

# RT20 Pulse Series 380V AC Servo Drive User Manual



A&TS TECHNOLOGY CORPORATION LIMITED

[www.a-ts.cn](http://www.a-ts.cn)

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<b>Version</b>	<b>Product</b>	<b>Release Date</b>	<b>Note</b>
V-23-01	RT20	24.03.2023	N/A
V-23-02	RT20	10.05.2023	N/A

# Forward

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The RT20 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.

Thank you for choosing A&TS.

A&TS, automation technologies, at your services.

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><b>INSTRUCTIONS</b></p>	<p>It is widely used. It reminds the instructions and prompts.</p>
<p><b>EXAMPLE</b></p>	<p>For the better understanding of the users, to show a brief example.</p>
<p><b>NOTE</b></p>	<p>It offers small functions and tips unnoticeable that are very convenient to use.</p>

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# 1 Safety Precautions

## 1.1 General precautions

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.

When installing, operating, and maintaining the RT20 series ac servo, please follow all the safety instructions in this manual, especially where there is safety symbols. All the safety symbols are the tips to the safety precautions. It doesn't include all the security matters or considerations.

For any injury or loss caused by improper operation, the A&TS technology will not take the responsibility. The A&TS technology is not legally bound in any manner either.

### Basic installation requirement

- Only qualified or strictly trained engineers are allowed to install, operate and maintain equipment.
- Only qualified professionals are allowed to dismantle devices and repair equipment.
- Replacing or changing hardware & software must be carried out by the authorized engineers.
- The operator shall report the failure or error to the person in charge in time promptly.

### Grounding requirement

The following requirements are for devices that need to be grounded only.

- Before installing the equipment, grounding first. When removing the equipment, keep the grounding until the end.
- It is forbidden to damage the grounding conductor.
- It is forbidden to operate equipment without the grounding conductor.
- The equipment shall be grounded always. Before operating, make sure the electrical connection is fine and reliable.

### **Equipment safety**

- Before operation, the equipment should be fixed in the electric cabinet or on other stable objects firmly, such as the table or floor.
- When the system is running, make sure the air vent is unobstructed.
- When installing the equipment, to tighten the screws, use the tool.
- After complete the installation, please take all the empty packing materials area away.



## 2 Product Information

### 2.1 Product introduction

RT20 series servo is all digital ac servo drive, with high reliability, performance and cost effectiveness.

- High voltage servo, working at three phases 380V AC, with high voltage motor.
- Supports position control, speed control and torque control mode.
- Supports incremental encoder, ABZ incremental encoder, absolute encoder including Tamagawa, BISS, and Nikon, and Magnetolectricity encoder (ME).
- Supports RS485 communication, standard Modbus protocol.
- Supports internal speed mode and demonstration running mode.

### 2.2 Order number

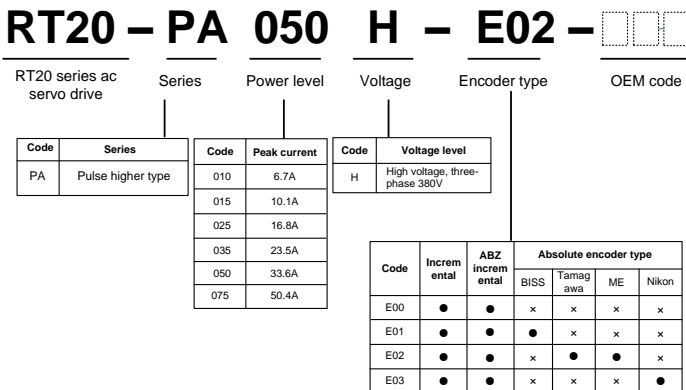


Figure 2-1 RT20 series AC servo drive order number

**INSTRUCTIONS**

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

## 2.3 Technical specifications

Table 2-1 RT20 series pulse series technical specification

Model		RT20 series AC servo drive					
RT20-PA□□□H-E02		010	015	025	035	050	075
Power supply		Three-phase AC380V (-15%)-440V(+10%), 50/60Hz					
Rated current (rmsA)		3.5	5.0	7.5	12.0	15.5	22.5
Maximum current (rmsA)		6.7	10.1	16.8	23.5	33.6	50.4
Peak current (o-pA)		9.5	14.3	23.8	33.3	47.5	71.3
Environm ent	Temperature	Working 0-55°C (If the ambient temperature is between 45°C and 55°C, the average load should not exceed 80% of the rated load.) 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		Optional, built-in or external					
Feedback		ABZ incremental encoder, standard incremental encoder, and absolute encoder					
Control mode		Position/Speed/Torque					
Control input		Up to 8 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, mode switch 1, mode switch 2, forward jog, backward jog, torque command direction setting, speed command direction setting, 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 5 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 in limitation, speed in limitation, origin return (homing) 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	Command source	Internal position command, pulse command
	Input frequency	Pulse command port, differential input≤4Mpps single-ended input≤500kpps
	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	Command	Parameter setting

	ACC/DEC	
	Analog command input	Support -10V - +10V input
	Command source	Internal speed command, analog command
Torque	Speed limitation	Parameter setting
	Analog command input	Support -10V - +10V input
	Command source	Internal torque command, analog command
Special function		Origin return(homing), gain switch, mechanical resonance notch filter
Monitoring function		Rotation speed, current position, position deviation, motor torque, motor current, command pulse frequency, etc.
Protection function		Over speed, over voltage, over current, over load, braking abnormal, encoder abnormal, position out of 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

# 3 Installation and Wiring

## 3.1 Installation

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

### 3.1.1 Installation environment

- Working temperature 0-55°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/s<sup>2</sup>
- Altitude below 2000m
- 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.**

### 3.1.2 Products appearance and dimensions

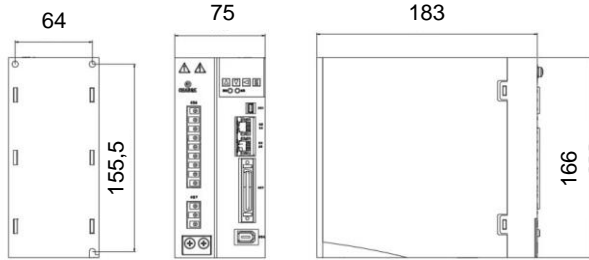


Figure 3-1 RT20-PA010/015H Appearance and dimensions (Unit, mm)

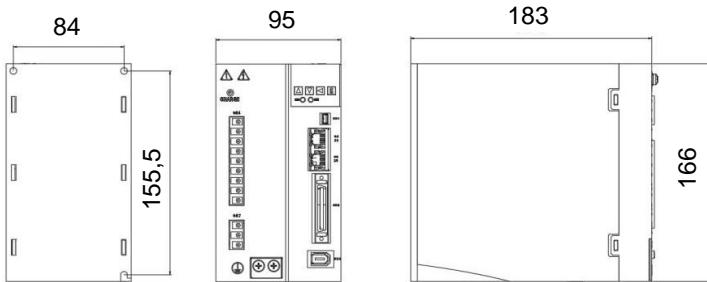


Figure 3-2 RT20-PA025/035H Appearance and dimensions (Unit, mm)

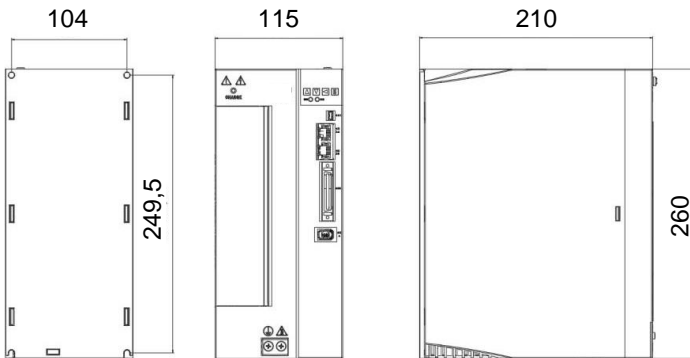


Figure 3-3 RT20-PA050/075H Appearance and dimensions (Unit, mm)

### 3.1.3 Installation direction

Install the servo drive as the figure below. Good ventilation and heat dissipation must be ensured.

