RT10 EA Bus Series 220VAC Servo Drive User Manual

A&TS

A&TS TECHNOLOGY CORPORATION LIMITED

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Version	Product	Release Date	Note
V-20-01	RT10	10.07.2020	N/A
V-21-01	RT10	21.04.2021	N/A
V-23-01	RT10	10.05.2023	N/A

Forward

The RT10 series ac servo is provided by the 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.

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

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

Contents

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, and absolute encoder including Tamagawa, BISS, EnDat and Nikon.

- EA series support the EtherCAT industrial fieldbus interface, MA series support Mechatrolink-III bus interface.

- The bus series product supports to extend the internal I/O to the PLC I/O interface.

- Supports internal speed mode and demonstration running mode.

1.2 Order Number

RT10 – EA 030 L – E02 – ☐☐☐

RT10 series ac servo drive / Series / Power level / Voltage / Encoder type / OEM code

Code	Series
PA	Pulse higher type
EA	EtherCAT bus with higher type

Code	Peak current
005	5.9A
010	9.3A
015	16.9A
030	28A
050	56A

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

Code	Increm ental	ABZ increm ental	Absolute encoder type			
			BISS	Tamag awa	Endat	Nikon
E00	●	●	×	×	×	×
E01	×	×	●	×	×	×
E02	●	●	×	●	×	×
E03	×	×	×	×	●	×
E04	×	×	×	×	×	●

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 AC servo drive technical specification

Model	RT10 series ac servo drive				
RT10-EA□□□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℃ (If the temperature is too high, please make sure the surrounding air to flow) Storage -20℃ - 65℃				
	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				
Fieldbus	EA series supports the EtherCAT industrial fieldbus				

		interface The fieldbus interface product supports to extend the internal I/O to the PLC I/O interface
Control mode		Position/Speed/Torque/Origin return
Control input		Up to 7 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, positional deviation clearance, pulse input prohibition, origin return(homing) trigger, origin return(homing) reference point, external handwheel pulse generator
Control output		Up to 5 output terminals (optoelectronic isolation). 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.
Position	Command source	Internal position command, Bus command
	Electronic gear ratio	Numerator, 1-32767 Denominator, 1-32767
Speed	Command ACC/DEC	Parameter setting
	Command source	Internal speed command, bus command
Torque	Speed	Parameter setting

	limitation	
	Command source	Internal torque command, bus command
Special function		Origin return(homing), gain switch, mechanical resonance notch filter
Monitoring function		Rotation speed, current position, position deviation, motor torque, motor current, etc.
Protection function		Over speed, over voltage, over current, over load, braking abnormal, encoder abnormal, position out of tolerance, etc.

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 Products appearance and dimensions
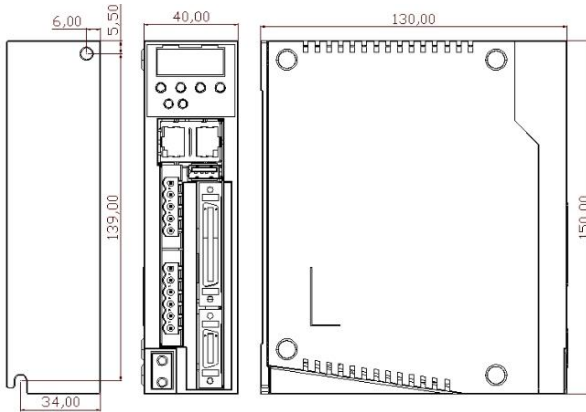
Figure 2-1 RT10-EA005L appearance and dimensions (Unit, mm)
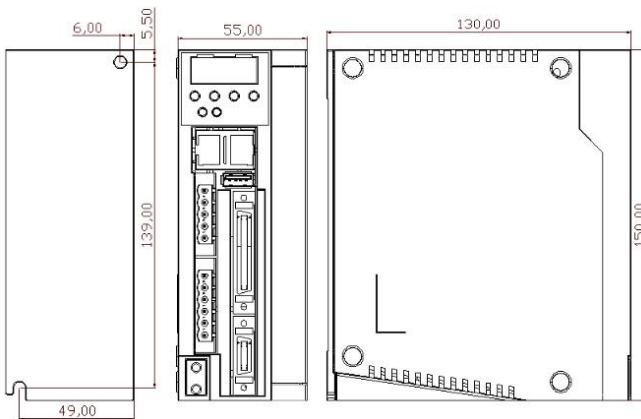
Figure 2-2 RT10-EA010L appearance and dimensions (Unit, mm)
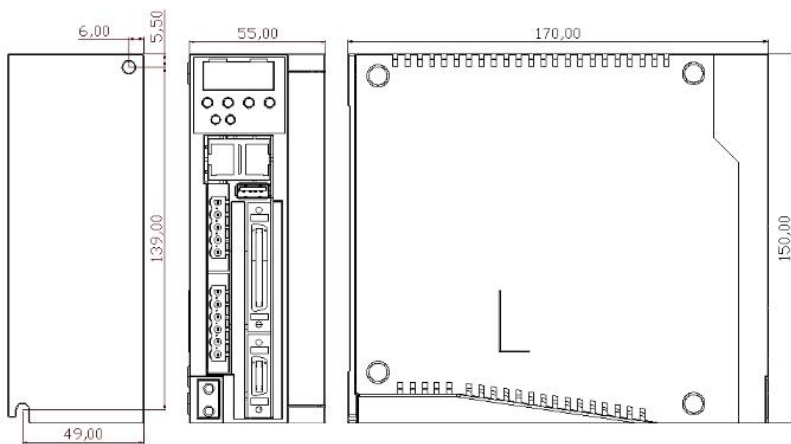
Figure 2-3 RT10-EA015L appearance and dimensions (Unit, mm)
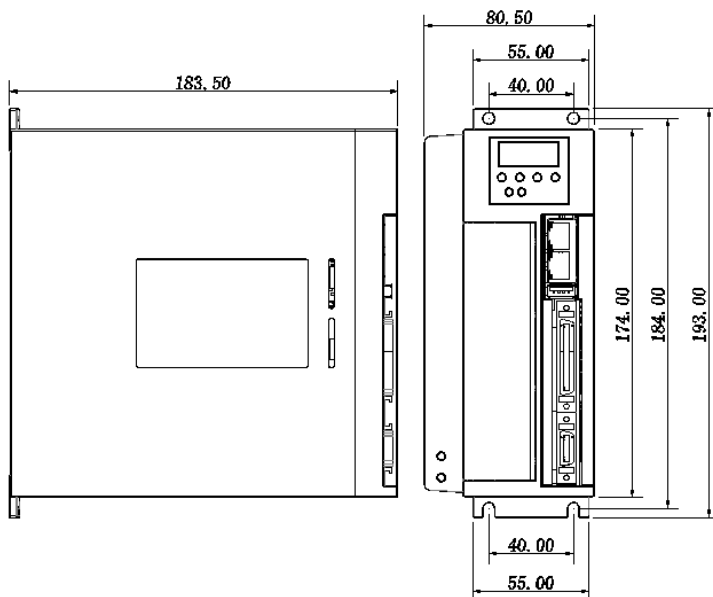
Figure 2-4 RT10-EA030L appearance and dimensions (Unit, mm)
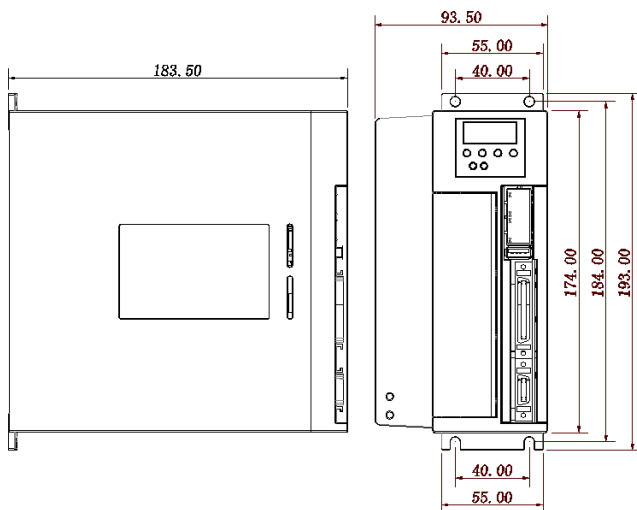
Figure 2-5 RT10-EA050L appearance and dimensions (Unit, mm)

