YAKOTEC®

YKD2405PC

Bus Type Stepper Drive
User Manual

Version：V1.3

Shenzhen YAKO Automation Technology Co., Ltd.
www.yankong.com

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

YKD2405PC bus-type stepper motor driver is a digital stepper drive based on the traditional open-loop stepper drive, but is added bus communication and single-axis controller function. Bus communication using CAN bus interface, protocol support CANopen agreement CiA301 and CiA402 sub-protocol.

1.2 Features

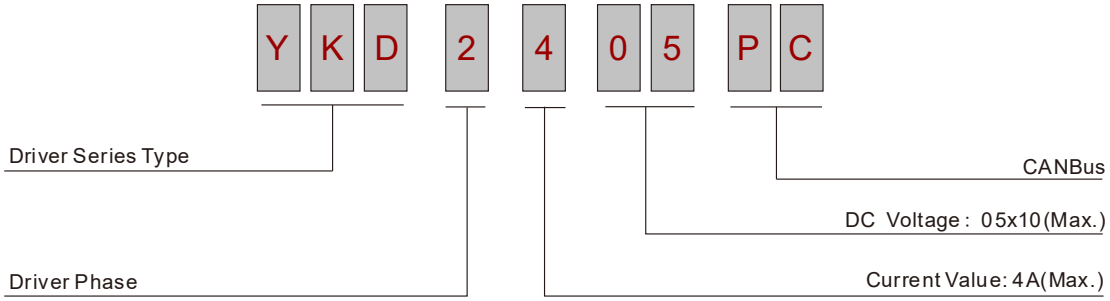
- New generation of 32-bit DSP technology, cost-effective, good stability, low noise, low vibration.
- CAN bus communication, support CiA301 and CiA402 subprotocol of CANopen agreement, and support 32 devices.
- Bus-type driver can achieve long-distance reliable control, which effectively solve the problem 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
- Voltage： DC24-50V
- Over-voltage, under-voltage, over-current protection

1.3 Applications

Mainly used in engraving machine, special industrial sewing machines, wire stripping machines, marking machines, cutting machines, stage lighting, robots, medical

equipment, laser equipment, plotters and other automation equipment.

1.4 Product naming rules



2 Performance indicators

2.1 Electrical features

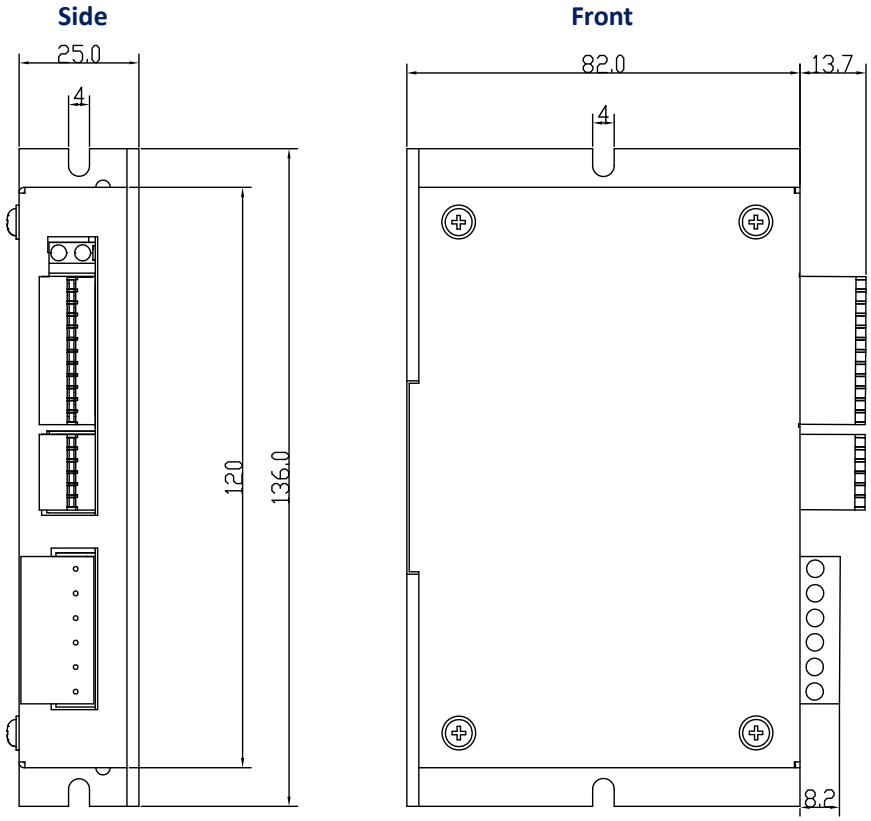
Spec.	YKD2405PC			
	Min value	Typical value	Max value	Unit
Output current	0.5	-	4.2	A
Input voltage	18	24	50	Vdc
Logic input current	7	10	16	mA
Logic input voltage	-	5	24	V
Pulse frequency	0	-	200	kHz
Insulation resistance	100	-	-	MΩ

2.2 Working environment

Cooling	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（No condensation）
	Vibration	10~55Hz/0.15mm
Storage temperature	-20℃~+80℃	

3 Installation

3.1 Installation dimensions



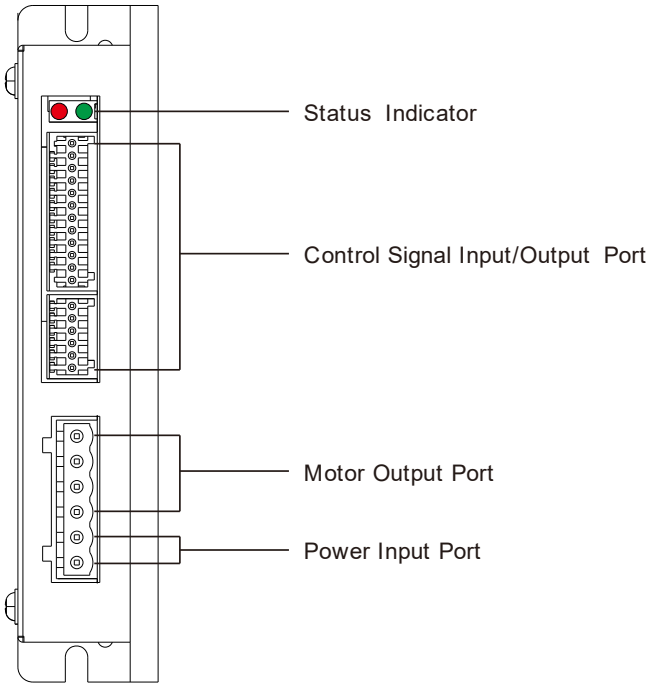
Installation dimensions（unit：mm）

3.2 Installation requirements

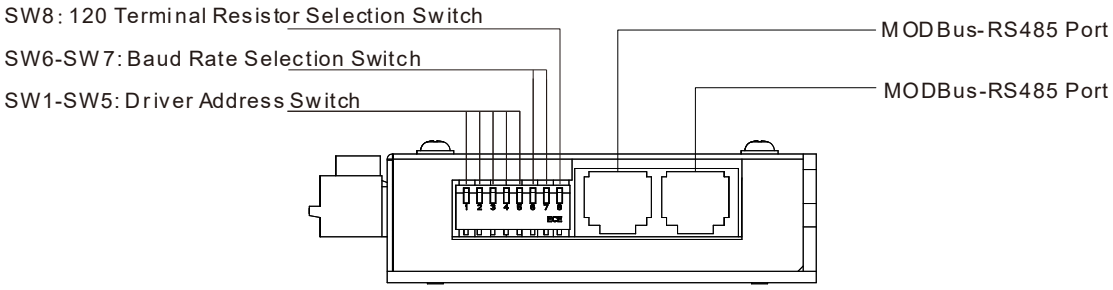
When installing the driver, please use upright side mounting to make the radiator surface have strong air convection; if necessary, install a fan near the driver to force the heat dissipation to ensure the driver work in a reliable working temperature (the reliable operating temperature of the driver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

4 Drive port and wiring

4.1 Wiring diagram



Drive side wiring diagram



Drive top wiring diagram

Caution:

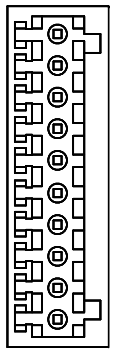
- The personnel involved in the wiring must have professional ability.
- No wiring with electricity power on.
- Wiring after the installation is firmly finished.
- Do not wrongly connect + and – of power, input voltage should not exceed 50V.

