ADIO-EC (TwinCAT 3 Guide)

User Manual MTO-ADIOECU1-V1.0-2202US

Thank you for purchasing an Autonics product.
This user manual contains information about the product and its proper use,
and should be kept in a place where it will be easy to access.

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Contents

Preface

Thank you for purchasing Autonics products.
Be sure to read and follow the **Safety Precautions** thoroughly before use.
This manual contains information about the product and how to use it properly, so keep it in a place where users can easily find it.

Manual Guide

- Use the product after fully reading the contents of the manual.
- The manual explains the product functions in detail and does not guarantee the contents other than the manual.
- Any or all of the manual may not be edited or copied without permission.
- The manual is not provided with the product.
- Download and use from our website (www.autonics.com).
- The contents of the manual are subject to change without prior notice according to the improvement of the product's performance, and upgrade notices are provided through our website.
- We put a lot of effort to make the contents of the manual a little easier and more accurate. Nevertheless, if you have any corrections or questions, please feel free to comment through our website.

Common Symbols in the Manual

Failure to follow instructions may result in serious injury or death.

Failure to follow instructions may result in injury or product damage.

Supplementary explanation of the function

Example of that function

Important information about the feature

1. ADIO-EC (TwinCAT 3 Guide)

Be sure to see the product manual of the ADIO-EC (EtherCAT) model and follow the precautions.

1.1. Prepare Your Environment

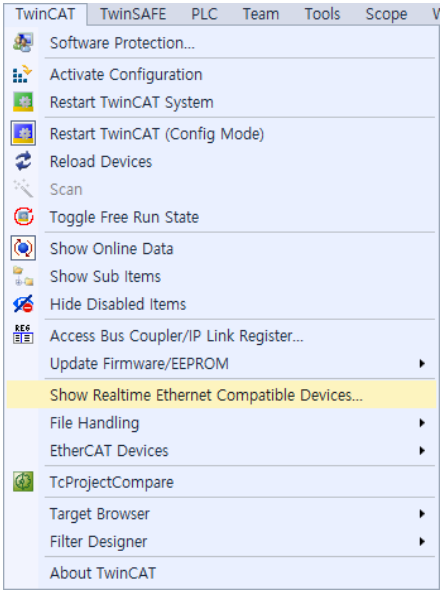
1.1.1. Install ESI File

1. Download the ADIO-EC's ESI file on the Autonics website. The structure of the ESI file is as below.
   - ADIO-EC_v1.x
   - ADIO-EC_Modules_v1.x
2. Copy the downloaded file to the following subdirectory of the TwinCAT installation directory.
   The path of the folder: ~\TwinCAT\3.1\Config\Io\EtherCAT
3. Launch the TwinCAT 3.

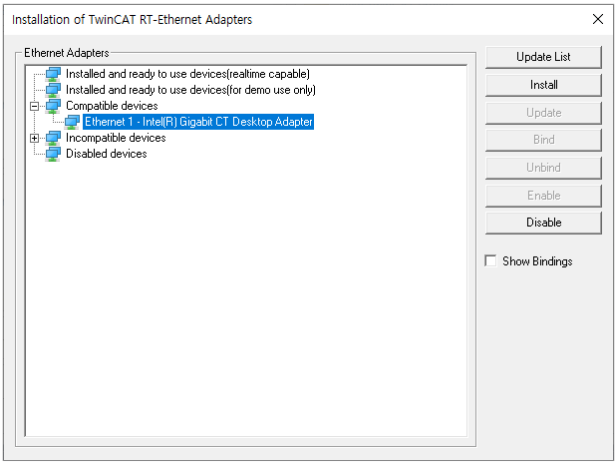
- The EtherCAT Slave Information (ESI) file describes specific data of the EtherCAT Slave, and defines the parameters, process data, valid values and more.
  The EtherCAT Master recognizes the Slave and obtains the necessary information for control via the ESI file.
- To integrate the ESI file when the project file is running in the TwinCAT 3, select the **TwinCAT** » **EtherCAT Devices** » **Reload Device Descriptions** on the top menu.

1.1.2. Install the Ethernet Adapter

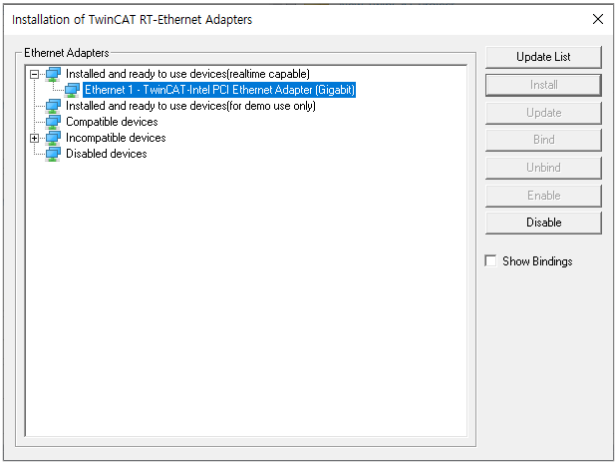
1. Connect the cable connected to the Ethernet port of the ADIO-EC to the port of the device that the TwinCAT is installed.
2. Launch the TwinCAT 3.
3. Select the **TwinCAT** » **Show Realtime Ethernet Compatible Device** on the top menu.



4. Select the LAN card that is connected with the ADIO-EC in the sub-list of the Compatible devices, and then select **Install**. Selecting a device in the sub-list of the Incompatible devices does not guarantee a successful installation.



5. Check that the LAN card is located to the sub-list of the Installed and Ready to use devices (realtime capable). The installation of LAN card is complete.



1.2. Integrate IO-Link Master to TwinCAT Project

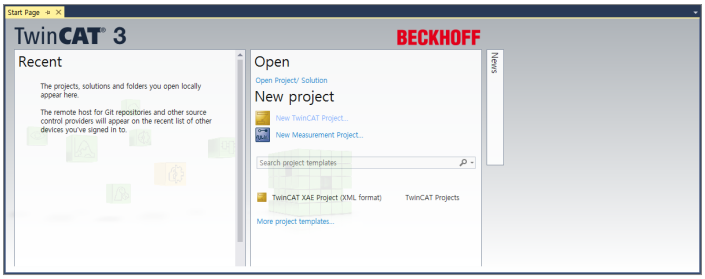
This chapter explains how to integrate the ADIO-EC to the project as an EtherCAT Slave.

1.2.1. Before You Begin

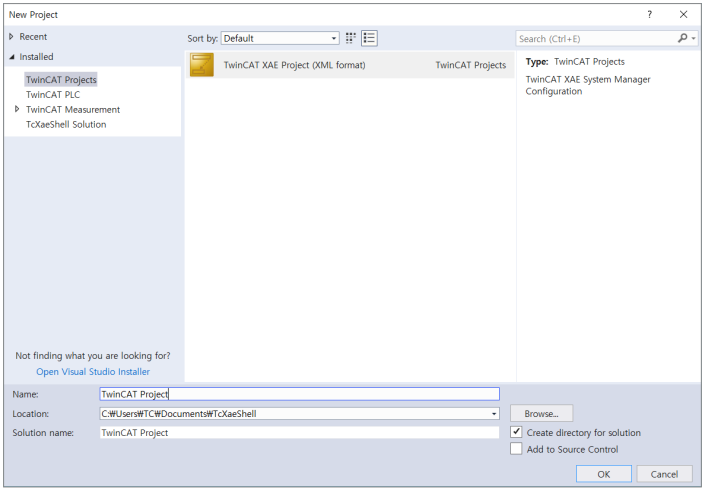
- The ESI file of the ADIO-EC is already installed.

1.2.2. Create a New Project

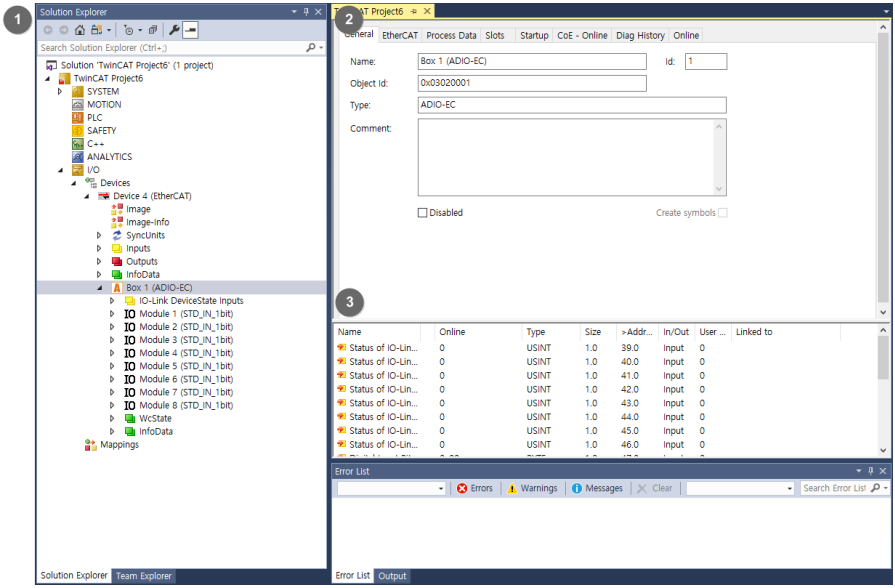
1. Launch the TwinCAT 3.
2. On the Start Page, select New TwinCAT project…



3. In pop-up window, select TwinCAT XAE Project (XML format). Enter a project name and select **OK**.



1.2.3. Main Screen on the EtherCAT Slave



① Solution Explorer

It shows the EtherCAT Slave as the tree structure.

You can see the port configuration and status of the ADIO-EC, selecting the menu to go to the each tab of the Editor Window.

② Editor Window

The tab of the Editor Window shows the configuration of the EtherCAT Slave and the functions can be configured. Select **Solution Explorer** » **Box 1 (ADIO-EC)** to go to the tab.

For more information, see the following chapters.

- EtherCAT
- Slots
- Startup
- CoE-Online

③ Port Status Viewer

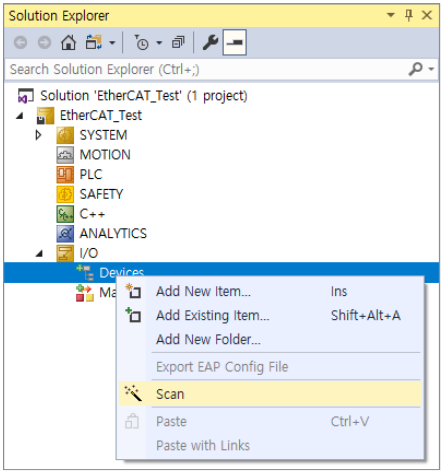
You can monitor the status of each I/O port via the value of Online.

You can also monitor it in the **Solution Explorer** » **IO-Link DeviceState Inputs**.

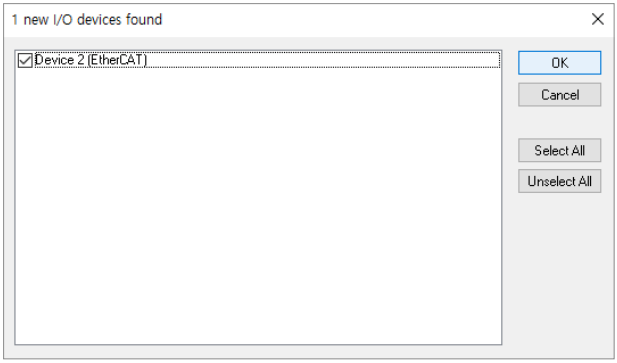
1.2.4. Add EtherCAT Slave

The number after Device/Box in the figure below may vary depending on the installation environment.