2.2 Wiring and terminals

2.2.1 Wiring diagram
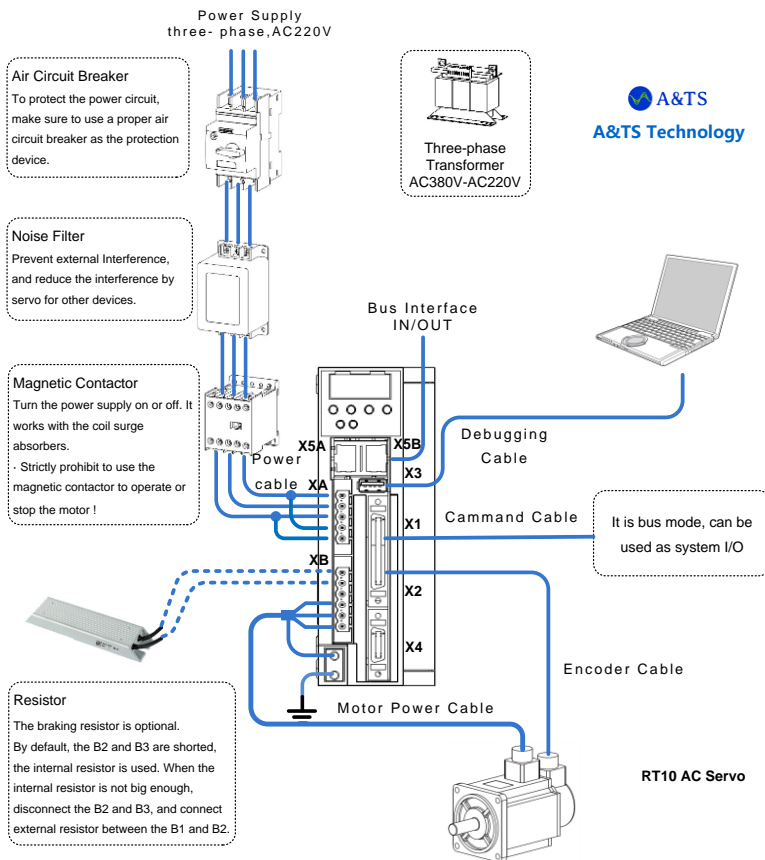
Figure 2-6 RT10 bus series AC servo drive wiring diagram

INSTRUCTIONS

➢ RT-STP is the RT 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

1. RT10-EA005/10/15 servo drive terminals.
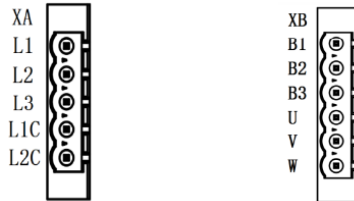
Table 2-1 RT10-EA005/10/15 servo drive strong power terminals

Socket number	Terminal labels	Name	Specifications
XA	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		
XB	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	It must be connected with the U, V, W, PE terminals of the motor
	V		

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

2. RT10-EA030/50 servo drive terminals.
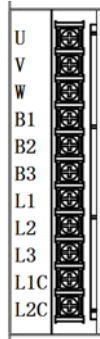
Table 2-2 RT10-EA030/50 servo drive strong power terminals

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.
L2		If is single-phase AC 220V, use L1 and 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 Chapter 5.8 braking resistor
B2		
B3		

		setting for the braking resistor selection and others, to prevent damage.
U		It must be connected with the U, V, W, PE terminals of the motor correspondingly. (Note, PE is the terminal for the metal heat sink on the drive)
V	Motor power line terminals	
W		
PE		

INSTRUCTIONS

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

WARNING

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

2.2.3 IO terminal X1 and digital circuit
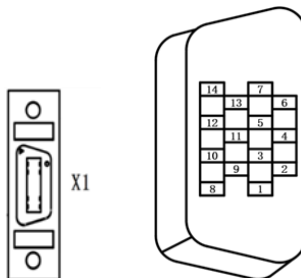
The IO terminal X1 includes 7 digital input pins, 5 digital output pins. Functions can be configured according to actual needs. The input is defined by parameters Fn00- Fn06, and the output is defined by parameters Fn10- Fn14.

