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ASDA A2-E EtherCAT Interface Servo Drive User Manual

ASDA A2-E EtherCAT Interface Servo Drive User Manual

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Chapter 1 CoE Drive Overview

1.1 Communication Specification

EtherCAT Communication	Physical layer	100BASE-TX
	Communication connector	RJ45 × 2 (Connector CN6A = input, CN6B = output)
	Network topology	Line connection
	Baud rate	2 x 100 Mbps (full duplex)
	Frame data length	Maximum 1484 bytes
	SyncManager	SM0: Mailbox output SM1: Mailbox input SM2: Process data output SM3: Process data input
	FMMU (Fieldbus Memory Management Units)	FMMU0: Process data output area FMMU1: Process data input area FMMU2: Mailbox status area
	Device profile	CoE: CANopen over EtherCAT
	Synchronization mode	DC synchronization (SYNC0) Non-synchronized (Free Run)
	Communication object	SDO: Service Data Object PDO: Process Data Object EMCY: Emergency Data Object
	LED indicator (On RJ45 connector)	EtherCAT ERR (ER) × 1 EtherCAT Link/Activity (L/A) × 2 EtherCAT RUN (RN) × 1
	Application layer specifications	IEC61800-7 CiA402 Drive Profile
The supported CiA402 operation modes		■ Profile Position Mode (PP) ■ Profile Velocity Mode (PV) ■ Profile Torque Mode (PT) ■ Homing Mode (HM) ■ Interpolated Position Mode (IP) ■ Cycle Synchronized Position Mode (CSP) ■ Cycle Synchronized Velocity Mode (CSV) ■ Cycle Synchronized Torque Mode (CST)

1.2 The Interface of Delta EtherCAT Servo Drive

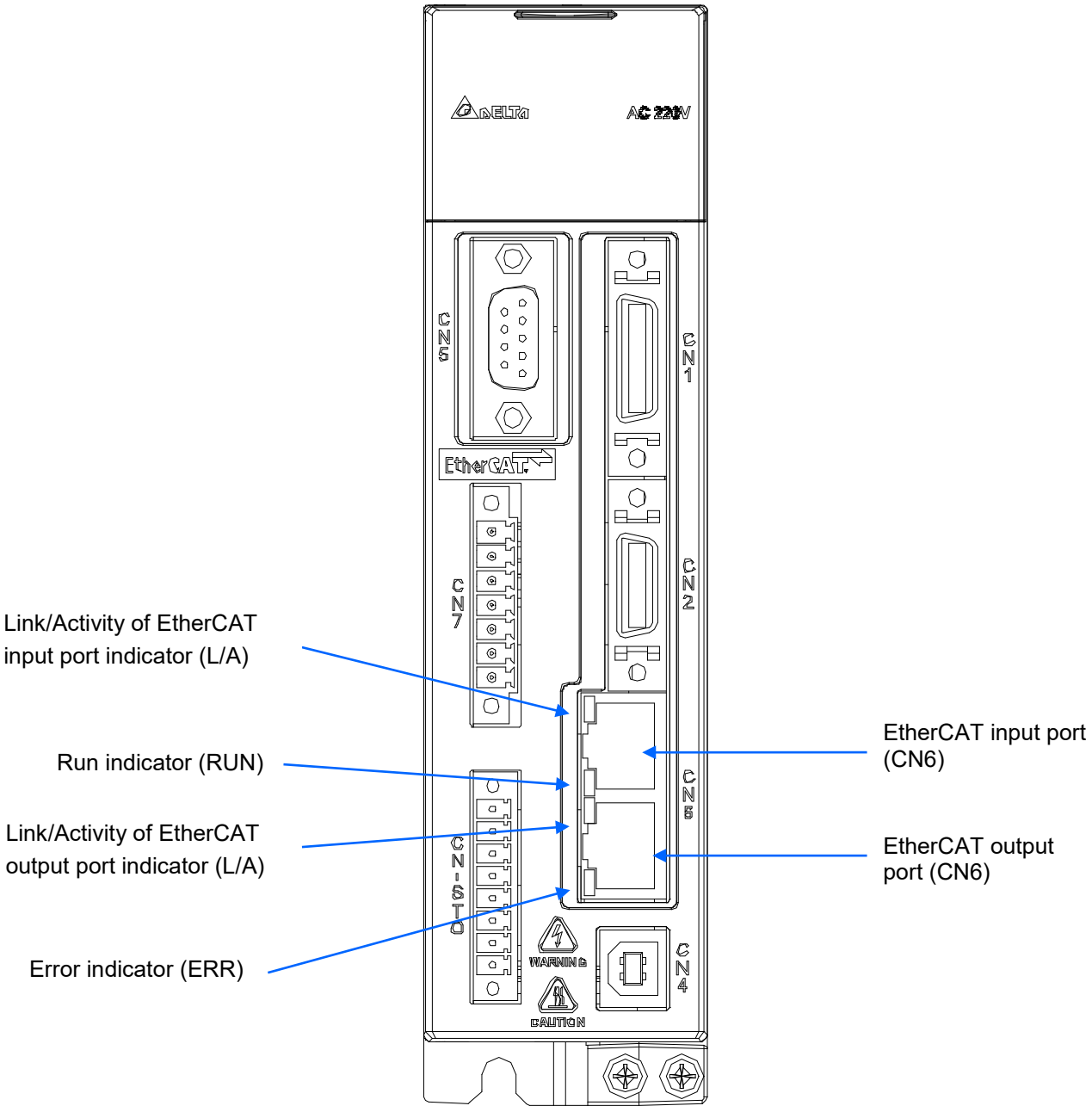

Figure 1 The Interface of Delta EtherCAT Servo Drive

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1.3 LED Indicators

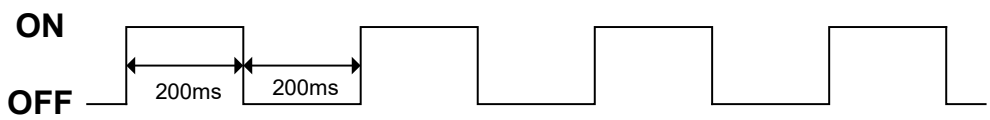
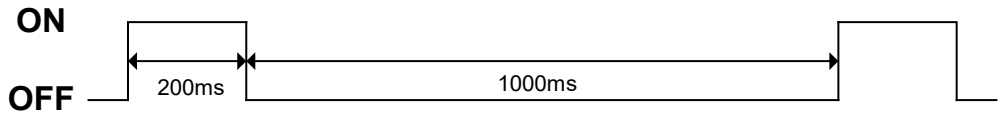
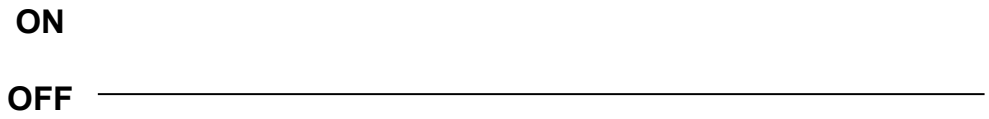
Indicator state	Indicator pattern
ON	
Blinking	
Single Flash	
OFF	

Figure 2. RJ45 LED indicator pattern

- ERROR (ERR) LED

The ERR LED indicator shows the error status of EtherCAT communication.

Indicator state	Slave State
Off	No error
Blinking	State change error
Single Flash	Synchronization error SyncManager error
On	PDI Watchdog timeout

State change error	The state machine does not allow the system to change its state because of the wrong parameter settings. Please refer to Figure 29 for its switching conditions.
Synchronization error	The synchronization of Master Clock and Slave Clock is failed.
SyncManager error	The data of Process data is lost when receiving.
PDI Watchdog timeout	The hardware failure on slave. Please contact Delta distributors for assistance.

- RUN LED

The RUN LED indicator shows the status of EtherCAT state machine.

Indicator state	Slave State
Off	INIT (Initialization)
Blinking	Pre-Operational
Single Flash	Safe-Operational
On	Operational

INIT (Initialization)	After power on, the EtherCAT slave will get into INIT state if there is no error. At INIT state, no communication servo is provided. Accessing the slave's register from the host is available at this state.
Pre-Operational	The SDO can be used to communicate with its host controller.
Safe-Operational	Both SDO and TxPDO, which can send cyclic data from the slave to the host, are workable.
Operational	SDO, TxPDO, and RxPDO are working.

- Link Activity (L/A) LED

The L/A LED indicator shows the physical link status and the link activity.

Indicator state	Slave State
Off	No link
Blinking	Link and activity
On	Link without activity

No link	The link has not established yet.
Link and activity	The data is exchanging with its partners.
Link without activity	The link is established but no data is exchanging now.

1.4 The Topology

The topology is defined by the host controller. Refer to the host controller's application manual. There are only one input port and one output port on Delta servo drive for EtherCAT communication ports.

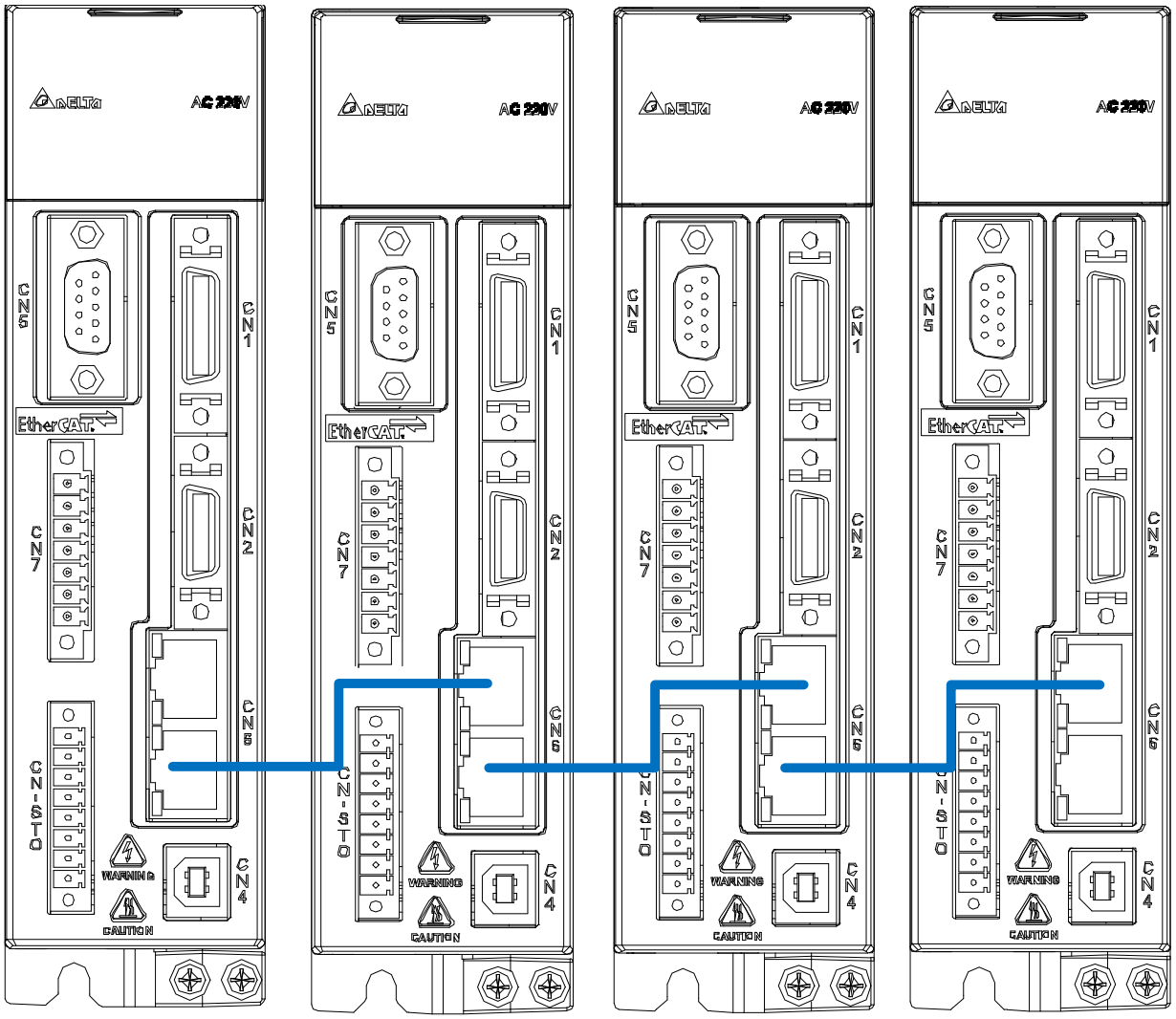


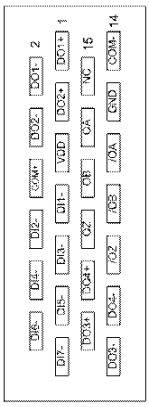
Figure 3 EtherCAT connection topology example

1.5 Wiring

I/O Signal (CN1) Connection and Connector Terminal Layout

In order to have a more flexible communication with the master, 4 programmable Digital Output (DO) points and 7 programmable Digital Input (DI) points are provided, which are parameters P2-18 ~ P2-21 and P2-10 ~ P2-16 respectively. In addition, the differential type encoder signals A+, A-, B+, B-, Z+, and Z- are also provided. The followings are the pin diagrams.

CN1 Connector (female)



CN1 Connector (male)
rear view

2	DO1-	Digital output
4	DO2-	Digital output
6	COM+	Power input (12~24V)
8	DI2-	Digital input
10	DI4-	Digital input
12	DI6-	Digital input

1	DO1+	Digital output
3	DO2+	Digital output
5	VDD	+24V Power output
7	DI1-	Digital input
9	DI3-	Digital input
11	DI5-	Digital input
13	DI7-	Digital input

15	NC	N/A
17	OA	Encoder/ A pulse output
19	OB	Encoder/ B pulse output
21	OZ	Encoder/ Z pulse output
23	DO4+	Digital output
25	DO3+	Digital output

14	COM-	VDD power ground
16	GND	Analog input signal ground
18	/OA	Encoder/ A pulse output
20	/OB	Encoder/ B pulse output
22	/OZ	Encoder/ Z pulse output
24	DO4-	Digital output
26	DO3-	Digital output

Note: NC means “No connection.” This terminal is for internal use only. Do not connect it, or it may damage the servo drive.

1.5.1 Explanation of I/O (CN1) Connector Signal

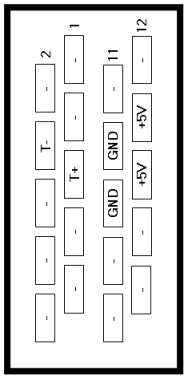
The following details the signals listed in the previous section.

General signals:

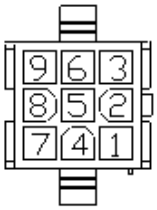
Signal Name		Pin No.	Function	Wiring Method (Refer to 3.4.3)
Position pulse (output)	OA /OA	17 18	Encoder signal output A, B, Z (Line Driver output)	C13/C14
	OB /OB	19 20		
	OZ /OZ	21 22		
Power	VDD	5	VDD is the +24V power provided by the drive and is for Digital Input (DI) and Digital Output (DO) signals. The maximum permissible current is 500 mA.	-
	COM+	6	COM+ is the common voltage input for Digital Input (DI) and Digital Output (DO). When using VDD, connect VDD to COM+. If not using, apply the external power (+12V ~ +24V) to the drive. Its positive end should connect to COM+ and the negative end should connect to COM-.	
	COM-	14		
	GND	16	VCC voltage is based on GND.	
Other	NC	15	No connection. This terminal is for internal use only. Do not connect it, or it may damage the servo drive.	

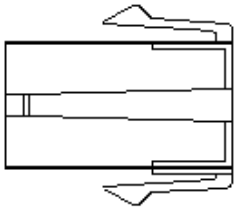
1.5.2 CN2 Connector

CN2 Connector (female)

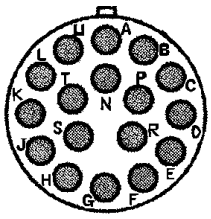


CN2 Connector (male)
Rear view





Quick Connector
HOUSING: AMP(1-172161-9)

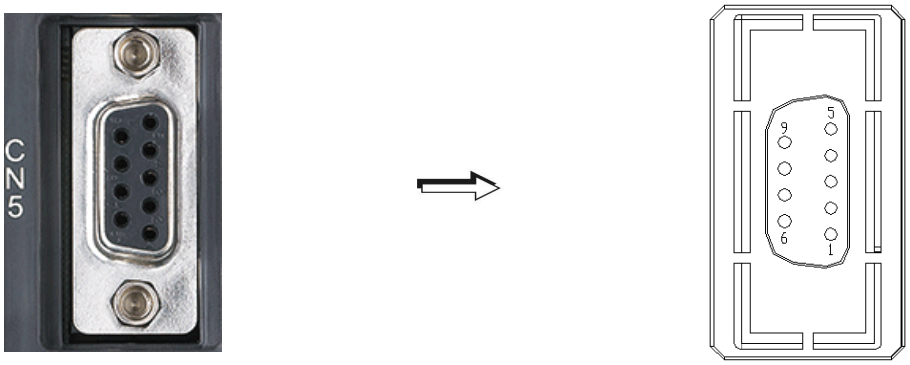


Military Connector
3106A-20-29S

Drive Connector			Motor Connector		
Pin No.	Terminal Symbol	Function and Description	Military connector	Quick connector	Color
5	T+	Serial communication signal input / output (+)	A	1	Blue
4	T-	Serial communication signal input / output (-)	B	4	Blue & Black
-	-	Reserved	-	-	-
-	-	Reserved	-	-	-
14,16	+5V	Power +5V	S	7	Red / Red & white
13,15	GND	Power ground	R	8	Black / Black & white
-	-	Shielding	L	9	-

1.5.3 CN5 Connector (Full-closed Loop)

Connect the linear scale or encoder (A, B, Z format) to the servo and form a full-closed loop. In Position mode, the pulse command issued by the controller is based on the control loop of the external linear scale. Refer to Chapter 5.



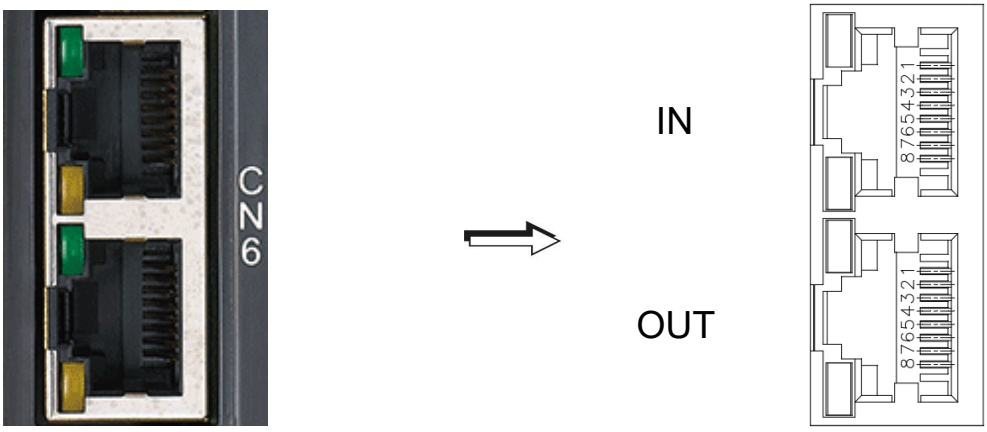
CN5 Connector (female)

Pin No.	Signal Name	Terminal Symbol	Function and Description
1	/Z phase input	Opt_/Z	/Z phase
2	/B phase input	Opt_/B	/B phase
3	B phase input	Opt_B	B phase
4	A phase input	Opt_A	A phase
5	/A phase input	Opt_/A	/A phase
6	Encoder grounding	GND	Ground
7	Encoder grounding	GND	Ground
8	Encoder power	+5V	+5V power
9	Z phase input	Opt_Z	Z phase

Note:

1. It only supports AB phase signals and the encoder of 5V.
2. The application of full-closed loop: it supports the encoder of highest resolution 1280000 pulse/rev (the pulse number per motor revolution for a full-closed loop that corresponds to an optical signal with AB (Quadrature) phase pulses (4x).).

1.5.4 CN6 EtherCAT Terminal



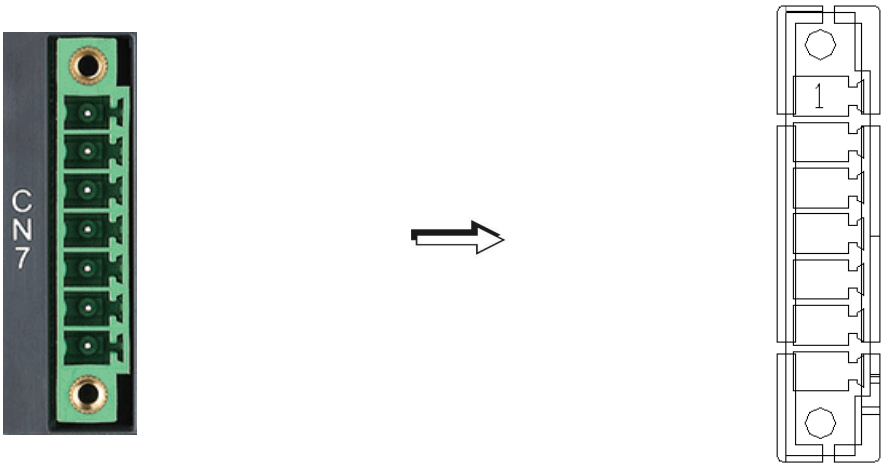
CN5 Connector (female)

Pin No.	Signal Name	Terminal Symbol	Function and Description
1	TX +	TX +	Transmit +
2	TX -	TX -	Transmit -
3	RX +	RX +	Receive +
4	-	-	-
5	-	-	-
6	RX -	RX -	Receive -
7	-	-	-
8	-	-	-

Note:

1. The maximum distance between two stations should be 50 meters.
2. Please use CAT5e STP Shielding.

1.5.5 CN7 Extension DI



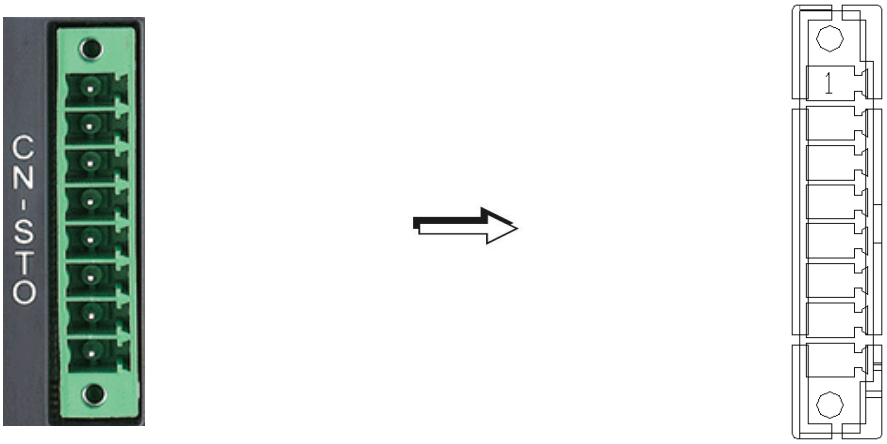
CN7 Connector (male)

Pin No.	Signal Name	Terminal Symbol	Function and Description
*1	VDD 24V power	COM+	VDD (24V) power is the same as the voltage of Pin 11 in CN1
2	Extension DI9	EDI 9-	Digital input pin 9-
3	Extension DI10	EDI 10-	Digital input pin 10-
4	Extension DI11	EDI 11-	Digital input pin 11-
5	Extension DI12	EDI 12-	Digital input pin 12-
6	Extension DI13	EDI 13-	Digital input pin 13-
7	Extension DI14	EDI 14-	Digital input pin 14-

