

MS-S3

Digital Easy Servo User Manual

Ver: V2.1



Shenzhen YAKO Automation Technology Co., Ltd.

www.yankong.com

Content

Foreword	1
1 Overview	2
1.1 Product Description	2
1.2 Feature	2
1.3 Application field	2
1.4 Product Naming Rules	3
2 Performance Indicators	4
2.1 Electrical Characteristics	4
2.2 Working Environment	4
3 Installation	5
3.1 Installation Size	5
3.2 Installation Method	5
4 Port and wiring	6
4.1 Wiring diagram	6
4.2 Port definition	6
4.2.1 Power input port and motor output port	6
4.2.2 Encoder feedback port	7
4.2.3 Control signal port	7
4.2.4 RS232 communication port	8
4.2.5 Status Indicator	8
4.2.6 Button X4	8
5 Menu Operation	9
5.1 Operation interface	9
5.2 Menu introduction	9
5.2.1 System monitor menu items dP-	10
5.2.2 Parameter setting menu PA-	11
5.2.3 Parameter management menu EE-	15
5.2.4 Internal test menu item Sr-	16
5.2.5 History fault display dE-	16
6 Matched Motor	17
6.1 Motor size	17
6.2 Encoder Cable Specifications	18
6.3 Motor specifications	18
6.4 Technical Parameters	18
6.5 Motor torque-speed characteristic curve (for reference only)	19
7 Common faults and handling	20
7.1 Troubleshooting	20

7.2 Fault analysis and solution.....	21
8 Warranty and after-sales service	23
8.1 Warranty and after-sales service.....	23
8.2 After-sales service	23

Foreword

Thank you for using our easy servo drive.

Before using this product, be sure to read the manual to learn the necessary safety information, precautions, and operating methods.

Incorrect handling may lead to extremely serious consequences.

Statement

This product is designed and manufactured without the ability to protect personal safety from mechanical system threats. Users are advised to consider safety precautions during use to prevent accidents caused by improper operation or product abnormalities.

Due to product improvements, the contents of this manual are subject to change without notice.

Our company will not be responsible for any modification of the product by the user.

When reading, please pay attention to the following signs in the manual:



Notice: Remind you to pay attention to the main points in the text.



Caution: Indicates that incorrect operation may result in personal injury and equipment damage.

1 Overview

1.1 Product Description

MS-S3 belongs to easy servo (servo-stepper) drives. With new generation of 32-bit DSP motor control technology, which completely overcomes the problem of lost step of open-loop stepping motor, MS-S3 greatly improves the high and low speed performance and torque utilization rate of stepping motor, and effectively reduces motor heat.

The servo stepper drive system combines the advantages of open-loop stepper and servo control, and is particularly suitable for the upgrade of open-loop stepper drive control and the cost reduction of traditional servo control.

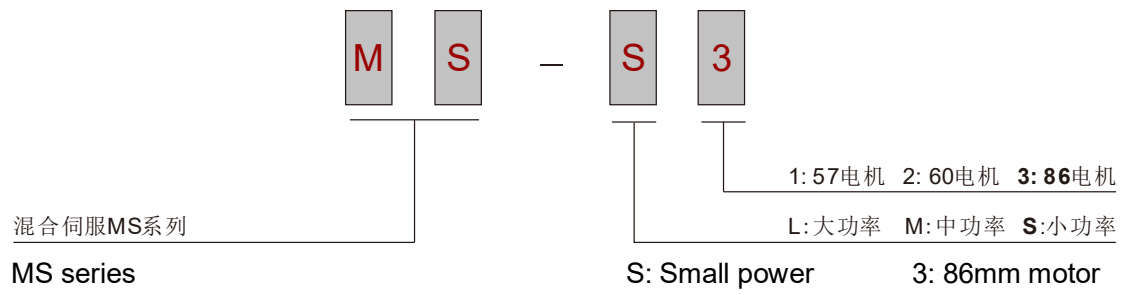
1.2 Feature

- Digital PI current loop, low noise.
- Three operating modes:
 - Self-operating mode: The motor can be triggered by a pulse signal. When the pulse signal optocoupler is turned on, the motor starts self-run according to the parameter setting of PA-45~PA-53; when it is turned off, the motor stops self-running.
 - Open loop mode: for testing and emergency use. The motor temperature rise is higher.
 - Position mode: This mode is the default mode of the drive and is suitable for most occasions. When the driver works in this mode, the motor does not lose step, the temperature is low, and the high and low speed performance are better than the open loop mode.
- The microstep setting can be any number between 400-60000.
- Protection functions such as overcurrent, phase error, overvoltage and position deviation error.
- 6 digital LED display, which can easily set parameters and monitor motor running status.
- Pulse command averaging filter, the filter can turn the curve without acceleration and deceleration into a trapezoidal acceleration/deceleration curve, which greatly smoothes the motion. The trapezoidal acceleration/deceleration curve is filtered to become a smoother S-shaped acceleration/deceleration curve. Especially suitable for point-to-point sports occasions.
- Three types of pulse command: pulse + direction, double pulse(CW/CCW) and quadrature input.

1.3 Application field

Mainly used in robots, industrial robot arms, engraving machines, wire stripping machines, marking machines, cutting machines, plotters, CNC machine tools, automatic assembly equipment and pattern machines.

