CANopen

Manual

Rev. 2.3

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Instructions

This manual describes Shenzhen Just Motion Control Electromechanics Co., Ltd.'s CANopen products that support the CIA301 and CIA402 protocols.It is recommended that users fully understand the CIA301 protocol to use later, to make it easier for users to use our products to develop their own motion control system.This manual supports only the version of CANopen with version V2.0 or above, version V2.0 or below. Please refer to the V1.1 version of this manual.

Users can get more information on automation products and international standards at http://www.can-cia.com. At the same time you can also visit JMC official website http: //www.jmc-motion.com download application software and related instruction manual.

Shenzhen Just Motion Control Electromechanics Co., Ltd.

version	write	approval
V2.3	R & D department	R & D department

Catalog

References

Hardware manual for JMC CANopen products
User manual for JMC handheld intelligent debugger
CIA 301
CIA 303
CIA 402
Bosch CAN Physical Layer Protocol 2.0B

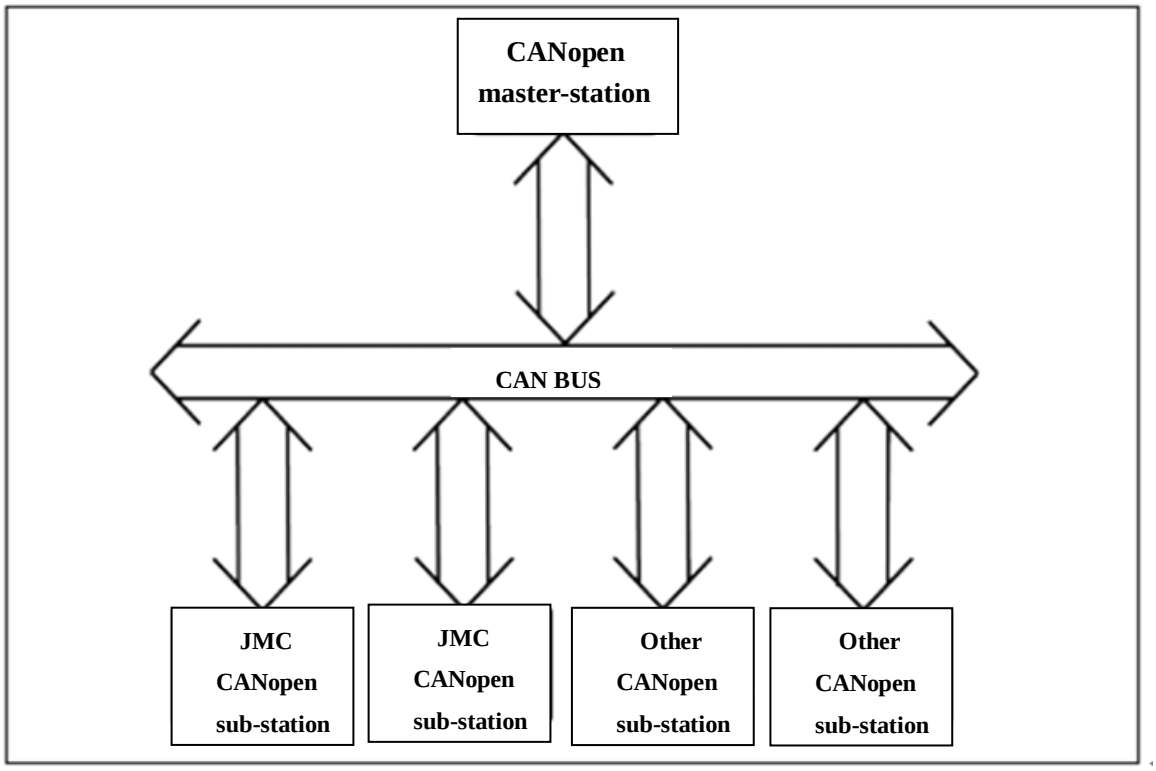
Common shorthand

CAN	Controller Area Network
CIA	CAN in Automation Group (Standards Body)
COB-ID	Communication Object Identification
EDS	Electronic Data Sheet
NMT	Network Management
OD	Object Dictionary
PDS	Power Drive System
PDO	Process Data Object
RPDO	Receive (incoming) PDO
SDO	Service Data Object
TPDO	Transmit (outgoing) PDO

Summarize

CANopen Network Topology

JMC CANopen equipment can be compatible with other CANopen manufacturers equipment integrated use，As shown below.



Driver Setting

Set the drive by the following four steps:

- connect the power supply and motor
- driver connected to the CANopen network
- set the baud rate and station number
- configuration drive parameters

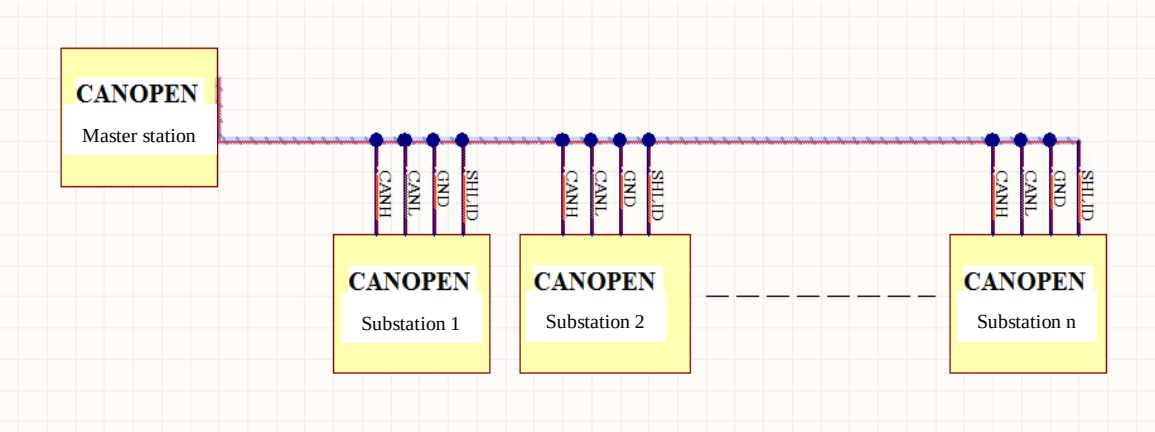
Connect the power supply and motor

Please refer to the related hardware manual connection of power supply and motor drive, relevant documents can be downloaded from JMC official website：http: //www.jmc-motion.com

Driver connected to the CANopen network

Please refer to the corresponding hardware manual to connect with the CANopen network.JMC CANopen product adopts four wire connection, the interface as shown in the figure below.Wiring must accord with CIA303 agreement from station equipment with the Daisy chain type, and on the network terminal equipment connected a 120 ohm resistor.Since may because of the Electrical surge, do not recommend use of star connection, please refer to the manual hardware to make connection of telecommunication lines.

As shown in the following figure, there are multiple 2DM556-RC connections in the CANopen network.



Terminal resistance: At the end of the network, a terminal resistance of a 120 ohm is connected between the CANL and CANH on the last sub-station device to avoid communication disorders.

n: One CAN communication network can support up to 127 connections from the sub-station.

Set the baud rate and station number

The CANopen product has three spin codes, in which S1, S3 are used for the sub-station number setting, and S2 is used for the baud rate settings (or with the debug panel to modify the parameters). The following table shows the value of the baud rate corresponding to the S2 spin code value. The S1 spin code is used to set the lower four bits of the sub-station number, and S3 is used to set the three high bits of the sub-station number, that is, from the sub-station number =S3*16 + S1. For specific code definition, please refer to the corresponding hardware manual.

Note: when the sub-station number and baud rate are set, the power reboot or the network reset will take effect. Driver will not identify modification of sub-station number or baud rate during running.

S2 value	Baud rate（bps）
0	12.5K
1	20K
2	50K
3	100K
4	125K
5	250K
6	500K
7	1M

Configuration drive parameters

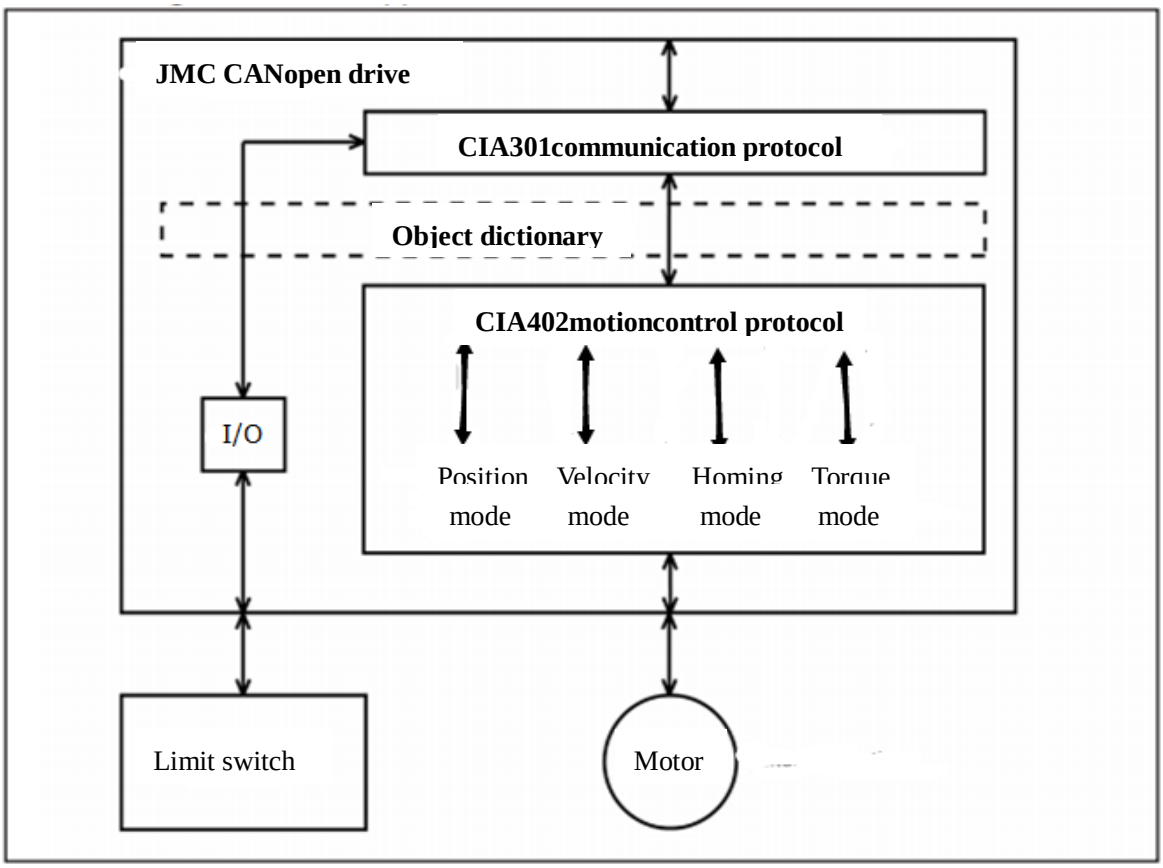
Connect the drive to the CANopen network, set up the baud rate and sub-station number, and adjust the drive parameters with handheld intelligent debugger. It does not need to debug through the RS232 connection to PC .

Note: driver automatically detects if it is connected with handheld debugger when powered on. If connects to handheld debugger, driver is in initialized state. After handheld debugger is disconnected, driver switches to normal CANopen boot program: initialization of drive parameter, sending start message, entering pre-operation state and sending NMT message.

Support CIA402 motion control protocol

Mode	Step servo product support mode
Profile position mode	●
Profile velocity mode	●
Homing mode	●
Torque profile mode	

The above Velocity mode, Position mode, and Homing mode will be introduced in the subsequent chapters. The relevant content can also be referred to the CIA402 protocol.



Object Dictionary

The index and sub-index of the object dictionary is defined in the EDS file ,and is associated with the parameters of the drive control. In the subsequent chapters, we will give a detailed description of the functions of each of the object dictionaries. Some specific object dictionaries can only be accessed by the SDO, and some object dictionaries can also be quickly accessed through the PDO.

EDS file

EDS file lists all the attributes of the object dictionary, can be downloaded from the official website of JMC. The following is the description of the object dictionary by the EDS file of the CANopen device.

