

SDA2-C Series Servo System

CANopen Application Manual



SDA2 Series Servo System (motor & drive)

CANopen Application manual

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CONTENTS

Preface	1
Chapter 1 Overview	2
Chapter 2 System Configuration	3
2.1 Wiring	3
2.2 Parameter setting	5
2.3 Control Panel Display	6
Chapter 3 CANopen communication	7
3.1 Summarize	7
3.1.1 Object dictionaries	7
3.1.2 Commonly used communication objects	7
3.1.3 Communication object identifier	8
3.2 Network management (NMT)	9
3.3 Service Data Object (SDO)	10
3.4 Process data object (PDO)	11
3.4.1 Communication parameter object	12
3.4.2 Mapping object	13
3.5 Synchronization object (SYNC)	14
3.6 Emergency Object(EMCY)	14
3.7 Heartbeat	15
Chapter 4 Equipment control	16
4.1 Control State Machine	16
4.1.1 CiA402 State Machine	16
4.1.2 Control Word	16
4.1.3 Status word	17
4.2 Position Control Mode	18
4.3 Interpolation position mode	21
4.4 Homing method	23
4.5 Speed control mode	26
4.6 Torque control mode	28
Chapter 5 Fault handling	30

5.1 CANopen Communication error	30
5.2 Fault clearing method	31
5.3 SDO Abort code	32
Chapter 6 Object dictionary	33
6.1 Communication parameter object	33
6.2 Sub-protocol object	35
6.3 SDA2 Specific object	38
6.3.1 Parameter	40
6.3.2 Monitoring data	40
6.3.3 Alarm record	41
6.3.4 Positioning data	41
6.3.5 Communication digital terminal	41

Preface

Thank you very much for choosing SAVCH servo drive! The instructions for using the servo driver are not described in this manual. Please read this manual and the instruction manual of the servo driver before use and understand how to use it properly. Improper use will prevent proper operation, reduce service life and cause malfunctions.

Please keep the instruction manual safe after use.

Chapter 1 Overview

Table1-1 comprehensive parameter description

Item	Description
CAN-ID type	11bit-CAN2.0A
Supported baud rate	1Mbit/s, 750Kbit/s, 500Kbit/s, 250Kbit/s, 125Kbit/s, 100Kbit/s, 50Kbit/s, 20Kbit/s, 10Kbit/s
Maxima sub-station quantity	127
CAN frame length	0~8byte
CAN frame type	Data frames
Terminal resistance	120Ω
Supported protocol	CiA-301 V4.02: CANopen application layer and communication protocol
	DSP-402 V2.0: drive and motion control sub-protocol
Supported service	NMT: Network Management
	SDO: Service Data Object
	PDO: Process Data Object
	SYNC: Synchronization Object
	HeartBeat (Producer): NMT Error Control
	EMCY: Emergency Object
PDO transport type	Time triggered (asynchronization), event triggered (asynchronization), synchronization triggered
Supported PDO quantity	4 TPDO, 4 RPDO
SDO transport type	Expedited transfer
Supported operating mode	Profile position mode
	Poming mode
	Profile speed mode
	Profile torque mode
	Interpolation position mode

The CANopen of SDA2 series servo driver supports below 9 types Baud rate. The communication distance is related to the baud rate and the communication cable.

Table 1-2 the relation between baud rate and communication distance

Baud rate(bps)	1M	750K	500K	250K	125K	100K	50K	20K	10K
Distance(m)	25	50	100	250	500	500	1000	1000	1000

Chapter 2 System Configuration

2.1 Wiring

Double RJ45 terminal is communication port at CN4 and CN5, which can be used to CANopen communication and modbus communication. The terminal port is as below

Table 2-1 CN4 port signal description

Pin.No	Name	Function code	Function description
1	CAN bus CANH	CANH	CAN bus communication signal
2	CAN bus CANL	CANL	
3	Power output	+5V	Power output for communication peripherals
4	RS485 communication data positive pole	485P	RS485 Communication difference signal
5	RS485 communication data negative pole	485N	
6, 7	no-use	NC	Do not connect
8	GND	GND	GND

Table 2-2 CN5 port signal description

Pin.No	name	function code	function description
1	CAN bus CANH	CANH	CAN bus communication signal
2	CAN bus CANL	CANL	
3	no-use	NC	Do not connect
4	RS485 communication data positive pole	485P	RS485 Communication difference signal
5	RS485 communication data negative pole	485N	
6, 7	no-use	NC	Do not connect
8	GND	GND	GND

There is two connection between bus of CAN communication and multi-node:

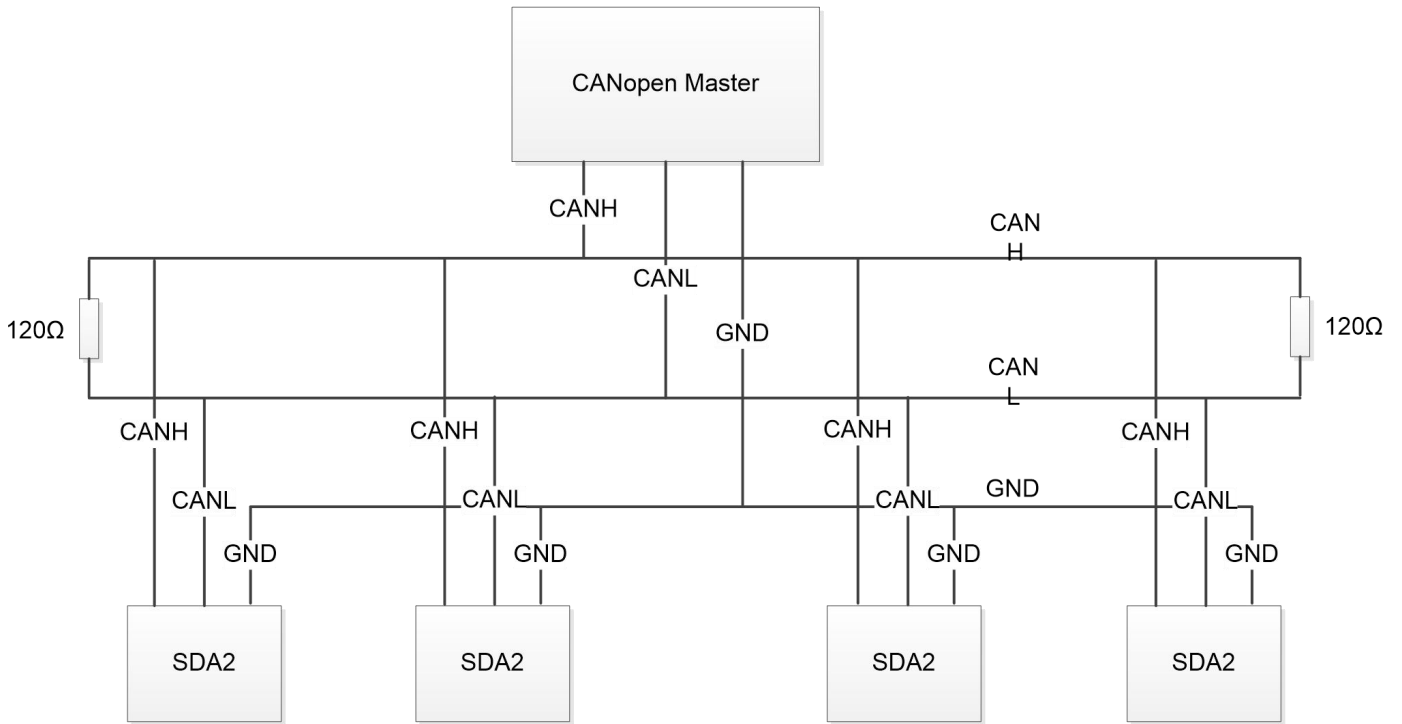


Figure2-1 bus of CAN communication and multi-node mode 1

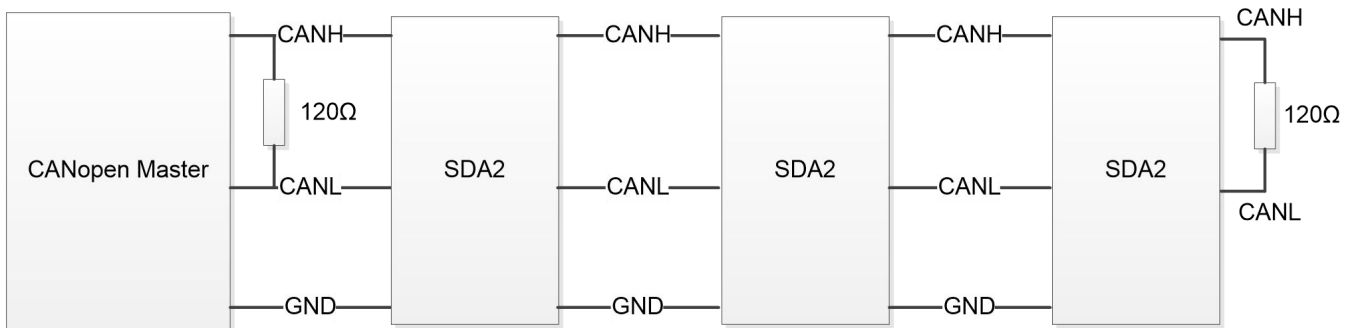


Figure2-1 bus of CAN communication and multi-node mode 2

- There connect two terminal matching resistances at the ends of bus in case of signal reflecting
- Test the value of resistance between CANH and CANL by multimeter, which can confirm if the field end resistance is correct or not. The resistance value should be about 60Ω(two resistance should be parallel)
- When the CAN device communicates over long distances or connects multiple nodes, the common ground GND of the different CAN circuits must be connected to each other to ensure that the reference potentials between the different communication devices are equal.

