acontis technologies GmbH

SOFTWARE

EC-Engineer

User Manual

Version 3.9

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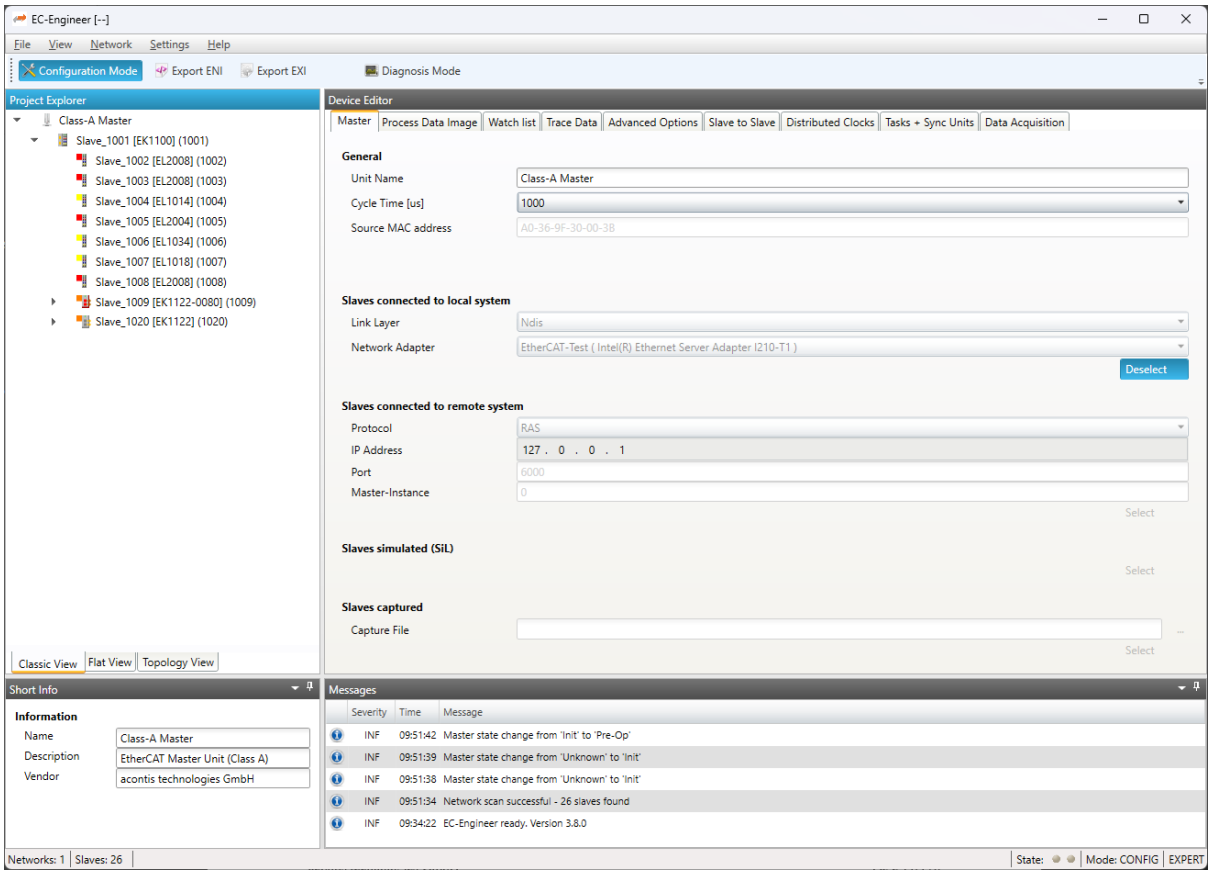
Contents

1 Introduction

1.1 Overview

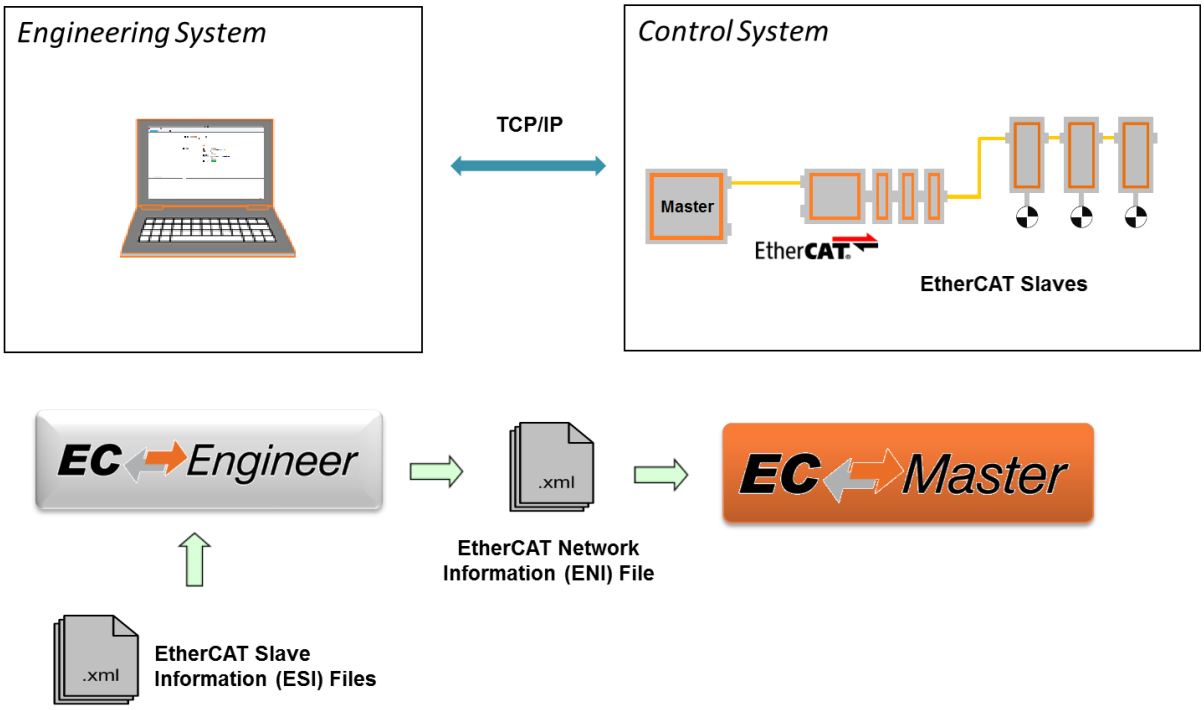
EC-Engineer is a configuration and diagnosis tool for EtherCAT networks that are controlled by the EC-Master.

The following screenshot shows the EC-Engineer in configuration mode:



It runs on the Engineering System where the engineer can configure the EtherCAT network. All slaves default to settings that match the Slave's typical use case. Complex networks or installations with special requirements need adjustments to the default settings. Using the Configuration Mode, the user can configure his EtherCAT network according to the project's needs.

As the result of his work the user can export the EtherCAT Network Information (`ENI`) file, which is necessary to run the EC-Master on the Control System:



If he has the possibility to connect his Engineering System to the Control System, he can also scan his existing EtherCAT network. The EC-Engineer will then read the network configuration and add all slaves to the project explorer. Now the user can fine tune the network or directly export the `ENI` file.

If the control system is now running, he can connect to it by using the remote diagnosis functionality and verify that everything is fine by accessing the states, variables, object dictionaries, ESC registers EEPROM data.

1.2 Features

The following table shows the features of the EC-Engineer:

General features	Feature ID	Free	Standard	Plus
Classic view	100	✔	✔	✔
Flat view	101	✔	✔	✔
Topology view	102	✔	✔	✔
Multiple Instances	103	✔	✔	✔
Different themes	104	✔	✔	✔
Different Languages	105	✔	✔	✔
Command line interface	106	✔	✔	✔
EMI Manager	107	✔	✔	✔
ESI Manager	108	✔	✔	✔
Expert Mode	109	✔	✔	✔
Edit topology view	110	✔	✔	✔
Offline Diagnosis	111	✘	✔	✔
Unlimited Slave Count	112	✘	✔	✔

Configuration features	Feature ID	Free	Standard	Plus
Set up distributed clocks	200	✔	✔	✔
Configure MDP slaves	201	✔	✔	✔
Custom PDO mapping	202	✔	✔	✔
Changing name of variables	203	✔	✔	✔
Group support / Hot Connect / Pinned Group	204	✔	✔	✔
EoE Support	205	✔	✔	✔
Startup Commands	206	✔	✔	✔
CoE Object-Dictionary (offline)	207	✔	✔	✔
Enable / disable slave	208	✔	✔	✔
Slave to Slave	209	✔	✔	✔
Support gateway slaves (EL6692, EL6224, EL6631-0010, …)	210	✔	✔	✔
Export ENI-File	211	✘	✔	✔
Export Process variables	212	✔	✔	✔
Multiple Cyclic Tasks	213	✘	✔	✔
Import slaves from ENI	214	✔	✔	✔
SoE Object-Dictionary (offline)	215	✔	✔	✔
Change revision of slave	216	✔	✔	✔
Scan topology of local system	217	✔	✔	✔
Scan topology of remote system	218	✘	✔	✔
Scan PDO configuration from slave	219	✔	✔	✔
Scan MDP configuration from slave	220	✔	✔	✔
Define project templates	221	✘	✔	✔
Support gateway masters (EL6751, EL6731, …)	222	✘	✔	✔
EtherCAT P support	223	✔	✔	✔
Slave to Slave in Cycle	224	✘	✔	✔

Diagnosis features	Feature ID	Free	Standard	Plus
Watch list with export	300	✔	✔	✔
ESC Register	301	✔	✔	✔
FoE support	302	✘	✔	✔
DC Diagnosis	303	✔	✔	✔
Extended Diagnosis	304	✔	✔	✔
Trace Data Variables	305	✔	✔	✔
EoE endpoint support	306	✘	✔	✔
Export CoE Object-Dictionary	307	✔	✔	✔
Local System with Windows Master	308	✔	✔	✔
Remote System via RAS-Client	309	✘	✔	✔
Reading count of slaves or frames	310	✔	✔	✔
Compare configured and found slaves	311	✔	✔	✔
See value of variables in a list view or chart view	312	✔	✔	✔
Changing value of a variable	313	✔	✔	✔
Reading/Writing values (CoE OD)	314	✔	✔	✔
EEPROM Reading/Writing values	315	✘	✔	✔
Reading error or frame counters	316	✔	✔	✔
Diagnosis History of master or slave	317	✔	✔	✔
Reading/Writing values (SoE OD)	318	✔	✔	✔

1.3 Supported Slaves of Beckhoff EL6xxx

The following table shows the supported slaves of Beckhoff EL6xxx in the EC-Engineer:

Name	Free	Standard	Plus
EL6001 Interface (RS232)	✔	✔	✔
EL6002 Interface 2Ch. (RS232)	✔	✔	✔
EL6021 Interface (RS422/485)	✔	✔	✔
EL6021-0021 Interface (RS422/485 line device)	✔	✔	✔
EL6022 Interface 2Ch. (RS422/485)	✔	✔	✔
EL6080 EtherCAT Memory Terminal (128kB)	✔	✔	✔
EL6224 / EP6224 IO-Link Gateway	✔	✔	✔
EP6228 / EPP6228 IO-Link Gateway	✔	✔	✔
EL6601 1 Port Switch (Ethernet, CoE)	✔	✔	✔
EL6614 4 Port Switch (Ethernet, CoE)	✔	✔	✔
EL6631-0010 PROFINET IO Device	✔	✔	✔
EL6690 EtherCAT Bridge terminal (Primary)	✔	✔	✔
EL6690 EtherCAT Bridge terminal (Secondary)	✔	✔	✔
EL6692 EtherCAT Bridge terminal (Primary)	✔	✔	✔
EL6692 EtherCAT Bridge terminal (Secondary)	✔	✔	✔
EL6695 EtherCAT Bridge terminal (Primary)	✔	✔	✔
EL6695 EtherCAT Bridge terminal (Secondary)	✔	✔	✔
EL6731 PROFIBUS DP Master	✘	✘	✔
EL6731-0010 PROFIBUS DP Slave	✔	✔	✔
EL6751 CANopen Master	✘	✘	✔
EL6751-0010 CANopen Slave	✘	✘	✔

Not listed devices are not supported.

1.4 Requirements

- Microsoft Windows 10 and above
- Microsoft .NET Framework 4 Client Profile
- Screen resolution at least 1024x768 pixel
- Memory as recommended for operating system
- Disk space approximately 80 MB (depend on number of `ESI` files)

1.5 EtherCAT Slave descriptions (ESI files)

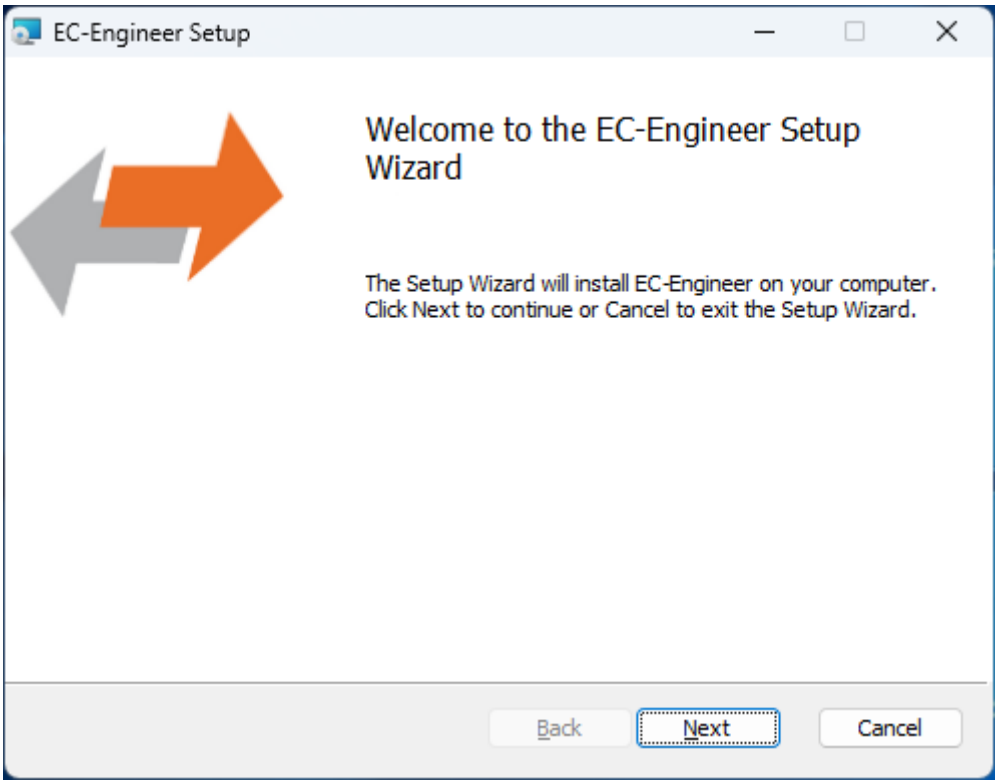
The EC-Engineer needs information about each Slave Type to correctly initialize it, give reasonable default settings and present the configurable properties to the user. The knowledge about the different Slave types is gathered from `ESI` files. The `ESI` files can be managed by the *ESI-Manager*.

2 Installation

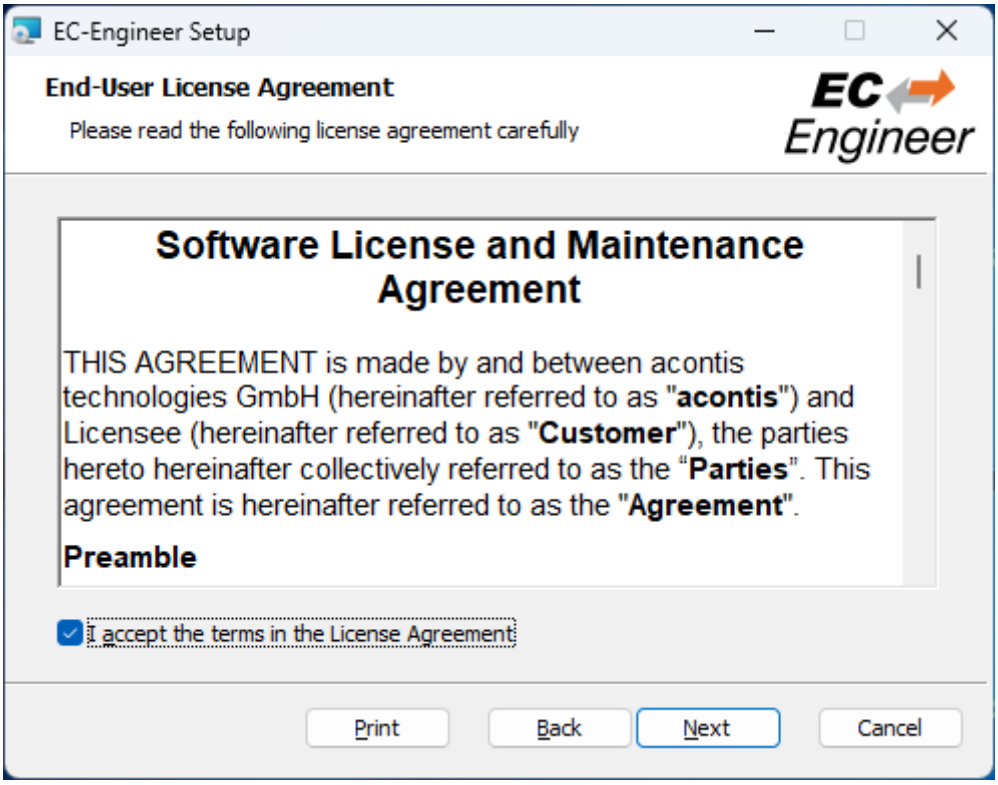
2.1 Setup Process

The product can be installed by executing the `setup.exe` (requires administrator privileges) and follow the screen instructions:

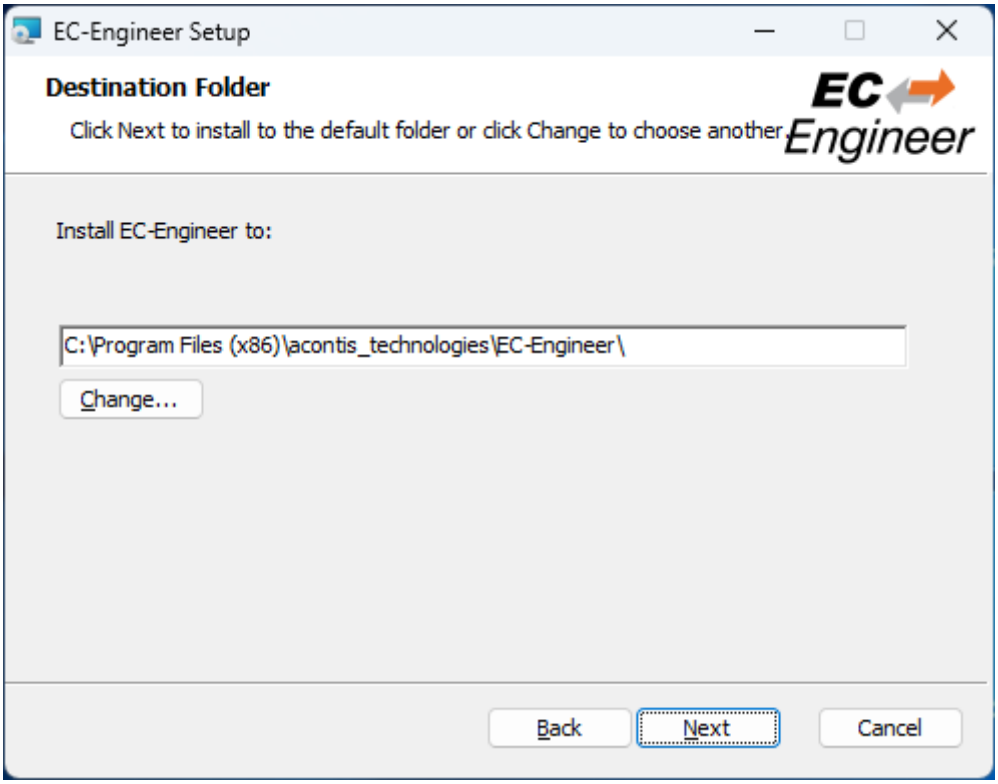
Welcome page:



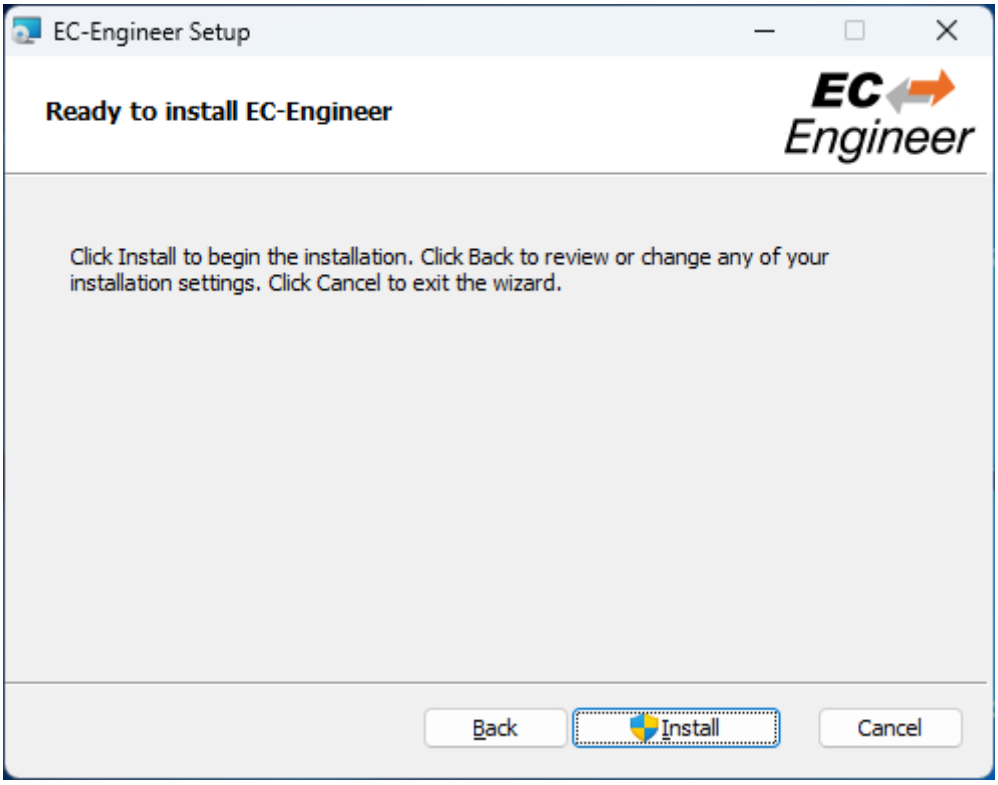
License Agreement:



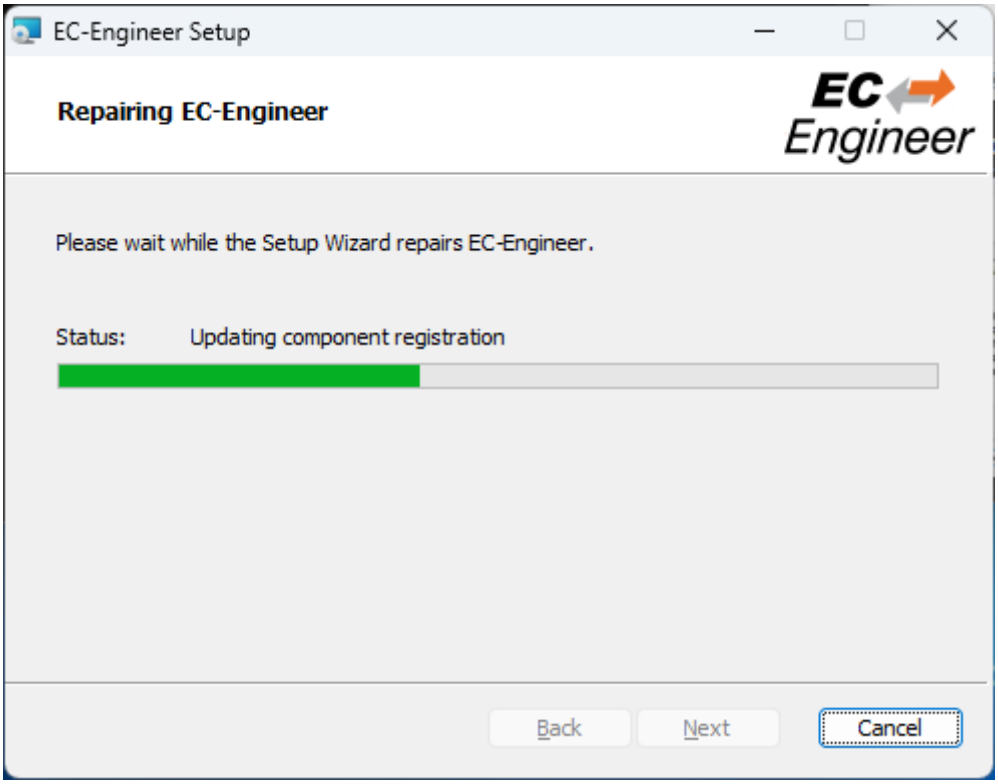
Select Installation Folder:



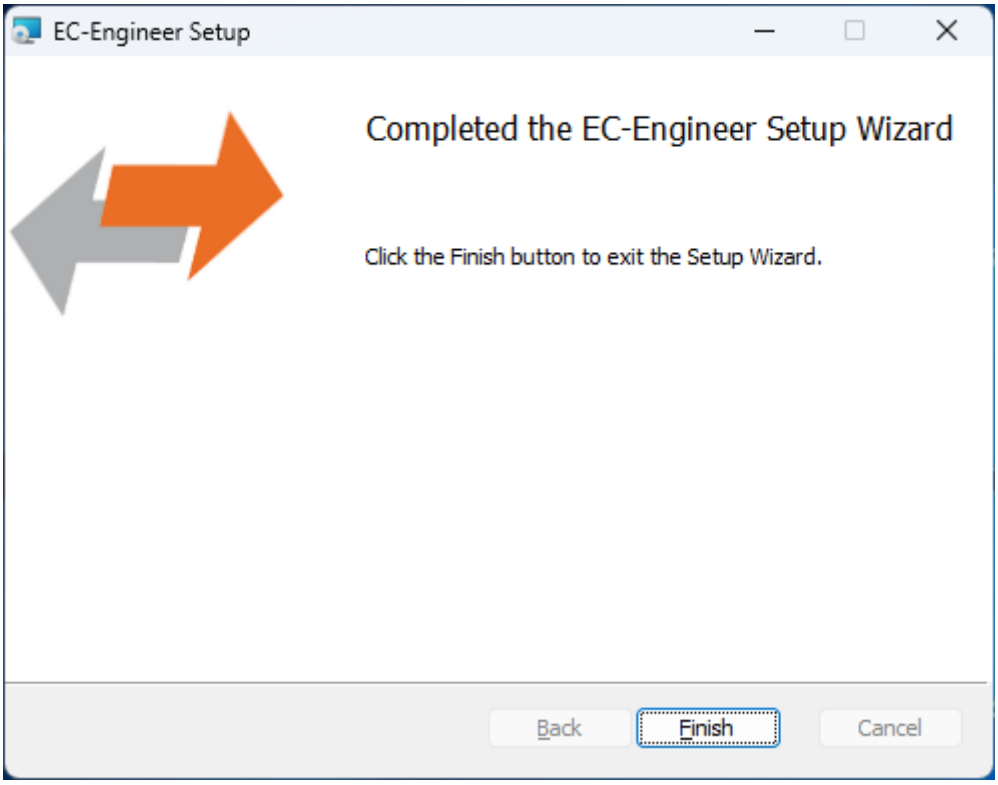
Confirm Installation:



Installing EC-Engineer:



Installation Complete:



2.2 Silent Installation (optional)

The product can be also installed in silent mode by using the command line parameters of `msiexec`.

Sample 1: Installs EC-Engineer into default installation folder

```
$ msiexec /i c:/temp/ECEngineerSetup.msi /quiet /qn /norestart /log
↪  c:/temp/install.log
```

Sample 2: Installs EC-Engineer into `C:/EC-Engineer`

```
$ msiexec /i c:/temp/ECEngineerSetup.msi /quiet /qn /norestart /log
↪  c:/temp/install.log INSTALLLOCATION="C:/EC-Engineer"
```

For more information please refer command line parameters of `msiexec`.

Note: The system requirements *Supported Slaves of Beckhoff EL6xxx* will be not checked!

2.3 File and Folder Structure

The setup process will copy all necessary files into the following folder:

Installation directory: (Default: `%ProgramFiles%/acontis_technologies/EC-Engineer`)

`/Doc`
: Release notes and the user manual

`/EEC`
: Files for mapping emergency error codes

`/Languages`

- Lanugage specific files
- `EC-Engineer.exe`
- `EcMaster.dll`
- ...

All users directory: (`%ALLUSERSPROFILE%/EC-Engineer`, like `C:/ProgramData/EC-Engineer`)

`/CAPTURE`
Capture files which can be analysed in offline diagnosis mode (see *Capture File*)

`/EtherCAT`
EtherCAT Slave Information (`ESI`) Files Can be modified via *ESI-Manager*

`/EMI`
EtherCAT Master Information files (see *Themes*)

`ESICache.xml`
ESI-File-Cache for faster access of `ESI` files

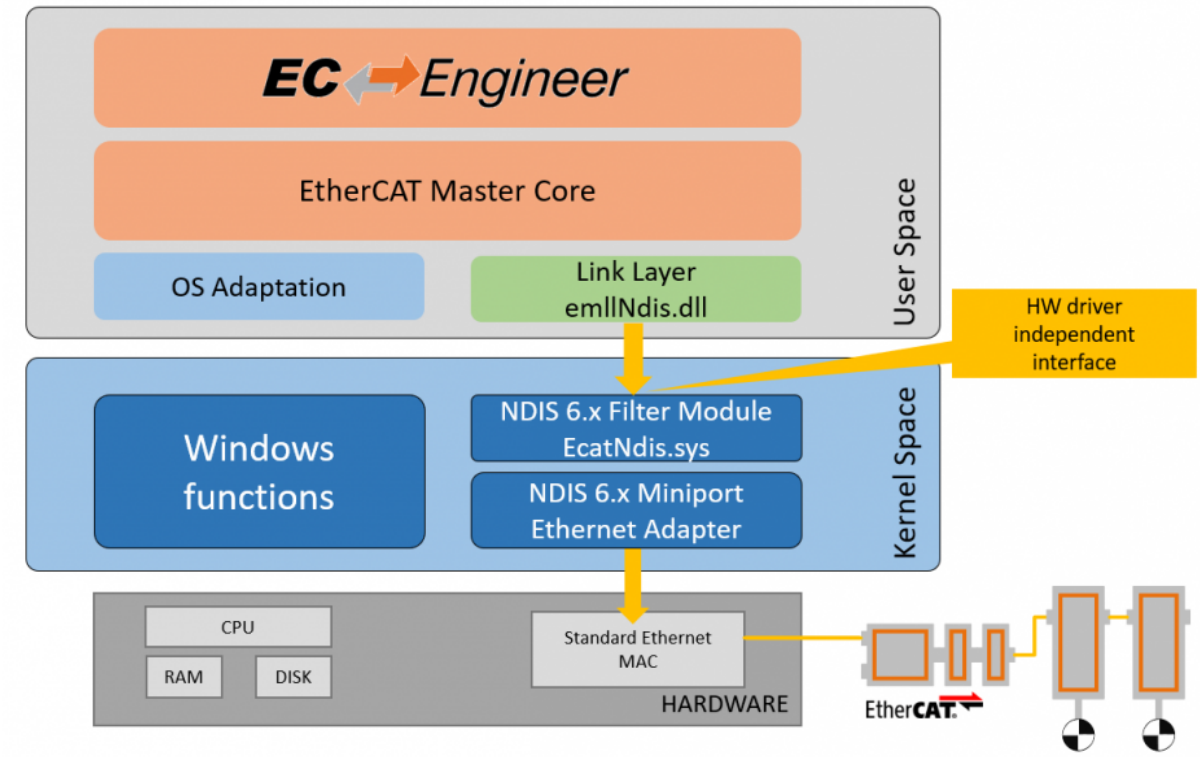
`EC-Engineer.log`
Log file

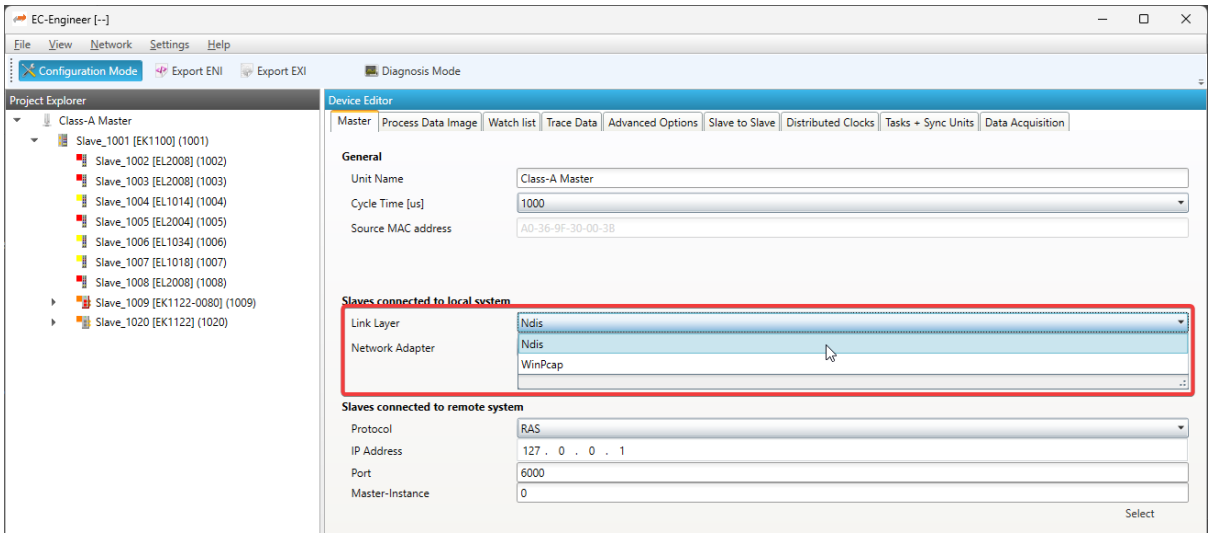
`User.myusername.xml`
User specific settings

2.4 NDIS Driver

The Network Driver Interface Specification (NDIS) is the specification for a network driver architecture that allows transport protocols like TCP/IP to communicate with an underlying physical network adapter. For sending and receiving EtherCAT frames in Windows, EC-Engineer makes use of the well-known Windows packet capture library, WinPcap. However, WinPcap was based on the NDIS 5.x driver model, and development has ceased. The latest versions of Windows 10 do not support this old NDIS 5.x version anymore, so now EC-Engineer (V3.2 and higher) includes an installation package in the install directory of EC-Engineer to install the acontis NDIS 6.x Filter Module `EcatNdis.sys`. With this new Filter Module and the new NDIS Link Layer `emllNdis.dll`, it is now possible for EC-Engineer to work without WinPcap on all Windows 10 versions.

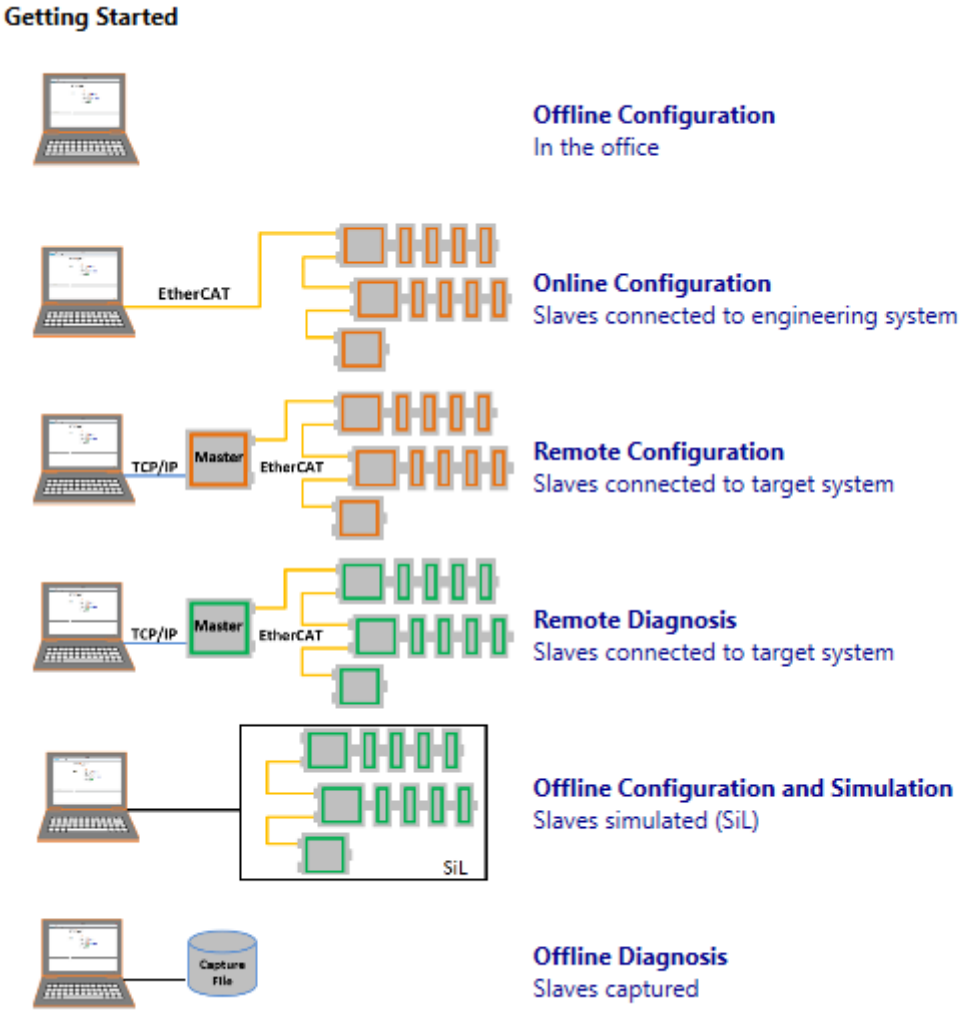
Note: Please restart EC-Engineer after the NDIS installation.


EC Engineer
EtherCAT Master Core
OS Adaptation
Link Layer
emllNdis.dll
User Space
HW driver
independent
interface
Windows
functions
NDIS 6.x Filter Module
EcatNdis.sys
NDIS 6.x Miniport
Ethernet Adapter
Kernel Space
CPU
RAM
DISK
Standard Ethernet
MAC
HARDWARE
EtherCAT


EC-Engineer [--]
File View Network Settings Help
Configuration Mode
Export ENI
Export EXI
Diagnosis Mode
Project Explorer
Class-A Master
Slave_1001 [EK1100] (1001)
Slave_1002 [EL2008] (1002)
Slave_1003 [EL2008] (1003)
Slave_1004 [EL1014] (1004)
Slave_1005 [EL2004] (1005)
Slave_1006 [EL1034] (1006)
Slave_1007 [EL1018] (1007)
Slave_1008 [EL2008] (1008)
Slave_1009 [EK1122-0080] (1009)
Slave_1020 [EK1122] (1020)
Device Editor
Master
Process Data Image
Watch list
Trace Data
Advanced Options
Slave to Slave
Distributed Clocks
Tasks + Sync Units
Data Acquisition
General
Unit Name
Class-A Master
Cycle Time [us]
1000
Source MAC address
A0-36-9F-30-00-3B
Slaves connected to local system
Link Layer
Ndis
Network Adapter
Ndis
WinPcap
Slaves connected to remote system
Protocol
RAS
IP Address
127 . 0 . 0 . 1
Port
6000
Master-Instance
0
Select

3 Getting Started

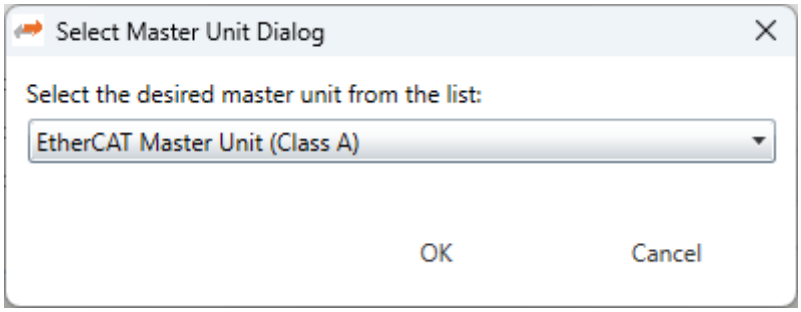
For a better usability, the product comes up with a start page, where the user can choose what he wants to do:



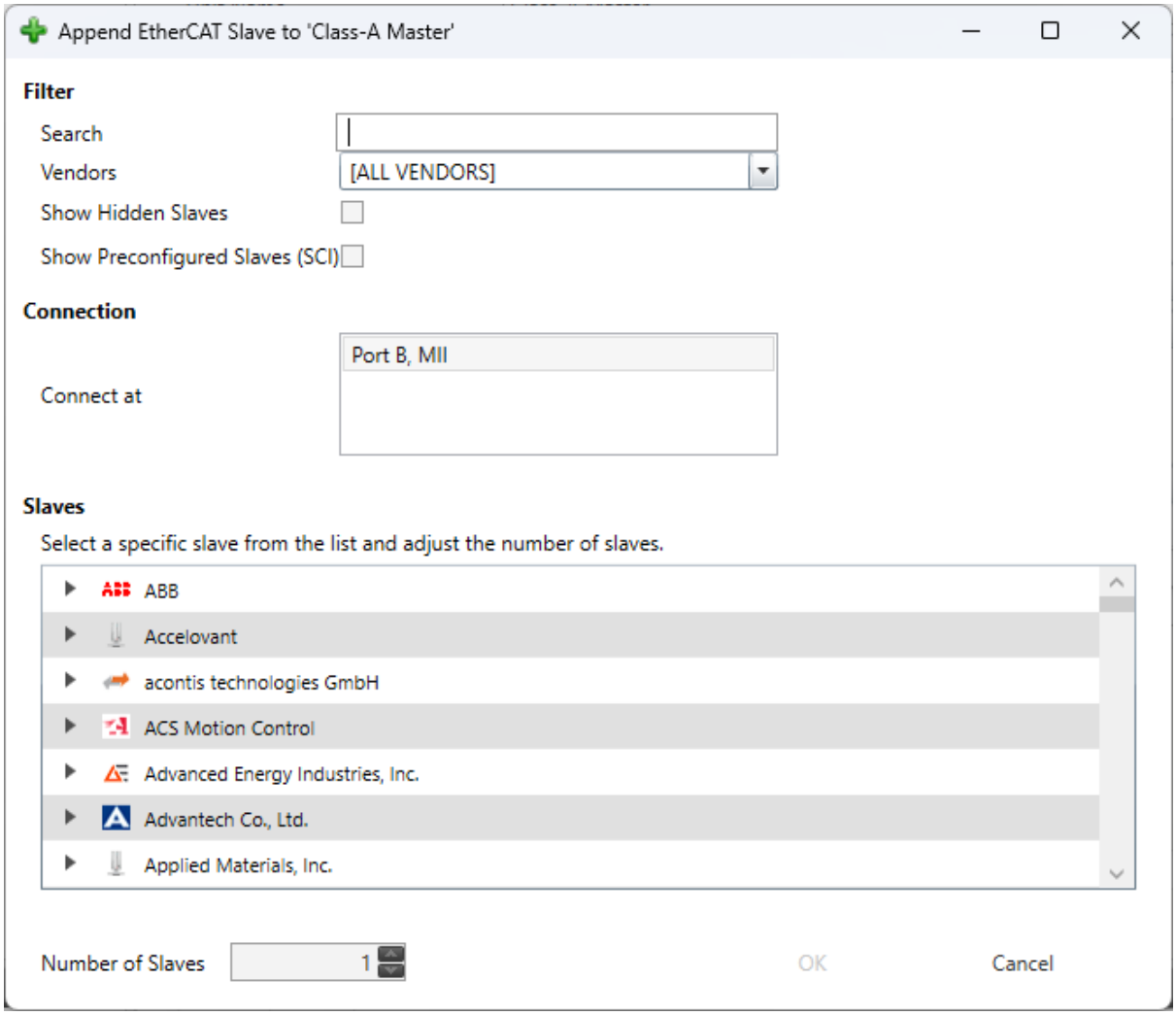
3.1 Offline Configuration

This mode is for configuring the EtherCAT network in the office by manually adding slaves to the network.

If the user clicks on this link he will see first the *Select Master Unit Dialog* for choosing the desired master unit (at the moment he can choose between Class A and Class B master):



Afterwards he will see the *Slave Select Dialog*, where he can configure his EtherCAT network:

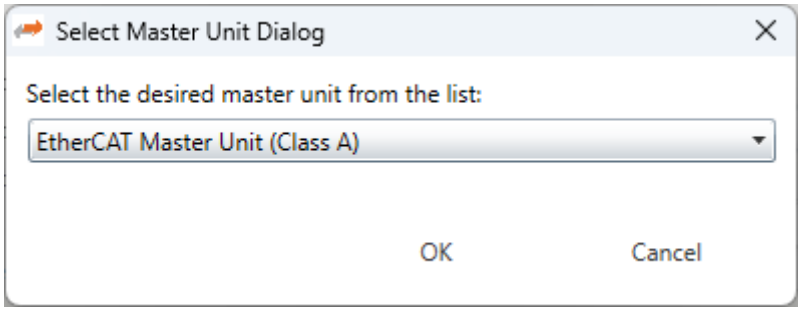


If you can not find your slave or if you want to use your own `ESI` file, you can edit this list by using the *ESI-Manager*. After configuring the network you can select the *network* node and use the *Export ENI* button for generating an `ENI` file.

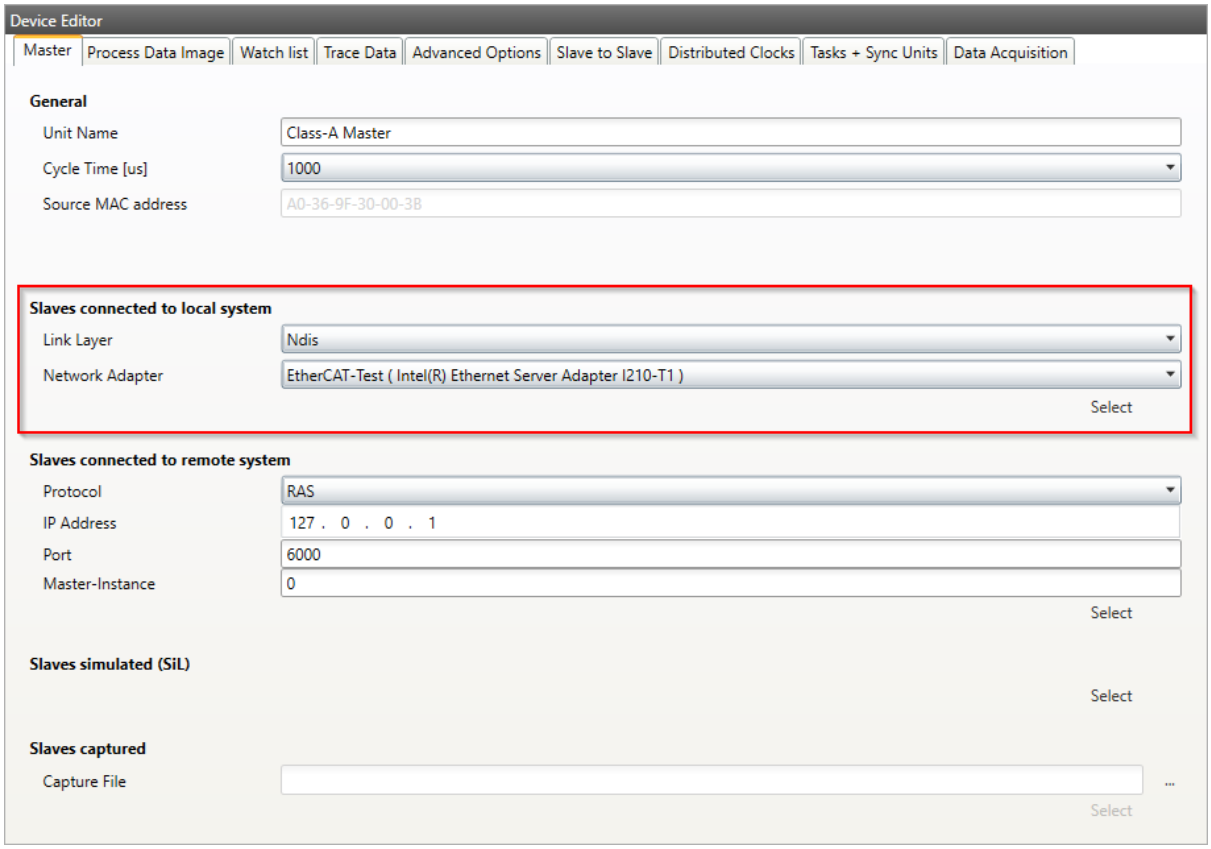
3.2 Online Configuration

This mode can be used if slaves are connected to the Engineering System by scanning the EtherCAT network configuration.

If user clicks on this link he will see first the *Select Master Unit Dialog* for choosing the desired master unit (at the moment he can choose between Class A and Class B master):



Afterwards he will see the *Master-Tab*, where he can choose the network adapter which is connected to the control system:



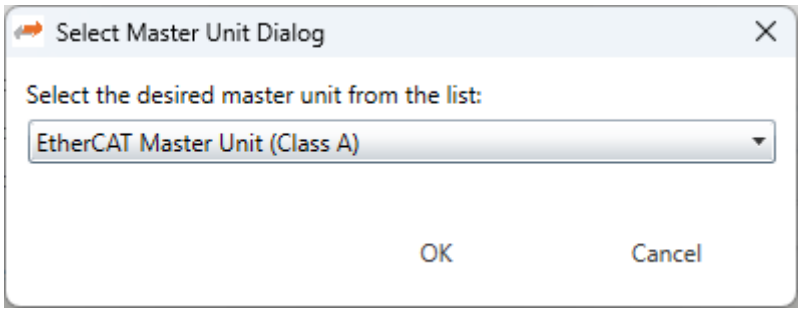
After selecting the network adapter, the EC-Engineer scans the control system and adds the network configuration to the project explorer. Here the user can adjust the configuration or use the *Export ENI* button for generating directly an `ENI` file.

Note: Please make sure that the selected network adapter is connected to the EtherCAT slaves.

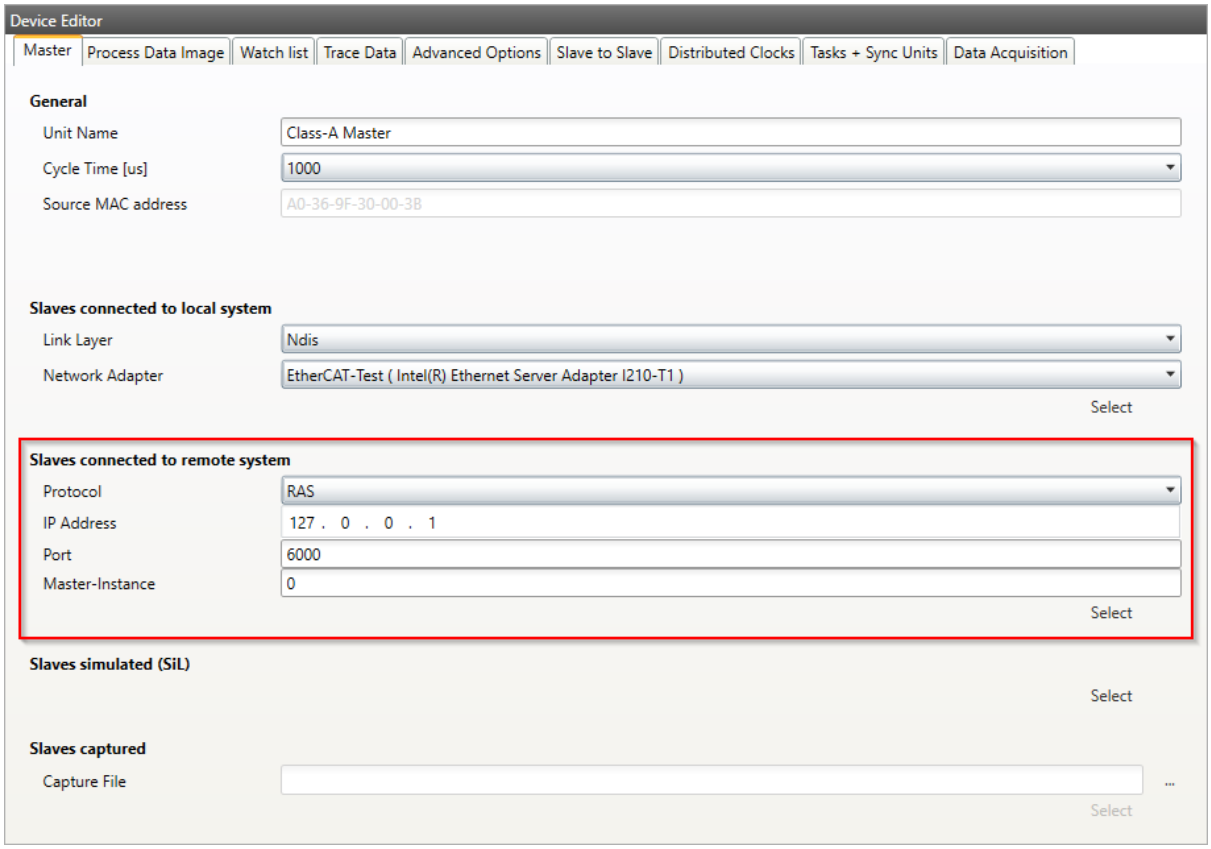
3.3 Remote Configuration

This mode can be used if slaves are connected to the control system. Means user can connect via TCP/IP to the control system if EC-Master RAS (remote access service) server is running and scan the EtherCAT network configuration.

If user clicks on this link he will see first the *Select Master Unit Dialog* for choosing the desired master unit (at the moment he can choose between Class A and Class B master):



Afterwards he will see the *Master-Tab*, where he can enter the IP address of the remote system (and if necessary change the port and the master-instance, but normally this should not be necessary):

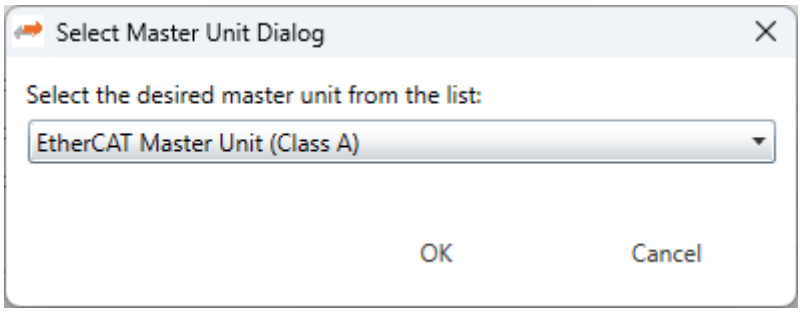


After entering the IP address, a click to *Select* tells the EC-Engineer to connect to and scan the remote system. The EC-Engineer adds all Slaves of the network configuration to the project explorer. Here the user can adjust the configuration or use the *Export ENI* button for generating directly an `ENI` file.

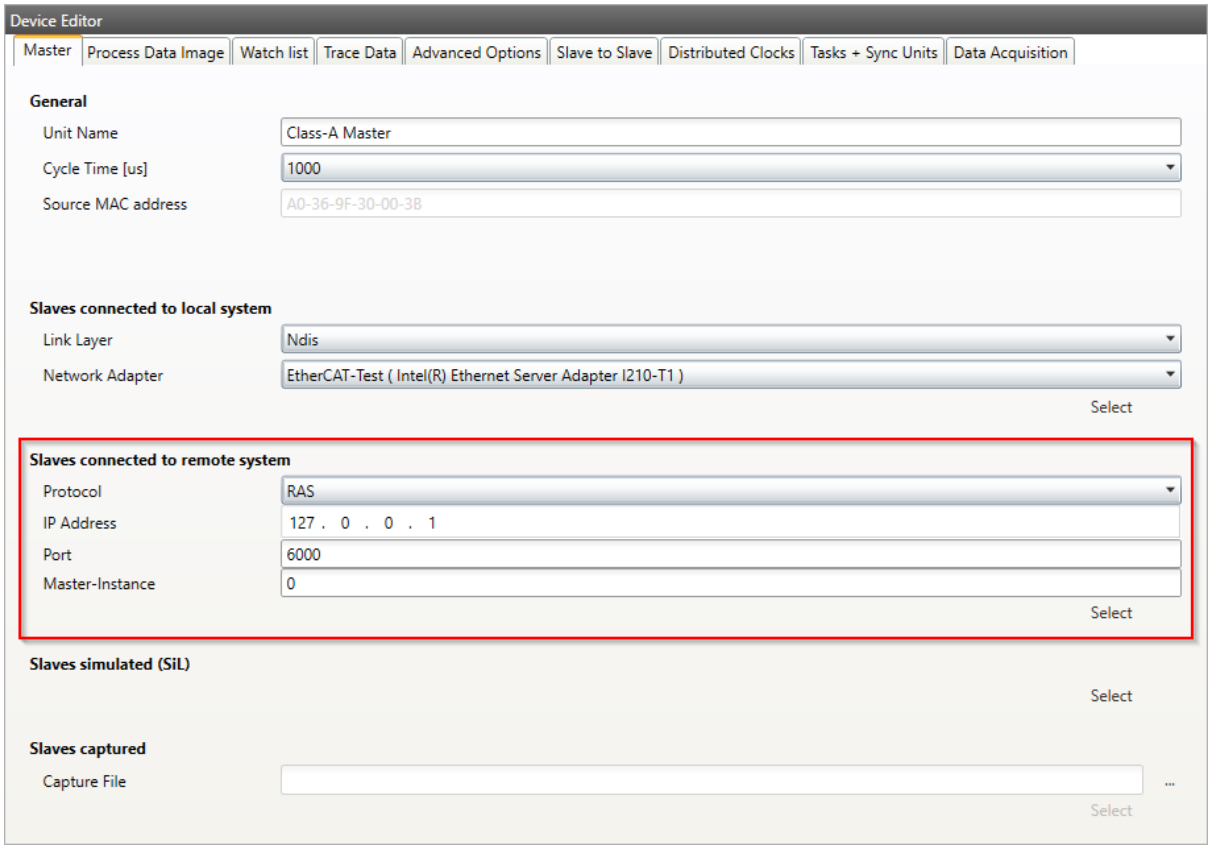
3.4 Remote Diagnosis

This mode should be used if the EC-Master is already running on the control system and the user wants to take a look into the “health” of the EtherCAT system.

If user clicks on this link he will see first the *Select Master Unit Dialog* for choosing the desired master unit (at the moment he can choose between Class A and Class B master):



Afterwards he will see the *Master-Tab*, where he can enter the IP address of the remote system (and if necessary change the port and the master-instance, but normally this should not be necessary):

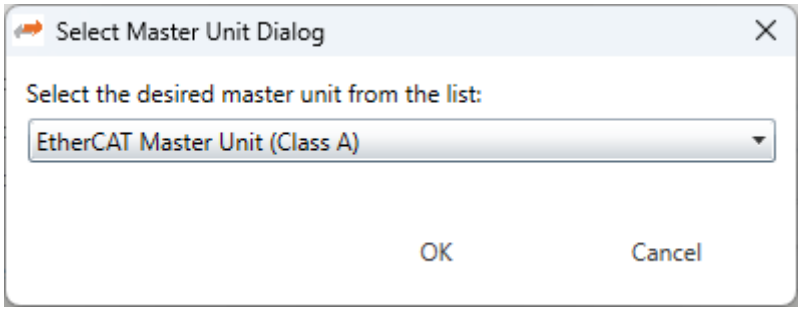


After entering the IP address, a click to *Select* switches the EC-Engineer into Diagnosis Mode. There the user sees the “health” of his EtherCAT system.

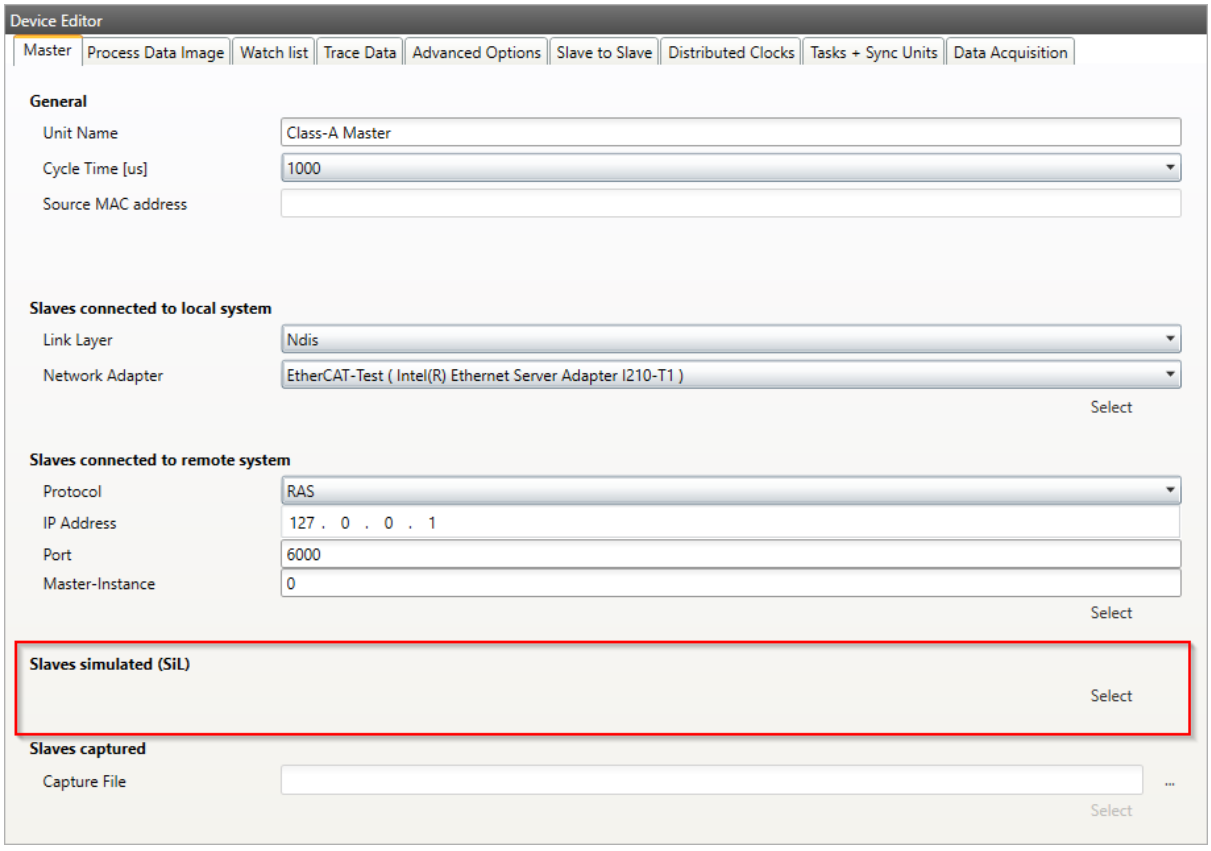
3.5 Offline Configuration and Simulation

This mode is for configuring the EtherCAT network in the office by manually adding slaves to the network.

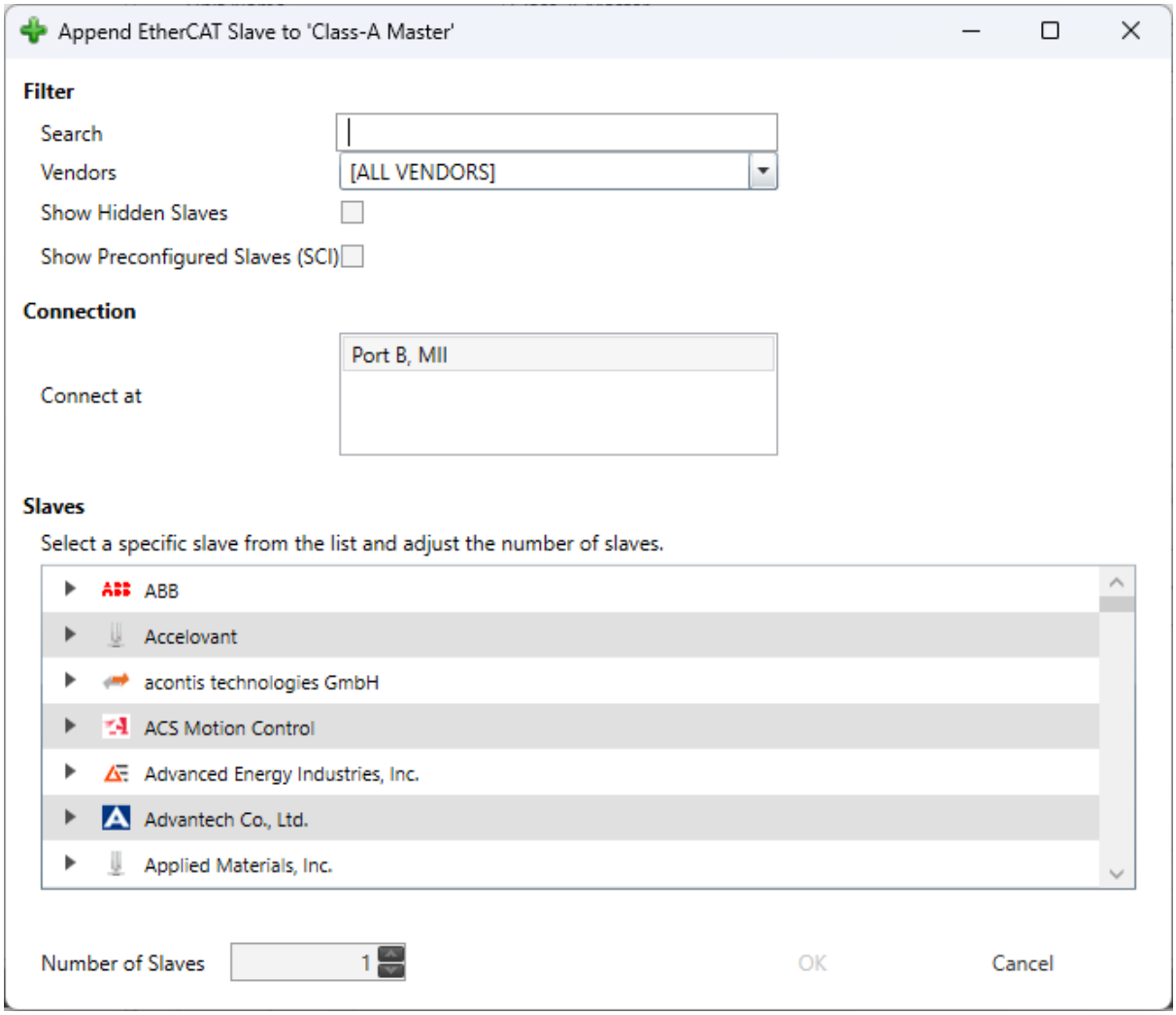
If the user clicks on this link he will see first the *Select Master Unit Dialog* for choosing the desired master unit (at the moment he can choose between Class A and Class B master):



Then the user have to select the simulator:



Afterwards he will see the *Slave Select Dialog*, where he can configure his EtherCAT network:



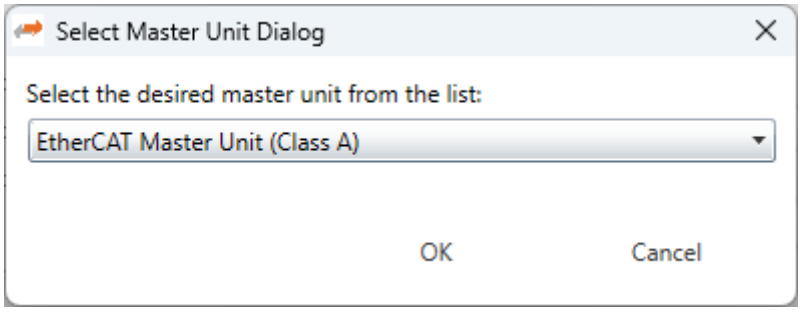
If you can not find your slave or if you want to use your own `ESI` file, you can edit this list by using the *ESI-Manager*.

After configuring the network you can select the *network* node and use the *Export ENI* button for generating an `ENI` file or switch to diagnosis mode and simulate the network.

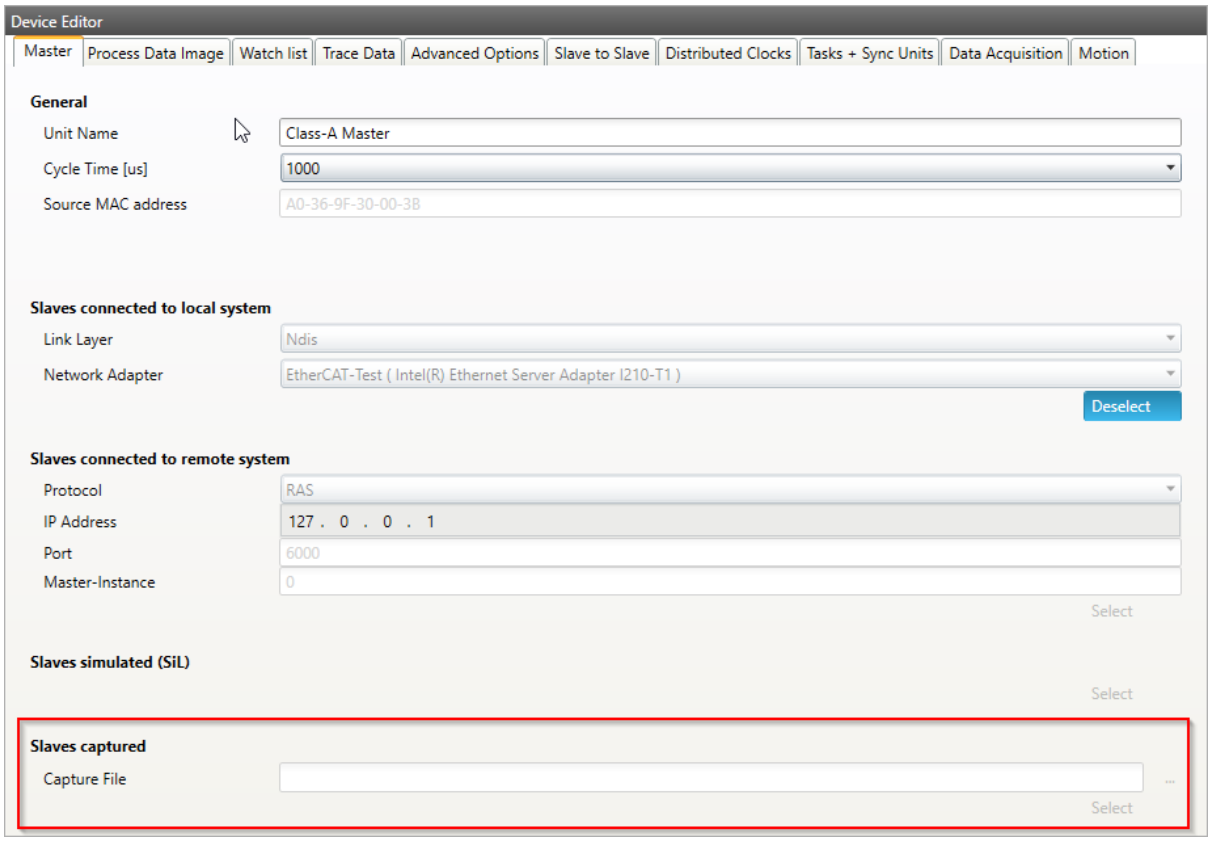
3.6 Offline Diagnosis

This mode should be used if the user wants to analyse a previously created capture file. This can be done offline, which means that the “real system” no not necessary.

If user clicks on this link he will see first the *Select Master Unit Dialog* for choosing the desired master unit (at the moment he can choose between Class A and Class B master):



Afterwards he will see the *Master-Tab*, where he can enter the path to the capture, which contains one or more previously taken snapshots:

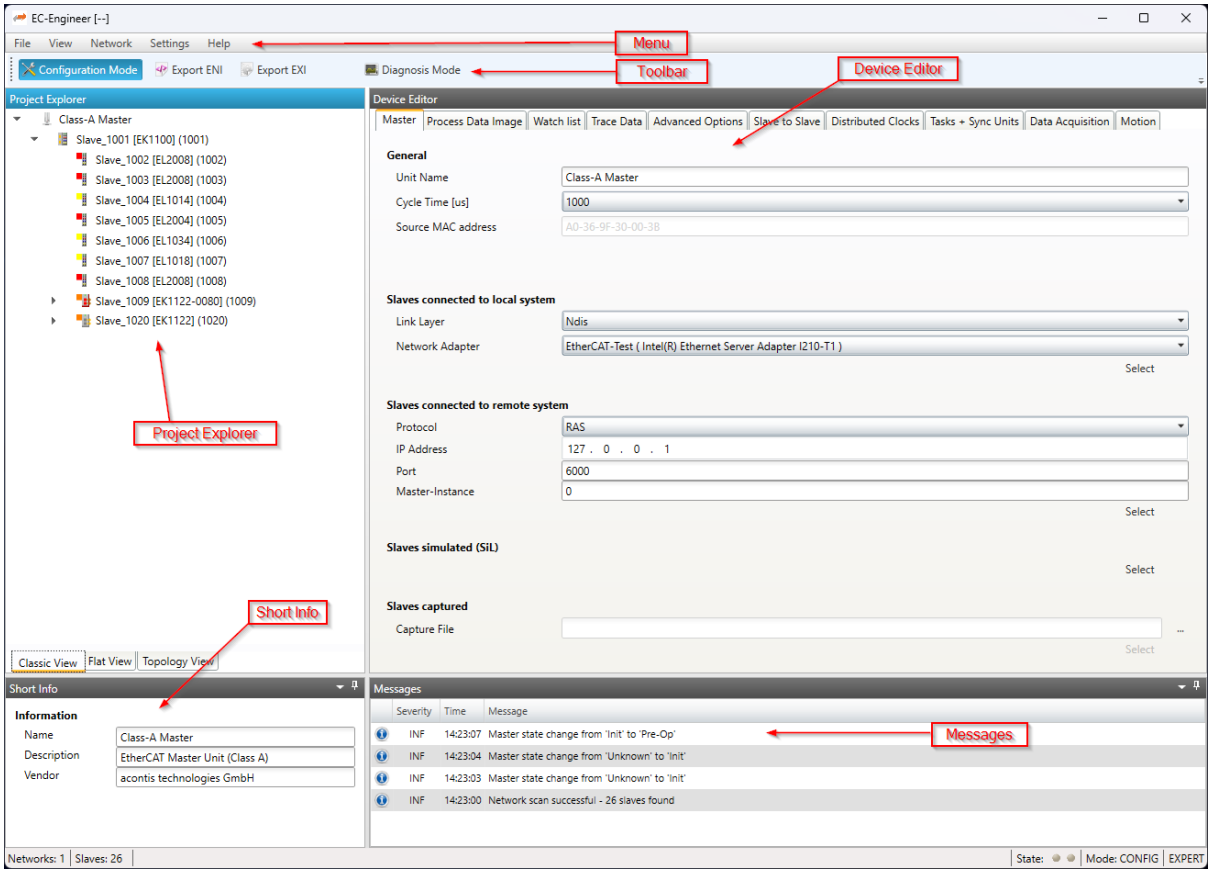


After choosing the path to the capture file, a click to *Select* switches the EC-Engineer into Diagnosis Mode. Now, the user can analyse the previously taken snapshots of a EtherCAT system.

4 Graphical user interface

4.1 Overview

This section gives an overview about the graphical user interface:



The graphical user interface is divided into five parts:

Menu/Tool/Status bar:
Shows current status or mode of the EC-Engineer and allows the user to change it.

Project Explorer:
Shows different views of the current network configuration and allows the user to change it by adding or removing devices/slaves/modules.

Device Editor:
Show information about the selected device, like process variables or PDO mappings. It allows the user also change this information.

Short Info:
Show short information about selected device, like name, description or vendor.

Messages:
Shows notifications which occur e.g. when the EtherCAT Master has changed its operation state or a slave has been removed from (or added to) the EtherCAT network.

