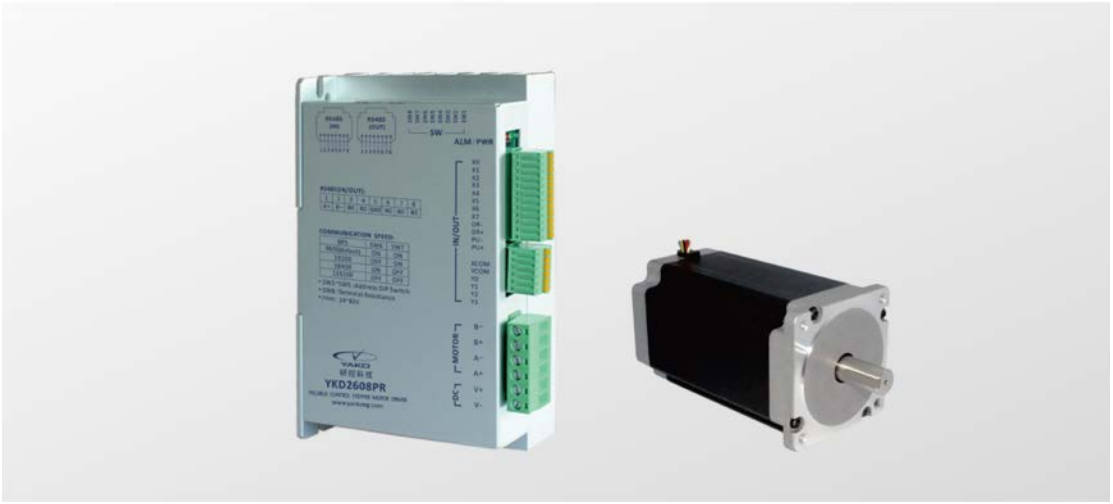
YAKOTEC®

YKD2608PR

Fieldbus Stepper Drive
User Manual

Version：V1.3



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Content

Foreword

Thank you for using our bus type stepper drive.

Before using this product, be sure to read this manual carefully for necessary safety information, precautions and operating instructions.

Wrong operation may have serious consequences.

Statement

The design and manufacture of this product do not have the ability to protect personal safety from mechanical systems. Please consider safety precautions in the design and manufacture of mechanical systems to prevent accidents due to improper operation or product abnormalities.

Due to product improvements, the contents of this manual may be changed without notice.

YAKO will not take any responsibility for user's any modification of the product.

Please note the following mark in the manual:

 **Note: to remind you to note the main points in the text.**

 **Caution: Incorrect operation can result in personal injury and equipment damage.**

1 Overview

1.1 Product introduction

YKD2608PR Fieldbus stepper motor driver is a digital stepper drive based on the traditional open-loop stepper drive, but it added bus communication and single-axis controller function. Fieldbus communication using RS-485 interface, supports the standard MODBUS-RTU protocol.

1.2 Feature

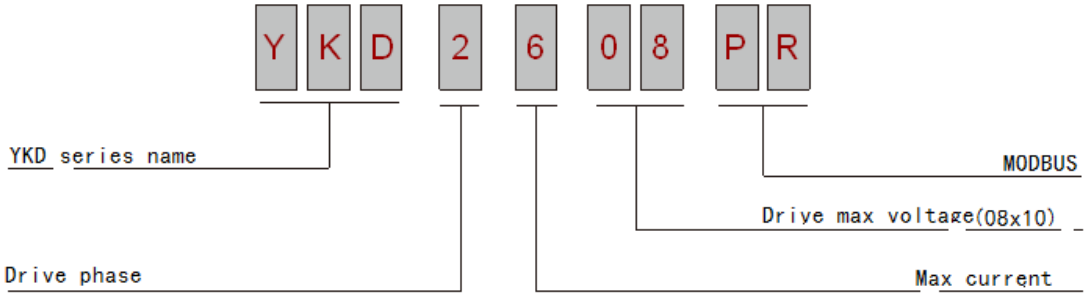
- New generation of 32-bit DSP technology, cost-effective, good stability, low noise, low vibration.
- RS-485 isolated bus, supports standard MODBUS-RTU protocol, mount up to 30 devices.
- Bus-type driver can achieve long-distance reliable control, which effectively solve the problem of pulse loss in interference environment.
- Users can set the current through the bus, subdivision, lock current, control motor start and stop and inquire real-time status of the motor.
- Built-in single-axis controller function: The user can set the start speed, acceleration time, deceleration time, maximum speed, the total number of pulses and other parameters through the bus to achieve trapezoidal acceleration and deceleration position control, with homing, multi-position mode and other functions.
- Support position control, speed control and multi-position mode.
- 2 photoelectric isolation programmable high-speed differential input interface, external signal can be used to control the motor start and stop
- 8 optical isolated programmable input interface, receiving external control signals to enable the drive, start & stop, emergency stop, position limit and other functions
- 4 photoelectric isolated programmable output interface, output driver status and control signals
- 16 constant torque microstep, 40000 microstep the highest
- Smooth and precise current control, small motor heat
- Motor current automatic halve when the step pulse stops more than 200ms
- Excellent smoothness in low frequency and small subdivision
- Driving current adjustable below 4.2 A
- Voltage： DC24-80V
- Over-voltage, under-voltage, over-current protection

1.3 Applications

Mainly used in textile machines, embroidery machines, security equipment, stage

lighting, robots, medical equipment, laser equipment, marking machines, plotters and other automation equipment.

1.4 Product naming rule



2 Performance indicators

2.1 Electrical feature

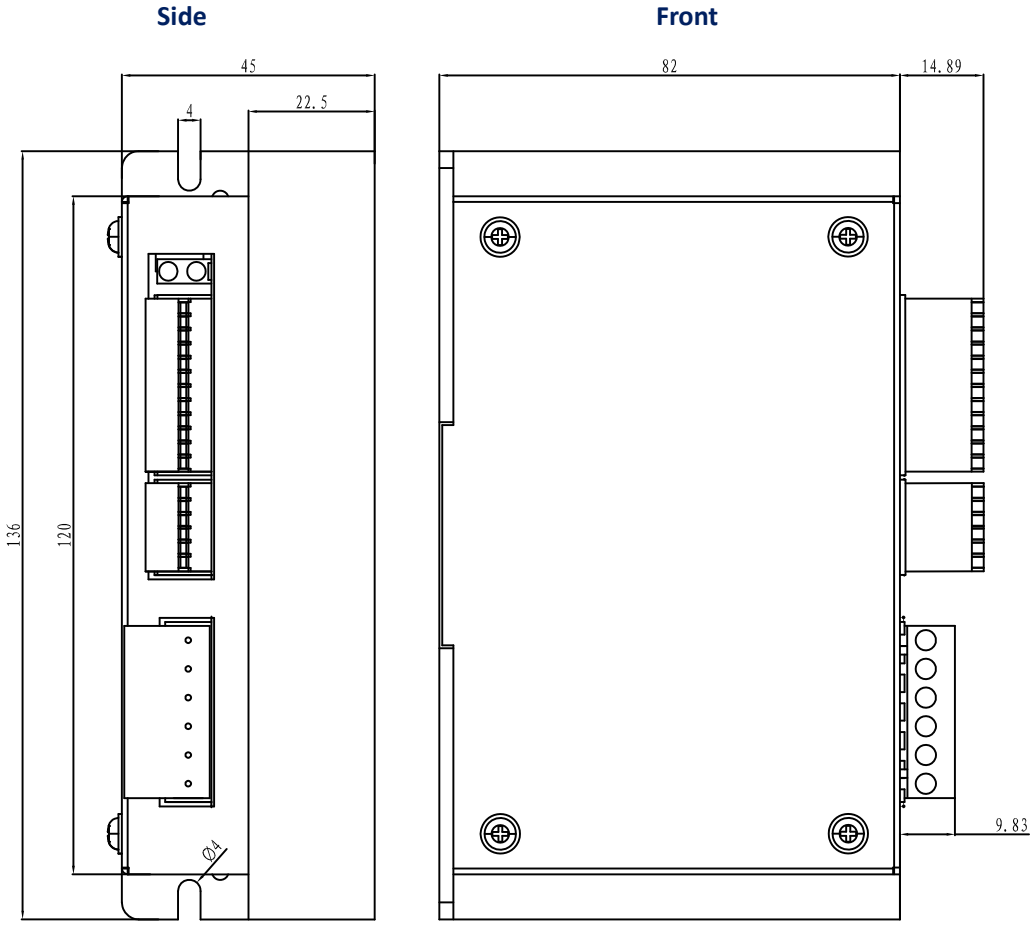
Para.	YKD2608PR			
	Min	Typical	Max	Unit
Output current	0.5	-	4.2	A
Input voltage	18	48	80	Vdc
Logic input current	7	10	16	mA
Logic input voltage	-	5	24	V
Pulse frequency	0	-	200	kHz
Resistance	100	-	-	MΩ

