Bus Type Stepper Motor Drive

SSD2505PC

User Manual V1.0

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Content

1 product overview

1.1 Product overview

SSD2505PC Bus type stepping motor drive added bus communication and single-axis controller functions to the traditional close-loop stepping drive. Bus communication use CAN bus interface, supports CANopen Protocol CiA301 and CiA402.

1.2 Product features

- 32 bit DSP control technology, low noise/vibration with excellent stability and low cost
- CAN-Bus, support standard CANopen protocol, mounting 127 devices the most
- Remote control and effectively slove loss of pulses in interference environment
- Users can set current, microstep and and lock current by bus; Control motor start-stop and the real-time status query
- Built-in single-axis controller and digital drive function, supporting position control, speed control and multi-position control mode
- Supports position control, speed control and multi-position mode
- 2 photoelectric isolation programmable high-speed differential

input terminal, controlled motor start and stop by external signals

- 5 programmable photoelectric isolation input terminal to receive external control signal, realize drive enable, start-stop, emergency stop, position limit and other functions
- 3 photoelectric isolation programmable output terminal, output drive status and control signals
- 16 constant-torque microstep settings, 40,000 microsteps the highest
- Smooth, accurate current control, less heat
- When step pulse stop over 200ms, automaticly halve motor current
- Excellent stability in low frequency, small microstep setting
- Input voltage range: DC24~50V
- Overvoltage, undervoltage, overcurrent protection

2 Installation dimension and terminal definitions

2.1 Installation dimension

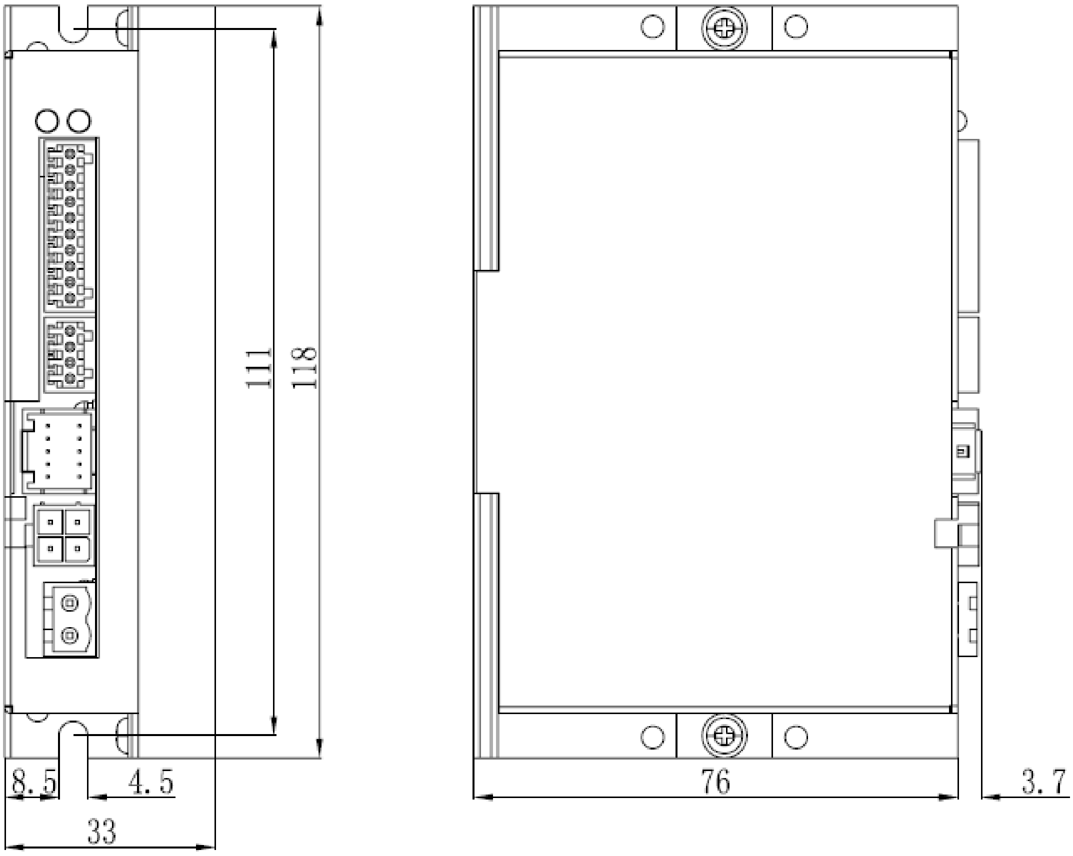

Diagram 2.1 SSD2505PC Installation dimension

2.2 Product part name

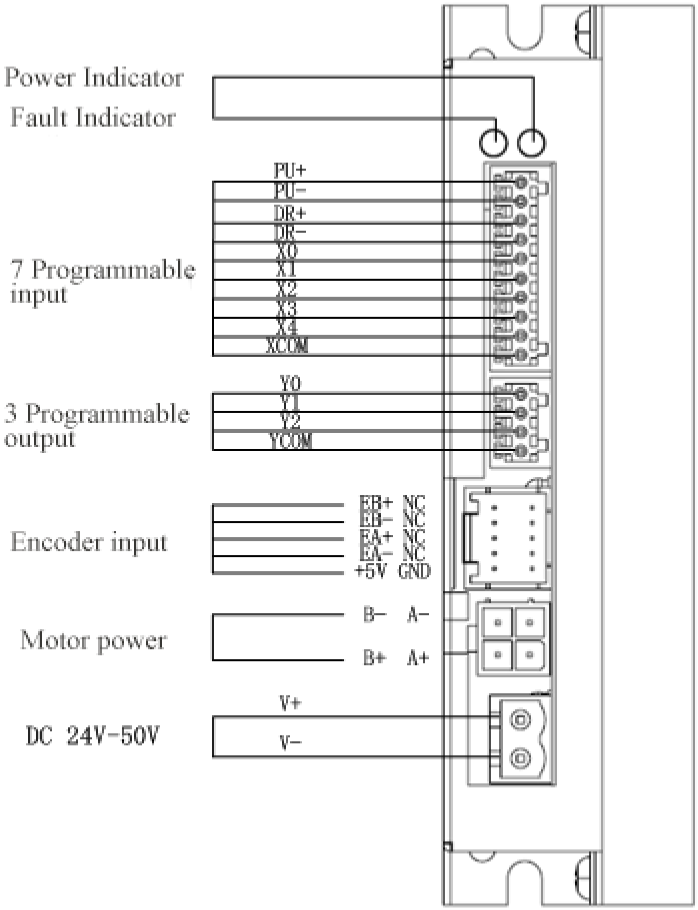

Diagram 2.2 SSD2505PC side terminal schematic

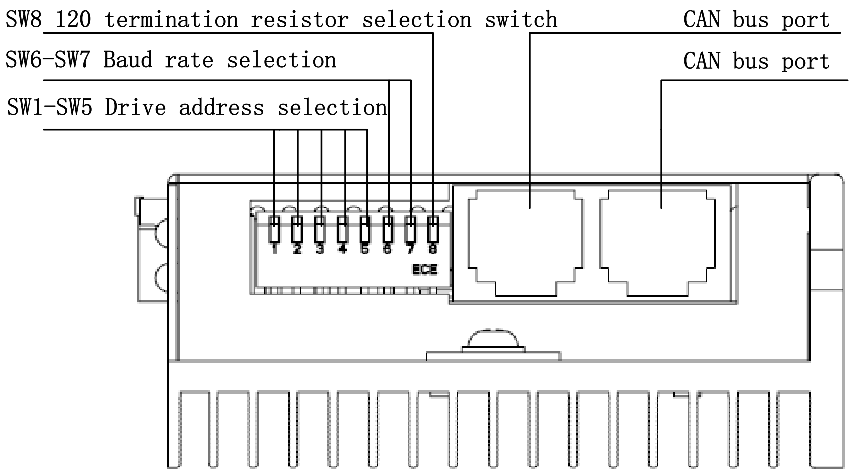

Diagram 2.3 SSD2505PC top terminal schematic

2.2.1 Drive terminal introduction

Table 2.1 Drive terminal

Terminal		SSD2505PC	Function
Switch		SW1-8	SW1-5： Drive address sets
			SW6-7：Baud rate setting
			SW8：120 termination resistance effective
CAN communications terminal		RJ45-2	CAN communication input/output terminal
PWR		Power indicator	Illuminate when power on
ALM		Alarm indicator	Over-current, cycle flashing of 1 time; Over-voltage, cycle flashing of 2 time; Under-voltage, cycle flashing of 3 time; EEPROM read-write errors, cycle flashing of 4 time; Tracking variance error, cycle flashing of 5 time;
IO 口	PU+	Differential input	High-speed digital signal input
	PU-		
	DR+		
	DR-		
	X0	Single-port input	Low-speed digital signal input interface
	X1		
	X2		
	X3		
	X4		
	XCOM	Single-port input common terminal	Compatible with common cathode and common anode
	Y0	Single-port output	Low-speed digital signal output
	Y1		
	Y2		
	YCOM	Single-port output common terminal	Compatible with common cathode and common anode
Power supply and motor terminal	A+	Motor terminal	Two phase stepper motor wiring
	A-		
	B+		
	B-		
	V+		Power supply input: DC24-50V
	V-		

Note: for the drive terminal actual locations, please see instructions on the drive shell;

2.2.2 Introduction of indicator

Table 2.2 Indicator definitions

Name	SSD2505PC	Function
LED1 green	ALM/PWR	Power indicator
LED2 red		Alarm indicator

2.3 Switch

2.3.1 Drive address setting

With CAN Bus, user can simultaneously control up to 32 SSD2505PC drive. Drive address is set by 5 switches. Address setting range is 0~31, but address 0 was reserved for system. When the drive address need to be set higher than 31, PC debugging software is required, and SW1~SW5 must set to OFF.