WARNING

➢ ***Caution: do not apply to dual power or it may damage the servo drive.***

1.5.6 CN-STO



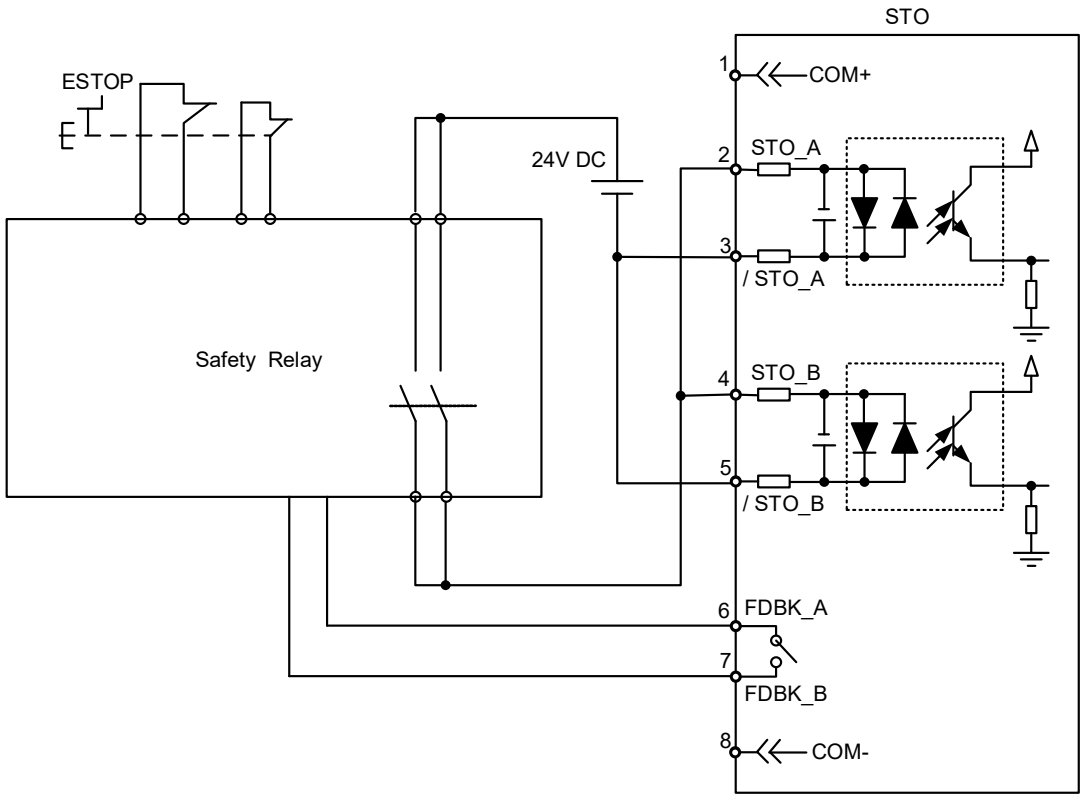
CN-STO Connector (male)

Pin No.	Signal Name	Terminal Symbol	Function and Description
*1	VDD 24V power	COM+	VDD (24V) power is the same as the voltage of Pin11 in CN1
2	STO_A	STO_A	STO input pin A+
3	/STO_A	/STO_A	STO input pin A-
4	STO_B	STO_B	STO input pin B+
5	/STO_B	/STO_B	STO input pin B-
6	FDBK_A	FDBK_A	STO alarm output pin A, Relay max. output current: 1 A
7	FDBK_B	FDBK_B	STO alarm output pin B, Relay max. output current: 1 A
8	COM-	COM-	VDD (24V) power ground

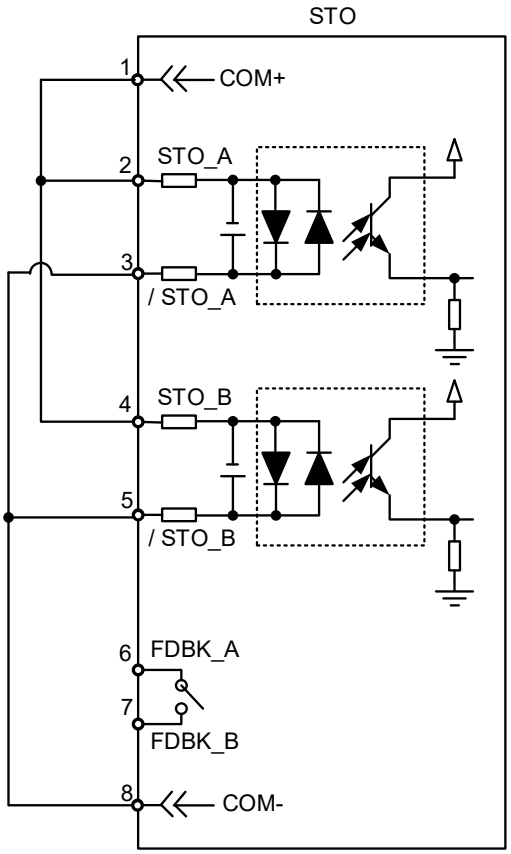
WARNING

➢ ***Caution: do not apply to dual power or it may damage the servo drive.***

1.5.7 STO with Safety Relay



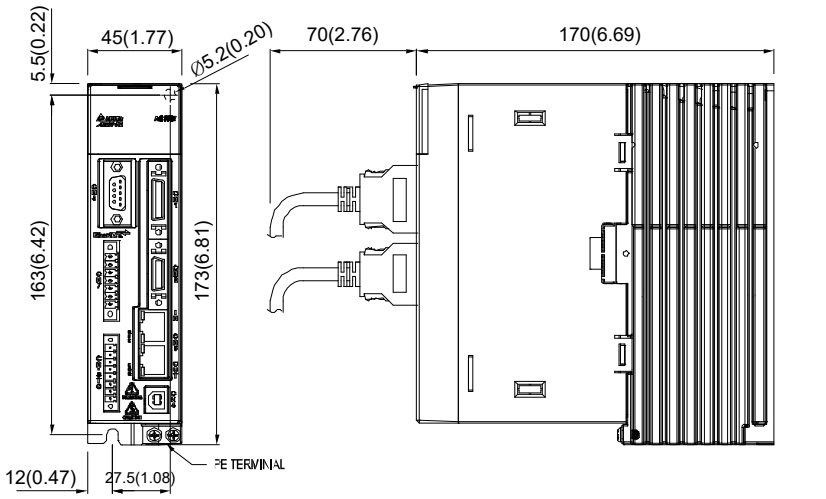
1.5.8 Disable STO

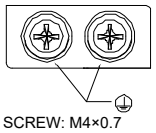


1.6 Dimensions

1.6.1 220V Series

100 W / 200 W / 400 W

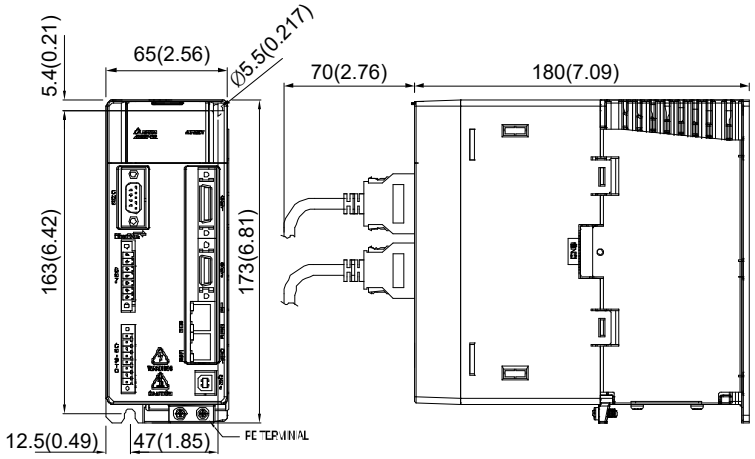


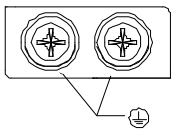


SCREW: M4×0.7
MOUNTING SCREW TORQUE:14(kgf-cm)

Weight	1.5 kg (3.3 lbs)

750 W / 1 kW / 1.5 kW

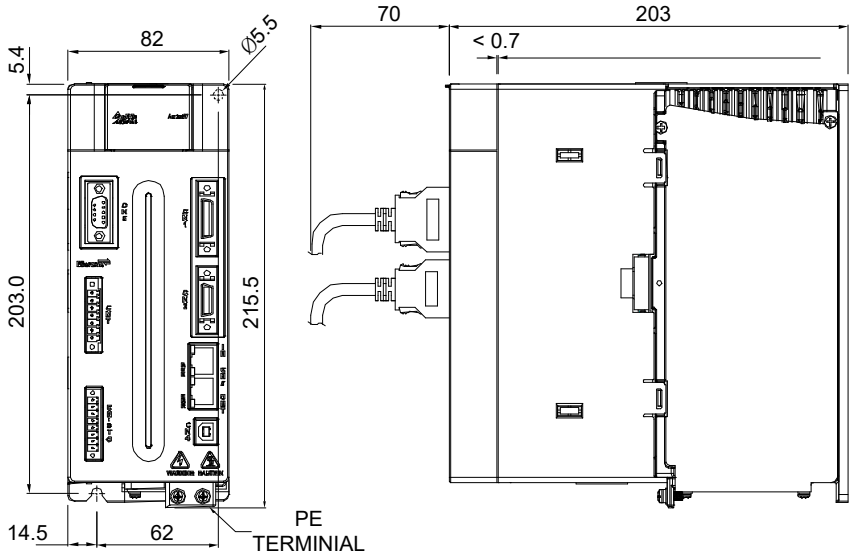


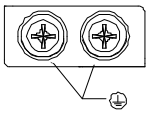


SCREW: M4×0.7
MOUNTING SCREW TORQUE:14(kgf-cm)

Weight	2.0 kg (4.4 lbs)

2 kW / 3 kW



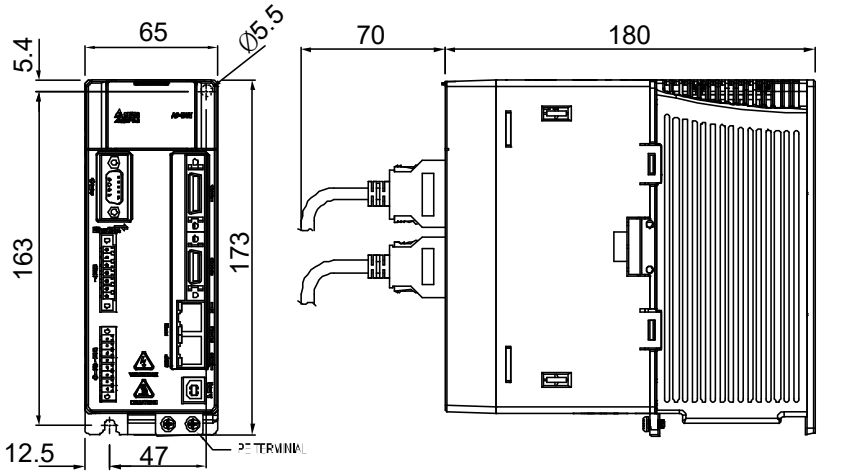


SCREW: M4×0.7
MOUNTING SCREW TORQUE:14(kgf-cm)

Weight	2.89 kg (6.36 lbs)

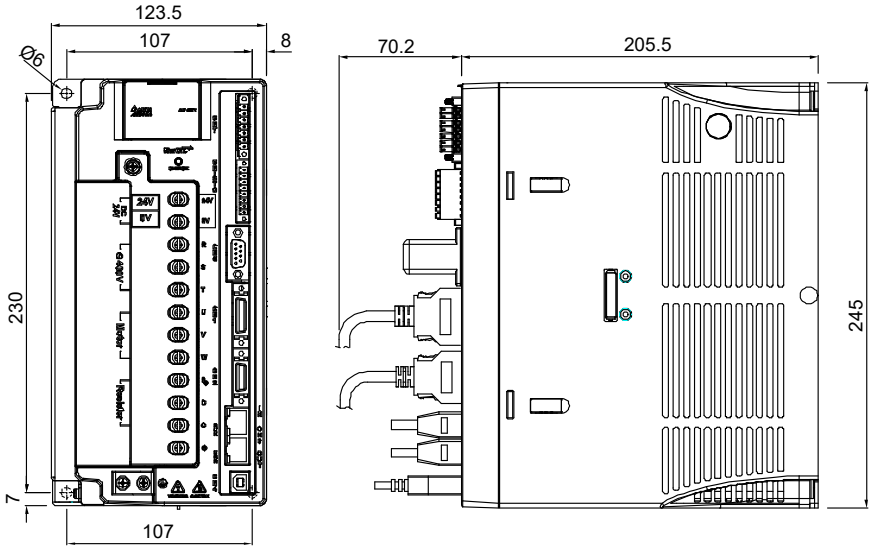
1.6.2 400V Series

400 W / 750 W / 1 kW / 1.5 kW



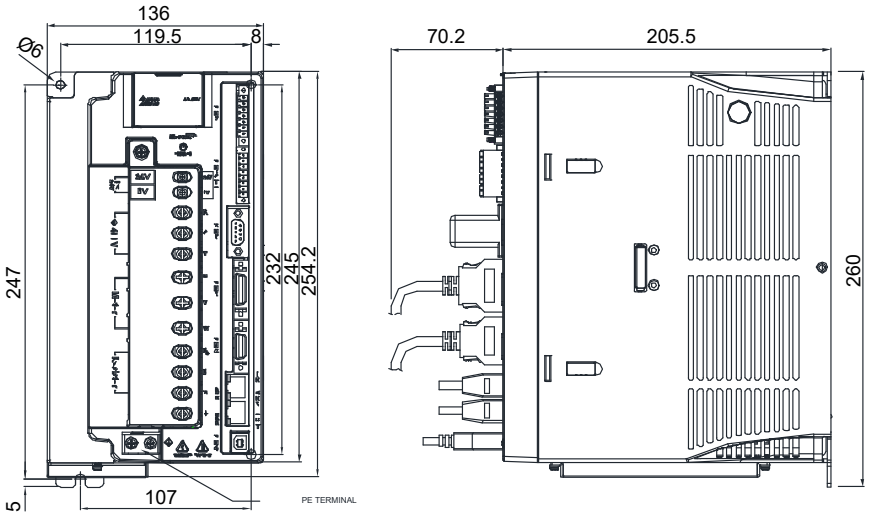
Weight	2.0 kg (4.4 lbs)

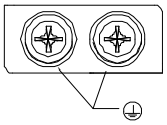
2 kW / 3 kW / 4.5 kW / 5.5 kW



Weight	4.6 kg (10.1 lbs)

7.5 kW





SCREW: M4×0.7
MOUNTING SCREW TORQUE:14(kgf-cm)

Weight	4.6 kg (10.1 lbs)

Note:
1. Dimensions are in millimeters.
2. Dimensions and weights of the servo drive may be revised without prior notice.

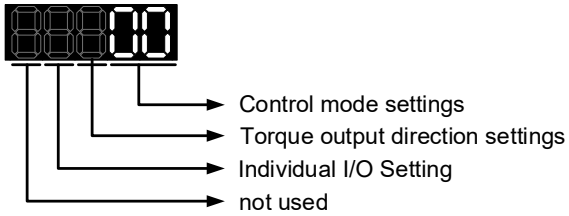
Chapter 2 System Setup

2.1 Parameter Settings of EtherCAT Mode

1. Set parameter **P1-01** to **0x0C$_h$** for EtherCAT communication and CANopen as the application layer.
2. Restart the system of servo drive.

P1-01●	**CTL**	**Control Mode and Input Direction**		**Address：0102H 0103H**
Interface：	Panel / Software	Communication	Reference：	-
Default：	0x0C$_h$		Control Mode：	ALL
Unit：	Pulse (P mode); r/min (S mode); N-m (T mode)		Range：	00 ~ 0x110F
Format：	Hex		Data Size：	16-bit

Settings：



Control mode settings:

	PT	PR	S	T	Sz	Tz
Single Mode						
00	▲					
01		▲				
02			▲			
03				▲		
04					▲	
05						▲
Multiple Mode						
0E	▲	▲	▲			
0F	▲	▲		▲		

	PT	PR	S	T	Sz	Tz
Dual Mode						
06	▲		▲			
07	▲			▲		
08		▲	▲			
09		▲		▲		
0A			▲	▲		
0B	N/A					
0C	CANopen Mode					
0D	▲	▲				

PR: Position control mode. The command is from the internal signal. Execution of 64 positions is via DI.POS0 ~ POS5. A variety of homing methods are also provided.

S: Speed control mode. The command is from the external signal or internal signal. Execution of the command selection is via DI.SPD0 and DI.SPD1.

T: Torque control mode. The command is from the external signal or internal signal. Execution of the command selection is via DI.TCM0 and DI.TCM1.

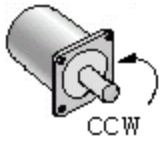
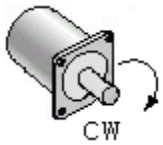
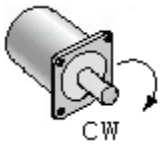
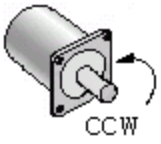
Sz: Zero speed / internal speed command

Tz: Zero torque / internal torque command

Dual Mode: you can switch the control mode with DI signals. For example, you can switch to PT-S control mode with DI.S-P.

Multiple Mode: you can switch the control mode with DI signals. For example, you can switch to PT-PR-S control mode with DI.S-P and DI.PT-PR.

Torque output direction settings:

Direction	0	1
Forward		
Reverse		

Note: when P1-01 = 0xC, you need to set P3-12.Z to 1 to control the torque output direction with parameters, or the direction setting in the parameters is not effective.

Individual I/O settings:

1: when you switch to a different mode, digital inputs/outputs (P2-10 ~ P2-22) will be set to the default value according to the mode you selected.

0: when you switch to a different mode, the setting value of digital inputs/outputs (P2-10 ~ P2-22) will remain the same and will not be changed.

2.2 TwinCAT Setup

A lot of software can be applied to configure EtherCAT system. The following procedures are the example of TwinCAT of Beckhoff. Please install the software properly before you start to configure the system.

1. Copy Delta XML description to the folder where the TwinCAT is installed (usually C:\TwinCAT\Io\EtherCAT).
2. Restart the TwinCAT.
3. The configuration procedure can be started by applying TwinCAT manager which is shown as below.

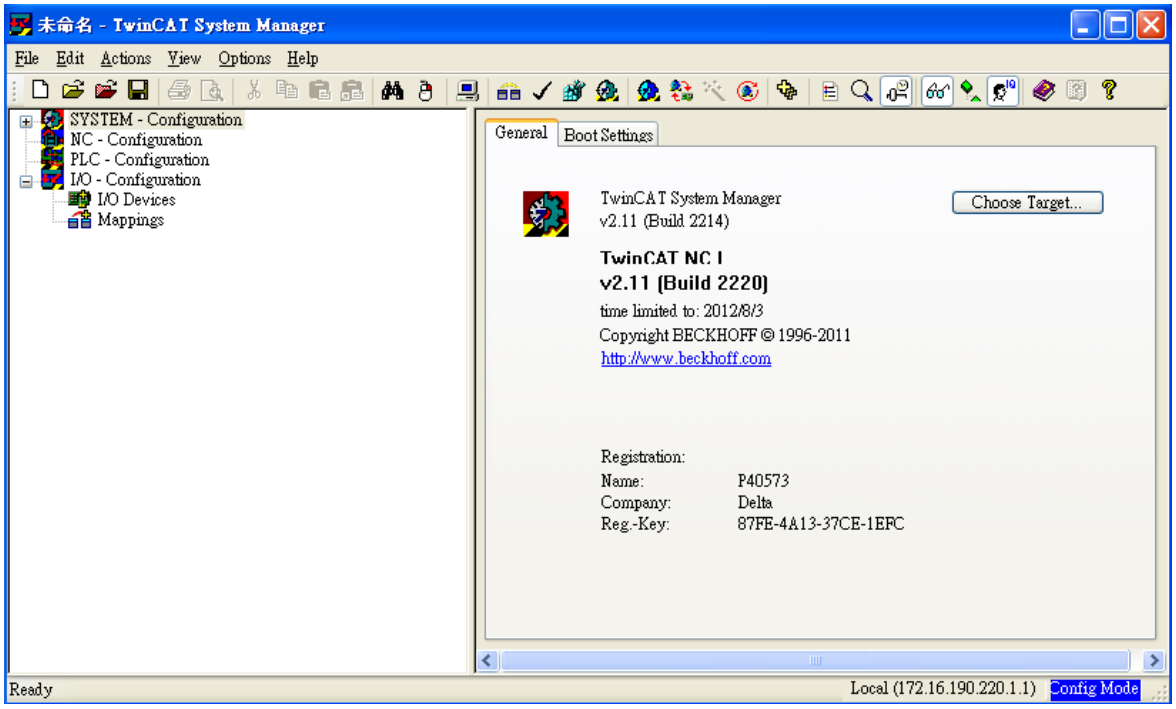


Figure 4

4. Install the Network Interface Card (NIC) for EtherCAT communication.

■ Select [Options] > [Show Real Time Ethernet Compatible Devices...].

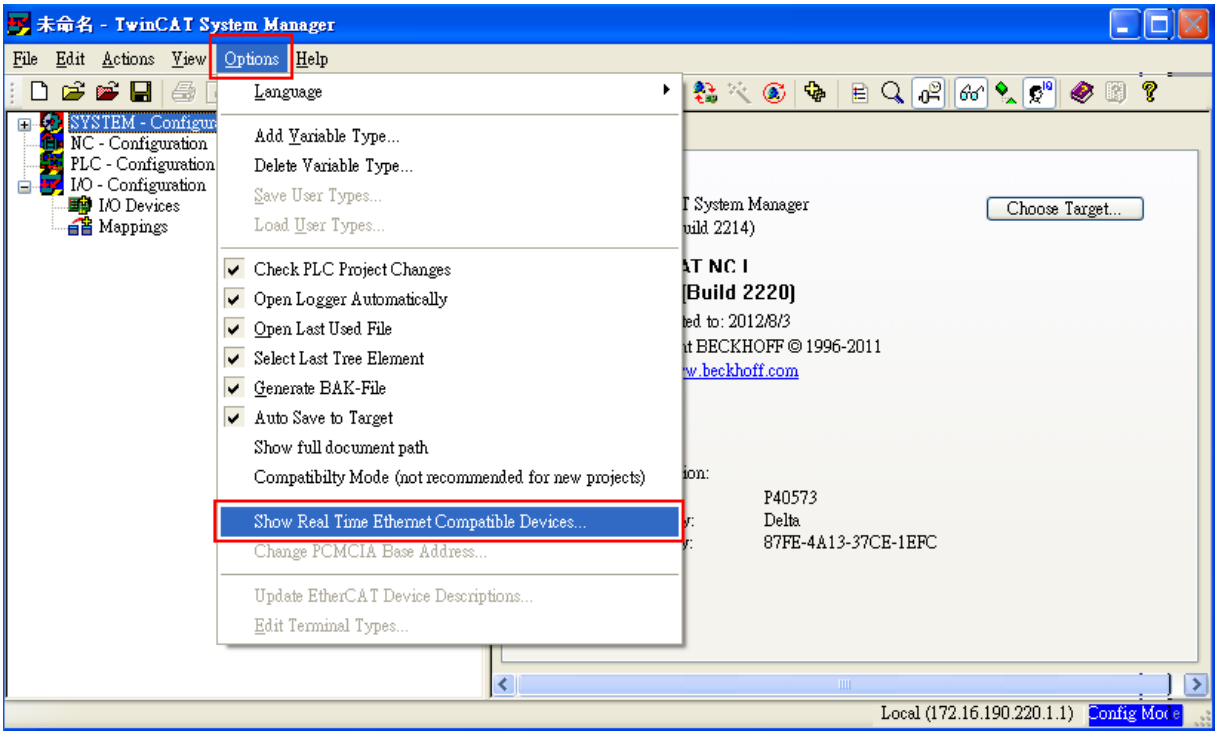


Figure 5

■ Select the correct Adapter from the devices (NICs) installed in the computer for EtherCAT communication and click **Install**.

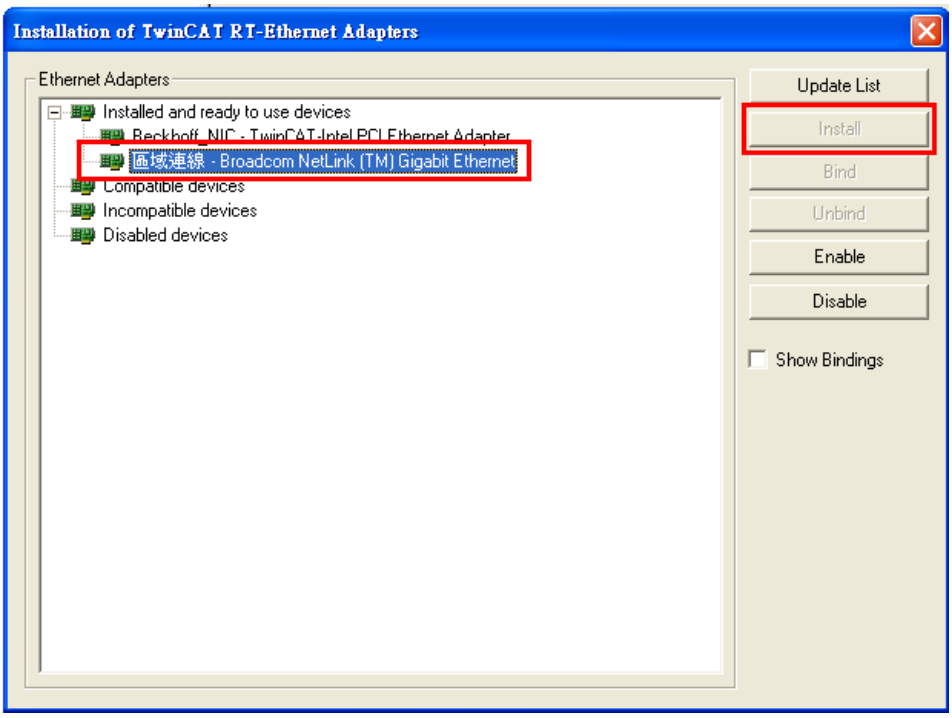


Figure 6

5. Select [File] > [New] from the drop-down list to create a new project.

6. Right-click [I/O Devices], and select [Scan Devices…] or press **F5** to scan the devices. Click **OK (確定)** in the pop-up window to proceed to the next step.