2.2 Working environment

Cooling mode	Cooling fin	
Working environment	Environment	Keep away from other heating equipment as far as possible. Avoid dust, oil mist, corrosive gas, strong vibration, prohibit combustible gas and conductive dust
	Temperature	0℃~50℃
	Humidity	40－90%RH
	Vibration	10~55Hz/0.15mm
Storage temperature	-20℃~+80℃	

3 Installation

3.1 Installation dimension



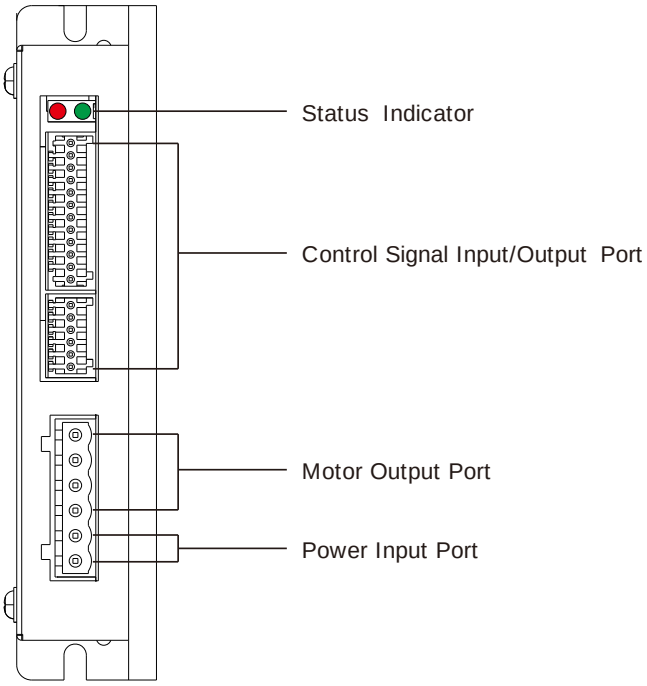
（unit：mm）

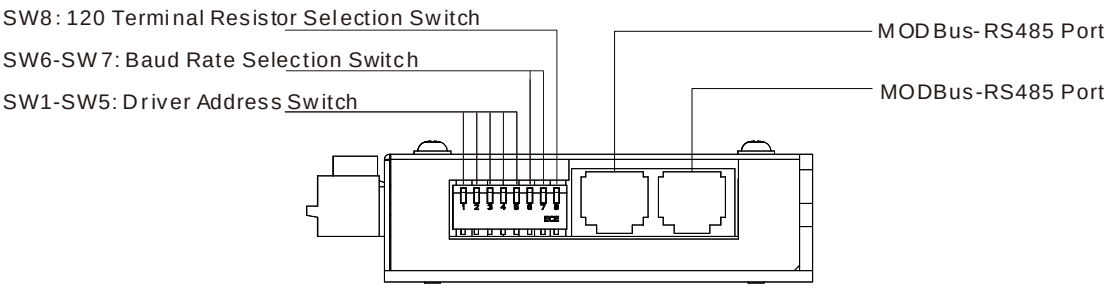
3.2 Installation method

When installing the driver, please use upright side mounting to make the radiator surface have strong air convection; if necessary, install a fan near the driver to force the heat dissipation to ensure the driver work in a reliable working temperature (the reliable operating temperature of the driver is usually 60℃, the motor operating temperature is 80 ℃ or less).

4 Drive port and wiring

4.1 Wiring diagram





Caution:

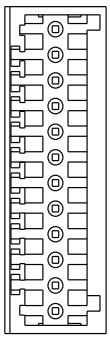
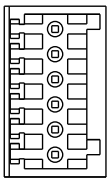
- The personnel involved in the wiring must have professional ability.
- No wiring with electricity power on.
- Wiring after the installation is firmly finished.
- Do not wrongly connect + and – of power, input voltage should not exceed 50V

4.2 Port definition

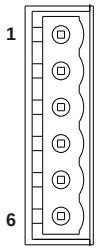
4.2.1Status lights

Color	Name	Function
Green	Power light	When power on, the green light is on.
Red	Alarm light	Overcurrent, the indicator flashing once for cycle; Over-voltage, the indicator flashing twice for cycle; Undervoltage, the indicator flashing three times for cycle; EEPROM error, the indicator flashing four times for cycle; COM error, the indicator flashing five times for cycle.

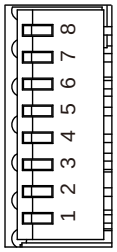
4.2.2 Control I/O

Port	Pin	Mark	Name	Function
1  12	1	X0	single input port	① (P/D mode) pulse signal(only suitable for high speed differential port PU); ② (P/D mode)direction signal(only suitable for high speed differential port DR); ③ home signal; ④ limit+ signal; ⑤ limit- signal; ⑥ motor free signal; ⑦ alarm clear signal; ⑧ PV enable signal; ⑨ PV direction signal; ⑩ stop signal; ⑪ emergency stop signal; ⑫ position mode movement; ⑬ speed mode movement; ⑭ JOG+; ⑮ JOG-; ⑯ homing enable signal; ⑰ PT enable signal; ⑱ PIN0~4;
	2	X1		
	3	X2		
	4	X3		
	5	X4		
	6	X5		
	7	X6		
	8	X7		
	9	DR−	differential input	
	10	DR+		
	11	PU−		
	12	PU+		
1  6	1	XCOM	single input common port	Common port：compatible with common cathode and common anode wiring
	2	YCOM	single output common port	
	3	Y0	single output port	① Alarm signal; ② brake signal; ③ back home signal; ④ motor status signal; ⑤ position signal;
	4	Y1		
	5	Y2		
	6	Y3		

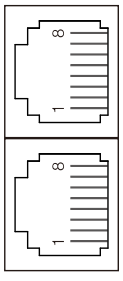
4.2.3 Power input/motor output ports

Port	Pin	Mark	Name	Function
	1	B−	motor ports	2 phase stepper motor port
	2	B+		
	3	A−		
	4	A+		
	5	V+	power port	DC24−80V
	6	V-		

4.2.4 Dip switch

Port	Pin	Mark	Name	Function
	1	SW1	dip switch	SW1-5： drive address setting
	2	SW2		
	3	SW3		
	4	SW4		
	5	SW5		
	6	SW6		SW6-7： baud rate setting
	7	SW7		
	8	SW8		SW8 ： 120 significant bit of terminal resistor

4.2.5 MODBUS ports

Port	Pin	Mark	Name	Function
	1	RS-485-A	COM port	RS485
	2	RS-485-B		
	3	NC	reserved	reserved
	4	NC		
	5	RS-485-GND	common GND	common GND
	6	NC	reserved	reserved
	7	NC		
	8	NC		

4.3 I/O operation

- **Port hardware description**

YKD2608PR provides 8 optical isolated programmable input ports, compatible with common cathode and common anode connection, 2 differential signal input.

