VEICHI

Manual

SD700 Series servo system

VEICHI

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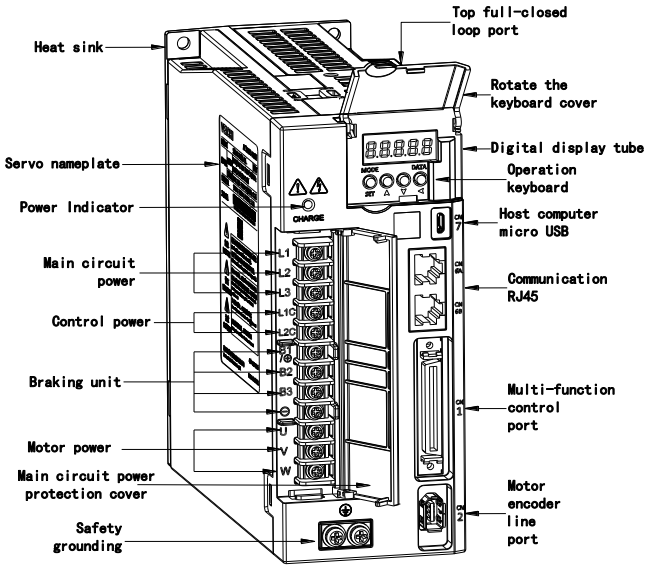
Contents

1. Abstract

1.1. **Series Introduction**

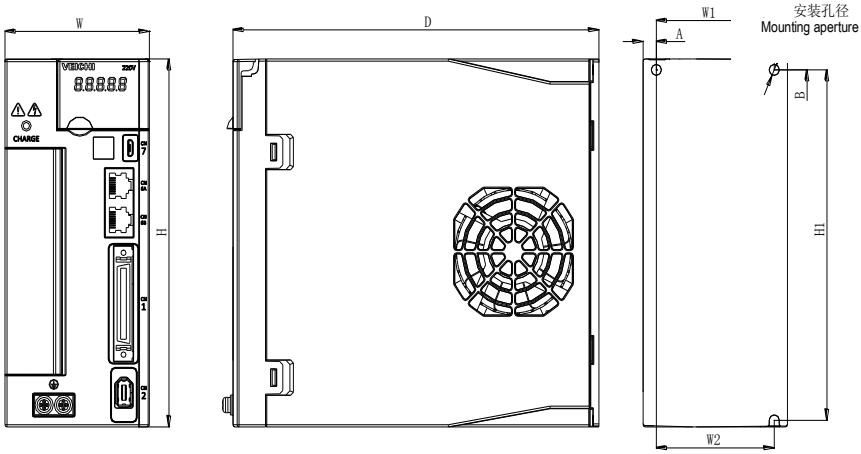
SD700 series servo drives are mainly used for the occasion of high speed, high frequency and high positioning accuracy. The servo unit can maximize the performance of the machine in the shortest time, which can improve the production efficiency.

1.2. **Name of Each Part of the Servo Drive**



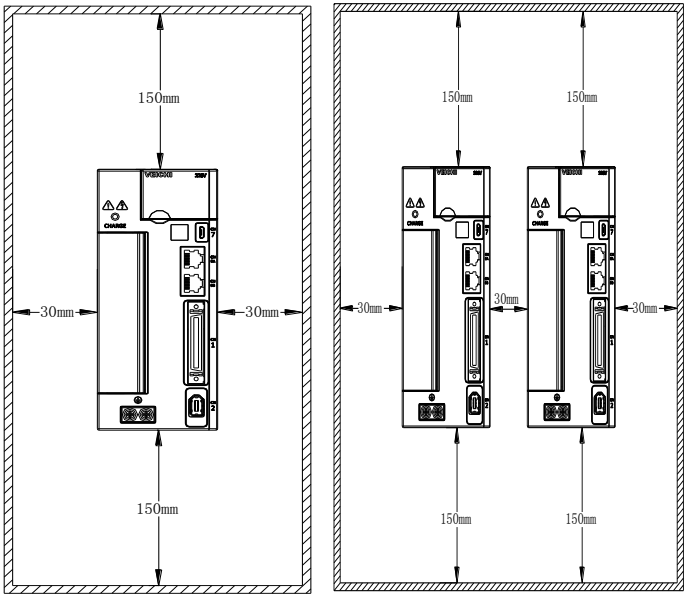
1.3. **Basic Information of Servo Unit**

1.3.1. **Installation Dimensions**



Structure	Machine model	External size(mm)			Installation size(mm)						Installation aperture
		W	H	D	W1	W2	H1	H2	A	B	
SIZE A	SD700-1R1A-**	45	168	170	\	20	160	\	7.5	5	2-M4
	SD700-1R8A-**										
	SD700-3R3A-**										
SIZE B	SD700-5R5A-**	71	168	180	58	58	160	\	6.5	5	3-M4
	SD700-7R6A-**										
	SD700-9R5A-**										
	SD700-2R5D-**										
	SD700-3R8D-**										
SIZE C	SD700-160A-**	92.5	188	182	82.5	75	180	\	5	5	3-M4
	SD700-6R0D-**										
	SD700-8R4D-**										
	SD700-110D-**										
SIZE D	SD700-170D-**	120	260	210	100	84.5	250	236	\	\	4-M5
	SD700-240D-**										
	SD700-300D-**										

1.3.2. **Installation Way**



Single installation　　Multiple installation

1.3.3. **Rated electrical parameters**

Drive specification	1R1A	1R8A	3R3A	5R5A	7R6A	9R5A		
Continuous output current Arms	1.1	1.8	3.3	5.5	7.6	9.5		
Maximum output current Arms	3.9	6.3	11.6	16.5	22.8	23.8		
Case	A				B			
Drive specification	2R5D	3R8D	6R0D	8R4D	110D	170D	240D	300D
Continuous output current Arms	2.5	3.8	6	8.4	11	17	24	30
Maximum output current Arms	7.5	11.4	18	25.2	27.5	42.5	60	70
Case	B		C		D			

1.3.4. **Basic specifications**

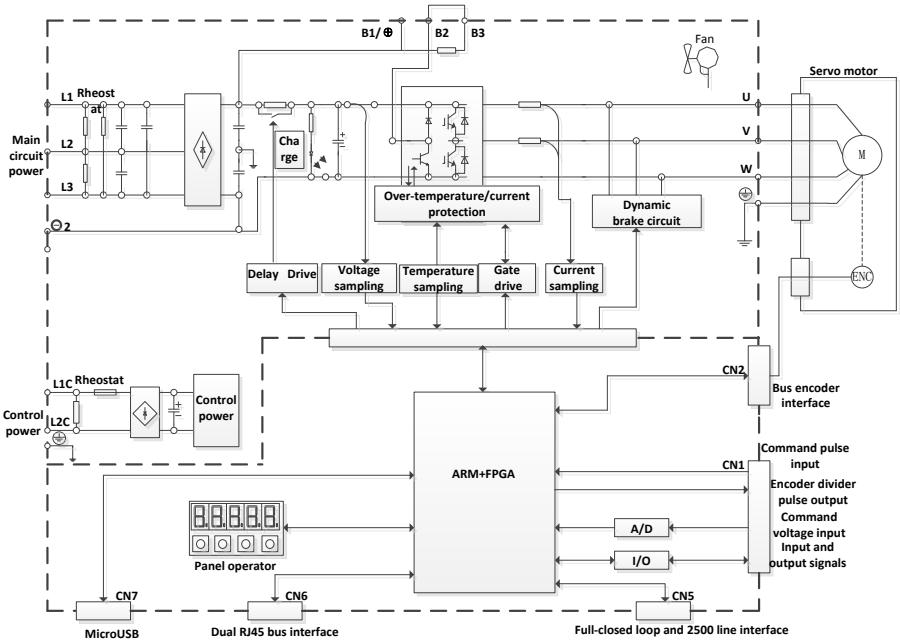
Project			Specifications
Control Mode			IGBT, PWM Control, Sine wave current drive mode
Feedback	Rotary Motor Combination		Serial communication encoders: 17-bit, 20-bit, 24-bit (absolute encoder)
			Pulse encoder: Provincial linear encoder: 2500 line
			Rotary transformer type encoder
Environmental conditions	Environment temperature		-5℃～55℃（55 °C ~ 60 °C, can reduce the rated value to use）
	Storage temperature		-20℃ ~ 85℃
	Environmental humidity		Less 95%RH（No freezing, no condensation）
	Storage humidity		Less 95%RH（No freezing, no condensation）
	Vibration resistance		4.9m/s²
	Impact resistance		19.6m/s²
	Protection level		IP20
	Cleanliness		Non-corrosive and flammable gas
			No water, oil, pharmacy splash
			Dust, salt, and metal powder are less in the environment
	Altitude		Below 1000m (1000m～2000m, can reduce the rated value to use)
	others		No static electricity interference, strong electric field, strong magnetic noise, radiation, etc.
Applicable standard			EN 61800-5-1:2007 EN 61800-3:2004/A1:2012
Installation type			Base mounting Type: All models
			Shelf mounting type: All models
Performance	Speed control range		1:6000 (The lower limit of the speed control range is the value under non-stop condition at the rated torque load)
	Speed fluctuation rate	Load fluctuation	Below ±0.01% of rated speed (load fluctuation: 0%~100%)
		Voltage fluctuation	Rated speed 0% (rated voltage ±10%)
		Temperature fluctuation	Below ±0.1% of rated speed (temperature fluctuation: 25±25°C)
	Torque control accuracy		±1%
Soft-start time setting			0～10s (acceleration and deceleration can be set separately)

Communication function	RS-485	1:N communication	When RS-485 port, N max = 127 stations
		Axis address setting	Through parameter setting
	USB communication	Connected equipment	Computer
			According to USB1.1 specification (12M)
Display function			Charge indicator
Panel operation function			Push button switch × 4
Input and output signals	Encoder divider pulse output		A-phase, B-phase, and C-phase: linear drive transmission frequency pulse number, can free to set
	Sequence input signal	Fixed input	Operating voltage range: DC 5V±5%
			Input points: 1 point
			Encoder absolute data request input (SEN) signal
		Assignable input signal	Operating voltage range: DC24V±20%
			Input points: 9 points
			Input method: common collector input, common emitter input
			Input signal
			Servo ON (/S-ON)
			P operation/P-CON
			Home reset deceleration switch signal (/DEC)
			Forward drive prohibition (P-OT), reverse drive prohibition (N-OT)
			Alarm reset (/ALM-RST)
			Forward external torque limit (/P-CL), reverse external torque limit (/N-CL)
			Speed rotation direction selection (/SPD-D) signal
			Control Mode Switch (/C-SEL)
			Zero Fixed (/ZCLAMP)
			Command Pulse Disable (/INHIBIT)
			Magnetic pole detection input (/P-DET) signal
			Gain switching (/G-SEL)
			Command pulse input override switch (/PSEL)
			SEN input (/SEN) signal
			Assignable signals and change positive/negative logic
	Sequential output	Fixed output	Operating voltage range: DC5V~DC30V

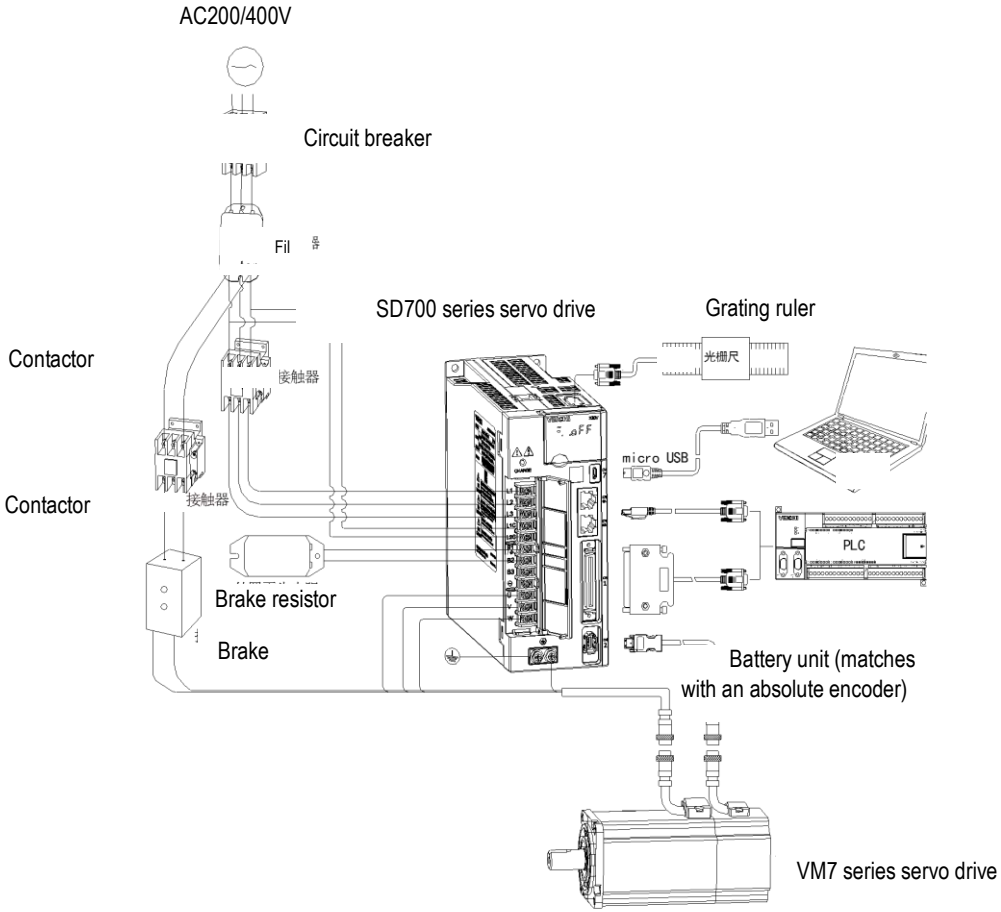
	signal				Output points: 1 point
					Output signal: servo alarm (ALM)
			Assignable output signal		Operating voltage range: DC5V~DC30V
					Output points: 3 points
					Input method: opt coupler output (isolated type)
					Output signal
					Positioning completed (/COIN)
					Rotary checkout (/TGON)
					Servo ready (/S-RDY)
					Torque Limit Detection (/CLT)
					Speed Limit Checkout (/VLT)
					Brakes (/BK)
					Warning (/WARN)
					Locate nearby (/NEAR)
					Assignable signals and change positive/negative logic
Dynamic brake					Operation in the main circuit power OFF, servo alarm, servo OFF, and over-travel (OT)
Regenerative					Function built-in
Over-travel (OT) protection					Dynamic brake (DB) stop, deceleration stop or free-running stop during P-OT, N-OT input operation
Protective function					Over-current, over-voltage, under-voltage, overload, regenerative failure, etc.
Accessibility function					Gain adjustment, alarm records, JOG operation, origin search, etc.
Security function	Input				STO: Base of the power module block signal
Control method	Position Control	Feed forward compensation			0%~100%
		Location reach arrange			0~1073741824 instruction unit
		Input signal	Comm and pulse	Command pulse form	Choose any of the followings
					Symbol & pulse sequence, CW+CCW pulse sequence, 90° phase difference two-phase pulse
				Input form	Linear drive, open collector
				Maximum input frequency	Line driver
					Symbol + pulse sequence, CW + CCW pulse sequence: 4Mpps
					90° phase difference two-phase pulse: 1Mpps
					Open collector

					Symbol + pulse sequence, CW + CCW pulse sequence: 200 Kpps
					90° phase difference two-phase pulse: 200Kpps
				Input override switch	1~100 times
			Clear signal		Position deviation clearing
	Speed control	Soft-start time setting			0 ~ 10s (acceleration and deceleration can be set separately)
		input signal	Command voltage		Maximum input voltage: ±10V (Forward rotation of motor when positive voltage is commanded)
					Rated speed at DC6V [factory setting]
					Can change input gain setting
			input resistance		About 14KΩ
			Loop time parameter		30μs
		Internally set speed control	Rotation direction selection		Use P operation signal
			Speed selection		Using Forward/Reverse External Torque Limit Signal Input
					Stop or change to other control mode when both sides are OFF
	Torque control	input signal	Command voltage		Maximum input voltage: ±10V (positive rotation of motor when positive voltage is commanded)
					Rated speed at DC6V [factory setting]
					Can change input gain setting
			Input resistance		About 14KΩ
			Loop time parameter		16μs

1.4. **System Diagram**



1.5. System Configuration Example



1.6. **Name the Drive**

SD700-3R3A-PA*

A B C D E F G

Field ID	Field Explanation	
A	SD：Servo product code	
B	700：Product series	
C	Current class：	
	1R1：1.1A 1R8：1.8A 3R3：3.3A 5R5：5.5A 7R6：7.6A 9R5：9.5A 2R5：2.5A 3R8：3.8A 6R0：6A 8R4：8.4A 110：11A 170：17A 240：24A 300：30A	
D	Input voltage class：	
	A：220VAC；D：400VAC	
E	Type：	
	P: pulse type; S: standard type; C: CAN open bus type; N: Ether CAT bus type; M: MECHATROLINK-II bus type; L: MECHATROLINK-III bus type	
F	Supported encoder types：	
	A	Absolute type
	B	Incremental
	T	Rotary transformer type
G	Product management number, standard product default.	

Difference functions between different types：

Code	model	Input pulse	16-bit analog value	Full closed loop	RS485	CAN open	Ether CAT	MECHATROLINK Ⅱ	MECHATROLINK Ⅲ
P	Pulse type	√	×	×	√	×	×	×	×
S	Standard type	√	√	√	√	×	×	×	×
C	CAN type	×	×	×	×	√	×	×	×
N	Ether CAT type	×	×	×	×	×	√	×	×
M	MECHATROLINK Ⅱ type	×	×	×	×	×	×	√	×
L	MECHATROLINK Ⅲ type	×	×	×	×	×	×	×	√

*1.M-II type refers to the servo unit interface specification for MECHATROLINK-II communication command type

*2.M-III type refers to the servo unit interface specification for MECHATROLINK-III communication command type

1.7. **Maintenance and Inspection of Servo Unit**

The servo system is made up of many parts. The equipment performs its functions only when all the parts work properly. In mechanical parts and electronic parts, some parts need to be maintained depending on the conditions of use. It must be regularly checked or replaced according to the service-time to ensure that the servo motor and servo drive can operate normally for a long time.

1.7.1. **Overhaul of Servo Motor**

Since the AC servo motor does not have the electric brush so that only a simple daily maintenance is required. The maintenance period in the table is a rough standard. Please judge and determine the most appropriate time for repair according to the conditions of use and use environment.

Inspect items	Inspect time	The essentials of inspection and maintenance	Notes
Vibration and sound confirmation	every day	Tactile and auditory judgments	No increase compared to usual
Appearance overhaul	According to the insult	Erasing with a cloth or cleaning with an air gun	-
Insulation resistance measurement	At least once a year	Disconnect the servo unit and measure the insulation resistance with a 500V megger. Resistance value exceeding 10MΩ is normal	When it is 10MΩ or less, please contact our maintenance department.
Replacement of oil seals	At least once every 5000 hours	Please contact our agents or technical support.	Only servo motor with oil seal.
Comprehensive maintenance	At least once every 20,000 hours or 5 years		-

1.7.2. **Overhaul of Servo Drive**

Although the servo drive unit does not require daily inspections, it should be overhauled more than once a year.

Maintenance project	Inspect time	The essentials of inspection and maintenance	Notes
Appearance maintenance	more than once a year	No garbage, dust, oil traces, etc.	Erasing with a cloth or cleaning with an air gun
Loose screws		Wiring board, connector mounting screws and so on must not loosen	Please tighten

1.7.3. **Approximate Standards for Changing Internal Parts of Servo Units**

Electrical and electronic parts are subject to mechanical wear and aging. To ensure safety,

please do regular inspections. In addition, please refer to the following table for the standard number of years of replacement, and contact our agency or sales office. After the inspection, we will judge whether we need to replace the parts. The servo unit serviced by our company has its user parameters adjusted back to the factory settings. Be sure to reset the user parameters before use by yourself.

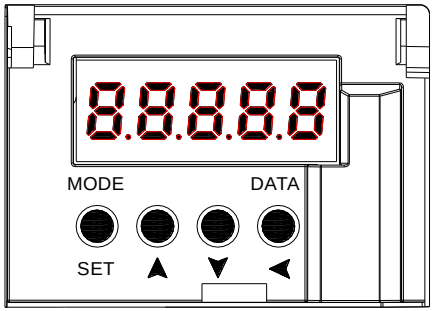
Parts' name	Standard replacement period	Conditions of use
Cooling fan	4～5 years	Ambient temperature: annual average 30°C Load rate: 80% or less Operating rate: 20 hours or less
Smoothing capacitor	7～8 years	
Relay	According to actual use conditions	
Aluminum electrolytic capacitors on printed circuit boards	5 years	

2. Panel Operation

2.1. **Basic Operation**

2.1.1. **Keys' Names and Functions of the Panel Operator**

The panel operator consists of panel monitor and keys. The panel operator could display condition, operate the accessory functions, set parameters and monitor the motions of the drive unit. The panel operator keys' names and functions are shown as below:

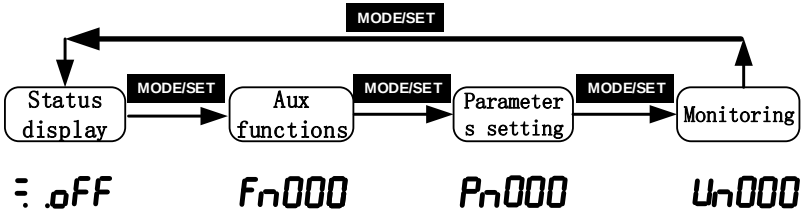


Keys' name	Functions
MODE/SET key	Shift the function modes
	Confirm parameter settings
	Operate the accessory functions
UP key	Select parameters up or increase the value, switch between high, medium, and low segment values in multiple segment display parameters
▼ DOWN key	Select parameters down or decrease the value, switch between high, medium, and low segment values in multiple segment display parameters
DATA/SHIFT key	Press and hold the DATA/SHIFT button for about 1 second to enter or exit
	Short press to move to the left one (when flashing)

Pressing the Up and Down keys at the same time could reset the drive alarm, but remember to exclude causes of the alarm before reset the drive alarm.

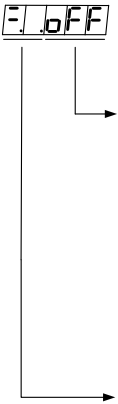
2.1.2. **Functions Switch**

Press the MODE/SET key, the function will be switched like this shown as below:



2.1.3. **Status Display**

The method of judging the status display is as follows:



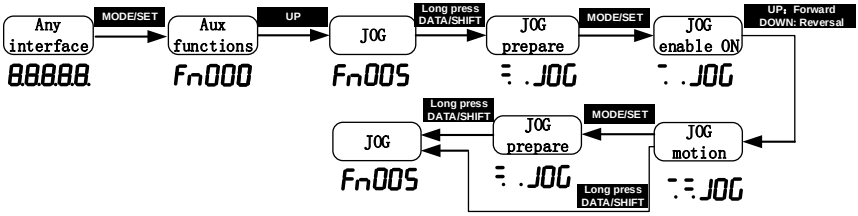
Display	Meaning	Display	Meaning
oFF	Means that the drive is OFF	not	Means that the input signal(N-OT) is an open circuit
on	Means that the drive is ON	C90	Flashing displays fault code, more details on the "fault code"
Pot	Means that the input signal(P-OT)is an open circuit	on / tSt	No-motor testing function displays the running status alternately, more details in this function

Display	Meaning	Display	Meaning
	It lights on when the control power is ON and lights off when OFF		It lights on when the main circuit is ON and lights off when OFF
	Speed control: speed outputs(/V-CMP) are absolutely same Position control: it lights on when the positioning is OK(/COIN) Torque control: it lights on all the time		It lights on when the rotation detection outputs(/TGON)
			Speed control: it lights on when the speed command inputs Position control: it lights on when the position command inputs
	It lights on when the drive is OFF and lights off when ON		Torque control: it lights on when the torque command inputs Position control: it lights on when the pulse clear signal outputs

2.2. **Auxiliary Functions Operation of Fn group**

Auxiliary functions are about performing the settings and adjustment of the drive unit. The panel operator displays the numbers which begin with Fn.

Let's take the JOG function (Fn005) as an example to explain the operating method of the auxiliary functions:



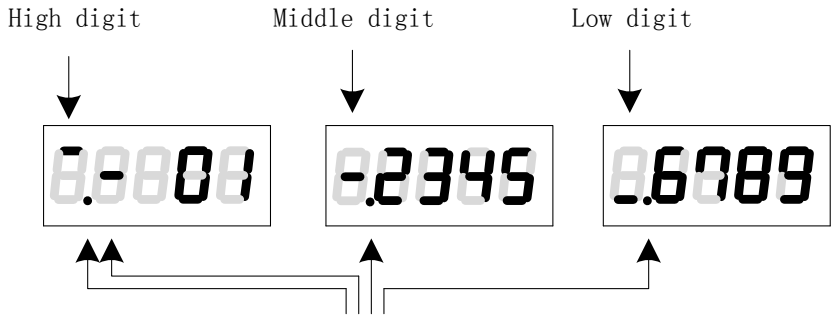
2.3. **Parameter Pn Group's Operation**

Let me introduce the parameters Pn's setting method:Take the setting method of the speed loop gain rise from 40.0 to 100.0 as an example:

1. When the setting range is within 5-digit numbers. Because the panel operator could only display 5-digit number, so the setting display with 6-digit number is shown as

below:

2. When the setting range is beyond 6-digit numbers:



They appear only when the number is a negative

2.4. **Operations of Monitoring Display Un Group**

This function could monitor setting command values of the drive unit, the status of input and output signals and internal conditions of the drive unit. The panel operator displays the numbers which begin with Un, then let's take this function as an example to explain the operating method of the monitoring display: when the motor speed is 3000rpm:

3. Wiring and Connections

3.1. **Main Circuit Wiring**

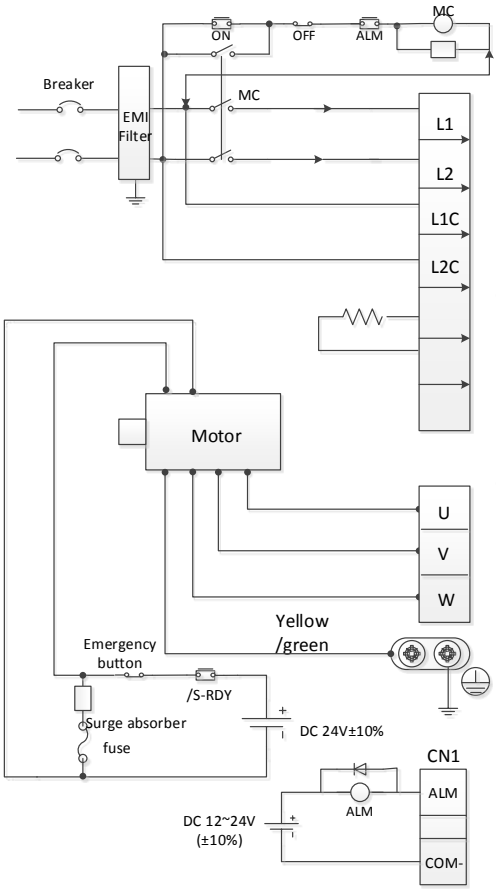
3.1.1. **Terminals Explanation:**

Needle code	Signal name	Functions
1	L1	Main circuit power input
2	L2	Main circuit power input
3	L3	Main circuit power input
4	L1C	Control power input
5	L2C	Control power input
6	B1/+	Internal and external braking resistor pins/regulated DC power supply positive
7	B2	Energy-consumption braking output
8	B3	Pin of internal brake resistor
9	-	Negative of DC power supply
10	U	Motor power U phase
11	V	Motor power V phase
12	W	Motor power W phase
Casing	Grounding	Safely grounding

The A volume main circuit wiring can only be connected to single phase (provide two terminals), please pay attention to the correct wiring according to the wiring identification when wiring.

3.1.2. **Wiring Diagram**

1. volume single-phase wiring diagram



- Please make this emergency stop protection circuit.
- Electromagnetic contactor package surge absorbing device at both ends.

- 220V system input voltage range:
  AC 220V(-15%)~240(+10%)
- 400V system input voltage range:
  AC 380V(-15%)~440(+10%)

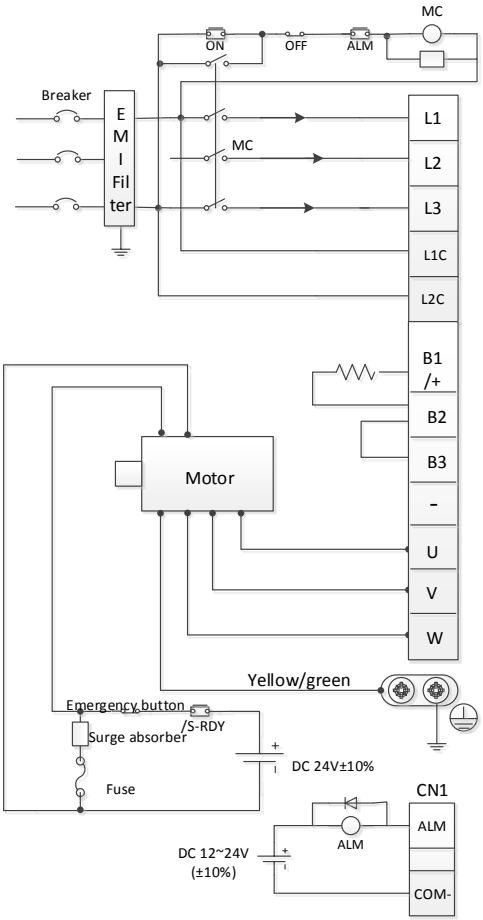
- When using an external regenerative braking resistor, connect it by the dotted line in the figure.

- Please connect the U, V, W, and output of the drive correctly according to the motor cable phase sequence of the servo motor. The wrong phase sequence will cause the drive to malfunction.

- Be sure to ground the servo drive to avoid electrical damage.

- The 24V power supply for electromagnetic braking needs to be provided by the user and must be isolated from the 12~24V power supply for the control signal.
- Pay attention to the connection of the freewheeling diode. Reversing the positive and negative poles may damage the driver.

3.1.3. **B/C/D-volume three-phase wiring diagram**



- Please make this emergency stop protection circuit.
- Electromagnetic contactor package surge absorbing device at both ends.

- 220V system input voltage range:
  AC 220V(-15%)~240(+10%)
- 400V system input voltage range:
  AC 380V(-15%)~440(+10%)

- Please connect the U, V, W, and output of the drive correctly according to the motor cable phase sequence of the servo motor. The wrong phase sequence will cause the drive to malfunction.
- Do not disconnect short wires between B2 and B3 unless using an external regenerative braking resistor.
- When using an external regenerative braking resistor, disconnect the short wiring between B2 and B3 and connect them by the dotted line in the figure.

- Be sure to ground the servo drive to avoid electrical damage.

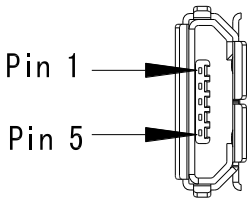
- The 24V power supply for electromagnetic braking needs to be provided by the user and must be isolated from the 12~24V power supply for the control signal.
- Pay attention to the connection of the freewheeling diode. Reversing the positive and negative poles may damage the driver.

3.1. **Definition of CN1 Terminal**

1	SG	Signal ground	2	SG	Signal ground	27	/SO2+ (TGON+)	General sequence control output 2	26	/SO1- (V-CMP-)	General sequence control output 2
3	PL1	OC power output of command pulse	4	SEN	Requirement input of encoder absolute data （SEN）	29	/SO3+ (S-RDY+)	General sequence control output 3	28	/SO2- (TGON-)	General sequence control output 2
5	V-REF	Speed command input	6	SG	Signal ground	31	ALM+	Servo alarm output	30	/SO3- (S-RDY-)	General sequence control output 3
7	PULS	Pulse command input	8	/PULS	Pulse command input	33	PAO	A phase of encoder pulse division output	32	ALM-	Servo alarm output
9	T-REF	Torque command input	10	SG	Signal ground	35	PBO	B phase of encoder pulse division output	34	/PAO	A phase of encoder pulse division output
11	SIGN	Sign command input	12	/SIGN	Sign command input	37	STO	Safe torque limit	36	/PBO	B phase of encoder pulse division output
13	PL2	OC power output of command pulse	14	/CLR	Clearance input of position deviation	39	/SI9	General sequence control input 9	38	/SI8	General sequence control input 8
15	CLR	Clearance input of position deviation	16	OCP	OC power input of command pulse	41	/SI3 (P-CON)	General sequence control input 3	40	/SI0 (/S-ON)	General sequence control input 0
17	OCS	OC input of pulse direction	18	PL3	OC power output of command pulse	43	/SI2 (N-OT)	General sequence control input 2	42	/SI1 (P-OT)	General sequence control input 1
19	PCO	C phase of encoder pulse division output	20	/PCO	C phase of encoder pulse division output	45	/SI5 (/P-CL)	General sequence control input 5	44	/SI4 (/ALM-RTS)	General sequence control input 4
21	BAT+	Battery(+) of absolute encoder	22	BAT-	Battery(-) of absolute encoder	47	+24VIN	Power input of sequence control input signal	46	/SI6 (/N-CL)	General sequence control input 6
23	OCZ	OC output of Z phase pulse division	24	OCS	OC input of pulse clearance	49	/PSO	Position output of absolute encoder	48	PSO	Position output of absolute encoder
25	/SO1+ (V-CMP+)	General sequence control output 1							50	TH	Overheat protection input of linear motor

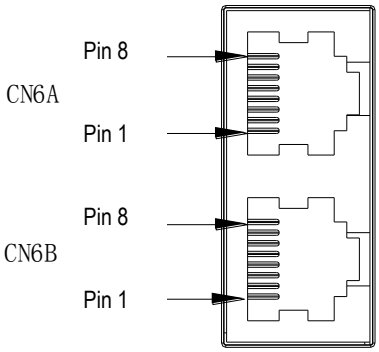
Note: When using multi-turn absolute encoder, please pay attention to the connection of battery and serial data. For the setting of multi-turn absolute encoder.

3.2. **CN7 USB Communication Terminal Connection**



Pin number	Name	Function
1	VBUS	External power supply +5V
2	D-	Data-
3	D+	Data+
4	-	Unused
5	GND	Ground

3.3. **CN6A and CN6B Communication Terminal Connection**



Depending on the model, the definition of the port is different. When using the model, you need to confirm the definition of the interface. For the model identification, see "1.6 Drive Naming".

The field identification bit E is P: pulse type; S: standard type; C: CANopen bus type.

CN6A/CN6B Interface definition					
Pin number	Signal name	Function	Pin number	Signal name	Function
1	CANH	CAN Data+	6	-	

2	CANL	CAN Data-	7	GND	485 Ground
3	CANG	CAN Ground	8	-	-
4	485-	485 Data-	Case	shield	shield
5	485+	485 Data+			

The field identification bit E is M: MECHATROLINK-II bus type.

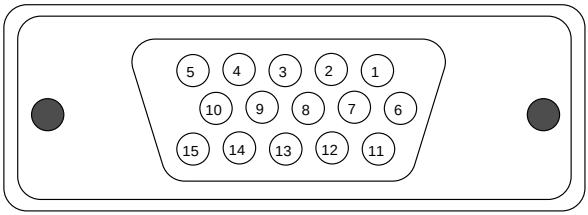
CN6A/CN6B Interface definition					
Pin number		Signal name		Function	
1	SRD+	M-II Data+	6	-	-
2	SRD-	M-II Data-	7	-	-
3	-	-	8	-	-
4	-	-	Case	Shield	Shield
5	-	-			

The field identification bit E is N: EtherCAT bus type; L: MECHATROLINK-III bus type.

CN6A/CN6B Interface definition					
Pin number	Signal name	Function	Pin	Signals	Function
1	TX+	Data sending+	6	RX-	Data accept-
2	TX-	Data sending-	7	-	-
3	RX+	Data accept+	8	-	-
4	-	-	Case	Shield	Shield
5	-	-			

For the simultaneous use of multiple drives, the cascading mode is CN6A, CN6B is out, the cascading cable is below 50cm, and the last CN6B needs to be connected to the terminating resistor as appropriate.

3.4. **CN5 Full Closed Loop Port**



2500 line encoder and full closed loop interface

Pin number	Signal name	Function	Pin number	Signal name	Function
1	EA-	Full closed loop signal EA-	9	-	-
2	EB-	Full closed loop signal EB-	10	-	-
3	EZ-	Full closed loop signal EZ-	11	-	-
4	-	-	12	-	-
5	-	-	13	0V	Encoder power 0V
6	EA+	Full closed loop signal EA+	14	0V	Encoder power 0V
7	EB+	Full closed loop signal EB+	15	5V	Encoder power 5V
8	EZ+	Full closed loop signal EZ+	Case	Shield	-

3.5. **Switch-Value Input Signal**

3.5.1. **Input Signal Explanation**

Control mode	Signal name	Needle number	Function number and description	
Normal	/S-ON	Allocated signal (38~46)	0x01	Control signal of servo motor ON/OFF (power on/off)
	POT		0x02	Prohibited forward rotation drive When the mechanical movement exceeds the movable range, stop the servo motor drive (over travel prevention function)
	NOT		0x03	Prohibited reverse drive When the mechanical movement exceeds the movable range, stop the servo motor drive (over-travel prevention function)
	/ALM-RST		0x04	Alarm clear
	/P-CON		0x05	When the P action command signal is ON, the speed control loop is switched from PI (proportional, integral) control to P (proportional) control.
	/TLC		0x06	Torque limit switching Use when changing the torque limit during operation
	/SPD-D		0x08	used to change the direction of motor control in internal speed,
	/SPD-A		0x09	When used as internal speed mode, it is used to select the internal speed command
	/SPD-B		0x0A	
	/C-SEL		0x0B	Control mode switching, used as a switching control mode when the control mode is mixed mode
	/ZCLAMP		0x0C	Zero fixed signal speed mode, used as a fixed zero.
	/INHIBIT		0x0D	Pulse input inhibit when used in position mode, it is used as disable pulse input count
	/G-SEL		0x0E	Gain switching gain switching to manual gain switching used as a switching gain
	/PSEL		0x10	Command pulse input override switch position mode, used as switching pulse input override signal
	+24VIN	47	Use when the sequence signal is input with the control power supply. Operating voltage range: +11V to +25V (please provide your own +24V power supply.)	

	SEN	4	Enter the signal that requires initial data when using an absolute encoder
	BAT+ BAT-	21 22	Spare battery connection pin for absolute encoder. Note: do not connect when using an encoder cable with a battery pack.
Speed	V-REF	5（6）	Enter the speed command. Maximum input voltage: ± 10V
Position	PULS /PULS SIGN /SIGN	7 8 11 12	Set any of the following input pulse patterns. Symbol + pulse sequence CW+CCW pulse sequence 90° phase difference 2-phase pulse
	CLR /CLR	15 14	Clear position deviation during position control
Torque	T-REF	9（10）	Enter the torque command and the maximum input voltage: ±10V

3.5.2. **Input Signal Configuration**

1. The digital input signal distribution mode is internally fixed (Pn600=0). The function servo unit of each input signal is internally fixed and cannot be changed. When selecting different control modes, the functions of the pins are different as shown in the following table:

Control mode（Pn000）	NO. of CN1 pins							
	40	42	43	41	44	45	46	38/39
0- position control	/S-ON servo enable	P-OT forward limit	N-OT reverse limit	/P-CON proportional control	/ALM-RST alarm clear	/TLC torque limit switching	Reserved	invalid
1- analog speed								
2- torque control								
3- internal speed				/SPD-D internal speed command direction selection		/SPD-A internal speed command selection A	/SPD-B internal speed command selection B	
4- internal speed <-> analog speed								
5- internal speed <-> position								
6- internal speed <-> torque								
7- position <-> analog speed				/C-SEL control mode switching		/TLC torque limit switching	Reserved	
8- position <-> torque								
9- torque <-> analog speed								

10- speed <-> speed control with zero fixed function				/ZCLAMP zero fixed				
11- speed <-> position control with command pulse inhibit function				/INHIBIT command pulse prohibition				

2. The switching input signal distribution mode is the parameter configuration (Pn600=1 default parameter). The function of each input signal is configured by the user and is set by parameters Pn601~Pn609.

(a) Default setting

Function code	NO. of CN1 pins	Default function
Pn601	40	0x01: Servo enable
Pn602	42	0x02: Can run in forward direction
Pn603	43	0x03: Can run in reverse direction
Pn604	41	0x05: Manual P, PI control
Pn605	44	0x04: Alarm clear
Pn606	45	0x06: Torque limit switching
Pn607	46	0x07: Reserved
Pn608	39	0x00: Invalid
Pn609	38	

(b) Negation

The driver provides reverse input signal switching function in order to facilitate wiring:

1. Take the servo enable (/S-ON) as an example, the default setting is Pn601=0x01. When the signal is ON, the servo is enabled. When the setting is Pn601=0x101, the servo is disabled when the signal is ON.

2. Take the positive travel limit (POT) as an example, the default setting is Pn602=0x02. When the signal is OFF, the servo positive stroke limit is set. If the setting is Pn602=0x102, the servo forward stroke limit is released when the signal is OFF.

Cautions

1. Signal ON: The state when the digital input signal (/S-ON, etc.) is connected to the ground terminal of the external +24 VIN power supply
2. Signal OFF: The status when the digital input signal (/S-ON, etc.) is disconnected from the ground terminal of the external +24VIN power supply
3. The positive travel limit (POT)/negative travel limit (NOT) in the digital input signal is the OFF valid signal, and the other input signal is the ON effective signal.

c) Always valid

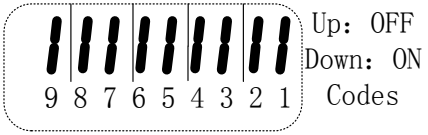
Through the setting of parameters Pn610, Pn611 and Pn612, the configured input signal can always be valid. For example, when Pn610=0x01 (servo enable), the servo is always in the enabled ON state after power-on, and the external enable signal (/ S-ON) does not take effect.

Cautions

If the same function is configured on different pin numbers, Er.040 will be reported (parameter setting error alarm). Refer to "Diagnostics Codes and Countermeasures" for related alarms and processing methods.

3.5.3. **Confirming the Input Status**

The status of the input signal can be checked by input signal monitoring (Un100). The Un100 segment display and corresponding pin numbers are as follows:



Display LED	Number of input pin	Signal name (factory configuration)
1	CN1-40	/S-ON
2	CN1-41	/P-CON
3	CN1-42	P-OT
4	CN1-43	N-OT
5	CN1-44	/ALM-RST
6	CN1-45	/TLC
7	CN1-46	Reserved
8	CN1-39	Invalid
9	CN1-38	Invalid

The upper SEG (LED) lights up when the input signal is OFF.
The lower SEG (LED) lights up when the input signal is ON.