Index	Sub-index	Name	Data type	Access type	PDO Mapping
1000h	0	Device type	USIGNED32	RO	
1001h	0	Error register	USIGNED8	RO	Yes
1003h		Predefined error field	ARRAY		
	0	Sub-index number	USIGNED32	RW	
	1	Error state	USIGNED32	RO	
	2	Error state	USIGNED32	RO	
	3	Error state	USIGNED32	RO	
	4	Error state	USIGNED32	RO	
1005h	0	COB-ID synchronous messages	USIGNED32	RW	
1006h	0	Synchronization period	USIGNED32	RW	
1007h	0	Synchronization window length	USIGNED32	RW	
1008h	0	Manufacturer Device name	VISIBLE_STRING	CONST	
1009h	0	Manufacturer hardware version	VISIBLE_STRING	CONST	
100Ah	0	Manufacturer software version	VISIBLE_STRING	CONST	
1010h		Store parameters	ARRAY		
	0	Sub-index number	USIGNED8	RO	
	1	Store all parameters	USIGNED32	RW	
1014h	0	Emergency message COB-ID	USIGNED32	RO	
1017h	0	Producer heart beat time	USIGNED16	RW	

1018h		Object identification	RECORD		
	0	Sub-index number	USIGNED8	RO	
	1	Vendor id	USIGNED32	RO	
	2	Product code	USIGNED32	RO	
	3	Revision number	USIGNED32	RO	
	4	Serial number	USIGNED32	RO	
1200h	0	SDO parameter	RECORD		
1400h	0	RPDO communication parameter 0	RECORD		
1401h	0	RPDO communication parameter 1	RECORD		
1402h	0	RPDO communication parameter 2	RECORD		
1403h	0	RPDO communication parameter 3	RECORD		
1600h	0	RPDO mapping parameter 0	RECORD		
1601h	0	RPDO mapping parameter 1	RECORD		
1602h	0	RPDO mapping parameter 2	RECORD		
1603h	0	RPDO mapping parameter 3	RECORD		
1800h	0	TPDO communication parameter 0	RECORD		
1801h	0	TPDO communication parameter 1	RECORD		
1802h	0	TPDO communication parameter 2	RECORD		
1803h	0	TPDO communication parameter 3	RECORD		
1A00h	0	TPDO mapping parameter 0	RECORD		
1A01h	0	TPDO mapping parameter 1	RECORD		
1A02h	0	TPDO mapping	RECORD		

		parameter 2			
1A03h	0	TPDO mapping parameter 3	RECORD		

Index	sub-index	Name	Data type	Access type	PDO Mapping	Whether to use
6040h	0	Control word	UNSIGNED16	WO	yes	yes
6041h	0	Status word	UNSIGNED16	RO	yes	yes
605Ah	0	Quick stop option code	INSIGNED16	WR	yes	yes
605Dh	0	Halt option code	INSIGNED16	WR	yes	no
6060h	0	Modes of operation	INSIGNED8	WO	yes	yes
6061h	0	Mode code response	INSIGNED8	RO	yes	yes
6064h	0	Position actual value	INSIGNED32	WR	yes	yes
606Ch	0	Velocity actual value	INSIGNED32	WR	yes	yes
607Ah	0	Target position	INSIGNED32	WR	yes	yes
607Ch	0	Home offset	INSIGNED32	WR	yes	yes
6081h	0	Target velocity	INSIGNED32	WR	yes	yes
6083h	0	acceleration	UNSIGNED32	WR	yes	yes
6084h	0	deceleration	UNSIGNED32	WR	yes	yes
6085h	0	Quick stop deceleration	UNSIGNED32	WR	yes	yes
6098h	0	Homing method	INSIGNED8	WR	yes	yes
6099h		Homing speeds	ARRAY			
	0	Sub-index number	UNSIGNED8	RO		
	1	the speed of finding mechanical origin	UNSIGNED32	WR	yes	yes
	2	the speed of finding zero origin	UNSIGNED32	WR	yes	yes
609Ah	0	Homing acceleration	UNSIGNED32	WR	yes	yes
60C5h	0	Maximum acceleration	UNSIGNED32	WR	yes	yes
60C6h	0	Maximum deceleration	UNSIGNED32	WR	yes	yes

Control word

Bit definition of control word：

Byte	BIT	Bit definition			
		Position mode	Velocity mode	Homing mode	Torque mode
LSB	0	0—>1：Parameter variable initialization（Brake shut down）.			
	1	0—>1：The operation of drive（Brake open）.			
	2	0—>1：quick stop			
	3	0—>1：Motor enable 1—>0：Motor disable			
	4	0—>1：Position sampling	Reserve	Start homing	Reserve
	5	0：Complete the current position and then execute the next location； 1：Run directly to the next given location；	Reserve	Reserve	Reserve
	6	0：Absolute positioning； 1：Relative positioning；	Reserve	Reserve	Reserve
	7	0—>1：Error reset clearance			
MSB	8	0—>1：Halt 1—>0：normal operation			
	9	0：Finish the previous position stop and run the next position； 1：The current position and the next position do not stop；	Reserve	Reserve	Reserve
	10	Reserve			
	11	Reserve			
	12	Reserve			
	13	Reserve			
	14	Reserve			
	15	Reserve			

Control word state switching command：

Command	The bit of the Control word				
	Error resetbit8	Enable operation bit3	Quick stop bit2	Enable voltage bit1	Initialization device bit0
Shut down	0	X	1	1	0
Initialization device	0	0	1	1	1
Enable device operation	0	1	1	1	1
Quick stop	0	X	0	1	X
Forbid enable	0	0	1	1	1
Error reset	0→1	X	X	X	X

Status word

Bit definition of status word：

<table>
<tr><td rowspan="2">Byte</td><td rowspan="2">BIT</td><td colspan="7">Bit definition</td></tr>
<tr><td colspan="2">Position mode</td><td colspan="2">Velocity mode</td><td colspan="2">Homing mode</td><td>Torque mode</td></tr>
<tr><td rowspan="8">LSB</td><td>0</td><td colspan="7">0：Unprepared initialization 1：Ready to initialize</td></tr>
<tr><td>1</td><td colspan="7">0：Initialization drive is not completed 1：Initialization drive completion</td></tr>
<tr><td>2</td><td colspan="7">0：Motor disable 1：Motor enable</td></tr>
<tr><td>3</td><td colspan="7">0：Drive normal status 1：Drive error status</td></tr>
<tr><td>4</td><td colspan="7">0：Drive not work 1：Drive work normally</td></tr>
<tr><td>5</td><td colspan="7">0：Normal operation 1：Quick stop</td></tr>
<tr><td>6</td><td colspan="7">0：Normal operation 1：Device enters the initialization state</td></tr>
<tr><td>7</td><td colspan="7">0：Normal operation 1：Warning</td></tr>
<tr><td rowspan="8">MSB</td><td>8</td><td colspan="7">0：Normal operation 1：Motor halt</td></tr>
<tr><td>9</td><td colspan="7">0：motor not run 1：Motor running sign</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">0：Not reach position</td><td rowspan="2">0</td><td>Bit8=0:Not reaching the target speed</td><td rowspan="2">0</td><td>Bit8=0:Not reaching the homing position</td><td rowspan="2">Reserve</td></tr>
<tr><td>Bit8=1:Deceleration</td><td>Bit8=1:Deceleration</td></tr>
<tr><td rowspan="2">1：Reach position</td><td rowspan="2">1</td><td>Bit8=0:reaching the target speed</td><td rowspan="2">1</td><td>Bit8=0:reaching the homing position</td></tr>
<tr><td>Bit8=1:The speed is 0</td><td>Bit8=1:The speed is 0</td></tr>
<tr><td>11</td><td colspan="7">SW mechanical origin limit mark</td></tr>
<tr><td rowspan="2">12</td><td>0：Not set new location</td><td colspan="2">0：The speed is not 0</td><td colspan="2">0：Homing operation not complete</td><td rowspan="4">Reserve</td></tr>
<tr><td>1：set new location</td><td colspan="2">1：The speed is equal to 0</td><td colspan="2">1：Homing operation complete</td></tr>
<tr><td rowspan="2">13</td><td>0：Normal operation</td><td colspan="2">0：No maximum acceleration</td><td colspan="2">0：Homing operation not error</td></tr>
<tr><td>1：over position</td><td colspan="2">1:maximum acceleration</td><td colspan="2">1：Homing operation error</td></tr>
<tr><td>14</td><td colspan="7">CW clockwise direction limit mark</td></tr>
<tr><td>15</td><td colspan="7">CCW counter clockwise direction limit mark</td></tr>
</table>

The status word indicates the state of the device：

Status word value（Binary）	State
XXXX XXXX X0XX 0000	Uninitialized device
XXXX XXXX X01X 0001	Initialized device
XXXX XXXX X01X 0011	Device operation
XXXX XXXX X01X 0111	Device enable
XXXX XXXX X00X 0111	Quick stop active
XXXX XXXX X0XX1111	Fault reaction active
XXXX XXXX X0XX1000	Fault

Object dictionary description

The description of the object dictionary is an important part of the communication protocol. The object dictionaries can be accessed through the network in the order they are set, and at the same time, each object dictionary is composed of 16-bit indexes.

The definition of standard object dictionary below accords with other devices that follow standard serial bus system manufacturers.

Index（hex）	object
0000	Reserve
0001-01F	Static data type
0020-003F	Complex data type
0040-005F	manufacturer specific Complex data type
0060-007F	Device profile specific static data type
0080-009F	Device profile specific complex data type
00A0-0FFF	Reserve
1000-1FFF	Communication profile area
2000-5FFF	Manufacturer specific profile area
6000-9FFF	Standardized device profile area
A000-FFFF	Reserve

Communication profile

0x1000 - device type

1000h describes the device type and its function. Composed of 32-bit data, the lower 16 bits describe the protocol used by the device and the upper 16 bits provide additional information describing optional features of the device. Additional information is defined in the standard agreement, this article does not elaborate. When the additional information is 0000h, the device does not comply with the standard protocol. For the MUX device module, the additional information is FFFFh. Device Protocol = 67FFh + x * 800h, where X is the internal device number.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RO	NO	NO	0x00060912

Bit 0-15: Device Protocol

Bit 16-31: additional information

Notes: COS: TPDO Detection of changes in their state

0x1001 - error register

The device's internal error will be mapped to this register. 1001h is the object part of the emergency message sending.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED8	RO	Optional	NO	0

Bit 0: generic error

Bit 1: current error

Bit 2: voltage error

Bit 3: temperature error

Bit 4: communication error

Bit 5: over position (Stepping servo drive)

Bit 6: Reserve (Default 0)

Bit 7: Motor phase loss (Stepping servo drive)

0x1002 -device status register（not available）

This register is a device status special register.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RO	Optional	NO	0

0x1003 －Predefined error field

This object dictionary stores false alarms occurred on devices and sent via emergency messages.
1. Sub-index 0 indicates that the device has recorded the number of error states.
2. The latest error status is stored in sub-index 1, followed by other historical errors move backwards.
3. Writing "0" to sub-index 0 detects if there is a recorded error status and clears the error history. Values other than 0 will not be recognized by them and will return error code 0609 0030h.
4. The error code data type is UNSIGNED32, which consists of the lower 16-bit error codes and additional error messages defined by the upper 16-bit manufacturers. The object dictionary has at least two entries, sub-index 0 and sub-index 1.

Object type	Sub-index	Data type	Access type	PDO mapping	COS	Default value
VAR	4	UNSIGNED32	RO	optional	NO	0

Sub-index	Name	Default value
00	The number of error status	0
01	History error status	0
02	History error status	0
03	History error status	0

Error number (sub-index number = 0) :
Bit 0-7: Write “0”to erase history error
Standard error code (sub-index number = 1~ 3) :
Bit 0-15: Emergency message transmission error code
Bit 16-31:Manufacturer-defined additional error code

0x1005 –COB-ID synchronous messages

0x1005h defines the COB-ID of the synchronization message object. At the same time, whether the synchronization message sends a synchronization message or not is defined in the structure of the object dictionary as follows:

Bit	Value	Meaning of bits
31(MSB)	0 1	The device does not support synchronization message The device support synchronization message
30	0 1	The device does not generate synchronization message The device generates synchronization message
29	0 1	11-bit ID (CAN 2.0A) 29-bit ID (CAN 2.0B)
28-11	0 X	If bit 29=0 If bit 29=1:bit 28-11 of 29-bit-TIME-COB-ID
10-0(LSB)	X	Bits 10-10 of TIME-COB-ID

Bits 29 and 30 are fixed state, and can not be changed. If the device does not support the generation of synchronization messages, modifying the 30th bit will result in an end code: 0609 0030h. The device supports standard CAN data frames. When attempting to modify bit 29, Will be invalid and an error code of 0609 0030h will be returned. When bit 30 is set to 1, it takes one time period to transmit the first synchronization message. At bit 30 = 1, 0-29 bits are not allowed to be modified.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RW	NO	NO	0x00000080

Bit 0-10: COB-ID of the synchronization object

Bit 11-29: set 0

Bit 30: 1(0) – The node generates (does not generate) synchronization messages

Bit 31: set 0

0x1006 Synchronization period

The object dictionary defines the communication time period in ms. It defines the period of the internal synchronization message. If the value is 0, it is invalid. If the value is not 0, a synchronization message will be sent at each value.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RW	NO	NO	0

Bit 0-31: The unit of synchronous transmission is ms (0 = no transmission, no detection)

0x1007 Synchronization window length

The object dictionary contains the PDO transmission time window length in ms. A value of 0 means it is not enabled.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RW	NO	NO	0

Bits 0-31: PDO must be sent in window length after synchronization message in μs, (0 = invalid)

0x1008 Manufacturer Device name （not available）

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	Text variables	constant	NO	NO	AMA CANopen Motor Driver

0x1009 Manufacturer hardware version （not available）

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	Text variables	RW	NO	NO	A001

0x100A Manufacturer software version（not available）

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	Text variables	constant	NO	NO	2.00A

0x1010 Store parameters

This object dictionary is used to support parameter saving to non-volatile memory

1.Sub-index 0 indicates the maximum number of sub-index support

2. Sub-index 1 saves all the parameters

3. Sub-index 2 Save communication related parameters (1000h - 1FFFh).

4. Sub-index 3 saves the application layer related parameters (6000h - 9FFFh).

5. Sub-index 4-127 Save manufacturer-defined parameters

6. Sub-index 128-256 Reserved.

To avoid parameter saving errors, the relevant parameters are only saved when a special "save" instruction is written to the corresponding sub-index.