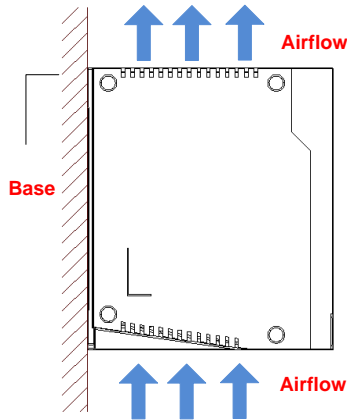


Figure 3-4 RT20 series AC servo drive installation direction (Unit, mm)

#### INSTRUCTIONS

- The drive should be mounted vertically on the base.
- Use natural convection or fan to cool the drive.
- Use M4 screws for the installation.

### 3.1.4 Installation space

Reserve enough space as shown in Figure 3-5. Make sure that the air flows from bottom to top, good for heat dissipation.

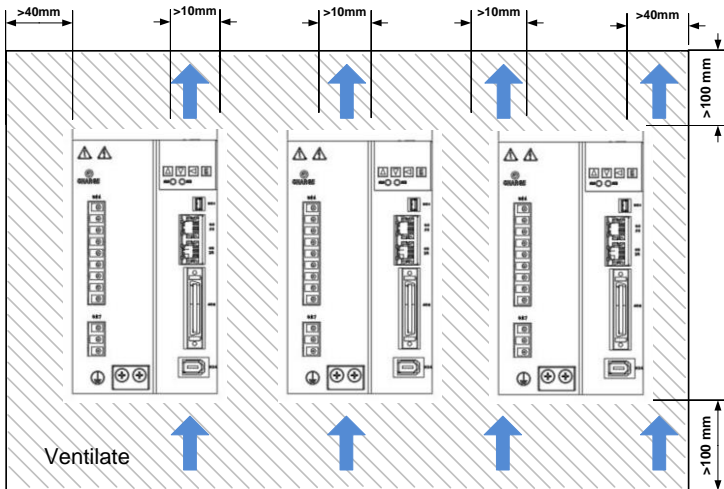


Figure 3-5 RT20 series AC servo drive installation space

- The working temperature should be below 45°C, to make sure the reliable performance.
- If the working temperature keeps above 45°C, please place the drive in the place with good ventilation. If it is installed in an electric cabinet, make sure that the size and ventilation is good enough inside the cabinet to avoid overheating.
- Make sure to ground the terminals, otherwise it may cause electric shock or interference that may cause danger due to misoperation.
- When wiring the drive, please route the cable downwards to prevent liquid from flowing into the drive when it is attached to the cable.



### 3.2 Wiring and terminals

#### 3.2.1 Wiring diagram

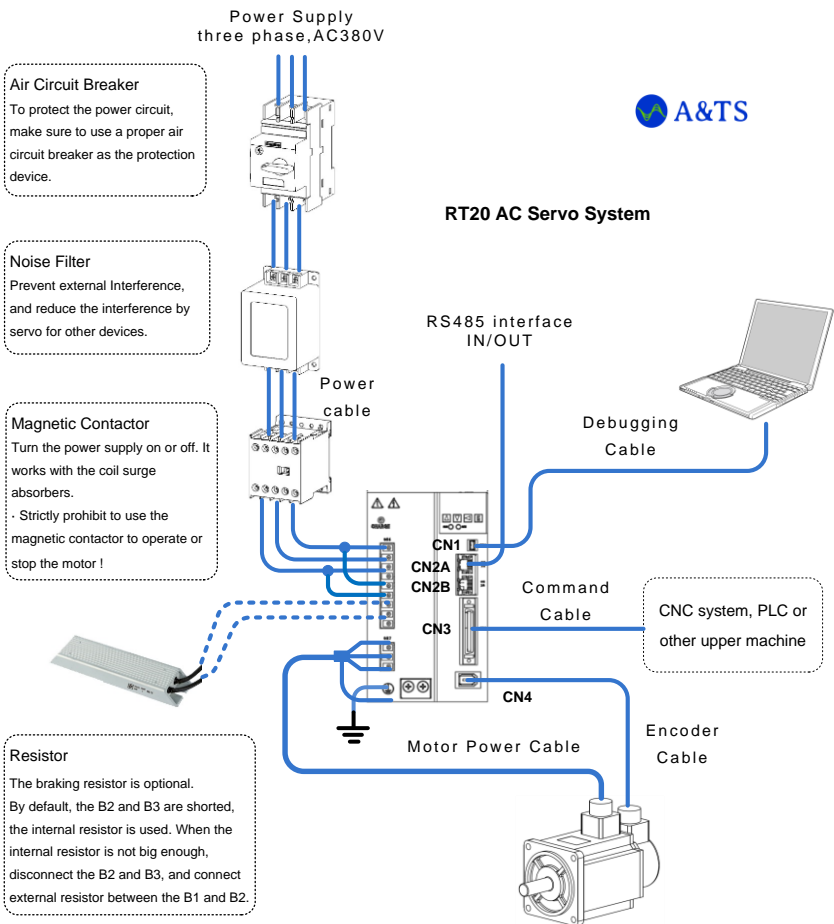


Figure 3-6 RT20-PA pulse series AC servo drive wiring diagram



- **Wiring operation should be performed by professional technicians.**
- **In order to avoid electric shock, after turn off the power, wait for more**

than 5 minutes, and then disassemble the drive.

- Please connect the servo drive and servo motor after completing the installation, otherwise it may cause electric shock.
- Do not damage the cable, apply excessive pressure to it, hang heavy objects or squeeze, etc., otherwise it may cause electric shock.
- To avoid electric shock, please insulate the power terminal wiring.
- The specifications and installation methods of external wiring must be complied with all the local regulations.
- Make sure to ground the entire system.



#### ATTENTION

- Please wire correctly and carefully, otherwise it will cause abnormal operation of the servo motor and may cause injury.
- Do not make mistakes in the connection terminals, otherwise it may cause cracks and damage.

#### INSTRUCTIONS

- RT-STP is the Servo Tuning Program. It's a debugging software provided by the A&TS Technology. For more details, please contact with us at [www.a-ts.cn](http://www.a-ts.cn).

### 3.2.2 Strong power terminals

1. RT20-PA010/15/25/35 strong electricity terminals.

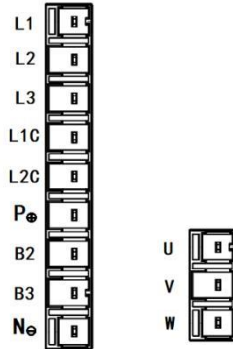


Table 3-1 RT20 series drive strong power terminals

Terminal Labels	Name	Specifications
L1C	Control power input terminals	Connect to single-phase 380V AC power 380V (-15%)-440V (+10%)
L2C		
L1	Main power supply input terminals	Connect to three-phase 380V AC power 380V (-15%)-440V (+10%)
L2		
L3		
B1/P(+)	Braking resistor terminals, common DC bus terminal	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 P and B2. When using a common DC bus, P/N terminals are connected to positive/negative voltage respectively.
B2		
B3		
N(-)		
U	Motor power terminals	It must be connected with the U, V, W, PE terminals of the motor correspondingly. (Note, the PE is the terminal on the metal
V		
W		

PE		heat sink of the drive)
----	--	-------------------------



**L1/L2/L3 cannot be connected to single-phase 380V, but must be connected to three-phase 380V. Short-circuit L1C and L1, L2C and L2.**

2. RT20-PA050/75 strong electricity terminals.

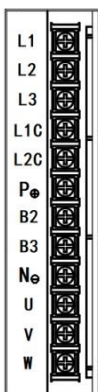


Table 3-2 RT20-EA050/75 servo drive strong power terminals

Terminal labels	Name	Specifications
L1C	Control power input terminals	Connect to single-phase 380V AC power 380V (-15%)-440V (+10%)
L2C		
L1	Main power supply input terminals	Connect to three-phase 380V AC power 380V (-15%)-440V (+10%)
L2		
L3		
B1/P(+)	Braking resistor	When using internal braking resistor, short

B2	terminals, common DC bus terminal	circuit B2 and B3.  When using external braking resistor, disconnect B2 and B3, and connect the braking resistor between P and B2.  When using a common DC bus, P/N terminals are connected to positive/negative voltage respectively.
B3		
N(-)		
U	Motor power terminals	It must be connected with the U, V, W, PE terminals of the motor correspondingly. (Note, the PE is the terminal on the metal heat sink of the drive)
V		
W		
PE		

**WARNING**

**L1/L2/L3 cannot be connected to single-phase 380V, but must be connected to three-phase 380V. Short-circuit L1C and L1, L2C and L2.**

### 3.2.3 Command terminal CN3

Pulse sequence command mode

RT20 command terminal CN3 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 CN3 are as shown below.

