

RT10 PA Pulse Series 220VAC Servo Drive User Manual



A&TS TECHNOLOGY CORPORATION LIMITED

www.a-ts.cn

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Version	Product	Release Date	Note
V-20-01	RT10	20.05.2020	N/A
V-21-01	RT10	19.04.2021	N/A
V-23-01	RT10	10.05.2023	N/A

Forward

The RT10 series ac servo is provided by A&TS Technology Co., Ltd. in China.

To have a thorough understanding, please read this manual carefully and follow all safety precautions before moving, installing, operating and maintaining the servo.

This manual provides guidance on safety precautions, product specifications, installation and wiring, keyboard operation, parameter settings, alarms, trouble-shooting, routine maintenance etc. It doesn't include all the security matters or considerations.

Local laws and regulations

All the local laws, regulations, and codes of practice should be obeyed first, besides the instructions in the manual.

Disclaimer of Liability




We have reviewed the contents of this publication to ensure consistency with the hardware and software described.

Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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In this document, the following symbols may appear. The meaning they represent is as follows.

Symbol	Instructions
	<p>Attention, please! If there is improper operation, it may cause serious consequences such as personal safety, equipment safety or environmental safety.</p>
	<p>Be careful! If there is improper operation, it may cause major accident, such as equipment damage or physical injury.</p>
	<p>If there is misoperation, it may cause bad effects or cannot be operated normally. Generally speaking, the issues caused could be solved.</p>
<p>INSTRUCTIONS</p>	<p>It is widely used. It reminds the instructions and prompts.</p>
<p>EXAMPLE</p>	<p>For the better understanding of the users, to show a brief example</p>
<p>NOTE</p>	<p>It offers small functions and tips unnoticeable that are very convenient to use.</p>

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1 Product Information

1.1 Product introduction

RT10 series servo is all digital ac servo drive, with high reliability, performance and cost effectiveness.

- Low voltage servo, working at single phase/three phase 220V AC, with low voltage motor
- Supports position control, speed control and torque control mode
- Supports incremental encoder, ABZ incremental encoder, and absolute encoder including Tamagawa, BISS, EnDat and Nikon
- Support RS485 communication, standard Modbus protocol
- Supports internal speed mode and demonstration running mode

1.2 Order Number

RT10 – PA 015 L – E00 – 0000

RT10 series ac servo drive

Series

Power level

Voltage

Encoder type

OEM code

Code	Series
PB	Pulse base type
PA	Pulse higher type

Code	Max current
005	4.2A
010	6.6A
015	12.0A
030	19.8A
050	39.6A

Code	Power voltage
L	Low voltage, single/three-phase 220V
H	High voltage, three-phase 380V

Code	Incremental	ABZ incremental	Absolute Encoder type			
			BISS	Tamagawa	Endat	Nikon
E00	●	●	x	x	x	x
E01	x	x	●	x	x	x
E02	●	●	x	●	x	x
E03	x	x	x	x	●	x
E04	x	x	x	x	x	●

Figure 1-1 RT10 series AC servo drive order number

INSTRUCTIONS

- Support this feature.
- × Don't support this feature.

1.3 Technical specifications

Table 1-1 RT10 series pulse series technical specification

Model		RT10 series ac servo drive				
RT10-PA□□□L-E02		005	010	015	030	050
Power supply		Single/three-phase AC220V, -15% - +10%, 50/60Hz			Three-phase AC220V, -15% - +10%, 50/60Hz	
Rated current (rmsA)		1.6	2.8	5.5	11.6	21.0
Maximum current (rmsA)		4.2	6.6	12.0	19.8	39.6
Peak current (o-pA)		5.9	9.3	16.9	28.0	56.0
Environ ment	Temperature	Working 0 - 45°C (If the temperature is too high, please make sure the surrounding air to flow) Storage -20°C - 65°C				
	Humidity	Working 40% - 80% (No condensation) Storage Less than 93% (No condensation)				
Protection grade		IP20				
Control method		PWM sine wave vector control				
Regenerative braking		External		Optional, built-in or external		

Feedback		ABZ incremental encoder, Standard incremental encoder, and Absolute encoder
Control mode		Position / Speed / Torque
Control input		Up to 11 input terminals (optoelectronic isolation). Servo-enable, alarm clearance, CWL, CCWL, forward torque limitation, reverse torque limitation, zero speed clamp, internal speed selection 1, internal speed selection 2, internal torque selection 1, internal torque selection 2, emergency stop, control mode switch, gain switch, electronic gear selection 1, electronic gear selection 2, position deviation clearance, pulse input prohibition, origin return (homing) trigger, origin return (homing) reference point
Control output		Up to 8 output terminals (optoelectronic isolation). Servo ready (S-RDY), alarm, zero speed, positioning complete, speed reached, torque reached, electromagnetic brake, servo in operation, location nearby, positioning, torque limitation, speed limitation, origin regression complete.
Encoder signal output	Signal type	A, B, Z differential output , Z signal open collector output
	Frequency dividing ratio	It can be configured with parameter PA78
Position	Input	Low speed pulse command port, differential

	frequency	input \leq 500kpps, single-ended input \leq 200kpps High speed pulse command port, differential input \leq 4Mpps
	Command mode	Direction + pulse sequence. CW+CCW pulse sequence. Two phase A/B orthogonal pulse Internal position command
	Electronic gear ratio	Numerator, 1 - 32767 Denominator, 1 - 32767
Speed	Analog command input	Support -10V - +10V input
	Command ACC/DEC	Parameter setting
	Command source	Internal speed command, analog command
Torque	Analog command input	Support -10V - +10V input
	Speed limitation	Parameter setting
	Command source	Internal torque command, analog command
Special function		Origin return(homing), gain switching, mechanical resonant trap filter
Monitoring function		Rotational speed, current position, positional deviation, motor torque, motor current,

		command pulse frequency, etc.
Protection function		Over speed, over voltage, over current, over load, abnormal braking, abnormal encoder, position exceeding tolerance, etc.
Features	Speed frequency response	$\geq 1500\text{Hz}$
	Speed fluctuation ratio	$\leq \pm 0.03\%$ (Load 0 - 100%) $\leq \pm 0.02\%$ (Power -15% - +10%)
	Speed ratio	1:10000

1.4 Adapted motor

The RT10 series AC servo drive matches the RT series servo motor. Please refer to the RT series servo motor selection guide, or contact A&TS Company for service.

2 Installation and Wiring

2.1 Installation

When installing, operating and maintaining the RT series ac servo drive, please follow the instructions in the manual.

2.1.1 Installation environment

- Working temperature, 0 - 45°C
- Working humidity, below 80% RH (no condensation)
- Storage temperature, -20°C - 65°C
- Storage humidity, below 80% RH (no condensation)
- Vibration, below 4.9 m/s²
- Install in a well-ventilated place with little humidity and dust
- Install in the place without corrosive gas, flammable gas, pyrophoric gas, oil gas, cutting fluid, cutting powder, or iron powder etc.



WARNING

- When in a vibration environment, to prevent transmitting vibration to the servo drive, please install the anti-rattle device on the mounting surface of the servo drive.
- When it has to be used in a corrosive gas environment, please try to keep corrosive gas out of the devices. The corrosive gas will cause the aging of electronic components and circuit boards.

2.1.2 Products appearance and dimensions

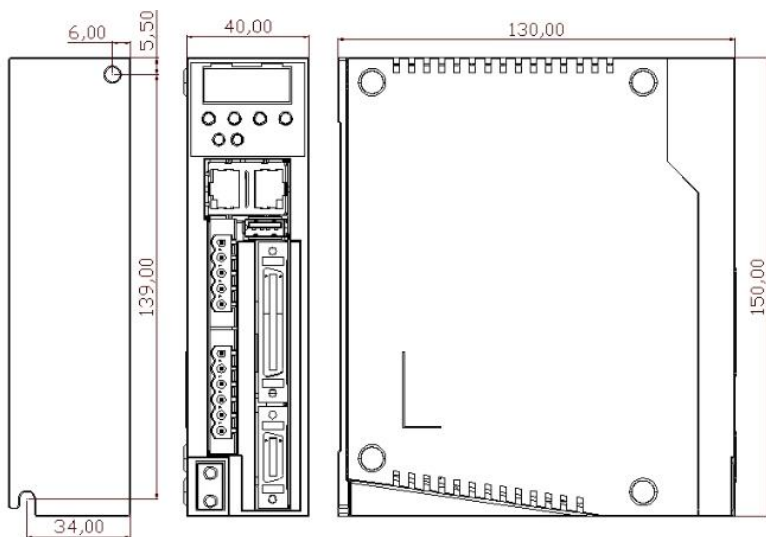


Figure 2-1 RT10-□□005L Product appearance and dimensions (Unit, mm)