Signature	MSB			LSB
ISO 8859 (“ASCII”) hex	e	v	a	s
	65h	76h	61h	73h

Object type	Sub-index	Data type	Access type	PDO mapping	COS	Object type
Array	3	UNSIGNED32	RW	NO	NO	0x00000003

Sub-index	Name	Default value
00	Maximum sub-index number	3
01	Store parameter 1	0
02	Store parameter2	0x00000003
03	Store parameter3	0x00000003

Write 0x65766173 (‘s’,’a’,’v’,’e’ From low to high) to the corresponding sub-index, save all the manufacturers parameters into the EEP read-only M.

0x1011 Reset the default parameters

Restore default value for all parameters

Object type	Sub-index	Data type	Access type	PDO mapping	COS	Default value
VAR	3	UNSIGNED32	RW	NO	NO	0x00000003

sub-index	Name	Default value
00	Maximum sub-index number	3
01	Reset parameter 1	0xFFFFFFFF
02	Reset parameter2	0xFFFFFFFF
03	Reset parameter3	0xFFFFFFFF

0x1014 Emergency message COB-ID

Define the COB-ID of the emergency message

Bit	Value	Description
31（Highest bit）	0 1	EMCY Existing / valid EMCY Not existing / invalid
30	0	Reserved (value is fixed to 0)
29	0 1	11-bit-ID(CAN2.0A) 29-bit-ID(CAN2.0B)
28-11	0 x	If bit 29=0 If bit 29=1:bit 28-11 of 29-bit-COB-ID
10-0（Lowest bit）	x	Bits 10-0 of COB-ID

The device only supports standard CAN protocol data frames. If you modify the 29th bit, it will return the error code: 0609 0030h. When bit 31 is 0, 0-29 bits are not allowed to be changed.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED32	RO	NO	NO	0x80+$NODEID

Bit 0-10: COB-ID

Bit 11-30: 0 represents the 11 bits COB-ID

Bit 31: 0(1) – The node uses (does not use) emergency messages.

0x1015 Emergency message prohibited time (not available)

Emergency message prohibition time, the basic unit of time is 100ms.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	NO	NO	200

Bit 0-15:Emergency message prohibited time

0x1017 Producer heart beat

NMT Heartbeat Period, heartbeat time is not used when value is 0. If value is not zero, heartbeat time unit is ms.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	NO	NO	1000

Bit 0-15: Heartbeat time period (ms)

0x1018 Object identifier (not available)

Device General Information

1. Sub-index 1 is vendor ID

2. Sub-index 2 is the manufacturer's product code.

3. Sub-index 3 is the revision number, including the major revision number and minor revision number. Among them, the main revision number pointed out that a particular version of the CANOPAN function, if the function increases, the main revision number will increase. Minor revision numbers represent CANOPEN devices of the same functionality, different version numbers.

4. Sub-index 4 represents the production serial number.

Object type	Sub-index number
Record	3

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Maximum sub-index number	UNSIGNDE8	RO	NO	NO	4
01	vendor ID	UNSIGNDE32	RO	NO	NO	0x000002D9
02	manufacturer's product code	UNSIGNDE32	RO	NO	NO	0x00000000
03	revision number	UNSIGNDE32	RO	NO	NO	0x00000000
04	production serial number.	UNSIGNDE32	RO	NO	NO	0x00000000

Vendor-ID

Bit 0-31: The product code assigned by the CIA

Manufacturer's product code

Bit 0-31: Manufacturer-defined code

Revision number

Bit 0-15: minor revision number production

Bit 16-31: major revision number

Serial number.

Bit 0-31:Vendor definition serial number

0x1019 Synchronous count overflow （not available）

Counting value of synchronization messages. 0 means sending synchronization message without counting value. Not 0 represents synchronization message with a byte count value.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED8	RW	NO	NO	0

0:synchronization message without counting value.

2-240:the synchronization message with a byte count value.

Other values are reserved.

0x1029 error behavior （not available）

Device error message

Object type	Sub-index number	Data type	Access type	PDO mapping	COS
VAR	2	UNSIGNED32	RW	NO	NO

Sub-index	Name	Default value	actual value
00	Maximum sub-index number	6	
01	Communication error	0x00	
02	Other communication errors	0x00	
03	Passive communication error	0x01	
04	General error	0x00	
05	Device protocol error	0x00	
06	Manufacturer definition error	0x00	

Definition of Sub-index :

0x00 - Switch to NMT pre-operation status if operating status.

0x01 - No function.

0x02 - Switch to NMT stop status.

01 - communication error, offline or receive heartbeat error.

02 - Other communication errors, can bus error passive, offline or errors besides receiver errors.

03 - Communication Passive Error - Includes bus error message.

04 - Common error

05 - Device Protocol Error - Set bit 5 of the error status register.

06 - Manufacturer-defined error - Set bit 7 of the error status register.

0x1200 SDO Server parameters

Access the drive's COB-ID.

1. Sub-index 0: This object contains number of sub-index.
2. Sub-index 1: Used to receive SDO packets by drive, value is 0x600 + $ NODEID.
3. Sub-index 2: Used to send SDO packets by drive, value is 0x580 + $ NODEID.

Object type	Sub-index number
Record	3

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Maximum sub-index number	UNSIGNDE8	RO	NO	NO	3
01	Receive SOD packet	UNSIGNDE32	RO	NO	NO	0x600+$NODEID
02	Send SOD packet	UNSIGNDE8	RO	NO	NO	0x600+$NODEID
03	Node ID	UNSIGNDE8	RO	NO	NO	$NODEID

0x1400~0x1403 RPDO Communication parameters 0~3

The device receives the PDO communication parameters. For details about the communication parameters, refer to 9.5.4 of CIA 301. Sub-index 0: The number of valid sub-indexes, which is at least 2. If the prohibition time is supported, the value is 3. Sub-index 1: COB-ID of the PDO.

PDO COB-ID description

Bit number	Value	Description
31（MSB）	0 1	PDO exists / valid PDO does not exist / is not valid
30	0 1	PDO allows RTR PDO does not allow RTR
29	0 1	11-bit ID(CAN 2.0A) 29-bit ID(CAN 2.0B)
28-11	0 x	If bit 29=0 If bit 29=1:bits 28-11 of 29-bit-COB-ID
10-0(LSB)	x	Bits 10-0 of COB-ID

PDO transmission is valid only in operating state. PDO can be all configured or at the same time set to invalid. By default, the device supports 4 TPDO and 4 RPDO. The device supports standard CAN data frames, does not support the remote request frame, modify the 29th bit is 1 or the 30th bit is 0 will cause the error code: 0609 0030h. When PDO already exists, it is not allowed to modify the value of bits 0-29.

Sub-index 2 defines the PDO transmission type, which is described below. Modifying the PDO

transfer type will generate an error code: 0609 0030h.

Description of transmission type

transmission type	PDO transmission				
	Periodic	Aperiodic	Synchronize	asynchronous	RTR only
0		X	X		
1-240	X		X		
241-251	Reserve				
252			X		X
253				X	X
254				X	
255				X	

Synchronous transmission (transmission types 0-240 and 252) represents the PDO transmission associated with the SYNC message. It is reasonable to use SYNC to trigger the output or to process the PDO received by the last SYNC to update the next transmitted data.

Asynchronous transmission means PDO transfering is not relevant to synchronous message. Transmission type "0" indicates that PDO needs to synchronize with synchronized SYNC object, but does not periodically send. 1-240 indicates that PDO needs to be sent synchronously with SYNC.

With transmission type 0-240, receiving PDOs is triggered by the next SYNC. Transmission types 252 and 253 indicate that PDO transmits only on a remote request. When transmission type is 252, it automatically updates data upon receipt of SYNC but does not send. When transmission type is 253, data will be updated upon receipt of remote request frame. The data will only be used for TPDO.

When the transmission type is 254, the events defined by the application layer will be triggered.

When the transmission type is 255, the application event is defined in the device protocol definition. The RPDO and trigger type will decide to update the received mapping data.

Sub-index 3 is forbidden time, the shortest internal time for PDO transmission, the basic unit is 100us. When the PDO has been established, it will not be allowed to modify the sub-index.

Sub-index 4 Reserved.

When the transmission type is 254, 255, sub-index 5 is the TPDO's event time. If this time exists (not 0) then the TPDO considers the past time as an event. The basic unit of time is 100ms. This event will trigger the TPDO. In RPDO, this value is used to determine if the receive timed out.

Object type	sub-index number
Record	3

sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Maximum sub-index number	UNSIGNDE8	RO	NO	NO	2
01	RPDO's COB-ID	UNSIGNDE32	RW	NO	NO	$NODEID+0x200
02	transmission type	UNSIGNDE8	RW	NO	NO	254

0x1400 - 0x1403 RPDO communication parameters

sub-index number

COB-ID

Bit 0-10:PDO's COB-ID, if you need to modify the value, the bit31 needs to be set.
allowed11-29: 11 bit COB-ID set 1。
Bit 30: 0(1) – PDO allowed(not allowed) RTR。
Bit 31: 0(1) – The node is used (not used) PDO.

Transmission type
0-240: receives the synchronization message and handles the synchronization message that is received next time.
241-253:Reserve
254: The events defined by the manufacturer
255:Asynchronous transfer

***note 2:** Index 1400.01h default 0x200+$NODEID
Index 1401.01h default 0x300+$NODEID
Index 1402.01h default 0x400+$NODEID
Index 1403.01h default 0x500+$NODEID

0x1600~0x1603 RPDO mapping parameter 0~3

Receive PDO mapping parameters, see CIA 301's 9.5.4 for details. The sub-index 0 represents the number of the sub-indexes. The sub-index 1 and the subsequent sub-indexes contain mapping information of the applied variables.The index, sub-index, and length of the PDO map are described. It contains up to 64 entry information. This parameter can be used to force the length of all mappings. The structure of the sub index:

Byte： MSB LSB

Index	Sub-index	Object length（8 bit）

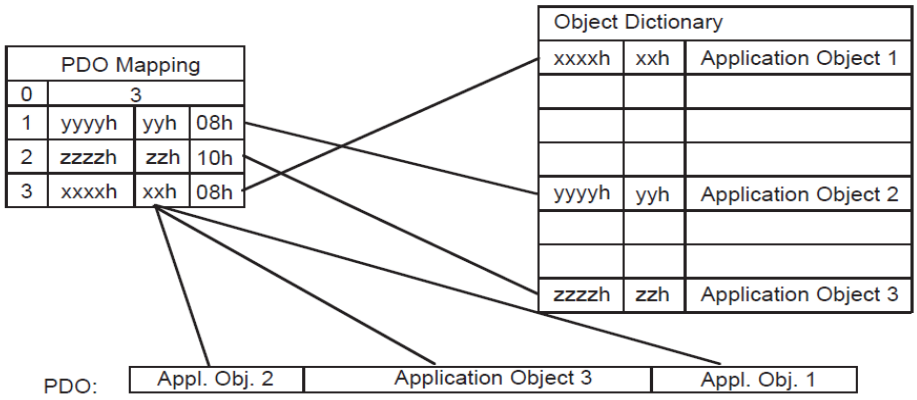
If you modify the mapping parameters unsuccessfully, The device will return a termination SDO transfer code.

Sub-index 0 indicates the number of valid data objects to be mapped.If you need to remap the sub-index first set to 0. In the newly added mapping, the device will check the object dictionary index, sub-index exists, if it does not exist will have a termination code 0602 0000h or 0604 0041h.

After all objects are mapped, Sub-index 0 indicates the number of valid data objects to be mapped.After writing the COB-ID of the communication parameters, the PDO will be set up. New PDO mapping When the value of sub-index 0 is greater than 0, the device will take effect before sending SDO transmissions. If the device detects an error, an end code will be transmitted via SDO: 0602 0000h, 0604 0041h or 0604 0042h.

Reading the value of sub-index 0 will return the actual number of mapped objects. If the data type is mapped as a "virtual portal," the device will not evaluate the responding PDO data. When multiple devices use one PDO transfer, each device uses only a portion of the PDO. You can not create a TPDO virtual map.

If a device supports the dynamic mapping of the PDO, it must support dynamic mapping under pre-operation. If the device supports dynamic mapping in operating mode, the SDO client must maintain data consistency.