2 differential internal high-speed optocoupler differential signal can be configured for

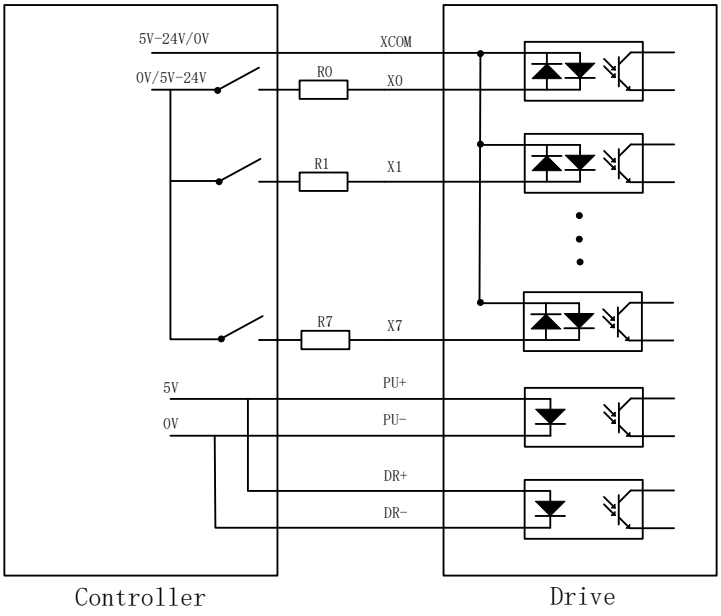
pulse direction or double pulse control, and it can also be configured as a common differential input port. The input signal voltage is 5V, current limit resistor is needed when the voltage is higher than 5V (such as when the input signal is 24V, 2~3K resistance should be connected).

8 (X0-X7) programmable input signal and external control interface are isolated through optocoupler. The driver is compatible with common cathode and common anode connection, as shown below. In order to ensure that the drive optocoupler conduction is reliable, the controller requires to provide drive current at least 10mA. The driver has been inserted with optocoupler current limiting resistor, when the input signal voltage is higher than 5V, an external resistor can be added according to needs.

Current-limiting resistor selection：if voltage is +5V, R=0；if voltage is +12V, R=1KΩ；if voltage is +24V, R=2KΩ.

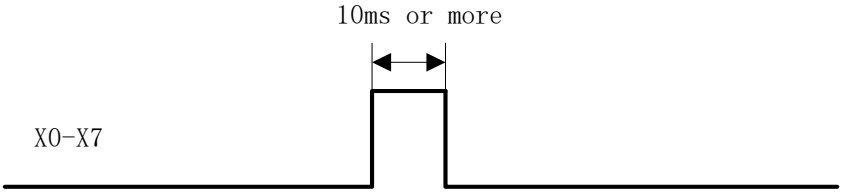
Note：

- If the controller outputs 24V control voltage by default, YKD2608PR-A1 can be selected to avoid trouble of adding resistance. The default input terminal control voltage of this sub-model is 24V.



Input ports connection for inference

The level of X0-X7 input pulse width needs more than 10ms, otherwise the drive may not respond properly. X0-X7 timing diagram as below:



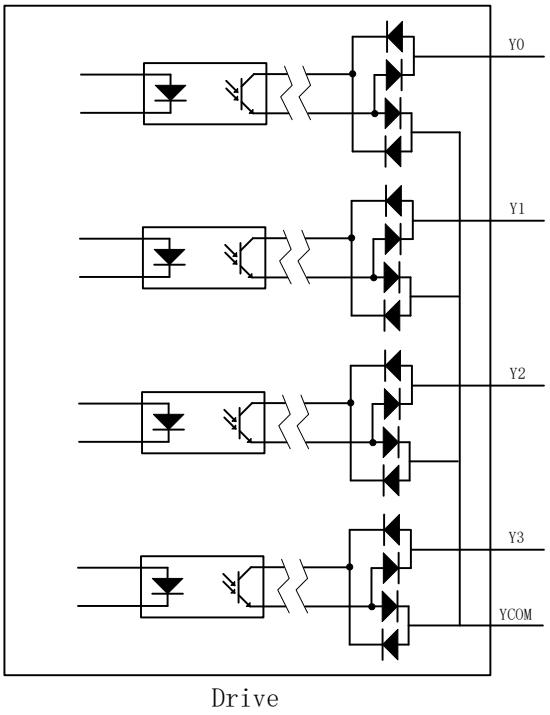
Each time the driver is powered on, X0-X7 are defaulted to be in unspecified state. In this condition, the input signal is invalid. The user can configure the X0-X7 input via ModBus.

For example, to configure X0-X2 input signal as table※ Terminals function setting, host needs to send slave the following command: 01 06 00 43 00 01 B9 DE, 01 06 00 44 00 02 48 1E, 01 06 00 45 00 03 D8 1E.

※ Terminals function setting

Input signal	Function
X0	home signal
X1	limit+
X2	limit-

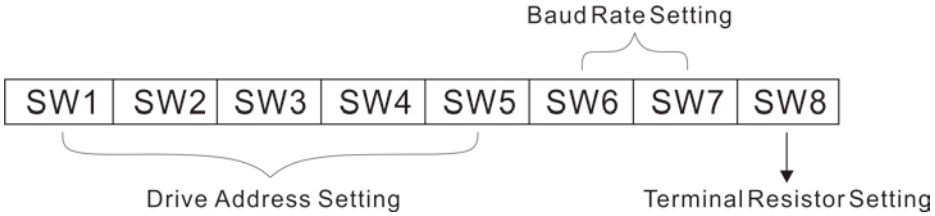
The driver provides 4 optocoupler isolated output terminals, supports NPN and PNP, support high or low level effective controller.



Internal circuit of Y0-Y3 output

4.4 Dip switch setting

YKD2608PR stepper motor drive use 8-bit DIP switch to set the drive address, communication baud rate and termination resistor, described in detail as below:



- **Drive address setting**

One controller can control 30pcs at same time via RS-485. The drive address setting applies 5-bit dip switch, the address scope is 0-31, 0 is system reserved. If the address is bigger than 31, it needs upper computer software to adjust and save, and set all switch OFF as below:

SW5	SW4	SW3	SW2	SW1	Address
OFF	OFF	OFF	OFF	OFF	customize
OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	ON	OFF	2
OFF	OFF	OFF	ON	ON	3
OFF	OFF	ON	OFF	OFF	4
OFF	OFF	ON	OFF	ON	5
OFF	OFF	ON	ON	OFF	6
OFF	OFF	ON	ON	ON	7
OFF	ON	OFF	OFF	OFF	8
OFF	ON	OFF	OFF	ON	9
OFF	ON	OFF	ON	OFF	10
OFF	ON	OFF	ON	ON	11
OFF	ON	ON	OFF	OFF	12
OFF	ON	ON	OFF	ON	13
OFF	ON	ON	ON	OFF	14
OFF	ON	ON	ON	ON	15
ON	OFF	OFF	OFF	OFF	16
ON	OFF	OFF	OFF	ON	17
ON	OFF	OFF	ON	OFF	18
ON	OFF	OFF	ON	ON	19
ON	OFF	ON	OFF	OFF	20
ON	OFF	ON	OFF	ON	21
ON	OFF	ON	ON	OFF	22

ON	OFF	ON	ON	ON	23
ON	ON	OFF	OFF	OFF	24
ON	ON	OFF	OFF	ON	25
ON	ON	OFF	ON	OFF	26
ON	ON	OFF	ON	ON	27
ON	ON	ON	OFF	OFF	28
ON	ON	ON	OFF	ON	29
ON	ON	ON	ON	OFF	30
ON	ON	ON	ON	ON	31

Note：

- One controller can control 30pcs of drives at same time via RS-485.
- Every drive's COM address must be unique, or it will cause COM error.

※Braud rate setting

SW7	SW6	Braud rate
ON	ON	9600
ON	OFF	19200
OFF	ON	38400
OFF	OFF	115200

Note：

- If the above brad rate cant meet requirements, it can be customized via upper computer, and set SW6 & SW7 be ON, its default braud rate is 9600.