3.6. **Switching Output Signal**

3.6.1. **Output Signal Explanation**

Control mode	Signal name	Needle number	Function number and explanation	
Usual	/TGON	Allocate Allocated signal 25(+) 26(-) 27(+) 28(-) 29(+) 30(-)	0x03	ON (closed) when the speed of the servo motor is higher than the set value.
	/S-RDY		0x00	ON (closed) when servo ON (/S-ON) signal is acceptable.
	/CLT		0x04	Torque limit ON (closed) when the motor output torque is limited.
	/VLT		0x05	In the speed limit, the motor speed is ON after closing the speed limit (closed).
	/BK		0x06	Brake interlocking, the output of the motor is ON during operation. Refer to “Retaining the brake” for timing details.
	/WARN		0x07	Warning output
Speed	/V-CMP		0x02	Consistent speed output ON when the speed of the servo motor is the same as the command speed (closed).
Location	/COIN		0x01	Positioning completed output ON (closed) when the difference between the command pulse number and the servomotor movement amount (position deviation) is lower than the position reach range.
	/PSELA		0x09	Command pulse override switching can be switched to operate with the value of the input command pulse n times (Pn203).
	/NEAR		0x08	Positioning close, output ON (closed) when the difference between the positioning command pulse number and the servo motor movement amount (position deviation) is lower than the position proximity signal.
	PL1 PL2 PL3	3 13 18	Position pulse is power supply for open collector command.	
Usual	ALM+ ALM-	31(+) 32(-)	OFF (disconnected) at alarm (Output logic can be changed by parameter)	
	PAO /PAO	33 34	Frequency division output A phase signal	
	PBO /PBO	35 36	Frequency division output B phase signal	
	PCO /PCO	19 20	Frequency division output C phase signal	

3.6.2. **Output Signal Configuration**

a) Default configuration

The function of each output signal is configured by the user and is set by parameters Pn613 ~ Pn615. The default functions are as follows:

Function code	CN1 pin number	Default function
Pn613	25/26	0x00: Servo ready
Pn614	27/28	0x01: Positioning completed
Pn615	29/30	0x02: Consistent speed

b) Negation

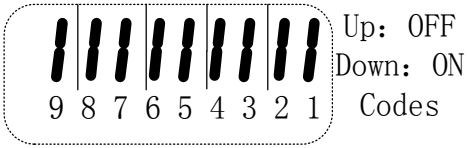
1. General switch output signal inversion function, take the servo ready signal (/S-RDY) as an example, default setting Pn613=0x00, servo ready and then the output signal is ON; change the setting Pn613=0x100, the servo is ready, then the output signal is OFF.

2. The alarm output signal (ALM) is the output of the fixed pin number. The default setting is Pn622.1=0. If the servo alarm occurs, the output signal will be OFF. If the change is set to Pn622.1=1, the servo alarm will output the signal ON.

1. Pn622.1 indicates the first bit of parameter Pn622. Refer to function code parameter explanation for details.
2. The signal that is not output is in the "invalid" state. Example speed control, positioning complete (/COIN) signal is "invalid".
3. If the polarity of the brake signal (/BK) is reversed and used with positive logic, the brake will not be actuated when the signal line is broken. If you have to use this setting, be sure to check the operation to ensure that there are no safety issues.
4. When multiple signals are distributed on the same output circuit, the output will be XORed.

3.6.3. **Confirming the Output Status**

The status of the output signal can be confirmed by the output signal monitor (Un101). The Un101 segment display and corresponding pin numbers are as follows:



Display LED	The number of input pin	Signal name (factory setting)
1	CN1-31、32	ALM
2	CN1-25、26	/S-RDY
3	CN1-27、28	/COIN

4	CN1-29、30	/V-CMP

The upper SEG (LED) lights up when the output signal is OFF.
The lower SEG (LED) lights up when the output signal is ON.

3.7. **Connection with the Upper Device**

3.7.1. **Analog Input Circuit 3**

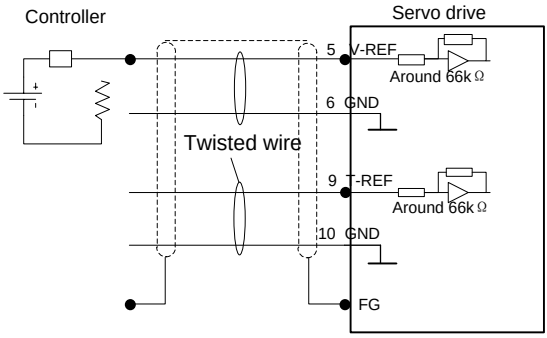
The following describes the 5-6 (speed command input) and 9-10 (torque command input) terminals of the CN1 connector.

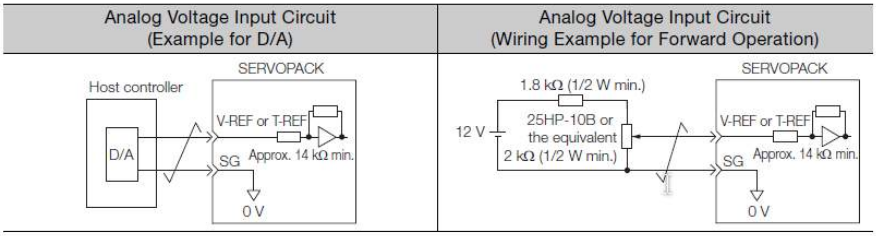
Analog signals are speed commands or torque command signals. The input impedance is as follows.

Speed command input: about 66kΩ

Torque command input: about 66kΩ

The maximum allowable input signal voltage is ± 10V



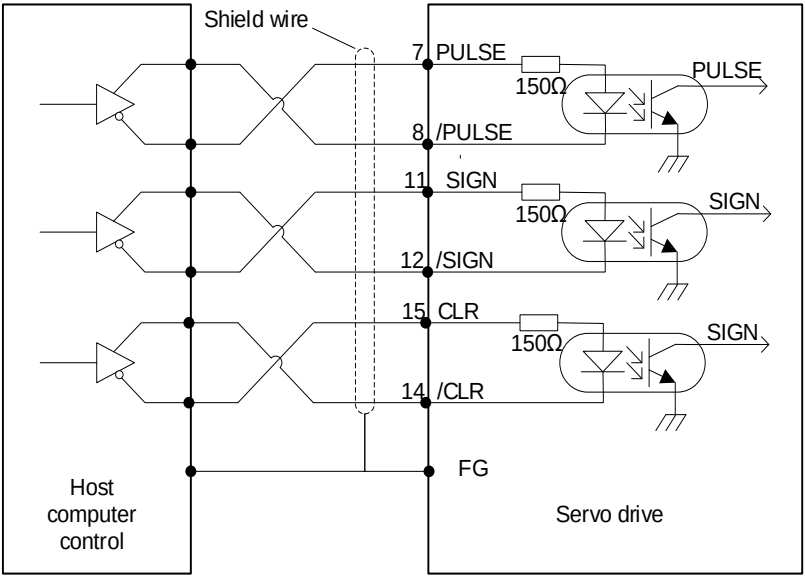


The above wiring is an example of wiring during forward rotation.

3.7.2. **Position Instruction Input Circuit**

The following describes the 7-8 (command pulse input), 11-12 (command symbol input), and 14-15 (clear input) terminals of the CN1 connector. The output circuit of the command pulse and position deviation clear signal from the host device may be one of the linear driver output and the open collector output.

Connection example of linear drive output

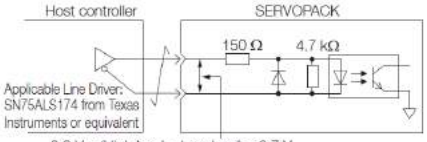
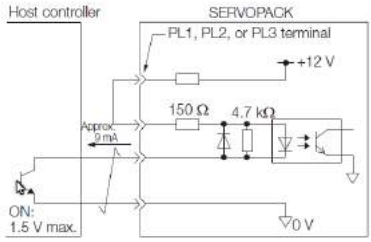


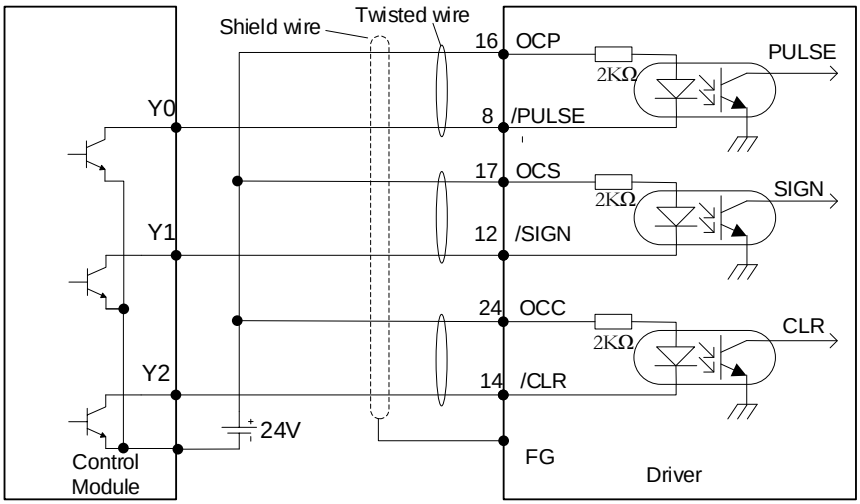
The differential pulse input signal voltage is ±3.3V and the maximum frequency is 4MHz. This signal transmission method has the best anti-noise capability. It is recommended to use this connection preferentially.

3.7.3. **Connection example of open collector outtput**

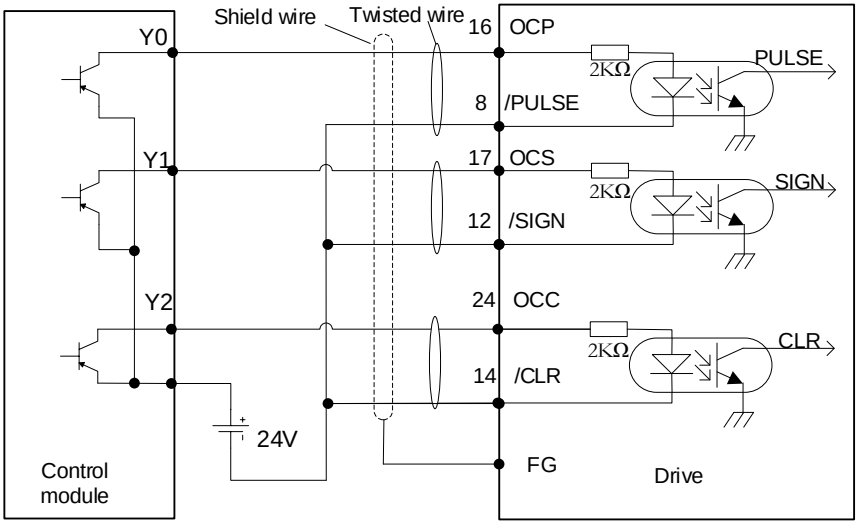
External 24V power supply:

1 control module is NPN type (common cathode):

Line-Driver Output Circuit	Open-Collector Output Circuits (12-V Power Supply in SERVOPACK)
	

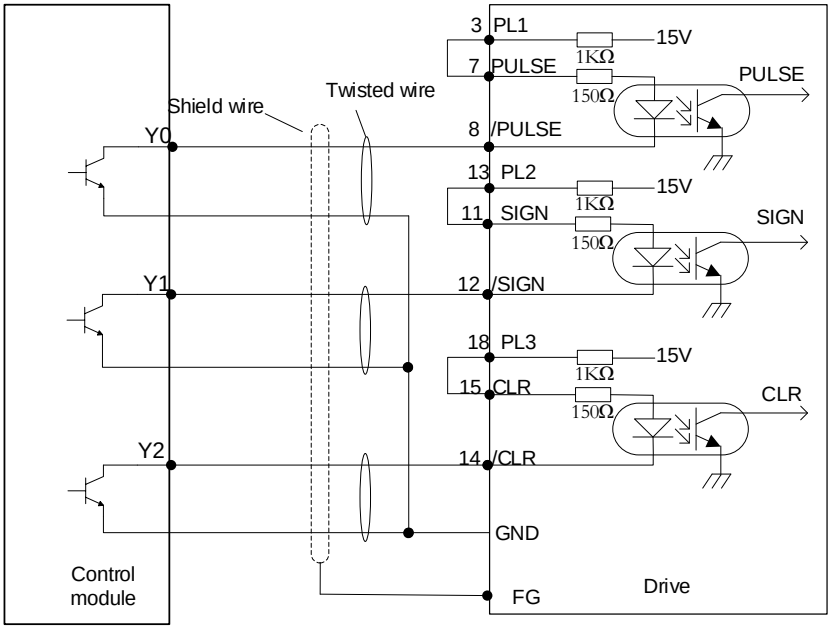


2 control modules is PNP type (common anode):

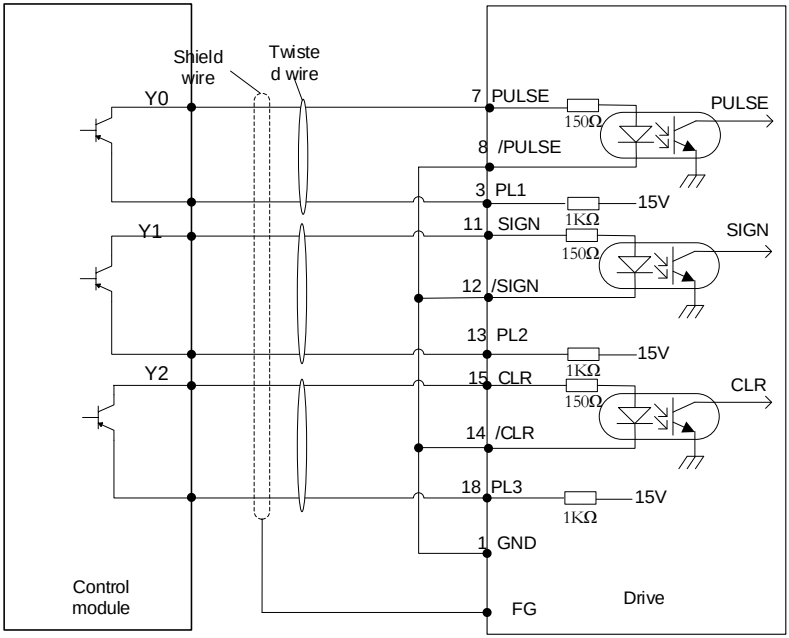


Internal 15V power supply:

1 control module is NPN type (common cathode):



2 control modules is PNP type (common anode):

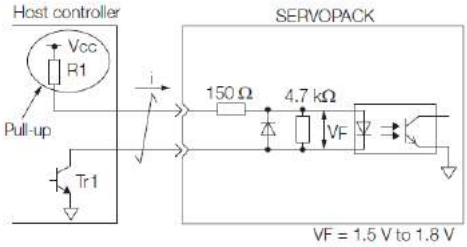


Precaution When Host Controller Uses Open-Collector Output with User-Supplied Power Sup ply

The SERVOPACK may fail depending on the relationship between the pull-up voltage (Vcc) anc the pull-up resistance (R1). Before you wire the circuits, confirm that the specifications of the host controller satisfy the values shown in the following table.

Pull-Up Voltage (Vcc)	Pull-Up Resistance (R1)	Output Current (i)
24 V	1.8 kΩ to 2.7 kΩ	20 mA max.
12 V max.	820 Ω to 1.5 kΩ	
5 V max.	180 Ω to 470 Ω	

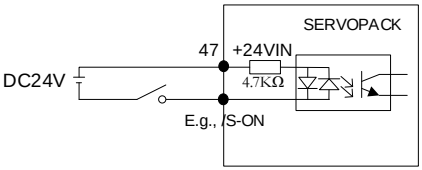
Circuit Example for Open-Collector Outputs



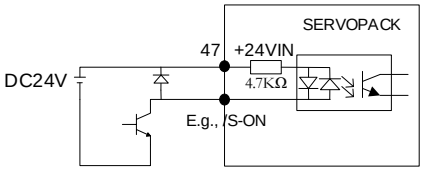
3.7.4. **Sequence Control Input Circuit**

The following describes the 38 to 46 terminals of the CN1 port. Connect via a relay or open collector transistor circuit. When using a relay connection, select the relay for the minute current. If you do not use a minute current relay, it will cause poor contact.

Examples for Relay Circuit

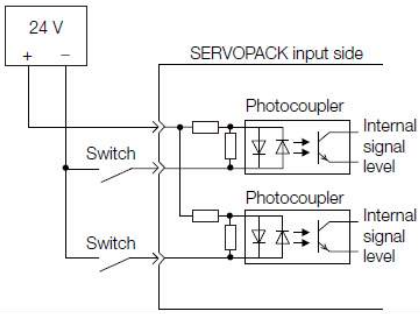
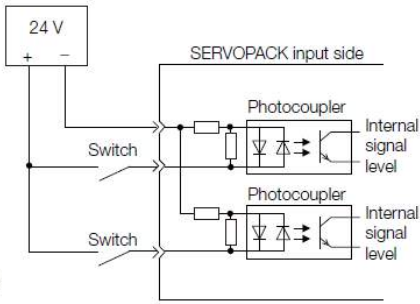


Examples for Open-Collector Circuits



Note: The external power supply (DC24V) must have a capacity of 50 mA or more.

The input loop of the servo unit uses a bidirectional optocoupler. Please select the sink circuit connection or the source circuit connection according to the specifications of the machine.

Sink Circuits	Source Circuits
	

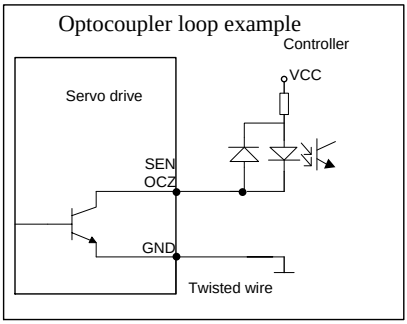
Input Signal Polarity		Input Signal Polarity	
Photocoupler	Internal Signal Level	Photocoupler	Internal Signal Level
ON	Low level	ON	Low level
OFF	High level	OFF	High level

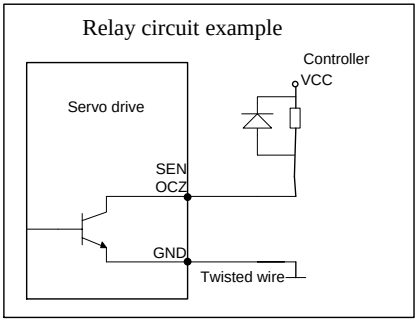
3.7.5. **Sequence Output Loop**

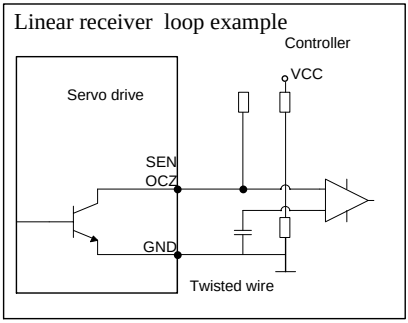
Servo unit signal output circuit is the following three kinds:

1. Open collector output circuit

The output signal (SEN, OCZ) is an open collector transistor output circuit. Please receive through optocoupler circuit, relay circuit or linear receiver circuit.

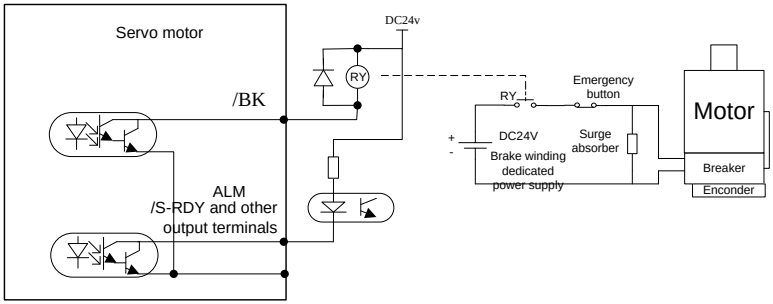






2. Optocoupler output circuit

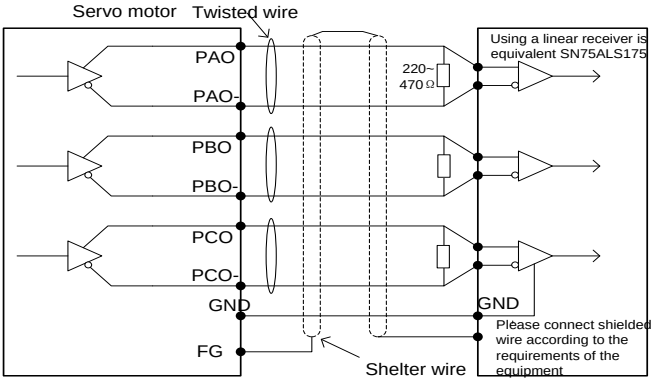
The brake linkage (/BK), servo alarm (ALM), servo ready (/S-RDY) and other sequence output signals belong to the optocoupler output circuit. Connect via relay or line receiver circuit.



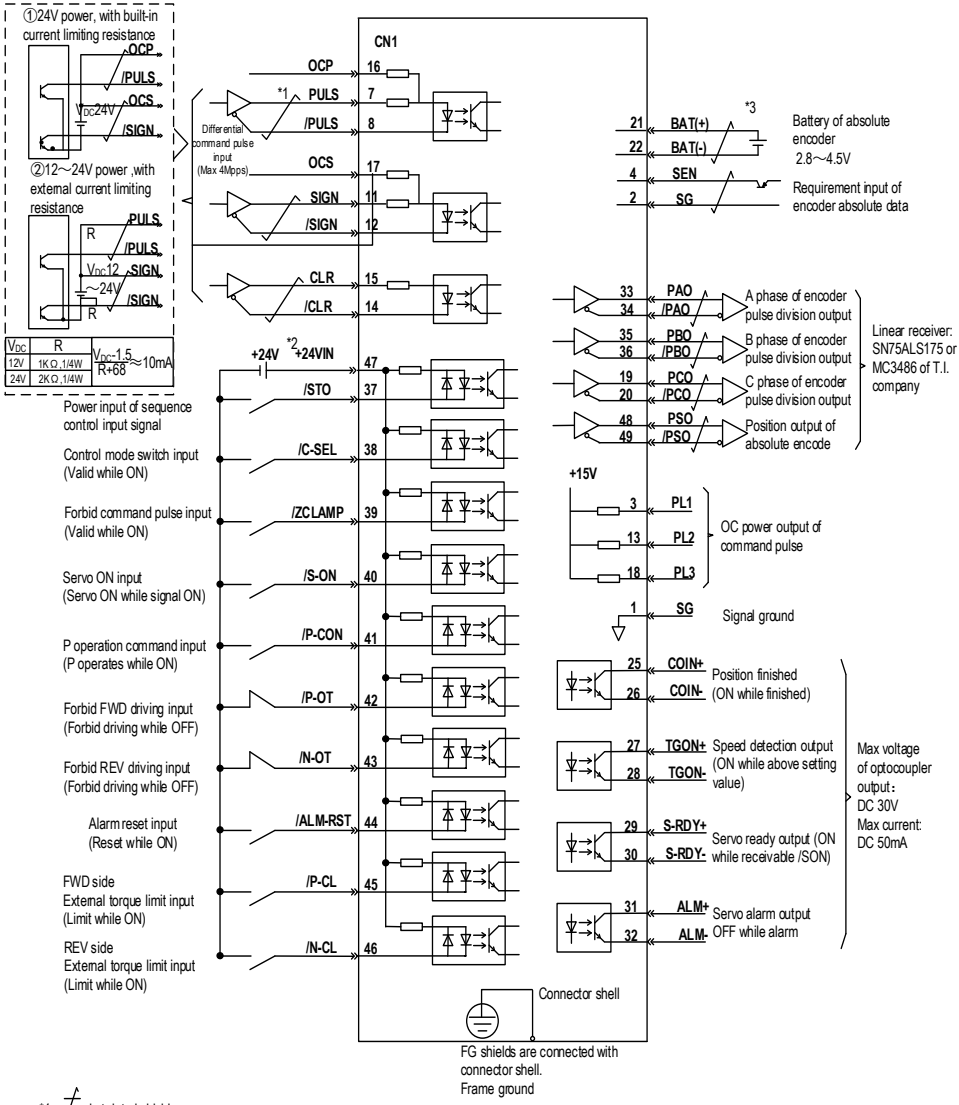
3. Linear drive output circuit

The following describes the 33-34 (phase A signal), 35-36 (phase B signal), and 19-20 (phase C signal) terminals of the CN1 port. The output signal (PAO, /PAO, PBO, /PBO) and the origin pulse signal (PCO, /PCO) of the encoder's serial data are converted into two-phase (A-phase, B-phase) pulses and output through the line driver output circuit. On the upper device

side, please use a linear receiver circuit.



3.8. **Position Control Wiring Diagram**



*1. ≠ is twisted shields;

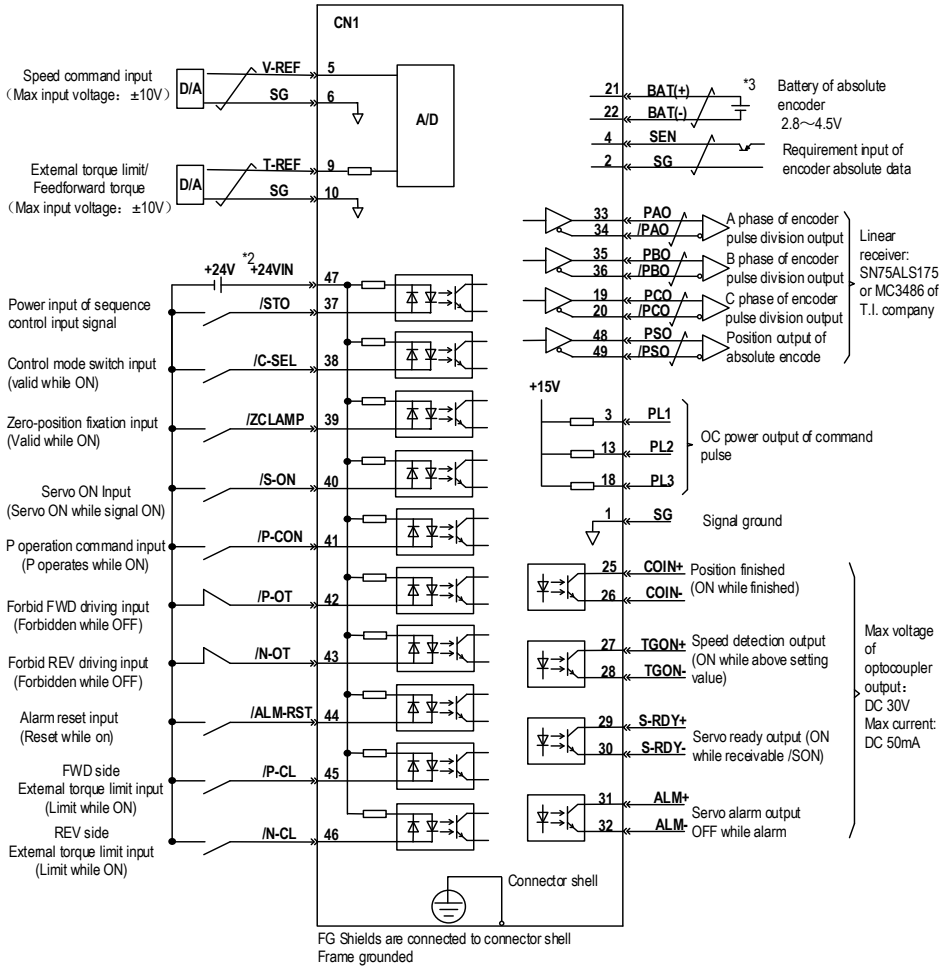
*2. DC24V power should be prepared by user. And double insulation or reinforced insulation equipment should be used for DC24V power.

*3. Connected while using absolute encoder. But never connect backup battery while using encoder cables with battery unit

*4. Output signal should be received by linear receiver.

Note: while using 24V braker,DC24V power should be separated from the power for input and output signal (CN1). Please prepare other power individually, otherwise, there may be misoperation of input and output signal while power on.

3.9. **Speed Control Wiring Diagram**



*1. ≠ is the twisted shields

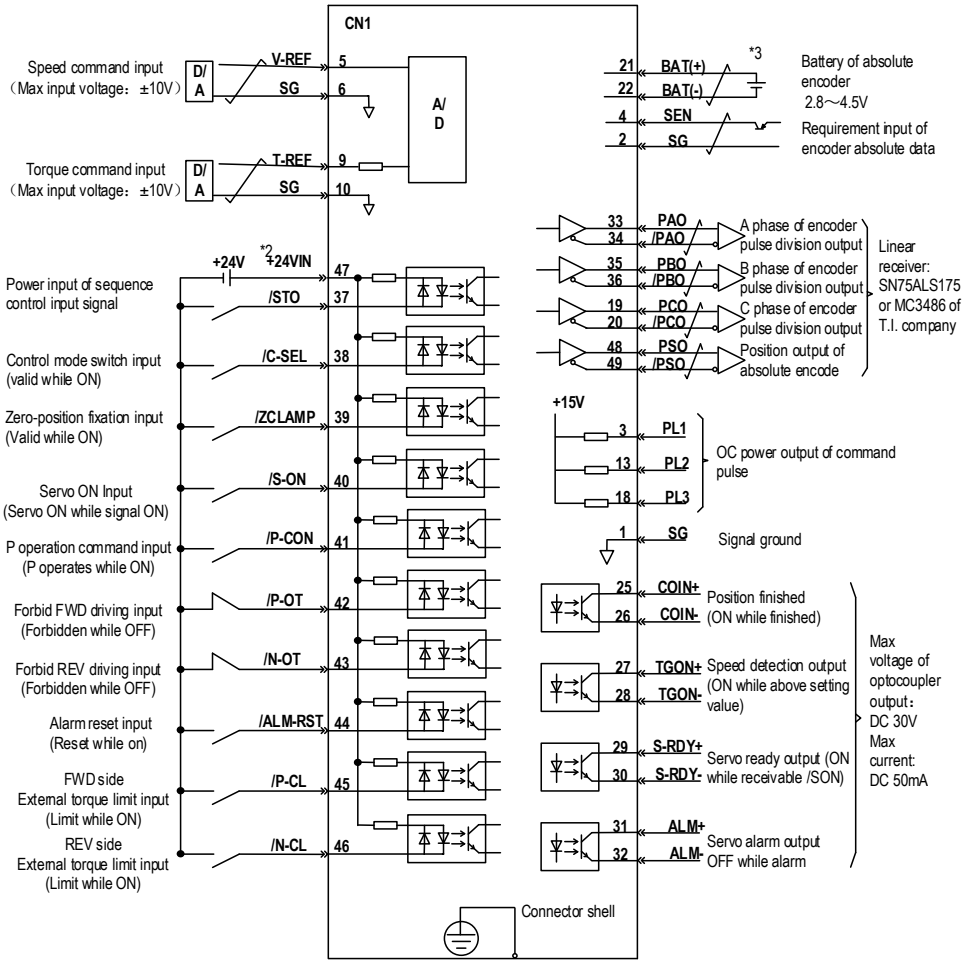
*2. DC24V power should be prepared by user. And double insulation or reinforced insulation equipment should be used for DC24V power.

*3. Connected while using absolute encoder. But never connect backup battery while using encoder cables with battery unit.

*4. Output signal should be received by linear receiver.

Note: while using 24V braker,DC24V power should be separated from the power for input and output signal (CN1). Please prepare other power individually, otherwise, there may be misoperation of input and output signal while power on.

3.10. **Torque Control Wiring Diagram**



*1. ≠ is the twisted shields

*2. DC24V power should be prepared by user. And double insulation or reinforced insulation equipments should be used for DC24V power.

*3. Connected while using absolute encoder. But never connect backup battery while using encoder cables with battery unit.

*4. Output signal should be received by linear receiver.

Note: While using 24V braker,DC24V power should be separated from the power for input and output signal(CN1). Please prepare other power individually, otherwise, there may be misoperation of input and output signal while power on.

3.11. **CN2 Encoder Connection**

- When Using a Rotary Servomotor

Pin No.	Signal	Function
1	PG5V	Encoder power supply +5 V
2	PG0V	Encoder power supply 0 V
3	BAT (+)*	Battery for absolute encoder (+)
4	BAT (-)*	Battery for absolute encoder (-)
5	PS	Serial data (+)
6	/PS	Serial data (-)
Shell	Shield	–

3.12. **Regenerative Resistor Connection**

When the regenerative energy processing capacity is insufficient, connect an external regenerative resistor as required to set the regenerative resistor capacity (Pn012).

3.12.1. **Connection of Regenerative Resistors**

The driver models 1R1A, 1R7A, and 3R3A have no built-in regenerative resistor. When a regenerative resistor is externally connected, the resistor is connected to the B1/+ and B2 terminals. Refer to “A single-phase wiring diagram”.

In addition to 1R1A, 1R7A, and 3R3A, the driver model has a built-in regenerative resistor. When the internal regenerative resistor does not meet the requirements, a regenerative resistor can be connected to remove the short wiring between the B2-B3 terminals and connect the external regenerative resistor to the driver. For B1/+, B2 terminals, refer to "B/C/D volume three-phase wiring diagram".

3.13. **Selection of Regenerative Resistor**

Mode	Break resister	internal resister	Minimal of external resister	Maximal of external resister resister
SD700-1R1A	380	/	40	400
SD700-1R7A	380	/	40	200
SD700-3R3A	380	/	40	100
SD700-5R5A	380	40Ω 60W	25	70
SD700-7R6A	380	40Ω 60W	15	50

SD700-9R5A	380	40Ω 60W	15	40
SD700-2R5D	700	80Ω 60W	80	225
SD700-3R8D	700	80Ω 60W	55	180
SD700-6R0D	700	40Ω 60W	35	110
SD700-8R4D	700	40Ω 60W	25	85
SD700-110D	700	40Ω 60W	25	70
SD700-170D	700	30Ω 100W	30	50
SD700-240D	700	30Ω 200W	15	40
SD700-300D	700	30Ω 200W	15	30

Note: When external braking resistor is needed, please select the resistance value of the braking resistor according to the above table. Select the braking resistor's power according to the braking frequency of the field conditions and the cooling conditions of the braking resistor, you could consult factory if you have any problem.

3.14. **Noise and High Harmonic Countermeasures**

The following describes noise and harmonic measures:

This servo unit has a built-in microprocessor. Therefore, it may be subject to noise from its peripheral equipment.

To prevent mutual noise interference between the servo unit and its peripheral devices, the following measures to prevent noise interference can be taken as required.

- Set the input command device and noise filter as close to the servo unit as possible.
- Be sure to connect a surge suppressor to the coils of relays, solenoids, and electromagnetic contactors.
- Do not use the same bushing for the main circuit cable and the input/output signal cable/encoder cable, and do not bind them together. When wired, the main circuit cable and the input/output signal cable/encoder cable should be separated by more than 30cm.
- Do not use the same power supply as the electric welder or EDM machine. Even if it is not the same power supply, connect a noise filter to the input side of the main circuit power cable and the control power cable when there is a high-frequency generator nearby.

4. Trial operation

4.1. **Inspections and Notes before Trail Operation**

In order to ensure the safe and correct trail operation, please check the programs as below

before that:

4.1.1. **Conditions of the Servo Motor:**

You need to check and confirm all programs as below, if there is any problem, please handle it properly before that trail operation

1. Are the Settings, wires and connections correct?

2. Is there any looseness in each fastening part?

3. When you use servo motors with oil seals, is the oil seal damaged? Is it smeared with organic oil?

4. Is the brake released beforehand when it is a servo motor with a holding brake?

4.1.2. **Conditions of the Servo Drive**

You need to check and confirm all programs as below, if there is any problem, please handle it properly before that trail operation.

1. Are the Settings, wires and connections correct?
2. Is the supply voltage of the servo unit normal?
3. Is the driver status display interface free of warnings, alarms, etc.?

4.1.3. **Installation**

1. Install the servo motor and servo unit according to the installation conditions.
2. The servo motor may fall when it rotates, so be sure to fix it on the machine.
3. Be sure to leave the servomotor at no load.

4.2. **JOG trail operation**

The trial run refers to the JOG operation of the servo motor unit. The purpose of the single trial operation of the servo motor is to confirm whether the servo unit and the servo motor are correctly connected and whether the servo motor is operating normally. Confirm the following points before running:

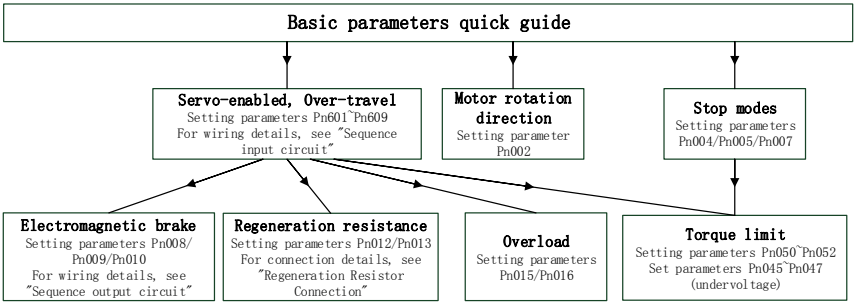
The motor is in the enabled state and the jog operation is invalid during the operation.We suggest that the load inertia is not greater than thirty times of the motor inertia, or it could possibly cause strong mechanical vibration.

The Pn500, Pn310, Pn311 parameters set JOG speed, acceleration and deceleration time.For details on the panel operation steps, see "Auxiliary Functions".

5. Operation

5.1. **Basic Functions**

5.1.1. **Quick Guide**



5.1.2. **Servo Enable and Over-range Setting**

Enable

Set the servo ON (/S-ON) signal that controls servo motor electrification / non- electrification. Pin numbers can be configured by parameters Pn601 ~ Pn609, and are always configured effectively by parameters Pn610~Pn612. See “Input Signal Configuration” for details.

Over-range

The over-range prevention function of the servo unit refers to the safety function of forcibly stopping the servo motor by inputting a signal of the limit switch when the movement part of the machine exceeds the safe movement range. For rotary applications such as circular tables and conveyors, the over-range function may not be required. In this case, the input signal wiring for over-range is not required.

1. In the one-way over-travel state, commands in the opposite direction of over-travel can be received.
2. In position control, when the servo motor stops due to over-travel, the position deviation remains unchanged. To clear the position deviation, a clear signal (CLR) must be input.

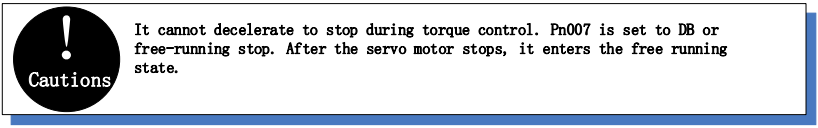
1. Signal Setting

Pin numbers can be configured by parameters Pn601~Pn609, and are always configured effectively by parameters Pn610~Pn612. See “Input Signal Configuration” for details.

2. Stop Mode

- When an over-range occurs, the servo motor can be stopped by any of the following three methods.

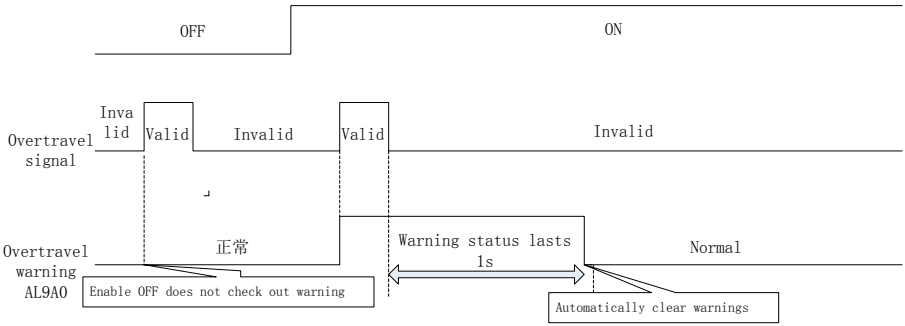
- Dynamic brake (DB) stop: By short-circuiting the electrical circuit, the servo motor can be quickly stopped.
- Deceleration stop: Decelerate to stop with the emergency stop torque (Pn053).
  Free-running stop: Naturally stopped due to friction when the motor rotates.
- The servo motor status after stopping is divided into the following two types.
- Free running state: A state that naturally stops due to friction when the motor rotates.
- Zero-fixed state: The state of the zero position is maintained in the position loop.
- When the over-range occurs, select the stopping method of the servo motor through Pn007. For details, please see parameter Pn007.



3. Warning Checkout

The over-range warning function is a function that detects the over-range warning (A.9A0) after the over-range is entered when the servo is turned on. With this function, the servo unit can transmit the information on detecting the over-range to the upper device even if the over-range signal is input instantaneously. When using this function, please set Pn006=1 "Check over-range warning".

The timing of check out over-travel warning



A warning is detected when an over-range occurs in the same direction as the command.

When an over-range in the opposite direction to the command is issued, no warning is detected. For example, under the forward command, no warning will be issued even if the N-OT signal (reverse drive prohibited) is turned on while moving.

When there is no instruction, an over-range warning in the forward or reverse direction will be detected.

When the servo is turned off, no warning will be detected even if it enters the over-range state.

In the over-range state, no warning is detected when the servo is switched from the servo OFF state to the servo ON state.
The warning I/O will remain output for 1 second after the over-range status is released and will be automatically cleared afterwards.

5.1.3. **Motor Rotation Direction**

The actual rotation direction of the servo motor can be switched by Pn002 without changing the polarity of the speed command/position command. At this time, although the rotation direction of the motor is changed, the polarity of the output signal from the servo unit, such as the encoder frequency-divided pulse output, does not change.

Pn002=0 in the factory setting (forward rotation direction) indicates that the counterclockwise rotation (CCW) is positive when looking at the servo motor cover.

Function mode	Parameter name	Range	Defaults	Unit	Communication address	When enabled
Pn002	Motor rotation direction selection	**0~1**	**0**	**-**	**0x0002**	After restart
	Faces to the motor end: 0- Counterclockwise direction is positive 1- Clockwise direction is positive					

5.1.4. **Stop Mode**

1. Servo OFF and class 1 alarms

Motor stop method can be selected by Pn004

• Dynamic brake (DB) stops and maintains DB status: By shorting the electrical circuit, the servo motor can be stopped in an emergency, and the DB status is maintained after stopping.

• Dynamic brake (DB) stops and DB status is released: By shorting the electrical circuit, the servo motor can be stopped in an emergency and the DB status is released after stopping.

• Free running stop: The friction when the motor rotates naturally stops.

When the servo motor stops or rotates at a very low speed, when the dynamic brake is selected to stop, it will be the same as the free stop, and no braking force will be generated.

2. Topping modes for type 2 alarms

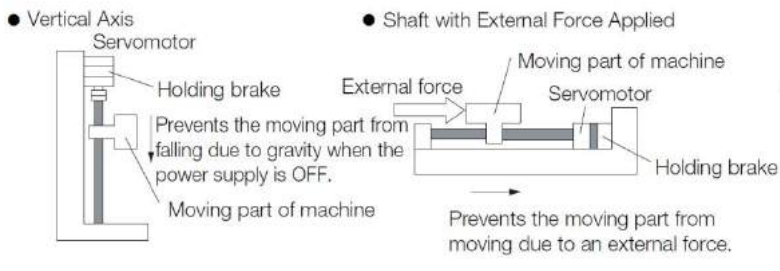
Type 2 alarms can select zero speed stop in addition to the servo motor OFF method and type 1 alarm stop method. See the description of parameter Pn053 for the torque limit at zero speed stop.

Cautions

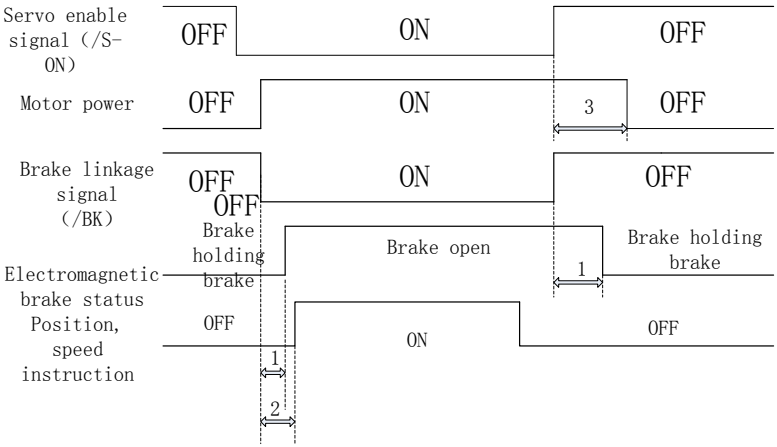
The setting of zero speed stop mode is valid only for position control and speed control.