PDO mapping rules

0x1600 RPDO

Object type	Sub-index number
Record	4

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Mapping object number	UNSIGNDE8	RW	NO	NO	3
01	Mapping object 1	UNSIGNDE32	RW	NO	NO	0x60810020
02	Mapping object 2	UNSIGNDE32	RW	NO	NO	0x60830010
03	Mapping object 3	UNSIGNDE32	RW	NO	NO	0x60840010

0x1601 RPDO

Object type	Sub-index number
Record	3

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Mapping object number	UNSIGNDE8	RW	NO	NO	2
01	Mapping object 1	UNSIGNDE32	RW	NO	NO	0x607C0020
02	Mapping object 2	UNSIGNDE32	RW	NO	NO	0x60990220

0x1602 RPDO

Object type	Sub-index number
Record	4

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Mapping object number	UNSIGNDE8	RW	NO	NO	3
01	Mapping object 1	UNSIGNDE32	RW	NO	NO	0x60990120
02	Mapping object 2	UNSIGNDE32	RW	NO	NO	0x609A0010
03	Mapping object 3	UNSIGNDE32	RW	NO	NO	0x609A0010

0x1603 RPDO

Object type	Sub-index number

Record	5

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Mapping object number	UNSIGNDE8	RW	NO	NO	4
01	Mapping object 1	UNSIGNDE32	RW	NO	NO	0x60600008
02	Mapping object 2	UNSIGNDE32	RW	NO	NO	0x60980008
03	Mapping object 3	UNSIGNDE32	RW	NO	NO	0x607A0020
04	Mapping object 4	UNSIGNDE32	RW	NO	NO	0x60400010

0x1600 - 0x1603 RPDO mapping parameter

The number of Mapping object

Mapping object

Bit 0-7: The length of the data

Bit 8-15: sub-index

Bit 16-31: index

0x1800~0x1801 TPDO communication parameter 0~3

PDO communication parameters transmitted by device. For details, please refer to 9.5.4 in CIA 301, RPDO communication parameters (1400h - 1403h) for detailed description of the portal.

Object type	Sub-index number
Record	3

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Maximum sub-index number	UNSIGNED8	RO	no	no	2
01	TPDO's COB-ID	UNSIGNED32	RW	no	no	0x180+$NODEID
02	transmission type	UNSIGNED8	RW	no	no	0x00000001

0x1800 - 0x1803 TPDO communication parameter

The number of sub-index

COB-ID

Bit 0-10: PDO's COB-ID，Set bit31 to 1 when modifying

Bit 11-29: Set to 0 for 11-bit COB-ID

Bit 30: 0(1) – PDO allows (does not allow) RTR transmission

Bit 31: 0(1) – Node uses (not used) PDO transmission

transmission type

0: Asynchronous transmission

1-240: Synchronized transmit after every N SYNC objects

241-251: Reserve

252-253:Transmitting when receive a remote request frame

254: Events defined by Vendor

255: Events defined by Device protocol

Prohibition time

Bit 0-15:PDO transmission interval of the shortest time

compatibility entry

Bit 0-7: Reserve

Event time

Bit 0-15: PDO cycle transmission time

SYNC Starting value

0: The sync count will not be processed

1-240: When the count value of the synchronization message equals this value, the synchronization message will be considered as the first received SYNC message.

Note 3: Index 1800.01h default 0x180+$NODEID

Index 1801.01h default 0x280+$NODEID

Index 1802.01h default 0x380+$NODEID

Index 1803.01h default 0x480+$NODEID

0x1A00 ~ 0x1A01 TPDO mapping parameter 0~3

For details, refer to CIA 301's 9.5.4. Please refer to the RPDO mapping parameters (1600h - 1603h) for a detailed description of the portal.

0x1A00 PDO

Object type	Sub-index number
Record	3

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Mapping object number	UNSIGNED8	RW	no	no	2
01	Mapping object 1	UNSIGNED32	RW	no	no	0x60410010
02	Mapping object 2	UNSIGNED32	RW	no	no	0x60640020

0x1A01 PDO

Object type	Sub-index number
Record	2

Sub-index	Name	Data type	Access type	PDO mapping	COS	Default value
00	Mapping object number	UNSIGNED8	RW	no	no	1
01	Mapping object 1	UNSIGNED32	RW	no	no	0x606C0020

0x1A00 - 0x1A03 TPDO mapping parameter

The number of mapping object

mapping object

Bit 0-7: the length of data

Bit 8-15: sub-index

Bit 16-31: index

Device protocol

Object dictionaries for Motion Control protocols such as position mode, velocity mode, and homing mode.

0x603F DSP error code（not available）

The DSP error code contains the driver's most recent alarm signal.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RO	yes	no	0

Each bit of the DSP error code indicates an error condition.

(Please refer to Appendix C for details)

0x6040 Control word

Drive status and motion control word are used to enable or disable power output of the drive, start and stop the motor, clear the error alarm ect. in different operating modes.

Description of control word structure:

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	WO	yes	yes	0

Bit definition of control word：

Byte	BIT	Bit definition			
		Position mode	Velocity mode	Homing mode	Torque mode
LSB	0	0—>1：Parameter variable initialization（Brake shut down）.			
	1	0—>1：The operation of drive（Brake open）.			
	2	0—>1：quick stop			
	3	0—>1：Motor enable 1—>0：Motor disable			
	4	0—>1：Position sampling	Reserve	Start homing	Reserve
	5	0：Complete the current position and then execute the next location； 1：Run directly to the next given location；	Reserve	Reserve	Reserve
	6	0：Absolute positioning； 1：Relative positioning；	Reserve	Reserve	Reserve
	7	0—>1：Error reset clearance			
MSB	8	0—>1：Halt 1—>0：normal operation			
	9	0：Finish the previous position stop and run the next position； 1：The current position and the next position do not	Reserve	Reserve	Reserve

		stop；			
	10	Reserve			
	11	Reserve			
	12	Reserve			
	13	Reserve			
	14	Reserve			
	15	Reserve			

Control word state switching command：

Command	The bit of the Control word				
	Error reset bit8	Enable operation bit3	Quick stop bit2	Enable voltage bit1	Initialization device bit0
Shut down	0	X	1	1	0
Initialization device	0	0	1	1	1
Enable device operation	0	1	1	1	1
Quick stop	0	X	0	1	X
Forbid enable	0	0	1	1	1
Error reset	0→1	X	X	X	X

0x6041 Status word

The status word can only be read, reflecting the current status of the drive. Its structure is defined as follows:

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RO	yes	yes	0

Bit definition of status word：

Byte	BIT	Bit definition							
		Position mode		Velocity mode		Homing mode		Torque mode	
LSB	0	0：Unprepared initialization		1：Ready to initialize					
	1	0：Initialization drive is not completed		1：Initialization drive completion					
	2	0：Motor disable		1：Motor enable					
	3	0：Drive normal status		1：Drive error status					
	4	0：Drive not work		1：Drive work normally					
	5	0：Normal operation		1：Quick stop					
	6	0：Normal operation		1：Device enters the initialization state					
	7	0：Normal operation		1：Warning					
	8	0：Normal operation		1：Motor halt					
	9	0：motor not run		1：Motor running sign					
	10	0 ：Not reach position	0	Bit8=0:Not reaching the target speed	0	Bit8=0:Not reaching the homing position		Reserve	

MSB				Bit8=1:Deceleration		Bit8=1:Deceleration	
		1：Reach position	1	Bit8=0:reaching the target speed	1	Bit8=0:reaching the homing position	
				Bit8=1:The speed is 0		Bit8=1:The speed is 0	
	11	SW mechanical origin limit mark					
	12	0：Not set new location		0：The speed is not 0		0：Homing operation not complete	Reserve
		1：set new location		1：The speed is equal to 0		1：Homing operation complete	
	13	0：Normal operation		0：No maximum acceleration		0：Homing operation not error	
		1：over position		1:maximum acceleration		1：Homing operation error	
	14	CW clockwise direction limit mark					
	15	CCW counter clockwise direction limit mark					

The status word indicates the state of the device：

Status word value（Binary）	State
XXXX XXXX X0XX 0000	Uninitialized device
XXXX XXXX X01X 0001	Initialized device
XXXX XXXX X01X 0011	Device operation
XXXX XXXX X01X 0111	Device enable
XXXX XXXX X00X 0111	Quick stop active
XXXX XXXX X0XX1111	Fault reaction active
XXXX XXXX X0XX1000	Fault

Structure for the message:

The bits marked X indicate that the corresponding status has nothing to do with the other bits must be consistent with the corresponding status.

Bit 9: Run flag, device is performing operation

Bit 10: Reach the corresponding target position

If the drive is set this bit indicates that the set point has been reached. This bit must be selected by software when changing the target value. If quick stop_option_code is 5, 6, 7, 8, this bit must be set to 1 when the drive is stopped quickly or the drive is halted.

Bit 11: Origin limit

This position is set when the drive motion reaches the upper limit.

Bit 12:

Position Mode: This bit is set to 1, can not be given a new location. Clear to give a new location.

Velocity mode: set to 1, the speed reaches the target speed. Cleared, speed did not reach the target speed.

Homing mode: Set to 1, homing mode completed has found the origin. Cleared, homing mode has not been completed.

Bit 13: homing mode is error.

Bit 14: CW limit reached.

Bit 15: CCW limit reached.

0x605A Quick stop code

The stop code determines how to stop when the command is quickly stopped

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER16	RW	No	no	0

Quick stop code	Perform the operation
1	Stop with the current deceleration
2	Stop with fast stop speed
3…32767	Stop immediately

Now only modes 1 and 2 are supported.

0x605D Halt code

The halt code determines how to halt when the command is suspended.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER16	RW	No	no	0

Halt code	Perform the operation
1	halt with the current deceleration
2	halt with fast stop speed
3…32767	halt immediately

0x6060 Modes of operation

Operating mode is used to select the appropriate sport mode

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER8	WO	yes	no	0

Mode of operation	operation
1	Position mode
2	Pulse direction mode
3	Velocity mode
4	Torque mode（servo）
6	Homing mode

The device supports three modes: velocity mode, position mode and homing mode.

0x6061 Mode code response

The mode code response indicates the current operating mode. The return value is related to the corresponding mode status. (index 6060h)

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER8	RO	yes	yes	0

0x6064 Position actual value

The current position represents the position of the current moment in the position mode.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER32	RO	yes	yes	0

0x606C Velocity actual value

The current speed indicates the speed of the current time.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER32	RO	yes	yes	0

Unit rps / min unit.

e.g .: If the value of index 606C is 100, it means the current speed is 10rps.

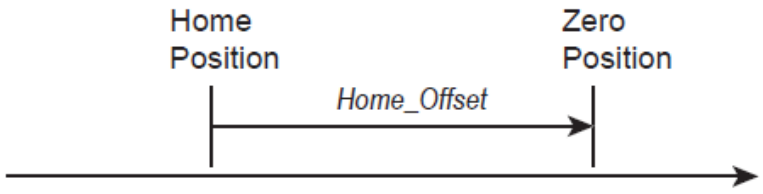
0x607A Target position

The target position is the position that the drive should move in position mode. The related parameters are the target velocity, acceleration and deceleration. The target position is related to different subdivisions and can be treated as a calculation or related parameter according to the bit6 of the control word.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER32	RW	yes	no	0

0x607C Home offset

Homing offset indicates the offset position between the homing position and the zero position. After finding the mechanical origin, all the parameters will be cleared after a short distance from the mechanical far point. This is shown below.



Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER32	RW	yes	No	0

0x6081 Target velocity

The target speed is the speed at which the drive runs at a constant speed

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INSIGNED32	RW	yes	No	0

This object is consistent with the actual speed (index 0x606C) and operating speed (0x60FF) units.The setting value is 10 times the actual value, for example: the value is 100, the actual speed value is 10r / s.

0x6083 acceleration

Motor running acceleration

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	yes	No	0

The unit of this value is rps / s. The drive internally divides this value by 10.

e.g .:Set this value to 10 rps / s, which the drive internally sees as 1 rps / s.

0x6084 deceleration

Motor running deceleration

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	yes	No	0

The unit of this value is rps / s. The drive internally divides this value by 10.

e.g .:Set this value to 10 rps / s, which the drive internally sees as 1 rps / s.

0x6085 Quick stop deceleration

This deceleration is used to quickly stop, according to the quick stop code selection. If the quick stop code has a value of 2, this deceleration is used. If the value is 3, you do not need to slow down, stop directly.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	yes	No	0

The unit of this value is rps / s. The drive internally divides this value by 10.

e.g .:Set this value to 10 rps / s, which the drive internally sees as 1 rps / s.

0x6098 Homing method

The object dictionary determines the choice of homing mode

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	INTEGER8	RW	yes	No	0

Please refer to Appendix F for details.

0x6099 Homing speeds

The homing speed is the homing speed in homing mode.There are two kinds of zero return speed:
Sub-index1:the speed of finding mechanical origin.
Sub-index2:the speed of finding zero origin.

Object type	Data type	Access type	PDO mapping	COS	Default value	Object type
Array	3	UNSIGNED32	RW	yes	no	0

Sub-index	Name	Default value
00	Maximum sub-index number	2
01	the speed of finding mechanical origin	0
02	the speed of finding zero origin	0

0x609A Homing acceleration

Homing acceleration is used for the acceleration（deceleration ）speed in homing mode.

Object type	Data type	Access type	PDO mapping	COS	Default value
VAR	UNSIGNED16	RW	yes	No	0

The unit of this value is rps / s. The drive internally divides this value by 10.
e.g .:Set this value to 10 rps / s, which the drive internally sees as 1 rps / s.

Motion control mode

Position mode

Position mode: The point-to-point motion control mode is realized by parameters such as acceleration, deceleration, target speed and target position. When all the parameters are set, the drive will run according to the corresponding parameters. During the movement, the position of the next point can be set during the operation of one point, so as to realize the continuous motion control.

Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes control word 0x000F to the drive control register to put the device into operation enabled state.

Enable position mode

To enable position mode, you first need to write 0x01 to object dictionary 6060h. View Current exercise mode from object dictionary 6061h .When a point is running, a new point can be set, and the second position is run directly after the current point bit is completed.