- **Terminal resistor setting**

Through this bit, users can choose to merge the terminal COM into 120 terminal resistor according to the application as below:

SW8	120 Select bit of terminal resistor
OFF	invalid
ON	valid

4.5 RS485 COM

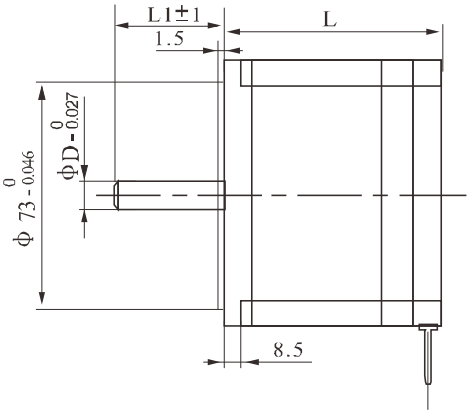
YKD2608PR has 2pcs of RS-485 COM, which applies standard RJ45 sockets. RJ45 has 8 pins, and pin 1&2 are used for half-duplex COM, pin 5 is the common GND of RS-485, other pins are not used.

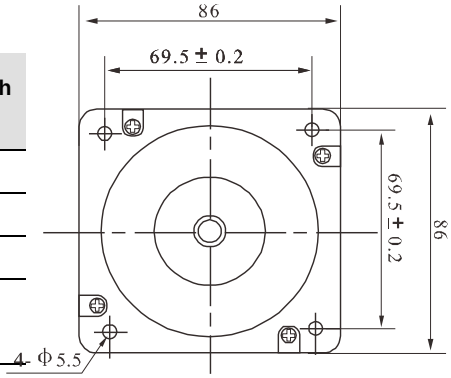
5 Matchable motors

YK86HB65-04A, YK86HB80-04A, YK86HB80-0613A, YK86HB118-06A and YK86HB118-0613A

5.1 Motor dimension

- **86mm(nema 34 2 phase stepper motors)（unit：mm）**





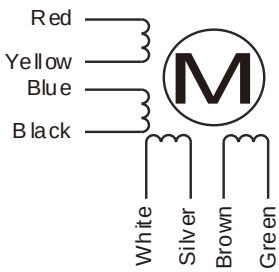
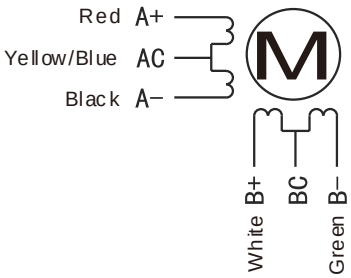
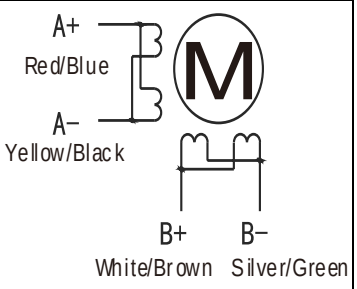
Model	Shaft diameter D（mm）	Shaft extension （mm）	Shaft length L1(mm)
YK86HB65-04A	9.5	Flat 1x15	32
YK86HB80-04A	12.7	Flat 1x15	32
YK86HB80-0613A	13	Flat 0.3x15	37
YK86HB118-06A	12.7	Flat key 5x 5x25	32
YK86HB118-0613A	13	Flat 0.3x25	37

5.2 Technical specification

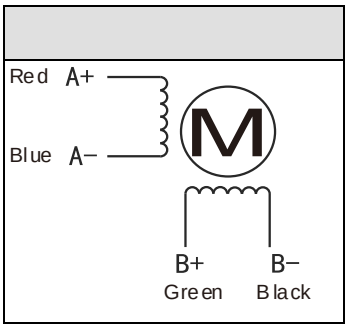
Motor model	Angle (°)	Length (mm)	Torque (N.m)	Current (A/phase)	Resistance (Ω)	Inductance (mH)	Rotor inertia (g.cm)	Weight (kg)	Leads
YK86HB65-04A	1.8	65	3.4	2.8	1.4	3.9	1000	1.8	8
YK86HB80-04A		80	4.6	4.2	0.75	3.4	1400	2.26	8
YK86HB80-0613A		80	4.5	6	0.38	3.5	1400	2.3	4
YK86HB118-06A		118	8.7	4.2	0.9	6.0	2700	3.67	8
YK86HB118-0613A		118	8.5	6	0.6	6.0	3400	3.7	4

5.3 Motor wiring diagram

- **8 leads motor**

8 leads	6 leads	4 leads
		

- **4 leads motor**



Note：

- When installing the motor, be sure to use the flange of the motor to install and pay attention to the tolerance, strictly ensure the concentricity of the motor shaft and the load.
- Please don’t connect wrong phase when connect motor with drive.

6 MODBUS COM protocol

6.1 MODBUS register address definition

※ Register address definition table

Register address	Item	Description	Setting range Note:other values are invalid	Default
Status para. group（read only）				
0x0000	Drive model	Drive model code	（RO）	0x0301/ 0x0302
0x0001	Drive version	Drive version	（RO）	V1.0
0x0002	Drive node no.	MODBUS slave station node no.	（RO）	-
0x0003	Drive's working mode	0：postion/speed mode； 1：back home mode； 2：PT mode； 3：PV mode；	（RO）	-
0x0004	Motor's moving status	0：Static； 1：move；	（RO）	-
0x0005	Motor's moving direction	0：DR+； 1：DR-；	（RO）	-
0x0006	Current error codes	0：normal； 1~5：error；	（RO）	-
0x0007	Drive's status bit	Bit0：in-position bit，0：not in-position，1：in-position； Bit1：homing completion bit，0：not complete，1：complete； Bit2：motor running bit，0：static，1：running； Bit3：alarm bit，0：normal，1：alarm； Bit4：motor enable bit，0：enable，1：release； Bit5~Bit15：reserved；	（RO）	-
0x0008	Input terminals' status bit	Bit0：PU input status； Bit1：DR input status； Bit2：X0 input status； Bit3：X1 input status； Bit4：X2 input status；	（RO）	-

		Bit5：X3 input status； Bit6：X4 input status； Bit7：X5 input status； Bit8：X6 input status； Bit9：X7 input status； Bit10~Bit15：reserved； 0： invalid input level； 1： valid input level；		
0x0009	Output terminals'status bit	Bit0：Y0 output status； Bit1：Y1 output status； Bit2：Y2 output status； Bit3：Y3 output status； Bit4~Bit15：reserved； 0：invalid output level； 1：valid output level；	（RO）	-
0x000A	Current high position	Current position of absolute position(read 0x0026 function codes)	（RO）	-
0x000B	Current low position	Current position of absolute position(read 0x0026 function codes)	（RO）	-
0x000C	Current speed	current motor speed	（RO）	-
Drive's basic control para. Group 1				
0x0010	Current setting	RMS value(peak) Lock current 0—0.5A（0.7A）； 1—0.8A（1.1A）； 2—1.0A（1.4A）； 3—1.2A（1.7A）； 4—1.5A（2.1A）； 5—1.9A（2.7A）； 6—2.3 A（3.3A）； 7—2.7A（3.8A）； 8—3.1A（4.3A）； 9—3.5A（4.9A）； 10—4.0A（5.6A）； 11—4.2A（5.9A）；	0~11 （RW/S）	6 （2.3A）
0x0011	Microstep setting	Address-microstep 0—200（Pu/rev）； 1—400 （Pu/rev）； 2—800 （Pu/rev）； 3—1600（Pu/rev）； 4—3200（Pu/rev）；	0~15 （RW/S）	8 （1000Pu/rev）