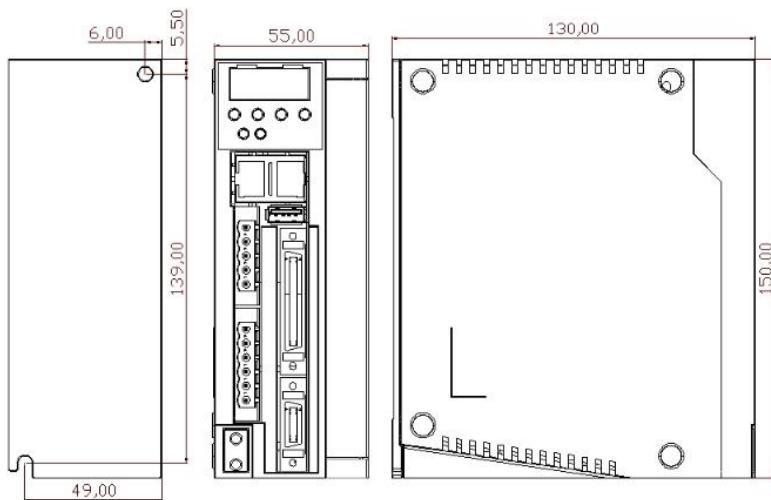


Figure 2-2 RT10-□□010L Product appearance and dimensions (Unit, mm)

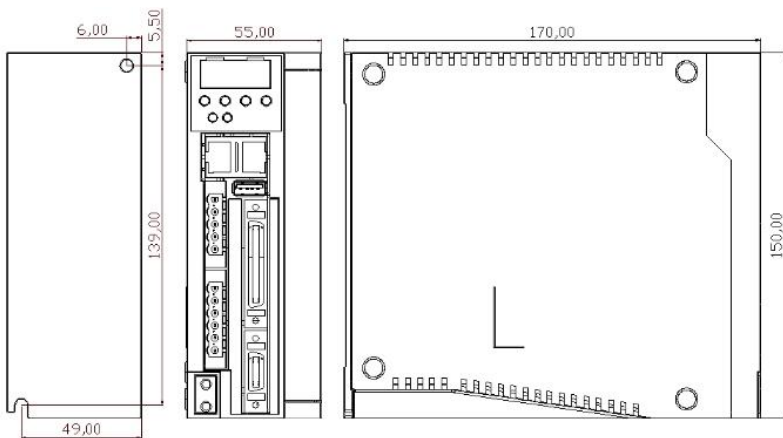


Figure 2-3 RT10-□□015L Product appearance and dimensions (Unit, mm)

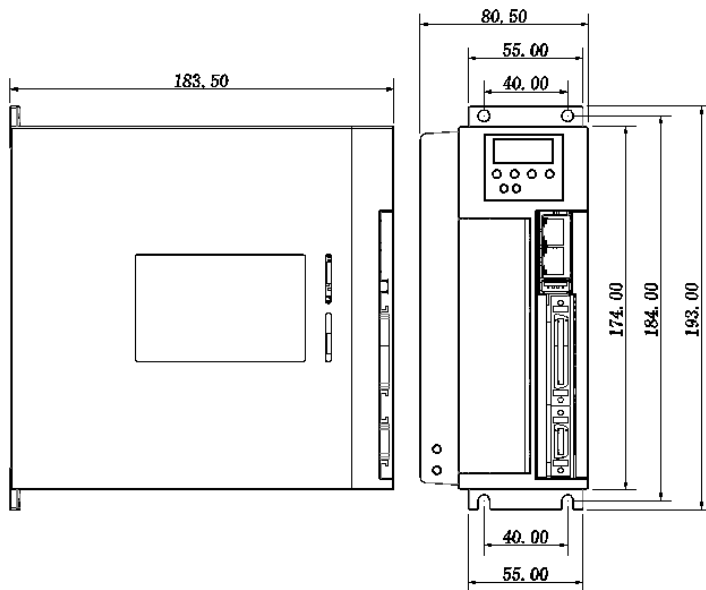


Figure 2-4 RT10-□□020L/RT10-□□030L Product appearance and dimensions (Unit, mm)

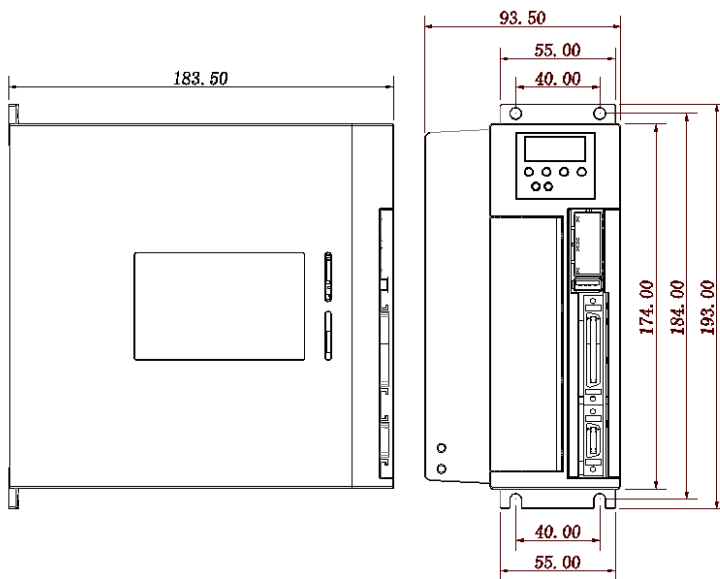


Figure 2-5 RT10-050L Product appearance and dimensions (Unit, mm)

2.2 Wiring and terminals

2.2.1 Wiring diagram

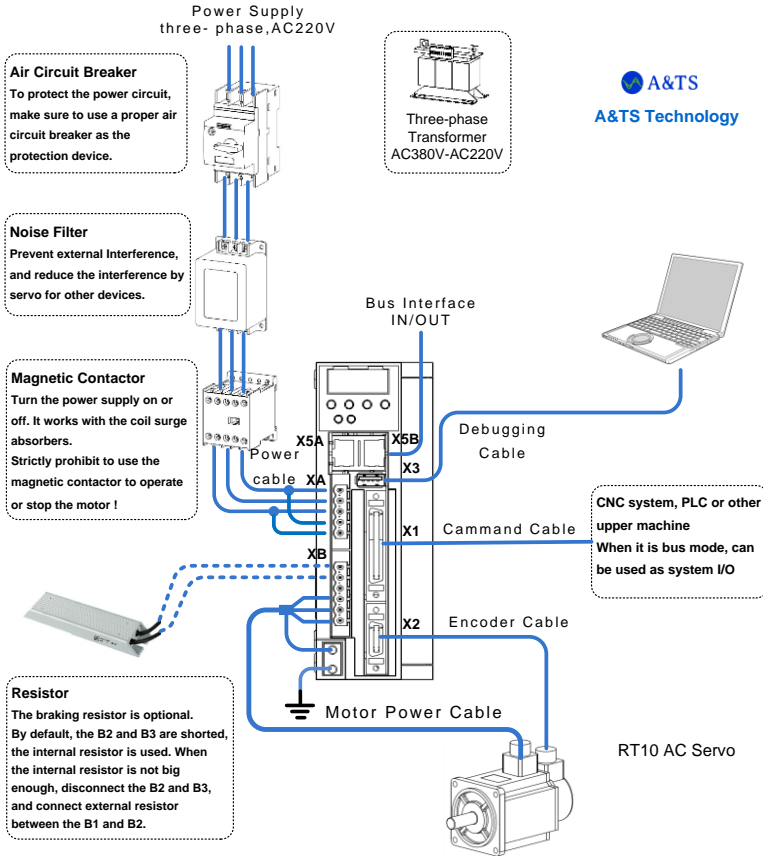


Figure 2-6 RT10-PA/RT10-PB pulse series AC servo drive wiring diagram

INSTRUCTIONS

- RT-STP is the Servo Tuning Program. It's a tuning software provided by the A&TS Technology. For more details, please contact with us at www.a-ts.cn.

2.2.2 Strong power terminals

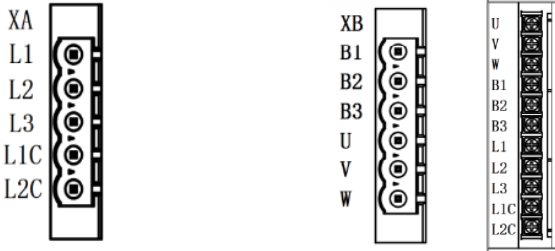


Table 2-1 RT10 series drive strong power terminals

Terminal labels	Name	Specifications
L1C	Control power input terminals	Connect to single phase 220V AC power.
L2C		
L1	Main power supply input terminals	Connect to single / 3 phase 220V AC power. If is single-phase AC 220V, use L1 and L2.
L2		
L3		
B1	Braking resistor terminals	When using internal braking resistor, short circuit B2 and B3. When using external braking resistor, disconnect B2 and B3, and connect the braking resistor between B1 and B2. Refer to 5.8 braking resistor setting for the braking resistor selection and others , to prevent damage.
B2		
B3		
U	Motor power line terminals	It must be connected with the U , V , W , PE terminals of the motor
V		

W		correspondingly. (Note, PE is the terminal for the metal heat sink on the drive)
PE		

INSTRUCTIONS

Only when the drive is connected to single phase ac power, L1C&L1 and L2C&L2 shall be shorted.