4.2 Menu/Tool/Status bar

4.2.1 File

New / Open / Save / Save As / Print:
Start new configuration or open/save/print existing configuration

Add Master-Unit:

Add a new Master-Unit to the configuration. At the moment we have three Master-Units:

- EtherCAT Master Unit (Class A)
- EtherCAT Master Unit (Class B)

ESI-Manager:
Add, delete or export `ESI` and `SCI` files (see: *ESI-Manager*)

EMI-Manager:
Add, delete or modify `EMI` files (see: *EMI-Manager*)

Recent Projects:
Open recent project

Exit:
Closes the EC-Engineer

4.2.2 View

Message Window:
Shows/Hides the message window

Short-Info Window:
Shows/Hides the short-info window

Expert Mode:
(De-)Activates expert mode

Motion Mode:
(De-)Activates motion mode

Refresh:
Updates the current view

4.2.3 Network

Scan EtherCAT Network:
Scans the connected network for slaves

Edit Topology:
Opens a dialog to change the current topology of the project and a bus merge is possible (for more information see *EoE Endpoint Configuration*)

Export `ENI` File / Export `ENI` Variants / Import `ENI` File / Process Variables / EEPROM File
Creates an `ENI` file, or ENI variants (see *Export ENI Variants*) / imports an `ENI` file or export the process variables or the eeprom to a file

Network Mismatch Analyzer (active only in diagnosis mode):
Compares the configured slaves with the connected slaves. See *Network Mismatch Analyzer*

Line Crossed Analyzer (active only after scan):
Shows wrong connected slaves. See *Line Crossed Analyzer*

Inspection Report (active only in diagnosis mode):
Opens a statistic about the state of the network. Collects some useful data like error counters and so on. Possibility to print a PDF. See *Inspection Report*

Clear Error Counters (active only in diagnosis mode):
Clears the error counters of all connected slaves (for more information about the extended diagnosis, see *Extended Diagnosis (Expert)*)

Acknoledge all warnings (active only in diagnosis mode):
Clears the yellow warning icon of all slaves

Self Test Scan:
Executes a self test routine for EC-Master and the network

Rescue Scan:
Executes the rescue scan. Can help if frames get lost with a switch for example

Take Snapshot (active only for local or remote system):
Takes a snapshot from the current diagnosis state and saves it into a capture file (for more information about the snapshots and capture files, see *Capture File*)

Automatic Snapshot Mode (active only for local or remote system):
Activates the automatic snapshot mode to take snapshots based on the configured rules

Snapshot (active only for offline diagnosis system):
Changes the active snapshot

EoE Endpoint Configuration (active only for local or remote system):
Activates EoE Endpoint support in diagnosis mode

4.2.4 Settings

Language:
Changes the current language

Theme:
Changes the current theme

Message Level:
Change the current message level

Capture File:
Shows capture file settings dialog

Project Template:
Shows project template settings dialog

4.2.5 Help

Show User Manual:
Shows this user manual

Show Log File:
Shows the log file

Check for updates:
Enable / disable automatic update check (once per month). Also a manual update check is performed on activation.

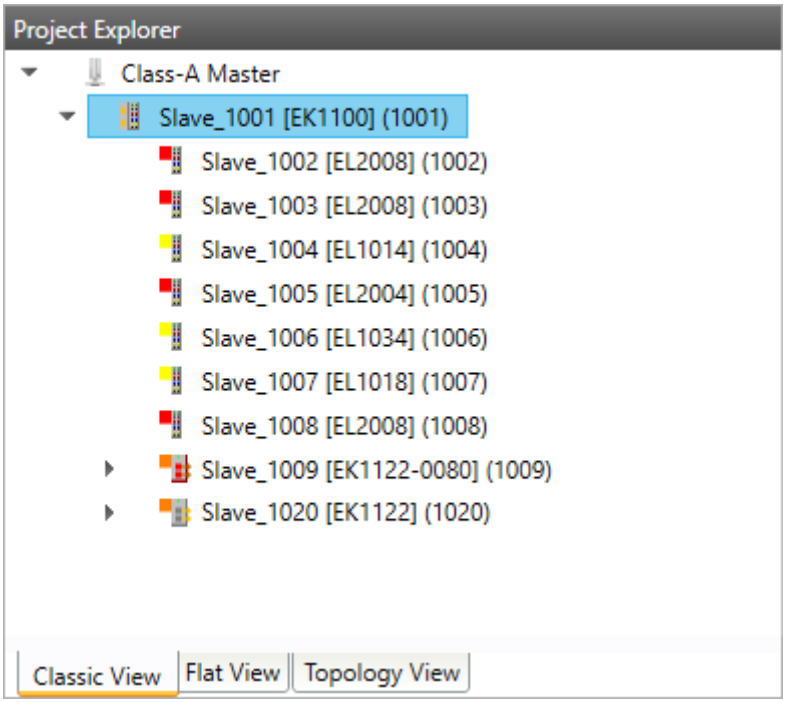
About …:
Show the about dialog

4.3 Project Explorer

4.3.1 Configuration Mode

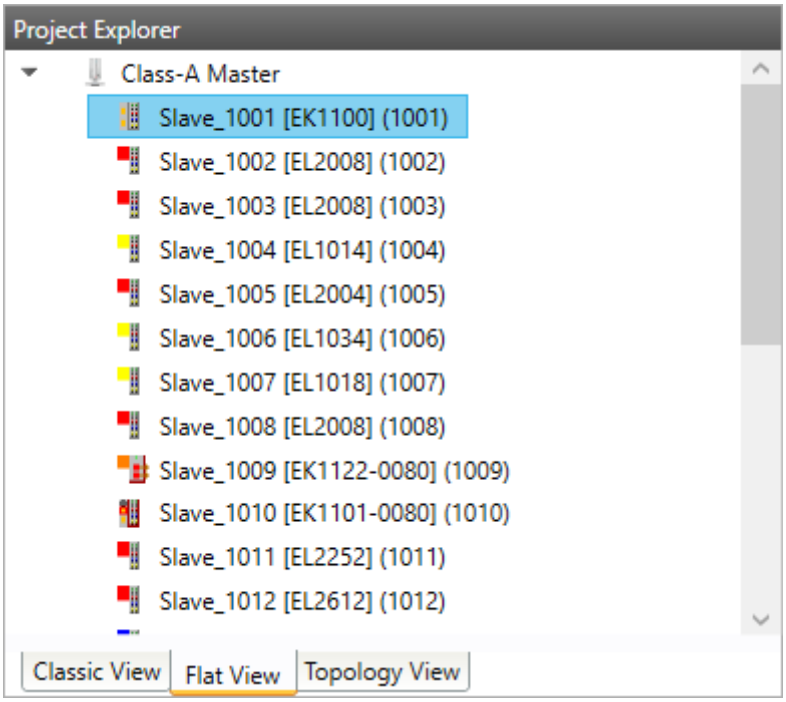
There are three topology visualisation views:

Classic View



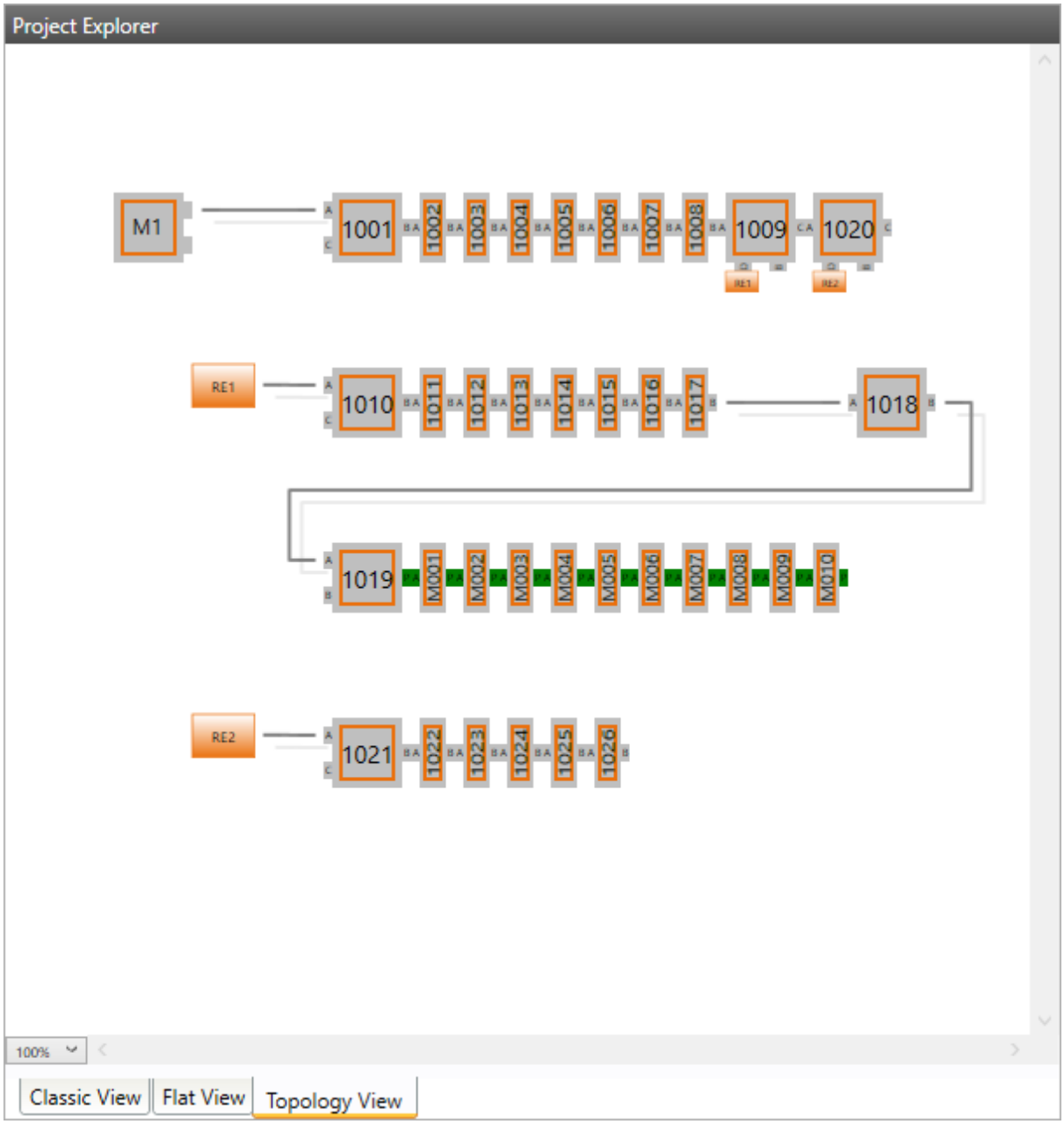
This is a tree view which has two levels. In the first level you can find coupler slaves or MDP slaves and in the second level you will see the connected slaves/modules.

Flat View



This view shows all slaves in a flat list, as they are connected in the EtherCAT network.

Topology View



This view shows a graphical tree of all slaves, as they are connected in the EtherCAT network.

The context menu of one or more selected slaves has the following entries:

Append Slaves:
Appends a new slaves

Remove Slaves:
Deletes the selected slaves

Cut/Copy/Paste:
Extended clipboard operations, which should help the user to move or multiply existing slave definitions.

Enable Slaves:
Appends disabled slaves to the process image at the previous position. If this is not possible, the slave will be marked as “not connected” and the user can append the slave by using “cut” & “paste”.

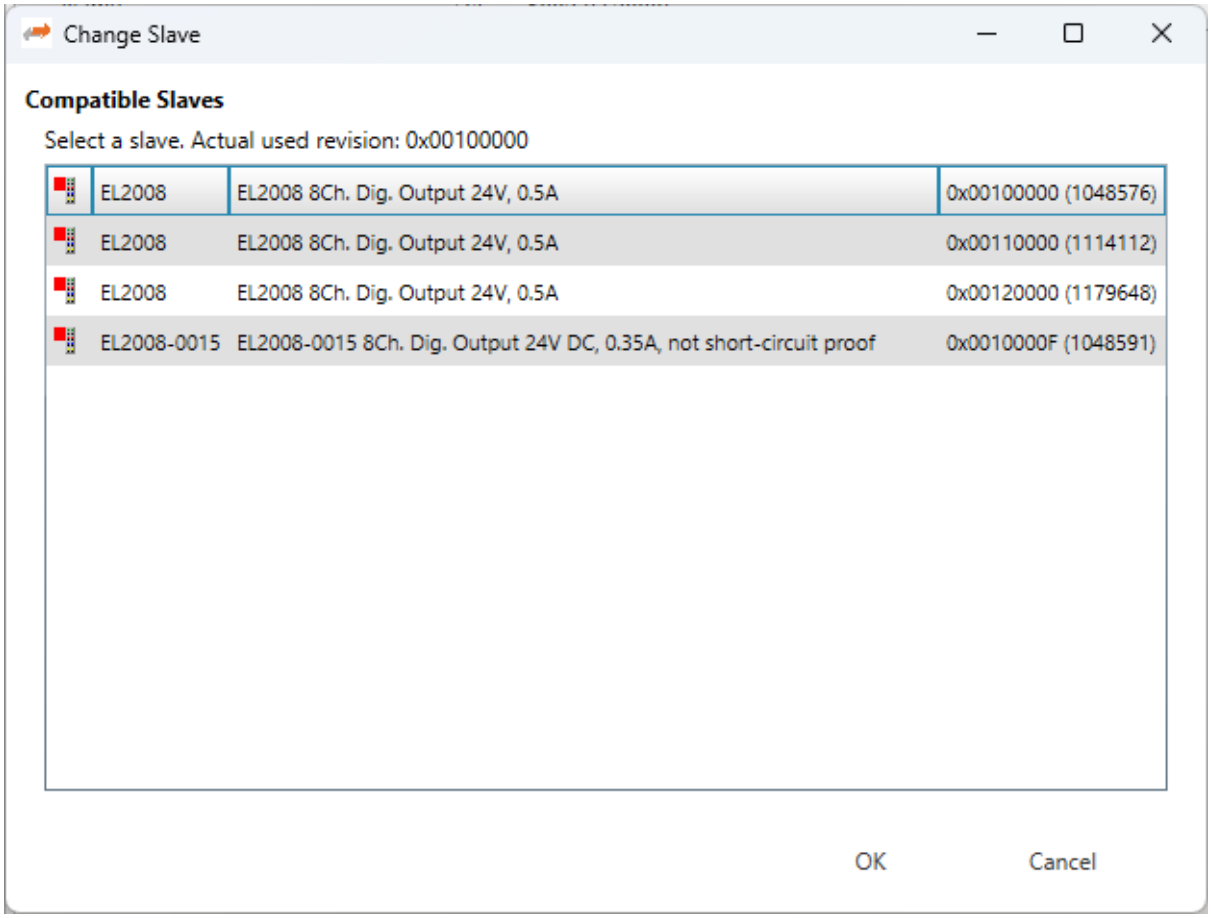
Disable Slaves:
Removes the slaves from process image and from the exported `ENI` file, but keeps the slave as “disabled”

in the project.

Reload ESI data:
Reloads `ESI` data which are stored in the project file from global `ESI` cache (after adding a slave to the project the `ESI` data will be stored in the project file).

Export SCI:
Exports a `SCI` file. A SCI file is like an ESI file but preconfigured. So it is possible to create a fixed slave which can be added to the configuration and is working out of the box.

Change Slave:
Opens the following dialog, where the user can select a compatible slave (this is helpful, if the user wants to update the slave to a new revision and keeps his configuration). This is also used to change from an ESI to a SCI file.



Import Beckhoff Slave Description, to import slave settings from TwinCAT (or ET9000)

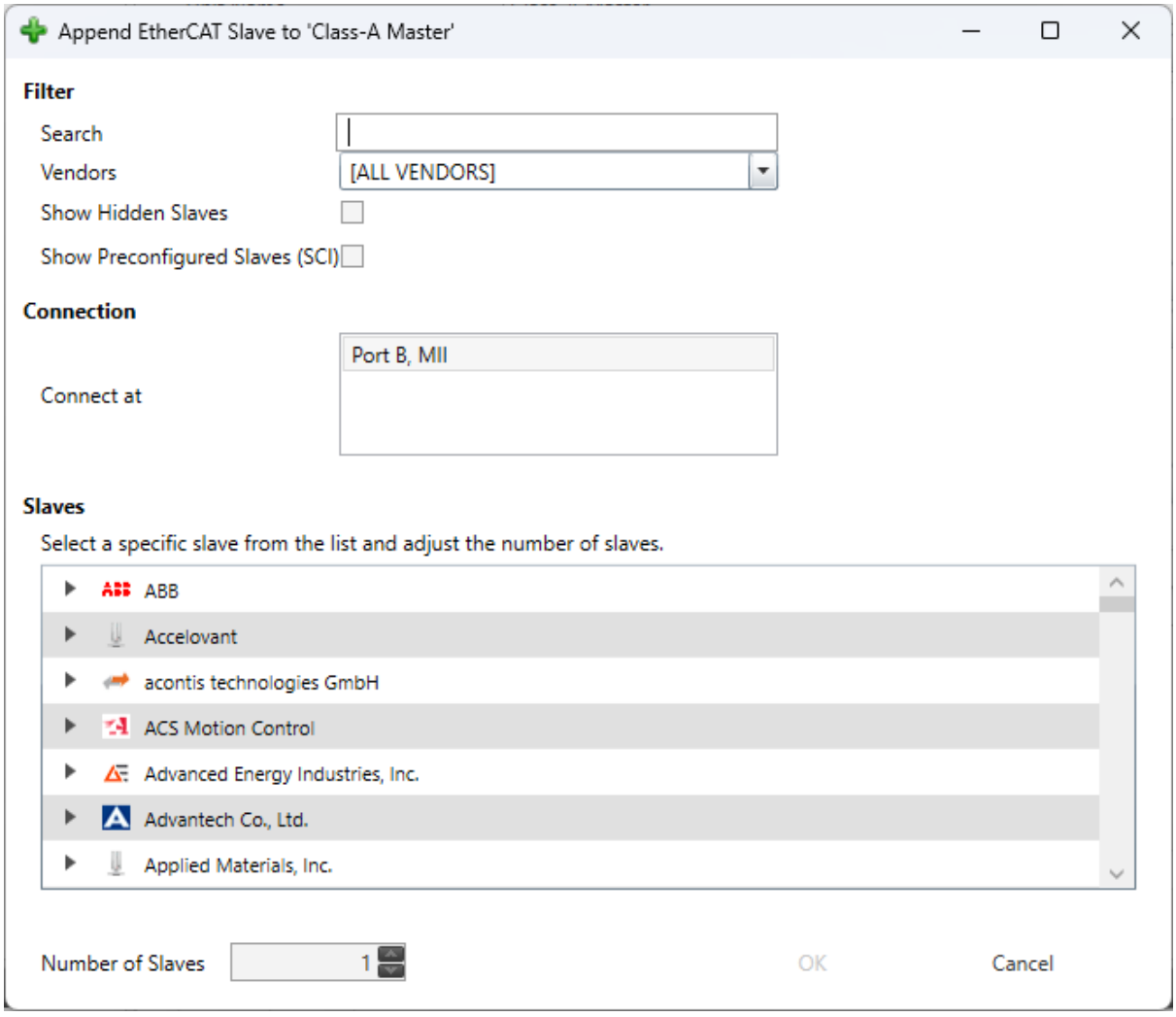
Import slave settings from "Beckhoff Slave Description" files

- Open project in TwinCAT
- Select slave to export
- Main menu "TwinCAT"
- Selected Item
- Export `XML` Description
- Import the exported file (imported will be MDP configuration, PDOs, DC settings, …)

Import init commands of slave from “Beckhoff Init Command Description” files

- Open project in TwinCAT
- Select slave to export
- Open tab “Startup”
- Context menu: “Export to `XML`”
- Import the exported file (imported will be the exported init commands)

If user tries to append slave he will see the following dialog:



Filter
: Search: Keyword to filter the slaves by type name. Vendors: List of all available vendors. User can filter all slaves by selecting the desired vendor from the list. If it makes sense, the recommended vendor is already preselected, e.g. if you try to append a slave to an E-Bus. Show Hidden Slaves: Shows also hidden slaves (e.g. with older revisions, if newer slaves are available) Show Preconfiguren Slaves: Shows also slaves from SCI files

Connection
: Select the port where the predecessor device is connected (see *General*).

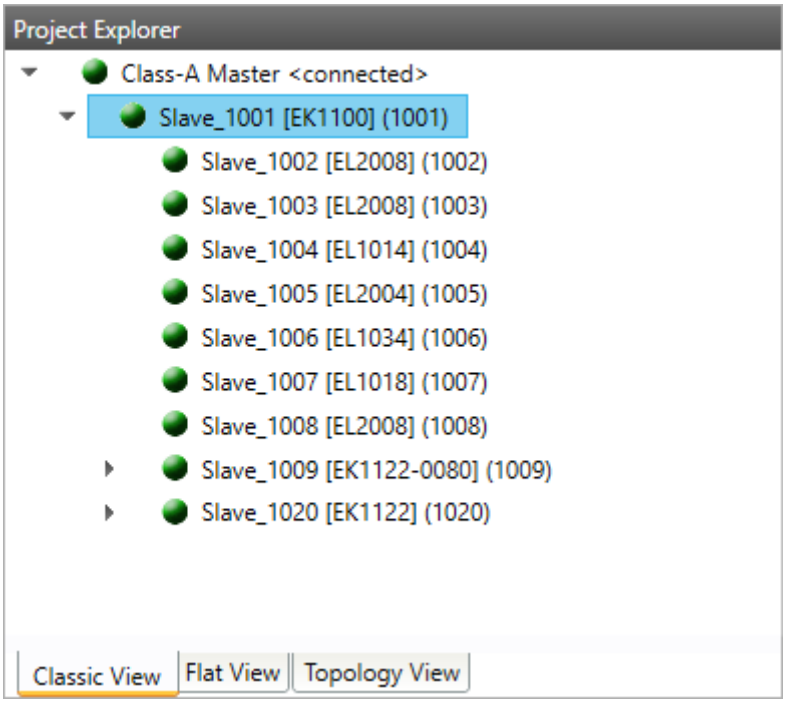
List of available slaves
: User can select the slave which he wants, be expanding the three levels: vendors, groups and the slaves themselves. The 3rd level consists of three parts: Type name, description and the revision number.

Number of slaves
User can change this value if he wants to add more than one slave of the same type.

4.3.2 Diagnosis Mode

There are three topology visualisation views:

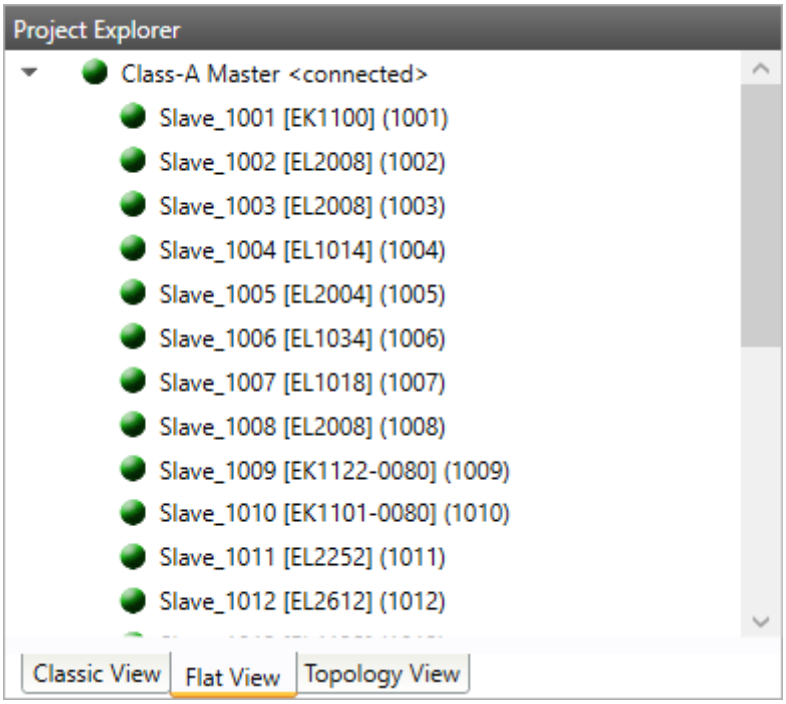
Classic View



This is a tree view which has two levels. In the first level you can find coupler slaves and in the second level you will see the connected slaves.

Possible device states:
- Init Bootstrap
- Pre-Op
- Safe-Op
- Op

Flat View

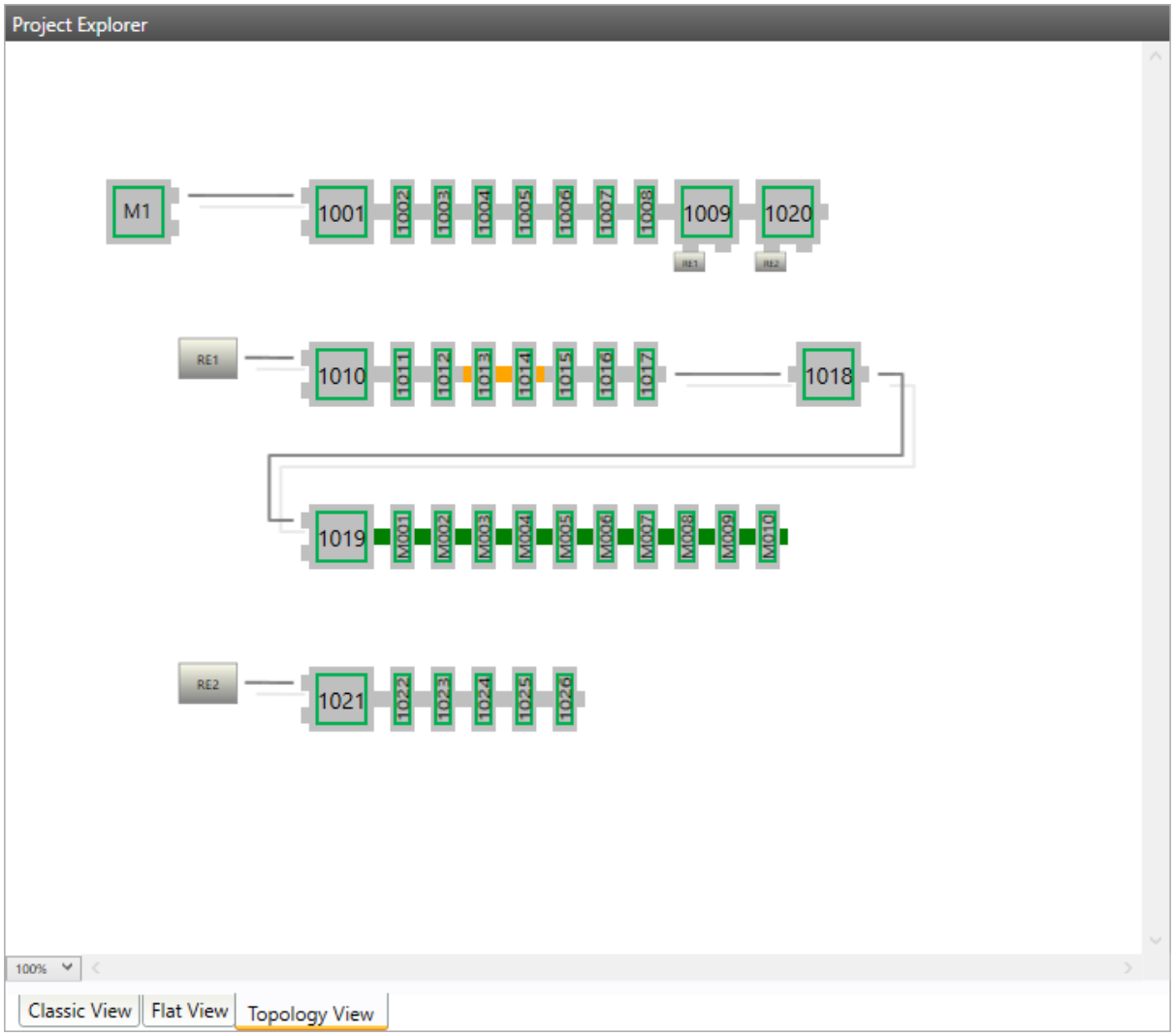


This view shows all slaves in a flat list, as they are connected in the EtherCAT network.

Possible device states:

- Init Bootstrap
- Pre-Op
- Safe-Op
- Op

Topology View



This view shows a graphical tree of all slaves, as they are connected in the EtherCAT network.

Possible device states:

- Init Bootstrap
- Pre-Op
- Safe-Op
- Op

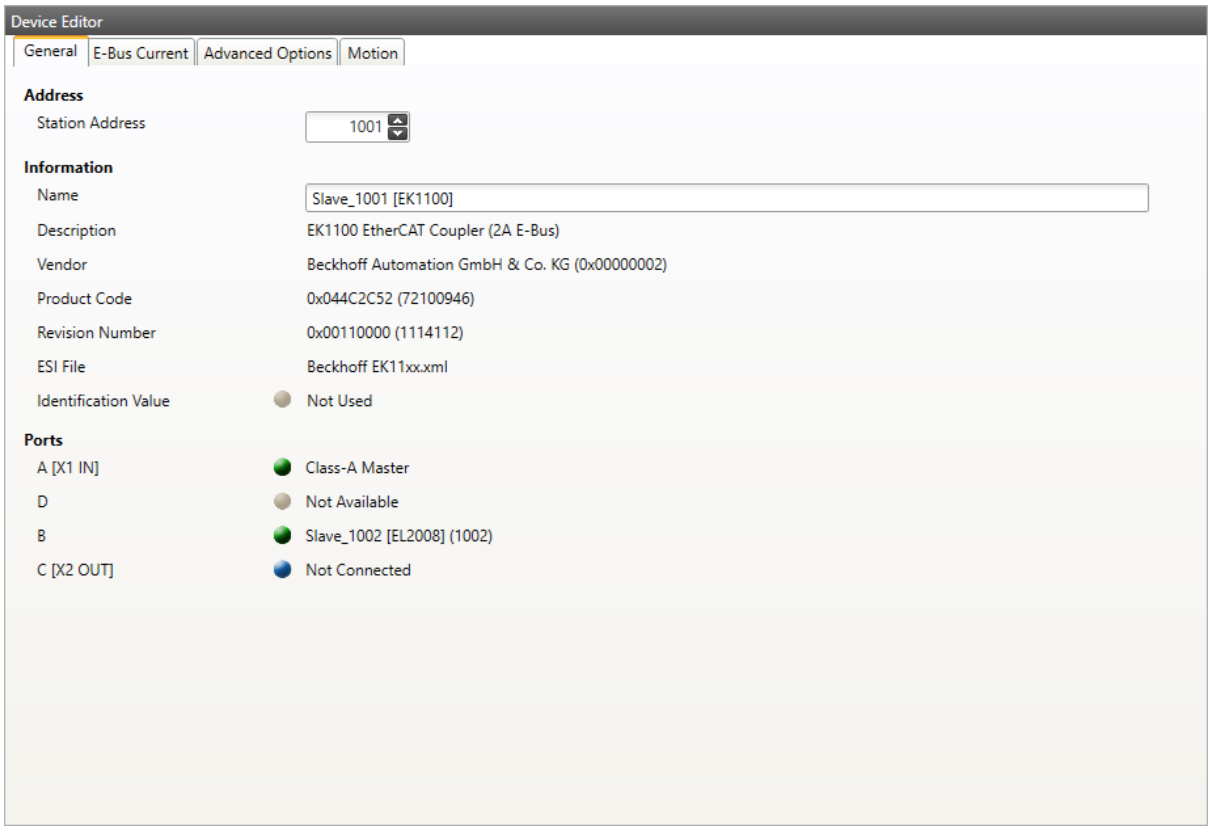
Possible port states:

- Bad Cable Quality
- Constricted Cable Quality
- Good Cable Quality

If cable quality is constricted or bad, please check the error counters of the slave (for more information about the extended diagnosis, see *Extended Diagnosis (Expert)*).

4.4 Device Editor

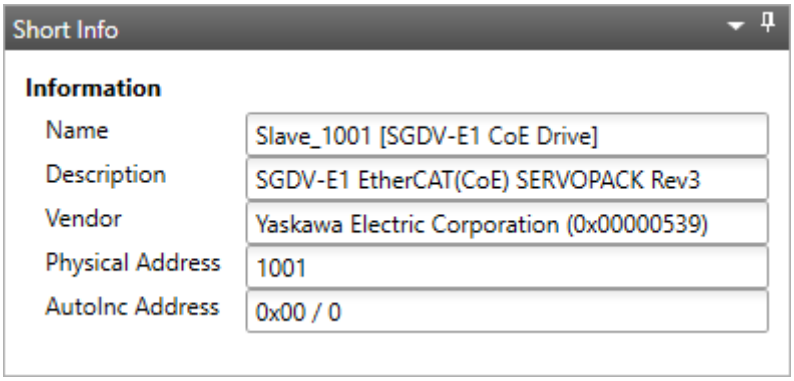
This Editor gives the user the possibility to read and write information of the selected master or slave:



Some tabs in the Device Editor are Expert Settings. The menu item *View Expert Settings* enables or disables the Expert Settings' visibilty. Some tabs appear when configuring the first Slave.

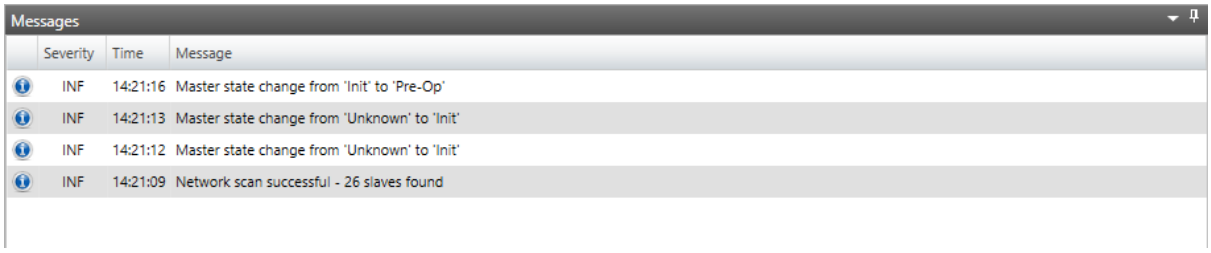
4.5 Short Info

This window shows short information about selected device, like name, description or vendor:



4.6 Message Window

Shows notifications which occur e.g. when the EtherCAT Master has changed its operation state or a slave has been removed from (or added to) the EtherCAT network:

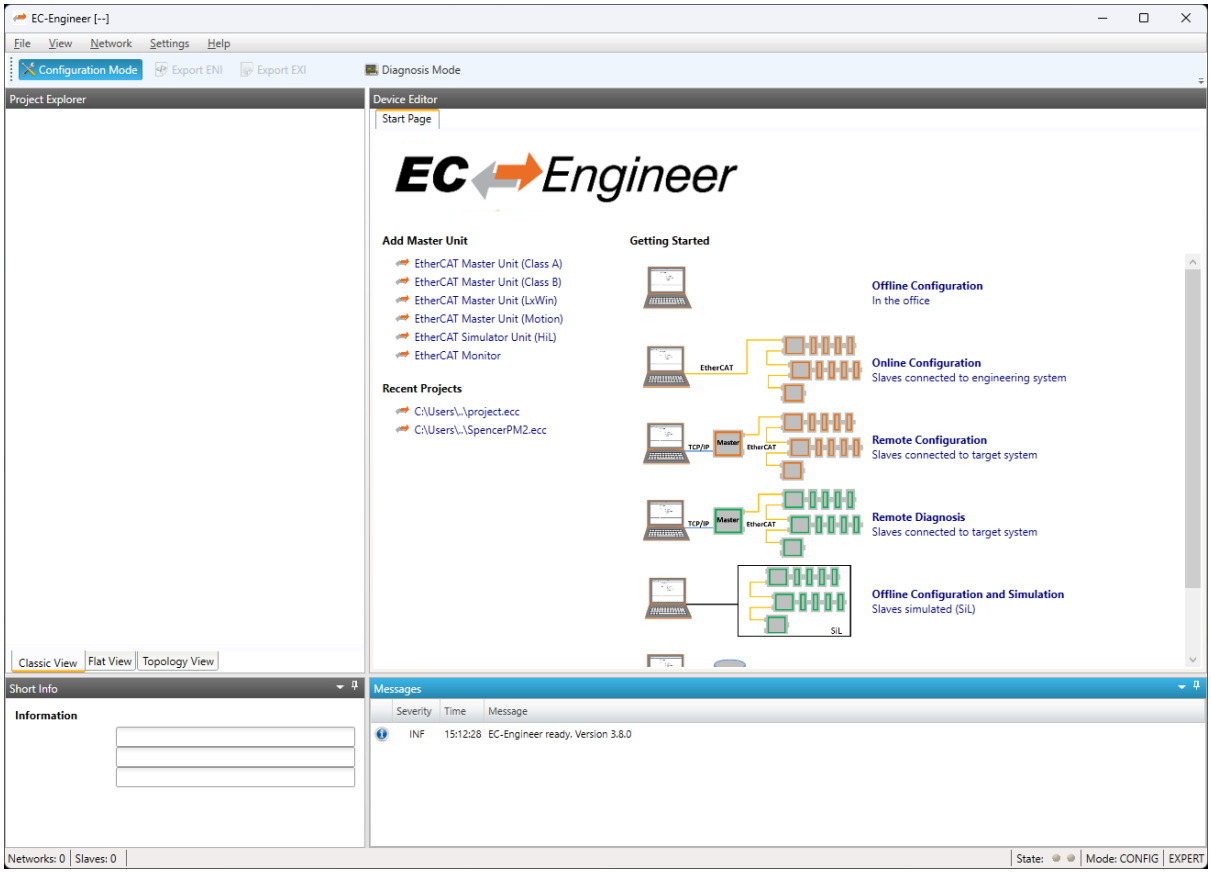


5 Configuration Mode

5.1 Overview

The EC-Master needs the EtherCAT-Network-Information (`ENI`) file to initialize and control the EtherCAT network. In most cases the automatically generated Slave settings can be used to run the EtherCAT network. In this chapter you can read how EC-Engineer helps you to view or adjust those settings.

At startup of EC-Engineer, the user will see this page:



It consists of three sections:

- Add Master Unit: List of available master units
- Recent Projects: List of the last five opened projects
- Getting Started: List of available run modes

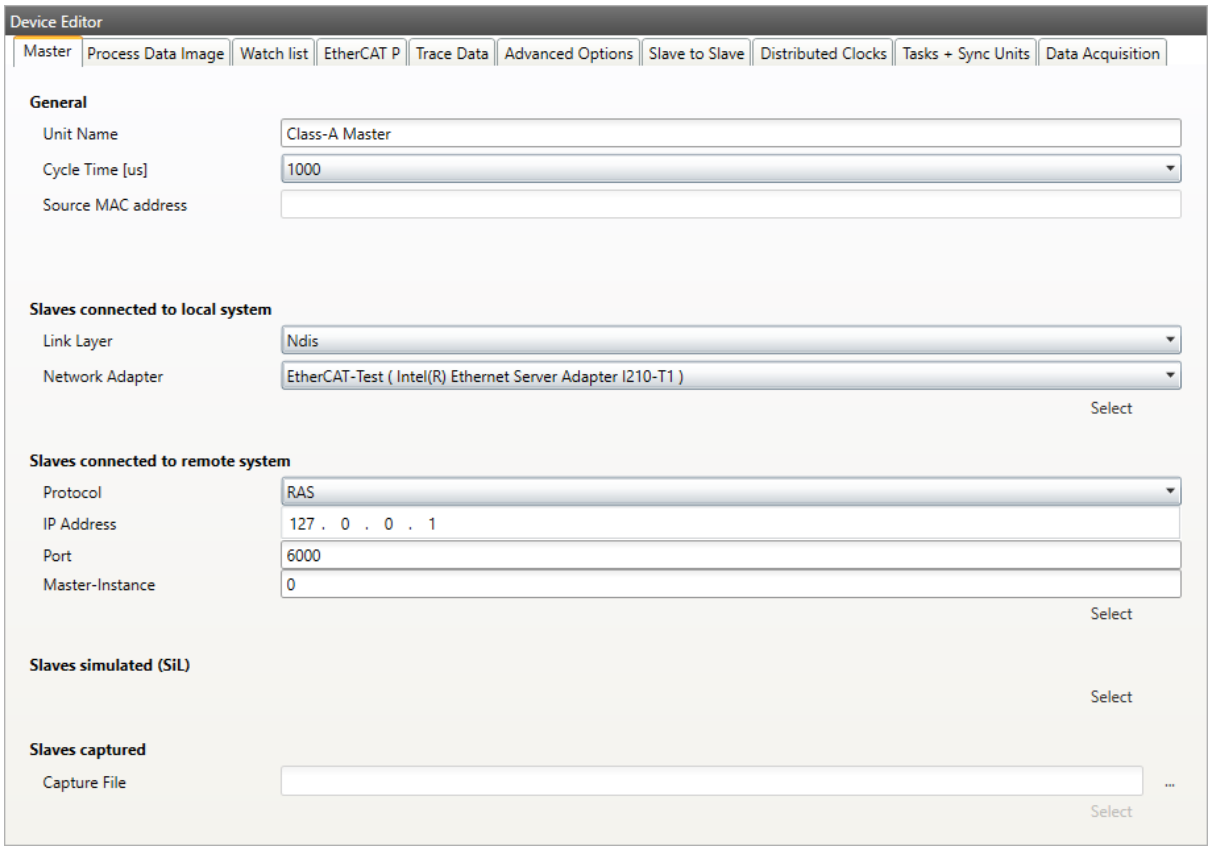
If the user clicks on one of the links, it runs a new master unit, opens an already existing project or switches in the “Getting Started” mode.

5.2 Master Settings

This section includes network related or master related settings. Some of those settings will also affect the “Master” section of the ENI.

5.2.1 Master

In this tab, the user can configure the name of the master and the cycle time. If he wants to connect to a control system, this can be also configured:



General

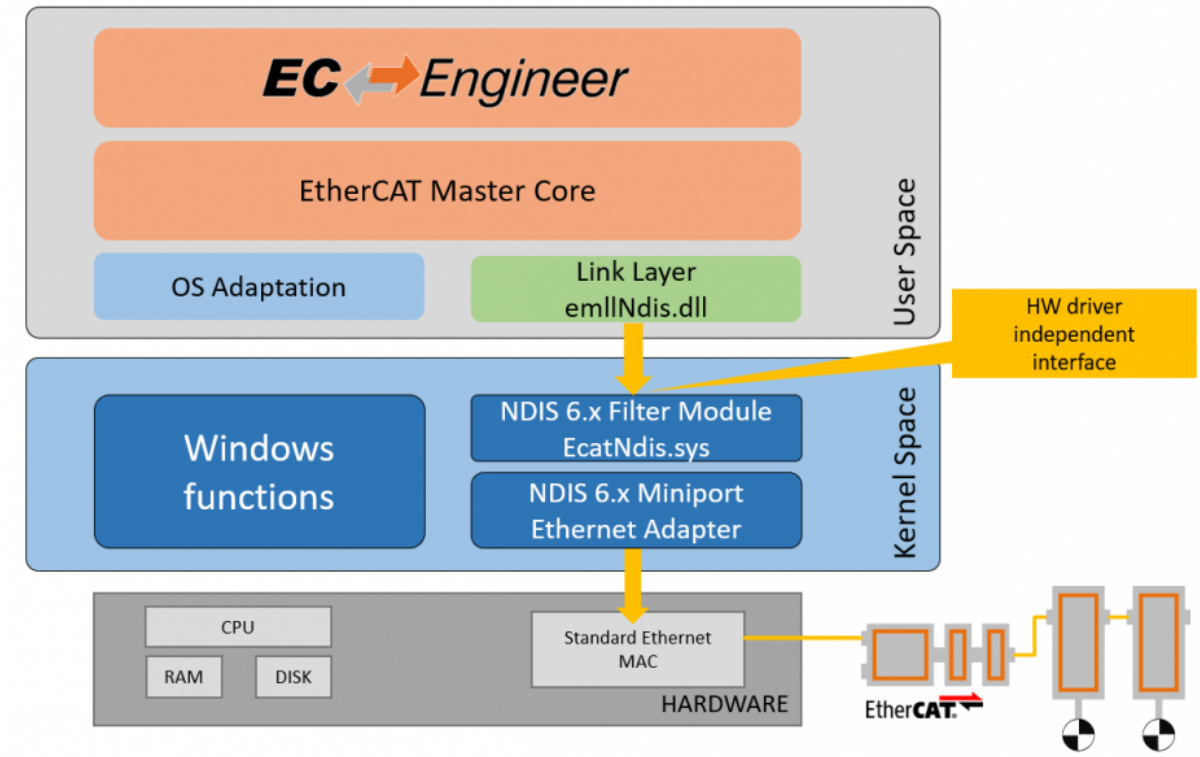
Unit Name:
Name of the master device

Cycle Time:
Interval in microseconds in which all EtherCAT commands will be sent from the master. The user can choose between the following values: 125, 250, 500, 1000, 2000 and 4000.

Source MAC address:
MAC address of the connected system (will be filled during bus scan)

Slaves connected to local system

Network Adapter:
Network adapter which is connected to the control system. In newer versions it is also a possibility to select the Link-Layer.



Slaves connected to remote system

Protocol:

Protocol of the remote system

- RAS (Default port is 6000)
- **Mailbox Gateway (Default port is 34980)**
  - EC-Master V3.0.1.22 and above
  - TwinCAT 3.1.4024 or TwinCAT 3.1.4022.30 and above

IP Address:
IP address of the remote system, which is connected to the control system

Port:
Port of the remote system, which is connected to the control system

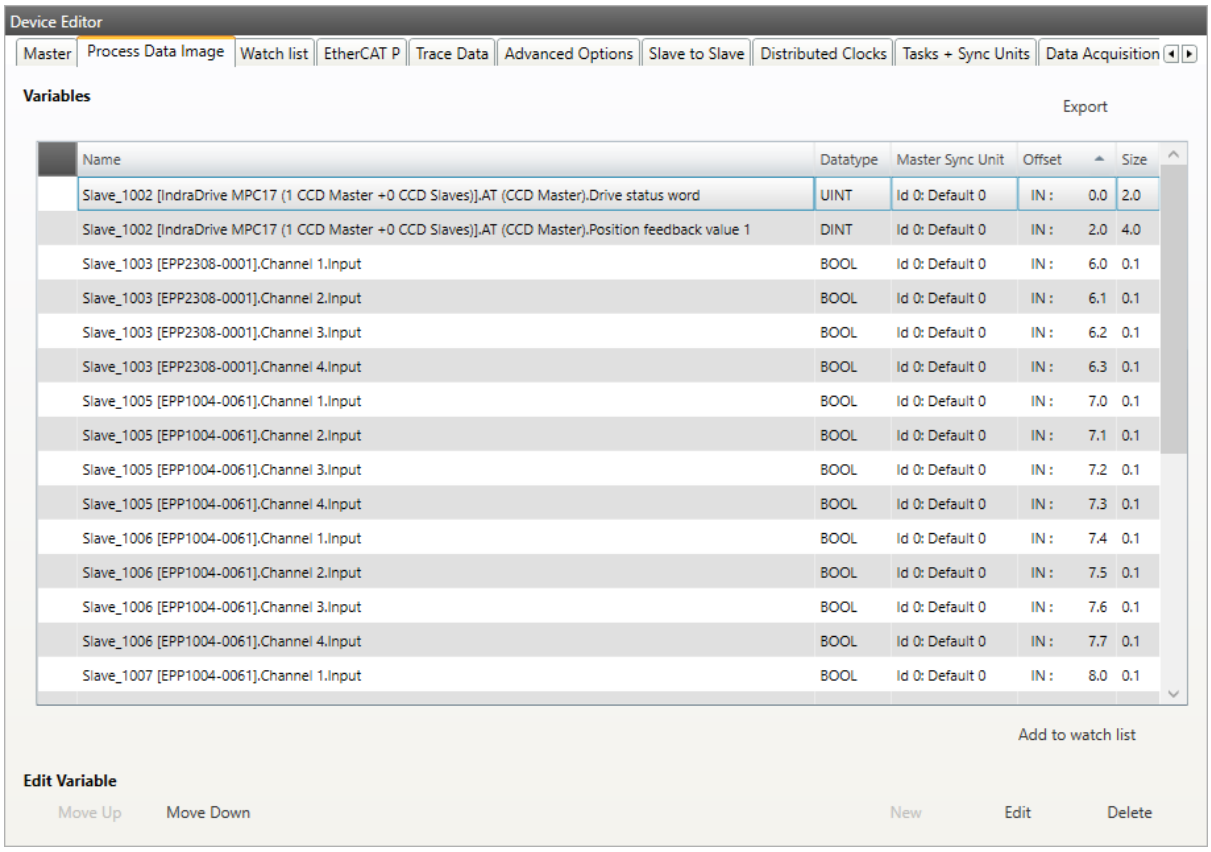
Master-Instance:
Used to determine which master instance should be used in the remote system (Master supports up to 10 instances).

Data to load from capture file

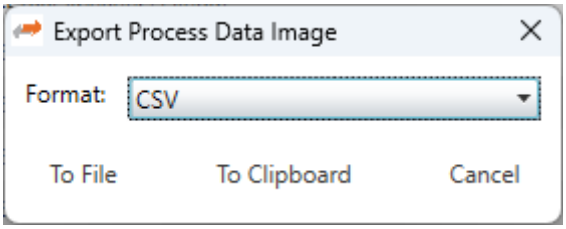
Capture File:
Path to the capture file, which contains one ore more snapshots

5.2.2 Process Data Image

In this tab, the user can see all variables of the process data image. If he wants, he can also export the list:



If user wants to export the variables, he will see the following dialog:

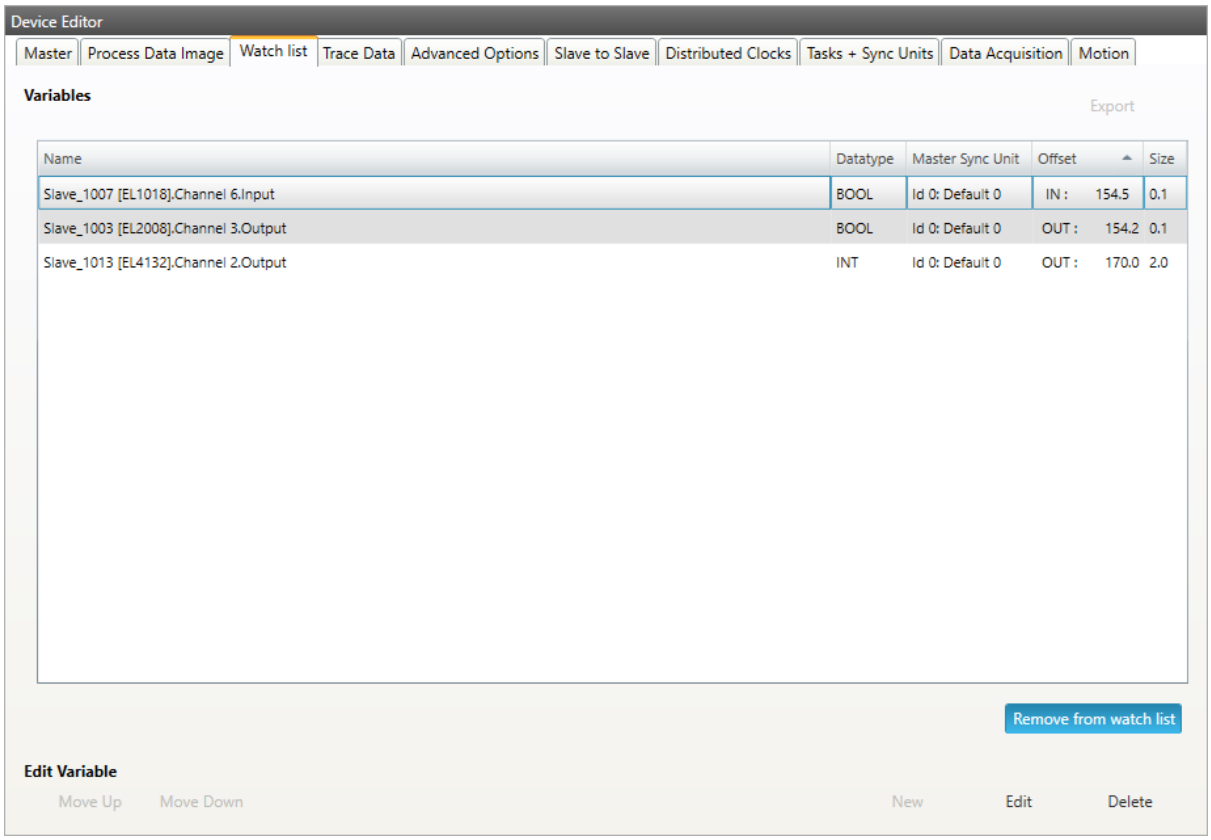


Export Formats:

- `CSV` File (Semicolon separated text file)
- `CSV PLC` File (Semicolon separated text file, where offsets are in PLC format)
- `PD Layout` File (C-Header file which can be used from EC-Master-Demo application)
- `XML` File (Like ProcessImage in `ENI`)

5.2.3 Watchlist

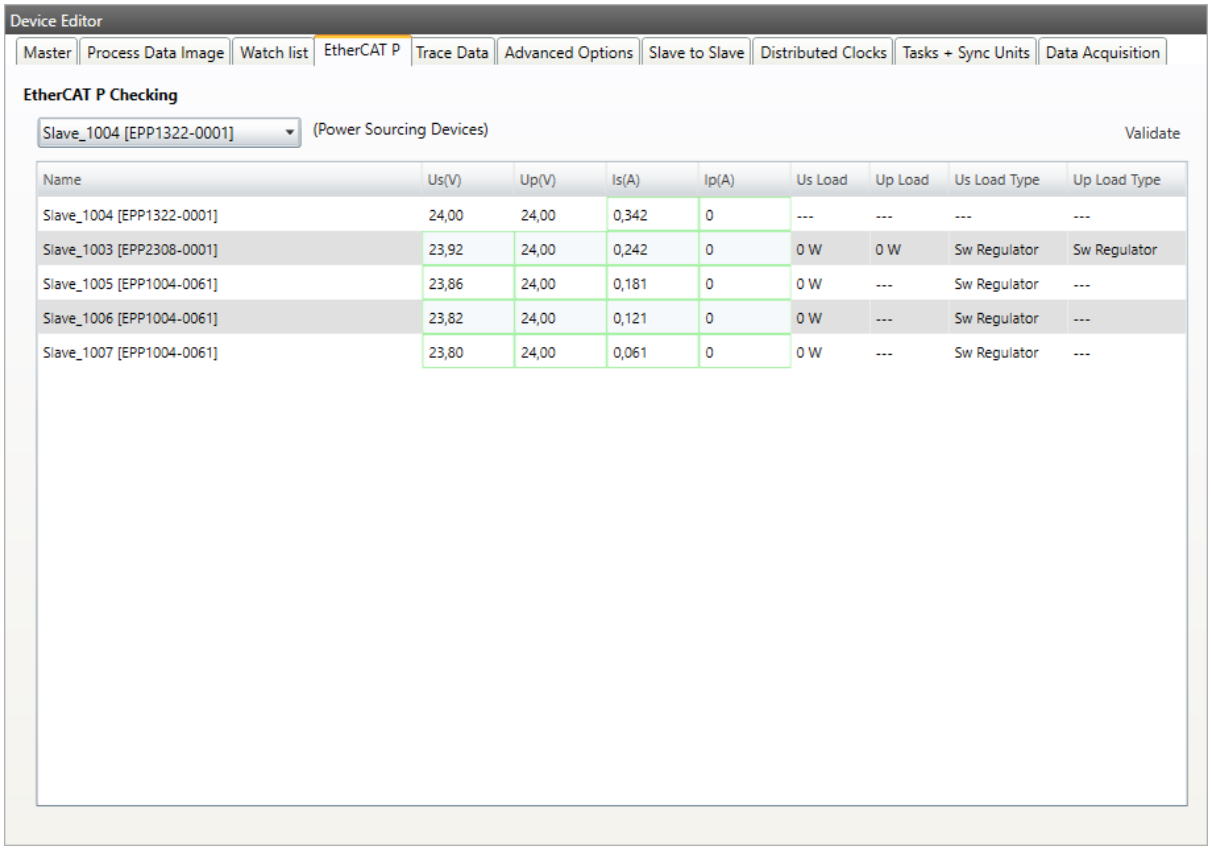
In this tab, the user can see all variables which were added to the watchlist in config mode:



The variables can be edited and removed from the watchlist.

5.2.4 EtherCAT P Overview

In this tab, the user can check the EtherCAT P system, if there are EtherCAT P slaves in the configuration. For those EtherCAT P slaves, he can calculate and check the power consumptions in the EtherCAT P segments based on cables and loads:



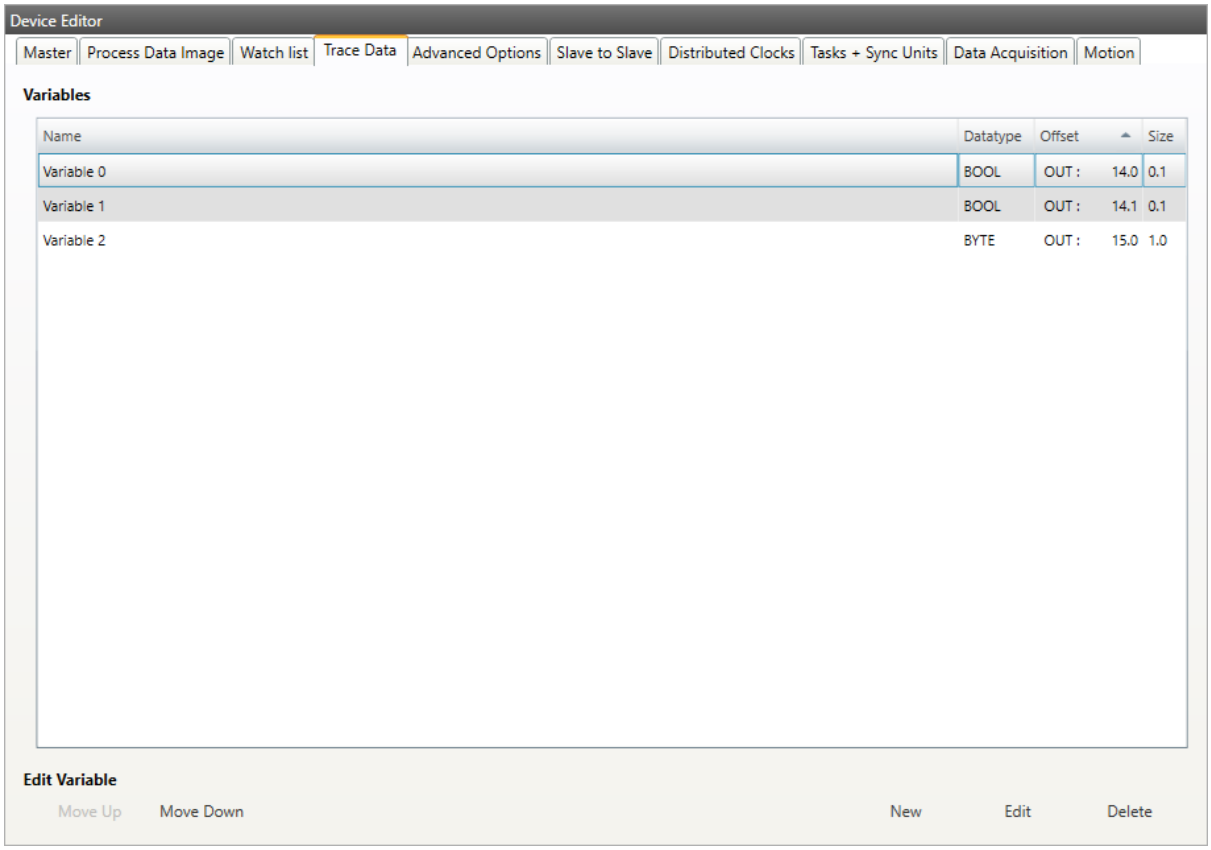
In the ComboBox the user can switch between all Power Sourcing Devices (PSD) in the configuration. In the grid are shown all the supplied slaves from the selected PSD, with the calculated voltages and currents and the selected loads. The values which are to high or to low are marked red.

Hint: These values are not relevant for the `ENI`-File. They are just a help for the user what might not work. The `ENI` File can be exported anyway.

On the *Validate* Button, the user can check the whole configuration. If there is an error somewhere, the correspondending PSD is selecte. If there are no errors the user will get a message box.

5.2.5 Trace Data (Expert)

In this tab, the user can add trace variables:



Trace Data
Trace variables which can be added from the user.

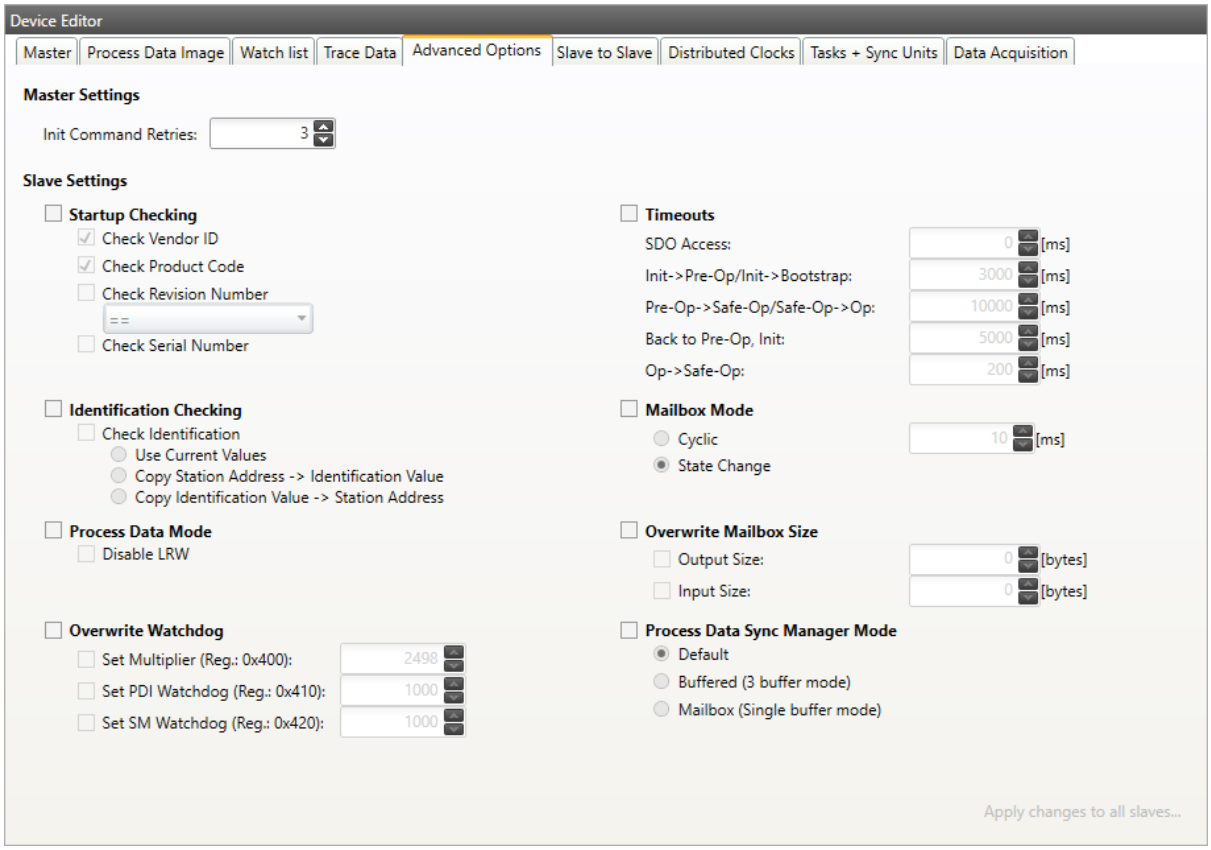
Buttons

New/ Edit/Delete:
Used for changing the list.

Up/Down:
Moving the selected variable up or down

5.2.6 Advanced Options (Expert)

In this tab, the user can change master specific settings or he can change slave specific settings which will be applied to all slaves:



Master Settings

Init Command Retries: Number of retries, to handle transmission errors.

Slave Settings

- Slave settings can be applied to all slaves with one click on the button *Apply changes to all slaves*. For a detailed description of the Advanced Slave Options, see *Advanced Slave Options (Expert)*.
- **Identification Checking**

  Use Current Values Identification Checking will be activated for all slaves with the current values

  ---

  Important: If current is 0, the Identification is not activated!

  Copy Station Address –> Identification Checking will be activated for all slaves with the station address as identification value

  Copy Identification Value –> Identification Checking will be activated for all slaves and the identification value is also used as station address

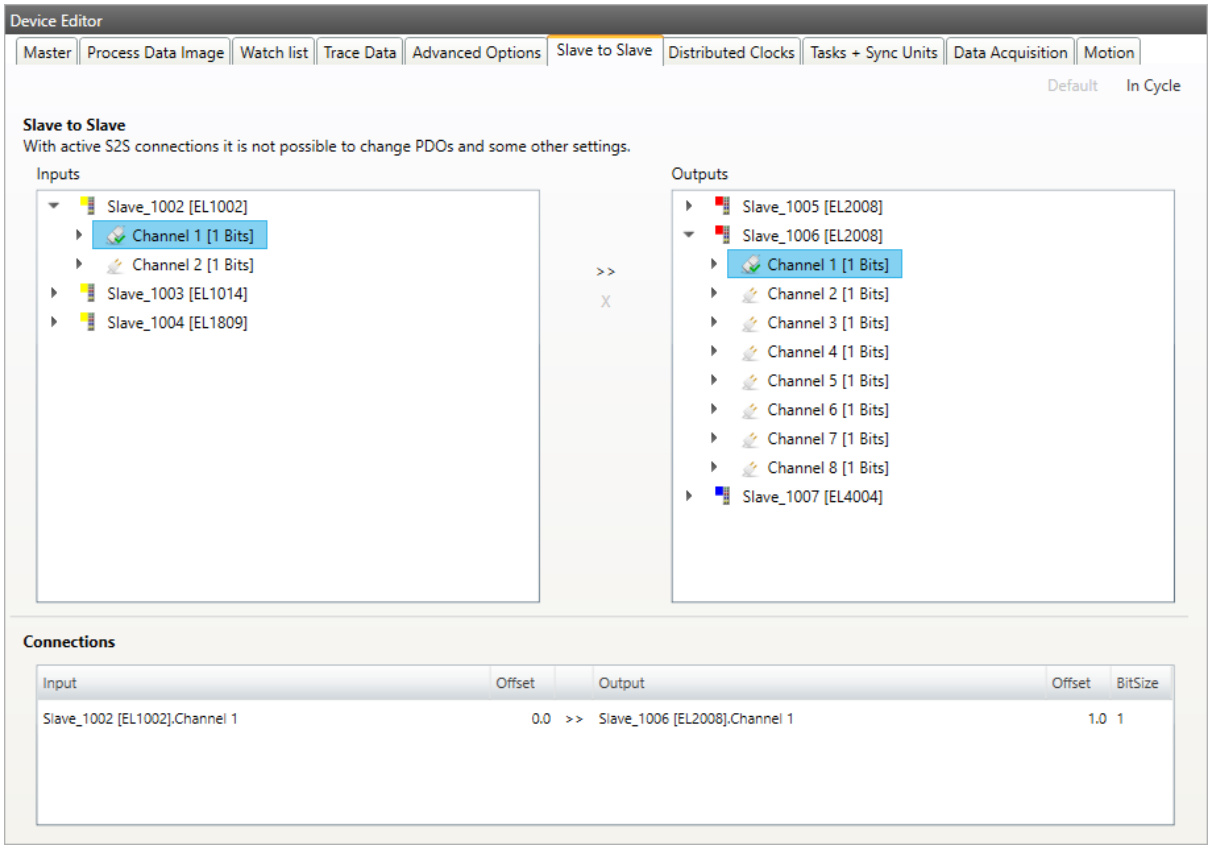
5.2.7 Slave to Slave (Expert)

In this tab, the user can configure the slave to slave communication by connecting 2 variables or PDOs.

This tab consists of 2 views:

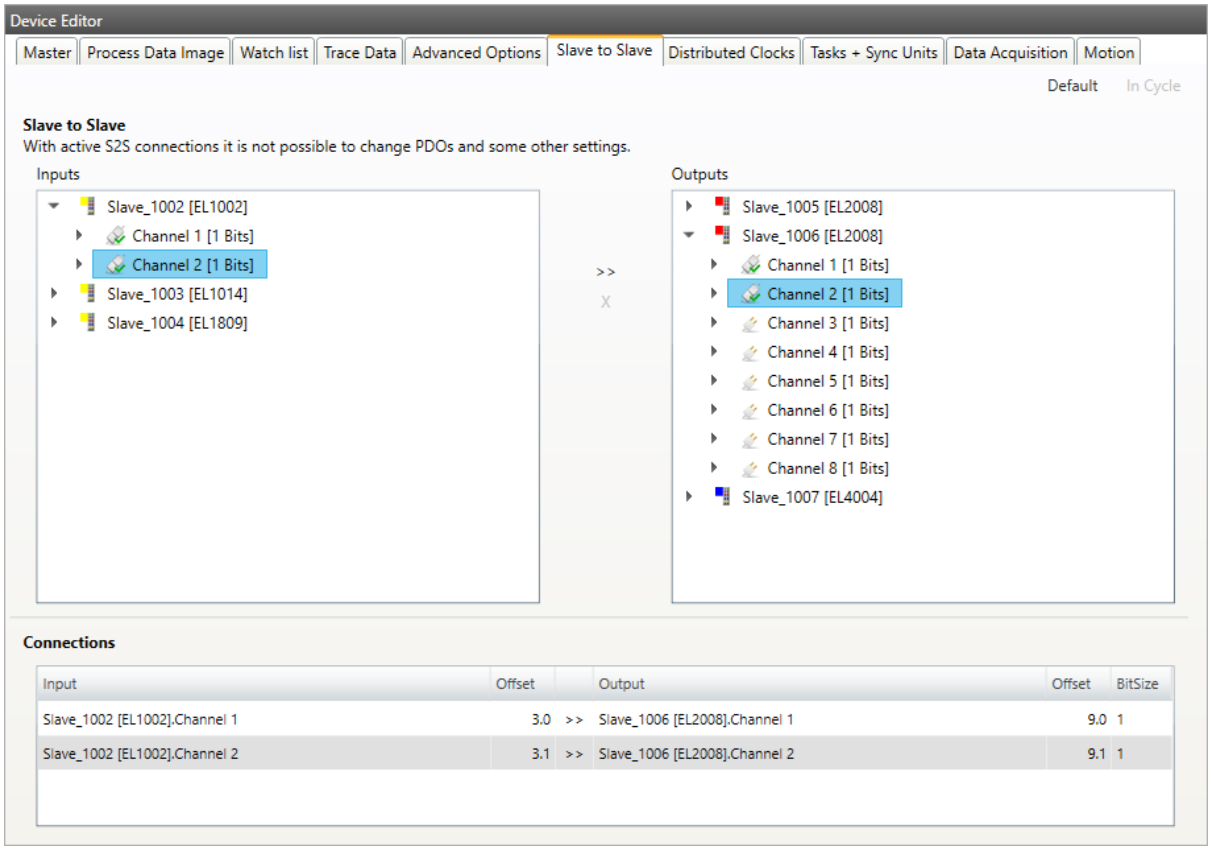
Default view

In this view, the user can configure the slave to slave communication by using copy infos in `ENI` file. This is the default way.



In cycle view

In this view, the user can configure the on cycle slave to slave communication by setup the process image and the FMMU in a way that inputs of the source slave will be directly written into the outputs of the destination slave during one cycle.

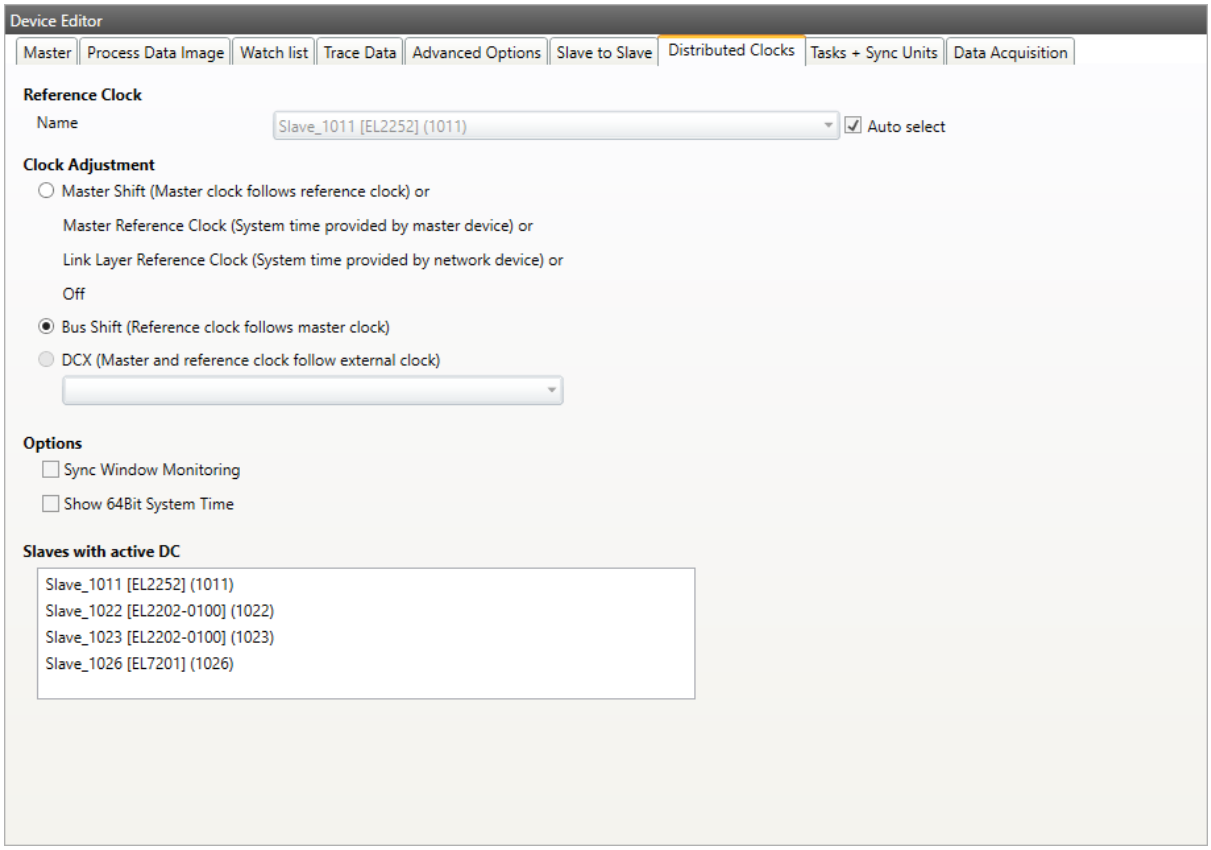


Limitations of one cycle slave to slave communication:

- Input slave must be located before output slave
- Complete sync unit of the slave must be connected (this means all PDOs of a sync unit must be connected and not only one variable)

5.2.8 Distributed Clocks (Expert)

In this tab, the user can change distributed clock related settings:



Reference Clock

Name:
Name of the reference clock. By default, this is the first slave with DC support.

Clock Adjustment

Master Shift:
The reference clock controls the Master time

Bus Shift:
The Master time controls the reference clock

External Mode:
The reference clock is controlled by an external sync device

Options

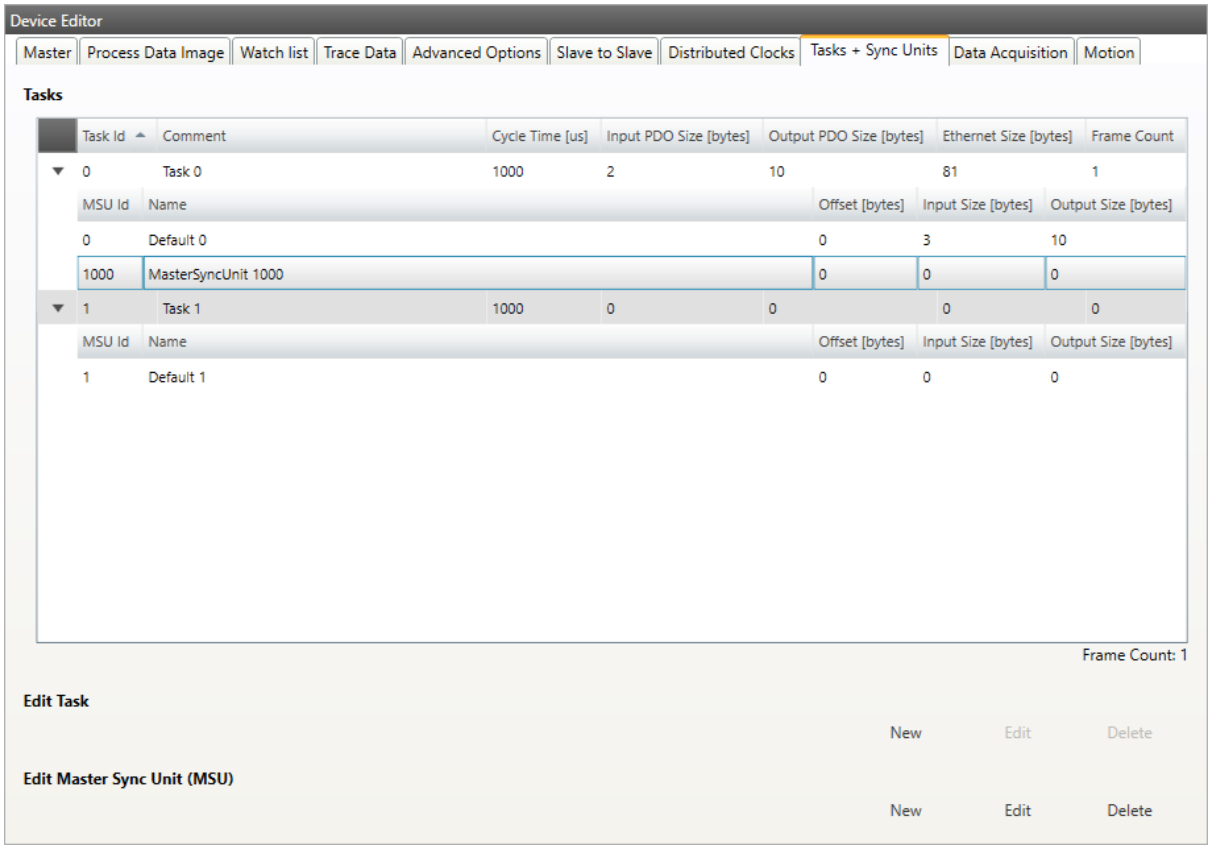
Sync Window Monitoring:
A command (datagram) will be inserted in the cyclic frame to read the ESC registers 0x092C. If this is selected the master will throw a notification.