Table 2.3 Drive address setting

SW5	SW 4	SW 3	SW 2	SW 1	Address
OFF	OFF	OFF	OFF	OFF	User define
OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	ON	OFF	2
…… ……					
ON	ON	ON	ON	OFF	30
ON	ON	ON	ON	ON	31

2.3.2 Communication baud rate setting

Table 2.4 Communication baud rate setting

SW7	SW6	Baud rate / Communication distances（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 2.5 Customize baud rates

Customize communication baud rate register	Setting values	Baud rate / Communication distances（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 Table 2.4 can not meet the requirements, communication baud rate register can be customized through host computer, and SW6, SW7 should all turn to ON, the default baud rate is 125 Kbit/s;

Table 2.5 gives the longest theory communication distance for different communication baud rate.

2.3.3 Terminal resistors setting

The user can use this bit to select whether the communication end is connected with the 120 terminal resistor, which is determined according to application. Under normal circumstances, only main station and the last slave station need to be connected with 120Ω terminal resistor.

Table 2.6 120Ω terminal resistance select

SW8	120Ω terminal resistance select bit
OFF	Invalid
ON	Valid

2.4 Communications interface

CAN communication protocol mainly describes the information transmission between devices. The definition of CAN layer is the same with Open System Interconnection (OSI) model, each layer communicate with the same layer of another device, the actual communication occurs in adjacent two layers of each device, and the device only interconnect through the physical layer of physical media, CAN standard defines the model of data link layer of the bottom two layers and physical layer. CAN bus physical layer is not strictly defined, can use a variety of physical media such as twisted pair fiber, the most commonly used is twisted pair signal, the use of differential voltage transmission, two signal lines are called CAN_H and CAN_L, static are around 2.5V, at this time the state is logic 1, can also be called the hidden position. If CAN_H higher than CAN_L said logic 0, called the show position, this time the voltage is usually CAN_H = 3.5V and CAN_L = 1.5V, show position is priority in competition.

SSD2505PC driver provides side by side two CAN bus communication interface, communication interface using standard RJ45 socket. RJ45 socket shown in Figure 2.4 has 8 pins, including pins 1, 2 for CANH, CANL communication line, pin 5 for the common ground, other pins are not used, pay attention to the communication cable, please use shielded twisted pair , And grounding well to ensure communication stability.

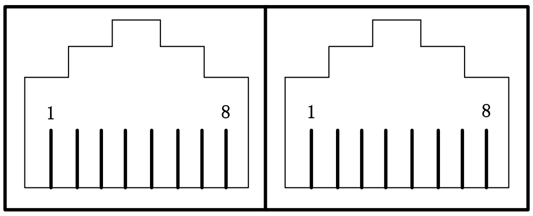

Figure 2.4 RJ45 Interface

Table 2.7 RJ45 PIN definition

PIN	Definition
1	CAN_H
2	CAN_L
3	NC
4	NC
5	CAN-GND
6	NC
7	NC
8	NC

2.5 I/O terminal definitions

Table 2.8 I/O terminal definitions

CN terminal pins	Signal name	Description	Function
1	PU+	PU differential input +	① (P/D mode) Pulse signal (only for high-speed differential PU terminal); ② (P/D mode) Direction signal(only for high-speed differential DR terminal); ③ 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 to factory setting signal; ⑩ Stop signal; ⑪ Emergency stop signal; ⑫ Position mode control; ⑬ Speed mode control; ⑭ JOG+ Point movement; ⑮ JOG- Point movement; ⑯ Enable signal for back to origin; ⑰ PT enable signal; ⑱ PIN0~4;
2	PU-	PU differential input -	
3	DR+	DRdifferential input +	
4	DR-	DRdifferential 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	Common terminal: compatible with common cathode/anode

11	YCOM	Output common terminal	connection mode
12	Y0	Y 0 terminal output	① Alarm signal; ② Motor running status signals; ③ Back to the origin finish signal; ④ Position reached signal; ⑤ PT Mode running signal; ⑥ POUT0~3；
13	Y1	Y 1 terminal output	
14	Y2	Y 2 terminal output	

Note: The drive can be controlled through the CANopen instruction or external pulse signals. In the external pulse-direction control mode, the input terminal signal: 6. Motor enable signal; 7. Motor release signal; 8. Alarm clear signal; 9 . Function code restore to factory signal is valid, other input signal is invalid. Output terminal signal: 1. Alarm signal; 4. Motor running status signal; 5. Position reached signal, other output signal is invalid;

Table 2.9 I/O terminal functional description

Description	**Function**
① Pulse signal (only for high-speed differential terminal)	External pulses signal, valid in external pulse-direction (P/D) or double-pulse control mode;
② Direction signal (only for high-speed differential terminal)	External direction signal, valid in external pulse-direction (P/D) or double-pulse control mode;
③ Origin signals	Connect with origin point sensor
④ Forward limit signal	Connect with position limit sensor
⑤ Backward limit signal	Connect with position limit sensor
⑥ Motor enable signal	Enable signal, the motor enter to locked state
⑦ Motor release signal	Release signal, the motor is released
⑧ Alarm clear signal	EEPROM Read/write error, communication error recovery; Over-voltage and under-voltage automatic recovery;
⑨ Function code restore to factory setting signal	Function code restore to factory settings
⑩ Stop signal	Motor decelerate stops;
⑪ Emergency stop signal	Motor stops immediately
⑫ Position mode control	Set motion according to function code 0x20~0x25;
⑬ Speed mode control	Set motion according to function code 0x20~0x23;
⑭ JOG+ Point movement	Set forward motion according to function code 0x20~0x23;

⑮ JOG- Point movement	Set backward motion according to function code 0x20~0x23;
⑯ Enable signal for back to origin	Trigger back to origin function;
⑰ PT enable signal	Trigger multi-position mode;
⑱ PIN0~PIN4	Multi-position mode input terminals, see Sections 4.3 for specification;
Input common terminal	Common terminal: compatible with common cathode/anode connect mode
Output common terminal	
① Alarm signal	Signal is valid when the drive is in alarm status;
② Back to the origin finish signal	Signal is valid after the completion of back to origin;
③ Motor running status signals	Signal is valid when the motor is in running status;
④ Position reached signal	Signal is valid when position reached in position mode;
⑤ PT Mode running signal;	Drive is in PT mode and running
⑥ POUT0-2	Multi-position mode output terminals, please refer to Sections 4.3 for specification;

3 Input and output terminal operation

3.1 Terminal hardware description

SSD2505PC drive provides a 5-channel opto-isolated programmable input interface, compatible with common cathode/anode connect, 2 differential signal input.

2 differential signal internal high-speed optocoupler isolation, can be configured for external pulse-direction or double pulse control, can also be configured for ordinary differential input terminals, the input signal voltage of 5V. When input signal voltage is higher than 5V, need to add a resistor to limit current (Such as the input signal is 24V, it is needed to add 2 ~ 3K resistor).

5 (X0-X4) programmable input signal and external control terminal through the optocoupler isolation, the driver is compatible with the common cathode/anode connection, which is shown in Figure 3.1. In order to ensure the reliability of the drive internal optocoupler conduction, requiring the controller to provide the drive with current at least 10mA. The drive has been integrated into the internal optocoupler current limiting resistor, the input signal voltage is 24V, the electrical wiring diagram is as follows (when the common signal is higher than 24V, it is needed to string into a current limit resistor):

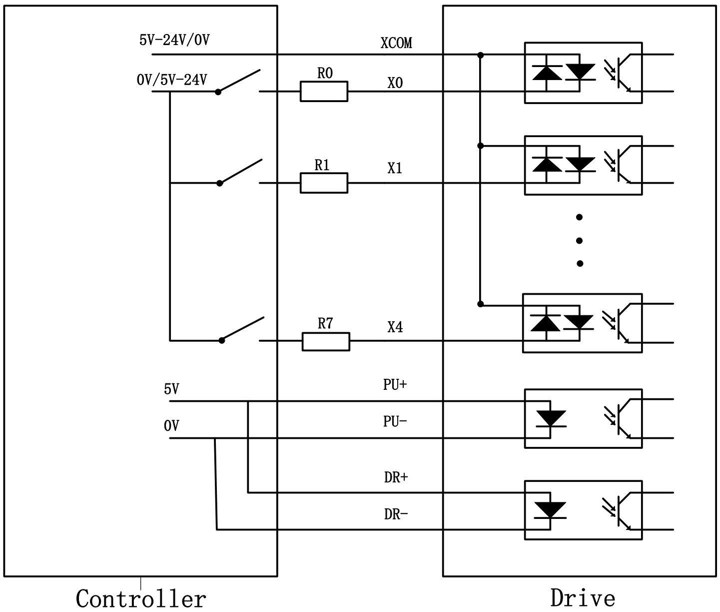

Figure 3.1 Input connection reference circuit

X0-X4 Input pulse width should be greater than 10ms, otherwise the drive may not respond normally. X0-X4 timing diagram figure 3.2 as below.

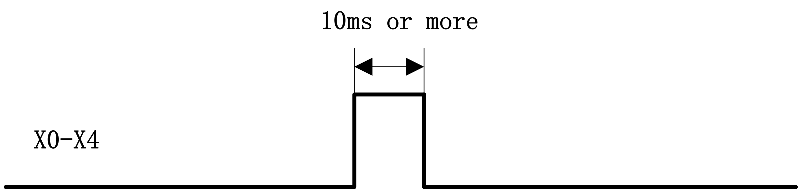

Figure 3.2 X0-X4 Timing diagram

After each power-up of the drive, X0-X4 defaults to be unspecified state, and the input signal is invalid. The user can configure the X0-X4 input function via bus.

