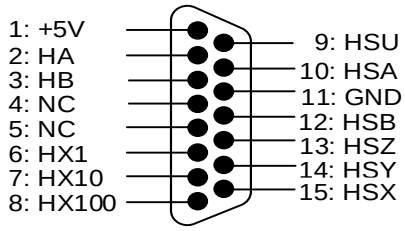
    See for Wiring of LINK Bus Interface details.

3.1. Wiring of the Handwheel Interface

The servo drives support six-axis handwheels. The handwheel is an optional component. You can choose the handwheels from Weihong company or other companies.

The handwheel adopts the DB15 connector.

The pin definition is as follows:

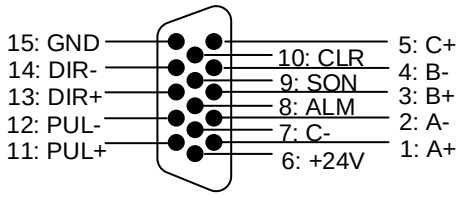


Pin No.	Signal	Description
1	+5V	Power supply +5V for handwheels
2	HA	Encoder A-phase signal
3	HB	Encoder B-phase signal
4	NC	-
5	NC	-
6	HX1	Override X1
7	HX10	Override X10
8	HX100	Override X100
9	HSU	Axis 4
10	HSA	Axis 5
11	GND	Ground
12	HSB	Axis 6
13	HSZ	Z-axis
14	HSY	Y-axis
15	HSX	X-axis

3.2. Interface Wiring for Moving Axes

The servo drives provide one pulse output interface connecting the pulse spindle servo drive. Its interface is the DB15 connector.

The pin definition is as follows:



Signal	Definition	Output/Input	Description
A+, A-	A-phase feedback signal of the encoder	Input (Differential transmission)	Receive the differential output signal of the encoder (A-phase, B-phase, C-phase) from the drive divider(Equivalent to RS422)
B+, B-	B-phase feedback signal of the encoder		
C+, C-	C-phase feedback signal of the encoder		
ALM	Alarm signal of the drive	Input	When breakdown occurs in the drive, drive error occurs, signal output stops.(the transistor is turned off).
SON	Servo-on signal	Output	Used to turn on/off the servo motor. When it is connected to the terminal COM-, the dynamic brake will be released and the servo drive can run (servo-on).
CLR	Alarm clearing signal of the drive	Output	Used to cancel the alarm status. It only can cancel the alarm that can be clearable. You can check error attributions in the List of Error Codes.

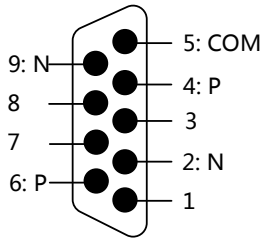
Signal	Definition	Output/Input	Description
PUL+, PUL-	Pulse output signal	Output(Differential transmission)	-
DIR+, DIR-	Direction output signal	Output(Differential transmission)	-
+24V, GND	DC 24V power supply	Output	Connected with a servo drive

Note: SON signal takes effect after power is on for 2s. Don't try to drive the servo motor through the external servo on or servo off drive signal at any time, since the software will control the power-up state of the servo motor.

3.3. Interface Wiring for Extended Board

The servo drive supports EX31A extended board.

The interface diagram is as follows:

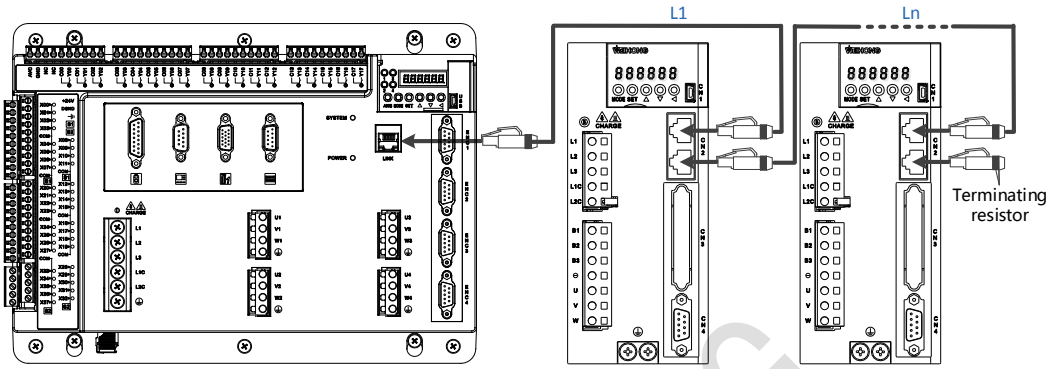


P and N separately refer to the positive pole and negative pole of two groups of differential signals.

3.4. Wiring of LINK Bus Interface

LINK interface is used for extended axes, so far, supporting M-II bus system. It is used to connect the bus devices and terminating resistor so as to establish communication between single axis drives and the multi-axis servo drive.

The wiring diagram is as follows:



From L1 to Ln is bus communication.

Note: The last single axis drive must be connected with a terminating resistor.

The cable of LINK bus interface is as follows:

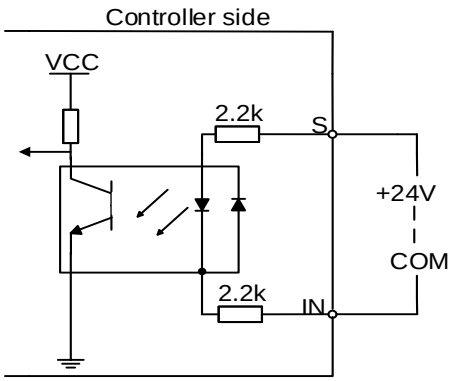
1. Drive side
2. Drive side or terminating resistor

3.5. Signal Type

3.5.1. Binary Input Signal

The input signal includes active high and active low.

The diagram of wiring is as follows:



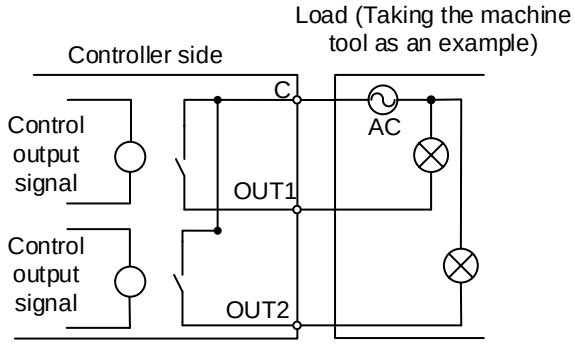
The input signal differs in wiring:

- When **S** is connected to **COM**, the input signal is active high.
- When **S** is connected to **+24V**, the input signal is active low.

3.5.2. Relay Output Signal

The load capacity of relay output contacts is 5A/250V AC. If you need to connect the load with high power, use a contactor.

The diagram about the relay output and connection between the relay and load is as follows:



3.5.3. Analog Output Signal

Single-ended output voltage is 0 ~ 10V. The precision of output voltage is 2%. It can control the spindle speed with an inverter.

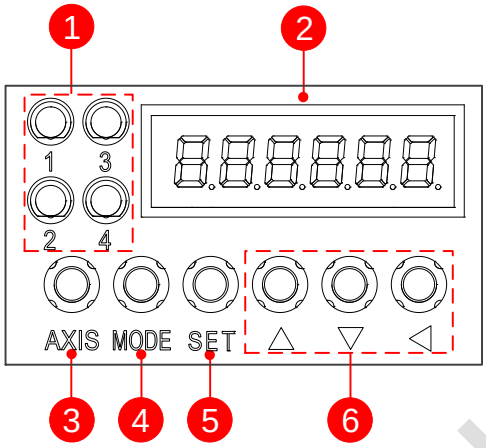
4. Operation Panel

With the operation panel, you can access to four operation modes, namely, the monitor mode, the parameter setup mode, the EEPROM writing mode, and the auxiliary function mode. In addition, you can also lock the operation panel to avoid inappropriate operations, including wrongly modifying a parameter.

4.1. About the Operation Panel

This part introduces the operation panel in details.

The diagram of the operation panel is as follows:



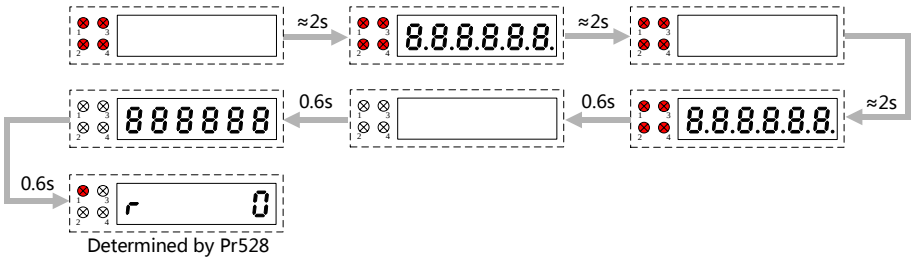
1. Axis indicator light:
   - If you switch to a single axis, the corresponding indicator light is on.
   - If you switch to the common axes (ie. all axes.), all indicator lights are on.

2. LED display (6-digit)

   It is used to do the following:

   – Show the current mode, parameter value, etc.

     After the power is on, the display shows as follows:



     Switch to error display screen when an error occurs, with LED flashing at a frequency about 2Hz.

3. **AXIS** button

   It is used to switch to a single axis or the common axes.

4. **MODE** button

   It is used to switch among the following modes:

   - Monitor mode
   - Parameter setup mode
   - EEPROM writing mode
   - Auxiliary function mode

   Every time you press **MODE** button, the current operation mode change to the other one.

   See Operation Modes for details.

5. **SET** button

   It is used to do the following:

   - Change between **Selection** and **Execution** display.
   - Save the modification and enter the submenu.

6. Direction button

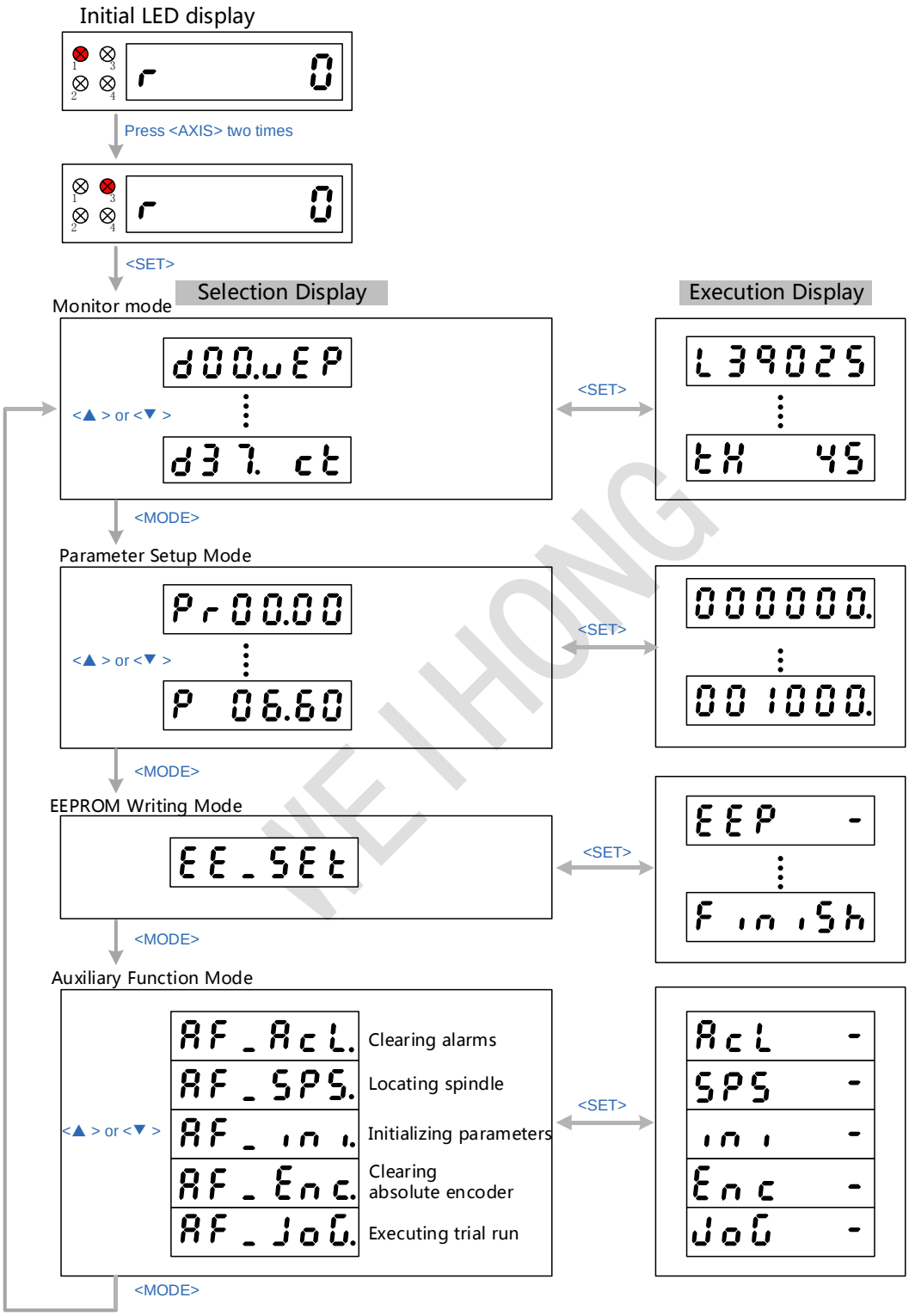
   Including the following buttons:

   - ▲ / ▼ button: used to do the following:
     – Select parameters.
     – Increase/decrease a value.
   - ◄ button: used to change the place value of debugging data.

The procedure on the operation panel is as follows:

1. Turn on the power.
2. To switch to the target axis, do one of the following:
   - To switch to a single axis, press **AXIS** button.
   - To switch to common axes, press **AXIS** button for 2s.
3. To enter selection display, press **SET** button.
4. To switch among execution displays, press **MODE** button.
5. To turn to the previous or next page, press ▲ / ▼ button.
6. After finishing all setups, press **SET** button to set the specific command.

Taking axis 3 as an example, the procedure of common operations is as follows:



4.2. Operation Modes

This part introduces operation modes.

Operation modes include the following:

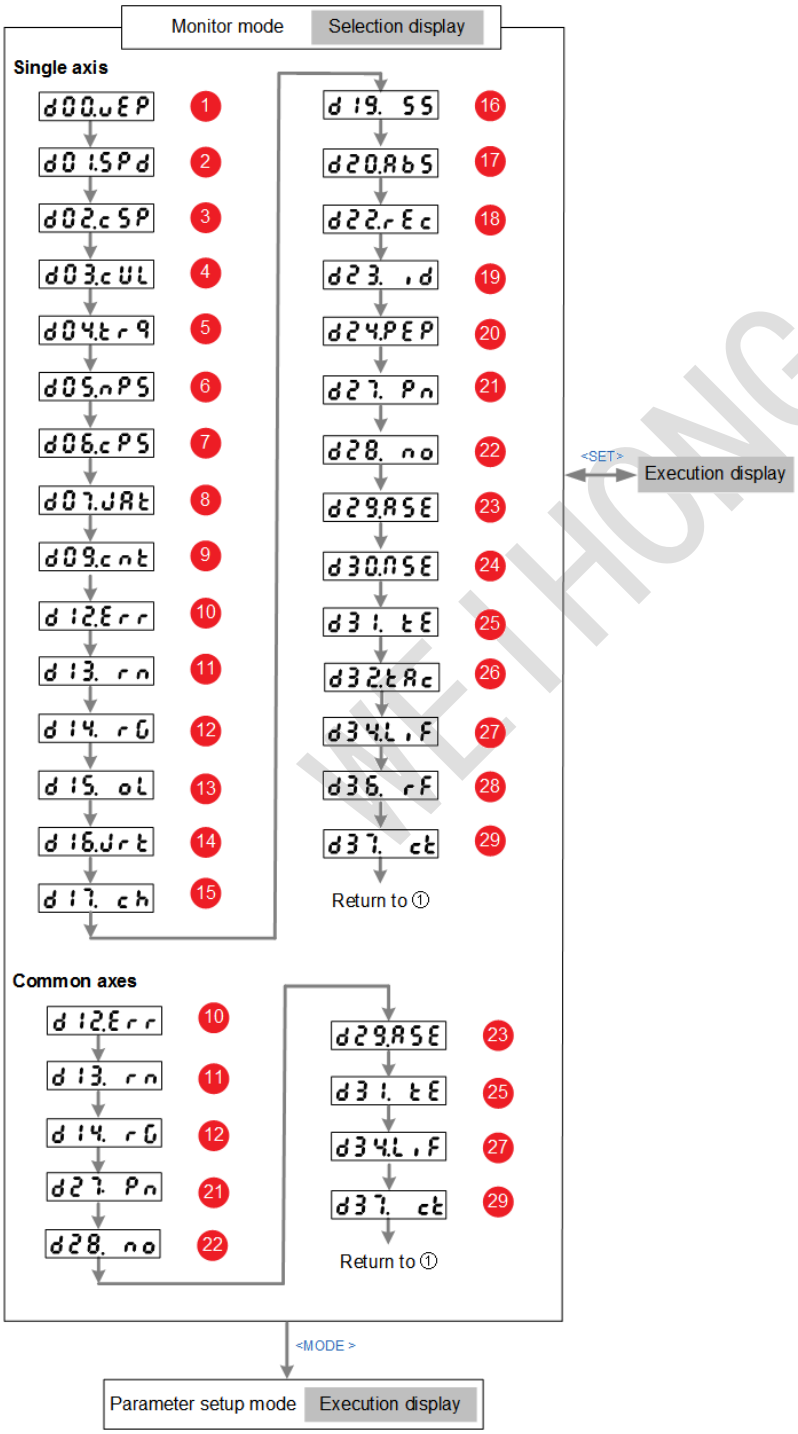
- Monitor Mode
- Parameter Setup Mode
- EEPROM Writing Mode
- Auxiliary Function Mode

4.2.1. Monitor Mode

This mode is used to monitor the running status of the servo drive.

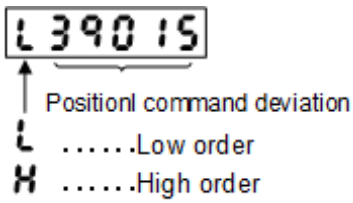
The procedure of operation in monitor mode is as follows:

Note: Press ▼ to select the target command towards the arrowed direction, and press ▲ to select the command towards to the reverse direction.

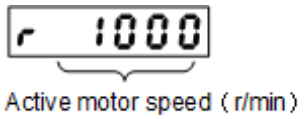


1. Positional command deviation (**d00uEP**)

   To switch between the low order (L) and high order (H), press ◄.



2. Motor speed (**d01SPd**)



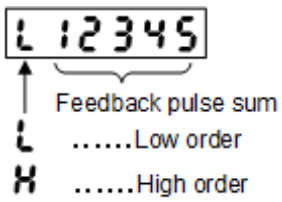
3. Positional command speed (**d02cSP**)

4. Velocity control command (**d03cUL**)

5. Torque command (**d04trq**)

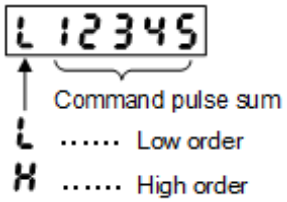
6. Feedback pulse sum (**d05nPS**)

   To switch between the low order (L) and high order (H), press ◄.

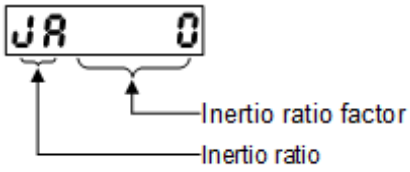


7. Command pulse sum (**d06cPS**)

   To switch between the low order (L) and high order (H), press ◄.



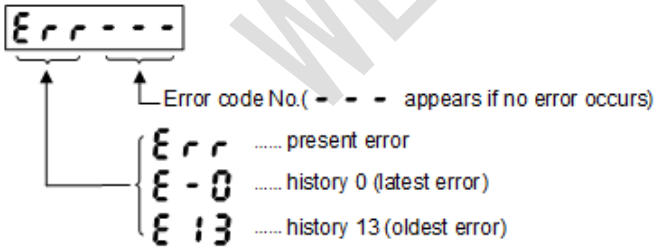
8. Load estimated inertial ratio (**d07JAt**)



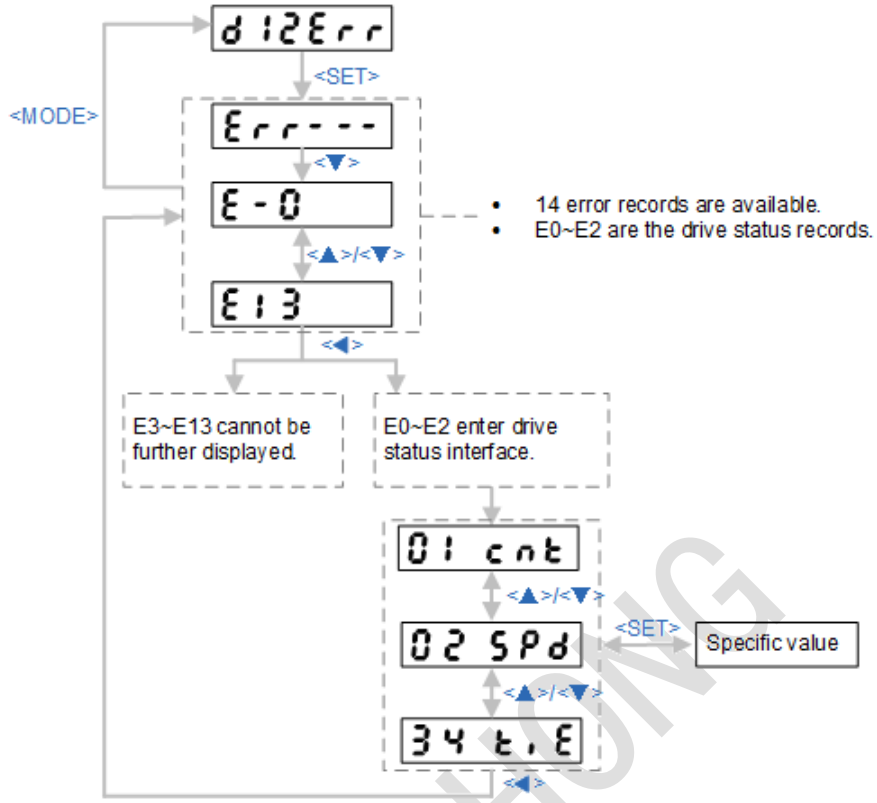
9. Control mode (**d09cnt**)

   Related parameter is **Pr001 Control Mode Setup**.

10. Error causes and history (**d12Err**)



The steps to check error causes are as follows:



Note: When a history error occurs again, the present one shares the same error code number with history 0.

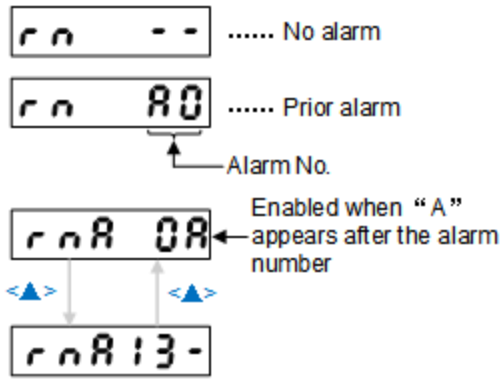
According to the error code, you can find the servo drive status information when an alarm occurs:

Code	Description	Unit
01 cnt	Control mode	-
02 SPd	Motor speed	rpm
03 cSp	Position command speed	rpm
04 cUL	Speed control command	rpm
05 trq	Torque command	%
06 uEP	Command position deviation	Command unit
07 nPS	Motor position	Encoder unit
08 Hyb	Hybrid deviation	Command unit
09 in	Logic input port	-
10 oUt	Logic output port	-
11 An1	Analog input 1	0.01V

Code	Description	Unit
12 An2	Analog input 2	0.01V
13 An3	Analog input 3	0.01V
14 oL	Over-load factor	%
15 rG	Regeneration load factor	%
16 Pn	Voltage across PN	0.01V
17 AtH	Drive temperature	℃
18 rn	Alarm No.	-
19 Jrt	Inertia ratio	%
20 PoG	Position loop gain	0.1/s
21 SPG	Speed loop gain	0.1Hz
22 SiG	Time constant of velocity loop integration	0.1ms
23 EtH	Encoder temperature	℃
24 nF3	3rd notch frequency	Hz
25 nF4	4th notch frequency	Hz
26 rSd	For internal use	-
27 iU	Detected U-phase current value	AD value
28 iE	Detected W-phase current value	AD value
29 rSd	For internal use	-
30 ii	M-Ⅱ communication command	-
31 ESt	Single revolution data of encoder	Encoder unit
32 rEc	Occurring times of encoder communication error	-
33 PEc	Occurring times of grating scale connection error	-
34 tiE	Alarm time	0.1h

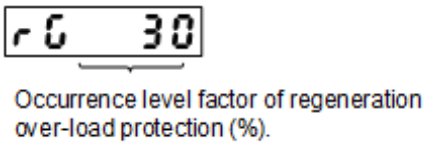
11. Alarm number (**d13_rn**)

    To display the alarm occurrences, press ▲ / ▼.

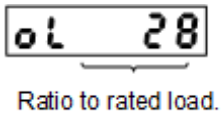


12. Regeneration load factor (**d14_rG**)

    It is enabled when parameter **Pr016 External regenerative resistor setup** is set to **0** / **1**.



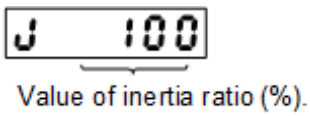
13. Over-load factor (**d15_oL**)



    See Troubleshooting for details.

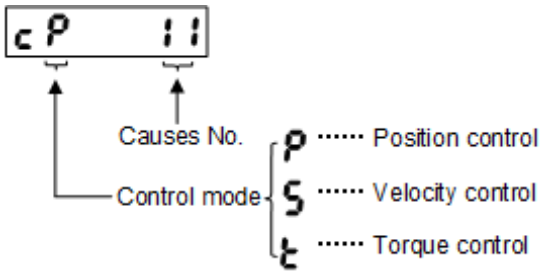
14. Inertia ratio (**d16Jrt**)

    The display directly shows the value of parameter **Pr004 Inertia ratio**.



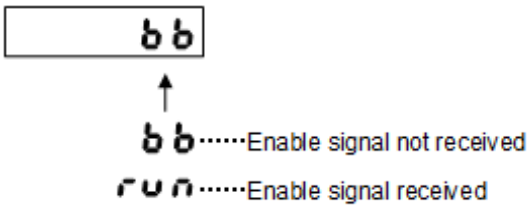
    See Troubleshooting for details.

15. Causes for no running of the motor (**d17_ch**)



See Troubleshooting for details.

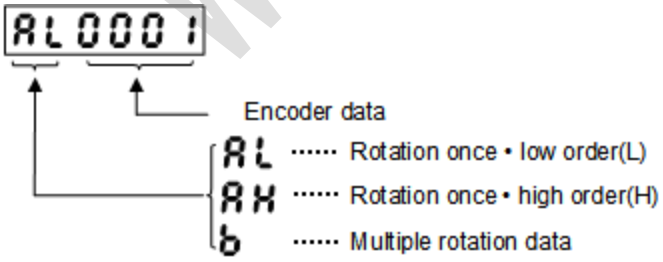
16. Servo enable status (**d19_SS**)



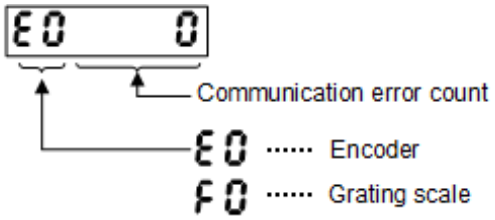
17. Absolute encoder data (**d20AbS**)

- When the servo drive is connected with an incremental encoder, the display is as follows:

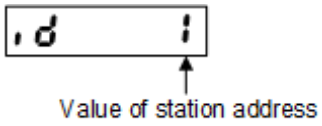
- When the servo drive is connected with an absolute encoder, the display is as follows:



18. Encoder and feedback grating scale communication error count monitor (**d22rEc**)

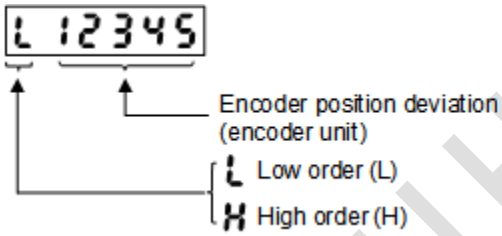


19. Slave station address of the bus drive (**d23_id**)



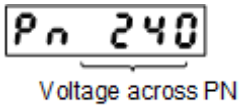
20. Encoder position deviation [Encoder unit] (**d24PEP**)

    To switch between the high order (H) and low order (L), press ◄.



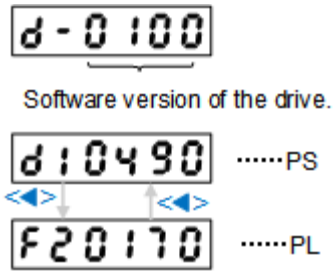
21. Voltage across PN (**d27_Pn**)

    The value is only for reference.



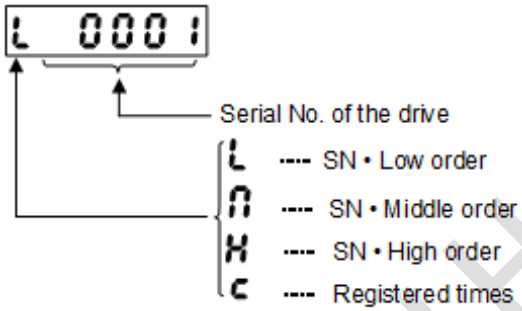
22. Software version (**d28_no**)

Press ◄ to switch between PS and PL.



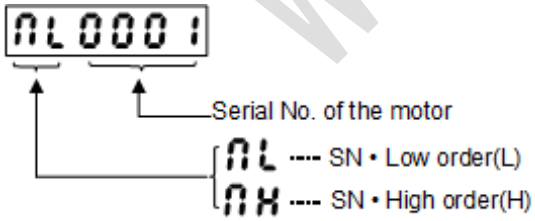
23. Serial number of the servo drive (**d29ASE**)

To switch among the high order (H), middle order (N), low order (L) and registered times, press ▲ / ▼.



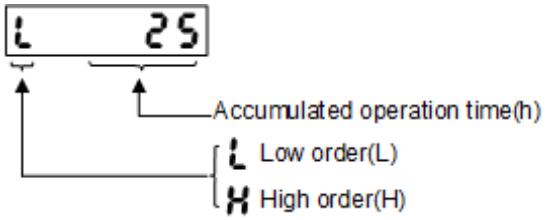
24. Serial number of the motor (**d30NSE**)

To switch between the high order (H) and low order (L), press ◄.

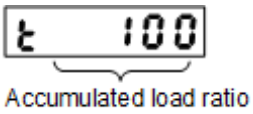


25. Accumulated operation time (**d31_tE**)

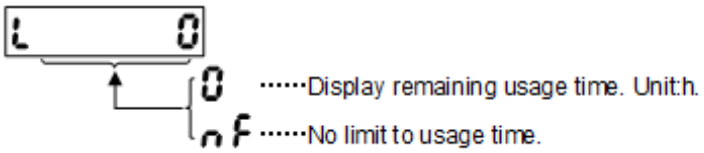
To switch between the high order (H) and low order (L), press ◄.



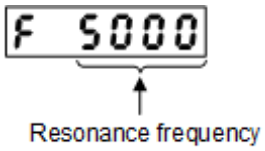
26. Accumulated load ratio (**d32tAc**)



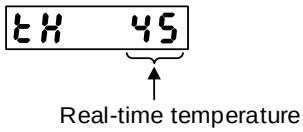
27. Registered time (**d34LiF**)



28. Resonance frequency monitor (**d36_rF**)



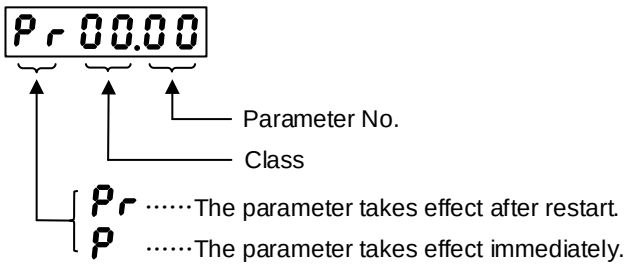
29. CPU chip temperature (**d37_ct**)



4.2.2. Parameter Setup Mode

This mode is used to set the parameters of the servo drive.

The meaning of the characters on the display is as follows:



To modify the parameter, do the following:

1. To select the parameter, press ◄ to switch between the parameter class and number and press ▲ /▼ to modify the corresponding value.

   The digit before the decimal point can be modified:

2. Press **SET** to enter the execution display.
3. To increase/decrease the value of the last digit, select the last digit and press ▲ /▼.
4. To select the digit at the higher order position, press ◄.
5. To increase/decrease the value of the selected digit, press ▲ /▼.
6. Repeat step 4~5 until all desired digits have been modified.
7. To confirm the modification, press **SET** for a while.

To write the parameter into EEPROM, press **MODE**.

See EEPROM Writing Mode for details.

For parameters which take effect after restart, you need to return to the selection display in parameter setup mode and press **MODE** to enter EEPROM writing mode.

If you need to cancel the modification, press **MODE** and return to the selection display in parameter setup mode.

Note: To modify parameters which greatly affect the motor movement (especially the velocity loop and the position loop gains), please do not modify them to an extremely large value at one time.

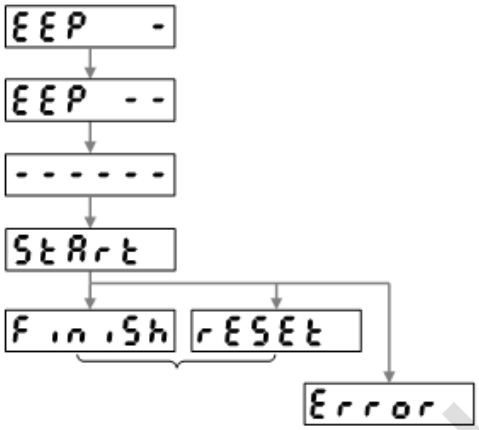
4.2.3. EEPROM Writing Mode

This mode is used to make settings of parameters effective.

To write the parameter into EEPROM writing mode, do the following:

1. To enter the execution display, press **SET**.
2. Press ▲ for about 5 seconds. Sign **-** keeps increasing.
3. Keep pressing ▲ until the display changes to **Start**. Writing starts.

Note: Start may not be observed since it lasts for a very short time.



- When **reset** shows, parameter writing succeeds.

  Restart power to make the parameter effective.

- When **Error** shows, parameter writing fails.

4.2.4. Auxiliary Function Mode

Auxiliary functions differ in the number of the axis:

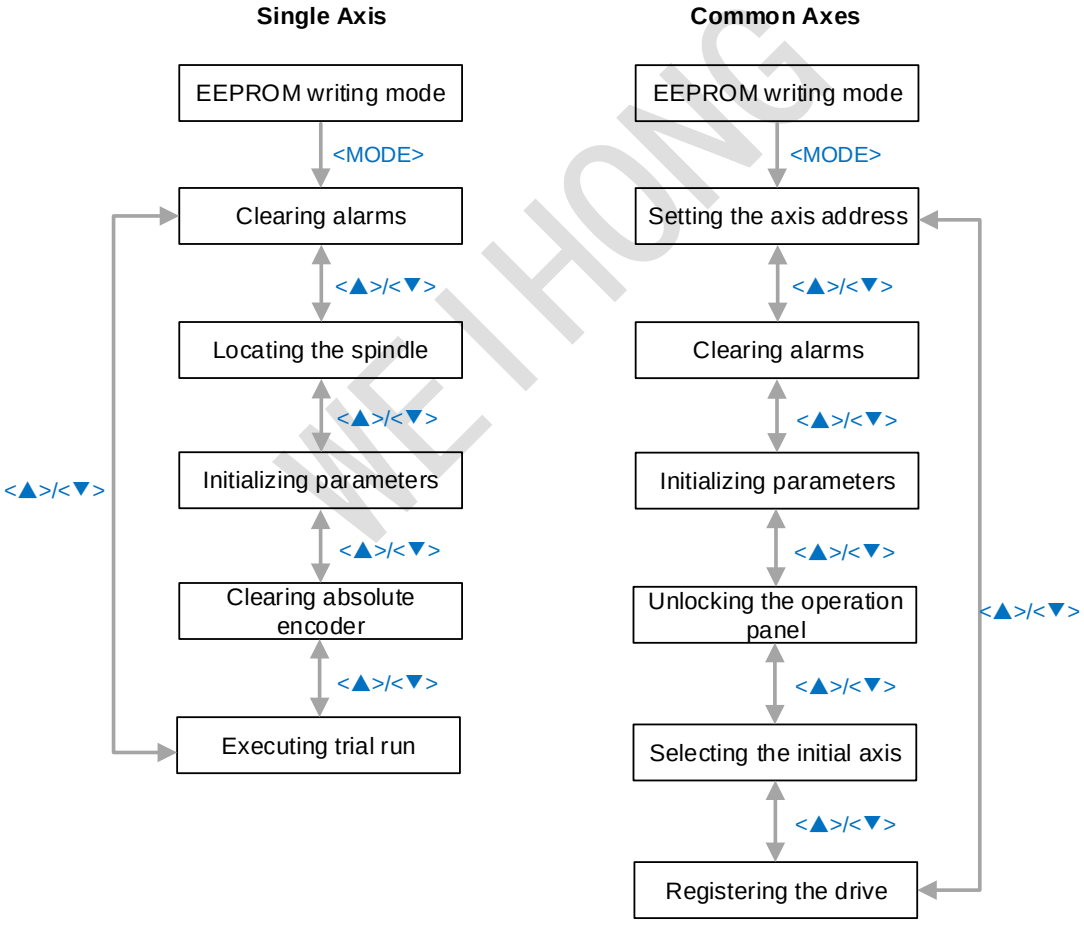
- Single axis
  - Clearing Alarms (AF_AcL)
  - Locating the Spindle (AF_SPS)
  - Initializing Parameters (AF_ini)
  - Clearing Absolute Encoders (AF_Enc)
  - Executing a Trial Run(AF_JoG)

- Common axes
  - Setting the Axis Address (AF_Adr)
  - Registering the Servo Drive (AF_rEG)
  - Selecting the initial axis (AF_LiS)
  - Unlocking the Operation Panel(AF_unL)
  - Initializing Parameters(AF_ini)
  - Clearing Alarms (AF_AcL)

  Note: Setting the axis address is the default function after entering the auxiliary function mode.

The whole procedure to switch between these functions is as follows:

Note: Press ▼ to select the target command towards the arrowed direction, and press ▲ to select the command towards to the reverse direction.

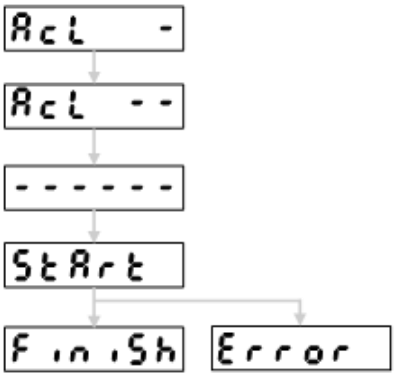


During executing an auxiliary function, **Start** may not be observed since it lasts for a very short time.

4.2.4.1. Clearing Alarms

To clear alarms in auxiliary function mode, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_AcL**.
2. To enter the execution display, press **SET**.
3. keep pressing ▲ until the display changes to **Start**:



- When **Finish** shows, alarm clearing succeeds.

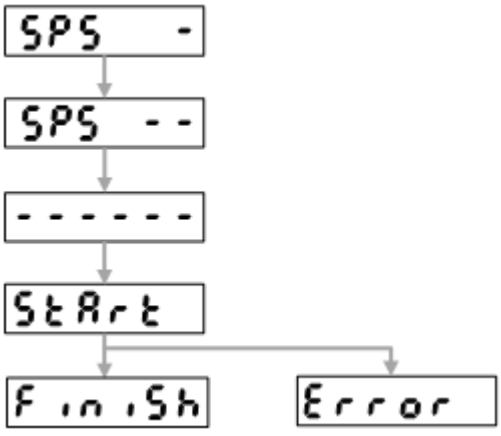
  Restart power to make the parameter effective.

- When **Error** shows, alarm clearing fails.

4.2.4.2. Locating the Spindle (Single axis)

To locate the spindle in auxiliary function mode, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_SPS**.
2. To enter the execution display, press **SET**.
3. keep pressing ▲ until the display changes to **Start**:



- When **Finish** shows, spindle locating succeeds.

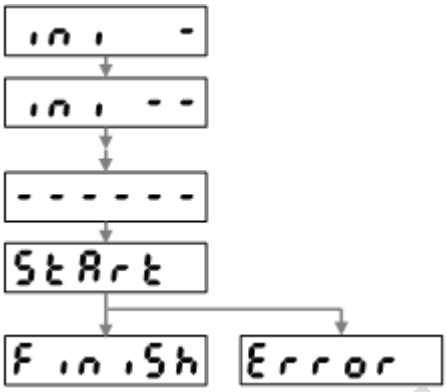
  Restart power to make the parameter effective.

- When **Error** shows, spindle locating fails.

4.2.4.3. Initializing Parameters

To initialize parameters in auxiliary function mode, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_ini**.
2. To enter the execution display, press **SET**.
3. Keep pressing ▲ until the display changes to **Start**:



- When **Finish** shows, parameters initializing succeeds.