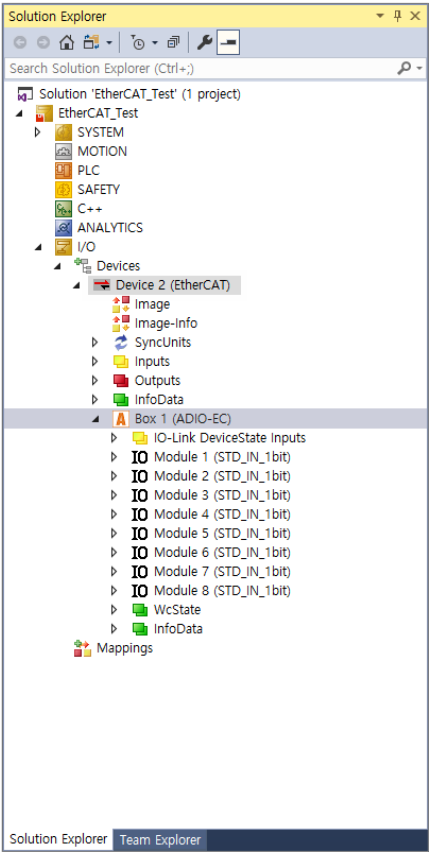
1. Right-click on the **Solution Explorer** » **Devices**.
2. Select **Scan**.



3. In pop-up window, confirm the checkbox of the **Device 2 (EtherCAT)** and select **OK**.



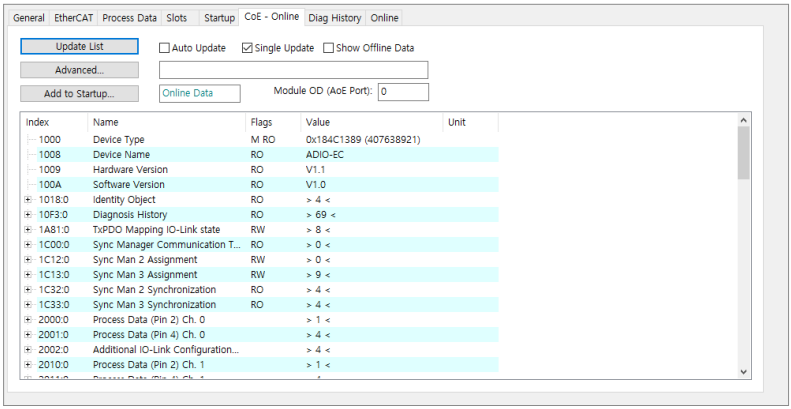
4. Check **Solution Explorer** » **Box 1 (ADIO-EC)**.
   Device and Box shown in the Solution Explorer are defined as below.
   - Device 2 (EtherCAT): EtherCAT Master
   - Box 1 (ADIO-EC): EtherCAT Slave



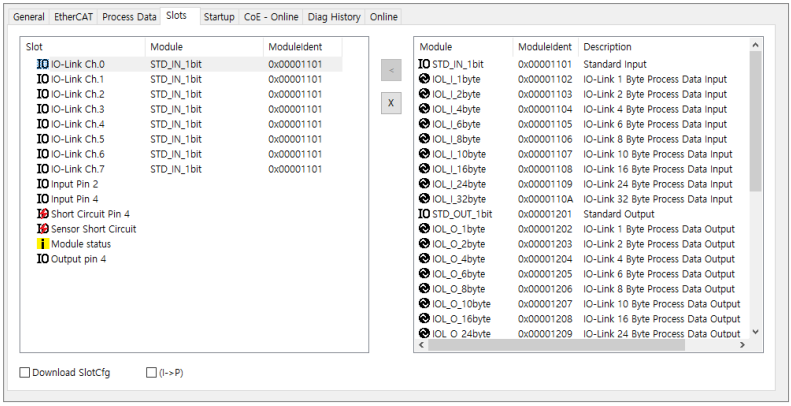
Box no. (ADIO-EC) does not appear in the Solution Explorer, check the power supply of the ADIO-EC and the status of EtherCAT communication cable.

5. Double-click the **Solution Explorer** » **Box 1 (ADIO-EC)**.

6. Check the Online Data in the **Editor Window** » **CoE-Online tab**.



7. Check the list of slots and modules in the **Editor Window** » **Slots tab**.
   For detailed information on the configuration of slots and modules, refer to 4, Configure the I/O Port.



8. The ADIO-EC has been successfully added.

1.2.5. Apply to the EtherCAT Slave

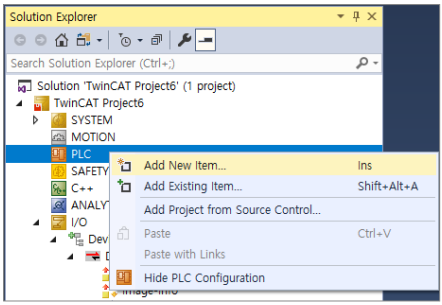
When a change occurs in the configuration of acyclic data in the TwinCAT project, follow the procedure below for applying to the EtherCAT Slave.

1. Select (Restart TwinCAT) or (Reload Device) on the top menu.
2. Select **OK** in pop-up window.
3. The changes have been applied to the ADIO-EC.

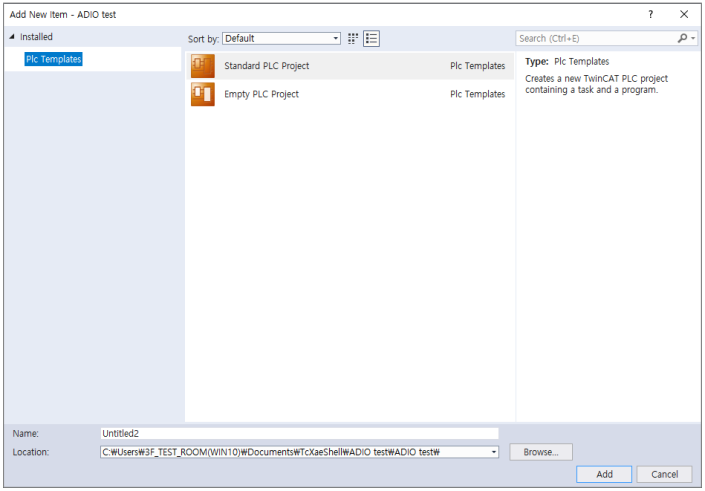
- Cyclic data:
  It is the process data objects (PDO) which is related to the input and output data of the IO-Link device.
- Acyclic data:
  It is the vendor specific object lists such as the data of port configuration information and diagnostics.

1.2.6. Integrate the ADIO-EC to the PLC Project

1. Select the **Solution Explorer** » **PLC** » **Add New item**.

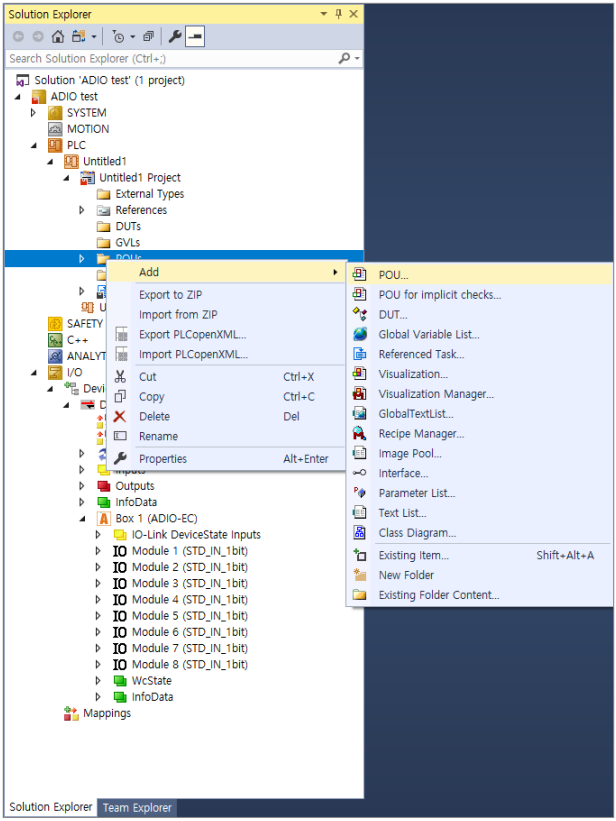


2. In pop-up window, select the Standard PLC Project. Enter a project name and select **Add**.

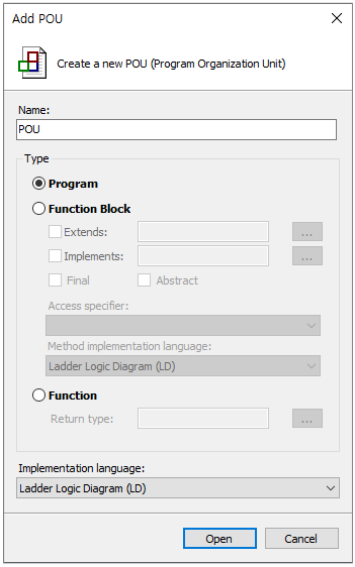


3. MAIN (PRG) is created by default in the sub-list of the **Solution Explorer** » **POUs**. MAIN (PRG) only supports ST language.

4. Right-click on the **Solution Explorer** » **PLC** » **POUs** and select **Add** » **POU…**.



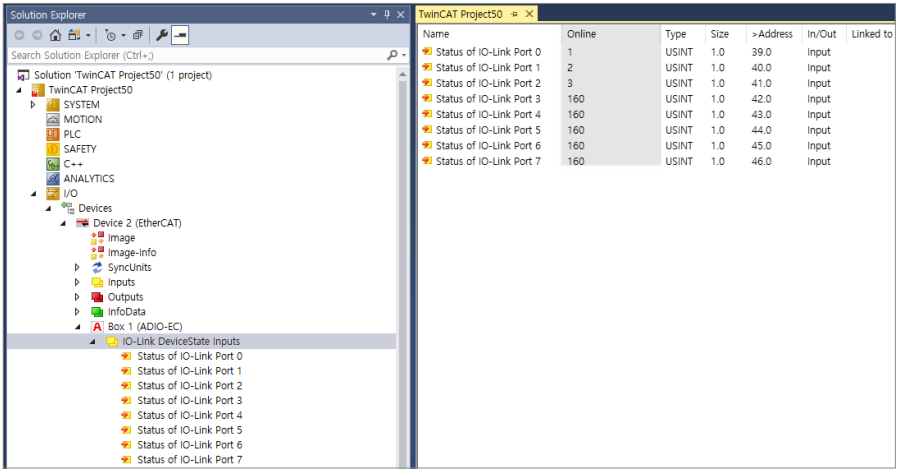
5. In pop-up window, Enter a Name, Type, and Language and select **Open**.



6. The screen of TwinCAT Ladder program appears.

2. Monitor the Port Status

1. Select the **Solution Explorer** » **Box 1 (ADIO-EC)** » **IO-Link DeviceState Inputs**.
2. Check the value on the Online tab in the Editor Window.
   For detailed information on the port status, refer to the mapping of 11.9, “IO-Link Status Data Ch. x”.

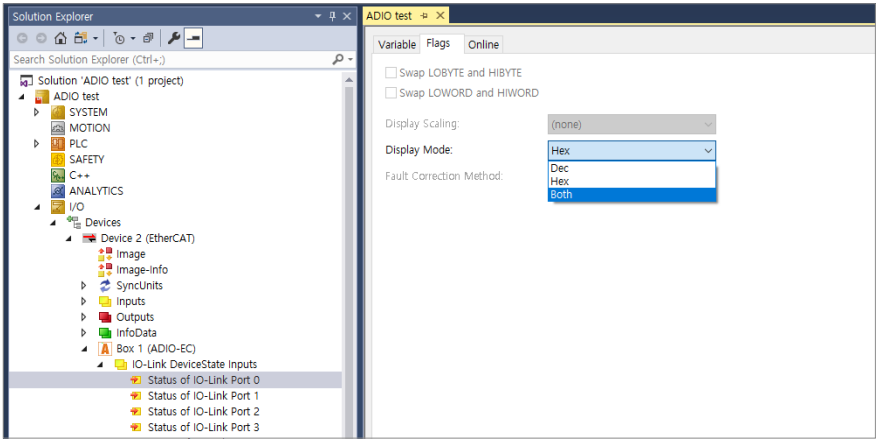


2.1. Definition of the Online Values

Hex	Dec	Description
0x_0	0	Port disabled
0x_1	1	Port in std dig in
0x_2	2	Port in std dig out
0x_3	3	Port in communication OP
0x_4	4	Port in communication COMSTOP
0x1_	16	Watchdog detected
0x2_	32	initial Error
0x3_	48	invalid DID
0x4_	64	invalid VID
0x5_	80	invalid IO-Link Version
0x6_	96	invalid Frame Capability
0x7_	112	invalid Cycle Time
0x8_	128	invalid PD in length
0x9_	144	invalid PD out length
0xA_	160	no device detected

Setting the Display Mode

1. Select the **Solution Explorer** » **Box 1 (ADIO-EC)** » **IO-Link DeviceState Inputs** » **Status of IO-Link Port x**.
2. Select the display format of the Online values among Dec, Hex, and Both in the Display Mode of the Flags tab.