SSD2505PC driver provides three optocoupler isolation output terminals, support NPN wiring and PNP wiring, support high/low voltage effective controller.

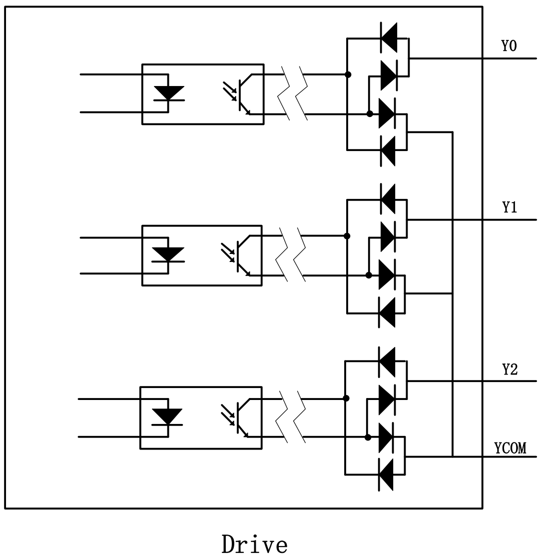

Figure 3.3 Y0-Y3 Output terminals internal circuit

3.2 Terminal function registers description

SSD2505PC driver can set I/O port function settings by CANopen bus protocol, and set terminal high/low voltage effective, register for control terminal function setting are shown in Table 3.1.

Table 3.1 Terminal function control registers

Index	Sub Index	Name	Introductions	Type	Property	Default
2030h	00	I/O terminal control register number	I/Oterminal control register number	U16	RO	16
	01	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 terminalX2 control bit; Bit5：Input terminal X3 control bit; Bit6：Input terminal X4 control bit; Bit7~Bit15：reserved; 0：Default; 1：Electric level reversal; The drive default input terminal level rising edge is valid;	U16	RW	0
	02	Input terminal PU function choose	0：Undefined; 1：Origin signals; 2：Forward limit signal; 3：Backward limit signal; 4：Motor enable signal; 5：Motor release signal; 6：Alarm clear signal; 7：Function code restore to factory setting signals; 8：Stop signal; 9：Emergency stop signal; 10：Position mode forward motion; 11：Position mode backward motion 12：Speed mode forward motion; 13：Speed mode backward motion; 14： Enable signal for back to origin; 15：PT Enable signal;	U16	RW	0
	03	Input terminal DR function choose		U16	RW	0
	04	Input terminal X0 function choose		U16	RW	0
	05	Input terminal X1 function choose		U16	RW	0
	06	Input terminal X2 function choose		U16	RW	0
	07	Input terminal X3 function choose		U16	RW	0
	08	Input terminal X4 function choose		U16	RW	0

			16：PIN0; 17：PIN1; 18：PIN2; 19：PIN3; 20：PIN4; Note: When using external pulse control mode, set the PU and DR functions to 0 to avoid accidental effects.			
	0C	Output terminal active level	Bit0：Output terminal Y0 control bit; Bit1：Output terminal Y1 control bit; Bit2：Output terminal Y2 control bit; 0：Default; 1：Electric level reversal; The drive default input terminal level rising edge is valid;	U16	RW	0
	0D	Output terminal Y0 function choose	0. Undefined; 1. Alarm signal; 2. The brake signal; 3. Drive status signals; 4. Back to the origin finished signals; 5. PT mode signal; 6. POUT0; 7. POUT1; 8. POUT2;	U16	RW	0
	0E	Output terminal Y1 function choose		U16	RW	0
	0F	Output terminal Y2 function choose		U16	RW	0

4 CANopen protocol

4.1CANopen protocol overview

4.1.1 CAN Bus 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 characteristics:

（1）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.

（2）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.

（3）Communication verification: CAN protocol using CRC, and can provide the corresponding error handling function to ensure the reliability of data communications.

（4）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, SSD2505PC 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 SSD2505PC supports the CiA 301 communication sub-protocol and the CiA 402 device sub-protocol for the drive.

4.1.2CANopen functional description

1. 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. The contents of the SSD2505PC object dictionary are described in detail in Appendix 1.

2. 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.

601	40	60	61	00	00	00	00	00
COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	Byte 1	Byte 2	Byte 3

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.

Table 4.1CANopen identifier format

CANopen predefined master / slave the connect set

10	9	8	7	6	5	4	3	2	1	0
Function Code				Node-ID						

SSD2505PC 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.

Table 4.2 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

3. 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.

SSD2505PC support fast SDO protocol and ordinary SDO protocol two transmission methods described in CiA301.

4. Process data objects（PDO）

SDO protocol are 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.

SSD2505PC supports 4 RPDO and 4 TPDO, and described the PDO communication port communication parameters and mapping parameters according to CiA 301 sub-protocol.

5. 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.

6. 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.

7. 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.

4.2 Drive control protocol CiA 402

4.2.1 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.

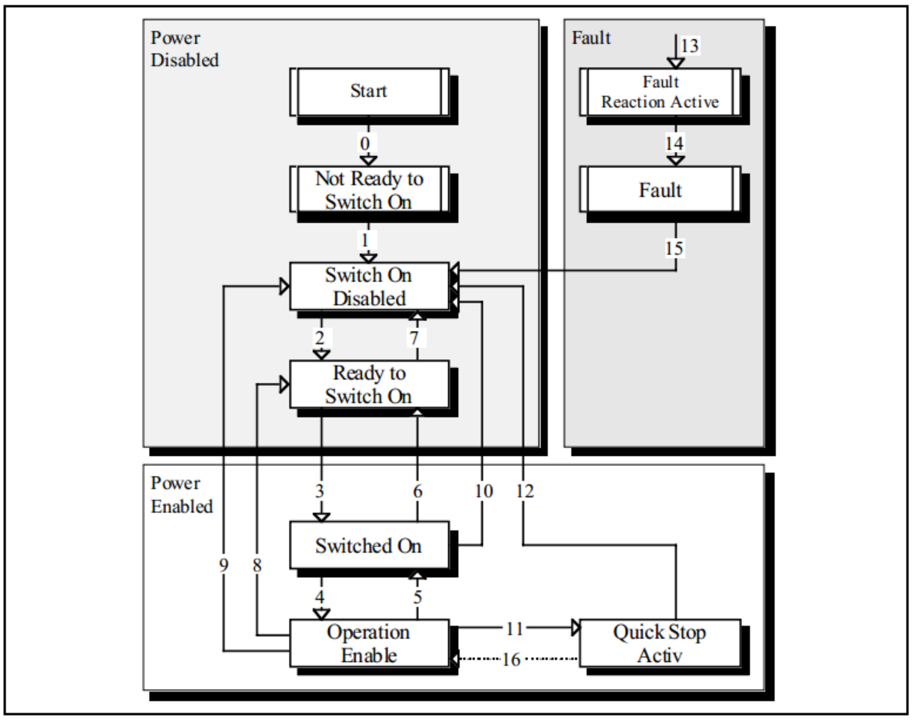

Figure 4.1 Drive state machine

Machine states corresponding to the following table:

Table 4.3 State machine description

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:

Table 4.4 Control word the 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:

Table 4.5 Status word the 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

4.2.2 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). SSD2505PC currently supports four operating modes: Position Mode, Speed Mode, Origin Mode, Multi- Position Mode. The first three kinds of work modes are described in detail in CiA402, and the multi-position mode is factory custom mode.

Table 4.5 Drive working mode

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

4.2.3 Position mode

1. 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 in Figure 4.2.

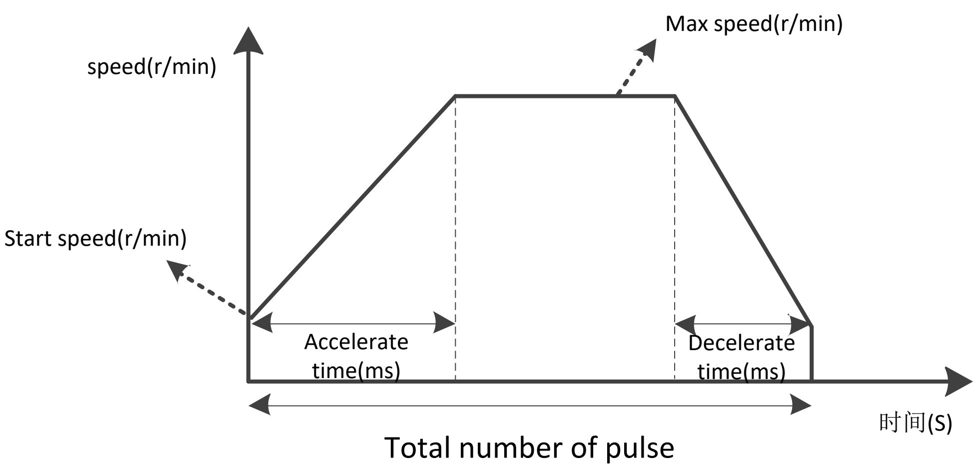

Figure 4.2 Position mode acceleration and deceleration curve

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 in Figure 4.3. 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 in Figure 4.3.

