RTELLIGENT

To become the Innovation Engine of Motion Control

Rtelligent IT57-E EtherCAT Integrated Stepper Motor

User Manual

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Revision History

Date	Updated version	Changes
2026.2	V5.0	Initial product release

Contents

1. Driver Instructions

1.1 Product Introduction

Thank you for choosing the Rtelligent IT57-E series bus stepper all-in-one. The IT57-E is an EtherCAT high-performance integrated stepper motor that integrates the functionality of an intelligent motion controller. Supports CoE (CANopen over EtherCAT).

1.1.1 Features

1. Supports CoE (CANopen over EtherCAT), compliant with CiA 402 standard
2. Supports CSP, CSV, PP, PV, Homing modes
3. Minimum synchronization cycle: 100us
4. Control methods: open-loop control, closed-loop control
5. Motor type: Two-phase
6. Debugging interface: Type-C
7. Encoder: 17-bit magnetic code (single-turn and multi-turn optional)
8. Single-turn model suffix: -E
9. Multi-turn model suffix: -EQ
10. Digital IO port
11. 4 optically isolated digital signal inputs: DI1 to DI4 are 24V single-ended inputs, supporting NPN and PNP inputs;
12. 2 channels of photoelectrically isolated digital signal output, with a maximum withstand voltage of 30V and a maximum input or output current of 100mA, common cathode connection.

1.1.2 Electrical characteristics

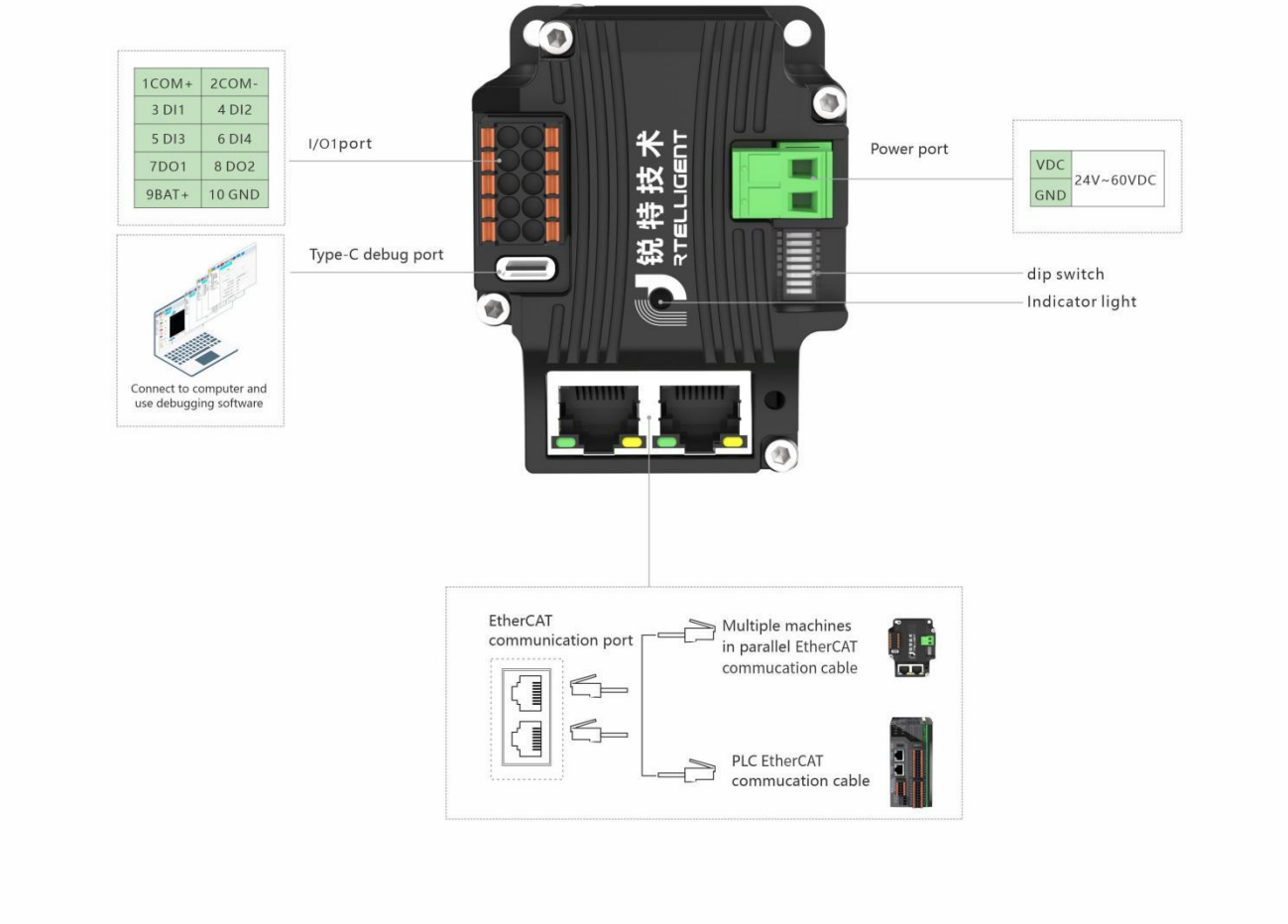
IT57-E product specifications:

Product Model	IT57-E
Output current (A)	0.5 ~ 6 A
Power supply voltage	24~80VDC

Matching motor	Two-phase stepper motor
Encoder resolution	131072
Photoelectric isolated input	4 24V inputs
Photoelectric isolation output	2 Photoelectric isolation outputs: Alarm, in place and general output
Communication interface	Dual RJ45

Do not use beyond the above regulations.

1.2 Driver wiring diagram



1.3 Digital input/output ports

The IT57-E integrated stepper has 4 digital input ports and 2 digital output ports.

1.3.1 IO port definition

Functional Classification	Signal Name	Signal Definition	Default Features	Instructions
Public end	COM+	Input public end	---	---
	COM-	Output public end	---	
Input Port	DI1	Input 1	Negative limit	Below 24V; Support co-positive (NPN); Support co-negative (PNP).
	DI2	Input 2	Positive limit	
	DI3	Input 3	Origin switch	
	DI4	Enter 4	Offline	
Output port	DO1	Output 1	Alarm output	Below 24V Only co-negative (PNP) is supported.
	DO2	Output 2	In place signal	
Battery interface	BAT+	Battery positive electrode	---	---
	GND	Battery negative terminal	---	

1.3.2 Digital input port

The IT57-E integrated stepper has 4 input ports.

Object dictionary	Name	Attributes	Type	Range	Default values	Units
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 following are the values for the input port Settings and the corresponding functions:

value	Features
0	Universal Input Port
1	Negative limit input
2	Positive limit input
3	Origin signal input
4	Clearing faults
5	Emergency stop signal
6	Motor offline
7	Probe 1
8	Probe 2

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

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

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x2008	Inputs Polarity	R/W/S	UINT	0~0xF	0xF	---

Each Bit defines the polarity of the corresponding port as follows, as Bit 0 defines the polarity of input port 1:

Bit15~bit4	Bit3	Bit2	Bit1	Bit0
---	DI4	DI3	DI2	DI1

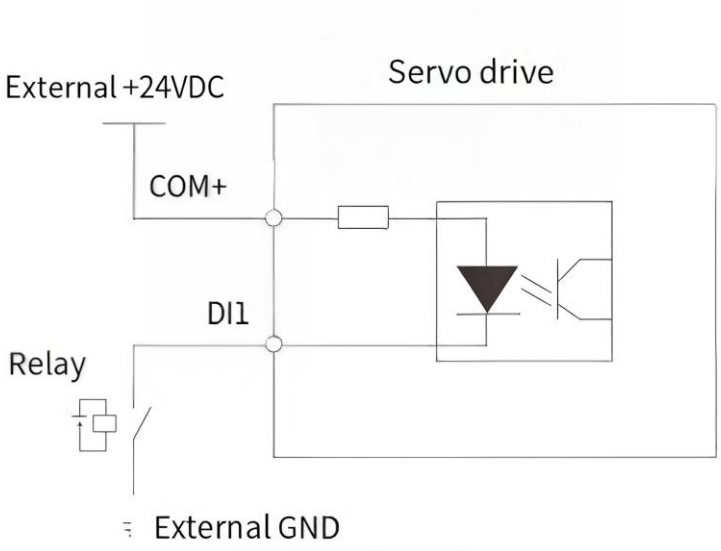
0 -- normally closed, 1 -- normally open

The input port polarity is normally open by default. The default value for 0x2008 is hexadecimal, and the factory default value is F (which is 15 in decimal). To change the polarity of DI1 (negative limit) and DI2 (positive limit) to normally closed, you need to change the corresponding Bit0 and Bit1 to 0.

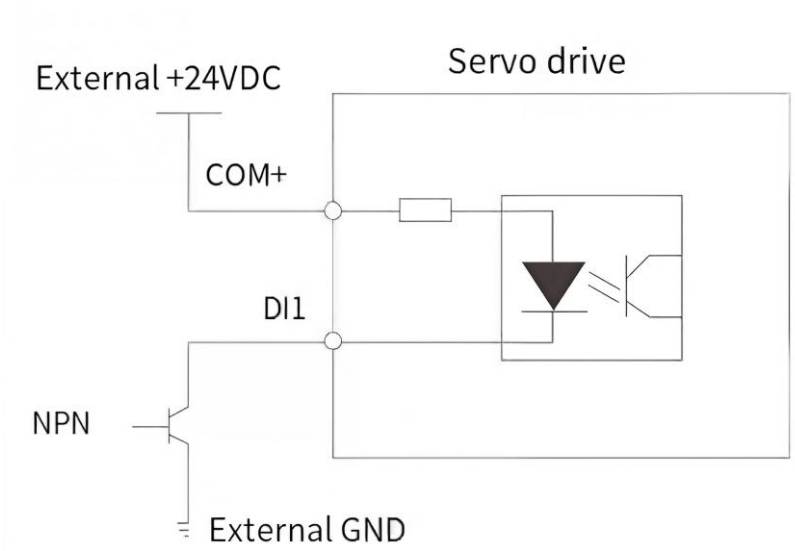
DI1 to DI4 single-ended input terminals:

For example, for DI1, the DI1 to DI4 interface circuits are the same.

When the upper device is a relay output:



When the upper device is an open collector output:



Support PNP input

1.3.3 Digital output port

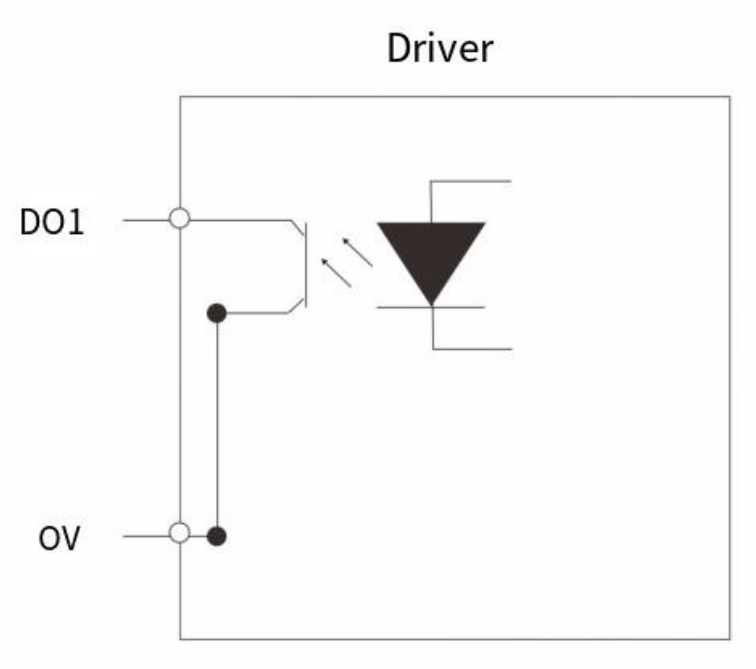
The IT57-E contains two optically isolated output signals with an output current capability of up to 30mA.

The digital output ports are all normally open by default, and the function of selecting the output ports is available through the object dictionary 0x2005, which is used to set the polarity of the output ports.

Output Port

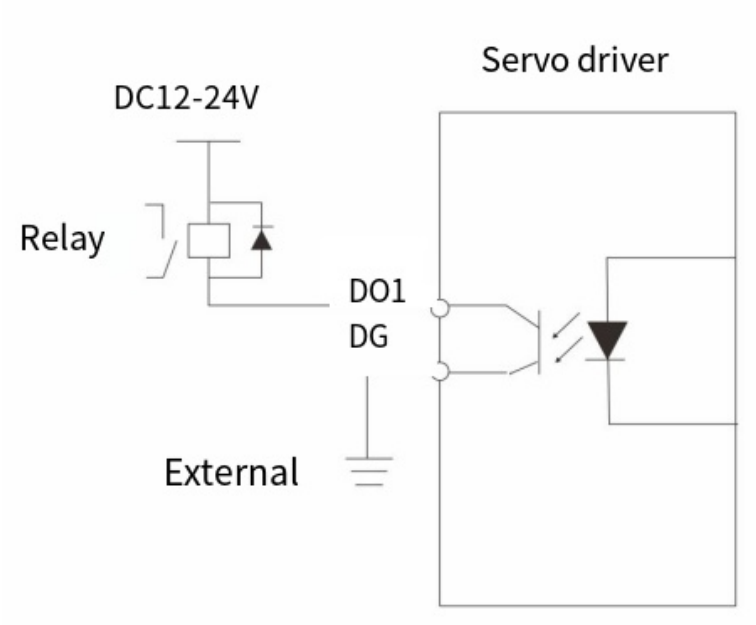
Object Dictionary	Name	Attributes	Type	Range	Default values	Units	Notes
0x2005:01	Output port 1 function	R/W/S	UINT	0 ~ 3	1	---	Output port function selection: 0 -- Custom output 1 - Alarm output 3 - In place output
0x2005:02	Output port 2 functionality	R/W/S	UINT	0 ~ 3	3	---	
0x2006	Output port polarity Settings	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

Take DO1 as an example. The circuits of DO1 to DO2 interfaces are the same:

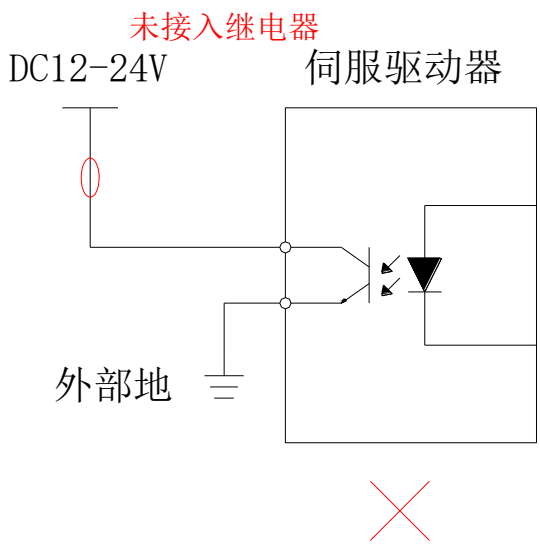


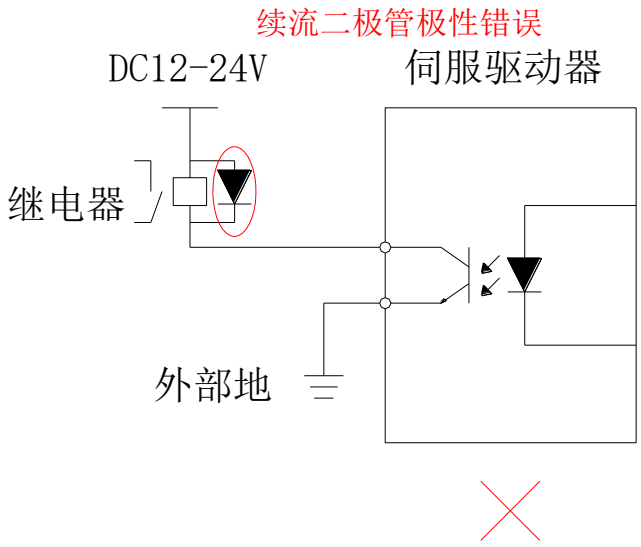
When the upper device is a relay input:

Correct wiring diagram:

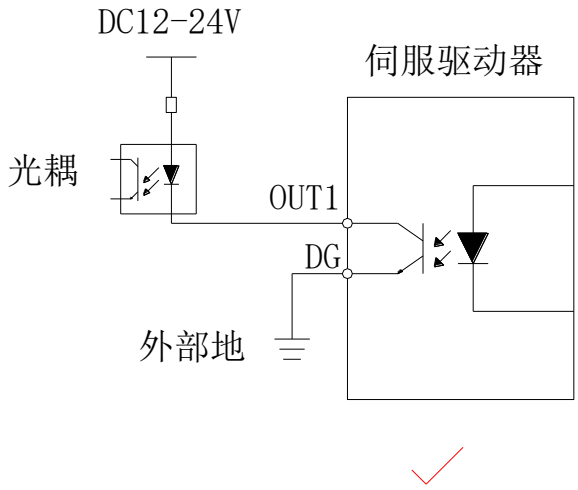


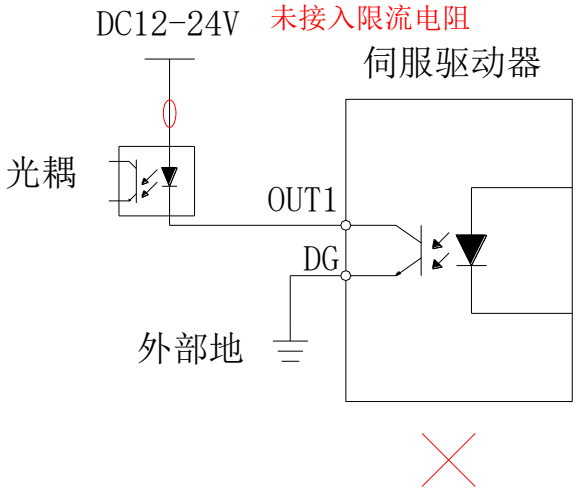
Incorrect wiring diagram:





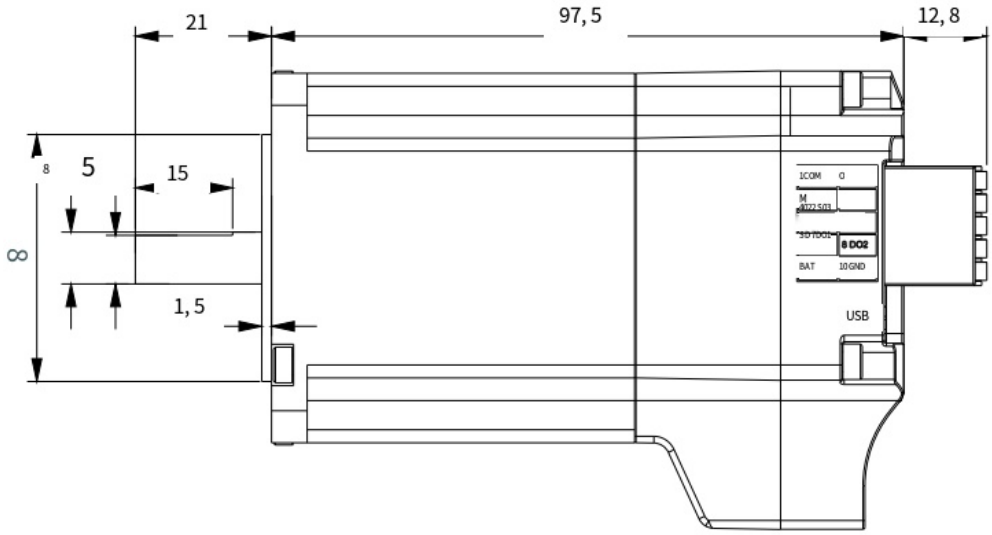
When the upper device is optocoupler input:

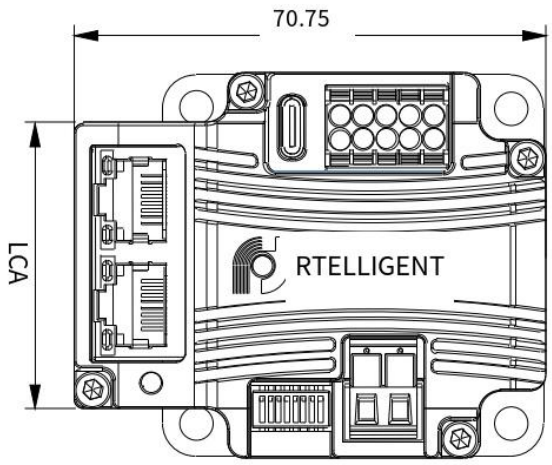


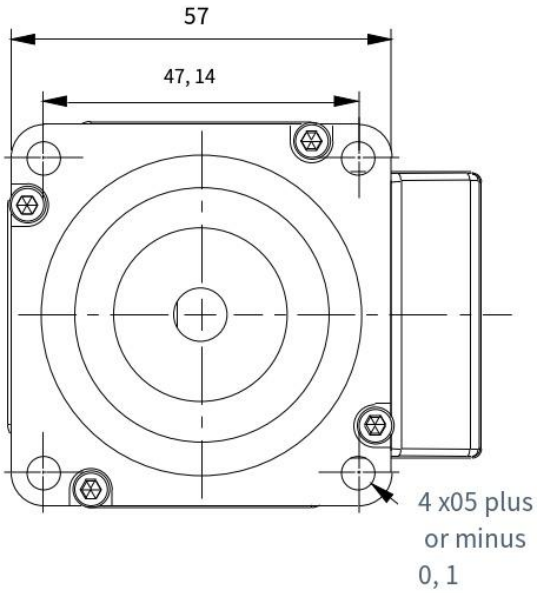


1.4 Mechanical dimensions

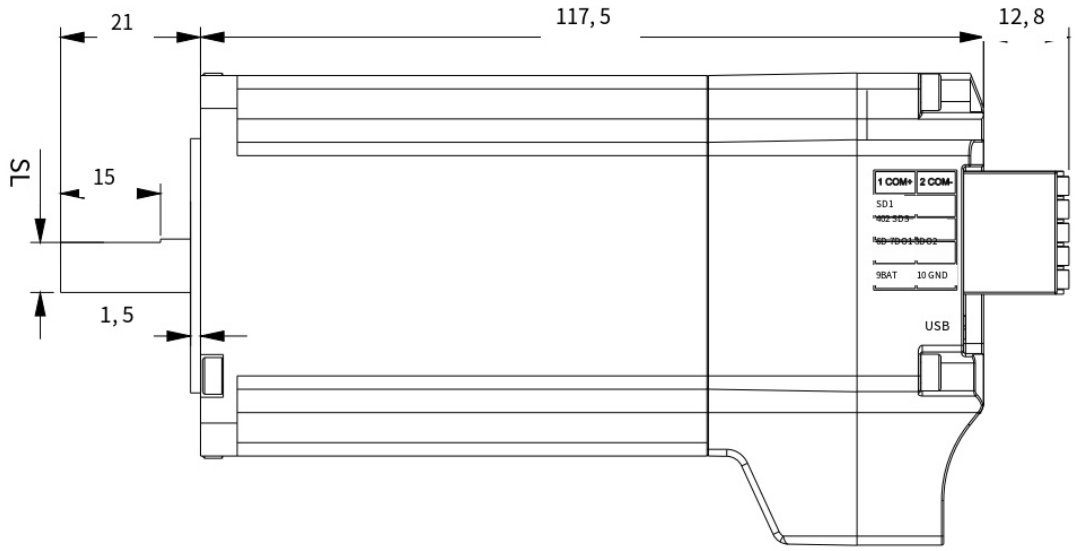
1.4.1 IT57AM13-D0821-24V-E

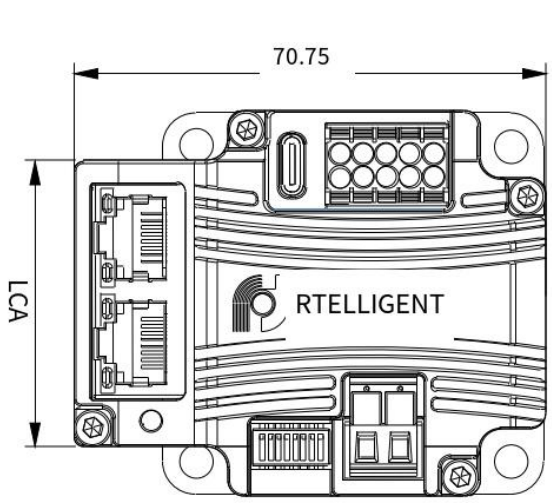


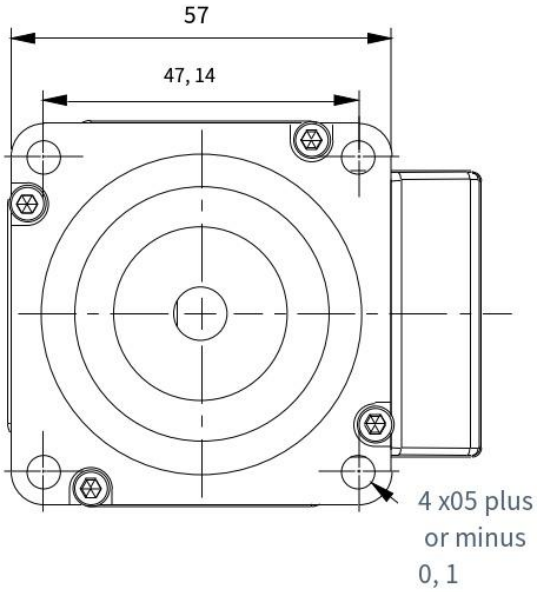




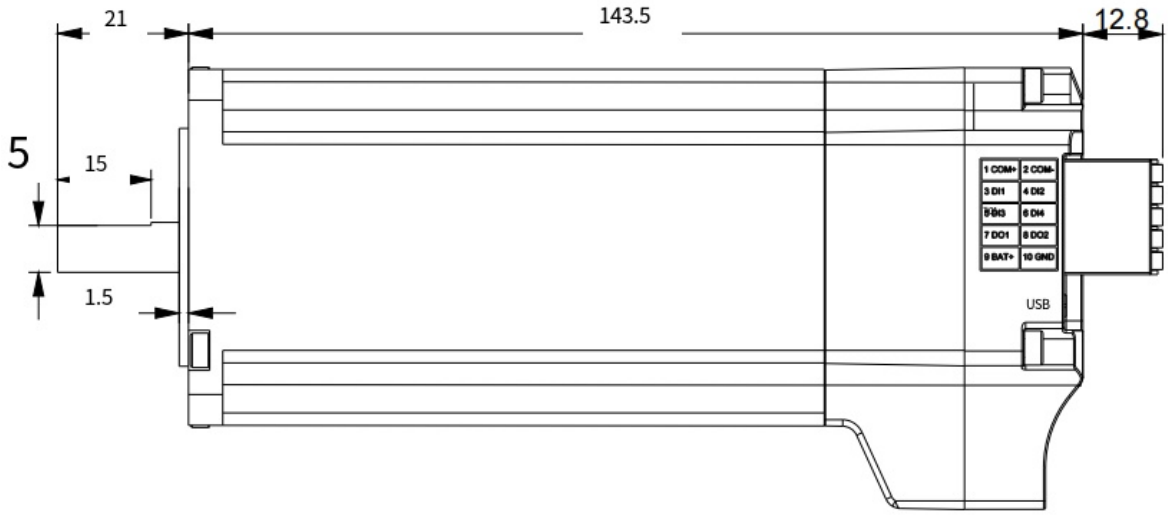
1.4.2 IT57AM23-D0821-24V-E

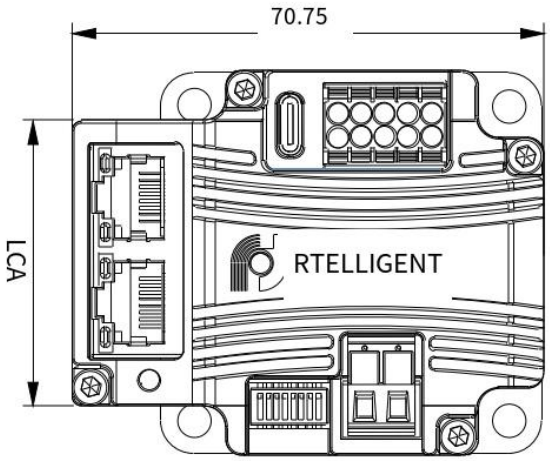


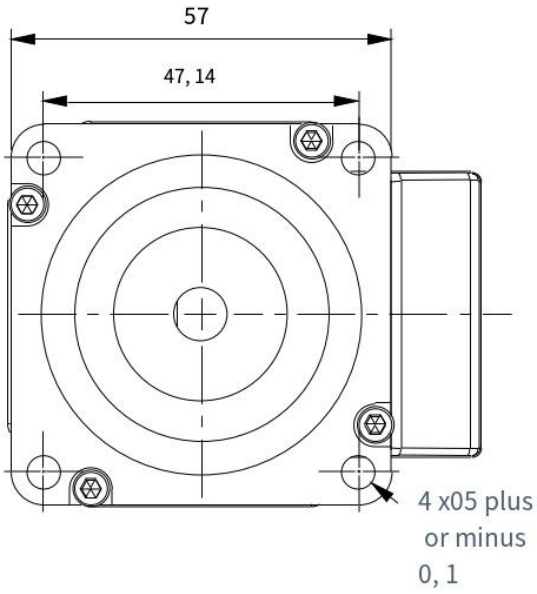




1.4.3 IT57AM30-D0821-24V-E







2. EtherCAT Communications

2.1 Communications Overview

EtherCAT Communications is an efficient, low-latency real-time industrial Ethernet protocol designed for automation. It supports a variety of network topologies, including linear, star, tree and ring, to accommodate network requirements of different scales. EtherCAT provides precise inter-node synchronization through integrated timestamp and clock synchronization capabilities, suitable for applications with high requirements for precise timing such as multi-axis control and distributed data acquisition. In addition, EtherCAT supports redundancy mechanisms such as dual network cards and ring redundancy to enhance system stability and reliability. For stepper drivers, EtherCAT communication can provide stronger anti-interference capabilities, reduce sensitivity to EMC issues, achieve more precise control and synchronization, and improve overall system performance and stability.

2.2 Communication connection Settings

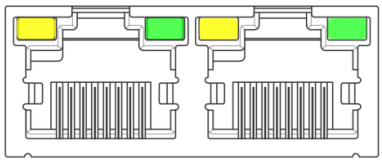
Use a CAT5E (or higher) network cable.

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

2.2.1 EtherCAT status indicator light

The RJ45 green light is used for the Link status, indicating whether there is a network cable connection.

The yellow light on the RJ45 is used for the Activity status, indicating whether there is data communication.



2.2.2 Definition of the EtherCAT communication port

Signal Name		Pin number	Description
Communication signals	TX+	1	EtherCAT data sending + end

	TX-	2	EtherCAT data sending - end
	RX+	3	EtherCAT data receiving + end
	---	4	---
	---	5	---
	RX-	6	EtherCAT data receiver - end
	---	7	---
	---	8	---

2.2.3 EtherCAT site address

The IT57-E series drives support two ways to set the slave address: Object dictionary 0x2150 setting the site alias and ESC setting the site alias and selecting through Object dictionary 0x2151.

By default, 0x2151 is 0. The node address is allocated by the master station and saved in the EEPROM.

When a user needs to set a fixed address themselves, 0x2151 should be set to 1, and then the required address value should be written into 0x2150.

0x2151	0x2150	Site Address
0	1001	The master site configures the site alias to the EEPROM 0x0004 word address of the ESC
1	Set values	Object Dictionary 2150 sets the value to the node address value

3. Object Dictionary

3.1. General Parameters

3.1.1.0x1000 device type

Object Dictionary	Name	Attributes	Type	Range	Default value	Units
0x1000	Device type	RO	UNSIGNED 32	-	0x40192	-

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

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

3.1.2.0x1008 Device name

Show the current drive model name.

Object Dictionary	Name	Attributes	Type	Range	Default value	Units
0x1008	Device name	RO	Visible string	-	IT57-E	-

3.1.3.0x1009 hardware version

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x1009	Hardware version	RO	Visible string	-	V5.0	-

3.1.4.0x100A software version

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x100A	Software version	RO	Visible string	-	V5.00	-

3.1.5.0X1010 Save parameters -- MODBUS address: 90

Sub-index of object dictionary 0x1010:01 Writing 1 will save the current parameter.

Note: When saving the parameter, stop the motor first and then save the parameter.

The data structure is as follows:

Object dictionary	Name	Attributes	Sub-indexes	Range	Default values	Units
0x1010	Store Parameter	R/W	01	-	0	-

3.1.6.0X1011 Restore factory Settings -- MODBUS address: 91

The sub-index of object dictionary 0x1011:01 Write 1 to restore the drive to factory state.

Note: When restoring to factory Settings, stop the motor first and then restore to factory Settings.

Object Dictionary	Name	Attributes	Sub-indexes	Range	Default values	Units
0x1011	Restore Parameters	R/W	01	-	0	-

3.2. Manufacturer-specific object

3.2.1.0x2000 Peak current -- MODBUS address: 0

Object dictionary	Name	"Attribute"	Type	Range	Default values	Units
0x2000	Peak Current	R/W/S	UINT	0 ~ 7000	4000	mA

This object is used to set the sinusoidal peak current when the stepper motor operates in an open loop; When matching smaller motors, modify the current before connecting the motor to prevent the motor from burning out due to excessive current.

3.2.2.0x2001 subdivision - MODBUS address: 1

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2001	Motor Resolution	R/W/S	UINT	0 ~ 65535	10000	Pulse/rev

This object is used to set the number of pulses a stepping motor needs to make one full rotation when it is running in an open-loop manner; In closed-loop mode, the subdivision is

the encoder resolution of 0x2020. If you need to modify the subdivision in closed-loop mode, first change 0x2057 to 1 and then modify the value of 0x2001. Do not modify the value of 0x2020 directly, otherwise the closed-loop mode operation will fail.

3.2.3.0x2002 standby time - MODBUS address: 2

Object dictionary	Name	Attributes	Type	Scope	Default values	Units
0x2002	Idle Time	R/W/S	UINT	0 ~ 65535	1000	ms

This object is used to set the time when the stepper motor enters standby mode after it stops running.

3.2.4.0x2003 Standby current percentage -- MODBUS address: 3

Object dictionary	Name	Attributes	Type	Range	Default value	Units
0x2003	Idle Current Percent	R/W/S	UINT	0 ~ 100	50	%

This object is used to set the percentage of the holding current relative to the operating current set by 0x2000 when the stepper motor stops running and enters standby mode.

3.2.5.0x2005 Output port function - MODBUS address: 4

Object dictionary	Name	Attributes	Type	Range	Default values	Units
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 IT57-E drive contains two output ports, and this object is used to set the functions corresponding to the output ports.

Port function is defined as follows:

value	Function
0	Custom output
1	Alarm output
3	In-place output

When set to custom output, the status of this port can be controlled by the polarity setting of 0x2006.

3.2.6.0x2006 output port polarity -- MODBUS address: 6

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2006	Outputs Polarity	R/W/S	UINT	0 ~ 31	3	---

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

0 - Normally closed

1 - normally open

Bit15~bit2	Bit1	Bit0
---	OUT2	OUT1

3.2.7.0x2007 Input port function - MODBUS address: 7-10

Object dictionary	Name	Attributes	Type	Range	Default values	Units
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 IT57-E contains four input ports, and this object is used to set the functions corresponding to the input ports:

value	Function
0	Universal Input Port
1	Negative limit input
2	Positive limit input
3	Home signal input
4	Clearing faults
5	Emergency stop signal
6	Motor offline
7	Probe 1

8	Probe 2

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

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

3.2.8.0x2008 input port polarity -- MODBUS address: 11

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2008	Inputs Polarity	R/W/S	UINT	0~F	0xF	---

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

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

0 -- normally closed, 1 -- normally open

3.2.9.0x2009 Filter time -- MODBUS address: 12

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2009	Filter Time	R/W/S	UINT	0 ~ 25600	25600	us

The IT57-E has a built-in moving average filter, and this object is used to set the time of the moving average filter. The longer the filtering time, the smoother the motor starts and stops, but the greater the motor's response lag.

Lag time = filter time

3.2.10. 0x200A lock shaft time -- MODBUS address: 13

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x200A	Soft lock Time	R/W/S	UINT	0 ~ 65535	1000	us

When the IT57-E is enabled, the stepper motor needs to be locked for initial positioning. To reduce jitter during initial positioning, the IT57-E has built-in ramp lock axis functionality. This object is used to set the ramp time of the motor locking shaft when the motor is enabled.