5.1.5. **Electromagnetic Brake**

The brake is a part that holds the position when the servo unit power is off so that the moving part of the machine does not move due to its own weight or external force. It is built into the servo motor with a brake. Please use it as shown below.



The brake has a delay time for operation. ON and OFF of the operation ensure the brake operation time.

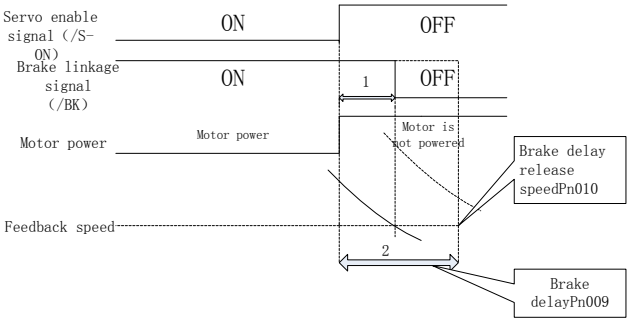


1. Different types of brakes may have slightly different holding brakes and loosening brakes.
2. Please ensure that the input command is after the brake opening operation time to ensure the accuracy of the command

3. When the motor is locked, it may cause danger when the servo motor is prevented from operating when the servo is turned off. The motor lock time (Pn008) can be set to ensure that the motor during the brake is not operated.

The motor stops locking/BK signal OFF timing

When an alarm occurs during servo motor rotation, the servo motor stops and the brake signal (/BK) turns OFF. At this time, the brake signal (/BK) output time can be adjusted by setting the brake command output speed value (Pn010) and the servo OFF-brake command waiting time (Pn009), the brake signal (/BK) output time can be adjusted.

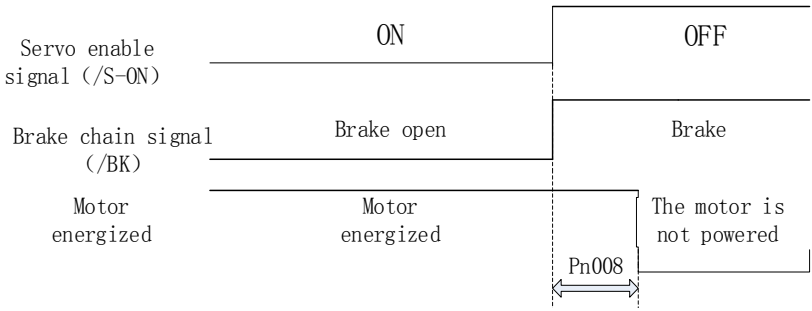


When the motor enters the non-energized state, when the motor speed is lower than the set value of Pn010, the /BK signal output time is subject to 1

After the motor enters the non-energized state, the set time of Pn009 is passed first, and the output time of /BK signal is subject to 2

The motor is running / BK signal OFF timing

When the servo motor is stopped, the brake (/BK) signal and the servo ON (/S-ON) signal are turned off at the same time. By setting Pn008, it is possible to change the time from when the servo ON (/S-ON) signal is OFF to when the motor actually enters the non-energized state.



Note:

An alarm occurs when the servo is locked. Regardless of this setting, the servo motor immediately enters the non-energized state.

At this time, the machine may move before the brake due to the delay of the brake action.

5.1.6. **Regenerative Resistor**

Refer to "Regeneration Resistor Connection" for the wiring method. When connecting an external regenerative resistor, set parameters Pn012 and Pn013 according to the external resistance.

The regenerative resistor capacity should be set to a value that matches the allowable capacity of the connected external regenerative resistor. The setting differs depending on the cooling condition of the external regenerative resistor.

• Self-cooling method (natural convection cooling): Set to 20% or less of the regenerative resistor capacity (W).

• Forced air cooling: Set to 50% or less of the regenerative resistor capacity (W).

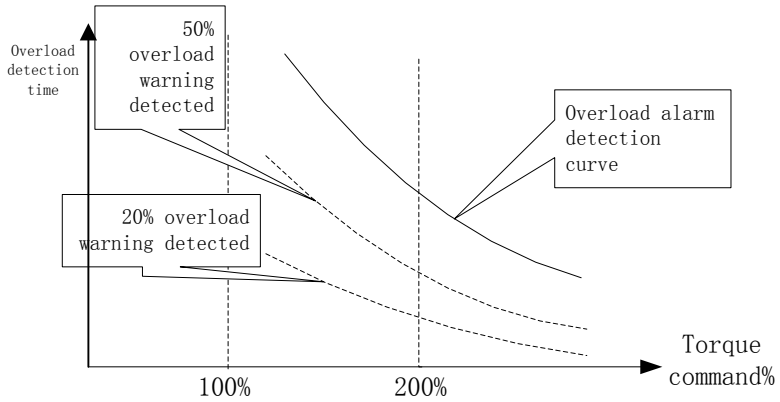
Example: When the capacity of the self-cooling external regenerative resistor is 100W, the setting value is 100W × 20% = 20W. Therefore, set Pn012 = 2 (setting unit: 10W).

5.1.7. **Overload**

This servopack can change the detection time of the overload warning (AL.910) and overload (continuous maximum) alarm (Er. 720). However, it is not possible to change the detection value of the overload characteristic and overload (instantaneous maximum) alarm (Er. 710). The factory defaults are:

1. Change of the time of detection of overload warning (AL.910)

The factory overload warning detection time is 20% of the overload alarm detection time. The overload warning detection time can be changed by changing the overload warning value (Pn015). In addition, using it as an overload protection function corresponding to the system used can improve the security of the system.
For example, as shown below, after changing the overload warning value (Pn015) from 20% to 50%, the overload warning detection time is half (50%) of the overload alarm detection time.



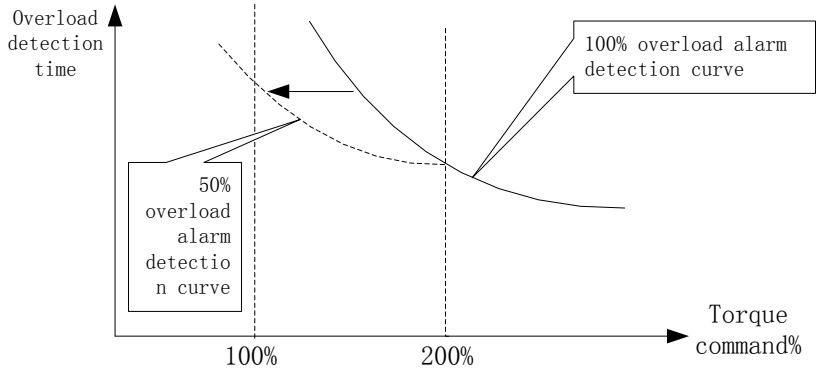
2. Change of the detection time of the overload warning (Er. 720)

The overload (continuous maximum) alarm (Er. 720) can be detected in advance to prevent motor overload.

By detecting the overload alarm by using the “decreased base current”, the overload alarm detection time can be shortened. The detection value of the overload (instantaneous maximum) alarm (Er. 710) cannot be changed.

Motor base current after rating reduction = motor current threshold for calculating overload alarm (default is 1.15 times motor) * motor overload detection base current decrease rated (Pn016).

For example, as shown in the following figure, after setting Pn016 to 50%, the overload alarm can be detected earlier because the motor overload is calculated from 50% of the base current. When the value of Pn016 is changed, the overload alarm detection time will be changed.



5.1.8. **Multi-turn Absolute Encoder**

When using a multi-turn absolute encoder, an absolute value detection system can be constructed by a host device. With the absolute value detection system, it is not necessary to perform an origin return operation every time the power is turned on. In order to save the position data of the absolute encoder, a battery unit needs to be installed. Install the battery on the battery unit with the encoder cable of the battery unit. When using an encoder cable with a battery pack, install the battery in the host device.

Related setting parameters:

Function code	Name	Range	Defaults	Unit	Communication address	When enabled
Pn040	**Method to use absolute encoder**	**0~1**	**0**	—	**0x0040**	After restart
	0 - Use an absolute e ncoder as an absolute encoder: If the motor is an absolute multi-turn encoder, setting this parameter to 1 can use the multi-turn absolute function 1- Use an absolute encoder as an incremental encoder: When used as an incremental encoder, the power-off position won’t be recorded and warning or alarm, corresponding to multiple revolutions, won’t happen either when the battery is					

	under-voltage or the drive is de-energized					
Pn041	**Absolute encoder battery warning/warning selection**	**0~1**	**0**	**—**	**0x0041**	After restart
	0- Set the low battery voltage as a fault: The driver powers up/resets for 4~9 seconds to monitor the battery status. Under-voltage will be reported as an under voltage alarm (Er. 830). Over time will not be detected. 1- Set the low battery voltage as a warning: Under-voltage (below 3V) will be reported as an under voltage alarm (Al.930). It will always monitor the battery voltage and can be self-recovery meanwhile enable running is out of restriction.					
Pn792	Absolute encoder operation	**0~2**	**0**	**—**	**0x0792**	After restart
	0 - No action 1- Write motor parameters to encoder EEPROM 2- Clear multi-turn encoder laps: if you use it initially or replace or insert/remove the battery during power-down of the drive. After power on, an encoder backup alarm (Er. 810) will be reported. This parameter is set to 2 and it can only be cleared after re-powered.					

Related monitoring data:

Monitoring code	Monitoring name	**Range**	**Unit**	**Communication address**
Un010	Absolute encoder single-turn value	**0x80000000~0x7fffffff**	Encoder pulse unit	**0xE011**
	Displays the single-turn absolute position of the servo motor rotor's current position			
Un011	Absolute encoder multi-turn value	**0x80000000~0x7fffffff**	Encoder pulse unit	**0xE011**
	Displays the single-turn absolute position of the servo motor rotor's current position.			

1. When replacing the battery, please make sure that the driver is powered on and the encoder cable is connected normally. Otherwise, the encoder will be notified of the backup warning by reconnecting the encoder.

5.1.9. **Torque Limit**

1. Torque limit method

For the purpose of protecting the machine etc., the output torque can be limited and set by parameter Pn050. The torque limit can be in the following four ways:

Pn050	Torque limit method description	Related parameters

0	Analog torque (torque mode is invalid)	Pn405
1	Maximum torque limit 1	Pn051
2	Positive torque limit 1 (Pn051), reverse maximum torque limit 2	Pn051 、 Pn052
3	Maximum torque limit 1 when the torque limit switching (/TLC) signal is OFF; Maximum torque limit 2 when ON.	Pn051 、 Pn052

1. The input voltage of the analog command for torque limit has no polarity. Take the absolute value of the voltage and use the torque limit value corresponding to this absolute value for both the forward direction and reverse direction.
2. The set value exceeds the maximum torque of the servo motor used, and the actual torque is also limited to the maximum torque of the servo motor.
3. When the set value is too small, the torque may be insufficient when the servo motor accelerates or decelerates. Please set according to the actual situation.

2. Torque limit output signal

The torque limit (/CLT) output is ON means the motor output torque is in the limit state. This signal can be used to confirm the status of the current torque limit of the motor. Refer to “Sequence Output Circuit” for the wiring method. Refer to “Switching Output Signal” for parameter setting.
Torque limit under voltage

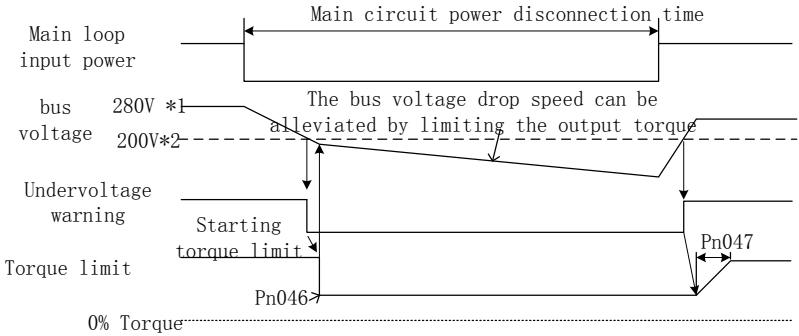
When the instantaneous power failure and the main circuit power supply voltage are insufficient for a short period of time, the main circuit DC voltage inside the servo unit is below the specified value, an under-voltage warning is detected, and the function for limiting the output current can be selected. Related parameters are as below:

Function code	Parameters name	Range	Default	Unit	Communication address	When enabled
Pn045	Under-voltage function selection	0x00~ 0x02	0	—	0x0045	After restart
	0 – No Detection of Main Circuit Descent Warning 1- Detection of Main Circuit Descent Warning 2 - Detect main circuit down warning and perform torque limit. The relevant torque limit is matched with Pn046/Pn047. For details, refer to "Main circuit under-voltage torque limit".					
Pn046	Torque limit when main circuit voltage drops	0~100	50	%	0x0046	Immediately
	According to the under voltage warning, it will impose the torque limit inside the servo unit.					
Pn047	Torque limit release time when main circuit voltage	0~100 0	100	Ms	0x0047	Immediately

	drops					
	After the under-voltage warning signal releases, the torque limit value is controlled within the servo unit according to the set time. For details, see "Under-voltage limit of the main circuit".					

By combining this function with the setting function of the instantaneous stop holding time, when the power supply voltage is insufficient, it is possible to avoid the shutdown due to the alarm and continue the operation without performing the power restoration operation.

Uner-voltage warning, apply torque limit inside the servo unit. After receiving the under voltage warning release signal, the torque limit value is controlled within the servo unit according to the set release time. The logical timing is as follows:

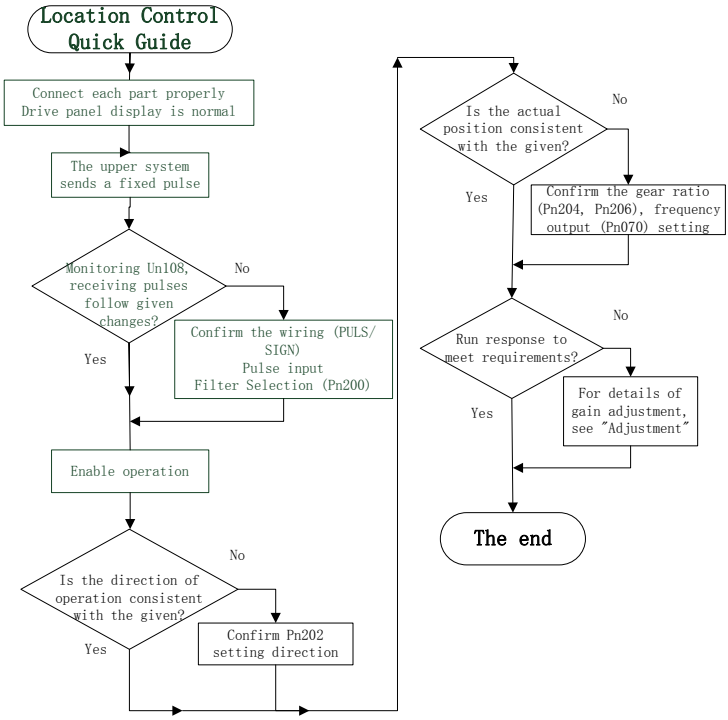


1: 560V at 400VAC
2: 400V at 400VAC

5.2. **Position Mode**

For details on the wiring related to the position mode; see "Connection Control Example for Position Control". The position control is selected by the control mode selection (Pn000 = 0, factory default).

5.2.1. **Quick Guide**



5.2.2. **Basic Settings**

The following describes the basic settings for position control:

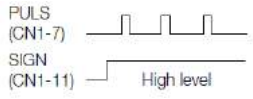
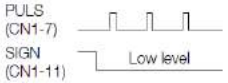
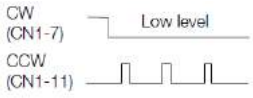
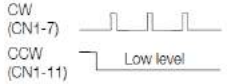
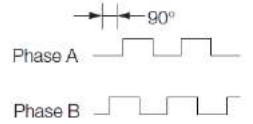
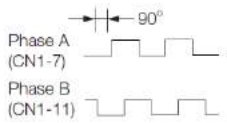
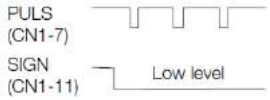
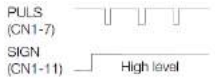
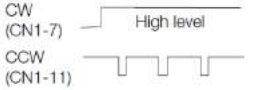
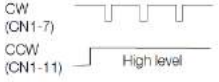
1. Pulse input form

According to the pulse output form of the upper system, the pulse input form of the servo unit is selected.

2. Command pulse filter selection

The appropriate command pulse filter can be selected according to the frequency of the highest pulse in operation, which can be set by parameter Pn200. For details, refer to the relevant description of the function code. If the selection is not appropriate, the received pulse of the servo unit may be lost or increased.

Function code	Setting value	Order form	Forward instruction	Reverse instruction

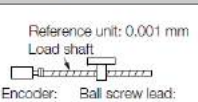
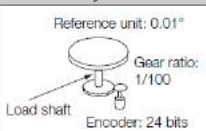
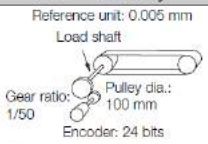
Pn201	0	Pulse + direction positive logic		
	1	CW+CCW positive logic		
	4	Quadrature encoding 4 times		
	5	Pulse + direction negative logic		
	6	CW+CCW negative logic		

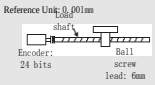
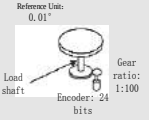
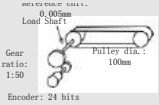
3. Electronic gear ratio

When the reduction ratio of the motor shaft and the load side is n/m (when the load shaft rotates by n revolutions when the motor rotates by m revolutions), the set value of the electronic gear ratio can be obtained by the following formula:

$$\text{Electronic gear ratio}\frac{B}{A}=\frac{Pn204}{Pn206}$$

$$=\frac{\text{Encoder resolution}}{\text{Load shaft movement amount in 1 rotation (command unit)}}\times\frac{m}{n}$$

Step	Description	Machine Configuration		
		Ball Screw	Rotary Table	Belt and Pulley
				
1	Machine Specifications	• Ball screw lead: 6 mm • Gear ratio: 1/1	• Rotational angle per revolution: 360° • Gear ratio: 1/100	• Pulley dia.: 100 mm (Pulley circumference: 314 mm) • Gear ratio: 1/50
2	Encoder Resolution	16,777,216 (24 bits)	16,777,216 (24 bits)	16,777,216 (24 bits)
3	Reference Unit	0.001 mm (1 μm)	0.01°	0.005 mm (5 μm)
4	Travel Distance per Load Shaft Revolution (Reference Units)	6 mm/0.001 mm = 6,000	360°/0.01° = 36,000	314 mm/0.005 mm = 62,800
5	Electronic Gear Ratio	$\frac{B}{A}=\frac{16,777,216}{6,000}\times\frac{1}{1}$	$\frac{B}{A}=\frac{16,777,216}{36,000}\times\frac{100}{1}$	$\frac{B}{A}=\frac{16,777,216}{62,800}\times\frac{50}{1}$
6	Parameters	Pn204: 16,777,216 Pn206: 6,000	Pn204: 167,772,160 Pn206: 3,600	Pn204: 838,860,800 Pn206: 62,800

Step	Description	Machine Configuration		
		Ball Screw	Rotary Table	Belt + Pulley
				
1	Machine specification	Ball screw lead: 6mm Gear ratio: 1/1	Rotational angle per revolution: 360° Gear ratio: 1/100	Pulley dia.: 100mm (Pulley circumference: 314mm) Gear ratio: 1/50
2	Encoder revolution	16777216 (24 bits)	16777216 (24 bits)	16777216 (24 bits)
3	Reference Unit	0.001mm （1mm）	0.01°	0.005mm （5mm）
4	Travel distance per load shaft revolution	6mm/0.001mm = 6000	360°/0.01°= 36000	314mm/0.005mm = 62800
5	Electronic gear ratio	$\frac{B}{A}=\frac{16777216}{6000}\times\frac{1}{1}$	$\frac{B}{A}=\frac{16777216}{36000}\times\frac{100}{1}$	$\frac{B}{A}=\frac{16777216}{62800}\times\frac{50}{1}$
6	Parameters	Pn204：1048576 Pn206：6000	Pn204：104857600 Pn206：36000	Pn204：52428800 Pn206：62800

1. When the electronic gear ratio numerator is 0, the denominator setting is the number of command pulses corresponding to one revolution of the motor.
2. If 0.001 ≤ electronic gear ratio (B/A) ≤ 16778 is out of this setting range, "Er. 040 alarm" will occur.

5.2.3. **Deviation Clearance**

The deviation clear signal (/CLR) is the input signal to clear the servo unit deviation counter.

1. Clear signal wiring

Deviation clear signal wiring can be divided into linear driver output and open collector output. Please refer to "Position Command Input Circuit" for wiring details.

2. Setting the deviation clear mode

The shape of the clear signal is set by Pn272.

function code	parameter name	range	Defaults	unit	mailing address	Effective mode
Pn272	Position deviation clear mode	0x00~0x03	0	—	0x0272	Power down effective
	Set the clear mode of the digital position deviation clear signal (/CLR): 0-level clear when cleared 1-rising edge OFF->ON clear Clear when 2-level OFF 3-falling edge clears when ON->OFF					

When Pn272 = 0 or 2, in order to perform clear signal processing, the amplitude of the clear signal must be 250μs or more.

When Pn272 = 1 or 3, in order to perform clear signal processing, the amplitude of the clear signal must be 20μs or more.

About the pulse amplitude of the clear signal

When Pn272 = 0 or 2, the clear signal must have a width of 250 μs or more in order to perform clear signal processing.

When Pn272 = 1, 3, the clear signal amplitude must be 20 μs or more in order to perform clear signal processing.

When set to keep clear, the servo lock function is invalid. Therefore, the servo motor will rotate at a slight speed due to the drift pulse in the speed loop.

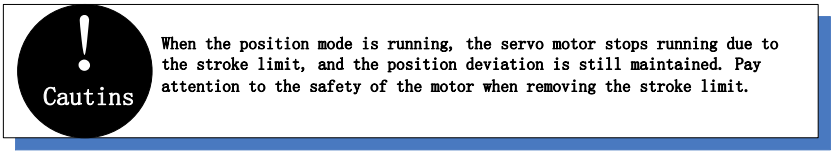
3. Deviation clearing method selection

Depending on the status of the servo unit, you can choose when to clear the position deviation. Set the deviation clearing method by Pn273:

function code	parameter name	range	Defaults	unit	mailing address	Effective mode
Pn273	Position deviation clear mode	0x00~0x02	0	—	0x0273	Power down effective
	Set the clear mode of the digital position deviation clear signal (/CLR): 0-level clear when cleared 1-rising edge OFF->ON clear Clear when 2-level OFF 3-falling edge clears when ON->OFF					

See the “Deviation Clearance” for details on the pulse amplitude of the clear signal.

In position control, the positional deviation remains unchanged when the servo motor is stopped due to the travel limit.



5.2.4. **Command Pulse Prohibition**

The command pulse inhibition (/INHIBIT) function is a function that prohibits the command pulse input from being counted during position control. When this function is enabled, the servo unit enters a state where it cannot receive the command pulse input.

1. Configuration of Command Pulse Prohibition

The signal is not configured in the factory default switch configuration. Therefore, the pin number configuration (0x0D) needs to be performed by parameters Pn601~Pn609.

2. Command pulse inhibited wiring

The command pulse disable signal is a universally configurable digital input. See "Sequence Input Circuit" for wiring details.

5.2.5. **Positioning Approach**

When positioning is close to (/NEAR) position control, the host device may receive the positioning proximity signal before confirming the positioning completion signal, so as to prepare for the sequence of actions after the positioning is completed. In this way, the time required to complete the positioning can be shortened. This signal is usually used in pair with the positioning completion signal. Refer to the “Positioning completed” instruction for the positioning completion signal.

1. Positioning close to the configuration

The signal is not configured in the factory default digital output configuration. Therefore, the

pin number configuration (0x08) needs to be performed by parameters Pn613~Pn615.

When the difference between the command pulse number of the host device and the movement amount of the servo motor (position deviation) is lower than the setting value of Pn260 (position proximity signal width), the signal is output when the positioning close output condition is satisfied.

2. Locating close wiring

The positioning proximity signal is a universally configurable digital output. See “Sequence Output Circuit” for wiring details

5.2.6. **Positioning Completion**

In position control, it indicates the servo motor positioning completed (/COIN) signal.

1. Positioning completed configuration

In the factory default digital output configuration, the signal is configured as CN1's 27th and 28th pin numbers (Pn614=0x01) by default. Please confirm before use.

Function code	Parameter name	Range	Defaults	Unit	Communication address	When enabled
Pn262	Positioning completion range	0~1073741824	7	Command unit	0x0262 0x0263	Immediately
	In the position control, the servo motor positioning completion signal will be output when the difference between the command pulse number from the host device and the servo motor movement amount (position deviation) is lower than the set value that means the host device confirming positioning has been completed.					

If the set value is too large, the permanent positioning completion signal may be output when the deviation is small during low-speed operation. When outputting a constant positioning signal, please lower the setting until the signal is no longer output.

Function code	Parameter name	Range	defaults	unit	Communication address	When enabled
Pn274	Positioning completion signal output time	0x00~0x02	0	—	0x0274	Immediately
	Set the output timing of the positioning completion signal /COIN: 0- Output when the absolute value of position deviation is less than the positioning completion range (Pn262). 1- Output when the absolute value of the position deviation is smaller than the positioning completion range (Pn262) and the command after the position command filtering is 0. 2- Output When the absolute value of the position deviation is smaller than the positioning completion range (Pn262) and the positioning command input is 0.					

2. Positioning completion wiring

The positioning completion signal is a universally configurable digital output. For wiring details, refer to “Sequence Output Circuit”.

5.2.7. **Command Pulse Input Magnification Switching**

The ON/OFF of the override input switching signal (/PSEL) of the command pulse input switches the input override of the position command pulse to 1 and n times (n = 1 to 100). The switching of the override can be confirmed by the command pulse input of the override switching output signal (/PSELA).

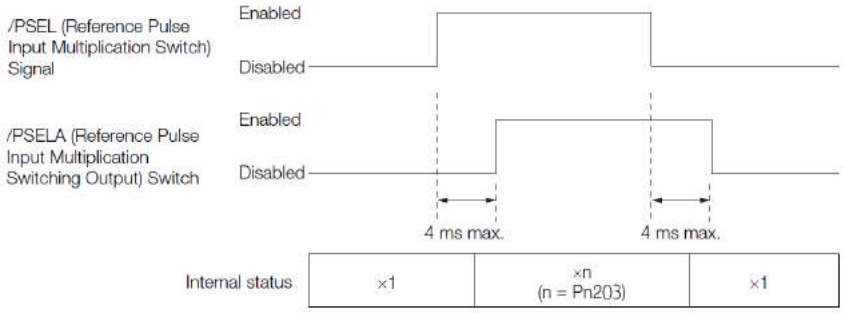
Please switch the command pulse magnification while the position command pulse is 0. If the position command pulse is not 0, the servo motor may cause a position error or cause a position loss.

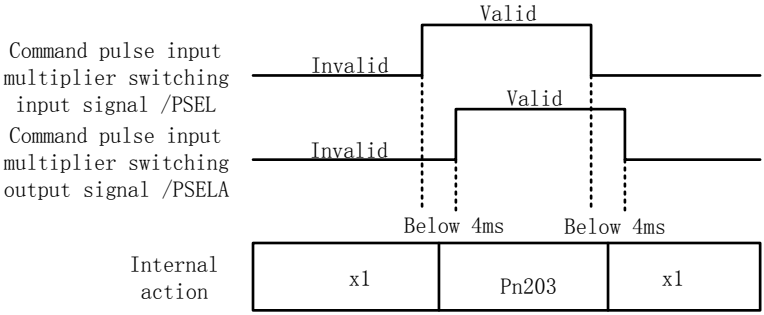
1. Configuration of command pulse input magnification switching

The signal is not configured in the factory default digital input configuration. Therefore, the pin number configuration (0x10) needs to be performed by parameters Pn601~Pn609.

Command pulse input magnification Pn203

Function code	Parameter name	Range	defaults	unit	Communication address	When enabled
Pn203	Command pulse input magnification	1~100	1	x1 times	0x0203	Immediately
	Set the command pulse input magnification value to be used in conjunction with ON/OFF of the command pulse magnification switching signal for switching the position command pulse input magnification to 1 and the parameter setting multiple. Note: The input pulse frequency is too low. If the value is set too large, the speed may not be steady.					





2. Command pulse input magnification switching wiring

The command pulse input override signal is a universally configurable digital input. See "Sequence Input Circuit" for wiring details.

5.2.8. **Smooth Settings**

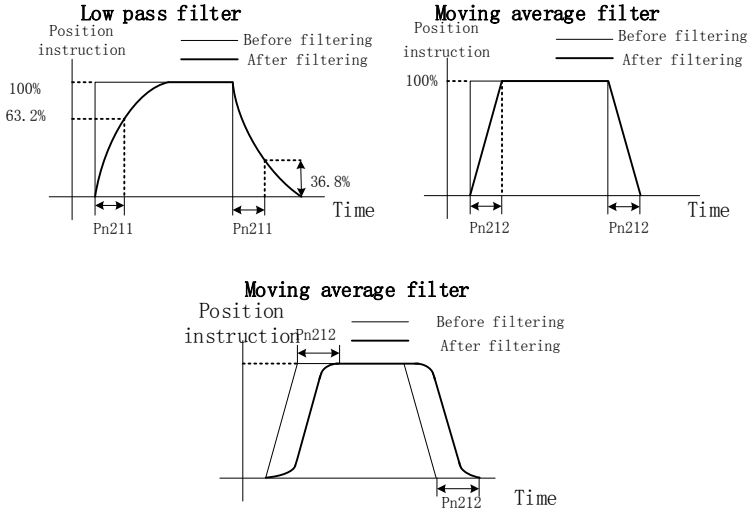
The command pulse input is filtered to make the rotation of the servo motor smoother. This function is more effective in the following situations:

- The host device that issued the command does not perform acceleration / deceleration
- When the instruction pulse frequency is extremely low
- When the position command smoothing function is set, the system response may be affected. Please use it reasonably.

The filter-related parameter settings are as follows:

Function code	Parameter name	Range	defaults	unit	Communication address	When enabled
Pn211	Position command low-pass filter time constant	0~655	0	ms	0x0211	After stop
	This parameter is used to set the time constant of the first-order low-pass filter corresponding to the position command and it can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter.					
Pn212	Average filter time in position instruction rolling	0~1000	0	ms	0x0212	After stop
	This parameter is used to set the time constant of the moving average filter of the corresponding position instruction. It can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter.					

The difference between the position command low-pass filter time constant and the position command's moving average filter time is shown below:



5.2.9. **Frequency Output**

The encoder frequency-divided pulse output is a signal that is output to the outside in the form of a two-phase pulse (phase A, phase B) with a phase difference of 90° after processing the signal from the encoder inside the servo unit. Used as position feedback in the upper device.

Frequency-division pulse output parameter configuration

How to set the encoder frequency pulse output as follows:

Function code	Parameter name	Range	defaults	unit	Communication address	When enabled
Pn070	Encoder divider pulses	16~4194304	2048	-	0x0070	After restart
	The number of pulses per cycle from the encoder is divided by frequency in accordance with the set value of this parameter. Please set it according to the system specifications of the machine and host device.					
Pn072	Divided frequency output negation	0~1	0	-	0x0072	After restart
	A/B pulse phase sequence logic when setting forward/reverse: 0- Don't negate the pulse output: When forward, A is ahead of B 1- Negate the pulse output: When forward, B is ahead of A					

1. Frequency division pulse

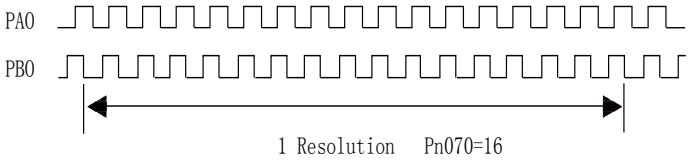
The number of pulses per revolution from the encoder is processed inside the servo pack and then divided down and output to the set value of Pn070.

The encoder's number of divided pulse outputs is set according to the system specifications of the machine and the host device.

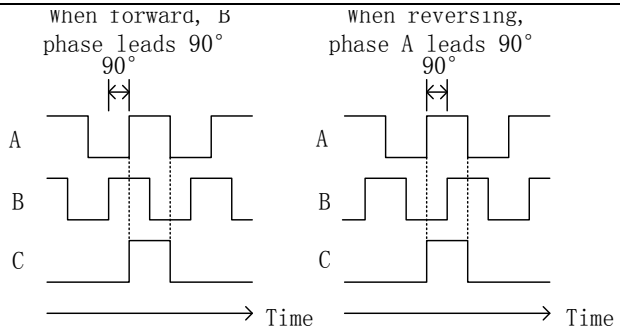
The setting of the number of encoder crossover pulses is limited by the resolution of the encoder as shown in the following table:

Setting of the Number of Encoder Output Pulses (Pulse/r)	Setting increment	Encoder Resolution			Upper Limit of Servomotor Speed for Set Number of Encoder Output Pulses r/min
		19 bits	20 bits	24 bits	
16~16384	1	o	o	o	6000
16386~32768	2	o	o	o	3000
32772~65536	4	o	o	o	1500
65544~131072	8	o	o	o	750
131088~262144	16	-	o	o	375
262176~524288	32	-	o	o	187
524352~1048576	64	-	o	o	93
1048704~2097152	128	-	-	o	46
2097408~4194304	256	-	-	o	23

Output example: When Pn070=16 (16 pulses per revolution), an example of the output of the encoder-divided pulse output A-phase (PAO) signal and the encoder-divided pulse output B-phase (PBO) signal is shown below.



2. Divided frequency output negation



Parameter Pn072 can be set to invert the logic of the AB phase signal of the divided output pulse.

The amplitude of the Z-phase pulse varies with the number of encoder-divided pulses (Pn070) and is consistent with the amplitude of the A-phase.

Split pulse output wiring

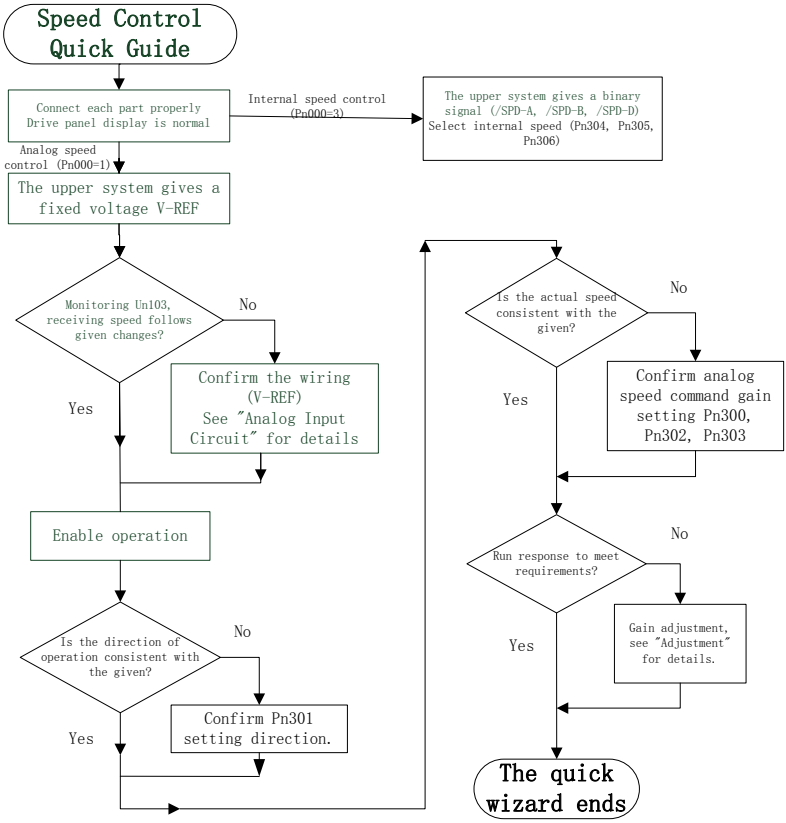
See the “Linear Drive Output Circuit” for details on the wiring of the divided pulse output.

5.3. **Speed Mode**

For details on speed mode wiring, see "Speed Control Connection Example". It is selected by control mode selection (Pn000).

The speed control mode is divided into internal speed mode (Pn000=3) and analog speed mode (Pn000=1) according to the command source.

5.3.1. **Quick Guide**



5.3.2. **Basic Settings**

Control mode selection (Pn000=3), internal speed mode, internal speed command direction selection based on digital input (/SPD-D) internal speed command selection A (/SPD-A), internal speed command selection B (/SPD- B) configuration to select the speed instruction.

The control mode selection (Pn000 = 1) is the analog speed mode. The speed command is given according to the voltage of V-REF (CN1-5, CN1-6) and the set value of analog speed command gain Pn300.

The basic settings for these two modes are described below:

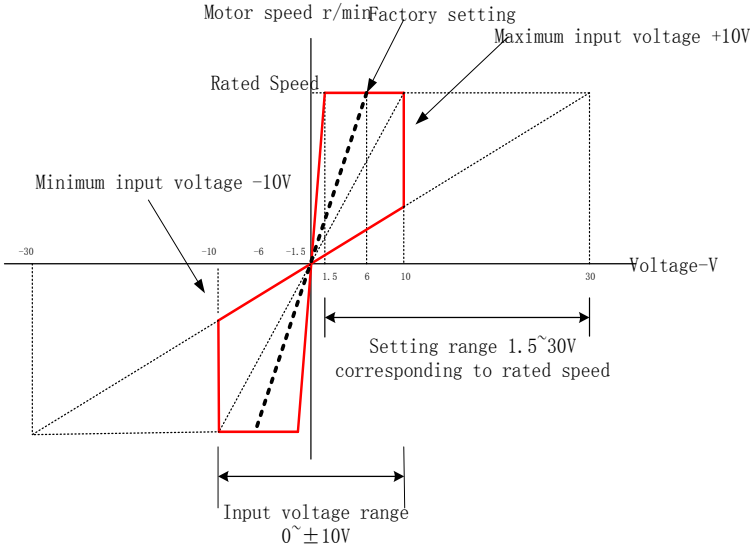
1. Analog speed

Function code	Parameter name	Range	Defaults	Unit	Communication Address	When enabled
Pn300	Analog	**150~3**	**600**	**0.01V/**	**0x0300**	Immediately

	speed command gain	**000**		**rated speed**		
	This parameter is used to set servo motor speed that should be equal to analog voltage value (V-REF) required for the speed command of the rated value. Caution: Do not apply more than -10~10V and exceeding this range may cause damage to the driver.					
Pn301	Analog speed command negation	**0~1**	**0**	**-**	**0x0301**	Immediately
	Set the voltage polarity of the analog speed command: 0-Positive polarity: positive voltage corresponds to positive speed command. 1- Negative polarity: positive voltage corresponds to negative speed command.					
Pn302	Analog speed instruction filter time	**0~655.35**	**0.40**	**Ms**	**0x0302**	Immediately
	The function could be set to smooth the speed command when one delay filter is applied to the analog speed command (V-REF) input and it does not usually need to be changed. If the set value is too large, the responsiveness may decrease. Please set this parameter while confirming the response.					
Pn303	Analog speed command dead zone range	**0~3**	**0**	**V**	**0x0303**	Immediately
	In the analog speed control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the commands inside the servo unit. This error can be eliminated by setting an appropriate analog speed command deadband range.					

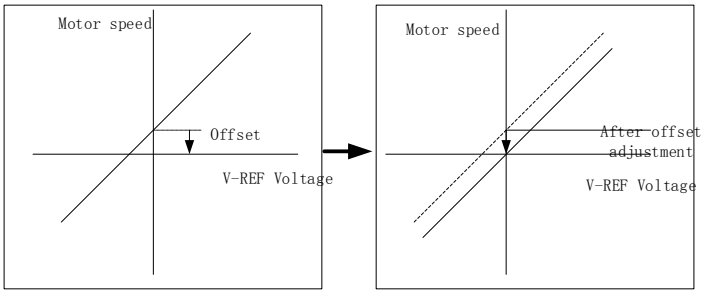
Set the analog voltage value of the speed command (V-REF, see “Analog Input Circuit” for wiring) that makes the speed of the servo motor rated as the analog speed command gain Pn300.

Example: The factory default parameter Pn300 = 600 (6V corresponds to the rated speed (assuming 3000rpm). If the V-REF input voltage is 1V, the speed command corresponds to 500rpm. If 3V is input, the speed command corresponds to 1500rpm.



Adjustment of instruction offset

When analog speed control is used, even if the command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the instructions inside the servo unit. This slight deviation is called "offset".



There are two methods of automatic adjustment and manual adjustment of offset adjustment. Automatic adjustment is automatic adjusting command offset (Fn100) and manual adjustment is manually adjusting command offset (Fn101). For details, see "Auxiliary Functions".

Cautions

1. When adjusting automatically, be sure to adjust the command offset while the servo is off.
2. When adjusting manually, observe the running status of the motor while adjusting under the state of servo ON.
3, the implementation of parameters to restore the factory settings, offset adjustment value will not be initialized

2. Internal speed

Function code	Parameter name	Range	Defaults	Unit	Communication address	When enabled
Pn304 Pn305 Pn306	Internal speed 1	0~10000	100	rpm	0x0304	Immediately
	Internal speed 2	0~10000	200	rpm	0x0305	Immediately
	Internal speed 3	0~10000	300	rpm	0x0306	Immediately
	When operating in the internal speed mode, the servo unit provides 3 internal speed commands and selects A and B through the internal speed command of the switch.					

The speed is selected through the digital input signal control:

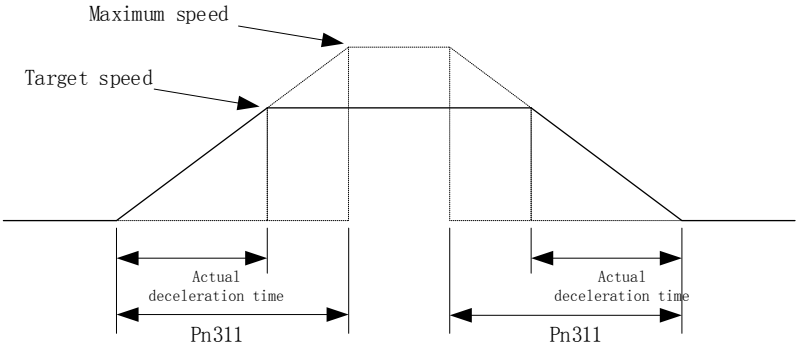
Switch input signal			Direction of speed instruction	Speed instruction size
/SPD-D	/SPD-A	/SPD-B		
OFF	OFF	OFF	Positive	0
	OFF	ON		Internal speed 1(Pn304)
	ON	ON		Internal speed 2(Pn305)
	ON	OFF		Internal speed 3(Pn306)
ON	OFF	OFF	Negative	0
	OFF	ON		Internal speed 1(Pn304)
	ON	ON		Internal speed 2(Pn305)
	ON	OFF		Internal speed 3(Pn306)

5.3.3. **Soft Start**

The soft start function is a speed command that converts a step speed command to a smoother constant acceleration/deceleration. You can set the acceleration time and deceleration time, and use this function when you want to achieve smooth speed control during speed control.

Function code	Parameter name	Range	Defaults	Unit	Communication address	When enabled
Pn310	Speed command trapezoidal acceleration time	0~10000	0	ms	0x0310	Immediately
	Acceleration of the set speed from 0r/min to the rated speed (corresponding to the motor model). When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.					
Pn311	Speed command trapezoidal deceleration time	0~10000	0	ms	0x0311	Immediately

	Acceleration time of the set speed from 0r/min to the rated speed (corresponding to the motor model). When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.



