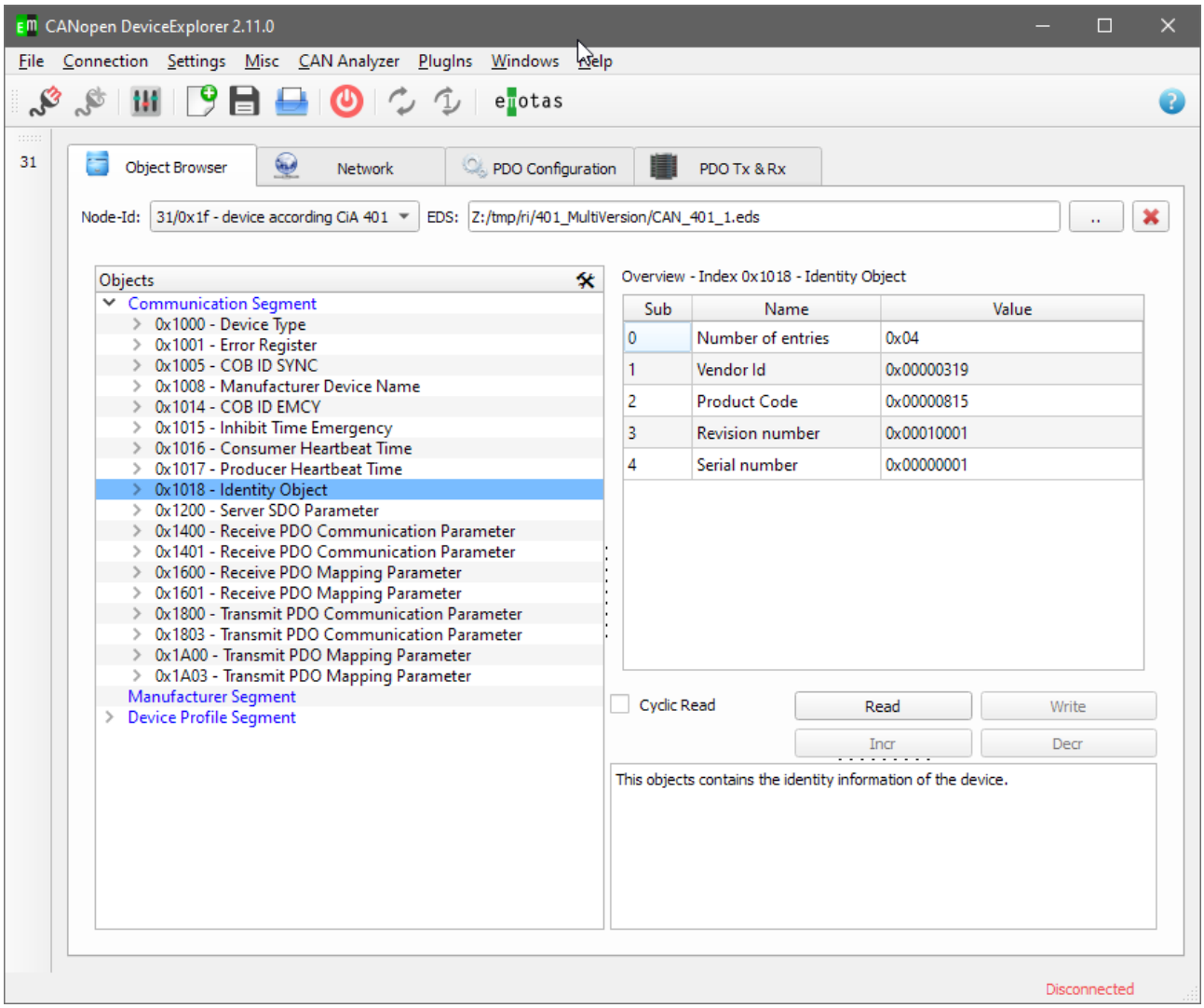
User Manual
CANopen DeviceExplorer



Version history

Version	Changes	Date	Editor
V1.1.5	Additional PlugIns added	2013/06/26	ged
V1.3	Additional Features added	2013/09/20	ged
V2.0	Additional PlugIns and Features added	2014/02/20	ged
V2.4	SRDO Configuration and CANReplayer extended	2016/03/29	ged
V 2.5	Improved and added descriptions and pictures	2017/04/10	ri
V 2.6	Added description for multi interfaces	2020/04/21	ri
V 2.7	Supplement temporary floating license	2024/05/23	ri

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1 Introduction

Thank your for using the CANopen DeviceExplorer. The CANopen DeviceExplorer is a versatile tool to test, configure and monitor CANopen devices. The following manual explains the installation and usage of the program.

2 Installation

Windows

To install the tool on Windows start the setup setup_canopen_deviceexplorer.exe and follow the instructions of the setup. The setup creates a shortcut to start the program. At the first connection to CAN the program requires a license file, which is copied to the program and enables the licensed features.

It is possible to use the tool without license file for 1 hour. The node-IDs are limited to 1,2,32 and 64 and only the bitrate 125 kbit/s is possible in demo mode.

Following CAN – Interfaces are supported at windows:

Bezeichnung	**getestete Treiberversion**	**Verweis**
Ixxat/HMS CAN-Interfaces	VCI V4 (4.0.162.0)	Ixxat Support
Janz Tec CAN-USB	2.10	--
SYS TEC USB-CANmodul	6.05.0154	SYS TEC Driver
PEAK PCAN-USB	4.2.2	PEAK Driver
Kvaser CAN-Interfaces	5.31.0.0	Kvaser Driver
EMS Wünsche CAN-Interfaces	2.2.3.0	--
Vector CAN-Interfaces (XL-Driver)	XL Driver 20.30.16	Vector XL Vector XL Driver

2.1 Linux

To install the tool in Linux just unzip the ZIP file linux_emotas_cde_v.v.v.zip into a directory. To start the program run the script cde.sh in this directory. At the first connection to CAN the program requires a license file, which is copied to the program and enables the licensed features.

3 License handling

3.1 Named User and Node Locked License

For one of these license types, it is sufficient to select the license file via "Settings" -> "Update License File" before connecting to the CAN bus.

3.2 Floating License

With this license type, the license file must be selected via "Settings" -> "Update License File" and the provided USB dongle must be connected to the PC.

The floating license works without a dongle for 30 days after issuance. This ensures that the tool can be used even if the dongle is still in the mail.

The use of the dongle under Linux requires the call of the CDE with 'sudo' or the creation of corresponding udev rules. With this the dongle is automatically integrated with corresponding access rights, so that normal users can also access the dongle. You can do this by creating a file 91-Dongles.rules in /etc/udev/rules.d/ with the following content

```
KERNEL=="hiddev*", NAME="%k", MODE=="0666"
SUBSYSTEM=="usbmisc", KERNEL=="hiddev*", ATTRS{idVendor}=="1bc0", ATTRS{idProduct}=="8101",
MODE="0666"
```

You can also run the supplied createUdevRules.sh script with sudo. You will find the script within the zip file.

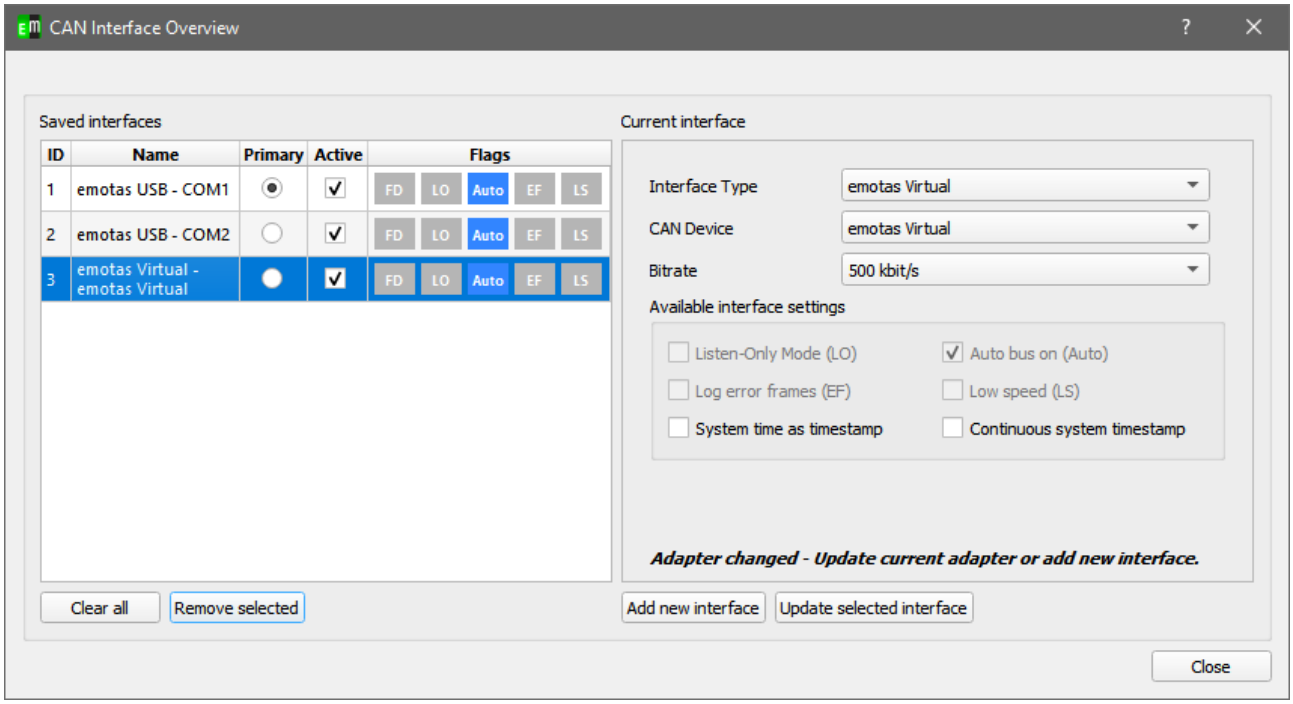
3.3 Vendor-Bound License

After selecting the corresponding license via "Settings" -> "Update License File", it must be activated. This can be done in the dialog of the license selection via "Activate license". If a license is not activated, a dialog box also prompts you to activate it when connecting. To activate the license a manufacturer's device must be in the network.

An activated license is valid for 90 days before it must be reactivated.

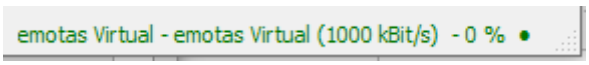
4 First steps

The first step at the very first start of the tool is the configuration of the CAN interface. Open CAN interface settings at the menu entry “Connection → CAN Interface Settings”. The following mask appears.



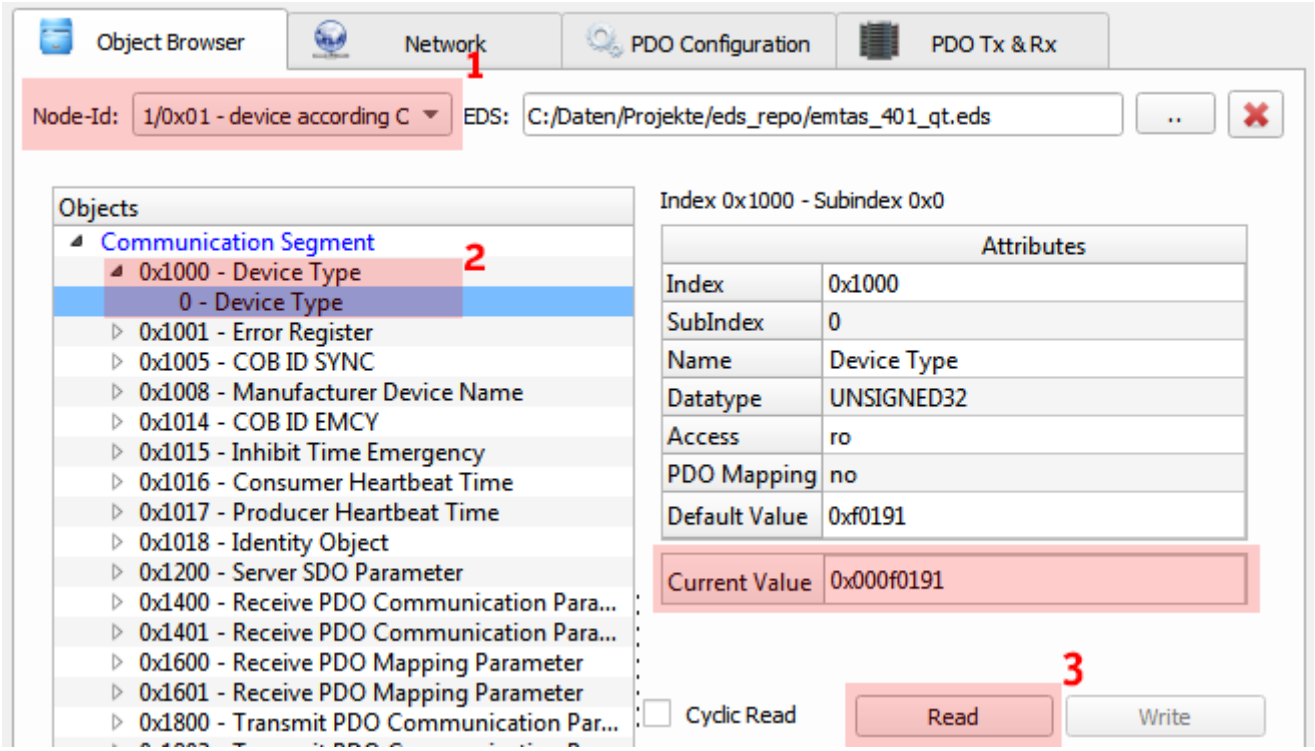
Choose the type of the CAN interface, the name of the CAN device and the bit rate in the CANopen network and confirm the settings with “Add new interface” before closing the dialog.

Connect now the CANopen DeviceExplorer with the CAN interface via “Connection → Connect”. In the status bar you can see now the name of the CAN device and the current bitrate. Depending on the CAN-State the font color differs. It is green for active, yellow for passive and red on bus-off.



To test the functionality of the CAN connection, select the “Object Browser” tab. After that configure the node-Id of the device(1) and click in the object tree at the object 0x1000(2) and press “Read”(3) afterwards. Now the object 0x1000[2] is read and the result is displayed at “Current Value”.

2 Device Type … available at each CANopen device



In parallel the CAN messages can be watched in CAN view. CAN View can be activated via “PlugIns → CAN View”.

If a valid value has been read, this indicates that the node Id is correct and the CAN connection works. If you do not receive a response, but a SDO timeout, please check the node Id and the CAN bit rate. Unless switched off, the tool saves all settings when quiting the tool, so at next start you can start with the same settings.

5 CAN Multiinterface handling

5.1 General

With version 2.13.0 of this tool the possibility to connect to several CAN adapters at the same time was added, if your license supports this. There is always **one primary adapter** and the possibility to set other adapters active.

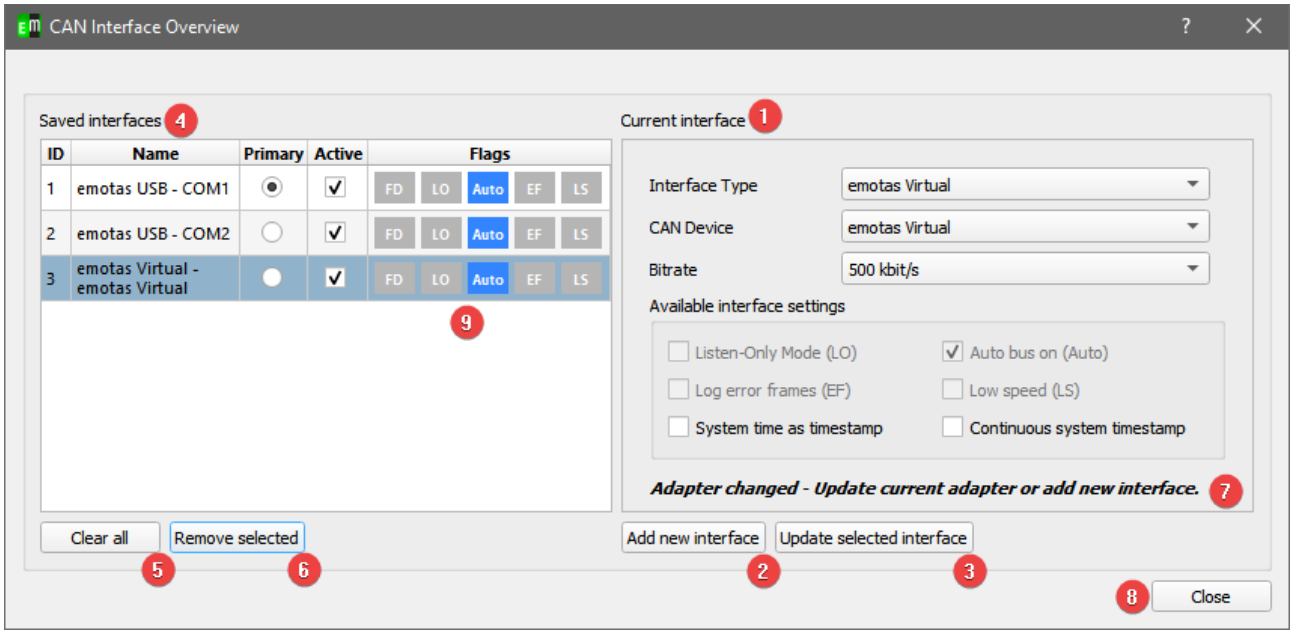
All write actions of the tool are handled by the primary adapter. This includes, for example, interaction with the Object Browser, Network Overview, PDO Configuration, PDO Tx & Rx, but also scripting, LSS Master etc.

The CAN messages of the active adapters are displayed in the supported CAN analyzers. The supported analyzers include CAN View, CAN Object View, CANopen Interpretation, CANopen Object View, EnergyBus Object View, User-defined Interpretation, J1939 Interpretation, J1939 Object View and ISO-TP Interpretation.

Each adapter has its unique ID. See the screenshot below. This ID can be found in the column "IF" in the individual CAN analyzers.

5.2 Configuration

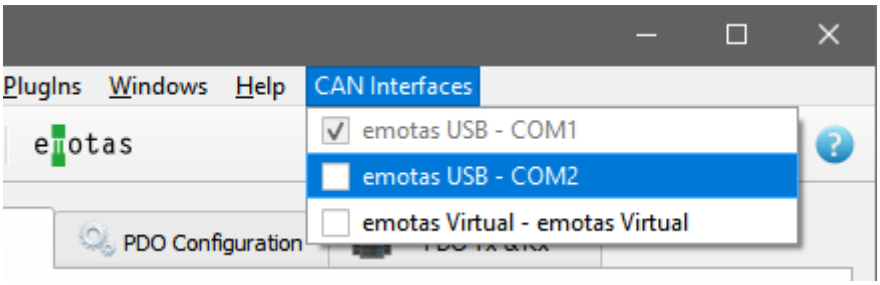
The configuration of several CAN lines is done via the "CAN Interface Overview" dialog.



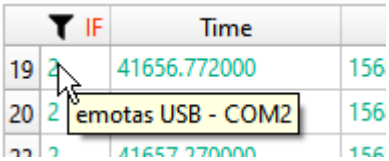
1. The "Current Interface" area contains all information about the currently selected adapter or possible new adapter.
2. "Add new interface" adds a new adapter with settings from "Current Interface" to the list.
3. "Update selected interface" updates the currently selected adapter in the left list to the new settings.
4. The "Saved Interfaces" overview shows the currently saved interfaces. In this list, one adapter is always the primary and therefore active. Additionally, several adapters can be set to active if the corresponding license is available.
5. "Clear all" deletes all set interfaces from the list.
6. „Remove selected“ deletes the currently selected interface.
7. The message "Adapter changed - Update current adapter or add new interface" appears as soon as an adapter is selected and the input mask has been changed by the user. It is then necessary to apply the changes to the current adapter or add it as a new adapter.
8. "Close" closes the dialog.
9. The Flags column highlights the flags set for the adapter. The following abbreviations are used:
   FD - CAN FD LO - Listen-Only Mode Auto - Auto bus on
   EF - Error frames LS - Low Speed

5.3 Global usage

After setting several active adapters and successfully connecting them, a new menu item "CAN Interfaces" is displayed in the main window. The primary adapter can be changed at any time using this menu.



5.4 Usage in CAN Analyzer



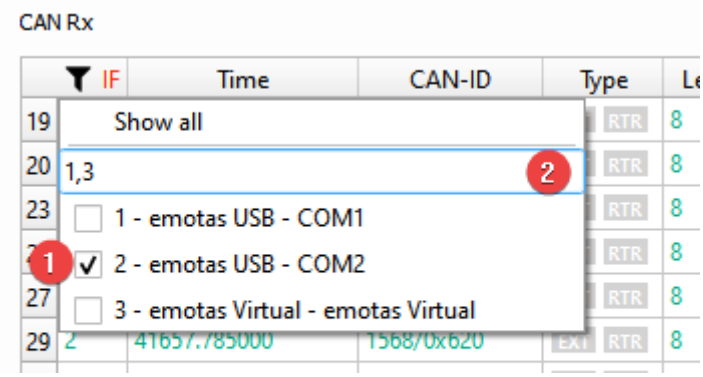
Each supported analyzer shows the ID of the adapter in the column "IF" and has the possibility to display, hide and color the CAN messages of the different adapters. The tooltip of the column shows the name of the currently set adapter of the ID.

Note that only the ID and not the corresponding adapter is saved when importing and exporting data. So there could be a mismatch when importing datafiles.

5.4.1 Quick filter

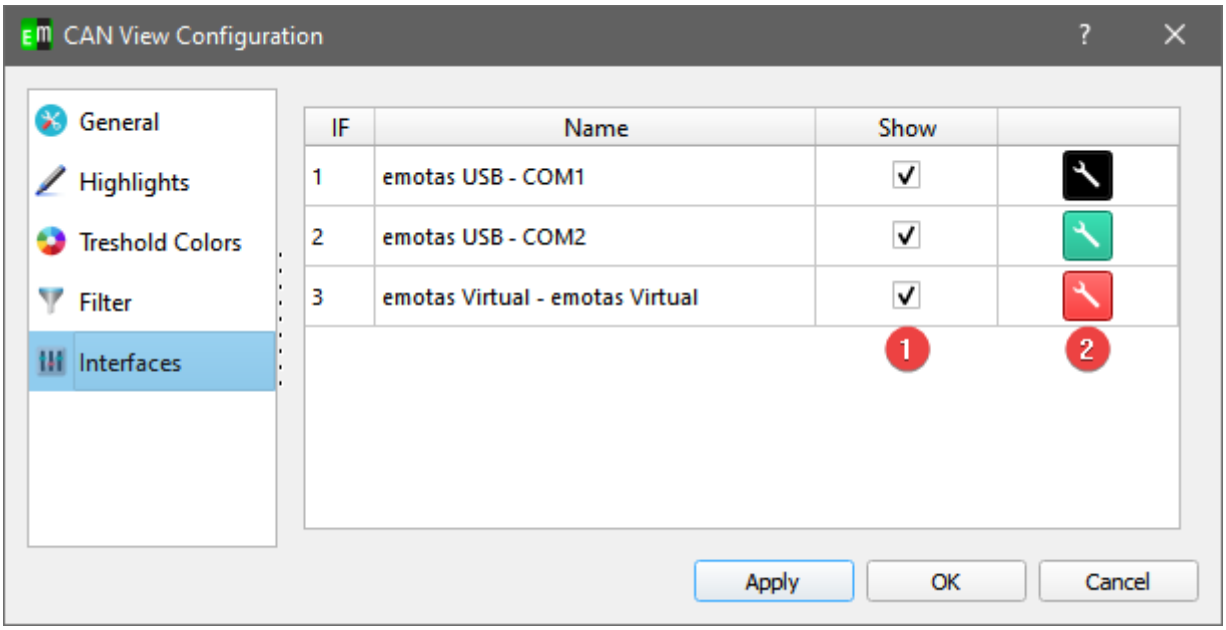
In the individual views, each active adapter can be quickly hidden by right-clicking on the title of the "IF" column. At this point a menu with all active adapters opens, which can be deselected by a simple click. (1)

Since it can happen that the current list of active adapters does not match the displayed data, for example, after importing old data, each adapter can be filtered with its unique ID by entering this ID in the comma-separated list and confirming with Enter. (2)
The IDs of the adapters are shown in the column "IF".



5.4.2 Configuration in the CAN Analyzer

In each view, an extended configuration of the adapters is possible via the menu item "Configuration". Here you can also show or hide the adapter and set the font color of the CAN messages for the adapter.



With the boxes in the "Show" column (1) the CAN messages of the adapters can be shown or hidden as with the quick filter. With the buttons of the last column (2) the font color can be changed. The buttons are colored according to the selected font color.

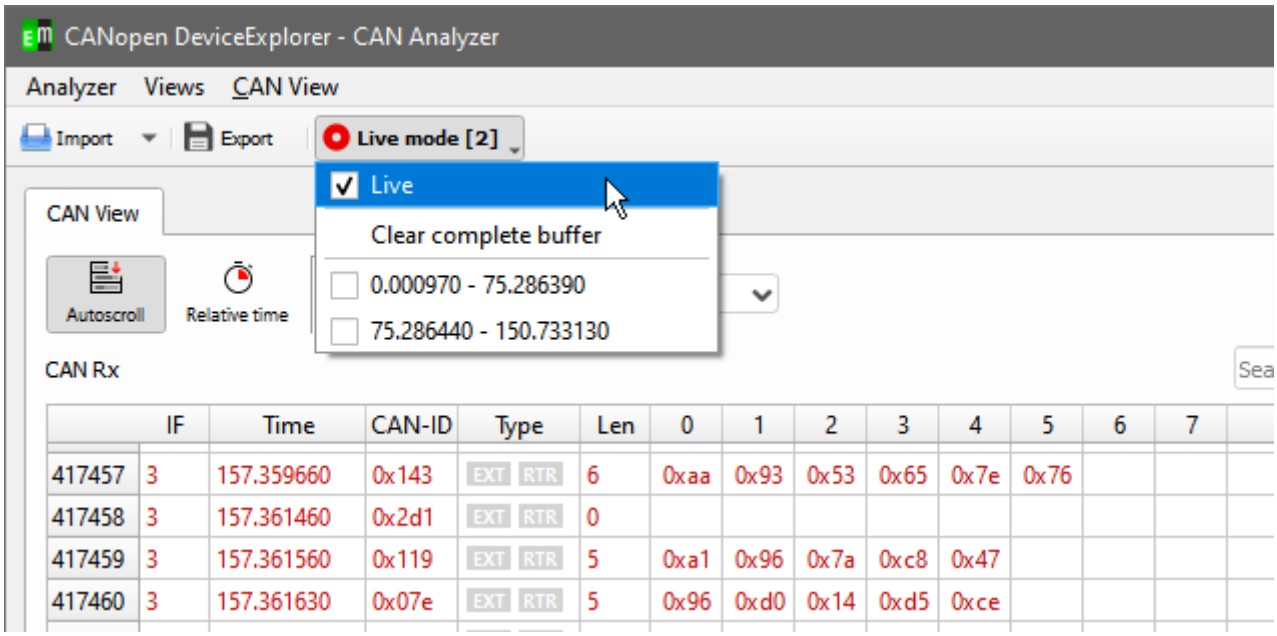
6 CAN message handling

With version 2.6.0 the internal data handling of the can messages gets improved. Those improvements affects the following program elements:

- CAN View
- CANopen Interpretation
- J1939 Interpretation

The received messages are stored as message package to the hard disc drive if the "Maximal message count" (9.2 Program Settings) is reached and removed from the internal buffer.

The saved messages could be viewed via the menu in the upper right corner of the analyzer window.



Each message package holds the timestamp of the first and of the last message as name.

If a message package is selected newly received message are still being processed in the background and could be viewed by switching back to "Live". The buttons text changed also to "File mode" instead of "Live mode".

The CANopen and J1939 interpretation have the restriction that a maximum of 200'000 messages are viewed if the "Live" mode is selected. If an old message package is loaded, all messages are displayed.

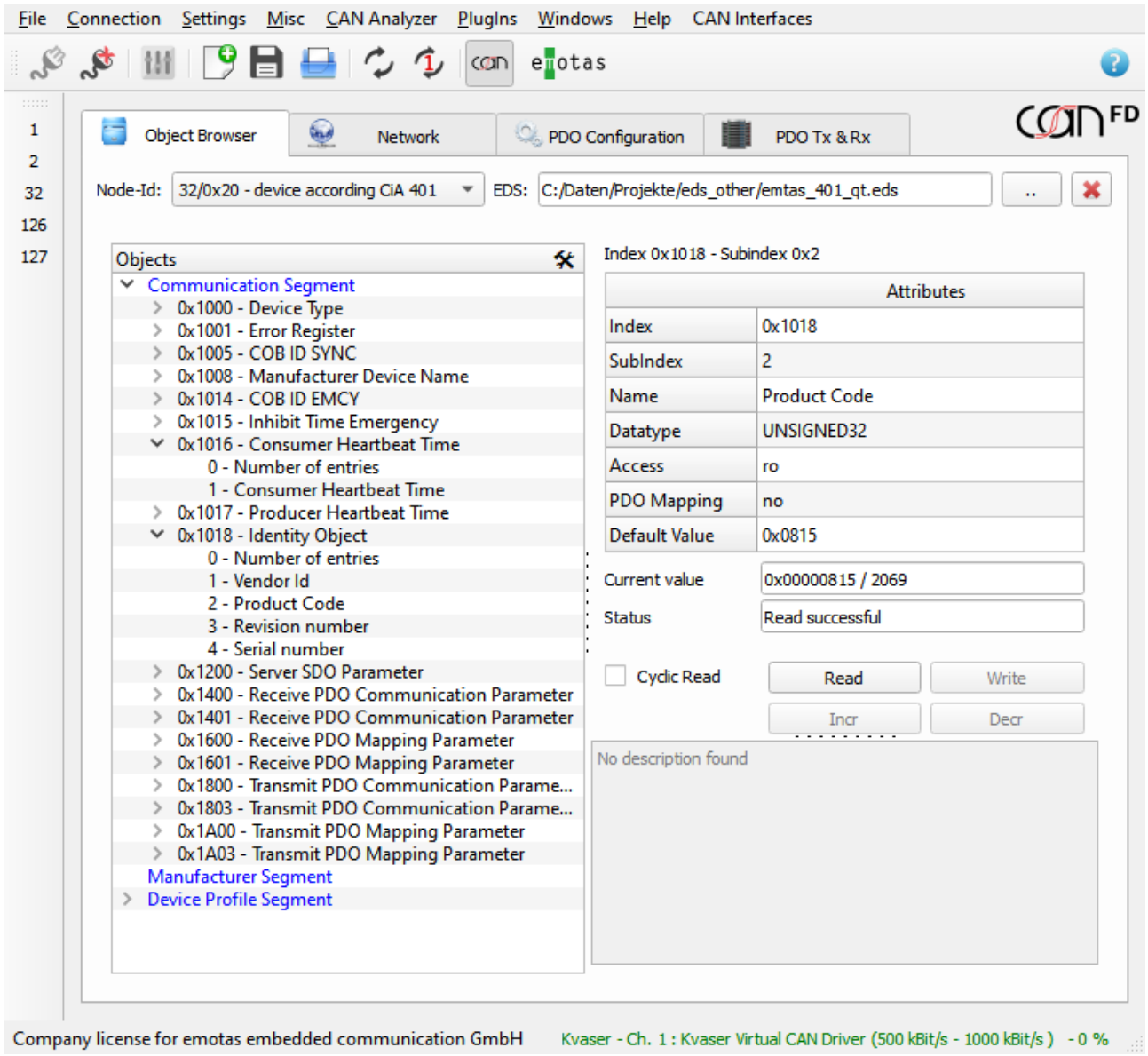
6.1 Analyzer interaction

Between the mentioned program elemts an interaction is possible. A right click on a message views a context menu, which makes it possible to jump to the specific message in another view.

7 Program components

7.1 Object Browser

Using the object browser all objects of a CANopen device can be read or written – depending on access rights. An EDS file, which contains the information about the CANopen objects, can be imported for each device in the network. If the global option “Read objects automatically at selection” is active, the objects are read by SDO immediately when they are selected in the object tree, otherwise after pressing the 'Read' button. If no EDS file is available or if any other objects shall be accessed, it is possible to specify the index, subindex or data type directly in the 'Attributes' table. After reading a value it is displayed in the 'Current Value' field in decimal and hexadecimal notation. When writing a value the last value from the 'Current Value' field is transmitted.



Meaning of the buttons

- **Read**

  Read the value of the currently selected object

- **Write**

  Write the value of the currently selected object

- **Incr**

  Increment the value of the currently selected object by 1.

- **Decr**

  Decrement the value of the currently selected object by 1.

- **Cyclic Read**

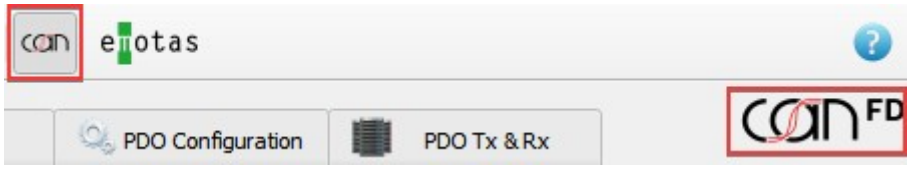
  Cyclic read of the object (interval: 1s) and display of the value in the Current Value field

Objects of type "Domain" can be written with a file by right click on an object to open the context menu.

USDO Usage

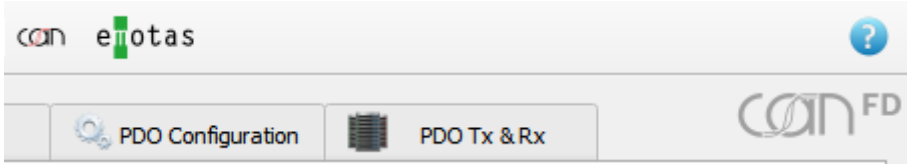
If the CDE is connected via CAN FD it is possible to switch between SDO and USDO.

This is done either by the CANFD icon in the menu bar or by the CAN FD logo in the tool on the right side above. Both are framed red in the following picture.



USDO activated

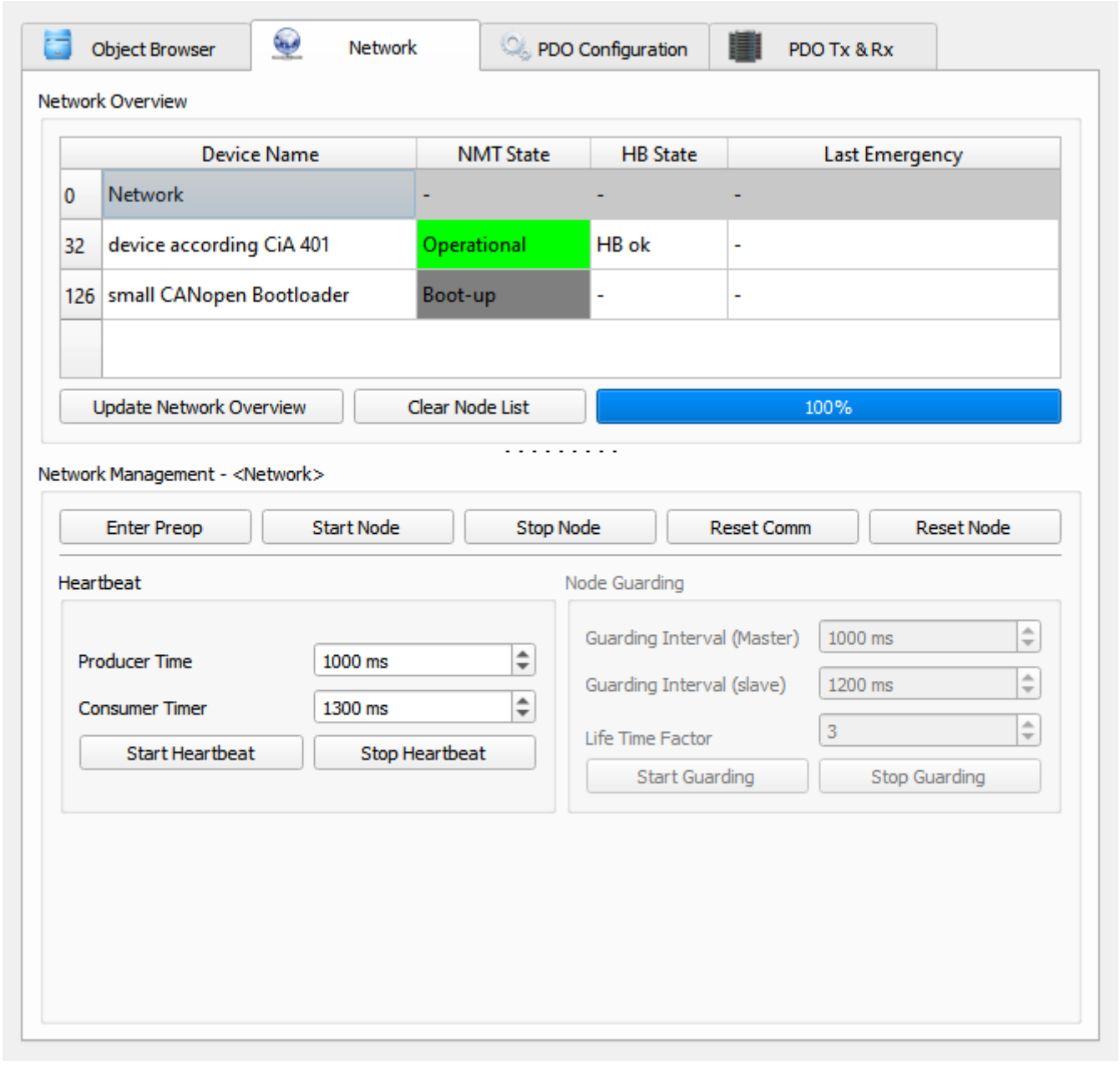
If USDO is activated, the button in the menu is "pressed" and the symbol on the right is coloured, otherwise it is grey.



USDO deactivated

Network Overview

The Network tab shows all CANopen devices in the network with their NMT states and their last received Emergency messages. Additionally, NMT master commands to start or stop distinct devices or for the complete network can be sent. The tab also provides masks to configure Heartbeat and Node Guarding and there monitoring by the tool.



- **Network Overview**

  The table lists all device in the network. If the devices send Heartbeat messages these are detected automatically by the CANopen DeviceExplorer. Alternatively, using "Update Network Overview" scans for devices in the CANopen network. The search is done by SDO read access to object 0x1000 of all nodes.

- The columns of the table have the following meanings:
  - Device Name – Name of the device – read from EDS file
  - NMT State – current NMT state
  - HB State - State of Heartbeat or NodeGuarding monitoring
  - Last Emergency – last Emergency message sent by the node

  A right click in the table opens a pop-up menu with access to the following actions: Start a node, Reset communication, Enter Pre-operational and load an EDS file.

- **Network Management**

  The CANopen NMT master commands Start, Enter Pre-Operational, Stop, Reset Communication and Reset Node can be send to the node which is selected in network overview. If the complete network is selected, the commands are sent to all nodes (id 0).

- **Heartbeat**

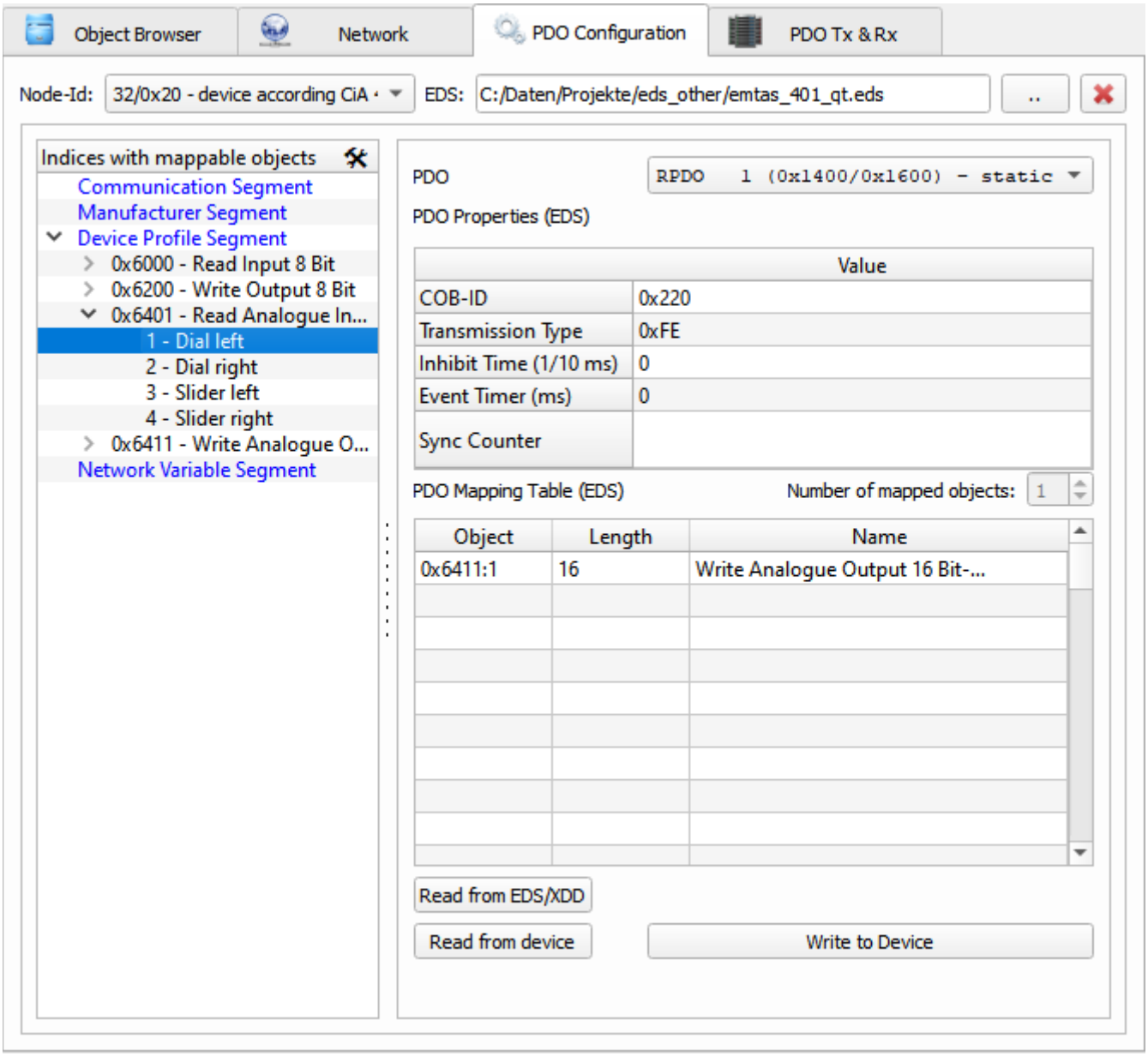
  Configuration of the Heartbeat producer interval and the Heartbeat consumer time for the selected node. After the start of the heartbeat monitoring errors(loss of heartbeat messages) are displaed in the column "HB State". The value for the producer interval is send by SDO to the device. The configuration mask is only active, if the device supports Heartbeat and if the object 0x1017 exists in the EDS file.

- **Node Guarding**

  Configuration of Node Guarding for the selected node. After the start of the Node Guarding monitoring errors(Loss of messages, Guarding Lost or Connection Lost) are shown in the column "HB state". The values for the guarding interval and the life time factor are written by SDO to the device. The Node Guarding configuration is only active if the device supports Node Guarding and if it is indicated in the EDS file of the device.

7.2 PDO Configuration

The PDO Configuration tab can be used to configure PDOs with static or dynamic mapping. The mapping of dynamic changeable PDOs can be configured by Drag&Drop.



According to the object browser in the top row the node Id and the EDS file of the device can be configured. The object tree on the left side only contains objects that can be mapped into PDOs. On the right side of the tab there is a PDO with its properties and its mapping table.

- **Read from EDS**

  Read the properties and the mapping of the PDO from the device description file.

- **Read from Device**

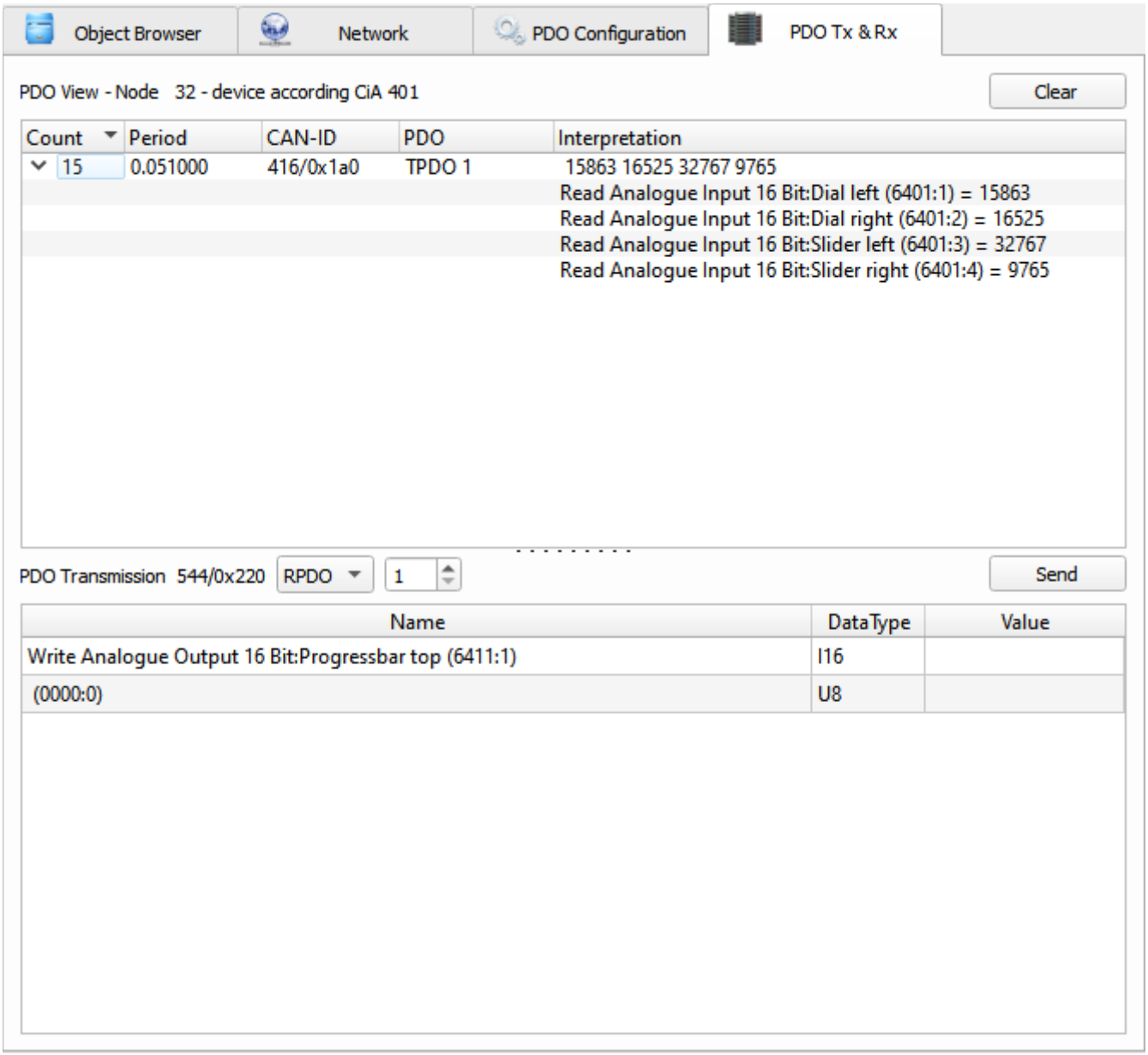
  Read the properties and the mapping of the PDO from the device by SDO.

- **Write to Device**

  Download of properties and mapping table to the device by SDO. Specialities of the CANopen protocol are considered, like e.g. that a PDO has to be deactivated before it can be configured.

7.3 PDO Tx & Rx

The PDO Tx&Rx Tab provides the functionality do send and receive PDOs of the active CANopen node. In the upper part of the tab the received PDOs are displayed with the interpreted values and in the lower part PDOs of this node can be sent.



The interpretation is done according to the current PDO mapping of the device.

8 Menu

The menu provides access to various functions and settings of the CANopen DeviceExplorer.

File

- **Load EDS**

  Load an EDS file for the selected node.

- **Recent EDS**

  Load a previous used EDS file

- **Device Configuration**
  - **Load DCF**

    Load a DCF file with saved parameter values for the active node.

  - **Save DCF**

    Save a DCF file with current parameter values of the active node

  - **Save Concise DCF**

    Save the current parameter values for the active node in a binary DCF file.

- **Projects**
  - **New**

    Create a new empty project

  - **Open**

    Open an existing project

  - **Save**

    Save the current project using the current name. With new projects the tool asks for a name of the project file.

  - **Recent Projects**

    List of 10 recently used projects.

- **Quit**

  Quit the application.

Connection

- **CAN Interface Settings**

  Dialog to configure the CAN interface and the bit rate

- **Connect**

  Connect to CAN using the configured interface

- **Disconnect**

  Disconnect from CAN

Settings

- **Options**

  Open the options dialog to configure various settings of the program.

- **Save**

  Save the current settings. If "Settings → Options → Save settings automatically at exit" is enable, the settings are automatically saved when the program is quit.

- **Export Settings**

  Export of the current settings into a configuration file. It can be used to store various settings of different use cases.

- **Import Settings**

  Import of the settings from a configuration file.

- **Update Licence File**

  Dialog to select a new license file. The content of the license file can be viewed and it can be imported.

- **Check for Updates**

  Query the web server for updates of the tool. Beside the IP address no additional data is transmitted.

Misc

- **EDS Viewer**

  Open the EDS file in the text viewer.

- **HTML Project Documentation**

  Creates an HTML project documentation. It contains the names and paths to EDS files of all projects and the current values of all write-able resp. configurable objects of the devices.

- **Update Device Configuration**

  Open the dialog to Send/Read/Store/Restore of certain objects of the CANopen devices.

- **Update Network Configuration**

  Open the dialog to send the device configurations to multiple devices in the network.

CAN Analyzer

This menu contains program components to display and interpret CAN messages.

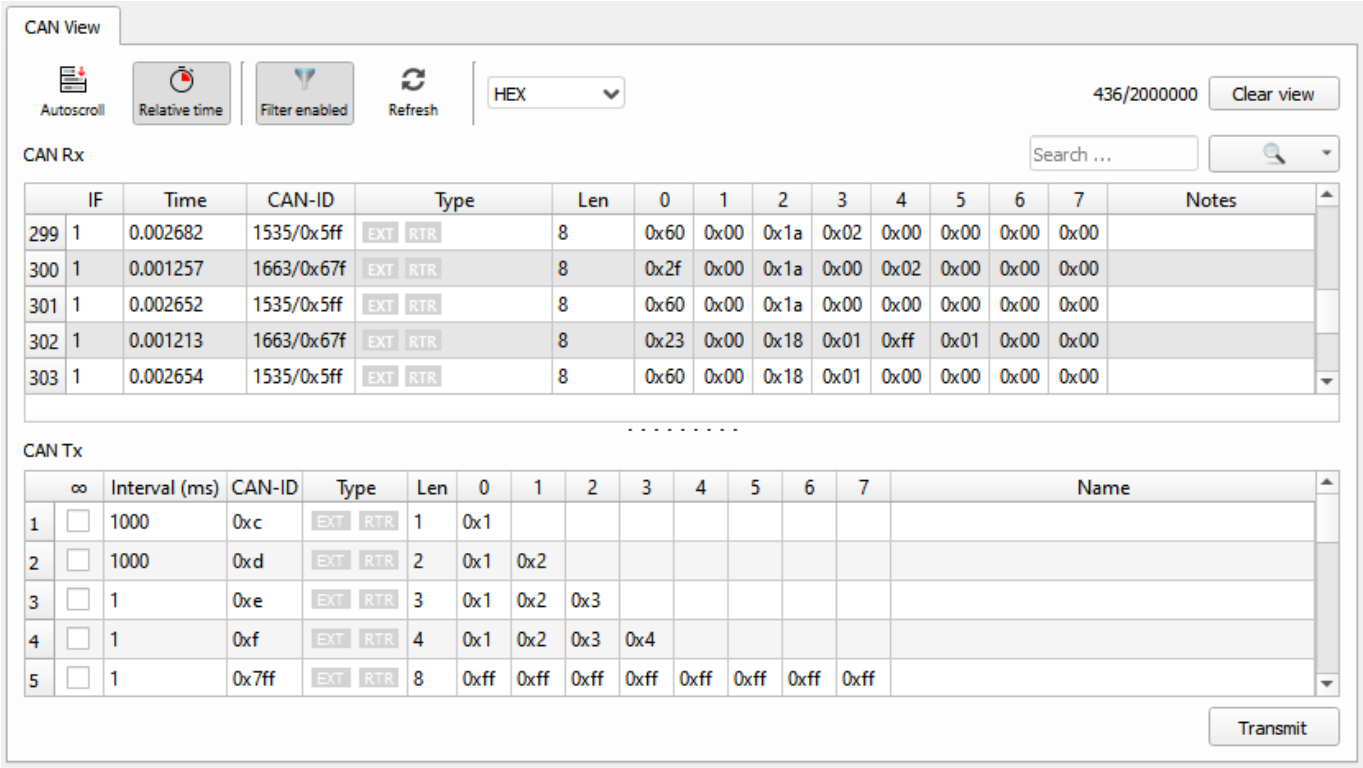
- **CAN View**
  The CAN View shows received and transmitted CAN messages. To send a CAN message the Transmit table below can be used. The values for CAN-IDs, DLC and data can be specified as decimal values or as hexadecimal values with leading 0x.

  Up to 16 transmit messages can be defined. The selected one is sent by clicking on the Transmit button. Cyclic messages can be sent automatically by the tool, if the value in the column 'Interval(ms)' is larger than 0.

  In the menu of the CAN View windows a filter for distinct CAN IDs can be defined. A list of CAN IDs can be defined, which either can be displayed or ignored. The list can be a list of single values like (100,200,0x400,0x500) or a range (0x100-0x200) or a combination of both e.g. 1,2,0x300-0x400,720.

  The filter type defines the behavior of the filter:

  - PASS – only the CAN IDs in the filter list are displayed
  - REJCECT – the CAN IDs in the filter list are ignored, all other CAN IDs are displayed



The time stamp of the CAN message can be absolute or relative values and the accuracy depends on the used CAN interfaces and the operation system. For most CAN interfaces no TX time stamp is available.

The recorded CAN messages can be exported into text files by CAN View → Export CAN-Logging.

The format of the save text is explained below:

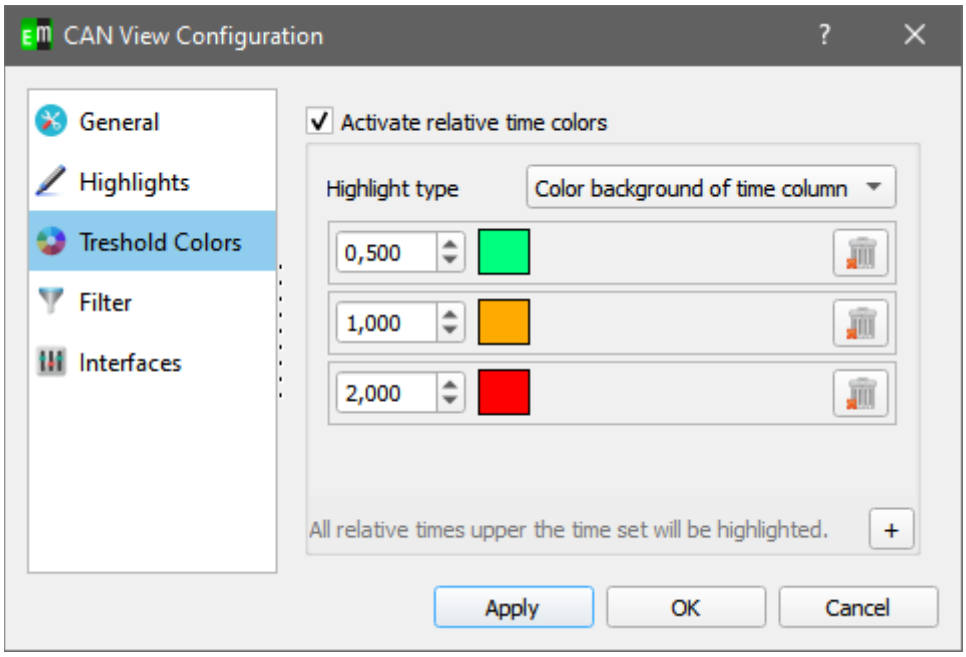
```
3.653302 0x5a0/1440 (8): 43 18 10 03 00 00 00 00
time stamp
           CAN-ID
                    DLC
                         Data in hexadecimal notation
```

The CAN View PlugIn is part of the standard scope of delivery of the CANopen DeviceExplorer.

Relative times

If "relative time" is set, each message could be used as time reference by right-clicking on it and select "Use messages as time reference". The relative times of each other message is now calculated to this messages.

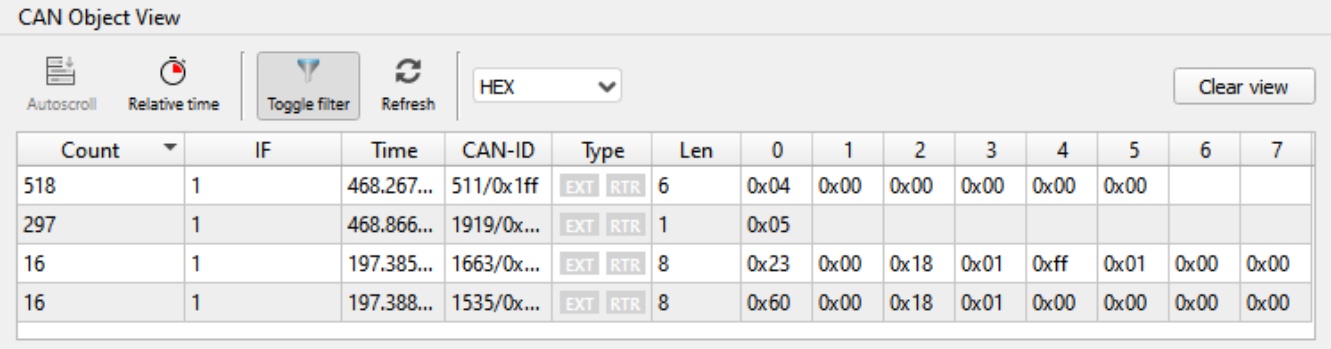
Furthermore if "relative time" is set, the messages could be highlighted. To setup the thresholds and colors select "Configuration" in the "CAN View" menu.



In this dialog you could add new thresholds and add a color. If the relative time of one message is higher than the threshold, the message is highlighted in the chosen color.

- **CAN Object View**

  The CAN Object View shows all received CAN messages in the so called 'Object View'. That means all received CAN IDs are shown in a table with the last data and the number of receptions.



Count	IF	Time	CAN-ID	Type	Len	0	1	2	3	4	5	6	7
518	1	468.267...	511/0x1ff	EXT RTR	6	0x04	0x00	0x00	0x00	0x00	0x00		
297	1	468.866...	1919/0x...	EXT RTR	1	0x05							
16	1	197.385...	1663/0x...	EXT RTR	8	0x23	0x00	0x18	0x01	0xff	0x01	0x00	0x00
16	1	197.388...	1535/0x...	EXT RTR	8	0x60	0x00	0x18	0x01	0x00	0x00	0x00	0x00

The table can be sorted by the number, the time stamp of the CAN ID. A filter can be configured in the same way as in the CAN View PlugIn. The CAN Object View is included in the standard scope of delivery of the CANopen DeviceExplorer.

CAN Object View Configuration

At the CAN Object View you could highlight changed bytes or highlight the whole row if a CAN ID was not received within a certain time. You will find those settings via the “CAN Object View”- menu at “Configuration”.

General

- Refresh interval

  This time determine the refresh rate of the view. The lower this time, the more computing time is required.

- Highlight changed bytes

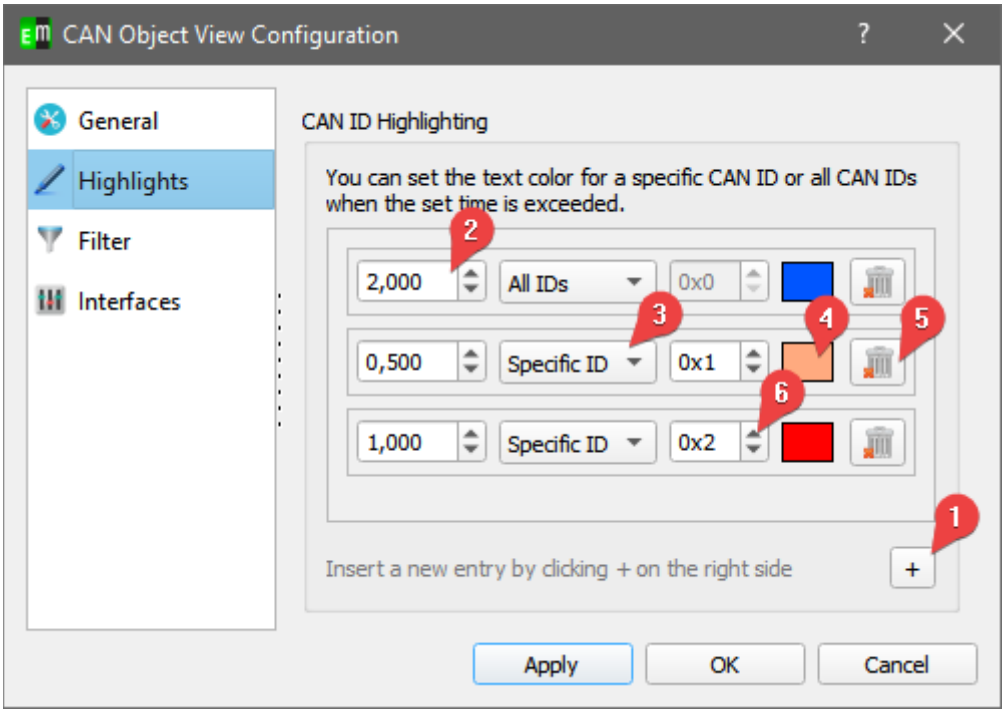
  If this option is enabled changed bytes will be printed bold, if they changed from message to message.

Filter

Please refer to the description of the CAN View filtering.

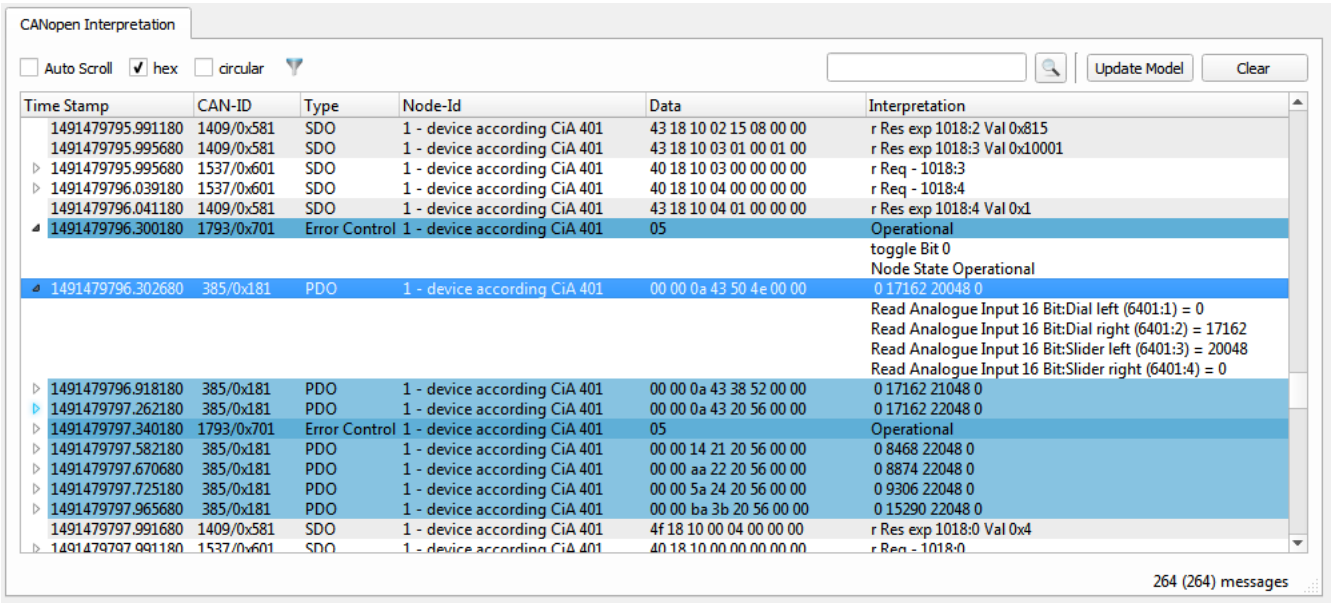
Highlighting

With the Highlighting-Tab you could set a textcolor for the case a special CAN ID or all CAN IDs were not received within a certain time.



1. Add a new entry for the highlighting.
2. The time in seconds after which the CAN ID should be highlighted if they was not received.
3. Select “Specific ID” if you want to highlight only a specific CAN ID or select “All IDs” to highlight all CAN IDs.
4. Select the color for the text if the CAN ID was not received within the time.
5. Deletes the entry
6. Set the specific CAN ID

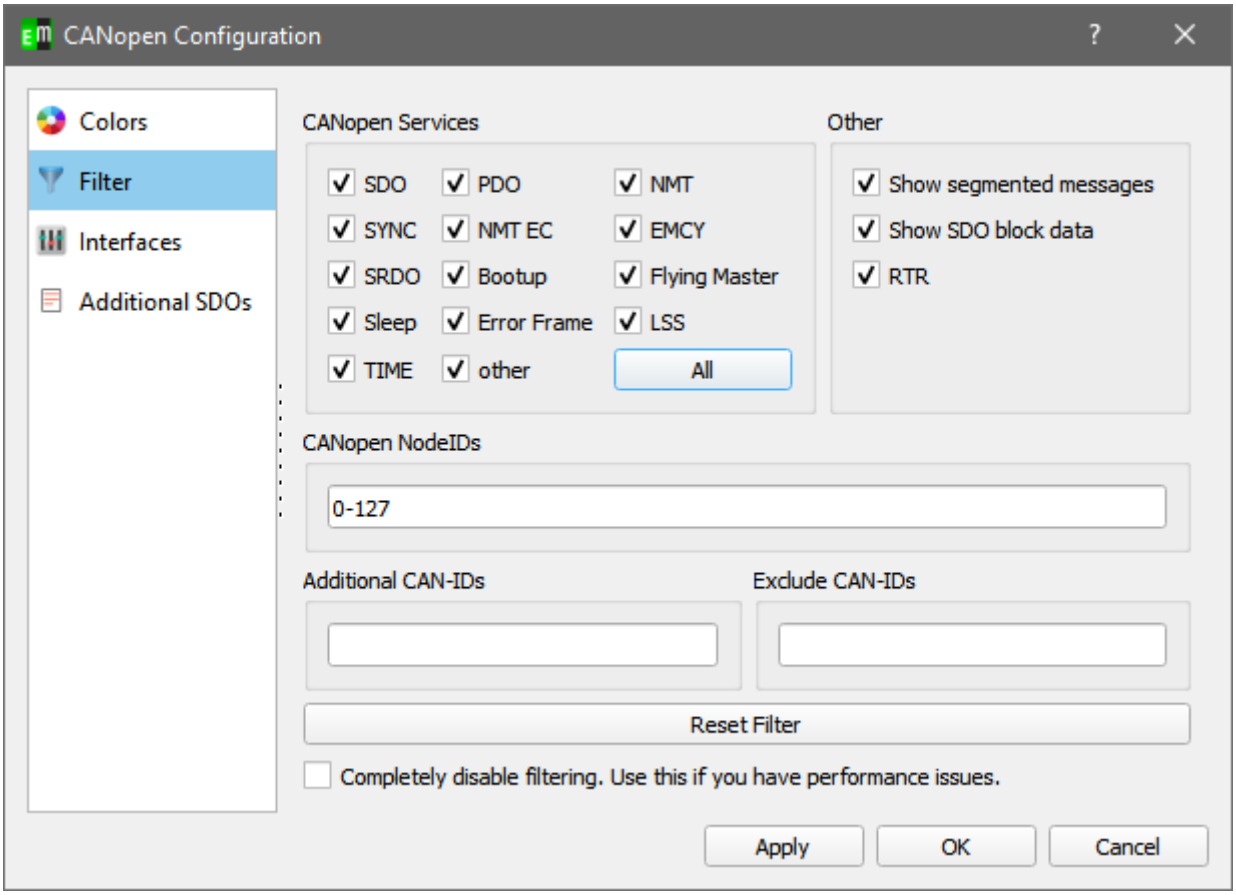
- **CANopen Interpretation (optional)**
  The CANopen Interpreter interprets all received CAN messages according to the CANopen protocol and displays the CANopen service of the message, the source or target node ID and a service-specific interpretation in a human-readable format. Additionally the CANopen Interpreter can interpret the content of PDO messages according to the PDO mapping as defined in EDS or DCF files.