Lock shaft time = set value *50us

3.2.11. 0x200B current loop parameters -- MODBUS address: 14-17

Object dictionary	Name	Attributes	Type	Range	Default values	Notes

0x200B:01	AutoPI enable	R/W/S	UINT	0 ~ 1	1	The driver is initially positioned while recognizing the motor parameters and automatically calculating the PI gain: 0- Not enabled; 1- Enable
0x200B:02	Iloop_Kp	R/W/S	UINT	100 ~ 65535	1000	When 0x200B:01 is 1, this register cannot be set; When it is 0, the user can set it.
0x200B:03	Iloop_Ki	R/W/S	UINT	0 ~ 10000	200	
0x200B:04	Iloop_Kc	R/W/S	UINT	0 ~ 1024	256	Anti-integral saturation coefficient.

The IT57-E uses current control to achieve subdivision operation of stepper motors. The IT57-E series uses an automatic parameter recognition algorithm by default to identify the electrical parameters of the motor and automatically calculate the appropriate current loop PI parameters. When the automatically identified PI parameters do not meet the requirements, the user can set the parameters themselves.

3.2.12. 0x200C motor parameters -- MODBUS address: 18-23

Object Dictionary	Name	Attributes	Type	Range	Default values	Notes
0x200C:01	Motor type	R/W/S	UINT	0 ~ 1	0	0 - Two-phase stepper motor 1 - Three-phase stepper motor, reserved function, not available in the current version
0x200C:02	Resistance Auto	R	UINT	100 ~ 65535	1000	When the automatic PI is on, the resistance value of the motor winding is recognized. Unit: mOhm
0x200C:03	Inductance Auto	R	UINT	0 ~ 10	1	When the automatic PI is enabled, the inductance value of the motor winding is recognized. Unit: mH
0x200C:04	Resistance Set	R/W/S	UINT	0 ~ 10000	1000	Motor winding resistance value Unit: mOhm
0x200C:05	Inductance Set	R/W/S	UINT	1 ~ 10	1	Motor winding inductance value Unit: mH
0x200C:06	BEMF coefficient	R/W/S	UINT	0 ~ 1000	256	Back electromotive force coefficient

Servo Mode 1:

When the IT57-E operates in servo mode 1, the motor parameters themselves do not participate in motor control, and users do not need to set them specifically. The user can

determine whether the motor connection is normal by checking the self-identification resistance and inductance values of this object.

Servo Mode 2:

When the IT57-E operates in servo Mode 2, the closed-loop stepper motor is in FOC control mode. Due to the special structure of the stepper motor, demagnetization control is required for FOC control. The demagnetization control parameters are estimated from the resistance, inductance and back electromotive force coefficient of the motor.

Usually the automatically estimated resistance and inductance can meet the requirements, and the user can also set the resistance to inductance according to the motor parameters provided by the motor manufacturer. The counter electromotive force coefficient can be calculated using the following formula:

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

3.2.13. 0x200D running direction - MODBUS address: 24

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x200D	Invert motor direction	R/W/S	UINT	0 ~ 1	0	---

If the forward direction of the motor is not consistent with the system requirements, the object can reverse the motor's running direction without modifying the motor wiring.

3.2.14. 0x200E internal alarm code -- MODBUS address: 25

Object dictionary	Name	Attributes	Type	Default value
0x200E	Alarm Code	R	UINT	0

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

Alarm code	Decimal values	Alarm status
0x0001	1	Internal voltage error
0x0002	2	Over-current alarm
0x0004	4	Over-voltage alarm
0x0008	8	Under-voltage alarm
0x0010	16	The encoder end is disconnected
0x0020	32	Parameter storage error
0x0040	64	Motor phase loss

0x0080	128	Closed-loop deviation
0x0400	1024	Emergency stop alarm

When the above fault occurs, after eliminating the fault condition, the fault codes for 0x603F and 0x200E will be cleared by writing 0x80 to the 0x6040 object. (Note that under-voltage and encoder terminal disconnection can be automatically restored by external conditions, while over-current and internal voltage errors cannot be cleared by the upper computer alarm)

3.2.15. 0x200F internal status code -- MODBUS address: 26

Object dictionary	Name	Attributes	Type	Default values
0x200F	Status Code	R	UINT	0

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

Status code	Decimal values	Status
0x0001	1	Drive enable
0x0002	2	Drive failure
0x0004	4	Arrival signal
0x0008	8	Whether the motor is running or stopped
0x0010	16	homing is completed
0x0020	32	Drive ready
Others	reserved	reserved

3.2.16. 0x2010 position clear -- MODBUS address: 27

Object dictionary	Name	Attributes	Type	Range	Default values	"Unit
0x2010	Zero Position	R/W	UINT	0 ~ 1	0	---

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

Typically used in situations where the motor is moving in one direction all the time, 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 have a saturation problem.

3.2.17. 0x2011 Control mode - MODBUS address: 28

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2011	Control mode	R/W/S	UINT	0 ~ 2	1	---

Set the working mode of the stepper motor. (Sync with the driver's firmware, generally no change)

0 - Run in an open loop

1 - Closed loop operation

2 - Closed-loop operation /FOC mode

3.2.18. 0x2020 encoder resolution -- MODBUS address: 29

Object dictionary	Name	Attributes	Type	Range	Default values	"Unit
0x2020	Encoder Resolution	R/W/S	UINT	0 ~ 65535	4000	Pulse/rev

When the stepper motor operates in a closed-loop mode, you need to set the encoder resolution corresponding to one revolution of the motor. Once this parameter is set, it needs to be saved and then powered on again to take effect.

3.2.19. 0x2021 encoder parameters -- MODBUS address: 30

Object dictionary	Name	Attributes	Type	Range	Default values	Notes
0x2021	Encoder parameters	R	UINT	0 ~ 255	0	Encoder parameters
0x2021	Encoder single-turn value	R	INT	- 2147483648 ~ 2147483648	0	Encoder single-turn values Unit: Pulse/rev
0x2021	Encoder multi-turn value	R	INT	- 2147483648 ~ 2147483648	0	Encoder multi-turn values Unit: Pulse/rev
0x2021	Number of rotations	R	INT	- 2147483648 ~ 2147483648	0	Number of turns Unit: R
0x2021	Offset multi-turn value	R	INT	- 2147483648 ~ 2147483648	0	The value of multiple turns after offset Unit: R

This object reflects the current position of the motor in one circle.

3.2.20. 0x2022 position deviation alarm threshold -- MODBUS address: 31

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2022	Position deviation Error Limit	R/W/S	UINT	1000 ~ 30000	4000	Pulse/rev

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

3.2.21. 0x2023 Servo Mode 1 control parameters -- MODBUS address: 33-37

Object dictionary	Name	Attributes	Type	Range	Default values	Notes
0x2023:01	PosLoop_Kp	R/W/S	UINT	0 ~ 10000	2000	Proportional gain: Adjusting motor position response rigidity
0x2023:02	PosLoop_Ki	R/W/S	UINT	0 ~ 1000	0	Integral gain, used to eliminate positional 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 resonances Typically this gain cannot be greater than 200

This object is only effective for IT57-E series drives with closed-loop control in servo mode 1. Gain is usually set to default.

3.2.22. 0x2024 arrival signal -- MODBUS address: 38-40

Object dictionary	Name	Attributes	Type	Range	Default values	Remarks
0x2024:01	InPosMode	R/W/S	UINT	0 ~ 10000	0	In place signal determination mode 0 - Detect at all times 1 - Detect after the pulse command stops
0x2024:02	InPosCnt	R/W/S	UINT	0 ~ 1000	10	It is considered in place when the position error is less than the set pulse value and persists for the set time in place.
0x2024:03	InPosTime	R/W/S	UINT	0 ~ 10000	1000	

This object works in the closed-loop mode of the IT57-E series and is used to detect whether the motor is within the set accuracy range.

3.2.23. 0x2025 Servo speed filter - MODBUS address: 41-43

Object dictionary	Name	Attributes	Type	Range	Default values	Notes
0x2025:01	FV1_HZ	R/W/S	UINT	0 ~ 1000	200	Set the filter in 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 works in IT57-E servo mode 2 and is used to set the bandwidth of the speed loop feedback parameter.

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

FV2_HZ is used to set the bandwidth of the speed feedback filter's secondary low-pass filter. Typically set FV2HZ = 3* FV1_HZ

FPOUT_HZ is used to set the bandwidth of the FOC speed loop number output variable, and the default value is usually adopted.

3.2.24. 0x2026 Servo Mode 2 control parameters -- MODBUS address: 44-48

Object dictionary	Name	Attributes	Type	Range	Default values	Notes
0x2026:01	PVIA_Kp	R/W/S	UINT	0 ~ 10000	2000	Position-proportional gain: adjusting motor position response rigidity.
0x2026:02	PVIA_Ki	R/W/S	UINT	0 ~ 1000	100	Integral gain, used to eliminate positional 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 works under the condition that the IT57-E is in servo mode 2, using the vector control algorithm.

Typically PVIA_Kv1+ PVIA_Kv2 > PVIA_Kvff

3.2.25. 0x2043 speed given -- MODBUS address: 49

Object dictionary	Name	Attributes	Type	Range	Default values	"Unit
0x2043	Speed Reference	R	UINT	0 ~ 65535	0	RPM

This object reflects the given speed of the current motor.

3.2.26. 0x2044 Speed feedback -- MODBUS address: 50

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2044	Speed Feedback	R	UINT	0 ~ 65535	0	RPM

This object reflects the actual speed of the current motor.

3.2.27. 0x2048 bus voltage -- MODBUS address: 51

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x2048	Bus Voltage	R	UINT	---	0	10mV

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

3.2.28. 0x2049 Input level -- MODBUS address: 52

Object dictionary	Name	Attributes	Type	Range	Default values	Units
0x2049	Input Level	R	UINT	---	0	---

Show 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 - has an input signal

3.2.29. 0x204A output level -- MODBUS address: 53

Object dictionary	Name	Attributes	Type	Scope	Default values	Units
0x204A	Output Level	R	UINT	---	0	---

Show the physical level of the current output port

Bit15~bit2	Bit1	Bit0
---	OUT2	OUT1

0 -- indicates that there is output at the current output port

1 - indicates no output at the current output port

3.2.30. 0x2057 Pulse selection per turn (closed-loop mode) -- MODBUS address: 55

Object dictionary	Name	"Attribute "	Type	Range	Default values	Units
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

3.2.31. 0x2060 Harmonic amplitude of the first resonance point

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

Used to eliminate the vibration at the first resonance point of a two-phase stepping motor. This method offsets resonance by adding a certain amount of harmonics on the basis of the set current. It is necessary to adjust the amplitude and phase of the harmonics to eliminate the vibration.

3.2.32. 0x2061 First Resonance point A phase harmonic phase

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x2061	Phase A of First Anti-Vibration	R/W/S	UINT	0-1024	0	---

Adjust the harmonic phase of the A-phase winding

3.2.33. 0x2062 First resonance point B phase harmonic phase

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x2062	Phase B of First Anti-Vibration	R/W/S	UINT	0-1024	0	---

Adjust the harmonic phase of the B-phase winding

3.3. CiA 402 Object dictionary

3.3.1. 0x603F fault code

Object Dictionary	Name	Attributes	Type	Range	Default values
0x603F	Error Code	RW	UINT	---	0

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

The fault code is as follows:

Error Code	Description
0x3150	Internal voltage error in Phase A circuit
0x3151	Internal voltage error in Phase B circuit
0x2211	Over-current error
0x3210	Over-voltage error
0x3220	Under-voltage error
0x5441	Phase A of the encoder is disconnected
0x5442	Phase B of the encoder is disconnected
0x5443	Both encoder AB are disconnected
0x7500	Communication failure
0x7122	Motor error or phase loss fault
0x8611	Tracking error exceeds limit
0x5445	Emergency stop alarm

3.3.2.0x6040 control word

This object is used to control the state of the drive and the motion. It can enable/disable the drive; Starting and stopping the motor; Clearing faults, etc.

Object dictionary	Name	Attributes	Type	Range	Default values
0x6040	Control Word	RW	UINT	---	0

The bits of the control word are defined as follows:

Bit	Description
0	Servo ready (Switch ON)
1	Enable Voltage
2	Quick Stop
3	Enable Operation
4	New Set-Point/Home Start

5	Change Set Immediately
6	Absolute/Relative position
7	Fault Reset
8	Halt
9	Operation mode related
10	Reserved
11-15	Manufacturer-specific

Detailed combinations of Bit 0-3 and Bit7:

Commands	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 bits 4, 5, 6, 8, and 9 in their respective related modes are as follows:

PP mode

Bit	Name	value	Description
4	A new target location	0 - > 1	Switch from 0 to 1 and set a new target position
5	Reserved		
6	Absolute/Relative	0	Absolute position mode
		1	Relative position mode
8	Pause	0	The motor waits to complete positioning
		1	Stop running
9	Reserved		

PV mode

Bit	Name	value	Description
8	Pause/Run	0	Run the motor to the set speed
		1	The motor slows down to 0 and stops

homing mode

Bit	Name	value	Description
4	Start homing	0 - > 1	Start homing
8	Pause	0	Controlled by bit4
		1	Stop homing

3.3.3.0x6041 status word

This object sets the probe functionality.

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

Register bits are defined as follows:

Bit	Description
0	Servo Ready To Switch ON
1	Can turn ON (Switch ON)
2	Operation Enabled
3	Fault
4	Voltage Enabled on the main circuit
5	Quick Stop
6	The Switch is Disabled.
7	Warning
8	Reserved
9	Remote control
10	Target reach/ Speed Reach
11	Internal Limit Active
12-13	Depending on the mode of operation
14	Manufacturer specific
15	Home found

Bit 9: Remote

Bit9 is used to show whether the control word is set. This bit indicates Control word has settled.

3.3.4.0x6060 operation mode

Used to set the operation mode.

Object Dictionary	Name	Attributes	Type	Range	Default values
0x6060	Mode of Operation	RW	INTEGER8	---	0

The IT57-E series bus driver 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)

3.3.5.0x6061 operation mode display

Display the current operation mode, defined as 0x6060.

Object dictionary	Name	Attributes	Type	Range	Default values
0x6061	Mode of Operation Display	R	INTEGER8	---	0

3.3.6.0x6064 Actual location

Show the actual position of the current motor in Pulse

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

3.3.7.0x606C actual speed

Show the actual position of the current motor in Pulse/s

Object dictionary	Name	Attributes	Type	Range	Default values
0x606C	Position Actual Velocity	R	INTEGER32	---	0

3.3.8.0x607A target location

This object sets the target location in PP mode and CSP mode. The unit is Pulse.

Object dictionary	Name	Attributes	Type	Scope	Default values
0x607A	Profile Target Position	RW	INTEGER32	---	0

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

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

3.3.9.0x607C zero offset

This object is used to set the offset of the zero sensor from position 0. The unit is Pulse.

Object dictionary	Name	Attributes	Type	Range	Default values
0x607C	Home Offset	RW	INTEGER32	---	0

3.3.10. 0x6081 Profile velocity

This object is used to set the maximum speed for the trapezoidal acceleration and deceleration command in PP mode. The unit is Pulse/s

Object dictionary	Name	Attributes	Type	Range	Default values
0x6081	Profile Velocity	RW	INTEGER32	---	10000

3.3.11. 0x6083 Profile acceleration

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

Object Dictionary	Name	Attributes	Type	Range	Default values
0x6083	Profile Acceleration	RW	INTEGER32	---	100000

3.3.12. 0x6084 Profile deceleration

This object is used to set the deceleration of the trapezoidal acceleration/deceleration command in PP mode, PV mode, with the unit of Pulse/s^2

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

3.3.13. 0x6098 homing method

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

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

Describe the reference homing mode in detail.

3.3.14. 0x6085 Quick-stop Deceleration

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

Object dictionary	Name	Attributes	Type	Range	Default values
0x6085	Quick-stop Deceleration	RW	INTEGER32	---	500000

3.3.15. 0x6099 homing speed

This object sets the speed at which the motor homing.

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x6099:01	Homing Velocity (fast)	R/W/S	UNSIGNED32	---	10000	Pulse/s
0x6099:02	Homing Velocity (slow)	R/W/S	UNSIGNED32	---	2000	Pulse/s

3.3.16. 0x609A homing acceleration

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

Object dictionary	Name	Attributes	Type	Range	Default values
0x609A	Homing Acceleration	RW	UNSIGNED32	---	100000

3.3.17. 0x60B8 probe function Settings

This object sets the probe function.

Object Dictionary	Name	Attributes	Type	Range	Default values
0x60B8	Touch Probe Function	RW	UNSIGNED16	0 ~ 65535	0

Register bits are defined as follows:

Bit	Value	Definition
0	0	Probe 1 disabled
	1	Probe 1 enabled
1		Reserved
2		Reserved
3		Reserved
4	0	Disable Probe 1 rising edge latch
	1	Enable Probe 1 rising edge latch
5	0	Disable Probe 1 falling edge latch
	1	Enable Probe 1 falling edge latch
6		Reserved
7		Reserved
8	0	Probe 2 Prohibited
	1	Probe 2 enabled
9		Reserved
10		Reserved
11		Reserved
12	0	Disable Probe 2 rising edge latch
	1	Enable Probe 2 rising edge latch
13	0	Disable Probe 2 falling edge latch
	1	Enable Probe 2 falling edge latch
14		Reserved
15		Reserved

Positive positions are locked at the rising edge moment, and negative positions are locked at the falling edge moment.

3.3.18. 0x60B9 probe status

This object defines the functional status of the probe.

Object Dictionary	Name	Attributes	Type	Range	Default value
0x60B9	Touch Probe Status	R	UNSIGNED16	0 ~ 65535	0

Status bits are defined as follows:

Bit	Value	Definition
0	0	Probe 1 disabled
	1	Probe 1 enabled

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	Reserved
8	0	Probe 2 disabled
	1	Probe 2 enabled
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	Reserved

3.3.19. 0x60BA probe 1 positive latch value

This object holds the position where the rising edge of Probe 1 is latched.

Object dictionary	Name	Attributes	Type	Range	Default values
0x60BA	Touch Probe 1 Positive Value	R	UNSIGNED32	0 ~ 65535	0

3.3.20. 0x60BB probe 1 negative latch value

This object holds the position where Probe 1 is latched along the falling edge.

Object dictionary	Name	Attributes	Type	Range	Default values
0x60BB	Touch Probe 1 Negative Value	R	UNSIGNED32	0 ~ 65535	0

3.3.21. 0x60BC probe 2 positive latch value

This object holds the position where the rising edge of Probe 2 is latched.