Setting running parameters

Set the target position (607Ah), speed (6081h), acceleration (6083h), deceleration (6084h) and other parameters.

Start / stop running

After writing the above operating parameters of the position operation, set bit 4 of the control word to start the motor running. During the operation of the motor, if the control word bit8 is set, the motor will stop running.

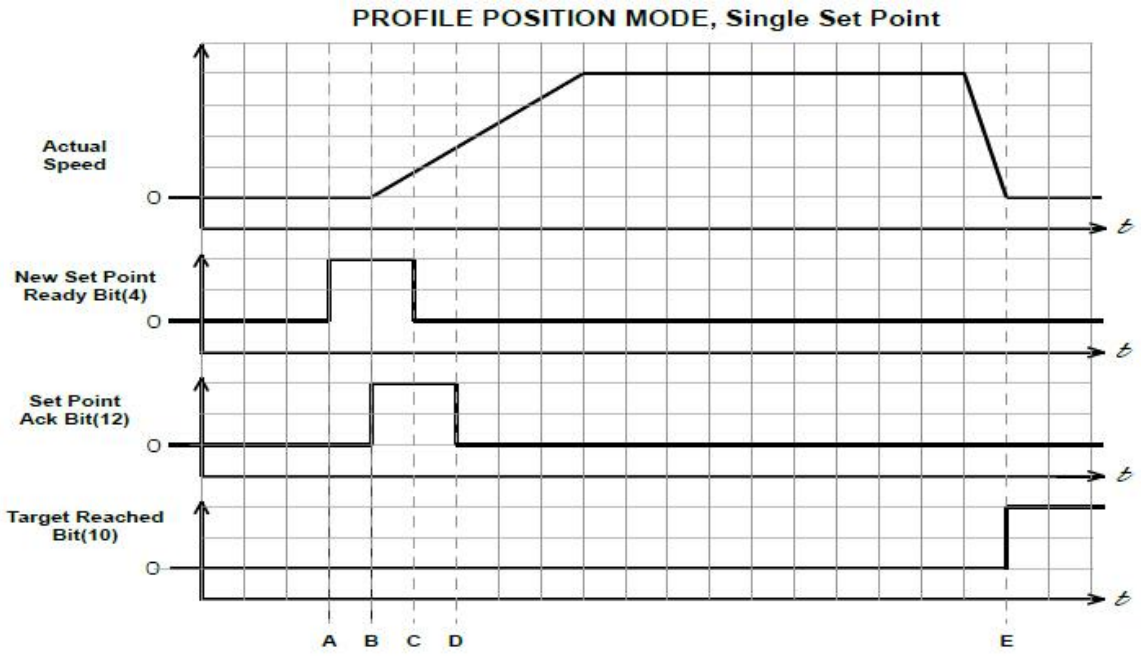
The bit of control word

New target position acquisition: When the status word bit12 is 1, the bit 4 of the control word is changed from 0 to 1, the current position value will be acquired, and the status word bit12 will be 0, the current position value will not be acquired .
If the control word bit 9 is 0, the drive will run to the last set point and stop. If bit 9 is 1, the drive will complete the movement of the previous point according to the current speed and then change to the

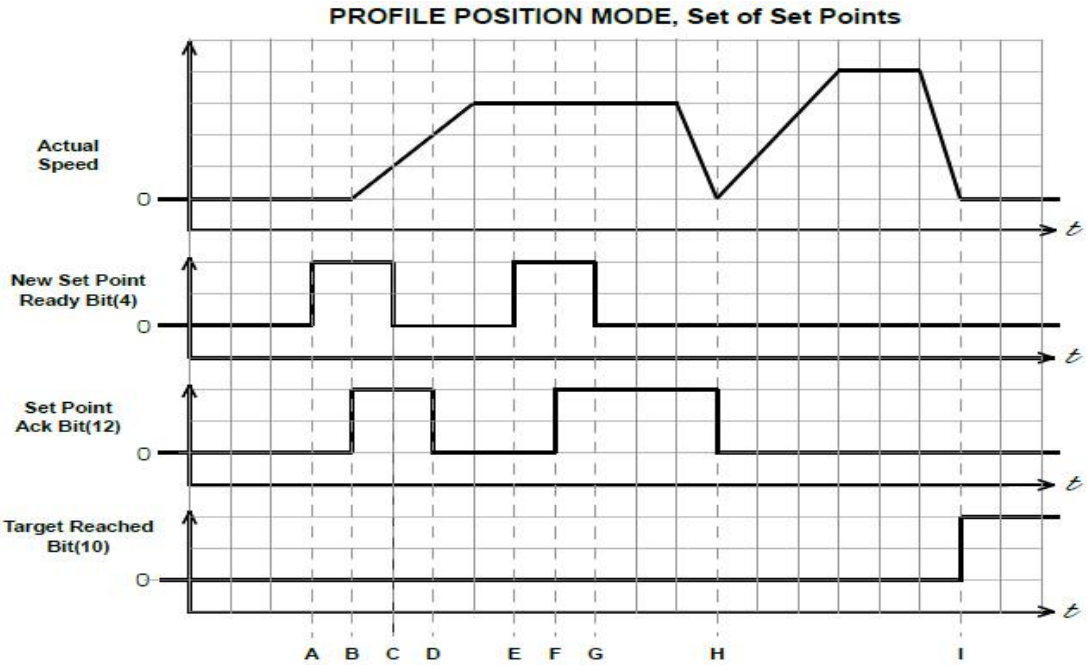
next point of the running speed to run to the next point.

Set bit 5 to 1, the newly set position will take effect immediately, and the drive will run immediately at the new position and at the new speed.

Set bit 6 to 1, the final position of the operation is the sum of two positions before and after, that is, the relative positioning. When bit 6 is 0, the final position of operation is the latest position, that is, absolute positioning. The following are four ways to achieve position settings:

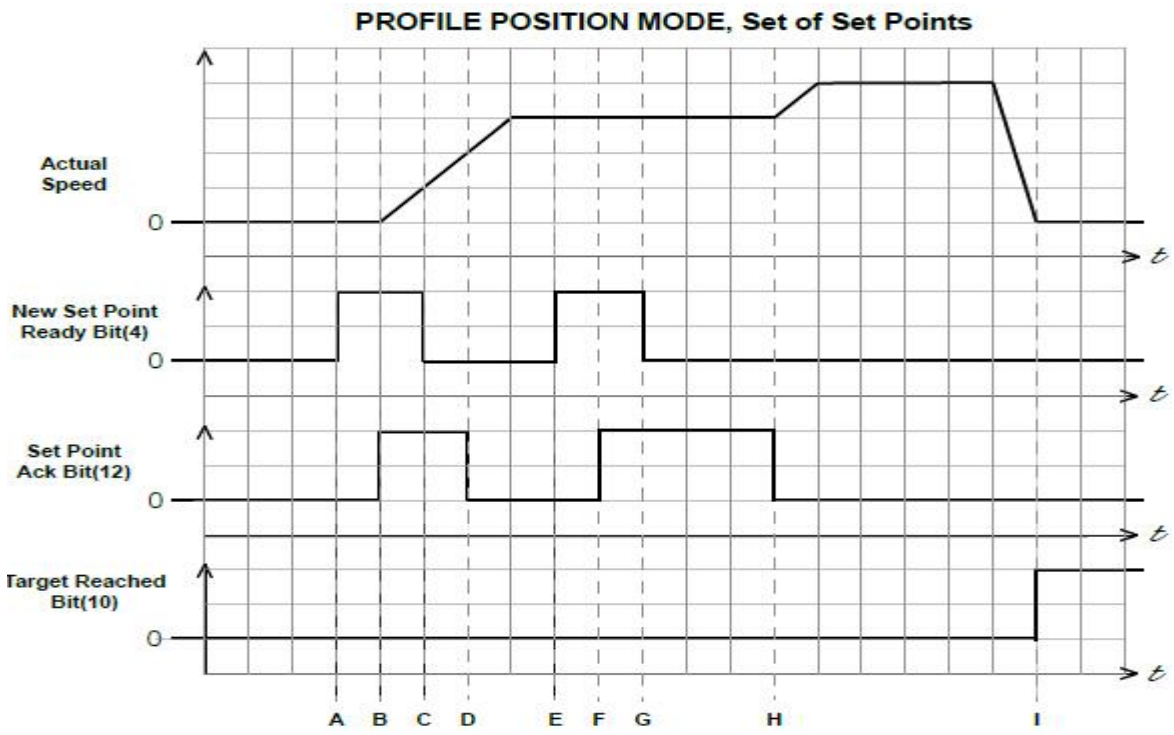


Single point motion



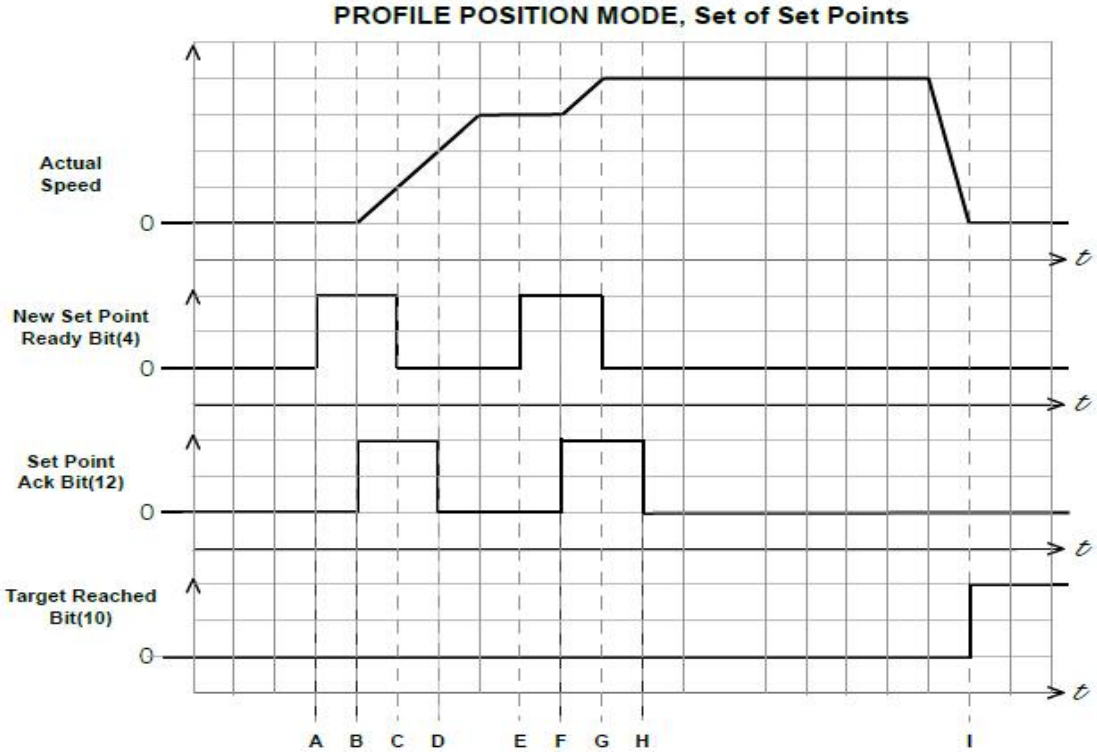
Multi-point motion to stop running between two positions

In this way, the control word bit 9 and bit 5 are all 0. motors will stop during the two operation.



Multi-point movement, the motor will do not stop the continuous movement

In this mode, the bit9 of the control word is 1, the 5th bit is 0, and The motor runs at a constant speed according to the speed set by the first point before reaching the first point. After reaching the first point, the motor will run at the speed set by the second point, and the motor will not stop.



Multi-point motion, the speed of switching to second points directly after setting second points

In this way, the ninth position 1 of the control word and fifth bits are placed 1, the motor will

switch directly to the second point's velocity without completing the first point's motion. The motor is running at a continuous speed.

Velocity mode

velocity mode: The velocity mode is determined by the target speed (0x6081), acceleration (0x683), deceleration (0x6084) and other parameters. During running can be suspended by the control word to pause the movement.

Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 0x000F to the drive control register to put the device into operation enabled state. Before writing the speed parameter, the control word bit 8 can be set to 1 to suspend the motor running,write 0x010F to the control word (0x6040). After writing the parameters, the operation can be enabled.

Enable velocity mode

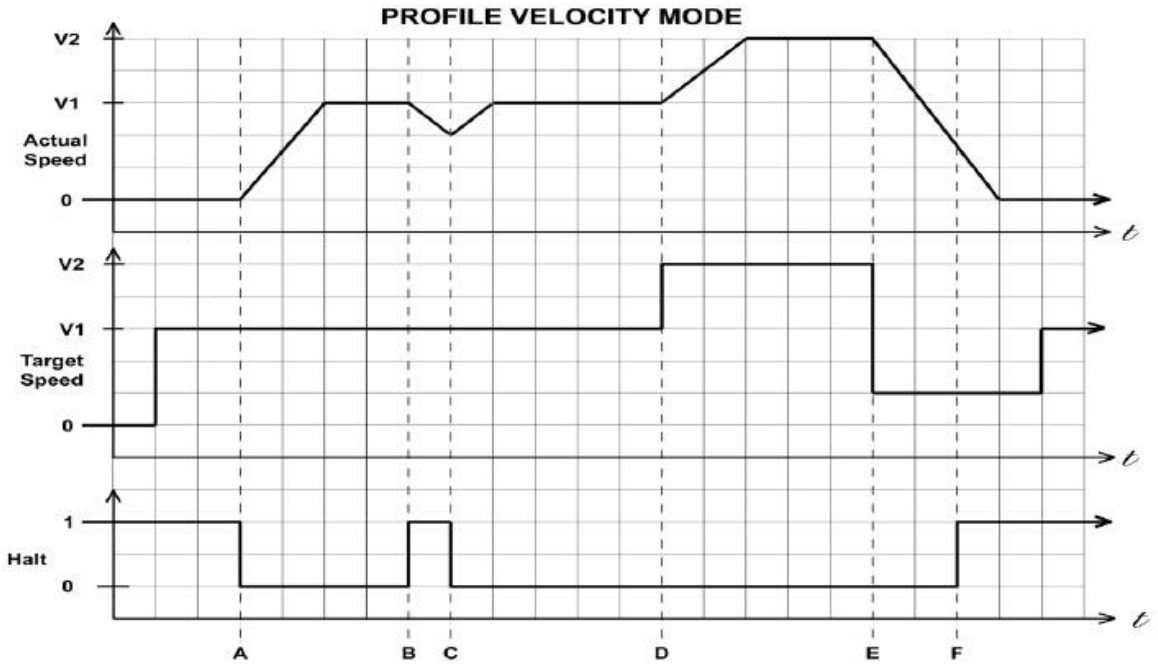
Write 0x0003 to the object dictionary 0x6060h, enabling velocity mode.

Setting running parameters

Set speed (0x6081h), acceleration (0x6083h), deceleration (0x6084h) parameters.

start /stop

Write 0x000F to the control word to start the motor. Write 0x010F to the control word to stop the motor.



Homing mode

In homing mode, we will go back to homing operation through three limit switches, namely CW limit, CCW limit, and origin limit (optional).

Enable the operation of the drive

The drive is disabled after the drive is powered on or reset. Writes 0x000F to the drive control register to put the device into operation enabled state.

Enable homing mode

Writes 0x06 to object dictionary 6060h, enabling home mode.

Setting running parameters

The drive is disabled after the drive is powered on or reset. Writes 0x000F to the drive control register to put the device into operation enabled state.

Start homing operation

In the object dictionary 0x6098h choose to homing method. The fourth bits in the control word are turned over and start to homing operation. You can check the status of the status word.

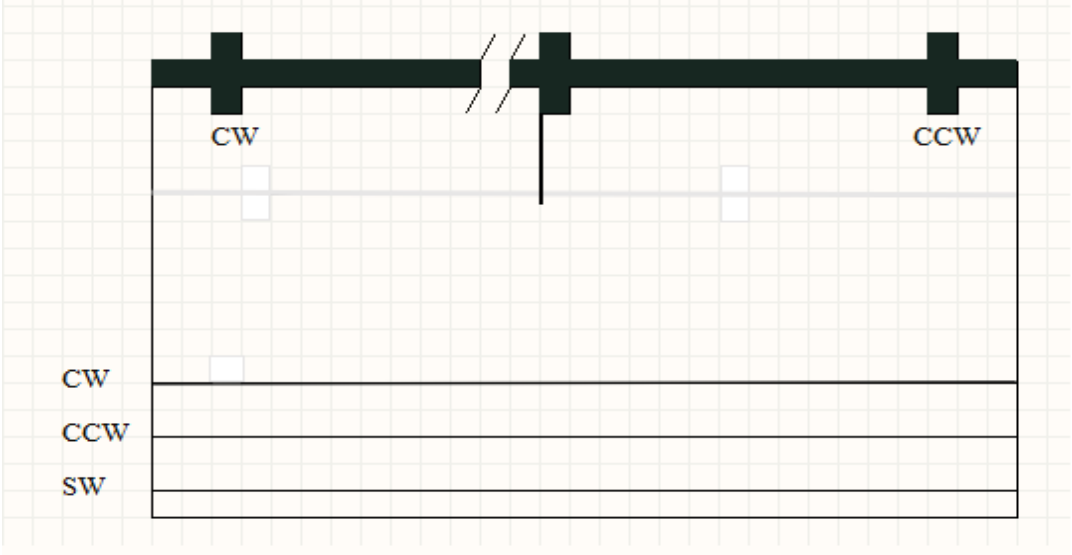
Homing offset

Homing offset is the offset distance between the mechanical origin and the homing origin we set, and the direction of the offset can be on the left or right of the mechanical origin.

Diagram of homing operation

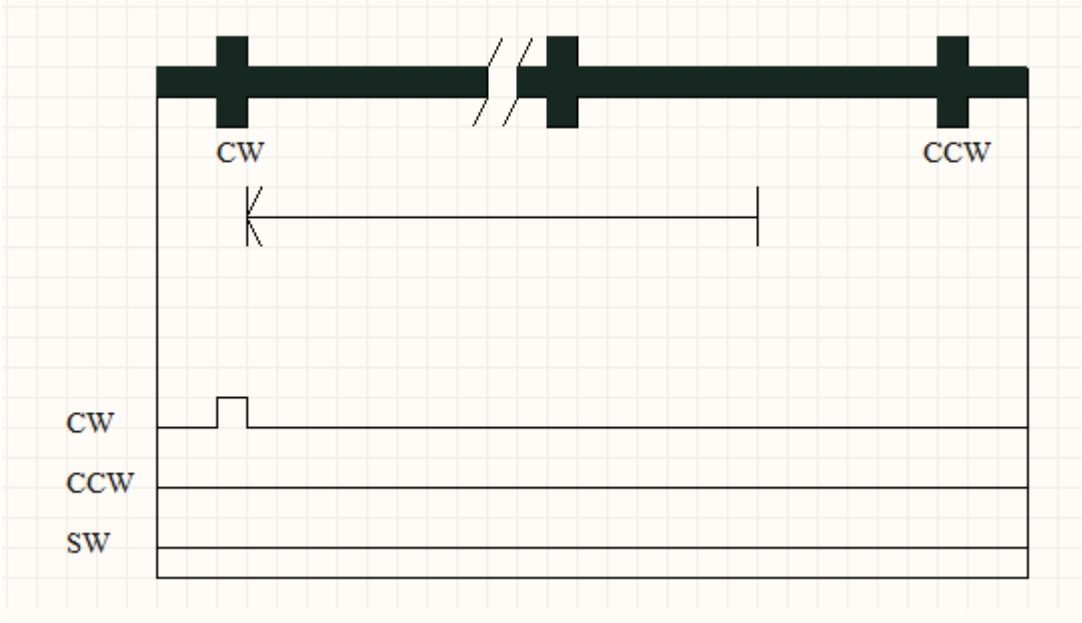
Homing method 0

No movement, the motor residence as a mechanical origin.



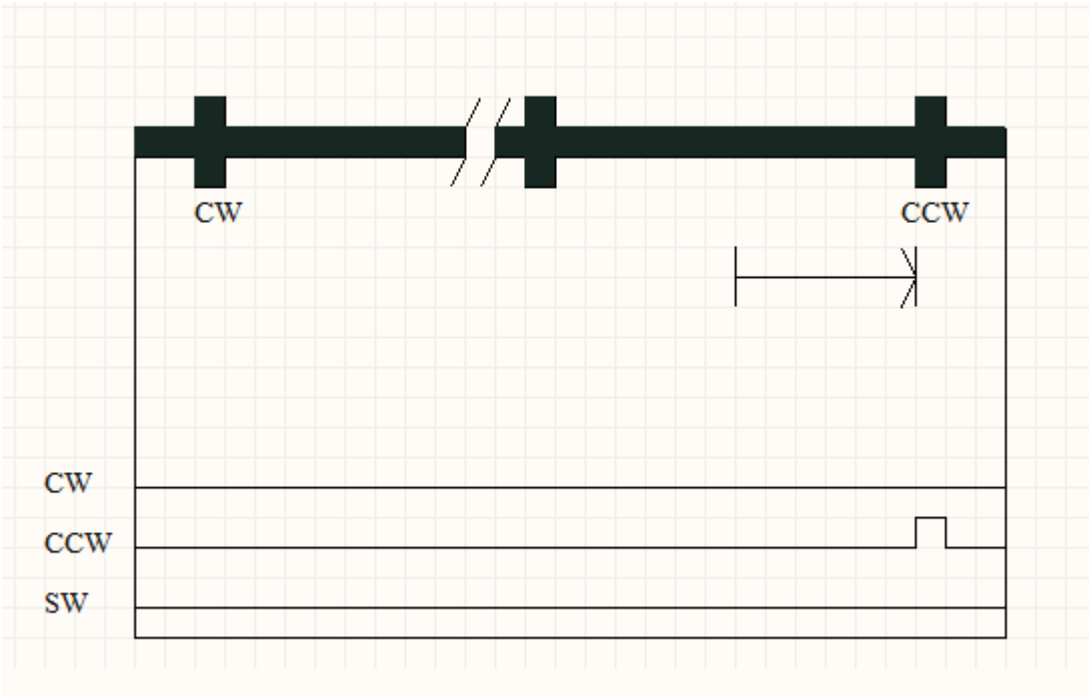
Homing method1

Move left and stop when moving back to CW limit. (maximum homing speed of 300r / min)



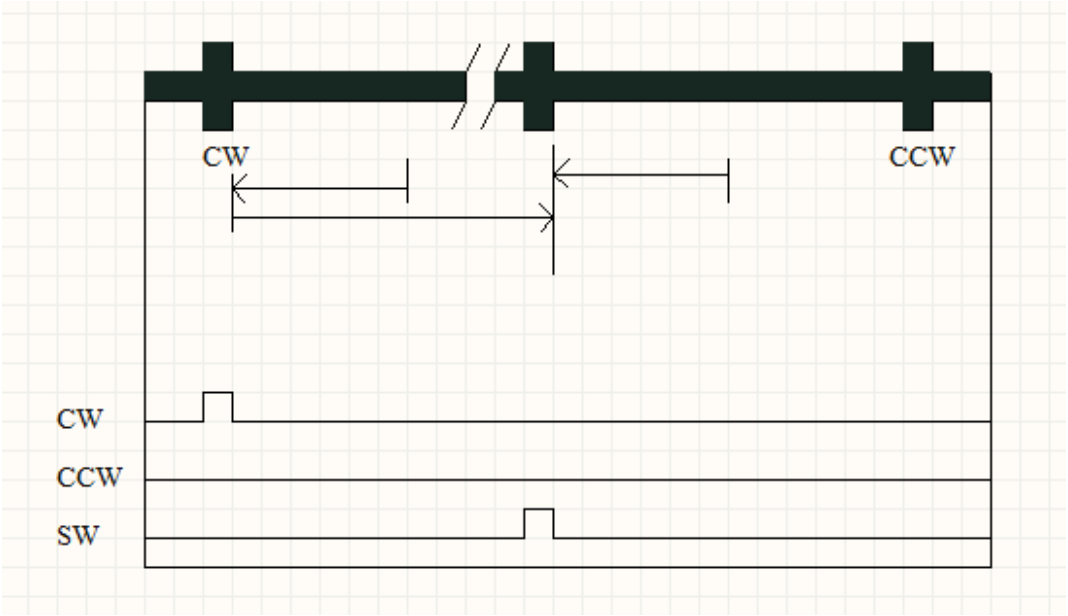
Homing method 2

Move right and stop when moving back to CCW limit. (maximum homing speed of 300r / min)



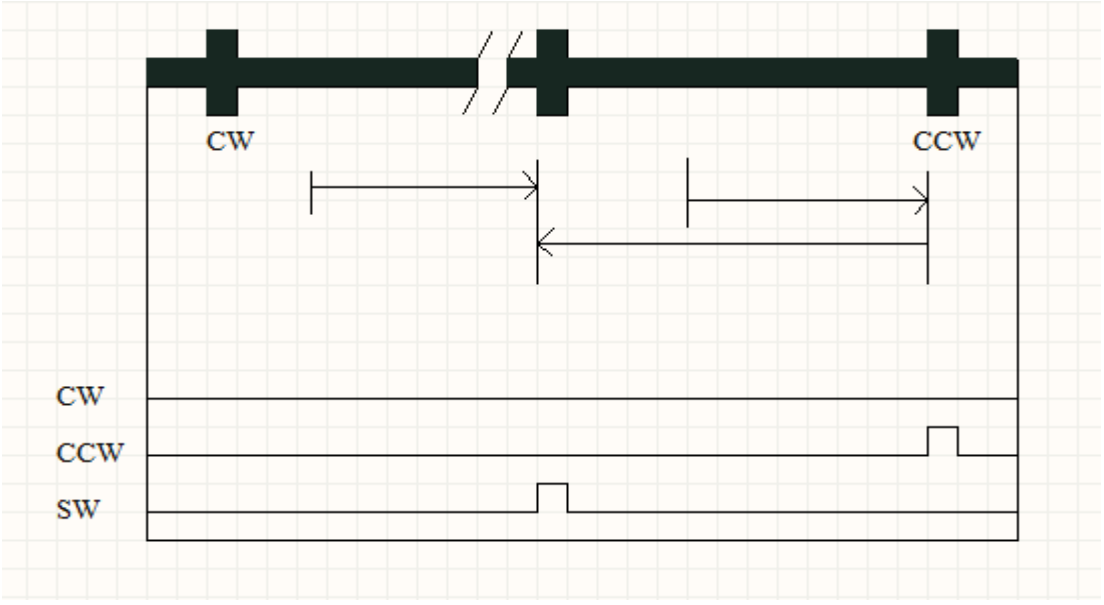
Homing method 3

To the left, (continue to the left without touching the SW limit) if the CW limit is reached, run to the right and stop when reaching the mechanical origin limit. (maximum homing speed of 300r / min)



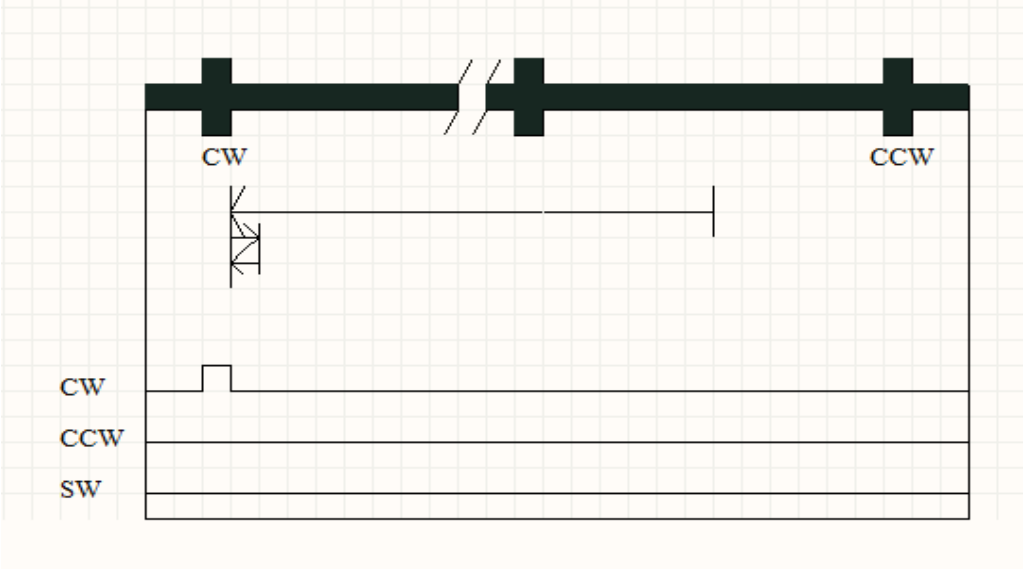
Homing method 4

To the right, (continue to the right without touching the SW limit) if the CCW limit is reached, run to the left and stop when reaching the mechanical origin limit. (maximum homing speed of 300r / min)



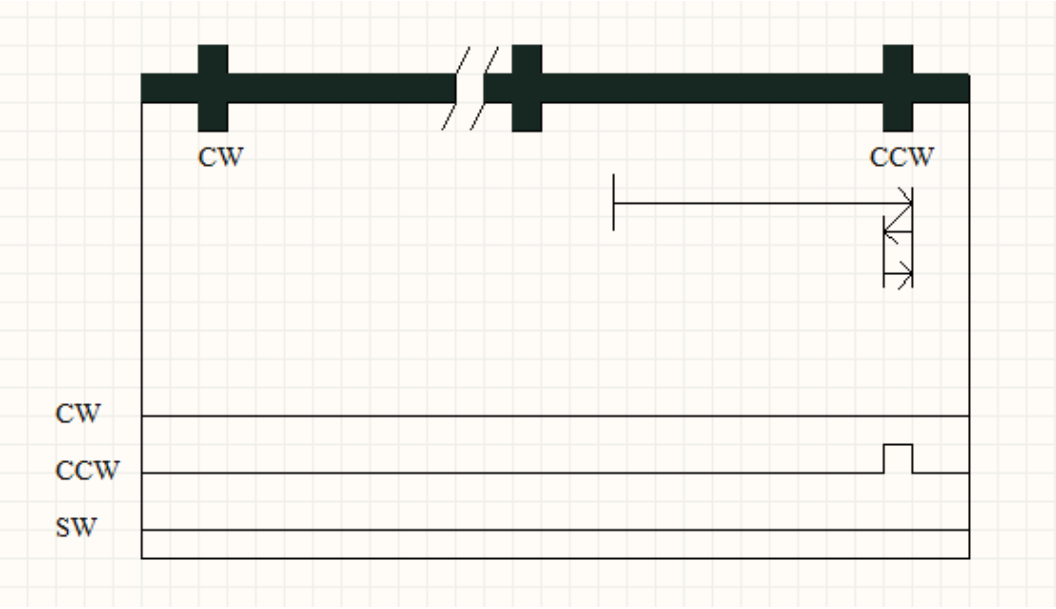
Homing method 5

High speed to the left after the limit switch to quickly reduce, and then move to the right at low speed, After crossing the limit switch, low speed to the left and stop when moving back to CW limit. (maximum homing speed of 1200r / min)



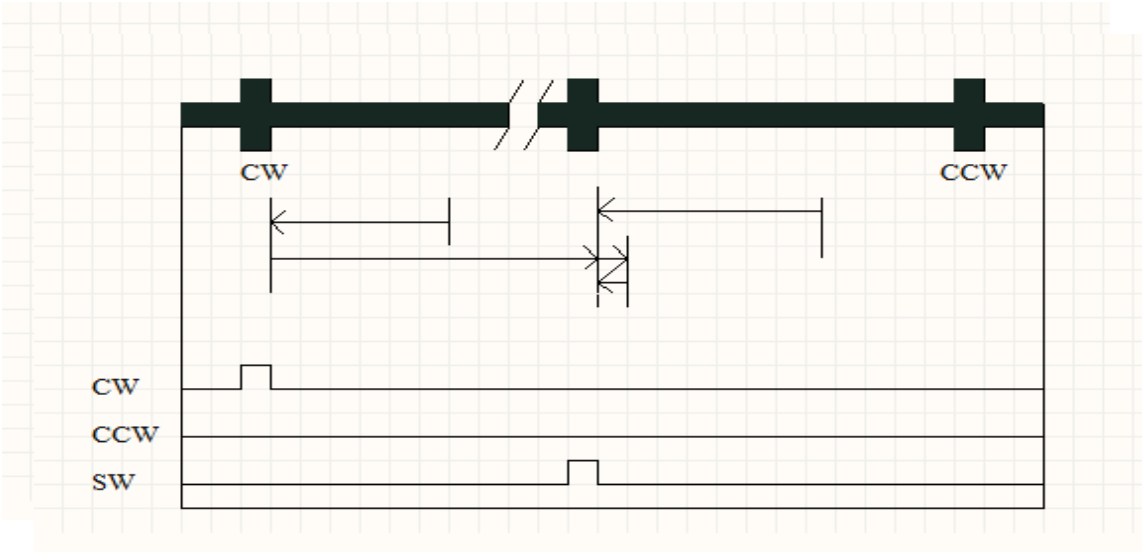
Homing method 6

High speed to the right after the limit switch to quickly reduce, and then move to the left at low speed, After crossing the limit switch, low speed to the right and stop when moving back to CCW limit. (maximum homing speed of 1200r / min)



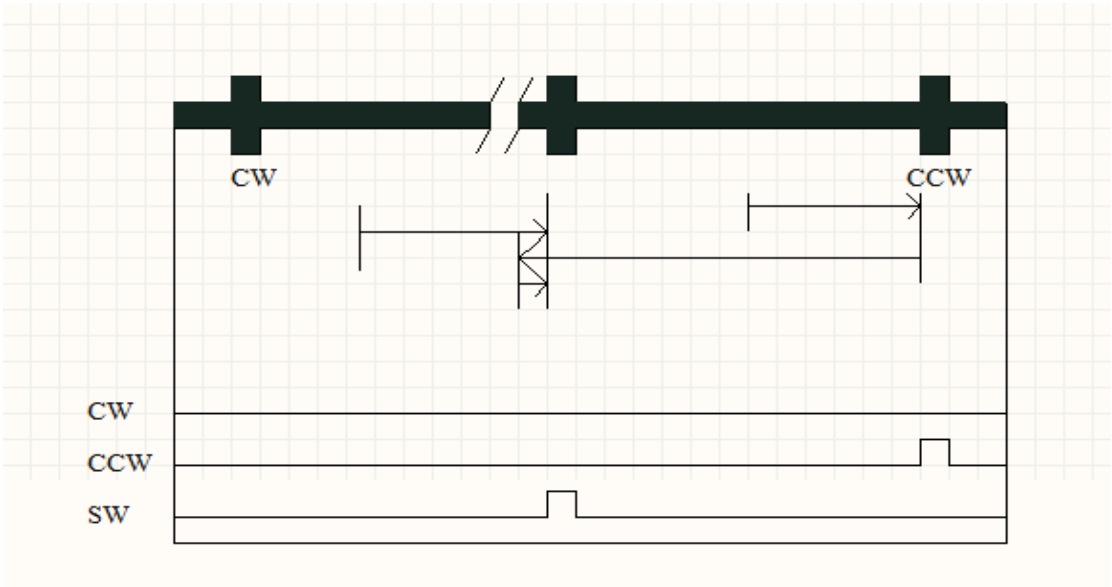
Homing method 7

The high speed is left to run, if it does not meet the mechanical origin, it will continue to run to the left.If the CW limit switch is operated, it runs to the right and runs at a high speed. When it encounters the machine origin limit switch, it rapidly decreases and then moves to the right and low speed ,After crossing the limit switch, low speed to the left and stop when moving back to limit switch . (maximum homing speed of 1200r / min)



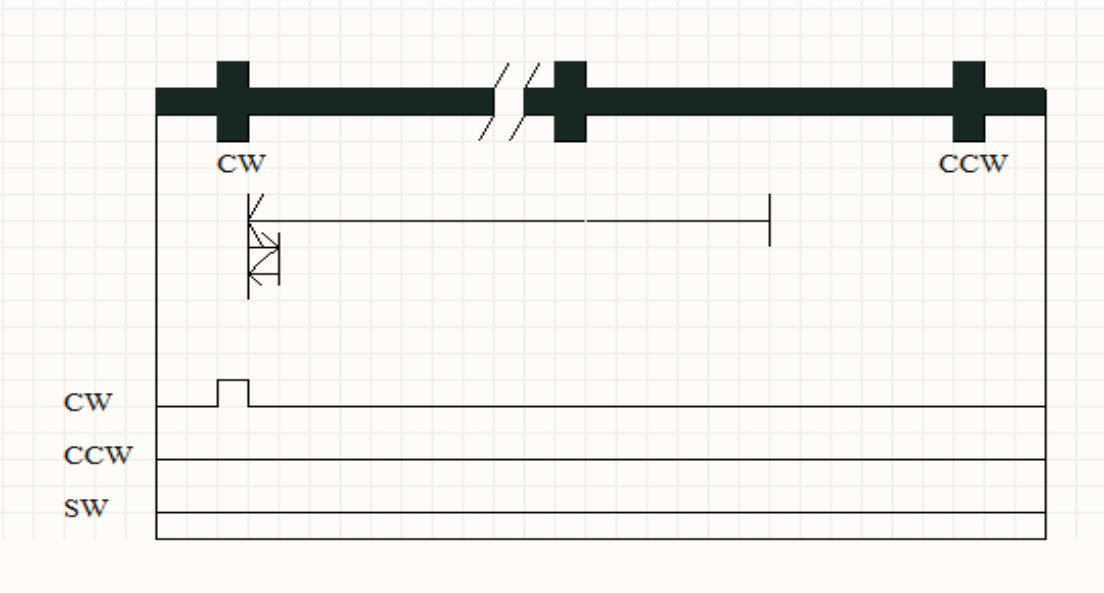
Homing method 8

The high speed is right to run, if it does not meet the mechanical origin, it will continue to run to the right.If the CCW limit switch is operated, it runs to the left at a high speed. When it encounters the machine origin limit switch, it rapidly decreases and then moves to the left and low speed ,After crossing the limit switch, low speed to the right and stop when moving back to limit switch . (maximum homing speed of 1200r / min)



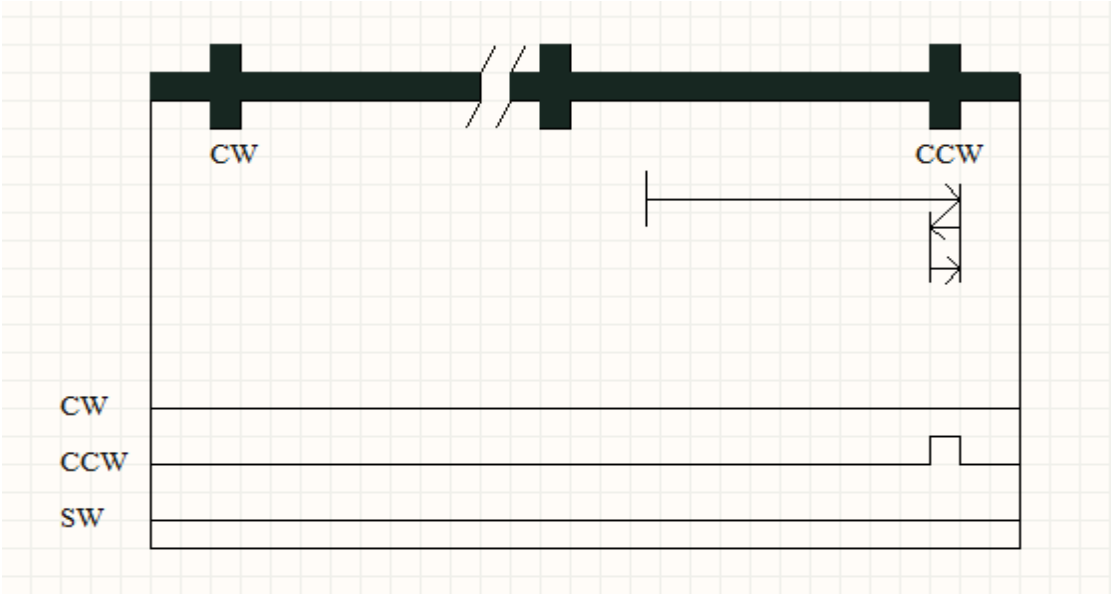
Homing method 9

High speed to the left after the limit switch to quickly reduce, and then move to the right at low speed, After crossing the limit switch, low speed to the left and stop when moving back to CW limit. (maximum homing speed of 1200r / min)(Note: This mode can set positive and negative homing offset)



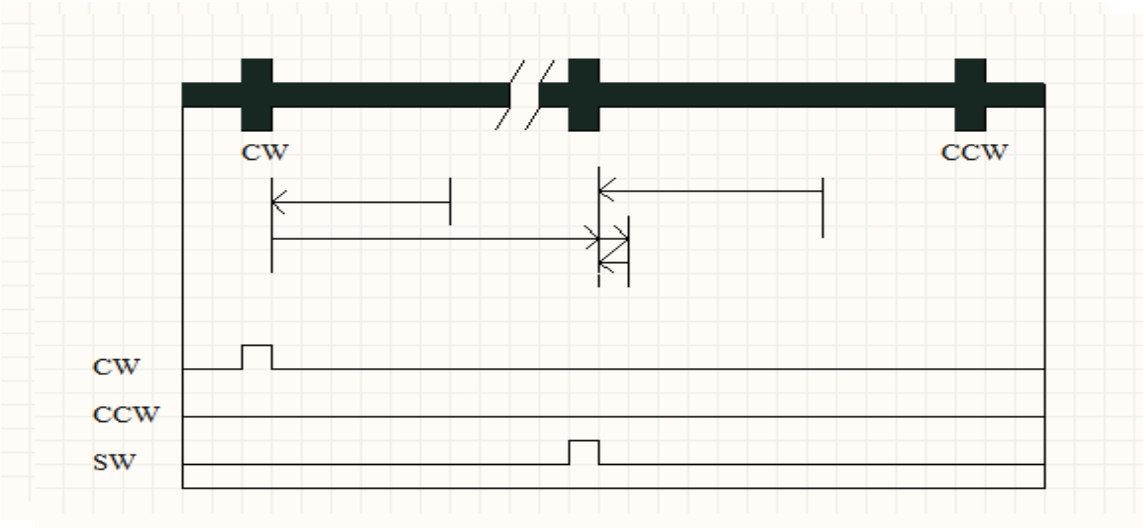
Homing method 10

High speed to the right after the limit switch to quickly reduce, and then move to the left at low speed, After crossing the limit switch, low speed to the right and stop when moving back to CCW limit. (maximum homing speed of 1200r / min)(Note: This mode can set positive and negative homing offset)



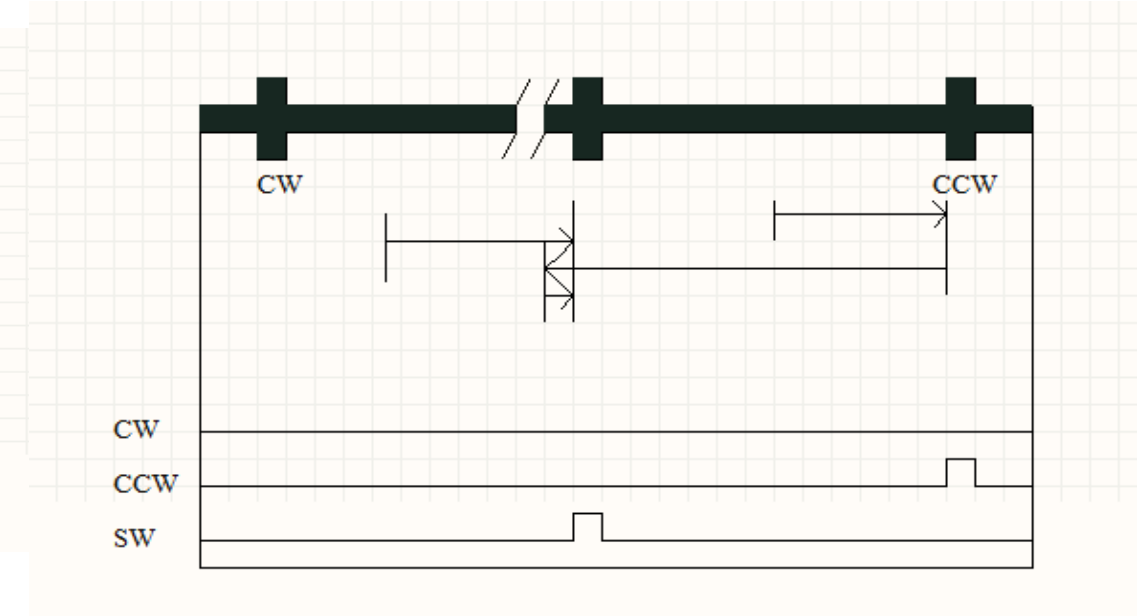
Homing method 11

The high speed is left to run, if it does not meet the mechanical origin, it will continue to run to the left.If the CW limit switch is operated, it runs to the right and runs at a high speed. When it encounters the machine origin limit switch, it rapidly decreases and then moves to the right and low speed ,After crossing the limit switch, low speed to the left and stop when moving back to limit switch . (maximum homing speed of 1200r / min)(Note: This mode can set positive and negative homing offset)



Homing method 12

The high speed is right to run, if it does not meet the mechanical origin, it will continue to run to the right.If the CCW limit switch is operated, it runs to the left at a high speed. When it encounters the machine origin limit switch, it rapidly decreases and then moves to the left and low speed ,After crossing the limit switch, low speed to the right and stop when moving back to limit switch . (maximum homing speed of 1200r / min)(Note: This mode can set positive and negative homing offset)



Appendix – Programming routine

1. RPDO Configuration

Configure node 3's index 1402h to receive PDOs for each synchronization message, and Configure control word 6040h and destination 607Ah.

ID:	data:
603	23 02 14 01 03 02 00 00
603	2F 02 14 02 01 00 00 00
603	2F 02 16 00 00 00 00 00
603	23 02 16 01 10 00 40 60
603	23 02 16 02 20 00 7A 60
603	2F 02 16 00 02 00 00 00

2. TPDO Configuration

Configure TPDO to send data on every SYNC cycle and map Status Word 6041h and Actual Location 6064h as follows.

ID:	data:
603	23 01 18 01 83 01 00 00
603	2F 01 18 02 01 00 00 00
603	2F 01 1A 00 00 00 00 00
603	23 01 1A 01 10 00 41 60
603	23 01 1A 02 20 00 64 60
603	2F 01 1A 00 02 00 00 00

3.Position mode

**** CIA301 state the pre-operation state to switch to the operating state****

$000 $2 $01 $03 'the pre-operation state to switch to the operating state'

**** CIA402 state Power the motor****

ID DLC Data

$0603 $8 $2B $40 $60 $00 $06 $00 $00 $00 'Shutdown'

$0603 $8 $2B $40 $60 $00 $07 $00 $00 $00 'Switched on'

$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 'Operation Enabled'

**** Set the position mode****

$0603 $8 $2F $60 $60 $00 $01 $00 $00 $00 'Set the position mode'

**** Set point parameter****

$0603 $8 $23 $81 $60 $00 $0A $00 $00 $00 'Set the speed of running 1 rps'

$0603 $8 $2B $83 $60 $00 $E8 $03 $00 $00 'Set acceleration100 rps/s '
$0603 $8 $2B $84 $60 $00 $E8 $03 $00 $00 'Set deceleration100 rps/s'

Single point motion

$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00 'Set target position 200000steps'
$0603 $8 $2B $40 $60 $00 $1F $00 $00 $00 'Sampling new position'
$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 'Clear the flag'

Multi-point motion, need to stay between two points

$0603 $8 $23 $81 $60 $00 $32 $00 $00 $00 'Set the speed of running 5 rps'
$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00 'Set target position 200000 steps'
$0603 $8 $2B $40 $60 $00 $5F $00 $00 $00 'Sampling new position'
$0603 $8 $2B $40 $60 $00 $4F $00 $00 $00 'Clear the flag'
$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00 'The speed of setting second segments is 10 rps '
$0603 $8 $23 $7A $60 $00 $C0 $27 $09 $00 'Set target position 600000 steps'
$0603 $8 $2B $40 $60 $00 $5F $00 $00 $00 'Sampling new position'
$0603 $8 $2B $40 $60 $00 $4F $00 $00 $00 'Clear the flag'

Multi-point motion, no need to stay between two points

$0603 $8 $23 $81 $60 $00 $32 $00 $00 $00 'Set the speed of running 5 rps '
$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00 'Set target position 200000 steps '
$0603 $8 $2B $40 $60 $00 $5F $02 $00 $00 'Sampling new position'
$0603 $8 $2B $40 $60 $00 $4F $02 $00 $00 'Clear the flag'
$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00 'Set the speed of running 10 rps'
$0603 $8 $23 $7A $60 $00 $C0 $27 $09 $00 'Set target position 600000 steps'
$0603 $8 $2B $40 $60 $00 $5F $02 $00 $00 'Sampling new position'
$0603 $8 $2B $40 $60 $00 $4F $02 $00 $00 'Clear the flag'

Multi-point motion, which directly changes the speed of operation

$0603 $8 $23 $81 $60 $00 $32 $00 $00 $00 'Set the speed of running 5 rps'
$0603 $8 $23 $7A $60 $00 $40 $0D $03 $00 'Set target position 200000 steps'
$0603 $8 $2B $40 $60 $00 $7F $02 $00 $00 'Sampling new position'
$0603 $8 $2B $40 $60 $00 $6F $02 $00 $00 'Clear the flag'
$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00 'The speed of setting second segments is 10 rps'
$0603 $8 $23 $7A $60 $00 $C0 $27 $09 $00 'Set target position 600000 steps'
$0603 $8 $2B $40 $60 $00 $7F $02 $00 $00 'Sampling new position'
$0603 $8 $2B $40 $60 $00 $6F $02 $00 $00 'Clear the flag'

4.Velocity mode

****CIA301 state the pre-operation state to switch to the operating state****

$000 $2 $01 $03 'the pre-operation state to switch to the operating state'

**** CIA402 state Power the motor****

ID DLC Data

$0603 $8 $2B $40 $60 $00 $06 $00 $00 $00 'Shutdown'

$0603 $8 $2B $40 $60 $00 $07 $00 $00 $00 'Switched on'

$0603 $8 $2B $40 $60 $00 $0F $01 $00 $00 'Operation Enabled; Motion Halted'

**** Set the velocity mode****

$0603 $8 $2F $60 $60 $00 $03 $00 $00 $00 'Set the velocity mode'

**** Set operation parameter ****

$0603 $8 $23 $81 $60 $00 $0A $00 $00 $00 'Set the speed of running 1 rps'

$0603 $8 $2B $83 $60 $00 $E8 $03 $00 $00 'Set acceleration100 rps/s'

$0603 $8 $2B $84 $60 $00 $E8 $03 $00 $00 'Set deceleration 100 rps/s'

**** Start / stop operation ****

$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 'Start operation'

$0603 $8 $23 $81 $60 $00 $64 $00 $00 $00 'Change the speed of running 10 rps'

$0603 $8 $2B $40 $60 $00 $0F $01 $00 $00 'Start operation'

5.Homing mode

****CIA301 state the pre-operation state to switch to the operating state****

$000 $2 $01 $03 'the pre-operation state to switch to the operating state'

**** CIA402 state Power the motor***

ID DLC Data

$0603 $8 $2B $40 $60 $00 $06 $00 $00 $00 'Shutdown'

$0603 $8 $2B $40 $60 $00 $07 $00 $00 $00 'Switched on'

$0603 $8 $2B $40 $60 $00 $0F $00 $00 $00 'Operation Enabled'

**** Set the homing method****

$0603 $8 $2F $60 $60 $00 $06 $00 $00 $00 'Set homing mode'

$0603 $8 $2F $98 $60 $00 $01 $00 $00 $00 'Select homing method 1'

**** Set homing parameter ****

$0603 $8 $2B $9A $60 $00 $E8 $03 $00 $00 'Set homing acceleration 100rps/s'

$0603 $8 $23 $99 $60 $01 $0A $00 $00 $00 'Set homing speed 1rps'

$0603 $8 $23 $99 $60 $02 $05 $00 $00 $00 'Set speed of finding homing origin 0.5rps'

**** Start / stop operation ****

$0603 $8 $2B $40 $60 $00 $1F $00 $00 $00 'Start homing'

$0603 $8 $2B $40 $60 $00 $1F $01 $00 $00 'stop homing'

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