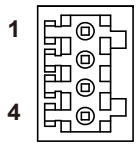
4.2 Port definition

4.2.1 Status Indicator

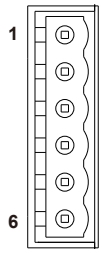
Color	Name	Function
Green	Power Indicator	After powered on, the green light illuminate
Red	Alarm indicator	Overcurrent, the indicator flashing once for cycle; Over-voltage, the indicator flashing twice for cycle; Undervoltage, the indicator flashing three times for cycle; EEPROM error, the indicator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

4.2.2 Control signal input/output port

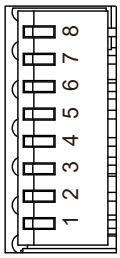
Port	PIN	Mark	Name	Function
1  10	1	PU+	Differential input port	① (P/D mode) pulse signal (only for high-speed differential port PU); ② (P/D mode) direction signal (only for high speed differential port DR); ③ Home signal; ④ Forward limit signal; ⑤ Backward limit signal; ⑥ Motor enable signal; ⑦ Motor release signal; ⑧ Alarm clear signal; ⑨ Restore factory setting signal; ⑩ Stop signal; ⑪ Emergency stop signal ⑫ Position mode movement; ⑬ Speed mode movement; ⑭ JOG+ point movement; ⑮ JOG- point movement; ⑯ Homing enable signal;
	2	PU−		
	3	DR+		
	4	DR−		
	5	X0	Single-ended input port	
	6	X1		
	7	X2		
	8	X3		
	9	X4		
	10	XCOM	Single-ended input common	Common port: Compatible with common cathode and common anode wiring

	1	Y0	Single-ended output	① Alarm signal; ② Brake signal; ③ Motor running status signal; ④ Homing completion signal; ⑤ Position ready signal;
	2	Y1		
	3	Y2		
	4	YCOM	Single-ended output common	Common port: Compatible with common cathode and common anode wiring

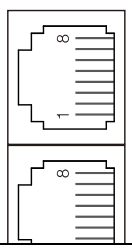
4.2.3 Power input/motor output port

Port	PIN	Mark	Name	Function
	1	B−	Motor power port	Two-phase stepper motor connection port
	2	B+		
	3	A−		
	4	A+		
	5	V+	Power input port	DC24−50V
	6	V-		

4.2.4 Switch

Port	PIN	Mark	Name	Function
	1	SW1	Switch	SW1-5：Drive address setting
	2	SW2		
	3	SW3		
	4	SW4		
	5	SW5		
	6	SW6		SW6-7：Communication baud rate setting
	7	SW7		
	8	SW8		SW8：120 terminal resistor effective bit

4.2.5 CAN bus port

Port	PIN	Mark	Name	Function
	1	CANH	Communication port	CANL CANH Communication line
	2	CANL		
	3	NC	Reserve	Reserve
	4	NC		
	5	GND	Common ground	Common ground
	6	NC	Reserve	Reserve

	7	NC		
	8	NC		

4.3 Input/output port operation

- **Port hardware description**

YKD2405PC drive provides 8 optical isolated programmable input interface, compatible with common cathode and common anode connection, 2 differential signal input.

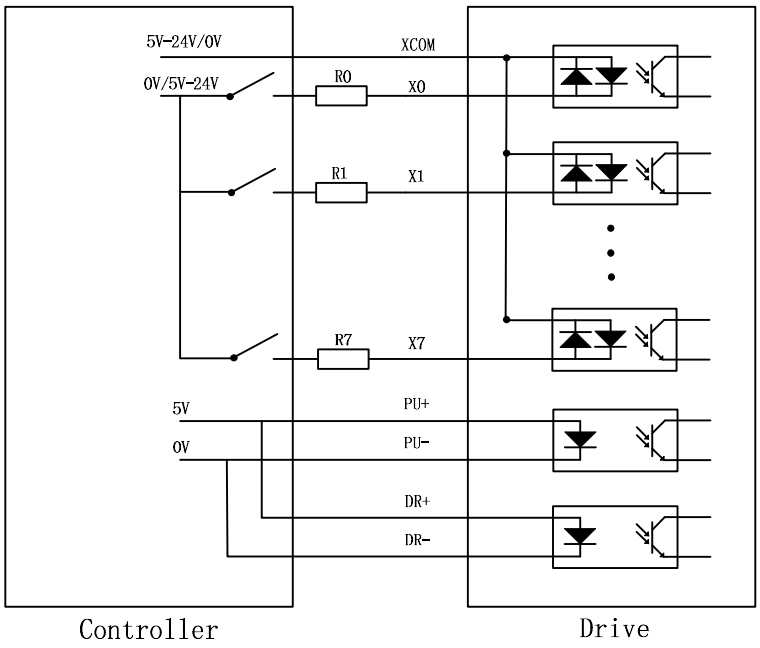
2 differential internal high-speed optocoupler differential signal can be configured for pulse direction or double pulse control, and it can also be configured as a common differential input terminal. The input signal voltage is 5V, current limit resistor is needed when the voltage is higher than 5V (such as when the input signal is 24V, 2~3K resistor 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.

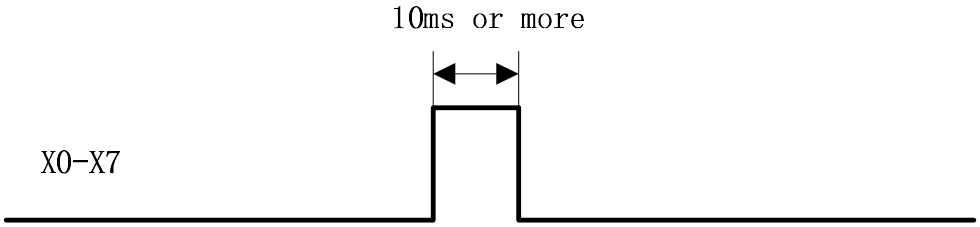
Note：

- If the controller outputs 24V control voltage by default, YKD2405PC-A1 can be selected to avoid trouble of adding resistance. The default input terminal control voltage of this sub-model is 24V.



Input terminal connection reference circuit

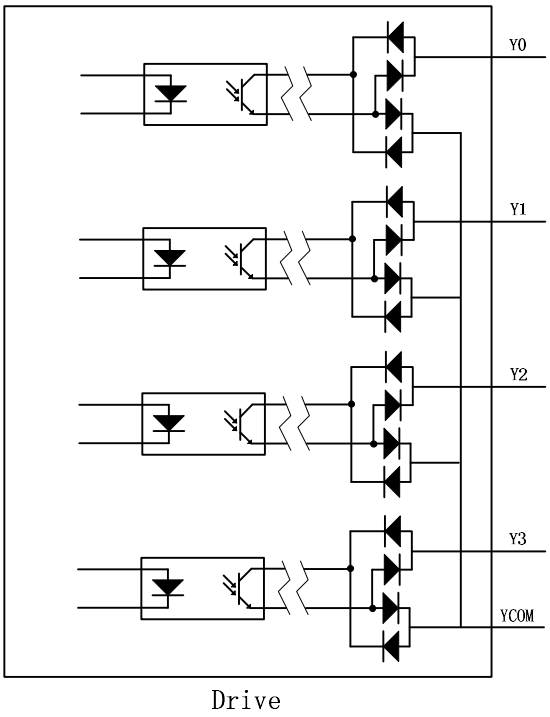
The level of X0-X7 input pulse width needs more than 10ms, otherwise the drive may not respond properly. X0-X7 timing diagram as shown below.



X0-X7 timing diagram

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 the bus.

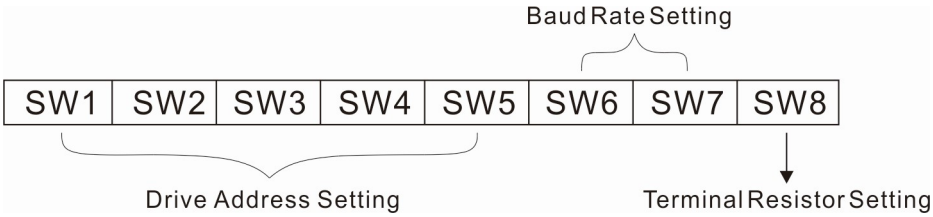
The driver provides 4 optocoupler isolated output terminals, supports NPN wiring and PNP wiring, support high or low level effective controller.



Y0-Y3 output terminal internal circuit

4.4 Switch setting

YKD2405PC bus type stepper motor drive use 8-bit DIP switch to set the drive address, communication baud rate and termination resistor, described in detail as follows:



DIP switch combination diagram

- **Drive address settings**

With CAN bus, up to 32 drives can be controlled simultaneously. Drive communication address setting using 5 DIP switches, address setting range is 0-31. 0 is reserved for the system.When the drive address is more than 31, you need to use the host debugging software to set and save it, in this condition, all the switch should be set to OFF. As shown in the following table:

SW5	SW4	SW3	SW2	SW1	Address
OFF	OFF	OFF	OFF	OFF	Customize
OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	ON	OFF	2

.....					
.....					
ON	ON	ON	ON	OFF	30
ON	ON	ON	ON	ON	31

- **Communication baud rate setting**

※ Table 1: Communication baud rate setting

SW7	SW6	Baud rate /distance（m）
ON	ON	125 kbit/s / 500（m）（default）
ON	OFF	250kbit/s / 250（m）
OFF	ON	500 kbit/s / 100（m）
OFF	OFF	1Mbit/s / 25（m）

※ Table 2: Custom baud rate settings

Custom communication baud rate register	Set value	Baud rate /distance（m）
2009h	00	125 kbit/s / 500（m）
	01	100 kbit/s / 800（m）
	02	50 kbit/s / 1000（m）
	03	25 kbit/s / 1500（m）

Note：

- When the communication baud rate in the above table can not meet the usage requirements, the baud rate can be customized by the host computer. In this condition, SW6 and SW7 are all turned ON. The default baud rate is 125Kbit/s；
- Table 2 listed the longest distance of corresponding communication baud rate theoretically.

- **Terminal resistor setting**

This bit can be used to select whether the communication 120 termination resistor is effective, which is depended on the application. Under normal circumstances, only the master and the last slave need to connect 120Ω termination resistor.