Table 2-3 IO Terminal X1 Definition

Signal name		Default function	Pin No.	Signal interpretation
Digital Input signal	DI1	SRV-ON	1	Servo enable input
	DI2	A-CLR	2	Alarm clearance input
	DI3	Touch probe 1	3	Touch probe input
	DI4	Touch probe 2	4	Touch probe input
	DI5	M1-SEL	5	Mode switch 1 input
	DI6	M2-SEL	6	Mode switch 2 input
	DI7	P-ATL	7	Positive torque limiting input
	COM	COM	8	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.
Digital Output signal	DO1	S-RDY	9	Servo ready output
	DO2	ALM	10	Servo alarm output
	DO3	AT-POS	11	Position reached output
	DO4	BRKOFF	12	The motor brake release output, single-ended output.
	DO5	AT-SPD	13	Speed reached output, single-ended output.
	GND	GND	14	Digital(on-off) IO output common ground

2.2.4 The encoder terminals

The RT10-EA series drive supports two encoder interfaces. It is selected through the parameter PA18. When using X2 as the encoder interface, PA18 should be set to xxx0x. When using X4 as the encoder interface, PA18 should be set to xxx1x. The user can choose to use them according to the actual situation, or the encoder failure alarm may appear.

1) X2 definition

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

20, 36 & 40 Position
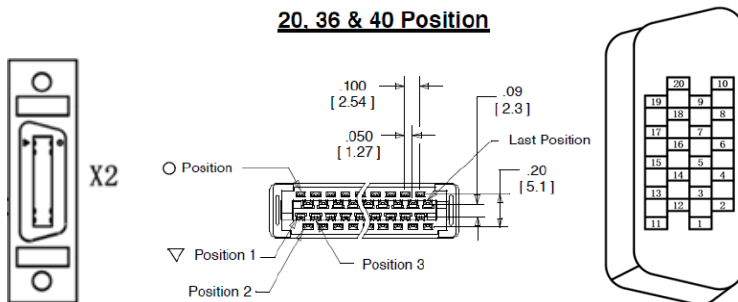
- It is recommended to use the original accessory cable of the RT10 AC servo drive.

- The encoder terminal is MDR/SCSI-20 core plug. Please confirm the pin sequence according to the solder side shown in the diagram above.

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

2) X4 definition
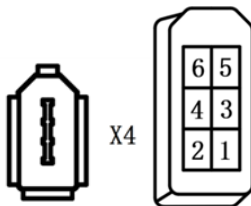
IEEE1394-R-6 Terminal

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 (When it is the Nikon/ Biss /
4	CLK-	Endat encoder)

5	SDATA+	Bidirectional serial data
6	SDATA-	

The absolute encoder signal reference circuit.
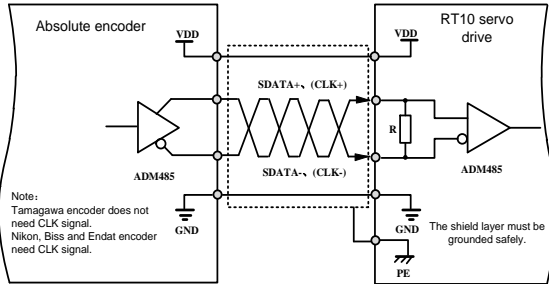
Figure 2-7 The absolute encoder input signal interface circuit

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.
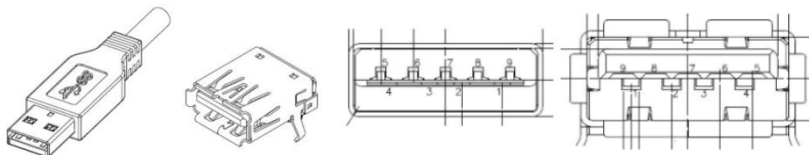
Figure 2-8 USB3.0 A type USB plug (left) and socket (right)

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
Shell	FG	Floating shield ground

⚠️ **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.

INSTRUCTIONS

● Convert the specially made USB3.0 into a serial communication cable (USB to RS232). One end is USB3.0, the other is DB9 hole, welded as the table below.

USB3.0		DB9 hole	
Pin number	Pin name	Pin number	Pin name
5	TX	2	RXD
6	RX	3	TXD
7	GND	5	GND

● DB9 hole figure reference

Fig 2-9 DB9 hole definition

2.2.6 EtherCAT communication port X5A, X5B definition

This terminal is the standard RJ45 interface for EtherCAT bus communication. X5A is the input, and X5B is the output.

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

Pin no.	Signal name	Description	Port definition
1	TX+	data transmission +	
2	TX-	data transmission -	
3	RX+	data receive +	
4	-	-	
5	-	-	
6	RX-	data receive -	
7	-	-	
8	-	-	

2.2.7 Standard wiring
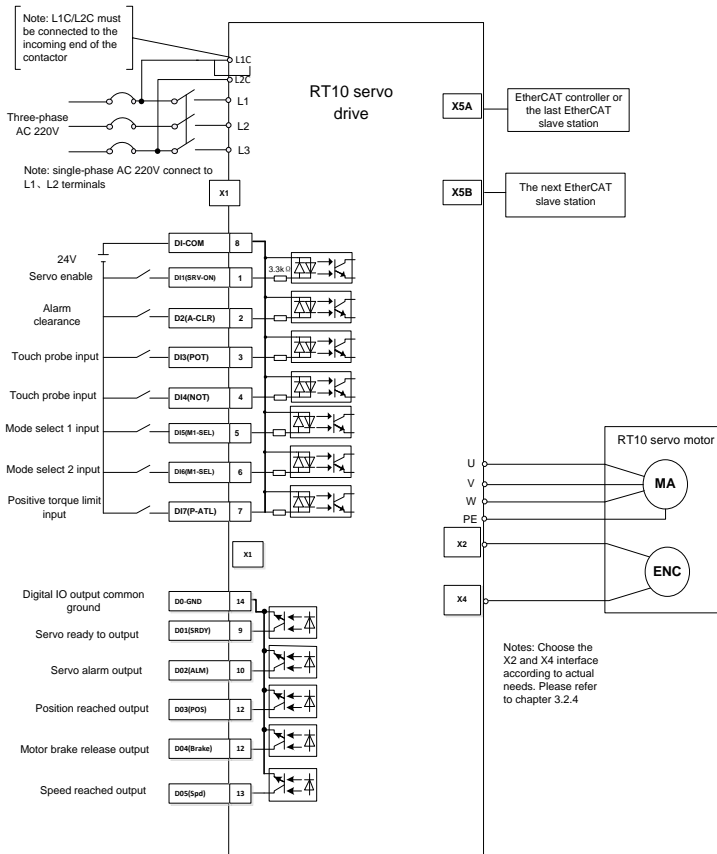
Figure 2-10 RT10-EA series control wiring connection diagram

➢ The RT10 series servo drive can be connected to the external handwheel encoder. When using it, the IO input of the X1 port is used as the shaft selection and spindle override, and the A/B signal & 5V output of the X2 code port can be used as the the A/B & 5V signal source of the handwheel pulse generator. At this time, only X4 port could be used as the encode port interface in the drive.