5.3.4. **Zero Fixed Functions**

The zero-fixed function means that when the zero-position fixed signal (/ZCLAMP) is ON, the servo lock is performed when the input voltage of the speed command (V-REF) is lower than the speed set by the fixed zero value (Pn501). At this time, the position loop is formed inside the servo unit, and the speed command will be ignored. Therefore, when used for speed control, the host device does not build a position loop.

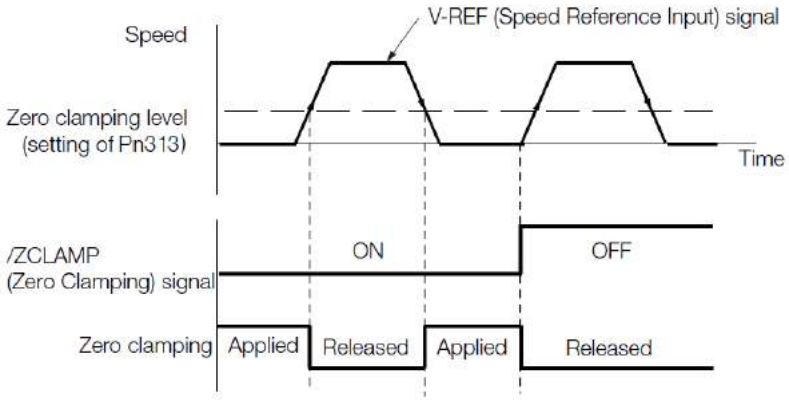
The servo motor is fixed within ±1 pulse of the zero position fixing effective position. Even if rotation occurs due to external force, it will return to the zero position.

1. Zero-fixed configuration

The signal is not configured in the factory default switch configuration. Therefore, the pin number configuration (0x0C) needs to be performed by parameters Pn601~Pn609.

Function code	Parameter name	Range	defaults	Unit	Communication address	When enabled
Pn312	Zero speed clamp mode	0~3	3	-	0x0312	Immediately
	Speed mode, setting the switching speed zero clamp signal (/ZCLAMP) working mode: 0- Invalid 1- Speed command is set to 0, not clamped after shutdown 2- Speed command is set to 0, clamped after shutdown 3- Speed command is lower than "zero speed clamp speed threshold"(Pn313), the first speed command is set to 0, clamped after shutdown.					
Pn313	Zero Speed Clamp Speed Threshold	0~10000	10	rpm	0x0313	Immediately
	Set the zero control switching threshold when "zero speed clamp mode"(Pn312) is set to 3.					

The relationship between zero fixed speed thresholds and zero fixed function is shown in the figure below:



2. Zero-fixed wiring

The zero-fixed signal is a universally configurable digital input. See “Sequence Input Circuit” for wiring details.

5.3.5. **Rotation Detection Signal**

When the motor speed is greater than the set value, a digital rotation detection signal (/TGON) is output.

1. Configuration of rotation detection signal

Function code	Parameter name	Range	defaults	unit	Communication address	When enabled
Pn317	Rotation determination threshold	1~10000	20	rpm	0x0317	Immediately
	When the motor speed is higher than the set value, the switch rotation detection signal (/TGON) is output.					

This signal is not configured in the factory default digital output configuration. Please confirm before use.
The signal is not configured in the factory default digital output configuration. Therefore, the pin number configuration (0x03) needs to be performed by parameters Pn613~Pn615.

The output condition is that the signal is output when the current feedback speed (absolute value) of the motor is higher than the setting value of Pn317 (rotation determination threshold).

2. Wiring of rotation detection signals

The rotation detection signal is a universally configurable digital output signal. See “Sequence Output Circuit” for wiring details.

5.3.6. **Consistent Speed**

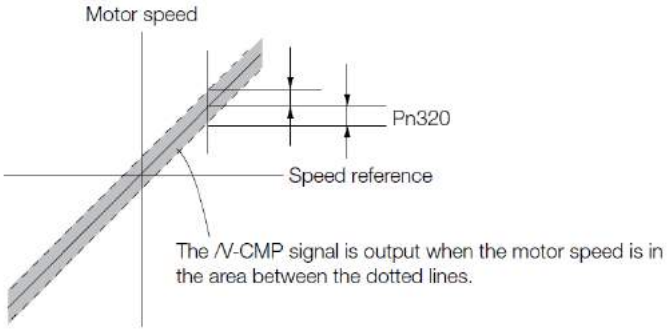
The speed coincidence signal (/V-CMP) is a signal that is output when the difference between the speed of the servo motor and the command speed is equal to or lowers than the set value of the speed coincidence range Pn320. Used when interlocking with the upper device. This signal is the output signal during speed control.

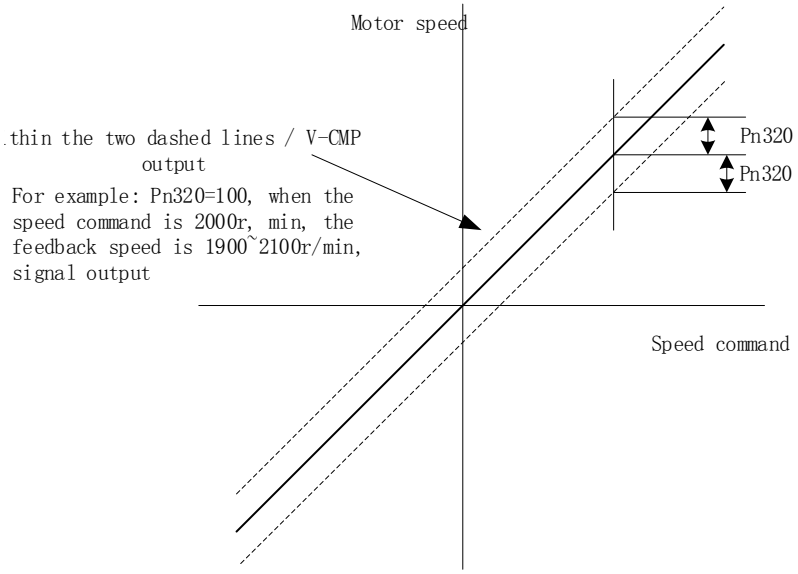
1. Configuration of Speed-consistent Signals

Function code	Parameter name	Range	Defaults	Unit	Communication address	When enabled
Pn320	Speed consistent range	0~100	10	rpm	0x0320	Immediately
	When the difference between the motor speed and the command speed is lower than the set value, the switch-speed match signal (/V-CMP) is output.					

In the factory default digital output configuration, the signal is configured as CN129 and 30 pin numbers (Pn614=0x02) by default. Please confirm before use.

If Pn320 is set to 100 and the speed reference is 2000mm-1, the signal would be output when the motor speed is between 1900 mm-1and 2100 mm-1.





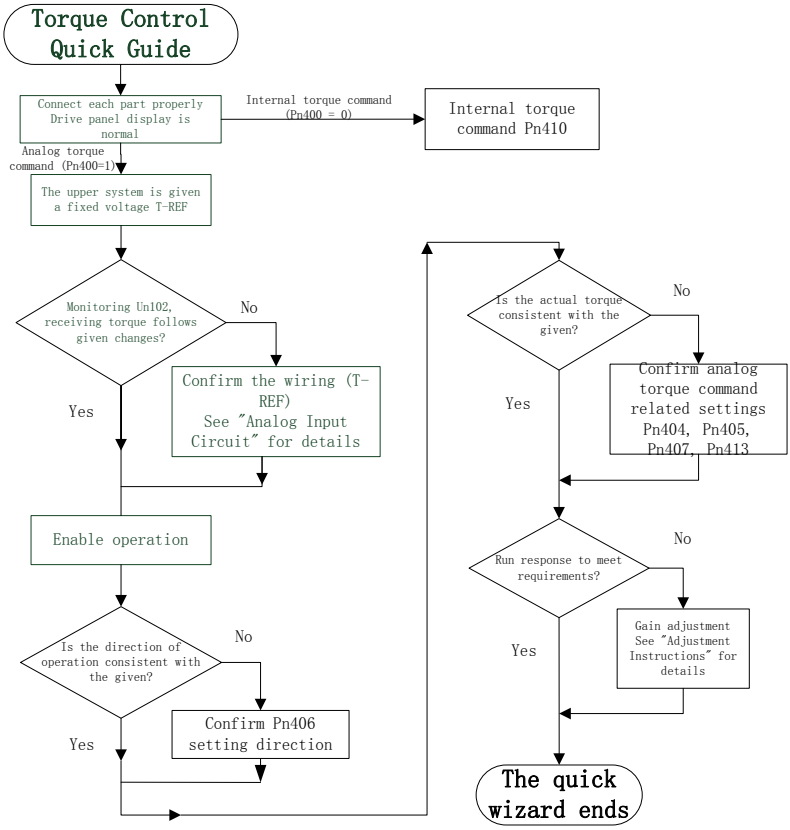
2. Wiring of speed-consistent signals

The speed-consistent signal is a universally configurable digital output signal. For details on wiring, see "Sequence Output Circuit".

5.4. **Torque Mode**

Refer to "Connection Example of Torque Control" for details on the wiring related to the torque mode. It is selected by control mode selection (Pn000=2). The torque mode is divided into the internal torque command (Pn400=0) and the analog torque command (Pn400=1, factory default) by the selection of the torque command source.

5.4.1. **Quick Guide**



5.4.2. **Basic Settings**

Torque control is the operation method of inputting the torque command to the servo unit and controlling the output of the servo motor through the size of the torque command.

The torque command selection source Pn400=0 is the internal torque command, the torque command size is set directly by the paramet r Pn410, Pn400=1, is the analog torque command, and it is based on the access to the T-REF (CN1-9, The voltage of CN1-10) and the value of analog torque command gain Pn405 are used to set the torque command.

The basic settings for the two command sources are described below.

Analog torque

Function code	Parameter name	Range	defa ults	unit	Communication address	When enabled

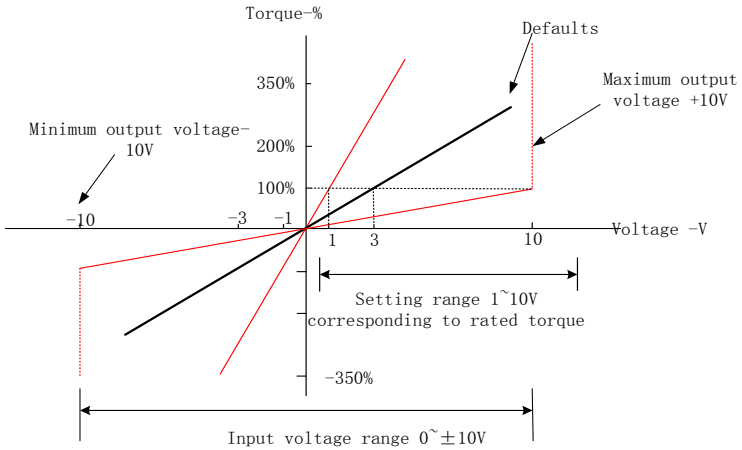
Pn404	Analog torque command filter time	0~655.35	0.00	ms	0x0404	Immediately
	The parameter is used to smooth the torque command when we apply a delay filter to the analog torque command (T-REF) input, usually it does not need to be changed. If the set value is too large, the responsiveness may decrease. So please set it up as we check the response.					
Pn405	Analog torque command gain	10~100	30	0.1V/Rated speed	0x0405	Immediately
	This parameter is used to set the analog voltage value (T-REF) required for the rated torque of the servo motor. Caution: Do not apply more than -10~10V, exceeding this range may cause damage to the driver.					
Pn406	Analog torque command negation	0~1	0	-	0x0406	Immediately
	The analog voltage corresponds to the polarity setting of the torque command: 0- Positive polarity: Positive voltage corresponds to positive torque command. 1- Negative polarity: Positive voltage corresponds to negative torque command.					
Pn407	Analog torque command dead zone range	0~3	0	V	0x0407	Immediately
	In analog torque control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because a slight deviation occurs in the command inside the servo unit. This error can be eliminated by setting an appropriate analog torque command deadband range.					

Inner torque

Function code	Parameter name	Range	Defaults	Unit	Communication address	When enabled
Pn410	Internal torque command in torque control	-500~500	0	%	0x0410	Immediately
	The command source for selecting the torque control is the torque command size setting for internal setting.					

Set the analog voltage value of the speed command (T-REF, see “Analog Input Circuit” for wiring) to make the speed of the servo motor the rated value through the analog speed command gain Pn405.

Example: The factory default parameter Pn405=30 (3V corresponds to the rated torque). If the input voltage at the T-REF terminal is 1.5V, the torque command corresponds to 50%. If 3V is input, the torque command corresponds to 100%.



5.4.3. **Adjustment of Instruction Offset**

When using torque control, even if the command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the instructions inside the servo unit. This slight deviation is called "offset".

There are two methods of automatic adjustment and manual adjustment of offset adjustment. Automatic adjustment is automatically adjusting the command offset (Fn100) and manual adjustment is manually adjusting using command offset (Fn102). For details, see "Auxiliary Functions".

Cautions

1. When adjusting automatically, be sure to adjust the command offset while the servo is off.
2. When adjusting manually, observe the running status of the motor while adjusting under the state of servo ON.
3, the implementation of parameters to restore the factory settings, offset adjustment value will not be initialized

Internal torque

5.4.4. **Speed Limit in Torque Control**

In order to protect drive and operator, motor speed could be limited by these parameters;
In torque control mode, motor torque is control accrodding to torque given value, not motor speed. So when torque given excess load torque, output speed will be increase.so motor speed need be limited in this situation.

5.5. **Hybrid Control Mode Selection**

The servo unit can combine the two modes from various control modes and switch them. The control method is selected by Pn000. The following describes the switching method and switching conditions:

Function	Parameter	Range	Default	Unit	Communication	When enabled

code	name		s		address	
Pn000	Control mode selection	0~11	0	-	0x0000	After restart
	4- Internal Speed <-> Analog Speed: Switch control mode via ON/OFF of switch/SPD-A and /SPD-B 5- Internal Speed <-> Position Mode : Switch control mode via ON/OFF of switch/SPD-A and /SPD-B 6- Internal Speed <-> Torque Mode: Switch control mode via ON/OFF of switch/SPD-A and /SPD-B 7- Position Mode <-> Analog Speed: ON/OFF Switching Control Mode of Switching (/C-SEL) Signal by Switching Control Mode 8- position mode <-> torque mode: ON/OFF switching control mode of the (C-SEL) signal switching 9- Torque Mode <-> Analog Speed: ON/OFF Switching Control Mode of (C-SEL) Signal Switching Mode 10- Analog speed <-> Speed mode for zero function: When controlling speed, zero fixed function can be used 11- Position Mode <-> Command Pulse Disabled Position Mode: When Control Position, Command Pulse Disable Function					

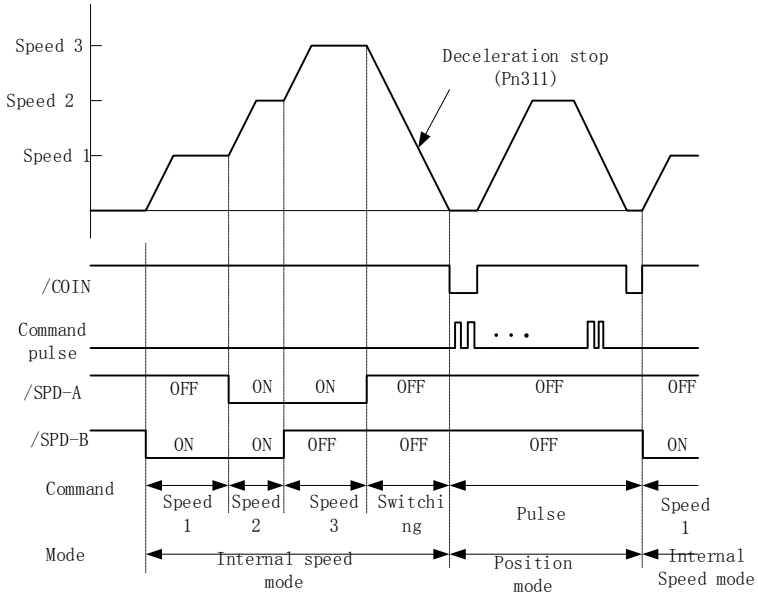
1. Internal speed control switching (Pn000 = 4, 5, 6)

a) The conditions for switching combinations with the internally set speed control are as follows.The digital input signal distribution mode is internally fixed (Pn600=0)

The control mode (second mode) and internal set speed can be switched by the /SPD-A and /SPD-B signals.

Switch input signal			Speed positive and negative instructions	Pn000 setting		
/SPD-D （CN1-41）	/SPD-A （CN1-45）	/SPD-B （CN1-46）		4	5	6
OFF	OFF	OFF	Second mode determines	Analog speed mode	Position mode	Torque mode
	OFF	ON	Positive	Internal speed 1 (Pn304)		
	ON	ON		Internal speed 2 (Pn305)		
	ON	OFF		Internal speed 3 (Pn306)		
ON	OFF	OFF	Second mode determines	Analog speed mode	Position mode	Torque mode
	OFF	ON	Negative	Internal speed 1 (Pn304)		
	ON	ON		Internal speed 2 (Pn305)		
	ON	OFF		Internal speed 3 (Pn306)		

Each mode switch is unconditionally limited. In motor rotation, speed control, position control or torque control can be switched to internally set speed control.



Note: The internal speed mode is decelerated during the deceleration time set by Pn311 to stop the motor, then switch to the position mode.

Note:

Internally set speed control, it will be automatically switched to the position control after the motor decelerates to stop within the deceleration time set in Pn311.

b) Switch input signal distribution mode is parameter configuration (Pn600=1 default parameter)

Through the ON/OFF switching control mode of the control mode switching (/C-SEL) signal, the signal is not configured in the factory default digital input configuration. Therefore, the pin number configuration of the function is required by parameters Pn601~Pn609 (0x0B).

Digital input signal	Pn000 setting		
/C-SEL (Parameter configuration)	4	5	6
ON	Analog speed mode	Position mode	Torque mode
OFF	Internal speed mode		

2. Switching outside the set speed control (Pn000 = 7, 8, 9)

a) The digital input signal distribution mode is internally fixed (Pn600=0).

Digital input signal	Pn000 Setting

/C-SEL（CN1-41）（parameter configuration）	7	8	9
ON	Analog speed mode	Torque mode	Analog speed mode
OFF	Position mode	Position mode	Torque mode

b) Switch input signal distribution mode is parameter configuration (Pn600=1 default parameter).

Digital input signal	Pn000 Setting		
/C-SEL (Parameter configuration）	7	8	9
ON	Analog speed mode	Torque mode	Analog speed mode
OFF	Position mode	Position mode	Torque mode

3. Internally set speed control switching (Pn000 = 10, 11)

a) The digital input signal distribution mode is internally fixed (Pn600=0)

Digital input signal	Pn000 setting	
/C-SEL（CN1-41）	10	11
ON	Speed mode with zero fixed function	Positioning mode with command pulse inhibit function
OFF	Speed mode	Position control

b) Switch input signal distribution mode is parameter configuration (Pn600=1 default parameter)

Switch input signal		Pn000 Setting	
		10	11
/ZCLAMP（parameter configuration）	ON	Speed mode with zero fixed function (*1)	-
	OFF	Speed mode	-
/INHIBIT（parameter configuration）	ON	-	Positioning mode with command pulse inhibit function
	OFF	-	Position control

*1: The effective mode of the digital zero-speed clamp signal (/ZCLAMP) must be used in conjunction with the setting of parameters Pn312 and Pn313. For details, see the description of the function code.

5.6. **Other Output Signals**

5.6.1. **Servo Ready Output Signal**

The servo ready output signal (/S-RDY) is a signal that indicates that the servo unit can receive servo ON (/S-ON) signals and command signals.

This signal is output under the following conditions:

- The main circuit power is on. For details on the output timing of /S-RDY during power-on, see "Power-up enable ON timing".
- Non-hardwired base blocking status
- No alarm occurred
- When using an absolute encoder, the SEN signal turns ON (H level)

1. Servo-ready parameter configuration

In the factory default digital output configuration, the signal is configured as CN1's 25th and 26th pin numbers (Pn613=0x00) by default. Please confirm before use.

2. Servo ready wiring

The servo ready signal is a universal configurable digital output. See "Sequence Output Circuit" for wiring details.

5.6.2. **Warning Output Signal**

The warning output signal (/WARN) is a warning function before the alarm, which makes it easier for the host device to judge the operation of the servo unit in advance. For detailed warning code, please refer to "Warning Code".

3. Configuration of warning output signals

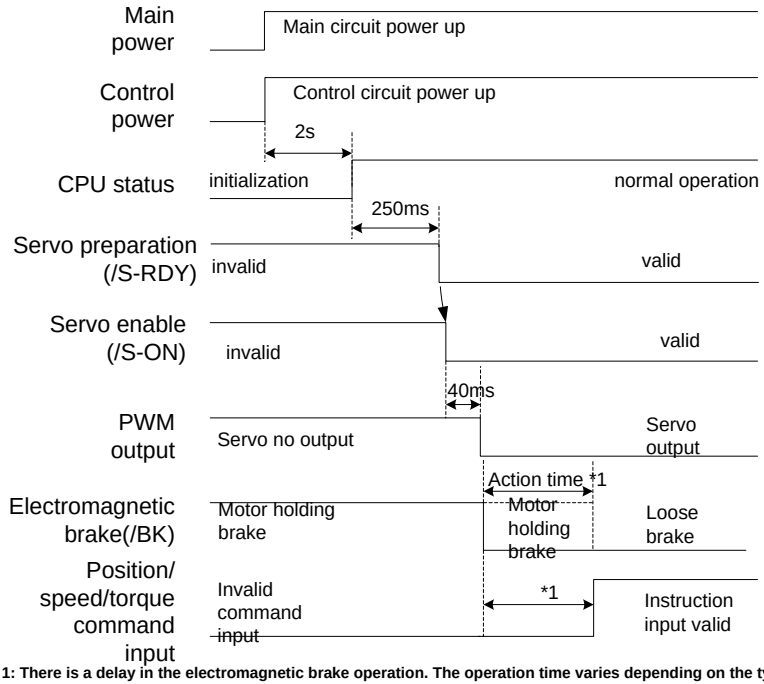
This signal is not configured in the factory default digital output configuration. The pin number configuration (0x07) needs to be performed by parameters Pn613~Pn615.

4. Wiring of warning output signals

The warning output signal is a universally configurable digital output signal. See “Sequence Output Circuit” for wiring details.

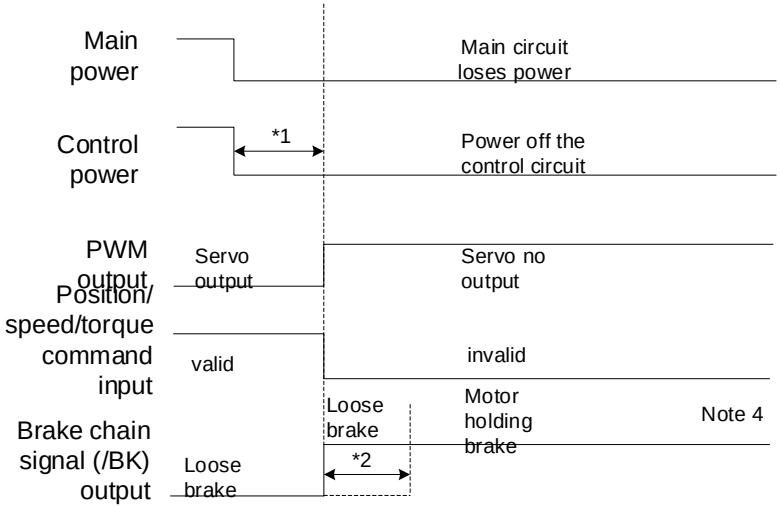
5.7. **Timing**

5.7.1. **Power Enable ON Timing**



1: There is a delay in the electromagnetic brake operation. The operation time varies depending on the type of the brake. It is recommended to be more than 100ms to ensure that the electromagnetic brake is completely released when the command is input. This time can be omitted when the motor is not braked.

5.7.2. **Power-Off Enable OFF Timing**



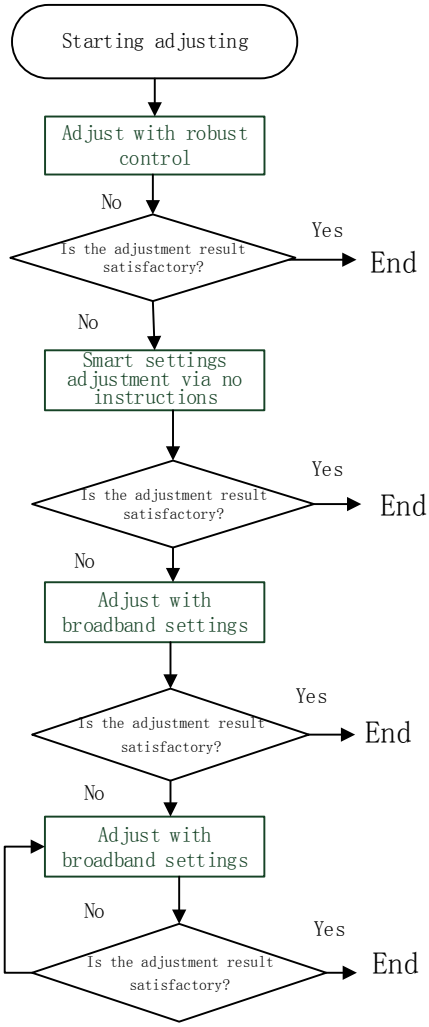
1: Undervoltage fault occurs when the control power supply voltage drops below 170V/350V (220V series/400V series)
2: Output from /BK to the actual brake of the motor. The time varies depending on the type of the brake. See "Electromagnetic brake" for the timing of the /BK signal when the alarm or enable is OFF.

6. Adjustment

6.1. **Adjustments**

6.1.1. **Adjustments Steps**

Adjustments refer to optimaize the function of responsiveness by adjusting the servo unit's servo gain. Servo gain is set by the combinations of many parameters, including speed circle gain, position circle gain, filter, friction compensation, rotation inertia and so on. These paramenters would influence with each other, so you must take the balance among all paramenters into the consideration while setting. The factory settings of the servo gain are stable settings. Use all the adjusting functions according to the uses' mechanical conditions in order to improve the responsiveness. The following figure is basic adjustment procedure flow chart; please adjust the machine according to the status and operating conditions of the machine.



6.1.2. **Safety Precautions When Adjusting**

When you are making adjustments, please set the servopack protection functions shown below under appropriate conditions.

Set the overtravel

Please set the overtravel and you could refer to the servo enable and overtravel setting if you want more details.

The settings of the torque limit

The torque limit function is about calculate the torque that mechanical motions need in order to make sure that the torque is not greater than this troque limit value. If the torque is set below the value required for operation, overshoot or vibration may occur.

See more details in the “torque limit”.

Set excessive position deviation alarm value

The excessive position deveiation alarm is an effective protection function when we are using servo unit for position control. When the motor operation does not match the command, you can detect the abnormal condition and stop the motor by setting an appropriate position deviation alarm. The position deviation is the difference between the position command value and the actual position. The position deviation can be expressed by the relationship between the following position loop gain (Pn103) and motor speed.

$$\text{Position deviation instruction unit} = \frac{\text{Motor speed}[\text{min}^{-1}]}{60} * \frac{\text{Encoder resolution}^{*1}}{\text{Pn103}[0.1/\text{s}]/10^2} * \frac{\text{Pn206}}{\text{Pn204}}$$

When the acceleration/deceleration of the position command exceeds the tracking ability of the motor, the follow-up hysteresis will become large, resulting in the positional deviation not satisfying the above relation. Please reduce the acceleration and deceleration of the position command to the value that can be tracked by the motor or increase the value of the excessive position error alarm.

Set the vibration detection function

Please initialize (Fn105) the detection value detected by the vibration and set an appropriate value for the vibration detection function. For details, refer to the corresponding "Accessibility"

Set excessive position deviation alarm value when servo is ON

If the servo is turned ON while the position deviation is accumulated, the motor will return to the original position to make the position deviation "0"and avoid causing a danger. In order to avoid this kind of situation, you can set an excessive position deviation alarm value when the servo is turned on to restrict the operation.

6.2. **Robust Control**

In factory default, the robust control function is valid. When resonance and vibration occur, please change the attune value and load value via Fn301 or set Pn177 and Pn178.

6.2.1. **Profile**

Robust function could get stable response through adjusting the whole system automatically no matter what kind of mechanisim or fluctuation of load.

Function code	Name	Range	Default	Unit	Communication address	When enabled
Pn175	Robust control selection	0x00~0x01	1	—	0x0175	After restart
	Set the robust control function switch: 0-invalid 1-valid					
Pn177	Robust control tuning value	10~80	40.0	Hz	0x0177	Immediately
	Set a greater robust control gain tuning value, systematic response gets faster, but system overshoot and excessive noise may occur					
Pn178	The minmum value of robust control	0~500	0	%	0x0178	Immediately
	Set a greater load ratio of robust control, systematic response gets faster, but the systematic excessive noise may occur, and we could increase this value in order to decrease the over-sdjustment and overshoot when torque is excessive.					

Robust control function is valid in position control or speed control and invalid in torque control. When robust control is valid, some of the control functions of the table below would be restrained.

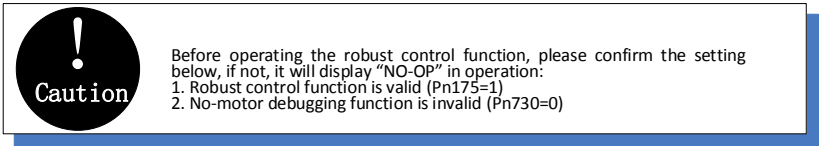
Function name	Operation	Executable conditions and notes
Vibration detection value initialization (Fn105)	Yes	Robust control is invalid in operation, and it turns to be valid when the operation is over
Bandwidth setting(Fn303)	No	
EasyFFT （Fn401）	Yes	Robust control is invalid in operation, and it turns to be valid when the operation is over

Gain shift	No	
Inertia recognization	Yes	Robust control is invalid in operation, and it turns to be valid when the operation is over
Mechanical analysis	Yes	Robust control is invalid in operation, and it turns to be valid when the operation is over

Parameters which become invalid when robust control function are valid. When we set robust control function valid in factory default, the Pn100、Pn101、Pn102, Pn103, Pn105, Pn106, Pn107, Pn140, Pn110, Pn170 are invalid.

6.2.2. **Steps**

Robust control function could be set via the auxiliary function Fn301 on panel operator and more details on"Accessibility", or we could set relevant parameters via"parameters setting"



6.2.3. **Supplement**

In robust control, due to the increase of the tuning value, the system may cause resonance noise. You can set the Pn151 to choose whether to automatically set the notch. The factory default is "Auto-tuning". Only when the corresponding notch function is not needed, it is set to "Auto-adjust without auxiliary function."

Function code	Name	Range	default	Unit	Communication address	When enabled
Pn151	Automatic adjustment and selection of notch filter 2	0x00~0x01	1	—	0x0151	Immediately
	0-No automatic adjustment via auxiliary functions 1-Automatic adjustment via auxiliary functions					

6.2.4. **Relevant Parameters**

The parameters need to be set are shown as below when operating robust control function:

Parameter	Name
Pn175	Robust switch
Pn104	First torque command filter

Pn156	Second notch filter frequency
Pn157	Second stage notch filter Q value

6.3. **Inertia Recognition**

6.3.1. **Profile:**

Inertia recognition means that the servo unit performs automatic operation (forward and reverse reciprocating motion) without issuing commands from the upper device, and the load inertia moment is recognized during operation. The rotary inertia ratio (ratio of load inertia to motor rotor inertia) is the reference parameter for performing the gain adjustment, and the correct value must be set as far as possible. The load moment of inertia can be calculated based on the weight and composition of each part of the machine, but the operation is very tedious. With this function, after the motor is driven several times in the positive/negative direction, a high-precision load moment of inertia value can be obtained.

The motor operates according to the following operating specifications.

The highest speed: ± 1000min-1 (changeable)

Acceleration: ± 20000min-1/s (changeable)

Travel distance: maximum ± 2.5 turns (changeable)

6.3.2. **Steps**

The inertia recognition function can only be identified by the upper computer debugging software VCSDsoft. For details on the identification procedure, refer to “Upper Position Debugging Related” - “Inertia Identification”.

6.3.3. **Supplyment**

When identifying the inertia, please make sure that the system can operate the range and set the operating conditions reasonably according to the operable range. Under different operating conditions, the recognition result may have minor deviations.

If the servo torque limit is set too small, the result of inertia identification may be affected, resulting in discrepancy between the identification result and the actual inertia. Please confirm before identification.

After inertia identification, after changing the inertia ratio (Pn100), the original gain-related parameters of the servo system need to be re-adjusted, otherwise vibration and noise may occur.

6.4. **Intelligent Setting**

6.4.1. **Profile**

Users can choose intelligent setting with command input and no command input

No command input

It means the function of automatically adjusting the servo unit according to the mechanical characteristics when the automatic operation (forward and reverse reciprocating motions) is performed within the set range. Intelligent settings can be performed without connection to the control system. The automatic operation is as follows

Highest speed: motor rated speed

Acceleration torque: motor rated torque about 100%

Move distance: can be set arbitrarily. The factory setting is equivalent to 3 turns of the motor

Command input

It is the method of automatically adjusting the running command from the host control system. The command intelligent setting can also be used for additional adjustments after the commandless intelligent setting. When the correct moment of inertia ratio is set, no-instruction intelligent setting can be omitted, and only the intelligent setting operation with instructions is performed.

The command smart setting starts with the current speed loop gain (Pn101) as a reference. If vibration occurs at the start of the adjustment, correct adjustment cannot be performed. In this case, lower the speed loop gain (Pn101) until the vibration disappears, and then readjust.

The intelligent setting process adjusts the following items:

Moment of inertia ratio (intelligent setting without command)

Gain adjustment (speed loop gain, position loop gain, etc.)

Filter adjustment (torque command filter, notch filter)

Friction compensation

IF suppression control

Vibration suppression

Low-frequency vibration suppression (only when Mode = 2 or 3) (without command smart setting)

6.4.2. **Steps**

The intelligent setting function cannot be set by the panel operator, and it needs to cooperate with the host computer debugging software to perform related operations. The instructionless intelligent setting is slightly different from the related operation of the instructional intelligent setting.

For detailed steps, see "host computer operation instructions" - "Intelligent setting".

Confirmation before execution

Before performing intelligent settings, be sure to confirm the following settings. If set incorrectly, this function cannot be performed during operation.

No overtravel has occurred

No torque control

Gain switching selection switch is manual gain switching (Pn110 = 0) and is the first gain

No motor test function is invalid (Pn730 = 0)

No alarm or warning occurred

Robust control function is invalid (Pn175 = 0)

1. When the commandless intelligent setting is executed in the speed control status, it will automatically switch to position control to perform adjustment, and return speed control after adjustment is completed.
2. The intelligent command setting cannot be executed in the speed control status.
3. During the intelligent setting process, the command pulse input override switch function becomes invalid.

Failed to perform adjustment or adjustment failed example

In the following occasions, intelligent settings will not be performed properly. Please use the bandwidth setting (see "Bandwidth setting" for details).

The motor is in power (in servo ON) in position control (with command intelligent setting)

When the mechanical system can only run in one direction

The scope of activities is narrow, below 0.5 laps

When the moment of inertia changes within the set operating range

When the mechanical dynamic friction is large

The mechanical rigidity is low and vibration occurs during positioning

When P (proportional) control is selected, "Load inertia moment measurement" is selected, In the moment of inertial recognition, or when switching from P/CON signal to P control

When using the mode switch, when "Load moment of inertia measurement" is selected, the mode switch function becomes invalid during the moment of inertia recognition and becomes PI control. The mode switch function becomes active again after the moment of inertia recognition is completed.

When speed feed forward and torque feed forward are input

When the positioning complete width (Pn262) is small

1. When there is no command intelligent setting, when the variable inertia load is changed and the adjustment fails, please replace the adjustment mode and adjust with broadband settings or robust control.
2. In the intelligent setting, please set "electronic gear ratio (Pn204/Pn2016)" and "positioning completion range (Pn262)" to the actual running values, otherwise the adjustment may fail or the adjustment result does not match the actual operation result.

6.4.3. **Supplyment**

Vibration suppression function

Before the intelligent setting, you can set whether the related vibration suppression function is automatically set. The factory default is to set automatically, please set the corresponding function switch to “Do not adjust automatically” before you want to change the value of the smart setting.

Function code	Name	Range	Default	Unit	Communication address	When enabled
Pn140	IF suppression control options	0x00~0x11	0x0010	—	0x0140	Immediately
	The IF suppression control function effectively suppresses the continuous vibration of about 100 to 1000 Hz that occurs when the control gain is increased. 0x1#: Automatically set IF vibration suppression frequency through smart setting and bandwidth setting 0x0#: Not set automatically through intelligent setting and bandwidth setting, only manual setting 0x#1: IF suppression frequency setting is valid 0x#0: IF suppression frequency setting is invalid					
Pn150	Notch filter 1 automatic adjustment selection	0x00~0x01	1	—	0x0150	Immediately
	0- Automatic adjustment without auxiliary functions 1- Automatic adjustment through auxiliary functions					
Pn151	Notch filter 2 automatic adjustment selection	0x00~0x01	1	—	0x0151	Immediately
	0- Automatic adjustment without auxiliary functions 1- Automatic adjustment through auxiliary functions					
Pn231	Low frequency vibration suppression function	0x00~0x01	1	—	0x0231	Immediately

	automatic adjustment selection					
	This parameter is set in the intelligent settings, bandwidth settings and other auxiliary functions under low-frequency vibration suppression is automatically set to choose: 0 - Vibration suppression function is not automatically adjusted by auxiliary functions 1- Vibration suppression function is automatically adjusted by auxiliary functions					

Feed forward function

In the factory setting mode, when the tuning mode is executed by "2", "3", "feedforward command (Pn109)", "speed feedforward (VREF) input", and "torque feedforward (T-REF) input "will become invalid.

According to the system configuration, if you want to use "V-REF input", "Torque feedforward (T-REF) input" and model tracking control from the upper device at the same time, set Pn249 = 1.

When using model tracking control under this function, the model tracking control will set the optimal feed forward within the servo. Therefore, the "V-REF input" and "T-REF input" from the upper device are not always used at the same time. If the input feedforward is incorrect, overshoot may be caused. However, it can be used as appropriate, so please pay attention.

6.4.4. **Related Parameters**

The parameters that may be changed when executing the smart setting function are as follows:

Parameter	Name
Pn100	Rotary inertia ratio
Pn101	First speed gain
Pn102	First speed integral time constant
Pn103	First position gain
Pn104	First torque command filter
Pn140	Medium frequency vibration suppression control selection
Pn141	Medium frequency vibration suppression inertia modification
Pn142	IF suppression frequency
Pn143	IF damper attenuation gain
Pn153	Notch filter 1 frequency
Pn154	Notch filter 1Q value
Pn155	Notch filter 1 depth
Pn156	Notch filter 2 frequency

Pn157	Notch Filter 2Q Value
Pn158	Notch filter 2 depth
Pn240	Model tracking control selection
Pn241	Model tracking control gain
Pn242	Model tracking control attenuation coefficient
Pn243	Model tracking control speed feed forward gain
Pn244	Model tracking control forward torque feed forward gain
Pn245	Model tracking control reverse torque feed forward gain

6.5. **Bandwidth Setting**

6.5.1. **Profile**

The bandwidth setting is a method of inputting a speed command or a position command from the host device, and manually adjusting the running speed.

By adjusting one or two values with the bandwidth setting, the relevant servo gain setting can be automatically adjusted.

The bandwidth setting adjusts the following items:

Gain adjustment (speed loop gain, position loop gain, etc.)

Filter adjustment (torque command filter, notch filter)

Friction compensation

IF suppression control

Low frequency vibration suppression

Use the bandwidth setting when you cannot achieve satisfactory response characteristics after setting it by smart settings. If you want to further fine-tune each servo gain after adjusting the bandwidth setting, see “Manual adjustment” for manual tuning.

6.5.2. **Steps**

Before performing bandwidth setting, be sure to confirm the following settings. If it is set incorrectly, "NO-OP" will be displayed in the operation and this function cannot be performed.

Invalid selection of no motor test function (Pn730 = 0)

Robust control selection is invalid (Pn175 = 0)

Tuning mode is set to 0 or 1 when tuning is performed by speed control

The bandwidth setting procedure can be performed by any one of the panel operator or the upper level debugging software. However, the panel operator can only operate when the tuning mode is set to “0-stability” or “1-high response”. For detailed operation procedure, see “Bandwidth Setting (Fn303)”. When positioning-specific adjustments "2-positioning" and "3-positioning are not required to be over-tuned" are required, they must be used in conjunction with "host computer

debugging software".

After the inertia recognition or intelligent setting correctly set the moment of inertia ratio (Pn100), perform the broadband setting operation.

6.5.3. **Supplyment**

Viabration suppression function

Before setting the bandwidth, you can set whether the related vibration suppression function is automatically set. The factory default is to set automatically. Please set the corresponding function switch to “Do not adjust automatically” before you want to change its value through the bandwidth setting.

Function code	Name	Range	Default	Unit	Communication address	When enabled
Pn140	IF suppression control options	0x00~0x11	0x0010	—	0x0140	Immediately
	The IF suppression control function effectively suppresses the continuous vibration of about 100 to 1000 Hz that occurs when the control gain is increased. 0x1#: Automatically set IF vibration suppression frequency through smart setting and bandwidth setting 0x0#: Not set automatically through intelligent setting and bandwidth setting, only manual setting 0x#1: IF suppression frequency setting valid 0x#0: IF suppression frequency setting invalid					
Pn150	Notch filter 1 automatic adjustment selection	0x00~0x01	1	—	0x0150	Immediately
	0- Automatic adjustment without auxiliary functions 1- Automatic adjustment through auxiliary functions					
Pn151	Notch filter 2 automatic adjustment selection	0x00~0x01	1	—	0x0151	Immediately
	0- Automatic adjustment without auxiliary functions 1- Automatic adjustment through auxiliary functions					
Pn231	Low frequency vibration	0x00~0x01	1	—	0x0231	Immediately

	suppressio n function automatic adjustment selection					
	This parameter is set in the intelligent settings, bandwidth settings and other auxiliary functions under low-frequency vibration suppression is automatically set to choose: 0 - Vibration suppression function is not automatically adjusted by auxiliary functions 1- Vibration suppression function is automatically adjusted by auxiliary functions					

Feed forward function

In the factory setting mode, when the tuning mode is executed by "2", "3", "feedforward command (Pn109)", "speed feedforward (VREF) input", and "torque feedforward (T-REF) input "will become invalid. According to the system configuration, if you want to use "V-REF input", "Torque feed forward (T-REF) input", and model tracking control from the host device at the same time, set Pn249 = 1.

When using model tracking control under this function, the model tracking control will set the optimal feed forward within the servo. Therefore, the "V-REF input" and "T-REF input" from the upper device are not always used at the same time. If the input feedforward is incorrect, overshoot may be caused. However, it can be used as appropriate, so please pay attention.

