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EST60 EtherCAT Stepper Drive

User Manual

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Revision History

Date	Version	Description
2025.02.18	V1.0	Products first launched
2025.02.22	V2.0	Modified errors

Content

1 Drive Description

1.1 Product Introduction

Thank you for choosing the Rtelligent EST60 Stepper Drive. EST60 is a high-performance bus-controlled stepper drive with integrated intelligent motion controller functionality. It features CoE (CANopen over EtherCAT) protocol support.

1.1.1 Characteristics

1. Support CoE (CANopen over EtherCAT), meet CiA 402 standards
2. Support CSV, CSP, PP, PV, Homing mode
3. The minimum synchronization period is 100us
4. Control Method: Open-loop control, Closed-loop control
5. Motor Type: 2-phase, 3-phase
6. Brake Port: Directly connect the brake wires
7. Debugging Interface: Type-C
8. 4-digit LED Display: allows convenient parameter monitoring and adjustment.
9. 4 Optically Isolated Digital Inputs (IN3 – IN6):24V single-ended inputs; default functions: IN3: Positive limit, IN4: Negative limit, IN5: Homing (Origin) input, IN6: Motor disable (OFF).
10. 2 Optically Isolated Digital Outputs: maximum withstand voltage: 30V, maximum sink/source current: 100mA, common-cathode configuration.

1.1.2 Electrical Characteristics

EST60 product specifications:

Product Model	EST60
Output current (A)	0.5~6A
Power supply voltage	20~80VDC，18~50VAC

Matched motor	Below 60 base (Closed Loop)
Encoder Interface	Incremental quadrature encoder
Encoder Resolution	0~65535
Optically Isolated Inputs	4 common-anode 24V digital inputs
Optically Isolated Outputs	2 outputs (Alarm, Positioning Complete, and general-purpose output)
Communication Interface	Dual RJ45
Brake Interface	Direct brake connection (no external relay required)

Do not exceed the specified operational limits.

1.2 Power Supply & Motor

Drive Label	Description
AC	The power supply supports both AC and DC inputs. It can operate with: DC input: 20VDC to 80VDC AC input: 18VAC to 50VAC The above voltage ranges represent the safe operating values for the drive.
AC	
A+	Please refer to the motor manufacturer's instructions for specific wiring connections.
A-	
B+	
B-	

1.3 Drive Interface & Wiring

*注意：ESR系列不带编码器接口

1.4 Digital Input and Output Ports

1.4.1 Digital Input Ports

EST60 Bus Stepper Drive features 4 digital inputs and 2 digital outputs. For object dictionary configuration, 0x2007 is input port function settings and 0x2008 is input port polarity settings

Object Dictionary	Name	Property	Type	Range	Default	Unit
0x2007:01	Input 3 Function	R/W/S	UINT	0~8	1	---
0x2007:02	Input 4 Function	R/W/S	UINT	0~8	2	---
0x2007:03	Input 5 Function	R/W/S	UINT	0~8	3	---
0x2007:04	Input 6 Function	R/W/S	UINT	0~8	6	---

Input port configuration values and their corresponding functions:

Value	Function
0	General-Purpose Inputs
1	IN3 Default function: CW Limit Input
2	IN4 Default function: CCW Limit Input
3	IN5 Default function: HOME Input
4	Fault Reset
5	E-Stop Signal
6	IN6 Default function: Motor Disable
7	Probe 1
8	Probe 2

Input port states can be read via Object 0x60FD.

Input port polarity can be configured through Object 0x2008.

Object Dictionary	Name	Property	Type	Range	Default	Unit
0x2008	Inputs Polarity	R/W/S	UINT	0~0xF	0xF	---

Each bit defines the polarity of its corresponding input port, e.g., Bit 0 configures Input 1 polarity

Bit15~bit4	Bit3	Bit2	Bit1	Bit0
---	IN6	IN5	IN4	IN3

0: Normally Closed (NC) 1: Normally Open (NO)

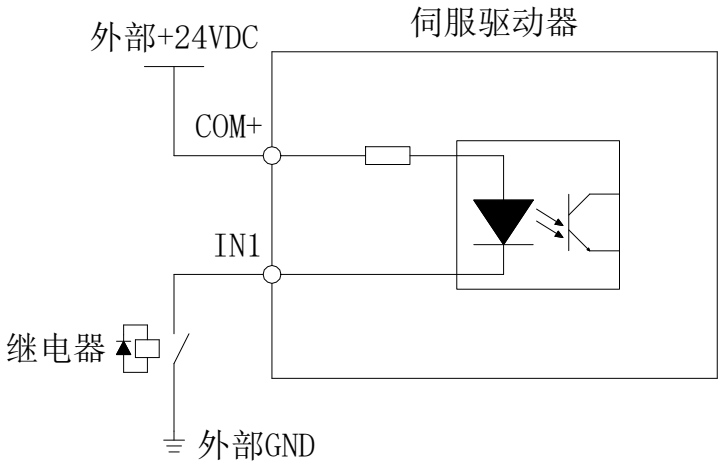
Default polarity of input ports is Normally Open (NO)

The default value of 0x2008 is hexadecimal, with a factory default of F (15 in decimal).

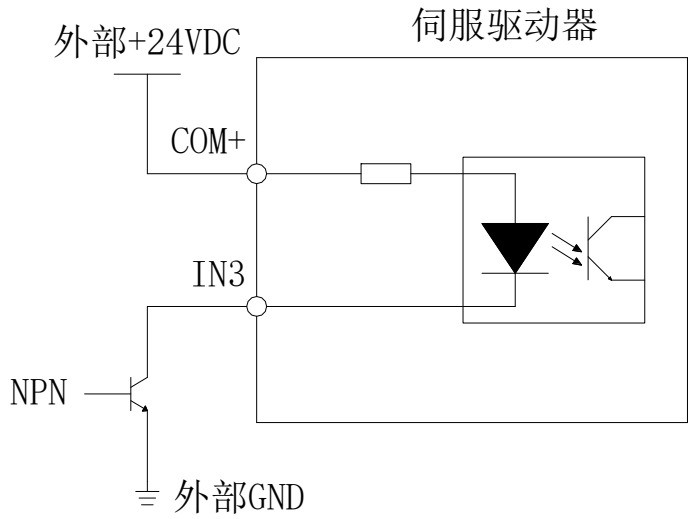
To configure IN3 (positive limit) and IN4 (negative limit) as normally closed, set Bit0 and Bit1 to 0.

The single-ended input terminals IN3 to IN6 is the same interface circuit, as illustrated by the example of IN3.

When the upper device is of relay output type:



When the upper device is of open collector type:



Note: PNP Input Not Supported

1.4.2 Digital Output Ports

The EST60 features two optically isolated output signals.

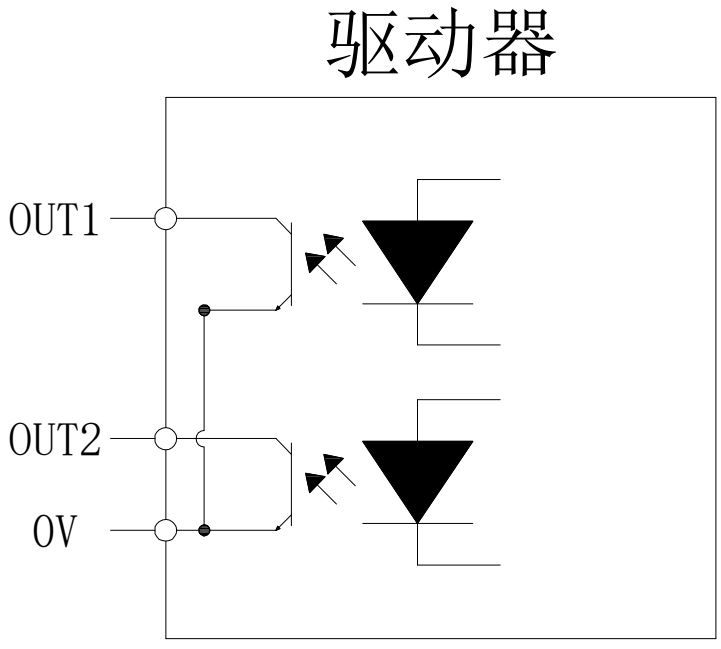
OUT1 supports up to 30mA output current.

OUT2 supports up to 100mA output current.

All digital outputs are normally open (NO) by default. Output port functions can be selected via Object Dictionary 0x2005. Output polarity is configured through Object Dictionary 0x2006.

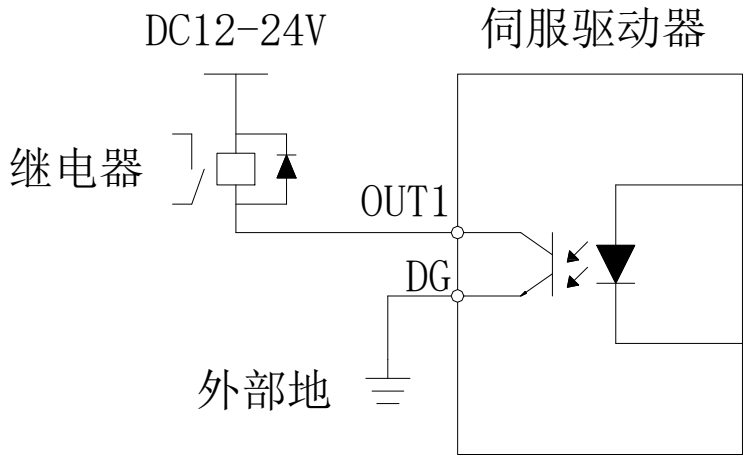
Object Dictionary	Name	Property	Type	Range	Default	Unit	Remark
0x2005：01	Output port 1 function	R/W/S	UINT	0~3	1	---	Output port function selection: 0: Custom output 1: Alarm output 3: In-place output
0x2005：02	Output port 2 function	R/W/S	UINT	0~3	3	---	
0x2006	Output port polarity setting	R/W/S	UINT	0~3	3	---	Set the normally open and normally closed characteristics of the output port: 0: Normally closed 1: Normally open

The interface circuit for OUT1 is identical to OUT2 (as shown in the OUT1 example).

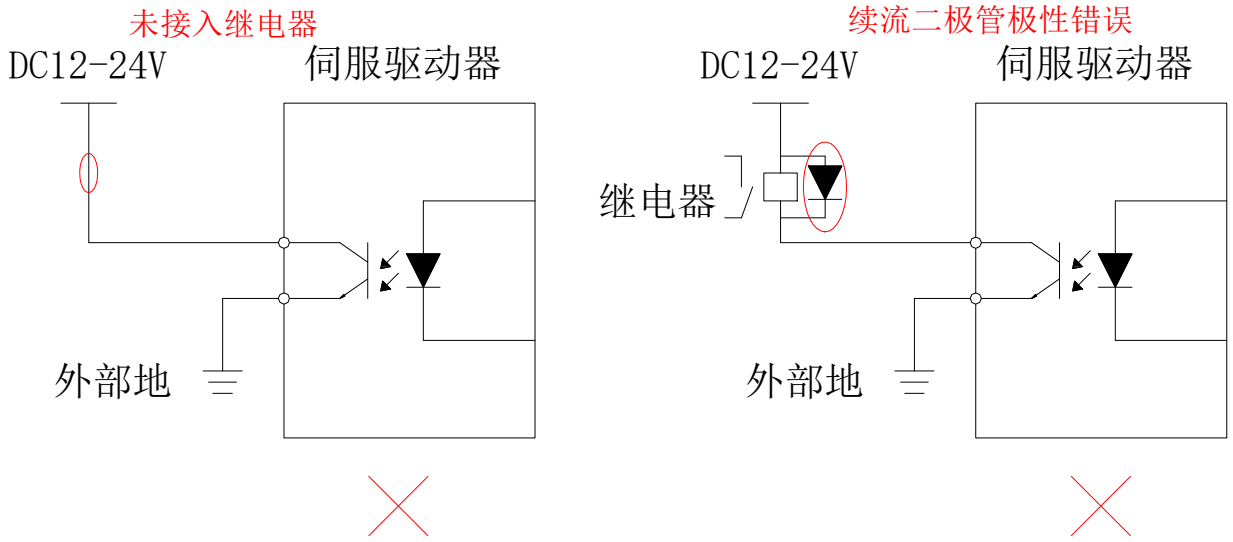


When the master device provides relay input:

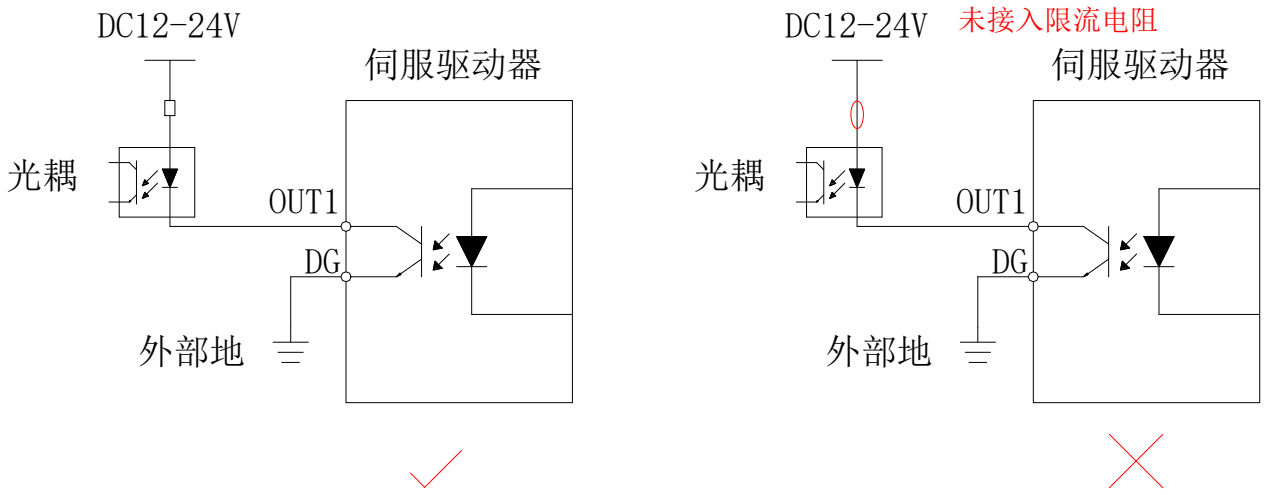
Correct Wiring Diagram:



Incorrect Wiring Diagram:

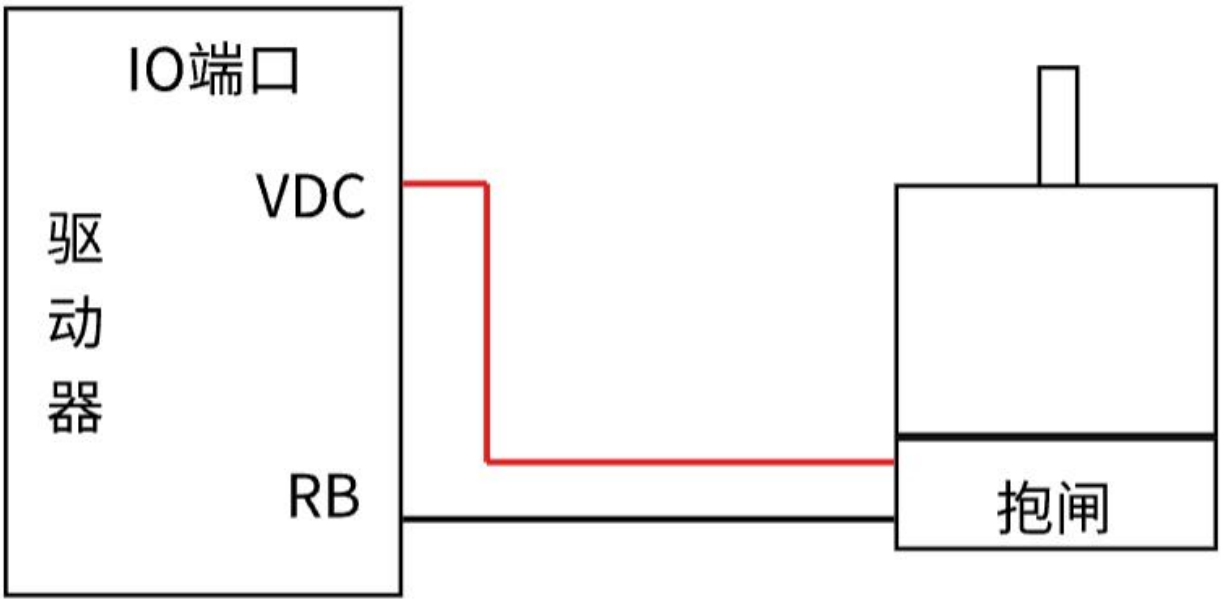


When the upper device is optocoupler input:

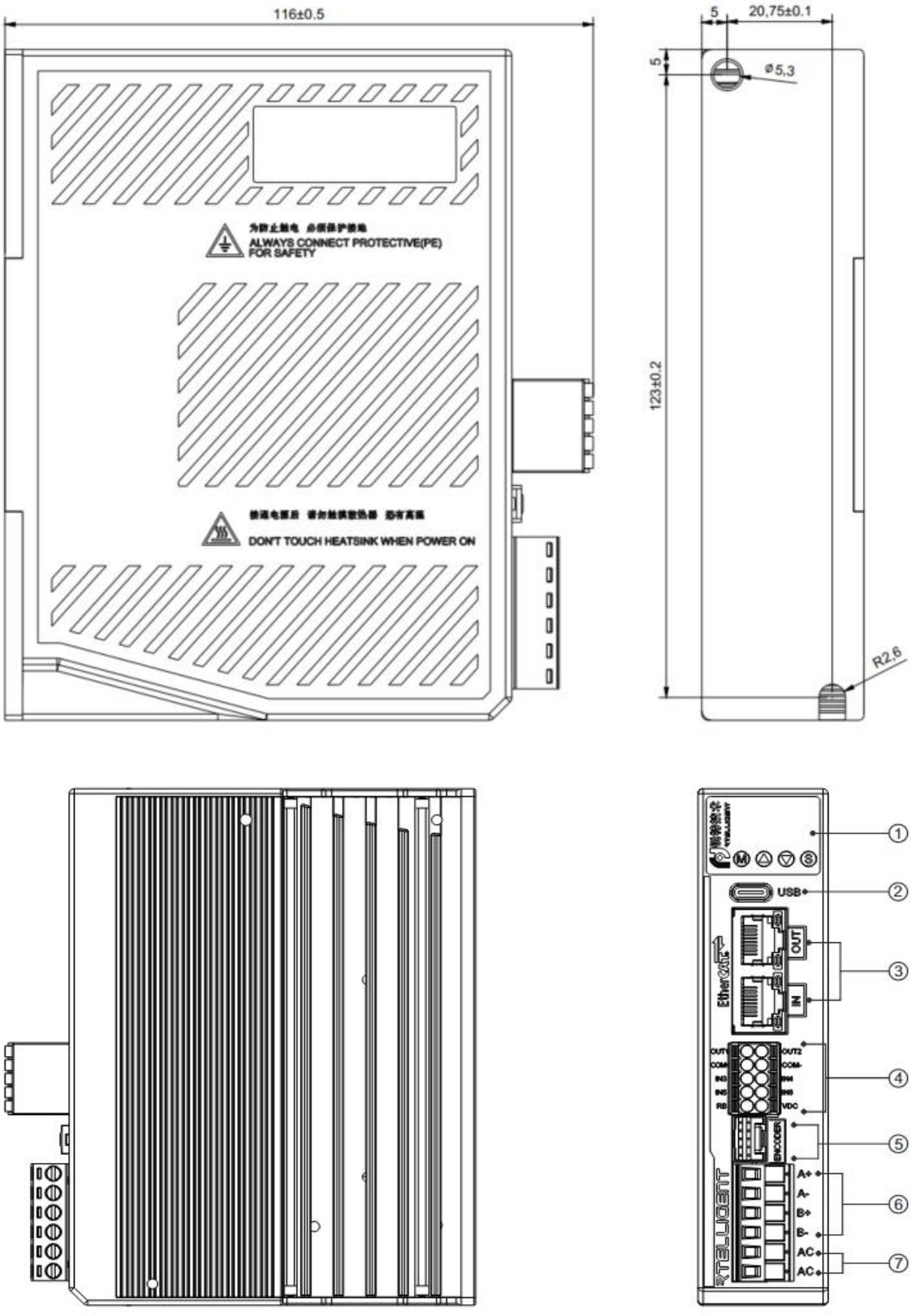


1.4.3 Brake Wiring Diagram

At the drive's I/O port, connect VDC to the positive terminal of the brake (usually the red wire) and RB to the negative terminal (typically the black wire), as shown in the figure below.



1.5 Mechanical Dimensions



2 Panel Display and Operation

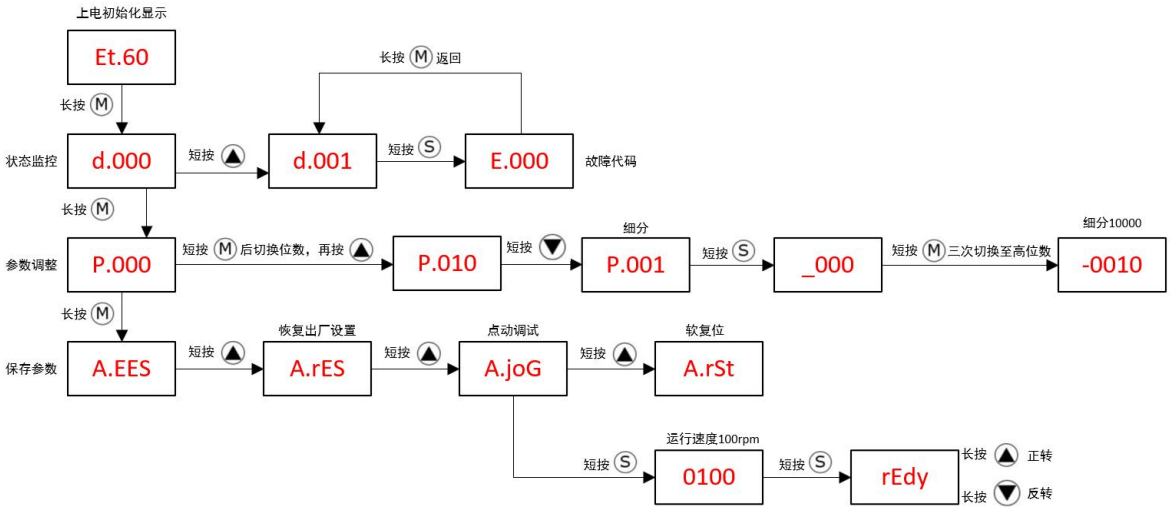
2.1 Panel Keys Overview

The EST60 drive display panel consists of four keys and a 4-digit LED display, enabling functions such as status monitoring, test runs, and parameter management. The four buttons are labeled as follows:

Icon	Description
	MODE key: Long press for mode switching, short press for shifting or exiting.
	UP key: Short press for menu navigation or parameter setting.
	DOWN key: Short press for menu navigation or parameter adjustment.
	SET key: Short press to confirm settings.

2.2 Display Panel Operation

Taking the EST60 closed-loop mode as an example



2.3 Digital Display Function Overview

Upon power connection, the EST60 drive enters monitoring display mode immediately after completing initialization.

Long-press the M key to switch between three primary interfaces: data monitoring interface, parameter editing interface, auxiliary function configuration interface.

The EST60 drive automatically displays fault codes when errors occur.

The EST60 bus-compatible drive features: type-C debugging interface, default baud rate: 115200, allowable parameter modification within defined ranges

Debugging Interface via Type-C Port

2.3.1 Monitoring Display

The monitoring display provides real-time operational status tracking for the EST60 drive. Upon power-on initialization completion, the display automatically presents the monitored parameter values.