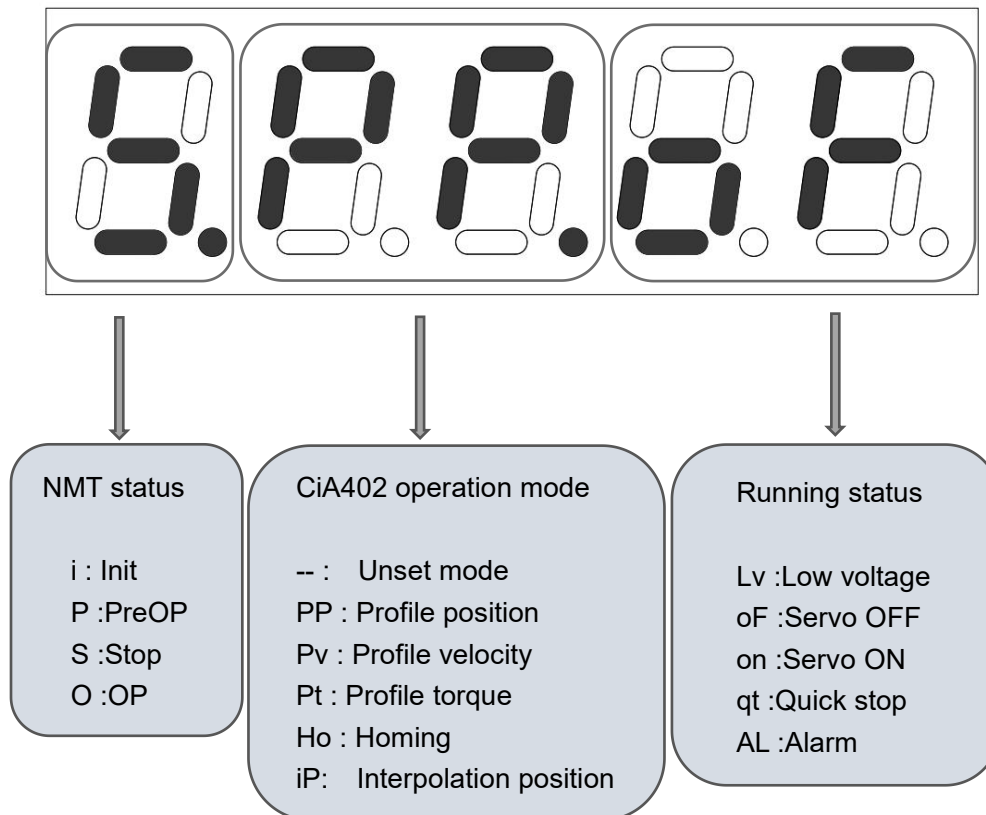
2.2 Parameter setting

CANopen related parameter setting is as below:

Parameter number	Parameter name	Setting range	Default value	Description
P1.01	Servo mode	0~8	8	Servo works at the Canopen mode
P1.36	Acceleration/deceleration selection at speed control	0: Disable 1: Enable	0	Set whether the acceleration/deceleration is effective in the contour speed mode
P3.89	Feedback speed and sampling time	0: 62.5 [us] 1: 125 [us] 2: 250 [us] 3: 500 [us] 4: 1 [ms] 5: 2 [ms] 6: 4 [ms] 7: 8 [ms]	1	Set the sampling time of feedback speed, object dictionary is 606Ch
P4.01	Node ID	1~127	1	Set node ID
P4.02	Communication baud rate	0: 1mbps 1: 750kbps 2: 500kbps 3: 250kbps 4: 125kbps 5: 100kbps 6: 50kbps 7: 20kbps 8: 10kbps	0	Set the bus baud rate of can according to the requirement
P4.03	Rpdo receive length error alarm detection	0: no detection 1: detection	0	When the length error is not detected, the rpdo that receives the wrong length will be discarded without any prompt
P4.04	Interpolation data loss alarm detection	0: no detection 1~20: After the data loss is accumulated to the corresponding number, the alarm will be issued.	0	If it does not detect the case of interpolation data loss, it will not receive the interpolation position is considered interpolation position unchanged
P4.05	Interpolation data loss processing settings	0: no processing 1: Update the position command with the last interpolation data increment value	1	Processing setting when interpolation data is lost

2.3 Control Panel Display

The SDA2-C series servo drive will display the CANopen related status by default after power-on (the initial display can be changed by parameter P2.77). The displayed status is divided into three types, separated by decimal point, including NMT status, CiA402 operation mode and servo running status, the specific meaning is as shown below:



Chapter 3 CANopen communication

3.1 Summarize

CANopen is an application layer protocol for a network transmission system based on the CAN serial bus, following the ISO / OSI standard model. The different devices in the network exchange data with each other through object dictionaries or objects, where the master node can obtain or modify data in other node object dictionary lists through a process data object (PDO) or a service data object (SDO).

3.1.1 Object dictionaries

The object dictionary is the most important part of the device specification. It is an ordered set of parameters and variables that contain all the parameters of the device description and the device network state. A set of object can be accessed in an orderly manner through the network.

The CANopen protocol uses an object dictionary with a 16-bit index and an 8-bit sub-index. The structure of the object dictionary is shown in Table 3-1.

Table 3-1 object dictionaries structure

Index	Object
0000h	No-use
0001h—001Fh	Static data type
0020h—003Fh	Complex data type
0040h—005Fh	The complex data type specified by the manufacturer
0060h—007Fh	The static data type specified by the device sub-protocol
0080h—009Fh	The complex data type specified by the device sub-protocol
00A0h—0FFFh	Reserve
1000h—1FFFh	Communication profile area
2000h—5FFFh	Manufacturer-specific profile area
6000h—9FFFh	Standardized profile area
A000h—FFFFh	Reserve

3.1.2 Commonly used communication objects

CANopen communication defines the following types of messages (communication object) :

Table 3-2 Commonly used communication objects

Communication object	Description
Network management (NMT)	For CANopen network management, the host configures the slave node status
Service data object (SDO)	Used to transfer non-time critical data, such as CANopen communication parameters
Process data object (PDO)	Used for the transmission of time-critical process data, such as location data for location data transmission

Communication object	Description
Synchronize objects (SYNC)	Used to synchronize each node
Emergency object (EMCY)	Used to transmit drive alarm data
Error Control (HeartBeat)	Used to monitor the node's life status

3.1.3 Communication object identifier

The communication object identifier (COB-ID) specifies the priority of the object during communication and the identification of the communication object. The COB-ID corresponds to the 11-bit frame ID of the CAN 2.0A. The 11-bit COB-ID consists of two parts: the 4-bit object function code and the 7-bit node address, as follows.

Table 3-3 Composition of COB-ID

Function code				Node id						
10	9	8	7	6	5	4	3	2	1	0

CANopen communication object has a default COB-ID, can be read through the SDO. Some can be modified by SDO. The list of objects is shown in Table 3-4.

Table 3-4 Object COB-ID list

Communication object	Function code	Node id	COB-ID	The corresponding object index
Network management	0000b	0	0h	-
Synchronize objects	0001b	0	80h	1005h
Emergency message object	0001b	1~127	80h + Node ID	1014h
TPDO1	0011b	1~127	180h + Node ID	1800h
RPDO1	0100b	1~127	200h + Node ID	1400h
TPDO2	0101b	1~127	280h + Node ID	1801h
RPDO2	0110b	1~127	300h + Node ID	1401h
TPDO3	0111b	1~127	380h + Node ID	1802h
RPDO3	1000b	1~127	400h + Node ID	1402h
TPDO4	1001b	1~127	480h + Node ID	1803h
RPDO4	1010b	1~127	500h + Node ID	1403h
T_SDO	1011b	1~127	580h + Node ID	1200h
R_SDO	1100b	1~127	600h + Node ID	1200h
Error control	1110b	1~127	700h + Node ID	1017h

3.2 Network management (NMT)

Network Management System (NMT) is responsible for initializing, starting and stopping the network and equipment in the network, belonging to the master / slave system. There are only one NMT host in the CANopen network and can be configured to include the CANopen network itself.