Show 64Bit System Time:
Master supports slaves with 32bit and 64bit system time register (0x0910). If this is selected he will interpret it as 64bit system time.

Slaves with active DC
Shows a list of all slaves with active DC.

5.2.9 Tasks + Sync Units (Expert)

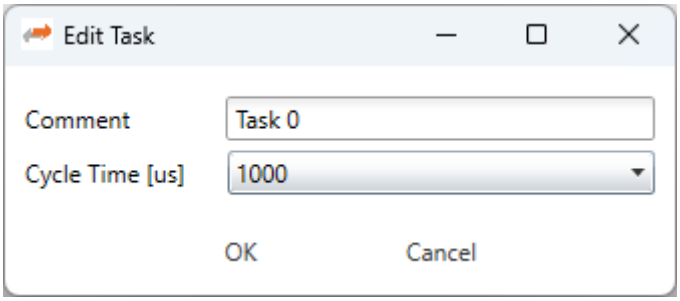
In this tab, the user can define additional cyclic tasks and master sync units. After adding a new master sync unit, the user can assign one or more slave sync units on tab *Slave Sync* ▸ *Units* to this master sync unit:



Tasks:
List of cyclic tasks and master sync units.

Buttons:
New/Edit/Delete: Used for changing the list.

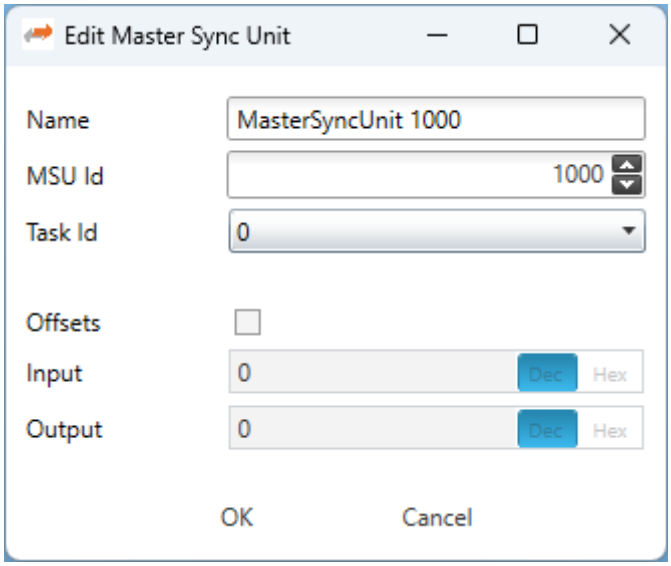
If user wants to edit a task, he will see the following dialog:



Comment:
Comment of this task (will be written to `ENI` file)

Cycle Time:
Cycle time of this task

If user wants to edit a master sync unit, he will see the following dialog:



Name:
Name of this master sync unit (will be written to `ENI` file)

Sync Unit Id:

Id of this master sync unit (will be written to `ENI` file).

- ID 0 .. 9: Generated / internal master sync unit
- ID 10 .. 999: Generated / internal master sync unit for groups
- ID 1000 .. 1999: User defined master sync unit

Task Id:
Task Id to which is this master sync unit assigned

Offsets:
Activate to pin this master sync unit to a specific offset

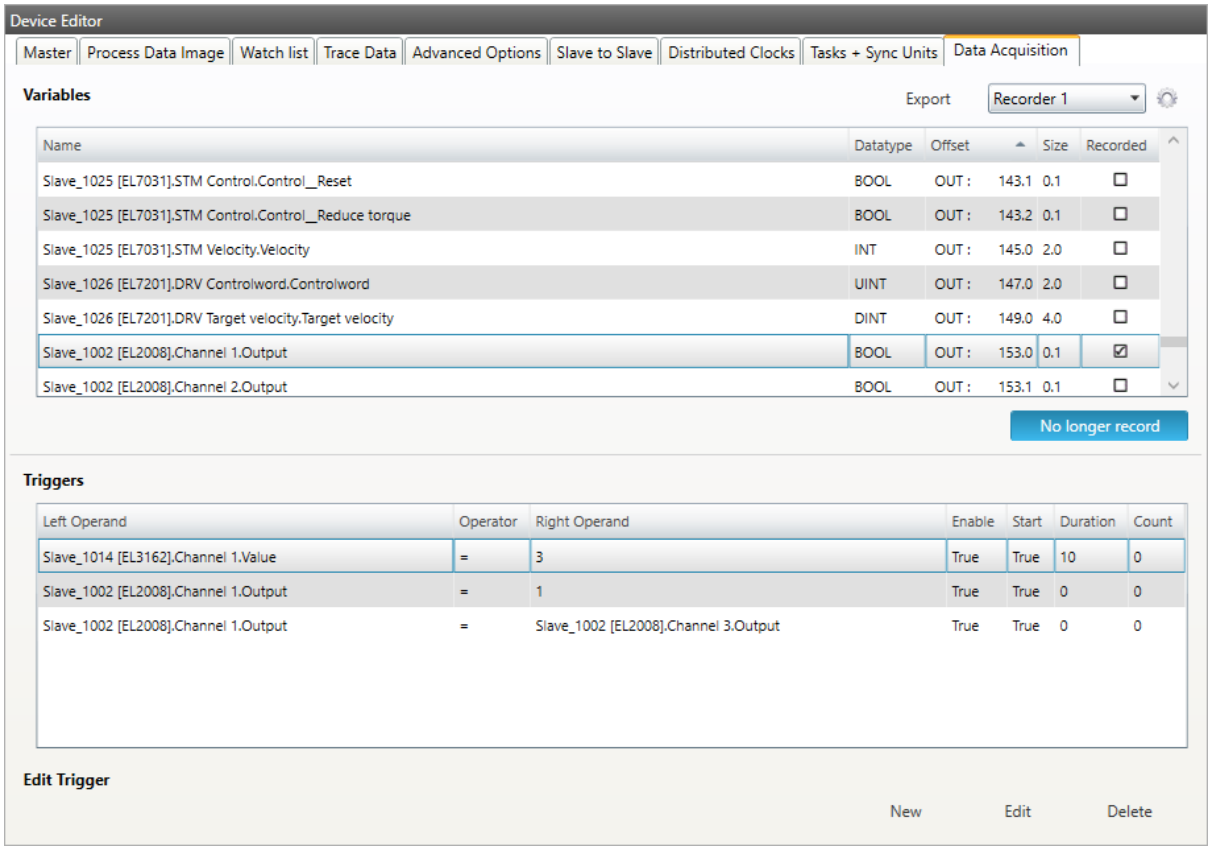
Input:
Input offset of pinned master sync unit

Output:
Output offset of pinned master sync unit

5.2.10 Data Acquisition (Expert)

In this tab, the user can configure our Data Acuisition (DAQ) library. This library can used from EC-Master to record process data in realtime.

After adding a new *recorder*, the user can select the variables which should be recorded and specify some triggers:



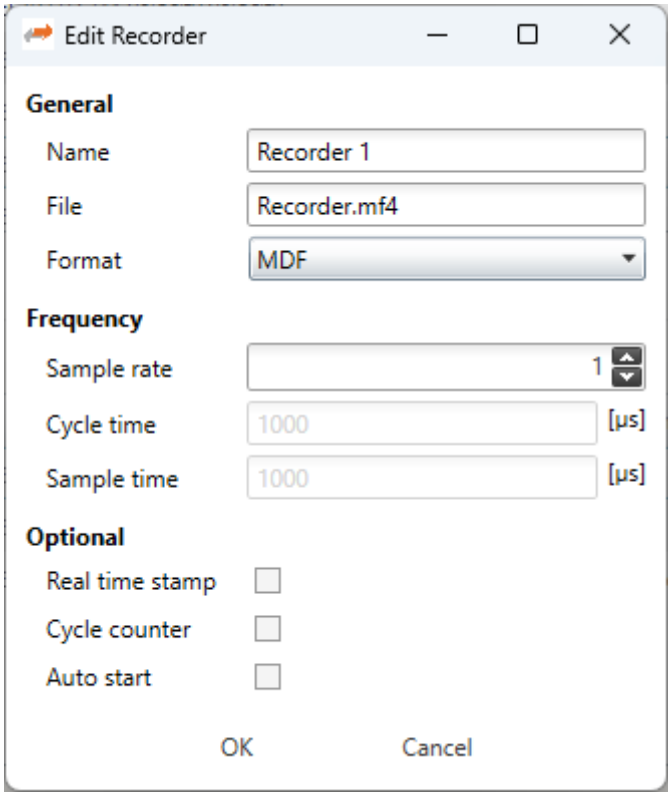
Variables:

Add/Remove:
Used for adding or removing the selected variable to the recording.

Triggers:

New/Edit/Delete:
Used for changing the trigger list.

If user wants to edit a recorder, he will see the following dialog:



Name:
Name of the recorder

File:
Absolute path of the recorder file on the master system

Format:

Format of the recorder file, e.g.

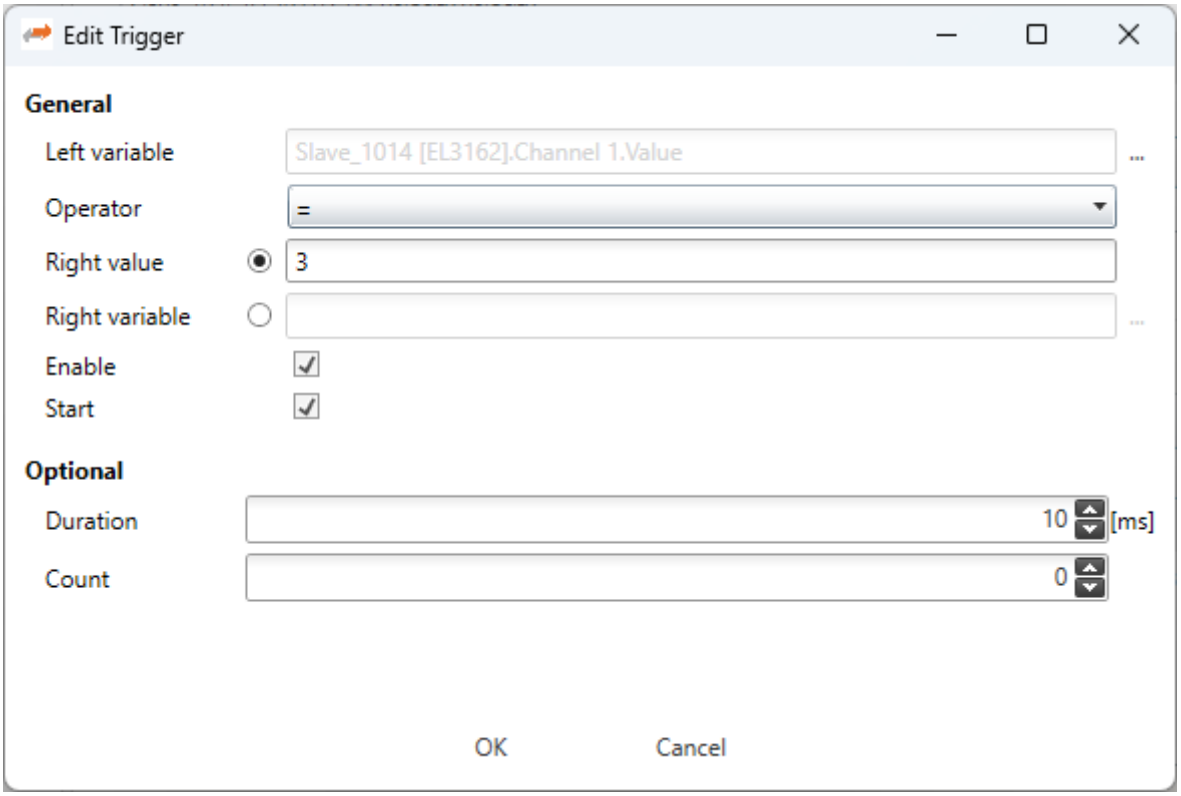
- `MDF` (Measurement Data Format)
- `CSV` (Comma Separated Values)

Sample Rate:
Sample rate of the recorded data e.g. every cycle or every second cycle, …

Real time stamp:
Adds a real time stamp to the recorded data

Cycle counter:
Adds a cycle counter to the recorded data

If user wants to edit a trigger, he will see the following dialog:



General

Left variable:
Name of the left variable

Operator:
Operator of the trigger (e.g. =, >, >=, <, <=, !=)

Right value:
Value of the right operand to compare the left variable against a static value e.g. trigger, if variable is greater than 5

Right variable:
Name of the right variable to compare the left variable against the value of another variable e.g. trigger, if variable 1 is smaller than variable 2

Enable:
Enabled or disabled trigger (can be enabled from application later)

Start:
Start or stop trigger

Optional

Duration:
Duration in ms (0 = infinite) e.g. trigger should start recording for 500 ms

Count:
Trigger count (0 = infinite) e.g. trigger should hit only for 5 times

For more information please refer the manual of the EC-Master-Data-Acquisition-Library.

5.2.11 Motion Settings (Motion Mode only)

In this tab, the user change settings for the EcMasterDemoMotion Configuration. It is also possible to export the `DemoMotionConfig.xml` file:

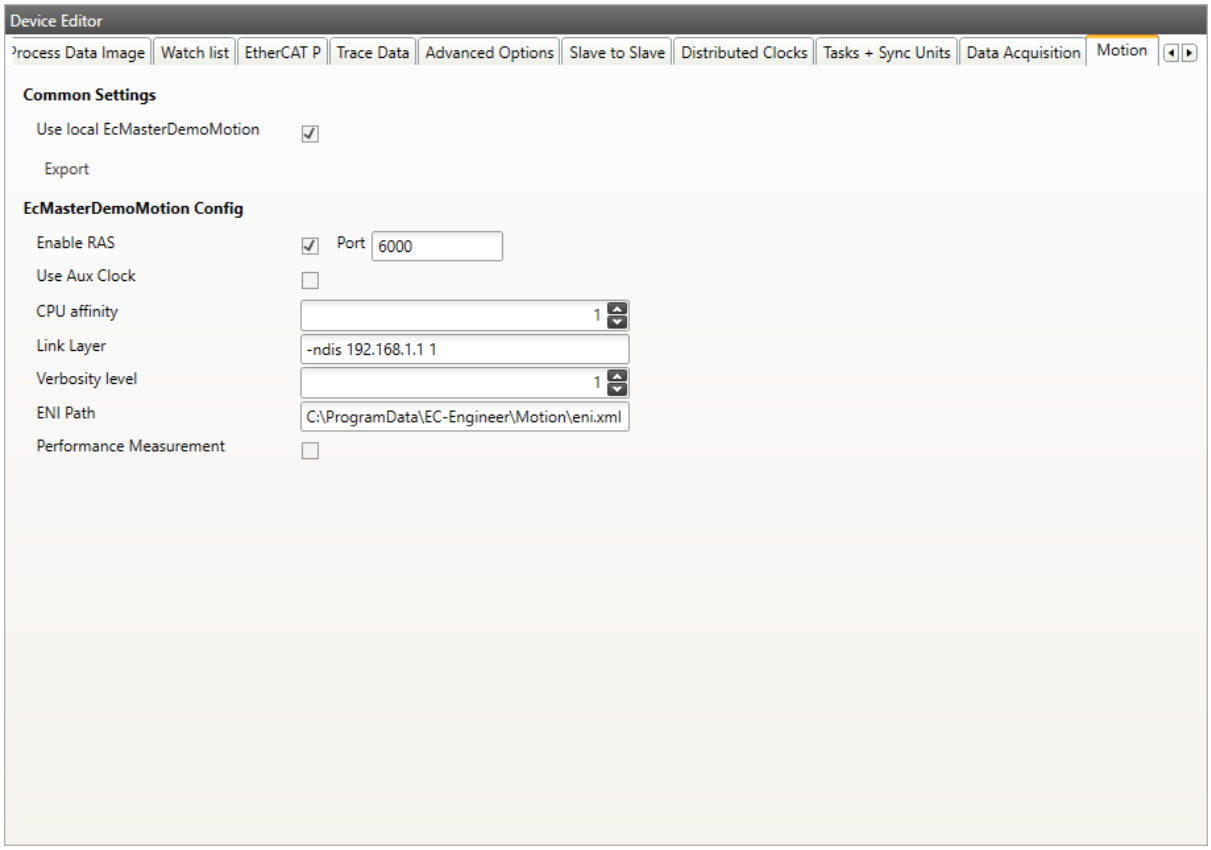
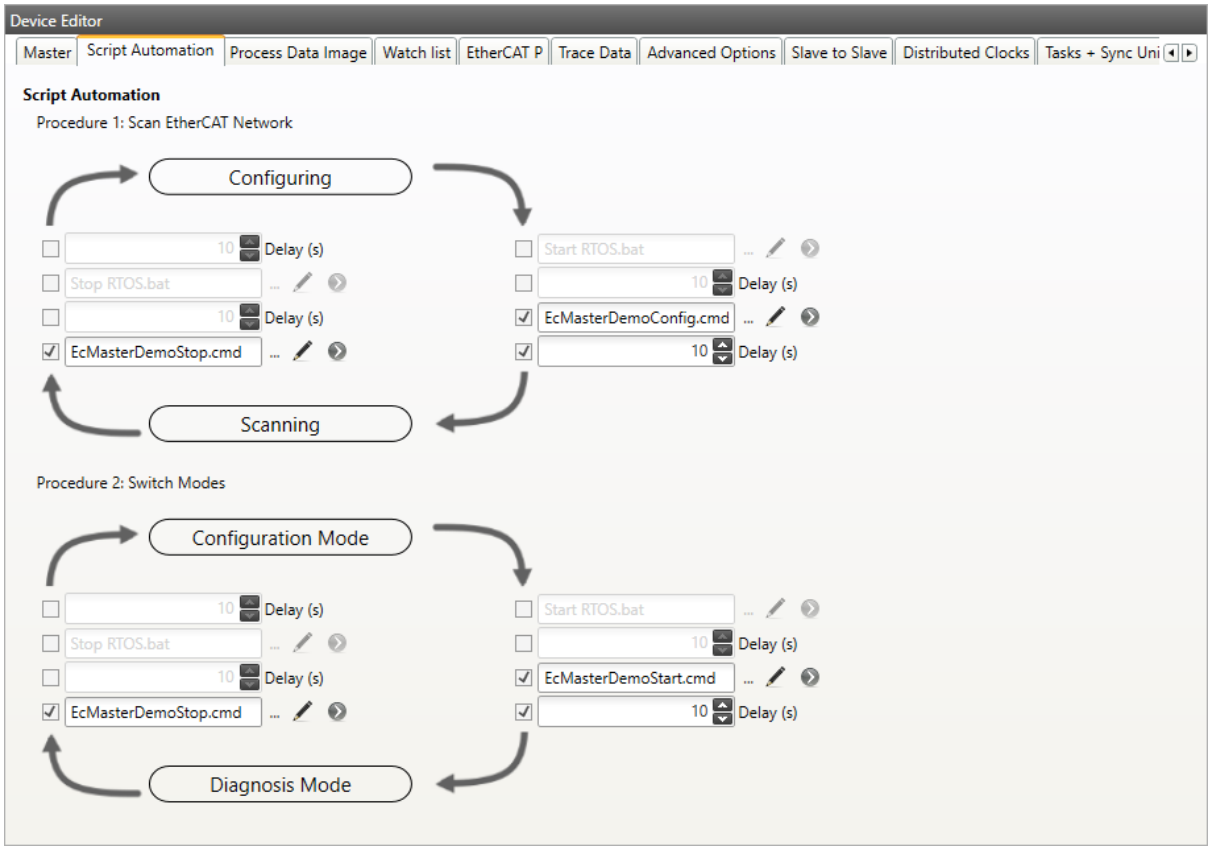


Fig. 1: When "Use local EcMasterDemoMotion" is selected, the ENI and the config files are automatically exported to the EC-Engineer Motion folder in ProgramData when switching to diagnosis mode. With the Motion EMI, the script automation is activated. Per default when switching to diagnosis mode the EcMasterDemoMotion.exe is started and EC-Engineer connects with RAS. So it is very simple to start with Motion directly in EC-Engineer.

5.2.12 Scripts

In this tab, the user can select scripts that are executed in the different modes. The tab is only visible when the script mode is activated in the `EMI` file:



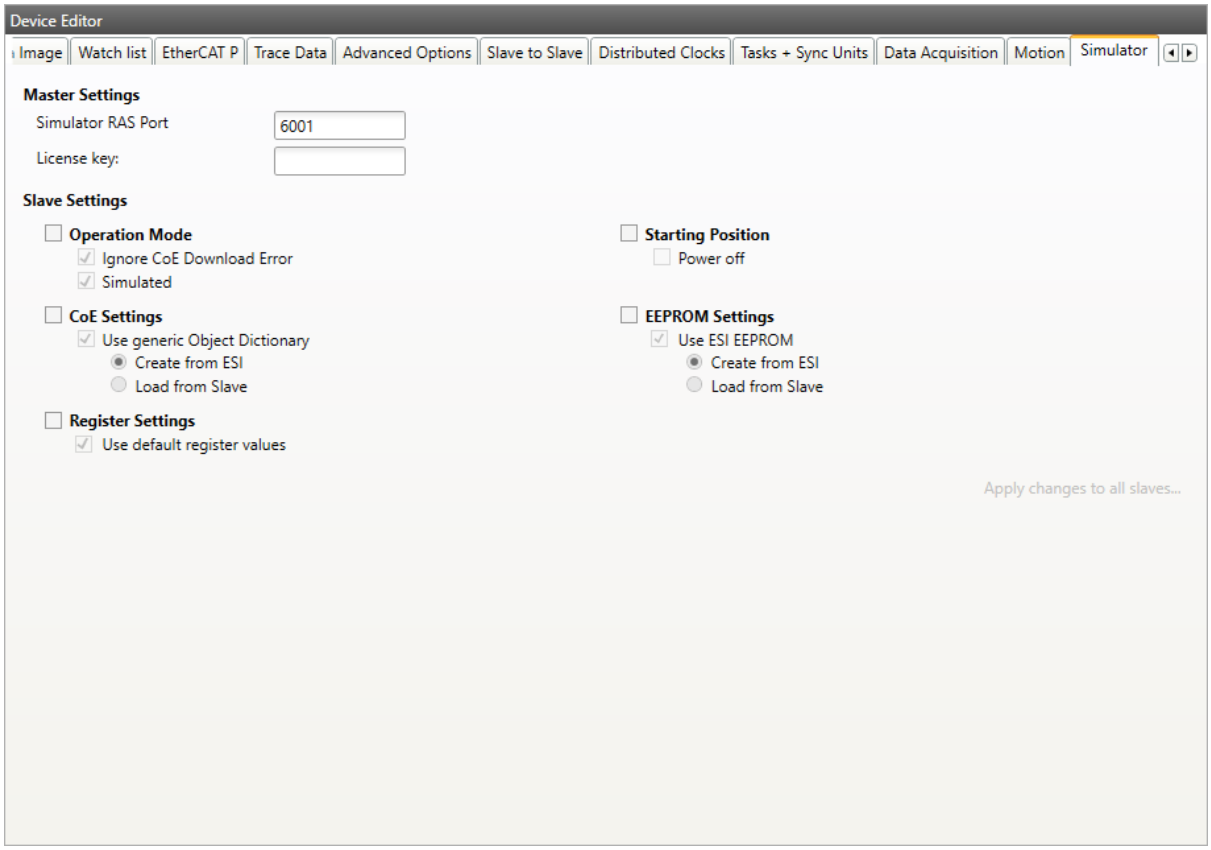
The first procedure is for scanning the network. There is the possibility of starting two scripts before the scan, and two scripts after the scan. It is also possible to set a delay between them. A usecase for this could be to start e.g. LxWin –> then start the master on the real-time system –> scan the network –> stop the master –> stop LxWin.

The second procedure is for switching the modes (configuration and diagnosis). The user can e.g. start LxWin –> start the master –> switch to diagonis. On switching back the user can stop the master and stop LxWin. Or it is also possible not to stop the LxWin for example.

The *Configuration* and *Configuration Mode* circles are the starting points. Then the scripts are called clockwise following the arrows and the red numbers.

5.2.13 Simulator Settings

In this tab, the user can change the settings for the simulator. The tab is only visible when the user uses EC-Simulator `EMI` or when the Master Unit has an linked simulator unit. The linked simulator unit can be created through the context menu of the master unit, or when the simulator link layer is selected:



Simulator RAS Port:
The port which is opend through the simulator link layer

License key:
The license key for the simulator

Slave Settings:

Operation Mode:
Ignore Download Error

CoE Settings:
Select which CoE should be used in `EXI`

Register Settings:
Select if register should be in `EXI`

Starting Position:
Select if slave shall be powered on or off on start

EEPROM Settings:
Select which EEPROM values should be used

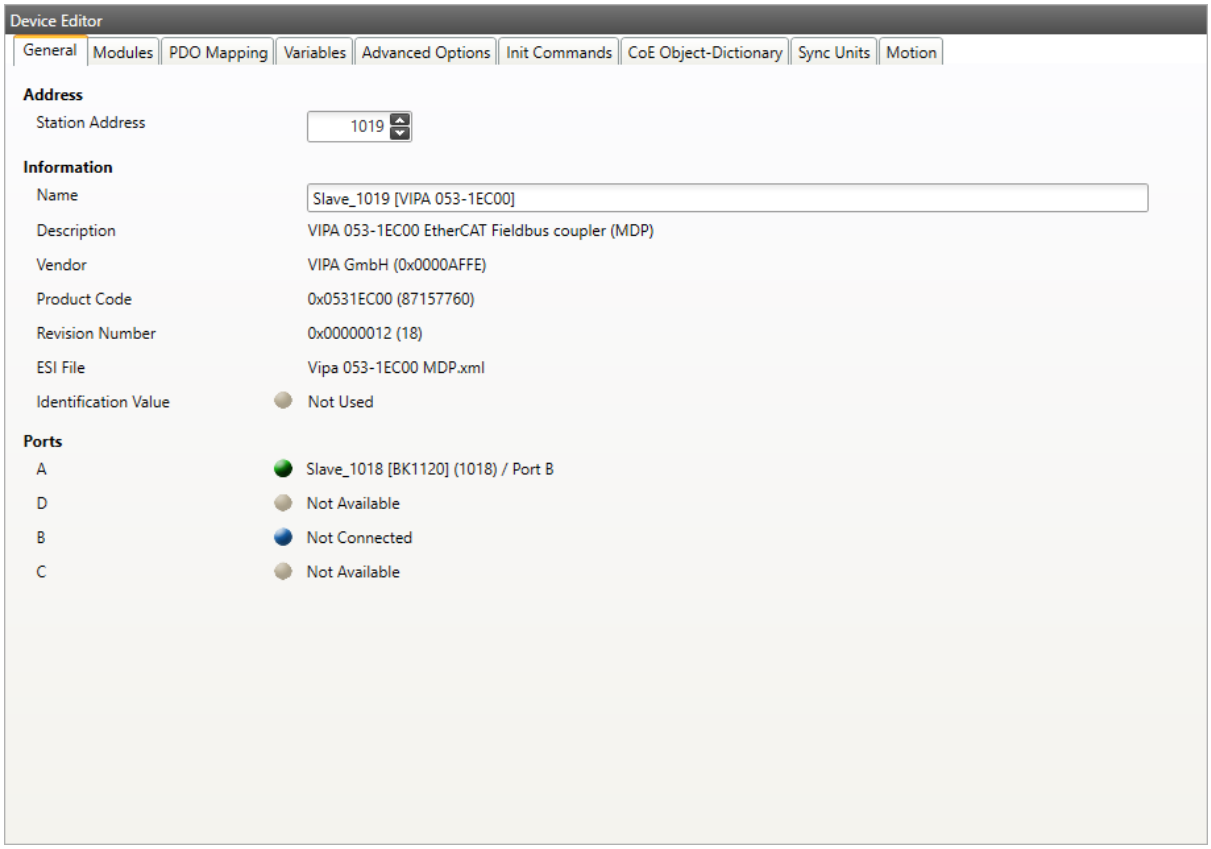
The `EXI` file can be exported through the *Export EXI* button right from the *Export ENI* Button or through the context menu.

5.3 Slave Settings

This section includes slave related settings. The most of all settings will affect the “Slave” section of the `ENI`.

5.3.1 General

In this tab, the user can change general slave settings like station address or the name of the slave. He has also the possibility to change his predecessor device:



Address

Station Address:
Station address of the slave. By default, the first station address is 1001.

Information

Name:
Name of the slave. By default the following format is used “Slave_N [TYPE]”

Description:
Description of the slave (Read from `ESI` file)

Vendor:
Name of the vendor the slave

Product Code:
Product Code of the slave

Revision Number:
Revision Number of the slave

ESI File:
Name of the `ESI `file where the description of the slave is stored. :file:`ESI` files can be managed by using the *ESI-Manager*

Identification Value:
Identification Value of the slave

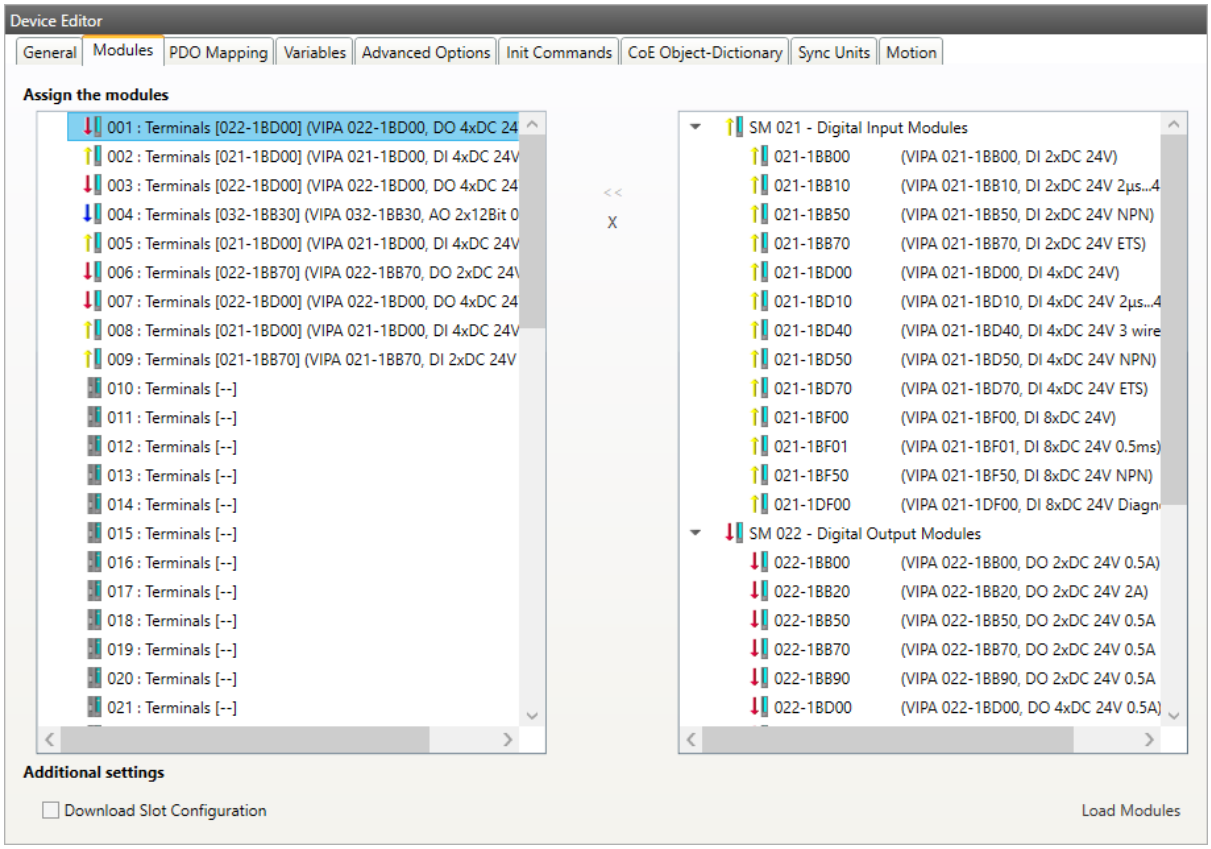
Ports

Connected Devices:
List of connected devices

Predecessor Device:
Name of the predecessor device. If topology should be changed, please use the *Edit Topology* dialog

5.3.2 Modules

In this tab, the user has can assign modules into the specific slots. He can also change the setting for downloading the slot configuration to the slave:



Connect module to slot (“<<”)
Used for connecting the selected module (from the right list) to the selected slot (from the left list). If the slot is already connected, the module will be inserted and the subsequent modules will be moved (if this is supported from the slave)

Disconnect module from slot (“X”)
Used for disconnecting the selected slot (left list)

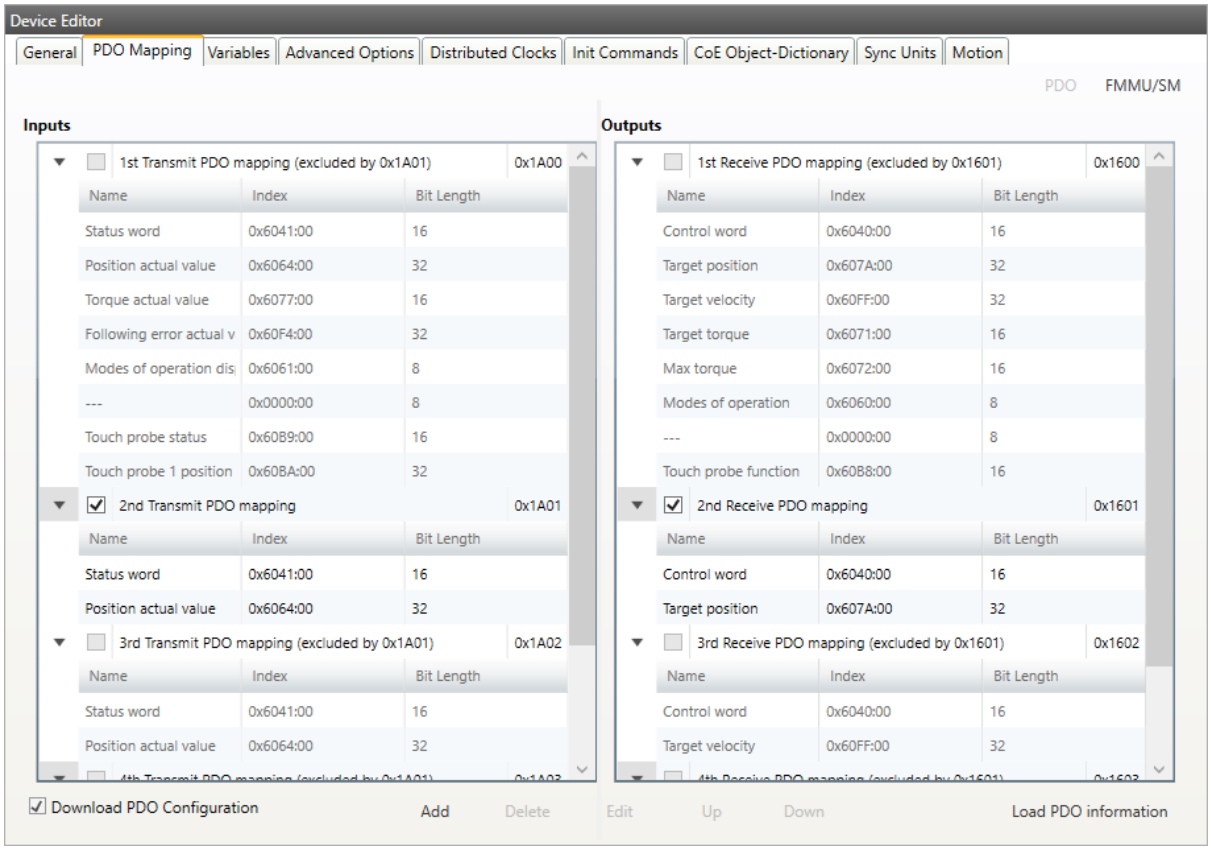
Note: The modules can be also connected and disconnected by using the context menu in the project explorer.

5.3.3 PDO Mapping

This tab consists of 2 views:

PDO

In this tab, the user can see the current PDO mappings. For some Slave types the user can activate or deactivate some PDO configurations:



Lists of inputs or outputs

Checkbox:
Signals if PDO will be used for the current configuration or not.

Buttons (Expert mode only!)

Add/Delete/Edit:
Used for changing the lists, if it is allowed by the `ESI`. First the list which should be changed must be selected.

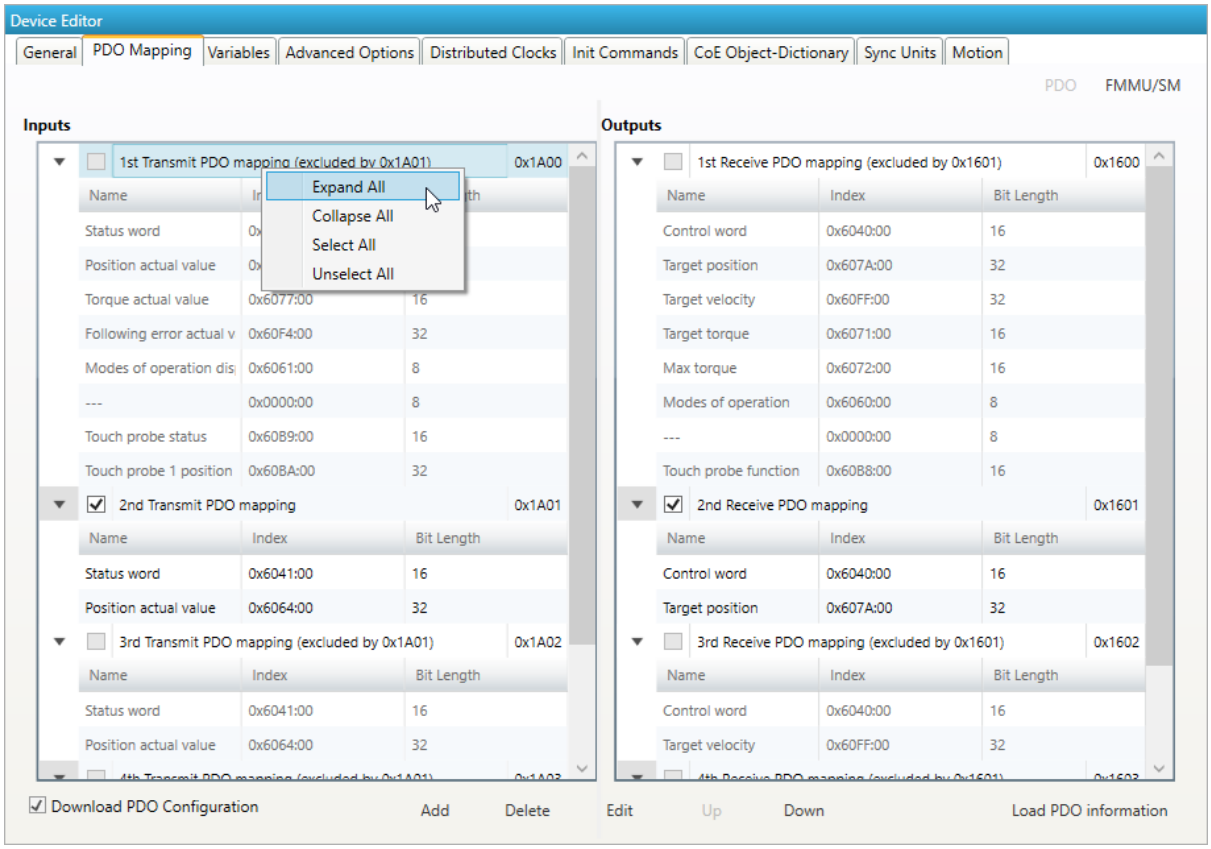
Up/Down:
Moving the selected PDO in the selected list up or down

Load PDO information:

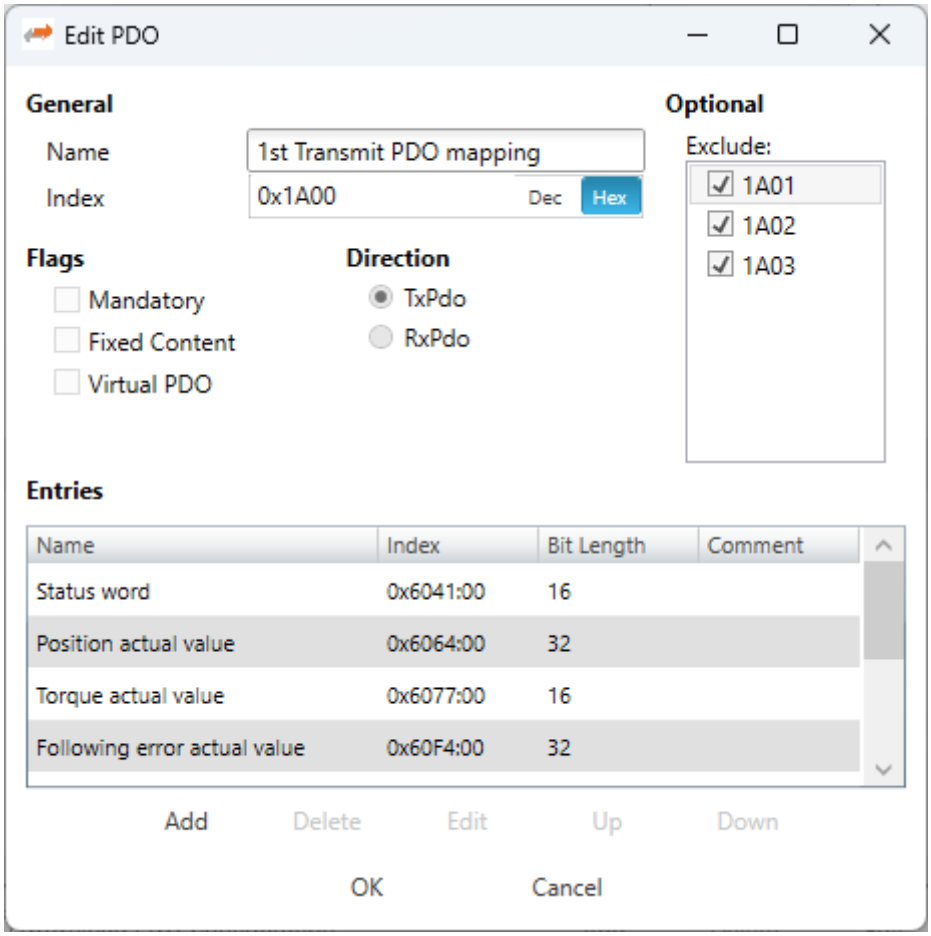
If EC-Engineer is connected to the control system, the user can load the PDO information directly from the slave

Context Menu

Both lists provide a context menu:



If user wants to add or edit a PDO, he will see the following dialog:



General:

Name:
Name of the PDO

Index:
Index of the PDO (can be entered in hexadecimal or decimal)

Flags:

Mandatory:
PDO cannot be deleted

Fixed Content:
Content of PDO cannot be changed

Virtual PDO:
PDO has no entries

Direction:

TxPdo:
Input PDO

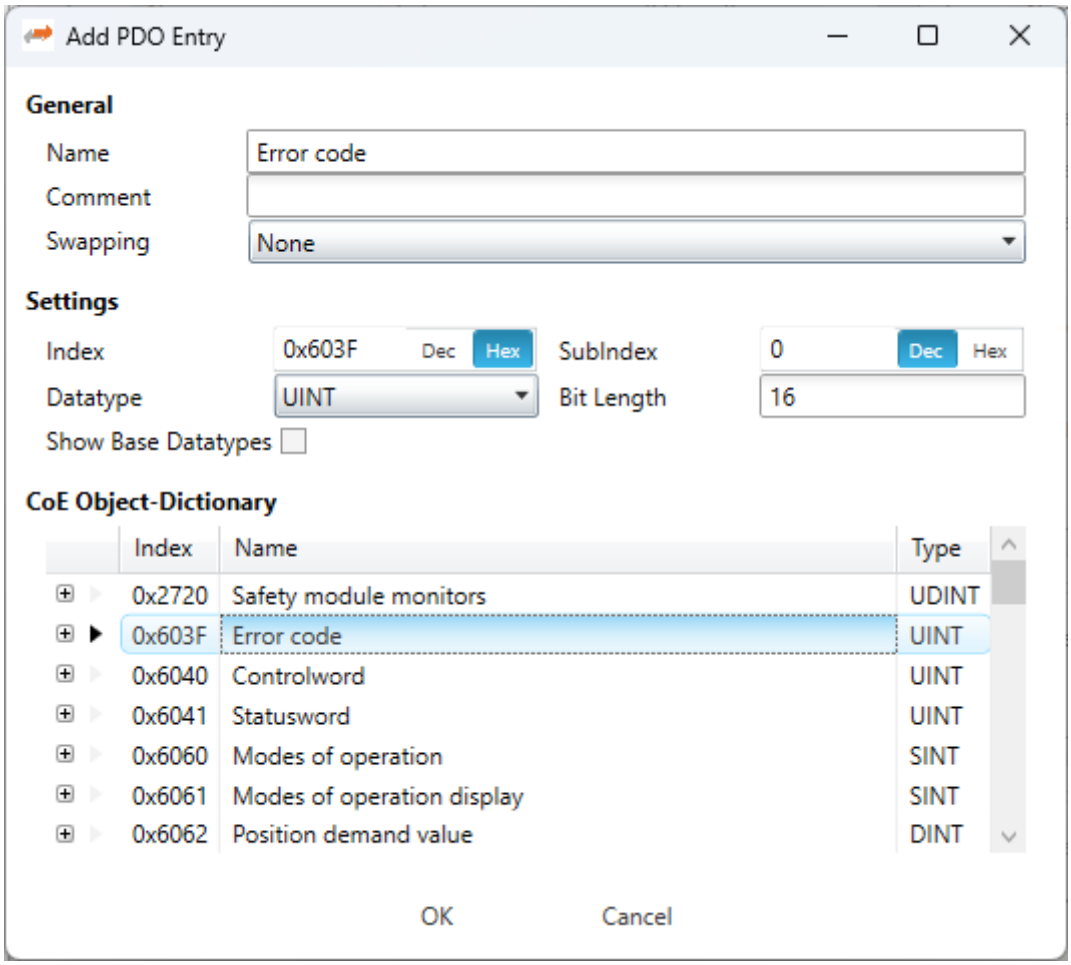
RxPdo:
Output PDO

Sync Manager:
Selected the Sync Manager, which should be used (only visible if more than one can be used)

Exclude:
Select the PDOs which cannot be activated if this PDO is activated

Entries:
List of configured PDO entries

If user wants to add a PDO entry, he will see the following dialog:



General

Name:
Name of the PDO entry

Comment:
Commet of the PDO entry

Swapping:
Swapping mode of the PDO entry

Settings

Index:
Index of the PDO entry (can be entered in hexadecimal or decimal)

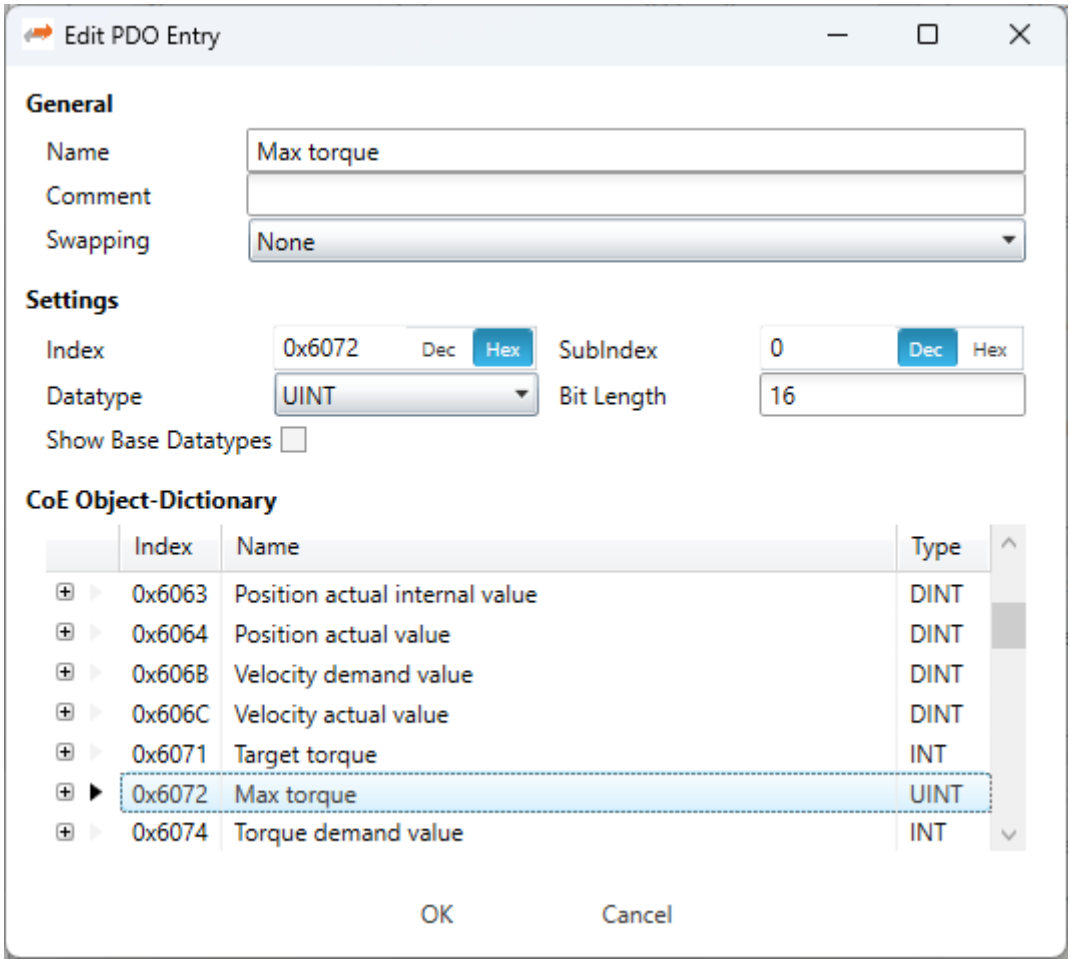
Subindex:
Subindex of the PDO entry (hexadecimal)

Datatype:
List of available datatypes

Bit Length:
Length of the PDO entry in bits

CoE Object-Dictionary (loaded only if Object-Dictionary is supported by slave)

If user wants to edit a PDO entry without a CoeOD, he will see the following dialog:



General

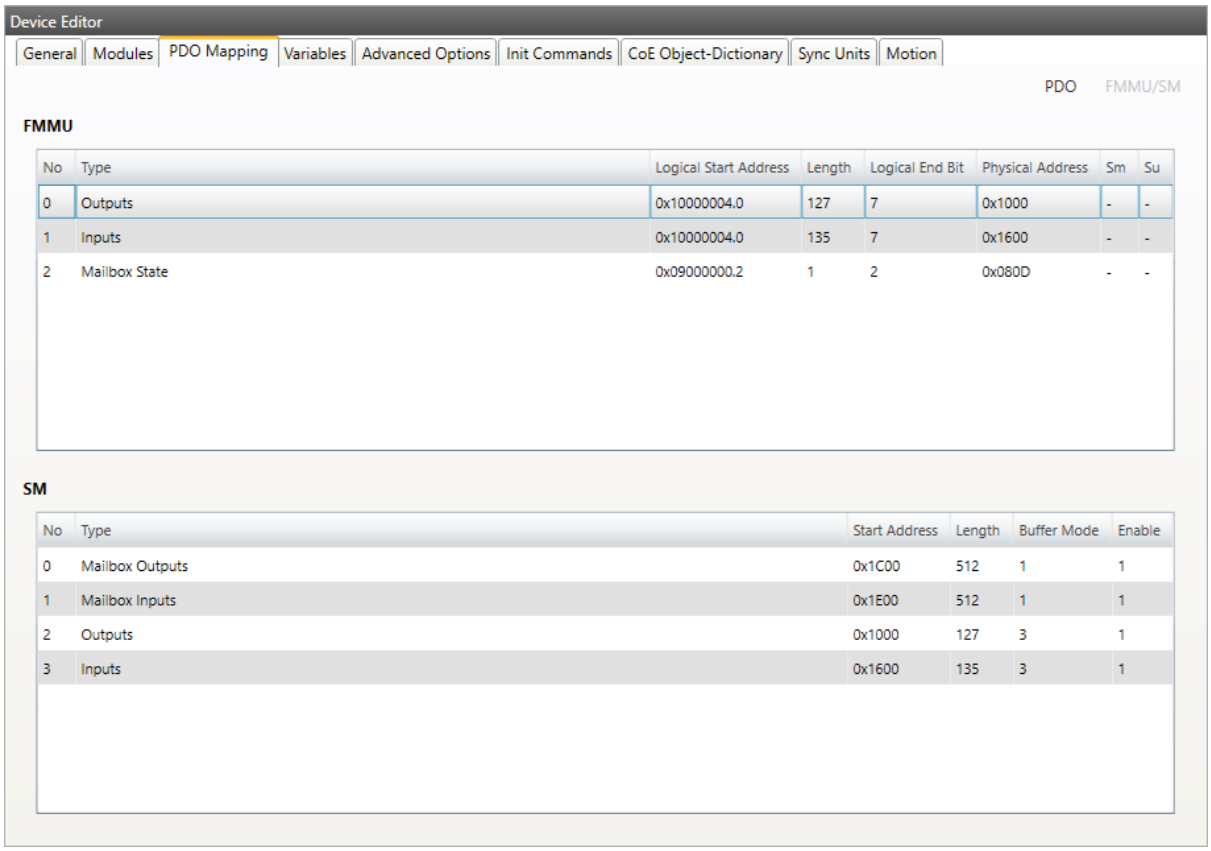
Name:
Name of the PDO entry

Comment:
Commet of the PDO entry

Swapping:
Swapping mode of the PDO entry

FMMU/SM

In this tab, the user can see some information about FMMU and SyncManager:

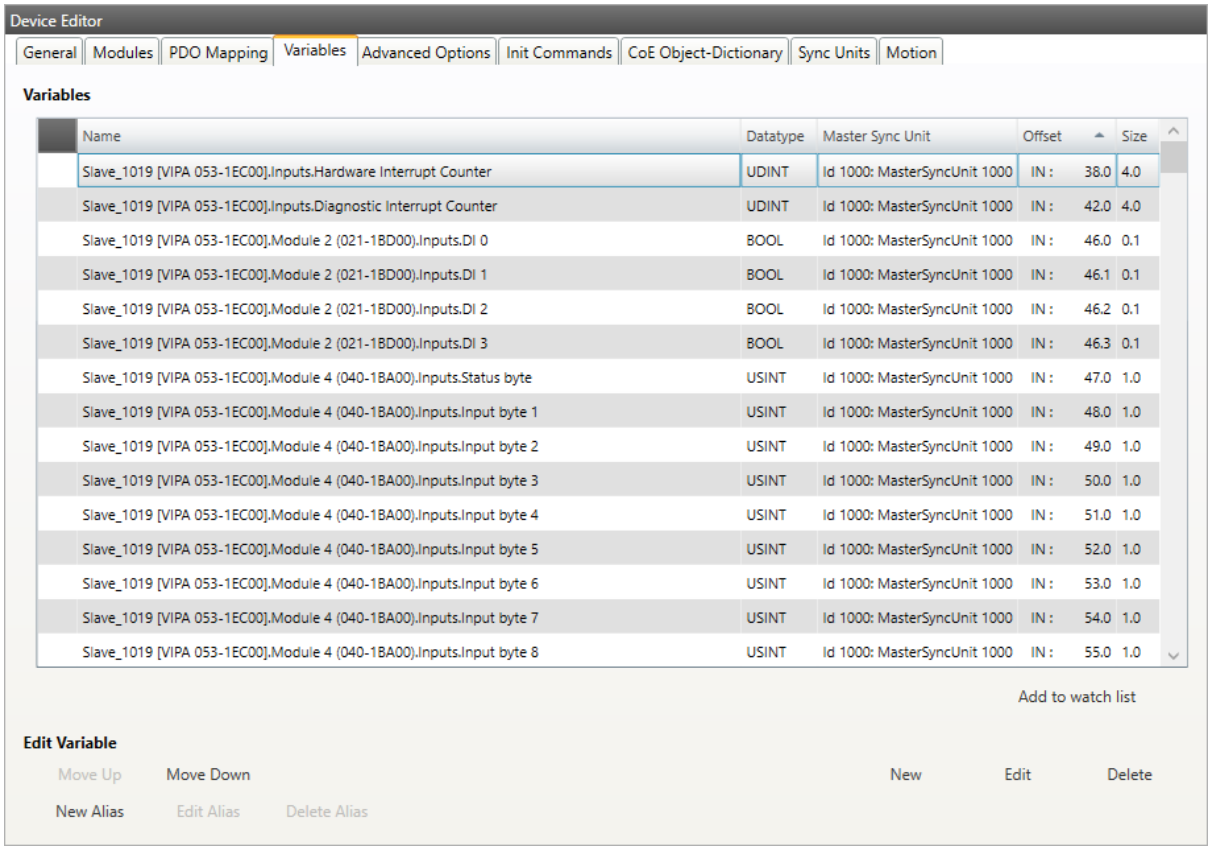


Lists of FMMUs
: Available FMMUs comes from the `ESI` file.

Lists of SyncManagers
: Available SyncManagers comes from the `ESI` file.

5.3.4 Variables

In this tab, the user can see the variables of the slave and if it is allowed he can also add/edit/delete/move variables. Also "Add to watchlist" is possible:



Lists of Variables

Variables comes from the `ESI` file or will be generated from the configurator.

Buttons

New/Edit/Delete:

Used for changing the list.

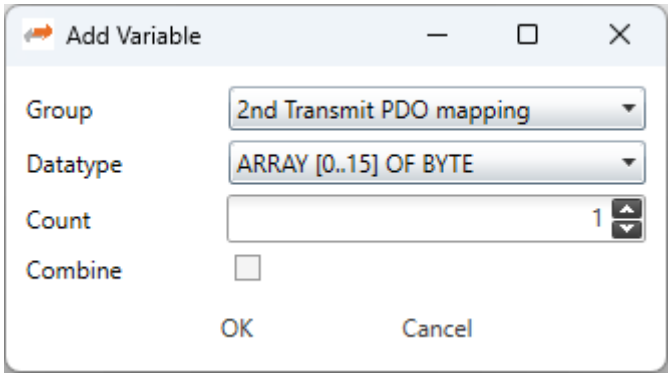
Up/Down:

Moving the selected variable up or down

New/Edit/Delete Alias:

Used for changing alias variables

If user wants to add a variable, he will see the following dialog:



Options

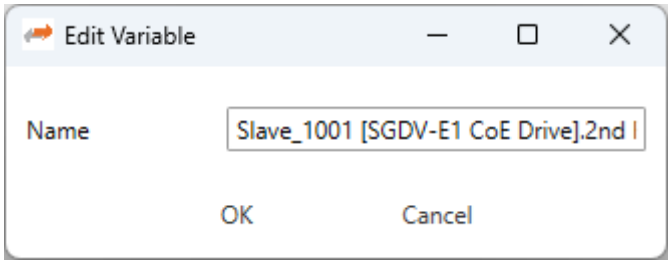
Group:
List of possible groups, where the new variable should be added

Datatype:
List of possible datatypes of the new variable

Count:
Number of variables, which should be added

Combie:
Combines all variables to an array

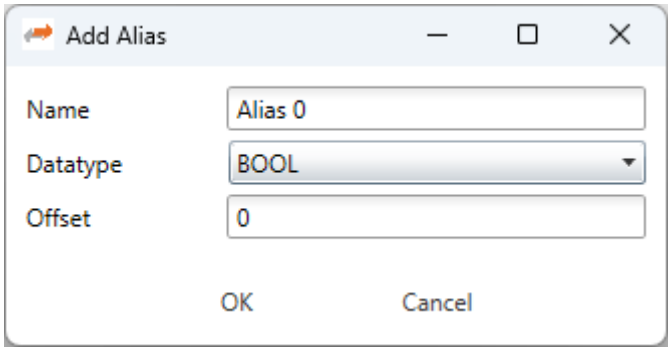
If user wants to edit a variable, he will see the following dialog:



Options

Name:
Name of the variable, which can be changed from the user

If user wants split a variable into multiple parts to build e.g. a structure, he can add an alias to a vailable. In that case he will see the following dialog:



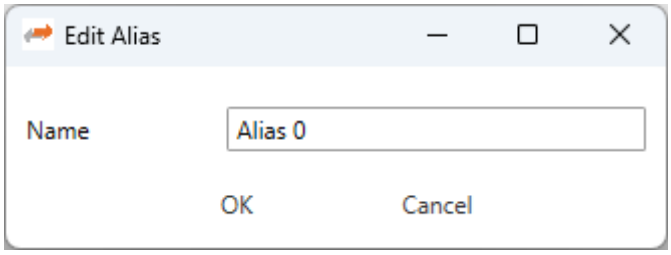
Options

Name:
Name of the alias

Datatype:
List of possible datatypes of the new alias

Offset:
Bit offset of the alias

If user wants to edit a alias, he will see the following dialog:

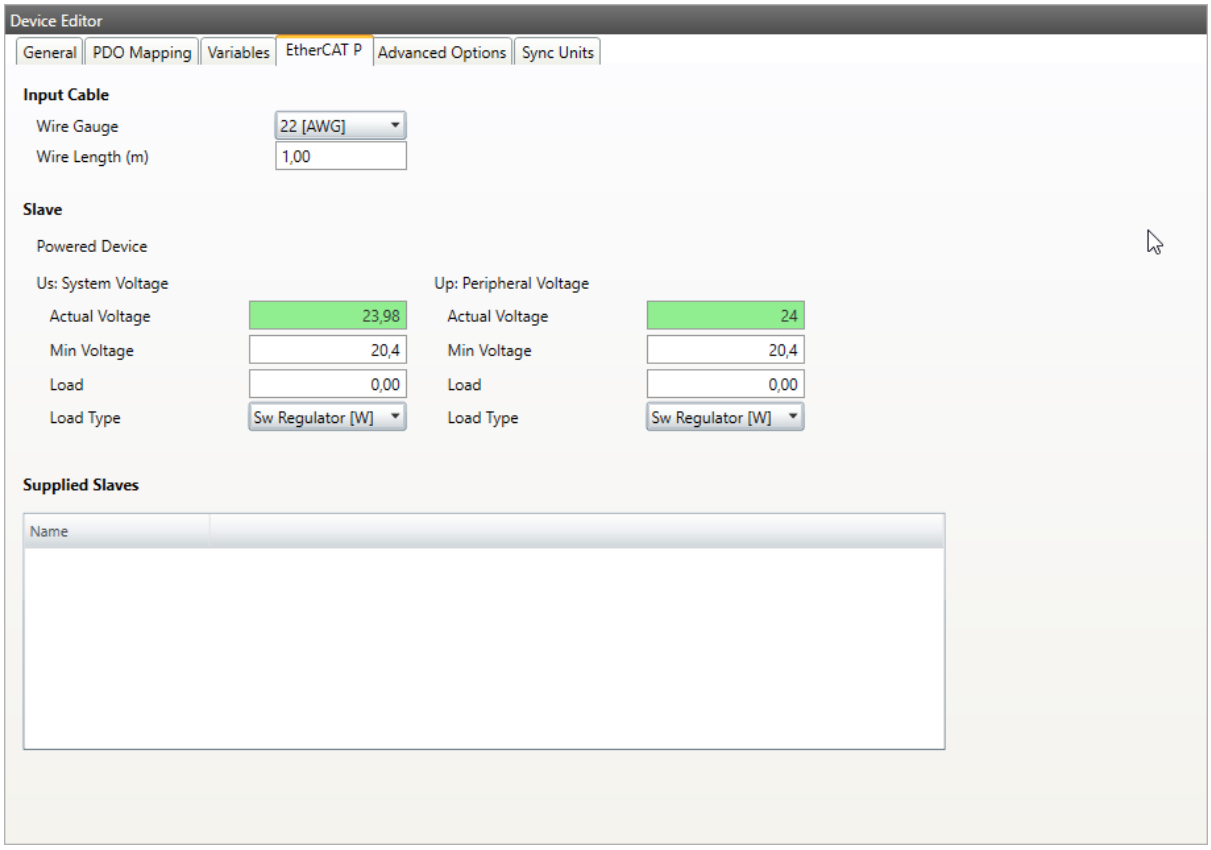


Options

Name:
Name of the alias, which can be changed from the user

5.3.5 EtherCAT P

In this tab, the user can configure the selected EtherCAT P slave. The Tab is only visible when the selected slave is an EtherCAT P slave:



Wire Gauge:
The wire type of the input cable

Wire Length:
The wire length of the input cable

Us:

System Voltage

The system voltage shall supply all internal and externally connected types of sensors and inputs. All bus system relevant parts of the device shall completely be powered by the Us.

Actual Voltage:
The actual voltage at the slave

Min Voltage:
The min Voltage the slave needs. Value is from `ESI` but also editable.

Load:
The Load which is externally needed.

Load Type:
The Load Type of the externally needed load

Up:

Peripheral Voltage:

Up is used to supply internal and externally connected actuators and outputs.

Actual Voltage:
The actual voltage for the outputs

Min Voltage:
The min Voltage the slave needs. Value is from `ESI` but also editable.

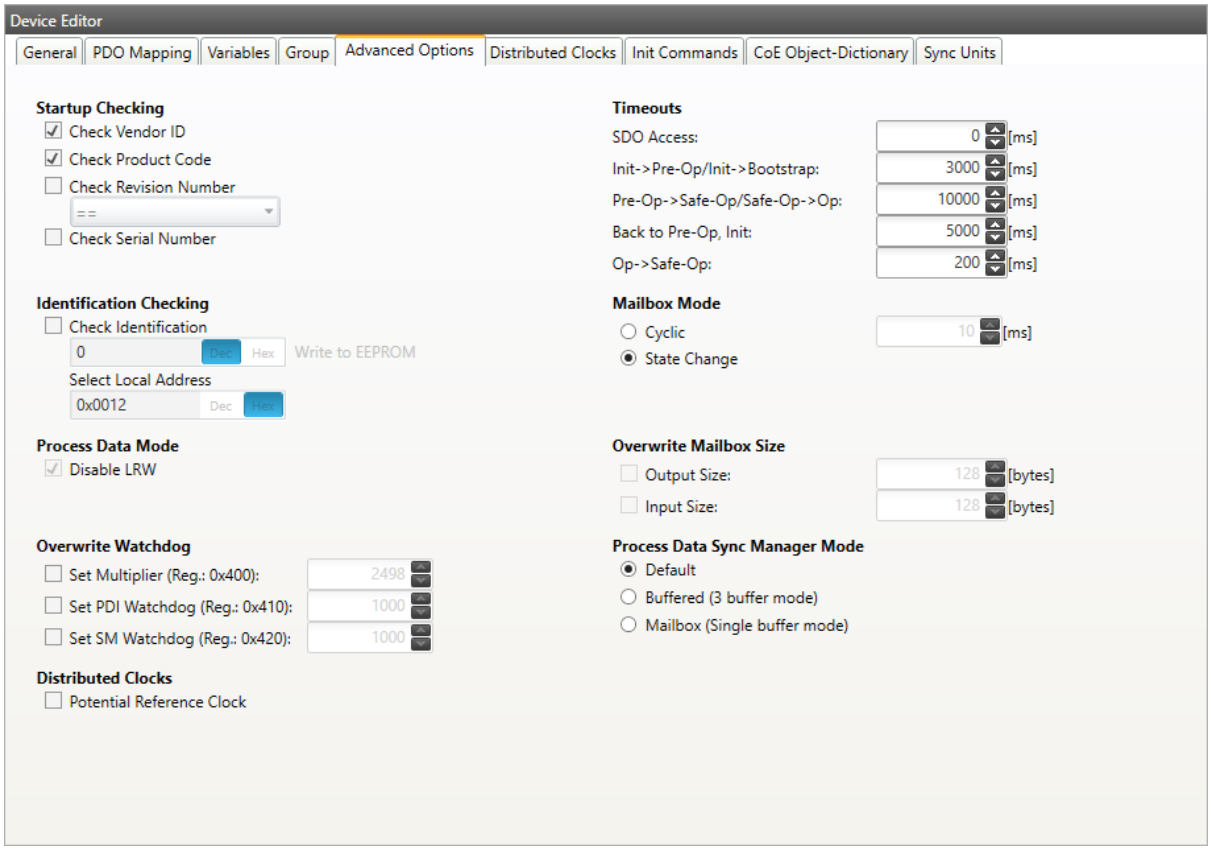
Load:
The Load which is externally needed.

Load Type:
The Load Type of the externally needed load

Load Types:
Sw Regulator in Watt LDO in Ampere Resistor in Ohm

5.3.6 Advanced Slave Options (Expert)

In this tab, the user can change advanced options of the slave:



Startup Checking

Master will check the Vendor ID, Product code, Revision number if the state machine changes from INIT to PREOP of the slave. Revision number can be verified by six ways:

- “==” –> HI word is equal, LO word is equal
- “>=” –> HI word is equal or greater, LO word is equal or greater
- “LW ==” –> HI word is equal
- “LW ==, HW >=” –> LO word is equal, HI word is equal or greater
- “HW ==” –> LO word is equal
- “HW ==, LW >=” –> HI word is equal, LO word is equal or greater

Identification Checking

If ‘Check Identification is selected, the Identification Value of the slave is checked. In the ‘Select Local Address’ Box is the register of the Identification Value.

Process Data Mode

Disable LRW: Determines whether LRD/LWR command or the LRW command is used for accessing process data. Cable redundancy needs LRD/LWR, Slave-to-slave-copy needs LRW.

Watchdog

Set Multiplier:
Writes the configured value to the corresponding slave register: 0x0400

Set PDI Watchdog:
Writes the configured value to the corresponding slave register: 0x0410 (0 = Watchdog is disabled)

Set SM Watchdog:
Writes the configured value to the corresponding slave register: 0x0420 (0 = Watchdog is disabled)

Distributed Clocks

Potential Reference Clock: Set to use slave as a potential reference clock

- This might be useful, if e.g. a hot connect slave, which is used as reference clock, was disconnected from the network
- In that case the EC-Master searches for the first potential reference clock
- If no potential reference clock slave was found, the first DC slave will be used

Timeouts

SDO Access:
Internal master timeout which is used for accessing the SDO (0 = Use internal default value of the master)

Init –> PreOp:
Internal master timeout with is used for changing slave state

Pre-Op –> Save-Op or Safe-Op –>Op:
Internal master timeout with is used for changing slave state

Back to Pre-Op, Init:
Internal master timeout with is used for changing slave state

Op –> Safe-Op:
Internal master timeout with is used for changing slave state

Mailbox Mode

Cyclic:
Interval in milliseconds within the input mailbox will be read (polling mode)

State Change:
The input mailbox will be read only if the status bit is set

Overwrite Mailbox Size

Output Size:
Overwrites mailbox output size

Input Size:
Overwrites mailbox input size

Process Data Sync Manager Mode

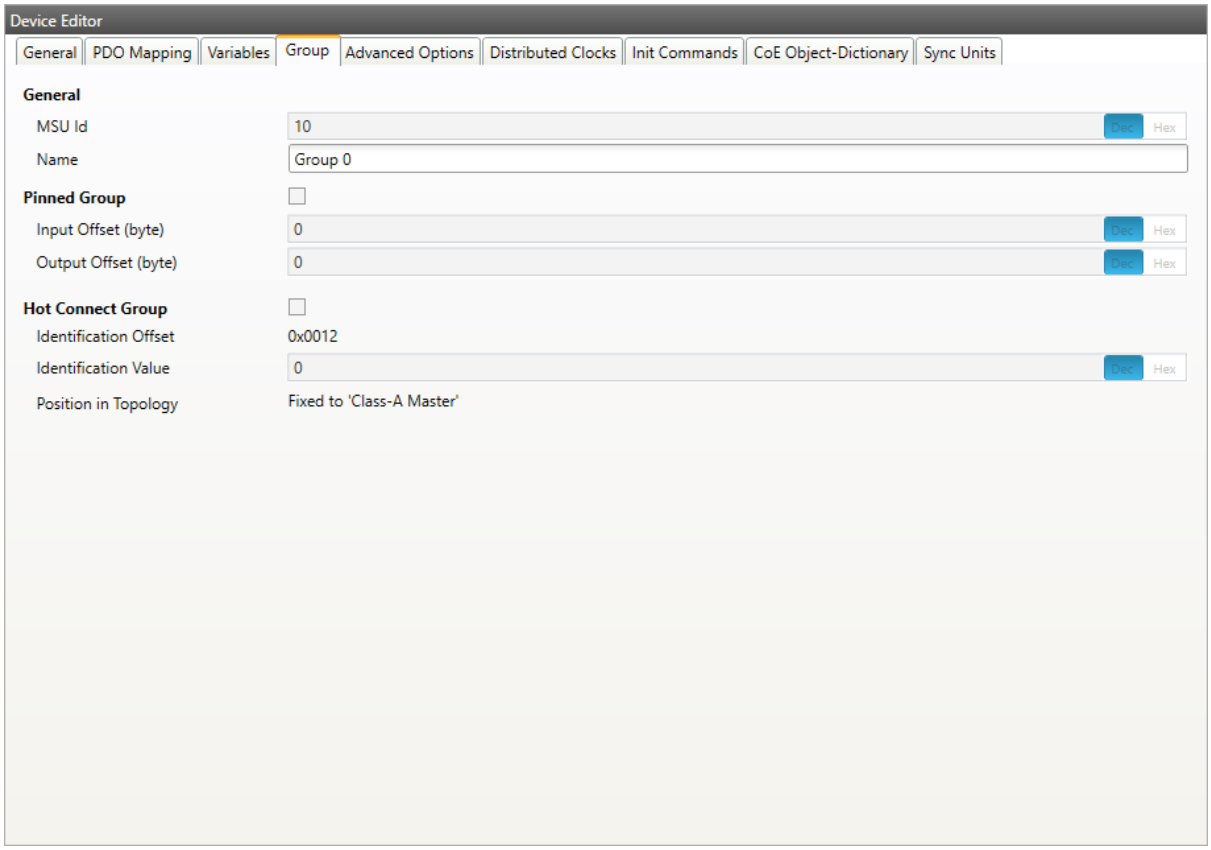
Default:
Uses sync manager mode from `ESI` file

Buffered (3 buffer mode):
Enables 3 buffer mode

Mailbox (Single buffer mode):
Enables single buffer mode

5.3.7 (Hot Connect) Groups

In this tab, the user can choose if this group has a fixed offset in the process data image or if this group is a hot connect group:



Note: Tab is only visible if slave is the first member of a group.