1.4 Product Naming Rules



2 Performance Indicators

2.1 Electrical Characteristics

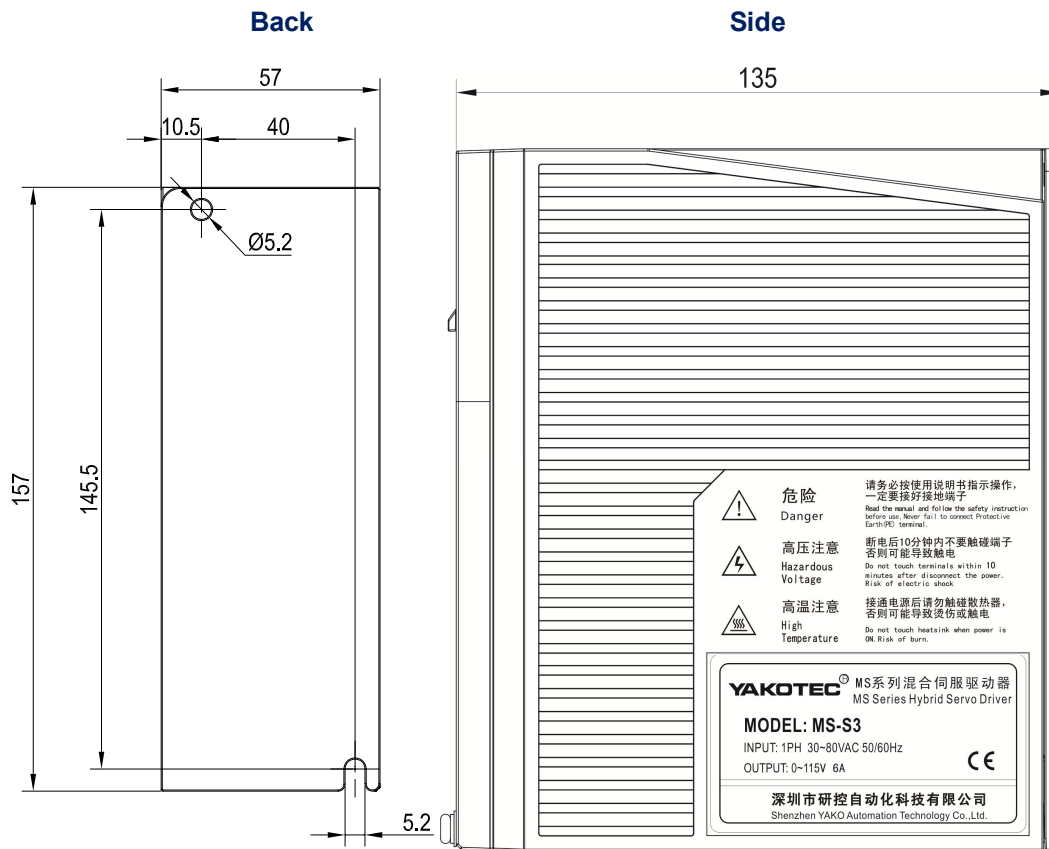
Parameter	MS-Mini3E			
	Minimum value	Typical value	Maximum value	Unit
Continuous Output Current	0	-	6.5	A
Input Supply Voltage	30	70	80	Vac
Logic Input Current	7	10	20	mA
Logic Input Voltage	0	-	200	kHz
Pulse Frequency	500			MΩ

2.2 Working Environment

Cooling Method	Natural cooling or external heat sink	
Working Environment	Working occasion	Keep away from other heating equipment as far as possible to avoid dust, oil mist, corrosive gas, strong vibration, flammable gas and conductive dust
	Temperature	0°C-50°C
	Humidity	40—90%RH
	Vibration	5.9 m/s ² Max
Storage Temperature	-20°C— +80°C	
Weight	Around 1000g	

3 Installation

3.1 Installation Size



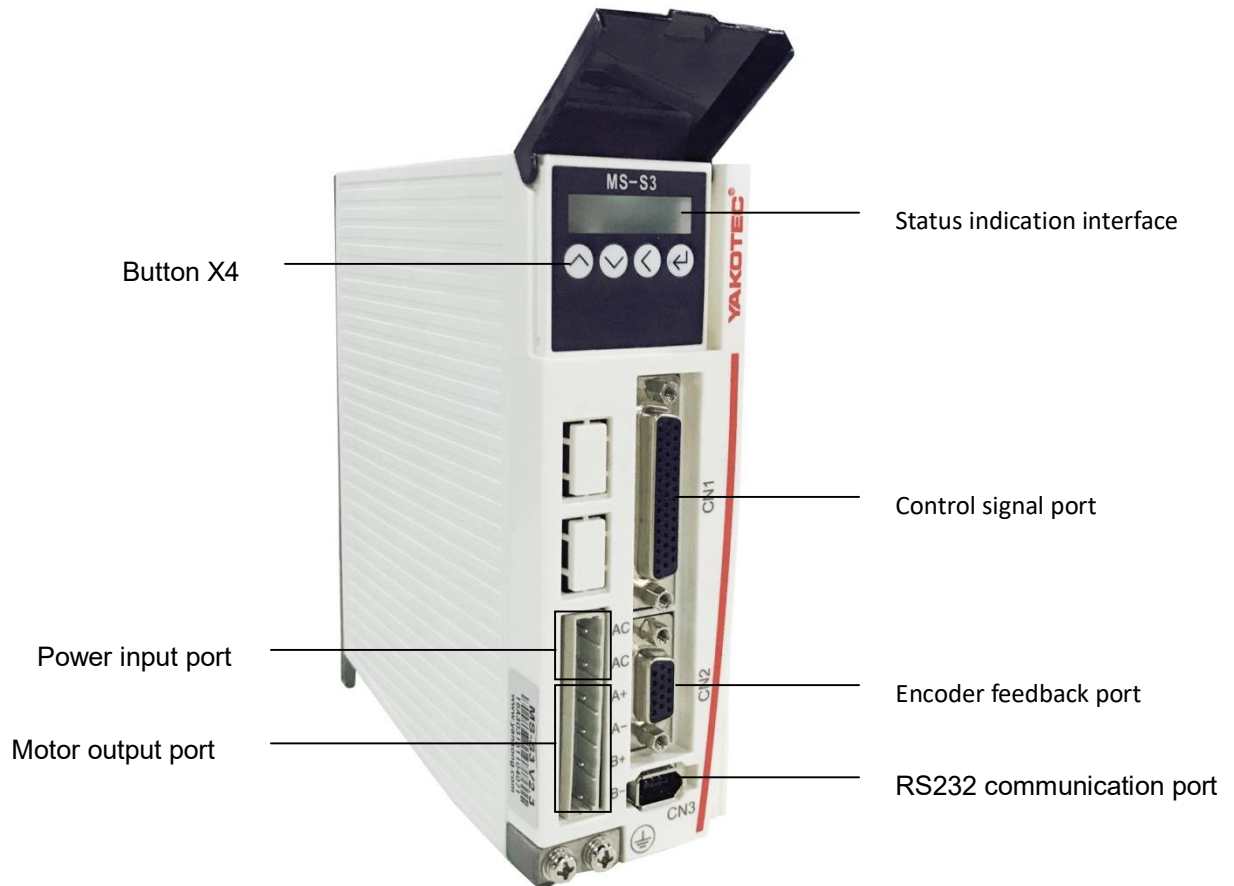
Installation dimension drawing (unit: mm)