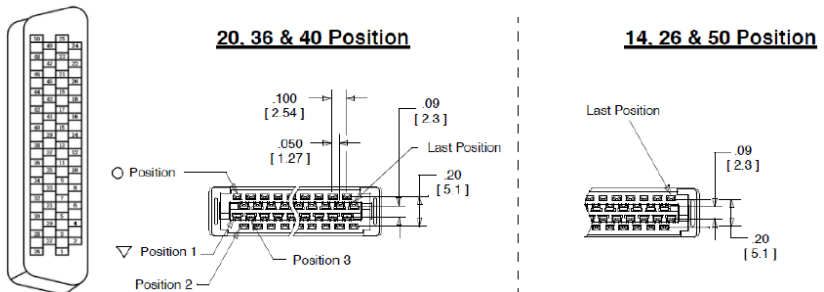


The 380V ac power shall not be used, or it will burn the drive out.

2.2.3 Command terminal X1

Pulse sequence command mode

RT10 command terminal X1 includes pulse and direction input pins, digital input pins, digital output pins, and encoder feedback output pins. In the pulse sequence command mode, the pins on the terminal X1 are as shown below.



INSTRUCTIONS

- It is recommended to use the original RT10 ac servo drive cable.

- The command terminals are MDR/SCSI-50 pins plug. Please confirm the pin sequence according to the solder side as the figure above.

Table 2-2 Command Terminal X1 Definition

Signal name		Pin No.	Signal interpretation
Digital input signal	DI-COM	7	The digital input optocoupler common end. According to the digital input low level or high level (the active one), the 24V or 0V external power supply shall be provided.
	DI1(SRV-ON)	29	Digital input 1. The default function, servo enable input
	DI2(A-CLR)	31	Digital input 2. The default function, alarm clearance input
	DI3(POT)	9	Digital input 3. The default function, positive drive inhibiting input
	DI4(NOT)	8	Digital input 4. The default function, reverse drive inhibiting input
	DI5(M1-SEL)	30	Digital input 5. The default function, mode switch 1 input
	DI6(M2-SEL)	26	Digital input 6. The default function, mode switch 2 input
	DI7(P-ATL)	27	Digital input 7. The default function, positive torque limiting input
	DI8(N-ATL)	28	Digital input 8. The default function, negative torque limiting input

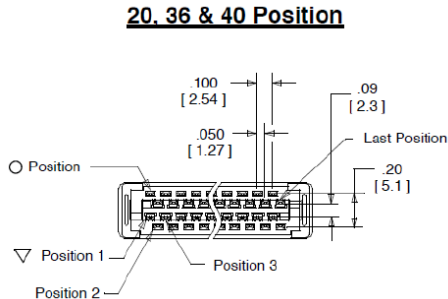
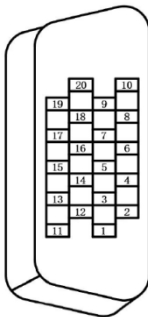
	DI9	33	Digital input 9
	DI10	32	Digital input 10
	DI11	38	Digital input 11
Digital output signal	DO1+(S-RDY+)	35	Digital output 1. The default function, servo ready output
	DO1-(S-RDY-)	34	
	DO2+(ALM+)	37	Digital output 2. The default function, servo alarm output
	DO2-(ALM-)	36	
	DO3+ (AT-POS+)	40	Digital output 3. The default function, position reached output
	DO3-(AT-POS-)	41	
	DO4+ (BRKOFF+)	11	Digital output 4. The default function, the motor brake release output, single-ended output
	DO5+ (AT-SPD+)	12	Digital output 5. The default function, speed reached output, single-ended output
	DO6+	18	Digital output 6, single-ended output
	DO7+	42	Digital output 7, single-ended output
	DO8+	39	Digital output 8, single-ended output
	DO-GND	10	Digital IO output common ground
Position pulse command	OPC1	1	Low-speed command, when the pulse sequence voltage is 12V or 24V, replace PULS +.

	OPC2	2	Low-speed command, when the pulse direction voltage is 12V or 24V, replace SIGN+.
	PULS+	3	Low-speed command pulse sequence input
	PULS-	4	
	SIGN+	5	Low-speed command pulse direction input
	SIGN-	6	
	PULSH+	44	High-speed command pulse sequence input
	PULSH-	45	
	SIGNH+	46	High-speed command pulse direction input
	SIGNH-	47	
Analog command input	AI1+	13	Analog command channel 1 input
	AI1-	14	
	AGND	15	Analog reference ground
	AI2+	16	Analog command channel 2 input
	AI2-	20	
	AGND	17	Analog reference ground
Encoder signal output	OA+	21	Encoder frequency division output, Phase A
	OA-	22	
	OB+	48	Encoder frequency division output, Phase B
	OB-	49	

	OZ+	23	Encoder frequency division output, Phase Z
	OZ-	24	
	CZ	19	Encoder frequency division output, Phase Z, open collector output
	GND	25	Reference level, signal ground
	GND	43	Reference level, signal ground
Shielding ground	PE	50	Shielding / protection of the ground

2.2.4 Encoder terminal X2 definition

The servo motor encoder signal is input by the X2 terminal. The schematic diagram of encoder terminal pins is below.



- It is recommended to use the original accessory cable of the RT10 AC servo drive.
- The encoder terminal is MDR/SCSI-20 core plug. Please confirm the pin sequence according to the solder side shown in the diagram above.

The standard incremental encoder signal input terminals.

Pin No.	Signal name	Description
1	EC-5V	Encoder power output, 5V±5%
2	EC-GND	Encoder power / signal ground, 0V
7	A+	Encoder phase A signal input
8	A-	
9	B+	Encoder phase B signal input
10	B-	
19	Z+	Encoder phase Z signal input
20	Z-	
13	U+	Encoder phase U signal input
14	U-	
15	V+	Encoder phase V signal input
16	V-	
17	W+	Encoder phase W signal input
18	W-	
11	PE	Shield ground

The absolute encoder signal input terminals

Pin No.	Signal name	Description
1	EC-5V	Encoder power output, 5V±5%
2	EC-GND	Encoder power / signal ground, 0V

3	SDATA+	Bidirectional serial data
4	SDATA-	
5	CLK-	Serial clock (When it is the Nikon/ Biss / Endat encoder)
6	CLK+	
11	PE	Shield ground, it is connected to the metal shield layer of shield wire.

2.2.5 USB debugging port X3 definition

This terminal is the USB3.0A plug, compatible with USB2.0. But it's different from the standard USB3.0 definition. This port is mainly used for the upper machine software communication debugging, and MCU firmware updating.

Doing the MCU firmware updating, it uses the USB communication, by the standard USB2.0 cable.

When communicating with upper machine, the serial communication is used. The communication cable is an optional accessory, and is the standard USB3.0 cable specially made. Only the 5/6/7 pins need to be welded as below.

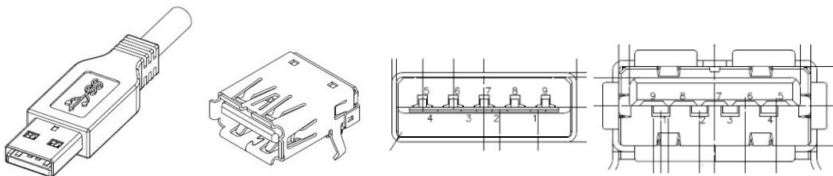


Figure 2-7 USB3.0 A type USB plug (left) and socket (right)

USB3.0 pins as follows

Pin No.	Signal name	Description
---------	-------------	-------------

1	D5V	USB positive pole (optional)
2	USB_D-	USB data-
3	USB_D+	USB data+
4	DGND	USB signal / power ground
5	RS232-TX	RS232 send
6	RS232-RX	RS232 receive
7	DGND	RS232 signal ground
8	D5V/D3V3	RS232 positive pole (optional)
9	NC	None
Housing/ Shell	FG	Floating shield ground



WARNING

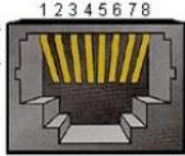
Do not connect USB3.0 cable to the drive directly, or it may cause damage to the drive or PC port.

2.2.6 RS485 communication port X5A/X5B definition

This terminal is the standard RJ45 interface for RS485 bus communication.