General

MSU Id:
Generated Master Sync Unit Id

Name:
Name of the group

Pinned Group

Input Offset:
Fixed input offset of the group in the process data image in bytes

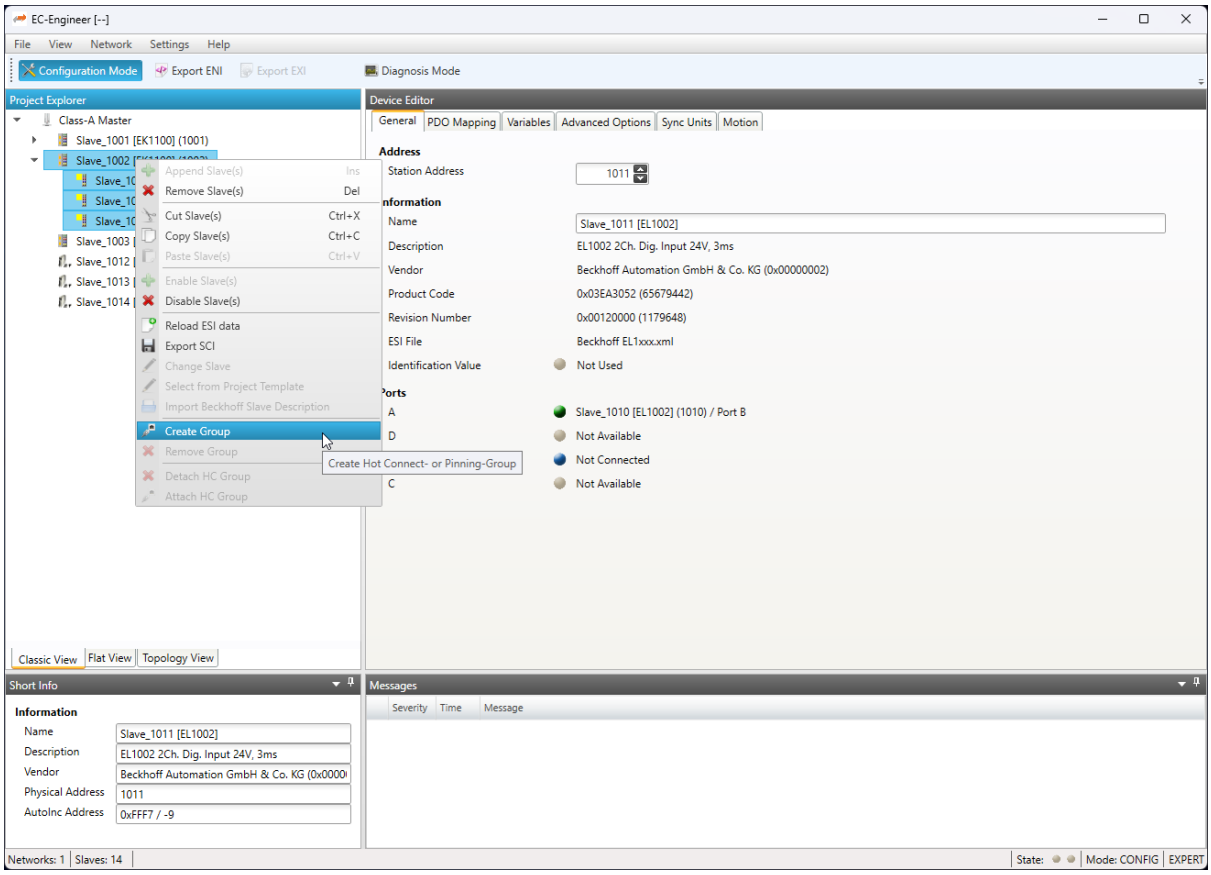
Output Offset:
Fixed output offset of the group in the process data image in bytes

Hot Connect Group

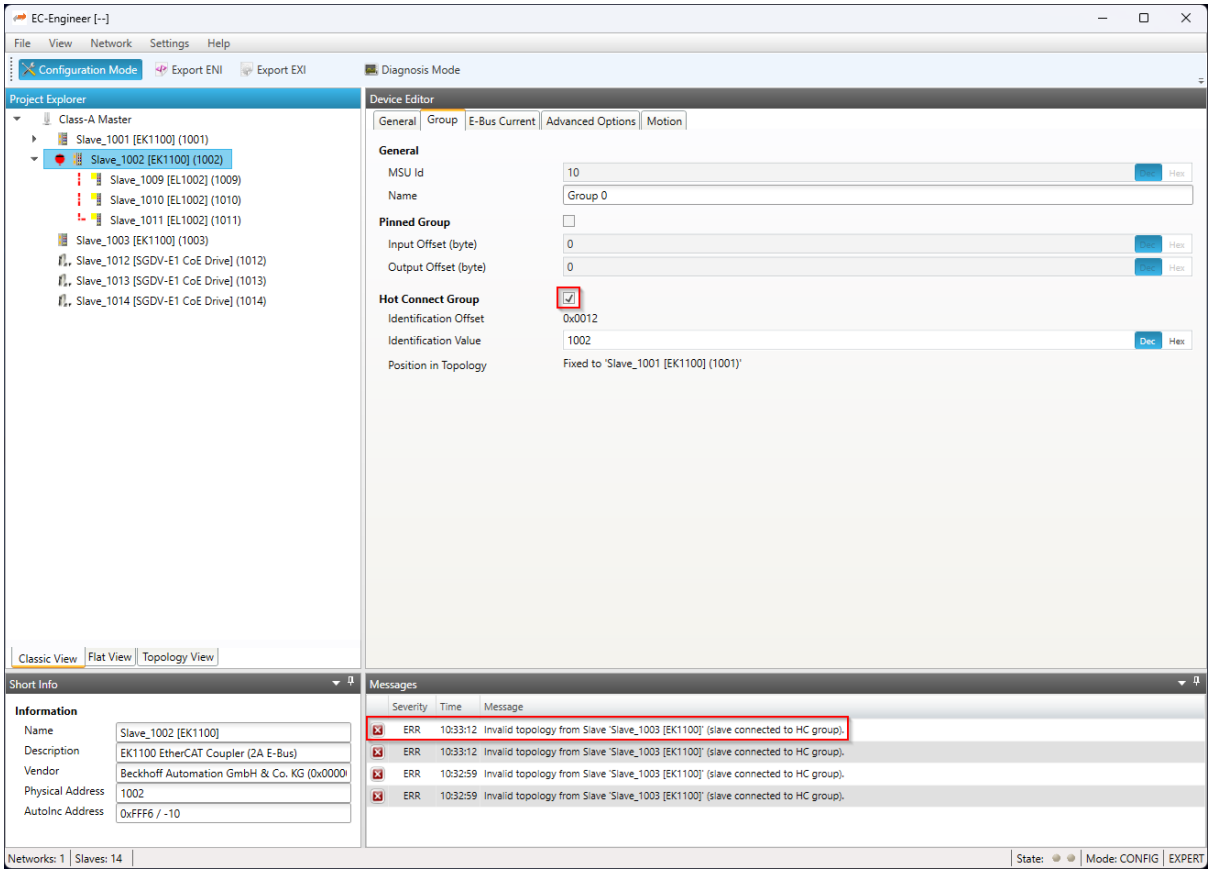
Identification Offset:
Register offset where the identification can be read from the slave

Identification Value:
Hardware identification value or configured station alias address can be used. For more information about the configured station alias address, see *EEPROM (Expert)*

A new group can be created by selecting all slaves (by using the `SHIFT` key or the `CTRL` key), open the context menu and select *Create Group* in the project explorer:

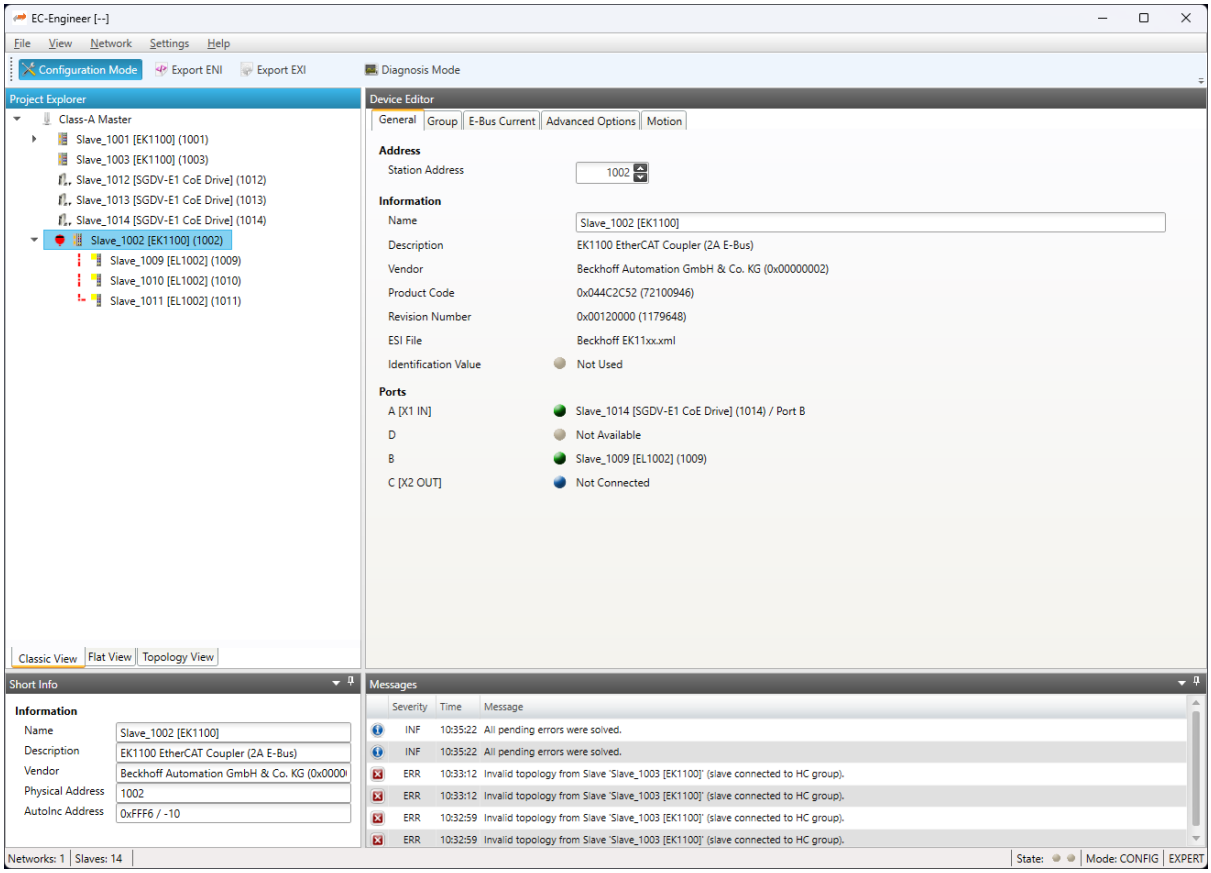


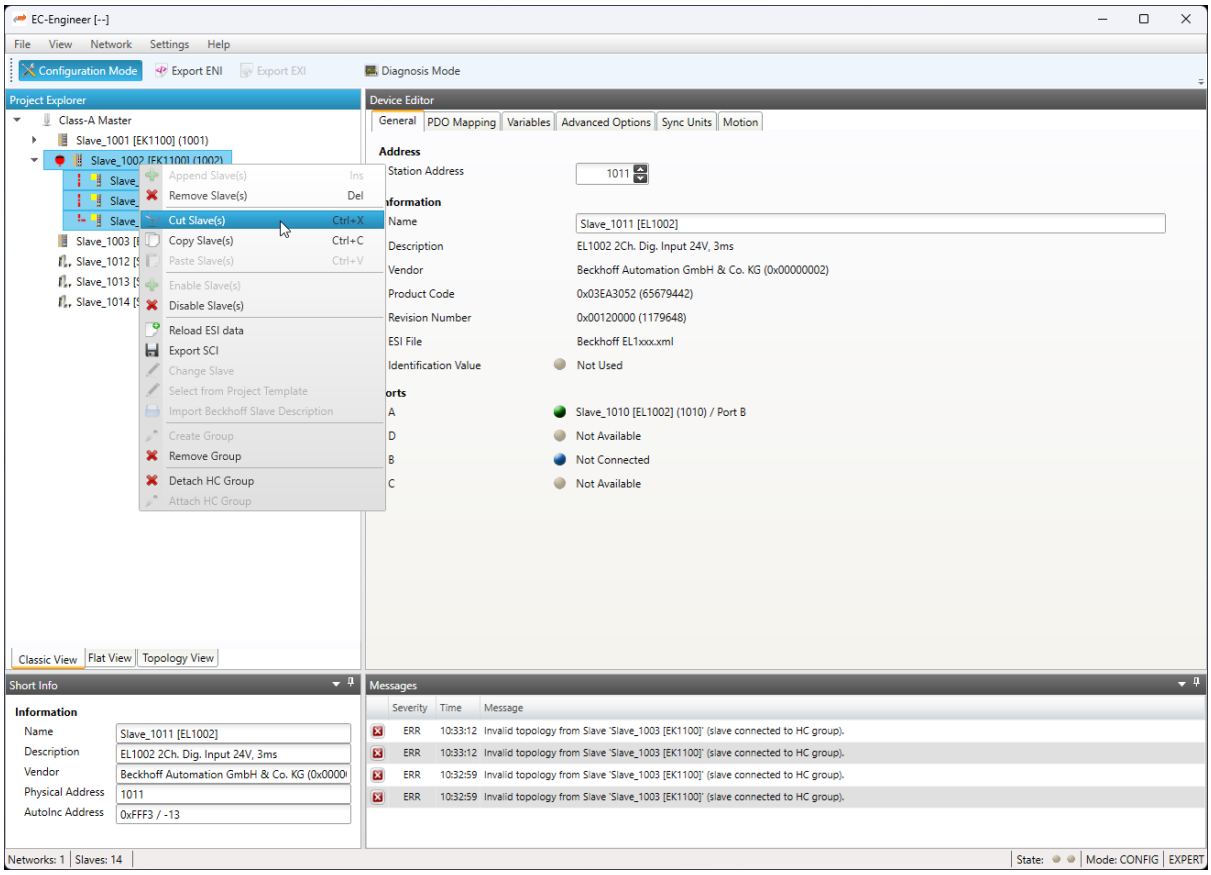
The new group can be modified by selecting the head slave of this group and open tag *Group*:



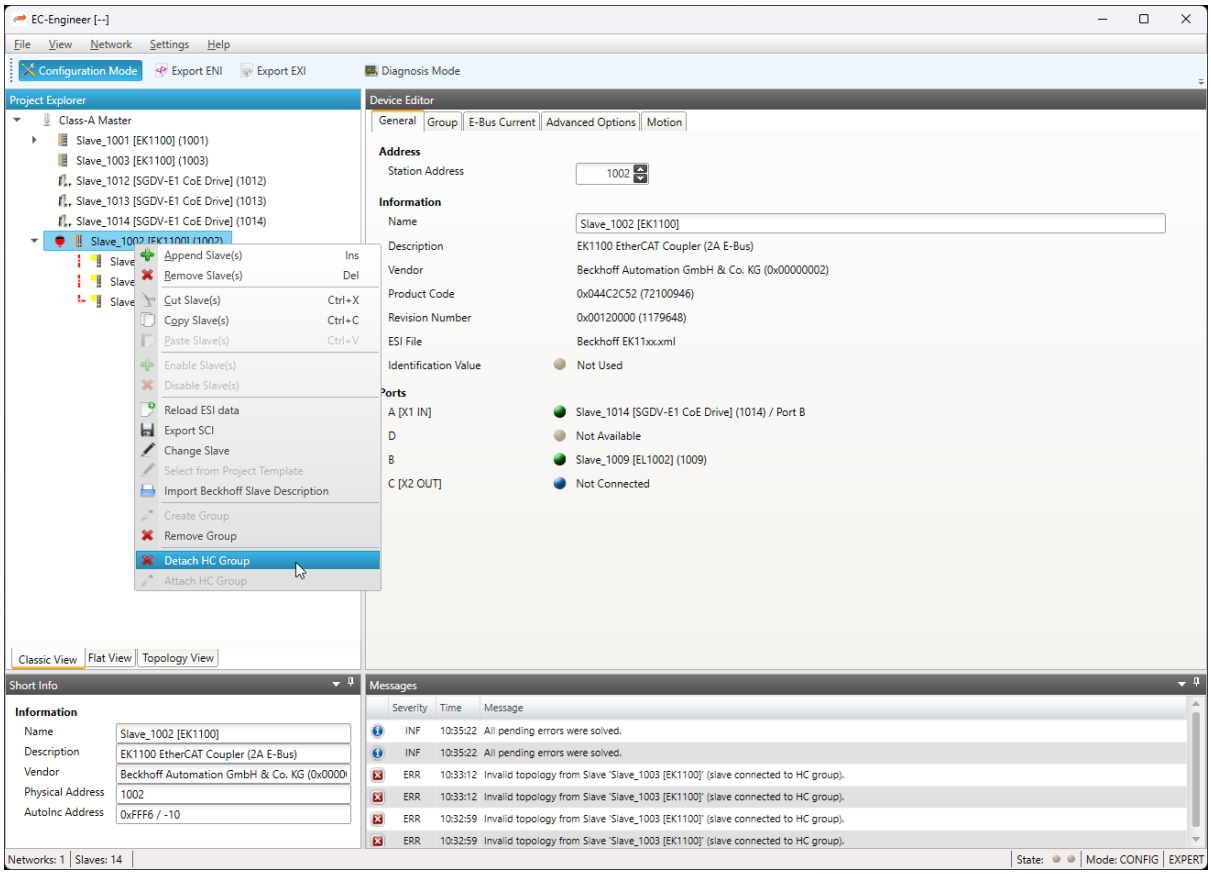
On this tab, the user can pin this group of slaves to a specific offset in the process image and / or build a hot connect group. If we do this, in that case this will generate an invalid topology error, because a normal slave is still connected to this hot connected, which is not allowed.

In that case we can use “cut & paste” to solve this issue by connecting this hot connect group to the end of the slaves:


EC-Engineer [--]
File View Network Settings Help
Configuration Mode
Export ENI
Export EXI
Diagnosis Mode
Project Explorer
Class-A Master
Slave_1001 [EK1100] (1001)
Slave_1003 [EK1100] (1003)
Slave_1012 [SGDV-E1 CoE Drive] (1012)
Slave_1013 [SGDV-E1 CoE Drive] (1013)
Slave_1014 [SGDV-E1 CoE Drive] (1014)
Slave_1002 [EK1100] (1002)
Slave_1009 [EL1002] (1009)
Slave_1010 [EL1002] (1010)
Slave_1011 [EL1002] (1011)
Device Editor
General
Group
E-Bus Current
Advanced Options
Motion
Address
Station Address
1002
Information
Name
Slave_1002 [EK1100]
Description
EK1100 EtherCAT Coupler (2A E-Bus)
Vendor
Beckhoff Automation GmbH & Co. KG (0x00000002)
Product Code
0x044C2C52 (72100946)
Revision Number
0x00120000 (1179648)
ESI File
Beckhoff EK11xx.xml
Identification Value
Not Used
Ports
A [X1 IN]
Slave_1014 [SGDV-E1 CoE Drive] (1014) / Port B
D
Not Available
B
Slave_1009 [EL1002] (1009)
C [X2 OUT]
Not Connected
Classic View
Flat View
Topology View
Short Info
Information
Name
Slave_1002 [EK1100]
Description
EK1100 EtherCAT Coupler (2A E-Bus)
Vendor
Beckhoff Automation GmbH & Co. KG (0x0000
Physical Address
1002
AutoInc Address
0xFFF6 / -10
Messages
Severity
Time
Message
INF 10:35:22 All pending errors were solved.
INF 10:35:22 All pending errors were solved.
ERR 10:33:12 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
ERR 10:33:12 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
ERR 10:32:59 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
ERR 10:32:59 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
Networks: 1
Slaves: 14
State:
Mode: CONFIG
EXPERT


EC-Engineer [--]
File View Network Settings Help
Configuration Mode
Export ENI
Export EXI
Diagnosis Mode
Project Explorer
Class-A Master
Slave_1001 [EK1100] (1001)
Slave_1002 [EK1100] (1002)
Slave_1003 [E
Slave_1012 [S
Slave_1013 [S
Slave_1014 [S
Append Slave(s) Ins
Remove Slave(s) Del
Cut Slave(s) Ctrl+X
Copy Slave(s) Ctrl+C
Paste Slave(s) Ctrl+V
Enable Slave(s)
Disable Slave(s)
Reload ESI data
Export SCI
Change Slave
Select from Project Template
Import Beckhoff Slave Description
Create Group
Remove Group
Detach HC Group
Attach HC Group
Device Editor
General
PDO Mapping
Variables
Advanced Options
Sync Units
Motion
Address
Station Address
1011
Information
Name
Slave_1011 [EL1002]
Description
EL1002 2Ch. Dig. Input 24V, 3ms
Vendor
Beckhoff Automation GmbH & Co. KG (0x00000002)
Product Code
0x03EA3052 (65679442)
Revision Number
0x00120000 (1179648)
ESI File
Beckhoff EL1xxx.xml
Identification Value
Not Used
Ports
A
Slave_1010 [EL1002] (1010) / Port B
D
Not Available
B
Not Connected
C
Not Available
Classic View
Flat View
Topology View
Short Info
Information
Name
Slave_1011 [EL1002]
Description
EL1002 2Ch. Dig. Input 24V, 3ms
Vendor
Beckhoff Automation GmbH & Co. KG (0x0000
Physical Address
1011
AutoInc Address
0xFFF3 / -13
Messages
Severity
Time
Message
ERR 10:33:12 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
ERR 10:33:12 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
ERR 10:32:59 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
ERR 10:32:59 Invalid topology from Slave 'Slave_1003 [EK1100]' (slave connected to HC group).
Networks: 1
Slaves: 14
State:
Mode: CONFIG
EXPERT

Now, we have a hot connect group which is connectable only to slave 1011. If we want to connect this group to any slave on the network, we have to detach the group:



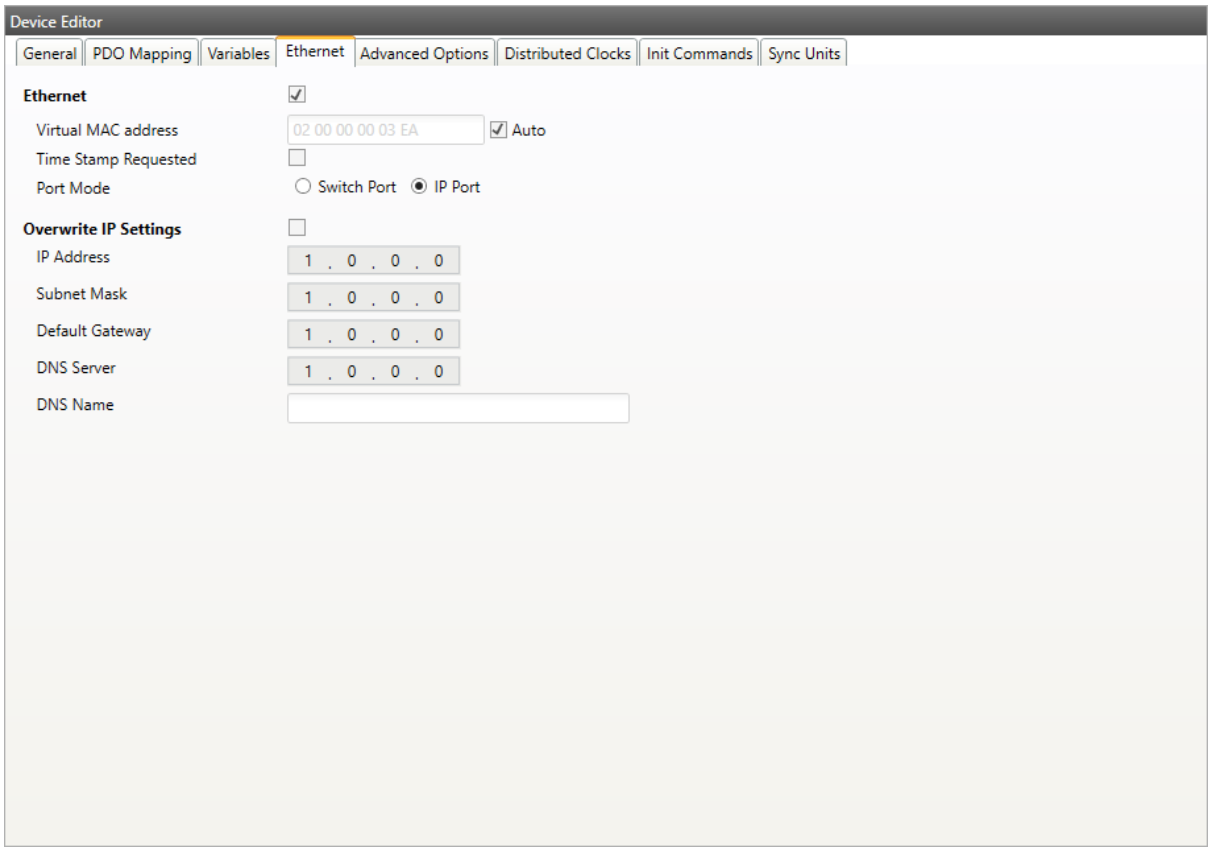
A group can be deleted by selecting the head slave of this group, open the context menu and select “Remove Group” in the project explorer (only attached HC groups can be deleted).

Possible group related error messages:

- Detached group can not be attached to the old position in the tree (e.g. previous slaves was deleted or disabled) the head slave of the group will be reported as “not connected”. In that case the user can connect the head slave by using “cut” and “paste”.
- Invalid topology from slave (fixed HC group on master) was displayed: this means that the first HC group which is connected to the master should be detached, because this is not valid in the `ENI` file
- Invalid topology from slave (slave connected to HC group) was displayed: this means that a normal slave is connected to a hot connect group and should be also moved also into a hot connect group or moved to another position in the tree

5.3.8 Ethernet (EoE)

In this tab, the user can activate EoE support and change the settings:



Ethernet (activates EoE support):

Virtual MAC address:
Virtual MAC address. If “Auto” is checked, the Virtual MAC address will be generated from the Station Address, e.g. Station Address is “1010” (= 0x03F2), will generate the Virtual MAC address: “01 00 00 00 03 F2”

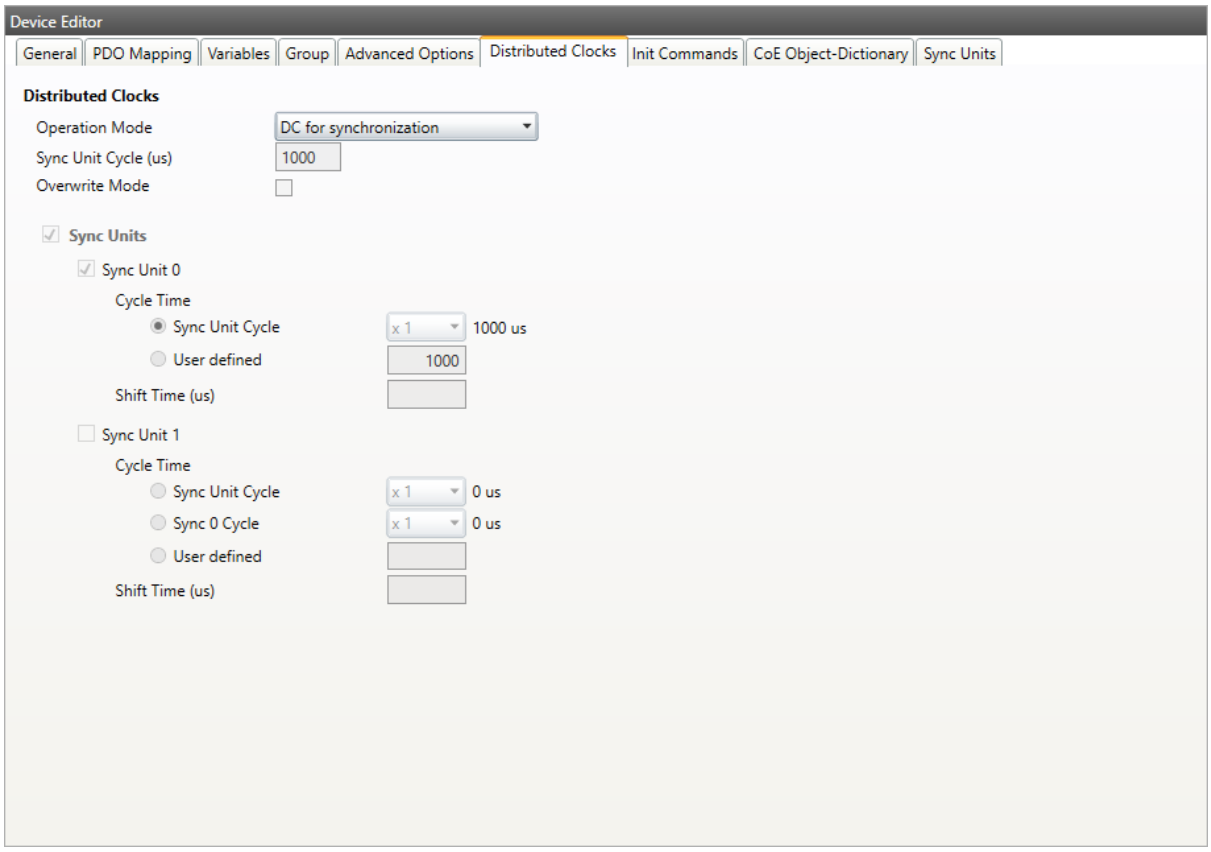
Time Stamp Requested:
Slave will response with the exact send time and the same Frame Number and he should response as soon as possible

Port Mode:
Slave can run in “Switch Port” or in “IP Port” mode

Override IP Settings:
All IP settings will be overwritten from master like IP Address, Subnet Mask, Default Gateway, DNS Server and DNS Name.

5.3.9 Distributed Clock (Expert)

In this tab, the user can change distributed clock related settings:



Reference Clock

Operation Mode:
Selectable DC operation modes. The modes cannot be edited.

Sync Unit Cycle:
Base interval in microseconds which will be used from master (see *Master*)

Overwite Mode:
Overwrites the settings of the selected operation mode (might be necessary, if the slave doesn't offer the right operation mode)

Sync Units

Sync Unit 0

Cycle Time

Sync Unit Cycle:
Unit is synchronized relative to the Unit Cycle

User defined:
Unit has its own interval

Shift Time
Unit is adjusted by the shift time

Sync Unit 1

Cycle Time

Sync Unit Cycle:
Unit is synchronized relative to the Unit Cycle

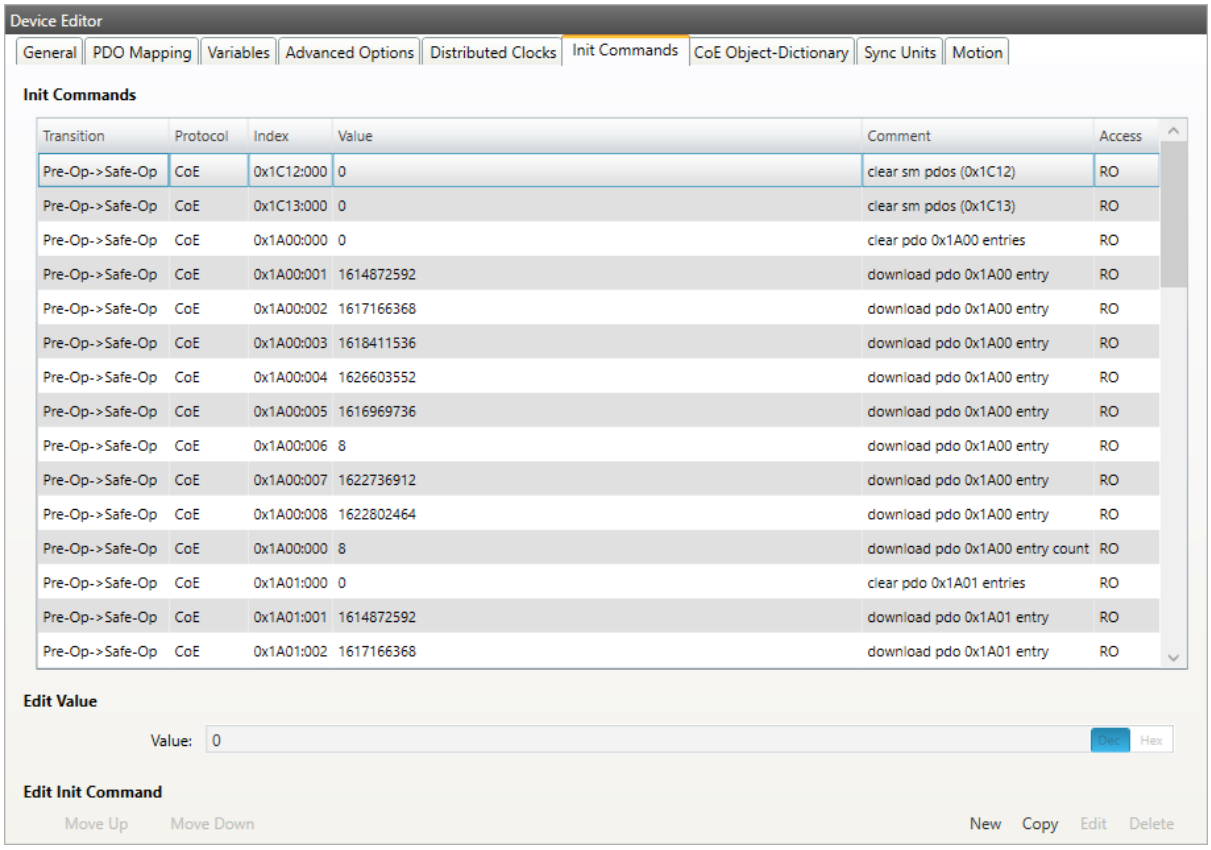
Sync 0 Cycle:
Unit is synchronized relative to the first Sync Unit

User defined:
Unit has its own interval

Shift Time
Unit is adjusted by the shift time

5.3.10 Init Commands (Expert)

In this tab, the user can view the current configured init commands and if it is allowed he can also add/edit/delete init commands:



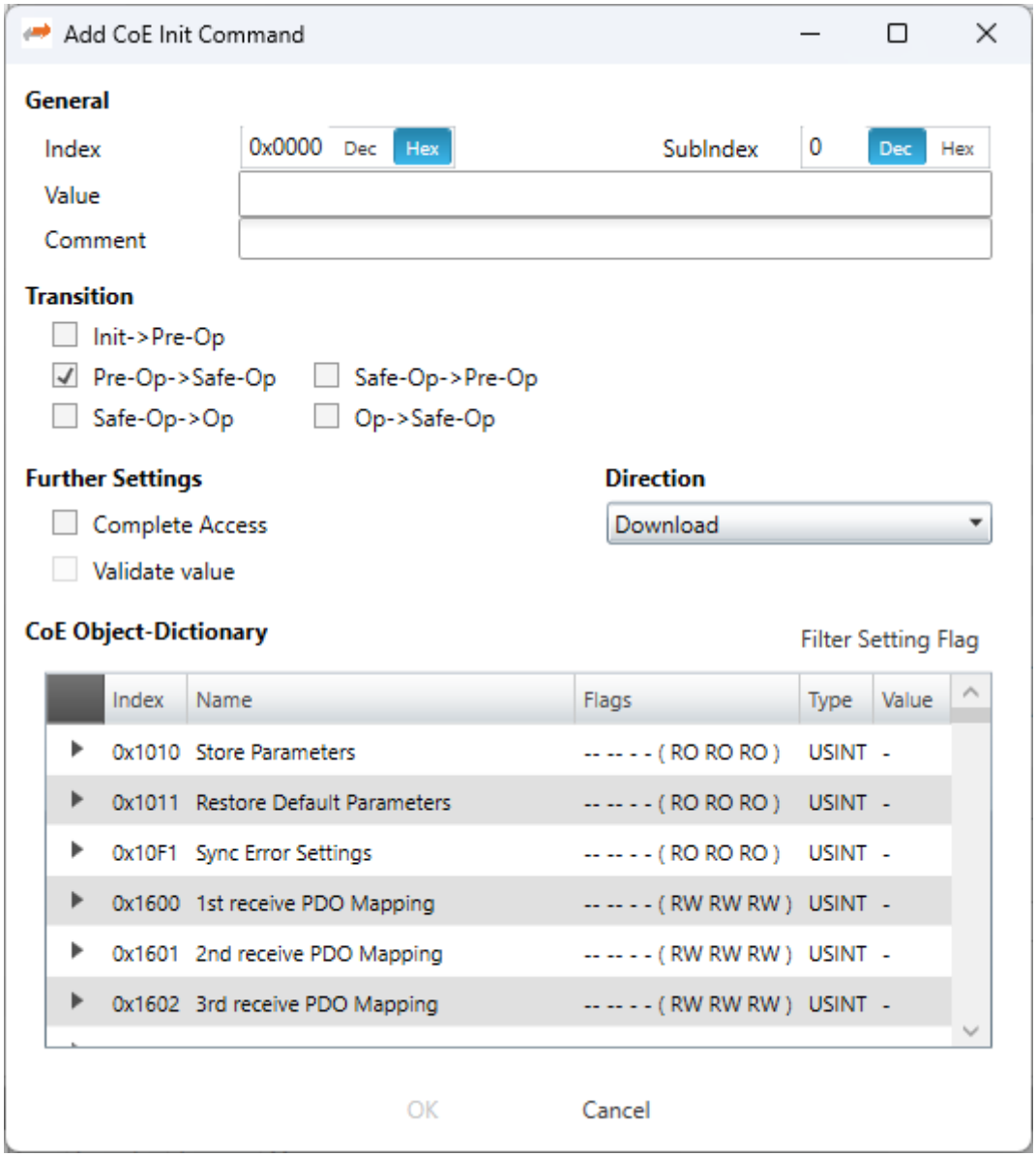
Lists of Init Commands
Init Commands comes from the `ESI` file or will be generated from the configurator. The “Access” column tells the user if this Init Command can be edited (RW = Read/Write) or not (RO = Read-Only).

Buttons

New/Copy/Edit/Delete:
Used for changing the list

Up/Down:
Moving the selected Init Command up or down

At the moment only Init Commands of the CoE- and SoE- Protocol can be added or changed. If the user wants to do this he will see the following dialog (CoE):



General

Index:
CoE-Index of the Init Command

SubIndex:
CoE-SubIndex of the Init Command

Value:
Value of the Init Command, which should be written in the chose transition (only available if direction is set to “Download”). If type of value is unknown, the hex format must be used like “00 11 22 33 …”.

Comment:
Comment of the Init Command

Transition
Determines in which transition the Init Command will be executed

Further Settings
Determines if the complete SDO object should be written/read

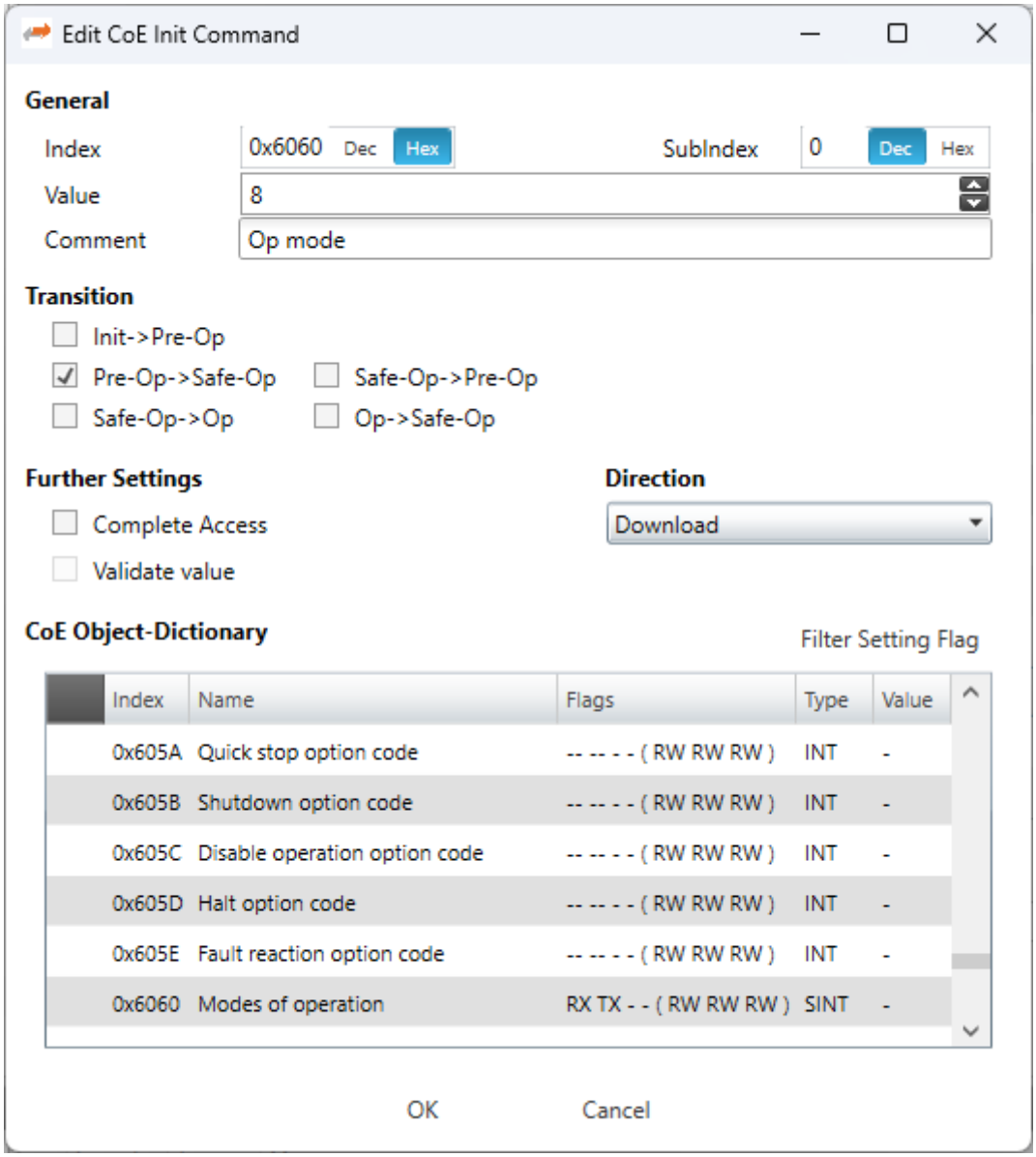
Direction

Determines the direction of the Init Command

Download:
Writes value to slave

Upload:
Reads value from slave (e.g. necessary if value must be confirmed)

For SoE the user will see the following dialog:



General

Index:
SoE Idn of the Init Command

Channel:
The channel of the Init Command

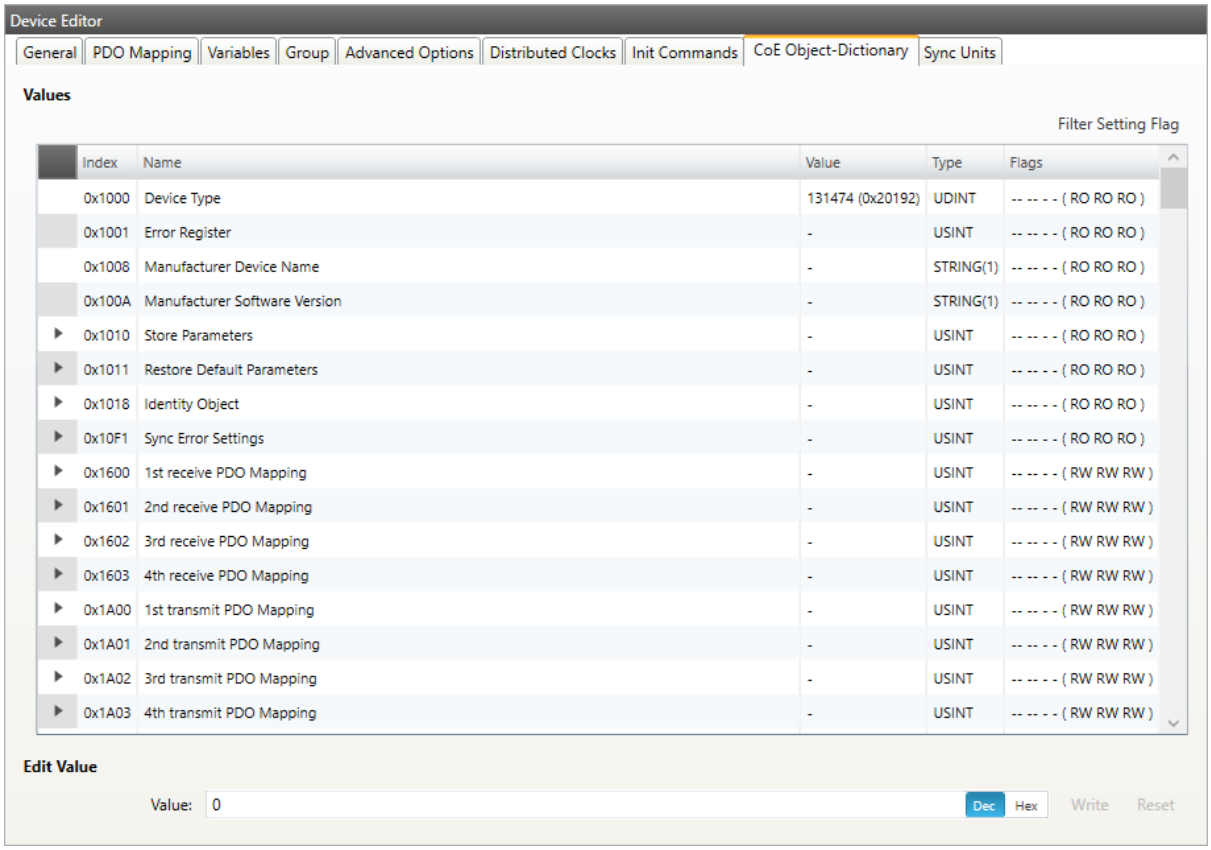
Value:
Value of the Init Command

Comment:
Comment of the Init Command

Transition
Determines in which transition the Init Command will be executed

5.3.11 CoE Object-Dictionary (Expert)

In this tab, the user can see and edit the offline CoE object dictionary.



Lists of CoE Object-Dictionary entries

- Entries comes from the `ESI` file or will be generated from the configurator.
- **The "Flags" column tells the user if this entry is an PDO entry and if it can be edited**
  - "AA BB C D (EE FF GG)"
  - AA = Mapping as RX PDO or not
  - BB = Mapping as TX PDO or not

- C = Backup Flag
- D = Settings Flag
- EE = Access rights for PreOp (RO, WO, RW)
- FF = Access rights for SafeOp (RO, WO, RW)
- GG = Access rights for Op (RO, WO, RW)

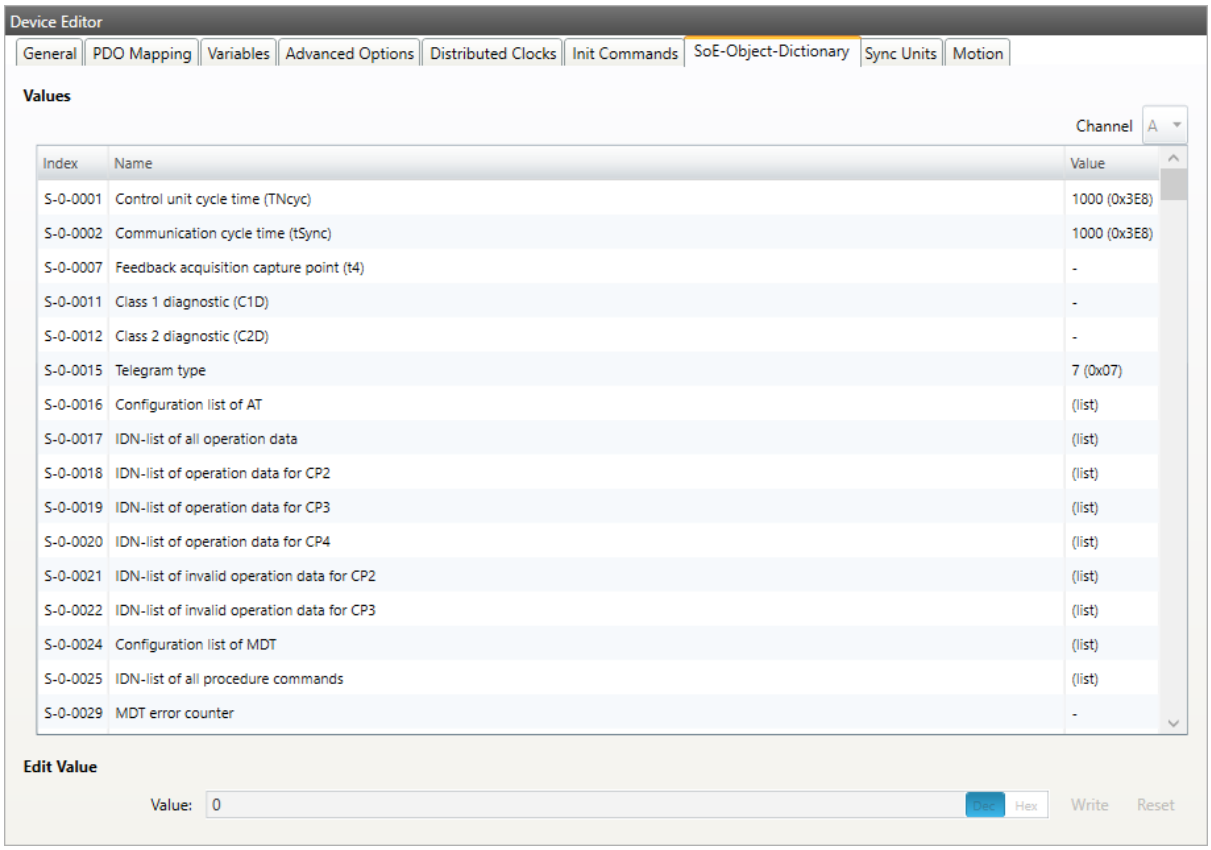
Buttons

Update:
Changes the selected entry

Reset:
Resets the selected entry to `ESI` default

5.3.12 SoE Object-Dictionary (Expert)

In this tab, the user can see and edit the offline SoE object dictionary.



Lists of SoE Object-Dictionary entries
Entries comes from the `ESI` file

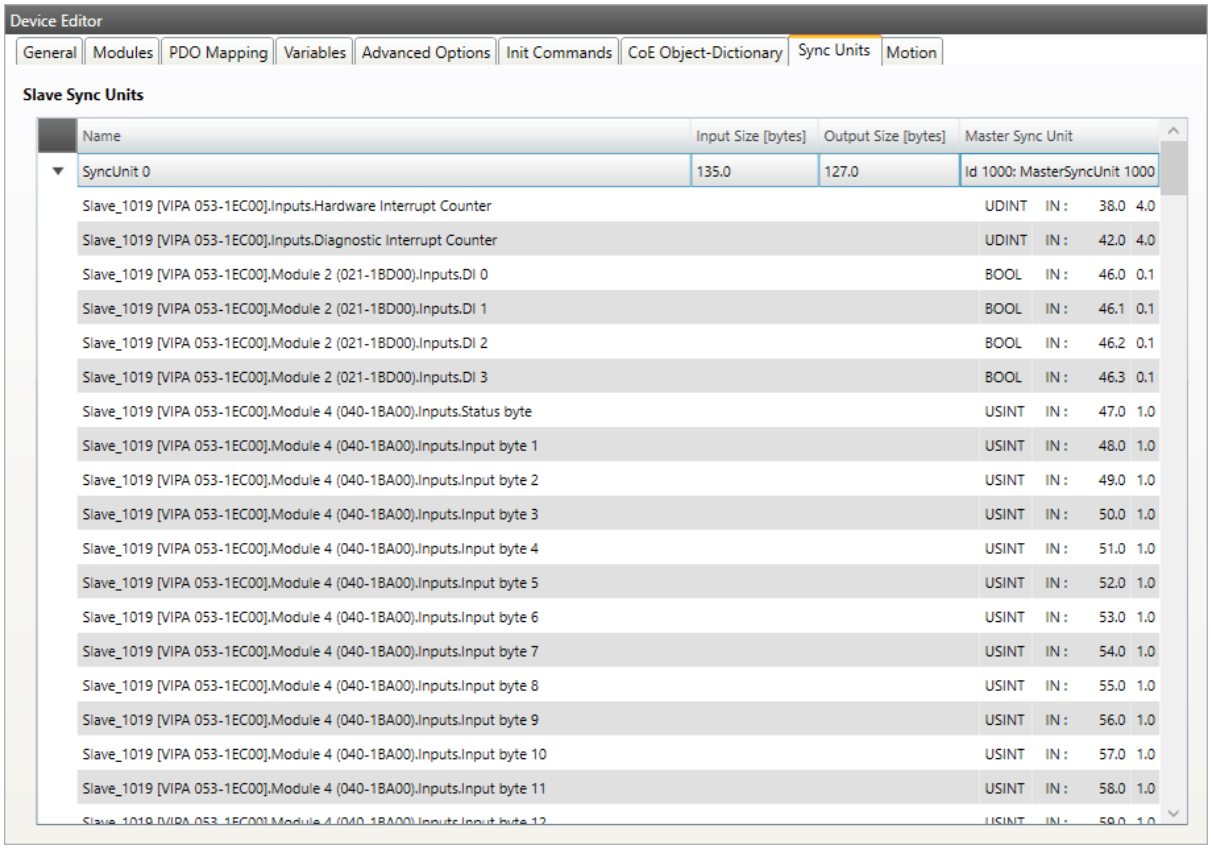
Buttons

Update:
Changes the selected entry

Reset:
Resets the selected entry to `ESI` default

5.3.13 Sync Units (Expert)

In this tab, the user can assign a slave sync unit to a specific master sync unit by using the combobox column "Master Sync Unit" (only visible if user has defined additional master sync units).



5.3.14 Slave Specific Tabs (Expert)

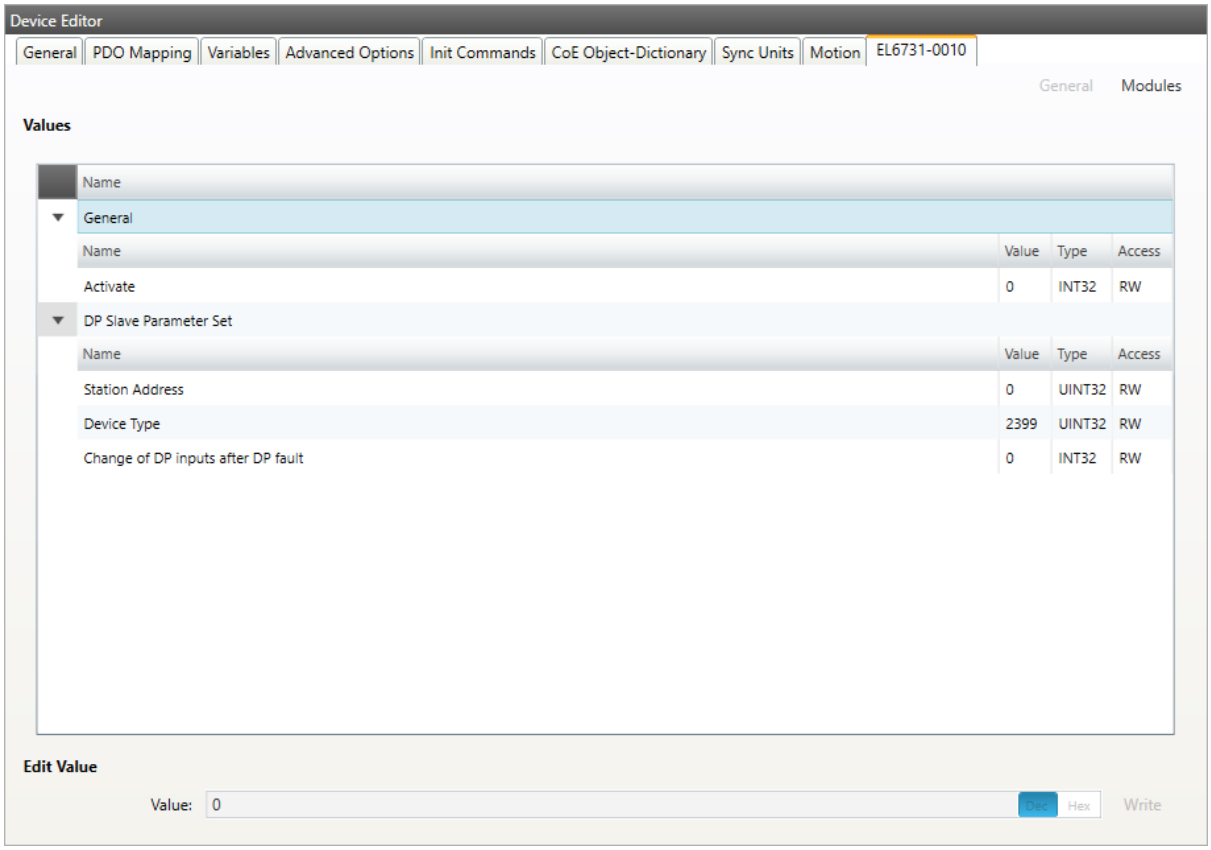
Some slaves needs special configuration options. If this is necessary we display a slave specific tab.

Important: At first "Activate" have to be set, to activate the automatism for generating PDOs and Init Commands.

This tab will be displayed for the following slaves:

EL6731-0010 PROFIBUS DP Slave

General:



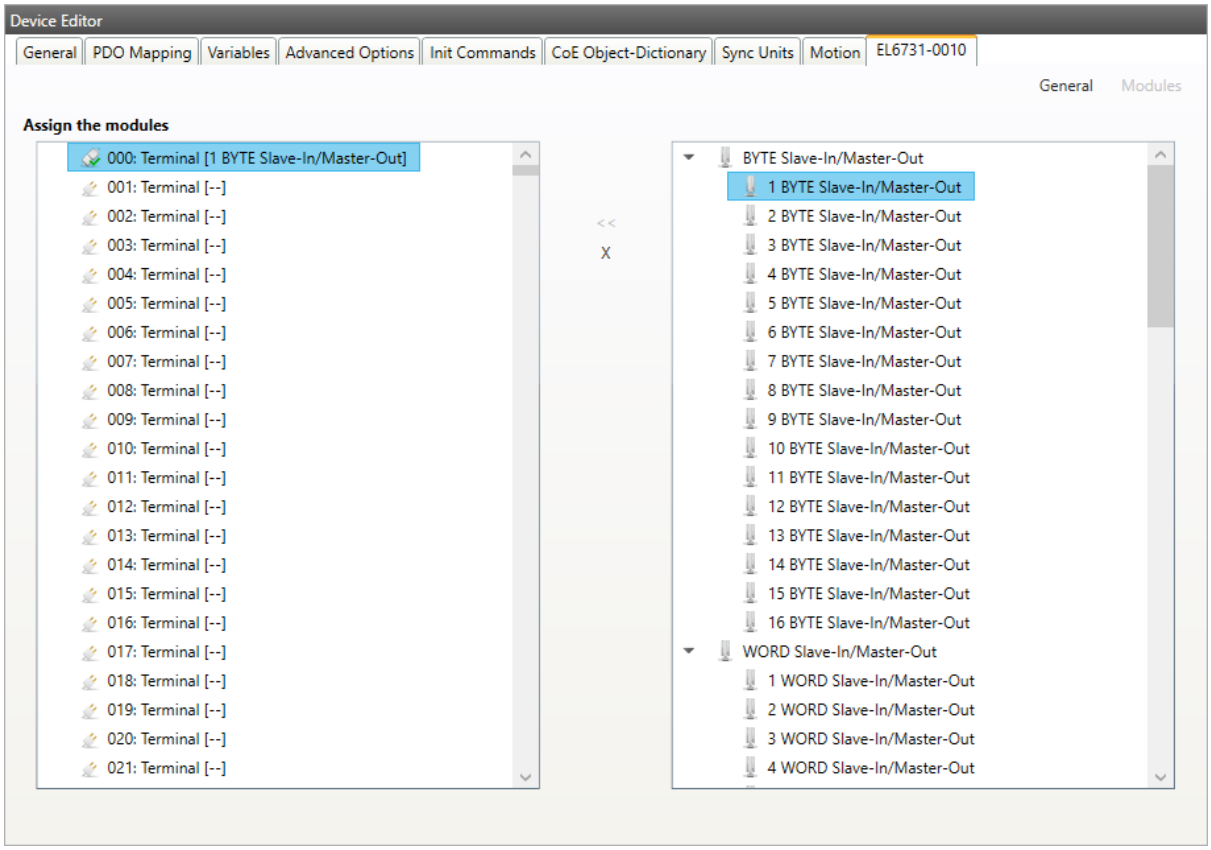
Activate: Activates the automatism for generating PDOs and Init Commands

DP Slave Parameter Set

Station Address:
DP station address of the DP slave (permitted values: 0-125)

Device Type:
DP Ident Number of the DP slave

Modules:

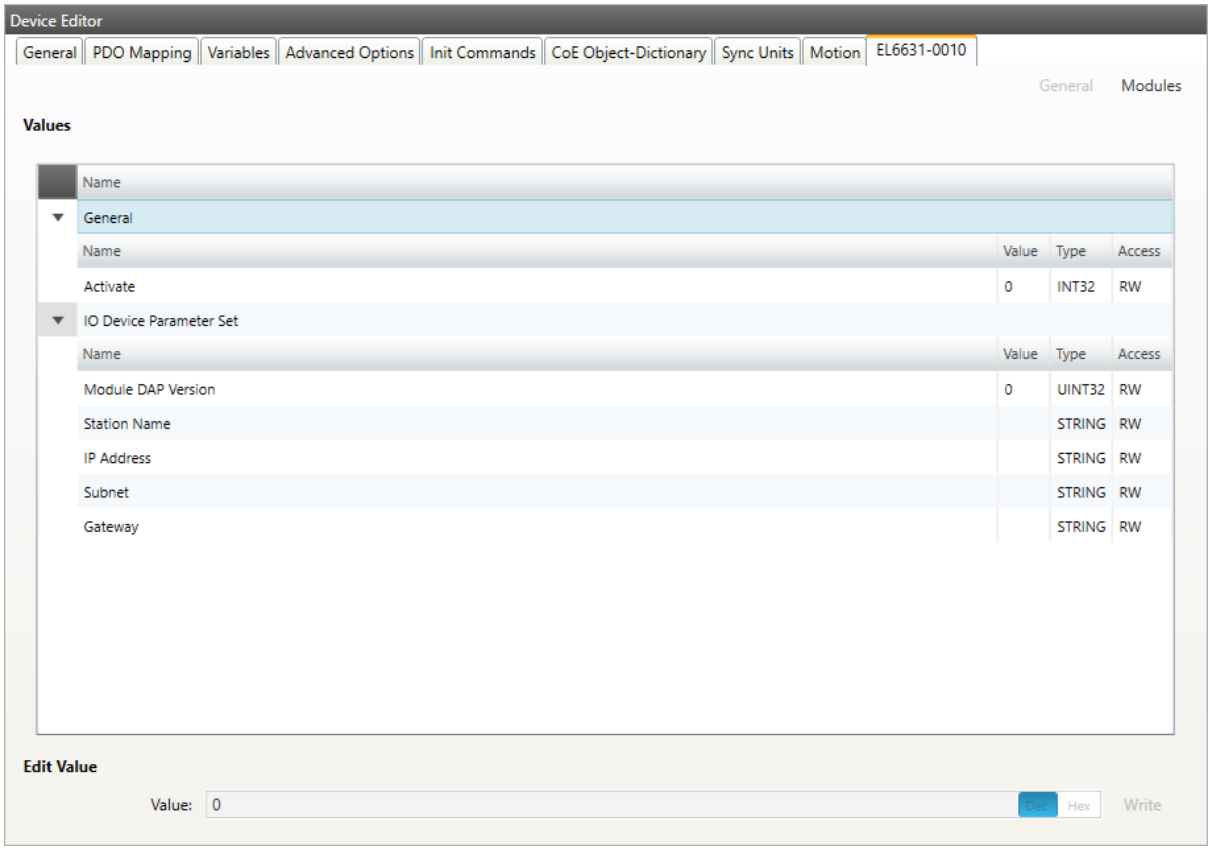


Connect modules to slot (“<<”)
Used for connecting the selected modules (from the right list) to the selected slot (from the left list).

Disconnect module from slot (“X”)
Used for disconnecting the selected slot (left list)

EL6631-0010 PROFINET IO Device

General:



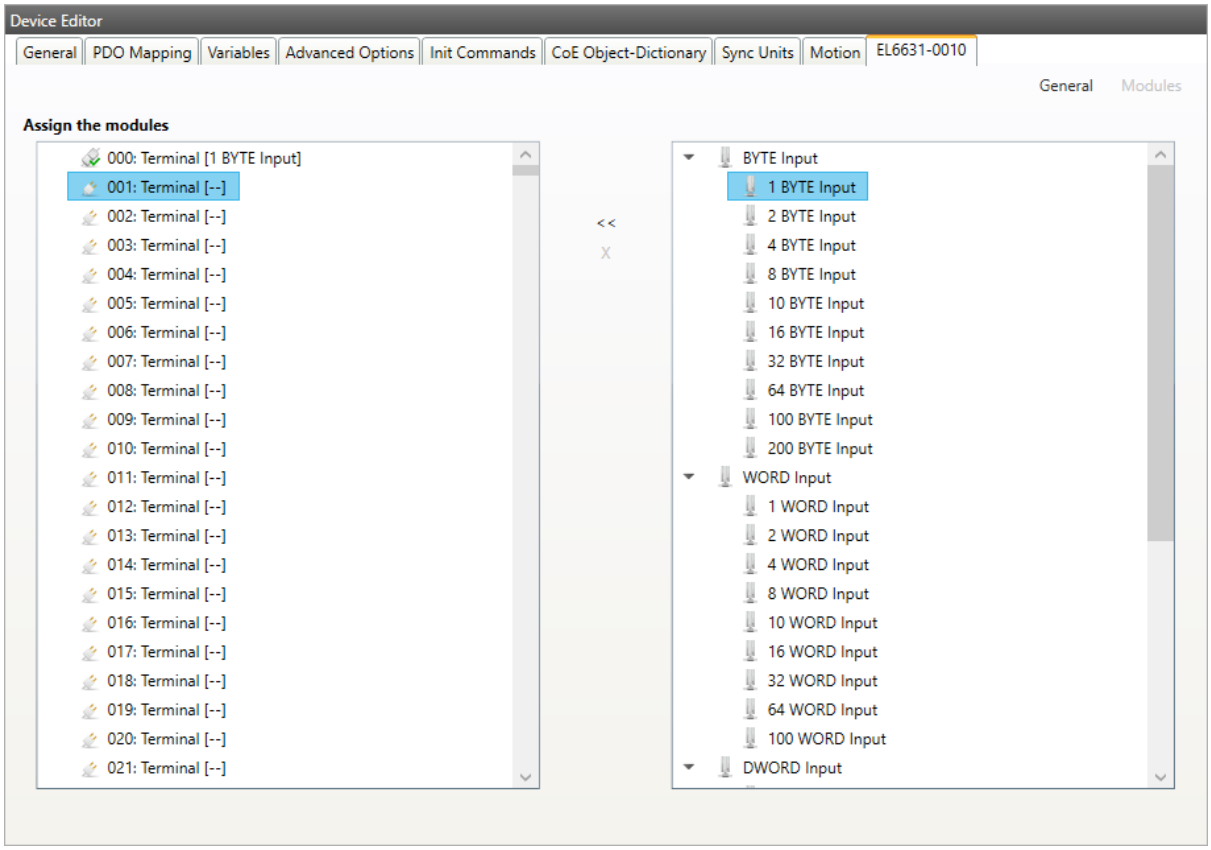
Activate: Activates the automatism for generating PDOs and Init Commands

IO Device Parameter Set

Module DAP Version:
Module DAP version of the DP slave (0 = Auto, 1 = V2.0, 2 = V2.25, 3 = V2.3, at least FW 02, 4 = V2.31, at least FW 03, 5 = V2.32, at least FW 08, 6 = V2.33, at least FW 10, 7 = V2.33, at least FW 14)

Station Name:
Station name of the DP slave (max: 240 chars)

Modules:



Connect module to slot (“<<”)
Used for connecting the selected module (from the right list) to the selected slot (from the left list).

Disconnect module from slot (“X”)
Used for disconnecting the selected slot (left list)

K-bus Coupler / IP Link Coupler

Supported devices:

K-bus Coupler

- BK1120
- BK1150
- BK1250

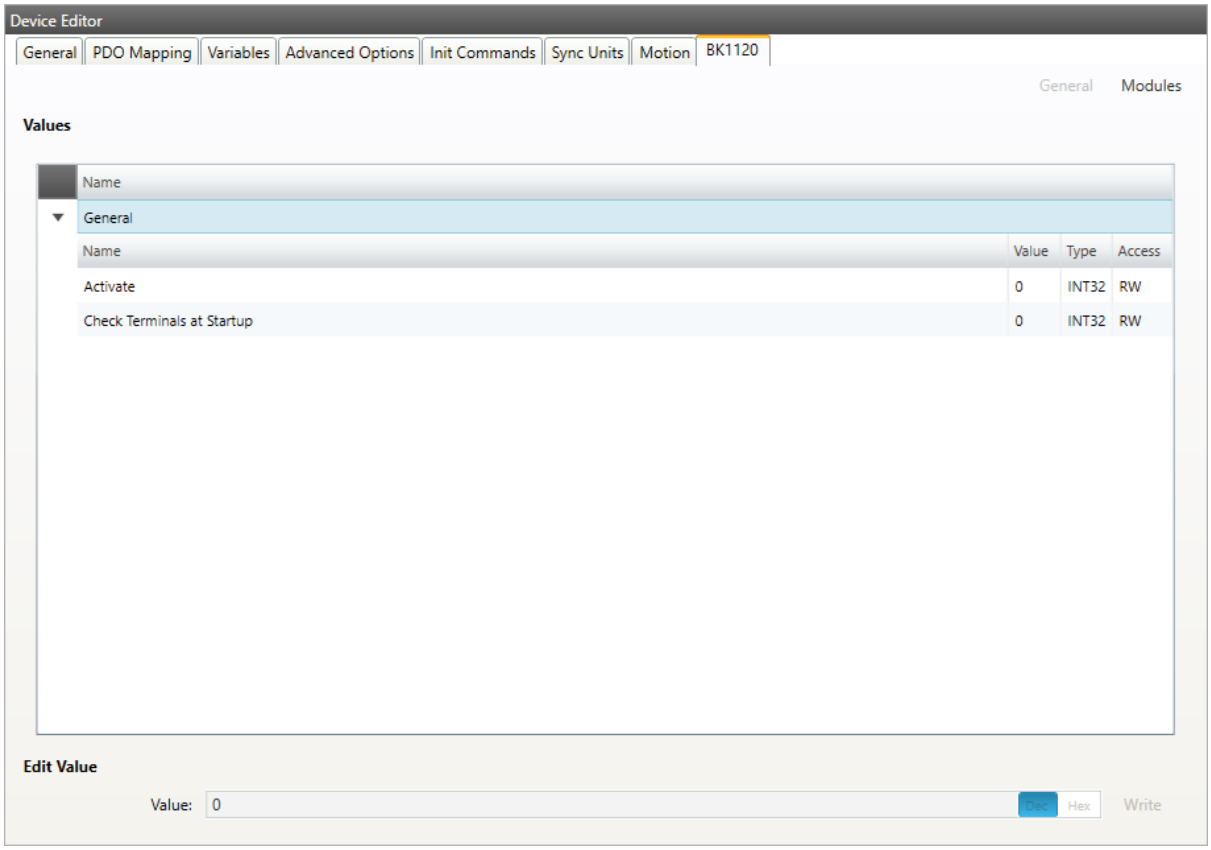
IP Link Coupler

- IL2300-B110
- IL2301-B110
- IL2302-B110

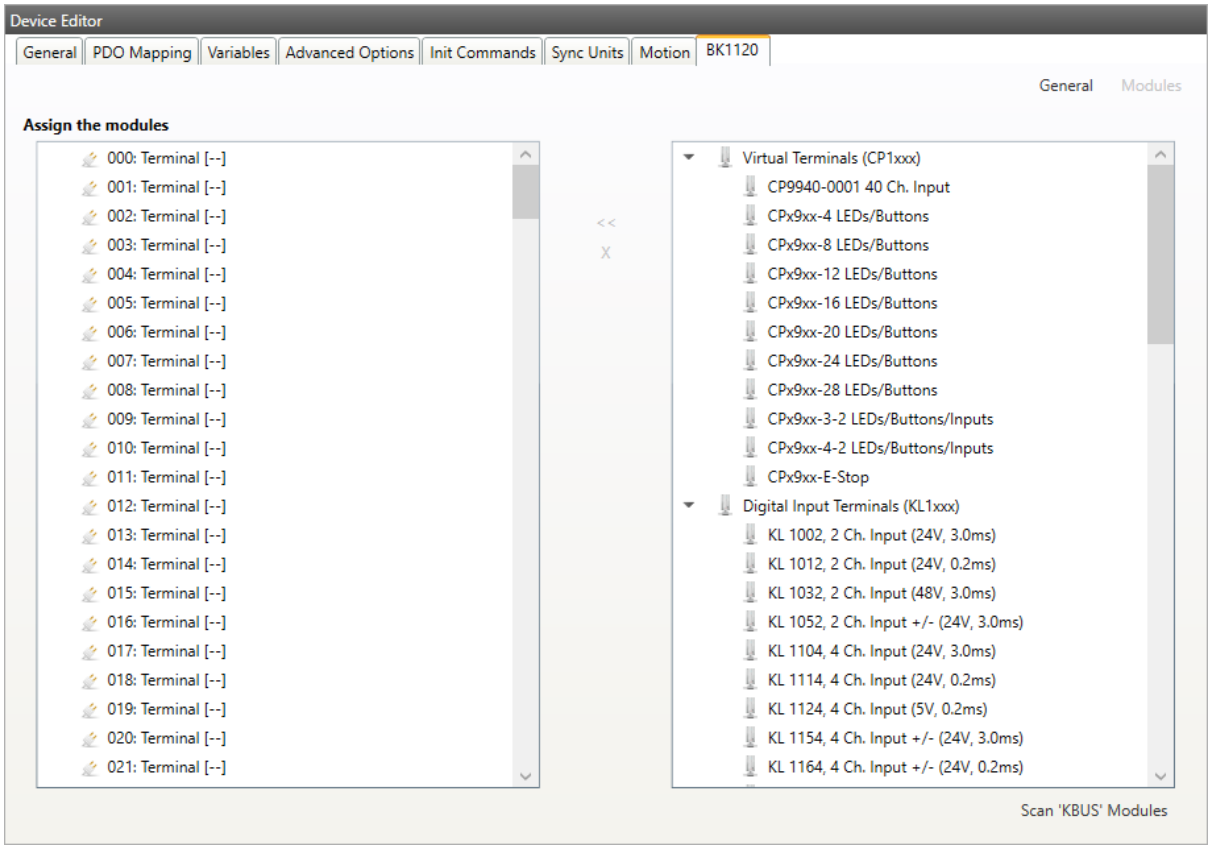
General:

Activate:
Activates the automatism for generating PDOs and Init Commands

Check Terminals at Startup:
Activates the automatism for checking terminals at startup


Device Editor
General
PDO Mapping
Variables
Advanced Options
Init Commands
Sync Units
Motion
BK1120
General
Modules
Values
Name
General
Name
Value
Type
Access
Activate
0
INT32
RW
Check Terminals at Startup
0
INT32
RW
Edit Value
Value:
0
Dec
Hex
Write

Terminals:


Device Editor
General
PDO Mapping
Variables
Advanced Options
Init Commands
Sync Units
Motion
BK1120
General
Modules
Assign the modules
000: Terminal [--]
001: Terminal [--]
002: Terminal [--]
003: Terminal [--]
004: Terminal [--]
005: Terminal [--]
006: Terminal [--]
007: Terminal [--]
008: Terminal [--]
009: Terminal [--]
010: Terminal [--]
011: Terminal [--]
012: Terminal [--]
013: Terminal [--]
014: Terminal [--]
015: Terminal [--]
016: Terminal [--]
017: Terminal [--]
018: Terminal [--]
019: Terminal [--]
020: Terminal [--]
021: Terminal [--]
<<
X
Virtual Terminals (CP1xxx)
CP9940-0001 40 Ch. Input
CPx9xx-4 LEDs/Buttons
CPx9xx-8 LEDs/Buttons
CPx9xx-12 LEDs/Buttons
CPx9xx-16 LEDs/Buttons
CPx9xx-20 LEDs/Buttons
CPx9xx-24 LEDs/Buttons
CPx9xx-28 LEDs/Buttons
CPx9xx-3-2 LEDs/Buttons/Inputs
CPx9xx-4-2 LEDs/Buttons/Inputs
CPx9xx-E-Stop
Digital Input Terminals (KL1xxx)
KL 1002, 2 Ch. Input (24V, 3.0ms)
KL 1012, 2 Ch. Input (24V, 0.2ms)
KL 1032, 2 Ch. Input (48V, 3.0ms)
KL 1052, 2 Ch. Input +/- (24V, 3.0ms)
KL 1104, 4 Ch. Input (24V, 3.0ms)
KL 1114, 4 Ch. Input (24V, 0.2ms)
KL 1124, 4 Ch. Input (5V, 0.2ms)
KL 1154, 4 Ch. Input +/- (24V, 3.0ms)
KL 1164, 4 Ch. Input +/- (24V, 0.2ms)
Scan 'KBUS' Modules

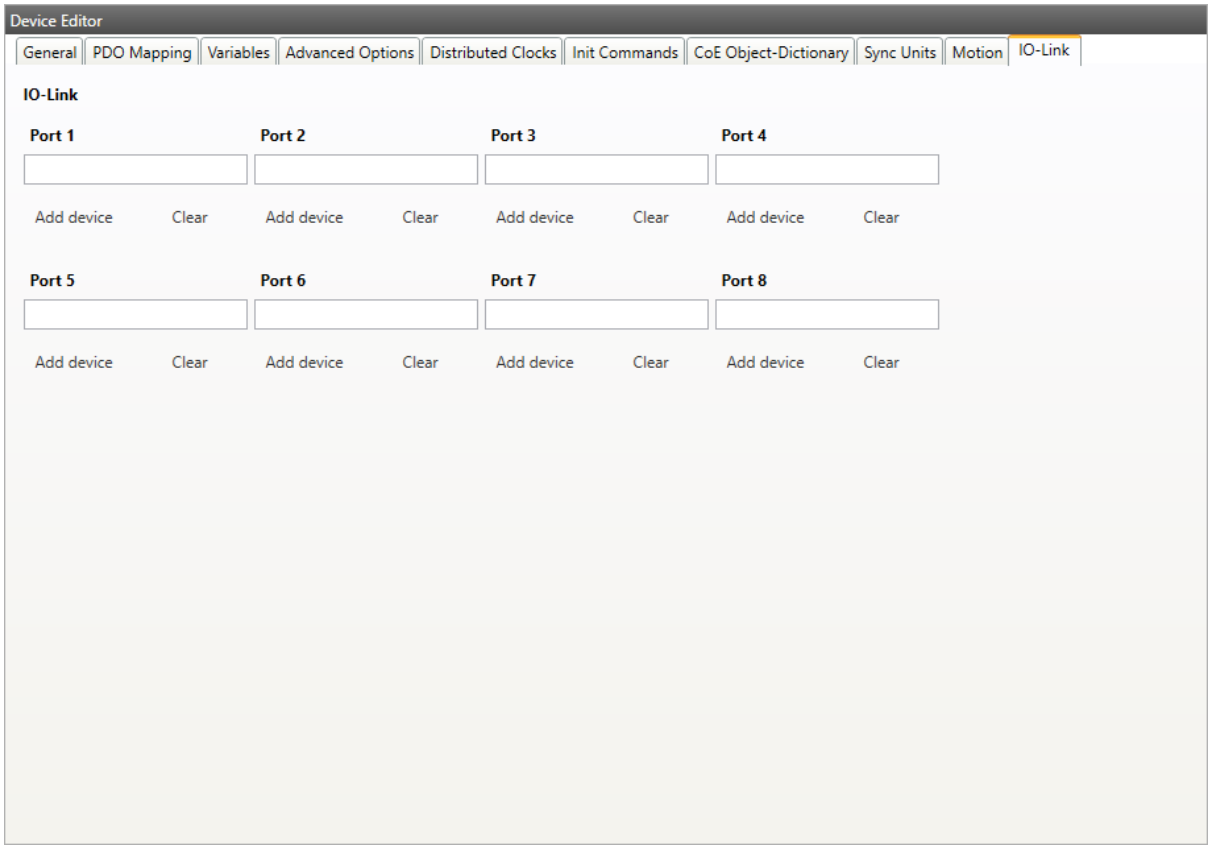
Connect terminials to slot (“<<”)
Used for connecting the selected terminal (from the right list) to the selected slot (from the left list).

