ECT Series

User Manual

Shenzhen Rtelligent Mechanical Electrical Technology Co., Ltd

Revision history

V202

1、 Add the missing phase detection function, when 0x2056 bit7 is 1, enable the missing phase detection.

2、 PP, PV mode status flag perfect, zero parameter 0x6099 to standard 32bit, the previous version is 16bit, non-standard

3、 zero method 0x6098 to INT8 type, before the UINT16 for non-standard

4、 Add control support for three-phase motors

5、 Add CSV mode

6、 Add ECR86/ECT86 product type description

7、 Product version unified upgrade to V202

一 Drive Description

1.1 Product Introduction

thank you for choosing the sharp EC series stepper motor driver. EC series is a high performance bus control stepper motor driver, while integrating the functions of intelligent motion controller. EC series EtherCAT drives can be run as standard EtherCAT slave and support CoE (CANopenover). ECT series is closed loop control.

1.1.1 Characteristics

- Support CoE (CANopen over EtherCAT), meet CiA 402 standards
- C SP,PP,PV,Homing support model
- 500 us minimum synchronization cycle
- Dual port RJ45 connector for EtherCAT communication
- Control methods: open loop control, closed loop control / FOC control (ECT series support)
- Motor type: two phase, three phase;
- Digital IO port:

The digital signal input of 4 channels photoelectric isolation: IN 1、IN 2 is encoder input; IN 3~IN 6 is 24 V single end input, common anode connection method;

Two-way photoelectrical isolated digital signal output, maximum tolerance voltage 30 V, maximum pouring or pulling current 100 mA, common cathode connection method.

1.1.2 **Electrical characteristics**

ECT series product specifications

Product model	ECT 42	ECT60	ECT86
Output current (A)	0.1~2 A	0.5~6 A	0.5~7 A
Default current (mA)	450	3000	6000
Power supply voltage	24~80 VDC	24~80 VDC	24~80 VAC
Matching motor	42 below base	Below 60 base	86 below base
Encoder Interface	Incremental orthogonal encoder		
Encoder Resolution	1000~65535 pulse/turn		
Photoelectric isolation input	24 V input for 4 common anodes		
Photoelectric isolated output	2 channels photoelectric isolation output: alarm, lock, in place and general output		
Communication interface	Two RJ45, with communication LED indication		

Do not exceed the scope of use specified above.

1.2 Power and motor

Type			Note
ECT 42	ECT 60	ECT 86	
V+		AC	To ECT42、ECT60, power supply for DC power supply, V+ connect the power supply positive pole, V- connect the power supply negative pole. Recommended supply voltage 24~80 VDC. for ECT86, power supply for ac, dc compatible power supply, AC、AC can input 24~100 V dc power supply, or 24 to 80 VAC ac power supply. *:: The above supply voltage is the limit value of the driver. Due to the influence of the back EMF of the stepper motor, the customer needs to reserve a certain voltage margin in use*
V-		AC	
A +		A +	Two phase stepper motor winding connection port, specific motor wire connection please refer to the motor manufacturer instructions.
A-		A-	
B +		B +	
B -		B -	
IN1+		IN1+	Encoder input interface, specific encoder connection please refer to the motor manufacturer instructions.
IN1-		IN1-	
IN2+		IN2+	
IN2-		IN2-	

1.3 Digital input and output ports

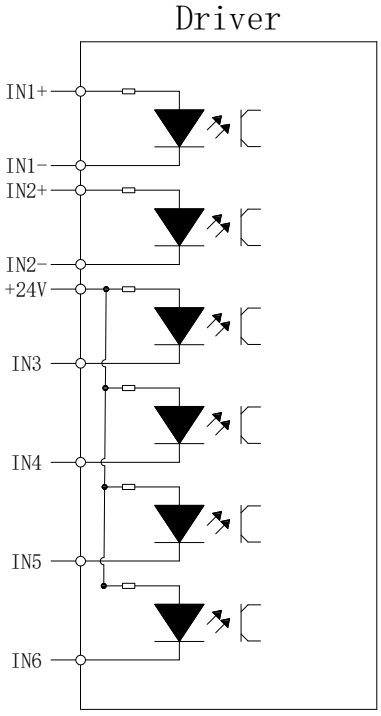
ECT series can no longer be used for other input port functions because IN1 and IN2 are assigned to orthogonal encoder interfaces and will not work for IN1、IN2 function settings.

1.3.1 Digital input port

EC T series step drive has 4 channels digital input port ,2 channels digital output port. the object dictionary 0 x2007 the function setting of the input port and 0 x2008 the polarity setting of the input port.

Note: IN 1+/ IN1-、IN2IN 1+/ IN2- is motor encoder input terminal, do not directly connect the input signal above this voltage, otherwise will cause driver damage!

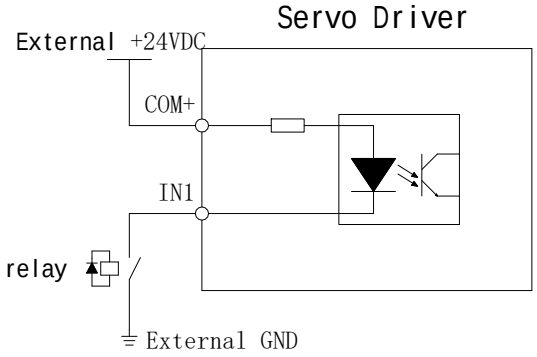
The schematic diagram of the input port is shown below, and the user can connect the system according to the schematic diagram.



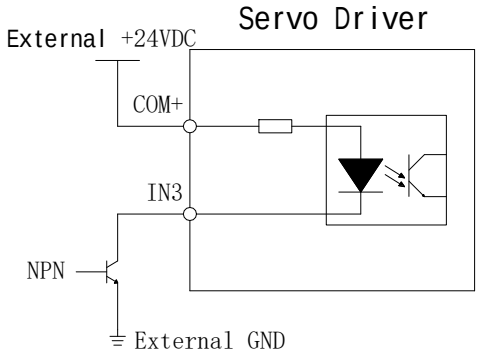
IN 3~IN 6 single terminal input terminal

Taking IN 3 as an example, the IN 3~IN 6 interface circuit is the same.

When the upper device is relay output:



When the upper device is an open circuit output of the collector:



Attention: PNP input is not supported

1.3.2 **Digital output port**

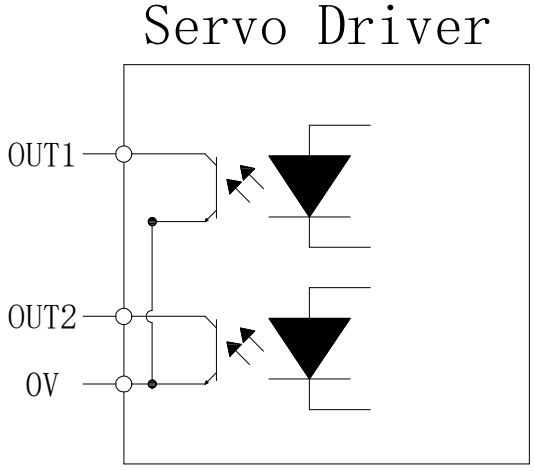
ECT series contains two optoelectronic isolation output signals.

OUT1 output current capacity up to 30 mA.

OUT2 output current capacity up to 150 mA.

By default, the digital output is all open points, the function of output port can be selected through object dictionary 2005, and object dictionary 2006 is used to set the polarity of output port.

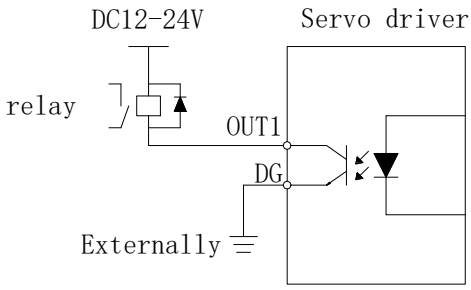
Object Dictionary	Name	Property	Type	Scope	Default	Unit	Remarks
0x2005：01	Output Port 1 function	R/W/S	UINT	0~3	1	---	Output port function selection: 0—— Custom output 1—— Alarm output 2—— Lock output 3—— In-place output
0x2005：02	Output port 2 function	R/W/S	UINT	0~3	2	---	
0x2006	Output port polarity setting	R/W/S	UINT	0~3	3	---	Set output port opening and closing characteristics 0—— Frequently Closed 1—— Regular



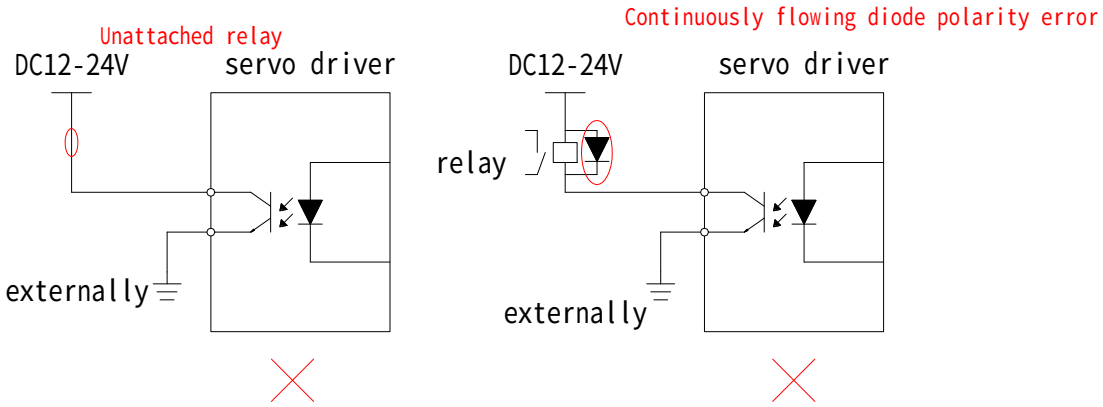
Taking OUT1 as an example, the OUT 1~OUT2 interface circuit is the same.