		5—6400（Pu/rev）; 6—12800（Pu/rev）; 7—25600（Pu/rev）; 8—1000 （Pu/rev）; 9—2000（Pu/rev）; 10—4000（Pu/rev）; 11—5000（Pu/rev）; 12—8000（Pu/rev）; 13—10000（Pu/rev）; 14—20000（Pu/rev）; 15—40000（Pu/rev）;		
0x0012	Lock current	0：half current; 1：full current;	0~1 （RW/S）	0
0x0013	User-defined drive's node number	0~31：undefined 32~127 use it when the node number is bigger than 31.;	0~127 （RW/S）	0
0x0014	User-defined COM braud rate	0：9600 1：14400 2：128000 3：256000 Note：Power-on again to make it effective after adjusting	0~3 （RW/S）	0
0x0015	Serial port data format	0：8 bits, no check, 1 stop bit; 1：8 bits, no check, 2 stop bits; 2：8 bits, even parity check, 1 stopbit; 3：8 bits, odd parity check, 1 stop bit; Note：Power-on again to make it effective after adjusting;	0~3 （RW/S）	0
0x0016	COM write function code value update to EEPROM	0： RW/S para. are updated to EEPROM; 1：no update;	0~1 （RW/S）	0
0x0017	Overtravel's stop modes	0：free stop; 1：emergency stop; 2：invalid;	0~2 （RW/S）	0
0x0018	Bus control mode/pulse direction(P/D) control mode	0： Bus control; 1： external pulse/direction(P/D) control mode; 2： double pulse control mode; Note: After shifting to external pulse control mode, users have to power-on again to make it effective.	0~2 （RW/S）	0

Drive's basic control para. Group 2				
0x0020	Start speed	Start speed	2-300r/min （RW）	5 (5r/min)
0x0021	Acceleration time	Acceleration time	0-2000ms （RW）	100 (100ms)
0x0022	Deceleration time	Deceleration time	0-2000ms （RW）	100 (100ms)
0x0023	Max speed	In low microstep setting, max speed is 3000rpm; in high microstep setting, max output frequence is 200KHz	-3000~3000 r/min （RW）	60 (60r/min)
0x0024	Total pulse number high bit	Total pulse number in postion mode running(includes the total steps in stage of acceleration,constant speed and deceleration). If you set 100000 pulse, the high bit is 0x0001，the low bit is 0x86A0	-32767~32768 （RW）	0
0x0025	Total pulse number low bit		-32767~32768 （RW）	5000
0x0026	Relative/absolute position	This bit is valid when it use external IO to activate position/multi-position operation： 0：relative position：start from current position； 1：absolute position： start from power-on position or the position after back home；	0~1 （RW）	0
0x0027	Start command	Bit0-1: 1：position mode；2：speed mode； Bit2:0：relative position；1：absolute position； this bit is valid in postion mode； Bit3~Bit15：reserved	0~6 （RW）	-
0x0028	Stop command	Bit0: 0：normal stop；1：emergency stop；	0~2 （RW）	-
0x0029	Motor enable/free signal	0：free； 1：enable；	0~1 （RW）	-
0x002A	Alarm clear	0：invalid； 1：alarm clear；	0~1 （RW）	-
0x002B	MODBUS register para. setting	0：invalid； 1：factory reset； 2：save all RW attributive para. to EEPROM；	0~2 （RW）	-

0x002C	Current position reset	Used to reset current position in absolute position mode： 0：invalid； 1：reset current position；	0~1 （RW）	-
Back home para. group				
0x0030	homing enable command	0： invalid； 1： valid；	0~1 （RO）	-
0x0031	Homing mode	0：positive limit+home mode； 1：negative limit+home mode； 2：positive limit mode 正； 3：negative limit mode； Note：under mode 0 &1, no need to connect limit signal if it’s not needed.	0~3 （RW/S）	0
0x0032	Homing speed	the speed when querying home point.	5-3000r/min （RW/S）	120 (60r/min)
0x0033	Homing query speed	the speed after querying home point	5-300 r/min （RW/S）	60 (60r/min)
0x0034	Homing acceleration/deceleration time	the acceleration time when querying home point	30-2000ms （RW/S）	100 (100ms)
0x0035	Positive home compensation value	CCW compensation value	0~65535 （RW/S）	0
0x0036	Negative home compensation value	CW compensation value	0~65535 （RW/S）	0
I/O para. group				
0x0040	Valid level of input ports	Bit0：PU control bit； Bit1：DR control bit； Bit2： X0 control bit； Bit3： X1 control bit； Bit4： X2 control bit； Bit5： X3 control bit； Bit6： X4 control bit； Bit7： X5 control bit； Bit8： X6 control bit； Bit9： X7 control bit； Bit10~Bit15：reserved； 0：default； 1： reversal level； Rising edge or high level of input level is valid；	0~65535 （RW/S）	0

0x0041	Function selection of input PU	0：undefined； 1：home signal； 2：limit+； 3：limit-； 4： MF； 5：alarm clear signal； 6：PV enable signal； 7：PV direction signal； 8：stop signal； 9：emergency stop signal； 10：position mode movement； 11：speed mode movement； 12：JOG+； 13：JOG-； 14：homing enable signal； 15：PT enable signal； 16：PIN0； 17：PIN1； 18：PIN2； 19：PIN3； 20：PIN4； Note：Set PU & DR function to be 0 when using external pulse control mode.	0~20 （RW/S）	0
0x0042	Function selection of input DR		0~20 （RW/S）	0
0x0043	Function selection of input X0		0~20 （RW/S）	0
0x0044	Function selection of input X1		0~20 （RW/S）	0
0x0045	Function selection of input X2		0~20 （RW/S）	0
0x0046	Function selection of input X3		0~20 （RW/S）	0
0x0047	Function selection of input X4		0~20 （RW/S）	0
0x0048	Function selection of input X5		0~20 （RW/S）	0
0x0049	Function selection of input X6		0~20 （RW/S）	0
0x004A	Function selection of input X7		0~20 （RW/S）	0
0x004B	Valid level of output ports	Bit0：output Y0 control bit； Bit1：output Y1 control bit； Bit2：output Y2 control bit； Bit3：output Y3 control bit； 0：default； 1：reversal level； Rising edge or high level of input level is valid；	0~65535 （RW/S）	0
0x004C	Function selection of output Y0	0. undefined 1. alarm signal； 2. brake signal； 3. drive status signal； 4. back home signal； 5. position signal； 6. PT mode；	0~8 （RW/S）	0
0x004D	Function selection of output Y1		0~8 （RW/S）	0
0x004E	Function selection of output Y2		0~8 （RW/S）	0
0x004F	Function selection of output Y3		0~8 （RW/S）	0
Multi-position para. group				

0x0090~ 0x009F	Total pulse high bit in PT （seg.1~ 16）	Total pulse number under position mode(includes total steps of acceleration, constant and deceleration). For example, set pulse be 100000, the high bit is 0x0001, low bit is 0x86A0.	0x00~ 0xFFFF （RW/S）	0
0x00A0~ 0x00AF	Total pulse low bit in PT （seg.1~ 16）		0x00~ 0xFFFF （RW/S）	0
0x00B0~ 0x00BF	Running speed in PT （seg.1~ 16）	running speed；	0-3000r/min （RW/S）	0 (0/min)
0x00C0~ 0x00CF	Acceleration/deceleration time in PT （seg.1~ 16）	acceleration/deceleration time；	30-2000ms （RW/S）	0 (0ms)
0x00E0~ 0x00EF	Max speed in PV （seg.1~ 16）	Running speed under PV multi-speed mode；	0-3000r/min （RW/S）	0 (0/min)
Performance para. group				
0x0110	Proportionality coefficient of current loop	Factory default, normally do not need to adjust it	0~65535 （RW/S）	-
0x0111	Integral coefficient of current loop	Factory default, normally do not need to adjust it	0~65535 （RW/S）	-
0x0112	Proportionality coefficient of high speed	Factory default, normally do not need to adjust it	0~65535 （RW/S）	-
0x0113	Integral coefficient of high speed	Factory default, normally do not need to adjust it	0~65535 （RW/S）	-
0x0114	Proportionality coefficient of braking	Factory default, normally do not need to adjust it	0~65535 （RW/S）	-
0x0115	Integral coefficient of braking	Factory default, normally do not need to adjust it	0~65535 （RW/S）	-
0x0116	X0/X1 input filtering time	Factory default, normally do not need to adjust it	0~65535 （RW/S）	10
0x0117	X2/X3 input filtering time	Factory default, normally do not need to adjust it	0~65535 （RW/S）	10
0x0118	X4/X5 input filtering time	Factory default, normally do not need to adjust it	0~65535 （RW/S）	10
0x0119	X6/X7 input filtering time	Factory default, normally do not need to adjust it	0~65535 （RW/S）	10

6.2 MODBUS common function codes

6.2.1 Read holding register command 03

- Host->slave data

01	03	00 23	00 01	75 C0
Device address	**Function code**	**Register address**	**Number of read register**	**CRC check**

The host sends command to slave to query the max speed register.