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.
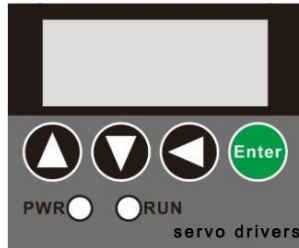
Figure 3-1 Operation panel

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, $\boxed{12345}$ indicates positive number 12345. $\boxed{12.345}$ indicates negative number -12345. $\boxed{-2.345}$ 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 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.

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.
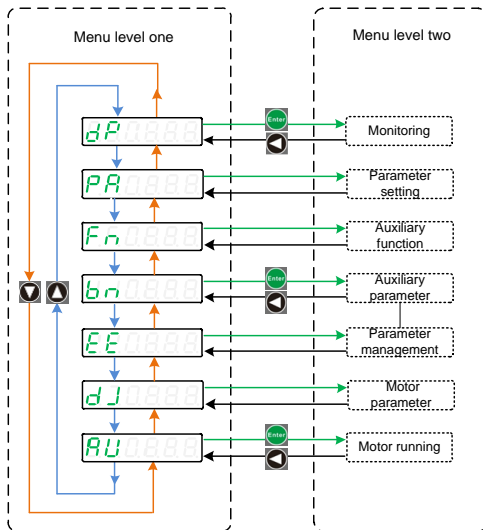
Figure 3-2 Menu level one

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 $\boxed{dP}$ 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.

Display	Description	Display	Description
0.0SPd	Motor speed r/min	r 1000	Motor speed 1000 r/min
0.1PoS	Current position pulse	2345 / 12	Current position 1202345
0.2PoS	Current position high eight-bit (×100000 Pulse)		
0.3CPo	System position command pulse	345	System position command 345
0.4CP1	Servo internal position command pulse	17345	Servo internal position command pulse -17345
0.5EPo	Position deviation pulse low five-bit	345 / 12	Position deviation 1200345
0.6EPo	Position deviation high five-bit (×100000 pulse)		
0.7tr9	Motor torque %	173	Motor torque 17.3%
0.8	Motor phase current Arms	1 0.8	Motor phase current 0.8Arms
0.9LSP	Reserved	88888	Reserved
10.Cnt	Control mode	0	Control mode 0
11.Fr9	Position command pulse frequency kHz	F 157	Position command pulse frequency 157kHz
12.CS	Speed command r/min	r 1000	Speed command 1000 r/min
13.Ct	Torque command %	180	Torque command 18.0%
14.APo	Rotor absolute position	10607	Rotor absolute position 10607
15.1n	Input terminal	' ' ' ' ' '	Input terminal
16.oUt	Output terminal	o ' ' ' ' '	Output terminal
17.Cod	Encoder UVW signal display	Cod 4	Encoder UVW signal display
18.rn	Running status	Cn on	Running status, running
19.Err	Alarm symbol	Err 6	Alarm No. 6
20. Jr	Load inertia-ratio	3 120	Load inertia-ratio 3.12 times
21.tEP	Out of range parameter number	8	Parameter No. 8 out of range
22.dSu	Software version	6.02.40	Software version 6.02.40
23.rE1	Reserved	0	Reserved
24. dc	Bus voltage	312	Bus voltage 312V
25.2oF	Encoder null offset	0	Reserved
26. r3	Reserve	0	Reserved
27.oF1	Reserve	0	Reserved
28.oF2	Reserve	0	Reserved
29. oL	Average load rate	oL 10	Average load rate 10%
30. EU	Multi-turn position	218	Multi-turn position 218
31.dEC	Frame errors (for BUS)	0	Frame errors 0
32.SAr	Slave station set address (for BUS)	1005	Slave address 1005
33.ALS	Slave station bus status (for BUS)	8	Bus status 8
34.C1A	CIA402 status(for BUS)	16	CIA status 16
35.rSu	Dynamic monitoring items	0	Display content set by PA38

Figure 3-3 Menu level two

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3.3.2 Parameter setting (Pa/Fn parameter)

In the menu level one, select $\boxed{PA\ \square\square\square}$ or $\boxed{Fn\ \square\square\square}$ 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 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.
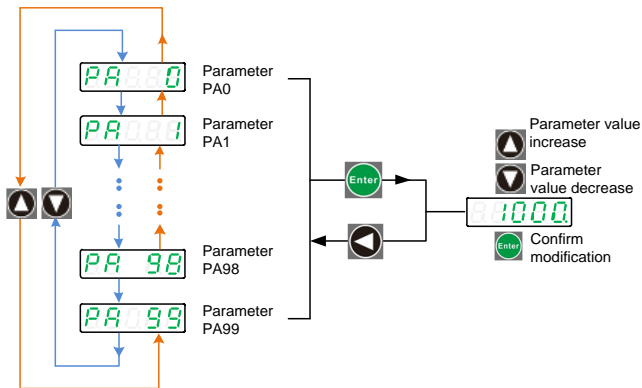
Figure 3-4 PA parameter setting menu

3.3.3 Parameter management

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

In the menu level one select $\boxed{EE\;\;\;}$ 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 $\boxed{E-SEt}$

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 $\boxed{E\text{-}dEF}$

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 $\boxed{E\text{-}rSt}$

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.

POWER ON: RAM ⇐ EEPROM PKW

Parameter save $\boxed{E\text{-}5Et}$: RAM ⇒ EEPROM PKW

Restore defaults $\boxed{E\text{-}dEF}$: Parameter default value ⇒ RAM EEPROM PKW

System soft reset $\boxed{E\text{-}rSt}$: System reset is equal to the drive power up again
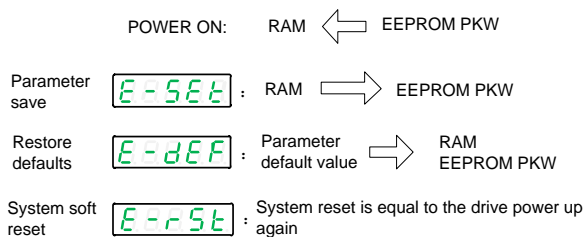
Figure 3-5 Parameter management menu

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

Step 1. Select $\boxed{E\text{-}5Et}$, $\boxed{E\text{-}dEF}$, or $\boxed{E\text{-}rSt}$ and press the

Enter key.

