MS-L3 Servo-Stepper Drive
User Manual V1.2

【Before use, please read this manual carefully to avoid damaging the drive】

Content

I Product Profile

1 Overview

MS-L3 series servo-stepper drive is the latest technology of YAKO. It combines 32-bit DSP motor control technology and power angle control technology, thus completely solved the problem of losing step.

MS-L3 increases high and low speed performance and torque utilization efficiency, effectively reduce motor heat, thus to enhance machine's processing efficiency/accuracy and reduce energy consumption. It has obvious advantage on cost compared with traditional AC servo system.

2 Technical features

- 32 bit DSP control technology
- Advanced lead angle and vector control algorithm;
- Current automatically change according to load
- Microstep settings: continuously changeable from 400 to 60,000 pulse per round
- Suitable for 86~110mm (NEMA 34~42) close-loop motor
- Photoelectric isolated signal input/output, high anti-interference ability
- 200Kpps pulse response frequency
- Input voltage range: AC220V
- Fault protection: over current, over voltage, low voltage protection, position warning

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- Six-digit LED display, user friendly for setting and monitoring

3 Applications

Suitable for high torque large automation equipments such as robots, engraving machine, stripping machine, marking machine, cutting machine, plotter, CNC machine, automatic assembly equipment.

4 Naming rules

MS - L 3 - xx

① ② ③ ④

①	Series code	Hybrid servo series (Servo-stepper)
②	Power rate	L：High power（AC220） S：Low power（AC80V）
③	Motor flange size	3:86mm 4:110mm
④	Customize number	1—99

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II Electrical, mechanical, and environmental spec

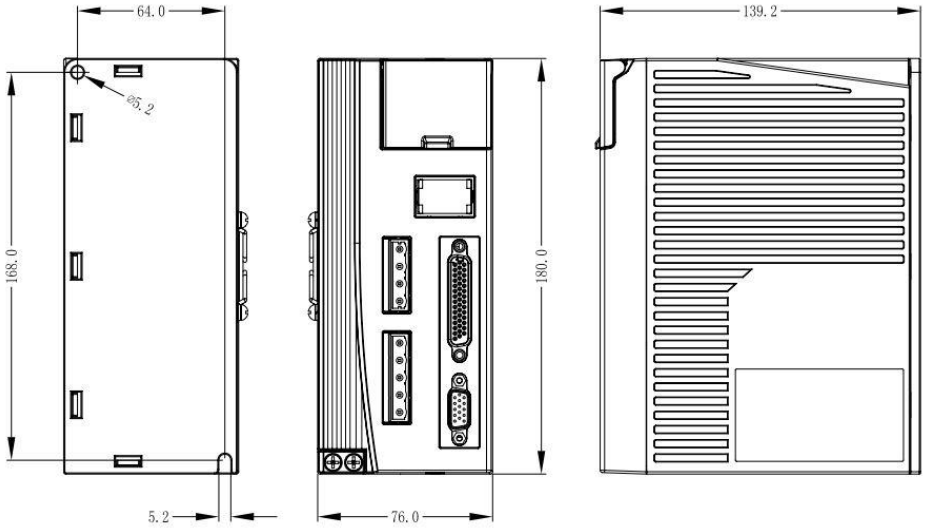
1 Electric spec

Spec	MS-L3			
	Minimum value	Typical value	Maximum value	Unit
Continuous output current	0	-	6.0	A
Input power voltage	150	220	240	Vac
Logic input current	7	10	20	mA
Pulse frequency	0	-	200	kHz
Insulation resistance	500			MΩ

2 Using the environment and parameters

Cooling way	Air cooled	
Use environment	Environment	Try to avoid dust, mist and corrosive gases
	Temperature	0℃－50℃
	Humidity	40－90%RH
	Vibration	5.9 m/s^2 Max
Storage temperature	-20℃－+65℃	
Weight	Around 1500g	

3 Mechanical installation dimensions (unit : mm)



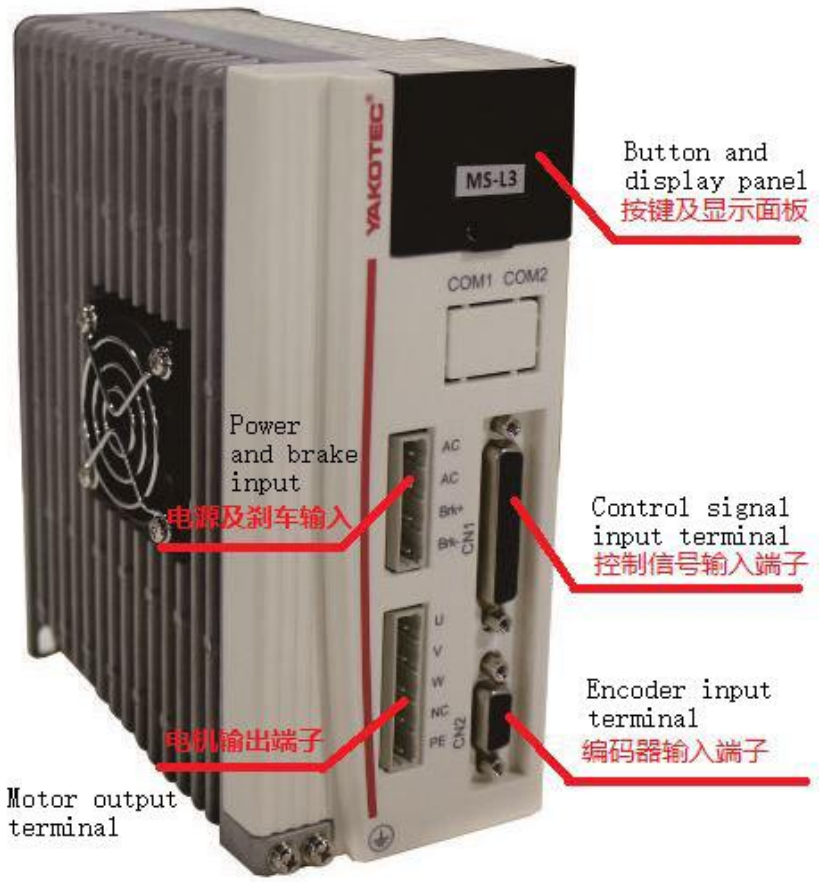
4 Enhance heat dissipation

（1）Drives reliable operating temperatures are usually under the 60 ℃, the motor operating temperatures up to 80 ℃ or less;

（2）Please use upright side mount when installing the drive, to form strong convection on the surface of the heatsink. If necessary install a fan near the drive, to forced cooling, guarantee drives in safe operating temperature range.

III Drive terminal and wiring introduction

1 Interface schematic diagram



2 Terminal definition

1）Power input terminal and output terminal for motor

Terminal number	Abbreviation	Name	Definition
1	AC	Power input	110V~220V AC
2	AC		
3	BRK+	Brake output+	Connect with external brake resistor or none
4	BRK-	Brake output-	
5	U	Motor cable	U, V, W correspond to black, blue, brown or correspond to red, blue, black
6	V		
7	W		
8	NC		Not connected
9	PE	Grounding Terminal	Yellow-green line

2）Encoder feedback terminal

Encoder connection is provided by YAKO, use the encoder extension cord to directly connecting the motor encoder and drive.

3）Control signal terminal

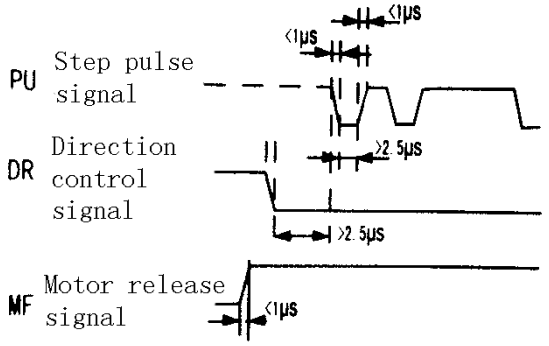
Control signal correspond as follows:

Terminal number	Terminal name	Terminal description	Introductions
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 alarm clear 5V positive input	Deviation alarm clear signals (Input signal)
14	CLR_A-	Deviation alarm clear negative input	
29	24CLR_A+	Deviation alarm clear 24V positive input	
9	PEND+	Position reached signal positive output	Position reached signal (Output signal)
10	PEND-	Position reached signal negative output	
7	ALM+	Alarm signals positive output	Alarm signals (Output signal)
8	ALM-	Alarm signals negative output	
16	A+	Encoder A channel positive output	Encoder pulse differential output signal
31	A-	Encoder A channel negative output	
18	B+	Encoder B channel positive output	
32	B-	Encoder B channel negative output	

34	Z+	Encoder Z channel positive output	
35	Z-	Encoder Z channel negative output	
41	BK+	Motor brake positive output	Brake control signal (Output signal)
42	BK-	Motor brake negative output	
39	Z_OUT	Encoder Z collector open output	Encoder Z signal single output
22 33	GND	Signal ground	

In order to avoid malfunction and deviation, PU, DR, MF should meet certain requirements as follows shown:



5）Communication terminal

Not open to the public.

6）Status indicator

MS-L3 has six-digit LED display. When a drive has a malfunction, the drive

will stop, and displayed the corresponding faulty codes. When multiple faulty occur at the same time, the fault code will display one by one. Drive saving the latest failure in the drive's EEPROM according to the faulty queue, the drive can up to save 10 recent history of faulty.

IV Menu operation

1 Operation interface

There are four touch buttons in MS-L3 buttons display panel, to realize of up page, down page, shifting, cancel and confirm function, as shown in the following figure:

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

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.

				▼	dP–Display menu
			▼	dE-History of failure	▲
		▼	Sr–Test	▲	
	▼	EE-Parameter management	▲		
▼	PA–Parameter settings	▲			
dP–Display menu	▲				

1）System monitor menu items dP–

dP－Under this menu, there're total 14 second-level items, you can monitor 11 system State. Under the first-level menu, press ▲ and ▼ to select dP－menu item, and then press the ← to enter dP－ menu secondary menu. Secondary menu as shown in the following table:

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Level 1 menu	Level 2 menu	Meaning	Remark
dP -	dP – SPd	Motor speed (r/min)	
	dP – SPr	The given speed (r/min)	
	dP – PoS.	Current position high 4 bit (Feedback pulse number)	encoder measurement unit
	dP – PoS	Current position low 4 bit (Feedback pulse number)	encoder measurement unit
	dP – CPo.	Position command high 4 bit (Pulse command number)	Input pulse measurement units
	dP – CPo	Position command low 4 bit (Pulse command number)	Input pulse measurement units
	dP – EPo.	Position deviation high 4 bit	Encoder measurement units
	dP – EPo	Position deviation low 4 bit	Encoder measurement units
	dP – I	Motor current (mA)	
	dP –buS	Drive busbar voltage（V）	
	dP –MtP	Motor type	86 Motor; 110 Motor
	dP – Err	Alarm code	00——No alarm
			01——Memory read error
			02——Overvoltage protection
			04——Encoder fault
			05——Overcurrent protection（IPM）
			07——Position deviation protection
	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 ◂ key.

2）Setting menu item PA-

PA- Menu has 63 second-level menu item, each second-level menu item corresponds to a system parameter. Adjustable parameters are listed in the table, the rest parameters are reserves. By press ▲ and ▼ to select the parameter that you want to set, then press the ← key to enter parameter setup interface.

In the process of setting parameters, short press ◂ key to shift, by press ▲ and ▼ button to modify the value. the values displayed will not be applied immediately, only after the user press the ← button, the values displayed are effective. When you need to exit the parameter setting, please press ◂.

PA values specification:

Parameter sequence	Parameter name	Parameter description	The default value	Range	Remark
PA-02	Operation mode selection	1 Open-loop mode 2 Servo mode 0	2	1-2	
PA-03	Initial display state	0 Motor speed (r/min)	0	0-11	

		1 The given speed (r/min) 2 Current position high 4 bit 3 Current position low 4 bit 4 Position command high 4 bit 5 Position command low 4 bit 6 Position deviation high 4 bit 7 Position deviation low 4 bit 8 Motor current (mA) 9 Drive busbar voltage（V） 10 Motor type 11 Alarm code			
PA-06	E-gear ratio numerator		4000	1-60000	When the E-gear ratio

PA-07	E-gear ratio denominator		1600	1-60000	numerator equal to the encoder resolution, E-gear ratio denominator equal to the microsteps
PA-08	Encoder resolution		4000	4000	
PA-09	Track error alarm thresholds		4000	1-65535	
PA-10	Current loop Kp		1000	0-65535	
PA-11	Current loop Ki		200	0-65535	
PA-12	Current loop Kc		256	0-1024	
PA-13	CLR_ALM function select	0 Variances alert cleared 1 Changing the direction of the motor rotation	0	0-1	
PA-14	MF function setting	0 Pulse blocking function 1 Release the	1	0-1	

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		motor axis			
PA-15	MF input polarity	0 Enabled when input optic-coupler is on 1 Enabled when input optic -coupler is off	0	0-1	
PA-16	ALM output polarity	0 When alarm, output optic-coupler is off 1 When alarm, output optic-coupler is on	1	0-1	
PA-17	Single and double pulse options	0 Pulse + direction （PU+DR） 1 Double pulse （CW/CCW） 2 Orthogonal （A/B）	0	0-2	Re-power needed
PA-18	Pulse effective edge	0 Effective when pulse optic-coupler from off to on (rising edge)	0	0-1	
		1 Effective when pulse optic-coupler from on to off (falling edge)			
PA-19	Motor rotation direction	0 Counter clockwise 1 Clockwise	1	0-1	
PA-20	Impulse bandwidth filter		10	1-128	
PA-21	Position reached signal （PEND） output mode	0 Output when absolute position deviation is less than PA-23 1 Output when absolute position deviation is less than PA-23, position command before the filter is 0, and after the time set in PA-24	0	0-1	

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PA-22	Position reached signal（PEND）level select	0 When position reached, output optic-coupler is on 1 When position reached, output optic-coupler is off	0	0-1	
PA-23	The end range of positioning		5	1-100	
PA-24	Positioning completion time	The unit is one interrupted cycle (62.5us)	10	0-1000	
PA-25	Pulse command microstep enable	0 Pulse command microstep disable 1 Pulse command microstep enable	1	0-1	
PA-28	Pulse instruction filter		256	1-512	

	coefficients				
PA-31	Power-on ramp time		5000	1-65535	
PA-45	Starting speed		50	0-65535Hz	
PA-46	Acceleration time		50	0-65535ms	
PA-47	Deceleration time		50	0-65535ms	
PA-48	Target speed		1600	0-65535Hz	
PA-49	Running pulse number (high 2 bytes)		0	0-20000	Pulse number = high 2 bytes *65536+ low 2 bytes
PA-50	Running pulse number (low 2 bytes)		1600	0-65535	
PA-51	Interval time		100	0-65535	Unit：ms
PA-52	Repeat times		10	0-65535	
PA-53	Cyclic running	0 Running back and forth 1 Running in single	0	0-1	

		direction			
PA-56	Open-loop current percentage	Maximum current for open loop operation	100	0-100	
PA-57	Closed-loop basic current percentage		40	0-100	
PA-58	Closed-loop maximum current percentage		100	0-100	
PA-60	Position deviation ratio factor		2048	0-65535	
PA-61	Speed deviation ratio factor		409	0-65535	
PA-62	Speed feedback coefficient		20	0-100	
PA-64	Integral coefficient		0	0-10000	

Note: 1) PA-17 need to be re-powered to be effective, others effective immediately.

2）After parameter was changed, it is needed to save parameter by EE-SEt menu, otherwise, the drive will restore to previous value.

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3）Parameter management menu item 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 operations (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:

1) Find level 1 menu of EE-

2) Enter to the level 2 menu of EE-SET

3) Long press the ← button, StArt will be displayed on the screen. About 2

seconds later, appears FInISH, which represent the parameters successfully saved.

4）The running test menu item Sr-

Level 1 menu	Level 2 menu	Function
Sr- (Running test mode）	Sr-On	Test running started, motor running in begin with a fixed speed
	Sr-Off	End test run, the motor stops running.

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-（Historical troubleshooting）	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	

V YAKO warranty

1 Warranty for 12 months：

YAKO provide 12 months warranty from date of delivery for the product of raw material and processing defects. YAKO provide free maintenance service during the warranty period for defective products.

2 Not covered under warranty：

- ●Inappropriate wiring, such as power and motor cables reversed.
- ●Unauthorized changes to internal components
- ●Beyond the electrical and environmental requirements
- ●Environmental heat dissipation environment is too bad

VI Version and change description

V1.0 The initial version

V1.1 Modified PA-02 , PA-16 , PA-19 default parameters, modified PA-05 default to 40, modified PA-29 default to 6000.

V1.2 Modify the parameters to the same with MS-S3.