EMP-2848M Website User Manual

English Ver. 1.1, JUN. 2024

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service@icpdas.com, service.icpdas@gmail.com





SUPPORT

EMP-2848M

Revision History

Revision	Date	Description	Firmware Version
1.0	2024/04	• Web page interface update, modify the following instructions and images: 1. Web interface introduction figure. 2. Navigation area figure. 3. Offline configuration right-click menu figure. 4. Scanning slave instructions. 5. Configure the single-axis motion control right-click menu figure. 6. Software update instructions. 7. Quick start instructions. • Remove the Enable/Disable EtherCAT status area display button. • Rename the Build ENI File button to New ENI File button and explain the Append axes to motion control option in the dialog box. • ENI Merge button renamed ENI Update button. • EtherCAT network comparison table display format updated, modified network comparison table descriptions. • Add “Archive All” description to ENI file list right-click menu and update the right-click menu figure. • Add “Archive All” description to ESI file list right-click menu and update the right-click menu figure. • Remove Alias Mode and add ID Mode from slave addressing mode. • Remove the Configuration Alias information from the slave page and add the ID information. • Remove Configured Station Alias from slave page. • Add Set Slave ID description to the slave page. • Toolbar has been added to show the name of the last ENI file reloaded by the EtherCAT Runtime. • Toolbar add button to select ENI file and restart EtherCAT operation task. • Toolbar remove Import/Export buttons. • Added EtherCAT Category chapter. • Added OPC UA chapter.	• EtherCAT Web server, v1.0.1
1.0	2022/08	• Initial issue	• EtherCAT Web server, v1.0.0

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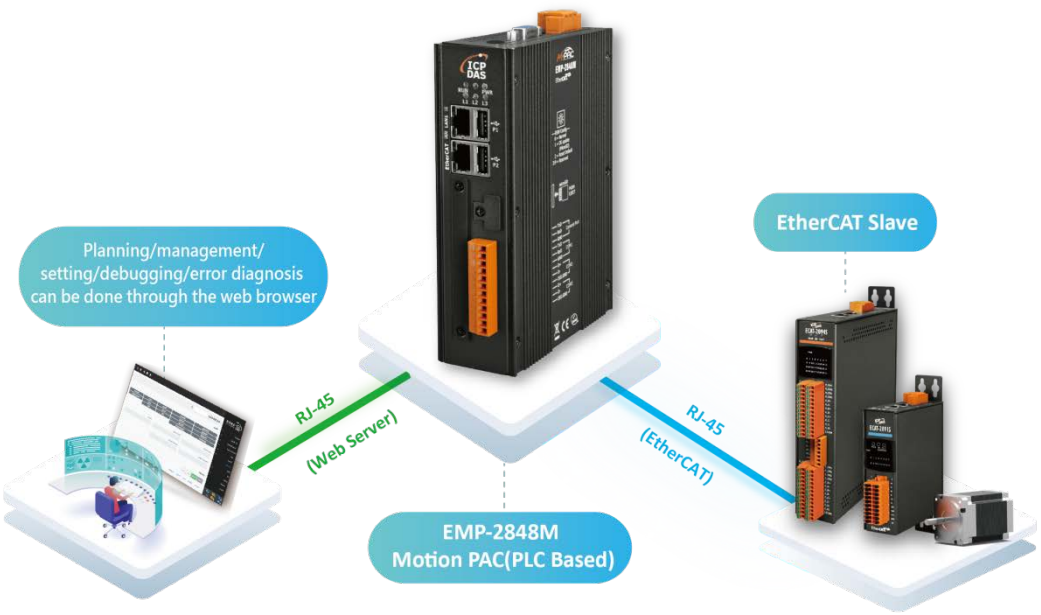
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1. Introduction

EMP-2848M is integrated with the web server which allows users to use a web browser to connect to the web server through the Ethernet network to configure EtherCAT ENI files. The ENI configuration file provides the parameters required for the initialization of EtherCAT Master Runtime, such as: master communication cycle, slave information, slave PDO Mapping, initialization parameters of the motion control axis, etc.

After the ENI file is configured and reloaded, the users can operate various functions on different working pages. For example: the EtherCAT packet diagnosis function can be performed to diagnose the packet on the master page. On the Slave page, the PDO and SDO functions can be performed; the slave module can also be configured on this page. The testing of motion control can be performed on the axis test page. And on the PLC operation page, the PLC task information (name, version, cycle time, cycle time status) can be accessed and the PLC Tasks (start, stop, pause, resume, delete) can be performed on this page. This manual will give detailed description of functions on each work page.



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2.Getting Started

2.1. Login into the webpage

Please complete the network settings of the PC before entering the webpage. The factory default settings of the hardware LAN network are as follows:

Factory Default		
Network Setting	IP (LAN1)	192.168.255.1
	Netmask	255.255.0.0
	Gateway	192.168.1.1

1. Change the network settings of the PC to the same network segment as the hardware, for example:

Network Setting	IP (LAN1)	192.168.255.10
	Netmask	255.255.0.0
	Gateway	192.168.1.1

2. Make sure the hardware and PC are properly connected to the network. Start the browser and type “http://192.168.255.1” in the address bar to enter the login page.

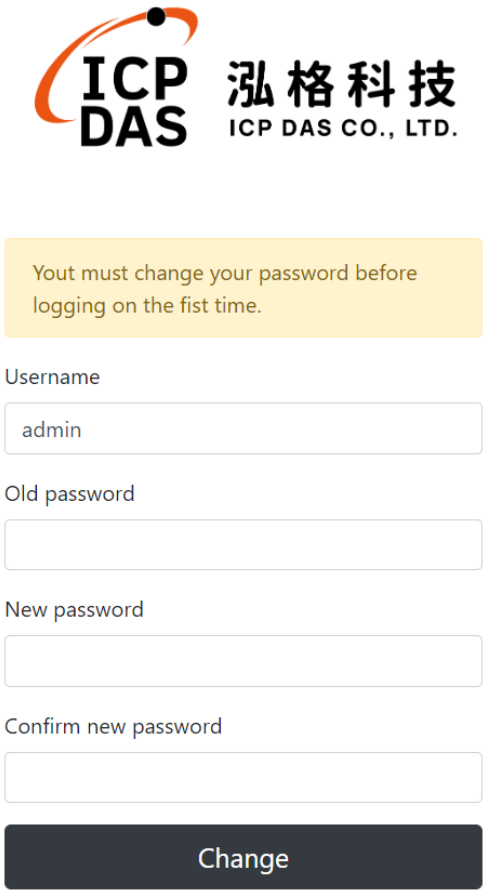
3. Enter the account and password on the login page, and click the "Login" button to log in.
   - Default account: admin
   - Default password: admin



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4. When using the default account and password to log in for the first time, the system will require the user to change the password. Please log in again after changing the password.



5. After logging into the webpage, change the hardware network settings according to the actual network environment. For detailed network setting, please refer to the section Network.

6. Users can also modify the network settings through the eSearch Utility software. For details, please refer to Appendix A. eSearch Tool Software.

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2.2. Web Interface Introduction

As shown in Figure 2-1, the web interface consists of the following parts:

1. Toolbar
2. Navigation area
3. Workspace
4. EtherCAT Status Area
5. Error/Message Notification Box

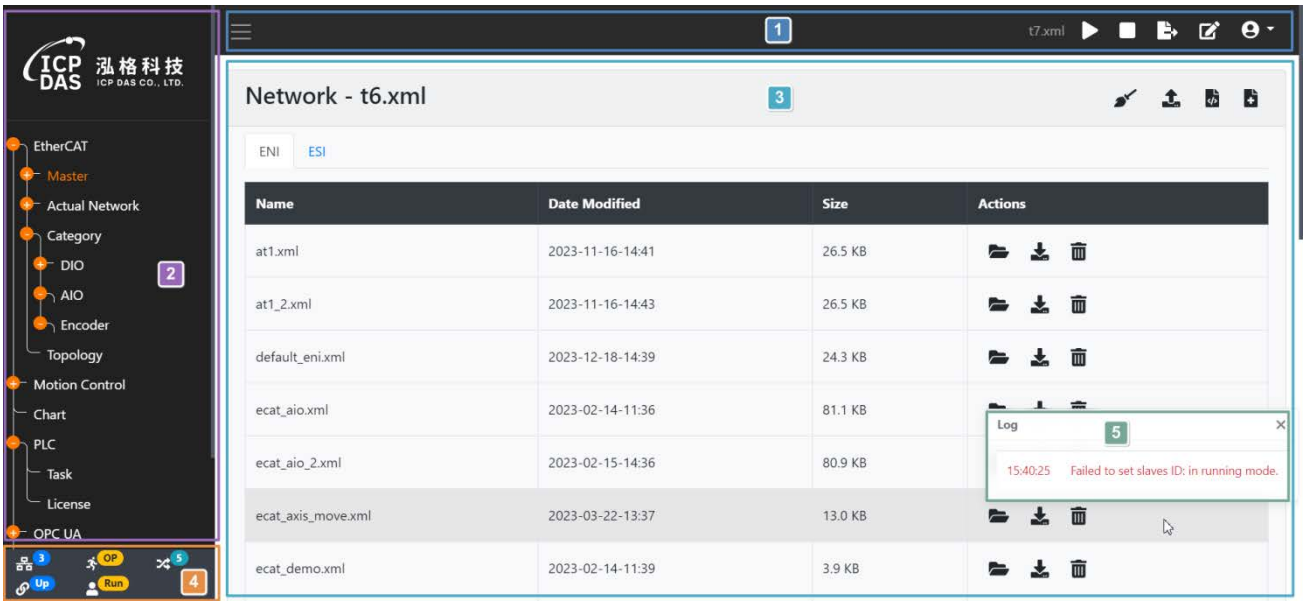


Figure 2-1

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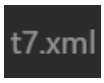
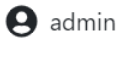
2.2.1. Toolbar

The toolbar (shown as Figure 2-2) is always displayed at the top of the web interface.



Figure 2-2

The toolbar has the following controls:

-  - Show/Hide “Navigation area” button.
-  - Display the file name of the last reloaded ENI on EtherCAT Runtime.
-  - Start the EtherCAT operation task button.
-  - Stop EtherCAT operation task button.
-  - Select ENI file and restart EtherCAT operation task button. When you click this button, the following dialog box will appear, you can select the ENI file to be reloaded by the EtherCAT Runtime, clicking "OK" will reload the selected ENI file and restart the EtherCAT task, before restarting the EtherCAT task, the Win-GRAF Runtime program will be stopped to make sure that it will not cause any unexpected results.
-  - Save settings button, after completing the settings in the work area, click this button to submit and save the settings
-  - Account drop down menu.
  -  - Login account name.
  -  - To change the password, please refer to the section: Account Settings for detailed information.
  -  - Log out of account.

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2.2.2. Navigation Area

The Navigation Area is shown in Figure 2-3, which is located on the left side of the web interface. You can use the toolbar "Show/Hide Navigation Area Button" to display and hide it. The default is the display state. The main purpose of the Navigation Area is to switch the workspace to different work pages.

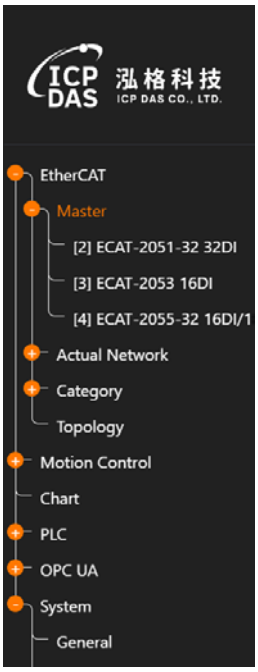


Figure 2-3

The following work pages are accessible:

- EtherCAT->Master
  The user can create a new ENI file or open a previously saved ENI file for editing on this page. Please refer to section EtherCAT Master for detailed information.

- EtherCAT->Slave
  This page can perform DC, PDO Mapping settings and other advanced operations for the configured slave modules. Please refer to section EtherCAT Slave for further instructions.

- EtherCAT->Actual Network->Slave
  The Slave node will appear after the EtherCAT network is scanned and find there are slave modules connected. This page will show the information of connected slave modules and operations of SDO and FoE. Please refer to section EtherCAT Actual Slave for more detailed information.

- Motion Control->Axes->Axis
  Users can initialize parameter settings such as: axis type, PPU, maximum speed, maximum acceleration, etc. for axes that have been configured with motion control

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functions on this page. Please refer to section Motion Control Axis for detailed information.

- Motion Control->Axis Test
  After the motion control function is configured and starting the EtherCAT operation task, the users can perform single-axis motion control test on this page. Please refer to section Motion Control Axis Test for detailed information.

- Chart
  After the EtherCAT task is operated, a trend graph of variables over time can be draw on this page. The variables can be PDO variables or motion control variables. Please refer to the section Chart for detailed information.

- PLC->Task
  This page displays information of PLC control tasks (name, version, cycle time, cycle time status, etc.) and can perform operations of control tasks (start, stop, pause, resume, delete, etc.). Please refer to section PLC Task for detailed information.

- PLC->License
  This page displays the authorization status and activation of the PLC Runtime. Please refer to section PLC License for detailed information.

- System->General
  The user can set system parameters such as: host name, network settings, date & time, software updates, etc. on this page. Please refer to section System General for detailed information.

- System->Service
  The user can manually control the start or stop of EtherCAT Runtime and PLC Runtime on this page. It can also display various log information. Please refer to section System Service for detailed information.

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2.2.3. Workspace

The workspace is located at the right side of the web interface; it will display the work page the user selected from the Navigation area. The content of the work page is composed of multiple card content container as shown in Figure 2-4, each card represents a function, and these functions can be status, parameter setting or operations of functions.



Figure 2-4

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2.2.4. EtherCAT Status

The EtherCAT status area is shown in Figure 2-5. It is located at the bottom of the left side of the web interface. EtherCAT status will be displayed or hidden along with navigation area, it will display statuses of EtherCAT operation tasks.



Figure 2-5

The status area includes the following information:

-  - The actual number of connected slave modules.

-  - EtherCAT AL Status. Display the AL status of all slave modules, this is a composite display. For example, if the status is OP, it indicates that all slave stations are in Operational State. If the status is P, S, it indicates that there are some slave stations are in Pre-Operational State, and some slave stations are in Safe-Operational State.
  - Init - Init State
  - Pre - Pre-Operational State
  - Safe - Safe-Operational State
  - OP - Operational State
  - I,S - Init, Safe-Operational State
  - P,S - Pre-Operational, Safe-Operational State
  - I,P,S - Init, Pre-Operational, Safe-Operational State
  - I,O – Init, Operational State
  - P,O - Pre-Operational, Operational State
  - I,P,O - Init, Pre-Operational, Operational State
  - S,O - Safe-Operational, Operational State
  - I,S,O - Init, Safe-Operational, Operational State
  - P,S,O - Pre-Operational, Safe-Operational, Operational State
  - I,P,S,O - Init, Pre-Operational, Safe-Operational, Operational State

-  - Workings Counter status.

-  - EtherCAT socket connection status.
  Up: Connecting.
  Down: disconnected.

-  - EtherCAT Runtime operation task status.
  Edit: The operation task is stopped, and is in editing mode.
  Run: The operation task is running.

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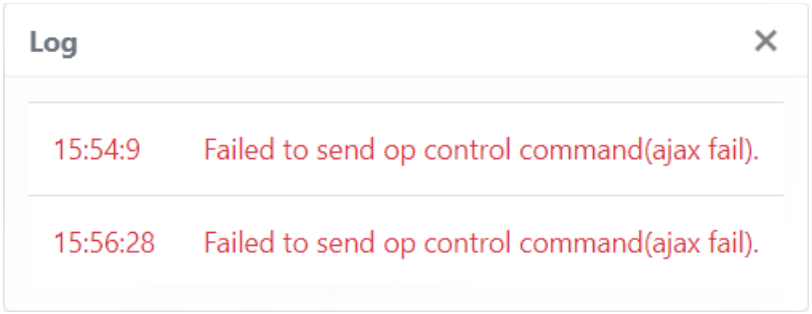
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2.2.5. Error / Message Notification Box

The error/message notification box usually will not appear on the web interface, it only pops up when there is an error or message requires to be notified to the user. Notification boxes includes the following types:

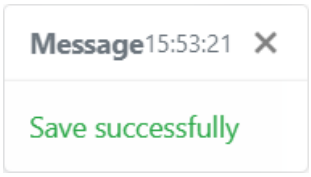
- Error notification box

  When an error occurs during the operation of web interface, this notification box will pop up and inform the user of the detailed error message. The notification box will appear on the web interface, and the last error message will be added to the list and will not be cleared until the user closes the notification box.



- Message notification box

  The message notification box will notify the user whether the operations on the web interface is successful or not and will prompt additional information if required. After the notification box pops up, it will appear for 3 seconds, and will automatically close after 3 seconds.



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3.EtherCAT Master

This working page can be used to open and create an ENI file, and set the initial parameters of the master station before starting the EtherCAT operation task. The following will explain the function of each card.

3.1. ENI/ESI Editor

The ENI/ESI editor is shown in Figure 3-1. The user can open or create an ENI file here, and upload/download/delete ENI and ESI files on this page. The "ENI", "ESI" tabs can be used to switch between different editors.



Figure 3-1

3.1.1. ENI Editor

The left half of the card title displays the name of the currently opened ENI file, as shown in Figure 3-2, and the right half is the function buttons, the functions are as follows:

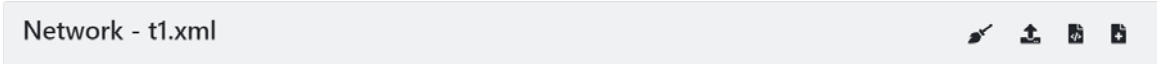


Figure 3-2

-  - Upload ENI file
-  - New ENI file. Click this button and the dialog box shown in Figure 3-3 will appear. If the “Append actual network” is checked, it will scan the actually connected slave module and automatically create the ENI file content from the ESI. If the “Append actual network” is unchecked, an empty ENI file will be created. When Append axes to motion control is checked, the motion control axes will be created automatically according to the connection sequence if the actual connected slave is CiA402 motion control module. Input the file name and press OK to create a new ENI file. If the file name already exists, a warning message will appear under the dialog box and Replace button will appear, as shown in Figure 3-4. Click Replace button to overwrite the old file. If you don’t want to overwrite the old file, change the file name and press the OK button to save the new file.

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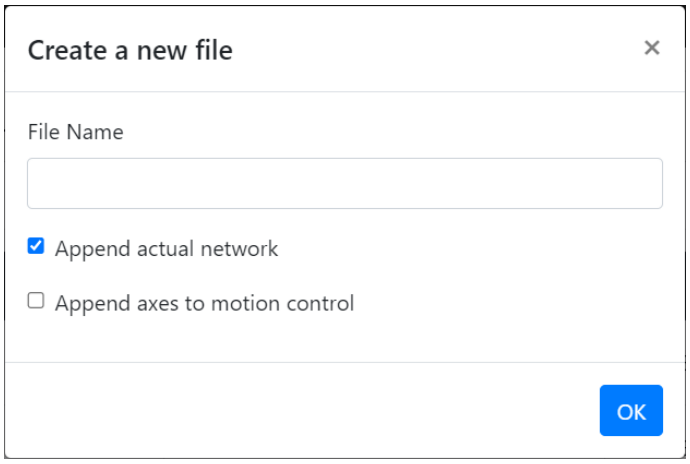


Figure 3-3

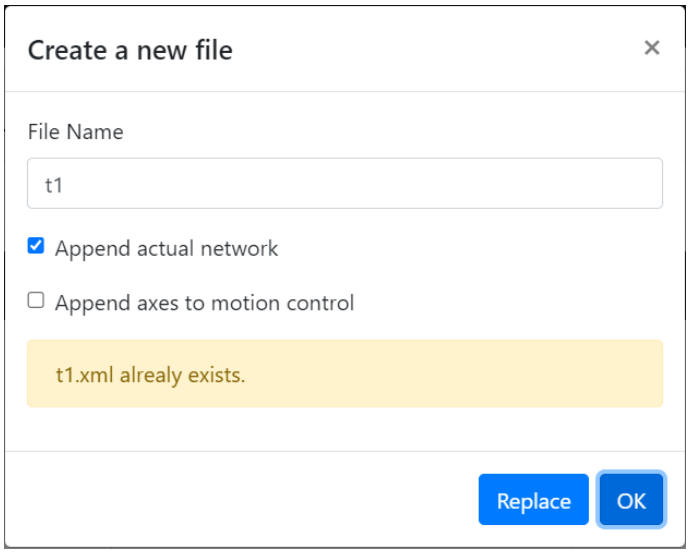
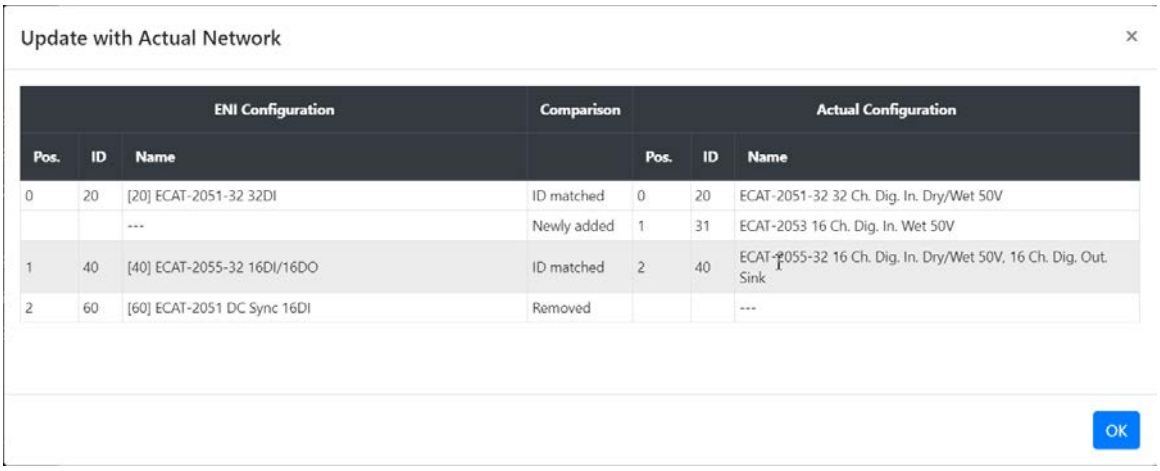


Figure 3-4

-  - Update ENI file. When the EN file is opened, if there are newly added or disconnected slave modules, the update function can be used for comparisons. The module with the same setting value will be kept and the one with different values will be added or deleted. Click the update ENI file, the following dialog box will be shown as bellow, and the descriptions of the fields in the comparison table are as follows:

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Field		Description
ENI Configuration	Pos.	Slave configuration position in ENI file.
	ID	Slave configuration ID in ENI file.
	Name	Slave name in ENI file.
Comparison		The comparison results are defined as follows:

Result	Description
ID matched	The comparison result is the same, so the set value is kept.
Not matched	The comparison result is not the same.
Newly added	There is no configuration setting in the ENI file but there is a slave module actually connected, new configuration settings will be added.
Removed	There are configuration settings in the ENI file but there is no slave module actually connected, the configuration settings will be deleted.

Actual Configuration	Pos.	Actual slave connection position.
	ID	Actual slave ID.
	Name	Actual slave name.

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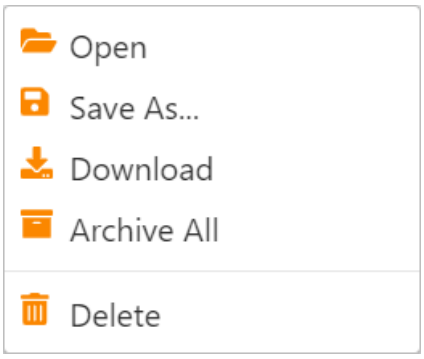
The content under the "ENI" tab is the list of established ENI files, as shown in the figure below, each field indicates the name, modification date, size and function buttons.



The function buttons are as follows:

-  - Open the ENI.
-  - Download ENI file.
-  - Delete ENI file.

The right-click menu is shown below.



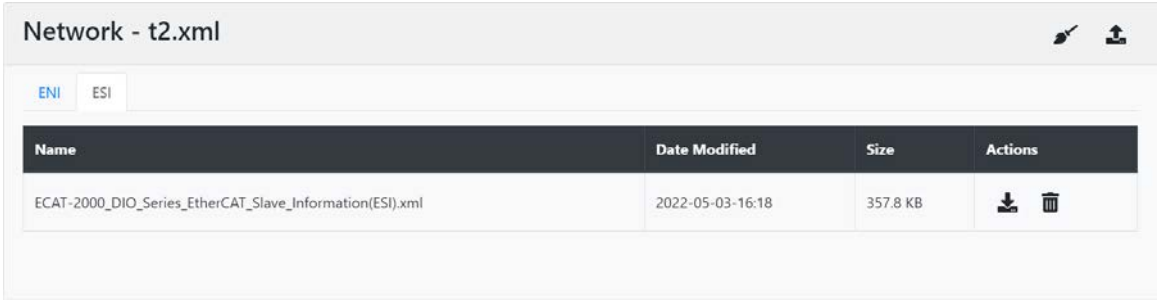
- Open: Open ENI file.
- Save As...: Save as ENI file.
- Download: Download as ENI file.
- Archive All: Compress all ENI files into zip archive.
- Delete: Delete ENI file.

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3.1.2. ESI Editor

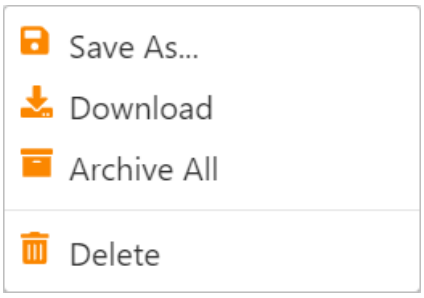
The content under the "ESI" tab is the list of ESI files, as shown in the figure below, each field indicates the name, modification date, size and function buttons.



The function buttons on the right hand side of the list are as follows:

-  - Upload ESI file.
-  - Download ESI file.
-  - Delete ESI file.

The right-click menu is shown below.



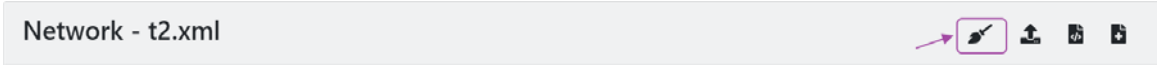
- Save As...: Save as ESI file.
- Download: Download as ESI file.
- Archive All: Compress all ESI files into zip archive.
- Delete: Delete ESI file.

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3.1.3. Reset EtherCAT Errors

As shown in the figure below, this button is located in the function buttons of the card title. When an EtherCAT operation task is started, the button can be clicked to reset the errors if the errors states are set to be kept (for example: Working Counter error).



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3.2. Settings

The initialization parameters of the master station are shown in Figure 3-5; they can be set after starting or creating an ENI file. When starting the EtherCAT operation task, the parameters can be initialized according to the settings. The description of each parameter is as follows:

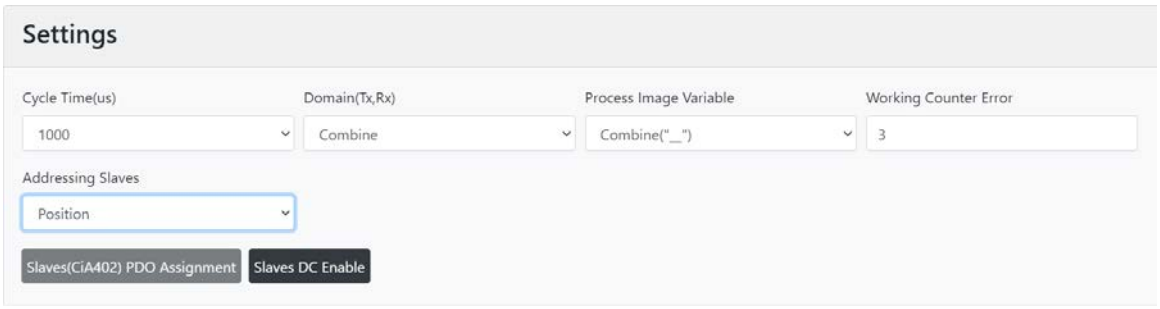


Figure 3-5

- Cycle Time(us)
  EtherCAT operation task communication cycle, in microseconds.

- Domain(Tx,Rx)
  The Domain type of TX/RX data can be set as follows:
  - Combine:
    Combined type, TX/RX data are in the same Domain, EtherCAT Datagram is packaged by LRW command during communication.
  - Separate:
    Separated type, TX/RX data are separated in separate Domain, EtherCAT Datagram uses LRD/LWR command to pack TX/RX data separately during communication.

- Process Image Variable
  Process Image variable type, the values to be set are as follows:
  - Individual:
    Independent type, each variable is generated according to the item (Entry) of the PDO Mapping, and no more parent variable will be generated when the name has a double bottom line "__", as shown in the following figure.

Status__Latch extern valid	BOOL	1	49	0
Status__Set counter done	BOOL	1	50	0
Status__Counter underflow	BOOL	1	51	0
Status__Counter overflow	BOOL	1	52	0
Status__Status of extern latch	BOOL	1	60	0
Status__Sync error	BOOL	1	61	0
Status__TxPDO Toggle	BOOL	1	63	0

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- Combine("__"):

  In the combine type, each variable is generated according to the item (Entry) of the PDO Mapping. When the name has a double bottom line "__", a parent variable will be generated, as shown in the following figure.



▾ Status	UINT	16	48	0
Latch extern valid	BOOL	1	49	0
Set counter done	BOOL	1	50	0
Counter underflow	BOOL	1	51	0
Counter overflow	BOOL	1	52	0
Status of extern latch	BOOL	1	60	0
Sync error	BOOL	1	61	0
TxPDO Toggle	BOOL	1	63	0

- Working Counter Error

  The number of working counter errors. When the set value is greater than zero, the error flag will be set to true when the number of consecutive errors of the Working Counter is greater than or equal to the set value. It can be cleared by the "Reset EtherCAT Errors". When the set value is equal to zero, the error flag is set to true when the Working Counter is invalid and false when the Working Counter is correct.

- Addressing Slaves

  Slave addressing mode, the values to be set are as follows:

  - Position

    The EtherCAT operation task is addressed according to the connection location when editing.

  - ID

    The EtherCAT operation tasks is addressed according to the ID value.

- Slaves(CiA402) PDO Assignment button

  All CiA402 slave modules perform automatic PDO assignment. Please refer to the information in section regarding CiA402 PDO Assignment.

- Slaves DC Enable button

  Set all slave modules to “Enable DC”, if the slave modules support this function, it will be automatically set to enable.