CANopen performs the corresponding work according to the state machine specified by the protocol. Among them, some of the internal automatic conversion, part of the NMT host must send NMT packets to achieve conversion, as shown below.

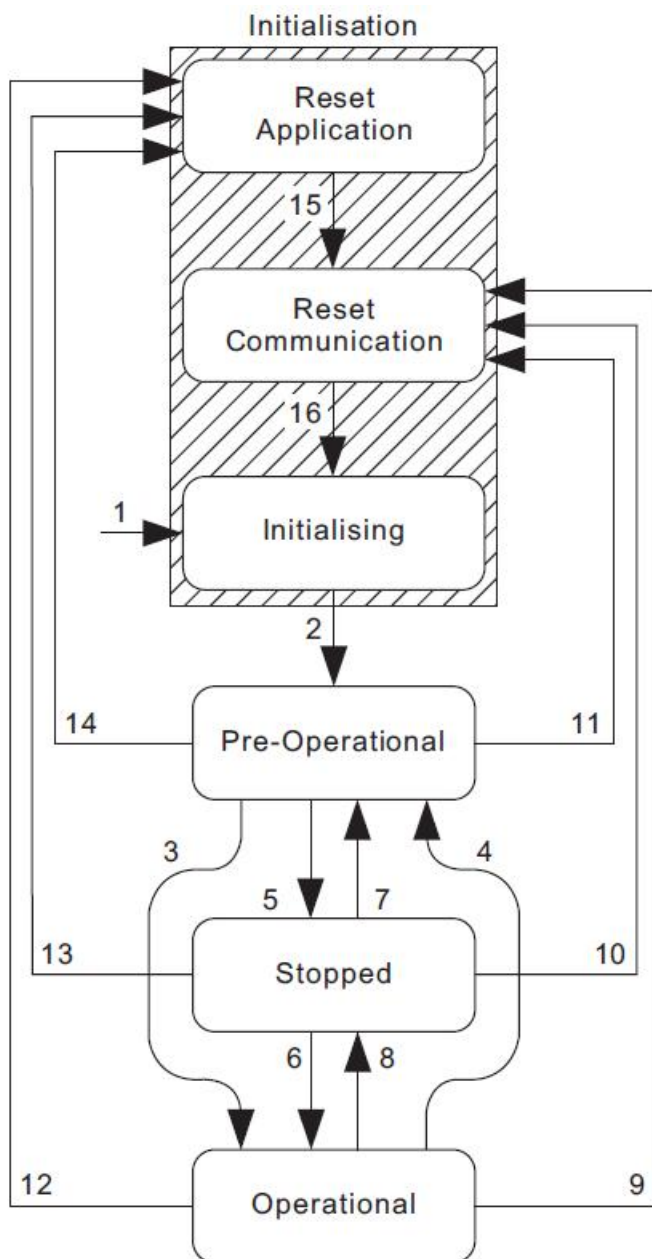


Figure 3-1 Node state transition diagram

The NMT management packet structure is shown in the following table:

Table 3-5 NMT Management Frame Structure

COB-ID	DLC	0	1	2	3	4	5	6	7
000h	2	CS	nodeID	None					

When node ID is 0, it means to control all nodes. CS is command word, control NMT state of the switch, its specific meaning and switch as follows:

Table 3-6 CS command word details

CS	Meaning	State transaction	Target state
01h	Start the node	3, 6	Operation
02h	Stop node	5, 8	Stop
80h	Enter pre-operation state	4, 7	Pre-operation
81h	Reset node	12, 13, 14	Reset node
82h	Reset communication	9, 10, 11	Reset communication

When the nodes are in different states, different communication objects may not run, the specific relationship is as follows:

Table 3-7 Node status corresponds to service operation

State	Meaning	NMT	SDO	PDO	SYNC	EMCY	Heart Beat
Reset node	After completion of reset the node and then reset the communication, it enters into pre-operation state	x	x	x	x	x	x
Reset communication	After completion of reset communication, it enters into pre-operation state	x	x	x	x	x	x
Pre-operation	Except PDO and SYNC, it supports other all service	o	o	x	x	o	o
Operation	Supporting all service	o	o	o	o	o	o
Stop	Stop state, supporting NMT and heartbeat	o	x	x	x	x	o

3.3 Service Data Object (SDO)

SDO through the object index and sub-index establishes contact with object dictionary through the SDO object dictionary reading the contents of the object, or in the case of permission to modify the object data. A visitor is called a client, and a CANopen device whose object dictionary is accessed and provides the requested service is called a server. The CAN message of the client and the response of the CAN message always contain 8 bytes of data. A client request must have a complete SDO service from the server's response.

SDO has two kinds of transmission mechanism

Expedited transfer : Transfer up to 4 bytes of data

Segmented transfer: Transfer data length greater than 4 bytes (SDA2 not yet supported)

The basic frame structure of SDO Expedited transfer is as follows:

Table 3-8 SDO Expedited transfer Frame Structure

COB-ID	DLC	0	1	2	3	4	5	6	7
580h+Node_ID(server) 600h+Node_ID(Client)	8	SDO command	object index		object sub-index	data			

The SDO command has the following meaning:

Table 3-9 SDO command word details

Write command		Read command		Abort command	
2Fh	Write one byte	40h	Read	80h	Abnormal response
2Bh	Write two bytes	4Fh	Read response to one byte		
27h	Write three bytes	4Bh	Read response to two byte		
23h	Write four bytes	47h	Read response to three bytes		
60h	Write successful response	43h	Read response to four bytes		

Through SDO, the value in object dictionary of CANopen nod can be directly read and modify, so in the parameter configuration, but also often as a key data transmission purposes.

For example CANopen control servo motor rotation fixed angle, you can use SDO to transmit, to ensure reliable arrival.

3.4 Process data object (PDO)

Process data object (PDO) is used to transmit real-time data. Data from one producer to one or more consumers is the most important data transmission of CANopen. The PDO data content is defined only by its CAN ID, assuming that the producer and the consumer know the data content of the PDO. Since the PDO transmission does not need to be answered, and the length of the PDO can be less than 8 bytes, the transmission speed is fast.

According to the difference between receive and send, PDO can be divided into RPDO and TPDO, PDO transmission content does not include the contents of the agreement, including only 1 to 8 bytes of data, each PDO through the communication parameter object to determine the PDO communication mode, through the Mapping objects to determine the specific meaning of this data, the relevant object list is as follows

Table 3-10 List of PDO related objects

Item		COB-ID	Communication parameter object	Mapping object
RPDO	1	200h+ Node_ID	1400h	1600h
	2	300h+ Node_ID	1401h	1601h
	3	400h+ Node_ID	1402h	1602h
	4	500h+ Node_ID	1403h	1603h
TPDO	1	180h+ Node_ID	1800h	1A00h
	2	280h+ Node_ID	1801h	1A01h
	3	380h+ Node_ID	1802h	1A02h
	4	480h+ Node_ID	1803h	1A03h

3.4.1 Communication parameter object

PDO communication parameter object has four contents, including COB-ID, transmission type, inhibit time and event timer (RPDO only use COB_ID and trigger mode two parameters).

(1) COB-ID

The COB-ID is located on the sub-index 01 of the communication parameter and contains the control bits and the identification data. The highest bit determines whether the PDO is valid (0: active, 1: disabled), the lower bits include the identifier and the node ID.

(2) Transmission type

The PDO transmission type is located on the sub-index 02 of the communication parameters that determines which transmission mode the PDO follows, as shown in the following table.

Table 3-11 PDO Transmission Type Table

Transmission type value	Trigger mode	TPDO	RPDO
0	Non-cyclic synchronization	Sent when SYNC is received and the mapping object data changes	After receiving the PDO, it needs to receive SYNC frame data to update the data to mapping objects
1~240	Cyclic synchronization	The PDO is sent after receiving n SYNC frames	
241~253	reserve	reserve	reserve
254~255	Asynchronization	The PDO is sent when mapping object data changes or the event timer triggers	The data is updated immediately after receiving the PDO to the mapping object

(3) Inhibit time

The inhibit time is set for the TPDO of the asynchronous transfer (transmission type 254 or 255) and is stored on the sub-index 03 of the communication parameter to prevent the CAN network from being preempted by the higher priority PDO. The unit of this parameter is 100us. After setting the non-zero value, the same TPDO transmission interval should not be less than the time corresponding to the parameter.

(4) Event timer

TPDO asynchronous transferring (transmission type 254 or 255) defines event timer which is located on the sub-index 05 of the communication parameter. When the event timer count arrives, the TPDO is sent and the count value is reset and the count is restarted. Event timer unit is 1ms, set non-0 value, the same TPDO transmission interval is not greater than the corresponding time of the parameter. If other events such as data changes occur during the timer run cycle, TPDO also triggers and the event counter is reset immediately.

Note: To change the PDO communication parameters, you need to close the corresponding PDO channel.