6.5.4. **Related Parameters**

The relevant parameters and parameters that are automatically set when executing the bandwidth setting function are as follows:

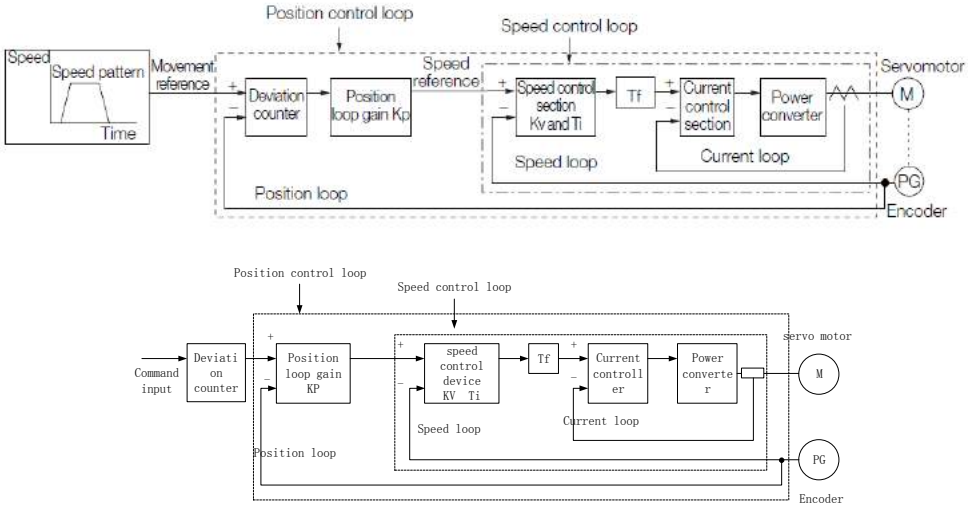
Parameter	Name
Pn100	Rotary inertia ratio
Pn101	First speed gain
Pn102	First speed integral time constant
Pn103	First position gain
Pn104	First torque command filter
Pn140	Medium frequency vibration suppression control selection
Pn141	Medium frequency vibration suppression inertia modification
Pn142	IF suppression frequency
Pn143	IF damper attenuation gain
Pn153	Notch filter 1 frequency
Pn154	Notch filter 1Q value
Pn155	Notch filter 1 depth

Pn156	Notch filter 2 frequency
Pn157	Notch Filter 2Q Value
Pn158	Notch filter 2 depth
Pn240	Model tracking control selection
Pn241	Model tracking control gain
Pn242	Model tracking control attenuation coefficient
Pn243	Model tracking control speed feed forward gain
Pn244	Model tracking control forward torque feed forward gain
Pn245	Model tracking control reverse torque feed forward gain

6.6. **Manual Adjustment Function**

After the intelligent setting and bandwidth setting adjustment, the function for further individual adjustment is required:

6.6.1. **Servo Gain**



To manually adjust the servo gain, adjust the servo gains one by one based on understanding the composition and characteristics of the servo unit. In most cases, if there is a large change in one parameter, the other parameter must be adjusted again. In order to confirm the response characteristics, preparations must be made to observe the output waveform of the analog monitor using a measuring instrument. The servo unit consists of three feedback loops (position loop, speed loop, and current loop). The more the inner loop, the more responsive it needs to be. Failure to follow this principle will result in poor responsiveness or vibration. Since the

current loop ensures sufficient responsiveness, the user does not have to make adjustments. By setting the following servo gains, the response characteristics of the servo unit can be adjusted.

Function code	parameter	Range	Default	Unit	Communication address	When enabled
Pn100	Rotary inertia ratio	0~20000	100	%	0x0100	Immediately
	Moment of inertia ratio = load inertia of motor shaft conversion / rotor moment of inertia of servo motor *100%					
Pn101	First speed gain	1~2000	40.0	Hz	0x0101	Immediately
	Determine the parameters of the speed loop responsiveness. If the response of the speed loop is low, it becomes a delay factor of the outer position loop, so overshoot or vibration of the speed command occurs. In the range where the mechanical system does not generate vibration, the larger the setting value, the more stable the servo system is. The better the responsiveness					
Pn102	First speed integration time constant	0.15~512	20.00	ms	0x0102	Immediately
	In order to respond to small input, the speed loop contains integral elements. Because this integral element is a delay element for the servo system, when the time parameter is set too large, overshoot may occur, or the positioning time may be prolonged, and the responsiveness may be deteriorated.					
Pn103	First position gain	1~2000	40.0	1/s	0x0103	Immediately
	The position loop response is determined by the position loop gain. The higher the setting of the position loop gain, the higher the responsiveness and the shorter the positioning time. The position loop gain cannot be increased beyond the rigidity of the mechanical system. To increase the position loop gain to a larger value, the rigidity of the machine must be increased.					
Pn104	First torque command filter	0~655.35	1.00	ms	0x0104	Immediately
	Adjusting the parameters of the torque command filter may eliminate the machine vibration caused by the servo drive. The smaller the value, the better the responsiveness can be controlled. However, the conditions are restricted by the machine conditions.					
Pn401	Torque command second-order low-pass filter cut-off frequency	100~5000	5000	Hz	0x0401	Immediately
	Use this parameter to set the cutoff frequency of the second-order torque filter. When this parameter is set to 5000, the function of the filter is invalid.					
Pn402	Torque	0.5~1	0.50	1	0x0402	Immediatel

	command second-order low-pass filter Q					y
	By setting this parameter, the Q value of the second-order torque filter can be set. Increasing the Q value can improve the system responsiveness, but noise will be generated when the setting is too large.					

6.6.2. **Gain Switching**

The gain switching function includes "manual gain switching" that uses an external input signal and "automatic gain switching" that automatically switches. By using the gain switching function, the gain can be increased during positioning, the positioning time can be shortened, and the gain can be reduced and vibration can be suppressed when the motor stops.

Function code	Parameter name	Range	Default	Unit	Communication address	When enabled
Pn110	Gain switching mode selection switch	0x00~0x01	0	—	0x0110	Immediately
	The gain switching function includes two methods of “manual gain switching” using an external input signal and “automatic gain switching” automatically switching. By using the gain switching function, the gain can be increased during positioning, and the positioning time can be shortened when the motor is stopped. Reduce gain and suppress vibration. 0-Manual Gain Switching by Manual Gain Switching of External Input Signal (G-SEL) 1- When the automatic switching condition is established (Pn111), it automatically switches from the first gain to the second gain; otherwise, it switches back to the first gain.					
Pn111	Position control gain automatic switching condition	0x00~0x05	0	—	0x0111	Immediately
	Set the conditions for automatic gain switching: 0-positioning completion signal ON 1- Positioning completion signal OFF 2-positioning approach signal ON 3-positioning proximity signal OFF 4-position command is 0 after filter and pulse input is OFF 5-position command pulse input ON If the condition is met, then switch to the second gain, otherwise switch to the first gain					
Pn112	Gain switching transition time	0~65535	0	ms	0x0112	Immediately

	1					
	After waiting for the waiting time from the time when the switching condition has been established, the gain of the first position loop is increased to the gain of the second position loop in the transition time.					
Pn113	Gain switching transition time 2	0~65535	0	ms	0x0113	Immediately
	After waiting for the waiting time from the time when the switching condition has been established, the second position loop gain is changed to the first position loop gain to change linearly during the transition time.					
Pn114	Gain switching wait time 1	0~65535	0	ms	0x0114	Immediately
	The time from when the switching condition is established from the first gain to the second gain to when the switching is actually started					
Pn115	Gain switching wait time 2	0~65535	0	ms	0x0115	Immediately
	The time from when the switching condition is established from the second gain to the second gain to when the switching is actually started					

Switched gain combination

Switching gain	Speed loop gain	Velocity loop integration time constant	Position loop gain	Torque command filter	Model tracking control gain	Model tracking control gain correction
First gain	First speed loop gain（Pn101）	First velocity loop integration time constant（Pn102）	First position loop gain（Pn103）	First torque command filter（Pn104）	First model tracking control gain（Pn241）	First model tracking control gain attenuation coefficient（Pn242）
Second gain	Second speed loop gain（Pn105）	Second velocity loop integration time constant（Pn106）	Second position loop gain（Pn107）	Second torque command filter（Pn108）	Second model tracking control gain（Pn246）	Second model tracking control gain attenuation coefficient（Pn247）

Cautions

1. Gain switching of model tracking control gain and model tracking control attenuation coefficient is only applicable to "manual switching gain"
2. Gain switching of model tracking control gain and model tracking control attenuation factor is switched only when the following conditions are met:
   - No instruction
   - The motor is stopped

Manually switch

"Manual switching gain" means the first gain and the second gain are switched by the external input signal gain switching signal (/G-SEL).

Gain switching configuration

The signal is not configured in the factory default switch configuration. Therefore, the pin number configuration (0x0E) needs to be performed by parameters Pn601~Pn609.

Gain switching wiring

The gain switching signal is a universally configurable digital input. See "Sequence Input Circuit" for wiring details.

Automatic switching

Function code	Parameter	Range	Default	Unit	Communication address	Way to be effective
Pn111	Position control gain automatic switching condition	0x00~0x05	0	—	0x0111	Immediately
	Set the conditions for automatic gain switching: 0-Position completion signal ON 1-Position completion signal OFF 2-positioning proximity signal ON 3-positioning proximity signal OFF 4-position command filtered to 0 and pulse input OFF 5-position command pulse input ON If the condition is met, switch to the 2nd gain, otherwise switch to the 1st gain.					

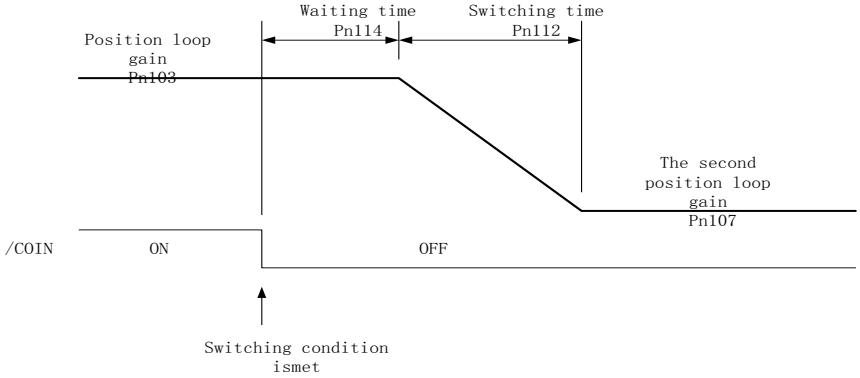
"Auto switching gain" is only valid in position control. The switching conditions are performed by the following settings:

Switching logic

parameter	Switching conditions	Switching gain	Switching waiting time	Switching time
Pn111 setting corresponding condition A	Condition A is met	The first gain → Second gain	Waiting time 1 Pn114	Switching time 1 Pn112
	Condition A isn't met	The second gain → First gain	Waiting time 2 Pn115	Switching time 2 Pn113

Please select the "switching condition A" which automatically switches the gain from the following settings.

For example, in the automatic switching gain mode conditioned on the completion of the positioning signal (/COIN), it is assumed that the position loop gain Pn103 is switched to the second position loop gain Pn107. The /COIN signal of the switching condition is ON, and after waiting for the waiting time Pn114 from the time when the switching condition has been met, the gain is changed from Pn103 to Pn107 in a straight line during the switching time Pn112.



6.6.3. **Speed Feedforward**

Feedforward is the function of feedforward compensation to shorten the positioning time during position control. The speed feed forward is divided into internal speed feed forward (Pn121/Pn122) and analog (V-REF) given speed feed forward (using V-REF as speed feed forward selection Pn123). This command is sent to the servo together with the position command unit.

Related parameters

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn121	Speed feed forward gain	0~100	0	%	0x0121	Immediately
	Speed feed forward is a function to shorten the positioning time. This function is effective when the servo unit performs position control. Note: When the feed forward command is too large, position overshooting will occur. Please check the response while setting appropriatly					
Pn122	Speed feedforward filter time	0~64	0.00	Ms	0x0122	Immediately
	Speed feed forward low-pass filter time constant, which can slow position overshoot and torque jump caused by feed forward					

Pn123	Use V-REF as speed feedforward selection	0x00~0x01	0	—	0x0123	After restart
	Speed feedforward is a function to shorten the positioning time. It is possible to select speed feed forward via external analog V-REF. 0-None 1- Use V-REF as speed feed forward input					
Pn300	Analog speed command gain	150~3000	600	0.01V/Rated speed	0x0300	Immediately
	Required for the rated torque when using this parameter to set the analog voltage value (T-REF) of the servo motor. Caution: Do not apply -10~10V voltage. Exceeding this range may cause damage to the driver.					

6.6.4. **Torque Feedforward**

Torque feed forward is a function to shorten the positioning time. The command is generated by deviating the position command on the upper device side. This command is sent to the servo unit together with the speed command. The speed command from the upper device is connected to V-REF (CN1-5, 6), and the torque feedforward command is connected to T-REF (CN1-9, 10).

Related parameters

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn124	Speed/position control selection (T-REF assignment)	0~1	0	—	0x0124	After restart
	Torque feed forward is a function to shorten the positioning time. Torque feedforward can be selected by external analog T-REF. 0-None 1- Use T-REF as a torque feed forward input					
Pn405	Analog torque command gain	10~100	30	0.1V/Rated torque	0x0405	Immediately
	Required for the rated torque when using this parameter to set the analog voltage value (T-REF) of the servo motor. Caution: Do not apply -10~10V voltage. Exceeding this range may cause damage to the driver.					

6.6.5. **P/PI Switching**

When the control mode is speed control or position control, P/PI control can be switched.

When the control mode is mixed, it is valid only when it is switched to internal speed, analog speed and position mode. The P/PI switching can be switched by the binary signal manual P-PI control signal (/P-CON). When the /P-CON signal is turned ON, P control is performed. The conditions for selecting automatic switching can also be selected by the parameter speed loop P/PI switching condition selection switch Pn131.

Manual P-PI Control

Manual P-PI Control Configuration

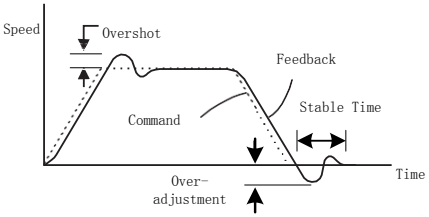
The signal is not configured in the factory default switch configuration. Therefore, the pin number configuration (0x05) needs to be performed by parameters Pn601~Pn609.

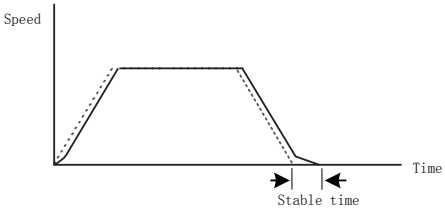
Manual P-PI control wiring

The gain switching signal is a universally configurable digital input. See "Sequence Input Circuit" for wiring details.

Automatic switching

For automatic P/PI switching, the switching condition is set by Pn131, and the switching condition value is set by Pn132, Pn133, Pn134, and Pn135. By properly setting the switching conditions and condition values, overshoot during acceleration and deceleration can be suppressed and the settling time can be shortened.

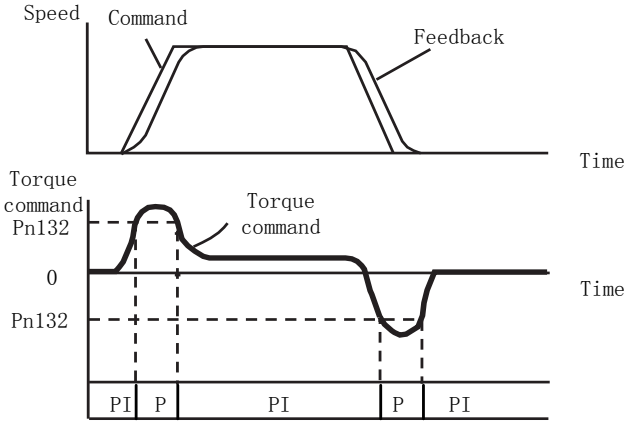




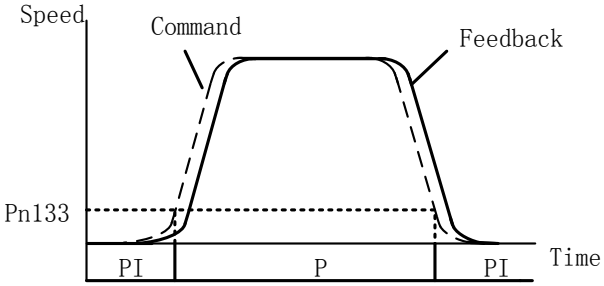
Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn131	Speed loop P/PI switching condition selection switch	0x00~0x04	0	—	0x0131	Immediately
	The mode switch is a function that automatically performs P control and PI control switching. Setting the switching condition by this parameter and satisfying the corresponding switching condition value can suppress overshoot during acceleration and deceleration and shorten the settling time. 0 - Conditioned by internal torque command 1- Conditional speed instruction 2- Conditional acceleration 3- Conditional position deviation pulse 4-No mode switch function					

Pn132	Speed loop P/PI switching condition (torque command)	0~800	200	%	0x0132	Immediately
	When the torque command exceeds the torque set by this parameter, the speed loop will be switched to P control, otherwise PI control					
Pn133	Speed loop P/PI switching condition (speed command)	0~10000	0	rpm	0x0133	Immediately
	When the speed command exceeds the speed set by this parameter, the speed loop will be switched to P control, otherwise PI control					
Pn134	Speed loop P/PI switching conditions (accelerati on)	0~30000	0	rpm/s	0x0134	Immediately
	When the speed command exceeds the acceleration set by this parameter, the speed loop will be switched to P control, otherwise PI control					
Pn135	Speed loop P/PI switching conditions (position deviation)	0~10000	0	Instruction unit	0x0135	Immediately
	When the position deviation exceeds the value set by this parameter, the speed loop will be switched to P control, otherwise PI control					

When the switching condition of the mode switch is set as a torque command [factory setting], when the torque command exceeds the torque set in Pn10C, the speed loop will switch to P control. The factory torque command value is set to 200%.

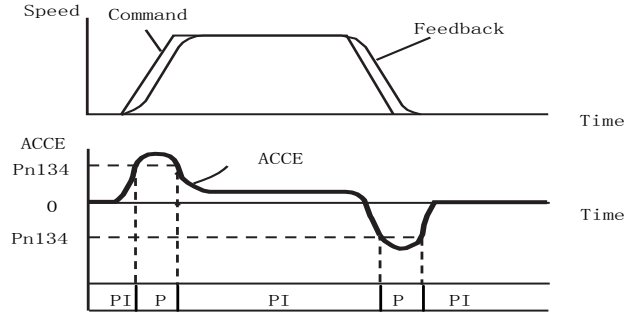


When the switching condition of the mode switch is used as a speed instruction, when the speed command exceeds the speed set in Pn10D, the speed loop will switch to P control.

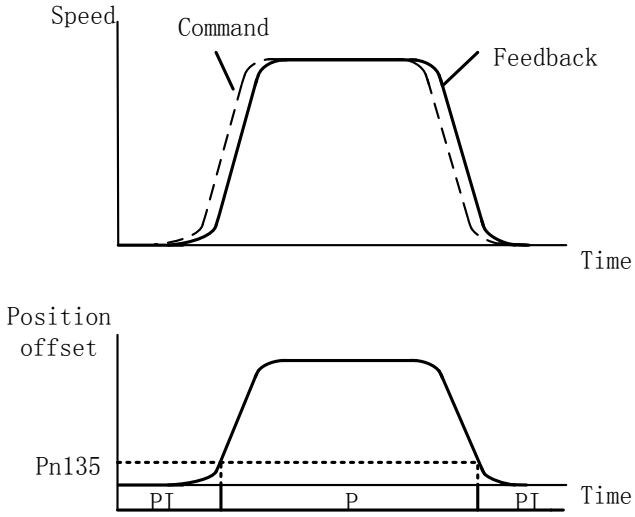


When the switching condition of the mode switch is used as acceleration

When the speed command exceeds the acceleration set in Pn10E, the speed loop will switch to P control.



When the switching condition of the mode switch is set as the position deviation, when the position deviation exceeds the value set in Pn10F, the speed loop will switch to P control. This setting is valid only for position control.



7. Accessibility

7.1. **List of Auxiliary Functions** The auxiliary function is displayed with a number starting with Fn, and functions related to the operation and adjustment of the servo motor are performed. The following table lists the auxiliary functions and reference items.

Auxiliary function number	Function description
Fn 000	Display alarm record
Fn 001	Clear alarm record
Fn 002	Software reset
Fn 003	Restore factory parameters
Fn 005	JOG operation
Fn 006	Program JOG operation
Fn 100	Automatic adjustment of instruction offset
Fn 101	Speed command offset manual adjustment
Fn 102	Torque command offset manual adjustment
Fn 103	Current offset automatic adjustment
Fn 104	Current offset manual adjustment
Fn 105	Initialize the detected value of the vibration detection
Fn 303	Bandwidth setting
Fn 401	Easy FFT
Fn 402	Online vibration monitoring

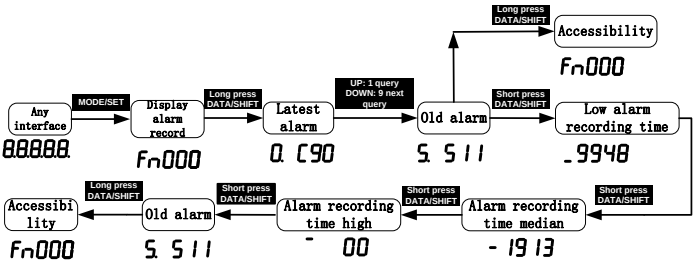
7.2. Displaying Alarm Logs (Fn000)

7.2.1. Overview

The servo unit has a record alarm function and can record up to 10 alarms that have occurred. This auxiliary function allows you to confirm the number and time of the alarm (measurement of the duration of the control power supply and the main circuit power supply in 100ms increments, and the function to display the total operation time in the event of an alarm, if it is 365 days per year. it can last for about 31 years if you operating it 24 hours a day.)

1. When the same alarm occurs continuously, if the interval between alarms is less than 1 hour, it will not be saved. If it exceeds 1 hour, it will be saved.
2. When an alarm does not occur, "□ ----" is displayed on the panel operator.
3, the alarm record can only be cleared by "clear alarm record (Fn001)".

7.2.2. **Operating Procedure**

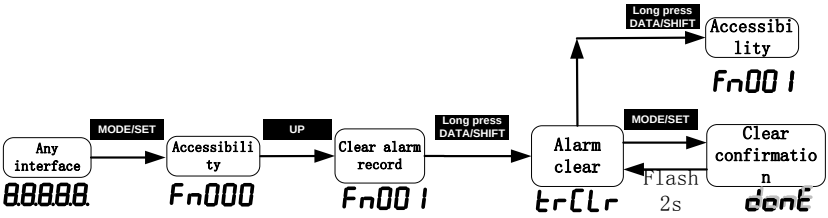


7.3. **Clear Alarm Record (Fn001)**

7.3.1. **Summary**

The alarm record of the servo unit can only be cleared by clearing the alarm record (Fn001) function. Alarm recording cannot be cleared by resetting the alarm or switching off the main circuit power of the servo unit.

7.3.2. **Operating Procedure**



7.4. **Software Reset (Fn002)**

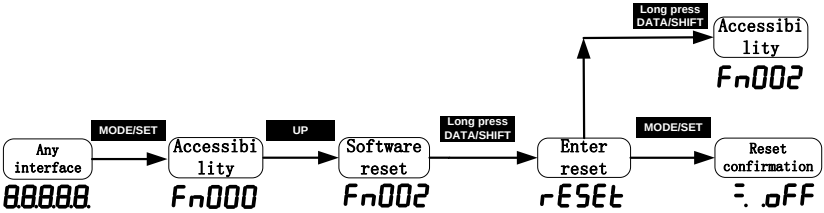
7.4.1. **Summary**

The function of resetting the servo unit is from the inside by software. Used to re-power on or reset the alarm after changing the parameter setting. It is also possible to validate the setting without turning the power back on.

Cautions

1. This function must be started with servo off.
2. This function has nothing to do with the upper device to reset the servo unit. Same as when the power is turned on, the servo unit outputs the ALM signal, and other output signals may also be forcibly changed.

7.4.2. **Operating Procedure**



7.5. **Restoring Factory Parameters (Fn003)**

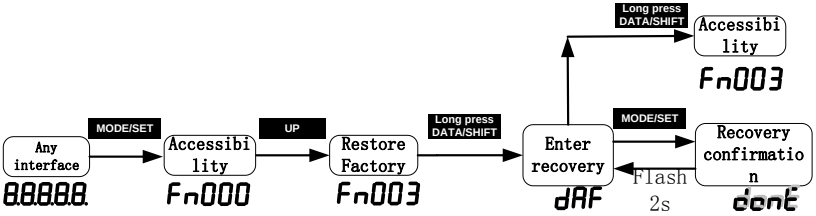
7.5.1. **Overview**

The parameter is restored to the function used at the factory setting.

Cautions

1. Initialization of the parameter setting value must be performed in the servo OFF state. It cannot be executed while the servo is ON.
2. For the setting to take effect, the servo unit must be turned on again after the operation.
3. When this function is executed, the values adjusted with parameters Fn100, Fn101, Fn102, Fn103, Fn104 will not be initialized.

7.5.2. **Operating Procedure**



7.6. **JOG Operation (Fn005)**

7.6.1. **Summary**

The JOG operation is a function that confirms the operation of the servo motor by speed control without connecting a host device.

To perform JOG operation, the following confirmation must be made in advance:

The motor is in the enabled state and the jog operation is invalid during the operation.

It is recommended that the load inertia is not more than 30 times the motor inertia; otherwise it may cause large mechanical vibration;

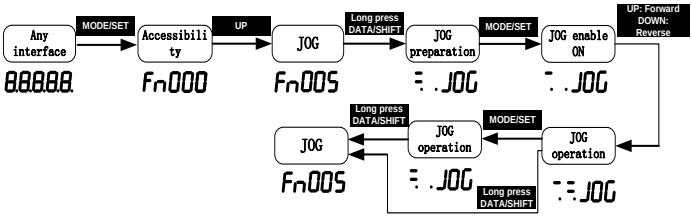
Parameter Pn500, Pn310, Pn311 set the jog speed, acceleration and deceleration time;

Function code	Parameter name	Range	defaults	unit	Communication address	When enabled
Pn500	Jog speed	0~1000	500	rpm	0x0500	Immediately
Pn310	Speed command trapezoidal acceleration time	0~10000	0	ms	0x0310	Immediately
	Acceleration of the set speed from 0r/min to the rated speed (corresponding to the motor model). When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.					
Pn311	Speed command trapezoidal deceleration time	0~10000	0	ms	0x0311	Immediately
	Acceleration time of the set speed from 0r/min to the rated speed (corresponding to the motor model). When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.					

Cautions

The overtravel prevention function is invalid during JOG operation. When running, the operating range of the machine used must be considered.

7.6.2. **Operating Procedure**



7.7. **Program JOG Operation (Fn006)**

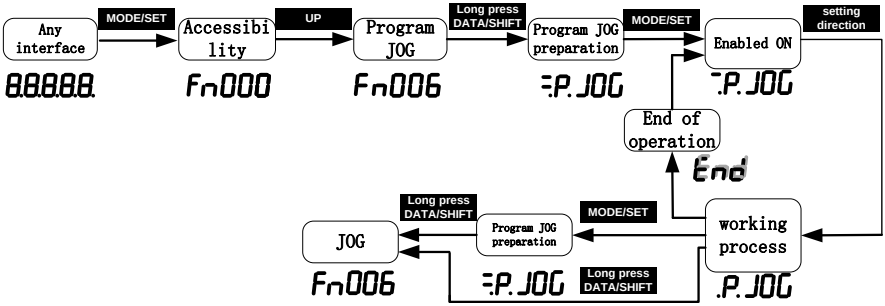
7.7.1. **Summary**

Program JOG operation is a function that continuously runs with the previously set operation mode, movement distance, movement speed, acceleration/deceleration time, waiting time, and number of movements. This function is the same as JOG operation (Fn005). When the setting is not connected to the host device, the operation of the servo motor can be confirmed and a simple positioning operation can be performed.

Cautions

1. Program JOG operation is position control, gear ratio and position command filtering are valid, but pulse instructions cannot be input to the servo unit.
2. The overtravel prevention function takes effect.

7.7.2. **Operating Procedure**



7.8. **Automatic Adjustment of Instruction Offset (Fn100)**

7.8.1. **Summary**

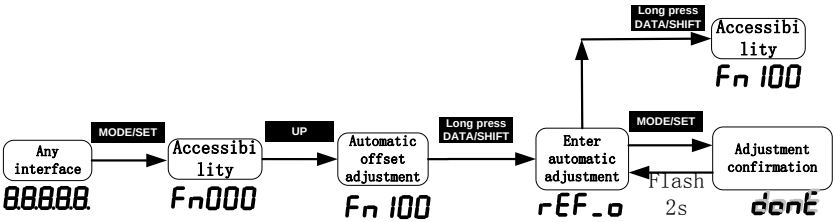
The automatic adjustment command offset is a method of automatically adjusting the command voltage after measuring the offset amount.
The measured offset will be stored in the servo unit.

Cautions

1, the servo is OFF
2. Offset adjustment overrange or input voltage instruction during offset adjustment may fail to adjust

7.8.2. **Operating Procedure**

Turn off the servo drive and input the 0V command voltage from the host device or external circuit.



7.9. **Speed Command Offset Manual Adjustment (Fn101)**

7.9.1. **Summary**

Directly input the instruction offset to adjust.

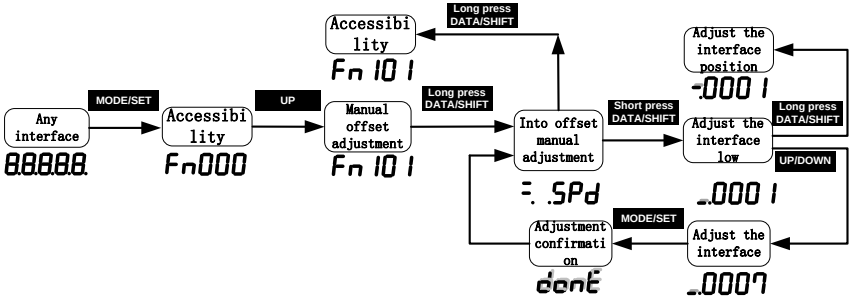
Manual adjustments are used for the following occasions:、The host device has built a position loop and sets the position deviation when the servo lock stops to zero.

When you need to set an offset

When confirming the offset amount set by automatic adjustment

7.9.2. **Operating**

Procedure



7.9.3. **Summary**

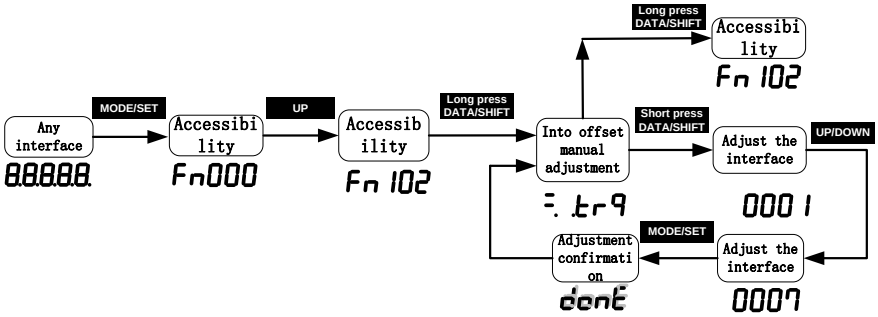
It is a method of directly inputting the torque command offset.

Manual adjustments are used for the following occasions:

When you need to set an offset

When confirming the offset amount set by automatic adjustment

7.9.4. **Operating Procedure**



7.10. **Current Offset Automatic Adjustment (Fn103)**

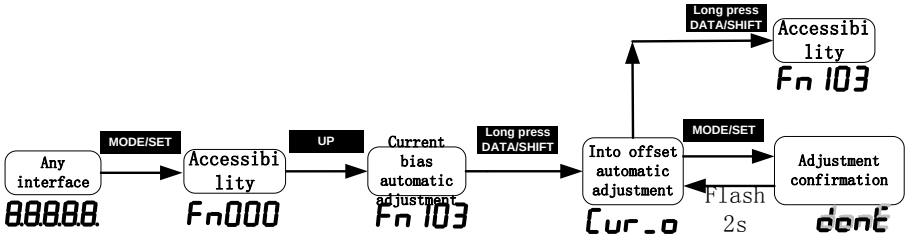
7.10.1. **Summary**

This function is only used when it is necessary to further reduce the torque ripple and other adjustments that need to be performed with higher precision, and usually does not require adjustment.

Cautions

1. The automatic adjustment of the motor current detection signal offset must be performed with the servo off.
2. When the generated torque ripple is significantly larger than other servo units, perform automatic adjustment of the offset.

7.10.2. **Operating Procedure**



7.11. **Current Offset Manual Adjustment (Fn104)**

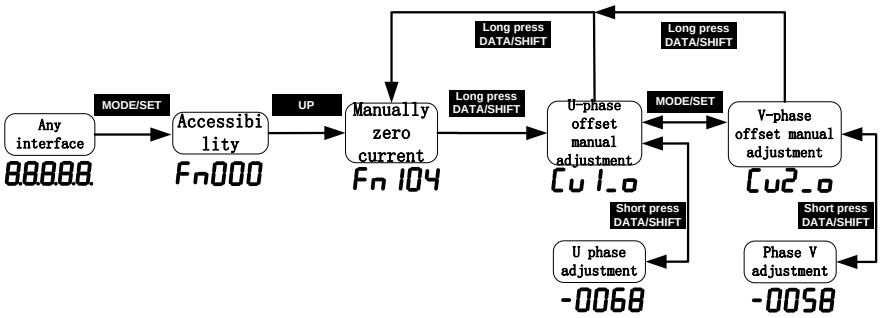
7.11.1. **Overview**

This function is used only when the torque ripple is still large after the motor current detection signal offset auto tuning (Fn103) is executed.

Cautions

When performing manual adjustments, if this function is accidentally performed, the characteristics may be degraded. When making manual adjustments, observe the following precautions.
• Make the servo motor speed about 100min-1.
• Observe the torque command in the analog monitor state and adjust the pulsation to the minimum.
• The U-phase current and V-phase current offset of the servo motor must be adjusted in a balanced manner. Please repeat the adjustment several times.

7.11.2. **Operating Procedure**



7.12. **Initializing the Detection Value of Vibration Detection (Fn105)**

7.12.1. **Summary**

The vibration detection function can detect the vibration in the feedback speed of the servo motor. This function is used to detect the "vibration warning (Er. 520)" and "vibration warning (AL. 911)" that is more accurately after detecting the machine vibration in the running state.", and the function also could be used to automatically set the vibration detection value (Pn187).
Related parameters:

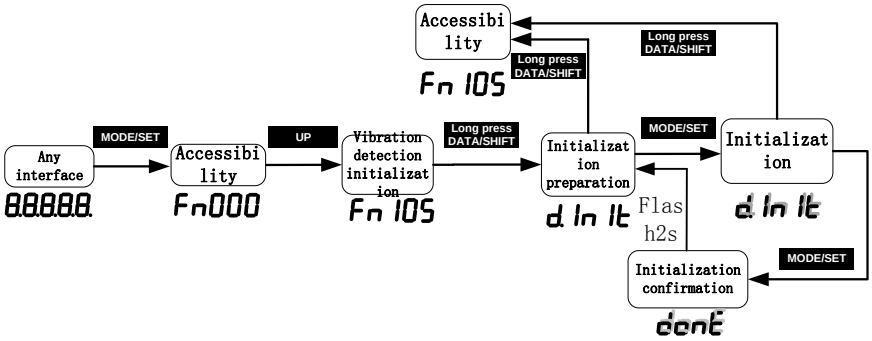
Function code	Parameter name	Range	defaults	unit	Communication address	When enabled
Pn185	Vibration detection options	0x00~0x02	0	—	0x0185	Immediately
	This function can automatically detect the value related alarms or warnings in order to detect the machine vibration under normal operating conditions. The perform way after setting the vibration detection: 0-No vibration detected 1-warning after vibration is detected 2-Alarming after vibration is detected					
Pn186	Vibration detection sensitivity	50~500	100	%	0x0186	Immediately

	Set the sensitivity of the detected vibration. The smaller the setting value is, the more sensitive it is. If the setting is too small, the vibration may be detected by mistake during normal operation. Note: The detection sensitivity of the vibration alarm and vibration alarm may differ depending on the state of the machine being used.					
Pn187	Vibration detection value	0~5000	50	rpm	0x0187	Immediately
	Set the threshold for vibration detection. The smaller the setting is, the easier it is to detect the vibration. If the setting is too small, the vibration may be detected by mistake during normal operation. Note: The vibration detection values of vibration alarm and vibration warnings may differ according to the condition of the used machine.					

Cautions

- When the servo gain is set incorrectly, it may be difficult to detect the vibration. And it may not be possible to detect all the vibrations that have occurred.
- When you set the improper moment of inertia ratio (Pn100), vibration alarms and vibration alarms may be detected by mistake or not detected.
- This operation is performed when the motor is operated with actually used instructions.
- When performing this action, make sure that the motor runs at a maximum speed of 10% or more.

7.12.2. **Operating Procedure**

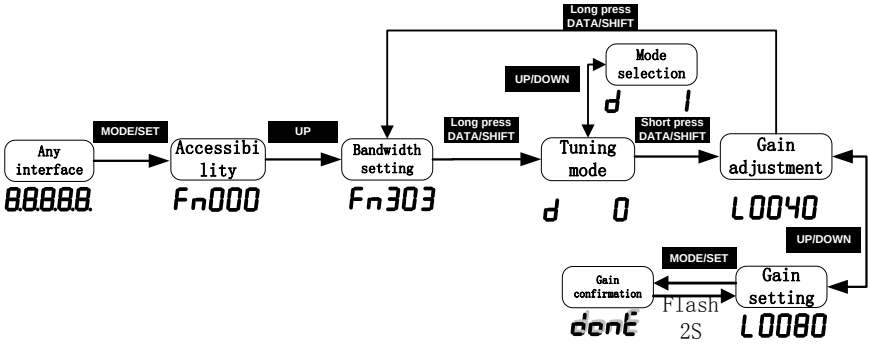


7.13. **Bandwidth Settings (Fn303)**

7.13.1. **Summary**

For detailed description of this function, see "6.5 Bandwidth Settings."

7.14.2 Operating Procedure



7.14. **EasyFFT (Fn401)**

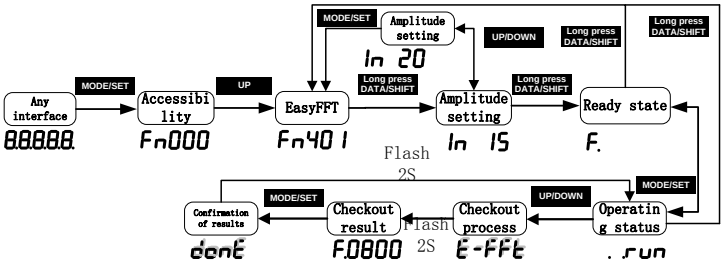
7.14.1. **Summary**

EasyFFT transfers the periodic waveform commands from the servo unit to the servo motor, causing the servo motor to rotate a few times for a certain period of time, causing the machine to vibrate. The servo unit detects the resonance frequency based on the vibration generated by the machine, and then sets the corresponding notch filter according to the resonance frequency. The notch filter effectively removes high-frequency vibrations and noise. If vibration occurs due to a loud sound (abnormal sound) during operation, perform this function after the servo is turned off.

Cautions

1. It must be used in the low gain state such as the initial stage of servo adjustment. If you perform the EasyFFT function after setting a high gain, accept due to mechanical characteristics and gain balance, the machine may vibrate.
2. The detected resonance frequency can be automatically set to the notch filter 1/2. If 1 has been set, it will be automatically set to 2. If 1/2 is set, the notch filter cannot be set by this operation.
3. When changing the amplitude setting value, gradually increase the amplitude value and change it while observing the situation.

7.14.2. **Operating Procedure**



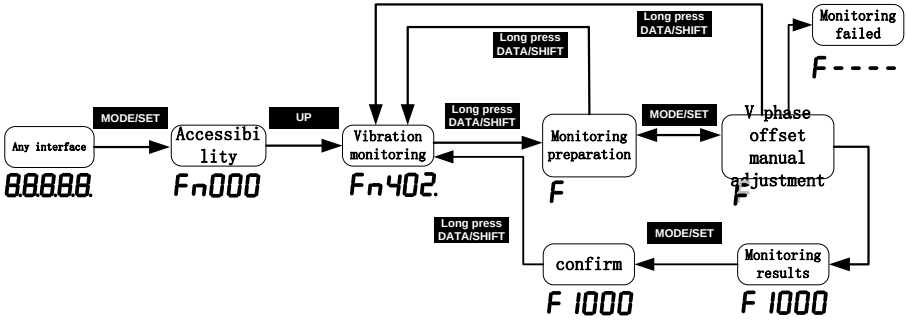
7.15. Online Vibration Monitoring (Fn402)

7.15.1. Overview

When the servo is ON and vibration occurs during operation, this operation can set the notch filter 1 or the torque command filter according to the vibration frequency, sometimes eliminating the vibration. The vibration frequency of the noise generated by the mechanical resonance or the like is detected, and the frequency of the large-peak vibration is displayed on the manipulator. For this frequency, an effective torque command filter or notch filter 1 frequency is automatically selected and related parameters are automatically set.

When using the upper computer debugging software to adjust, it is recommended to perform the smart setting or bandwidth setting. Generally, no manual operation is required. Only if the upper level debugging software is not used, it is key-assisted.