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3.3. Process Image

Process Image variable operation is shown in Figure 3-6. When starting an EtherCAT operation task, use the Inputs/Outputs tab to switch the variable list to read and write the variables. The function buttons feature the following functions:

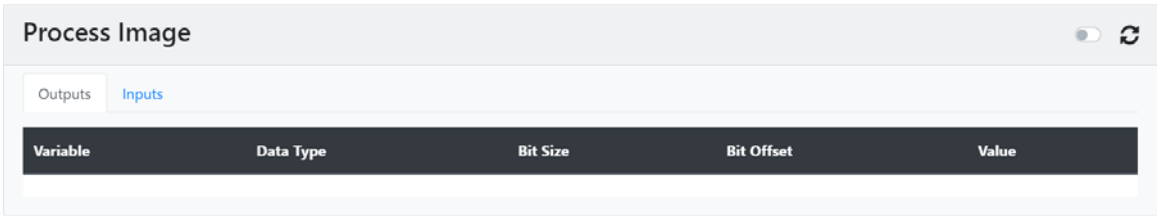


Figure 3-6

-  - Enable/Disable the automatic update of all variable values.
-  - Manually update all variable values.

Each fields of the Outputs/Inputs variable form are as follows:

- Variable
  The name of the variable.
- Data Type
  The data type of the variable.
- Bit Size
  The size of the variable (in bits).
- Bit Offset
  The offset of the variable in the Process Image (in bits).
- Value
  The content value of the variable

Process Image variables are described as follows:

- Outputs
  Currently no variables are defined. The function is reserved.
- Inputs
  - Status
    - Error - error status flag
      - Run Mode - currently is in edit mode

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- Link Down – disconnection error
- OP - error of all slaves do not enter OP state
- WC - Working Counter error
- Cycle Exceed - Communication cycle timeout error
- Slave - Slave error
- Network - Slave communication error

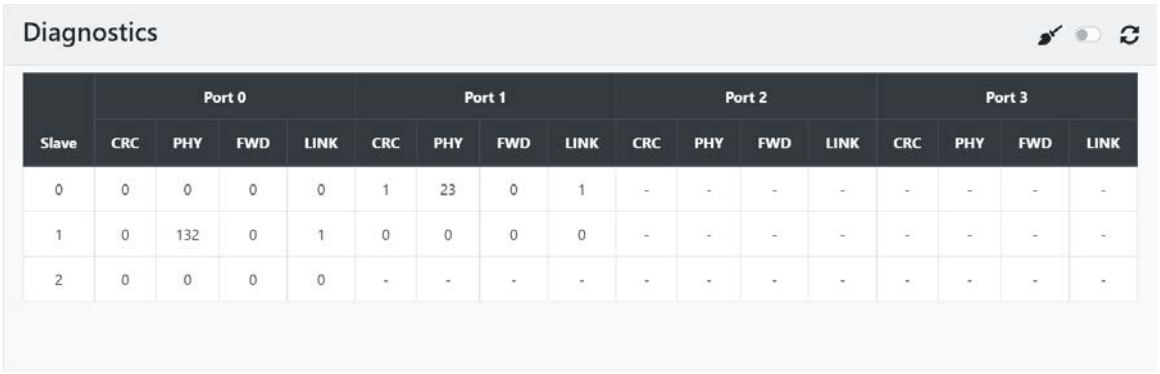
- Slave Count - the number of slaves configured in the ENI file

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3.4. Diagnostics

The EtherCAT packet diagnosis function (shown in Figure 3-7) can obtain the count of errors when EtherCAT packet pass through the 4 ports of the slave module. The function buttons are as follows:



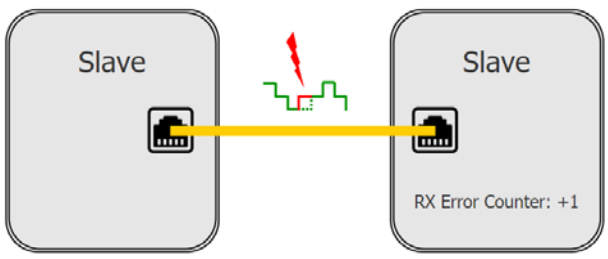
	Port 0				Port 1				Port 2				Port 3			
Slave	CRC	PHY	FWD	LINK	CRC	PHY	FWD	LINK	CRC	PHY	FWD	LINK	CRC	PHY	FWD	LINK
0	0	0	0	0	1	23	0	1	-	-	-	-	-	-	-	-
1	0	132	0	1	0	0	0	0	-	-	-	-	-	-	-	-
2	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3-7

-  - Clear counter.
-  - Enable/Stop auto update counter.
-  - Update counter.

The description of error counters are as follows:

- CRC - Frame Error Counter (0x0300, 0x0302, 0x0304, 0x0306)
- PHY - Physical Layer Error Counter (0x0301, 0x0303, 0x0305, 0x0307)
  The 2 counters are generally called as the RX error counter. The change of the RX error counter indicates that the received hardware signal is corrupted, and its carried data will be discarded.



Most likely reasons for signal corruption are:

- External EMC disturbances (usually sporadic counter increment)

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- Damaged devices or interconnections (usually fast and systematic
- counter increment)

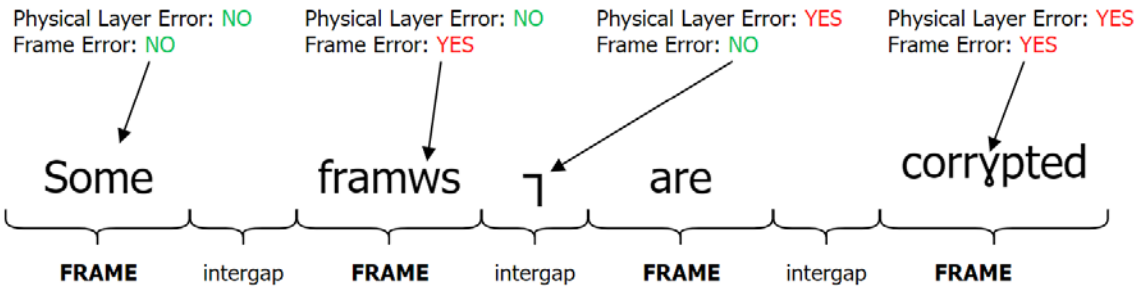
Physical Layer Error:

- Correspond to individual invalid symbols
- Can occur both within and outside frames (when occurring within frames, they represent usually also Frame Errors)

Frame Error:

- Correspond to frames whose overall bit sequence was corrupted
- Can occur only within frames

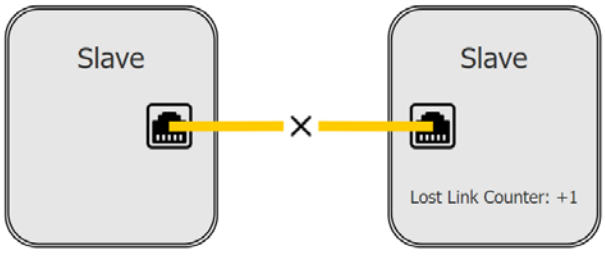
The difference between the two error types can be explained taking a written language as comparison:



- FWD - Forwarded RX Error Counter (0x0308:0x030D)
  The previous device ESC detected an invalid frame and forwarded to this device.

- LINK - Lost Link Counter (0x0310:0x0313)
  An increment in a Lost Link Counter indicates an interruption in the hardware communication channel, during link down frames are not send to the neighboring device.

  Most likely reasons for link loss are:
  - Temporary or permanent device power-supply loss, or device reset
  - Damaged cables or connectors or poor/oxidized contacts
  - EMC disturbances

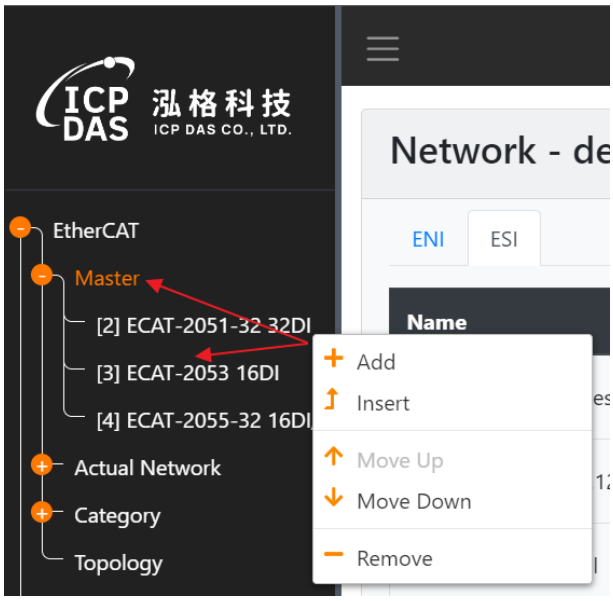


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3.5. Offline Configuration

Offline configuration can manually add the slave configuration to the ENI file. First open or create an empty ENI file, and right-click the EtherCAT->Master or EtherCAT->Slave node in the work navigation area (as shown in the figure below). Bring up the right-click menu to perform offline configuration.



The right-click menu functions are as follows:

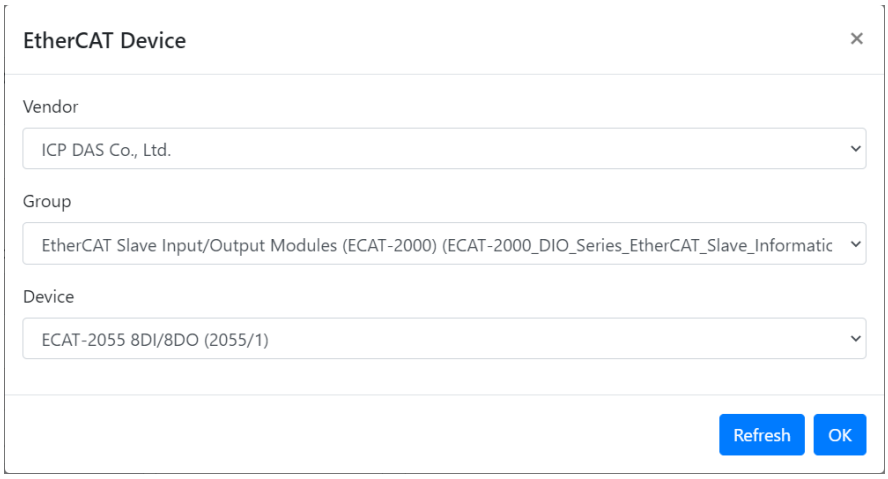
-  - Adding a new slave configuration. The new configuration will be added under the currently selected slave node.

-  - Inserting a new slave configuration. The new configuration will be added above the currently selected slave node.

  After clicking the Add or Insert option, the following dialog box will pop up. According to the supplier and group, select the slave module to be added and click “OK”. It will read all uploaded ESI files and classify them according to vendors, groups, and devices. Therefore, it will take more time to analyze when loading for the first time.

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The parameters of the dialog box are as follows:

- Vendor

  List of vendors of the slave stations.

- Group

  List of device groups under the vendors of the slave stations.

- Device

  List of devices under the groups of the vendors in the slave stations.

- Refresh button

  Update vendors, groups and devices list. After the dialog box is classified for the first time, these classification results will be kept, and it will be used directly when the dialog box is brought up next time without reading all the contents of the ESI file again, saving the time for reading the classification. But if the ESI file is uploaded again after the first reading of the classification, the user can click this button to read and classify it again.

-  - Moves up the currently selected slave configuration.

-  - Moves down the currently selected slave configuration.

- - Delete the currently selected slave configuration.

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4.EtherCAT Slave

After the ENI file is created, the users can perform configuration of Slave initialization parameters when starting the EtherCAT operation task and the operations of the Slave when performing EtherCAT operation task on this page. The functions of each card is as follow.

4.1. Information

As shown in Figure 4-1, the configuration information of the slave will be displayed, and the function buttons are as follows:

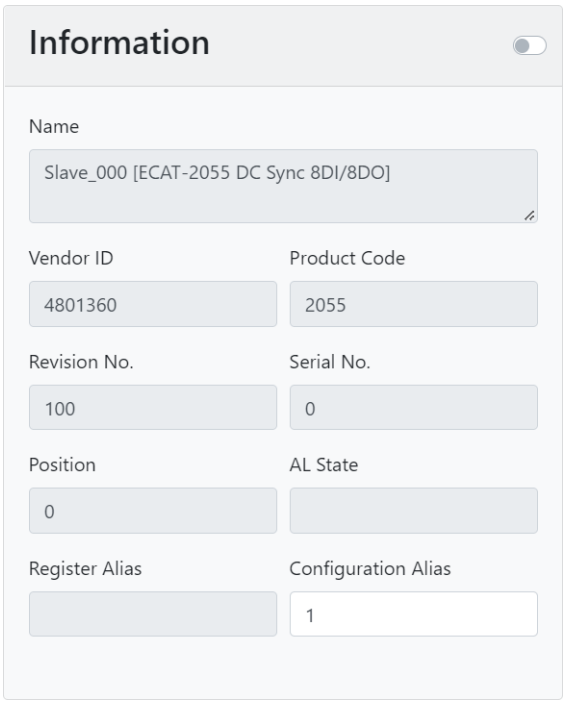


Figure 4-1

-  - Display online slave information.

The slave station information is as follows:

- Name
  The name of the slave.

- Vendor ID
  The vendor ID of the slave.
- Product Code
  Product code of the slave.

- Revision No.

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The revision number of the slave.

- Serial No.
  The serial number of the slave.

- Position
  The configuration position or actual connection position of the slave.

- AL State
  AL status of the slave. The states are defined as follows:
  Init - Init State
  Pre - Pre-Operational State
  Boot - Bootstrap State
  Safe - Safe-Operational State
  OP - Operational State

- Register Alias
  Alias address of Slave Register (0x0012:0x0013).

- ID
  ENI file configuration ID value.

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4.2. DC

As shown in Figure 4-2, the DC parameter can be set to DC or non-DC operation mode. The operation mode is directly read from the ESI file and initialized according to the options set by the user when the EtherCAT operation task is started. Please refer to the manuals of each slave station for detailed information.

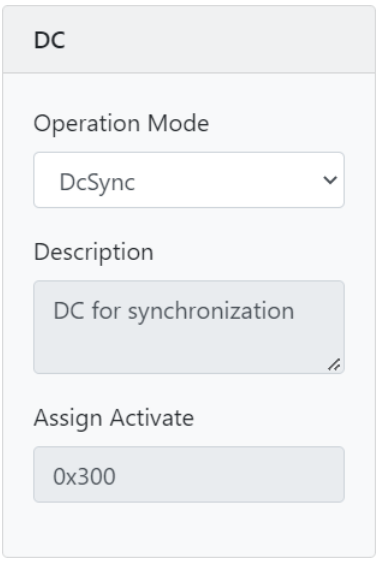


Figure 4-2

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4.3. Process Data

The process data (Process Data Objects, PDOs) transferred by an EtherCAT slave during each cycle are user data which the application expects to be updated cyclically or which are sent to the slave. The configuration of process data includes Sync Manager, PDO Assignment, PDO List, Entry List form and Predefined PDO Assignment selection list, CiA402 PDO Assignment, as shown in Figure 4-3, Please refer to the following information:

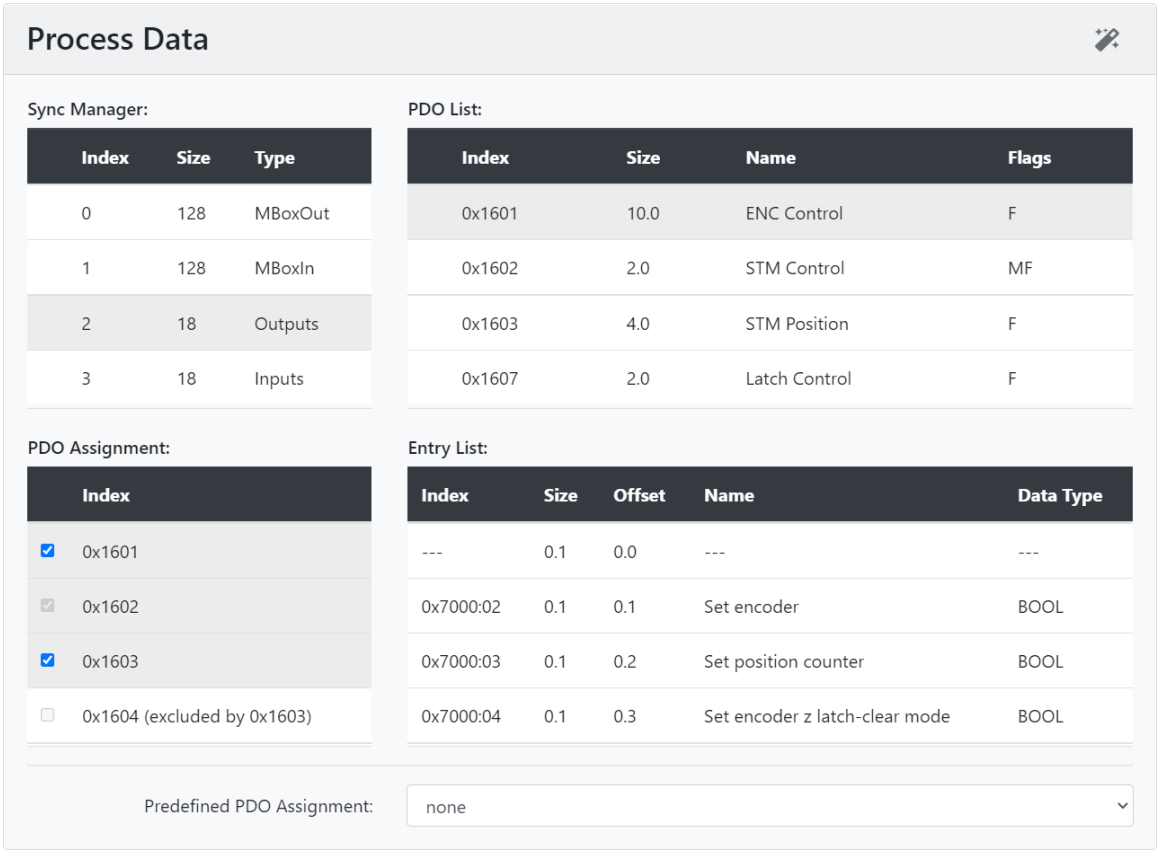


Figure 4-3

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4.3.1. Sync Manager

This form lists the configuration of the Sync Manager (SM) as shown in the figure below, if the slave has Mailbox communication, SM0 is used for Mailbox output (MBoxOut) and SM1 is used for Mailbox input (MBoxIn). If the slave has PDO communication, SM2 is used for process data output (Outputs) and SM3 is used for process data input (Inputs). The Size column in the form displays the size of the Sync Manager in bytes. If an item is selected, the corresponding PDO assignment will be displayed in the "PDO Assignment" form.

Index	Size	Type
0	128	MBoxOut
1	128	MBoxIn
2	18	Outputs
3	18	Inputs

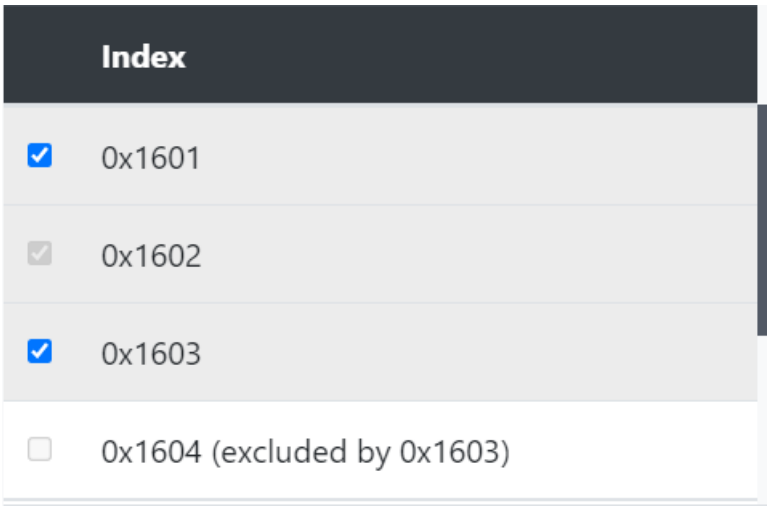
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4.3.2. PDO Assignment

This form lists all PDO assignments of the selected Sync Manager, as shown in the figure below. If the selected type is Outputs in the Sync Manager form, all RxPDOs will be displayed. If the selected type is Inputs selected in the Sync Manager form, all TxPDOs will be displayed.

Items with a check mark indicates the list of PDOs that will participate in the PDO transmission. These PDO lists will be displayed as variables in the "Process Image" form. The name of the variable is the same as the Name of "PDO List". If the item in the PDO Assignment form cannot be checked and “(excluded by xxxx)”is displayed after the item, it means that the item is excluded and disabled by an item. To enable the check, you must uncheck the item xxxx (during the “excluded by xxxx”). However, if the item is grayed out and checked, it means that this item is a mandatory item and is designed to must-assign item in the slave station.



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4.3.3. PDO List

This form lists the details of all PDO assignments for the selected Sync Manager. Each field are as follows:

Index	Size	Name	Flags
0x1601	10.0	ENC Control	F
0x1602	2.0	STM Control	MF
0x1603	4.0	STM Position	F
0x1607	2.0	Latch Control	F

- Index
  PDO index.

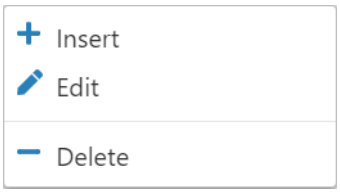
- Size
  Size of the PDO in bytes.

- Name
  Name of the PDO.

- Flags
  F: Fixed content. The content of this PDO is fixed, and the content of PDO Entry cannot be added or changed.

  M: Mandatory PDO. This PDO is mandatory, so it must be assigned to the Sync Manager, so you cannot delete this PDO from the PDO assignment form.

As shown in the figure below, you can edit the PDO configuration by right click on the mouse on the form to bring up the right-click menu. The functions to be edited are as follows:

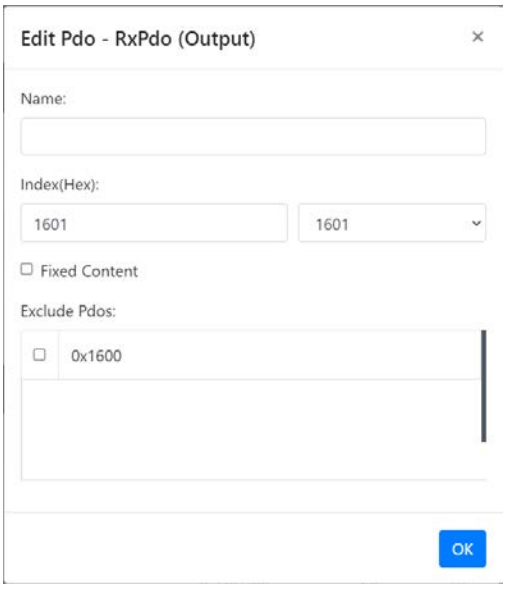


- + - Added new PDO configuration.

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- - Edit the currently selected PDO configuration.
  After clicking the Add and Edit options, the following dialog box will pop up. The parameters of the dialog box are as follows:



  - Name
    Name of the PDO.

  - Index(Hex)
    PDO index. You can manually input the hexadecimal index value in the text box or select a PDO index value from the dropdown list to automatically bring the value into the text box.

  - Fixed Content
    Enable or disable PDO fixed content.

  - Exclude Pdos
    Set the PDO items that need to be disabled when this PDO is selected.

- - Delete the currently selected PDO configuration.

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4.3.4. Entry List

This form lists the Entry configuration content of the selected PDO list item. Each field is as follows:

Index	Size	Offset	Name	Data Type
---	0.1	0.0	---	---
0x7000:02	0.1	0.1	Set encoder	BOOL
0x7000:03	0.1	0.2	Set position counter	BOOL
0x7000:04	0.1	0.3	Set encoder z latch-clear mode	BOOL

- Index
  The Index and SubIndex of the object, presented as "Index: SubIndex".

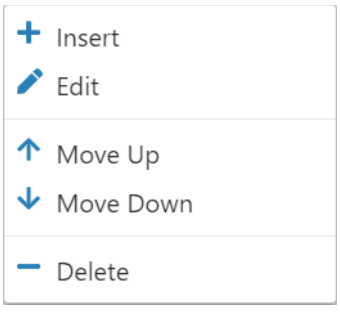
- Size
  The size of the object in bytes. "0.1" means a size of one bit.

- Offset
  The offset of the object in the PDO configuration, in bytes. "0.1" means an offset of one bit.

- Name
  The name of the object.

- Data Type
  The data type of the object.

As shown in the figure below, you can edit the Entry configuration by right click on the mouse on the form to bring up the right-click menu. The functions to be edited are as follows:

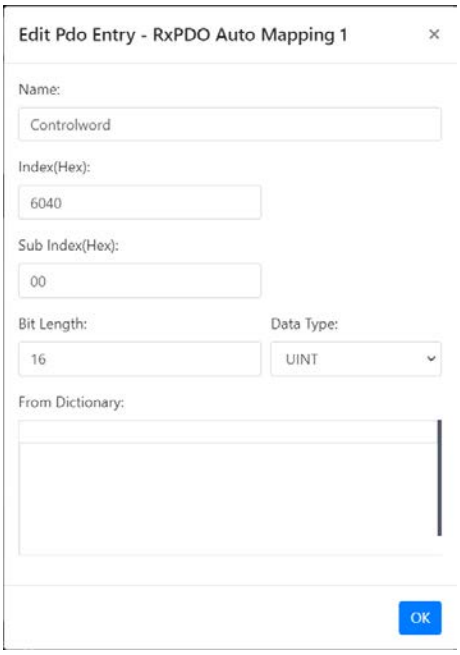


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-  - Add new Entry configuration.
-  - Edit the currently selected Entry configuration.

After clicking the Add and Edit options, the following dialog box will pop up. The parameters of the dialog box are as follows:



- Name
  The name of the object.
- Index(Hex)
  The index of the object.
- Sub Index(Hex)
  The SubIndex of the object.
- Bit Length
  For the size of the object, you can manually input the self-defined size in the text box or select a data type from the dropdown list (Data Type) to automatically bring the size of the data type into the text box (the input of text box will be disabled).
- Data Type
  The data type of the object.
- From Dictionary
  Select from object dictionary. This feature has not been implemented yet.

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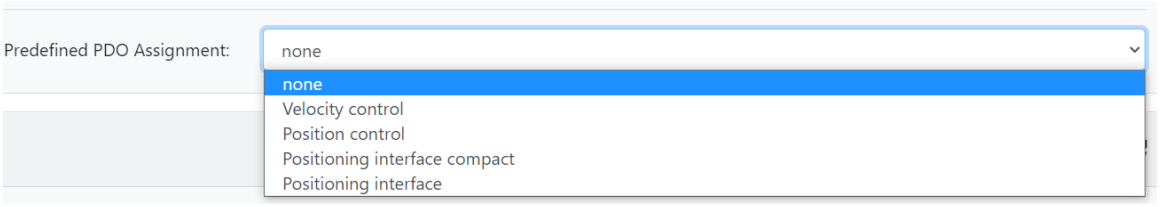
-  - Moves up the currently selected Entry configuration.
-  - Moves down the currently selected Entry configuration.
- - Delete the currently selected Entry configuration.

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4.3.5. Predefined PDO Assignment

The Predefined PDO Assignment selection list is shown in the figure below, which is a pre-defined PDO Assignment list for the slave station vendors according to its functions of the slave station, this function is used to simplify the PDO assignment process. The user can select the required function from the pre-defined PDO assignment list according to the instructions of the slave station manual, all necessary PDOs will be automatically enabled, and unnecessary PDOs will be disabled. If there is no pre-defined PDO assignment list in the slave ESI file, the selection box will freeze and cannot be selected.

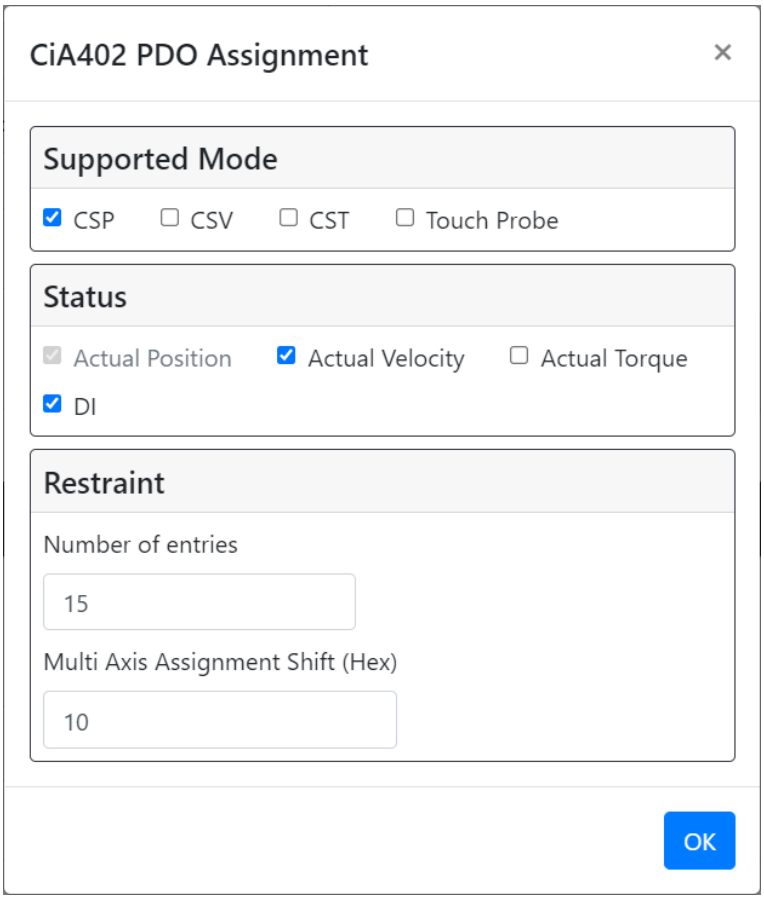


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4.3.6. CiA402 PDO Assignment

The PDO Automatic Assignment Function of CiA402 Slave Module is located on the right side of the title of the card, which will automatically assign PDO configuration to the slave module according to its motion control functions. The following dialog box will appear after clicking this button:



Each parameter is as follows:

- Default - The PDO that will be configured after pressing OK in the dialog box, these are basic configuration that is required for motion control.

RxPdo		TxPdo	
Index	**Name**	**Index**	**Name**
0x6040	Controlword	0x6041	Statusword
0x6060	Modes of Operation	0x6061	Modes of operation display

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- CSP - Configure or unconfigure the following PDO, it is required for position control.

RxPdo		TxPdo	
Index	**Name**	**Index**	**Name**
0x607A	Target position	0x6064	Position actual value
		0x606C	Velocity actual value

- CSV - Configure or unconfigure the following PDO, it is required for velocity control.

RxPdo		TxPdo	
Index	**Name**	**Index**	**Name**
0x60FF	Target velocity	0x6064	Position actual value
		0x606C	Velocity actual value

- CST - Configure or unconfigure the following PDO, it is required for torque control.

RxPdo		TxPdo	
Index	**Name**	**Index**	**Name**
0x6071	Target torque	0x6077	Torque actual value

- Touch Probe - It is the configuration required for the Touch Probe function. When this option is checked, the following Touch Probe setting parameters will appear in the dialog box. Touch Probe 1 is basic configuration and is required to be configured, so it cannot be canceled and only operation mode can be selected. Touch Probe 2 can be activated as an option. The configuration of Touch Probe 1,2 is as follows:
-



  - Touch Probe x - It must be configured when Touch Probe is checked.

RxPdo		TxPdo	
Index	**Name**	**Index**	**Name**
0x60B8	Touch probe function	0x60B9	Touch probe status

  - Touch Probe 1 - When Rising is selected, configure the following PDO.

TxPdo	
Index	**Name**
0x60BA	Touch probe positon1 positive value

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- Touch Probe 1 - When Falling is selected, configure the following PDO.

TxPdo	
Index	**Name**
0x60BB	Touch probe positon1 negative value

- Touch Probe 2 - When Rising is selected, configure the following PDO.

TxPdo	
Index	**Name**
0x60BC	Touch probe positon2 positive value

- Touch Probe 2 - When Falling is selected, configure the following PDO.

TxPdo	
Index	**Name**
0x60BD	Touch probe positon2 negative value

- Actual Position - Configure or unconfigure the following PDO. If this option is mandated to be configured, it will be freezed.

TxPdo	
Index	**Name**
0x6064	Position actual value

- Actual Velocity - Configure or unconfigure the following PDO.

TxPdo	
Index	**Name**
0x606C	Velocity actual value

- Actual Torque - Configure or unconfigure the following PDO. If this option is mandated to be configured, it will be freezed.

TxPdo	
Index	**Name**
0x6077	Torque actual value

- DI - Configure or unconfigure the following PDO, it is recommended to configure this option for position control, so that when left or right limit is reached, the internal motion control can take stop action immediately.

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TxPdo	
Index	**Name**
0x60FD	Digital inputs

- Number of entries

  When performing automatic assignment, RxPdo will start from 0x1600, while TxPdo starts from 0x1A00. This parameter can limit the maximum Entry to be assigned to 0x1600 or 0x1A00. When exceeds the maximum value, it will be assigned to the next PDO (0x1601, 0x1602…, 0x1A01, 0x1A02…) for configuration.

- Multi Axis Assignment Shift

  When the slave is a multi-axis slave module, this parameter can be used to set the RxPdo, TxPdo configuration offset of each axis. As shown in the following figure, when this parameter is set to 0x10, axis 0 is configured from 0x1600, and offset of axis 1 is set to 0x10, configured from 0x1610 and so on. And when the number of Entry configurations per axis (0x1600, 0x1610…) exceeds maximum number of entries, the configuration will be assigned to the next PDO (0x1601, 0x1611…).

Index	Size	Name	Flags
0x1600	11.0	Axis0 RxPDO Auto Mapping 1	
0x1610	11.0	Axis1 RxPDO Auto Mapping 1	
0x1620	11.0	Axis2 RxPDO Auto Mapping 1	
0x1630	11.0	Axis3 RxPDO Auto Mapping 1	

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4.4. Process Image

Process Image variable operation is shown in Figure 4-4. When the EtherCAT operation task is started, the user can click on the Inputs/Outputs tabs to read and write the variables on the variable list. The function buttons are as follows:

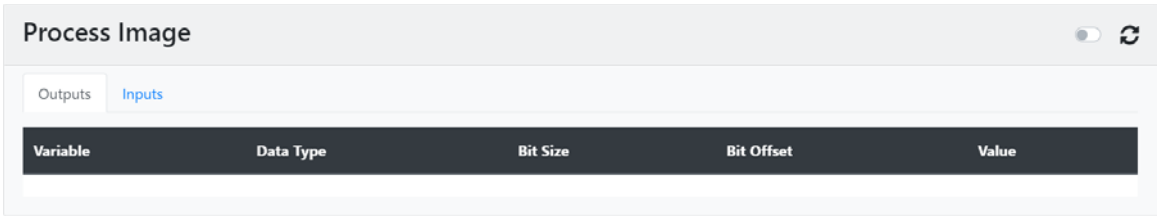


Figure 4-4

-  - Enable/disable automatic update values of all variables.
-  - Manually update values of all variables.

The fields of the Outputs/Inputs variable are as follows:

- Variable
  The name of the variable.
- Data Type
  The data type of the variable.
- Bit Size
  The size of the variable in bits.
- Bit Offset
  The offset of the variable in the Process Image, in bits.
- Value
  The value of the variable.

Process Image variables are as follows:

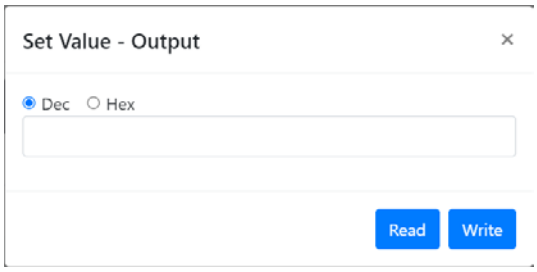
- Outputs
  - RxPDO Variables - The displayed variable is the assignment result of Process Data Outputs. Please refer to the slave manual of the for information of each variable.
- Inputs
  - TxPDO Variables - The displayed variable is the assignment result of Process Data Inputs. Please refer to the slave manual of the for information of each variable.

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- Stauts
  - Error - error status flag.
    - Network - The actual slave does not match the configuration of the ENI file.
    - Communication - Communication error.
    - OP - Error that Slave is not in OP state.
  - Network Position - The current actual network connection position of the slave.
  - AL State - AL state value of the slave.
    1: Init State
    2: Pre-Operational State
    3: Bootstrap State
    4: Safe-Operational State
    8: Operational State

To write the value of the Outputs variable, click the left mouse button twice on the variable to bring up the following dialog box. Select the input value in decimal (Dec) or hexadecimal (Hex) according to actual requirement, input the value and click the "Write" button to write. You can also click the "Read" button to read. After clicking the "Read" or "Write" buttons, this dialog box will not be closed automatically so that the user can keep on performing read or write operations.



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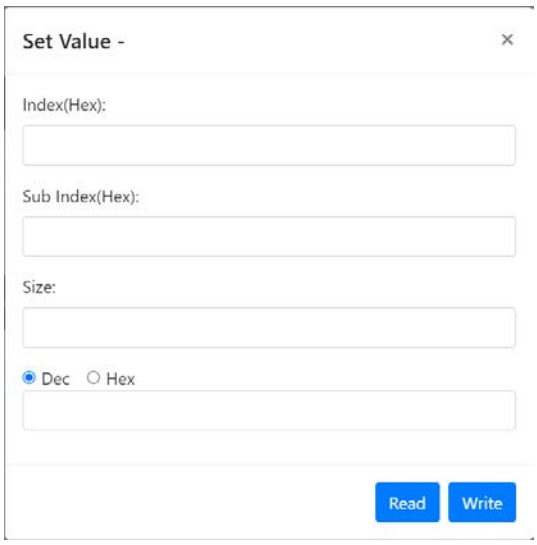
4.5. SDO

As shown in Figure 4-5, this part is the non-periodic communication operation function of SDO (Service Data Object). If the slave station supports CANopen over EtherCAT (CoE), the handshaking mechanism of SDO Mailbox can be used to access the object of the object dictionary for configurations of the slave station. The function buttons are as follows:



Figure 4-5

-  - Manual access to objects.
  The following dialog box will be brought up after clicking the button. The user can manually input the Index of the object, the Sub Index of the object, data Size, and then select Dec (decimal) or Hex(hexadecimal) according to actual requirement, and finally click on "Read" or "Write" button to perform read or write operations.



-  - Fetch Object Dictionary of the Slave.
  The following dialog box will be brought up after clicking the button. After selecting the display range of the list, click "OK", the fetch of the content of object dictionary will start. The fetch progress will be displayed, when the progress reaches 100%, the result will be displayed on the form of the object dictionary list.

  - Online
    If “Online” is checked, it will read the contents of the slave object

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dictionary by using “SDO information”. If “Online” is not checked, then it will read the contents of the slave object dictionary from the ESI file.

- All
  Displays all object dictionary contents.

- Range
  Display part of the object dictionary content according to the input range.



The fetched content of the object dictionary is shown in the figure below, and the fields are as follows:

Index	Name	Flags	Data Type	Bit Size	Value
0x1000	Device type	r-r-r-	uint32	32	-
0x1001	Error register	r-r-r-	uint8	8	-
0x1008	Device name	r-r-r-	string	136	-
0x1009	Hardware version	r-r-r-	string	24	-
0x100A	Software version	r-r-r-	string	24	-

- Index
  The Index and SubIndex of the object, presented as "Index:SubIndex".

- Name
  The name of the object.

- Flags
  The object's access permission flag. "ABCDEF" flags are as follows:
  A = Read access in Pre-Operational state (r, -).
  B = Write access in Pre-Operational state (w, -).
  C = Read access in Safe-Operational state (r, -).
  D = Write access in Safe-Operational state (w, -).
  E = Read access in Operational state (r, -).
  F = Write access in Operational state (w, -).

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The value of each flag are as follows:
”r”: Reading is permitted in this state.
”w”: Writing is permitted this state.
”-”: Reading and writing are not permitted in this state.

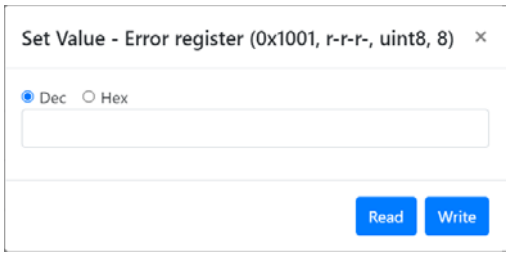
- Data Type
  The data type of the object.

- Bit Size
  The size of the object, in bits.

- Value
  The content value of the object.

-  - Manual update content value of the object.

To access the object, double-click the left mouse button on the object to bring up the following dialog box. Select the input value in decimal (Dec) or hexadecimal (Hex) according to actual requirement, click on “Read” or "Write" button to perform read or write operations.



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4.6. Diagnostics

The diagnostic function is shown in Figure 4-6, which is mainly used to obtain various error counters of the ESC and the connection status of the 4 ports. The functions are as follows:

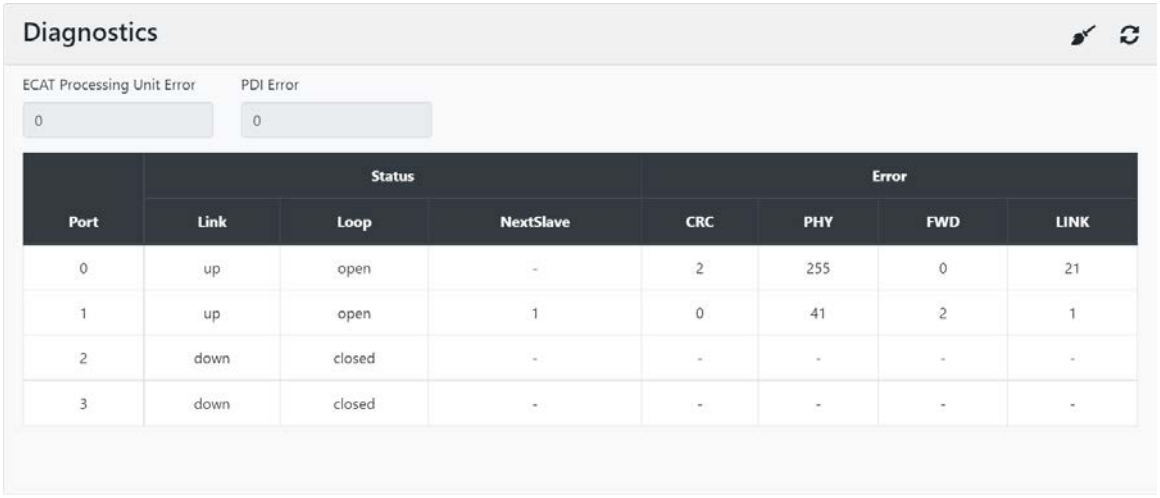


Figure 4-6

-  - Clear counter.
-  - Update diagnostic content.

The parameters are as follows:

- ECAT Processing Unit Error
  Invalid frame via EtherCAT processing unit, read from ECAT Processing Unit Error Counter (0x30C) register.

- PDI Error
  Physical error detected by PDI, read from PDI Error Counter (0x30D) register.

The 4 port connection and error status are as follows:

- Port
  Port number.

- Status
  - Link
    Port connection status.
    up: Connected.

    down: Disconnected.

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- Loop

  Port Loop status.

  open: Indicates that the port can be used to send or receive packets.

  closed: Indicates that this port is prohibited from sending or receiving packets, and the packet will be sent to the next port in “open” status.

- NextSlave

  The position number of the slave that is connected to the port.

- Error

  Please refer to information of the error counter in the section of Master Diagnostics.

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5.EtherCAT Actual Slave

This working page is for performing operations of online slave modules. After scanning the connected slave modules, the operations such as SDO, FoE, Diagnostics, etc. can be performed on this page. The function of each card is as follow:

5.1. Scan

As shown in Figure 5-1, right click on the mouse on EtherCAT->Actual Network to bring up the right-click menu and click on “Scan” to scan the currently connected slave modules. After the scan is completed, the scan result will be compared to the configuration of the opened ESI file, and the comparison result will be displayed as shown in Figure 5-2.

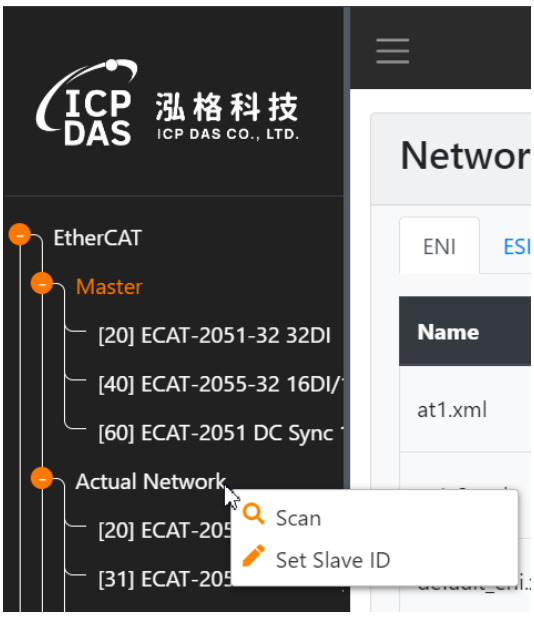


Figure 5-1

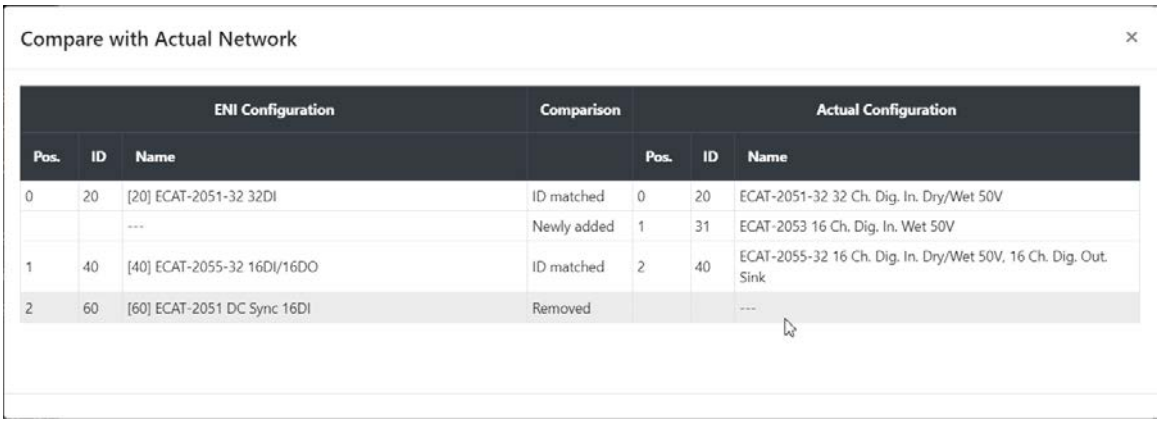


Figure 5-2

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The fields in the comparison table are as follows:

<table>
<tr><th colspan="2">Field</th><th>Description</th></tr>
<tr><td rowspan="3">ENI Configuration</td><td>Pos.</td><td>Slave configuration position in ENI file.</td></tr>
<tr><td>ID</td><td>Slave configuration ID in ENI file.</td></tr>
<tr><td>Name</td><td>Slave name in ENI file.</td></tr>
<tr><td>Comparison</td><td></td><td>The comparison results are defined as follows:
<table>
<tr><th>Result</th><th>Description</th></tr>
<tr><td>ID matched</td><td>The comparison result is the same, so the set value is kept.</td></tr>
<tr><td>Not matched</td><td>The comparison result is not the same.</td></tr>
<tr><td>Newly added</td><td>There is no configuration setting in the ENI file but there is a slave module actually connected, new configuration settings will be added.</td></tr>
<tr><td>Removed</td><td>There are configuration settings in the ENI file but there is no slave module actually connected, the configuration settings will be deleted.</td></tr>
</table></td></tr>
<tr><td rowspan="3">Actual Configuration</td><td>Pos.</td><td>Actual slave connection position.</td></tr>
<tr><td>ID</td><td>Actual slave ID.</td></tr>
<tr><td>Name</td><td>Actual slave name.</td></tr>
</table>

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5.2. Set Slave ID

The Set Slave ID function can be used to set the ID of all slaves. as shown in Figure 5-3, user can right-click in EtherCAT->Actual Network, and use the "Set Slave ID" in the right-click menu to open the Set Slave ID dialog box, as shown in Figure 5-4.

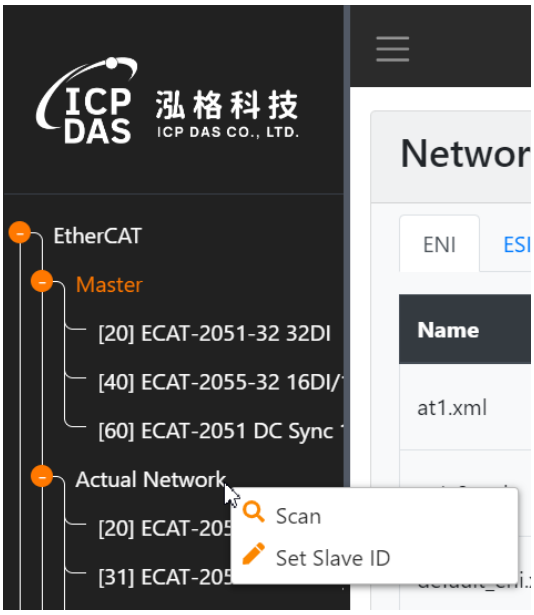


Figure 5-3

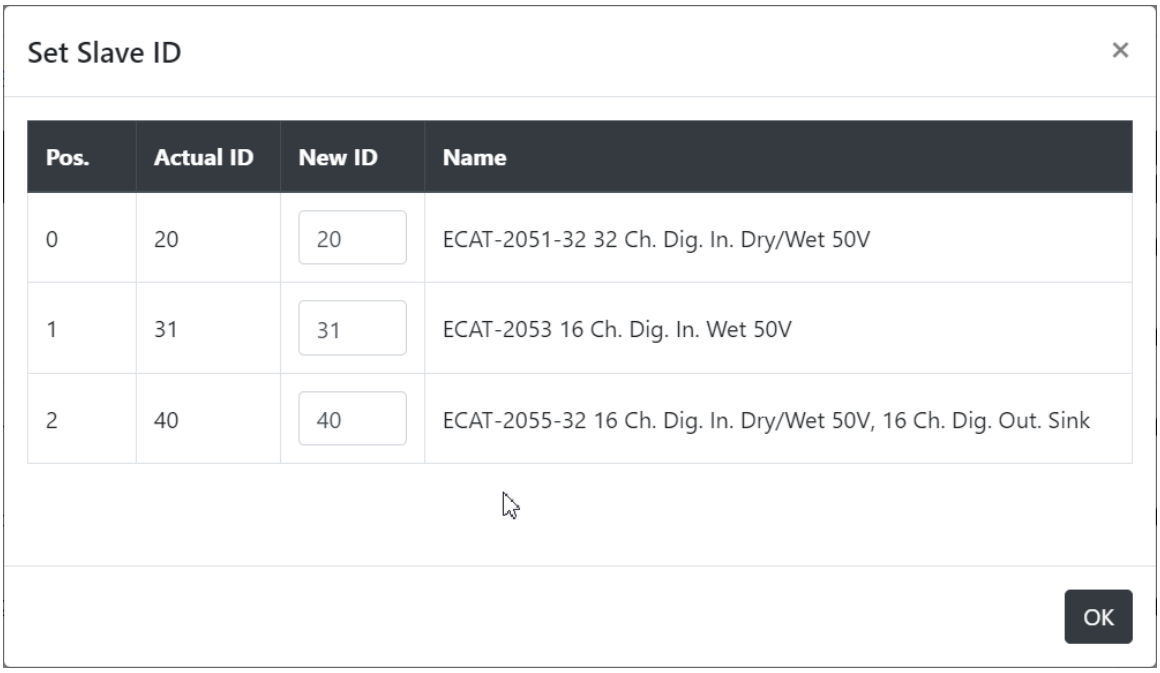


Figure 5-4

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Each parameter is described as follows:

- Pos.
  Slave connection position.
- Actual ID
  Current slave ID value.
- New ID
  New ID value for slave.
- Name
  Slave name.
- OK
  Set all slave to the New ID value. If the New ID value is zero, no setting action will be performed.

5.3. Information

Please refer to “Information” in the EtherCAT Slave section.

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5.4. FoE

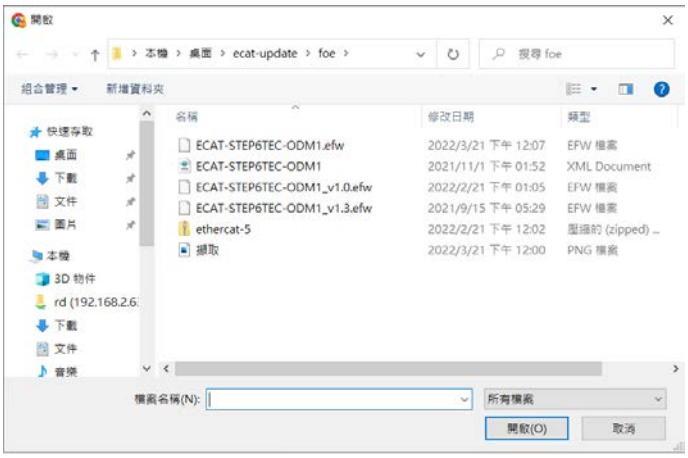
The function of FoE (File Access over EtherCAT) is shown in Figure 5-5. FoE is a protocol that can be used to access files in the slave device or write the firmware of the slave into the device. Using FoE, the update of firmware can be performed online at any time without sending technicians to the site to update the firmware, the functions are as follows:



Figure 5-5

- Write - Write file or firmware to slave module.
  The process of writing a file or firmware is as follows:

  1. After clicking the "Write" button, the Open File dialog box will appear, select a local file or firmware.



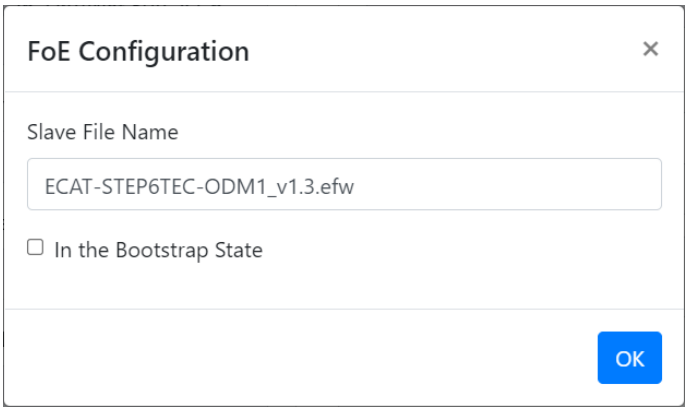
  2. Then the FoE setting dialog box will appear. After inputting the setting parameters, click "OK". The parameters are as follows:

     Slave File Name
     The file name written to the slave device can be different from the selected written file name. The selected written file name will be brought up as the default Slave File Name.

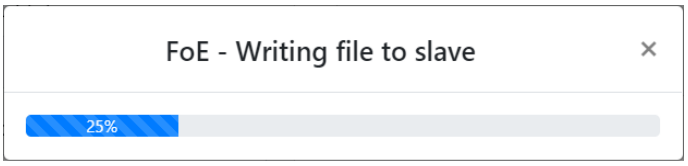
     In the Bootstrap State
     When checked, the AL state will be switched to the Bootstrap State before performing the FoE process. Generally, it is required to switch the state to the Bootstrap state before updating the firmware of the slave.

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3. When the progress bar of the FoE writing process reaches 100% and no errors occurs, it means that the writing of the file or firmware is successful. When updating the firmware of the slave station, the slave station will restart after the update success, and it is normal the slave station will be disconnected temporarily at this time.



- Read - read file from slave device.
  The process of reading a file is as follows:

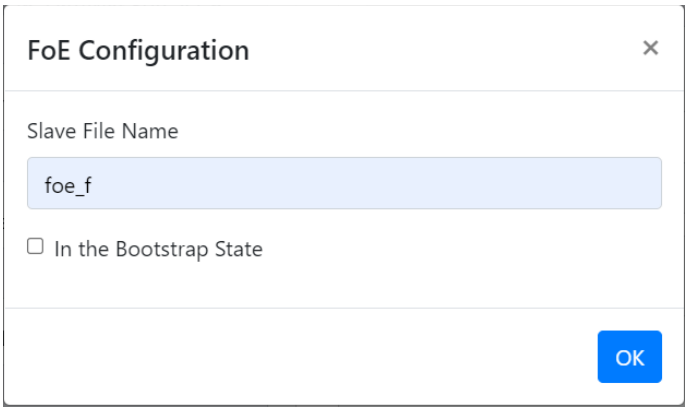
  1. After clicking the "Read" button, the FoE setting dialog box will appear. After inputting the setting parameters, click "OK". The parameters are as follows:

     Slave File Name
     The filename to be read from the slave device.

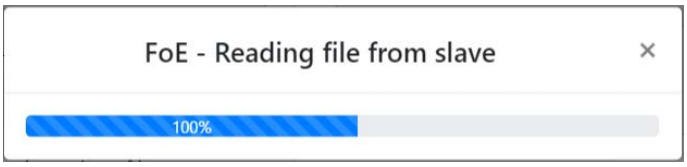
     In the Bootstrap State
     When checked, the AL state will be switched to the Bootstrap State before performing the FoE process. Generally, it is not necessary to switch the state to Bootstrap before reading the file, unless the manual of the slave indicates it is required to switch to Bootstrap state before the reading.

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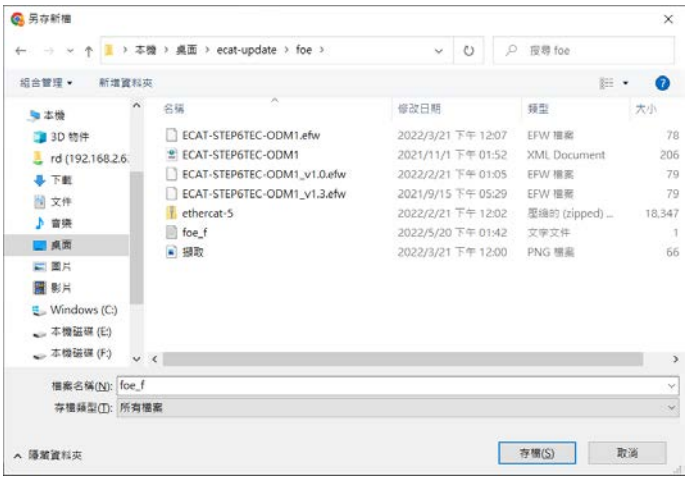
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2. When the progress bar of the FoE reading process reaches 100% and no errors occur, it means that the file is successfully read.



3. After the reading process is successfully completed, the Save New File dialog box will appear, enter the file name to save.



5.5. SDO

Please refer to section EtherCAT Slave for information of the SDO.

5.6. Diagnostics

Please refer to section EtherCAT Slave for information of the Diagnostics.

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6.EtherCAT Category

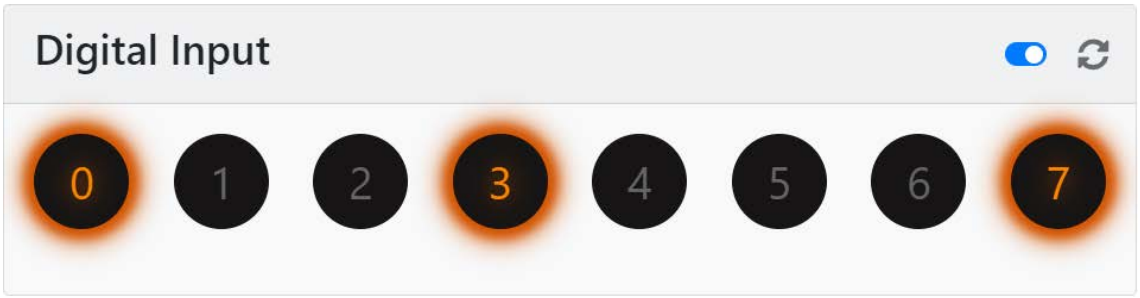
In this section of the user manual, we will provide a detailed overview of EtherCAT slave devices, categorizing them based on their functionalities. The primary classifications include Digital Input/Output (DIO), Analog Input/Output (AIO), and Encoder. Each category is further detailed on separate pages, allowing users to efficiently and effortlessly perform operations related to these functionalities.

6.1. DIO

This page provides a user-friendly interface for reading the status of DI signals and configuring the output states of DO channels.

6.1.1. Digital Input

Users can easily monitor the current status of DI through the use of LED indicators.



-  - DI is in the OFF state.
-  - DI is in the ON state
-  - Enables or disables automatic updates of DI status.
-  - Manually update the DI status.

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6.1.2. Digital Output

Users can utilize LED buttons to easily toggle and control the output states of DO channels.



-  - DO is in the OFF state.
-  - DO is in the ON state
-  - Manually update the DO status.

6.2. AIO

The AIO page is dedicated to reading Analog Input (AI) values and configuring Analog Output (AO) signals. This section provides functionalities for precise control and monitoring of analog signals.

6.2.1. Analog Input

The Analog Input section allows users to read Analog Input (AI) values and provides two distinct display modes: Gauge Mode and Chart Mode. Users can seamlessly switch between these modes using tabs.



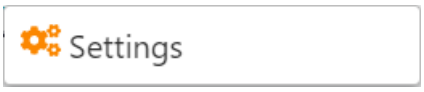
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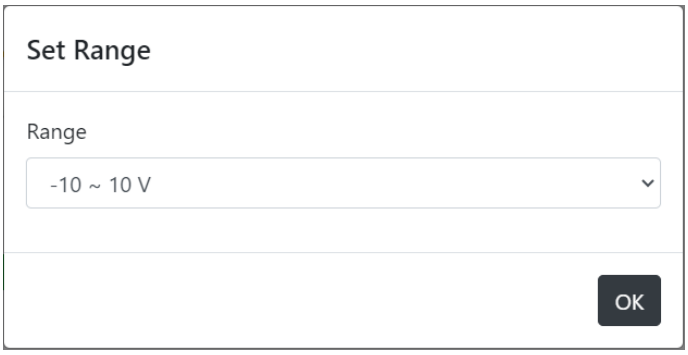
-  - Gauge Mode
  As shown below, visualize AI values through an intuitive gauge display.



-  - Data channel
  The right-click menu functions are as follows:



  - Settings - The following dialog box appears when the item is clicked, so you can set the range according to your application.



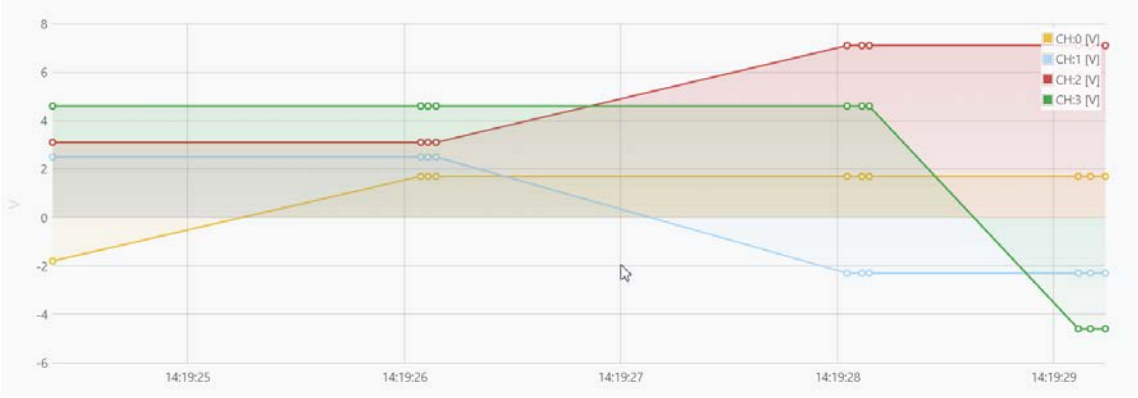
-  - Unit
  V: Volts.
  mA: Milliampere.

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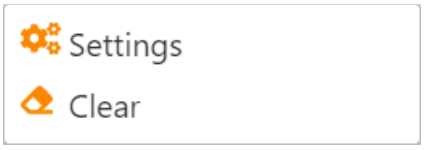
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-  - Chart Mode

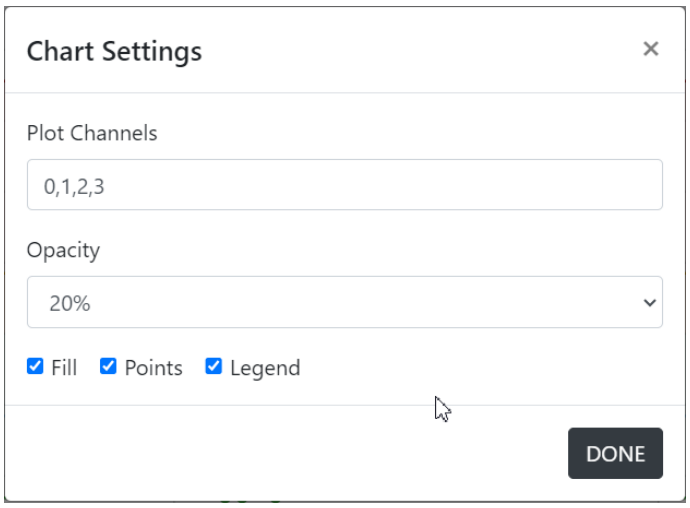
  As shown below, view the trend of Analog Input values over time through a graphical representation.



The right-click menu functions are as follows:



- Settings - Chart Settings, when clicked, the following dialog box will appear.



  - Plot Channels

    Specify data channels to display on the chart. Comma-separated entries like "0,1,2" determine the specific channels to show.

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- Opacity

  Adjust transparency of the filled area beneath the lines.
  20%:



  80%:



- Fill

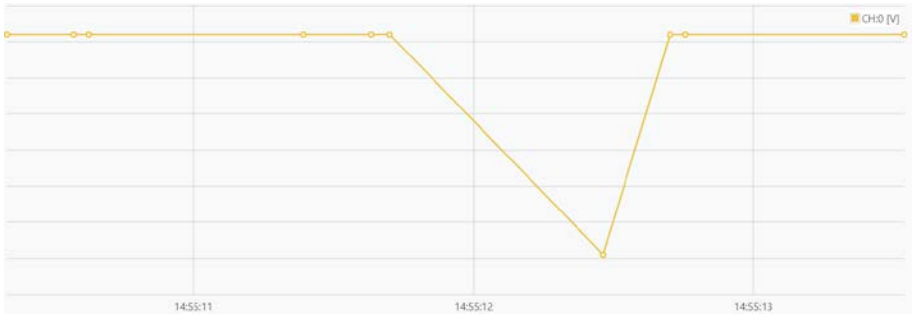
  Toggle whether the area below the lines is filled.
  Check:



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Uncheck:



- Points

  Control the visibility of endpoints at each data point.
  Check:



Uncheck:

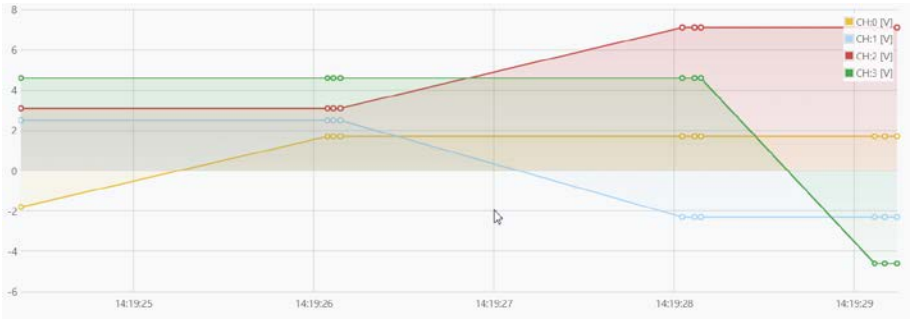


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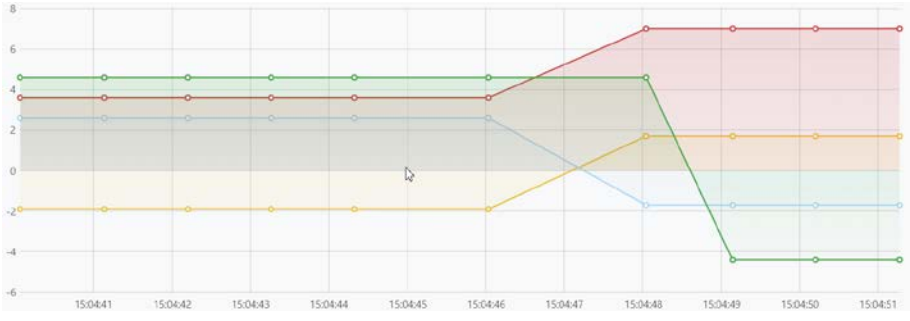
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- Legend

  Choose whether to display a legend identifying each channel.
  Check:



  Uncheck:



  - Clear - Clear chart data.

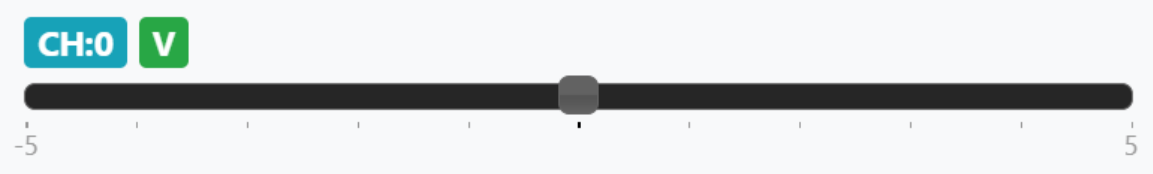
-  - Enables or disables automatic updates of AI status.
-  - Manually update the AI status.

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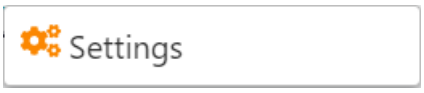
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6.2.2. Analog Output

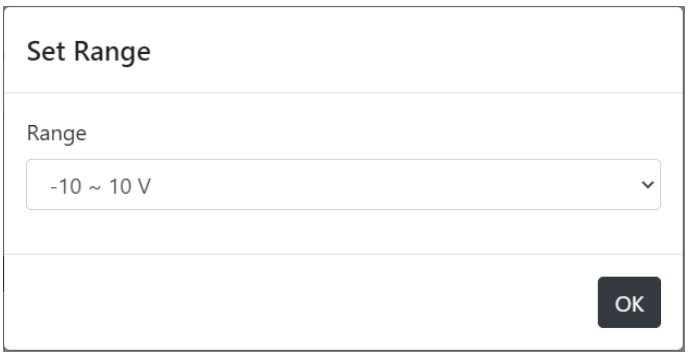
The Analog Output section provides users with a user-friendly interface for controlling Analog Output (AO) values.



- CH:0 - Data channel
  The right-click menu functions are as follows:



  - Settings - The following dialog box appears when the item is clicked, so you can set the range according to your application.



- V - Unit
  V: Volts.
  mA: Milliampere.

-  - Manually update the AO status.

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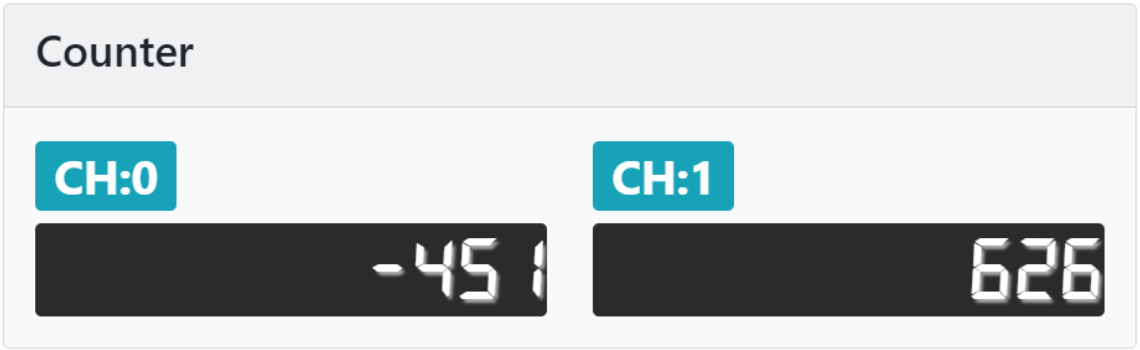
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6.3. Encoder

The Encoder page is dedicated to providing users to read and write encoder position, latch encoder position, and configure equidist position compare trigger

6.3.1. Counter

This section can be used to configure the encoder mode and read/write the encoder position..



- CH:0 - Data channel
  The right-click menu functions are as follows:



  - Mode - Set the encoder mode, when clicked, the following dialog box will appear.



  - Value - Set the encoder positon, when clicked, the following dialog box will appear.

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-  - Encoder position.

6.3.2. Latch

This section can be used to enable the latch encoder position and display the latch position.



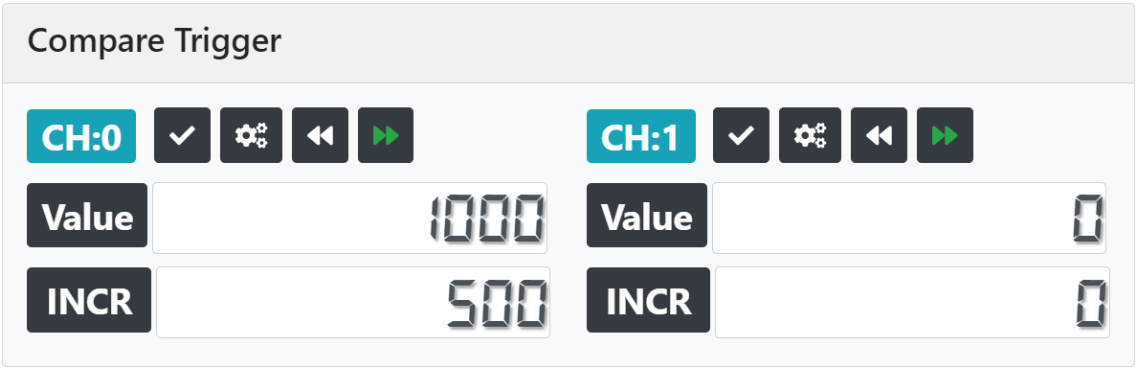
-  - Data channel
-  - Enable latch encoder position button.
  -  - Latch encoder position not enabled.
  -  - Latch encoder position enable.
-  - Latch encoder position validity.
  -  - Function not supported.
  -  - Latch encoder position is invalid.
  -  - Latch encoder position is valid.
-  - Latch the value of the encoder position.

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6.3.3. Compare Trigger

This section can be used to configure the equidist position compare trigger.



- CH:0 - Data channel
- - Enable position compare trigger button.
  - - Position compare trigger not enabled.
  - - Position compare trigger enable.
- - Position compare trigger setting button, you can use the following input box to set the position compare trigger.
  - Value 1000 - Comparison value of the first position.
  - INCR 500 - Auto incremental value, the value is automatically incremented by the first comparison position to set the subsequent comparison position.
- - Negative direction auto increment value setting button.
  - - The negative direction auto increment value is not active.
  - - The negative direction auto increment value is active.
- - Positive direction auto increment value setting button.
  - - The positive direction auto increment value is not active.
  - - The positive direction auto increment value is active.

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6.4. Rule Configuration

By clicking the "Category" node, users can enter the rule configuration page. This page allows users to define rules for categorizing EtherCAT slave devices into specific functional categories, such as DIO, AIO, and Encoder. Additionally, users can set up corresponding control objects associated with each category.



- 

  This toggle enables or disables the rule editing functionality in the right-click menu. When enabled, users can add, edit, or delete rules using the right-click menu.

- 

  Click this button to reset all rules to their default values.

- DIO/AIO/Encoder tabs:

  These three tabs allow users to switch between different rule tables, each corresponding to the rule configuration for DIO, AIO, and Encoder.

6.4.1. Rule Tables

- DIO Rule Table

Slave	Input	Output
ECAT-2045 16DO (0x494350/0x7FD/---)	0	16
ECAT-2045-32 32DO (0x494350/0x7FD/0x200001)	0	32

  - Slave: Comprising Rule Name, Vendor ID, Product Code, Revision No.
  - Input: Number of Digital Input Channels.

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- Output: Number of Digital Output Channels.

- AIO Rule Table

Slave	Input	Output
ECAT-2012H (0x494350/0x7DC/---)	8	0
ECAT-2016N (0x494350/0x7E0/---)	1	0

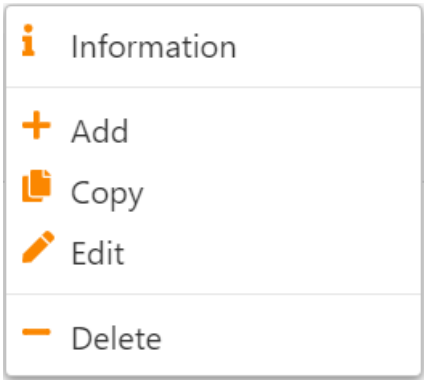
- Slave: Comprising Rule Name, Vendor ID, Product Code, Revision No.
- Input: Number of Analog Input Channels.
- Output: Number of Analog Output Channels.

- Encoder Rule Table

Slave	Channel
ECAT-2092T (0x494350/0x209254/---)	2
ECAT-2093 (0x494350/0x82D/---)	3

- Slave: Comprising Rule Name, Vendor ID, Product Code, Revision No.
- Channel: Number of Encoder Channels.

Each rule form has the same right-click menu functionality.



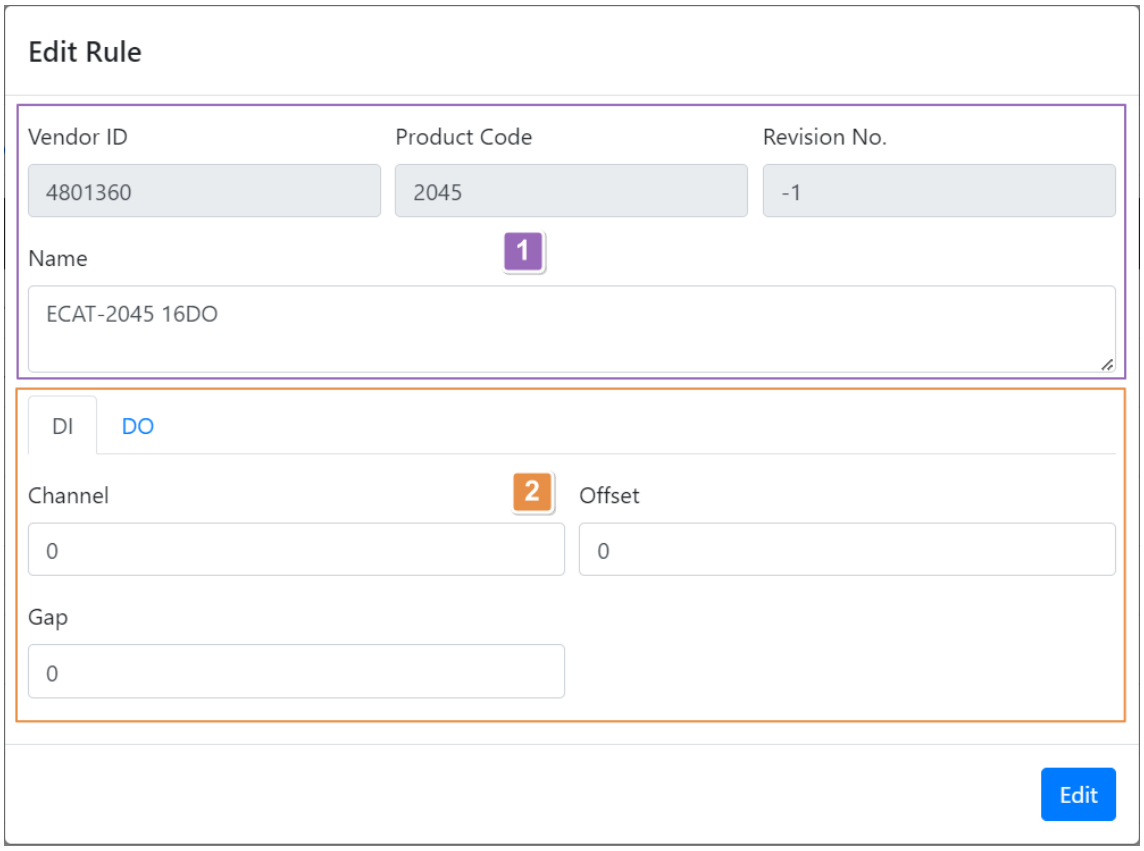
- Information: Display detailed information about the selected rule.
- Add: Add a new rule to the table.
- Copy: Duplicate the content of the selected rule, creating a similar new rule.
- Edit: Modify the content of the selected rule.
- Delete: Delete the selected rule.

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6.4.2. Rule Editing Dialog

When selecting "Information", "Add", "Copy" or "Edit" from the right-click menu in the rule table, the Rule Editing Dialog will open. This dialog is divided into two sections, as illustrated in the diagram below:



1. Basic Settings: This section is used to identify the slave device, ensuring it is correctly classified into the corresponding category.
   - Vendor ID
     The vendor ID of the slave.
   - Product Code
     Product code of the slave.
   - Revision No.
     The revision number of the slave. Set to -1 to allow any revision number to be classified into the category.
   - Name
     Rule name.

2. Control Settings: This section is used to configure the number of channels and set control objects for PDO (Process Data Object) and SDO (Service Data Object) for the respective category.
   (1) DIO

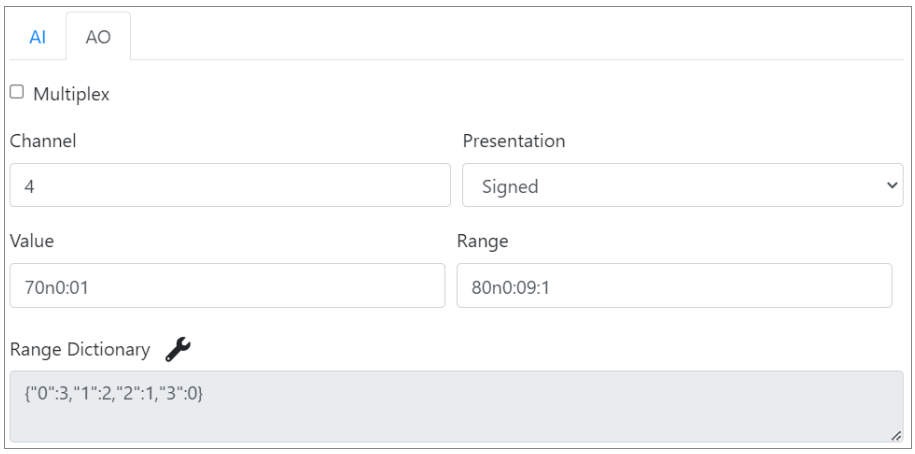
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- Chnanel
  Number of channels.
- Offset
  Offset in bits before each channel in the PDO data.
- Gap
  Gap in bits after each channel in the PDO data.

(2) AIO



- Multiplex
  Indicates whether it is a multiplexed channel. If multiplexed, the range settings for all channels will be consisten.
- Chnanel
  Number of channels.
- Presentation
  Method of representation of the measured value.
- Value
  PDO object for AI/AO value.

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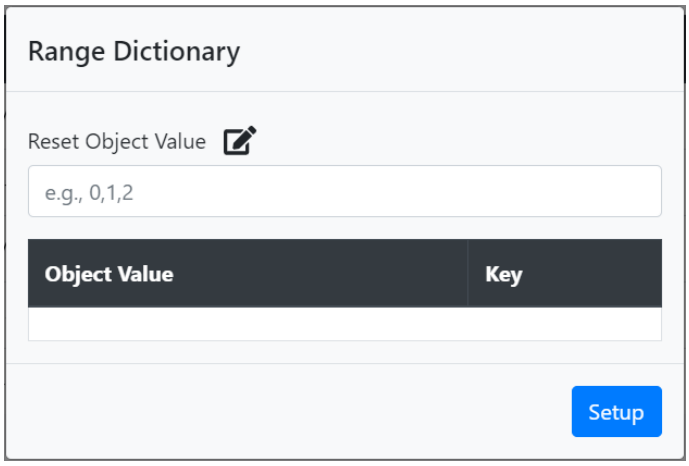
- Range

  SDO object for AI/AO range.

- Range Dictionary

  Dictionary for AI/AO range, as each slave may have different range settings. Establish a dictionary for range queries.

  - Create Range Dictionary button. When clicked, the following dialog box appears.



Process to Create Range Dictionary:

(1) Enter all the setting values of the AI/AO range SDO object in the "Reset Object Value" input box. For example, for ECAT-2024, if SDO object 80n0:09 has values "0,1,2,3", input "0,1,2,3" and click to reset dictionary parameters.

Value	Description
0	Unipolar 5V (0-5V)
1	Bipolar 5V (±5V)
2	Unipolar 10V (0-10V)
3	Bipolar 10V (±10V)

(2) After resetting dictionary parameters, the table will display the range corresponding to SDO object values. Use the dropdown menu to set the range for each value and click the "Setup" button to complete the range dictionary configuration.

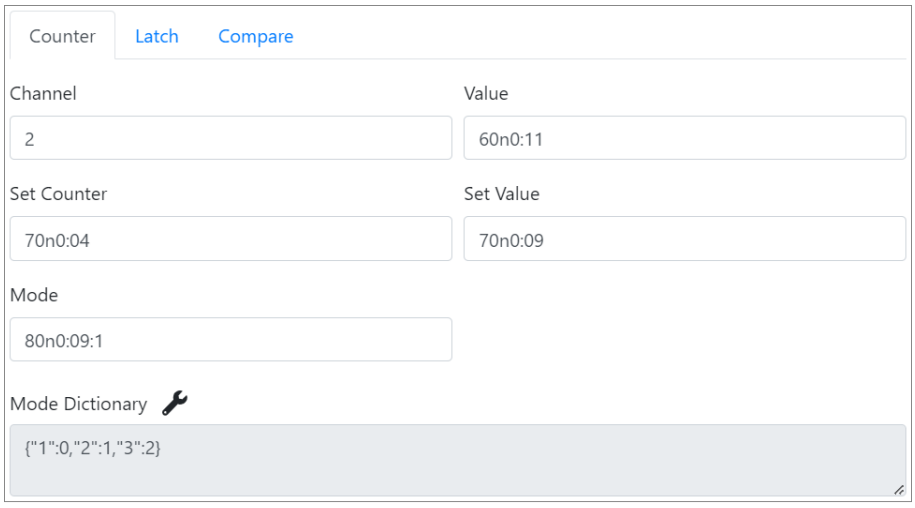
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Object Value	Key
0	0 ~ 5 V
1	-5 ~ 5 V
2	0 ~ 10 V
3	-10 ~ 10 V

(3) Encoder

(3.1) Counter



- Chnanel

  Number of channels.
- Value

  PDO object for encoder value[1].
- Set Counter

  PDO object for activating encoder value setting[1].
- Set Value

  PDO object to set the encoder value[1].
- Mode

  SDO object for set the encoder mode[2].

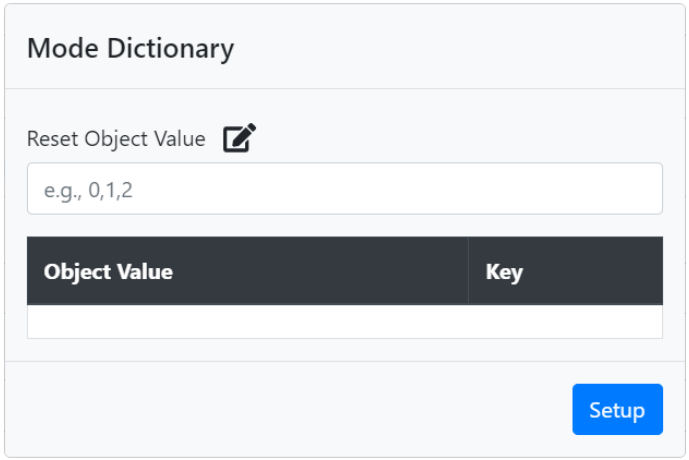
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- Mode Dictionary

  Dictionary for encoder mode, as each slave may have different mode settings. Establish a dictionary for mode queries.

  - Create Encoder Mode button. When clicked, the following dialog box appears.



Process to Create Encoder Mode Dictionary:

(1) Enter all the setting values of the encoder mode SDO object in the "Reset Object Value" input box. For example, for ECAT-2092T, if SDO object 80n0:09 has values "0,1,2", input "0,1,2" and click to reset dictionary parameters.

Value	Description
0	CW/CCW
1	Pulse/Direction
2	Quadrant

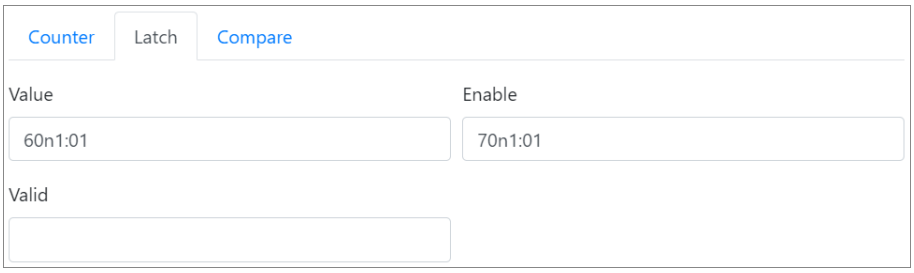
(2) After resetting dictionary parameters, the table will display the mode corresponding to SDO object values. Use the dropdown menu to set the mode for each value and click the "Setup" button to complete the mode dictionary configuration.

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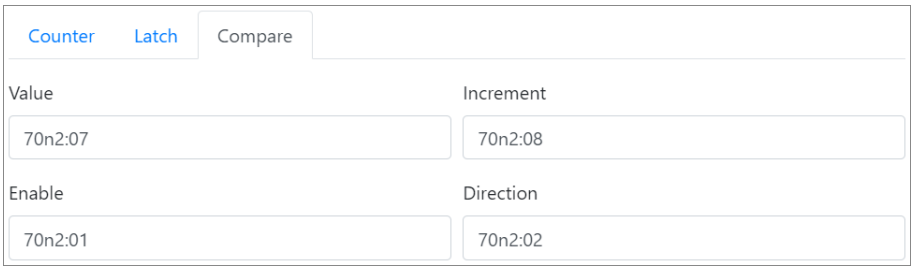
Object Value	Key
1	CW/CCW
2	Pulse/Dir.
3	Quadrant

(3.2) Latch



- Value
  PDO object for encoder latch position[1].
- Enable
  PDO object to enable encoder latch[1].
- Valid
  PDO object indicating whether the latched encoder position is valid[1].

(3.3) Compare



- Value
  PDO object for the first position compare value[1].

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- Increment

  PDO object for auto increment compare value[1].

- Enable

  PDO object to enable equidistant position compare trigger [1].

- Direction

  PDO object for the direction of auto increment compare value[1].

Note:

[1] For PDO object, use a colon to separate Index and Subindex values (e.g., 70n0:01, where n is the channel index).

[2] For SDO object, use a colon to separate Index, Subindex, and Size (Byte) values (e.g., 80n0:09:1, where n is the channel index).

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7. Motion Control Axis

When the motion control function is enabled in the EtherCAT operation task, the initialization parameters for single-axis motion control can be configured in this page. The following section will introduce how to enable single-axis motion control functions and how to configure the parameters in each card of this work page.

7.1. Enable single-axis motion control

As shown in Figure 7-1, right click on the mouse on Motion Control->Axes or Motion Control->Axes->Axis to bring up the right-click menu and click on “Add” to add the number of axes and then set up the initialized parameters to start the motion control function of the EtherCAT operation task.

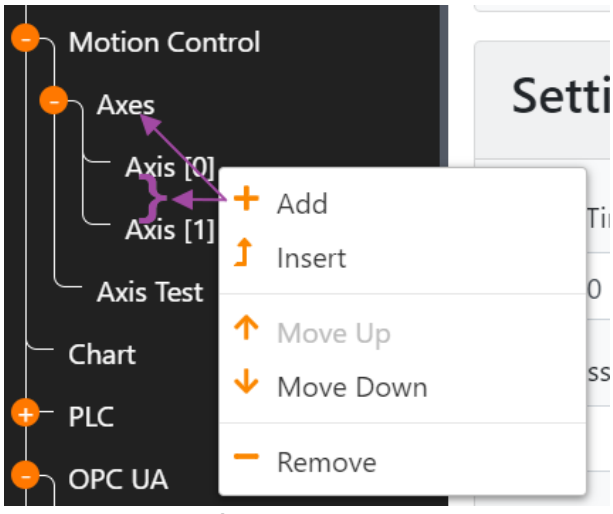


Figure 7-1

The right-click menu functions are as follows:

- + - Adding a new single axis. The new single axis will be added below the currently selected single axis node.
- ↕ - Inserting a new single axis. The new single axis will be added above the currently selected single axis node.
- ↑ - Moves up the position of the currently selected single axis.
- ↓ - Moves down the position of the currently selected single axis.
- − - Delete the currently selected single axis.

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7.2. Basic Settings

As shown in Figure 7-2, this part is the basic settings for single axis, which is used to determine the type of axis and the slave module to be controlled by the axis. The parameters are as follows:

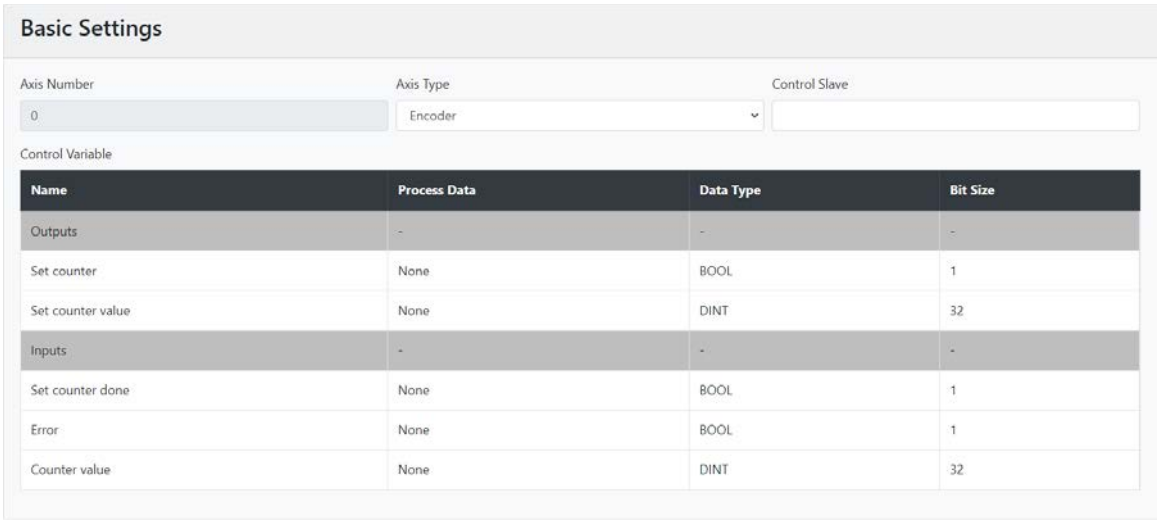


Figure 7-2

- Axis Number
  The number of the axis.

- Axis Type
  The type of axis.

  - Virtual Servo
    Set the axis as a virtual axis. If the axis is set as a virtual axis, single-axis motion control can be simulated without setting the slave station to be controlled.

  - Servo (CiA402)
    Set the axis as a CiA402 servo axis. The slave module to be controlled is required to be set.

  - Generic Drive
    Set the axis as a generic drive axis. It is necessary to set the slave module to be controlled and the PDO variables to be controlled. Currently this feature is still in beta testing.

  - Encoder
    Set the axis as an encoder. It is necessary to set the slave module to be controlled and the PDO variables to be controlled.

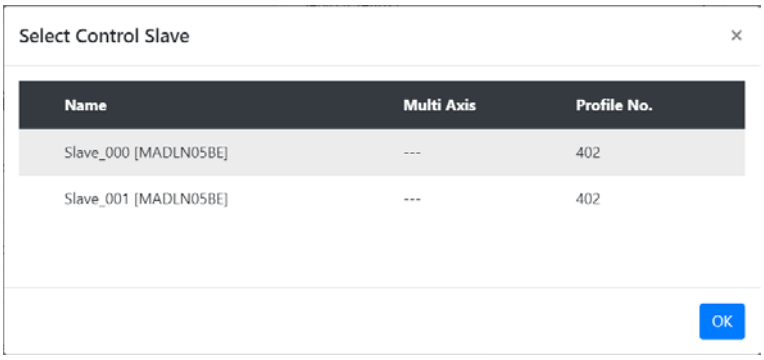
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- Control Slave

  The slave module to be controlled by the axis. After clicking the input box below the text lable, a dialog box as shown below will appear, select the number of the slave module to be controlled, the selected row will be grayed out and then click "OK" or click twice on the row to complete the selection.

  .



- Control Variable

  PDO variable for axis control. The following will introduce the PDO variables that need to be set for the control of different types of axes.

  - Virtual Servo

    No need to set control variables.

  - Servo (CiA402)

    No need to set control variables, it is based on CiA402 standard, it only need to take PDO automatic assignment function of the CiA402 slave module to perform the control.

  - Generic Drive

    The PDO variables controlled by the Generic Drive are shown in the figure below. The variable are as follows:

Name	Process Data	Data Type	Bit Size
Outputs	-	-	-
Enable	None	BOOL	1
Reset	None	BOOL	1
Target Position	None	DINT	32
Inputs	-	-	-
Ready	None	BOOL	1
Error	None	BOOL	1
Actual Position	None	DINT	32
Actual Velocity	None	DINT	32

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Enable

Set this variable to “true”, the axis will be “Power ON (Servo ON)”.
Set this variable to “false”, the axis will be “Power OFF (Servo OFF)”.

Reset

During the clearing error process of the axis, it will set this variable to “true”, after clearing the error, the value will be set to “false” again.

Target Position

When the axis is performing the motion control, the position of the calculation result will be written to this variable.

Ready

This variable is used to judge the axis Power ON/OFF (Servo ON/OFF) status.

Error

This variable is used to judge whether there is an error happens to the axis.

Actual Position

This variable is used to read the actual position of the axis.

Actual Velocity

This variable is used to read the actual velocity of the axis.

- Encoder

When the axis type is encoder, the PDO variables to be controlled are shown as the figure below, the variables are as follows:

Name	Process Data	Data Type	Bit Size
Outputs	-	-	-
Set counter	None	BOOL	1
Set counter value	None	DINT	32
Inputs	-	-	-
Set counter done	None	BOOL	1
Error	None	BOOL	1
Counter value	None	DINT	32

Set counter

Set value to the counter of the encoder.

Set counter value

The value to be set as the encoder counter value

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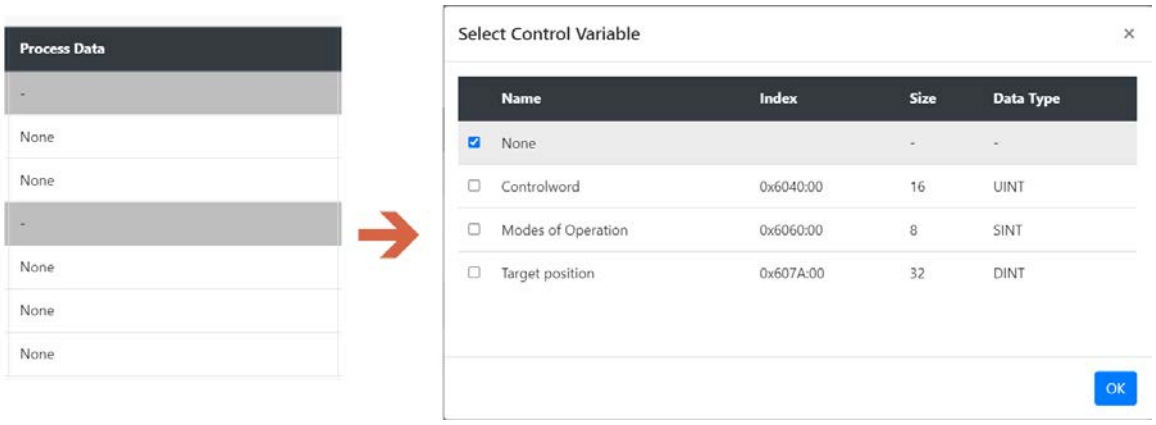
Set counter done

It is used to judge whether the setting of the encoder counter to the set value is completed.

Counter value

The variable is used to read the encoder counter value.

As shown in the figure below, the dialog box to select the variable will be brought up after clicking twice on the “Process Data” field of each variable. The user can select the PDO variable to be controlled according to the requirements of the application.



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7.3. Unit Conversion

The setting of unit conversion is shown in Figure 7-3. The unit conversion can be used to convert the units to user's units according to different requirements. The parameters are as follows:

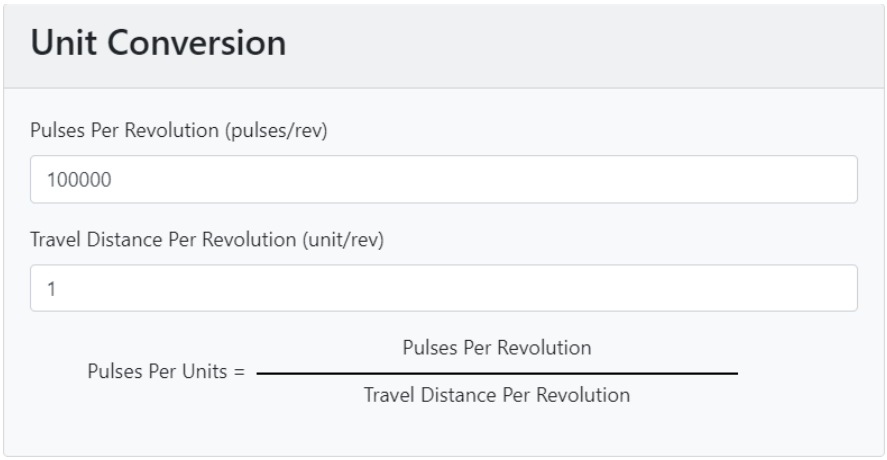


Figure 7-3

- Pulses Per Revolution (pulses/rev)
  The number of pulses per revolution.

- Travel Distance Per Revolution (unit/rev)
  The travel distance of the mechanism per revolution.

- Pulses Per Units
  The number of pulses per unit. Pulses per Unit = Pulses per Revolution / Travel Distance per Revolution.

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7.4. Homing

As shown in Figure 7-4, the Homing parameter provides the choice of actions of the CiA402 slave module during the homing process. For some CiA402 slave modules do not fully implement the CiA402 specification, at this time, these parameters can be used to determine the actions. The parameters are as follows:

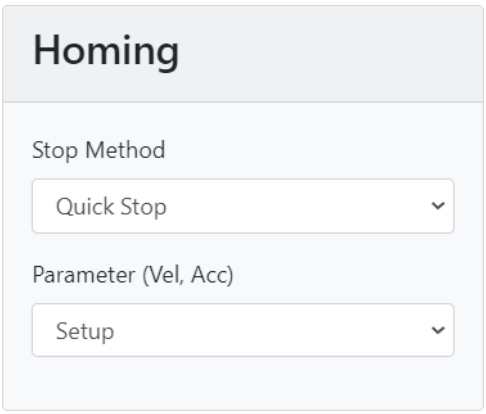


Figure 7-4

- Stop Method

  How to stop during homing.

  Quick Stop

  Use the Quick Stop command of the CiA402 to stop the operation.

  Halt

  Use the Halt command of the CiA402 to stop the operation.

- Parameter (Vel, Acc)

  Whether to set the velocity or acceleration parameters or not during the homing.

  Ignore

  During the homing process, there is no need to use the SDO to set parameters (such as speed or acceleration parameters).

  Setup

  During the homing process, use the SDO to set parameters (such as speed or acceleration parameters).

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7.5. Parameter

The advanced motion parameter setting is shown in Figure 7-5, which can be used to set limits in motion control. The parameters are as follows:

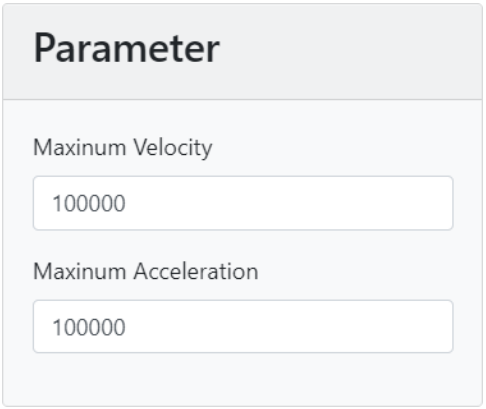


Figure 7-5

- Maximum Velocity
  Limit of maximum speed.

- Maximum Acceleration
  Limit of maximum acceleration.

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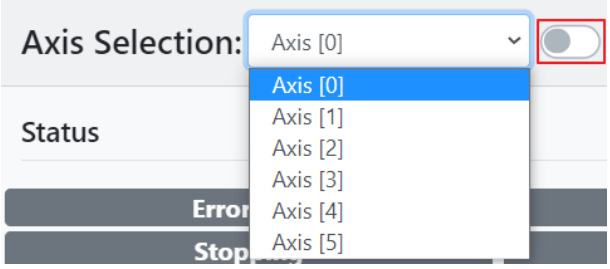
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8. Motion Control Axis Test

When the motion control function is enabled in the EtherCAT operation task, the user can perform a simple motion control test on this page. The following are the functions of this test page.

8.1. Enable Axis Test

As shown in the figure below, select the axis to perform the test from the drop-down list, and click the enable button on the right to enable the test of the specified axis number.

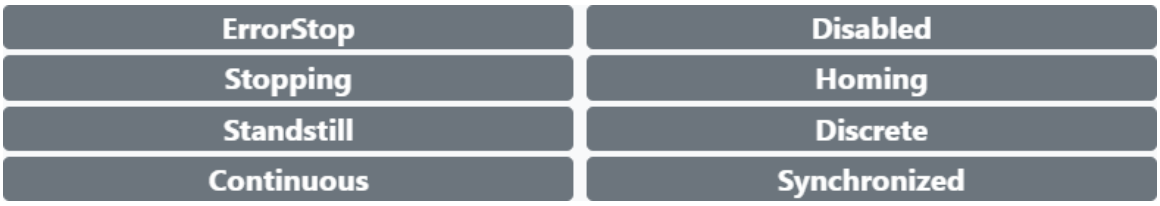


8.2. Axis Status

The axis status includes three parts: PLCopen status, axis flags, motion control status. The following section will give detailed information of these three parts.

8.2.1. PLCopen Status

The PLCopen status is shown in the figure below, which is the state machine defined by the PLCopen specification (PLCopen Part 1) for single-axis motion control. Each state is as follows:



- Disabled

  The disabled state is the initial state of the axis, the power state is off and there are no errors on the axis.

- Standstill

  The standstill state is the state the power is on, there is no error on the axis, and the axis is not executing any motion commands.

- ErrorStop

  The ErrorStop state is the state to be held on when an axis error occurs.

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- Homing
  The Homing state is the state to be switched to when the axis performs Homing.

- Stopping
  The Stopping state is the state to be switched to when the axis receives a stop command.

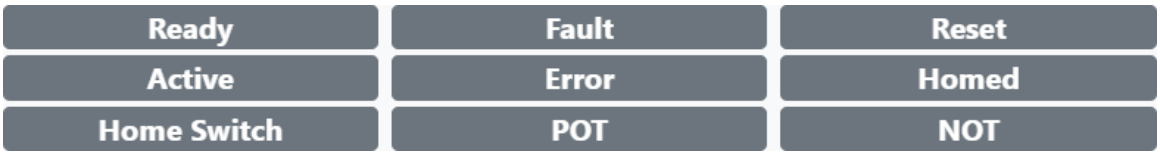
- Discrete
  The Discrete motion state is the state to be switched to when the axis receives motion commands such as absolute position, relative position, or additional position.

- Continuous
  The Continuous motion state is the state to be switched to when the axis receives a velocity motion command.

- Synchronized
  The Synchronized motion state is the state to be switched to when the axis receives a gear motion command.

8.2.2. Axis Flags

Axis flags are shown in the figure below, showing information of axis such as Ready, Active, Fault, limit switches, etc., and the descriptions are as follows.



- Ready
  Ready flag shows if the axis is ready to operate.

- Active
  Active flag shows if the axis is receiving an Active or Power ON command.

- Fault
  Fault flag shows if the axis hardware is damaged or an error has occurred.

- Error
  Error flag shows whether there is any error happens to the software or hardware of the axis.

- Reset
  Reset flag shows if the axis is in the process of resetting.

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- Homed
  Homed flag shows whether the axis has completed the Homing or not.

- Home Switch
  Home switch flag shows the logic state of the axis home switch.

- POT
  Positive limit switch flag, showing the logical state of the positive limit switch of the axis.

- NOT
  Negative limit switch flag, showing the logic state of the negative limit switch of the axis.

8.2.3. Motion Control Status

The motion control status is shown in the figure below, displaying information such as axis position, speed, error code, etc. The information is as follows.



- Actual Position
  The actual position of the axis.

- Command Position
  The command position of the axis.

- Actual Velocity
  The actual velocity of the axis.

- Command Velocity
  The command velocity of the axis.

- Error ID
  The error code when an axis error occurs.

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8.3. Axis Control

Axis control consists of general control, absolute and relative position control, loop motion control, homing, parameter setting, etc. The description of each part is as follows.

8.3.1. General Control

The general control is shown as the figure below, general control includes controls of: Enable, Disable, Reset and Stop the axis. The control buttons are as follows:



- Enable
  Enable the control axis or Power ON (Servo ON).

- Disable
  Disable the control axis or Power OFF (Servo OFF).

- Reset
  Reset the control axis due to error.

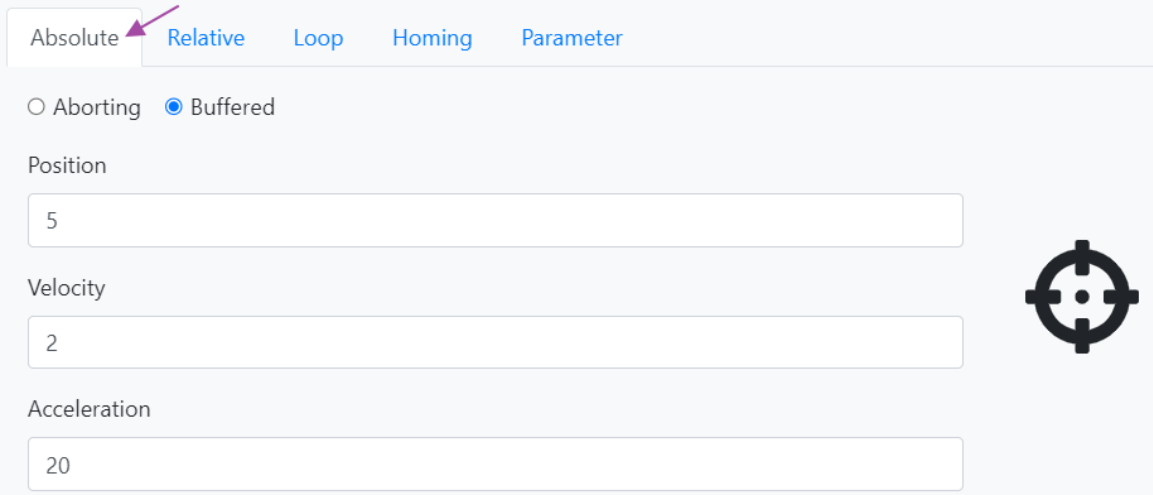
- Stop
  Stop the axis in motion.

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8.3.2. Absolute Position Control

As shown in the figure below, the absolute position control interface can be displayed by clicking the "Absolute" tab. The parameters and buttons are as follows:



- Aborting

  Aborting mode. When this mode is selected, if the axis was executing a motion command, it will abort the executing of the original motion command and execute the new motion command. If no motion command is being executed, it will execute the new motion command directly.

- Buffered

  Buffered mode. When this mode is selected, if the axis was executing a motion command, it will not stop the executing of motion command. The new motion command will enter the internal buffer, wait for the execution of the motion command to be completed, and then continue the new motion. If no motion command is being executed, it will execute the new motion command directly.

- Position

  Absolute position (user unit).

- Velocity

  Velocity (user unit/s).

- Acceleration

  Acceleration (user unit/s^2).

- 

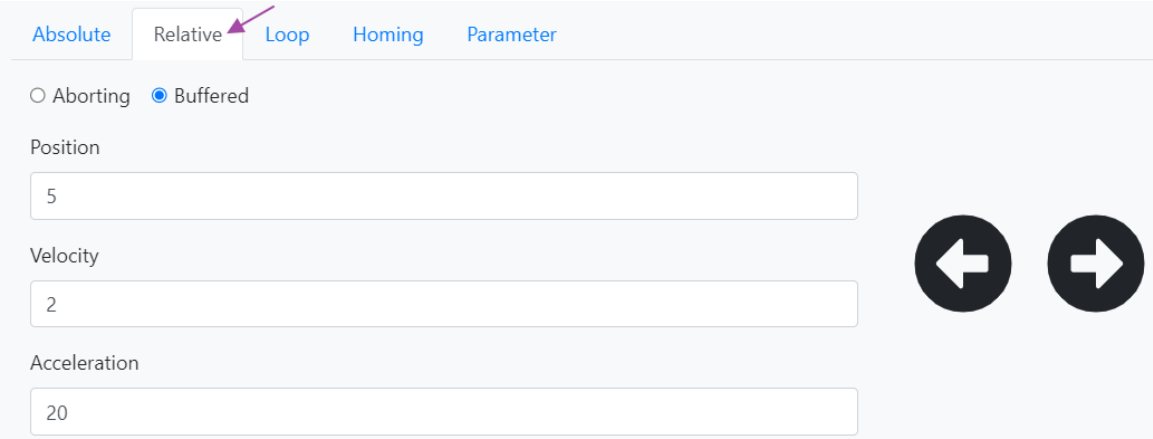
  Start absolute position movement.

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8.3.3. Relative Position Control

As shown in the figure below, the relative position control interface can be displayed by clicking the "Relative" tab. The parameters and buttons are as follows:



- Aborting

  Aborting mode. When this mode is selected, if the axis was executing a motion command, it will abort the executing of the original motion command and execute the new motion command. If no motion command is being executed, it will execute the new motion command directly.

- Buffered

  Buffered mode. When this mode is selected, if the axis was executing a motion command, it will not stop the executing of motion command. The new motion command will enter the internal buffer, wait for the execution of the motion command to be completed, and then continue the new motion. If no motion command is being executed, it will execute the new motion command directly.

- Position

  Relative distance (user unit).

- Velocity

  Velocity (user unit/s).

- Acceleration

  Acceleration (user unit/s^2).

- 

  Start moving relative distance in positive direction.

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- 

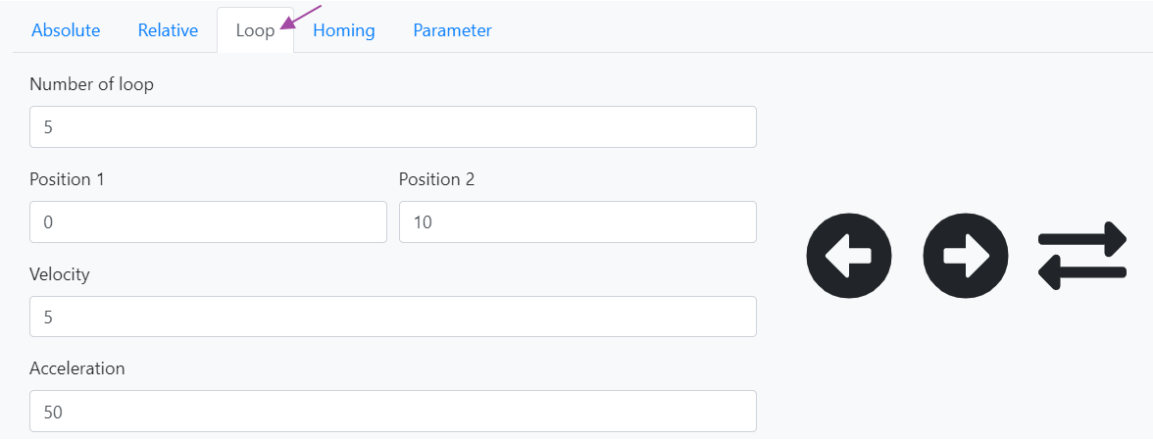
  Start moving relative distance in negative direction. That is, the relative distance is automatically multiplied by a negative number.

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8.3.4. Loop Motion Control

As shown in the figure below, this function allows the user to enter two positions for convenient loop motion control. Click the “Loop” tab to display the loop motion control interface. The parameters and buttons are as follows:



- Number of loop
  The number of loop, up to 50 times.

- Position 1
  Position 1 of the loop (absolute position).

- Position 2
  Position 2 of the loop (absolute position).

- Velocity
  Velocity (user unit/s).

- Acceleration
  Acceleration (user unit/s^2).

- 
  Jog moves in the positive direction. The Jog will keep moving after the button is pressed, and will not stop until the user releases the button.

- 
  Jog moves in the negative direction. The Jog will keep moving after the button is pressed, and will not stop until the user releases the button.

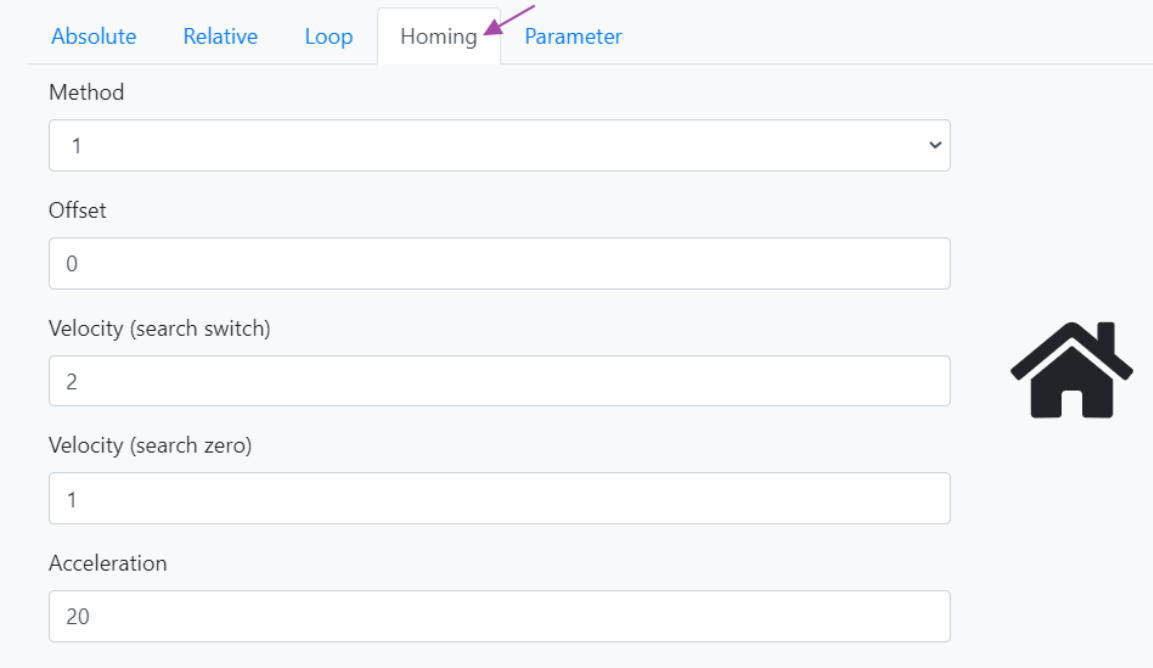
- 
  Start moving the controls in loop.

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8.3.5. Homing

As shown in the figure below, the homing interface can be displayed by clicking the "Homing" tab. The parameters and buttons are as follows:



- Method
  Homing method. Please refer to the description of the SDO object (0x6098) in the Slave Manual for detailed information.

- Offset
  Position offset after homing is completed ($\mathrm{user\ unit}$). Please refer to the description of the SDO object (0x607C) in the Slave Manual for detailed information.

- Velocity (search switch)
  Homing velocity ($\mathrm{user\ unit/s}$) is the velocity to search the switch. Please refer to the description of the SDO object (0x6099:01) in the Slave Manual for detailed information.

- Velocity (search zero)
  Homing velocity ($\mathrm{user\ unit/s}$) is the velocity to search the origin. Please refer to the description of the SDO object (0x6099:02) in the Slave Manual for detailed information.

- Acceleration
  Homing acceleration ($\mathrm{user\ unit/s^2}$). Please refer to the description of the SDO object (0x609A) in the Slave Module Manual for detailed information.

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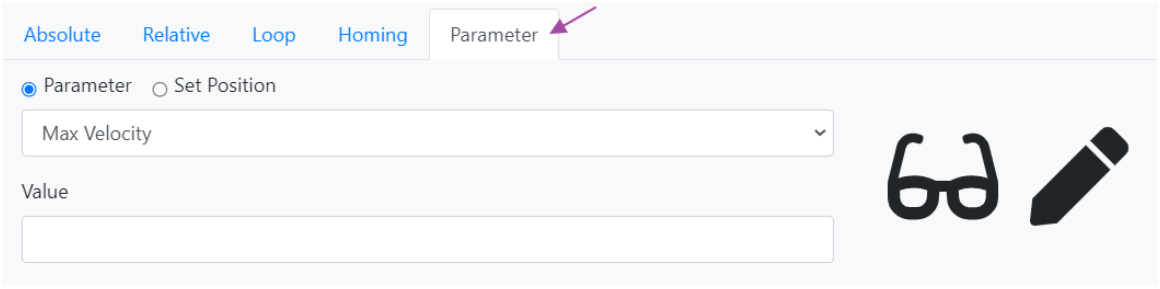
-  Start Homing.

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8.3.6. Parameter Settings

As shown in the figure below, the parameter settings interface can be displayed by clicking the "Parameter" tab. The parameters and buttons are as follows:



- Parameter

  Parameter settings of the axis. The parameters to be set from the drop-down list are as follows:

  Max Velocity

  Maximum velocity limit.

  Max Acceleration

  Maximum acceleration limit.

  Velocity Factor

  Velocity scaling factor (0 to 1).

- Set Positon

  Set the axis position.

  Absolute

  In absolute mode, the axis position is set to be absolute position.

  Relative

  In relative mode, the axis position is set to the sum of the current position + the distance value to be entered.

  Hardware

  Set the encoder hardware counter value, this option is only available when the axis type is encoder.

- Value

  Read and write parameter values.

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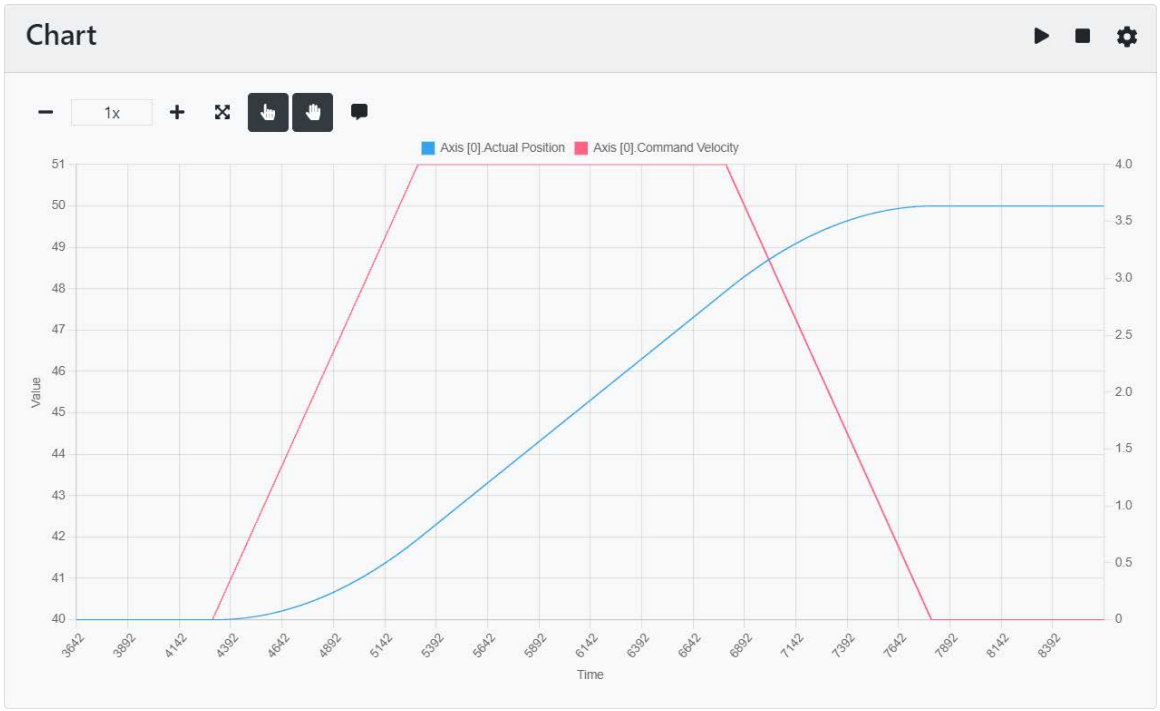
- 
  Read parameter value.
- 
  Override parameter values.

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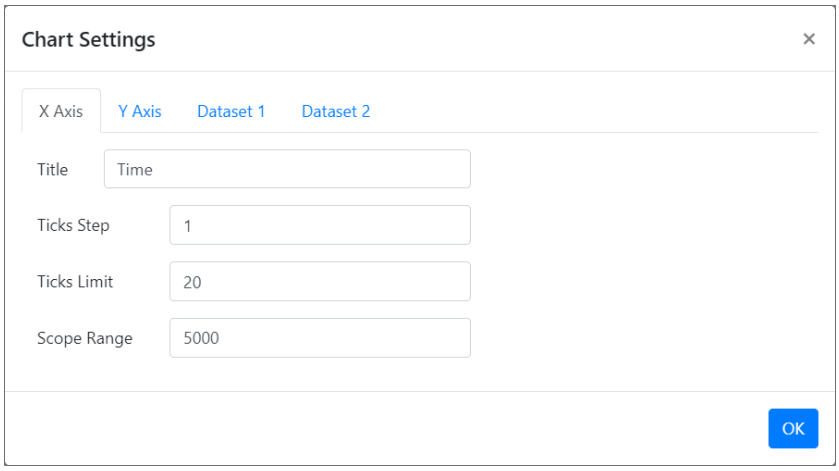
9.Chart

The chart function is shown in the figure below, which allows users to draw a trend chart to identify changes of variables over time when the EtherCAT operation task is started. These variables can be PDO variables or motion control variables. A total of 2 sets of data sets can be recorded. The following will explain how to set the chart, start the chart drawing and use the chart tools.



9.1. Setting the Chart

As shown in the figure below, click the function button  on the right side of the tab to bring up the chart setting dialog box. The contents and parameters of each tab are as follows.

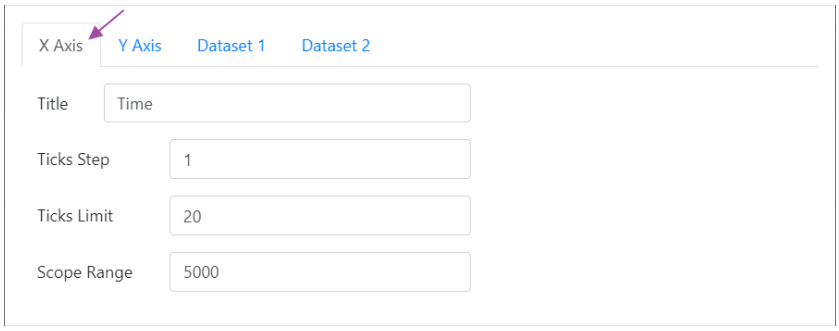


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9.1.1. X Axis

As shown in the figure below, the X-axis parameter setting page can be switched by clicking the "X Axis" tab. The parameters are as follows.

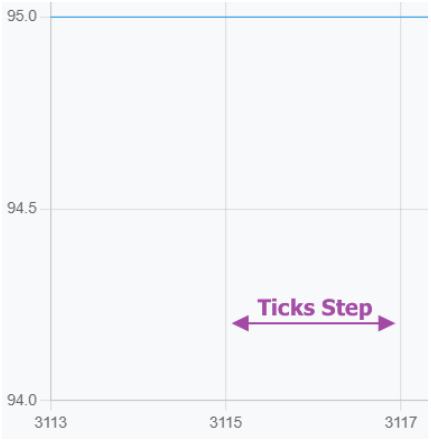


- Title

  The title of the X-axis. The text will appear below the graph.

- Ticks Step

  The size of each tick on the X-axis. The chart will automatically adjust to an appropriate value according to the number of strokes drawn or the actual value changes.

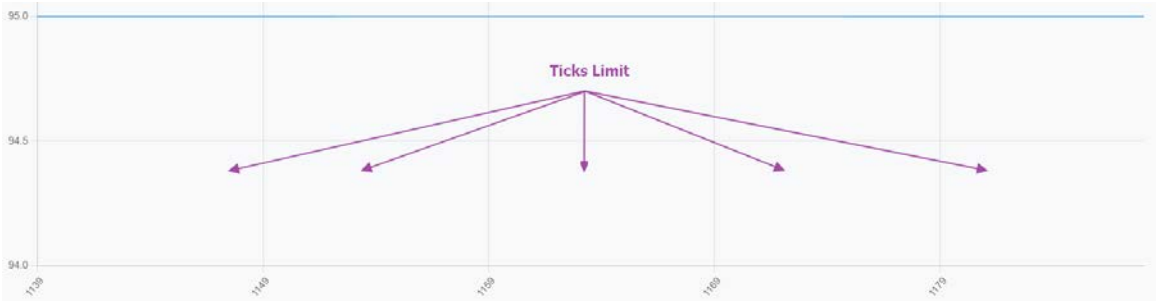


- Ticks Limit

  Maximum total number of X-axis ticks. The chart will automatically adjust to an appropriate value according to the number of strokes drawn or the actual value changes.

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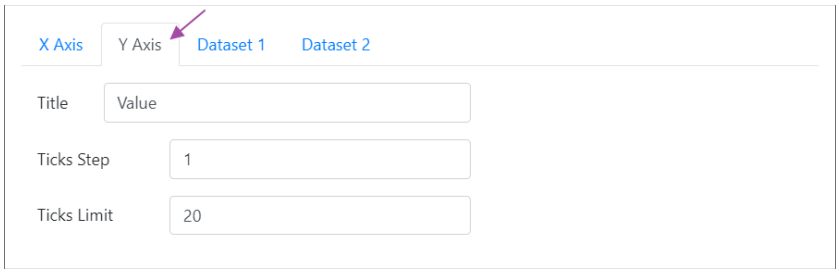


- Scope Range

  The total number of X -axis records. The time unit of each X-axis data is determined according to the communication cycle of the EtherCAT operation task.
  When the total number of records exceeds this set value, the data recorded earlier will be deleted to record the new data. If the number of record strokes is too large, the drawing performance will be reduced, and the drawing screen may pause temporarily.

9.1.2. Y Axis

As shown in the figure below, the Y-axis parameter setting page can be switched by clicking the "Y Axis" tab. The parameters are as follows.



- Title

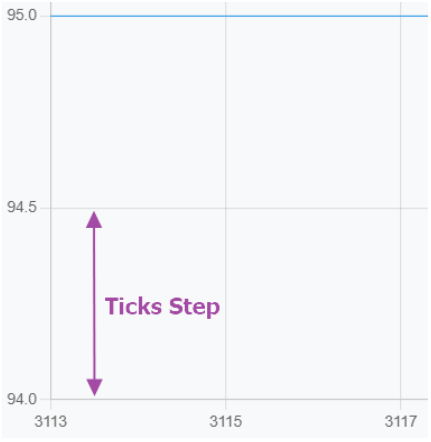
  The title of the Y-axis. The text will appear to the left of the graph.

- Ticks Step

  The size of each tick on the Y-axis. The chart will automatically adjust to an appropriate value according to the number of strokes drawn or the actual value changes.

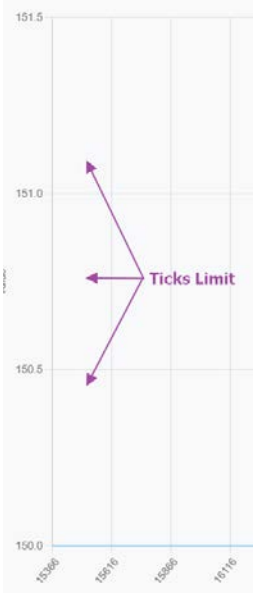
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- Ticks Limit

  Maximum total number of Y-axis ticks. The chart will automatically adjust to an appropriate value according to the number of strokes drawn or the actual value changes.

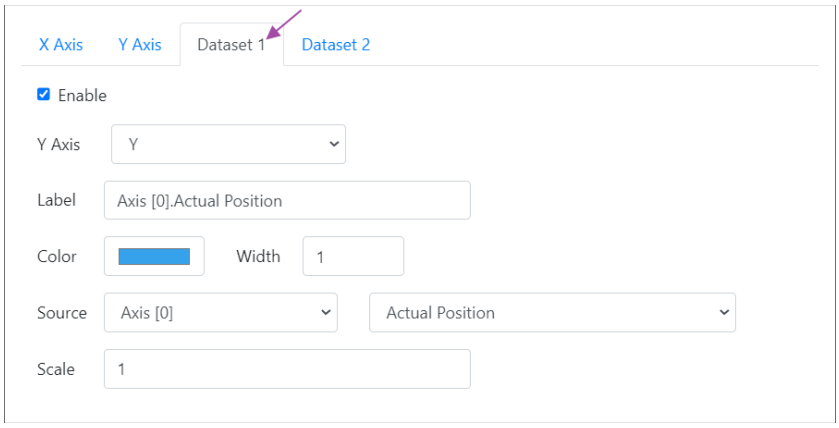


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9.1.3. Dataset 1

As shown in the figure below, the parameter setting of Dataset 1 can be switched by clicking the "Dataset 1" tab. The parameters are as follows.



- Enable
  Whether to enable this dataset or not.

- Y Axis
  The Y axis on which the dataset is drawn.

  Y
  Left Y-axis, use the left scale range.

  Y1
  Right Y-axis, use the right scale range.

- Label
  Dataset label. The text will appear above the graph.

- Color
  The line color on the chart of the dataset.

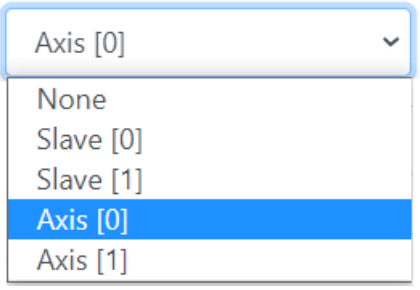
- Width
  The width of the lines on the chart of the dataset.

- Source
  Source of dataset variable.

  Drop down list 1
  Select slave number or axis number.

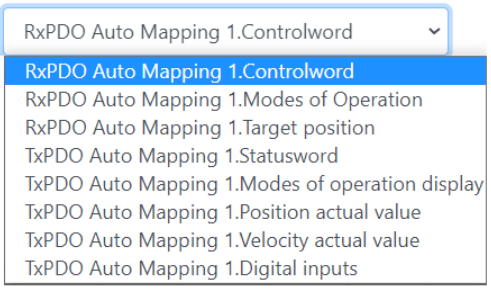
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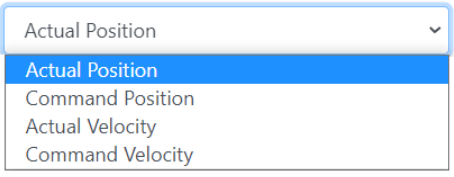


Drop down list 2

Select slave PDO variable or motion control variable.



Slave PDO Variable



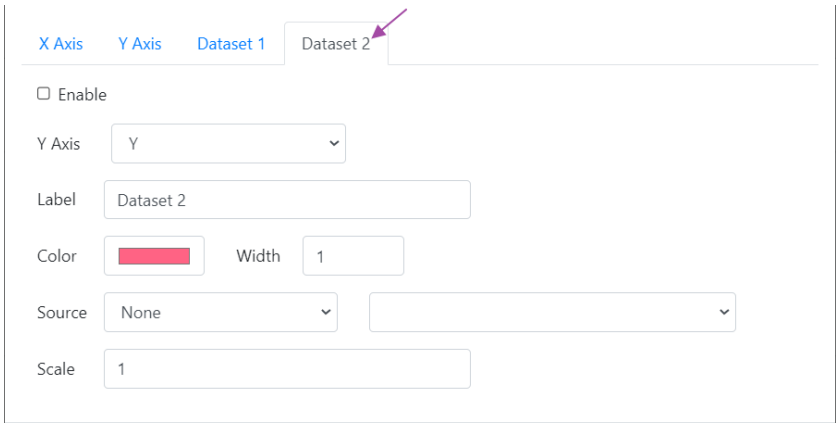
Axis Variable

- Scale

  Scale factor. The source variable will be multiplied by this scale and plotted on the graph.

9.1.4. Dataset 2

As shown in the figure below, the parameter setting of Dataset 2 can be switched by clicking the "Dataset 2" tab. Please refer to Section “Dataset 1” for detailed information of the parameters.



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9.2. Start / Stop Chart Drawing

The drawing of the chart can be started or stopped by using the function buttons on the right side of the title, as shown below:

- 
  Start drawing the chart.
- 
  Stop drawing the chart.

9.3. Chart Tools

As shown in the figure below, the chart tools are located above the chart. When the drawing of the chart is completed and stopped, you can use these tools to analyze the chart. The function buttons are as follows.

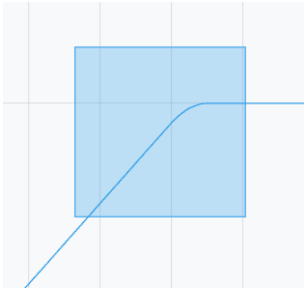


-
  Zoom out the chart.
- 

  The current zoom ratio.
- 
  Zoom in the chart.
- 
  Reset the zoom ratio, it will automatically zoom to the appropriate ratio.
- 
  Enable the drag-to-zoom function. As shown in the figure below, when this function is enabled, click on the left mouse button and drag to zoom in the chart.

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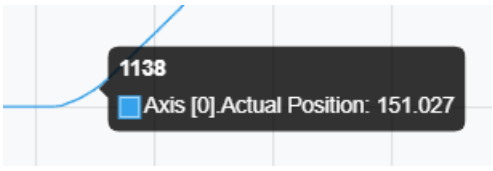


- 

  Enable the panning chart function. When this function is enabled, click on the left mouse button and drag to pan the chart.

- 

  Enable the tooltip function. As shown in the figure below, when this function is enabled, when the mouse cursor passes over the line segment of the chart, the detailed information of the point will appear.



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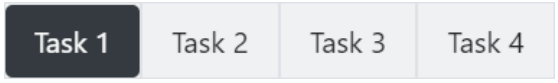
10. PLC Task

As shown in Figure 10-1, this part allows users to obtain the information of each PLC task and perform PLC task control without using Win-GRAF Workbench.



Figure 10-1

The function buttons are as follows:

- 

Switch to the task by clicking on specific task tab. The information of the task will be displayed below, and the user can perform control of the task by the function buttons on the right hand side.
- 
Automatically update information of task cycle time.
- 
Start or stop the task.
- 
Pause cycle to cycle mode.
- 
Resume cycle to cycle mode. Can only be used when the cycle to cycle mode is paused.
- 
Execute a single cycle. Can only be used when the cycle to cycle mode is paused.

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- 
  Delete the code file of the task.

The task information is as follows:

- Application - ”xxx”
  "xxx" is the running status of the task, the status are as follows:

  IDLE: Stop task execution.

  RUN: The task is being executed.

  STOP: The task is paused.
  - Name
    Task or project name
  - Version
    Program version
  - CRC
    CRC check code of the program
  - Date
    Program creation time
- Cycle Time
  Task cycle time information.
  - Period (μs)
    The task period, in microseconds.
  - Last (μs)
    The task execution time, taking the latest cycle as the last cycle time, in microseconds.
  - Max. (μs)
    The maximum execution time of the task, in microseconds.
  - OverFlow
    The count times when the task execution time exceeds the cycle time.

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11. PLC License

As shown in Figure 11-1, the authorization status of PLC Runtime is displayed, and the parameters and function buttons are as follows:

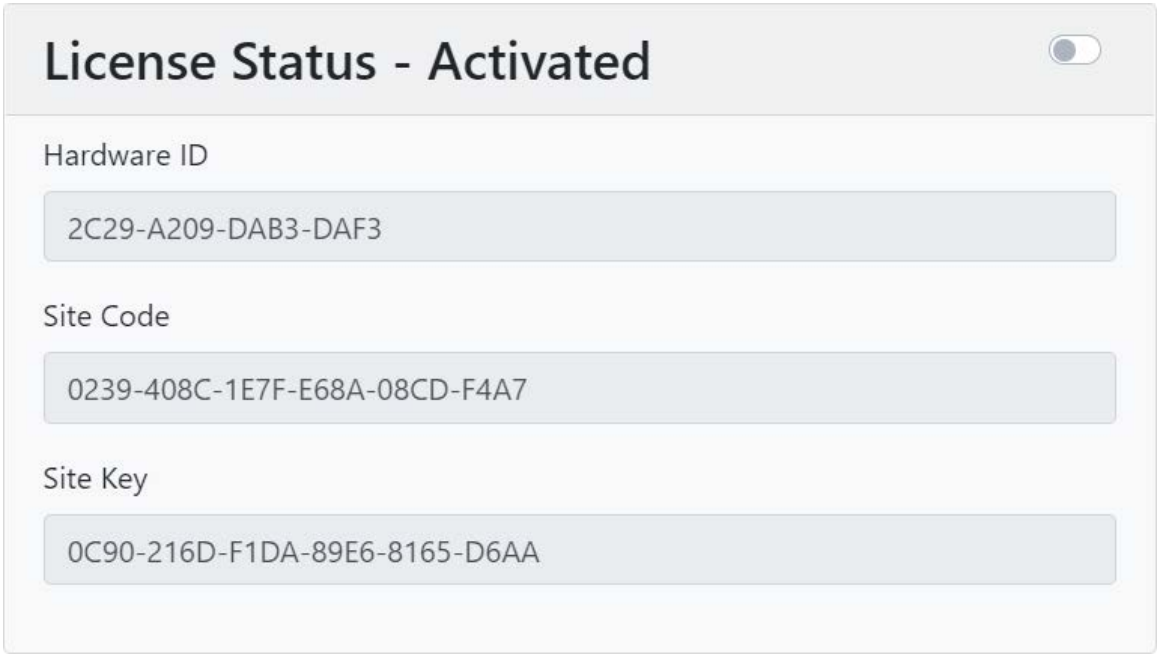


Figure 11-1

- License Status - ”xxx”
  "xxx" is the authorization status, the status are as follows:

  Activated: Activated.

  Deactivated: Not activated.

- Hardware ID
  Hardware ID of the controller

- Site Code
  The Site Code of the authorization code

- Site Key
  The Site Key of the authorization code

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- 

  Edit the authorization code. The "Activate" button will appear after enabling the button, please input the Site Code and Site Key of the authorization code. Then press the "Activate" button to activate the authorization. Whether the authorization is successful can be shown by the License Status - "xxx".

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12. OPC UA

OPC UA (Open Platform Communications Unified Architecture) is an open standard communication protocol designed for facilitating data exchange and communication between different devices and systems. Its primary goal is to provide interoperability across platforms, networks, and vendors while ensuring high scalability and security.

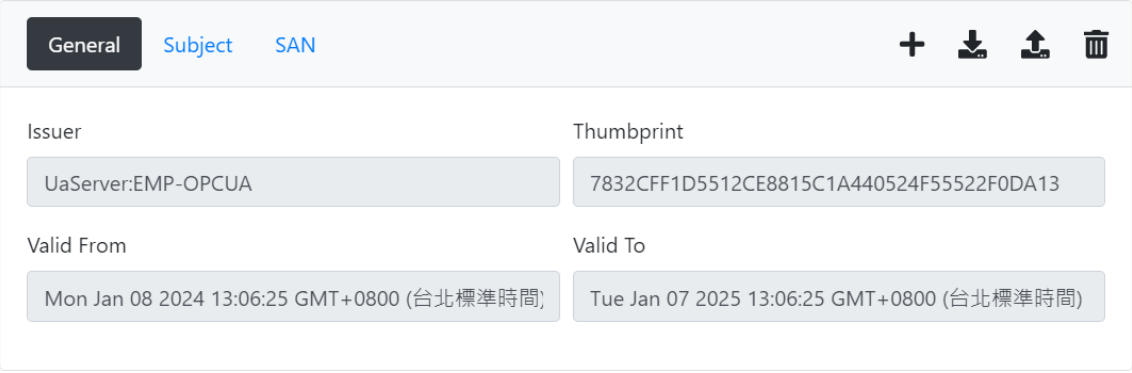
12.1. Server Certificate

The contents of this page are used to manage the certificate files of the Win-GRAF Runtime OPC UA Server to ensure the security of communications. The following is a detailed description of the contents of each tab:

- Own

  This tab displays existing server certificates and allows the creation of new self-signed certificates. Detailed information about server certificates can be accessed through the General/Subject/SAN tabs. The following details are explained:

  - General: General information.

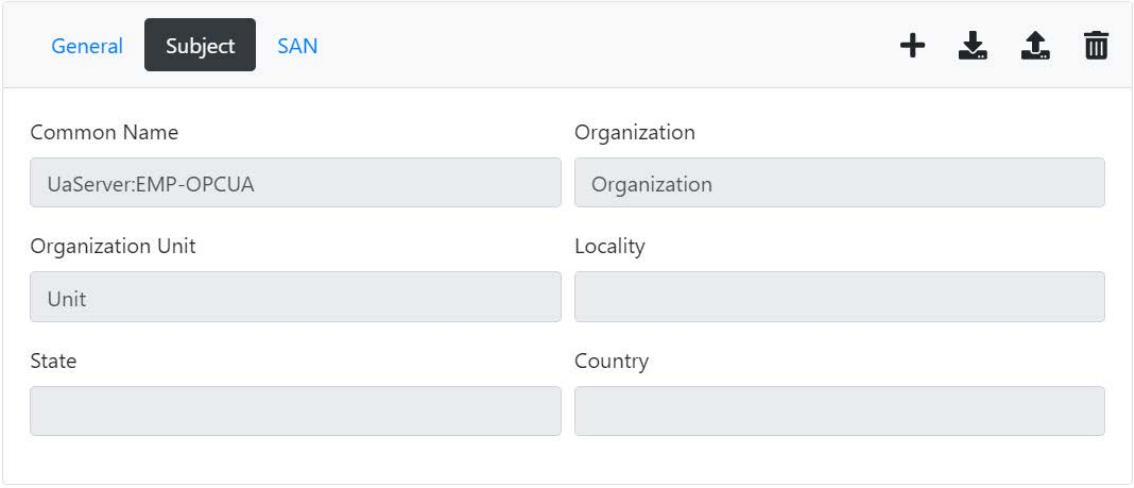


  - Issuer: Issuer name.
  - Thumbprint: This is commonly called a “fingerprint”.
  - Valid From: Start date of certificate.
  - Valid To: Expiry date of a certificate.

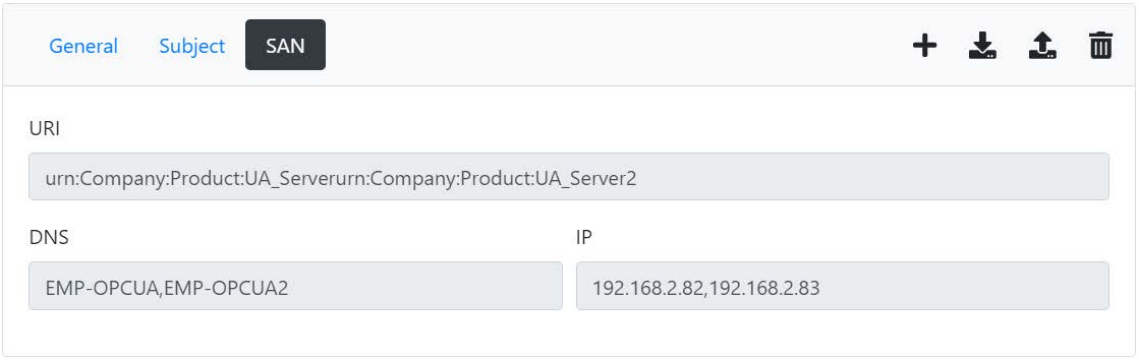
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- Subject: Subject field.



- SAN: Subject Alternative Name.



- URI: Uniform Resource Identifier.
- DNS: Domain Name System. Use commas to separate multiple entries.
- IP: IP Address. Use commas to separate multiple entries.

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Buttons on the right:

- 

  Create Self-Signed Certificate. After clicking the button, the following dialog box will appear, and each parameter is described as follows:



  - General: General Settings.
    - Validity (days): Certificate validity period, unit days.
  - Subject: Please refer to the Subject SubjectSubjectdescription in the Own server certificate information.
  - SAN: Please refer to the SAN SubjectSubjectdescription in the Own server certificate information.

- 

  Download the server certificate.

- 

  Upload the server certificate. After clicking the button, the following dialog box appears, select public key or private key to upload server certificate.



- 

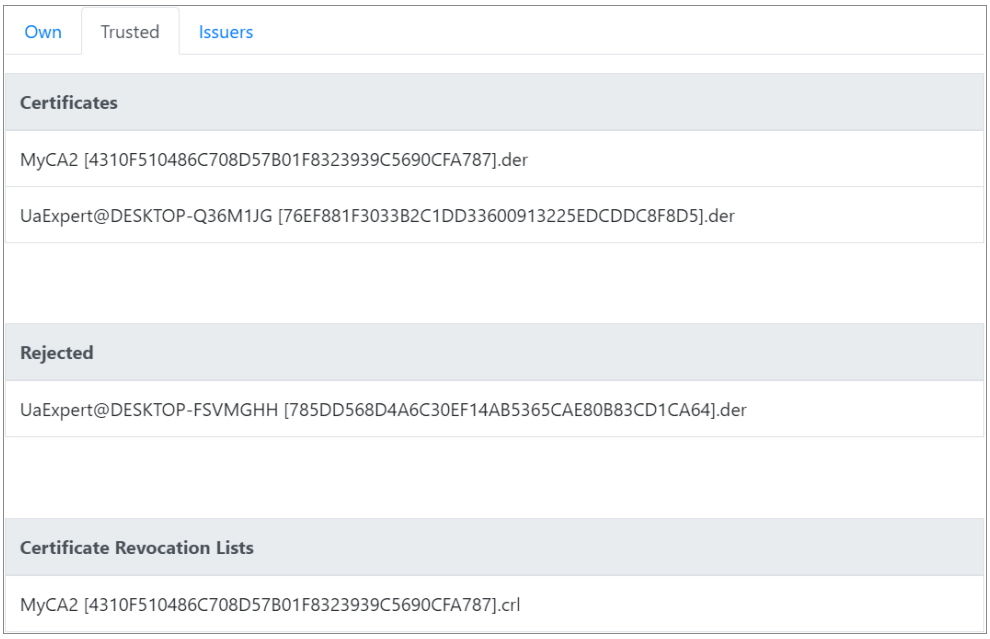
  Delete the server certificate.

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- Trusted

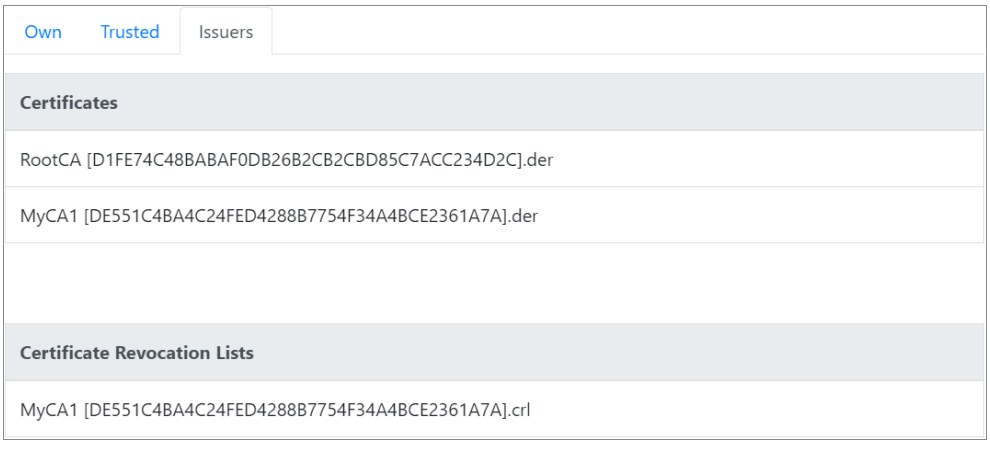
  Used to manage server trust and rejected certificates. You can also trust or reject specific certificates.



  - Certificates: List of trusted certificates.
  - Rejected: List of rejected certificates.
  - Certificate Revocation Lists: Certificate Revocation Lists of trusted certificates.

- Issuers

  Manage issuer certificates. An issuer certificate is used to verify the legality and authenticity of other certificates. It establishes a trust chain to ensure that it comes from a trusted source.

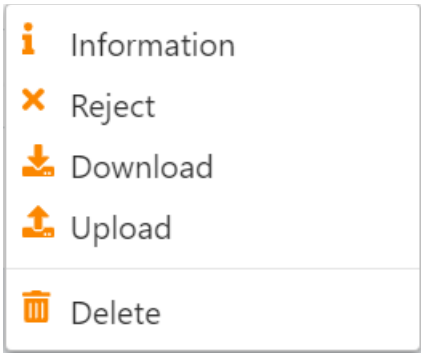


  - Certificates: List of issuer certificates.
  - Certificate Revocation Lists: Certificate Revocation Lists of issuer certificates.

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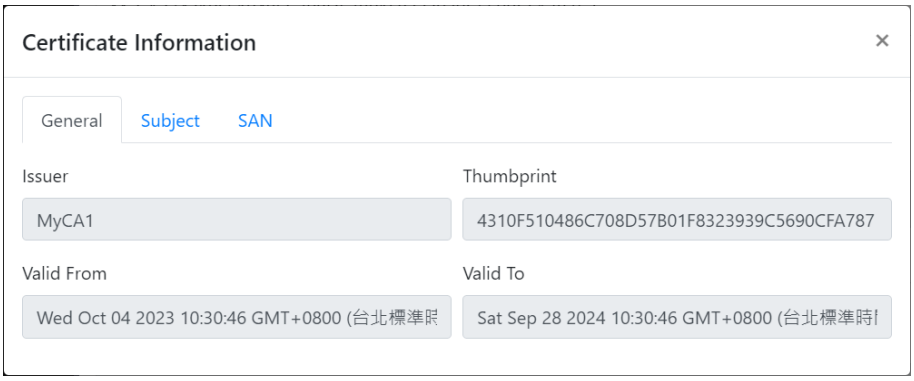
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The right-click menu of the Certificates/Rejected/Certificate Revocation Lists file list is as follows:

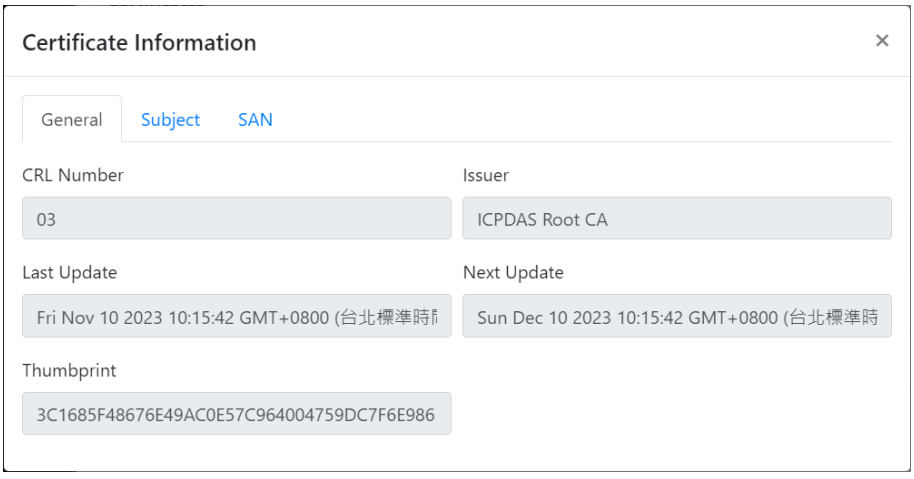


- Information: Display detailed information for certificates or certificate revocation lists. The instructions are as follows:
  - Certificate Information

    Please refer to the description of the Own server certificate information.



  - Certificate Revocation Lists (CRL) Information



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- General: General information.
- Subject: Please refer to the Subject description in the Own server certificate information.
- SAN: Please refer to the SAN SubjectSubjectdescription in the Own server certificate information.

- Download: Download certificate or certificate revocation lists file.
- Upload: Upload certificate or certificate revocation lists file.
- Delete: Delete certificate or certificate revocation lists file.
- Reject: Move the certificate to the rejected certificate list. (This option is available only in the trusted certificate list.)
- Trust: Move the certificate to the trusted certificate list. (This option is available only in the rejected certificate list.)

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13. System General

The system general page is for parameter settings such as host name, network setting, date & time, software update, etc. The following are the functions.

13.1. Hostname

The name of the host controller is set as shown in Figure 13-1. The parameters and function buttons are as follows:

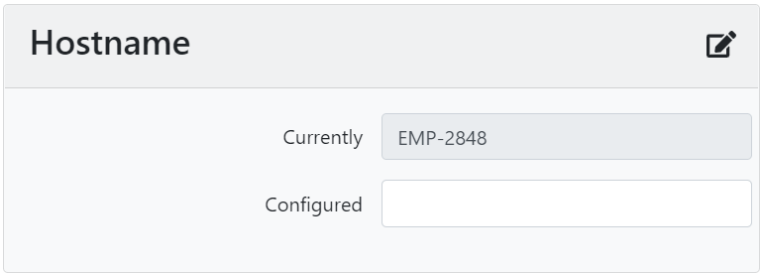


Figure 13-1

- Currently
  The current hostname.
- Configured
  The newly set hostname.
- 
  Write the newly set hostname to the controller.

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13.2. Date & Time

The date and time settings of the controller are shown in Figure 13-2. The parameters and function buttons are as follows:

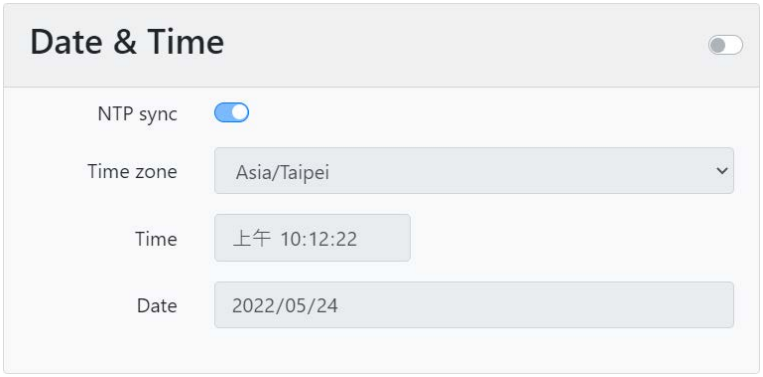


Figure 13-2

- 

  The switch on the right side of the title is used to enable or disable the date and time setting function. When it is disabled, it will only display the current date and time. If it is enabled, a  write button will appear.

- NTP sync

  Enable or disable NTP synchronization. The NTP network time protocol will synchronize the system time of the controller to the system time on the network. Time zone

- Time zone

  Time zone.

- Time

  Time. Can only be set when NTP sync is disabled.

- Date

  Date. Can only be set when NTP sync is disabled.

- 

  Write new Settings to the controller, which only appears if the settings function is enabled.

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13.3. Network

The network settings of the controller are shown in Figure 13-3, and the descriptions of the parameters and function buttons are as follows:

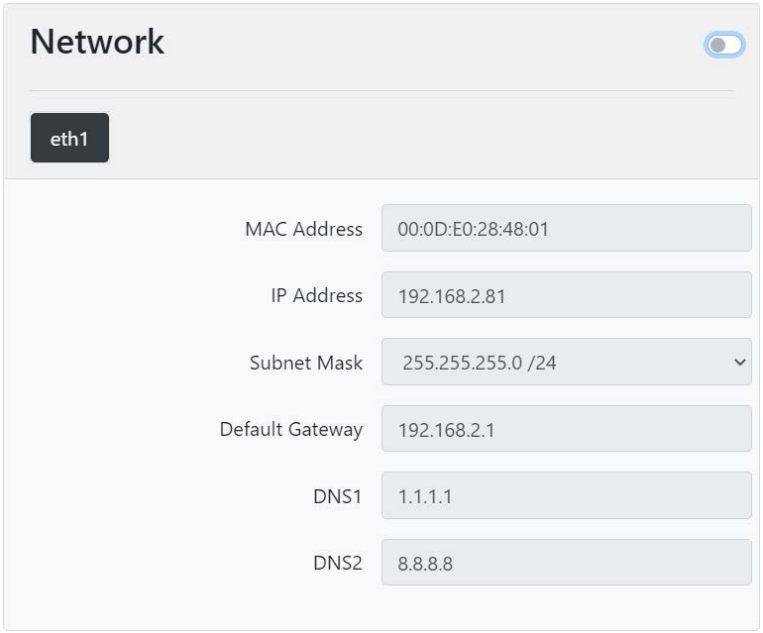


Figure 13-3

- 

  The switch is used to enable or disable the network settings. When it is disabled, it will only display the current network interface and network configuration. If it is enabled, a  write button will appear.

- MAC Address
  MAC address.

- IP Address
  IP Address.

- Subnet Mask
  Subnet mask.

- Default Gateway
  Default gateway.

- DNS1
  DNS server 1.

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- DNS2
  DNS server 2.

- Connection Type
  Connection Type will only appear when the setting is enabled.

  Static IP: Static IP address.

  DHCP: Request an IP address by using DHCP.

- 
  Write new Settings to the controller, which only appears if the settings function is enabled.

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13.4. Maintenance

The maintenance function of the controller is shown in Figure 13-4, which can be used to update the software, display the software version, etc. The function buttons are as follows:

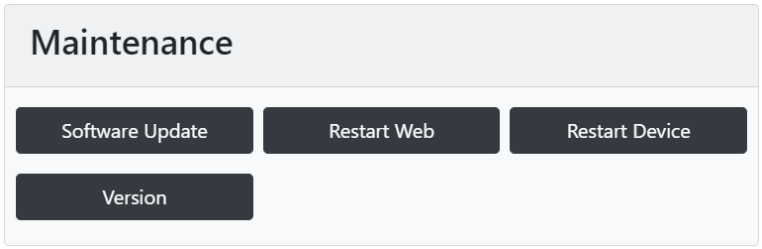
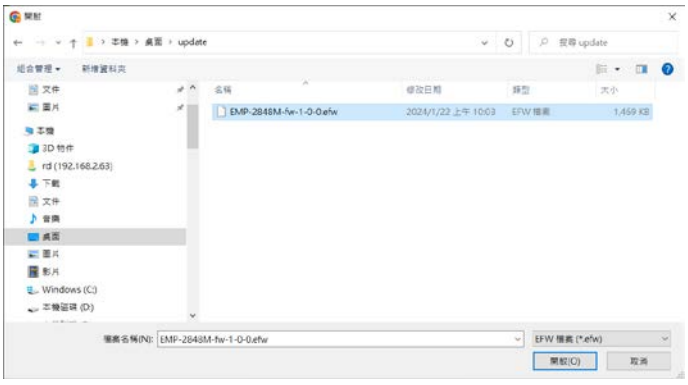


Figure 13-4

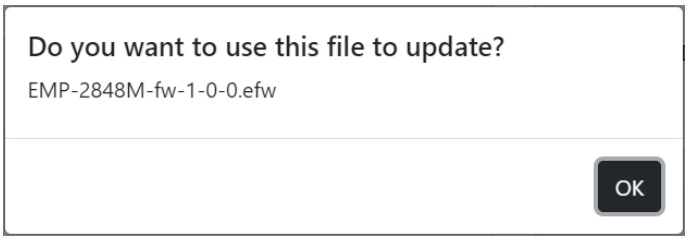
- Software Update

  The software update button is used to update the relevant software inside the system. The update steps are as follows:

  1. After clicking the “Software Update” button, the open file dialog box will appear, select the local firmware update file(.efw).



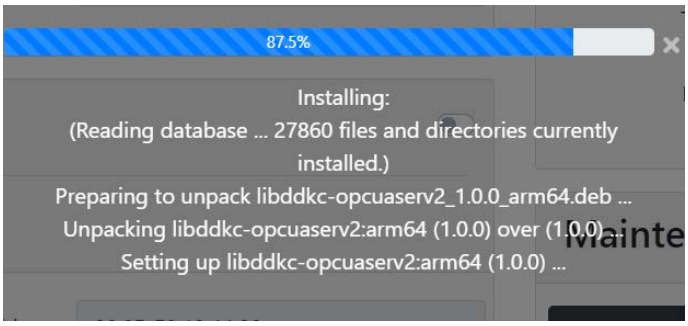
  2. Then a file confirmation dialog box will appear. Click “OK” button to confirm the update.



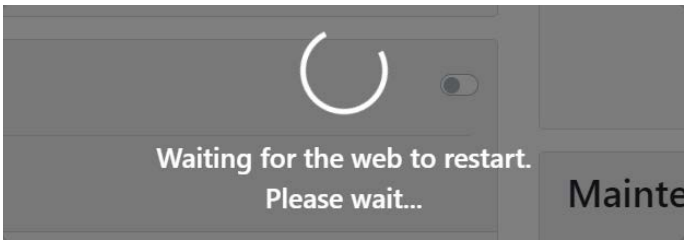
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3. Start the software update process, wait until the progress bar reaches 100% without any error, it means the software update is successful.



4. If the software update package includes a web software update, the web server will be restarted and wait for the restart to complete.



After the web server restart is complete, perform a hard refresh in your browser to clear the cache. Below are common browser shortcut keys:

- Chrome
  - Windows/Linux:
    1. Hold down Ctrl and click the Reload button.
    2. Ctrl + F5.
    3. Ctrl + Shift + R.
  - MacOS:
    1. Hold Shift and click the Reload butto.
    2. Command + Shift + R.
- Firefox
  - Windows/Linux:
    1. Hold down Ctrl and click the Reload button.
    2. Ctrl + F5.
    3. Ctrl + Shift + R.
  - MacOS:
    1. Hold Shift and click the Reload butto.
    2. Command + Shift + R.

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- Edge

  Windows/Linux:

  1. Hold down Ctrl and click the Reload button.
  2. Ctrl + F5.
  3. Ctrl + Shift + R.

  MacOS:

  1. Hold Shift and click the Reload butto.
  2. Command + Shift + R.

- Safarix

  1. Option + Command + E.

- Reboot Web

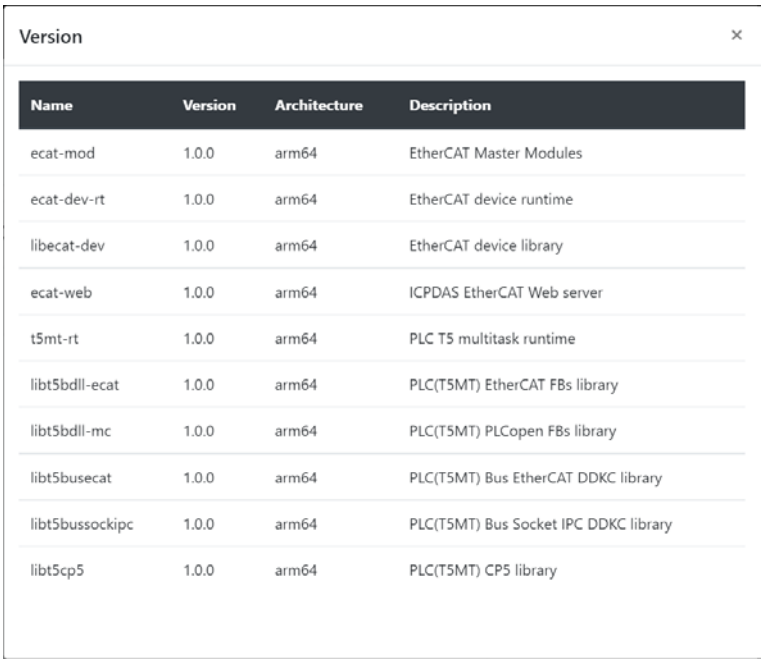
  Reboot web server.

- Reboot Device

  Reboot controller.

- Version

  Show software version information. The following version information dialog box will appear after clicking this button.



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14. System Service

This working page can be used to view the status of the controller service program and view the related logs of the controller. The functions are as follow.

14.1. Service

As shown in Figure 14-1, this part shows the status of the controller service program. The action buttons allow users to manually start, stop, restart, etc. Each column of the system service program are as follows:



Figure 14-1

- Name

  Name of the service.

  EtherCAT module: EtherCAT kernel modules service.

  EtherCAT device runtime: EtherCAT Runtime service.

  PLC(T5) runtime: PLC Runtime service

- Status

  Status of the service.

  active: service or daemon is running.

  inactive: service is not running.

- Actions

  action button.

  : Start the service.

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: Stop the service.

: Restart the service.

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14.2. Log

The controller log function is shown in Figure 14-2, which records the errors, warnings and other prompt messages generated by the internal program of the controller. These messages allow developers to understand the operation status of the program and the cause of the error.

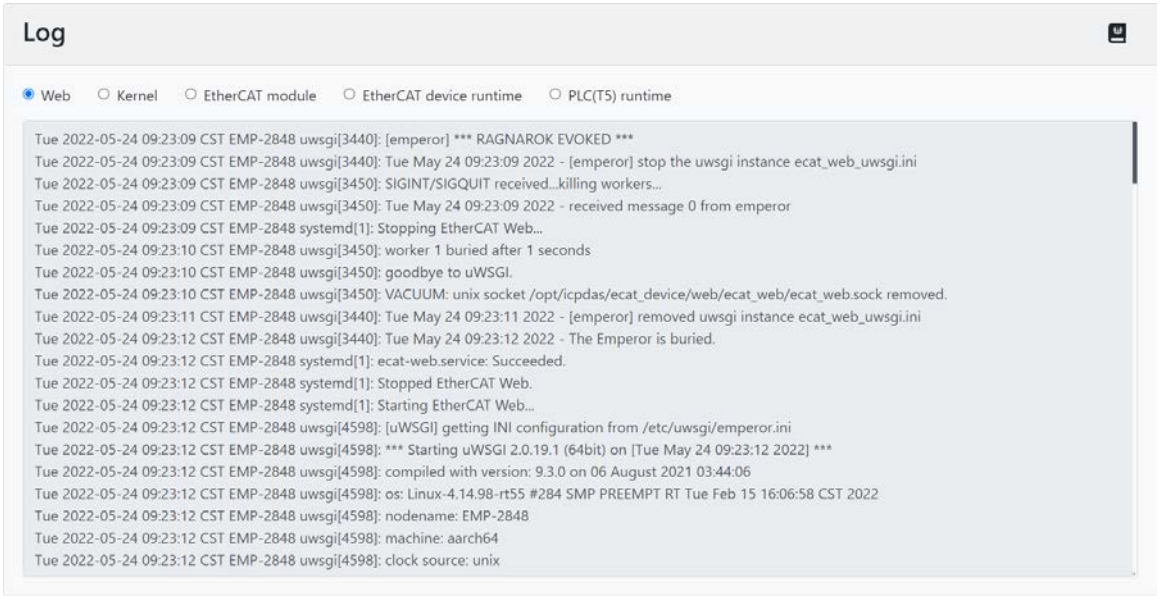


Figure 14-2

The types of logs to be displayed are as follows:

- Web
  Logs of web interface.

- Kernel
  Logs of controller kerenl.

- EtherCAT module
  Logs of EtherCAT kernel modules service.

- EtherCAT device runtime
  Logs of EtherCAT Runtime service.

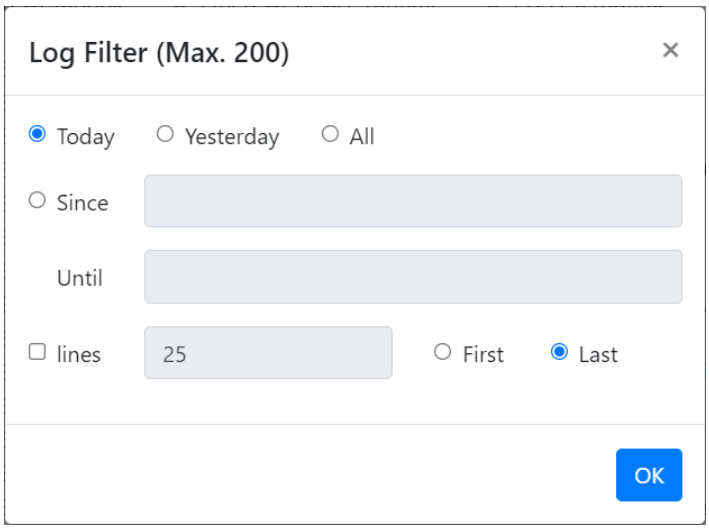
- PLC(T5) runtime
  Logs of PLC Runtime service.

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- 

The button is used to access the content of the selected log. After clicking the button, the following Log Filter dialog box will appear, and the records within the range of the log time will be filtered according to the filter items.



Filter items are as below:

- Today
  Filter logs within today.
- Yesterday
  Filter logs within yesterday.
- All
  All logs.
- Since - Until
  Filter logs within the specified time range.

The display restriction items are as follows:

- lines
  Limit the number of lines displayed in the log. By default, no matter what filter item is selected, the maximum number of displayed lines is 200 lines. The parameter can be set to limit the number of lines to less than 200 lines.

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- First

  Based on the filter range, the logs that are order in time will be displayed.

- Last

  Based on the filter range, the logs that are later in time will be displayed.

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15. Account Settings

This page can be used to modify the user account password on the web interface. After the user logs in the web interface for the first time (using the factory default account/password), please change the password as soon as possible. The password change is shown as Figure 15-1.

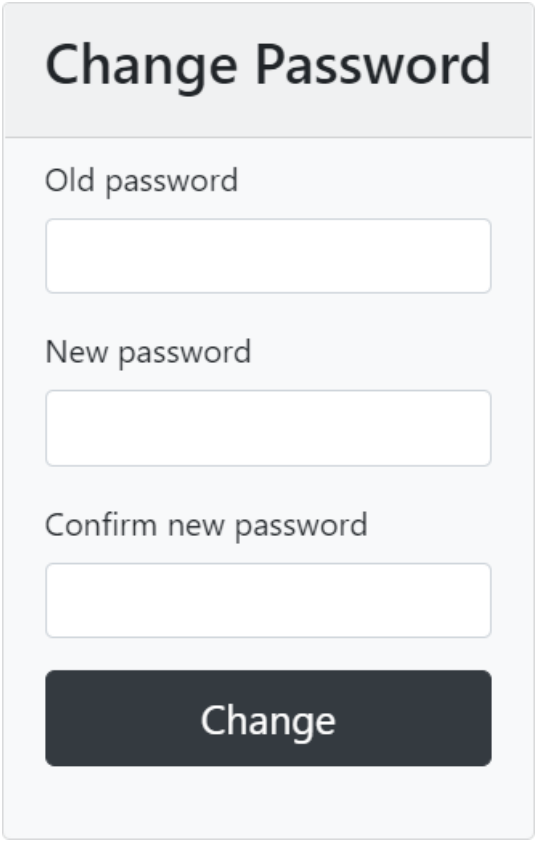


Figure 15-1

The modification steps are as follows:

1. Enter the old password in the "Old password" input box.

2. Enter a new password in the "New password" input box.

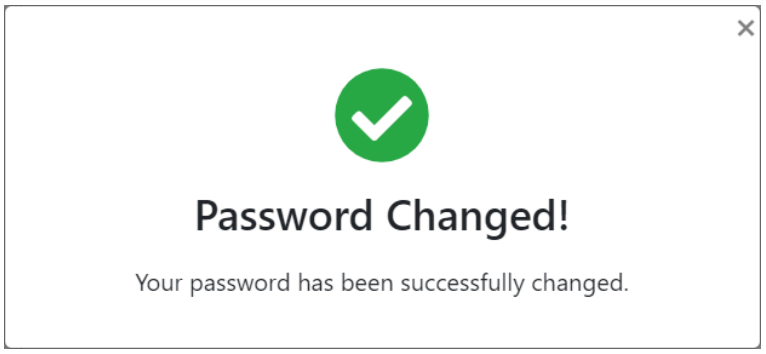
3. Enter the new password again in the "Confirm new password" input box to confirm the password accuracy.

4. Click the “Change” button. After the password is successfully changed, the following dialog box will appear. When you log in to the web interface next time, please log in with the new password. The new password features the following verification restrictions:

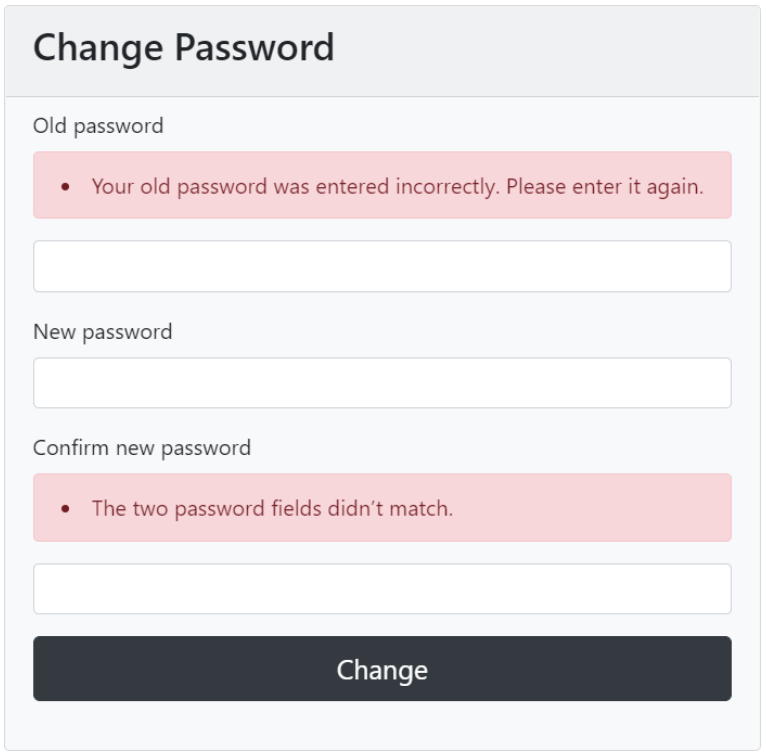
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- Which checks the similarity between the password and a set of attributes of the user.
- Which checks whether the password meets a minimum length, the default is 8 characters.
- Which checks whether the password occurs in a list of common passwords. By default, it compares to an included list of 20,000 common passwords.
- Which checks whether the password isn't entirely numeric.



5. If there is an error in changing the password, an error message will be displayed below each input box, as shown in the figure below.



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16. Quick Start

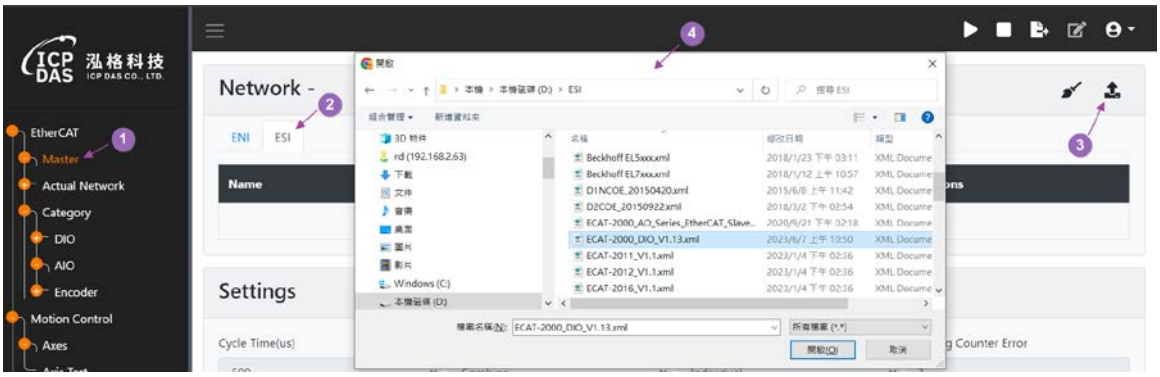
This chapter will give a quick introduction of how to create an ENI file required for EtherCAT Runtime on the web interface, use this ENI file to start the EtherCAT operation task, and then control the slave module through the web interface.

16.1. Slave Free-Run/DC Setting and Control Steps

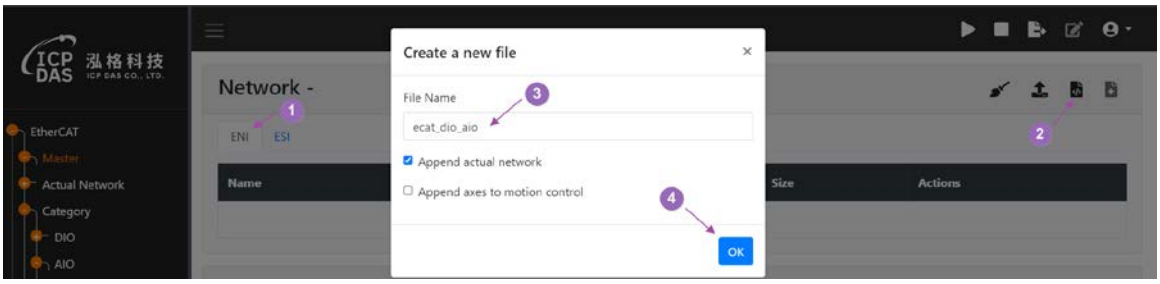
This section will introduce how to create, configure and control the slave modules by connecting the slave modules ECAT-2055 (DI/DO) , ECAT-2028 (AO), ECAT-2012H (AI) as an example.

[Steps]

A. Upload the ESI file.
   (1) Click on the EtherCAT->Master node.
   (2) Click the "ESI" tab.
   (3) Click the Upload button.
   (4) The file selection dialog box appears, select the ESI file of the slave module, if there are multiple ESI files, please upload each file one by one and wait for the upload to complete.



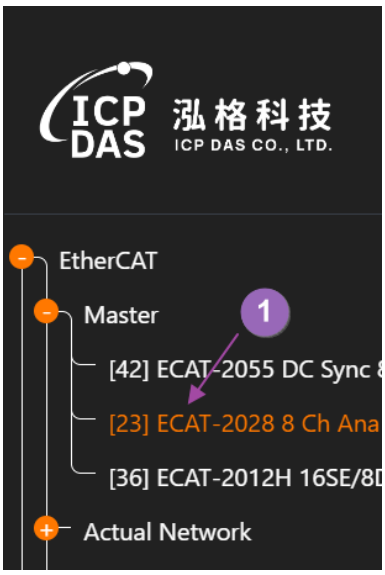
B. Create an ENI file.
   (1) Click on the "ENI" tab.
   (2) Click the New ENI button.
   (3) A new file dialog box will appear, enter the file name.
   (4) Click the "OK" button.



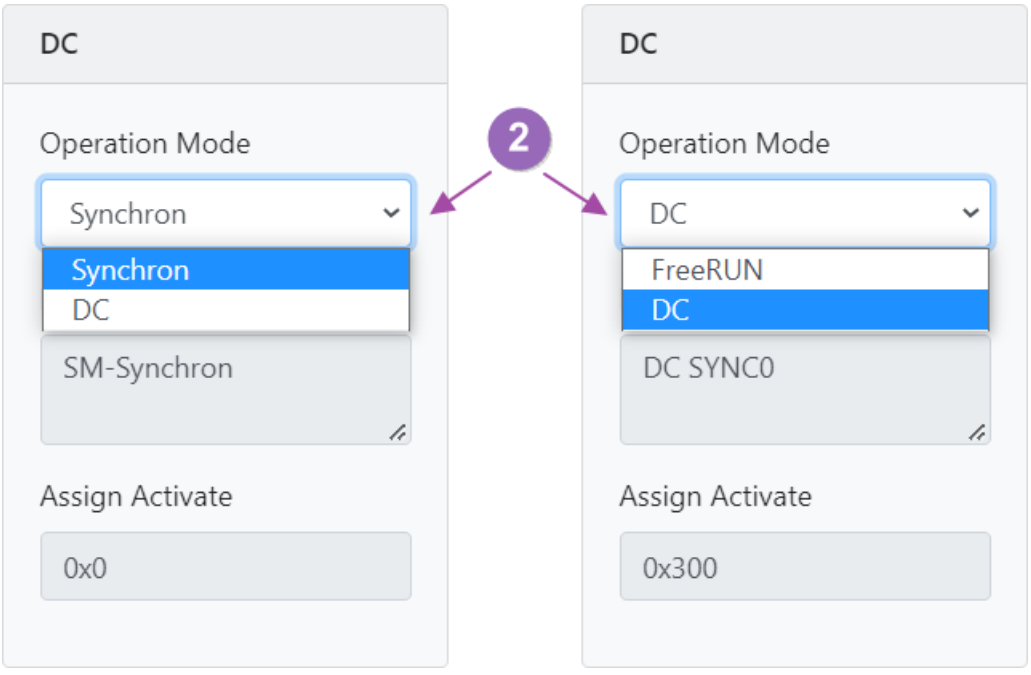
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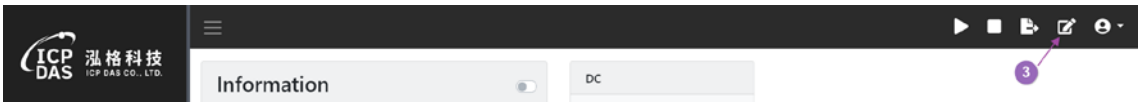
C. Set the operation mode of the slave to SM-Synchron, Free-Run, DC.
(1) Click on the node of EtherCAT->Slave node.