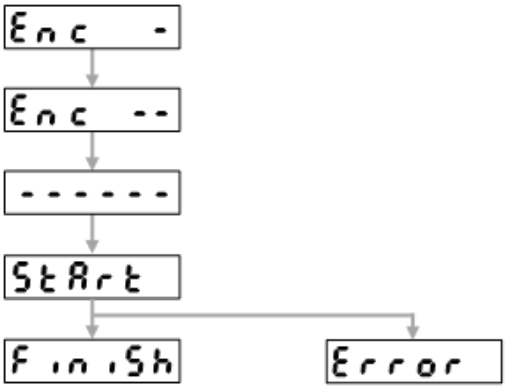
  Restart power to make the parameter effective.

- When **Error** shows, parameters initializing fails.

4.2.4.4. Clearing Absolute Encoders (Single axis)

To clear absolute encoders in auxiliary function mode, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_Enc**.
2. To enter the execution display, press **SET**.
3. Keep pressing ▲ until the display changes to **Start**:



- When **Finish** shows, absolute encoders clearing succeeds.

  Restart power to make the parameter effective.

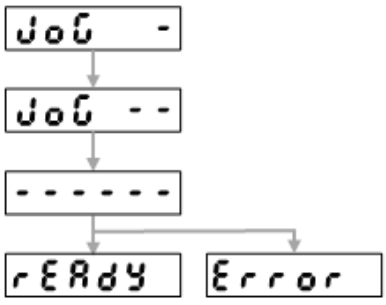
- When **Error** shows, absolute encoders clearing fails.

4.2.4.5. Executing a Trial Run (Single axis)

To execute a trail run in auxiliary function mode, do the following:

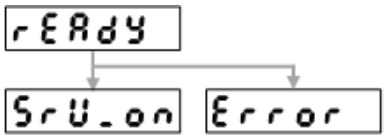
1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_JoG**.
2. To enter the execution display, press **SET**.
3. To enter preparation stage 1, keep pressing ▲ until the display changes to **ready**.

   When an error occurs or the main power supply is disconnected, **Error** shows.



4. To enter preparation stage 2, keep pressing ◄ until the display changes to **SRV-ON**.

   When SRV-ON signal input or non-servo preparation status exists, **Error** shows.

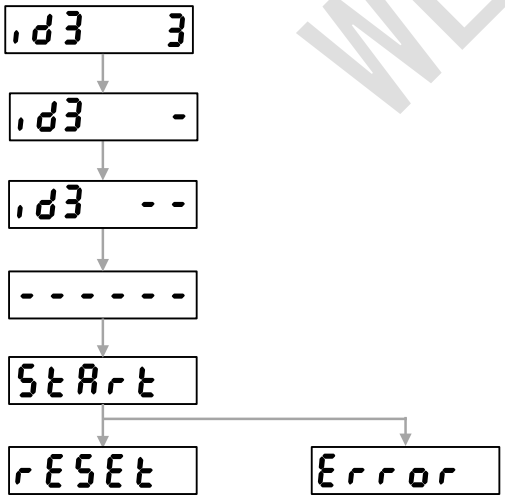


5. In preparation stage 2, to make the motor rotate in CCW/CW direction, press ▲ /▼ . The motor runs at speed set by parameter **Pr604 JOG speed**.

4.2.4.6. Setting the Axis Address (Common axes)

To set the axis address in auxiliary function mode, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_Adr**.
2. To enter the execution display, press **SET**.
3. To select the target axis, press ◄. The digit after **id** is the axis number.
4. To increase/decrease the value of the axis address, press ▲ / ▼.
5. **Optional:** If you need to continue to set the address of the other axes, repeat steps 3~4.
6. Keep pressing ◄ until the display changes to **reset**.



- When **reset** shows, axis address setting succeeds.

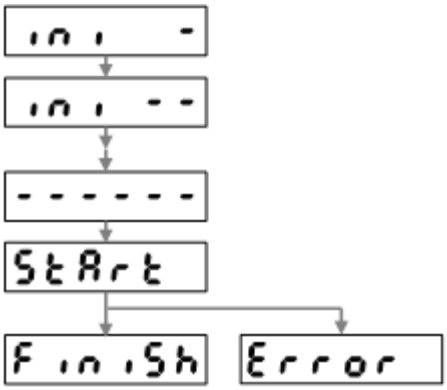
  Restart power to make the parameter effective.

- When **Error** shows, axis address setting fails.

4.2.4.7. Unlocking the Operation Panel (Common axes)

To unlock the operation panel in auxiliary function mode, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_unL**.
2. To enter the execution display, press **SET**.
3. keep pressing ▲ until the display changes to **Start**:



- When **Finish** shows, operation panel unlocking succeeds.

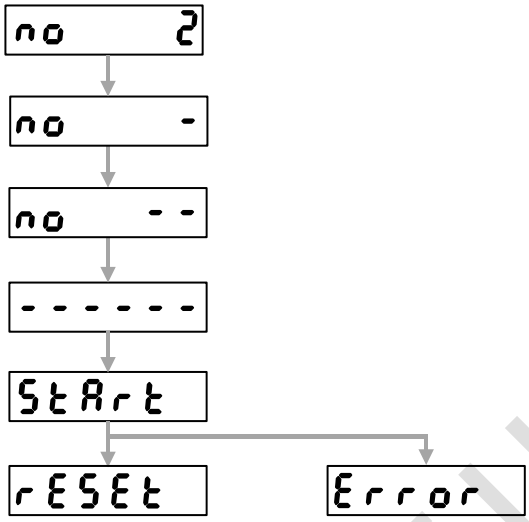
  Restart power to make the parameter effective.

- When **Error** shows, operation panel unlocking fails.

4.2.4.8. Selecting the initial axis (Common axes)

To select the initial axis in auxiliary function mode, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_Lis**.
2. To enter the execution display, press **SET**.
3. To set the address of the initial axis, press ▲ / ▼.
4. Keep pressing ▲ until the display changes to **Start**:



- When **reset** shows, initial axis selecting succeeds.

  Restart power to make the parameter effective.

- When **Error** shows, initial axis selecting fails.

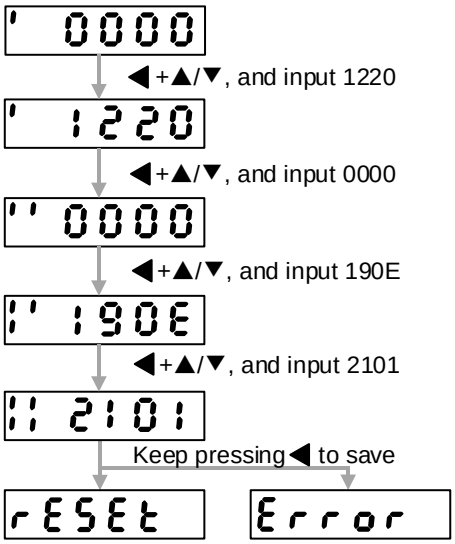
4.2.4.9. Registering the Servo Drive (Common axes)

To register the servo drive, do the following:

1. Enter the auxiliary function mode and press ▲ / ▼ until the display changes to **AF_rEG**.
2. To enter the execution display, press **SET**.

Example

Taking the registration code 1220-0000-190E-2101 as an example:



- When **reset** shows, registration succeeds.

  Restart power to make the parameter effective.

- When **Error** shows, registration fails.

4.3. Locking of the Operation Panel

This part introduces how to lock the operation panel, which is used to avoid inappropriate operations such as a wrong modification to parameters.

Limits with the operation panel locked differ in operation modes:

- Monitor mode: No limit. You can check all monitor data.
- Parameter setup mode: You cannot modify parameters but can check their values.
- EEPROM writing mode: No display. You cannot write parameters into EEPROM.
- Auxiliary function mode: No display. You cannot execute all auxiliary functions except Unlocking the Operation Panel.

To lock the operation panel, do the following on the operation panel or with iMotion software:

1. Set parameter **Pr535 Lock Setup of Front Panel** to **1**, and write it into EEPROM.
2. Restart the servo drive.

If you need to unlock the operation panel, do one of the following:

- On the operation panel of the servo drive
  - Switch to common axes and enter the auxiliary function mode to execute Unlocking the Operation Panell.
  - Restart the servo drive.
- With iMotion software
  - Set the value of parameter **Pr535 Lock Setup of Front Panel** to **0** and write it into EEPROM.
  - Restart the servo drive.

5. Absolute System

With the absolute system, you can exactly capture the current position. To establish the absolute system, you should well connect the host controller with the battery of an absolute encoder via the built-in absolute encoder motor or the "absolute + incremental" dual specification encoder motor, and set parameter **Pr015 Absolute encoder setup** to **0**.

- Installation/Replacement of a Battery
- Making Your Own Cable for an Absolute Encoder
- Absolute Function Adjustment

5.1. Installation/Replacement of a Battery

This part introduces how to install a battery for the absolute encoder for the first time and replace it when a battery alarm occurs.

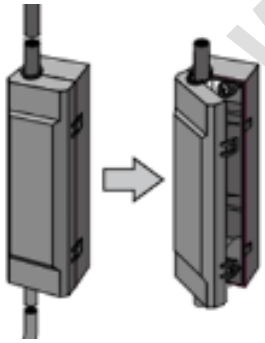
The process of replacing a battery is the same with that of installing it.

Before installing/replacing a battery for the absolute encoder, ensure the specification of the battery for the absolute encoder is 3.6V, 2000mAh.

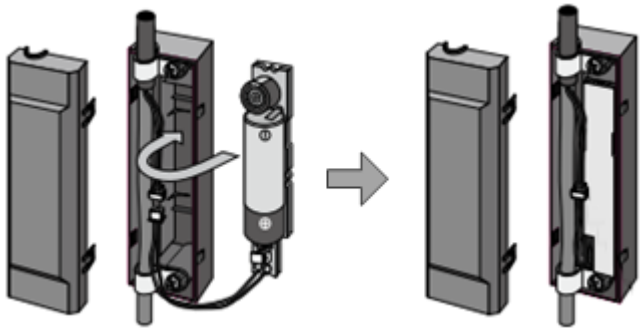
You need to replace the battery with the power on. If the power is off, data stored in the encoder will be lost.

To install a battery for the absolute encoder, do the following:

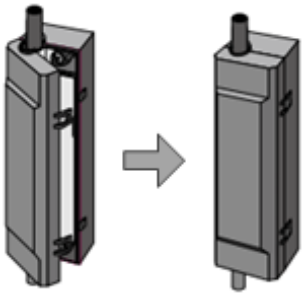
1. Raise the latch and take off the cover of the battery box.



2. To install the battery to the battery box, place the battery with **+** electrode facing downward, and connect it with the connector.



3. Close the cover of the battery box.



Note: Please do not pinch the connector cable.

When starting the machine tool for the first time after installing the battery, do the following:

1. Clear the absolute encoder data to 0 on the operation panel or in iMotion software.
2. Restart power.
3. **Optional:** After replacing the battery, to clear the battery alarm, do one of the following:
   - In iMotion software, click **Alarm Clear** in **Alarm** window.
   - On the operation panel, enter auxiliary function mode, and select clearing alarms function.

     See Clearing Alarms for details.
   - Connect it with the master station. The system automatically clears the alarm.

After being installed, the battery should be placed in the environment as follows:

- Indoors, where the products are free from rain or direct sun beam.
- Places where the products are not subjected to corrosive atmosphere such as hydrogen sulfide, sulfurous acid, chlorine, ammonia, chloric gas, sulfuric gas, acid, alkaline and salt and so on, and are free from splash of inflammable gas, grinding oil, oil mist, iron powder or chips, etc.
- Places where are well-ventilated and humid and dust-free.
- Places where is vibration-free.

Note: It is recommended to replace the battery every two years. If the electrolyte inside the battery leaks out, it will corrode the surrounding parts and result in short circuit.

5.2. Making Your Own Cable for an Absolute Encoder

You can make your own cable for an absolute encoder.

Before making your own cable for an absolute encoder, do the following:

1. Prepare the connector for the battery of the absolute encoder.
2. Securely install and fix the battery.

   Otherwise, it may cause the wire breakdown or damage of the battery.

   See *Instruction Manual of the Battery* for the battery handling.

To make your own cable for an absolute encoder, see Wiring Diagrams of Encoders (WISE) and Wiring Diagrams of Encoders for details.

5.3. Absolute Function Adjustment

Good adjustment of the absolute function can help to read the actual position of the motor again after abnormal status is removed, such as power off, alarm clearance (except for Err44.0 Absolute single turn counter error protection, so as to ensure the coordinate in the software is the same with the actual position.

Taking NK300CX software as an example, to adjust the absolute function, do the following:

1. Selecting the Control System Type.
2. Enabling the Absolute Function.
3. Setting Related Parameters.

5.3.1. Selecting the Control System Type

To select the control system type, set NK300CX system parameter **Control System Type** to **1**.

Control System Type
0: non-bus type control system.
1: bus type control system.

5.3.2. Setting the Axis Address

This operation is used to achieve communication among the control system, controller, and the servo drive after each component is well connected.

The setup range of the axis address is [0, 32]. When the axis address is set to **0**, it means the communication function is disabled. It is recommended to set the axis address in order. E.g. X-axis: 1; Y-axis: 2; Z-axis: 3 and so forth

In the same control system, the address number of each servo drive must be unique.

Before setting the axis address, do the following:

1. Well connect the servo drive with the control system.

   See Overall Wiring for details.

2. Set parameter **Pr001 Control mode setup** to **1**.

To set the axis address, do one of the following:

- In iMotion software (Version 1.0.6 or higher), set the axis address.
- On the operation panel, set the axis address.

  See Setting the Axis Address for details.

Restart the servo drive, to make the axis address effective.

5.3.3. Enabling the Absolute Function

Before enabling the absolute function, ensure the motor connecting with the used servo drive is an absolute motor, and set drive parameter **Pr015 Absolute encoder setup** to **0**.

To enable the absolute function, do the following:

1. Set NK300CX system parameters **Enable Encoder Feedback Function** to **Yes**, and **Encoder Type** to **1**.

   Enable Encoder Feedback Function
   Whether to enable encoder feedback function.

Encoder Type
0: incremental encoder
1: absolute encoder

2. **Optional:** If it is your first time to use the system, set datum for each axis.

   See *NK300CX Integrated CNC System Manufacturers' Manual* for details.

5.3.4. Setting Related Parameters

To set related parameters, do the following:

1. Set the following NK300CX system parameters:

   - **N16000 Drive Station Address**
     Being in accordance with the setting of drive station address knob, 0 is invalid address. Under integral double Y configuration, Y2-axis address is fixed as 4; under multi-Z and double Y configuration, Y2-axis address is fixed as 5.
     Note: Each axis address is only. Therefore, the same address cannot exist.
   - **N16020 Encoder Digit**
     Encoder digit.
   - **N16030 Electronic Gear Ratio Numerator**
     In accordance with the setting of drive parameter "Electronic Gear Ratio Numerator"
   - **N16040 Electronic Gear Ratio Denominator**
     In accordance with the setting of drive parameter Electronic Gear Ratio Denominator.
   - **N74130 Mechanical Reducer Ratio Numerator**
     The numerator of ratio of the input speed and output speed in mechanical reducer.
   - **N74140 Mechanical Reducer Ratio Denominator**
     The denominator of ratio of the input speed and output speed in mechanical reducer.
   - **N74100 Leadscrew Pitch**
     For analysis of switch distance of fine and coarse positioning in backing to machine origin

2. Set the following drive parameters:

   - **Pr009 1st numerator of electronic gear**
   - **Pr010 Denominator of electronic gear**

6. Motor Running

To run the motor, do the following:

1. Checking before Running
2. Doing Commissioning
3. Conducting a Trial Run
4. Troubleshooting

6.1. Checking before Running

This operation is used to offer checking items before running the motor, so as to ensure the safety of running.

Before running the motor, check the following:

- Wiring: make sure the wiring is correct, especially the power input and the motor output.
- Circuit: make sure the grounding cable is not short-circuited.
- Connections: make sure all connections are sound and stable.
- Power supply: make sure the power supply is within rated voltage.
- Motor: make sure the motor is stable.

6.2. Doing Commissioning

Before running the motor, basic commissioning is required.

The process of basic commissioning is as follows:

1. Selecting the Control Mode
2. Turning the Servo on
3. Selecting the Motor Rotational Direction
4. **Optional:** Enabling Brake
5. **Optional:** Setting Overload Level of the Servo Motor
6. **Optional:** Stopping the Motor at Servo-OFF or Alarm

6.2.1. Selecting the Control Mode

To select the control mode, set the value of parameter **Pr001 Control mode setup**.

See Control Modes for details.

6.2.2. Turning the Servo on

It is used to control the power on/off status of the servo motor.

To turn the servo on via one of the following:

- Via connecting the bus

  After connecting the bus, the motor enabled.

- Via trial running

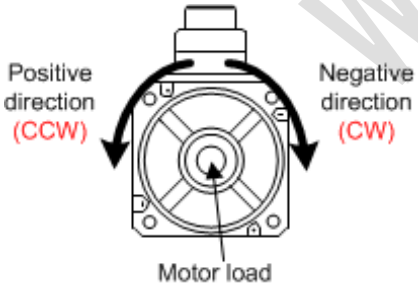
  It can only be used during a trial run.

  See Conducting a Trial Run for details.

6.2.3. Selecting the Motor Rotational Direction

You can set up the motor rotational direction by setting parameter **Pr000 Rotational direction setup**. In this way, you can obtain the same command polarity and rotational direction without changing the polarity of command pulse to the servo motor.

In the standard setting, the positive direction is the rotation in counter clockwise (CCW) in the view of servo motor load.



To select the motor rotational direction, set the value of parameter **Pr000 Rotational direction setup**:

- Set to **0**

Command Direction	Motor Rotational Direction	Positive Direction Over-travel Inhibition Input	Negative Direction Over-travel Inhibition Input
Positive	CW	Valid	—
Negative	CCW	—	Valid

- Set to **1**

Command Direction	Motor Rotational Direction	Positive Direction Over-travel Inhibition Input	Negative Direction Over-travel Inhibition Input
Positive	CCW	Valid	—
Negative	CW	—	Valid

6.2.4. Enabling Brake

This operation is used to maintain the position when the servo motor is turned off, preventing moving parts of the machine from additional movements caused by self-mass or external force.

This kind of brakes is special and exclusive without magnetic excitation and is embedded in the servo motor, and cannot be used for braking purpose. Please keep the servo motor off.

6.2.5. Setting Overload Level of the Servo Motor

This operation is used to set overload level of the servo motor.

To set the overload level of the motor, set the value of parameter **Pr512 Over-load level setup**, and modify Err16.0 Over-load protection and detected time of overload alarm.

Note: This operation cannot change the characteristics of overload.

6.2.6. Stopping the Motor at Servo-OFF or Alarm

This operation is used to stop the motor when the servo is turned off or an alarm occurs.

To stop the motor at servo-off or alarm, set the status in deceleration and after stopping by setting the following parameters:

- **Pr506 Sequence at Servo-off**

Set Value	In Deceleration	After Stopping	Position Deviation
0	DB action	DB action	Clear
1	Free run (DB OFF)	DB action	Clear
2	DB action	Free run (DB OFF)	Clear
3	Free run (DB OFF)	Free run (DB OFF)	Clear
4	DB action	DB action	Clear
5	Free run (DB OFF)	DB action	Clear
6	DB action	Free run (DB OFF)	Clear
7	Free run (DB OFF)	Free run (DB OFF)	Clear
8	Stop immediately	DB action	Clear
9	Stop immediately	Free run (DB OFF)	Clear

- **Pr510 Sequence at alarm**

Set Value	In Deceleration	After Stopping	Position Deviation
0	DB action	DB action	Clear
1	Free run (DB OFF)	DB action	Clear
2	DB action	Free run (DB OFF)	Clear
3	Free run (DB OFF)	Free run (DB OFF)	Clear
4	Action A: Stop immediately Action B: DB action	DB action	Clear
5	Action A: Stop immediately Action B: DB action	DB action	Clear
6	Action A: Stop immediately Action B: DB action	Free run (DB OFF)	Clear

Set Value	In Deceleration	After Stopping	Position Deviation
7	Action A: Stop immediately Action B: DB action	Free run (DB OFF)	Clear

Dynamic brake (DB)
One way to make the servo motor immediately stop by shorting motor electrical circuits. It is embedded in the servo drive.

Stop immediately
Make the servo motor stop immediately by control functions at servo-on.

Clear
Make positional deviation maintain zero.

In deceleration
The action when the motor decelerates from the current speed to below 30r/min.

6.3. Conducting a Trial Run

This operation is used to conduct a trial run of the servo motor, so as to help check the working condition of the motor.

Before conducting a trial run, do the following:

1. Connect the main power, control power, motor cable and encoder cable. See Overall Wiring for details.
2. Remove the brake, and do not connect it to the machine.

During conducting a trial run, note the following:

- Disconnect the bus and the motor load.
- Restore parameters **Pr004 Inertia ratio**, **Pr101 ~ Pr104** to the default value before enabling them.
- To avoid oscillation and other unexpected accidents during the trial run, set the parameters related to gain to appropriate values, especially set **Pr004 Inertia ratio** to **0** during unloading loads.
- Set the parameters based on velocity control mode, because the servo motor is running in velocity control mode.
- Press **SET** or **MODE** to exit **JOG** mode and switch to normal status once **Error** displays when servo-on is valid.

To conduct a trial running, do one of the following:

- Operating on the Operation Panel.
- Operating in iMotion Software.

Note: The motor will be out of control for at most 1s when the cable is disconnected or connectors fall off during a trial run. Please be careful.

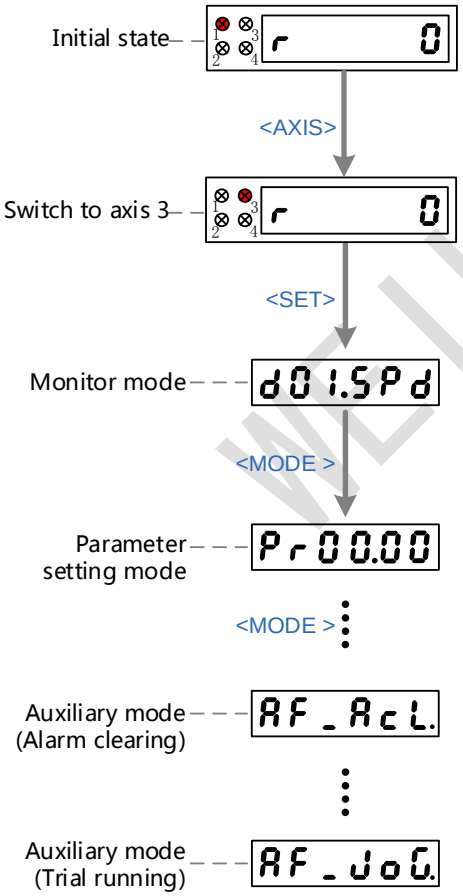
6.3.1. Operating on the Operation Panel

During the trial run:

- The motor speed is decided by parameter **Pr604 JOG Speed**.
- Time to accelerate and decelerate remains 1(r/min)/ms all the time.

Taking axis 3 as an example, to turn the servo on and run it, do the following:

1. Follow the following settings:



2. Execute a trial run.

   See Executing a Trial Run for details.

After the end of a trial run, press **SET** to exit the trial run mode.

6.3.2. Operating in iMotion Software

Before operating in iMotion software, do the following:

1. Install iMotion software on your computer.
2. Connect the computer with the servo drive through the USB wire.

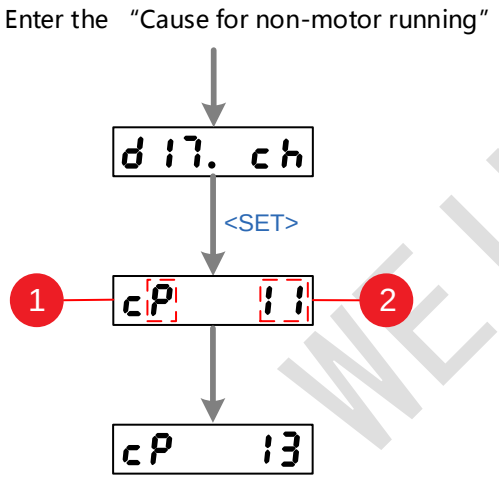
To conduct a trial run in iMotion software, do the following:

1. Turn on the servo drive, and start iMotion software.
2. Click **Trial Run** in the function menu.

6.4. Troubleshooting

When the servo motor does not run, you can find the cause via the operation panel, and troubleshoot it.

The procedure to find causes in the monitor mode via the operation panel is as follows:



1. Current control mode
   - P: position control
   - S: velocity control
   - T: torque control
2. The number of cause

When there are multiple causes, the servo drive displays them with the minimum number and the LED is flashing. Only when the cause is troubleshot, the next one can be displayed.

Cause for Non-motor Running

No.	Error name	Content	P	S	T
Flash	Errors or alarms	Errors or alarms occurred.	●	●	●
00	No cause	No causes were found for non-motor running.	●	●	●
01	Main power cutoff	Main power supply to the servo drive was not connected or turned ON.	●	●	●
02	No SRV-ON input	No SRV-ON input was connected to COM.	●	●	●
03	Drive inhibit input is valid	Pr504=0 (drive inhibit input was valid). • When positive direction over-travel inhibition input (POT) was valid, speed command is in positive direction. • When negative direction over-travel inhibition input (NOT) was valid, speed command was in negative direction.	●	●	●
04	Torque limit is too small	Set the valid torque setup of Pr013 (1st) or Pr522 (2nd) to a value that was lower than 5% of the rated value.	●	●	●
06	INH input is valid	Pr518=0 (command pulse inhibit input was valid), and INH was in open circuit.	●		
07	The frequency of command pulse wave input is too low	The following would lead to less than one pulse position command in each control cycle: • Command pulse was not input correctly. • Input form for Pr006 and Pr007 was different.	●		
08	CL input is valid	Deviation counter reset input (CL) was connected to COM-.	●		
09	ZEROSPD input is valid	Pr315=1 (zero clamp is valid) and ZEROSPD was in open circuit.		●	●
11	Internal speed command is 0	When the internal speed command was selected, the speed was set below 30 r/min.		●	

No.	Error name	Content	P	S	T
12	Torque command is too small	The input value of torque command was lower than 5% of the rated value.			●
13	Speed limit is too small	• When Pr317=0, the value of Pr321 was too small. • When Pr317=2, the value of Pr321 or Pr322 was too small.			●
14	Other causes	Besides cause 1~13, the rotational speed of the motor was still below 20 r/min. The following causes might occur: • The speed command was too small. • The motor was overloaded. • The motor was being locked or collided. • Errors occurred in the servo drive or servo motor.	●	●	●

7. Gain Adjustment

You can adjust the gain via the operation panel, iMotion software or bus control system, to run the motor in the least time delay and as faithful as possible against the commands from the host controller, and obtain the optimum performance of the servo motor.

- Preparing for Adjusting the Gain
- Estimating the Inertia Ratio
- Automatically Adjusting the Gain
- Manually Adjusting the Gain
- Setting the Adaptive Filter
- Adjusting the Gain with Bus Control System

7.1. Preparing for Adjusting the Gain

To adjust the gain, select and do the following according to the actual situation:

- Setting Torque Limit
- Setting Over-speed Protection
- Setting Positional Deviation Excess Protection
- Setting the Motor Working Range

7.1.1. Setting Torque Limit

This operation is used to limit the maximum torque of the motor, so as to reduce the damage to the machine caused by errors such as clutch or collision.

To set the torque limit, set the value of parameter **Pr013 1st torque limit**.

Note: If the torque is limited below actual requirement level, over-speed protection and positional deviation protection may be triggered due to overshoot command and command reception delay.

7.1.2. Setting Over-speed Protection

This operation is used to set over-speed protection, so that Err26.0 Over-speed protection occurs when the motor speed becomes extremely high, that is when the maximum motor speed exceeds the value of parameter **Pr513 Over-speed level setup**.

The default motor speed has been specified as 1.2 times of the maximum of the motor.

To set over-speed protection, set the value of parameter **Pr513 Over-speed level setup** as follows:

```
Pr513 = Vmax × (1.2~1.5)
```

Vmax
The maximum speed [r/min] of the motor during running.

1.2~1.5
The safety coefficient to avoid frequent occurrence of over-speed.

Note: You can run the motor at a low speed at the primary adjustment phase, or add safety coefficient to the velocity, in order to trigger protection when oscillation occurs.

7.1.3. Setting Positional Deviation Excess Protection

This operation is used to set positional deviation excess protection in position control mode, so that List of Error Codes

Err24.0 Positional deviation excess protection occurs once difference between positional command and motor position is too large.

Positional deviation in normal operations is changing with settings of active velocity and gain.

To set positional deviation excess protection, set the following calculation result to the value of parameter **Pr014 Position deviation excess setup** in accordance with the running condition:

- When parameter **Pr520 Position setup unit selection** is set to **0** (with command position deviation detection): `Pr014= Vc/Kp * (1.2~2.0)`

  When position command filter is enabled, plus the value of [Vc * time constant of filter [s]].

- When parameter **Pr520 Position setup unit selection** is set to **1** (with encoder positional deviation detection): `Pr014= Ve/Kp * (1.2~2.0)`

  Setting of positional command filter will not affect the setting of **Pr014 Position deviation excess setup**.

  Vc
  The maximum frequency (pulse/s) of the positional command pulse.

  Ve
  The maximum pulse (pulse/s) of the encoder unit.

  Kp
  The position loop gain (1/s).

  During switching the position loop gain (Kp), you need to use the minimum value.

  1.2~2.0
  The safety coefficient to avoid frequent occurrence of over-speed.

7.1.4. Setting the Motor Working Range

This operation is used to set the working range of the motor in position control mode, so that Err34.0 Motor movable range protection occurs once the range of the current position command exceeds the value of parameter **Pr514 Motor working range setup**.

To set the motor working range, set the value of parameter **Pr514 Motor working range setup**.

7.2. Estimating the Inertia Ratio

This operation is used to estimate the ratio of the load inertia against the rotor (of the motor) inertia, so as to accurately know the load inertia.

The conditions for estimating the inertia ratio:

- Load inertia: load is too small or large compared to the rotor inertia, or the load inertia changes too quickly.
- Load: the machine stiffness is extremely low, or there is a nonlinear characteristic, such as backlash.
- Action requirements velocity and acceleration should be separately higher than 200r/min and 80r/s^2.

  During testing in iMotion software, velocity and acceleration time should be separately set to 500r/min and 100ms.

To estimate the inertia ratio, do the following:

1. Set the value of parameter **Pr002 Real-time auto-gain tuning setup** to **1**.
2. Run the machine according to the action demands.
3. Set the value of parameter **Pr004 Inertia ratio** to a relatively stable value.

   Once parameter **Pr002 Real-time auto-gain tuning setup** is changed to **1**, the value of parameter **Pr004 Inertia ratio** keeps changed within a certain range.
4. Set the value of parameter **Pr002 Real-time auto-gain tuning setup** to **0**.

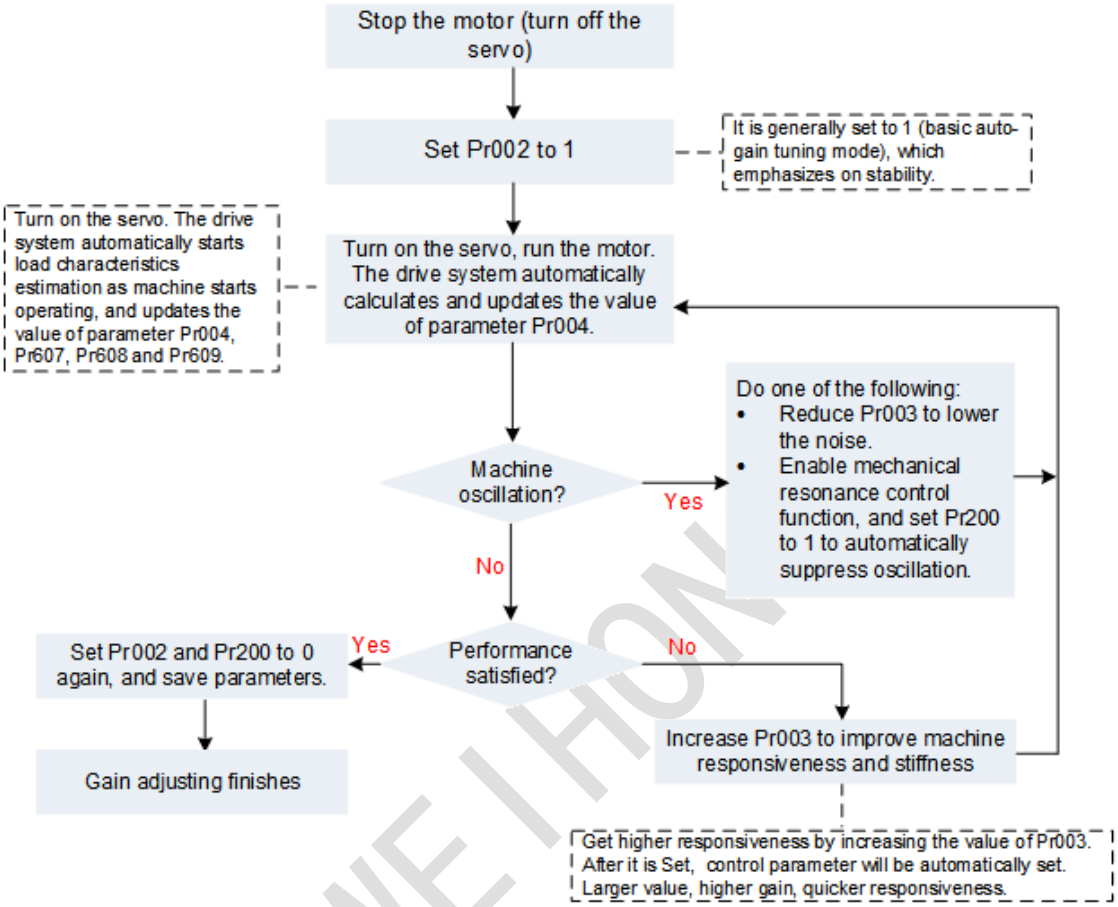
7.3. Automatically Adjusting the Gain

Before automatically adjusting gain, ensure the following:

- The servo is turned on.
- Input signals such as **Deviation counter clear** and **Command input inhibition**, and other parameters except for controls such as **Torque limit setup**, are correctly set.
- The servo motor can smoothly run.

7.3.1. Operation

To automatically adjust the gain, do the following:



During the real time auto-tuning process, the values of parameter **Pr004 Inertia ratio**, **Pr607 Torque command additional value**, **Pr608 Positive direction torque compensation** and **Pr609 Negative torque compensation in** will be written into EEPROM every 30 minutes. When you turn on the servo drive again, the servo drive will take these values as the initial data to automatically adjust the gain.

For how to suppress oscillation, see Suppressing the Machine Resonance and Setting the Adaptive Filter for details.

Note: If power is turned off within 30 minutes after the end of tuning process, the result of the real time auto-tuning is not saved. In this case, you can manually write parameters to EEPROM and then turn off the power.

To invalidate the real time auto-gain tuning, set parameter **Pr002 Real-time auto-gain tuning setup** to **0** and stop the automatic calculation of parameter **Pr004 Inertia ratio**.

7.3.2. Troubleshooting

The abnormal phenomenon and solutions are as follows:

Phenomenon 1

Abnormal sound or oscillation lasts or repeats for 3s or more reciprocating operations.

When you turn on the servo motor for the first time or increase the value of parameter **Pr003 Real time auto-tuning stiffness setup**, it is a normal condition that the load characteristics estimation immediately enters into stable status. If abnormal sound or oscillation occurs, there may be something wrong.

Solution

1. Lower the value of parameter **Pr003 Real time auto-tuning stiffness setup**.
2. Set parameter **Pr002 Real time auto-tuning setup** to **0** to disable the real time auto-tuning.
3. Set parameter **Pr004 Inertia ratio** to the value calculated by the equipment and set parameters **Pr607 Torque command additional value**, **Pr608 Positive direction torque compensation value** and **Pr609 Negative direction torque compensation value** to **0**.

Phenomenon 2

Parameters **Pr004**, **Pr607**, **Pr608** and **Pr609** turns to extreme values.

When abnormal sound or oscillation occurs, parameters **Pr004 Inertia ratio**, **Pr607 Torque command additional value**, **Pr608 Positive direction torque compensation** and **Pr609 Negative torque compensation** may change to extreme values.

Solution

Take the measures mentioned above to resolve this problem.

Phenomenon 3

Parameter **Pr004 Inertia ratio** becomes obviously abnormal.

Solution

1. Use the general mode to automatically adjust the gain.
2. Manually set it to an appropriate calculated value.

7.3.3. Related Information

The related information about automatically adjusting the gain is as follows:

- How to enhance the machine stiffness
  - Well mount the equipment on the ground base and secure without vibration.
  - Use the servo couplings with the high stiffness.
  - Use a wide synchronization belt and set the tensile force of the belt within the over-load range of motor axial load during installation.
  - Use gear with small backlash: the inherent vibration (resonance frequency) of the mechanical system will greatly affect gain adjustment of the servo motor; for machines with low resonance frequency (low machine stiffness), response setup of the servo motor cannot be set too high.
- Basic gain parameter setting table

Stiff-ness	1st Gain				2nd Gain			
	Pr100	Pr101	Pr102	Pr104	Pr105	Pr106	Pr107	Pr109
	Gain of Position Loop (0.1/s)	Gain of Velocity Loop (0.1Hz)	Time Constant of Velocity Loop Integra-tion (0.1ms)	Time Constant of Torque Filter (0.01ms)	Gain of Position Loop (0.1/s)	Gain of Velocity Loop (0.1Hz)	Time Constant of Velocity Loop Integra-tion (0.1ms)	Time Constant of Torque Filter (0.01ms)
0	20	15	3700	1500	25	15	10000	1500
1	25	20	2800	1100	30	20	10000	1100
2	30	25	2200	900	40	25	10000	900
3	40	30	1900	800	45	30	10000	800
4	45	35	1600	600	55	35	10000	600
5	55	45	1200	500	70	45	10000	500
6	75	60	900	400	95	60	10000	400
7	95	75	700	300	120	75	10000	300
8	115	90	600	300	140	90	10000	300
9	140	110	500	200	175	110	10000	200
10	175	140	400	200	220	140	10000	200
11	320	180	310	126	380	180	10000	126
12	390	220	250	103	460	220	10000	103

Stiff-ness	1st Gain				2nd Gain			
	Pr100	Pr101	Pr102	Pr104	Pr105	Pr106	Pr107	Pr109
	Gain of Position Loop (0.1/s)	Gain of Velocity Loop (0.1Hz)	Time Constant of Velocity Loop Integra-tion (0.1ms)	Time Constant of Torque Filter (0.01ms)	Gain of Position Loop (0.1/s)	Gain of Velocity Loop (0.1Hz)	Time Constant of Velocity Loop Integra-tion (0.1ms)	Time Constant of Torque Filter (0.01ms)
13	480	270	210	84	570	270	10000	84
14	630	350	160	65	730	350	10000	65
15	720	400	140	57	840	400	10000	57
16	900	500	120	45	1050	500	10000	45
17	1080	600	110	38	1260	600	10000	38
18	1350	750	90	30	1570	750	10000	30
19	1620	900	80	25	1880	900	10000	25
20	2060	1150	70	20	2410	1150	10000	20
21	2510	1400	60	16	2930	1400	10000	16
22	3050	1700	50	13	3560	1700	10000	13
23	3770	2100	40	11	4400	2100	10000	11
24	4490	2500	40	9	5240	2500	10000	9
25	5000	2800	35	8	5900	2800	10000	8
26	5600	3100	30	7	6500	3100	10000	7
27	6100	3400	30	7	7100	3400	10000	7
28	6600	3700	25	6	7700	3700	10000	6
29	7200	4000	25	6	8400	4000	10000	6
30	8100	4500	20	5	9400	4500	10000	5
31	9000	5000	20	5	10500	5000	10000	5

7.4. Manually Adjusting the Gain

This operation is required when the best gain cannot be obtained due to the limits of load condition, or the best response and stability are required at each load.

When oscillation occurs in the servo system or its control performance is far from satisfaction, you can manually adjust the gain by adjusting parameters related to velocity loop or position loop, in order to enhance the system performance or remove oscillation.

To manually adjust the gain, do the following:

1. Doing Basic Adjustment
2. **Optional:** Switching the Gain
3. **Optional:** Suppressing the Machine Resonance
4. **Optional:** Setting two-stage torque filter.

   It is available only when suppressing the machine resonance is required.

7.4.1. Doing Basic Adjustment

This operation is used to adjust parameters **Pr101 Velocity loop gain**, **Pr102 Time constant of velocity loop integration** and **Pr100 Position loop gain**.