Object dictionary	Name	Attributes	Type	Range	Default values
0x60BC	Touch Probe 2 Positive Value	R	UNSIGNED32	0 ~ 65535	0

3.3.22. 0x60BD probe 2 negative latch value

This object stores the position where the falling edge of Probe 2 is latched.

Object Dictionary	Name	Attributes	Type	Range	Default values
0x60BD	Touch Probe 2 Negative Value	RO	UNSIGNED32	0 ~ 65535	0

3.3.23. 0x60FD input port logical state

This object monitors the input port of the drive.

Object Dictionary	Name	"Attribute"	Type	Range	Default values
0x60FD	Digital Inputs	RO	UNSIGNED32	0 ~ 65535	0

Bit0	CW negative limit	0 -- invalid 1 - The limit takes effect
Bit1	CCW positive limit	
Bit2	HOMING signal	0 -- zero invalid 1 - zero is valid
Bit3~ Bit15	Reserved	
Bit16	IN1	Physical state of the input port 0 - Input signal invalid 1 - The input signal is valid
Bit17	IN2	
Bit18	IN3	
Bit19	IN4	
Bit20	IN5	
Bit21	IN6	
Bit22~Bit31	Reserved	

3.3.24. The logical state of the 0x60FE output port

This object controls the digital output signal

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x60FE:01	physical outputs	R/W	UNSIGNED32	---	0	
0x60FE:02	bit mask	R/W	UNSIGNED32	---	0	

Physical outputs:

Bit 0 to 15 are reserved functions.

Bit 16-17 is used to control OUT1-out2.

Bits 18 to 31 are reserved

0 and 1 correspond to output off and on

Bit mask:

Bit 0 to 15 are reserved functions.

Bit 16-17 is used to enable OUT1-out2.

Bits 18 to 31 are reserved

0 and 1 control whether the output port is enabled.0 - not enabled, 1 - enabled

3.3.25. 0x60FF PV mode speed Settings

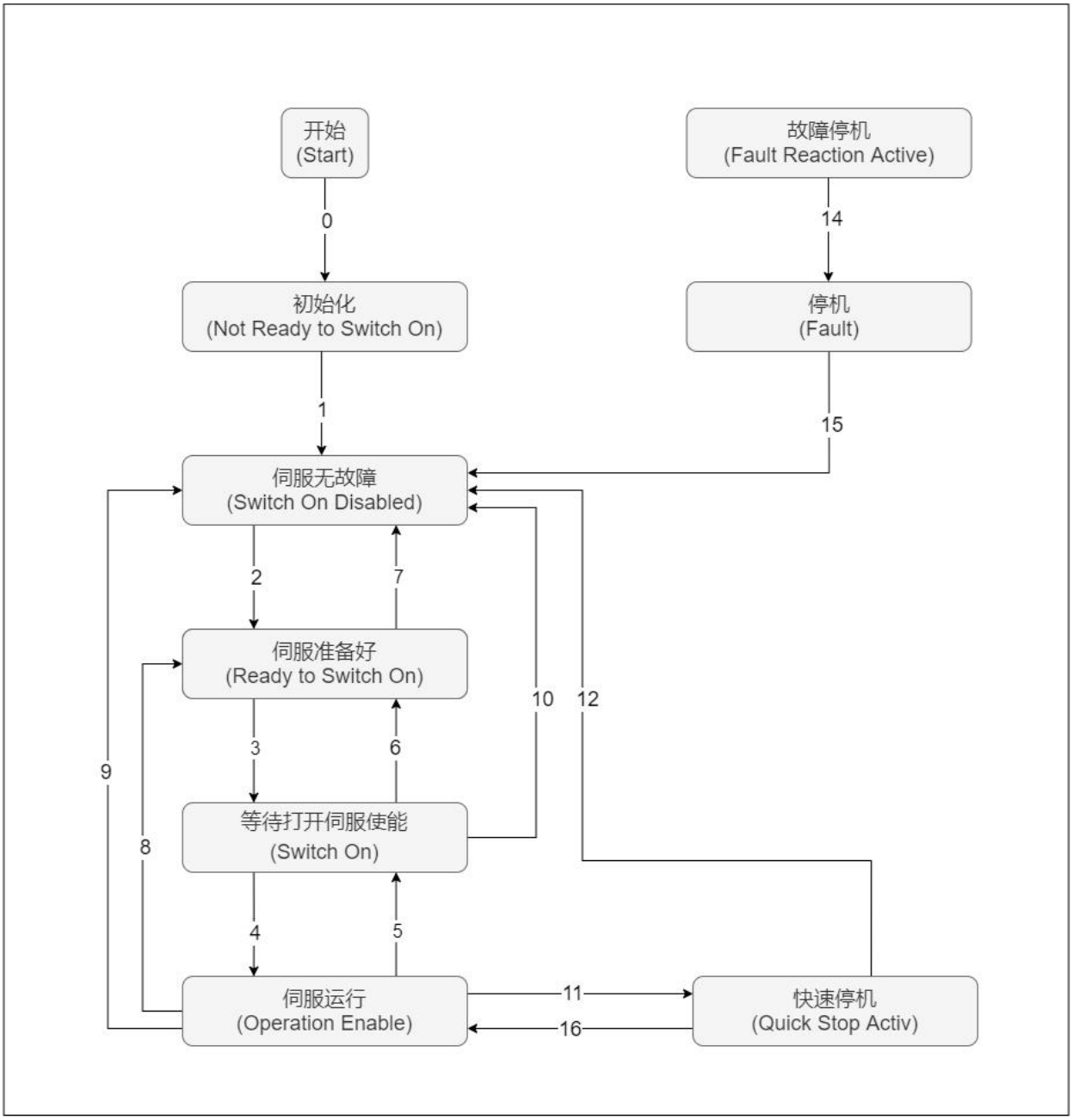
This object sets the speed in PV mode in units of Pulse/s

Object Dictionary	Name	Attributes	Type	Range	Default values	Units
0x60FE:01	physical outputs	R/W	UNSIGNED32	---	0	
0x60FE:02	bit mask	R/W	UNSIGNED32	---	0	

This object is 32-bit signed data, with positive and negative values representing the two directions in which the motor is running.

3.4. Servo status Settings

The servo drive must be guided according to the process specified in the standard CiA 402 protocol in order to operate in the desired state.



Initialization	Drive initialization and internal self-test have been completed Drive parameters cannot be set, nor can drive functions be executed
Servo without fault	Servo drive has no fault, or errors have been cleared Drive parameters can be set

Servo ready	The servo drive is ready Drive parameters can be set
Wait for the servo to be enabled	Servo drive waiting for servo enable to be turned on Driver parameters can be set
Servo running	The driver is running normally, a servo operation mode has been enabled, the motor is powered on, and the motor rotates when the command is not zero
Quick stop	The quick stop function is activated, and the drive is executing the quick stop function The driver parameter attribute can be set if it is "Run Changes", otherwise it cannot be set
Fault stop	The drive has failed and is in the process of performing a fault stop. Drive parameter attribute "Run Changes" can be set; otherwise, it cannot be set
Fault	The fault stop is completed, all drive functions are disabled, and drive parameters are allowed to be changed in order to troubleshoot.

Control commands and status switching:

CiA402 Status switching		Control word 6040h	Status word 6041h Bit0 to Bit9
0	Power on → Initialize	Automatic transition after stop completes	0x0000
1	Initialization → Servo no fault	Automatic transition after stop completes	0x0250
2	Servo no faults → Servo ready	0x0006	0x0231
3	Servo ready → Waiting for servo enable	0x0007	0x0233
4	Waiting for servo enable →Operation enabled	0x000F	0x0237

5	Operation enabled → Waiting for servo enable	0x007	0x0233
6	Waiting for servo enable→ Servo ready	0x006	0x0231
7	Servo ready → servo no fault	0x0000	0x0250
8	Operation enabled → Servo ready	0x0006	0x0231
9	Operation enabled→ Servo no fault	0x0000	0x0250
10	Wait to enable the servo → servo no fault	0x0000	0x0250
11	Servo running → Quick stop	0x0002	0x217
12	Quick stop→ Servo no fault	A natural transition after the stop is completed, no control instructions required	0x0250
13	→ Fault stop	In any state other than "Fault", the servo drive will automatically switch to the fault stop state upon failure without command control	0x021F
14	Fault stop → Fault	After the fault is done for you, a natural transition is needed without control instructions	0x0218
15	Fault → Servo no fault	0x80	0x0250
16	Quick stop → Operation enabled	Once the stop is complete, send 0x0F	0x0237

3.4.1. Control word 6040h

Index 6040h	Name	Control word					Data structure	VAR	Data types	Uint16
	Data range	0～65535	Factory Settings	0	Accessibility	RW	Related Patterns	ALL	Can it be mapped	RPDO

Set control instructions:

Bit	Name		Description
0	Servo operation can be enabled	Switch on	0: Invalid, 1: valid
1	Connect the main circuit power	Enable voltage	0: Invalid, 1: valid
2	Quick shutdown	Quick stop	0: Invalid, 1: valid
3	Operation enabled	Enable operation	0: invalid, 1: valid
4～6	Operation mode related	Operation mode specific	Related to servo operation mode
7	Fault Reset	Fault reset	For resettable faults and warnings, perform the fault reset function Bit7 rising edge is effective; Bit7 remains at 1, and all other control instructions are invalid
8	Pause	Halt	See Object dictionary 605Dh for how to pause in each mode
9	Run Mode related	Operation mode specific	Related to each servo operation mode
10	Reserve	ReveR5L EtherCAT	Undefined
11～15	Manufacturer-specific	Manufacturer-specific	Manufacturer's Own

It is meaningless to assign each Bit of the control word separately; it must be combined with other bits that do not constitute a certain control instruction.

Bit0 to Bit3 and Bit7 have the same meaning in each servo mode, and commands must be sent in sequence to direct the servo driver to the desired state according to the CiA402 state machine switching process, with each command corresponding to a determined state;

Bit4 to Bit6 are related to each servo mode. Please refer to the control instructions for different modes.

Bit9 does not define functions.

3.4.2. Status word 6041h

Index	Name	Status words					Data structure	VAR	Data types	Uint16
6041h	Data range	0～65535	Factory Settings	0	Accessibility	RO	Related Patterns	ALL	Can it be mapped	TPDO

Reflecting the current operating status of the servo drive:

Bit	Name		Description
0	Servo ready	Ready to switch on	0: Invalid, 1: valid
1	Servo operation can be enabled	Switch on	0: Invalid, 1: valid
2	Operation enabled	Operation enabled	0: Invalid, 1: valid
3	Fault	Fault	0: Invalid, 1: valid
4	The main circuit is powered on	Voltage enabled	0: Invalid, 1: valid
5	Quick shutdown	Quick stop	0: Invalid, 1: valid
6	The servo is not running	Switch on disabled	0: Invalid, 1: valid
7	Warnings	Warning	0: Invalid, 1: valid
8	Manufacturer-specific	Manufacturer specific	Undefined functionality
9	Remote control	Remote	0: Ineffective, 1: effective (control words take effect)
10	Target reached	Target reached	0: Invalid, 1: valid
11	Internal restrictions are valid	Internal limit active	0: Invalid, 1: valid
12～	Operation mode	Operation limit	Related to each servo operation mode

13	related	active	
14	Manufacturer specific	Manufacturer specific	Undefined function
15	Reserved	---	---

Display values (binary values)	Description
xxxx xxxx x0xx 0000	Not ready to switch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready to switch on
xxxx xxxx x01x 0011	Start (Switch on)
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

Bit0 to Bit9 have the same meaning in all servo modes. After the control word 6040h sends commands in sequence, the servo gives a definite state.

Bit12 to Bit13 are associated with each servo mode (see control instructions for different modes)

Bit10, Bit11, and Bit15 have the same meaning in each servo mode and indicate the state of the servo

after it executes a certain servo mode.

3.5. Servo mode Settings

3.5.1. Introduction to Servo Mode

<table>
<tr><td rowspan="2">---</td><td>Name</td><td colspan="5">Support servo running mode</td><td>Data structures</td><td>---</td><td>Data types</td><td>---</td></tr>
<tr><td>Data Range</td><td>-</td><td>Factory Settings</td><td>---</td><td>Accessibility</td><td>---</td><td>Related mode</td><td>-</td><td>Can it be mapped</td><td>---</td></tr>
<tr><td colspan="11">Reflect the servo operating mode supported by the drive:
<table>
<tr><th></th><th>Description</th><th>Support or not (0: no support, 1: Support)</th></tr>
<tr><td>0</td><td>Profile Position Mode (PP)</td><td>1</td></tr>
<tr><td>1</td><td>Velocity Mode (VL)</td><td>0</td></tr>
<tr><td>2</td><td>Profile Velocity Mode (PV)</td><td>1</td></tr>
<tr><td>3</td><td>Profile Torque Mode (PT)</td><td>0</td></tr>
<tr><td>4</td><td>NA</td><td>0</td></tr>
</table></td></tr>
</table>

5	Homing Mode (HM)	1
6	Interpolated Position Mode (IP)	0
7	Cyclic Synchronous Position Mode (CSP)	1
8	Cyclic Synchronous Velocity Mode (CSV)	1
9	Cyclic Synchronous Torque Mode (CST)	0
10～31	NA	0

Index 6060 h	Name	Mode selection					Data structure	VAR	Data types	Int16
	Data range	0～10	Factory Settings	8	Acces sibility	RW	Related Patterns	ALL	Can it be mapped	RPDO

Select the servo operation mode

Settings	Servo mode
0/2/5	NA
1	Profile Position Mode (PP)
3	Profile Velocity Mode (PV)
4	Profile Torque Mode (PT)
6	Homing Mode (HM)
7	Interpolated Position Mode (IP)
8	Cyclic Synchronous Position Mode (CSP)
9	Cyclic Synchronous Velocity Mode (CSV)
10	Cyclic Synchronous Torque Mode (CST)

Index 6061 h	Name	Operation mode display					Data structure	VAR	Data types	Int16
	Data range	0～10	Factory Settings	0	Acces sibility	RO	Related Patterns	ALL	Can it be mapped	TPDO

Swear the current operating mode of the servo drive:

Set values	Servo mode
0/2/5	NA
1	Profile Position Mode (PP)
3	Profile Velocity Mode (PV)
4	Profile Torque Mode (PT)
6	Homing Mode (HM)
7	Interpolated Position Mode (IP)
8	Cyclic Synchronous Position Mode (CSP)
9	Cyclic Synchronous Velocity Mode (CSV)
10	Cyclic Synchronous Torque Mode (CST)

3.5.2. Mode switching

Notes for using the servo operation status switching mode:

(1) When the servo drive is in any state, after switching from Profile Position Mode or Cyclic Synchronous Position Mode to another mode, any unexecuted position commands will be discarded.

(2) When switching from other modes to run in a cyclic synchronous mode, please wait at least 5 ms before sending commands; otherwise, command loss or errors may occur.

3.6. Cyclic Synchronous Position Mode (CSP)

In Cyclic Synchronous Position Mode, the host controller performs position command planning and then sends the planned target position (607Ah) to the servo drive in a cyclic synchronous manner. Position and speed control are then completed internally by the servo drive.

3.6.1. Related objects

Control word 6040h

position	Name	Description
0	Servo ready (Switch On)	The motor is enabled when Bit0 to Bit3 values are all 1
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
7	Fault Reset	0: No effect 1: Reset drive fault

Status word 6041h		
position	Name	Description
10	Target Reached	0: Target position not reached 1: Target position arrived
11	Internal Limit Active	0: Both position command and position feedback are within limits 1: Either position command or position feedback exceeds the limit
12	Slave command following	0: Slave not following command 1: Slave following command
13	Following Error	0: No excessive position deviation fault 1: Excessive position deviation fault has occurred
15	Reserve	---

3.6.2. Suggested configuration

RPDO	TPDO	Instructions
6040h: Control Word	6041h: Status Word	Must
607Ah: Target Position	6064h: Position Actual Value	Must
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
	603Fh: Error Code	Optional
	60FDh: Digital Inputs	Optional

3.7. Cyclic Synchronous Velocity Mode (CSV)

In Cyclic Synchronous Velocity Mode, the host controller sends the planned target velocity (60FFh) to the servo drive in a cyclic synchronous manner, and the velocity control is completed internally by the servo drive.

3.7.1. Related objects

Control word 6040h		
position	Name	Description
0	Servo ready (Switch On)	The motor is enabled when Bit0 to Bit3 values are all 1
1	Enable Voltage	
2	Quick Stop	
3	Operation enabled	
7	Fault Reset	0: No effect 1: Reset drive fault

Status word: 6041h		
position	Name	Description
10	Target Reached	0: Target speed not reached 1: Target speed reached
11	Internal Limit Active	0: Both position command and position feedback are within limits 1: Either position command or position feedback exceeds the limit
12	Driver Follow the Command	0: Slave not following command 1: Slave following command
15	Reserve	---

3.7.2. Suggested Configuration

RPDO	TPDO	Instructions
6040h: Control Word	6041h: Status Word	Must
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
60FFh: Target Velocity		Must
	6064h: Position Actual Value	Optional
	606Ch: Velocity Actual Value	Optional
	603Fh: Error Code	Optional
	60FDh: Digital Inputs	Optional

3.8. Profile Position Mode (PP)

Profile Position Mode is mainly used for point-to-point positioning applications. In this mode, the host controller provides the target position (absolute or relative), as well as the velocity, acceleration, and deceleration of the position profile. The internal trajectory generator of the servo drive generates the target position profile command based on the settings, and the drive internally completes position and speed control.

3.8.1. Related objects

Control word 6040h		
position	Name	Description
0	Servo ready (Switch On)	The motor is enabled when Bit0 to Bit3 values are all 1
1	Enable Voltage	
2	Quick Stop	
3	Operation enabled	
4	New Set-Point	A rising edge from 0 to 1 indicates that a new target position (607Ah), profile velocity (6081h), acceleration (6083h), and deceleration (6084h) are pre-triggered.
5	Change Set Immediately	0: Not immediately updated 1: Immediately updated
6	Absolute/Relative position	0: Slave not following command 1: Slave following command
7	Fault Reset	0: No action 1: Reset drive fault
8	Halt	0: Servo follows Bit0–Bit3 settings 1: Servo stops according to 605Dh setting
Status word 6041h		
position	Name	Description
10	Target Reached	0: Target position not reached 1: Target position arrived
11	Internal Limit Active	0: Both position command and position feedback are within limits 1: Either position command or position feedback exceeds the limit
12	Set-Point Acknowledge	0: The slave did not follow the instruction 1: The slave follows the instruction
13	Following Error	0: No excessive position deviation fault 1: Excessive position deviation fault has occurred
15	Reserve	---

3.8.2. Position curve generator

1. Immediate Update Mode

(1) The host controller first updates other attributes of the position command as needed (acceleration time 6083h, deceleration time 6084h, profile velocity 6081h, target position 607Ah).