- Dec: Decimal format

Name	Online	Type	Size	>Addr...	In/Out	Linked to
Status of IO-Link Port 0	160	USINT	1.0	39.0	Input	

- Hex: Hexadecimal format

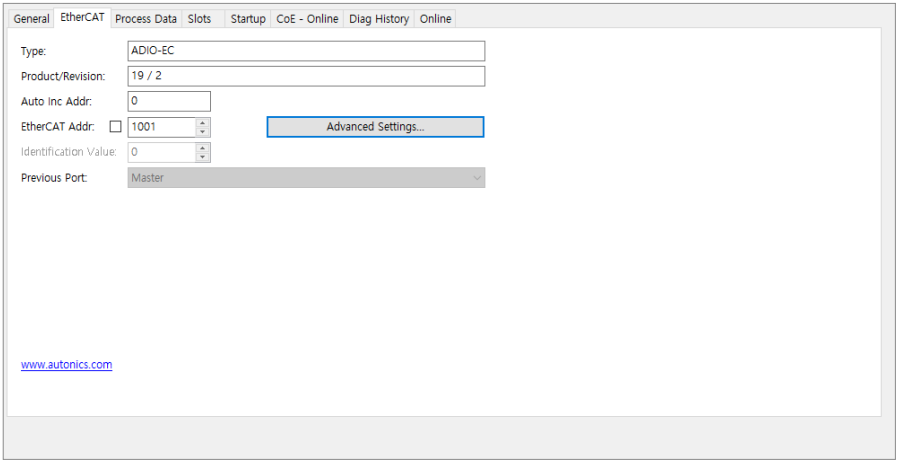
Name	Online	Type	Size	>Addr...	In/Out	Linked to
Status of IO-Link Port 0	0xa0	USINT	1.0	39.0	Input	

- Both: Decimal (hexadecimal) format

Name	Online	Type	Size	>Addr...	In/Out	Linked to
Status of IO-Link Port 0	160 (0xa0)	USINT	1.0	39.0	Input	

3. Check the Address of the ADIO-EC

3.1. EtherCAT Tab



Type

It shows the device type of the EtherCAT Slave.

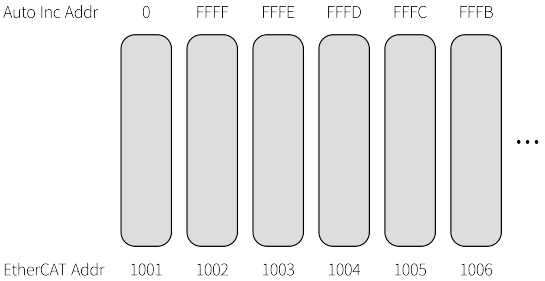
Product/Revision

It shows the product and revision number of the EtherCAT Slave.

"19" is the product number of the ADIO-EC and "2" is the revision number.

Auto Inc Addr

It contains the auto-increment address of the EtherCAT Slave. It is assigned by the EtherCAT Master. In the ring topology, the address is assigned in the form of decreasing the value by 1, such as the address of the first EtherCAT Slave: 0x0000, the second device: 0xFFFF, the third device: 0xFFFE…



EtherCAT Addr

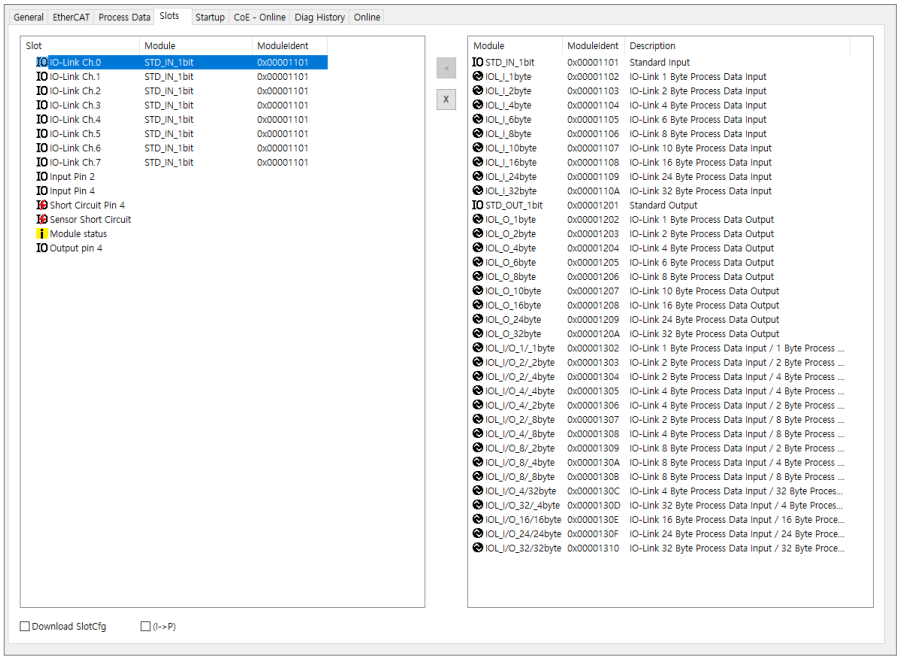
It contains the communication address of the EtherCAT Slave. It is assigned by the EtherCAT Master in the same as with the Auto Inc Addr. If the checkbox on the left side is selected, the EtherCAT address of the slave device does not change even if another device (Box) is added to the ring network (the fixed address). You can also change the assigned address value.

4. Configure the I/O Port

4.1. Slots Tab

The I/O ports on the ADIO-EC, as a modular device, can be configured by assigning the (physical) modules to the slots.

In the figure below, the list of slots on the left side acts as a placeholder to find the modules on the right side. The modules on the right side are defined by the ModuleIdent The ModuleIdent varies depending on the manufacturers and identifies a specific module.



4.2. List of Slots

Slot no.	Slot	Description
1 to 8	IO-Link Ch.0 to 7	Configure the operation mode (IO-Link/DI/DO) and the process data length on each I/O port
9	Input Pin 2	Create an address that can read the input value of Pin 2
10	Input Pin 4	Create an address that can read the input value of Pin 4
11	Short Circuit Pin 4	Create an address that can read the short circuit status of Pin 4
12	Sensor Short Circuit	Create an address that can read the short circuit status of the connected sensor
13	Module status	Create an address that can read the status of each I/O port
14	Output Pin 4	Create an address to set the output value of Pin 4

4.3. List of Modules

Module	Description
STD_IN_1bit	Configuration of Pin 4: Standard Input
STD_OUT_1bit	Configuration of Pin 4: Standard Output
IOL_I/O_x/_xbyte	Configuration of the port: Select the size (byte) of the IO-Link input and output data (1) I/O • I: data input • O: data output • I/O: data input and output (2) x/_xbyte • input byte/_output byte, the size of process data
INPUT_PIN2_8CH	Monitoring: Value of Pin 2 in the standard input mode
INPUT_PIN4_8CH	Monitoring: Value of Pin 4 in the standard input mode
ACTOR_SHORTCIRCUIT_PIN4_8CH	Monitoring: Short circuit of Pin 4
SENSOR_SUPPLY_SHORTCIRCUIT_8CH	Monitoring: Short circuit of connected sensor (US)
MODULE_STATUS	Monitoring: Port status • Bit 0: US low • Bit 1: UA low • Bit 2: no UA
OUTPUT_PIN4_8CH	Configuration of Pin 4: Output value of the standard output

4.4. Mapping: Modules

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Port 7	Port 6	Port 5	Port 4	Port 3	Port 2	Port 1	Port 0

The corresponding modules

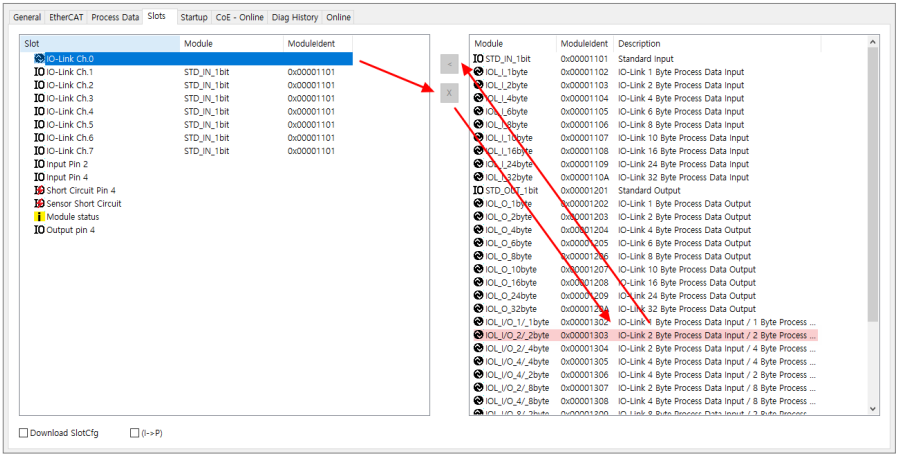
- INPUT_PIN2_8CH
- INPUT_PIN4_8CH
- ACTOR_SHORTCIRCUIT_PIN4_8CH
- SENSOR_SUPPLY_SHORTCIRCUIT_8CH
- OUTPUT_PIN4_8CH

5. Assign the Modules

5.1. Before You Begin

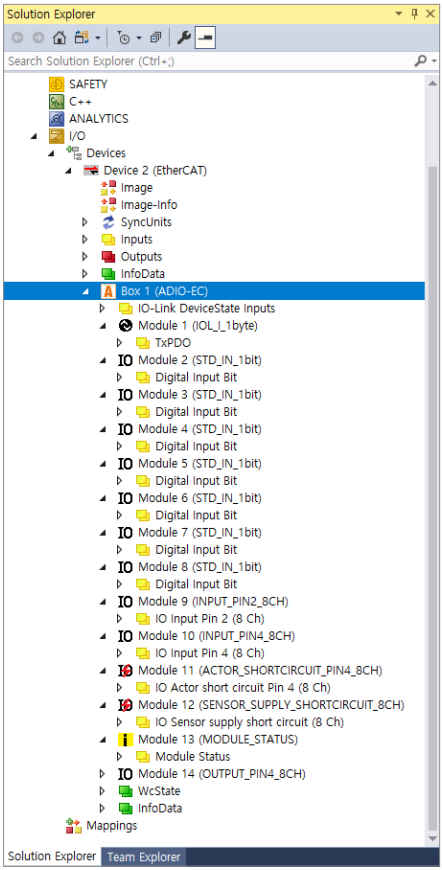
- The ADIO-EC is integrated to the TwinCAT project.

5.2. Assigning a Module



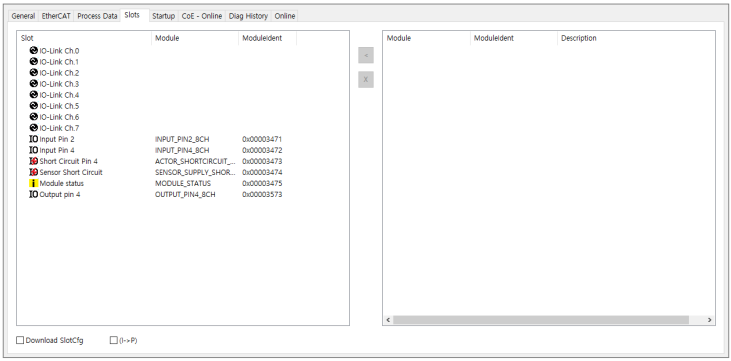
1. Select the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)**.
2. Select the **Editor Window** » **Slots Tab**.
3. Select the the slot you want to change in the left side.
4. Select the `X` to delete the module.
5. Select a module to be assigned in the right side.
6. Select the `<` to assign the module to the slot.
7. The module has been assigned to the slot.

8. Repeat the procedure above to configure the I/O port. You can check the configuration of I/O port in the Solution Explorer.



