

### Bholanath Modbus stepper motor driver BHSS-1500-MBUS User Manual



**Note:-** Modbus Drive Step Servo & motor are matched pair with **BH-75VAC** power supply

#### Office Address

### **Bholanath Precision Engineering Pvt.Ltd.**

11,Kembros Industrial Estate,Near Asian Paint Company,  
Sonapur Lane,Bhandup (West),Mumbai - 400078,India.

#### Contact Us

#### FACTORY ADDRESS

Plot No - 1, Gut No - 203 , Dahagaon , Vasind (West) , Wada Link Road ,  
Off Mumbai Nashik Road ,  
Opposite Jindal Steel Factory ,  
Taluka - Shahpur , District - Thane - 421 302 ,  
Maharashtra State , India.

#### Phone No : -

+91 - 9821671733  
+91 - 9920903825  
+91 - 9930514603  
+91 - 9323166582

91 - 22 - 25664338 /25662856 / 67993260

Email : support@bholanath.in

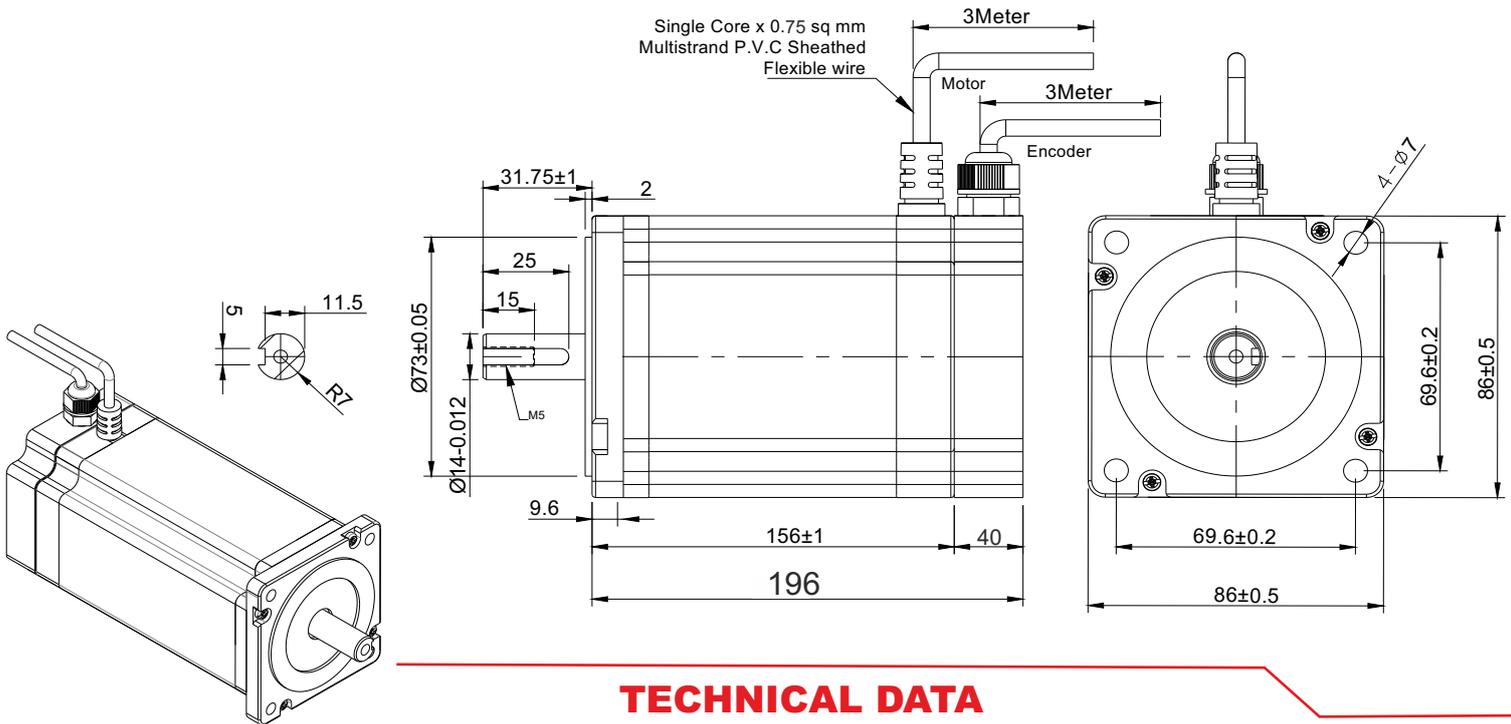
# Content

<b>BHSS-1500W-MBUS Step Servo</b> .....	3
1 Product overview .....	4
1.1 Product overview.....	4
1.2 Product features.....	4
2 Installation size and interface definitions .....	5
2.1 Installation dimensions.....	5
2.2 Parts name .....	6
2.2.1 Drive interface spec.....	7
2.2.2 Introduction to Indicator.....	8
2.3 Switch.....	8
2.3.1 Drive address sets.....	8
2.3.2 Communication baud rate setting .....	9
2.3.3 Termination resistors setting .....	10
2.4 Communications interface.....	10
2.5 I/O terminal definitions .....	11
3 Communication .....	13
3.1 Basic parameters of communications .....	13
3.2 MODBUS Register address defined.....	13
3.3 MODBUS Function code .....	23
3.3.1 Read holding registers command 03 .....	23
3.3.2 Write single register commands 06 .....	24
3.3.3 Write multiple registers command 16 .....	24
3.3.4 Communication error code .....	25
3.3.5 Application example.....	27
4 Motion control functions introduction.....	28
4.1 Position mode .....	28
4.2 Speed mode .....	30
4.3 Multi-position mode .....	30
4.3.1 Position section parameters .....	31
4.3.2 Basic mode .....	32
4.3.3 Trigger mode .....	34
4.4 Back to the origin function.....	48
4.5 Motion control commands.....	40
4.5.1 The start command (0x0027) .....	40
4.5.2 Stop command (0x0028) .....	40
4.5.3 Back to origin command (0x0030) .....	41
4.5.4 Multi position command (0x0070) .....	41
5 Input/output terminal operation.....	42
6 Alarm clear .....	44



**Closed Loop Stepping System which includes High Speed (>1500 RPM) Stepper Motors with Incremental Optical Encoders, Digital Drives and 3 Meter Cable.**

**SUITABILITY** - The BHSS - 1500 W-MBUS Step Servo is comparable to 1500 Watts Servo Motor upto 500RPM. The Step - Servo Motor BHSS - 1500 W-MBUS gives more torque at lower RPM's thus giving a better performance than 1500 Watts Servo Motors as seen in the graph.

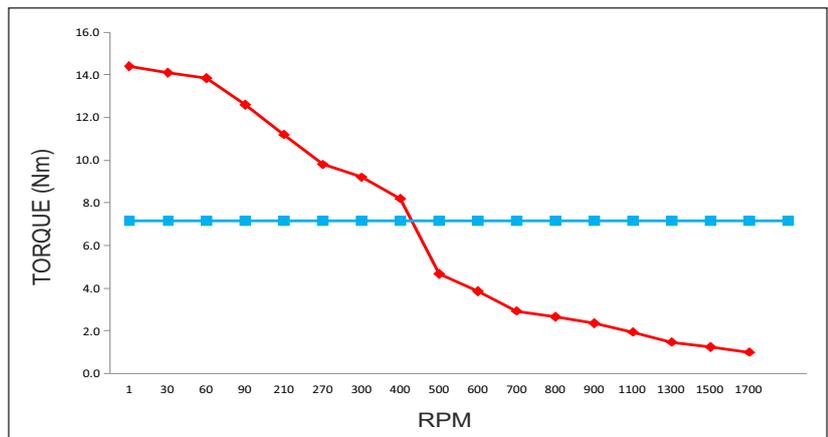


## TECHNICAL DATA

- BHOANATH STEP SERVO MOTOR BHSS - 1500 W-MBUS
- SERVO MOTOR 1500 WATTS

## Characteristics

Power Input - BH-75VAC
Encoder Options - 1000 PPR/2500 PPR
Cable Length - 3 / 5 Meters
Motor - Bipolar Hybrid Stepper Motor
Step Angle - 1.8 Degree
Degree Of Protection - DIN 40050 IP 60 / IP 65
Insulation Class - H
Weight - 6.45 Kg
Current Per Phase - 6.2 A
Torque - 14 Nm - 7.16 Nm
RPM - 0 - 1500
Stock Temperature - ( - 10° C to + 70° C )
Operation Temperature - ( - 10° C to + 40° C )
Shaft Axial Play - 0.08 Max.Play (450 G Load)
Shaft Radial Play - 0.02 Max.Play (450 G Load)
Max. Radial Force - 220 N (20 MM from Front Flange)
Ma. Axial Force - 60 N (20 MM from Front Flange)



### Motor Options Available -

- Standard Model - **S**
- With Low Backlash Planetary Gearbox - **PL**
- With Electro Magnetic Brake - **BRK**
- With Helical Gearbox - **HL**
- CE Certificate - **N** - STANDARD/CE - CERTIFIED
- ORDERING CODE** - BHSS- 1500 W-MBUS - S - 1000 - 3MTR.- IP 60-N

# 1 Product overview

## 1.1 Product overview

MODBUS Bus type stepping motor driver is based on digital closed loop stepping drive, but added bus and single-axis controller functions. Bus communication using RS 485 interfaces, protocol support standard MODBUS RTU Protocol.