3.2 Installation Method

Install the drive with the upright side installation to create a strong air convection on the surface of the heat sink; if necessary, install a fan near the drive to force heat dissipation to ensure that the drive works within a reliable operating temperature range (The reliable operating temperature of the drive is usually within 60 ° C and the motor operating temperature is within 80 ° C).

4 Port and wiring

4.1 Wiring diagram



Drive wiring diagram



Note:

- Personnel involved in the wiring must have the professional ability.
- Input voltage should not exceed AC 80V.

4.2 Port definition

4.2.1 Power input port and motor output port

	No.	Symbol	Name	Definition
	1	AC	Power input port	Connect 30V ~ 80V AC
	2	AC		
	3	A+	Motor power port	Connect motor red line
	4	A-		Connect motor blue line
	5	B+		Connect motor green line
	6	B-		Connect motor black line



Note:

- Must use the matching YAKO motor, if the user uses other motor and caused an accident, YAKO shall not be responsible.
- Refer to **Chapter 6 Motor matching** for motor info.

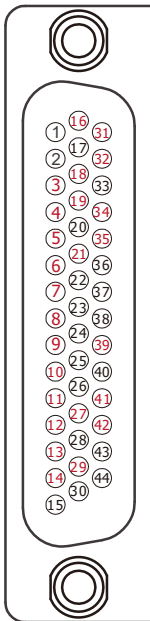
4.2.2 Encoder feedback port

Encoder extension cable provided by YAKO (please refer to 6.2 Encoder Extension Cable Specifications for reference), connect the encoder extension cable directly to the motor encoder and drive.

4.2.3 Control signal port

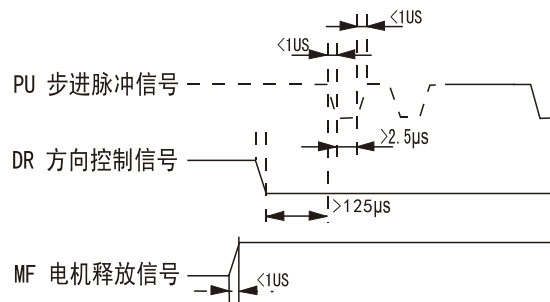
The correspondence definition of each control signal is as follows:

No.	Symbol	Name	Definition
3	5PU+	Pulse 5V positive input	Pulse signal (input signal)
4	PU-	Pulse negative input	
19	24PU+	Pulse 24V positive input	
5	5DR+	Direction 5V positive input	Direction signal (input signal)
6	DR-	Direction negative input	
21	24DR+	Direction 24V positive input	
11	5MF+	Enable 5V positive input	Enable signal (input signal)
12	MF-	Enable negative input	
27	24MF+	Enable 24V positive input	
13	5CLR_A+	Deviation clear 5V positive input	Deviation clear signal (input signal)
14	CLR_A-	Deviation clear negative input	
29	24CLR_A+	Deviation clear 24V positive input	
9	PEND+	In-position signal positive output	In-position signal (output signal)
10	PEND-	In-position signal negative output	
7	ALM+	Alarm signal positive output	Alarm signal (output signal)
8	ALM-	Alarm signal negative output	
41	S-OFF+	Motor brake control signal positive output	Motor brake control signal (output signal)
42	S-OFF-	Motor brake control signal negative output	
16	A+	Encoder A channel positive outputting	Encoder pulse differential (output signal)
31	A-	Encoder A channel negative	



			outputting	
	18	B+	Encoder B channel positive outputting	
	32	B-	Encoder B channel negative outputting	
	34	Z+	Encoder Z channel positive outputting	
	35	Z-	Encoder Z channel negative outputting	
	39	PZOut	Encoder Z channel single-ended output	Encoder Z channel single-ended output (output signal)

In order to avoid some wrong actions and deviations, PU, DR and MF should meet certain requirements, as shown in the following figure:



4.2.4 RS232 communication port

Reserved

4.2.5 Status Indicator

MS-S3 has a 6-digit LED to display the status. When the drive fails, the drive will stop and show corresponding fault code; the drive will save the latest fault in the EEPROM of the drive according to the queue form, and the drive can save up to 10 latest history failure.