When the upper device is relay input:

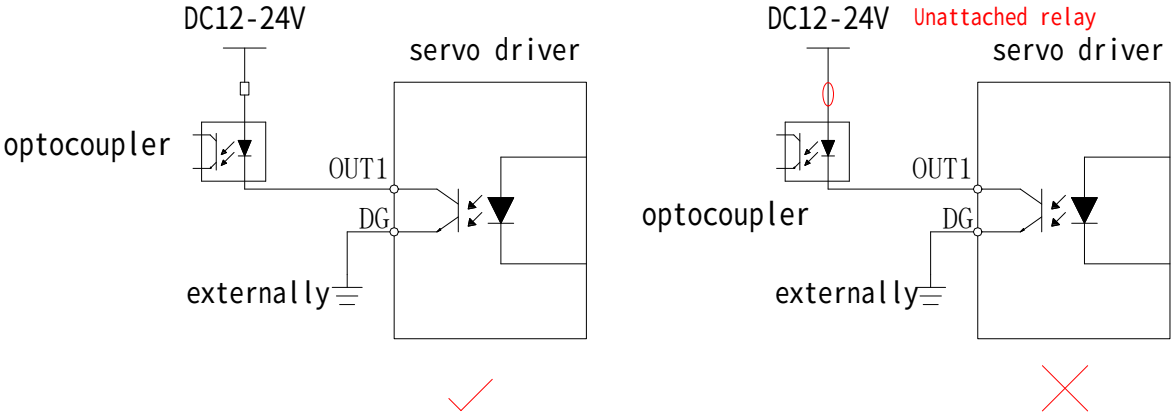
Correct wiring diagram:



Error wiring diagram:



When the upper device is optocoupler input:



1.4 Connection EtherCAT

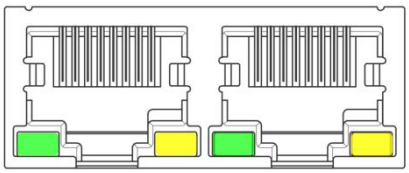
please use CAT5E (or higher level) mesh wire.

the ethernet input interface IN OUT connected to the ethernet output interface of the previous drive on the controller or bus. the ethernet output interface OUT IN connected to the ethernet input interface of the next drive on the bus. If the drive is the last node on the bus, simply connect to the Ethernet input interface IN..

1.4.1 EtherCAT status indicator

RJ45 yellow light is used for Link status, indicating whether there is a wire connection.

RJ45 green light is used to Activity the status, indicating whether there is data communication.



RUN/ERRLED indicator:

LED	Color	Status	Description
RUN	Green	Not bright	initialization status
		Slow Flash	pre-operational status
		Single flash	safe-operational status
		Always bright	operational status
ERR	Red	Not bright	No error
		Slow Flash	General error
		Single flash	Synchronization error
		Double flash	Watchdog error

Flash: Bright 50 ms, extinguish 50 ms (10 Hz). So circular.

slow flash: bright 200 ms, extinguish 200 ms (2.5 hz). So circular.

Single flash :200 ms, out 1 s. So circular.

Twinkle: Light 200 ms, Out 200 ms, Light 200 ms, Out 1 s. So circular.

1.5 EtherCAT site address

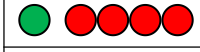
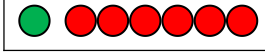
EC T series supports two kinds of methods to set slave address: object dictionary 0 x 2150 set site alias and ESC set site alias, and select by object dictionary 0 x2151.

The default 0 x2151 is 0, and the node address is assigned through the master station and saved to the EEPROM.

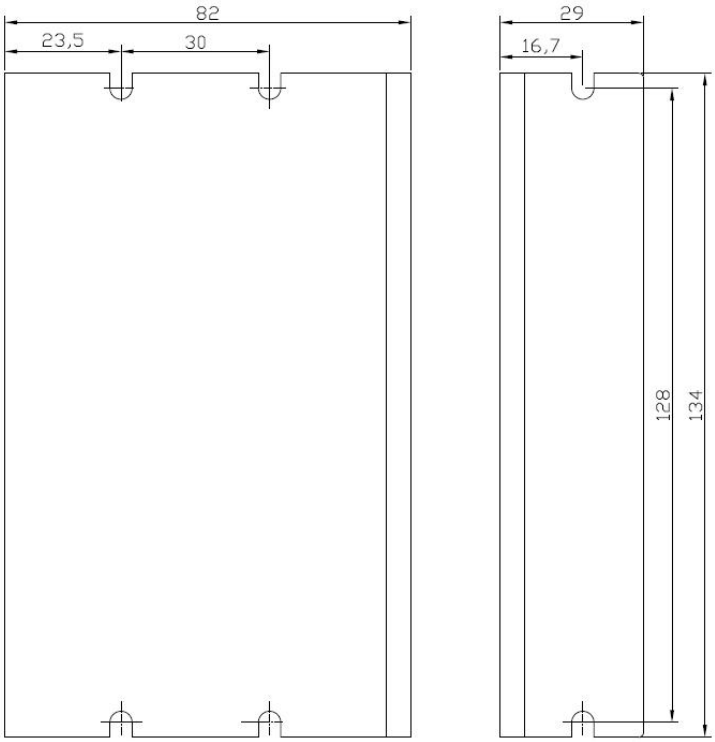
When users need to set their own fixed address, they need to set 0 x2151 to 1, and then write the required address value in 0 x2150.

0x2151	0x2150	Site address
0	1001	Master station configures site aliases to ESC EEPROM 0x0004 word addresses
1	Set value	Object dictionary 2150 sets the value to the node address value

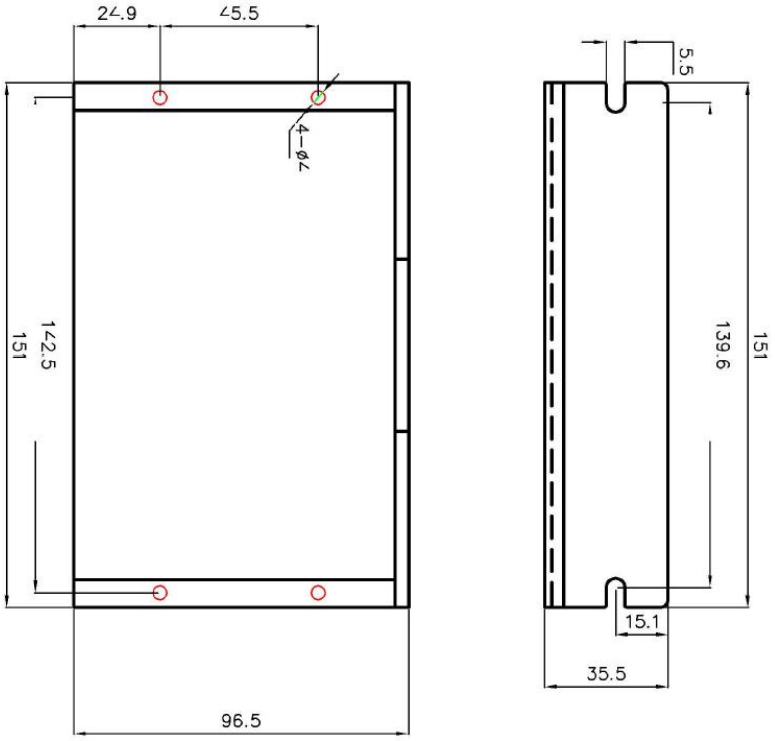
1.6 Alarm code

LED status		Driver status
	The green light is on	The drive failed
	Green light flashing	The drive works fine
	1 Green ,1 Red	Drive Overflow
	1 Green ,2 Red	Driver Input Power Overpass
	1 Green ,3 Red	Error in internal voltage of driver
	1 Green ,4 Red	Encoder Overreach Alarm
	1 Green ,6 Red	Parameter check error

1.7 Mechanical dimensions



ECT42、ECT60 mounting dimensions



ECT86 mounting dimensions

二 Parameter Description and Settings

2. 1 General parameters

2.1.1 0 x1000 Type of device

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED32	RO	NO	0x00040192

Bit 0~15: Device profile number 0x0192：CiA402

Bit 16~31: Additional information 0x0004：Stepper Drive

2.1.2 0 x1001 Device name

displays the current drive model name.

EC T42 function is the same as EC T60, only limit the default current of the driver, prevent the user to match the small motor, there is no first time to modify the current of the driver resulting in excessive current, damage the driver and motor. On x1001 0, both show EC T 60""

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	Visible string	RO	NO	ECR60

E CT60

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	Visible string	RO	NO	ECT60

2.1.3 0 x1009 Hardware version

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	Visible string	RO	NO	0xA1

2.1.4 0 x100A Software version

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	Visible string	RO	NO	x 101B 0

2.1.5 **Save parameters**

object dictionary 0 x 1010 subindex :01 write 1, will save the current parameter.

When saving the parameters, first stop the motor running, then save the parameters.

The data structure is as follows:

Index	Sub-index	Name	PDO mapping	Default
1010	00	Maximum number of sub-indexes	N o	1
	01	Save parameters	N o	0

2.1.6 **Restoring factory settings**

object dictionary 0 x 1011 subindex :01 write 1, then re-power the drive back to factory status.

When restoring the factory setting, first stop the motor running, then save the parameters.

Index	Sub-index	Name	PDO mapping	Default
1011	00	Maximum number of sub-indexes	N o	1
	01	Save parameters	N o	0

2. 2 Manufacturer-specific object

2.2.1 0 x2000 Operating current

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2000	P eak Current	R/W/S	UINT	100~6000	3000	mA

This object is used to set the sinusoidal peak current when the stepper motor is open loop running.

2.2.2 0 x2001 Subdivision/resolution

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2001	M otor Resolution	R/W/S	UINT	200~65535	10000	Pulse/rev

this object is used to set the number of pulses required for the motor to run one lap when the stepping motor is open loop running.

ECT60 default works in closed-loop mode, at which point the number of pulses required for the motor to run one lap is set by x2020 0 encoder resolution.

2.2.3 0 x2002 Standby time

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2002	I dle Time	R/W/S	UINT	200~65535	500	ms

This object is used to set the time to enter the standby state after the motor stops running when the stepping motor is open loop.

2.2.4 0 x2003 Percentage of standby current

Object Dictiona	Name	Property	Type	Scope	Default	Unit

ry						
0x2003	I dle Current Percent	R/W/S	UINT	0~100	50	%

this object is used to set the percentage of the current relative to the operating current set at 0 x2000 when the stepping motor is open-loop running and the motor stops running into standby state.

2.2.5 0 x2005 Output Port Function

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2005:01	Output 1Function	R/W/S	UINT	0~3	1	---
0x2005:02	Output 2Function	R/W/S	UINT	0~3	2	---

EC T series contains two output ports, which are used to set the function corresponding to the output port.

The port function is defined as follows:

Value	Function
0	Custom output
1	Alarm output
2	Lock output
3	Output in place

when set to custom output, the state of this port can be controlled by a polarity setting of 0 x2006.

2.2.6 0 x2006 Output port polarity

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2006	Outputs Polarity	R/W/S	UINT	0~3	3	---

Set the output port often open, often closed characteristics: Bit0 for the output port 1 polarity, Bit 1 for output port 2 polarity setting.

0—— Frequently Closed

1—— Regular

Bit15~bit2	Bit1	Bit0
---	OUT2	OUT1

2.2.7 0 x2007 Input port function

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2007:03	Input 3Function	R/W/S	UINT	0~8	1	---
0x2007:04	Input 4Function	R/W/S	UINT	0~8	2	---
0x2007:05	Input 5Function	R/W/S	UINT	0~8	3	---
0x2007:06	Input 6Function	R/W/S	UINT	0~8	6	---

EC T60 contains 4 input ports, this object is used to set the function corresponding to the input port.