Disconnect terminals from slot (“X”)
Used for disconnecting the selected slot (left list)

5.3.15 IO–Link

In this tab, the user can configure the IO-Link terminal EL6224, EP6224 and EP(P)6228. He can add different devices to the ports (IODD). The user can see 4 or 8 ports. Depends on the configured slave.

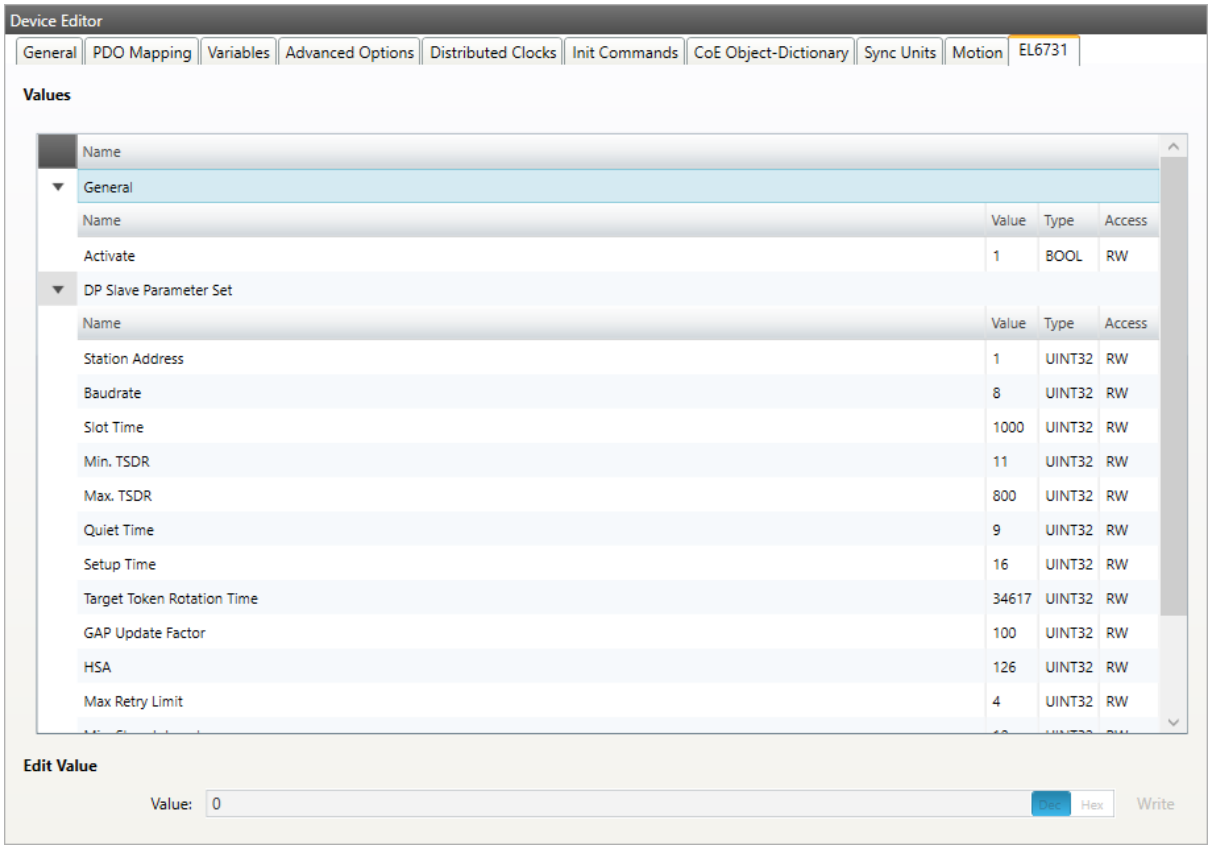
Please be careful when using the EP(P)6228 that there are no double assignments through the Modules-Tab:



5.3.16 Profibus Master (EL6731)

In this tab, the user can configure the Profibus Master EL6731. New Profibus modules can be added in the tree. Right click and then 'Append module'.

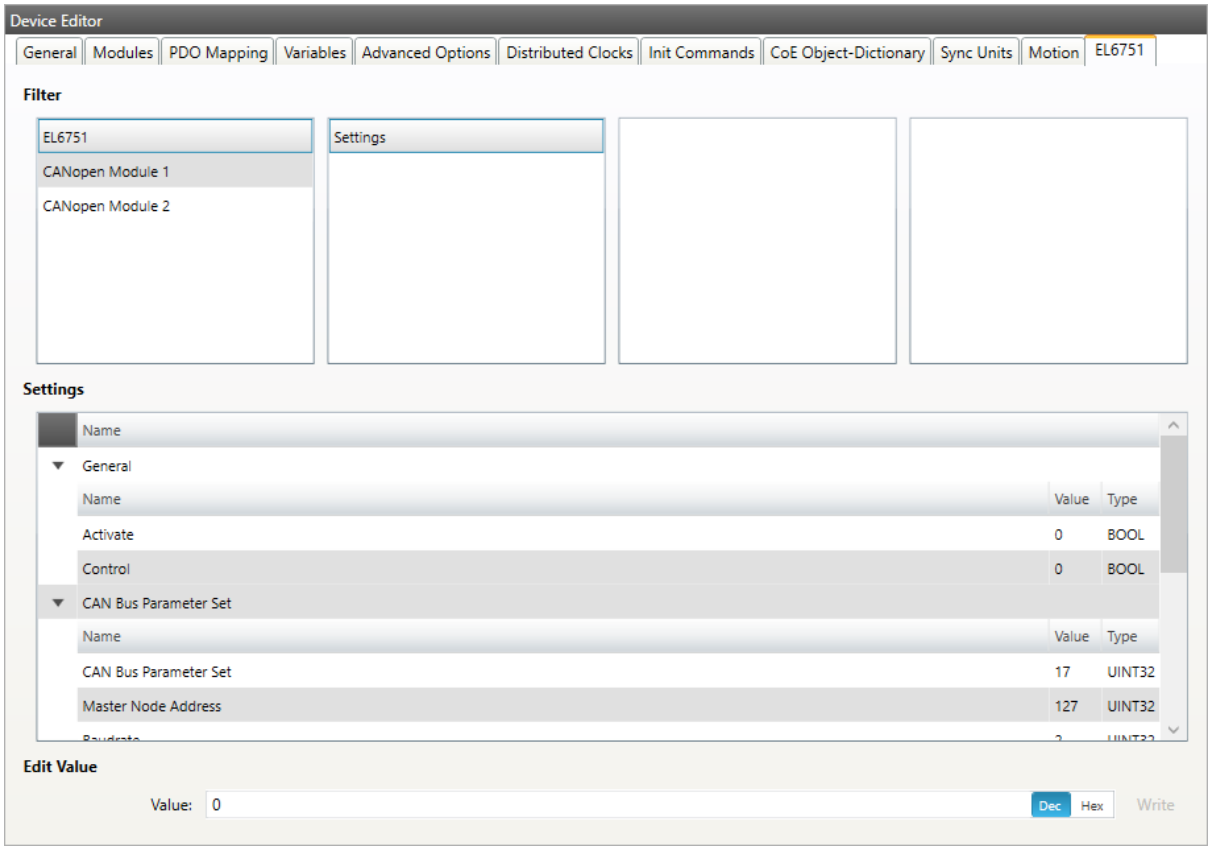
Each module has an own EL6731 tab with settings and the possibility to load a GSD file. After the GSD file was loaded the user gets also PRM data settings and the possibility to add a submodule (e.g. K-Bus) via the tree.



5.3.17 CANopen Master (EL6751)

In this tab, the user can configure the CANopen Master EL6751. He can add Modules, PDOs, SDOs and variables by clicking the right mouse button. To activate the master, the user have to go to the general settings of the EL6751 entry, and set activated to '1'. If activated is '1' all init commands and PDOs will be activated automatically.

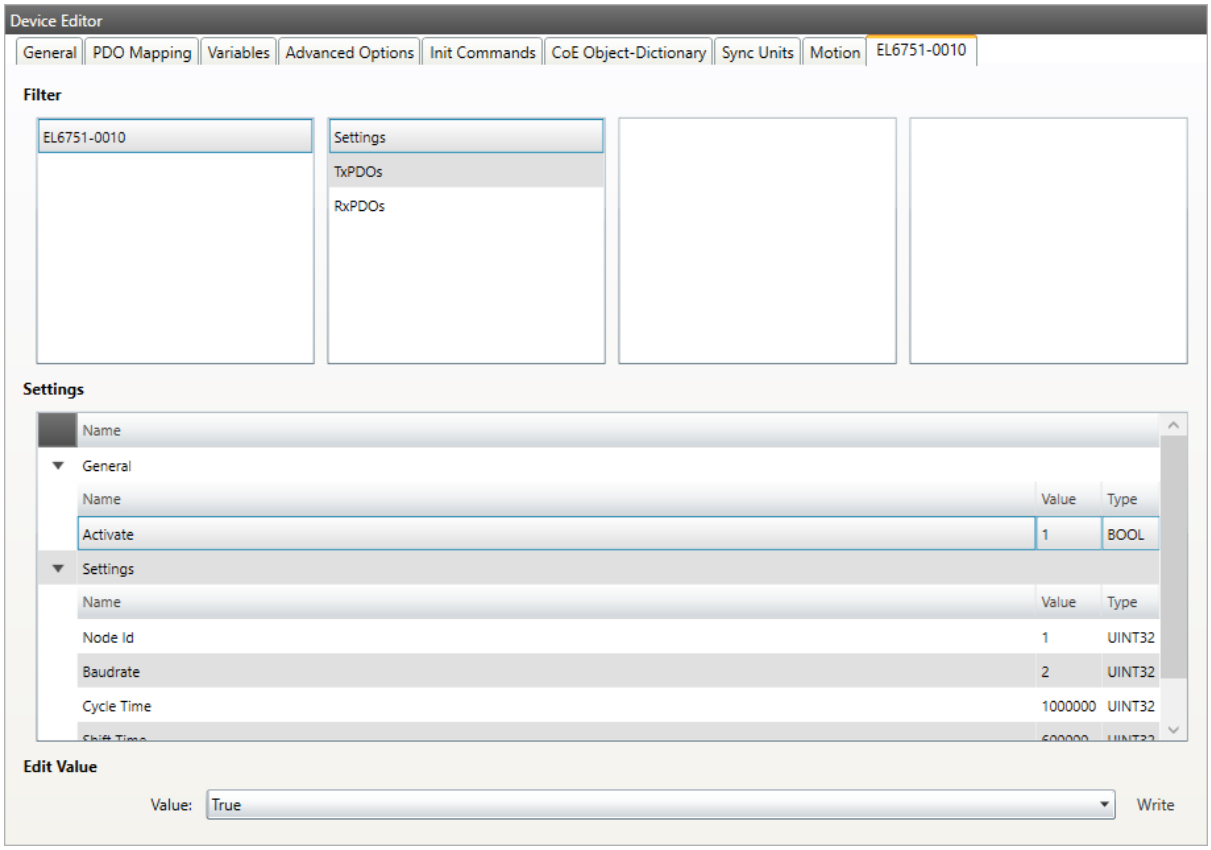
Also the user can rename and delete modules, PDOs, SDOs, and variables:



5.3.18 CANopen Slave (EL6751-0010)

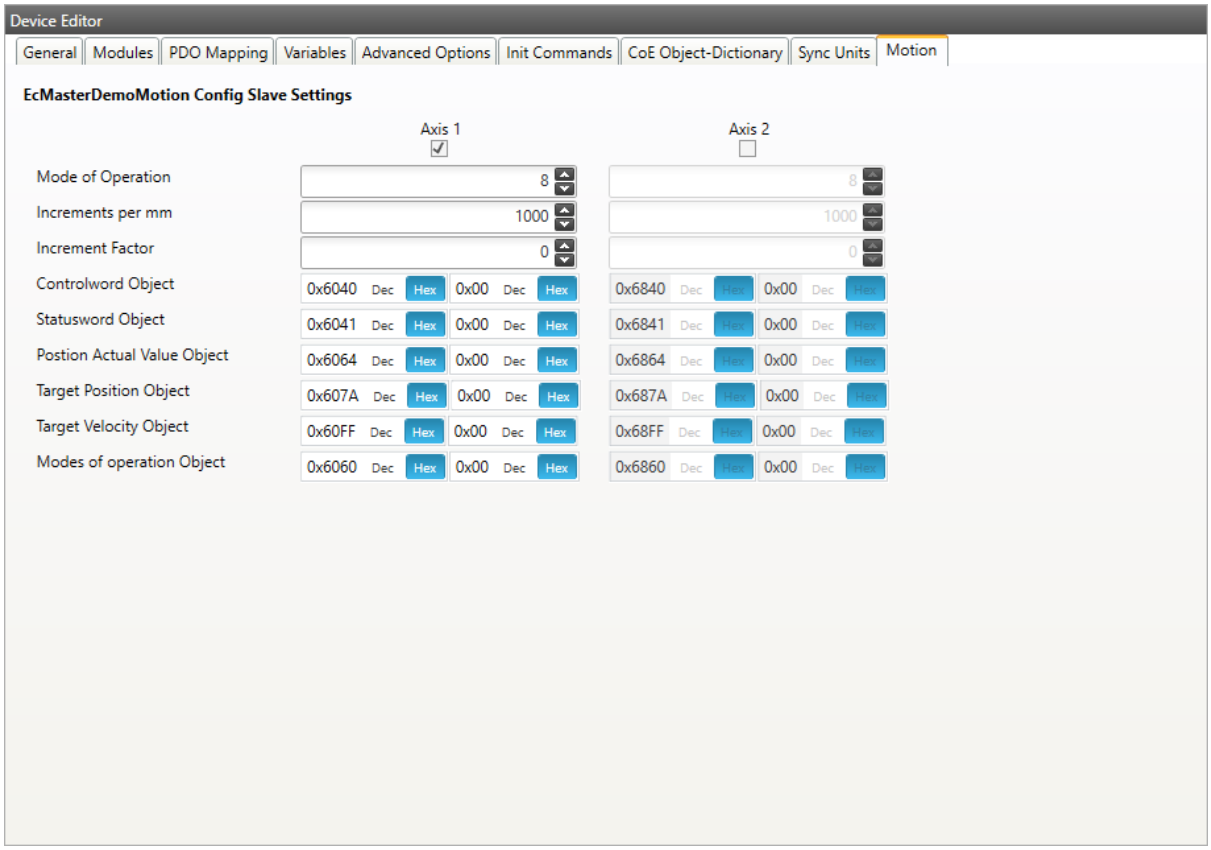
In this tab, the user can configure the CANopen Slave EL675-0010. He can add PDOs and variables by clicking the right mouse button. To activate the gateway, the user have to go to the general settings of the EL6751-0010 entry, and set activated to '1'. If activated is '1' all init commands and PDOs will be activated automatically.

Also the user can rename and delete PDOs and variables:



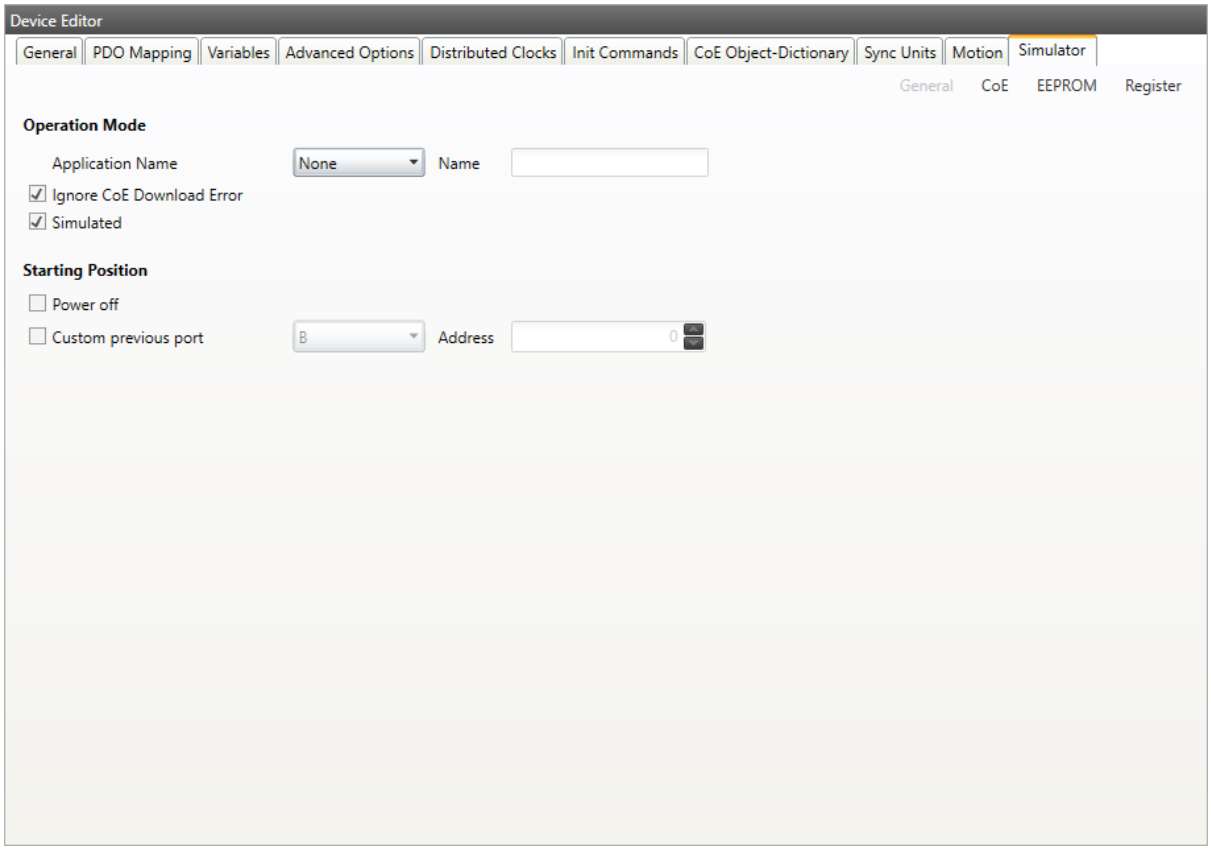
5.3.19 Motion (Motion Mode only)

On this tab the user can change the and activate the axis for the motion. The settings are used in the `xml` file which can be exported from the master motion tab, to configure the Demo Motion:



5.3.20 Simulation Settings

On this tab the user can change the simulator settings for the slave:



Application Name:
The application name for the `EXI` file

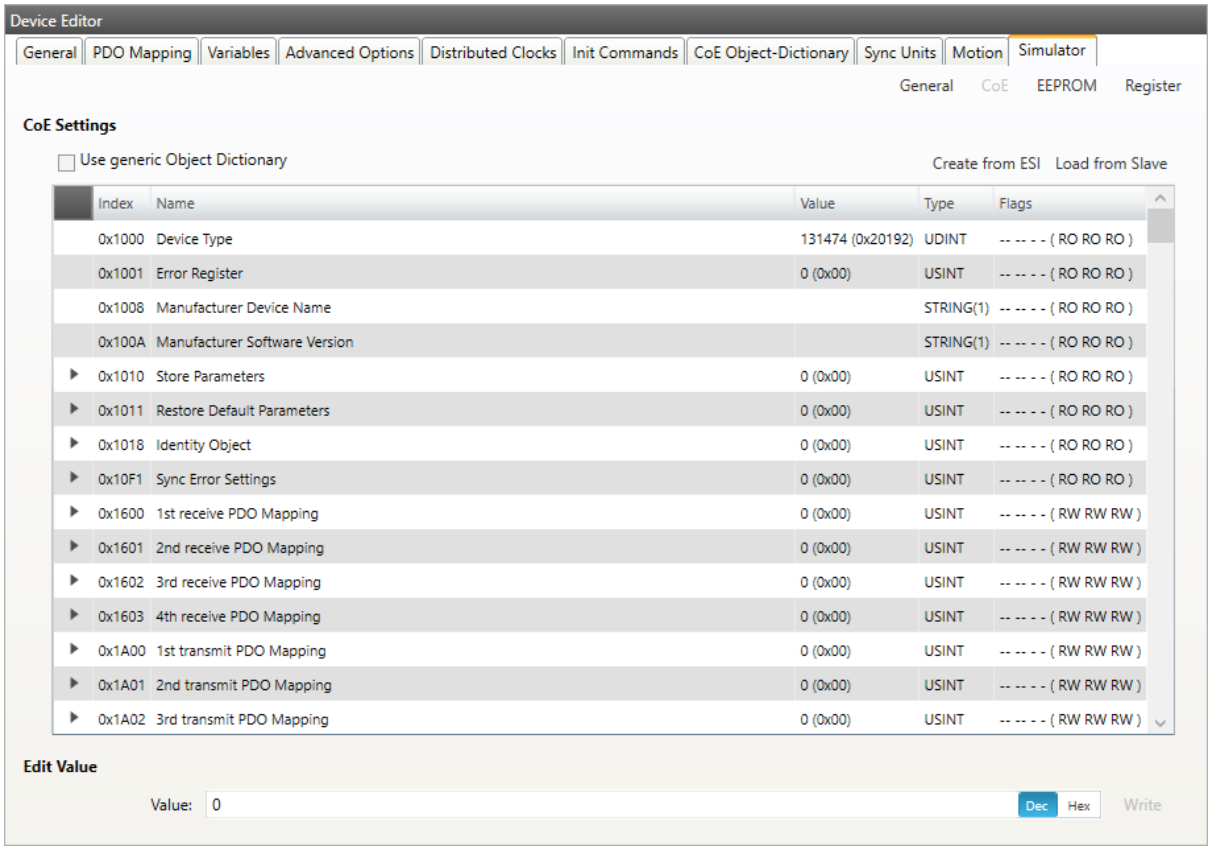
Ignore Download Error:
Ignores errors on download

Starting Position

Power Off:
Select if slave should be powered on or off on start

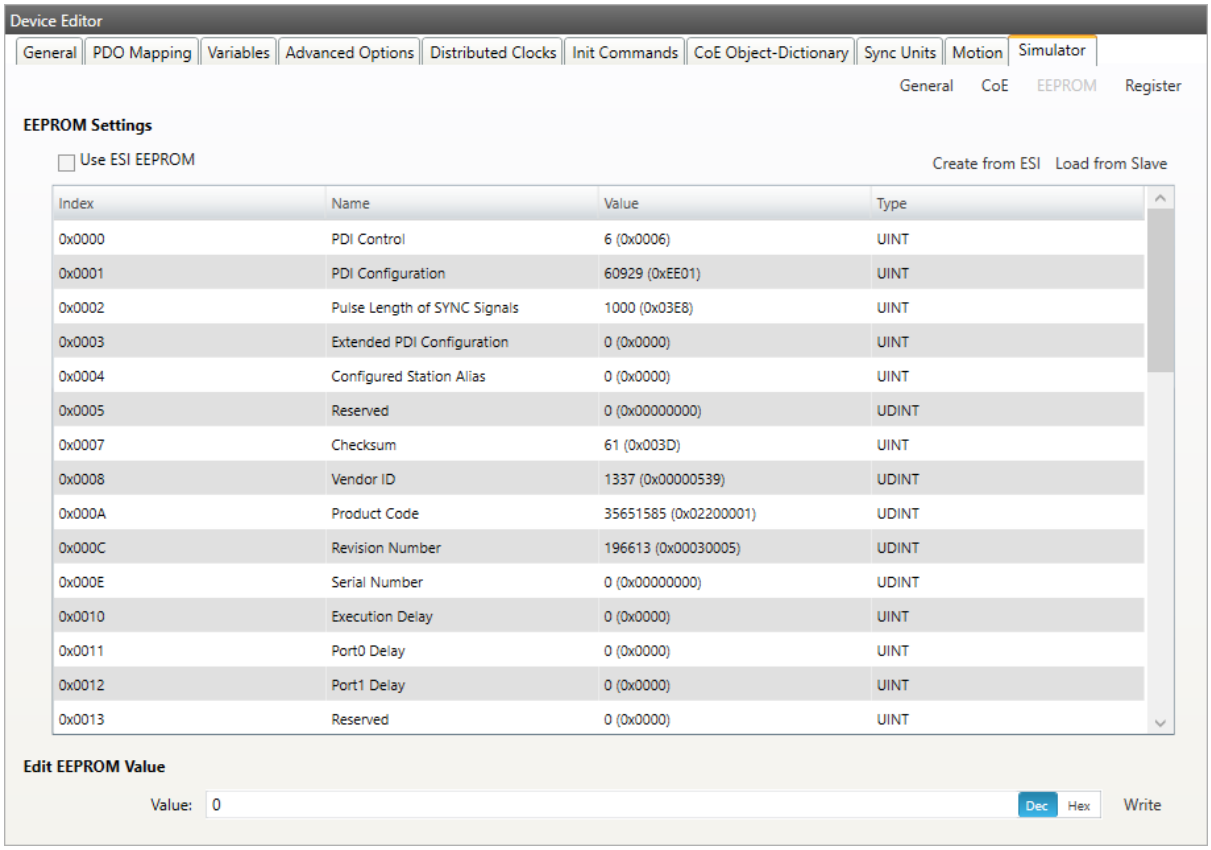
Custom previous port:
manipulate the topology

CoE Tab



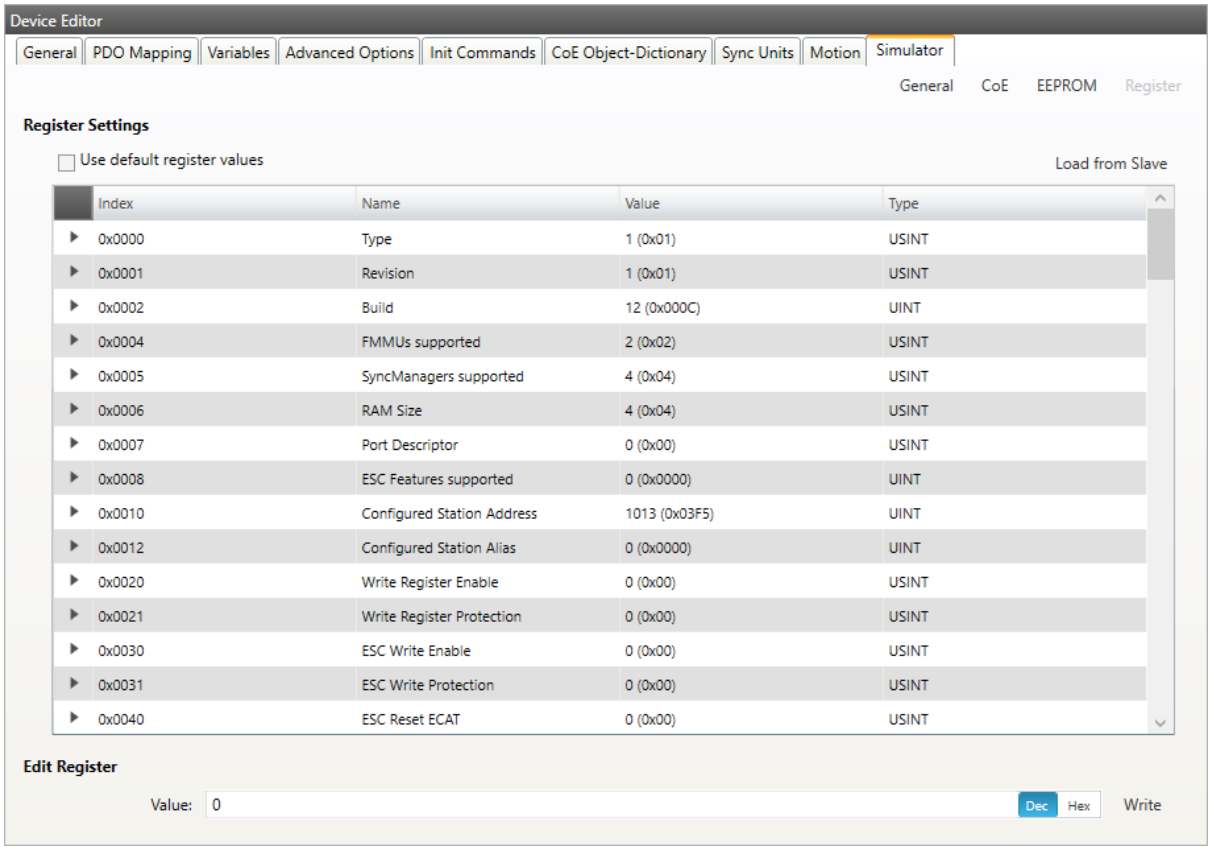
The simulated CoE can be changed here.

EEPROM Tab



The simulated EEPROM can be changed here.

Register Tab



The simulated Registers can be changed here.

5.4 Export ENI

To run the EC-Master you basically need an EtherCAT-Network-Information (`ENI`) file to initialize and control an EtherCAT network. After configuring the EtherCAT network with EC-Engineer, you can export this `ENI` file and copy it on the control system to run the EC-Master.

Note: The EtherCAT-Network-Information (`ENI`) File will be generated according to ETG.2100 standard V1.0.1

5.5 Export EXI

To run the EC-Simulator you basically need an `ENI` or better an `EXI` file to simulate an EtherCAT network. After configuring the EtherCAT network with EC-Engineer, you can export this `EXI` file and use it to start the EC-Simulator.

6 Diagnosis Mode

6.1 Overview

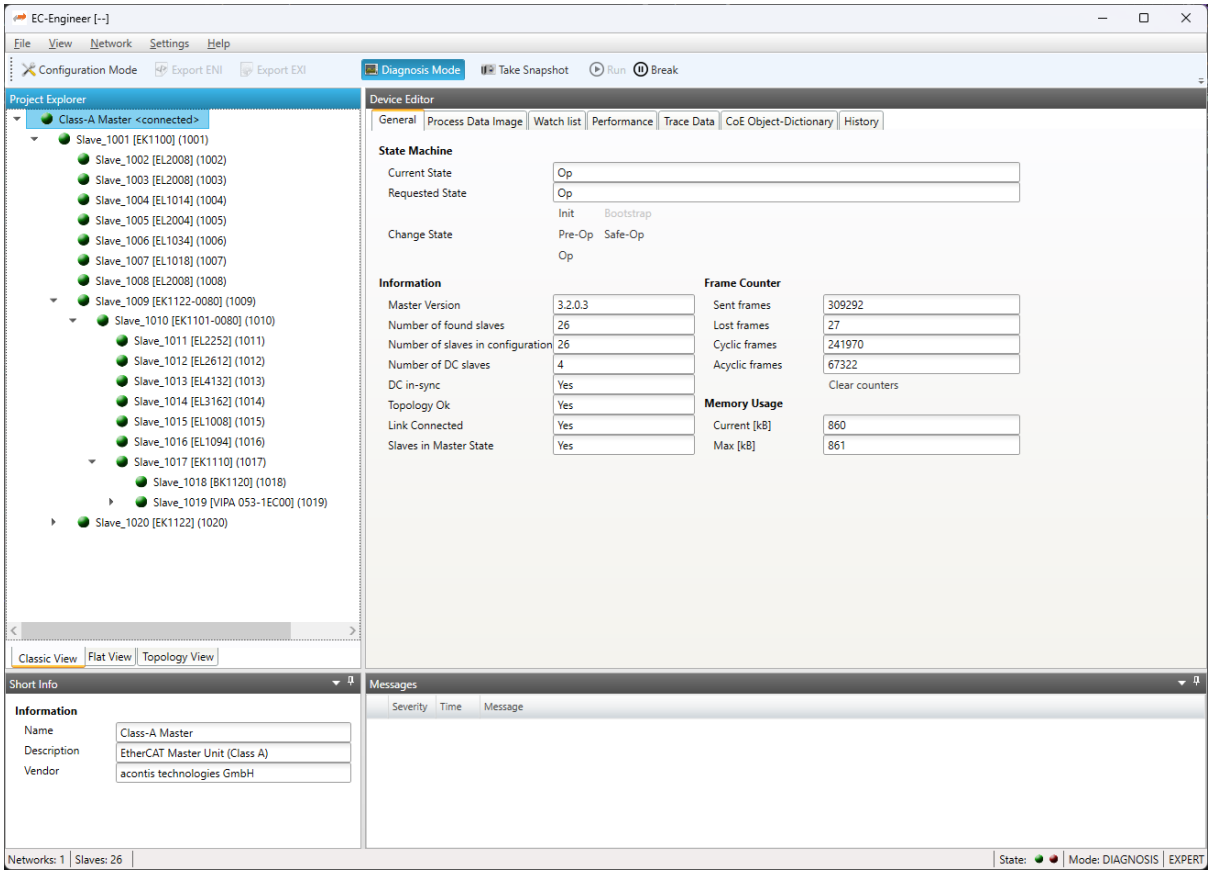
EC-Engineer is also a diagnosis application specifically developed to analyze EtherCAT networks that are controlled by the EC-Master. Automated control systems usually require high availability of the whole system. Due to the rough industrial environment this is often hardly to achieve.

If high availability shall be guaranteed for an automated control system it is important to verify and maintain the field bus. Using EC-Engineer it is possible to take a look into the “health” of the EtherCAT system. Detection of signs of system degradation prior to running into a system failure will be of great benefit. In that case it is possible to exchange the problematic components (cables, slave devices).

Many aspects of diagnosis are covered by the EC- Engineer:

- Useful for setting up the system
- System analysis and maintenance
- Error detection
- Documentation

After switching into diagnosis mode of EC-Engineer, the user will see this page:

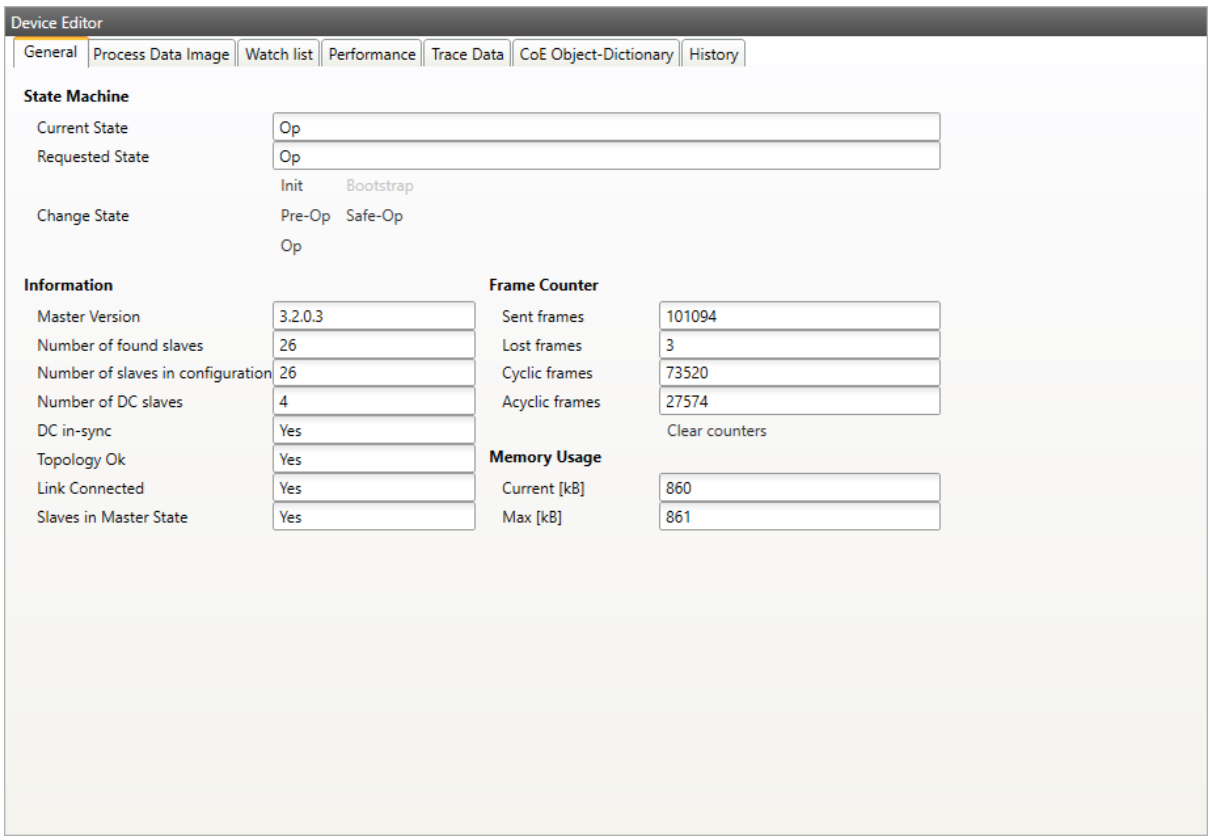


6.2 Master

This section shows the current “health” state of the master and helps the user to analyze master related problems.

6.2.1 General (Master)

In this tab, the user can see and change the current state of the state machine of the master. He has also an overview over the current “health” state of his EtherCAT network:



State Machine

Current State:
Current state of the master

Requested State:
Requested state of the master

Change State:
Master can reach the states INIT, PRE-OP, SAFE-OP and OP.

Information

Master version:
Version number of the running master

Number of found slaves:
Number of slaves, which were found from master on the network

Number of slaves in configuration:
Number of slaves, which are configured in the `ENI` file

Number of DC slaves:
Number of slaves with DC support, which were found from master on the network

DC in-sync:
Signals that all slaves with DC support are correctly synchronized or not. If not all slaves are correctly synchronized, please refer the *Message Window* for more information.

Topology OK:
Signals that topology is “okay” or not. If topology is not “okay”, you have a mismatch between the configured bus and the currently connected bus. Please open the ‘Network Mismatch Analyzer’ (Menu Network Network Mismatch Analyzer) to solve the problem.

Link Connected:
Signals the link is connected.

Slaves in Master State:
Signals that all slaves are in master state.

Frame Counter

Sent frames:
Number of sent frames

Lost frames:
Number of lost frames

Cyclic frames:
Number of cyclic frames

Acyclic frames:
Number of acyclic frames

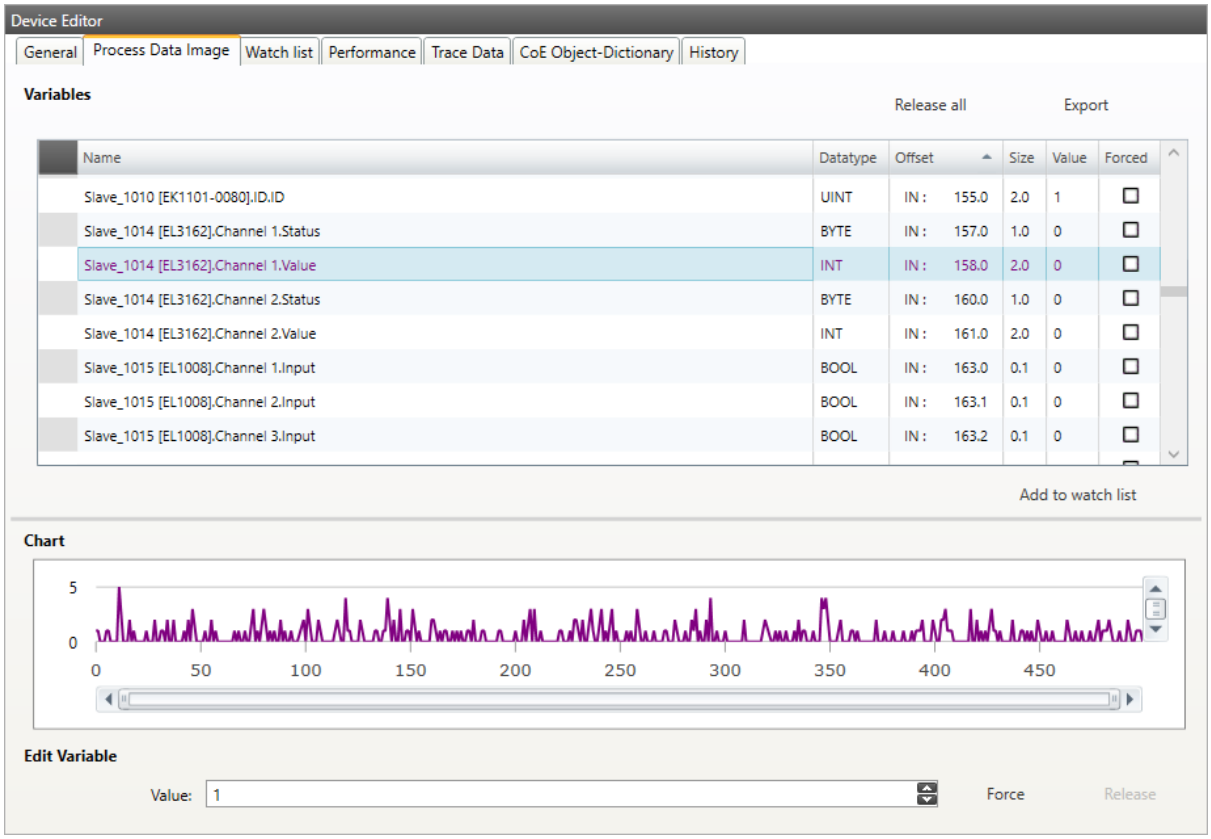
Memory Usage

Current:
Current memory usage in bytes

Max:
Maximum memory usage in bytes

6.2.2 Process Data Image

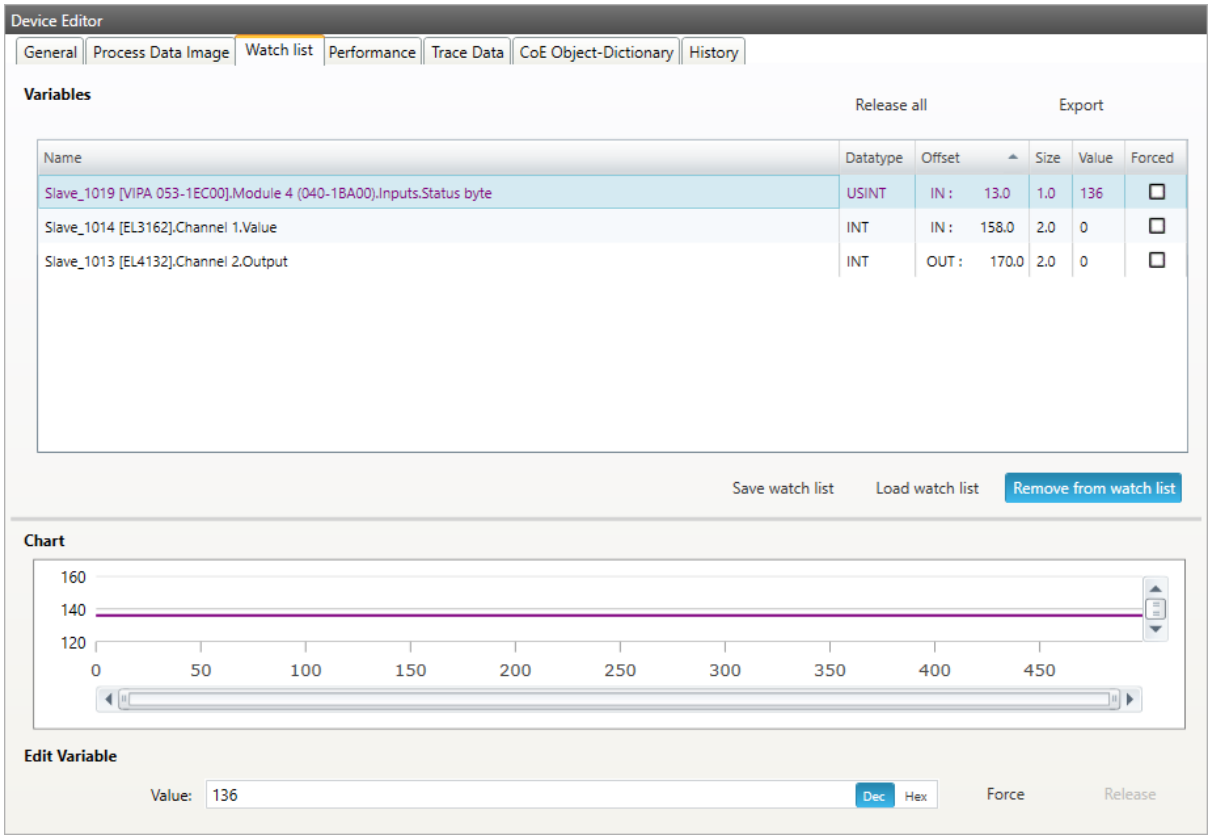
In this tab, the user can see and change the values of the process variables. The variables will be forced to the value the user entered. The user can press release to release the variable. If one or two variables are selected, a chart of the values is shown. Also resize and zoom is possible to see more details. The chart will be updated every 250 milliseconds:



It is also possible to add the variables to a watch list (next chapter).

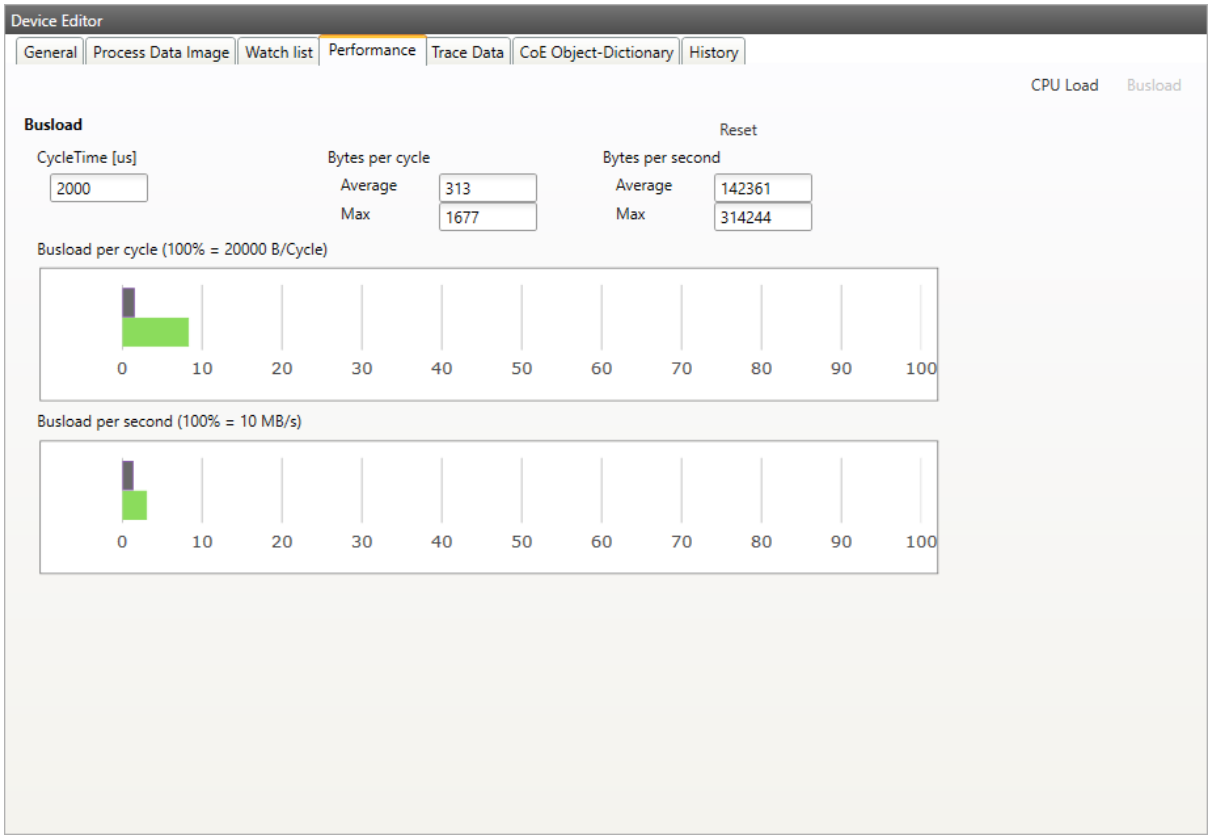
6.2.3 Watch list

In this tab, the user can monitor selected variables. He can go through the slaves and add variables to the watch list to monitor them. The user can also export or import the watch list, so changes can be saved:

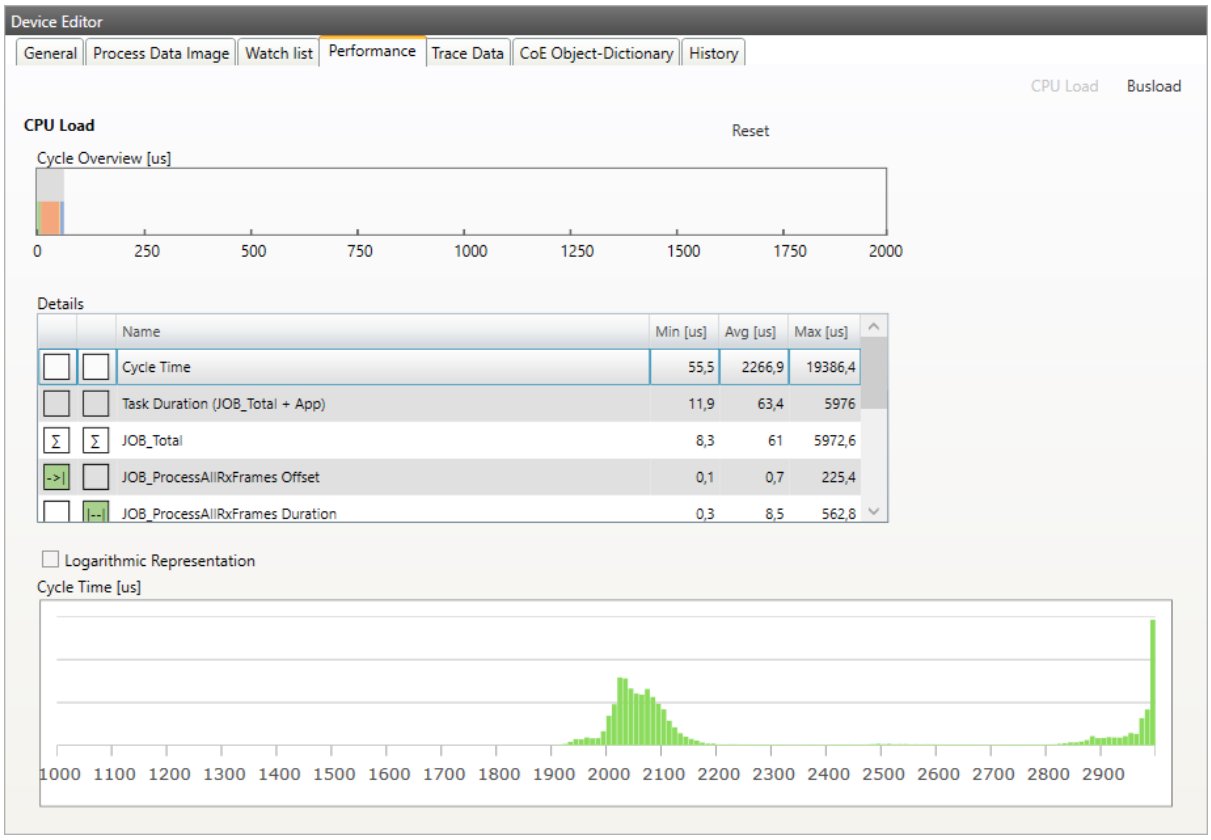


6.2.4 Performance

This tab is split into two sub tabs. On one the user can see the busload per cycle and per second:

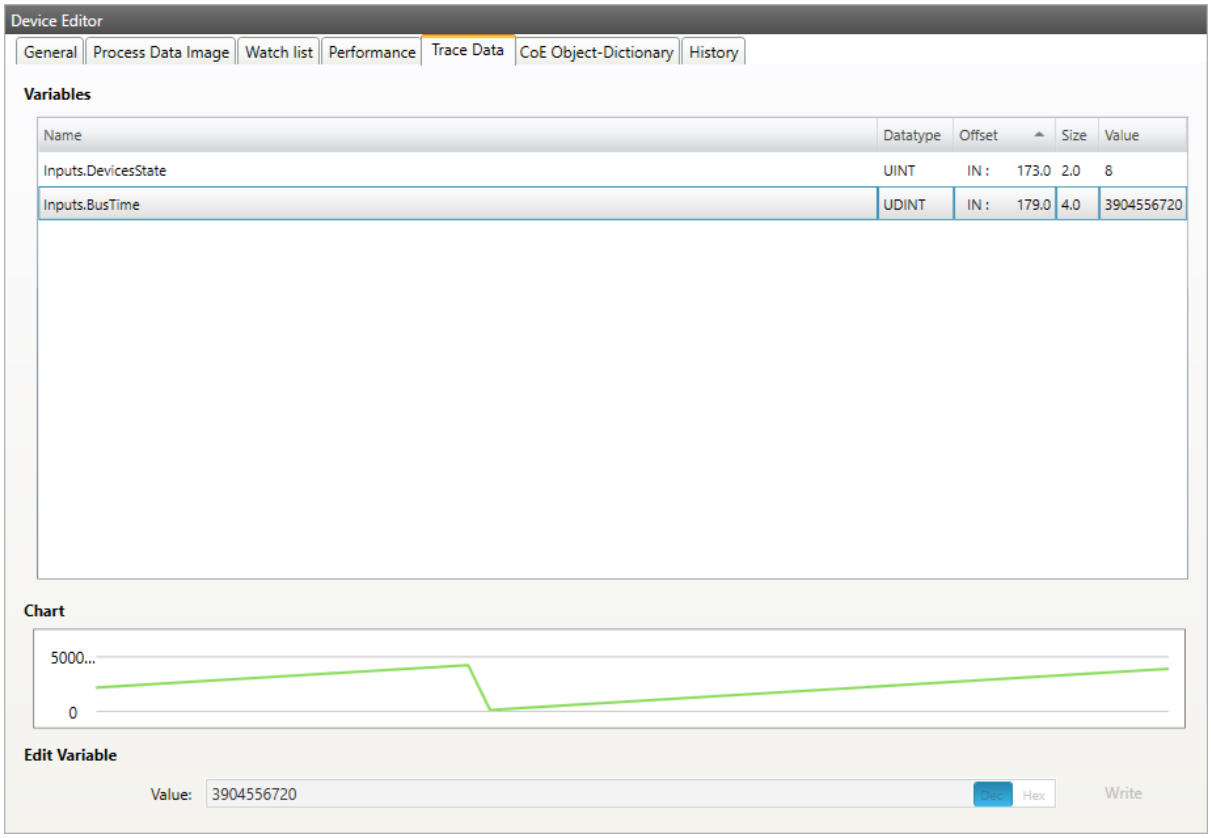


On the other tab the user can the CPU load. In the grid is a list of all running jobs and how long they take. In the diagram above is a summary of all jobs. When a job is selected, the chart shows how many times a job has taken how long to complete.



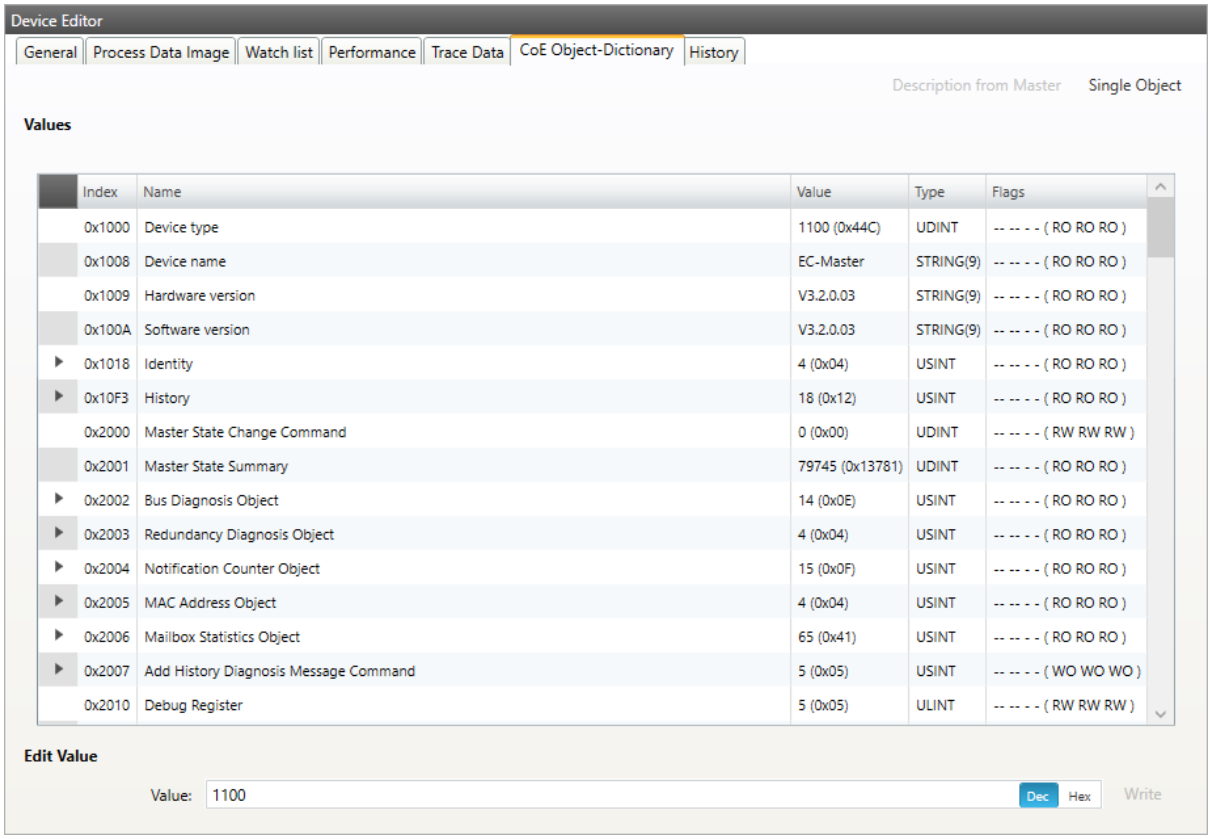
6.2.5 Trace Data (Expert)

In this tab, the user can see and change the values of the trace variables. If he selects a variable he will see a chart of the values. The chart will be updated every 250 milliseconds:



6.2.6 CoE Object-Dictionary (Expert)

In this tab, the user can see and change the values of the object dictionary of the master:



Lists of CoE Object-Dictionary entries

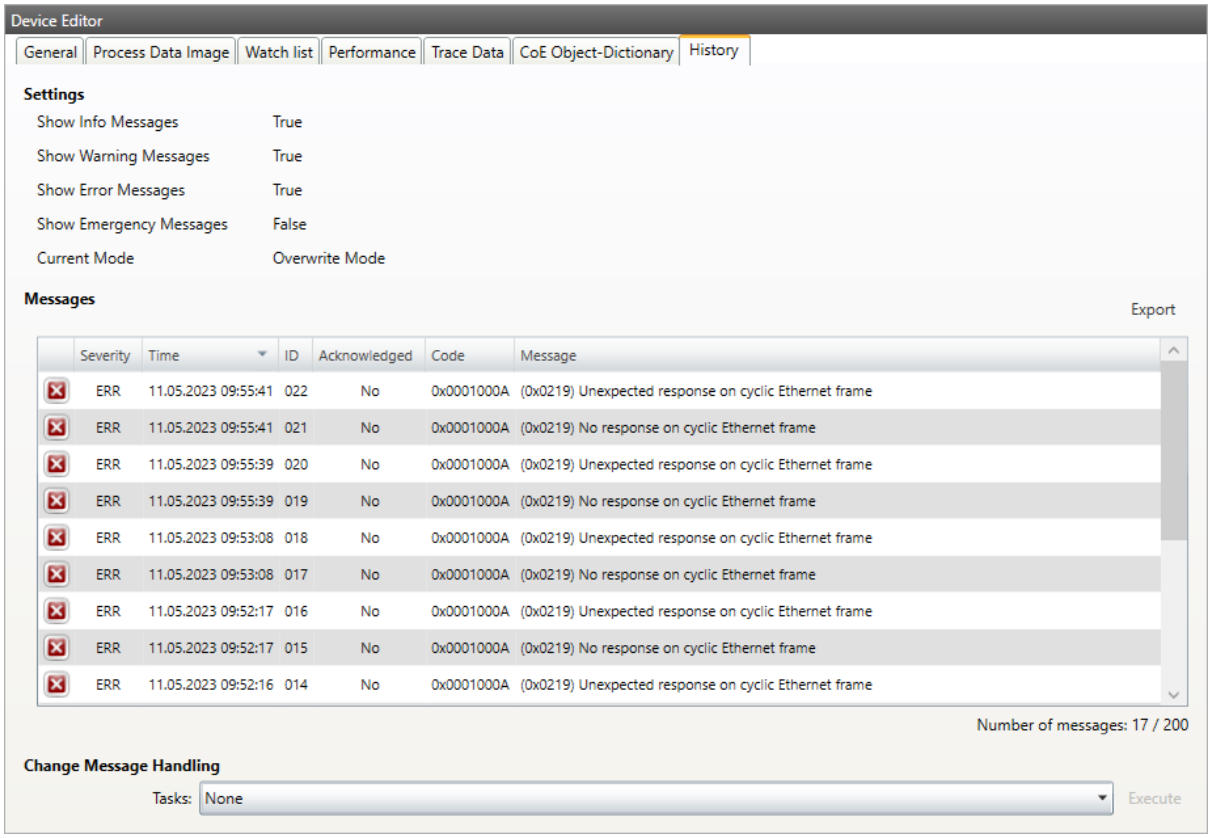
- Entries are uploaded by the master from the slave
- **The "Flags" column tells the user if this entry is an PDO entry and if it can be edited**
  - "AA BB (CC DD EE)"
  - AA = Mapping as RX PDO or not
  - BB = Mapping as TX PDO or not
  - CC = Access rights for PreOp (RO, WO, RW)
  - DD = Access rights for SafeOp (RO, WO, RW)
  - EE = Access rights for Op (RO, WO, RW)

Buttons

Update:
Changes the selected entry

6.2.7 Master History (Expert)

In this tab, the user can see and change the diagnosis history of the master (Supported from EC-Master V2.7 and above). It is also possible to export the data:



Settings

Show Info Messages:
Info messages will be collected from master

Show Warning Messages:
Warning messages will be collected from master

Show Error Messages:
Error messages will be collected from master

Show Emergency Messages:
Not supported from master

Current Mode:
Overwrite Mode: Messages will be overwritten if buffer is full Acknowledge Mode: Not supported from master

Messages
List of history messages

Change Message Handling

Enable/Disable Info Messages:
Enable or disable info messages

Enable/Disable Warning Messages:
Enable or disable warning messages

Enable/Disable Info Messages:
Enable or disable info messages

Enable/Disable Error Messages:
Enable or disable error messages

Enable Acknowledge Mode:
Enable acknowledge mode

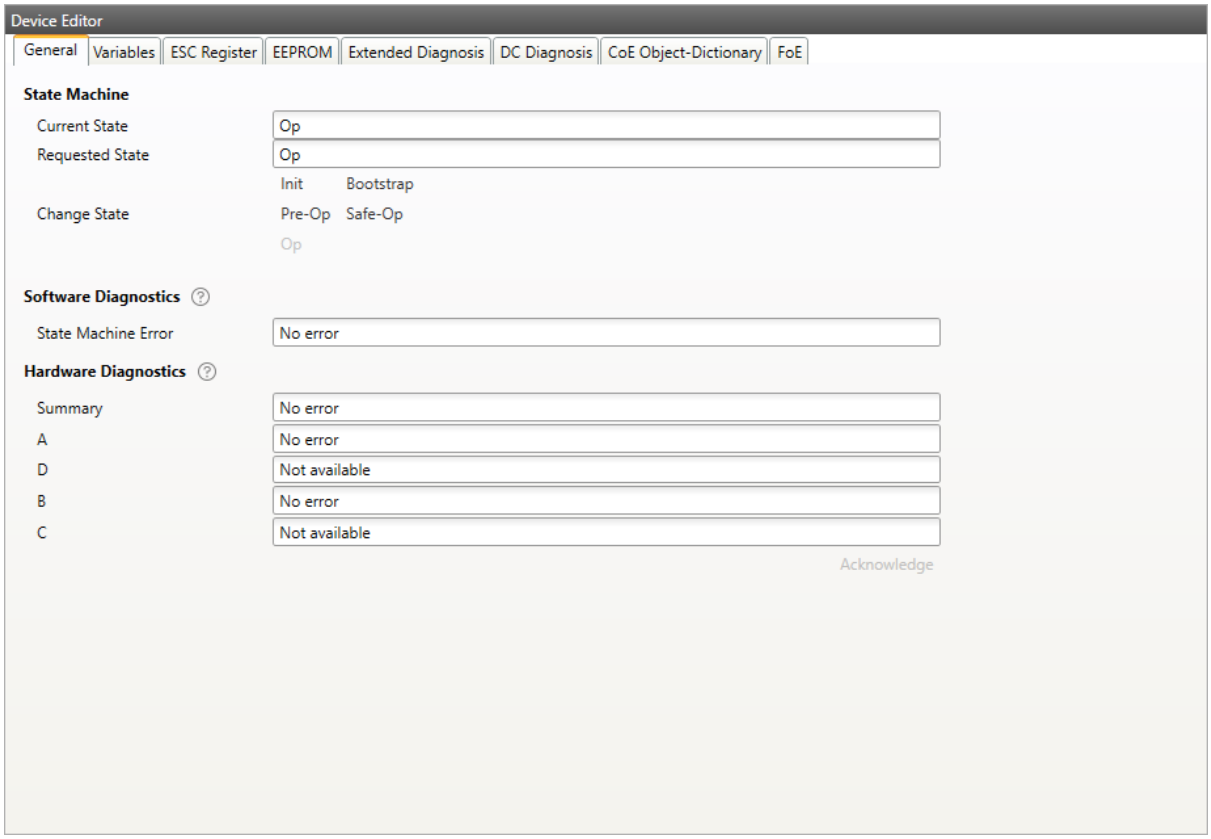
Clear All Messages:
Clear all messages

6.3 Slave

This section shows the current “health” state of the selected slave and helps the user to analyze slave related problems.

6.3.1 General (Slave)

In this tab, the user can see and change the current state of the state machine of the slave. He can see and clear also the current error state of the slave:



State Machine

Current State:
Current state of the selected slave

Requested State:
Requested state of the selected slave

Change State:
Slave can reach the states INIT, BOOTSTRAP, PRE-OP, SAFE-OP and OP.

Note: The BOOTSTRAP mode can only be reached from the INIT state.

Software Diagnostics

State Machine Error:
Slave error which occurred during state transition

Hardware Diagnostics

Summary:
Summary of hardware diagnostics

Port A:
Port specific error

Port D:
Port specific error

Port B:
Port specific error

Port C:
Port specific error

Buttons

Acknowledge:
Acknowledge the current error state and notify the user again if error state was changed again.

Possible warning and errors:

Disturbed Connection:
There may be problems in the connection between two slaves. The message will tell either that there is a problem between two slaves or two ports. The warning appears if error counters are increased (Invalid Frame: 0x300-0x306, RX Errors: 0x301-0x307, Lost Link: 0x308-0x30B). The value from which a warning is issued can be set in the User.xml files in C:ProgramDataEC-Engineer. More information below.

Bad Connection:
The same as “Disturbed Connection” but the error counters are higher. The value from which an error is issued can be set in the User.xml files in C:ProgramDataEC-Engineer. More information below.

Line break:
A line break is detected before a slave. This error is detected by looking at the topology.

Link missing:
A link is missing on input port of the slave. This error is detected by looking at the topology.

Multiple warnings:
There are multiple warning for this port.

Multiple errors:
There are multiple errors for this port.

Multiple warnings and errors:
There are multiple warning and errors for this port.

State Machine:
See ETG1020 “Description of AL Status Codes” or ETG.1000.6. This error is detected by looking at the AL Status (0x130).

How to solve errors?

- Lost Link errors are often caused by the power supply system
- Helpful might be the usage of an extra power supply
- It is recommended to clear all error counters after startup

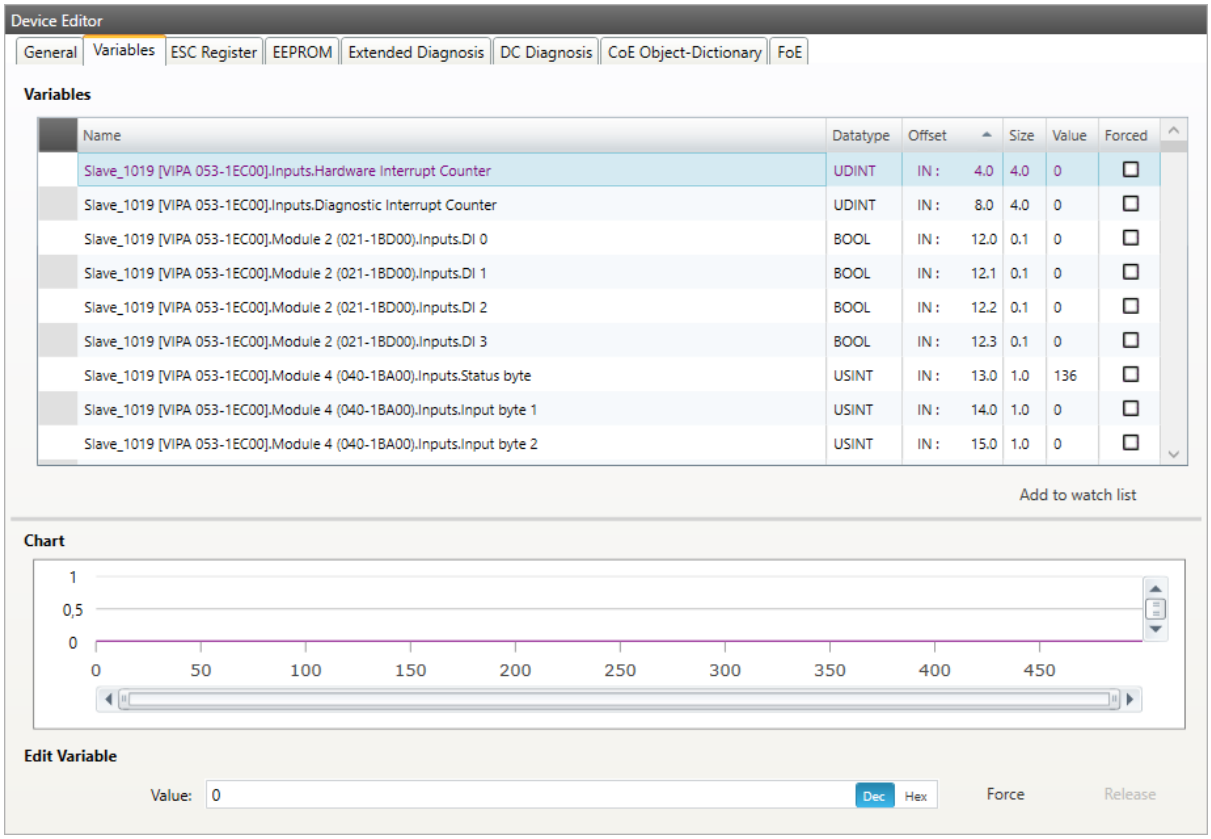
How to change amount of errors leading to a warning or error:

- Open C:ProgramDataEC-Engineer
- Search for DiagGeneral
- **Change the values which should be adjusted**
  - LostLink: The value entered is used
  - All others are calculated depending on the amount of cyclic frames: (Value / CyclicFrames) x 10^6

Note: Please refer also the “ETG.1600 EtherCAT Installation Guideline”: http://www.ethercat.org/ETG1600.