The RT10 series AC servo drive communicates with the controller through RS485 interface (adopting the Modbus protocol or Panasonic A5 driver communication protocol), to read and write parameters and monitor the status. Please refer to the chapter 10. Communication Function. The pins are defined as below.

Pin	Signal	Description	Port definition
-----	--------	-------------	-----------------

no.	name		
1	CAN+	CAN bus data positive, reserved	
2	CAN-	CAN bus data negative, reserved	
3	RS485+	RS485 Data+	
4	DGND	Reference ground	
5	DGND	Reference ground	
6	RS485-	RS485 Data-	
7	NC	N/A	
8	NC	N/A	



ATTENTION

- The RT10-PB series drive doesn't support this function.

2.2.7 Wiring of three control mode

- The position control mode wiring sample graph

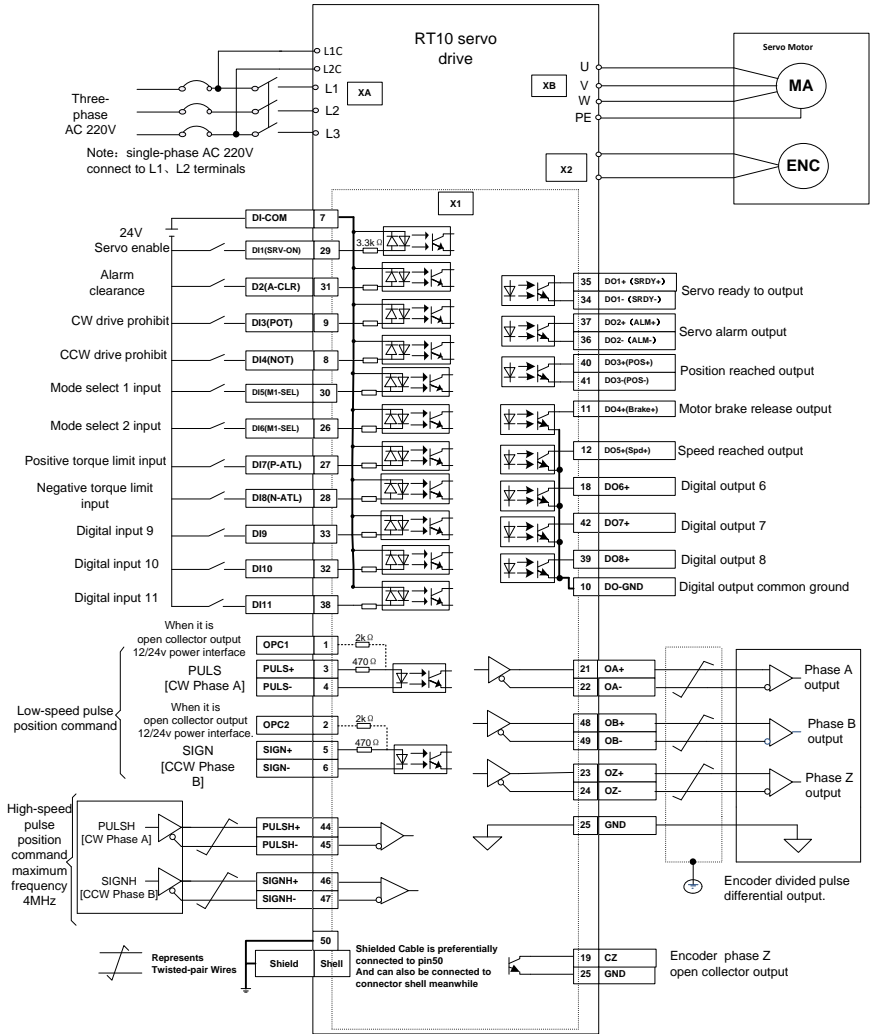


Figure 2-8 Position control mode wiring

● Speed / torque control mode wiring sample graph

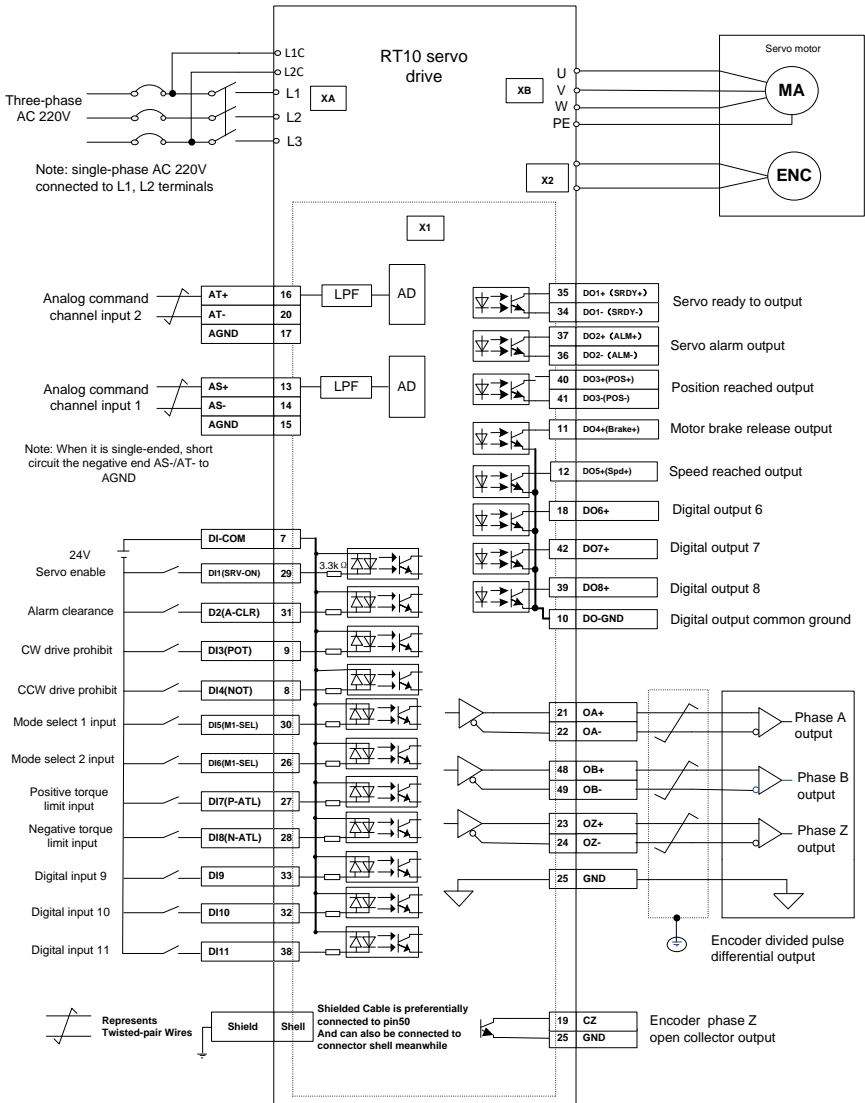


Figure 2-9 Analog speed / torque command control mode wiring

3 Display and Keyboard Operation

3.1 Basic operation

The operator panel adopts five LED tubes, two LED indicators, and four keys, as shown in the Figure 3-1.

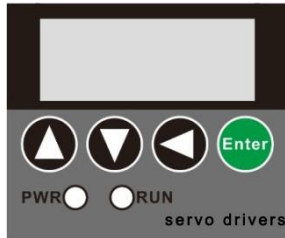


Figure 3-1 operation panel

Five Led tubes

LED works to display the states and parameters of the servo drive.

If the decimal point of the rightmost eight-segment LED flashes, there is alarm.

Numeric display

It adopts 5 LED tubes to display numeric values. Some display items have prefix characters.

If the displayed value is negative, the decimal point of the displayed value will be lit up. And when the decimal value is greater than -10000, the highest digit displays a negative sign '-'. For example, 12345 indicates positive number 12345. 12.345 indicates negative number -12345. -2345 indicates negative number -2345.

Four keys



Page up, to display page, increase serial number or value.



Page down, to display page, decrease serial number or value.



Return key, Return or cancel.



Enter key, Enter or OK.

Two LED indicator

PWR, it indicates that the drive main circuit is powered on.

RUN, it indicates that the drive has already been enabled, and the motor is powered on.

NOTE

Keep pressing the page up or page down keys, the serial number (or value) will be increased or reduced continuously. And the longer the keep pressing is, the faster the increase or decrease is.

EXAMPLE

If you need to modify a parameter from 0 to 3000, please follow steps below.

Step one, keep pressing the page up key. The value increases from 0 continuously.

Step two, the value increases continuously, until the value reaches near the 3000, releasing the page up key.

Step three, press the page up or page down key discontinuously, to adjust the value until it reaches 3000.

3.2 Menu level one

The menu level one is used to select operating mode. Pressing the page up or page down key, it cycles between the 7 operation modes. Press Enter key to enter the menu level two, and press the return key back to the menu level one, as shown in the Figure 3-2.