7.15.2. Operating Procedure



8. Function Code Instructions

8.1. **Basic Control Related Pn0 Group Parameters**

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn000	Control mode selection	0~11	0	-	0x0000	After restart
	0-position mode: The position of the machine is controlled by the pulse sequence position command. The position is controlled by the number of input pulses, and the speed is controlled by the frequency of the input pulse that is used in the place where positioning action is required 1- Analog speed: The servo motor speed is controlled by the analog voltage speed command 2-Torque Mode: The output torque of the servo motor is controlled by the analog voltage torque command/internal torque command that's used to output the necessary torque (pressing action, etc.) 3-Internal speed: The speed is controlled by three internally set speeds set in the servo unit. When this control method is selected, no analog voltage is required. 4-Internal Speed <-> Analog Speed: Switch control mode via ON/OFF of switch/SPD-A and /SPD-B 5-Internal Speed <-> Position Mode : Switch control mode via ON/OFF of switch/SPD-A and /SPD-B 6-Internal Speed <-> Torque Mode: Switch control mode via ON/OFF of switch/SPD-A and /SPD-B 7-Position Mode <-> Analog Speed: ON/OFF Switching Control Mode of Switching (/C-SEL) Signal by Switching Control Mode 8-position mode <-> torque mode: ON/OFF switching control mode of the (C-SEL) signal switching 9-Torque Mode <-> Analog Speed: ON/OFF Switching Control Mode of (C-SEL) Signal Switching Mode 10 - Analog speed <-> Speed mode for zero function: When controlling speed, zero fixed function can be used 11-Position Mode <-> Command Pulse Disabled Position Mode: When Control Position, Command Pulse Disable Function See the "mixed control mode selection" for detailed switching timing.					
Pn002	Motor rotation direction selection	0~1	0	-	0x0002	After restart
	For motor end faces: 0-Counterclockwise is positive 1- Clockwise direction is positive					
Pn003	Default monitoring parameters	0x0~0xfff	0xfff	-	0x0003	Immediately

	Set the monitoring parameters that are displayed by default after power-on. The setting values are detailed in the monitoring parameters. 0xfff indicates that the monitoring parameters are not displayed and the system status is displayed. Note: The alarm is displayed first when the alarm is displayed. The setting parameter cannot be displayed normally.					
Pn004	Servo OFF and stop method selection when Type 1 alarm occurs	0~2	0	—	0x0004	After restart
	0- Stop motor by DB 1- Stop the motor through the DB and then release the DB 2- Do not use DB to keep the motor free Note: DB (Dynamic Brake) is an emergency stop function. If the servo motor is started or stopped by ON/OFF power supply or servo ON in the state that the command is input, the DB circuit will frequently operate, which may cause the internal components of the servo unit to deteriorate. Please execute start and stop of the servo motor with speed input command or position command.					
Pn005	Second type Alarm Stop Method Selection of Servo Generation	0x00~0x01	0	—	0x0005	After restart
	0 - Zero speed stop: Set the speed command to "0" and perform a quick stop 1- Same as Pn004 stop method					
Pn006	Override Warning Checkout Selection	0~1	0	—	0x0006	After restart
	0-No overtravel warning when limit is checked 1-Override warning is detected when the limit is set					
Pn007	Stopping method selection at servo overtravel (OT)	0~2	0	—	0x0007	After restart
	Set the stop mode and post-stop status when servo overtravel occurs: 0 - same as Pn004 stop method 1- Use the torque set by Pn053 as the maximum value, and enter the locked state after decelerating to stop. 2- Use the torque set by Pn053 as the maximum value, enter the free running state after decelerating to stop					
Pn008	Servo lock time after	0~50	0	10ms	0x0008	Immediately

	electromagnetic brake holding					
	When the servo motor is enabled but not running and the brake (/BK) signal and the servo ON (/S-ON) signal are off at the same time, setting this parameter can change the non-powered time from the brake (/BK) signal OFF to the actual input of the motor. Note: The brake delay time is slightly different. When this parameter is set, the motor can be prevented from the slight moving by the weight or the external force of the vertical-axis mechanical movement.					
Pn009	Electromagnetic brake holding time delay	10~100	50	10ms	0x0009	Immediately
	The servo motor won't be electrified when the Servo OFF/Alarm/Main circuit OFF occur during the rotation. By setting this parameter and Pn010 (any one is met), the output timing of the brake signal (/BK) OFF can be adjusted. Note: The relevant logic is described in "Keep brake action"					
Pn010	Electromagnetic brake brake delay release speed	0~10000	100	rpm	0x0010	Immediately
	See the description of "Electromagnetic brake brake delay" for details					
Pn012	External regenerative resistor power	0~65535	0	10W	0x0012	Immediately
	When connecting an external regenerative resistor, the regenerative resistor power should be set to a value that matches the allowable capacity of the connected external regenerative resistor. The setting differs depending on the cooling condition of the external regenerative resistor. Note: Refer to "Setting the regenerative resistor" for details					
Pn013	External regenerative resistor	0~65535	0	mΩ	0x0013	Immediately
	When connecting an external regenerative resistor, the regenerative resistor value should be set to the value matching the connected external regenerative resistor. Note: The minimum regenerative resistance of each power section could be different. Please refer to "Set regenerative resistor" for details. Otherwise, the internal components of the servo unit may be damaged.					
Pn015	Overload warning value	1~100	20	%	0x0015	After restart
	Setting this parameter can change the overload warning detection time. For example, the factory overload warning detection time is 20% of the overload warning detection time. Note: The overload alarm detection time is detailed in "Overload alarm"					

Pn016	Motor overload detection base current derating setting	10~100	100	%	0x0016	After restart
	This parameter can change the motor current threshold for calculating the overload alarm, which can shorten the overload alarm detection time. Note: This value is invalid when the motor current is rated above 200%.					
Pn030	Reserved	0~65535	0	-	0x0030	Immediately
Pn031	Parameter modification operation lock	0~1	0	-	0x0031	After restart
	0-allow panel parameters modification 1-prohibit panel parameters modification					
Pn040	Method to use absolute encoder	0~1	0	—	0x0040	After restart
	0 - Use an absolute encoder as an absolute encoder: If the motor is an absolute multi-turn encoder, setting this parameter to 1 can use the multi-turn absolute function 1- Use an absolute encoder as an incremental encoder: When used as an incremental encoder, the power-off position won't be recorded and warning or alarm, corresponding to multiple revolutions, won't happen either when the battery is undervoltage or the drive is de-energized					
Pn041	Absolute encoder battery warning/warning selection	0~1	0	—	0x0041	After restart
	0- Set the low battery voltage as a fault: The driver powers up/resets for 4~9 seconds to monitor the battery status. Undervoltage will be reported as an under voltage alarm (Er. 830). Over time will not be detected. 1- Set the low battery voltage as a warning: Undervoltage (below 3V) will be reported as an under voltage alarm (Al.930). It will always monitor the battery voltage and can be self-recovery meanwhile enable running is out of restriction					
Pn045	Undervoltage function selection	0x00~0x02	0	—	0x0045	After restart
	0 – No Detection of Main Circuit Descent Warning 1- Detection of Main Circuit Descent Warning 2 - Detect main circuit down warning and perform torque limit. The relevant torque limit is matched with Pn046/Pn047. For details, refer to "Main circuit undervoltage torque limit".					
Pn046	Torque limit	0~100	50	%	0x0046	Immediat

	when main circuit voltage drops					ely
	According to the under voltage warning, it will impose the torque limit inside the servo unit. For details, see the "Torque limit under voltage" instruction.					
Pn047	Torque limit release time when main circuit voltage drops	0~1000	100	ms	0x0047	Immediat ely
	After the under-voltage warning signal releases, the torque limit value is controlled within the servo unit according to the set time. For details, see “Under-voltage limit of the main circuit”.					
Pn050	Torque limit setting	0~3	1	-	0x0050	Immediat ely
	0 - Analog torque (torque mode is invalid) 1- maximum torque limit is 1 2- maximum Forward torque limit is 1 and maximum Reverse torque limit is 2 3- Maximum torque limit is 1 when the "Torque Limit Switching" switch is OFF while Maximum torque limit is 2 when it’s ON					
Pn051	Maximum torque limit 1	0~500	500	%	0x0051	Immediat ely
Pn052	Maximum torque limit 2	0~500	500	%	0x0052	Immediat ely
Pn053	Emergency stop torque	0~800	800	%	0x0053	Immediat ely
	The torque when set the motor stop method to deceleration stop.					
Pn061	Panel parameter display selection	0x00~0x0 1	1	—	0x0061	After restart
	0- Only display setting parameters 1- Show all parameters					
Pn070	Encoder divider pulses	16~41943 04	2048	-	0x0070	After restart
	The number of pulses per cycle from the encoder is divided by frequency in accordance with the set value of this parameter. Please set it according to the system specifications of the machine and host device. Note: The set value is the number of A/B quadrature output pulses in one turn. The setting of the number of encoder crossover pulses will be limited due to the resolution of the encoder. For details, see the “Divided pulse output setting” instruction.					
Pn072	negate the divide frequency output	0~1	0	-	0x0072	After restart

	A/B pulse phase sequence logic when setting forward/reverse: 0- Don't negate the pulse output: When forward, A is ahead of B 1- Negate the pulse output: When forward, B is ahead of A					
Pn080	Local communication address	0x00~0x7F	1	—	0x0080	After restart
Pn081	485 communication baud rate selection	0~4	1	—	0x0081	After restart
	0-9600bps 1-19200bps 2-38400bps 3-57600bps 4-115200bps					
Pn082	485 communication verification method	0~5	1	—	0x0082	After restart
	0-no parity (N,8,1) 1-even parity (E,8,1) 2-odd check (O,8,1) 3-no check (N,8,2) 4-Even Check (E,8,2) 5-Odd Check (O,8,2)					

8.2. **Gain Related Pn1 Group**

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn100	Rotary inertia ratio	0~20000	100	%	0x0100	Immediately
	Rotary inertia ratio = load inertia of motor shaft conversion / rotor rotary inertia of servo motor *100%					
Pn101	First speed gain	1~2000	40.0	Hz	0x0101	Immediately
	Determine the parameters of the speed loop responsiveness. It becomes a delay element of the outer position loop when the response of the speed loop is low, so overshoot or vibration of the speed command occurs. In the range where the mechanical system does not vibrate, the larger the value is set, the more stable the servo system becomes and the better the responsiveness will be.					
Pn102	First speed integration time constant	0.15~512	20.00	ms	0x0102	Immediately
	In order to respond to small input, the speed loop contains integral elements. Since this integral element is a delay factor for the servo system, when the time parameter is set too large, overshoot may occur, or the positioning time may be extended meanwhile resulting in poor responsiveness.					
Pn103	First position gain	1~200	40.0	1/s	0x0103	Immedia

		0				tely
	The position loop response is determined by the position loop gain. The higher the setting of the position loop gain is, the higher the responsiveness and the shorter the positioning time will be. The position loop gain cannot be increased beyond the rigidity of the mechanical system. To increase the position loop gain to a larger value, the rigidity of the machine must be increased.					
Pn104	First torque command filter	0~655.35	1.00	ms	0x0104	Immediately
	Adjusting the parameters of the torque command filter may eliminate the machine vibration caused by the servo drive. The smaller the value is, the better the responsiveness can be. However, the conditions are restricted by the machine conditions.					
Pn105	Second speed gain	1~2000	40.0	Hz	0x0105	Immediately
	Determine the parameters of the speed loop responsiveness. It becomes a delay element of the outer position loop when the response of the speed loop is low, so overshoot or vibration of the speed command occurs. In the range where the mechanical system does not vibrate, the larger the value is set, the more stable the servo system becomes and the better the responsiveness will be					
Pn106	The second speed integration time constant	0.15~512	20.00	ms	0x0106	Immediately
	In order to respond to small input, the speed loop contains integral elements. Since this integral element is a delay factor for the servo system, when the time parameter is set too large, overshoot may occur, or the positioning time may be extended meanwhile resulting in poor responsiveness.					
Pn107	Second position gain	1~2000	40.0	1/s	0x0107	Immediately
	The position loop response is determined by the position loop gain. The higher the setting of the position loop gain is, the higher the responsiveness and the shorter the positioning time will be. The position loop gain cannot be increased beyond the rigidity of the mechanical system. To increase the position loop gain to a larger value, the rigidity of the machine must be increased.					
Pn108	Second torque command filter	0~655.35	1.00	ms	0x0108	Immediately
	Adjusting the parameters of the torque command filter may eliminate the machine vibration caused by the servo drive. The smaller the value is, the better the responsiveness can be. However, the conditions are restricted by the machine conditions.					
Pn110	Gain switching mode selection switch	0x00~0x01	0	—	0x0110	Immediately
	The gain switching function includes two methods of “manual gain switching” using an external input signal and “automatic gain switching” automatically switching. By using the gain switching function, gain can be increased and positioning time can be shortened during the positioning time. When the motor is stopped. Reduce gain and suppress vibration. 0- Manual Gain Switching of the External Input Signal (G-SEL) 1- When the automatic switching condition is met (Pn111), it automatically switches from the first gain to the second gain; otherwise, it switches back to the first gain.					
Pn111	automatic switching condition of position control gain	0x00~0x05	0	—	0x0111	Immediately

	Set the conditions for automatic gain switching: 0-positioning completion signal ON 1-Positioning completion signal OFF 2-positioning proximity signal ON 3- positioning proximity signal OFF 4- position command is 0 after filtering and pulse input is OFF 5- position command pulse input is ON If the conditions are met, then switch to the second gain, otherwise switch to the first gain					
Pn112	Gain switching transition time 1	0~65535	0	ms	0x0112	Immediately
	After finish the Waiting Time from the time when the switching condition has been met, the gain of the first position loop is changed linearly to the gain of the second position loop in the transition time.					
Pn113	Gain switching transition time 2	0~65535	0	ms	0x0113	Immediately
	After finish the Waiting Time from the time when the switching condition has been met, the gain of the second position loop is changed linearly to the gain of the first position loop in the transition time.					
Pn114	Gain switching wait time 1	0~65535	0	ms	0x0114	Immediately
	The time from when switching condition is established from the first gain to the second gain to when the switching is actually started					
Pn115	Gain switching wait time 2	0~65535	0	ms	0x0115	Immediately
	The time from when switching condition is established from the second gain to the first gain to when the switching is actually started					
Pn121	Speed feedforward gain	0~100	0	%	0x0121	Immediately
	The time from when switching condition is established from the second gain to the first gain to when the switching is actually started					
Pn122	Speed feedforward filter time	0~64	0.00	ms	0x0122	Immediately
	Speed feedforward low-pass filter time constant can slow position overshoot and torque jump caused by feedforward					
Pn123	Use V-REF as speed feedforward selection	0x00~0x01	0	—	0x0123	After restart
	Speed feedforward is a function to shorten the positioning time. It is possible to select speed feed forward via external analog V-REF. 0-None 1- Use V-REF as speed feed forward input					
Pn124	Speed/position control selection (T-REF assignment)	0~1	0	—	0x0124	After restart

	Torque feedforward is a function to shorten the positioning time. Torque feedforward can be selected by external analog T-REF. 0-None 1- Use T-REF as a torque feed forward input					
Pn130	Speed loop control method (PI/IP)	0~1	0	—	0x0130	After restart
	0-PI control 1-I-P control					
Pn131	Speed loop P/PI switching condition selection switch	0x00~0x04	0	—	0x0131	Immedia tely
	The mode switch is a function that automatically switches P control and PI control. Through setting the switching condition by this parameter and meeting the corresponding switching condition value can suppress overshoot during acceleration and deceleration and shorten the settling time. 0- Conditioned by internal torque command 1- Conditioned by speed instruction 2- Conditioned by acceleration 3- Conditioned by position deviation pulse 4-No mode switch function					
Pn132	Speed loop P/PI switching condition (torque command)	0~800	200	%	0x0132	Immedia tely
	When the torque command exceeds the torque set by this parameter, the speed loop will be switched to P control, otherwise PI control					
Pn133	Speed loop P/PI switching condition (speed command)	0~10000	0	rpm	0x0133	Immedia tely
	When the speed command exceeds the speed set by this parameter, the speed loop will be switched to P control, otherwise PI control					
Pn134	Speed loop P/PI switching conditions (acceleration)	0~30000	0	rpm/s	0x0134	Immedia tely
	When the speed command exceeds the acceleration set by this parameter, the speed loop will be switched to P control, otherwise PI control					
Pn135	Speed loop P/PI switching conditions (position deviation)	0~10000	0	指令单位	0x0135	Immedia tely
	When the position deviation exceeds the value set by this parameter, the speed loop will be switched to P control, otherwise PI control					
Pn140	IF suppression control options	0x00~0x11	0x0010	—	0x0140	Immedia tely
	The IF suppression control function effectively suppresses the continuous vibration of about 100 to 1000 Hz that occurs when the control gain is increased. 0x1#: Automatic setting of IF suppression frequency through intelligent setting and bandwidth setting 0x0#: Not set by intelligent setting, bandwidth setting, only manual setting 0x#1: IF suppression frequency setting is valid 0x#0: IF suppression frequency setting is invalid					
Pn142	IF suppression frequency	1~3000	100.0	Hz	0x0142	Immedia tely

	Set IF vibration frequency value					
Pn143	IF damper attenuation gain	0~300	0	%	0x0143	Immedia tely
	Increasing this parameter can increase the vibration suppression effect. However, if the setting is too large, the vibration may be increased. When confirming the vibration suppression effect, simultaneously gradually increase the setting value by each 10% in the range of 0% to 200%. If the vibration suppression effect is still not achieved after reaching 200%, please stop the setting and reduce the control gain appropriately.					
Pn150	Notch filter 1 automatic adjustment selection	0x00~ 0x01	1	—	0x0150	Immedia tely
	0 - Automatic adjustment without auxiliary functions 1- Automatic adjustment through auxiliary functions					
Pn151	Notch filter 2 automatic adjustment selection	0x00~ 0x01	1	—	0x0151	Immedia tely
	0 - Automatic adjustment without auxiliary functions 1- Automatic adjustment through auxiliary functions					
Pn152	Automatic trap resonance detection sensitivity	1~200	100	%	0x0152	Immedia tely
	It's used to set the sensitivity for automatically detecting the resonant frequency. The smaller the value is set, the more sensitive it will be for resonance, the easier it is to detect vibration, and the smaller it is, the more likely it is to falsely detect the resonance frequency.					
Pn153	Notch filter 1 frequency	50~50 00	5000	Hz	0x0153	Immedia tely
	Sets the frequency of the first notch filter that suppresses resonance. When this parameter is set to 5000, the function of the notch filter is invalid. Note: Do not set the notch filter frequency close to the response frequency of the speed loop. At least this frequency should be set to more than 4 times of the speed loop gain, otherwise it may affect the overall performance of the system.					
Pn154	Notch filter 1Q value	0.5~10	0.70	-	0x0154	Immedia tely
	The Q value of the notch filter refers to the setting value of the filter frequency width related to the notch filter frequency. The width of the recess varies with the Q value of the notch filter, and the larger the Q value of the notch filter is set. The more sunk and the narrower the width of the filter frequency will be.					
Pn155	Notch filter 1 depth	0~1	0.000	-	0x0155	Immedia tely
	The notch filter depth refers to the setting of the filter frequency depth related to the notch filter frequency. The depth of the recess varies with the depth of the notch filter. The smaller the notch filter depth value is, the deeper the depression and the higher the vibration suppression effect will be. But setting it too small will increase the vibration					
Pn156	Notch filter 2 frequency	50~50 00	5000	Hz	0x0156	Immedia tely
	Sets the frequency of the second notch filter that suppresses resonance. When this parameter is set to 5000, the function of the notch filter is invalid. Note: Do not set the notch filter frequency close to the response frequency of the speed loop.					

	At least this frequency should be set to more than 4 times of the speed loop gain, otherwise it may affect the overall performance of the system.					
Pn157	Notch filter 2Q value	0.5~10	0.70	-	0x0157	Immedia tely
	The Q value of the notch filter refers to the setting value of the filter frequency width related to the notch filter frequency. The width of the recess varies with the Q value of the notch filter, and the larger the Q value of the notch filter is set. The more sunk and the narrower the width of the filter frequency will be.					
Pn158	Notch filter 2 depth	0~1	0.000	-	0x0158	Immedia tely
	The notch filter depth refers to the setting of the filter frequency depth related to the notch filter frequency. The depth of the recess varies with the depth of the notch filter. The smaller the notch filter depth value is, the deeper the depression and the higher the vibration suppression effect will be. But setting it too small will increase the vibration					
Pn160	Disturbance compensation function selection	0x00~ 0x01	0	—	0x0160	Immedia tely
	Set disturbance compensation function switch: 0- Not use 1-use					
Pn161	Disturbance observer cutoff frequency	1~100 0	150.0	Hz	0x0161	Immedia tely
	Set the disturbance compensation gain. Increasing it can increase the effect of suppressing the disturbance effect, but excessive noise will occur.					
Pn163	Disturbance compensation coefficient	0~100	0	%	0x0163	Immedia tely
	Set the disturbance compensation coefficient and the received position command or speed command, then add the disturbance torque compensation value to the torque command					
Pn165	Disturbance observer inertia correction coefficient	1~100 0	100	%	0x0165	Immedia tely
	The disturbance observer inertia is set by this parameter to adjust the identification error caused by inaccurate inertia setting. Note: When the inertia ratio is set correctly, the value is set to 100					
Pn166	Speed observer switch	0~1	0		0x0166	After restart
	Set speed observation function switch: 0- Invalid 1- valid					
Pn167	Speed observer cutoff frequency	1~500	80	Hz	0x0167	Immedia tely
	This parameter sets the speed observer bandwidth. Increasing the set value will increase the response speed of the speed feedback value to track the real speed. If the speed is too large, vibration and noise may occur.					
Pn170	Friction torque compensation	0~100	20	rpm	0x0170	Immedia

	cutoff speed	0				tely
	Friction compensation function is a function that compensates for viscous friction and fixed load changes. It is adjusted according to the friction compensation coefficient. Generally, please set the friction compensation coefficient to 95% or less. If the effect is not obvious enough, please increase the friction compensation cut-off speed at a rate of 10% each within the range that does not generate vibration					
Pn171	Friction torque positive compensation coefficient	0~100	0	%/100 rpm	0x0171	Immedia tely
	The higher the setting value is, the better the effect is. However, if the setting value is too high, the response is more likely to vibrate. Usually we set the setting value below 95%.					
Pn172	Friction torque reverse compensation coefficient	0~100	0	%/100 rpm	0x0172	Immedia tely
	The higher the setting value is, the better the effect is. However, if the setting value is too high, the response is more likely to vibrate. Usually we set the setting value below 95%.					
Pn175	Robust control options	0x00~ 0x01	1	—	0x0175	After restart
	Robust control function means that the function of stable response can be obtained through automatic adjustment within a certain range, regardless of mechanical type, load fluctuation, or inertia change. Set the robust control function switch: 0-Invalid 1-valid					
Pn177	Robust control tuning value	10~80	40.0	Hz	0x0177	Immedia tely
	Set the gain-tuning value of the robust control. The larger the value is set, the faster the system responds, but system overshoot and excessive noise may occur.					
Pn178	Minimum load value of robust control	0~500	0	%	0x0178	Immedia tely
	Set the robust control load factor. The larger the value is set, the faster the system responds, but it will be noisier. When the inertia is large, increasing the value properly could reduce overshoot.					
Pn185	Vibration detection options	0x00~ 0x02	0	—	0x0185	Immedia tely
	This function can automatically detect the value related alarms or warnings in order to detect the machine vibration under normal operating conditions. The perform way after setting the vibration detection: 0-No vibration detected 1-warning after vibration is detected 2-Alarming after vibration is detected					
Pn186	Vibration detection sensitivity	50~50 0	100	%	0x0186	Immedia tely
	Set the sensitivity of the detected vibration. The smaller the setting value is, the more sensitive it is. If the setting is too small, the vibration may be detected by mistake during normal operation. Note: The detection sensitivity of the vibration alarm and vibration alarm may differ depending on the state of the machine being used.					

Pn187	Vibration detection value	0~5000	50	rpm	0x0187	Immediately
	Set the threshold for vibration detection. The smaller the setting is, the easier it is to detect the vibration. If the setting is too small, the vibration may be detected by mistake during normal operation. Note: The vibration detection values of vibration alarm and vibration warnings may differ according to the condition of the used machine					

8.3. **Position Related Pn2 Group Parameters**

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn200	Pulse input filter selection	0~2	0	-	0x0200	After restart
	Use this parameter to select the position command filter to better suppress the interference in the command pulse 0-line drive filter ~1MHZ 1-collector open-circuit filter 2-line drive filter 1~4MHZ Note: Please set a reasonable filter according to the pulse frequency, otherwise it may cause poor pulse immunity or pulse loss.					
Pn201	Pulse input form	0~6	0	-	0x0201	After restart
	0-pulse + direction positive logic 1-CW+CCW positive logic 4-4 times of quadrature encoding 5-pulse + direction negative logic 6-CW+CCW negative Logic					
Pn202	Pulse input direction negation	0~1	0	-	0x0202	After restart
	Select the negation of pulse input direction: 0-positive polarity 1-negative polarity					
Pn203	Command pulse input magnification	1~100	1	x1倍	0x0203	Immediately
	Set the command pulse input magnification value to be used in conjunction with ON/OFF of the command pulse magnification switching signal for switching the position command pulse input magnification to 1 and the parameter setting multiple Note: The input pulse frequency is too low. If the value is set too large, the speed may not be steady.					

Pn204 Pn206	Electronic gear ratio numerator	0~1073741824	64	-	0x0206 0x0207	After restart
	Electronic gear ratio denominator	1~1073741824	1	-	0x0208 0x0209	After restart
	The electronic gear ratio is a function for setting the workpiece movement amount of one pulse unit of the upper device input command. Take the screw drive as an example, it has a screw pitch of 10mm, When the upper system requires that reduction ratio of the motor shaft and the load side machine is N1/N2 (the motor shaft rotates N2 revolutions when the load shaft rotates N1 revolutions), the set value of the electronic gear ratio is obtained by the following formula: Electronic Gear Ratio numerator /Electronic Gear Ratio denominator = Encoder Resolution / Pulse Number of Upper System 1r * Reduction Ratio N1/N2					
Pn211	Position command low-pass filter time constant	0~655	0	ms	0x0211	After stop
	This parameter is used to set the time constant of the first-order low-pass filter corresponding to the position command and it can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter.					
Pn212	Average filter time in position instruction rolling	0~1000	0	ms	0x0212	After stop
	This parameter is used to set the time constant of the moving average filter of the corresponding position instruction. It can reduce the mechanical shock in the case of abrupt changes in the input pulse command frequency by setting this parameter.					
Pn230	Low-frequency vibration suppression options	0x00~0x02	0	—	0x0230	Immediately
	This parameter is used with Pn231 as the automatic adjustment mode setting 0 - No vibration suppression 1- Additional vibration suppression function for specific frequency 2-Add vibration suppression to 2 different frequencies					
Pn231	Automatic adjustment selection in low-frequency vibration suppression	0x00~0x01	1	—	0x0231	Immediately
	This parameter is set to choose if the low-frequency vibration suppression is automatically set in the intelligent settings, bandwidth settings and other auxiliary functions: 0 - Vibration suppression function won't be automatically adjusted via auxiliary functions 1- Vibration suppression function will be automatically adjusted via auxiliary functions					
Pn232	Low-frequency vibration	0.1~300	40.0	%	0x0232	Immediately

	detection sensitivity					
	This parameter is used to set the sensitivity of low-frequency vibration detection when the positioning is completed. The smaller the sensitivity is set, the easier it is to automatically detect the low frequency vibration frequency point.					
Pn235	Low-frequency vibration suppression 1 frequency	1~200	200.0	Hz	0x0235	Immediately
	This parameter is used to set the frequency of low frequency vibration suppression 1					
Pn236	Low Frequency Vibration Suppression 1 Correction	10~1000	100	%	0x0236	Immediately
	This parameter is used to set the correction coefficient of low-frequency vibration suppression 1. The larger the value is set, the more obvious the suppression effect of low-frequency is, and settting it too small may cause long positioning time.					
Pn237	Low-frequency vibration suppression 2 frequency	1~200	200.0	Hz	0x0237	Immediately
	This parameter is used to set the frequency of low-frequency vibration suppression 2					
Pn238	Low-frequency Vibration Suppression 2 Correction	10~1000	100	%	0x0238	Immediately
	This parameter is used to set the correction coefficient of low-frequency vibration suppression 2. The larger the value is set, the more obvious the suppression effect of low-frequency is, and settting it too small may cause long positioning time.					
Pn240	Model tracking control selection	0x00~0x01	0	—	0x0240	Immediately
	Model-tracking control specifically selects the function of positioning, model tracking control selection switch is: 0- Not use model tracking control 1- Use model tracking control					
Pn241	Model tracking control gain	1~2000	50.0	1/s	0x0241	Immediately
	The size of the model tracking control gain determines the response speed of the servo system. If the model tracking control gain is increased, the responsiveness becomes faster and the positioning time becomes shorter. When the model tracking control is effective, the position response and deviation of the servo system are determined by this parameter, rather than position gain					
Pn242	Model tracking control attenuation	50~200	100.0	%	0x0242	Immediately

	coefficient					
	The tracking attenuation coefficient of the model decreases, and the position tuning section is easy to cause excessive overshoot. If the setting is too small, the position oscillates easily. When the setting increases, the position overshoot decreases, but when the position is too large, the position easily rebounds, causing the positioning time to change. Long, it is recommended to keep this value unchanged during normal use.					
Pn243	Model tracking control speed feedforward gain	0~1000	100.0	%	0x0243	Immediately
	The feed forward gain of the model tracking speed is reduced, and the responsiveness is slower, but position overshoot doesn't easily occur. If the feedforward gain is too small, the position deviation will end in a long time.					
Pn244	Model tracking control forward torque feedforward gain	0~1000	100.0	%	0x0244	Immediately
	It's a forward position command and could be used when adjusting the forward response separately. When it is increased, the torque feed forward rises faster and the positioning time can be shortened appropriately.					
Pn245	Model tracking control reverse torque feedforward gain	0~1000	100.0	%	0x0245	Immediately
	It's a reverse position command and could be used when adjusting the forward response separately. When it is increased, the torque feed forward rises faster and the positioning time can be shortened appropriately.					
Pn246	Second model tracking control gain	1~2000	50.0	1/s	0x0246	Immediately
	Use second gain when model tracking is valid.					
Pn247	Second model tracking control attenuation coefficient	50~200	100.0	%	0x0247	Immediately
	Use second gain when model tracking is valid.					
Pn249	Speed feedforward/torque feedforward selection	0x00~0x01	0	—	0x0249	Immediately
	0-not use model tracking control and external speed and torque feed forward at the same time 1-use model tracking control and external speed and torque feed forward at the same time When using the model tracking control, the optimal feedforward will be set inside the servo, and it is not recommended to use the "speed feed forward (V-REF) input" and "torque feed forward (T-REF) input" from the upper unit at the same time. However, it can be used at the same time as needed. In this case, if the input feed forward is incorrect, it may cause overshoot and system instability.					

Pn260	Position near signal width	1~1073741824	1073741824	Command unit	0x0260 0x0261	Immediately
	In the position control, the host device can receive the positioning proximity signal before confirming the positioning completion signal, so as to prepare for the sequence of actions after the positioning is completed and shorten the time required for the positioning to complete the operation, The signal will be output as the difference between the command pulse number of the host device and the servo motor movement (position deviation) is lower than the set value					
Pn262	Positioning completion range	0~1073741824	7	Command unit	0x0262 0x0263	Immediately
	In the position control, the servo motor positioning completion signal will be output when the difference between the command pulse number from the host device and the servo motor movement amount (position deviation) is lower than the set value that means the host device confirming positioning has been completed.					
Pn264	Maximum position deviation threshold	1~1073741823	5242880	Command unit	0x0264 0x0265	Immediately
	When the motor operation does not match the instruction, by setting the appropriate Pn264 (maximum position deviation threshold), an abnormal condition can be detected and the motor can be stopped.					
Pn266	Excessive position deviation warning setting	10~100	100	%	0x0266	Immediately
	This parameter is used to set the position deviation excessive warning threshold. When the position deviation is greater than the product of the Pn264 (maximum position deviation threshold) and this parameter, an excessive position deviation warning will be generated.					
Pn267	Position Deviation Alarm Threshold when the Servo is ON	1~1073741823	5242880	Command unit	0x0267 0x0268	Immediately
	This parameter is used to set the threshold for excessive position deviation alarm at the moment of servo ON. When the servo is ON, if the position deviation value exceeds this setting value, an excessive servo deviation alarm will be generated when the servo is ON.					
Pn269	Position Deviation Warning Threshold when the Servo is ON	10~100	100	%	0x0269	Immediately
	This parameter is used to set the warning threshold for excessive position deviation at the servo ON moment. When the servo is turned ON and the position deviation is greater than the product of “Excessive position deviation warning threshold at servo ON” and the parameter, the warning will be generated when the servo is ON.					
Pn270	speed limit value when the Servo is ON	0~10000	10000	rpm	0x0270	Immediately

	If the servo is turned ON with the position deviation accumulated, the speed limit is executed by this parameter. When the command pulse is input in this state, the alarm Er.D02 (Excessive position deviation alarm caused by speed limit during servo ON) is displayed when the set value of Pn264 (maximum position deviation threshold) is exceeded.					
Pn272	Position deviation clear mode	0x00~0x03	0	—	0x0272	After restart
	Set the clear mode of the switch position deviation clear signal (/CLR): 0- Cleared when level is ON 1- Cleared when the rising edge OFF->ON 2-Cleared when level is OFF 3- Cleared when the falling edge ON->OFF					
Pn273	Position deviation removal method selection	0x00~0x02	0	—	0x0273	After restart
	Set the deviation removal method: 0- Servo OFF, Alarm and /CLR Signal Position Deviation can be cleared 1-/CLR signal position deviation can be cleared 2-Alarm and /CLR signal position deviation can be cleared Note: 1. For details on the pulse amplitude of the clear signal, refer to the description of "Deviation Clearance". 2. In the position control, the position deviation remains unchanged when the servo motor stops due to the travel limit.					
Pn274	Positioning completion signal output time	0x00~0x02	0	—	0x0274	After restart
	Set the deviation removal method: 0- Servo OFF, Alarm and /CLR Signal Position Deviation can be cleared 1-/CLR signal position deviation can be cleared 2-Alarm and /CLR signal position deviation can be cleared Note: 1. For details on the pulse amplitude of the clear signal, refer to the description of "Deviation Clearance". 2. In the position control, the position deviation remains unchanged when the servo motor stops due to the travel limit.					

8.4. **Speed Related Pn3 Group Parameters**

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn300	**Analog speed command gain**	**150~3000**	**600**	**0.01V/ Rated speed**	**0x0300**	**Immediately**
	This parameter is used to set servo motor speed that should be equal to analog voltage value (V-REF) required for the speed command of the rated value. Caution: Do not apply more than -10~10V and exceeding this range may cause damage to the driver.					
Pn301	**Analog speed command**	**0~1**	**0**	**-**	**0x0301**	**Immediately**

	negation					
	Set the voltage polarity of the analog speed command: 0-Positive polarity: positive voltage corresponds to positive speed command 1- Negative polarity: positive voltage corresponds to negative speed command					
Pn302	**Analog speed instruction filter time**	**0~655.35**	**0.40**	**ms**	**0x0302**	**Immediately**
	The function could be set to smooth the speed command when one delay filter is applied to the analog speed command (V-REF) input and it does not usually need to be changed. If the set value is too large, the responsiveness may decrease. Please set this parameter while confirming the response.					
Pn303	**Analog speed command dead zone range**	**0~3**	**0**	**V**	**0x0303**	**Immediately**
	In the analog speed control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because there is a slight deviation in the commands inside the servo unit. This error can be eliminated by setting an appropriate analog speed command deadband range.					
Pn304 **Pn305** **Pn306**	**Internal speed 1**	**0~10000**	**100**	**rpm**	**0x0304**	**Immediately**
	Internal speed 2	**0~10000**	**200**	**rpm**	**0x0305**	**Immediately**
	Internal speed 3	**0~10000**	**300**	**rpm**	**0x0306**	**Immediately**
	When operating in the internal speed mode, the servo unit provides three internal speed commands and through Switch Internal Speed Command Selection A and B we could select as follow: /SPD-A /SPD-B speed command OFF OFF Zero Speed OFF ON Internal speed 1 ON ON internal speed 2 ON OFF Internal Speed 3					
Pn310	**Speed command trapezoidal acceleration time**	**0~10000**	**0**	**ms**	**0x0310**	**Immediately**
	Acceleration of the set speed from 0r/min to the rated speed (corresponding to the motor model). When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.					
Pn311	**Speed command trapezoidal deceleration time**	**0~10000**	**0**	**ms**	**0x0311**	**Immediately**
	Acceleration time of the set speed from 0r/min to the rated speed (corresponding to the motor model). When the given speed is greater or less than the rated speed, the actual acceleration time is calculated in proportion.					
Pn312	**Zero speed clamp mode**	**0~3**	**3**	**-**	**0x0312**	**Immediately**

	Speed mode, setting the switching speed zero clamp signal (/ZCLAMP) working mode: 0-Invalid 1-speed command is set to 0, not clamped after shutdown 2-speed command is set to 0, clamped after shutdown 3-speed command is lower than "zero speed clamp speed threshold"(Pn313), the first speed command is set to 0, clamped after shutdown					
Pn313	**Zero Speed Clamp Speed Threshold**	**0~10000**	**10**	**rpm**	**0x0313**	**Immediately**
	Set the zero control switching threshold when "zero speed clamp mode"(Pn312) is set to 3					
Pn317	**Rotation determination threshold**	**1~10000**	**20**	**rpm**	**0x0317**	**Immediately**
	When the motor speed is higher than the set value, the switch rotation detection signal (/TGON) is output.					
Pn320	**Speed consistent range**	**0~100**	**10**	**rpm**	**0x0320**	**Immediately**
	When the difference between the motor speed and the command speed is lower than the set value, the switch-speed match signal (/V-CMP) would be output.					

8.5. **Torque Related Pn4 Group Parameters**

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn400	**Torque command selection**	**0~1**	**1**	**-**	**0x0400**	**Immediately**
	Select the torque control command source: 0-Internal settings 1- Analog input					
Pn401	**Torque command second-order low-pass filter cut-off frequency**	**100~5000**	**5000**	**Hz**	**0x0401**	**Immediately**
	This parameter is used to set the cut-off frequency of the second-order torque filter. When this parameter is set to 5000, the filter function is invalid.					
Pn402	**Torque command second-order low-pass filter Q**	**0.5~1**	**0.50**	**1**	**0x0402**	**Immediately**
	This parameter is used to set the Q value of the second-order torque filter. Increasing the Q value can improve the system response, but noise will be generated when the setting is too large.					
Pn403	**Torque command direction setting**	**0~1**	**0**	**-**	**0x0403**	**Immediately**

	Set the switching torque command direction selection (/T-SIGN) signal to activate the switch: 0 - Torque command direction selection (/T-SIGN) signal is invalid 1- Torque command direction selection (/T-SIGN) signal is valid Note: Torque command is invalid when /T-SIGN is valid, torque command is positive when /T-SIGN signal is ON, and torque command is negative when /T-SIGN signal is OFF.					
Pn404	**Analog torque command filter time**	**0~6535**	**0.00**	**ms**	**0x0404**	**Immediately**
	The parameter is used to smooth the torque command when we apply a delay filter to the analog torque command (T-REF) input, usually it does not need to be changed. If the set value is too large, the responsiveness may decrease. So please set it up as we check the response.					
Pn405	**Analog torque command gain**	**10~100**	**30**	**0.1V/rated torque**	**0x0405**	**Immediately**
	This parameter is used to set the analog voltage value (T-REF) required for the rated torque of the servo motor. Caution: Do not apply more than -10~10V, exceeding this range may cause damage to the driver.					
Pn406	**Analog torque command negation**	**0~1**	**0**	**-**	**0x0406**	**Immediately**
	The analog voltage corresponds to the polarity setting of the torque command: 0-Positive polarity: Positive voltage corresponds to positive torque command 1-Negative polarity: Positive voltage corresponds to negative torque command					
Pn407	**Analog torque command dead zone range**	**0~3**	**0**	**V**	**0x0407**	**Immediately**
	In analog torque control, even if the input command is 0V, the servo motor may rotate at a slight speed. This is because a slight deviation occurs in the command inside the servo unit. This error can be eliminated by setting an appropriate analog torque command deadband range.					
Pn410	**Internal torque command in torque control**	**-500~500**	**0**	**%**	**0x0410**	**Immediately**
	The command source for selecting the torque control is the torque command size setting for internal setting.					
Pn411	**Speed control mode setting in torque control**	**0~1**	**1**	**-**	**0x0411**	**After restart**
	0- select the lower one between the speed corresponding to the analog voltage (V-REF) and the speed set by Pn413 1-select the speed set by Pn413					
Pn412	**Speed limit selection**	**0x00~0x01**	**0**	**—**	**0x0412**	**After restart**
	0-motor maximum speed (determined by internal part of the motor model) + torque mode speed limit (Pn411) 1- Overspeed detection alarm speed (determined by internal part of the motor model) +					

	torque mode speed limit (Pn411)					
Pn413	Speed limit in torque control	0~10000	1000	rpm	0x0413	Immediately
	This parameter is used to set speed limit in torque control with Pn411					

8.6. **Jogging Related Pn0 Group Parameters**

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn500	JOG speed	0~1000	500	rpm	0x0500	Immediately
Pn502	Program JOG operation mode	0x00~0x05	0	—	0x0502	Immediately
	0-(waiting time->forward motion)*number of cycles 1-(waiting time->backward motion)*number of cycles 2-(waiting time->forward motion)*number of cycles->(waiting time->backward motion)*number of cycles 3-(waiting time->backward motion)*number of cycles->(waiting time->forward motion)*number of cycles 4-(waiting time->forward motion->waiting time->backward motion)*number of cycles 5-(waiting time->backward motion->waiting time ->forward motion)*number of cycles					
Pn503	Program JOG moving distance	1~1073741824	32768	Command unit	0x0503	Immediately
	Set the JOG movement distance of the running program as the command unit					
Pn505	Program JOG acceleration/deceleration time	2~10000	100	ms	0x0505	Immediately
	Set the time of accelerating from 0r/min to the rated speed (corresponding to the motor model). When the set speed is greater or less than the rated speed, calculate the actual acceleration/deceleration time according to the ratio.					
Pn506	Program JOG waiting time	0~10000	100	ms	0x0506	Immediately
	Set the waiting time between JOG sections of the running program in conjunction with the program JOG operation mode (Pn502)					
Pn507	Program JOG movement times	0~10000	1	回	0x0507	Immediately
	Set the movement times of the running program in conjunction with JOG operation mode (Pn502) Note: it is infinite when set to 0					
Pn508	Program JOG movement speed	1~10000	500	rpm	0x0508	Immediately

8.7. **Switch Configuration Related Pn6 Group Parameters**

Function code	Parameter	Range	Default	Unit	Communication address	When enabled
Pn600	Digital input signal distribution	0~1	1	-	0x0600	After restart

	mode					
	Set the binary input signal distribution method: 0-Internal fixed: used by pins and functions fixed inside the servo unit. See “CN1 terminal” for details. 1-parameter configuration: It is used according to the function configured on each pin and is configured and used by function code Pn601~Pn609					
Pn601 Pn602 Pn603 Pn604 Pn605 Pn606 Pn607 Pn608 Pn609	**CN1-40 input configuration**	**0~0x114**	**0x01**	**-**	**0x0601**	**After restart**
	CN1-42 input configuration	**0~0x114**	**0x02**	**-**	**0x0602**	**After restart**
	CN1-43 input configuration	**0~0x114**	**0x03**	**-**	**0x0603**	**After restart**
	CN1-41 input configuration	**0~0x114**	**0x05**	**-**	**0x0604**	**After restart**
	CN1-44 input configuration	**0~0x114**	**0x04**	**-**	**0x0605**	**After restart**
	CN1-45 input configuration	**0~0x114**	**0x06**	**-**	**0x0606**	**After restart**
	CN1-46 input configuration	**0~0x114**	**0x07**	**-**	**0x0607**	**After restart**
	CN1-39 input configuration	**0~0x114**	**0x00**	**-**	**0x0608**	**After restart**
	CN1-38 input configuration	**0~0x114**	**0x00**	**-**	**0x0609**	**After restart**
	0x00: Invalid 0x01: Servo enable 0x101: Servo enable negation 0x02: Run in positive direction 0x102: Run in positive direction is prohibited 0x03: Run in negative direction 0x103: Run in negative direction is prohibited 0x04: Alarm clear 0x104: Counter clear 0x05: Manual P-PI control 0x105: Manual P-PI control negation 0x06: Torque limit switch 0x106: Torque limit switch negation 0x07: Reserved 0x107: Reserved 0x08: Internal speed command direction selection 0x108: Internal speed command direction selection D negation 0x09: Internal speed command selection A 0x109: Internal speed command selection A negation 0x0A: Internal speed command selection B 0x10A: Internal speed command selection B is negation 0x0B: Control mode switch 0x10B: Control mode switch negation 0x0C: Zero speed clamp 0x10C: Zero speed clamp negation 0x0D: Command pulse disable 0x10D: Command pulse disable negation 0x0E: Gain switching 0x10E: Gain switching negation 0x0F: Direction selection of torque command 0x10F: Direction selection of torque command negation 0x10: Command pulse rate switching 0x110: Command pulse rate switch negation					
Pn610 Pn611 Pn612	**Switch input internal**	**0~0x14**	**0x00**	**-**	**0x0610**	**After restart**

	configuration 1					
	Switch input internal configuration 2	**0~0x14**	**0x00**	**-**	**0x0611**	**After restart**
	Switch input internal configuration 3	**0~0x14**	**0x00**	**-**	**0x0612**	**After restart**
	0x00: Invalid **0x01: Servo enable** **0x02: Run in positive direction** **0x03: Run in negative direction** **0x04: Alarm clear** **0x05: Manual P, PI control** **0x06: Torque limit switching** **0x08:Internal speed command direction selection** **0x09: Internal speed command selection A** **0x0A: Internal speed command select B** **0x0B: Control mode switch 0x0C: Zero speed anvil** **0x0D: Pulse input disable** **0x0E: Gain switching** **0x0F: Direction selection of torque command** **0x10: Command pulse override switch**					
Pn613 **Pn614** **Pn615**	**CN1-25, 26 output configuration**	**0~0x109**	**0x000**	**-**	**0x0613**	**After restart**
	CN1-27, 28 output configuration	**0~0x109**	**0x001**	**-**	**0x0614**	**After restart**
	CN1-29, 30 output configuration	**0~0x109**	**0x002**	**-**	**0x0615**	**After restart**
	0x00: Servo ready 0x100: Servo ready signal negation 0x01: Positioning completed 0x101: Positioning completion signal negation 0x02: Speed is consistent 0x102: Speed match signal negation 0x03: rotation detection signal 0x103: rotation detection signal negation 0x04: In the torque limit 0x104: The signal in the torque limit negation 0x05: In speed limit 0x105: The signal in speed limit negation 0x06: Brake chain 0x106: Brake chain signal negation 0x07: warning 0x107: warning signal negation 0x08: Positioning proximity signal 0x108: Positioning proximity signal negation 0x09: Command pulse input override switching signal 0x109: Command pulse input override switching signal negation					
Pn622	**Function selection switch**	**0x00~0x11**	**0**	**–**	**0x0622**	**After restart**
	Function selection switch: 0x1#: High binary output alarm output (ALM) signal is valid 0x0#: Low binary output alarm output (ALM) signal is valid 0x#1: Check out warning 0x#0: Not check out warning					

8.8. **Expansion Related Pn7 Group Parameters**

Function code	Parameter	Min	Max	Range	Default	Unit	Communication address	When enabled
Pn730	**No-motor test function selection**	0x00	0x01	0x00~0x01	0		0x0730	After restart
	The no-motor test function is used to simulate the motion of the motor inside the servo unit without starting the motor and confirm the operation of the host device and peripheral equipment. Through this function, the wiring confirmation, parameter value verification and verification when the system debug fault occurs can be performed to shorten the set up time and avoid mechanical damage due to erroneous actions. When no-motor test function is running, the motor can be checked whether the motor is connected or not. 0-Invalid 1-Valid							
Pn731	**No-motor test function encoder resolution selection**	0	3	0~3	1		0x0731	After restart
	When no-motor test mode is selected, the motor encoder resolution is set: 0-13 bits 1-17 bits 2-20 bits 3-23 bits Note: The actual encoder resolution is used when the encoder is actually connected							
Pn732	**No-otor test function encoder type selection**	0x00	0x01	0x00~0x01	0		0x0732	After restart
	Set no-motor test function encoder type: 0-incremental encoder 1-Absolute encoder							
Pn792	**Absolute encoder operation**	0	2	0~2	0		0x0792	After restart
	0 - No action 1- Write motor parameters to encoder EEPROM 2- Clear multi-turn encoder laps: if you use it initially or replace or insert/remove the battery during power-down of the drive. After power on, an encoder backup alarm (Er. 810) will be reported. This parameter is set to 2 and it can only be cleared after re-powered.							