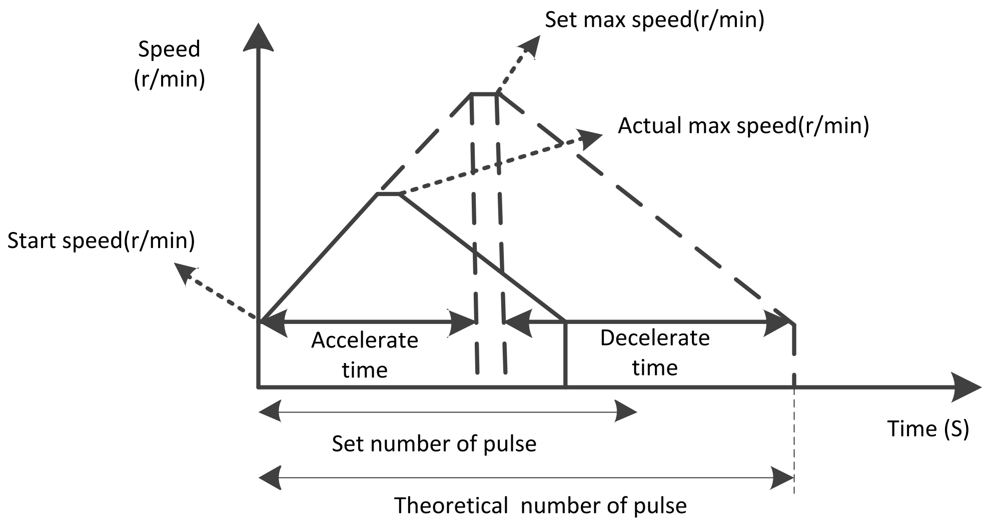

Figure 4.3 Position mode acceleration/deceleration curve (not accelerated to the set max speed)

Dictionary content of related objects:

Index	Sub index	Name	Type	Atrr.	Set Range	Setting
6060h	00	Working mode	I8	RW	-1,1,3,6	1

200Eh	00	Starting speed	U16	RW	2-300r/min	10 r/min
607Ah	00	Total number of pulses	I32	RW	-1000000~ 1000000	5000
6081h	00	Maximum speed	U16	RW	5-3000 r/min	120 r/min
6083h	00	Acceleration time	U16	RW	0-2000ms	100ms
6084h	00	Deceleration time	U16	RW	0-2000ms	100ms

2. 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	Not in place
		1	In place

3. 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	

4.2.4 Speed mode

1. Process description

The acceleration curve of the speed mode is shown in Figure 4.4. Unlike the position mode, the speed mode only requires three parameters of the initial speed (address 200E0010h), the maximum speed (address 60810010h), 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.

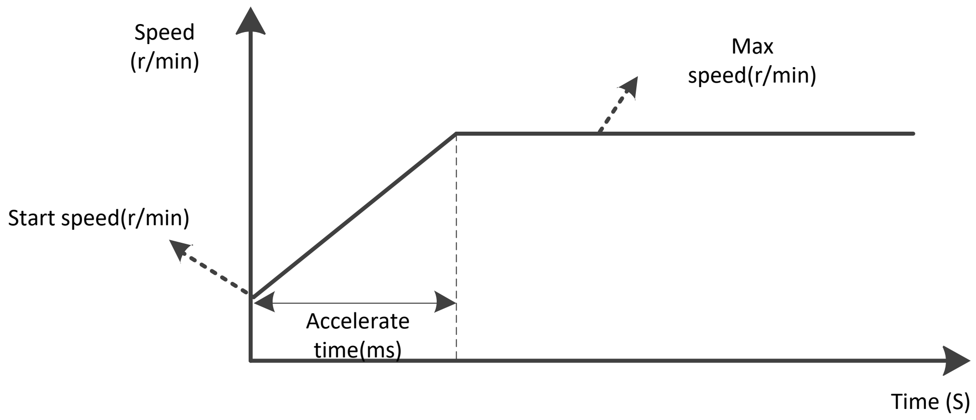

Figure 4.4 Speed mode accelerate curve

Dictionary content of related objects:

Index	Sub index	Name	Type	Atrr.	Set Range	Setting
6060h	00	Work mode	I8	RW	-1,1,3,6	3
60FFh	00	Maximum speed	I16	RW	-3000-300 0r/min	0
6083h	00	Acceleration time	U16	RW	0-2000ms	100ms
6084h	00	Deceleration time	U16	RW	0-2000ms	100ms

2. 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 location reached; Halt=1：Shaft speed is 0;
Bit12	Speed	0	The speed is not 0;

		1	The speed is 0;

3. 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		

4.2.5 Origin mode

1. Process description

SSD2505PC currently has two origin modes. In the back to origin process, it need to use the position limit signal or the origin signal, before using the origin function, please select the position limit signal or the origin signal function of the input terminal according to working mode.

At the same time, the origin function can be triggered by an external I/O or triggered by a communication command. If an external I/O trigger is used, an input terminal must be set as a "origin enable" function.

1) Position limit + origin mode

After receiving the "back to origin enable" command, the drive starts to move with the "back to origin speed (60990110h)" and "back to origin acceleration / deceleration time (609A0010h)". When the rising edge of the origin signal is encountered, motor will decelerate and stop by the setting of “acceleration and deceleration time (609A0010h)”, and then motor will reverse its movement. After that, the motor will slowdown to stop after received the decline in the origin signal. After the completion of stop, motor will apply forward movement by the setting of "return to the original query speed (60990210h)". And stop immediately when the rise of the origin signal received. If the "back to origin compensation value (607C0010h)" in the function code is not zero, a certain distance will be adjusted according to the compensation value.

If it’s not needed to connect this signal, there’s no need for position limit.

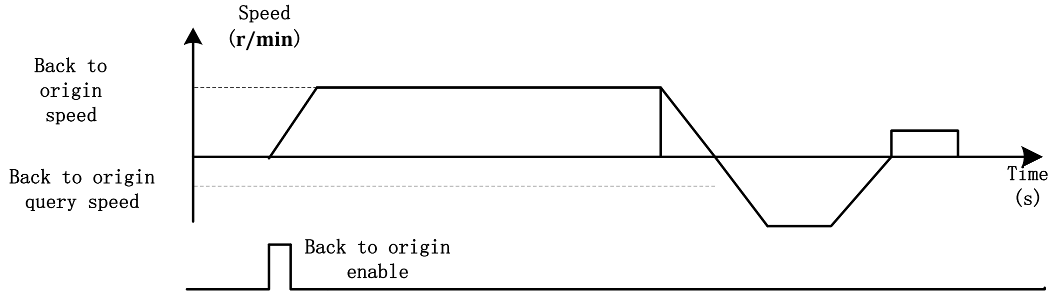

Figure 4.5 Schematic diagram of position limit + origin mode

2) Position limit mode + compensation

After receiving the "back to origin enable" command, the drive starts to move with the "back to origin speed (60990110h)" and "back to origin acceleration / deceleration time (609A0010h)". When the rising edge of the origin signal is encountered, motor will decelerate and stop by the setting of "acceleration and deceleration time (609A0010h)", and then motor will reverse its movement. After that, the motor will slowdown to stop after received the decline in the origin signal. After the completion of stop, motor will apply forward movement by the setting of "return to the original query speed (60990210h)". And stop immediately when the rise of the origin signal received. If the "back to origin compensation value (607C0010h)" in the function code is not zero, a certain distance will be adjusted according to the compensation value.

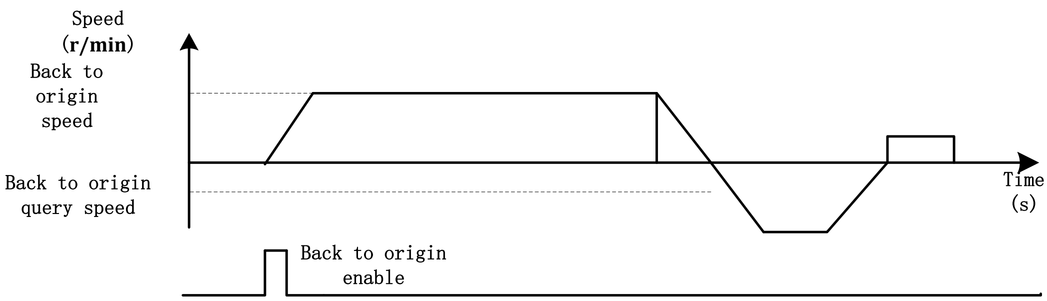

Figure 4.6 Position limit + compensation back to origin workflow

Related object dictionary content:

Index	Sub index	Name	Type	Atrr.	Set range	Setting
6060h	00	Work mode	I8	RW	-1,1,3,6	6
6098h	00	Back to origin mode	U8	RW	0~3	0

6099h	00	Sub index number	U16	RO	-	2
	01	Back to origin speed	U16	RW	5-3000r/min	120 r/min
	02	Back to origin query speed	U16	RW	5-300r/min	60 r/min
609Ah	00	Back to the origin accelerate / decelerate time	U16	RW	30-2000ms	100ms
607Ch	00	Compensation value for back to origin	I32	RW		0

2. Control and status word

The control word in the back to origin mode is controlled by bit4, bit8:

Bytes	Name	Value	Decription
Bit4	Back to origin operation start	0	Back to origin not activate
		0→1	Back to origin start
		1	Back to origin activate
		1→0	Back to origin stop
Bit8	Halt	0	Apply bit4 command
		1	Stop shaft by back to origin decelerate rate

Note: According to the table, back to origin command control word sent as 0x0F-> 0x1F;

Status word bit8, bit10 shows the drive status:

Bytes	Name	Value	Decription
Bit8	Back to origin finished	0	Back to origin not finished
		1	Back to origin finished successfully
Bit10	Position reached	0	Halt=0：Back to origin position not reached; Halt=1： Shaft decelerate;
		1	Halt=0：Back to origin position reached; Halt=1：Shaft speed zero;

3. Example

To complete the back to origin work, select the positive position limit + origin mode for the back to origin, back to origin speed 120r / min, back to origin query speed of 60r / min, acceleration and deceleration time 100ms, the origin is not compensated.