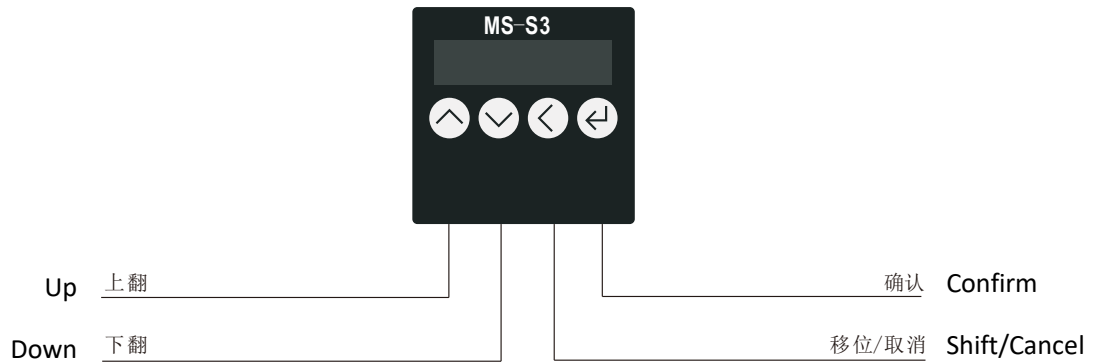
4.2.6 Button X4

There are four touch buttons on the MS-S3 button display panel to implement the functions of up, down, shift/cancel and confirm. For details, see Chapter 5: Menu Operation.

5 Menu Operation

5.1 Operation interface

There are four touch buttons on the MS-S3 button display panel to achieve up, down, shift/cancel and confirm functions. As shown below:








The table below shows the function of each button:

Buttons	Name	Function
	up page	Switch up in the menus at the same level or increase parameter value
	down page	Switch down in the menus at the same level or decrease parameter value
	shifting	Short press this key to shift in parameter set
	cancel	Long press this key to return to the previous menu or cancel the operation
	confirm	Enter the next menu or to confirm the operation



5.2 Menu introduction


There are three levels for system menu. Level 1 menu contains 5 item, the menu items can be switched up and down by button up page and button down page . Press confirm button once, to go to the next menu. Long press to return to the previous menu. Short press on other menu to return to previous directory.

					dP -
				dE-	
			Sr -		

		EE-			
	PA -				
dP -					





5.2.1 System monitor menu items dP-

dP- : Under this menu, there're total 12 second-level items, you can monitor 11 system State. Under the first-level menu, press  and  to select dP-menu item.




And then press  to enter dP- menu secondary menu. Secondary menu as shown in the following table:






Level 1 menu	Level 2 menu	Meaning	Remark
dP -	dP – SPd	Motor real time speed (r/min)	
	dP – SPr	Given speed (r/min)	
	dP – PoS	Current position low 4 bit (Encoder pulse number)	
	dP – PoS.	Current position high 4 bit (Encoder pulse number)	
	dP – CPo	Position command low 4 bit (Command pulse number)	
	dP – CPo.	Position command high 4 bit (Command pulse number)	
	dP – EPo	Position deviation low 4 bit (Encoder pulse number)	
	dP – EPo.	Position deviation high 4 bit (Encoder pulse number)	
	dP – I	Motor current (mA)	
	dP – bUS	Drive internal bus voltage (V)	
		dP – Err	Error code

	dP – VEr	Software Version	
--	----------	------------------	--

After entering the secondary menu, by press  and  to select the item that you want to view the status, and then press the  button, the display shows the status value. If you want to exit, press  .

5.2.2 Parameter setting menu PA-

PA- Menu has 100 second-level menu item, each second-level menu item corresponds to a system parameter. By press  and  to select the parameter that you want to set, then press  to enter parameter setup interface.

In the process of setting parameters, short press  to shift, by press  and  to modify the value. the values displayed will not be applied immediately, only after the user press  button, the values displayed are effectively applied to system. When you need to exit the parameter setting, please long press  .

※ PA-common parameters list:

No.	Name	Function	Default	Range
PA-2	Operation mode selection	0: Self-running (Triggered by pulse signal. When the pulse signal is turned on, the motor starts to run according to the parameter settings of PA-45 ~ PA-53; when it is off, the motor stops running)	2	0~3
		1: Open loop mode (run without encoder line)		
		2: Servo mode 0		
		3: Servo mode 1		
PA-4	Positional accuracy		2	1~65535 encoder pulses
PA-6	Electronic gear ratio numerator		4000	1~65535
PA-7	Electronic gear ratio denominator (pulse per round)	When PA-6 is set to 4000, PA-7 value is equivalent to the number of pulses required for one round of the stepper motor (microstep).	1600	1~60000
PA-8	Encoder resolution		4000	4000
PA-9	Tracking error alarm threshold	This value can be changed based on actual need	5000	0~65535 encoder pulses
PA-10	Current loop Kp		1817	0~65535
PA-11	Current loop Ki		50	0~65535
PA-12	Current loop Kc		256	0~65535
PA-13	Alarm clear signal (CLR-A) function selection	0 CLR-A to clear deviation alarm; 1 CLR-A to change the direction of the motor rotation	0	0/1
PA-14	Enable (MF) function setting	1 MF is used as a general motor release signal 0 MF as a pulse blocking function	1	0/1
PA-15	Enable (MF) level selection	0 The default set is: the driver respond to pulse command when MF is not connected 1 Respond to pulse command need 5V MF signal	0	0/1
PA-16	Alarm signal (ALM)	1 Alarm output ALM normally	1	0/1

