HIWIN MIKROSYSTEM

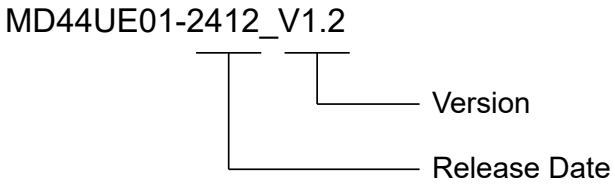
E2 Series Servo Drive

EtherNet/IP Communication Command Manual

www.hiwinmikro.tw
MD44UE01-2412_V1.2

Revision History

The version of the manual is also indicated on the bottom of the front cover.



Release Date	Version	Applicable Product	Revision Contents
Dec. 10th, 2024	1.2	E2 series servo drive	1. Add Time Sync specification description in section 2.1 **Communication specification**.
Aug. 15th, 2024	1.1	E2 series servo drive	1. Update section 2.3 **Cyclic I/O data format**. 2. Add section 2.4 **Cyclic I/O data description**. 3. Update section 3.7.1 **E2 drive objects**: Update the description of object 306Ch bit 8~15, add PT function objects 306Dh~3070h, and add gantry control objects 3080h~3088h.
Mar. 01st, 2024	1.0	E2 series servo drive	First edition.

Related Documents

Through related documents, users can quickly understand the positioning of this manual and the correlation between manuals and products. Go to HIWIN MIKROSYSTEM's official website → Download → Manual Overview for details (https://www.hiwinmikro.tw/Downloads/ManualOverview_EN.htm).

Table of Contents

1. About this manual

1.1 Preface

This manual provides information necessary to operate HIWIN E2 series servo drive via EtherNet/IP communication. For further understanding of E2 series servo drive, please refer to related user manuals.

1.2 Trademarks

CIP and EtherNet/IP are trademarks of ODVA, Inc.

2. EtherNet/IP communication

2.1 Communication specification

Table 2.1.1

EtherNet/IP Communication Specification	
Communication protocol	EtherNet/IP adaptation of CIP
Device profile	Generic device
Physical layer	10BASE-T/100BASE-TX, full duplex
Auto-MDI/MDIX detection	Yes
Time Sync (CIP Sync)	No
Cable	CAT5e or CAT6 shielded
Node-to-node distance	Max. 100 m
Cyclic update period	Min. 1.0 ms
IP addressing mode	Static/DHCP/BOOTP
Data transmission mode	Cyclic I/O data, Explicit message
Supported network features	Link Layer Discovery Protocol (LLDP) Device Level Ring (DLR) Address Conflict Detection (ACD) Quality of Service (QoS) CIP Reset Services: Type 0, Type 1, Type 2
CIP objects	Identity Object (0x01) Message Router Object (0x02) Assembly Object (0x04) Connection Manager Object (0x06) Time Sync Object (0x43) Device Level Ring Object (0x47) QoS Object (0x48) TCP/IP Interface Object (0xF5) Ethernet Link Object (0xF6) LLDP Management Object (0x109) LLDP Data Table Object (0x10A)
Motion profile	CiA402: PP, PV, TQ, HM

2.2 Panel indicators

Figure 2.2.1 is the panel of E2 series servo drive. On this panel, the 7-segment display is used to display the drive's status and the current alarm/warning code, the LEDs are used to display the EtherNet/IP communication status, and the rotary switches are not functional here. The states of each LED are described in Table 2.2.1, and the states of 7-segment display are described in Table 2.2.2.

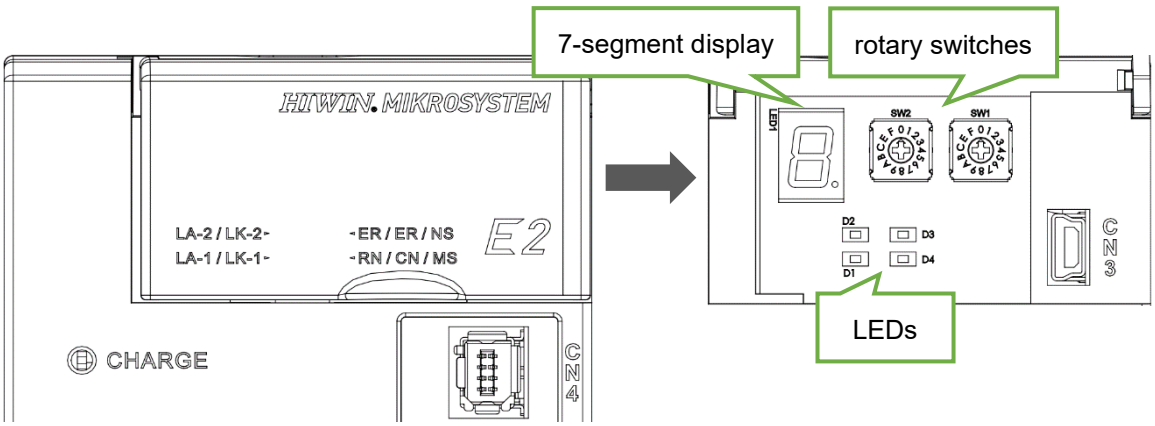


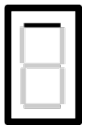
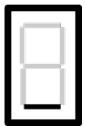
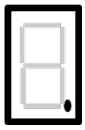
Figure 2.2.1

Table 2.2.1

Label	LED Mark	Name	Color	State	Description
LA-1 / LA-2	D1 / D2	Link status	Off	Power off, or link not established.	The drive is power off, or the port has no physical link.
			Steady Green	Link is established without traffic.	The physical link is created without data transmission.
			Flashing Green	Link is established with traffic.	The physical link is created with data transmission.
NS	D3	Network status	Off	Power off, or no IP address.	The drive is power off, or without IP configuration.
			Flashing Green	No connection	An IP address is configured, but CIP connection is not established.
			Steady Green	Connected	An IP address is configured, and a CIP connection is established.
			Flashing Red	Connection timeout	An IP address is configured, and a CIP connection has timeout. The network status goes to steady green when a CIP connection is re-established.
			Steady Red	Duplicate IP	The drive has detected that its IP address is already in use.
			Flashing Green/Red	Self-test	The drive is performing its power up testing.
MS	D4	Module status	Off	Power off	The drive is in power off state.
			Flashing Green	Drive not ready	The drive is not ready.
			Steady Green	Drive ready	The drive is in drive ready state.

Label	LED Mark	Name	Color	State	Description
			Steady Red	Drive alarm	The drive is in alarm state.
			Flashing Green/Red	Self-test	The drive is performing its power up testing.

Table 2.2.2

Display	Function Description
	Status of rotation detection output (TGON) signal Light up when the rotary velocity of the servo motor exceeds the setting value. (Set via Pt502 or Pt581. The default setting is 20 rpm or 20 mm/s.) Do not light up when the rotary velocity of the servo motor is below the setting value.
	Servo ready display Light up when servo OFF. Do not light up when servo ON.
	Display of command input Light up during command input.
	Display of connection Light up during connection.

2.3 Cyclic I/O data format

Table 2.3.1 shows the I/O data format of cyclic data transmission. The data format is 64-Byte input and 64-Byte output for data transmission between a drive and a controller.

Table 2.3.1

Word	Command		Response	
	Name	Object No.	Name	Object No.
0	Mode of operation	6060h	Mode of operation display	6061h
1	Controlword	6040h	Statusword	6041h
2	Target position	607Ah	Position actual value	6064h
3				
4	Target velocity	60FFh	Velocity actual value	606Ch
5				
6	Target torque	6071h	Torque actual value	6077h
7	Controlword 2	-	Statusword 2	-
8	Profile velocity	6081h	Following error actual value	60F4h
9				
10	Profile acceleration	6083h	Reserved	-
11			Drive alarm code	-
12	Profile deceleration	6084h	Drive warning code	-
13			Touch probe status	60B9h
14	Torque slope	6087h	Touch probe 1 positive edge	60BAh
15				
16	Reserved	-	Touch probe 2 positive edge	60BCh
17	Touch probe function	60B8h		
18	Digital output	60FE:01h	Digital input	60FDh
19				
20~25	Reserved	-	Reserved	-
26	Ext. user command 1	-	Ext. user monitor 1	-
27				
28	Ext. user command 2	-	Ext. user monitor 2	-
29				
30	Ext. user command 3	-	Ext. user monitor 3	-
31				

2.4 Cyclic I/O data description

Items without object No. in Table 2.3.1 are described in this section. For the description of items with object No., please refer to section 3.7.2.

2.4.1 Controlword 2

This item is not implemented yet.

2.4.2 Statusword 2

The drive states are responded to a controller via Statusword 2. Please refer to “E2 Series Servo Drive User Manual” for the detailed description of each state.

Table 2.4.2.1

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
VLT	CLT	BK	STO	SF2	SF1	S-RDY	D-RDY
bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
Reserved		Reserved		INDEX	HOMED	NEAR	COIN / V-CMP

D-RDY: Drive ready state
S-RDY: Servo ready state
SF1: STO SF1 input state
SF2: STO SF2 input state
STO: STO function active state
BK: Brake active state
CLT: Torque limit detection state
VLT: Velocity limit detection state

COIN: Positioning completion state
V-CMP: Velocity reach state
NEAR: Positioning near state
HOMED: Homing completion state
INDEX: Index signal output

2.4.3 Ext. user command/monitor 1~3

Word 26 to 31 of the cyclic IO data offer three extension user command parameters and three user monitor parameters for users to set in Thunder. The setting path is “Tools→EtherNet/IP setup→Ext. I/O data tab”, as Figure 2.4.3.1 shows. For the setting parameter No. (object No.), please refer to section 3.7.

Notice: When setting the extension user parameter, please ensure its data type is writable. Thunder cannot inform such setting errors, and the drive will ignore the incorrect parameter settings.

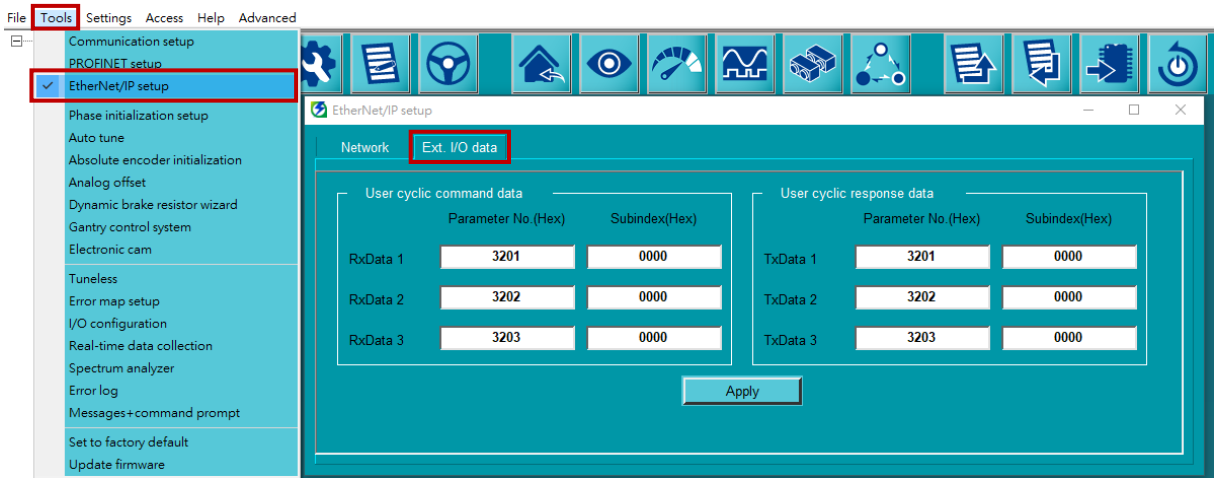


Figure 2.4.3.1

(This page is intentionally left blank.)

3. Drive profile

E2 EtherNet/IP servo drive implements drive profile based on CiA402 standard. The applied Finite State Automaton (FSA) and the operation modes, including profile position mode (PP), profile velocity mode (PV), profile torque mode (TQ) and homing mode (HM), are described in this chapter.

3.1 Finite State Automaton (FSA)

Figure 3.1.1 defines FSA of E2 EtherNet/IP servo drive. The transitions between the states depend on the Controlword (6040h) from a host and the internal states of drive. The drive state is set to the Statusword (6041h) to respond to the host.

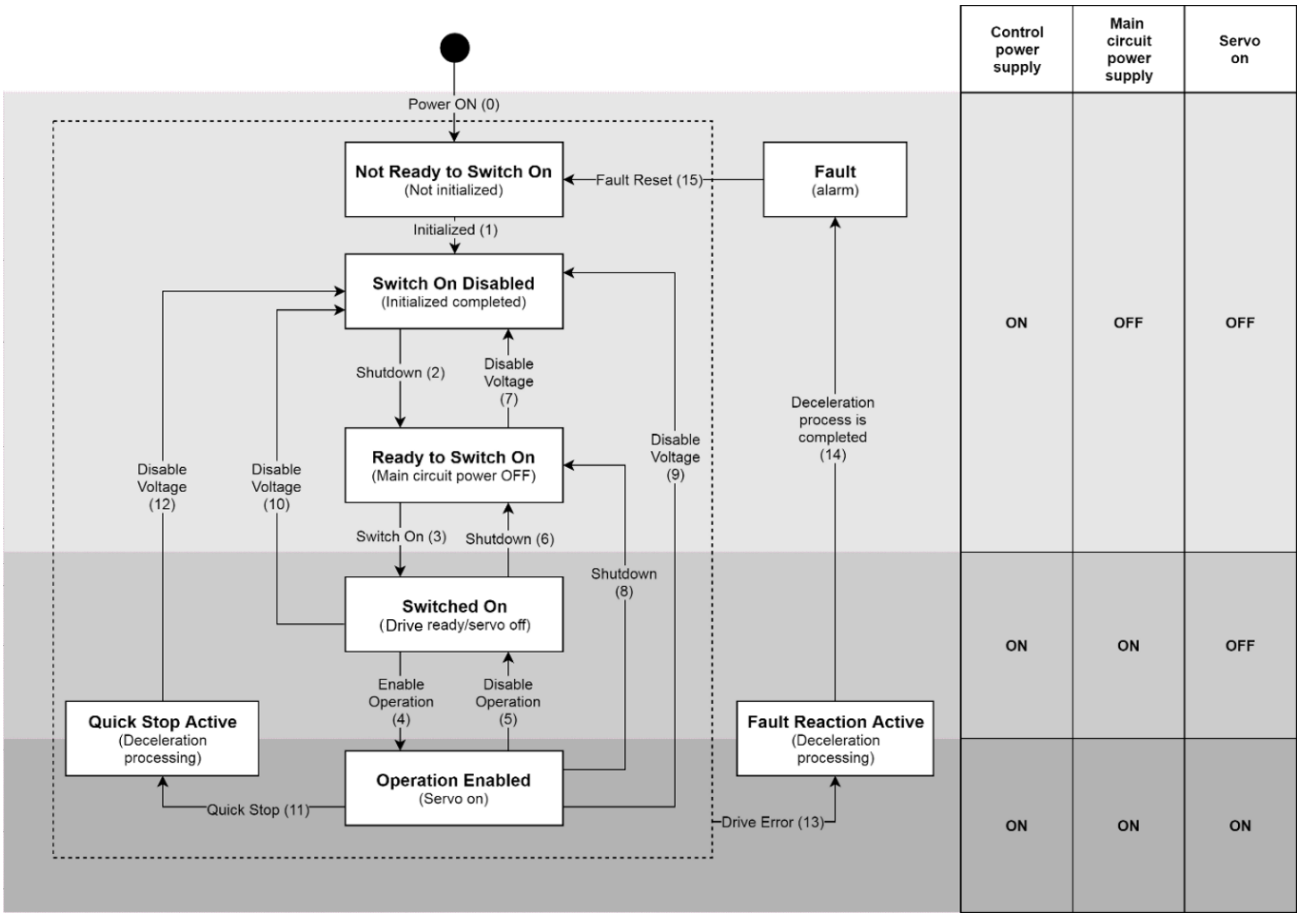


Figure 3.1.1

The events and actions in Figure 3.1.1 are described in Table 3.1.1.

Table 3.1.1

Trans	Event	Action
0	Control power is ON or drive is reset.	Drive performs initialization and self-test.
1	Initialization is completed.	Communication is activated.
2	Receive “Shutdown” command.	None
3	Receive “Switch on” command when high-level power is ON.	None
4	Receive “Enable operation” command.	The motor and the drive functions are enabled, and all command settings are cleared.
5	Receive “Disable operation” command.	The motor and the drive functions are disabled.
6	Receive “Shutdown” command.	None
7	1. Receive “Quick stop” or “Disable voltage” command. 2. ESM is in Init state.	None
8	Receive “Shutdown” command.	The motor and the drive functions are disabled.
9	Receive “Disable voltage” command.	The motor and the drive functions are disabled.
10	1. Receive “Quick stop” or “Disable voltage” command. 2. ESM is transited to Init state.	None
11	Receive “Quick stop” command.	“Quick stop” function starts.
12	An automatic transition when “Quick stop” function is completed	The motor and the drive functions are disabled.
13	The drive detects an error.	The drive-defined or user-configured fault reactions are executed.
14	An automatic transition after deceleration process is completed	The motor and the drive functions are disabled.
15	Receive “Fault reset” command.	Reset the fault state if the fault situation of drive is no longer stayed.