9. Monitoring Parameters

Monitoring code	Monitoring name	range	unit	mailing address
Un000	Motor rotation speed	0x80000000~0x7fffffff	rpm	0xE000
	Display the actual speed of the servo motor			
Un001	Speed command	0x80000000~0x7fffffff	rpm	0xE001
	Display the current speed command of the servo motor Note: When it is not enabled, this value shows the analog speed (corresponding to V-REF)			
Un002	Internal torque command	0x80000000~0x7fffffff	%	0xE002
	Display current actual torque command with servo motor rated torque as 100%			
Un003	Rotor pulse position relative to the Z axis	0x80000000~0x7fffffff	pulse	0xE003
	Shows the mechanical absolute position of the motor within one revolution of the encoder			
Un004	Electrical angle	0x80000000~0x7fffffff	°	0xE004
	Displays the electrical angle of the current position of the servo motor rotor			
Un005	Speed of input pulse command	0x80000000~0x7fffffff	rpm	0xE005
	Display input position pulse command speed			
Un006	Counter of input command pulse	0x80000000~0x7fffffff	Command Unit	0xE006
	Displays the number of command pulses received by the servo motor			
Un007	Counter of feedback pulse	0x80000000~0x7fffffff	Command Unit	0xE007
	Displays cumulative pulses fed back from the servo motor encoder			
Un008	Counter of feedback pulse 1	0x80000000~0x7fffffff	Encoder pulse unit	0xE008
	Displays cumulative pulses fed back from the servo motor encoder			
Un009	Position deviation	0x80000000~0x7fffffff	Command Unit	0xE009
	Display the difference between the command pulse number of the upper device and the servo motor movement amount			
Un00A	Cumulative load rate	0x80000000~0x7fffffff	%	0xE00A
Un00B	Regeneration load rate	0x80000000~0x7fffffff	%	0xE00B
Un00C	Electricity consumption of DB resistance	0x80000000~0x7fffffff	%	0xE00C
Un00D	Effective gain monitoring	1~2	—	0xE00D
Un00E	Total running time	0~0xFFFFFFFF	100ms	0xE00E
Un00F	Overload rate	0~0xFFFFFFFF	%	0xE00F
Un035	DSP software version	0~0xFFFF	-	0xE035

Un036	FPGA software version	0~0xFFFF	-	0xE036
Un089	Heat sink temperature	0~0xFFFF	℃	0xE090
Un100	IO port input signal monitoring	0~0xFFFF	—	0xE100
	See "3.3.3 Confirming the input status" for details			
Un101	IO port output signal monitoring	0~0xFFFF	—	0xE101
	See "3.3.3 Confirming the output status" for details			
Un102	T-REF monitoring	0~0xFFFF	%	0xE102
	Corresponds to the T-REF input voltage, according to the analog torque command gain			
Un103	V-REF monitoring	0~0xFFFF	rpm	0xE103
	Corresponds to the T-REF input voltage, according to the analog torque command gain			
Un104	Pulse command input frequency	0~0xFFFFFFFF	Hz	0xE104
Un108	External input command pulse counter	0~0xFFFFFFFF	Command Unit	0xE108
Un110	Integrated monitoring of internal signal status	0~0xFFFFFFFF	—	0xE110
Un120	Integrated monitoring of internal input signal status	0~0xFFFFFFFF	—	0xE120
Un130	Integrated monitoring of internal output signal	0~0xFFFFFFFF	—	0xE130
Un140	Main circuit bus voltage	0~0xFFFF	V	0xE140
Un141	Effective current feedback	0~0xFFFF	0.01A	0xE141
	Three-phase synthetic feedback current effective value			
Un300	Current alarm code	0~0xFFFF	—	0xE300
Un301	Last alarm code	0~0xFFFF	—	0xE301
Un302	Timestamp while alarm occurs	0~0xFFFFFFFF	100ms	0xE302
Un303	Motor speed while alarm occurs	0~0xFFFF	rpm	0xE303
Un304	Speed command while alarm occurs	0~0xFFFF	rpm	0xE304
Un305	Internal torque command while alarm occurs	0~0xFFFF	%	0xE305
Un306	Input command pulse speed while alarm occurs	0~0xFFFF	rpm	0xE306
Un307	Deviation counters (position deviation)while alarm occurs	0~0xFFFFFFFF	pulse	0xE307
Un308	DC bus voltage while alarm occurs	0~0xFFFF	V	0xE308
Un309	Effective current feedback while alarm occurs	0~0xFFFF	%	0xE309

Un30A	Cumulative load rate while alarm occurs	0~0xFFFF	%	0xE30A
Un30B	Regenerative load rate while alarm occurs	0~0xFFFF	%	0xE30B
Un30C	Electricity consumption of DB resistance while alarm occurs	0~0xFFFF	%	0xE30C
Un30D	Maximum cumulative load rate while alarm occurs	0~0xFFFF	%	0xE30D
Un30E	Rotation inertia ratio while alarm occurs	0~0xFFFF	%	0xE30E
Un30F	Abnormal times of serial encoder communication while alarm occurs	0~0xFFFF	—	0xE30F
Un310	Internal signal monitoring while alarm occurs	0~0xFFFFFFFF	-	0xE310
Un313	Internal input signal monitoring while alarm occurs	0~0xFFFFFFFF	-	0xE313
Un317	Internal output signal monitoring while alarm occurs	0~0xFFFFFFFF	-	0xE317
Un320	Fault code history 1	0~0xFFFF	-	0xE320
Un321	Fault code history 2	0~0xFFFF	-	0xE321
Un322	Fault code history 3	0~0xFFFF	-	0xE322
Un323	Fault code history 4	0~0xFFFF	-	0xE323
Un324	Fault code history 5	0~0xFFFF	-	0xE324
Un325	Fault code history 6	0~0xFFFF	-	0xE325
Un326	Fault code history 7	0~0xFFFF	-	0xE326
Un327	Fault code history 8	0~0xFFFF	-	0xE327
Un328	Fault code history 9	0~0xFFFF	-	0xE328
Un329	Fault code history 10	0~0xFFFF	-	0xE329
Un330	Fault time history 1	0~0xFFFFFFFF	100ms	0xE330
Un331	Fault time history 2	0~0xFFFFFFFF	100ms	0xE331
Un332	Fault time history 3	0~0xFFFFFFFF	100ms	0xE332
Un333	Fault time history 4	0~0xFFFFFFFF	100ms	0xE333
Un334	Fault time history 5	0~0xFFFFFFFF	100ms	0xE334
Un335	Fault time history 6	0~0xFFFFFFFF	100ms	0xE335
Un336	Fault time history 7	0~0xFFFFFFFF	100ms	0xE336
Un337	Fault time history 8	0~0xFFFFFFFF	100ms	0xE337
Un338	Fault time history 9	0~0xFFFFFFFF	100ms	0xE338
Un339	Fault time history 10	0~0xFFFFFFFF	100ms	0xE339

10. Fault Code and Countermeasures

10.1. **Fault Code**

Fault code	Fault type	Solutions
Er.020	**Abnormal parameter and check**	1. Enter the parameters again after initializing parameter settings, 2. Write the power level of the driver to 0 first, and then write the correct power level. Note: Remember to perform the current detection correction, analog input correction and bus voltage correction after writing the power level 3. servo driver failure, replace the servo drive
Er.021	**Parameter formatting exception (inconsistent version number)**	1. Perform a soft reset. If the fault is still reported, write the driver's power level to 0 and then write the correct power level. Note: Remember to perform the current detection correction, analog input correction and bus voltage correction after writing the power level 2. servo driver failure and replace the servo drive
Er.022	**Abnormal system and check**	1. Perform a soft reset. If the fault is still reported, write the driver's power level to 0 and then write the correct power level. Note: Remember to perform the current detection correction, analog input correction and bus voltage correction after writing the power level 2. servo driver failure and replace the servo drive
Er.040	**Abnormal parameter setting**	1. Check whether the changed parameters are out of range 2. Check if the setting of electronic gear ratio is within the setting range (electronic gear ratio: 0.001~16777216/1000) 3. Check whether the servo drive and servo motor capacity match 4. I/O terminal definition repeat
Er.041	**Abnormal frequency division pulse output setting**	According to the number of encoder bits, the number of encoder frequency division pulses is set to an appropriate value, see the specification
Er.042	**Abnormal parameter combination**	1. Make the setting value of electronic gear ratio within the setting range 2. make the program JOG settings related to logic
Er.050	**Unmatched drive and motor capacity**	1. check if the driver power and motor power are correct 2. replace the drive or motor so that it is within a reasonable range
Er.0B0	**Invalid servo ON command alarm**	Re-power on or perform a soft reset

Er.100	**Over-current fault**	1. Check whether the motor phase sequence is wrong 2. Check whether the motor is damaged and use a multimeter to measure whether U/V/W is short together. 3. Check the motor encoder angle is correct 4. Monitor the UV phase current sampling AD value in the disabled state through a virtual oscilloscope to determine whether it is a driver hardware current sampling fault. Normally, it is near zero.
Er.320	**Regeneration overload**	1. Check whether the bus voltage of the driver is within a reasonable range when it is not enabled. If the bus voltage is detected incorrectly, there is a possibility of accidental braking or accidental protection. 2. Confirm the brake resistor wiring is correct; see the instructions for details. 3. According to the load situation, consider the current choice of braking resistor is appropriate; see the braking resistor selection rules for details. 4. If the wiring is correct, and the braking resistor is selected properly, and the operation still reports regenerative overload, you can monitor whether there is a small drop when the bus voltage reaches the braking point during operation by the host computer or the keyboard. If the bus voltage reaches the braking point and it still rises smoothly, it can be judged that the brake pipe is damaged. 5. If the fault is reported in the last operation, run after waiting for a while after powering on.
Er.400	**Over-voltage**	1. When the power supply voltage is not enabled, measure the power supply voltage at the same time monitor whether the bus voltage (Un140) is 1.414 times of the input power voltage (AC RMS). If the deviation is large, it can be determined as bus voltage detection hardware failure. 2. Measure the power supply voltage. If the power supply voltage is adjustable, adjust the power supply voltage within the product specification range. If it is not adjustable and the power supply voltage is in an unstable state, you may consider installing a voltage regulator. 3, consider the operating conditions and load, determine the brake resistor selection is reasonable (whether the resistance is too large), if the overvoltage caused by frequent acceleration and deceleration, you may consider replacing the brake resistor 4. there may be brake pipe damage, check the brake pipe 5. Make sure to guarantee that the motor is running at a tolerable moment of inertia ratio and mass ratio 6, servo drive failure, replace the servo drive

Er.410	**Under-voltage**	1. check whether the power input terminal line is connected 2. When the power supply voltage is not enabled, measure the power supply voltage at the same time monitor whether the bus voltage (Un140) is 1.414 times of the input power voltage (AC RMS). If the deviation is large, it can be determined as bus voltage detection hardware failure. 3. Measure the power supply voltage. If the power supply voltage is adjustable, adjust the power supply voltage within the product specification range. 4. Measure the power supply voltage. If the power supply voltage is in an unstable state, you may consider installing a voltage regulator. 5. if the power capacity is adjustable, you can advise customers to increase in power capacity
Er.510	**Over-speed**	1. Check whether there is any problem with the motor wiring and whether the UVW three-phase connection is reversed. 2. Confirm that the encoder connection is abnormal. 3. Check if the maximum speed setting in the motor parameters is correct 4. Check whether the input command exceeds the over-speed value 5. Reduce the servo gain or set a certain smoothing time
Er.511	**Divided pulse output speed**	1. Reduce the number of divided output pulses per revolution (Pn070) 2. If the working conditions are allowed, you may reduce the motor speed
Er.520	**Vibration alarm**	1. If the working conditions are allowed, you may reduce the motor speed or reduce the speed loop gain. 2. correctly set the rotary inertia ratio 3. properly set the vibration detection value (Pn187) and vibration detection sensitivity (Pn186)
Er.550	**Abnormal maximum speed setting**	
Er.710	**Overload (instantaneous maximum load)**	1. Check if the motor is stalled during operation 2. Check whether there is any problem with the motor wiring (phase sequence, connection) and encoder wiring. 3. consider the operating conditions and load and determine if the driver or motor selection is reasonable 4. Observe whether there is large vibration in the running process of the motor. If there is a large noise, adjust the gain parameter to eliminate noise or jitter. At the same time, you can use the virtual oscilloscope to monitor whether the motor output torque is abnormal or not.
Er.720	**Overload (continuous maximum load)**	1. Check whether there is any problem in the motor wiring (phase sequence and connection) and encoder wiring. 2, consider the operating conditions and load and determine the driver or motor selection is reasonable 3. Observe whether the motor has large jitter during operation. If

		there is a huge noise, adjust the gain parameter to eliminate noise or jitter. Also, use a virtual oscilloscope to monitor whether the motor output torque is abnormal.
Er.730	**DB overload 1**	1. The load is too heavy when the machine stops that cause the overload of DB resistor and you could try to reduce the operating speed or reduce the load. 2. check whether the motor is driven by external force 3. according to customer needs, re-evaluate whether it needs to pass the DB mode requirements during the shutdown, if you do not need, you can choose other ways to stop 4. If the fault is reported in the last operation, run after waiting for a while after powering on.
Er.7A0	**Heat sink over-heat**	1. Check whether the air duct is blocked and the fan is damaged with a fan drive. 2. Check the installation conditions of the driver, whether the heat dissipation condition is good or not and increase the heat dissipation condition of the driver as much as possible. 3. Check the drive load conditions, if the load is too heavy, you can suggest that customers replace a high-power segment of the drive. 4. If possible, reduce the driver carrier frequency
Er.810	**Abnormal encoder backup**	1. Check the multi-turn encoder battery power condition 2. Perform multi-turn encoder clear operation
Er.830	**Battery under-voltage**	Replace multi-turn encoder battery
Er.BF4	**Hardware over-current**	Unplug the power cable and turn on the servo unit again. If an alarm still occurs, the servo unit may be malfunctioning, and then you could replace the servopack. If not, confirm whether it is power line or motor failure
Er.C10	**Out of control alarm**	1. Check if the motor wiring is normal 2. Check if the motor and encoder are normal 3. Re-connect the servo drive power, if an alarm still occurs, it may be a servo drive failure
Er.C90	**Encoder communication failure: line-broken**	1. Use multimeter to test every signal line of the encoder line and see if signal lines break. 2. Check the encoder line model and confirm the model is correct. 3. Check the length of the encoder line and the encoder line can not be too long. 4. It may be caused by interference, try to ground the driver or wire the encoder around the magnetic ring 5. check the motor group parameters and confirm the motor is correct 6. If you already exclude various reasons and the servo driver may malfunction, then you could consider replacing the servo unit.
Er.C91	**Abnormal encoder communication position data acceleration**	
Er.CA0	**Abnormal encoder parameters**	

Er.D00	**Excessive position deviation**	1. Set the appropriate position deviation excessive alarm value 2. Check whether the encoder cable and motor cable are connected properly. You can use the hand to rotate the motor and monitor whether the Un003 (rotor relative Z pulse position) varies between 0 and 16777216 (24-bit encoder). 3. Calculate the pulse frequency input and acceleration planning and check if the electronic gear ratio setting is reasonable 4. Determine whether the relevant parameters are reasonable. For example: you could check the torque limit, speed limit, inertia ratio, position gain, speed gain is too small or the position filter is too large, etc. 5. Calculate if the motor selection is too small or the acceleration and deceleration are too slow that cause huge position deviation.
Er.D01	**Excessive position deviation during servo ON**	Set correct value of Pn267 (overrunning position deviation when servo is ON)
Er.D02	**Excessive position deviation alarm caused by speed limit during servo ON**	Set correct Maximum position deviation threshold (Pn264) or set correct speed limit value (Pn270) during servo ON.

10.2. **Warning Code**

Warning code	Type	Solutions
AL.900	Excessive Position deviation warning	1. Correctly set relevant parameters such as gear ratio, gain, position filtering, torque limit, etc.
		2. confirm the encoder line motor wiring is correct
		3. If you already exclude various reasons, the servo driver may malfunction and you could consider replacing the servo unit.
AL.901	Excessive position deviation warning during servo ON	Set correct excessive position deviation value during servo ON
AL.910	Overload warning	1. Check if there is any problem of the motor wiring and encoder wiring.
		2. Incorrect motor or driver selection
AL.911	Vibration warning	1. Reduce the motor speed or reduce the speed loop gain.
		2. Set the moment of inertia ratio correctly
AL.920	Regeneration overload warning	1. Set the power supply voltage within the specification range.
		2. Set resistance value and capacity correctly
		3. Replace the servo drive because of servo driver failure
AL.921	DB overload warning	1. Reduce the servo motor command speed.
		2. Reduce the rotary inertia ratio.
		3. Replace the servo drive because of servo driver failure
AL.930	Battery under-voltage warning	Replace the battery
AL.941	Parameter change warning needed to re-power off	Power down the drive before restart it
AL.971	Under-voltage warning	1. Adjust the AC/DC power supply voltage to the product specifications.
		2. increase the power capacity.

11.Communication

11.1. **Communication introduction**

Servo driver can support RS485, CANopen bus type, EtherCAT bus type, MECHATROLINK-II bus type. Here we mainly introduce the related content of general model RS485 communication. Other communication needs to refer to the special communication manual. 485 communications can realize the following functions.

a) Read and write servo driver function code related parameters

b) Monitor the working status of the servo drive

c) Constitute a multi-axis control system

d) Operate the servo assist function

11.2. **RS485 communication protocol description**

Provide RS485 communication interface, the wiring is detailed in CN6, and the master-slave communication is carried out by the international standard Modbus communication protocol. Users can achieve centralized control through PC/PLC, control PC, etc. to suit specific application requirements.

The Modbus serial communication protocol defines the frame content and usage format for asynchronous transmission in serial communication. These include: host polling and broadcast frame, slave response frame format; host organization frame content includes: slave address (or broadcast address), execution commands, data and error check. The response of the slave is also the same structure, including: action confirmation, return data and error check. If the slave encounters an error while receiving a frame, or fails to complete the action requested by the host, it will organize a fault frame as a response to the host.

The communication protocol is an asynchronous serial master-slave Modbus communication protocol. Only one device (host) in the network can establish a protocol (called "query/command"). Other devices (slave) can only respond to the host's "query/command" by providing data, or according to the host's "query/command". The host here refers to a personal computer (PC), an industrial control device or a programmable logic controller (PLC), etc. The slave refers to a servo drive or other control device having the same communication protocol. The host can communicate with a slave separately and broadcast information to all slaves. For a host "query/command" that is accessed separately, the slave must return a message (called a response). For the broadcast message sent by the host, the slave does not need to feed back the response message to the host.

11.3. **Communication frame structure**

Modbus only supports RTU transmission mode. The user can configure the serial communication parameters (baud rate, check mode, etc.).

Each 8Bit byte in the message frame contains two 4Bit hexadecimal characters.

Start bit	Device address	command	data	CRC check	Terminator
T1-T2-T3-T4	8Bit	8Bit	N 8Bit	16Bit	T1-T2-T3-T4

In this mode, the message transmission starts at least at a pause interval of 3.5 characters. During transmission, the network device continuously detects the network bus, including the pause interval. When the first field (address field) is received, the corresponding device decodes the next transmitted character, and if there is a pause of at least 3.5 characters, it indicates the end of the message.

In RTU mode, the entire message frame must be transmitted as a continuous stream. If there is a pause time of more than 1.5 characters before the frame is completed, the receiving device will refresh the incomplete message and assume that the next byte is the address of a new message. area. Similarly, if a new message begins with the previous message in less than 3.5 character times, the receiving device will consider it a continuation of the previous message. If the above two situations occur during the transmission, the CRC check will inevitably generate an error message and feed back to the sender device.

11.4. **Command code and communication data description**

In the communication command, the data address read and written is the hexadecimal number of the parameter name, for example, the address of the inertia ratio Pn100 is 0x0100.

(1) Command code: 03H

Function: Read N words (Word can read up to 16 words in succession).

For example, if the servo drive with the slave address 01H reads the address e003 and reads two consecutive words, the structure of the frame is described as follows.

Host command information:

START	T1-T2-T3-T4（3.5 bytes of transmission time）
ADDR	01H
CMD	03H
Read start address high	e0H
Read start address low	03H
high number of data (in word)	00H
low number of data is (in word)	02H
CRC CHK low bit	03H
CRC CHK high bit	CBH
END	T1-T2-T3-T4（3.5 bytes of transmission time）

The slave responds to the message:

START	T1-T2-T3-T4（3.5 bytes of transmission time）
ADDR	01H
CMD	03H
Number of bytes	04H
The high content of the starting data address 03F2H	3AH
Content status of the starting data address 03F2H	9AH
The content of the second data address 03F3H is high	00H
The lower content of the second data address 03F3H	05H
CRC CHK low bit	16H
CRC CHK high bit	C7H
END	T1-T2-T3-T4（3.5 bytes of transmission time）

(2) Command code: 10H

Function: Write N words (Word), N ≥ 2.

For example, write 100 to the 0100H address of the slave address 01H servo drive and 400 to the 0101H address of the slave address 01H servo drive.

The structure of the frame is described as follows:

Host command information:

START	T1-T2-T3-T4（3.5 bytes of transmission time）
ADDR	01H
CMD	10H
Write data address high	01H
Write data address low	00H
The number of data is high (in word)	00H
Number of data status (calculated in word)	02H
Number of bytes	04H
The first word high of the data content	00H
The first word of the data content is low	64H
The second word high of the data content	01H
The second word of the data content is low	90H
CRC CHK low bit	BEH
CRC CHK high bit	1CH
END	T1-T2-T3-T4（3.5 bytes of transmission time）

The slave responds to the message:

START	T1-T2-T3-T4（3.5 bytes of transmission time）
ADDR	01H
CMD	10H
Write data start address high	01H
Write data start address low	00H
The number of data is high (in word)	00H
Number of data status (calculated in word)	02H
CRC CHK low bit	40H
CRC CHK high bit	34H
END	T1-T2-T3-T4（3.5 bytes of transmission time）

11.5. **Communication frame error check mode:**

The error check mode of the frame mainly includes two parts of the check, that is, the bit check of the byte (odd/even check) and the entire data check of the frame (CRC check or LRC check).

11.5.1 Byte Bit Check

Users can choose different bit verification methods as needed, or they can choose no parity, which will affect the parity bit setting of each byte.

The meaning of even parity: an even parity bit is added before data transmission to indicate whether the number of "1" in the transmitted data is odd or even. When it is even, the check position is "0", otherwise it is set. It is "1" to keep the parity of the data unchanged.

The meaning of the odd check: an odd parity bit is added before the data transmission to indicate whether the number of "1" in the transmitted data is odd or even. When it is odd, the check position is "0", otherwise it is set. It is "1" to keep the parity of the data unchanged.

For example, you need to transfer "11001110", the data contains 5 "1", if you use even parity, its even parity bit is "1", if you use odd parity, its odd parity bit is "0", transmission In the case of data, the parity bit is calculated at the position of the check bit of the frame, and the receiving device also performs parity check. If the parity of the accepted data is found to be inconsistent with the preset, it is considered that the communication has an error.

11.5.2 CRC check method --- CRC (Cyclical Redundancy Check)

Using the RTU frame format, the frame includes a frame error detection field calculated based on the CRC method. The CRC field detects the contents of the entire frame. The CRC field is two bytes and contains a 16-bit binary value. It is calculated by the transmission device and added to the frame. The receiving device recalculates the CRC of the received frame and compares it with the value in the received CRC field. If the two CRC values are not equal, the transmission has an error.

The CRC is first stored in 0xFFFF, and then a procedure is called to process the consecutive

6 or more bytes in the frame with the values in the current register. Only the 8Bit data in each character is valid for the CRC, and the start and stop bits as well as the parity bit are invalid.

During the CRC generation process, each 8-bit character is individually different from the register contents (XOR), and the result moves to the least significant bit direction, and the most significant bit is padded with 0. The LSB is extracted and detected. If the LSB is 1, the register is individually or different from the preset value. If the LSB is 0, it is not performed. The entire process is repeated 8 times. After the last bit (bit 8) is completed, the next octet is individually different from the current value of the register. The value in the final register is the CRC value after all the bytes in the frame have been executed.

This calculation method of CRC adopts the international standard CRC check rule. When editing the CRC algorithm, the user can refer to the CRC algorithm of the relevant standard to write a CRC calculation program that truly meets the requirements.

11.6. **Error message response**

When the slave responds, it uses the function code field and the fault address to indicate whether it is a normal response (no error) or an error (called an objection response). For a normal response, the slave responds with the corresponding function code and data address or sub-function code. In response to the objection, the device returns a code equivalent to the normal code, but the first position is logic 1.

For example, if a message sent by a master device to a slave device requires reading a set of servo driver function code address data, the following function code will be generated:

0 0 0 0 0 0 1 1 (hex 03H)

For a normal response, the slave responds with the same function code. In response to the objection, it returns:

1 0 0 0 0 0 1 1 (hexadecimal 83H)

In addition to the modification of the function code due to an objection error, the slave device will respond with a one-byte exception code, which defines the cause of the exception.

After the master application responds with an objection, the typical process is to resend the message or make a command change for the corresponding failure.

Modbus exception code		
Code	name	meaning
01H	Illegal function	When the function code received from the host computer is an operation that is not allowed, this may be because the function code is only applicable to the new device and is not implemented in the device; at the same time, the slave may also process the request in an error state.
02H	Illegal data address	For the servo drive, the request data address of the upper computer is an unallowable address; in particular, the combination of the register address and the transmitted byte number is invalid.
03H	Illegal data value	The received data value exceeds the range of the address parameter, causing the parameter change to be invalid.

Modbus exception code		
Code	name	meaning
11H	Parity error	When the RTU format CRC check bit or the ASCII format LRC check bit is different from the check calculation number of the lower computer in the frame information sent by the host computer, the check error information is reported.

12.Host Debugging Instruction

12.1. **System Requirements**

12.1.1. **System Configuration**

1. When the user uses the software for the first time, please confirm whether the NET3.5 and NET4.0 frameworks are installed. This is a prerequisite; otherwise the software cannot be opened. But for Win7 and above operating systems, there is no need to install NET 3.5 and NET 4.0 frameworks.

2. The host computer system currently supports USB communication debugging.

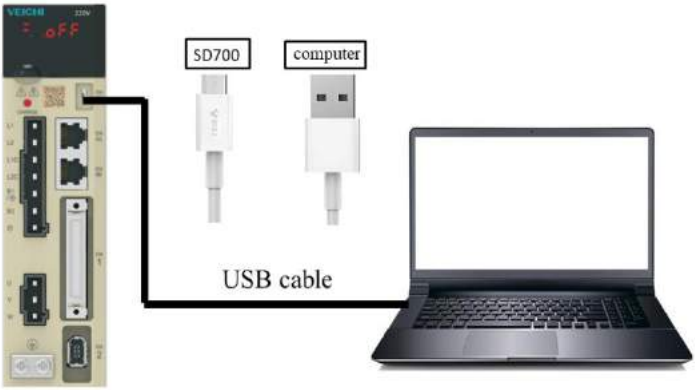
3. The system only supports servo SD700 series servo product debugging;

4. Verify that the "Use FIPS-compliant algorithms for encryption" option is set to disabled (Control Panel - Administrative Tools - Local Security Policy - Security Options - Use FIPS-compliant algorithms for encryption - disabled)

12.1.2. **Connection Configuration**

The servo driver is connected to the computer through the communication connector, and the interface type is USB. Basic configuration:

1. Anti-jamming Android micro phone data cable.

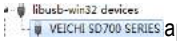


1. Connection between PC and SD700 servo drive via Android micro mobile phone data cable

2. Click My Computer - Manage - Device Manager and find 

3. Right-click and select "Update Driver", select "Browse calculations to find driver software"

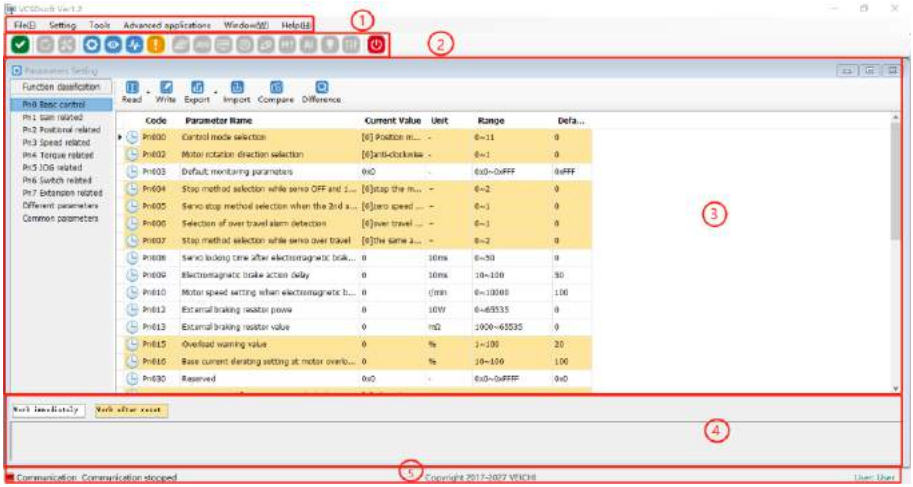
4. Manually select the upper machine installation package file for driver installation.

5. Then the device manager 

appears, indicating that the installation has been successful.

12.2. **Main Interface**

The main interface includes menu bar, toolbar, function display area, information bar, status bar and other functions, as shown in the following figure;



Menu bar

The menu bar includes functions such as files, settings, tools, advanced applications, windows, and help;

[File]: Open and exit the system;

[Settings]: user rights, service personnel rights, developer rights;

[Tools]: parameter settings, real-time monitoring, digital oscilloscope, fault information, screenshots and other functions;

[Advanced applications]: inertia identification, JOG, program JOG, homing, mechanical characteristics, FFT analysis, single parameter adjustment, intelligent adjustment, offset adjustment;

[Window]: Cascading display, horizontal display, vertical display, all off;

[Help]: about;

[Toolbar]

The toolbar includes communication disconnection, communication connection, JOG, program JOG, soft reset, factory reset, parameter setting, monitoring parameters, digital oscilloscope, fault maintenance, screenshot, mechanical characteristics, FFT analysis, intelligent adjustment, offset adjustment, single parameter adjustment, exit and other functions;

Function display area

The function display area is used as a form container to provide sub-window display of reading and writing parameters, monitoring parameters, digital oscilloscope, fault maintenance, and function debugging;

Information columns

[Some parameters] show supplementary explanation

Status bar

The status bar includes the current communication status and servo work status.

12.3. Features

File

Documents include open, exit, etc.;

Turn on

Open function: open the existing file;

Step:

Click the menu bar [File] -> [Open] -> [Select the current system directory folder Test32] -> [Select VCDGSmsyc.vcb file];

Exit

Exit function: Close the current system

Step:

Click [Exit] in the file column, exit the system, or click [Exit System] on the motor toolbar to exit the system.

Read and write parameters

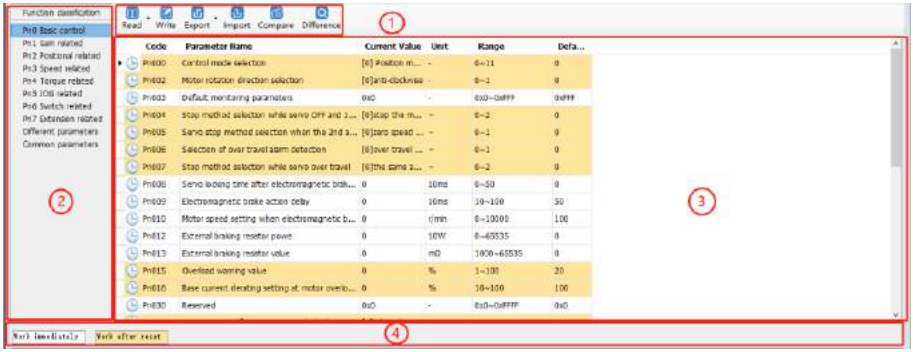
Read and write parameters include functions such as reading and writing of function codes, import, and export;

Step:

1. Start reading and writing parameters interface:

Click on the menu bar "Tools" -> "Parameter Settings"

2. The pop-up read/write parameters (parameter setting) interface is displayed in the display area, as shown in the following figure:



1- Toolbar

The toolbar includes reading the current page function code, reading all page function codes, writing function codes to EERPOM, exporting the current page function code, exporting all function codes, importing function codes in batches, comparing the differences of two file parameters and finding out modified parameters, as shown below:

2-Multi page

Each page is displayed in different functional groups. At the same time, common parameters and different parameter pages are added to facilitate viewing of function codes.

3-function code

The function code is a specific function and provides relevant information such as the current state, name, current value, unit, default value, minimum value, maximum value, and attribute, etc. When a row is clicked, the corresponding function code comment is provided as below;

 : Waiting  : Communication is normal

4— Information column

Display parameter modification after the effective mode and function code supplementary explanation;

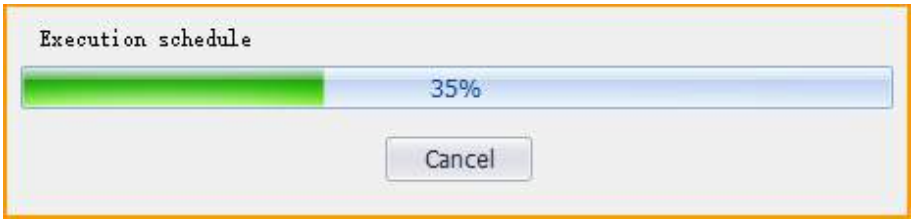
Function code reading

Function code reading can be read individually or in batches.

Step:

1. Current group read: switch to a group of parameters, left-click on [read] -> select [current group], read the current group parameters

2. Read all: Left-click on [Read] -> Select [All] to read all parameters and the pop-up dialog box will display the progress of the read function code in the form of a progress bar; as shown in the following figure:



Function code write/import

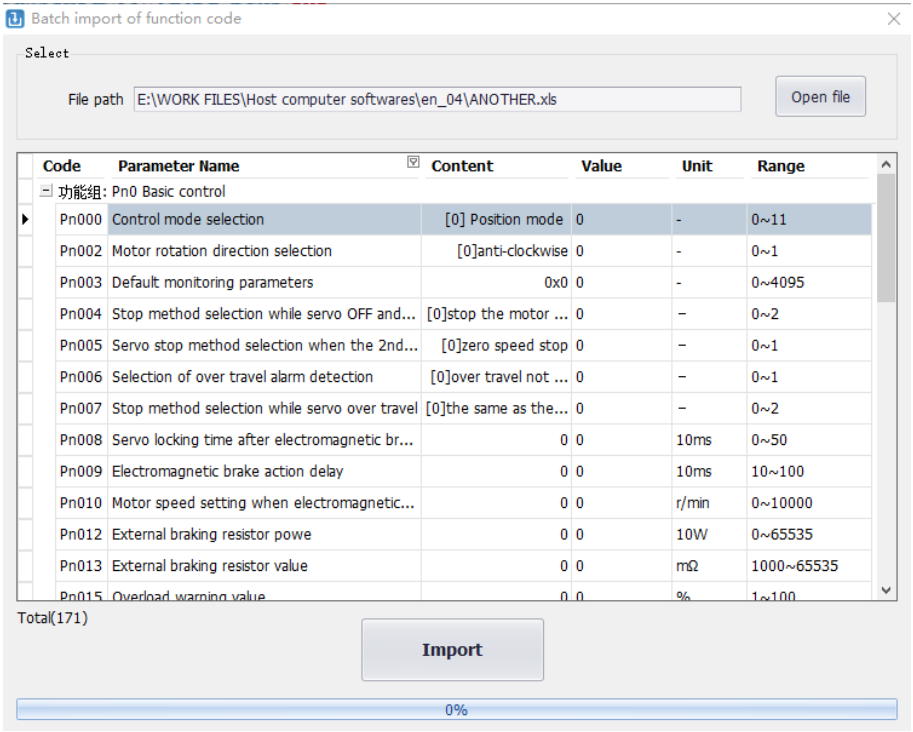
Function code writing can be individually written.

Step:

1. write individually: select a function code, click on the column corresponding to the current value, click twice in succession, it may enter the editing state, enter the value then click on Enter, the system will automatically send a write command, or directly click [Write] on the toolbar after editing to finish writing the parameters.

2, Steps to import in batches:

Click [Import] → [Select File] -> Click [Import], as shown in the following figure:



Function code export

Function code export can export current and all function codes;

Step:

1. Click on the toolbar icon  to select the current group and complete the current group export; or select all to complete the export of all function codes.

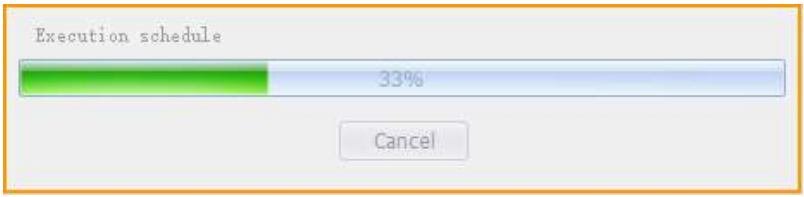
Find different function codes

Finding different function codes can find out the modified parameters to facilitate user

analysis

Step:

1. Click on the toolbar icon to find out the modified parameters. At the same time, the pop-up dialog box will display the progress in the form of a progress bar as shown in the following figure.

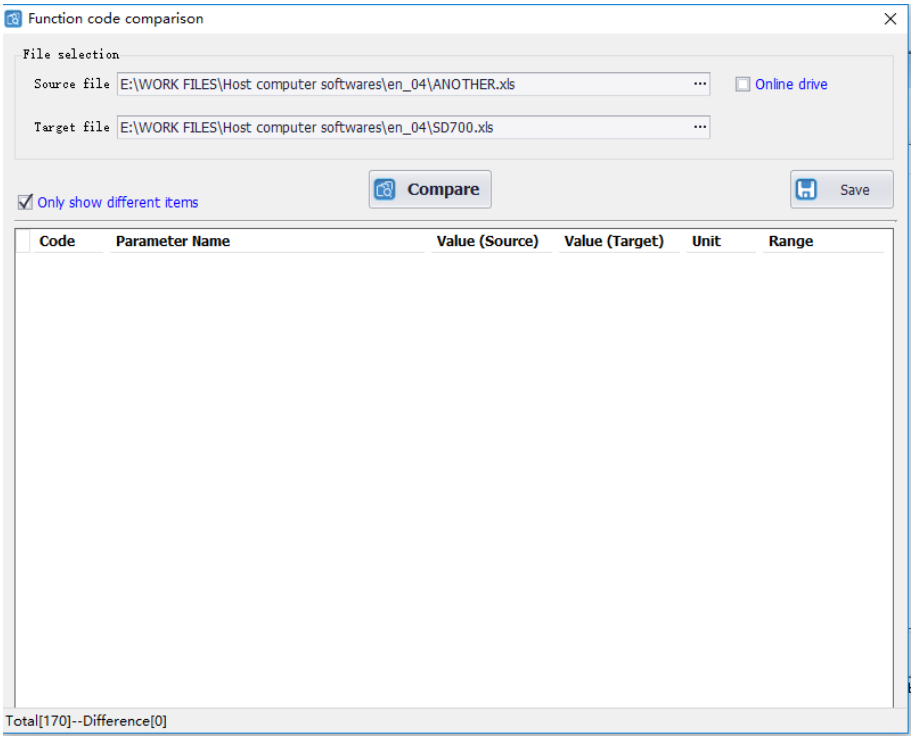


Function code comparison

Compare two sets of exported function codes

Step:

1. Click on the toolbar icon, the function code comparison file selection interface appears. Select the source file and the target file respectively then click on [Compare], and the following interface appears. Click on Save to save the two parameters of the two files.

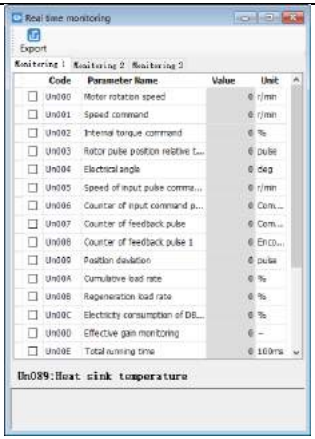


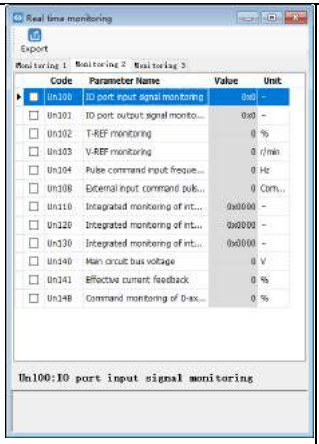
12.4. **Real-Time Monitoring**

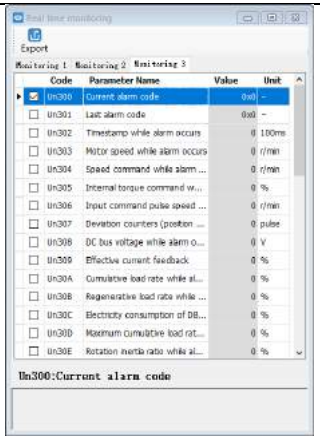
Real-time monitoring provides real-time monitoring of monitoring parameters and I/O status, as well as current fault information;

Step:

1. Start the real-time monitoring interface. As shown in the figure below, the monitoring parameters are divided into three groups. The monitoring parameters can be added to the common parameters.