Value	Function
0	General input port
1	CW limit input
2	CCW limit input
3	HOME input
4	Clearance
5	Stop signal
6	Motor offline
7	Probe 1
8	Probe 2

status of the input port can be read through x60FD 0 object.

polarity of the input port can be set via x2008 0 object.

2.2.8 0 x2008 Input port polarity

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2008	Inputs Polarity	R/W/S	UINT	0~3 F	x3F 0	---

Each bit defines the polarity of the corresponding port. Bit 0 defines the polarity of input port 1:

Bit15~bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
---	IN 6	IN 5	IN 4	IN 3	IN 2	IN1

0—— normally closed ,1—— often open

2.2.9 0 x2009 Filter time

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2009	Filter Time	R/W/S	UINT	0~25600	6400	us

EC T60 built-in a sliding average filter, this object is used to set the time of the sliding average filter. The larger the filter time, it can make the motor start and stop more smoothly, but the greater the response lag of the motor.

Delay time = filter time

2.2.10 0 x200A Shaft locking time

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2009	Soft lock Time	R/W/S	UINT	0~65535	1000	50 us

EC T60 when enabling, it is necessary to lock the stepping motor for initial positioning. in order to reduce the jitter of initial positioning, EC T 60 the built-in slope locking function. This object is used to set the ramp time of the motor lock shaft when the motor is enabled.

Locking time = set value *50 us*2= set value *100 us

2.2.11 0 x200B Current loop parameters

Object Dictionary	Name	Property	Type	Scope	Default	Remarks
0x200B:01	AutoPI enable	R/W/S	UINT	0~1	1	Identification of motor parameters while initial positioning of the driver and automatic calculation of PI gain 0-- No energy ;1-- Enable
0x200B:02	Iloop_Kp	R/W/S	UINT	100~	1000	At 0 x200B： 01 1, this register is

				65535		not set. Can be set to 0
0x200B:03	Iloop_Ki	R/W/S	UINT	0~ 10000	200	
0x200B:04	Iloop_Kc	R/W/S	UINT	0~1024	256	anti-integral saturation coefficient.

EC T60 use current control to realize the subdivision operation of stepping motor. EC T60 by default, automatic identification parameter algorithm is used to identify the electrical parameters of the motor, and the appropriate current loop PI parameters are automatically calculated. when the automatically identified PI parameters can not meet the requirements, the user can set the parameters by himself.

2.2.12 **0 x200C Motor parameters**

Object Dictionary	Name	Property	Type	Scope	Default	Remarks
0x200C:01	Motor type	R/W/S	UINT	0~1	0	0—— Two-phase stepper motor 1—— Three-phase stepper motor
x200C : 02 0	Resistance Auto	R	UINT	100~ 65535	1000	Automatic PI on, identify the motor winding resistance value. Unit: mOhm
x200C : 03 0	Inductance Auto	R	UINT	0~ 10	1	Automatic PI on, identify the motor winding inductance value. Unit: mH
x200C : 04 0	Resistance Set	R/W/S	UINT	0~ 10000	1000	Electrical winding resistance Unit: mOhm
x200C :	Inductance Set	R/W/S	UINT	1~10	1	Electrical inductance of

05 0						motor windings Unit: mH
0x200C:06	BEMF coefficient	R/W/S	UINT	0~1000	256	ECT60

Servo Mode 1:

ECT60 working in servo mode 1, the motor parameters themselves do not participate in the motor control, and the user does not need to be specially set. The user can judge whether the connection of the motor is normal by checking the self-identification resistance, inductance value of this object.

Servo Mode 2:

the closed-loop stepper motor is in FOC control mode when the E CT60 works in servo mode 2. Because of the special structure of stepping motor, in order to carry out FOC control, weak magnetic control is needed. The weak magnetic control parameters are estimated by the resistance, inductance and back EMF of the motor.

Usually the automatically estimated resistance and inductance can meet the demand, the user can also set the resistance to the inductance according to the motor parameters of the motor manufacturer. The inverse EMF coefficient can be calculated by the following formula:

x200C：06=0(rated torque (N.M)/rated current (A)*500

2.2.13 **0 x200D Reverse running**

Object Dictionary	Name	Property	Type	Scope	Default	Unit
x200D 0	Invert motor direction	R/W/S	UINT	0~1	0	---

If the positive direction of the motor operation is inconsistent with the system requirements, the object can reverse the direction of the motor operation without modifying the motor wiring.

2.2.14 **0 x200E Internal alarm code**

Object Dictionary	Name	Property	Type	Default
x200E 0	Alarm Code	R	UINT	0

this object displays the current fault code of the drive, and each bit of the object corresponds to an alarm status.

Alarm code	Alarm status
0x0001	Internal voltage error
0x0002	Overflow
0x0004	Overpressure
0x0008	Reservations
0x0080	Excess position error
Other	Reservations

When the above fault occurs, after eliminating the fault condition, the fault code of 0 x603F and 0 x200E will be cleared by writing 0 x80, the object of 0.

2.2.15 0 x200F Internal status code

Object Dictionary	Name	Property	Type	Default
x200F 0	Status Code	R	UINT	0

This object displays the current state code of the drive, and each bit of the object corresponds to a state.

Status code	Status
0x0001	Drive enables
0x0002	Driver malfunction
0x0004	Signal in place, keep it
0x0008	Does the motor run or stop
0x0010	Zero return completed
0x0020	Drive ready
Other	Reservations

2.2.16 0 x2010 Position cleared

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2010	Zero Position	R/W	UINT	0~1	0	---

Setting the object to 01 h clears the position value (position actual value) in the 0 x6064. usually used for the occasion where the motor has been moving in one direction, the user needs to stop the motor in due course, clear the actual position value through this object, and then enable the motor again. otherwise the motor position counter has saturation problem.

2.2.17 0 x2011 Control mode

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2011	Control mode	R/W/S	UINT	0~2	0	---

Set the working mode of step motor.

0—— Open-loop operation

1—— Closed-loop operation

2—— Closed-loop operation/ FOC mode

ECR60 can only work in open loop mode, setting other values is invalid.

2.2.18 **0 x2020 Encoder Resolution**

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2020	Encoder Resolution	R/W/S	UINT	1000~65535	4000	Pulse/rev

When the working mode of stepping motor is closed loop, it is necessary to set the encoder resolution corresponding to the motor running one turn. After this parameter is set, it needs to be saved and re-powered to take effect. ECT series products only valid.

2.2.19 **0 x2021 Encoder position**

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2021	Encoder Counter in one rev	R	UINT	1000~65535	0	Pulse/rev

This object reflects the position of the current motor in one lap. ECT series products only valid.

2.2.20 **0 x2022 Position Excess Alarm Value**

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2022	Position Trae Error Limit	R/W/S	UINT	1000~65535	4000	Pulse/rev

When the working mode of the stepping motor is closed loop, when the position error exceeds this set value, the motor will alarm and disconnect the enable. This parameter is set and takes effect immediately. ECT series products only valid.

2.2.21 **0 x2023 Servo Mode 1 Control Parameters**

Object Dictionary	Name	Property	Type	Scope	Default	Remarks
0x2023：01	PosLoop_Kp	R/W/S	UINT	0~ 10000	2000	proportional gain: adjusting motor position to respond to rigidity
0x2023：02	PosLoop_K i	R/W/S	UINT	0~ 1000	100	integral gain, which is used to eliminate the position error when the motor is still.
0x2023：03	PosLoop_Kd	R/W/S	UINT	0~ 10000	200	
0x2023：04	PosLoop_Kvff	R/W/S	UINT	0~100	30	Speed compensation
0x2023：05	PosLoop_Kdi	R/W/S	UINT	0~500	0	To eliminate low - speed resonance Usually this gain is not greater than 200

this object takes effect only when the ECT60 is closed loop controlled using servo mode

1. Gain is usually available by default.

2.2.22 **0 x2024 Arrival signal**

Object Dictionary	Name	Property	Type	Scope	Default	Remarks
0x2024：01	InPosMod e	R/W/S	UINT	0~10000	2000	In place signal decision mode 0—— Test at any time 1—— Detection after pulse instruction stops
0x2024：02	InPosCnt	R/W/S	UINT	0~1000	100	When the position error is less than the set pulse value and the continuously set time in place, it is judged to be in place.
0x2024：03	InPosTime	R/W/S	UINT	0~10000	200	

this object takes effect in ECT60 closed-loop mode for detecting whether the motor is

within the set accuracy range.

2.2.23 **0 x2025 Servo Speed Filter**

Object Dictionary	Name	Property	Type	Scope	Default	Remarks
0x2025：01	FV1_HZ	R/W/S	UINT	0~1000	200	Filter when Servo Mode 2 is set
0x2025：02	FV2_HZ	R/W/S	UINT	0~2000	600	
0x2025：03	FPOUT_HZ	R/W/S	UINT	0~5000	5000	

Effective in ECT60 servo mode 2, this object is used to set the bandwidth of the speed loop feedback parameter

FV1_HZ is used to set the speed feedback filter once low pass filter bandwidth.

FV2_HZ used to set the speed feedback filter secondary low pass filter bandwidth.

Usually set FV2HZ =3* FV1_HZ

FPOUT_HZ bandwidth used to set the number of output variables for FOC speed loops, typically using default values.

2.2.24 **0 x2026 Servo Mode 2 Control Parameters**

Object Dictionary	Name	Property	Type	Scope	Default	Remarks
0x2026：01	P VIA_Kp	R/W/S	UINT	0~ 10000	2000	Position proportional gain: adjusting motor position response to rigidity
0x2026：02	P VIA_K i	R/W/S	UINT	0~ 1000	100	integral gain, which is used to eliminate the position error when the motor is still.
0x2026：03	P VIA_K v1	R/W/S	UINT	0~ 10000	200	Speed feedback gain1
0x2026：04	P VIA_K v2	R/W/S	UINT	0~100	30	Speed feedback gain 2
0x2026：05	P VIA_K vff	R/W/S	UINT	0~500	0	Speed feedforward gain 1

ECT60 this object takes effect under the condition of servo mode 2, vector control

algorithm is adopted.

P VIA_K v1+P VIA_K v 2>P VIA_K vff usually

2.2.25 0 x2043 Speed given

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2043	Speed Reference	R	UINT	-3000~3000	0	RPM

This object reflects the given speed of the current motor.

2.2.26 0 x2044 Speed feedback

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2044	Speed Feedback	R	UINT	-3000~3000	0	RPM

This object reflects the actual speed of the current motor.

ECT60 return is the actual speed, ECR60 the value returned = the given speed.