9. Save the project.
10. Select (Restart TwinCAT) or (Reload Device).

- All modules assigned to the slots of IO-Link Ch.0 to Ch.7 must exist.
  For unused I/O port, it is recommended to assign the STD_IN_1bit module (factory settings).
- When assigning the OUTPUT_PIN4_8CH module, make sure that no module is assigned to the slots of IO-Link Ch.0 to Ch.7.



6. Monitor the Module Status

For more information on the IOL_I/O_x/_xbyte module, refer to 7, Process Data Object (PDO).

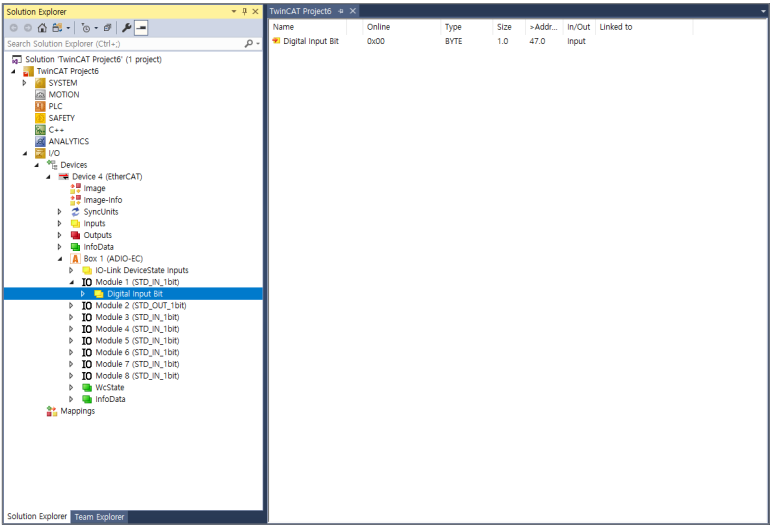
6.1. STD_IN_1bit / STD_OUT_1bit

You can monitor the status of SIO (standard input and standard output) mode on each I/O port.
For PNP model of the ADIO-EC,

- 0x00 (0): Input and output signal of Pin 4 is Low
- 0x01 (1): Input and output signal of Pin 4 is High

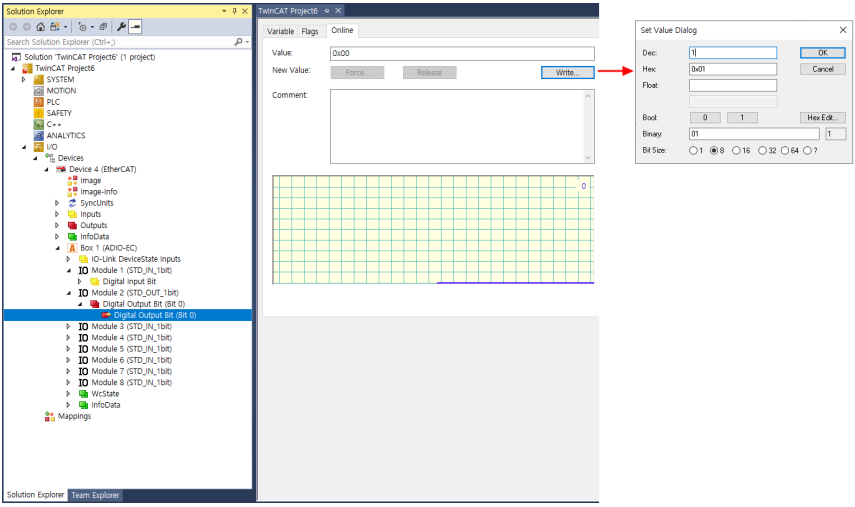
Standard Input

1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 1 (STD_IN_1bit)** » **Digital Input Bit (sub-variable)**.
2. Check the value in the **Editor Window** » **Online tab**.



Standard Output

1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 2 (STD_OUT_1bit)** » **Digital Output Bit (sub-variable)**.
2. Select the **Editor Window** » **Online Tab**.
3. Select the **Write** to enter a value.



6.2. INPUT_PIN2_8CH / INPUT_PIN4_8CH

Input pin 2/4: Read the digital input signal from Pin 2/4 on all I/O ports.

Pin 2 (I/Q) is fixed as the digital input mode.

For PNP model of the ADIO-EC,

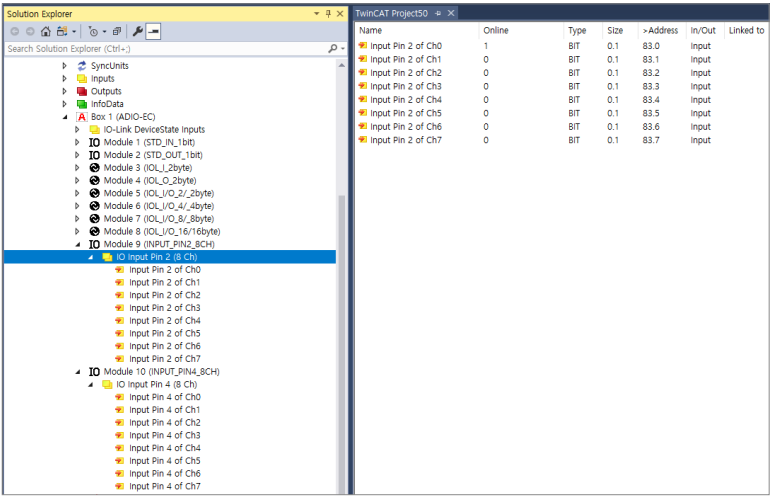
• 0x00 (0): OFF the input signal to Pin 2 or 4

• 0x01 (1): ON the input signal to Pin 2 or 4

Input Pin 2

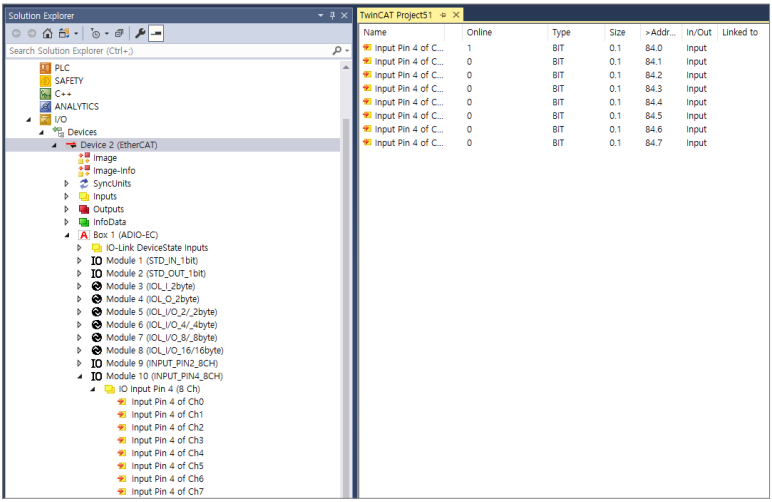
1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 9 (INPUT_PIN2_8CH)** » **IO Input Pin 2 (8 Ch)**.

2. Check the Online value in the Editor Window.



Input Pin 4

1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 10 (INPUT_PIN4_8CH)** » **IO Input Pin 4 (8 Ch)**.
2. Check the Online value in the Editor Window.

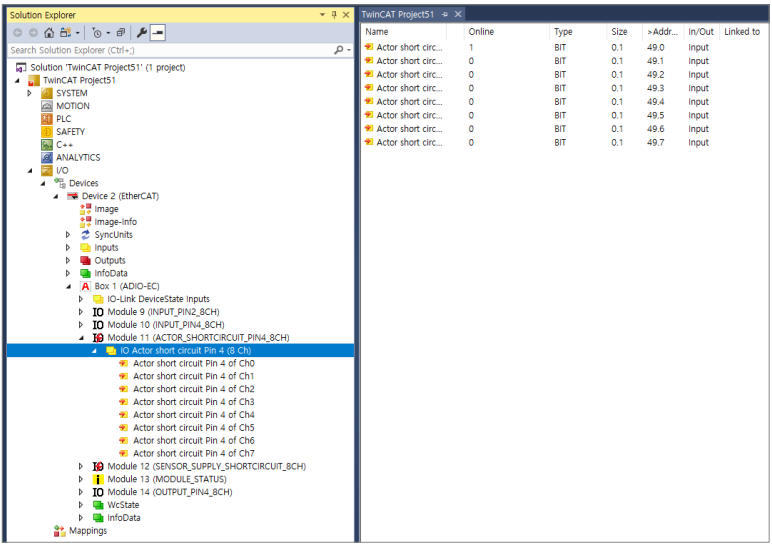


6.3. ACTOR_SHORTCIRCUIT_PIN4_8CH

If the short circuit occurs on Pin 4 of each I/O port,
the Online value of the corresponding port is changed to 1.
• 0x01 (1): Short circuit occurred on Pin 4

Actor short circuit Pin 4

1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 11 (ACTOR_SHORTCIRCUIT_PIN4_8CH)** » **IO Actor short circuit Pin 4 (8 Ch)**.
2. Check the Online value in the Editor Window.

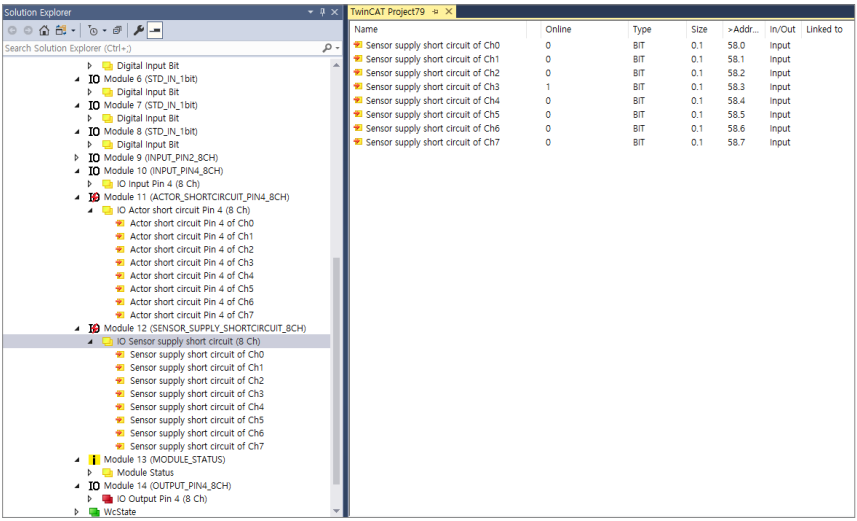


6.4. SENSOR_SUPPLY_SHORTCIRCUIT_8CH

If the short circuit occurs on the I/O supply power (Pin 1: L+ and Pin 3: L-),
the Online value of the corresponding port is changed to 1.
• 0x01 (1): Short circuit occurred on Pin 1 and 3

Sensor supply short circuit

1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 12 (SENSOR_SUPPLY_SHORTCIRCUIT_8CH)** » **IO Sensor supply short circuit (8 Ch)**.
2. Check the Online value in the Editor Window.



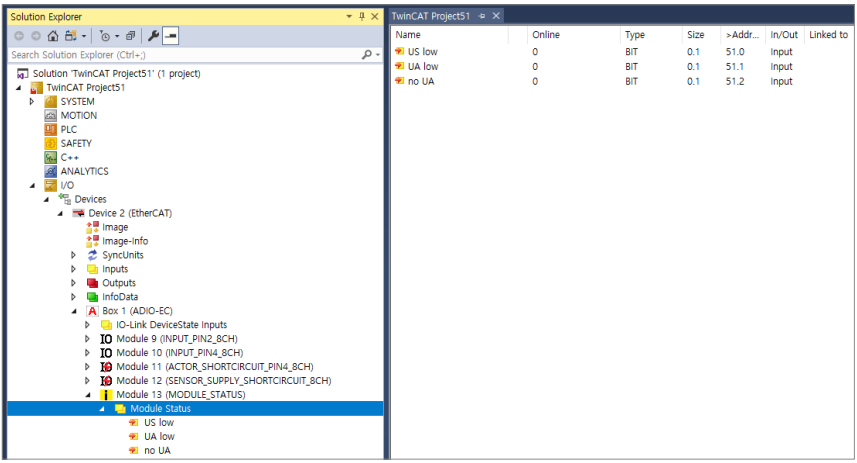
6.5. MODULE_STATUS

The Online value shows the status of the supply voltage.