Slave->Host data：

01	03	02	00 3C	B8 55
Device address	**Function code**	**Number of returned bit**	**Register value**	**CRC check**

The max register value of slave's return is 60.

- Other examples of reading register commands as belo：
- Query start speed (0x0020), acceleration time (0x0021), deceleration time (0x0022), max speed (0x0023)
- Host->Slave data：01 03 00 20 00 04 45 C3
- Slave->host data：01 03 08 00 05 00 64 00 64 00 3C F0 D1 (Start speed 5r/min, acceleration time 100ms, deceleration time 100ms, max speed 60r/min)

Note: The max number of register queries can not exceed 16.

6.2.2 Write single register command 06

- Host->slave data

01	06	00 23	00 3C	78 11
Device address	**Function code**	**Register address**	**Write data**	**CRC check**

The max speed register write-in value from host to salve is 60, the slave will confirm the command once it received it.

Slave->host data：

➢ Other examples of writing single register command as below：

Set acceleration time register to be 500ms：

Host->slave data：01 06 00 21 01 F4 D9 D7

Slave->host data：01 06 00 21 01 F4 D9 D7

6.2.3 Write multi-register command 16

01	10	00 24	00 02	04	00 00	13 88	FD 12
Address	Function code	Start address	Number of register writed	Number of bit	Write content	Write content	CRC check

Examples of writing multi-register command as below：

Host writes two register to slave, and set them as pulse high bit register and pulse low bit register.

Host->slave data：01 10 00 24 00 02 04 00 00 13 88 FD 12

Slave->host data：01 10 00 24 00 02 01 C3

6.2.4 COM error code

➢ CRC check error

If an error occurs during the data transmission, the slave device calculates a CRC value of the frame of data. If it is not 85 C0, then the slave discards this frame data and does not return any data.

Host->slave data：01 03 00 20 00 01 85 C1

Slave->host data：01 83 01 80 F0

➢ Function code error

If the function code requested by host is not 03 or 06, the device returns an exception code 01. Refer to Table 3 for details of exception code 01.

Host->slave data：01 02 00 00 00 04 79 C9

Slave->host data：01 82 02 61 C1

➢ Illegal data address

If the host requests an invalid data address, the device returns an exception code 03.

Host->slave data：01 03 00 19 00 01 55 CD

Slave->host data：01 83 03 01 31

Register address 0x0019 is empty; the device returns an exception code 03.

➢ Read address out out of range

If the data inquired by host is out of read range one time, the device will response

error code 05. For more details of error code 05, pls read MOBUS error cods table.

Host->slave data： 01 03 00 20 00 20 45 D8

Slave->host data：01 83 05 81 33

Read 32 pcs of data in one time, it's out of range, and device will return error code 05.

➢ Read-write error

Read-write function can be devided into read only, write only and read-write. For other operation which not belongs to the three functions, device will return error code 06.

Host->slave data：01 03 00 27 00 01 34 01

Slave->host data：01 83 06 C1 32

Function code 0x27 belongs to write only function code, read operation to it will return error code 06.

➢ Write-in error

The content of write-in function code is out of the range.

Host->slave data：01 06 00 26 00 08 69 C7

Slave->host data：01 86 07 03 A2

If the write-in function code is out of range, it will return error code 07.

※ MODBUS error codes

Code	Name	Remark
01	CRC check error	CRC check error
02	command code error	Function codes the slave receives other than 03 and 06.
03	function code address error	Received data address which is not allowed by slave.
04	out of function code address	Received data address is out of function code range.
05	read function codes out of range	Max read 16 pc of function code one time.
06	Function code read-write error	Read-write function is devided into read only, write only and read-write. Other operations will return error 06.
07	function code write-in error	Function code write-in data which is out of range.

6.2.5 Application examples

➢ Applications under position mode：

For example, the motor is driven forward by the parameter (current 2.3A, lock current is the half of running current, microstep is 1000 pulses/ring, initial speed 10r/min, acceleration time 100ms, deceleration time 100ms, max speed 500r/min) to rotate one ring.

➢ Before starting this example, be sure to set the drive device address to 1, that is, DIP switches SW5-SW2 are set to OFF and SW1 is set to ON.

The following steps 1-3 must be set before step 4 (that is, set the parameters first, and then start to run), but there is no specific order for setting steps 1-3.

Step 1： Set current (RMS value 2.3A, locked half current)

Host—>slave：01 06 00 10 00 06 08 0D

Slave—>host：01 06 00 10 00 06 08 0D

Step 2： Set microstep (1000 pulse/ring)

Host—>slave：01 06 00 11 00 08 D8 09

Slave—>host：01 06 00 11 00 08 D8 09

Step 3： Set start speed, acceleration/deceleration time, max speed and pulse value.

Host—>slave：01 10 00 20 00 06 0C 00 0A 00 64 00 64 01 F4 00 00 03 E8 3D 69

Slave—>host：01 10 00 20 00 06 41 C1

Step 4: Start command under relative position mode

Host—>slave：01 06 00 27 00 01 F8 01

Slave—>host：01 06 00 27 00 01 F8 01

➢ Examples under speed mode：

For example, the motor accelerates backwards to 500r/min and runs at a constant speed according to the parameter (current 2.3A, locking current is half of the operating current, microstep 1000Pu/rev, initial speed 10r/min, acceleration time 100ms).

Before starting this example, be sure to set the drive device address to 1, that is, DIP switches SW5-SW2 are set to OFF and SW1 is set to ON.

Step 1： Set current(RMS value 2.3A, locked half current) and microstep.

Host—>slave：01 10 00 10 00 02 04 00 06 00 08 13 64

Slave—>host：01 10 00 10 00 02 40 0D

Step 2： Set start speed, acceleration/deceleration time and max speed

Host—>slave：01 10 00 20 00 04 08 00 0A 00 64 00 64 01 F4 AD C5

Slave—>host：01 10 00 20 00 04 C0 00

Step 3： Start command under speed mode

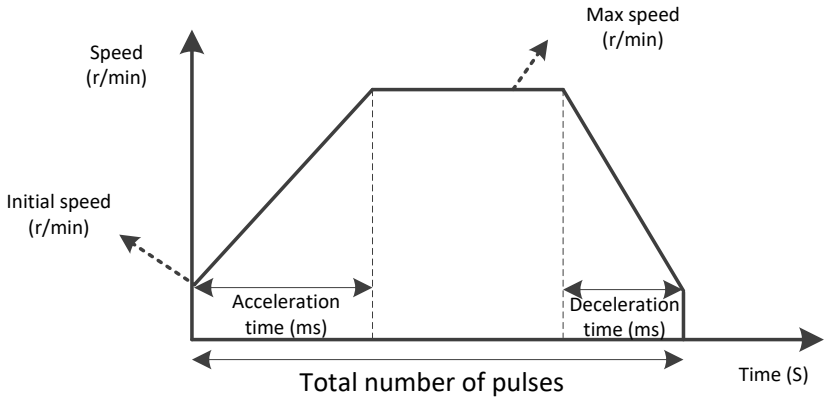
Host—>slave：01 06 00 27 00 02 B8 00

Slave—>host：01 06 00 27 00 02 B8 00

7 Motion control function

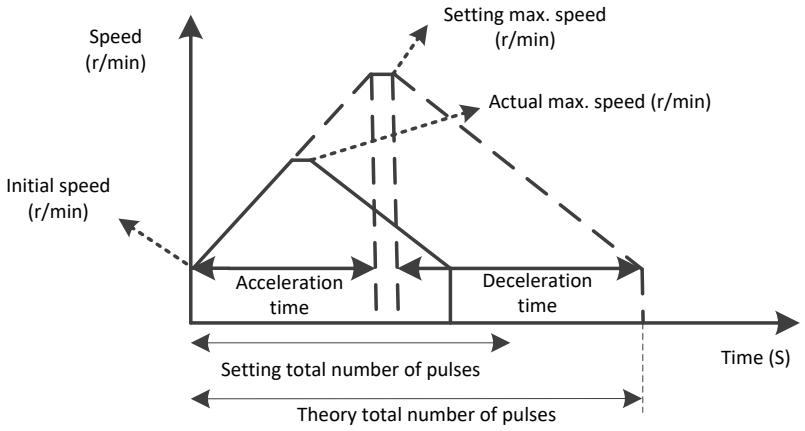
7.1 Position mode

The position mode is realized by trapezoidal acceleration and deceleration curve. Users can set the initial speed (address 0x0020), maximum speed (address 0x0023), acceleration time (address 0x0021), deceleration time (address 0x0022), the total number of pulses (address 0x0024, 0x0025) to achieve precise position control. By controlling the positive and negative of the total number of pulses to change motor rotation direction. Usually when the total number of pulses is positive, the motor is defined as forward. When the total number of pulses is negative, the motor is defined as backward. Trapezoidal acceleration and deceleration curve as shown below.



Acceleration/deceleration curve under postion mode

When users set a small number of total impulse, motor deceleration may be required before accelerate to maximum speed (that is, in the actual operation of the motor, the motor does not accelerate to user-defined maximum speed). Velocity curve is shown as follow. In the figure, solid lines shown the actual run curves, dotted lines shown the curves needed for speed up to the set maximum speed. Theoretical total number of minimum pulses is calculated in accordance with user-defined parameters (start speed, maximum speed, acceleration time, deceleration time). When a user sets the total number of pulses is less than total number of theory pulse, motor will run in according with the solid line in the following figure.

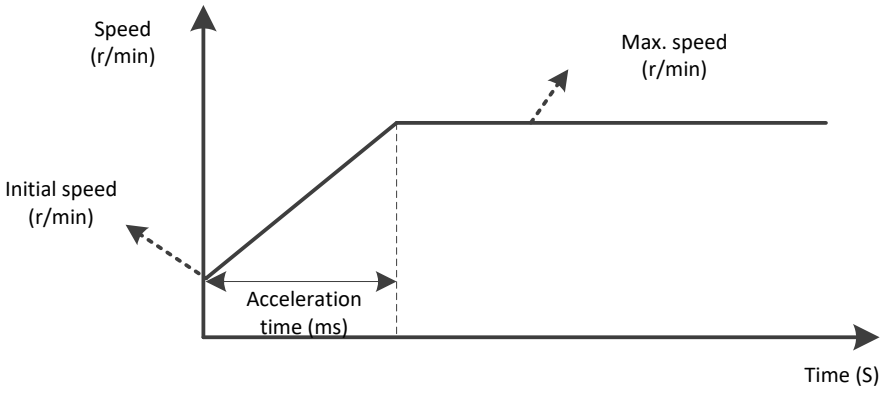


Acceleration/deceleration curve under postion mode（not up the max speed）

In addition, use the 0027 start command register to control whether to select relative position or absolute position under position mode. For more details, please see the description in chatper 7.6.1 Start command.

7.2 Speed mode

The acceleration curve of Speed mode is shown as follow. Different with position mode, in speed mode, you only need to set the start speed (Address 0x0020), acceleration time (Address 0x0021) and maximum speed (Address 0x0023) parameters. Motor will accelerate to maximum speed according to three parameters, then run at a constant speed when it reaches maximum speed. Among them, the positive and negative of maximum speed registers determined motor direction. Usually maximum speed registers is positive, the motor is defined as forward rotate; maximum speed register is negative, the motor is defined as backward rotate.

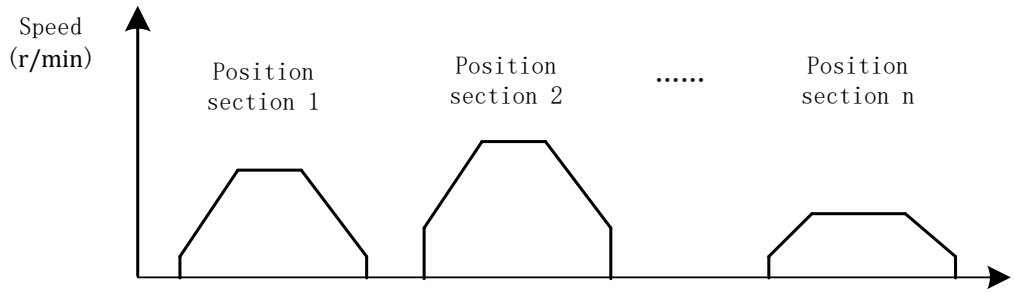


Acceleration curve under speed mode

7.3 Multi-position mode

Multi-position mode function is to combine multiple position segment in a certain order, trigger movement through external signal; it's a way of work through a series of actions. The function also can be treat as a combination of position mode movements in

chapter 7.1. The difference is that user can save several position parameters (such as deceleration time, total pulse number) in EEPROM in advance, users only need to set a trigger to complete the motion process. Its work process description is shown as below:



Multi-position work mode

7.3.1 Position para. introduction

User can save parameters which describe the same speed segement in EEPROM, it mostly supports 16 speed segments at present.

※Parameter group to describe one position segment

Parameter name	Function
total pulse high bit (0x0090~0x009F)	pulse number high bit
total pulse low bit (0x00A0~0x00AF)	pulse number low bit
running speed (0x00B0~0x00BF)	running speed in position segment
Acceleration/deceleration time (0x00C0~0x00CF)	acceleration/deceleration time in position segment

7.3.2 Multi-position control mode

Start command and segment selection for multi-position functions can be set via external IO. When using external IO as start command and segment selection, the input port function needs to be set. The external port start function needs to configure the port function as "PT enable signal", and the external terminal segment selection function needs to configure the port function as " PIN0 ~ 4 ", the input port can be any choice from X0 ~ X7:

※I/O setting under multi-position mode

Input ports	Function
X0~X7	PT enable signal
X0~X7	PIN0~PIN4

Select position section according to the binary number composed by PIN0 ~ PIN4, the corresponding relation as the following table:

※Input ports choose position segment

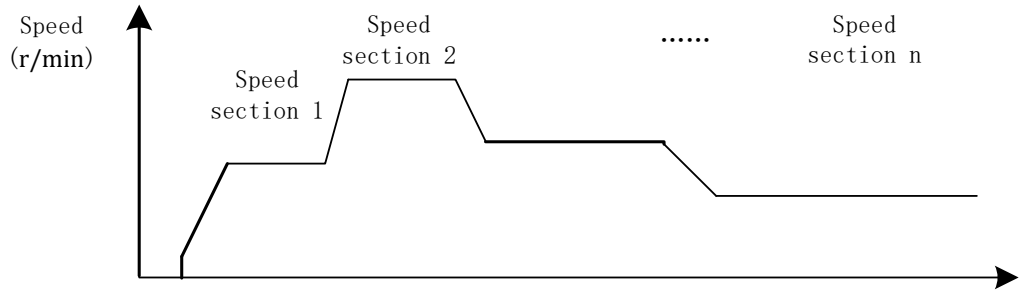
PIN4	PIN3	PIN2	PIN1	PIN0	Position segment
0	0	0	0	0	Not choose
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16

Note：

- When using the PIN to choose position section, the PIN signal should be valid for 5ms before and after "PT (Multi-position) enable signal".
- In multi-position mode, the relative/absolute position register 0x0026 controls whether the position section is relative position or absolute position. The default is relative position.

7.4 Multi-speed mode

Multi-speed mode function is pre-save multiple speed segments, trigger movement by external IO signal, to complete a series of different speed movements. In multi-speed mode, each acceleration / deceleration time is the same as the acceleration/deceleration time parameter (0x00C0 ~ 0x00CF) of multi-position. The value of different segment speeds is set by PV speed segment max speed parameter group (0x00E0~0x00EF). After the parameter modification is completed, it will be automatically saved into EEPOM.



Multi-speed work mode

7.4.1 Speed parameter

User can save parameters which describe the same speed segement in EEPROM, it mostly supports 16 speed segments at present.

※Parameter group to describe one position segement

Parameter name	Function
Acceleration/deceleration time (0x00C0~0x00CF)	acceleration/deceleration time of the switch of different speeds
Max speed of PV mode (0x00E0~0x00EF)	running speed in different speed segment

7.4.2 Multi-speed control mode

The start command, direction and segment selection of multi-speed function are completed by external IO trigger. Before using the external IO, you need to set the input port function. The external ports start function needs to configure the port function as "PV enable signal", and the external port segment select function needs to configure the terminal function as "PIN0 ~ 4", those ports can be any choice of X0 ~ X7：

※Multi-speed mode I/O setting

Input ports	Function
X0~X7	PV enable signal
X0~X7	PV direction signal
X0~X7	PIN0~PIN4

External ports segment selection: select the speed segment according to the binary number composed by PIN0 ~ PIN4. The corresponding relationship is as follows：

※Input ports choose speed segment

PIN4	PIN3	PIN2	PIN1	PIN0	Speed seg.
0	0	0	0	0	Not choose
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3

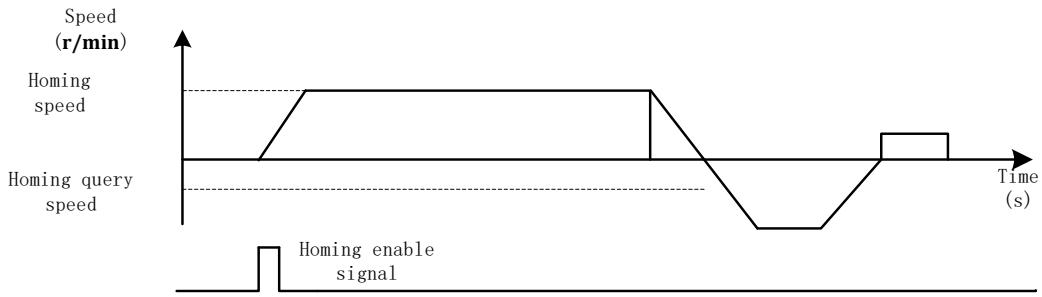
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16

7.5 Back home function

YKD2608PR supports two kinds of homing modes at present, and it needs to use the limit signal or the origin signal in the back home process. When using back home function, users need to choose input port as limit signal or origin signal according to the homing mode selection. At the same time, back home function can be triggered by external I/O or by MODBUS command. When using external I/O trigger, please enable any input port function as "Homing Enable".

- **Limit+home mode**

The driver starts the motion with "Homing speed (0x0032)" and "back home acceleration/deceleration time (0x0034)" after receiving the "Homing Enable (0x0030)" command. When it encounters the rising edge of the back home signal, it will decelerate to stop according to the speed of "back home acceleration/deceleration time (0x0034)", and reverse after stopping. Then the drive stops again when encountering the falling edge of the origin signal. After that, the drive will seek for home at the speed of "back home query speed (0x0033)" . When receiving the rising edge of the origin signal, the drive stops the movement and finishes the process of homing. If the "back home compensation value (0x0035, 0x0036)" in the function code is not zero, the drive will rotate the motor according to the compensation value. In the process of returning to the origin, if the limit signal is encountered, the motor will reverse according to the upper and lower limit signals. If there is no limit requirement, the limit signal can not be connected



Limit+back home workflow

- **Limit mode**

  The drive starts the motion with "back home speed (0x0032)" and "back home acceleration/deceleration time (0x0034)" after receiving the "Homing Enable (0x0030)" command. When it encounters the rising edge of the position limit signal, it will decelerate to stop according to the speed of "back home acceleration/ deceleration time (0x0034)", and reverse after stopping. Then the drive stops again when encountering the falling edge of the position limit signal. After that, the drive will seek for home at the speed of "Homing query speed (0x0033)" slowly. When receiving the rising edge of the position limit signal, the drive stops the movement and finishes the process of homing. If the "back home compensation value (0x0035, 0x0036)" in the function code is not zero, the drive will rotate the motor according to the compensation value.

7.6 Motion control command

7.6.1 Start command（0x0027）

Refer to **6.1 MODBUS Register Address DefinitionTable for** description of register 0x0027：

Bit0~1: 1：position mode; 2：speed mode；

Bit2: 0：relative position; 1：absolute position；This bit is valid in position mode. Bit3~Bit15：reserved

This register is used to trigger position/speed movement and control movement direction, details as below：

Relative position movement：01 06 00 27 00 01 F8 01

absolute position movement：01 06 00 27 00 05 F9 C2

speed movement：01 06 00 27 00 02 B8 00

7.6.2 Stop command（0x0028）

Refer to **6.1 MODBUS Register Address DefinitionTable for** description of register 0x0028：

Bit0: 0：normal stop；1：emergency stop；

This register stops the moving motor, stop modes is divided into normal stop and emergency stop.

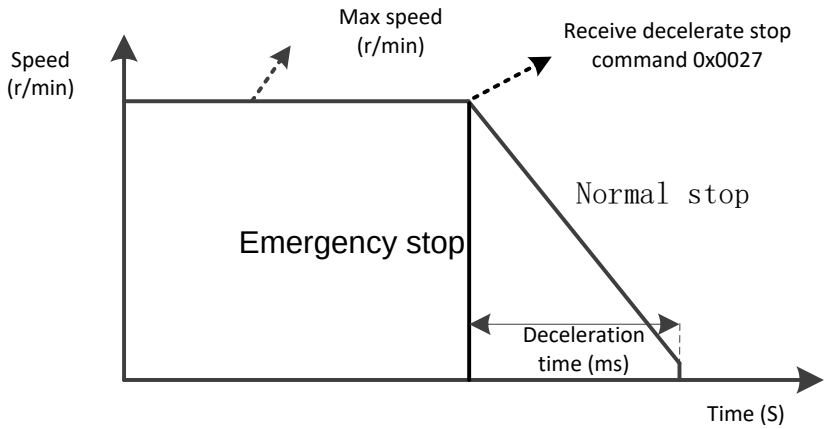
Normal stop： 01 06 00 28 00 00 09 C2

Emergency stop： 01 06 00 28 00 01 C8 02

While the motor is operating in position mode and speed mode, the motor will decelerate and stop according to the set deceleration time (address 0x0022) after it receives the normal stop command (00 28 00 00). After the drive receives emergency stop command (00 28 00 01), it will stop directly without deceleration.

Note：

- The deceleration time parameter needs to be set before the motor starting. If the drive receives the command after the motor starting, the previous deceleration time parameter will be executed.



Normal stop and emergency stop

7.6.3 Back home command（0x0030）

Refer to chapter 6.1 MODBUS Register Address Definition Table for the description of register 0x0030:

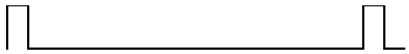
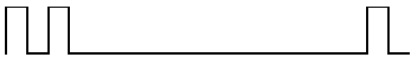
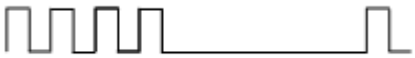
0：invalid；1：valid；

This register is used to trigger back home function.

Back home command：01 06 00 30 00 01 48 05

8 Alarm diagnosis

YKD2608PR has 5 kinds of alarm information, the alarm flashing times according to the alarm code, details as below:

Alarm code	Alarm information	Indicator	Reset
Err1：0x01	over-current or short circuit		lock motor/power down to reset
Err2：0x02	over-voltage		Lock motor/automatic recover
Err3：0x03	under-voltage		Lock motor/automatic recover
Err4：0x04	EEPROM(read-write error)		can be reset
Err5：0x05	Out of tolerance		power down to reset

9 Version histories

Version	Description	Time	Remark
V1.0	First version	2015/11/12	
V1.1	Revise register table	2016/02/15	
V1.2	Revise typo	2016/08/23	
V1.3	Add motor size, specification and parameters	2017/07/07	

10 Warranty and after-sales service

10.1 Warranty

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.

10.2 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, ShenzhenCity, P.R. China.

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

Tel：(86) 755-26037414

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