2. Check the monitored parameters and monitor the servo. During the monitoring process, you can also export and save the monitoring content.

Monitoring parameter export

The export of monitoring parameters is a way to output and save the monitoring parameters, which can facilitate the customer to save the monitored parameters.

Step:

1. Check the monitored parameters. If you want to export all parameters in the current group, right-click in the monitored parameters area, select All group, and then click Export. Select the save path and save the monitoring data in the EXCEL file format.

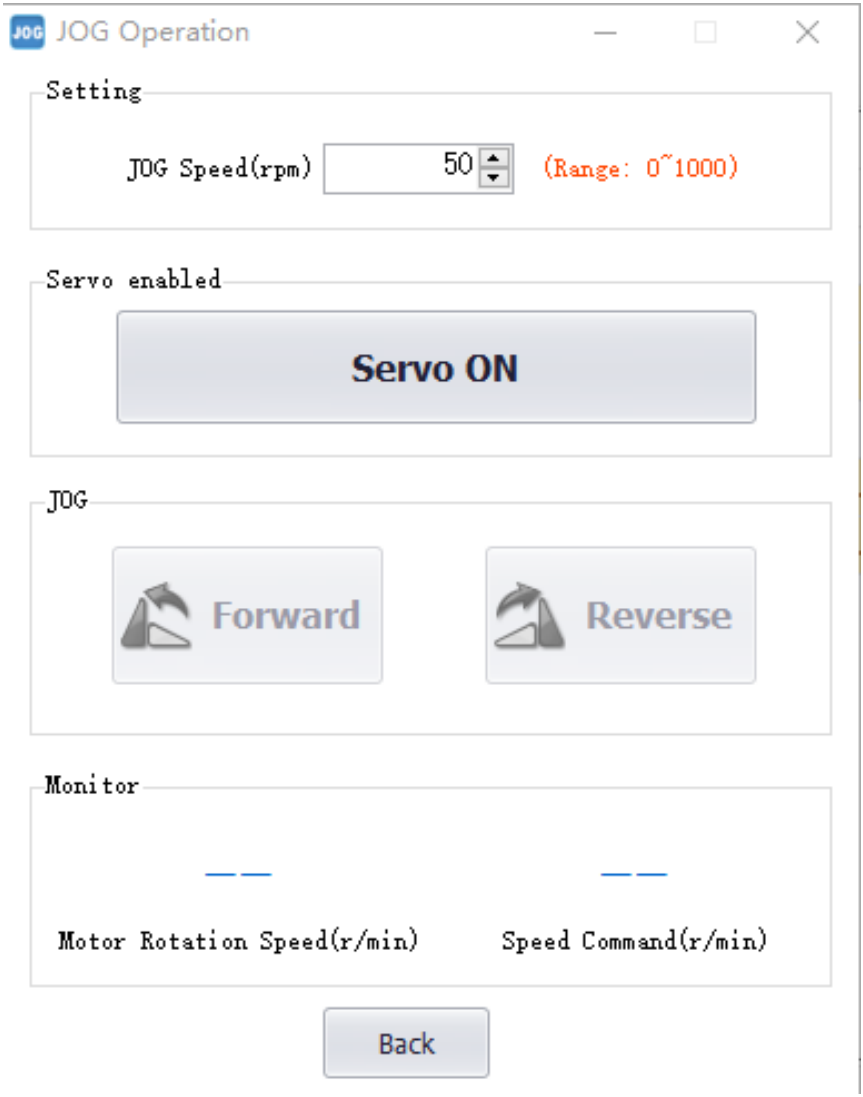
12.5. **Auxiliary Functions**

12.5.1. **JOG**

The JOG operation is a function to confirm the operation of the servo motor by driving the servo motor at the previously set JOG speed (rotation speed) without connecting the host device. By performing this operation confirmation, it is possible to confirm whether or not the connection to the wire is improper and whether the servo motor has failed.

Step:

1. Click the icon JOG on the main interface of the host computer to enter the jog operation interface. As shown in the left figure below, click Start, and then click forward rotation. The servo will execute forward rotation, click Reverse, and the motor will perform reverse rotation.

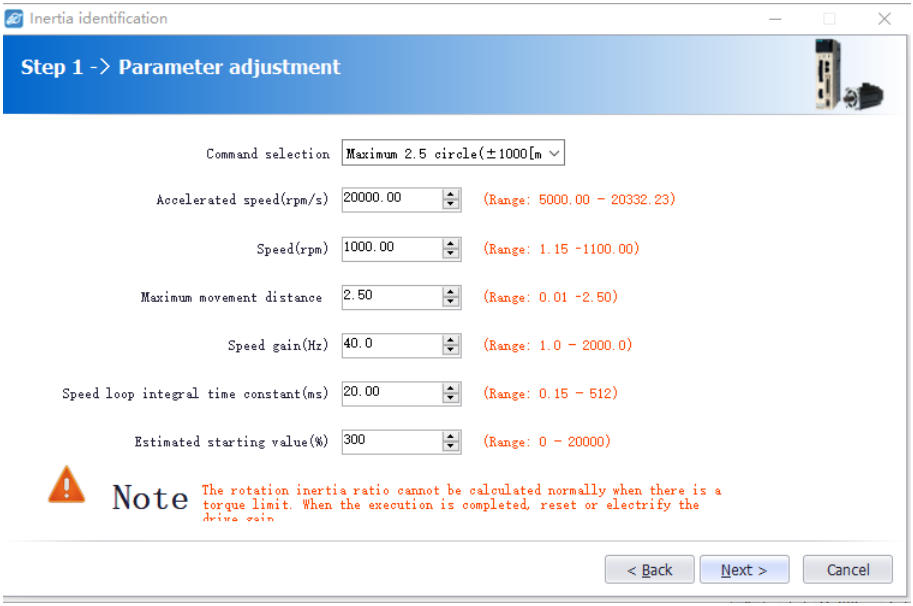


12.5.2. **Inertia Identification**

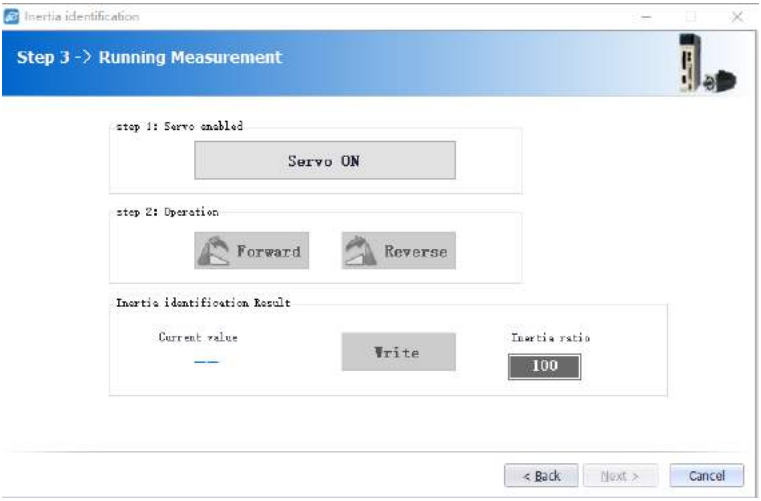
The inertia Identification function allows the servo unit to perform automatic operation (forward and reverse reciprocating motions), and estimates the moment of inertia of the load during operation.

Step:

1. Click [Inertia Identification]→[Next] on the host interface to enter the following interface in the inertia identification operation process, as shown in the following figure.



2. As shown in the above figure, set the corresponding parameters according to the actual situation (usually keep the default), and click [Next] → [Write] → [Next] → [Enable] → [Forward] → [Reverse] After the forward rotation is repeated three times, the final inertia identification result is displayed, as shown in the following figure.



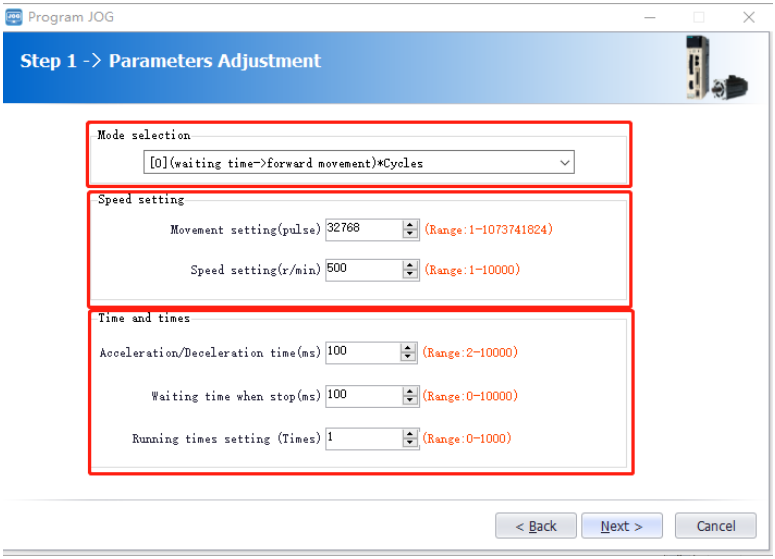
3. Click [Write]→[Next]→[Complete] to finish the inertia recognition process.

1.1.1.1.1 12.5.3 Program JOG

The JOG operation of the program refers to the function of executing the continuous operation in the previously set operation mode (moving distance, moving speed, acceleration/deceleration time, waiting time, number of movements). This function is the same as the JOG operation, and the upper apparatus is not connected during the setting. The servo motor operation can be confirmed and a simple positioning operation can be performed.

Step:

1. Click on of the main interface of the host computer to enter the program jog operation process, and then click on [Next] to enter the parameter adjustment interface and set related parameters as required. The detailed interface is as shown in the figure below.



4. After setting the corresponding parameters, click on [Next] → [Write] → [Next] → [Enable] → [Execution] → [Next] → [Complete]. The program JOG operation process ends.

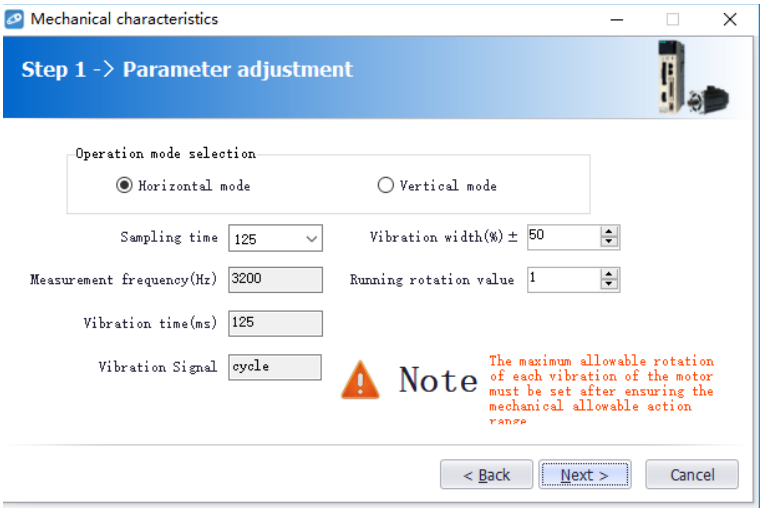
12.5.3. **Mechanical Characteristics**

Mechanical analysis characteristics mean that the servo unit performs automatic operation (positive and negative reciprocating motion) without issuing an instruction from the host computer, and the function of estimating the common vibration frequency of the mechanical system during operation is performed.

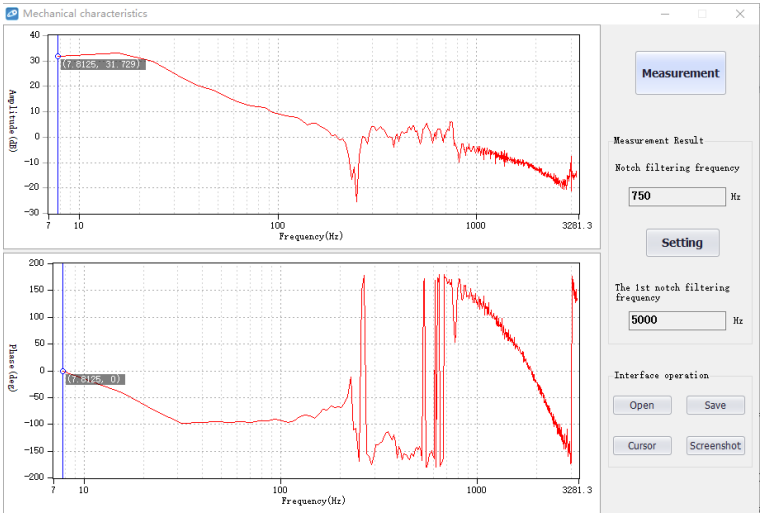
Step:

1. Click on of the main interface of the upper computer to enter the mechanical

characteristics analysis operation process, click on [Next] → [Next] to enter the parameter adjustment interface, and adjust the corresponding parameters according to the actual situation, as shown in the following figure.



2. Click [Next] → [Write] → [Next] → [Enable] → [Forward] → [Enable] → [Reverse] → [Next] → [Complete] to enter the mechanical properties FFT analysis interface, as shown in the figure below



2. From the above figure, you can analyze the frequency, amplitude, and phase of the

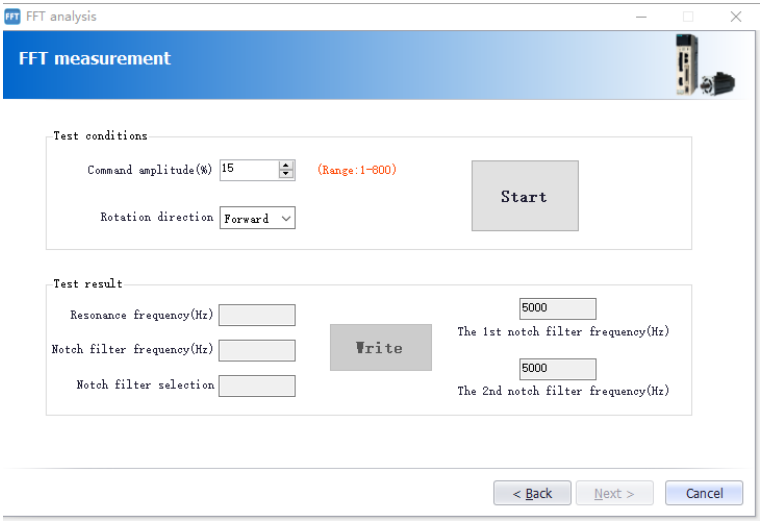
resonance frequency. Click on [Settings] to set the frequency of the first notch filter. After the setting is completed, the screen is closed. Mechanical properties are completed.

12.5.4. **Analysis**

EasyFFT transfers the periodic waveform commands from the servo unit to the servo motor and rotates the servo motor slightly for a certain time to cause the vibration of the machine. The servo unit detects the resonance frequency based on the vibration generated by the machine, and then sets the corresponding notch filter according to the resonance frequency. The notch filter effectively removes high-frequency vibrations and noise.

Step:

1. Click on to enter the FFT measurement interface. Set the command amplitude and rotation direction in the measurement conditions. Click to start measurement and you can measure the frequency of the first notch filter, as shown in the figure below.



2. Click on [Start] to measure the first notch, and then click on [Write] to write the frequency of the first notch filter.

3. Click on [Start] to measure the second notch, and then click on [Write] to write the second notch filter frequency

4. Click on [Next] → [Done] to close the operation interface and the FFT analysis is completed.

12.5.5. **Bandwidth setting**

Bandwidth setting is the method of inputting a speed command or position command from the host device and manually adjusting it while it is running. By adjusting one or two values via

bandwidth setting, the relevant servo gain settings can be automatically adjusted.

Bandwidth setting adjusts the following items.

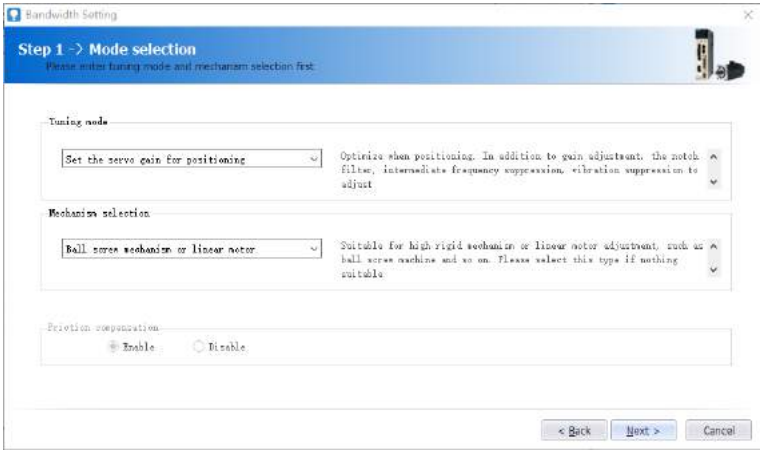
• Gain adjustment (speed loop gain, position loop gain, etc.)

• Filter adjustment (torque command filter, notch filter)

• IF suppression control

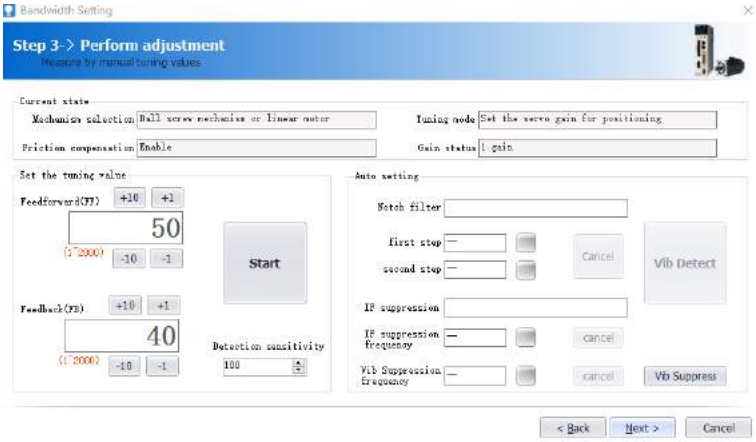
Step:

1. Click of the main interface of the upper computer to enter the single parameter adjustment prompt interface, click on [Next] to enter the parameter adjustment interface, select the organization selection according to the actual situation, and select the desired mode, as shown in the following figure.



2. Click on [Next] to enter the setting interface of inertia moment ratio and set the inertia ratio (inertia ratio can be obtained through inertia identification function);

3. Click on [Next] to enter the single parameter tuning interface as shown in the following figure



3. Click on [Adjust Start] to tune the tuning value (generally increase). During the process of increasing the tuning value, the servo will vibrate. At this time, vibration detection will be performed automatically. If not, operation can be performed manually, and the tuning value can be set in combination with the figure captured by the digital oscilloscope, or 80% of the tuning value of the motor can be selected as the tuning value. Specific or combined with the actual site requirements for adjustment settings.

4. In the tuning process, when the servo motor is vibrating, it will detect the resonance frequency and the intermediate frequency suppression frequency. After the tuning is completed, click on [Next] to enter the auto tuning completion interface and click on [Finish] to complete the single parameter adjustment operation.

12.5.6. **Offset Adjustment**

Offset adjustment is divided into two parts:

1: Speed/torque command offset (automatic/manual) adjustment

2: Motor/current detection signal offset (automatic/manual) adjustment

Step:

1. Click  on the main interface of the host computer to enter the offset wizard interface. Click on [Next] to enter the offset adjustment function selection interface, select the function you need to adjust, and click on [Next] to enter the adjustment interface.

2. Set the adjustment method, click on [Next], click on [Finish], the offset adjustment screen closes, and the adjustment process ends.

12.5.8 Back to Origin

The origin search is a function that determines the position of the origin pulse (Z phase) of the incremental encoder and stops at this position.

Step:

1. Click  on the main interface of the host computer to enter the origin setting wizard

interface. Click [Next] to enter the execution instruction interface, as shown in the following figure.

2. Click [Enable] to enable the servo motor to enter the enable state, and then click [Forward Run] or [Reverse Run] to perform the origin search. After the search is completed, click [Next] to enter the back to origin setting interface and click [Completed] to return to origin operation

12.5.7. **Soft Reset**

The function could reset the servo unit from the inside by software. Used to re-power on or reset the alarm after changing the parameter setting. It is also possible to validate the setting without turning the power back on.

Step:

Click on the main interface of the host computer to perform a soft reset operation.

12.5.8. **Restoring the Factory Value**

The function is used to restore the parameter to the factory setting. Parameter initialization should note the problems as bellow:

1. Initialization of the parameter setting value must be performed during the servo OFF and it cannot be executed during the servo ON.

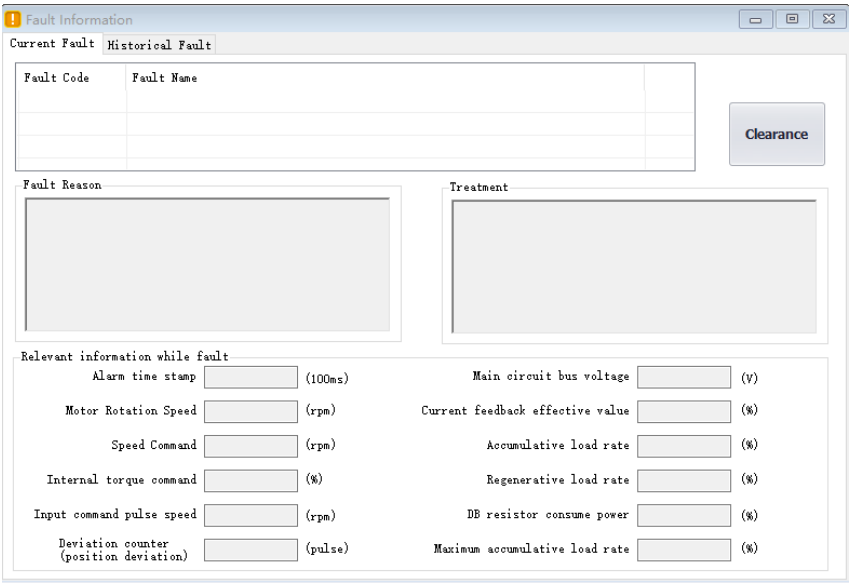
2. For the setting to take effect, the servo unit must be turned on again after the operation.

Steps:

Click on the main interface of the upper computer to restore the factory value. After the operation is completed, power it on again.

12.5.9. **Fault Information**

The fault information can display current faults, historical faults, causes of faults, handling measures, information related to faults, and clearing of fault information. Click to display the following interface



According to the above information, the servo fault is repaired.

12.6. **Digital Oscilloscope**

Digital oscilloscopes collect data at high speeds and display them graphically to analyze data.

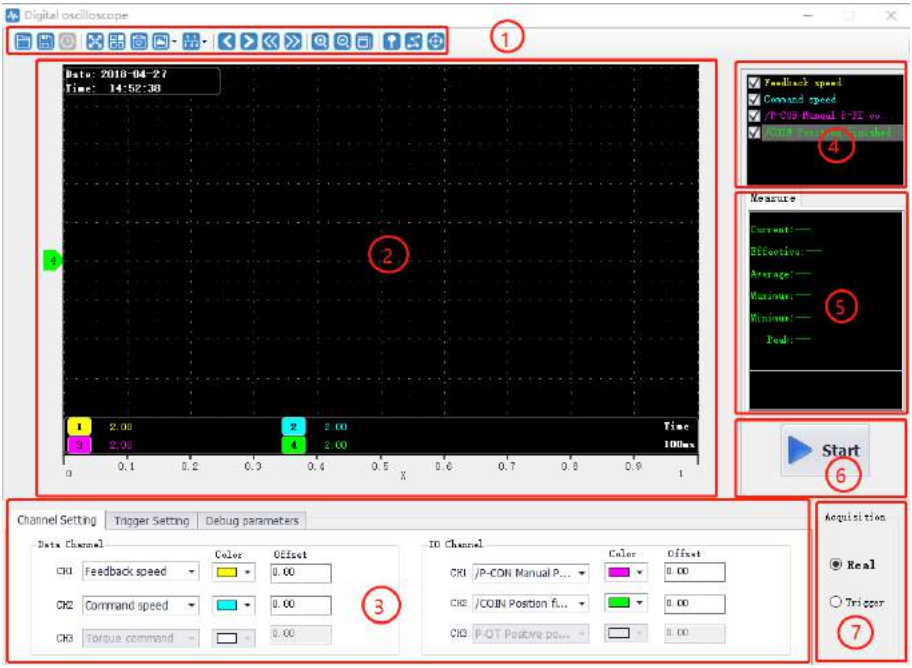
Steps:

1, start the data oscilloscope interface (provide two ways):

Method one: Click on the main menu of the host computer menu [Tools] -> [Oscilloscope], start the oscilloscope;

Method 2: Click the icon on the main interface of the host computer to start the oscilloscope.

3, display data oscilloscope interface, as shown below



1 - Toolbar

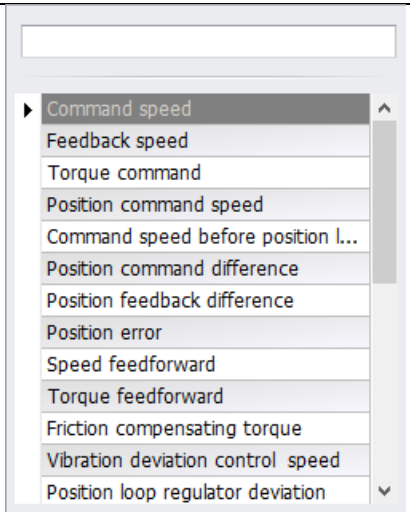
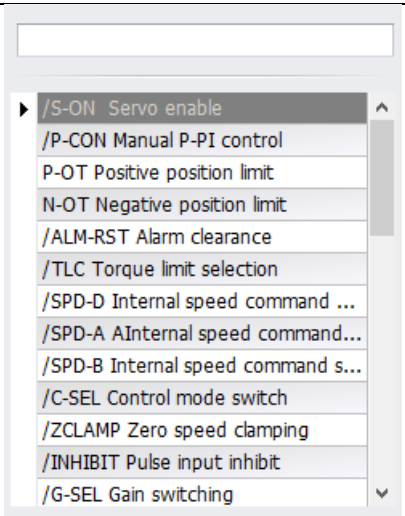
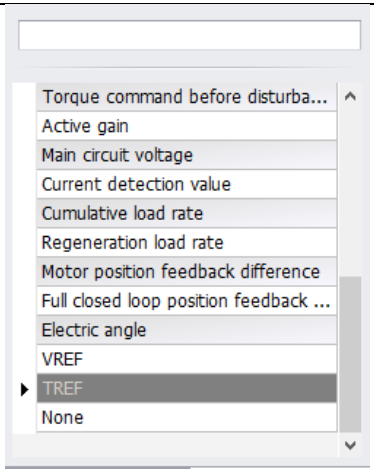
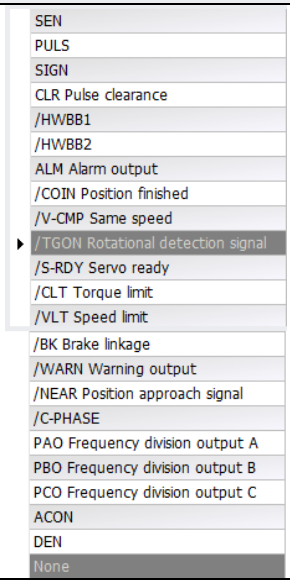
The toolbar includes open, save, full screen, style (switch to display background), settings, screenshots, legend, timeline, back, forward, rewind, fast forward, zoom in, zoom out, adaptive, zero position, dot/line , measurement and other functions

2 - Curve display area

Different curves provide visual display and measurement results for display;

3-channel setting and trigger setting

It provides channel-related parameter settings and trigger related parameter settings. Parameter setting includes trigger condition settings and channel settings; data channel detailed functions are as follows

Data channel	I/O channel
	
	

4 - Waveform display selection area

It provides selection and display of desired waveforms.

5 - Digital display of measured value

It provides display of current value, effective value, average value, maximum value, minimum

value, peak value, etc.

6 - Record button operation button

It's used to start and stop recording

7 - Collection method selection

It's used to choose the mode of wave recording, real-time and triggered acquisition

12.6.1. **Real-Time Acquisition**

Real-time acquisition is displayed in real time in the form of waveforms on the servo operating conditions.

Steps:

1. Start: Select real-time acquisition mode, set the channel settings, as shown in the figure below, then click the record button 

, start recording, and the status of the icon changes to 

,

2. Stop: click on the record button 

to stop recording, and the status of the icon changes to 

.

12.6.2. **Trigger Acquisition**

The trigger acquisition is based on the trigger condition and the acquisition cycle and makes the servo operation status displayed in the form of a waveform.

Steps:

1. Select the trigger for the acquisition mode. After the data channel and trigger conditions are set, as shown in the following figure, click the record button 

, which triggers the start of recording.

Note: After setting the trigger condition parameters, the terminal receives the trigger condition and will automatically judge according to the conditions.

2. After the waveform to be triggered is received, the waveform will remain in the last state;

the record button will change to 

.

3. If you need to trigger again, you need to start recording again;

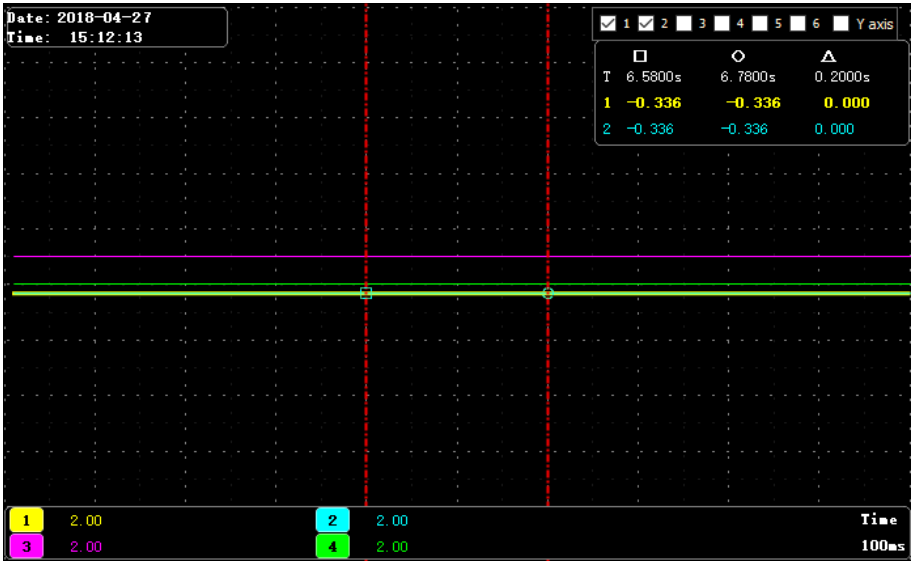
12.6.3. **Graphic Operations**

Graphic operations include X/Y zoom, XY label value, Y axis curve point and point display/hide and measurement, X axis curve point and point display/hide and measurement, curve zoom in/out, curve shift, curve zero adjustment , curve adaptive adjustment, graphics attribute settings and other functions

X axis cursor

Steps:

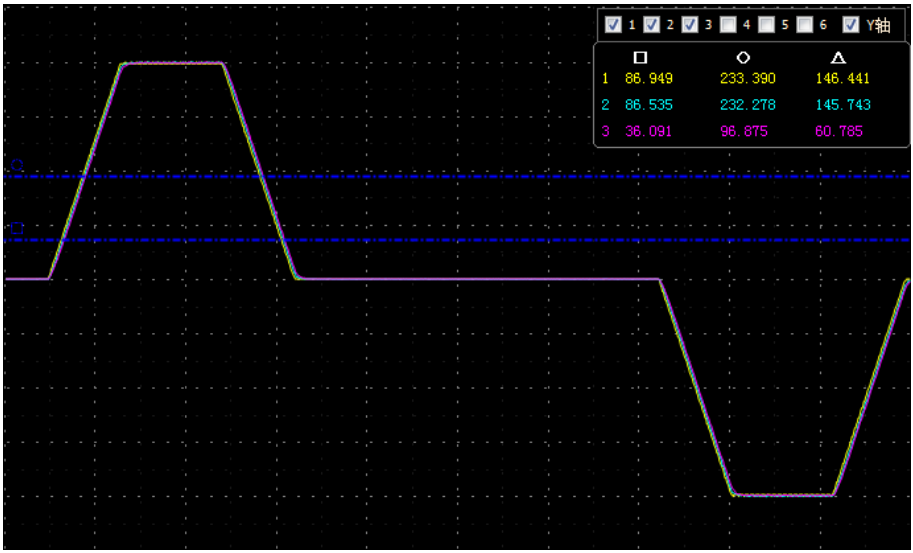
1. Click on the toolbar icon  , the graph will automatically display the two axes of the X-axis, and the upper right corner will automatically display the two axis values corresponding to the X-axis cursor, the difference between the data and real time as shown in the figure below:



Y axis cursor

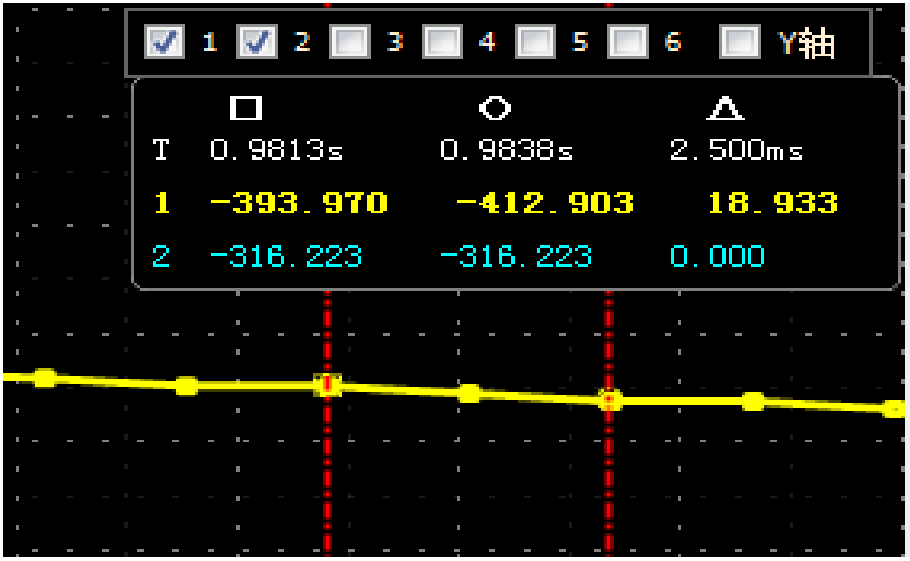
The Y-axis has two coordinate axes and functions are similar to the X-axis.

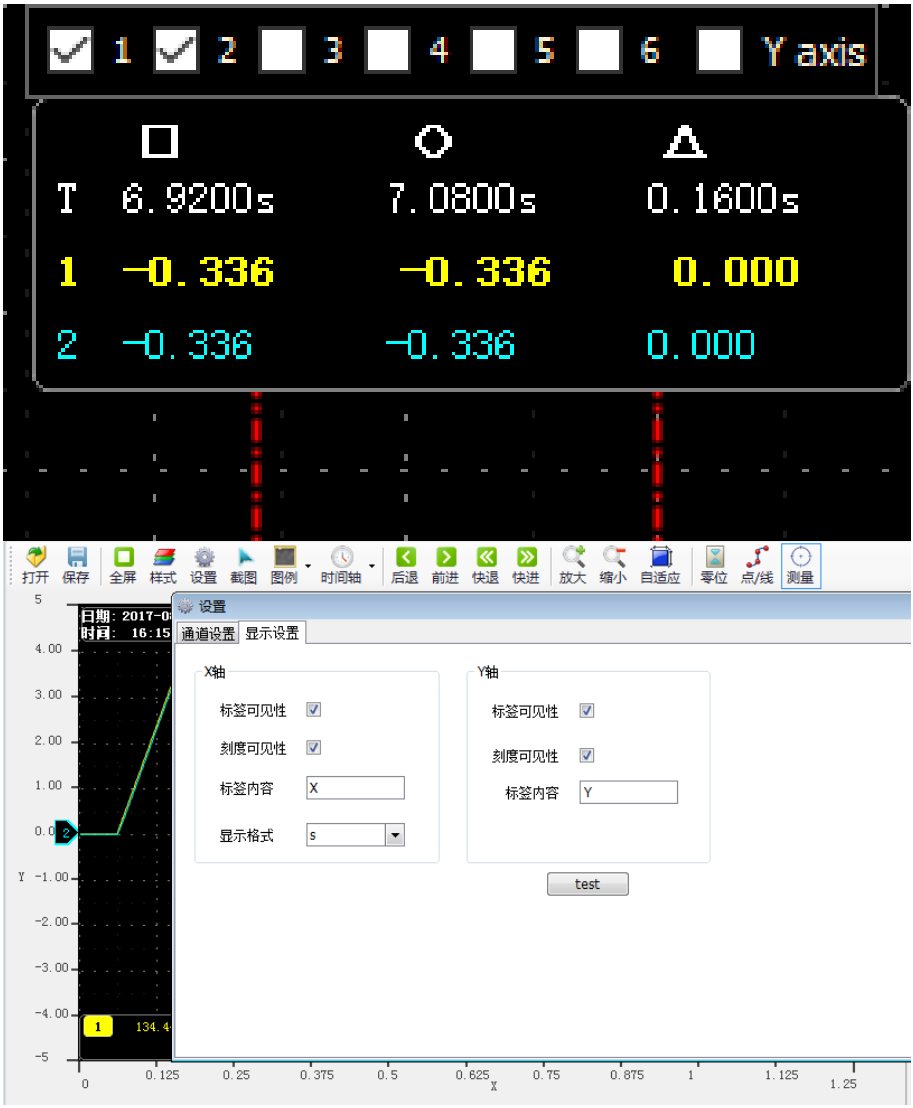
1. Click on the toolbar icon  to check the Y axis. The graph will automatically display the two axes of the Y axis. The two axes of the X axis cursor are automatically displayed in the upper right corner. The data difference between the two axes is shown in the figure below:



XY digital display

There are multiple axes on the Y axis, which can be selected according to the needs. Through the measurement function, the mouse will display the XY value of the current point in digital form as shown in the following figure.





Y axis scale display/hide

The Y coordinate scale is displayed as a fixed value, and the Y axis scale display/hide can be modified through the toolbar settings.

Steps:

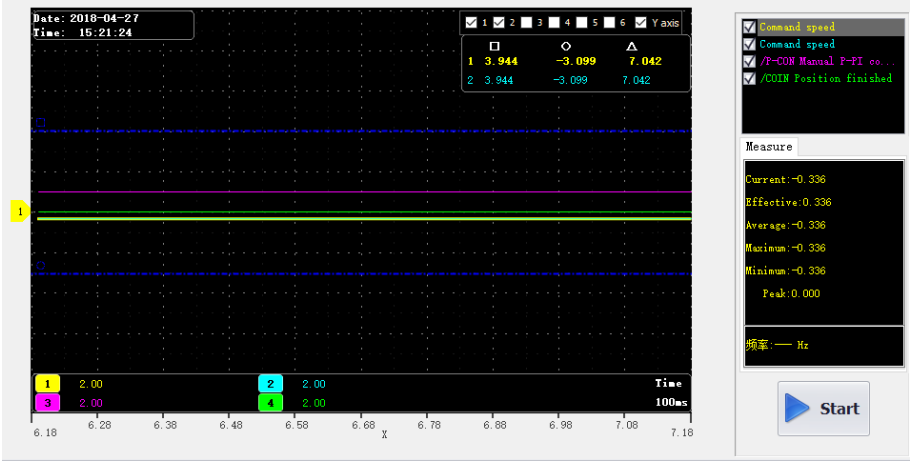
1. Click the top right corner of the oscilloscope interface and and in the Y axis option, check the label visibility and scale visibility.

Y-axis curve display/hide

The Y-axis has multiple curves, which can be selected according to the channel. The Y-axis curve is displayed by default.

Steps:

1. In the interface of digital oscilloscope, remove the unnecessary waveform options, and the corresponding Y-axis curve will be automatically hidden in the graphics; for example, let the position instruction speed waveform be hidden, remove the check signal in the corresponding options as shown in the following figure.



Curve zooms in/out

Steps:

1. Zoom in the area: Press the left mouse button and pull a zone from the upper left corner to the lower right corner, this area can be enlarged.

2. Zoom out the area: Press the left mouse button and pull a zone from the lower right corner to the upper left corner, this area can be reduced.

3. Zoom in curve X/Y: click on the button ;

4. Zoom out curve X/Y: click on the button ;

5. Zoom in curve X: Click on the button to decrease the time in the options.

6. Zoom out curve X: Click on the button to increase the time in the options.

7. Zoom in curve Y: Click on the gain option of the corresponding curve to decrease the gain value. As shown in the figure below, you can adjust the gain of six Y curves.

8. Zoom out curve Y: Click on the gain option of the corresponding curve to increase the gain value. As shown below:

Curve translation

Steps:

1. Horizontal panning of the curve: left-click on the toolbar , move left and right and move right and left fast (Note: When you move to the right to the maximum scale point, it will no longer move to the right).

2. A single curve vertical translation: left-click and hold the corresponding curve number and drag it up and down to perform a vertical translation.

Graphic import/export

According to the current graph, data and pictures can be exported at the same time. Only the bak format export is supported. In addition, the exported data can be imported for viewing.

Steps:

1. Data import: Click the digital oscilloscope toolbar icon to pop up the open dialog box and find the existing file;

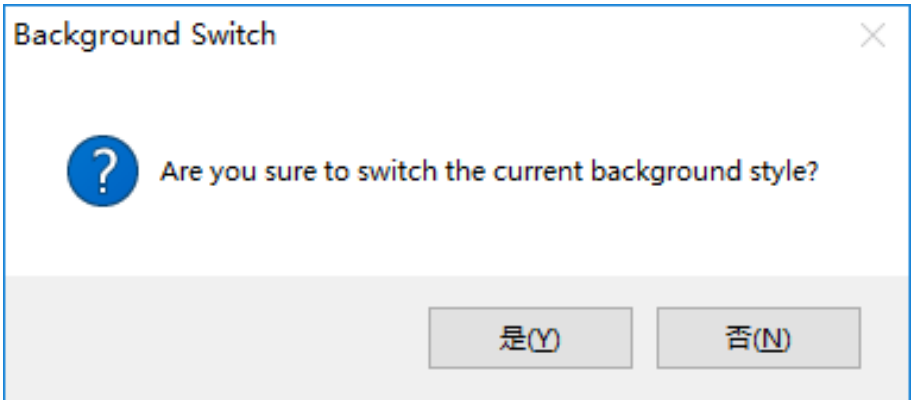
2. Data export: Click the toolbar icon to pop up the save dialog and save it to the specified path.

Background:

Digital oscilloscope display area provides two backgrounds, black color and white color

Steps:

1. Click the icon on the oscilloscope toolbar to display the prompt interface. As shown in the figure below, click OK to switch the display interface.



12.7. Others

12.7.1. Window Display

The window display is divided into: cascade, horizontal, vertical display, all off;

1. Cascade: click on the main menu of the host computer window [window] -> [cascade display];

2, level: click on the host computer interface menu bar [window] -> [horizontal display];

3, vertical: click on the main interface of the host computer menu window [window] -> [vertical display];

4. Close: Click on the main window of the host computer menu bar [Window] -> [Close all];

12.7.2. Help

It provides servo debugging software version and other information.

Steps:

Click on the menu bar [help] -> [about], the software version information appears, as shown below