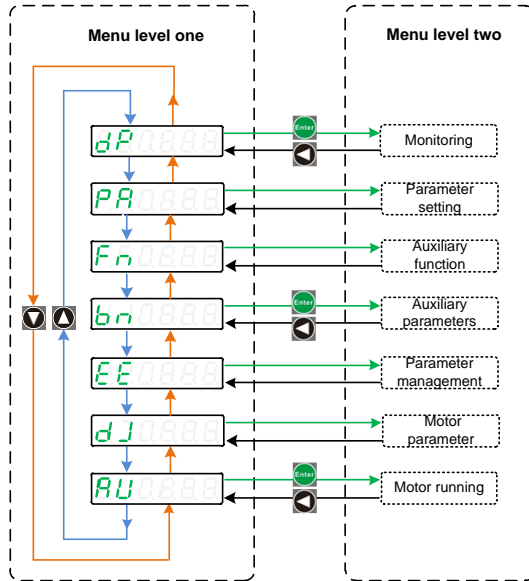


Figure 3-2 Menu level one

3.3 Menu level two

Enter the menu level two by selecting the different menu level one. Access the corresponding menu level two through a different menu level. This section introduces the monitoring mode monitoring, motor parameter, jog run, run test, parameter management, auxiliary function, and parameter setting etc.

3.3.1 Monitoring

Select dP 0000 in the menu level one, press the Enter key to enter the monitoring mode. Press the Page up or Page down key to select the parameters that need to be monitored, and then press the Enter key to show the value. Press the Return key to return.



Figure 3-3 Menu level two

3.3.2 Parameter setting (Pa/Fn parameter)

In the menu level one, select `PA 000` or `Fn 000` and press the Enter to go to the parameter setting mode.

Use the Page up or Page down key to select the parameter number, and press the Enter key to display the parameter value. Then use the Page up or Page down key to modify the parameter value. The value will be modified by pressing Enter key, and it will be valid in the servo control.

Press the Return key to return.

NOTE

- When the parameter value is being modified, the decimal point of the rightmost digital tube is lit, and press the Enter key to set the modified value valid. At this time, the lit decimal point will go out. Then pressing the Page up or Page down Key to continue to modify parameters.
- To cancel the modification, don't press the Enter key, and press the Return key. The parameter will not be modified, and the menu returns back to the previous menu.

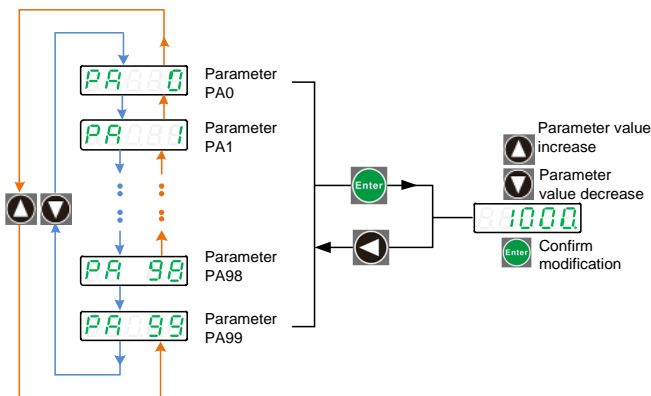


Figure 3-4 PA parameter setting menu

- In the RT10 series servo, the PA menu only displays parameters up to parameter 99 by default. If it is old version, change the PA0 to 527, it will display all the parameters.

3.3.3 Parameter management

Parameter management mainly handles the operation between the parameter table and EEPROM.

In the menu level one select `EEPRM` and press the Enter key to go to the parameter management mode. Use the Page up or Page down button to switch between the three parameter management options. Press and hold the Enter key for more than 3 seconds to complete the parameter management command. Press the return key to return.

① Parameter save `E-SET`

Write the parameters in the parameter table to the EEPROM parameter zone.

When the parameter is modified, it only changes the parameter values in the parameter table. If the servo is powered off and then powered up, and the original parameter value will be restored by default again. If you want to change the parameter value permanently, you need to perform parameter save operation and write the parameters in the parameter table to the EEPROM.

② Reset to factory defaults `E-DEF`

The factory values of all parameters are read to the parameter table and written to the EEPROM parameter area. After power cycle, the factory default values of all parameters are applied.

When the parameter configuration is disordered, you can use this operation to recover the system.

③ System soft reset `E-RST`

It resets the MCU processor in the servo drive. It is equal to the drive does power cycle. After save the parameter, we could use this operation to avoid power the drive off and power it on again.

After the parameter modification, usually the drive needs to be restarted. There are two ways to restart the drive. One is to power off and restart directly. The second is soft reset. Which way to choose, it depends on the situation.

Parameter management mainly includes parameter save, restoring factory value and system soft reset. Each parameter management performs read-write operation in the MCU memory and the EEPROM.

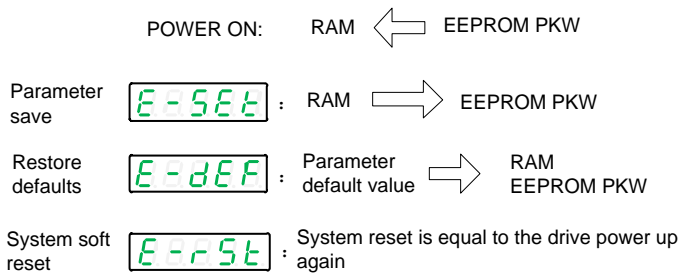


Figure 3-5 Parameter management menu

4 Running

4.1 Set motor type

1) Power on

After the power is up, the PWR indicator is lit. If an alarm occurs, please check the wiring.

2) Check the motor type

Check the parameter PA1 value, and find the motor type corresponding to this parameter in the Motor selection guide. Check whether the motor type connected to the drive is in accord with the one above. If they are the same, go to the next step. If not the same, please modify the motor type.

INSTRUCTIONS

RT10 series servo drive supports standard motor and user defined motor. If it is standard motor, set the motor type code according to the motor adaptation table (in the motor selection guide). If it is user-defined motor, need to set the parameters of motor manually.

3) Modify the motor type code

Follow the steps below to modify the motor type

- Change the PA0 'parameter password' to 385, and press the Enter key to save.
- Set in as the motor manufacturer type, and press the Enter key to save.
- Find the motor type code in the Motor Selection Guide, and set the PA1 parameter Motor type to this type code. If there is no type code

matching the motor, it is the user-defined motor. Just change parameter PA1 to `U-DEF`.





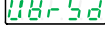
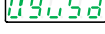






- Save the modified parameters in `EEPROM`.
- Select `E-SET` in the menu level two, and press the Enter key. Keep pressing the Enter key for more than 3 seconds, and it will display `StArt`, which indicates that the parameter is being written to the EEPROM. Then wait 1 - 2 seconds, if the operation is successful, it will display `donE`, otherwise display `Error`.

4) Set user-defined motor parameter

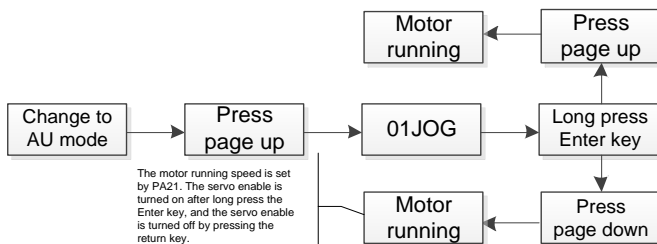
If it is the user-defined motor, please set the motor parameters `dJ` according to the following table. If it is the standard motor, skip this step, and do the test running.

Table 4-1 Servo motor parameter table

Menu Name	Description	Value range
<code>00UEd</code>	User-defined motor manufacturer	Please contact A&TS company directly
<code>01Ed</code>	Reserved	
<code>02 PL</code>	Encoder resolution low-order digit	0 - 10000
<code>03 PH</code>	Encoder resolution high-order	0 - 10000

	digit (x10000)	
	Z-pulse offset pulse (incremental)	0 - 50000
	Motor pole pairs	1 - 60
	Rated current	0.1 - 100.0(A)
	Rated torque	0.1 - 100.0(Nm)
	Rated speed	1 - 9000(rpm)
	Maximum speed	1 - 9000(rpm)
	Rotary inertia	0.0 - 200.00(x10 ⁻⁴ Kgm ²)
	Back-EMF constant	0.00 - 200.00(V/Krpm)
	Absolute zero offset low-order digit	0 - 10000
	Absolute zero offset high-order digit (x10000)	0 - 10000
	Phase resistance	0 - 60.00(Ω)
	Phase inductance	0 - 60.00(mH)

4.2 JOG trial running



4.3 Position control

Position control is applied in the systems require precise positioning, such as CNC machine tools, textile machinery etc. The pulse command of the control system is the position command source. The pulse inputs by the PULS +/- and SIGN +/- input terminals.