(2) The host controller sets bit4 of control word 6040h from 0 to 1, indicating that a new position command is ready to be enabled on the slave.

(3) Upon detecting the rising edge of bit4 in 6040h, the slave determines whether it can accept the new position command:

If the initial state of bit5 in 6040h is 0 and bit12 in 6041h is 0, the slave can accept the new position command ①. After accepting the new position command, the slave sets bit12 of 6041h from 0 to 1, indicating that the new position command ① has been accepted and the slave is currently unable to accept further new position commands. In Immediate Update Mode, once the new position command is accepted (bit12 of 6041h changes from 0 to 1), the servo executes the position command immediately.

(4) Only after receiving that bit12 of status word 6041h has become 1 can the host controller release the position command data and set bit4 of control word 6040h from 1 to 0, indicating that no new position command is pending. Since bit4 of 6040h is edge-sensitive, this operation does not interrupt the position command currently being executed.

(5) When the slave detects that bit4 of control word 6040h has changed from 1 to 0, it can set bit12 of status word 6041h from 1 to 0, indicating that the slave is ready to accept a new position command.

- When the slave detects that bit4 of 6040h changes from 1 to 0, it always clears bit12 of 6041h.
- If a new position command ② is accepted while the previous position command ① is still being executed, the unexecuted part of command ① is not discarded. For relative position commands, after the second position command completes, the total position increment = target position increment of ① (607Ah) + target position increment of ② (607Ah). For absolute position commands, after the second position command completes, the user absolute position = target position of ② (607Ah).

2. Not an immediate update

(1) The host computer first updates other properties that modify the displacement command as needed (acceleration time 6083h, deceleration time 6084h, contour speed 6081h, target displacement 607Ah).

(2) The host computer sets bit4 of 6040h from 0 to 1, indicating that the slave station has a new displacement command that needs to be enabled.

(3) After receiving the rising edge of bit4 of 6040h, the slave station makes a judgment on whether it can receive the new displacement instruction:

If the initial state of bit5 of 6040 is 0 and bit12 of 6041h is 0 at this time, it indicates that the slave station can receive the new displacement instruction ①; After the slave receives the new displacement instruction, set the bit12 of 6041 from 0 to 1, indicating that the new displacement instruction ① has been received, and the slave is currently in a state where it cannot continue to receive the new displacement instruction.

(4) The host computer can release the displacement instruction data and set the bit4 of the control word 6040h from 1 to 0, indicating that there are no new position instructions at present. Since the bit4 of 6040h is valid along the change, this operation does not interrupt the displacement instruction being executed.

(5) When the slave station detects that the bit4 of the control word 6040 changes from 1 to 0, after the current segment positioning is completed, it releases the bit12 of 6041, indicating that the slave station is ready to receive new displacement instructions. In non-immediate update mode, the servo cannot receive new displacement instructions while the current segment is running. Once the current segment positioning is completed, the servo can receive new displacement instructions. Once received (bit12 of 6041 changes from 0 to 1), the servo immediately executes the displacement instructions.

3.8.3. Suggested configuration

RPDO	TPDO	Instructions
6040h: Control Word	6041h: Status Word	Must
607Ah: Target Position	6064h: Position Actual Value	Must
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
6081h: Profile Velocity		Must
6083h: Profile Acceleration		Optional
6084h: Profile Deceleration		Optional

3.9. Profile Velocity Mode (PV)

In this mode, the host computer sends the target speed, acceleration, and deceleration to the servo driver, and the speed adjustment is performed internally by the servo.

3.9.1. Related objects

Control word 6040h		
position	Name	Description

0	Servo ready (Switch On)	The motor is enabled when Bit0 to Bit3 values are all 1
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
7	Fault Reset	0: No effect 1: Reset drive fault
8	Halt	0: The server is set from Bit0 to Bit3 1: Pause the servo at 605Dh

Status word 6041h		
position	Name	Description
10	Target Reached	0: Target speed not reached 1: Target speed reached
11	Internal Limit Active	0: Position instructions and position feedback are not out of limit 1: Position command or position feedback is out of limit
15	Retain	---

3.9.2. Suggested Configuration

RPDO	TPDO	Instructions
6040h: Control Word	6041h: Status Word	"Must
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
60FFh: Target Velocity		Must
6083h: Profile Acceleration	6064h: Position Actual Value	Optional
6084h: Profile Deceleration	606Ch: Velocity Actual Value	Optional
	603Fh: Error Code	Optional
	60FDh: Digital Inputs	Optional

3.10. Homing Mode (HM)

Homing mode is used to find the mechanical origin and to determine the positional relationship between the mechanical origin and the mechanical origin.

- Mechanical origin: A fixed position on a machine that corresponds to a definite homing switch or motor Z signal.
- Mechanical origin: The absolute homing position on a machine.

After homing is completed, the motor stops at the mechanical home. By setting 607Ch, the relationship between the Mechanical origin and the mechanical origin can be defined:

Mechanical origin = mechanical origin + 607Ch (origin offset)

When 607Ch = 0, the Mechanical origin coincides with the mechanical origin.

3.10.1. Related objects

Control word 6040h		
position	Name	Description
0	Servo ready (Switch On)	The motor is enabled when Bit0 to Bit3 values are all 1
1	Enable Voltage	
2	Quick Stop	
3	Enable operation	
4	Home Start	0 -> 1: Start to home 1: Homing 1 -> 0: End to home
7	Enable operation	0: No effect 1: Reset drive failure
8	Halt	0: The servo decides whether to start homing by setting Bit4 1: Pause the servo by setting 605Dh

Status word 6041h		
position	Name	Description
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Both position command and position feedback are within limits 1: Either position command or position feedback exceeds the limit
12	Homing Attained	0: Both position command and position feedback are within limits 1: Either position command or position feedback exceeds the limit
13	Homing Error	0: No homing error occurred 1: Homing error occurred
15	Reserve	---

3.10.2. Suggested configuration

RPDO	TPDO	Instructions

6040h: Control Word	6041h: Status Word	Must
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
6098h: Homing Method		Optional
6099-01h: Speed during search for switch		Optional
6099-02h: Speed during search for zero	603Fh: Error Code	Optional
609Ah: Homing acceleration	60FDh: Digital Inputs	Optional

3.11. Homing method

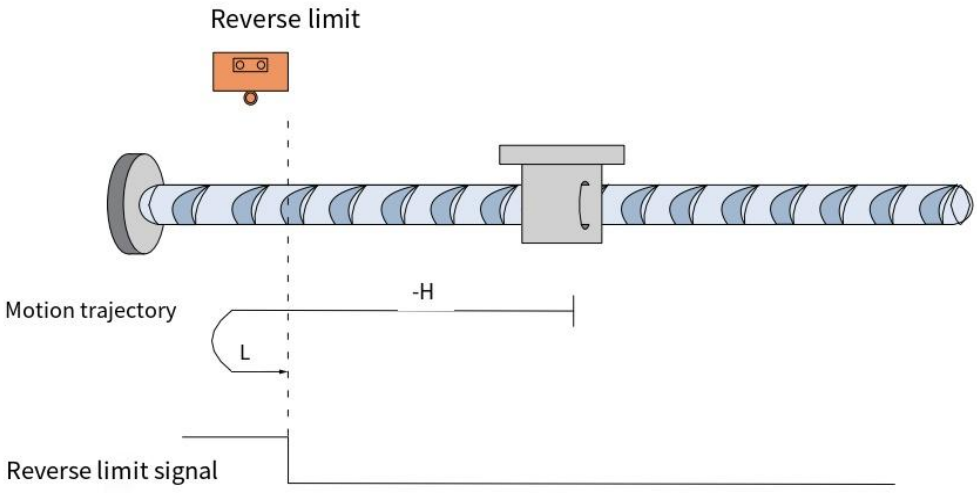
The IT57-E drive supports 17 to 35 return-to-origin methods, which are defined and the return-to-origin process as follows:

3.11.1 Method 17 (6098=17)

HOME: Reverse limit Signal (NOT)

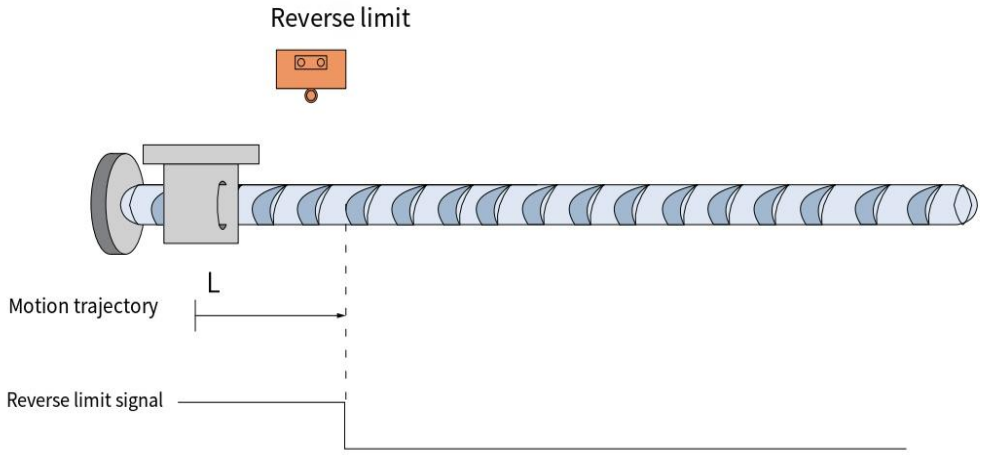
Deceleration point: Reverse limit signal (NOT)

- The reverse limit signal is invalid when starting homing



Start the homing when NOT=OFF, start the homing at reverse high speed, decelerate and reverse after encountering the NOT rising edge, run forward at low speed, stop after encountering the NOT falling edge.

- The reverse limit signal is effective when starting homing



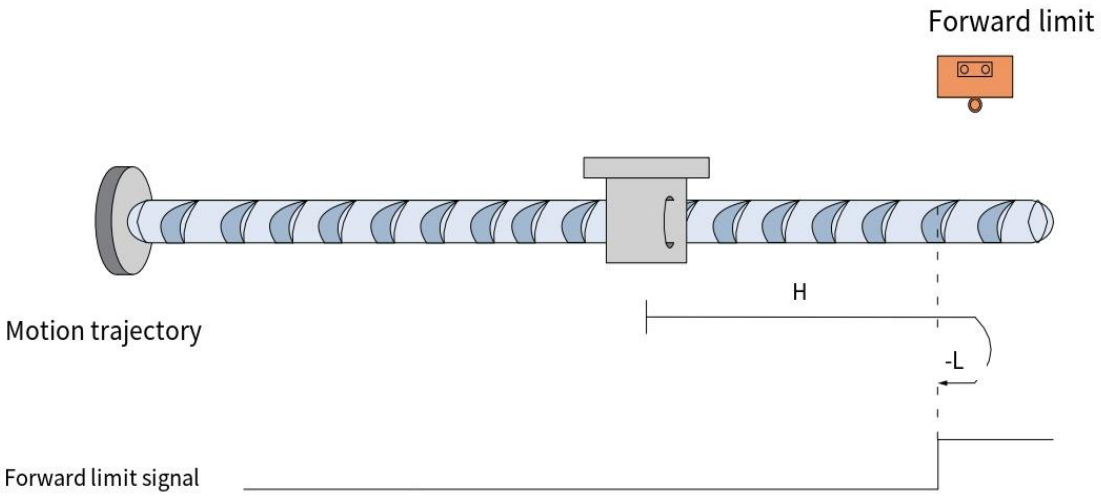
Start the homing when NOT=ON, start the homing at a forward low speed, and stop when the NOT falling edge is encountered.

3.11.2 Method 18 (6098=18)

HOME: Forward Limit Signal (POT)

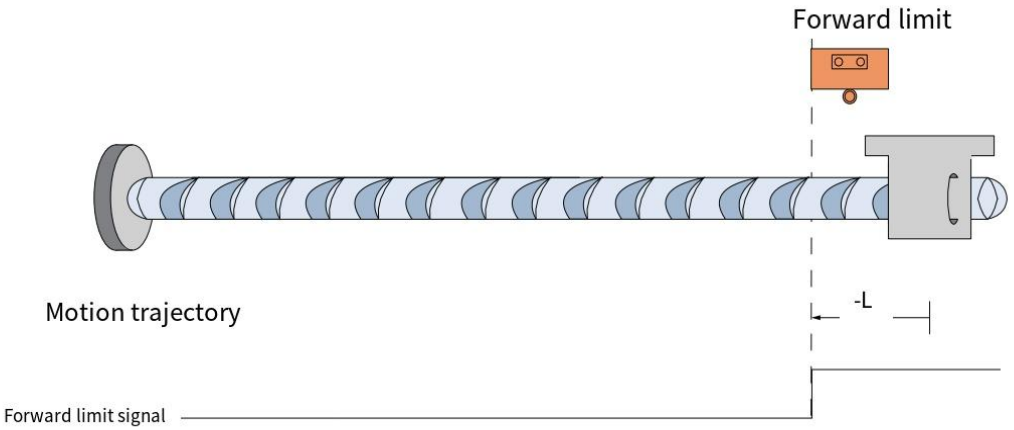
Deceleration point: Forward limit signal (POT)

- The forward limit signal is invalid when starting homing



Start the homing when POT=OFF, start the homing at high forward speed, decelerate and reverse after encountering the rising edge of POT, run the reverse at low speed, stop after encountering the falling edge of POT.

- The forward limit signal is effective when starting homing



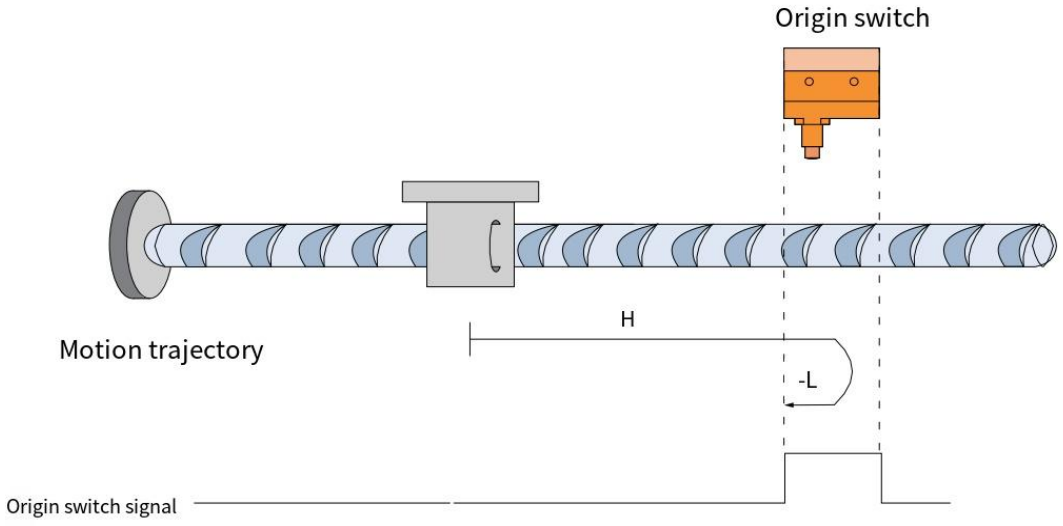
It starts homing when POT=ON, start to homing at reverse low speed, and stops when it encounters the POT falling edge.

3.11.3 Method 19 (6098=19)

HOME: Homing Switch Signal (HOME)

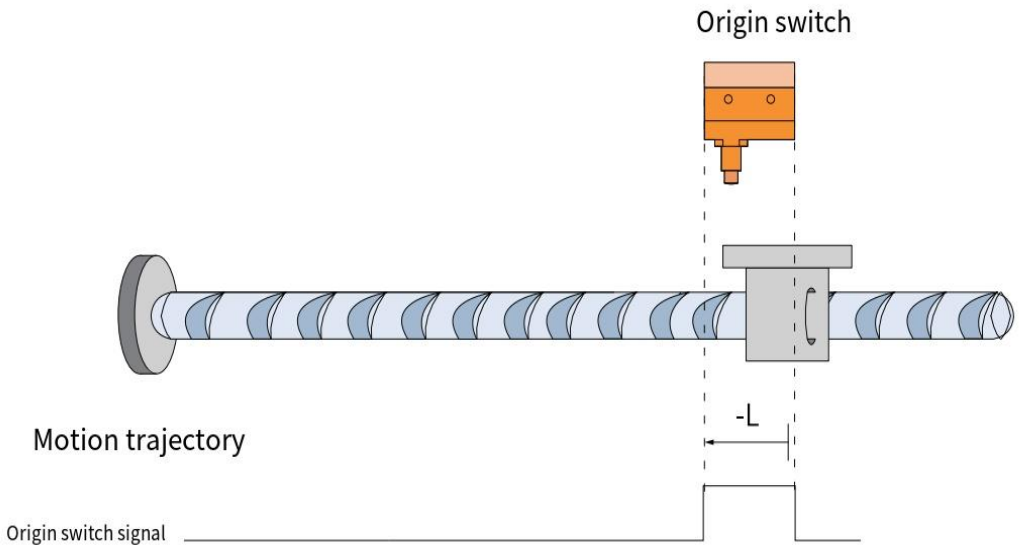
Deceleration point: Homing switch signal (HOME)

- The origin switch signal is invalid when starting homing



Start the homing when HOME=OFF, start the homing at high forward speed, decelerate and reverse after encountering the rising edge of HOME, run the reverse low speed, stop after encountering the falling edge of HOME.

- The origin switch signal is valid when homing start



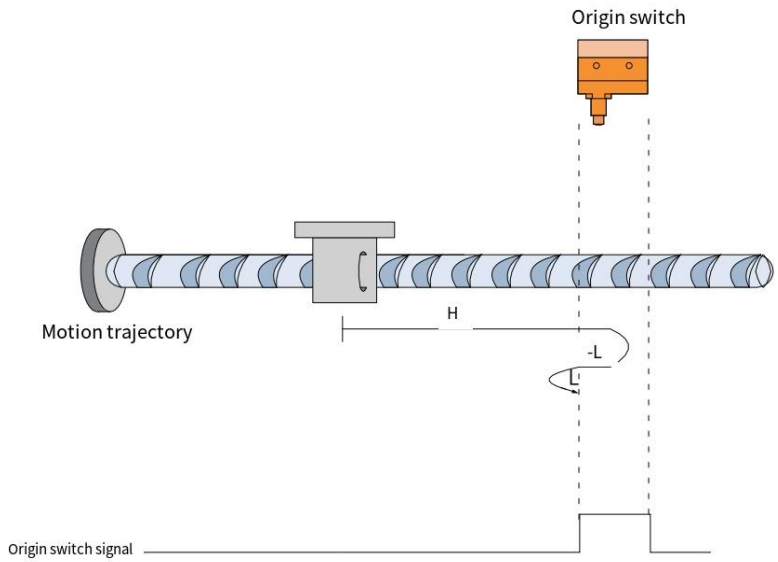
It starts homing when HOME=ON, start to homing at reverse low speed, and stops when it encounters the falling edge of HOME.