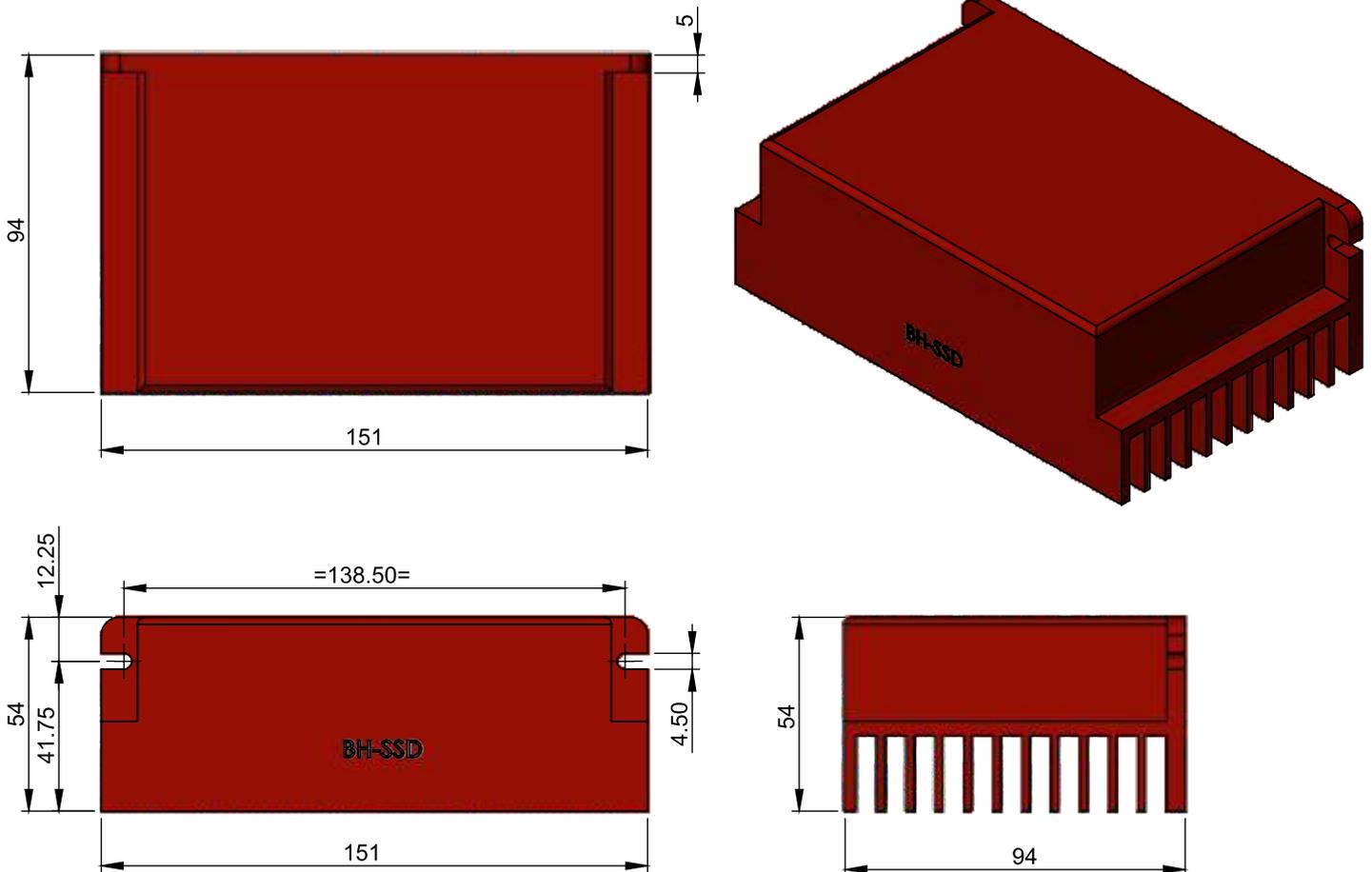
## 1.2 Product features

- A new generation of 32 DSP Technology, high performance-price ratio, more smooth, less noise and Vibration.
- RS-485 -Isolated bus, supports standard MODBUS-RTU protocol, maximum mount 30 devices.
- Bus drivers can realize remote control and effectively solve loss of pulses in the bad environment problem.
- Users can set current, micro steps and lock current by bus; Control motor start-stop, monitor the motor running in real-time.
- Built-in single axis controller functionality: users can sets the starting speed, Acceleration time, Deceleration time , Maximum speed, total number of pulse and other parameters through bus, such as the trapezoidal acceleration/ deceleration control function. Also have original point, features such as multi-position mode.
- Supports position control, speed control and multi-position mode
- Two photoelectric isolation programmable high-speed differential input channel interface can control motor start and stop by external signals.
- 5 programmable input channel photoelectric isolation interface to receive external control signal, realize the drive-enabled, the start-stop, emergency stop, position limit and other functions.

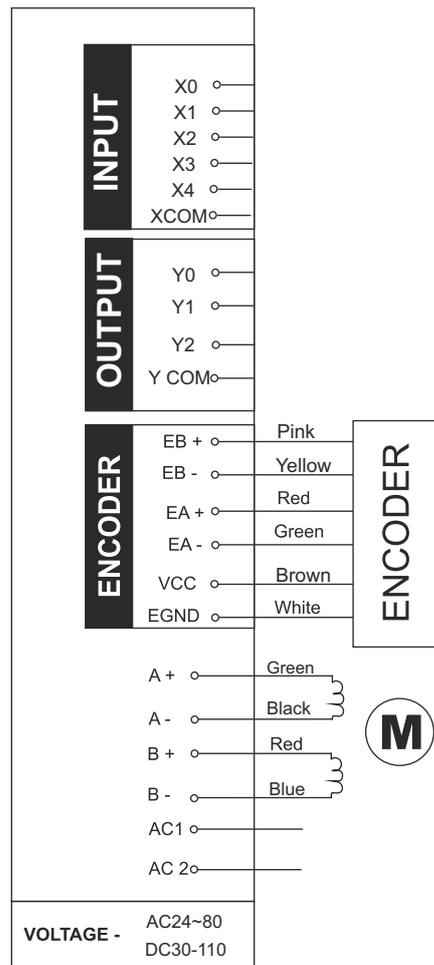
- 3 channel optic-isolated output programmable interface, output drive status and control signals.
- Equipped with 16 Constant angle and constant torque micro step, maximum 40000 micro steps.
- Smooth, accurate current control, heat less
- When step pulse stops over 200ms, drive automatically halve the motor current
- Excellent stability in small micro steps
- Voltage range: AC24-80V & DC 30-110V
- Over voltage, undervoltage, over current protection functions

## 2 Installation size and interface definitions

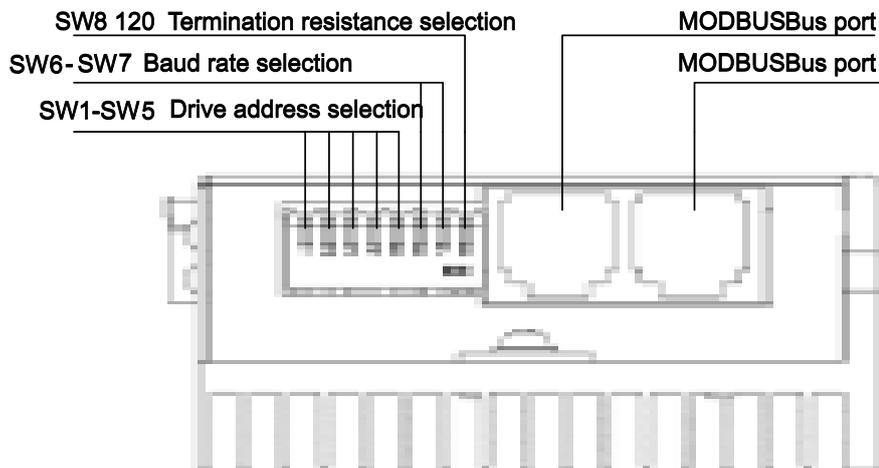
### 2.1 Installation dimensions



# Connection Diagram



## 2.2 Parts name



## 2.2.1 Drive interface spec

Table 1 Drive interface

Interface		MBUS Drive	Function
switch	SW1-8		SW1-5 : Drive address sets
			SW6-7 : Baud rate setting
			SW8 : 120 Termination effective
MODBUS Communications interface	RJ45-2		RS-485 Communication input/output port
PWR	Power indicator		light on after power
ALM	Alarm led		Overcurrent, cycle LED flashing for one time Overvoltage, cycle LED flashing for two times Under-voltage, cycle LED flashing for three times EEPROM Read and write errors, cycle LED flashing for four times Overtime of tracking error variance, cycle LED flashing for five times
IO □	PU+	Differential input	High-speed digital signal input interface
	PU-		
	DR+		
	DR-		
	X0	Single input	The low-speed digital signal input interface
	X1		
	X2		
	X3		
	X4		
	XCOM	Single input common Terminal	Compatible with common cathode and anode
	Y0	Single output	Low-speed digital signal output interface
	Y1		
Y2			
	YCOM	Single output common Terminal	Compatible with common cathode and anode
Power supply and motor interface	A+	Motor Terminal	Two phase stepper motor wiring
	A-		
	B+		
	B-		
	V+		
	V-		Power supply DC24-50V input

Note: for the actual drive interface, please see instructions on the drive;

## 2.22 Introduction to Indicator

Table 2 Indicator definitions

Name	MBUS Drive	Function
LED1 Green	ALM/PWR	Power Indicator
LED2 red		Alarm Indicator

## 2.3 Switch

### 2.3 1 Drive address sets

With adoption of RS-485 Bus, you can simultaneously control up to 30 MODBUS Drives. Drive address is set using 5-bit switch address setting in the range of 0-31, which addresses 0 reserved for system. When the drive address is set more than 31, Host debugging software is required to set and save. In this case, the switch required to be set to all OFF. For relevant details of the function code, please refer to section 3.2 description.

#### **Note:-**

- 1) One controller RS 485 Bus can control simultaneously 30 MODBUS Drives.**
- 2) Addresses of each drive settings must be unique, otherwise it will cause a communication error.**

Table 3 Drive address sets

SW5	SW 4	SW 3	SW 2	SW 1	Address
OFF	OFF	OFF	OFF	OFF	Definition by software
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

## 2.3.2 Communication baud rate setting

Communication baud rate setting

SW 7	SW 6	Baudrate
ON	ON	9600 (Note)
ON	OFF	19200
OFF	ON	38400
OFF	OFF	115200

Note: when the communication baud rate in the table can't meet the requirements, we can customize the baud rate by host PC, in this case, SW6 , SW7 All turns to ON , the default baud rate is 9600 ;

### 2.3.3 Termination resistors setting

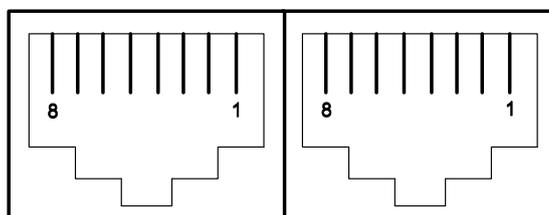
User can select the effectiveness of 120 termination resistors by this bit, determined according to the application.

Table 5 120 Terminal resistance select

SW8	120 Terminal resistance select
OFF	Invalid
ON	Effective

### 2.4 Communications interface

MODBUS Drive provides a side-by-side two RS-485 Communication interface with standard RJ45 Socket. RJ45 Socket figure 4 shows 8 pins, pin 1 and 2 are for RS-485 Half-duplex communications, pin 5 to RS-485 common ground side, the other PIN is not used.



4 RJ45 Interface

Table 6 RJ45 Distribution of pin functions

PIN	Definition
1	RS-485-A
2	RS-485-B
3	NC
4	NC
5	GND
6	NC
7	NC
8	NC

## 2.5 I/O terminal definitions

Table 7 I/O terminal function definition

CN Terminal pins	Signal name	Description	Function
1	PU+	PU+ Differential input	① (P/D mode) Pulse signal (only for high-speed differential PU); ② (P/D mode) Direction signal (only for high-speed differential DR); ③ The origin signals ; ④ Forward limit signal ; ⑤ Backward limit signal ; ⑥ Motor enable signal ; ⑦ Motor release signal ; ⑧ Alarm clear signal ; ⑨ Function code restore factory setting signals ; ⑩ Stop signal ; ⑪ Emergency stop signal ; ⑫ Position mode and motion ; ⑬ Speed mode and motion ; ⑭ JOG+ Point movement ; ⑮ JOG- Point movement ; ⑯ Enable signal for back to the origin ; ⑰ PT Enable signal ; ⑱ PIN0~4 ;
2	PU-	PU- Differential input	
3	DR+	DR+ Differential input	
4	DR-	DR- Differential input	
5	X0	X0 terminal input	
6	X1	X1 terminal input	
7	X2	X2 terminal input	
8	X3	X3 terminal input	
9	X4	X4 terminal input	
10	XCOM	Input common Terminal	
11	YCOM	Output common Terminal	
12	Y0	Y 0 terminal output	① Alarm signal ; ② Motor running status signals ; ③ Back to the origin position OK signals ; ④ Position OK signal ; ⑤ PT Mode signals ; ⑥ POUT0~2 ;
13	Y1	Y 1 terminal output	
14	Y2	Y 2 terminal output	
15	Y1	Y1 terminal output	
16	Y2	Y2 terminal output	

**Note:-** the drive can be controlled by MODBUS Instruction and external pulse direction control. In the mode of external pulse control, the input signal: 6. motor enable signal; 7. Motor release signals; 8. the alarm clears signal;9. Function code restore factory signal, other input signals are invalid. Signal output terminals:1. Alarm signal; 4. motor running status signals;5. Position arrived Signal, other output signal are invalid;

Table 8 I/O terminal description

Description	Function
① Pulse signal (only for high-speed differential)	External pulses, valid when external pulse direction( P/D ) control mode or double-pulse control mode
② Direction (only for high-speed differential)	Valid in external direction signal, external pulse direction( P/D ) control mode or double-pulse control mode
③ Original signal	Connect with origin sensor
④ Forward limit signals	Connect with position limit sensor
⑤ Backward limit signals	Connect with position limit sensor
⑥ Motor enable signal	Enable signal, the motor enters the locked state;
⑦ Motor release signal	Release signal, the motor is released
⑧ Alarm clear signals	EEPROM Read/write error and communication error recovery; Over-voltage and under-voltage automatic recovery;
⑨ Function code restore factory setting signal	Function code restore factory settings;
⑩ Stop signal	Motor reduce speed and stops;
⑪ Emergency stop signal	Motor stops directly without deceleration;
⑫ Position mode and motion ;	Set the motion according to the function code 0x20~0x25;
⑬ Speed mode and motion	Set the motion according to the function code 0x20~0x23;
⑭ JOG+ Point movement	Set the forward motion according to the function code 0x20~0x23;
⑮ JOG- Point movement ;	Set the backward motion according to the function code 0x20~0x23;
⑯ Enable signal for back to the origin ;	Trigger for back to origin function
⑰ PT Enable signal ;	Trigger for multi-position mode
⑱ PIN0~4 ;	Multi-position mode input terminals, see 4.3 Sections for specific
Input common Terminal	Common terminal: compatible with common cathode anode connection mode
Output common Terminal	
① Alarm signal	When the drive is in alarm, the signal is valid
② Back to the origin position OK signals	After the completion of back to the origin, the signal is valid
③ Motor running status signals	When the motor is running, the signal is valid
④ Position OK signal	When position is ready signal in position mode, the signal is valid
⑤ PT Mode running signals ;	Drive is work in PT Mode
⑥ POUT0-2	Multi-position mode output terminals, see 4.3 Sections for specific

# 3 Communication

## 3.1 Basic parameters of communications

Table 9 Basic parameters of communications

Basic parameters of communications	Description
Hardware interface	RS-485
Communication type	Asynchronous half-duplex
Baud rate	Adjustable (see 2.3.2 )
Communication protocol	MODBUS-RTU
Check bit	NO (Default)
Stop bit	1 (Default)
Data bits	8
Number of devices	30

## 3.2 MODBUS Register address defined

Table 10 Register address definition table

Register address	Item	Introductions	Setting range Note: other values are invalid	The default value
<b>Status parameter group (read-only)</b>				
0x0000	The drive model number	Returns the high byte 0x03 Low byte 0x05	(Read-only)	0x0305
0x0001	Driver version	Driver version	(Read-only)	0x0101
0x0002	Drive node number	MODBUS Current slave communications node number	(Read-only)	-
0x0003	Drive mode	0 : Position / Speed mode ; 1 : Back to the original point mode ; 2 : PT mode ;	(Read-only)	-
0x0004	Motor State	0 : Static ; 1 : Turning ;	(Read-only)	-
0x0005	Motor direction	0 : Counterclockwise (positive direction); 1 : Clockwise (opposite direction);	(Read-only)	-
0x0006	The current error code	0 : Normal ; 1~5 : Error ;	(Read-only)	-
0x0007	Motion status bits	Bit0 : Position reached ; Bit1 : Back to the original point of completion ; Bit2 : Motor turning state ; Bit3 : Alarm status ; Bit4 : Motor released ; Bit5 : The current position and the positions given the same status ; Bit6~Bit15 : Reserved ;	(Read-only)	-

0x0008	Terminal input status symbol	Bit0 : PU Terminal input status ; Bit1 : DR Terminal input status ; Bit2 : X0 Terminal input status ; Bit3 : X1 Terminal input status ; Bit4 : X2 Terminal input status ; Bit5 : X3 Terminal input status ; Bit6 : X4 Terminal input status ; Bit7~Bit15 : Reserved ;  0 : Invalid input level ; 1 : Valid input level ;	(Read-only)	-
0x0009	Terminal output status symbol	Bit0 : Y0 Terminal output status ; Bit1 : Y1 Terminal output status ; Bit2 : Y2 Terminal output status ; Bit4~Bit15 : Reserved ;  0 : Invalid output level ; 1 : Valid output level ;	(Read-only)	-
0x000A	Current position high	Current position of absolute position (See 0x0026 function code)	(Read-only)	-
0x000B	Current position low	Current position of absolute position (See 0x0026 function code)	(Read-only)	-

### Drive control parameters group 1

0x0010	Pulse direction signal level switch	0 : Pulse Sign ; 1 : Pulse /Sign ; 2 : /Pulse Sign ; 3 : /Pulse /Sign ;	0~3 (Read and write)	0
0x0011	Microstep setting	Address—microstep 0—400 (Pu/rev); 1—800 (Pu/rev); 2—1600 (Pu/rev); 3—3200 (Pu/rev); 4—6400 (Pu/rev); 5—12800 (Pu/rev); 6—25600 (Pu/rev); 7—51200 (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);	0~15 (Read and write)	8 (1000Pu/rev)

0x0012	Customize open-closed-loop operation mode	0 : Closed-loop ; 1 : Open-loop ;	0~1 (Read and write)	0
0x0013	Custom drive node number	0~31 : Undefined 32~127 use it when node numbers greater than 31 ;	0~127 (Read and write)	0
0x0014	Customize communication baud rate	0 : 9600 1 : 14400 2 : 128000 3 : 256000 Note: the modifications need power on again to be active	0~3 (Read and write)	0
0x0015	Serial data format	0 : 8 bits data, no parity, 1 stop bit ; 1 : 8 bits data, no parity, 2 stop bit ; 2 : 8 bits data, even parity, 1 stop bit ; 3 : 8 bits data, odd parity, 1 stop bit ; Note: the modifications need power on again to be active	0~3 (Read and write)	0
0x0016	Communicate write functional code value update to EEPROM	0 : update to EEPROM ; 1 : no update ;	0~1 (Read and write)	0
0x0017	Stop way when position off the limit	0 : stop freely ; 1 : stop emergently ; 2 : Invalid ;	0~1 (Read and write)	0
0x0018	Bus control / Pulse direction ( P/D ) Controlled mode select	0 : Bus control ; 1 : External pulse / Direction ( P/D ) Control ; 2 : Double-pulse control mode ; Note: Switch to the external pulse control need a re-power.	0~1 (Read and write)	0

**Drive control parameters group 2**

0x0020	Starting speed	Starting speed	2-300r/min (Read and write)	5 (5r/min)
0x0021	Acceleration time	Acceleration time	0-2000ms (Read and write)	100 (100ms)
0x0022	Deceleration time	Deceleration time	0-2000ms (Read and write)	100 (100ms)
0x0023	Maximum speed	Low microstep settings, maximum speed up to 3000r/min; High microstep setting, the maximum output frequency is 200KHz	-3000~3000 r/min (Read and write)	60 (60r/min)
0x0024	High bits of total number of pulses	Total number of pulses in position mode (including acceleration, constant speed and deceleration)	-32767~32768 (Read and write)	0
0x0025	Low bits of total number of pulses	Such as setting 100000 Pulse, high bits 0x0001 , Low bits 0x86A0	-32767~32768 (Read and write)	5000
0x0026	Relative positions / Absolute position	When you choose to use an external IO Trigger position / Multi location mode, the parameter effective: 0 : Relative position: starting with the current point ; 1 : Absolute positioning: use the motor starter position, or original point as a starting point;	0~1 (Read and write)	0
0x0027	Startup command	Bit0-1: 1 : Position mode ; 2 : Speed mode ; Bit2: 0 : Relative position ; 1 : Absolute position ; only valid when in position mode ; Bit3~Bit15 : Reserved	0~6 (Read and write)	-
0x0028	Stop command	Bit0: 0 : Normal stop ; 1 : urgent stop ;	0~1 (Read and write)	-
0x0029	Motor enable / release signals	0 : release ; 1 : enable ;	0~1 (Read and write)	-
0x002A	Clear alarm	0 : Invalid ; 1 : Clear alarm ;	0~1 (Read and write)	-
0x002B	Parameter restore to factory settings	0 : Invalid ; 1 : restore to factory settings ;	0~1 (Read and write)	-
0x002C	Clear the current position	Clear the current position in absolute mode : 0 : Invalid ; 1 : Clear the current position ;	0~1 (Read and write)	-

### Back to origin function parameter group

0x0030	Back to origin enable	0 : Invalid ; 1 : Valid ;	0~1 (Read and write)	-
0x0031	Back to the origin mode	0 : forward position limit + origin mode ; 1 : backward position limit + origin mode ; 2 : forward position limit mode ; 3 : forward position limit mode ;	0~3 (Read and write)	0
0x0032	Back to the origin speed	Running speed when querying the origin position;	5-3000r/min (Read and write)	120 (60r/min)
0x0033	Back to the original query speed	Speed to return the origin after query;	5-300 r/min (Read and write)	60 (60r/min)
0x0034	Back to the original point acceleration/deceleration time	Acceleration and deceleration time when querying the origin point;	30-2000ms (Read and write)	100 (100ms)
0x0035	The origin positive compensation value	Counterclockwise direction compensation ;	0~65535 (Read and write)	0
0x0036	The origin negative compensation value	Clockwise direction compensation ;	0~65535 (Read and write)	0

### Input/output terminals parameter group

0x0040	Input terminal active level	Bit0 : PU Terminal control bit ; Bit1 : DR Terminal control bit ; Bit2 : Input terminal X0 control bit ; Bit3 : Input terminal X1 control bit ; Bit4 : Input terminal X2 control bit ; Bit5 : Input terminal X3 control bit ; Bit6 : Input terminal X4 control bit ;  Bit7~Bit15 : reserved ;  0 : The default ; 1 : reverse active level ; Default input terminal effective level is rising or high level;	0~65535 (Read and write)	0
--------	-----------------------------	---	-----------------------------	---

0x0041	Input terminal PU function choose	0 : Undefined ; 1 : Origin signals ; 2 : Forward limit signal ;	0~20 (Read and write)	0
0x0042	Input terminal DR function choose	3 : Backward limit signal ; 4 : Motor enable signal ; 5 : Motor release signals ;	0~20 (Read and write)	0
0x0043	Input terminal X0 function choose	6 : Alarm clear signal ; 7 : Function code restore factory signals ; 8 : Stop signal ;	0~20 (Read and write)	0
0x0044	Input terminal X1 function choose	9 : Emergency stop signal ; 10 : Position mode and motion; 11 : Speed mode and motion;	0~20 (Read and write)	0
0x0045	Input terminal X2 function choose	12 : JOG+ Point movement ; 13 : JOG- Point movement ; 14 : Enable signal for back to origin;	0~20 (Read and write)	0
0x0046	Input terminal X3 function choose	15 : PT Enable signal ; 16 : PIN0 ; 17 : PIN1 ;	0~20 (Read and write)	0
0x0047	Input terminal X4 function choose	18 : PIN2 ; 19 : PIN3 ; 20 : PIN4 ;  Note: when using an external pulsed control mode, set the PU and DR to 0 to avoid unintended impacts; These terminals function: 4 Motor enable signal, 5 Motor release signals, 11 , 12,13 signal is constant level active, others are active when levels changes;	0~20 (Read and write)	0
0x004B	Output terminal active level	Bit0 : Output terminal Y0 control bit ; Bit1 : Output terminal Y1 control bit ; Bit2 : Output terminal Y2 control bit ;  0 : The default ; 1 : reverse active level ; Default input terminal effective level is rising or high level;	0~65535 (Read and write)	0
0x004C	Output terminal Y0 function choose	0. Undefined 1. Alarm signal ; 2. Drive status signals ;	0~8 (Read and write)	0
0x004D	Output terminal Y1 function choose	3. Back to the origin complete signals ; 4. Position reached signal ; 5. PT Mode signals ;	0~8 (Read and write)	0
0x004E	Output terminal Y2 function choose	6. POUT0 ; 7. POUT1 ; 8. POUT2 ;	0~8 (Read and write)	0

**Multi positional parameter group**

0x0070	Multi position Enable command	Bit0 : 0 : Invalid ; 1 : Enabled ; Bit1~Bit7 : Reserved ; Bit15~Bit8 : 0 : Invalid ; 1~16 : position section choose ; 17~255 : Reserved ;	0~65535 (Read and write)	0
0x0071	Multi position operation mode	0 : Basic model ; 1 : Trigger mode ;	0~1 (Read and write)	0
0x0072	Multi position loop mode	0 : Run for single time and then stop ; 1 : Cycling ;	0~1 (Read and write)	0
0x0080 0x0081 0x0082 0x0083 0x0084 0x0085 0x0086 0x0087 0x0088 0x0089 0x008A	01 position section JPT number 02 position section JPT number 03 position section JPT number 04 position section JPT number 05 position section JPT number 06 position section JPT number	JPT(jump point) : After you run a jump from its current location to the next location, such as the location 01 JPT Number is 8 , In position 01, after the run is complete, go to location 08 to operate;  0 : Do not jump; 1~16 : Next position;	0~16 (Read and write)	0
0x008B 0x008C 0x008D 0x008E 0x008F	JPT number 07 position section JPT number 08 position section JPT number 09 position section JPT number 10 position section JPT number 11 position section JPT number 12 position section JPT number 13 position section JPT number 14 position section JPT number 15 position section JPT number 16 position section JPT number			

0x0090~ 0x009F	Number of pulses of high bit for PT position section ( section 1~ section 16)	Number of pulses of position mode (including acceleration, constant speed, and deceleration)  Such as setting 100000 Pulse, then high 0x0001 , Low 0x86A0	0x00~ 0Xffff (Read and write)	0
0x00A0~ 0x00AF	Number of pulses of low bit for PT position section ( section 1~ section 16)		0x00~ 0Xffff (Read and write)	0
0x00B0~ 0x00BF	Running speed of PT position section ( section 1~ section 16)	Running speed	10-3000r/min (Read and write)	0 (0/min)
0x00C0~ 0x00CF	Acceleration and deceleration time of PT position section ( section 1~ section 16)	Acceleration and deceleration time	30-2000ms (Read and write)	0 (0ms)
0x00D0~ 0x00DF	waiting time of PT position section ( section 1~ section 16)	The time gap between two running section;	0-65535ms (Read and write)	0
0x00E0~ 0x00EF	The output terminal settings at the beginning of position section motion (section 1~ section 16)	Output status of POUT at the beginning of one position section ; Bit0 : POUT0 State ; Bit1 : POUT1 State ; Bit2 : POUT2 State ;  0: Low level output; 1: High level output;	0~0x000F (Read and write)	0
0x00F0~ 0x00FF	The output terminal settings at the end of position section motion ( section 1~ section 16)	Output status of POUT at the end of one position section ; Bit0 : POUT0 State ; Bit1 : POUT1 State ; Bit2 : POUT2 State ;  0: Low level output; 1: High level output;	0~0x000F (Read and write)	0

### Performance parameters group

0x0110	Encoder resolution	0 : 1000 line ; 1 : 2500 line ;	0~1 (Read and write)	0
0x0111	Pulse input limit frequency	The factory default, generally do not need adjustment	0~65535 (Read and write)	5
0x0112	Percentage of closed-loop current	The factory default, generally do not need adjustment	0~150 (Read and write)	100
0x0113	Open-loop current percentage	The factory default, generally do not need adjustment	0~100 (Read and write)	50
0x0114	Lock motor current percentage	The factory default, generally do not need adjustment	0~100 (Read and write)	40
0x0115	Lock motor current time	The factory default, generally do not need adjustment	100-500 (Read and write)	100
0x0116	Position Variances alert thresholds	The factory default, generally do not need adjustment	0~20000 (Read and write)	4000
0x0117	Position reached signal output control mode and threshold	The factory default, generally do not need adjustment	1~4000 (Read and write)	10
0x0118	Speed smooth intensity	The factory default, generally do not need adjustment	0~1024 (Read and write)	5
0x0119	Position proportion	The factory default, generally do not need adjustment	1~256 (Read and write)	16
0x011A	Speed proportion	The factory default, generally do not need adjustment	1~256 (Read and write)	16
0x011B	Speed feed coefficient	The factory default, generally do not need adjustment	0~200 (Read and write)	162
0x011C	Current loop proportion coefficient	The factory default, generally do not need adjustment	0~30000 (Read and write)	8000
0x011D	Current loop integral coefficient	The factory default, generally do not need adjustment	0~1000 (Read and write)	48

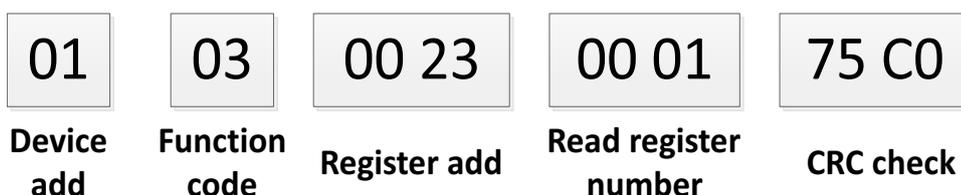
0x011E	Encoder feedback filter coefficients	The factory default, generally do not need adjustment	0~1024 (Read and write)	358
0x011F	Position complete accuracy	The factory default, generally do not need adjustment	1~200 (Read and write)	10
0x0120	Closed-loop control algorithm	The factory default, generally do not need adjustment	0~1 (Read and write)	0
0x0121	High speed adjustment coefficient (ea Limiting)	The factory default, generally do not need adjustment	0~65535 (Read and write)	15360
0x0122	Torque adjustment coefficient (ea)	The factory default, generally do not need adjustment	1~50 (Read and write)	16
0x0123	Speed node 1	The factory default, generally do not need adjustment	1~50 (Read and write)	10
0x0124	Position proportion coefficient 1	The factory default, generally do not need adjustment	0~65535 (Read and write)	32
0x0125	Speed proportion coefficient 1	The factory default, generally do not need adjustment	0~65535 (Read and write)	320
0x0126	Speed node 2	The factory default, generally do not need adjustment	1~50 (Read and write)	15
0x0127	Position proportion coefficient 2	The factory default, generally do not need adjustment	0~65535 (Read and write)	33
0x0128	Speed proportion coefficient 2	The factory default, generally do not need adjustment	0~65535 (Read and write)	320
0x0129	Speed node 3	The factory default, generally do not need adjustment	1~50 (Read and write)	20
0x012A	Position proportion coefficient 3	The factory default, generally do not need adjustment	0~65535 (Read and write)	35
0x012B	Speed proportion coefficient 3	The factory default, generally do not need adjustment	0~65535 (Read and write)	320
0x012C	Speed node 4	The factory default, generally do not need adjustment	1~50 (Read and write)	30

0x012D	Position proportion coefficient 4	The factory default, generally do not need adjustment	0~65535 (Read and write)	38
0x012E	Speed proportion coefficient 4	The factory default, generally do not need adjustment	0~65535 (Read and write)	384
0x012F	Speed node 5	The factory default, generally do not need adjustment	1~50 (Read and write)	40
0x0130	Position proportion coefficient 5	The factory default, generally do not need adjustment	0~65535 (Read and write)	39
0x0131	Speed proportion coefficient 5	The factory default, generally do not need adjustment	0~65535 (Read and write)	512
0x0132	Speed node 6	The factory default, generally do not need adjustment	1~50 (Read and write)	45
0x0133	Position proportion coefficient 6	The factory default, generally do not need adjustment	0~65535 (Read and write)	40
0x0134	Speed proportion coefficient 6	The factory default, generally do not need adjustment	0~65535 (Read and write)	640
0x0135	Static position proportion coefficient	The factory default, generally do not need adjustment	0~65535 (Read and write)	32
0x0136	Static speed proportion coefficient	The factory default, generally do not need adjustment	0~65535 (Read and write)	320

### 3.3 MODBUS Function code

#### 3.3.1 Read holding registers command

(1) Master->Slave :



Master send queries to slave for maximum speed register

Slave->Master :



Slave returns the maximum speed from register value of 60

(2) Other examples of reading holding registers command is as follows :

Query starting speed (0x0020), Acceleration time (0x0021)  
 Deceleration time (0x0022), Maximum speed (0x0023)

Master->Slave : 01 03 00 20 00 04 45 C3

Slave->Master : 01 03 08 00 05 00 64 00 64 00 3C F0 D1 (starting speed  
 5r/min, Acceleration time 100ms, Deceleration time 100ms, Maximum  
 speed 60r/min)

**Note: the maximum number of queries may not exceed 16 registers**

### 3.3.2 Write single register commands 06

(1) Master->Slave :



Master write to the slave for the registers of maximum speed for value 60, The slave receives the instruction and returns the same instructions for confirmation.

Slave->Master :



(2) Other examples of write single register commands are as follows:

Set the acceleration time registers to 500ms:

Master->Slave : 01 06 00 21 01 F4 D9 D7

Slave->Master : 01 06 00 21 01 F4 D9 D7

### 3.3.3 Write multiple registers command 16



Command examples of write multiple registers are as follows:

Master to slave write two registers, respectively, set the number of pulses high register and the number of pulses low registers.

Master->Slave : 01 10 00 24 00 02 04 00 00 13 88FD12

Slave->Master : 01 10 00 24 00 0201 C3

### 43.3. Communication error code

(1) CRC Validation error :

If an error occurs during data transmission, the slave device calculates one frame data received CRC Checksum is not 85 C0 , the slave will drop the frame data, and does not return any data.

Master->Slave : 01 03 00 20 00 01 85 C1

Slave->Master : 01 83 01 80 F0

(2) Command error :

If the master requested function code is not 03 or 06, The slave returns the exception code 01. For more information of exception code 01, please refer to table 3.

Master->Slave : 01 02 00 00 00 04 79 C9

Slave->Master : 01 82 02 61 C1

(3) Illegal data address :

If the data address requested by master is not valid, the slave returns the exception code 03.

Master->Slave : 01 03 00 19 00 01 55 CD

Slave->Master : 01 83 03 01 31

Register address 0x0019 is empty, the slave returns the exception code 03.

(4) Outside the address range

Master->Slave : 01 06 FF 00 0B 580B

Slave->Master : 01 86 0443 A3

Register address 0Xff00 beyond the scope of register address. Slave returns the exception code 04.

(5) Read address out of range :

If the master requests a data beyond the scope of one time data reading limit, the slave returns the exception code 05. For more information of exception code 05, please refer to table 11.

Master->Slave : 01 03 00 20 00 20 45 D8

Slave->Master : 01 83 05 81 33

Read 32 data for one time, it is out of range, returned exception code 05.

(6) Read and write illegal error

Function code's read-write property is divided into read-only, write-only, read-write three type, command which does not meet the functional code attribute will return exception code 06.

Master->Slave : 01 03 00 27 00 01 34 01

Slave->Master : 01 83 06 C1 32

Function code 0x27 is write- only code, read action returns exception code 06.

(7) Write error

Write function code content beyond the scope of its provisions.

Master->Slave : 01 06 00 26 00 08 69 C7

Slave->Master : 01 86 07 03 A2

Write functional code is out of range, return exception code returned

07. Table 11 MODBUS Exception code

Code	Name	Meaning
01	CRC Parity error	CRC Parity error
02	Command error	Slave received function code other than 03 or 06.
03	Function code address errors	Address data received from master is not allowed.
04	Beyond the function code address	Received data address is beyond the scope of a function code.
05	Read function code number overflow	Maximum read 16 function code for one time.
06	Function code read and write illegal error	Function code read and write attributes are divided into read-only, write-only, read and write, do not meet the function code attribute error.
07	The function code is written incorrectly	Write data to the function code beyond its specified range.

### 3.35 Application example

(1) The running example of Position mode :

For example, the motor parameters (start speed 10r/min , Acceleration time 100ms , Deceleration time 100ms , Maximum speed 500r/min ) rotated 1 round forward.

Before starting the sample, make sure to the drive address is set to 1, in which case the switch SW5-SW2 is OFF, SW1 is ON.

The following steps 1-6 Must be set before the steps 7 (that is to set the parameters first, and then starts running), and the step 1-6 Set the order do not has specific requirements.

- Step 1 : Sets the starting speed 10 r/min

Master->Slave : 01 06 00 20 00 0A 08 07

Slave->Master : 01 06 00 20 00 0A 08 07

- Step 2 : Set the acceleration time 100ms

Master->Slave : 01 06 00 21 00 64 D8 2B

Slave->Master : 01 06 00 21 00 64 D8 2B

- Step 3 : Set the deceleration time 100ms

Master->Slave : 01 06 00 22 00 64 28 2B

Slave->Master : 01 06 00 22 00 64 28 2B

- Step 4 : Set the maximum speed 500 r/min

Master->Slave : 01 06 00 23 01 F4 78 17

Slave->Master : 01 06 00 23 01 F4 78 17

- Step 5 : Set the total number of pulses high 2 byte ( 0x0000 )

Master->Slave : 01 06 00 24 00 00 C9C1

Slave->Master : 01 06 00 24 00 00 C9 C1

- Step 6 : Set the total number of pulses low 2 byte ( 1000 pulse)

Master->Slave : 01 06 00 25 03 E8 98 BF

Slave->Master : 01 06 00 25 03 E8 98 BF

- Step 7 : Relative position mode start commands

Master->Slave : 01 06 00 27 00 01 F8 01

Slave->Master : 01 06 00 27 00 01 F8 01

## (2) The example of speed mode running :

For example the motor parameters (start speed 10r/min, acceleration time 100ms), Reverse speed accelerate to 500r/min. After that, running at a constant speed.

Before starting the sample, make sure to the drive address is set to 1, in which case the switch SW5-SW2 is OFF, SW1 is ON.

- Steps 1 : Sets the starting speed 10 r/min

Master->Slave : 01 06 00 20 00 0A 08 07

Slave->Master : 01 06 00 20 00 0A 08 07

- Step 2 : Set the acceleration time 100ms

Master->Slave : 01 06 00 21 00 64 D8 2B

Slave->Master : 01 06 00 21 00 64 D8 2B

- Step 3 : Set the maximum speed 500 r/min

Master->Slave : 01 06 00 23 01 F4 78 17

Slave->Master : 01 06 00 23 01 F4 78 17

- Step 4 : Speed mode start command

Master->Slave : 01 06 00 27 00 02 B8 00

Slave->Master : 01 06 00 27 00 01 B8 00

## 4 Motion control functions introduction

### 4.1 Position mode

Position mode using trapezoidal acceleration/deceleration curve, the user can sets the starting speed (Address 0x0020) , Acceleration time ( Address 0x0021) , Deceleration time ( Address 0x0022) , Maximum speed ( Address 0x0023) And the total number of pulses ( Address 0x0024, and 0x0025) and other parameters through can-bus to achieve accurate position control. By controlling the positive or negative of the total number of pulse to control the direction of motor rotation, usually rotate forward is defined as positive; rotate backward is defined as negative. Trapezoidal acceleration/deceleration curve is show as figure 5 below.

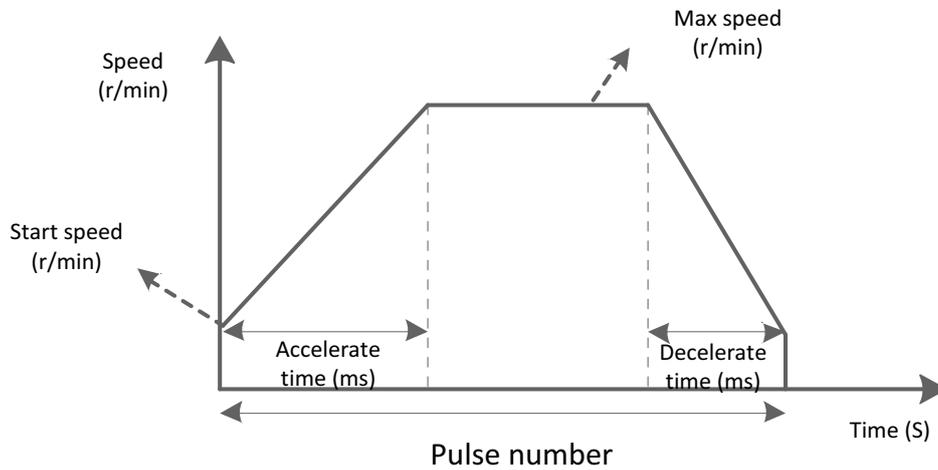


Figure 5 Position mode curve acceleration and deceleration

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 in Figure 6. 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 figure 6

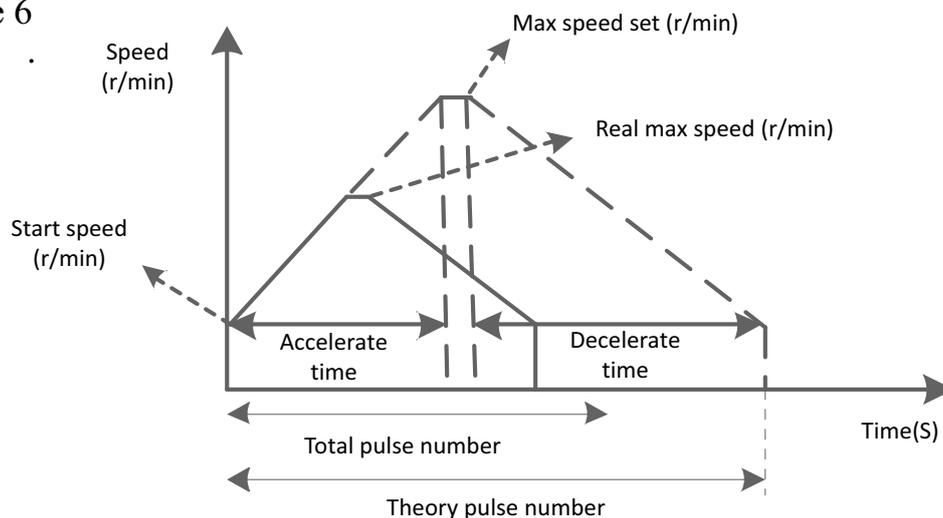


Figure 6 Position model of acceleration and deceleration curve (do not accelerated to the set maximum speed)

In addition, through the 0027 Starting command register in position mode to select controls in the relative position mode or absolute position mode, see chapter 4.5.1 description of the start command.

## 4.2 Speed mode

The acceleration curve of Speed mode is shown in figure 7. 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 the forward rotate; maximum speed register is negative, the motor is defined as the backward

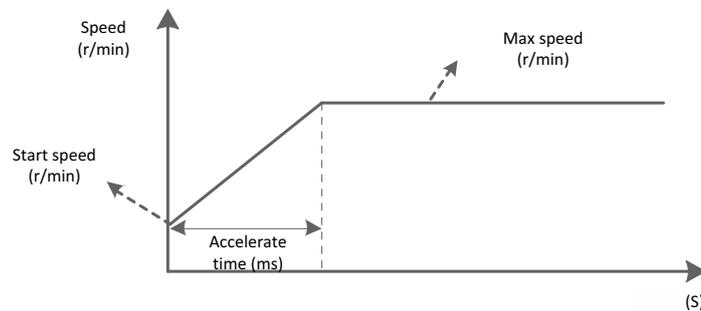


Figure 7 Speed mode accelerate curve

## 4.3 Multi-position mode

Multi-position mode function is to combine multiple position section in a certain order, trigger movement through the MODBUS or external signal, it's a way of work through a series of actions. The function also can treat as a combination of position mode movements in chapter 4.1. The difference is 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 figure 8.

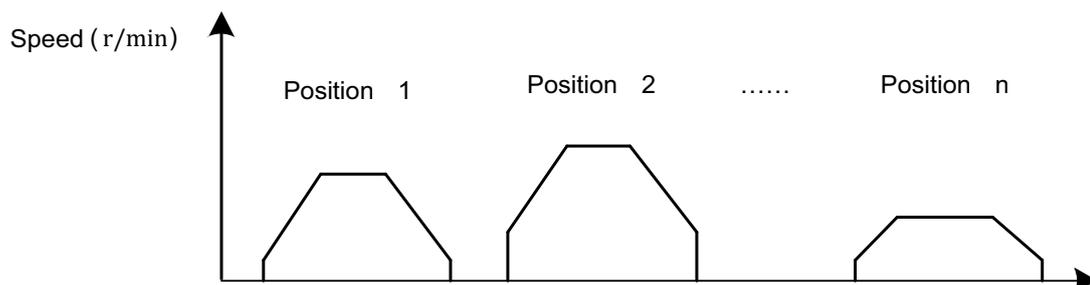


Figure 8 Multi-position working modes

### 4.3.1 Position section parameters

From the prior chapter, we know that users can save parameter for describing a position movement in EEPROM. For the current Modbus, it supports up to 16 section position, this chapter describes the requirements to describe a position section.

Table 12 Parameter set of describing a position section

Parameter name	Function description
JPT number (JPT)	The section number of next movement after the finish of current movement
Total number of pulses high bit (PUH)	The same as position mode
Total number of pulses low bit (PUL)	The same as position mode
Running speed (SPEED)	The same as position mode
Time of acceleration/deceleration (ACCDEC)	The same as position mode
Waiting time (WAIT)	The time between two movement sections
The output terminal settings at the beginning of movement (OUTS)	The enable output terminals state at the beginning of section movement
The output terminal settings at the end of movement (OUTO)	The enable output terminals state at the end of section movement

In table 12, the parameters "total number of pulses high bit, total number of pulses low bit, speed, acceleration and deceleration time, direction" listed have the same meaning of the parameters in position mode. The "output terminal settings at the beginning of movement" and the "output terminal settings at the end of movement " stand for the terminal state of movements start and end, here of output terminal is refers to POUT0~POUT2, Such as user define Y0~Y2 output terminal as POUT0~POUT2 by software, then user can control the output status of Y0~Y2. (At least one terminal of Y0~Y2 need to be configured as POUT ).

These parameters correspond MODBUS-RTU communicating address is described in chapter 3.2.

### 4.3.2 Basic mode

Multi-position mode has two modes of work, one is basic mode, and another is trigger mode. Two working modes have in common is the need of set up at least one movement section, the main difference is the trigger number. Basic model only need one trigger after setting the groups of position section parameters, then the set position section can be applied one by one. There's no need for other command. It is shown in the following example:

Example: set 3 position section, location 1, location 5, location 3. Requiring: run location 1 first , wait for 500ms, then jump to position 5, after another wait for 1000ms, jump to position 3. Then end action, and demands that:

- ① Running total number of pulses is 5000 for position 1. Speed 60r/min, Acceleration and deceleration time 300ms. At start, the POUT0=1, at the end POUT1=1 ;
- ② Reverse running total number of pulses is 2000 for position 5. Speed 120r/min, Acceleration and deceleration time is 100ms. At start, the POUT1=1, at the end POUT0=1, POUT1=1 ;
- ③ Running total number of pulses is 3000 for position 3. Speed 240r/min, Acceleration and deceleration time 200ms. At start, the POUT0=1 ; POUT1=1, at the end POUT0~2=1;

Motion process is shown in Figure 9

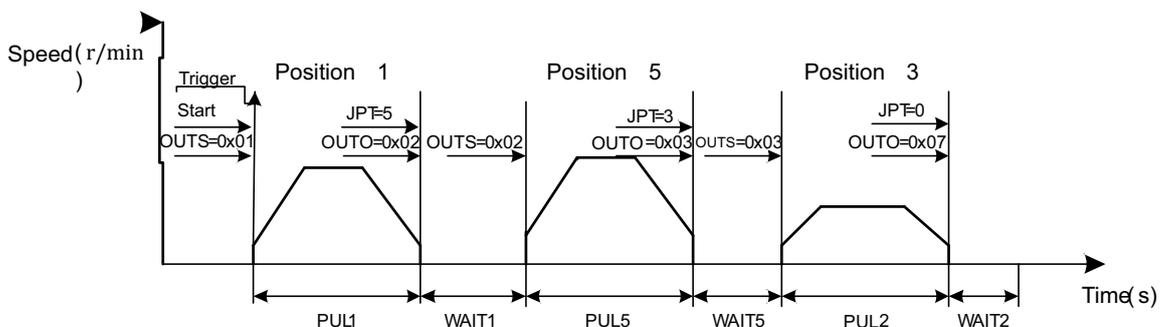


Figure 9 Three-stage process

To complete movement described above, need to do the following:

2016、 Y0~Y2 output terminal function set to POUT0~POUT2, specific function code command in the following table:

Table 13 Function code settings content

Function code address	Function code name	Writing content
0x004C	Output terminal Y0 terminal function choose	6
0x004D	Output terminal Y1 terminal function choose	7
0x004E	Output terminal Y2 terminal function choose	8

(2) And setting the parameters as in the following table:

Table 14 Function code settings content

Function code address	Function code name	Writing content
0x0080	JPT number of position section 1	5
0x0090	Total number of pulses high bit	0
0x00A0	Total number of pulses low bit	5000
0x00B0	Running speed	60
0x00C0	Time of acceleration/deceleration	300
0x00D0	Waiting time	500
0x00E0	The output terminal settings at the beginning of movement	1
0x00F0	The output terminal settings at the end of movement	2
0x0085	JPT number of position section 5	3
0x0095	Total number of pulses high bit	-1
0x00A5	Total number of pulses low bit	-2000
0x00B5	Running speed	120
0x00C5	Time of acceleration/deceleration	100
0x00D5	Waiting time	1000
0x00E5	The output terminal settings at the beginning of movement	2
0x00F5	The output terminal settings at the end of movement	3
0x0083	JPT number of position section 3	0
0x0093	Total number of pulses high bit	0
0x00A3	Total number of pulses low bit	3000
0x00B3	Running speed	240
0x00C3	Time of acceleration/deceleration	200
0x00E3	The output terminal settings at the beginning of movement	3
0x00F3	The output terminal settings at the end of movement	7

(3) Send PT movement trigger to start movement and observe the motor.

Master->Slave : 01 06 00 70 00 01 49 D1

Slave->Master : 01 06 00 70 00 01 49 D1

Basic mode working process described as above, you need to know the following points:

(1) The currently Modbus support PT Segment in total 16 section;

(2) If there's no need for POUT output terminal functions, simply configure Y0~Y2 to other functions, or set parameters OUTS and OUTO to 0.

(3) Of the above mentioned movements trigger, there are 2 methods: MODBUS function code 0x0070 write 1 trigger movement; external trigger input signal: need to take any one of the input terminals (PU,DR,X0~X4) configured as "PT Enable signal" function, and input a signal from it to trigger.

(4) For position after the last section, if you don't need movement anymore, the section needs to set JPT parameter to 0. Automatically exit multi-position mode after that.

(5) In multi-position mode, position mode and speed mode is disabled, by stopping or emergency stopping command, you can exit multi-position mode, or automatically exit multi-position mode after the end of it.

### **4.3.2 Trigger mode**

Basic model processes are described in the previous chapter, this chapter mainly introduces the process of triggering mode. In basic model, only need one trigger after set all needed parameters, followed by motion in accordance with parameters, no other action is required. However, trigger mode need trigger several times through the whole motion process, that is, after every position section, you need send a trigger command again to trigger next movement, when to trigger is decided by users.

In addition, the basic model selecting a next position section by JPT Parameters. For trigger mode, except by JPT Parameter settings for next position section, we also set through MODBUS communications commands and external input terminal. In PT mode, there are total PIN0~PIN4 5 input terminals, PIN0~PIN4 terminal counted as binary from low to high. As the following table:

Table 15 Input terminal select the location

PIN4	PIN3	PIN2	PIN1	PIN0	Position section
0	0	0	0	0	Do 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 use PIN terminal choice, it need remains in effect for more than 5ms before and after PT Enabling signal;

Specific examples are as follows:

Example: set 3 position, position 1, position 5, and position 3.  
Requiring first run position 1, then trigger to position 5. And then trigger to position 3. And end of action. Also demands that:

- ① Running total number of pulses is 5000 for position 1. Speed 60r/min, Acceleration and deceleration time 300ms. At start, the POUT0=1, at the end POUT1=1 ;
- ② Running total number of pulses is 2000 for position 5. Speed 60r/min, Acceleration and deceleration time is 100ms. At start, the POUT1=1, at the end POUT0=1, POUT1=1 ;

- ③ Running total number of pulses is 3000 for position 3. Speed 60r/min, Acceleration and deceleration time 200ms. At start, the POUT0=1 ; POUT1=1, at the end POUT0~2=1;

Motion process is shown in Figure 10

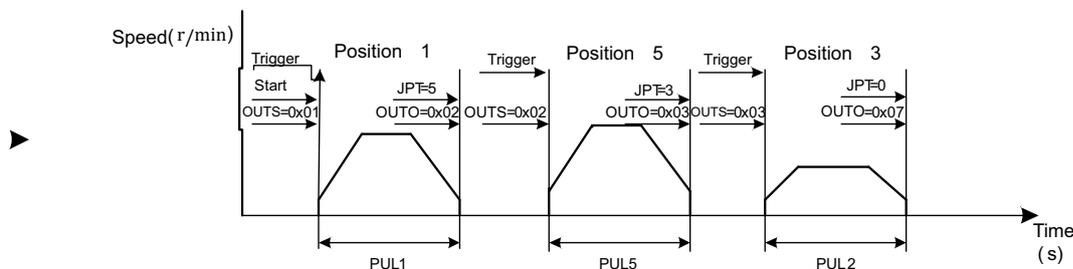


Figure 10 Three-stage process

Complete movement described above, need to do the following:

Y0~Y2 output terminal function set to POUT0~POUT2, specific function code command in the following table:

Table 16 Function code settings content

Function code address	Function code name	Writing content
0x004C	Output terminal Y0 terminal function choose	6
0x004D	Output terminal Y1 terminal function choose	7
0x004E	Output terminal Y2 terminal function choose	8

(2) and set parameters as follow :

Table 17 Function code settings conten

Function code address	Function code name	Writing content
0x0080	JPT number of position section 1	5
0x0090	Total number of pulses high bit	0
0x00A0	Total number of pulses low bit	5000
0x00B0	Running speed	60
0x00C0	Time of acceleration/deceleration	300
0x00D0	Waiting time	500
0x00E0	The output terminal settings at the beginning of movement	1
0x00F0	The output terminal settings at the end of movement	2
0x0085	JPT number of position section 5	3

0x0095	Total number of pulses high bit	-1
0x00A5	Total number of pulses low bit	-2000
0x00B5	Running speed	120
0x00C5	Time of acceleration/deceleration	100
0x00D5	Waiting time	1000
0x00E5	The output terminal settings at the beginning of movement	2
0x00F5	The output terminal settings at the	3
0x0083	JPT number of position section 3	0
0x0093	Total number of pulses high bit	0
0x00A3	Total number of pulses low bit	3000
0x00B3	Running speed	240
0x00C3	Time of acceleration/deceleration	200
0x00E3	The output terminal settings at the beginning of movement	3
0x00F3	The output terminal settings at the end of movement	7

(3) Send PT movement trigger to start movement and observe the position section 1.

Master->Slave : 01 06 00 70 00 01 49 D1

Slave->Master : 01 06 00 70 00 01 49 D1

(4) Send PT movement trigger to start movement and observe the position section 5.

Master->Slave : 01 06 00 70 00 01 49 D1

Slave->Master : 01 06 00 70 00 01 49 D1

(5) Send PT movement trigger to start movement and observe the position section 3.

Master->Slave : 01 06 00 70 00 01 49 D1

Slave->Master : 01 06 00 70 00 01 49 D1

Trigger mode working process described as above, you need to know the following points:

(1) In the example above the triggers are MODBUS commands. You can also use external trigger input signal: need to take any one of the input terminals (PU,DR,X0~X4) configured as "PT Enable signal" function, and input a signal from it to trigger.

(2) In the example above next positions are chose by JPT parameters. Also available via MODBUS command to select next positions, specific command refer to the function code section 0x0070 description. Position also can be selected via external input terminals. For the three options, MODBUS commands have the highest priority, followed by external input selection, JPT parameter is the lowest priority.

When using an external terminal to select the next section:

- ① First of all, you need to set X0~X2 input terminal function to PIN0~PIN2;
- ② Set PIN0~PIN2 Status bits before each trigger, such as selecting position 5, the controller input PIN2=1 , PIN1=0 , PIN0=1, then send trigger command and complete movement of section 5.

Note: in a multiple-position mode, control Relative / Absolute position motion according to 0x0026 Relative / Absolute position register.

#### **4.4 Back to the origin function**

Modbus Current modes for backing to origin, and you need to use the position limit signal or the origin signal when you back to the origin point. Please choose the position limit signal or origin signal of enabled terminal before you use back to origin function. Meanwhile, back to the original function can be triggered through external I/O or through MODBUS commands. If you use an external I/O trigger, you need to set one input terminal as "back to origin" function.

2016、 Position limit + origin mode

After drive received "back to origin points enable (0x0030)" command, it will run in "back to origin point speed (0x0032)" and the "back to origin point accelerate and deceleration time (0x0034)" parameters, when it received original points signal rise edge, it will stop in the parameter of " back to origin point accelerate and deceleration time (0x0034)"

. After stop completed, it will run reverse movement, after receiving original signal falling edge, it will stop again. Then it will search for the rise edge of origin point signal at the speed of "back to the original query speed (0x0033)". When it receives a origin signal rising edge, it will stop the motion and finish the process of looking for origin. If the function code in the "back to the original point compensation (0x0035 and 0x0036)" is not zero, then, it will run a compensation angle. In the process of back to origin, if you hit a position limit signal, the turning will reverse.