The command codes of Controlword corresponding to FSA transitions are described in Table 3.1.2.

Table 3.1.2

Command	Bits of 6040h (Controlword)					Transition
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3+4*
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4
Fault reset	0→1	X	X	X	X	15
*It will automatically transit to “Enable operation” after “Switched on” is executed.						

The state codes of Statusword corresponding to FSA states are described in Table 3.1.3.

Table 3.1.3

6041h (Statusword)	FSA state
xxxx xxxx x0xx 0000b	Not ready to switch on
xxxx xxxx x1xx 0000b	Switch on disabled
xxxx xxxx x01x 0001b	Ready to switch on
xxxx xxxx x01x 0011b	Switched on
xxxx xxxx x01x 0111b	Operation enabled
xxxx xxxx x00x 0111b	Quick stop active
xxxx xxxx x0xx 1111b	Fault reaction active
xxxx xxxx x0xx 1000b	Fault

3.2 Profile position mode (PP)

PP mode is used for positioning with the setting of a profile velocity and a profile acceleration. Figure 3.2.1 shows the input and output objects of the structure of PP mode.

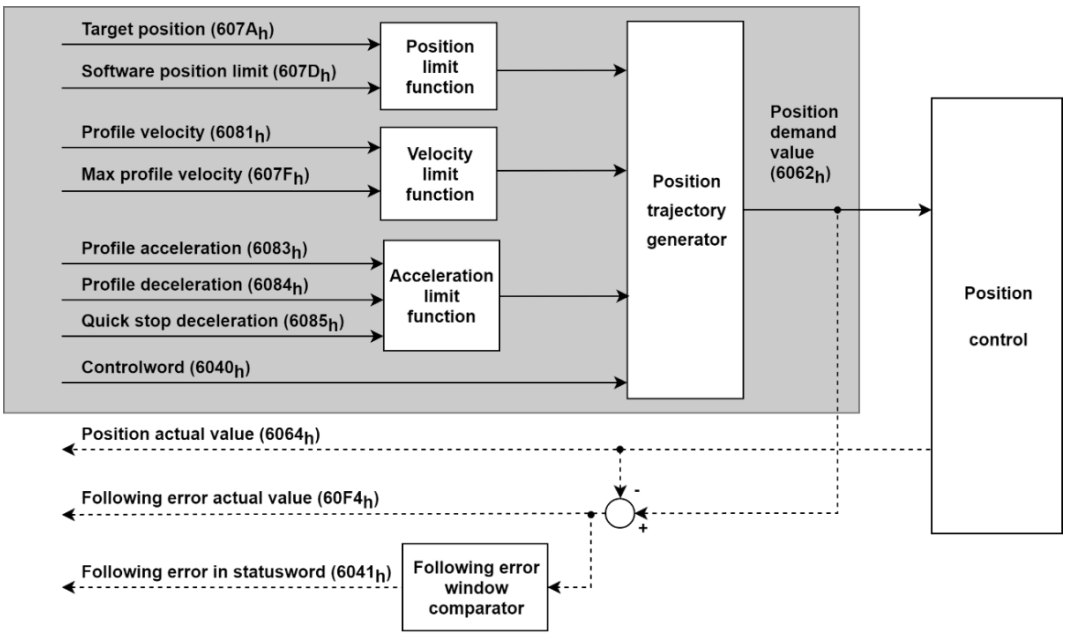


Figure 3.2.1

Note: When the motor is moving, the change of Profile acceleration (6083h) and Profile deceleration (6084h) will not be executed until the moving is done.

The related objects of PP mode are listed in Table 3.2.1.

Table 3.2.1

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
6040h	00h	Controlword	U16	rw	0x0 ~ 0xFFFF	-
6041h	00h	Statusword	U16	ro	0x0 ~ 0xFFFF	-
605Dh	00h	Halt option code	I16	ro	1, 2	-
6062h	00h	Position demand value	I32	ro	-2147483648 ~ 2147483647	inc
6063h	00h	Position actual internal value	I32	ro	-2147483648 ~ 2147483647	count
6064h	00h	Position actual value	I32	ro	-2147483648 ~ 2147483647	inc
6065h	00h	Following error window	U32	rw	0 ~ 4294967295	inc
6066h	00h	Following error time out	U16	rw	0 ~ 65535	ms
6067h	00h	Position window	U32	rw	0 ~ 4294967295	inc
6068h	00h	Position window time	U16	rw	0 ~ 65535	ms
606Ch	00h	Velocity actual value	I32	ro	-2147483648 ~ 2147483647	inc/s
6072h	00h	Max torque	U16	rw	0 ~ 65535	0.1%

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
6074h	00h	Torque demand	I16	ro	-32768 ~ 32767	0.1%
6076h	00h	Motor rated torque	U32	ro	0 ~ 4294967295	mNm
6077h	00h	Torque actual value	I16	ro	-32768 ~ 32767	0.1%
607Ah	00h	Target position	I32	rw	-2147483648 ~ 2147483647	inc
607Fh	00h	Max profile velocity	U32	rw	0 ~ 4294967295	inc/s
6081h	00h	Profile velocity	U32	rw	0 ~ 4294967295	inc/s
6083h	00h	Profile acceleration	U32	rw	0 ~ 4294967295	inc/s^2
6084h	00h	Profile deceleration	U32	rw	0 ~ 4294967295	inc/s^2
6085h	00h	Quick stop deceleration	U32	rw	0 ~ 4294967295	inc/s^2
60C5h	00h	Max acceleration	U32	rw	0 ~ 4294967295	inc/s^2
60C6h	00h	Max deceleration	U32	rw	0 ~ 4294967295	inc/s^2
60F4h	00h	Following error actual value	I32	ro	-2147483648 ~ 2147483647	inc
60FCh	00h	Position demand internal value	I32	ro	-2147483648 ~ 2147483647	count

■ Controlword (6040h) of PP mode

Table 3.2.2

Bit 9	Bit 5	Bit 4	Definition
change on set-point	change set immediately	new set-point	
0	0	0→1	Positioning is completed (target reached) before the next one gets started.
X	1	0→1	Immediately start next positioning.
1	0	0→1	Execute positioning with current profile velocity to the current set-point and then apply next positioning.

Table 3.2.3

Bit	Value	Definition
6 (absolute / relative)	0	Target position is an absolute value.
	1	Target position is a relative value.
8 (halt)	0	Execute or continue positioning.
	1	Axis is stopped according to 605Dh (halt option code).

■ Statusword (6041h) of PP mode

Table 3.2.4

Bit	Value	Definition
10 (target reached)	0	Halt (Bit 8 in Controlword) = 0: target position not reached Halt = 1: axis decelerates
	1	Halt = 0: target position reached Halt = 1: velocity of axis is 0
12 (set-point acknowledge)	0	The last set-point is already processed. Wait for new set-point (the buffer is empty).
	1	Previous set-point is still in process.
13 (following error)	0	No following error
	1	Following error

■ Definition of Halt option code (605Dh)

Table 3.2.5

Value	Definition
0	Reserved
1	Axis is stopped according to 6084h (profile deceleration) and remains in Operation enabled state.
2	Axis is stopped according to 6085h (quick stop deceleration) and remains in Operation enabled state.

■ Example of setting basic set-point

[1] The master sets 607Ah (target position), and then sets bit 4 of 6040h (Controlword) from 0 to 1 (edge trigger).

[2] The drive acknowledges the new set-point by setting bit 12 of 6041h (Statusword) to 1. Then, the drive starts to move toward target position from 607Ah (target position).

[3] The master sets bit 4 of 6040h (Controlword) to 0 after bit 12 of 6041h (Statusword) is set to 1.

[4] The drive sets bit 12 of 6041h (Statusword) to 0 after bit 4 of 6040h (Controlword) is set to 0.

[5] When the motor reaches the target position, the drive sets bit 10 of 6041h (Statusword) to 1.

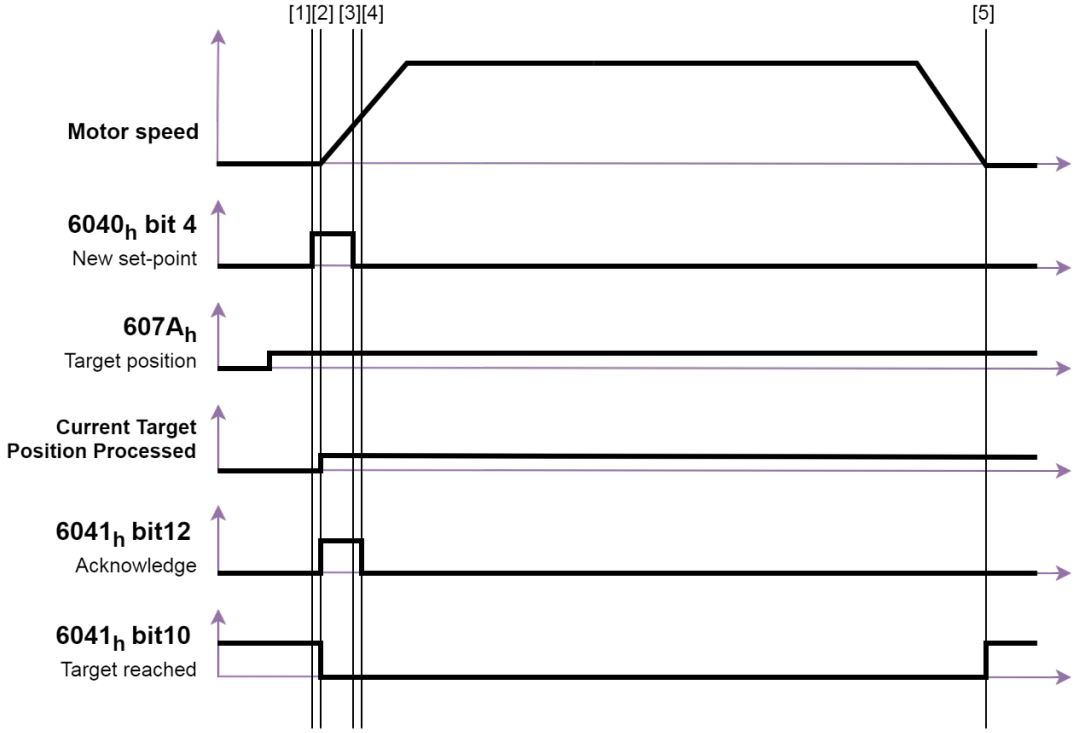


Figure 3.2.2

Note: The velocity of the motion is from 6081h (profile velocity), which is limited by 607Fh (max profile velocity).

■ Example of setting single set-point

When bit 5 of 6040h (Controlword) is 1, the new set-point is immediately validated by bit 4 of 6040h (Controlword). Thus, the set-point in progress will be interrupted.

[1] After bit 12 of 6041h (Statusword) is set to 0, the master changes the value of 607Ah (target position) and sets bit 4 of 6040h from 0 to 1 (edge trigger).
[2] The drive acknowledges the new set-point by setting bit 12 of 6041h (Statusword) to 1. Then, the drive starts to move toward the new target position from 607Ah (target position).
[3] The master sets bit 4 of 6040h (Controlword) to 0 after bit 12 of 6041h (Statusword) is set to 1.
[4] The drive sets bit 12 of 6041h (Statusword) to 0 after bit 4 of 6040h (Controlword) is set to 0.

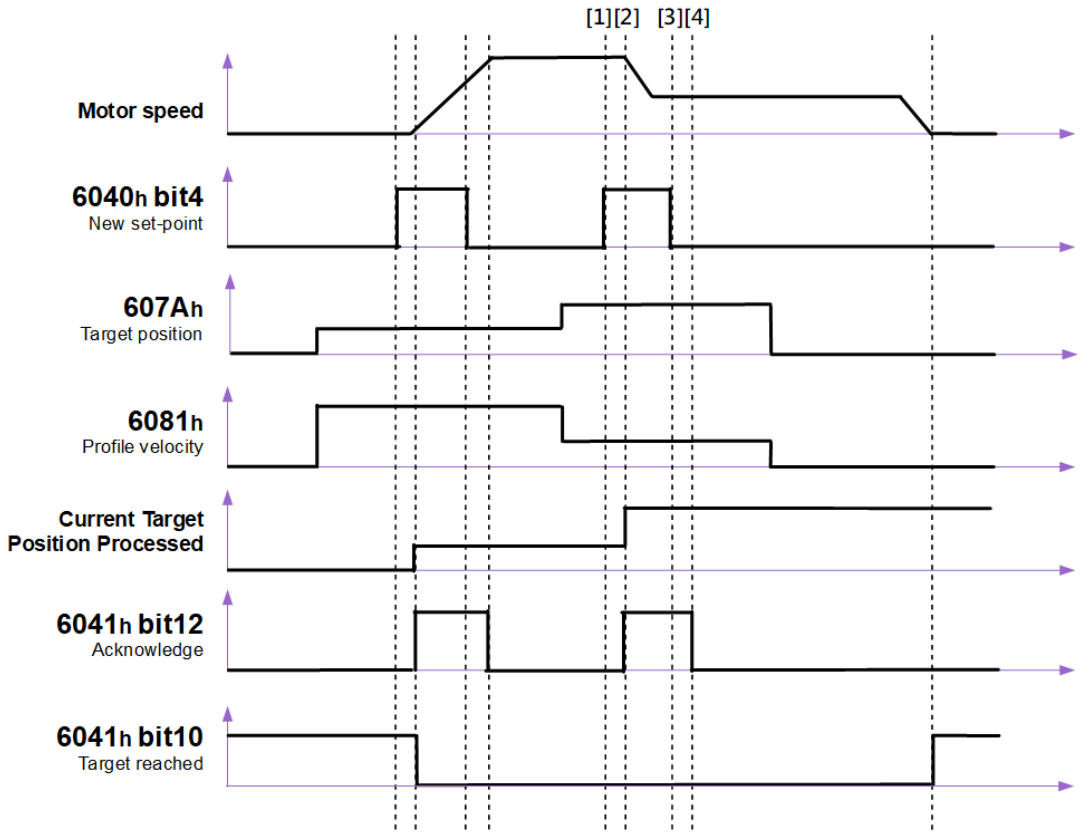


Figure 3.2.3

■ Example of setting set of set-points (change target during motion)

[1] After bit 12 of 6041h (Statusword) is set to 0, the master changes the value of 607Ah (target position) and sets bit 4 of 6040h (Controlword) from 0 to 1 (edge trigger).

[2] The drive acknowledges the new set-point by setting bit 12 of 6041h (Statusword) to 1. The drive buffers 607Ah (target position) as a new target position and continues the ongoing target position.

[3] The master sets bit 4 of 6040h (Controlword) to 0 after bit 12 of 6041h (Statusword) is set to 1.

[4] The drive starts to move to the new target position after the ongoing set-point is completed. Then, the buffer becomes empty, and bit 12 of 6041h (Statusword) is set to 0.

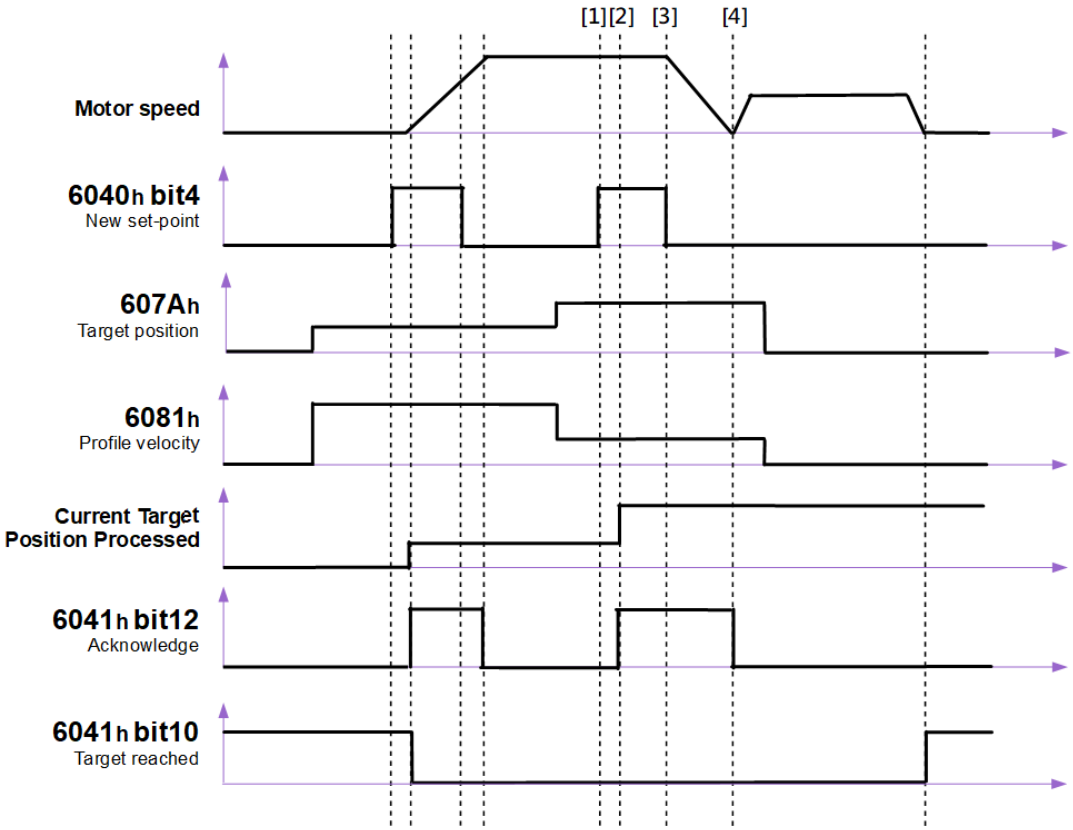


Figure 3.2.4

Note: If the new target position is in the opposite direction, the motor will complete the movement of the current target position first and then execute the reverse movement.