4.3.1 Position control simple example

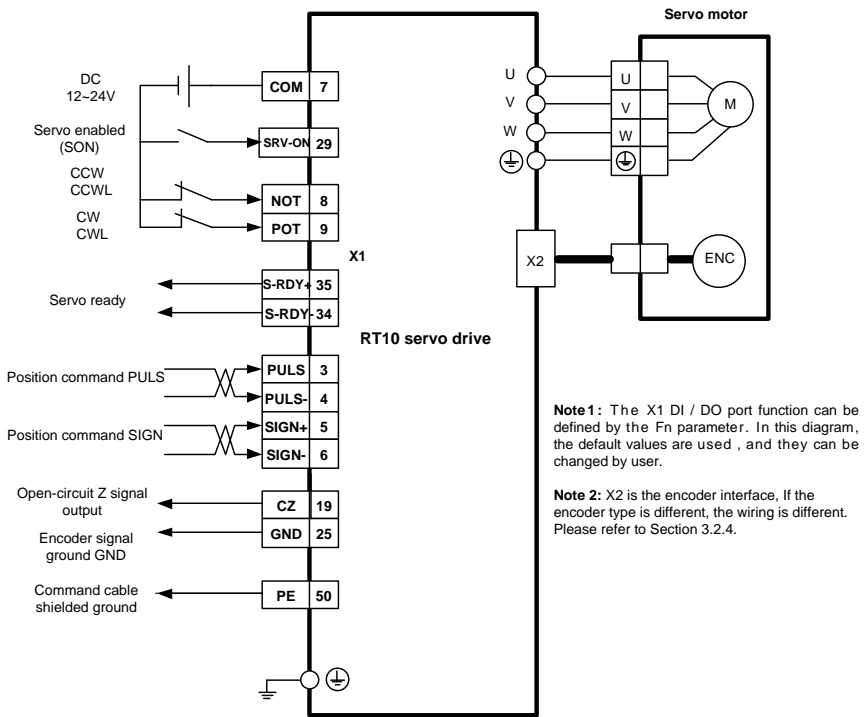


Figure 4-1 Wiring diagram of the position control simple example

4.3.2 Position command

Parameters related to the position command

Table 4-2 Parameters related to position command

Parameter	Name	Set value	Factory value	Parameter description
PA4	Control mode	0	0	Position control
PA12	Electronic gear numerator	Appropriate value	1	Electronic gear numerator
PA13	Electronic gear denominator	Appropriate value	1	Electronic gear denominator
PA14	Position command input pulse mode	0	0	0: pulse + direction 1: CW + CCW 2: A B orthogonal
PA15	Position command input pulse direction reverse	0	0	
PA44	Pulse command function selection	Appropriate value	0	Select the pulse command type
PA52	Position command smoothing time constant	0.0	0	Position command smoothing time
PA81	Lower 5 bits of the command pulse number, for each rotation of the motor	Appropriate value	0	
PA84	Higher 5 bits of the command pulse number, for each rotation of the motor	Appropriate value	1	x10000 pulse

Command pulse transmission path

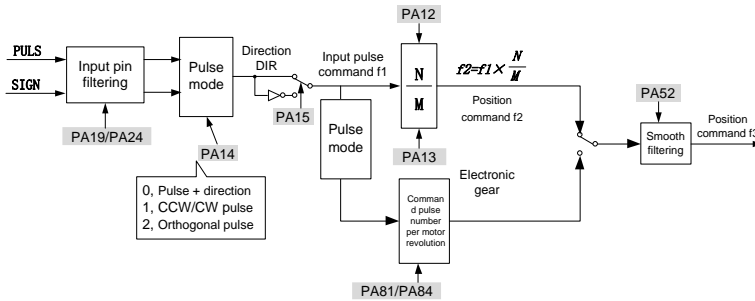


Figure 4-2 Instruction pulse transmission path

4.3.3 Electronic gear setting

In the drive, if the encoder is 10000 pulses/revolution, the needed pulse equivalent can be set by the electronic gear parameters PA12&PA13, or PA81&PA84.

Table 4-3 The relationship between the input pulse number and revolution

The input pulse number	Electronic gear numerator	Electronic gear denominator	Motor revolutions
P	PA12	PA13	$(P \times PA12) / (10000 \times PA13)$
10000	1	1	1
5000	2	1	1
3000	10	3	1
800	25	2	1
20000	1	2	1
1000	20	3	2/3
4000	30	4	3

4.4 Speed control

Speed control is applied where precise speed control is required. It's can also be configured by the upper device.

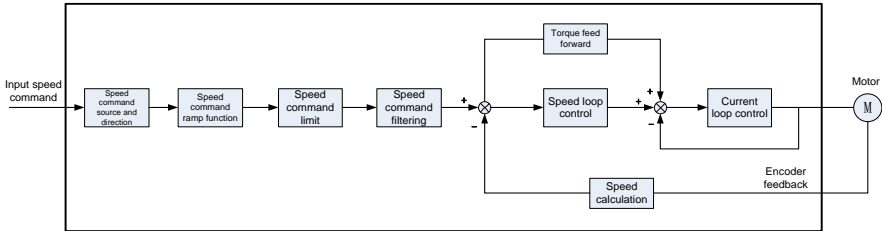


Figure 4-3 The speed control diagram

Parameters related to the speed commands

Table 4-4 The parameters related to the speed commands

Parameter	Name	Set value	Factory default	Description
PA4	Control mode	9	0	Set to speed control
PA15	Speed command direction setting	xxx0xb	00000b	
PA22	Speed command source selection	Appropriate value	1	1, internal parameter PA27 input 2, analog AI1 input
PA27	Internal speed command 1	Appropriate value	0	Unit, rpm
PA40	ACC time constant	Appropriate value	20	Time to accelerate from zero speed to maximum speed (ms)

PA41	DEC time constant	Appropriate value	20	Time to decelerate from maximum speed to zero speed (ms)
PA36	Speed command filter time constant	Appropriate value	0.2	Speed command smoothing time (ms)
Fn50	Analog AI1 filter time constant	Appropriate value	2.0	Analog smoothing time (ms)
Fn51	Analog AI1 zero drift	Appropriate value	0	Zero drift compensation (mV)
Fn52	Analog AI1 offset	Appropriate value	0	Offset (mV)
Fn53	Analog AI1 dead time	Appropriate value	10	Enforcement in the dead time is 0
Fn54	Speed value corresponding to analog 10V	Appropriate value	3000	Unit, rpm

4.5 Inertia identification

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

The load inertia ratio is an important parameter of the servo system, and the setting the proper load inertia ratio helps to complete the commissioning quickly.

Before inertia identification, confirms the items below.

① Between the mechanical limit switch, there are forward and reverse 10 circles movable stroke.

- ② Servo drive with the motor can work normally.
- ③ The motor and the load has been connected.

The inertia identification process is as below.

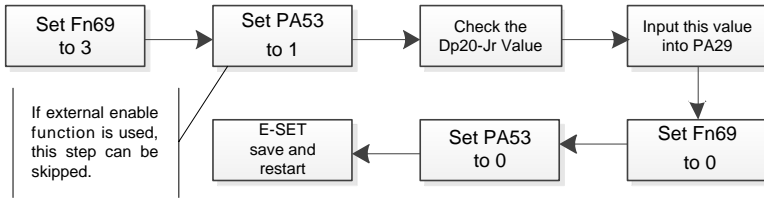


Figure 4-4 Inertia identification flow chart

4.6 Automatic gain adjustment

By the rigid equivalence selection function (PA33), automatically the servo drive will generate a set of matched gain parameters to meet the requirements of speediness and stability. And it is the automatic gain adjustment.

Below is the rigidity grade description.

When it is set to 0, the rigidity grade parameter is invalid. When it is grade 1, the rigidity is the weakest. When it is grade 31, the rigidity is the strongest. According to different load types, the following experience values are for reference.

Table 4-5 Rigidity grade reference

Suggested rigidity grade	Load types
Grade 4 to 8	Some large machinery

Grade 8 to 15	Low rigidity applications such as belts
Grade 15 to 20	High rigidity applications such as ball screws and ball linear.

**ATTENTION**

Before using the automatic gain adjustment function, make sure to acquire the load inertia ratio correctly.

5 Parameters

5.1 Parameter list

INSTRUCTIONS

- The applicability column shows the applicable control mode. P means position control applicable, S means speed control applicable, T means torque control applicable, and ALL means it is applicable for position, speed and torque control all.
- Parameter number plus ★ indicates that after modification the parameter needs to be saved, to will be effective after the power cycle. Parameter number without ★ indicates that after modification the parameter will be effective at once.
- Parameter value plus * means the factory default may be different, if the drive model is different.