3.11.4 Method 20 (6098=20)

HOME: Homing Switch Signal (HOME)

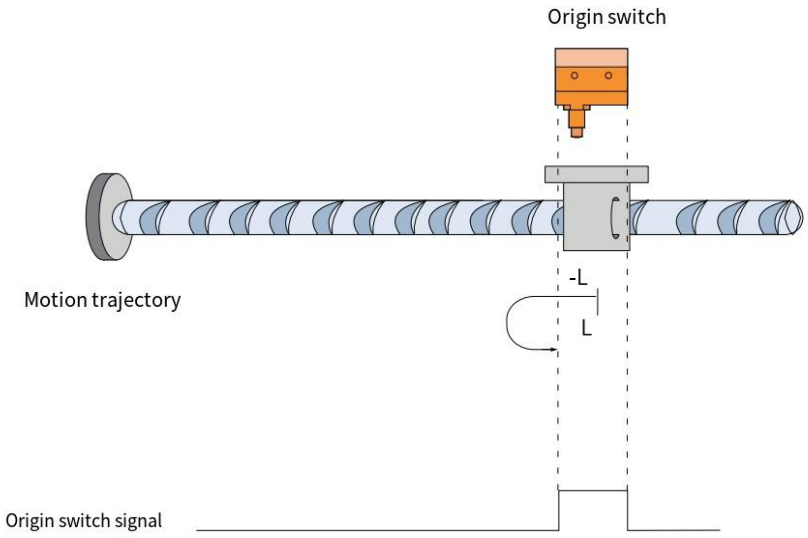
Deceleration point: Homing switch signal (HOME)

- The homing signal switch is invalid when starting homing



Start the homing when HOME=OFF, start the homing at high forward speed, after encountering the rising edge of HOME, decelerate and reverse, run at low reverse speed, after encountering the falling edge of HOME, decelerate and reverse, run at low forward speed, stop when encountering the rising edge of HOME again.

- The homing signal switch is effective when starting homing



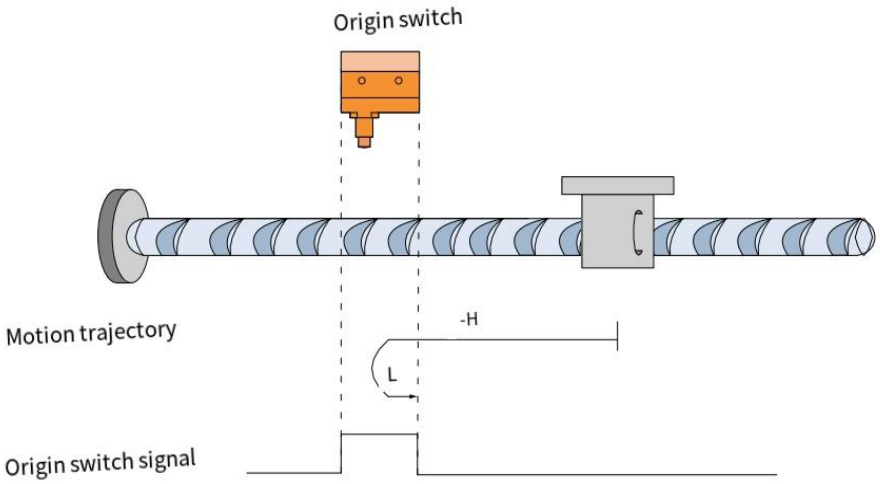
Start the homing when HOME=ON, start the homing at reverse low speed, decelerate and reverse when encountering the HOME falling edge, run forward at low speed, stop when encountering the HOME rising edge.

3.11.5 Method 21 (6098=21)

HOME: Homing Switch Signal (HOME)

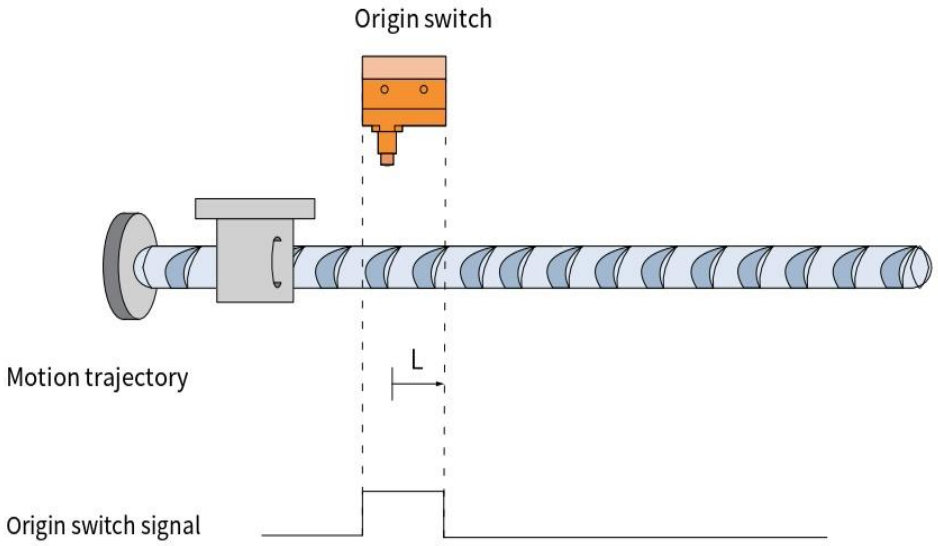
Deceleration point: Homing switch signal (HOME)

- The homing signal switch is invalid when starting homing



Start the homing when HOME=OFF, start the homing at high speed in the reverse direction, decelerate in the reverse direction after encountering the rising edge of HOME, run forward at low speed, stop when encountering the falling edge of HOME.

- The homing switch signal is effective when homing starts



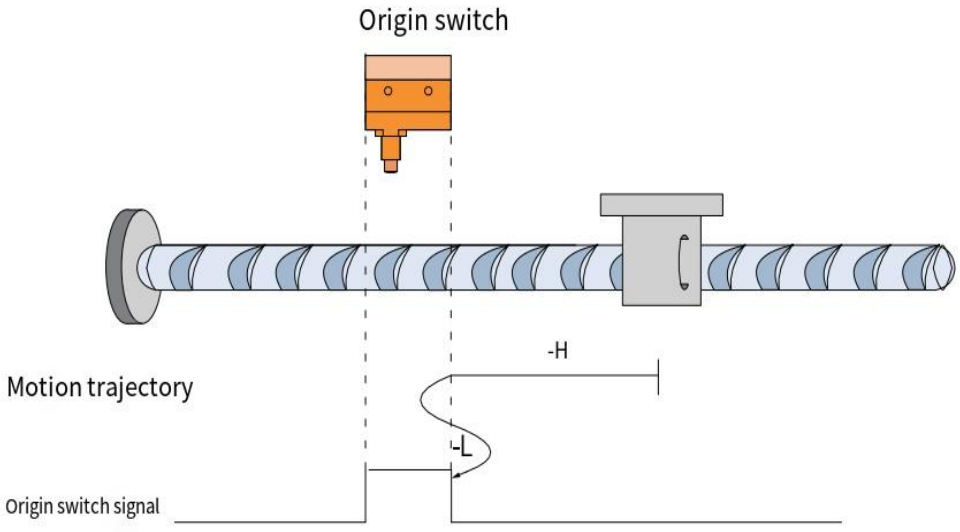
It starts homing when HOME=ON, start to homing at a forward low speed, and stops when it encounters the falling edge of HOME.

3.11.6 Method 22 (6098=22)

HOME: Homing Switch Signal (HOME)

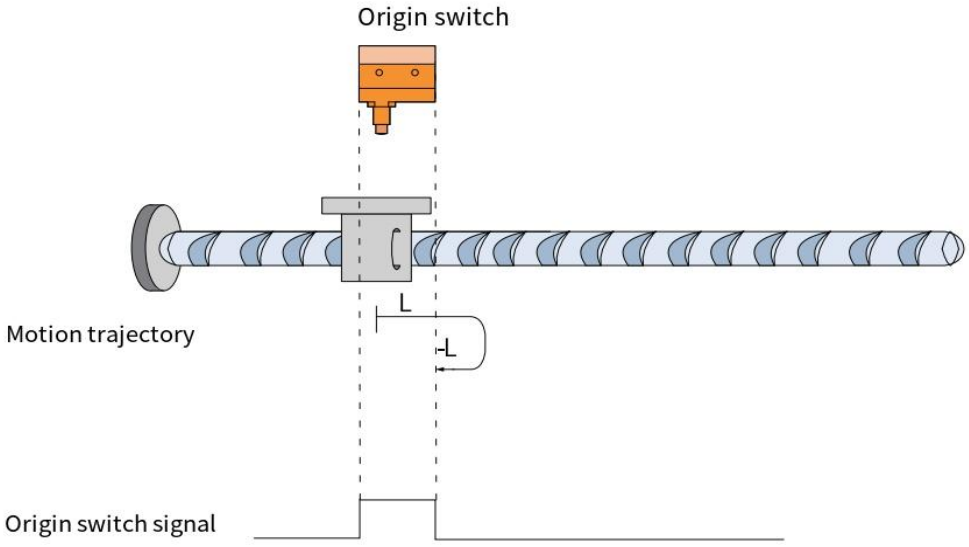
Deceleration point: Homing switch signal (HOME)

- The origin switch signal is invalid when starting homing



Start the homing when HOME=OFF, start the homing at reverse high speed, after encountering the rising edge of HOME, decelerate and reverse, run forward at low speed, after encountering the falling edge of HOME, decelerate and reverse, run backward at low speed, stop when encountering the rising edge of HOME again.

- The homing switch signal is valid when starting to homing



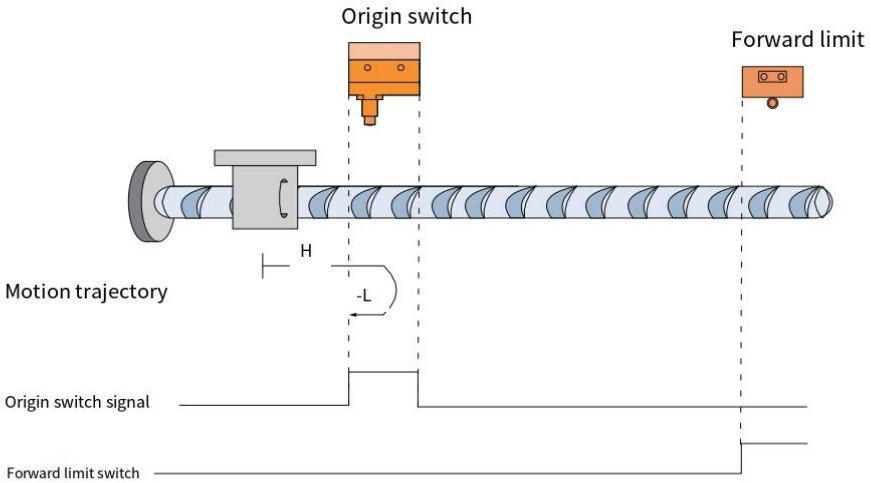
When HOME=ON, it starts homing. start to homing at a forward low speed. After encountering the HOME falling edge, it decelerates and reverses. It runs in the reverse low speed and stops when encountering the HOME rising edge.

3.11.7 Method 23 (6098=23)

HOME: Homing Switch Signal (HOME)

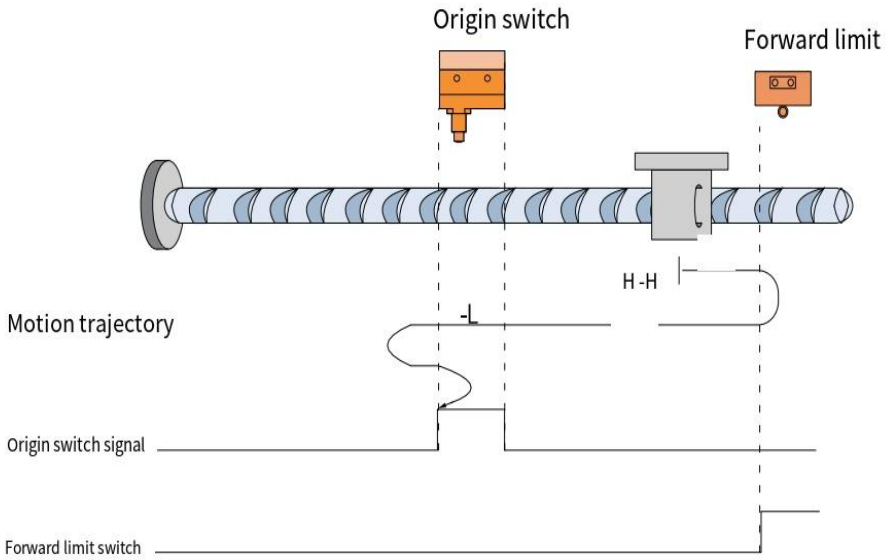
Deceleration point: Homing switch signal (HOME)

- When starting homing, the homing switch signal is invalid and the forward limit switch is not encountered.



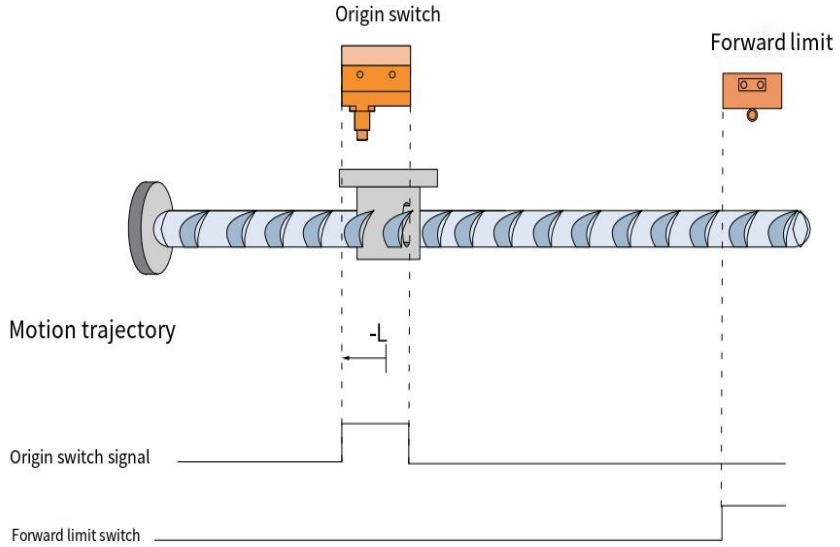
When HOME=OFF, POT=OFF, start the homing, start the homing at high forward speed, after encountering the rising edge of HOME, decelerate and reverse, reverse and run at low speed, stop when encountering the falling edge of HOME.

- When starting to homing, the origin switch signal is invalid when encountering the forward limit switch.



When HOME=OFF, POT=OFF, start to homing, start to homing at high forward speed, after encountering the rising edge of POT, immediately reverse high speed, after encountering the rising edge of HOME, reverse low speed, after encountering the falling edge of HOME, decelerate reverse, forward low speed, after encountering the rising edge of HOME, decelerate reverse, reverse low speed, Stop when you encounter the HOME falling edge again.

- The homing switch signal is effective when starting homing.



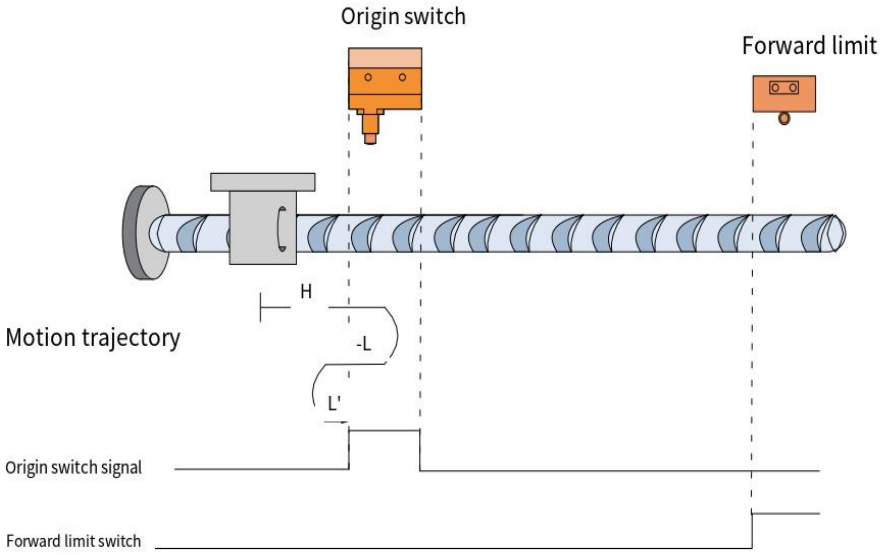
It starts homing when HOME=ON, POT=OFF, start to homing at reverse low speed, and stops when it encounters the falling edge of HOME.

3.11.8 Method 24 (6098=24)

HOME: Homing Switch Signal (HOME)

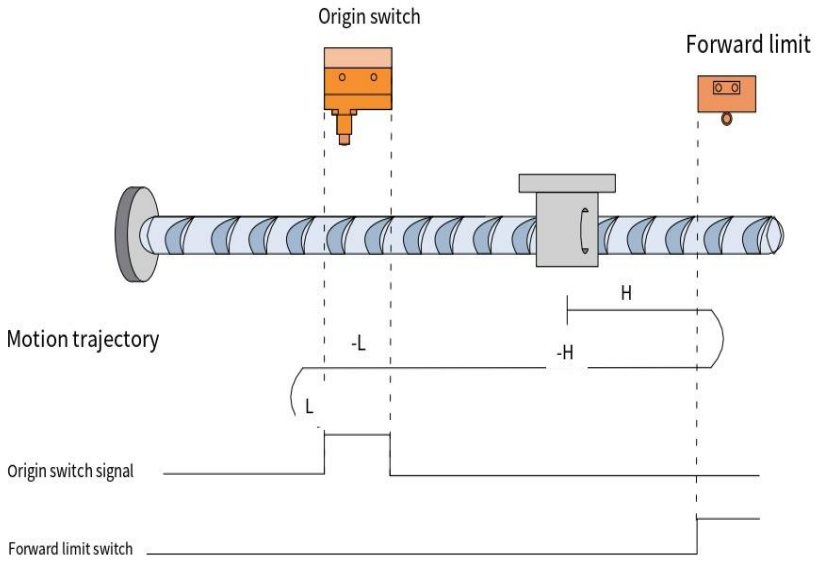
Deceleration point: Homing switch signal (HOME)

- When starting homing, the homing switch signal is invalid and the forward limit switch is not encountered.