■ Example of buffering set-points

E2 EtherNet/IP servo drive only supports 2 set-points maximum. The handling of the set-points is shown as follows.

[1] When there is no set-point in progress, a new set-point A is immediately effective.
[2] When there is a set-point in progress, the new set-point B and C are stored in the buffers.
[3] When all set-point buffers are all in use (bit 12 of 6041h is 1), the new set-point D is discarded.
[4] When all set-point buffers are all in use (bit 12 of 6041h is 1) and bit 5 of 6040h (Controlword) is set to 1, the new set-point E is immediately processed as a single set-point. All previous setpoints are discarded.
[5] Bit 10 of 6041h (Statusword) remains 0 until all set-points are processed.

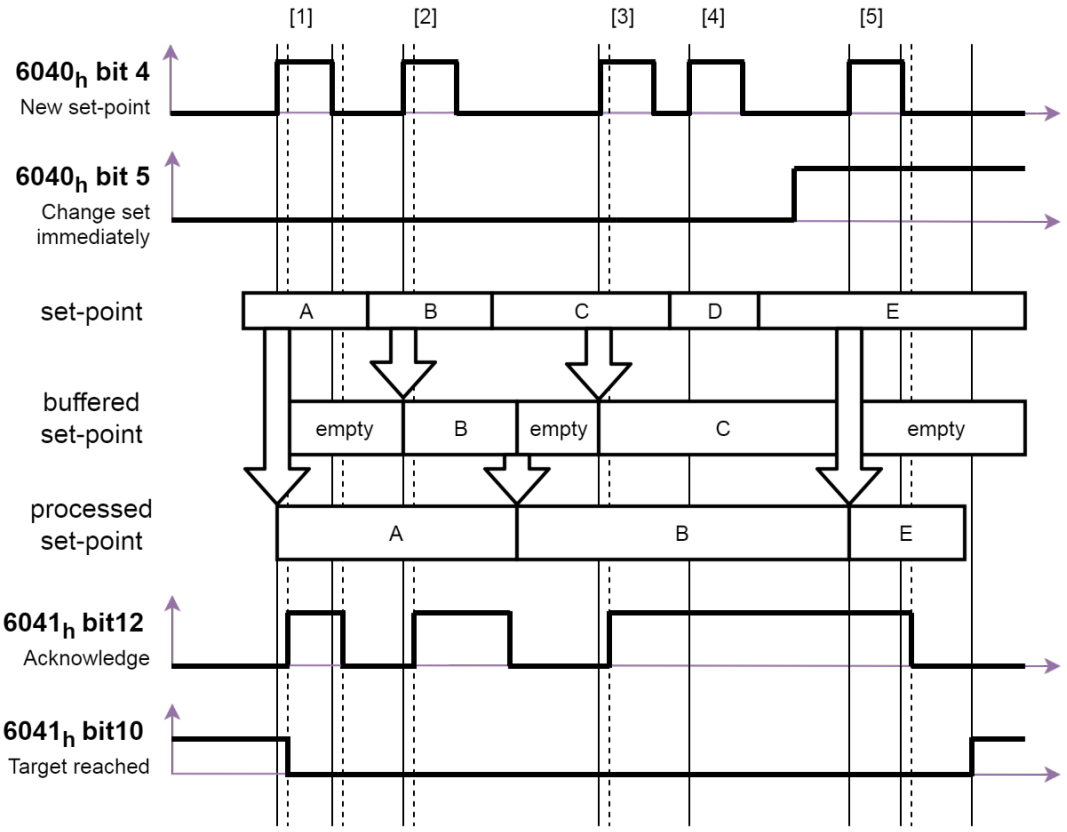


Figure 3.2.5

■ Example of halt bit

When bit 8 of 6040h (Controlword) is set to 1 in PP mode, the motion will be temporarily stopped. After bit 8 of 6040h (Controlword) returns to 0, unfinished set-points will be resumed.

[1] When there is no set-point in process, the new set-point A is taken immediately.
[2] When set-point A is still in process, the new set-point B is stored if the buffer is empty.
[3] When set-point A is still in process but bit 8 of 6040h (Controlword) is set to 1, the motion is halted. After the motor speed decelerates to 0, bit 10 of 6041h (Statusword) changes to 1.
[4] When bit 8 of 6040h (Controlword) returns to 0, the motion towards set-point A is resumed. Bit 10 of 6041h (Statusword) changes to 0.
[5] After set-point A is reached, set-point B is processed.
[6] Bit 10 of 6041h (Statusword) remains 0 until all set-points are processed.

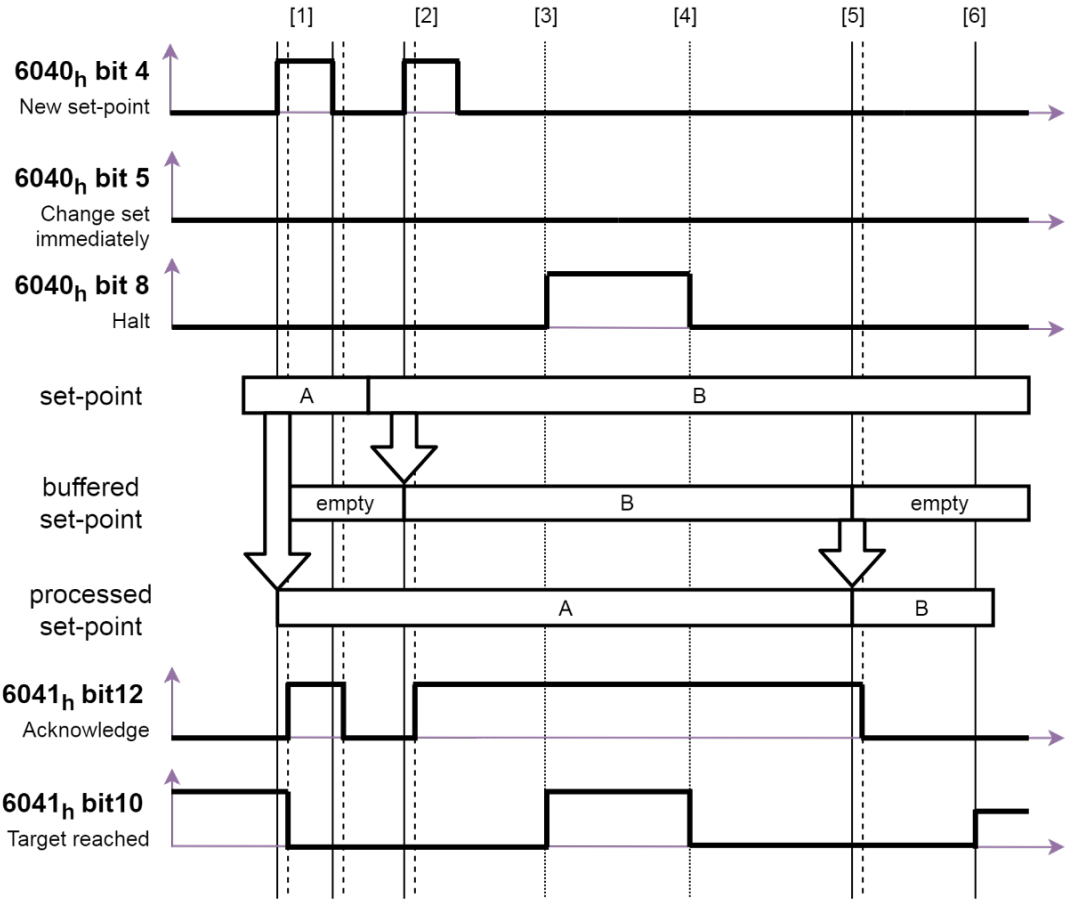


Figure 3.2.6

3.3 Homing mode (HM)

This mode is for incremental encoder. After the homing procedure is done, the home position of the machine will be defined. To make position zero offset from the home position, set an offset value to the object 607Ch. After homing is completed, the values of the following position objects will be recalculated accordingly.

6062h (position demand value) = 6064h (position actual value) = 607Ch (home offset)
6063h (position actual internal value) = 60FCh (position demand internal value) = 0

The input and output objects of HM mode are shown in Figure 3.3.1.

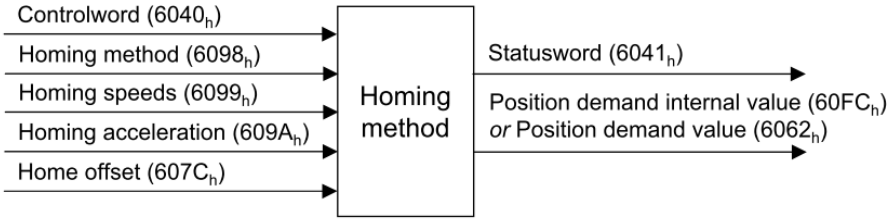


Figure 3.3.1

The related objects of HM mode are listed in Table 3.3.1.

Table 3.3.1

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
6040h	00h	Controlword	U16	rw	0x0 ~ 0xFFFF	-
6041h	00h	Statusword	U16	ro	0x0 ~ 0xFFFF	-
6062h	00h	Position demand value	I32	ro	-2147483648 ~ 2147483647	inc
6063h	00h	Position actual internal value	I32	ro	-2147483648 ~ 2147483647	count
6064h	00h	Position actual value	I32	ro	-2147483648 ~ 2147483647	inc
606Ch	00h	Velocity actual value	I32	ro	-2147483648 ~ 2147483647	inc/s
6072h	00h	Max torque	U16	rw	0 ~ 65535	0.1%
6074h	00h	Torque demand	I16	ro	-32768 ~ 32767	0.1%
6076h	00h	Motor rated torque	U32	ro	0 ~ 4294967295	mNm
6077h	00h	Torque actual value	I16	ro	-32768 ~ 32767	0.1%
607Ch	00h	Home offset	I32	rw	-2147483648 ~ 2147483647	inc
607Fh	00h	Max profile velocity	U32	rw	0 ~ 4294967295	inc/s
6085h	00h	Quick stop deceleration	U32	rw	0 ~ 4294967295	inc/s^2
6098h	00h	Homing method	I8	rw	-128 ~ 127	-
6099h	-	Homing speeds	-	-	-	-
	00h	Number of entries	U8	ro	2	-
	01h	Speed during search for switch	U32	rw	0 ~ 4294967295	inc/s
	02h	Speed during search for zero	U32	rw	0 ~ 4294967295	inc/s

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
609Ah	00h	Homing acceleration	U32	rw	0 ~ 4294967295	inc/s^2
60C5h	00h	Max acceleration	U32	rw	0 ~ 4294967295	inc/s^2
60C6h	00h	Max deceleration	U32	rw	0 ~ 4294967295	inc/s^2

■ Controlword (6040h) of HM mode

Table 3.3.2

Bit	Value	Definition
4 (homing operation start)	0	Do not start homing procedure.
	1	Start or continue homing procedure.
8 (halt)	0	Enable bit 4.
	1	Stop axis.

■ Statusword (6041h) of HM mode

Table 3.3.3

Bit 13	Bit 12	Bit 10	Definition
homing error	homing attained	target reached	
0	0	0	Homing procedure is in progress.
0	0	1	Homing procedure is interrupted or not started.
0	1	0	Homing is attained, but target is not reached.
0	1	1	Homing procedure is successfully completed.
1	0	0	Homing error occurs, and velocity is not 0.
1	0	1	Homing error occurs, and velocity is 0.
1	1	X	Reserved

Note:

1. Bit 12 will be cleared to zero in the following cases.
   – The drive is power cycled.
   – The operation mode is changed to other modes.
2. If multi-turn absolute encoder is used, bit 12 will always be 1.

■ Example of successful homing procedure

[1] Set 6098h (homing method) to the required homing method. Homing methods supported by E2 EtherNet/IP servo drive are given in Table 3.3.4.

[2] Accordingly set homing parameters, 609Ah (homing acceleration), 6099:01h (speed during search for switch), 6099:02h (speed during search for zero) and 607Ch (home offset).

[3] Set bit 4 of 6040h (Controlword) from 0 to 1. Then, the homing procedure starts.

[4] When the homing procedure is successfully completed, the drive sets bit 10 and bit 12 of 6041h (Statusword) to 1.