Monitoring Address	Definition	Unit
d.000	The leftmost digit displays dual-port LINK/ACTIVE status. The second digit shows slave states (0-Unknown, 1-INIT, 2-Pre-OP, 4-Safe-OP, 8-OP). The third digit indicates current CIA402 operation mode (0x6061). The rightmost digit shows drive status (r-Servo ON, n-Servo OFF, E-Fault), with a decimal point indicating closed-loop mode when present or open-loop mode when absent.	-
d.001	Decode fault codes by bitwise analysis	-
d.002	Motor Speed	rpm
d.003	Pulse Command Speed	rpm
d.004	DC Bus Voltage	0.01V
d.005	Drive Fault Code	-
d.006	Status Code	-
d.007	CIA402 Error Code	-
d.008	Current Input Pin Status	-
d.009	Current Output Pin Status	-
d.010	Position Error	Encoder unit
d.011	Current Sync Cycle	us
d.012	Current ESC Register Sync Cycle	us
d.013	DC Sync Status [1=Active, 0=Inactive]	-
d.014	Sensor Status:bit0: Negative Limit, bit1: Positive Limit, bit2: Home Position [0=Invalid, 1=Valid]	-
d.050	PWM Interrupt Entry GPT0 Timer Count Value	-
d.051	PWM Interrupt Entry GPT1 Timer Count Value	-
d.052	PWM Interrupt Entry GPT11 Timer Count Value	-
d.053	PWM Interrupt Entry GPT12 Timer Count Value	-
d.054	SYNC0 Cycle Time	0.1us

d.055	GPT0 counter value at SYNC0 start	-
d.056	GPT0 counter value at SYNC0 end	-
d.057	GPT0 counter value at PDI start	-
d.058	GPT0 counter value at PDI end	-
d.059	SYNC0 ISR execution time	0.1us
d.060	SYNC0 ISR cycle period	0.1us
d.061	PDI ISR execution time	0.1us
d.062	PDI ISR cycle period	0.1us
d.063	PWM ISR execution time	0.1us
d.064	PWM ISR cycle period	0.1us
d.065	GPT11 capture value at SYNC0 trigger	-
d.066	GPT12 timer capture value upon SYNC0 signal generation	-
d.067	SYNC0 real-time jitter	0.1us
d.068	SYNC0 maximum skew error	0.1us
d.069	GPT0 timer period	0.1us
d.070	GPT1 timer period	0.1us
d.071	GPT11 timer period	0.1us
d.072	GPT12 timer period	0.1us
d.073	Sync compensation overflow counter	-
d.074	ESC configuration register	-

2.3.2 Alarm Display

Parameter Index	Description
E.001	Internal Voltage Error
E.002	Overcurrent Fault
E.003	Overvoltage Fault
E.004	Undervoltage Fault
E.006	Parameter Storage Error
E.007	Motor Phase Fault
E.008	Following Error Exceeded
E.009	Encoder Phase Error
E.010	EtherCAT Initialization Failed
E.011	EtherCAT Init OK, PHY Communication Fault

2.3.3 Parameter Configuration

The front panel allows parameter modification within defined limits. Operational details are as follows:

Parameter Index	Description	Range	Default Value
P.000	Peak Current	0~7500	4000
P.001	Microstepping	0~65535	10000
P.002	Standby Delay	0~65535	1000
P.003	Standby Current (%)	0~100	50
P.004	OUT1 Function	0~31	1
P.005	OUT2 Function	0~31	3
P.006	Output Polarity	0~15	3
P.007	IN3 Function	0~31	1
P.008	IN4 Function	0~31	2
P.009	IN5 Function	0~31	3
P.010	IN6 Function	0~31	6
P.011	Input Polarity	0~15	15
P.012	Smoothing Filter Time/Count	0~25600	25600
P.013	Torque Ramp Time (ms)	0~65535	1000
P.014	Auto PI Enable	0~1	1
P.015	Current Loop Kp	0~65535	1000
P.016	Current Loop Ki	0~65535	200
P.017	Current Loop Kc	0~65535	256
P.018	Motor Type [0=2-phase, 1=3-phase]	0~1	0

P.019	Auto Resistance Identification (Ω)	0~65535	1000
P.020	Auto Inductance Identification (mH)	0~65535	1
P.021	Motor Resistance Setting	0~65535	1000
P.022	Motor Inductance Setting	0~65535	1
P.023	Back-EMF Constant (V/kRPM)	0~65535	256
P.024	Motor Direction Invert	0~1	0
P.025	Fault Code	0~65535	0
P.026	Status Code	0~65535	0
P.027	Home Position Address	0~65535	0
P.028	Control/Drive Mode	0~9	1
P.029	Encoder Resolution	0~65535	4000
P.030	Encoder Count	0~65535	0
P.031	Following Error Threshold (Low)	0x0000~0x0000	4000
P.032	Following Error Threshold (High)	0xFFF0~0x0010	-
P.033	Servo mode 1 Kp	0~65535	2000
P.034	Servo mode 1 Ki	0~65535	0
P.035	Servo mode 1 Kv	0~65535	100
P.036	Servo mode 1 Kvff	0~65535	30
P.037	Servo mode 1 Kdi	0~65535	0
P.038	In-position Output Mode	0~65535	0
P.039	Positioning Error	0~65535	10
P.040	Pulse Stop Detection Time	0~65535	1000
P.041	Velocity LPF1 (Hz)	0~65535	200
P.042	Velocity LPF2 (Hz)	0~65535	600
P.043	Position Loop Output LPF (Hz)	0~65535	2000
P.049	Command Speed Monitoring	0~65535	0
P.050	Actual Velocity	0~65535	0
P.051	DC Bus Voltage	0~9999	0
P.052	DI Status Monitoring	0~65535	0
P.053	DO Status Monitoring	0~65535	0
P.054	Fault Detection Function Enable	0~65535	128 (0x0080)
P.055	Encoder Resolution Mode	0~65535	0
P.059	DI Digital Filter Time	0~65535	5
P.060	EtherCAT Slave Alias Address Setting	0~65535	1001
P.061	EtherCAT Slave Alias Source Selection	0~1	0
P.062	Drive Unit ID	0~65535	Er60 (0x12)
P.063	Firmware Version	0~65535	303
P.064	Hardware Version	0~65535	300
P.065	Homing Mode Selection	0~65535	0
P.066	ECAT TXCLK Delay	0~3	0
P.067	ECAT Sync Error Threshold	0~65535	0
P.068	Current ECAT Slave Alias Address	0~65535	0
P.069	Master-configured Slave Address	0~65535	0
P.070	LED Default Monitoring Index	0~65535	0
P.090	Save Parameters	0~65535	0
P.091	Factory Reset	0~65535	0

P.100	Port0 Invalid Frame Count	0~65535	0
P.101	Port0 RX Error Count	0~65535	0
P.102	Port1 Invalid Frame Count	0~65535	0
P.103	Port1 RX Error Count	0~65535	0
P.104	Port0 Forwarding Error Count	0~65535	0
P.105	Port1 Forwarding Error Count	0~65535	0
P.106	ECAT Processing Error Count	0~65535	0
P.107	PDI Communication Error Count	0~65535	0
P.108	Port0 Link Loss Count	0~65535	0
P.109	Port1 Link Loss Count	0~65535	0

2.3.4 Auxiliary Functions

The auxiliary functions include saving parameter changes, factory reset, jog operation, and MCU soft reset.

Save Parameters

Enter the "R.EES" Interface, users can modify parameters via the "Parameter Setting" interface or an upper computer (host PC). These changes take effect only in volatile memory and will be lost upon power-off. To permanently save the modified parameters, execute the "Save Parameters" command. This writes the changes to the EEPROM inside the EST60 drive. After saving, the EST60 drive will load the stored parameters from EEPROM on every power-up, instead of using the temporary values in memory.

Factory Reset

Enter the "R.rES" interface, the operation loads the factory default values of all parameters into the chip's volatile memory and writes them to EEPROM. Upon the next power cycle, the EST60 will use these default parameter values. If parameter modifications cause the EST60 to malfunction, executing this operation will restore all parameters to factory defaults, allowing the system to resume normal operation.

Jog Test

Enter the "R.JoG" interface, you can select the operating speed by:briefly pressing the M key to shift positions, clicking the UP/DOWN keys to increase/decrease values. Click the SET key to enter ready state, then use the UP/DOWN keys to perform forward/reverse test runs on the EST60.

Note: When using this function, ensure the EST60 drive's enable signal is disabled.

MCU soft reset

When power cycling is not available for the drive device, the MCU soft reset function can be utilized to restart the EST60, ensuring proper equipment operation.

3 EtherCAT Communication

3.1 Communication Overview

EtherCAT is a high-efficiency, low-latency real-time industrial Ethernet protocol specifically designed for automation applications. It supports various network topologies, including linear, star, tree, and ring configurations, making it adaptable to networks of different scales.

By incorporating integrated timestamping and clock synchronization functions, EtherCAT provides precise node-to-node synchronization, making it ideal for applications with demanding timing requirements, such as multi-axis motion control and distributed data acquisition.

Additionally, EtherCAT supports redundancy mechanisms (e.g., dual-network interfaces and ring redundancy) to enhance system stability and reliability. For stepper drives, EtherCAT communication offers: stronger noise immunity, reduced sensitivity to EMC issues, more precise control and synchronization, improved overall system performance and stability.

This protocol ensures robust operation in industrial environments while maintaining high-speed data transmission.

3.2 Communication Connection Settings

Please use CAT5e (or higher category) Ethernet cables for all connections.

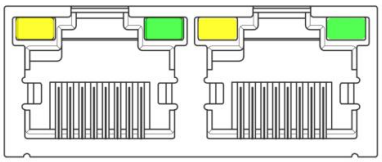
The Ethernet IN port should be connected to either the controller's output port or the OUT port of the previous drive in the bus network. The Ethernet OUT port must be connected to the IN port of the next drive in the chain. When the drive serves as the final node in the network, only the IN port requires connection while the OUT port remains unused.

3.2.1 EtherCAT Status Indicator

The RJ45 port features two status indicators:

The green LED shows Link status, indicating whether an Ethernet cable is properly connected.

The yellow LED shows activity status, indicating whether there is data communication.



3.2.2 EtherCAT Station Address

The EST60 provides two configurable methods for slave station addressing: either through the Object Dictionary (0x2150) for setting station aliases or via ESC-defined station aliases, with the selection mechanism determined by Object Dictionary 0x2151.

By default (when 0x2151=0), the node address is automatically assigned by the master station and permanently stored in EEPROM.

To configure a fixed address manually, users must first set 0x2151 to 1, then write the desired address value into 0x2150, enabling customized station addressing while maintaining non-volatile storage through EEPROM retention.

0x2151	0x2150	Site address
0	1001	The master writes the station alias to EEPROM address 0x0004 of the ESC
1	Parameter Settings	The value written to Object Dictionary 2150 represents the node address value.

4 Object Dictionary

4.1 General Parameters

4.1.1 0x1000 Device Type

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

4.1.2 0x1008 Device Name

Displays current drive model name

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	Visible string	RO	NO	EST60

4.1.3 0x1009 Hardware Version

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	Visible string	RO	NO	40

4.1.4 0x100A Software Version

Object Type	Data Type	Access Type	PDO Mapping	Default Value
VAR	Visible string	RO	NO	4000

4.1.5 0X1010 Save Parameters -- MODBUS Address：90

The Object Dictionary entry 0x1010 (sub-index 01) controls parameter saving functionality -writing a value of 1 to this address saves all current parameters to non-volatile storage.

Critical safety notice: Motor operation must be completely stopped prior to executing the save command to prevent equipment damage or data corruption.

The complete data structure specification for this operation is as follows:

Index	Sub-Index	Name	PDO Mapping	Default Value
1010	01	Save Parameters	No	0

4.1.6 0X1011 Restore Factory Defaults -- MODBUS Address：91

To restore the drive to factory settings, write a value of 1 to sub-index 01 of Object Dictionary 0x1011.

Note: Always stop motor operation before executing factory reset to ensure safe restoration of default parameters.

Index	Sub-Index	Name	PDO Mapping	Default Value
1011	01	Restore Default Parameters	No	0

4.2 Manufacturer-Specific Objects

4.2.1 0x2000 Peak Current -- MODBUS Address：0

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2000	Peak Current	R/W/S	UINT	0~7000	3000	mA

This object sets the sinusoidal peak current for stepper motor open-loop operation. When matching with smaller motors, please adjust the current setting first and then connect the motor to prevent motor burnout due to excessive current.

4.2.2 0x2001 Subdivision -- MODBUS Address：1

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2001	Motor Resolution	R/W/S	UINT	0~65535	10000	Pulse/rev

This object configures the pulse per revolution for stepper motors in open-loop operation. In closed-loop mode, the subdivision is determined by encoder resolution (object 0x2020). To modify closed-loop subdivision, please set object 0x2057 to 1 (enable write access) first and then adjust object 0x2001 (new subdivision value).

Warning: Direct modification of 0x2020 will cause closed-loop operation faults.

4.2.3 0x2002 Standby Time -- MODBUS Address：2

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2002	Idle Time	R/W/S	UINT	0~65535	1000	ms

This object configures the standby delay time for stepper motors after coming to a complete stop in open-loop operation mode.

4.2.4 0x2003 Standby Current Percentage -- MODBUS Address：3

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2003	Idle Current Percent	R/W/S	UINT	0~100	50	%

This object sets the standby holding current percentage (relative to the operational current defined in 0x2000) for stepper motors when entering idle state after stopping in open-loop mode.

4.2.5 0x2005 Output Port Function -- MODBUS Address：4-5

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2005:01	Output 1 Function	R/W/S	UINT	0~31	1	---
0x2005:02	Output 2 Function	R/W/S	UINT	0~31	3	---

The EST60 features two configurable output ports, with this object defining their operational functions.

Port functions are defined as follows:

Value	Function
0	User-defined Output
1	Alarm Output
3	In-position Output

When configured as a user-defined output, the port's active state can be controlled via polarity setting in object 0x2006.

4.2.6 0x2006 Output Port Polarity -- MODBUS Address：6

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2006	Outputs Polarity	R/W/S	UINT	0~31	3	---

Set the normally open/normally closed characteristics of the output ports: Bit0 for the polarity setting of output port 1 and Bit1 for the polarity setting of output port 2.

0—— Normally closed

1——Normally Open

Bit15~bit2	Bit1	Bit0
---	OUT2	OUT1

4.2.7 0x2007 Input Port Function -- MODBUS Address：7-10

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2007:01	Input 3 Function	R/W/S	UINT	0~8	1	---
0x2007:02	Input 4 Function	R/W/S	UINT	0~8	2	---
0x2007:03	Input 5 Function	R/W/S	UINT	0~8	3	---
0x2007:04	Input 6 Function	R/W/S	UINT	0~8	6	---

The EST60 includes 4 input ports, and this object is used to configure the functions corresponding to the input ports.

Value	Function
0	General-purpose input
1	CW limit input (default function of IN3)
2	CCW limit input (default function of IN4)
3	HOME input (default function of IN5)
4	Fault reset
5	Emergency stop signal
6	Motor disable (default function of IN6)
7	Probe 1
8	Probe 2

Input port status is readable from object 0x60FD.

Input port polarity is configurable through object 0x2008.

4.2.8 0x2008 Input Port Polarity -- MODBUS Address：11

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x2008	Inputs Polarity	R/W/S	UINT	0~F	0xF	---

Each bit configures the polarity of its respective port, with Bit 0 defining input port 1's polarity.

Bit15~bit4	Bit3	Bit2	Bit1	Bit0
---	IN6	IN5	IN4	IN3

0——Normally Closed，1—— Normally Open

4.2.9 0x2009 Filter Time -- MODBUS Address：12

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

The EST60 has a built-in moving average filter, and this object is used to set the filter's time constant. A longer filtering time results in smoother motor starts/stops but increases response latency.

Delay time = Filtering time

4.2.10 0x200A Motor Lock Time -- MODBUS Address：13

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x200A	Soft lock Time	R/W/S	UINT	0~65535	1000	50us

The EST60 requires locking the stepper motor for initial positioning upon enable. To reduce initial positioning jitter, the EST60 features a built-in ramp lock function. This object is used to set the ramp time for motor locking during enable.

Shaft Lock Time=setting value*50us*2=setting value*100us

4.2.11 0x200B Current Loop Parameters -- MODBUS Address：14-17

Object Dictionary	Name	Property	Type	Range	Default Value	Unit
0x200B:01	AutoPI enable	R/W/S	UINT	0~1	1	The drive identifies motor parameters during initial positioning and automatically calculates PI gains: 0 = Disabled; 1 = Enabled
0x200B:02	Iloop_Kp	R/W/S	UINT	100~65535	1000	0x200B:01 = 1: Register locked (read-only) 0x200B:01 = 0: Register unlocked (user-writable)
0x200B:03	Iloop_Ki	R/W/S	UINT	0~10000	200	
0x200B:04	Iloop_Kc	R/W/S	UINT	0~1024	256	Anti-windup coefficient

The EST60 achieves microstepping control of the stepper motor through current regulation. By default, it employs an auto-tuning algorithm to identify the motor's electrical parameters and automatically calculate optimal current-loop PI gains. When the auto-tuned parameters prove insufficient, users may manually configure these parameters.

4.2.12 0x200C Motor Parameters -- MODBUS Address: 18-23

Object Dictionary	Name	Property	Type	Range	Default Value	Remark
0x200C:01	Motor type	R/W/S	UINT	0~1	0	0 — Two-phase stepper motor 1 — Three-phase stepper motor (reserved function, currently unavailable in this version)
0x200C:02	Resistance Auto	R	UINT	100~65535	1000	When auto PI is enabled, the identified motor winding resistance value is obtained. Unit: mΩ (milliohms)
0x200C:03	Inductance Auto	R	UINT	0~10	1	When auto PI is enabled, the motor winding inductance value is identified. Unit: mH (millihenries)
0x200C:04	Resistance Set	R/W/S	UINT	0~10000	1000	Motor Winding Resistance Unit: mΩ (milliohms)
0x200C:05	Inductance Set	R/W/S	UINT	1~10	1	Motor Winding Inductance Unit: mH (millihenries)
0x200C:06	BEMF coefficient	R/W/S	UINT	0~1000	256	EST60

Servo Mode 1:

When the EST60 operates in Servo Mode 1, the motor parameters do not participate in motor control, and no user configuration is required. Users can verify proper motor connection by checking the auto-identified resistance and inductance values in this object.

Servo Mode 2:

In Servo Mode 2, the closed-loop stepper motor operates under FOC (Field-Oriented Control) mode. Due to the stepper motor's unique structure, field-weakening control is required for FOC implementation. The field-weakening parameters are derived from the motor's resistance, inductance, and back-EMF coefficient.

Typically, the auto-identified resistance and inductance suffice for most applications. Users may also manually configure these values based on the motor manufacturer's specifications.

The back-EMF coefficient can be calculated using the following formula:

0x200C:06 = (Rated Torque (N • m) / Rated Current (A)) × 500

4.2.13 0x200D Run Direction Reversal -- MODBUS Address: 24

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

When the motor's rotation direction contradicts system requirements, this object allows reversing the motor's operational direction without physical rewiring.

4.2.14 0x200E Internal Alarm Code - MODBUS Address: 25

Object Dictionary	Name	Attribute	Type	Default value
0x200E	Alarm Code	R	UINT	0

This object displays the current fault code of the drive, with each bit of the object corresponding to an alarm status.

Alarm code	alarm status
0x0001	Internal voltage error
0x0002	overcurrent
0x0004	Overvoltage
0x0008	reserve
0x0080	Position error exceeds tolerance
Other	reserve

When the above fault occurs, after eliminating the fault conditions, the fault codes 0x603F and 0x200E will be cleared by writing 0x80 in the 0x6040 object.

4.2.15 0x200F Internal Status Code - MODBUS Address: 26

Object Dictionary	Name	Attribute	Type	Default Value
0x200F	Status Code	R	UINT	0

This object displays the current status code of the drive, with each bit of the object corresponding to a status.

Status Code	Status
0x0001	drive Enable
0x0002	Drive error
0x0004	In place signal
0x0008	Run or stop
0x0010	Whether homing completed or not
0x0020	Drive ready
Other	Reserve

4.2.16 0x2010 Position reset - MODBUS address: 27

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2010	Zero Position	R/W	UINT	0~1	0	---

Setting the object to 01h can clear the position value (actual position value) in 0x6064.

Usually used in situations where the motor moves continuously in one direction, the user needs to stop the motor at the appropriate time, clear the actual position value through this object, and then enable the motor again, otherwise the motor position counter will experience saturation issues.

4.2.17 0x2011 Control Mode -- MODBUS address：28

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2011	Control mode	R/W/S	UINT	0~2	0	---

Set the working mode of the stepper motor. (Synchronize with the firmware of the drive and generally do not make any changes)

0——Open loop operation

1- Closed loop operation

2- Closed loop operation/FOC mode

4.2.18 0x2020 Encoder Resolution -- MODBUS Address：29

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2020	Encoder Resolution	R/W/S	UINT	0~65535	4000	Pulse/rev

When the working mode of the stepper motor is closed-loop, it is necessary to set the encoder resolution corresponding to one rotation of the motor. After setting this parameter, it needs to be saved and powered on again to take effect.

4.2.19 0x2021 Encoder Position - MODBUS Address: 30

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2021	Encoder Counter in one rev	R	UINT	0~65535	0	Pulse/rev

This object reflects the current position of the motor within a circle.

4.2.20 0x2022 Position Error Alarm Threshold - MODBUS address: 31

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

When the working mode of the stepper motor is closed-loop, if the position error exceeds this set value, the motor will alarm and disconnect the enable. This parameter takes effect immediately after being set.

4.2.21 0x2023 Servo Mode 1 Control Parameters - MODBUS Address: 33-37

Object Dictionary	Name	Attribute	Type	Range	Default Value	Note
0x2023:01	PosLoop_Kp	R/W/S	UINT	0~10000	2000	Proportional gain: Adjust motor position response rigidity
0x2023:02	PosLoop_Ki	R/W/S	UINT	0~1000	0	Integral gain, used to eliminate position errors when the motor is stationary.
0x2023:03	PosLoop_Kd	R/W/S	UINT	0~10000	100	
0x2023:04	PosLoop_Kvff	R/W/S	UINT	0~100	30	Speed compensation
0x2023:05	PosLoop_Kdi	R/W/S	UINT	0~500	0	Used to eliminate low-speed resonance Usually, this gain cannot exceed 200

This object is only effective for closed-loop control of the EST60 drive using servo mode 1. The gain is usually set to default.

4.2.22 0x2024 In place signal - MODBUS address: 38-40

Object	Name	Attribute	Type	Range	Default Value	Note
0x2024:01	InPosMode	R/W/S	UINT	0~10000	0	In place signal determination mode 0- Detect at all times 1- Detection after pulse command stops
0x2024:02	InPosCnt	R/W/S	UINT	0~1000	10	When the position error is less than the set pulse value and continues for the set arrival time, it is judged to be in place.
0x2024:03	InPosTime	R/W/S	UINT	0~10000	1000	

This object is effective in the closed-loop mode of EST60 and is used to detect whether the motor is within the set accuracy range.

4.2.23 0x2025 Servo speed filter - MODBUS address: 41-43

Object Dictionary	Name	Attribute	Type	Range	Default Value	Note
0x2025:01	FV1_HZ	R/W/S	UINT	0~1000	200	Filter for setting servo mode 2
0x2025:02	FV2_HZ	R/W/S	UINT	0~2000	600	
0x2025:03	FPOUT_HZ	R/W/S	UINT	0~5000	5000	

This object is effective under the EST60 servo mode 2 condition and is used to set the bandwidth of the speed loop feedback parameters.

FV1_HZ is used to set the bandwidth of the first low-pass filter for speed feedback filtering.

FV_2HZ is used to set the bandwidth of the secondary low-pass filter for speed feedback filtering. Usually set FV2HZ=3 * FV1_HZ

FPOUT_SZ is used to set the bandwidth of the FOC speed loop output variable, usually using the default value.

4.2.24 0x2026 Servo Mode 2 Control Parameters - MODBUS Address: 44-48

Object Dictionary	Name	Attribute	Type	Range	Default Value	Note
0x2026:01	PVIA_Kp	R/W/S	UINT	0~10000	2000	Position proportional gain: Adjust the rigidity of motor position response.
0x2026:02	PVIA_Ki	R/W/S	UINT	0~1000	100	Integral gain, used to eliminate position errors when the motor is stationary.
0x2026:03	PVIA_Kv1	R/W/S	UINT	0~10000	200	Speed feedback gain 1
0x2026:04	PVIA_Kv2	R/W/S	UINT	0~100	30	Speed feedback gain 2
0x2026:05	PVIA_Kvff	R/W/S	UINT	0~500	0	Speed feedforward gain 1

This object takes effect under the condition of using servo mode 2 in EST60, using vector control algorithm.

Usually PVIA_Kv1+ PVIA_Kv2 > PVIA_Kvff

4.2.25 0x2043 Speed Reference - MODBUS Address: 49

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2043	Speed Reference	R	UINT	0~65535	0	RPM

This object reflects the given speed of the current motor.

4.2.26 0x2044 Speed Feedback -- MODBUS Address：50

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2044	Speed Feedback	R	UINT	0~65535	0	RPM

This object reflects the actual speed of the current motor.

4.2.27 0x2048 Bus Voltage -- MODBUS Address: 51

Object	Name	Attribute	Type	Range	Default Value	Unit
0x2048	Bus Voltage	R	UINT	---	0	10mV

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

4.2.28 0x2049 Input Level -- MODBUS Address：52

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2049	Input Level	R	UINT	---	0	---

Display the physical level of the current IO input

Bit15~bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
---	IN6	IN5	IN4	IN3	IN2	IN1

0- No input signal

1- There is an input signal

4.2.29 0x204A Output Level -- MODBUS Address：53

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x204A	Output Level	R	UINT	---	0	---

Display the physical level of the current output port

Bit15~bit2	Bit1	Bit0
---	OUT2	OUT1

0- indicates that the current output port has output

1- Indicates that the current output port has no output

4.2.30 0x2057 Number of pulses per revolution selection(closed loop mode) -- MODBUS Address：55

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2057	Number of pulses per revolution selection	R/W/S	UINT	---	0-1	---

0- The number of pulses per revolution is a value of 0X2020

1- The number of pulses per revolution is a value of 0X2001

4.2.31 0x2060 Amplitude of First Anti-Vibration

Object Dictionary	Name	Attribute	Type	Range	Default Value	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 a two-phase stepper motor. This method cancels out resonance by adding a certain amount of harmonics to the set current. It is necessary to adjust the amplitude and phase of harmonics to eliminate vibration.

4.2.32 0x2061 Phase A of First Anti-Vibration

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2061	Phase A of First Anti-Vibration	R/W/S	UINT	0-1024	0	---

Adjust the harmonic phase of the A-phase winding

4.2.33 0x2062 Phase B of First Anti-Vibration

Object Dictionary	Name	Attribute	Type	Range	Default Value	Unit
0x2062	Phase B of First Anti-Vibration	R/W/S	UINT	0-1024	0	---

Adjust the harmonic phase of the B-phase winding

4.3 CIA402 Object Dictionary

4.3.1 0x603F error code

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x603F	Error Code	RW	UINT	---	0

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

The error code is as follows:

Error Code	Description
0x7122	Motor error or commutation fault

0x7500	Communication Failure
0x3150	Internal voltage error in A-phase circuit
0x3151	Internal voltage error in B-phase circuit
0x8611	Closed loop mode tracking error exceeds the limit
0x2211	overcurrent
0x3210	overvoltage

4.3.2 0x6040 Control Word

This object is used to control the status of the drive and motion. Can enable/disable the drive; Start and stop of the motor; Clear faults, etc.