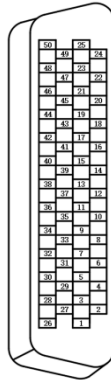


Figure 3-7 the CN3 terminal

**INSTRUCTIONS**

- It is recommended to use the original RT20 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 3-3 Command Terminal CN3 Definition

Signal name		Pin No.	Signal Description
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
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
	DO4+(BRKOFF-)	10	
	DO5+(AT-SPD+)	12	Digital output 5. The default function, speed reached output
	DO5+(AT-SPD-)	18	
Position pulse	OPC1	1	Low-speed command, when the pulse sequence voltage is 12V or 24V, replace PULS +.

command	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	
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

### 3.2.4 Encoder terminal CN4/CN5 definition

The RT20-PA series drive supports two encoder interfaces. The user can choose to use them according to the actual situation, or the encoder failure alarm may appear.

#### 1) CN4 definition

This terminal is used to input the servo motor encoder signal. It can be connected to absolute encoders only.

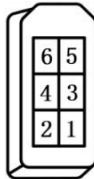


Table 3-4 The absolute encoder terminal definition

Pin No.	Signal Name	Description
1	EC-5V	Encoder power output, 5V±5%
2	EC-GND	Encoder power/signal ground, 0V
3	CLK+	Serial clock (used when connecting to Nikon/Biss/Endat encoder)
4	CLK-	
5	SDATA+	Bidirectional Serial Data
6	SDATA-	

Shell/ housing	PE	Shield ground/protective earthing
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➤ **The absolute encoder signal reference circuit.**

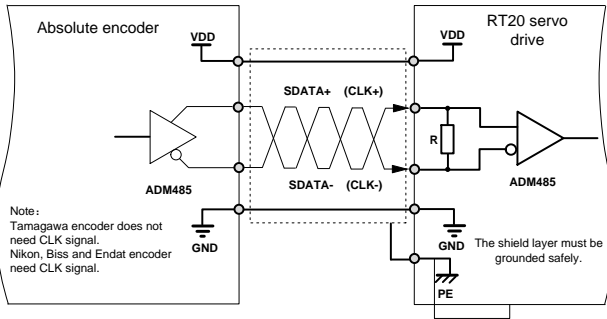
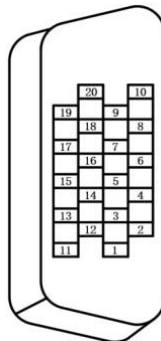


Figure 3-9 the absolute encoder input signal interface circuit

**2) CN5 definition**

This terminal is used to input the servo motor encoder signal. It can be connected to standard incremental encoder and ABZ incremental encoder only. The schematic diagram of encoder terminal pins is below.



- It is recommended to use the original accessory cable of the RT20 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 below.

Table 3-5 Standard incremental encoder signal input terminals

Pin No.	Signal Name	Description
1	EC-5V	Encoder power output, $5V\pm 5\%$
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. Don't connect it when using the ABZ incremental encoder.
14	U-	
15	V+	Encoder phase V signal input. Don't connect it when using the ABZ incremental encoder.
16	V-	
17	W+	Encoder phase W signal input. Don't connect it when using the ABZ incremental encoder.
18	W-	
11	PE	Shield ground/protective earthing



Without the permission or authorization by A&TS Technology, no motor or motor encoder shall be matched with RT20 servo drive. Otherwise, it may cause damage to the motor or even danger to personal safety.

**INSTRUCTIONS**

- When using an absolute motor, choose the encoder terminal CN4.
- Terminal CN5 supports standard incremental and ABZ incremental encoder.
- When the encoder cable is longer than 10 meters and the signal cable diameter is not greater than 24AWG, two power signal cables must be connected in parallel.

➤ **The standard incremental encoder signal reference circuit**

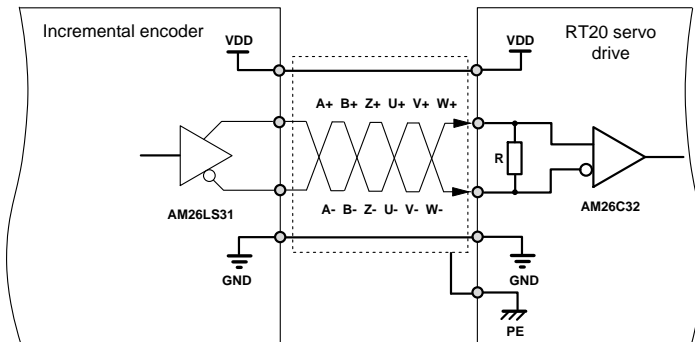


Figure 3-10 the incremental encoder input signal interface circuit

Table 3-6 ABZ 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-	
11	PE	Shield ground

➤ **ABZ incremental encoder signal reference circuit**

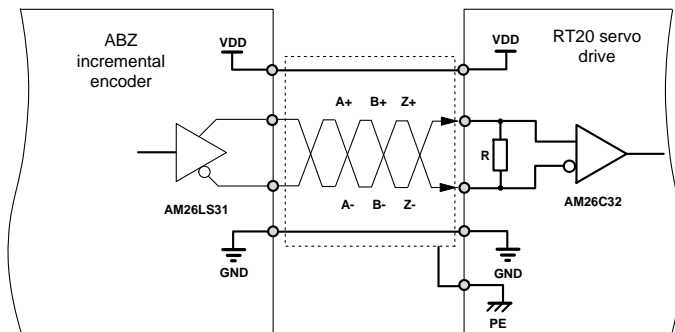


Figure 3-11 the ABZ incremental encoder input signal interface circuit

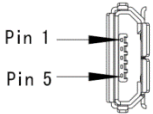
### 3.2.5 USB debugging port CN1 definition

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.

Table 3-7 USB pin definition

Pin No.	Signal Name	Description	Port Definition
1	-	-	 <p>Pin 1 →</p> <p>Pin 5 →</p>
2	USB_D-	USB data-	
3	USB_D+	USB data+	
4	-	-	
5	DGND	USB power/signal ground, 0V	



**WARNING**

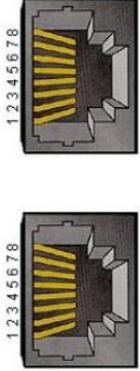
**When updating the program, do not connect USB3.0 cable to the drive directly, or it may cause damage to the drive or PC port.**

### 3.2.6 RS485 communication port CN2A/CN2B definition

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

The RT20 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 9 (Communication Function). The pins are defined as below.