5.1.1 PA parameters

No.	Name	Parameter range	Factory default	Unit	Applicability
PA0	Parameter password	0 - 9999	315		ALL
PA1 ★	Motor model	1 - 132	1		ALL
PA2 ★	Drive model	0 - 4	0		ALL
PA3 ★	Initial display status	0 - 25	0		ALL

PA4 ★	Control method	0 - 16	0		ALL
PA5	Speed proportional gain	2 - 2000	150*		ALL
PA6	Speed integral time constant	1.0 - 1000.0	50.0*	ms	P, S
PA7	Torque filter time constant	0 - 20.0	0.20	ms	ALL
PA8	Speed feedback filter time constant	0 - 10.00	0.50	ms	P, S
PA9	Position proportional gain	1 - 1000	50*		P
PA10	Speed feed forward gain	0 - 200	0	%	P
PA11	Speed feed forward filter time constant	0 - 10.0	0.5	ms	P
PA12 ★	Position command pulse frequency division numerator	1 - 32767	1		P
PA13 ★	Position command pulse frequency division denominator	1 - 32767	1		P
PA14 ★	Position command pulse input mode	0 - 4	0	0, pulse + direction 1, CW + CCW 2, AB orthogonal	P

				3, bus instruction 4, internal location	
PA15 ★	Command reverse direction setting	00000b - 11111b	00000b	Bit0, Position command reverse direction Bit1, Speed command reverse direction Bit2, Torque command reverse direction Bit3/4, rsv	All
PA16	Location complete range	0 - 30000	100	pulse	P
PA17	Location out of tolerance detection range	0 - 3000	30	x 0.1 laps	P
PA18	Absolute encoder usage mode	00000b - 11111b	00101b	Bit0: Whether to use the battery Bit1: ABS source Bit2: Motor parameter	ALL

				automatic identification Bit3:rsv	
PA19 ★	Position command pulse signal filter time constant	0.0 - 20.0	0.0	microsecond (us)	P
PA20 ★	Servo control auxiliary switch	00000b - 11111b	00000b	Bit1, Control mode switch allowed Bit2, IO jog function allowed Bit3, rsv	ALL
PA21	JOG speed/Torque mode max speed	0 - 3000	300	rpm	S
PA22 ★	Speed command source selection	0 - 2	0		S
PA23 ★	User sets the max speed percentage limit	1 - 200	100	%	ALL
PA24 ★	Position command direction signal filter time constant	0.0 - 20.0	0.0	microsecond (us)	P
PA25	Torque command source selection	0 - 8	0		T
PA26	Speed command frequency setting	0 - 3000	0	Hz	S

PA27	Internal speed command 1	-9000 - 9000	0	rpm	S
PA28	Arrival speed	0 - 3000	500	rpm	P, S
PA29	Load rotation inertia ratio	0 - 8000	200	%	P, S
PA30 ★	Motor torque overload alarm value	10 - 300	160	%	ALL
PA31 ★	Motor torque overload alarm detection time	0 - 12000	3000	ms	ALL
PA32	Control mode switch allowed	0 - 1	0		ALL
PA33	Rigidity level	0 - 31	0		ALL
PA34	Internal CCW torque limit	0 - 300	300*	%	ALL
PA35	Internal CW torque limit	-300 - 0	-300*	%	ALL
PA36	Speed command filter time constant	0 - 10.0	0.2	ms	ALL
PA37	Torque feed forward filter time constant	0 - 10.0	0.5	ms	ALL
PA38	DP menu dynamic display items	0 - 300			ALL
PA39	Serial communication rate	0 - 15	0		T
PA40	Acceleration time constant	0 - 10000	20	ms,0 to max speed time	S

PA41	Deceleration time constant	0 - 10000	20	ms, max speed to 0 time	S
PA42	Incremental encoder AB signal filter time	0 - 1000	1	x20ns	ALL
PA43	Braking resistor maximum allowable impact time	10 - 5000	1700	ms	ALL
PA44 ★	Pulse command function selection	00000b - 11111b	00000b	bit0: High-speed pulse selection bit1: get it by hand function	P
PA45 ★	Absolute encoder lap digits	0 - 30	0	0 means the default digits	ALL
PA46	Speed integral filter time constant	0 - 500	1.0	ms	P, S
PA47	Enable disconnect waiting time when the motor is stationary	0 - 5000	0	ms	ALL
PA48	Electromagnetic brake braking waiting time when the motor is running	0 - 5000	50	ms	ALL
PA49	Brake action speed when the motor is running	0 - 3000	100	rpm	ALL

PA50	Brake off delay when motor is enabled	0 - 3000	20	ms	ALL
PA51 ★	Braking resistor selection switch	0 - 1	0		ALL
PA52	Position command smoothing time constant	0.0 - 100.0	0.0	ms	P
PA53	Lower 5 bits input terminals forced ON	00000b - 11111b	00000b	Binary	ALL
PA54	Higher 5 bits input terminals forced ON	00000b - 11111b	00000b	Binary	ALL
PA55	Lower 5-bits input terminals logical reverse	00000b - 11111b	00000b	Binary	ALL
PA56	Higher 5-bits input terminals logical reverse	00000b - 11111b	00000b	Binary	ALL
PA57	Output terminal logic reverse	00000b - 11111b	00000b	Binary	ALL
PA58	Input terminal debouncing time constant	0.1 - 800	1.0	ms	ALL
PA60	Torque command filter time constant	0 - 50.00	0.20	ms	ALL
PA61 ★	Motor encoder type setting	-1 - 7	-1	-1: Motor default setting 0: Incremental	ALL

				1: ABZ incremental 2: Tamagawa protocol 3: Reserved 4: Nikon protocol 5: Panasonic protocol 6: BissC protocol 7: Increment without HALL 9: Sankyo protocol	
PA62	Alarm shield setting bits	00000b - 11111b	00000b	Bit0:Err18 Bit1:Err35 Bit2:Err41&6 Bit3:Err25 Bit4:Err8	ALL
PA63	Disturbance torque compensation gain filter cut-off frequency	0 - 2000	50	Hz	P, S
PA64	Current proportional gain	1 - 500	150*		ALL
PA65	Current integration time constant	1 - 100.0	20.0*	ms	ALL

PA66	Torque feed forward gain	0 - 100	0	%	P, S
PA67	Gravity axis offset compensation	-100 - 100	0	%	ALL
PA68	PDFF feed forward factor	0 - 100	100	%	P, S
PA69 ★	External braking resistor value	0 - 750	50	Ω	ALL
PA70 ★	External braking resistor power	0 - 10000	50	W	ALL
PA71	Forward friction compensation feedforward gain	0 - 300	0	%	P, S
PA72	Current Loop PID limiting adjustment factor	20 - 100	100	%	ALL
PA73	Disturbance torque compensation gain	0 - 200	0	%	ALL
PA74	Internal current command	-300 - 300	0	%	T
PA75 ★	Current loop reserved parameter 1	0 - 5	0		ALL
PA76	RS485 response frame delay time	0 - 1000	3	ms	ALL
PA77 ★	Current loop reserved parameter 2	0 - 2	0	0- single update 1- double	ALL

				update 2- Instant update	
PA78 ★	The output pulses per motor revolution	1 - 32767	2500	x4 pulses	ALL
PA79 ★	System feedback pulse output logical reverse	0 - 1	0		ALL
PA80	Absolute encoder reset setting	00000b - 11111b	00000b		ALL
PA81 ★	The low bits of command pulses per motor revolution	0 - 32000	0		P
PA82 ★	RS485/232 communication address setting	0 - 255	1		P
PA83 ★	RS485/232 communication rate setting	0 - 6	2		P
PA84 ★	The high bits of command pulses per motor revolution	0 - 10000	0	x10000	P
PA85	Vibration detection current percentage	0 - 500	100	%	ALL
PA86	Zero speed detection value	0 - 100	10	rpm	ALL
PA87	RS485	0 - 6	0	0-no parity	

★	communication check method selection			1-even parity check 2-odd parity check	
PA88	Backward friction compensation feedforward gain	0 - 300	0	%	P, S
PA89	Friction compensation filter time constant	0 - 10.0	1.0	ms	P, S
PA90 ★	UVW encoding Corresponding to Z pulse	0 - 6	0		ALL
PA91 ★	Incremental encoder UVW direction	0 - 1	0		ALL
PA93 ★	System feedback Z pulse polarity setting	0 - 1	0		ALL
PA94 ★	System feedback Z pulse width setting	0 - 15	4		ALL
PA97	Alarm shield setting bits	00000b - 11111b	00000b		ALL
PA98	Origin position confirmation range	0 - 30	0		ALL

5.1.2 Fn parameters

No.	Name	Range	Factory default	Unit	Applicability
-----	------	-------	-----------------	------	---------------