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

Master station	Slave station	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 98 60 00 00 00 00 00	581：60 98 60 00 00 00 00 00	Set back to origin mode 0	Set back to origin
601：2B 99 60 00 78 00 00 00	581：60 99 60 00 00 00 00 00	Set back to origin speed 120r/min	Set back to origin speed
601：2B 99 60 01 3C 00 00 00	581：60 99 60 01 00 00 00 00	Set back to origin query speed 60r/min	Set back to origin query speed
601：2B 9A 60 00 64 00 00 00	581：60 9A 60 00 00 00 00 00	Set acceleration / deceleration time 100ms	Set acceleration / deceleration time
601：2F 60 60 00 06 00 00 00	581：60 60 60 00 00 00 00 00	Swith work mode	Back to origin 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 1F 00 00 00	581：60 40 60 00 00 00 00 00	Sent back to origin command	Sent back to origin command

4.2.6 Multi-position mode

The multi-position mode function is a way of combining a plurality of position segments in a certain order, triggering a motion by a bus command or an external signal to complete a series of positional actions. This function can also be regarded as a combination of the position movements described in section 4.1, except that the user can store parameters of several segment positions in the EEPROM, such as acceleration / deceleration time, total pulse number, etc. To enable these positions section, user only need to provide a trigger signal to complete the work, the work process is described in Figure 4.7.

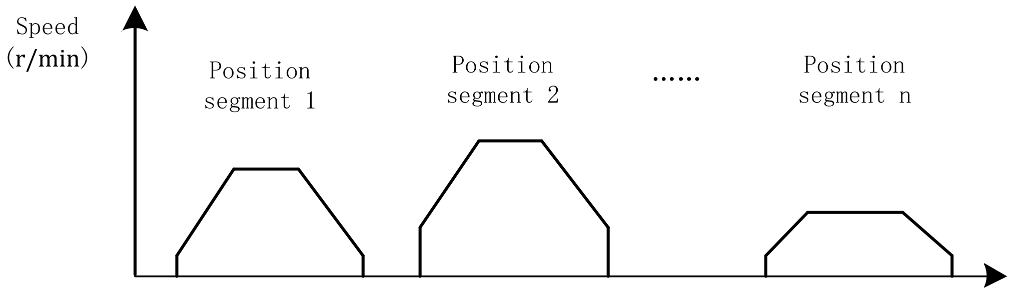

Figure 4.7 Multi-position working mode

1. Position segment parameters

As described above, the user can store the parameters describing a position segment in the EEPROM. Currently, the SSD2505PC supports up to 16 position segments. This section describes the required parameter sets for describing a position segment.

Parameter group describing a position segment:

Parameter name	Function description
JPT	The number of next segment after action completed
Total number of pulses（PU）	The same with in position mode
Running speed（SPEED）	The same with in position mode
Acceleration/deceleration time（ACCDEC）	The same with in position mode
Wait time（WAIT）	The time interval after the end of current action and the start of next segment
Direction（DIR）	The movement direction of the current segment
Output terminal settingsvalue（PTOUT）	The enable output terminal status betweent the beginning and the end of this segment

Corresponding CANopen object dictionary content is as follows:

Index	Sub index	Name	Type	Atrr.	Set range	PDO mapping	Default
6060h	00	Work mode	I8	RW	-1,1,3,6	YES	-1
2031h	00	Multi position operation mode	U16	RW	0~1	NO	0

2032h	00	Multi position loop mode	U16	RW	0~1	NO	0
2033h	00	Register number	U16	RO	-	NO	16
	01~16	Segment JPT number	U16	RW	1~16	NO	0
2034h	00	Register number	U16	RO	-	NO	16
	01~16	PT position segment total number of pulses （segment 1~ segment 16） Refer to 607Ah	U32	RW	Refer to 607Ah	NO	0
2035h	00	Register number	U16	RO	-	NO	16
	01~16	PT position segment speed （segment 1~ segment 16） Refer to 6081h	U16	RW	Refer to 6081h	NO	0
2036h	00	Register number	U16	RO	-	NO	16
	01~16	PT position segment acceleration / deceleration time （segment 1~ segment 16） Refer to 6083h，6084h	U16	RW	Refer to 6083h 6084h	NO	0
2037h	00	Register number	U16	RO	-	NO	16
	01~16	PT position segment direction （segment 1~ segment 16） Refer to 200Eh	U16	RW	Refer to 200Eh	NO	0
2038h	00	Register number	U16	RO	-	NO	16
	01~16	PT position segment wait time （segment 1~ segment 16）	U16	RW	0-65535ms	NO	0
2039h	00	Register number	U16	RO	-	NO	16

	01~16	Output terminal settingsvalue at the start and end of segment（segment 1~ segment 16）	U16	RW	0~16	NO	0

Among the parameters listed above, "the total number of pulses, the running speed, acceleration / deceleration time, running direction" is the same as they are in the position mode. "Wait time" indicates the time interval between two motion segments; "The output terminal setting value at the beginning and end of the segment movement" refers to the output terminals of POUT0 ~ POUT2. If the user configures the Y0 ~ Y2 output terminal functions as POUT0 ~ POUT2 by software, the output status can be controlled by the above parameters (at least one of the Y0 ~ Y2 is configured as the POUT function).

Control word of multi-position mode control through the bit8, bit11:

Bytes	Name	Value	Description
Bit8	Halt	0	Apply bit8 command
		1	Stop shaft
Bit11	MultiPostionStart	0	-
		1	Enable PT segment

2. Basic mode

Multi-position mode has two modes of operation which are basic model and trigger mode. The similarity of the two modes of operation is the need to set at least one segment for movement, the main difference is the number of triggers. The basic mode only needs to be triggered once after the parameter group is set in each position, and the set position segment can be finished according to the parameters. No other operation is needed. See the following example:

Example: Set 3 position segments, position segment 1, position segment 5, position segment 3. Run position 1 first, jump to run position 5 after interval 500ms, then jump to run position 3 after interval 1000ms, then end of the action, and request:

① Position segment 1 total number of positive running pulses 5000, speed 60r / min acceleration and deceleration time 300ms; at the beginning POUT0 = 1; at the end of POUT1 = 1;

② Position section 5 reversely run the total number of pulses 2000, speed 120r / min, acceleration and deceleration time 100ms; at the beginning POUT1 = 1; at the end of POUT0 = 1, POUT1 = 1;

③ Position segment 3 total number of positive running pulses 3000, speed 240r / min, acceleration and deceleration time 200ms; at the beginning POUT0 = 1; POUT1 = 1; at the end of POUT0 ~ 3 = 1;

The motion process is shown in Figure 9.

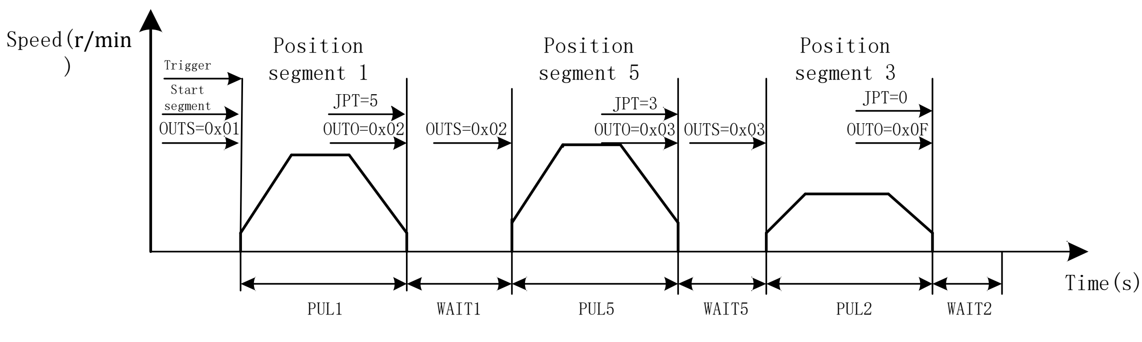

Figure 4.8 Three segments of motion process

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

（1）Y0 ~ Y3 output terminal function is set to POUT0 ~ POUT3, the specific function code operation as follows:

Function code address	Function code name	Write data
20300D10h	Output terminal Y0 function selection	5
20300E10h	Output terminal Y1 function selection	6
20300F10h	Output terminal Y2 function selection	7
20301010h	Output terminal Y3 function selection	8

（2）And set the parameters as follows:

Function code address	Function code name	Write data
20330110h	JPT number of position segment 1	5
20340110h	The total pulses of segment	5000
20350110h	The speed of segment	60
20360110h	The deceleration and accelerate time of segment	300
20370110h	The direction of segment	0
20380110h	The wait time of segment	500
20390110h	Output terminal status	0201h
20330510h	JPT number of position segment 5	5
20340510h	The total pulses of segment	2000
20350510h	The speed of segment	120
20360510h	The deceleration and accelerate time of segment	100
20370510h	The direction of segment	1
20380510h	The wait time of segment	1000
20390510h	Output terminal status	0302h
20330310h	JPT number of position segment 3	0
20340310h	The total pulses of segment	3000
20350310h	The speed of segment	240
20360310h	The deceleration and accelerate time of segment	200
20370510h	The direction of segment	0
20390310h	Output terminal status	0F03h

（3）Send the PT motion command to trigger the movement to observe the motor movement.

Master	Slave	Description
201：0F 08	-	Send operating command
601： 2B 40 60 00 0F 08 00 00	601：60 40 60 00 00 00 00 00	

The above describes the work process of basic model, the other need to understand the following:

（1）Currently SSD2505PC support 16 PT segment;

（2）If there's no need of POUT output terminal function, simply configure Y0 ~ Y2 as other function, or set the parameter PTOUT to 0.

（3）The above-mentioned motion trigger has two kinds of ways：the bus instruction trigger and the external input signal trigger; for the external input signal trigger, take any input terminal（PU，DR，X0~X4）configured as "PT enable signal" function, give an active voltage level to trigger motion.

（4）If there is no other position after the last segment, you need to set the JPT parameter to 0, after the completion of the last segment, drive will exit multi-position mode.

（5）In the multi-position mode, the position mode and speed mode are disabled, user can exit the multi-position mode through the stop command or emergency stop command, or wait for the self-exit of multi-position mode after the completion;

3. Trigger mode

The former chapter describes the work process of the basic mode, this chapter describes the the work process of trigger mode. Basic mode only need to trigger once, but the trigger mode needs to trigger once for each of the set movement. That is, after the completion of each section of the movement, a trigger command is needed, but when to trigger is decided by user.

In addition, the basic mode selects the next segment by the JPT parameter. The trigger mode can set next segment by the communication command or the external input terminal in addition to the JPT parameter. PT mode can use PIN0 ~ PIN4 input terminals, PIN0 ~ PIN4 terminal sorted by binary from low to high count. As follows:

Table 14 Input terminal select position segment

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

Note: When using the PIN terminal for segment selection, it needs to be valid for 5ms before and at the end of the PT enable signal.

Specific examples are as follows:

Example: Set 3 position segments, position segment 1, position segment 5, position segment 3, request first position 1, then trigger jump run position 5, then trigger jump to run position 3, and then end the action, and request:

① Position segment 1 total number of running pulses 5000, speed 60r / min acceleration and deceleration time 300ms; at the beginning POUT0 = 1; at the end of POUT1 = 1;

② Position section 5 run the total number of pulses 2000, speed 60r / min, acceleration and deceleration time 100ms; at the beginning POUT1 = 1; at the end of POUT0 = 1, POUT1 = 1;

③ Position segment 3 total number of running pulses 3000, speed 60r / min, acceleration and deceleration time 200ms; at the beginning POUT0 = 1; POUT1 = 1; at the end of POUT0 ~ 3 = 1;

The movement process is shown in Figure 4.9.

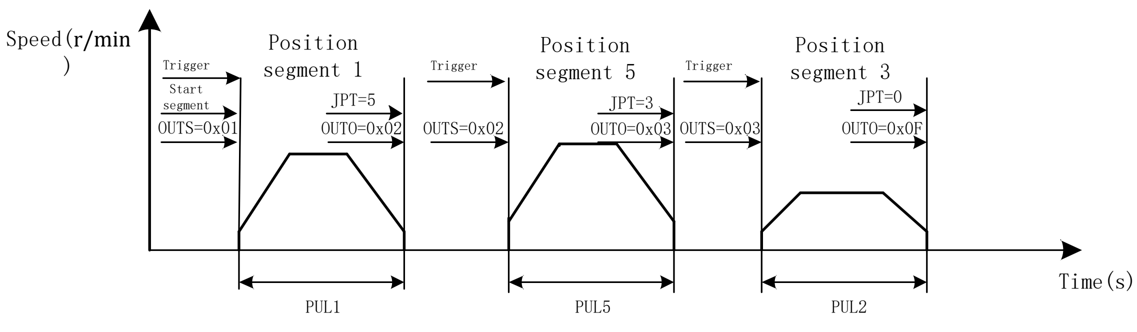

Figure4.9 Three segment working progess

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

（1）Y0 ~ Y3 output terminal function is set to POUT0 ~ POUT3, the specific function code operation as follows:

Function code address	Function code name	Write data
20300D10h	Output terminal Y0 function selection	5
20300E10h	Output terminal Y1 function selection	6
20300F10h	Output terminal Y2 function selection	7
20301010h	Output terminal Y3 function selection	8

（2）And set the parameters as follows:

Function code address	Function code name	Write data
20330110h	JPT number of position segment 1	5
20340110h	The total pulses of segment	5000
20350110h	The speed of segment	60
20360110h	The deceleration and accelerate time of segment	300
20370110h	The direction of segment	0
20380110h	The wait time of segment	500
20390110h	Output terminal status	0201h
20330510h	JPT number of position segment 5	5
20340510h	The total pulses of segment	2000
20350510h	The speed of segment	120
20360510h	The deceleration and accelerate time of segment	100
20370510h	The direction of segment	1
20380510h	The wait time of segment	1000
20390510h	Output terminal status	0302h
20330310h	JPT number of position segment 3	0
20340310h	The total pulses of segment	3000
20350310h	The speed of segment	240
20360310h	The deceleration and accelerate time of segment	200
20370510h	The direction of segment	0
20390310h	Output terminal status	0F03h

（3）Send PT motion command to trigger the motion, and the motor completes the position segment 1.

Master	Slave	Description
201：0F 08	-	Send operating command
601：　2B 40 60 00 0F 08 00 00	601：60 40 60 00 00 00 00 00	

（4）Send PT motion command to trigger the motion, and the motor completes the position segment 5.

Master	Slave	Description
201：0F 08	-	Send operating command
601： 2B 40 60 00 0F 08 00 00	601：60 40 60 00 00 00 00 00	

（5）Send PT motion command to trigger the motion, and the motor completes the position segment 3.

Master	Slave	Description
201：0F 08	-	Send operating command
601： 2B 40 60 00 0F 08 00 00	601：60 40 60 00 00 00 00 00	

The above describes the work process of the trigger mode, need to pay attention to several points:

（1）The triggering mode in the above example is triggered by command; it can also be triggered by an external input signal: any input terminal (PU, DR, X0 ~ X5) can be configured as "PT enable signal" to trigger motion.

（2）In the above example, the next position is selected by the JPT parameter, and it can also be selected by the external input terminal.

When using the external terminal to select the next position segment:

① First need to set the X0 ~ X2 input terminal function to PIN0 ~ PIN2;

② The PIN0~PIN2 status bits are set before each trigger command. If the position segment 5 is selected, the controller needs to input PIN2 = 1, PIN1 = 0 and PIN0 = 1, and then send a trigger command to complete the motion of position 5.

5 Object dictionary

5.1 Basic communication object

1. Object 1000h：Device type

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1000h	0	Device type	This device supports the CIA301, CIA402 protocol	U32	RO	NO	0x00040192

1000h object describes the device type: bit0 ~ bit15: device support protocol: 402; bit16 ~ bit23: drive type: stepper driver (0x04);

2. Object 1001h：Error register

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1001h	0	Error register	Drive current error status	U8	RO	NO	0

The 1001h object describes the current state of the drive's error, and the bits are defined as follows:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Manufacturer-defined	Reserved	Sub-protocol	Communication	Temperature	Voltage	Current	General

3. Object 1003h：Pre-defined Error Field

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1003h	0	Sub-Index number	Sub-Index number	U8	RO	NO	0
	1-4	Error memory	The drive recently caused an emergency message error, supporting five error storage units	U32	RO	NO	0

The 1003h object describes a predefined error memory to store the error that occurred when the drive was operating. The SSD2505PC supports a total of four levels of storage and stores the last four errors. In addition, writing "0" to subindex 0 clears the error history, writing other values is not accepted.

4. Object 1005h：COB-ID SYNC message

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1005h	0	Synchronous message COB identifier	Synchronous message COB identifier	U32	RW	NO	0x80

The 1005h object describes the identifier of the SYNC synchronization message.

5. Object 1006h：Communication Cycle Period

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1006h	0	Synchronous communication cycle	Synchronous communication cycle	U32	RW	NO	0

The 1006h object describes the SYNC synchronization message synchronization cycle, the units is: μs.

6. Object 1009h：Hardware version

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1009h	0	Hardware version	Hardware version	U16	RO	NO	According to the factory hardware settings

The 1009h object describes the SSD2505PC factory hardware version.

7. Object 100Ah：Software version

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
100Ah	0	Software version	Software version	U16	RO	NO	According to the factory software settings

The 100Ah object describes the SSD2505PC factory software version.

8. Object 1014h：COB-ID Emergency Object

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1014h	00	EMNC emergency message COB	EMNC emergency message COB	U32	RW	NO	0x80+Node-ID

The 1014h object defines the COB-ID of the EMCY message.

15. Object 1017h：Producer Heartbeat Time

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1017h	00	Producer heartbeat time	Producer heartbeat time interval units ms	U16	RW	NO	0

The 1017h object describes the producer heartbeat interval in milliseconds, and if it is 0, it does not work. If it isn’t 0, it will generate a heartbeat message according to the time period.

5.2 SDO（Process data object）

1. Object 1200h：Se rver SDO Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1200h	00	Sub-Index number	Sub-Index number	U8	RO	NO	2
	01	COB-ID （slave	COB-ID （slave receive）	U32	RO	NO	600h+Node-ID

		receive）					
	02	COB-ID（slave send）	COB-ID（slave send）	U32	RO	NO	580h+Node-ID

The 1200h object describes the COB-ID of the SDO message.

5.3 PDO（Service data object）

1. Object 1400h：RPDO1 CommunicationParameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1400h	00	Sub-Index number	Sub-Index number	U8	RO	NO	5
	01	COB-ID	COB-ID identifier	U32	RO	NO	200+ Node-ID
	02	Transport type	Transport type	U8	RW	NO	FFh
	03	Prohibited time	Prohibited time	U16	RW	NO	0
	04	Reserved	Reserved	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW	NO	0

1400h object describes the RPDO message communication parameters, SSD2505PC support 4 RPDO, COB-ID configuration is as follows.

1400h	200+ Node-ID
1401h	300+ Node-ID
1402h	400+ Node-ID
1403h	500+ Node-ID

2. Object 1800h：TPDO1 Communication Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1800h	00	Sub-Index number	Sub-Index number	U8	RO	NO	5

	01	COB-ID	COB-ID identifier	U32	RO	NO	180+ Node-ID
	02	Transport type	Transport type	U8	RW	NO	FFh
	03	Prohibited time	Prohibited time	U16	RW	NO	0
	04	Reserved	Reserved	U8	RW	NO	0
	05	Event timer	Event timer	U16	RW	NO	0

1800h object describes the TPDO message communication parameters, SSD2505PC support 4 TPDO, COB-ID configuration is as follows.

1800h	180+ Node-ID
1801h	280+ Node-ID
1802h	380+ Node-ID
1803h	480+ Node-ID

3. Object 1600h：RPDO1 MappingParameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1600h	00	Sub-Index number	Sub-Index number	U8	RO	NO	1
	01	Mapping 1	Mapping to 6040h register	U32	RW	NO	60400010h
	02	Mapping 2	Not mapped	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-
	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1600h object describes the mapping parameters of RPDO1.

4. Object 1601h：RPDO2 Mapping Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1601h	00	Sub-Index number	Sub-Index number	U8	RO	NO	0

	01	Mapping 1	Mapping to 6040h register	U32	RW	NO	-
	02	Mapping 2	Mapping to 6060h register	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-
	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1601h object describes the mapping parameters of RPDO2.

15. Object 1602h：RPDO3 Mapping Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1602h	00	Sub-Index number	Sub-Index number	U8	RO	NO	0
	01	Mapping 1	Mapping to 6040h register	U32	RW	NO	-
	02	Mapping 2	Mapping to 607Ah register	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-
	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1602h object describes the mapping parameters for RPDO3.

15. Object 1603h：RPDO4 Mapping Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1603h	00	Sub-Index number	Sub-Index number	U8	RO	NO	0
	01	Mapping 1	Mapping to 6040h register	U32	RW	NO	-
	02	Mapping 2	Mapping to 60FFh register	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-
	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1603h object describes the mapping parameters for RPDO4.

15. Object 1A00h：TPDO1 Mapping Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1A00h	00	Sub-Index number	Sub-Index number	U8	RO	NO	0
	01	Mapping 1	Mapping to 6041h register	U32	RW	NO	-
	02	Mapping 2	Not mapped	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-
	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1A00h object describes the mapping parameters for TPDO1.

15. Object 1A01h：TPDO2 Mapping Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1A01h	00	Sub-Index number	Sub-Index number	U8	RO	NO	0
	01	Mapping 1	Mapping to 6041h register	U32	RW	NO	-
	02	Mapping 2	Mapping to 6061h register	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-
	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1A01h object describes the mapping parameters of TPDO2.

15. Object 1A02h：TPDO3 Mapping Parameter

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1A02h	00	Sub-Index number	Sub-Index number	U8	RO	NO	0
	01	Mapping 1	Mapping to 6041h register	U32	RW	NO	-
	02	Mapping 2	Mapping to 6064h register	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-

	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1A02h object describes the mapping parameters of TPDO3.

15. **Object 1A03h: TPDO4 Mapping Parameter**

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
1A03h	00	Sub-Index number	Sub-Index number	U8	RO	NO	0
	01	Mapping 1	Mapping to 6041h register	U32	RW	NO	-
	02	Mapping 2	Not mapped	U32	RW	NO	-
	03	Mapping 3	Not mapped	U32	RW	NO	-
	04	Mapping 4	Not mapped	U32	RW	NO	-

The 1A03h object describes the mapping parameters of TPDO4.

5.4 Drive description object

The SSD2505PC defines several drive description objects from 603Fh to 60FFh according to the CiA 402 protocol, as described in Appendix 1 for details.

5.5 The driver subdefined object

The SSD2505PC defines objects from 2000h to 2039h to implement drive functions, as described in Appendix 1 for a detailed description.

6 Alarm diagnose

SSD2505PC driver has four kinds of alarm information, the alarm indicator flashing several times according to the alarm code, the specific alarm code and handle methods as shown in Table 6.1.

Table 6.1 Alarm codes and treatment measures

Alarm code	Alarm message	Indicator	Reset
Err1：0x01	Overcurrent or short circuit between phases	Flash once	Lock machine / Re-power reset
Err2：0x02	Power supply voltage high	Flash twice	Lock machine / Automatic reset
Err3：0x03	Power supply voltage low	Flash 3 times	Lock machine / Automatic reset
Err4：0x04	EEPROM Read/write error	Flash 4 times	Reset available
Err4：0x05	Position variance	Flash 5 times	Re-power reset

7 Version history

1. V1.0 Initial Release

Appendix 1 CANopen Object Dictionary List

Index	Sub index	Name	Introductions	Type	Atrr.	PDO mapping	Default
CiA 301 basic communication parameters group							
1000h	00	Device type	This device supports CIA301, CIA402	U32	RO	NO	0x00040192
1001h	00	Error register	Drive current error state	U8	RO	NO	0
1003h	00	Sub-Index number	Sub-Index number	U8	RO	NO	4
	01~04	Error memory	The drive recent emergency message error, supporting five error storage units;	U32	RO	NO	0
1005h	00	Synchronous messages COB identifier	Synchronous messages COB identifier	U32	RW	NO	0x80

1006h	00	Synchronous communication cycle	Set synchronization cycle, the unit: μs	U32	RW	NO	0
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 time	Producer heartbeat time interval units ms	U16	RW	NO	0
Factory customized parameter							
2000h	00	Drive node number	Can be set by switch and 0x2008 register	U16	RO	YES	-
2001h	00	Motor State register	The drive controls the motor motion state 0: motor stationary; 1: motor running;	U16	RO	YES	0
2002h	00	Motor current speed	The current speed of the motor;	I16	RO	YES	0
2003h	00	Input signal status	7 input signal level status Bit0 ~ Bit7: PU, DRX0 ~ X4 input level status;	U16	RO	YES	0
2004h	00	Output signal status	3 output signal level status Bit0 ~ Bit2: Y0 ~ Y2 output status;	U16	RO	YES	0
2005h	00	Pulse direction level select	Value - RMS value (peak) lock machine current 0：Pulse Sign； 1：Pulse /Sign； 2：/Pulse Sign； 3：/Pulse /Sign；	U16	RW	YES	0
2006h	00	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）；	U16	RW	YES	8

			12—8000（Pu/rev）； 13—10000（Pu/rev）； 14—20000（Pu/rev）； 15—40000（Pu/rev）；				
2007h	00	Open/closed loop operation mode	0 : Closed-loop; 1 : Open loop;	U16	RW	YES	0
2008h	00	Customize drive node number	0~31 : Undefined 32~127 Use it when node numbers greater than 31;	U16	RW	YES	0
2009h	00	Customize communication baud rate high bit	0：125 Kbit/s 1：100 Kbit/s 2：50 Kbit/s 3：25 Kbit/s	U16	RW	YES	0
200Ah	00	Sync to EEPROM	0：Sync 1：No Sync	U16	RW	YES	0
200Bh	00	Overposition stop mode	0：normal stop 1：emergent stop	U16	RW	YES	0
200Ch	00	Bus control mode / pulse direction (P / D) control mode selection	0：bus control 1：external pulse direction (P / D) control 2：Double-pulse control	U16	RW	YES	0
200Dh	00	When the MF signal is active, the brake signal handle setting	0：When the MF signal is active, the brake signal is valid; 1：When the MF signal is active, the brake signal is not valid;	U16	RW	YES	0
200Eh	00	Starting speed	The initial speed of the moving start; Unit r / min; range 2-300r / min;	U16	RW	YES	5r/min
200Fh	00	Motor enable / Release	0 : Release; 1 : Enabled;	U16	RW	YES	0
2010h	00	Parameter reset	0 : Invalid; 1 : Reset the factory parameters;	U16	RW	YES	0
2011h	00	Fault reset command	0 : Invalid; 1 Fault reset;	U16	RW	YES	0
2012h	00	Current position clear	Used to clear the current position in absolute position mode 0: invalid; 1: the current position is cleared;	U16	RW	YES	0
2013h	00	Absolute / Relative positions	0: relative position; 1: absolute position; Note: Valid in multi-position mode;	U16	RW	YES	0
2030h	00	Sub-Index number	Sub-Index number	U16	RO	NO	16

	01	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: default; 1: level reversal; The drive default input terminal level rising edge is valid;	U16	RW	YES	0
	02	Input terminal PU function selection	0：undefined; 1：origin signal; 2：positive position limit signal; 3：negative position limit signal; 4: motor enable signal; 5: motor release signal; 6: alarm clear signal; 7: function code to restore the factory signal; 8: stop signal; 9: emergency stop signal; 10: position mode forward movement; 11: position mode reverse movement; 12: speed mode forward movement; 13: speed mode reverse movement; 14: back to origin enable signal; 15: PT enable signal; 16：PIN0； 17：PIN1； 18：PIN2； 19：PIN3； 20：PIN4； Note: When using external pulse control mode, set the PU and DR functions to 0 to avoid accidental effects.	U16	RW	YES	0
	03	Input terminal DR function selection		U16	RW	YES	0
	04	Input terminal X0 function selection		U16	RW	YES	0
	05	Input terminal X1 function selection		U16	RW	YES	0
	06	Input terminal X2 function selection		U16	RW	YES	0
	07	Input terminal X3 function selection		U16	RW	YES	0
	08	Input terminal X4 function selection		U16	RW	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 input terminal level rising edge is valid;	U16	RW	YES	0
	0D	Output terminal Y0 terminal function selection	0: undefined 1: alarm signal; 2: drive status signal; 3: back to origin completion signal; 4: position ready signal; 5: PT mode signal; 6：POUT0； 7：POUT1； 8：POUT2；	U16	RW	YES	0
	0E	Output terminal Y1 terminal function selection		U16	RW	YES	0
	0F	Output terminal Y2 terminal function selection		U16	RW	YES	0
2031h	00	Multi-position operation mode	0: basic mode; 1: trigger mode;	U16	RW	YES	0
2032h	00	Multi-position cycle mode	0: single time run; 1: cycle operation;	U16	RW	YES	0
2033h	00	Number of sub-indexs	Number of sub-indexs	U16	RO	NO	16
	01~16	01 position section JPT number 02 position section JPT number … 15 position section JPT number 16 position section JPT number	JPT (jump point): After the current position segment is completed, it jumps to the segment number of the next position. If the JPT number of the position segment 01 is set to 8, then after the position 01 is completed, it will jump to the position segment 08 run; 0: do not jump; 1 to 16: next running position segment;	U16	RW	YES	0
2034h	00	Number of sub-indexs	Number of sub-indexs	U16	RO	NO	16
	01~16	The total number of pulses of PT segment	The total number of pulses of position mode (including	U32	RW	YES	0