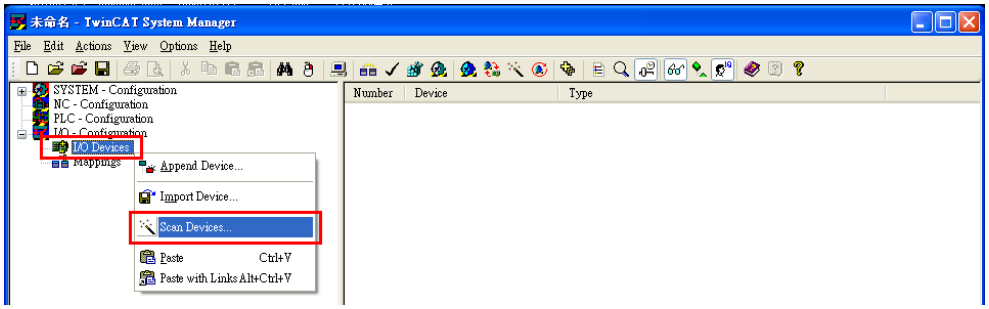


Figure 7

Figure 8

7. Select Device [n] (EtherCAT) and click **OK**.

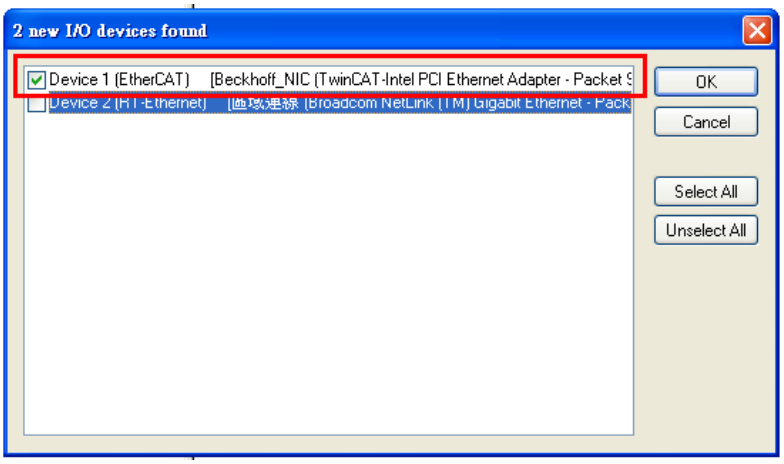


Figure 9

8. Click **Yes (是)** to scan for the control boxes.

Figure 10

9. Click **Yes (是)** to add drives to NC-Configuration.

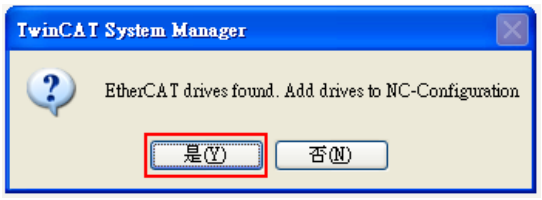


Figure 11

10. Click **No (否)** and TwinCAT will be switched to Config mode.

Figure 12

11. TwinCAT is in Config Mode. The window on the left shows Device 3 (EtherCAT) and Drive 1 (ASDA A2-E CoE Drive).

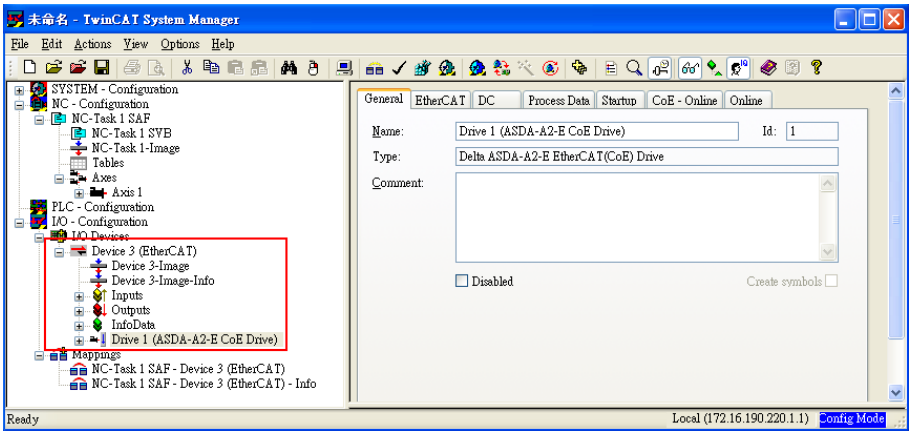


Figure 13

12. Select [Drive 1 (ASDA A2-E CoE Drive)] and in the Online tab you can check if the EtherCAT state machine (ESM) of the device is in PREOP state.

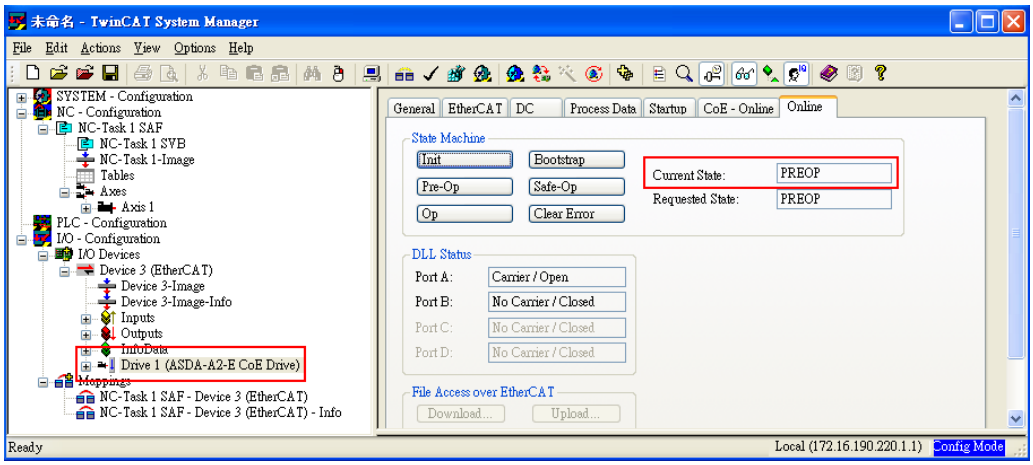


Figure 14

13. Double-click on [Drive 1 (ASDA A2-E CoE Drive)] and it will show:

    2nd TxPDO Mapping
    3rd RxPDO Mapping
    WcState
    InfoData

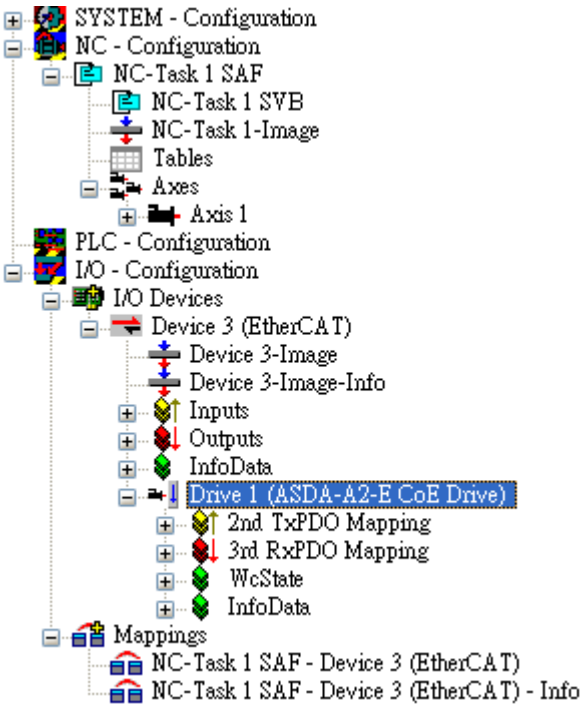


Figure 15

14. Set the communication cycle time* and the default value is 2 ms.

■ Select [NC-Task 1 SAF] in the left window, and set the communication cycle time (the minimum value is 1 ms) for Cycle ticks in the right window.

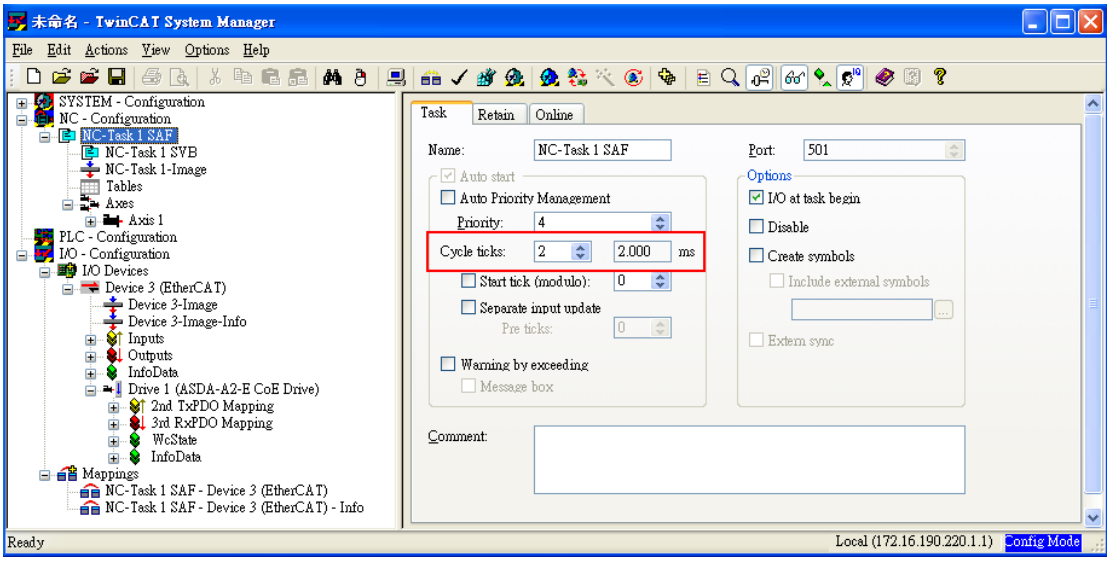


Figure 16

*The communication cycle time, SYNC0 cycle time, and PDO cycle time should be set to the same value.

15. Set Following Error Calculation to Extern.

■ Select [Axis 1_Drive] in the left window > in the Parameter tab of the right window, select Extern for Following Error Calculation > click **Download** and then click **OK** in the pop-up window.

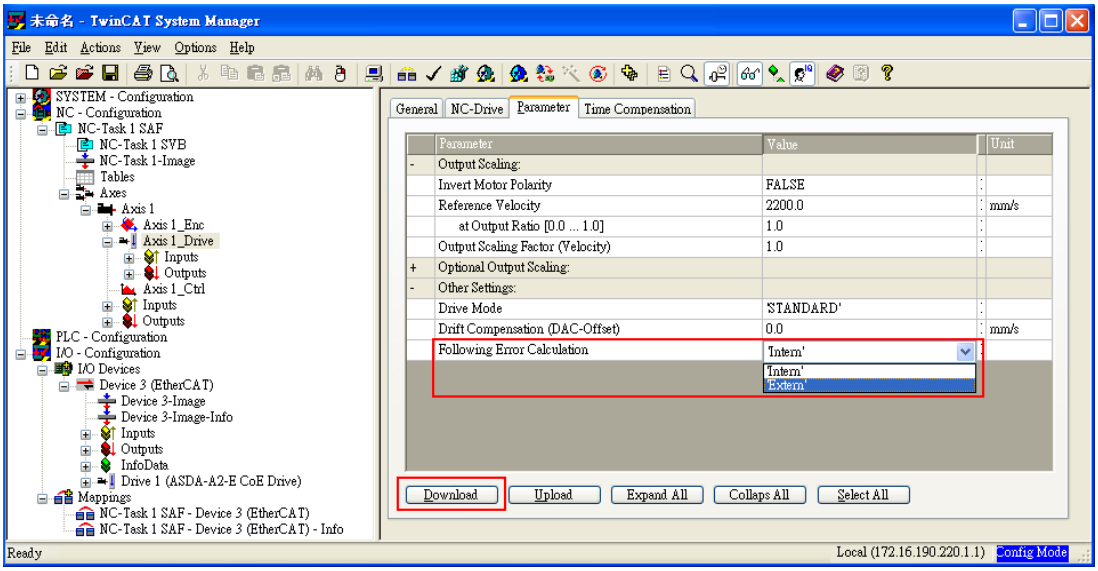


Figure 17

16. Switch TwinCAT to Run Mode.

■ Press  to generate Mappings, press  to confirm the configuration, press  to activate the configuration, and then TwinCAT will be switched to Run Mode. Click **OK** in the pop-up window.

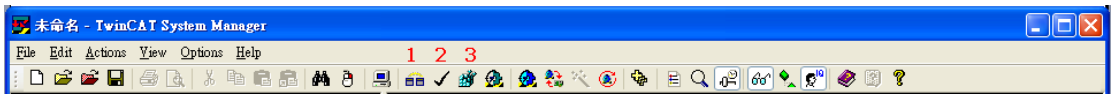


Figure 18

17. Enable the axis (Servo On).

■ Under [NC-Configuration] in the left window, select [Axis 1] > select the Online tab in the right window > click **Set**.

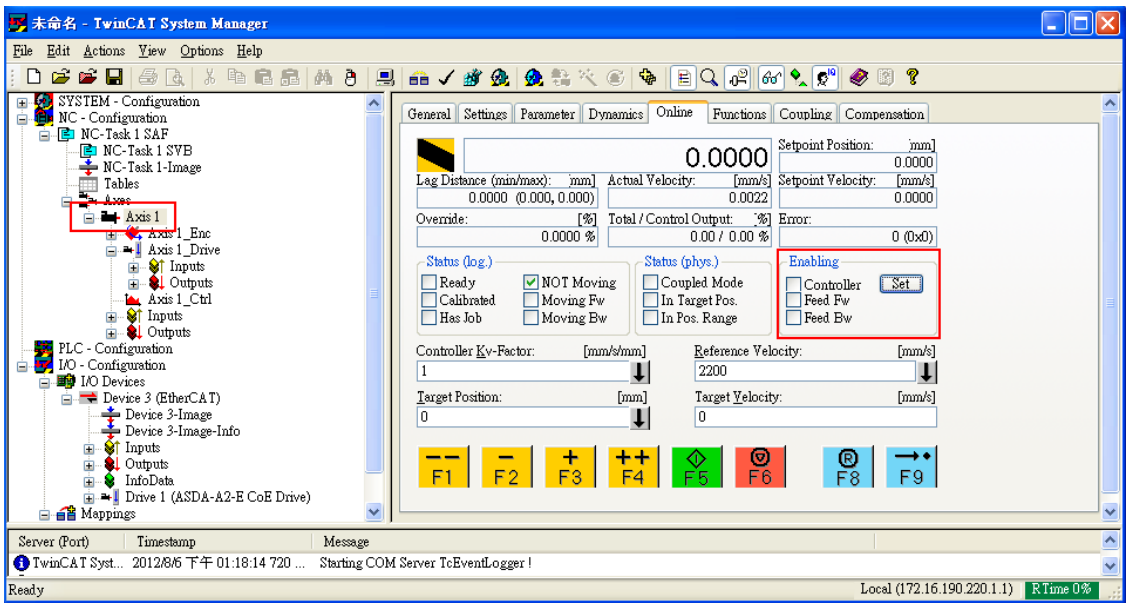


Figure 19

■ In the pop-up window, click **All** to enable the motor.

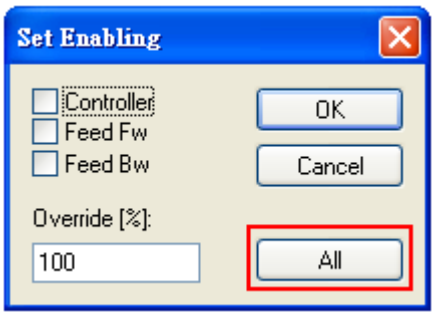


Figure 20

18. In the Online tab, there are jogging buttons with two different speed levels for forward and backward movement which can be used to test the system. During the operation, please ensure that the movement would not damage your system and endanger the personnel safety.

Figure 21

2.3 Synchronization Modes Setting

2.3.1 Two Synchronization Modes of Delta Servo Drive

ASDA A2-E supports two synchronization modes, Free Run mode and DC-Synchronous mode. Note that the asynchronous Free Run mode is still under the definition of “Synchronization Modes” within EtherCAT specification guide.

■ Free Run Mode (Asynchronous)

The master and slaves are running in an asynchronous manner. The master and the slave both have their own clock to calculate the time. In other words, clocks of the master and the slave are not synchronized. The command and feedback transmission between the master and slave is based on a sequential order instead of the synchronized timing. For example, the master sends a PDO at tick t1 and the slave will receive it at tick t1 or tick t2 and vice versa.

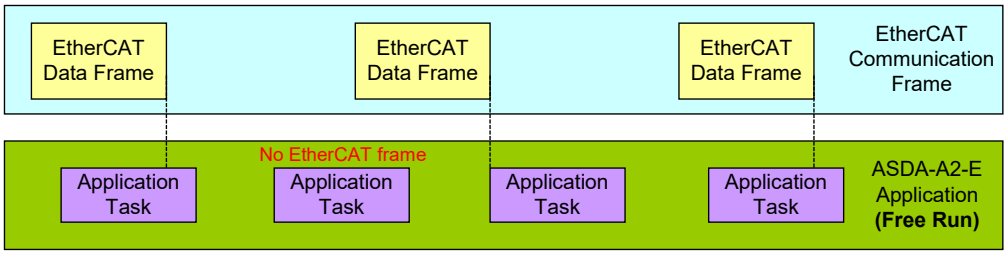


Figure 22 Free Run Mode synchronization

■ DC-Synchronous Mode (SYNC0 synchronization)

There is a clock tick for the master and all slaves operation. A data sent by the master will be received by the slave(s) at the same clock interval. The master will inform all slaves about its clock and ask the slaves to align according to the time. A strict clock tick is always running within this system.

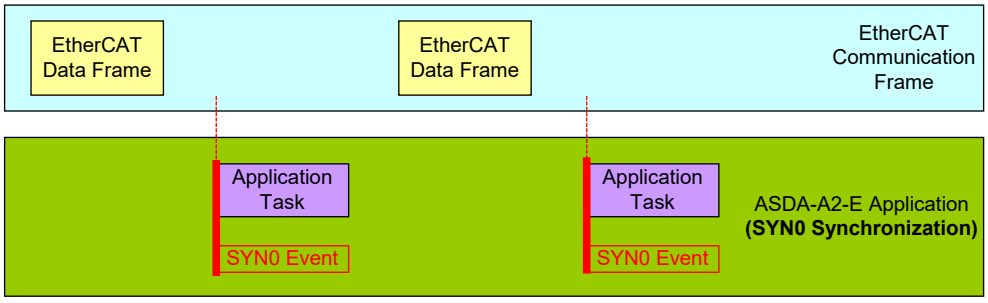


Figure 23 DC-Synchronous mode synchronization

2.3.2 Select the Synchronization Mode

1. Select [Drive 1 (ASDA-A2-E CoE Drive)] in the left window.
2. In DC tab in the right window, you can select DC-Synchronous or Free Run as the Operation Mode. This is for selecting synchronous or asynchronous mode.

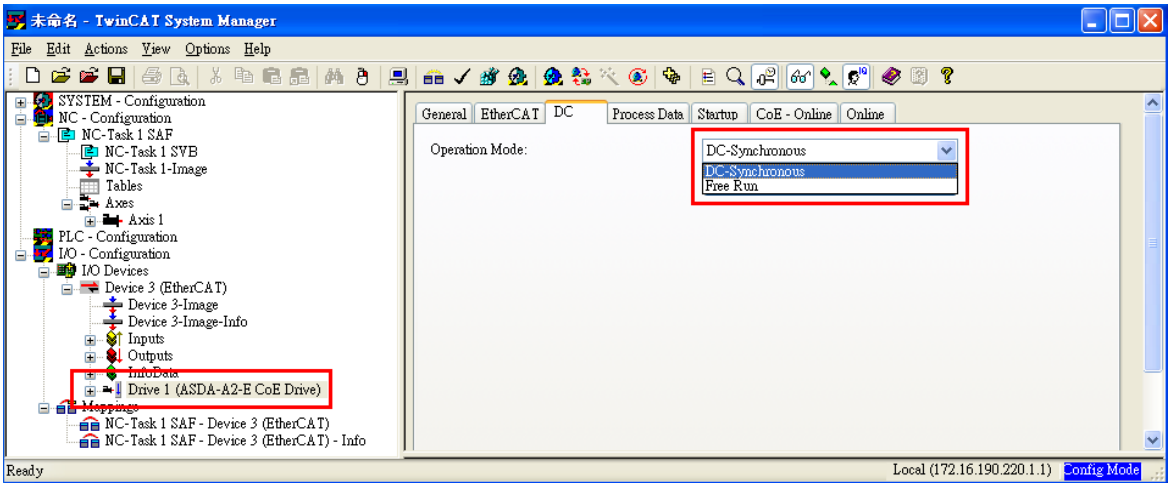


Figure 24

2.3.3 Synchronous Clock Time Setting

1. Select [NC-Task 1 SAF] in the left window.
2. Click the Task tab in the right window.
3. Set the data exchanging period in the Cycle ticks field under the Task tab.

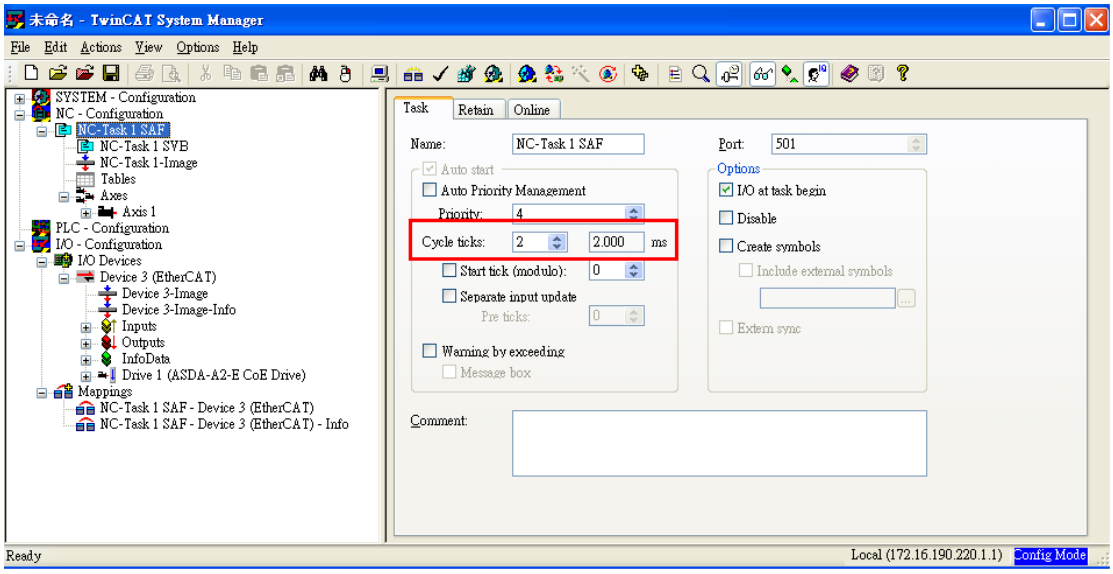


Figure 25

The unit for SYNC0 cycle time is 1 ms.

Supported SYNC0 cycle time	1 ms (PDO cycle time = 1 ms) 2 ms (PDO cycle time = 2 ms) 3 ms (PDO cycle time = 3 ms) …
* SYNC0 cycle time is used to define PDO cycle time.	

2.4 PDO Mapping

The PDO mapping Objects are allocated from index 0x1600 to 0x1603 for RxPDOs and 0x1A00 to 0x1A03 for TxPDOs in Object Dictionary.

2.4.1 Default PDO Mappings

The following tables are the default PDO mappings of ASDA A2-E CoE Drive for cyclic data exchange and are also defined in EtherCAT Slave Information file (XML file).