2.2.27 0 x2048 Voltage

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2048	Bus Voltage	R	UINT	---	0	10 mV

bus voltage value (V)= object value/100;

2.2.28 0 x2049 Input level

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2049	Input Level	R	UINT	---	0	---

Displays the physical level of the current IO input

Bit15~bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
---	IN 6	IN 5	IN 4	IN 3	IN 2	IN1

0—— No input signal

1—— Input signal

2.2.29 0 x204A Output level

Object Dictionary	Name	Property	Type	Scope	Default	Unit
x204A 0	Output Level	R	UINT	---	0	---

Displays the physical level of the current output port

Bit15~bit2	Bit1	Bit0
---	OUT2	OUT1

0—— Represents output from the current output port

1—— Indicates that the current output port has no output

2.2.30 Harmonic Amplitude of 0 x2060 First Common Point

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2060	Amplitude of First Anti-Vibration	R /W /S	UINT	0-1000	0	---

used to eliminate the vibration of the first resonance point of the two-phase stepping motor. This method counteracts the resonance by adding some harmonics to the set current. the amplitude and phase of harmonics need to be adjusted to eliminate vibration.

2.2.31 Phase harmonic phase A 0 x2061 first resonance point

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x2060	Phase A of First Anti-Vibration	R /W /S	UINT	0-1024	0	---

Adjust the harmonic phase of A phase windings

2.2.32 Phase harmonic phase B 0 x2062 first resonance point

Object Dictionary	Name	Property	Type	Scope	Default	Unit
x204A 0	Phase B of First Anti-Vibration	R	UINT	0-1024	0	---

Adjust the harmonic phase of B phase windings

2.3 CIA402 object dictionary

2.3.1 0 x603F Fault code

Object Dictionary	Name	Property	Type	Scope	Default
x603F 0	Error Code	R W	UINT		0

When a fault occurs, first eliminate the fault condition, then write 0 to the control word 0 x6040 x0080, clear 0 x603F..

The breakdown code is as follows:

Error Code	Description
0x7500	Communication malfunction
0x3150	A phase circuit internal voltage error
0x3151	B phase circuit internal voltage error
0x8611	Closed-loop mode tracking error over-limit
0x2211	Overflow
0x3110	Overpressure

2.3.2 **0 x0640 Control words**

This object is used to control the state of the drive and motion. can enable / prohibit the drive; motor start, stop; clear the fault, etc.

Object Dictionary	Name	Property	Type	Scope	Default
0x6040	Control Word	RW	UINT		0

The bit of the control word is defined as follows:

Bit	Description
0	Switch ON
1	Enable Voltage
2	Quick Stop
3	Enable Operation
4	Operation mode related
5	Operation mode related
6	Operation mode related
7	Fault reset
8	Suspension of suspension
9	Operation mode related
10-15	Reservations

B it 0~3 and Bit7:

Command	Control word position				
	Bit 7	Bit 3	Bit 2	Bit 1	Bit0
Shutdown	0	x	1	1	0
Switch on	0	0	1	1	1
Switch on +Enable operation	0	1	1	1	1
Disable voltage	0	x	x	0	x
Quick stop	0	x	0	1	x
Disable Operation	0	0	1	1	1
Enable Operation	0	1	1	1	1
Fault reset	0->1	x	x	x	x

Bit4、5、6、8、9 definitions in relevant modes

PP mode

Bit	Name	Value	Description
4	A new target location	0->1	Change from 0 to 1, set a new target location
5	Reservations		
6	Absolute/relative	0	Absolute position mode
		1	Relative position mode
8	Suspension of suspension	0	Motor waiting to locate
		1	Stop running
9	Reservations		

PV mode

Bit	Name	Value	Description
8	Pause/run	0	Motor running to set speed
		1	The motor decelerates to 0 and stops

Zero-back mode

Bit	Name	Value	Description
4	Start back to zero	0->1	Start back to zero
8	Suspension of suspension	0	bit4 control
		1	Stop Zero

2.3.3 **0 x6041 Status**

this object sets the probe function.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED16	RW	Yes	0

Register bits are defined as follows:

Bit	Description
0	Ready To Switch ON
1	Switch ON
2	Operation Enabled
3	Fault
4	Voltage Enabled
5	Quick Stop
6	Switch On Disabled
7	Warning
8	Reservations
9	Remote
10	Target arrival
11-15	Reservations

Bit 9：Remote

shows whether the control word is set.This bit indicates Control word has settled.

2.3.4 **0 x6060 Operating mode**

for setting operation mode.

Object Dictionary	Name	Property	Type	Scope	Default
0x6060	Mode of Operation	RW	INTEGER8		0

EC series of drives support the following modes of operation:

Value	Patterns
1	Profile Position Mode (PP)
3	Profile Velocity Mode (PV)
6	Homing Mode (HM)

8	Cyclic Synchronous Position Mode (CSP)

2.3.5 0 x6061 Operating mode display

Displays current mode of operation, defined as x6060.0

Object Dictionary	Name	Property	Type	Scope	Default
0x6061	Mode of Operation Display	R	INTEGER8		0

2.3.6 0 x6064 Actual position

Displays the actual position of the current motor in Pulse.

Object Dictionary	Name	Property	Type	Scope	Default
0x6064	Position Actual Value	R	INTEGER 32		0

2.3.7 0 x606C Actual speed

Displays the actual position of the current motor in Pulse.

Object Dictionary	Name	Property	Type	Scope	Default
0x6064	Position Actual Velocity	R	INTEGER 32		0

2.3.8 0 x607A Target location

This object sets the target position in PP mode and CSP mode. Pulse. units

Object Dictionary	Name	Property	Type	Scope	Default
x607A 0	Profile Target Position	RW	INTEGER 32		0

the Bit6 of the control word (0x6040.6) used to set the coordinates in PP mode is relatively absolute.

in CSP mode, this target position is in absolute position mode.

2.3.9 0 x607C Zero offset

This object is used to set the offset between the zero sensor and position 0. Pulse. units

Object Dictionary	Name	Property	Type	Scope	Default
x607C 0	Home Offset	R W	INTEGER 32		0

2.3.10 0 x6081 Track velocity

this object is used to set the maximum speed of a trapezoidal acceleration and decelerationinstruction in PP mode. Pulse/s units

Object Dictionary	Name	Property	Type	Scope	Default
0x6081	Profile Velocity	R W	INTEGER 32		10000

2.3.11 0 x6083 Track acceleration

This object is used to set the acceleration of the trapezoidal acceleration anddeceleration instruction in Pulse/s ^2 when the PP mode and PV mode are set

Object Dictionary	Name	Property	Type	Scope	Default
0x6083	Profile Acceleration	R W	INTEGER 32		100000

2.3.12 0 x6084 trajectory deceleration

This object is used to set the PP mode, PV mode, trapezoidal acceleration and decelerationinstructions in Pulse/s ^2

Object Dictionary	Name	Property	Type	Scope	Default
0x6084	Profile Deceleration	R W	INTEGER 32		100000

2.3.13 0 x6085 Fast Stop Reductions

This object is used to set the PP mode, PV mode, HOME mode, when touching the limit, zeroand other sensors, the motor stop deceleration. Pulse/s. units

Object Dictionary	Name	Property	Type	Scope	Default
0x6085	Quickstop Declaration	R W	INTEGER 32		500000

2.3.14 0 x6098 Zero-return method

This object is used to set the method of the motor returning to zero.

Object Dictionary	Name	Property	Type	Scope	Default
0x6098	Homing Method	R W	INTEGER8	17~35	17

specifically describe the reference back to zero mode.

2.3.15 0 x6099 Return to zero

this object sets the speed of the motor back to zero.

Object Dictionary	Name	Property	Type	Scope	Default	Unit
x 6099: 01 0	Homing Velocity (fast)	R/W/S	UNSIGNED32	---	10000	Pulse/s
x 6099: 02 0	Homing Velocity (slow)	R/W/S	UNSIGNED32	---	2000	Pulse/s

2.3.16 0 x609A Zero acceleration

This object is used to set the acceleration and deceleration of the motor back to zeroposition curve. unit is Pulse/s ^2.

Object Dictionary	Name	Property	Type	Scope	Default
x609A 0	Homing Acceleration	R W	UNSIGNED 32		100000

2.3.17 **0 x60B8 Probe Function Setup**

this object sets the probe function.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED16	RW	Yes	0

Register bits are defined as follows:

Bit	Value	**Definition**
0	0	Probe 1 Banning
	1	Probe 1 enables
1		Reservations
2		Reservations
3		Reservations
4	0	Disable probe 1 down along latch
	1	Enable probe 1 to rise along latch
5	0	Disable probe 1 down along latch
	1	Enable probe 1 down along latch
6		Reservations
7		Reservations
8	0	Probe 2 Banning
	1	Probe 2 enables
9		Reservations
10		Reservations
11		Reservations
12	0	Disable probe 2 drop along latch
	1	Enable probe 2 to rise along latch
13	0	Disable probe 2 drop along latch
	1	Enable probe 2 down along latch
14		Reservations
15		Reservations

the positive position is latched at the rising edge moment and the negative position is latched at the falling edge moment.

2.3.18 0 x60B9 Probe status

this object defines the probe functional state.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED16	R	Yes	0

The status bit is defined as follows:

Bit	Value	**Definition**
0	0	Probe 1 Banning
	1	Probe 1 enables
1	0	Probe 1 Rise Edge Latch: No
	1	Probe 1 Rise Edge Latch: Yes
2	0	Probe 1 Down Edge Latch: No
	1	Probe 1 Downside Latch: Yes
3-7	0	Reservations
8	0	Probe 2 Banning
	1	Probe 2 enables
9	0	Probe 2 Rise Edge Latch: No
	1	Probe 2 rising edge latch: available
10	0	Probe 2 Downside Latch: No
	1	Probe 2 Downside Latch: Yes
11-15	0	Reservations

2.3.19 0 x60B A Probe 1 positive lock value

this object holds the position of probe 1 rising edge latch.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED 32	R	Yes	0

2.3.20 0 x60B B Probe 1 negative lock value

this object holds the position of probe 1 down along the latch.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED 32	R	Yes	0

2.3.21 0 x60B C Probe 2 positive lock value

this object holds the position of the probe 2 rising edge latch.

Object Type	Data Type	Access Type	PDO Mapping	Default Value

VAR	UNSIGNED 32	R	Yes	0

2.3.22 **0 x60B D Probe 2 negative lock value**

this object holds the position of probe 2 down along the latch.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED 32	R	Yes	0

2.3.23 **x60FD Digital Inputs 0**

This object monitors the input port of the drive.

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED32	RO	Yes	0x00000000

B it0	CW limit	0—— Invalid 1—— Limit effective
B it1	CCW limit	
B it2	HOME	0—— Zero invalid 1—— Zero effective
B it3~B it15	Reservations	
B it16	IN1	Physical state of the input port 0—— Input signal invalid 1—— Input signal valid
B it17	IN 2	
B it18	IN 3	
B it19	IN 4	
B it20	IN 5	
B it21	IN 6	
B it22~Bit31	Reservations	

2.3.24 0 x60FF PV Mode Speed Set

This object sets PV speed in Pulse/s mode

Object Dictionary	Name	Property	Type	Scope	Default	Unit
x60FF 0	Target Velocity	RW	DINT		0	Pulse/s

this object is 32-bit signed data with positive and negative values representing the two directions of motor operation, respectively.