		(segment 1 to 16)	acceleration, constant speed and deceleration stage)				
2035h	00	Number of sub-indexs	Number of sub-indexs	U16	RO	NO	16
	01~16	PT Position segment speed (Segment 1~ 16)	Motion speed	U16	RW	YES	0
2036h	00	Number of sub-indexs	Number of sub-indexs	U16	RO	NO	16
	01~16	PT Position segment acceleration / deceleration time (Segment 1~ 16)	Acceleration / deceleration time	U16	RW	YES	0
2037h	00	Number of sub-indexs	Number of sub-indexs	U16	RO	NO	16
	01~16	PT Position segment running direction (Segment 1~ 16)	Running direction	U16	RW	YES	0
2038h	00	Number of sub-indexs	Number of sub-indexs	U16	RO	NO	16
	01~16	PT Position segment waiting time (Segment 1~ 16)	The time interval after the completion of one position segment and the next position segment; Unit: ms;	U16	RW	YES	0
2039h	00	Number of sub-indexs	Number of sub-indexs	U16	RO	NO	16
	01~16	The output terminal value sets at the beginning of the segment motion (Segment 1~ 16)	Bit0 ~ Bit7: POUT output status at the beginning of a position segment operation; Bit0: POUT0 state; Bit1: POUT1 state; Bit2: POUT2 state; 0: low level output; 1: high level output; Bit8 ~ Bit15 POUT output status after one position segment is finished; Bit8: POUT0 state; Bit9: POUT1 state; Bit10: POUT2 state; 0: low level output;	U16	RW	YES	0

			1: high level output;				
2040h	00	Encoder resolution	0: 1000 lines; 1: 44000 lines;	U16	RW	YES	0
2041h	00	Pulse input frequency limit	0~255	U16	RW	YES	5
2042h	00	Percentage of closed-loop current	0~150	U16	RW	YES	70
2043h	00	Percentage of open-loop current	0~100	U16	RW	YES	40
2044h	00	Lock current percentage	0~100	U16	RW	YES	40
2045h	00	Lock current time	100~500ms	U16	RW	YES	100
2046h	00	Variances alert thresholds	0~20000	U16	RW	YES	4000
2047h	00	Position ready signal output control mode and threshold	1~4000	U16	RW	YES	10
2048h	00	Speed smoothing strength	0~1024	U16	RW	YES	5
2049h	00	Position proportional factor	1~256	U16	RW	YES	16
204Ah	00	Speed proportional factor	1~256	U16	RW	YES	16
204Bh	00	Speed feedforward coefficient	1~200	U16	RW	YES	162
204Ch	00	Current loop proportional coefficient	0~30000	U16	RW	YES	8000
204Dh	00	Current loop integral coefficient	0~1000	U16	RW	YES	48
204Eh	00	Encoder feedback filter coefficients	0~1024	U16	RW	YES	358
204Fh	00	Positioning accuracy	1~200	U16	RW	YES	10
2050h	00	Closed - loop control algorithm	0~1	U16	RW	YES	0
2051h	00	High-speed adjustment factor (ea limit)	0~65535	U16	RW	YES	15360
2052h	00	Torque adjustment factor (ea)	1~50	U16	RW	YES	16
2053h	00	Speed node 1	1~50	U16	RW	YES	10

2054h	00	Position proportional factor 1	0~65535	U16	RW	YES	32
2055h	00	Speed proportional factor 1	0~65535	U16	RW	YES	320
2056h	00	Speed node 2	1~50	U16	RW	YES	15
2057h	00	Position proportional factor 2	0~65535	U16	RW	YES	33
2058h	00	Speed proportional factor 2	0~65535	U16	RW	YES	320
2059h	00	Speed node 3	1~50	U16	RW	YES	20
205Ah	00	Position proportional factor 3	0~65535	U16	RW	YES	35
205Bh	00	Speed proportional factor 3	0~65535	U16	RW	YES	320
205Ch	00	Speed node 4	1~50	U16	RW	YES	30
205Dh	00	Position proportional factor 4	0~65535	U16	RW	YES	38
205Eh	00	Speed proportional factor 4	0~65535	U16	RW	YES	384
205Fh	00	Speed node 5	1~50	U16	RW	YES	40
2060h	00	Position proportional factor 5	0~65535	U16	RW	YES	39
2061h	00	Speed proportional factor 5	0~65535	U16	RW	YES	512
2062h	00	Speed node 6	1~50	U16	RW	YES	46
2063h	00	Position proportional factor 6	0~65535	U16	RW	YES	40
2064h	00	Speed proportional factor 6	0~65535	U16	RW	YES	640
2065h	00	Static position ratio	0~65535	U16	RW	YES	32
2066h	00	Static speed ratio	0~65535	U16	RW	YES	320
2067h	00	PU / DR differential signal filtering time	PU / DR differential signal filter time, Unit: ms	U16	RW	YES	10
2068h	00	X0/X1 differential signal filtering time	X0/X1 differential signal filter time, Unit: ms	U16	RW	YES	10
2069h	00	X2/X3 differential signal filtering time	X2/X3 differential signal filter time, Unit: ms	U16	RW	YES	10

206Ah	00	X4 differential signal filtering time	X4 differential signal filter time, Unit: ms	U16	RW	YES	10
CiA 402 parameter group							
603Fh	00	Drive fault code	The manufacturer's custom drive error condition is the same as the lower 16 bits of the 1003h register. 0000h: no error; FF01h: overcurrent; FF02h: overvoltage; FF03h: undervoltage; FF04h: EEPROM read and write errors; FF05h: position tolerance alarm;	U16	RO	YES	0
6040h	00	Control word	Control the drive working state; Control the drive in different modes;	U16	RW	YES	0
6041h	00	Status word	Reflect the drive working state; Reflect the different working state in different modes of the drive;	U16	RO	YES	0
605Ah	00	Quick stop control register	the drive handle method after quick stop command: 0: release motor; 1: normal stop; 2: emergency stop;	I16	RW	NO	0
605Bh	00	Shutdown control register	the drive handle method after Shutdown command: 0: Emergency stop, release motor; 1: normal stop, release the motor;	I16	RW	NO	0
605Ch	00	Disable Operation control register	the drive handle method after Disable Operation command: 0: Emergency stop, release motor; 1: normal stop, release the motor;	I16	RW	NO	0
605Dh	00	Halt control register	the drive handle method after halt command: 0: normal stop, maintain Operation Enabled status; 1: emergency stop, maintain Operation Enabled state;	I16	RW	NO	0
6060h	00	Running mode control register	-1: Multi-position mode; 0: undefined; 1: position mode; 3: speed mode; 6: back to origin mode;	I8	RW	YES	0

6061h	00	Running mode status register	-1: Multi-position mode; 0: undefined; 1: position mode; 3: speed mode; 6: back to origin mode;	I8	RO	YES	0
6064h	00	Drive actual location register	Drive actual position, unit: pul	I32	RW	YES	0
607Ah	00	Total number of pulses	The total number of running pulses for position mode (including acceleration, constant speed and deceleration) Range: -1000000 ~ 1000000;	U32	RW	YES	5000
6081h	00	Maximum speed	The maximum speed of position mode; Low microstep setting, the maximum speed up to 3000r / min; high microstep settings, the output frequency up to 200KHz, range: 5-3000r / min;	U16	RW	YES	120 r/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	Maximum speed	The maximum speed of speed mode; Low microstep setting, the maximum speed up to 3000r / min; high microstep settings, the output frequency up to 200KHz, range: -3000-3000r / min;	U16	RW	YES	0
6098h	00	Back to the origin mode	0: forward position limit + origin mode; 1: reverse position limit + origin mode 2: forward limit mode; 3: reverse limit mode;	U8	RW	YES	0
6099h	00	Number of sub-indexs	Number of sub-indexs	U8	RO	NO	2
	01	Back to the origin speed	The speed for searching origin point; Range: 5-3000r/min；	U16	RW	YES	120 r/min
	02	Back to the origin query speed	The speed for back to origin point after found it; Range: 5-3000r/min；	U16	RW	YES	60 r/min

609Ah	00	Back to the origin acceleration/deceleration time	Back to the origin acceleration / deceleration time; Range: 30-2000ms	U16	RW	YES	100ms
607Ch	00	Origin compensation value	Origin compensation value: Range: -1000000~1000000	I32	RW	YES	0

Note: U16 is an unsigned 16-bit; I16 represents a signed 16-bit; U32 represents an unsigned 32-bit; I32 represents a signed 32-bit;