	output level selection	open		
		0 Alarm output ALM normally close		
PA-17	Single and double pulse selection	0 Pulse + direction mode	0	0/1/2
		1 Double pulse mode		
		2 Orthogonal input		
PA-18	Pulse valid edge selection	0 Respond to the pulse when optocoupler turn from off to on.	0	0/1
		1 Respond to the pulse when optocoupler turn from on to off.		
PA-19	Motor rotation direction selection	0 Counterclockwise	1	0/1
		1 Clockwise		
PA-20	Pulse width filter	Filter pulse signal glitches	10	1~128
PA-21	In-position signal (PEND) mode selection	<p>0 When the position deviation is less than the number of encoder pulses set by PA-23, it is in position.</p> <p>1 No position command, when the position deviation is less than the number of encoder pulses set by PA-23, it is in position.</p> <p>2 No position command, and the position deviation is less than the number of encoder pulses set by PA-23, output in-position signal until the time set in PA-24 (in-position hold time in milliseconds) is passed. After the holding time of the in-position signal, the status is determined by the position command at that time and the status of the position deviation.</p>	1	0~2
PA-22	In-position signal (PEND) level selection	<p>0 PEND turns on when in position</p> <p>1 PEND turns off when in position</p>	0	0/1
PA-23	Positioning end range	To set the in-position pulse range in controlled position. For details, refer to PA-21.	5	0~65535 encoder pulses
PA-24	In-position signal	In-position signal holding time, unit is ms, refer to PA-21 for	10	0~65535

	holding time	details.		
PA-25	Pulse command microstep enable	0 microstep enable 1 microstep disable	1	1
PA-28	Pulse command filtering	Filter time = (PA-28) * 50us. This filter can change no acceleration and deceleration curve into a trapezoidal acceleration and deceleration curve, greatly smooth movement. And change trapezoidal acceleration and deceleration curve into a smoother S-shaped acceleration and deceleration curve. Particularly suitable for point to point occasions.	30	1~2048
PA-45	Start speed	The motor rotates according to the parameters of PA-45 to PA-53 when the operation mode is self-running or when the Sr-ON (internal test) menu is executed.	50	0~65535Hz
PA-46	Acceleration time		50	0~65535ms
PA-47	Deceleration time		50	0~65535ms
PA-48	Target speed		1600	0~65535 Hz
PA-49	Running pulse number (high 2 bytes)		0	0~20000
PA-50	Running pulse number (low 2 bytes)		1600	0~65535 pulse
PA-51	Intermittent time		100	0~65535ms
PA-52	Repeat time		10	0~65535 times
PA-53	Whether to run back and forth		0	0/1
PA-56	Open loop current percentage			100
PA-57	Closed-loop base current percentage		60	0~100
PA-58	Closed loop maximum current percentage		100	0~100
PA-60	Position error proportional coefficient		1024	0~65535
PA-61	Speed error proportional coefficient		0	0~65535

PA-62	Speed feed forward coefficient		0	0~65535
PA-63	Vibration damp coefficient		512	0~65535
PA-64	Integral coefficient	In the point to point movement occasions, if there's need for high positioning accuracy, please increase this value, increase it by 10 for each time.	0	0~65535




Note: These parameters need re-power after change: PA-2, PA-17, PA-18, PA-20.

5.2.3 Parameter management menu EE-

EE- Menu has 6 second-level menu item, as shown in the following table:

Level 1 menu	Level 2 menu	Function
EE- (Parameters Management)	EE-SEt	Write parameters, it would write parameters from drive memory to EEPROM parameter area. If you do not do this, the drive will restore to previous value after re-power.
	EE-rd	Parameters read, read EEPROM parameter data into memory.
	EE-bA	Parameter backup, write parameters from drive memory to EEPROM backup area.
	EE-rS	Restore the backup to memory. This operation does not write parameter to EEPROM parameter area. If users want to permanently use EEPROM backup zone data, you need to perform write operation (EE-SEt).
	EE-dEF	Restore the default value of the parameter, it resets all parameters to the default values are read into memory and write to EEPROM.
	EE-ACL	Clearing the history fault

To save parameters, you need to do the following:

- Find level 1 menu of EE-
- Enter to the level 2 menu of EE-SET
- Long press  button, StArt will be displayed on the screen. About 3 seconds later, appears FInISH, which represent the parameters successfully saved.

5.2.4 Internal test menu item Sr-

Level 1 menu	Level 2 menu	Function
Sr- (Internal test)	Sr-On	The internal test starts and the motor starts running at the speed set by PA-45~PA-53.
	Sr-Off	The internal test ends and the motor stops running.