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6040	Control Word	RW	UINT	---	0

The definition of control word is as follows:

Bit	Description
0	Switch ON
1	Enable Voltage
2	Quick Stop
3	Enable Operation
4	Related to operation mode
5	Related to operation mode
6	Related to operation mode
7	fault reset
8	pause
9	Related to operation mode
10-15	reserve

Detailed combination description of Bit 0~3 and Bit7:

Command	Control word position				
	Bit7	Bit3	Bit2	Bit1	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

The definitions of Bit4, 5, 6, 8, and 9 in each relevant mode are as follows:

PP mode

Bit	Name	Value	Description
4	A new target position	0->1	changed from 0 to 1, and set a new target position
5	reserve		
6	Absolute/Relative	0	Absolute Position Mode
		1	Relative position mode
8	Pause	0	wait for positioning to be completed
		1	Stop running
9	reserve		

PV mode

Bit	Name	Value	Description
8	Pause/Run	0	The motor runs to the set speed
		1	The motor decelerates to 0 and stops

Homing Mode

Bit	Name	Value	Description
4	Homing Start	0->1	Homing Start
8	pause	0	Controlled by Bit4
		1	Homing Stop

4.3.3 0x6041 Status Words

This object configures the probe function.

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

The definition of register bits is 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	reserve
9	Remote
10	Target achieved
11-15	reserve

Bit 9: Remote

Bit9 indicates whether the control word has been set.

4.3.4 0x6060 Operation Mode

Used to set the operation mode.

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6060	Mode of Operation	RW	INTEGER8	---	0

The EST60 fieldbus drive supports the following operating modes:

Value	Mode
1	Profile Position Mode (PP)
3	Profile Velocity Mode (PV)
6	Homing Mode (HM)
8	Cyclic Synchronous Position Mode (CSP)
9	Cyclic Synchronous Velocity Mode (CSV)

4.3.5 0x6061 Operation Mode Display

Display the current operating mode, defined as 0x6060.

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6061	Mode of Operation Display	R	INTEGER8	---	0

4.3.6 0x6064 Position Actual Value

Display the actual position of the current motor. Units: Pulse

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6064	Position Actual Value	R	INTEGER32	---	0

4.3.7 0x606C Speed Actual Velocity

Display the actual speed of the current motor. Units: pulse

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x606C	Speed Actual Velocity	R	INTEGER32	---	0

4.3.8 0x607A Profile Target Position

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

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x607A	Profile Target Position	RW	INTEGER32	---	0

In PP mode, the Bit6 (0x6040.6) of the control word is used to set the coordinates to be relative or absolute.

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

4.3.9 0x607C Home offset

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

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x607C	Home Offset	RW	INTEGER32	---	0

4.3.10 0x6081 Profile Velocity

This object is used to set the maximum speed for trapezoidal acceleration and deceleration commands in PP mode. Unit: Pulse/s

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6081	Profile Velocity	RW	INTEGER32	---	10000

4.3.11 0x6083 Profile Acceleration

This object is used to set the acceleration of trapezoidal acceleration and deceleration commands in PP mode and PV mode, Units: Pulse/s ^ 2

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6083	Profile Acceleration	RW	INTEGER32	---	100000

4.3.12 0x6084 Profile Deceleration

This object is used to set the deceleration of trapezoidal acceleration and deceleration commands in PP mode and PV mode, Units: Pulse/s ^ 2

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6084	Profile Deceleration	RW	INTEGER32	---	100000

4.3.13 0x6085 Quickstop Deceleration

This object is used to set the deceleration at which the motor stops when encountering sensors such as limit and zero points in PP mode, PV mode, and HOME mode. The unit is Pulse/s

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6085	Quickstop Deceleration	RW	INTEGER32	---	500000

4.3.14 0x6098 Homing Method

This object is used to set the homing method for motor.

Object Dictionary	Name	Attribute	Type	Range	Default Value
0x6098	Homing Method	RW	INTEGER8	1~35	17

Please refer to the homing mode for specific description.

4.3.15 0x6099 Homing Velocity

This object sets the speed at when the motor is in homing mode.

Object	Name	Attribute	Type	Range	Default Value	Unit
0x6099:01	Homing Velocity (fast)	R/W/S	UNSIGNED32	---	10000	Pulse/s
0x6099:02	Homing Velocity (slow)	R/W/S	UNSIGNED32	---	2000	Pulse/s

4.3.16 0x609A Homing Acceleration

This object is used to set the acceleration and deceleration of the motor's homing position curve. The unit is Pulse/s ^ 2.

Object	Name	Attribute	Type	Range	Default Value
0x609A	Homing Acceleration	RW	UNSIGNED32	---	100000

4.3.17 0x60B8 Probe Function Settings

This object is equipped with probe functionality.

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

The definition of register bits is as follows:

Bit	Value	Definition
0	0	Probe 1 prohibited
	1	Probe 1 Enable
1		reserve
2		reserve
3		reserve
4	0	Prohibit probe 1 from rising edge locking
	1	Enable probe 1 to latch the rising edge
5	0	Prohibit probe 1 from falling edge locking
	1	Enable probe 1 to latch the falling edge
6		reserve
7		reserve
8	0	Probe 2 is prohibited
	1	Probe 2 Enable
9		reserve
10		reserve
11		reserve
12	0	Prohibit probe 2 from rising edge locking
	1	Enable probe 2 rising edge latch
13	0	Prohibit probe 2 from falling edge locking
	1	Enable probe 2 to lower edge latch
14		reserve
15		reserve

The positive position is locked at the rising edge moment, and the negative position is locked at the falling edge moment.

4.3.18 0x60B9 Probe Status

This object defines the functional status of the probe

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

The definition of status bits is as follows:

Bit	Value	Definition
0	0	Probe 1 prohibited
	1	Probe 1 Enable
1	0	Probe 1 rising edge latch: none
	1	Probe 1 rising edge latch: Yes
2	0	Probe 1 falling edge latch: none
	1	Probe 1 falling edge latch: Yes
3-7	0	reserve
8	0	Probe 2 is prohibited
	1	Probe 2 Enable
9	0	Probe 2 rising edge latch: none
	1	Probe 2 rising edge latch: Yes
10	0	Probe 2 falling edge latch: none
	1	Probe 2 falling edge latch: Yes
11-15	0	reserve

4.3.19 0x60BA Probe 1 positive latch value

This object stores the position of the rising edge latch of probe 1.

Object Dictionary	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED32	R	Yes	0

4.3.20 0x60BB Probe 1 negative latch value

This object stores the position of probe 1's falling edge latch.

Object Dictionary	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED32	R	Yes	0

4.3.21 0x60BC Probe 2 positive latch value

This object stores the position of the rising edge latch of probe 2.

Object Dictionary	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED32	R	Yes	0

4.3.22 0x60BD Probe 2 negative latch value

This object stores the position of probe 2's falling edge latch.

Object Dictionary	Data Type	Access Type	PDO Mapping	Default Value
VAR	UNSIGNED32	R	Yes	0

4.3.23 0x60FD Digital Inputs

This object monitors the input port of the drive.

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

Bit0	CW limit	0- Invalid 1- Limit effective
Bit1	CCW limit	
Bit2	HOME	0- Zero point is invalid 1- Zero point effective
Bit3~ Bit15	Reserve	
Bit16	IN1	The physical state of the input port 0- Invalid input signal 1- Input signal is valid
Bit17	IN2	
Bit18	IN3	
Bit19	IN4	
Bit20	IN5	
Bit21	IN6	
Bit22~Bit31	Reserve	

4.3.24 0x60FE Digital Outputs

The speed of this object when setting PV mode, in Pulse/s

Object	Name	Attribute	Type	Range	Default Value	Unit
0x60FE:01	physical outputs	R/W/S	UNSIGNED32	---	0	
0x60FE:02	bit mask	R/W/S	UNSIGNED32	---	0	

Physical outputs:

Bit 0~15 is reserve function

Bit 16~17 is used to control OUT1~OUT2。

Bit 18~31 reserve

4.4 CIA 402 Motion Control

4.4.1 Operation Modes

The ECR series EtherCAT stepper drive supports the following operation modes (via object 0x6060):

Profile Position (PP)

Profile Velocity (PV)

Cyclic Synchronous Position (CSP)

Homing (HM)

4.4.2 Profile Position (PP) Mode

1. Description:

The Profile Position mode is a standard point-to-point operation mode that uses setpoints composed of velocity, acceleration, deceleration, and target position. Once all parameters are configured, the drive buffers the commands and begins executing the motion profile.

2. Enabling PP Mode

To enable Profile Position mode, Set object 0x6060 (Operation Mode) to 0x0001 (PP mode).

Verify the active mode by reading object 0x6061 (Operation Mode Display).

3. Set operating parameters

Use object dictionaries 607Ah, 6081h, 6083h, and 6084h to set position, velocity, acceleration, and deceleration respectively.

4. Start and Stop

After power on, the drive is in a disabled state. Writing control word 6040h to 0006h will cause the drive to enter the "ready to switch on" state.

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

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

5. Control Word Bits

New set point (bit 4) - set this bit high to clock in a new set point. Once the drive receives the set point, the status word Bit12 will be set to high (1), and the control word Bit4 needs to be set to 0;

Setpoint change (bit 9) - If it is low, the negative enters an idle state after completing the current setpoint and waits for the next new setpoint. If it is high, the drive will run at the previous set speed to the previous set point, then switch to the new speed and run to the new set point.

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

Absolute mode/Relative mode (bit 6) - If high, the set point is in Relative Position mode. For example, if the previous motor position is 10000 steps and the new set point is 20000, the final position will be 30000. If it is low, set the absolute position mode of the point position. If the previous motor position was 10000 and the newly set position is 20000, then the new position will be 20000.

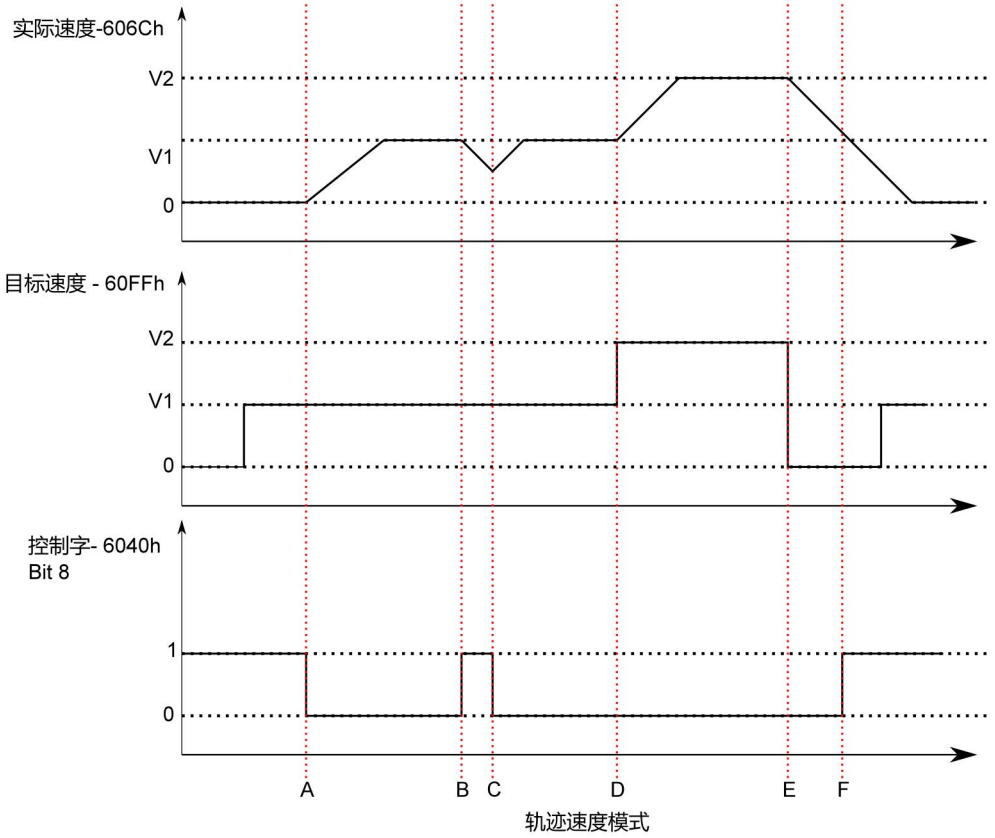
The distance from the previous location to the new location is 10000 steps. Do not change this position while the motor is moving.

4.4.3 Profile Velocity Mode (PV)

1. Description

Profile velocity mode is a relatively simple operation mode. Once the speed, acceleration, and deceleration are set, the negative will command the motor to accelerate to the operating speed based on the acceleration parameters, or stop the motion based on the deceleration parameters.

The following figure shows an example of configuring speed mode.



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

	Target speed	6040h Stop position Bit4	motor motion status
Start	0	1	Motor stops
A	V1	1 -> 0	Motor accelerates to V1
B	V1	0 ->1	The motor decelerates to a stop
C	V1	1 -> 0	The motor has not stopped yet, but it has accelerated to V1 again
D	V1 -> V2	0	The motor accelerates from V1 to V2
E	V2 -> 0	0	The motor decelerates from V2

			to 0
F	0	0 -> 1	Motor stops
G	0 -> V1	1	Motor stops

The above table explains how to use the stop position and target speed together to affect motor speed. Between points B and C, the motor does not completely stop, but decelerates according to the deceleration value of the profile starting at point B. When the stop position is switched at point C, it immediately accelerates back to the target speed. At point E, reducing the target speed to zero has the same effect as using the stop position.

It should be noted that whether setting the stop position or the target speed to zero, there will be torque maintained on the motor. If the shaft is to move freely, the negative must be placed in the disabled (not enabled) state.

2. Enable Profile Velocity Mode

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

3. Set operating parameters

Use the object dictionaries 60FFh, 6083h, and 6084h to set the speed, acceleration, and deceleration of the trajectory speed mode respectively.

4. Enable the negative

After power on, the negative is in a disabled state. Writing control word 6040h to 0006h will cause the negative to enter the "ready to switch on" state. Then writing 010Fh to 6040h will cause the negative to enter the "Operation Enabled" state and the motor to stop running.

5. Start and Stop

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

A profile speed (60FFh) greater than zero indicates that the motor is rotating in the forward direction, less than zero indicates that the motor is rotating in the reverse direction, and equal to zero indicates that the motor has stopped. Users can directly set the motor to enter the reverse state when the motor is rotating in the forward direction, and the motor will decelerate, stop, and accelerate in the reverse direction to the set speed.

4.4.4 CSP synchronous position mode

1. Description of synchronous position mode

In this mode, the main controller generates a position trajectory and sends the target position (0x607A) to the negative during each PDO update cycle. The negative provides feedback on the actual motor position and optional actual motor speed and torque.

2. Enable CSP mode

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

3. Enable the negative

After power on, the drive is in a disabled state. The control word 6040h defaults to 0006h, and the drive is in the "ready to switch on" state. Writing the value 0x000F into 6040h will put the drive in an enabled state, and the motor will be able to respond to CSP commands. Set the target position and write the value 0X001F into 6040h again, and the motor will start.

4.4.5 CSV synchronization speed mode

1. Description of synchronous speed mode

Synchronous speed mode refers to multiple motors or devices working together at the same speed and direction in motion control applications to maintain their motion synchronization. In this mode, the main controller generates speed trajectories and sends the target speed (0x60FF) to the negative at each PDO update cycle. The negative provides feedback on the actual motor speed and optional motor torque.

2. Enable CSV mode

To enable the loop synchronization speed mode, the value 0008h must be written to the dictionary address 6060 h.

3. Enable the negative

After power on, the drive is in a non enabled state. Writing the control word 6040h to 0006h will cause the drive to enter the "ready to switch on" state. Writing the value 0x000F again to 6040h will put the drive in an enabled state, and the motor will be able to respond to CSV commands.

4.4.6 Homing Mode

The EST series stepper drive from Rtelligent not only supports homing mode defined by CIA402: 17-35, but also supports torque homing mode (homing modes 36, 37).

1. Set homing parameter

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

2. Dictionary of related objects

Object	Description
0x607C	Homing offset
0x6098	Homing method setting
0x6099	Homing speed
0x609A	Homing acceleration and deceleration
0x2007	Input port function selection
0x2008	Input port polarity setting

3. Enable homing function

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

After the negative is initially powered on, it is in a disabled state. Write 6 to control word 6040h, set the negative to the "ready to switch on" state, then write 000Fh to control word 6040h, and set the negative to "Operation Enabled Mode".

4. Activate the homing function

Set homing method through the 6098h object dictionary.

Set the speed of homing through 0x6099.

By controlling the Bit4 of word 6040h, the rising edge from 0 to 1 can start homing. The status of homing can be queried through the status word 6041.

5. Stop homing function:

Set homing method through the 6098h object dictionary. By controlling the Bit8 of word 6040h, the rising edge from 0 to 1 can stop homing. Homing state is queried through the 6041 status word.

4.5 Homing Method

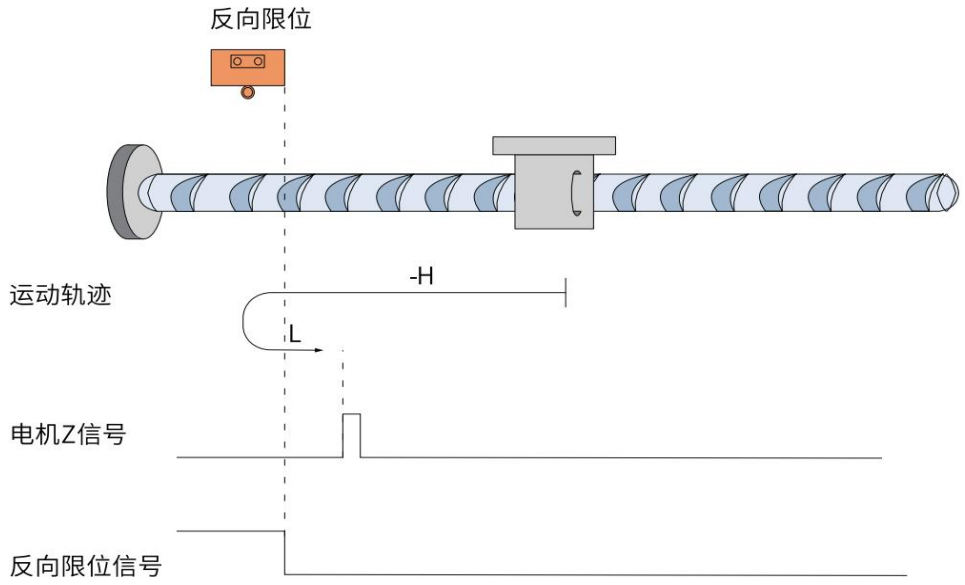
The EST60 drive supports a homing mode from 1 to 35. The specific definition and homing process are as follows:

4.5.1 Method 1 (6098=1)

Origin: Z signal

Deceleration point: Negative limit signal (NOT)

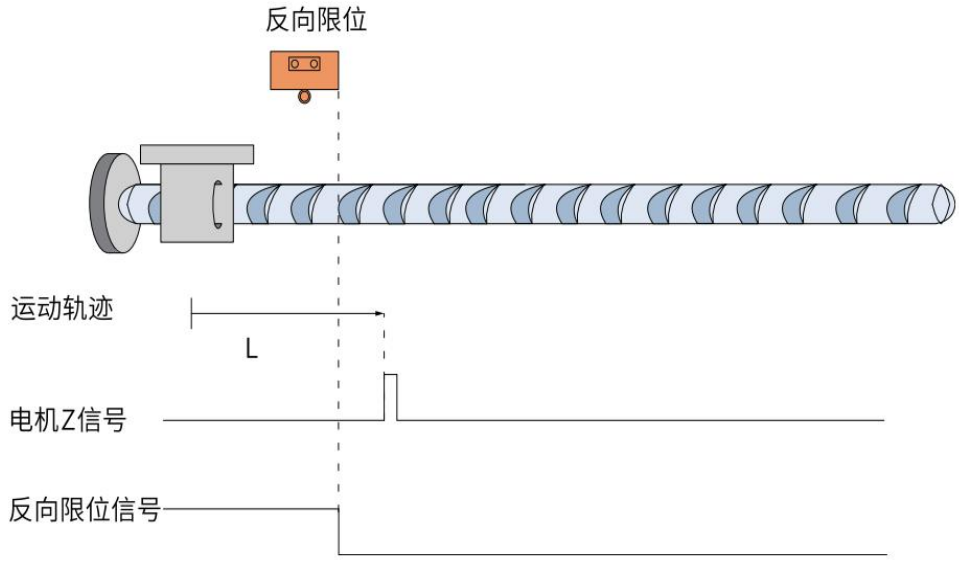
The negative limit signal is invalid when starting homing



In the figure, "H" represents high-speed 6099.01, and "L" represents low-speed 6099.02.

When NOT=OFF, it starts homing at high speed in reverse. When encountering the rising edge of NOT, it slows down in reverse and runs at low speed in forward direction. When encountering the falling edge of NOT, the first Z signal stops the machine.

The negative limit signal is valid when starting homing



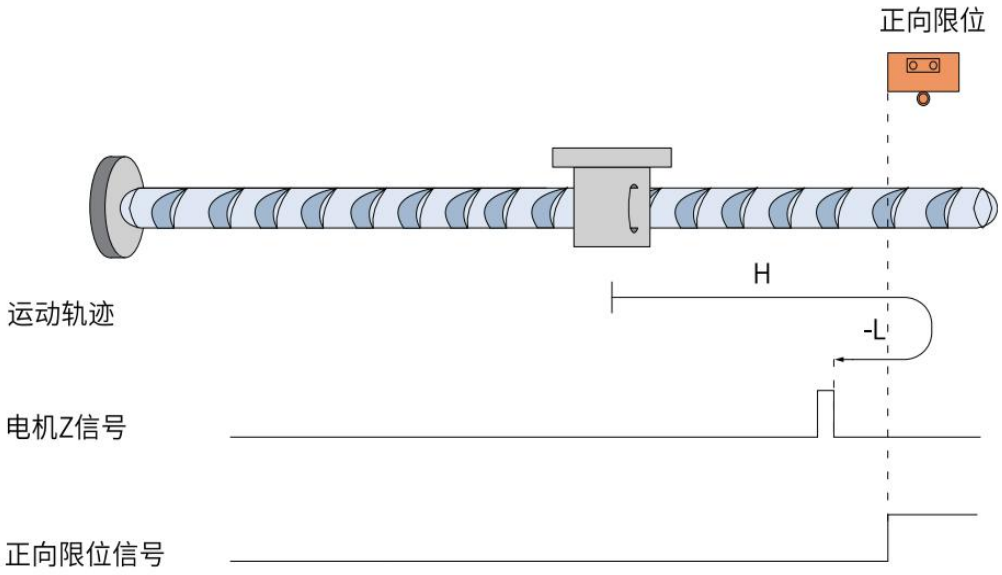
When NOT=ON, it starts homing, directly returning homing at a low speed in the forward direction, and stops at the first Z signal after encountering the NOT falling edge.

4.5.2 Method 2 (6098=2)

Origin: Z signal

Deceleration point: Positive limit signal (POT)

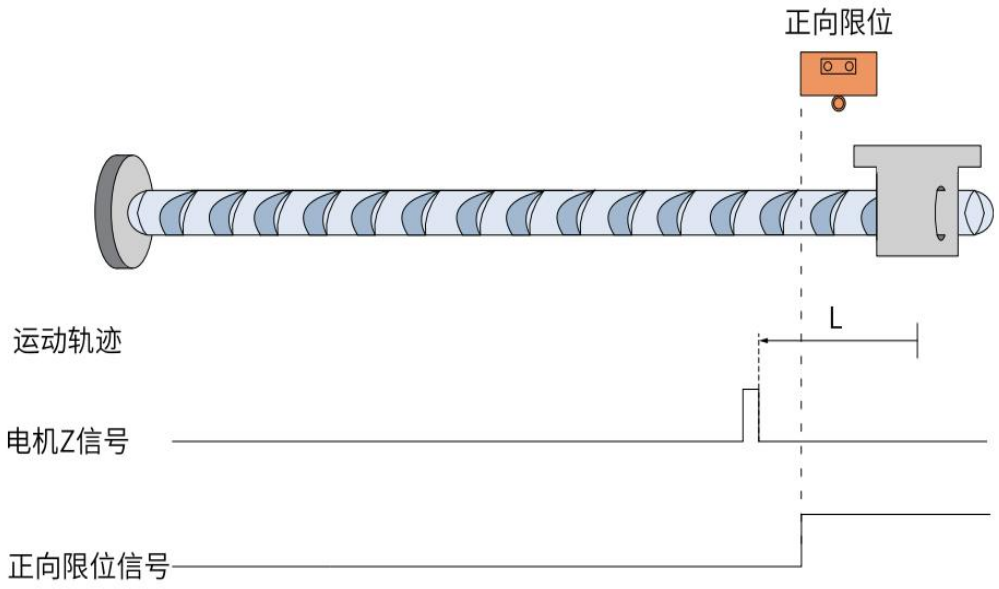
The positive limit signal is invalid when starting homing



When POT=OFF, start homing at high speed in the forward direction. When encountering the rising edge of POT, slow down, reverse, and run at low speed in the reverse direction

Okay, stop the first Z signal after encountering the POT falling edge.