3.4.2 Mapping object

The PDO mapping parameter contains a pointer to the process data corresponding to the PDO that the PDO needs to send or receive, including the index, the sub-index, and the length of the mapping object. Each PDO data can be up to 8 bytes long and can map one or more objects at the same time. Where the sub-index 0 records the number of objects mapped to the PDO, and the sub-indexes 1 to 8 map the contents. The mapping parameter content is defined as follows.

Table 3-12 PDO Mapping Structure Table

bits	31	16	15	8	7	0
Meaning	object index			sub-index			object length		

The index and the sub-index together determine the position of the object in the object dictionary. The object length indicates the specific bit length of the object, expressed in hexadecimal,

Table 3-13 Relationship between object length and object bit length

object length	bits
08h	8bits
10h	16bits
20h	32bits

For example:

It indicates that the mapping parameter of the 16-bit command word 6040h-00 is 60400010h.

Note: Before setting the PDO mapping parameters, turn off the corresponding PDO channel service and set the corresponding PDO mapping activation number to 0.

3.5 Synchronization object (SYNC)

Synchronization object (SYNC) is a special mechanism for controlling the coordination and synchronization between multiple nodes to send and receive. It is used to control the synchronous transmission of data between network devices, such as synchronizing multiple axes simultaneously. The transmission of synchronous packets is based on the producer-consumer model. All nodes that support synchronous PDOs can receive this message as a consumer (both) and use that object to synchronize with other nodes.

The frame structure of the synchronization object is as follows:

Table 3-14 Synchronization frame structure

COB-ID	DLC	0	1	2	3	4	5	6	7
80h	0	no							

The general application is SYNC master node regularly sent SYNC object, SYNC received from the node then the synchronization of the implementation of the task.

SDA2 series servo drives only support the synchronization object consumers.

3.6 Emergency Object(EMCY)

When the CANopen node error occurs, according to the standardization mechanism, the node will send an emergency message. The emergency message follows the producer-consumer model. After the node fault is issued, the other nodes in the CAN network can choose to handle the fault.

The SDA2 servo drive acts only as an emergency message producer and does not process other node emergency messages.

The COB-ID of the emergency object can be accessed through the object dictionary 1014. The most significant bit is the emergency message switch (when the maximum is 1, the emergency message is closed, 0 is the emergency message), and the low bit is 0x80h + Node_ID.

When a node fails, it is necessary to update the error register and the predefined error field regardless whether an emergency object is activated or not. The contents of the emergency message are as follows:

Table 3-15 Emergency message frame structure

COB-ID	DLC	0	1	2	3	4	5	6	7
80h + Node_ID	8	error code		error resistor	reserve	Auxiliary error code		reserve	

For error Code and Auxiliary Error Code Definitions, please refer to Chapter 5 for details.

3.7 Heartbeat

Heartbeat mode is based on the producer-consumer model. The CANopen device can send heartbeat packets in ms based on the period set by the producer heartbeat interval object 1017h. When 1017h is set to 0, the heartbeat producer function turns off. The frame structure of heartbeat packets is shown in the following table.

Table 3-16 Heartbeat message frame structure

COB-ID	DLC	0	1	2	3	4	5	6	7
700h + Node_ID	1	NMT state	no						

NMT status of the following three kinds:

4 : stop

5 : run

127 : pre-run

SDA2 only supports heartbeat producers and does not support heartbeat consumers.

4.1 Control State Machine

4.1.1 CiA402 State Machine

Using the SDA2-CANopen drive, the servo drive should be guided in accordance with the procedure specified in the standard 402 protocol, and the servo drive can operate in the specified state

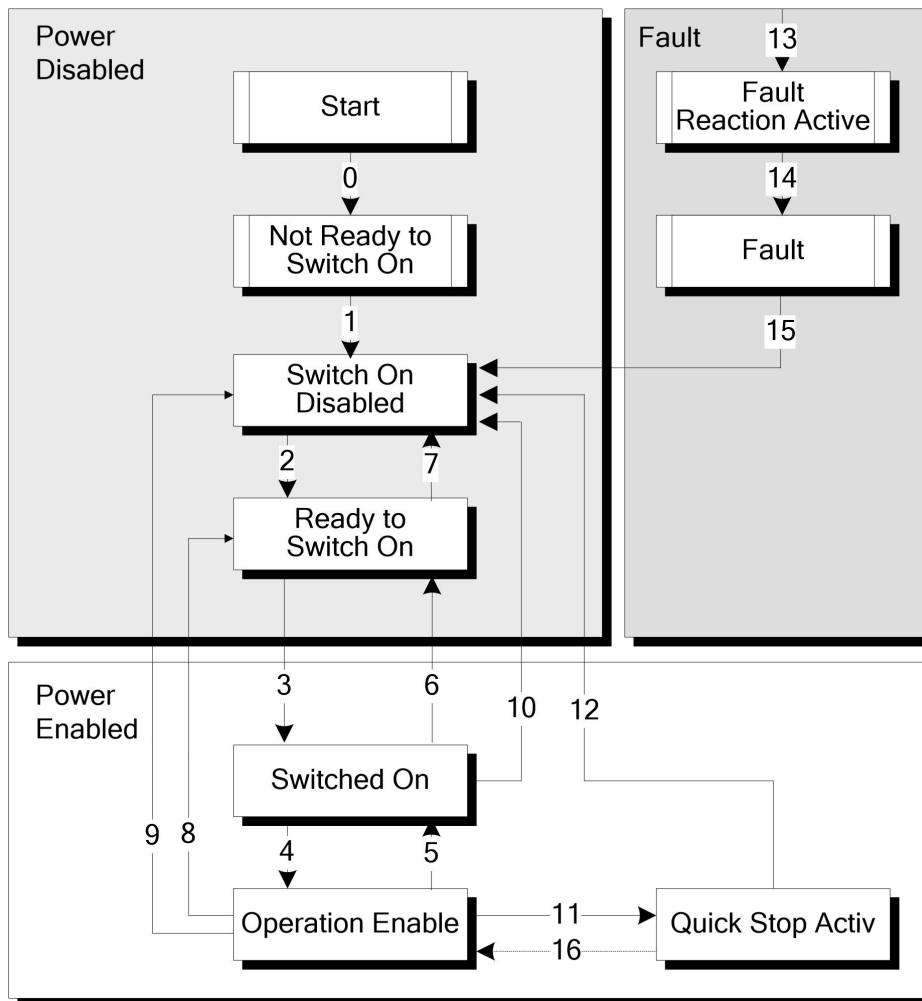


Figure 4-1 CiA402 state diagram

4.1.2 Control Word

The control word contains the following functions:

1. Control the switch of the state machine;
2. Each mode-related control;
3. Manufacturer specific control word;

The specific functions of the control bits are as follows:

Bit	15~11	10~9	8	7	6~4	3	2	1	0
Function	Manufacturer specific	Reserved	halt	Fault reset	Operation mode specific	Enable operation	Quick stop	Enable voltage	Switch on
Remark	Reserve			State machine control	Control mode	State machine control			

The state machine is triggered by the corresponding control commands consisting of bit 0 to bit 3 and bit 7 of the control word.

Command	Bit of the control word					Transitions
	Fault reset	Enable operation	Quick stop	Enable voltage	Switch on	
Shutdown	0	X	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
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	↑	X	X	X	X	15

Note: the symbol X represents not affected by this bit, and the symbol ↑ represents the rising edge.

4.1.3 Status word

The status word contains the following functions:

1. Indicates the current state machine status
2. Indicates the status of each mode
3. Manufacturer specific status (SDA2 not supported)

The status bits are related to each bit as follows:

Bit	Function	Remark
0	Ready to switch on	Status machine state
1	Switched on	
2	Operation enabled	
3	Fault	
4	Voltage enabled	Servo driver is ready
5	Quick stop	Status machine state

Bit	Function	Remark
6	Switch on disabled	
7	Warning	Warning
8	Manufacturer specific	Reserve
9	Remote	
10	Target reached	Control mode
11	Internal limit active	
12 - 13	Operation mode specific	
14 - 15	Manufacturer specific	Reserve

State machine status indication through Bit0 ~ 3, bit5 ~ 6 to carry out, the specific meaning of the following table:

Value(binary)	State
xxxx xxxx x0xx 0000	Not ready toswitch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready toswitch on
xxxx xxxx x01x 0011	Switched on
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

4.2 Position Control Mode

Description

The servo drive receives the position command from the host computer and then controls the servo motor to reach the specified target position.

The position of the servo motor is unit unit, the relationship between the unit quantity and the actual pulse number of the encoder is as follows:

$$\text{Encoder actual pulse number} = \text{unit quantity} \times \text{electronic gear molecular} / \text{electronic gear denominator}$$

The basic steps:

1. Set [Modes of operation: 6060h] to position control mode (6060h = 01h).
2. Set [Target position: 607Ah] to the target position. (Unit: unit amount)
3. Set [Profile velocity: 6081h] to the operating speed. (Unit: 0.01 rpm)
4. Set [Profile acceleration: 6083h] to the acceleration slope. (Unit: ms from 0 rpm to 2000 rpm)
5. Set [Profile deceleration: 6084h] to the deceleration slope. (Unit: ms from 2000 rpm to 0 rpm)

6. Set [control word: 6040h], according to the state machine to enable the servo, and set the position mode related control word.

7. Read [Position actual value(unit): 6064h] Get the current motor feedback position.

8. Read [Status Word: 6041h] to obtain the status of the drive.

Position control related object dictionary:

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
603F	0	Error Code	-	u16	RO	TPDO	-	0
6040	0	Controlword	-	u16	RW	Y	-	0
6041	0	Statusword	-	u16	RO	TPDO	-	0
605A	0	Quickstop option code	-	s16	RW	NO	0,1,5	0
6060	0	Modes of operation	-	s8	RW	Y	0,1,3,4,6,7	0
6061	0	Modes of operation display	-	s8	RO	TPDO	-	0
6062	0	Position demand value(unit)	unit	s32	RO	TPDO	-	0
6063	0	Position actual value(pulse)	pulse	s32	RO	TPDO	-	0
6064	0	Position actual value(unit)	unit	s32	RO	TPDO	-	0
6065	0	Following error window	rev/10	u32	RW	Y	Follower motor	Follower motor
6067	0	Position window	unit	u32	RW	Y	0~200000	100
607A	0	Target position	unit	s32	RW	Y	-	0
607D	0	Software position limit	-	u8	RO	NO	2	2
	1	Minimal position limit	unit	s32	RW	Y	-2000000000 ~2000000000	-2000000000
	2	Maximal position limit	unit	s32	RW	Y		2000000000
607F	0	Maximal profile velocity	rpm/10	u32	RW	Y	6000.00	Follower motor
6081	0	Profile velocity	rpm/10	u32	RW	Y	-6000.00~6000.00	0
6083	0	Profile acceleration	ms	u32	RW	Y	1~999999	100
6084	0	Profile deceleration	ms	u32	RW	Y	1~999999	100

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
6093	0	Position factor	-	u8	RO	NO	2	2
	1	Position factor numerator	-	u32	RW	Y	1~4194303	16
	2	Position factor divisor	-	u32	RW	Y	1~4194303	1
60F4	0	Following error actual value	unit	s32	RO	TPDO	-	0
60FC	0	Position demand value(pulse)	pulse	s32	RO	TPDO	-	0

Related control word of Position control mode

Bit	Name	Description
15~7		Refer 4.1
6	ABS/INC Select	When set to 1, the target position is an absolute value and 0 is an incremental value
5	Changed immediately	When set to 1, the data is changed immediately, and it is not changed immediately when it is 0
4	New set point	If the immediate change bit is 1, a new positioning operation is turned on at the rising edge of the bit, otherwise the bit is valid only when the positioning is completed
3~0		Refer 4.1

Related status word of Position control mode

Bit	Name	Description
15~14		Refer 4.1
13	Following error	The deviation between the feedback position and the command position is greater than Following error window
12	Set-point acknowledge	You can receive a new set of new run signals
11	Internal limit active	servo motor position up to Software position limit
10	Target reached	The deviation between the feedback position and the command position is less than the Position window and the speed is at Velocity threshold
9~0		Refer 4.1

4.3 Interpolation position mode

Description:

The interpolation position mode is used to implement multi-axis synchronous control or single-axis position interpolation. The position change value of each position loop period is calculated based on the interpolation period and the interpolation target position according to the set interpolation period, the transmission timing signal (SYNC) and the interpolation target position of the host computer timing, and the position Instruction to complete position control.

SDA2 only supports absolute position instructions.

When the deviation of the SYNC signal from the synchronization period exceeds one quarter of the synchronization period, the servo generates a synchronization error alarm and stops.

When the SYNC signal is normal and the interpolation position data is delayed, if the parameter P4.05 is 1, the servo will automatically change the position change amount of the previous time as the current change amount, otherwise it is considered that there is no position data update.

When the interpolation position data is continuously lost beyond the parameter P4.04 setting value and the P4.04 setting value is greater than 0, the alarm will stop.

Setps:

1. Set 【Modes of operation:6060h】 to interpolation position mode (6060h = 07h).
2. Set 【Interpolation time index:60C2h Sub-2】 to -3, The interpolation time multiplier is 1ms.
3. Set 【Interpolation time units:60C2h Sub-1】 , The set value multiplied by the time multiple is the interpolation cycle.
4. The host computer sends the SYNC and the interpolation target position according to the set interpolation period.
5. Read 【Statusword:6041h】 bit13, Confirm whether the synchronization is successful, If successful, proceed to the next step.
6. Set 【Controlword:6040h】 to (0x06 > 0x07 > 0x0F > 0x1F), Causes the drive to power up and let the motor run and activate the interpolation.
7. Read 【Statusword:6041h】 to Get the drive status.
8. Read 【Position actual value(unit):6064h】 Get the current feedback position of the motor.

Related object dictionary of interpolation position mode:

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
603F	0	Error Code	-	u16	RO	TPDO	-	0
6040	0	Controlword	-	u16	RW	Y	-	0
6041	0	Statusword	-	u16	RO	TPDO	-	0
605A	0	Quickstop option code	-	s16	RW	NO	0,1,5	0
6060	0	Modes of operation	-	s8	RW	Y	0,1,3,4,6,7	0

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
6061	0	Modes of operation display	-	s8	RO	TPDO	-	0
6062	0	Position demand value(unit)	unit	s32	RO	TPDO	-	0
6063	0	Position actual value(pulse)	pulse	s32	RO	TPDO	-	0
6064	0	Position actual value(unit)	unit	s32	RO	TPDO	-	0
6065	0	Following error window	rev/10	u32	RW	Y	Follower motor	Follower motor
6067	0	Position window	unit	u32	RW	Y	0~200000	100
607D	0	Software position limit	-	u8	RO	NO	2	2
	1	Minimal position limit	unit	s32	RW	Y	-2000000000~2000000000	-2000000000
	2	Maximal position limit	unit	s32	RW	Y		2000000000
607F	0	Maximal profile velocity	rpm/10	u32	RW	Y	6000.0	Follower motor
6093	0	Position factor	-	u8	RO	NO	2	2
	1	Position factor numerator	-	u32	RW	Y	1~4194303	16
	2	Position factor divisor	-	u32	RW	Y	1~4194303	1
60C1	0	Interpolation data record	-	u8	RO	NO	1	1
	1	Interpolation target position	unit	s32	RW	YES	-2000000000~2000000000	0
60C2	0	Interpolation time period	-	u8	RO	NO	2	2
	1	Interpolation time units	-	u8	RW	NO	1~20	10
	2	Interpolation time index	-	s8	RW	NO	-3,-2	-3
60F4	0	Following error actual value	unit	s32	RO	TPDO	-	0
60FC	0	Position demand value(pulse)	pulse	s32	RO	TPDO	-	0

Related control word of interpolation position mode

Bit	Name	Description
15~7		Refer 4.1
6	NO	NO
5	NO	NO
4	Enable ip mode	Interpolated position mode active
3~0		Refer 4.1

Related control word of interpolation position mode

Bit	Name	Description
15~14		Refer 4.1
13	Synchronization success	SYNC signal and interpolation target position data are synchronized successfully
12	ip mode active	DSP 402 state machine is in OPERATION ENABLE and Enable ip mode is ON, then the ip mode active ON
11	Internal limit active	servo motor position up to Software position limit
10	Target reached	The deviation between the feedback position and the command position is less than the Position window and the speed is at Velocity threshold
9~0		Refer 4.1

4.4 Homing method

Description:

This mode helps the drive search for the homing position. The user can set the speed of the reset and the homing method.

Steps:

1. Set [Modes of operation: 6060h] to the homing method (6060h = 06h).
2. Set [Home offset: 607Ch].
3. Set the [homing method: 6098h], ranging from 1 to 37 (refer to the OD-6098h definition below).
4. Set the [Speed for switch search: 6099h Sub-1], find the speed when the speed point switch. (Unit: 0.01 rpm)
5. Set the [Speed for zero search: 6099h Sub-2], set the search homing speed. (Unit: 0.01 rpm)
6. Set [Control Word: 6040h] to (0x06> 0x07> 0x0F> 0x1F), enable the drive to power up and let the motor run and perform homing.
7. Read [Status Word: 6041h] to obtain the drive status.

Related object dictionary of homing method:

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
603F	0	Error Code	-	u16	RO	TPDO	-	0
6040	0	Controlword	-	u16	RW	Y	-	0
6041	0	Statusword	-	u16	RO	TPDO	-	0
605A	0	Quickstop option code	-	s16	RW	NO	0,1,5	0
6060	0	Modes of operation	-	s8	RW	Y	0,1,3,4,6,7	0
6061	0	Modes of operation display	-	s8	RO	TPDO	-	0
6062	0	Position demand value(unit)	unit	s32	RO	TPDO	-	0
607C	0	Home offset	unit	s32	RW	Y	0~2000000000	1000
6098	0	Homing method	-	s8	RW	Y	0~37	0
6099	0	Homing speeds	-	u8	RO	NO	2	2
	1	Speed for switch search	rpm/100	u32	RW	Y	0.01~6000.00	500
	2	Speed for zero search	rpm/100	u32	RW	Y	0.01~6000.00	50

Related control word of homing method

Bit	Name	Description
15~7		refer to 4.1
6	None	None
5	None	None
4	Start homing	start homing(rising edge is enabled)
3~0		refer to 4.1

Related status word of homing method

Bit	Name	Description
15~14		refer to 4.1
13	None	None
12	Homing completed	Homing completed
11	Internal limit active	servo motor position up to Software position limit
10	Target reached	The deviation between the feedback position and the command position is less than the Position window and the speed is at Velocity threshold
9~0		refer to 4.1

SDA2 series servo driver supports 37 kinds of home return mode, the specific way to see the following table:

Method no	Starting direction	Deceleration point signal	Homing signal	Homing Displacement Moving direction	LS Effective edge
1	Negative	-OT	Z	Positive	-
2	Positive	+OT	Z	Negative	-
3	Condition judge	LS	Z	Negative	Falling edge
4		LS	Z	Positive	Rising edge
5		LS	Z	Positive	Falling edge
6		LS	Z	Negative	Rising edge
7	The same to method 3				
8	The same to method 4				
9	Positive	LS	Z	Negative	Rising edge
10	Positive	LS	Z	Positive	Falling edge
11	The same to method 5				
12	The same to method 6				
13	Negative	LS	Z	Positive	Rising edge
14	Negative	LS	Z	Negative	Falling edge
15	Reserved				
16					
17	Negative	-	-OT	Positive	-
18	Positive	-	+OT	Negative	-
19	Condition judge	-	LS	Negative	Falling edge
20		-	LS	Positive	Rising edge
21		-	LS	Positive	Falling edge
22		-	LS	Negative	Rising edge
23	The same to method 19				
24	The same to method 20				
25	Positive	-	LS	Negative	Rising edge
26	Positive	-	LS	Positive	Falling edge
27	The same to method 21				
28	The same to method 22				

Method no	Starting direction	Deceleration point signal	Homing signal	Homing Displacement Moving direction	LS Effective edge
29	Negative	-	LS	Positive	Rising edge
30	Negative	-	LS	Negative	Falling edge
31	Reserved				
32					
33					
34					
35	Position preset				
36	Positive	-	Stoppers	-	-
37	Negative	-	Stoppers	-	-

Note 1: LS is the origin return speed switching point signal given by the external sensor, which is realized by setting the external terminal function.

Note 2: The position preset needs to be in the zero speed range to take effect;

Note 3: The homing method 36 and 37 are required to match parameters P2.22 and P2.23.

Note 4: You can not switch the homing method or switch from the homing method to the other mode during homing

4.5 Speed control mode

Description

The drive can receive speed commands and plan acceleration and deceleration.

Steps

1. Set [Modes of operation: 6060h] to speed control mode (6060h = 03h).
2. Set [Control Word: 6040h] to enable the servo to start and let the motor run.
3. Set [Profile acceleration: 6083h] to plan the acceleration slope. (Unit: ms from 0 rpm to 2000 rpm)
4. Set [Profile deceleration: 6084h] to plan the deceleration slope. (Unit: ms from 2000 rpm to 0 rpm)
5. Set [target speed: 60FFh], the target speed of the unit is 0.1 rpm. If the servo is activated, the drive will start the action immediately after receiving the speed command.
6. Read [Status Word: 6041h] to obtain the drive status.

Related object dictionary of the speed control:

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
603F	0	Error Code	-	u16	RO	TPDO	-	0
6040	0	Controlword	-	u16	RW	Y	-	0
6041	0	Statusword	-	u16	RO	TPDO	-	0
6060	0	Modes of operation	-	s8	RW	Y	0,1,3,4,6,7	0
6061	0	Modes of operation display	-	s8	RO	TPDO	-	0
606B	0	Velocity demand value	rpm/10	s32	RO	TPDO	-	0
606C	0	Velocity actual value	rpm/10	s32	RO	TPDO	-	0
606D	0	Velocity window	rpm	u16	RW	Y	10~6000	50
606F	0	Velocity threshold	rpm	u16	RW	Y	10~6000	50
607F	0	Maximal profile velocity	rpm/100	u32	RW	Y	0.01~6000.00	Follower motor
6083	0	Profile acceleration	ms	u32	RW	Y	1~999999	100
6084	0	Profile deceleration	ms	u32	RW	Y	1~999999	100
60FF	0	Target velocity	rpm/10	s32	RW	Y	-6000.0~+6000.0	0

Related control word of the speed control mode

Bit	Name	Description
15~7		refer to 4.1
6	None	None
5	None	None
4	None	None
3~0		refer to 4.1

Related control word of the speed control

Bit	Name	Description
15~14		refer to 4.1

Bit	Name	Description
13	None	None
12	Speed zero	feedback speed handling speed within Velocity threshold
11	None	None
10	Speed arrival	The difference of feedback speed and command speed is within Velocity window
9~0		refer to4.1

4.6 Torque control mode

Description

The drive can receive torque commands.

Steps

1. Set [Modes of operation: 6060h] to the torque control mode (6060h = 04h).
2. Set [Control Word: 6040h] to start the servo and let the motor run.
3. Set [Target Torque: 6071h] to the target torque. (Unit: one thousandth rated torque)
4. Read [Status Word: 6041h] to get the drive status.

Related object dictionary of the torque control:

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
603F	0	Error Code	-	u16	RO	TPDO	-	0
6040	0	Controlword	-	u16	RW	Y	-	0
6041	0	Statusword	-	u16	RO	TPDO	-	0
6060	0	Modes of operation	-	s8	RW	Y	0,1,3,4,6	0
6061	0	Modes of operation display	-	s8	RO	TPDO	-	0
6071	0	Target torque	1‰	s16	RW	Y	-300.0%~300.0%	0
6074	0	Torque demand value	1‰	s16	RO	TPDO	-300.0%~300.0%	0
6078	0	Current actual value	1‰	s16	RO	TPDO	-300.0%~300.0%	0

Related control word of the torque control

Bit	Name	Description
15~7		Refer to 4.1
6	None	None
5	None	None
4	None	None
3~0		Refer to 4.1

Related status word of the torque control

Bit	Name	Description
15~14		Refer to 4.1
13	None	None
12	None	None
11	None	None
10	None	None
9~0		Refer to 4.1

Chapter 5 Fault handling

5.1 CANopen Communication error

When the servo drive fails or there is communication error, the servo drive sends an emergency message to the network, including fault-related content, as shown in the following table.

Table5-1 Communication error code

Alarm type	Alarm display	Alarm no	Alarm content	Fault register	Alarm code	Auxiliary fault code *	Alarm reset or not
Servo drive alarm	OC1	1	over current 1	03h	2311h	8001h	YES
	OC2	2	over current 2	03h	2312h	8002h	YES
	OS	3	over speed	81h	8400h	8003h	YES
	HV	5	over voltage	05h	3210h	8005h	YES
	ET1	6	encoder error 1	81h	7305h	0006h	NO
	ET2	7	encoder error 2	81h	7305h	0007h	NO
	CT	8	Control power error	05h	FF00h	0008h	NO
	DE	9	data error	81h	5530h	0009h	NO
	EC	13	encoder communication error	81h	7305h	800Dh	NO
	CTE	14	EI Repeat	81h	6320h	000Eh	NO
	OL1	15	Overload 1	81h	3230h	800Fh	YES
	OL2	16	overload 2	81h	3230h	8010h	YES
	LVP	33	Main-circuit power shortage	05h	3220h	8021h	YES
	RH3	36	Regenerative resistance overheat	09h	4210h	0024h	NO
	OF	37	Deviation is exceeded	81h	8611h	8025h	YES
AH	38	Servo drive overheat	09h	4210h	8026h	YES	
CANopen Alarm	cA1	18	CANBus off	41h	8100h	8012h	YES
	cA2	19	CAN Bus error passive	41h	8120h	8013h	YES
	obi	20	Object dictionary initialization error	41h	FF00h	0014h	NO
	nt	46	NMT Jump error	41h	8150h	802Eh	YES
	Pd1	48	PDO Mapping error	41h	8210h	8030h	YES
	Pd2	49	RPDO receive length error	41h	8220h	8031h	YES
	iP	50	Interpolation synchronization failed	41h	8100h	8032h	YES
	iPd	51	Interpolation data is missing	41h	8100h	8033h	YES

*The highest bit of the auxiliary fault code indicates whether the current fault can be reset (1: can be reset by 0: can not be reset)

5.2 Fault clearing method

When a fault occurs, you need to troubleshoot the fault and then perform a fault reset. Refer to the manual for the troubleshooting of the servo drive body. This section describes only the fault clearing method for CANopen-related faults.

Table 5-2 Fault clearing method

Alarm display	Alarm content	Reason	Corrective measures
cA1	CAN bus off	CAN bus communication error overflow	Check the CANopen network and reconnect it
cA2	CAN bus error passive	CAN bus communication error has reached the wrong passive limit	Check the CANopen network and reconnect it
obi	Object dictionary initialization error	Object dictionary initialization error	If the fault still exists after restart, the servo drive is better
nt	NMT jump error	Skip NMT status to stop or reset status when servo is enabled	Reset the NMT node to disable the output stage when NMT is changed.
Pd1	PDO mapping error	1. The total length of the mapping object is exceeded 2. The active mapping object does not exist	Detect PDO mapping parameters, excluding unreasonable mapping parameters
Pd2	RPDO receive length error	The data length received by RPDO does not match the mapped data length	Check the RPDO mapping parameters Check the RPDO data sent by the host computer
iP	Interpolation synchronization failed	The period deviation of the SYNC signal exceeds one quarter of the set period	Adjust the setting of the interpolation cycle Check the cycle of the host computer SYNC signal
iPd	Interpolation data is missing	The number of times the interpolation position data has not been received exceeds the P4.04 parameter setting value.	Check the host computer to send the position data

5.3 SDO Abort code

SDO way to access the drive, there may be some errors, then the drive will reply to SDO abort code, the specific meaning shown in the following table.

Table 5-3 SDO Abort code

Abort code	Abort reason
06010000	Object does not support access
06010001	Try to read only write objects
06010002	Try to write a read-only object
06020000	Object object does not exist in object dictionary
06040041	PDO Objects can not be mapped to PDOs
06040042	The number and length of mapped objects exceeds the PDO length
06070010	The data type does not match and the service parameter length does not match
06070012	Data type does not match, service parameter length is too long
06070013	The data type does not match and the service parameter length is too short
06090011	The sub-index does not exist
06090030	The value range of the parameter value is exceeded
06090031	The write parameter value is too large
06090032	The write parameter value is too small
08000000	General error
08000021	Data can not be transmitted due to local control

Chapter 6 Object dictionary

6.1 Communication parameter object

The 1000h object group contains the parameters required for CANopen communication, and the communication parameters are not mapped to PDO.

Table 6-1 Communication parameter object

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
1000	0	Device Type	-	u32	RO	NO	-	0x00000192
1001	0	Error Register	-	u8	RO	NO	-	0
1003	0	Pre-defined Error Field	-	u8	RW	NO	0~4	0
	1~4	Error Record	-	u32	RO	NO	-	0
1005	0	SYNC COB ID	-	u32	RW	NO	-	0x80
1006	0	SYNC priod		u32	RW	NO	-	0
1010	0	Store Parameters	-	u8	RO	NO	-	3
	1	Store All Parameters	-	u32	RO	NO	-	0
	2	Store Communication Parameters	-	u32	RW	NO	-	0
	3	Store Device Profile 4Parameters	-	u32	RW	NO	-	0
	4	Reserve	-	u32	RW	NO	-	0
1011	0	Restore Default Parameters	-	u8	RO	NO	-	3
	1	Restore All Parameters(except servo parameter)	-	u32	RW	NO	-	0
	2	Restore Communication Parameters	-	u32	RW	NO	-	0
	3	Restore Device Profile Parameters	-	u32	RW	NO	-	0
	4	Restore Servo Parameters	-	u32	RW	NO	-	0
1014	0	Emergency COB ID	-	u32	RW	NO	-	0x80+nodeid
1017	0	Producer Heartbeat Time	ms	u16	RW	NO	0~65535	0

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
1018	0	Identity Object	-	u8	RO	NO	-	4
	1	Vendor ID	-	u32	RO	NO	-	0x7E6
	2	Product code	-	u32	RO	NO	-	0x53444132
	3	Revision number	-	u32	RO	NO	-	0x00170010
	4	Serial number	-	u32	RO	NO	-	0x00000000
1029	0	Error Behavior	-	u8	RO	NO	-	1
	1	Communication Error	-	u8	RW	NO	0,1,2	0
1200	0	Server SDO Parameter	-	u8	RO	NO	-	2
	1	COB ID Client to Server (Receive SDO)	-	u32	RO	NO	-	0x600+nodeid
	2	COB ID Server to Client (Transmit SDO)	-	u32	RO	NO	-	0x580+nodeid
1400~1403	0	RPDO Communication Parameter	-	u8	RO	NO	2	2
	1	COB ID used by RPDO	-	u32	RW	NO	-	0x200~0x500+nodeid
	2	Transmission Type	-	u8	RW	NO	0~255	0xFF
1600~1603	0	Number of RPDO Mapping	-	u8	RW	NO	0~8	-
	1	RPDO Mapping object 1	-	u32	RW	NO	-	-
	2	RPDO Mapping object 2	-	u32	RW	NO	-	-
	3	RPDO Mapping object 3	-	u32	RW	NO	-	-
	4	RPDO Mapping object 4	-	u32	RW	NO	-	-
	5	PDO Mapping object 5	-	u32	RW	NO	-	-
	6	RPDO Mapping object 6	-	u32	RW	NO	-	-
	7	RPDO Mapping object 7	-	u32	RW	NO	-	0
	8	RPDO Mapping object 8	-	u32	RW	NO	-	0
1800~1803	0	TPDO Communication Parameter	-	u8	RO	NO	5	5
	1	COB ID used by TPDO	-	u32	RW	NO	-	0x180~0x480+nodeid
	2	Transmission Type	-	u8	RW	NO	0~255	0xFF

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
1800~1803	3	Inhibit Time	100us	u16	RW	NO	0~65535	0
	4	Reserve	-	u8	RW	NO	-	-
	5	Event Timer	ms	u16	RW	NO	0~65535	0
1A00~1A03	0	Number of TPDO Mapping	-	u8	RW	NO	0~8	-
	1	TPDO Mapping object 1	-	u32	RW	NO	-	-
	2	TPDO Mapping object 2	-	u32	RW	NO	-	-
	3	TPDO Mapping object 3	-	u32	RW	NO	-	-
	4	TPDO Mapping object 4	-	u32	RW	NO	-	-
	5	TPDO Mapping object 5	-	u32	RW	NO	-	-
	6	TPDO Mapping object 6	-	u32	RW	NO	-	-
	7	TPDO Mapping object 7	-	u32	RW	NO	-	-
	8	TPDO Mapping object 8	-	u32	RW	NO	-	-

6.2 Sub-protocol object

The 6000h object group contains the associated sub-protocol DSP 402 related objects.

Table 6-2 CiA402 Sub-protocol object

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
603F	0	Error Code	-	u16	RO	TPDO	-	0
6040	0	Controlword	-	u16	RW	YES	-	0
6041	0	Statusword	-	u16	RO	TPDO	-	0
605A	0	Quickstop option code	-	s16	RW	NO	0,1,5	0
6060	0	Modes of operation	-	s8	RW	YES	0,1,3,4,6,7	0
6061	0	Modes of operation display	-	s8	RO	TPDO	-	0
6062	0	Position demand value(unit)	unit	s32	RO	TPDO	-	0
6063	0	Position actual value(pulse)	pulse	s32	RO	TPDO	-	0
6064	0	Position actual value(unit)	unit	s32	RO	TPDO	-	0

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
6065	0	Following error window	rev	u32	RW	YES	Follower motor	Follower motor
6067	0	Position window	unit	u32	RW	YES	0~200000	100
606B	0	Velocity demand value	rpm/10	s32	RO	TPDO	-6000.0~+6000.0	0
606C	0	Velocity actual value	rpm/10	s32	RO	TPDO	-6000.0~+6000.0	0
606D	0	Velocity window	rpm	u16	RW	YES	10~6000	50
606F	0	Velocity threshold	rpm	u16	RW	YES	10~6000	50
6071	0	Target torque	1‰	s16	RW	YES	-300.0%~300.0%	0
6074	0	Torque demand value	1‰	s16	RO	TPDO	-300.0%~300.0%	0
6077	0	Actual torque value	1‰	s16	RO	TPDO	-300.0%~300.0%	0
6078	0	Current actual value	1‰	s16	RO	TPDO	-300.0%~300.0%	0
607A	0	Target position	unit	s32	RW	YES	-200000000 0~200000000	0
607C	0	Home offset	unit	s32	RW	YES	0~200000000	1000
607D	0	Software position limit	-	u8	RO	NO	2	2
	1	Minimal position limit	unit	s32	RW	YES	-200000000 0~200000000	-200000000
	2	Maximal position limit	unit	s32	RW	YES	00	200000000
607F	0	Maximal profile velocity	rpm/10	u32	RW	YES	6000.00	Follower motor
6081	0	Profile velocity	rpm/10	u32	RW	YES	-6000.00~6000.00	0
6083	0	Profile acceleration	ms	u32	RW	YES	1~999999	100
6084	0	Profile deceleration	ms	u32	RW	YES	1~999999	100