■ 1st PDO Mapping

RxPDO (0x1600)	Control Word (0x6040)	Target Position (0x607A)	Target Velocity (0x60FF)	Target Torque (0x6071)	Mode of Operation (0x6060)
TxPDO (0x1A00)	Status Word (0x6041)	Actual Position (0x6064)	Actual Velocity (0x606C)	Actual Torque (0x6077)	Mode of Operation Display (0x6061)

■ 2nd PDO Mapping (default PDO assignment)

RxPDO (0x1601)	Control Word (0x6040)	Target Position (0x607A)
TxPDO (0x1A01)	Status Word (0x6041)	Actual Position (0x6064)

■ 3rd PDO Mapping

RxPDO (0x1602)	Control Word (0x6040)	Target Velocity (0x60FF)	
TxPDO (0x1A02)	Status Word (0x6041)	Actual Position (0x6064)	Actual Velocity (0x606C)

■ 4th PDO Mapping

RxPDO (0x1603)	Control Word (0x6040)	Target Torque (0x6071)	
TxPDO (0x1A03)	Status Word (0x6041)	Actual Position (0x6064)	Actual Torque (0x6077)

2.4.2 Re-define a PDO Mapping

Setup procedure

1. Set 【RxPDO Assignment:0x1C12:0/ TxPDO Assignment: 0x1C13:0】to 0x0 for disabling the PDO assignment.
2. Set 【RxPDO mapping entry: ex. 0x1601:0/ TxPDO mapping entry: ex. 0x1A01:0】to 0x0 for disabling the PDO mapping entry setting.
3. Set 【RxPDO mapping entry: ex. 0x1601:0 - 0x1601:7/ TxPDO mapping entry: ex. 0x1A01:0 - 0x1A01:7】.
4. Set 【RxPDO mapping entry: ex. 0x1601:0/ TxPDO mapping entry: ex. 0x1A01:0】to the number of mapping entries in PDO mapping.
5. Set 【RxPDO Assignment:0x1C12:1/ TxPDO Assignment: 0x1C13:1】to the specified PDO assignment.
6. Set 【RxPDO Assignment:0x1C12:0/ TxPDO Assignment: 0x1C13:0】to 0x1 for enabling the PDO assignment.

2.4.3 Using TwinCAT

1. Press  or **Shift** and **F4** to set / reset TwinCAT to Config Mode (Click **OK** in the pop-up window).
2. Select [Drive 1 (ASDA A2-E CoE Drive)] in the left window. In Process Data field, you can change PDO Assignment for another PDO mapping.
3. Right-click the PDO Content window, and find the PDO mapping that you desire to set, and then you can configure (Insert… / Delete… / Edit… / Move Up / Move Down) the PDO mapping content. (Each set of PDO mapping allows up to 8 PDO assignments.)

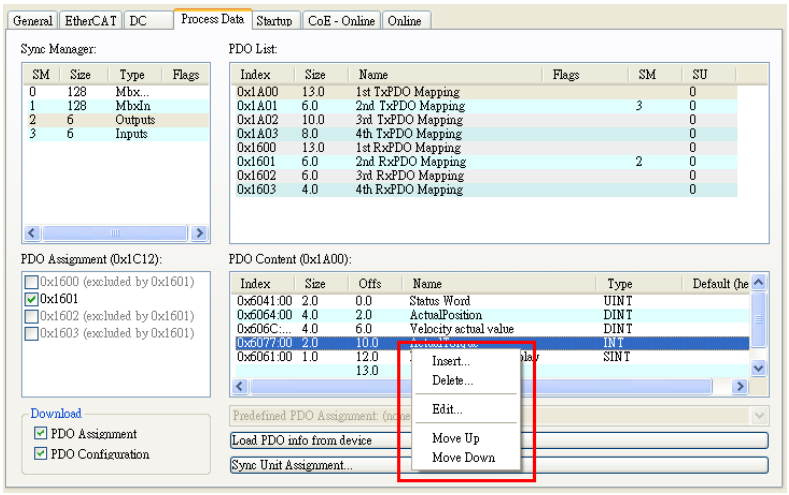


Figure 27

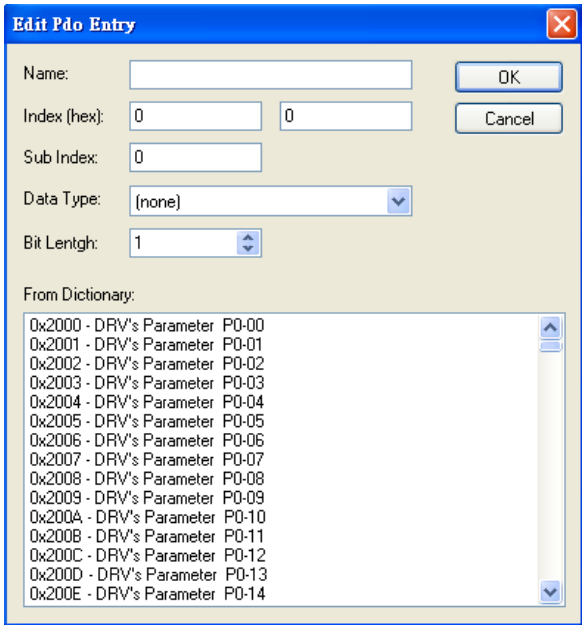


Figure 28 ASD-A2-E CoE drive Object List

4. After changing the PDO Assignment, press  or **F4** to reload I/O devices. (Click **No** in the pop-up window and stay in Config Mode.)

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Chapter 3 EtherCAT Communication States

ASDA A2-E supports four EtherCAT communication states which are shown as below:

- Init (Initialization)
- Pre-Operational
- Safe-Operational
- Operational

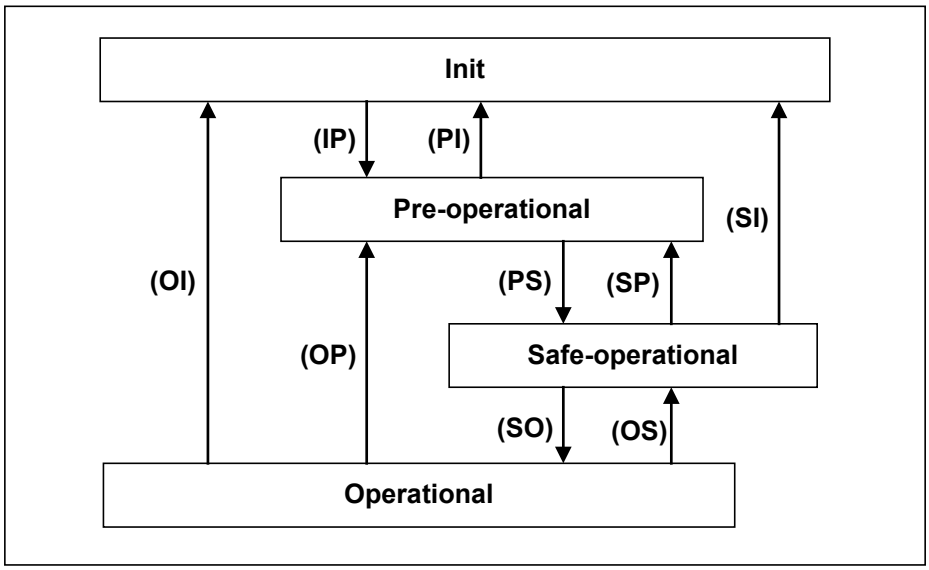


Figure 29 The EtherCAT State machine

The EtherCAT host controller can have the servo drive switch between states. Different states support different service.

State	Description
Init	After power on, the system will be located in this state when the hardware is initialized without any error. No communication packet is sent at this stage.
Pre-Operational	The mailbox can be accessed via SDO (Service Data Object). The emergency message will be sent to the host controller if any alarm occurs.

Safe-Operational	Except SDO, for accessing Mailbox, the PDO (Process Data Object) can only be applied for Process Data Input (TxPDO) at this stage.
Operational	The full function of SDO and PDO (TxPDO and RxPDO) are available now.

3.1 State Switching Operation

The EtherCAT host will send different state switching commands for requesting different service.

Switching Command	Description
IP	● The master will define the slave address and register SyncManager (0/1), and establish the mailbox communication. ● The master will send the command to have the slave switch to Safe-Operational state.
PS	● The master uses the SDO to set the PDO mapping related parameters. ● The master will define FMMU and register SyncManager (2/3), and the slaves keep sending the PDO (TxPDO) packets to the master. ● The master requests the slave to switch to Operational state.
SO	● The master starts to send the PDO (RxPDO). ● The distributed clock synchronization procedure takes place between the master and slaves.
PI, SI, OI	● Disable all communication functions, including the SDO and PDO. ● Switch to Init state.
SP, OP	● Disable the PDO function. ● Switch to Pre-Operational state.
OS	● The master stops sending PDO (RxPDO). ● Switch to Safe-Operational state.

Chapter 4 EtherCAT Troubleshooting

Q: Why my TwinCAT cannot find EtherCAT Device from the installed NIC (Network Interface Card) and only shows RT-Ethernet devices?

A:
1. Refer to TwinCAT setup procedures and make sure the NIC is installed properly.
2. Check if the cable is correctly connected and L/A LED is lit.

Q: The window shows “Unknown device type found” while using TwinCAT Scan boxes.

A: Copy XML description of the ASDA-A2-E to TwinCAT device description folder (usually in C:\TwinCAT\Io\EtherCAT) and restart TwinCAT System.

Q: Why does EtherCAT state machine only show INIT in Current State field and blank in DLL Status fields when TwinCAT is in Config Mode?

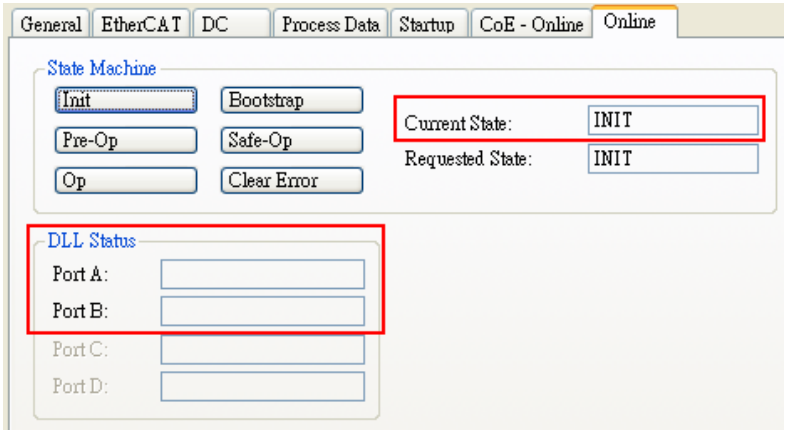


Figure 30

A:
1. Set P1-01 to 0x0C (EtherCAT communication mode).
2. Check the wiring from the host to EtherCAT communication port CN6A for input and CN6B for output on the servo drive. If the Link LED lights up, it indicates

that the physical connection is correct and the drive is connecting.

Q: TwinCAT shows “following error”.

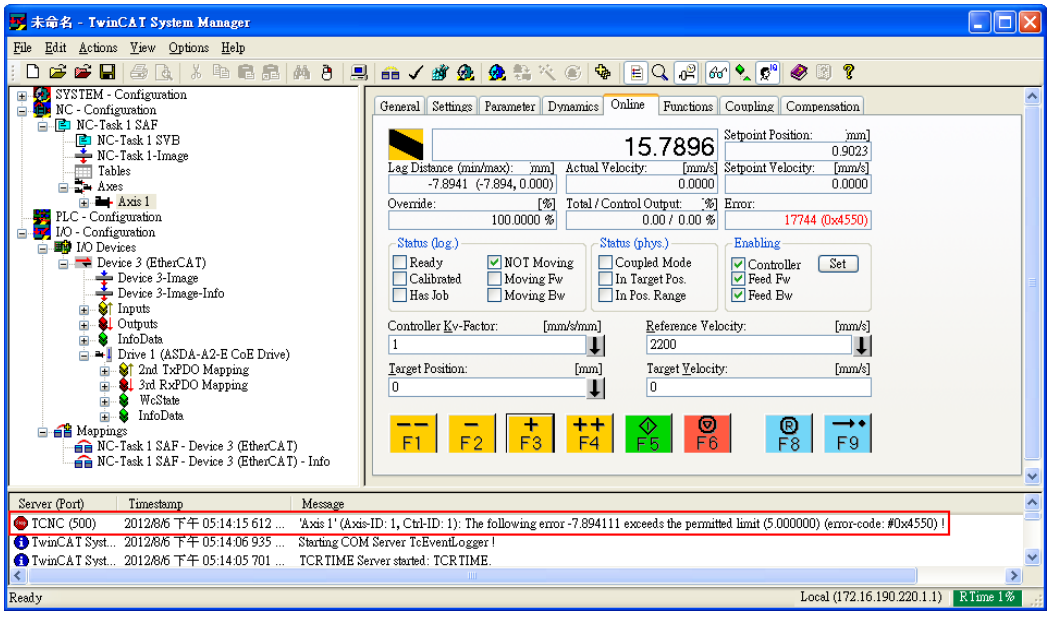


Figure 31

A: Set Following Error Calculation to Extern:

1. Select [Axis 1_Drive] in the left window.
2. Under the Parameter tab, select Extern for Following Error Calculation.
3. Click **Download** and click **OK** in the pop-up window.

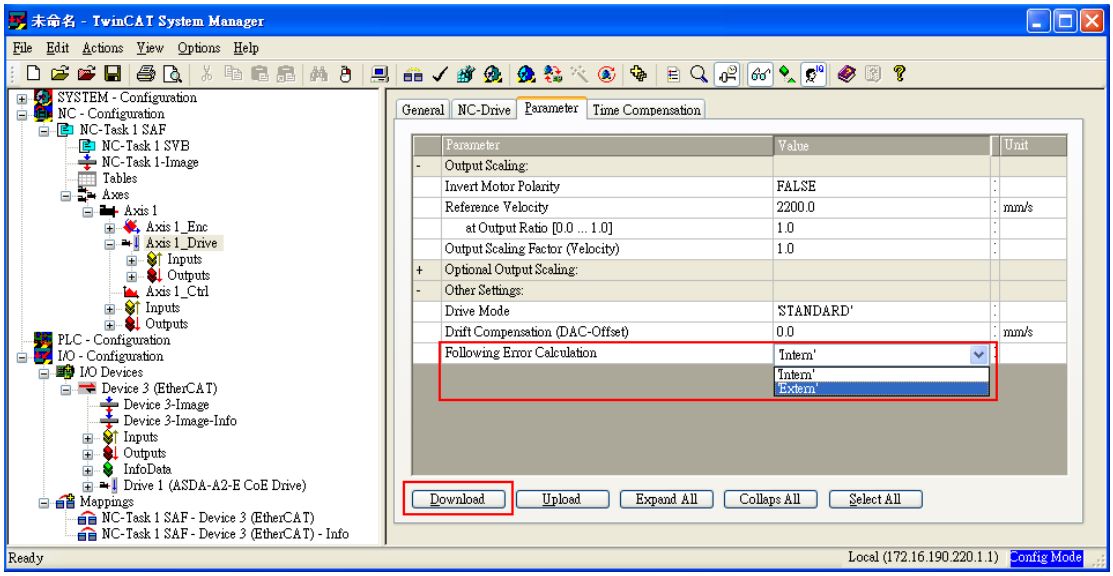


Figure 32

Q: ASDA A2-E servo drive shows AL185.

A: This alarm message occurs because of the disconnecting EtherCAT communication between the host and the slave. Check the wiring and then switch the servo drive to on again or set OD 0x6040 to 0x86 for fault reset.

Q: ASDA A2-E servo drive shows AL180.

A: Working under Operational state without receiving any PDOs will trigger this alarm.

1. A mechanism inside Delta Servo Drive can be used to monitor the error when receiving PDOs by setting P0-02 to 121. If the value keeps increasing, it means there is server interference on the communication cable.
2. Select the drive and click the Online tab. If the values in the columns of Lost Frames and Rx Errors keep increasing, it means the system is severely interfered.

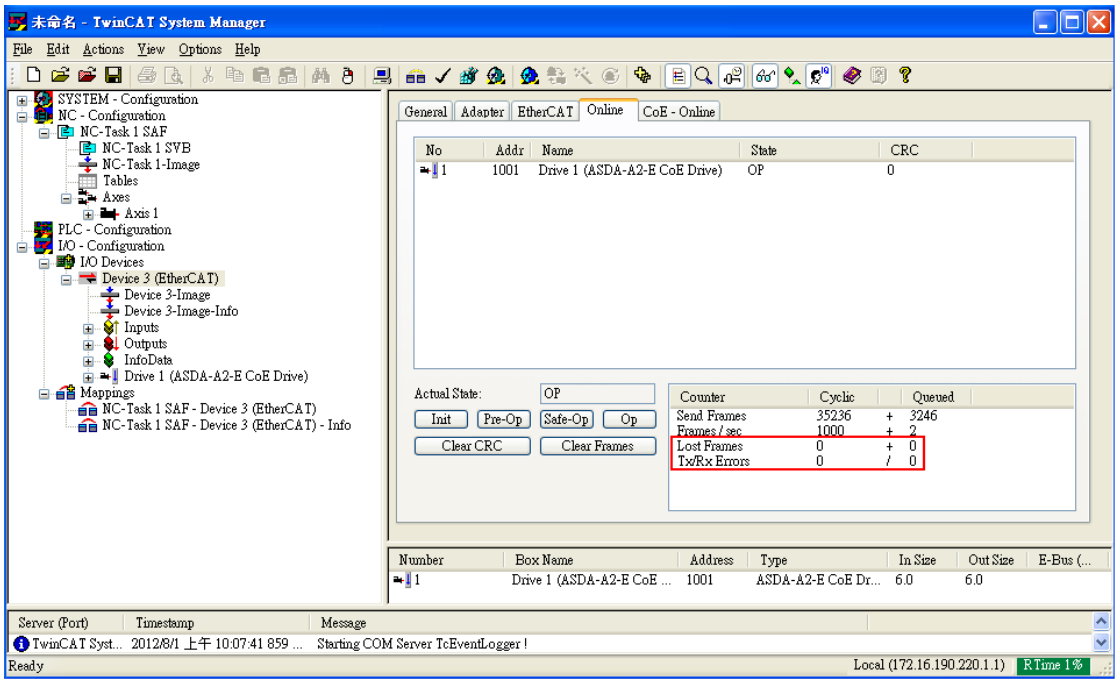


Figure 33

3. You can adjust the settings for P3-22 with the application requirement for triggering AL180 when not receiving PDOs for some consecutive communication cycle times.

Q: ASDA A2-E servo drive shows AL3E1.

A: When you enable DC synchronization, if the reference clock jitters violently, it may trigger this alarm.

1. Check the reference clock for violent time jitter.
2. Set the control word 0x6040.7 = 1 for fault reset.

Q: ASDA A2-E servo drive shows AL3E3.

A: Working under Operational state in CANopen CSP/CSV/CST mode without receiving any PDOs for consecutive times triggers this alarm.

1. Make sure the host controller periodically and stably sends PDOs.
2. Make sure the drive is properly grounded and wired.
3. You can adjust the settings for P3-22 with the application requirement for triggering AL3E3 when not receiving PDOs for some consecutive communication cycle times.

Chapter 5 CANopen Operation Mode

5.1 Profile Position Mode

5.1.1 Description

Servo drive (hereinafter “Drive”) receives position command from the host (external) controller (hereinafter “Host”) and then controls the servo motor to reach the target position.

Pulse of User-defined Unit Definition:

Pulse of User Unit (PUU): No. of $\frac{\text{PUU}}{\text{Rev}}$ = 1280000 × $\frac{\text{Ox6093 Sub2}}{\text{OD}-\text{6093h Sub1}}$

5.1.2 Operation Procedures

1. Set 【Modes of operation: 6060_h】to profile position mode (0x01).
2. Set 【Target position: $607A_h$】to the target position (unit: PUU).
3. Set 【Profile velocity: 6081_h】to the profile velocity (unit: PUU per second).
4. Set 【Profile acceleration: 6083_h】to plan acceleration slope (millisecond from 0 rpm to 3000 rpm).
5. Set 【Profile deceleration: 6084_h】to plan deceleration slope (millisecond from 0 rpm to 3000 rpm).
6. Set 【Controlword: 6040_h】to (0x06 > 0x07 > 0x0F) in sequence, switch the drive to Servo On state and enable the motor.
7. Read 【Position actual value: 6064_h】to obtain feedback position of the motor.
8. Read 【Statusword: 6041_h】to obtain the drive status, including the following error, set-point acknowledge, and target reached.

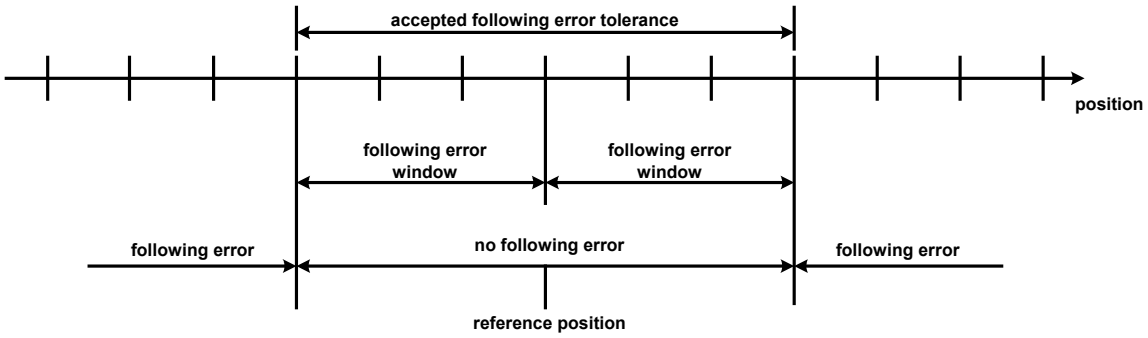
5.1.3 Advanced Setting Procedures

1. The Host could obtain more information about profile position mode.

   - Read 【Position demand value: 6062h】to obtain the internal position command. (unit: PUU)
   - Read 【Position actual value*: 6063h】to obtain the actual position value. (unit: increments)

2. Following error

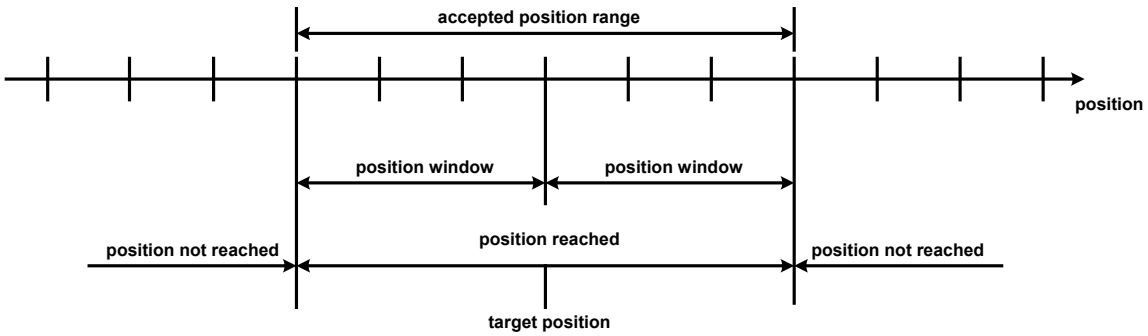
   - Set 【Following error window: 6065h】 to define a symmetrical range of the tolerated position value which is relative to the position demand value. (unit: PUU)
   - Read 【Following error actual value: 60F4h】to obtain the actual value of the following error. (unit: PUU)



Reference position

3. Position window

   - Set 【Position window: 6067h】to define a symmetrical range of the accepted positions which is relative to the target position. (unit: PUU)
   - Set 【Position window time: 6068h】to plan the activation time of target reached. (unit: millisecond)



Position reached

5.1.4 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
6062_h	Position demand value [PUU]	INTEGER32	RO
6063_h	Position actual value [increment]	INTEGER32	RO
6064_h	Position actual value	INTEGER32	RO
6065_h	Following error window	UNSIGNED32	RW
6067_h	Position window	UNSIGNED32	RW
6068_h	Position window time	UNSIGNED16	RW
$607A_h$	Target position	INTEGER32	RW
6081_h	Profile velocity	UNSIGNED32	RW
6083_h	Profile acceleration	UNSIGNED32	RW
6084_h	Profile deceleration	UNSIGNED32	RW
6093_h	Position factor	UNSIGNED32	RW
$60F4_h$	Following error actual value	INTEGER32	RO
$60FC_h$	Position demand value	INTEGER32	RO

5.2 Interpolation Position Mode

5.2.1 Description

The Host sends PDOs to the drive periodically with each PDO carrying the next reference Xi, difference $\triangle X_i$, and controlword. While receiving the next SYNC0, the drive interpolates from X_{i-1} to X_i.

■ Extrapolation, Jitter Compensation

- When PDO is delayed, the interpolator predicts the speed and position for the next time according to the last acceleration.
- If PDO is delayed, the Drive stops and sends out an error message. Set the maximum tolerable delay time with P3-22.

■ PDO Rx/Tx Mapping record

- The Drive receives PDOs from the Host
  - 32-bit reference position [position increment]
  - 16-bit symmetrical difference [increments]

    $\triangle X_i = (X_{i+1} – X_{i-1})/2$ (It is the same for velocity.)
  - 16-bit controlword

The Drive receives PDOs from the Host. (Every PDO contains 8 bytes field, which is shown as below.)