The positive limit signal is valid when starting homing



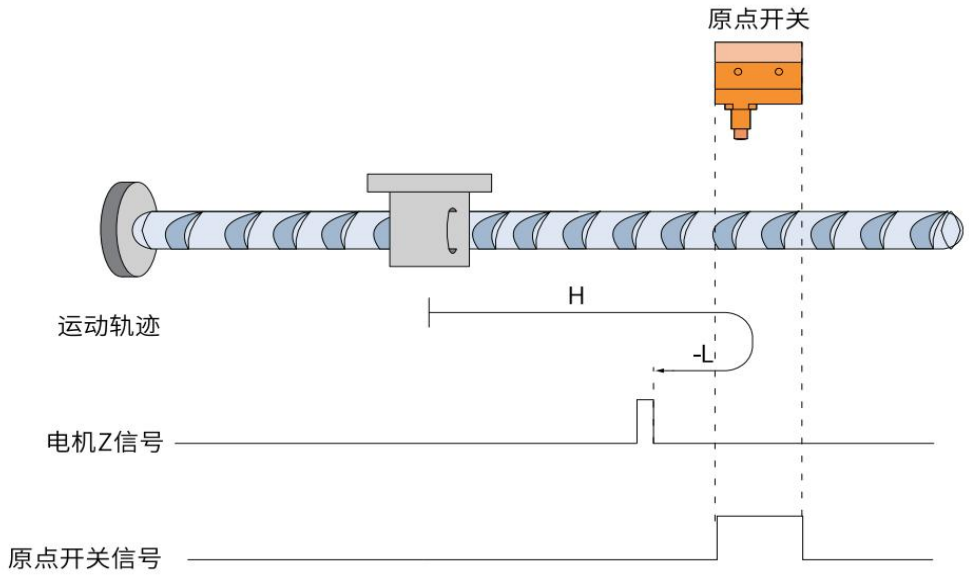
When POT=ON, it starts homing, directly reverse homing at low speed, and stops at the first Z signal after encountering the falling edge of POT.

4.5.3 Method 3 (6098=3)

Origin: Z signal

Deceleration point: Origin signal (HOME)

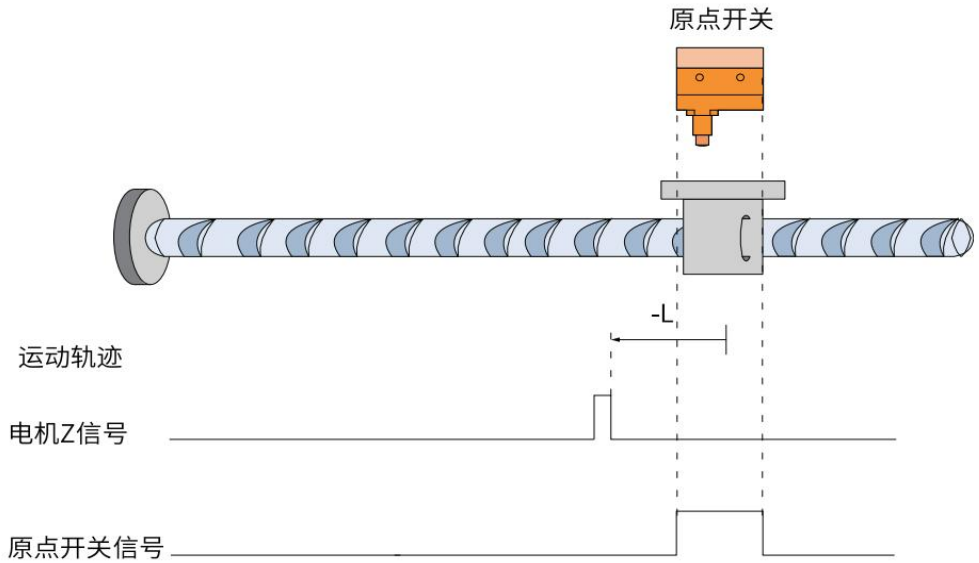
The origin switch signal is invalid when starting homing



When HOME=OFF, it starts homing at a high speed in the forward direction. When encountering the rising edge of HOME, it slows down in the reverse

direction and runs at a low speed in the reverse direction. When encountering the falling edge of HOME, the first Z signal stops the machine.

When starting **homing,** the origin switch signal is valid



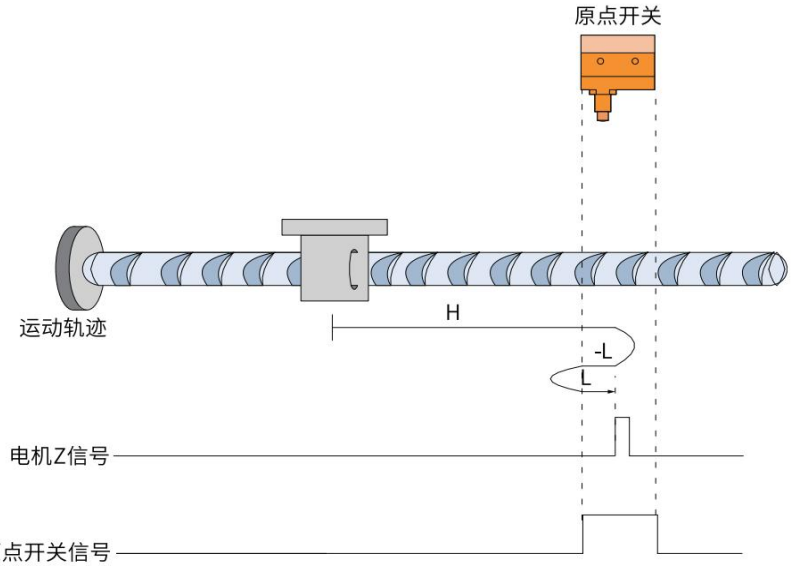
When HOME=ON, it starts **homing**, starting **homing a**t low reverse speed, and stopping at the first Z signal after encountering the falling edge of HOME.

4.5.4 Method 4 (6098=4)

Origin: Z signal

Deceleration point: Origin signal (HOME)

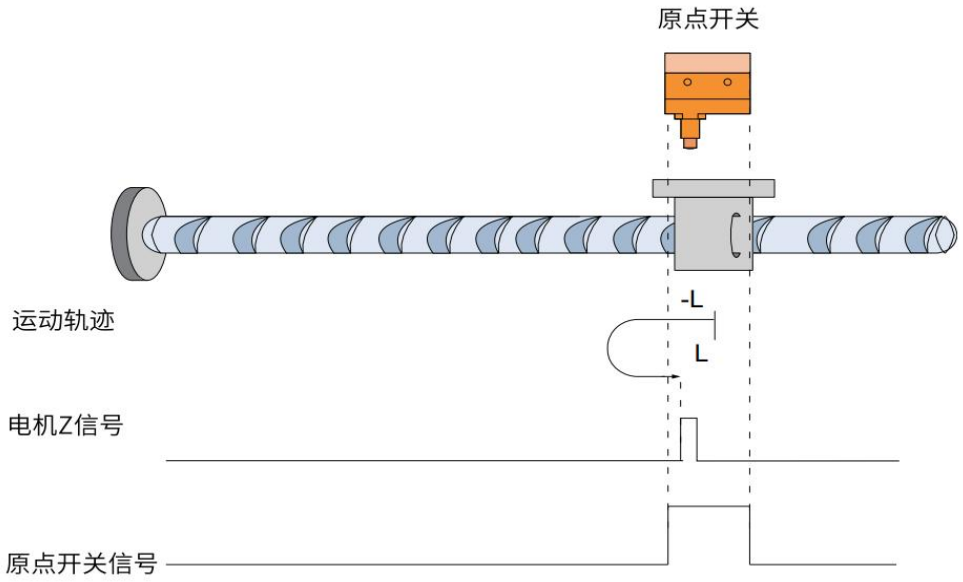
The origin switch signal is invalid when starting homing



When HOME=OFF, it starts homing at a high speed in the forward direction. When encountering the rising edge of HOME, it slows down in the reverse

direction and runs at a low speed in the reverse direction. When encountering the falling edge of HOME, it slows down in the reverse direction and runs at a low speed in the forward direction. It stops at the first Z signal after encountering the rising edge of HOME.

When starting homing, the origin switch signal is valid



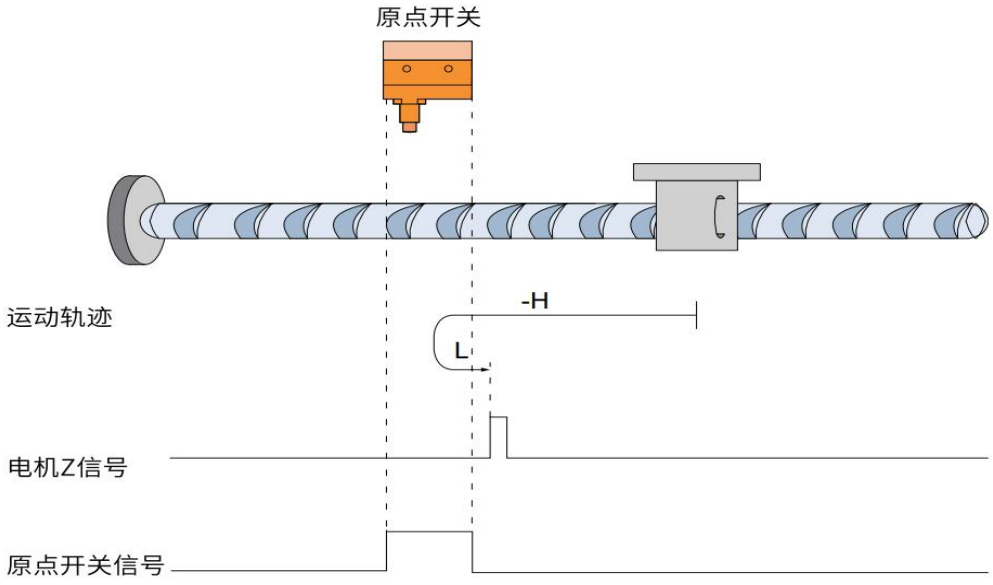
When HOME=ON, it starts homing at low speed in reverse. When encountering the NOT falling edge, it slows down in reverse and runs at low speed in forward direction. When encountering the HOME rising edge, the first Z signal stops the machine.

4.5.5 Method 5 (6098=5)

Origin: Z signal

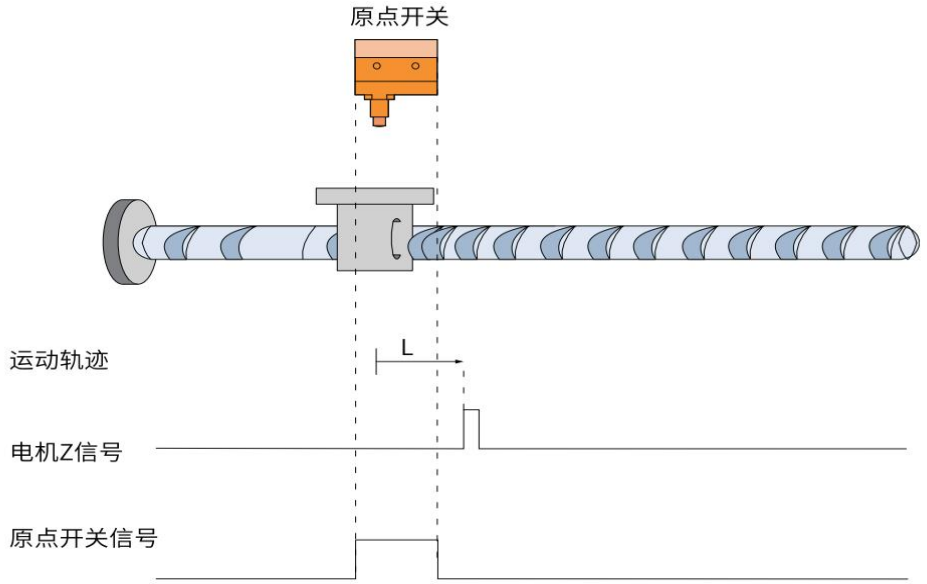
Deceleration point: Origin signal (HOME)

The origin switch signal is invalid when starting homing



When HOME=OFF, start homing at reverse high speed. When encountering the rising edge of HOME, slow down in reverse and run at low speed in forward direction. Stop at the first Z signal after encountering the falling edge of HOME.

When starting homing, the origin switch signal is valid



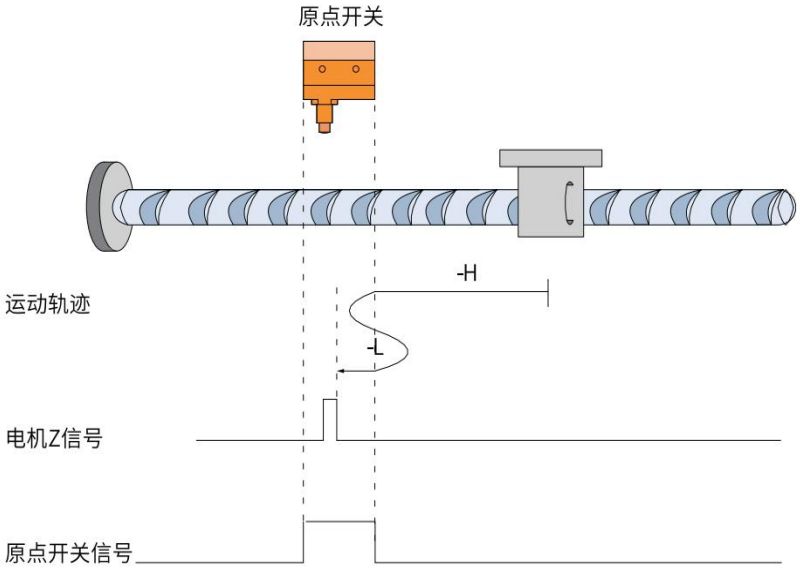
When HOME=ON, it starts homing at a low forward speed, and stops at the first Z signal after encountering the falling edge of HOME.

4.5.6 Method 6 (6098=6)

Origin: Z signal

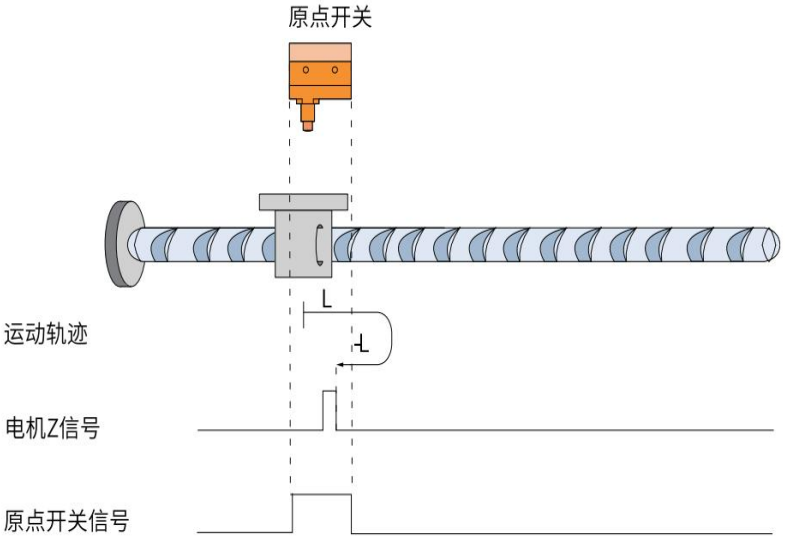
Deceleration point: Origin signal (HOME)

The origin switch signal is invalid when starting homing



When HOME=OFF, it starts homing at high speed in reverse. When encountering the rising edge of HOME, it slows down in reverse and runs at low speed in forward direction. When encountering the falling edge of HOME, it slows down in reverse and runs at low speed in reverse direction. The first Z signal after encountering the rising edge of HOME stops the machine.

When starting homing, the origin switch signal is valid



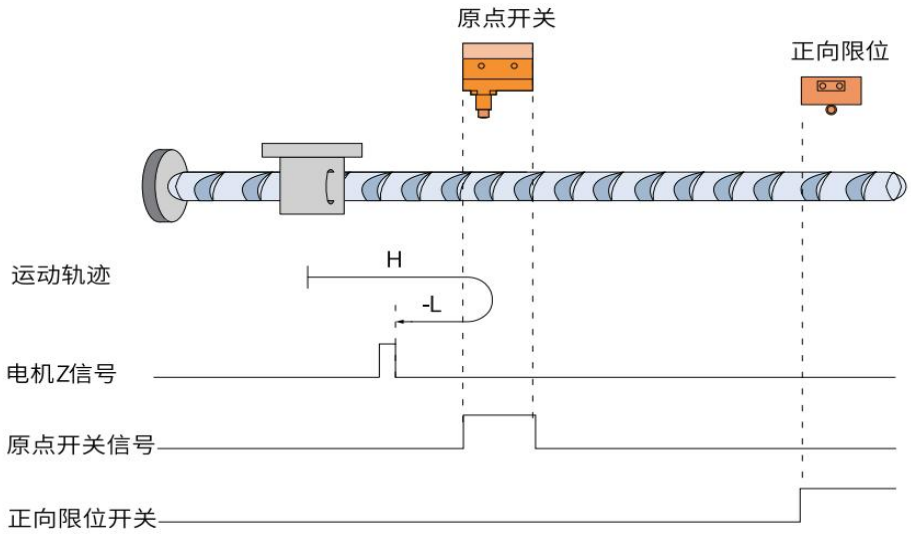
When HOME=ON, it starts homing at a low speed in the forward direction. When encountering the descending edge of HOME, it slows down in the reverse direction and runs at a low speed in the reverse direction. When encountering the rising edge of HOME, the first Z signal stops the machine.

4.5.7 Method 7 (6098=7)

Origin: Z signal

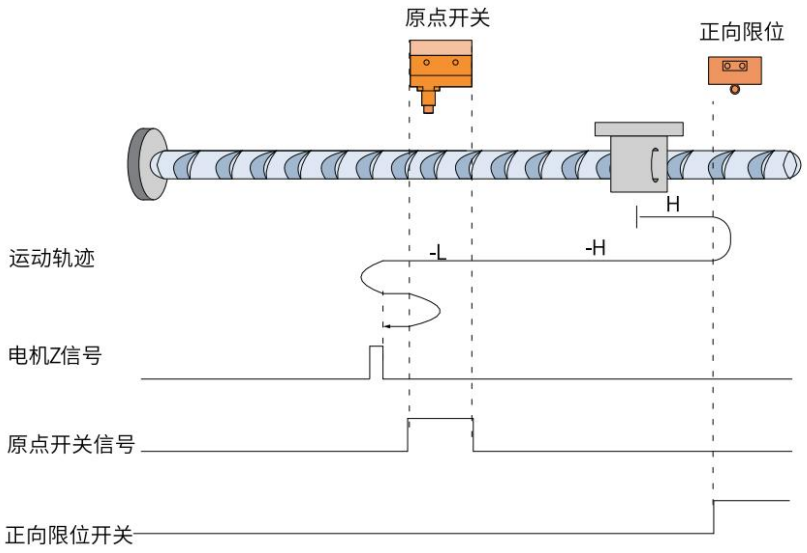
Deceleration point: Origin signal (HOME)

When starting homing, the origin switch signal is invalid and no forward limit switch has been encountered



When HOME=OFF and POT=OFF, the homing process starts. It begins moving at high speed in the positive direction. After encountering the rising edge of the HOME signal, it decelerates and reverses direction, then continues moving at low speed in the reverse direction. It stops at the first Z signal encountered after the falling edge of the HOME signal.

If the origin switch signal is invalid when homing starts, it will trigger the positive limit switch.



When **HOME=OFF** and **POT=OFF**, the homing process begins. It starts moving at **high speed in the positive direction**. Upon detecting the **rising edge of the POT signal**, it automatically reverses direction and moves at **high speed in the negative direction**. After encountering the **rising edge of the HOME signal**, it switches to **low-speed reverse movement**.

Upon detecting the **falling edge of the HOME signal**, it decelerates, reverses direction again, and moves at **low speed in the positive direction**. When it encounters the **next rising edge of the HOME signal**, it decelerates once more, reverses direction, and continues at **low speed in the negative direction**, finally stopping at the **first Z signal** after the **falling edge of the HOME signal**.

If the origin switch signal is valid when homing starts.

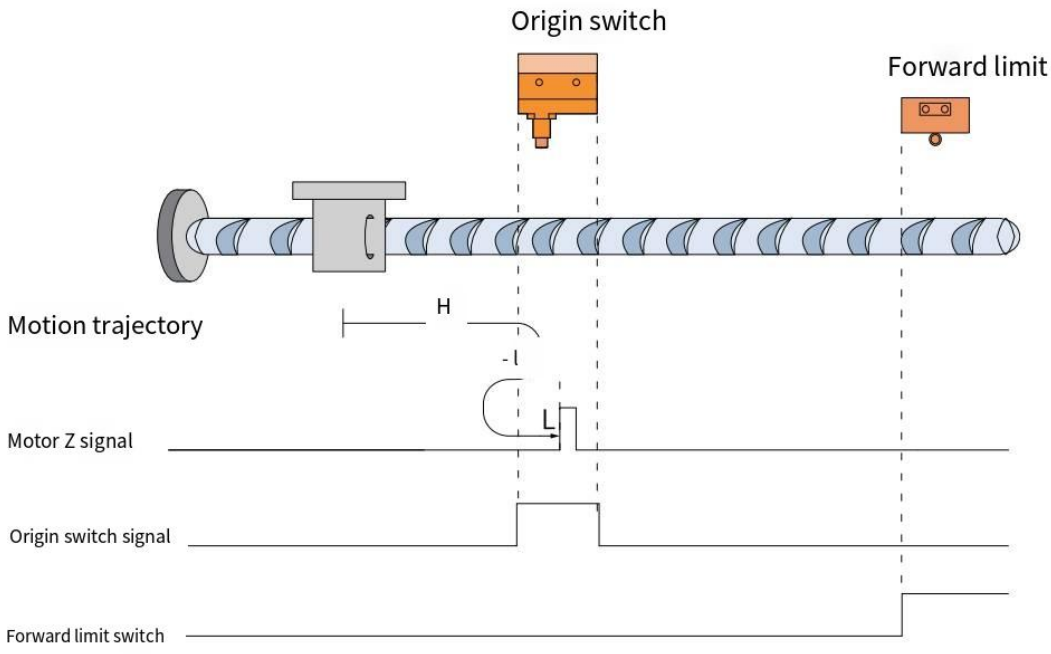
When HOME=ON, POT=OFF, it starts to homing at a low speed in the reverse direction, and stops when it encounters the first Z signal after the falling edge of HOME.

4.5.8 Method 8 (6098=8)

Origin: Z signal

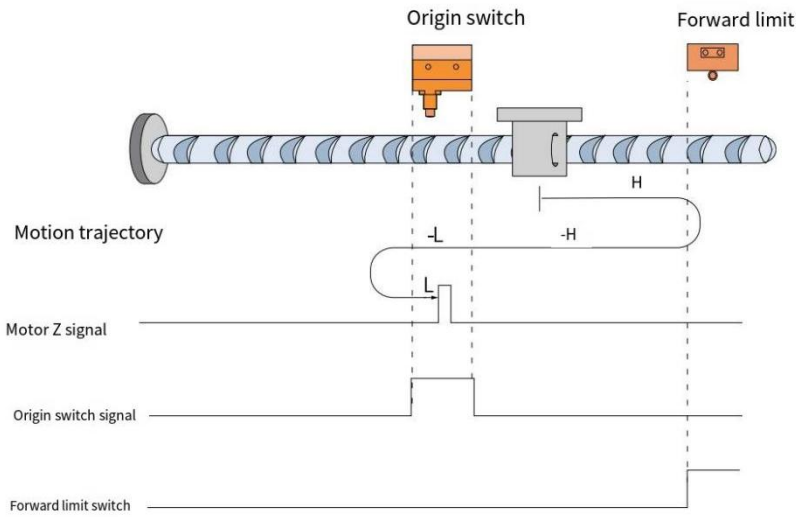
Deceleration point: origin signal（HOME）

The origin switch signal is invalid when starting homing, and the positive limit switch is not encountered.



When HOME=OFF, POT=OFF, it starts to homing at high speed in the forward direction. After encountering the rising edge of HOME, it decelerates and reverses, and runs at low speed in the reverse direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at low speed in the forward direction. It stops at the first Z signal after the rising edge of HOME.

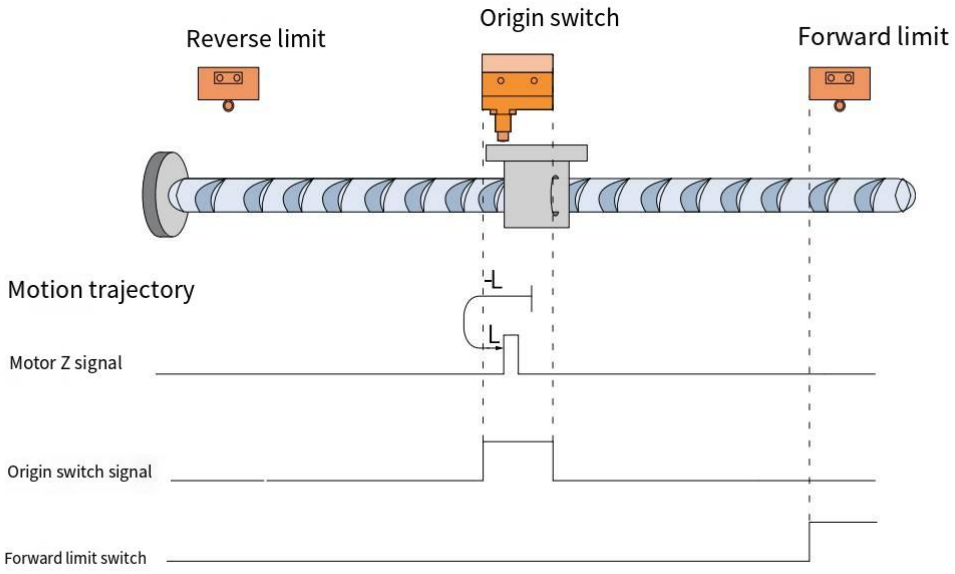
- When homing, the origin switch signal is invalid and encounters the positive limit switch



When HOME=OFF, POT=OFF, it starts to homing at high speed in the forward direction. After encountering the rising edge of POT, it automatically runs in the reverse direction at high speed. After encountering the rising edge of HOME, it runs in the reverse direction at low speed. After encountering the falling edge of

HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops at the first Z signal after the rising edge of HOME.