   Step 2. Keep pressing the Enter key and hold for 3 seconds above.

Digital tube will display $\boxed{StArt}$, which indicates that the parameter is

being written to the EEPROM.

   Step 3. Wait 1- 2 seconds. If the operation succeeds, it will display

$\boxed{donE}$, otherwise it will show $\boxed{Error}$.

⚠ **ATTENTION**

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

4 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

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 310 or 385, and press the Enter key to save.

- Set $\boxed{00uEd}$ in $\boxed{dJ}$ as the specified motor manufacturer, 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 $\boxed{U-dEF}$.

- Save the modified parameters in $\boxed{EE088}$.

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

4) Set user-defined motor parameter

If it is the user-defined motor, please set the motor parameters $\boxed{dJ}$ 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

`00uEd`	User-defined motor manufacturer	Please contact A&TS company directly
`01Ecd`	Reserved	
`02 PL`	Encoder resolution low-order digit	0-10000
`03 PH`	Encoder resolution high-order digit (x10000)	0-10000
`042oF`	Z-pulse offset pulse (incremental)	0-50000
`05PoP`	Motor pole pairs	1-60
`06rdL`	Rated current	0.1-100.0(A)
`07rt9`	Rated torque	0.1-100.0(Nm)
`08r5d`	Rated speed	1-9000(rpm)
`09u5d`	Maximum speed	1-9000(rpm)
`10  J`	Rotary inertia	0.0-200.00($\times 10^{-4}$ Kgm^2)
`11 uE`	Back-EMF constant	0.00-200.00(V/Krpm)
`12AoL`	Absolute zero offset low-order digit	0-10000
`13AoH`	Absolute zero offset high-order digit (x10000)	0-10000
`14 r5`	Phase resistance	0-60.00(Ω)
`15 L5`	Phase inductance	0-60.00(mH)

4.2 JOG trial running
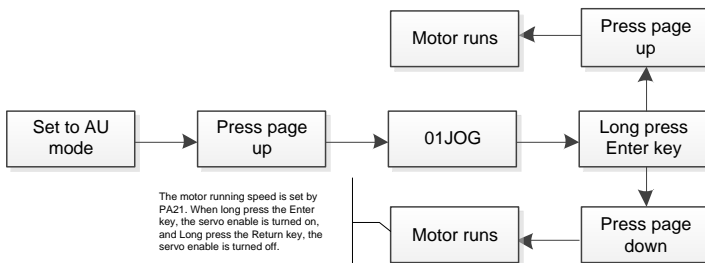
4.3 Internal position control

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.

Parameters related to the position command

Table 4-2 Parameters related to position command

Para meter	Name	Set value	Factory value	Parameter description
PA14	Control mode	4	0	Set to internal position control
Fn70	Internal position mode target position	-1000.0-1000.0	0.0	Set target position
Fn71	Internal position mode maximum speed	0-6000	100	Set running speed
Fn72	Internal position mode ACC/DEC time constant	1-3000	300	Set ACC/DEC time

Fn73	Internal position mode waiting time	1-10000	500	Set waiting time command

EXAMPLE

After setting and saving parameters PA14=4, PA53=1, Fn70=10, Fn71=100, and Fn72=100, the drive will run back and forth 10 circles at the speed 100 rpm.

5 Communication

5.1 EtherCAT communication principle

5.1.1 EtherCAT frame structure

EtherCAT is based on Ethernet. It is an industrial communication protocol that can be controlled in real time. It only expands the IEEE 802.3 Ethernet specification, and does not make any changes to the basic structure. So it can transfer the standard Ethernet data frames.

Because the EtherType of the Ethernet Header is 0x88A4h, the subsequent Ethernet Data is handled as an EtherCAT frame. The EtherCAT frame is composed of the EtherCAT frame header and at least one EtherCAT sub-message. Further, subdivide the EtherCAT sub-messages. Only EtherCAT frames with the Type=1 frame header are processed according to the ESC.

5.1.2 ESM (EtherCAT State Machine)

The state of EtherCAT application layer (ESM state) is shown in the figure below.
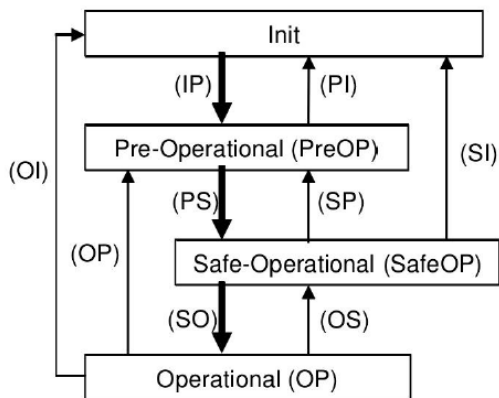
Figure 5-1 EtherCAT state transition diagram

EtherCAT must supports 4 states, to coordinate the relationship between the applications of the master station and slave station in the initial state and running state.

5.3 Drive mode

5.3.1 Servo state machine

The precondition of the servo ready state is that the High-level power (main power supply) is ON. When the High-level power (main power supply) is OFF and it is not in the servo ready state, it cannot be switched to the Switched on state. After switching to Operation enabled (servo enable ON), increase the time to more than 100ms and input the operation command.