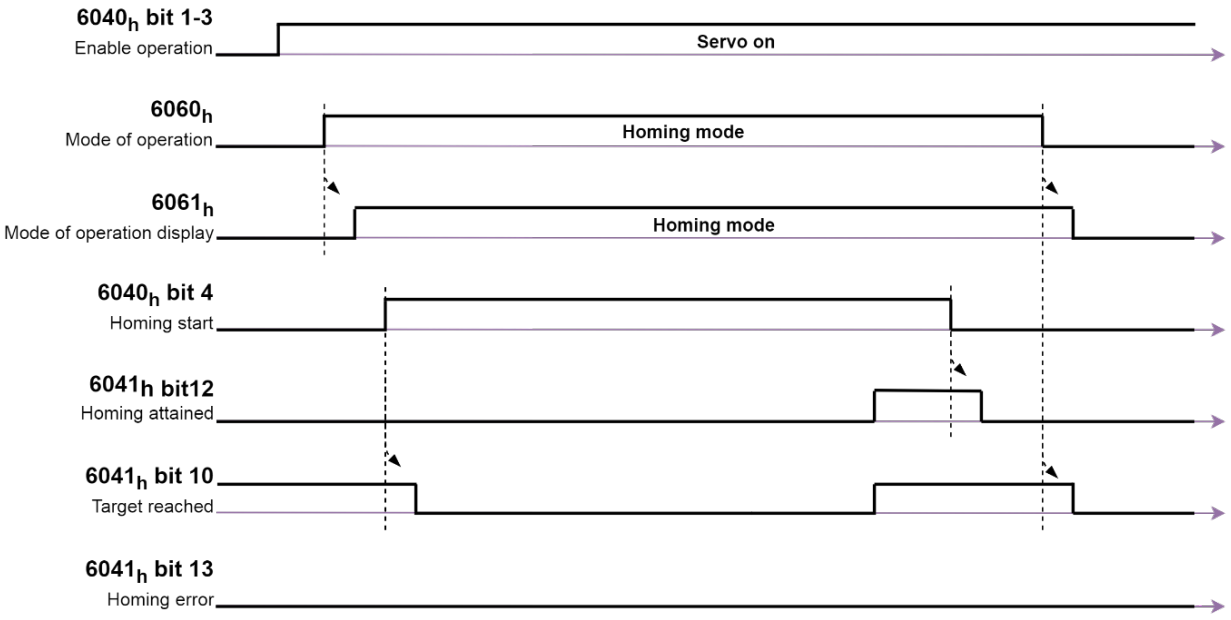
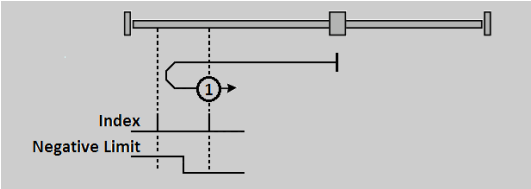
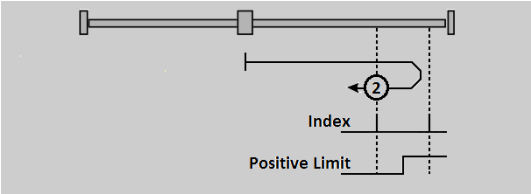
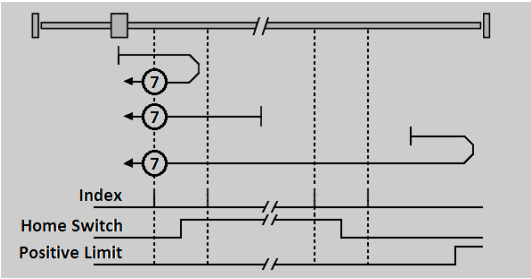
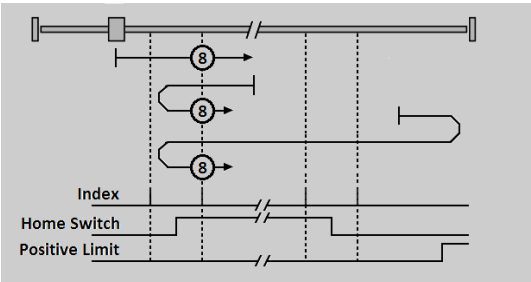
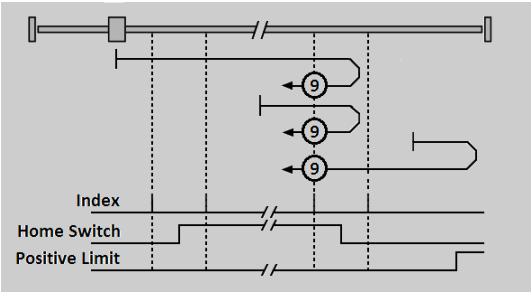
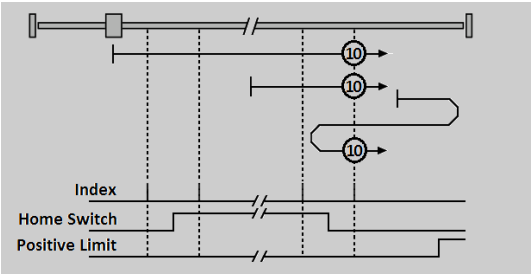
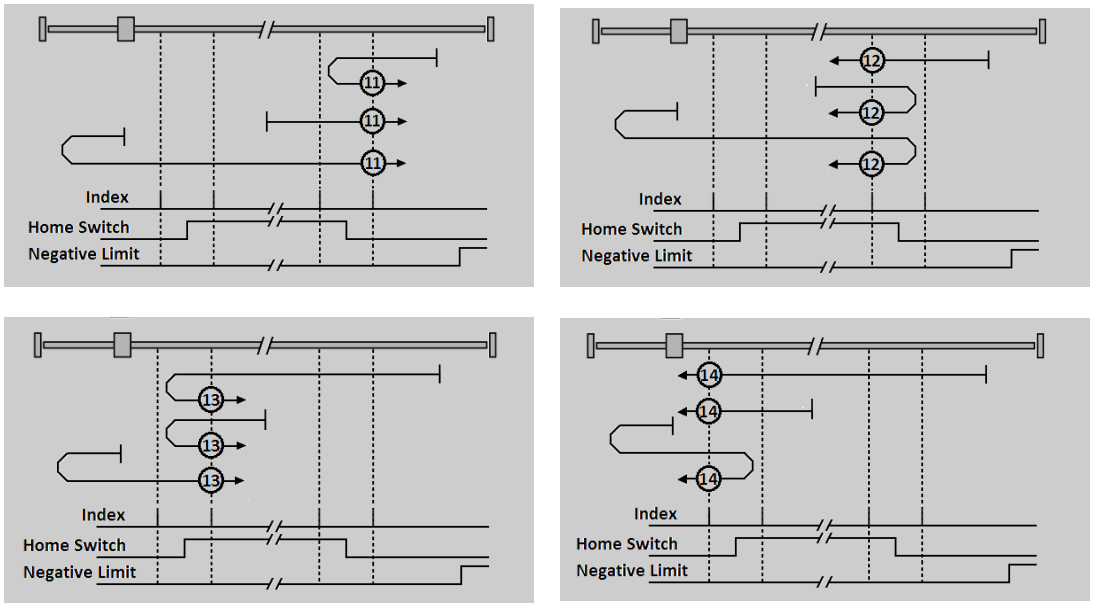
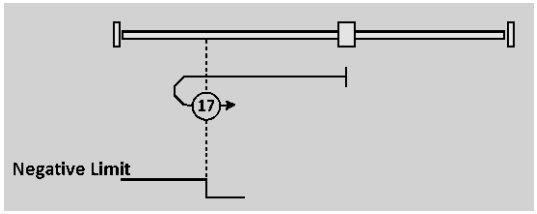
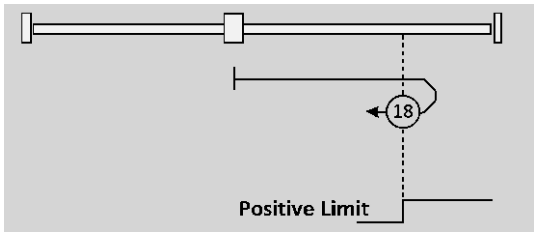
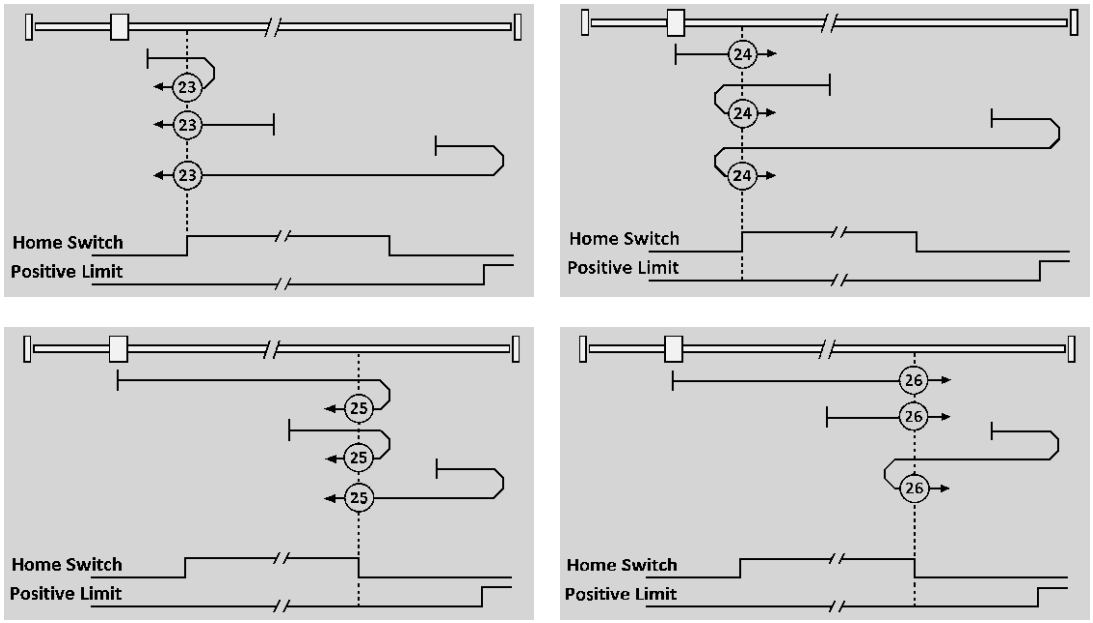
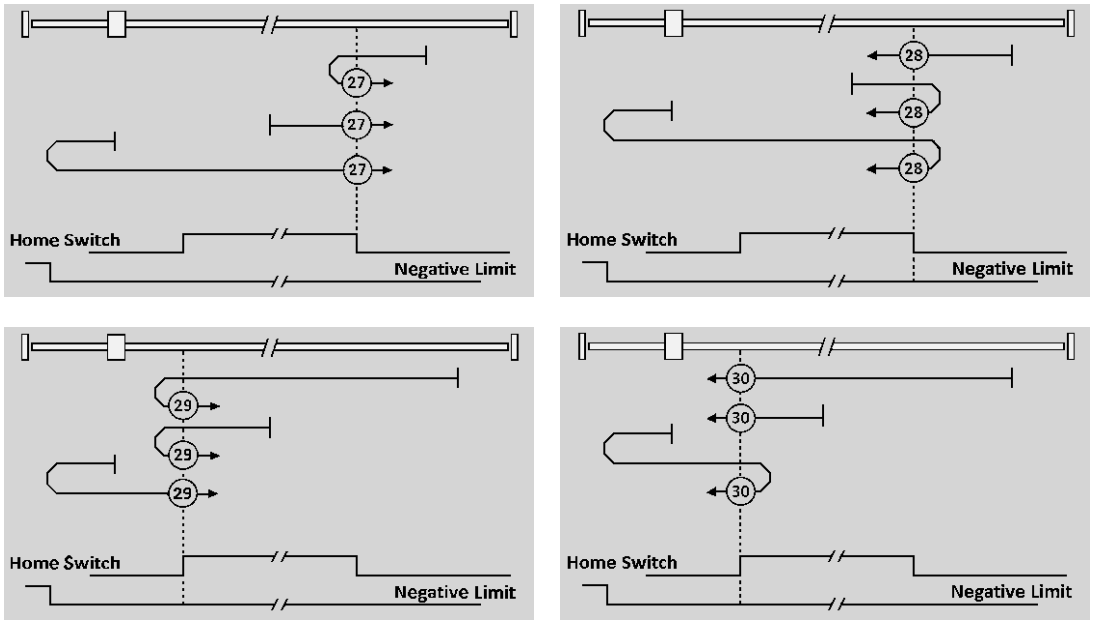


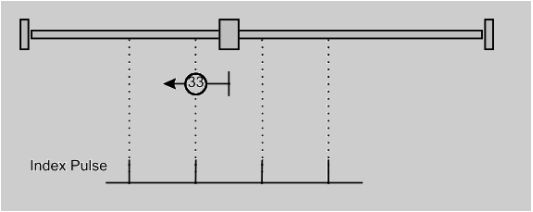
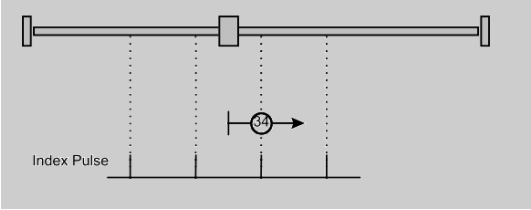
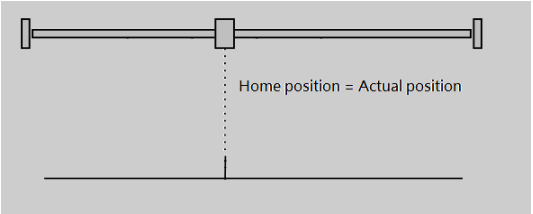
Figure 3.3.2

Table 3.3.4

Method	Description
1	**Homing on negative limit switch and index pulse** If the negative limit switch is inactive, the initial direction of the movement is leftward. The home position is at the first index pulse to the right of the position where the negative limit switch becomes inactive. If the negative limit is not assigned, homing will fail. 
2	**Homing on positive limit switch and index pulse** If the positive limit switch is inactive, the initial direction of the movement is rightward. The home position is at the first index pulse to the left of the position where the positive limit switch becomes inactive. If the positive limit is not assigned, homing will fail. 
7~10	**Homing on home switch and index pulse – positive initial direction** The initial direction of the movement depends on the home switch edge being sought. If the home switch is active at the beginning, the initial direction of method 7 and 8 is negative. The initial direction of all other cases is positive. If the home switch and the positive limit are not assigned, homing will fail.    

Method	Description
11~14	**Homing on home switch and index pulse – negative initial direction** The initial direction of the movement depends on the home switch edge being sought. If the home switch is active at the beginning, the initial direction of method 11 and 12 is positive. The initial direction of all other cases is negative. If the home switch and the negative limit are not assigned, homing will fail. 
17	**Homing on negative limit switch** If the negative limit switch is inactive, the initial direction of the movement is leftward. The home position is at the right of the position where the negative limit switch becomes inactive. If the negative limit is not assigned, homing will fail. 
18	**Homing on positive limit switch** If the positive limit switch is inactive, the initial direction of the movement is rightward. The home position is at the left of the position where the positive limit switch becomes inactive. If the positive limit is not assigned, homing will fail. 

Method	Description
23~26	**Homing on home switch – positive initial direction** The initial direction of the movement depends on the home switch edge being sought. If the home switch is active at the beginning, the initial direction of method 23 and 24 is negative. The initial direction of all other cases is positive. If the home switch and the positive limit are not assigned, homing will fail. 
27~30	**Homing on home switch – negative initial direction** The initial direction of the movement depends on the home switch edge being sought. If the home switch is active at the beginning, the initial direction of method 27 and 28 is positive. The initial direction of all other cases is negative. If the home switch and the negative limit are not assigned, homing will fail. 

Method	Description
33~34	**Homing on index pulse** The direction of homing is negative (33) or positive (34) respectively. The home position is at the index pulse found in the selected direction.  
37	**Homing on current position** Current position of the motor is defined as the home position. In this method, the drive does not need to be in Operation enabled state. Objects are initialized as follows. 6062h (position demand value) = 6064h (position actual value) = 607Ch (home offset) 6063h (position actual internal value) = 60FCh (position demand internal value) = 0 

3.4 Profile velocity mode (PV)

The motor speed is output according to the profile acceleration and the profile deceleration until it reaches the target velocity. Figure 3.4.1 shows the input and output objects of the structure of PV mode.

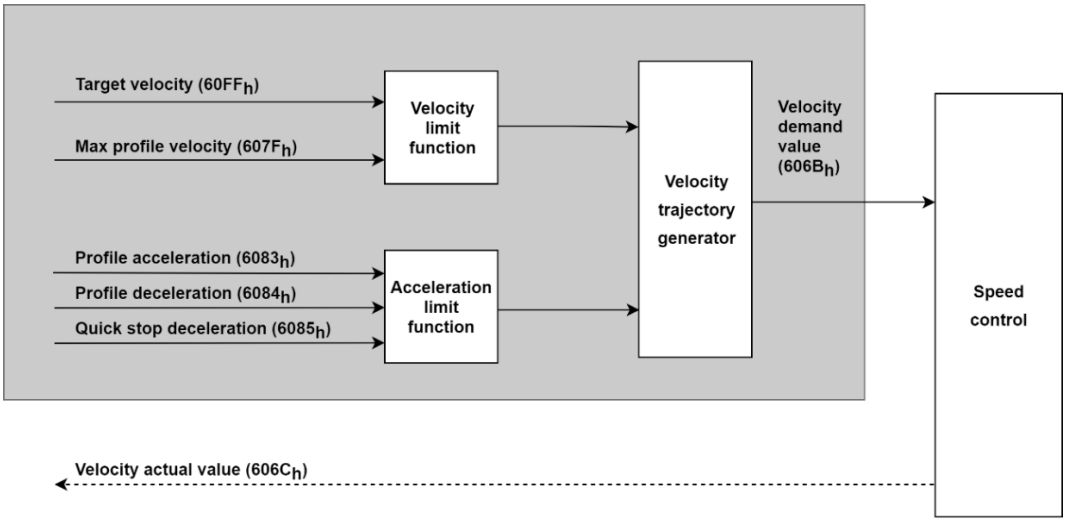


Figure 3.4.1

Note: When the motor is moving, the change of Profile acceleration (6083h) and Profile deceleration (6084h) will not be executed until the moving is done.

The related objects of PV mode are listed in Table 3.4.1.

Table 3.4.1

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
6040h	00h	Controlword	U16	rw	0x0 ~ 0xFFFF	-
6041h	00h	Statusword	U16	ro	0x0 ~ 0xFFFF	-
6062h	00h	Position demand value	I32	ro	-2147483648 ~ 2147483647	inc
6063h	00h	Position actual internal value	I32	ro	-2147483648 ~ 2147483647	count
6064h	00h	Position actual value	I32	ro	-2147483648 ~ 2147483647	inc
606Bh	00h	Velocity demand value	I32	ro	-2147483648 ~ 2147483647	inc/s
606Ch	00h	Velocity actual value	I32	ro	-2147483648 ~ 2147483647	inc/s
606Dh	00h	Velocity window	U16	rw	0 ~ 65535	inc/s
606Eh	00h	Velocity window time	U16	rw	0 ~ 65535	ms
6072h	00h	Max torque	U16	rw	0 ~ 65535	0.1%
6076h	00h	Motor rated torque	U32	ro	0 ~ 4294967295	mNm
6077h	00h	Torque actual value	I16	ro	-32768 ~ 32767	0.1%
607Fh	00h	Max profile velocity	U32	rw	0 ~ 4294967295	inc/s
6083h	00h	Profile acceleration	U32	rw	0 ~ 4294967295	inc/s^2
6084h	00h	Profile deceleration	U32	rw	0 ~ 4294967295	inc/s^2
6085h	00h	Quick stop deceleration	U32	rw	0 ~ 4294967295	inc/s^2

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
60C5h	00h	Max acceleration	U32	rw	0 ~ 4294967295	inc/s^2
60C6h	00h	Max deceleration	U32	rw	0 ~ 4294967295	inc/s^2
60FFh	00h	Target velocity	I32	rw	-2147483648 ~ 2147483647	inc/s

■ Controlword (6040h) of PV mode

Table 3.4.2

Bit	Value	Definition
8 (halt)	0	Execute or continue the motion.
	1	Axis is stopped according to 605Dh (halt option code).

■ Statusword (6041h) of PV mode

Table 3.4.3

Bit	Value	Definition
10 (target reached)	0	Halt (Bit 8 in Controlword) = 0: target velocity not reached Halt = 1: axis decelerates
	1	Halt = 0: target velocity reached Halt = 1: velocity of axis is 0
12 (speed)	0	Speed is not equal to 0.
	1	Speed is equal to 0.

3.5 Profile torque mode (TQ)

The torque is output up to the target torque according to the torque slope setting. Torque command is generated from 6071h (target torque) and 6087h (torque slope), as Figure 3.5.1 shows.

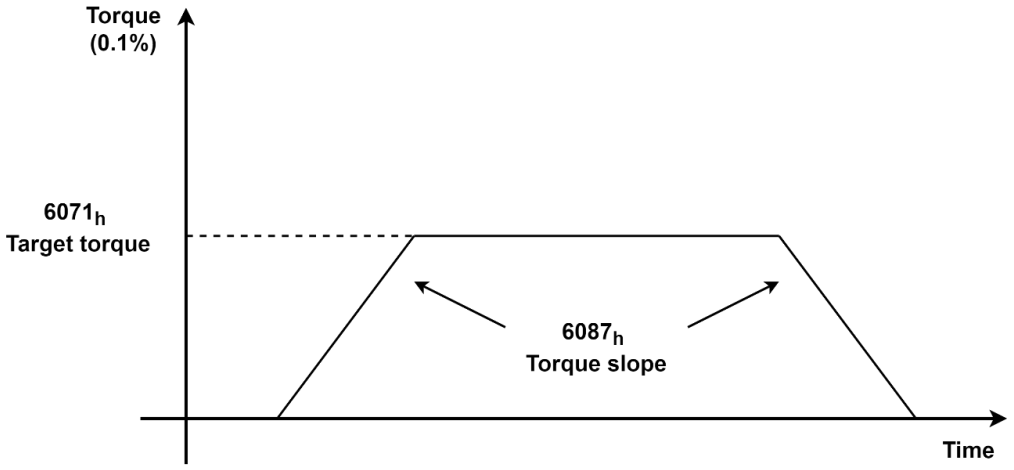


Figure 3.5.1

Figure 3.5.2 shows the input and output objects of the structure of TQ mode.