- The origin switch signal is valid when starting homing



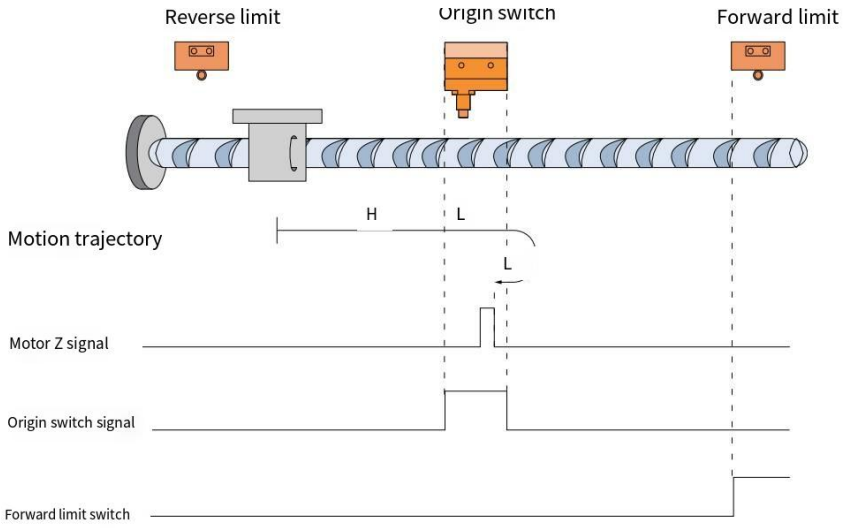
When HOME=ON and POT=OFF, the machine starts homing at a low speed in the reverse direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at a low speed in the forward direction. It stops at the first Z signal after the rising edge of HOME.

4.5.9 Method 9（6098=9）

Origin: Z signal

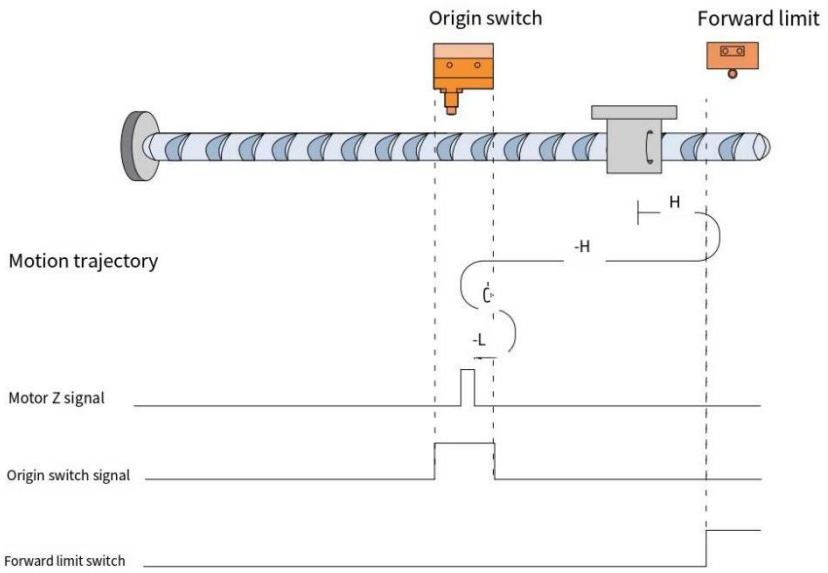
Deceleration point: origin signal（HOME）

- The origin switch signal is invalid when starting homing, and the positive limit switch is not encountered



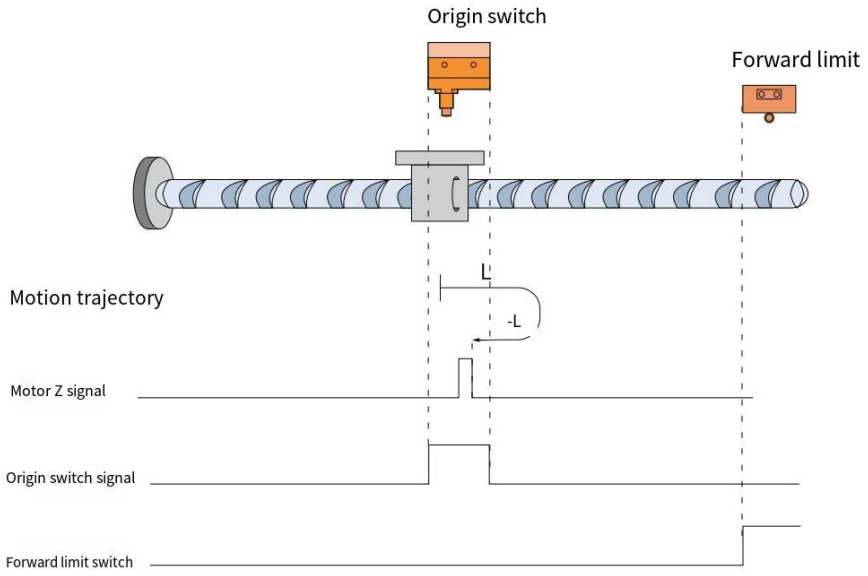
When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of HOME, it runs at low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at low speed in the reverse direction, and stops at the first Z signal after the rising edge of HOME.

- When homing, the origin switch signal is invalid and encounters the positive limit switch



When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of POT, it automatically runs in the reverse direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs at low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at low speed in the reverse direction. It stops at the first Z signal after the rising edge of HOME.

- The origin switch signal is valid when starting homing



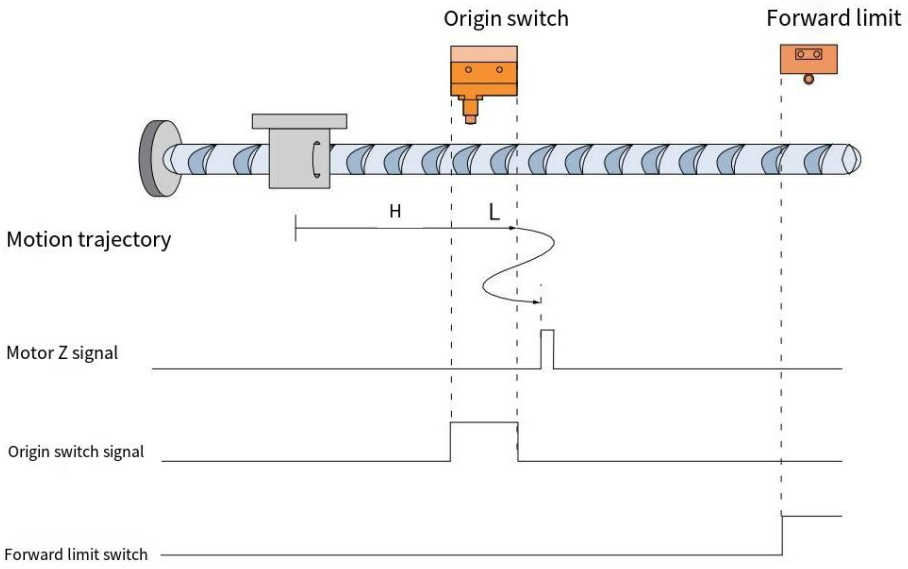
When HOME=ON, POT=OFF, it starts homing at a low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at a low speed in the reverse direction, and stops at the first Z signal after the rising edge of HOME.

4.5.10 Method 10（6098=10）

Origin: Z signal

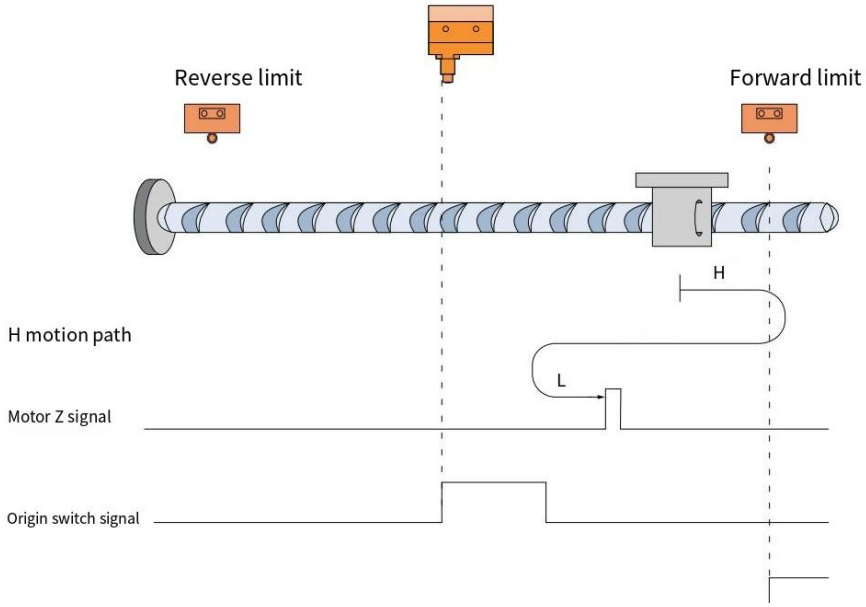
Deceleration point: origin signal（HOME）

- The origin switch signal is invalid when starting homing, and the positive limit switch is not encountered.



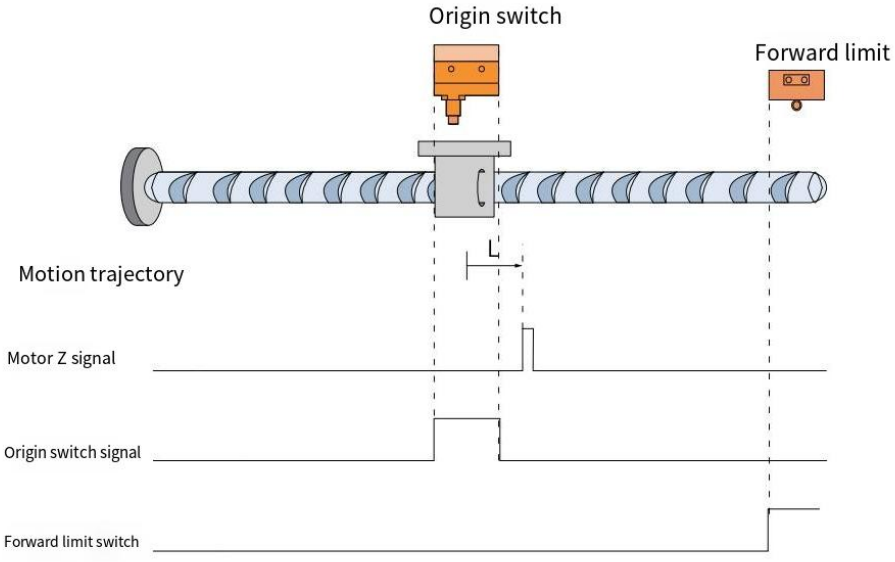
When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of HOME, it runs at low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at low speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, and runs at low speed in the forward direction. It stops at the first Z signal after the falling edge of HOME.

- When homing, the origin switch signal is invalid and encounters the positive limit switch.



When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of POT, it automatically runs in the reverse direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops at the first Z signal after the falling edge of HOME.

- The origin switch signal is valid when starting homing



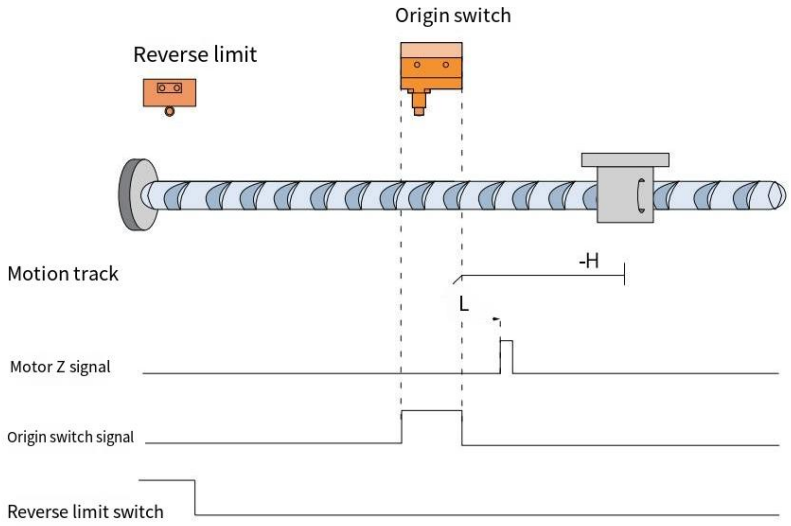
When HOME=ON and POT=OFF, the machine starts homing at a low forward speed and stops at the first Z signal after the falling edge of HOME.

4.5.11 Method 11(6098=11)

Origin: Z signal

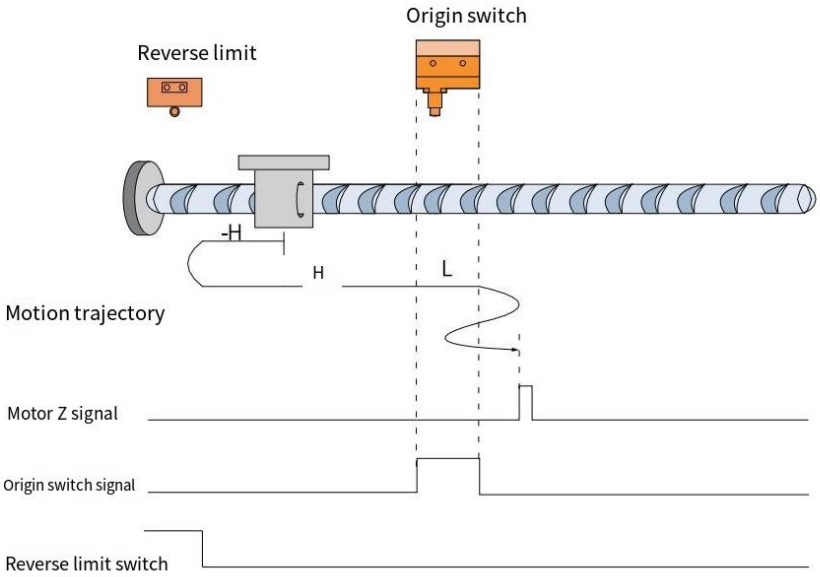
Deceleration point: Origin signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, runs at low speed in the forward direction, and stops when encountering the first Z signal of the falling edge of HOME.

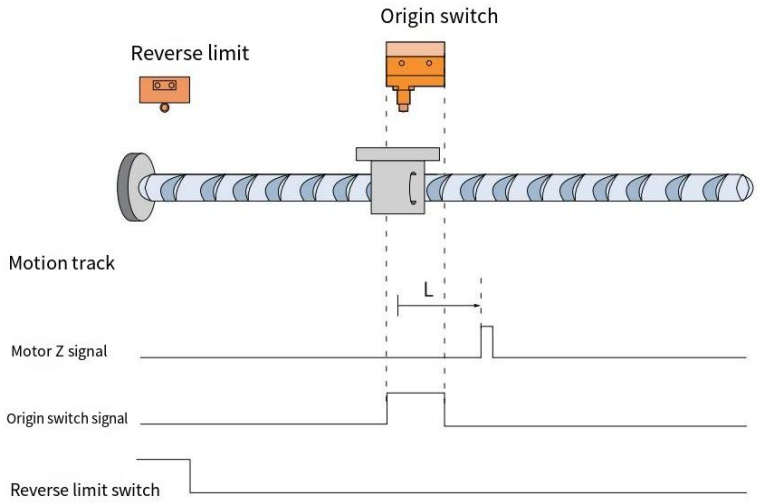
- The origin switch signal is invalid when starting homing, and the negative limit switch is encountered.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it immediately runs in the

forward high speed. After encountering the rising edge of HOME, it runs in the forward low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the reverse low speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the forward low speed. It stops at the first Z signal after the falling edge of HOME.

- The origin switch signal is valid when starting homing



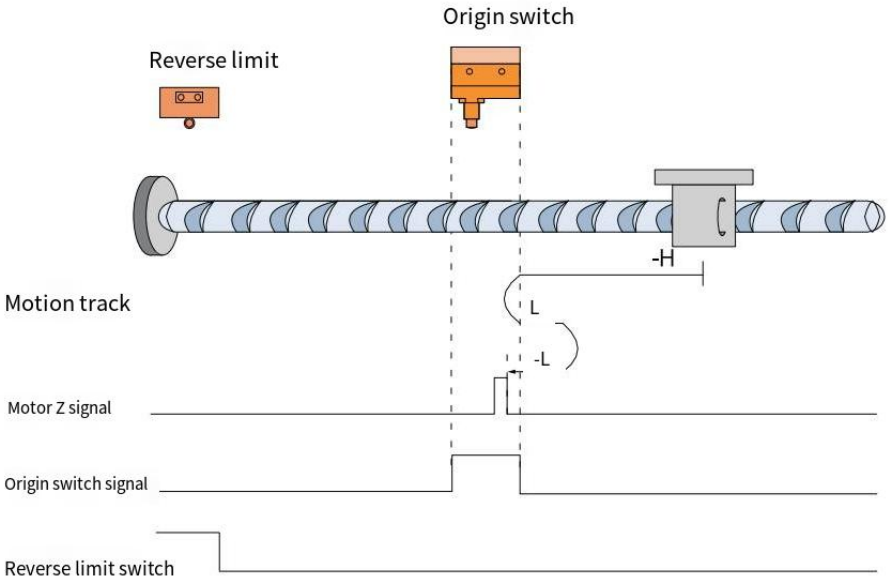
When HOME=ON, NOT=OFF, the machine starts homing at a low forward speed and stops at the first Z signal after the falling edge of HOME.

4.5.12 Method 12 (6098=12)

Origin: Z signal

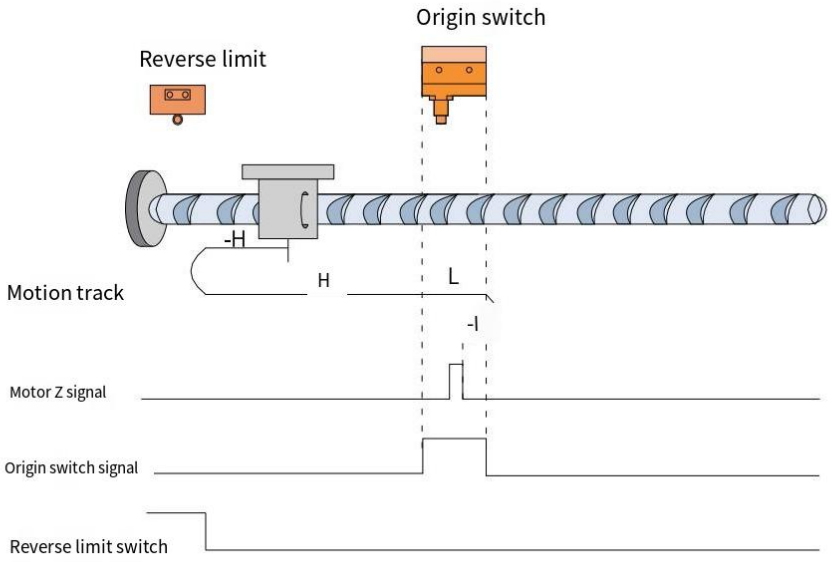
Deceleration point: Origin signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, and runs at low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at low speed in the reverse direction. It stops at the first Z signal after the rising edge of HOME.

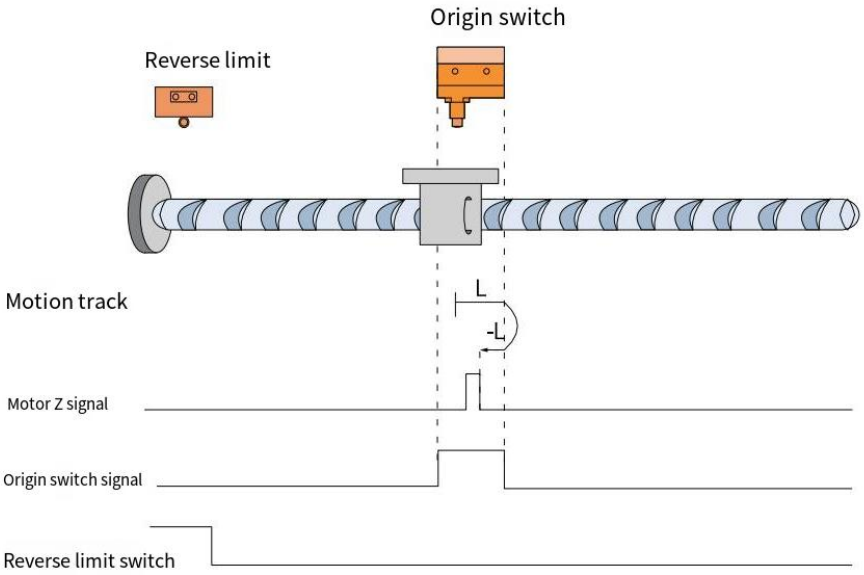
- When homing, the origin switch signal is invalid and encounters a negative limit switch.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it immediately runs in the forward direction at high speed. After encountering the rising edge of HOME, it runs in the forward direction at low speed. After encountering the falling edge of

HOME, it decelerates and reverses, runs in the reverse direction at low speed, and stops at the first Z signal after the rising edge of HOME.

- The origin switch signal is valid when starting homing



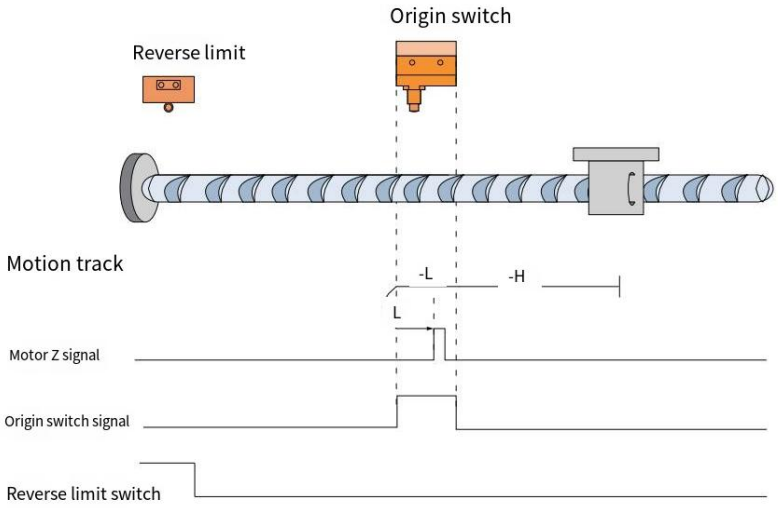
When HOME=ON, NOT=OFF, it starts homing at a low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, running at a low speed in the reverse direction. It stops at the first Z signal after the rising edge of HOME.

4.5.13 Method 13（6098=13）

Origin: Z signal

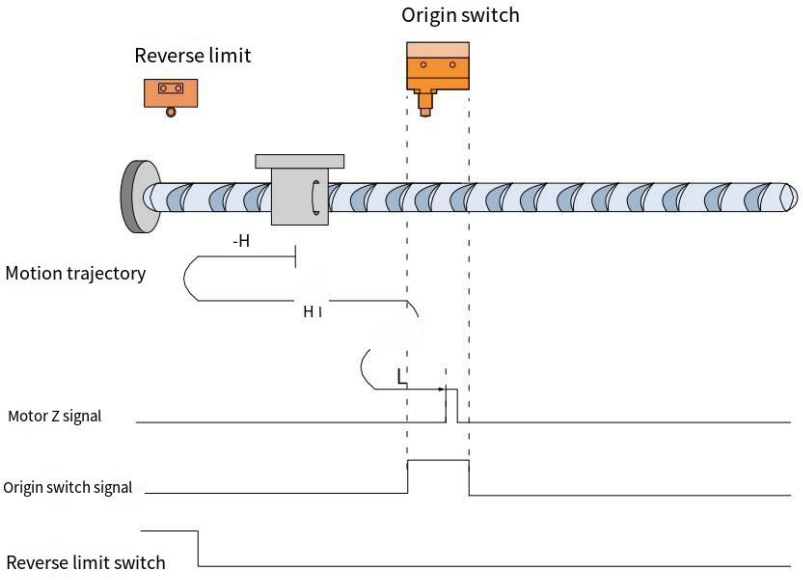
Deceleration point: Origin signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered



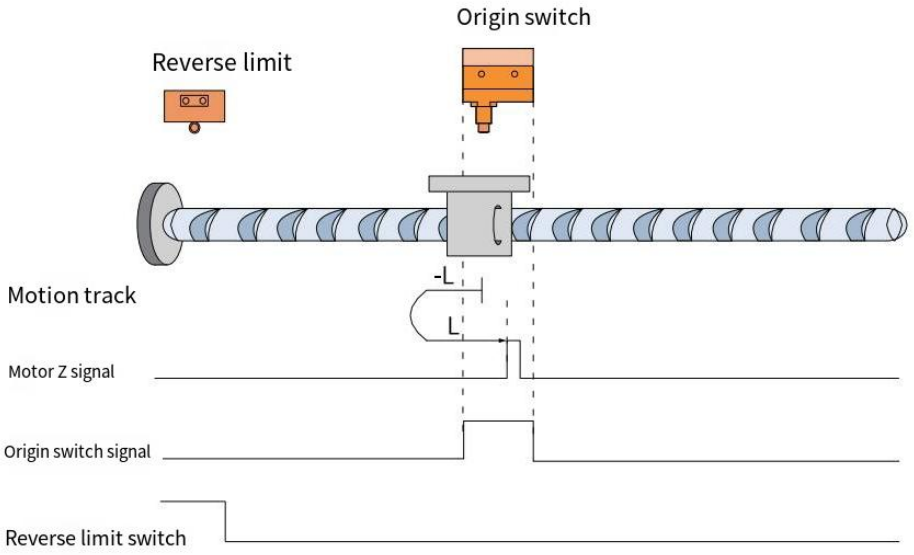
When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops at the first Z signal after the rising edge of HOME.