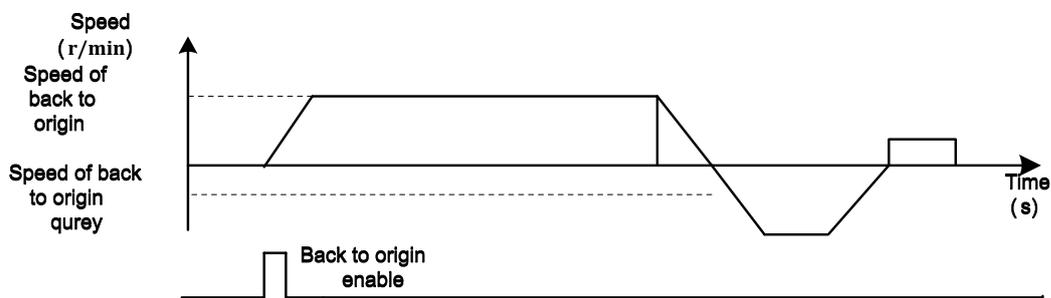


Figure 11 Position limit + back origin workflow chart

## 2、 Position limit mode

After drive received "back to origin points enable (0x0030)" command, it will run in "back to origin point speed (0x0032)" and the "back to origin point accelerate and deceleration time (0x0034)" parameters, when it received position limit signal rise edge, it will stop in the parameter of " back to origin point accelerate and deceleration time (0x0034)". After stop completed, it will run reverse movement, after receiving position limit signal falling edge, it will stop again. Then it will search for the rise edge of position limit signal at the speed of "back to the original query speed (0x0033)". When it receives a position limit signal rising edge, it will stop the motion and finish the process of looking for origin. If the function code in the "back to the original point compensation (0x0035 and 0x0036)" is not zero, then, it will run a compensation angle.

## 4.5 Motion control commands

### 4.5.1 The start command (0x0027)

See table 10 register address definition table for description of 0x0027:

Bit0~1: 1 : Position mode; 2 : Speed mode ;

Bit2: 0 : Relative position; 1 : Absolute position ; activate in position mode.

Bit3~Bit15 : Reserved

This register is used for the trigger of position motion and speed motion, as well as the control of movement direction, specification are as follows:

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

### 4.5.2 Stop command (0x0028)

See table 10 Register address definition table 0x0028 description:

Bit0: 0 : Normal S<sup>top</sup> ; 1 : E<sup>mergency</sup> Stop ;

This register stops motion of the motor, stop mode have 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

Motor running on the position mode and speed mode, when normal stop command received (00 28 00 00), the motor will decelerate to stop in deceleration time setting (address 0x0022). When emergency stop command received (00 28 00 01) , it will stops directly without deceleration.

**Note: the deceleration time parameters need to be set before the motor is running, if the motor starts running, driver receives this command, motor will running the command according to the motor**

**deceleration time set before.**

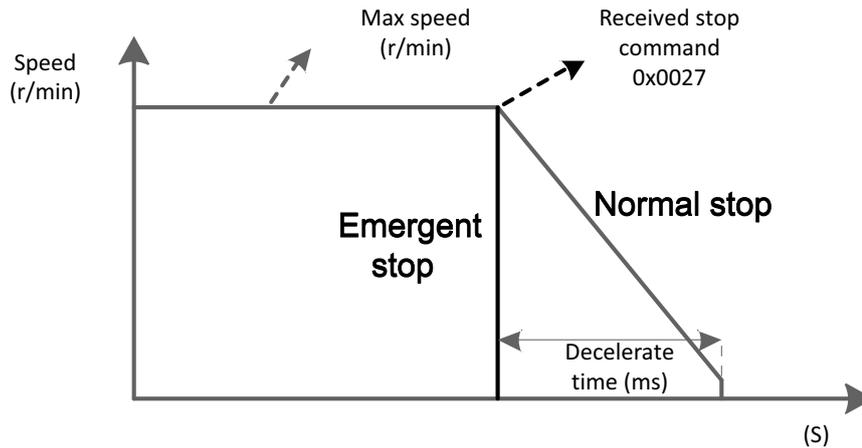


Figure 12 normal stop and emergency stop

### 4.5.3 Back to origin command (0x0030)

See table 10 Register address definition table 0x0030 description:

0 : Invalid ; 1 : Valid ;

The register is used to trigger back to origin function.

Back to origin command : 01 06 00 30 00 01 48 05

### 4.5.4 Multi position command (0x0070)

See table 10 Register address definition table 0x0070 description:

Bit0 : 0 : Invalid ; 1 : Valid ;

Bit1~Bit3 : Reserved ;

Bit4~Bit7 : 0 : Invalid ; 1~16 : position section choose ; 17~255 :

Reserved ;

The register is used to trigger the multi-position mode function, and choose position section number in multi-position trigger mode.

Multi-position trigger, do not select position section number: 01 06 00 70 00 01 49 D1

Multi-position trigger, select position section number 5: 01 06 00 70 05 01 4A 81

## 5 Input/output terminal operation

Bholanath MBUS drive provides 5 programmable input photoelectric isolation terminal, compatible with common cathode and anode connection, 2 differential signal input.

High-speed optic-coupler isolation within the 2 differential signal input, can be configured as an external pulsed control, and can also be configured as a common input terminal.

5 ( X0-X4 ) Programmable input signals and external control interface are isolated with optical coupling, drive internal compatible with common cathode and anode connection, as shown in Figure 13. In order to ensure a reliable optic-coupler conduction in the drive, requirements drive control current provides at least 10mA. Drive internal have optic-couplers current-limiting resistor, when the input signal voltage higher than 5V, require external resistors for current limiting.

Selection of current-limiting resistor:

When the controller / actuator signal output level is

+5V :  $R=0\Omega$

+12V :  $R=1.5K\Omega$

+24V :  $R=3.3K\Omega$

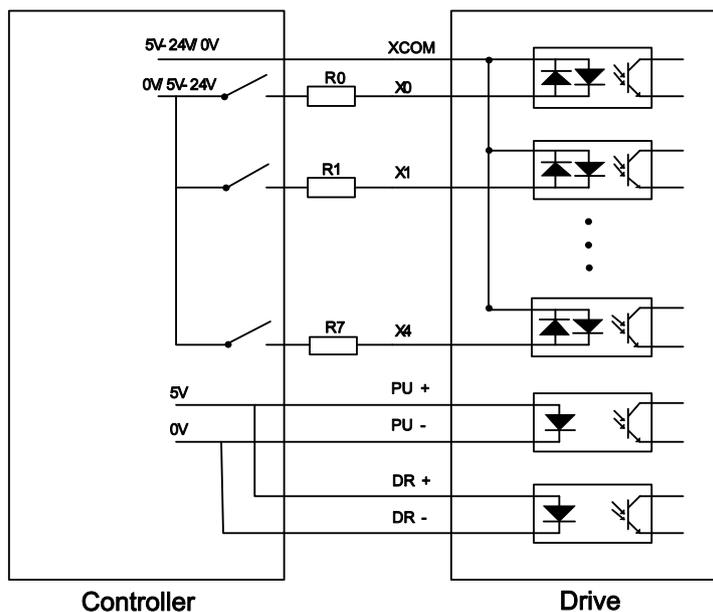


Figure 14 Input terminal reference circuit connection

X0-X4 input level pulse width is more than 10ms , otherwise the drive may not respond normally. X0-X4 timing diagram as in Figure 15 below.

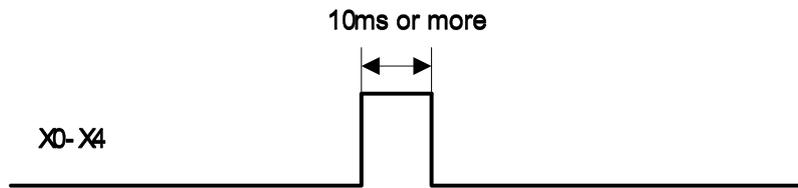


Figure 15 X7-X0 Timing diagram

After power up of drive, X0-X4 default status is not specified, input signal is not valid at this time. Users can use the bus to configure X0-X4 input function. Such as the X0-X2 input signal configuration for a table 15 settings. Master need to send the slave machine: 01 06 00 43 00 01 B9 DE,01 06 00 44 00 01 08 1F,01 06 00 45 00 01 59 DF.

Table 15 Terminal function set content

Input signal	Function
X0	Original signal
X1	Forward position limit signals
X2	Backward position limit signals

Bholanath MODBUSdrive provides 3 optical coupling isolation output terminals. Support NPN wiring and PNP wiring two ways to support high level and low level valid controller.

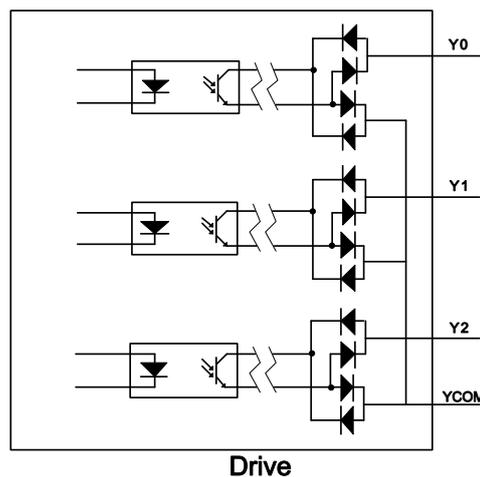


Figure 16 Y0-Y2 Output terminals internal circuit

## 6 Alarm clear

Bholanath Modbus drive has 5 alarm information. drive alarm light flashes differently for different alarm code. Specific alarm codes and treatment as shown in table 16.

Table 15 Fault codes and treatment measures

Fault code	Fault subcode	Fault information	Lights	Reset
Err1 : 0x01	SubErr : 0x10 ;	Over current or short circuit between phases	Flashing 1 time	Lock machine / Re-Power reset
Err2 : 0x02	SubErr : 0x20 ;	Power supply voltage too high	Flashing 2 time	Lock machine / automatic reset
Err3 : 0x03	SubErr : 0x30 ;	Power supply voltage too low	Flashing 3 time	Lock machine / automatic reset
Err4 : 0x04	SubErr : 0x41 : Read error ; 0x42 : Write error ;	EEPROM Read/write error	Flashing 4time	Resettable
Err5 : 0x05	SubErr : 0x50 ;	Location deviation errors	Flashing 5 time	Lock machine / Re-Power reset

In addition, when a drive alarm, alarm messages are automatically stored in EEPROM , can be found in table 10 Register description on "alarm parameter group" related content.