32-bit reference position	16-bit difference	16-bit controlword

5.2.2 Operation Procedures

1. Set 【Modes of operation: 6060_h】to interpolation position mode (0x07).

2. Set 【Interpolation sub mode select: $60C0_h$】to Interpolation mode.

   - If $60C0_h$ is [0], the Host does not need to send [$60C1_h$ Sub-2], which saves the calculating time for the host and the Drive is still operable.
   - If $60C0_h$ is [-1], the Host needs to send [$60C1_h$ Sub-2] to increase the Drive precision.

3. Set 【Interpolation time period: $60C2_h$】, and the value should be identical to that of the SYNC0 cycle time.

   - $60C2_h$ Sub-1 is used for Interpolation time units, with the range from 1 ms to 20 ms.
     - $60C2_h$ Sub-2 is used for Interpolation time index. The value is always -3, meaning the interpolation time unit is 10^{-3} second.

4. Drive PDO Rx:

   - Use $60C1_h$ Sub-1 to set Pos Cmd (32-bit).
   - Use 6040_h Sub-0 to set Controlword.

5.2.3 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
6093_h	Position factor	UNSIGNED32	RW
$60C0_h$	Interpolation sub mode select	INTEGER16	RW
$60C1_h$	Interpolation data record	ARRAY	RW

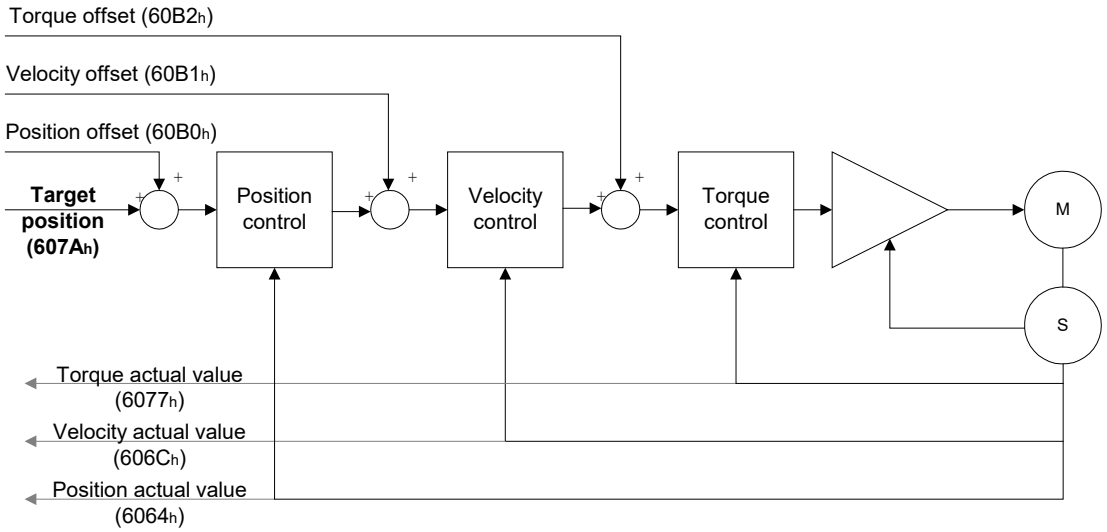
(Refer to the Section 6.4 Details of Objects for more details)

5.3 Cyclic Synchronous Position Mode

5.3.1 Description

The Host plans the path in Cyclic Synchronous Position mode and sends PDOs periodically to the drive with each PDO carrying the target position and controlword. The velocity offset and torque offset can be used as the velocity and torque feed forward.

5.3.2 The Function of CSP Mode



5.3.3 Operation Procedures

1. Set 【Modes of operation: 6060_h】to cyclic synchronous position mode (0x08).

2. Set 【Interpolation time period: $60C2_h$】, and the value should be identical to that of the SYNC0 cycle time.

   - $60C2_h$ Sub-1 is used for Interpolation time units with the range from 1 ms to 20 ms.
     - $60C2_h$ Sub-2 is used for Interpolation time index. The value is always -3, meaning the interpolation time unit is 10^{-3} second.

3. Drive PDO Rx:

   - Use $607A_h$ to set Target Pos Cmd (32-bit).
   - Use 6040_h Sub-0 to set Controlword.

5.3.4 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
$607A_h$	Target position	INTEGER32	RW
$60B0_h$	Position offset	INTEGER32	RW
6064_h	Position actual value	INTEGER32	RO
$60B1_h$	Velocity offset	INTEGER32	RW
$606C_h$	Velocity actual value	INTEGER32	RO
$60B2_h$	Torque offset	INTEGER16	RW
6077_h	Torque actual value	INTEGER16	RO

(Refer to Section 6.4 Details of Objects for more details.)

5.4 Homing Mode

5.4.1 Description

This mode helps the Drive to find the home position. Users can specify the speed, acceleration, and method of homing.

5.4.2 Operation Procedures

1. Set【Modes of operations: 6060h】to the homing mode (0x06).
2. Set【Home offset: 607Ch】.
3. Set【Homing method: 6098h】. The setting range is from 1 to 35. (Refer to the OD-6098h definition shown below.)
4. Set【Homing speed: 6099h Sub-1】to set speed during the search for Home Switch. (unit: rpm)
5. Set【Homing speed: 6099h Sub-2】to set speed during the search for zero. (unit: rpm)
6. Set【Homing acceleration: 609Ah】for homing acceleration. (unit: millisecond from 0 rpm to 3000 rpm)
7. Set【Controlword: 6040h】to (0x06 > 0x07 > 0x0F) in sequence, switch the drive to Servo ON state and enable the motor.
8. Set【Controlword: 6040h】to (0x0F > 0x1F) in sequence to search for Home Switch and perform homing.
9. Read【Statusword: 6041h】to obtain the drive status.

5.4.3 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
$607C_h$	Home offset	INTEGER32	RW
6093_h	Position factor	UNSIGNED32	RW
6098_h	Homing method	INTEGER8	RW
6099_h	Homing speed	ARRAY	RW
$609A_h$	Homing acceleration	UNSIGNED32	RW

(Refer to Section 6.4 Details of Objects for more details.)

5.5 Profile Velocity Mode

5.5.1 Description

The Drive receives velocity command, and plans acceleration and deceleration.

5.5.2 Operation Procedures

1. Set【Modes of operation: 6060_h】to profile velocity mode (0x03).
2. Set【Controlword: 6040_h】to (0x06 > 0x07 > 0x0F) in sequence, switch the drive to Servo ON state and enable the motor. (After Servo On, the internal velocity command will be reset and OD-$60FF_h$ will be cleared.)
3. Set【Profile acceleration: 6083_h】to plan the acceleration slope. (millisecond from 0 rpm to 3000 rpm)
4. Set【Profile deceleration: 6084_h】to plan the deceleration slope. (millisecond from 0 rpm to 3000 rpm)
5. Set【Target velocity: $60FF_h$】. The unit of the target velocity is 0.1 rpm.

   (If the drive is already servo-on, it will work immediately after receiving the velocity command. OD-$60FF_h$ will be cleared to 0 if OD-6060_h [Mode] is changed, Servo is off, or Quick-Stop is activated.)
6. Read【Statusword: 6041_h】to obtain the drive status.

5.5.3 Advanced Setting Procedures

1. The Host could obtain more information about velocity mode.

   - Read【Velocity demand value: $606B_h$】to inquire the internal velocity command. (unit: 0.1 rpm)
   - Read【Velocity actual value: $606C_h$】to obtain the actual velocity value. (unit: 0.1 rpm)

2. The Host could set velocity monitor threshold.

   - Set【Velocity window: $606D_h$】to allocate the velocity reached zone. (unit: 0.1 rpm)
   - Set【Velocity window time: $606E_h$】in order to ensure the activation time is before the velocity reached. (unit: millisecond)
   - Set【Velocity threshold: $606F_h$】to allocate the zero speed level. (unit: 0.1 rpm)

5.5.4 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
$606B_h$	Velocity demand value	INTEGER32	RO
$606C_h$	Velocity actual value	INTEGER32	RO
$606D_h$	Velocity window	UNSIGNED16	RW
$606E_h$	Velocity window time	UNSIGNED16	RW
$606F_h$	Velocity threshold	UNSIGNED16	RW
$60FF_h$	Target velocity	INTEGER32	RW

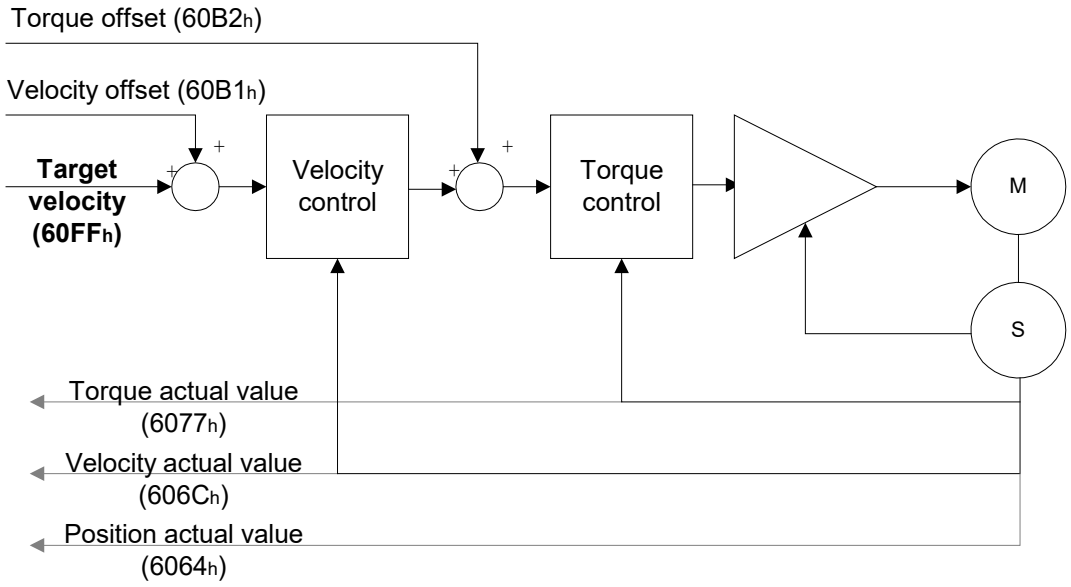
(Refer to Section 6.4 Details of Objects for more details.)

5.6 Cyclic Synchronous Velocity Mode

5.6.1 Description

The Host plans the path in Cyclic Synchronous Velocity mode and sends PDOs periodically to the drive with each PDO carrying the target position and controlword. In addition, the velocity offset and torque offset can be used as the velocity and torque feed forward.

5.6.2 The Function of CSV Mode



5.6.3 Operation Procedures

1. Set 【Modes of operation: 6060h】to cyclic synchronous velocity mode (0x09).

2. Set 【Interpolation time period: 60C2h】, and the value should be identical to that of the SYNC0 cycle time.

   ■ 60C2h Sub-1 is used for Interpolation time units with the range from 1 ms to 20 ms.

   - 60C2h Sub-2 is used for Interpolation time index. The value is always -3, meaning the interpolation time unit is 10^{-3} second.

3. Drive PDO Rx:

- Use $60FF_h$ to set Target Velocity Cmd (32-bit).
- Use 6040_h Sub-0 to set Controlword.

5.6.4 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
$60FF_h$	Target velocity	INTEGER32	RW
$60B1_h$	Velocity offset	INTEGER32	RW
$606C_h$	Velocity actual value	INTEGER32	RO
6064_h	Position actual value	INTEGER32	RO
$60B2_h$	Torque offset	INTEGER16	RW
6077_h	Torque actual value	INTEGER16	RO

5.7 Profile Torque Mode

5.7.1 Description

The Drive receives torque command and plans profile torque slope.

5.7.2 Operation Procedures

1. Set 【Modes of operation: 6060_h】to profile torque mode (6060_h = 04h).
2. Set 【Controlword: 6040_h】to (0x6 > 0x7 > 0x0F) in sequence, switch the drive to Servo ON state and enable the motor.

   (After Servo On, the internal torque command will be reset and OD-6071h will be cleared. It means the drive is servo-on and starts to receive the torque command.)
3. Set 【Torque slope: 6087_h】to plan torque slope time. (unit: millisecond from 0 to 100% rated torque)
4. Set 【Target torque: 6071_h】to the target torque. The unit is given one rated torque in a thousand. (OD-6071_h will be cleared to 0 if OD-6060_h [Mode] is changed, Servo is off, or Quick-Stop is activated.)

5.7.3 Advanced Setting Procedures

The Host could obtain more information about torque mode.

- Read 【Torque demand value: 6074_h】to obtain the output value of the torque limit function. (unit: one rated torque in a thousand)
- Read 【Torque rated current: 6075_h】to obtain the rated current determined by the motor and drive type. (unit: multiples of milliamp)
- Read 【Torque actual value: 6077_h】to obtain the instantaneous torque in the servo motor. (unit: one rated torque in a thousand)
- Read 【Current actual value: 6078_h】to obtain the instantaneous current in the servo motor. (unit: one rated torque in a thousand)

5.7.4 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
6071_h	Target torque	INTEGER16	RW
6074_h	Torque demand value	INTEGER16	RO
6075_h	Motor rated current	UNSIGNED32	RO
6077_h	Torque actual value	INTEGER16	RO
6078_h	Current actual value	INTEGER16	RO
6087_h	Torque slope	UNSIGNED32	RW

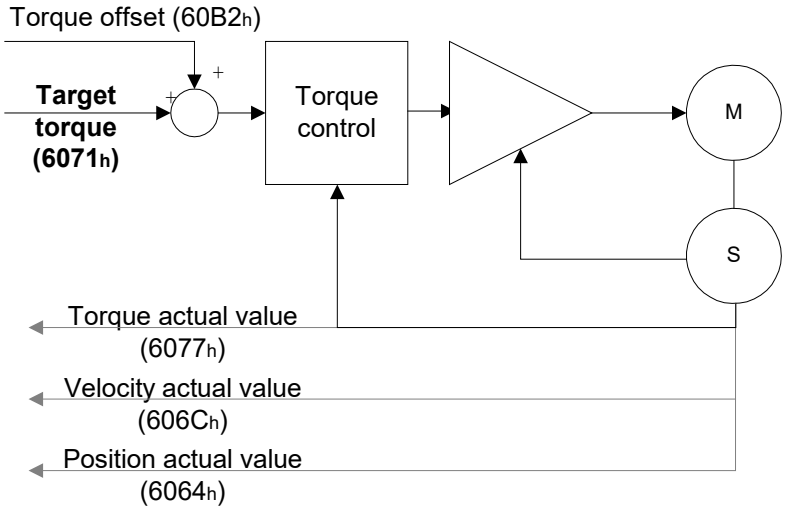
(Refer to Section 6.4 Details of Objects for more details.)

5.8 Cyclic Synchronous Torque Mode

5.8.1 Description

The Host plans the path in Cyclic Synchronous Torque mode and sends PDO periodically to the drive with each PDO carrying the target position and controlword. In addition, the velocity offset and torque offset can be used as the velocity and torque feed forward.

5.8.2 The Function of CST Mode



5.8.3 Operation Procedures

1. Set【Modes of operation: 6060h】to cyclic synchronous torque mode (0x0A).
2. Set【Interpolation time period: 60C2h】to predict the cycle that SYNC0 receives PDO.
   - 60C2h Sub-1 is used for Interpolation time units with the range from 1 ms to 20 ms.
     - 60C2h Sub-2 is used for Interpolation time index. The value is always -3, meaning the interpolation time unit is 10^{-3} second.

3. Drive PDO Rx:

- Use 6071_h to set Target Torque Cmd (16-bit)
- Use 6040_h Sub-0 to set Controlword.

5.8.4 Associated Object List

Index	Name	Type	Attr.
6040_h	Controlword	UNSIGNED16	RW
6041_h	Statusword	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
6071_h	Target torque	INTEGER16	RW
$60B2_h$	Torque offset	INTEGER16	RW
6077_h	Torque actual value	INTEGER16	RO
$606C_h$	Velocity actual value	INTEGER32	RO
6064_h	Position actual value	INTEGER32	RO

(Refer to Section 6.4 Details of Objects for more details.)

5.9 Limit Position Handling Procedure

5.9.1 Description

The Drive switches to Quick-Stop status while the motor travels to the position of positive or negative limit sensors, and it can be handled by the following procedures.

5.9.2 Operation Procedures

1. The servo panel shows the alarm while the sensors are close to the positive or negative limit. The motor is stopped by a deceleration slope and the drive is at Quick-Stop status. The drive keeps in servo-on status but will not accept further motion commands.
2. Set 【Controlword: 6040_h】to 0x8F for fault reset and clear the alarm displayed on the panel.
3. Set 【Controlword: 6040_h】to 0x1F / 0x0F for Operation Enabled, and then the servo drive can receive the motion command again.
4. When the motor reaches the limit position, there must be a command which can drive the motor to the backward direction. Or the alarm will be triggered again while the motor starts moving.

5.10 Touch Probe Function

5.10.1 Description

Touch Probe function can be enabled by the high-speed DI on CN7 (only DI13 is a high-speed DI, with the hardware response time as 5 μs) or by the zero signal from the encoder; among that, the feedback position can be latched as positive or negative edge with DI13 on CN7 with P2-40. This function is used for high-speed measurement or wrapping applications.

5.10.2 Touch Probe Function

The current status of Touch Probe can be obtained by Object $60B8_h$. The definition of each bit is as the followings.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Function	Description
Bit 0	Touch Probe 1 switch	0: disable Touch Probe 1. 1: enable Touch Probe 1.
Bit 1	Trigger counts for Touch Probe 1	0: capture the data once. 1: capture the data continuously.
Bit 2	Trigger source for Touch Probe 1	0: trigger with DI13 on CN7. 1: trigger with Z-pulse of the encoder.
Bit 3	Reserved	-
Bit 4	Rising-edge triggered Touch Probe 1 action	0: invalid. 1: capture the data at the rising-edge of Touch Probe 1 and store the value to Object $60BA_h$.
Bit 5	Falling-edge triggered Touch Probe 1 action	0: invalid. 1: capture the data at the falling-edge of Touch Probe 1 and store the value to Object $60BB_h$.
Bit 6 - 15	Reserved	-

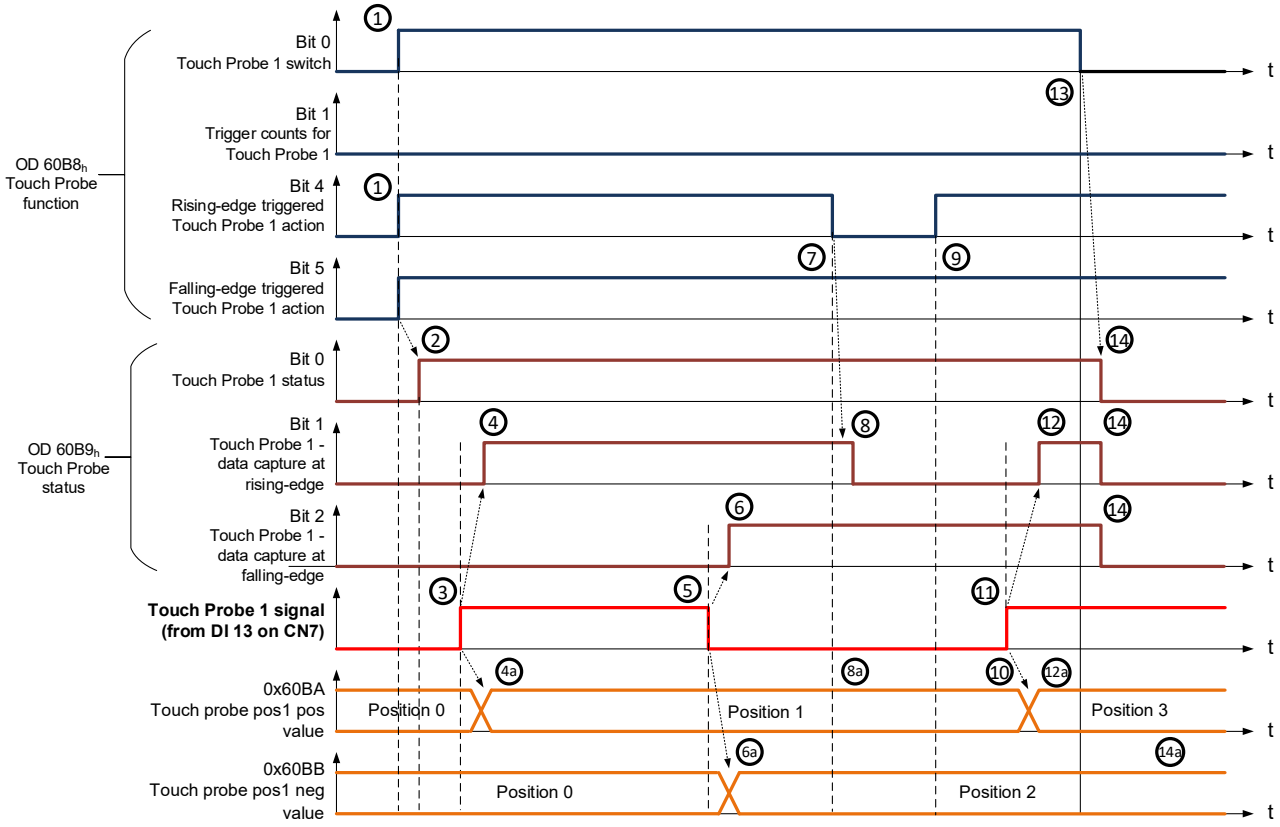
5.10.3 Touch Probe Status

The current status of Touch Probe can be obtained by Object $60B9_h$. The definition of each bit is as the follows.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Function	Description
Bit 0	Touch Probe 1 status	0: Touch Probe 1 disabled. 1: Touch Probe 1 enabled.
Bit 1	Touch Probe 1 – data capture at rising-edge	0: data is not captured yet. 1: data is successfully captured at rising-edge.
Bit 2	Touch Probe 1 – data capture at falling-edge	0: data is not captured yet. 1: data is successfully captured at falling-edge.
Bit 3 - 5	Reserved	-
Bit 6	Trigger source for Touch Probe 1	0: trigger with DI13 on CN7. 1: trigger with the Z pulse of the encoder.
Bit 7	Trigger signal for Touch Probe 1 (only available when $60B8_h$ Bit 1 is enabled)	0: N/A 1: toggle with every update of Touch Probe 1 value stored.
Bit 8 - 15	Reserved	-

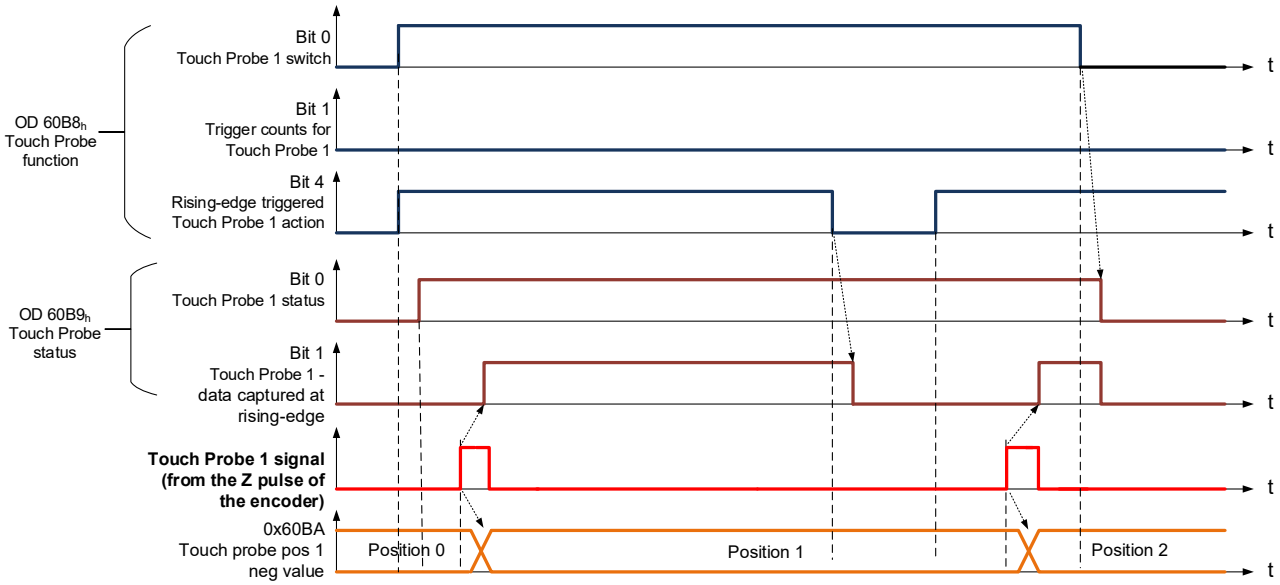
Example 1: the following is the timing diagram for Touch Probe function. In this example, the data capturing action is triggered through the external DI. When Object 60B8$_h$ Bit 4 is enabled, the data is captured once; and the data is captured whenever it is rising-edge or falling-edge triggered.



The timing status is described below:

Status	Function	Description
(1)	OD 60B8$_h$ Bit 0 = 1 OD 60B8$_h$ Bit 1 = 0 OD 60B8$_h$ Bit 4 = 1 OD 60B8$_h$ Bit 5 = 1	1: enable Touch Probe 1. 0: capture the data once. 1: capture the data when it is rising-edge triggered. 1: capture the data when it is falling-edge triggered.
(2)	OD 60B9$_h$ Bit 0 = 1	Touch Probe status: Touch Probe 1 enabled.
(3)	-	Touch Probe 1 is rising-edge triggered by external signal.
(4)	OD 60B9$_h$ Bit 1 = 1	Status for position capture: Touch Probe is rising-edge triggered and the data is successfully captured.
(4a)	OD 60BA$_h$	Store the captured data at rising-edge to OD 60BA$_h$.
(5)	-	Touch Probe 1 is falling-edge triggered by external signal.
(6)	OD 60B9$_h$ Bit 2 = 1	Touch Probe status: Touch Probe is falling-edge triggered and the data is successfully captured.
(6a)	OD 60BB$_h$	Store the captured data at falling-edge to OD 60BB$_h$.
(7)	OD 60B8$_h$ Bit 4 = 0	Disable the rising-edge triggered Touch Probe 1 action.
(8)	OD 60B9$_h$ Bit 1 = 0	Touch Probe status: reset the rising-edge triggered status as non-triggered.
(8a)	OD 60BA$_h$	Data at rising-edge remains the same.
(9)	OD 60B8$_h$ Bit 4 = 1	1: capture data when it is rising-edge triggered.
(10)	OD 60BA$_h$	Data at rising-edge remains the same.
(11)	-	Touch Probe 1 is rising-edge triggered by external signal.
(12)	OD 60B9$_h$ Bit 1 = 1	Touch Probe status: data successfully captured at rising-edge.
(12a)	OD 60BA$_h$	Store the captured data at rising-edge to OD 60BA$_h$.
(13)	OD 60B8$_h$ Bit 0 = 1	0: disable Touch Probe 1.
(14)	OD 60B9$_h$ Bit 0 = 0 OD 60B9$_h$ Bit 1 = 0 OD 60B9$_h$ Bit 2 = 0	Reset Touch Probe status.
(14a)	OD 60BA$_h$,OD 60BB$_h$	Data at rising-edge and falling-edge remain the same.

Example 2: the following is the timing diagram for Touch Probe. The Touch Probe function is triggered by the Z pulse of the encoder and the data is captured once only when it is rising-edge triggered.



5.10.4 Associated Object List

Index	Name	Type	Attr.
$60B8_h$	Touch probe function	UNSIGNED16	RW
$60B9_h$	Touch probe status	UNSIGNED16	RO
$60BA_h$	Touch probe pos1 pos value	INTEGER32	RO
$60BB_h$	Touch probe pos1 neg value	INTEGER32	RO

(Refer to Section 6.4 Details of Objects for more details.)

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Chapter 6 Object Dictionary Entries

6.1 Specifications for Objects

6.1.1 Object Type

Object Name	Comments
VAR	A single value such as an UNSIGNED8, Boolean, float, or INTEGER16, etc.
ARRAY	A multiple data field object where each data field is a sample variable of the SAME basic data type e.g. array of UNSIGNED16 etc. Sub-index 0 is UNSIGNED8 but is not part of the ARRAY data.
RECORD	A multiple data field object where the data fields may be any combination of simple variables. Sub-index 0 is UNSIGNED8 but is not part of the RECORD data.

6.1.2 Data Type

Refer to CANopen Standard 301.

6.2 Overview of Object Group 1000_h

Index	Object Type	Name	Data Type	Access
1000_h	VAR	device type	UNSIGNED32	RO
1001_h	VAR	error register	UNSIGNED8	RO
1600_h - 03_h	RECORD	Receive PDO mapping	UNSIGNED32	RW
$1A00_h$ - 03_h	RECORD	Transmit PDO mapping	UNSIGNED32	RW

※ Only 1001_h could be mapped to PDO.

6.3 Overview of Object Group 6000_h

Index	Object Type	Name	Data Type	Access	Mappable
$603F_h$	VAR	Error Code	UNSIGNED16	RO	Y
6040_h	VAR	Controlword	UNSIGNED16	RW	Y
6041_h	VAR	Statusword	UNSIGNED16	RO	Y
$605B_h$	VAR	Shutdown option code	INTEGER16	RW	N
$605E_h$	VAR	Fault reaction option code	INTEGER16	RW	N
6060_h	VAR	Modes of operation	INTEGER8	RW	Y
6061_h	VAR	Modes of operation display	INTEGER8	RO	Y
6062_h	VAR	Position demand value [PUU]	INTEGER32	RO	Y
6063_h	VAR	Position actual value [increment]	INTEGER32	RO	Y
6064_h	VAR	Position actual value	INTEGER32	RO	Y
6065_h	VAR	Following error window	UNSIGNED32	RW	Y
6067_h	VAR	Position windows	UNSIGNED32	RW	Y
6068_h	VAR	Position window time	UNSIGNED16	RW	Y
$606B_h$	VAR	Velocity demand value	INTEGER32	RO	Y
$606C_h$	VAR	Velocity actual value	INTEGER32	RO	Y
$606D_h$	VAR	Velocity window	UNSIGNED16	RW	Y
$606E_h$	VAR	Velocity window time	UNSIGNED16	RW	Y
$606F_h$	VAR	Velocity threshold	UNSIGNED16	RW	Y
6071_h	VAR	Target torque	INTEGER16	RW	Y
6072_h	VAR	Max torque	UNSIGNED16	RW	Y
6074_h	VAR	Torque demand value	INTEGER16	RO	Y
6075_h	VAR	Motor rated current	UNSIGNED32	RO	Y
6076_h	VAR	Motor rated torque	UNSIGNED32	RO	Y
6077_h	VAR	Torque actual value	UNSIGNED16	RO	Y
6078_h	VAR	Current actual value	INTEGER16	RO	Y
$607A_h$	VAR	Target position	INTEGER32	RW	Y

Index	Object Type	Name	Data Type	Access	Mappable
$607C_h$	VAR	Home Offset	INTEGER32	RW	Y
$607D_h$	ARRAY	Software position limit	INTEGER32	RW	Y
$607E_h$	VAR	Polarity	UNSIGNED8	RW	Y
$607F_h$	VAR	Max profile velocity	UNSIGNED32	RW	Y
6080_h	VAR	Max motor speed	UNSIGNED32	RW	Y
6081_h	VAR	Profile velocity	UNSIGNED32	RW	Y
6083_h	VAR	Profile acceleration	UNSIGNED32	RW	Y
6084_h	VAR	Profile deceleration	UNSIGNED32	RW	Y
6085_h	VAR	Quick stop deceleration	UNSIGNED32	RW	Y
6086_h	VAR	Motion profile type	INTEGER16	RW	Y
6087_h	VAR	Torque slope	UNSIGNED32	RW	Y
6093_h	ARRAY	Position factor	UNSIGNED32	RW	Y
6098_h	VAR	Homing method	INTEGER8	RW	Y
6099_h	ARRAY	Homing speeds	UNSIGNED32	RW	Y
$609A_h$	VAR	Homing acceleration	UNSIGNED32	RW	Y
$60B0_h$	VAR	Position offset	INTEGER32	RW	Y
$60B1_h$	VAR	Velocity offset	INTEGER32	RW	Y
$60B2_h$	VAR	Torque offset	INTEGER16	RW	Y
$60B8_h$	VAR	Touch probe function	UNSIGNED16	RW	Y
$60B9_h$	VAR	Touch probe status	UNSIGNED16	RO	Y
$60BA_h$	VAR	Touch probe pos1 pos value	INTEGER32	RO	Y
$60BB_h$	VAR	Touch probe pos1 neg value	INTEGER32	RO	Y
$60BC_h$	VAR	Touch probe pos2 pos value	INTEGER32	RO	Y
$60BD_h$	VAR	Touch probe pos2 neg value	INTEGER32	RO	Y
$60C0_h$	VAR	Interpolation sub mode select	INTEGER16	RW	Y
$60C1_h$	ARRAY	Interpolation data record	UNSIGNED16/32	RW	Y
$60C2_h$	RECORD	Interpolation time period	SIGNED8	RW	Y
$60C5_h$	VAR	Max acceleration	UNSIGNED32	RW	Y
$60C6_h$	VAR	Max deceleration	UNSIGNED32	RW	Y

Index	Object Type	Name	Data Type	Access	Mappable
$60F2_h$	VAR	Positioning option code	UNSIGNED16	RW	Y
$60F4_h$	VAR	Following error actual value	INTEGER32	RO	Y
$60FC_h$	VAR	Position demand value	INTEGER32	RO	Y
$60FD_h$	VAR	Digital inputs	UNSIGNED32	RO	Y
$60FF_h$	VAR	Target velocity	INTEGER32	RW	Y
6502_h	VAR	Supported drive modes	UNSIGNED32	RO	Y
Delta parameter definition					
2xxx	VAR	Parameter Mapping	INTEGER16/32	RW	Y

6.4 Details of Objects

Object 1000h: Device Type

INDEX	1000_h
Name	device type
Object Code	VAR
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	04020192_h: A2 Series

Object 1001h: Error Register

INDEX	1001_h
Name	error register
Object Code	VAR
Data Type	UNSIGNED8
Access	RO
PDO Mapping	Yes
Value Range	UNSIGNED8
Default Value	0

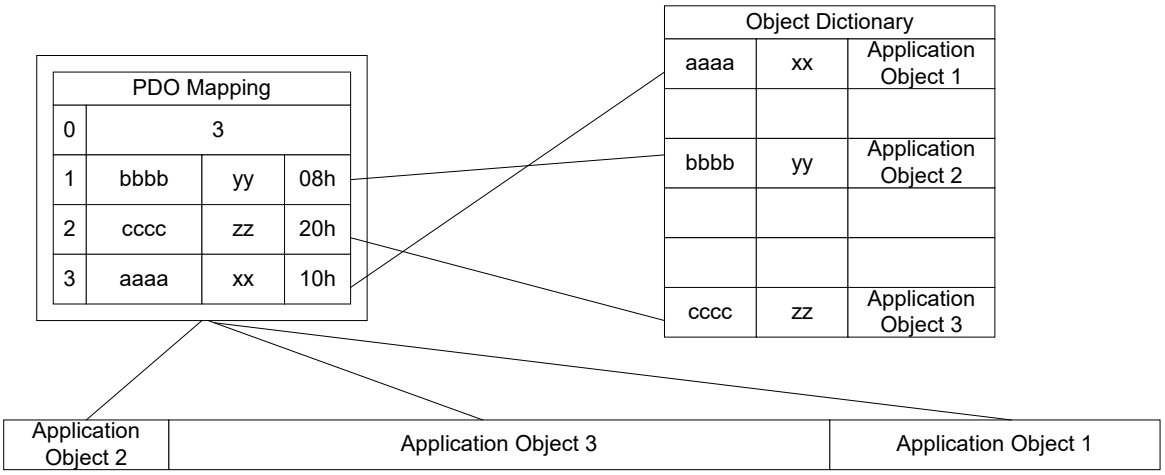
Object 1600h ~ 1604h: Receive PDO Mapping Parameter

INDEX	1600_h ~ 1603_h
Name	Receive PDO mapping
Object Code	RECORD
Data Type	PDO Mapping
Access	RW
PDO Mapping	No

Sub-Index	0
Description	Number of mapped application objects in PDO
Data Type	UNSIGNED8
Access	RW

PDO Mapping	No
Value Range	0: deactivated 1 ~ 8: activated
Default Value	0

Sub-Index	1 ~ 8
Description	PDO mapping for the nth application object to be mapped
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0



Object $1A00_h$ ~ $1A04_h$: Transmit PDO Mapping Parameter

INDEX	$1A00_h$ ~ $1A03_h$
Name	Transmit PDO mapping
Object Code	RECORD
Data Type	PDO Mapping
Access	RW
PDO Mapping	No

Sub-Index	0
Description	Number of mapped application objects in PDO
Data Type	UNSIGNED8
Access	RW

PDO Mapping	No
Value Range	0: deactivated 1 ~ 8: activated
Default Value	0

Sub-Index	1 ~ 8
Description	PDO mapping for the nth application object to be mapped
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0

Object $1C12_h$: RxPDO assign

INDEX	$1C12_h$
Name	RxPDO assign
Object Code	RECORD
Data Type	PDO Mapping assign
Access	RW
PDO Mapping	No

Sub-Index	0
Description	Number of assigned PDO mapping
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	0: deactivated 1: one PDO mapping be assigned to SycManager2 for RxPDO
Default Value	1

Sub-Index	1
Description	Index of assigned PDO mapping
Data Type	UNSIGNED16
Access	RW
PDO Mapping	No
Value Range	1600_h to 1603_h

Default Value	1601_h

Object $1C13_h$: TxPDO assign

INDEX	$1C13_h$
Name	TxPDO assign
Object Code	RECORD
Data Type	PDO Mapping assign
Access	RW
PDO Mapping	No

Sub-Index	0
Description	Number of assigned PDO mapping
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	0: deactivated 1: one PDO mapping be assigned to SycManager3 for TxPDO
Default Value	1

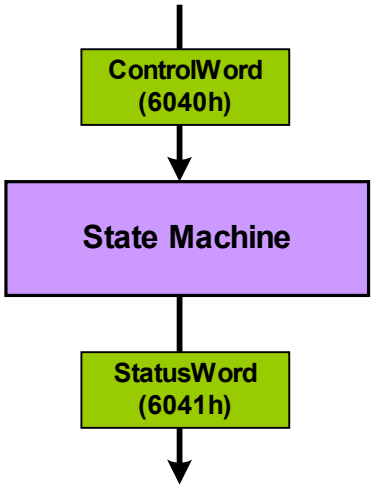
Sub-Index	1
Description	Index of assigned PDO mapping
Data Type	UNSIGNED16
Access	RW
PDO Mapping	No
Value Range	$1A00_h$ to $1A03_h$
Default Value	$1A01_h$

Object $603F_h$: Error code (error code of CANopen defined)

INDEX	$603F_h$
Name	Error code
Object Code	VAR
Data Type	UNSIGNED16
Access	RO
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	0

Object 6040_h: Controlword

INDEX	6040_h
Name	Controlword
Object Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	P1-01 = 0x0C, default is 0x0004



State machine in system context

Bit definition

15 ~ 9	8	7	6 ~ 4	3	2	1	0
N/A	Halt	Fault reset	Operation mode specific	Enable operation	Quick Stop (B-contact)	Enable voltage	Switch on

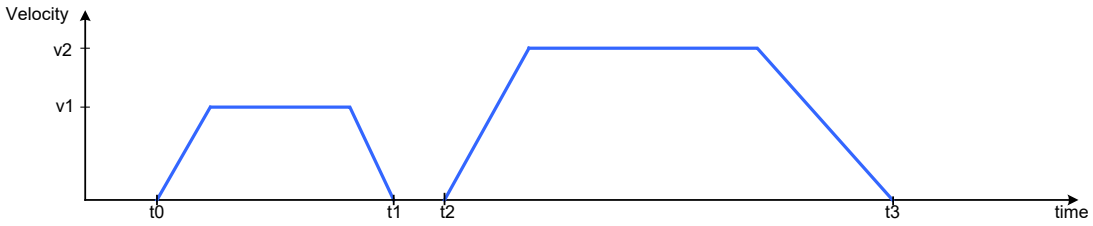
Note:

You need to set 6040h to 0x0006 > 0x0007 > 0x000F for Servo On step by step.

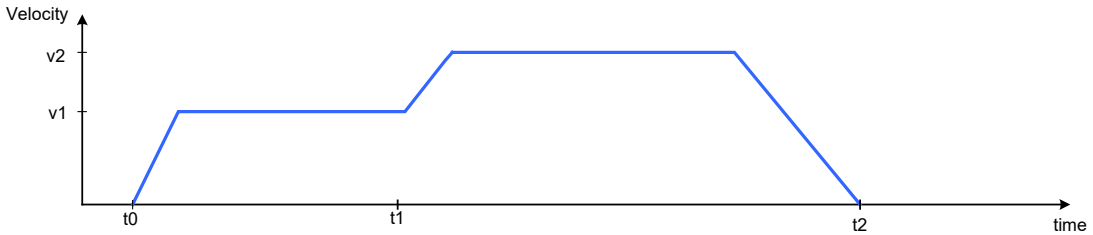
Bit	Operation mode				
	PP	HM	IP	PV	PT
4	New set-point (positive trigger)	Homing operation start (positive trigger)	N/A	N/A	N/A
5	Change set immediately	N/A	N/A	N/A	N/A
6	Absolute(0) / relative(1)	N/A	N/A	N/A	N/A

Abbreviation:

PP Profile Position Mode
HM Homing Mode
IP Interpolated Position Mode
PV Profile Velocity Mode
PT Profile Torque Mode



Single set-point



Change settings immediately

Object 6041_h: Statusword

INDEX	6041_h
Name	Statusword
Object Code	VAR
Data Type	UNSIGNED16
Access	RO
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	0

Data description

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

Bit definition

0	Ready to switch on				
1	Switch on				
2	Operation enabled (status of servo on)				
3	Fault (the drive will servo off)				
4	Voltage enabled				
5	Quick stop				
6	Switch on disabled				
7	Warning (the drive is still servo on)				
8	N/A				
9	Remote				
10	Target reached				
11	Internal limit active (Not supported)				
	PP	HM	IP	PV	PT
12	Set-point acknowledge	Homing attained	IP mode active	Zero Speed	N/A
13	Following error	Homing error	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A

Note:

Set-point acknowledge: Trajectory generator has assumed the positioning values

Homing attained: Homing mode carried out successfully

IP mode active: interpolated position mode active – mode is running in IP mode

Object $605B_h$: Shutdown option code

INDEX	$605B_h$
Name	Shutdown option code
Object Code	VAR
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0
Comment	0: disable drive function -1: dynamic break enable

Object $605E_h$: Fault reaction option code

INDEX	$605E_h$
Name	Fault reaction option code
Object Code	VAR
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	2
Comment	0: disable drive, motor is free to rotate 1: slow down on slow down ramp 2: slow down on quick stop ramp

Object 6060_h: Modes of operation

INDEX	6060_h
Name	Modes of operation
Object Code	VAR
Data Type	INTEGER8
Access	RW
PDO Mapping	Yes
Value Range	INTEGER8
Default Value	0
Comment	0: reserved 1: Profile position mode 3: Profile velocity mode

	4: Profile torque mode 6: Homing mode 7: Interpolated position mode 8: Cyclic synchronous position mode 9: Cyclic synchronous velocity mode 10: Cyclic synchronous torque mode

Object 6061_h: Modes of operation display

INDEX	6061_h
Name	Modes of operation display
Object Code	VAR
Data Type	INTEGER8
Access	RW
PDO Mapping	Yes
Value Range	INTEGER8
Default Value	0

Object 6062_h: Position demand value

INDEX	6062_h
Name	Position demand value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Position command is calculated by Interpolation theory Unit: PUU

Object 6063_h: Position demand value

INDEX	6063_h
Name	Position actual value*
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32

Default Value	0
Comment	Unit: increments

Object 6064_h: Position actual value

INDEX	6064_h
Name	Position actual value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: PUU

Object 6065_h: Following error window

INDEX	6065_h
Name	Following error window
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	3840000
Comment	Unit: PUU

Object 6067_h: Position window

INDEX	6067_h
Name	Position window
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	100
Comment	Unit: PUU

Object 6068_h: Position window time

INDEX	6068_h
Name	Position window time
Object Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	0
Comment	Unit: millisecond

Object $606B_h$: Velocity demand value

INDEX	$606B_h$
Name	Velocity demand value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Comment	Unit: 0.1 rpm

Object $606C_h$: Velocity actual value

INDEX	$606C_h$
Name	Velocity actual value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Comment	Unit: 0.1 rpm

Object 606D$_h$: Velocity window

INDEX	606D$_h$
Name	Velocity window
Object Code	VAR
Data Type	INTEGER16
Access	RO
PDO Mapping	Yes
Value Range	0 ~ 3000
Default Value	100
Comment	Unit: 0.1 rpm

Object 606E$_h$: Velocity window time

INDEX	606E$_h$
Name	Velocity window time
Object Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	0
Comment	Unit: millisecond

Object 606F$_h$: Velocity threshold

INDEX	606F$_h$
Name	Velocity threshold
Object Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Mapping	Yes
Value Range	0 ~ 2000
Default Value	100
Comment	Unit: 0.1 rpm

Object 6071_h: Target torque

INDEX	6071_h
Name	Target torque
Object Code	VAR
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	-3000 ~ 3000
Default Value	0
Comment	Unit: one rated torque in a thousand

Object 6072_h: Max torque

INDEX	6072_h
Name	Max torque
Object Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Mapping	Yes
Value Range	0 ~ 3000
Default Value	3000
Comment	Unit: one rated torque in a thousand

Object 6074_h: Torque demand value

INDEX	6074_h
Name	Torque demand value
Object Code	VAR
Data Type	INTEGER16
Access	RO
PDO Mapping	Yes
Value Range	INTEGER16
Comment	Unit: one rated torque in a thousand

Object 6075_h: Motor rated current

INDEX	6075_h
Name	Motor rated current
Object Code	VAR
Data Type	UNSIGNED32
Access	RO
PDO Mapping	Yes
Value Range	UNSIGNED32
Comment	Unit: milliamp

Object 6076_h: Motor rated torque

INDEX	6076_h
Name	Motor rated torque
Object Code	VAR
Data Type	UNSIGNED32
Access	RO
PDO Mapping	Yes
Value Range	UNSIGNED32
Comment	Unit: one rated torque in a thousand

Object 6077_h: Torque actual value

INDEX	6077_h
Name	Torque actual value
Object Code	VAR
Data Type	INTEGER16
Access	RO
PDO Mapping	Yes
Value Range	INTEGER16
Comment	Unit: one rated torque in a thousand

Object 6078_h: Current actual value

INDEX	6078_h
Name	Current actual value
Object Code	VAR
Data Type	INTEGER16
Access	RO

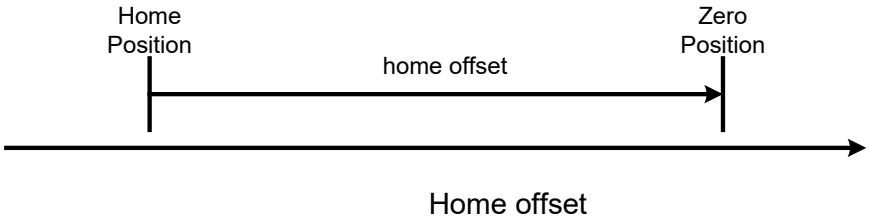
PDO Mapping	Yes
Value Range	INTEGER16
Comment	Unit: one rated current in a thousand

Object 607A$_h$: Target position

INDEX	607A$_h$
Name	Target position
Object Code	VAR
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	For Profile position mode 6060$_h$ = 1 Unit: PUU

Object 607C$_h$: Home offset

INDEX	607C$_h$
Name	Home offset
Object Code	VAR
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit : PUU



Home offset

Object 607D$_h$: Software position limit

INDEX	607D$_h$
Name	Software position limit
Object Code	ARRAY
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes

Sub-Index	0
Description	Number of entries
Data Type	UNSIGNED8
Access	RO
PDO Mapping	Yes
Value Range	2
Default Value	2
Sub-Index	1
Description	Min position limit
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	-2147483648 ~ +2147483647
Default Value	-2147483648
Comment	Unit: PUU

Sub-Index	2
Description	Max position limit
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	-2147483648 ~ +2147483647
Default Value	+2147483647
Comment	Unit: PUU

Object $607F_h$: Max profile velocity

INDEX	$607F_h$
Name	Max profile velocity
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	P1-55 (rpm) * 10
Comment	Unit: 0.1 rpm

Object 6080_h: Max motor speed

INDEX	6080_h
Name	Max motor speed
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	P1-55 (rpm)
Comment	Unit: rpm

Object 6081_h: Profile velocity

INDEX	6081_h
Name	Profile Velocity
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	10000
Comment	For Profile position mode 6060_h = 1 Unit: PUU per second

Object 6083_h: Profile acceleration

INDEX	6083h
Name	Profile acceleration
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	1 ~ UNSIGNED32
Default Value	200
Comment	For Profile position mode 6060_h = 1 & Profile velocity mode 6060_h = 3 Unit: millisecond (time from 0 rpm to 3000 rpm)

Object 6084_h: Profile deceleration

INDEX	6084_h
Name	Profile deceleration
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	1 ~ UNSIGNED32
Default Value	200
Comment	For Profile position mode 6060_h = 1 & Profile velocity mode 6060_h = 3 Unit: millisecond (time from 0 rpm to 3000 rpm)

Object 6085_h: Quick stop deceleration

INDEX	6085_h
Name	Quick stop acceleration
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	0
Comment	Unit: millisecond (time from 0 rpm to 3000 rpm)