- When homing, the origin switch signal is invalid and encounters a negative limit switch.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it immediately runs in the forward direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the forward direction at low speed. It stops at the first Z signal after the rising edge of HOME.

- The origin switch signal is valid when starting homing



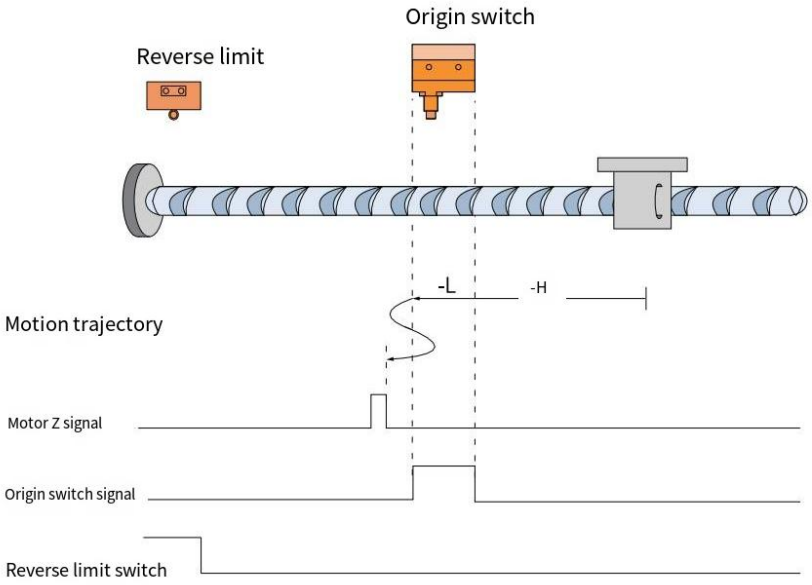
When HOME=ON, NOT=OFF, it starts homing at a low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, running at a low speed in the forward direction. It stops at the first Z signal after the rising edge of HOME.

4.5.14 Method 14 (6098=14)

Origin: Z signal

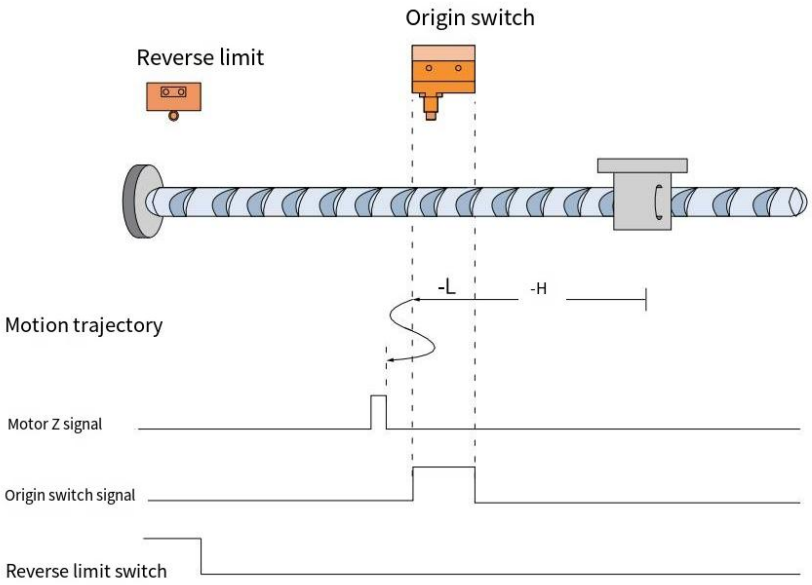
Deceleration point: Origin signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered.



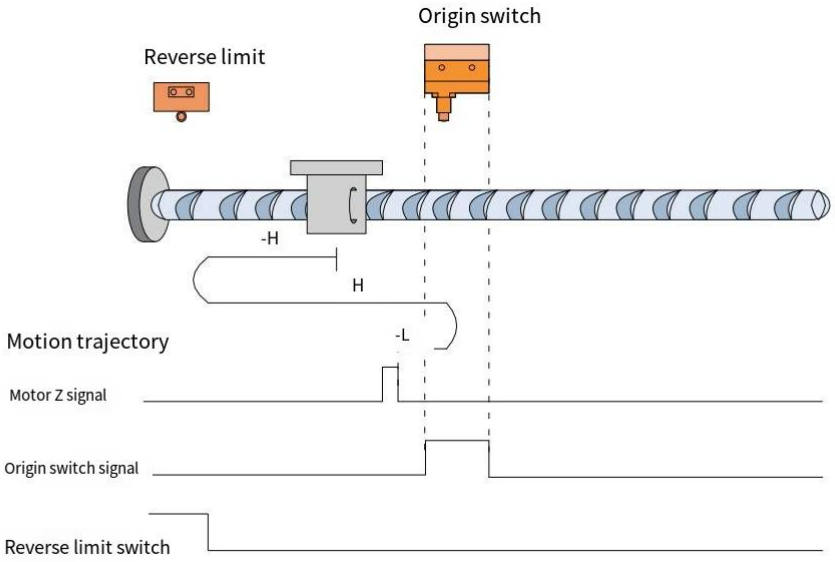
When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops at the first Z signal after the rising edge of HOME.

- When homing, the origin switch signal is invalid and encounters a negative limit switch.



When HOME=ON, NOT=OFF, it starts homing at a low speed in the reverse direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at a low speed in the forward direction, and stops at the first Z signal after the rising edge of HOME.

- The origin switch signal is valid when starting homing.



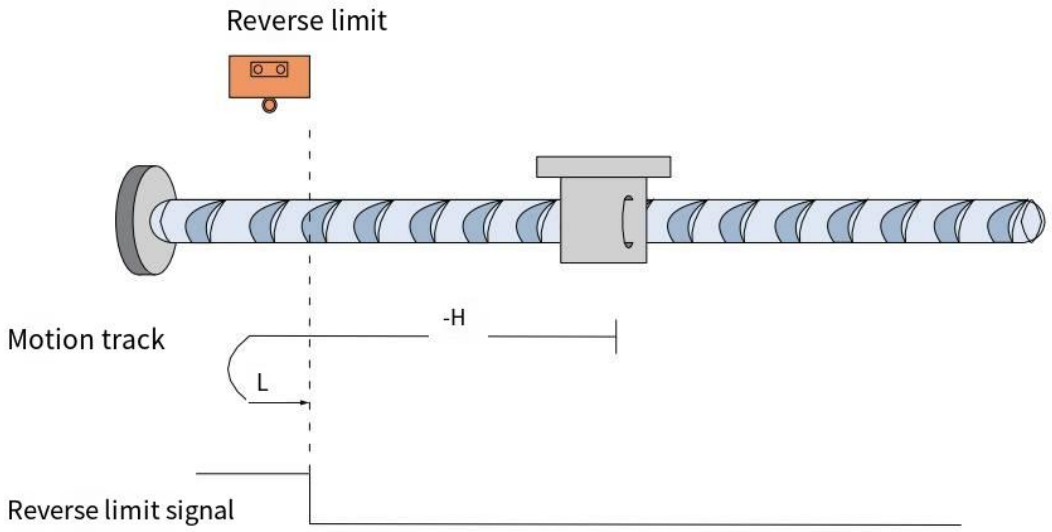
When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it immediately runs in the forward direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the forward direction at low speed. After encountering the rising edge of HOME again, it stops at the first Z signal.

4.5.15 Method 17 (6098=17)

Origin: Reverse limit signal (NOT)

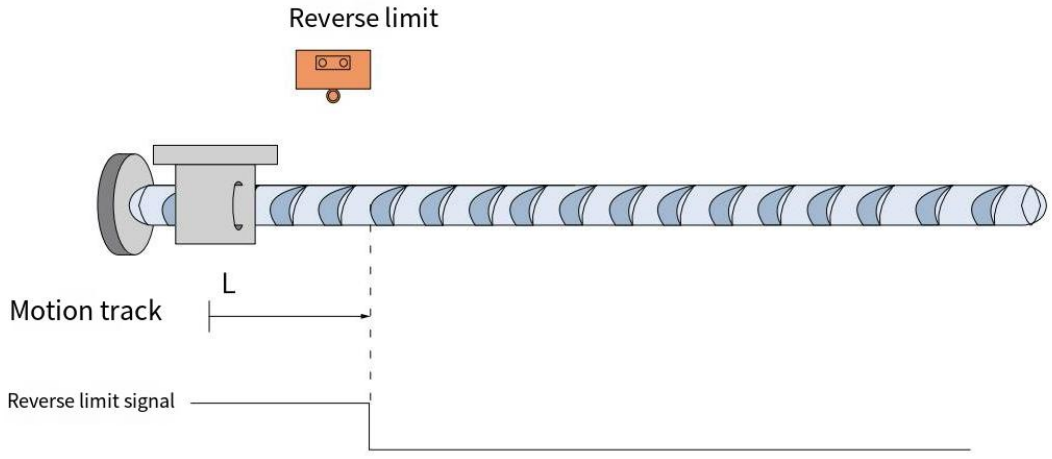
Deceleration point: Reverse limit signal (NOT)

- The reverse limit signal is invalid when starting homing



When NOT=OFF, it starts homing at a high speed in the reverse direction. After encountering the rising edge of NOT, it decelerates and reverses, runs at a low speed in the forward direction, and stops after encountering the falling edge of NOT.

- Reverse limit signal is valid when starting homing



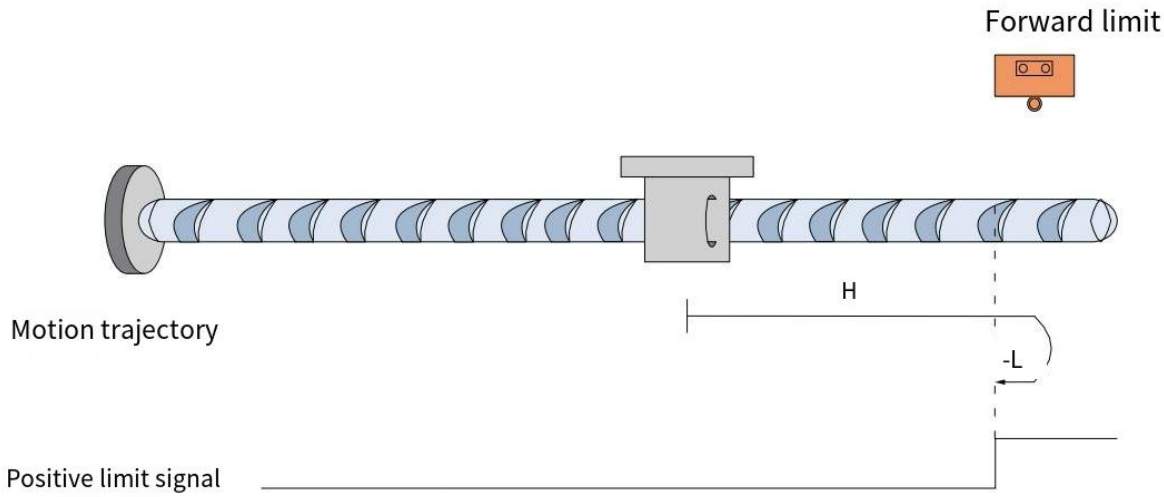
When NOT=ON, it starts homing at a low speed in the forward direction and stops when it encounters the falling edge of NOT.

4.5.16 Method 18(6098=18)

Origin: Positive limit signal (POT)

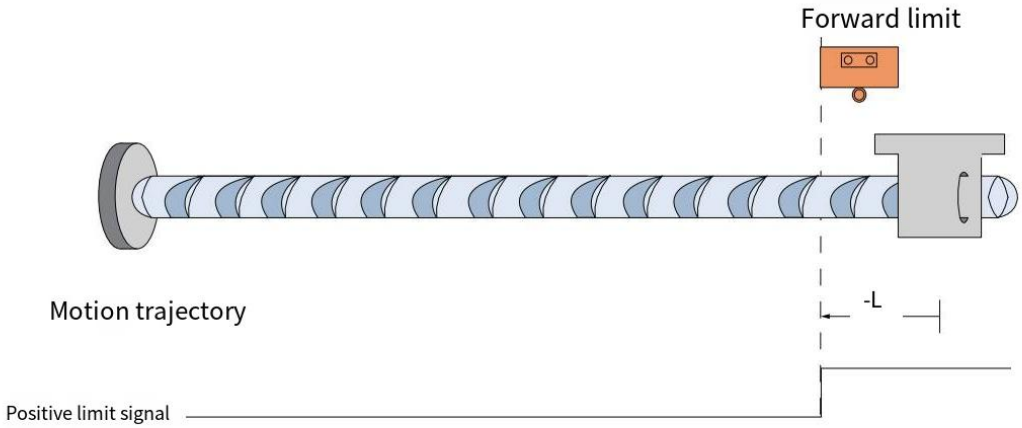
Deceleration point: Positive limit signal (POT)

- The positive limit signal is invalid when starting homing



When POT=OFF, it starts homing at a high forward speed. After encountering the rising edge of POT, it decelerates and reverses, runs at a low speed in the reverse direction, and stops after encountering the falling edge of POT.

- The positive limit signal is valid when starting homing



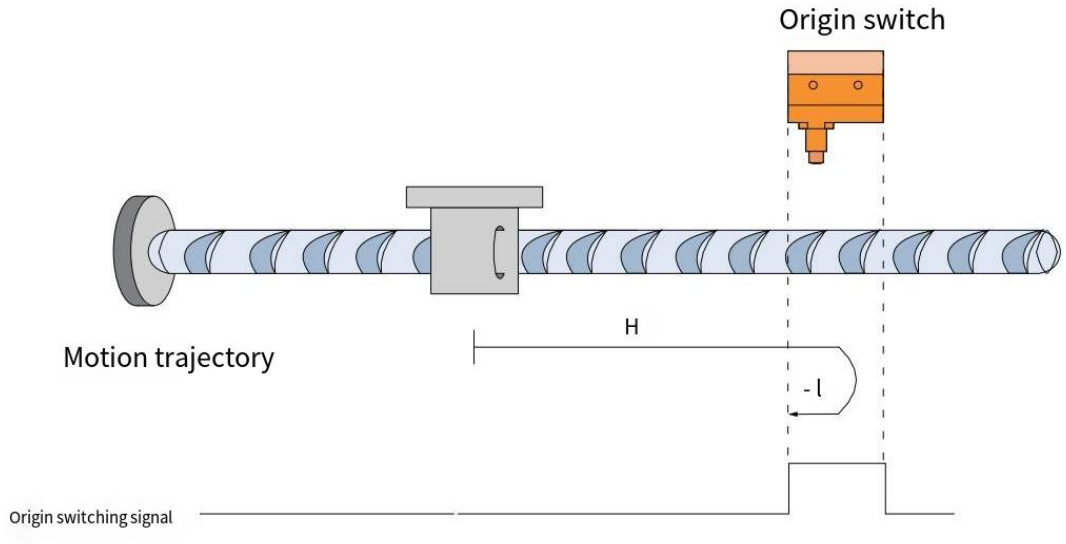
When POT=ON, it starts homing at a low speed in the reverse direction and stops when it encounters the falling edge of POT.

4.5.17 Method 19(6098=19)

Origin: Origin switch signal（HOME）

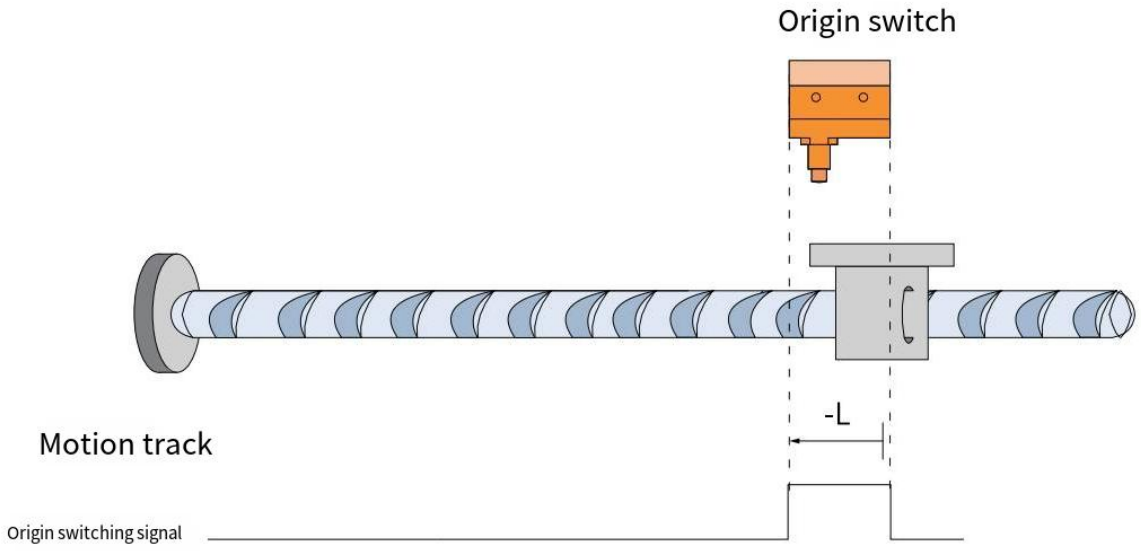
Deceleration point: origin switch signal（HOME）

- The origin switch signal is invalid when starting homing



When HOME=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of HOME, it decelerates and reverses, runs at low speed in the reverse direction, and stops after encountering the falling edge of HOME.

- The origin switch signal is valid when starting homing.



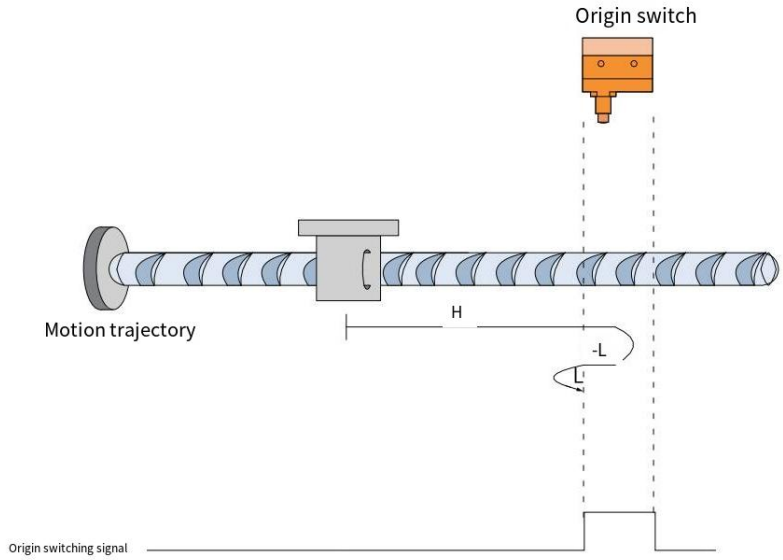
When HOME=ON, the machine starts homing at a low speed in the reverse direction and stops when it encounters the falling edge of HOME.

4.5.18 Method 20(6098=20)

Origin: Origin switch signal (HOME)

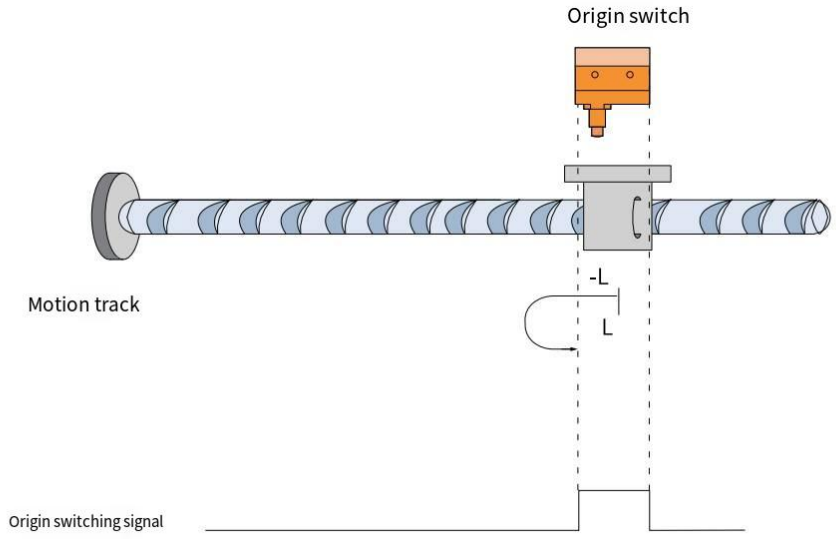
Deceleration point: Origin switch signal (HOME)

- The origin signal switch is invalid when starting homing



When HOME=OFF, it starts homing at a high forward speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs at a low speed in the reverse direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at a low forward speed. It stops after encountering the rising edge of HOME again.

- The origin signal switch is effective when starting homing



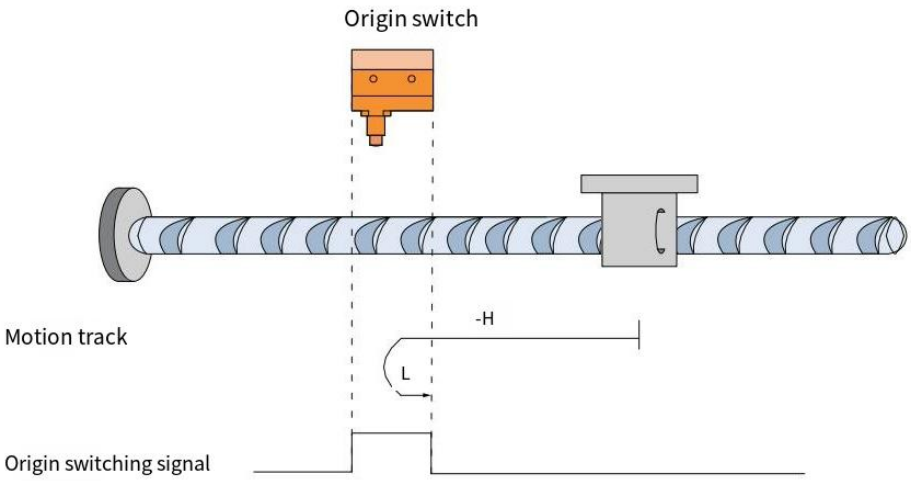
When HOME=ON, it starts homing at a low speed in the reverse direction. After encountering the falling edge of NOT, it decelerates and reverses, runs at a low speed in the forward direction, and stops after encountering the rising edge of HOME.

4.5.19 Method 21(6098=21)

Origin: Origin switch signal (HOME)

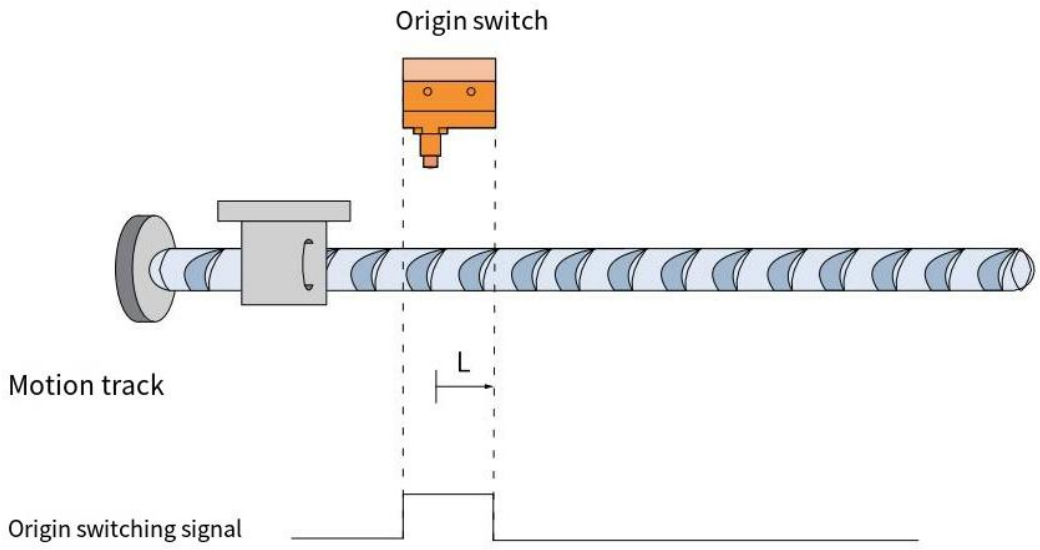
Deceleration point: Origin switch signal (HOME)

- The origin signal switch is invalid when starting homing



When HOME=OFF, it starts homing at a high speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, runs at a low speed in the forward direction, and stops after encountering the falling edge of HOME.

- The origin switch signal is valid when starting homing.



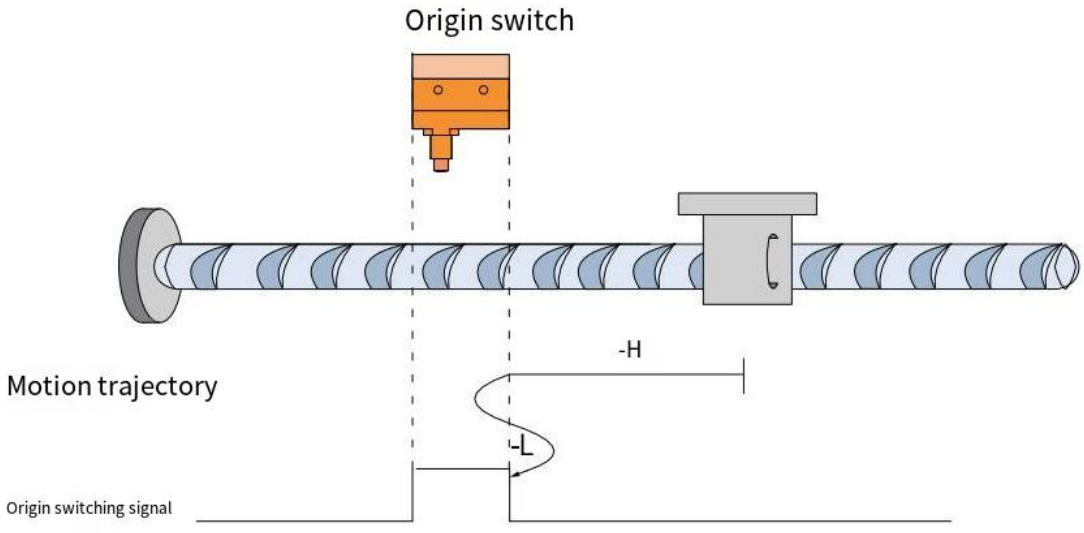
When HOME=ON, it starts homing at a low speed in the forward direction and stops when it encounters the falling edge of HOME.