Recommended values of these parameters are as follows:

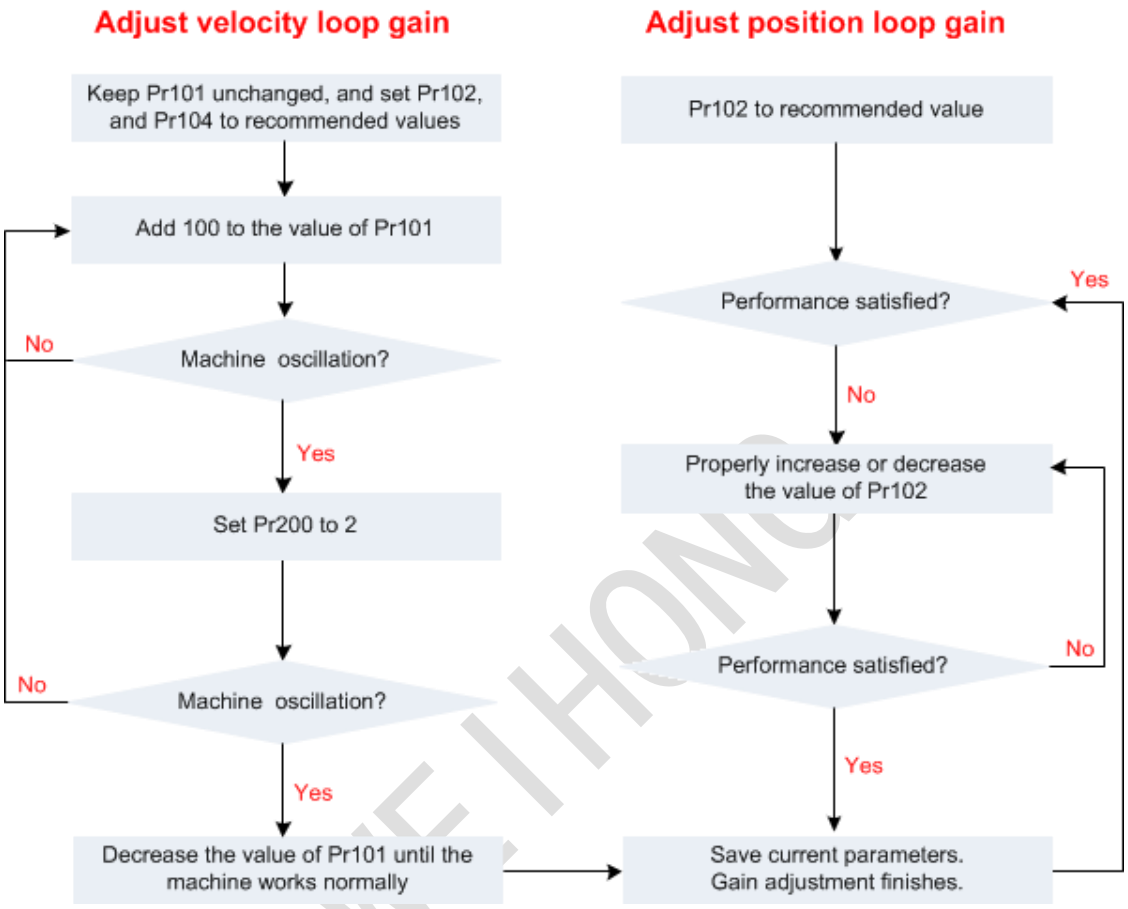
Industry	Pr100	Pr102	Pr104
Wood	300~600	150	30
Aluminum Engraving	500~800	120	
Metalwork	1000~1600	90	
3C	1000~1600	90	
Laser cutting	1500~2800	100	
Waterjet cutting	400~600	100	

Parameters of the system are inter-restricted. Sole increase of gain of position loop may result in instability of position loop output command, finally causing instability of whole servo system.

Before doing basic adjustment, estimate the inertia ratio.

To do basic adjustment, do the following:

1. Adjust velocity loop gain.
2. Adjust position loop gain.



Note: On most occasions, gain of velocity is larger than gain of position loop. When gain of position loop exceeds gain of velocity loop largely, adjustment out of available range may occur caused by filter signal, which will severely destroy system performance.

The motor speed is in accordance with the positional command, velocity is within allowable range and positioning time is short, if these parameter settings are proper.

After basic adjustment, set the value of parameter **Pr200 Adaptive filter mode setup** to **0**.

If you are still not satisfied with the machining performance, please contact us for help.

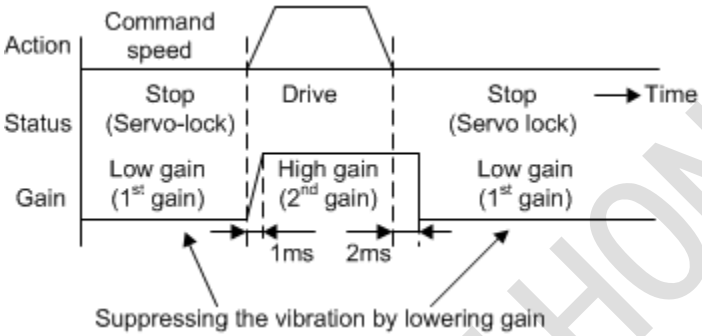
7.4.2. Switching the Gain

This operation is used to switch between the first gain and the second gain.

By selecting the proper gain based on the internal data or external signal, the following effects can be obtained:

1. Decrease the gain when the servo motor stops (servo lock) to reduce vibration.
2. Increase the gain when the servo motor stops (stable status) to shorten the time to keep the stable status.
3. Increase the gain during operation to improve command compliance.
4. Based on the condition of the servo motor, change the gain with the external signal.

The principle of gain switching is as follows:



To switch the gain, refer to **Gain Switching Condition**.

Example

Taking the following as an example, to reduce the noise when the servo motor stops (servo lock) by setting the gain to a lower value after the motor stops, do the following:

1. Manually adjust the gain without switching the gain.
2. Set parameters of 2nd gain **Pr105 ~ Pr109** to the same value with parameters **Pr100 ~ Pr104**.
3. To set the condition for gain switching, set parameters **Pr114 ~ Pr119**
4. Modify parameters of 1st gain **Pr101 1st gain of velocity loop** and **Pr104 1st time constant of torque filter** when the servo motor stops.

Param	Step 1	Step 2	Step 3	Step 4
Pr100	630			
Pr101	350			270
Pr102	160			
Pr103	0			

Param	Step 1	Step 2	Step 3	Step 4
Pr104	65			84
Pr110	300			
Pr111	50			
Pr105		630		
Pr106		350		
Pr107		160		
Pr108		0		
Pr109		65		
Pr114			1	
Pr115			7	
Pr116			30	
Pr117			0	
Pr118			0	
Pr119			0	
Pr004	It depends			

Gain Switching Condition

Gain switching condition differs in the control mode.

In the following three tables, ●represents **Valid**, while — represents **Invalid**.

- Position control mode

Gain Switching Condition Setting			Parameters in Position Control Mode		
Pr115	Switching to 2nd gain	Fig.*5	Delay time*1	Level	Hysteresis*2
			Pr116	Pr117	Pr118
0	Fixed to 1st gain		—	—	—
1	Fixed to 2nd gain		—	—	—
2	Gain switching input		—	—	—
3	Torque command	A	●	● (%)	● (%)
4	Invalid (Fixed to 1st gain)		—	—	—
5	Velocity command	C	●	● (r/min)	● (r/min)
6	Position deviation	D	●	●*3(pulse)	●*3(pulse)
7	Position command exists	E	●	—	—
8	Not in positioning complete	F	●	—	—
9	Actual speed	C	●	● (r/min)	● (r/min)
10	Positional command + velocity	C	●	● (r/min)	● (r/min)

- Velocity control mode

Gain Switching Condition Setting			Parameters in Velocity Control Mode		
Pr120	Switching to 2nd gain	Fig.*5	Delay time*1	Level	Hysteresis*2
			Pr121	Pr122	Pr123
0	Fixed to 1st gain		—	—	—
1	Fixed to 2nd gain		—	—	—
2	Gain switching input		—	—	—
3	Torque command	A	●	● (%)	● (%)

Gain Switching Condition Setting			Parameters in Velocity Control Mode		
Pr120	Switching to 2nd gain	Fig.*5	Delay time*1	Level	Hysteresis *2
			Pr121	Pr122	Pr123
4	Velocity command variation	B	—	●*4([10r/min]/s)	●*4([10r/min]/s)
5	Velocity command	C	●	● (r/min)	● (r/min)

- Torque control mode

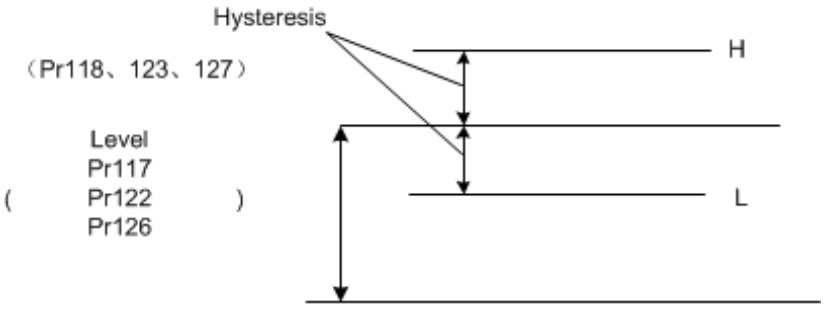
Gain Switching Condition Setting			Parameters in Torque Control Mode		
Pr124	Switching to 2nd gain	Fig.*5	Delay time*1	Level	Hysteresis*2
			Pr125	Pr126	Pr127
0	Fixed to 1st gain		—	—	—
1	Fixed to 2nd gain		—	—	—
2	Gain switching input, GAIN ON		—	—	—
3	Torque command	A	●	● (%)	● (%)

***1**

Delay time (parameters **Pr116 Delay time of position control switching**, **Pr121 Delay time of velocity control switching** and **Pr125 Delay time of torque control switching**) is valid only during returning from 2nd gain to 1st gain.

***2**

Hysteresis (parameters **Pr118 Hysteresis at position control switching, Pr123 Hysteresis at velocity control switching and Pr127 Hysteresis at torque control switching**) is defined as follows:



***3**

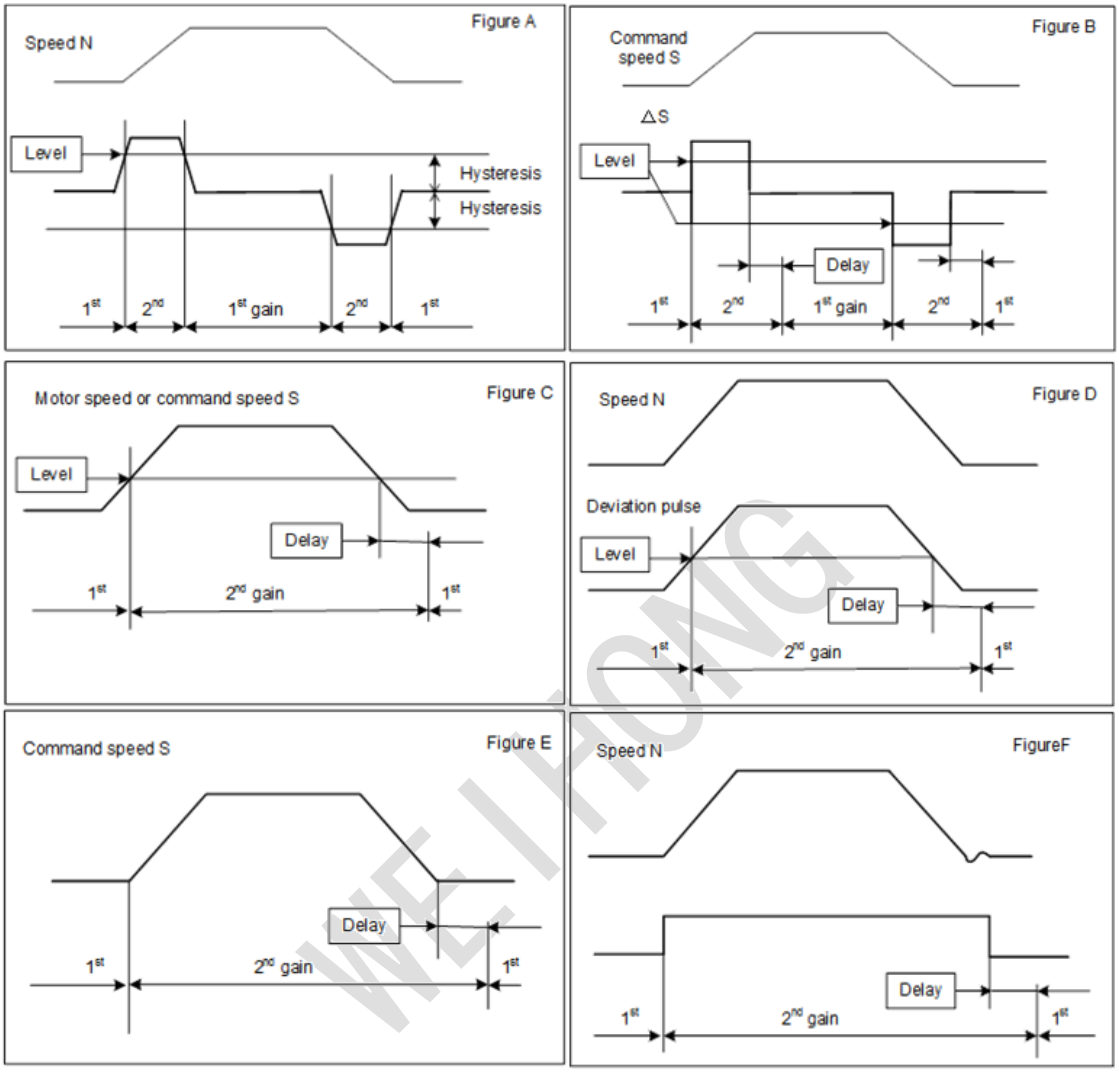
Specify the encoder resolution through the control mode.

***4**

When there is a speed variation of 10r/min in 1 second, set the value to **1**.

***5**

The time sequences of the gain switching in these three control modes:



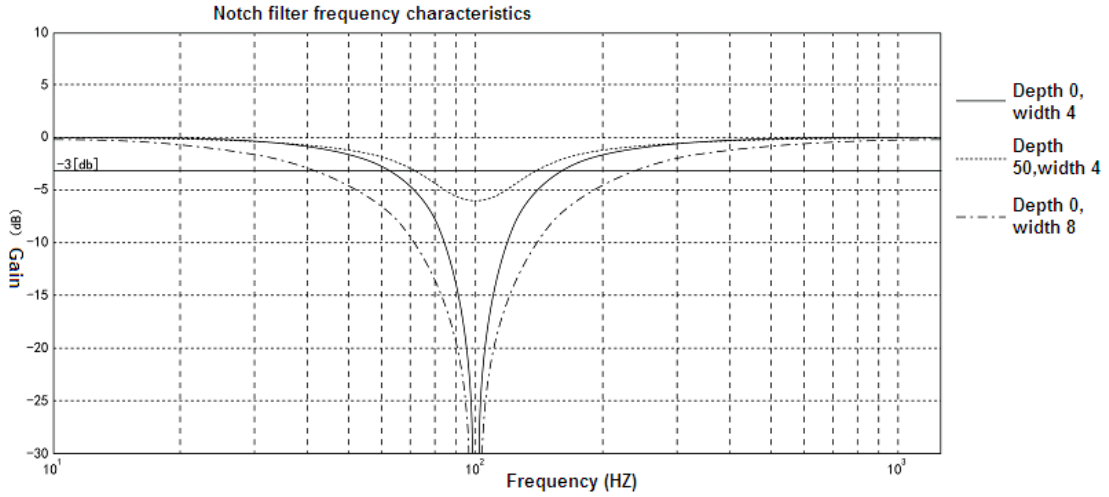
Note The figure does not reflect a timing lag of gain switching due to hysteresis (**Pr118 Hysteresis at position control switching**, **Pr123 Hysteresis at velocity control switching and Pr127 Hysteresis at torque control switching**).

7.4.3. Suppressing the Machine Resonance

In case of low machine stiffness, you cannot set up a higher gain because vibration and noise occur due to resonance caused by axis distortion or other causes. This operation is used to suppress the resonance peak at the notch filter, so as to get a higher gain or reduce the level of vibration.

Generally, the system is equipped with four notch filters.

The characteristics of notch filter frequency are as follows:



To suppress the machine resonance, do the following:

1. To damp the frequency at the vicinity of resonance frequency, set parameter **Pr104 1st time constant of torque filter** and **Pr109 2nd time constant of torque filter**.

   You can obtain the cut off frequency of the torque command filter according to the following formula:

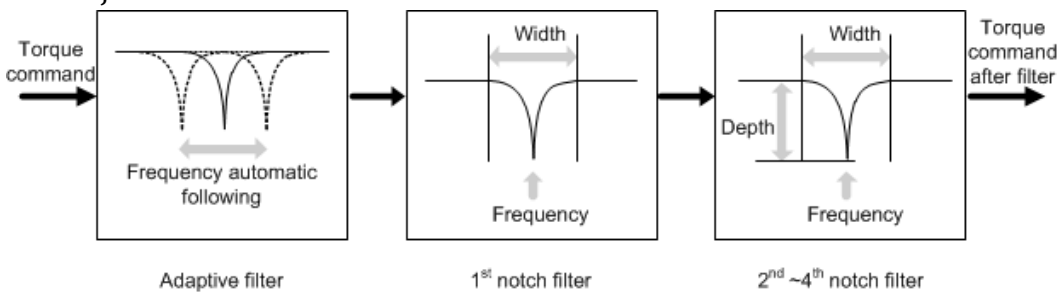
   ```
   Cut off frequency (Hz)fc = 1 / (2 × parameter set value×0.00001)
   ```

2. To adjust the notch filter, set the following parameters:

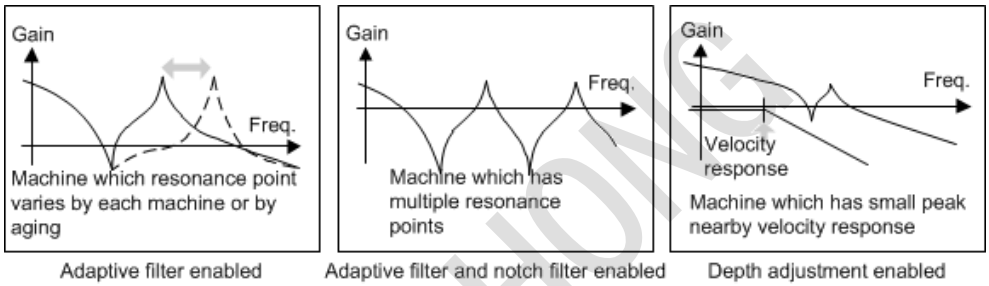
   - **Pr201 1st notch frequency**
   - **Pr202 1st notch width selection**
   - **Pr203 1st notch depth selection**
   - **Pr204 2nd notch frequency**
   - **Pr205 2nd notch width selection**
   - **Pr206 2nd notch depth selection**
   - **Pr207 3rd notch frequency**
   - **Pr208 3rd notch width selection**
   - **Pr209 3rd notch depth selection**

- **Pr210 4th notch frequency**
- **Pr211 4th notch width selection**
- **Pr212 4th notch depth selection**

After setting the above parameters, the frequency, width and depth of the notch filter are adjusted as follows:

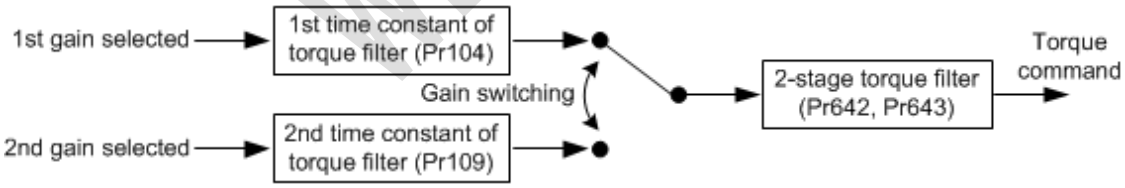


Example



7.4.4. Setting Two-stage Torque Filter

This operation is used to set the 3rd torque filter, namely, the two-stage torque filter, so as to effectively suppress oscillating component in high frequency range.



This operation can be operated in any control mode.

Before setting two-stage torque filter, ensure the following:

- The servo is turned on.
- Factors other than control parameters such as torque limit are properly set.
- Motor can run normally.

To set two-stage torque filter, do the following:

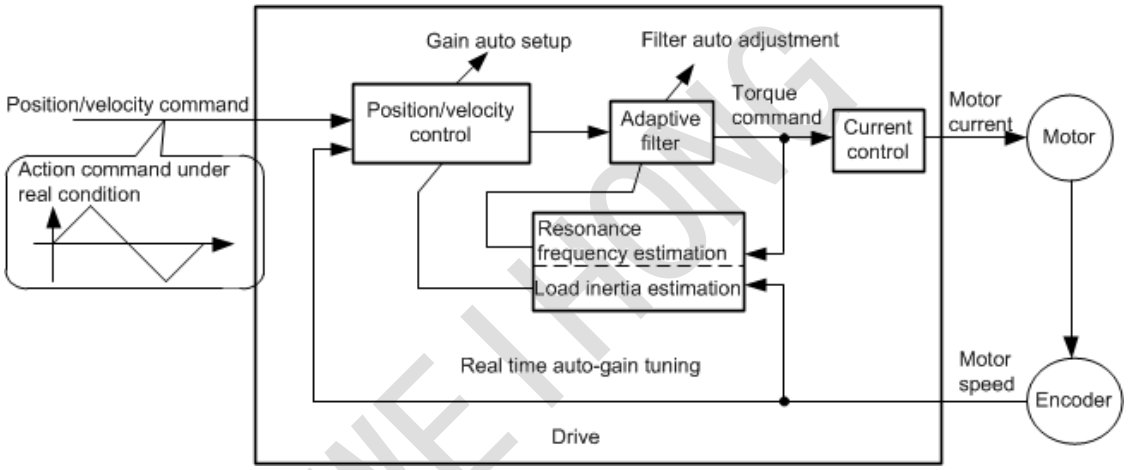
1. Set the value of parameter **Pr643 Two-stage torque filter attenuation term** to **100** (i.e.ζ=1).

2. Gradually increase the value of parameter **Pr642 Absolute origin position offset** from the minimum 5.

7.5. Setting the Adaptive Filter

This operation is used to estimate the resonance frequency according to the vibration component in the motor speed, and automatically set the notch filter coefficient and remove the resonance component in the torque command, so as to reduce the resonance vibration.

The principle is as follows:



7.5.1. Operation

Before setting the adaptive filter, ensure the following:

- The control mode is in position or speed mode.
- The servo is turned on.
- Parameters, such as deviation counter clear, command inhibit and torque limit, are appropriately set.
- The motor can normally run.

To set the adaptive filter, set the value of parameter **Pr200 Adaptive filter mode setup** and select a mode of adaptive filter.

Note: When it is set to **0**, the adaptive filter is unavailable.

If the resonance point affects the motor speed, the following parameters of 3rd and 4th notch filters are automatically set according to the number of adaptive filters:

- **Pr207 3rd notch frequency**
- **Pr208 3rd notch width selection**
- **Pr209 3rd notch depth selection**
- **Pr210 4th notch frequency**
- **Pr211 4th notch width selection**
- **Pr212 4th notch depth selection**

The values of the above parameters are written to EEPROM every 30 minutes. Once power on, these data are used as default values during the adaptive process.

Conditions for Invalid adaptive filter

Under the following conditions, normal operations may not be expected. In this case, please manually set the notch filter to prevent resonance.

- Resonance Point
  - Resonance frequency is lower than 3 times of velocity loop band width.
  - Resonance peak or control gain is low where the motor speed is not affected by it.
  - The number of resonance points is greater than or equal to 3.
- Load

  Motor speed variation with high harmonic component is generated due to non-linear factors such as backlash.

- Command Mode

  Acceleration/deceleration is rapid, such as 30000r/min per 1s.

7.5.2. Troubleshooting

Phenomenon 1

After the first servo-on, or after increasing the value of parameter **Pr003 Setting of machine stiffness at real-time auto-gain tuning**, the adaptive filter does not enter into the stable status. And abnormal sound or oscillation lasts or repeats for 3 or more reciprocating operations.

Solution

1. Write the value of parameters in the stable status into EEPROM.
2. Reduce parameter **Pr003 Setting of machine stiffness at real-time auto-gain tuning**.
3. To disable the adaptive filter, set parameter **Pr200 Adaptive filter mode setup** to **0**.
4. Manually set the notch filter.

Phenomenon 2

After abnormal sound or oscillation occurs, the set value of 3rd and 4th notch filters may change to extreme values.

Solution

1. To disable the adaptive filter, set the value of **Pr200 Adaptive filter mode setup** to **0**.
2. Change the values of parameter **Pr207 3rd notch frequency** and **Pr210 4th notch frequency** to **5000** (invalid).
3. Enable the adaptive filter again.

7.6. Adjusting the Gain with Bus Control System

This operation is used to adjust the gain with the bus control system for the servo drives.

At present, certain control systems developed by Weihong Company support this operation.

To automatically adjust the gain with bus control system, do the following:

1. Well connect each component.

   See Overall Wiring for details.

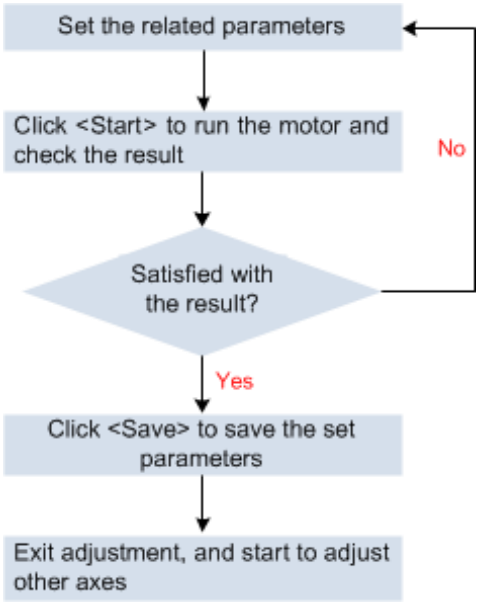
2. Enter **Servo Parameter** interface, and set related parameters including the control system mode, servo drive type in the control system.

3. Enter **Auto adjustment** interface in the control system.

4. Set 1st limit, 2nd limit, initial mode, and initial stiffness.

5. Click **Start Estimation**. The motor runs, the system automatically estimates inertia ratio, friction, and variable loads, and writes the result into the related parameters after the estimation.

6. Click **Next** to enter **Gain Adjustment** interface, and do as follows:



Repower the servo drive to make the adjustment result effective.

See the corresponding manuals for details about the process of automatically adjusting the gain.

8. Registration

By registering the time length, you can specify the working time of the servo drive. When the accumulated working time reaches, an error appears and the servo drive cannot work normally.

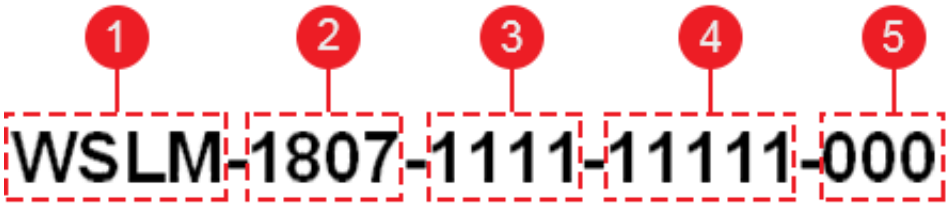
To register servo drives, do the following:

1. Getting the Drive Serial Number.
2. Getting the Registration Code.
3. Registering the Servo Drive.

8.1. Getting the Drive Serial Number

This operation is used to get the drive serial number.

The drive serial number consists of the following:



1. Product series
2. High (4 digits): H—represent year and month
3. Middle (4 digits): n—represent production order
4. Low (5 digits): L—represent running number
5. Lowest (3 digits): C—represent the registered times

To get the drive serial number, do one of the following:

- Getting the Drive Serial Number on the Operation Panel.
- Getting the Drive Serial Number in iMotion Software.

8.1.1. Getting the Drive Serial Number on the Operation Panel

To get the drive serial number on the operation panel, do the following:

1. Press **AXIS** for 2 seconds to switch to the common axes.
2. Press **Set** to switch to the monitor mode, press ▲ / ▼ to check the drive manufacturing number.
3. Press **Set**:

   - Order in drive serial number
   - Drive manufacturing number
4. To switch order in serial number, press ▲ / ▼.

   e.g. H 1111

5. Organize the serial number order and manufacturing number.

   The serial number is the decimal value.

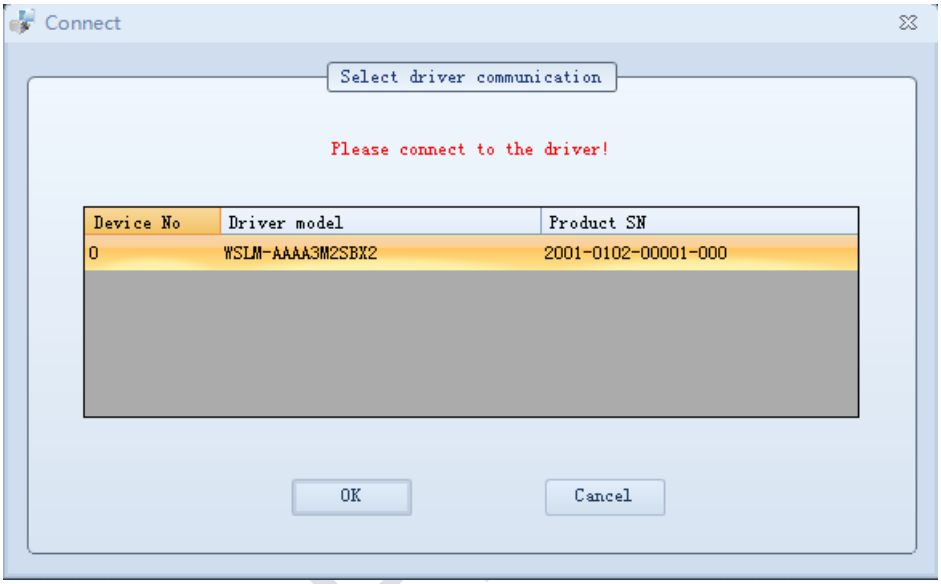
8.1.2. Getting the Drive Serial Number in iMotion Software

Before getting the drive serial number in iMotion software, ensure the following；

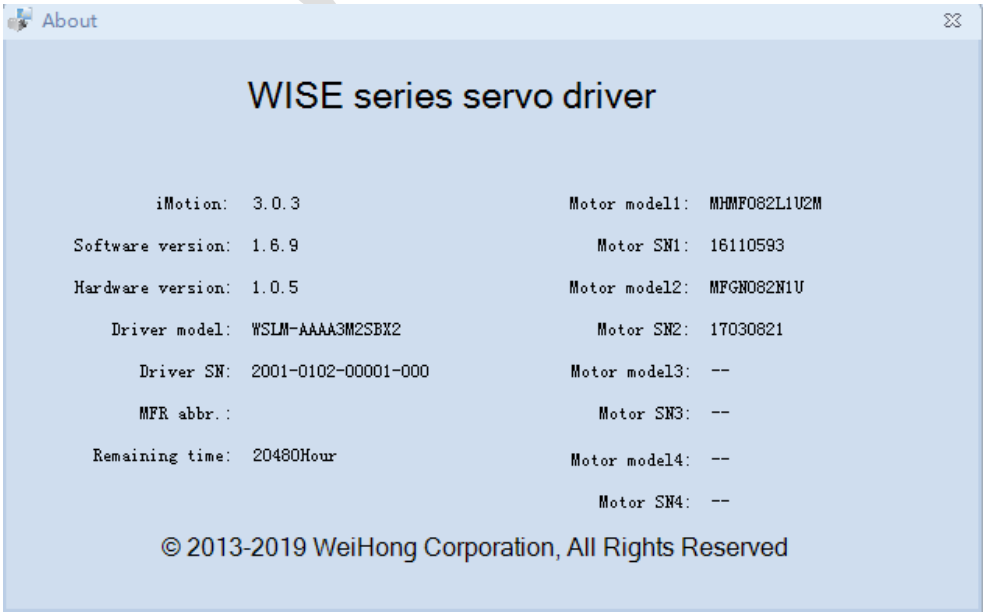
1. iMotion software with version 1.0.6 or above is installed.
2. The servo drive is successfully connected with PC.

To get the drive serial number in iMotion software, do one of the following:

- To open **Connect** dialog box, open iMotion software. **Driver SN** column is the serial number:



- To open **About** dialog box, open iMotion software, select **Function preview** → **Other** → **About iMotion**. **Driver SN** is the serial number:



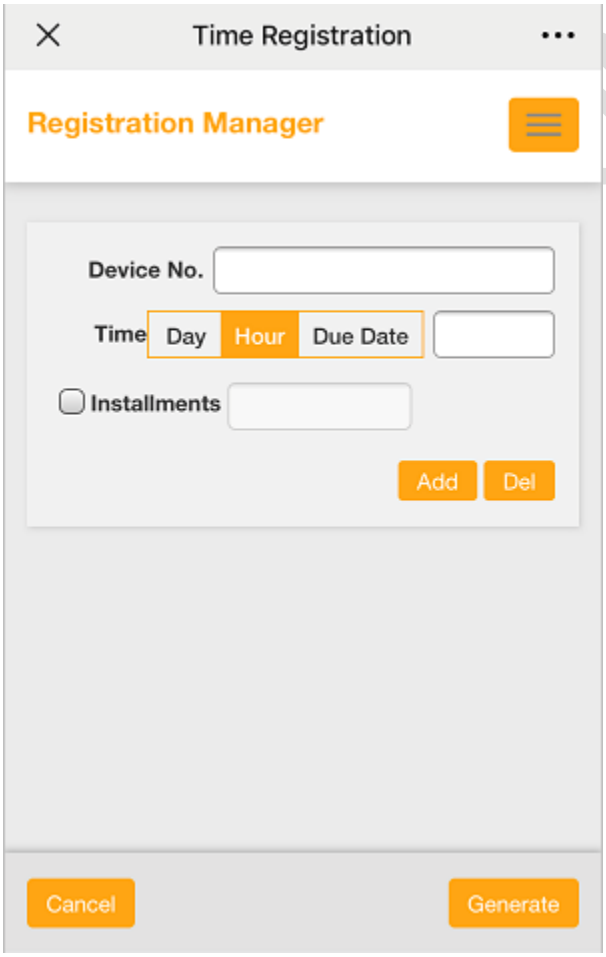
8.2. Getting the Registration Code

Before getting the registration code, do the following:

1. To get an NcCloud account, contact the local sales, sales assistant or dial our customer service phone 400-882-9188.
2. To put on records, fill in *Registration Confirmation Letter*, seal and send it to Weihong company. Weihong company records the information in the confirmation letter you have returned.

To get the registration code, do the following:

1. Search and follow official account **WEIHONG** on WeChat.
2. To obtain a temporary login password, click **Service** → **Registration** → **Activate Account**, and input your telephone number.
3. Return to the login interface, and log in:



4. Input the drive serial number.

   See Getting the Drive Serial Number for details.

5. Select a registration type (by day or by hour), and input the registration time.

   If you choose to register the servo drive by day, the registration time will be calculated from the day you register, and according to the internal clocking of the system, no matter the system is power off or not.

6. **Optional:** To register several servo drives at the same time, click **Add**.

7. To generate the registration code, click **Generate** if you are sure the above information is correct.

Note: After the servo drive powers off, the remaining time will not be calculated.

8.3. Registering the Servo Drive

To register the servo drive, do one of the following:

- Register the servo drive in iMotion software.
- Register the servo drive on the operation panel.
- Register the servo drive through Weihong products.

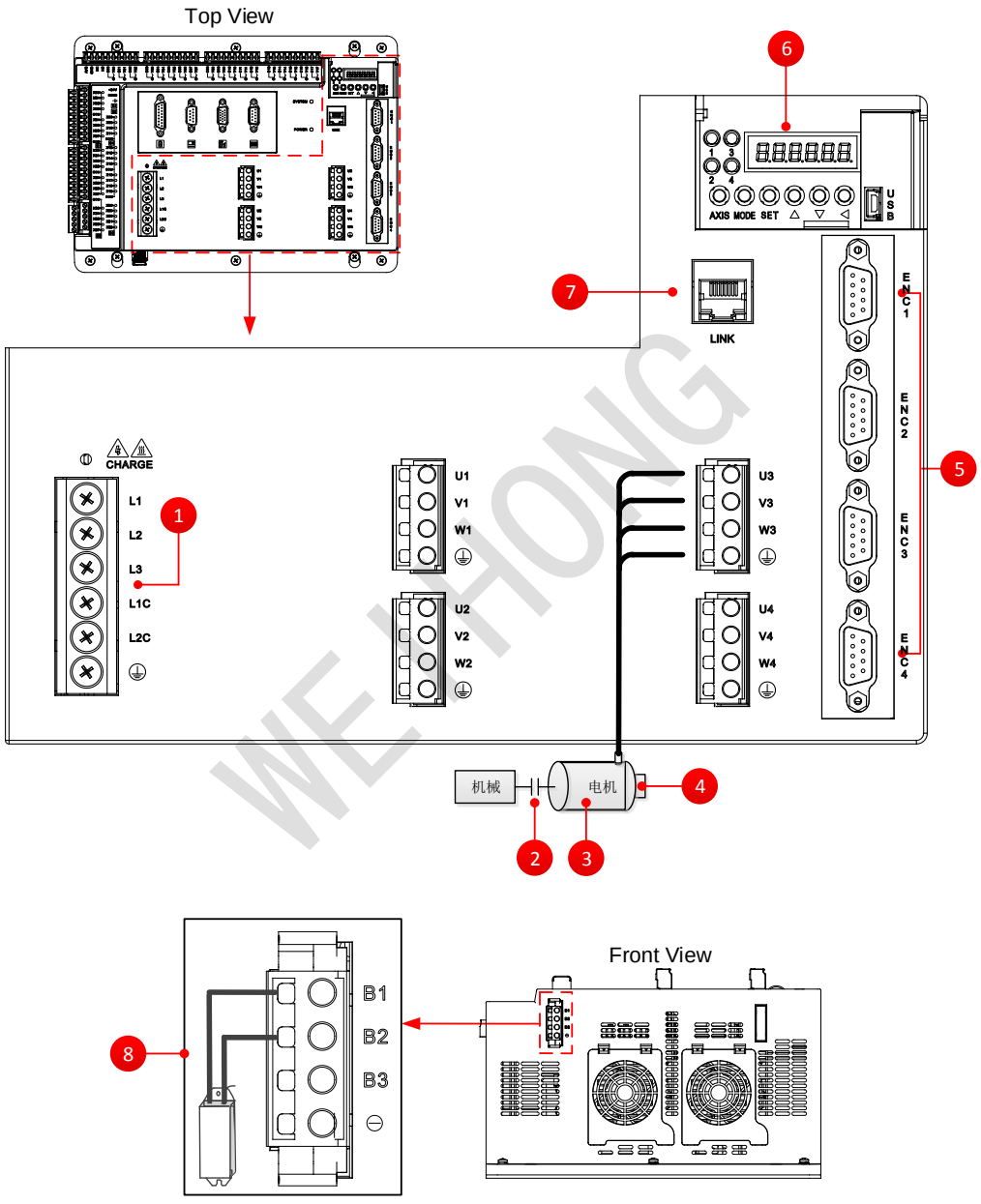
  At present, parts of Weihong products, including NcStudio software, and NK300CX integrated CNC system, support direct registration.

  Please contact us for details.

9. Troubleshooting

9.1. Common Troubleshooting

When an error occurs, troubleshoot it as follows:



1. Check the following:
   - Whether power voltage changes?
   - Whether power is turned on?
   - Whether connection is loose?
2. Check whether connection is loose?
3. Check whether abnormal noise is generated from motor?

   If the motor does not run, find causes in the monitor mode and take corresponding measure. See Troubleshooting for details.
4. Check whether the magnetic brake works normally?
5. Check whether wiring to encoder is correct or any wire is pulled off?
6. Check the following:
   - Whether error code number is displayed?
   - Whether parameter settings are wrong?
7. Check the following:
   - Whether connection is loose?
   - Whether the last servo drive connects to a terminating resistor
5. Check the following:
   - Whether the connection part is disconnected? (broken wire, contact)
   - Whether wiring is correct?
   - Whether the connector is pulled off?
   - Whether the short wire is pulled off?

During error status, error code (Err.) will be displayed on operation panel LED and the servo cannot be enabled.

9.2. Communication Troubleshooting

According to different flashing frequencies of SYSTEM light on the servo drive, you can check the running status of the current system so as to judge if there are any exceptions in the system communication.

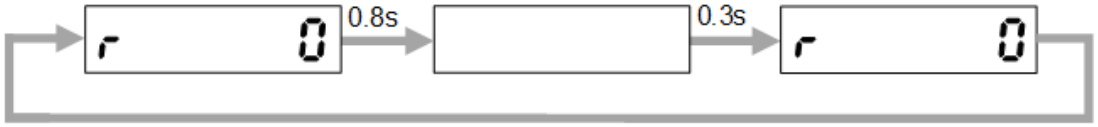
The exceptions are as follows:

- When the current system is disconnected, the SYSTEM light flashes at the frequency of 0.33Hz (flash every 3 s).
- When the system communication is normal, the SYSTEM light flashed at the frequency of 2Hz (flash twice every 1 second).

- When the system communication is abnormal, the SYSTEM light flashed at the frequency of 10Hz (flash ten times every 1 second).
- When the hardware is abnormal, such as under-voltage, damage, pseudo solder, short circuit and so on, the SYSTEM light keeps ON/OFF.

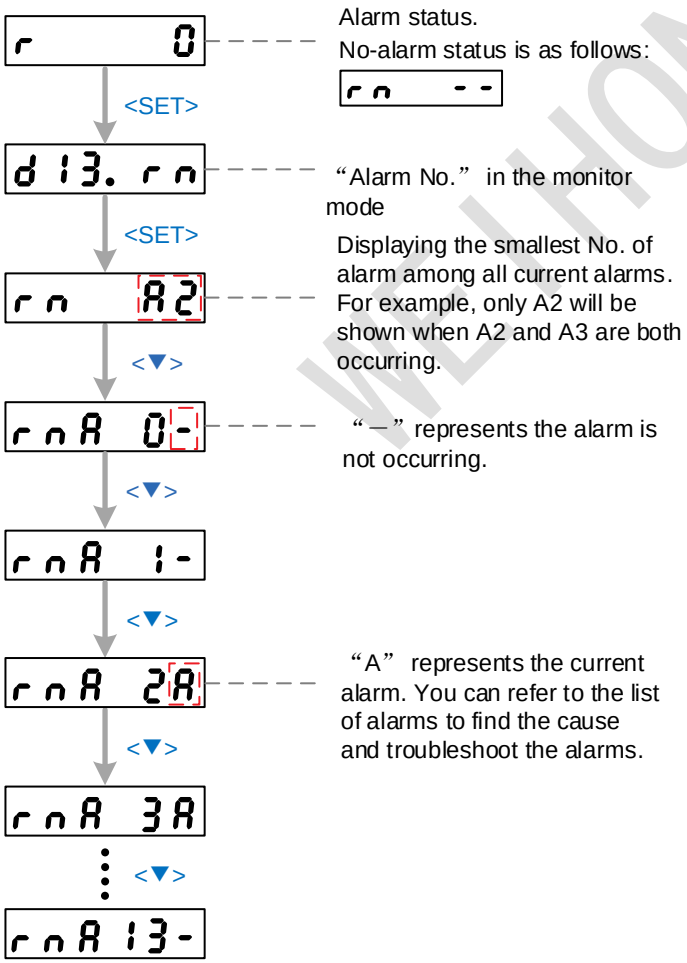
9.3. Alarm

When an alarm occurs in the servo drive, the operation panel displays according to the following cycle every 0.8/0.3s:



9.3.1. Viewing Alarms

To view alarms, refer to the following steps:



9.3.2. List of Alarms

Alarms with sign ▲is for the single axis and common axes, alarms without sign ▲ is only for the single axis.

Detailed information of alarms is as follows:

A0

- Name: Overload protection
- Cause: Load ratio exceeds 85% of the protection level.
- Latch time: 1~10s or ∞

▲A1

- Name: Over-regeneration alarm
- Cause: Regenerative load ratio exceeds 85% of the protection level.
- Latch time: 1~10s or ∞

A2

- Name: Battery alarm
- Cause: Battery voltage is 3.2V or lower.
- Latch time: ∞

▲A3

- Name: Fan 1 alarm
- Cause: Fan has stopped for 1s.
- Latch time: 1~10s or ∞

A4

- Name: Encoder communication alarm
- Cause: The number of successive encoder communication errors exceeds the specified value.
- Latch time: 1~10s or ∞

A5

- Name: Encoder overheat alarm
- Cause: The encoder detects overheat alarm.
- Latch time: 1~10s or ∞

A6

- Name: Oscillation detection alarm
- Cause: The motor vibration is detected.
- Latch time: 1~10s or ∞

▲A7

- Name: Registered time expiration alarm
- Cause: Remaining registered time is shorter than the specified time.
- Latch time: ∞

A8

- Name: External scale error alarm
- Cause: The feedback scale detects the alarm.
- Latch time: 1~10s or ∞

A9

- Name: External scale communication alarm
- Cause: The number of successive feedback scale communication errors exceeds the specified value.
- Latch time: 1~10s or ∞

▲A10

- Name: MECHATROLINK data setup alarm
- Cause: Parameter No., data range and parameter value exceed the specified value.
- Latch time: 1~10s or ∞

▲A11

- Name: MECHATROLINK unsupported command alarm
- Cause: Unsupported commands are received.
- Latch time: 1~10s or ∞

▲A12

- Name: MECHATROLINK command executing condition not met alarm
- Cause: The command is run in unsupported layer and does not meet the requirements for executing the command.
- Latch time: 1~10s or ∞

▲A13

- Name: Fan 2 alarm
- Cause: Fans is still for 1s.
- Latch time: 1~10s or ∞

9.4. List of Error Codes

The error codes that are displayed as `ErrXXY` on the front panel will be displayed in the format of `Err XX.Y` (XX: main code; Y: sub code) hereinafter.

Alarms with sign ▲is for the single axis and common axes, alarms without sign ▲ is only for the single axis. ● represents that this error code has this attribute.

To return to the normal operation, please power off, troubleshoot the problem, and then power on again.

The following is the list of error codes for the servo drives:

Error Code	Name	Attribute		
		History	Clearable	Stop Immediately
▲Err 11.0	Control power under-voltage protection		●	
▲Err 12.0	Over-voltage protection	●	●	
▲Err 13.0	Main power supply under-voltage protection (between P and N)		●	
▲Err 13.1	Main power supply under-voltage protection (AC interception detection)		●	
Err 14.0	Over-current protection	●		
Err 14.1	IPM error protection	●		
▲Err 15.0	Heat sink 1 over-heat alarm	●		●
▲Err 15.1	Heat sink 2 over-heat alarm			
▲Err 15.2	Main controller chip over-heat protection			
Err 16.0	Over-load protection	●	●	●
▲Err 18.0	Regeneration over-load protection	●		●
▲Err 18.1	Regeneration Tr error protection	●		
Err 19.0	DB (dynamic brake) over-load protection	●		

Error Code	Name	Attribute		
		History	Clearable	Stop Immediately
Err 21.0	Encoder communication disconnect error protection	●		
Err 21.1	Encoder communication error protection	●		
Err 23.0	Encoder communication data error protection	●		
Err 24.0	Positional deviation excess protection	●	●	●
Err 24.1	Velocity deviation excess protection	●	●	●
Err 26.0	Over-speed protection	●	●	●
Err 26.1	2nd over-speed protection	●	●	
Err 27.1	Command pulse division/multiplication error protection	●	●	●
Err 28.0	Pulse regeneration limit protection	●	●	●
Err 29.0	Deviation count overflow protection			
Err 33.5	I/F output function number error 2	●		
Err 34.0	Software limit function	●	●	●
▲Err 36.0~Err 36.2	EEPROM parameter error protection			
▲Err 37.0~Err 37.2	EEPROM code error protection			
Err 38.0	Drive inhibited input protection		●	●
Err 40.0	Absolute encoder system down error protection	●		
Err 41.0	Absolute count overflow error protection	●		
Err 42.0	Absolute encoder over-speed error protection	●	●	

Error Code	Name	Attribute		
		History	Clearable	Stop Immediately
Err 43.0	Encoder initialization error protection	●		
Err 44.0	Absolute encoder single turn count error protection	●		
Err 45.0	Absolute encoder multi-turn count error protection	●		
Err 46.0	Absolute encoder overheat protection	●		
Err 47.0	Absolute status error protection	●		
Err 48.0	Encoder Z-phase error protection	●		
Err 49.0	Encoder CS signal error protection	●		
Err 50.1	External scale communication data error protection			
Err 56.0	ABZ incremental encoder over-speed error protection	●		
Err 56.1	ABZ incremental encoder UVW error protection	●		
Err 56.2	ABZ incremental encoder ABZ error protection	●		
Err 57.0	Current sampling offset excess protection	●		
Err 57.1	Current gain diagnosis error protection	●		
▲Err 58.0	Chip working error protection	●		
▲Err 59.0	Registered time expired	●		
▲Err 59.1	Mismatching software version	●		
▲Err 60.0	M-II communication ASIC fault 1	●		●

Error Code	Name	Attribute		
		History	Clearable	Stop Immediately
▲Err 61.0	M-II communication ASIC fault 2	●		●
▲Err 62.0	M-II internal synchronous error 1	●	●	●
▲Err 63.0	M-II transmission cycle setup error	●	●	●
▲Err 64.0	M-II synchronous error		●	●
▲Err 64.1	M-II synchronous failure	●	●	●
▲Err 65.0	M-II communication fault (receipt error)		●	●
▲Err 65.1	M-II transmission cycle error (synchronous interval error)	●	●	●
Err 87.0	Forced alarm input protection		●	●
Err 95.0~Err 95.4	Motor automatic recognition error			
Err 99.0	Other error protection	●		

9.5. Details of Error Codes

Error codes with sign ★cannot be removed by the alarm clear input (A-CLR).

9.5.1. Err10 Series

9.5.1.1. Err11.0

9.5.1.1.1. Error Code

Err11.0: Control power supply under-voltage protection

9.5.1.1.2. Cause

1. Voltage between P and N of the converter portion of the control power supply has fallen below the specified value.
2. Power supply voltage is low. Instantaneous power failure has occurred.
3. Lack of power capacity…power supply voltage has fallen down due to inrush current at the main power-on.
4. Failure of the servo drive (failure of the circuit).

9.5.1.1.3. Solution

1. Measure the voltage between lines of connector and terminal block.
2. Increase the power capacity, and change the power supply.
3. Increase the power capacity.
4. Replace the servo drive with a new one.

Related Topic

List of Error Codes

9.5.1.2. Err12.0

9.5.1.2.1. Error Code

Err12.0: Over-voltage protection

9.5.1.2.2. Cause

1. Voltage between P-N of the converter portion has exceeded the specified value.
2. Voltage of the power supply has exceeded the permissible input voltage. Voltage surge due to the phase-advancing capacitor or UPS (uninterruptible power supply) have occurred.
3. Disconnection of the regeneration discharge resistor.
4. External regeneration discharge resistor is not appropriate and could not absorb the regeneration energy.
5. Failure of the servo drive (failure of the circuit).

9.5.1.2.3. Solution

1. Measure the voltage between lines of connector (L1 L2 L3).
2. Input correct voltage, remove a phase-advancing capacitor. And measure resistance of the external resistor for P-B of the servo drive.
3. If the value is ∞, replace the external resistor.
4. Change to the one with specified resistance and wattage.
5. Replace the servo drive with a new one.

Related Topic

List of Error Codes

9.5.1.3. Err13.0, Err 13.1

9.5.1.3.1. Error Code

Err13.0：Main power supply under-voltage protection (PN)

Err13.1：Main power supply under-voltage protection (AC)

9.5.1.3.2. Cause

1. When the value of parameter **Pr508 LV trip selection at the main power-OFF** is set to 1, instantaneous power failure has occurred between L1 and L3 for longer period than the preset time with the value of parameter **Pr509 Detection time of main power off**.
2. The voltage between P and N of the converter portion of the main power supply has fallen below the specified value during Servo-On.
3. Power supply voltage is low. Instantaneous power failure has occurred.
4. Instantaneous power failure has occurred. Lack of power capacity…Power supply voltage has fallen down due to inrush current at the main power-on.
5. Phase lack …3-phase input drive has been operated with single phase input.
6. Failure of the servo drive (failure of the circuit).

9.5.1.3.3. Solution

1. Set a longer time to the value of parameter **Pr509 Detection time of main power off**, and correctly set each phase of the power.
2. Measure the voltage between lines of connectors (L1 L2 L3).
3. Increase the power capacity, change the power supply, rule out the causes of the shutdown of the magnetic contactor of the main power supply, and then re-enter the power.
4. Increase the power capacity.
5. Connect each phase of the power supply (L1 L2 L3). For single phase, use any two of the three terminals.
6. Replace the servo drive with a new one.

Related Document

List of Error Codes

9.5.1.4. Err14.0, Err 14.1

9.5.1.4.1. Error Code

★Err14.0: ★Over-current protection

★Err14.1: ★IPM error protection

9.5.1.4.2. Cause

1. Current through the converter portion has exceeded the specified value.
2. Failure of the servo drive (failure of the circuit, IGBT or other components).
3. Short of the motor wire (U, V and W).
4. Earth fault of the motor wire.
5. Burnout of the motor.
6. Poor contact of the motor wire.
7. Timing of pulse input is same as or earlier than servo on.

9.5.1.4.3. Solution

1. Turn to Servo-On, while disconnecting the motor. If error occurs immediately, replace with a new servo drive.
2. Check that the motor wire (U, V and W) is not short-circuited, and check the branched out wire out of the connector. Make a correct wiring connection.
3. Measure the insulation resistance between motor wires, U, V and W and earth wire. In case of poor insulation, replace the motor.
4. Check the balance of resistor between each motor line, and if unbalance is found, replace the motor.
5. Check the loose connectors. If they are loose or fall off, fix them securely.
6. Enter the pulse 100ms or longer after servo on.

Related Topic

List of Error Codes

9.5.1.5. Err15.0, Err15.1

9.5.1.5.1. Error Code

★Err15.0: ★Heat sink 1 over-heat alarm

★Err15.1: ★Heat sink 2 over-heat alarm

9.5.1.5.2. Cause

Temperature of the heat sink 1~2 or power device has been risen over the specified temperature:

1. Ambient temperature has risen over the specified temperature.
2. Over-load.

9.5.1.5.3. Solution

1. Improve the ambient temperature and cooling condition.
2. Increase the capacity of the servo drive and motor, set longer acceleration/deceleration time, and lower the load.

Related Topic

List of Error Codes

9.5.1.6. Err15.2

9.5.1.6.1. Error Code

Err15.2: Main control chip over-heat protection

9.5.1.6.2. Cause

Temperature of the main control chip of the servo drive has been risen over the specified temperature:

Ambient temperature has risen over the specified temperature.

9.5.1.6.3. Solution

Improve the ambient temperature and cooling condition.

Related Topic

List of Error Codes

9.5.1.7. Err16.0

9.5.1.7.1. Error Code

Err16.0: Over-load protection

9.5.1.7.2. Cause

Torque command value has exceeded the over-load level set with **Pr512 Over-load level setup** and resulted in overload protection according to the time characteristics.

1. Load was heavy and actual torque has exceeded the rated torque and kept running for a long time.
2. Oscillation and hunching action due poor adjustment. Set value of parameter **Pr004 Inertia ratio** is wrong.
3. Incorrect wiring, disconnection of the motor.
4. Machine has collided or the load has gotten heavy. Machine has been distorted.
5. Electromagnetic brake has been kept engaged.
6. While wiring multiple axes, incorrect wiring has occurred by connecting the motor cable to the other axis.

9.5.1.7.3. Solution

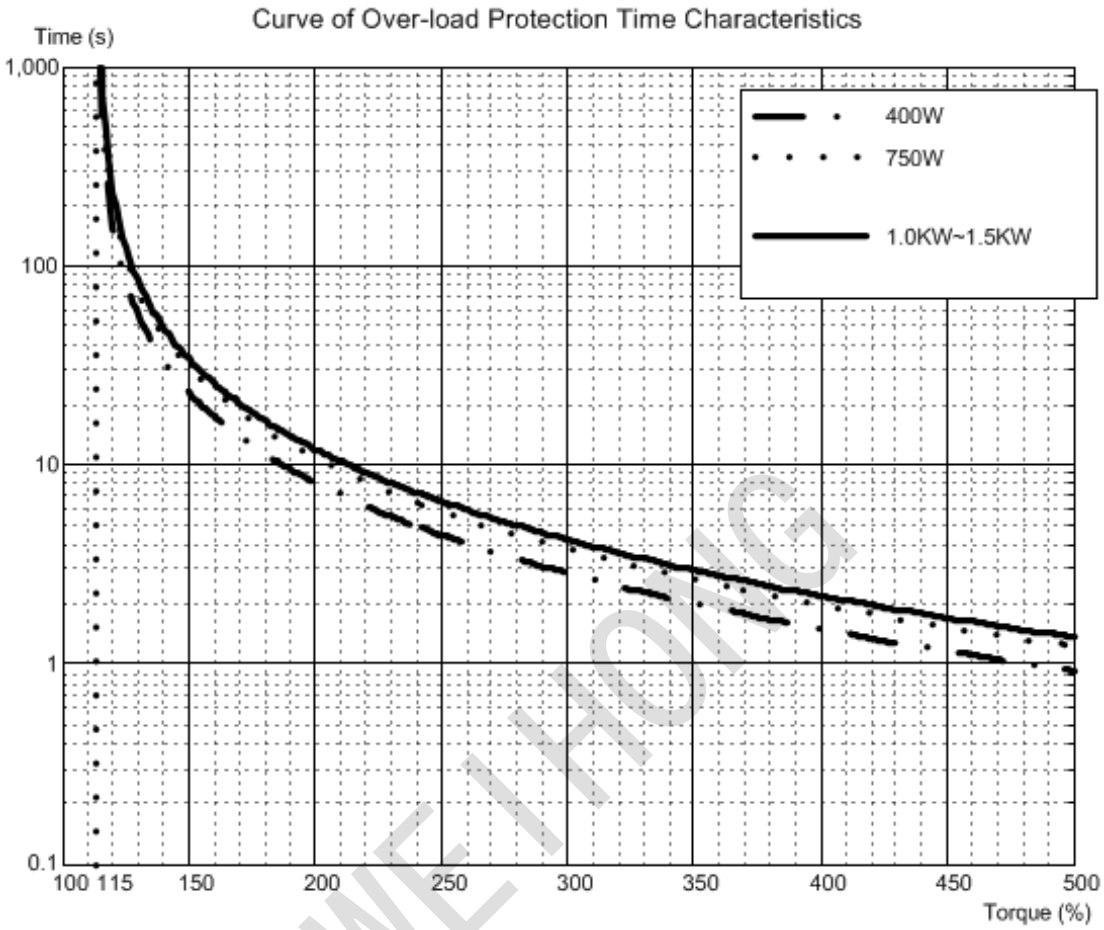
Check that the torque (current) does not oscillate nor fluctuate up and down very much on the analog output and via communication. And check the over-load alarm display and load factor with the analog output and via communication:

1. Increase the capacity of the servo drive and motor. Set up longer acceleration/deceleration time. Lower the load.
2. Make a re-adjustment of gain.
3. Wire correctly as wiring diagram. Replace the cables.
4. Remove the cause of distortion. Lower the load.
5. Release the brake, and measure the voltage between brake terminals.
6. Make a correct wiring by matching the correct motor and encoder wires.

Note: Once the error occurs, it cannot be cleared at lease for 10s.

9.5.1.7.4. Over-load Protection Time Characteristics

Please use over-load protection in torque range shown in the figure below:



Related Topic

List of Error Codes

9.5.1.8. Err18.0

9.5.1.8.1. Error Code

★Err18.0: ★Regeneration over-load protection

9.5.1.8.2. Cause

Regenerative energy has exceeded the capacity of regenerative resistor:

1. Due to the regenerative energy during deceleration caused by a large load inertia, converter voltage has risen, and the voltage is risen further due to the lack of capacity of absorbing this energy of the regeneration discharge resistor.
2. Regenerative energy has not been absorbed in the specified time due to a high motor rotational speed.
3. Active limit of the external regenerative resistor has been limited to 10% duty.

9.5.1.8.3. Solution

Check the load factor of the regenerative resistor from the front panel or via communication:

1. Check the running pattern (velocity monitor). Check the load factor of the regenerative resistor and over-regeneration warning display. Increase the capacity of the servo drive and the motor, and loosen the deceleration time. Use the external regenerative resistor.
2. Check the running pattern (velocity monitor). Check the load factor of the regenerative resistor. Increase the capacity of the servo drive and the motor, and loosen the deceleration time. Lower the motor rotational speed. Use an external regenerative resistor.
3. Set the value of parameter **Pr016 External regenerative resistor setup** to **2**.
4. Set the power voltage within the specification range.

Warning:

When you set the value of parameter **Pr016 External regenerative resistor setup** to **2**, install an external protection such as thermal fuse without fail. Otherwise, regenerative resistor loses the protection and it may be heated up extremely and may burn out.

Related Topic

List of Error Codes

9.5.1.8.4. Err18.1

9.5.1.8.4.1. Error Code

★Err18.1: ★Regenerative transistor error protection

9.5.1.8.4.2. Cause

Regenerative drive transistor on the servo drive is detective.

9.5.1.8.4.3. Solution

Replace the servo drive.

Related Topic

List of Error Codes

9.5.1.8.4.4. Err19.0

Error Code

★Err19.0: ★DB(Dynamic brake) over-load protection

Cause

1. The motor is driven by external power.
2. Rotating energy when DB is stopping exceeds the resistor capacity of DB.
3. Failure of the servo drive.
4. Too much power consumption of dynamic brake has been detected.)

Solution

1. Do not drive the motor with external power or force.
2. Decrease the command velocity of the servo drive, decrease load inertia ratio, and reduce times of DB stalling.
3. Replace the servo drive.

Related Topic

List of Error Codes

9.5.2. Err20 Series

9.5.2.1. Err21.0

9.5.2.1.1. Error Code

★Err21.0: ★Encoder communication disconnection error protection

9.5.2.1.2. Cause

Communication between the encoder and the servo drive has been interrupted in certain times, and disconnection detecting function has been triggered.

9.5.2.1.3. Solution

1. Check whether the signal of encoder cable is twisted pair, SD+ and SD-.
2. Make a wiring connection of the encoder as per the wiring diagram, and correct the miswiring of the connector pins.

Related Topic

List of Error Codes

9.5.2.2. Err21.1

9.5.2.2.1. Error Code

★Err21.1: ★Encoder communication error protection

9.5.2.2.2. Cause

Mainly data error due to noise. Encoder cables are connected, but communication data has some errors.

9.5.2.2.3. Solution

1. Secure the power supply for the encoder of DC5V±5% (4.75~5.25V), and pay special attention when the encoder cables are long.
2. Check whether the signal of encoder cable is twisted pair, SD+ and SD-.
3. Separate the encoder cable and the motor cable if they are bound together.
4. Connect the shield to FG.

Related Topic

List of Error Codes

9.5.2.3. Err23.0

9.5.2.3.1. Error Code

★Err23.0: ★Encoder communication data error protection

9.5.2.3.2. Cause

1. Data communication between the encoder is normal, but contents of data are not correct.
2. Mainly data error due to noise.
3. Encoder cables are connected, but communication data has some error.

9.5.2.3.3. Solution

1. Secure the power supply for the encoder of DC5V±5% (4.75~5.25V), and pay special attention when the encoder cables are long.
2. Check whether the signal of encoder cable is twisted pair, SD+ and SD-.
3. Separate the encoder cable and the motor cable if they are bound together.
4. Connect the shield to FG.

Related Topic

List of Error Codes

9.5.2.4. Err24.0

9.5.2.4.1. Error Code

Err24.0: Positional deviation excess protection

9.5.2.4.2. Cause

Deviation pulse has exceeded the value of parameter **Pr014 Position deviation excess setup**:

1. The motor movement has not followed the command.
2. The value of parameter **Pr014 Position deviation excess setup** is too small.

9.5.2.4.3. Solution

1. Check that the motor follows to the position command pulses, check that the output torque has not saturated in torque monitor, make a gain adjustment, Set parameters **Pr013 1st torque limit** and **Pr522 2nd torque limit** to maximum values, make encoder wiring as the wiring diagram, set a longer acceleration/deceleration time, and lower the load and speed.
2. Set a larger value for parameter **Pr014 Position deviation excess setup**.

Related Topic

List of Error Codes

9.5.2.5. Err24.1

9.5.2.5.1. Error Code

Err24.1: Velocity deviation excess protection

9.5.2.5.2. Cause

The difference between the internal positional command speed and actual speed (speed deviation) exceeds the value of parameter **Pr602 Velocity deviation excess setup**.

9.5.2.5.3. Solution

1. Increase the set value of **Pr602 Velocity deviation excess setup**.
2. Make the acceleration/deceleration time of internal positional command speed longer, or improve the follow-up characteristic by adjusting the gain.
3. Disable the excess speed deviation detection (Pr602 = 0).

Note: If the internal positional command speed is forcibly set to 0 due to instantaneous stop caused by the command pulse inhibit input (INH) or CW.CCW over-travel inhibition input, the speed deviation rapidly increases at this moment. The speed deviation also largely increases on the rising edge of the internal positional command speed. Therefore, **Pr602 Velocity deviation excess setup** set value should have sufficient margin.

Related Topic

List of Error Codes

9.5.2.6. Err26.0

9.5.2.6.1. Error Code

Err26.0: Over-speed protection

9.5.2.6.2. Cause

The motor rotational speed has exceeded the value of parameter **Pr513 Over-speed level setup**.

9.5.2.6.3. Solution

1. Avoid an excessive speed command.
2. Check the command pulse input frequency and division/multiplication ratio.
3. Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment.
4. Make a wiring connection of the encoder as the wiring diagram.

Related Topic

List of Error Codes

9.5.2.7. Err26.1

9.5.2.7.1. Error Code

Err26.1: 2nd over-speed protection

9.5.2.7.2. Cause

The motor rotational speed has exceeded the value of parameter **Pr615 2nd over-speed level setup**.

9.5.2.7.3. Solution

1. Avoid an excessive speed command.
2. Check the command pulse input frequency and division/multiplication ratio.
3. Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment.
4. Make a wiring connection of the encoder as the wiring diagram.

Related Topic

List of Error Codes

9.5.2.8. Err27.1

9.5.2.8.1. Error Code

Err27.1: Command pulse multiplier error protection

9.5.2.8.2. Cause

Division and multiplication ratio which are set up with the command pulse counts per single turn and the 1st and the 4th numerator/denominator of the electronic gear are not appropriate.

9.5.2.8.3. Solution

Check the values of division and multiplication ratio of the electronic gear.

Related Topic

List of Error Codes

9.5.2.9. Err28.0

9.5.2.9.1. Error Code

Err28.0: Pulse regeneration limit protection

9.5.2.9.2. Cause

The output frequency of pulse regeneration has exceeded the limit.

9.5.2.9.3. Solution

Check the values of parameters **Pr011 Output pulse counts per one motor revolution** and **Pr503 Denominator of pulse output division**.

To disable the detection, set the value of parameter **Pr533 Pulse regenerative output limit setup** to **0**.

Related Topic

List of Error Codes

9.5.2.10. Err29.0

9.5.2.10.1. Error Code

Err29.0: Deviation counter overflow protection

9.5.2.10.2. Cause

Positional deviation of encoder pulse reference has exceeded 229(536870912).

9.5.2.10.3. Solution

Check that the motor runs as per the position command pulses.

Related Topic

List of Error Codes

9.5.3. Err30 Series

9.5.3.1. Err33 Series

9.5.3.1.1. Error Code

★Err33.5: ★I/F output function number error2

9.5.3.1.2. Cause

Output signals (SO4, SO5, SO6) are assigned with undefined number.

9.5.3.1.3. Solution

Allocate correct function to each connector pin.

Related Topic

List of Error Codes

9.5.3.2. Err34.0

9.5.3.2.1. Error Code

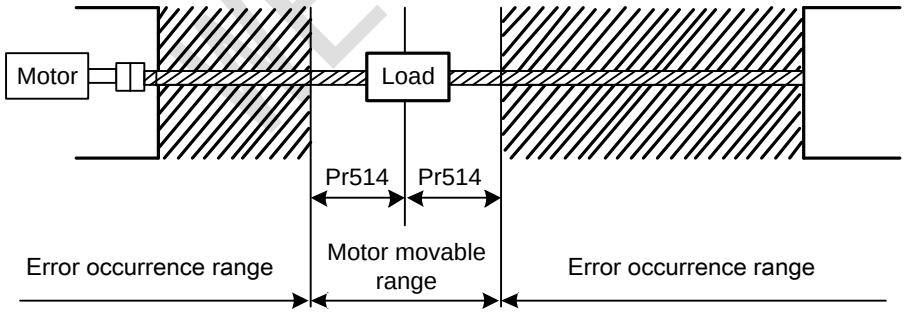
Err34.0: Software limit protection

9.5.3.2.2. Cause

With respect to the position command input range, when the motor travels exceeding the movable range which is set up by parameter **Pr514 Motor working range setup**, you can make an alarm stop of the motor with Err34.0 Software limit protection. With this function, you can prevent the work from colliding with the machine end caused by motor oscillation.

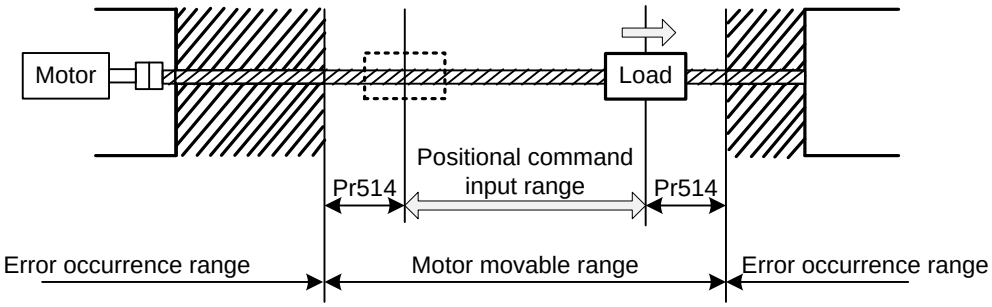
- **Applicable range**
  - Position control mode.
  - Should be in servo-on condition;
  - Input signals such as the deviation counter clear and command input inhibit, and parameters except for controls such as torque limit setup are set correctly, assuring that the motor can run smoothly.
- **Cautions**
  - This function is not a protection against the abnormal positional command.
  - When this software limit protection is activated, the motor will decelerate and stop according to parameter **Pr510 Sequence at alarm**.
  - The work (load) may collide to the machine end and be damaged depending on the load during this deceleration, therefore, set up the range of parameter **Pr514 Motor working range setup** including the deceleration movement.
- **Example of movement**
  - When no position command is entered (servo on status)

    The motor movable range will be the travel range which is set at both sides of the motor with parameter **Pr514 Motor working range setup** since no position command is input. When the load enters into **Err34.0 Software limit protection** occurrence range (oblique line range) due to oscillation, software limit protection will be activated.



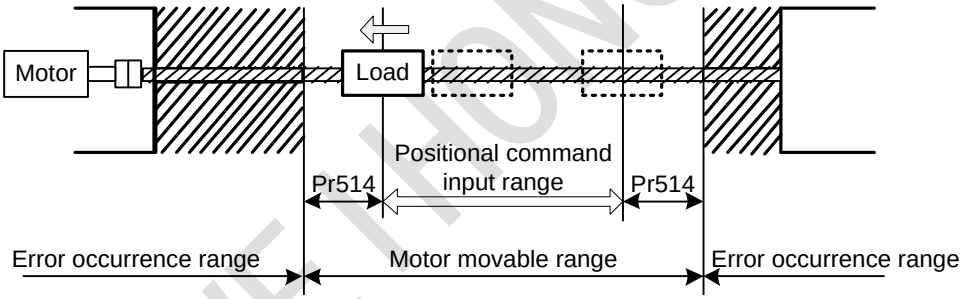
- When the load moves to the right (servo on status)

  When the position command to the right direction is input, the motor movable range will be expanded by entered position command, and the movable range will be the position command input range in both sides set by parameter **Pr514 Motor working range setup**.



- When the load moves to the left (servo on status)

  When the position command to the left direction is input, the motor movable range will be expanded further.



- **Condition under which the position command input range is cleared.**

  The position command input range will be 0-cleared under following conditions.

  - When the power is turned on.
  - While the position deviation is being cleared(Deviation counter clear is valid, and set parameter **Pr505 Sequence at over-travel inhibition** to 2 so as to make over-travel inhibition input valid.
  - At the beginning and ending of trial run during communication between servo drive and iMotion.

Related Topic

List of Error Codes

9.5.3.3. Err36 Series

9.5.3.3.1. Error Code

★Err36.0: ★EEPROM parameter error protection

★Err36.1: ★EEPROM parameter error protection

★Err36.2: ★EEPROM parameter error protection

9.5.3.3.2. Cause

Data in parameter storage area has been damaged when reading the data from EEPPOM at power-on.

9.5.3.3.3. Solution

1. Set all parameters again.
2. If the error persists, replace the servo drive (it may be a failure). And return the problem product to the manufacturer.

Related Topic

List of Error Codes

9.5.3.4. Err37 Series

9.5.3.4.1. Error Code

★Err37.0: ★EEPROM check code error protection

★Err37.1: ★EEPROM check code error protection

★Err37.2: ★EEPROM check code error protection

9.5.3.4.2. Cause

Operating to EEPROM failed when reading data from EEPROM at power-on.

9.5.3.4.3. Solution

1. Set all parameters again.
2. If the error persists, replace the servo drive (it may be a failure). And return the problem product to the manufacturer.

Related Topic

List of Error Codes

9.5.3.5. Err38.0

9.5.3.5.1. Error Code

★Err38.0: ★Over-travel inhibit protection

9.5.3.5.2. Cause

1. When the value of parameter **Pr504 Over-travel inhibit input setup** is set to **0**, both positive and negative over-travel inhibit inputs (POT /NOT) have been ON.
2. When the value of parameter **Pr504 Over-travel inhibit input setup** is set to **2**, positive or negative over-travel inhibit inputs has turned ON.

9.5.3.5.3. Solution

1. Check that there are not any errors in switches, wires or power supply which are connected to positive/negative direction over-travel inhibit input.
2. Check that the rising time of the control power supply (DC12 ～ 24V) is not slow.

Related Topic

List of Error Codes

9.5.4. Err40 Series

9.5.4.1. Err40.0

9.5.4.1.1. Error Code

★Err40.0: ★Absolute system down error protection

9.5.4.1.2. Cause

Voltage of the built-in capacitor has fallen below the specified value because the power supply or battery for the absolute encoder has been down.

9.5.4.1.3. Solution

After connecting the power supply for the battery, clear the absolute encoder.

Note: Once this error occurs, the alarm cannot be cleared until the absolute encoder is reset.

Related Topic

List of Error Codes

9.5.4.2. Err41.0

9.5.4.2.1. Error Code

★Err41.0: ★Absolute encoder count error protection

9.5.4.2.2. Cause

Multi-turn counter of the absolute encoder has exceeded the specified value.

9.5.4.2.3. Solution

1. Set the value of parameter **Pr015 Absolute encoder setup** to **2** to ignore the multi-turn counter over.
2. Limit the travel from machine origin with 32767 revolutions.

Related Topic

List of Error Codes

9.5.4.3. Err42.0

9.5.4.3.1. Error Code

Err42.0: Absolute over-speed error protection

9.5.4.3.2. Cause

The motor speed has exceeded the specified value when only the supply from the battery has been supplied during the power failure.

9.5.4.3.3. Solution

1. Check the supply voltage at the encoder side (5V±5%)
2. Check the connecting condition of the connector CN2.

Note: Once this error occurs, the alarm cannot be cleared until the absolute encoder is reset.

Related Topic

List of Error Codes

9.5.4.4. Err43.0

9.5.4.4.1. Error Code

★Err43.0: ★Encoder Initialization error failure

9.5.4.4.2. Cause

Error detected during initializing of encoder.

9.5.4.4.3. Solution

Replace the motor.

Related Topic

List of Error Codes

9.5.4.5. Err44.0

9.5.4.5.1. Error Code

★Err44.0: ★Absolute single turn counter error protection

9.5.4.5.2. Cause

Absolute encoder: single turn counter error protection.

9.5.4.5.3. Solution

Replace the motor.

Related Topic

List of Error Codes

9.5.4.6. Err45.0

9.5.4.6.1. Error Code

★Err45.0: ★Absolute multi-turn counter error protection

9.5.4.6.2. Cause

Absolute encoder: multi-turn counter error protection;

9.5.4.6.3. Solution

Replace the motor.

Related Topic

List of Error Codes

9.5.4.7. Err46.0

9.5.4.7.1. Error Code

Err46.0: Absolute overheat protection

9.5.4.7.2. Cause

Encoder temperature is too high.

9.5.4.7.3. Solution

Cool down the temperature of the environment of motor.

Related Topic

List of Error Codes

9.5.4.8. Err47.0

9.5.4.8.1. Error Code

★Err47.0: ★Absolute status error protection

9.5.4.8.2. Cause

Encoder has been running at faster speed than the specified value at power-on.

9.5.4.8.3. Solution

Avoid the motor to rotate when power is connected.

Related Topic

List of Error Codes

9.5.4.9. Err48.0

9.5.4.9.1. Error Code

★Err48.0: Encoder Z-phase error protection

9.5.4.9.2. Cause

1. Missing pulses of Z-phase serial incremental encoder has been detected.
2. The encoder might be a failure.

9.5.4.9.3. Solution

Replace the motor.

Related Topic

List of Error Codes

9.5.4.10. Err49.0

9.5.4.10.1. Error Code

★Err49.0: ★Encoder CS signal error protection

9.5.4.10.2. Cause

1. CS signal logic error of serial incremental encoder has been detected.
2. The encoder might be a failure.

9.5.4.10.3. Solution

Replace the motor.

Related Topic

List of Error Codes

9.5.5. Err50 Series

9.5.5.1. Err50.1

9.5.5.1.1. Error Code

Err50.1: External scale communication data error protection

9.5.5.1.2. Cause

Error of communication data from the external scale is mainly caused by noise.

9.5.5.1.3. Solution

Ensure the current and voltage of the external scale is DC5V±5%(4.75～5.25V), especially when the cable connecting with the external scale is long.

Related Topic

List of Error Codes

9.5.5.2. Err56.0

9.5.5.2.1. Error Code

Err56.0: ABZ incremental encoder over-speed error protection

9.5.5.2.2. Cause

Motor rotating speed exceeds the specified value.

9.5.5.2.3. Solution

Avoid extreme-speed rotation. Cut off control power and restart the servo drive.

Related Topic

List of Error Codes

9.5.5.3. Err56.1

9.5.5.3.1. Error Code

Err56.1: ABZ incremental encoder UVW error protection

9.5.5.3.2. Cause

1. Error is detected in UVW signals of incremental encoder.
2. Encoder error.

9.5.5.3.3. Solution

1. Check if there is miswiring for UVW signals of encoder.
2. Check if there is any strong disturbance source in the vicinity of encoder.

Related Topic

List of Error Codes

9.5.5.4. Err56.2

9.5.5.4.1. Error Code

Err56.2: ABZ incremental encoder ABZ error protection

9.5.5.4.2. Cause

1. Error is detected in ABZ signals of incremental encoder.
2. Encoder error.

9.5.5.4.3. Solution

3. Check if there is miswiring for ABZ signals of encoder.
4. Check if there is any strong disturbance source in the vicinity of encoder.

Related Topic

List of Error Codes

9.5.5.5. Err57.0

9.5.5.5.1. Error Code

Err57.0: Current sampling offset excess protection

9.5.5.5.2. Cause

Error is detected in current sampling chip circuit.

9.5.5.5.3. Solution

1. Cut off the power supply and re-power ON.
2. **Optional:** If the error display persists, stop using and replace with a new motor, and return to the manufacturer.

Related Topic

List of Error Codes

9.5.5.6. Err57.1

9.5.5.6.1. Error Code

★Err57.1: ★Current gain diagnosis error protection

9.5.5.6.2. Cause

Power circuit error, or motor cables U, V and W wires are disconnected.

9.5.5.6.3. Solution

1. Cut off the power supply and re-power ON.
2. **Optional:** If the error display persists, stop using and replace with a new motor. And return to the manufacturer.
3. Check U, V and W wires connection of the motor cable.

Related Topic

List of Error Codes

9.5.5.7. Err58.0

9.5.5.7.1. Error Code

★Err58.0: ★Chip working error protection

9.5.5.7.2. Cause

An error caused by power supply for the chip or noise.

9.5.5.7.3. Solution

1. Cut off the power supply and re-power ON.
2. **Optional:** If the error display persists, stop using and replace with a new motor, and return to the manufacturer.

Related Topic

List of Error Codes

9.5.5.8. Err59.0

9.5.5.8.1. Error Code

Err59.0: Registered time expired

9.5.5.8.2. Cause

Remaining usage time is insufficient.

9.5.5.8.3. Solution

1. Check the remaining usage time.
2. Contact with the distributors and manufacturers, and register again.

Related Topic

List of Error Codes

9.5.5.9. Err59.1

9.5.5.9.1. Error Code

Err59.1: Version does not match.

9.5.5.9.2. Cause

The software version No. does not match with the actual one.

9.5.5.9.3. Solution

1. Check the software version No.
2. Contact with the distributors and manufacturers.

Related Topic

List of Error Codes

9.5.6. Err60 Series

9.5.6.1. Err60.0

9.5.6.1.1. Error Code

Err60.0: M-II communication ASIC fault 1

9.5.6.1.2. Cause

The MECHATROLINK communication component of servo drive might be a failure.

9.5.6.1.3. Solution

1. Repower the servo drive.
2. **Optional:** If the alarm still exists, the servo drive might be a failure. Replace it with a new one.

Related Topic

List of Error Codes

9.5.6.2. Err61.0

9.5.6.2.1. Error Code

Err61.0: M-II communication ASIC fault 2

9.5.6.2.2. Cause

The value of MECHATROLINK communication parameter has been exceeded the specified range.

9.5.6.2.3. Solution

1. Check the value of MECHATROLINK communication parameter.
2. Change the set value to a right one.

Related Topic

List of Error Codes

9.5.6.3. Err62.0

9.5.6.3.1. Error Code

Err62.0: M-II internal synchronous error 1

9.5.6.3.2. Cause

1. The transmission cycle of MECHATROLINK has changed.
2. Servo unit might be a failure

9.5.6.3.3. Solution

1. Eliminate the causes which made the transmission cycle of host controller changed.
2. Repower the servo drive.
3. **Optional:** If the alarm still exists, the servo drive might have a failure. Replace it with a new one.

Related Topic

List of Error Codes

9.5.6.4. Err63.0

9.5.6.4.1. Error Code

Err63.0: M-II transmission cycle setup error

9.5.6.4.2. Cause

The setup of MECHATROLINK transmission cycle has been exceeded the specified range.

9.5.6.4.3. Solution

1. Check the value of MECHATROLINK transmission cycle.
2. Change the set value to a right one.

Related Topic

List of Error Codes

9.5.6.5. Err64.0

9.5.6.5.1. Error Code

Err64.0: M-II synchronous error

9.5.6.5.2. Cause

1. Update error of host controller WDT data has been occurred.
2. Servo drive might be a failure

9.5.6.5.3. Solution

1. Check the update of WDT data, and update WDT data correctly.
2. Repower the servo drive.
3. **Optional:** If the alarm still exists, the servo drive might have a failure. Replace it with a new one.

Related Topic

List of Error Codes

9.5.6.6. Err64.1

9.5.6.6.1. Error Code

Err64.1: M-II synchronous failure

9.5.6.6.2. Cause

1. When synchronous communication starts, if the update error of host controller WDT data is detected, the synchronous communication will fail.
2. Servo drive might be a failure

9.5.6.6.3. Solution

1. Check the update of WDT data, and update WDT data correctly.
2. Repower the servo drive.
3. If the alarm still exists, the servo drive might have a failure. Replace it with a new one.

Related Topic

List of Error Codes

9.5.6.7. Err65.0

9.5.6.7.1. Error Code

Err65.0: M-II communication fault (receipt error)

9.5.6.7.2. Cause

1. The wiring of MECHATROLINK is wrong.
2. The communication address of servo drive is not same with the setting of host controller.
3. Servo drive might be a failure

9.5.6.7.3. Solution

1. Correctly wire MECHATROLINK communication cables and terminal resistors.
2. Check the setting of servo drive communication address.
3. Repower the servo drive.
4. **Optional:** If the alarm still exists, the servo drive might have a failure. Replace it with a new one.

Related Topic

List of Error Codes

9.5.6.8. Err65.1

9.5.6.8.1. Error Code

Err65.1: M-II transmission cycle error (synchronous interval error)

9.5.6.8.2. Cause

1. MECHATROLINK transmission cycle has changed.
2. Servo drive might be a failure

9.5.6.8.3. Solution

1. Check the value of MECHATROLINK transmission cycle.
2. Eliminate the causes which made the transmission cycle of host controller changed.
3. Repower the servo drive.
4. **Optional:** If the alarm still exists, the servo drive might have a failure. Replace it with a new one.

Related Topic

List of Error Codes

9.5.7. Err80 Series

9.5.7.1. Err87.0

9.5.7.1.1. Error Code

Err87.0: Forced alarm input protection

9.5.7.1.2. Cause

Forced alarm input (E-STOP) is applied.

9.5.7.1.3. Solution

Check the wiring of forced alarm input (E-STOP).

Related Topic

List of Error Codes

9.5.8. Err90 Series

9.5.8.1. Err95.0~Err95.4

9.5.8.1.1. Error Code

Err95.0: Motor automatic recognition error protection

Err95.1: Motor automatic recognition error protection

Err95.2: Motor automatic recognition error protection

Err95.3: Motor automatic recognition error protection

Err95.4: Motor automatic recognition error protection

9.5.8.1.2. Cause

Err95.0: The motor and voltage specification of the servo drive does not match.

Err95.1: The motor and encoder connector of the servo drive does not match.

Err95.2: The motor and power rate of the servo drive does not match.

Err95.3: The encoder time of the motor and the servo drive does not match.

Err95.4: Reading from encoder EEPROM error.

9.5.8.1.3. Solution

Err95.0, Err95.1, Err95.2: Replace the motor which matches to the servo drive.

Err95.3: Check whether the encoder type of the motor and the value of parameter **Pr015** is correct.

Err95.4: Turn off the power once, and re-power ON. Stop using if the error persists. Replace the servo motor and the servo drive. Return the products to the manufacturer.

Related Topic

List of Error Codes

9.5.8.1.4. Err99.0

9.5.8.1.5. Error Code

★Err99.0: ★Other error

9.5.8.1.6. Cause

1. Control circuit has malfunctioned due to excess noise or other causes.
2. Some error has occurred inside of the servo drive while triggering self-diagnosis function of the servo drive.

9.5.8.1.7. Solution

1. Turn off the power once, then re-power ON.
2. Stop using the products, replace the motor and the servo drive, and return the products to the manufacturer.

Related Topic

List of Error Codes

10. Parameter

10.1. Parameter List

In the following list, modification to parameters with * will take effect after reboot; while modification to parameters without * will immediately take effect.

Para. No.	Name	Range	Unit	Default
Pr000*	Rotational direction setup	0~1	—	1
Pr001*	Control mode setup	0~3	—	1
Pr002	Real-time auto-gain tuning setup	0~6	—	0
Pr003	Real-time auto tuning mechanical stiffness setup	0~31	—	13
Pr004	Inertia ratio	0~10000	%	250
Pr008*	Command pulse counts per one motor revolution	0~8388608	pulse	0
Pr009	1st numerator of electronic gear ratio	0~1073741824	—	1
Pr010	Denominator of electronic gear ratio	1~1073741824	—	1
Pr011*	Output pulse counts per one motor revolution	1~2097152	pulse	2500
Pr012*	Reversal of pulse output logic	0~1	—	0
Pr013	1st torque limit	0~500	%	300
Pr014	Position deviation excess setup	0~1073741824	Unit-dependent	35000000
Pr015*	Absolute encoder setup	0~2	—	0
Pr016*	External regenerative resistor setup	0~3	—	0
Pr017*	Load factor of external regenerative resistor selection	0~4	—	0
Pr100	1st gain of position loop	0~30000	0.1/s	480
Pr101	1st gain of velocity loop	1~32767	0.1Hz	270
Pr102	1st time constant of velocity loop integration	1~10000	0.1ms	210

Para. No.	Name	Range	Unit	Default
Pr103	1st filter of speed detection	0~10000	0.01ms	0
Pr104	1st torque filter	0~2500	0.01ms	84
Pr105	2nd gain of position loop	0~30000	0.1/s	570
Pr106	2nd gain of velocity loop	1~32767	0.1Hz	270
Pr107	2nd time constant of velocity loop integration	1~10000	0.1ms	10000
Pr108	2nd filter of speed detection	0~10000	0.01ms	0
Pr109	2nd torque filter	0~2500	0.01ms	84
Pr110	Velocity feed forward gain	0~1000	0.001	300
Pr111	Velocity feed forward filter	0~6400	0.01ms	200
Pr112	Torque feed forward gain	0~1000	0.001	0
Pr113	Torque feed forward filter	0~6400	0.01ms	0
Pr114	2nd gain setup	0~1	—	1
Pr115	Position control switching mode	0~10	—	0
Pr116	Position control switching delay time	0~10000	0.1ms	50
Pr117	Position control switching level	0~20000	Mode-dependent	50
Pr118	Position control switching hysteresis	0~20000	Mode-dependent	33
Pr119	Position gain switching time	0~10000	0.1ms	33
Pr120	Velocity control switching mode	0~5	—	0
Pr121	Velocity control switching delay time	0~10000	0.1ms	0
Pr122	Velocity control switching level	0~20000	Mode-dependent	0
Pr123	Velocity control switching hysteresis	0~20000	Mode-dependent	0

Para. No.	Name	Range	Unit	Default
Pr124	Torque control switching mode	0~3	—	0
Pr125	Torque control switching delay time	0~10000	0.1ms	0
Pr126	Torque control switching level	0~20000	Mode-dependent	0
Pr127	Torque control switching hysteresis	0~20000	Mode-dependent	0
Pr200	Adaptive filter mode setup	0~4	—	0
Pr201	1st notch frequency	50~5000	Hz	5000
Pr202	1st notch width selection	0~20	—	2
Pr203	1st notch depth selection	0~99	—	0
Pr204	2nd notch frequency	50~5000	Hz	5000
Pr205	2nd notch width selection	0~20	—	2
Pr206	2nd notch depth selection	0~99	—	0
Pr207	3rd notch frequency	50~5000	Hz	5000
Pr208	3rd notch width selection	0~20	—	2
Pr209	3rd notch depth selection	0~99	—	0
Pr210	4th notch frequency	50~5000	Hz	5000
Pr211	4th notch width selection	0~20	—	2
Pr212	4th notch depth selection	0~99	—	0
Pr214	1st damping frequency	0~2000	0.1Hz	0
Pr215	1st damping ratio	0~500	0.001	0
Pr216	2nd damping frequency	0~2000	0.1Hz	0
Pr217	2nd damping ratio	0~500	0.001	0
Pr218	3rd damping frequency	0~2000	0.1Hz	0
Pr219	3rd damping ratio	0~500	0.001	0
Pr220	4th damping frequency	0~2000	0.1Hz	0
Pr221	4th damping ratio	0~500	0.001	0

Para. No.	Name	Range	Unit	Default
Pr222	Positional command smoothing filter	0~32767	0.1ms	0
Pr223	Positional command FIR filter	0~1000	0.1ms	0
Pr300	Switching between internal and external speed setup	0~3	—	1
Pr301	Speed command direction selection	0~1	—	0
Pr304	1st speed of speed setup	-20000 ~ 20000	r/min	0
Pr305	2nd speed of speed setup	-20000 ~ 20000	r/min	0
Pr306	3rd speed of speed setup	-20000 ~ 20000	r/min	0
Pr307	4th speed of speed setup	-20000 ~ 20000	r/min	0
Pr308	5th speed of speed setup	-20000 ~ 20000	r/min	0
Pr309	6th speed of speed setup	-20000 ~ 20000	r/min	0
Pr310	7th speed of speed setup	-20000 ~ 20000	r/min	0
Pr311	8th speed of speed setup	-20000 ~ 20000	r/min	0
Pr312	Acceleration time setup	0~10000	ms/(1000r/min)	0
Pr313	Deceleration time setup	0~10000	ms/(1000r/min)	0
Pr314	Sigmoid acceleration / deceleration time setup	0~1000	ms	0
Pr315	Speed-zero clamp function selection	0~3	—	0
Pr316	Speed-zero clamp level	10~20000	r/min	30
Pr317	Torque command selection	0~2	—	0
Pr318	Torque command direction selection	0~1	—	0
Pr321	Speed limit value 1	0~20000	r/min	0

Para. No.	Name	Range	Unit	Default
Pr322	Speed limit value 2	0~20000	r/min	0
Pr408*	SO1 output selection	0 ~ 00FFFFFFh	—	00010101h (65793)
Pr430	Positioning complete (In-position) range	0~262144	Unit-dependent	10
Pr431	Positioning complete (In-position) output setup	0~3	—	0
Pr432	INP hold time	0~30000	ms	0
Pr433	Zero-speed	10~20000	r/min	50
Pr434	Speed coincidence range	10~20000	r/min	50
Pr435	At-speed (speed arrival)	10~20000	r/min	1000
Pr436	Mechanical brake action at stalling setup	0~10000	ms	0
Pr437	Mechanical brake action at running setup	0~10000	ms	0
Pr438	Brake release speed setup	30~3000	r/min	30
Pr439	Selection 1 of alarm output	0~16	—	0
Pr440	Selection 2 of alarm output	0~16	—	0
Pr441	2nd positioning complete (In-position) range	0~262144	Command unit	800
Pr442	Linear acceleration constant in standard position mode	1~20971520	—	100
Pr443	Linear deceleration constant in standard position mode	1~20971520	—	100
Pr444	Command pulse count per revolution of machine	1 ~ 1073741823	—	4096
Pr445	Oriented position setup	0~36000	—	0
Pr446	External positioning final travel distance	-1073741823 ~ 1073741823	—	100

Para. No.	Name	Range	Unit	Default
Pr500	Numerator of 2nd electronic gear ratio	0~ 1073741824	—	0
Pr501	Numerator of 3rd electronic gear ratio	0~ 1073741824	—	0
Pr502	Numerator of 4th electronic gear ratio	0~ 1073741824	—	0
Pr503*	Denominator of pulse output division	0~8388608	—	0
Pr504*	Over-travel inhibit input setup	0~2	—	1
Pr505*	Sequence of over-travel inhibit	0~2	—	0
Pr506	Sequence at Servo-OFF	0~9	—	0
Pr507	Sequence of main power OFF	0~9	—	0
Pr508	LV trip selection at main power OFF	0~1	—	1
Pr509*	Detection time of main power OFF	70~2000	ms	70
Pr510	Sequence at alarm	0~7	—	0
Pr511	Torque setup for emergency stop	0~500	%	0
Pr512	Over-load level setup	0~500	%	0
Pr513	Over-speed level setup	0~20000	r/min	0
Pr514	Motor working range setup	0~1000	0.1 revolution	10
Pr516*	Alarm clear input setup	0~1	—	0
Pr520*	Position setup unit selection	0~1	—	0
Pr521	Selection of torque limit	0~6	—	1
Pr522	2nd torque limit	0~500	%	500
Pr523	Torque limit switching setup 1	0~4000	ms/100%	0
Pr524	Torque limit switching setup 2	0~4000	ms/100%	0
Pr525	Positive direction torque limit at external input	0~500	%	500

Para. No.	Name	Range	Unit	Default
Pr526	Negative direction torque limit at external input	0~500	%	500
Pr528*	LED initial status	0~36	—	1
Pr533*	Pulse regenerative output limit setup	0~1	—	0
Pr535*	Lock front panel setup	0~1	—	0
Pr601	Torque command setup	-500~500	%	0
Pr602	Velocity deviation excess setup	0~100	r/min	0
Pr604	JOG trial run command speed	0~500	r/min	300
Pr607	Torque command additional value	-100~100	%	0
Pr608	Positive direction torque compensation value	-100~100	%	0
Pr609	Negative direction torque compensation value	-100~100	%	0
Pr611	Current response setup	20~500	%	100
Pr612	Positive/negative torque compensation filter	0~30000	0.01ms	0
Pr615	2nd over-speed level setup	0~20000	r/min	0
Pr623	Disturbance torque compensating gain	-100~100	%	0
Pr624	Disturbance observer filter	0~2500	0.01ms	2000
Pr627*	Alarm latch time selection	0~10	s	5
Pr628	Auto resonance detection level	30~1000	%	100
Pr630	Damping filter ON/OFF switch	0~2	—	0
Pr632	Real-time auto-tuning customer setup	-32767 ~32767	—	0
Pr633	Friction compensation valid speed setup	0~1000	0.1r/min	0

Para. No.	Name	Range	Unit	Default
Pr638*	Alarm mask setup	-32768 ~32767	—	0
Pr640	Absolute origin position offset	-1073741823 ~ 1073741823	Command unit	0
Pr641	1st anti-vibration depth	0~1000	—	0
Pr642	Two-stage torque filter time constant	0~2500	—	0
Pr643	Two-stage torque filter attenuation term	0~1000	—	1000
Pr647	Exclusive for manufacturer	0~15	—	0
Pr648	Exclusive for manufacturer	0~2000	—	0
Pr649	Exclusive for manufacturer	0~99	—	0
Pr650	Viscous friction compensation gain	0~10000	—	0
Pr651	Immediate cessation completion wait time	0~10000	ms	0
Pr660	Internal use	-32767 ~ 32767	—	0

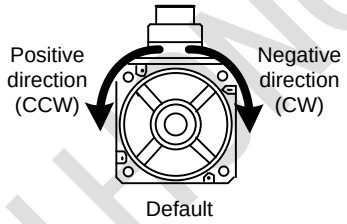
10.2. 【Class 0】Basic Setting

For parameters whose No. have a suffix of "*", changed contents will be validated when you turn on the control power; for parameters whose No. have no suffix of "*", changed contents will be validated immediately.

Pr000*	Name	Range	Unit	Default	Related Control Mode		
	Rotational direction setup	0~1	—	1	P	S	T

Description

- Specify the relationship between the direction of command and direction of motor rotation.
- 0: when positive direction command is received, motor turns in CW, which can be viewed from load side shaft end.
- 1: when positive direction command is received, motor turns in CCW, which can be viewed from load side shaft end.



Set Value	Command Direction	Motor Rotational Direction	Positive Direction Over-travel Inhibition Input	Negative Direction Over-travel Inhibition Input
0	Positive	CW	Valid	—
	Negative	CCW	—	Valid
1	Positive	CCW	Valid	—
	Negative	CW	—	Valid

Pr001*	Name	Range	Unit	Default	Related Control Mode		
	Control mode setup	0~3	—	1	P	S	T

Description

- Specify the control mode.

Set Value	Content
0	Invalid
1	Position control
2	Velocity control
3	Torque control

Pr002	Name	Range	Unit	Default	Related Control Mode		
	Real-time auto-gain tuning setup	0~6	—	0	P	S	T

Description

- Set the control mode for auto adjustment.

Set Value	Mode	Variation Degree of Load Inertia in Motion
0	Invalid	Real-time auto-gaining function is invalid.
1	Standard	Basic mode, which emphasizes stability. In this mode, changeable load, friction compensation and gain-switching cannot be used.
2	Positioning*1	This mode is mainly applied in positioning. It is suggested to use this mode on equipment with no unbalanced horizontal axis, ball screw driving equipment with low friction, etc.
3	Vertical axis*2	With additional feature of the positioning mode, use this mode to positively and effectively compensate for unbalanced load to the vertical axis or minimize variations in setting time.
4	Friction compensation *3	With additional feature of the vertical axis mode, use this mode to positively and effectively reduce positioning setting time when the belt driving axis has high friction.
5	Load characteristic measurement	Estimate the load characteristics without changing current parameter setting. This mode requires use of the setup support software.
6	Customize*4	Functions of real-time auto-gain tuning can be customized to meet the requirements of the specific application by combining desired functions according to parameter **Pr632 Real-time auto-gain tuning custom setting**.

*1: Velocity and torque control modes are the same as in the standard mode.

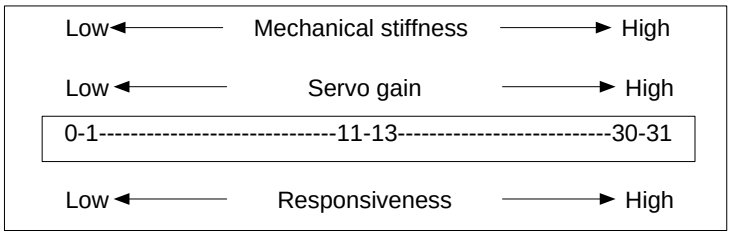
*2: Torque control is the same as in the standard mode.

*3: Velocity control is the same as in the vertical axis mode. Torque control is the same as in the standard mode.

*4: Certain function (s) is not available in a specific control mode. See parameter **Pr632 Real-time auto-gain tuning custom setting** for details.

Pr003	Name	Range	Unit	Default	Related Control Mode		
	Setting of machine stiffness at real-time auto-gain tuning	0~31	—	13	P	S	T

Mechanical stiffness setup with real time auto-gain tuning enabled



CAUTION

The greater the set value is, the higher velocity response and servo stiffness will be obtained. However, when increasing the value, check the resulting operation to avoid oscillation or vibration.

Pr004	Name	Range	Unit	Default	Related Control Mode		
	Inertia ratio	0~10000	%	250	P	S	T

Description

- Specify inertia ratio.
- Specify the ratio of the load inertia against the rotor (of the motor) inertia.

$$Pr004 = \frac{\text{Load inertia}}{\text{Rotor inertia}} \times 100\ [\%]$$

- The inertia ratio will be estimated at all time while the real-time auto-gain tuning is valid, and its result will be saved to EEPROM every 30 minutes.

CAUTION

If the inertia ratio is correctly set, the setup unit of parameters i **Pr101 1st gain of velocity loop** and **Pr106 2nd gain of velocity loop** is Hz.
When the inertia ratio of Pr004 is larger than the actual, the setup unit of the velocity loop gain becomes larger, and when the value of parameter **Pr004 Inertia ratio** is smaller than the actual, the setup unit of the velocity loop gain becomes smaller.

	Name	Range	Unit	Default	Related Control Mode		
Pr008*	Command pulse counts per motor revolution	0~8388608	pulse	0	P	S	T

Description

- Specify the command pulse that is caused by single turn of the motor shaft.
- When this parameter is set to 0, parameters **Pr009 1st numerator of electronic gear** and **Pr010 Denominator of electronic gear** are valid.

	Name	Range	Unit	Default	Related Control Mode		
Pr009	1st numerator of electronic gear	0~1073741824	—	1	P	S	T

Description

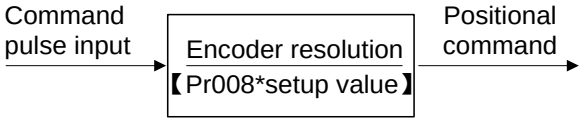
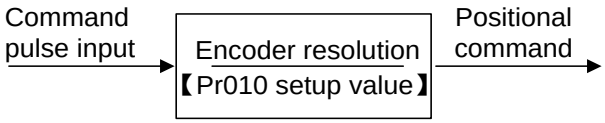
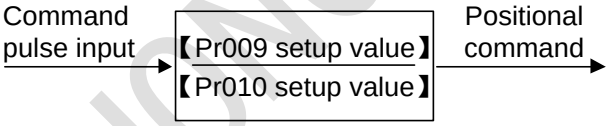
- Specify the numerator of division/multiplication operation for the command pulse input.
- Parameter **Pr008 Command pulse counts per motor revolution** is valid when it is set to 0.
- When this parameter is set to 0, the encoder resolution will be specified as the numerator.

	Name	Range	Unit	Default	Related Control Mode		
Pr010	Denominator of electronic gear	1 ~ 1073741824	—	1	P	S	T

Description

- Specify the denominator of division/multiplication operation for the command pulse input.
- Parameter **Pr008 Command pulse counts per motor revolution** is valid when it is set to 0.

Interrelationship among **Pr008 Command pulse counts per motor revolution**, **Pr009 1st numerator of electronic gear** and **Pr010 Denominator of electronic gear.**

Pr008	Pr009	Pr010	Comment
1~2^{20}	— (No effect)	— (No effect)	 Regardless of setup of **Pr009 1st numerator of electronic gear** and **Pr010 Denominator of electronic gear**, this operation is processed according to the set value of Pr008.
0	0	1~2^{30}	 When both **Pr008 Command pulse counts per motor revolution** and **Pr009 1st numerator of electronic gear** are set to 0, this operation is processed according to the set value of **Pr010 Denominator of electronic gear**.
	1~2^{30}	1~2^{30}	 When set value of **Pr008 Command pulse counts per motor revolution** is 0, and **Pr009 1st numerator of electronic gear**≠0, this operation is processed according to the set value of **Pr009 1st numerator of electronic gear** and **Pr010 Denominator of electronic gear**.

Pr011*	Name	Range	Unit	Default	Related Control Mode		
	Output pulse counts per one motor revolution	1 ~ 2097152	pulse	2500	P	S	T

Description

- Specify the output pulse counts per one motor revolution for each OA and OB with the set value of parameter **Pr011 Output pulse counts per one motor revolution**.
- Therefore, 4 times of pulse output resolution will be:

  Pulse output resolution per one motor revolution= **Pr011 Output pulse counts per one motor revolution**×4

	Name	Range	Unit	Default	Related Control Mode		
Pr503*	Denominator of pulse output division	0 ~ 8388608	—	0	P	S	T

Description

- If the number of output pulses per motor revolution is not an integer, set this parameter to a value other than 0, dividing ratio can be set by using **Pr011 Output pulse counts per one motor revolution** as the numerator and **Pr503 Denominator of pulse output division** as the denominator. Therefore, the upper end counts the pulse number by 4 times, as shown below:

$$\text{Output pulse counts per one revolution} = \frac{\text{【Pr011 set value】}}{\text{【Pr503 set value】}} \times \text{Encoder resolution}$$

	Name	Range	Unit	Default	Related Control Mode		
Pr013	1st torque limit	0~500	%	300	P	S	T

Description

- Specify the limit value of the motor output torque.

	Name	Range	Unit	Default	Related Control Mode		
Pr014	Position deviation excess setup	0 ~ 1073741824	Command unit	35000000	P	S	T

Description

- Specify excess range of positional deviation by the command unit (default).
- You can set parameter unit and deviation calculation method by setting parameter i **Pr520 Position setup unit selection**.
- Err24.0 Error detection of position deviation excess is invalid when you set the parameter to 0.

Pr015*	Name	Range	Unit	Default	Related Control Mode		
	Absolute encoder setup	0~2	—	0	P	S	T

Description

- Specify the using method of 17/23-bit absolute encoder.

Set Value	Function
0	Use as an absolute encoder.
1	Use as an incremental encoder.
2	Use as an absolute encoder, but ignore the multi-turn counter over.

	Name	Range	Unit	Default	Related Control Mode		
Pr016*	External regenerative resistor setup	0~3	—	0	P	S	T

Description

- With this parameter, you can select either to use the built-in regenerative resistor of the servo drive, or to separate this built-in regenerative resistor and externally install the regenerative resistor, and etc. See table below for details:

Set Value	Regenerative Resistor to Be Used	Function
0	Built-in resistor	Regenerative processing circuit will be activated and regenerative resistor overload protection will be triggered according to the built-in resistor (approx. 1% duty).
1	External resistor	The servo drive trips due to Err18.0 Regeneration over-load protection, when regenerative processing circuit is activated and its active ratio exceeds 10%.
2	External resistor	Exclusively used by manufacturers (setup is prohibited).
3	No resistor	Both regenerative processing circuit and regenerative protection are not activated, and built-in capacitor handles all regenerative power.

WARNING

1. Install an external protection such as thermal fuse when you use the external regenerative resistor. Otherwise, the regenerative resistor might be heated up abnormally and result in burnout, regardless of validation or invalidation of regenerative over-load protection.
2. Default set value for servo drive without built-in resistor is 3, and that of the servo drive with built-in resistor is 0.
3. When you use the built-in regenerative resistor, never to set up other value than 0.
4. Don't touch the external regenerative resistor.
5. External regenerative resistor gets very hot, and might cause burning

Pr017*	Name	Range	Unit	Default	Related Control Mode		
	Load factor of external regenerative resistor selection	0~4	—	0	P	S	T

Description

- When selecting the external regenerative resistor (**Pr016 External regenerative resistor setup** =1, 2), set according to the resistor parameter and power model.

Set Value	Application Range
0	Set when external resistor is about 40 Ω and 200W (for 400W model)
1	Set when external resistor is about 40 Ω and 400W (for 750W model)
2	Set when external resistor is about 30 Ω and 500W (for 1kW model)
3	Set when external resistor is about 20 Ω and 800W (for 1.5kW model)

10.3. 【Class 1】Gain Adjustment

For parameters whose No. have a suffix of "*", changed contents will be validated when you turn on the control power; for parameters whose No. have no suffix of "*", changed contents will be validated immediately.

Pr100	Name	Range	Unit	Default	Related Control Mode		
	1st gain of position loop	0~30000	0.1/S	320	P	S	T

Description

- Specify the response of the positional control system.
- Higher the gain of position loop you set, faster the positioning time you can obtain. Note that too high set value may cause oscillation.

Pr101	Name	Range	Unit	Default	Related Control Mode		
	1st gain of velocity loop	1~32767	0.1Hz	180	P	S	T

Description

- Specify the response of the velocity loop.
- In order to increase the response of overall servo system by setting high position loop gain, you need set the velocity loop gain greater as well. However, too great set value may cause oscillation.

Pr102	Name	Range	Unit	Default	Related Control Mode		
	1st time constant of velocity loop integration	1 ~ 10000	0.1ms	310	P	S	T

Description

- Specify the integration time constant of velocity loop.
- The smaller the set value, the faster you can dog-in deviation at stall to 0.
- The integration will be maintained by setting to “9999”. The integration effect will be lost by setting to “10000”.

Pr103	Name	Range	Unit	Default	Related Control Mode		
	1st filter of speed detection	0~10000	0.01ms	0	P	S	T

Description

- The greater the set value, the greater the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow.
- Use with a default value of 0 in normal operation.

Pr104	Name	Range	Unit	Default	Related Control Mode		
	1st time constant of torque filter	0~2500	0.01ms	126	P	S	T

Description

- Specify the time constant of the 1st delay filter inserted in the torque command portion.
- You might expect suppression of oscillation caused by distortion resonance.

	Name	Range	Unit	Default	Related Control Mode		
Pr105	2nd gain of position loop	0~30000	0.1/s	380	P	S	T
Pr106	2nd gain of velocity loop	1~32767	0.1Hz	180	P	S	T
Pr107	2nd time constant of velocity loop integration	1~10000	0.1ms	10000	P	S	T
Pr108	2nd filter of speed detection	0~10000	0.01ms	0	P	S	T
Pr109	2nd time constant of torque filter	0~2500	0.01ms	126	P	S	T

Description

- Position loop, velocity loop, velocity loop detection filter and torque filter have their 2 pairs of gain or time constant (1st and 2nd).
- Function and content of 1st is the same with that of 2nd. Generally, 1st gain is specified as default setting, you can manually adjust the parameters of 1 gain. For details of switching the 1st and 2nd gain or time constant, refer to related content in chapter 7.

	Name	Range	Unit	Default	Related Control Mode		
Pr110	Velocity feed forward gain	0~1000	0.1%	300	P	S	T

Description

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

Pr111	Name	Range	Unit	Default	Related Control Mode		
	Velocity feed forward filter	0~6400	0.01 ms	200	P	S	T

Description

- Specify the time constant of 1st delay filter which affects the input of velocity feed forward.
- For example: the velocity feed forward will become effective as the velocity feed forward gain is gradually increased with the velocity feed forward filter set at approx. 50 (0.5ms). The positional deviation during operation at a constant velocity is reduced as shown in following equation in proportion to the value of velocity feed forward gain.

$$\text{Positional deviation[unit of command]} = \frac{\text{Command speed[unit of command/S]}}{\text{Positional loop gian[1/S]}} \times \frac{\text{100-velocity feed forward gain[\%]}}{100}$$

Pr112	Name	Range	Unit	Default	Related Control Mode		
	Torque feed forward gain	0~1000	0.1%	0	P	S	T

Description

- Multiply the torque command which is calculated according to the velocity control command by the ratio of this parameter and add the result to the torque command resulting from the velocity control process.
- Positional deviation can be minimized close to 0 by increasing the torque forward gain while driving in trapezoidal speed pattern under ideal condition where disturbance torque is not active.

Pr113	Name	Range	Unit	Default	Related Control Mode		
	Torque feed forward filter	0~6400	0.01ms	0	P	S	T

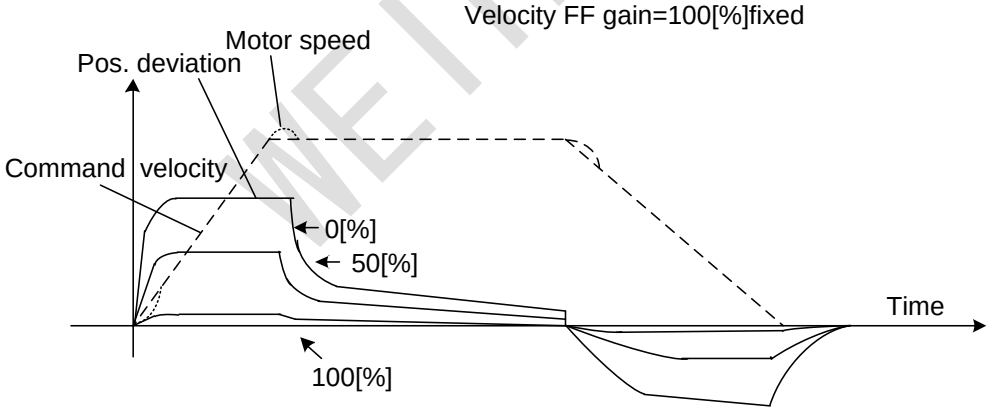
Description

- Specify the time constant of 1st delay filter which affects the input of torque feed forward.
- The torque feed forward will become effective as the torque feed forward gain is gradually increased with the torque feed forward filter is set at approx. 50 (0.5ms).
- Similar to velocity feed forward, if the time constant of torque feed forward filter is increased, the position deviation of acceleration point will be larger.

For example:

1) To use the torque feed forward, correctly set the inertia ratio. Use the value that was determined at the start of the real time auto tuning, or set the inertia ratio that can be calculated from the machine specification to parameter in 【Class 0】Basic Setting **Pr004 Inertia ratio**.

2) The torque feed forward will become effective as the torque feed forward gain is gradually increased with the torque feed forward filter is set at approx. 50 (0.5ms).



3) Positional deviation can be minimized to close to 0 by increasing torque feed forward gain while driving in trapezoidal speed pattern under ideal condition where disturbance torque is not active.

CAUTION

Zero positional deviation is impossible in actual situation because of disturbance toque.

Pr114	Name	Range	Unit	Default	Related Control Mode		
	2nd gain setup	0~1	—	1	P	S	T

Description

- By using the gain switching function, arrange this parameter when performing optimal adjustment.

Set Value	Gain Selection/Switching
0	1st gain is fixed at a value. By using the gain switching input (GAIN), change the velocity loop operation from PI to /P. GAIN input photo coupler OFF→PI operation GAIN input photo coupler ON→P operation *The above description applies when the logical setting of GAIN input is a-contact. OFF/ON of photo coupler is reversed when b-contact.
1	Enable gain switching of 1st gain (**Pr100~Pr104**) and 2nd gain (**Pr105~Pr109**).

- For switching condition of the 1st and the 2nd, see Switching the Gain for details.

Pr115	Name	Range	Unit	Default	Related Control Mode		
	Mode of position control switching	0~10	—	0	P	S	T

Description

- Specify the triggering condition of gain switching for position control.

Set Value	Switching Condition	Gain Switching Condition
0	Fixed to 1st gain	Fixed to the 1st gain (**Pr100~Pr104**).
1	Fixed to 2nd gain	Fixed to the 2nd gain (**Pr105~Pr109**).
2	With gain switching input	(1) 1st gain when the gain switching input (GAIN) is open. (2) 2nd gain when the gain switching input (GAIN) is connected to COM-. (3) If no input signal is allocated to the gain switching input (GAIN), the 1st gain is fixed.

Set Value	Switching Condition	Gain Switching Condition
3	Torque command is large	(1) Shift to the 2nd gain when the absolute value of the torque command exceeded (level+hysteresis) [%] previously with the 1st gain. (2) Return to the 1st gain when the absolute value of the torque command was kept below (level+hysteresis) [%] previously during delay time with the 2nd gain.
4	Speed command change is large	(1) Only valid for velocity control. (2) Shift to the 2nd gain when the absolute value of the speed command exceeded (level+hysteresis) [10r/min/s] previously with the 1st gain. (3) Return to the 1st gain when the absolute value of the speed command was kept below (level+hysteresis) [10r/min/s] previously during delay time with the 2nd gain. (4) For others except velocity control, fixed at 1st Gain.
5	Speed command is large	(1) Valid for position and velocity control. (2) Shift to the 2nd gain when the absolute value of the speed command exceeded (level+hysteresis) [r/min] previously with the 1st gain. (3) Return to the 1st gain when the absolute value of the speed command kept below (level+hysteresis) [r/min] previously during delay time with the 2nd gain.
6	Positional deviation is large	(1) Valid for position control. (2) Shift to the 2nd gain when absolute value of the positional deviation exceeded (level+hysteresis) [pulse] previously with the 1st gain. (3) Return to the 1st gain when the absolute value of the positional deviation was kept below (level+hysteresis) [pulse] previously over delay time with the 2nd gain. (4) Unit of level and hysteresis [pulse] is set as the encoder resolution for positional control.

Set Value	Switching Condition	Gain Switching Condition
7	With position command	(1) Valid for position control. (2) Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. (3) Return to the 1st gain when the positional command was kept 0 previously during delay time with the 2nd gain.
8	Positioning not completed	(1) Valid for position control. (2) Shift to the 2nd gain when the positioning was not completed previously with the 1st gain. (3) Return to the 1st gain when the positioning was kept in completed condition previously during delay time with the 2nd gain.
9	Actual speed is large	(1) Valid for position control. (2) Shift to the 2nd gain when the absolute value of the actual speed exceeded (level+hysteresis) [r/min] previously with the 1st gain. (3) Return to the 1st gain when the absolute value of the actual speed was kept below (level+hysteresis) [r/min] previously during delay time with the 2nd gain.
10	Position command exists + Actual speed	(1) Valid for position control. (2) Shift to the 2nd gain when the positional command was not 0 previously with the 1st gain. (3) Return to the 1st gain when the positional command was kept at 0 during the delay time and the absolute value of actual speed was kept below (level+hysteresis) [r/min] previously with the 2nd gain.

	Name	Range	Unit	Default	Related Control Mode		
Pr116	Delay time of position control switching	0~10000	0.1ms	50	P	S	T

Description

- For position control, if parameter **Pr115 Mode of position control switching** is set to 3, 5, 6, 7, 8, 9 or 10, when shifting from the 2nd gain to the 1st gain, set up the delay time from trigger detection to the switching operation.

	Name	Range	Unit	Default	Related Control Mode		
Pr117	Level of position control switching	0~20000	Mode dependent	50	P	S	T

Description

- For position control, set up triggering level when **Pr115 Mode of position control switching** is set at 3, 5, 6, 9, and 10.
- Unit of setting varies with switching mode.

CAUTION

Please set the level equal to or higher than the hysteresis.

	Name	Range	Unit	Default	Related Control Mode		
Pr118	Hysteresis at position control switching	0~20000	Mode dependent	33	P	S	T

Description:

- For position control, set up triggering hysteresis when **Pr115 Mode of position control switching** is set at 3, 5, 6, 9, and 10.
- Unit of setting varies with switching mode.

CAUTION

When level< hysteresis, the hysteresis is internally adjusted so that it is equal to level.

Pr119	Name	Range	Unit	Default	Related Control Mode		
	Position gain switching time	0~10000	0.1ms	33	P	S	T

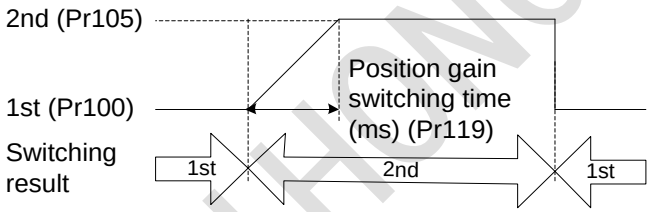
Description

- For position controlling, if the difference between **Pr100 1st gain of position loop** and **Pr105 2nd gain of position loop** is large, the increasing rate of position loop gain can be limited by this parameter.
- Position gain switching time:

  When using position control, gain of position loop rapidly changes, causing torque change and vibration. By adjusting **Pr119 Position gain switching time**, increasing rate of the position loop gain can be decreased and vibration level can be reduced.

CAUTION

Setting of the parameter does not affect the gain switching time when the gain of position loop is switched to lower level (gain is switched immediately).



Pr120	Name	Range	Unit	Default	Related Control Mode		
	Mode of velocity control switching	0~5	—	0	P	S	T

Description

- For velocity control mode, set the condition to trigger gain switching.

Set Value	Switching Condition
0	Fixed to the 1st gain
1	Fixed to the 2nd gain
2	Gain switching input
3	Torque command
4	Speed command variation is large
5	Speed command is large

	Name	Range	Unit	Default	Related Control Mode		
Pr121	Delay time of velocity control switching	0~10000	0.1ms	0	P	S	T

Description

- For velocity control mode, when shifting from the 2nd gain to the 1st gain with **Pr120 Mode of velocity control switching** set to 3, 4 or 5, set the delay time from trigger detection to the switching operation.

	Name	Range	Unit	Default	Related Control Mode		
Pr122	Level of velocity control switching	0~20000	Mode-dependent	0	P	S	T

Description

- For velocity controlling, set up triggering level when **Pr120 Mode of velocity control switching** is set to 3, 4 or 5. Unit of setting varies with switching mode.

CAUTION

Please set the level equal to or higher than the hysteresis.

	Name	Range	Unit	Default	Related Control Mode		
Pr123	Hysteresis at velocity control switching	0~20000	Mode dependent	0	P	S	T

Description

- For velocity controlling, set up triggering hysteresis when **Pr120 Mode of velocity control switching** is set to 3, 4 or 5. Unit of setting varies with switching mode.

CAUTION

When level < hysteresis, the hysteresis is internally adjusted so it is equal to level.

Pr124	Name	Range	Unit	Default	Related Control Mode		
	Mode of torque control switching	0~3	—	0	P	S	T

Description

- For torque controlling, set the condition to trigger gain switching.

Set Value	Gain Switching Condition
0	Fixed to the 1st gain
1	Fixed to 2nd gain
2	Use gain switching input
3	Torque command

Pr125	Name	Range	Unit	Default	Related Control Mode		
	Delay time of torque control switching	0~10000	0.1ms	0	P	S	T

Description

- For torque controlling, when shifting from the 2nd gain to the 1st gain with **Pr124 Mode of torque control switching** set to 3, set up the delay time from trigger detection to the switching operation.

Pr126	Name	Range	Unit	Default	Related Control Mode		
	Level of torque control switching	0~20000	Mode dependent	0	P	S	T

Description

- For torque controlling, set up triggering level when **Pr124 Mode of torque control switching** is set to 3. Unit varies depending on the setup of mode of control switching.

CAUTION

Please set the level equal to or higher than the hysteresis.

	Name	Range	Unit	Default	Related Control Mode		
Pr127	Hysteresis at torque control switching	0~20000	Mode dependent	0	P	S	T

Description

- For torque controlling, set up triggering hysteresis when **Pr124 Mode of torque control switching** is set to 3. Unit of setting varies with switching mode.

CAUTION

When level < hysteresis, the hysteresis is internally adjusted so that it is equal to level.

10.4.【Class 2】Damping Control

For parameters whose No. have a suffix of "*", changed contents will be validated when you turn on the control power; for parameters whose No. have no suffix of "*", changed contents will be validated immediately.

Pr200	Name	Range	Unit	Default	Related Control Mode		
	Adaptive filter mode setup	0~4	—	0	P	S	T

Description

- Specify the resonance frequency to be estimated by the adaptive filter and specify the operation after estimation.

Set Value	Content	
0	Adaptive filter: invalid	Parameters related to the 3rd and 4th notch filter hold the current value.
1	Adaptive filter: 1 filter is valid	One adaptive filter is enabled. Parameters related to the 3rd notch filter will be updated based on adaptive performance.
2	Adaptive filter: 2 filter are valid	Two adaptive filters are enabled. Parameters related to the 3rd will be updated based on adaptive performance, while the parameters related to 4th notch filter should be set based on the 2nd resonance point read from the "FFT analysis" oscillgram generated by iMotion software.
3	Resonance frequency measurement mode	Measure the resonance frequency. Result of measurement can be checked with "iMotion". Parameters related to 3rd and 4th notch filter hold the current value.
4	Clear result of adaptation	Parameters related to the 3rd and 4th notch filter are disabled and results of adaptive operation are cleared.

Pr201	Name	Range	Unit	Default	Related Control Mode		
	1st notch frequency	50~5000	Hz	5000	P	S	T

Description

- Specify the frequency of the 1st notch filter.