A filtering of the CAN message is possible by various criteria:

- CANopen Service – only the enabled services are displayed
- CANopen NodeID – only the selected node IDs are displayed. A definition of ranges like e.g (1,2-30,40) is possible.
- Additional CAN-IDs: CAN IDs, which are rejected by the previous filters can be enabled again.
- Exclude CAN-IDs: CAN IDs, which have passed the previous filters can be filtered out selectively. A definition of ranges like e.g. 100,0x710-0x730 is possible.

Interpreted CANopen messages can be exported as text files and raw CAN loggings can be imported and interpreted as well.


CANopen Configuration
Colors
Filter
Interfaces
Additional SDOs
CANopen Services
SDO
PDO
NMT
SYNC
NMT EC
EMCY
SRDO
Bootup
Flying Master
Sleep
Error Frame
LSS
TIME
other
All
Other
Show segmented messages
Show SDO block data
RTR
CANopen NodeIDs
0-127
Additional CAN-IDs
Exclude CAN-IDs
Reset Filter
Completely disable filtering. Use this if you have performance issues.
Apply
OK
Cancel

- **CANopen Object View (optional)**

  The CANopen ObjectView combines the CANopen interpretation with an object view of the CAN messages. All received CAN-IDs are shown with the last interpreted values.

- **EnergyBus Object View (optional)**

  The EnergyBus ObjectView combines the EnergyBus interpretation with an object view of the CAN messages. All received CAN-IDs are shown with the last interpreted values.

- **User Interpretation**

  The user interpretation allows to interpret the CAN message according to the configuration of the user.

- **File Logger**

  The File Logger is able to record CAN messages directly into log files according to certain trigger conditions.

- **CAN Replayer**

  The CAN Replay can be used to send CAN messages that has been logged in advance. Specific CAN-IDs may be skipped for transmision and the timings are reproduced as good as possible depending on the operating system.

PlugIns
Menu to activate various extensions of the CANopen DeviceExplorer. The availability of the PlugIns depends on the license.

Help

- **Help F1**

  Show the relevant chapter of the manual for the active component.

- **Enter help mode**

  Shows additional help to selected items.

- **Manual**

  Show the complete manual as PDF file.

- **About**

  Show about dialog including license information.

- **About Qt**

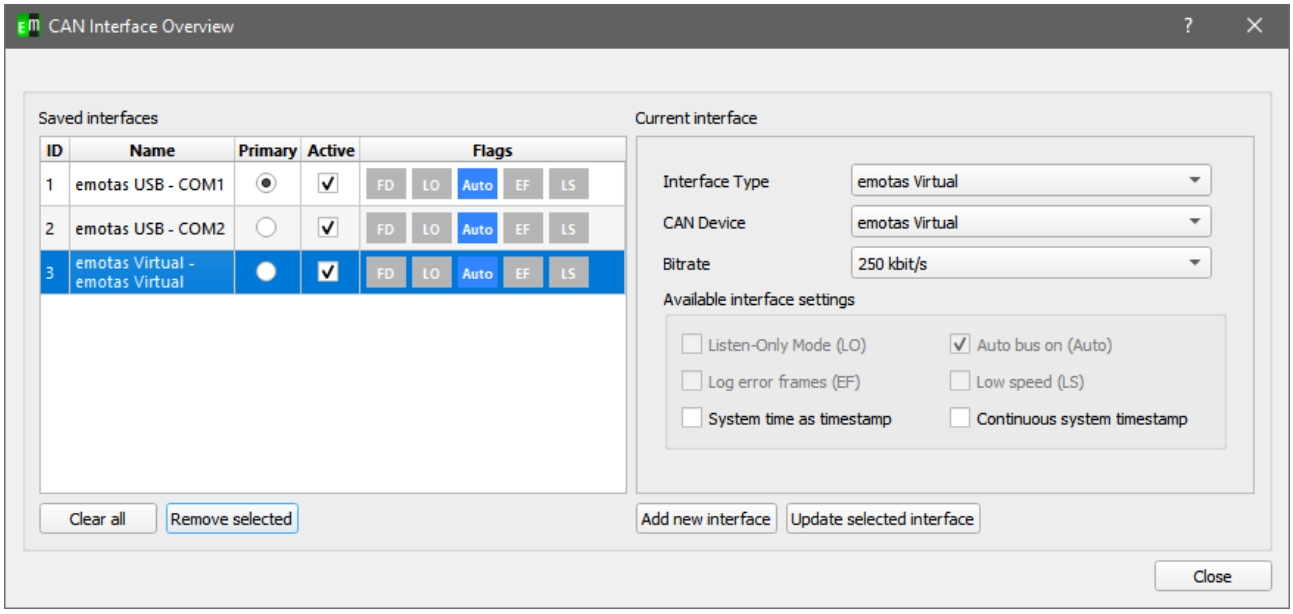
  Information about the Qt framework and license information about the used Qt components.

9 Settings

9.1 CAN Settings

The CAN interface can be configured using the CAN settings dialog.

With version 2.13.0 the support of multiple channels was added. The multi-channel usage is described in chapter 5 CAN Multiinterface handling. Independent of the license, several adapters can always be stored, but only with a multichannel license can several adapters be used in parallel.



- **Interface Type**

  Selection of the CAN interface. Currently different CAN interface manufacturers are supported on Windows and on Linux.

- **CAN Device**

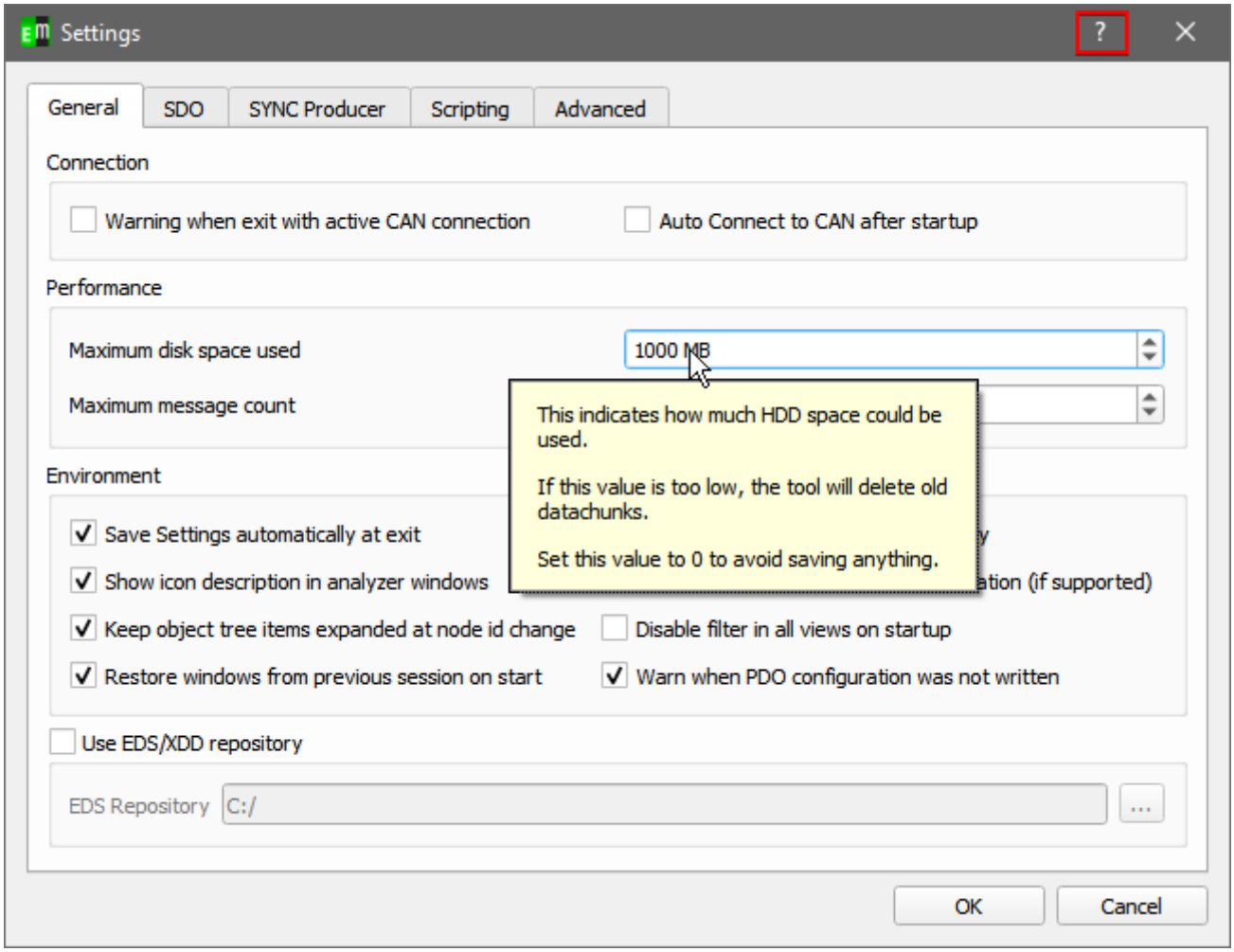
  Depending on the Interface type the available CAN devices are listed here to choose from.

- **Bit Rate**

  Configuration of the bit rate of the CANopen DeviceExplorer. The configured bit rate must match with the bit rate of the CAN network.

9.2 Program Settings

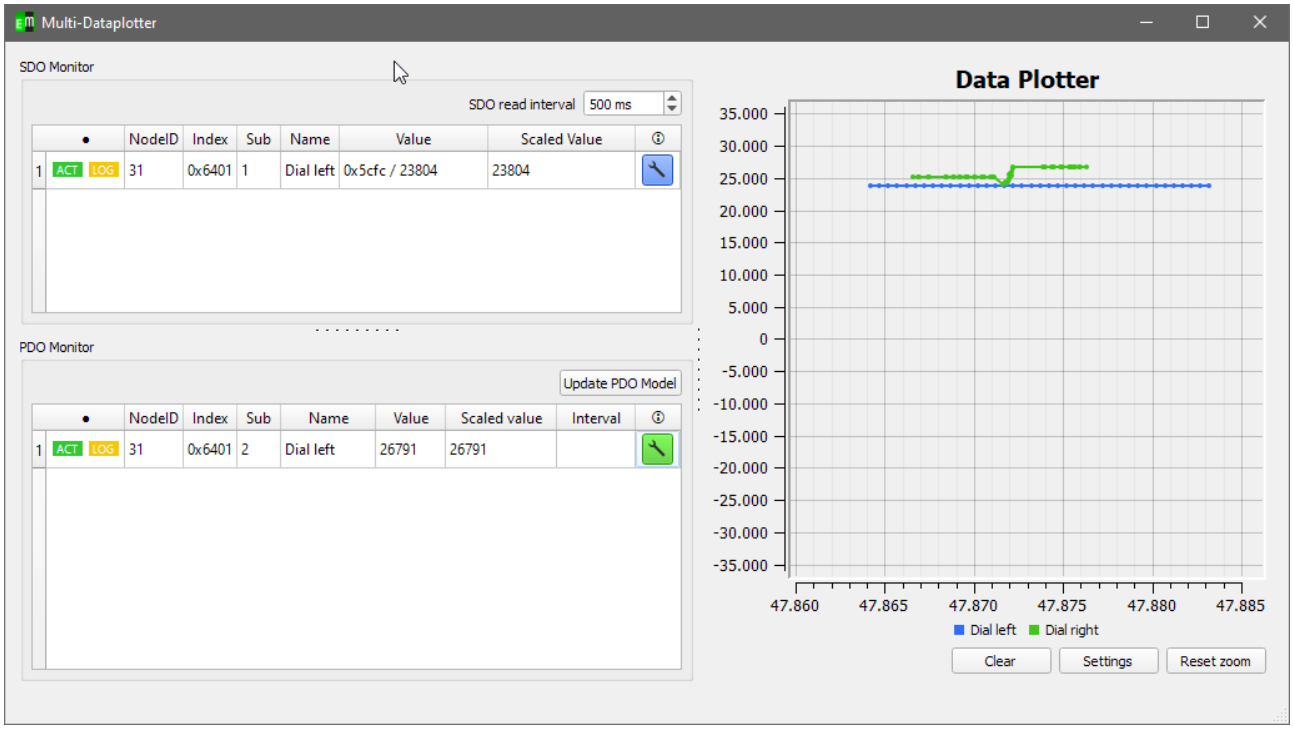
The option dialog provides access to various settings of the CANopen DeviceExplorer.



For a detailed description you can use the question mark in the upper right corner and click on any item.

10 PlugIns

10.1 Multidataplotter with SDO Monitor and PDO Monitor



Within the Multidataplotter you can monitor, log or plot SDO or PDO values from different nodes.

10.1.1 Handling the data plotter

Interaction:

- Moving: Press the middle mouse button and move your mouse to move the plot.
- Zooming: Press the right-mouse button and move your mouse to zoom in or out.

Settings:

- Enable auto scale
  If enabled the y-axis depends on the values in the plot.
- Zoom x-axis
  If this is enabled zooming with the right-mouse button influences the x-axis
- Zoom y-axis
  If this is enabled zooming with the right-mouse button influences the y-axis
- Plot update time
  This value determine the update rate of the plot in milliseconds

10.1.2 Adding objects

To add objects into the SDO or PDO monitor, you can do this either by right-click into a table and select "Add object" or drag and drop objects from the objectbrowser of the mainwindow into the table.