(2) Select the operation mode option from the "Operation Mode" drop-down list of the DC function.



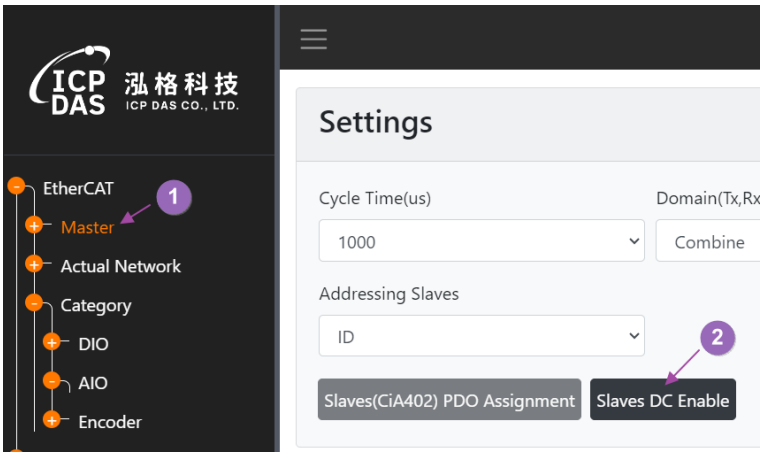
(3) Click the save settings button on the toolbar to save.



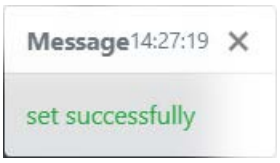
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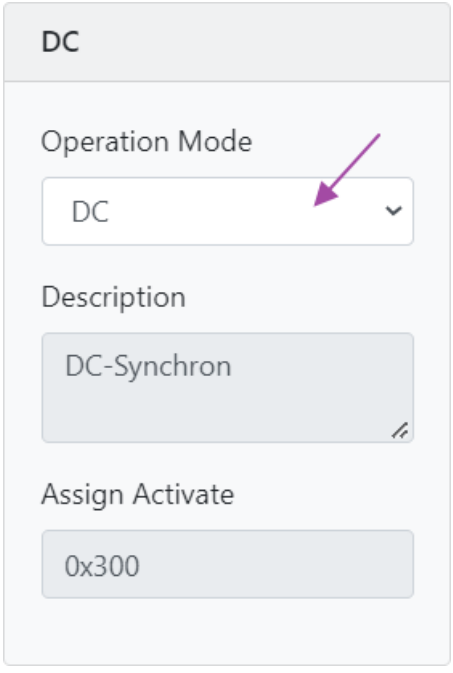
Follow the steps below to quickly set all slave to DC mode
(1) Click on the node of EtherCAT->Master.
(2) Click the "Slaves DC Enable" button.



(3) A “set successfully” message box will appear in the lower right corner.



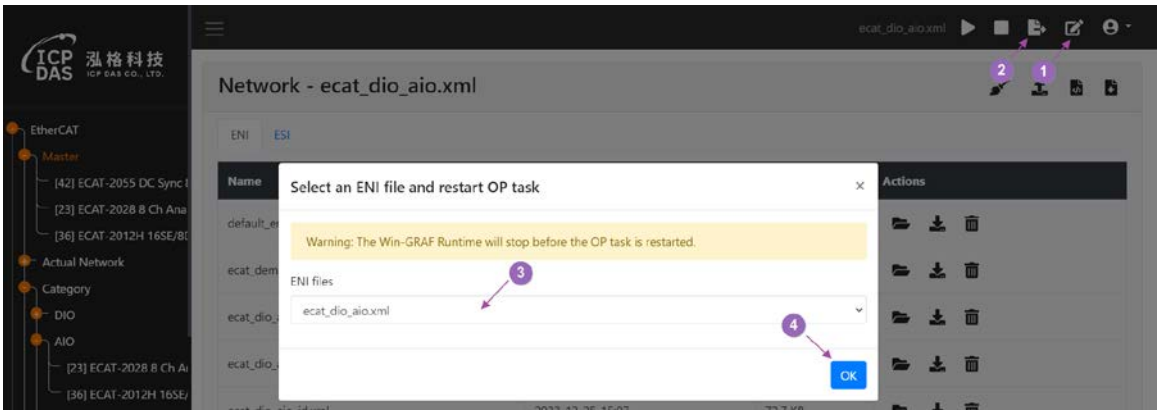
(4) Make sure that the 'Operation Mode' of each slave page is set to DC. If there is no setting, it means that the slave station does not support DC mode, please check if there is DC option in the “Operation Mode” dropdown list.



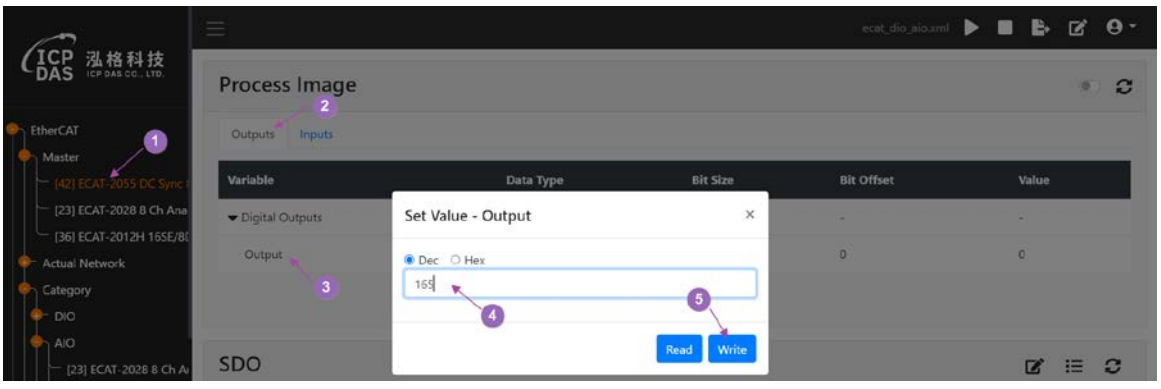
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D. EtherCAT Runtime reloads the ENI file.
(1) Click the save settings button on the toolbar to save.
(2) Click select ENI file and restart EtherCAT operation task button on the toolbar.
(3) Select the ENI file to be reloaded in the dialog box.
(4) Click the "OK" button.



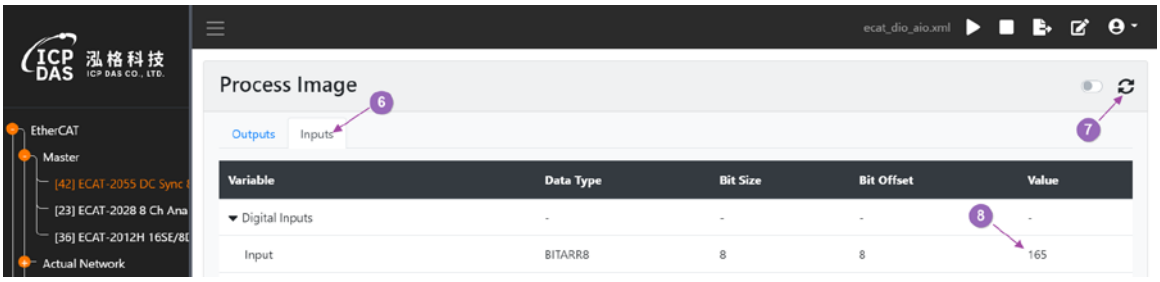
E. Enter the slave station page and use PDO to control the slave station module.
I. Read and write control of DI/DO module on slave station, it will connect ECAT-2055 (DI/DO) pin DIx to DOx on slave station.
(1) Click on the EtherCAT->Slave (ECAT-2055, DI/DO) node.
(2) Click on the Process Image->Outputs tab.
(3) Double click on the Digital Outputs->Output variable, and a read and write dialog box will appear.
(4) Input 165 value and output DO.
(5) Click the "Write" button.



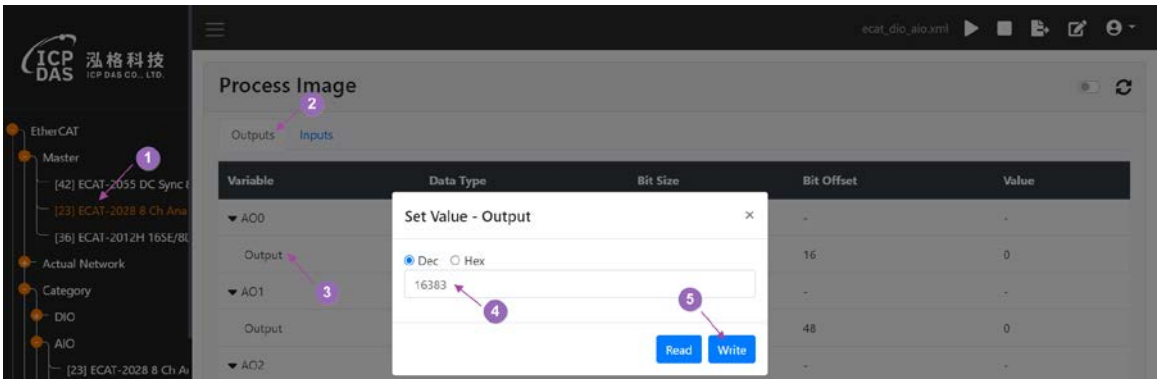
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(6) Click on the Process Image->Inputs tab.
(7) Click the refresh button.
(8) Check if Digital Inputs->Input is 165.



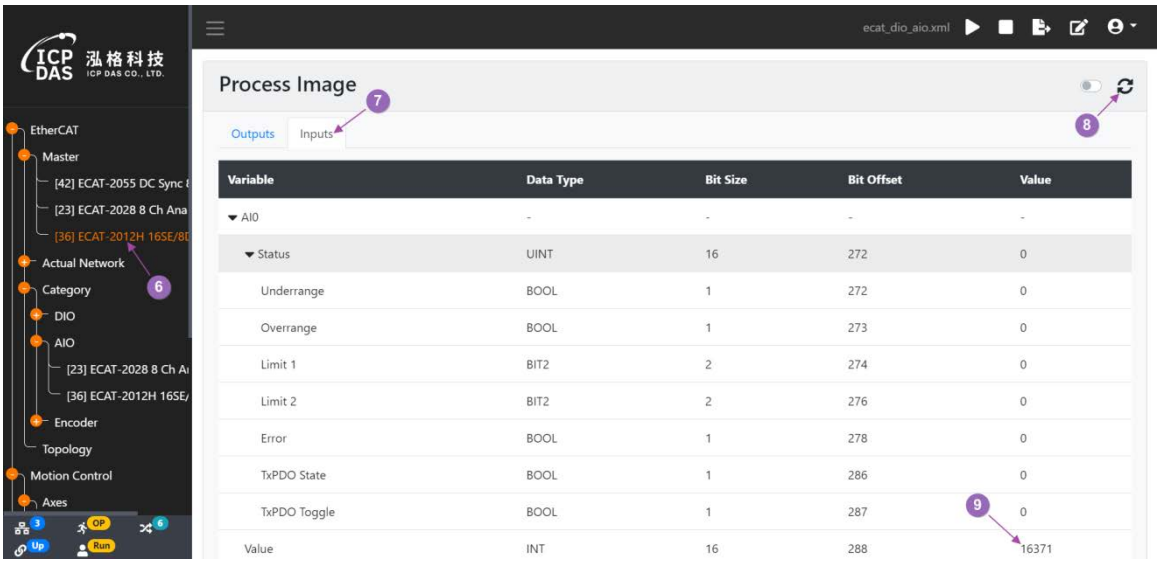
II. Connect channel 0 of AO (ECAT-2028) and AI (ECAT-2012H) for AI/AO control.
(1) Click on the EtherCAT->Slave (ECAT-2028, AO) node.
(2) Click on the Process Image->Outputs tab.
(3) Double click on the AO0->Output variable, and a read and write dialog box will appear.
(4) Input the value of 16383. When the AO range is ±10V, the output AO is about +5V.
(5) Click the "Write" button.



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(6) Click on the EtherCAT->Slave (ECAT-2012H, AI) node.
(7) Click on the Process Image->Inputs tab.
(8) Click the refresh button.
(9) Read the AI0->Value variable, and check whether the value is close to the value written in AO.



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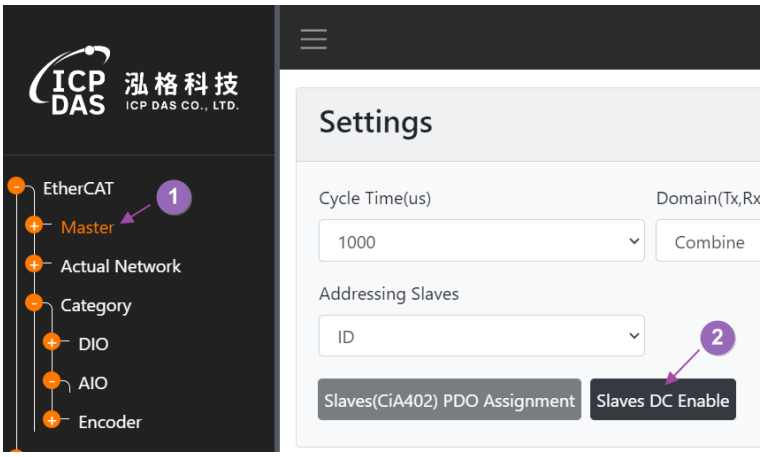
16.2. Motion Control Setting and Control Steps

This section will connect the CiA402 servo drive slave module to introduce how to start and set the motion control function, and use the web interface to perform a simple move test.

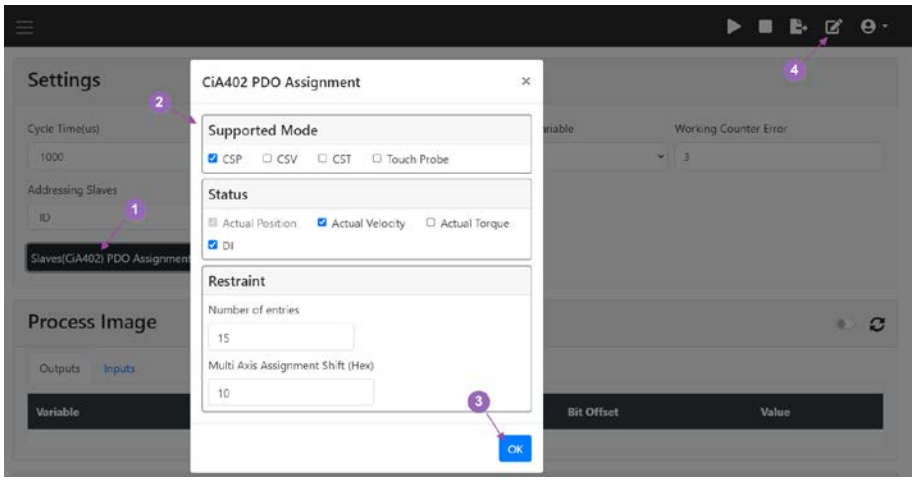
[Steps]

A. Configure the EtherCAT network deployment according to steps A to B in section 16.1.

B. Set all slave stations to DC mode.
   (1) Click on EtherCAT->Master node.
   (2) Click the "Slaves DC Enable" button.



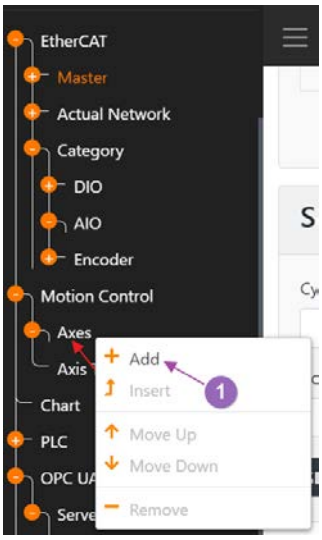
C. Automatically configure CiA402 PDO Mapping.
   (1) Click the "Slaves(CiA402) PDO Assignment" button.
   (2) The PDO Auto Assignment dialog box appears, use default selection.
   (3) Click the "OK" button.
   (4) Click the Save button.



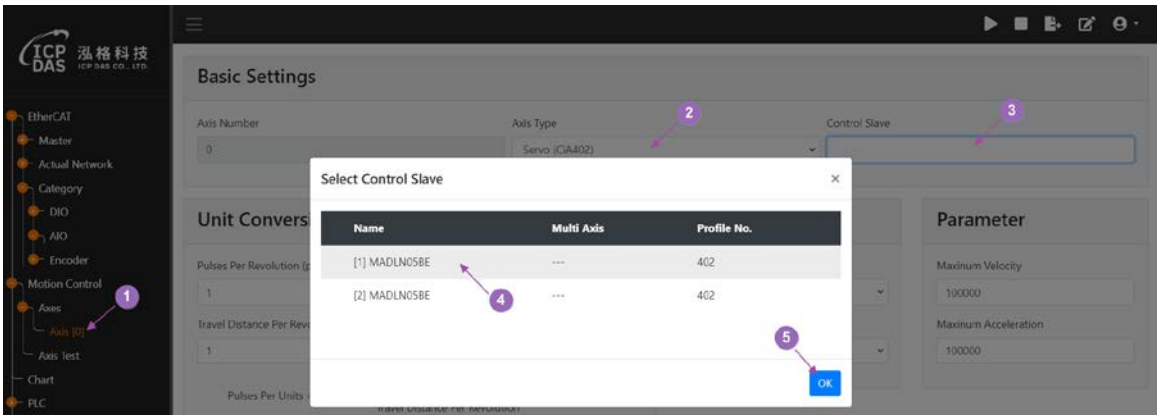
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D. Enable the motion control function.
(1) Right click on the node of Motion Control->Axes or Motion Control->Axes->Axis in the navigation area, click on the "Add" option in the right-click menu to increase the number of axes.



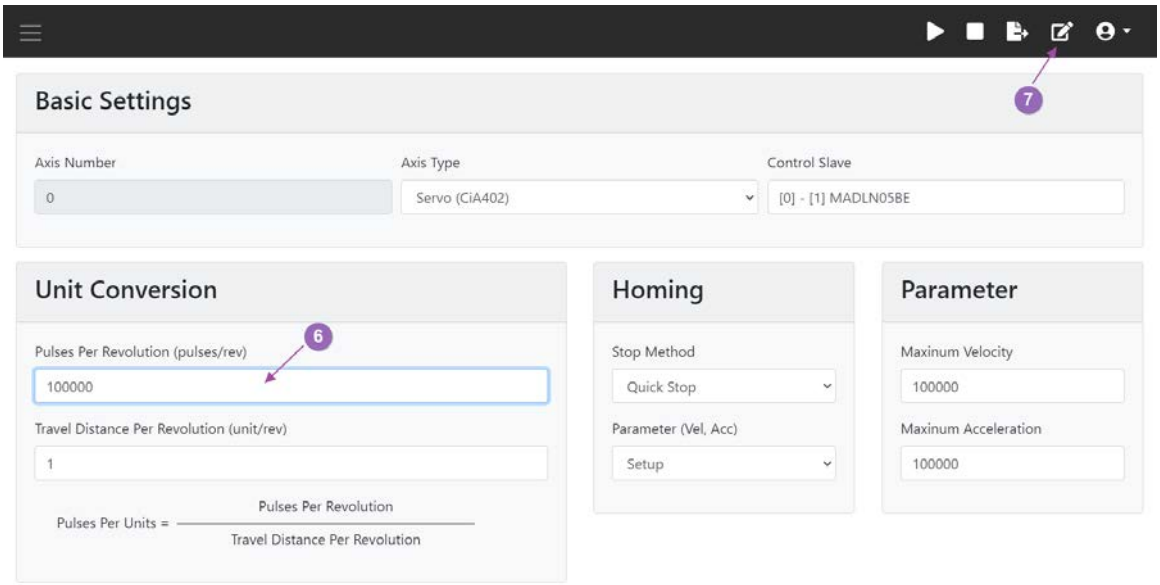
E. Parameter settings of motion control axis.
(1) Click the Motion Control->Axes->Axis[n] node.
(2) Select the axis type as "Servo (CiA402)".
(3) Click on the “Control Slave” button, a dialog box for selecting the slave module will appear.
(4) Select the number of the slave to be controlled.
(5) Click the "OK" button.



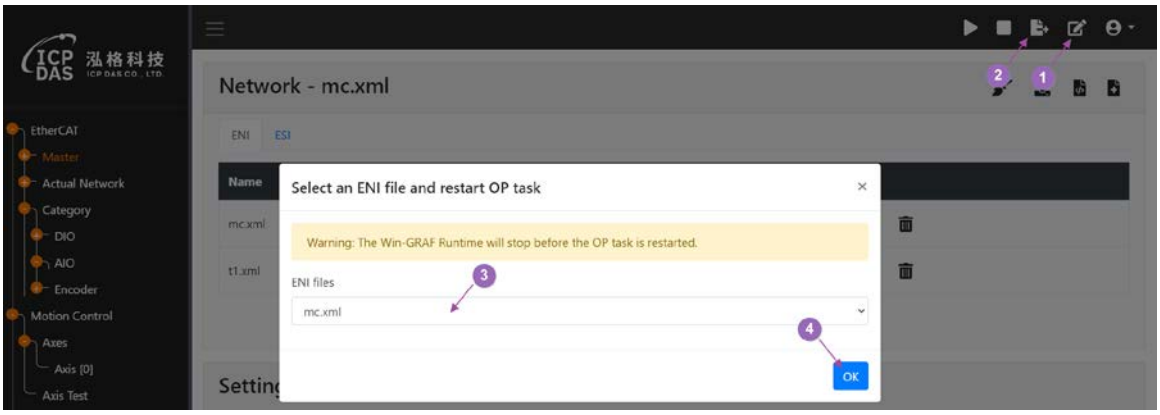
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(6) Set the PPU according to actual requirements.
(7) Click the Save button.



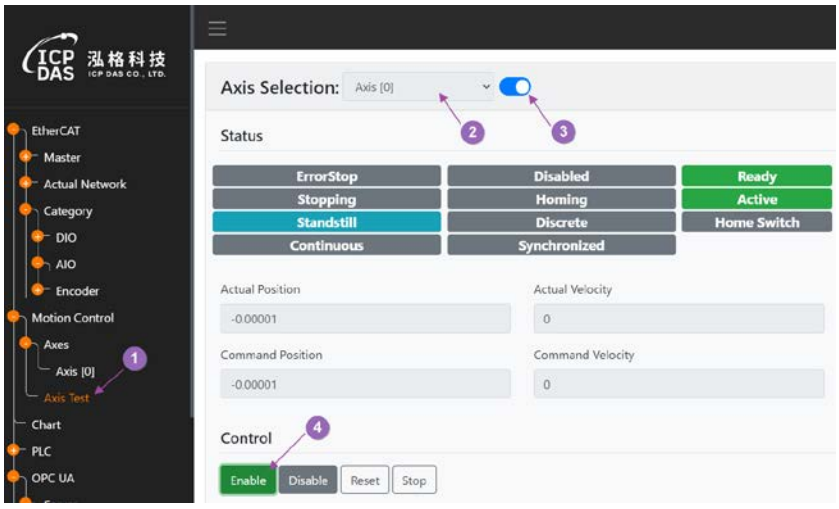
F. EtherCAT Runtime reloads the ENI file.
(1) Click the save settings button on the toolbar to save.
(2) Click the Start EtherCAT Operation Task button on the toolbar.
(3) A dialog box for starting the EtherCAT operation task appears, select the "Override Default" option.
(4) Click the "OK" button.



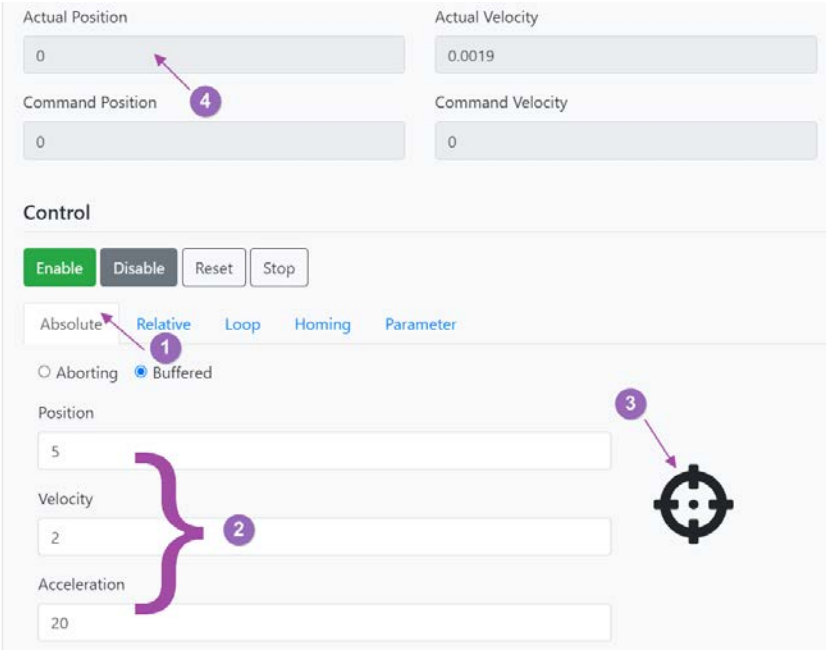
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G. Enter the motion control test page.
(1) Click on the Motion Control->Axis Test node.
(2) Select the axis number.
(3) Click the "Activate" button to activate the axis number.
(4) Click the "Enable" button to control the axis Power ON (Servo ON).



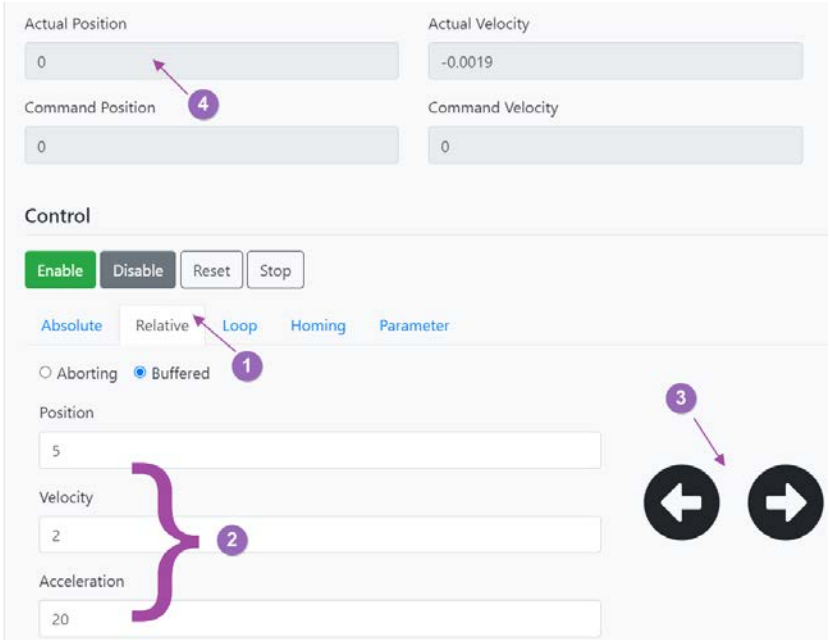
H. Perform absolute position movement control.
(1) Click the Control->Absolute tab.
(2) Input position, velocity, acceleration parameters.
(3) Click the move button for motion control.
(4) Make sure that the final stop position is consistent.



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I. Perform relative position movement control.
(1) Click the Control->Relative tab.
(2) Click the Control->Relative tab.
(3) Click the positive or negative movement buttons for motion control.
(4) Make sure the final stop position is consistent.



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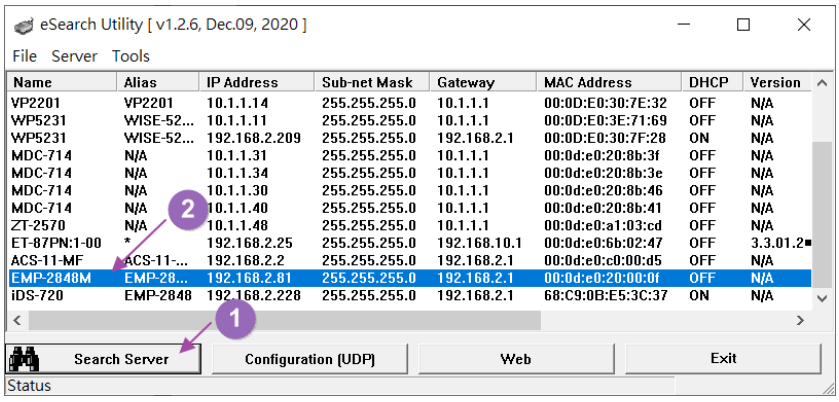
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Appendix A. eSearch Tool Software

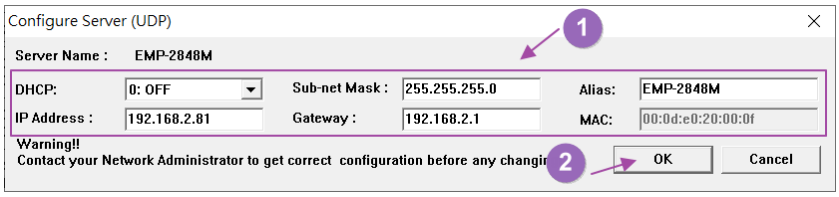
eSearch Utility is a set of easy-to-use portable software, which can be used to search and configure ICP DAS network communication devices on the Ethernet network. For software usage, please follow the steps below:

[Steps]

A. Search for EMP-2848M devices on the Ethernet network.
   (1) Click the "Search Server" button to start searching for devices.
   (2) The EMP-2848M device will appear in the search list.



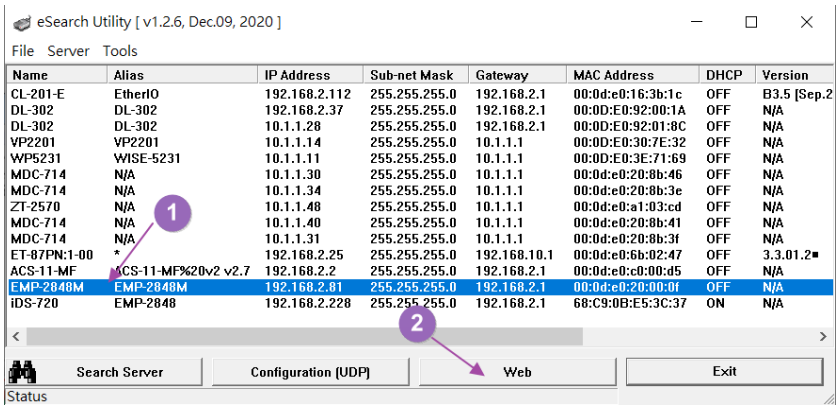
B. Modify network settings.
   (1) Double click on the search found EMP-2848M device, and a setting dialog box will appear. Change information such as the IP address, subnet mask, default gateway, alias and others according to actual requirements.
   (2) Click the "OK" button.



C. Open the device web interface.
   (1) Click on the searched device.
   (2) Click the "Web" button to automatically open the default browser of the system.

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