- When the Sensor Power is lower than 18 VDC, the online value of US low is changed to 1.
- When the Actuator Power is lower than 18 VDC, the online value of UA low is changed to 1.
- When the Actuator Power is lower than 10 VDC, the online value of no UA is changed to 1.

Module Status

1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 13 (MODULE_STATUS)** » **Module Status**.
2. Check the Online value in the Editor Window.



6.6. OUTPUT_PIN4_8CH

You can control the output on each I/O port.

For PNP model of ADIO-EC,

• 0x00 (0): Output signal of Pin 4 is Low

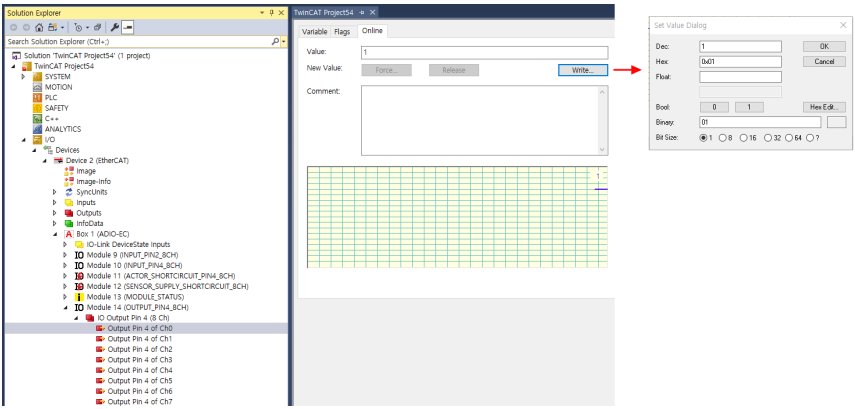
• 0x01 (1): Output signal of Pin 4 is High

Output Pin 4

1. Select the **Solution Explorer** » **Box 1 (ADIO-EC)** » **IO-Link DeviceState Inputs** to monitor the port status. The figure below shows the Port in std dig out status since the Online value is 0x_2 (2).

Name	Online	Type	Size	>Addr...	In/Out	User ...	Linked to
Status of IO-Link Port 0	2	USINT	1.0	39.0	Input	0	
Status of IO-Link Port 1	2	USINT	1.0	40.0	Input	0	
Status of IO-Link Port 2	2	USINT	1.0	41.0	Input	0	
Status of IO-Link Port 3	2	USINT	1.0	42.0	Input	0	
Status of IO-Link Port 4	2	USINT	1.0	43.0	Input	0	
Status of IO-Link Port 5	2	USINT	1.0	44.0	Input	0	
Status of IO-Link Port 6	2	USINT	1.0	45.0	Input	0	
Status of IO-Link Port 7	2	USINT	1.0	46.0	Input	0	

2. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 14 (OUTPUT_PIN4_8CH)** » **Output Pin 4 of Ch (sub-variable)**.
3. Select the **Editor Window** » **Online Tab**.
4. Select the **Write** to enter a value.



7. Process Data Object (PDO)

TwinCAT creates variables for cyclic input and output signals while configuring the slots.
The variables can be found in sub-folders of the created module.
You can check the process data of connected IO-Link device to the I/O port.
In general, you can find the length and information of the process data on the instructions manual of the IO-Link device.

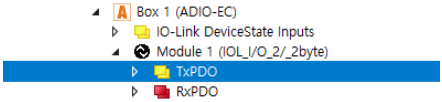
- TxPDO (← IOL_I_module): Check the input data
- RxPDO (← IOL_O_module): Write the output data

7.1. Before You Begin

- An IO-Link device is connected to the I/O port.
- The IO-Link module (IOL_I/O_x/_xbyte) is assigned to the slot (IO-Link Ch.0 to Ch.7) of the corresponding port.
- Check that the Online value of the status of IO-Link Port X is 3. (3: Port in communication OP)

7.2. Check the TxPDO

1. Double-click the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 1 (IOL_I/O_x/_xbyte)** » **TxPDO**.

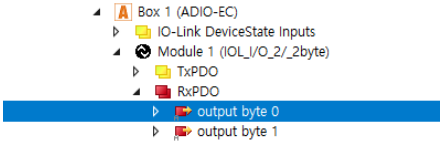


2. You can see the transferred process data via the Online value in the Editor Window.

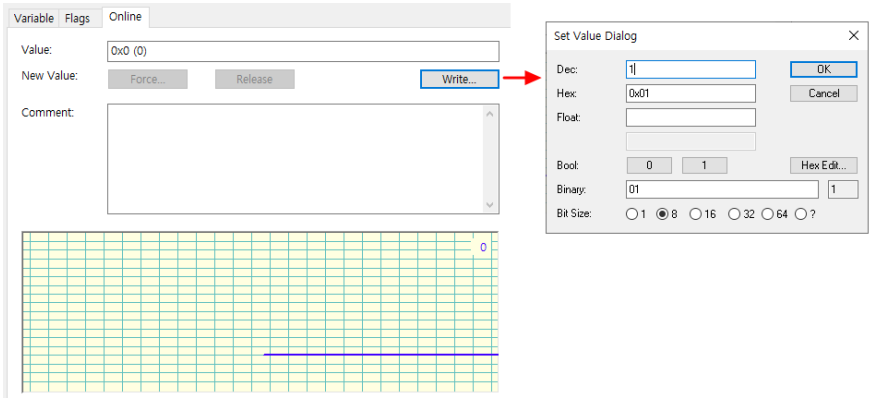
Name	Online	Type	Size	>Addr...	In/Out	Linked to
input byte 0	0x8D (141)	BITARR8	1.0	47.0	Input	
input byte 1	0x23 (35)	BITARR8	1.0	48.0	Input	

7.3. Write the RxPDO

1. Select the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 1 (IOL_I/O_x/_xbyte)** » **selection** » **output byte 0, 1⋯**



2. Select the **Editor Window** » **Online Tab**.
3. Select **Write** to enter a value.



4. Select the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 1 (IOL_I/O_x/_xbyte)** » **selection**. You can see that the output data has changed via the Online value in the Editor Window.

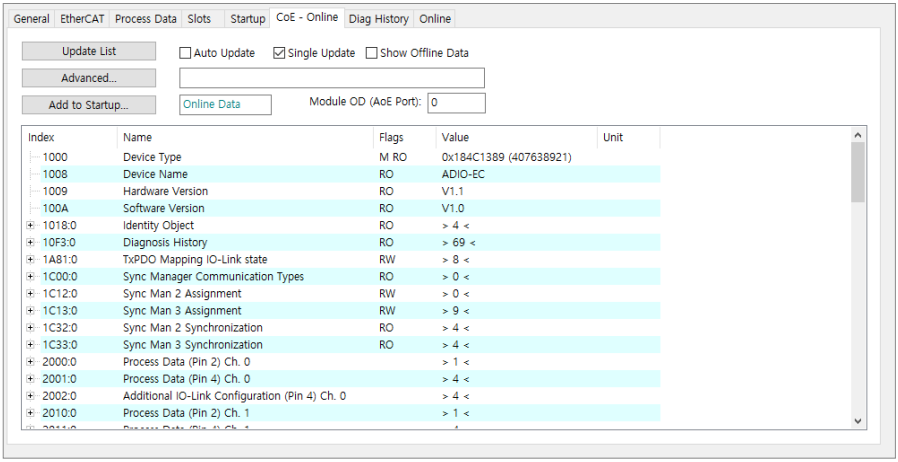
Name	Online	Type	Size	>Addr...	In/Out	Linked to
output byte 0	0x1 (1)	BITARR8	1.0	39.0	Output	
output byte 1	0x0 (0)	BITARR8	1.0	40.0	Output	

8. Access ISDU Parameters

8.1. CoE-Online Tab

If the EtherCAT Slave supports the CAN application protocol over EtherCAT (CoE) protocol, the CoE-Online tab is displayed. In this tab, you can check the object list of the slave device and change the value of the object.

The related object list: refer to 11, Object List.



Index

Index and Subindex of the object

The structure of index

2002:0 Additional IO-Link Configuration (Pin 4) Ch. 0

- The structure of Index is Index:Subindex, and the value is displayed in hexadecimal format.
- In the figure above, the index is displayed as 2002:0, but it consists of Index: 2002 and Subindex: 0.

Name

Name of the object

Flags

RW: The object can be read, and data can be written to the object (read/write).

RO: The object can be read, but no data can be written to the object (read only).

P: Identify the object as a process data object (PDO).

M: Mandatory, element or attribute must exist.

Value

Value of the object

8.2. Read and Write the Parameters

To access the ISDU parameters of the IO-Link device is available with the object 0x4000 (IO-Link Service Data Ch. X) in the TwinCAT 3. You can read and write parameters by entering values in the request data below.

The related object list: refer to 11.5, “IO-Link Service Data Ch. x”.

Read

- Request data: Index, Subindex
- Response data: Length, Data

Write

- Request data: Index, Subindex, Length, Data
- Response data: None

IO-Link Service Data

- Control
  0x00: No action
  0x02: Write
  0x03: Read
- Status
  0x00: No activity
  0x01: Busy
  0x02: Success
  0x04: Error
  0xFF: Failure

8.3. Before You Begin

- An IO-Link device is connected to the I/O port.
- The IO-Link module (IOL_I/O_x/_xbyte) is assigned to the slot (IO-Link Ch.0 to Ch.7) of the corresponding port.
- Check that the Online value of the status of IO-Link Port X is 3. (3: Port in communication OP)
- You can check the index of the connected IO-Link device.
- The checkbox of **CoE-Online** » **Auto Update** is checked.

8.4. Read the Parameter

The IO-Link device is connected to port 0.

1. In the CoE-Online tab, select the IO-Link Service Data of the port where the IO-Link device is connected.

Index	Name	Flags	Value	Unit
4000:0	IO-Link Service Data Ch. 0		> 7 <	
4000:01	Control	RW	0x00 (0)	
4000:02	Status	RO	0x00 (0)	
4000:03	Index	RW	0x0000 (0)	
4000:04	Subindex	RW	0x00 (0)	
4000:05	Length	RW	0x00 (0)	
4000:06	Data	RW	00 00 00 00 00 00 00 00...	
4000:07	Error Code	RO	0x0000 (0)	

2. Firstly enter the Index or Subindex. The value of 24 was entered in the value field of Index.
   - Index: 24 (Application specific tag for the IO-Link device)

Index	Name	Flags	Value	Unit
4000:0	IO-Link Service Data Ch. 0		> 7 <	
4000:01	Control	RW	0x03 (3)	2
4000:02	Status	RO	0x02 (2)	
4000:03	Index	RW	0x0018 (24)	1
4000:04	Subindex	RW	0x00 (0)	
4000:05	Length	RW	0x20 (32)	
4000:06	Data	RW	2A 2A 2A 00 00 00 00 0...	3
4000:07	Error Code	RO	0x0000 (0)	

3. Enter the 0x03 (3), the value of the Control object, to execute Read.
4. Check the value of the Status object. The value is successfully read since the value of 0x02 (Success) is displayed.
5. Check the values of the Length and Data objects.

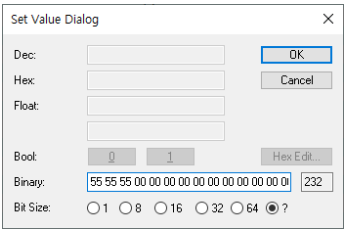
8.5. Write the Parameter

The IO-Link device is connected to port 0.

1. Firstly enter the Index or Subindex. The value of 24 was entered in the value field of Index.
   - Index: 24 (Application specific tag for the IO-Link device)

Index	Name	Flags	Value	Unit
4000:0	IO-Link Service Data Ch. 0		> 7 <	
4000:01	Control	RW	0x02 (2)	
4000:02	Status	RO	0x02 (2)	
4000:03	Index	RW	0x0018 (24)	
4000:04	Subindex	RW	0x00 (0)	
4000:05	Length	RW	0x03 (3)	
4000:06	Data	RW	55 55 55 00 00 00 00 00...	
4000:07	Error Code	RO	0x0000 (0)	

2. Enter the values of the Length and Data objects. The following values have been entered in the figure below.
   - Length: 3 (The data size of value to be written)
   - Data: 55 55 55 (Binary)



3. Enter the 0x02 (2), the value of the Control object, to execute Write.
4. Check the value of the Status object. The value is successfully written since the value of 0x02 (Success) is displayed.

8.6. Check the Changed Parameter

Read-out again to check whether the parameter is successfully written.

1. Enter the 0x03 (3), the value of the Control object, to execute Read.
2. Check the value of the Status object. Read is in progress since the value of 0x01 (Busy) is displayed.

Index	Name	Flags	Value	Unit
4000:0	IO-Link Service Data Ch. 0		> 7 <	
4000:01	Control	RW	0x03 (3)	
4000:02	Status	RO	0x01 (1)	
4000:03	Index	RW	0x0018 (24)	
4000:04	Subindex	RW	0x00 (0)	
4000:05	Length	RW	0x00 (0)	
4000:06	Data	RW	00 00 00 00 00 00 00 00...	
4000:07	Error Code	RO	0x0000 (0)	

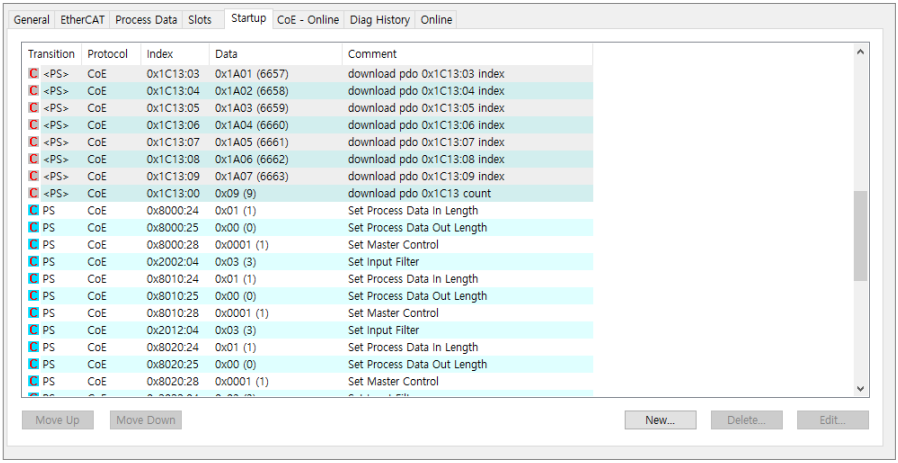
3. Check the value of the Status object again. The value is successfully read since the value of 0x02 (Success) is displayed.

Index	Name	Flags	Value	Unit
4000:0	IO-Link Service Data Ch. 0		> 7 <	
4000:01	Control	RW	0x03 (3)	
4000:02	Status	RO	0x02 (2)	
4000:03	Index	RW	0x0018 (24)	
4000:04	Subindex	RW	0x00 (0)	
4000:05	Length	RW	0x20 (32)	
4000:06	Data	RW	55 55 55 00 00 00 00 00...	
4000:07	Error Code	RO	0x0000 (0)	

4. Check the value of the Data object. You can see the “55 55 55”, the data to be written, is successfully reflected.

9. Startup Tab

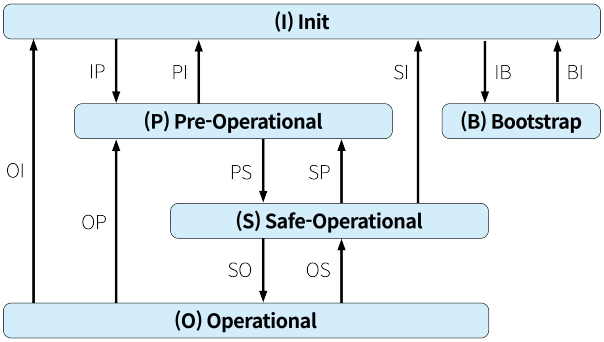
If the EtherCAT Slave has a mailbox and supports the CAN application protocol over EtherCAT (CoE) or Servo Drive over EtherCAT (SoE) protocol, the Startup tab is displayed. The values are transmitted to the EtherCAT Slave in the order displayed in the Startup tab when initially connecting the EtherCAT communication. You can also add or change the order of the Startup list.



Transition

It can be set the transition from Pre-Operational to Safe-Operational (PS) or from Safe-Operational to Operational (SO) status. If the value of Transition is closed with "< >" (e.g., <PS>), the data cannot be changed or deleted.

EtherCAT communication status (EtherCAT State Machine)



9.1. Supported Functions on the Startup

The startup tab supports the following functions.

- Input Filter
- Safe state
- Validation
- Data storage

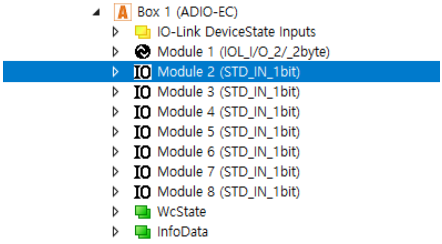
9.2. Input Filter

The processing time of the digital input signal can be set via this function. The digital input filtering time suppresses unwanted input signal changes or eliminates noise from input signals to prevent a data distortion or chattering. It can also be used as ON Delay/OFF Delay depending on the selected filter time.
The prerequisite condition for this function is that the operation mode of Pin 4 is the standard input.

The related object list: refer to 11.3, “Additional IO-Link Configuration Data (Pin 4) Ch. X”.

9.2.1. Before You Begin

- A device is connected to the I/O port.
- The STD_IN_1bit module is assigned to the corresponding port.

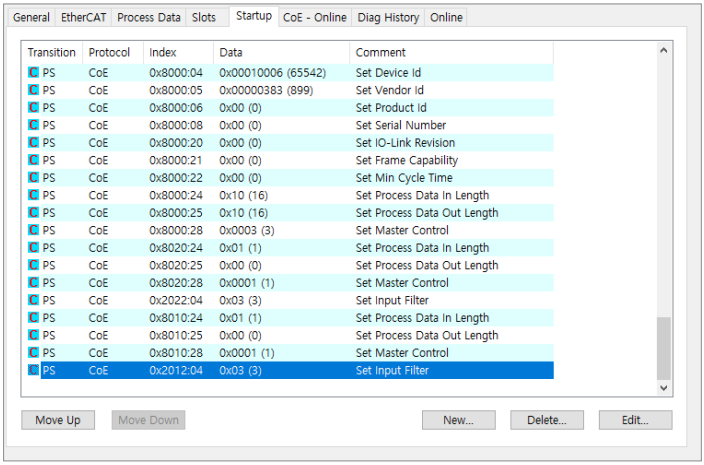


- Check that the Online value of Status of IO-Link Port X is 1. (1: Port in std dig in)

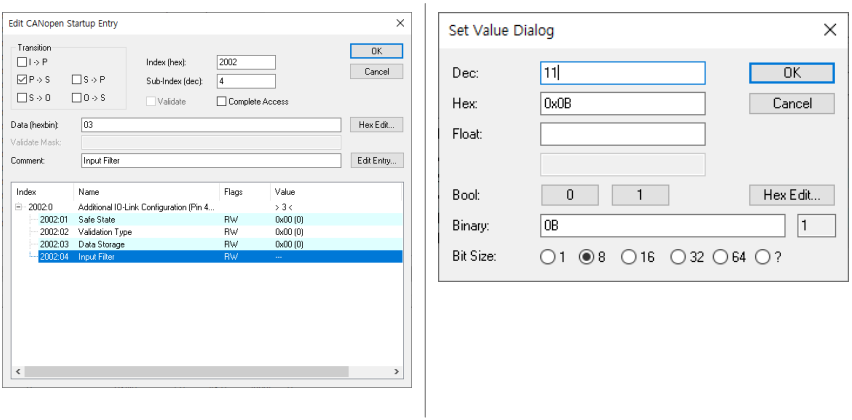
9.2.2. Select Input Filtering Time

The device is connected to port 1.

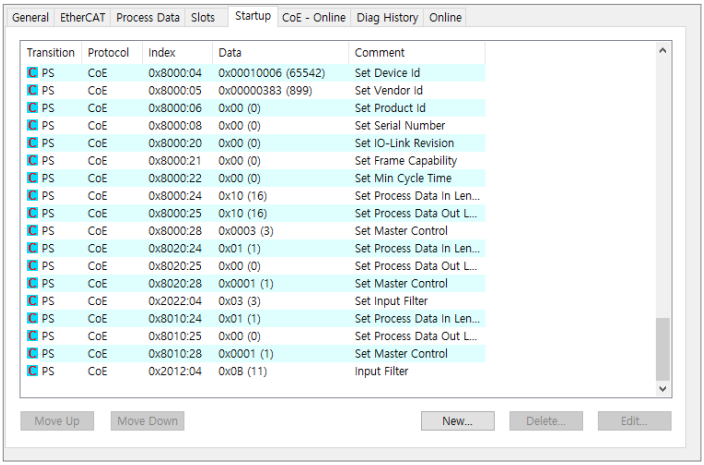
1. Firstly check the Index of the port number and double-click the Set Input Filter. The current value of the Input Filter is set to 3 (1 ms, factory settings).



2. Let's select the value of the Input Filter to 11 (256 ms).
   ① Enter the binary value directly in the field of Data (hexbin).
   ② Select Input Filter and then enter a value in decimal or hexadecimal format in the Set Value Dialog window.

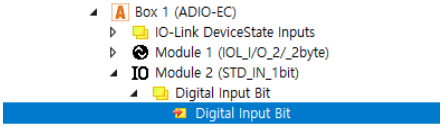


3. The value of Input Filter is set to 11.

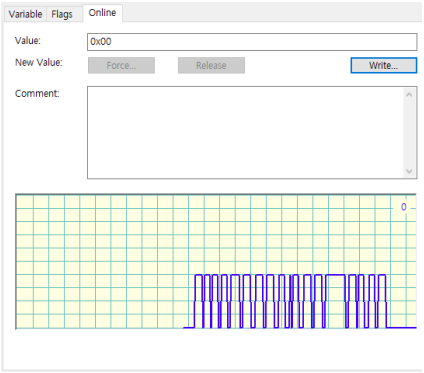


4. Select (Restart TwinCAT) or (Reload Device).

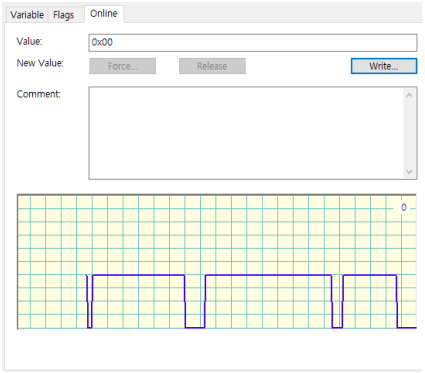
5. Select the **Solution Explorer** » **Device** » **Box 1 (ADIO-EC)** » **Module 2 (selection)** » **Digital Input Bit** to check the Online tab of the Editor Window. You can see the waveforms depending on the input filtering time.



Input Filter: 3



Input Filter: 11



9.3. Safe State

Define the behaviour of output on each I/O port when the communication connection is interrupted between the EtherCAT Master and the ADIO-EC.
The prerequisite condition for this function is that the operation mode of Pin 4 is the standard output.

The related object list: refer to 11.3, “Additional IO-Link Configuration Data (Pin 4) Ch. X”.

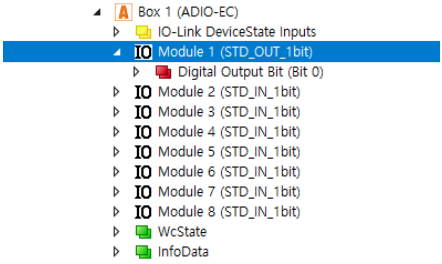
Safe state

In case of the output behaviour for the PNP model of ADIO-EC under the disconnection of EtherCAT communication,

- 0x00: 0
  - Output of Pin 4: Switch to Low
  - No. 0 of the I/O port indicator: OFF
- 0x01: 1
  - Output of Pin 4: Switch to High
  - No. 0 of I/O port indicator: ON (yellow LED)
- 0x02: 2, last state
  - Output of Pin 4: Keep the previous state
  - No. 0 of I/O port indicator: keep the previous state

9.3.1. Before You Begin

- A device is connected to the I/O port.
- The STD_OUT_1bit module is assigned to the corresponding port.