By adding the items, they are still deactivated. This means they will not be plotted until you activate them with the "ACT" button in the first column. The button will be green if the row is active.

10.1.3 Configure plotting curve

You can configure the plotting curve by clicking the wrench-button in each row.

Within this dialog you can set a filename for the singlerow-logging (see below), can change the line color or add a scale-factor and offset.

10.1.4 Logging values

There are two ways to log values.

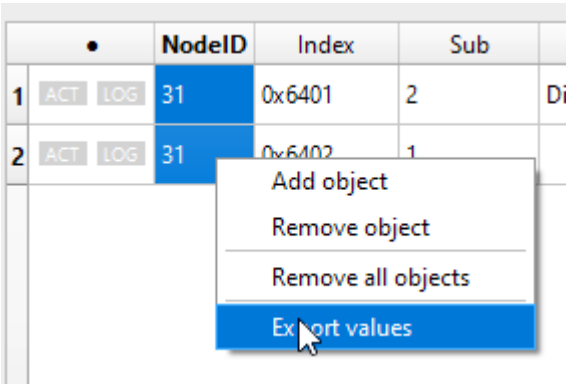
1. Log each value to a separate file

   There exists a fast accessible way to log each row. It is activated by clicking the "LOG" button in the first column. It will be yellow if it is activated.

   In this logging state each time a new value is received, the value will be outputted to a default file in the subfolder "CANopen DeviceExplorer" of own documents or in the file which is specified within the settings.

2. Export multiple columns

   You can export several values at any time my by selecting one or more rows and right-click to select "Export values". Each selected row will be exported together to one file.

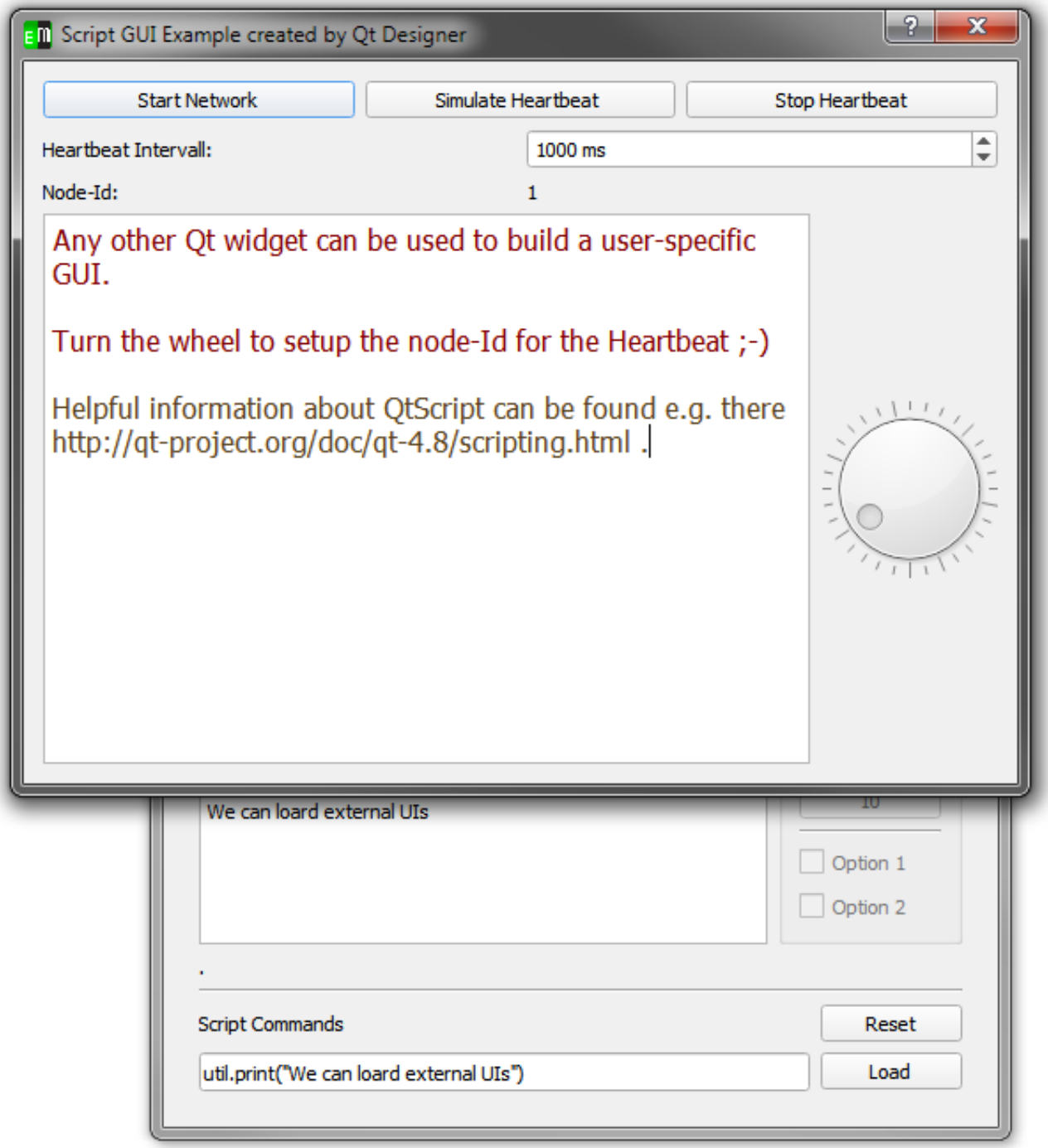


10.2 EnergyBus Interpretation (optional)

The optional EnergyBus Interpretation displays the state of EnergyBus devices in an EnergyBus (CiA-454) network.

10.3 CAN/CANopen Scripting (optional)

The Scripting Interpreter provides the possibility to run QtScript(JavaScript) programs with special extensions for CANopen.



Even own user interfaces can be generated by the QtDesigner and used in scripts.

All additional CANopen-specific commands are explained in the separate document "CANopen Scripting Interpreter – API Reference" (cde_script_api.pdf).

The following example shows the usage of a QtScript program:

```
// print something to console and set device to operational
util.print("Test of simple device");
```

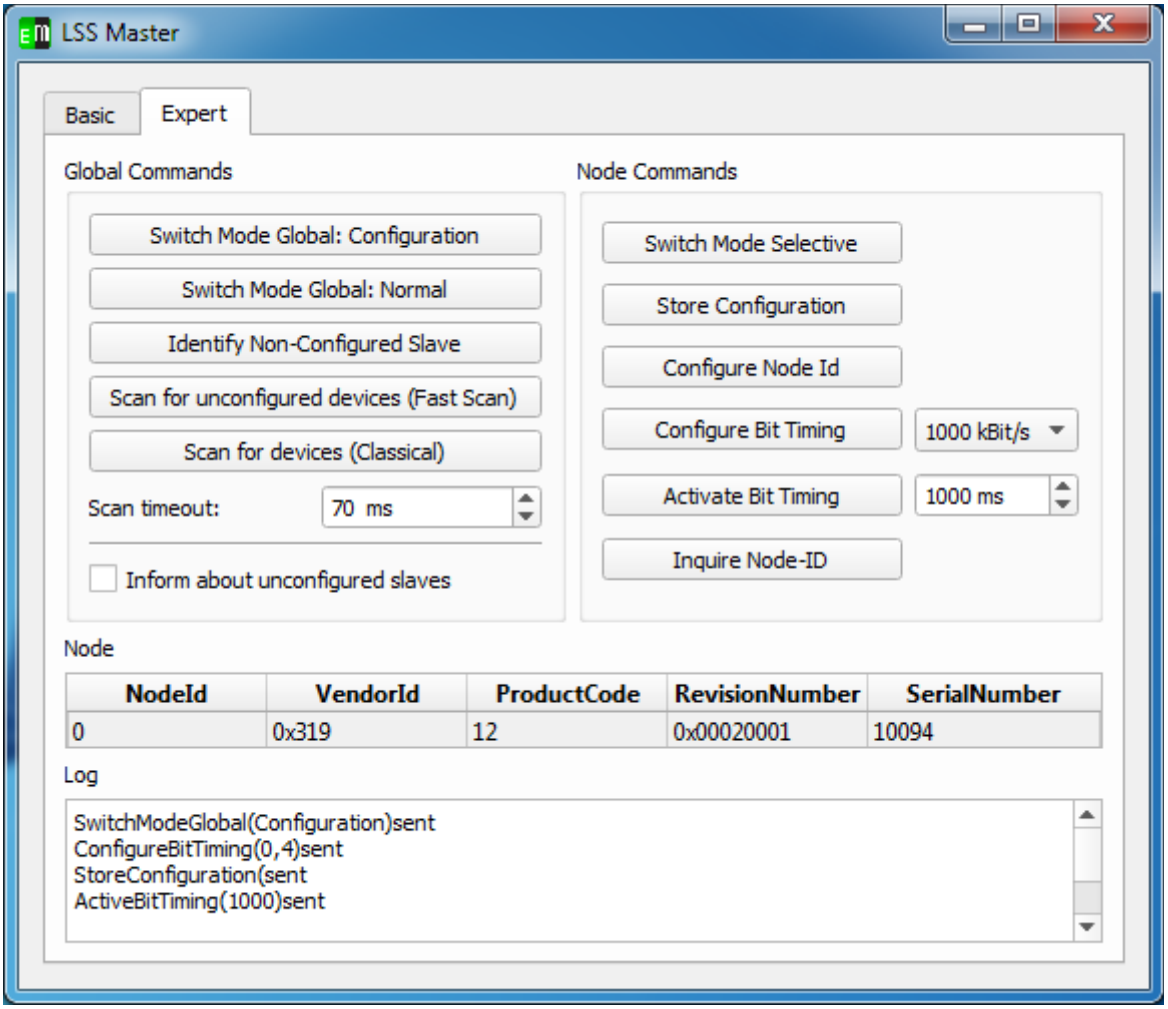
```
nmt.preopNetwork();
nmt.startNode(32);
i = 0;
util.print("We are in " + util.pwd());

// set node id for SDO access
sdo.setNodeId(32);

// loop over objects 0x4000 to 0x04010
for (object = 0x4000; object < 0x4005; object ++) {
    str = "Test object ";
    str = str + object;
    util.print(str);

    // write value to object 0x4000..
    result = sdo.write(object, 0x0, UNSIGNED32, i);
    if (result == "SDO_OK") {
        util.print(" Write OK");
    } else {
        util.print(" Write NOT OK");
    }
    // wait a bit to allow device update its internal values
    util.msleep(10);

    // read from 0x4100.. and expect same value
    result = sdo.read(object+0x100, 0x0, 0x07);
    if (result == i) {
        util.print("Read OK");
    } else {
        util.print(" Read NOT OK");
    }
    i++;
}

// user defined function that can be called from Scripting tab
function urk(count) {
    for (i = 0; i < count; i++) {
        nmt.startNetwork();
        nmt.stopNetwork();
        var dlc = 4;
        var canId = 0x100 + i;
        can.sendBaseFrame(canId, dlc, 1 , 2 , 3 ,4 , 0, 0, 0 ,0);
    }
}
// call user defined function
urk(4);
// setup cyclic timer every 2 seconds
timerId = util.every(2000, “urk(10)“ );
```

This example is installed with the CDE as example1.js.

Script commands can be entered into the command line at the bottom of the window. Complete script files can be loaded as well if a path to a script file is specified in the command line. The command line stores it history and using the cursor buttons up and down older commands can be selected again. The command line history is stored when the program is closed.

10.4 LSS Master (optional)

The LSS Master PlugIn provides Layer Setting Services (LSS) according to CiA-305. All LSS commands can be send in the expert view, so that device developers can test their LSS implementations. The Basic View provides an automatic node ID assignment for CANopen devices.



10.5 Process Data Linker (optional)

The Process Data Linker is a powerful extension to define connection between process data of different devices. CANopen-PLCs according to CiA 405 are supported and besides DCF files a PLC variable definition according to IEC 61131 is generated. The Process Data Linker is explained in the section Process Data Linker in detail.

11 Process Data Linker (optional)

Using the Process Data Linker connections between process data of different CANopen devices can be established automatically. After the definition of the connections the Process Data Linker automatically generates a configuration of all PDOs in the CANopen network, which is called PDO Linking.

11.1 Overview

In order to use the Process Data Linker PlugIn all EDS files of the device have to be loaded in the object browser and assigned to the individual node-IDs. An active CAN connection to the devices is only required if the devices shall be configured directly by the CANopen DeviceExplorer, otherwise no CAN connection is necessary to use the Process Data Linker.

If a valid license for the Process Data Linker is available, it can be activate via PlugIns → Process Data Linker. It will open a window with its own menu and 4 tabs.

11.2 Menu of Process Data Linker

Object Linker

- **Generate Linking**

  Generation of PDO configuration based on settings in object matrix and linking overview. After that, the configured PDOs are shown in the "Configured PDOs" tab.

- **Generate Linking & DCF Files**

  Generation of PDO configuration based on settings in object matrix and linking overview. After that, the configured PDOs are shown in the "Configured PDOs" tab. Additionally, the DCF file for each node are generated.

- **Download Configuration**

  Open dialog to configure all connected CANopen devices directly.

- **Close**

  Close Process Data Linker. All settings will remain valid until the CANopen DeviceExplorer is closed.

Settings

- **PLC Configuration**

  Configuration of network variables of CANopen-PLCs, if there are any in the project.

- **Linking Configuration**

  Configuration of various settings that configure the linking algorithm.