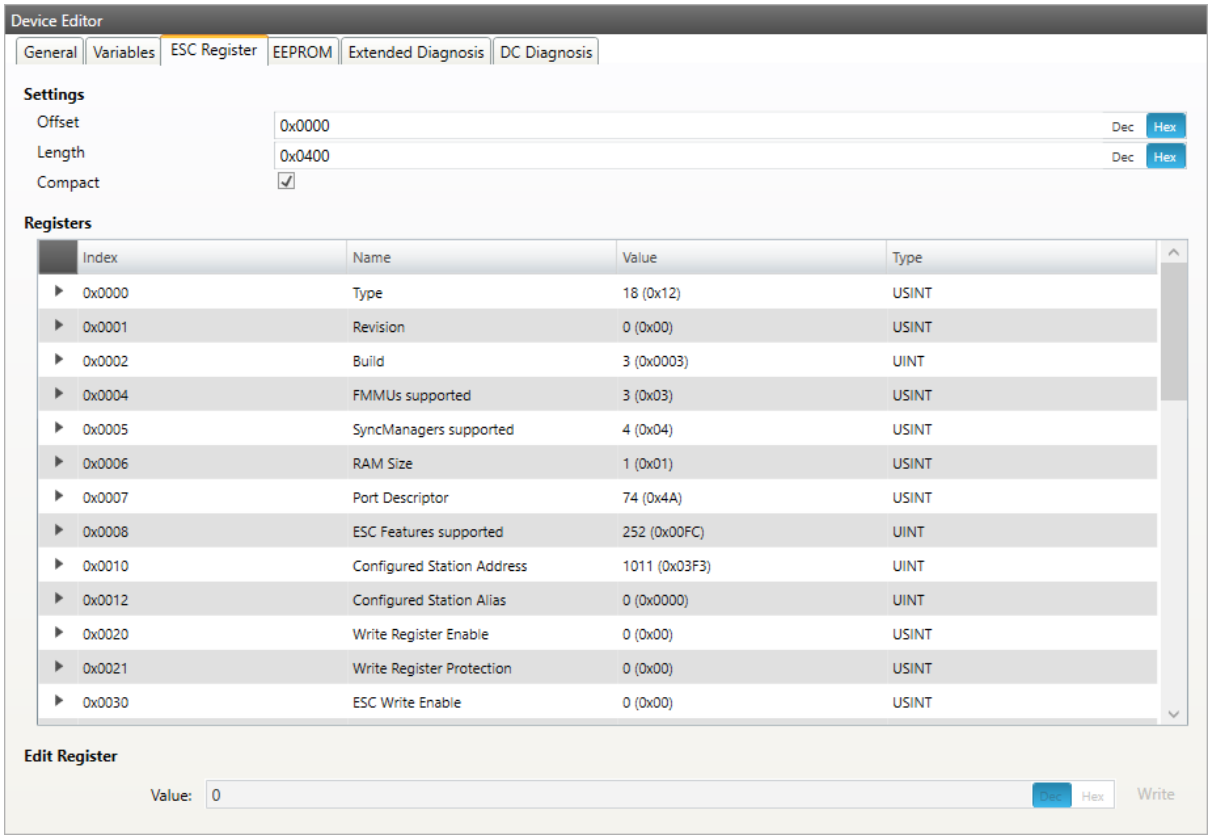
6.3.2 Variables

In this tab, the user can see and change the values of the process variables. The variables will be forced to the value the user entered. The user can press release to release the variable. If one or two variables are selected, a chart of the values is shown. Also resize and zoom is possible to see more details. The chart will be updated every 250 milliseconds:



6.3.3 ESC Register (Expert)

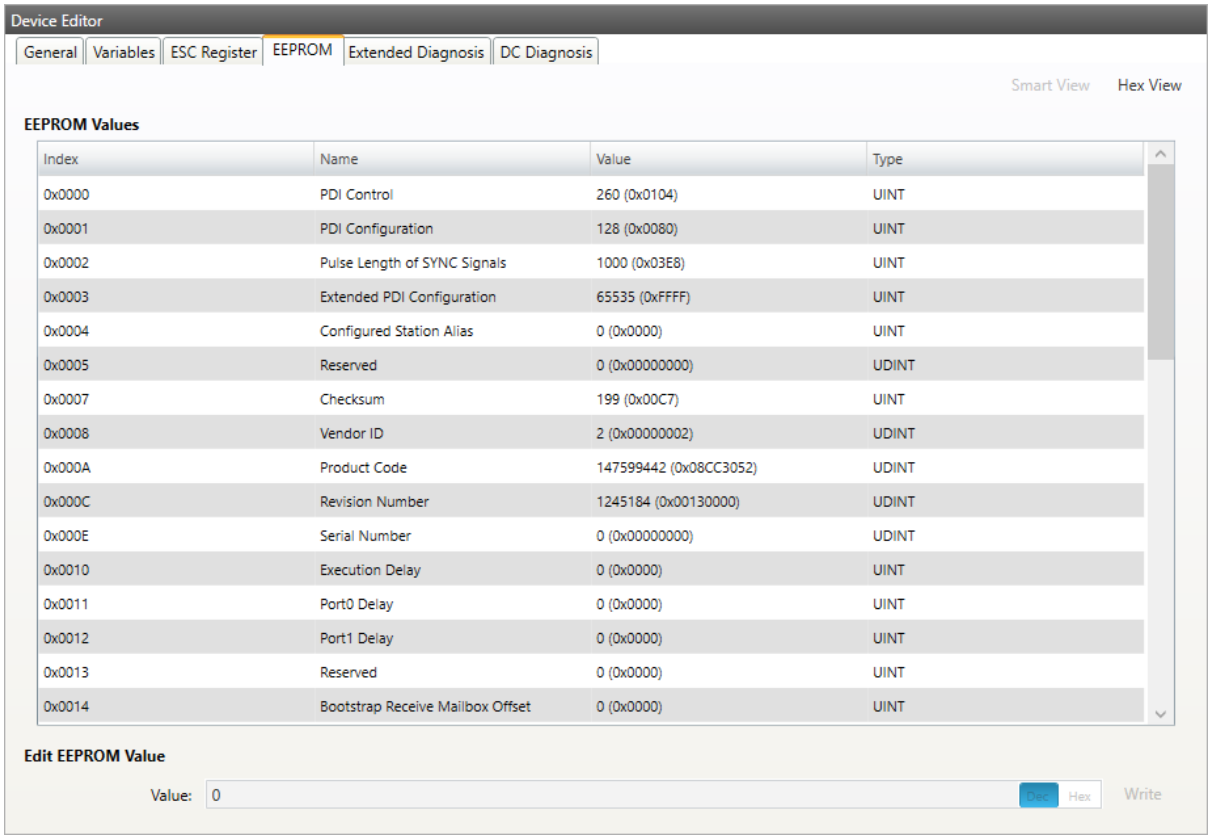
In this tab, the user can see and change the values of the registers. In the settings section he can set the offset and the length. If he activates the compact view, he will only see the registers which have a description:



6.3.4 EEPROM (Expert)

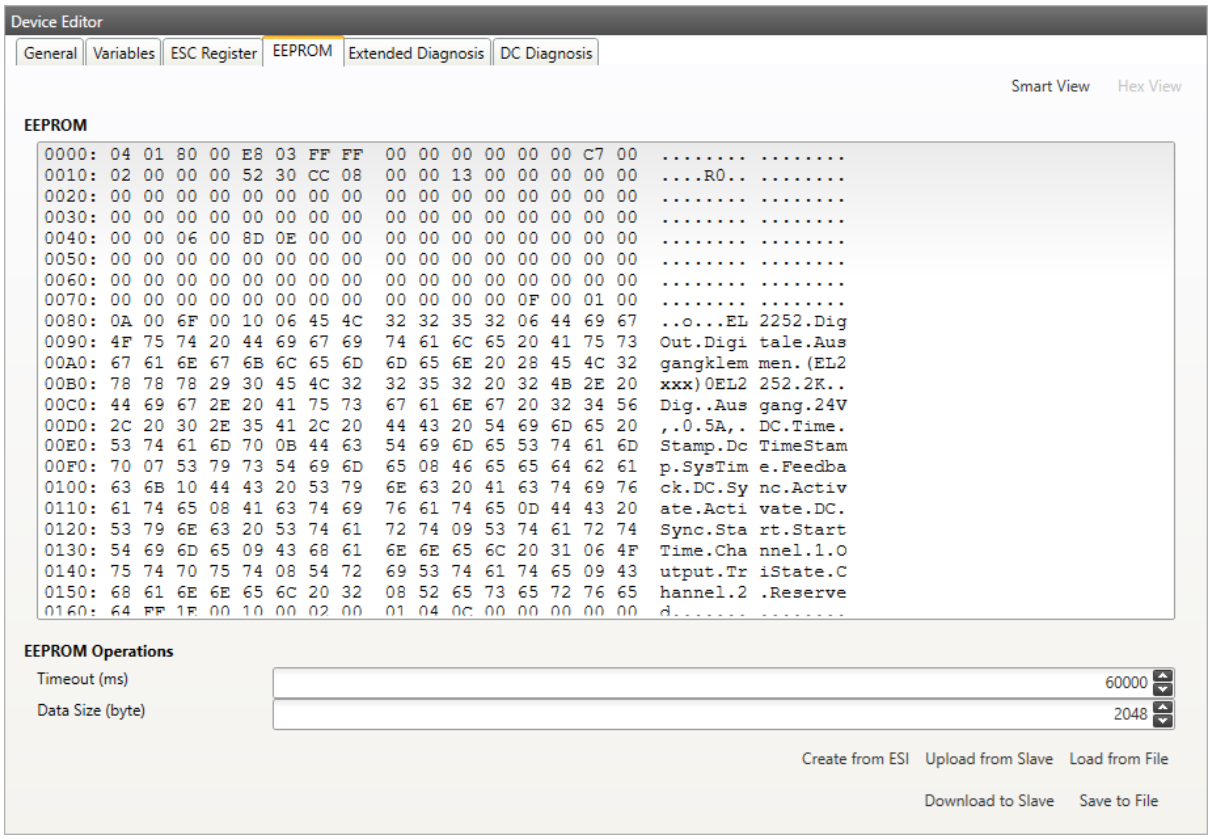
This tab consists of 2 views:

Smart View
: In this view, the user can see and change the values of the EEProm.



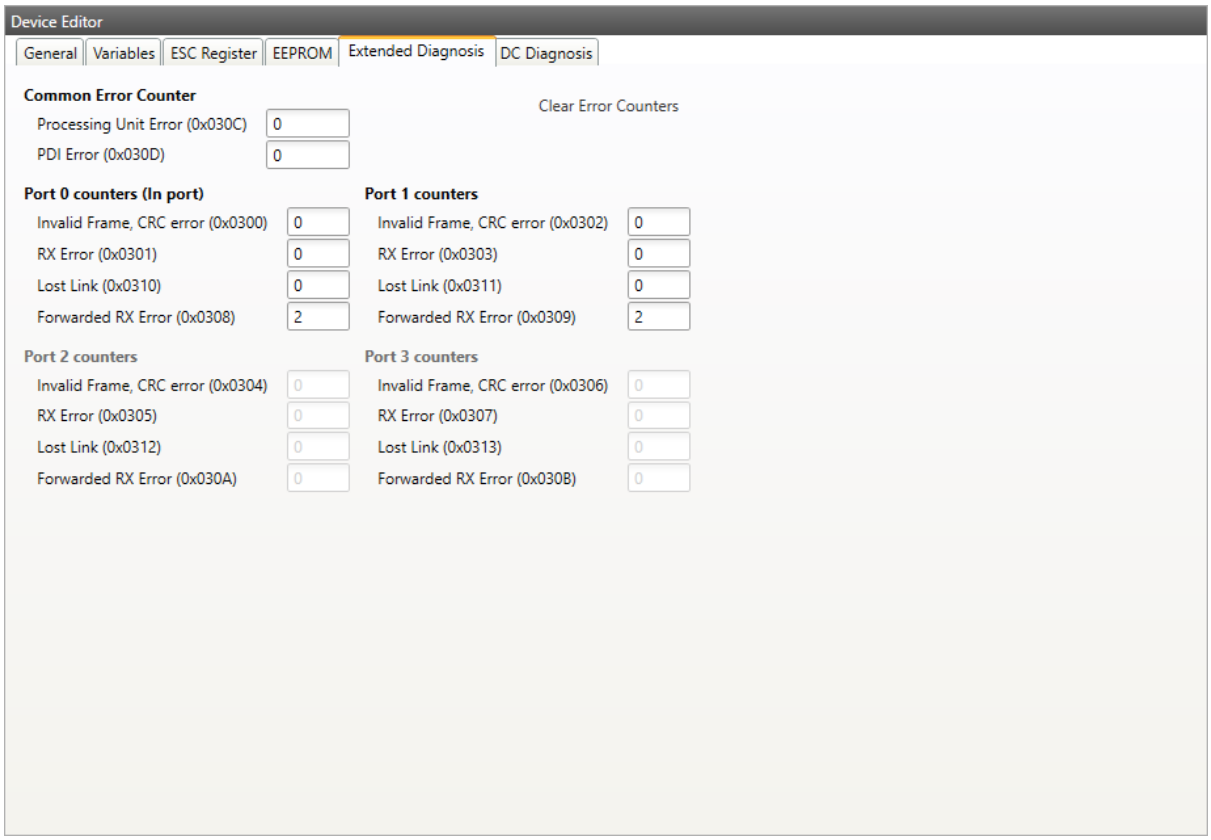
Hex View

In this view, the user can create an EEPROM from an `ESI` file, upload the EEPROM from the slave, load an EEPROM from the disk, download the EEPROM to the slave or save the EEPROM to disk.



6.3.5 Extended Diagnosis (Expert)

In this tab, the user can see the extended diagnosis information:



Common Error Counter

Processing Error Counter:
Indicates that slave received “not EtherCAT frames”, which are not allowed in the EtherCAT segment (of course acceptable in a test environment)

PDI Error Counter:
Counts if a PDI access has an interface error (read from register: 0x30D)

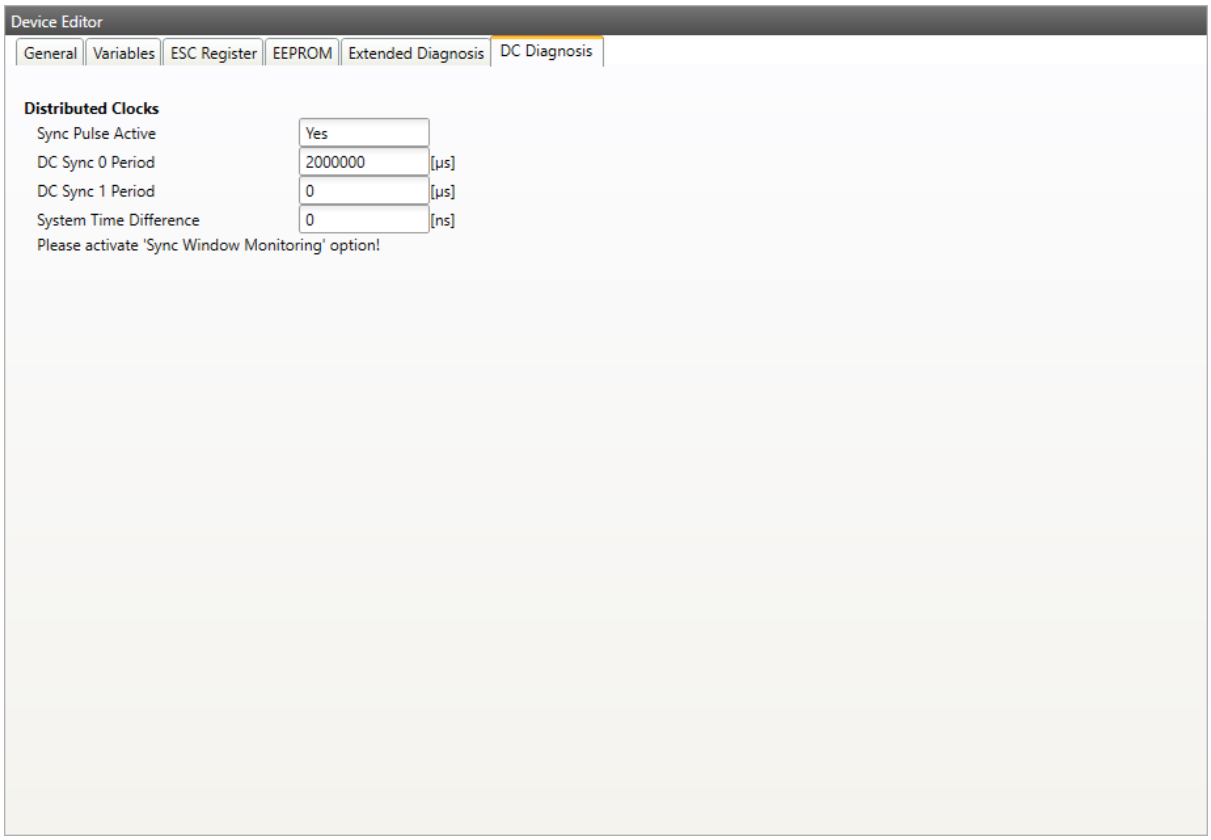
Port 0..3

- Invalid Frame Counter of Port y (read from register: 0x0300+y*2)
- RX Error Counter of Port y (read from register: 0x0300+y*2+8Bit)
- Lost Link Counter of Port y (read from register: 0x0310+y)
- Forwarded RX Error Counter of Port y (read from register: 0x0308+y)

Note: All error counters can be cleared by clicking on *Clear Error Counters* of the context menu of the master.

6.3.6 DC Diagnosis (Expert)

In this tab, the user can see all DC related values of the slave:



Distributed Clock

Sync Pulse Active:
Sync pulse was received or not

DC Sync 0 Period:
Configured period for sync unit 0

DC Sync 1 Period:
Configured period for sync unit 1

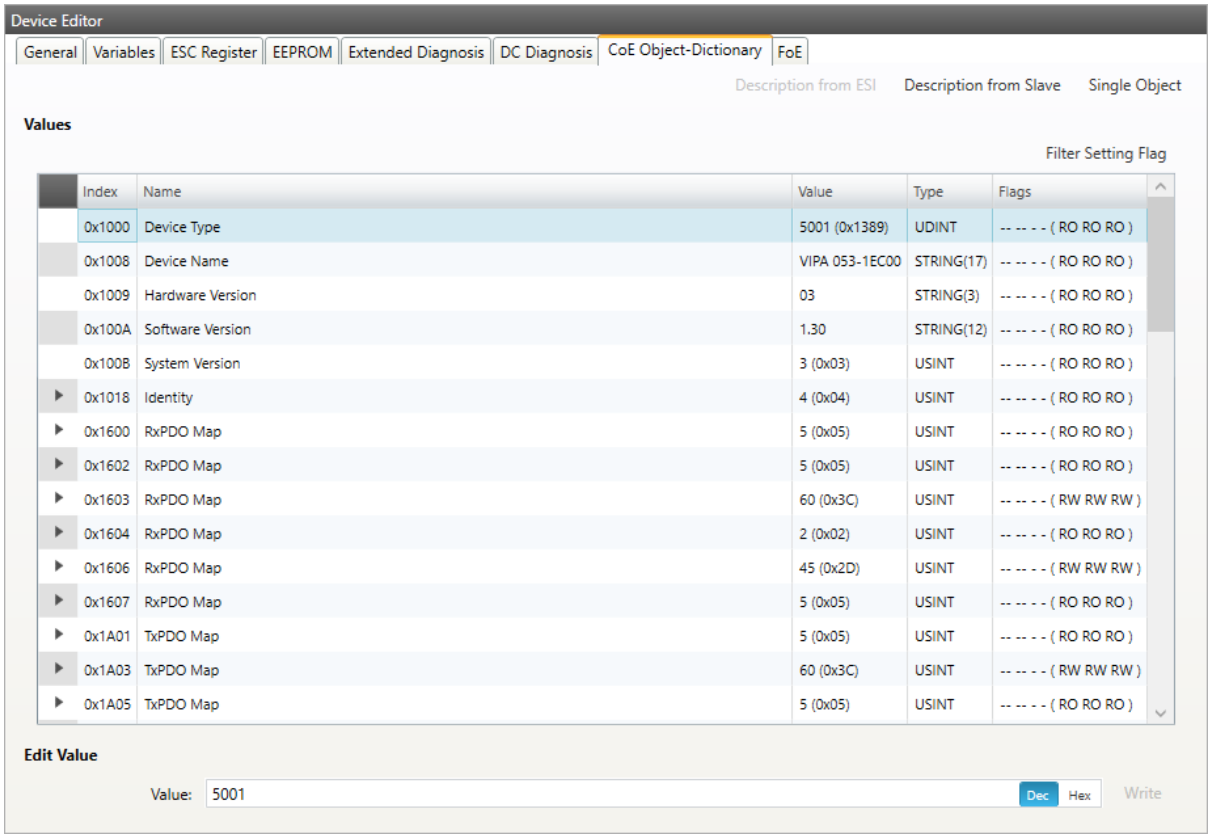
System Time Difference:
Time difference of slave clock to reference clock

Note: The option “Sync Window Monitoring” must be enabled (see *Distributed Clocks (Expert)*).

6.3.7 CoE Object-Dictionary

This tab consists of 3 modes (in user mode, only the description from ESI or slave is available):

Description from ESI
In this tab, the user can see the description of the object dictionary from ESI and the values from the slave. He can also change the values.



Lists of CoE Object-Dictionary entries

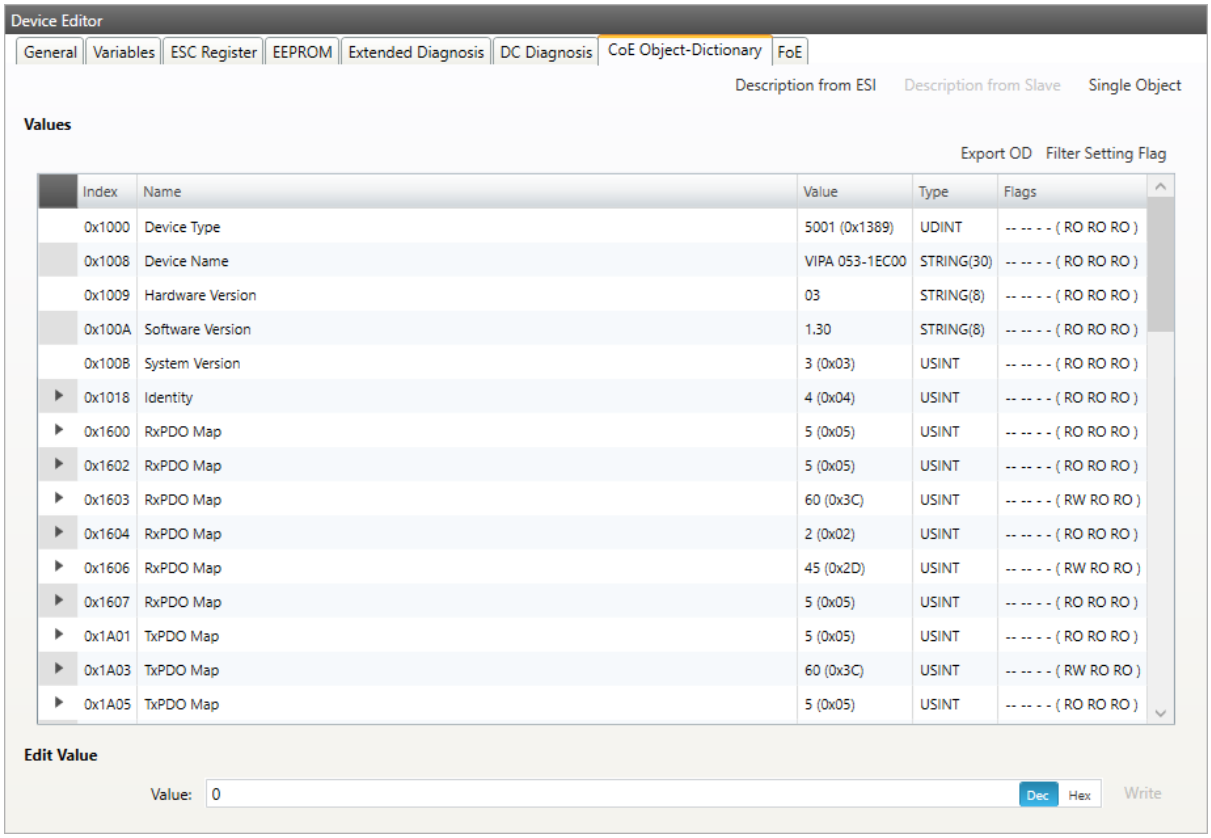
- Entries comes from ESI
- **The "Flags" column tells the user if this entry is an PDO entry and if it can be edited**
  - "AA BB C D (EE FF GG)"
  - AA = Mapping as RX PDO or not
  - BB = Mapping as TX PDO or not
  - C = Backup Flag
  - D = Settings Flag
  - EE = Access rights for PreOp (RO, WO, RW)
  - FF = Access rights for SafeOp (RO, WO, RW)
  - GG = Access rights for Op (RO, WO, RW)

Buttons

Write:
Writes the selected entry

Description from Slave

In this tab, the user can see the description of the object dictionary and the values from slave. He can also change the values and has the possiblillty to export the object dictionary.



Lists of CoE Object-Dictionary entries

- Entries are uploaded from the slave (if “SDO Information Service” is supported)
- **The “Flags” column tells the user if this entry is an PDO entry and if it can be edited**
  “AA BB C D (EE FF GG)” - AA = Mapping as RX PDO or not - BB = Mapping as TX PDO or not - C = Backup Flag - D = Settings Flag - EE = Access rights for PreOp (RO, WO, RW) - FF = Access rights for SafeOp (RO, WO, RW) - GG = Access rights for Op (RO, WO, RW)

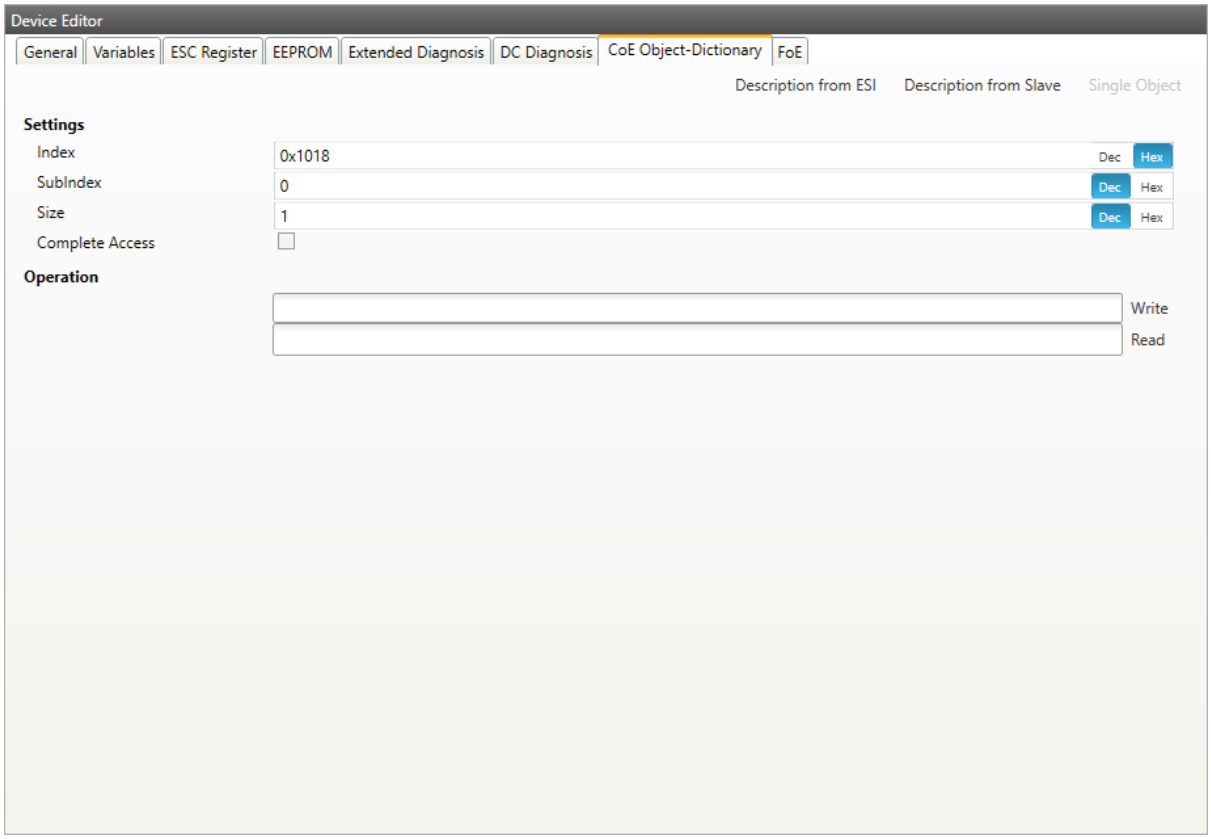
Buttons

Write:

Writes the selected entry

Single Object

In this tab, the user can read and write the values of the object dictionary of the slave.



Settings

Index:
Index of the CoE value

SubIndex:
SubIndex of the CoE value

Size:
Size of the CoE value (only used for reading)

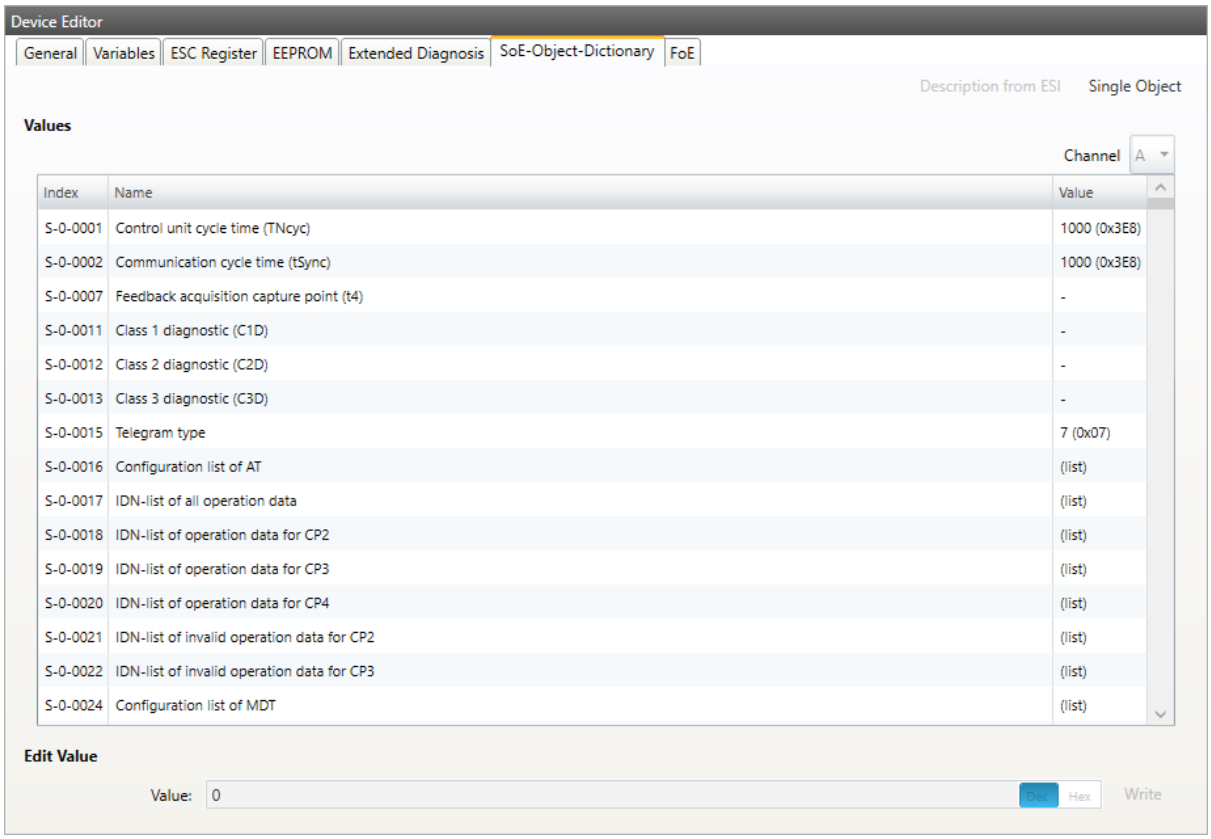
Complete Access:
Activate, if complete access mode should be used for reading or writing the CoE value (can be used only if it is supported from slave)

Operation

Write:
Writes the value to the slave (Hex format, like: “00 11 22 33 …”)

Read:
Reads the value from slave (Hex format, like: “00 11 22 33 …”)

6.3.8 SoE Object-Dictionary



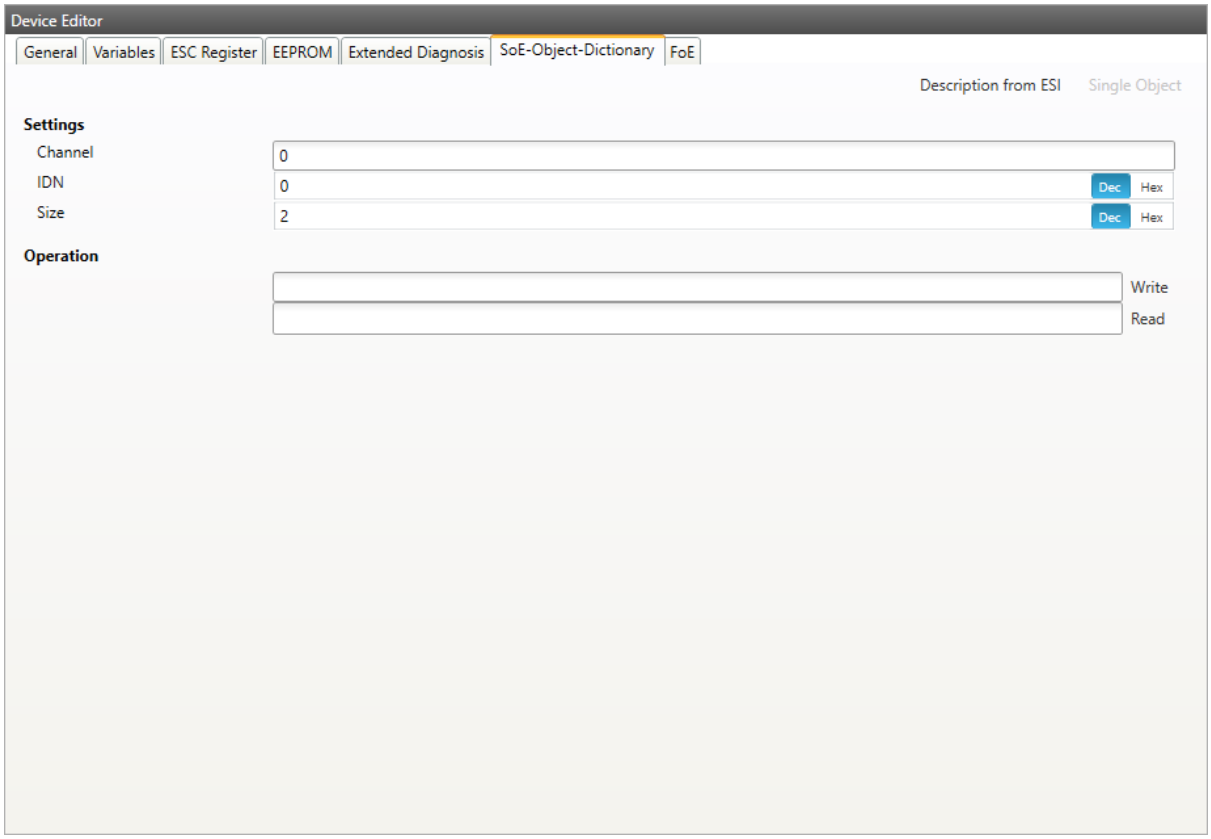
Lists of SoE Object-Dictionary entries

- Values are uploaded by the master from the slave
- Entries comes from the `ESI`

Buttons

Write:
Writes the selected entry

Expert View
In this tab, the user can read and write the values of the object dictionary of the slave:



Settings

Channel:
Channel of the SoE value

IDN:
Index of the CoE value

Size:
Size of the CoE value (only used for reading)

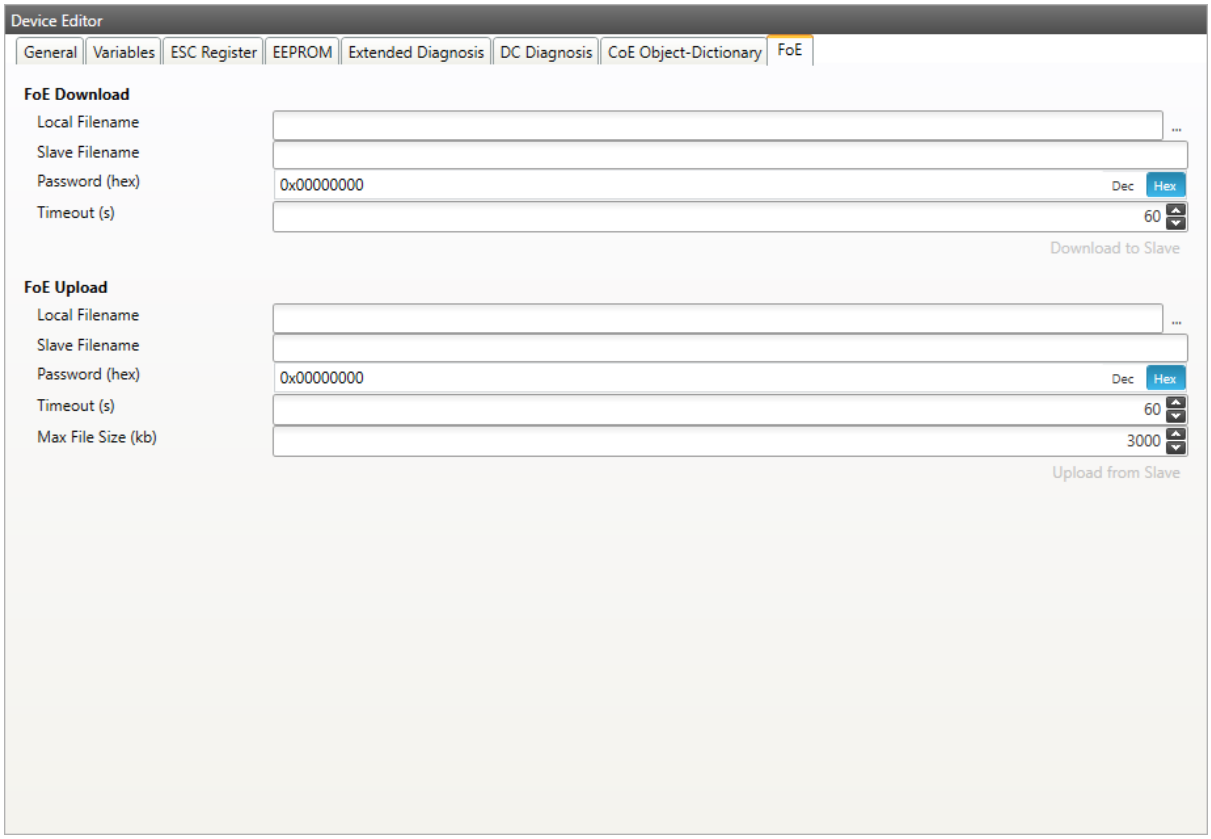
Operation

Write:
Writes the value to the slave (Hex format, like: “00 11 22 33 …”)

Read:
Reads the value from slave (Hex format, like: “00 11 22 33 …”)

6.3.9 File over Ethernet (FoE)

In this tab, the user has the possibility to download or upload a file to the slave:



FoE Operations

Local Filename:
Name of the file on the harddrive

Slave Filename:
Name of the file on the slave

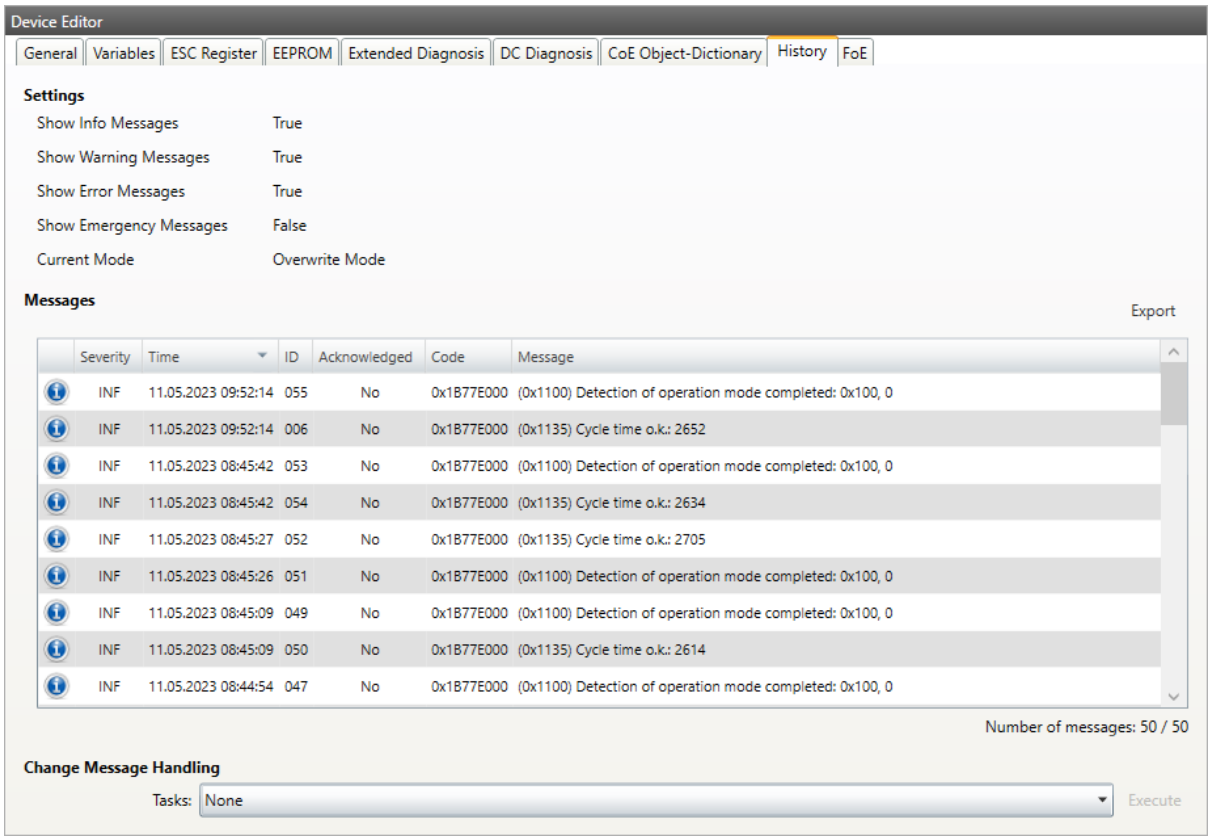
Password:
Password on the slave as a hex-number

Timeout:
Timeout for downloading or uploading the file in milliseconds

Max File Size:
Maximal file size which should be uploaded from the slave in kilo bytes

6.3.10 Slave History (Expert)

In this tab, the user can see and change the diagnosis history of the slave. It is also possible to export the data:



Settings

Show Info Messages:
Info messages will be collected from slave

Show Warning Messages:
Warning messages will be collected from slave

Show Error Messages:
Error messages will be collected from slave

Show Emergency Messages:
Emergency messages will be collected from slave

Current Mode:
Overwrite Mode: Messages will be overwritten if buffer is full Acknowledge Mode: Messages will be discarded if buffer is full

Messages
List of history messages

Change Message Handling

Enable/Disable Info Messages:
Enable or disable info messages

Enable/Disable Warning Messages:
Enable or disable warning messages

Enable/Disable Info Messages:
Enable or disable info messages

Enable/Disable Error Messages:
Enable or disable error messages

Enable/Disable Emergency Messages:
Enable or disable emergency messages

Enable Acknowledge Mode:
Enable acknowledge mode

Enable Overwrite Mode:
Enable overwrite mode

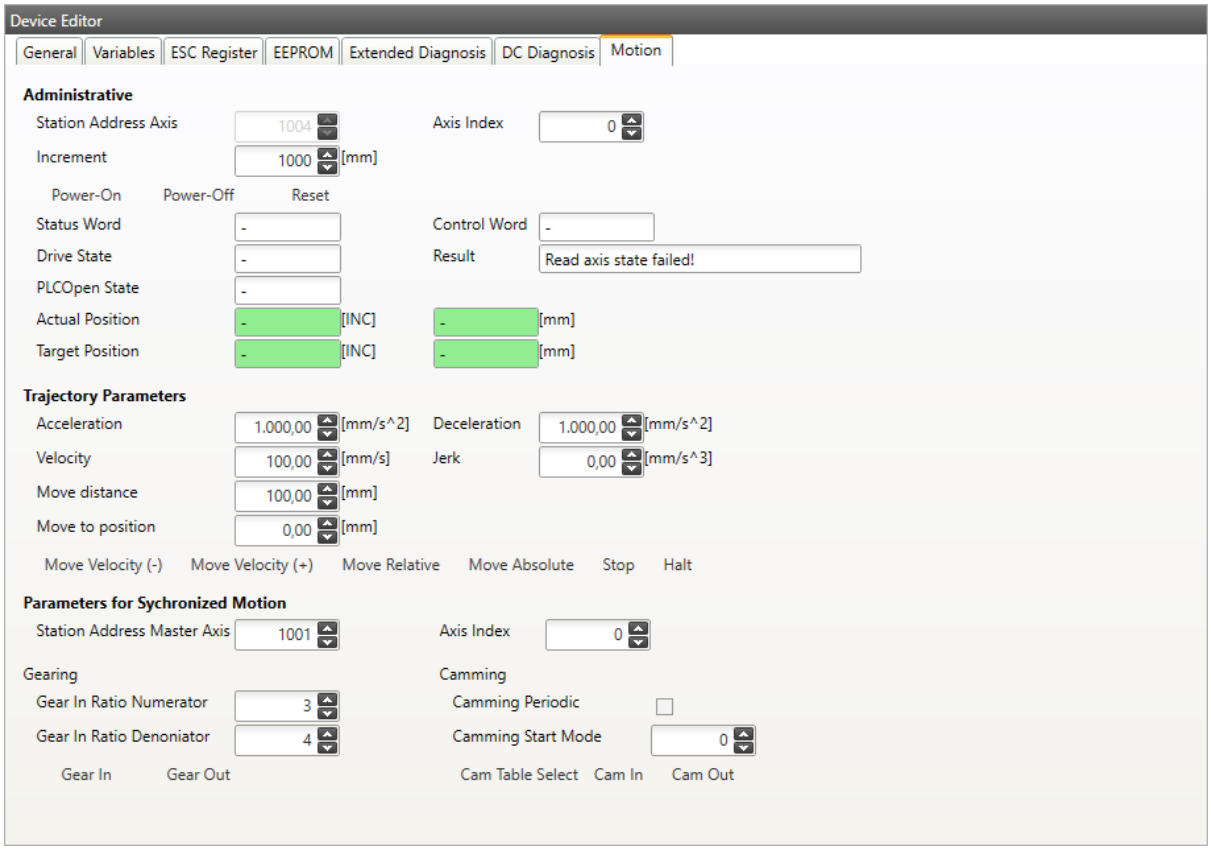
Clear All Messages:
Clear all messages (only available if “Overwrite Mode” is active)

Clear All Acknowledged Messages:
Clear all acknowledged messages (only available if “Acknowledge Mode” is active)

Acknowledge All Messages:
Acknowledge all messages, that they can be overwritten from new messages (only available if “Acknowledge Mode” is active)

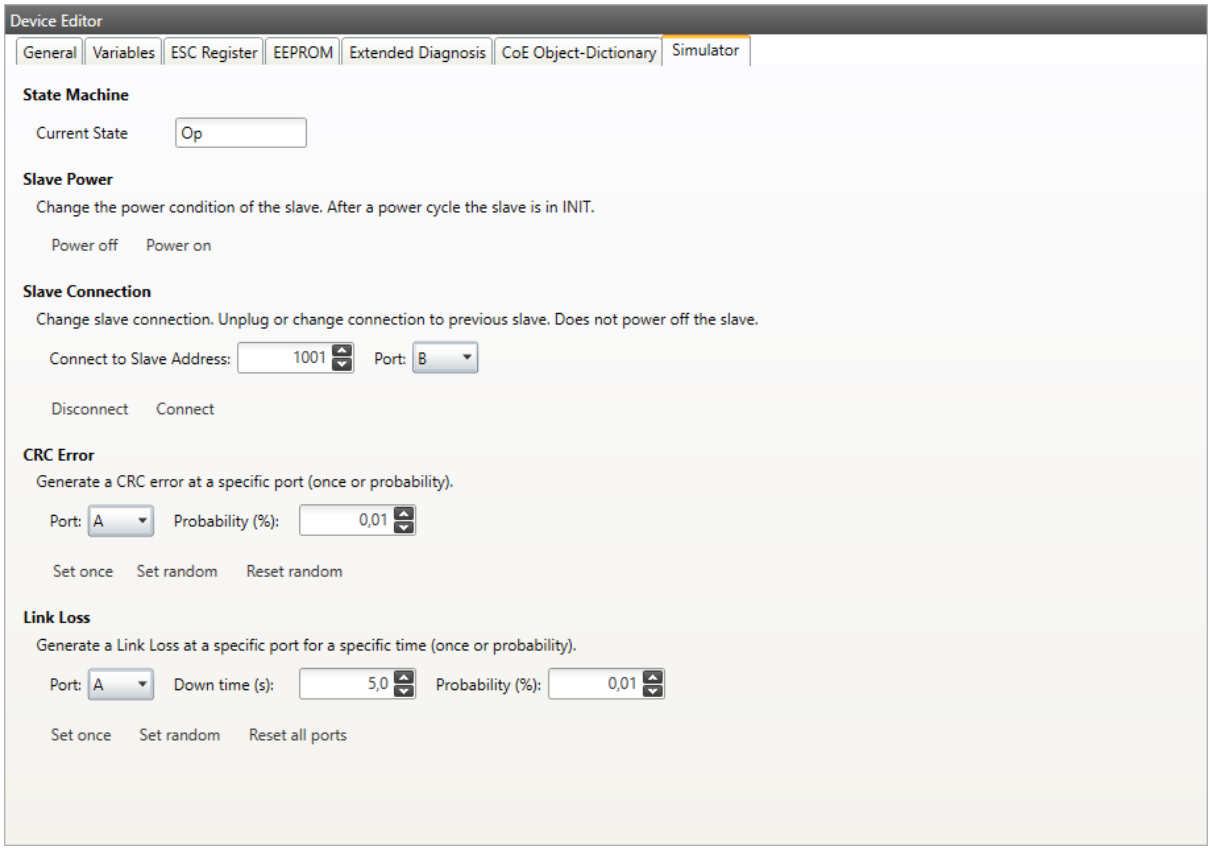
6.3.11 Motion (Motion Mode only)

In this tab, the user can see and change the motion settings of the slave. He can read important variables and change velocity and direction of the axis. Also gearing and camming are possible to use:



6.3.12 Simulator (Simulator only)

In this tab, the user can see and change the simulator settings of the slave. He can manipulate the slave e.g. power, disconnect and produce errors:



State Machine
Shows the current state of the slave

Slave Power

Power off:
Turn the slave power off

Power on:
Turn the slave on to Init state

Slave Connection

Disconnect:
Disconnect the slave. Slave will not be turned off

Connect:
Connect slave to selected address and port. Default is the port where the slave was connected before

CRC Error

Set once:
Create one CRC error at the selected port

Set random:
Generate CRC errors at the selected port with the selected probability until reset is executed

Reset random:
Reset the CRC generation

Link Loss

Set once:
Create one Link Loss at the selected port for the selected time

Set random:
Generate Link Losses at the selected port with the selected probability for the selected time until reset is executed

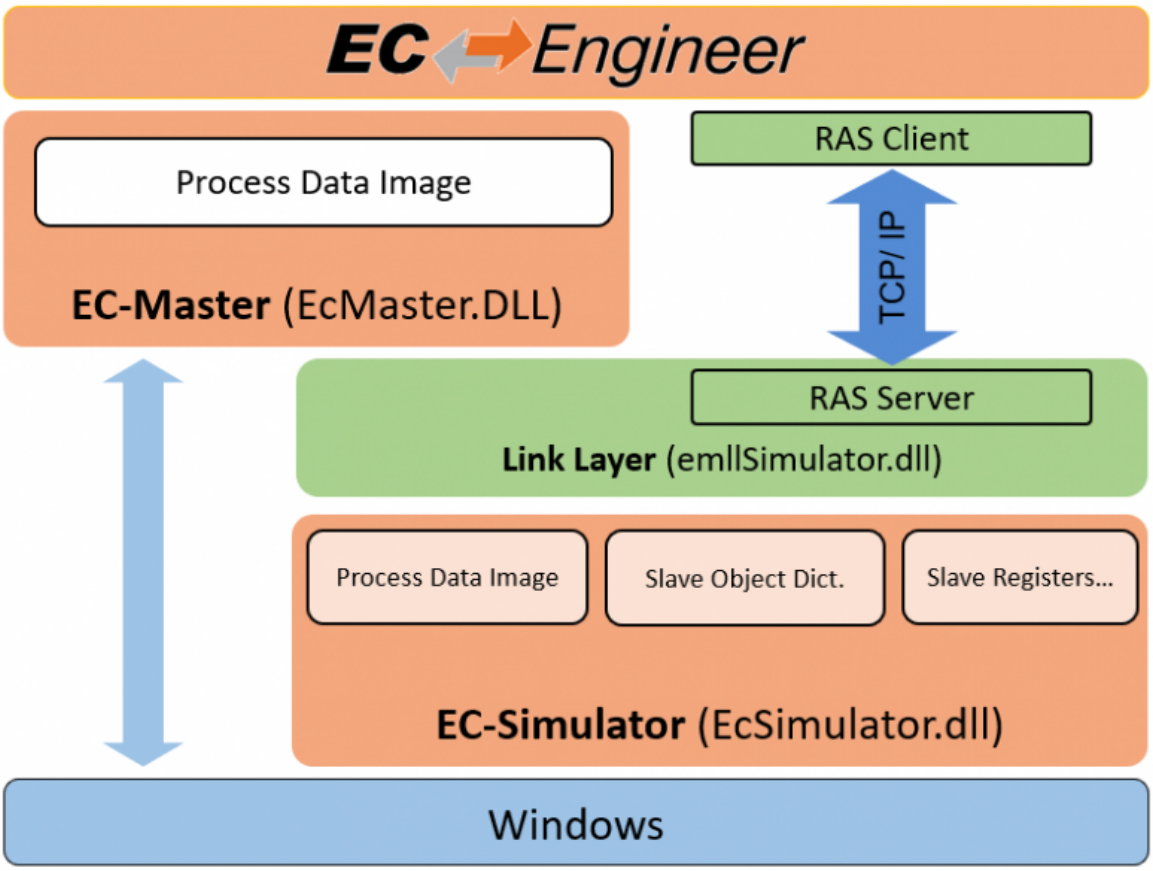
Reset random:
Reset the Link Loss on all ports

7 Simulator Mode

With the new EC-Engineer it is possible to use the EC-Simulator.

There are two possibilities:

1. The user can use the Simulator `EMI` file and create an `EXI` File to start the simulator. It is also possible to connect to a remote system with the running Simulator. More information about offline configuration and remote diagnosis can be found in the Getting Started Chapter.
2. The second possibility is, that the user has already a configuration with a master unit. Now the user can do a right click on the master unit and select: “Add EC-Simulator Unit (linked)”. A linked simulator unit is added. The user can change the connection settings of the simulator. Now, it is possible to start the master with the simulator link layer and also connect via RAS with the simulator node.

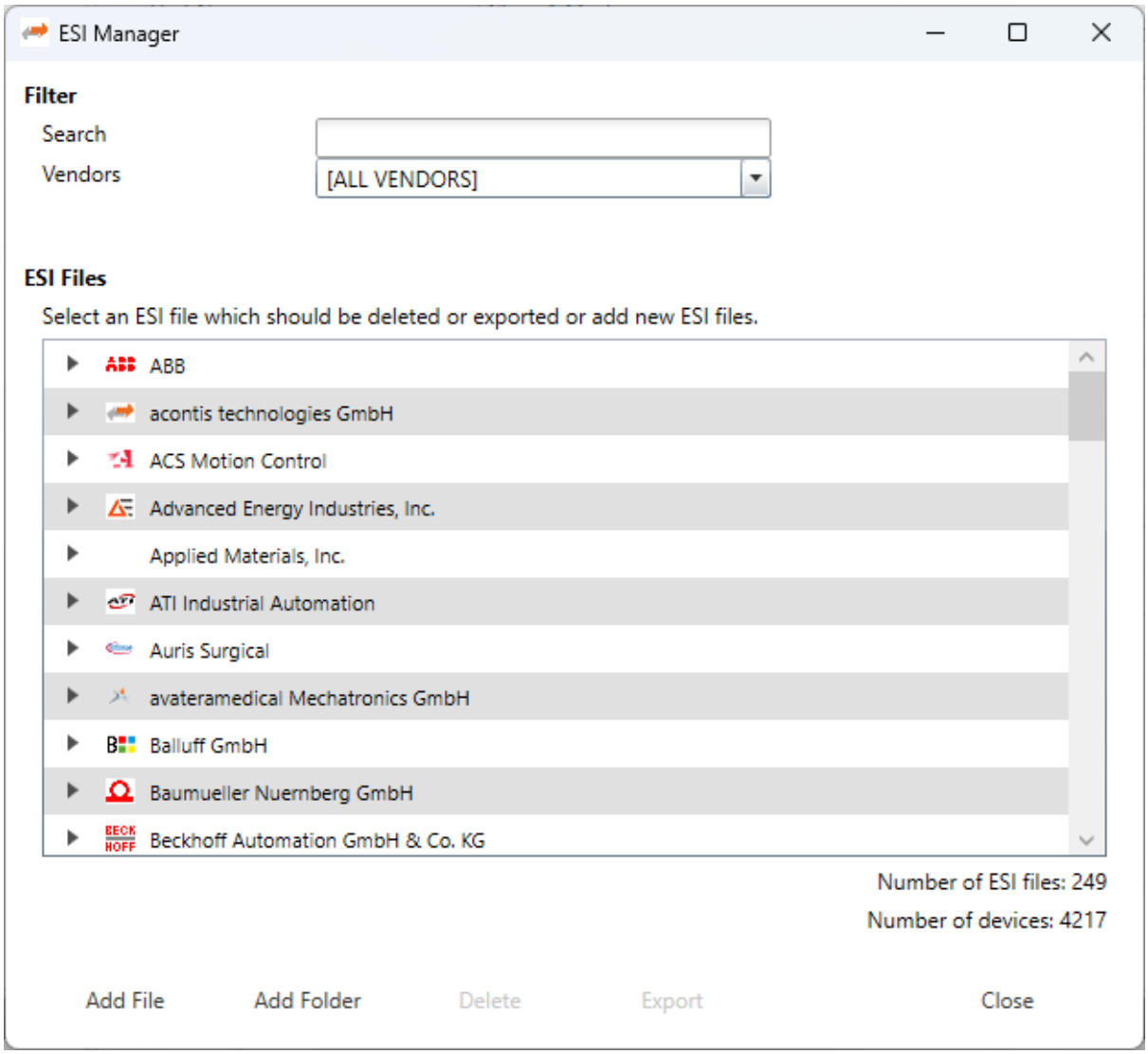


8 Additional Tools

8.1 ESI-Manager

ESI-Manager can be found through the main menu File -> ESI-Manager.

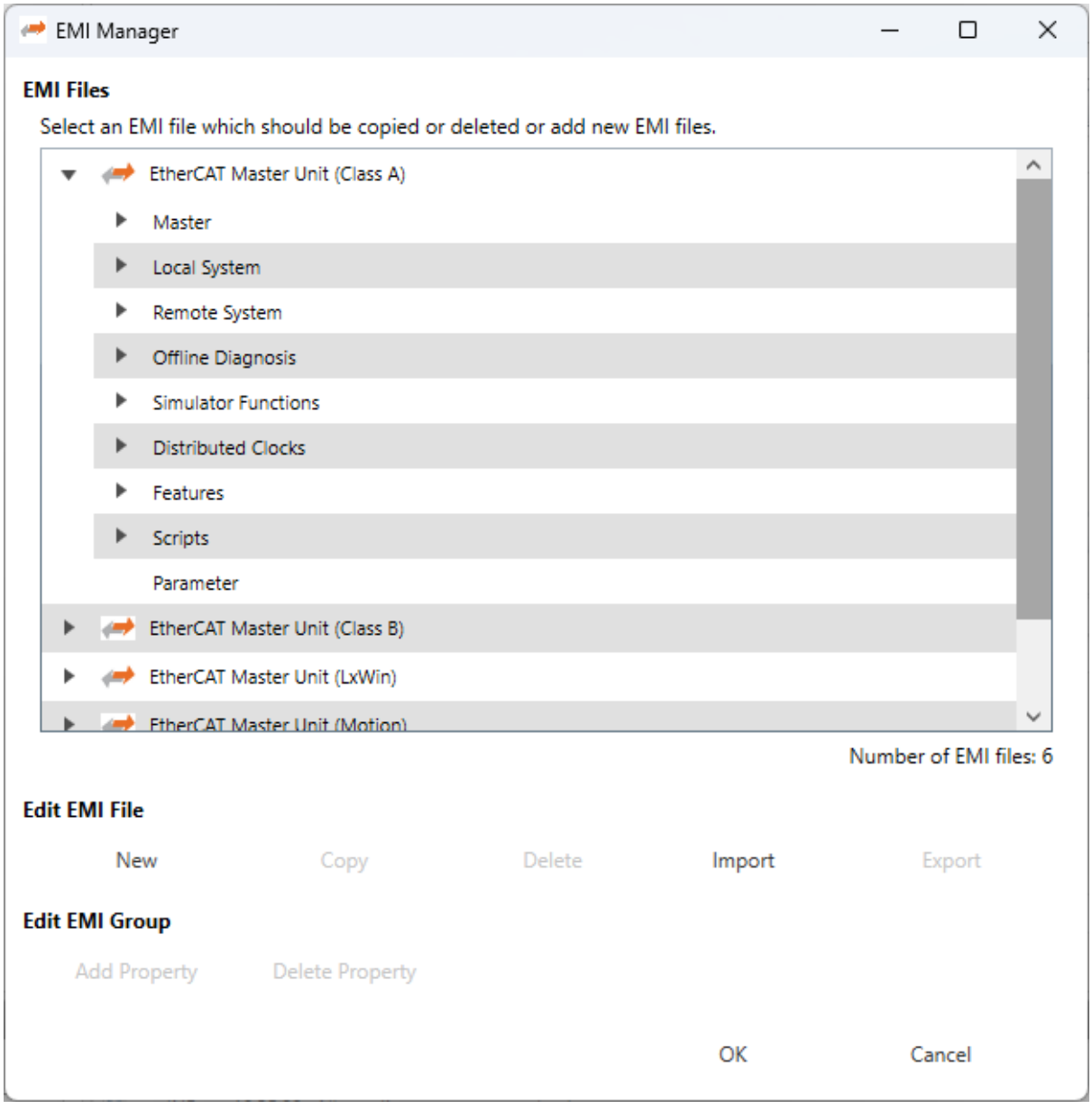
This dialog helps the user to administrate his `ESI` and `SCI` files. Here, he can add/delete/export `ESI` and `SCI` files.



8.2 EMI-Manager

EMI-Manager can be found through the main menu File -> EMI-Manager.

This dialog helps the user to administrate his EtherCAT Master Information (`EMI`) files.



`EMI` files, are files which are specify the master features. Means that options and dialogs can be restricted to those features which are supported by the control system, e.g. available cycle times, support of scan for MDP modules or DC synchronization.

8.2.1 Administration

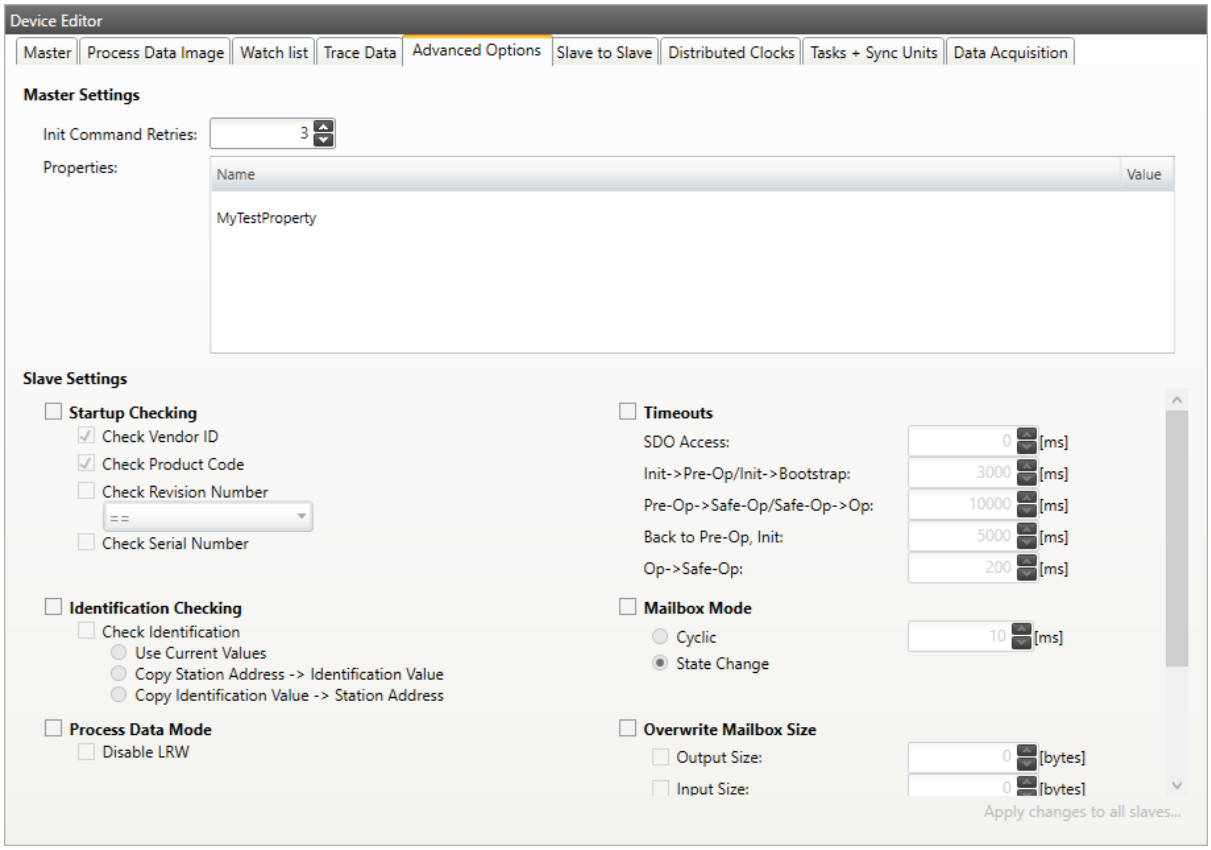
This dialog helps the user to administrate his EtherCAT Master Information (`EMI`) files.

By default EC-Engineer has two files included (read-only):

`EtherCATMaster_ClassA.emi`: `EMI` template which is prepared for configuring a “Class A” master
`EtherCATMaster_ClassB.emi`: `EMI` template which is prepared for configuring a “Class B” master

If the user wants to customize EC-Engineer, he can create a new `EMI` file with defaults, copy an existing `EMI` template or import an `EMI` file.

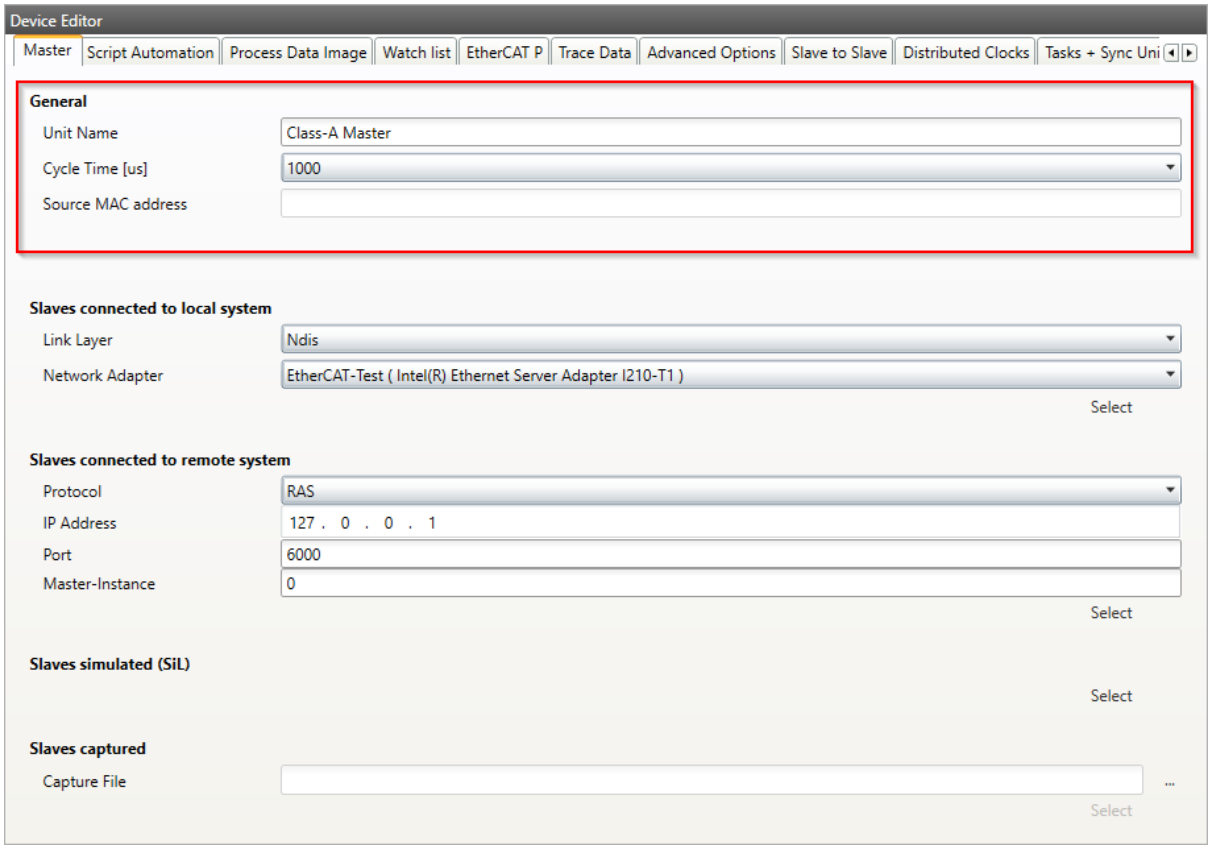
If he wants to add new properties to a group, he can add this only to the group “Parameters”. This group is by default empty, but if user has added some properties, he will see the list of properties on tab “Advanced Options (Expert)” of the master, where the values can be modified.