4.5.20 Method 22(6098=22)

Origin: Origin switch signal (HOME)

Deceleration point: Origin switch signal (HOME)

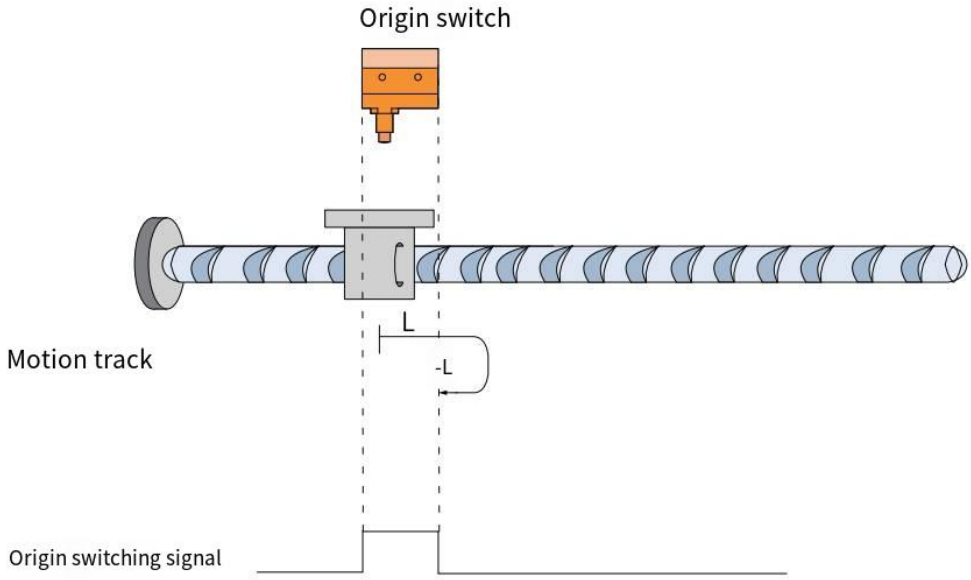
- The origin switch signal is invalid when starting homing



When HOME=OFF, it starts homing at a high speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, and runs at a low speed in the forward direction. After encountering the falling edge

of HOME, it decelerates and reverses, and runs at a low speed in the reverse direction. It stops after encountering the rising edge of HOME again.

- The origin switch signal is valid when starting homing



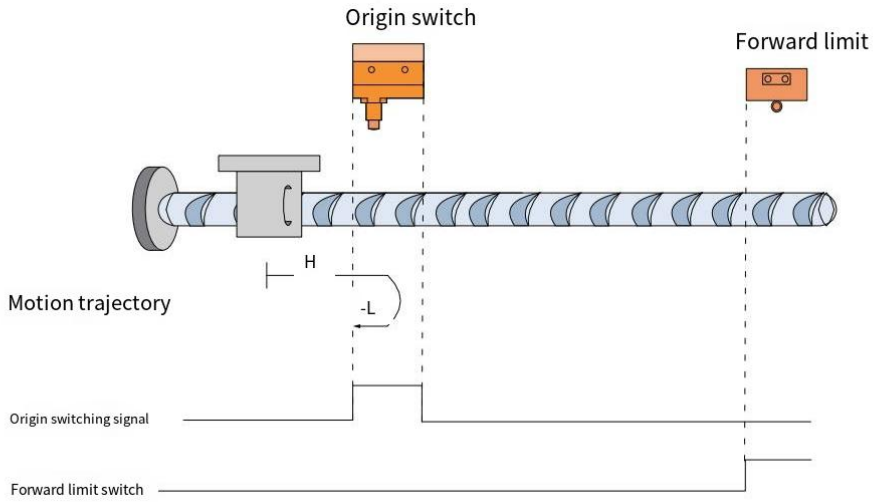
When HOME=ON, it starts homing at a low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at a low speed in the reverse direction, and stops after encountering the rising edge of HOME.

4.5.21 Method 23(6098=23)

Origin: Origin switch signal (HOME)

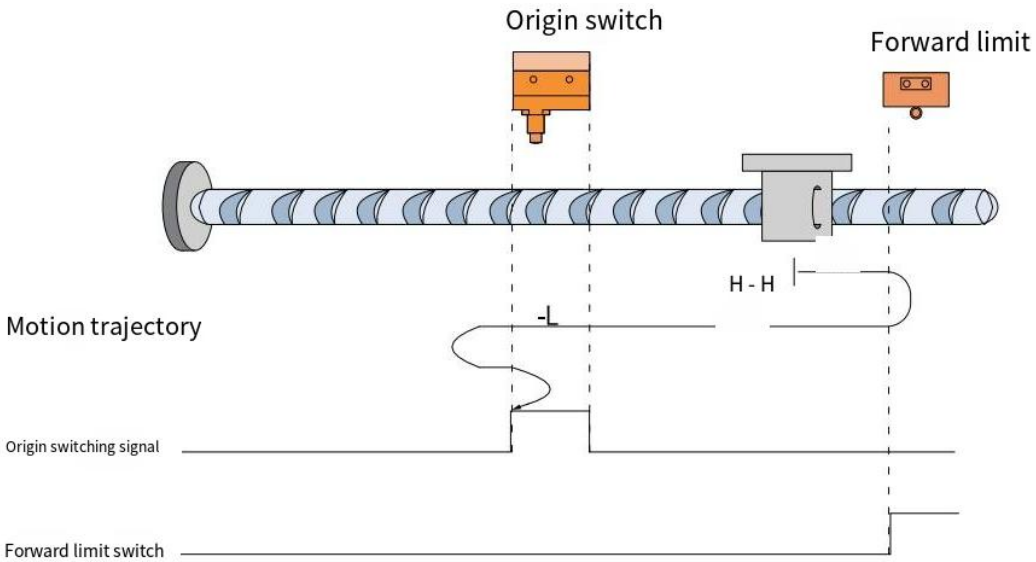
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and the positive limit switch is not encountered.



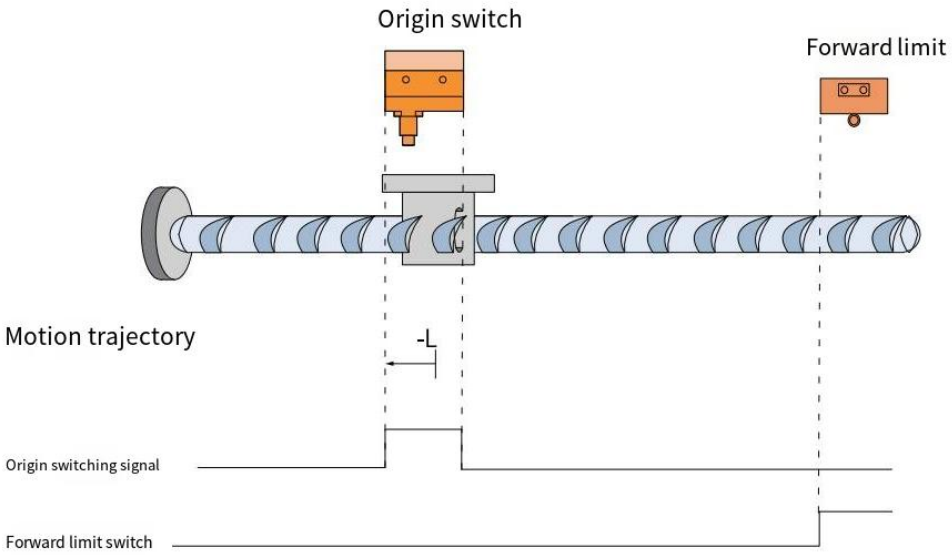
When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of HOME, it decelerates and reverses, runs at low speed in the reverse direction, and stops when encountering the falling edge of HOME.

- When homing, the origin switch signal is invalid and encounters a positive limit switch.



When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of POT, it immediately runs in the reverse direction at high speed. After encountering the rising edge of HOME, it runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the forward direction at low speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the reverse direction at low speed. It stops after encountering the falling edge of HOME again.

- The origin switch signal is valid when starting homing.



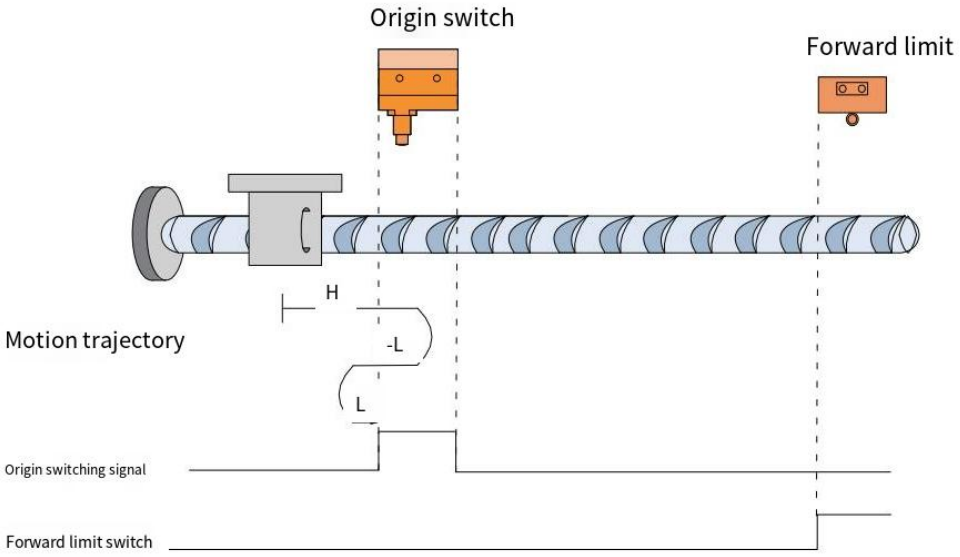
When HOME=ON and POT=OFF, the machine starts homing at a low speed in the reverse direction and stops when it encounters the falling edge of HOME.

4.5.22 Method 24(6098=24)

Origin: Origin switch signal (HOME)

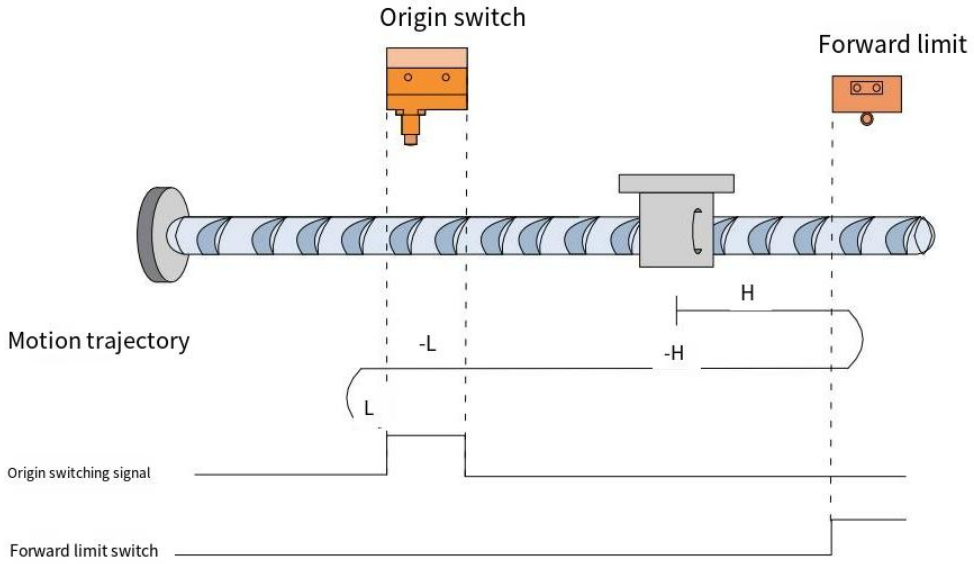
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and the positive limit switch is not encountered.



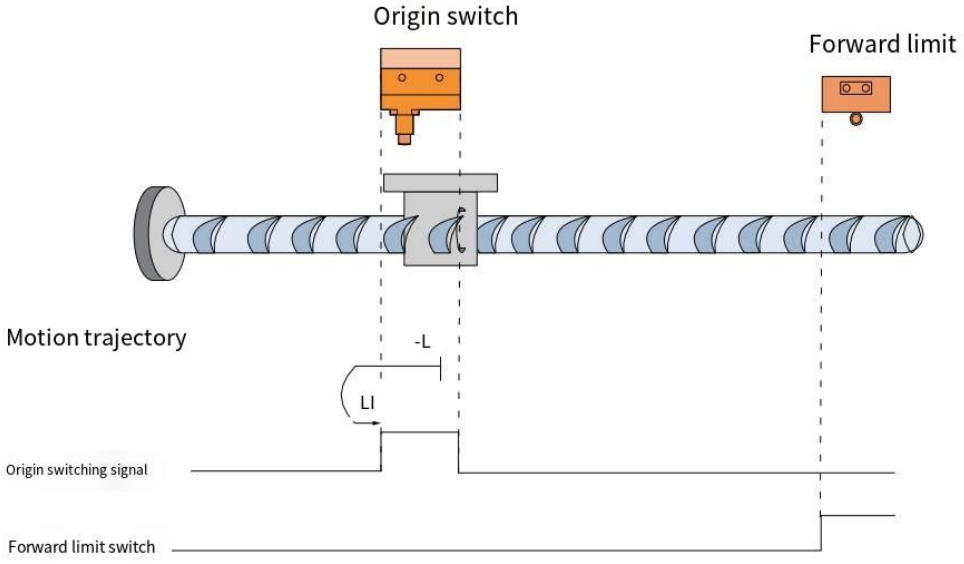
When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of HOME, it decelerates and reverses, and runs at low speed in the reverse direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at low speed in the forward direction. It stops after encountering the rising edge of HOME again.

- When homing, the origin switch signal is invalid and encounters a positive limit switch.



When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. When it encounters the rising edge of POT, it automatically runs in the reverse direction at high speed. When it encounters the rising edge of HOME, it runs in the reverse direction at low speed. When it encounters the falling edge of HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops when it encounters the rising edge of HOME.

- The origin switch signal is valid when starting homing.



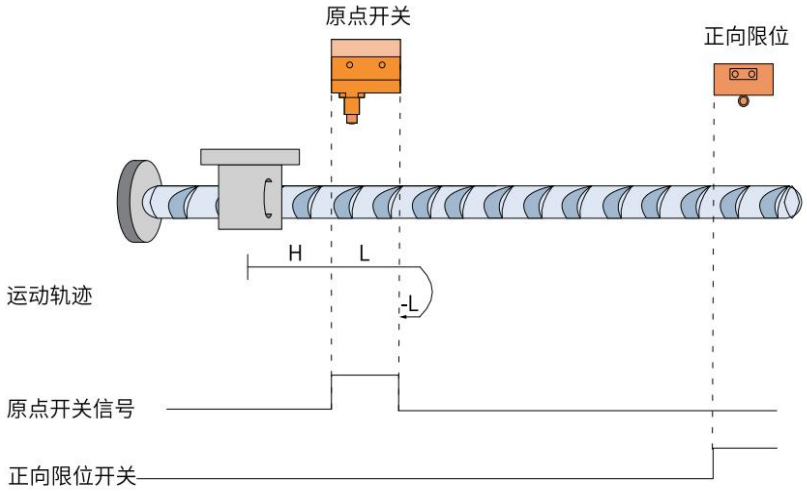
When HOME=ON and POT=OFF, it starts homing at a low speed in the reverse direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at a low speed in the forward direction, and stops after encountering the rising edge of HOME.

4.5.23 Method 25(6098=25)

Origin: Origin switch signal (HOME)

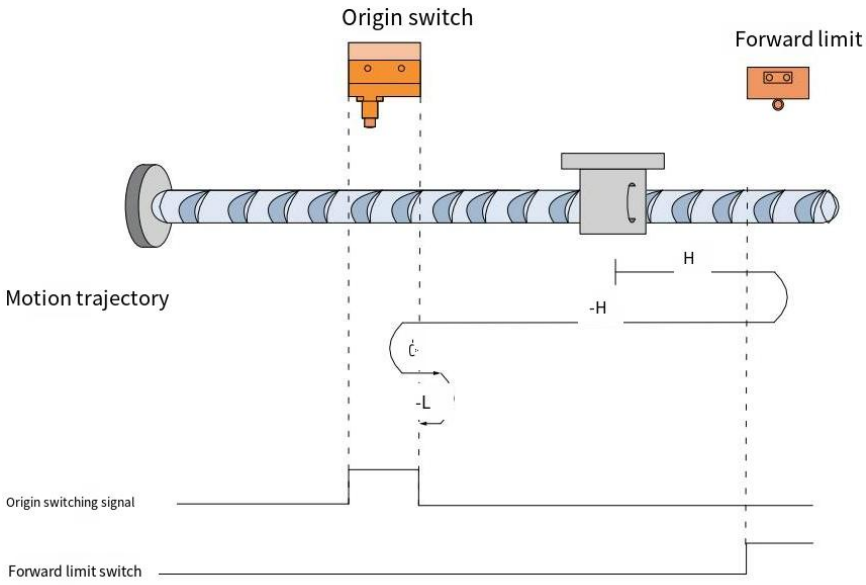
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and the positive limit switch is not encountered.



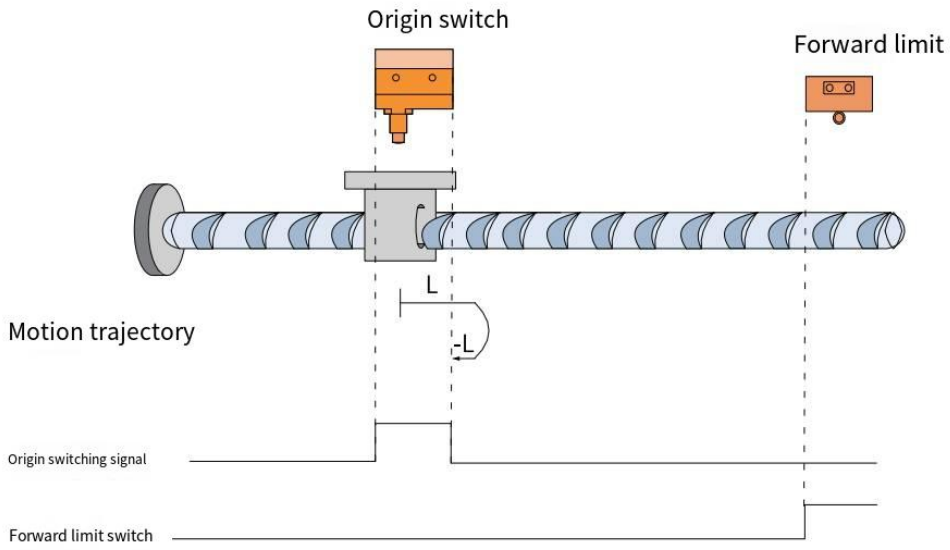
When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of HOME, it runs at low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at low speed in the reverse direction, and stops after encountering the rising edge of HOME.

- When homing, the origin switch signal is invalid and encounters a positive limit switch.



When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of POT, it automatically runs in the reverse direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the forward direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the reverse direction at low speed. It stops after encountering the rising edge of HOME again.

- The origin switch signal is valid when starting homing.



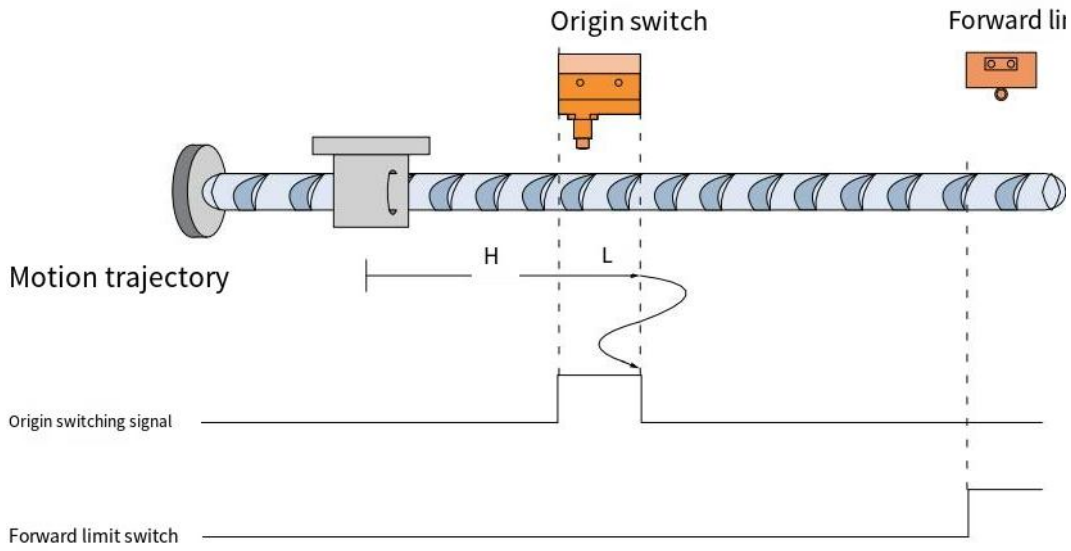
When HOME=ON and POT=OFF, the machine starts homing at a low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at a low speed in the reverse direction, and stops after encountering the rising edge of HOME.

4.5.24 Method 26(6098=26)

Origin: Origin switch signal (HOME)

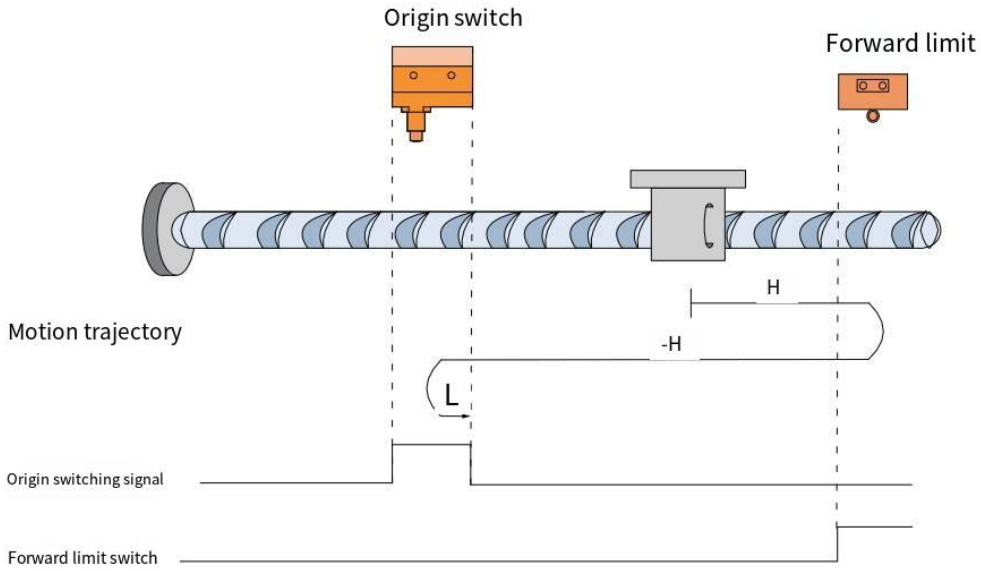
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and no positive limit switch is encountered.



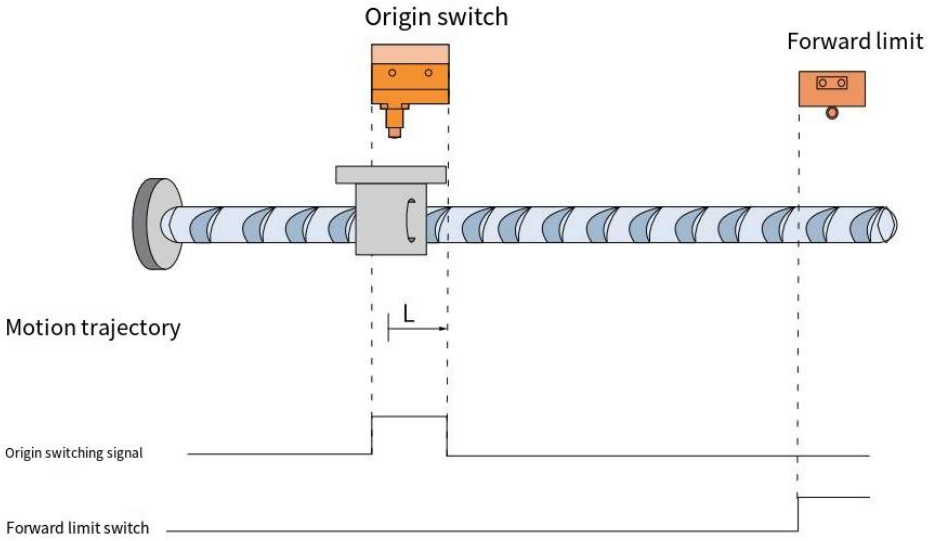
When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of HOME, it runs at low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at low speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, and runs at low speed in the forward direction. It stops after encountering the falling edge of HOME again.

- When homing, the origin switch signal is invalid and encounters a positive limit switch.