As shown in the following table:

SW8	120 termination resistor selection bit
OFF	Not effective
ON	Effective

4.5 CAN communication port

The CAN protocol describes the way that information is communicated between devices. The CAN layer is defined in the same way as the open system interconnect OSI model. Each layer communicates with the same layer on another device. The actual communication takes place on adjacent two layers of each device, and the equipment is only interconnected through the physical layer of physical medium. The CAN protocol defines the the data link layer and the physical layer of the two lowest layers. CAN bus physical layer is not strictly defined, so it can use a variety of physical media such as twisted paired wire and fiber, etc. The most commonly used is twisted pair signal, it use differential voltage transmission, the two signal lines are called CAN_H and CAN_L. Two lines are 2.5V in static status, which is expressed as logical 1, or be called as hidden bit. If CAN_H level is higher than CAN_L, it is logic 0, or be called as show bit, and the voltage is usually CAN_H = 3.5V, CAN_L = 1.5V, show bit has priority during competition.

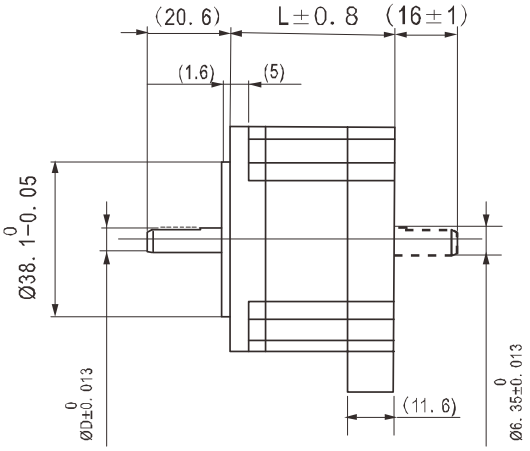
YKD2405PC drive provides two CAN bus communication port side by side, communication port using standard RJ45 socket. RJ45 socket has 8 pins. Pins 1 and pin 2 are for CANH, CANL communication line, pin 5 is common ground, other pins are not used. Pay attention to the use of shielded twisted pair communication cable, and make sure of well ground, to guarantee steady communication. For details, please refer to chapter 4.2.5 CAN bus port.

5 Applied motor

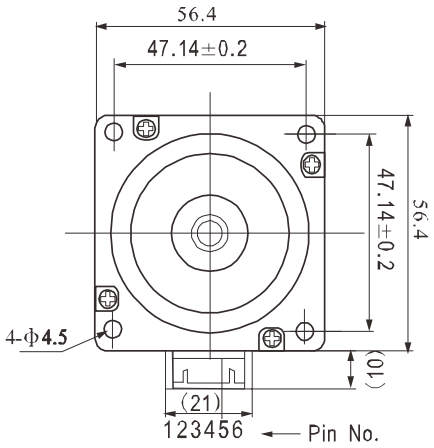
YKD2405PC standardard stepper motor model are YK57XN55-3506A, YK57XN78-3506A, YK57XN78-4208A, YK57XQ56-833A, YK57XQ76-833A and YK57XQ76-4008A , all of them are 57mm (NEMA 23) 4 line motor.

5.1 Motor dimension

- **57mm 2 phase stepper motor（unit: mm）**



Model	Shaft Diamerter（mm）	Shaft Connect Type（mm）	Shaft Length L1(mm)
YK57XN55-3506A	6.35	Flat 0.5x15	20.6
YK57XN78-3506A	6.35	Flat 0.5x15	20.6
YK57XN78-4208A	8	Flat 0.5x15	20.6
YK57XQ56-833A	8	Flat 0.5x25	33.0
YK57XQ76-833A	8	Flat 0.5x25	33.0
YK57XQ76-4008A	8	Flat 0.5x15	20.6

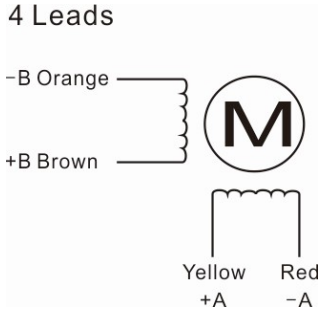
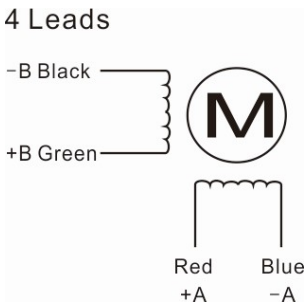


5.2 Technical Spec

Model	Step angle (°)	Voltege (v)	Motor length (mm)	Holding torque (N.m)	Rated current (A/phase)	Phase resistance (Ω)	Phase inductance (mH)	Rotor inertia (g.cm)	Motor weight (kg)	Motor line
YK57XN55-3506A	1.8	1.9	54.5	1.4	3.0	0.55	2.0	245	0.71	4
YK57XN78-3506A		3.0	77.5	2.2	3.0	0.85	3.3	470	1.11	4
YK57XN78-4208A		2.5	77.5	2.2	4.2	0.60	2.2	470	1.11	4
YK57XQ56-833A		1.6	55	1.2	4.0	0.40	1.6	280	0.7	4
YK57XQ76-833A		2.0	76	2.0	4.0	0.40	1.8	480	1.0	4
YK57XQ76-4008A		2.15	78	2.2	4.0	0.43	1.8	480	1.0	4

5.3 Motor wiring diagram

4 line motor（cable length 400mm）

YK57XN55-3506A YK57XN78-3506A	YK57XN78-4208A YK57XQ76-4008A YK57XQ56-833A YK57XQ76-833A
	

Note：

- The motor characteristic data and technical data are all measured with the drive. The test voltage is 24VDC.
- 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.
- When the motor and the drive are connected, please do not connect with wrong phase.

6 CANopen communication protocol

6.1 CANopen protocol overview

6.1.1 CANbus and CANopen

CAN is the abbreviation of Controller Area Network, that is, the controller local area network. Created by the German BOSCH company for the car monitoring and control, the application of CAN is no longer limited to the automotive industry, and also to the process industry, machinery industry, robotics, CNC machine tools, medical equipment and sensors and other fields.

Compared to other bus type, CAN Bus has the following features:

- Multi unints control: when the bus is idle, all units can start sending messages. When multiple units begin sending at the same time, high-priority ID Unit can obtaine the right to send message.
- Communication speed: According to the size of the entire network, you can set the appropriate communication speed, CAN bus support up to 1Mbit/s communication speed.
- Communication verification: CAN protocol using CRC, and can provide the corresponding error handling function to ensure the reliability of data communications.
- Error detection, notification and recovery: All units can detect errors, and the unit that detected the error will immediately informs all other units at the same time. At the same time, CAN bus can judge the type of error, when a continuous data error occurs on the bus, the unit which cause the fault can be isolated from the bus.

The CAN bus communication interface defined the physical and data link layer functions of the CAN protocol, but it does not define the application layer. It is not complete and requires a high level protocol to define how to use the 11/29 bit identifier COB-ID and 8 bytes of data in the CAN message, therefore, YKD2405PC introduced CANopen communication protocol.

The CANopen protocol is one of the standards defined by CAN-in-Automation (CiA) and has been widely recognized shortly after its release. Especially in Europe, the CANopen protocol is considered to be a leading position in CAN-based industrial systems.

The CANopen protocol consists of a series of sub-protocols, which are divided into communication sub-protocols and device sub-protocols. The communication sub-protocol presents the concept of the object dictionary and defines the objects and parameters of the communication sub-protocol area in the object dictionary. Each CANopen device must adhere to the communication sub-protocol at least, and on the basis of the communication

sub-protocol, the device sub-protocol is expanded according to the field of different industry or equipment applications. CiA301 is the most basic communication sub-protocol, which regulates the CANopen network framework and defines the communication and behavioral specifications between different CANopen devices. The YKD2405PC supports the CiA 301 communication sub-protocol and the CiA 402 device sub-protocol for the drive.

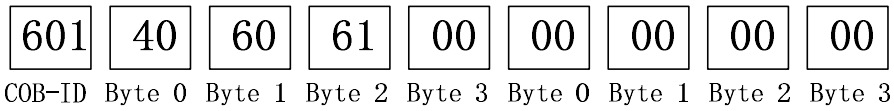
6.1.2 CANopen functional description

- **Object dictionary**

The object dictionary (OD: Object Dictionary) is the core concept of CANopen, and every CANopen device in the network has an object dictionary. An object dictionary is a collection of ordered data objects that describe all communication and device parameters for the device and determine the position in object dictionary by a 16-bit index and an 8-bit subindex.

Message format

As an application layer protocol for the CAN bus, the CANopen protocol mainly defines the arbitration field (11 bits) and the data field (up to 8 bytes) in the CAN message.



Among them, in the CANopen protocol, the 11-bit arbitration bits are divided into the upper 4-bit function code（Function Code）and the lower 7-bit node address (Node-ID), called COB-ID (Communication Object Identifier). The structure of the CANopen identifier is shown in the following table. The node address ranges from 1 to 127.

※ CANopen identifier format

CANopen predefined master / slave the connect set										
10	9	8	7	6	5	4	3	2	1	0
Function Code				Node-ID						

YKD2405PC supports the following types of CANopen messages:

- PDO（Process Data Object）messages
- SDO（Service Data Object）messages
- NMT（Network Management Object）messages
- SYNC（Synchronisation Object）messages
- EMCY（Emergency Object）messages

The following table shows the function codes of the various messages predefined in the communication sub-protocol CiA301 and the corresponding COB-ID.