8.2.2 Supported Entries

The following `EMI` entries are supported:

Master Group



Display Group:
Shows or hides group

Lock Group:
Locks or unlocks group

Name of Master-Unit:
Default Master-Unit name

Show name of Master-Unit:
Enable if user should be able to view and change the name of the Master-Unit

Lock name of Master-Unit:
Enable if user should not be able to change the name of the Master-Unit

Cycle Time:
Default Cycle Time

Show Cycle Time:
Enable if user should be able to view and change the Cycle Time

Lock Cycle Time:
Enable if user should not be able to change the Cycle Time

List values of Cycle Time:
Enter possible values of Cycle Time

Frequency:
Default Frequency

Show Frequency:
Enable if user should be able to view and change the Frequency

Lock Frequency:
Enable if user should not be able to change the Frequency

List values of Frequency:
Enter possible values of Frequency

Cycle Time Mode:
Enter Cycle Time Mode (0 = Cycle Time, 1 = Frequency)

Init Command Retries:
Init Command Retries

Maximal Slave Count:
Enter maximal count of slaves which are allowed to configure (0 = use default limit of master)

Slave Start Address:
Enter default start address for all slaves

Scan for MDP slaves:
Enable for activating MDP-Scan if it is supported from slave

PDO Upload:
Enable for activating PDO upload during scan if it is supported from slave

Byte-Align Process Data Image:
Enable if process data image should be byte aligned and not as small as possible

Edit Complete Variable Name:
Enable if user should be able to edit the complete variable name

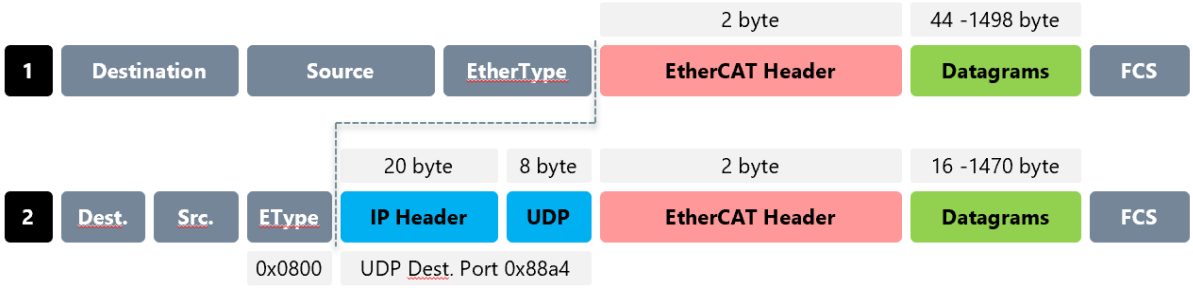
Process Image Layout:
Enter process image layout features (0 = default, 0x1 = with protocol data, 0x2 = with VLAN tag, 0x4 = without frame alignment, 0x8 = alphabetic port order, 0x10 = Compatibility to `ENI` spec V1.0.0, 0x20 = Moves AL Status command to the end), 0x40 = Disable command splitting

Output Port Vendor Id:
Enter output port vendor id of the master (0 = All Vendors, 1..n = Specific Vendor)

Word-Aligned EtherCAT Datagrams:
Enable if EtherCAT datagrams should be word aligned

Cyclic Frame Layout:
Enter cyclic frame layout mode (0 = default, 1 = single logical command per frame)

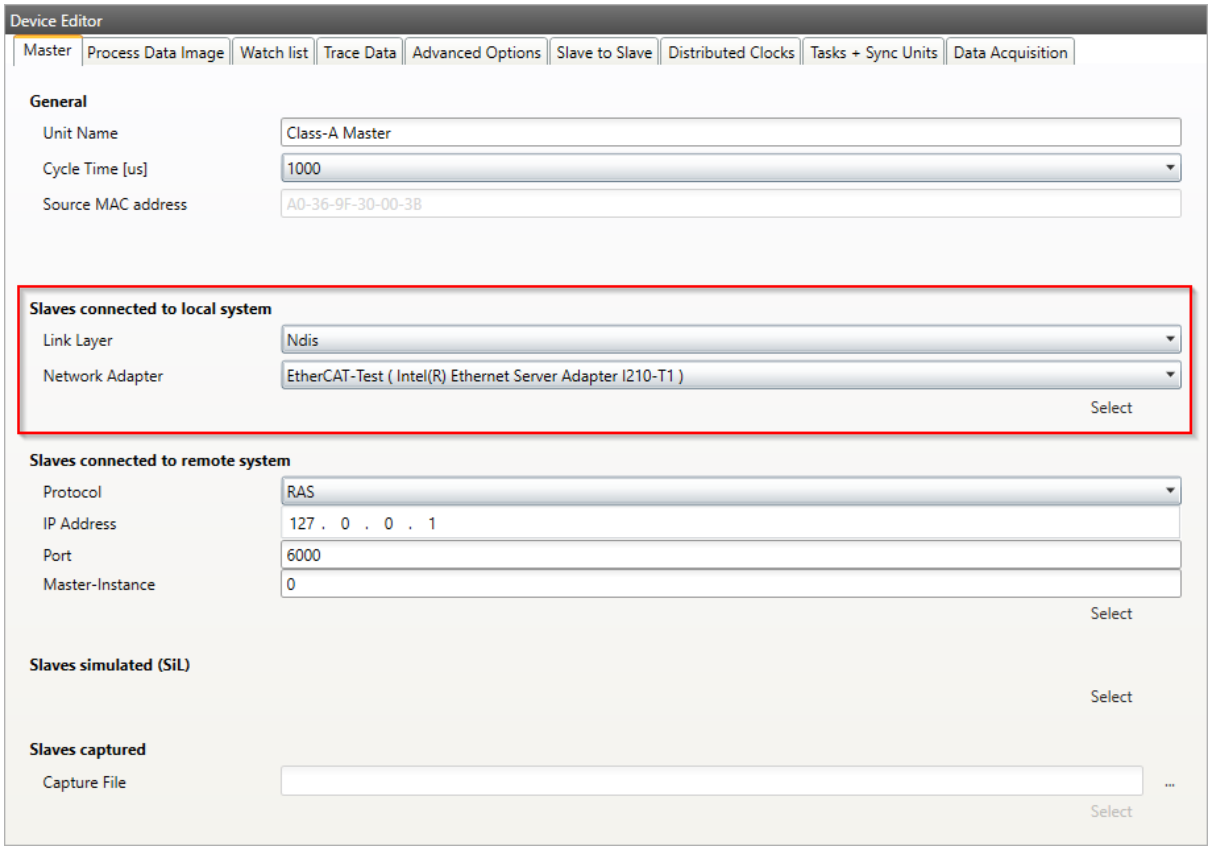
Ethernet Type UDP:



Remove DC NOP Command:
Does not include NOP Command in `ENI`

Cable Red active:
Sets disable LRW for all slaves to use cable redundancy

Local System



Display Group:
Shows or hides group

Lock Group:
Locks or unlocks group

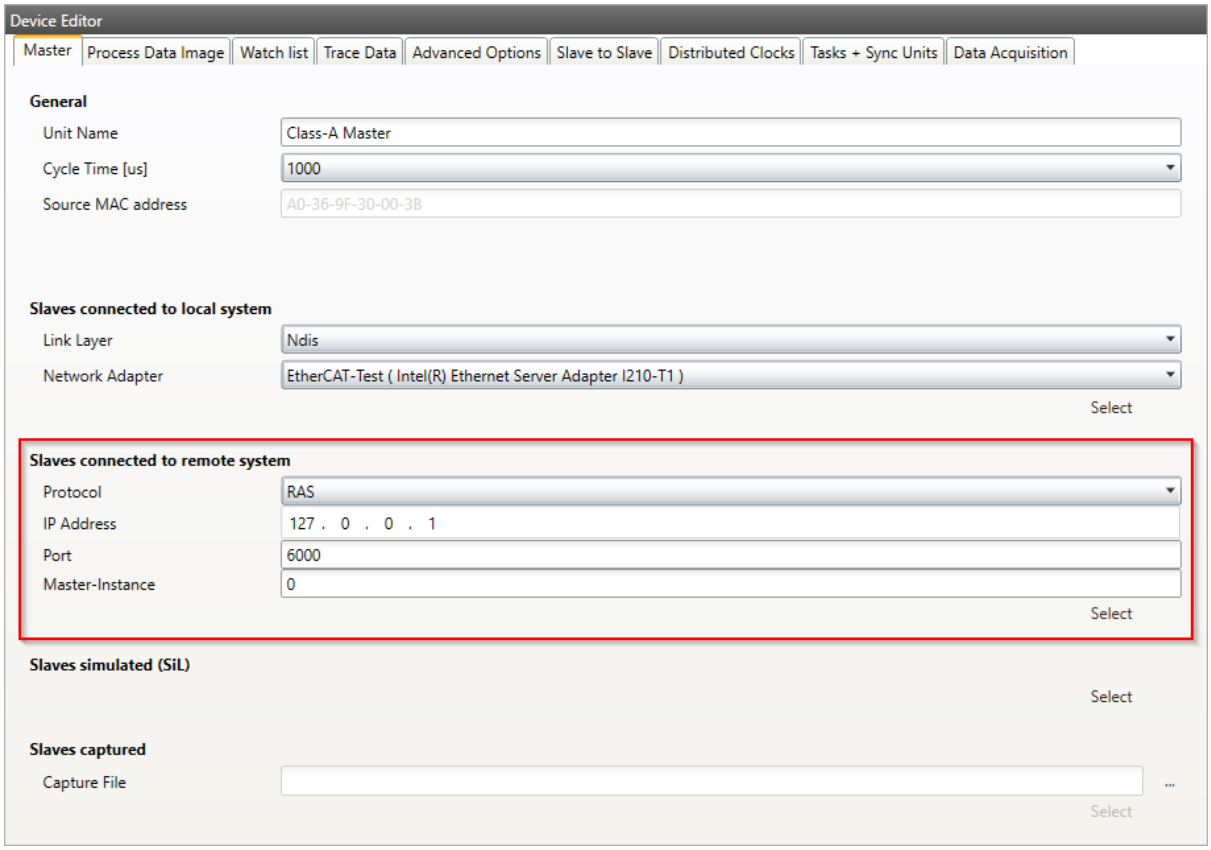
Network Adapter:
Enter index of Network Adapter in the Network Adapter List

Show Network Adapter:
Enable if user should be able to view and change the Network Adapter

Lock Network Adapter:
Enable if user should not be able to change the Network Adapter

DCM on:
EC-Engineer deactivated DCM on default. Enable if it should be turned off

Remote System



Display Group:
Shows or hides group

Lock Group:
Locks or unlocks group

Protocol:
Select protocol for Remote System

Show Protocol:
Enable if user should be able to view and change the protocol

Lock Protocol:
Enable if user should be not able to change the protocol

IP Address:
Enter IP Address for Remote System

Show IP Address:
Enable if user should be able to view and change the IP Address

Lock IP Address:
Enable if user should be not able to change the IP Address

Port:
Enter Port for Remote System

Show Port:
Enable if user should be able to view and change the Port”

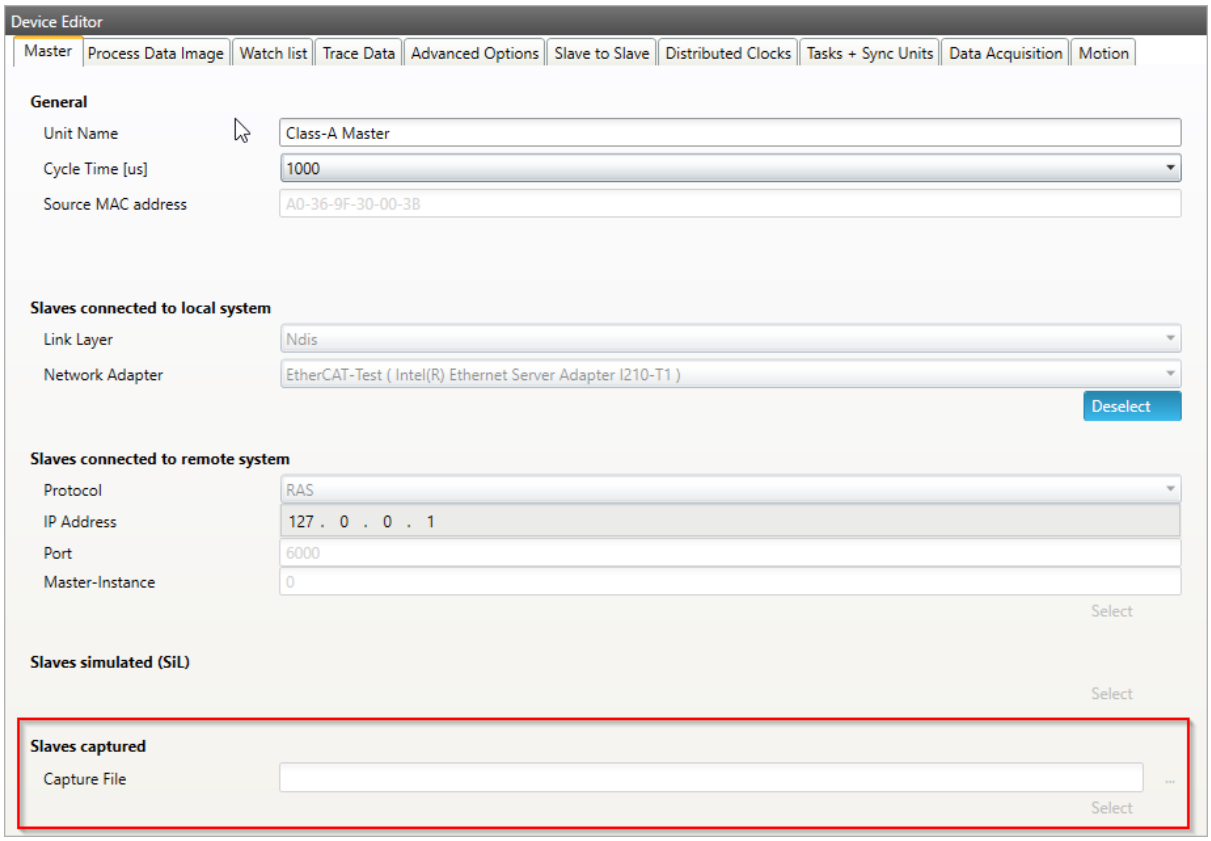
Lock Port:
Enable if user should be not able to change the Port

Master-Instance:
Enter Master-Instance number

Show Master-Instance:
Enable if user should be able to view and change the Master-Instance

Lock Master-Instance:
Enable if user should be not able to change the Master-Instance

Offline Diagnosis



Display Group:
Shows or hides group

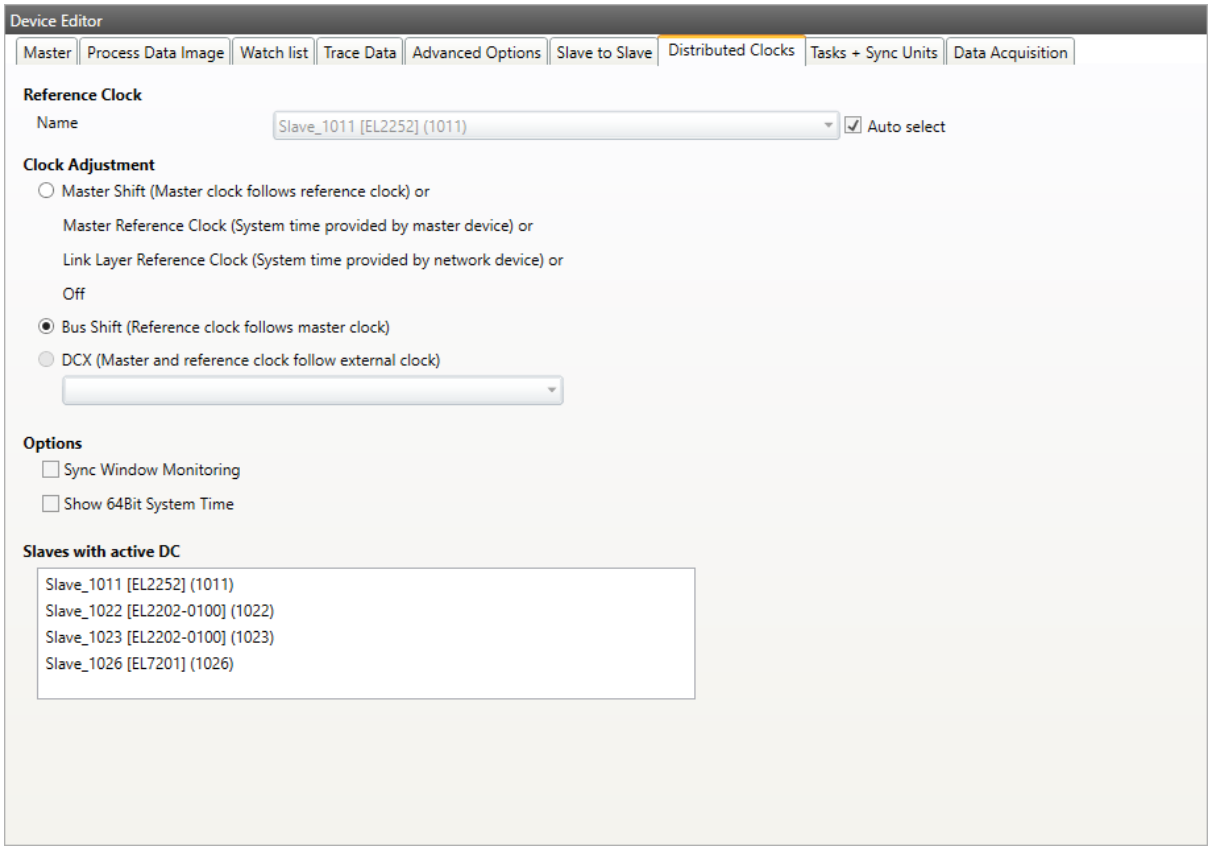
Lock Group:
Locks or unlocks group

Simulator Functions

Display Group:
Shows or hides group

Lock Group:
Locks or unlocks group

Distributed Clocks



Display Group:
Shows or hides group

Clock Adjustment:
Enter clock adjustment value (0 = default, 1 = Master Shift, 2 = Bus Shift

Lock Clock Adjustment:
Enable if user should not be able to change clock adjustment

Show Clock Adjustment:
Enable if clock adjustment should be visible

Continuous Propagation Compensation:
Enter default value of Continuous Propagation Compensation

Show Continuous Propagation Compensation:
Enable if user should be able to change value of Continuous Propagation Compensation

Sync Window Monitoring:
Enter default value of Sync Window Monitoring

Show External Mode:
Enable if user should be able to use an external sync device as reference clock

System Time 64 Bit:
Enter default value of System Time 64 Bit

Features

AoE:
Enable if master supports AoE

EoE:
Enable if master supports EoE

FoE:
Enable if master supports FoE

SoE:
Enable if master supports SoE

VoE:
Enable if master supports VoE

Export Variables:
Enable if user should be able to export variables

Show Enable Column:
Shows column for enable variables on `XML` export

Generate Slave Name with Type:
Enable if type of slave should be added to slave names on generating `ENI` file

Lock Variables:
Locks or unlocks variables for editing in diagnosis mode

Show Variable Chart:
Enable if user should be able to view the chart of a variable

Show Variable Comments:
Enable if user should be able to view and edit the comments of a variable

Allow E-Bus as HC Head:
Enable if Ebus shall be allowed as HC Head

`ENI` Deployment:
yes: something is done with `ENI` after export, no: nothing done ask: you will be ask to deploy

Deployment Mode:
0: copy to path, 1: execute batch at path

Deployment Path:
Path to copy `ENI` or to batch for execution

Hot Connect:
Enable if master supports hot connect

Scripts

Display Group:
Shows or hides the Scripts Tab

P1:

Scan Start Script 1:
First script executed before scanning

Scan Start Script 2:
Second script executed before scanning

Scan Stop Script 3:
First script executed after scanning

Scan Stop Script 4:
Second script executed after scanning

P2:

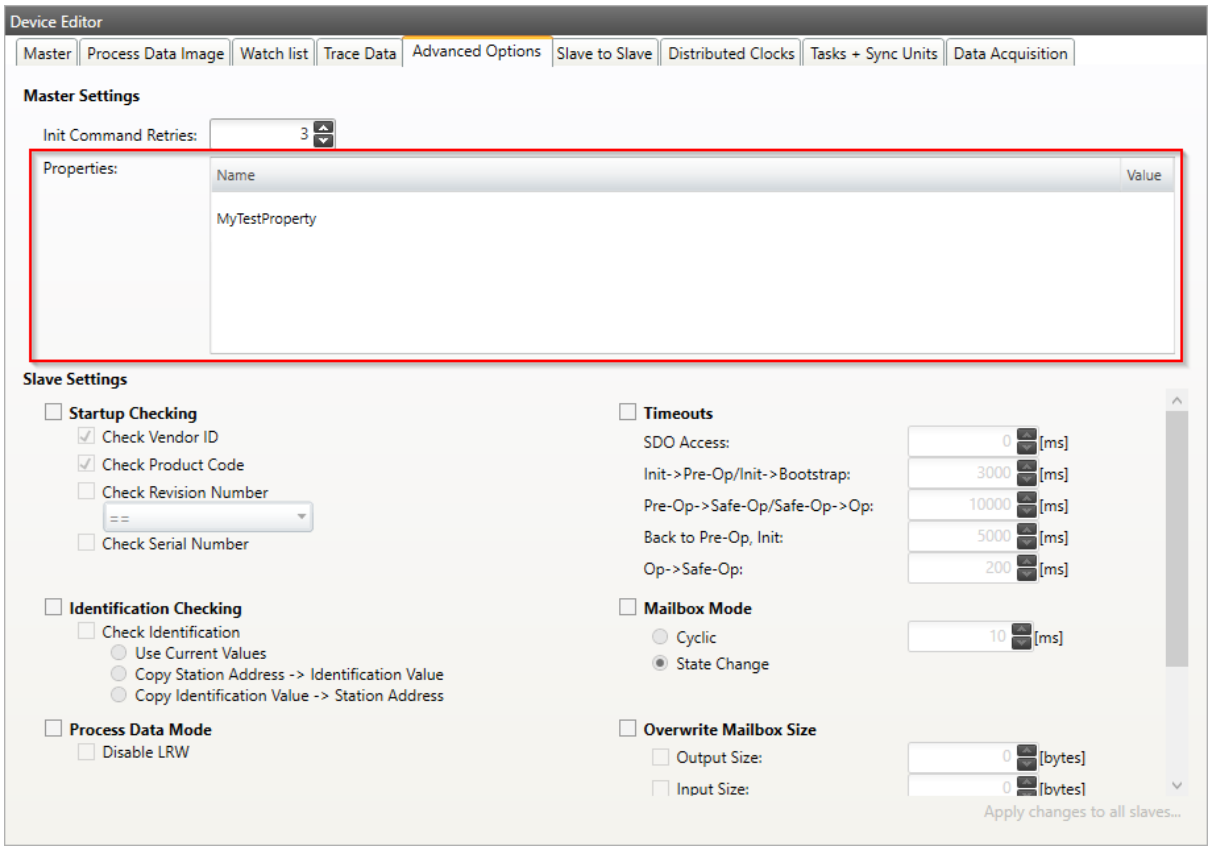
Diag Start Script 1:
First script executed before switch to diag

Diag Start Script 2:
Second script executed before switch to diag

Diag Stop Script 3:
First script executed before switching to config

Diag Stop Script 4:
Second script executed before switching to config

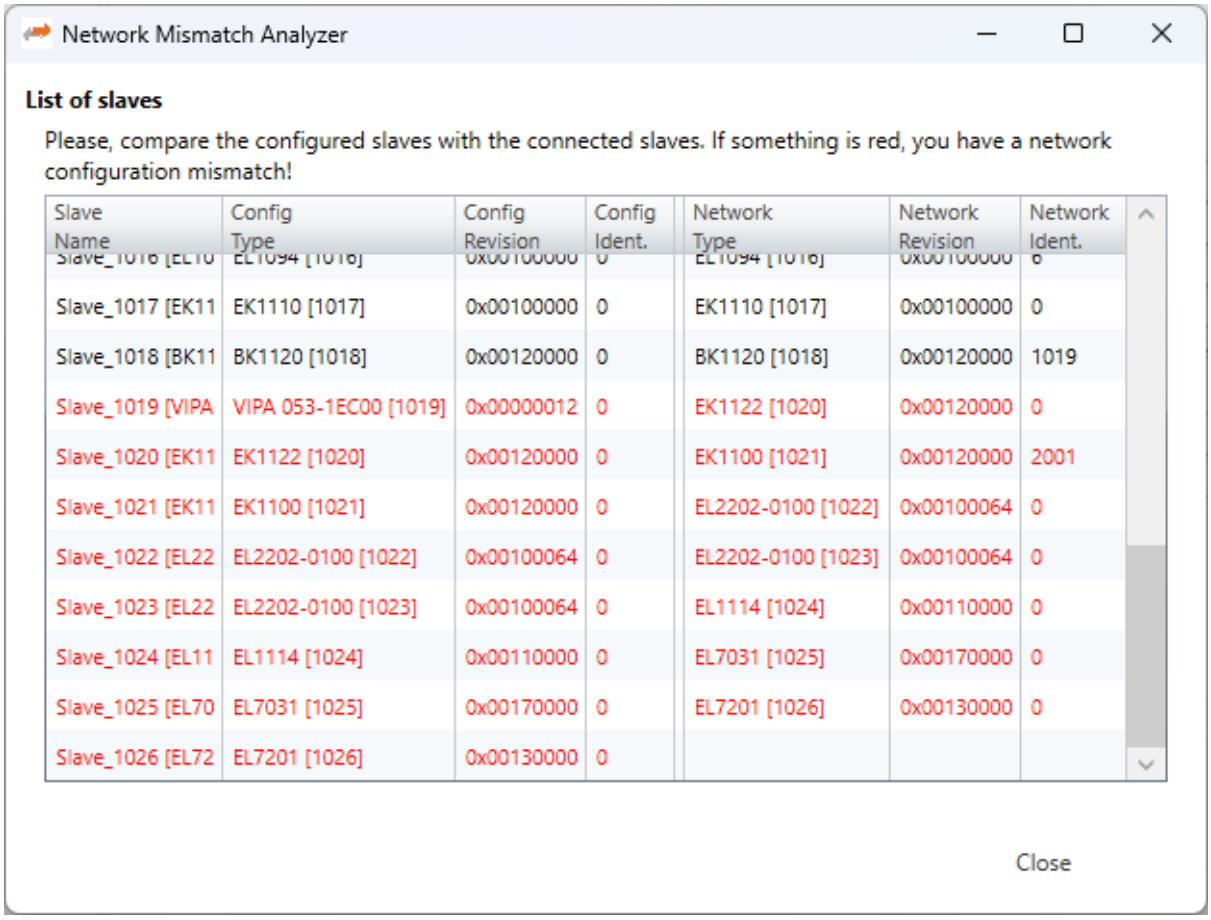
Parameters



User defined properties, which will be written into `ENI` file and can be interpreted by the application inside EC-Master.

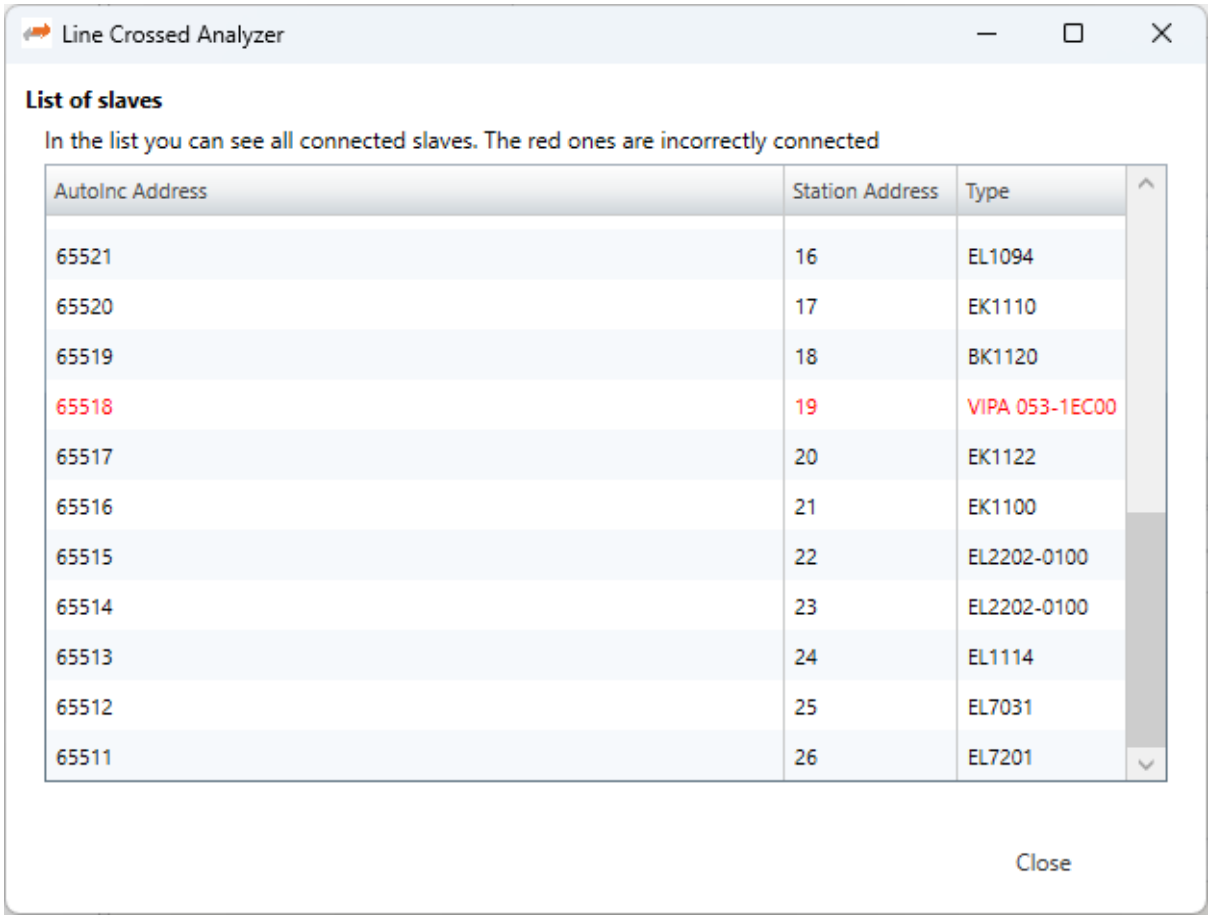
8.3 Network Mismatch Analyzer

If you have a network mismatch in your EtherCAT network it is not so easy to find the problem. For this you have the Network Mismatch Analyzer. You find it in the network main menu. If you see here some "red" entries, means that this is the start point of your network mismatch:



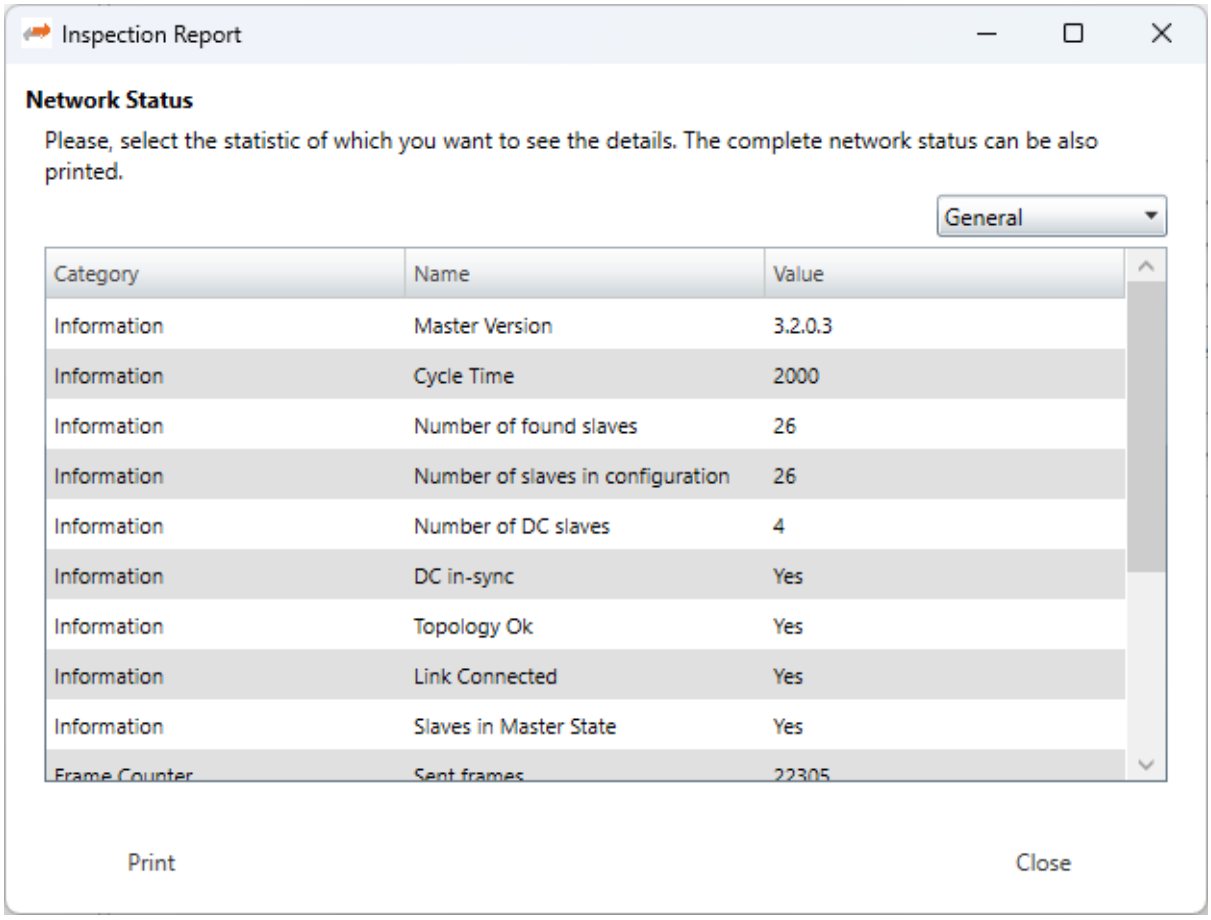
8.4 Line Crossed Analyzer

If you have connected a line to a wrong port, you can see in the Line Crossed Analyzer which slave is incorrectly connected. The wron entries will be red:



8.5 Inspection Report

If you want to print or show a report about the actual session, it is possible with the inspection report. I shows a lot of different data about the network communication. It is also possible to print a PDF.



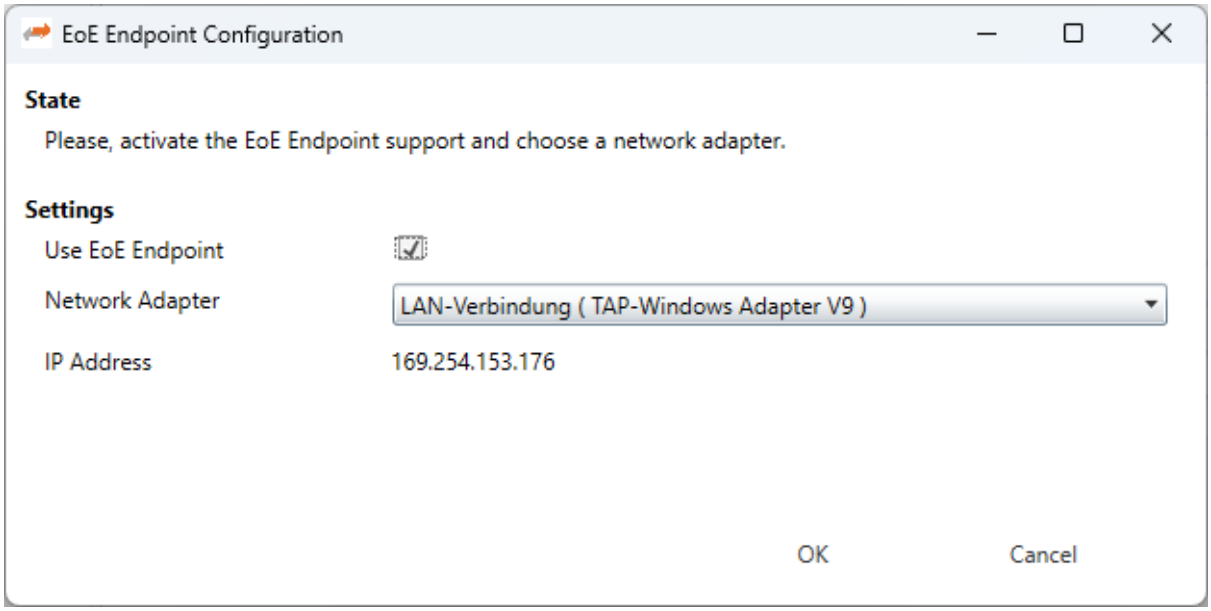
8.6 EoE Endpoint Configuration

If you want to use EoE slaves with your local master, you can activate the EoE Endpoint.

Note: This feature is only available if the package “Tap-Windows” from OpenVPN is installed: http://openvpn.net/index.php/download/community-downloads.html

---

If this package is installed, you will see the following dialog:



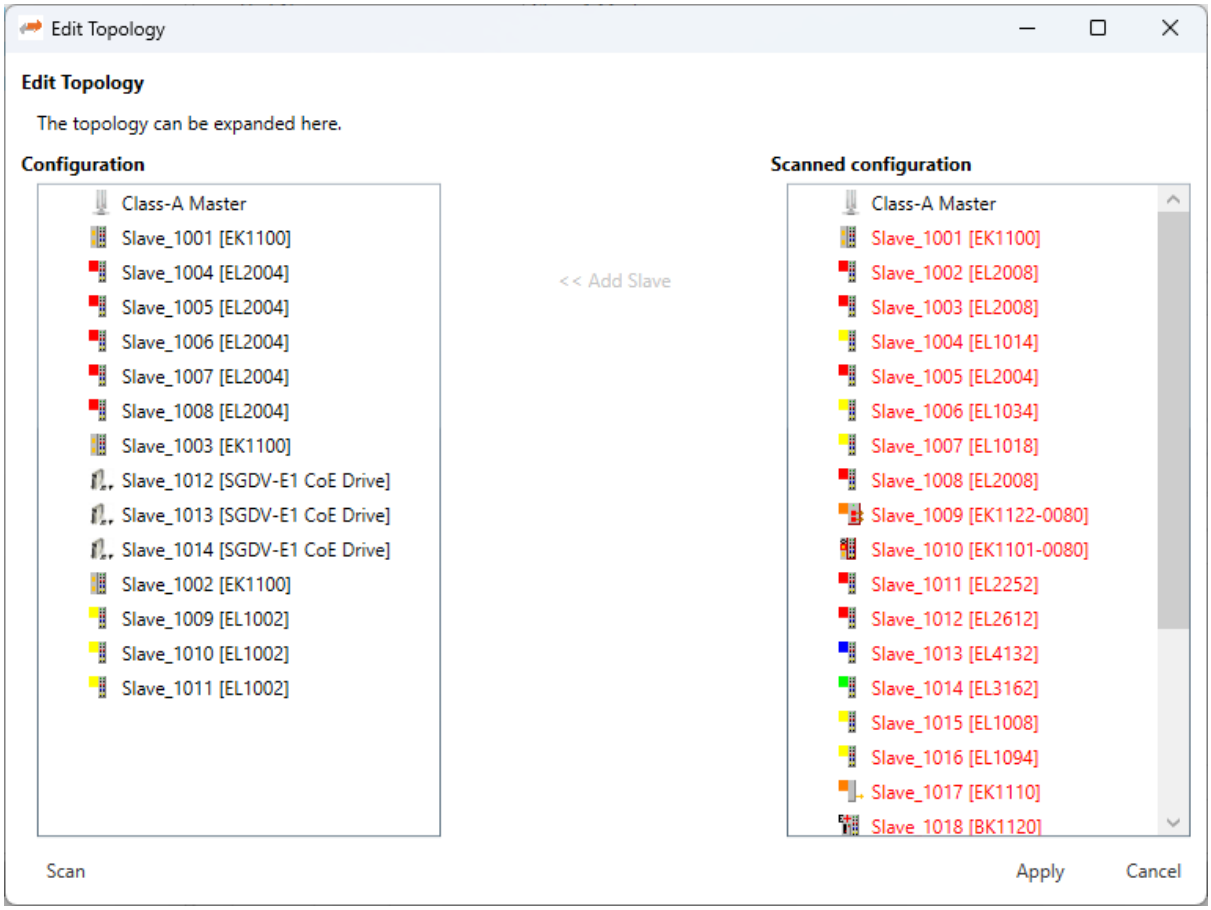
Settings

Use EoE Endpoint:
Activate EoE Endpoint support for the selected device

Network Adapter:
List of installed network adapters (TAP)

IP Address:
IP Address of the selected network adapter

8.7 Edit Topology



Disconnect:
Disconnets the selected port

Connect:
Connects the selected slave in the not connect slaves list, with the selected port in the configuration

Up: Moves the slave up in the configuration

Down:
Moves the slave down in the configuration

Scan:
Scans the network. The network is shown by the scanned configuration. It is possible to add slave to the configuration with “Add Slave”.

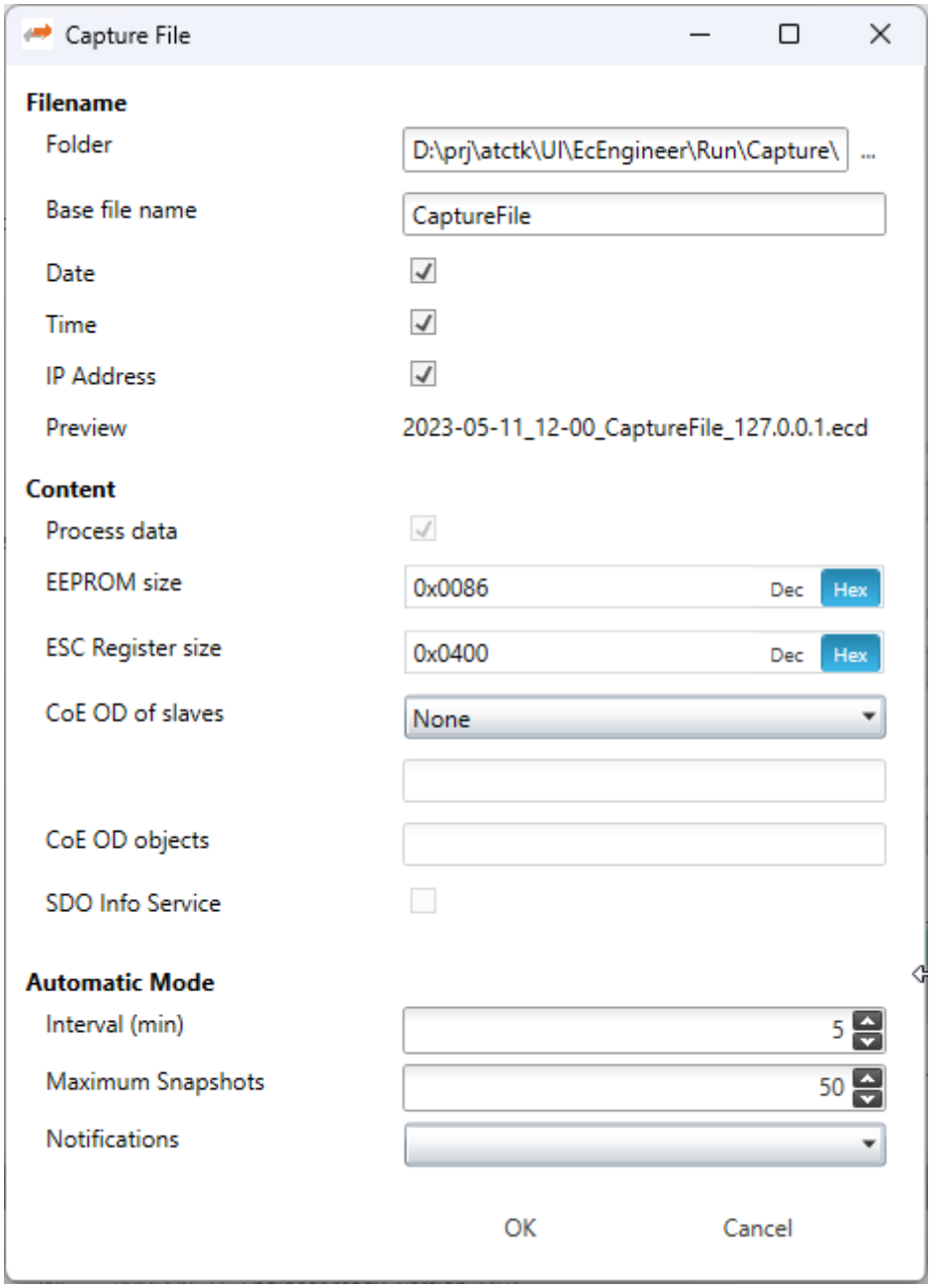
Apply:
The configuration will be applied to the EC-Engineer (only possible if all slaves are connected)

8.8 Capture File

A capture file could be helpful, if you have a very large system or system is not always available. In that case you can connect to your system, save one or more snapshots into a capture file and analyse the created capture file later.

Another use case is, that your system from time to time some problems. In that case you can activate the automatic mode and create the snapshots every specific interval or based on specific master notifications.

At the moment there are the following options:



Filename

Folder:
Path, where the capture files should be saved

Base file name:
Base file name of the generated capture file name

Date:
Activate, to add the date to the generated capture file name

Time:
Activate, to add the time to the generated capture file name

IP Address:
Activate, to add the IP address to the generated capture file name

Preview:
Shows a preview of the generated capture file name

Content

Process data:
Activate to add process data to the capture file (read-only)

EEPROM size:
Enter size of the EEPROM (0x86 = default, 0 = no EEPROM)

ESC Register size:
Enter size of the ESC Registers (0x400 = default, 0 = no ESC register)

CoE OD of slaves:

Select the slaves of which the CoE OD information will be captured

None:
CoE OD will be not captured

All:
CoE OD will be captured of all slaves

User defined:
CoE OD will be captured of the defined slaves by physical address (e.g. 1001-1003; 1005)

CoE OD objects:
Enter index of specific objects or all objects will be collected (e.g. 0x1018; 0x7000-0x7FFF)

SDO Info Service:
Activate to use the SDO Info Service for loading the CoE Object Dictionary instead of readying the information from the `ESI` file.

Automatic Mode

Interval (min):
Time to wait until next snapshot will be taken

Maximum Snapshots:
Enter count of maximum snapshots

Notifications:

Select the notifications, which will trigger a snapshot. The following notifications are availabe (for more information about notifications please refer the manual of EC-Master):

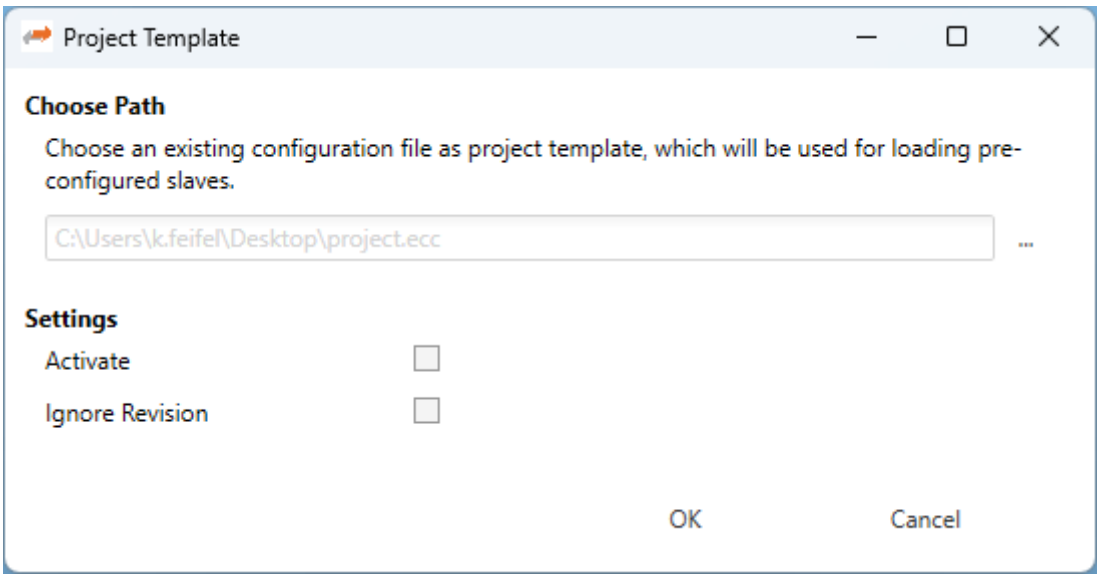
- STATECHANGED
- ETH_LINK_CONNECTED
- ETH_LINK_NOT_CONNECTED

- SLAVE_STATECHANGED
- SLAVE_PRESENCE
- SLAVE_INITCMD_RESPONSE_ERROR
- STATUS_SLAVE_ERROR
- SLAVE_UNEXPECTED_STATE
- DC_SLV_SYNC
- DCM_SYNC

8.9 Project Templates

If you have a lot of slaves with the same configuration (e.g. PDOs, InitCmds) you can use a project template. In that case new slaves will be first copied from this template (if available) and then taken from the `ESI` cache. This behaviour is also used for the bus scan.

At the moment there are the following options:



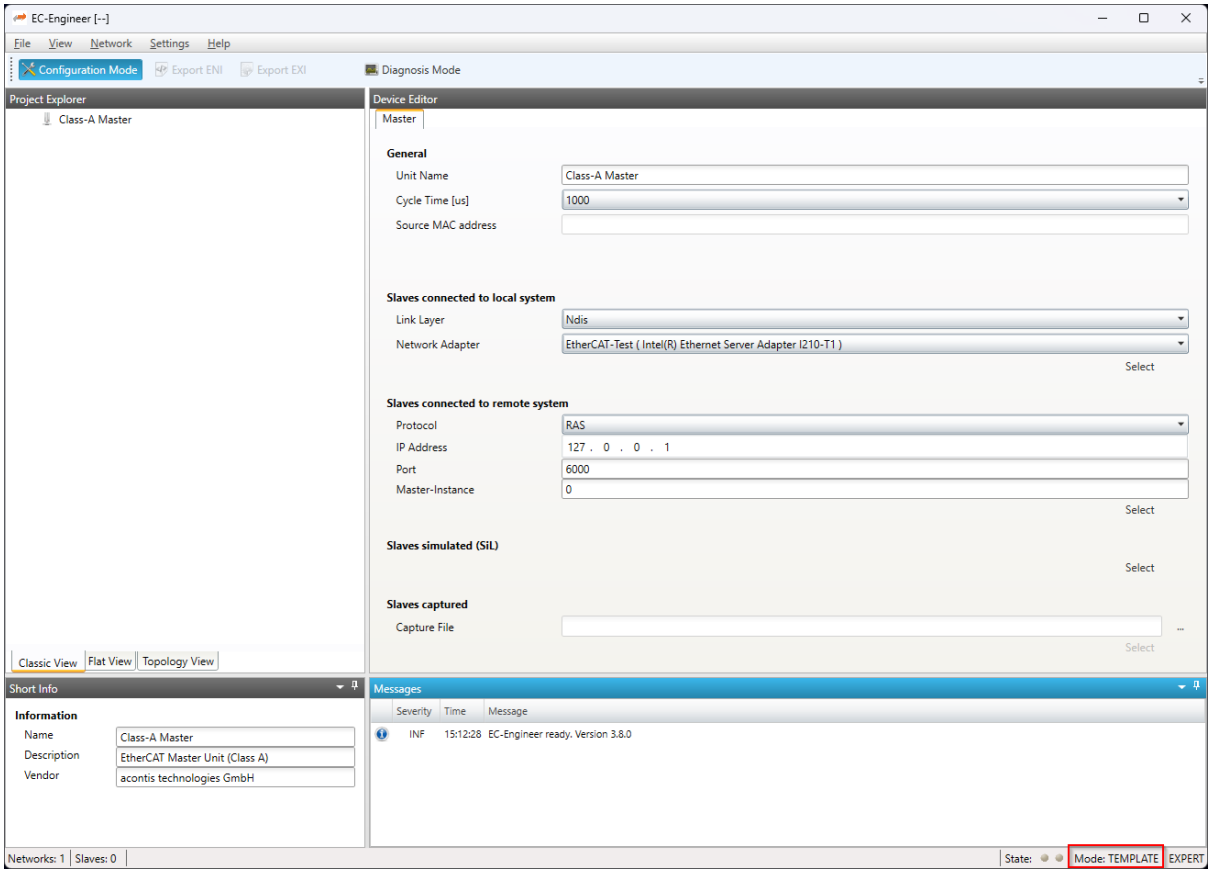
Path: Path to the selected project template

Settings

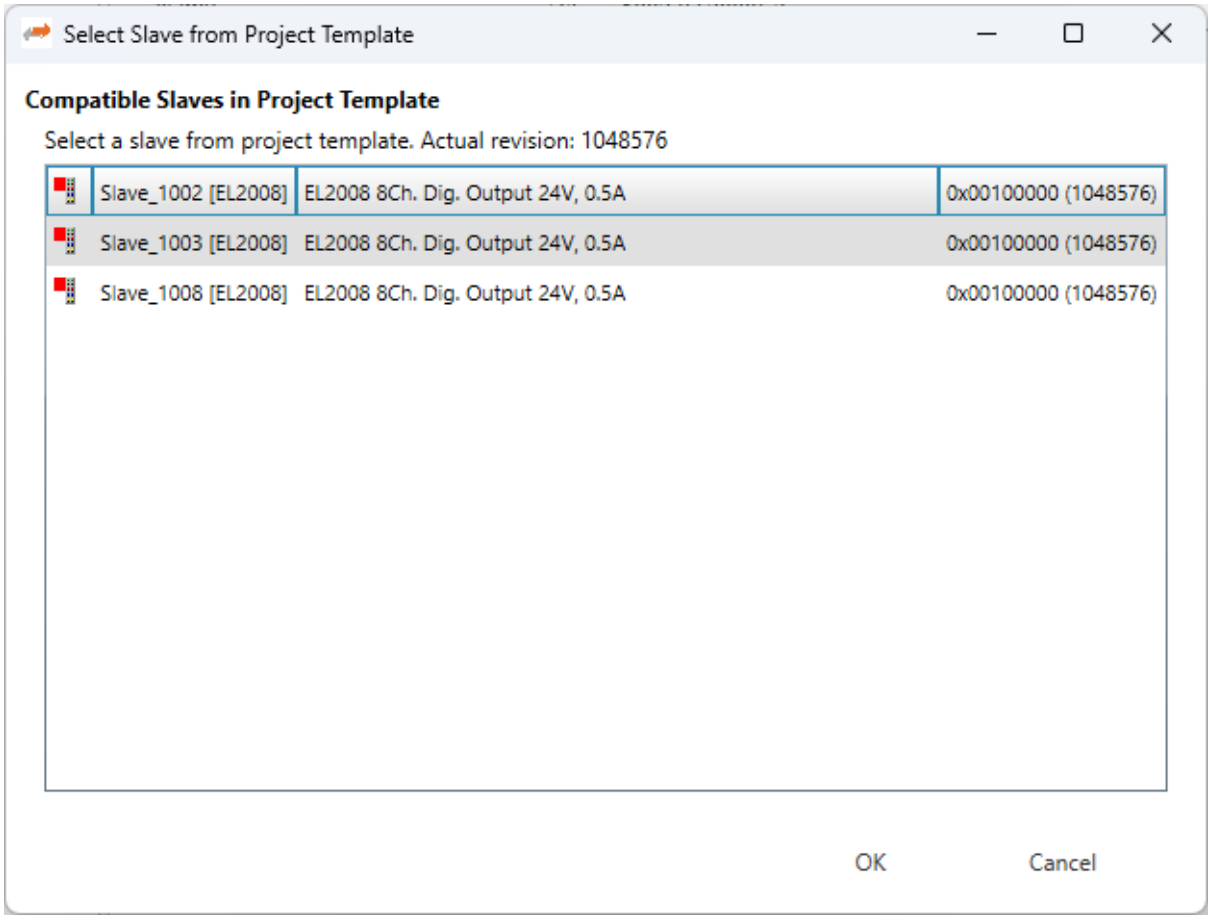
Activate:
True, for activating this project template (necessary if you want to turn it temporary off)

Ignore Revision:
The revision will be not used as search criteriom

If the project template mode is active, it will be displayed in the status bar:



Normally the first match will be taken from project template. If this is wrong, you can open the context menu *Select from Project Template* and select another one:



8.10 Real-time Support

Normally on Windows you do not have real-time support, but to get DCM in sync you can install the “ECAT driver” in the following modes:

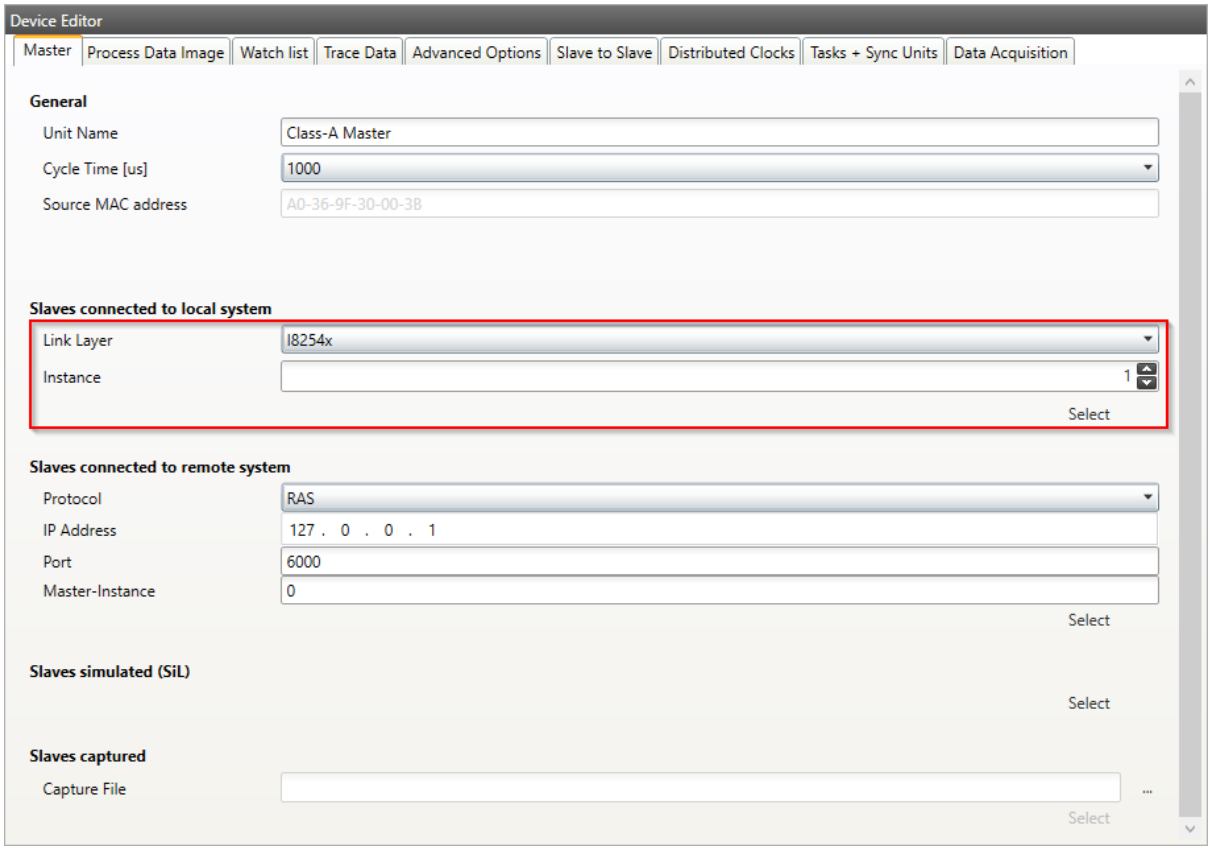
Network driver
: The network driver can be used from the optimized link layers

The real-time support is normally hidden in EC-Engineer. It can be activate by copying the specific link layer libraries into the installation directory of EC-Engineer.

For the local system, EC-Engineer will turn on DCM and use the real-time clock for generating the job task cylces. For more information about how to install the “ECAT driver” please refer the manual of EC-Master Class A DCM on Windows

8.10.1 Optimized Link Layers

After activating the real-time support the optimized link layer can be selected in the option “Link Layer”:



Depending on the link layer type the user can chose the network adapter or the instance.

The following optimized link layers are currenty supported:

`emllI8254x.dll` (Intel PRO/1000 Network Adapters)

`emllI8255x.dll` (Intel PRO/100 Network Adapters)

`emllIRTL8139.dll` (Realtek 8139 Fast Ethernet Adapters)

`emllIRTL8169.dll` (Realtek Gigabit Ethernet Adapters)

`emllICCAT.dll` (BECKHOFF CCAT)

For more information about optimized link layers and how to install the ECAT driver please refer the manual of EC-Master Class B EcatDrv for Optimized Link Layers

8.11 Export ENI Variants

With this function it is possible to export different ENI file variants of an config. Therefore a xml file has to be created. Then it is possible to select this xml file and create more ENI files at once. The xml file should look like this:

RenumberBus: If this is true, all slaves will be enumerated in a row. Otherwise each slave stays with his address.

Export Path: The path were the ENI / ECC files should be saved.

ExportEcc: If true, also the ECC file be exported and not only the ENI.

Each Config needs a name. This name is used for the ENI file and the optional ECC file.

CycleTime (optional): If this is set the cycle time will be changed to this value.

Exclude: To find a slave in the config the name is required. With that it is possible to remove some slaves from a big config for example.

Include: To find a slave in the config the name is required. With the include it is possible to easy delete all slaves in the config despite except the include ones.

Warning: Please use Exclude OR Include. Both in the same config does not work

9 Command Line Interface

For helping users in some special situations and to do not confuse other users the EC-Engineer supports a small command line interface:

/HELP, /?
Shows the help dialog

/CFG = config.ecc
Open a specific configuration file config.ecc directly after starting EC-Engineer

/EMI = emi.xml
Sets the path to the EMI file which should be used (Mandatory if ecc does not already exist)

/REMOTE = "127.0.0.1:6000:0"
Activates the remote system, where IP address is "127.0.0.1", port is 6000, master instance is set to 0

/ENIEXPORT = config.eni
Activates an automatic ENI export on close

/EXIEXPORT = config.exi
Activates an automatic EXI export on close

/CYCLETIME = "2000"
Changes the cycle time from ecc or EMI in config

/DIAG
Activates diagnosis mode

/CAPTURE= capture.ecd
Open a specific capture file capture.ecd directly after starting EC-Engineer and activates the diagnosis mode

/ENIBUILDER
Activates the EniBuilder support, means two additional context menu entries of the device will be available to export and import the configuration file for the EniBuilder

/PROJECTTEMPLATEPATH
Opens a specific configuration file as project template

/FORCECFG= config.ecc
Activates the "integration" mode, to be able create an ENI file automatically on closing EC-Engineer

Some menu entires are also hidden, like

- "New/Open/Save"
- "EMI Manager"
- "Export Process Variables / Import ENI file / Export ENI file"
- Toolbar

Further supported parameters:

/EMI = emi.xml
Sets the path to the EMI file which should be used (Mandatory)

/LOCAL = "127.0.0.1"
Activates the local system and the network adapter with IP address "127.0.01" will be chosen. If you use the optimized LinkLayer you can write */LOCAL* ="I8254x" or */LOCAL* ="RTL8169" (*/LOCAL* or */REMOTE* or */CAPTURE* is mandatory).

/REMOTE = "127.0.0.1:6000:0:0"
: Activates the remote system, where IP address is “127.0.0.1”, port is 6000, master instance is set to 0 and protocol is 0 (RAS). It is also supported to use the DNS name instead of the IP address (*/LOCAL* or */REMOTE* or */CAPTURE* is mandatory). It is also possible to set the parameter for more master instances (only if ecc exists with more master units). Therefore just add the additional parameter with a ‘;’. E.g.: */REMOTE* =”127.0.0.1:6000:1;127.0.0.2:6001:2” or */REMOTE* =”127.0.0.1:6000:1:0;127.0.0.2:6001:2:0”

/CAPTURE = C:/myfile.ccd:0
: Activates the offline diagnosis system, where the path to the capture file is `c:/myfile.ccd` and the selected snapshot is “0” (*/LOCAL* or */REMOTE* or */CAPTURE* is mandatory)

/ENIEXPORT = config.eni
: Activates the `ENI` export (Optional)

/EXIEXPORT = config.exi
: Activates the `EXI` export (Optional)

/VAREXPORT = config.var
: Activates the process variables export (Optional)

/VARTYPE = "csv|plc|pd|xml" (default=csv)
: Sets the format of the process variables export slave (for more information about the supported formats

/EBIEXPORT = config.ebi
: Activates the EBI (EniBuilder input file) export

/SCAN
: Scans the bus after startup

/FORCEDIAG
: Activates the diagnosis mode after startup. If diagnosis mode can not be activated the application will be closed.

/CYCLETIME ="1000"
: Sets the master cycle time and locks it for the user

/AUTOSAVE
: Current configuration will be saved automatically on exit (without asking the user if he want to discard all changes)

/ALLMASTERUNITS
: If there is more than one master unit in the ecc, you can create an `ENI` file and variable export for all with this paramter

Samples

Run “EC-Engineer”, scan automatically the local system with IP address 127.0.0.1, export `ENI` file and export process variables (as CSV Format) on closing

```
> EcEngineer.exe /FORCECFG="cfg_local.ecc" /EMI="emi.xml" /LOCAL=127.0.0.1
↪  /SCAN /ENIEXPORT="cfg_local.eni" /VAREXPORT="cfg_local.var"
↪  /VARTYPE="csv"
```

Run “EC-Engineer”, scan automatically the remote system with IP address 127.0.0.1, Port 6000, MasterInstance 0, export `ENI` file and export process variables (as PLC Format) on closing

```
> EcEngineer.exe /FORCECFG="cfg_remote.ecc" /EMI="emi.xml"
↪  /REMOTE=127.0.0.1:6000:0:0 /SCAN /ENIEXPORT="cfg_remote.eni"
↪  /VAREXPORT="cfg_remote.var" /VARTYPE="plc"
```

Run EC-Engineer and switch to diagnosis mode

```
> EcEngineer.exe /FORCECFG="cfg_remote.ecc" /EMI="emi.xml"
↪  /REMOTE=127.0.0.1:6000:0:0 /FORCEDIAG
```

Run EC-Engineer and switch to offline diagnosis mode

```
> EcEngineer.exe /FORCECFG="cfg_capture.ecc" /EMI="emi.xml"
↪  /CAPTURE=C:/myfile.ccd:0 /FORCEDIAG
```

In case of an error, EC-Engineer will do the following

- Add error message to the log file (message level must be set to “All Messages”)
- If the GUI is already visible, he will show a message box
- Set exit code to “-1”

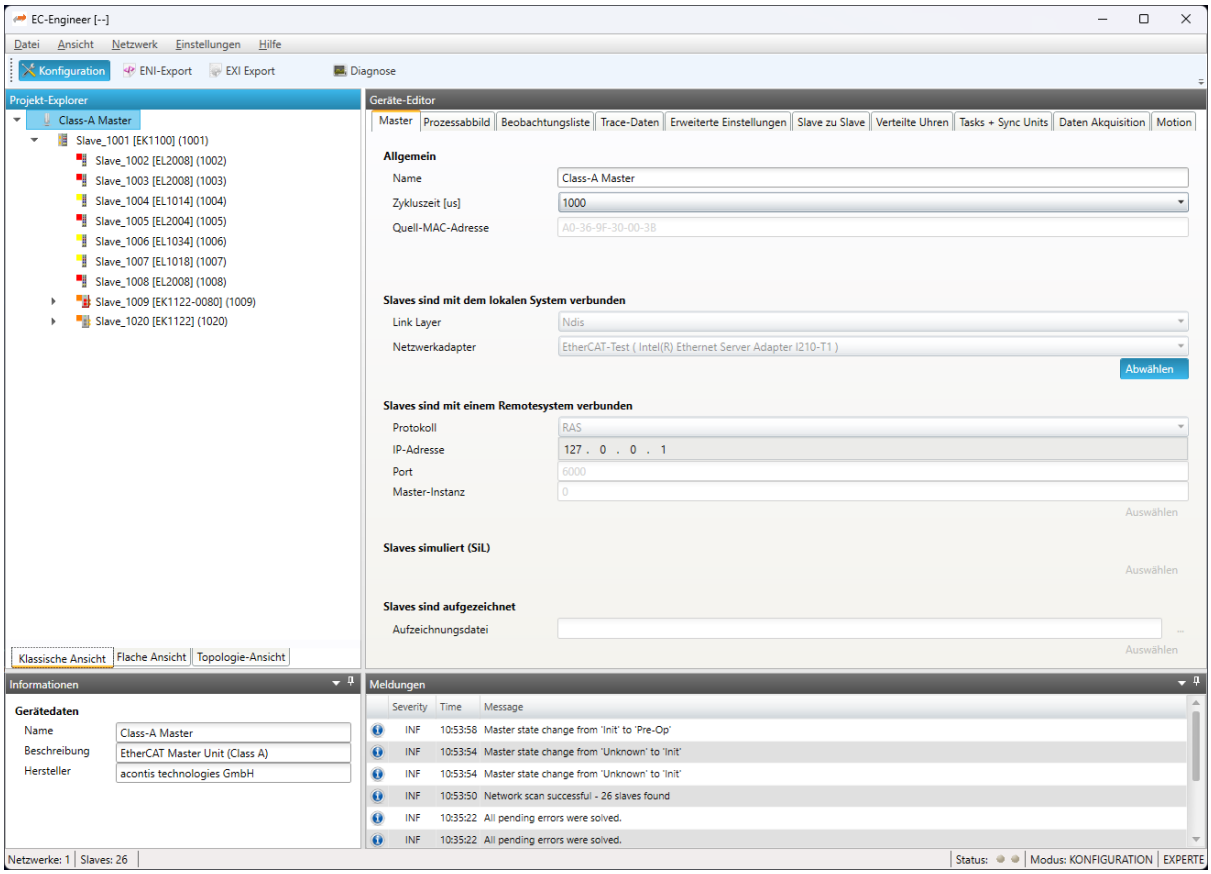
10 Customization

10.1 Multi-Language-Support

EC-Engineer supports multiple languages, which can be changed at runtime. Adding support for further lanuages is quite easy because it is just a simple `XML` file which must be added to the kit.

All language files are stored in: `"%ProgramFiles%/acontis_technologies/EC-Engineer/Languages/...`

EC-Engineer has also full UNICODE support, which means that it is also possible to support Asian languages:

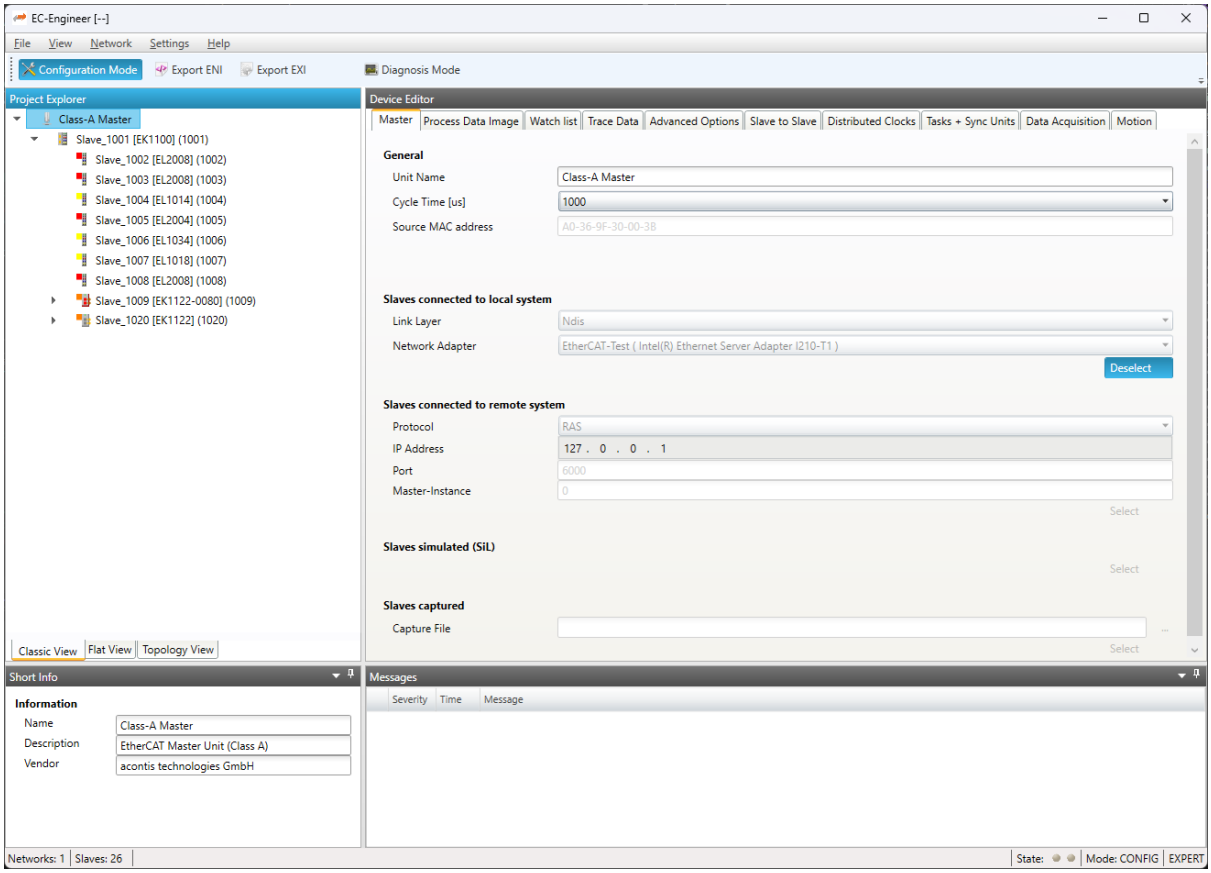


10.2 Themes

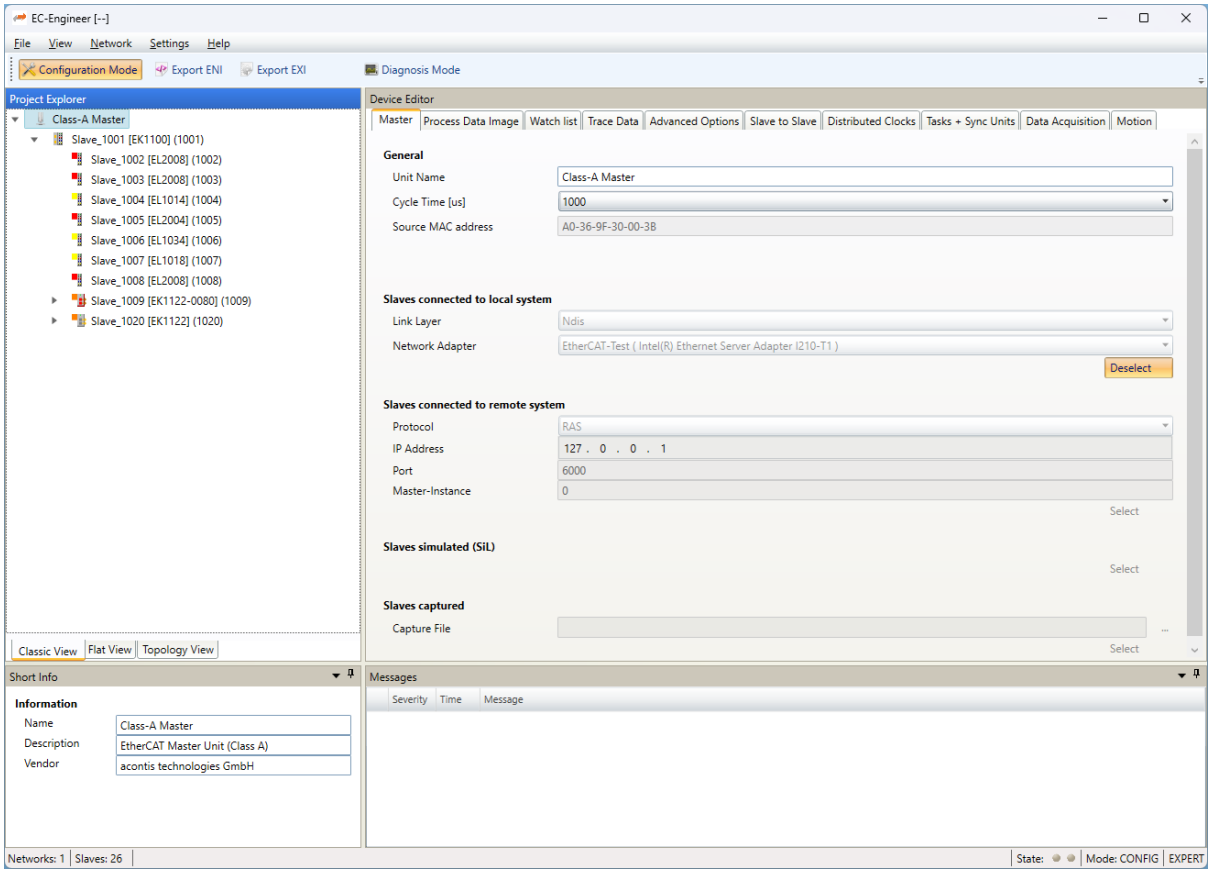
EC-Engineer supports multiple themes, which can be changed during compile time. Adding support for further themes is quite easy because a theme consists of a couple of XAML files which must be added to the kit.

Five themes are already included into EC-Engineer:

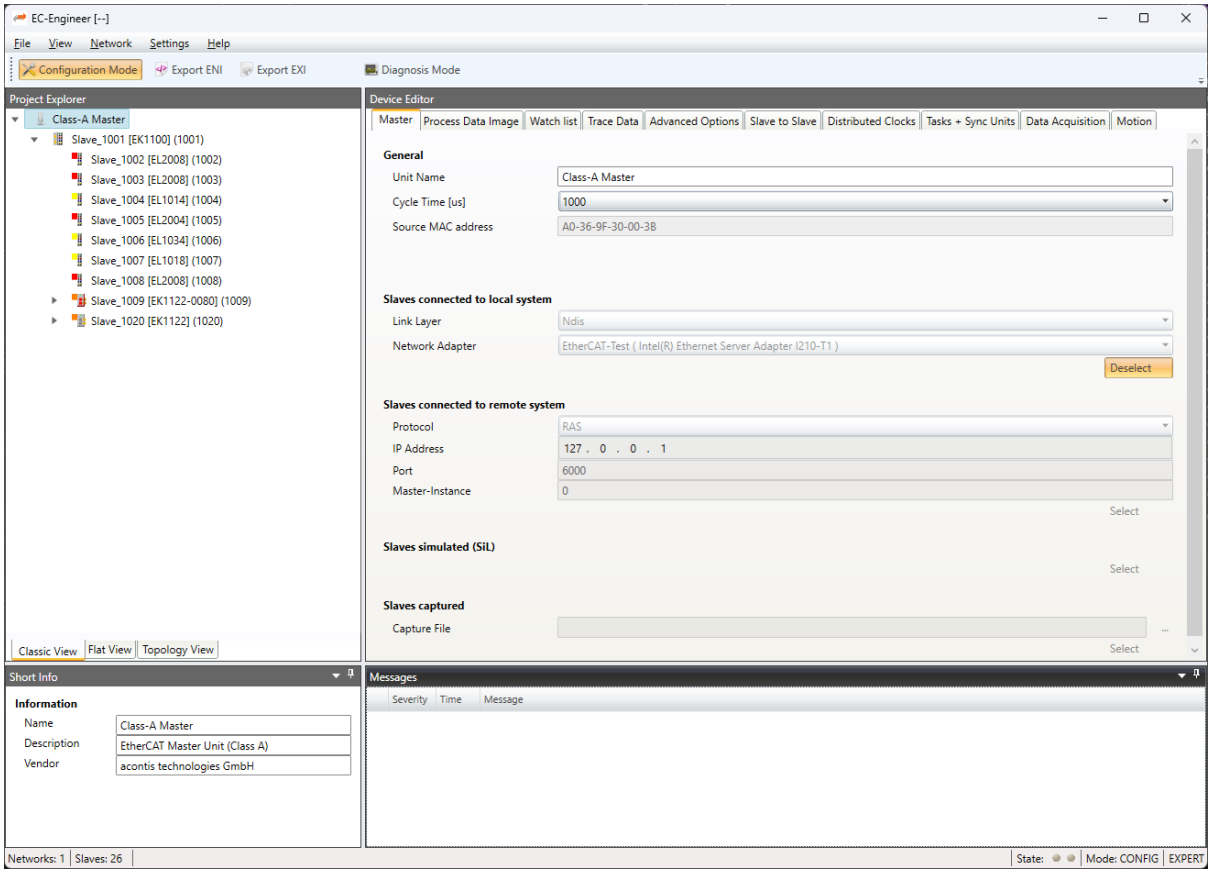
IG Theme



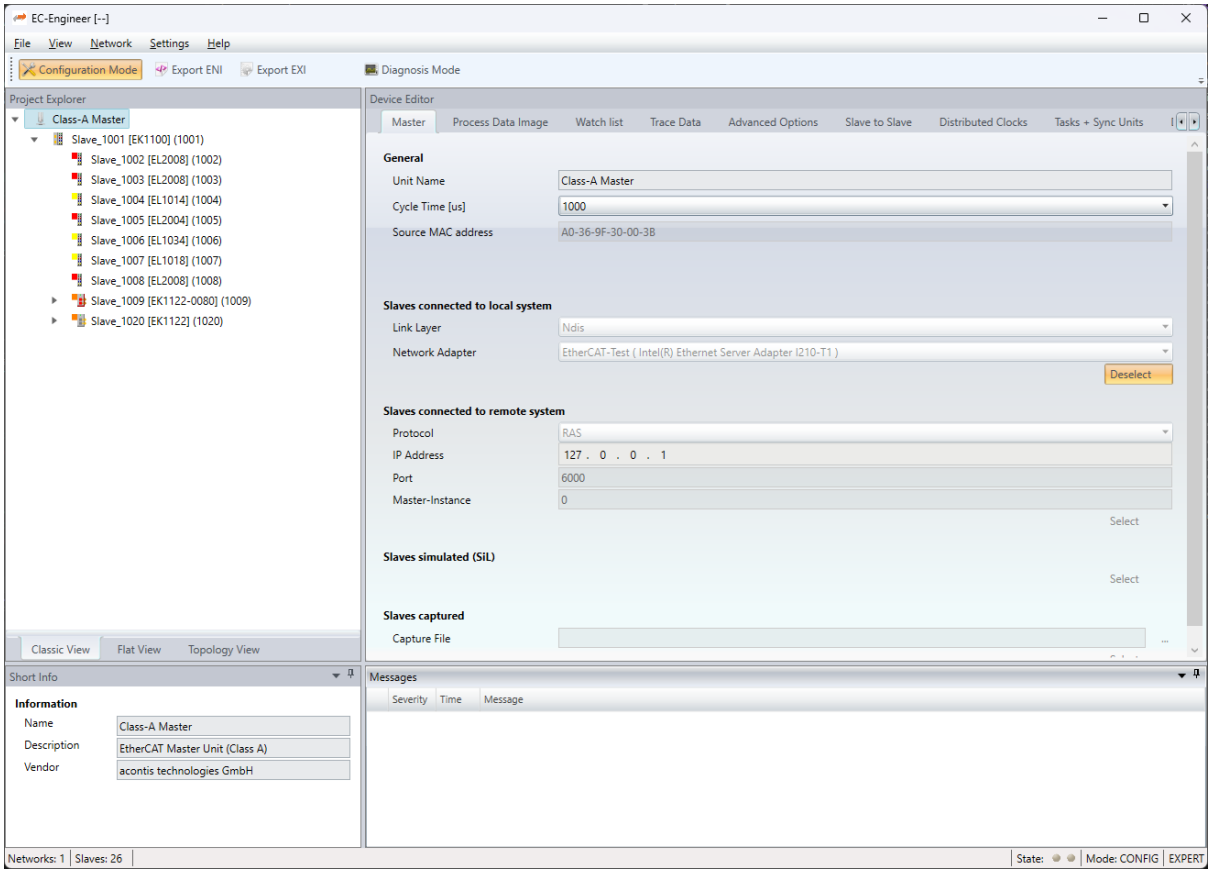
Office 2010 Blue Theme



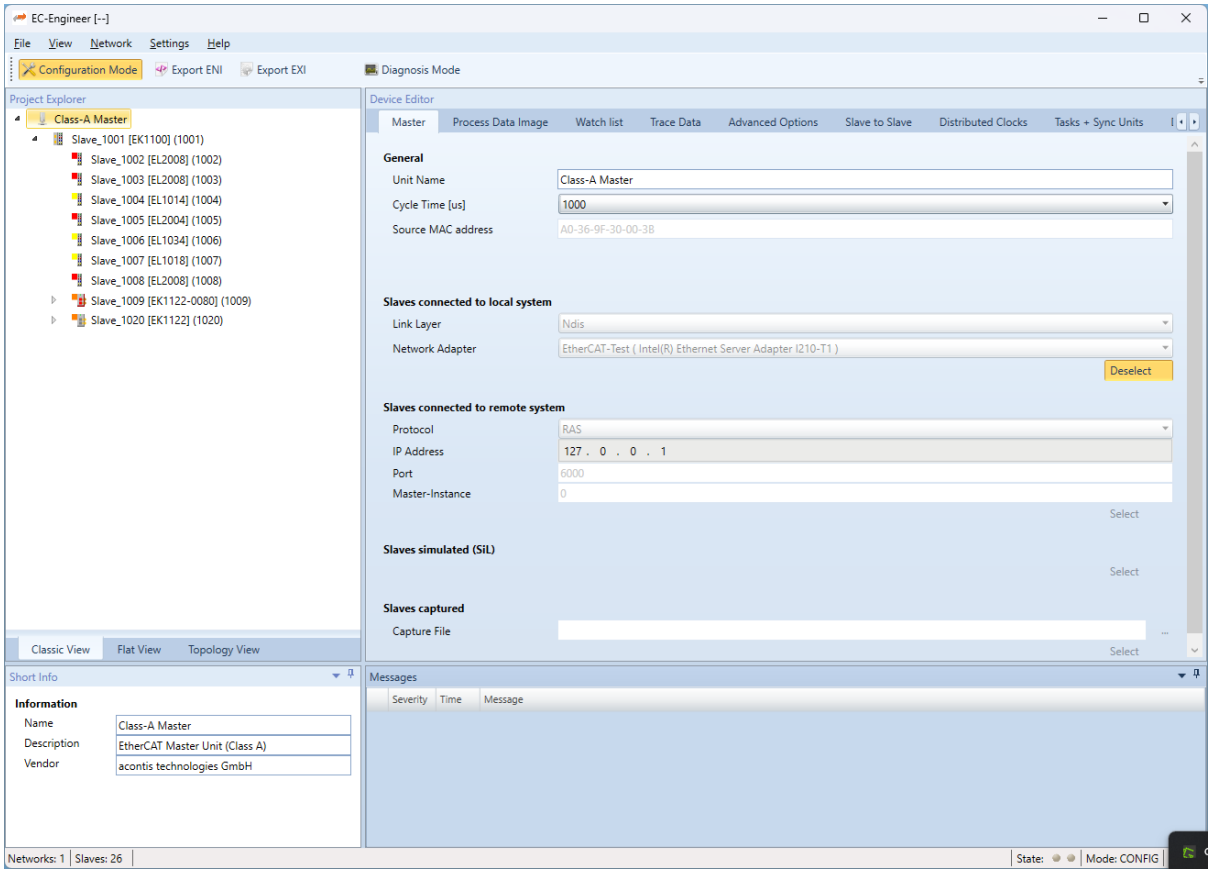
Office 2007 Black Theme



Office 2007 Sliver Theme

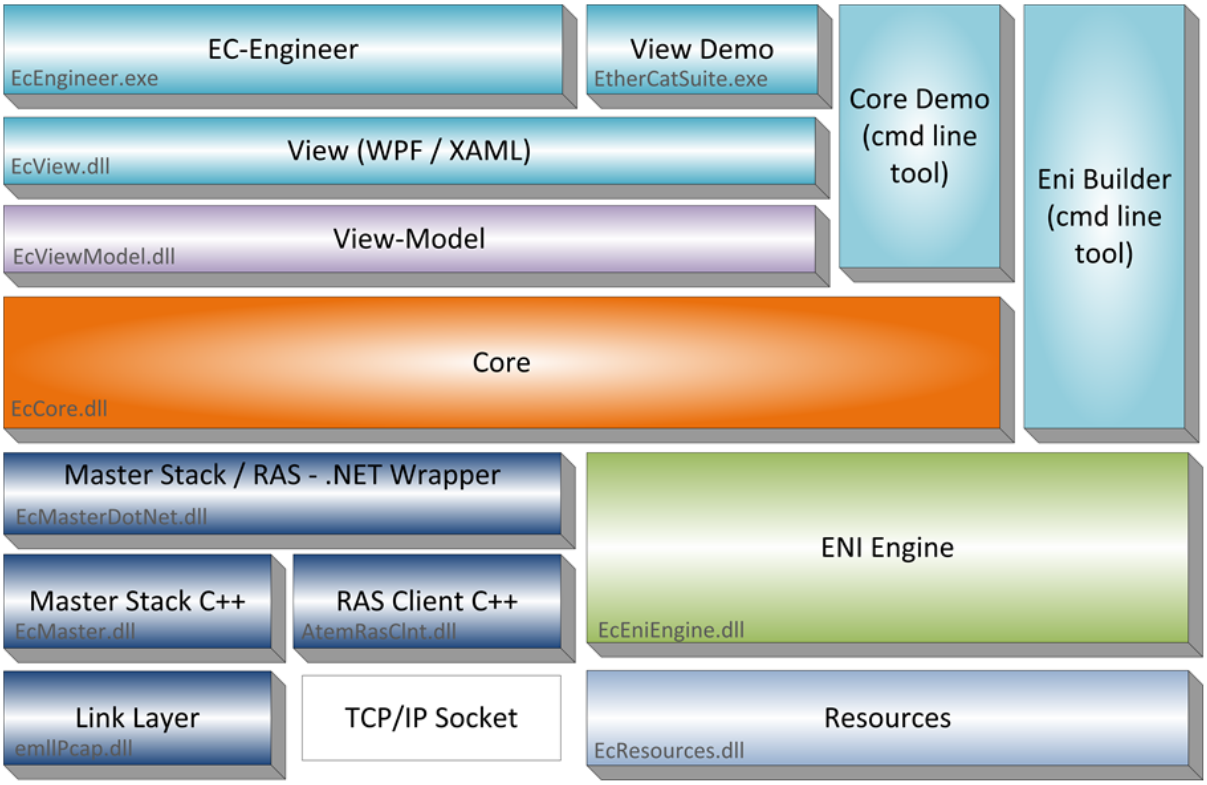

EC-Engineer [--]
File View Network Settings Help
Configuration Mode
Export ENI
Export EXI
Diagnosis Mode
Project Explorer
Class-A Master
Slave_1001 [EK1100] (1001)
Slave_1002 [EL2008] (1002)
Slave_1003 [EL2008] (1003)
Slave_1004 [EL1014] (1004)
Slave_1005 [EL2004] (1005)
Slave_1006 [EL1034] (1006)
Slave_1007 [EL1018] (1007)
Slave_1008 [EL2008] (1008)
Slave_1009 [EK1122-0080] (1009)
Slave_1020 [EK1122] (1020)
Classic View
Flat View
Topology View
Device Editor
Master
Process Data Image
Watch list
Trace Data
Advanced Options
Slave to Slave
Distributed Clocks
Tasks + Sync Units
General
Unit Name
Class-A Master
Cycle Time [us]
1000
Source MAC address
A0-36-9F-30-00-3B
Slaves connected to local system
Link Layer
Ndis
Network Adapter
EtherCAT-Test (Intel(R) Ethernet Server Adapter I210-T1)
Deselect
Slaves connected to remote system
Protocol
RAS
IP Address
127 . 0 . 0 . 1
Port
6000
Master-Instance
0
Select
Slaves simulated (SiL)
Select
Slaves captured
Capture File
Short Info
Information
Name
Class-A Master
Description
EtherCAT Master Unit (Class A)
Vendor
acontis technologies GmbH
Messages
Severity
Time
Message
Networks: 1
Slaves: 26
State:
Mode: CONFIG
EXPERT

Luna Theme



10.3 Integration into 3rd-Party Applications

The software architecture of EC-Engineer is keept very modular:



This allows us adjust to customer needs and to integrate it into nearly every customer engineering environment. We can integrate the complete product or only parts of it, like:

View-Layer
: Only changes on XAML-level needed, only a few changes are necessary to get your own look and feel

ViewModel-Layer
: For a customer which has already his own GUI or wants to be very flexible

Core-Layer

- Used with CoreDemo as a commandline tool
- Used directly as library by adding the C# assembly as reference to the exisiting project

EniEngine-Layer

- Used with EniBuilder as a commandline tool
- Used directly as library by adding the C# assembly as reference to the exisiting project

If you are interested in integrating the product or parts of the product into your existing framework, please contact us.

11 Licensing

11.1 Third party Software

EC-Engineer is using the following third party software:

- Infragistics

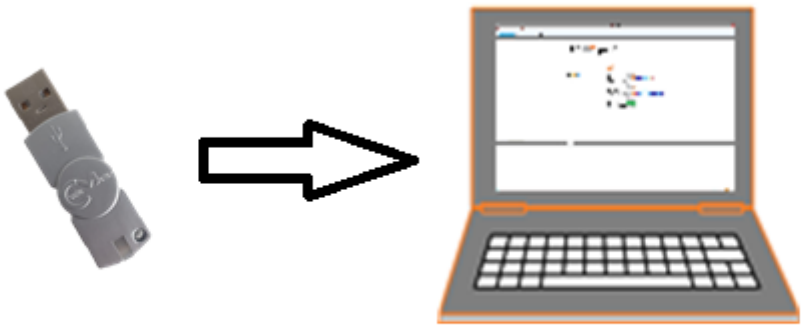
11.2 EC-Engineer License

For EC-Engineer we have two license models:

- Node Locked License
- Floating License

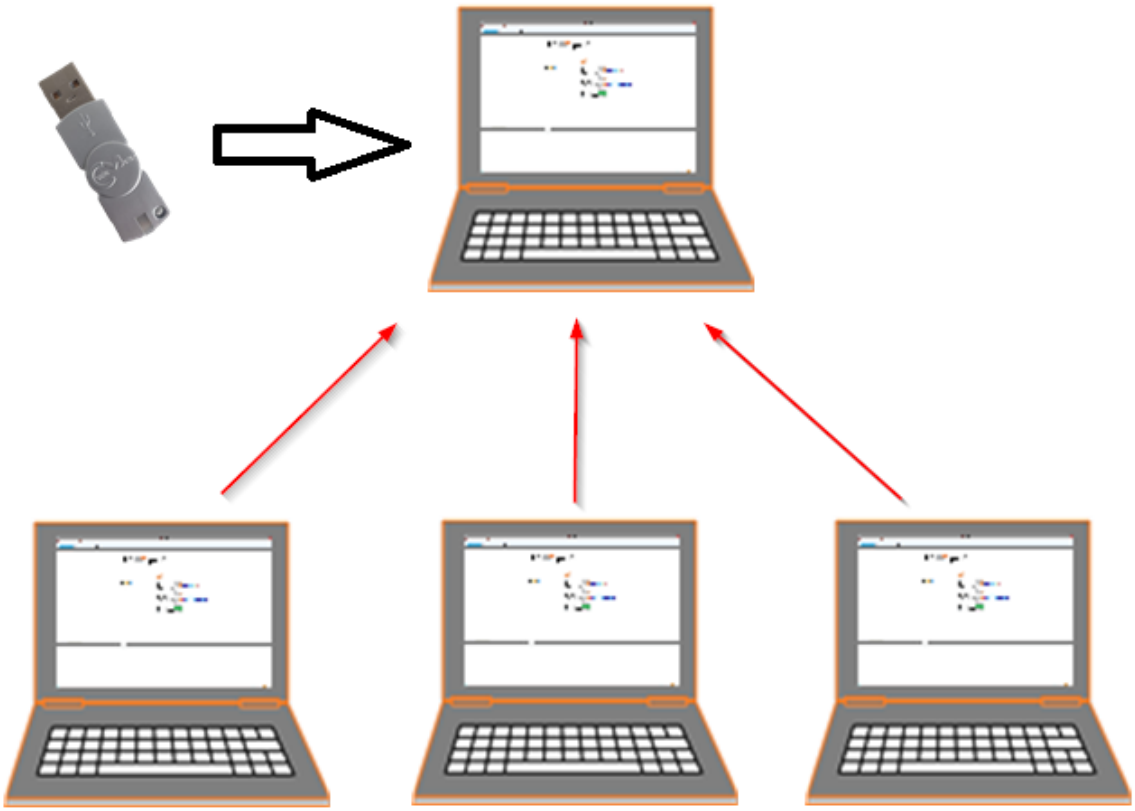
11.3 Node Locked License

If you choose this license model, you need an USB dongle for every single computer. This dongle must be plugged into the computer where you want to use EC-Engineer.



11.4 Floating License

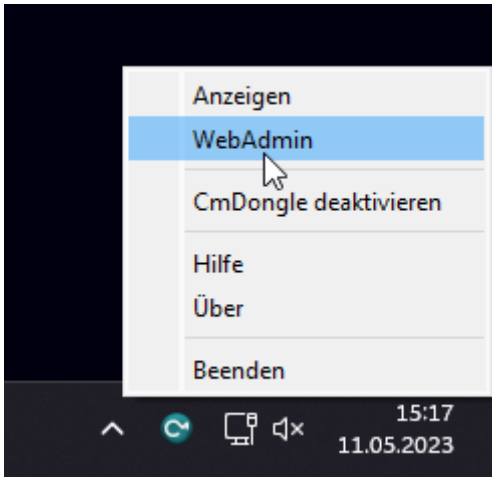
If you choose this license model, you need only one USB dongle with multiple floating licenses. This dongle must be plugged into your license server and all client computers will connect to this license server.



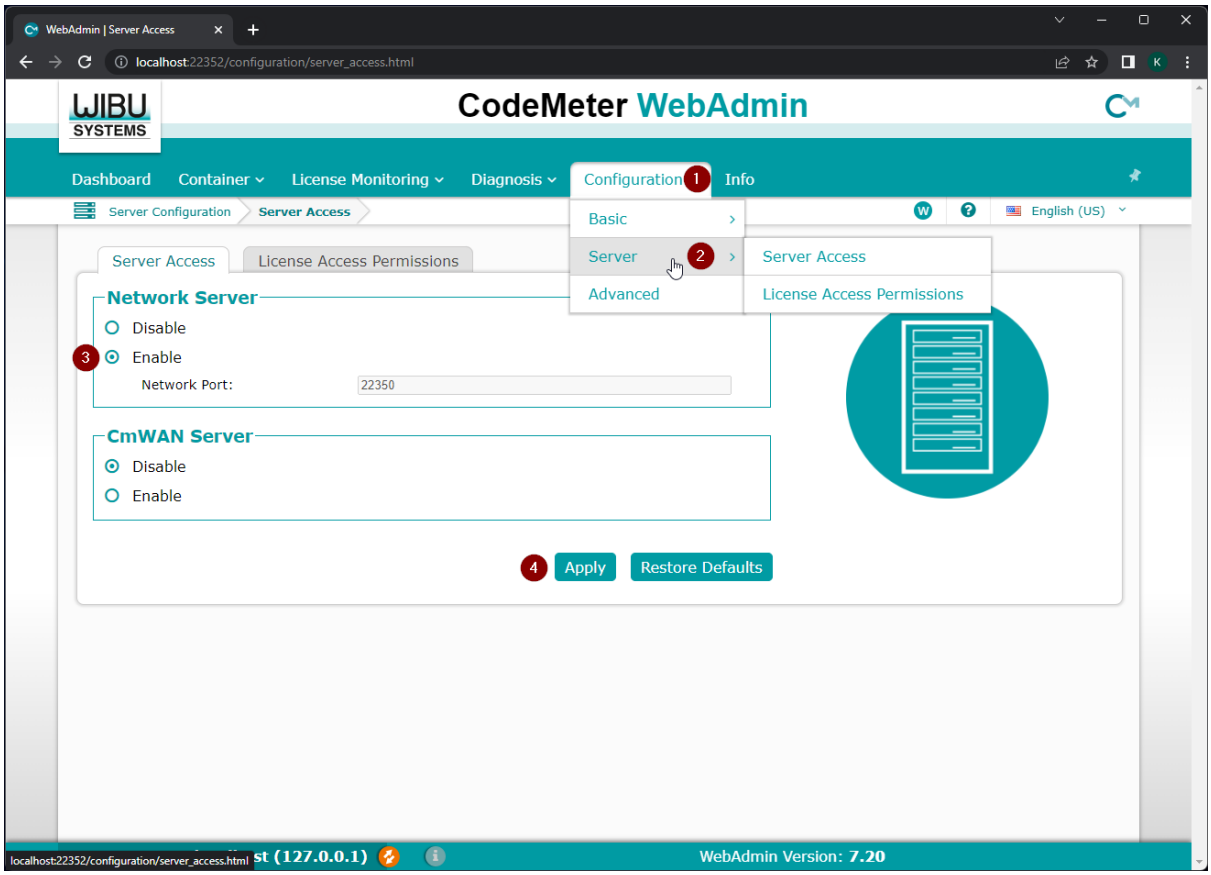
Note: This requires that the “WebAdmin” of the “Code Meter” is installed on the system. Please download and install the “Code Meter Runtime” from WIBU: https://www.wibu.com/

11.4.1 Configure License Server

Install the “Dongle-Version” of EC-Engineer on your license server, plug-in your USB dongle and open the “WebAdmin”:

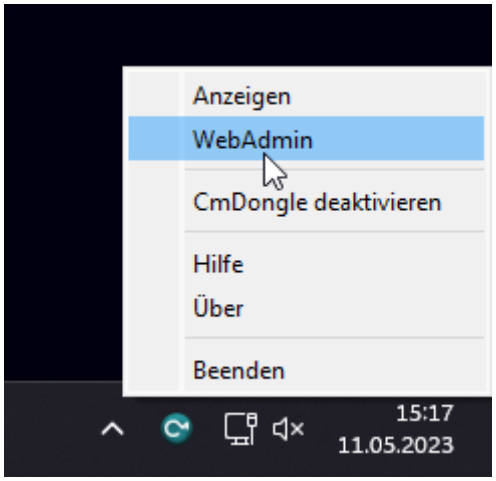


In the “WebAdmin” navigate to “Configuration Server”, select the option “Run Network Server” and press *Apply*:

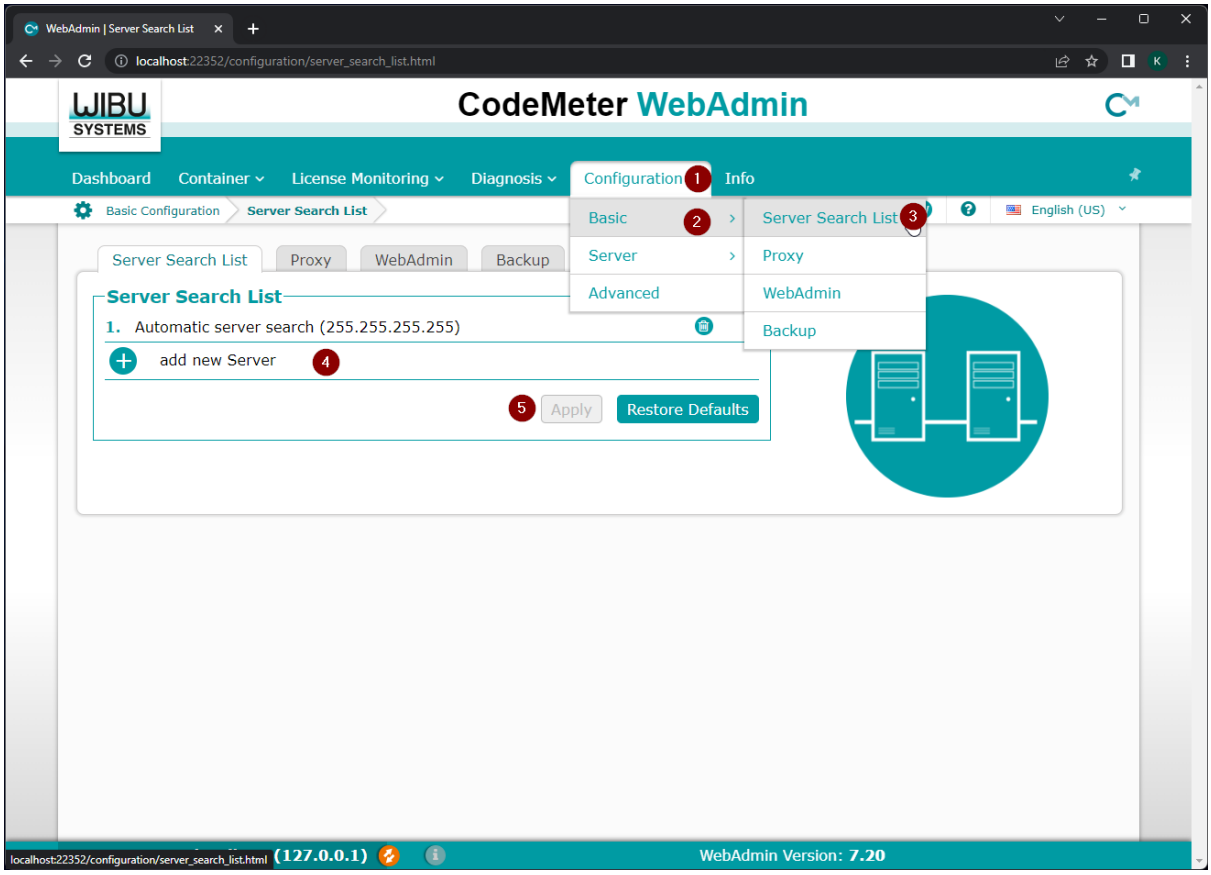


11.4.2 Configure Client Computer

Install the "Dongle-Version" of EC-Engineer and open the "WebAdmin":

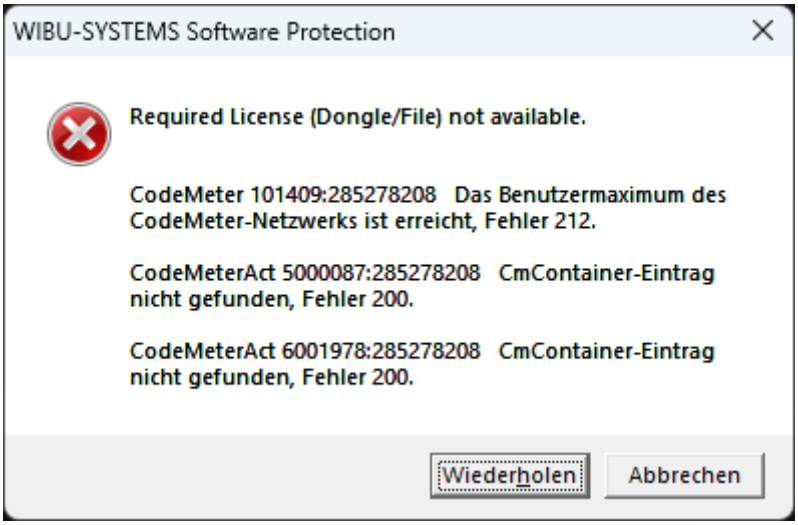


In the "WebAdmin" navigate to "Configuration Network", press *add*, enter your IP address of your license server and press *Apply*:



Now, you should be able to start EC-Engineer.

Note: If too many clients are connected you will, you will receive the following error message:

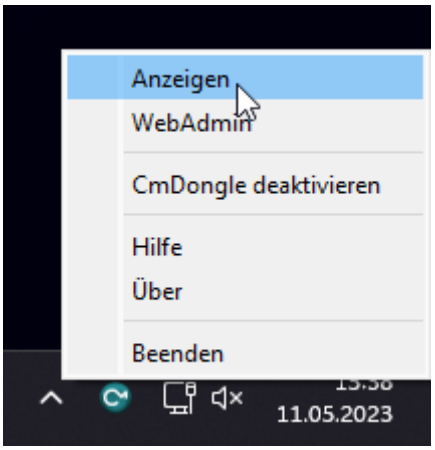


In that case, you should try to close unused EC-Engineer instances or buy more floating licenses.

11.5 License Update

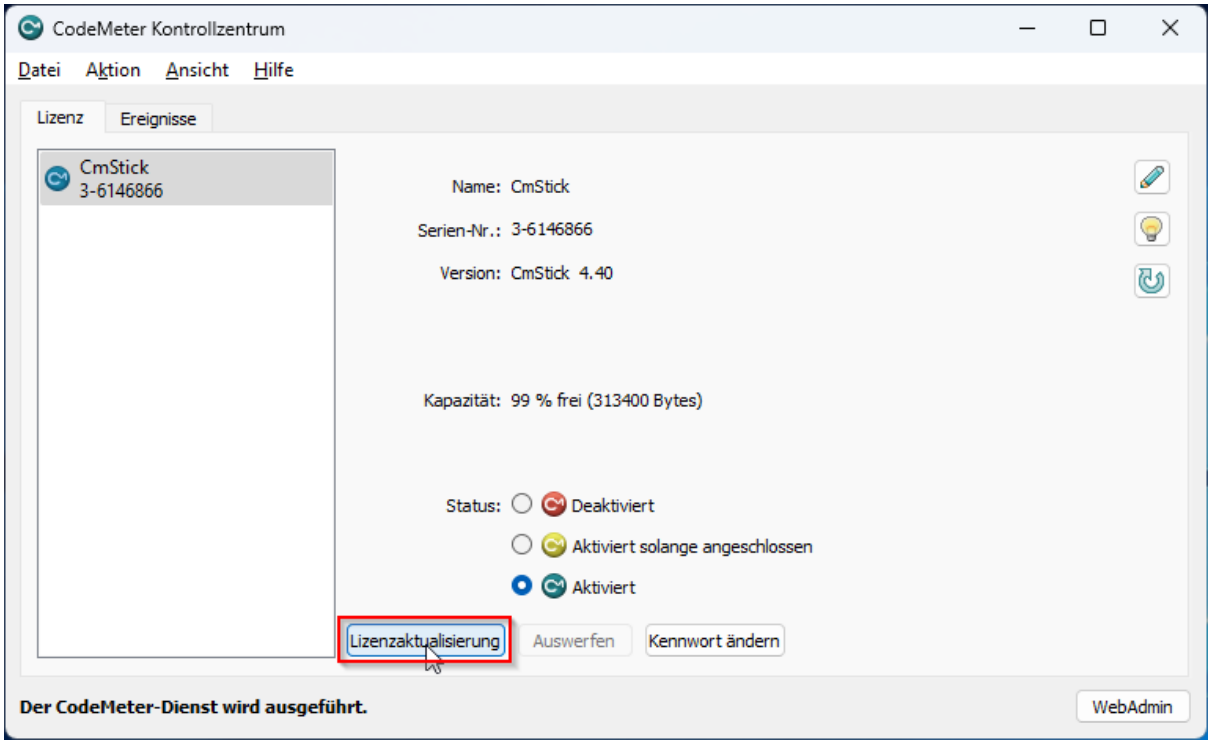
11.5.1 Request License Update

Step 1: Install the "Dongle-Version" of EC-Engineer and open the "CodeMeter Control Center":

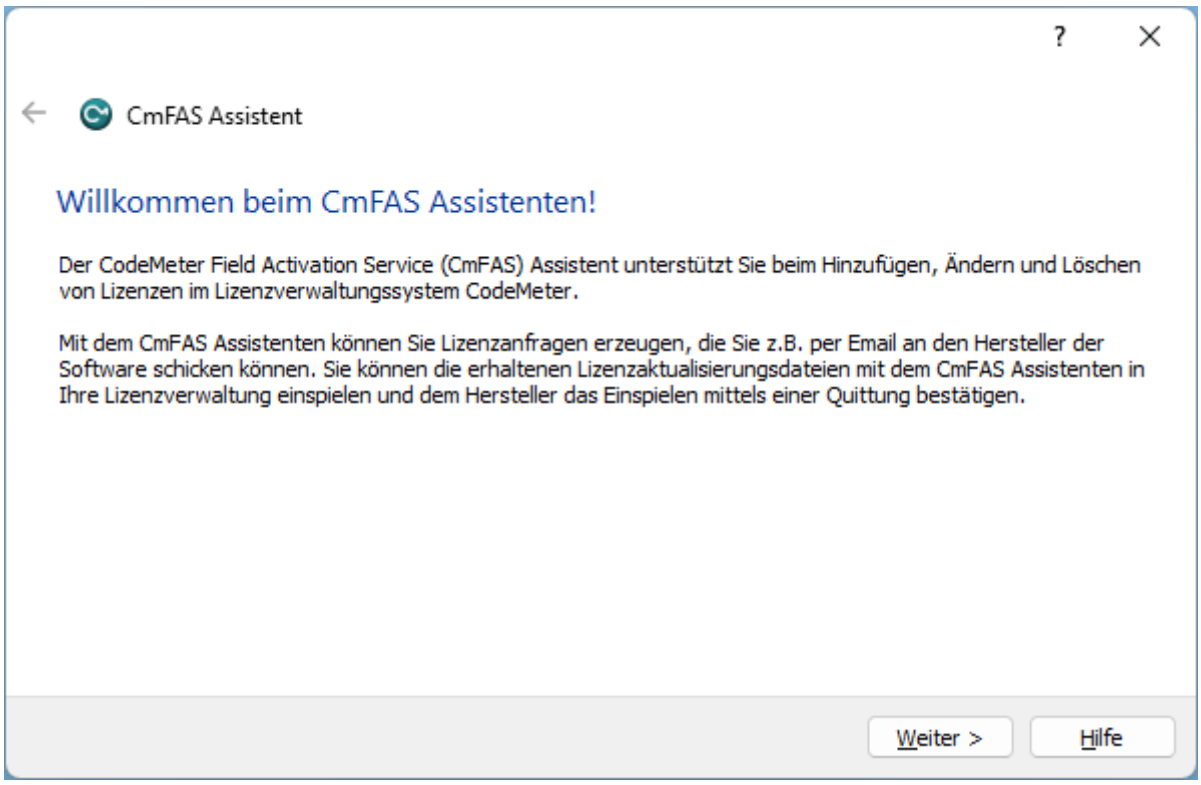


If the selected license is a virtual dongle, simply drag and drop the WibuCmLIF file onto the CodeMeter Control Center. Otherwise, the dongle should already be visible.

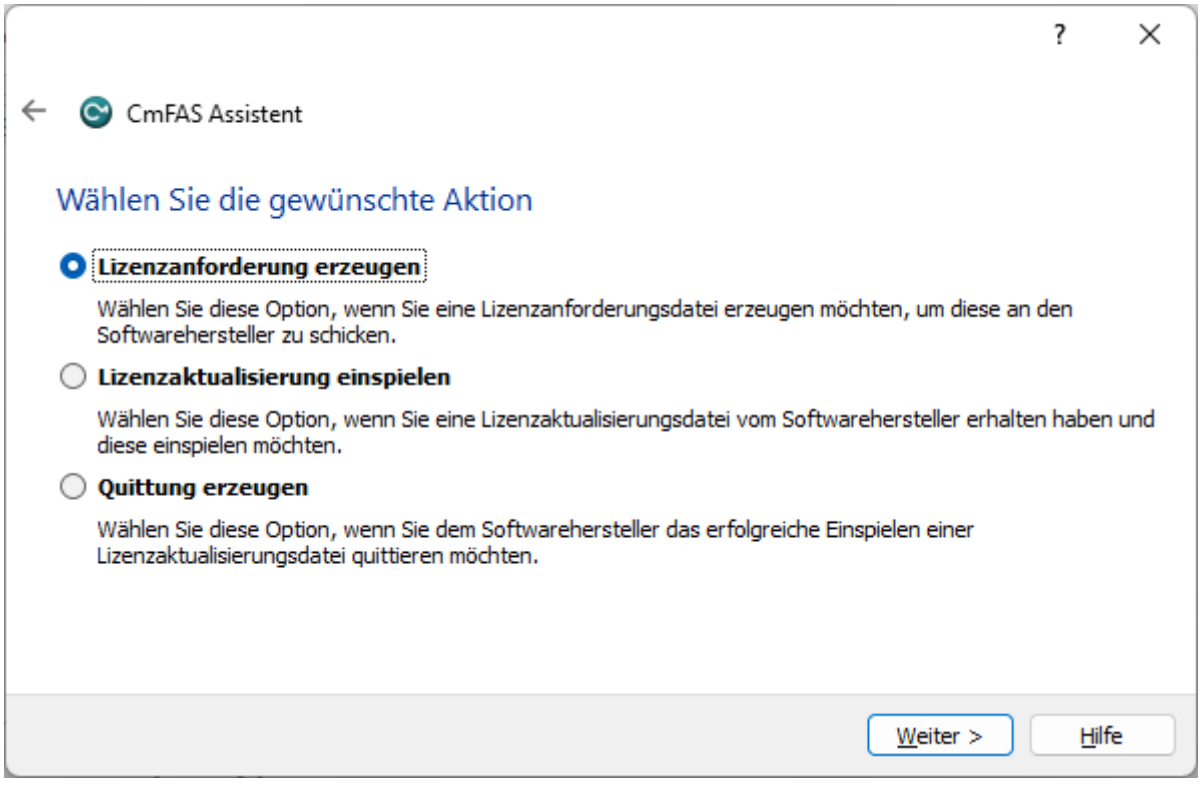
Step 2: In the "CodeMeter Control Center" open the "CmFAS Assistent" by clicking on *License Update*:



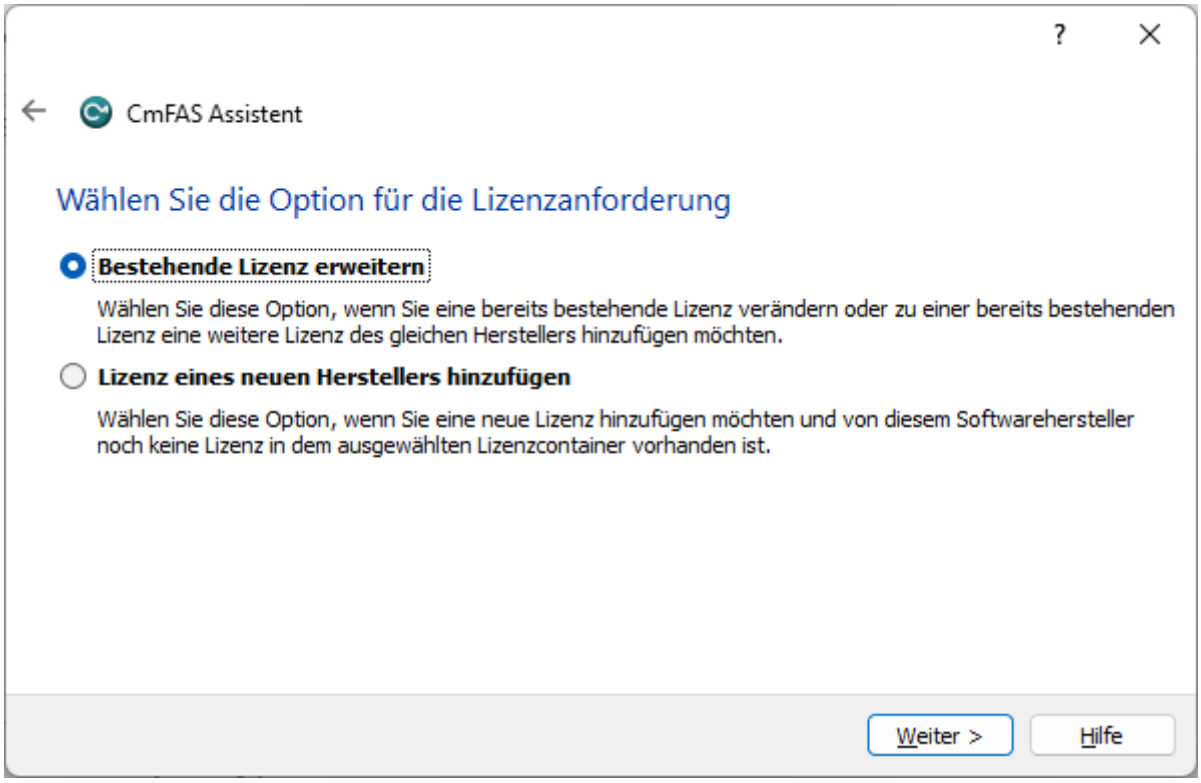
Step 3: Now, follow the assistant until you can select a file name:



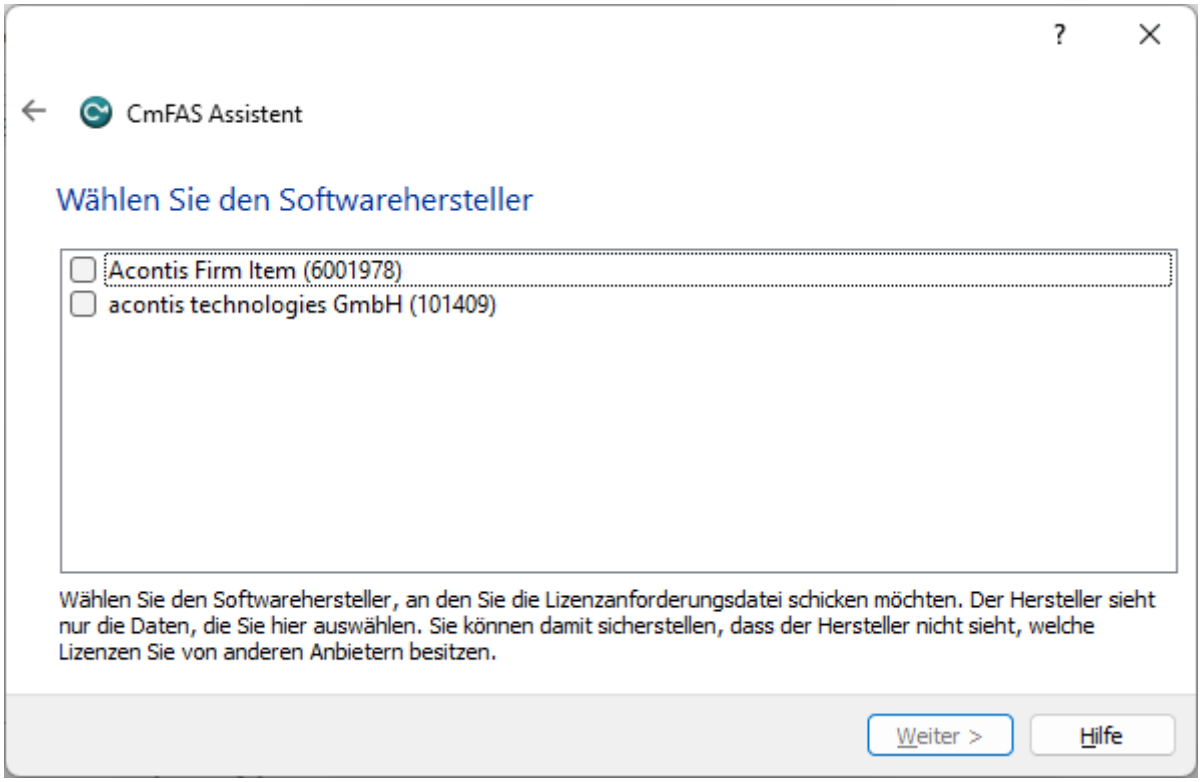
Step 4: Select "Create license request":



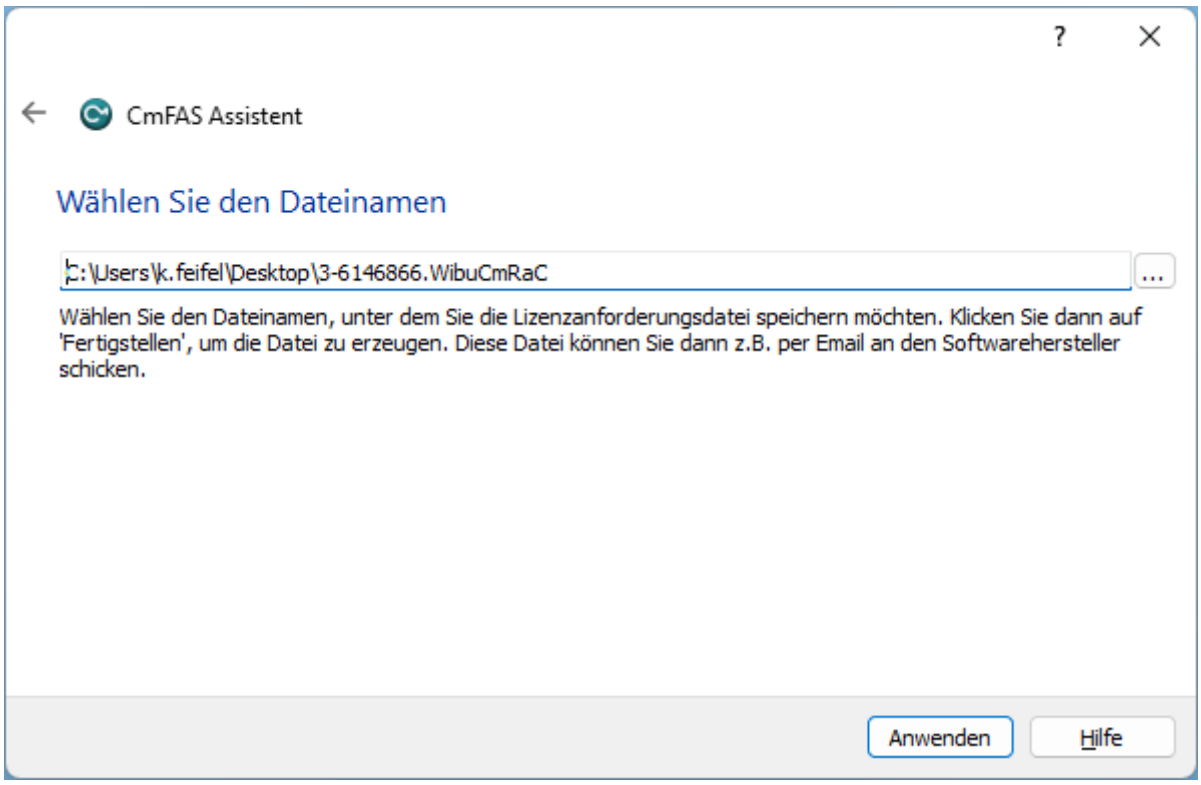
Step 5: Select "Extend existing license":



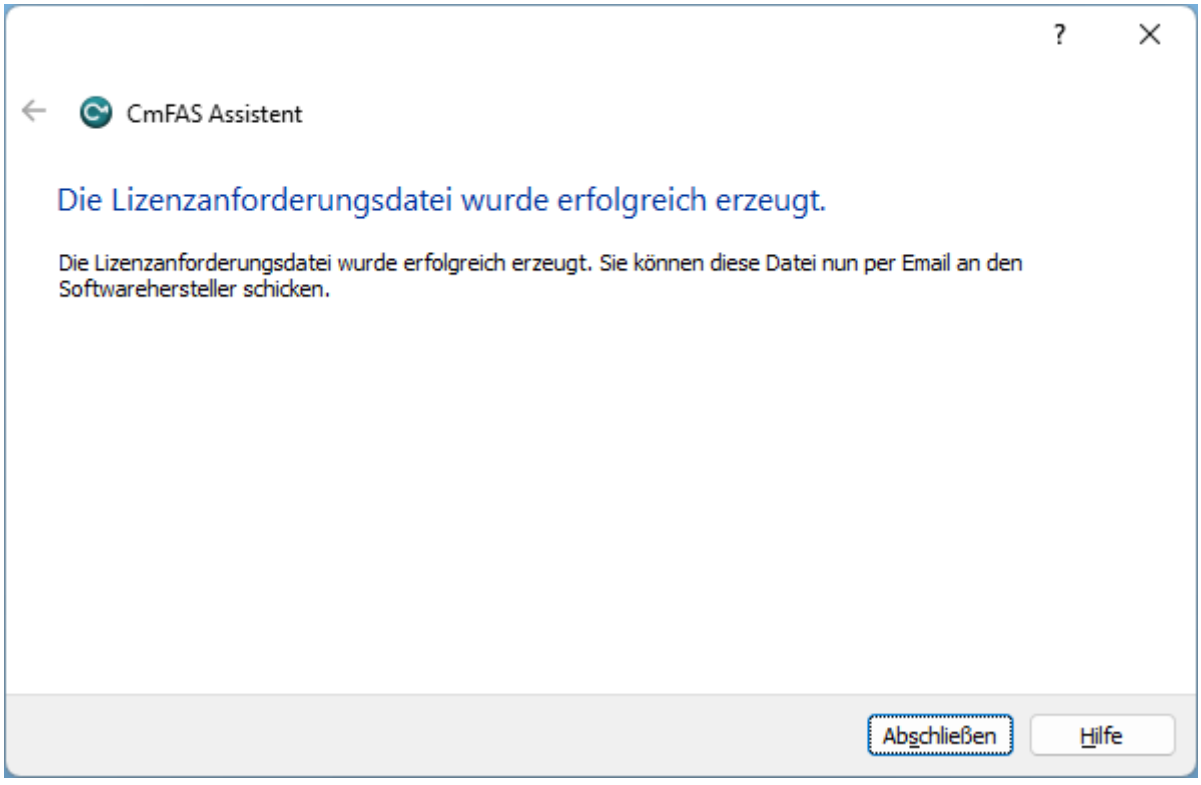
Step 6: Keep the selected the vendor:



Step 7: Select the file name:



Step 8: Finish the assistant:



Step 9: Your license request file `*.WibuCmRaC` has been successfully created. Please send it to sales@acontis.com

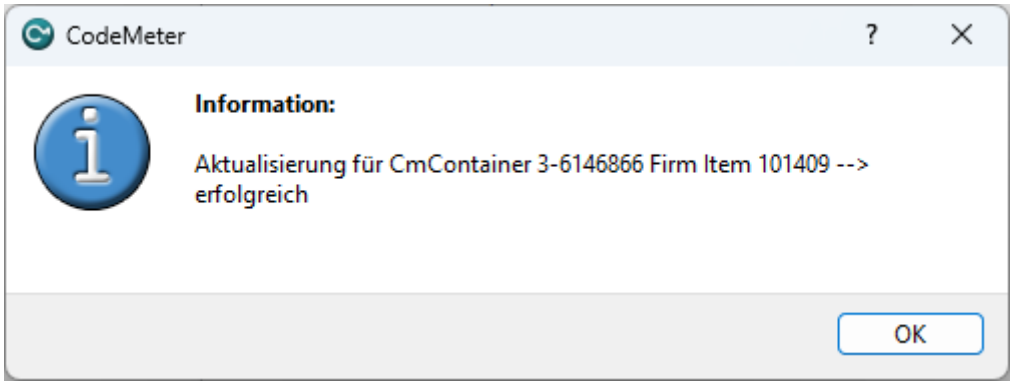
11.5.2 Install License Update

After you have been sent your license request file you will receive the license update file `*.WibuCmRaU`.

Step 1: Connect your dongle.

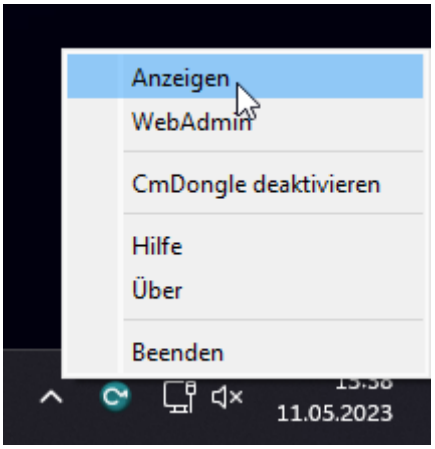
Step 2: Copy the license update file to your desktop.

Step 3: Double-click on the license update file:

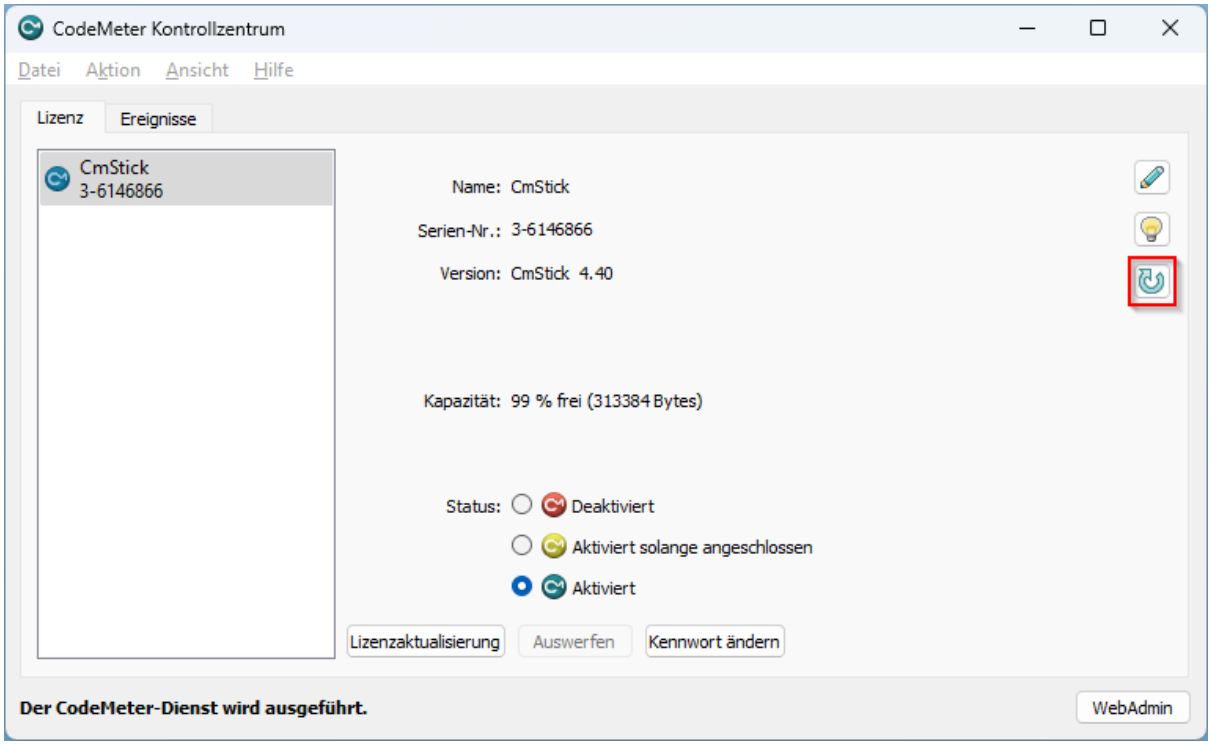


11.6 Dongle Firmware Update

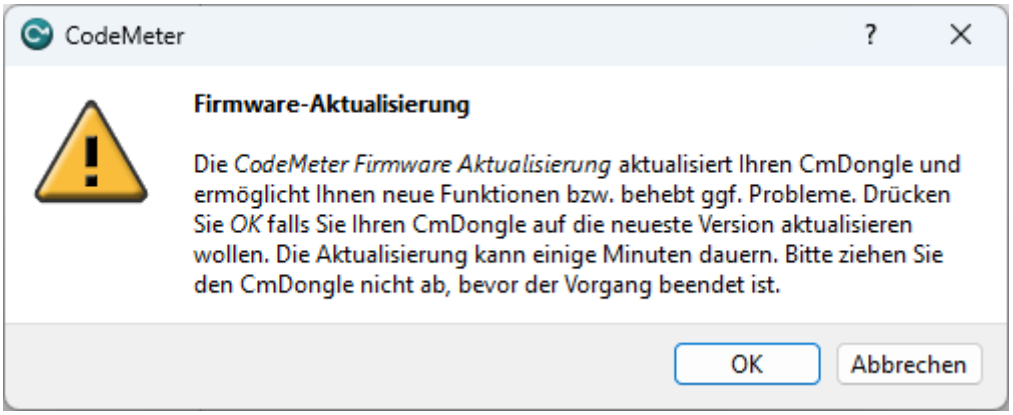
Step 1: Install the "Dongle-Version" of EC-Engineer and open the "CodeMeter Control Center":



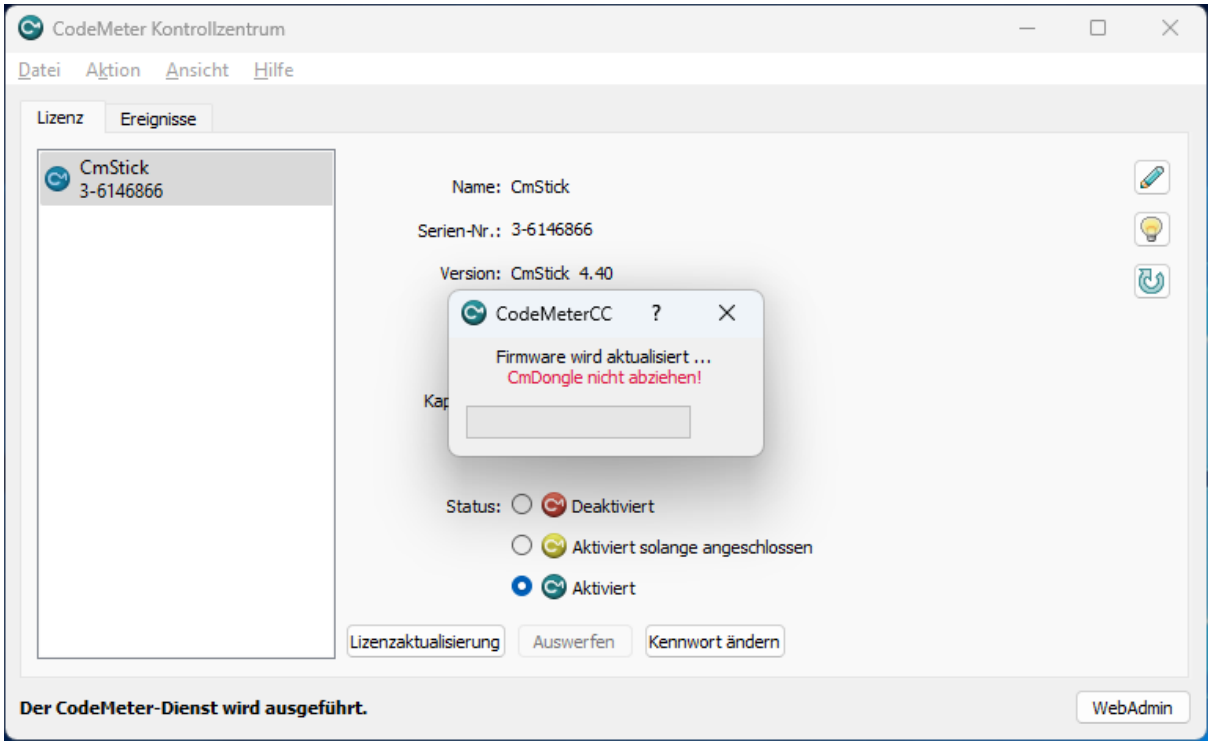
Step 2: In the "CodeMeter Control Center" click on *Update Firmware of selected Cm Dongle*:



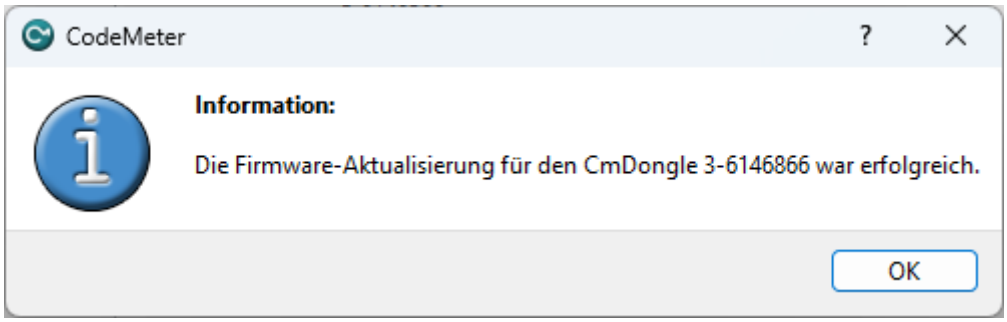
Step 3: Execute firmware update by pressing *OK*:



Step 4: Wait until firmware update was executed:



Step 5: Firmware update was done and dongle can be removed:

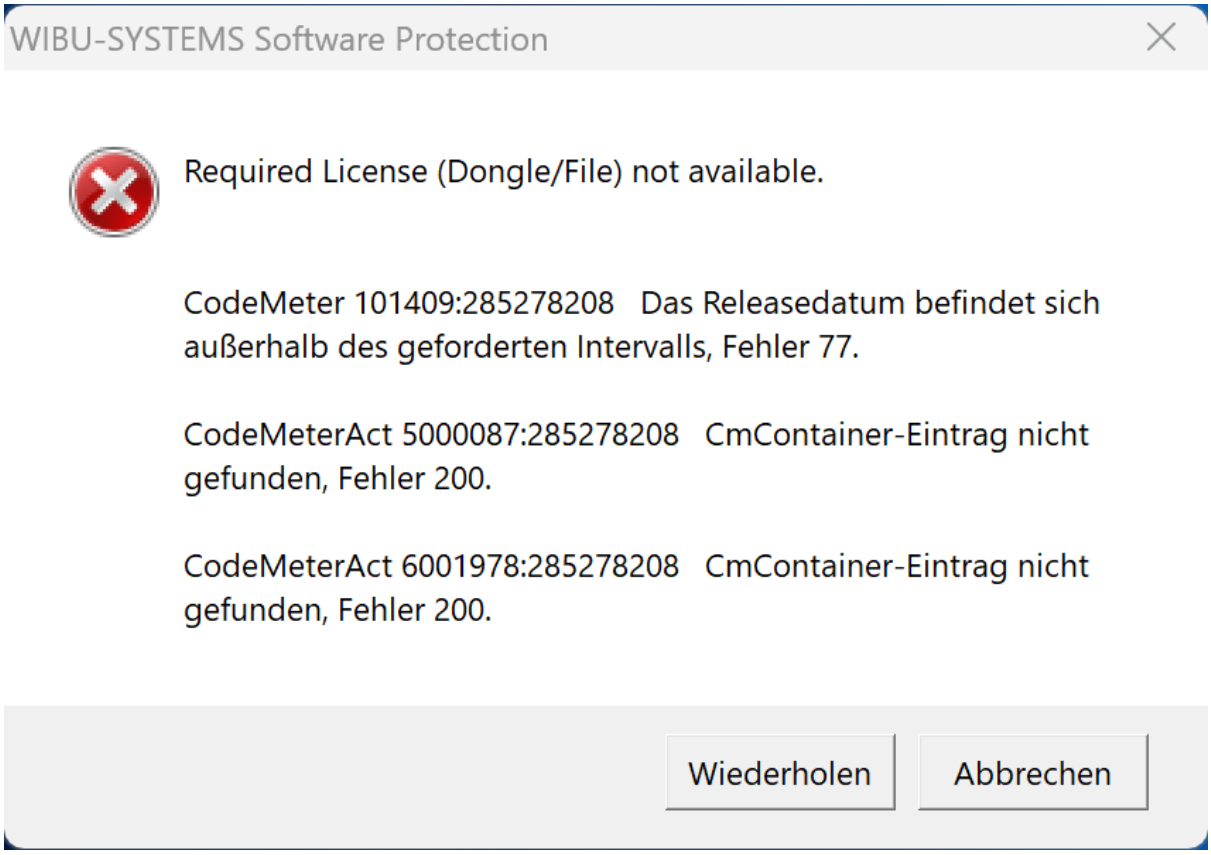


11.7 Expiration Date Dongle

If you chosed a expiration dongle you can find your expiration date in the 'About Dialog'. If you have an unlimited dongle you will not see a date in the dialog.

If you see this date you can not use an Engineer which was released after the expiration date, but all older ones are possible.

If you try to start an Engineer which is newer than the expiration date, you will get the following error:


WIBU-SYSTEMS Software Protection
Required License (Dongle/File) not available.
CodeMeter 101409:285278208 Das Releasedatum befindet sich außerhalb des geforderten Intervalls, Fehler 77.
CodeMeterAct 5000087:285278208 CmContainer-Eintrag nicht gefunden, Fehler 200.
CodeMeterAct 6001978:285278208 CmContainer-Eintrag nicht gefunden, Fehler 200.
Wiederholen
Abbrechen

12 FAQ, Tips

12.1 Problems with install or uninstall

If you have a problem with the setup of the EC-Engineer remove the following keys and folders to uninstall EC-Engineer manually:

`C:/Program Files (x86)/acontis_technologies/EC-Engineer`

`C:/ProgramData/EC-Engineer`

`C:/Windows/Installer/{07985CE9-9024-422C-8E72-C449BFC33CA0}`

`&temp%`

`HKEY_LOCAL_MACHINE/SOFTWARE/Microsoft/Windows/CurrentVersion/Uninstall/{07985CE9-9024-422C-8E72-C449BFC33CA0}`

`HKEY_LOCAL_MACHINE/SOFTWARE/acontis technologies/EC-Engineer`
`HKEY_LOCAL_MACHINE/SOFTWARE/Classes/Installer/Products/9EC589704209C224E8274C94FB3CC30A`

After these steps try to install EC-Engineer again.

12.2 Help in case of a problem

If you have a problem with EC-Engineer or something does not run as expected, please try first the following things:

- Read messages in message window
- Increase message level *Menu ▸ Settings ▸ All Messages*
- Read log file for more information *Menu ▸ Help ▸ Show ▸ Log ▸File*
- Restart EC-Engineer and try to do it again
- **Contact support by sending a mail to ecsupport@acontis.com and attach the following information**
  - Project file `.ecc`
  - EC-Engineer Version *Menu ▸ Help ▸ About*
  - Log file *Menu ▸ Help ▸ Show Log File*
  - Short description how the reproduce it

12.3 Shortcuts

EC-Engineer supports shortcuts for the most commonly used actions, like:

Menu

- `Ctrl` + `N`: Create new project
- `Ctrl` + `O`: Open project
- `Ctrl` + `S`: Save project
- `Alt` + `F4`: Exit program

Context menu of project explorer

- `Ctrl` + `X`: Cut slave including all subslaves
- `Ctrl` + `C`: Copy slave including E-Bus subslaves
- `Ctrl` + `V`: Paste (previously cut or copied) slave

12.4 Internal User Specific Settings

EC-Engineer saves all user specific settings in a subfolder of the all users directoy `%ALLUSERSPROFILE%/EC-Engineer` like `C:/ProgramData/EC-Engineer`.

In this directoy there is a `XML` file called `User.myusername.xml`. In this file, the user can find additional settings, which can be helpful for solving some problems:

MasterUnitLocalCycleTime = 1
Bus cycle time of the internal master in milliseconds

MasterUnitLocalWorkerSleepTimeMs = 100
Cycle time of the local master thread in milliseconds

MasterUnitRemoteWorkerSleepTimeMs = 300
Cycle time of the remote master thread in milliseconds

MasterUnitTimerNormalCount = 4

- Time shift to cycle time of the normal refresh cycle
- E.g. local master = 100 ms, normal refresh cycle is every 400 ms
- Used e.g. for updating master information, error counters of slave, …

MasterUnitTimerSlowerCount = 20

- Time shift to cycle time of the slower refresh cycle
- E.g. local master = 100 ms, slower refresh cycle is every 2 seconds
- Used e.g. for updating the slave information, EEPROM data, register data, …

MasterUnitTimerSlowestCount = 120

- Time shift to cycle time of the slowest refresh cycle
- E.g. local master = 100 ms, slower refresh cycle is every 12 seconds
- Used e.g. for updating the CoE Object Dictionary, …

MasterUnitScanBusTimeout = 5000
Timeot for bus scan in milliseconds

MasterUnitMailboxTimeout = 5000
Timeout for mailbox access in milliseconds

MasterUnitStateChangeTimeout = 5000
Timeout for changing state machines in milliseconds

MasterUnitRegisterTimeout = 3000
Timeout for register access in milliseconds

MasterUnitProcessDataTimeout = 1000
Timeout for process data access in milliseconds

MasterUnitEepromTimeout = 3000
Timeout for EEPROM access in milliseconds

MasterUnitRasCycleTime = 0
Internal RAS cycle time for polling

MasterUnitRasWatchDog = 0
Internal RAS watchdog interval

MasterUnitRasWdToLimit = 0
Internal RAS watchdog limit

DiagGeneralErrorLvlLostLink = 10
Theshold value for the “Lost Link Errors”, which leads to an error

DiagGeneralWarningLvlLostLink = 1
Theshold value of the “Lost Link Errors”, which leads to a warning

DiagGeneralErrLvlRxError = 10
Theshold value for the “RX Errors”, which leads to an error

DiagGeneralWarnLvlRxError = 0.001
Theshold value of the “RX Errors”, which leads to a warning

DiagGeneralErrLvlInvalidFrame = 10
Theshold value for the “Invalid Frames”, which leads to an error

DiagGeneralWarnLvlInvalidFrame = 0.001
Theshold value of the “Invalid Frames”, which leads to a warning

DiagGeneralErrLvlProcUnitErr = 1000
Theshold value for the “Processing Unit Errors”, which leads to an error

DiagGeneralWarnLvlProcUnitErr = 100
Theshold value of the “Processing Unit Errors”, which leads to a warning

MasterDebugMessageLevel = 0
Activates extended debug messages of the EC-Master (0 = Silent, 1 = Any, 2 = Critical, 3 = Error, 4 = Warning, 5 = Info, 6 = InfoApi, 7 = Verbose, 8 = VerboseCyc)

GuiDebugMessageLevel = 0
Activates extended debug messages of the GUI (0 = Off, 1 = Errors, 2 = All)

IndentXmlFiles = False
Activates indenting of `XML` files (makes exported `XML` files readable, but increases size)

EnhancedUtf8Support = False
Activates the enhanced UTF-8 support, which might be necessary if characters will be not displayed correctly

12.5 FAQ

Here you can find solutions of possible problems:

- **The integrated EC-Master does not react as estimated**
  Increase the message level (Menu Settings All Messages) and try it again.
- **EC-Engineer reports a message with ErrCode: 0x…**
  Error Codes comes directly from the EC-Master. If you want to know what to know how to solve this problem, please refer the manual of EC-Master.
- **EC-Engineer reports the following message: Not all EtherCAT slave devices are in operational state**
  Check if all slaves have a green icon. If the color is not green, open tab “Diagnosis Slave General”. Here you can see the error state of the slave. If it has no error, try to change the state to OP again.

- **EC-Engineer reports the following message: Changing topology failed: Bus configuration mismatch (ErrCode: 0x9811001E)**
  The configured bus and the currently connected bus does not match. Please open the 'Network Mismatch Analyzer' (Menu Network Network Mismatch Analyzer) to solve the problem.
- **EC-Engineer reports the following message: Slave '…' has unexpected state (Current state: '…', Expected state: '…')**
  Select the slave and open the tab "General". Here you can see the error state of the slave. If it has no error, try to change the state again.
- **Slave reports the error state: "Sync manager watchdog" (Diagnosis Slave General)**
  You need a realtime operating system. If you still want to use your slave on Windows, you can turn off this watchdog (Slave->Advanced Settings: Set SM Watchdog = 0).
- **How can I configure the modules of a BK1120 slave?**
  EC-Engineer supports only the MDP-Version of BK1120 slave. If you want to add this slave, enter "BK1120" into the search field, enable option "Show Hidden Slaves" and double-click on slave "BK1120 EtherCAT Fieldbus Coupler (MDP)" (Revision Number: 0x120001). The modules of this slave can be configured in tab "Modules" like in all other MDP slaves.

  If you have one of the other versions of BK1120 and you want to use it, please contact our support.
- **How can I update the firmware of my slave via FoE?**

  For updating the firmware of your slave via FoE, please follow these steps:

  - Enable diagnosis mode
  - Set master state to INIT
  - Select your slave, and set his state machine to BOOTSTRAP
  - Enter path of file on slave (optional)
  - Enter password (optional)
  - Press button "Download" (it will open the FileOpen-Dialog, where you can choose the file which contains the new firmware and uploads this file)
- **Connect to local system is not possible**
  Is WinPcap / Npcap / NDIS installed?

  Is at least one network adapter installed?
- **Why is the process image size different between EC-Engineer and EC-Master?**
  EC-Engineer shows on tab *Process Data Image* not the real size of the process data image. It show only the offsets and the size of the variables.

  If you want to get the real size of the process data image, which is used from EC-Master, you have to look into the `ENI` file: `EtherCATConfig/Config/ProcessImage/Inputs/ByteSize` or `EtherCATConfig/Config/ProcessImage/Outputs/ByteSize`. This is the offset + size of the last variable and additional administration data depending on the slaves which are used (ALStatus, DC Support, Mailbox, …).
- **EC-Engineer reports the following message: Failed to query EtherCAT Slaves. No slaves found.**
  Verify that WinPcap is correctly installed.

  Try to restart you operating system, because this is sometimes necessary if you e.g. using a USB network adapter

  Increase the message level (Menu Settings All Messages)

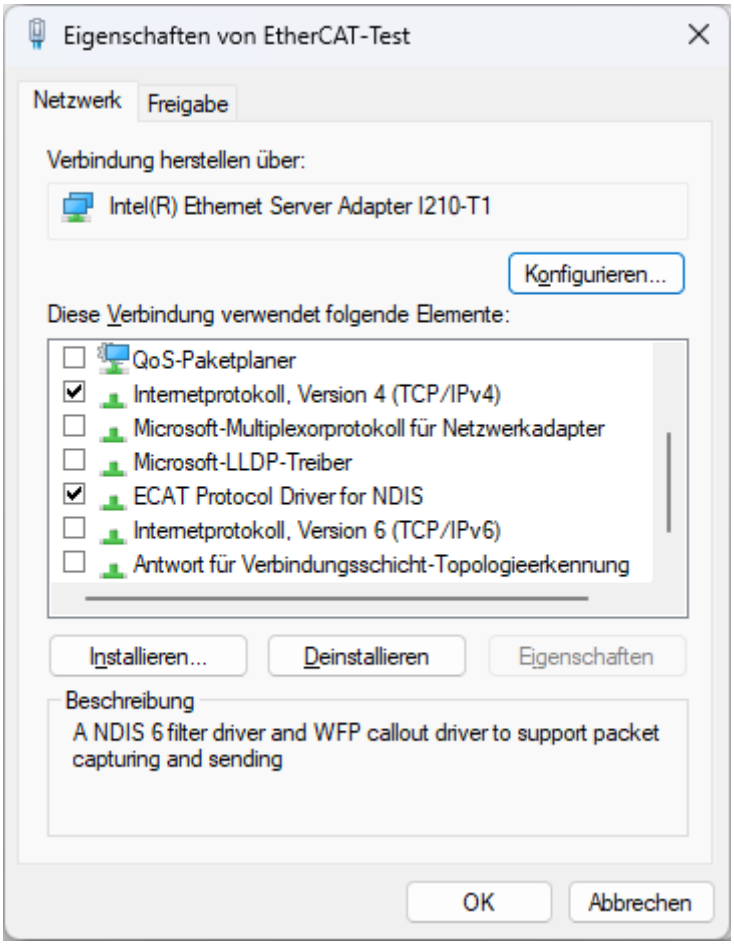
  Turn on debug message of the master

  - Stop "EC-Engineer"

  - Set “MasterDebugMessageLevel” to “7” (verbose) in `%ProgramData%/EC-Engineer/user.myusername.xml`
  - Start “EC-Engineer” again

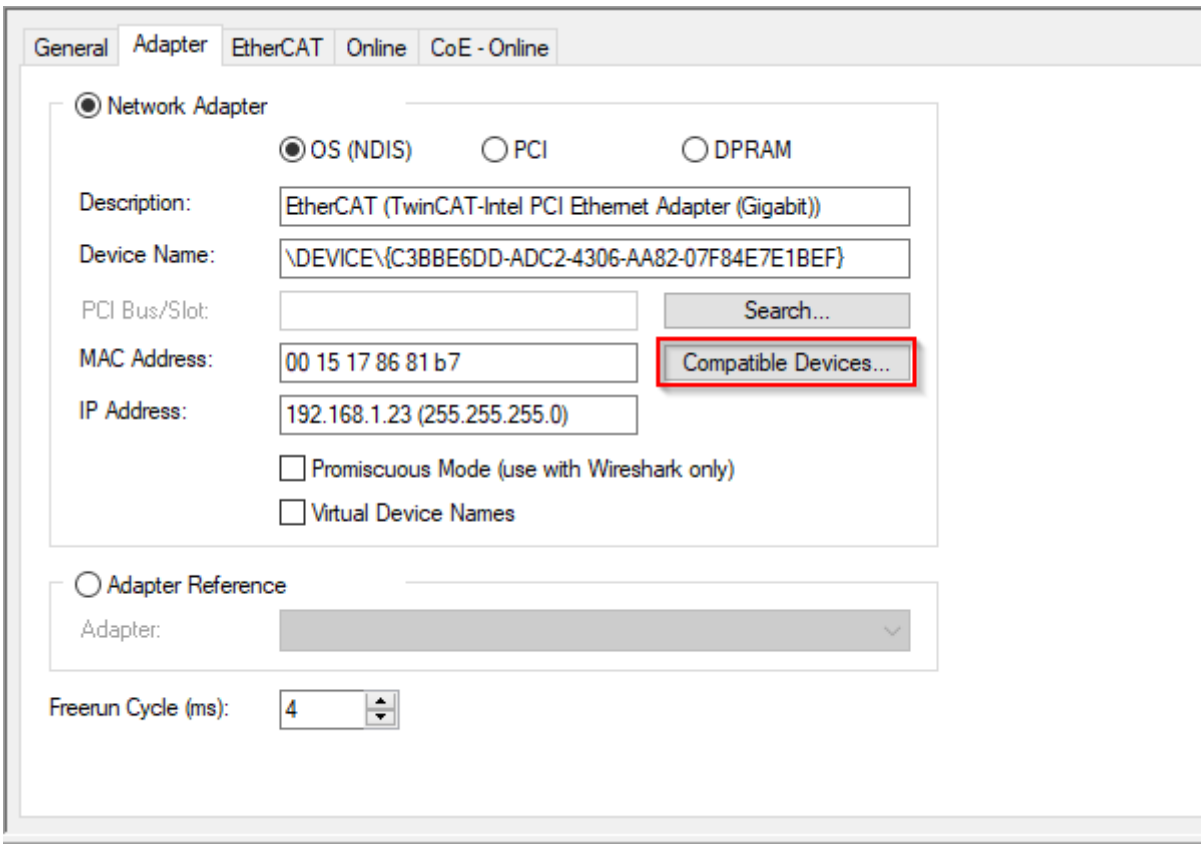
- **EC-Engineer reports the following message: Network scan successful - 0 slaves found.**
  Make sure you have connected the input and not the output port of your first slave to the computer.

  Open “Network and Internet Connections Network Connections” and open the properties of your network adapter and uncheck all protocols except “Internet Protocol (TCP/IPv4)”

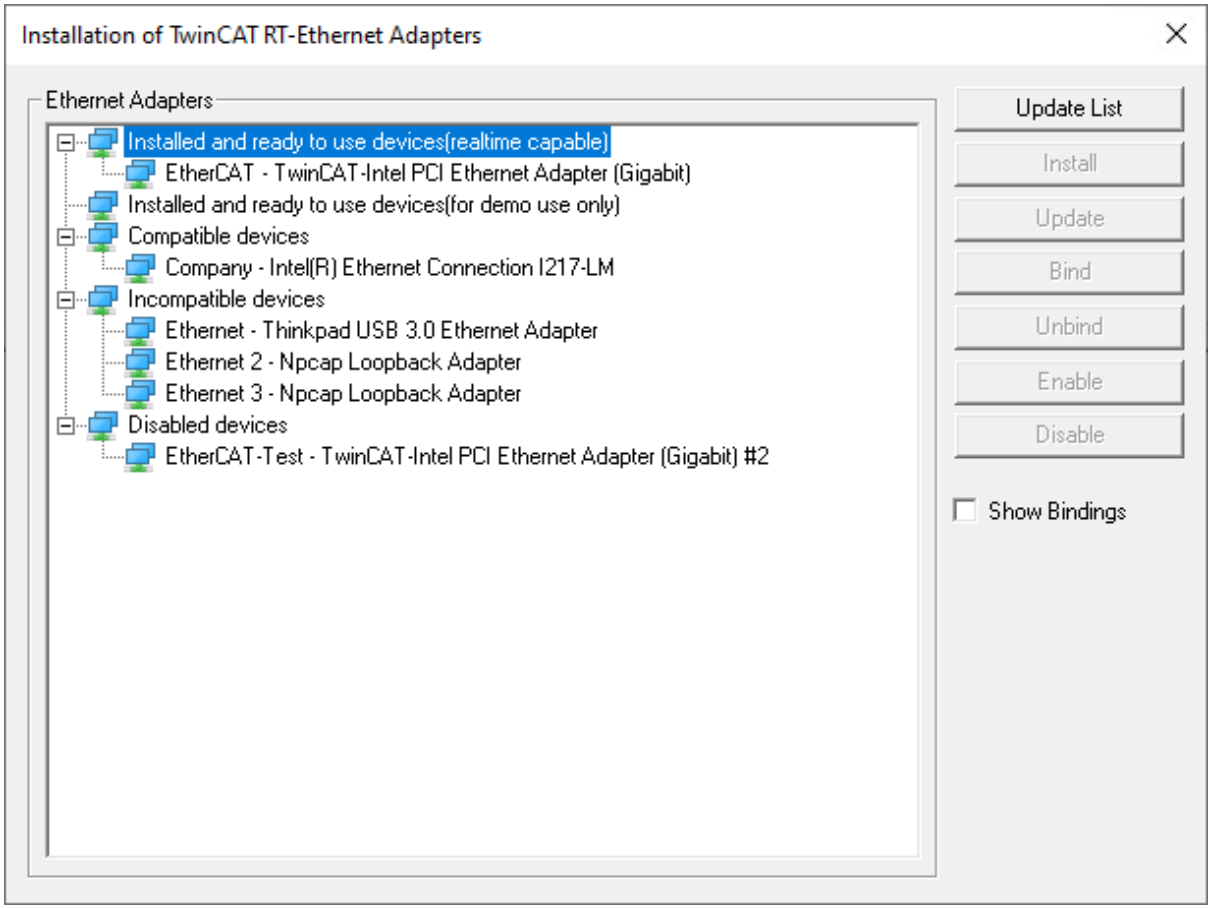


Do you have TwinCAT installed on this machine?

Open “Compatible Devices”:



Uninstall or disable the “TwinCAT RT-Ethernet Adapter” for your network adapter:



If this doesn't help, try to disable the "TwinCAT RT-Ethernet Driver" in the properties of your network adapter and reboot your system.

Run EC-Engineer with administrative rights? Does it help?

Do you have a some kind of security software (like firewall, antivirus, …) installed on this machine?
Try to turn it off and check if problem is solved

Do you have problems on sending or receiving pakets?
Install "Wireshark" and check which pakets are missing

Do you have only problems on sending packets?
Try to exclude ethernet protocol type "0x88a4" from your firewall. For more information see https://en.wikipedia.org/wiki/EtherCAT/

Try it with Npcap instead of WinPcap. Make sure you chose "Install Npcap in WinPcap API-compatible Mode"

- **How can I create `ENI` files for slaves from the Beckhoff CX5000 series?**
  The `ENI` file of those slaves must start with an Ebus slave, but EC-Master exports only an MII port. This problem can be solved by first adding a helper slave "EK1200". The "real" EBus slaves can be connected afterwords to this helper slave.
- **WebAdmin in Dongle-Version shows page not found, what can I do?**
  You have to download and install the Code Meter Runtime from WIBU https://www.wibu.com/
- **UTF8 characters e.g. in variables or PDOs will be not displayed correctly**
  This requires the enhanced UTF-8 support and can be enabled by setting "EnhancedUtf8Support = True", (see *Internal User Specific Settings*)