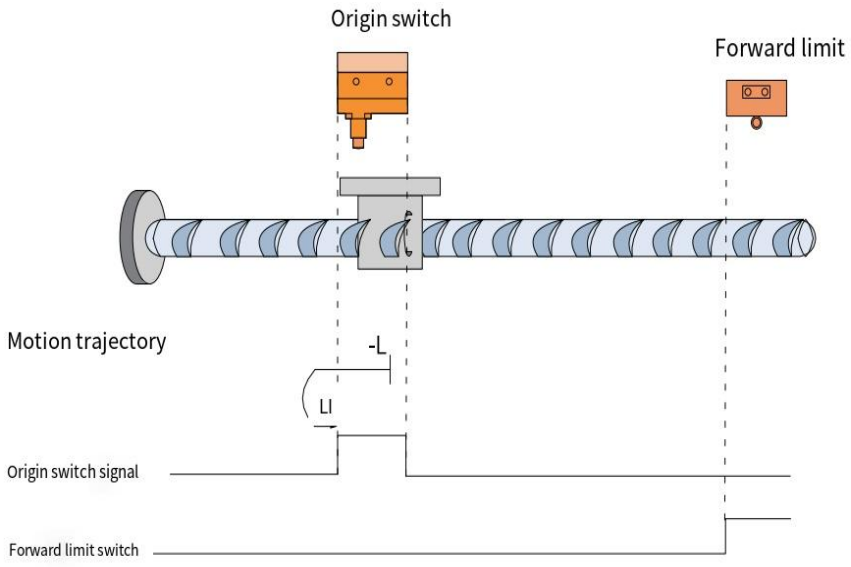
When HOME=OFF, POT=OFF, start the homing, start the homing at high forward speed, after encountering the rising edge of HOME, decelerate and reverse, run at low reverse speed, after encountering the falling edge of HOME, decelerate and reverse, run at low forward speed, stop after encountering the rising edge of HOME again.

- When starting the homing, the homing switch signal is invalid and the forward limit switch is encountered.



When HOME=OFF, POT=OFF, start to homing, start to homing at high forward speed, after encountering the rising edge of POT, automatically reverse high speed, after encountering the rising edge of HOME, reverse low speed, after encountering the falling edge of HOME, decelerate and reverse, forward low speed, stop when encountering the rising edge of HOME.

- The homing switch signal is valid when starting homing.



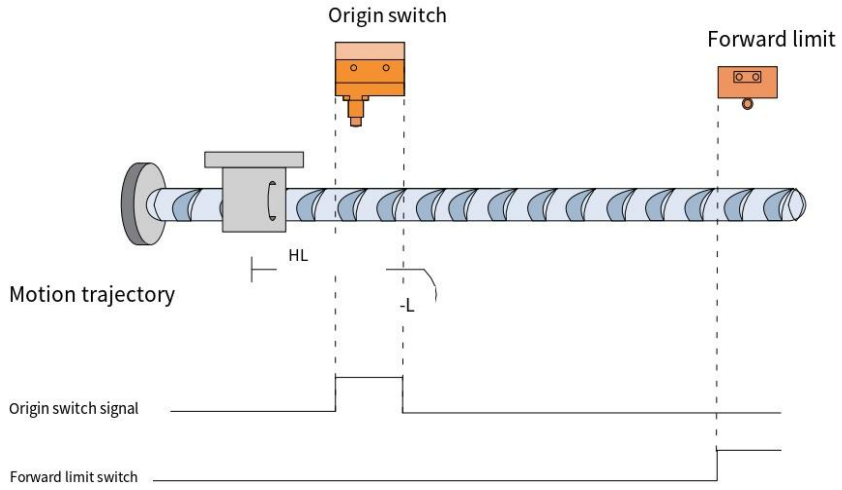
When HOME=ON, POT=OFF, start the homing, start the homing at reverse low speed, after encountering the HOME falling edge, decelerate and reverse, run forward low speed, stop when encountering the HOME rising edge.

3.11.9 Method 25 (6098=25)

HOME: Homing Switch Signal (HOME)

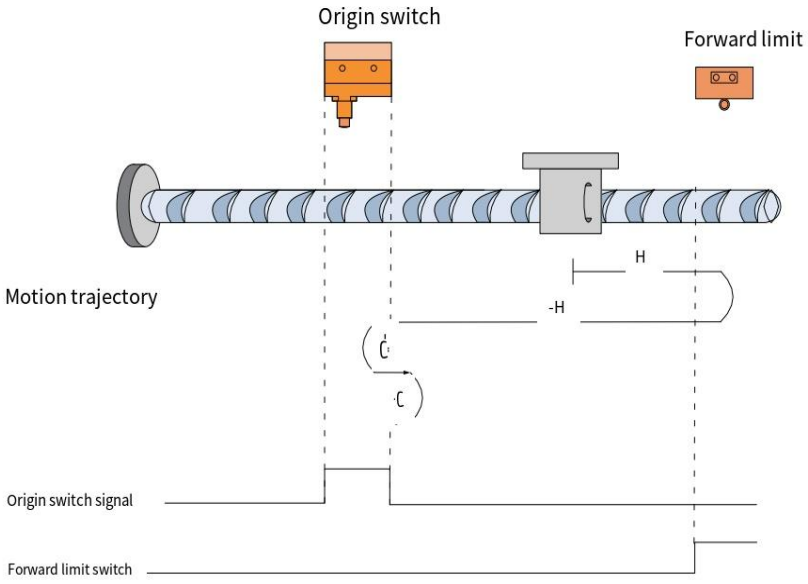
Deceleration point: Homing switch signal (HOME)

- When starting homing, the homing switch signal is invalid and the forward limit switch is not encountered.



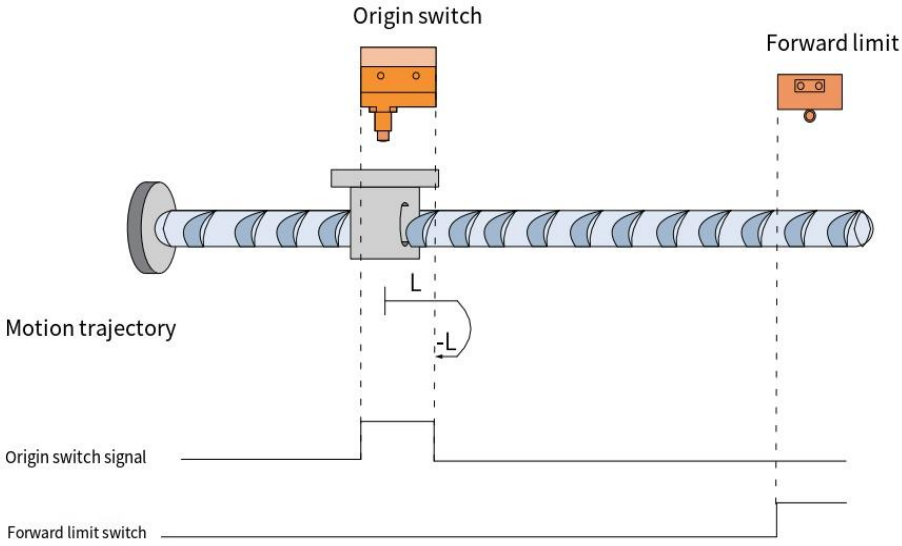
When HOME=OFF, POT=OFF, the homing begins at high forward speed, when encountering the rising edge of HOME, the forward low speed runs, when encountering the falling edge of HOME, the deceleration reverses, the reverse low speed runs, when encountering the rising edge of HOME stops.

- When starting to homing, the homing switch signal is invalid and the forward limit switch is encountered.



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

- The homing switch signal is valid at the start of the zero return.



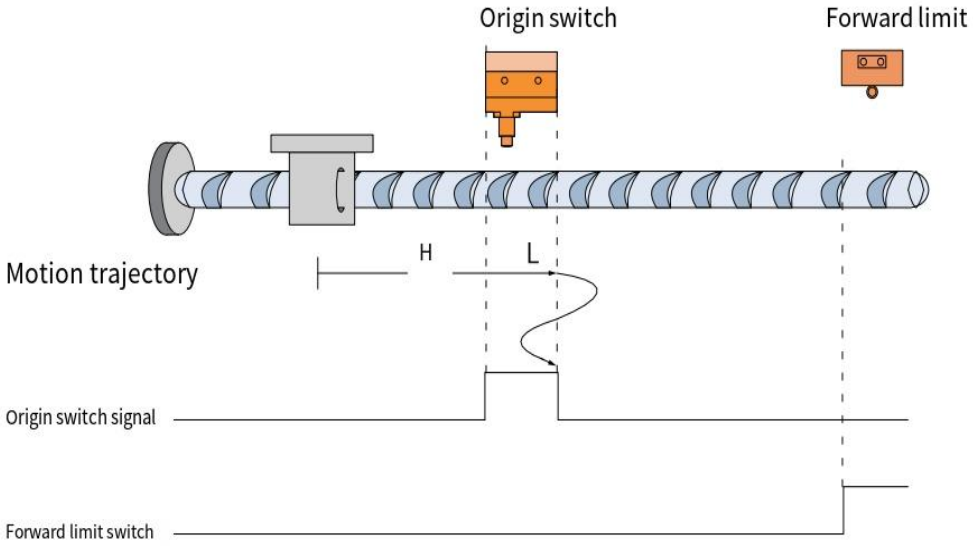
When HOME=ON, POT=OFF, start the homing, start the homing at the forward low speed, after encountering the HOME falling edge, decelerate and reverse, run the reverse low speed, stop when encountering the HOME rising edge.

3.11.10 Method 26 (6098=26)

HOME: Homing Switch Signal (HOME)

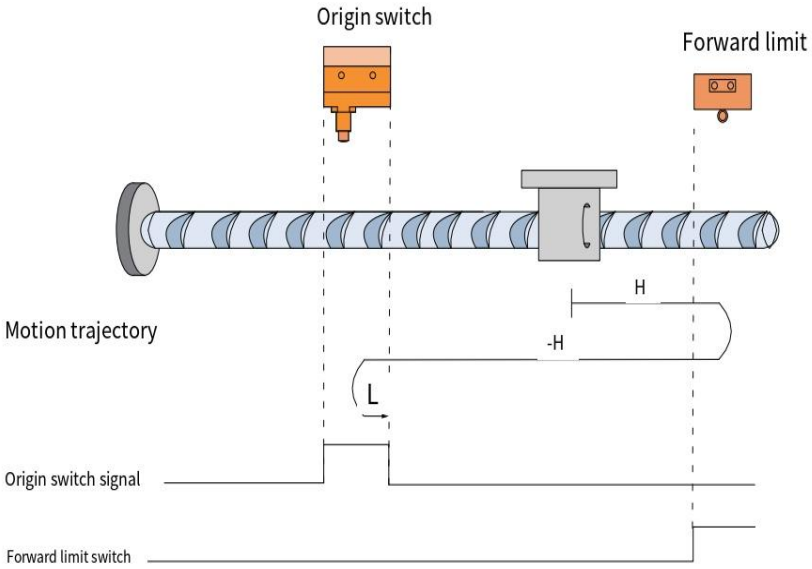
Deceleration point: Homing switch signal (HOME)

- When starting homing, the homing switch signal is invalid and the forward limit switch is not encountered.



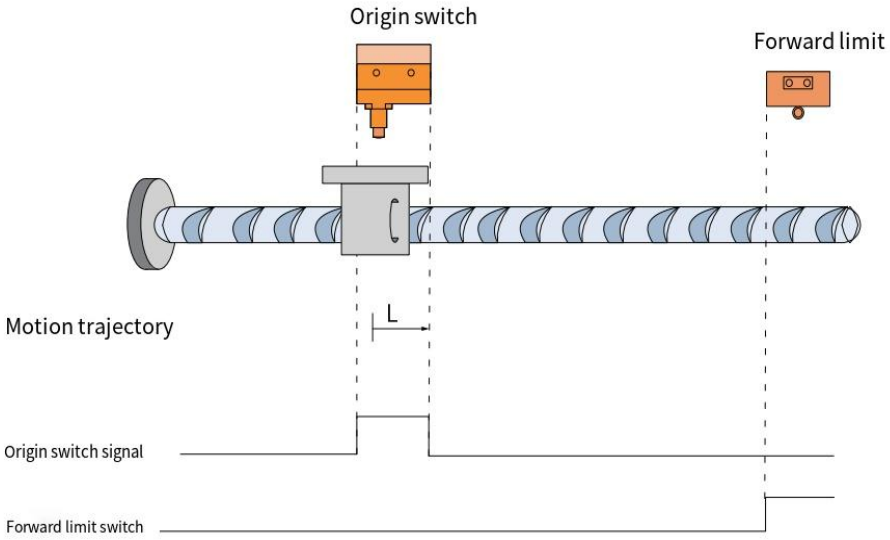
When HOME=OFF, POT=OFF, start the homing, start the homing at high forward speed, after encountering the rising edge of HOME, run forward at low speed, after encountering the falling edge of HOME, decelerate and reverse, run reverse at low speed, after encountering the rising edge of HOME, decelerate and reverse, run forward at low speed again, stop after encountering the falling edge of HOME.

- The homing switch signal is invalid when starting the homing, and it encounters the forward limit switch.



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

- The homing switch signal is valid when homing starts.



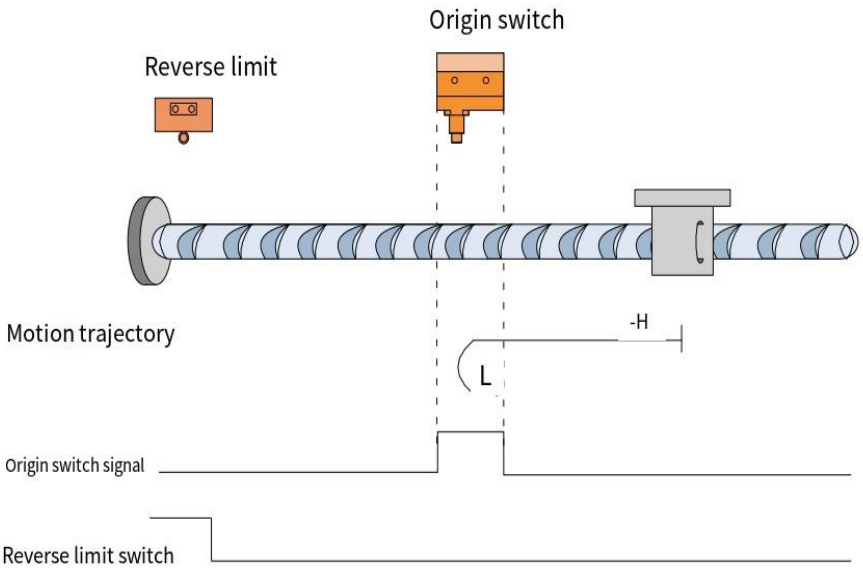
When HOME=ON, POT=OFF, it starts homing. Start to homing at a forward low speed and stops when it encounters the HOME falling edge.

3.11.11 Method 27 (6098=27)

HOME: Homing Switch Signal (HOME)

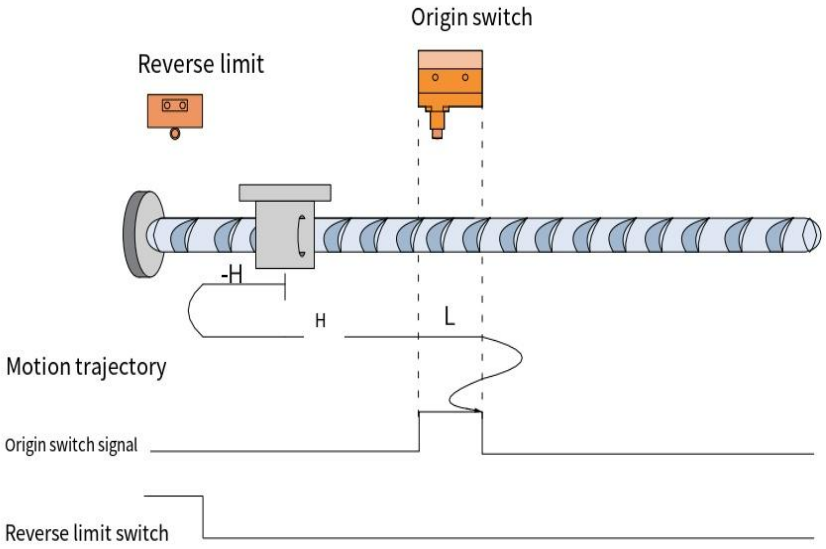
Deceleration point: Homing switch signal (HOME)

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



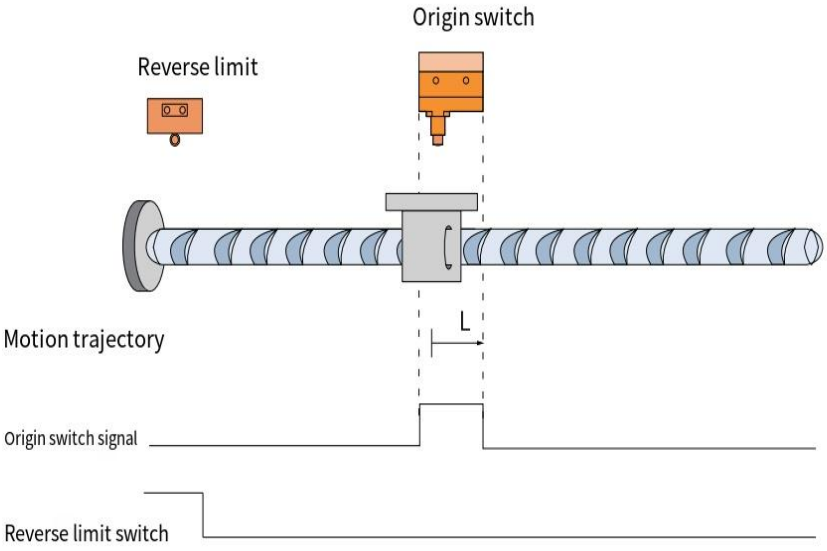
When HOME=OFF and NOT=OFF, start to homing, then homing at high speed in the reverse direction. After encountering the rising edge of HOME, it decelerates and reverses, runs at low speed in the forward direction, and stops when it encounters the falling edge of HOME.