※ The function code of the communications objects and COB-ID

Object	Function Code	COB-ID
NMT	0000	0h
SYNC	0001	80h
PDO1（TX）	0011	181h-lFFh
PDO1（RX）	0100	201h-27Fh
PDO2（TX）	0101	281h-2FFh
PDO2（RX）	0110	301h-37Fh
PDO3（TX）	0111	381h-3FFh
PDO3（RX）	1000	401h-47Fh
PDO4（TX）	1001	481h-4FFh
PDO4（RX）	1010	501h-57Fh
SDO（TX）	1011	581h-5FFh

SDO（RX）	1100	601h-67Fh
Heart Beat	1110	701h-77Fh

- **Process data objects（PDO）**

SDO protocol is used for the operation of the object dictionary, processing low real-time requirement data. High real-time requirement data is usually transmitted through the PDO.

The PDO communication method is based on the Producer / Consumer model, where data is sent from one device (producer) to another device (consumer) or many other devices (broadcast mode) and it is transmitted without acknowledgment mode, the data transfer is limited to 1 to 8 bytes. The CANopen device completes reception or transmission by describing two parameters of the PDO: Communication Parameter and Mapping Parameter.

YKD2405PC supports 4 RPDO and 4 TPDO, and described the PDO communication port communication parameters and mapping parameters according to CiA 301 sub-protocol.

- **Service data objects (SDO)**

SDO messages are used to access the object dictionary of the device and configure the devices in the CANopen network. The SDO communication method is based on the client/server model, that is, the messages sent must be confirmed by the receiver. A visitor is called a client, and devices that object dictionary is accessed and responds to read and write request is called a server. The protocol specifies that read the value of the parameter in the object dictionary is called Upload, and change the value of the modified parameter is called Download.

YKD2405PC support fast SDO protocol and ordinary SDO protocol two transmission methods described in CiA301.

- **Network management object（NMT）**

NMT network management based on master / slave architecture, the master station can control the slave state machine through the NMT message. When the CANopen device is powered on or reset, the device first enters the Initialization state. After the program is initialized, the device will automatically send a Boot-Up message and then enter the Pre-Operational status automatically. After that, the slave switches different states according to the NMT messages sent from the master station.

- **Synchronization object（SYNC）**

The synchronization object (SYNC) provides a reference clock for the network to synchronize devices in the network. SYNC belongs to the producer / consumer communication relationship, the SYNC object is sent by a SYNC producer, and all other devices in the network can receive SYNC. Assume that the device in the network supports synchronous PDO function, then you can use SYNC to achieve multiple devices action at the same time. The COB-ID of the SYNC messages are 0x80, which has a high priority to

ensures normal transmission of SYNC. In addition, SYNC packets may not contain data to reduce the amount of data of SYNC messages.

- **Emergency object（EMCY）**

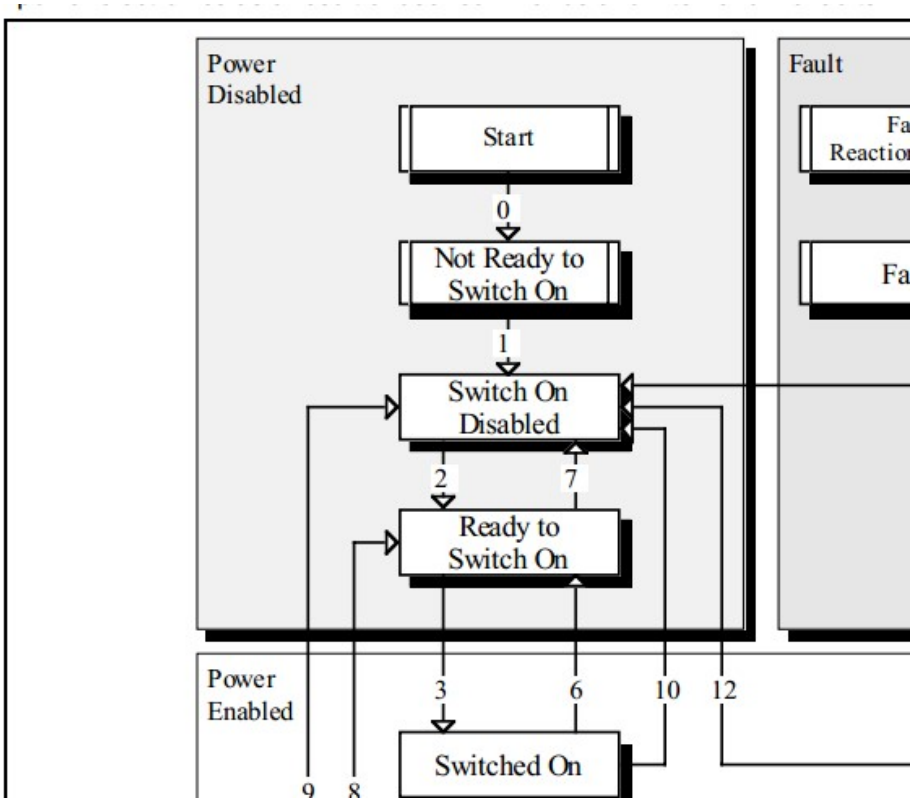
The device can report its own internal faults to the CANopen network via the emergency object (EMCY). EMCY belongs to the producer/consumer communication model, and all devices in the network can consume the message. EMCY messages occupy all 8 bytes of data. Among them, byte 0 and byte 1 are for the error code, the error code corresponds to a variety of error types appears in the device. Byte 2 is the error register, its value is stored in the object dictionary 1001h unit, and corresponds to the various types of malfunction that occured. The contents of byte 3 to byte 7 are manufacturer-defined error fields that can be a specific type of failure. Through the EMCY object, the master station can easily grasp the specific situation of the failure from the slave station.

6.2 Drive control protocol CiA 402

6.2.1 CiA402 state machine

The CiA402 protocol defines the standard state machine for motion control equipment, as well as various operating modes, and their definition in object dictionaries.

The state machine describes the state of the device and the possible drive control sequence. Each step state represents a specific internal or external behavior, and the status of the device also determines which commands can be received.



Drive state machine

※ Machine states corresponding to the following table:

State name	Description
Not Ready to Switch on	Device is powered on, the drive has been initialized, and performs an internal self-test, the brake is activated.
Switch on Disabled	CANopen communication has started, you can use SDO Communications services to set drive parameter
Ready to Switch on	Drive continue being set, motor no excitation
Switched on	The drive motor is ready and the output stage voltage on in this state will activate in the end, but the drive function can not be performed
Operation Enable	Drive motor is enabled, the drive is in normal operation, and the motor is controlled according to the control mode
Quick Stop Active	The quick stop function is activated, the drive function is activated, and the motor is started
Fault Reaction Active	The drive detects that an alarm has occurred and stops according to the setting method. The motor is still enabled
Fault	An error occurs, allows to change the drive parameters

The drive state machine is controlled by bits 0 to bit 3 and bit 7 of the control word (object 6040h), as described in the following table:

※ Control word switch state

Command	Control word					Switch state
	Bit7	Bit3	Bit2	Bit1	Bit0	
Shutdown	0	X	1	1	0	2,6,8
Switchon	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3+4
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable Operation	0	0	1	1	1	5
Enable Operation	0	1	1	1	1	4,16
Fault reset	0→1	X	X	X	X	15

Each state in the state machine can be displayed by bit0 ~ bit3, bit5, bit6 of the status word (object 6041h). The details are as follows:

※ Status word switch state

Status word						Status
Bit6	Bit5	Bit3	Bit2	Bit1	Bit0	
0	X	0	0	0	0	Not ready to switch on
1	X	0	0	0	0	Switch on disabled
0	1	0	0	0	1	Ready to switch on
0	1	0	0	1	1	Switched on
0	1	0	1	1	1	Operation enabled
0	0	0	1	1	1	Quick stop active
0	X	1	1	1	1	Fault reaction active
0	X	1	0	0	0	Fault

6.2.2 Control word and status word

The start and stop command and status descriptions are mainly implemented via the control word 6040h and the status word 6041h. Therefore, proficient use of the control word and status word is necessary. The following table briefly describes the definitions of the control word and the status word.

Control word	Command	Function description
6040h	00	Initialization step 0: At this moment, the state of 6041 low 4 bits is 0000, the motor is released;
	06	Initialization step 1: At this moment, the state of low 4 bits of 6041 is 0001, the motor is released;
	07	Initialization Step 2: At this moment, the status of the lower 4 bits of 6041 is 0011, the motor is enabled;
	0F	Initialization Step 3: At this moment, the status of the lower 4 bits of 6041 is 0111, the motor is enabled;
	0F	Start command in speed mode (6061 = 3)
	0F->1F	Start command in homing mode (6061 = 6)
		Absolute motion start command in position mode (6061 = 1)
	4F->5F	Relative motion start command in position mode (6061 = 1)
Status word	**Bit definition**	**Function description**
6041h	Bit0~Bit3	6040=0：xxxx xxxx x1xx 0000 6040=6：xxxx xxxx x1xx 0001 6040=7：xxxx xxxx x1xx 0011 6040=F：xxxx xxxx x1xx 0111
	Bit7	0: Drive is normal;
		1: Drive alarm;
	Bit8	0: Homing not completed;
		0: Homing completed;
	Bit11	0: indicates that the state of Bit4 in 6040h is 0 at this moment;

		1: indicates that the state of Bit4 in 6040h is 1 at this moment;
	Bit13	0: motor release
		1: Motor enable;
	Bit14	0: Motor stopped
		1: the motor is running;
	Bit15	0: Movement in position mode is not finished;
		1: Movement in position mode is finished;

Example: The driver is initialized after power-on, and then enters into normal working state after initialization. This operation is usually performed after power-on.