5.2.5 History fault display dE-

To view the latest 10 history of faults saved in drive EEPROM:

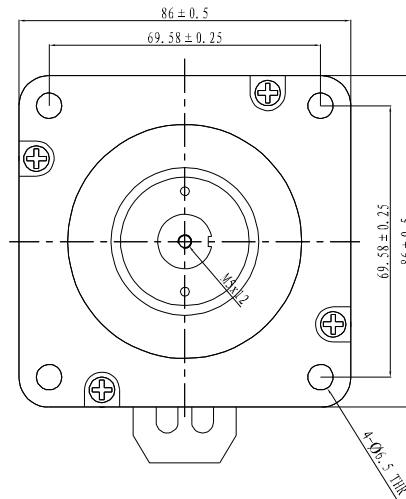
Level 1 menu	Level 2 menu	Function
dE- (History fault check)	dE-1	Displays the latest fault code in dE-01; Displays the second latest fault code in dE-02;
	dE-2	
	dE-3	
	dE-4	
	dE-5	
	dE-6	
	dE-7	
	dE-8	
	dE-9	
	dE-10	

6 Matched Motor

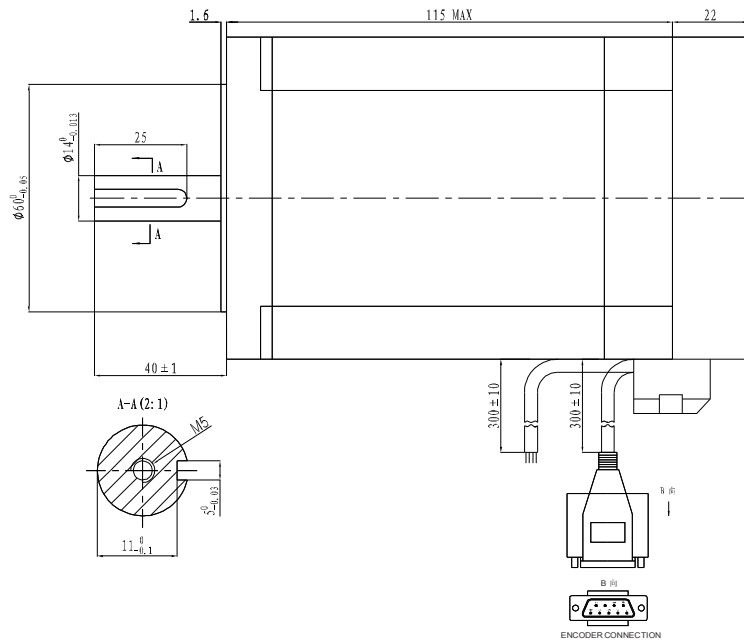
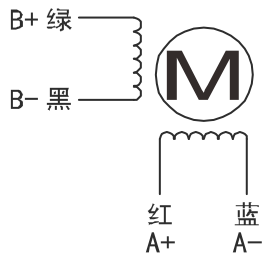
MS-S3 standard motor models are YK286EC80A1, YK286EC118A1 and YK286EC156A1.

6.1 Motor size

- 86mm 2 Phase Close-loop Motor (unit: mm)

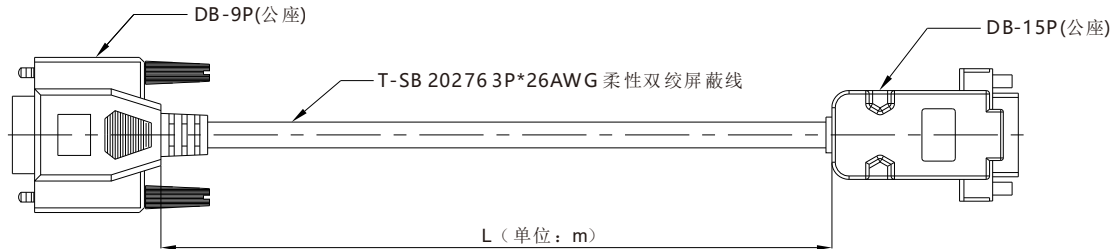


Motor Wiring



6.2 Encoder Cable Specifications

The encoder cable is used to connect the motor encoder and drive. The figure below shows the encoder cable size drawing. The standard encoder cable length is 2m, and other specifications such as 3m, 4m, 5m, 8m, 9m, 10m, 12m, 14m are available.



Encoder Wiring

	1	Blue	EA+
	2	Blue/White	EA-
	3	Orange	EB+
	4	Orange /White	EB-
	5	Red	+5VCC
	6	Black	EGND

6.3 Motor specifications

Model	Shaft Diameter (mm)	Shaft Type (mm)	Shaft Length L1 (mm)	Lug boss diameter D1(mm)
YK286EC80A1	14	Flat key 5x5 x25	40	60
YK286EC118A1	14	Flat key 5x5 x25	40	60
YK286EC156A1	14	Flat key 5x5 x25	40	60