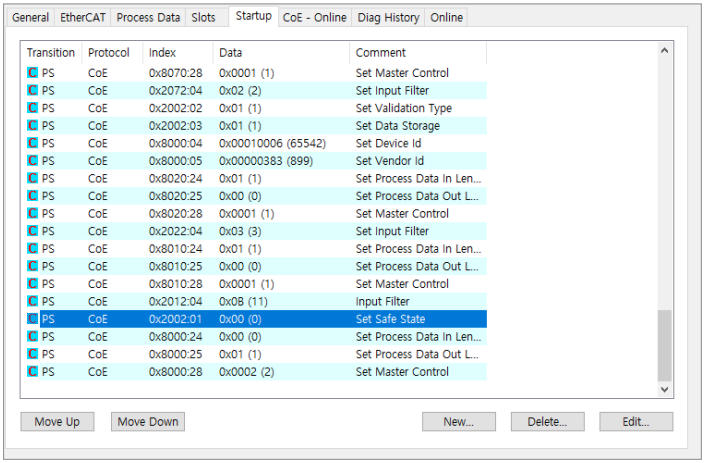


- Check that the Online value of Status of IO-Link Port X is 2. (2: Port in std dig out)

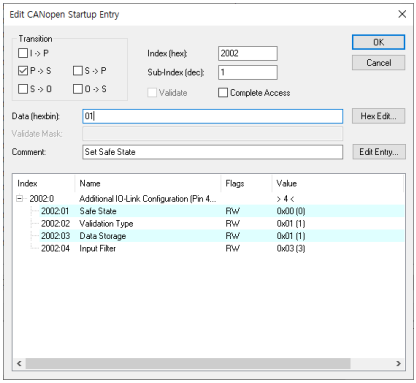
9.3.2. Setting Safe State

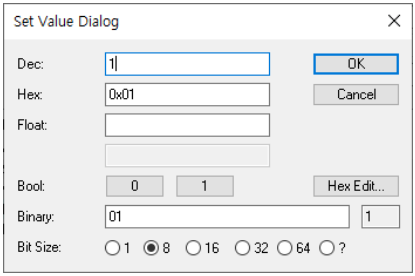
The device is connected to port 0.

1. Firstly check the Index of the port number and double-click Set Safe State.

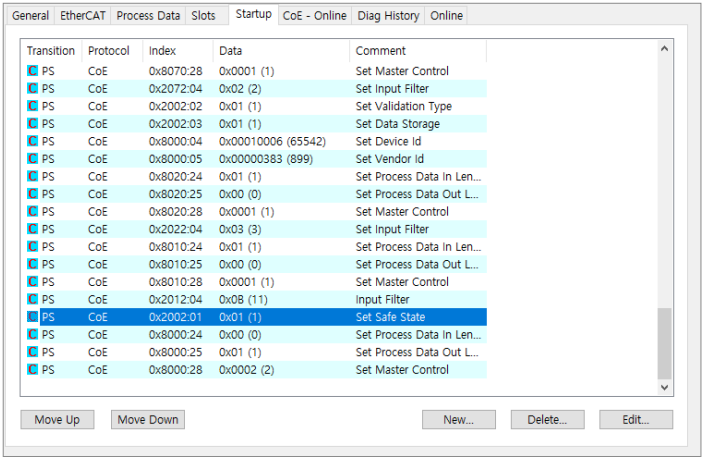


2. Let's set the Safe state value to 0x01 (1).
   ① Enter the binary value directly in the field of Data (hexbin).
   ② Select Safe state, and then enter a value in decimal or hexadecimal format in the Set Value Dialog window.





3. The value of Safe state is set to 1.



4. Select (Restart TwinCAT) or (Reload Device).
5. If the EtherCAT communication is interrupted, yellow LED on the no. 0 I/O port indicator of the port 0 lights up and the output state of Pin 4 is switched to High.

9.4. Validation

When the power is supplied, compare and verify a connected IO-Link device with a IO-Link device information (Vendor ID, Device ID) stored in the IO-Link Master.
The prerequisite condition for this function is that the operation mode of Pin 4 is the IO-Link.

The related object list: refer to
11.3, “Additional IO-Link Configuration Data (Pin 4) Ch. X”,
11.7, “IO-Link Information Data Ch. x”,
11.6, “IO-Link Configuration Data Ch. x”.

Validation Type

- 0x00 (0, No validation): Disabled
- 0x01 (1, TYPE COMP): Compare Vendor ID and Device ID and then start the IO-Link communication only if they are matched.

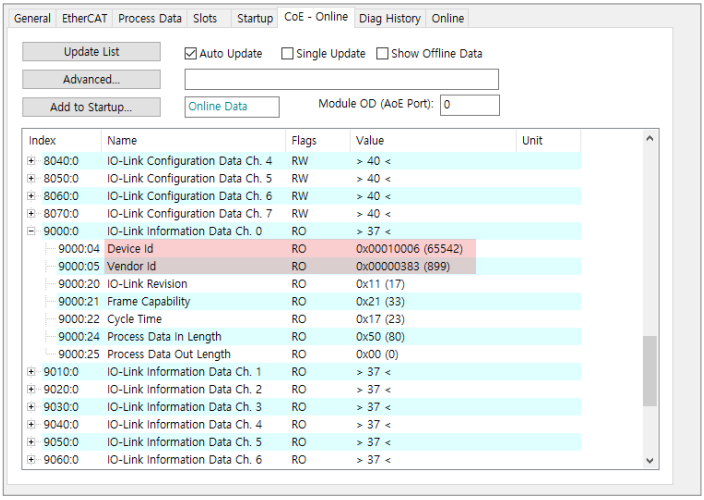
9.4.1. Before You Begin

- An IO-Link device is connected to the I/O port.
- The IO-Link module (IOL_I/O_x/_xbyte) is assigned to the slot (IO-Link Ch.0 to Ch.7) of the corresponding port.
- Check that the Online value of Status of IO-Link Port X is 3. (3: Port in communication OP)

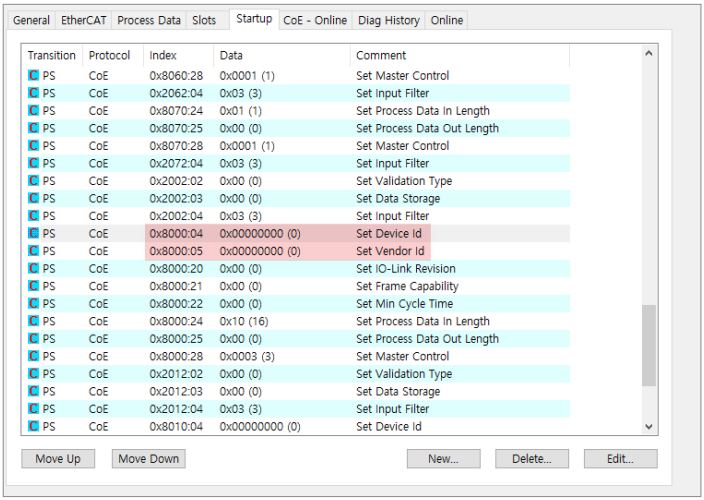
9.4.2. Setting Validation Type

The IO-Link device is connected to port 0.

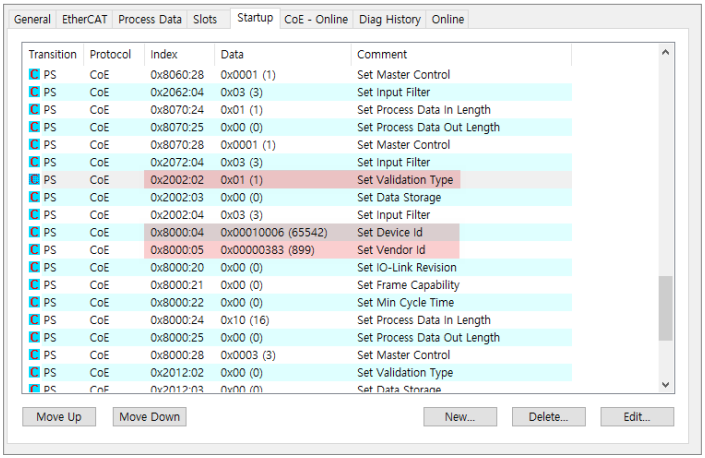
1. Check the Device Id and Vendor Id in the CoE-Online tab.



2. Open the Startup tab and check the Index of the port number.



3. Apply the information checked in the CoE-Online tab to Set Device Id and Set Vendor Id.
   Set the value of Set Validation Type to 1 (TYPE COMP).



4. Select (Restart TwinCAT) or (Reload Device).

5. If an IO-Link device with a different Device Id or Vendor Id is connected to port 0,
   ① 48 (invalid DID) or 64 (invalid VID) is displayed in the Online field of Status of IO-Link Port 0.

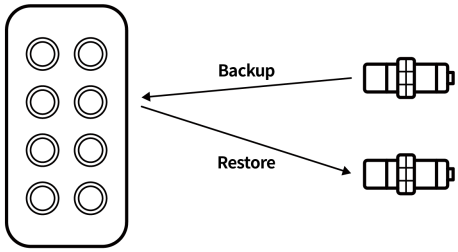
Name	Online	Type	Size	>Addr...	In/Out	Linked to
Status of IO-Link Port 0	48	USINT	1.0	39.0	Input	

Name	Online	Type	Size	>Addr...	In/Out	Linked to
Status of IO-Link Port 0	64	USINT	1.0	39.0	Input	

   ② Red LED blinks on the no. 0 I/O port indicator of the port 0.

9.5. Data Storage

The whole parameters of IO-Link device are stored/uploaded in the IO-Link Master (BACKUP), or apply/download last updated parameters to the compatible IO-Link device (RESTORE).
The prerequisite condition for this function is that Validation Type is set to 1 (TYPE COMP).



The related object list: refer to
11.3, “Additional IO-Link Configuration Data (Pin 4) Ch. X”,
11.5, “IO-Link Service Data Ch. x”,
11.7, “IO-Link Information Data Ch. x”,
11.6, “IO-Link Configuration Data Ch. x”.

Data storage

- 0x00 (0): DS DISABLE
- 0x01 (1): BACKUP/RESTORE
- 0x02 (2): RESTORE

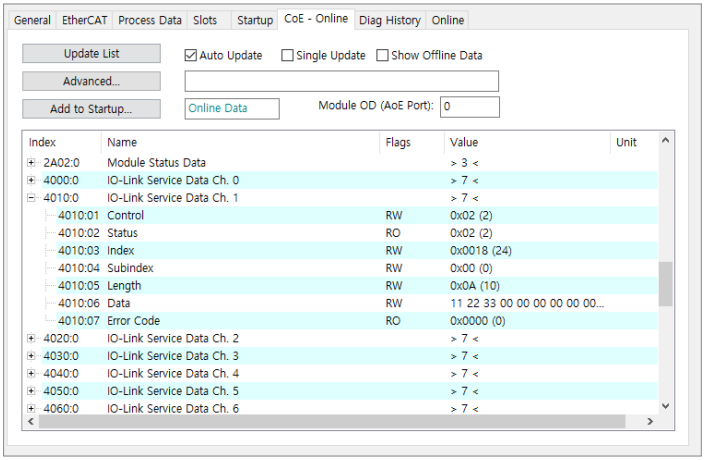
9.5.1. Before You Begin

- An IO-Link device is connected to the I/O port.
- The IO-Link module (IOL_I/O_x/_xbyte) is assigned to the slot (IO-Link Ch.0 to Ch.7) of the corresponding port.
- Check that the Online value of Status of IO-Link Port X is 3. (3: Port in communication OP)
- You can check the Index of the connected IO-Link device.
- The checkbox of **CoE-Online** » **Auto Update** is checked.

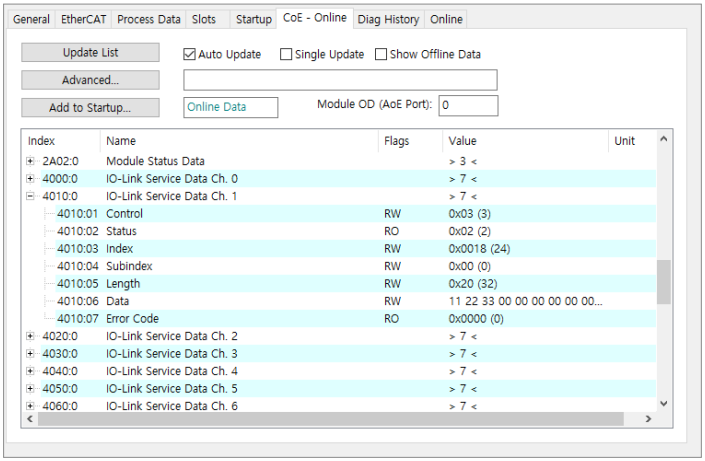
9.5.2. Setting Data Storage

Port 0: Used as the port for the data storage
Port 1: Accessing the parameters, refer to 8, Access ISDU Parameters.