- When starting the homing, the homing switch signal is invalid and the reverse limit switch is encountered.



When HOME=OFF and NOT=OFF, start to homing with reverse high speed. After encountering the NOT rising edge, automatically run forward high speed. After encountering the HOME rising edge, run forward low speed. After encountering the HOME falling edge, decelerate and reverse, run reverse low speed. After encountering the HOME rising edge, decelerate and reverse, run forward low speed. Stop when you encounter the HOME falling edge again.

- The homing switch signal is effective when starting homing.



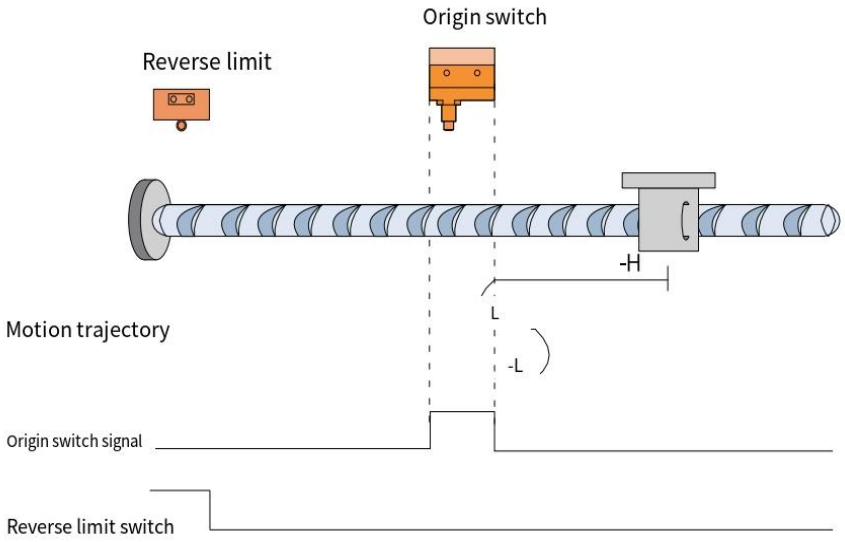
It starts homing when HOME=ON and NOT=OFF. start to homing at a forward low speed and stops when it encounters the HOME falling edge.

3.11.12 Method 28 (6098=28)

HOME: Homing Switch Signal (HOME)

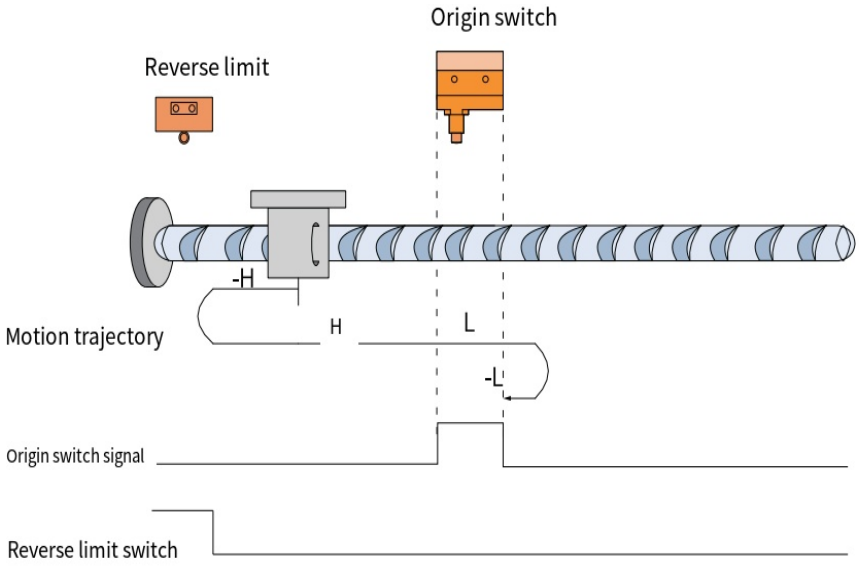
Deceleration point: Homing switch signal (HOME)

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



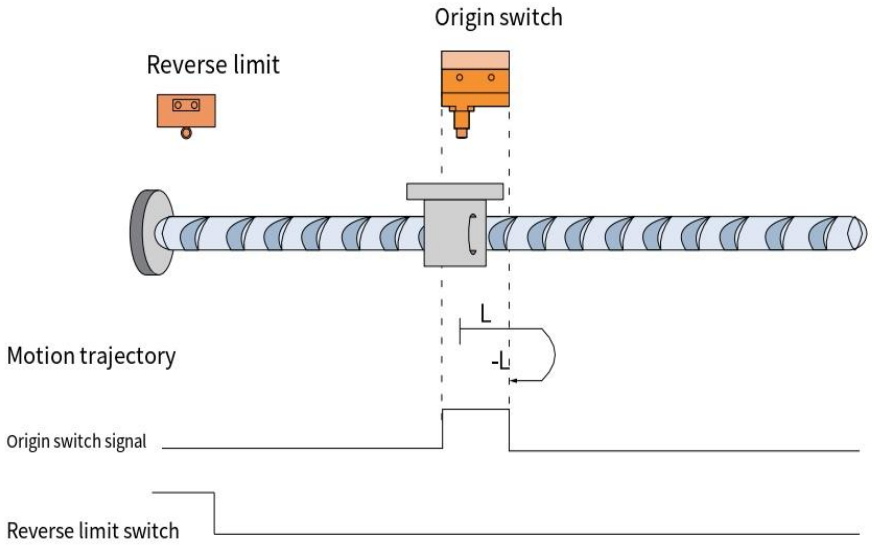
homing when HOME=OFF, NOT=OFF, start to homing at reverse high speed, after encountering the rising edge of HOME, decelerate and reverse, run forward at low speed, after encountering the falling edge of HOME, decelerate and reverse, run backward at low speed, stop when encountering the rising edge of HOME again.

- When starting the homing, the homing switch signal is invalid and the reverse limit switch is encountered.



When HOME=OFF, NOT=OFF, start to homing, start to homing at reverse high speed, when encountering the NOT rising edge, automatically run forward high speed, when encountering the HOME rising edge, run forward low speed, when encountering the HOME falling edge, decelerate and reverse, run reverse low speed, when encountering the HOME rising edge, stop.

- The homing switch signal is valid when starting to homing.



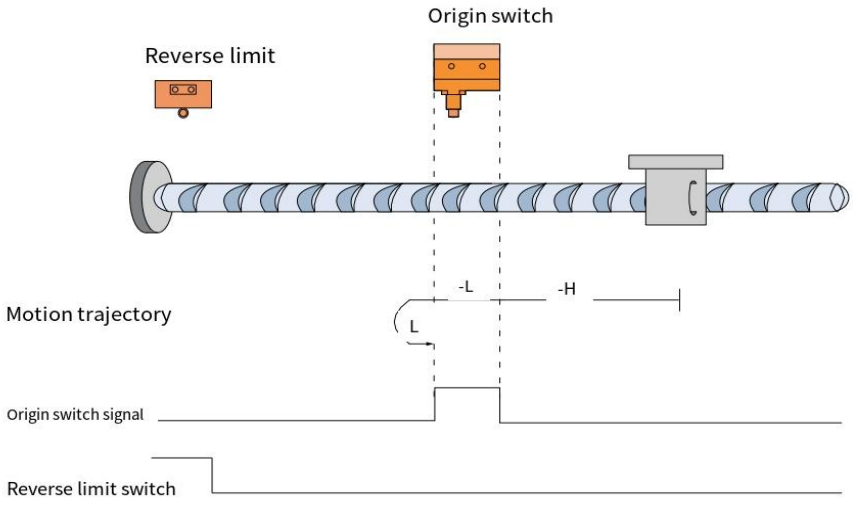
When HOME=ON and NOT=OFF, start the homing, start the homing at the forward low speed, after encountering the HOME falling edge, decelerate and reverse, run the reverse low speed, stop when encountering the HOME rising edge.

3.11.13 Method 29 (6098=29)

HOME: Homing Switch Signal (HOME)

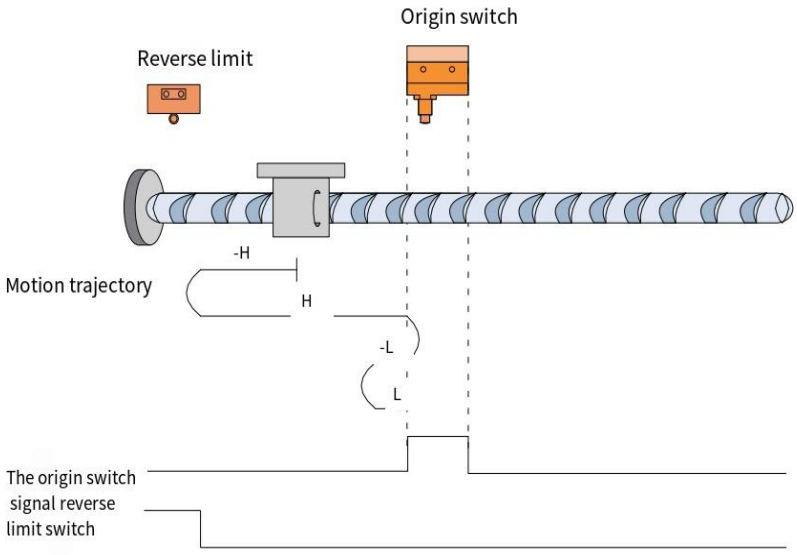
Deceleration point: Homing switch signal (HOME)

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



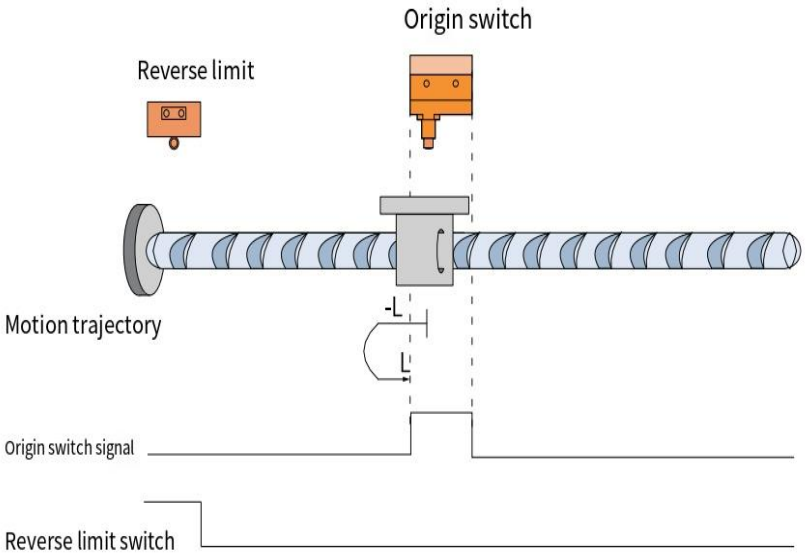
When HOME=OFF, NOT=OFF, start to homing with reverse high speed, after encountering the rising edge of HOME, run in reverse low speed, after encountering the falling edge of HOME, decelerate and reverse, run in forward low speed, after encountering the rising edge of HOME, stop.

- The homing switch signal is invalid when starting the homing and encountering the reverse limit switch.



When HOME=OFF and NOT=OFF, start to homing with reverse high speed. When encountering the NOT rising edge, automatically run forward high speed. When encountering the HOME rising edge, decelerate and reverse, run backward low speed. When encountering the HOME falling edge, decelerate and reverse, run forward low speed. When encountering the HOME rising edge again, stop.

- The homing switch signal is valid at the start of the homing.



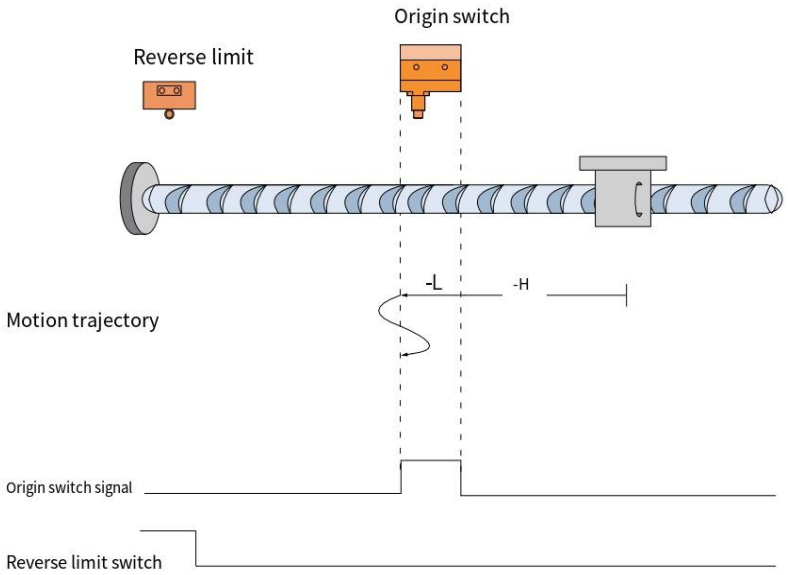
When HOME=ON and NOT=OFF, start the homing, start the homing at the forward low speed, after encountering the HOME falling edge, decelerate and reverse, run the reverse low speed, stop when encountering the HOME rising edge.

3.11.14 Method 30 (6098=30)

HOME:Homing Switch Signal (HOME)

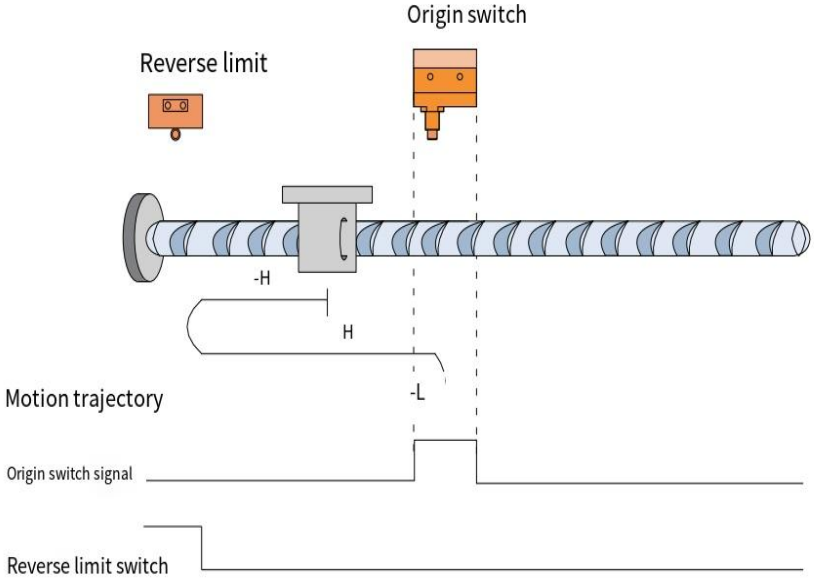
Deceleration point: Homing switch signal (HOME)

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



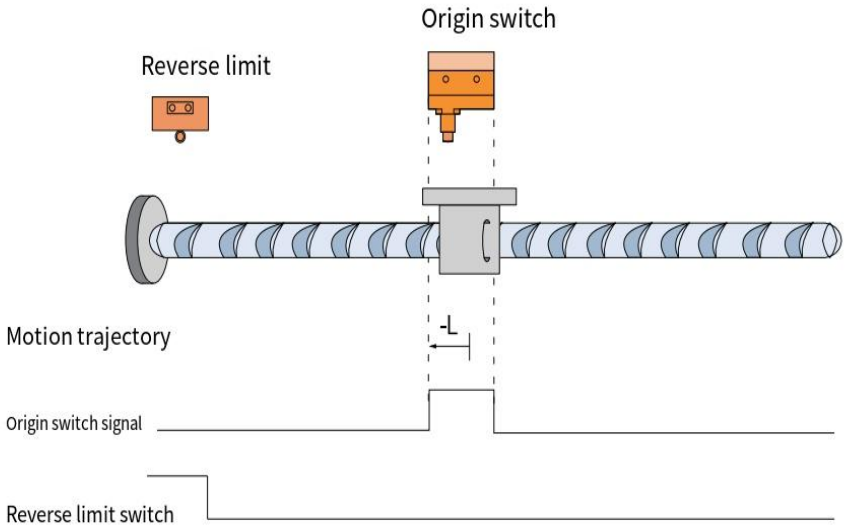
When HOME=OFF, NOT=OFF, start to homing with reverse high speed, after encountering the rising edge of HOME, run in reverse low speed, after encountering the falling edge of HOME, decelerate and reverse, run in forward low speed, after encountering the rising edge of HOME, stop.

- The homing switch signal is invalid when starting the homing and encountering the reverse limit switch.



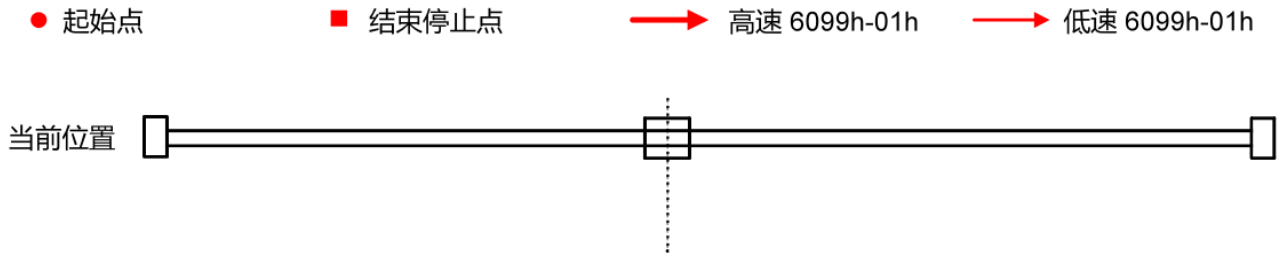
When HOME=OFF, NOT=OFF, it starts homing. start to homing at reverse high speed. After encountering the NOT rising edge, it automatically runs forward high speed. After encountering the HOME rising edge, it decelerates and stops.

- The homing switch signal is effective at the start of the homing.



homing when HOME=ON, NOT=OFF, start to zero at reverse low speed, and decelerate to stop when the HOME falling edge is encountered.

3.11.15 Method 35 (6098=35)



homing Method 35, with the current position as the Mechanical home.

SUPPORTS

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