Master	Slave	Slave status word
00：01 00	NMT initialization	NMT initialization
601：2B 40 60 00 00 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0000
601：2B 40 60 00 06 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0001
601：2B 40 60 00 07 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0011
601：2B 40 60 00 0F 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0111

6.2.3 Work mode

CANopen sets the drive operating mode with the object 6060h (Mode of Operation) and reflects the current operating mode status of the drive via the object 6061h (Mode of operation display). YKD2405PC currently supports 3 operating modes: Position Mode, Speed Mode, and Homing Mode.

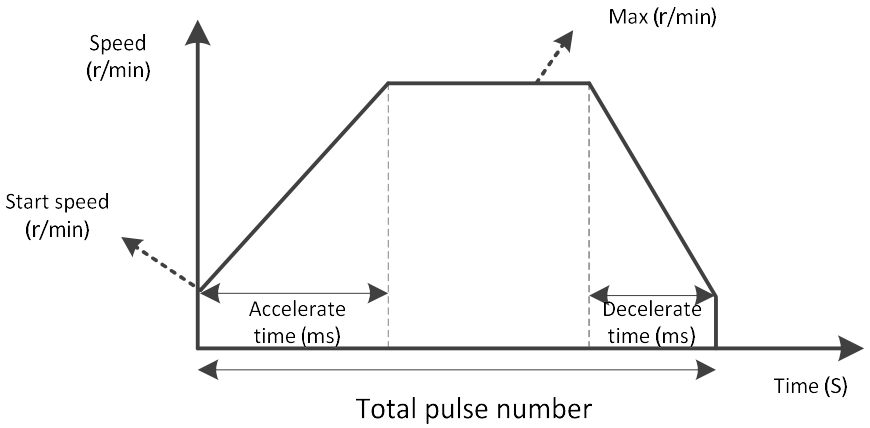
※ Drive working mode

Index	Sub index	Name	Type	Attr.	PDO map	Parameter range	Default value
6060h	00	Work mode	I8	RW	YES	0: Undefined 1: Position Mode 3: Speed Mode 6: Homing Mode	0

6.2.4 Position mode

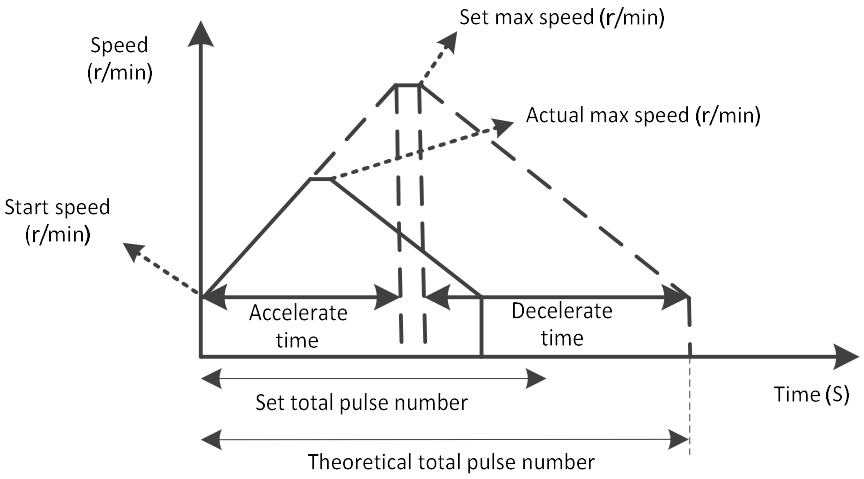
- **Process description**

The position mode is realized by trapezoidal acceleration and deceleration curve. The user can set the starting speed (address 200E0010h), the maximum speed (address 60810010h), the acceleration time (address 60830010h), the deceleration time (address 60840010h), the total pulse number (address 607A0020h) parameters by bus to achieve precise position control. The trapezoidal acceleration/deceleration curve is shown as follow:



Position mode acceleration and deceleration curve

When the total number of pulses set by the user is too little, the motor may need to be decelerated before accelerating to the maximum speed (not reach the set maximum speed in actual operation). The speed curve is shown as following figure. The solid line in the figure shows the actual running curve of the motor, and the dotted line is the curve to be accelerated to the set maximum speed. The total number of theoretical pulses is the minimum total number of pulses calculated according to the user setting parameters (start speed, maximum speed, acceleration time, deceleration time). When the total number of pulses set by the user is less than the total number of theoretical pulses, the motor will run as the solid line shown as following figure.



Position mode acceleration/deceleration curve

(not accelerated to the set max speed)

※ **Dictionary content of related objects:**

Index	Sub index	Name	Type	Atrr.	Set Range	Setting
6060h	00	Working mode	I8	RW	0,1,3,6	1
200Eh	00	Starting speed	U16	RW	0-300r/min	10 r/min
607Ah	00	Total number of pulses	I32	RW	-1000000~1000000	5000
6081h	00	Maximum speed	U16	RW	0-3000r/min	60 r/min
6083h	00	Acceleration time	U16	RW	0-2000ms	100ms
6084h	00	Deceleration time	U16	RW	0-2000ms	100ms

- **Control word and status word**

The control word in position mode is controlled by bit4 ~ bit6, bit8:

Bytes	Name	Value	Description
Bit4	New set-point	0	No assuming target position
		1	Assuming target position
Bit5	Change set immediately	0	Complete current position and start next position
		1	Stop current position and start next position
Bit6	abs/rel	0	Target position is an absolute value
		1	Target position is an relative value
Bit8	Halt	0	Terminate present position
		1	Deceleration to stop by setting the deceleration rete

Note：

- According to the above table, the absolute position motion command control word is sent as 0x0F-> 0x1F, relative position motion command control word is sent as 0x4F-> 0x5F;

※ Status word bit10, bit15 shows the drive status:

Bytes	Name	Value	Description
Bit10	Targetreached	0	Halt=0：The target location is not reached; Halt=1：Shaft deceleration;
		1	Halt=0：The target location is reached;

			Halt=1：Shaft speed is 0;
Bit15	Pend	0	Position movement not completed
		1	Position movement completed

- **Example**

For example, the motor according to the parameters (starting speed 10r / min, acceleration time 100ms, deceleration time 100ms, maximum speed 60r / min, the total number of pulses 5000) to realize relative movement.

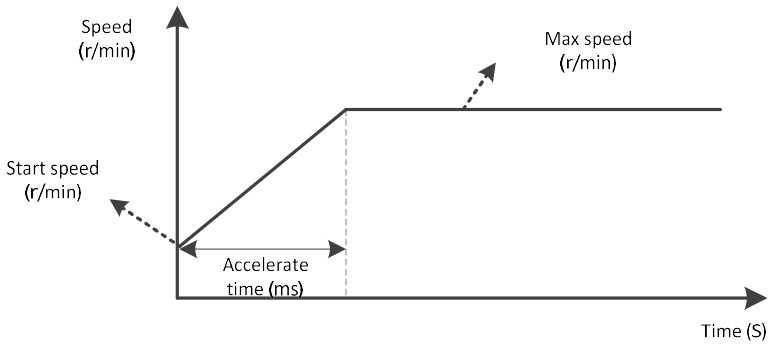
※ Assuming that the drive slave station number is 1, the CANopen control command is as follows:

Master	Slave	Function	Description
00：01 00	(Depending on PDO mapping)	Initialize the NMT state machine	Initialize the NMT state machine
601：2B 40 60 00 00 00 00 00	581：60 40 60 00 00 00 00 00	Initialize the server state machine	Initialize the server state machine
601：2B 0E 20 00 05 00 00 00	581：60 0E 20 00 00 00 00 00	Sets the starting speed 5r/min	Sets the starting speed
601：2B 83 60 00 64 00 00 00	581：60 83 60 00 00 00 00 00	Set acceleration time 100ms	Set acceleration time
601：2B 84 60 00 64 00 00 00	581：60 84 60 00 00 00 00 00	Set the deceleration time 100ms	Set the deceleration time
601：2B 81 60 00 3C 00 00 00	581：60 81 60 00 00 00 00 00	Set the maximum speed 60r/min	Set the maximum speed
601：23 7A 60 00 88 13 00 00	581：60 7A 60 00 00 00 00 00	Set the number of pulses 5000	Set the number of pulses
601：2F 60 60 00 01 00 00 00	581：60 60 60 00 00 00 00 00	Switching working mode	Position mode
601：2B 40 60 00 06 00 00 00	581：60 40 60 00 00 00 00 00	Switch the drive status machine (Reference 402 Protocol)	Switch the drive status machine
601：2B 40 60 00 07 00 00 00	581：60 40 60 00 00 00 00 00		
601：2B 40 60 00 0F 00 00 00	581：60 40 60 00 00 00 00 00		
601：2B 40 60 00 4F 00 00 00	581：60 40 60 00 00 00 00 00	Send relative movement command 1	Send relative movement command
601：2B 40 60 00 5F 00 00 00	581：60 40 60 00 00 00 00 00	Send relative movement command 2	

6.2.5 Speed mode

- **Process description**

The acceleration curve of the speed mode is shown as follow. Unlike the position mode, the speed mode only requires three parameters of the initial speed (address 200E0010h), the maximum speed (address 60810010h), and the acceleration time (address 60830010h). The motor accelerate to the maximum speed according to the three parameters, then running in constant speed according to the set maximum speed.



Speed mode accelerate curve

※ Dictionary content of related objects:

Index	Sub index	Name	Type	Atrr.	Set Range	Setting
6060h	00	Work mode	I8	RW	0,1,3,6	3
60FFh	00	Maximum speed	I16	RW	-3000-3000r/min	60r/min
6083h	00	Acceleration time	U16	RW	0-2000ms	100ms
6084h	00	Deceleration time	U16	RW	0-2000ms	100ms

- **Control and status word**

※ The control word in speed mode is controlled by bit 8:

Bytes	Name	Value	Description
Bit8	Halt	0	Execute movement
		1	Stop movement

※ Status word bit10, bit12 shows the drive status:

Bytes	Name	Value	Description
Bit10	Targetreached	0	Halt=0：The target position is not reached; Halt=1：Shaft deceleration;
		1	Halt=0：Target position reached; Halt=1：Shaft speed is 0;
Bit12	Speed	0	The speed is not 0;

		1	The speed is 0;

- **Example**

For example, the motor rotate according to the parameters (starting speed 10r / min, acceleration time 100ms, deceleration time 100ms, maximum speed 60r / min).

※ Assuming that the drive slave station number is 1, the CANopen control command is as follows:

Master	Slave	Function	Description
00：01 00	(Depending on PDO mapping)	Initialize the NMT state machine	Initialize the NMT state machine
601：2B 40 60 00 00 00 00 00	581：60 40 60 00 00 00 00 00	Initialize the server state machine	Initialize the server state machine
601：2B 0E 20 00 05 00 00 00	581：60 0E 20 00 00 00 00 00	Sets the starting speed 5r/min	Sets the starting speed
601：2B 83 60 00 64 00 00 00	581：60 83 60 00 00 00 00 00	Set acceleration time 100ms	Set acceleration time
601：2B 84 60 00 64 00 00 00	581：60 84 60 00 00 00 00 00	Set the deceleration time 100ms	Set the deceleration time
601：2B 81 60 00 3C 00 00 00	581：60 81 60 00 00 00 00 00	Set the maximum speed 60r/min	Set the maximum speed
601：2F 60 60 00 03 00 00 00	581：60 60 60 00 00 00 00 00	Switching working mode	Speed mode
601：2B 40 60 00 06 00 00 00	581：60 40 60 00 00 00 00 00	Switch the drive status machine (Reference 402 Protocol)	Switch the drive status machine
601：2B 40 60 00 07 00 00 00	581：60 40 60 00 00 00 00 00		
601：2B 40 60 00 0F 00 00 00	581：60 40 60 00 00 00 00 00		

6.2.6 Homing mode

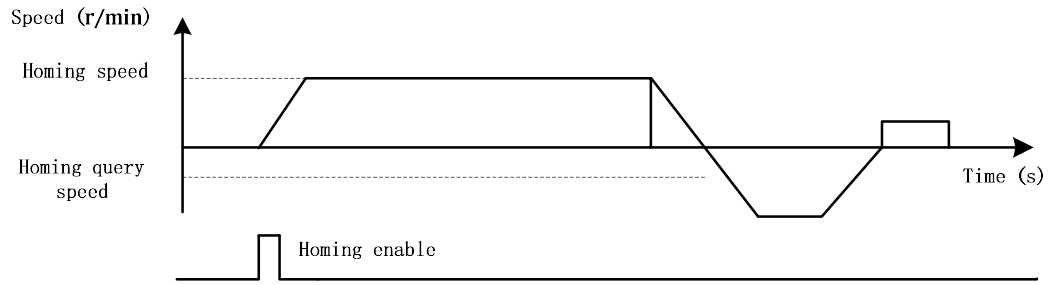
- **Work process description**

YKD2405PC currently supports two kinds of homing mode, and it need to use the limit signal or the origin signal in the homing process. When using the homing function, user needs to choose input terminal as limit signal or origin signal according to the homing mode selection. At the same time, the homing function can be triggered by external I/O or by communication command. When using external I/O trigger, please enable any input terminal function as "Homing Enable".

a) Position limit + home mode

The driver starts the motion with "Homing speed (60990110h)" and "Homing

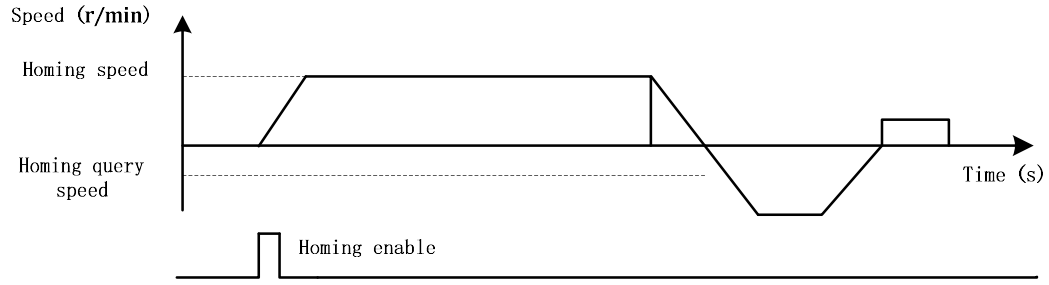
acceleration/deceleration time (609A0010h)" after receiving the "Homing Enable " command. When it encounters the rising edge of the homing signal, it will decelerate to stop according to the speed of "Homing acceleration/deceleration time (609A0010h)", and reverse after stopping. Then the drive stops again when encountering the falling edge of the origin signal. After that, the drive will seek for home at the speed of "Homing query speed (60990210h)" . When receiving the rising edge of the origin signal, the drive stops the movement and finishes the process of homing. If the "Homing compensation value (607C0010h)" in the function code is not zero, the drive will rotate the motor according to the compensation value. If there is no position limit requirement, the limit signal can not be connected.



Position limit + home workflow

b) Position limit mode + compensation mode

The driver starts the motion with "Homing speed (60990110h)" and "Homing acceleration/deceleration time (609A0010h)" after receiving the "Homing Enable" command. When it encounters the rising edge of the position limit signal, it will decelerate to stop according to the speed of "Homing acceleration/ deceleration time (609A0010h)", 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 (60990210h)" slowly. When receiving the rising edge of the position limit signal, the drive stops the movement and finishes the process of homing. If the "Homing compensation value (607C0010h)" in the function code is not zero, the drive will rotate the motor according to the compensation value.



Position limit mode + compensation mode workflow

※ Related object dictionary content

Index	Sub index	Name	Type	Attr.	Range	PDO Mapping	Set
6060h	00	Operation mode	I8	RW	0,1,3,6	YES	6
6098h	00	Homing mode	U8	RW	0~3	NO	0
6099h	00	Number of subindexes	U16	RO	-	NO	2
	01	Homing speed	U16	RW	5-3000r/min	NO	120 r/min
	02	Homing query speed	U16	RW	5-300r/min	NO	60 r/min
609Ah	00	Homing acceleration/ deceleration time	U16	RW	0-2000ms	NO	100ms
607Ch	00	Homing compensation value	I32	RW		NO	0

- **Control word and status word**

※ The control word in the homing mode is controlled by bit4 and bit8

Bytes	Name	Value	Description
Bit4	Homing operationstart	0	Homing mode is inactive
		0→1	Start homing mode
		1	Homing mode is active
		1→0	Stop homing mode
Bit8	Halt	0	Execute bit4 command
		1	Stop the axis by homing acceleration speed

Note： According to the above table, homing command control word is sent as 0x0F-> 0x1F.

※ Bit8, bit10 of the status word show the status of the drive

Bytes	Name	Value	Description
Bit8	Homingattained	0	Homing not completed
		1	Homing completed
Bit10	Targetreached	0	Halt=0：Homing position not reached； Halt=1：Axis deceleration；
		1	Halt=0：Homing position reached； Halt=1：Axis speed is 0；

- **Example**

Complete homing, select the forward position limit + origin mode for homing mode, homing speed 120r/min, homing query speed 60r/min, acceleration and deceleration time 100ms, the origin is not compensated.

※ Assuming the drive slave number is 1, the CANopen command control is described in the following table:

Master	Slave	Function	Description
00：01 00	(Depending on PDO mapping)	Initialize the NMT state machine	Initialize the NMT state machine
601：2B 40 60 00 00 00 00 00	581：60 40 60 00 00 00 00 00	Initialize servo state machine	Initialize servo state machine
601：2B 98 60 00 00 00 00 00	581：60 98 60 00 00 00 00 00	Set the homing mode 0	Set the homing mode
601：2B 99 60 00 78 00 00 00	581：60 99 60 00 00 00 00 00	Set homing speed 120r/min	Set homing speed
601：2B 99 60 01 3C 00 00 00	581：60 99 60 01 00 00 00 00	Set homing query speed 60r/min	Set homing query speed
601：2B 9A 60 00 64 00 00 00	581：60 9A 60 00 00 00 00 00	Set accelerate/deceleration time 100ms	Set accelerate/deceleration time
601：2F 60 60 00 06 00 00 00	581：60 60 60 00 00 00 00 00	Switching operation mode	Homing mode
601：2B 40 60 00 06 00 00 00	581：60 40 60 00 00 00 00 00	Switch drive state machine (Refer to 402 protocol)	Switch drive state machine
601：2B 40 60 00 07 00 00 00	581：60 40 60 00 00 00 00 00		
601：2B 40 60 00 0F 00 00 00	581：60 40 60 00 00 00 00 00		
601：2B 40 60 00 1F 00 00 00	581：60 40 60 00 00 00 00 00	Send homing motion command	Send homing motion command

7 Object dictionary

YKD2405PC bus stepper motor drive parameter register has three parts, respectively, CIA301 defined 1000h ~ 1FFFh registers, manufacturers custom 2000h ~ 2FFFh registers and CIA402 defined 6000h ~ 6FFFh registers.

1000h ~ 1FFFh registers are basic communication parameters related to CANopen defined by CIA301, including SDO, PDO and mapping registers;

2000h ~ 2FFFh registers are manufacturer's custom register content, including, such as microstep and current changes;

6000h ~ 6FFFh registers are the motion parameters related to motion control defined by CIA402, including operating mode registers such as position mode, speed mode and homing mode and related motion parameter registers.

Index	Sub index	Name	Description	Type	Attr.	PDO mapping	Default
CiA 301 basic communication parameter group							
1000h	00	Device type	This drive supports CIA301 and CIA402 protocol	U32	RO	NO	0x00040192
1001h	00	Error register	Drive current error status	U8	RO	NO	0
1003h	00	Number of subindexes	Number of subindexes	U8	RO	NO	4
	01~04	Error storage	Errors that caused an drive emergent message recently, support 5 error storage unit;	U32	RO	NO	0
1005h	00	Synchronous message COB identifier	Synchronous message COB identifier	U32	RW	NO	0x80
1009h	00	Hardware version	Hardware version	U16	RO	NO	-
100Ah	00	Software version	Software version	U16	RO	NO	-
1014h	00	EMNC emergency message COB	EMNC emergency message COB	U32	RW	NO	0x80
1017h	00	Producer heartbeat interval	Producer heart rate interval, unit ms	U16	RW/S	NO	0
1018h	00	Manufacturer information	Subindex	U8	RO	NO	5
	01	Vendor ID	Supplier ID	U32	RO	NO	0x0100
	02	Product Code	Supplier product code	U32	RO	NO	0x0001

1200h	00	Number of subindexes	Number of subindexes	U8	RO	NO	2
	01	COB-ID（slave receive）	COB-ID（slave receive）	U32	RO	NO	600h+Node-ID
	02	COB-ID（slave send）	COB-ID（slave send）	U32	RO	NO	580h+Node-ID
1400h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	RPDO0-COB-ID	Identifier COB-ID	U32	RO	NO	200+Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0
1401h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	RPDO1-COB-ID	Identifier COB-ID	U32	RO	NO	300+Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0
1402h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	RPDO2-COB-ID	Identifier COB-ID	U32	RO	NO	400+Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0
1403h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	RPDO3-COB-ID	Identifier COB-ID	U32	RO	NO	500+Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0
1600h	00	Number of subindexes	Number of subindexes	U8	RO	NO	1
	01	RPDO0-mapping 1	Mapping to 6040h register	U32	RW/S	NO	60400010h
	02	RPDO0-mapping	Not mapped	U32	RW/S	NO	-

		2					
	03	RPDO0-mapping 3	Not mapped	U32	RW/S	NO	-
	04	RPDO0-mapping 4	Not mapped	U32	RW/S	NO	-
1601h	00	Number of subindexes	Number of subindexes	U8	RO	NO	0
	01	RPDO1-mapping 1	Not mapped	U32	RW/S	NO	-
	02	RPDO1-mapping 2	Not mapped	U32	RW/S	NO	-
	03	RPDO1-mapping 3	Not mapped	U32	RW/S	NO	-
	04	RPDO1-mapping 4	Not mapped	U32	RW/S	NO	-
1602h	00	Number of subindexes	Number of subindexes	U8	RO	NO	0
	01	RPDO2-mapping 1	Not mapped	U32	RW/S	NO	-
	02	RPDO2-mapping 2	Not mapped	U32	RW/S	NO	-
	03	RPDO2-mapping 3	Not mapped	U32	RW/S	NO	-
	04	RPDO2-mapping 4	Not mapped	U32	RW/S	NO	-
1603h	00	Number of subindexes	Number of subindexes	U8	RO	NO	0
	01	RPDO3-mapping 1	Not mapped	U32	RW/S	NO	-
	02	RPDO3-mapping 2	Not mapped	U32	RW/S	NO	-
	03	RPDO3-mapping 3	Not mapped	U32	RW/S	NO	-
	04	RPDO3-mapping 4	Not mapped	U32	RW/S	NO	-
1800h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	TPDO0-COB-ID	Identifier COB-ID	U32	RO	NO	180+ Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0

1801h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	TPDO1-COB-ID	Identifier COB-ID	U32	RO	NO	280+ Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0
1802h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	TPDO2-COB-ID	Identifier COB-ID	U32	RO	NO	380+ Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0
1803h	00	Number of subindexes	Number of subindexes	U8	RO	NO	5
	01	TPDO3-COB-ID	Identifier COB-ID	U32	RO	NO	480+ Node-ID
	02	Transmission type	Transmission type	U8	RW/S	NO	FFh
	03	Prohibition of time	Prohibition of time	U16	RW/S	NO	0
	04	Reserve	Reserve	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW/S	NO	0
1A00h	00	Number of subindexes	Number of subindexes	U8	RO	NO	0
	01	TPDO0-mapping 1	Not mapped	U32	RW/S	NO	-
	02	TPDO0-mapping 2	Not mapped	U32	RW/S	NO	-
	03	TPDO0-mapping 3	Not mapped	U32	RW/S	NO	-
	04	TPDO0-mapping 4	Not mapped	U32	RW/S	NO	-
1A01h	00	Number of subindexes	Number of subindexes	U8	RO	NO	0
	01	TPDO1-mapping 1	Not mapped	U32	RW/S	NO	-
	02	TPDO1-mapping 2	Not mapped	U32	RW/S	NO	-
	03	TPDO1-mapping 3	Not mapped	U32	RW/S	NO	-
	04	TPDO1-mapping	Not mapped	U32	RW/S	NO	-

		4					
1A02h	00	Number of subindexes	Number of subindexes	U8	RO	NO	0
	01	TPDO2-mapping 1	Not mapped	U32	RW/S	NO	-
	02	TPDO2-mapping 2	Not mapped	U32	RW/S	NO	-
	03	TPDO2-mapping 3	Not mapped	U32	RW/S	NO	-
	04	TPDO2-mapping 4	Not mapped	U32	RW/S	NO	-
1A03h	00	Number of subindexes	Number of subindexes	U8	RO	NO	0
	01	TPDO3-mapping 1	Not mapped	U32	RW/S	NO	-
	02	TPDO3-mapping 2	Not mapped	U32	RW/S	NO	-
	03	TPDO3-mapping 3	Not mapped	U32	RW/S	NO	-
	04	TPDO3-mapping 4	Not mapped	U32	RW/S	NO	-
Manufacturers custom parameters							
2000h	00	Drive node number	Can be set by DIP switch and 0x2008 register	U16	RO	YES	-
2001h	00	Motor status register	Drive controls motor movement 0: Motor stopped 1: Motor running;	U16	RO	YES	0
2002h	00	Motor speed	Motor current speed	I16	RO	YES	0
2003h	00	Input signal status	10 input signal level status Bit0 ~ Bit7: X0 ~ X7 input level status; Bit8: DR input level status; Bit9: PU input level status;	U16	RO	YES	0
2004h	00	Output signal status	4 output signal level status Bit0 ~ Bit3: Y0 ~ Y3 output status;	U16	RO	YES	0
2005h	00	Current setting	Value - Root Mean Square (Peak) lock current 0—0.5A（0.7A）; 1—0.8A（1.1A）; 2—1.0A（1.4A）;	U16	RW/S	YES	6

			3—1.2A（1.7A）; 4—1.5A（2.1A）; 5—1.9A（2.7A）; 6—2.3 A（3.2A）; 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）;				
2006h	00	Microstep setting	Address—Microstep 0—200（Pu/rev）; 1—400 （Pu/rev）; 2—800 （Pu/rev）; 3—1600（Pu/rev）; 4—3200（Pu/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）;	U16	RW/S	YES	8
2007h	00	Lock current	0：half; 1：full;	U16	RW/S	YES	0
2008h	00	Custom drive node number	0~31：Undefined 32~127: Used when node number bigger than 31.	U16	RW/S	YES	0
2009h	00	Custom communication baud rate high bit	0：125 Kbit/s 1：100 Kbit/s 2：50 Kbit/s 3：25 Kbit/s	U16	RW/S	YES	0
200Ah	00	Position limit stop set	0：Normal stop; 1：Emergency stop; 2：Invalid;	U16	RW/S	YES	0
200Bh	00	Bus control mode / pulse direction (P/D) control mode selection	0: bus control; 1: External pulse / direction (P / D) control mode; 2: double pulse control mode;	U16	RW/S	YES	0
200Ch	00	Communication write function	0: Parameters with attribute RW / S are	U16	RW	YES	0

		code value updated to EEPROM	updated to EEPROM synchronously. 1: Not updated;				
200Eh	00	Start speed	The initial speed when movement begins Unit r/min; range 2-300r/min;	U16	RW	YES	5r/min
200Fh	00	Motor enable/release	0: Release 1: Enable	U16	RW	YES	0
2010h	00	Register parameter setting	0: Invalid 1: Restore to factory settings 2: Save all parameters of RW attribute to EEPROM;	U16	RW	YES	0
2011h	00	Fault reset command	0: Invalid 1: Fault reset	U16	RW	YES	0
2012h	00	Clear current position	Used to clear the current position when in absolute position mode 0: Invalid 1: Clear current position;	U16	RW	YES	0
2030h	00	Number of subindexes	Number of subindexes	U16	RO	NO	16
	01	Input terminal active level	Bit0：Input terminal X0 control bit； Bit1：Input terminal X1 control bit； Bit2：Input terminal X2 control bit； Bit3：Input terminal X3 control bit； Bit4：Input terminal X4 control bit； Bit5：Input terminal X5 control bit； Bit6：Input terminal X6 control bit； Bit7：Input terminal X7 control bit； Bit8：DR terminal control bit； Bit9：PU terminal control bit； Bit10~Bit15：Reserve； 0: default; 1: level reversal;	U16	RW/S	YES	0

			The drive default as input terminal level rising edge or high effective;				
	02	Input terminal X0 function choice	0：Undefined； 1：Homing signal； 2：Forward position limit signal； 3：Backward position limit signal； 4：Motor enable signal； 5：Motor releases signal； 6：Alarm clear signal； 7：Restore to factory setting signal； 8：Stop signal； 9：Emergent stop signal； 10：Position mode movement； 11：Speed mode movement； 12：JOG+ movement； 13：JOG- movement； 14：Homing enable signal； Note: When using external pulse control mode, please set the PU and DR functions to 0 to avoid unintended effects;	U16	RW/S	YES	0
	03	Input terminal X1 function choice		U16	RW/S	YES	0
	04	Input terminal X2 function choice		U16	RW/S	YES	0
	05	Input terminal X3 function choice		U16	RW/S	YES	0
	06	Input terminal X4 function choice		U16	RW/S	YES	0
	07	Input terminal X5 function choice		U16	RW/S	YES	0
	08	Input terminal X6 function choice		U16	RW/S	YES	0
	09	Input terminal X7 function choice		U16	RW/S	YES	0
	0A	Input terminal DR function choice		U16	RW/S	YES	0
	0B	Input terminal PU function choice		U16	RW/S	YES	0
	0C	Output terminal active level	Bit0：Output terminal Y0 control bit； Bit1：Output terminal Y1 control bit； Bit2：Output terminal Y2 control bit； Bit3：Output terminal Y3 control bit； 0: default; 1: level reversal; The drive default as input terminal level rising edge or high effective;	U16	RW/S	YES	0
	0D	Output terminal Y0 function choice	0：Undefined; 1：Alarm signal；	U16	RW/S	YES	0

	0E	Output terminal Y1 function choice	2: Brake signal； 3: Drive status signal； 4：Homing completion signal； 5: Position reached signal；	U16	RW/S	YES	0
	0F	Output terminal Y2 function choice		U16	RW/S	YES	0
	10	Output terminal Y3 function choice		U16	RW/S	YES	0
2040h	00	Current loop proportional coefficient	Factory default, don't need to change	U16	RW	YES	-
2041h	00	Current loop integral gain	Factory default, don't need to change	U16	RW/S	YES	-
2042h	00	High-speed proportional coefficient	Factory default, don't need to change	U16	RW/S	YES	-
2043h	00	High-speed integral coefficient	Factory default, don't need to change	U16	RW/S	YES	-
2044h	00	Lock current proportional coefficient	Factory default, don't need to change	U16	RW/S	YES	-
2045h	00	Lock current integral coefficient	Factory default, don't need to change	U16	RW/S	YES	-
204Bh	00	X0/X1 input filter time	Factory default, generally don't need to change	U16	RW/S	YES	-
204Ch	00	X2/X3 input filter time	Factory default, generally don't need to change	U16	RW/S	YES	-
204Dh	00	X4/X5 input filter time	Factory default, generally don't need to change	U16	RW/S	YES	-
204Eh	00	X6/X7 input filter time	Factory default, generally don't need to change	U16	RW/S	YES	-
CiA 402 parameter group							
603Fh	00	Drive fault code	The factory-defined drive error condition, which is the same with the low 16 bits of the 1003h register. 0000h: No error FF01h: Overcurrent FF02h: Over-voltage; FF03h: Undervoltage FF04h: EEPROM read and write error;	U16	RO	YES	0
6040h	00	Control word	Position mode: Absolute：0F->1F Position mode: Relative：4F->5F Speed: 0F	U16	RW	YES	0

			mode					
			Homing mode	0F->1F				
6041h	00	Status word	Bit7	0：Drive normal；	U16	RO	YES	0
				1：Drive alarm；				
			Bit8	0：Homing not completed；				
				1：Homing completed；				
			Bit11	0：6040-Bit4 is 0；				
				1：6040-Bit4 is 1；				
			Bit13	0：Motor enable；				
				1：Motor release；				
			Bit14	0：Motor stop；				
				1：Motro run；				
			Bit15	0：Position mode position not arrived；				
				1：Position mode position arrived；				
605Dh	00	Halt control register	Drive processing way after control word Halt command 0: Normal stop, maintain Operation Enabled state; 1: Emergency stop, maintain Operation Enabled state;		I16	RW	NO	0
6060h	00	Operation mode control register	0: Undefined 1: Position mode; 3: Speed mode 6: Homing mode;		I8	RW	YES	0
6061h	00	Operation mode status register	0: Undefined 1: Position mode; 3: Speed mode 6: Homing mode;		I8	RO	YES	0
6064h	00	Drive actual position register	Drive actual position, unit: pul；		I32	RW	YES	0
607Ah	00	Total number of pulses	Total number of pulses in position mode operation (including the total number of steps in three steps of acceleration, constant speed and deceleration). Range: -1000000 ~ 1000000;		I32	RW	YES	5000
6081h	00	Maximum speed	Maximum speed in **position mode** In low microstep setting, the maximum speed is		U16	RW	YES	120 r/min

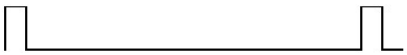
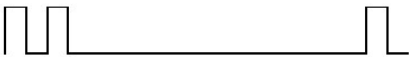
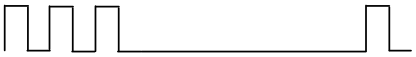
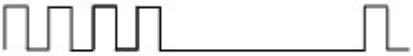
			3000r/min. In high microstep setting, the maximum output frequency is 200KHz Range: 5-3000r / min;				
6083h	00	Acceleration time	Acceleration time: Range：0-2000ms；	U16	RW	YES	100ms
6084h	00	Deceleration time	Deceleration time: Range：0-2000ms；	U16	RW	YES	100ms
60FFh	00	Max. speed	Maximum speed in **speed mode** In low microstep setting, the maximum speed is 3000r/min. In high microstep setting, the maximum output frequency is 200KHz Range: -3000-3000r / min;	I16	RW	YES	0
6098h	00	Homing mode	0: Forward position limit + homing mode; 1: Backward position limit + homing mode; 2: Forward position limit mode; 3: Backward position limit mode;	U8	RW	YES	0
6099h	00	Number of subindexes	Number of subindexes	U8	RO	NO	2
	01	Homing speed	Homing speed; Range: 5-3000r / min;	U16	RW	YES	120 r/min
	02	Homing query speed	Query speed after home is found； Range：5-3000r/min；	U16	RW	YES	60 r/min
609Ah	00	Homing acceleration/deceleration time	Acceleration/deceleration time； Range：30-2000ms	U16	RW	NO	100ms
607Ch	00	Homing compensation value	Homing compensation value； Range：-1000000~1000000	I32	RW	NO	0

Note：

- U16 for unsigned 16 bits; I16 for signed 16 bits; U32 for unsigned 32 bits; and I32 for signed 32 bits.

8 Alarm diagnosis

YKD2405PC drive has 4 kinds of alarm information, the alarm indicator flashing several times according to the alarm code, the specific alarm code and treatment as shown in the following table.

Alarm code	Alarm message	Indicator	Reset
Err1：0x01	Overcurrent or short circuit between phases		Lock motor / re-power to reset
Err2：0x02	Power supply voltage high		Lock motor / reset automatically
Err3：0x03	Power supply voltage low		Lock motor / reset automatically
Err4：0x04	EEPROM read/write error		Can be reset

9 Version histroy

Version	Descrition	Time	Remark
V1.0	First edition	2015.11.12	
V1.1	Revise register table	2016.2.15	
V1.2	Revise typo	2016.8.23	
V1.3	Add the size of the motor, specifications 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) 755-86142288 86142255

Fax：(86) 755-86142266

Web：www.yankong.com

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

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