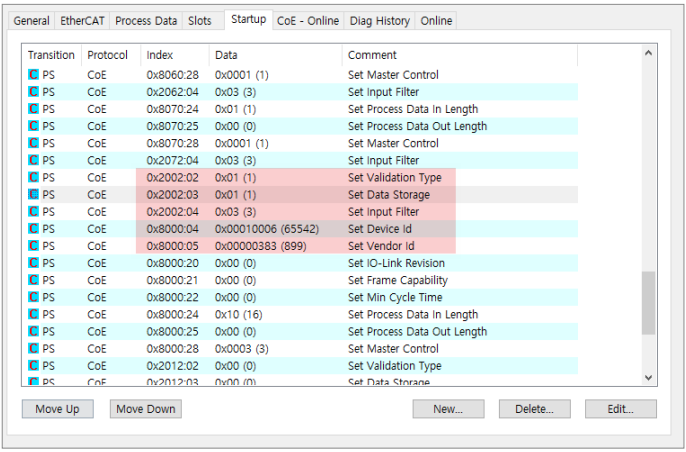
1. Check the information of the IO-Link device connected to port 1. Read parameters in the CoE-Online tab. In the figure below, the data is written as "11 22 33" for convenience.



2. Check the data is properly written by read-out the parameter.
   You can see that the write has been successfully applied in port 1.

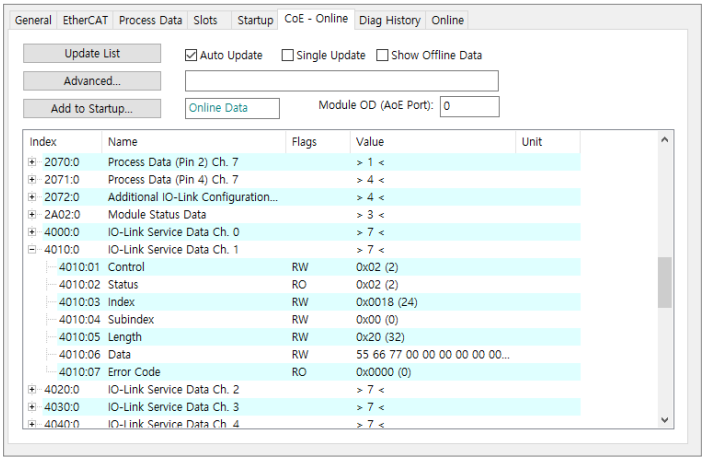


3. Open the Startup tab and check the index of port 0, and configure as below.
   - Set Device Id, Set Vendor Id: The same value as the IO-Link device of port 1
   - Set Validation Type: 1
   - Set Data Storage: 1

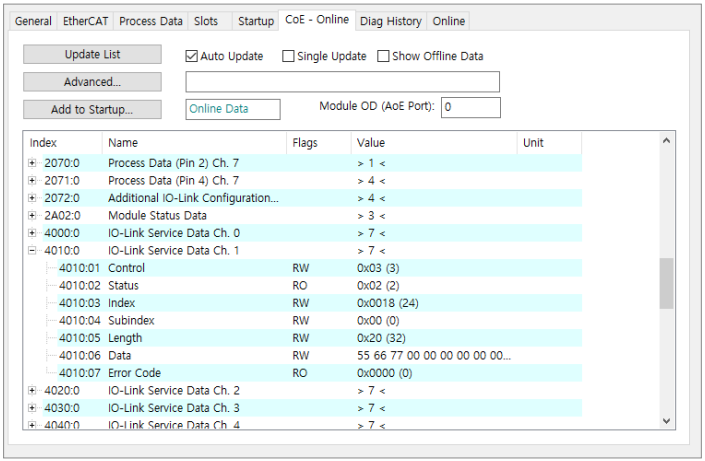


4. Select (Restart TwinCAT) or (Reload Device).
5. Disconnect the IO-Link device connected to port 1 for BACKUP.
6. Connect the previously disconnected IO-Link device to port 0 for more than 3 seconds.
7. Connect the IO-Link device to port 1 again.

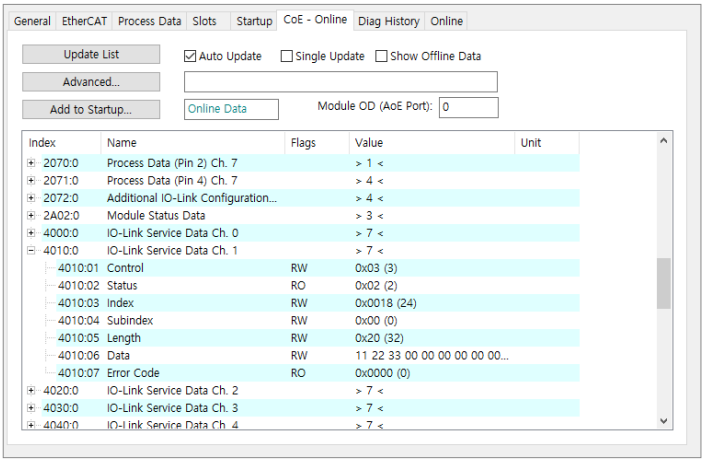
8. Change the data to check BACKUP/RESTORE.
   Write parameters in the CoE-Online tab. The changed value of data is "55 66 77".



9. Check the data by read-out the parameter. The write has been successfully applied.



10. Disconnect the IO-Link device connected to port 1 for RESTORE.
11. Connect the previously disconnected IO-Link device to port 0 for more than 3 seconds.
12. Connect the IO-Link device to port 1 again.
13. Read parameters in the CoE-Online tab.
    RESTORE is successfully completed since the data is "11 22 33".



Forced parameter backup of IO-Link device

1. Set Data storage to 1 (BACKUP/RESTORE).
2. Write 0x05 to Index 0x02 of the IO-Link device.

Clear data storage

Set as Validation Type: 1 and Data Storage: 0.

10. Replace the IO-Link Device

1. The parameter set of the new IO-Link device is factory settings.
2. The new IO-Link device has to support the IO-Link version 1.1 or higher.

1. Disconnect the IO-Link device from the IO-Link Master.
2. Connect the new IO-Link device to the same port.
3. Apply the parameter values stored in the memory of the IO-Link Master to the connected IO-Link device. For detailed information, refer to 9.5, “Data Storage”.

11. Object List

- The n in Index represents an I/O port. (n = 0 → Port 0, N = 1 → Port 1)
- RW: Read and Write
- RO: Read Only

11.1. Process Data (Pin 2) Ch. X

Index	Subindex	Name	Flags (Data type)	Value
0x20n0 (n: 0 to 7)	0x01	Input Pin 2	RO (BOOLEAN)	

11.2. Process Data (Pin 4) Ch. X

Index	Subindex	Name	Flags (Data type)	Value
0x20n1 (n: 0 to 7)	0x01	Actor short circuit Pin 4	RO (BOOLEAN)	
	0x02	Sensor supply short circuit	RO (BOOLEAN)	
	0x03	Input Pin 4	RO (BOOLEAN)	
	0x04	Output Pin 4	RO (BOOLEAN)	

11.3. Additional IO-Link Configuration Data (Pin 4) Ch. X

Index	Subindex	Name	Flags (Data type)	Value
0x20n2 (n: 0 to 7)	0x01	Safe State	RW (UINT8)	• 0x00: 0 • 0x01: 1 • 0x02: Last state
	0x02	Validation Type	RW (UINT8)	• 0: No validation • 1: Compatible (Vendor ID + Device ID)
	0x03	Data Storage	RW (UINT8)	• 0: DS DISABLE • 1: BACKUP/RESTORE • 2: RESTORE
	0x04	Input Filter	RW (UINT8)	• 0: No filter • 1: 250 us • 2: 500 us • 3: 1 ms (default) • 4: 2 ms • 5: 4 ms • 6: 8 ms • 7: 16 ms • 8: 32 ms • 9: 64 ms • 10: 128 ms • 11: 256 ms

11.4. Module Status Data

Index	Subindex	Name	Flags (Data type)	Value
0x2A02	0x01	US low	RO (BOOLEAN)	
	0x02	UA low	RO (BOOLEAN)	
	0x03	no UA	RO (BOOLEAN)	

11.5. IO-Link Service Data Ch. x

Index	Subindex	Name	Flags (Data type)	Value
0x40n0 (n: 0 to 7)	0x01	Control	RW (UINT8)	• 0: No control action • 2: Write • 3: Read
	0x02	Status	RO (UINT8)	• 0: No activity • 1: Busy • 2: Success • 4: Error • 0xFF: Failure
	0x03	Index	RW (UINT16)	
	0x04	Subindex	RW (UINT8)	
	0x05	Length	RW (UINT8)	
	0x06	Data	RW (UINT232)	
	0x07	Error Code	RO (UINT16)	

11.6. IO-Link Configuration Data Ch. x

Index	Subindex	Name	Flags (Data type)	Value
0x80n0 (n: 0 to 7)	0x04	Device Id	RW (UINT32)	
	0x05	Vendor Id	RW (UINT32)	
	0x20	IO-Link Revision	RW (UINT8)	
	0x21	Frame Capability	RW (UINT8)	
	0x22	Cycle Time	RW (UINT8)	
	0x24	Process Data In Length	RW (UINT8)	
	0x25	Process Data Out Length	RW (UINT8)	
	0x28	Master Control	RW (UINT16)	• 1: Standard Input • 2: Standard Output • 3: IO-Link Mode

11.7. IO-Link Information Data Ch. x

Index	Subindex	Name	Flags (Data type)	Value
0x90n0 (n: 0 to 7)	0x04	Device Id	RO (UINT32)	
	0x05	Vendor Id	RO (UINT32)	
	0x20	IO-Link Revision	RO (UINT8)	
	0x21	Frame Capability	RO (UINT8)	
	0x22	Cycle Time	RO (UINT8)	
	0x24	Process Data In Length	RO (UINT8)	
	0x25	Process Data Out Length	RO (UINT8)	

11.8. IO-Link Diagnosis Data Ch. x

Index	Subindex	Name	Flags (Data type)	Value
0xA0n0 (n: 0 to 7)	0x01	IO-Link State	RO (UINT8)	• Refer to the mapping.
	0x02	Lost Frames	RO (UINT8)	Number of lost frames

11.9. IO-Link Status Data Ch. x

Index	Subindex	Name	Flags (Data type)	Value
0xF100	0x01	Status of IO-Link Port 1	RO (UINT8)	• Refer to the mapping.
	0x02	Status of IO-Link Port 2	RO (UINT8)	
	0x03	Status of IO-Link Port 3	RO (UINT8)	
	0x04	Status of IO-Link Port 4	RO (UINT8)	
	0x05	Status of IO-Link Port 5	RO (UINT8)	
	0x06	Status of IO-Link Port 6	RO (UINT8)	
	0x07	Status of IO-Link Port 7	RO (UINT8)	
	0x08	Status of IO-Link Port 8	RO (UINT8)	

- Mapping: Status of IO-Link Port

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Error code				Port status			

- The Status of IO-Link mode

Port status			Error code		
Hex	Dec	Description	Hex	Dec	Description
0x_0	0	port disabled	0x1_	16	watchdog detected
0x_1	1	port in std dig in	0x2_	32	initial Error
0x_2	2	port in std dig out	0x3_	48	invalid Device ID
0x_3	3	port in communication OP	0x4_	64	invalid Vendor ID
0x_4	4	port in communication COMSTOP	0x5_	80	invalid IO-Link version
			0x6_	96	invalid Frame Capability
			0x7_	112	invalid Cycle Time
			0x8_	128	invalid PD in length
			0x9_	144	invalid PD out length
			0xA_	160	no device detected

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Dimensions or specifications on this manual are subject to change and some models may be discontinued without notice.

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