	Low-level Power	High-level Power	Drive function
	Yes	No	No
	Yes	Yes	No
	Yes	Yes	Yes
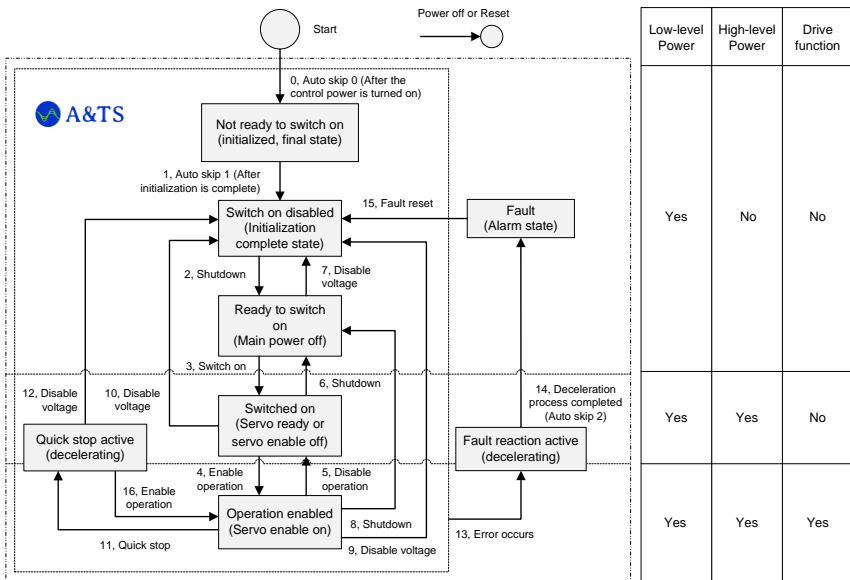
The operation mode can be changed by 6060h (operation mode). On the server, the operation mode is selected and the associated target is changed at the same time. If the main server is switched to a new operating

mode, it is immediately switched to the same mode.

5.4 Control mode

5.4.1 Servo mode introduction

RT10 series supports 4 kinds of servo modes. The control mode can be confirmed by 6502h.

Index	Sub-Index	Name/ Description			
		Supported drive modes			
		Value	Operation display mode	Abbr.	Support
6502h	00h	0	Profile position control mode	pp	No
		1	Velocity control mode	vl	No
		2	Profile velocity control mode	pv	No
		3	Profile torque control mode	tq	No
		4	Homing position return control mode	hm	Yes
		5	Interpolated position control mode	ip	No
		8	Cyclic synchronous position control mode	csp	Yes

		9	Cyclic synchronous velocity control mode	csv	Yes
		10	Cyclic synchronous torque control mode	cst	Yes

Servo pre-operation mode can be set by 6060h. The current servo running mode can be checked by 6061h.

1. 6060h

Index	Sub-Index	Name/ Description			
6060h	00h	Modes of operation			
		Value	Operation display mode	Abbr.	Support
		-128-1	Reserved	/	/
		0	No mode change/no mode assigned	/	Yes
		1	Profile position control mode	pp	No
		2	Velocity control mode	vl	No
		3	Profile velocity control mode	pv	No
		4	Profile torque control mode	tq	No
		6	Homing position return	hm	No

		7	Interpolated position control mode	ip	No
		8	Cyclic synchronous position control mode	csp	Yes
		9	Cyclic synchronous velocity control mode	csv	Yes
		10	Cyclic synchronous torque control mode	cst	Yes
		11-127	Reserved	/	/

(top partial row: control mode)

2. 6061h

Index	Sub-Index	Name/ Description			
6061h	00h	Modes of operation			
		Value	Operation display mode	Abbr.	Support
		-128-1	Reserved	/	/
		0	No mode change/no mode assigned	/	Yes
		1	Profile position control mode	pp	Yes
		2	Velocity control mode	vl	No

3	Profile velocity control mode	pv	Yes
4	Profile torque control mode	tq	Yes
6	Homing position return control mode	hm	Yes
7	Interpolated position control mode	ip	No
8	Cyclic synchronous position control mode	csp	Yes
9	Cyclic synchronous velocity control mode	csv	Yes
10	Cyclic synchronous torque control mode	cst	Yes
11-127	Reserved	/	/

 ATTENTION

- The control mode can be switched by changing the value of 6060h (operation mode).

- Please confirm the current servo drive control mode at 6061h (operation display mode).

- When switching the control mode, please update the RxPDO object

related to the control mode synchronized with 6060h.

- In the changed control mode, the value of the unsupported object is uncertain.

- It takes 2ms from when the control mode switch is started to when the switch is completed. During this period, 6061h and the object value of TxPDO related to the control mode is uncertain.

- The performing of the control mode switch should be more than 20ms. When the control mode is continuously switched, if the interval is shorter than 20ms, it will cause an exception.

- The control mode must be switched while the motor is stopped. The operation of the control mode switching during motor operation (including home return operation and deceleration stop) cannot be guaranteed.

- In the state of 6060h=0 and 6061h=0, if the PDS state is changed to Operation enabled, an abnormal error action will occur.

- After 6060h is set to a value other than 0, if 6060h=0 is set, the previous control mode is maintained.

5.4.2 Servo mode switching

Index	Name	Unit	Type	Access	pdo
6064h	Position actual value	Command unit	I32	ro	TxPDO
606Ch	Velocity actual value	Command unit/s	I32	ro	TxPDO
6077h	Torque actual value	0.1%	I16	ro	TxPDO
607Ah	Target position	Command unit	I32	rw	RxPDO
60B0h	Position offset	Command unit	I32	rw	RxPDO

		Command unit/s	I32	rw	RxPDO
60B1h	Velocity offset	Command unit/s	I32	rw	RxPDO
60B2h	Torque offset	0.1%	I16	rw	RxPDO

Index	Name	Unit	Type	Access	pdo
6064h	Position actual value	Command unit	I32	ro	TxPDO
606Ch	Velocity actual value	Command unit/s	I32	ro	TxPDO
6077h	Torque actual value	0.1%	I16	ro	TxPDO
60B1h	Velocity offset	Command unit/s	I32	rw	RxPDO
60B2h	Torque offset	0.1%	I16	rw	RxPDO
60FFh	Target velocity	Command unit/s	I32	rw	RxPDO

Index	Name	Unit	Type	Access	pdo
6064h	Position actual value	Command unit	I32	ro	TxPDO
606Ch	Velocity actual value	Command unit/s	I32	ro	TxPDO
6071h	Target torque	0.1%	I16	rw	RxPDO
6072h	Max torque	0.1%	U16	rw	RxPDO
6077h	Torque actual value	0.1%	I16	ro	TxPDO
60B2h	Torque Offset	0.1%	I16	rw	RxPDO
6080h	Max motor speed	r/min	U32	rw	RxPDO

Index	Sub-index	Name	Unit	Type	Access	pdo
6040h	00h	Control word	/	U16	rw	RxPDO
6098h	00h	Return to origin(homing) method	/	I8	rw	RxPDO
6099h	/	Return to origin (homing) speed	/	/	/	/
	00h	Number of entries	/	/	ro	No
	01h	Set speed (speed during search for switch) to the reference point	Command unit/s	U8	rw	RxPDO
	02h	Set speed (speed during search for zero) to the origin point	Command unit/s	U32	rw	RxPDO
609Ah	00h	Set ACC and DEC speed (homing)	Command unit/s²	U32	rw	RxPDO
607Ch	00h	Set the origin (home) offset position	Command unit	I32	rw	RxPDO

Index	Sub-index	Name	Unit	Type	Access	pdo
6041h	00h	Status word	/	U16	rw	TxPDO
	00h	Number of entries	/	U8	ro	No

	01h	Support the 1st homing method	/	U16	ro	No
	…	…	…	…	…	…
	20h	Support the 32nd homing method	/	U16	ro	No

Origin return (homing) related IO function

The input and output points can be defined as the origin return function. E.g., Change Fn0 to 26, after saving and restarting, DI1 becomes the reference point input.

IO input points:

- 26-Reference point input IO.
- 27-Origin return triggers IO
- 30-Absolute motor origin setting IO (DI_ZEROSET). When it is detected that this point is valid, the current absolute position of the motor is set as the origin position (home). It can be forced to be valid by PA parameter.
- 6-Origin return is completed. Only output after the internal origin return action is completed.
- 9-The origin is reached. When running to the set origin position, this signal output is valid. The origin position confirmation range is determined by the parameter PA98.

Control word 6040h, set the control commands.

Index	Sub-index	Name	Unit	Range	Type	Access	PDO
6040h	00h	Control word	/	0 - 65535	U16	rw	RxPDO

		Bit6	Bit5	Bit4
		oms		
		/	/	Start homing/Return to origin

6 Parameters

6.1 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.

- Parameters usually used are

  Test machine parameters: PA4, PA21, PA53

  Motor parameters: PA1, PA18, PA45, PA61

  Operating parameters: PA4, PA81, PA84

  Tuning parameters: PA5, PA6, PA9, PA29, PA33, Fn40

6.1.1 PA parameters

No.	Name	Parameter range	Factory default	Unit	Applicability	Bus address

PA0	Parameter password	0-9999	315	/	ALL	2000h
PA1 ★	Motor model	1-132	1	/	ALL	2001h
PA2 ★	Drive model	0-4	0	/	ALL	2002h
PA3 ★	Initial display state	0-25	0	/	ALL	2003h
PA4 ★	Control method	0-16	0	/	ALL	2004h
PA5	Speed proportional gain	2-2000	150*	/	ALL	2005h
PA6	Speed integral time constant	1.0-1000.0	50.0*	ms	P, S	2006h
PA7	Torque filter time constant	0-20.0	0.20	ms	ALL	2007h
PA8	Speed feedback filter time constant	0-10.00	0.50	ms	P, S	2008h
PA9	Position proportional gain	1-1000	50*	/	P	2009h
PA10	Speed feed forward gain	0-200	0	%	P	200Ah
PA11	Speed feed forward filter time constant	0-10.0	0.5	ms	P	200Bh
PA12 ★	Position command pulse frequency division numerator	1-32767	1	/	P	200Ch

PA13 ★	Position command pulse frequency division denominator	1-32767	1	/	P	200Dh
PA14 ★	Position command pulse input mode	0-4	0	0, Bus command (incremental motor) 3, Bus command (absolute motor) 4, internal location	P	200Eh
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	200Fh
PA16	Location complete range	0-30000	100	pulse	P	2010h
PA17	Location out of tolerance detection range	0-3000	30	X0.1 laps	P	2011h
PA18	Absolute encoder usage mode	00000b - 11111b	00101b	Bit0: Whether to use the battery Bit1: ABS source Bit2: Motor	ALL	2012h

				parameter automatic identification Bit3:rsv		
PA19 ★	Position command pulse signal filter time constant	0.0-20.0	0.0	microsecond (us)	P	2013h
PA20 ★	Servo control auxiliary switch	00000b - 11111b	00000b	Bit1, Control mode switch allowed Bit2, IO jog function allowed Bit3, rsv	ALL	2014h
PA21	JOG speed/Torque mode max speed	0-3000	300	rpm	S	2015h
PA22 ★	Speed command source selection	0-2	0	/	S	2016h
PA23 ★	User sets the max speed percentage limit	1-200	100	%	ALL	2017h
PA24 ★	Position command direction signal filter time constant	0.0-20.0	0.0	microsecond (us)	P	2018h
PA25	Torque command source selection	0 - 8	0	/	T	2019h
PA26	Speed command frequency setting	0-3000	0	Hz	S	201Ah
PA27	Internal speed command 1	-9000-9000	0	rpm	S	201Bh

PA28	Arrival speed	0-3000	500	rpm	P, S	201Ch
PA29	Load rotation inertia ratio	0-8000	200	%	P, S	201Dh
PA30 ★	Motor torque overload alarm value	10-300	160	%	ALL	201Eh
PA31 ★	Motor torque overload alarm detection time	0-1200 0	300 0	ms	ALL	201Fh
PA32	Control mode switch allowed	0-1	0	/	ALL	2020h
PA33	Rigidity level	0- 31	0	/	ALL	2021h
PA34	Internal CCW torque limit	0-300	300*	%	ALL	2022h
PA35	Internal CW torque limit	-300-0	-300 *	%	ALL	2023h
PA36	Speed command filter time constant	0-10.0	0.2	ms	ALL	2024h
PA37	Torque feed forward filter time constant	0-10.0	0.5	ms	ALL	2025h
PA38	DP menu dynamic display items	0-300	/	/	ALL	2026h
PA39	RT10-STP(Servo Testing Program) serial communication rate	0- 15	0	/	T	2027h
PA40	Acceleration time constant	0-1000 0	20	ms,0 to max speed time	S	2028h

PA41	Deceleration time constant	0-10000	20	ms, max speed to 0 time	S	2029h
PA42	Incremental encoder AB signal filter time	0-1000	1	x20ns	ALL	202Ah
PA43	Braking resistor maximum allowable impact time	10-5000	1700	ms	ALL	202Bh
PA44 ★	Pulse command function selection	00000b - 11111b	00000b	Bit2: handwheel pulse function	P	202Ch
PA45 ★	Absolute encoder single-turn bits	0- 30	0	0 means the default digits	ALL	202Dh
PA46	Speed integral filter time constant	0- 500	1.0	ms	P, S	202Eh
PA47	Enable disconnect waiting time when the motor is stationary	0- 5000	0	ms	ALL	202Fh
PA48	Electromagnetic brake braking waiting time when the motor is running	0- 5000	50	ms	ALL	2030h
PA49	Brake action speed when the motor is running	0-3000	100	rpm	ALL	2031h
PA50	Brake off delay when motor is enabled	0-3000	20	ms	ALL	2032h

PA51 ★	Braking resistor selection switch	0-1	0	/	ALL	2033h
PA52	Position command smoothing time constant	0.0-100.0	0.0	ms	P	2034h
PA53	Lower 5 bits input terminals forced ON	00000b - 11111b	00000b	Binary	ALL	2035h
PA54	Higher 5 bits input terminals forced ON	00000b - 11111b	00000b	Binary	ALL	2036h
PA55	Lower 5-bits input terminals logical reverse	00000b - 11111b	00000b	Binary	ALL	2037h
PA56	Higher 5-bits input terminals logical reverse	00000b - 11111b	00000b	Binary	ALL	2038h
PA57	Output terminal logic reverse	00000b - 11111b	00000b	Binary	ALL	2039h
PA58	Input terminal debouncing time constant	0.1-800	1.0	ms	ALL	203Ah
PA60	Torque command filter time constant	0-50.00	0.20	ms	ALL	203Ch
PA61 ★	Motor encoder type setting	-1- 7	-1	-1: Motor default setting 0: Incremental 1: ABZ	ALL	203Dh

				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	203Eh
PA63	Disturbance torque compensation gain filter cut-off frequency	0- 2000	50	Hz	P, S	203Fh
PA64	Current proportional gain	1- 500	150*	/	ALL	2040h
PA65	Current integration time constant	1- 100.0	20.0*	ms	ALL	2041h
PA66	Torque feed forward gain	0-100	0	%	P, S	2042h
PA67	Gravity axis offset	-100-1	0	%	ALL	2043h

	compensation	00				
PA68	PDFF feed forward factor	0-100	100	%	P, S	2044h
PA69 ★	External braking resistor value	0- 750	50	Ω	ALL	2045h
PA70 ★	External braking resistor power	0-10000	50	W	ALL	2046h
PA71	Forward friction compensation feedforward gain	0-300	0	%	P, S	2047h
PA72	Current Loop PID limiting adjustment factor	20- 100	100	%	ALL	2048h
PA73	Disturbance torque compensation gain	0- 200	0	%	ALL	2049h
PA74	Internal current command	-300-300	0	%	T	204Ah
PA75 ★	Current loop reserved parameter 1	0-5	0	/	ALL	204Bh
PA76	RS485 response frame delay time	0- 1000	3	ms	ALL	204Ch
PA77 ★	Current loop reserved parameter 2	0-2	0	/	ALL	204Dh
PA78 ★	The output pulses per motor revolution	1-32767	2500	x4 pulses	ALL	204Eh
PA79	System feedback	0-1	0	/	ALL	204Fh

★	pulse output logical reverse					
PA80	Absolute encoder reset setting	00000b - 11111b	000 00b	/	ALL	2050h
PA81 ★	The low bits of command pulses per motor revolution	0-3200 0	0	/	P	2051h
PA82 ★	RS485/232 communication address setting	0-255	1	/	P	2052h
PA83 ★	RS485/232 communication rate setting	0-6	2	/	P	2053h
PA84 ★	The high bits of command pulses per motor revolution	0-1000 0	0	x10000	P	2054h
PA85	Vibration detection current percentage	0- 500	100	%	ALL	2055h
PA86	Zero speed detection value	0- 100	10	rpm	ALL	2056h
PA87 ★	RS485 communication check method selection	0- 6	0	0-no parity 1-even parity check 2-odd parity check	/	2057h
PA88	Backward friction compensation feedforward gain	0- 300	0	%	P, S	2058h

PA89	Friction compensation filter time constant	0- 10.0	1.0	ms	P, S	2059h
PA90 ★	UVW encoding Corresponding to Z pulse	0- 6	0	/	ALL	205Ah
PA91 ★	Incremental encoder UVW direction	0- 1	0	/	ALL	205Bh
PA93 ★	System feedback Z pulse polarity setting	0- 1	0	/	ALL	205Dh
PA94 ★	System feedback Z pulse width setting	0- 15	4	/	ALL	205Eh
PA97	Alarm shield setting bits	00000b - 11111b	00000b	/	ALL	/
PA98	Origin position confirmation range	0- 30	0	/	ALL	2062h
PA99 ★	Absolute multi-turn data upper limit	0- 32000	0	/	ALL	2063h

6.1.2 Fn parameters

No.	Name	Parameter range	Factory default	Unit	Applic ability
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
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
Fn17	RT10-STP(Servo Testing Program) 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	2	0-Reserved 1-Panasonic A5 2-Modbus RTU	ALL
Fn22	Motor related parameter	0000b-	0000b	bit0, Auto zero	ALL

	setting	1111b		position enable bit1, Electrical angle reverse bit2, Speed feedback reverse bit3, Position feedback reverse	
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	0-32000	0	/	P
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	0-6000	3000	rpm	S

	corresponding speed				
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	0-1000	10	mV	S, T
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 max speed	0-6000	100	rpm	P
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

7 Fault Alarm

7.1 Alarm code list

Table 7-1 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 is 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 allocation error	Dynamic memory allocation error
Err 34	Flash reads CRC error	Flash reads CRC error
Err 35	Motor adaptation error	Non-adaptive motor
Err 36	Watchdog error	Drive 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 40	Bus communication error	In the periodic communication state, the data of 3 consecutive frames is wrong
Err 41	Bus connection is interrupted	The physical connection to the network is broken or the state changes
Err 43	The control mode is not written before switching the OP state	The control mode is not written before switching the OP state
Err 44	Bus state machine switching is abnormal	Abnormal switching of the bus state machine
Err 45	Bus cycle configuration is abnormal	Bus cycle is not an integer multiple of 0.2ms
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 failure	The drive incoming power line L1, L2, L3 power down
Err 54	AC main power phase loss	The drive incoming power line L1, L2, L3 phase loss
Err 55	Dynamic braking overcurrent	Dynamic braking overcurrent error
Err 56	Internal D5V undervoltage	The voltage supplied to the control board is less than 5 V

Err 58	Unsupported origin return mode	The unsupported origin return (homing) mode is used
Err 62	Motor speed out of control	There is large difference between command speed and actual speed.

The End

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