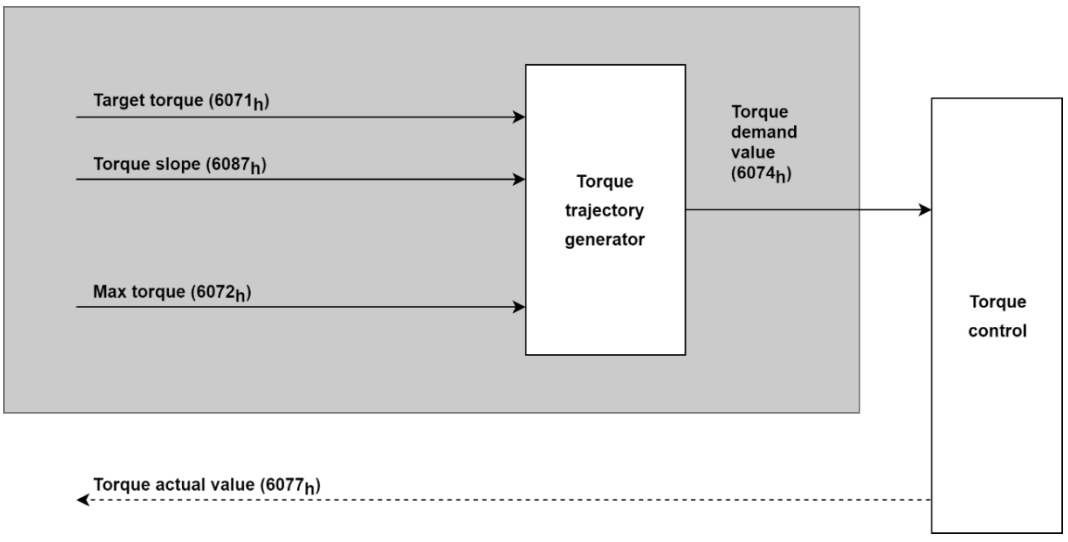


Figure 3.5.2

The related objects of TQ mode are listed in Table 3.5.1.

Table 3.5.1

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
6040h	00h	Controlword	U16	rw	0x0 ~ 0xFFFF	-
6041h	00h	Statusword	U16	ro	0x0 ~ 0xFFFF	-
6063h	00h	Position actual internal value	I32	ro	-2147483648 ~ 2147483647	count
6064h	00h	Position actual value	I32	ro	-2147483648 ~ 2147483647	inc
606Ch	00h	Velocity actual value	I32	ro	-2147483648 ~ 2147483647	inc/s
6071h	00h	Target torque	I16	rw	-32768 ~ 32767	0.1%
6072h	00h	Max torque	U16	rw	0 ~ 65535	0.1%
6074h	00h	Torque demand	I16	ro	-32768 ~ 32767	0.1%
6075h	00h	Motor rated current	U32	ro	0 ~ 4294967295	mA
6076h	00h	Motor rated torque	U32	ro	0 ~ 4294967295	mNm
6077h	00h	Torque actual value	I16	ro	-32768 ~ 32767	0.1%
6087h	00h	Torque slope	U32	rw	0 ~ 4294967295	0.1%/s
60B2h	00h	Torque offset	I16	rw	-32768 ~ 32767	0.1%
60E0h	00h	Positive torque limit value	U16	rw	0 ~ 65535	0.1%
60E1h	00h	Negative torque limit value	U16	rw	0 ~ 65535	0.1%

■ Controlword (6040h) of TQ mode

Table 3.5.2

Bit	Value	Definition
8 (halt)	0	Execute or continue the motion.
	1	Axis is stopped according to 605Dh (halt option code).

■ Statusword (6041h) of TQ mode

Table 3.5.3

Bit	Value	Definition
10 (target reached)	0	Halt (Bit 8 in Controlword) = 0: target torque not reached Halt = 1: axis decelerates
	1	Halt = 0: target torque reached Halt = 1: velocity of axis is 0

3.6 Touch probe function

Touch probe function is used to latch the position of a designated input signal. The input signal can be an encoder index signal (Z-phase signal) or an external probe signal (EXT-PROBE1 signal).

Some functions may not be supported by E2 EtherNet/IP servo drive. See the description of object 60B8h for the settings of available functions.

The related objects of touch probe function are listed in Table 3.6.1.

Table 3.6.1

Index	Sub-Index	Name	Data type	Access	Valid value	Unit
60B8h	00h	Touch probe function	U16	rw	0 ~ 65535	-
60B9h	00h	Touch probe status	U16	ro	0 ~ 65535	-
60BAh	00h	Touch probe 1 positive edge	I32	ro	-2147483648 ~ 2147483647	inc
60BBh	00h	Touch probe 1 negative edge	I32	ro	-2147483648 ~ 2147483647	inc
60BCh	00h	Touch probe 2 positive edge	I32	ro	-2147483648 ~ 2147483647	inc
60BDh	00h	Touch probe 2 negative edge	I32	ro	-2147483648 ~ 2147483647	inc

- Object 60B8h: Touch probe function

Table 3.6.2

Bit	Value	Definition
0	0	Switch off touch probe 1.
	1	Enable touch probe 1.
1	0	Trigger first event. (Single latch)
	1	Continuous latch.
2, 3	00	Trigger with touch probe 1 input. (by external probe signal)
	01	Trigger with zero impulse signal. (by encoder index signal)
	10	(Not support)
	11	Reserved
4	0	Switch off sampling at positive edge of touch probe 1.
	1	Enable sampling at positive edge of touch probe 1.
5	0	Switch off sampling at negative edge of touch probe 1.
	1	Enable sampling at negative edge of touch probe 1.
6, 7	-	Reserved
8	0	Switch off touch probe 2.
	1	Enable touch probe 2.
9	0	Trigger first event. (Single latch)
	1	Continuous latch.
10, 11	00	(Not support)
	01	Trigger with zero impulse signal. (by encoder index signal)
	10	(Not support)
	11	Reserved

Bit	Value	Definition
12	0	Switch off sampling at positive edge of touch probe 2.
	1	Enable sampling at positive edge of touch probe 2.
13	0	Switch off sampling at negative edge of touch probe 2.
	1	Enable sampling at negative edge of touch probe 2.
14, 15	-	Reserved

Note:

1. E2 EtherNet/IP servo drive does not support enabling touch probe 1 and touch probe 2 at the same time. In this case, only touch probe 1 will be executed.
2. Do not enable sampling at positive edge and negative edge (bit 4 and bit 5, bit 12 and bit 13) at the same time. Otherwise, only positive edge sampling will be executed.

■ Object 60B9h: Touch probe status

Table 3.6.3

Bit	Value	Definition
0	0	Touch probe 1 is switched off.
	1	Touch probe 1 is enabled.
1	0	Touch probe 1 no positive edge value stored.
	1	Touch probe 1 positive edge value stored.
2	0	Touch probe 1 no negative edge value stored.
	1	Touch probe 1 negative edge value stored.
3~7	-	Reserved
8	0	Touch probe 2 is switched off.
	1	Touch probe 2 is enabled.
9	0	Touch probe 2 no positive edge value stored.
	1	Touch probe 2 positive edge value stored.
10	0	Touch probe 2 no negative edge value stored.
	1	Touch probe 2 negative edge value stored.
11~15	-	Reserved

Note:

When touch probe 1 is switched off (bit 0 of object 60B8h is 0), bit 1 and bit 2 are set to 0.

When touch probe 2 is switched off (bit 8 of object 60B8h is 0), bit 9 and bit 10 are set to 0.

■ Example of touch probe 1 triggering first event

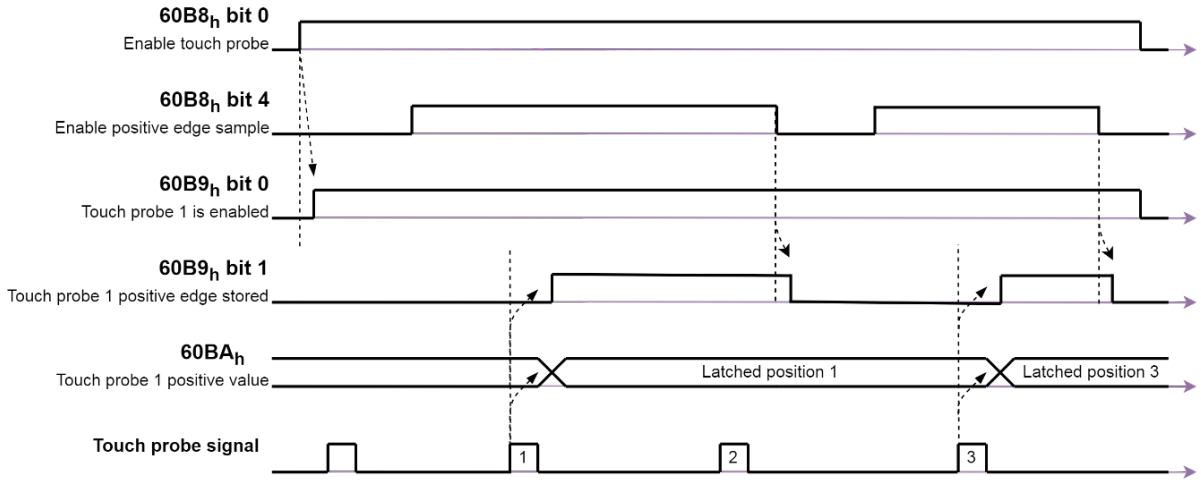


Figure 3.6.1

Table 3.6.4

#	Value	Description
(1)	60B8h bit 0 = 1 60B8h bit 1 = 0 60B8h bit 4 = 1	Touch probe 1 is enabled. First event is triggered. Touch probe 1 positive edge is configured and enabled.
(2)	→ 60B9h bit 0 = 1	Status “Touch probe 1 is enabled” is set to 1.
(3)		There is a positive edge in external touch probe signal.
(4)	→ 60B9h bit 1 = 1 → 60BAh	Status “Touch probe 1 positive edge stored” is set to 1. Touch probe position 1 positive value is stored.
(5)	60B8h bit 4 = 0	Positive edge sampling is switched off.
(6)	→ 60B9h bit 1 = 0 → 60BAh	Status “Touch probe 1 positive edge stored” is reset to 0. Touch probe position 1 positive value is not changed.
(7)	60B8h bit 4 = 1	Positive edge sampling is enabled.
(8)		There is another positive edge in external touch probe signal.
(9)	→ 60B9h bit 1 = 1 → 60BAh	Status “Touch probe 1 positive edge stored” is set to 1. New touch probe position 1 positive value is stored.
(10)	→ 60B8h bit 0 = 0	Touch probe 1 is swtiched off.
(11)	→ 60B9h bit 0 and bit 1 = 0	Status bits are reset.

■ Example of touch probe 1 continuous latch

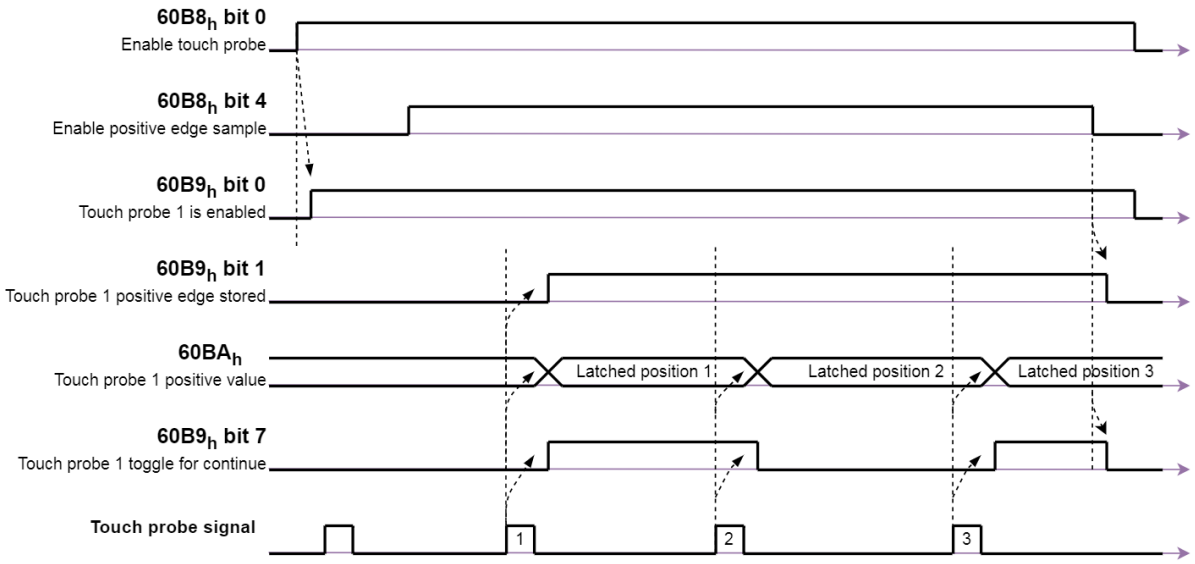


Figure 3.6.2

Table 3.6.5

#	Value	Description
(1)	60B8h bit 0 = 1 60B8h bit 1 = 1 60B8h bit 4 = 1	Touch probe 1 is enabled. Continuous latch. Touch probe 1 positive edge is configured and enabled.
(2)	→ 60B9h bit 0 = 1	Status “Touch probe 1 is enabled” is set to 1.
(3)		There is a positive edge in external touch probe signal.
(4)	→ 60B9h bit 1 = 1 → 60B9h bit 7 = 1 → 60BAh	Status “Touch probe 1 positive edge stored” is set to 1. Touch probe 1 positive edge is updated. Touch probe position 1 positive value is stored.
(5)		There is the 2nd positive edge in external touch probe signal.
(6)	→ 60B9h bit 7 = 0 → 60BAh	Touch probe 1 positive edge is updated. The 2nd touch probe position 1 positive value is stored.
(7)		There is the 3rd positive edge in external touch probe signal.
(8)	→ 60B9h bit 7 = 1 → 60BAh	Touch probe 1 positive edge is updated. The 3rd touch probe position 1 positive value is stored.
(9)	60B8h bit 4 = 0	Positive edge sampling is switched off.
(10)	→ 60B9h bit 1 = 0 → 60B9h bit 7 = 0 → 60BAh	Status “Touch probe 1 positive edge stored” is reset to 0. Continuous latch status is reset to 0. Touch probe position 1 positive value is not changed.
(11)	→ 60B8h bit 0 = 0	Touch probe 1 is switched off.
(12)	→ 60B9h bit 0 = 0	Status bit is reset.