Object 6086_h: Motion profile type

INDEX	6086_h
Name	Motion profile type
Object Code	VAR
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

Object 6087_h: Torque slope

INDEX	6087_h
Name	Torque slope
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	0
Comment	Unit: millisecond (time from 0 to 100% rated torque)

Object 6093_h: Position factor

INDEX	6093_h
Name	Position factor
Object Code	ARRAY
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Comment	Position factor = Numerator / Feed_constant

Sub-Index	0
Description	Number of entries
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No

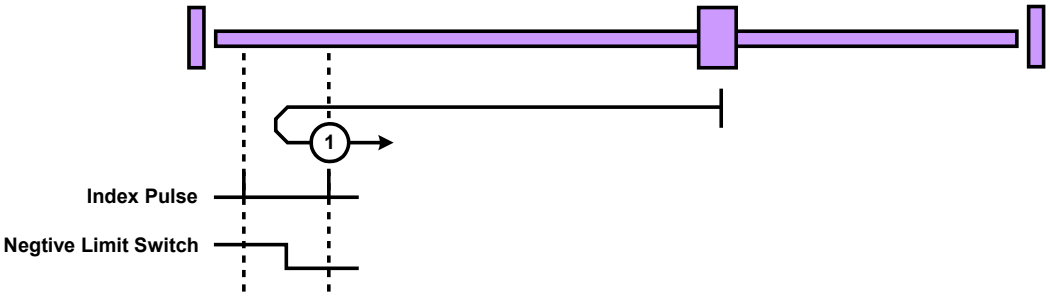
Value Range	2
Default Value	2

Sub-Index	1
Description	Numerator
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Default Value	1
Comment	Same as P1-44

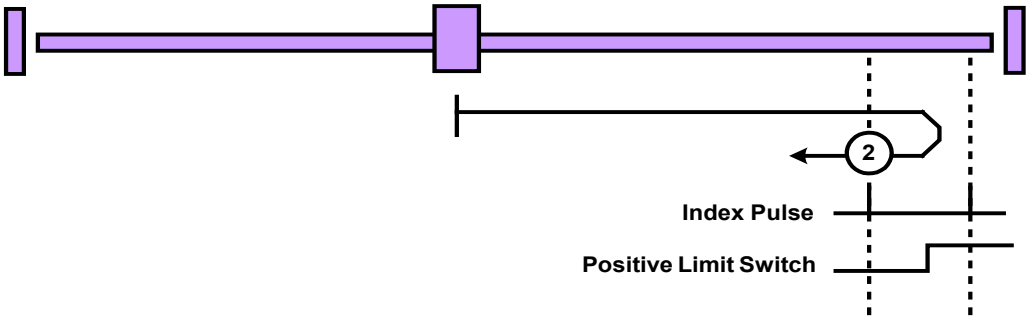
Sub-Index	2
Description	Feed_constant
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Default Value	1
Comment	Same as P1-45

Object 6098_h: Homing method

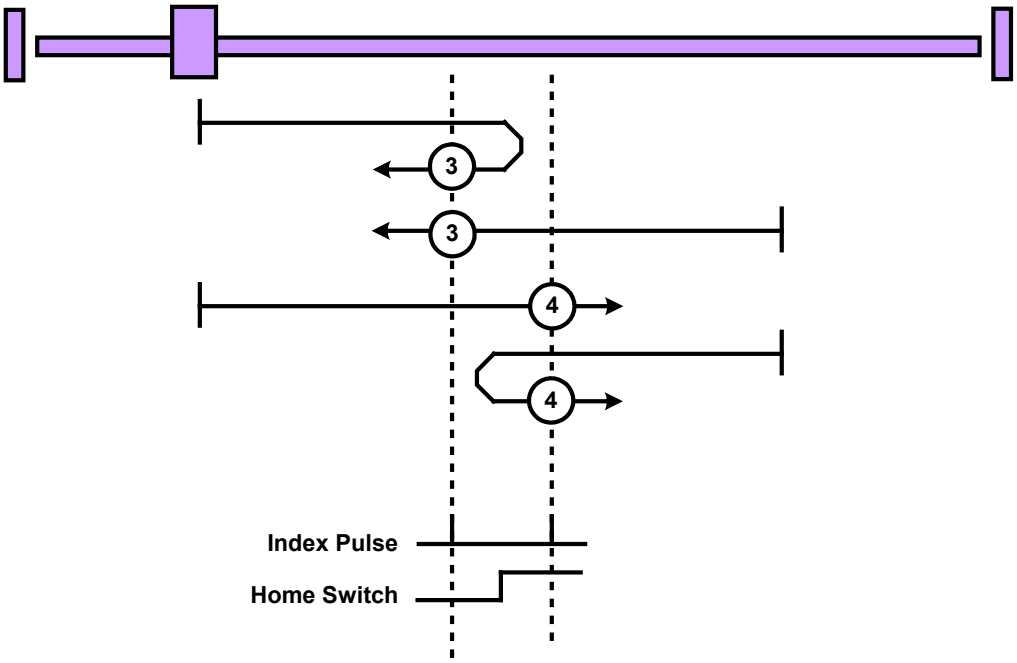
INDEX	6098_h
Name	Homing method
Object Code	VAR
Data Type	INTEGER8
Access	RW
PDO Mapping	Yes
Value Range	0 ~ 35
Default Value	0



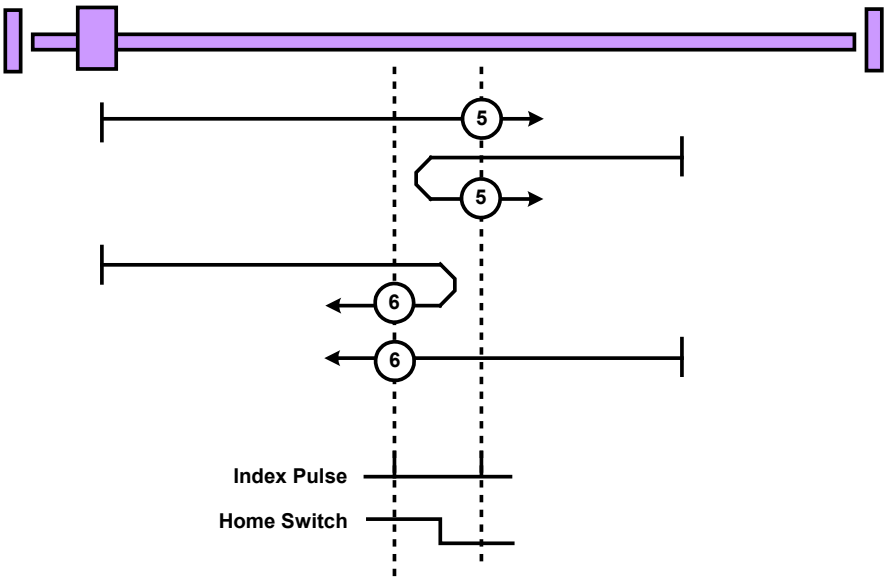
Method 1: homing on negative limit switch and index pulse



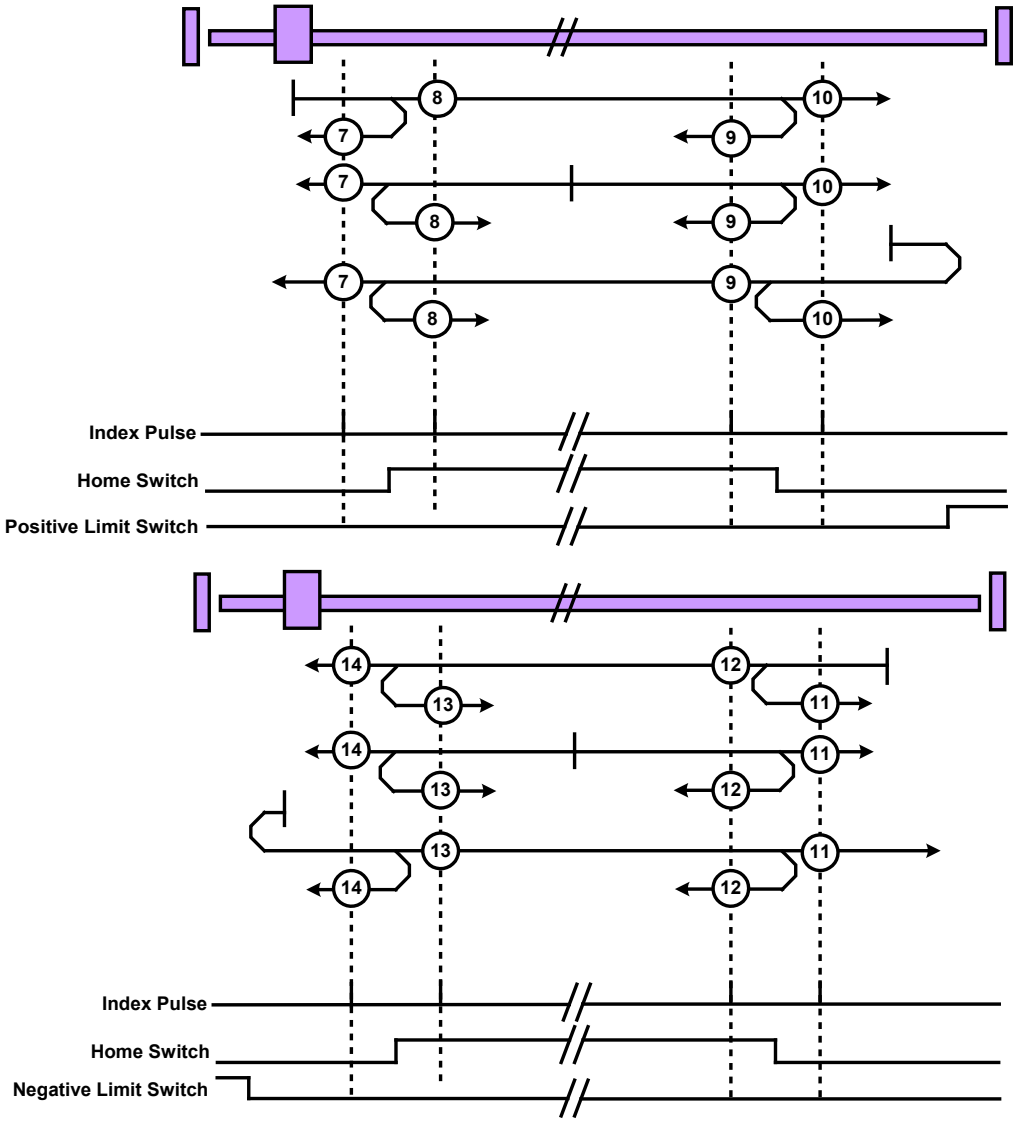
Method 2: homing on positive limit switch and index pulse



Methods 3 and 4: homing on positive home switch and index pulse

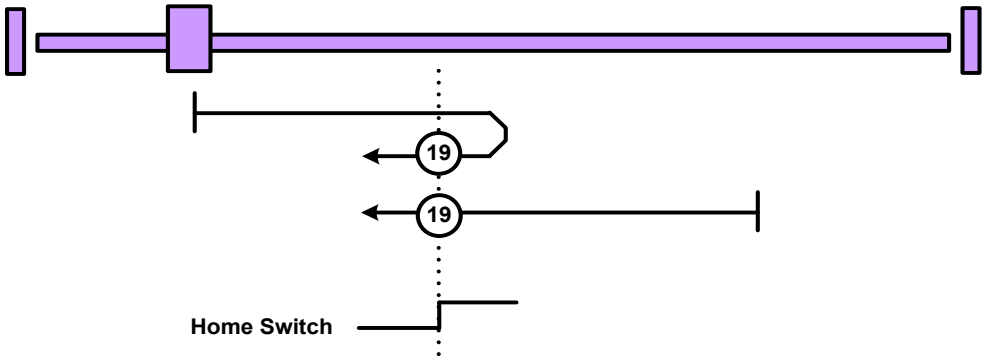


Methods 5 and 6: homing on negative home switch and index pulse



Methods 7 to 14: homing on home switch and index pulse

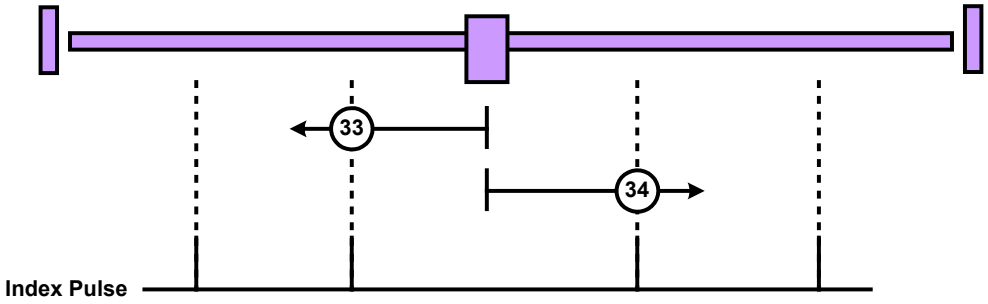
Methods 15 and 16: reserved (no picture)



Methods 17 to 30: Homing without an index pulse

Note: Methods 19 and 20 are the same. So are Methods 21 and 22, Methods 23 and 24, Methods 25 and 26, Methods 27 and 28, and Methods 29 and 30.

Methods 31 and 32: reserved (no picture)



Methods 33 to 34: homing on index pulse

Method 35: homing on current position (no picture)

Object 6099_h: Homing speed

INDEX	6099_h
Name	Homing speed
Object Code	ARRAY
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes

Sub-Index	0
Description	Number of entries
Data Type	UNSIGNED8
Access	RO
PDO Mapping	Yes
Value Range	2
Default Value	2
Sub-Index	1
Description	Speed during search for switch
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	1 ~ 2000 rpm
Default Value	100
Comment	Unit: 0.1 rpm

Sub-Index	2
Description	Speed during search for zero
Data Type	UNSIGNED32
Access	RW

PDO Mapping	Yes
Value Range	1 ~ 500 rpm
Default Value	20
Comment	Unit: 0.1 rpm

Object $609A_h$: Homing acceleration

INDEX	$609A_h$
Name	Homing acceleration
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	100
Comment	Unit: millisecond (time of acc from 0 rpm to 3000 rpm)

Object $60B0_h$: Position offset

INDEX	$60B0_h$
Name	Position offset
Object Code	VAR
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: PUU

Object $60B1_h$: Velocity offset

INDEX	$60B1_h$
Name	Velocity offset
Object Code	VAR
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: 0.1 rpm

Object $60B2_h$: Torque offset

INDEX	$60B2_h$
Name	Torque offset
Object Code	VAR
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	3000 ~ -3000
Default Value	0
Comment	Unit: one rated torque in a thousand

Object $60B8_h$: Touch probe function

INDEX	$60B8_h$
Name	Touch probe function
Object Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	0
Comment	0

Object $60B9_h$: Touch probe status

INDEX	$60B9_h$
Name	Touch probe status
Object Code	VAR
Data Type	UNSIGNED16
Access	RO
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	0
Comment	0

Object $60BA_h$: Touch probe pos1 pos value

INDEX	$60BA_h$
Name	Touch probe pos1 pos value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: PUU

Object 60BB$_h$: Touch probe pos1 neg value

INDEX	60BB$_h$
Name	Touch probe pos1 neg value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: PUU

Object 60BC$_h$: Touch probe pos2 pos value

INDEX	60BC$_h$
Name	Touch probe pos2 pos value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: PUU

Object 60BD$_h$: Touch probe pos2 neg value

INDEX	60BD$_h$
Name	Touch probe pos2 neg value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: PUU

Object $60C0_h$: Interpolation sub mode select

INDEX	$60C0_h$
Name	Interpolation sub mode select
Object Code	VAR
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0
Comment	0: manufacturer specific (Linear interpolation -- **no** need the Pos Difference [OD-60C1sub2]) -1: manufacturer specific (Delta definition -- need pos difference [OD-60C1sub2])

Object $60C1_h$: Interpolation data record

INDEX	$60C1_h$
Name	Interpolation data record
Object Code	ARRAY
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Comment	Set this record by PDO every ***T*** msec before SYNC message where ***T*** is specified by $60C2_h$: 01_h

Sub-Index	0
Description	Number of entries
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	2
Default Value	2

Sub-Index	1
Description	Pos_Cmd
Data Type	INTEGER32
Access	RW

PDO Mapping	Yes
Value Range	INTEGER32
Default Value	0
Comment	Unit: 32-bit CMD_PUU
Sub-Index	2
Description	Velocity – Pos_Cmd difference
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0
Comment	$\triangle X_i = (X_{i+1} - X_{i-1})/2$ (It is also the same as velocity.) Unit: PUU

Object $60C2_h$: Interpolation time period

INDEX	$60C2_h$
Name	Interpolation time period
Object Code	RECORD
Data Type	UNSIGNED8
Access	RW
PDO Mapping	Yes
Comment	The unit of ***the interpolation time unit*** is given in $10^{interpolation\ time\ index}$ seconds

Sub-Index	0
Description	Number of entries
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	2
Default Value	2

Sub-Index	1
Description	Interpolation time units
Data Type	UNSIGNED8
Access	RW
PDO Mapping	Yes

Value Range	UNSIGNED8
Default Value	1

Sub-Index	2
Description	Interpolation time index
Data Type	INTEGER8
Access	RW
PDO Mapping	Yes
Value Range	-128 ~ 63
Default Value	-3

Object $60C5_h$: Max acceleration

INDEX	$60C5_h$
Name	Max acceleration
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	1 ~ 65500
Default Value	200
Comment	Unit: millisecond (min. time from 0 rpm to 3000 rpm)

Object $60C6_h$: Max deceleration

INDEX	$60C6_h$
Name	Max deceleration
Object Code	VAR
Data Type	UNSIGNED32
Access	RW
PDO Mapping	Yes
Value Range	1 ~ 65500
Default Value	200
Comment	Unit: millisecond (min. time from 3000 rpm to 0 rpm)

Object $60F2_h$: Positioning option code

INDEX	$60F2_h$
Name	Positioning option code
Object Code	VAR
Data Type	UNSIGNED16
Access	RW
PDO Mapping	Yes
Value Range	UNSIGNED16
Default Value	0

Object $60F4_h$: Following error actual value

INDEX	$60F4_h$
Name	Following error actual value
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Comment	Unit: PUU

Object $60FC_h$: Position demand value*

INDEX	$60FC_h$
Name	Position demand value*
Object Code	VAR
Data Type	INTEGER32
Access	RO
PDO Mapping	Yes
Value Range	INTEGER32
Comment	Unit: increment

Object 60FD$_h$: Digital inputs

INDEX	60FD$_h$
Name	Digital inputs
Object Code	VAR
Data Type	UNSIGNED32
Access	RO
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	0

Object function:

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Function	Description
Bit 0	Negative limit switch	-
Bit 1	Positive limit switch	-
Bit 2	Home switch	-
Bit 3 - 15	-	-
Bit 16	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to DI 1.
Bit 17	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to DI 2.
Bit 18	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to DI 3.
Bit 19	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to DI 4.
Bit 20	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to DI 5.
Bit 21	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to DI 6.
Bit 22	Manufacturer-specific area	Set P3-18 U= 1 or 2 and this bit is mapped to DI 7.
Bit 23	Manufacturer-specific area	Reserved.
Bit 24	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to EDI 9.
Bit 25	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit mapped to EDI 10.

Bit	Function	Description
Bit 26	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this it is mapped to EDI 11.
Bit 27	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to EDI 12.
Bit 28	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to EDI 13.
Bit 29	Manufacturer-specific area	Set P3-18 U = 1 or 2 and this bit is mapped to EDI 14.
Bit 30	Manufacturer-specific area	Reserved.
Bit 31	Manufacturer-specific area	Set P3-18 U = 2 and this bit is mapped to the Z pulse of encoder.

Object 60FF$_h$: Target velocity

INDEX	60FF$_h$
Name	Target velocity
Object Code	VAR
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	INTEGER32
Comment	Unit: 0.1 rpm

Object 6502$_h$: Supported drive modes

INDEX	6502$_h$
Name	Supported drive modes
Object Code	VAR
Data Type	UNSIGNED32
Access	Ro
PDO Mapping	Yes
Value Range	UNSIGNED32
Default Value	3ED$_h$

31						16	15			7	6	5	4	3	2	1	0
Manufacturer specific							reserved				ip	hm	reserved	tq	pv	vl	pp
MSB																	LSB

Object $2xxx_h$: Manufacturer parameter

INDEX	$2xxx_h$
Name	Manufacturer parameter
Object Code	VAR
Data Type	INTEGER16 / INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	NTEGER16 / INTEGER32
Default Value	N/A

Object 2xxx is defined to parameter.

If you desire to use CANopen protocol for accessing parameter values, the conversion between parameter number and index is as follows:

Pa-bc <==> $2aBC_h$

'**BC**' is hexadecimal format of '**bc**'

You can read the Index first for knowing the Length of Parameter and then change the data by SDO or PDO.

Example 1: Object 2309_h: EtherCAT Synchronization Setting【P3-09】

INDEX	2309_h
Name	EtherCAT Synchronization Setting
Object Code	VAR
Data Type	INTEGER16
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	1512_h

Example 2: Object 212C$_h$: Electronic Gear 【P1-44】

INDEX	212C$_h$
Name	Electronic Gear
Object Code	VAR
Data Type	INTEGER32
Access	RW
PDO Mapping	Yes
Value Range	INTEGER32

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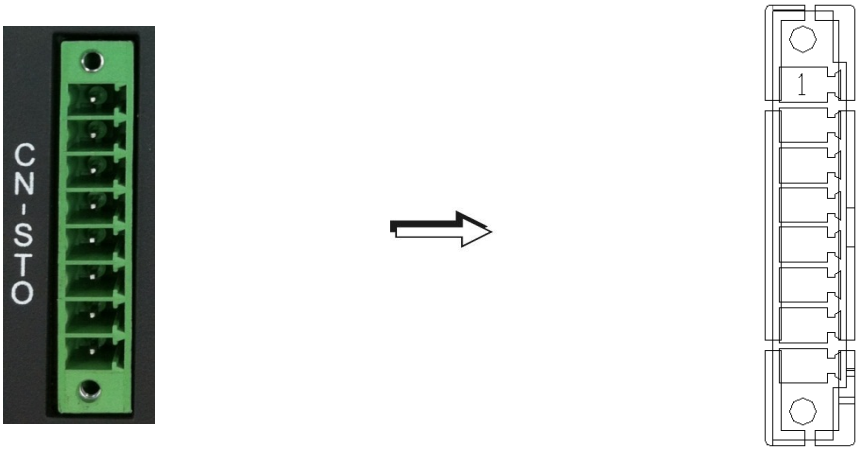
Chapter 7 Safety Function (Safe Torque Off, STO)

7.1 Description of Terminal Block



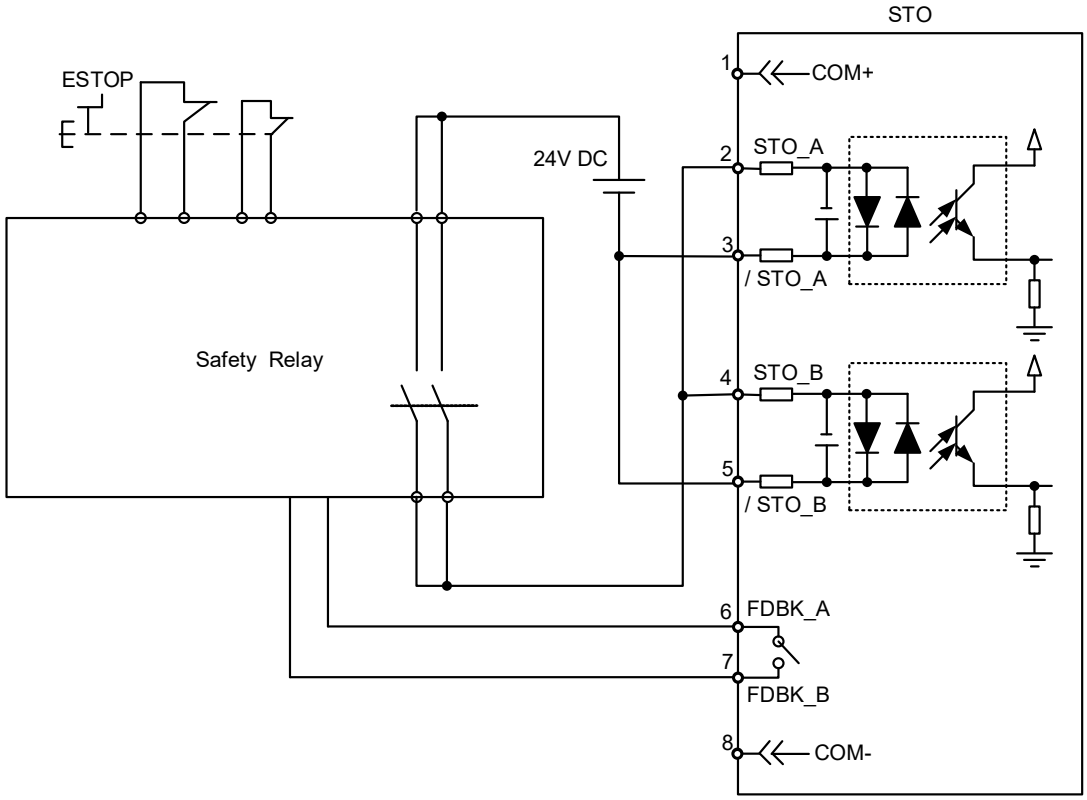
CN-STO Connector (male)

Pin No.	Terminal Symbol	Function and Description
*1	COM+	VDD (24V) power is identical to Pin 5 of CN1
2	STO_A	STO input pin A+
3	/STO_A	STO input pin A-
4	STO_B	STO input pin B+
5	/STO_B	STO input pin B-
6	FDBK_A	STO alarm output pin A, BJT maximum rated output: 80 V_{DC}, 0.5 A
7	FDBK_B	STO alarm output pin B, BJT maximum rated output: 80 V_{DC}, 0.5 A
8	COM-	VDD (24V) power ground

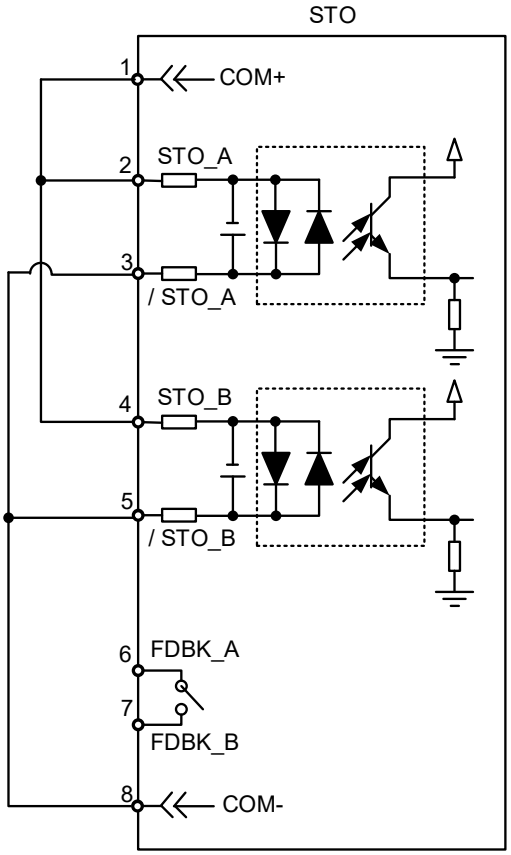
WARNING

- ***1: do not apply to dual power or it may damage the servo drive.***

STO with safety relay:



Disable STO:



7.1.1 Functional Safety Standard and Certificates

Refer to Chapter 9.

7.2 STO Safety Function

Fault Rate of Safety Function

Item	Definition	Standard	Features
SFF	Safe Failure Fraction	IEC61508	Channel 1: 80.08% Channel 2: 68.91%
HFT (Type A subsystem)	Hardware Fault Tolerance	IEC61508	1
SIL	Safety Integrity Level	IEC61508	SIL 2
		IEC62061	SILCL 2
PFH	Average frequency of dangerous failure [h-1]	IEC61508	9.56×10^{-10}
PFD_{av}	Probability of Dangerous Failure on Demand	IEC61508	4.18×10^{-6}
Category	Category	ISO13849-1	Category 3
PL	Performance Level	ISO13849-1	d
$MTTF_d$	Mean time to dangerous failure	ISO13849-1	High
DC	Diagnostic Coverage	ISO13849-1	Low

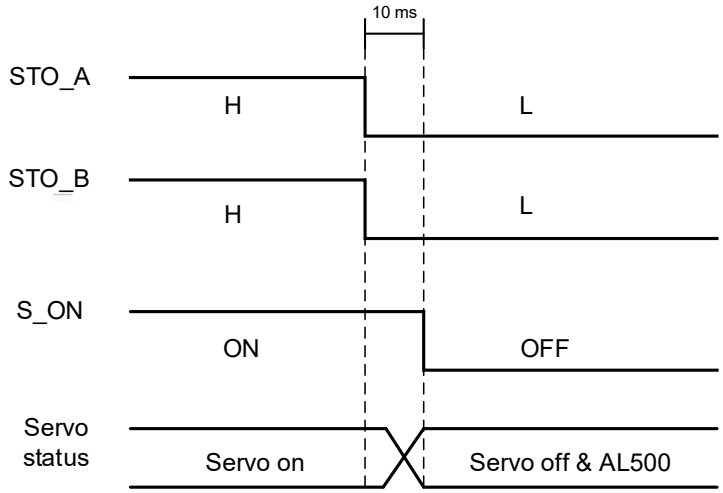
How does Safety Function Work?

The STO function is controlled by the motor current from two individual circuits, which can cut off the power supply when needed, after which the motor is free from torque force. See Table 1 for the actions description.

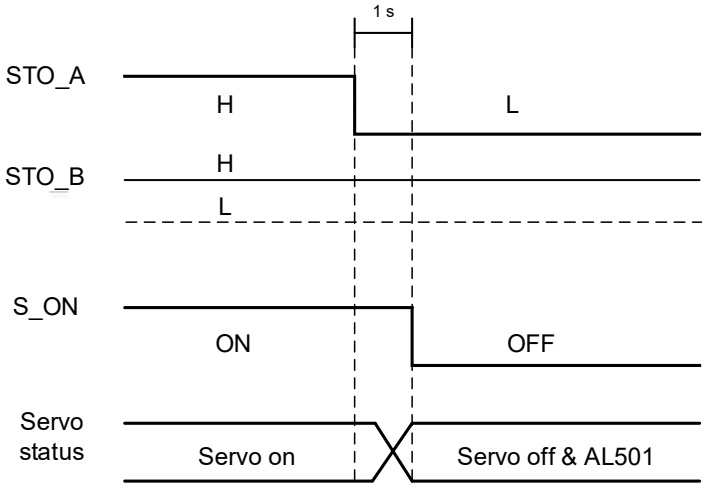
Table 1: ON = 24V OFF = 0V

Signal	Channel	Status of Opto-Isolator			
STO signal	STO_A ~ / STO_A	ON	ON	OFF	OFF
	STO_B ~ / STO_B	ON	OFF	ON	OFF
Servo drive output status		Ready	STO_B lost (AL502) (Torque off)	STO_A lost (AL501) (Torque off)	STO Mode (Torque off)

(1) Status description of STO alarms:
See the figure below. When the motor runs properly (Servo On), if STO_A and STO_B signals (which are also called safety signals) are lost for 10 ms at the same time, AL500 occurs. Then, the servo drive will be in Servo Off status.

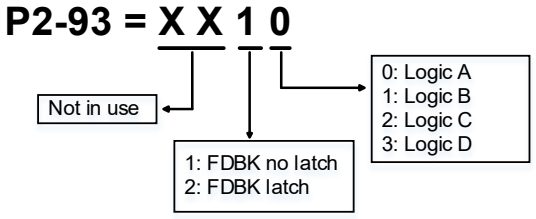


See the figure below. When the motor runs properly (Servo On), when one of the safety signal is lost for 1 s, AL501 or AL502 will occur. Then, the servo drive will be in Servo Off status.



7.3 Related Parameter Descriptions of STO Function

Through the setting of P2-93, you can determine FDBK status and if FDBK will latch when an STO alarm occurs. Refer to the following figure for the setting of P2-93:



Description of STO Function:
See the table below. Four logics (Logic A, Logic B, Logic C, and Logic D) are provided to standardize FDBK status when different STO alarms occur. You can select the corresponding logic according to the demands. (In this table, Open means FDBK+ and FDBK- of CN8 are open circuit. Take Logic C as the example. When AL500 occurs, FDBK+ and FDBK- of CN8 are short-circuited.)

Status of servo drive		FDBK_A & FDBK_B Status							
		Logic A		Logic B		Logic C		Logic D	
Parameter P2-93		XX10	XX20	XX11	XX21	XX12	XX22	XX13	XX23
FDBK behavior		No Latch	Latch	No Latch	Latch	No Latch	Latch	No Latch	Latch
No STO alarm occurs		Open		Close		Open		Close	
Alarm occurs	AL500 occurs	Close		Open		Close		Open	
	AL501 occurs	Close		Open		Open		Close	
	AL502 occurs	Close		Open		Open		Close	
	AL503 occurs	Close		Open		Open		Close	

Open = open circuit; Close = close circuit

If FDBK is latched, when an STO alarm occurs, status of FDBK will remain even when the alarm has been cleared. Note that when more than one alarm occur at the same time, the drive panel will only display AL500.

- Example of Latch:
  If Logic C P2-93 = XX22 is set, the FDBK status will be close when the safety signal is lost and AL005 occurs.
  1. Since FDBK is selected as Latch, even when the safety signal is back to normal, FDBK status still remains close. Use the approaches below to reset.
     i. Reconnect power supply. FDBK status returns to open.
     ii. Do not reconnect power supply. Instead, set P2-93 = XX12 to make FDBK status return to open. Then set P2-93 = XX22 again. This step is to set FDBK behavior to Latch.

2. After the FDBK status restores, alarms can be cleared by normal corrective actions. In this case, AL500 can be cleared by DI.Alm Reset.

- Example of No Latch:
  If Logic C P2-93 = XX12 is set, the FDBK status will be close when the safety signal is lost and AL005 occurs.
  1. Since FDBK is selected as No Latch, the safety signals return to normal and the FDBK status automatically changes from short-circuited to normal when AL500 occurs. You do not need to set P2-93 to XX12 again.
  2. After the FDBK status restores, alarms can be cleared by normal corrective actions. In this case, AL500 can be solved by DI.Alm Reset.

P2-93	**STO**	**STO FDBK Control**		**Address：02BAH 02BCH**
Interface：	Panel / Software	Communication	Reference：	-
Default：	0		Control Mode：	ALL
Unit：	-		Range：	-
Format：	DEC		Data Size：	16-bit

Settings：
BIT0: select the logic for FDBK status.
BIT1: determine if FDBK should be latched.

7.4 Related Alarm Descriptions of STO Function

Display	Alarm Name	Checking Method	Corrective Actions	Corresponding DO	Servo Status
AL500	STO function is enabled	Safety function (STO) is manually enabled. Please check the causes.	DI.ARST or write 0 into P0-01 or 0x6040.Fault Reset	ALM	Servo Off
AL501	STO_A loss (signal loss or signal error)	Make sure the wiring of STO_A is correct.	Power cycling	ALM	Servo Off
AL502	STO_B loss (signal loss or signal error)	Make sure the wiring of STO_B is correct.	Power cycling	ALM	Servo Off
AL503	STO_error	Internal circuit of STO_A ~ / STO_A and STO_B ~ / STO_B is diagnosed as error.	STO circuit error. Contact the distributors.	ALM	Servo Off

Causes and Corrective Actions:

AL500: STO Function is enabled

Causes	Checking Method	Corrective Actions
Safety function (STO) is enabled	Safety function (STO) is enabled. Please check the causes.	DI.ARST or write 0 into P0-01 or 0x6040.Fault Reset.

AL502: STO_A loss (signal loss or signal error)

Causes	Checking Method	Corrective Actions
STO_A loses enable signal or STO_A signal does not synchronize with STO_B signal for more than 1 second.	Make sure the wiring of STO_A is correct.	Power cycling.

AL502: STO_B loss (signal loss or signal error)

Causes	Checking Method	Corrective Actions
STO_B loses enable signal or STO_A signal does not synchronize with STO_B signal for more than 1 second.	Make sure the wiring of STO_B is correct.	Power cycling.

AL503: STO_error

Causes	Checking Method	Corrective Actions
STO self-diagnostic error	Check if the wiring between STO_A and STO_B is correct.	STO circuit error. Contact the distributors.

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Chapter 8 Parameters

The basic parameters for A2-E are the same as those for the general A2 models, so refer to ASDA-A2 User Manual for more details. The following introduces EtherCAT-related parameters only.

P3-18	ECATO	EtherCAT Special Function Switch		Address: 0324H 0325H
Interface:	Panel / Software	Communication	Reference:	-
Default:	0x00002000		Control Mode:	EtherCAT
Unit:	-		Range:	0x00000000~00112101
Format:	HEX		Data Size:	32-bit

Settings:

D C B A

U Z Y X

A	Source for EtherCAT Station Alias Register 0x0012	X	Select the unit for speed command and speed feedback
B	Calculating methods for OD 60F4$_h$ position error	Y	Reserved
C	Reserved	Z	Set the checking method for communication disconnection
D	Reserved	U	Set the manufacturer-specific area for OD 60FD$_h$ mapping
h	High bit	L	Low bit

- X: in Profile Velocity mode or CSV mode, select the unit for speed command (OD 60FF) and speed feedback (OD 606C).
  0: 0.1 rpm
  1: pulse/sec
- Y: reserved.
- Z: set the checking method for communication disconnection (AL185).
  0: check for the disconnection after the EtherCAT communication is in OP status.
  1: check for the disconnection after the EtherCAT communication is in INIT status.
- U: set the manufacturer-specific area for OD 60FD$_h$ mapping (see detailed information in Chapter 6)
  0: disabled. The manufacturer-specific area is not in use.
  1: map DI/EDI status to the manufacturer-specific area of OD 60FD$_h$.
  2: map the Z pulse of the encoder and DI/EDI status to the manufacturer-specific area of OD 60FD$_h$.
- A: set the source for the content of EtherCAT Station Alias Register 0x0012 after applying power to the drive.
  0: determined by the value in EtherCAT EEPROM address field (ADR 0x0004) set through the controller interface.

1: determined by the address set in P3-00.

- B: calculating method for OD 60F4$_h$ position deviation
  0: calculated by the motion controller.
  1: directly calculated by the motion controller (pos_err), and then converted with the E-gear ratio.

P3-19	CSTSA	Statusword Status Display Setting		Address: 0326H 0327H
Interface:	Panel / Software	Communication	Reference:	-
Default:	0x0021		Control mode:	CANopen/EtherCAT
Unit:	-		Range:	0x0000~0x1121
Format:	HEX		Data size:	16-bit

Settings:

X	OD 6041$_h$ Bit 4 status
Y	OD 6041$_h$ Bit 10 status
Z	OD 6041$_h$ Bit 14 status
U	OD 6041$_h$ Bit 15 status

- X: OD 6041$_h$ Bit 4 status (applicable to EtherCAT only)
  0: the bit is On
  1: RST output status
- Y: OD 6041$_h$ Bit 10 status (applicable to EtherCAT only)
  0: in CSP mode, OD 6041$_h$ Bit 10 is invalid.
  2: in CSP mode, OD 6041$_h$ Bit 10 is in Target Reach status.
- Z: OD 6041$_h$ Bit 14 status (applicable to CANopen/EtherCAT)
  0: OD 6041$_h$ Bit 14 is in positive limit status.
  1: OD 6041$_h$ Bit 14 outputs the current status of the servo and controller synchronization. If it shows On, it means they have already been synchronized (SYN_OK).
- U: OD 6041$_h$ Bit 15 status (applicable to CANopen / EtherCAT)
  0: OD 6041$_h$ Bit 15 is in negative limit status.
  1: N/A

P3-22	EPTO	EtherCAT PDO Timeout Setting		Address: 032CH 032DH
Interface:	Panel / Software	Communication	Reference:	-
Default:	0xFF04		Control mode:	EtherCAT
Unit:	-		Range:	0x0002~0xFF14
Format:	HEX		Data size:	16-bit

Settings:

When exchanging Process Data with PDOs, you can set the two sets of value below to monitor the number of continuous packet loss and thus triggering the alarm if the number is exceeded.

YX	Allowable cycle times of packet loss for AL3E3
UZ	Allowable time for AL180

- YX: allowable cycle times of packet loss for AL3E3

  When in synchronous modes (IP/CSP/CSV/CST), use this parameter to set the allowable consecutive cycle times for packet loss within the range from 0x02 to 0x14. If the cycle time exceeds the range, AL3E3 occurs.

  Example: the communication cycle time is 4 ms, and if you set this parameter to 02, it means 2 cycle times are permissible. That is, if A2-E does not receive a PDO within 8 ms, it triggers AL3E3.

- UZ: allowable time for AL180 (applicable to all modes)

  Calculate the consecutive milliseconds for not receiving PDOs. The allowable range is from 0x00(disabled) to 0xFF(default). If the time exceeds the range, AL180 occurs.

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Chapter 9 Alarm List

9.1 EtherCAT Communication Fault Messages

Emergency Object

Byte	0	1	2	3	4	5	6	7
Content	Emergency Error Code		Error register	Panel Alarm Code		N/A		

Fault Messages (If ALARM code is not showed here, refer to the ASDA-A2 User Manual)			
Display	Fault Name	Fault Description	Clearing Method
AL185	Communication disconnected	EtherCAT link is disconnected.	6040h fault reset
AL180	CANopen RxPDO timeout (Servo Off)	The drive does not receive any RxPDO within three communication cycle times.	6040h fault reset
AL122	Sub-index error occurs when accessing CANopen PDO object.	The specified Sub-index in the message does not exist.	6040h fault reset
AL123	Data type (size) error occurs when accessing CANopen PDO object.	The data length in the message does not match the specified object.	6040h fault reset
AL124	Data range error occurs when accessing CANopen PDO object.	The data in the message has exceeded the data range of the specified object.	6040h fault reset
AL125	CANopen PDO object is read-only and write-protected.	The specified object in the message is read-only and write-protected (cannot be changed).	6040h fault reset
AL126	CANopen PDO object does not support PDO.	The specified object in the message does not support PDO.	6040h fault reset

AL127	CANopen PDO object is write-protected when Servo On.	The specified object in the message is write-protected (cannot be changed) when Servo On.	6040h fault reset
AL128	Error occurs when reading CANopen PDO object from EEPROM.	An error occurs when loading the default settings from EEPROM at start-up. All CANopen objects return to the default settings automatically.	6040h fault reset
AL129	Error occurs when writing CANopen PDO object into EEPROM.	An error occurs when writing the current settings into EEPROM.	6040h fault reset
AL130	EEPROM invalid address range	The data amount saved in EEPROM has exceeded the space determined by the firmware orthe firmware version has been upgraded, so the data of the old firmware version saved in EEPROM cannot be used.	6040h fault reset
AL131	EEPROM checksum error	The data saved in EEPROM has been damaged and all CANopen objects return to the default settings automatically.	6040h fault reset
AL132	Password error	The parameter is password-protected when using CANopen communication to access the parameter. The users must enter the valid password to unlock the parameter.	6040h fault reset
AL201	CANopen load/save 1010/1011 error	An error occurs while reading / writing data from / to EEPROM.	Set P2-08 = 10 or P2-08 = 30, and then 28 after firmware upgrade.
AL3E1	CANopen SYNC failed (Servo Off)	The synchronous communication with the external controller has failed.	6040h fault reset
AL3E2	CANopen SYNC signal error (Servo Off)	The CANopen SYNC signal is received too soon.	6040h fault reset
AL3E3	CANopen SYNC time out (Servo Off)	The CANopen SYNC signal is not received within four consecutive communication cycle times. If the interference is too great to be removed by the hardware, increase the communication cycle for P3-22 XY to loosen the condition for triggering AL3E3.	6040h fault reset

AL3E4	CANopen IP command failed (Servo Off)	Internal command of CANopen IP mode cannot be sent and received.	6040h fault reset
AL3E5	SYNC period error (Servo Off)	SYNC period 1006h value is invalid.	6040h fault reset
AL500	Safe torque enabled (Servo Off)	The safety function (STO) is enabled. STO_A and STO_B change state simultaneously.	6040h fault reset
AL501	STO_A loss (Servo Off)	STO_A is de-energized and STO_B is energized. STO_A signal does not synchronize with STO_B signal for more than 1 second. Check wiring contact or STO safety relay.	6040h fault reset
AL502	STO_B loss (Servo Off)	STO_A is energized and STO_B is de-energized. STO_A signal does not synchronize with STO_B signal for more than 1 second. Check wiring contact or STO safety relay.	6040h fault reset
AL503	STO_error (Servo Off)	STO self-diagnostic error.	6040h fault reset

9.2 Error Code Table

Display	Description	32bit-ErrorCode (16bit-ErrorCode + 16bit-Additional Info)
AL001	Overcurrent	2310-0001$_h$
AL002	Overvoltage	3110-0002$_h$
AL003	Undervoltage	3120-0003$_h$
AL004	Motor error	7122-0004$_h$
AL005	Regeneration error	3210-0005$_h$
AL006	Overload	3230-0006$_h$
AL007	Overspeed	8400-0007$_h$
AL008	Abnormal pulse control command	8600-0008$_h$
AL009	Excessive deviation	8611-0009$_h$
AL010	Reserved	0000-0010$_h$
AL011	Encoder error	7305-0011$_h$
AL012	Adjustment error	6320-0012$_h$
AL013	Emergency stop activated	5441-0013$_h$
AL014	Reverse limit switch error	5443-0014$_h$
AL015	Forward limit switch error	5442-0015$_h$
AL016	IGBT temperature error	4210-0016$_h$
AL017	Memory error	5330-0017$_h$
AL018	Encoder output error	7306-0018$_h$
AL019	Serial communication error	7510-0019$_h$
AL020	Serial communication time out	7520-0020$_h$
AL021	Reserved	Reserved
AL022	Input power phase loss	3130-0022$_h$
AL023	Early warning for overload	3231-0023$_h$
AL024	Encoder initial magnetic field error	7305-0024$_h$
AL025	Encoder internal error	7305-0025$_h$
AL026	Unreliable internal data of the encoder	7305-0026$_h$

AL027	Encoder data error	7305-0027h
AL030	Motor protection error	7121-0030h
AL031	U,V,W wiring error	3300-0031h
AL040	Full-closed loop excessive deviation	8610-0040h
AL099	DSP firmware upgrade	5500-0099h
-		
AL201	CANopen Data Initial Error	6310-0201h
AL283	Forward software limit	5444-0283h
AL285	Reverse software limit	5445-0285h
-		
AL185	EtherCAT connection error (Servo Off)	8120-0185h
AL180	Node guarding or Heartbeat error (Servo Off)	8130-0180h
AL122	Sub-index error occurs when accessing CANopen PDO object.	8200-0122h
AL123	Data type (size) error occurs when accessing CANopen PDO object.	8200-0123h
AL124	Data range error occurs when accessing CANopen PDO object.	8200-0124h
AL125	CANopen PDO object is read-only and write-protected.	8200-0125h
AL126	CANopen PDO object does not support PDO.	8200-0126h
AL127	CANopen PDO object is write-protected when Servo On.	8200-0127h
AL128	Error occurs when reading CANopen PDO object from EEPROM.	8200-0128h
AL129	Error occurs when writing CANopen PDO object into EEPROM.	8200-0129h
AL130	EEPROM invalid address range.	8200-0130h
AL131	EEPROM checksum error.	8200-0131h
AL132	EEPROM zone error.	8200-0132h
AL201	CANopen load/save 1010/1011 error	6310-0201h
AL3E1	CANopen SYNC failed (Servo Off)	6200-03E1h
AL3E2	CANopen SYNC signal error (Servo Off)	6200-03E2h

AL3E3	CANopen SYNC time out (Servo Off)	6200-03E3$_h$
AL3E4	CANopen IP command failed (Servo Off)	6200-03E4$_h$
AL3E5	SYNC period error (Servo Off)	6200-03E5$_h$
AL500	Safe torque off (Servo Off)	9000-0500$_h$
AL501	STO_A lost (Servo Off)	9000-0501$_h$
AL502	STO_B lost (Servo Off)	9000-0502$_h$
AL503	STO_error (Servo Off)	9000-0503$_h$

9.3 SDO Error Message Abort Codes

Abort Code	Description
05040001 h	Client / server command specifier not valid or unknown
06010002 h	Attempt to write a read-only object
06020000 h	Object does not exist in the object dictionary
06040041 h	Object cannot be mapped to PDO
06040042 h	The number and the length of the objects to be mapped would exceed PDO length
06060000 h	Access failed due to a hardware error (store or restore error)
06070010 h	Data type does not match; length of the service parameter does not match
06090011 h	Sub-index does not exist
06090030 h	Value range of parameter exceeded (only for writing access)
08000000 h	General error
080000a1 h	Object error when reading from EEPROM
080000a2 h	Object error when writing to EEPROM
080000a3 h	Invalid range when accessing EEPROM
080000a4 h	Checksum error when accessing EEPROM
080000a5 h	Password error when writing encryption zone
08000020 h	Data cannot be transferred or stored in the application
08000021 h	Data cannot be transferred or stored in the application because of the local control (store or restore in wrong state)
08000022 h	Object is on the fly

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Chapter 10 Reference

1. CANopen Application Layer and Communication Profile, CiA Draft Standard 301, Version 4.02, Date: 13 February 2002
2. CANopen Device Profile Drives and Motion Control, CiA Draft Standard Proposal 402, Version 2.0, Date: 26 July 2002

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