CAUTION

The notch filter function will be invalid when his parameter is set to "5000".

Pr202	Name	Range	Unit	Default	Related Control Mode		
	1st notch width selection	0~20	—	2	P	S	T

Description

- Specify the width of notch at the frequency of the 1st notch filter.

CAUTION

The higher the set value, the larger the notch width you can obtain. Use with default setup in normal operation.

Pr203	Name	Range	Unit	Default	Related Control Mode		
	1st notch depth selection	0~99	—	0	P	S	T

Description

- Specify the depth of notch at the frequency of the 1st notch filter.

CAUTION

The higher the set value, the shallower the notch depth and smaller the phase delay you can obtain.

Pr204	Name	Range	Unit	Default	Related Control Mode		
	2nd notch frequency	50~5000	Hz	5000	P	S	T

Description

- Specify the center frequency of the 2nd notch filter.

CAUTION

The notch filter function will be invalid when this parameter is set to "5000".

Pr205	Name	Range	Unit	Default	Related Control Mode		
	2nd notch width selection	0~20	—	2	P	S	T

Description

- Specify the width of notch at the center frequency of the 2nd notch filter.

CAUTION

Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

Pr206	Name	Range	Unit	Default	Related Control Mode		
	2nd notch depth selection	0~99	—	0	P	S	T

Description

- Specify the depth of notch at the center frequency of the 2nd notch filter.

CAUTION

Higher the set value, shallower the notch depth and smaller the phase delay you can obtain.

Pr207	Name	Range	Unit	Default	Related Control Mode		
	3rd notch frequency	50~5000	Hz	5000	P	S	T

Description

- Specify the frequency of the 3rd notch filter.

CAUTION

The notch filter function will be invalid when this parameter is set to “5000”.

Pr208	Name	Range	Unit	Default	Related Control Mode		
	3rd notch width selection	0~20	—	2	P	S	T

Description

- Specify the width of notch at the center frequency of the 3rd notch filter.

CAUTION

The higher the set value, larger the notch width you can obtain. Use with the default setup in normal operation.

Pr209	Name	Range	Unit	Default	Related Control Mode		
	3rd notch depth selection	0~99	—	0	P	S	T

Description

- Specify the depth of notch at the center frequency of the 3rd notch filter.

CAUTION

The higher the set value, shallower the notch depth and smaller the phase delay you can obtain.

Pr210	Name	Range	Unit	Default	Related Control Mode		
	4th notch frequency	50~5000	Hz	5000	P	S	T

Description

- Specify the frequency of the 4th notch filter.

CAUTION

The notch filter function will be invalid when this parameter is set to 5000.

Pr211	Name	Range	Unit	Default	Related Control Mode		
	4th notch width selection	0~20	—	2	P	S	T

Description

- Specify the width of the notch at the center frequency of 4th notch filter.

CAUTION

The higher the set value, larger the notch width you can obtain. Use with default setup in normal operation.

Pr212	Name	Range	Unit	Default	Related Control Mode		
	4th notch depth selection	0~99	—	0	P	S	T

Description

- Specify the depth of notch at the center frequency of the 4th notch filter.

CAUTION

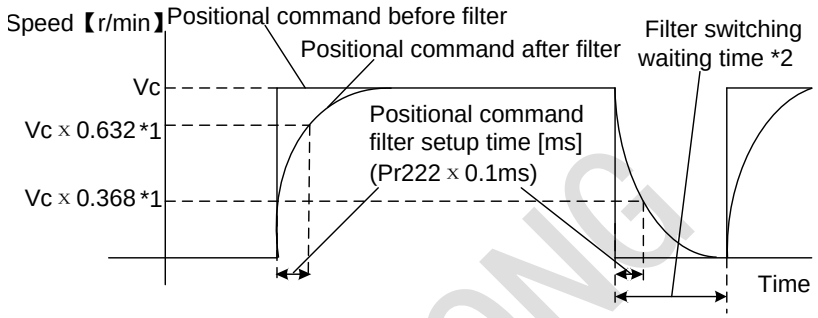
The greater the set value, the shallower the notch depth and smaller the phase delay you can obtain.

	Name	Range	Unit	Default	Related Control Mode		
Pr214	1st damping frequency	0~2000	0.1Hz	0	P	S	T
Pr215	1st damping ratio	0~500	0.001	0	P	S	T
Pr216	2nd damping frequency	0~2000	0.1Hz	0	P	S	T
Pr217	2nd damping ratio	0~500	0.001	0	P	S	T
Pr218	3rd damping frequency	0~2000	0.1Hz	0	P	S	T
Pr219	3rd damping ratio	0~500	0.001	0	P	S	T
Pr220	4th damping frequency	0~2000	0.1Hz	0	P	S	T
Pr221	4th damping ratio	0~500	0.001	0	P	S	T

	Name	Range	Unit	Default	Related Control Mode		
Pr222	Positional command smoothing filter	0~32767	0.1ms	0	P	S	T

Description

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



*1: Actual filter time constant (set value×0.1ms) has the maximum absolute error of 0.2ms for a time constant below 100ms and the maximum relative error of 0.1% for a time constant 20ms or more.

*2: Switching of **Pr222 Positional command smoothing filter** is performed, as the command pulse within each control cycle is changed from 0 to a value other than 0 and the positioning complete is being output.

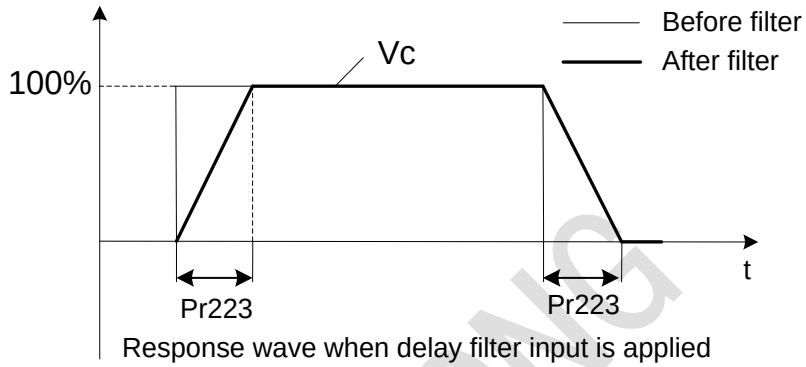
Note: If the time constant is decreased and positioning completer range is increased, and a many number of pulses are accumulated in the filter (the area equivalent of "value of positional command filter-value of positional command after filter" integrated over the time), at the time of switching, these pulses are discharged at a higher rate, causing the motor to return to the previous position-the motor runs at a speed higher than the command speed for a short time.

*3: Even if **Pr222 Positional command smoothing filter** is changed, it is not applied immediately. If the switching as described in *2 occurs during this delay time, the change of **Pr222 Positional command smoothing filter** will be suspended.

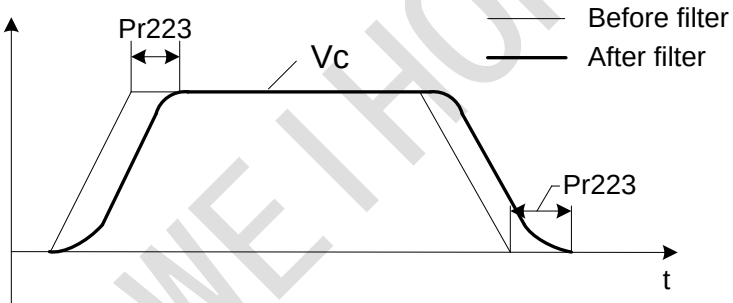
Pr223	Name	Range	Unit	Default	Related Control Mode		
	Positional command FIR filter	0~1000	0.1ms	0	P	S	T

Description

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



Response wave when delay filter input is applied



Response wave when trapezoidal command input is applied

10.5.【Class 3】Velocity/Torque Control

For parameters whose No. have a suffix of "*", changed contents will be validated when you turn on the control power; for parameters whose No. have no suffix of "*", changed contents will be validated immediately.

	Name	Range	Unit	Default	Related Control Mode		
Pr300	Speed setup, Internal/External switching	0~3	—	0	P	S	T

- Please check the servo drive model because some models do not support analog input.

Set Value	Speed Setting Method
0	Analog speed command(SPR)
1	Internal speed command 1st ~ 4th speed (Pr304~Pr307)
2	Analog speed command(SPR) Internal speed command 1st ~ 3rd speed (Pr304~Pr306)
3	Internal speed command 1st ~ 8th speed (Pr304~Pr311)

- Relationship among **Pr300 Speed setup, Internal/External switching** and the internal command speed selection 1~3 (INTSPD1~3), and selection of speed command is as follows:

Set Value	Selection 1 of Internal Command Speed (INTSPD1)	Selection 2 of Internal Command Speed (INTSPD2)	Selection 3 of Internal Command Speed (INTSPD3)	Selection of Speed Command
1	OFF	OFF	No effect	1st
	ON	OFF		2nd
	OFF	ON		3rd
	ON	ON		4th
2	OFF	OFF	No effect	1st
	ON	OFF		2nd
	OFF	ON		3rd
	ON	ON		SPR
3	The same as [**Pr300**=1]		OFF	1st~4th
	OFF	OFF	ON	5th
	ON	OFF	ON	6th
	OFF	ON	ON	7th
	ON	ON	ON	8th

	Name	Range	Unit	Default	Related Control Mode		
Pr301	Speed command direction selection	0~1	—	0	P	S	T

Description

- Select the positive /negative direction specifying method.

Set Value	Select Speed Command Sign (1st ~8th speed)	Speed Command Sign Selection (VC-SIGN)	Speed Command Direction
0	+	No effect	Positive direction
	-	No effect	Negative direction
1	Sign has No effect.	OFF	Positive direction
	Sign has No effect.	ON	Negative direction

	Name	Range	Unit	Default	Related Control Mode		
Pr304	1st speed of speed setup	-20000 ~20000	r/min	0	P	S	T
Pr305	2nd speed of speed setup	-20000 ~20000	r/min	0	P	S	T
Pr306	3rd speed of speed setup	-20000 ~20000	r/min	0	P	S	T
Pr307	4th speed of speed setup	-20000 ~20000	r/min	0	P	S	T
Pr308	5th speed of speed setup	-20000 ~20000	r/min	0	P	S	T
Pr309	6th speed of speed setup	-20000 ~20000	r/min	0	P	S	T
Pr310	7th speed of speed setup	-20000 ~20000	r/min	0	P	S	T
Pr311	8th speed of speed setup	-20000 ~20000	r/min	0	P	S	T

Description

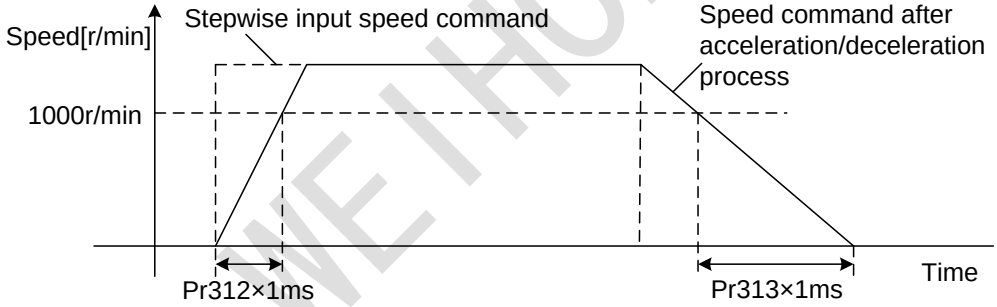
- Specify the internal command speeds, 1st to 8th.

	Name	Range	Unit	Default	Related Control Mode		
Pr312	Acceleration time setup	0~10000	ms/(1000r/min)	0	P	**S**	T
Pr313	Deceleration time setup	0~10000	ms/(1000r/min)	0	P	**S**	T

Description

- Specify the acceleration/deceleration processing time in response to the speed command input.
- Set the time required for the speed command (stepwise input) to reach 1000r/min to **Pr312 Acceleration time setup**. Also set the time required for the speed command to reach from 1000r/min to 0r /min, to **Pr313 Deceleration time setup**.
- Assuming that the target value of the speed command is Vc［r/min］, the time required for acceleration/deceleration can be computed from the following formula.

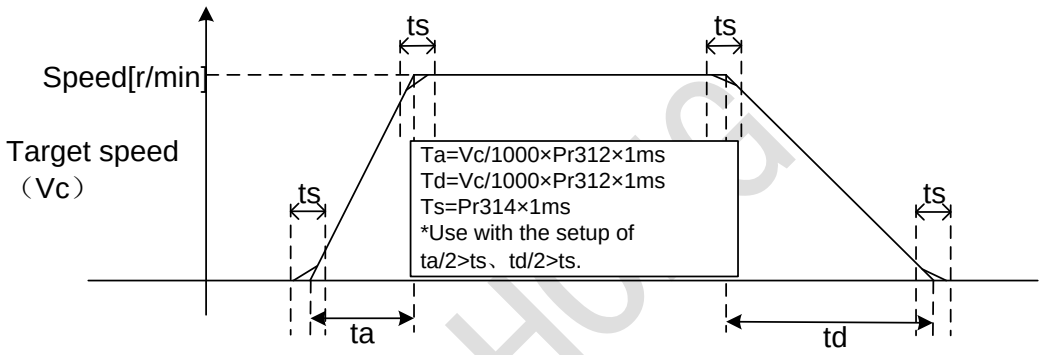
Acceleration time［ms］＝Vc/1000×Pr312×1ms
Deceleration time［ms］＝Vc/1000×Pr313×1ms



	Name	Range	Unit	Default	Related Control Mode		
Pr314	Sigmoid acceleration / deceleration time setup	0~1000	ms	0	P	S	T

Description

- Specify S-curve time for acceleration/deceleration process when the speed command is applied.
- According to **Pr312 Acceleration time setup** and **Pr313 Deceleration time setup**, set up sigmoid time with time width centering the inflection point of acceleration/deceleration.



	Name	Range	Unit	Default	Related Control Mode		
Pr315	Speed zero-clamp function selection	0~3	—	0	P	S	T

Description

- Specify the function of the speed zero clamp input.

Set Value	ZEROSPD Input Function
0	Invalid: speed zero-clamp input is ignored.
1	Speed command is forced to 0 when the speed zero clamp (ZEROSPD) input signal is turned ON.
2	Speed command is forced to 0 when the speed zero clamp (ZEROSPD) input signal is turned ON. And when the actual motor speed drops to **Pr316 Speed zero clamp level** or below, the position control is selected and servo lock is activated at this point.
3	When the speed zero clamp (ZEROSPD) input signal is ON, and speed command is below **Pr316**－10r/min, then the position control is selected and servo lock is activated at that point.

Pr316	Name	Range	Unit	Default	Related Control Mode		
	Speed zero clamp level	10~20000	r/min	30	P	S	T

Description

- Select the timing at which the position control is activated as the **Pr315 Speed zero-clamp function selection** is set to 2 or 3.
- If **Pr315 Speed zero-clamp function selection** = 3, then hysteresis of 10r/min is provided for detection.

Pr317	Name	Range	Unit	Default	Related Control Mode		
	Torque command selection	0~2	—	0	P	S	T

Description

- Select the input of the torque command and the speed limit by parameter **Pr601 Torque command setup**, **Pr321 Speed limit value 1** and **Pr322 Speed limit value2**.

Set Value	Torque Command Input	Velocity Limit Input
0	Parameter value (**Pr601**)	Parameter value (**Pr321**)
1	—	Parameter value (**Pr321**)
2	Parameter value (**Pr601**)	Parameter value (**Pr321**; **Pr322**)

CAUTION

If the parameter is set to 1, the torque will always be 0. Therefore, don't set this parameter to 1.

Pr318	Name	Range	Unit	Default	Related Control Mode		
	Torque command direction selection	0~1	—	0	P	S	T

Description

- Specify the method to select positive/negative direction for torque command.

Set Value	Specifying Method
0	Specify the direction with the sign of torque command. For example: torque command input 「＋」→positive direction, 「－」→negative direction.
1	Specify the direction with torque command sign (TC-SIGN)

Pr321	Name	Range	Unit	Default	Related Control Mode		
	Speed limit value 1	0~20000	r/min	0	P	S	T

Description

- Specify the speed limit used for torque controlling. During the torque controlling, the speed set by the speed limit value cannot be exceeded.
- When **Pr317 Torque command selection** = 2, the speed limit is applied upon receiving positive direction command.

Pr322	Name	Range	Unit	Default	Related Control Mode		
	Speed limit value2	0~20000	r/min	0	P	S	T

Description

- Speed limit value of negative direction command when **Pr317 Torque command selection** = 2.

Pr317	Pr321	Pr322	Pr315	Speed Zero Clamp (ZEROSPD)	Speed Limit Value
0	0 ~ 20000	No effect	0	No effect	**Pr321** set value
			1~3	OFF	**Pr321** set value
				ON	0
2	0 ~ 20000	0 ~ 20000	0	No effect	**Pr321** set value
					Pr322 set value
	0 ~ 20000	0 ~ 20000	1~3	OFF	**Pr321** set value
					Pr322 set value
	0 ~ 20000	0 ~ 20000	1~3	ON	0

10.6.【Class 4】I/F Monitor Setting

For parameters whose No. have a suffix of "*", changed contents will be validated when you turn on the control power; for parameters whose No. have no suffix of "*", changed contents will be validated immediately.

Pr408*	Name	Range	Unit	Default	Related Control Mode		
	SO1 output selection	0 ~ 00FFFFFFh	—	00010101h (65793)	P	S	T

Description

- Allocate functions to SO1~SO4 inputs.
- These parameters are set in hexadecimals while presented in decimals on the display panel.
- Hexadecimal presentation is followed by a specific control mode designation, as shown below. Replace 「★★」 with the function number.

0 0 – – – – ★★ h: position control
0 0 – – ★★ – – h: velocity control
0 0 ★★ – – – – h: torque control

Please refer to the following table for output signal pin number. Polarity of the signal is also shown in set value.

Signal Name	Symbol	Set Value
Invalid	—	00h
Servo alarm output	ALM	01h
Servo ready output	S-RDY	02h
External brake release signal	BRK-OFF	03h
Positioning complete	INP	04h
At-speed output	AT-SPPED	05h
Torque in-limit signal output	TLC	06h
Zero-speed detection output signal	ZSP	07h
Speed coincidence output	V-COIN	08h
Alarm output 1	WARN1	09h
Alarm output 2	WARN2	0Ah
Positional command ON/OFF output	P-CMD	0Bh
Positioning complete 2	INP2	0Ch
Speed in-limit output	V-LIMIT	0Dh
Alarm attribute output	ALM_ATB	0Eh
Speed command ON/OFF output	V-CMD	0Fh

CAUTION

1. Same output signal can be assigned to 2 or more output signals.
2. SO1 output should be fixed set to ALM output, otherwise, Err30 Series I/F output function number error1 will appear.
3. Control output pin set to invalid always has the output transistor turned OFF.
4. Don't change the set value shown in above table.
5. Note that the front panel indicates parameter value in decimal.

	Name	Range	Unit	Default	Related Control Mode		
Pr430	Positioning complete (In-position) range	0 ~ 262144	Unit dependent	10	**P**	S	T

Description

- Specify the timing of positional deviation at which the positioning complete signal (INP1) is output.
- The command unit is used as the default unit but it can be replaced by the encoder unit by using parameter **Pr520 Position setup unit selection**. Under such circumstance, unit of parameter **Pr014 Positional deviation excess setup** is also changed.

	Name	Range	Unit	Default	Related Control Mode		
Pr431	Positioning complete (In-position) output setup	0~3	—	0	**P**	S	T

Description

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

Set Value	Action of Positioning Complete Signal
0	The signal will turn on when the positional deviation is smaller than the set value of **Pr430 Positioning complete (In-position) range**.
1	The signal will turn on when there is no position command and the positional deviation is smaller than the set value of **Pr430 Positioning complete (In-position) range.**

Set Value	Action of Positioning Complete Signal
2	The signal will turn on when there is no position command, zero speed detection signal is connected and the positional deviation is smaller than the set value of **Pr430 Positioning complete (In-position) range**.
3	The signal will turn on when there is no position command and the positional deviation is smaller than the set value of **Pr430 Positioning complete (In-position) range**. Then holds "ON" status until the next position command is entered. ON state is maintained until **Pr432 INP hold time** has elapsed. After the hold time, INP output will be turned ON/OFF according to the coming positional command or condition of the positional deviation.

Pr432	Name	Range	Unit	Default	Related Control Mode		
	INP hold time	0~30000	1ms	0	P	S	T

Description

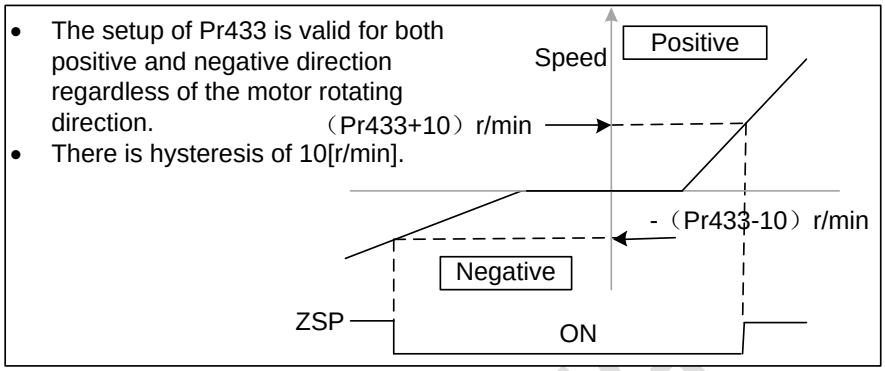
- Specify the hold time when **Pr431 Positioning complete (In-position) output setup**＝3.

Set Value	Action of Positioning Complete Signal
0	The hold time is maintained definitely, keeping ON state until the next positional command is received.
1~30000	ON state is maintained for setup time value [ms] but switched to OFF state as the positional command is received during hold time.

Pr433	Name	Range	Unit	Default	Related Control Mode		
	Zero speed	10~20000	r/min	50	P	S	T

Description

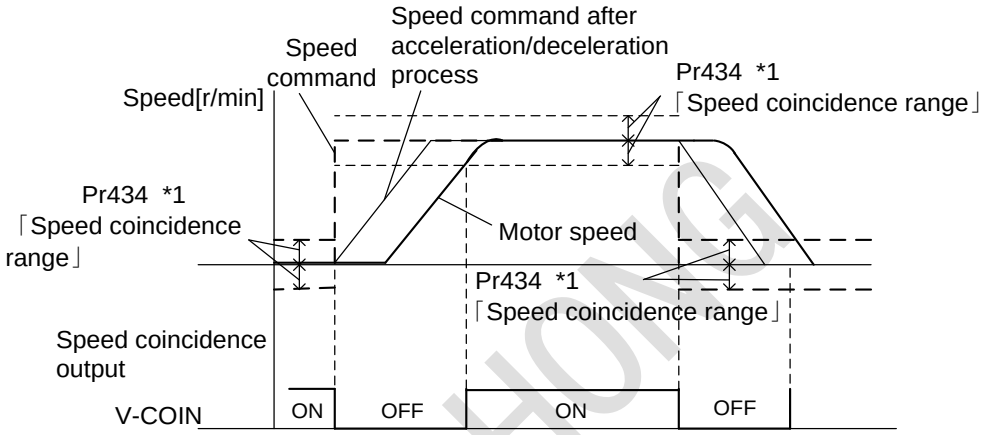
- The zero speed detection signal (ZSP) will be fed out when the motor speed falls below the setup of parameter **Pr433 Zero speed**.



Pr434	Name	Range	Unit	Default	Related Control Mode		
	Speed coincidence range	10~20000	r/min	50	P	S	T

Description

- Specify the speed coincidence (V-COIN) output detection timing.
- When the difference between the speed command and the motor speed is less than the speed specified by this parameter, output the speed coincidence (V-COIN).

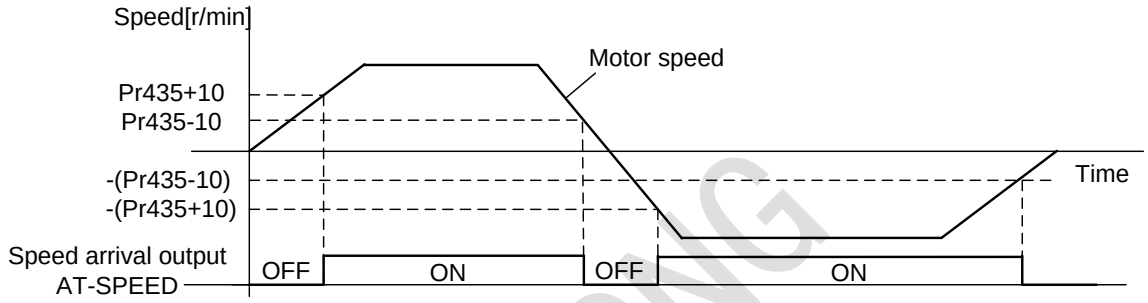


1. *1: Because the speed coincidence detection is associated with 10r/min hysteresis, actual detection range is as shown in the figure above.
2. Speed coincidence output OFF→ON timing: speed deviation below (**Pr434**－10) r/min.
3. ON →OFF timing: speed deviation higher than (**Pr434**＋10) r/min.

Pr435	Name	Range	Unit	Default	Related Control Mode		
	At-speed (Speed arrival)	10~20000	r/min	1000	P	S	T

Description

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

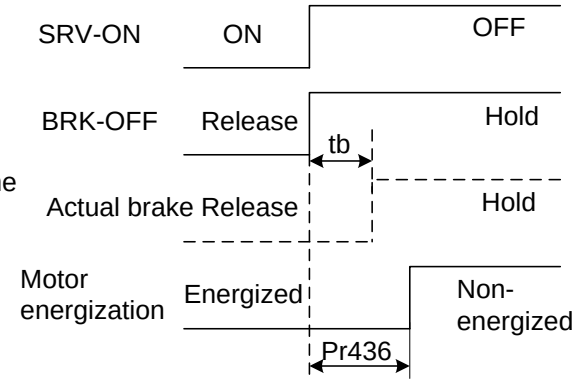


Pr436	Name	Range	Unit	Default	Related Control Mode		
	Mechanical brake action at stalling setup	0 ~ 10000	ms	0	P	S	T

Description

- Specify the time from the brake release signal (BRK-OFF) turns off to when the motor is de-energized (Servo free), when the motor turns to Servo-OFF while the motor is at stall.
  - Set to prevent a minor travel/drop of the motor due to the action delay time(tb) of the brake.
  - Pr436≧tb

  The driver turns to Servo-OFF after the brake is actually activated.

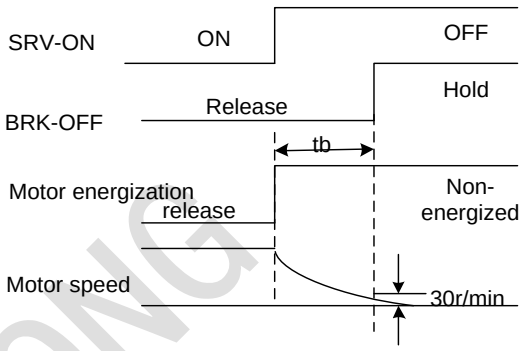


	Name	Range	Unit	Default	Related Control Mode		
Pr437	Mechanical brake action at running setup	0~10000	ms	0	P	S	T

Description

- Specify the time from when detecting the off of SVR-ON input signal (SRV-ON) to when external brake release signal (BRK-OFF) turns off, while the motor turns to servo off during the motor in motion.

  - Set up to prevent the brake deterioration due to the motor running.
  - At Servo-OFF during the motor is running, If time from when detecting the off of SRV-ON is to when the motor speed is below 30r/min is larger than Pr437 setup, then action of BRK-OFF signal will be done as Pr437 setup; while if the time is smaller than Pr437 setup, action of BRK-OFF signal will be done as time when motor speed is decreased to 30r/min.
  - "tb" of the right figure will be a shorter one of either Pr437 setup time or time lapse till the motor speed falls below 30r/min.



	Name	Range	Unit	Default	Related Control Mode		
Pr438	Brake release speed setup	30 ~ 3000	r/min	30	P	S	T

Description

- Specify the speed timing of brake output checking during operation.

	Name	Range	Unit	Default	Related Control Mode		
Pr439	Selection of alarm output 1	0~16	—	0	P	S	T
Pr440	Selection of alarm output 2	0~16	—	0	P	S	T

Description

- Select the type of alarm issued as the alarm output 1 or 2.

Set Value	Alarm	Content
0	—	OR output of all alarms.
1	Overload alarm	Load factor is 85% or more the protection level.
2	Over-regeneration alarm	Regenerative load factor is 85% or more the protection level.
3	Battery alarm	The voltage of battery is below 3.2V.
4	Fan alarm	Fan has stopped for 1 second.
5	Encoder communication alarm	Repeated encoder communication error times exceed specified value.
6	Encoder overheat alarm	Encoder overheat is detected.
7	Resonance detection alarm	Resonance is detected.
8	Registered time overdue	The servo drive has been registered for less than 24 hours.
9	Grating error alarm	The external scale detects the alarm.
10	Grating communication alarm	The number of successive external scale communication errors exceeds the specified value.
11	MECHATROLINK data setting alarm	The parameter number, data range or value is over specified value.
12	MECHATROLINK unsupported alarm	Unsupported command is received.
13	MECHATROLINK not meet the execution condition	Command execution is in unsupported layer, which does not meet the execution condition.
14~16	Internal use only	Internal use only

	Name	Range	Unit	Default	Related Control Mode		
Pr441	2nd positioning complete (In-position)range	0 ~ 262144	Command unit	10	P	S	T

Description

- Specify the positional deviation when 2nd positioning complete signal (INP2) turns on.
- The INP2 turns ON whenever the positional deviation is lower than the setup in this parameter, without being affected by **Pr431 Positioning complete (In-position) output setup**.

CAUTION

The command unit is used as the default unit but can be replaced by the encoder unit by using Pr520. Note that when encoder unit is used, unit of parameter **Pr014 Position deviation excess setup** is also changed.

	Name	Range	Unit	Default	Related Control Mode		
Pr442	Linear acceleration constant in standard position mode	1 ~ 209715 20	—	100	P	S	T

Description

- Specify the acceleration when position is controlled in the standard position mode.

	Name	Range	Unit	Default	Related Control Mode		
Pr443	Linear deceleration constant in standard position mode	1 ~ 20971520	—	100	P	S	T

Description

- Specify the acceleration during decelerating phrase when position is controlled in standard position mode.

	Name	Range	Unit	Default	Related Control Mode		
Pr444	Command pulse count per revolution of machine	1 ~ 1073741823	—	4096	P	S	T

Description

- Specify the command pulse count per revolution of machine.
- Command pulse count per revolution of machine = Command pulse count per revolution of motor * electronic gear ratio * speed-reduction rate

	Name	Range	Unit	Default	Related Control Mode		
Pr445	Oriented position setup	0~36000	—	0	P	S	T

Description

- Specify the oriented angle of machine.

	Name	Range	Unit	Default	Related Control Mode		
Pr446	External positioning final travel distance	-1073741823 ~1073741823	—	100	P	S	T

Description

- Input external latch signal before the motor arriving the target position. The motor slows down and stops in deceleration curve from the signal inputting position to the specified position of external positioning final travel distance.

	Name	Range	Unit	Default	Related Control Mode		
Pr450	Switch 2 for selecting applied function	-2147483647 ~2147483647	—	0	P	S	T

Description

- Use bit unit to set each function.

bit	Function	Set Value
0	P_TLIM and N_TLIM in the MECHATROLINK command is used as the limit value of torque	0: invalid. 1: valid
1	TFF in the MECHATROLINK command is used as feed forward input of torque	0: invalid. 1: valid
2	Used by the manufacturer	Please set it to **0**
3	Positioning mode	0: invalid. 1: valid
31~4	Used by the manufacturer	Please set it to **0**

1.10【Class 5】Enhancing Setting

For parameters whose No. have a suffix of "*", changed contents will be validated when you turn on the control power; for parameters whose No. have no suffix of "*", changed contents will be validated immediately.

	Name	Range	Unit	Default	Related Control Mode		
Pr500	2nd numerator of electronic gear	0 ~ 1073741824	—	0	P	S	T
Pr501	3rd numerator of electronic gear	0 ~ 1073741824	—	0	P	S	T
Pr502	4th numerator of electronic gear	0 ~ 1073741824	—	0	P	S	T

Description

- Specify the 2nd to 4th numerator of division/multiplication operation according to the command pulse input.
- This setup is enabled when parameter **Pr008 Command pulse counts per motor revolution** is set to **0**.
- When the set value is 0 for positioning controlling, encoder resolution is set as a numerator.

	Name	Range	Unit	Default	Related Control Mode		
Pr503*	Denominator of pulse output division	0~8388608	—	0	P	S	T

Description

- See Common Troubleshooting for details.

Pr504*	Name	Range	Unit	Default	Related Control Mode		
	Over-travel inhibit setup	0~2	—	1	P	S	T

Description

- Specify the operation of the run-inhibition (POT, NOT) inputs.

Set Value	Operation
0	POT: Inhibit positive direction travel NOT: Inhibit negative direction travel
1	POT and NOT invalid.
2	POT or NOT input triggers Err38.0 "Run-inhibition protection".

Pr505*	Name	Range	Unit	Default	Related Control Mode		
	Sequence at over-travel inhibit	0~2	—	0	P	S	T

Description

- When **Pr504 Over-travel inhibit setup**=0, specify the status during deceleration and stop after application of the over-travel inhibition (POT and NOT).
- Details of **Pr505 Sequence at over-travel inhibit** are shown as below.

Pr504	Pr505	During Deceleration	After Stalling	Deviation Counter Content
0	0	Dynamic brake action	Torque command= 0 towards inhibited direction	Hold
	1	Torque command=0 towards inhibited direction	Torque command= 0 towards inhibited direction	Hold
	2	Stop immediately	Torque command= 0 towards inhibited direction	Clear before/after deceleration

Pr506	Name	Range	Unit	Default	Related Control Mode		
	Sequence at Servo-off	0~9	—	0	P	S	T

Description

- Specify the status during deceleration and after stop, after servo-off. (DB: Dynamic brake)

Set Value	During Deceleration*3	After Stalling	Positional Deviation
0	Dynamic brake (DB)action	Dynamic brake (DB)	Clear *2
1	Free-run (DB OFF)	Dynamic brake (DB)	Clear *2
2	Dynamic brake (DB)	Free-run (DB OFF)	Clear *2
3	Free-run (DB OFF)	Free-run (DB OFF)	Clear *2
4	Dynamic brake (DB)	Dynamic brake (DB)	Clear *2
5	Free-run (DB OFF)	Dynamic brake (DB)	Clear *2
6	Dynamic brake (DB)	Free-run (DB OFF)	Clear *2
7	Free-run (DB OFF)	Free-run (DB OFF)	Clear *2
8	Emergency stop*1	Dynamic brake (DB)	Clear *2
9	Emergency stop*1	Free-run (DB OFF)	Clear *2

*1: Emergency stop refers to a controlled immediate stop at servo-on. The torque command value is limited by **Pr511 Emergency stop torque setup**.
*2: Positional deviation is always cleared to 0.

*3: Deceleration process is the time required for the running motor to speed down to 30r/min. Once the motor speed drops below 30r/min, it is treated as in stop state regardless of its speed.

CAUTION

If an error occurs during servo-off, follow **Pr510 Sequence at alarm**. If the main power is turned off during servo-off, follow **Pr507 Sequence at main power interruption**.

Pr507	Name	Range	Unit	Default	Related Control Mode		
	Sequence at main power OFF	0~9	—	0	P	S	T

Description

- Specify the status during deceleration after main power interruption or after stalling.
- The relationship between the setup of **Pr507 Sequence at main power OFF** and the operation and process at deviation counters is the same as that for **Pr506 Sequence at Servo-off**.

CAUTION

1. If an error occurs when the main power is turned off, follow **Pr510 Sequence at alarm**.
2. If the main power is turned off at servo on,Err13.0, Err 13.1 Main power under voltage protection will occur when **Pr508 LV trip selection with main power off**=1, and the operation follows **Pr510 Sequence at alarm**.

Pr508	Name	Range	Unit	Default	Related Control Mode		
	LV trip selection at main power OFF	0~1	—	1	P	S	T

Description

- While the main power shutoff continues for the setup of **Pr509 Detection time of main power off**, select whether or not to activate **Err13.1 Main power under voltage protection**.

Set Value	Action of Mina Power Under-Voltage Protection
0	When the main power is shut off during servo on, Err13.1 will not be triggered and the servo drive turns to servo off. The servo drive returns to servo on again after the main power resumption.
1	When the main power is shut off during servo on, the servo drive will trip Err13.0, Err 13.1 Main power under-voltage protection.

CAUTION

1. When **Pr509 Detection time of main power OFF**=2000, the parameter is invalid.
2. **Err13.0 Main power under-voltage protection** will be triggered when setup of **Pr509 Detection time of main power OFF** is long and P-N voltage of the main converter falls below the specified value before detecting the main power shutoff, regardless of the set value of **Pr508 LV trip selection at main power OFF**.

Pr509*	Name	Range	Unit	Default	Related Control Mode		
	Detection time of main power off	70~2000	1ms	70	P	S	T

Description

- Specify the time to detect the shutoff while the main power is kept shut off continuously.
- The main power off detection is invalid when you set this parameter to 2000.

Pr510	Name	Range	Unit	Default	Related Control Mode		
	Sequence at alarm	0~7	—	0	P	S	T

Description

- Specify the status during deceleration and after stop when alarm occurs.

Set Value	During Deceleration*3	After Stalling	Positional Deviation
0	Dynamic brake (DB)	Dynamic brake (DB)	Clear*1
1	Free run (DB OFF)	Dynamic brake (DB)	Clear*1
2	Dynamic brake (DB)	Free run (DB OFF)	Clear*1
3	Free run (DB OFF)	Free run (DB OFF)	Clear*1
4	Action A: Emergency stop Action B: DB action*2	Dynamic brake (DB)	Clear*1
5	Action A: Emergency stop Action B: DB OFF*2	Dynamic brake (DB)	Clear*1
6	Action A: Emergency stop Action: DB action*2	Free run (DB OFF)	Clear*1
7	Action A: Emergency stop Action B: DB OFF*2	Free run (DB OFF)	Clear*1

*1: Positional deviation is maintained during alarm condition while be cleared when the alarm is cancelled.
*2: Action A/B: whether the dynamic brake stops immediately when action A or B has a failure. If this parameter is set within the range 4~7, as an alarm requiring emergency stop occurs (see Preparing for Adjusting the Gain for details), follow action A. When an alarm not requiring emergency stop occurs, it triggers dynamic braking (DB) specified by action B, or BD OFF.
*3: Deceleration period is the time required for the running motor to speed down to 30r/min.

Pr511	Name	Range	Unit	Default	Related Control Mode		
	Torque setup for emergency stop	0~500	%	0	P	S	T

Description

- Specify the torque limit at E-stop

CAUTION

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

Pr512	Name	Range	Unit	Default	Related Control Mode		
	Over-load level setup	0~500	%	0	P	S	T

Description

- Specify the overload level. The overload level becomes 115[%] when this parameter is set to 0 or larger than 115.
- Use this with 0 in normal operation. Set up other value only when you need to lower the over-load level.

Pr513	Name	Range	Unit	Default	Related Control Mode		
	Over-speed level setup	0~20000	r/min	0	P	S	T

Description

- When this parameter is set to 0, the over-speed level becomes 1.2 times of the motor max. speed.
- If the motor speed exceeds this set value, Err26.0 “Over-speed protection” will occur.

Pr514	Name	Range	Unit	Default	Related Control Mode		
	Motor working range setup	0~1000	0.1 rev	10	P	S	T

Description

- Specify the moveable range of the motor against the position command input range.
- When the motor movement exceeds the set value, Err34.0 “Motor working range limit protection” will occur.

Pr516*	Name	Range	Unit	Default	Related Control Mode		
	Alarm clear input setup	0~1	—	0	P	S	T

Description

- Select alarm clear input (A-CLR) recognition time.

Set Value	Recognition Time
0	120ms
1	1ms

Pr520*	Name	Range	Unit	Default	Related Control Mode		
	Position setup unit selection	0~1	—	0	P	S	T

Description

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

Set Value	Unit
0	Command unit
1	Encoder unit

Pr521	Name	Range	Unit	Default	Related Control Mode		
	Torque limit selection	0~6	—	1	P	S	T

Description

- Specify the torque limiting method.

Set Value	Positive Direction	Negative Direction
0	Invalid	Invalid
1	**Pr013 1st torque limit**	
2	**Pr013 1st torque limit**	**Pr522 2nd torque limit**
3	TL-SEL OFF →**Pr013 1st torque limit** TL-SEL ON →**Pr522 2nd torque limit**	
4	Invalid	Invalid
5	Invalid	
6	TL-SEL OFF	
	Pr013 1st torque limit	**Pr522 2nd torque limit**
	TL-SEL ON	
	Pr525 External input positive direction torque limit	**Pr526 External input negative direction torque limit**

Pr522	Name	Range	Unit	Default	Related Control Mode		
	2nd torque limit	0~500	%	500	P	S	T

Description

- Specify the 2nd limit value of the motor output torque.
- The value is also restricted by the maximal torque of the applicable motor.

Pr523	Name	Range	Unit	Default	Related Control Mode		
	Torque limit switching setup 1	0~4000	ms/100%	0	P	S	T

Description

- Specify the rate of change (slope) from torque 2nd to 1st during torque limit switching.

Pr524	Name	Range	Unit	Default	Related Control Mode		
	Torque limit switching setup 2	0~4000	ms/100%	0	P	S	T

Description

- Specify the rate of change (slope) from torque 2nd to 1st during torque limit switching.

Pr525	Name	Range	Unit	Default	Related Control Mode		
	External input positive direction torque limit	0~500	%	500	P	S	T

Description

- Specify positive direction torque limit upon receiving TL-SEL with **Pr521 Torque limit selection**＝6.
- The value is also restricted by the maximal torque of the applicable motor.

Pr526	Name	Range	Unit	Default	Related Control Mode		
	External input negative direction torque limit	0~500	%	500	P	S	T

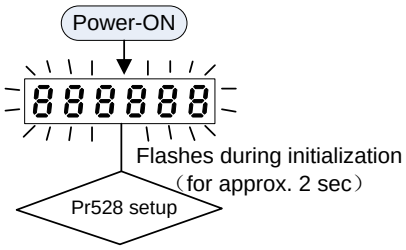
Description

- Specify negative direction torque limit upon receiving TL-SEL with **Pr521 Torque limit selection**＝6.
- The value is also restricted by the maximal torque of the applicable motor.

Pr528*	Name	Range	Unit	Default	Related Control Mode		
	LED initial status	0~36	—	1	P	S	T

Description

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



Set Value	Content	Set Value	Content
0	Positional command deviation	17	Cause of no-motor running
1	Motor speed	18	No. of changes in I/O signals
2	Positional command speed	19	Servo-on status
3	Velocity control command	20	Absolute encoder data
4	Torque command	22	No. of encoder/external scale communication errors monitor
5	Feedback pulse sum	23	Slave address of bus-type drive
6	Command pulse sum	24	Encoder positional deviation (encoder unit)
7	Load estimation inertia ratio	27	P-N voltage (voltage across PN)
9	Control mode	28	Software version
10	I/O signal status	29	Drive serial No.
12	Error cause and reference of history	30	Motor serial No.
13	Alarm No.	31	Accumulated operation time

Set Value	Content	Set Value	Content
14	Regenerative load factor	34	Drive remaining time
15	Over-load factor	36	Real-time resonance frequency
16	Inertia ratio		

Pr533*	Name	Range	Unit	Default	Related Control Mode		
	Pulse regenerative output limit setup	0~1	—	0	P	S	T

Description

- Enable/disable detection of Err28.0 Pulse regenerative limit protection.

Set Value	Content
0	Valid
1	Invalid

Pr535*	Name	Range	Unit	Default	Related Control Mode		
	Front panel lock setup	0~1	—	0	P	S	T

Description

- Lock the operation on the front panel.

Set Value	Content
0	No limit on the front panel operation
1	Lock the operation on the front panel

10.7.【Class 6】Special Setting

For parameters whose No. have a suffix of "*", changed contents will be validated when you turn on the control power; for parameters whose No. have no suffix of "*", changed contents will be validated immediately.

Pr601	Name	Range	Unit	Default	Related Control Mode		
	Torque command setup	-500~500	%	0	P	S	**T**

Description

- Specify input range for torque command.
- Enabled when the **Pr001 Control mode setup**=3 (for torque controlling).

Pr602	Name	Range	Unit	Default	Related Control Mode		
	Velocity deviation excess setup	0~100	r/min	0	**P**	S	T

Description

- When the speed deviation (difference between internal positional command and actual speed) exceeds this value, Err24.1 Velocity deviation excess protection will occur.
- When the set value is 0, this protection is not detected.

Pr604	Name	Range	Unit	Default	Related Control Mode		
	JOG trial run command speed	0~500	r/min	300	**P**	**S**	**T**

Description

- Specify the command speed used for JOG trial run (Velocity control).

CAUTION

Before using, see Conducting a Trial Run for details.

Pr607	Name	Range	Unit	Default	Related Control Mode		
	Torque command additional value	-100~100	%	0	P	S	T

Description

- Specify the offset load compensation value usually added to the torque command in a control mode except for the torque control mode.
- Update this parameter when the vertical axis mode for real time auto-tuning is valid.

Pr608	Name	Range	Unit	Default	Related Control Mode		
	Positive direction torque compensation	-100~100	%	0	P	S	T

Description

- For position controlling, set the dynamic friction compensation value to be added to the torque command when forward positional command is fed.
- Update this parameter when the friction compensation mode for real time auto-tuning is valid.

Pr609	Name	Range	Unit	Default	Related Control Mode		
	Negative torque compensation	-100~100	%	0	P	S	T

Description

- For position controlling, set the dynamic friction compensation value to be added to the torque command when negative direction positional command is fed.
- Update this parameter when the friction compensation mode for real time auto-tuning is valid.

Pr611	Name	Range	Unit	Default	Related Control Mode		
	Current response setup	20~500	%	100	P	S	T

Description

- Fine tune the current response with respect to default setup (100%).

Pr612	Name	Range	Unit	Default	Related Control Mode		
	Positive direction torque compensation filter	0~30000	0.01ms	0	P	S	T

Description

- Specify the time constant of positive or negative torque compensation filter.
- The greater the set value, the smoother the positive or negative torque compensation, which enhances system stability. However, if the set value is too great, the torque compensation effect is affected.

Pr615	Name	Range	Unit	Default	Related Control Mode		
	2nd over-speed level setup	0~20000	r/min	0	P	S	T

Description

- When it is set to 0, the over-speed level becomes 1.2 times of the motor maximal speed.
- When the motor speed exceeds this set value, Err26.1 2nd over-speed protection will be activated.

Pr623	Name	Range	Unit	Default	Related Control Mode		
	Disturbance torque compensation gain	-100~100	%	0	P	S	T

Description

- Set -100~100% compensation gain against disturbance torque.
- After setting up **Pr624 Disturbance observer filter**, increase the set value of **Pr623 Disturbance torque compensation gain**.
- Increasing the gain can increase the disturbance suppressing capability, but it is associated with increasing volume of operation noise.
- Please find a balance by adjusting **Pr624 Disturbance observer filter** and **Pr623 Disturbance torque compensation gain**.

Pr624	Name	Range	Unit	Default	Related Control Mode		
	Disturbance observer filter	0~2500	0.01ms	2000	P	S	T

Description

- Specify the filter time constant to the disturbance torque compensation.
- First, set **Pr624 Disturbance observer filter** to a greater value and check the operation with **Pr623 Disturbance torque compensation gain** set to a low value, and then gradually decrease the set value of **Pr624 Disturbance observer filter**. A low filter set value assures disturbance torque estimation with small delay and effectively suppresses effects of disturbance. However, this results in larger operation noise. Therefore, well balance setup is required.

Pr627*	Name	Range	Unit	Default	Related Control Mode		
	Alarm latch time selection	0~10	s	5	P	S	T

Description

- Specify the latch time.

Set Value	Content
0	Latch time is infinite.
1~10	Latch time range: 1~10 (s)

Pr628	Name	Range	Unit	Default	Related Control Mode		
	Auto resonance detection level	30~1000	%	100	P	S	T

Description

- The smaller the set value, more sensitive the resonance detection.

Pr629*	Name	Range	Unit	Default	Related Control Mode		
	Absolute multi-turn data upper limit	0~65534	rev	0	P	S	T

Description

- If multi-turn data exceeds the value of this parameter, multi-turn data turns to **0**. Otherwise, multi-turn data rotates down and turns to the value of this parameter.
  - When the value of parameter **Pr015** is set to **4**, this parameter is valid.
  - When the value of parameter **Pr015** is set to **0** or **2**, this parameter is invalid. That is, no matter the value of this parameter, the internal data is always 65535

Pr630	Name	Range	Unit	Default	Related Control Mode		
	Anti-vibration filter ON/OFF switch	0~2	—	0	P	S	T

Pr632	Name	Range	Unit	Default	Related Control Mode		
	Real time auto tuning custom setup	-32767 ~ 32767	—	0	P	S	T

Description

- When the operation mode of real time auto tuning is set to customize (**Pr002 Real-time auto-gain tuning setup** = 6), set the automatic adjustment function as below.

Bit	Content	Description
1~0	Load characteristics estimation*	Enable/disable the load characteristics estimation function. Set Value: 0 — Invalid; 1 — Valid If the load characteristics estimation is disabled, the current setup cannot be changed even if the inertia ratio is updated according to estimated value. When the torque compensation is updated by the estimated value, it is cleared to 0 (invalid).
3~2	Inertia ratio update	Set update to be made based on result of the load characteristics estimation of **Pr004 Inertia ratio**. Set Value: 0 — Use the current setup; 1 — Updated by the estimated value

<table>
<tr><th>Bit</th><th>Content</th><th>Description</th></tr>
<tr><td>6~4</td><td>Torque compensation</td><td>Set the update to be made according to results of load characteristics estimation of Pr607 Torque command additional value, Pr608 Positive direction torque compensation and Pr609 Negative torque compensation.
<table>
<tr><th>Set Value</th><th>Function</th><th colspan="3">Compensation Setup</th></tr>
<tr><td>0</td><td>Use current setup</td><td>Pr607</td><td>Pr608</td><td>Pr609</td></tr>
<tr><td>1</td><td>Torque compensation is invalid</td><td>Clear</td><td>Clear</td><td>Clear</td></tr>
<tr><td>2</td><td>Vertical axis mode</td><td>Update</td><td>Clear</td><td>Clear</td></tr>
<tr><td>3</td><td>Friction compensation (Low)</td><td>Update</td><td>Low</td><td>Low</td></tr>
<tr><td>4</td><td>Friction compensation (Middle)</td><td>Update</td><td>Middle</td><td>Middle</td></tr>
<tr><td>5</td><td>Friction compensation (High)</td><td>Update</td><td>High</td><td>High</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Bit</th><th>Content</th><th>Description</th></tr>
<tr><td>7</td><td>Stiffness setup</td><td>Enable/disable parameter Pr003 Setting of machine stiffness at real-time auto-gain tuning.
<table>
<tr><th>Set Value</th><th>Function</th></tr>
<tr><td>0</td><td>Invalid</td></tr>
<tr><td>1</td><td>Valid</td></tr>
</table></td></tr>
<tr><td>8</td><td>Fixed parameter setup</td><td>Enable/disable the change of parameter that is normally set at a fixed value.
<table>
<tr><th>Set Value</th><th>Function</th></tr>
<tr><td>0</td><td>Use the current setup</td></tr>
<tr><td>1</td><td>Set to a fixed value</td></tr>
</table></td></tr>
<tr><td>10
~9</td><td>Gain switching setup</td><td>Select the gain switching related parameters to be used when the real time auto tuning is enabled.
<table>
<tr><th>Set Value</th><th>Function</th></tr>
<tr><td>0</td><td>Use the current setup</td></tr>
<tr><td>1</td><td>Gain switching disabled</td></tr>
<tr><td>2</td><td>Gain switching enabled</td></tr>
</table></td></tr>
</table>

CAUTION

This parameter should be set in unit of bit. To prevent setting error, it is recommended to install software iMotion when editing parameter. Setup method for bit-wise parameter is as below.

1. Confirm the last bit of the setup.

   E.g.: LSB of the torque compensation function is 4.

2. Multiply the set value by power of 2 (LSB).

   E.g.: to set the torque compensation function to friction compensation (middle):$2^4 \times 4 = 64$.

3. For every setup, perform step 1) and step 2) above, sum up the values which are to be set value of **P r632 Real time auto tuning custom setup**.

   E.g.: Load characteristics measurement=enable, inertia ratio update=enable, torque compensation=friction compensation (middle), stiffness setup=enable, fixed parameter=a fixed value, gain switching setup=enable, then,

   $$2^0 \times 1 + 2^2 \times 1 + 2^4 \times 4 + 2^7 \times 1 + 2^8 \times 1 + 2^9 \times 2 = 1477$$

Pr633	Name	Range	Unit	Default	Related Control Mode		
	Speed setting at friction compensation taking effect	0~1000	0.1rpm	0	P	S	T

Description

- Specify the speed point of friction torque compensation taking effect.
- Since friction is different for different structures, the speed point can be different. Please set according to actual conditions.

Pr638*	Name	Range	Unit	Default	Related Control Mode		
	Alarm mask setup	-32768 ~ 32767	—	0	P	S	T

Description

- Specify the alarm detection mask.
- Placing 1 to the corresponding bit position disables detection of the alarm condition.

Pr640	Name	Range	Unit	Default	Related Control Mode		
	Absolute origin position offset	-1073741823 ~-1073741823	Command unit	0	P	S	T

Description

- Specify the position offset between encoder position (external scale position) and machine coordinate position when absolute encoder (absolute external scale) is enabled.

Pr641	Name	Range	Unit	Default	Related Control Mode		
	1st anti-vibration depth	0~1000	—	0	P	S	T

Description

- Specify the 1st anti-vibration depth.
- When the setup value is 0, the depth of anti-vibration is the deepest. The smaller the setup value, the shallower the depth.
- If the depth is too deep, the anti-vibration effect is not good and the delay time becomes longer. If the depth is too shallow, the situation turns to the opposite and the delay time becomes shorter.
- To tune the anti-vibration effect and delay, set the parameter.

Pr642	Name	Range	Unit	Default	Related Control Mode		
	Absolute origin position offset	0~2500	Command unit	0	P	S	T

Description

- Specify the time constant of the filter according to the torque command. The setup value 0 disables filter.
- Regardless of gain selecting state, this setting always remains valid.

Pr643	Name	Range	Unit	Default	Related Control Mode		
	Two-stage torque filter attenuation term	0~1000	—	0	P	S	T

Description

- Specify the attenuation term of 2-stage torque filter.

Pr647	Name	Range	Unit	Default	Related Control Mode		
	Internal use	0~15	—	0	P	S	T

Description

- It is exclusive for manufacturers.

Pr648	Name	Range	Unit	Default	Related Control Mode		
	Internal use	0~2000	—	0	P	S	T

Description

- It is exclusive for manufacturers.

Pr649	Name	Range	Unit	Default	Related Control Mode		
	Internal use	0~99	—	0	P	S	T

Description

- It is exclusive for manufacturers.

Pr650	Name	Range	Unit	Default	Related Control Mode		
	Viscous friction compensation gain	0~10000	—	0	P	S	T

Description

- Specify the gain of viscous friction compensation.
- Its value is automatically generated when parameter **Pr002 Real-time auto-gain tuning setup** is set to 4. Usually, use the value that is automatically generated.

Pr651	Name	Range	Unit	Default	Related Control Mode		
	Immediate cessation completion wait time	0~10000	—	0	P	S	T

Description

- When immediate stop alarm occurs, turn off brake release output (BRK-OFF) and set the time during which the current flows through the motor.

11. Connectors & Wiring Diagrams

For making your own encoder cables, power cables and brakes that mated with WISE or Panasonic servo drives, you need to check connectors and wiring diagrams of them.

- Wiring Diagrams for the Servo Drives and WISE MA/MB/MN/ME Motors
- Wiring Diagrams for the Servo Drives and Panasonic A5/A6 Motors

11.1. Wiring Diagrams for the Servo Drives and WISE MA/MB/MN/ME Motors

11.1.1. Wiring Diagrams of Encoders

It is about the wiring of encoders for WISE MA/MB/MN/ME motors.

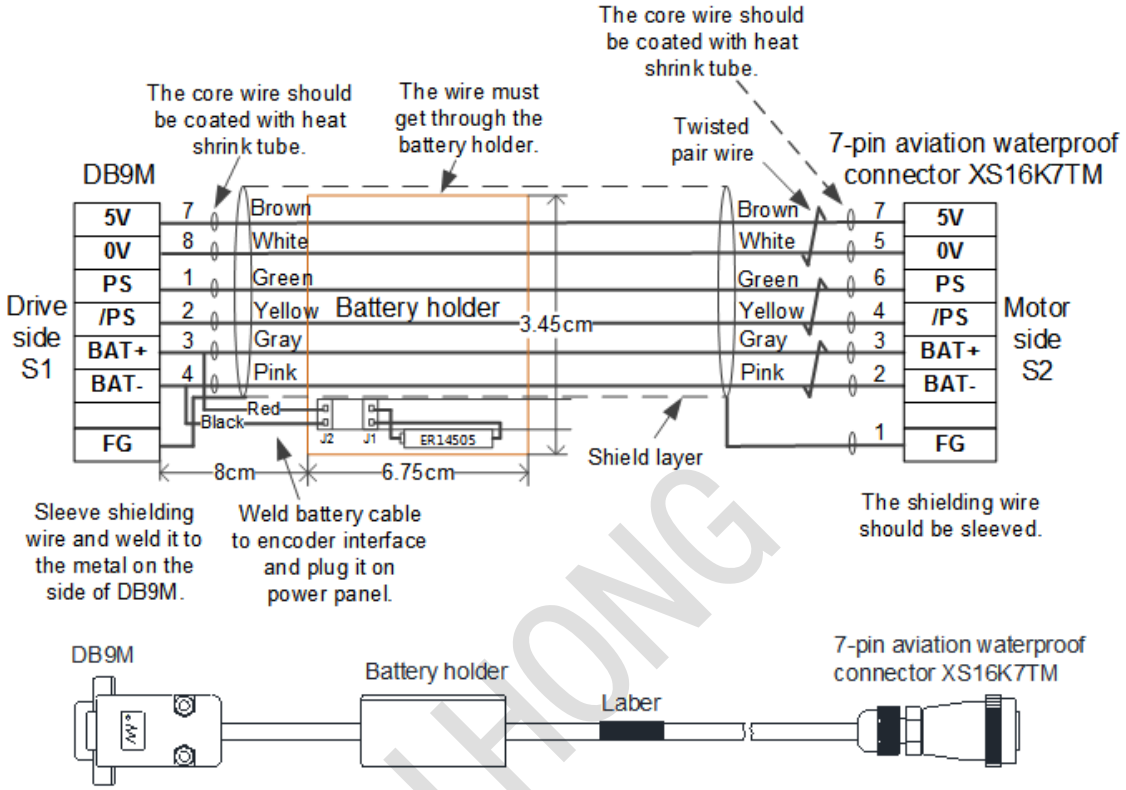
11.1.1.1. WISE MA040 / MA060 / MA080 / ME040 / ME060 / ME080/MN080

Basic information of the wiring is as follows:

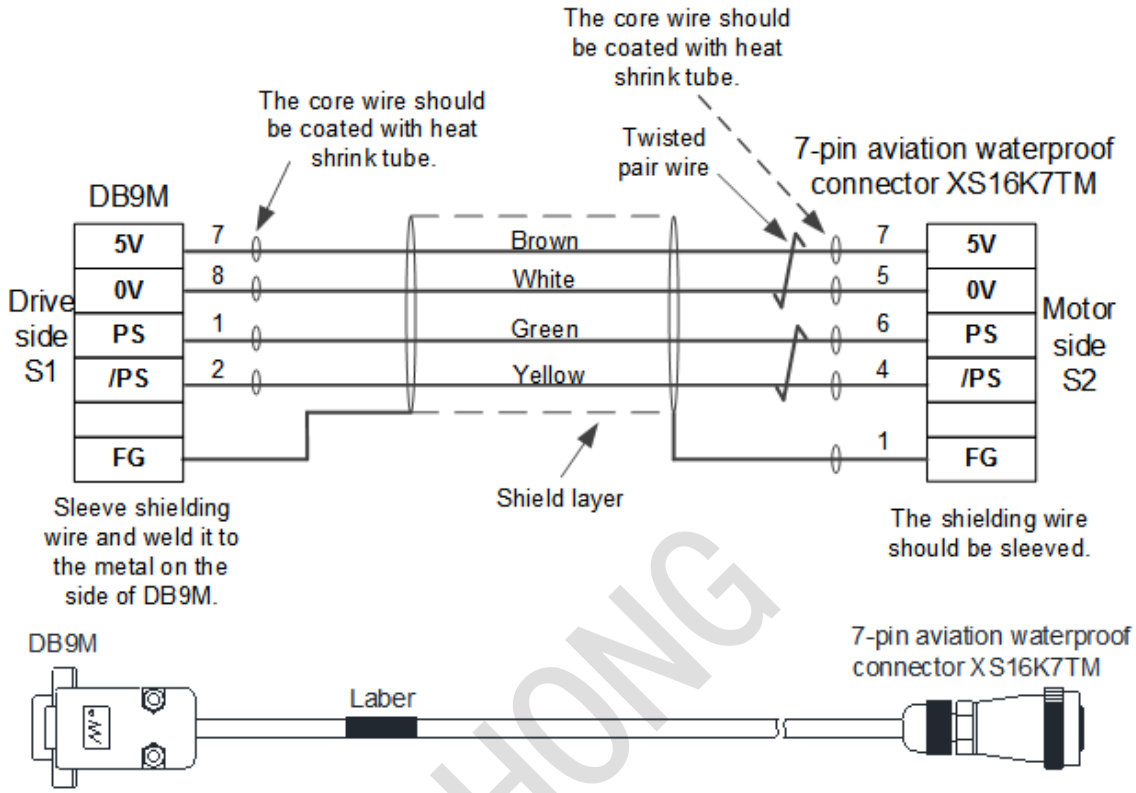
- Drive Model
  - Absolute: AELMNN□ □ □ A1B
  - Incremental: AELMNN□ □ □ A0A
- Connector
  - Drive-side: DB9M—1405-091-06-1; O-DB plastic case—1441-090-00-3; match with DB9M
  - Motor-side: 7-pin aviation waterproof connector —XS16K7TM

The wiring diagram is as follows:

- Absolute encoder



- Incremental encoder



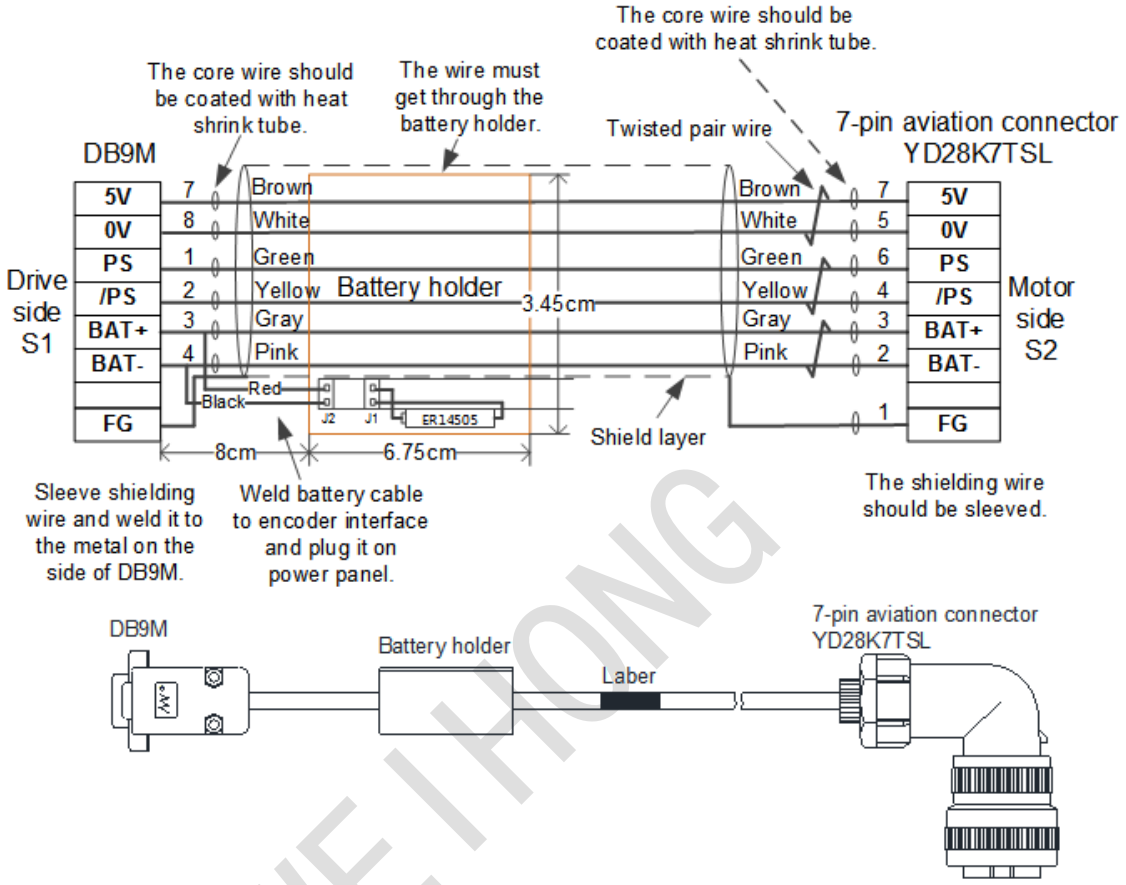
11.1.1.2. WISE MN110/MN130/MN180

Basic information of the wiring is as follows:

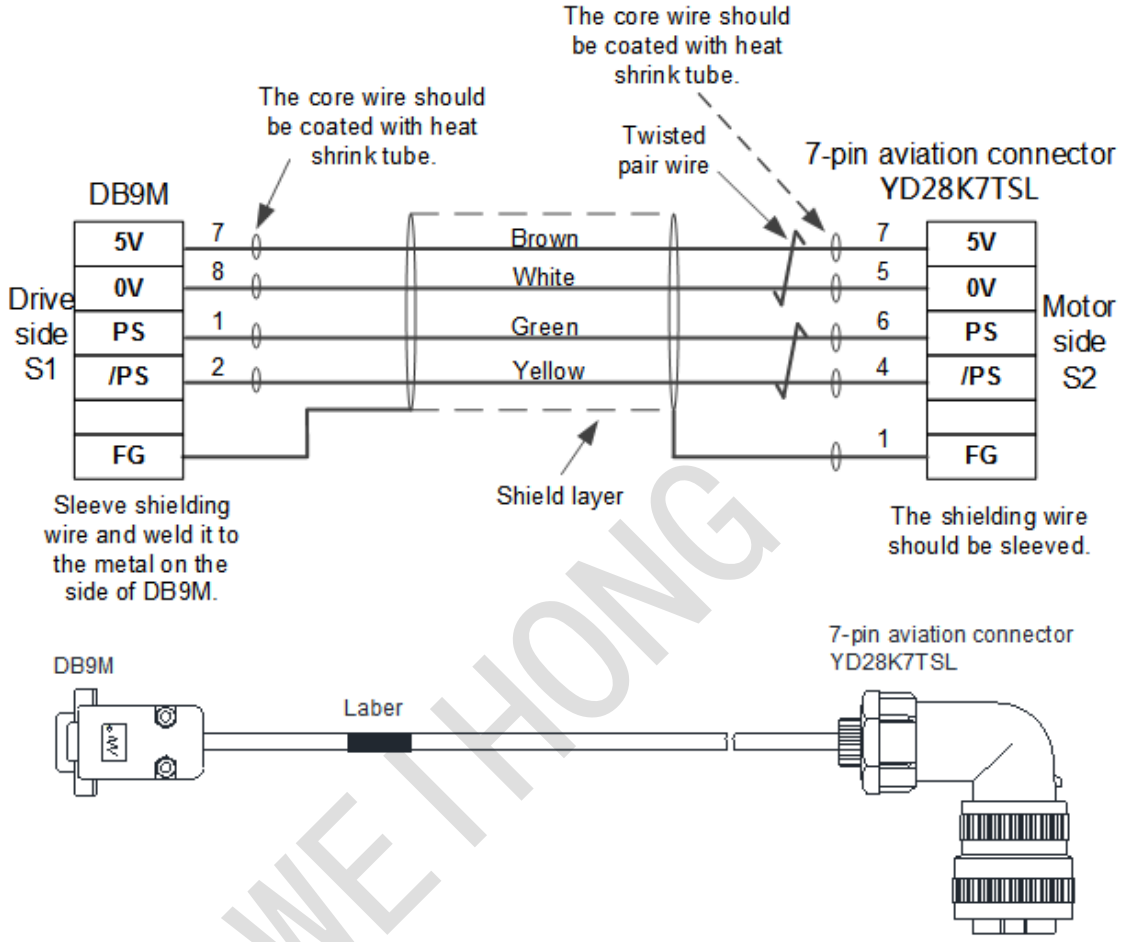
- Drive Model
  - Absolute: AELMNP □ □ □ A1B
  - Incremental: AELMNP□ □ □ A0A
- Connector
  - Drive-side: DB9M—1405-091-06-1; O-DB plastic case—1441-090-00-3; match with DB9M
  - Motor-side: 7-pin aviation connector—YD28K7TSL

The wiring diagram is as follows:

- Absolute encoder



- Incremental encoder



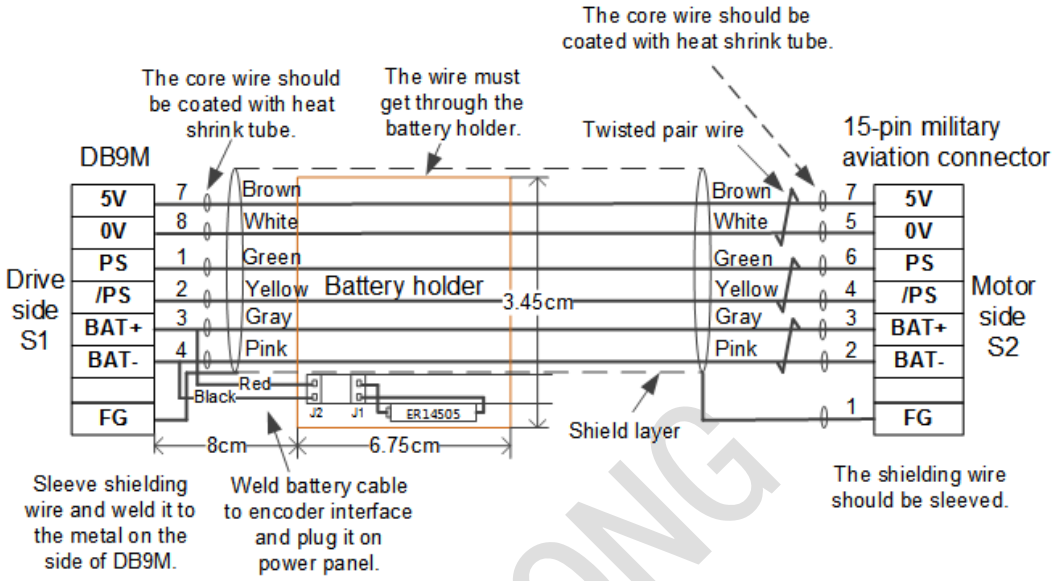
11.1.1.3. WISE MB100 / MB130

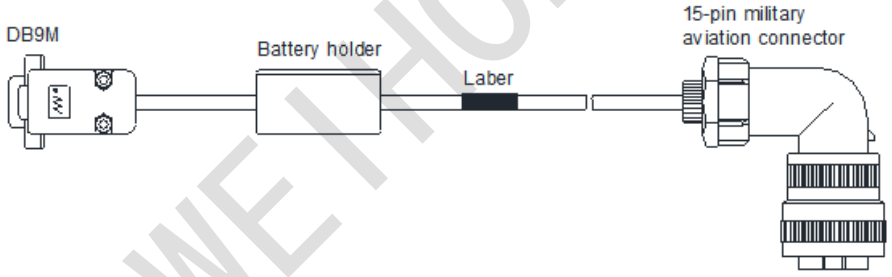
Basic information of the wiring is as follows:

- Drive Model
  - Absolute: AELMBQ□ □ □ A1B
  - Incremental: AELMBQ□ □ □ A0A
- Connector
  - Drive-side: DB9M—1405-091-06-1; O-DB plastic case—1441-090-00-3; match with DB9M
  - Motor-side: 15-pin military aviation connector—CMS3108A18-A5SI

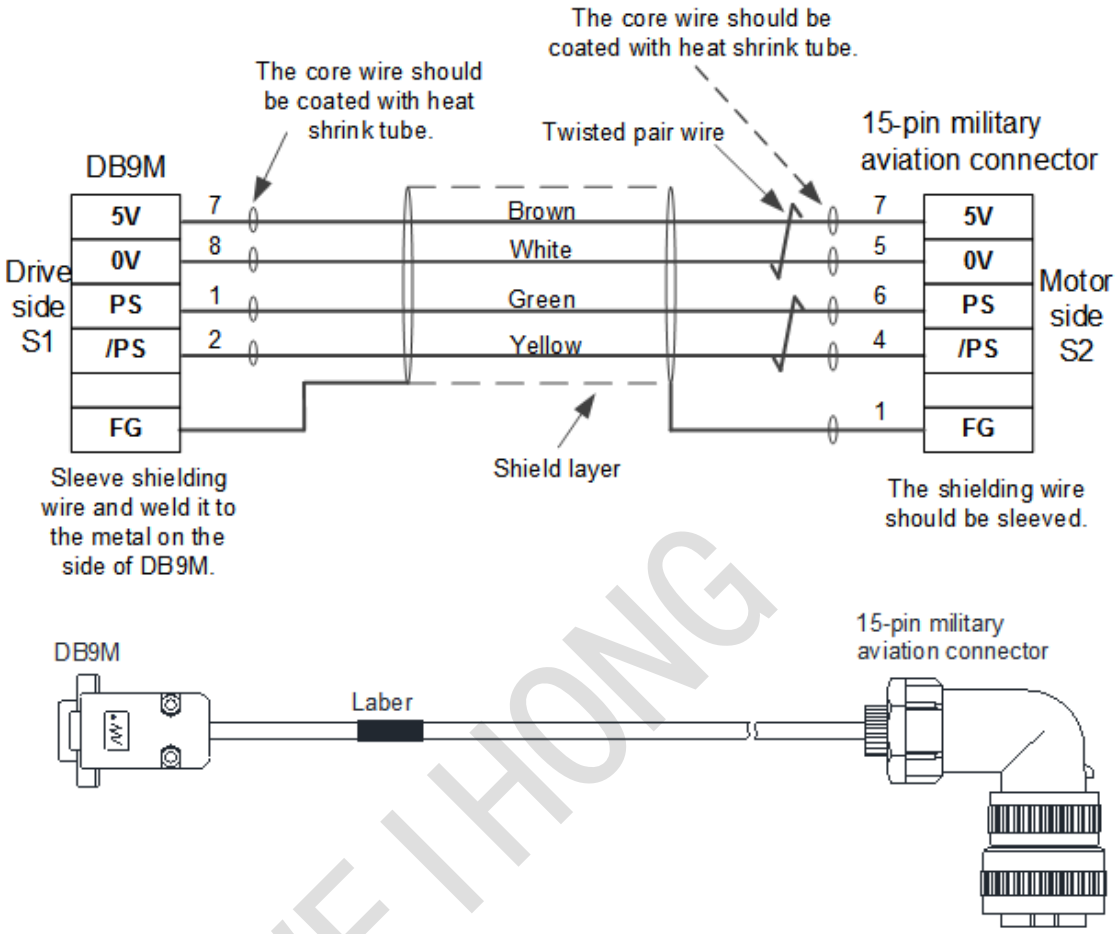
The wiring diagram is as follows:

- Absolute encoder





- Incremental encoder



11.1.2. Wiring Diagrams of Motors

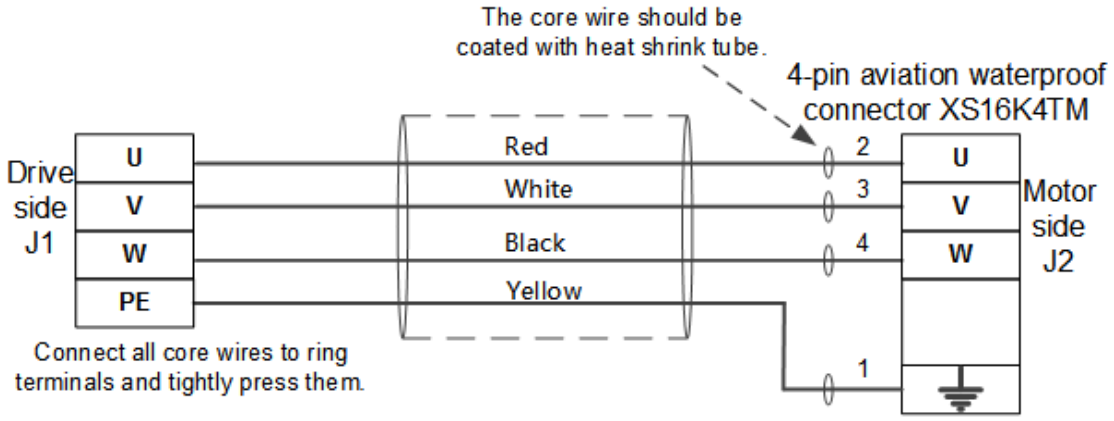
It is about the wiring of WISE MA/MB/MN/ME motors.

11.1.2.1. WISE MA040/MA060/ME040/ME060

Basic information of the wiring is as follows:

- Drive Model: TPLMNR□ □ □ A0
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-pin aviation waterproof connector—XS16K4TM

The wiring diagram is as follows:

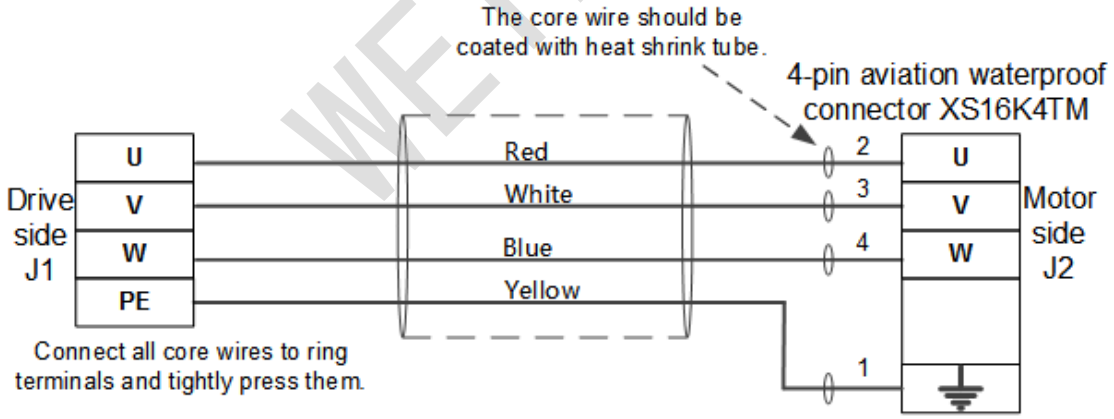


11.1.2.2. WISE MA080/ME080/MN080

Basic information of the wiring is as follows:

- Drive Model: TPLMNR□ □ □ A1
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-pin aviation waterproof connector—XS16K4TM

The wiring diagram is as follows:

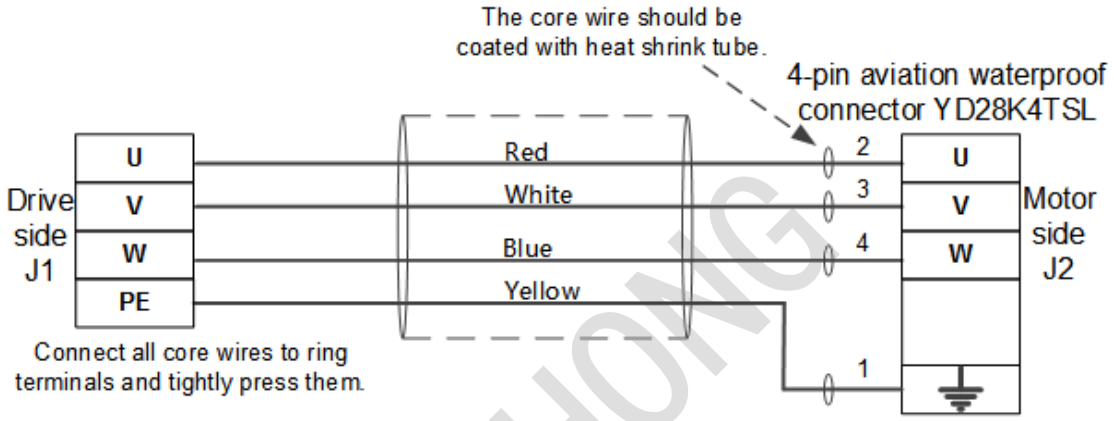


11.1.2.3. WISE MN110/MN130 (1.0kW)

Basic information of the wiring is as follows:

- Drive Model: TPLMNN□ □ □ A2
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-13-1000AH
  - Motor-side: 4-pin aviation connector—YD28K4TSL

The wiring diagram is as follows:

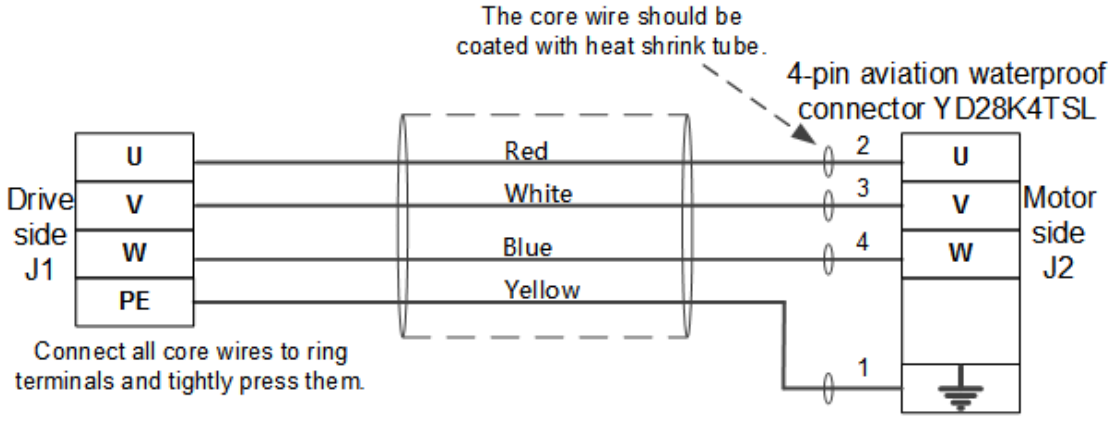


11.1.2.4. WISE MN110/MN130 (≥1.5kW)

Basic information of the wiring is as follows:

- Drive Model: TPLMNN□ □ □ A2
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-13-1000AH
  - Motor-side: 4-pin aviation connector—YD28K4TSL

The wiring diagram is as follows:

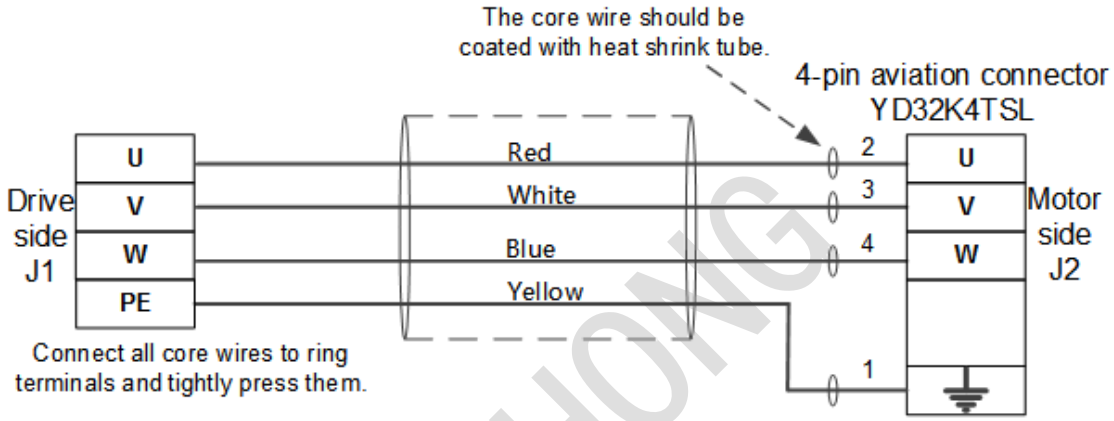


11.1.2.5. WISE MN180

Basic information of the wiring is as follows:

- Drive Model: TPLMNP□ □ □ A3
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-pin aviation connector— YD32K4TSL

The wiring diagram is as follows:

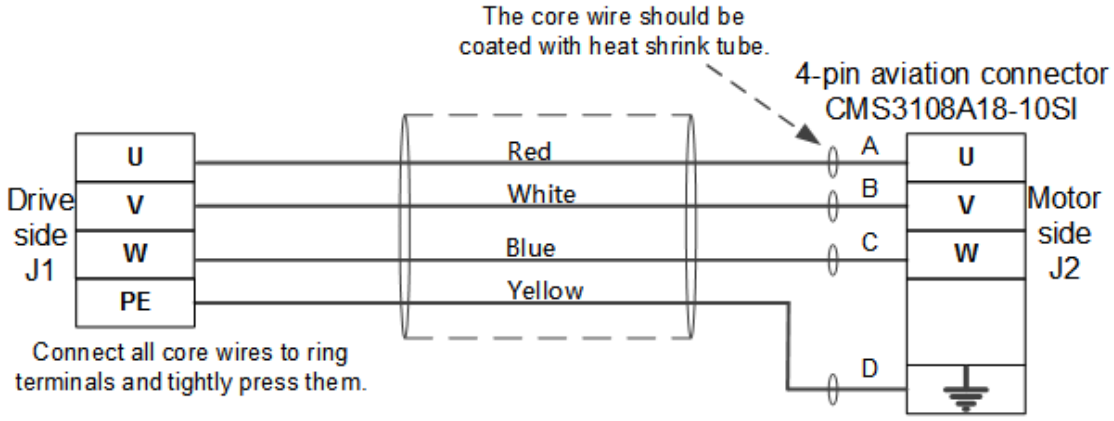


11.1.2.6. WISE MB100/MB130 (1.0kW)

Basic information of the wiring is as follows:

- Drive Model: TPLMBQ□□□A2
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-pin aviation connector— CMS3108A18-10SI

The wiring diagram is as follows:

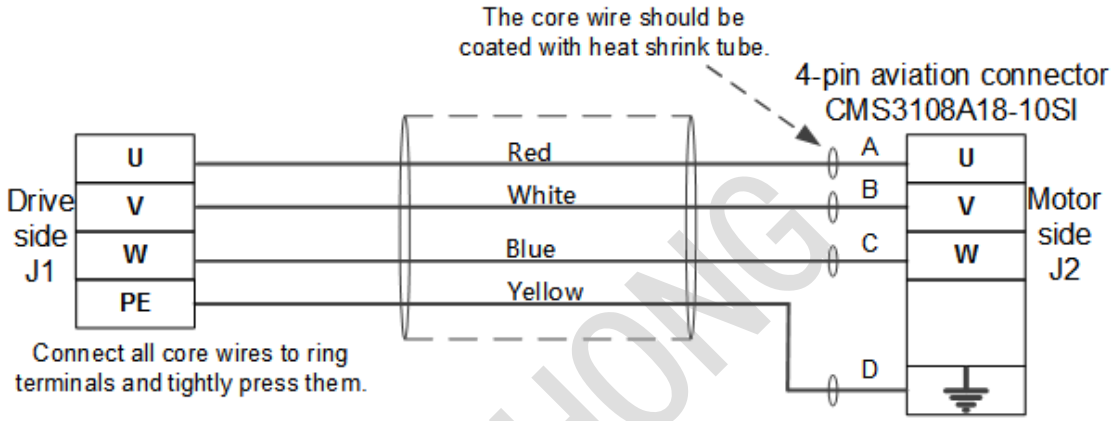


11.1.2.7. WISE MB100/MB130 (≥1.5kW)

Basic information of the wiring is as follows:

- Drive Model: TPLMBQ□ □ □ A3
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-pin aviation connector— CMS3108A18-10SI

The wiring diagram is as follows:



11.1.3. Wiring Diagrams of Brakes

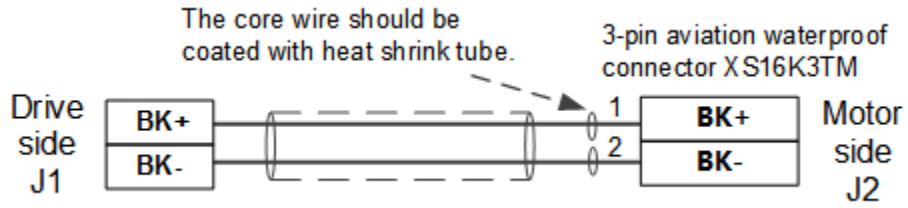
It is about the wiring of brakes for WISE MA/MB/MN/ME motors.

11.1.3.1. WISE MA040/MA060/MA080/ME040/ME060/ME080/MN080

Basic information of the wiring is as follows:

- Drive Model: BLMNN□ □ □ A0
- Connector
  - J1-side: 24V power interface
  - Motor-side: 3-pin aviation waterproof connector—XS16K3TM

The wiring diagram is as follows:

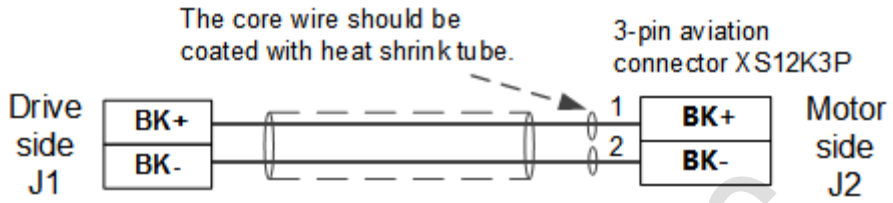


11.1.3.2. WISE MN110/MN130

Basic information of the wiring is as follows:

- Drive Model: BLMNY□ □ □ A0
- Connector
  - Drive-side: 24V power interface
  - Motor-side: 3-pin aviation connector—XS12K3P

The wiring diagram is as follows:

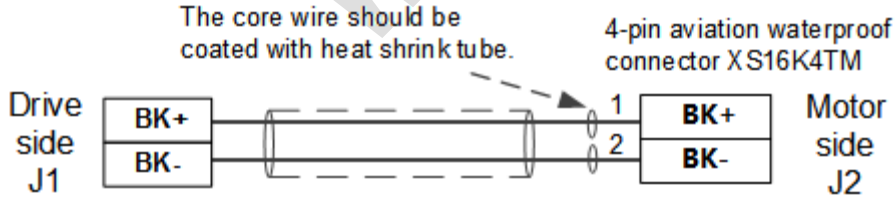


11.1.3.3. WISE MN180

Basic information of the wiring is as follows:

- Drive Model: BLMNR□ □ □ A0
- Connector
  - Drive-side: 24V power interface
  - Motor-side: 4-pin aviation waterproof connector—XS16K4TM

The wiring diagram is as follows:

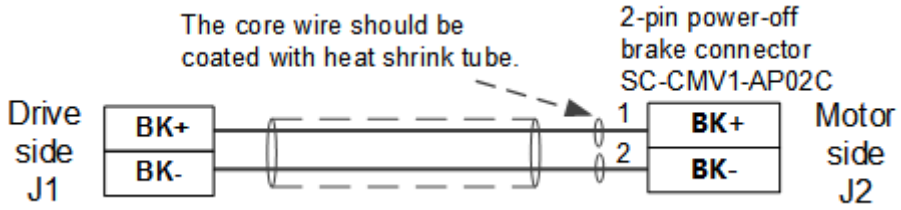


11.1.3.4. WISE MB100/MB130

Basic information of the wiring is as follows:

- Drive Model: BLMBQ□ □ □ A0
- Connector
  - Drive-side: 24 V power interface
  - Motor-side: 2-pin power-off brake connector—SC-CMV1-AP02C

The wiring diagram is as follows:



11.2. Wiring Diagrams for the Servo Drives and Panasonic A5/A6 Motors

11.2.1. Wiring Diagrams of Encoders

It is about the wiring of encoders for Panasonic A5/A6 motors.

11.2.1.1. Panasonic A5 MHMD/MHMJ Motors (≤750W)

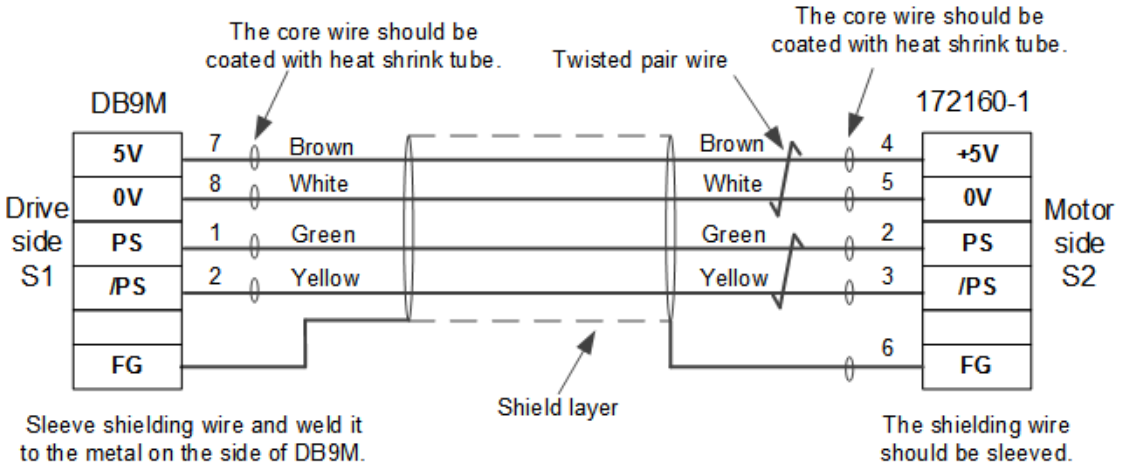
Basic information of the wiring is as follows:

- Drive Model

10. Incremental: AELP5S□ □ □ A0A

- Connector
  - Drive-side: DB9M—1405-091-06-1; O-DB plastic case—1441-090-00-3; match with DB9M
  - Motor-side: 6-pin white encoder connector—172160-1

The wiring diagram is as follows:



11.2.1.2. Panasonic A5&A6 MDME/MHME/MDMF motors (＞750W)

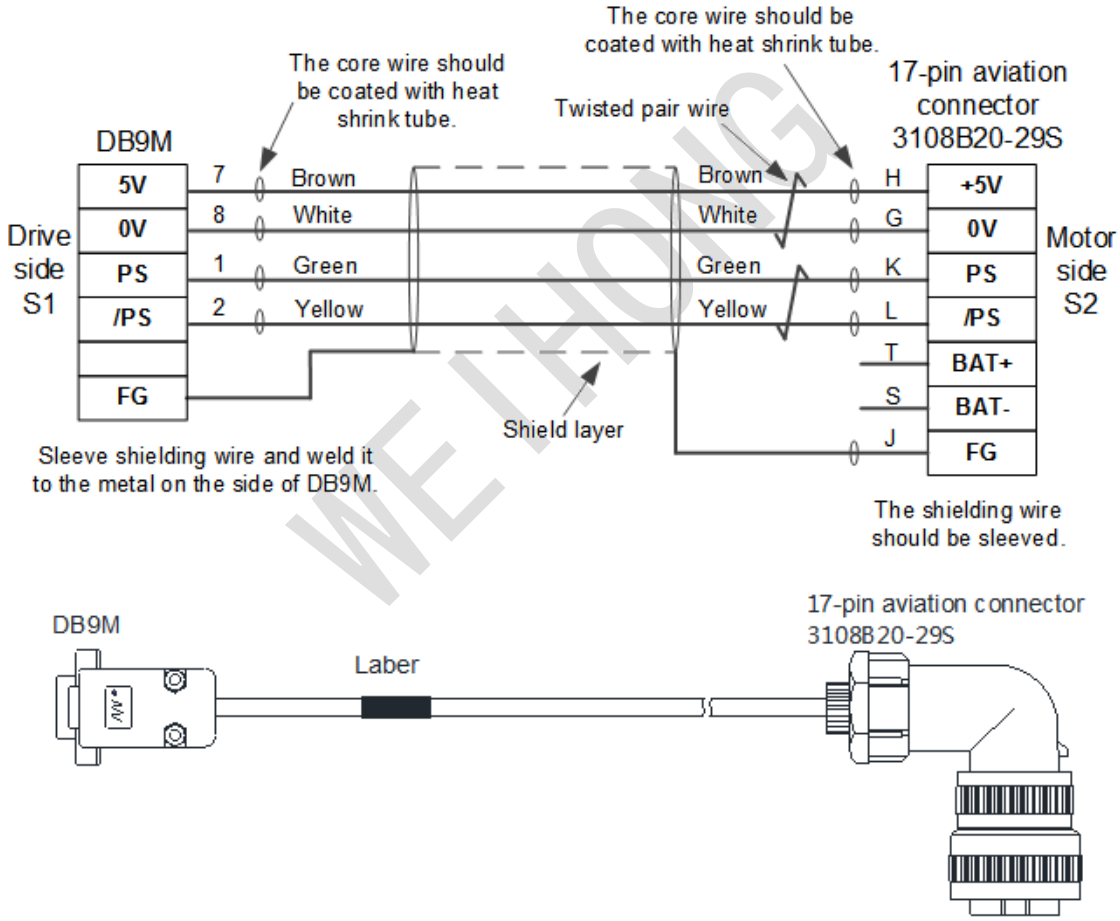
Basic information of the wiring is as follows:

- Drive Model

  Incremental: AELPAL□ □ □ A0A

- Connector
  - Drive-side: DB9M—1405-091-06-1; O-DB plastic case—1441-090-00-3; match with DB9M
  - Motor-side: 17-pin aviation connector—3108B20-29S

The wiring diagram is as follows:



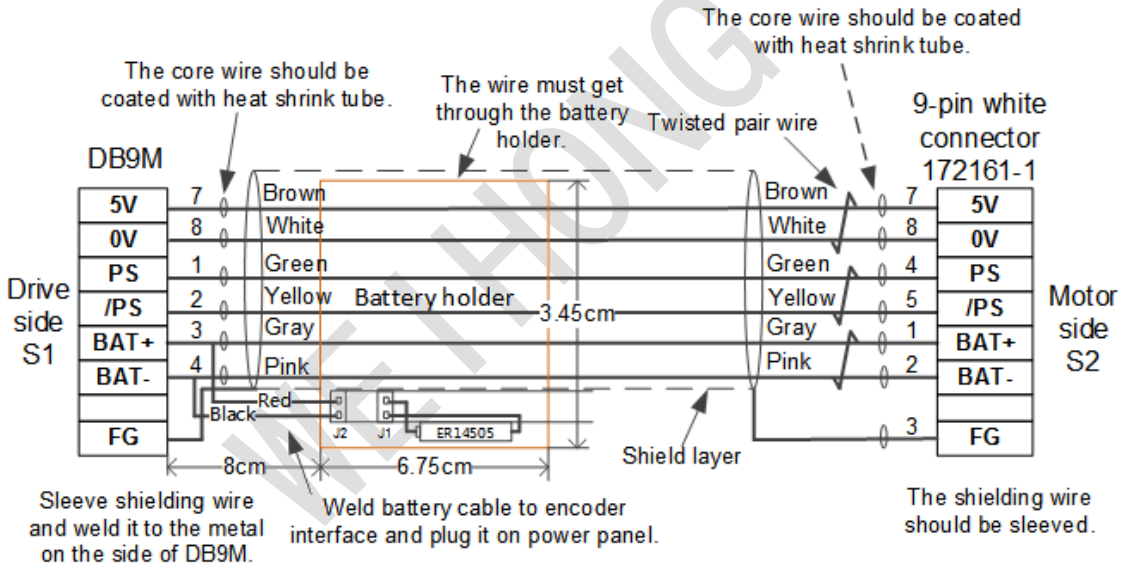
11.2.1.3. Panasonic A6 MHMF motors (≤750W)

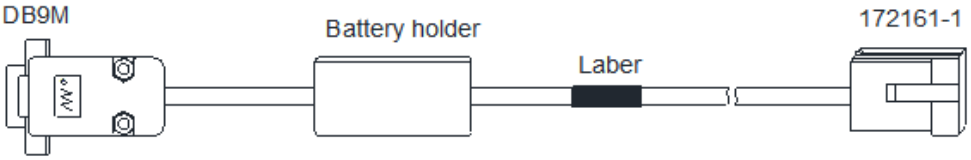
Basic information of the wiring is as follows:

- Drive Model
  - Absolute: AELP6T□ □ □ A1B
  - Incremental: AELP6T□ □ □ A0A
- Connector
  - Drive-side: DB9M—1405-091-06-1; O-DB plastic case—1441-090-00-3; match with DB9M
  - Motor-side: 9-pin white encoder connector—172161-1

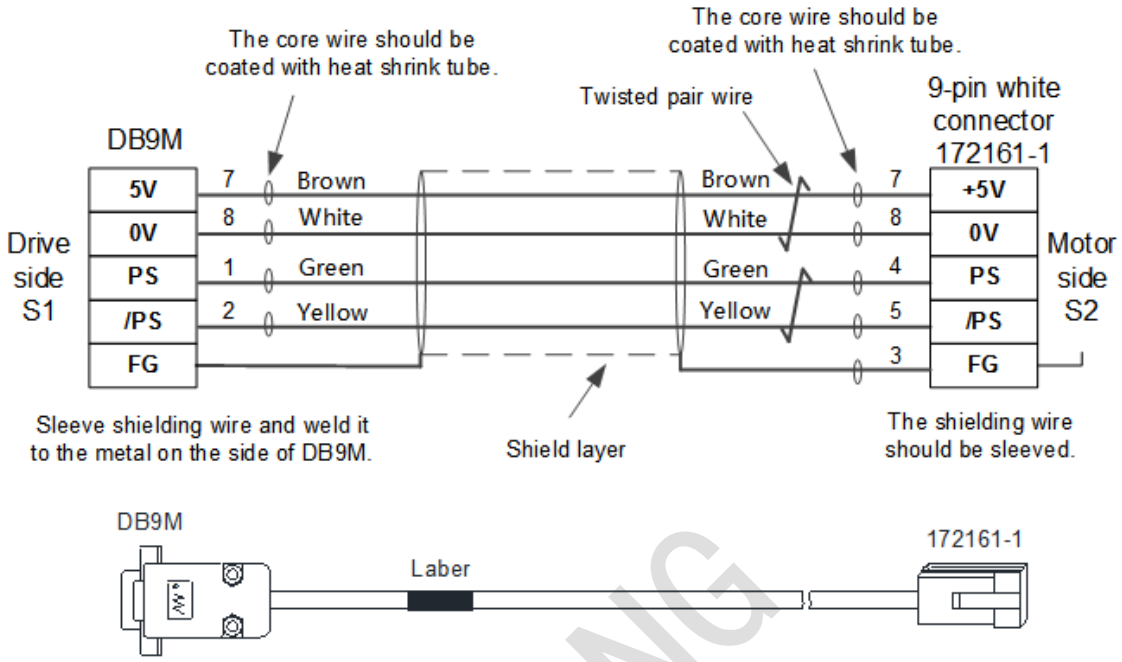
The wiring diagram is as follows:

- Absolute encoder





- Incremental encoder



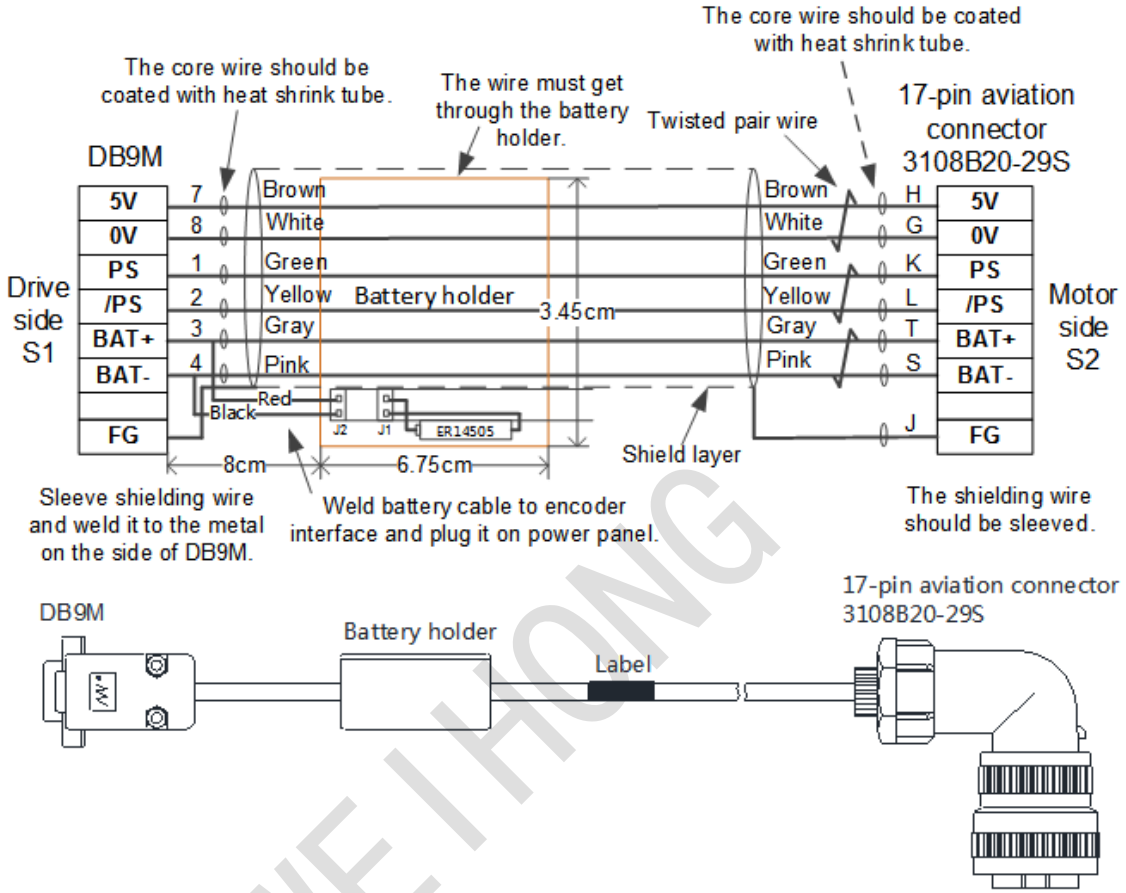
11.2.1.4. Panasonic A6 MDMF motors (＞750W) (Absolute) and Panasonic A5&A6 MDME/MHME/MDMF motors (＞750W) (Incremental)

Basic information of the wiring is as follows:

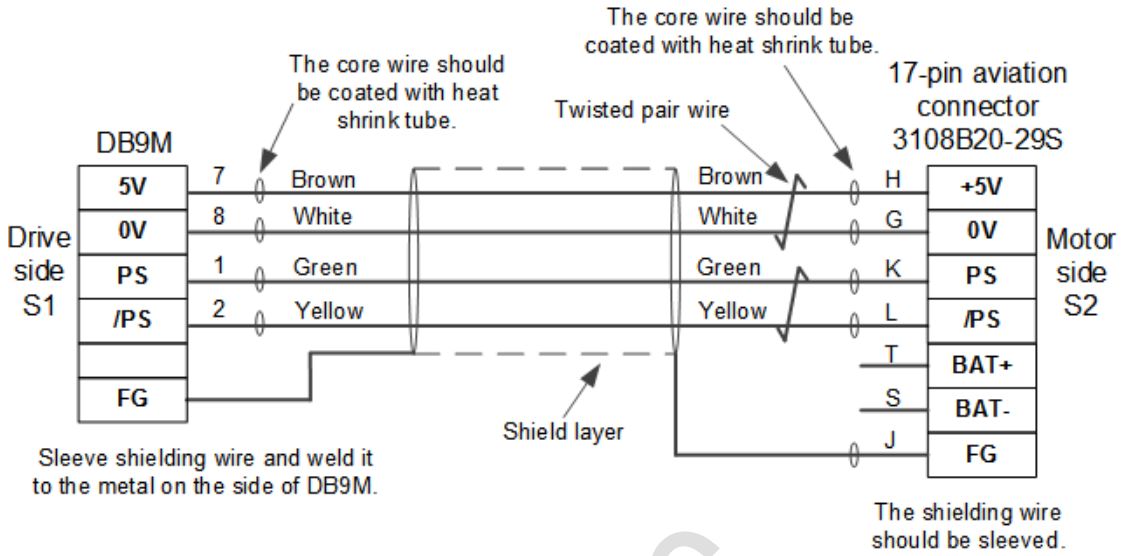
- Drive Model
  - Absolute: AELP6L□ □ □ A1B
  - Incremental: AELPAL□ □ □ A0A
- Connector
  - Drive-side: DB9M—1405-091-06-1; O-DB plastic case—1441-090-00-3; match with DB9M
  - Motor-side: 17-pin aviation connector—3108B20-29S

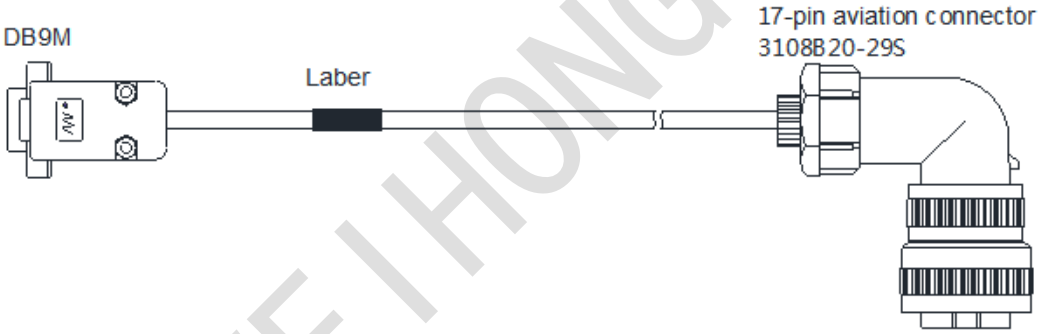
The wiring diagram is as follows:

- Absolute encoder



- Incremental encoder





11.2.2. Wiring Diagrams of Motors

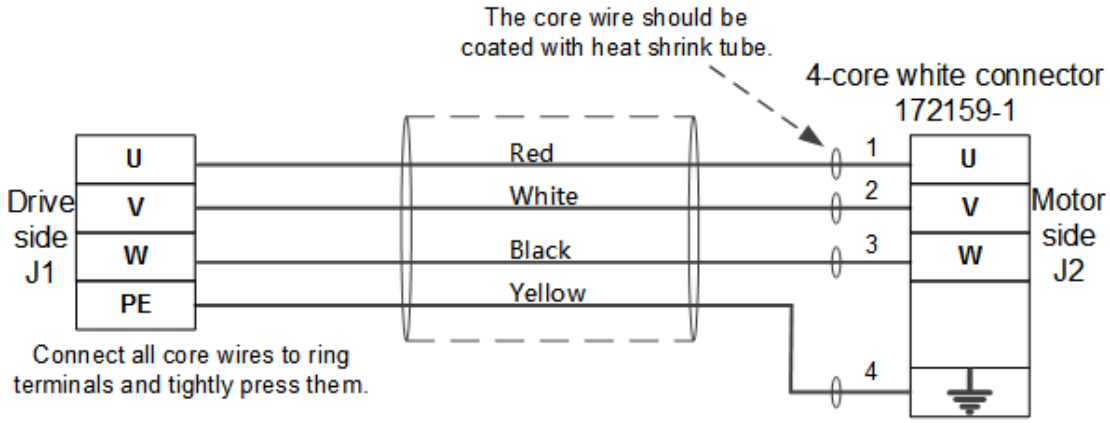
It is about the wiring of Panasonic A5/A6 motors.

11.2.2.1. Panasonic A5&A6 MHMD/MHMJ/MHMF Motors (≤400W)

Basic information of the wiring is as follows:

- Drive Model: TPLPAS□ □ □ A0
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-core white connector—172159-1

The wiring diagram is as follows:

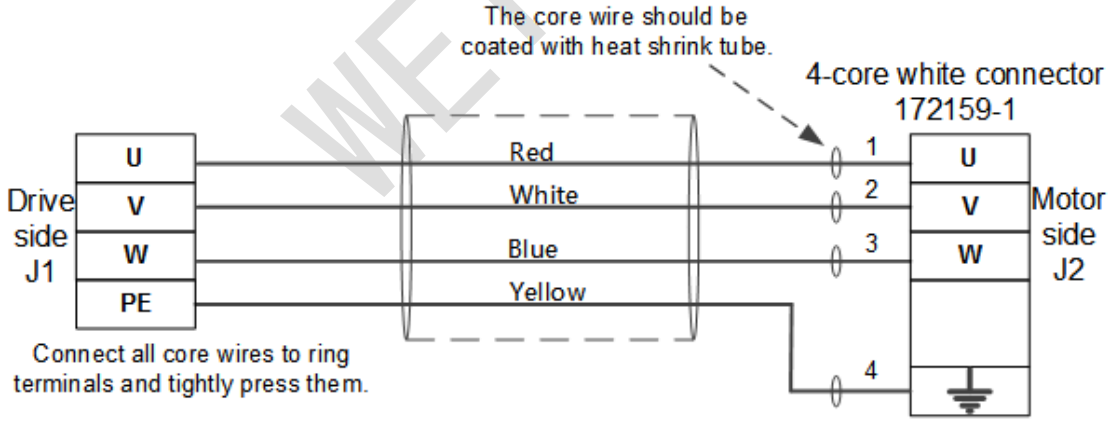


11.2.2.2. Panasonic A5&A6 MHMD/MHMJ/MHMF Motors (750W)

Basic information of the wiring is as follows:

- Drive Model: TPLPAS□ □ □ A1
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-core white connector—172159-1

The wiring diagram is as follows:

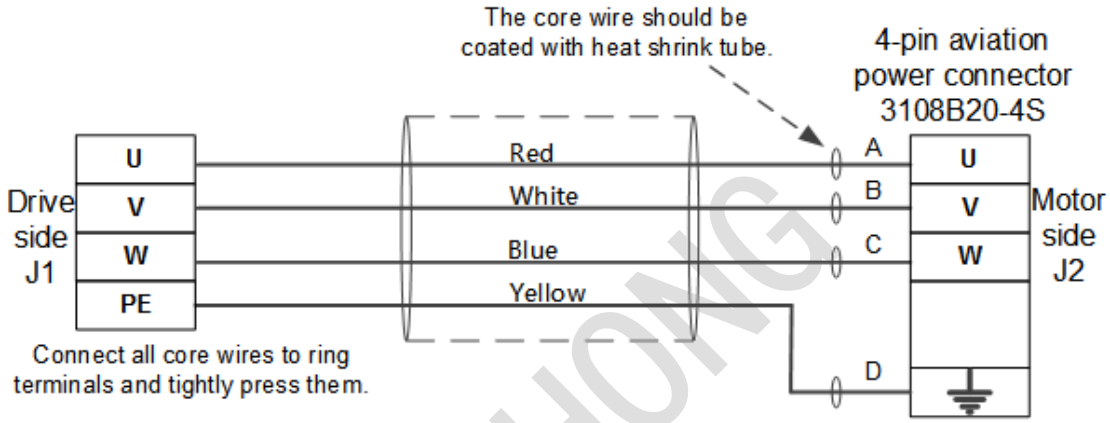


11.2.2.3. Panasonic A5&A6 MDME/MHME/MDMF Motors (1.0kW, without brake)

Basic information of the wiring is as follows:

- Drive Model: TPLPAL□ □ □ A2
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-pin aviation connector—3108B20-4S (without brake)

The wiring diagram is as follows:

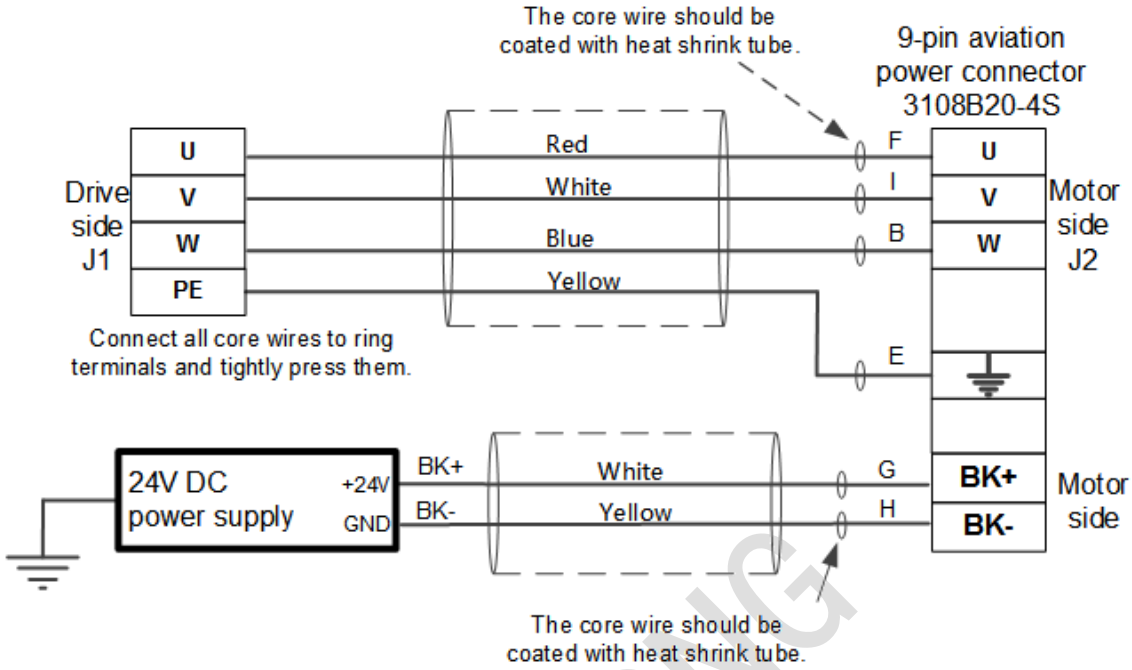


11.2.2.4. Panasonic A5&A6 MDME/MHME/MDMF Motors (1.0kW, with brake)

Basic information of the wiring is as follows:

- Drive Model: TPLPAM□ □ □ A2
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 9-pin aviation power connector—3108B20-18S (with brake)

The wiring diagram is as follows:

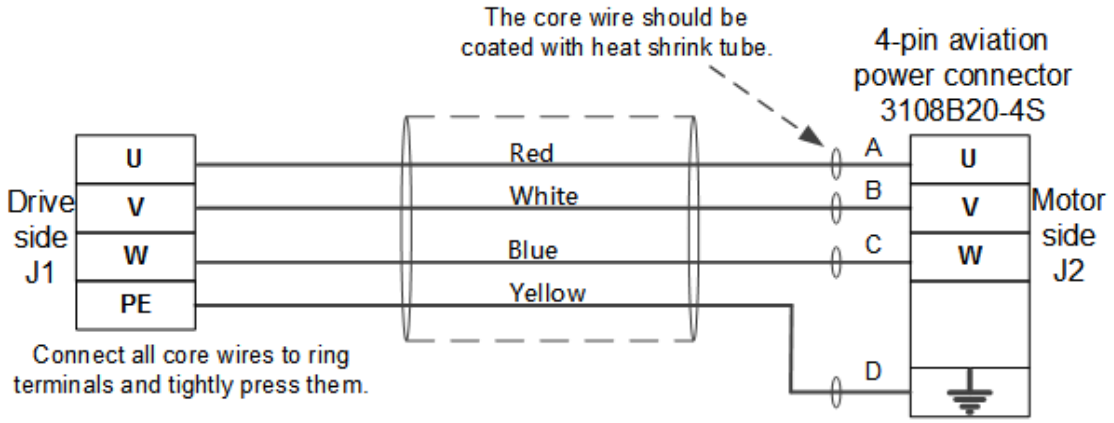


11.2.2.5. Panasonic A5&A6 MDME/MHME/MDMF/MSMF Motors (1.5kW/2.0kW, without brake)

Basic information of the wiring is as follows:

- Drive Model: TPLPAL□ □ □ A3
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 4-pin aviation power connector—3108B20-4S (without brake)

The wiring diagram is as follows:

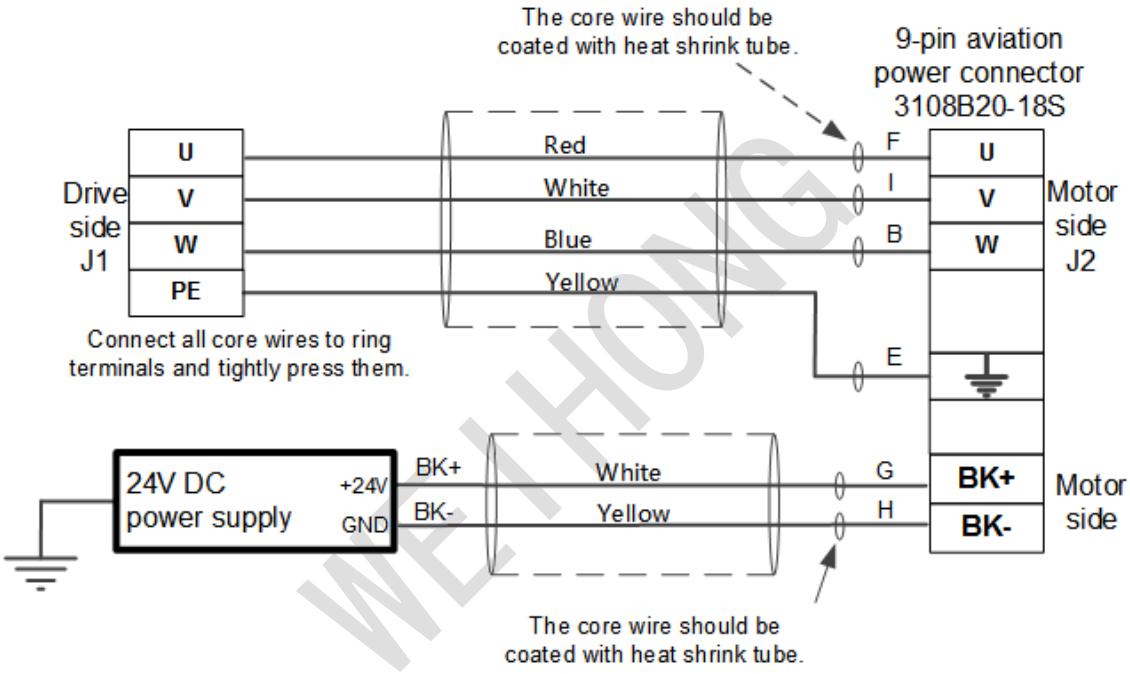


11.2.2.6. Panasonic A5&A6 MDME/MHME/ MDMF/MSMF Motors (1.5kW/2.0kW, with brake)

Basic information of the wiring is as follows:

- Drive Model: TPLPAM□ □ □ A2
- Connector
  - Drive-side: 4-pin connector—8EDGKB-7.5-04P-13-1000AH
  - Motor-side: 9-pin aviation power connector—3108B20-18S (with brake)

The wiring diagram is as follows:



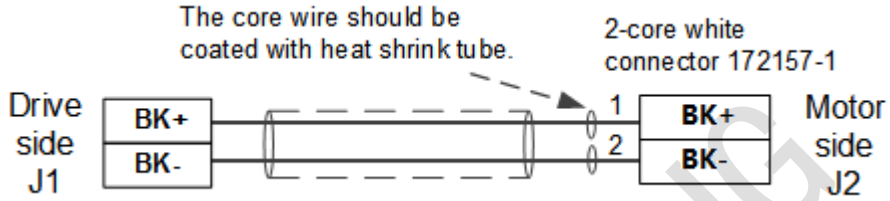
11.2.3. Wiring Diagrams of Brakes

It is about the wiring of brakes for Panasonic A5/A6 motors (≤750W).

Basic information of the wiring is as follows:

- Drive Model: BLMNS□ □ □ A0
- Connector
  - J1-side: 24 V power interface
  - Motor-side: 2-core white connector—172157-1

The wiring diagram is as follows:



SPECIALIZED / CONCENTRATED / FOCUSED

Shanghai Weihong Electronic Technology Co., Ltd.

Address: No. 1590, Huhang Rd., Fengxian, Shanghai, China, 201401

Hot-line: 400 882 9188

Website: www.weihong.com.cn/en