Fn0	Digital input DI1 function	0 - 31	1		ALL
Fn1	Digital input DI2 function	0 - 31	2		ALL
Fn2	Digital input DI3 function	0 - 31	3		ALL
Fn3	Digital input DI4 function	0 - 31	4		ALL
Fn4	Digital input DI5 function	0 - 31	5		ALL
Fn5	Digital input DI6 function	0 - 31	6		ALL
Fn6	Digital input DI7 function	0 - 31	7		ALL
Fn7	Digital input DI8 function	0 - 31	8		ALL
Fn8	Digital input DI9 function	0 - 31	9		ALL
Fn9	Digital input DI10 function	0 - 31	10		ALL
Fn10	Digital output DO1 function	0 - 15	1		ALL
Fn11	Digital output DO2 function	0 - 15	2		ALL
Fn12	Digital output DO3 function	0 - 15	3		ALL
Fn13	Digital output DO4 function	0 - 15	4		ALL
Fn14	Digital output DO5 function	0 - 15	5		ALL
Fn15	Digital output DO6 function	0 - 15	6		ALL
Fn16	Digital output DO7 function	0 - 15	7		ALL

Fn17	RT10-STP communication cycle parameter	0 - 15	10		ALL
Fn18	Reserved	0 - 100	0		ALL
Fn19	Reserved	0 - 15	0		ALL
Fn20	Position command correction factor	1.0 - 10.0	1.0		P
Fn21	RS485 communication protocol selection	0 - 4	0	0-Reserved 1-Panasonic A5 2-Modbus RTU	ALL
Fn22	Motor related parameter setting	0000b - 1111b	0000b	bit0, Auto zero position enable bit1, Electrical angle reverse bit2, Speed feedback reverse bit3, Position feedback reverse	ALL
Fn23	Auxiliary control policy setting	0000b - 1111b	0000b	bit0, Zero calibration bit1, dead time compensation bit2, Speed phase compensation bit3: Reserved	ALL
Fn25	Origin position low bits	0 -	0		P

★		32000			
Fn26 ★	Origin position high bits	0 - 32000	0	x10000	P
Fn29	Origin return mode	0 - 3	0		ALL
Fn30	Origin return first speed	1 - 3000	500	rpm	ALL
Fn31	Origin return second speed	1 - 3000	50	rpm	ALL
Fn32	The origin return ACC/ DEC time constant	0 - 3000	20	ms	ALL
Fn33	Origin return trigger mode	0 - 3	0	0, turn off the origin return 1, DI upper edge trigger 2, Auto-execute after power-on	ALL
Fn34	U-phase current offset compensation amount	0			ALL
Fn35	V-phase current offset compensation amount	0			ALL
Fn36	VF mode running frequency	0		Hz	
Fn37	VF mode running amplitude	0			
Fn40	Current loop bandwidth setting	0 - 8000		Hz	
Fn42	Low-frequency anti-vibration frequency	0 - 100.0	0	Hz	P

Fn43	Low-frequency anti-vibration width setting	0 - 20	0		P
Fn44	Low-frequency anti-vibration depth setting	0 - 100	0		P
Fn45	Notch filter center frequency	0 - 1000	1000	Hz	ALL
Fn46	Notch filter width	0 - 20	0		ALL
Fn47	Notch filter depth	0 - 100	2		ALL
Fn50	Analog AI1 filter time constant	0 - 600	2.0	ms	S, T
Fn51	Analog AI1 zero drift	-500 - 500	0	mV	S, T
Fn52	Analog AI1 offset	-5000 - 5000	0	mV	S, T
Fn53	Analog AI1 dead time	0 - 1000	10	mV	S, T
Fn54	Analog 10v corresponding speed	0 - 6000	3000	rpm	S
Fn55	Analog AI2 filter time constant	0 - 600	2.0	ms	S, T
Fn56	Analog AI2 zero drift	-500 - 500	0	mV	S, T
Fn57	Analog AI2 offset	-5000 - 5000	0	mV	S, T
Fn58	Analog AI2 dead time	0 -	10	mV	S, T

		1000			
Fn59	Analog 10v corresponding torque	0 - 800.0	100.0	%	T
Fn60 ★	Origin offset position low bits	0 - 10000	0		P
Fn61 ★	Origin offset position high bits	0 - 10000	0	x10000	P
Fn63	Internal speed command 2	-9000 - 9000	0	rpm	S
Fn64	Internal speed command 3	-9000 - 9000	0	rpm	S
Fn65	Internal speed command 4	-9000 - 9000	0	rpm	S
Fn66	Offline Inertia identification the max speed	100 - 3000	500	rpm	P, S
Fn67	Offline inertia identification ACC/DEC time	20 - 1000	125	ms	P, S
Fn68	Offline inertia identification waiting time	50 - 10000	800	ms	P, S
Fn69 ★	Inertia identification mode selection	0 - 3	0		P, S
Fn70	Internal position mode target position	-1000.0 - 1000.0	0.0	lap	P
Fn71	Internal position mode	0 -	100	rpm	P

	max speed	6000			
Fn72	Internal position mode ACC/DEC time constant	1 - 3000	300	ms	P
Fn73	Internal location mode waiting time	1 - 10000	500	ms	P
Fn75	Zero position locked current setting	1 - 200	50	%	ALL
Fn76	Speed compensation strategy selection	0			P, S

6 Fault Alarm

6.1 Alarm code list

Table 6-1 Alarm list

Alarm code	Alarm name	Description
0	Normal	
Err 1	Over speed	Servo motor speed exceeds the set value (PA23)
Err 2	Main voltage over voltage	Main circuit power supply voltage is too high
Err 3	Vibration detected	The drive has detected vibration that exceeds the set threshold
Err 4	Position out of tolerance	The positional deviation counter value exceeds the set value (PA17)
Err 5	Motor average load current alarm	The motor average load current is too large
Err 6	Speed amplifier saturation fault	Speed regulator is saturated for a long time
Err 7	CCWL/CWL abnormal	CCWL/CWL input are OFF
Err 8	IPM over temperature alarm	IPM temperature exceeds the set value
Err 9A/b/c	Encoder A / B / Z phase error	Encoder A / B / Z phase signal error
Err 10	Motor parameter error	Motor parameter is out of range
Err 11	IPM module faulty	IPM smart module is faulty
Err 12	Over current	Motor current is too large
Err 13	Over load	Servo drive and motor are overloaded (instantaneous overheating)
Err 14	Braking fault	Brake circuit is faulty
Err 15	Encoder count error	Encoder count is abnormal

Err 16	Braking resistor braking rate is too high	Braking ratio is out of range
Err 18	Absolute encoder alarm	Encoder communication error
Err 19	Absolute encoder battery failure	Battery voltage is lower than 2.5V, multi-turn location information has been lost
Err 20	EEPROM error	EEPROM error
Err 21	Phase A current sampling error	Phase A current sampling error
Err 22	Parameter is out of range	There is servo parameter out of range
Err 23	Phase B current sampling error	Phase B current sampling error
Err 24	Absolute encoder parameter read/write error	Motor encoder EEPROM parameter error
Err 25	Encoder AB feedback is abnormal	Encoder AB feedback frequency is too high
Err 26	IO input terminal function configuration is abnormal	Different IO input terminals are configured to the same function
Err 27	Absolute encoder battery alarm	Battery voltage is lower than 3.1V, the battery voltage is low
Err 28	Absolute encoder communication timeout alarm	Absolute encoder timeout return
Err 29	Torque overload	Motor load exceeds the value and duration set by user
Err 30	Encoder Z pulse lost	Encoder Z pulse lost
Err 31	Encoder UVW signal error	Encoder UVW signal is incorrect or does not match with the encoder
Err 32	Encoder UVW signal illegal encoding	UVW signal keeps at all high level or all low level
Err 33	Dynamic memory	Dynamic memory allocation error

	allocation error	
Err 34	Flash reads CRC error	Flash reads CRC error
Err 35	Motor adaptation error	Non-adaptive motor
Err 36	Watchdog error	Driver internal watchdog error
Err 37	Motor initial zero lock error	Zero position lock error
Err 38	External braking resistor is wrong	The resistance of the external braking resistor is less than the minimum allowable value
Err 51	Multi-turn data exceeds the set value	Multi-turn data exceeds the set value
Err 52	Main power supply under voltage alarm	In the enabled state, the bus voltage is lower than 245V
Err 53	AC main power supply failure/ is off	The power supply cable L1, L2, L3 is powered down
Err 54	AC main power supply phase loss	The power supply cable L1, L2, L3 is phase loss
Err 55	Dynamic braking overcurrent	Dynamic braking overcurrent fault
Err 56	Internal D5V undervoltage	The voltage supplied to the control board is less than 5 V
Err 62	Motor speed out of control	There is large difference between command speed and actual speed.

The End



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