File Viewer

- **HTML Project Documentation**

  Open browser to show HTML project documentation.
- **DCF Files**

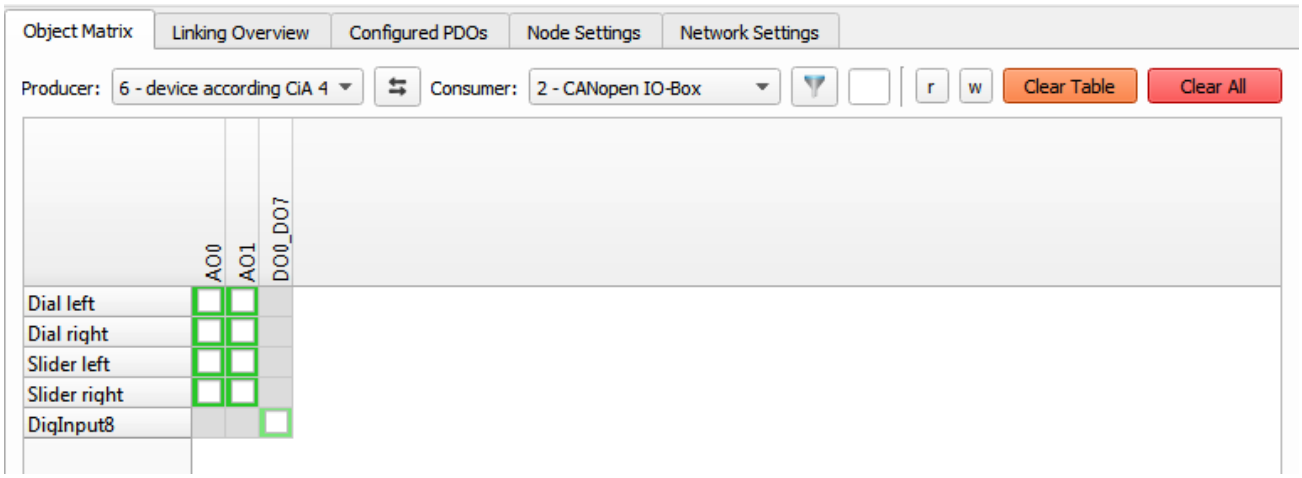
  Show generated DCF files in text viewer.
- **PLC Variable Definition**

  Show generated IEC61131 variable definitions in text viewer.

11.3 Object Matrix

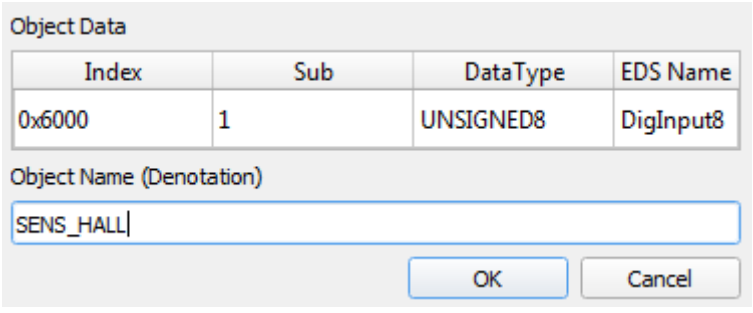
All communication connections are defined in the object matrix as communication pairs between a producer(source, sender) and a consumer(drain, receiver). To configure it, a pair of producer and consumer has to be selected. After that the matrix shows all linkable objects of both devices for the given direction.

If the intersection is white with a green border a connection between both objects is possible. If the fields are gray no connection is possible. An active connection is marked by a and an intersection which is partly filled with light gray indicates that the object at the consumer is already linked with another object. Anyway this connection can be changed by a single click.



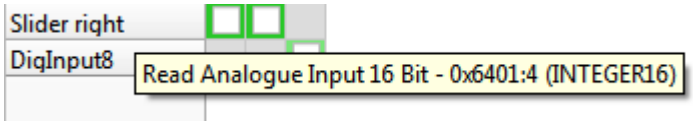
Object Matrix with connected objects

The button “Clear All” deletes all connections in a network and the button “Clear Table” only deletes the connections between the current producer-consumer-pair. A filtering by data types is possible via the filter button or by a text filter next to it. In addition to that objects can be renamed. This new name will be used in all following masks and it will be written as denotation into the DCF file.

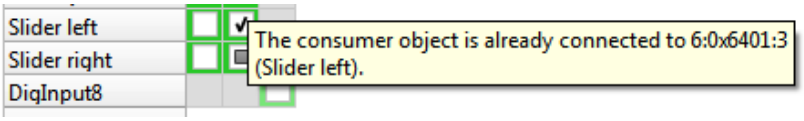


Dialog to rename an object

Additional information are shown as tool tip over an object or an intersection.



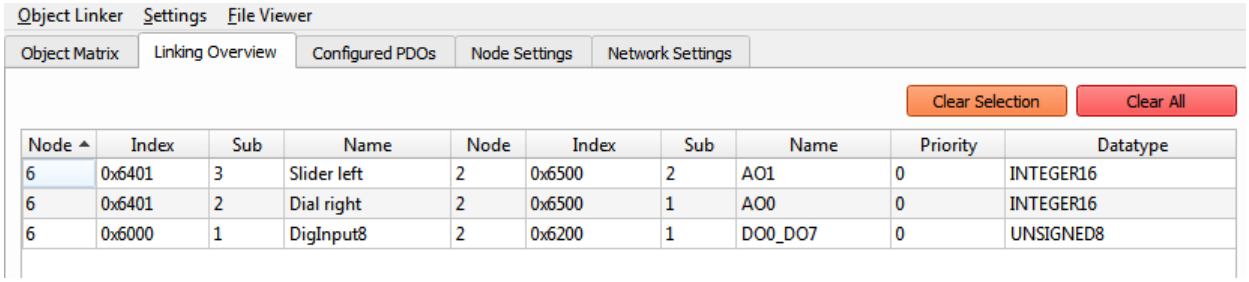
Tooltip at an object



Tooltip at an intersection

11.4 Linking Overview

The linking overview shows all connections in a table. The names of the objects and the priorities of the connections can be configured here as well.



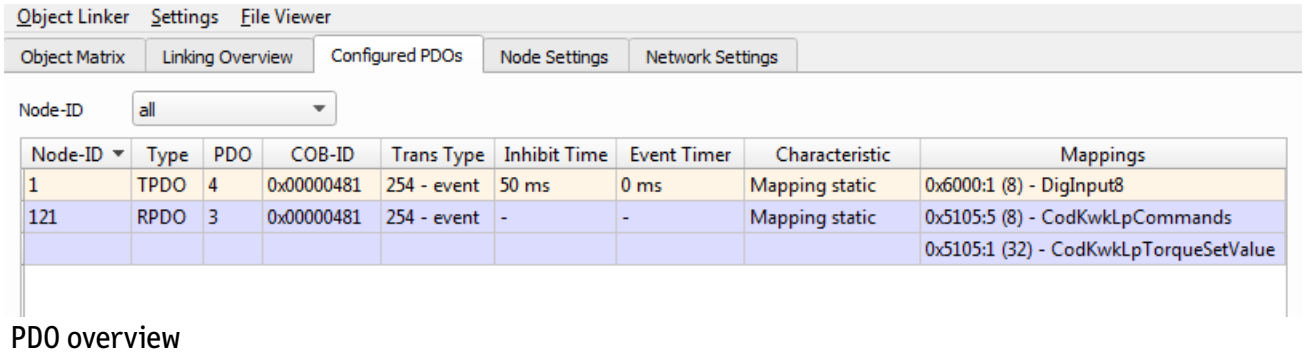
Node	Index	Sub	Name	Node	Index	Sub	Name	Priority	Datatype
6	0x6401	3	Slider left	2	0x6500	2	AO1	0	INTEGER16
6	0x6401	2	Dial right	2	0x6500	1	AO0	0	INTEGER16
6	0x6000	1	DigInput8	2	0x6200	1	DO0_DO7	0	UNSIGNED8

Table view for all connected objects

The priorities are only relevant for connections if both nodes support dynamic mapping. 0 is the highest priority and 255 the lowest. The objects are sorted into the Transmit-PDOs of the producer according to the priority. Only objects with the same priority are put into the same PDO. This mechanism can also be used to separate digital and analog data.

11.5 Configured PDOs

This tab show the configured PDOs as calculated by the Process Data Linker. Specific properties of the PDOs can be configured additionally. These are the COB-ID, the transmission type, the inhibit time and the event timer.



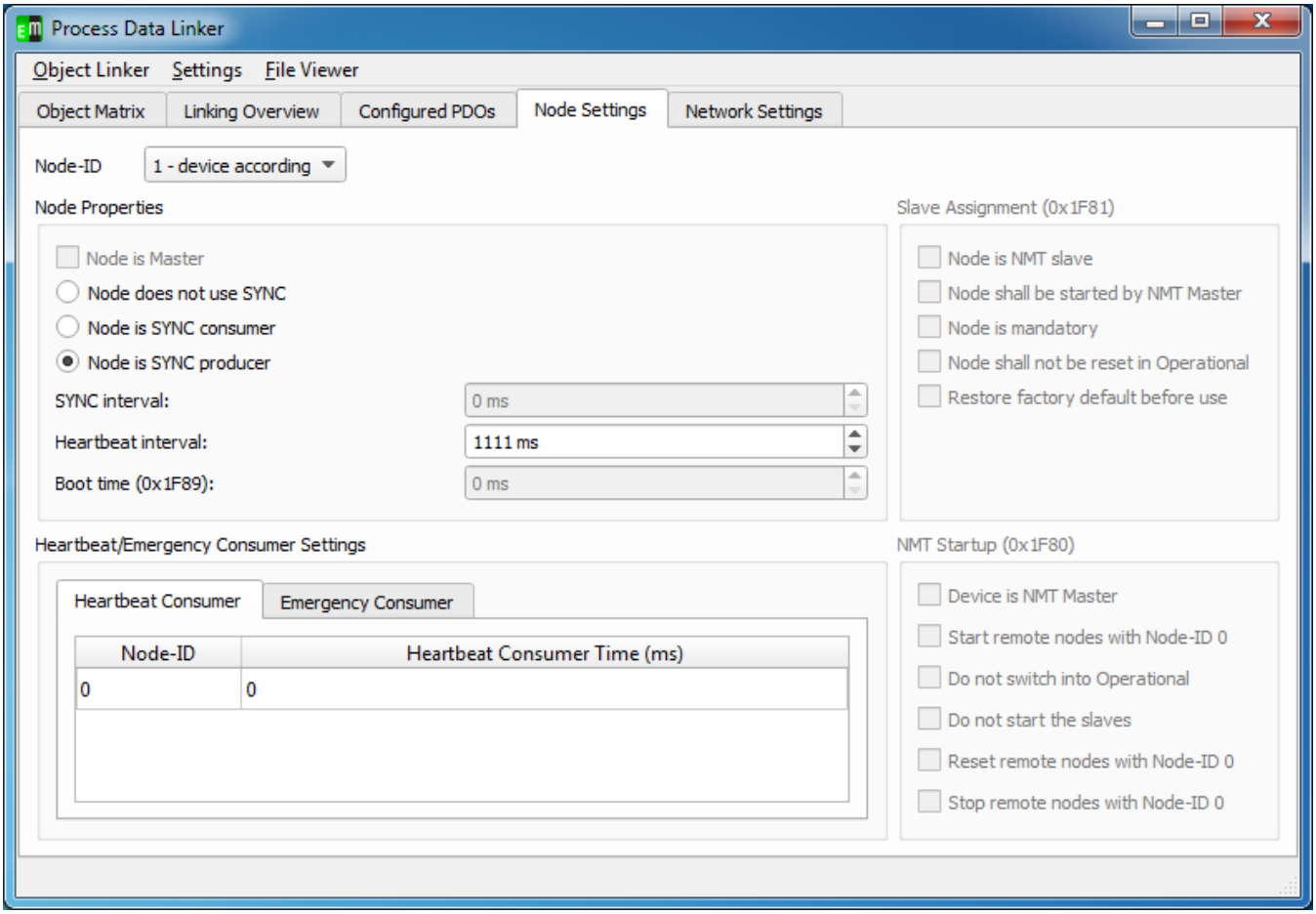
Node-ID	Type	PDO	COB-ID	Trans Type	Inhibit Time	Event Timer	Characteristic	Mappings
1	TPDO	4	0x00000481	254 - event	50 ms	0 ms	Mapping static	0x6000:1 (8) - DigInput8
121	RPDO	3	0x00000481	254 - event	-	-	Mapping static	0x5105:5 (8) - CodKwkLpCommands
								0x5105:1 (32) - CodKwkLpTorqueSetValue

PDO overview

11.6 Node Settings

The node properties box allows the configuration of SYNC and heartbeat settings of a device.

All additional nodes settings are only relevant, if a CANopen Manager is present in the network and if its network configuration objects (0x1F80, 0x1F81, 0x1F89) shall be configured. In this case a node has to be assigned ad master. In the fields “Slave Assignment” and “NMT Startup” the objects of the CANopen manager can be configured according to CiA 302.



Knoten- und Mastereinstellungen

11.7 Step-by-Step Guide

1) At first all EDS files for all nodes have to be loaded in the object browser. In this mask also additional objects like polarity can be configured manually. The values which are written and read there are stored in the DCF file as well.

2) The Process Data Linker PlugIn can be activated via PlugIns → Process Data Linker. It consists of 4 tabs. The 1st tab is the object matrix which is used to configure connections between producers and consumer.

3) The Linking Overview Tab shows a connections in a table. Names and priorities of the connections can be changed there as well. Connections with the same priority are put into the same PDO if possible (dynamic mapping)

If all connections are defined, the PDO configuration can be generated by "Generate Linking". The result is shown in the "Configured PDO"-Tab.

4) DCF files can be generated via "Object Linker" → "Generate Linking & DCF Files." The tool asks for a path for the project file and stores the generated files there as well. If a CANopen-PLC is used, the DCF files can be imported later on into the programming system of the PLC.

12 Start parameter

The following start parameters are supported by the CDE:

- -startScript s*riptpath*
  With this parameter the CDE will directly load the script at startup
  Example:

```
cde.exe "C:\Program Files (x86)\emotas\CANopenDeviceExplorer\
scriptexamples\example2.js"
```

13 Support & Contact

On all questions and upcoming problems on CANopen DeviceExplorer you may contact us via email (support@emotas.de) or by phone +49(0)3461/794160. If a CANopen device does not react as expected, a logging of the CAN communication is useful for the analysis. Please send us your current CAN logging by email, ideally also before you contact us by phone.