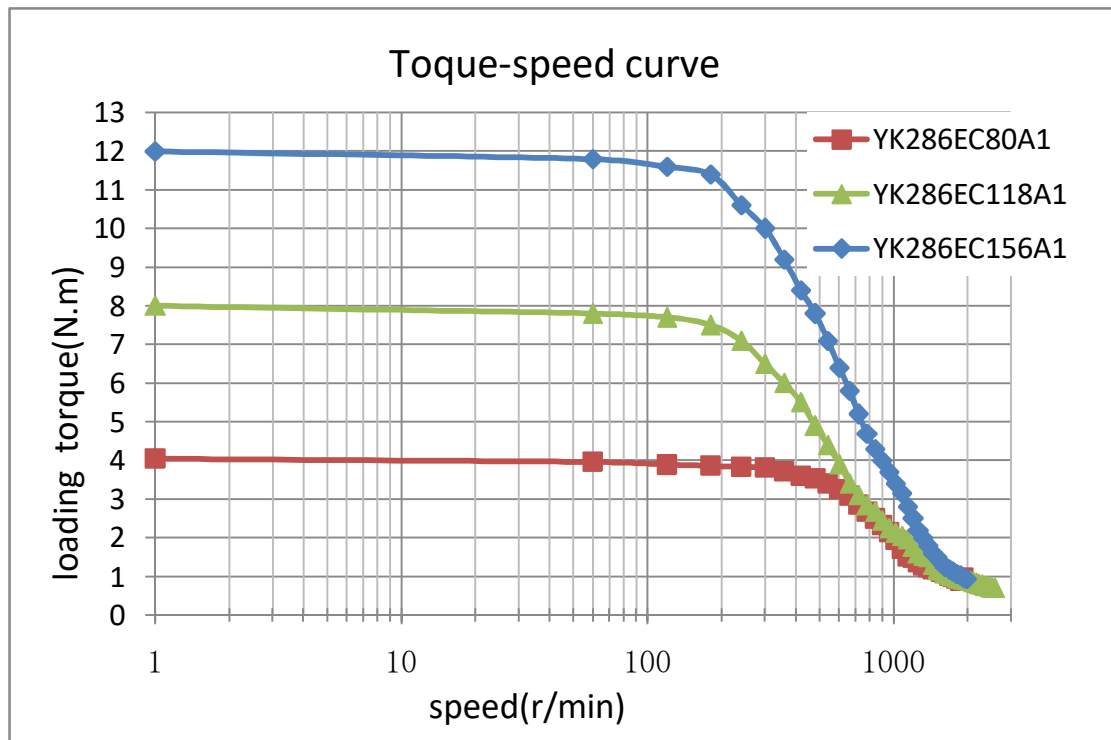
6.4 Technical Parameters

Model	Step Angle (°)	Rated Voltage (V)	Motor Length (mm)	Holding Torque (N.m)	Rated Current (A/phase)	Resistance (Ω)	Inductance (mH)	Rotor Inertia (g.cm ²)	Weight (kg)	Motor Leads
YK286EC80A1	1.8	3.0	106	4.0	6.0	0.5	6.5	3600	4.0	4
YK286EC118A1		2.45	144	8.0	6.0	0.44	3.73	3200	5.0	4
YK286EC156A1		4.2	155	12	6.0	0.7	5.6	4800	6.0	4

6.5 Motor torque-speed characteristic curve (for reference only)

Drive model: MS-S3

Voltage: 75Vac



Note:

- Please ensure that the motor and encoder are wired correctly, otherwise the motor will alarm for out of position deviation tolerance after receiving pulse.
- When installing the motor, it is strictly forbidden to strike the back cover of the motor to avoid damage to the encoder.

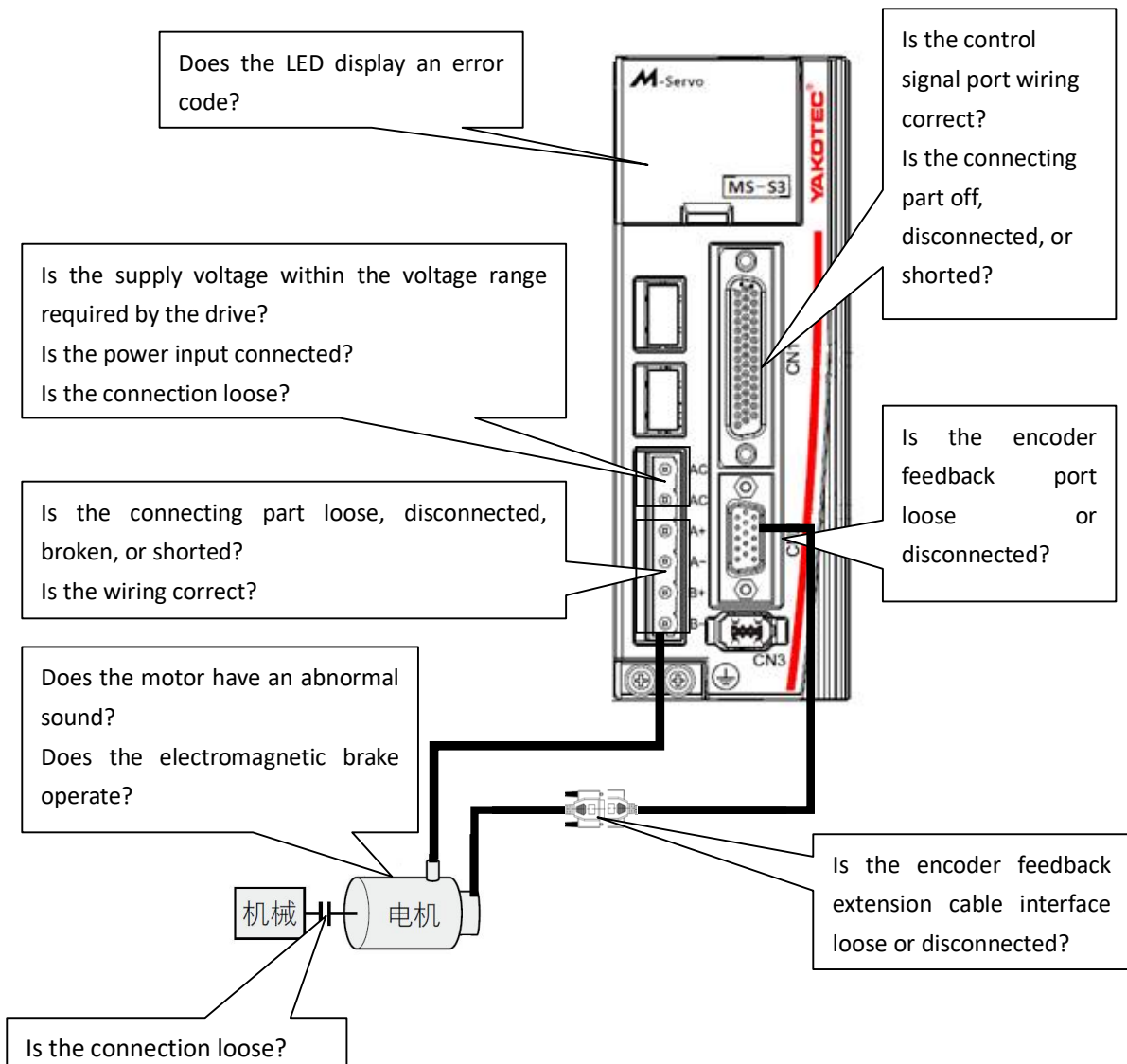
7 Common faults and handling



Caution:

- The drive and motor must be powered off for at least 5 minutes before touching the drive and motor to prevent electric shock and burns.
- After the drive fault alarm, it must be eliminated according to the alarm code before it can be put into use again.

7.1 Troubleshooting



7.2 Fault analysis and solution

Error code	Error name	Causes	Solution
Err-2	Overvoltage protection	<ul style="list-style-type: none"> ① The driver power input voltage exceeds the specified value. ② The regenerative energy is too large when the drive is braked. ③ Drive failure (loop failure) 	<ul style="list-style-type: none"> ① Use correct voltage ② Increase the acceleration / deceleration time, reduce load or increase the value of PA-28. ③ Replace a new drive
Err-5	Overcurrent protection	<ul style="list-style-type: none"> ① Motor current line A+, A-, B+, B- short circuit. ② Drive failure (loop, fail parts). ③ Motor burned out. 	<ul style="list-style-type: none"> ① Check if the motor current line is short-circuited, and if there is a burr on the line. Connect the current lines correctly. ② Replace a new drive ③ Replace a new motor
Err-8	Motor phase wiring connection wrong protection	<ul style="list-style-type: none"> ① Motor current line A+, A-, B+, B- line sequence error. ② Motor current line A+, A-, B+, B- short circuit. 	<ul style="list-style-type: none"> ① Verify that the motor current line is properly connected as required. ② Check if the motor current line is shorted.
Err-4	Encoder error	<ul style="list-style-type: none"> ① Encoder feedback interface is loose, off-line, disconnected, shorted. ② The motor components are damaged. ③ Drive failure. 	<ul style="list-style-type: none"> ① Check that the encoder feedback cable is correct and connected reliably. ② Replace a new motor ③ Replace a new drive.
Err-7	Tracking tolerance error protection	<ul style="list-style-type: none"> ① Motor current line A+, A-, B+, B- is not reliably connected, or the line sequence is wrong. ② The load is too large, the acceleration/deceleration time is too short, or the motor selection is not suitable. ③ The motor has an electromagnetic brake and the electromagnetic brake is not opened as required. ④ The motor has an electromagnetic brake, but 	<ul style="list-style-type: none"> ① Verify that the motor current line is correctly and reliably connected as required. ② Increase the value of PA-9 appropriately without affecting the processing requirements of the equipment. ③ Properly extend the acceleration and deceleration time to reduce the load and reduce the speed. ④ Check that the motor

		the closing and opening of the brake is not controlled by the S-OFF signal of the drive.	<p>electromagnetic brake working circuit is correct.</p> <p>⑤ Control the motor brake via the S-OFF+, S-OFF- signals that come with the drive.</p>
Err-1	Drive memory read error	<p>① The drive is powered off before parameter save completed.</p> <p>② The data in the drive parameter save area is damaged.</p> <p>③ Drive failure.</p>	<p>① Execute EE-dEF to restore the factory defaults of the drive and eliminate the fault.</p> <p>② Execute EE-dEF to restore the factory defaults of the drive and eliminate the fault.</p> <p>③ Replace a new drive.</p>

8 Warranty and after-sales service

8.1 Warranty and after-sales service

Please keep the box for transportation, storage or return of the product to YAKO for maintenance purposes.

One year warranty:

The warranty is for damage caused by the product within one year of purchasing.

Inapplicability of warranty:

- Improper wiring, power supply voltage and damage caused by user peripheral configuration.
- User changed the drive without written authorization from YAKO.
- Use beyond the electrical and environmental requirements.
- Drive serial number is missing or unreadable.
- Obviously damage of the shell.
- Irresistible disaster.

8.2 After-sales service

When you need product after-sales service support, please call the company's national toll-free service hotline (only Chinese): 400-033-0069

Monday to Friday (except for national holidays) 8: 30-17: 30

YAKO headquarters address : 6B, building B3, Guangming Science and Technology Park, Guangming District, Shenzhen City, P.R. China.

YAKO R&D center : 802A, Languang Building, Nanshan District, Shenzhen City, P.R. China.

Tel : (86) 755-86142288 86142255

Fax : (86) 755-86142266

Web : www.yankong.com

Before you make a call, please record the following information:

- Fault phenomenon
- Product model and serial number
- Installation date or production date