3.7 Object dictionary list

3.7.1 E2 drive objects

Table 3.7.1.1

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Op Mode</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td>2XXXh</td><td>00h</td><td colspan="6">The 2000h series objects are from servo Pt parameters. Please refer to the chapter “List of parameters” in each servo drive user manual. The mapping relationship between servo Pt parameter numbers and object indexes is as follows:
Object index = 2000h + servo Pt parameter number
Example: Servo drive’s parameter Pt100 is “Velocity loop gain”, and its corresponding object is 2100h.</td></tr>
<tr><td rowspan="2">3000h</td><td rowspan="2">00h</td><td>Motor type</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 2</td><td>-</td></tr>
<tr><td colspan="6">Motor type used with the drive
0: Linear motor (LM)
1: Direct drive motor / Torque motor (DM / TM)
2: AC servo motor (AC)</td></tr>
<tr><td rowspan="2">3001h</td><td rowspan="2">00h</td><td>Inner encoder resolution</td><td>I32</td><td>ro</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>-</td></tr>
<tr><td colspan="6">Encoder resolution for internal loop</td></tr>
<tr><td rowspan="2">3056h</td><td rowspan="2">00h</td><td>Software state[12]</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 0xFFFF</td><td>-</td></tr>
<tr><td colspan="6">Software state table. The state corresponding to each bit is described as follows.
<table>
<tr><th>Bit</th><th>State Name</th><th>State Definition</th></tr>
<tr><td>0</td><td>Reserved</td><td>N/A</td></tr>
<tr><td>1</td><td>Reserved</td><td>N/A</td></tr>
<tr><td>2</td><td>Reserved</td><td>N/A</td></tr>
<tr><td>3</td><td>Homing state</td><td>0: Homing is not executed
1: Homing is in process</td></tr>
<tr><td>4</td><td>Position trigger function state</td><td>0: Position trigger function is not enabled
1: Position trigger function is enabled</td></tr>
<tr><td>5</td><td>Communication state of gantry control system</td><td>0: Communication for gantry control system is not executed
1: Communication for gantry control system is normal</td></tr>
<tr><td>6</td><td>Motor power state of gantry yaw axis</td><td>0: Motor for gantry yaw axis is unpowered
1: Motor for gantry yaw axis is powered</td></tr>
<tr><td>7</td><td>Alarm state of gantry yaw axis</td><td>0: No alarm is in gantry yaw axis
1: An alarm occurs in gantry yaw axis</td></tr>
<tr><td>8</td><td>Activated state of gantry control system</td><td>0: Gantry control system is not activated
1: Gantry control system is activated</td></tr>
<tr><td>9</td><td>Homing state of gantry yaw axis</td><td>0: Homing for gantry yaw axis is not completed
1: Homing for gantry yaw axis is completed</td></tr>
<tr><td>10</td><td>Near home sensor state of gantry yaw axis</td><td>0: Gantry yaw axis is not in the range of near home sensor
1: Gantry yaw axis is in the range of near home sensor</td></tr>
<tr><td>11</td><td>Regulating state of gantry yaw axis</td><td>0: Gantry yaw axis regulating is incompleted
1: Gantry yaw axis regulating is completed</td></tr>
<tr><td>12</td><td>In-position state of gantry yaw axis</td><td>0: Gantry yaw axis is not in-position
1: Gantry yaw axis is in-position</td></tr>
<tr><td>13</td><td>Ready state of gantry yaw axis</td><td>0: Drive for gantry yaw axis is not ready
1: Drive for gantry yaw axis is ready without triggering STO</td></tr>
<tr><td>14</td><td>Reserved</td><td>N/A</td></tr>
<tr><td>15</td><td>Reserved</td><td>N/A</td></tr>
</table></td></tr>
<tr><td rowspan="2">3057h</td><td rowspan="2">00h</td><td>Application mode of gantry system</td><td>U16</td><td>rw</td><td>All</td><td>1, 2, 11</td><td>-</td></tr>
<tr><td colspan="6">Application mode setting of gantry control system. The applicable modes are as follows.
Please refer to “E Series Servo Drive Gantry Control System User Manual” for detailed settings.
1: Activate gantry control system
2: Deactivate gantry control system
11: Execute yaw axis regulating</td></tr>
<tr><td rowspan="2">3058h</td><td rowspan="2">00h</td><td>Yaw target position</td><td>I32</td><td>rw</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>control unit</td></tr>
<tr><td colspan="6">Target position for gantry yaw axis</td></tr>
</table>

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Op Mode</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td rowspan="2">3059h</td><td rowspan="2">00h</td><td colspan="5">Yaw feedback position</td><td>-2147483648 ~ 2147483647</td><td>control unit</td></tr>
<tr><td colspan="7">Feedback position for gantry yaw axis</td></tr>
<tr><td rowspan="2">3060h</td><td rowspan="2">00h</td><td colspan="5">Use touch probe enable specific function</td><td>0 ~ 3</td><td>-</td></tr>
<tr><td colspan="7">Enable specific function by touch probe function.
<table>
<tr><th>Bit</th><th>Function</th><th>Definition</th></tr>
<tr><td>0</td><td>Error map</td><td>0: Do not use touch probe function to enable error map.
1: Use touch probe function to enable error map.</td></tr>
<tr><td>1</td><td>Position trigger function</td><td>(Before using this function, set Pt00E = t.1□□□.)
0: Do not use touch probe function to enable position trigger function.
1: Use touch probe function to enable position trigger function.</td></tr>
<tr><td>2~15</td><td>Reserved</td><td>N/A</td></tr>
</table>
For the details of error map and position trigger function, please refer to each servo drive user manual.</td></tr>
<tr><td rowspan="2">3061h</td><td rowspan="2">00h</td><td colspan="5">Enable position trigger function</td><td>0 ~ 1</td><td>-</td></tr>
<tr><td colspan="7">Enable position trigger function.
For the details of position trigger function, please refer to each servo drive user manual.
0: Disable position trigger function
1: Enable position trigger function</td></tr>
<tr><td rowspan="2">3062h</td><td rowspan="2">00h</td><td colspan="5">Overtravel stop mode selection</td><td>0 ~ 1</td><td>-</td></tr>
<tr><td colspan="7">Reserved.</td></tr>
<tr><td rowspan="2">3063h</td><td rowspan="2">00h</td><td colspan="5">Velocity analog input voltage</td><td>-10000 ~ 10000</td><td>mV</td></tr>
<tr><td colspan="7">Control signal's velocity analog input (V_REF) (only available on E2 servo drive)
Formula: Object 3063h = Actual voltage - Object 3064h</td></tr>
<tr><td rowspan="2">3064h</td><td rowspan="2">00h</td><td colspan="5">Velocity analog input voltage offset</td><td>-10000 ~ 10000</td><td>mV</td></tr>
<tr><td colspan="7">Velocity analog input's offset (only available on E2 servo drive)</td></tr>
<tr><td rowspan="2">3065h</td><td rowspan="2">00h</td><td colspan="5">Torque analog input voltage</td><td>-10000 ~ 10000</td><td>mV</td></tr>
<tr><td colspan="7">Control signal's torque analog input (T_REF) (only available on E2 servo drive)
Formula: Object 3065h = Actual voltage - Object 3066h</td></tr>
<tr><td rowspan="2">3066h</td><td rowspan="2">00h</td><td colspan="5">Torque analog input voltage offset</td><td>-10000 ~ 10000</td><td>mV</td></tr>
<tr><td colspan="7">Torque analog input's offset (only available on E2 servo drive)</td></tr>
<tr><td rowspan="2">3067h</td><td rowspan="2">00h</td><td colspan="5">Analog output 1 voltage</td><td>-10000 ~ 10000</td><td>mV</td></tr>
<tr><td colspan="7">Control signal's analog output 1 (AO1)
When Pt006 = t.□□17 is set, users can control analog output 1 with this object.</td></tr>
<tr><td rowspan="2">3068h</td><td rowspan="2">00h</td><td colspan="5">Analog output 2 voltage</td><td>-10000 ~ 10000</td><td>mV</td></tr>
<tr><td colspan="7">Control signal's analog output 2 (AO2)
When Pt006 = t.□□17 is set, users can control analog output 2 with this object.</td></tr>
<tr><td rowspan="2">3069h</td><td rowspan="2">00h</td><td colspan="5">Position trigger array value</td><td>-2147483648 ~ 2147483647</td><td>inc</td></tr>
<tr><td colspan="7">Position trigger array's value</td></tr>
<tr><td rowspan="2">306Ah</td><td rowspan="2">00h</td><td colspan="5">Position trigger array index</td><td>0 ~ 255</td><td>-</td></tr>
<tr><td colspan="7">Position trigger array's index value</td></tr>
<tr><td rowspan="2">306Bh</td><td rowspan="2">00h</td><td colspan="5">Position trigger array control object</td><td>0 ~ 65535</td><td>-</td></tr>
<tr><td colspan="7">Writing procedure of operating position trigger array
Set 0x0001~0x0080 to select the writing procedure. The writing result will be displayed by 0x1000~0x2000.
<table>
<tr><th>Value</th><th>Definition</th><th>Category</th></tr>
<tr><td>0x0001</td><td>Write the value of object 3069h to the "position array" corresponding to object 306Ah.
(At this time, object 306Ah cannot exceed 255.)</td><td rowspan="4">Command</td></tr>
<tr><td>0x0008</td><td>Set all the values in the "position array" to 0.</td></tr>
<tr><td>0x0010</td><td>Write the value of object 3069h to the "status array" corresponding to object 306Ah.
(At this time, object 306Ah cannot exceed 7.)</td></tr>
<tr><td>0x0080</td><td>Set all the values in the "status array" to 0.</td></tr>
<tr><td>0x1000</td><td>The writing succeeds.</td><td rowspan="2">Result</td></tr>
<tr><td>0x2000</td><td>The writing fails. Refer to object 306Ch for the causes.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Op Mode</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td rowspan="2">306Ch</td><td rowspan="2">00h</td><td>Position trigger function error code</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 65535</td><td>-</td></tr>
<tr><td colspan="6">The reasons that the writing of position trigger array or the enabling of position trigger function fails
<table>
<tr><th>Bit</th><th>Definition</th></tr>
<tr><td colspan="2">※ The reasons that the writing of position trigger array fails</td></tr>
<tr><td>0</td><td>Fixed interval PT mode does not support the writing of position trigger array.</td></tr>
<tr><td>1</td><td>Wrong index value of array (object 306Ah)</td></tr>
<tr><td>2</td><td>Undefined command (object 306Bh)</td></tr>
<tr><td>3~7</td><td>Reserved</td></tr>
<tr><td colspan="2">※ The reasons that the enabling of position trigger function fails</td></tr>
<tr><td>8</td><td>The encoder does not support position trigger function.</td></tr>
<tr><td>9</td><td>Homing is not executed.</td></tr>
<tr><td>10</td><td>The parameter setting of Pt00E or Pt230~Pt232 is wrong.</td></tr>
<tr><td>11</td><td>The current motor position exceeds the end position set by Pt232 (fixed interval PT mode Pt00E = t.□□1□).</td></tr>
<tr><td>12~15</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td rowspan="2">306Dh</td><td rowspan="2">00h</td><td>Position trigger function status</td><td>I16</td><td>ro</td><td>All</td><td>0 ~ 32767</td><td>-</td></tr>
<tr><td colspan="6">Status of position trigger function
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Position trigger function is not enabled.</td></tr>
<tr><td>3</td><td>Fixed interval position trigger function is executing (trigger direction: position decreasing).</td></tr>
<tr><td>4</td><td>Fixed interval position trigger function is executing (trigger direction: position increasing).</td></tr>
<tr><td>13</td><td>Random interval position trigger function is executing (trigger direction: index value decreasing).</td></tr>
<tr><td>14</td><td>Random interval position trigger function is executing (trigger direction: index value increasing).</td></tr>
<tr><td>20</td><td>Wait until it goes back to the first set trigger position (if repeat mode is enabled Pt012 = t.□□□1).</td></tr>
<tr><td>99</td><td>Position trigger function is invalid (Pt00E = t.□□□0).</td></tr>
</table></td></tr>
<tr><td rowspan="2">306Eh</td><td rowspan="2">00h</td><td>Expected total number of position trigger</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 65535</td><td>-</td></tr>
<tr><td colspan="6">Expected total number of position trigger</td></tr>
<tr><td rowspan="2">306Fh</td><td rowspan="2">00h</td><td>Triggered number of position trigger</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 65535</td><td>-</td></tr>
<tr><td colspan="6">Triggered number of position trigger</td></tr>
<tr><td rowspan="2">3070h</td><td rowspan="2">00h</td><td>Remaining number of position trigger</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 65535</td><td>-</td></tr>
<tr><td colspan="6">Remaining number of position trigger</td></tr>
<tr><td rowspan="2">3080h</td><td rowspan="2">00h</td><td>Gantry control: index</td><td>U16</td><td>rw</td><td>All</td><td>0x2000 ~ 0x4FFF</td><td>-</td></tr>
<tr><td colspan="6">The index value of the operation object for gantry slave axis parameter.
Example: If this object is set to 0x2100, it indicates that index 2100h of gantry slave axis parameter is designated.</td></tr>
<tr><td rowspan="2">3081h</td><td rowspan="2">00h</td><td>Gantry control: subindex</td><td>U16</td><td>rw</td><td>All</td><td>0</td><td>-</td></tr>
<tr><td colspan="6">The subindex value of the operation object for gantry slave axis parameter.
The current version only supports the object with subindex value being 0.</td></tr>
<tr><td rowspan="2">3082h</td><td rowspan="2">00h</td><td>Gantry control: data type of selected object</td><td>I16</td><td>ro</td><td>All</td><td>-3 ~ 8</td><td>-</td></tr>
<tr><td colspan="6">The data type of the gantry slave axis parameter designated by object 3080h.
Different data type has different input / output register, the corresponding register is described as follows:
<table>
<tr><th>Value</th><th>Definition</th><th>Corresponding Input / Output Register</th></tr>
<tr><td>1</td><td>The data type of the designated object is BOOL.</td><td rowspan="6">3085h / 3086h (DINT)</td></tr>
<tr><td>2</td><td>The data type of the designated object is I8.</td></tr>
<tr><td>3</td><td>The data type of the designated object is I16.</td></tr>
<tr><td>4</td><td>The data type of the designated object is I32.</td></tr>
<tr><td>5</td><td>The data type of the designated object is U8.</td></tr>
<tr><td>6</td><td>The data type of the designated object is U16.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Op Mode</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td></td><td></td><td colspan="6">
<table>
<tr><td>7</td><td>The data type of the designated object is U32.</td><td rowspan="2">3087h / 3088h (REAL)</td></tr>
<tr><td>8</td><td>The data type of the designated object is F32.</td></tr>
<tr><td>-1</td><td>The index value cannot be operated.</td><td rowspan="3">N/A</td></tr>
<tr><td>-2</td><td>The designated index object does not exist.</td></tr>
<tr><td>-3</td><td>The designated subindex object does not exist.</td></tr>
</table>
Note: When object 3084h = -1, this object is not applicable.
</td></tr>
<tr><td rowspan="2">3083h</td><td rowspan="2">00h</td><td>Gantry control: command</td><td>U16</td><td>rw</td><td>All</td><td>0 ~ 3</td><td>-</td></tr>
<tr><td colspan="6">The operation command of gantry slave axis parameter. The function of each command is described as follows:
<table>
<tr><th>Value</th><th>Definition</th><th>Description</th></tr>
<tr><td>0</td><td>Idle / Reset state</td><td>Idle / Reset state.</td></tr>
<tr><td>1</td><td>Writing command</td><td>The command will be triggered (positive edge) when this object is switched from 0 to 1. When the command is triggered, the value of the input register will be written to the designated object (3080h).
Note: If the command is given during data processing (object 3084h is 1), it will be invalid.</td></tr>
<tr><td>2</td><td>Single reading command</td><td>The command will be triggered (positive edge) when this object is switched from 0 to 2. When the command is triggered, the value of the designated object (3080h) will be put into the corresponding output register.
Note: If the command is given during data processing (object 3084h is 1), it will be invalid.</td></tr>
<tr><td>3</td><td>Continuous reading command</td><td>The values of the designated object (3080h) will be continuously put into the corresponding output register.
Note: Continuous reading command is not periodically updated.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">3084h</td><td rowspan="2">00h</td><td>Gantry control: status</td><td>I16</td><td>ro</td><td>All</td><td>-6 ~ 2</td><td>-</td></tr>
<tr><td colspan="6">The operation status of gantry slave axis parameter. The definition is as follows:
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Not in operation.</td></tr>
<tr><td>1</td><td>Data is being processed.</td></tr>
<tr><td>2</td><td>Data processing succeeds.</td></tr>
<tr><td>-1</td><td>The operation function of gantry slave axis parameter cannot be operated.
Check if the firmware versions of master axis and slave axis are the same and the gantry control system is activated.</td></tr>
<tr><td>-2</td><td>The designated object (3080h) cannot be operated.</td></tr>
<tr><td>-3</td><td>The value of the input register exceeds the upper limit of the designated object (3080h)’s data type.</td></tr>
<tr><td>-4</td><td>The writing command is executed to read-only object.</td></tr>
<tr><td>-5</td><td>The unsupported operation command is used in object 3083h.</td></tr>
<tr><td>-6</td><td>Data processing timeout.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">3085h</td><td rowspan="2">00h</td><td>Gantry control: input register of DINT</td><td>I32</td><td>rw</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>-</td></tr>
<tr><td colspan="6">Input register for data type being BOOL, I8, I16, I32, U8, U16 or U32</td></tr>
<tr><td rowspan="2">3086h</td><td rowspan="2">00h</td><td>Gantry control: output register of DINT</td><td>I32</td><td>ro</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>-</td></tr>
<tr><td colspan="6">Output register for data type being BOOL, I8, I16, I32, U8, U16 or U32</td></tr>
<tr><td rowspan="2">3087h</td><td rowspan="2">00h</td><td>Gantry control: input register of REAL</td><td>F32</td><td>rw</td><td>All</td><td>-3.40282e+38 ~ 3.40282e+38</td><td>-</td></tr>
<tr><td colspan="6">Input register for data type being F32</td></tr>
<tr><td rowspan="2">3088h</td><td rowspan="2">00h</td><td>Gantry control: output register of REAL</td><td>F32</td><td>ro</td><td>All</td><td>-3.40282e+38 ~ 3.40282e+38</td><td>-</td></tr>
<tr><td colspan="6">Output register for data type being F32</td></tr>
<tr><td>3100h
|
3104h</td><td>N/A</td><td colspan="6">This section is about alarm state table, and it is not supported yet.
Use object 4095h (error code) to check the contents.</td></tr>
<tr><td rowspan="2">3110h</td><td rowspan="2">00h</td><td>Drive warning events 1</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 0xFFFF</td><td>-</td></tr>
<tr><td colspan="6">Warning state table 1. The warning corresponding to each bit is described as follows.
It is recommended to replace this object with the object 4096h (warning code).</td></tr>
</table>

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Op Mode</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td></td><td></td><td colspan="6">
<table>
<tr><th>Bit</th><th>Waning No.</th><th>Warning Name</th></tr>
<tr><td>0</td><td>AL.900</td><td>Position deviation overflow</td></tr>
<tr><td>1</td><td>AL.901</td><td><Not supported></td></tr>
<tr><td>2</td><td>AL.910</td><td>Overload</td></tr>
<tr><td>3</td><td>AL.911</td><td><Not supported></td></tr>
<tr><td>4</td><td>AL.912</td><td><Not supported></td></tr>
<tr><td>5</td><td>AL.920</td><td><Not supported></td></tr>
<tr><td>6</td><td>AL.921</td><td><Not supported></td></tr>
<tr><td>7</td><td>AL.923</td><td>Internal fan stop</td></tr>
<tr><td>8</td><td>AL.930</td><td>Encoder battery malfunction</td></tr>
<tr><td>9</td><td>AL.941</td><td>Parameter or function that goes into effect after saving or power off has been modified</td></tr>
<tr><td>10</td><td>AL.971</td><td>Undervoltage</td></tr>
<tr><td>11</td><td>AL.9A0</td><td>Overtravel detected when servo ON (P-OT or N-OT signal is received)</td></tr>
<tr><td>12</td><td>AL.9A1</td><td>P-OT signal is received</td></tr>
<tr><td>13</td><td>AL.9A2</td><td>N-OT signal is received</td></tr>
<tr><td>14</td><td>AL.9AA</td><td><Not supported></td></tr>
<tr><td>15</td><td>AL.9Ab</td><td><Not supported></td></tr>
</table>
When the value of the bit is 1, the warning occurs.
</td></tr>
<tr><td rowspan="2">3111h</td><td rowspan="2">00h</td><td>Drive warning events 2</td><td>U16</td><td>ro</td><td>All</td><td>0 ~ 0xFFFF</td><td>-</td></tr>
<tr><td colspan="6">
Warning state table 2. The warning corresponding to each bit is described as follows.
It is recommended to replace this object with the object 4096h (warning code).
<table>
<tr><th>Bit</th><th>Waning No.</th><th>Warning Name</th></tr>
<tr><td>0</td><td>AL.9F0</td><td>Servo voltage too big</td></tr>
<tr><td>1</td><td>AL.943</td><td>Fieldbus synchronous cycle time warning</td></tr>
<tr><td>2</td><td>AL.944</td><td>System warning</td></tr>
<tr><td>3</td><td>AL.945</td><td>Torque limit warning</td></tr>
<tr><td>4</td><td>AL.946</td><td>Encoder communication warning</td></tr>
<tr><td>5</td><td>AL.947</td><td>Multi-motion malfunction warning</td></tr>
<tr><td>6</td><td>AL.924</td><td>I^2T</td></tr>
</table>
When the value of the bit is 1, the warning occurs.
</td></tr>
<tr><td rowspan="2">3200h</td><td rowspan="2">00h</td><td>Absolute encoder initialization</td><td>I32</td><td>rw</td><td>All</td><td>0 ~ 1</td><td>-</td></tr>
<tr><td colspan="6">
Initialize absolute encoder. When it is set to 1, the multi-turn data of motor will be cleared. Keep servo off during the execution. The object will set the value according to the execution state:
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td>0</td><td>Not in operation.</td></tr>
<tr><td>1</td><td>Send the command of clearing multi-turn data.</td></tr>
<tr><td>2</td><td>The command of clearing multi-turn data is being executed.</td></tr>
<tr><td>4</td><td>The command of clearing multi-turn data is successfully executed.</td></tr>
<tr><td>16</td><td>Do not clear multi-turn data when the motor is enabled.
Please disable the motor before issuing the command again.</td></tr>
<tr><td>32</td><td>Fail to execute the command of clearing multi-turn data.</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">3201h</td><td rowspan="2">00h</td><td>General object i1</td><td>I32</td><td>rw</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>-</td></tr>
<tr><td colspan="6">Self-defined object with data type of DINT (1)</td></tr>
<tr><td rowspan="2">3202h</td><td rowspan="2">00h</td><td>General object i2</td><td>I32</td><td>rw</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>-</td></tr>
<tr><td colspan="6">Self-defined object with data type of DINT (2)</td></tr>
<tr><td rowspan="2">3203h</td><td rowspan="2">00h</td><td>General object i3</td><td>I32</td><td>rw</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>-</td></tr>
<tr><td colspan="6">Self-defined object with data type of DINT (3)</td></tr>
<tr><td rowspan="2">3204h</td><td rowspan="2">00h</td><td>General object i4</td><td>I32</td><td>rw</td><td>All</td><td>-2147483648 ~ 2147483647</td><td>-</td></tr>
<tr><td colspan="6">Self-defined object with data type of DINT (4)</td></tr>
</table>

Index	Sub-Index	Name	Data Type	Access	Op Mode	Valid Value	Unit
3205h	00h	General object i5	I32	rw	All	-2147483648 ~ 2147483647	-
		Self-defined object with data type of DINT (5)					
3206h	00h	General object i6	I32	rw	All	-2147483648 ~ 2147483647	-
		Self-defined object with data type of DINT (6)					
3207h	00h	General object i7	I32	rw	All	-2147483648 ~ 2147483647	-
		Self-defined object with data type of DINT (7)					
3208h	00h	General object i8	I32	rw	All	-2147483648 ~ 2147483647	-
		Self-defined object with data type of DINT (8)					
3209h	00h	General object i9	I32	rw	All	-2147483648 ~ 2147483647	-
		Self-defined object with data type of DINT (9)					
3210h	00h	General object f0	F32	rw	All	-3.40282e+38 ~ 3.40282e+38	-
		Self-defined object with data type of REAL (0)					
3211h	00h	General object f1	F32	rw	All	-3.40282e+38 ~ 3.40282e+38	-
		Self-defined object with data type of REAL (1)					
3212h	00h	General object f2	F32	rw	All	-3.40282e+38 ~ 3.40282e+38	-
		Self-defined object with data type of REAL (2)					
3213h	00h	General object f3	F32	rw	All	-3.40282e+38 ~ 3.40282e+38	-
		Self-defined object with data type of REAL (3)					
3214h	00h	General object f4	F32	rw	All	-3.40282e+38 ~ 3.40282e+38	-
		Self-defined object with data type of REAL (4)					
3215h	00h	Reset drive	I16	rw	All	0 ~ 1	-
		Reset the drive. When it is set to 1, the drive will be reset. After it is done, the object will be automatically set to 0.					
3216h	00h	Send parameter to flash	I16	rw	All	0 ~ 1	-
		Save parameters to drive. When it is set to 1, the current drive parameters will be saved. After it is done, the object will be automatically set to 0.					
4XXXh	00h	The 4000h series objects are from servo Ut parameters. Users can read more information of servo drive from this series of objects. Please refer to the chapter “List of panel monitoring parameters” in each servo drive user manual. The mapping relationship between servo Ut parameter numbers and object indexes is as follows: Object index = 4000h + servo Ut parameter number Example: Servo drive’s panel monitoring parameter Ut095 is “Alarm code”, and its corresponding object is 4095h.					

3.7.2 CiA402 objects

Table 3.7.2.1

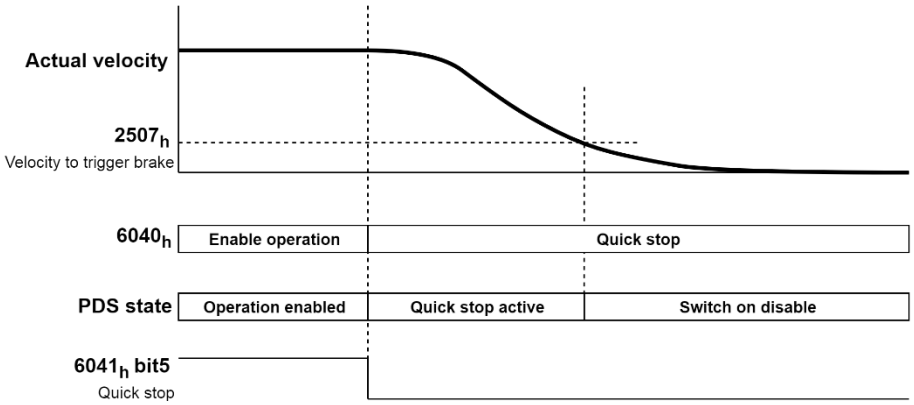
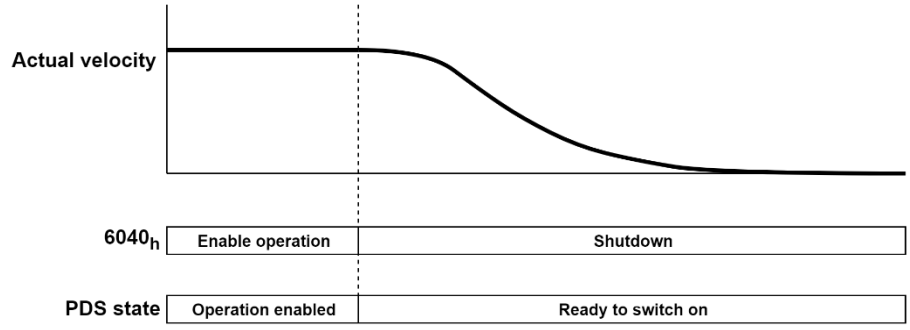
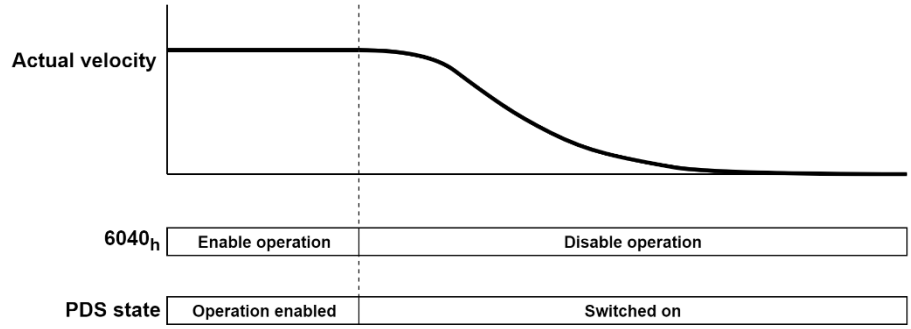
Index	Sub-Index	Name	Data Type	Access	Valid Value	Unit
603Fh	00h	Error code	U16	ro	0x0 ~ 0xFFFF	-

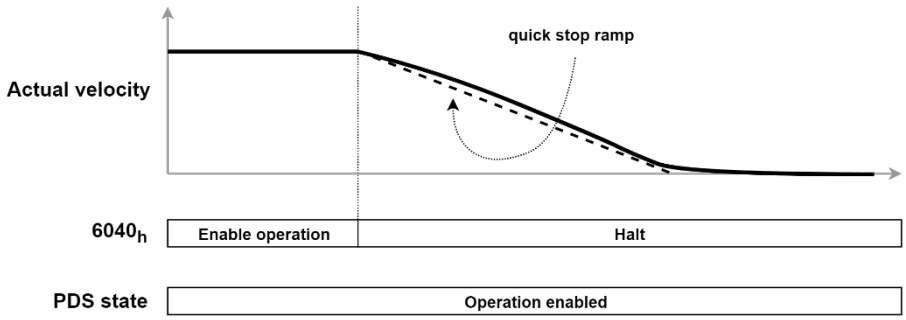
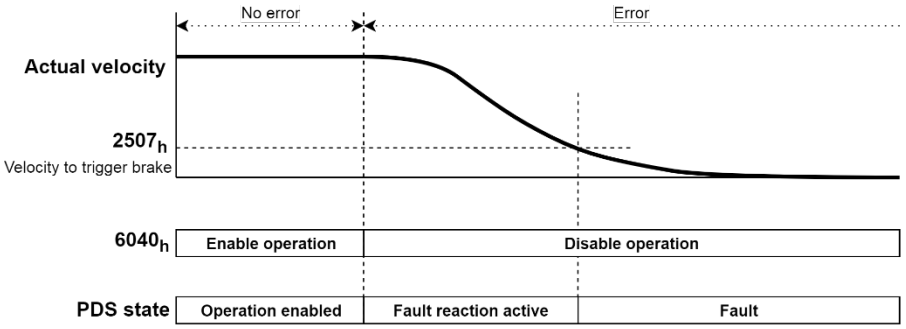
Display the last error that occurs.
The value of the error code is FF**h, where ** is the error code from E2 series servo drive.
Take FF10h as an example. 10h = 16d → Error 16 occurs.

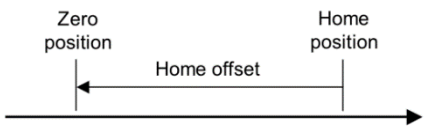
0x603F Error Code mapping table

0x603F Error Code (hex)	Alarm No.	Alarm Name
FF04	AL.024	System alarm 1
FF05	AL.025	System alarm 2
FF06	AL.030	Main circuit detector error
FF07	AL.040	Parameter setting error
FF0B	AL.050	Combination error
FF0C	AL.070	Motor type change detected
FF0E	AL.0b0	Invalid Servo ON command alarm
FF0F	AL.100	Over current detected
FF10	AL.320	Regenerative overload
FF11	AL.400	Over voltage
FF12	AL.410	Under voltage
FF13	AL.510	Over speed
FF14	AL.511	Encoder output pulse overspeed
FF18	AL.710	Instantaneous overload
FF19	AL.720	Continuous overload
FF1D	AL.7A1	Drive overload
FF1E	AL.7A2	Internal overheat error 2 (power board)
FF21	AL.800	Data backup error
FF22	AL.810	Battery error
FF23	AL.820	Encoder com. error
FF24	AL.830	Encoder data error
FF25	AL.840	Encoder crc error
FF26	AL.850	Encoder counting error
FF27	AL.860	Write data fail error
FF28	AL.870	Encoder over heat error
FF29	AL.880	Encoder sensor phase error (AqB)
FF2A	AL.890	ESC ALM - Incremental encoder cable not connected
FF2B	AL.8A0	ESC ALM - CH1 ESC side error
FF2C	AL.8b0	ESC ALM - CH1 Encoder side error
FF2D	AL.8C0	ESC ALM - CH2 ESC side error
FF2E	AL.8d0	ESC ALM - CH2 Encoder side error
FF2F	AL.8E0	Digital encoder cable not connected
FF30	AL.8F0	ESC ALM - Internal fault
FF31	AL.861	Motor overheated
FF32	AL.b10	Speed reference A/D error
FF34	AL.b20	Torque reference A/D error
FF35	AL.b33	Current detection error
FF36	AL.C10	Servomotor out of control
FF37	AL.C20	Phase detection error
FF38	AL.C21	Polarity sensor error (Hall sensor)
FF3A	AL.C50	Polarity detection failure
FF3B	AL.C51	Overtravel detected during polarity detection
FF3C	AL.C52	Polarity detection not completed
FF3E	AL.d00	Position error too big
FF41	AL.d10	Hybrid deviation error (motor to load)
FF42	AL.Eb0	Safety function alarm
FF43	AL.Eb1	Safety function signal input timing error
FF44	AL.Eb2	Safety function self-check error
FF45	AL.F10	Power supply line open phase
FF46	AL.F50	Servomotor main circuit cable disconnection (motor maybe disconnected)
FF47	AL.FA0	Power supply for encoder error (5V card fail)
FF48	AL.FB0	FieldBus Hardware Fault
FF49	AL.FB1	FieldBus Communication Fault
FF4A	AL.FC0	Group Communication Fault
FF4B	AL.FC1	Gantry system slave alarm

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>FF4C</td><td>AL.891</td><td>Incremental encoder signal error</td></tr>
<tr><td>FF4D</td><td>AL.FB2</td><td>Fieldbus communication setup error</td></tr>
<tr><td>FF4F</td><td>AL.Fd0</td><td>Electronic cam control system alarm</td></tr>
<tr><td>FF50</td><td>AL.EF9</td><td>Multi-motion alarm</td></tr>
</table>
</td></tr>
<tr><td>6040h</td><td>00h</td><td>
<table>
<tr><td>Controlword</td><td>U16</td><td>rw</td><td>0x0 ~ 0xFFFF</td><td>-</td></tr>
</table>
The object controls the transition of the drive's FSA and the commands of a specific operation mode. The details of the bits are described as follows.
<table>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Fault reset</td><td colspan="3">Operation mode specific</td><td>Enable operation</td><td>Quick stop</td><td>Enable voltage</td><td>Switch on</td></tr>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr>
<tr><td colspan="6">Reserved</td><td>Operation mode specific</td><td>halt</td></tr>
</table>
Bit 8 (halt): If it is set to 1, the motor decelerates and stops according to object 605Dh (halt option code). Setting the bit to 0 will resume the halt operation. It is only applicable in PP, PV, TQ and HM mode.
Bit 7, 3~0: FSA transition requests. The codes of the commands are described in section 3.1.
Bit 9, 6~4 (operation mode specific): The availability of each bit in each mode is listed as follows.
<table>
<tr><th>Op mode</th><th>Bit 9</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th></tr>
<tr><td>PP</td><td>change on set-point</td><td>absolute / relative</td><td>change set immediately</td><td>new set-point</td></tr>
<tr><td>PV</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>TQ</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>HM</td><td>-</td><td>-</td><td>-</td><td>homing operation start</td></tr>
</table>
</td></tr>
<tr><td>6041h</td><td>00h</td><td>
<table>
<tr><td>Statusword</td><td>U16</td><td>ro</td><td>0 ~ FFFFh</td><td>-</td></tr>
</table>
The object provides the state of FSA and the information of a specific operation mode. The details of the bits are described as follows.
<table>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Warning</td><td>Switch on disabled</td><td>Quick stop</td><td>Voltage enabled</td><td>Fault</td><td>Operation enabled</td><td>Switched on</td><td>Ready to Switch on</td></tr>
<tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr>
<tr><td colspan="2">Reserved</td><td colspan="2">Operation mode specific</td><td>Internal limit active</td><td>Target reached</td><td>Remote</td><td>Reserved</td></tr>
</table>
Bit 6, 5, 3~0: FSA states. The codes of the states are described in section 3.1.
Bit 4 (voltage enabled): If the main power normal input is normal, the bit should be 1.
Bit 5 (quick stop): If FSA is reacting on a quick stop request, the bit is set to 0.
Bit 7 (warning): If the bit is 1, it indicates a warning occurs. FSA does not change and the operation of the motor continues during warning (no error occurs).
Bit 9 (remote): Controlword is processed if the bit is set to 1. It will be set to 1 after ESM state becomes PreOp (SDO available).
Bit 10 (target reached):
<table>
<tr><th>Value</th><th>Definition</th></tr>
<tr><td rowspan="2">0</td><td>Halt (Bit 8 in Controlword) = 0: target not reached</td></tr>
<tr><td>Halt = 1: axis decelerates</td></tr>
<tr><td rowspan="2">1</td><td>Halt = 0: target reached</td></tr>
<tr><td>Halt = 1: axis stops (velocity = 0)</td></tr>
</table>
Bit 11 (internal limit active): The bit is set to 1 if one of the following conditions occurs.
<table>
<tr><th>Op mode</th><th>Condition</th></tr>
<tr><td>PP</td><td>Hardware limit, Torque limit</td></tr>
<tr><td>PV</td><td>Hardware limit, Torque limit</td></tr>
<tr><td>TQ</td><td>Hardware limit, Torque limit</td></tr>
<tr><td>HM</td><td>Torque limit</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td></td><td></td><td colspan="5">Bit 13, 12, 10 (operation mode specific): The availability of each bit in each mode is listed below.
<table>
<tr><th>Op mode</th><th>Bit 13</th><th>Bit 12</th><th>Bit 10</th></tr>
<tr><td>PP</td><td>following error</td><td>set-point acknowledge</td><td>target reached</td></tr>
<tr><td>PV</td><td>max slippage error</td><td>speed</td><td>target reached</td></tr>
<tr><td>TQ</td><td>-</td><td>-</td><td>target reached</td></tr>
<tr><td>HM</td><td>homing error</td><td>homing attained</td><td>target reached</td></tr>
</table></td></tr>
<tr><td rowspan="2">605Ah</td><td rowspan="2">00h</td><td>Quick stop option code</td><td>I16</td><td>rw</td><td>2</td><td>-</td></tr>
<tr><td colspan="5">The object indicates the action when quick stop function is executed. E2 series servo drive only supports option 2: slow down according to 6085h (quick stop deceleration). FSA (PDS state) changes to Switch on disabled.
 
</td></tr>
<tr><td rowspan="2">605Bh</td><td rowspan="2">00h</td><td>Shutdown option code</td><td>I16</td><td>rw</td><td>0</td><td>-</td></tr>
<tr><td colspan="5">The object indicates the action when FSA transits from Operation enabled to Ready to switch on. E2 series servo drive only supports option 0: Disable drive function. FSA (PDS state) changes to Ready to switch on.
 
</td></tr>
<tr><td rowspan="2">605Ch</td><td rowspan="2">00h</td><td>Disable operation option code</td><td>I16</td><td>rw</td><td>0</td><td>-</td></tr>
<tr><td colspan="5">The object indicates the action when FSA transits from Operation enabled to Switched on. E2 series servo drive only supports option 0: Disable drive function. FSA (PDS state) changes to Switched on.
 
</td></tr>
<tr><td rowspan="2">605Dh</td><td rowspan="2">00h</td><td>Halt option code</td><td>I16</td><td>rw</td><td>1, 2</td><td>-</td></tr>
<tr><td colspan="5">The object indicates the action when halt function is executed. E2 series servo drive only supports option 2: Slow down on quick stop ramp. FSA (PDS state) stays in Operation enabled.</td></tr>
</table>

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td></td><td></td><td colspan="5">Note: Only PP mode can set the object to 1. The motor will be stopped according to 6084h (profile deceleration).
 
</td></tr>
<tr><td rowspan="2">605Eh</td><td rowspan="2">00h</td><td>Fault reaction option code</td><td>I16</td><td>rw</td><td>0 ~ 2</td><td>-</td></tr>
<tr><td colspan="5">The object indicates the action during Fault reaction. The supported values are described as follows.
0: Disable drive function. The motor is free to rotate.
2: Slow down according to 6085h (quick stop deceleration). FSA (PDS state) changes to Fault.
 
</td></tr>
<tr><td rowspan="2">6060h</td><td rowspan="2">00h</td><td>Modes of operation</td><td>I8</td><td>rw</td><td>0 ~ 6</td><td>-</td></tr>
<tr><td colspan="5">Set the operation mode of the drive. The supported operation modes are listed as follows.
<table><tr><th>Value</th><th>Op mode</th><th>abbreviation</th></tr><tr><td>0</td><td>no mode change / assigned</td><td>-</td></tr><tr><td>1</td><td>profile position</td><td>PP</td></tr><tr><td>3</td><td>profile velocity</td><td>PV</td></tr><tr><td>4</td><td>profile torque</td><td>TQ</td></tr><tr><td>6</td><td>homing</td><td>HM</td></tr></table>The default value is 0. If the object is set to 0 or an unsupported value, there will be no mode change.
Stop the motor before switching the operation mode. If the operation mode is changed during motion, the behavior will not be guaranteed.
If dual-loop control is adopted, only PP and HM modes can be used.</td></tr>
<tr><td rowspan="2">6061h</td><td rowspan="2">00h</td><td>Modes of operation display</td><td>I8</td><td>ro</td><td>0 ~ 6</td><td>-</td></tr>
<tr><td colspan="5">The actual operation mode in the drive. The object will change to the commanded mode after internal mode is successfully changed. If the commanded mode is not supported, the object will remain unchanged.</td></tr>
<tr><td rowspan="2">6062h</td><td rowspan="2">00h</td><td>Position demand value</td><td>I32</td><td>ro</td><td>-2147483648 ~ 2147483647</td><td>inc</td></tr>
<tr><td colspan="5">The required position value.</td></tr>
<tr><td rowspan="2">6063h</td><td rowspan="2">00h</td><td>Position actual internal value</td><td>I32</td><td>ro</td><td>-2147483648 ~ 2147483647</td><td>count</td></tr>
<tr><td colspan="5">The actual value of motor position. In dual-loop control, the value is from external scale unit.</td></tr>
<tr><td rowspan="2">6064h</td><td rowspan="2">00h</td><td>Position actual value</td><td>I32</td><td>ro</td><td>-2147483648 ~ 2147483647</td><td>inc</td></tr>
<tr><td colspan="5">The actual value of motor position.</td></tr>
<tr><td rowspan="2">6065h</td><td rowspan="2">00h</td><td>Following error window</td><td>U32</td><td>rw</td><td>0 ~ 4294967295</td><td>inc</td></tr>
<tr><td colspan="5">The threshold of 60F4h (following error actual value). When 60F4h (following error actual value) exceeds 6065h, bit 13 of 6041h (Statusword) will be 1.
If the object is set to 0, a following error will always occur.</td></tr>
<tr><td rowspan="2">6066h</td><td rowspan="2">00h</td><td>Following error time out</td><td>U16</td><td>rw</td><td>0 ~ 65535</td><td>ms</td></tr>
<tr><td colspan="5">Refer to description of 6065h (following error window).</td></tr>
</table>

Index	Sub-Index	Name	Data Type	Access	Valid Value	Unit
6067h	00h	Position window	U32	rw	0 ~ 4294967295	inc
		If the difference between 6062h (position demand value) and 6064h (position actual value) is within 6067h (position window) for longer than the time set by 6068h (position window time), bit 10 of 6041h (Statusword) will be set to 1. Once the position deviation exceeds 6067h, bit 10 of 6041h (Statusword) will be set to 0.				
6068h	00h	Position window time	U16	rw	0 ~ 65535	ms
		Refer to description of 6067h (position window).				
606Bh	00h	Velocity demand value	I32	ro	-2147483648 ~ 2147483647	inc/s
		Internal command velocity.				
606Ch	00h	Velocity actual value	I32	ro	-2147483648 ~ 2147483647	inc/s
		The actual velocity of the motor.				
606Dh	00h	Velocity window	U16	rw	0 ~ 65535	inc/s
		If the difference between 60FFh (target velocity) + 60B1h (velocity offset) and 606Ch (velocity actual value) is within 606Dh (velocity window) for longer than the time set by 606Eh (velocity window time), bit 10 of 6041h (Statusword) will be set to 1. Once the velocity deviation exceeds 6067h (position window), bit 10 of 6041h (Statusword) will be set to 0.				
606Eh	00h	Velocity window time	U16	rw	0 ~ 65535	ms
		Refer to description of 606Dh (velocity window).				
6071h	00h	Target torque	I16	rw	-32768 ~ 32767	0.1%
		Torque command. The value is limited by 6072h (max torque). Output target torque (force) of the drive = motor torque (force) constant x motor rated current x object 6071h (target torque) / 1000				
6072h	00h	Max torque	U16	rw	0 ~ 65535	0.1%
		The configured maximum torque. The value is limited by the motor's ability.				
6074h	00h	Torque demand	I16	ro	-32768 ~ 32767	0.1%
		Internal torque command.				
6075h	00h	Motor rated current	U32	ro	0 ~ 4294967295	mA
		The rated current of the motor.				
6076h	00h	Motor rated torque	U32	ro	0 ~ 4294967295	mNm
		The rated torque of the motor.				
6077h	00h	Torque actual value	I16	ro	-32768 ~ 32767	0.1%
		The value is given per thousand of rated torque. The value is only for referenece.				
607Ah	00h	Target position	I32	rw	-2147483648 ~ 2147483647	inc
		Position command.				
607Ch	00h	Home offset	I32	rw	-2147483648 ~ 2147483647	inc
		After homing procedure is done, the detected index position is set to the value of 607Ch (home offset). Zero position = home position + home offset 				
607Fh	00h	Max profile velocity	U32	rw	0 ~ 4294967295	inc/s
		The configured maximum velocity. The value is limited by the motor's ability.				
6081h	00h	Profile velocity	U32	rw	0 ~ 4294967295	inc/s
		The velocity during profile motion.The value is limited by 607Fh.				
6083h	00h	Profile acceleration	U32	rw	0 ~ 4294967295	inc/s^2
		The configured acceleration of profile motion.				
6084h	00h	Profile deceleration	U32	rw	0 ~ 4294967295	inc/s^2
		The configured deceleration of profile motion.				

Index	Sub-Index	Name	Data Type	Access	Valid Value	Unit
6085h	00h	Quick stop deceleration	U32	rw	0 ~ 4294967295	inc/s^2
		The deceleration is used to stop the motor when quick stop function is activated and 605Ah (quick stop option code) is set to 2 or 6. Quick stop deceleration is also used when 605Dh (halt option code) and 605Eh (fault reaction option code) is 2.				
6087h	00h	Torque slope	U32	rw	0 ~ 4294967295	0.1%/s
		The rate of change of torque.				
6098h	00h	Homing method	I8	rw	-128 ~ 127	-
		The homing method used in HM mode. The homing method can not be changed during homing. The supported homing methods are method 1, 2, 7~14, 17, 18, 23~30, 33, 34 and 37. If homing procedure starts with unsupported homing method, bit 13 of 6041h (Statusword) will be set to 1.				
6099h	-	Homing speeds	-	-	-	-
		The velocity during HM mode.				
	00h	Number of entries	U8	ro	2	-
	01h	Speed during search for switch	U32	rw	0 ~ 4294967295	inc/s
		The velocity during searching for switch signal.				
	02h	Speed during search for zero	U32	rw	0 ~ 4294967295	inc/s
		The velocity during searching for index signal.				
609Ah	00h	Homing acceleration	U32	rw	0 ~ 4294967295	inc/s^2
		The acceleration and deceleration in HM mode.				
60B1h	00h	Velocity offset	I32	rw	-2147483648 ~ 2147483647	inc/s
60B2h	00h	Torque offset	I16	rw	-3000 ~ 3000	0.1%
60B8h	00h	Touch probe function	U16	rw	0 ~ 65535	-
		Refer to section 3.6 for the details of command settings.				
60B9h	00h	Touch probe status	U16	ro	0 ~ 65535	-
		Refer to section 3.6 for the bit definition of status feedback.				
60BAh	00h	Touch probe 1 positive edge	I32	ro	-2147483648 ~ 2147483647	inc
		The position value of touch probe 1 at positive edge.				
60BBh	00h	Touch probe 1 negative edge	I32	ro	-2147483648 ~ 2147483647	inc
		The position value of touch probe 1 at negative edge.				
60BCh	00h	Touch probe 2 positive edge	I32	ro	-2147483648 ~ 2147483647	inc
		The position value of touch probe 2 at positive edge.				
60BDh	00h	Touch probe 2 negative edge	I32	ro	-2147483648 ~ 2147483647	inc
		The position value of touch probe 2 at negative edge.				
60C5h	00h	Max acceleration (not implemented)	U32	rw	0 ~ 4294967295	inc/s^2
60C6h	00h	Max deceleration (not implemented)	U32	rw	0 ~ 4294967295	inc/s^2
60E0h	00h	Positive torque limit value	U16	rw	0 ~ 65535	0.1%
		The configured maximum positive torque in the motor.				
60E1h	00h	Negative torque limit value	U16	rw	0 ~ 65535	0.1%
		The configured maximum negative torque in the motor.				
60F4h	00h	Following error actual value	I32	ro	-2147483648 ~ 2147483647	inc
		60F4h (following error actual value) = 6062h (position demand value) – 6064h (position actual value)				
60FCh	00h	Position demand internal value	I32	ro	-2147483648 ~ 2147483647	count
		Internal command position.				

<table>
<tr><th>Index</th><th>Sub-Index</th><th>Name</th><th>Data Type</th><th>Access</th><th>Valid Value</th><th>Unit</th></tr>
<tr><td rowspan="2">60FDh</td><td rowspan="2">00h</td><td>Digital inputs</td><td>U32</td><td>ro</td><td>0 ~ FFFFFFFFh</td><td>-</td></tr>
<tr><td colspan="6">The input status of external input signal. The definition of each bit is as follows.
<table>
<tr><th colspan="8">15 ... 3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td colspan="8">Reseved</td><td>Home switch</td><td>Positive limit switch</td><td>Negative limit switch</td></tr>
<tr><td>31 ... 26</td><td>25</td><td>24</td><td>23</td><td>22</td><td>21</td><td>20</td><td>19</td><td>18</td><td>17</td><td>16</td></tr>
<tr><td>Reseved</td><td>SF2</td><td>SF1</td><td>I8</td><td>I7</td><td>I6</td><td>I5</td><td>I4</td><td>I3</td><td>I2</td><td>I1</td></tr>
</table>
The value of each bit is defined as follows.
0: switched off
1: switched on

Note: When SF1 and SF2 are both OFF, STO status is ON.</td></tr>
<tr><td rowspan="6">60FEh</td><td rowspan="2">-</td><td>Digital outputs</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="6">They are used to control the external output signal.
<table>
<tr><th>31 ... 21</th><th>20</th><th>19</th><th>18</th><th>17</th><th>16</th><th>15 ... 0</th></tr>
<tr><td>Reserved</td><td>O5</td><td>O4</td><td>O3</td><td>O2</td><td>O1</td><td>Reserved</td></tr>
</table>
This object controls the status of the general-purpose output signals from CN6 on E2 series servo drive.
Subindex 1 is used to control the status of the output signals. Subindex 2 determines which output signals in subindex 1 are enabled.
If drive status outputs are assigned to O1~O5 signals in object 3514h, 3515h and 3516h, the status of this object will be output in the logic of ORs. If any of these signals is assigned to functions that are enabled with object 3514h, 3515h, or 3516h, use Bit Masks in subindex 2 to disable the corresponding signal. By doing so, the signal will not be duplicated.

Brake can only be controlled by this object when servo is not on.</td></tr>
<tr><td>00h</td><td>Number of entries</td><td>U8</td><td>ro</td><td>2</td><td>-</td></tr>
<tr><td rowspan="2">01h</td><td>Physical outputs</td><td>U32</td><td>rw</td><td>0 ~ FFFFFFFFh</td><td>-</td></tr>
<tr><td colspan="5">Control the output of the external signal. The value of each bit is defined as follows.
0: switched off
1: switched on</td></tr>
<tr><td rowspan="2">02h</td><td>Bit mask</td><td>U32</td><td>rw</td><td>0 ~ FFFFFFFFh</td><td>-</td></tr>
<tr><td colspan="5">The output signal mask. The value of each bit is defined as follows.
0: disable output
1: enable output</td></tr>
<tr><td rowspan="2">60FFh</td><td rowspan="2">00h</td><td>Target velocity</td><td>I32</td><td>rw</td><td>-2147483648 ~ 2147483647</td><td>inc/s</td></tr>
<tr><td colspan="5">Velocity command. The value is limited by 607Fh (max profile velocity).</td></tr>
</table>