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
6086	0	Motion profile type	-	s16	RW	NO	0	0
6093	0	Position factor	-	u8	RO	NO	2	2
	1	Position factor numerator	-	u32	RW	YES	1~4194303	16
	2	Position factor divisor	-	u32	RW	YES	1~4194303	1
6098	0	Homing method	-	s8	RW	YES	0~37	0
6099	0	Homing speeds	-	u8	RO	NO	2	2
	1	Speed for switch search	rpm/ 10	u32	RW	YES	0.01~6000.0 0	500.0
	2	Speed for zero search	rpm/ 10	u32	RW	YES	0.01~6000.0 0	50.0
60C1	0	Interpolation data record	-	u8	RO	NO	1	1
	1	Interpolation target position	unit	s32	RW	YES	-200000000 0~20000000 00	0
60C2	0	Interpolation time period	-	u8	RO	NO	2	2
	1	Interpolation time units	-	u8	RW	NO	1~20	10
	2	Interpolation time index	-	s8	RW	NO	-3,-2	-3
60F4	0	Following error actual value	unit	s32	RO	TPDO	-	0
60FC	0	Position demand value(pulse)	pulse	s32	RO	TPDO	-	0
60FF	0	Target velocity	rpm/1 0	s32	RW	YES	-6000.0~600 0.0	0
6502	0	Supported drive modes	-	u32	RO	TPDO	0x6D	0x6D

* The unit of the tolerance range follows the setting of parameter P1.31. When P1.31 is 0, the unit of deviation is unit quantity (unit), and when it is 1, the unit of deviation is pulse quantity (pulse).

6.3 SDA2 Specific object

Object dictionary 3000h ~ 4001h for SDA2 servo drive unique objects.

Table 6-3 SDA2 Specific object

Index	Sub-Index	Name	units	Data Type	Access	Mappe d	Range	Default
3000	0	Number of Servo Para Group 1	-	u8	RO	NO	-	99
	1~99	Data of Servo Para Group 1	-	s32	RW	NO	Refer to the servo parameters	
3001	0	Number of Servo Para Group 2	-	u8	RO	NO	-	99
	1~99	Data of Servo Para Group 2	-	s32	RW	NO	Refer to the servo parameters	
3002	0	Number of Servo Para Group 3	-	u8	RO	NO	-	99
	1~99	Data of Servo Para Group 3	-	s32	RW	NO	Refer to the servo parameters	
3003	0	Number of Servo Para Group 4	-	u8	RO	NO	-	99
	1~99	Data of Servo Para Group 4	-	s32	RW	NO	Refer to the servo parameters	
3100	0	Number of Monitor Data	-	u8	RO	NO	-	18
	1	Feedback Speed	rpm	s32	RO	NO	-	-
	2	Command Speed	rpm	s32	RO	TPDO	-	-
	3	Command Torque	0.01	s32	RO	TPDO	-	-
	4	Peak Toque	0.01	s32	RO	TPDO	-	-
	5	Motor Current	0.1A	s32	RO	TPDO	-	-
	6	Effective Torque	0.01	s32	RO	TPDO	-	-
	7	Feedback Postion	unit	s32	RO	TPDO	-	-
	8	Command Postion	unit	s32	RO	TPDO	-	-
	9	Postion Deviation	-	s32	RO	TPDO	-	-
	10	Command Pulse Frequency	0.1kHz	s32	RO	TPDO	-	-

Index	Sub-Index	Name	units	Data Type	Access	Mappe d	Range	Default
3100	11	Feedback Cumulative Pulse	pulse	s32	RO	TPDO	-	-
	12	Cumulative Input Pulse	pulse	s32	RO	TPDO	-	-
	13	LS-Z Pulse	pulse	s32	RO	TPDO	-	-
	14	Load Inertia Ratio		s32	RO	TPDO	-	-
	15	DC Link Voltage(max.)	V	s32	RO	TPDO	-	-
	16	DC Link Voltage(min.)	V	s32	RO	TPDO	-	-
	17	VREF Input Voltage	0.01V	s32	RO	TPDO	-	-
	18	TREF Input Voltage	0.01V	s32	RO	TPDO	-	-
3200	0	Alarm history select	-	u8	RW	NO	1~20	1
3201	0	Number of Error Data	-	u8	RO	NO	14	14
	1	Alarm Code	-	s32	RO	NO	-	0
	2	Total Time Main Power Supply	h	s32	RO	NO	-	0
	3	Reserve	-	s32	RO	NO	-	0
	4	Motor Running Time	-	s32	RO	NO	-	0
	5	Feedback Speed	rpm	s32	RO	NO	-	0
	6	Feedback Speed(5ms before)	rpm	s32	RO	NO	-	0
	7	Command Speed	rpm	s32	RO	NO	-	0
	8	Command Torque	1%	s32	RO	NO	-	0
	9	Motor Current	1%	s32	RO	NO	-	0
	10	Effective Torque	1%	s32	RO	NO	-	0
	11	DC Link Voltage	V	s32	RO	NO	-	0
	12	EC Error Count	-	s32	RO	NO	-	0
	13	Command Position	unit	s32	RO	NO	-	0
	14	Sequence Mode	-	s32	RO	NO	-	0
3300~330E	0	Number of Elements	-	u8	RO	NO	7	7
	1	Positioning Status	-	u8	RW	NO	-	0

Index	Sub-Index	Name	units	Data Type	Access	Mapped	Range	Default
3300~330E	2	M Code	-	u8	RW	NO	0~0xFF	0xFF
	3	Stop Timer	-	u16	RW	NO	0~65535	0
	4	Stop Position	unit	s32	RW	NO	-200000000 0~200000000 00	0
	5	Rotation Speed	0.01rpm	u32	RW	NO	0.01~6000.0 0	0.01
	6	Acceleration Time	ms	u32	RW	NO	0~999999	0
	7	Deceleration Time	ms	u32	RW	NO	0~999999	0
4000	0	Communication Digital Input	-	u16	RW	Y	0~65535	0
4001	0	Communication Digital Output	-	u16	RO	TPDO	0~65535	0

SDA2 servo drive unique objects, the corresponding relationship as follows:

Table 6-4 SDA2 Specific object function correspondence table

Index high byte	Content	Index low byte	Sub-index
30h	Parameter	Corresponding content groups	Subproject of each group of content
31h	Monitoring data		
2h	Alarm record		
33h	Positioning data		
40h	Communication digital terminal		

Such as the parameter P1.52, for the first set of parameters, the corresponding object dictionary index 0x3000, sub-index of 52.

6.3.1 Parameter

Through the object dictionary 3000h ~ 3003h access to the servo drive parameters, all parameters of the data types are s32 (signed 32-bit data), the specific meaning of the parameters refer to Chapter VI of the manual.

6.3.2 Monitoring data

SDA2 series servo drive provides 18 sets of related monitoring data, through the object 3100h access.

6.3.3 Alarm record

The SDA2 series servo drive provides historical alarm data viewing. It can query all relevant data of the alarm time. Through the object dictionary 3200h and 3201h, you can select to view 20 sets of historical alarm data. Each group of alarm records contains 14 related data.

Note: The corresponding meaning of the sub-index 04h (motor power-on time) corresponds to the following:

When the value is greater than 32768, the valid value is the value after subtracting 32768, and the corresponding unit is hour;

When the value is less than 32768, the valid value is the current value, and the corresponding unit is second.

6.3.4 Positioning data

Through the object dictionary 3300h ~ 330Fh, you can view and modify the positioning data. When there are only a few fixed changes in the target position, the position of the servo can be controlled by positioning data combined with the communication digital port to reduce the load on the network. Please refer to the instructions for how to locate the data.

The contents of the positioning data are shown in the table below.

Table6-7 Positioning data

Index	Sub-index	Name	Data type	Unit
3300h~330Fh	1	Positioning Status	u8	-
	2	M Code	u8	-
	3	Stop Timer	u16	According to the parameters P2.42
	4	Stop Position	s32	Units
	5	Rotation Speed	u32	[rpm]
	6	Acceleration Time	u32	[ms]Accelerate from 0 to 2000
	7	Deceleration Time	u32	[ms]Decelerate from 2000 to 0

6.3.5 Communication digital terminal

Communication EI extends 16 communication digital inputs, you can set the corresponding function according to the parameters P3.09 ~ P3.24.

Communication EOUT extends 16 communication digital outputs, you can set the corresponding function according to the parameters P3.56 ~ P3.71.

For details, refer to Chapter 6 of the manual.

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