2.3.25 0 x6502 Operating mode supported

This object describes the operating mode supported by the drive.

Object Dictionary	Name	Property	Type	Scope	Default	Unit
0x6052	Supported Drive Modes	R	UDINT		0x000000A5(165)	---

The bits are defined as follows:

Bit	Description
0	PP：Profile Position Mode
1	VI：Velocity Mode
2	PV：Profile Velocity Mode
3	TQ：Torque Profile Mode
4	reserved
5	HM：Homing Mode
6	IP：Interpolated Position Mode
7	CSP：Cyclic Sync Position Mode
8	CSV：Cyclic Sync Velocity Mode
9	Cyclic Sync Torque Mode
10-31	Reservations

Bit value =0: not supported

Bit =1: Support

EC Series Stepper Drive Support PP,PV,HM,CSP modes.

2.4 CIA402 motion control

2.4.1 Operation mode

ECR series EtherCAT step drives support the following operating modes (0 x6060):

Profile Position (PP)

Profile Velocity (PV)

Cyclic Synchronous Position (CSP)

Homing (HM)

2.4.2 PP trajectory position pattern

Description of trajectory position pattern:

standard position mode is a point-to-point operation mode that uses set points consisting of velocity, acceleration, deceleration, and target position. Once all these parameters are set, the drive caches these commands and starts executing the setpoint.

enable trajectory position pattern

To enable trajectory position mode, the value of the object dictionary 6060 h(operating mode) must be set to h.0001 can be confirmed by object dictionary 6061 h(operating mode display) whether the drive has entered the correct operating mode.

Set run parameters

use the object dictionary 607 Ah,6081h,6083h,6084h to set the position, velocity, acceleration, and deceleration separately.

Start and stop

After power on, the drive is in an unenergetic state. the control word 6040 h write 0006 h,

will bring the drive into the "ready to switch on" state.

indicate a new set point and start motion by sending 001 Fh to the object dictionary 6040 h, of the control word.

To enable the drive operation, the value 001 Fh must be written to the object dictionary address 6040 h. of the control word It also means that a new set point is ready. the driver uses the Bit 12 of the status word (6041 h) to indicate that a valid set point is received. because the setting point is edge-triggered, once the drive receives and processes the setting point, the control word must be cleared by writing the 000 FH to the control word register.

Control word-related Controlword Bits

new set point (bit 4)-setthisbithightoclockinnewset-point. once the drive receives the set point, the Bit12 of the status word is set to high (1), and the bit4 of the control word needs to be set to 0;

set point change (bit 9)– if low, after the drive executes the current set point, go to idle state and wait for the next new set point. If it is high, the drive runs the set point of the last time at the speed set above, then switches to the new speed and runs to the new set point.

A setpoint takes effect immediately (bit 5)- If this bit is high, the new setpoint takes effect immediately and the motor will run to the new position at the speed of the new setpoint.

absolute mode/relative mode (bit 6)– if high, set point is relative position mode. For

example, if the front motor position is 10000 steps and the new set point is 20000, the final position will be 30000. If low, set point absolute position mode. If the previous motor position is 10000 and the newly set position is 20000, then the new position will be 20000. The distance from the previous position to the new position is 10000 steps. Do not change this bit when the motor moves.

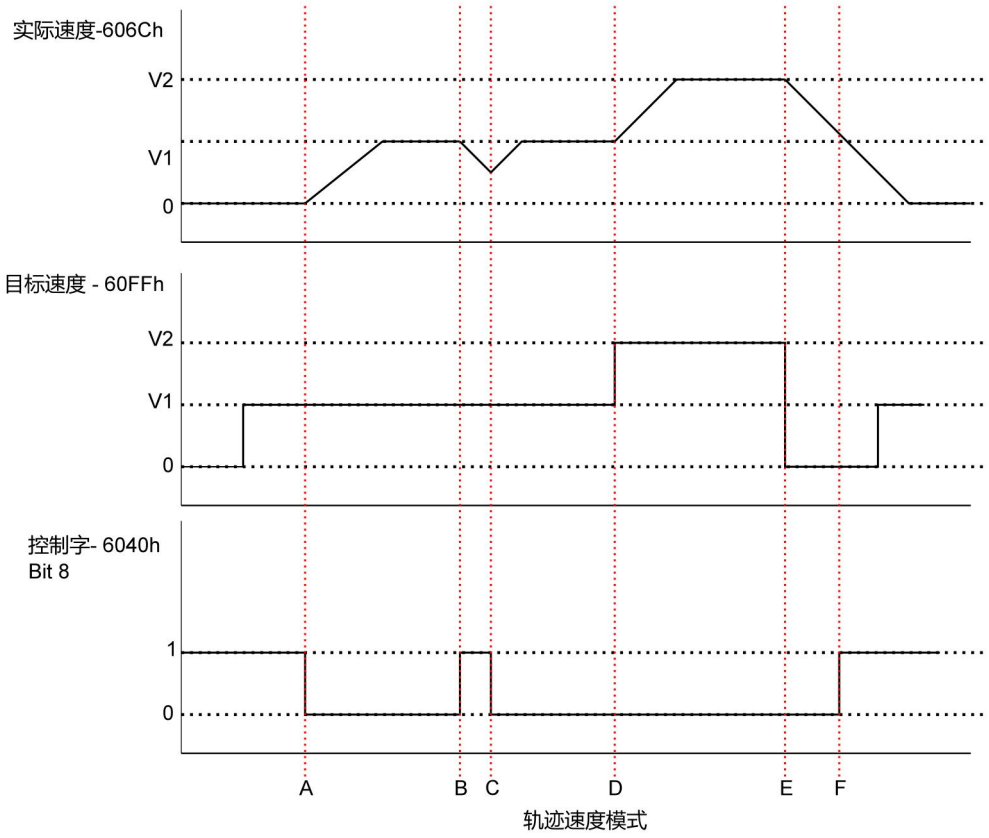
PP mode related control word.

2.4.3 PV trajectory velocity pattern

Description of trajectory velocity pattern

the trajectory velocity mode is a relatively simple mode of operation. Once the speed, acceleration, and deceleration are set, the drive commands the motor to speed up to the running speed according to the acceleration parameter or stops the movement according to the deceleration parameter.

The following figure shows an example of configuring speed mode.



The above figure shows the corresponding relationship between the motor running state, actual speed, target speed and control word.

	Target speed	Stop Bit4 h 6040	Motor state of motion
Start	0	1	Motor stop
A	V1	1->0	Motor acceleration to V1
B	V1	0->1	Motor decelerates to stop

C	V1	1->0	Before the motor stopped, it accelerated to V1.
D	V1->V2	0	Motor accelerates from V1 to V2
E	V2->0	0	From V2 to 0
F	0	0->1	Motor stop
G	0->V1	1	Motor stop

The above table explains how the stop bit and target speed are used together to affect the motor speed. between the B point and the C point, the motor does not stop completely, but decelerates according to the value of trajectory deceleration starting at point B. as the bit transition is stopped at point C, it accelerates immediately back to the target speed. at point E, reducing the target speed to zero has the same effect as using the stop bit.

it should be noted that there will be torque on the motor whether to make the stop bit and set the target speed to zero. if the axis is to move freely, the state of the drive must be placed in the drive disabled (not enabled) state.

Enable trajectory velocity pattern

To enable trajectory position mode, the value of the object dictionary 6060 h(operating mode) must be set to h.0003 can be confirmed by object dictionary 6061 h(operating mode display) whether the drive has entered the correct operating mode.

Set run parameters

object dictionary 60 FFh,6083h,6084h is used to set the velocity, acceleration, and deceleration of the trajectory velocity mode respectively.

Enable drive

After power on, the drive is in an unenergetic state. the control word 6040 h write 0006 h,

will bring the drive into the "ready to switch on" state. write 010 to 6040 h again Fh, make the drive into "Operation Enabled" state and the motor is in stop running state.

Start and stop

to start and stop the movement, switch the control word stop bit (bit 8 bit). when the stop bit is set to 0(000 Fh), the motion will start or continue; when the stop bit is set to 1(010 Fh), the motion will stop.

A trajectory velocity (60 FFh) greater than zero indicates positive motor turn, less than zero indicates motor reverse, equal to zero indicates motor stop. The user can directly set the motor to enter the reverse state when the motor is forward, and the motor will slow down and stop and reverse accelerate to the set speed.

2.4.4 **CSP synchronous position mode**

Sync Position Pattern Description

in this mode, the main controller generates the position trajectory and sends the target position (0 x607A) to the drive at each PDO update cycle. driver feedback actual motor position and optional actual motor speed and torque.

Enable CSP mode

To enable cyclic synchronous position mode, the value 0008 h must be written to the dictionary address 6060 h..

Enable drive

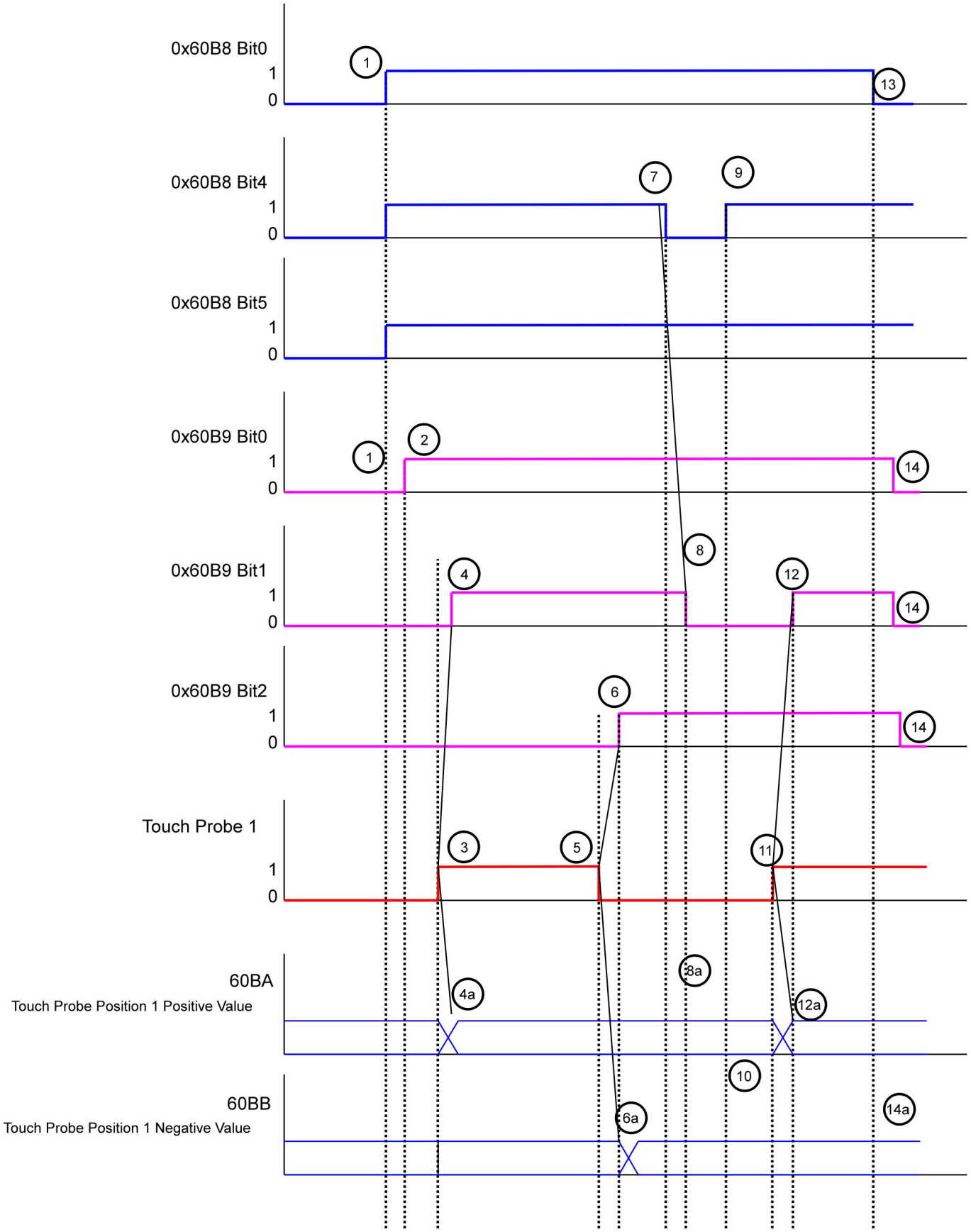
After power on, the drive is in an unenergetic state. the control word 6040 h write 0006 h, will bring the drive into the "ready to switch on" state. Write the value 0 x000F to 6040 again h, the drive will be in the enable state and the motor can respond to CSP instructions.