Pin No.	Signal Name	Description	Port Definition
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	

### 3.2.7 Wiring of three control mode

- The position control mode wiring sample graph

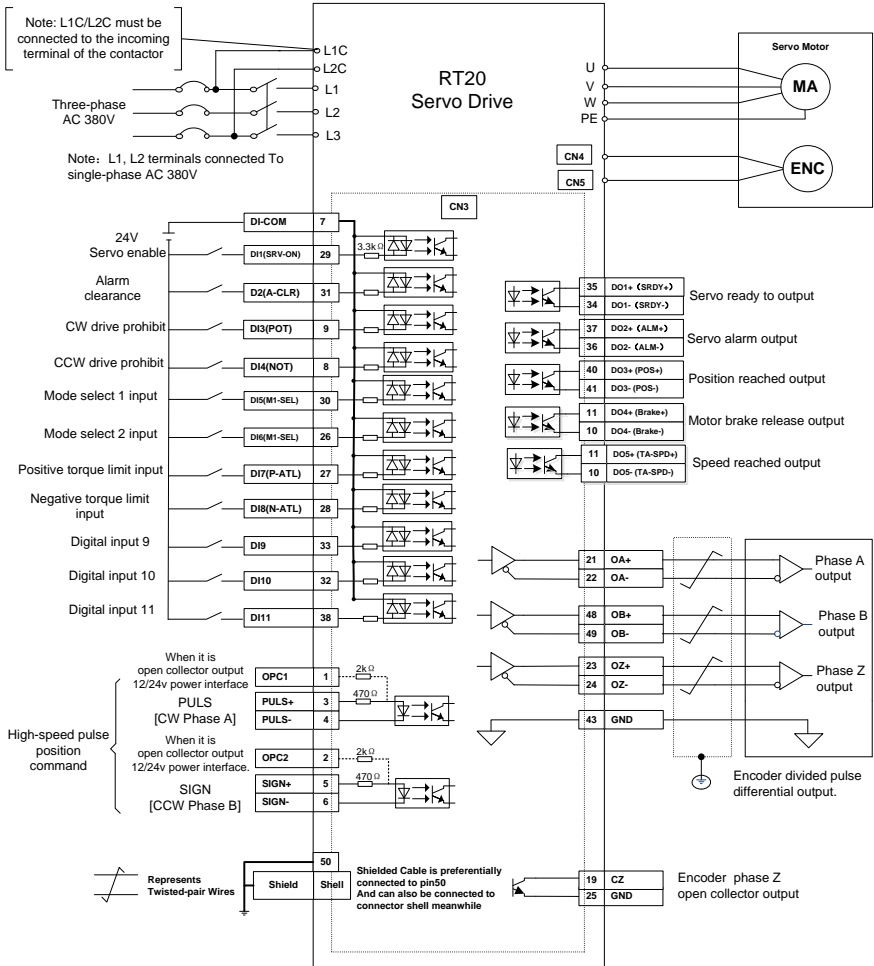


Figure 3-13 Position control mode wiring

● Speed / torque control mode wiring sample graph



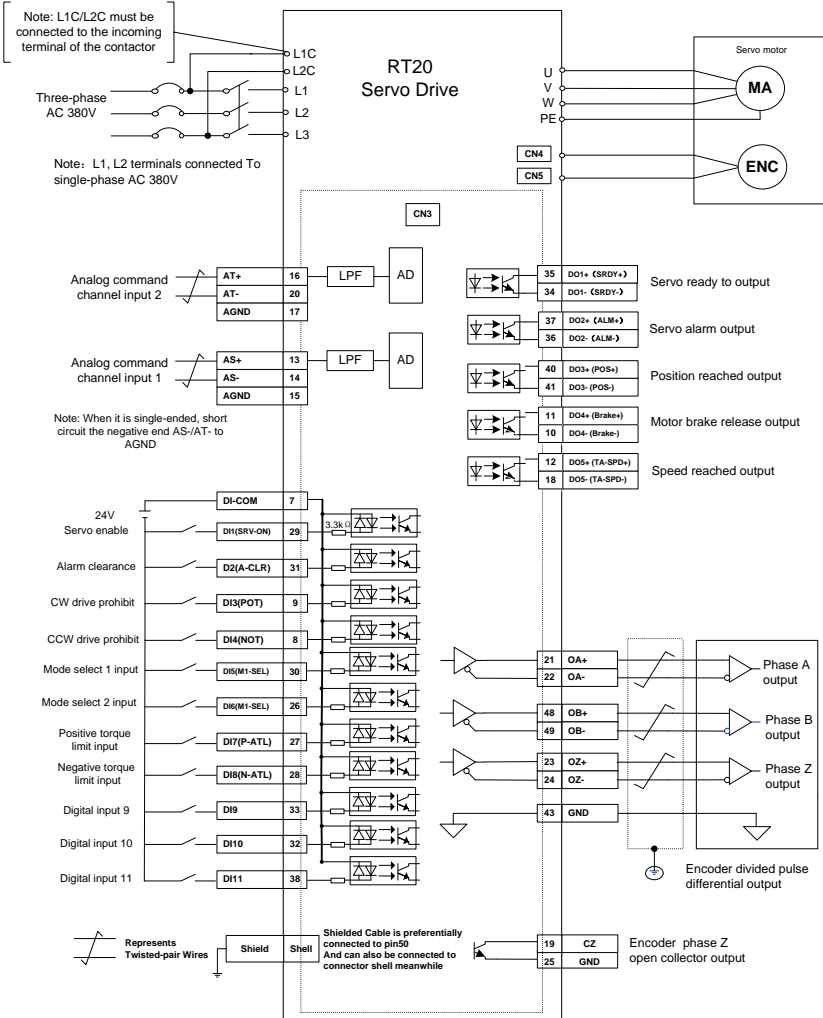


Figure 3-14 Analog speed / torque command control mode wiring

## 4 Display and Keyboard Operation

### 4.1 Basic operation

The operator panel adopts five LED tubes, two LED indicators, and four keys, as shown in the Figure 4-1.

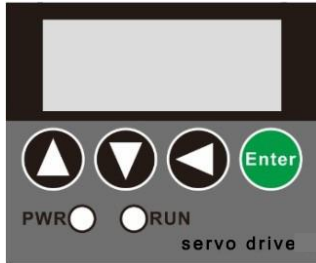


Figure 4-1 operation panel

#### 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. -12345 indicates negative number -12345. -2.345 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.

## 4.2 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 4-2.

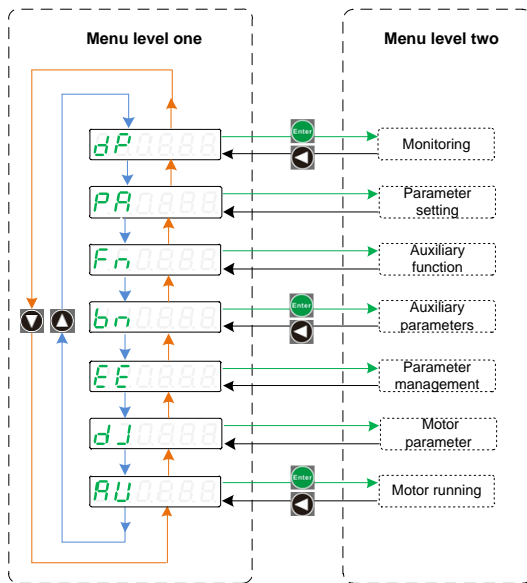


Figure 4-2 Menu level one

### 4.3 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.

#### 4.3.1 Monitoring

Select dP 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 4-3 Menu level two

### 4.3.2 Parameter setting (Pa/Fn parameter)

In the menu level one, select `PR 0000` or `Fn 0000` 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.
- There are many PA parameters. When modifying, you can press the Page up or Page down key to select the nearest one. If you modify PA5, press the Page up key. If you modify PA84, you can press the Page down key.
- In the RT20 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.

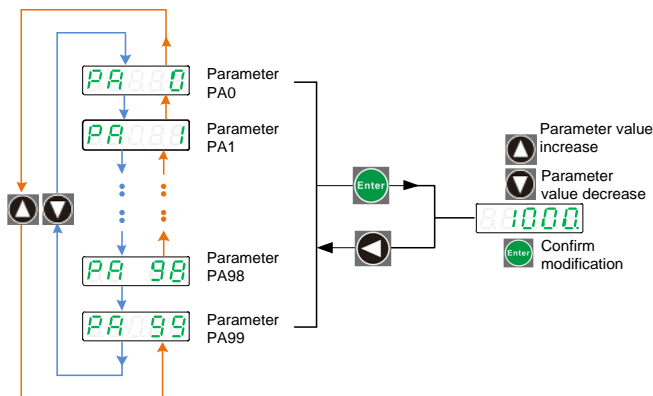


Figure 4-6 PA parameter setting menu

### 4.3.3 Parameter management

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

In the menu level one select `EE` 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.

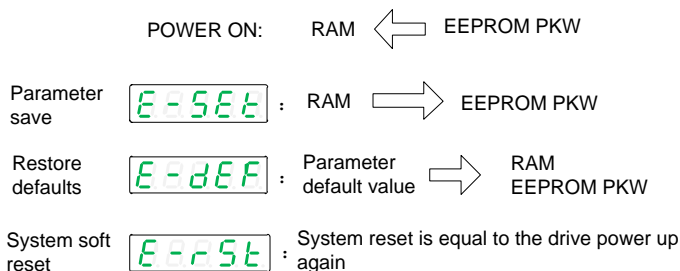


Figure 4-7 Parameter management menu

**EXAMPLE**

Example, Parameter save, Reset to factory defaults, System soft reset.



Step 1. Select `E-SEt`, `E-dEF`, or `E-rSt` and press the Enter key.

Step 2. Keep pressing the Enter key and hold for 3 seconds above. Digital tube will display `StArT`, which indicates that the parameter is being written to the EEPROM.

Step 3. Wait 1 - 2 seconds. If the operation succeeds, it will display `donE`, otherwise it will show `Error`.



ATTENTION

**Before doing the Reset to factory defaults operation, please change the PA0 value to 0.**

#### 4.3.4 Speed test run

Set the control mode PA4 to 2, save and restart. After the restart, change the PA53 to 1.

In the menu level one select `Sp000` and press the Enter key to go to the speed test run mode.

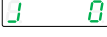
The prompt of speed test run is `8 00`, and the numeric unit is r/min. The system is in the speed control mode. The speed command is provided by the keys, and changed by the Page up and Page down keys. The motor runs at a given speed.

#### 4.3.5 JOG running

Set the control mode PA4 to 5, save and restart. After the restart, change the PA53 to 1.

In the menu level one select `Jr000`, and press Enter key to enter

## JOG mode.

The prompt of the JOG running is , and the Numeric unit is r/min.

The system is in the speed control mode, and the speed command is set by parameter PA21.

Press Page up key and hold, and the motor runs at the speed set by PA21. Release the key, and motor stops.

Press Page down key and hold, and the motor reverse runs at the speed set by PA21. Release the key, motor stops.

- When it is in the Speed test run or JOG running, please do keep the motor in no-load condition.
- If we don't know whether the drive and motor matches or not, please use a slow speed when doing the speed trial operation and JOG running operation.

# 5 Commissioning and Running

Trial running without load

The purpose of trial running is to confirm whether the following items are correct.

- The servo drive power supply wiring
- The servo motor wiring
- Encoder wiring
- The servo motor running direction and speed

## 5.1 Wiring and inspection

Before power on, please check the motor.

- No load on the motor or motor shaft. Please disconnect the couplings if it is already installed on the machine.
- The motor must be fixed, or the ACC/DEC will move the motor.
- Do the wiring as per the following diagram, and check the following before power on.
  - Is the wiring correct? Especially whether the L1 / L2 / L3 wiring and U / V / W have the one-to-one correspondence with the motor?
  - Is the input voltage correct?
  - Is the encoder cable wiring correct?

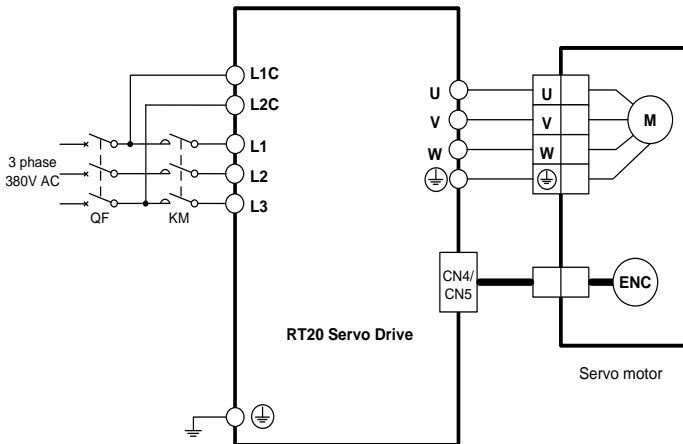


Figure 5-1 Servo drive wiring diagram

## 5.2 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

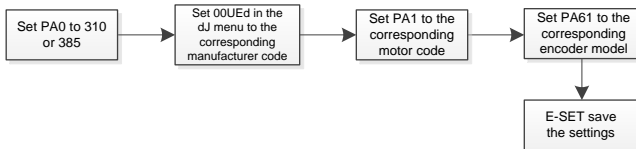
The RT20 series servo drive can identify motor parameters for some motors from several manufacturers automatically, and need to identify motor parameters through codes for other manufacturers' motors. In the case that the two methods are not

compatible, the motor parameters can only be identified through the user-defined method.

### Commissioning steps to automatic identification motor parameter



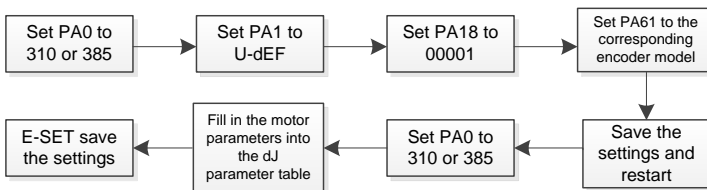
### Commissioning steps to identify motor parameters by code



**ATTENTION**

- **Set PA61 to the corresponding encoder type (0 is incremental, 1 is ABZ incremental, 2 is absolute)**

### Commissioning steps for user-defined parameters



**NOTE**

- If the motor encoder is equipped with a battery, set PA18 to 00001, otherwise set it to 00000.

### 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 `000Ed` in `dJ99` 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 `EEPR`.
- 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`.

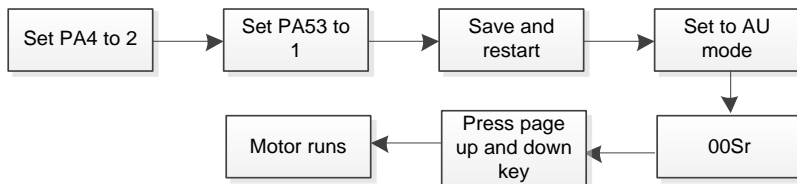
## 5.3 Speed trial running

### 1) Power on

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

### 2) Parameter setting

Set parameters according to the following table, save the setting and restart the servo.



Parameter	Name	Set value	Factory value	Parameter description
PA4	Control mode	2	0	Speed of trial running control mode
PA53	Lower 5 digit input	00001	00000	Drive enable

### 3) Running

First confirm there is no alarm or any abnormal condition. The motor is enabled at zero speed.

Select 5r000 in the menu level one, and press the Enter key to go to the speed trial running mode.

The prompt of speed trial running is 00000, the unit value is r/min. The speed commands are provided by the keyboard, and use the Page up key or Page down key to change the commands. The motor runs at the given speed.

## 5.4 JOG trial running

### 1) Power on

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

please check the wiring.

## 2) Parameter setting

Set the parameters according to the table below.

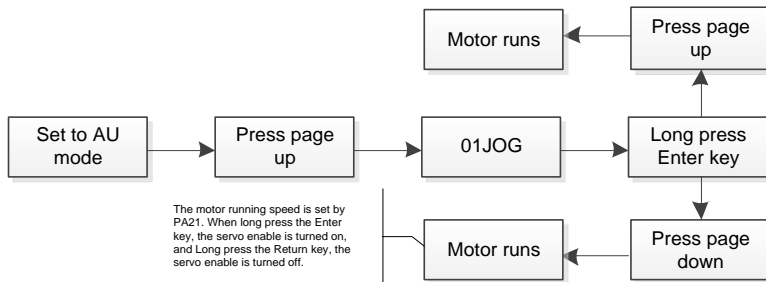


Figure 5-2 JOG trial running block diagram

Parameter	Name	Set value	Factory value	Parameter description
PA4	Control mode	5	0	JOG control
PA21	JOG running speed	Appropriate value	300	JOG speed
PA53	Lower 5 digit input terminal forced ON	00001	00000	Drive enable

## 3) Running

First confirm there is no alarm or any abnormal condition. The motor is enabled at zero speed.

Select Jr 0000 in the menu level one, and press the Enter key to go to the JOG trial running mode.

Press the Page up key and hold , the motor runs at JOG speed (PA21) CW. Release the Page up key, the motor will stop and keep at zero speed.



Press the Page down key and hold, the motor runs at JOG speed (PA21) CCW.

### 5.5 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.

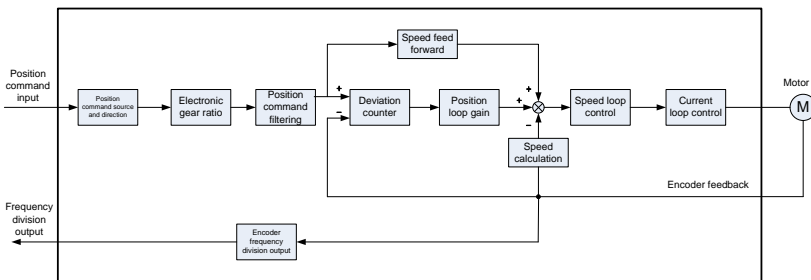


Figure 5-3 Position control block diagram

#### 5.5.1 Position control simple example

Wiring diagram for PLC Control

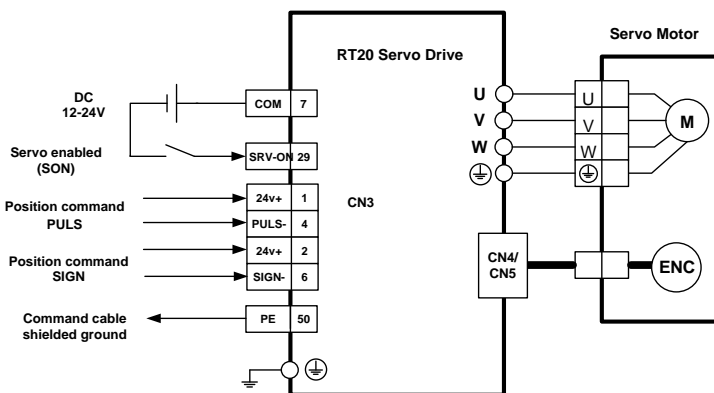


Figure 5-4 PLC control wiring diagram

## Wiring diagram of the CNC control

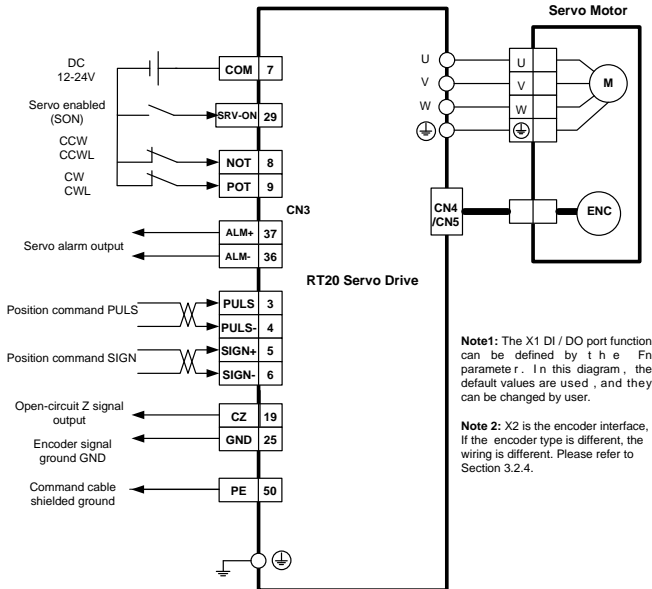


Figure 5-5 CNC control wiring diagram

**ATTENTION**

- Command cables must be shielded with two legs. One set of twisted pair is used for pulse and direction.
- By modifying PA19, the command pulse signal can be filtered to remove interference noise.

**5.5.2 Position command**

Parameters related to the position command

Table 5-4 Parameters related to position command

Parameter	Name	Set value	Parameter description
PA4	Control mode	0	Position control
PA12	Electronic gear numerator	Appropriate value	Only valid when both PA81 and PA84 are 0
PA13	Electronic gear denominator	Appropriate value	
PA14	Position command input pulse mode	0	0: pulse+direction 1: CW+CCW 2: A B orthogonal
PA15	Position command input pulse direction negation (NOT)	0	Set as the negation of 00001
PA19	Position command pulse signal filter time constant	Appropriate value	Filter the command pulse
PA52	Position command smoothing time constant	0.0	Position command smoothing time
PA81	Lower 5 bits of the command pulse number, for each rotation of the motor	Appropriate value	Pulses per motor revolution= $PA84 \times 1000 + PA81$
PA84	Higher 5 bits of the command pulse number, for each rotation of the motor	Appropriate value	

### Command pulse transmission path

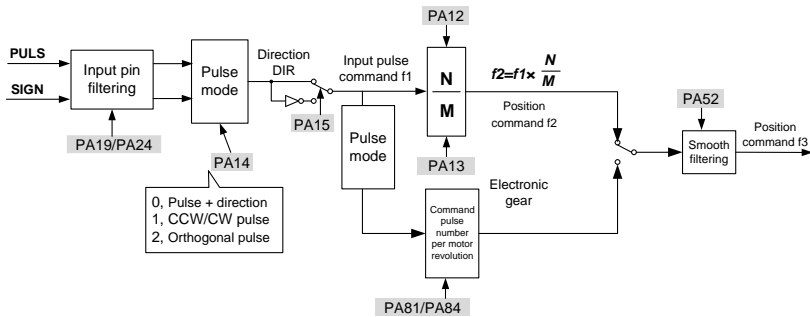


Figure 5-6 Instruction pulse transmission path

### 5.5.3 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 5-5 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

## 5.6 Speed and torque control

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

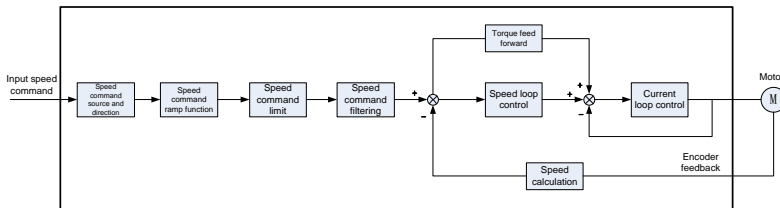


Figure 5-8 Speed control diagram

Parameters related to the speed commands

Table 5-7 The parameters related to the speed commands

Parameter	Name	Set value	Description
PA4	Control mode	9	Set as speed control
PA15	Speed command direction setting	0	Set as the negation of 00010
PA22	Speed command source selection	2	Set speed command source
Fn50	Analog AI1 filter time constant	Appropriate value	Suppress command fluctuations
Fn51	Analog AI1 zero drift	Appropriate value	Zero drift compensation (mV)
Fn52	Analog AI1 offset	Appropriate value	Offset (mV)
Fn53	Analog AI1 dead time	Appropriate value	Enforcement in the dead time is 0

Fn54	Speed value corresponding to analog 10V	Appropriate value	The proportional relationship between voltage and speed
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### Speed command transmission path

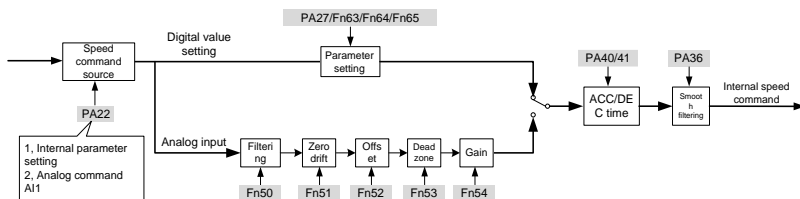


Figure 5-9 Speed command transmission path

## 5.7 RS485 control setting

Table 5-10 Parameters related to RS485 communication

Parameter	Name	Set value	Description
Fn21	RS485 communication protocol selection	Appropriate value	0- Yaskawa protocol 1-Panasonic protocol 2-Modbus RTU
PA76	RS485 response frame delay time	Appropriate value	Set the response time
PA82	RS485 communication address setting	Appropriate value	Set the station number, the maximum is 128
PA83	RS485 communication rate setting	Appropriate value	0-2400    1-4800 2-9600    3-19200 4-38400    5-57600 6-115200

PA87	RS485 communication verification method selection	Appropriate value	0-no parity 1-even parity 2-odd parity
------	--	----------------------	--

Each parameter is represented by 16 bits of data. The communication address of each parameter is determined by the parameter segment number and the parameter sequence number. The communication address has 16 bits of data, of which the high 8 bits are the parameter segment number and the low 8 bits are the parameter sequence number.

Table 5-11 Parameter address of the RS485 communication

Parameters type	Parameter segment number	Parameter sequence number	Read-write attribute
PA parameters	0x00	0-88	Read & write
Fn parameters	0x00	100+(0-79)	Read & write
dJ parameters	0x01	0-15	Read / write
dP parameters	0x03	0-35	Read-only

The internal state parameters of the servo drive can be read through the RS-485 communication port, but they can't be written. The state quantity is stored in 16BIT data, and the value accurate to the decimal place is amplified by 10 times and 100 times when read out through the communication port. State parameters are stored in 16-bit data, where the value is accurate to the decimal place. When they are read out through the communication port, the value is multiplied by 10 times and 100 times.

The following shows the sequential organization of related state

parameters.

0x0300, motor speed, in unit rpm, consistent with dp00.

0x0301, current position (pulse), 16 bits low

0x0302, current position (pulse), 16 bits high

0x0303, position command (pulse), 16 bits low

0x0304, position command (pulse), 16 bits high

0x0305, position deviation (pulse), 16 bits low

0x0306, position deviation (pulse), 16 bits high

0x0307, motor torque, in unit 0.1%, consistent with dp07

0x030B, position command pulse frequency, in unit kHz

0x030C, speed command, in unit rpm, consistent with dp12

0x030F, input terminal DI state, consistent with dp15

0x0310, output terminal DO state, consistent with dp16

0x0313, alarm code

0x0318, bus voltage, in unit V, consistent with dp24

0x031B, absolute position of the rotor (pulse), 16 bits low

0x031C, absolute position of the rotor (pulse), 16 bits high

0x031D, average load rate, in unit %, consistent with dp29

0x031E, multi-lap position, consistent with dp30

0x031F, absolute position (pulse) of the rotor, converted by the feedback electronic gear ratio (PA78), 16 bits low

0x0320, absolute position (pulse) of the rotor, converted by the feedback electronic gear ratio (PA78), 16 bits high

**EXAMPLE**



The speed and torque modes are switched over RS485, and the motor runs at a given speed. The steps are as follows.

- Set PA20 to 00010 (allow online switching of control modes)
- Set PA4 to 9 (Speed mode)
- Set PA22 to 1 (speed command source)
- The speed value is given by PA27 to realize the motor running.

# 6 Adjustment

## 6.1 Summary

The servo drive needs to drive the motor as fast as possible, and to track the commands from the upper machine or internal settings. To achieve it, the servo gain shall be adjusted reasonably.

The servo gain is set by a combination of multiple parameters (position loop, speed loop gain, current loop, load rotation ratio of inertias, etc.), and they affect each other. Therefore, the servo gain setting must take the balance of each parameter value into the consideration.

The general procedure for adjusting the servo gain is as follows.

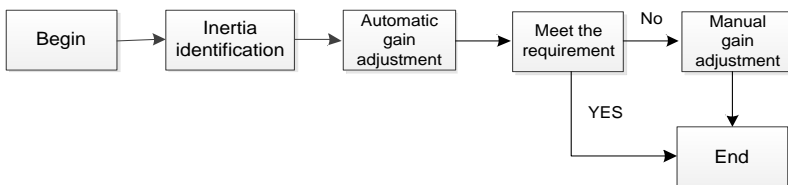


Figure 6-1 Gain adjustment flowchart

## 6.2 Inertia identification

$$\text{Load inertia ratio} = \frac{\text{Total rotational inertia of mechanical load}}{\text{Motor rotational inertia}}$$

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.

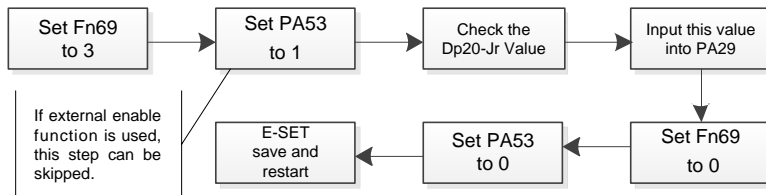


Figure 6-2 Inertia identification flow chart



#### ATTENTION

- After the inertia identification is completed, please be sure to set Fn69 to 0, otherwise normal servo operation will be affected.
- After the inertia recognition, the drive can recognize the field condition better. However, the gain parameters cannot be generated automatically, so the rigidity class (PA33) or gain parameters such as PA5 and PA6 need to be set.
- The dP-20Jr value is generally set to be about 300. If the value is too large, such as over 1000, or is negative (with a decimal point below each number), it indicates that the driver has failed to correctly identify the inertia. In the case of uneven load in general conditions (such as gear drive, belt drive, etc.), the inertia may not be recognized by the drive.
- If the inertia recognition is not completed, it will not affect the normal use of the drive.

## 6.3 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 6-1 Rigidity grade reference

Recommended stiffness grade	Load mechanism type
Grades 4 to 8	Large machinery and equipment
Grades 8 to 15	Machines with low stiffness such as belts
Grades 15 to 20	Machines with strong stiffness such as ball screws and linear



### ATTENTION

- **Before using the automatic gain adjustment function, make sure to acquire the load inertia ratio correctly.**
- **If the gain parameters obtained by setting PA33 cannot fully meet the field requirements, you can set PA33 to an appropriate fixed value, and then manually adjust PA5, PA6, PA9, and Fn40.**
- **When inertia recognition and automatic gain parameters are not implemented, the gain parameters can be adjusted manually.**

## 6.4 Manual gain adjustment

### 1) Purpose of the gain adjustment

For commands from the upper controller, the servo drive makes the motor to work as instructed as possible without delay. In order to make the motor work as the commanded with the optimal mechanical performance, the servo gain adjustment is required.

To adjust the servo gain manually, before adjust each servo gain one by one, please understand servo components and features. In most cases, if one parameter is changed significantly, the other parameters shall be adjusted again.

The servo unit is composed of three feedback loops (position loop, speed loop, current loop), the more inner the loop is, the more need to improve its responsiveness. If the principle is not followed, it will cause poor responsiveness or vibration.

### 2) Gain adjustment method

- ① Increase the current loop gain as much as possible, as long as there is no motor squeal.
- ② As long as the machine does not vibrate, increase the speed loop gain (PA5) as much as possible, and decrease the speed integral time constant (PA6) at the same time.
- ③ In the position control, increase the position proportional gain (PA9) as long as the machine does not vibrate.

## 6.5 Resonance suppression

Notch filter: There is a certain resonance frequency in the mechanical system. If the servo gain is set too high, resonance may occur near the mechanical resonance frequency. In this case, use a notch filter. The notch filter suppresses mechanical resonance by reducing the gain of a specific frequency, and therefore the gain can be set higher.

Parameters Fn45-Fn47 are the related to the notch filter. They are frequency, width level and depth level. When the frequency is the default value 1000HZ, the notch filter is actually invalid. If a manual notch filter is used to suppress resonance, the frequency can also be collected by the software provided by the A&TS. For the width level setting of the notch filter, the default value is usually adopted. When the notch depth level is 0, the input at the center frequency is completely suppressed. When the depth level of the notch filter is 100, the input at the center frequency is completely passable. Therefore, the larger the parameter is, the smaller the notch depth is, and the weaker the effect of suppressing mechanical vibration is. However, if the parameter setting is too large, the system will be unstable, so when using it, please pay attention.

No.	Description	Range	Factory default	Unit	Applicability
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

# 7 Parameters

## 7.1 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.

### 7.1.1 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 selection	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
PA9	Position proportional gain	1-1000	50*		P
PA10	Speed feed forward gain	0-200	0	%	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 3, bus instruction 4, internal location	P
PA15 ★	Command direction NOT(logical reverse) setting	00000b-11111b	00000b	Bit0, Position command direction NOT Bit1, Speed command	All



				direction NOT Bit2, Torque command direction NOT Bit3/4, rsv	
PA17	Position out of tolerance detection range	0-3000	30	x 0.1 laps	P
PA18	Absolute encoder usage mode	00000b-111 11b	00101b	Bit0, whether to use the battery Bit1, ABS source Bit2, Motor parameter automatic identification Bit3, rsv	ALL
PA19 ★	Position command pulse signal filter time constant	0.0-20.0	0.0	microsecond (us)	P
PA20 ★	Servo control auxiliary switch	00000b-111 11b	00000b	Bit1, Control mode switch allowed Bit2, IO jog function allowed Bit3, rsv	ALL
PA21	JOG running speed/	0-3000	300	rpm	S

	torque mode max speed				
PA22 ★	Speed command source selection	0-2	0		S
PA23 ★	User sets percentage of the maximum speed limit	1-200	100	%	ALL
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
PA29	Load rotation inertia ratio	0-8000	200	%	P, S
PA30 ★	Motor torque overload alarm value	10-300	160	%	ALL
PA33	Rigidity level	0-31	0		ALL
PA38	DP menu dynamic display items	0-300			ALL
PA39	RT-STP serial communication speed	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

PA44 ★	Pulse command function selection	00000b-11111b	00000b	bit0,high-speed pulse selection bit1, get it by hand function	P
PA45 ★	The number of bits of the absolute encoder per revolution	0-30	0	Set to 0, means the default is 17 bits	ALL
PA47	The waiting time for enabling disconnection when the motor is stationary	0-5000	0	ms	ALL
PA48	The waiting time for electromagnetic brakes to brake while the motor is running	0-5000	50	ms	ALL
PA49	Brake action speed when the motor is running	0-3000	100	rpm	ALL
PA50	The delay of the brake opening when the 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 terminal forced ON	00000b-11111b	00000b	Binary	ALL

PA54	Higher 5 bits input terminal forced ON	00000b-111 11b	00000b	Binary	ALL
PA55	Lower 5 bits input terminal NOT(logical reverse)	00000b-111 11b	00000b	Binary	ALL
PA56	Higher 5-bits input terminal NOT(logical reverse)	00000b-111 11b	00000b	Binary	ALL
PA57	Output terminal NOT(logical reverse)	00000b-111 11b	00000b	Binary	ALL
PA61 ★	Motor encoder type setting	-1-7	2	-1, Motor default setting 0, Incremental 1, ABZ incremental 2, Tamagawa protocol 3, Reserved 4, Nikon protocol 5, Panasonic protocol 6, BissC protocol 7, Increment without HALL 9, Sankyo protocol	ALL

PA62	Alarm shield setting bits	00000b-11111b	00000b	Bit0:Err18 Bit1:Err35 Bit2:Err41&6 Bit3:Err25 Bit4:Err8	ALL
PA64	Current proportional gain	1-500	150*		ALL
PA65	Current integration time constant	1-100.0	20.0*	ms	ALL
PA69 ★	External braking resistor value	0-750	50	Ω	ALL
PA70 ★	External braking resistor power	0-10000	50	W	ALL
PA74	Internal current command	-300-300	0	%	T
PA78 ★	The output pulses per motor revolution	1-32767	2500	x4 pulses	ALL
PA79 ★	System feedback pulse output NOT(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
PA84	The high bits of	0-10000	0	x10000	P

★	command pulses per motor revolution				
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

### 7.1.2 Fn parameters

No.	Name	Parameter 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

Set the point function corresponding to the digital IO input, the function codes are shown in the table below.

No.	Symbol	DI function	No.	Symbol	DI function
0	NULL	NULL	1	SON	Servo enabled
2	ALM_RST	Alarm clear	3	FSTP	CCWL
4	RSTP	CWL	5	M1_SEL	Mode switch1
6	M2_SEL	Mode switch2	7	RSV	Reserved
8	RSV	Reserved	9	CLE	Position deviation clear
10	ZEROSPD	Zero speed clamp	11	SENS	Yaskawa protocol feedback trigger
12	SPD_SEL1	Internal speed selection 1	13	SPD_SEL2	Internal speed selection 2
14	RSV	Reserved	15	RSV	Reserved
16	RSV	Reserved	17	INH	Position command pulse inhibit
18	JOG_CCW	Jog CCW	19	JOG_CW	Jog CW

20	RSV	Reserved	21	Torq_dir	Torque command direction setting
22	Spd_dir	Speed command direction setting	23	RSV	Reserved
26	Org_sw	Origin switch signal	27	Org_tog	Origin trigger signal
30	Org_set	Absolute motor origin setting			

No.	Name	Parameter range	Factory default	Unit	Applicability
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

Set the corresponding point function of digital IO output. The function code is shown in the following table.

No.	Symbol	DO function	No.	Symbol	DO function
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0	NULL	No definition	1	SRDY	Servo ready
2	ALM	Servo alarm	3	AT-POS	Position arrival
4	BRK	Brake action	5	AT-SPD	Speed reached
6	HOME	Origin return (homing) complete	7	TQ_LMT	Torque limiting
8	ZSP	Zero speed detection	9	Home	Origin (Home) position arrival

**ATTENTION**

The same DI function can't be assigned to 2 or more IO input terminals, otherwise the alarm Err26 occurs. (IO input terminal function configuration error).

### 7.1.3 Bn parameters

No.	Name	Parameter range	Factory default	Unit	Applic ability
Bn1	Emergency stop acceleration and deceleration time	0-1000	100	ms	ALL
Bn9	Alarm shielding setting bits	00000-1111 1b	00000b	/	ALL
Bn24	Command smoothing time	0-1024	0	x0.2ms	ALL

# 8 Fault Alarm

## 8.1 Alarm code list

### INSTRUCTIONS

- The alarm with ★ after the alarm code indicates that the alarm cannot be reset. To clear the alarm, the servo needs to be restarted.
- The digital tube shows Err x. x is the alarm code and can be viewed through the current interface of the digital tube. When the digital tube displays 'r 0', it can be viewed by the 19Err value under the Dp menu. If there is a decimal point flashing in the lower right corner of 0(r 0.), there are alarms in the servo.

Table 9-1 Alarm list

Alarm code	Alarm name	Description
0	Normal/No alarm	/
Err 1	Over speed	Servo motor speed exceeds the set value (PA23)
Err 2	Main circuit over voltage	Main circuit power supply voltage is too high
Err 3	Vibration detected	The vibration has been detected, 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 and CWL abnormal	Both of the CCWL and CWL input are OFF
Err 8	IPM over temperature alarm	IPM temperature exceeds the set value
Err	Encoder A / B / Z	Encoder A / B / Z phase signal error

9A/B/C	phase 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 ratio 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 position 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 values out of range	Some servo parameter values are out of the specified 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	Feedback from the absolute encoder timed out
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 encoding is invalid	The UVW signal is kept at full high or full low level
Err 33 ★	Dynamic memory allocation error	Dynamic memory allocation error
Err 34 ★	Flash reads CRC error	Flash reads CRC error
Err 35 ★	Motor adaptation error	The motor is not adapted.
Err 36	Watchdog error	Internal watchdog error
Err 37 ★	Motor initial zero lock error	Zero position lock error
Err 38 ★	External braking resistance value is incorrect	The resistance value of external braking resistance is less than the minimum allowed value
Err 51	Multi-turn value exceeds the set value	Multi-turn value 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	It is powered off in the power supply cable L1, L2, and L3
Err 54	AC main power supply phase loss	There is phase loss in power supply cable L1, L2, and L3
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.
Err 63	ABZ incremental encoder UVW abnormal	ABZ incremental encoder UVW signal is abnormal

**The End**

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## **A&TS Technology Corporation Limited**

Address: Building A, 1970 Creative Industry Park, Ping'an road, Longhua District, Shenzhen, China 518110

Web: <https://www.a-ts.cn>

Tel: +86-27-83520855

Mobile: +86-13322987810

Email: [contact@a-ts.cn](mailto:contact@a-ts.cn)

[service@a-ts.cn](mailto:service@a-ts.cn)

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