When HOME=OFF, POT=OFF, it starts homing at high speed in the forward direction. After encountering the rising edge of POT, it automatically runs in the reverse direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops after encountering the falling edge of HOME.

- The origin switch signal is valid when starting homing.



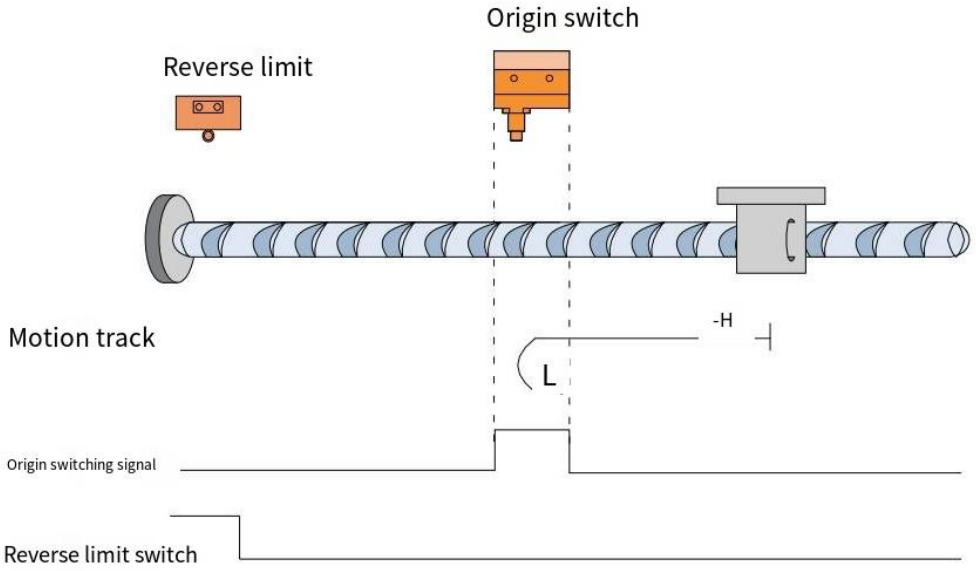
When HOME=ON and POT=OFF, the system starts homing at a low forward speed and stops when it encounters the falling edge of HOME.

4.5.25 Method 27(6098=27)

Origin: Origin switch signal (HOME)

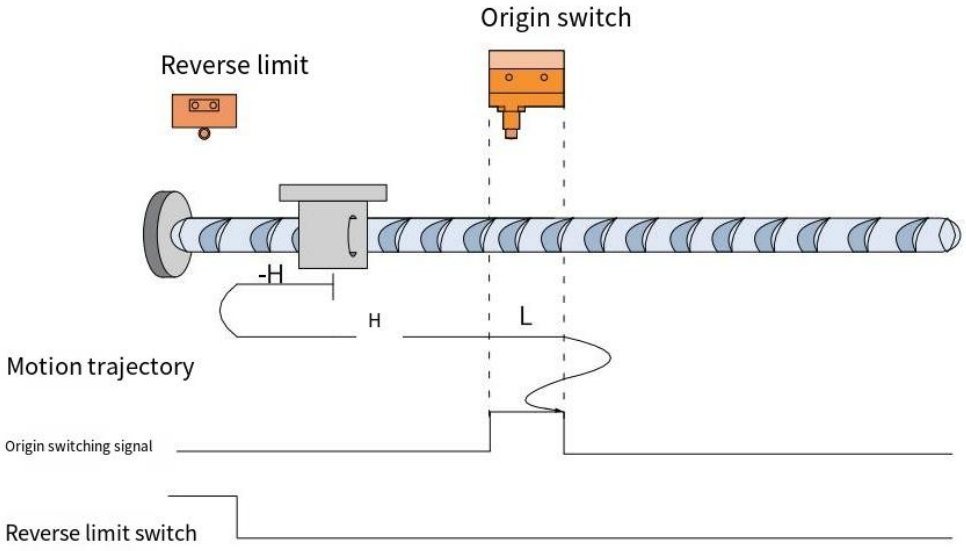
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, runs at low speed in the forward direction, and stops when encountering the falling edge of HOME.

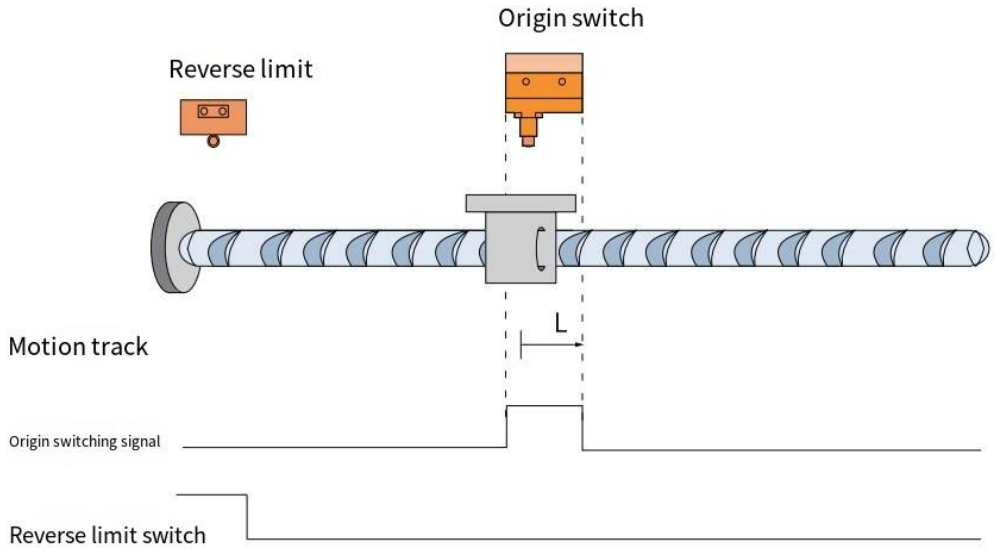
- When starting homing, the origin switch signal is invalid and encounters a negative limit switch.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it automatically runs in the

forward direction at high speed. After encountering the rising edge of HOME, it runs in the forward direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the reverse direction at low speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the forward direction at low speed. It stops after encountering the falling edge of HOME again.

- The origin switch signal is valid when starting homing.



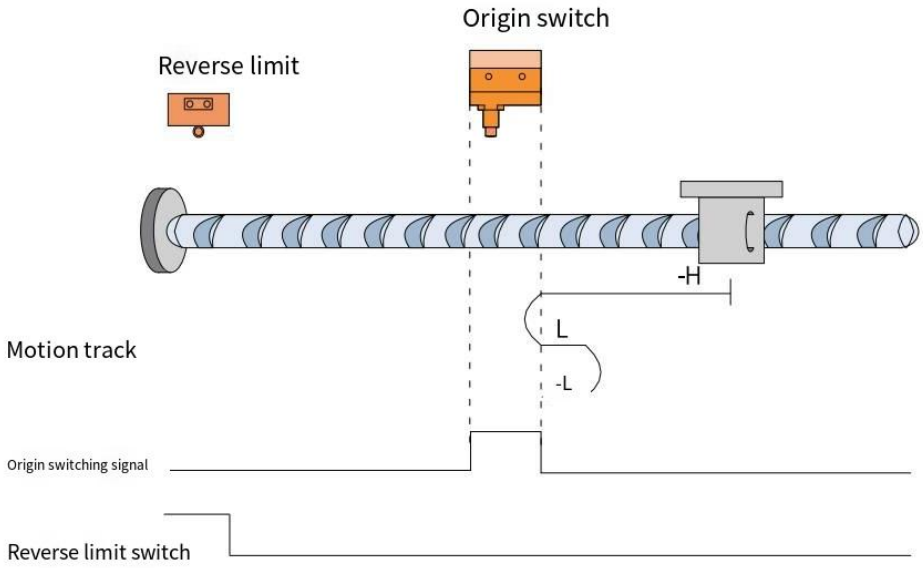
When HOME=ON, NOT=OFF, the system starts homing at a low forward speed and stops when it encounters the falling edge of HOME.

4.5.26 Method 28(6098=28)

Origin: Origin switch signal (HOME)

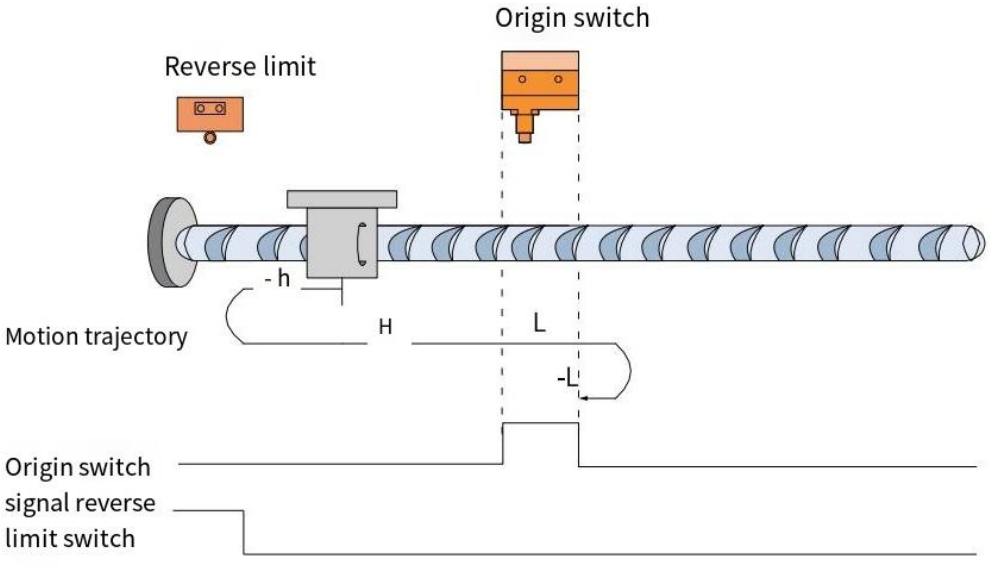
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, and runs at low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, and runs at low speed in the reverse direction. It stops after encountering the rising edge of HOME again.

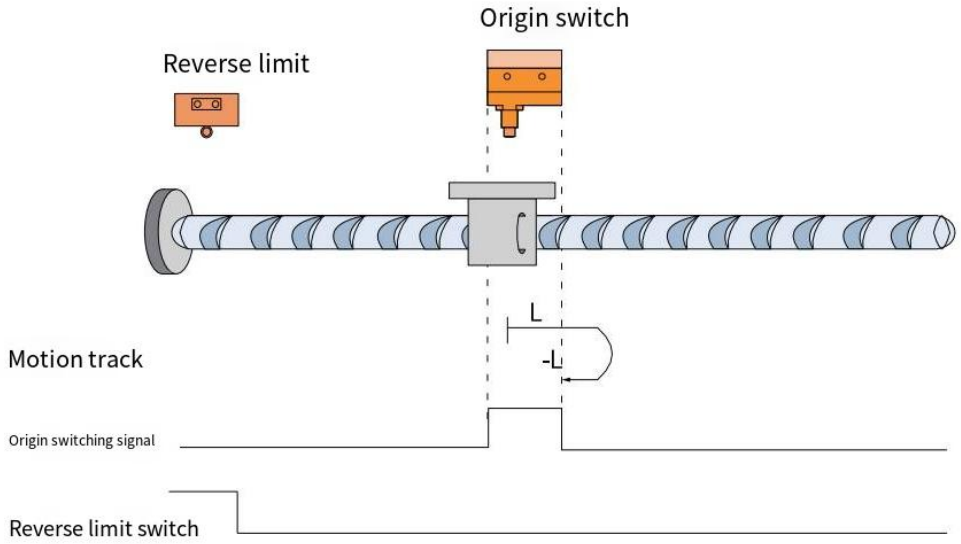
- The origin switch signal is invalid when starting homing, and a negative limit switch is encountered.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it automatically runs in the forward direction at high speed. After encountering the rising edge of HOME, it runs in the forward direction at low speed. After encountering the falling edge of

HOME, it decelerates and reverses, runs in the reverse direction at low speed, and stops after encountering the rising edge of HOME.

- The origin switch signal is valid when starting homing.



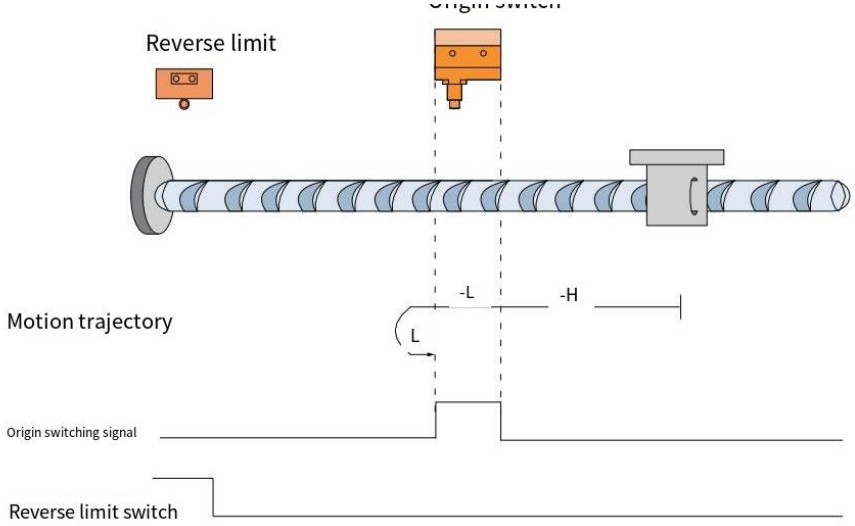
When HOME=ON, NOT=OFF, it starts homing at a low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at a low speed in the reverse direction, and stops after encountering the rising edge of HOME.

4.5.27 Method 29(6098=29)

Origin: Origin switch signal (HOME)

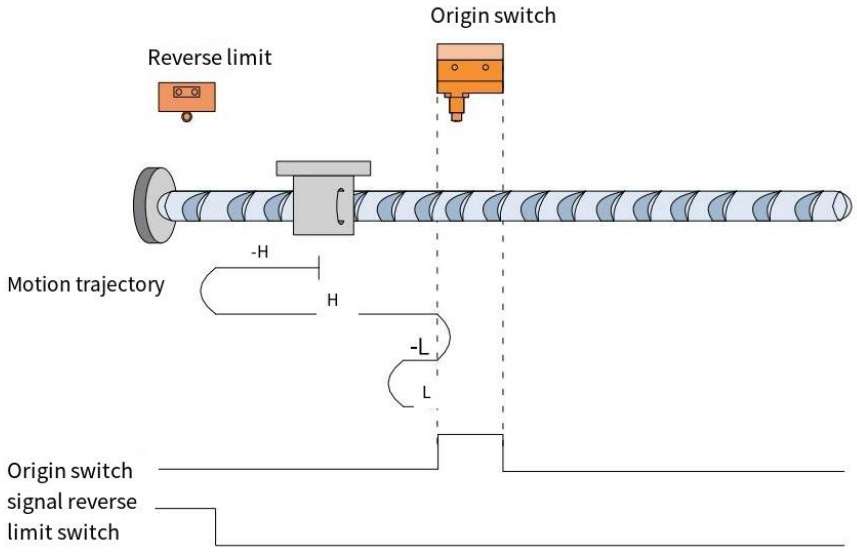
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered.



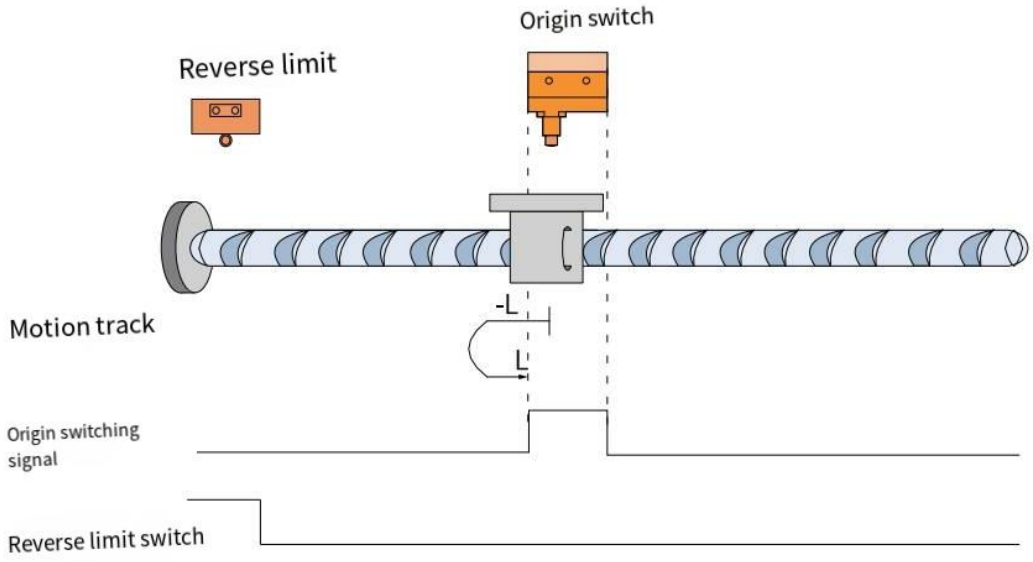
When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops after encountering the rising edge of HOME.

- The origin switch signal is invalid when starting homing, and the negative limit switch is encountered.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it automatically runs in the forward direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the forward direction at low speed. It stops after encountering the rising edge of HOME again.

- The origin switch signal is valid when starting homing.



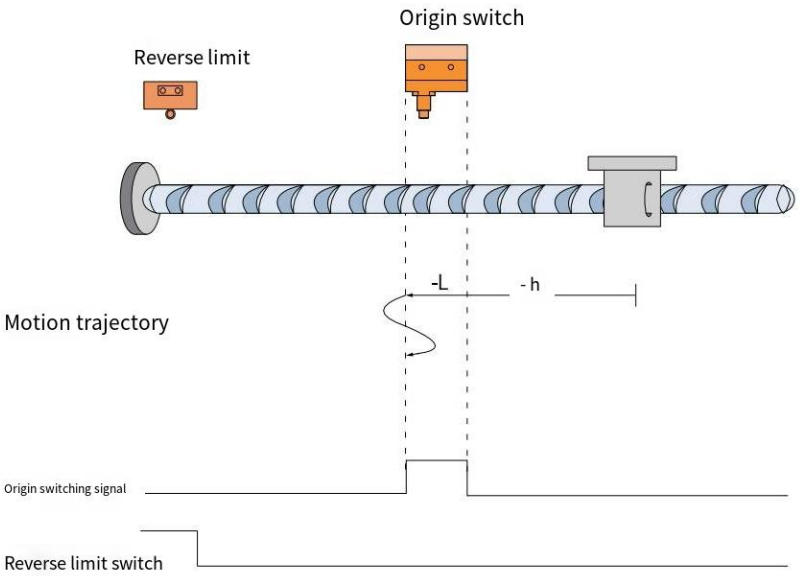
When HOME=ON, NOT=OFF, it starts homing at a low speed in the forward direction. After encountering the falling edge of HOME, it decelerates and reverses, running at a low speed in the forward direction, and stops after encountering the rising edge of HOME.

4.5.28 Method 30(6098=30)

Origin: Origin switch signal (HOME)

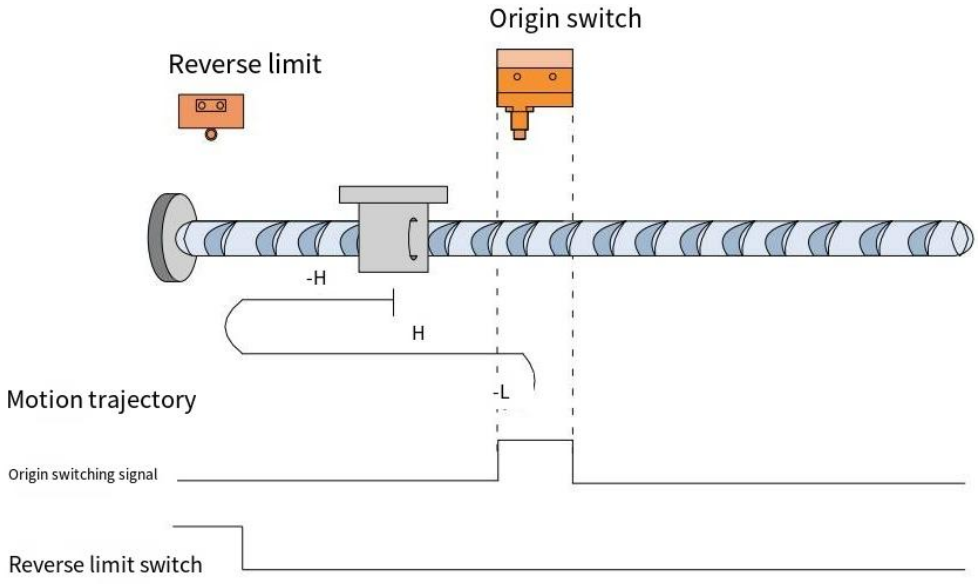
Deceleration point: Origin switch signal (HOME)

- The origin switch signal is invalid when starting homing, and no negative limit switch is encountered.



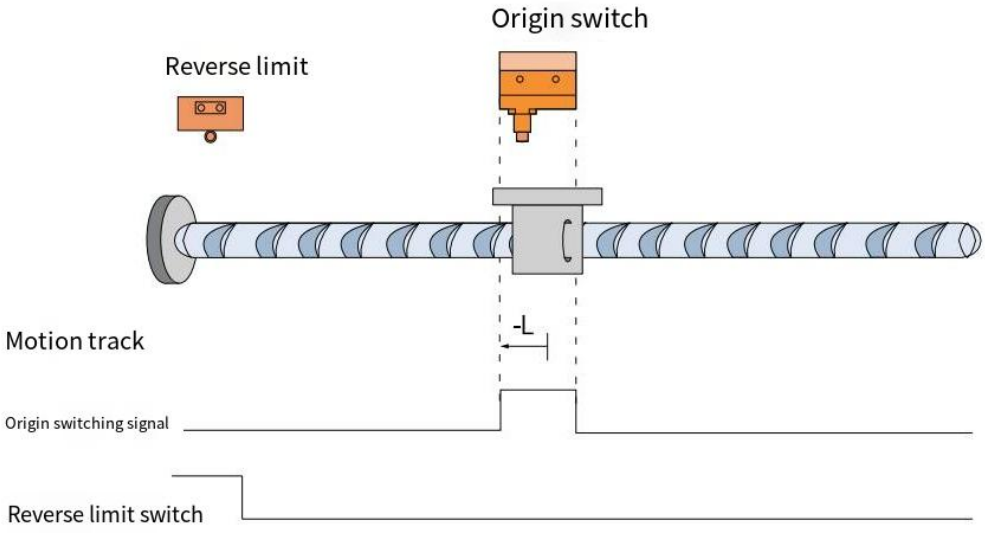
When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of HOME, it runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, runs in the forward direction at low speed, and stops after encountering the rising edge of HOME.

- When starting homing, the origin switch signal is invalid and encounters a negative limit switch.



When HOME=OFF, NOT=OFF, it starts homing at high speed in the reverse direction. After encountering the rising edge of NOT, it automatically runs in the forward direction at high speed. After encountering the rising edge of HOME, it decelerates and reverses, and runs in the reverse direction at low speed. After encountering the falling edge of HOME, it decelerates and reverses, and runs in the forward direction at low speed. It stops after encountering the rising edge of HOME again.

- The origin switch signal is valid when starting homing.

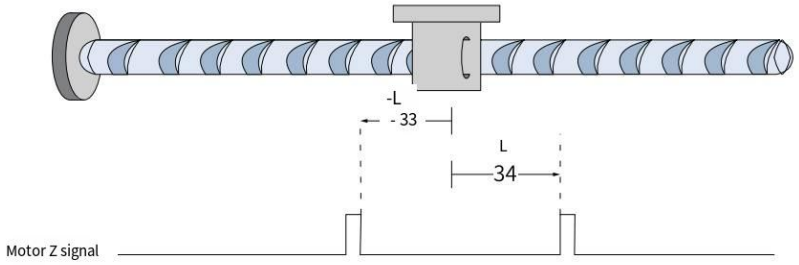


When HOME=ON, NOT=OFF, it starts homing at a low speed in the reverse direction. After encountering the falling edge of HOME, it decelerates and reverses, runs at a low speed in the forward direction, and stops after encountering the rising edge of HOME.

4.5.29 Method 33/34(6098=30/34)

Origin: Z signal

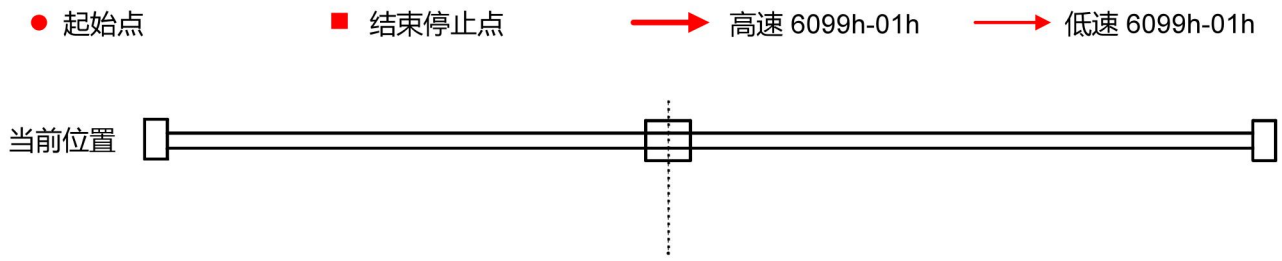
Slowdown point: None



Zero return method 33: Run in reverse at low speed and stop at the first Z signal.

Return to zero method 34: Run at low speed in the forward direction and stop at the first Z signal encountered.

4.5.30 Method 35(6098=35)



Return to zero method 35, using the current position as the mechanical origin.

SUPPORTS

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