2.4.5 **Probe Function**

the probe function latches the motor position information through the digital input port. ECR60 digital input port functions and polarity can be self-defined by 0 x2007、0x2008.

the probe function related object dictionary is as follows:

I ndex	Object Description	
0x60B8	Probe Function Setup	Touch Probe Function
0x60B9	Probe status	Touch Probe Status
x60B A 0	Probe 1 Rise Latch Position	Touch Probe Position 1Positive Value
x60B B 0	Probe 1 Down Latch Position	Touch Probe Position 1Negative Value
x60B C 0	Probe 2 Rise Latch Position	Touch Probe Position 2Positive Value
x60B D 0	Probe 2 Down Latch Position	Touch Probe Position 2Negative Value



Probe timing diagram

Serial	Register changes	Probe Action

number		
1	60B 8Bit 0=1 60B8Bit 1,4,5	Enable probe 1 Configuration enable probe rising edge and falling edge
2	->60 B9Bit 0=1	Status "Probe 1 Enable" Position
3	Rise of external probe signal	
4	->60 B9Bit 1=1	Status "Probe 1 Rise Latch" Position
4 a 4	->60 B A	Probe 1 positive position latched
5	External probe signal descending edge	
6	->60 B9Bit 2=1	Status "Probe 1 Down Latch" Position
6 a 6	->60 B B	Probe 1 negative position latched
7	->60 B 8Bit ： 4	Rise Edge Latch Function: Prohibited
8	->60 B9Bit 0=0	Status "Probe 1 Rise Latch" cleared
8 a	->60 B A	Probe 1 positive position, latch position unchanged
9	->60 B 8Bit 4=1	Rise edge latch function: enable
10	->60 B A	Probe 1 positive position, latch position unchanged
11	Rise of external probe signal	
12	->60 B9Bit 1=1	Status "Probe 1 Rise Latch" Position
12 a	->60 B A	Probe 1 positive position latched
13	->60 B 8Bit 0=0	Probe 1 Function: Prohibited
14	->60 B9Bit 0,1,2=0	Status bit cleared
14 a	->60 B A ,60BB	No change in positive/negative locking position of probe 1

Probe timing description

2.4.6 **Zero-back mode**

Set back zero parameter

Set back zero speed, acceleration, zero offset and related sensor input signals.

The related object dictionaries are as follows:

Object Dictionary	Note
x607C 0	Zero offset
x6098 0	Zero-back setting
x6099 0	Return to zero speed
x609A 0	Zero acceleration
x2007 0	Input port function selection
x2008 0	Input port polarity setting

Enable zero return function:

To enable trajectory position mode, the value of the object dictionary 6060 h(operating mode) must be set to h.0006 can be confirmed by object dictionary 6061 h(operating mode display) whether the drive has entered the correct operating mode.

the driver is in an unenergetic state after initial power-up. Write 6 h the control word 6040, set the drive to the ready to switch on "state, then write 000 to the control word 6040 Fh, set the drive to Operation Enabled Mode"..

Activate zero return function:

A zero return method is set h the object dictionary by 6098.

A zero return speed is set by 0 x6099.

You can start back to zero by controlling the rising edge of the Bit4, h word 6040 from 0 to 1. the status back to zero is queried via the 6041 status word.

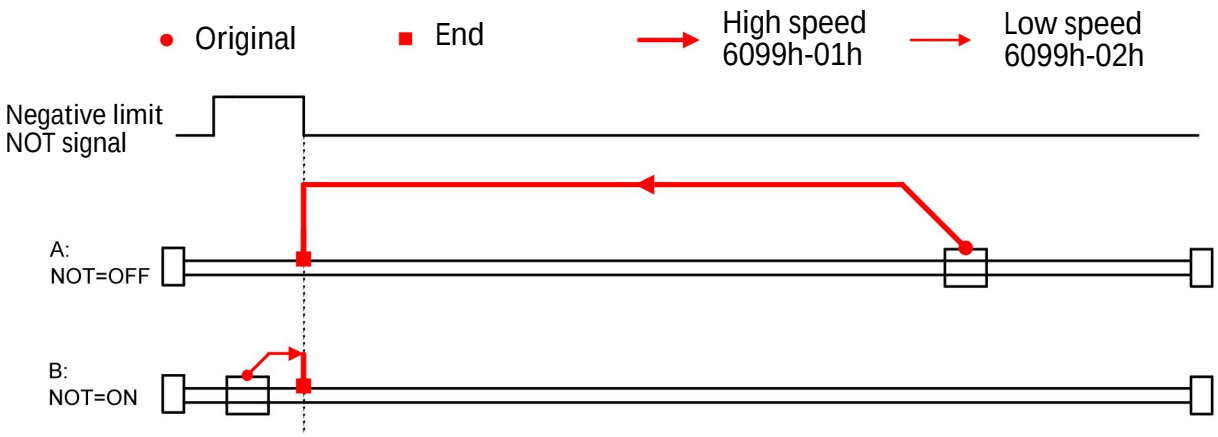
Discontinue function:

A zero return method is set h the object dictionary by 6098. Return to zero can be aborted by controlling the rising edge of the Bit8, h word 6040 from 0 to 1. the status back to zero is queried via the 6041 status word.

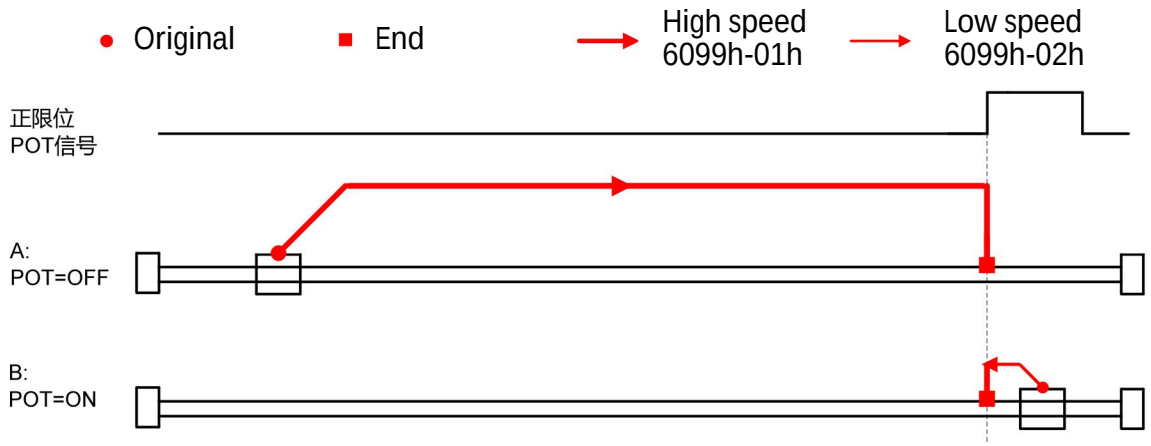
2.4.6.1 Zero-return method

ECR60 drive product supports 17~34,35 back to origin mode, the specific definition and back to origin process described below.

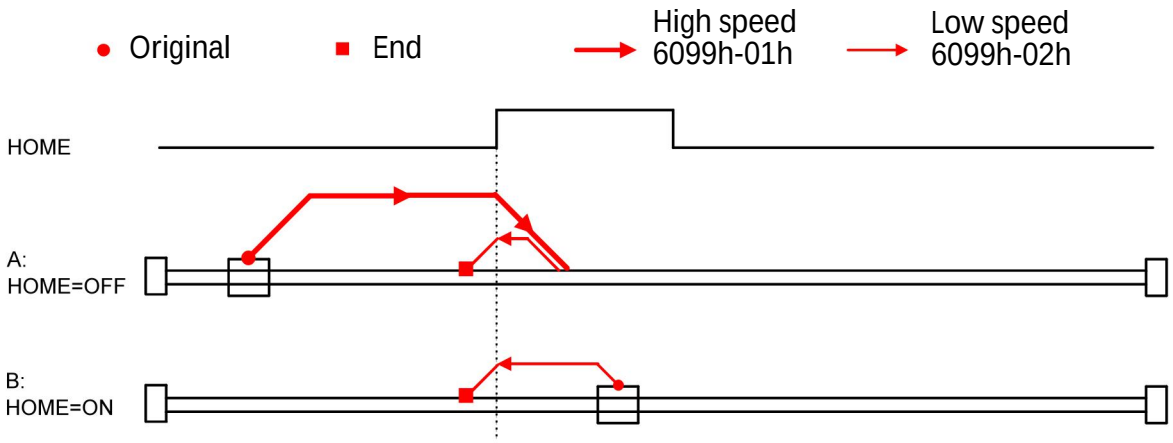
2.4.6.2 Method 17:



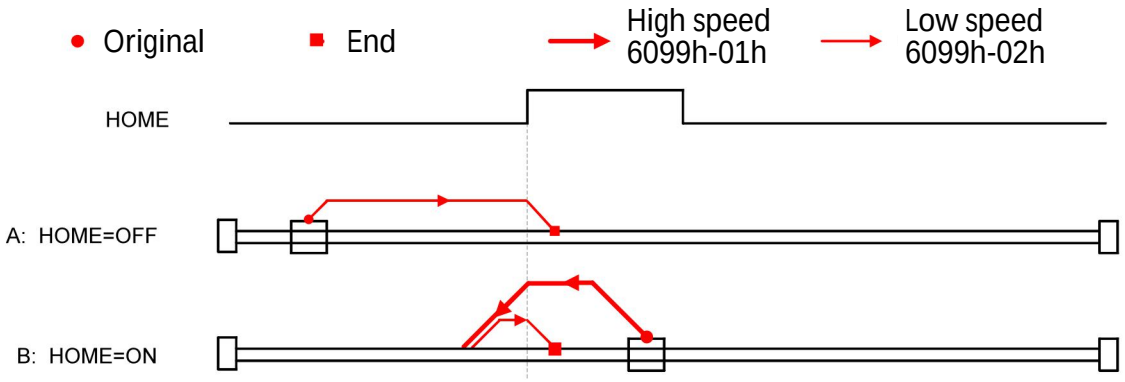
2.4.6.3 Method 18:



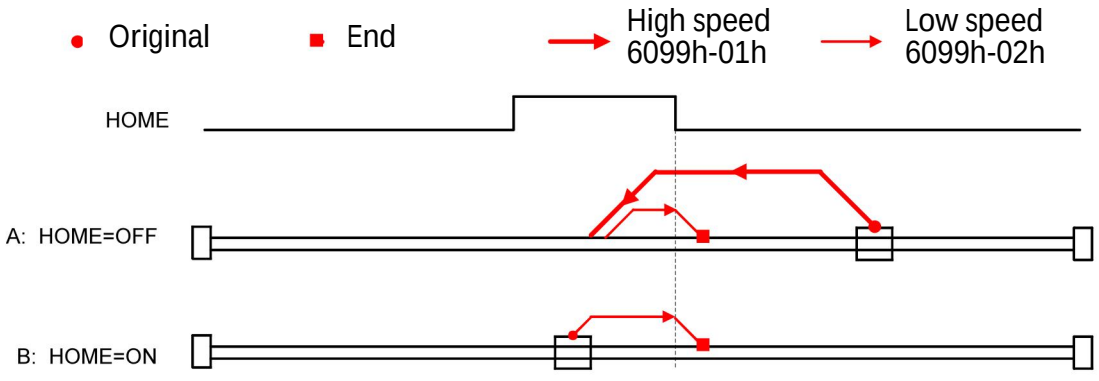
2.4.6.4 Method 19:



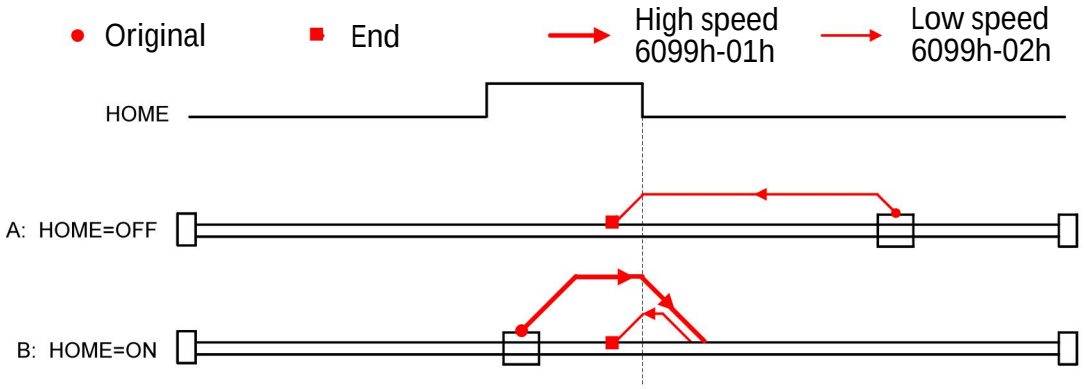
2.4.6.5 Method 20:



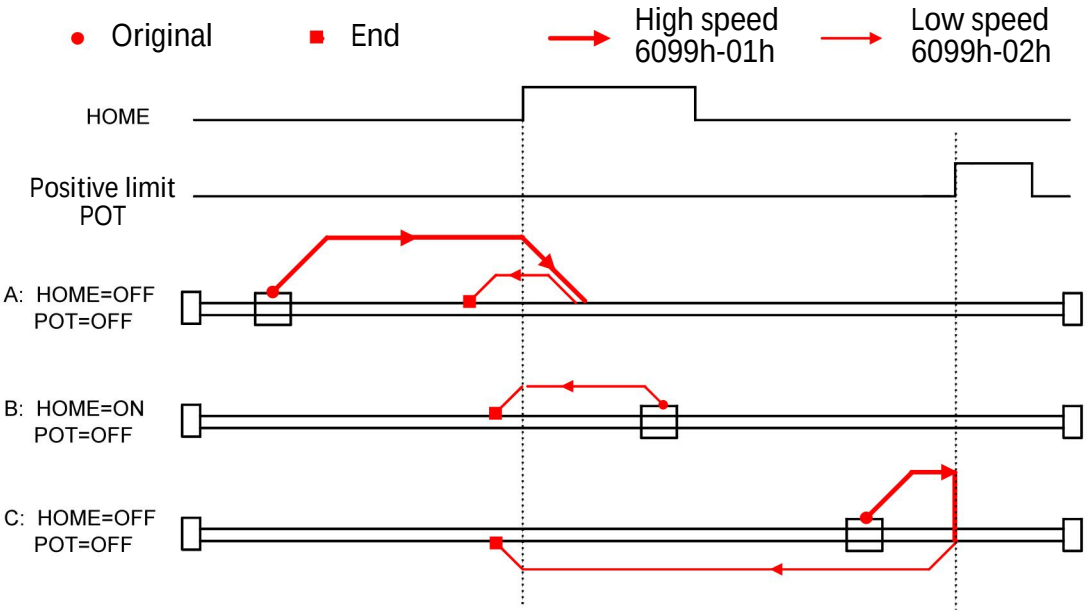
2.4.6.6 Method 21:



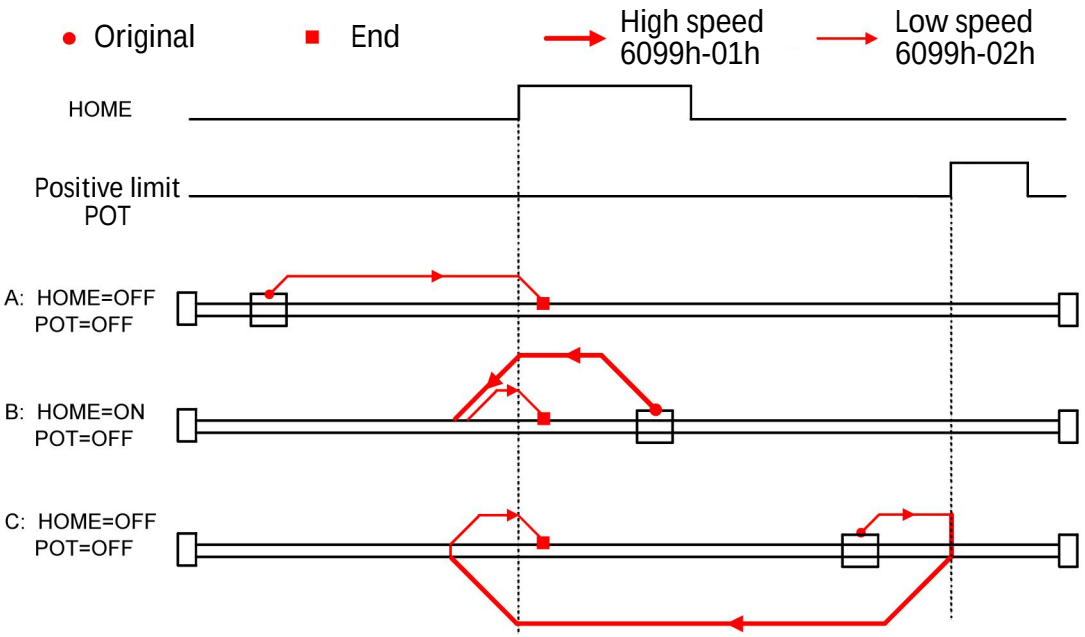
2.4.6.7 Method 22:



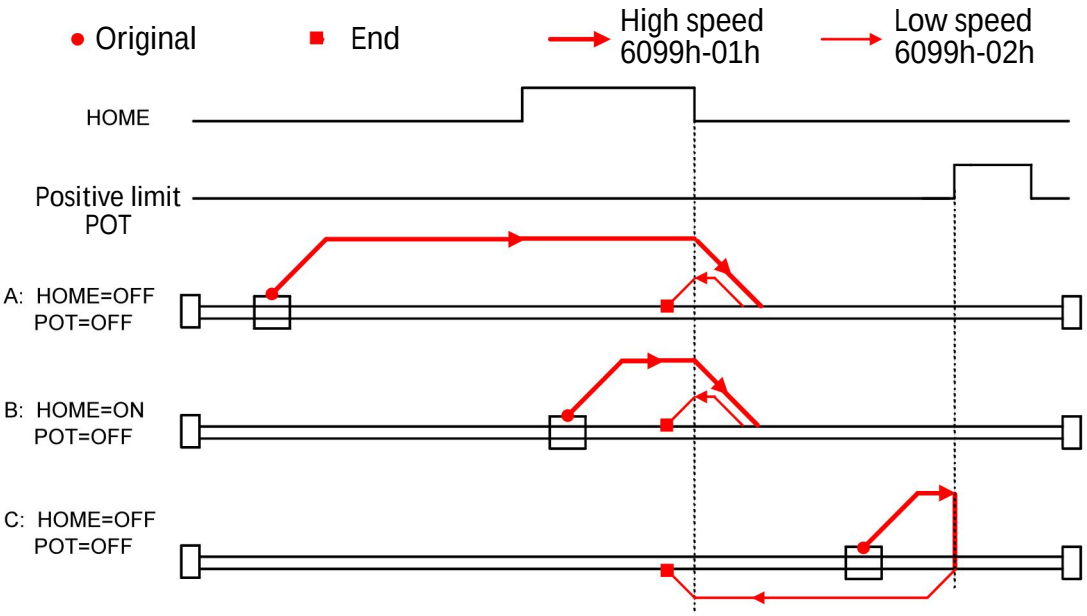
2.4.6.8 Method 23



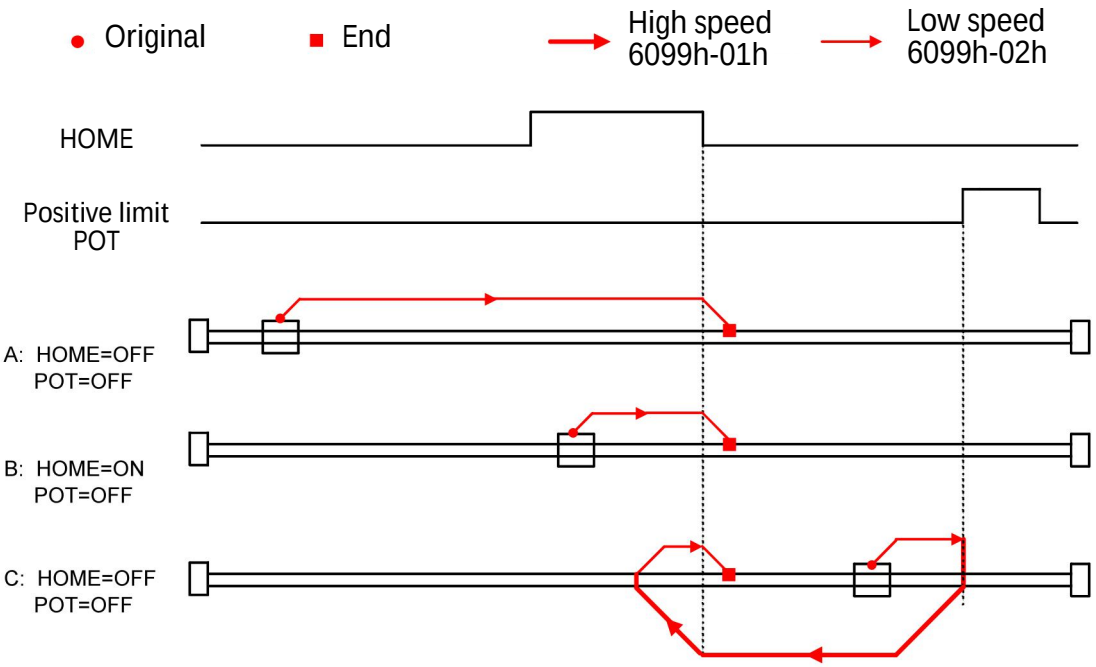
2. 4. 6. 9 **Method 24**



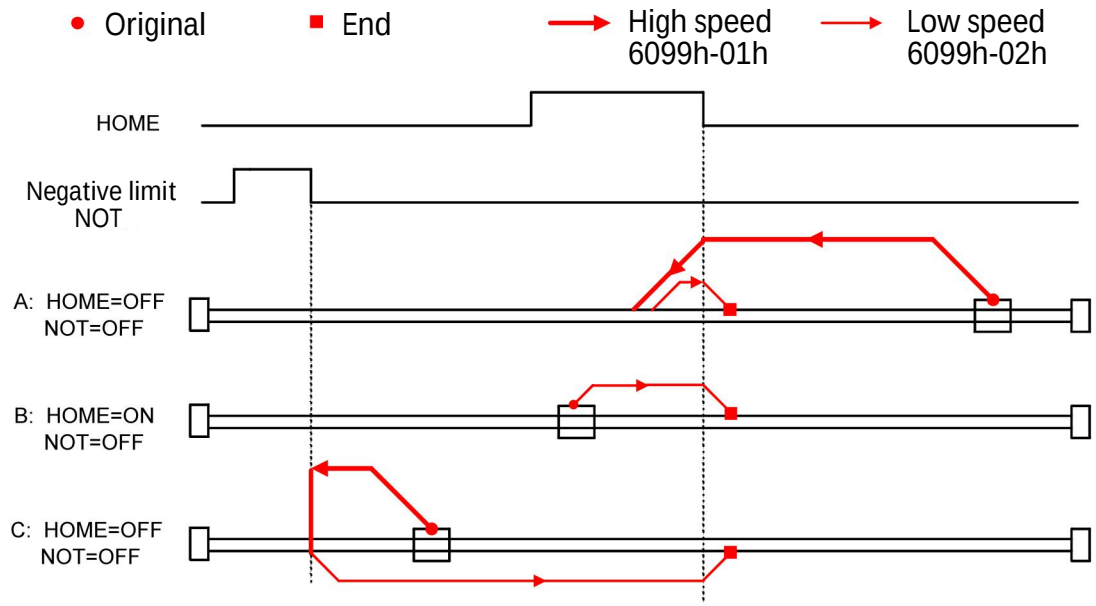
2. 4. 6. 10 **Method 25:**



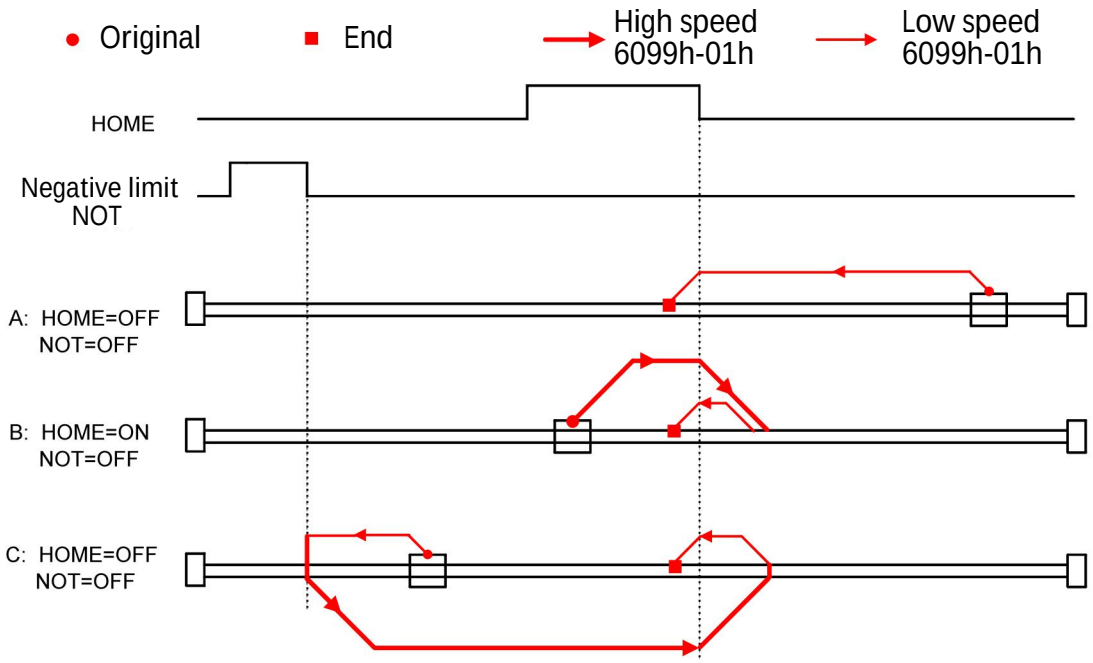
2. 4. 6. 11 **Method 26:**



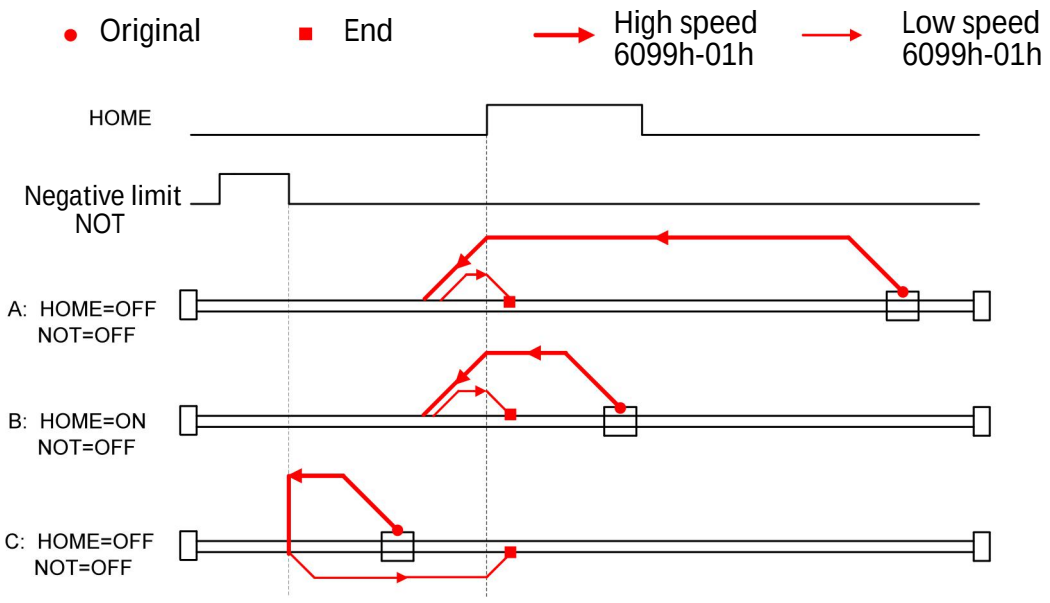
2. 4. 6. 12 **Method 27:**



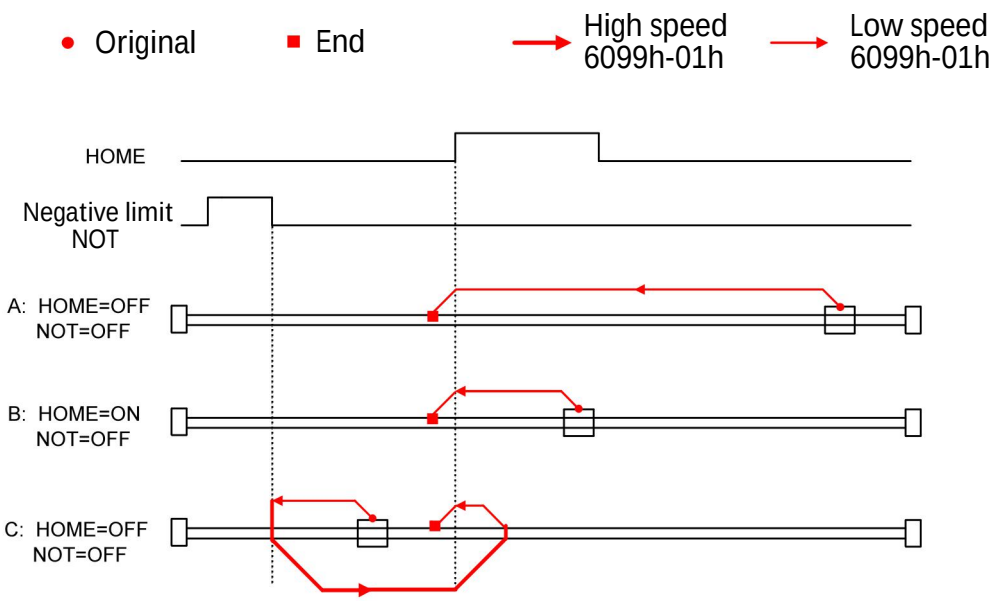
2.4.6.13 Method 28:



2.4.6.14 Method 29:



2.4.6.15 Method 30:



2.4.6.16 Method 35: