

# *CANopen Device Manager*

## *Service and Test Tool for CANopen® Devices*

**User Manual**  
**Doc. no. 4.12.0157.2000**  
**Rev. 3.3**

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# 1 Introduction

## IXXAT CANopen Device Manager

The CANopen Device Manager is a modular tool that provides simplified visual device management and access services for CANopen networks. Typical applications of the CANopen Device Manager include diagnostics and configuration of single devices and topology analysis of networks. It will help service technicians to analyze and solve problems in previously configured systems as well as assist engineers with testing individual CANopen components. The CANopen Device Manager is not intended to replace a dedicated CANopen network configuration tool, however it may be used to complement such a tool or to set up simple networks that include only a few devices and require limited configuration effort.

The efficient use of the CANopen Device Manager in application areas as indicated above is supported by the availability of an extensive range of CANopen services as described in the [CiA 301](#) specification by CAN in Automation. The supported functionality includes:

- Network topology analysis and device identification
- NMT and error control services, including heartbeat monitoring and node guarding
- Monitoring of emergency messages
- Support for SDO services normal, expedited, and block transfer, including support for CRC verification
- Event triggered, synchronously polled, or remotely requested PDO transmission, single shot SYNC transmission or adjustable communication cycle periods in steps of 1ms. Support of SYNC counter according to [CiA301](#)
- Support for EDS and XDD device description files as specified in [CiA 306](#) and [CiA 311](#)
- Object dictionary browser supported SDO access to CANopen devices
- SDO download or upload of bulk data to and from files
- Concise DCF download and firmware update as described in [CiA 302](#)
- Layer setting services master according to [CiA 305](#)

The available CANopen services are implemented using plug-in modules, which also allows for customer or CANopen device specific enhancements to the default functionality.

Although data logging is not inherently supported by CANopen Device Manager, this functionality can be added by running CANopen Device Manager concurrently with IXXAT bus monitoring tools such as MiniMon (included with the IXXAT VCI driver software) or IXXAT canAnalyser (separate product). For details see the section on [Operating CANopen Device Manager together with CAN Bus Monitors](#).

 Note that certain services provided by CANopen Device Manager may compromise network stability and may result in undefined network behavior if not used with the required precautions. The CANopen specifications allow only one active NMT master device in a CANopen network. When executing NMT services, CANopen Device Manager temporarily assumes NMT master functionality. Before executing NMT services in an unknown CANopen network verify that no other NMT master device is active. For network or device scan operations CANopen Device Manager uses the default server SDO of a device, which may also be used by another SDO client like a network manager. Please consult the CANopen specifications for further information on these services.

The improper use of CANopen Device Manager may cause malfunctioning or destruction of communication network devices and of systems controlled by them. IXXAT Automation GmbH is not liable for consequential damages of communication network devices and of the systems controlled by them.

## 2 Important User Information

### Liability

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There are many applications of this product. Those responsible for the use of this device must ensure that all the necessary steps have been taken to verify that the applications meets all performance and safety requirements including any applicable laws, regulations, codes, and standards

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## 3 Installation and First Steps

### System Requirements

To operate CANopen Device Manager, the following system requirements must be met:

- x86 compatible processor, 1 GHz or better
- Microsoft Windows Vista, Windows 7, Windows 8, Windows 8.1
- At least 256 MB RAM
- Installed .NET Framework 2.0
- Installed IXXAT VCI driver, version 3.2 or higher

Before installing CANopen Device Manager, the IXXAT VCI driver must be installed. To install the CAN hardware, please consult the corresponding hardware installation manual. For installation of the required IXXAT VCI driver, please consult the VCI installation manual.

### Installation

To install CANopen Device Manager, insert the program CD into the CD drive of your computer and start the installation program by running the file `CANopenDeviceManager3_3_X_XXXX_Setup.exe`. Follow the instructions of the installation program.

### Start-Up

CANopen Device Manager is started by clicking on the program icon created on the desktop or via the Windows Start menu.

### Software Protection

As of version 3.0 of CANopen Device Manager a software protection scheme has been introduced which uses as USB hardware dongle to license the software. The software protection uses the CodeMeter stick by Wibu Systems AG. For more information on additional features available to the user see the CodeMeter portal at <http://www.codemeter.com/>.

### Installation

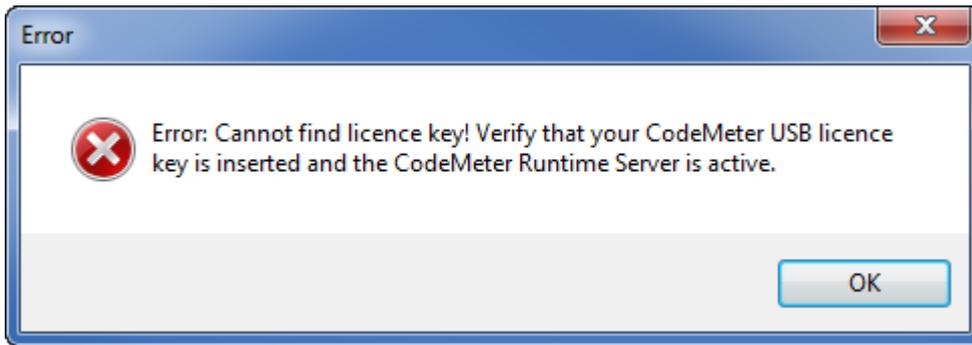
The installation of the CodeMeter user runtime is integrated into the CANopen Device Manager installation.

If you want to de-install the CANopen Device Manager you have to de-install the CodeMeter user runtime separately.

The CodeMeter Runtime Kit can be uninstalled easily on Microsoft Windows operating systems. Open the control panel and choose Add/Remove Programs, select CodeMeter Runtime Kit and choose Remove. All driver files and the entries in the registry will be removed from the computer automatically.

### Operation

During operation of the CANopen Device Manager the CodeMeter stick with the appropriate license has to be plugged into the USB port. Otherwise a dialog with a corresponding error message will be displayed and the CANopen Device Manager application will be terminated.



## Virtual Disk

 Please note that the removable disk that is created by the CodeMeter stick must not be used for storing user data! The displayed 2 MByte memory is only a virtual disk space, which is required by your system to correctly identify the CodeMeter stick.

## 4 CANopen Device Manager Functionality

### Overview

The IXXAT CANopen Device Manager is a single window application that implements the most frequently used CANopen communication mechanisms. The standard functionality of CANopen Device Manager is complemented by plug-in modules that provide additional support for dedicated analysis, configuration, or service tasks. User interface components associated with these plug-in modules are organized in individual tab pages inside the main application window of the CANopen Device Manager.

### Project Files

CANopen Device Manager supports backing up of network configuration data in project files. This includes parameters related to the network itself such as bit rate and frame format, but also parameters related to devices attached to the network and their current values. Using project files accelerates the process of restarting work with specific networks since parameters like path information of corresponding device description files do not have to be reassigned. CANopen Device Manager project files use a schema based XML data format. This enables other applications to easily access the information contained in the project files and process project data.

### User Interface

The user interface of CANopen Device Manager is divided into three primary areas. The menu system with main menu and the standard tool bar, the primary work space with a tab control allowing the selection of active plug-in modules, and the status bar providing status and progress information at the bottom of the main application window.



## 4.1 Menu, Toolbar, and Status Bar

### Menu Description

#### File (keyboard accelerator: Alt+F)

Icon	Command	Keyboard shortcut	Keyboard accelerator	Description
	New	Ctrl+N	Alt+F, N	Creates a new project file
	Open...	Ctrl+O	Alt+F, O	Opens an existing project file
	Save	Ctrl+S	Alt+F, S	Saves changes to the current project file
	Save As...		Alt+F, A	Save changes to the current project file under the specified file name
	Recent Projects		Alt+F, j	Contains the last recently used projects
	Exit		Alt+F, x	Closes the CANopen Device Manager application

#### Tools (keyboard accelerator: Alt+T)

Icon	Command	Keyboard shortcut	Keyboard accelerator	Description
	Clear Emergency Buffer			Clears the internal emergency message buffer of CANopen Device Manager
	Plug-Ins...		Alt+F, P	Opens the plug-in configuration dialog
	Options...		Alt+F, O	Opens the application options dialog

## Network (keyboard accelerator: Alt+N)

Icon	Command	Keyboard shortcut	Keyboard accelerator	Description
	Configuration...			Opens an options dialog specific to the CAN access parameters. Used to select the CAN hardware channel to connect to the network and to configure the corresponding bit rate settings
	Search Bit Rate			Attempts to identify the bit rate currently used for communication within the CAN network
	Connect			Connects to the network using the specified hardware channel and bit timing parameters
	Disconnect			Disconnects from the network

## Help (keyboard accelerator: Alt+H)

The Help menu gives access to online documentation.

Icon	Command	Keyboard shortcut	Keyboard accelerator	Description
	Contents		Alt+H, C	Displays this help file
	About...		Alt+H, A	Displays the About CANopen Device Manager window

## Toolbar

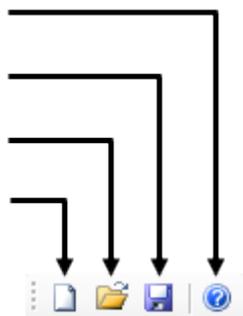
The tool bar provides fast access to frequently used commands of the main menu, like New, Open, and Save. Additionally a link to this help file is available.

Show on-line help

Save current project

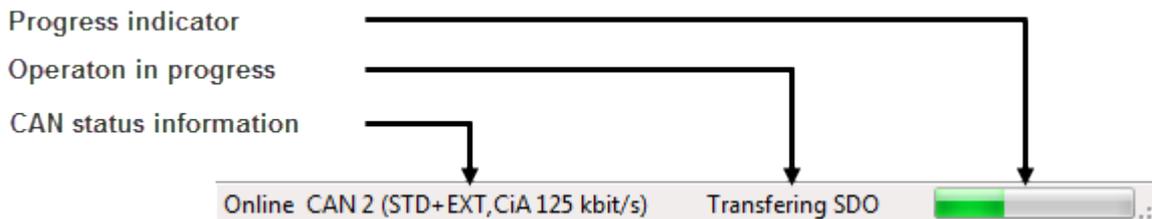
Open existing project

Create new project



## Status Bar

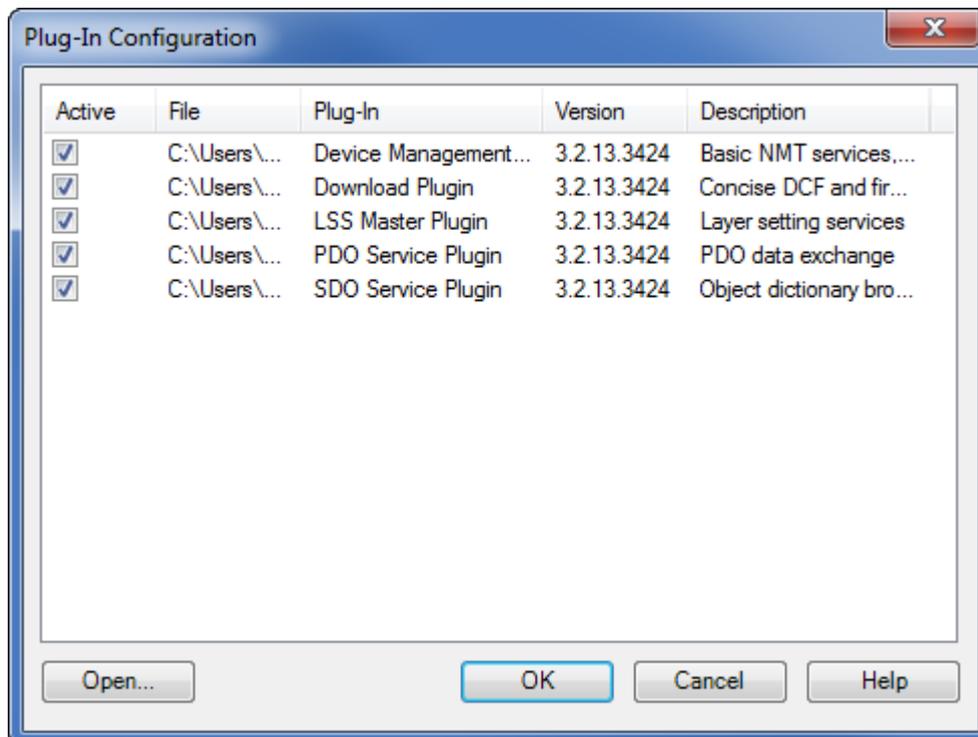
The status bar provides up to date information on the status and progress of operations currently performed by the CANopen Device Manager. The status bar is sub-divided into three sections. The left section indicates the current state of the CAN connection. It contains information on the current bit rate, the frame format and the activity of the connection. The middle section displays the kind of process currently being in execution. The right section contains a progress bar indicating the progress of the currently executed process.



## 4.2 Plug-In Configuration

CANopen Device Manager supports a plug-in mechanism, allowing for a customization of the available functionality. Each plug-in module is assigned to one tab page within the tab control of the main window. With the exception of the network configuration page, all tab pages and their corresponding plug-in modules can be activated and deactivated at run-time. The plug-in mechanism allows the user to configure an optimized workspace only containing the required functionality and thus reducing user interface overhead. Included with the standard installation are device management, SDO services, PDO services, configuration and firmware download, and LSS master plug-in modules.

The Plug-In Configuration dialog is opened from the Plug-Ins menu item under the Tools pull-down menu.



Description of column headers in the Plug-In Configuration dialog

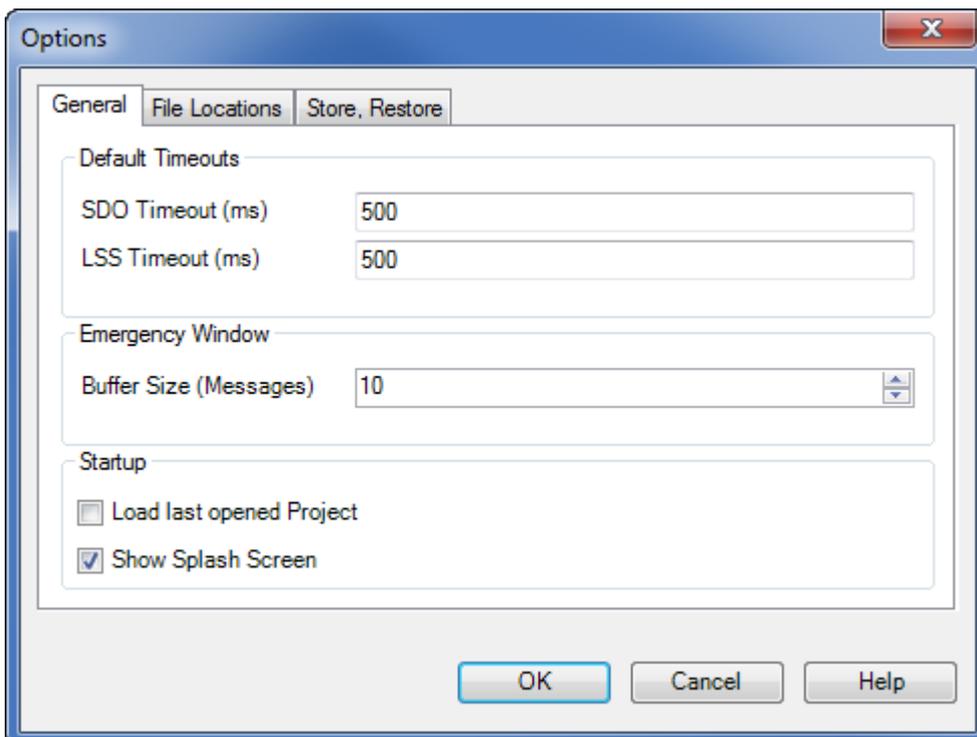
Header	Description
Active	Indicates if a plug-in is activated.
File	The file that contains the plug-in code.
Plug-In	The name of the plug-in.
Version	The version of the assembly the plug-in is contained in.
Description	A short description of the functionality of the plug-in.

The dialog lists all correctly identified plug-in modules. If a list item is checked the corresponding plug-in module is activated and visible in the tab control of the application main window. Un-checking the list item removes the plug-in from the list of active modules. Additionally the list contains additional information like file name and location, version number, and a functionality description.

CANopen Device Manager is only aware of plug-in modules that are either located in the plug-in sub directory in the application directory or that have been loaded at least once before. The Open... button allows the selection of any file having the extension .dll and implementing the required plug-in interface. If a valid plug-in is identified in the selected file it is added to the list in the plug-in configuration dialog. If the selected file does not contain a valid plug-in module or is not compatible with the installed version of CANopen Device Manager a corresponding error message is displayed.

### 4.3 Application Options

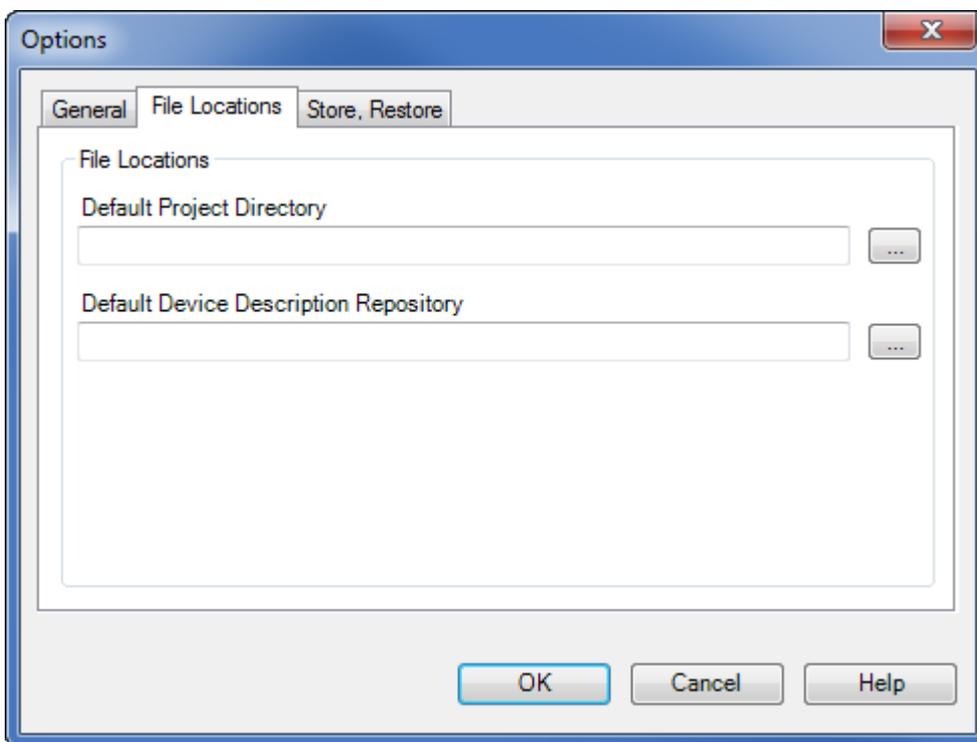
The Options dialog is used to set application specific parameters. These include timeout parameters for certain CANopen services, default locations for device description and project files, as well as specific preferences for the CANopen store, restore parameter services. The corresponding dialog window is opened from the Options menu item under the Tools pull-down menu.



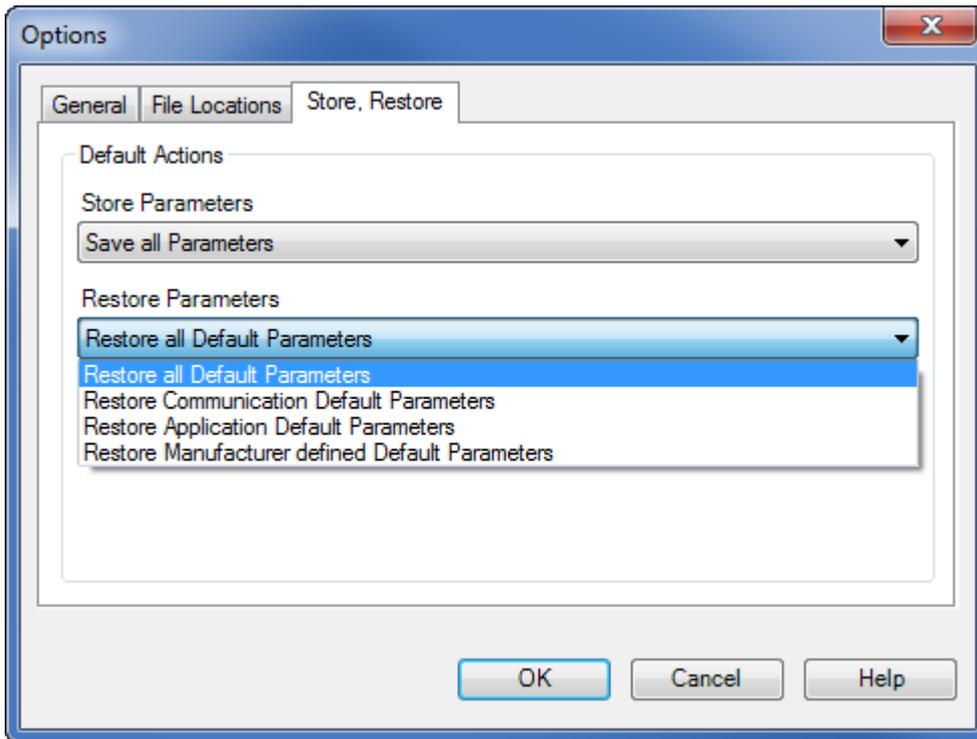
The first tab of the Options dialog window permits configuration of timeout parameters for SDO and LSS services. These parameters define the time the CANopen Device Manager application waits for a service request response from a SDO server or a LSS slave to a service request before it assumes that the services have failed. The value of these two parameters directly affects the operation of the CANopen Device Manager. If the timeout parameters are set too low a SDO transfer or a LSS command may not be executed successfully as the initiator of the service request will abort the operation before the SDO server or the LSS slave answers. A high value of the corresponding timeout parameters will result in long wait times if the communication partner is not available or cannot respond.

The lower group box on the General tab page relates to the emergency message list on the Network Configuration tab page of the main window. The buffer size control sets the number of messages buffered in the list which is implemented as a first in-first out buffer.

The last group on the General tab contains the "Load last opened Project" option. As the name indicates selecting this option causes CANopen Device Manager to load the most recently used project on start up. The Show Splash Screen option can be used to deactivate the splash screen shown at start up.



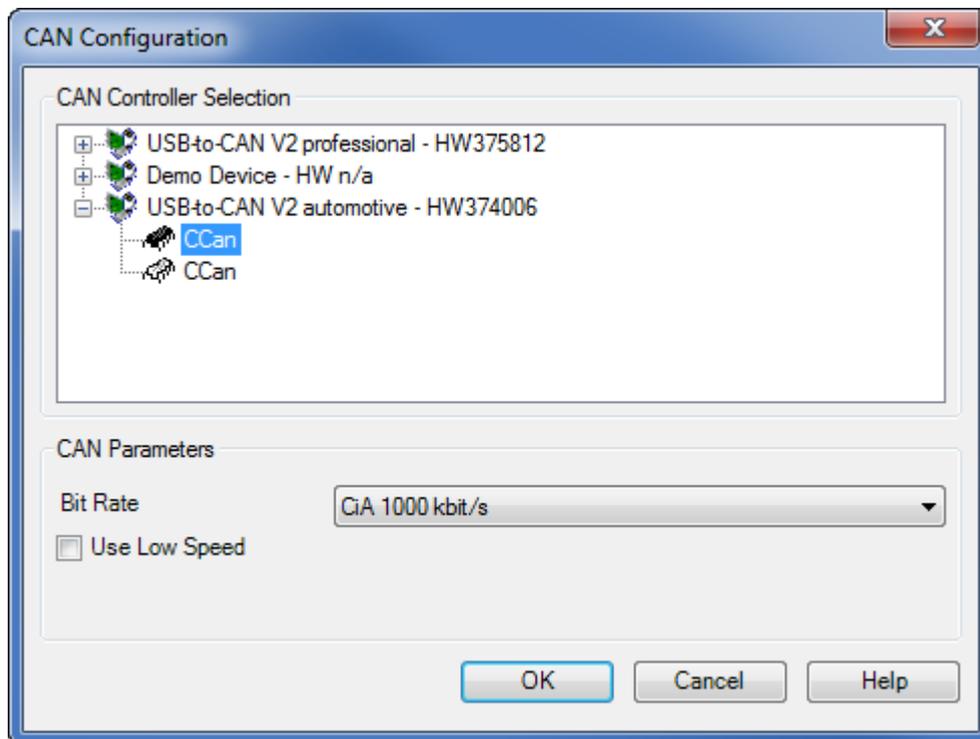
The second tab page allows the configuration of the default path for the device description file repository and the default path for project files. The default path names depend on the installation of the CANopen Device Manager and are typically `C:\Program Files\IXXAT\CANopen Device Manager\EDS` for the device description file repository and `C:\Program Files\IXXAT\CANopen Device Manager\Projects` for project files.



The third tab page defines default operations for the store, restore parameters mechanism that is an optional functionality of CANopen. The CANopen application layer and communication profile defines different groups of configuration parameters that may be selectively stored or restored. By setting the values of the combo boxes the user can select the group of parameters that will be stored or restored if the corresponding button on the Download tab page is pressed. The save all parameters, save communication parameters, save application parameters, and save manufacturer defined parameters (sub-index 04<sub>h</sub>) are supported, along with the corresponding restore operations. For additional information see [CiA 301](#).

## 4.4 Configuration of the CAN Interface

The connection to the physical CAN network requires the configuration of the interface card that is used for network access. Be careful to select the correct bit rate to avoid compromising network communication.



The CAN configuration dialog is opened from the Configuration... menu item under the Network pull-down menu. This dialog allows the selection of both the CAN channel used to connect to the network and the corresponding bit rate. The tree view used to select the CAN controller presents all interface cards that are recognized by the IXXAT VCI driver running on the local system. The particular interface is identified by a hardware number that may be found on the interface. Each interface card supports one or more CAN controllers. Clicking on such a controller selects the corresponding CAN channel and the color of the icon representing the particular controller turns from grey to black. Depending on the hardware interface this operation may take a few seconds as the controller has to be initialized by VCI. If the controller icon turns to red, the initialization has failed and the controller is not available for use by CANopen Device Manager. The icon color turns blue if the controller is locked by another application that uses the controller in parallel. In this case the controller can be used in parasite mode but may not be configured by CANopen Device Manager.

-  Unselected CAN controller
-  Selected CAN controller
-  CAN controller locked by another application
-  CAN controller initialization failure

The bit rate at which the CAN controller will operate is set from a combo box control. If the controller is locked by another application a blue icon appears for the selected controller and the combo box will be disabled.

If supported by the CAN interface low-speed CAN operation according to [ISO 11898-3](#) can be activated for the selected CAN channel using the Enable Low-speed CAN checkbox.

After finishing the CAN controller configuration the connection to the network can be established from the Connect menu item under the Network pull-down menu. Successful connection is indicated in the status bar by an Online text label. The connection to the CAN network is deactivated with the Disconnect menu item.

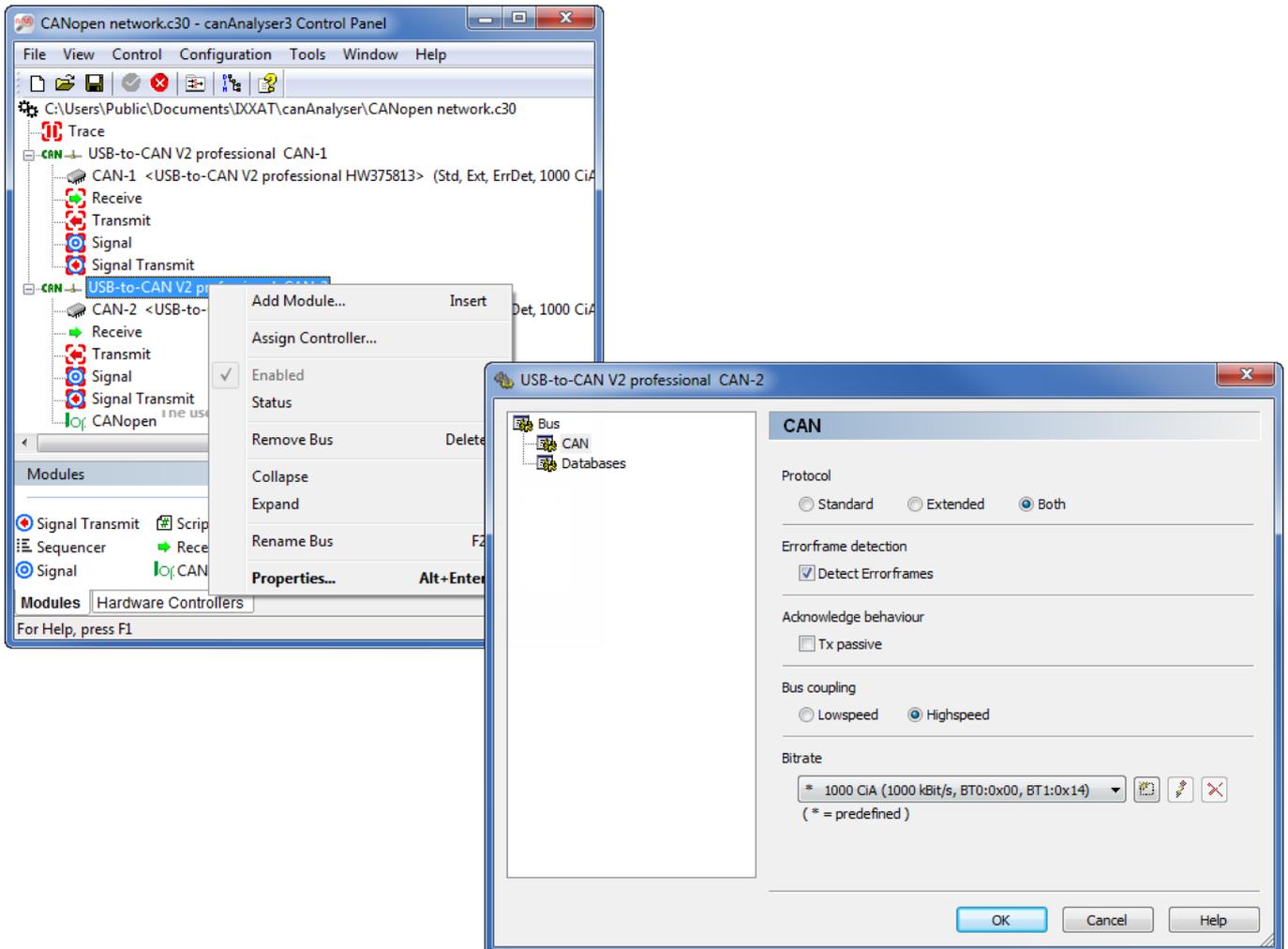
The CAN Configuration dialog will be automatically opened by CAN access operations if the configuration has not been previously performed or the CANopen Device Manager is offline. If the configuration is confirmed from within the CAN Configuration dialog, CANopen Device Manager will establish the network connection and execute the requested operation, otherwise the operation will be aborted.

## Bit Rate Detection

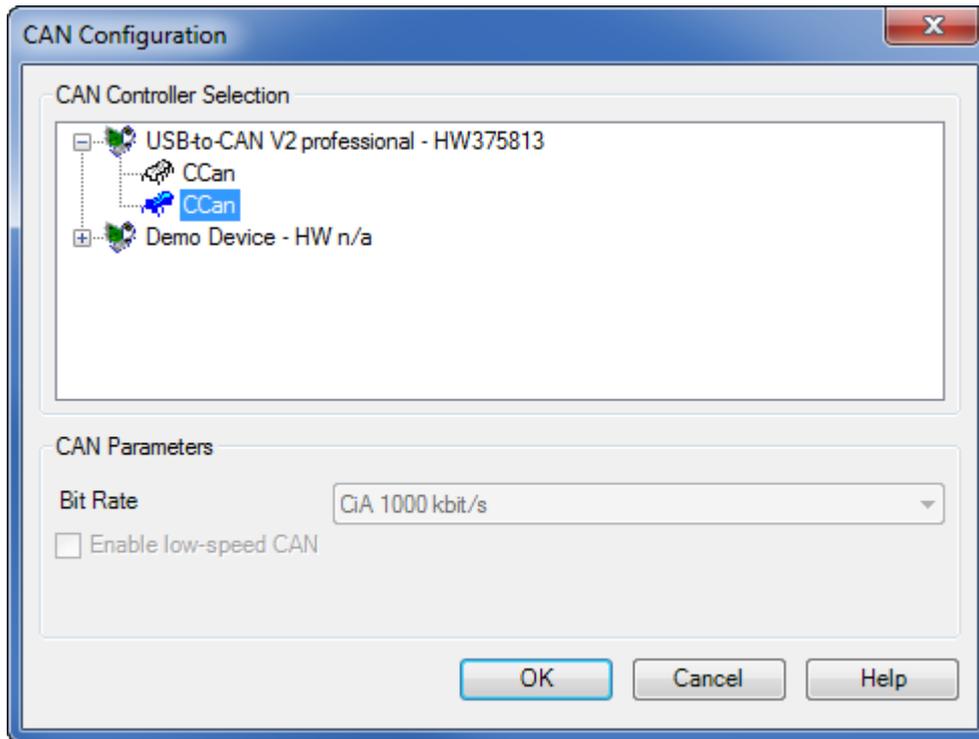
If the interface is configured to operate in [ISO 11898-2](#) high-speed CAN mode, CANopen Device Manager supports automatic detection of the bit rate utilized in the CAN network. Activating this mechanism from the Search Bit Rate menu item under the Network pull-down menu will stop all currently active communication. If the bit rate detection is successful, the controller is automatically set to the identified bit rate. The bit rate detection may not succeed if there is no or little traffic in the network.

## 4.5 Operating CANopen Device Manager together with CAN Bus Monitors

CANopen Device Manager may be operated concurrently with CAN bus monitors such as IXXAT MiniMon or IXXAT canAnalyzer that use VCI as software interface to the CAN network. If multiple interfaces share a common CAN interface one of the applications will acquire exclusive control of the CAN interface settings. Typically a bus monitor application will be started before and the CAN interface will be configured from the bus monitor. For an example based on the IXXAT canAnalyzer see the figure below.



Once this configuration has been performed CANopen Device Manager may be started. In the CAN Configuration dialog those CAN controllers that are controlled by the bus monitoring application are highlighted in blue when selected and the bit rate configuration control is disabled. See the example below.



## 5 Network Configuration

### Overview

The IXXAT CANopen Device Manager is implemented using an internal data storage to maintain device information that is either required for, or facilitates the access of CANopen devices. Before using CANopen Device Manager to access devices in a network, individual devices have to be initialized in the data storage representing the currently active network configuration. CANopen Device Manager offers two alternative approaches to add devices to a configuration. A scan of the connected network attempts to identify CANopen devices by uploading selected device data into the internal data storage of the CANopen Device Manager. Optionally a device may be added explicitly by specifying the node-ID with possible other data of the device.

Selected information on all currently available devices is summarized in the Network List on the Network Configuration tab page.

IXXAT CANopen Device Manager - Interoperability Network

File Tools Network Help

Network Configuration Device Management SDO Services PDO Services Download

Network List

Scan Network Add Device Delete Device

Node-ID	Name	Device Profile	Device Name	Vendor Name	Device
3	I/O Mod...	401	750-307		C:\Use
5	Drive Co...	402	ATV71H075M3	Schneider To...	C:\Use
9	I/O Mod...	401	OTB 1C0 DM...	Schneider Ele...	C:\Use
25	I/O Mod...	401	STB NCO 2212	Schneider Ele...	C:\Use

Emergency Messages

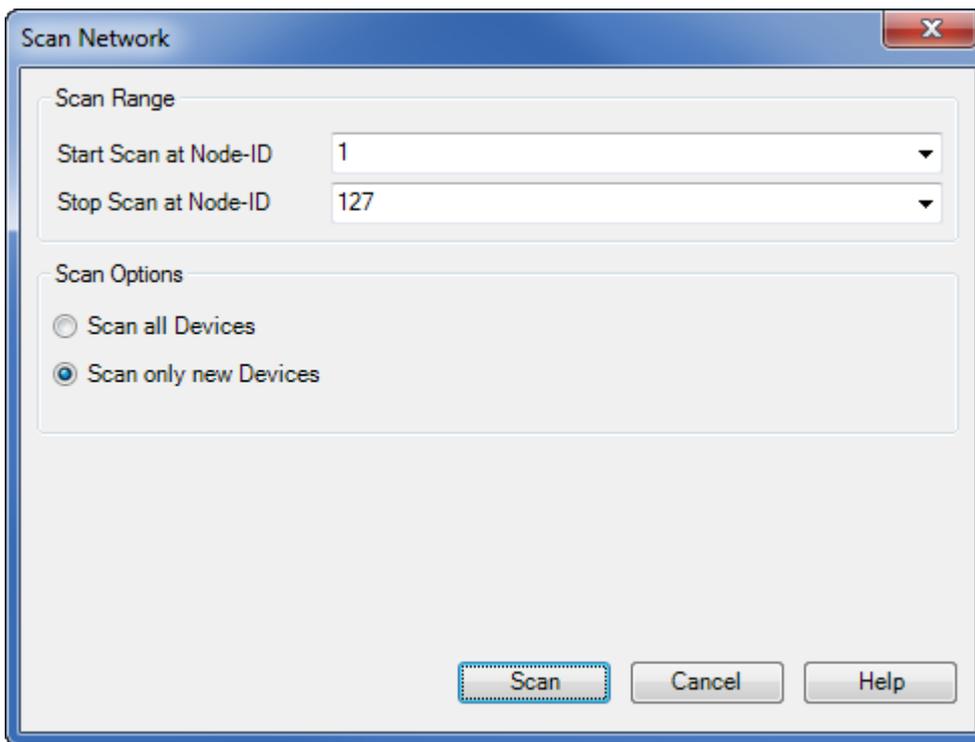
Node-ID	Error Code	Error Register	Error Data

Online CAN 2 (STD+EXT, CiA 125 kbit/s)



## 5.1 Working with the Network List

To scan for CANopen devices in a network, click the Scan Network button. This will display a dialog box which enables the user to specify the range of node-IDs that shall be scanned for actively connected CANopen devices. The scan will attempt to detect connected CANopen devices by uploading a predefined set of object dictionary entries from each possible device within the specified node-ID range, beginning with the mandatory object 1000<sub>h</sub> Device type (see [CiA 301](#) for a description of the CANopen device type).



 Note that the scan will only commence provided that either a CAN network interface has been configured prior to the scan operation or is in parasite mode. If not, the CAN configuration dialog is opened and the user is prompted to configure an adequate CAN channel.

The user may also specify if the scan operation shall include all node-IDs in the specified range, or only devices that have not yet been added to the data storage representing the current CANopen network configuration (default).

Depending on the specified scan range, the scan process may take several seconds. During the scan process, CANopen Device Manager will not only attempt to detect connected CANopen devices, but also upload device parameters like identification objects, information related to supported NMT error control mechanisms and configured SDO and PDO communication objects. For a complete list of scanned object dictionary entries, see the table below.

Objects uploaded from the device during a device scan

Object Index	Description
1000 <sub>h</sub>	Device type (scan is aborted for this device if the upload request is terminated with an SDO abort service).
1008 <sub>h</sub>	Manufacturer device name.
1009 <sub>h</sub>	Manufacturer hardware version.
100A <sub>h</sub>	Manufacturer software version.
100C <sub>h</sub>	Guard time (if not available, node guarding of this device is not supported).
100D <sub>h</sub>	Life time factor.
1014 <sub>h</sub>	COB-ID emergency object.
1017 <sub>h</sub>	Producer heartbeat time (if not available, heartbeat monitoring of this device is not available).
1018 <sub>h</sub>	Identity object.
1201 <sub>h</sub> - 127F <sub>h</sub>	SDO server parameter.
1400 <sub>h</sub> - 15FF <sub>h</sub>	RPDO communication parameter.
1600 <sub>h</sub> - 17FF <sub>h</sub>	RPDO mapping parameter (only scanned, if the corresponding RPDO communication parameters exist. The upload process covers only as many objects as indicated in sub-index 00 <sub>h</sub> . Currently at most eight mapping entries are supported. MPDOs are not supported in this release).
1800 <sub>h</sub> - 19FF <sub>h</sub>	TPDO communication parameter.
1A00 <sub>h</sub> - 1BFF <sub>h</sub>	TPDO mapping parameter. Only scanned, if the corresponding TPDO communication parameters exist. The upload process covers only as many objects as indicated in sub-index 00 <sub>h</sub> . Currently at most eight mapping entries are supported. MPDOs are not supported in this release.
1F51 <sub>h</sub>	Program control (if not available, program firmware update is not supported).
1F52 <sub>h</sub>	Verify program (only scanned if 1F51 <sub>h</sub> exists).

## 5.2 Add a Device to the Network List

To explicitly add a device to the network list, use the Add Device button. This will open the Device Properties dialog enabling the user to specify the following properties of the new device.

Description of properties that can be customized in the Device Properties dialog

Attribute	Description
Name	Descriptive name for the device to be inserted into the network.
Node-ID	A unique identification number that is used by CANopen to distinguish between different devices. The node-ID has to be selected to equal the node-ID settings of the corresponding device in the network.
EDS/XDD File	Path to a CiA 306 or CiA 311 compliant device description file.
Description	Optional description of the device. May contain information of the device functionality within the CANopen network.

The Scan Device Parameters check box may be used to request an explicit upload of parameters from the specified device. Some of these parameters are required to execute specific services available with CANopen Device Manager.

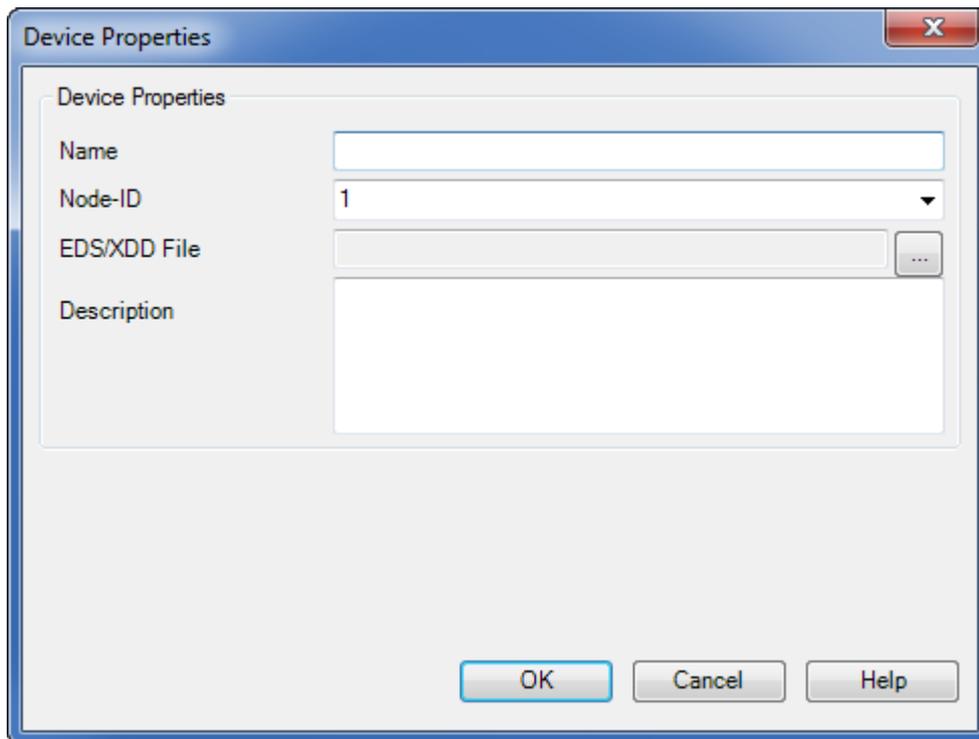
On confirmation the specified device will be added to the internal data storage of CANopen Device Manager. If a device description file has been specified in the dialog, this operation may require several seconds to complete as the EDS or the XDD file must be parsed and the information contained in the device description file has to be entered into the CANopen Device Manager internal data storage.

## Removing a Device from a Configuration

To remove a previously added device from the current network configuration, use the Delete Device Button. Before removing the device from the network list, CANopen Device Manager will request the user to confirm the operation.

## Modifying Device Properties

To modify previously configured parameters of a device in the current configuration, use the Device Properties dialog. The dialog is opened either by double-clicking the device in the network list or by a right-click on the device and selecting Properties... in the pop-up menu.



## 5.3 Emergency Messages

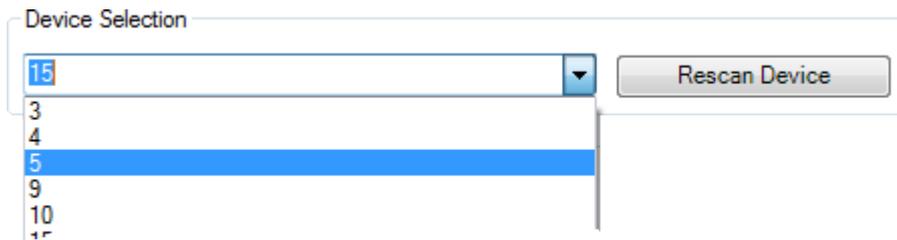
Emergency messages received from CANopen devices added to the current network list are displayed in a dedicated trace window on the Network Configuration tab page of CANopen Device Manager.

Emergency Messages			
Node-ID	Error Code	Error Register	Error Data
2	5000	81	00 01 00 00 00
2	5000	81	FF 01 10 01 81
10	5000	81	FF 01 10 01 81
10	5000	81	FF 01 10 01 81

Selecting the Clear Emergency Buffer menu item under the Tools pull-down menu clears all emergency messages currently buffered by CANopen Device Manager. The list may also be cleared by means of the context menu of the trace window. The size of the internal emergency message buffer is configured from the Options dialog.

## 6 Device Selection

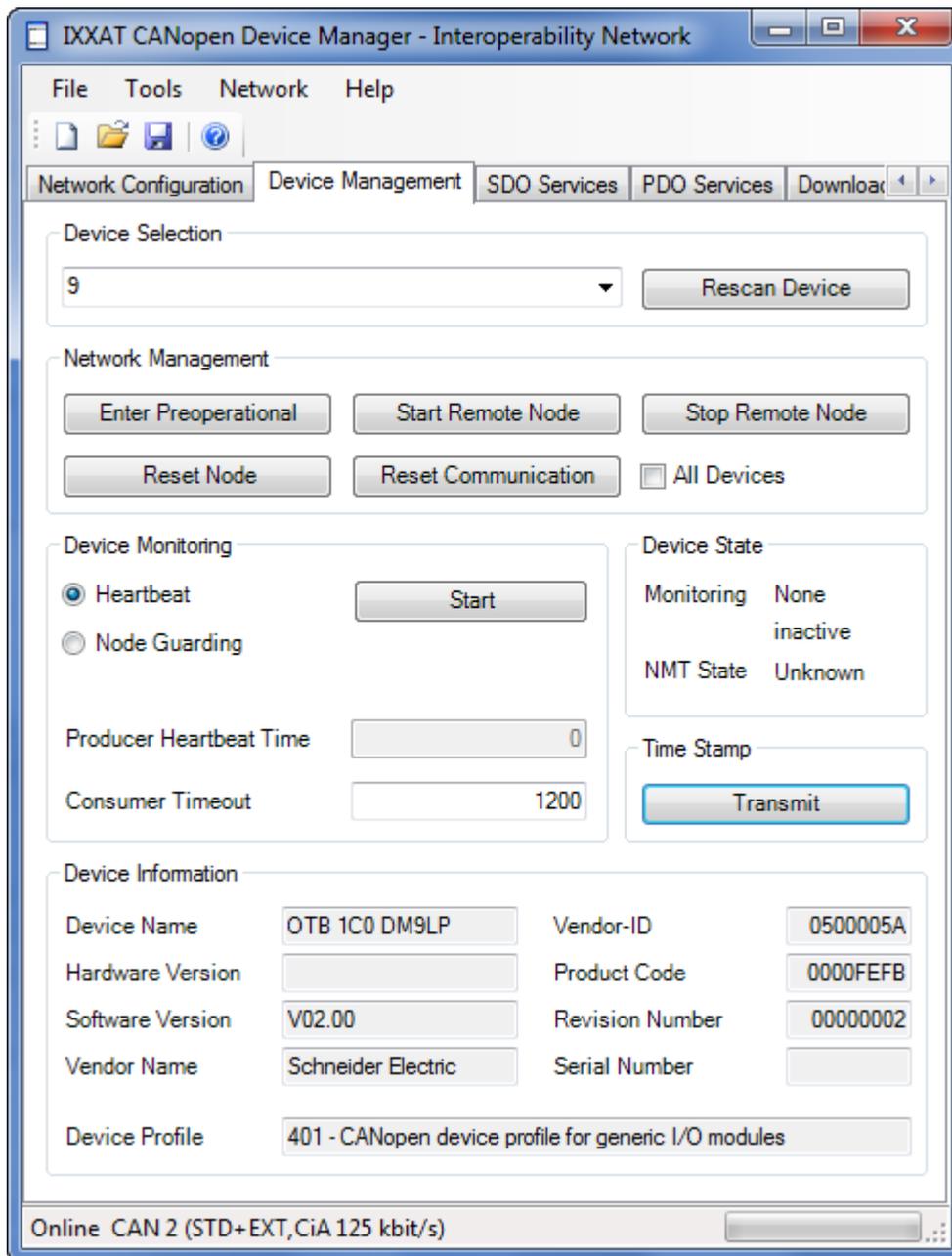
The device selection component is available all the tab pages of CANopen Device Manager that require explicit selection of the device that shall be addressed by the requested operations. It lists the node-ID of all devices that have been added to the CANopen Device Manager network list by either explicitly scanning the network for devices or manually adding devices in the Network Configuration tab page. In addition to the device selection, the user interface component also permits re-scanning the specified node-ID. This operation updates the internal data storage of the CANopen Device Manager with information retrieved directly from the object dictionary of the selected device by means of SDO upload services.



## 7 Device Management

### Overview

CANopen network management is device orientated and follows a master slave structure. Each slave device is controlled executing NMT node control services. CANopen Device Manager supports node control by providing direct access to the five available services Start Remote Node, Stop Remote Node, Enter Preoperational, Reset Node, and Reset Communication. In addition to node control CANopen Device Manager supports the error control services Node Guarding and Heartbeat. For further information on the protocols specified consult [CiA 301](#).



## NMT Node Control

CANopen Device Manager provides access to node control services by means of five buttons in the Network Management group box. Clicking any of these button triggers the transmission of the corresponding CAN frame, with the node-ID byte in the CAN frame set to the node-ID of the device currently selected in the Device Selection group box. Activate the All Devices check box if the NMT command shall be transmitted to all CANopen slaves as broadcast.



Note that using NMT node control commands in broadcast mode will affect all devices connected to the network and not only those that have been added to the current CANopen Device Manager configuration.

## NMT Error Control

CANopen Device Manager supports device monitoring by means of either Node Guarding or Heartbeat. Control of the corresponding services is available in the Device Monitoring function group on the Device Management tab page. When uploading device parameters, either through a scan during the network configuration process, or explicitly requested with the Rescan Device button, CANopen Device Manager evaluates which NMT error control services are supported by the individual devices. Depending on the available functionality, the corresponding radio buttons on the user interface of CANopen Device Manager are disabled or enabled.

To start NMT error control select one of the available radio buttons. Note that for Heartbeat monitoring to work a corresponding Heartbeat producer time has to be configured in object dictionary entry 1017<sub>h</sub> on the selected device. Use the SDO Services plug-in to perform this operation. The NMT error control status is indicated in the Device State group box. The available information includes if monitoring is activated or not and, if applicable, the current NMT state of the device.

The internal monitoring mechanism of CANopen Device Manager will attempt to re-synchronize with the toggle bit in the node guarding protocol after an error has occurred. If devices re-enter the expected NMT state after the occurrence of the error control event CANopen Device Manager will continue monitoring.

## Timestamp

The Time Stamp group box supports transmission of single time stamp messages. The message transmitted conforms to the TIME\_OF\_DAY format as specified [CiA 301](#). As the time stamp is based on the date and time properties of the host system on which CANopen Device Manager is executed, the accuracy of the CANopen time stamp message is limited by the precision of the system time of this particular system.

## Device Information

Information on the currently selected device is available in the lower part of the Device Management tab page. Indicated are manufacturer device name, corresponding to the string object at index 1008<sub>h</sub> in the devices' object dictionary, the hardware version as contained in object 1009<sub>h</sub>, the software version corresponding to object 100A<sub>h</sub>, and the vendor name. The vendor name is retrieved from the identity object at 1018<sub>h</sub>, which is displayed as a set of hexadecimal numbers and matched against a reference list available from CAN in Automation. In addition the implemented CANopen device profile is indicated. If the corresponding device profile specification is unknown to the installed version of CANopen Device Manager, only the device profile code is indicated.

Explanation of parameters listed in the device information panel

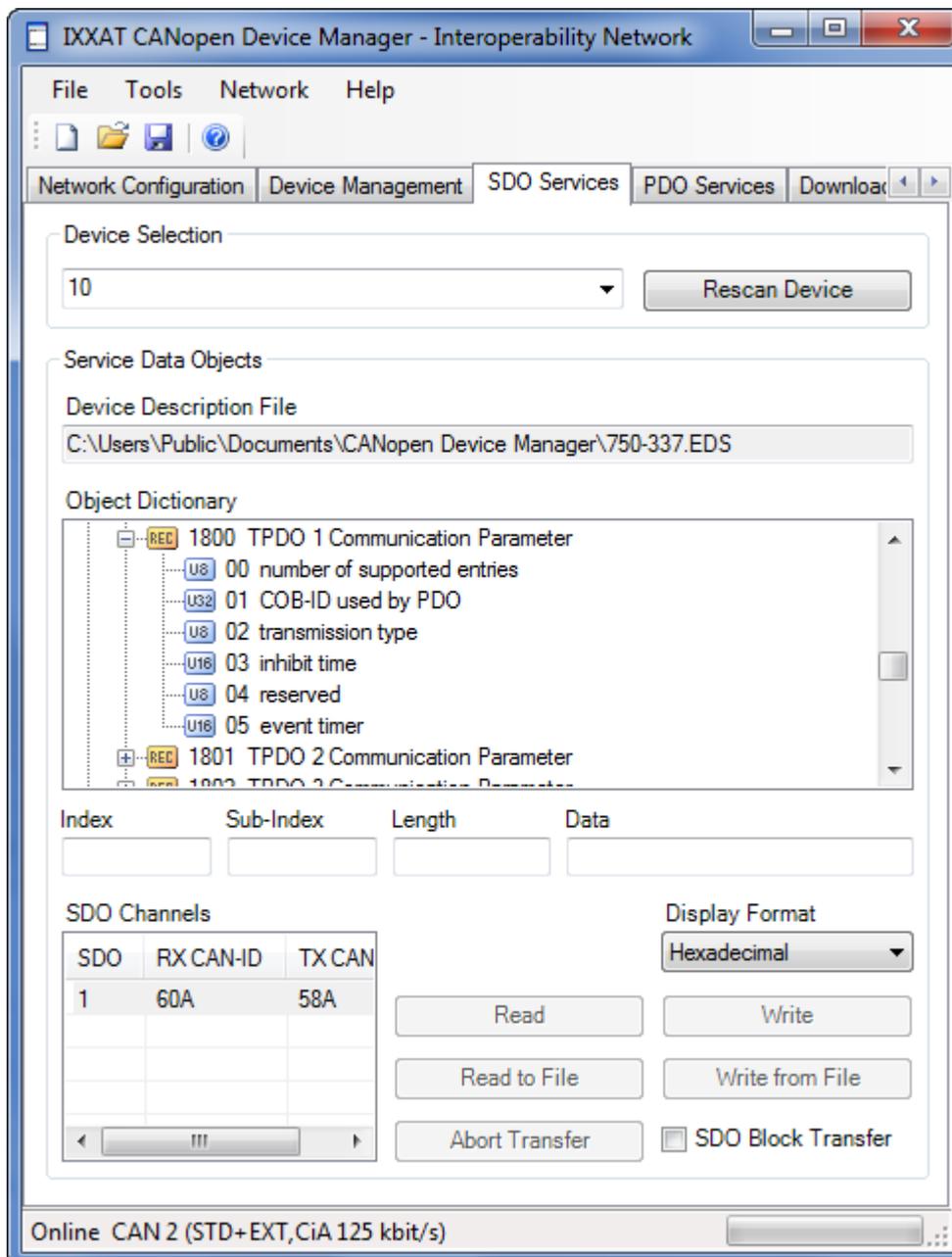
Information	Description
Device Name	The name of the device that is contained in the object 1008 <sub>h</sub> .
Hardware Version	The hardware version string that is contained in the object 1009 <sub>h</sub> .
Software Version	The software version string that is contained in the object 100A <sub>h</sub> .
Vendor-ID	The vendor-ID that is contained in the object 1018 <sub>h</sub> sub-index 01 <sub>h</sub> .
Product Code	The product code that is contained in the object 1018 <sub>h</sub> sub-index 02 <sub>h</sub> .
Revision Number	The revision number that is contained in the object 1018 <sub>h</sub> sub-index 03 <sub>h</sub> .
Serial Number	The serial number that is contained in the object 1018 <sub>h</sub> sub-index 04 <sub>h</sub> .
Vendor Name	The name of the vendor that corresponds to the vendor-ID.
Device Profile	The device profile number and a textual description of the profile.

## 8 SDO Services

### Overview

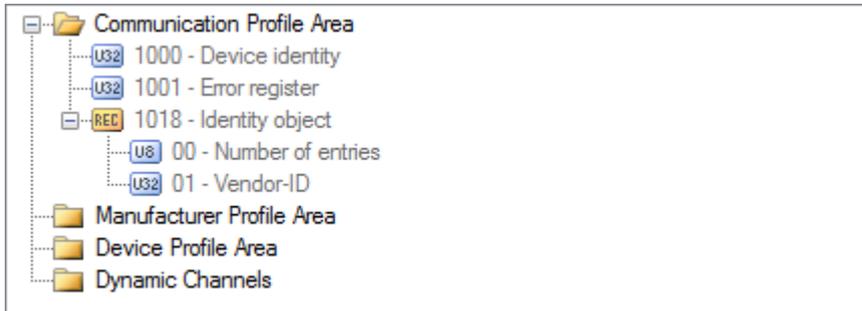
Service Data Objects (SDO) are used to access object dictionary entries on a remote CANopen device. The main purpose of SDOs are device configuration, they can however be used for the exchange of process data as well. Note that SDO services require a confirmed protocol, resulting in a potentially significant protocol overhead for the data transfer.

CANopen Device Manager provides full support for all specified SDO services, including expedited, normal, and block transfer.



By default either normal (segmented) or expedited transfer types will be used depending on the size of the transferred data. To explicitly activate SDO block transfer select the SDO Block Transfer checkbox.

To simplify the access of the object dictionary on a remote device, CANopen Device Manager supports a tree view based object dictionary browser. The browser uses data extracted from a device description file assigned to the device during network configuration. See the section on [Network Configuration](#) for corresponding instructions. If no device description file is assigned to the selected device, CANopen Device Manager displays a tree that contains only objects that are mandatory according to [CiA 301](#) and have to be implemented by all devices. The corresponding tree nodes are displayed in grey to indicate that no device description file has been loaded.



## Object Selection

CANopen Device Manager allows the specification of the object that will be accessed directly in the tree structure displayed in the object dictionary browser. Alternatively index, sub-index, and length of the object can be directly entered into the corresponding text boxes. The specification of the length is only required for SDO download operations, on upload operations the corresponding text field contains the length of the returned object data. If for integral data types the number of bytes specified in the Length field exceeds the amount of data entered into the Data text field on the user interface the unspecified data bytes are padded with either FF<sub>h</sub> or 00<sub>h</sub>, depending on the specified data type.

## SDO Transmission

To execute a SDO service first select the SDO channel to be used for the SDO communication. All configured SDO channels are listed on the SDO Services plug-in indicating the SDO number, as well as the CAN identifiers for transmit and receive frames. Entries displayed in grey represent SDO channels that are not configured and thereby can not be used for a transfer.

Explanation of columns in the SDO channels list

Header	Description
SDO	Contains the number of the SDO server in the device.
RX CAN-ID	Contains the CAN-ID that is used for client to server communication.
TX CAN-ID	Contains the CAN-ID that is used for server to client communication.

The SDO transmission is triggered using either the Read or the Write button. The data returned by the device or to be written to the device will be displayed in or retrieved from the Data field of the plug-in module. To support larger amounts of data than the text field can display, CANopen Device Manager provides two buttons that trigger SDO transfers using a file as either data source or target. In this case the data will not be displayed in the text field.

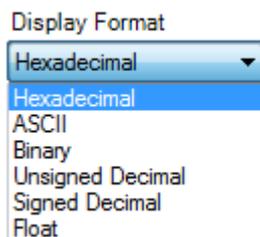
The Abort Transfer button is activated as long as a transfer is in progress. It supports the possibility to terminate a running transfer with a SDO abort message. For more information on the SDO abort protocol, consult [CiA 301](#).

## Data Representation

If the data is not written to or read from a stream it is displayed in the Data text field. The type of representation can be selected with a combo box.

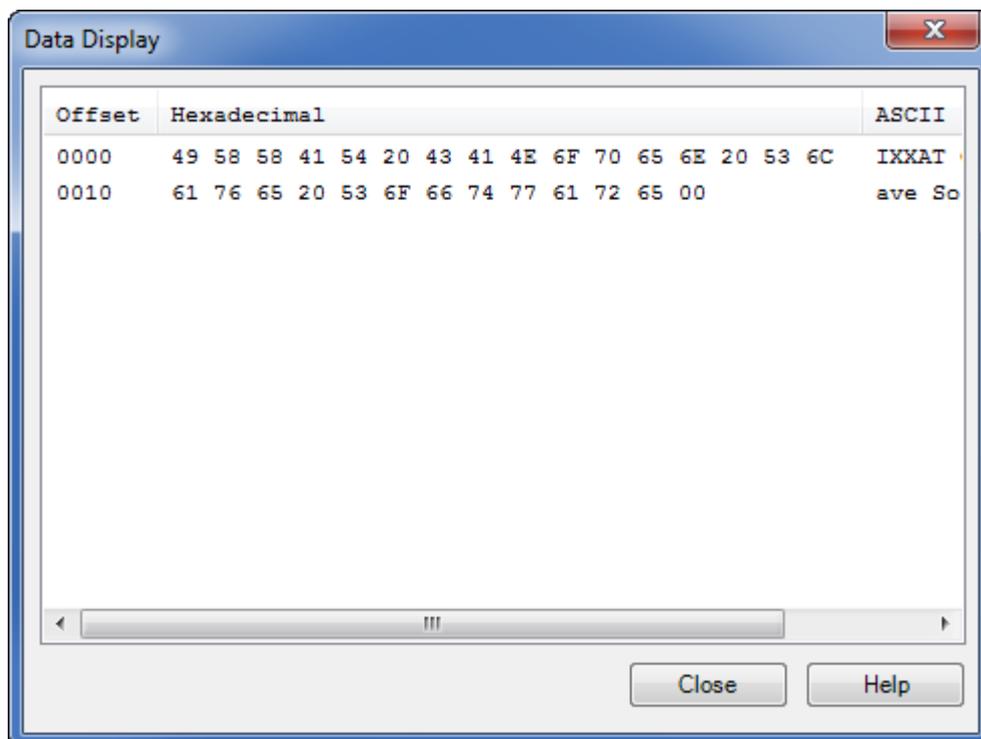
CANopen Device Manager will try to convert the representation on change of the representation format. However some combinations of formats can not be converted to each other. In this case the data field is empty. The data entered is not lost until a new value is entered. If the format is changed back the data reappears.

On entering data CANopen Device Manager applies some rules to the input. For example it does not accept characters that have no meaning for the selected format. Also spacing is automatically applied to the formats hexadecimal and binary.



If the size of the text field is not sufficient to display the entire data received on upload from a device, a button appears in the text field that allows the user to open a data display dialog in which the data will be listed in both hexadecimal and ASCII representations.

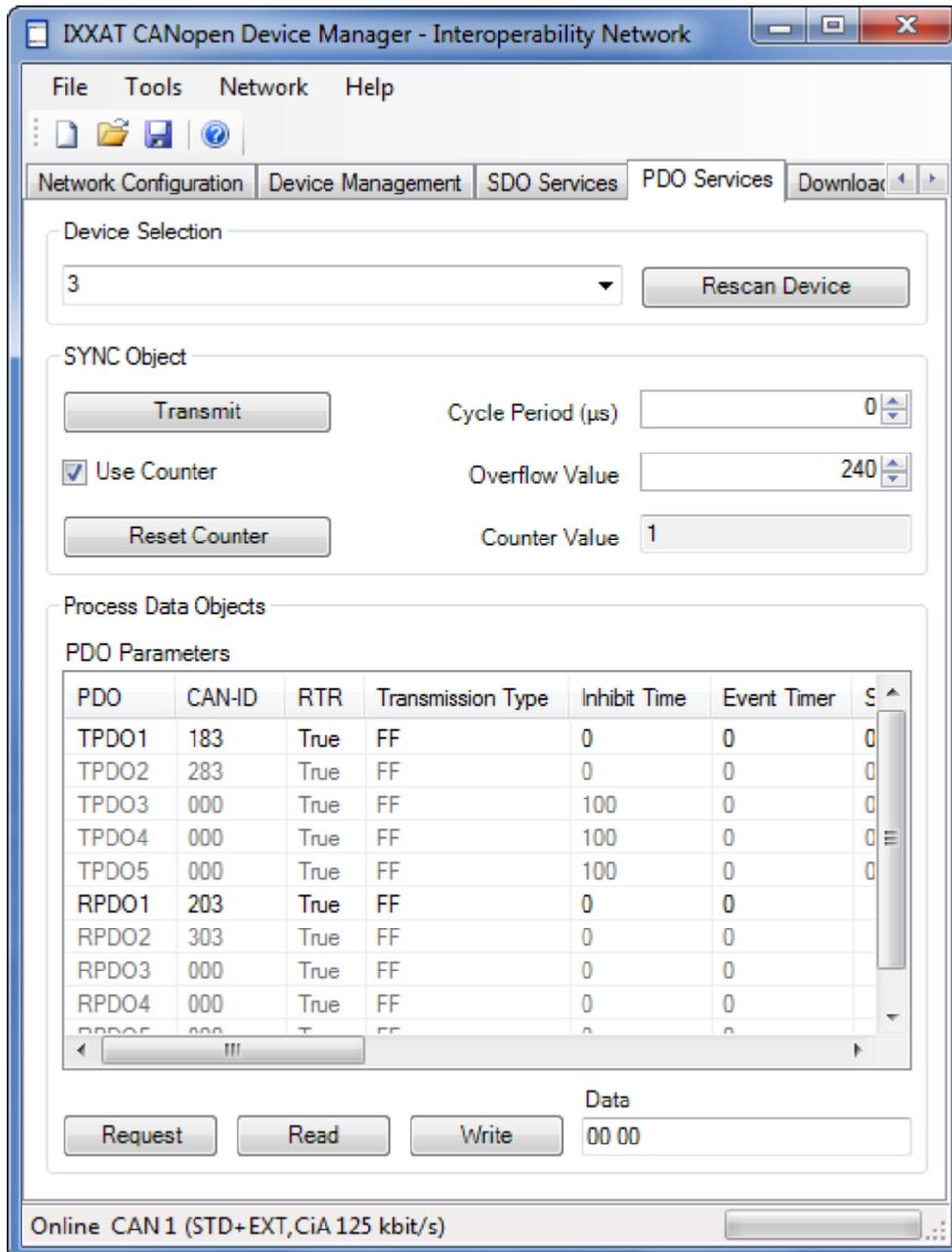
Index	Sub-Index	Length	Data
1008	00	7	2D 33 30 37 37 35 30 2D 33 30...



## 9 PDO Services

### Overview

The PDO services plug-in module supports both synchronous and asynchronous transmission of non-multiplexed process data objects. Processing of multiplexed PDOs according to [CiA 301](#) is not supported by this version of CANopen Device Manager. For synchronous PDO protocols CANopen Device Manager supports SYNC object generation with a user configurable cycle period in steps of 1ms.



## SYNC Object

CANopen Device Manager supports explicit or automatic transmission of CANopen SYNC objects. If the Cycle Period is set to zero, pushing the transmit button will cause one single SYNC message to be transmitted. For any other value the transmit button will start cyclic SYNC transmission with the specified cycle period. The button label then automatically changes to Stop, enabling the user to interrupt the SYNC object generation. CANopen Device Manager does only accept values that are a multiple of 1000. All other values will be rounded to the next multiple of 1000.

Checking the Use Counter box enables the SYNC counter. Overflow Value defines at which value the SYNC counter will recycle and restart with a value of 1. Counter Value displays the value that will be transmitted with the next SYNC message. This information is only available if the SYNC message is triggered manually. Also only in manual mode is a Reset Counter button available, which allows to reset the value of the counter back to 1. If cyclic transmission is used the counter always starts with a value of one, independently from the value that was displayed before the transmission was started. It is not possible to explicitly set the counter value

## PDO Services

The Process Data Objects box lists all active transmit and receive PDOs of the selected CANopen device. PDOs displayed in grey are currently not configured and can not be accessed via the PDO service. The presented information includes CAN identifier, if a remote transmission request is allowed on this PDO, the PDO transmission type, inhibit time, event timer, SYNC counter, its length, and a list of application objects mapped into the PDO. CAN identifier, PDO transmission type and mapped object are represented in hexadecimal format, inhibit time, event timer, SYNC counter and PDO length as a decimal number. For information on the PDO transmission type, consult [CiA 301](#).

Process data objects may be requested, read or written. Depending on the type of the PDO some operations may not be available. Transmit PDOs may be requested or read. Receive PDOs can only be written. Requesting a PDO causes a RTR frame for the specific PDO to be transmitted. The returned data will be directly displayed in the data field if the device responds. A Read command only retrieves the current data available for this particular PDO from an internal data buffer and displays them in the data field. This operation may return invalid information especially if CANopen Device Manager has not received the corresponding PDO from the device yet. The Write command transmits the corresponding PDO with the data specified in the data field. Data is always represented in hexadecimal format. CANopen Device Manager allows for entering zero to 8 data bytes, independent of the mapped data size in the selected PDO. On entering data, spaces are automatically inserted after every two digits. Characters that are not valid for hexadecimal numbers are not accepted.

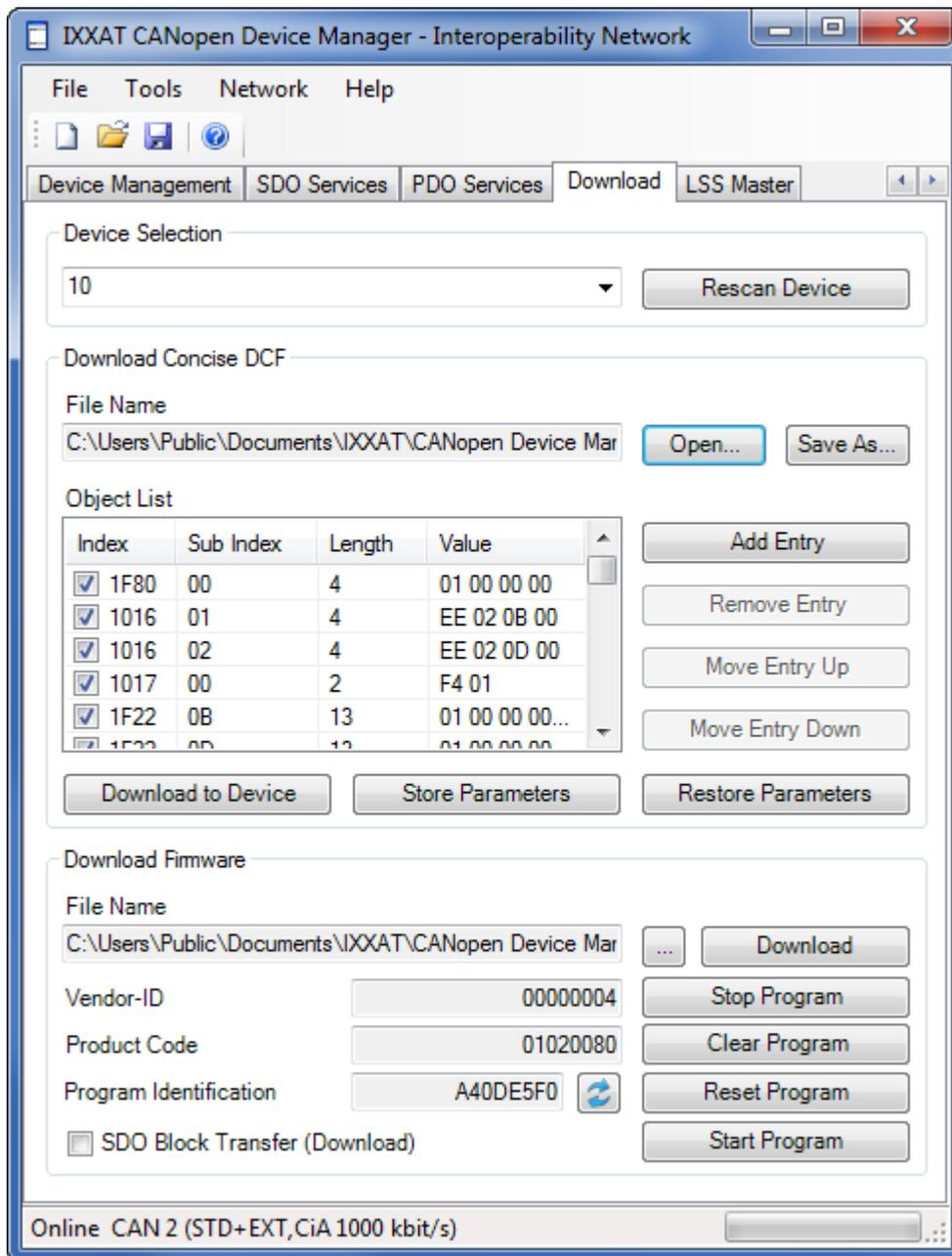
Explanation of columns in the PDO list view

Header	Description
PDO	Contains the number and the direction of the PDO (TPDO or RPDO).
CAN-ID	Contains the CAN-ID of the PDO.
RTR	Indicates if the PDO can be requested via a RTR frame.
Transmission Type	Contains the transmission type of the PDO in decimal format.
Inhibit Time	PDO inhibit time as configured in sub-index 03 <sub>h</sub> of the PDO communication parameters.
Event time	PDO event timer as configured in sub-index 05 <sub>h</sub> of the PDO communication parameters.
SYNC Start Value	SYNC Start Value as configured in sub-index 06 <sub>h</sub> of the PDO communication parameters. The enhanced SYNC mechanism was introduced by CiA with version 4.1 of <a href="#">CiA 301</a> .
Length	Contains the length of the PDO in bytes.
Object n	Contains the mapping entry of the nth object.

## 10 Configuration Download and Firmware Update

### Overview

CANopen Device Manager supports both download of configuration data and if supported by the device, an update of device firmware according to the program download mechanism as described in CiA 302-3. Configuration download supports concise device configuration files according to the specification in CiA 302-3, whereas firmware update may use any file format supported by a corresponding boot loader firmware resident on the target CANopen device.



## 10.1 Concise DCF Download

The concise DCF download control supports mechanisms to download and to modify concise device configuration files. These files may be generated by any standard CANopen configuration tool provided that the file format specified in [CiA 302-3](#) is respected. A file can be loaded via the Open... button. The file content is displayed in the form of a list view with index, sub-index, data type length in bytes, and the corresponding object value.

The download of the configuration data is started using the Download to Device button. Configuration data is always downloaded to the currently selected device. As the specification of the DCF format does not include information on the node-ID of the device the file has been created for, the user has to verify that the correct device is selected in the Device Selection control. If an error occurs during the download a corresponding notification dialog will be displayed. This dialog offers the choice to either abort the transfer or to continue it with the next object.

Complementing the configuration download functionality CANopen Device Manager supports initiation of store and restore commands. If supported by the target CANopen device the user may request storing of the current device parameters in non-volatile memory on the CANopen device using the Store button. The subset of device parameters that will be copied to non-volatile memory depends on the settings previously specified in the Store, Restore Options dialog (see chapter on Overview and Initial Setup).

Correspondingly the Restore button allows loading of default factory settings as programmed by the device manufacturer. The subset of parameters that will be restored is defined by the default restore behavior in the [Options](#) dialog.

Explanation of columns in the concise DCF list view

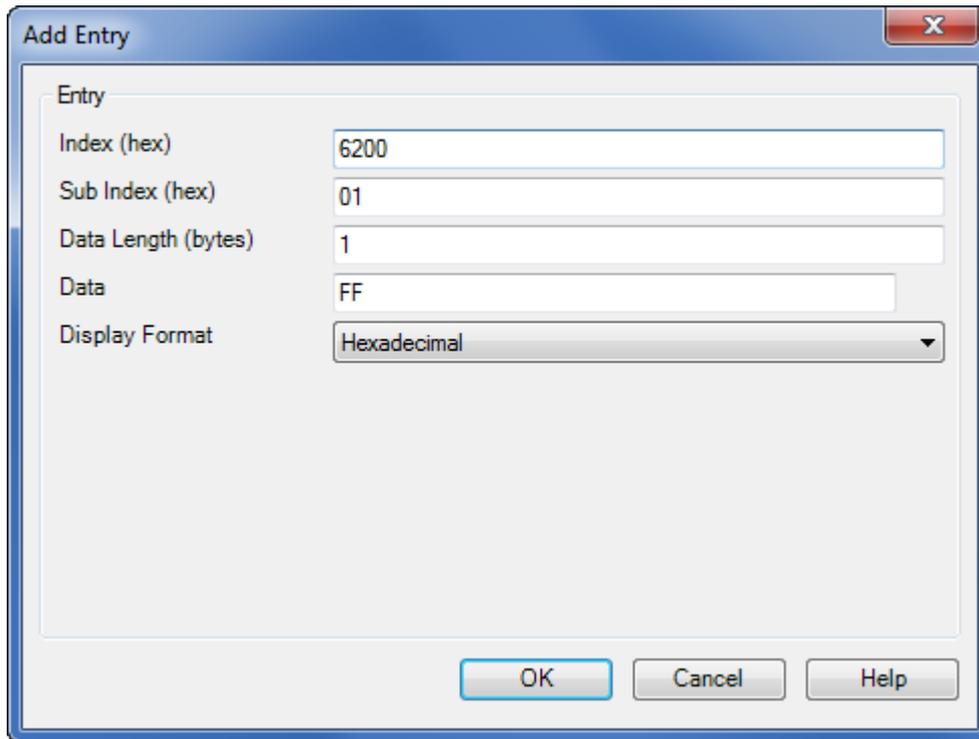
Header	Description
Index	The main index of the object that is written.
Sub-Index	The sub-index of the object that is written.
Length	The length of the entry in bytes.
Value	The data that is written as a hexadecimal string.

## Modifying a Concise Device Configuration File

CANopen Device Manager supports manipulation of data that is downloaded to the device using two different approaches. One is to selectively disable specific entries contained in the device configuration file, resulting in those entries being excluded from the download process, the other is to directly modify the contents of the device configuration file.

During download the concise device configuration file is processed sequentially, this means objects are written in the order as they are identified in the file. To allow for further modification of the download sequence, CANopen Device Manager supports reordering of entries. Use either the Move Entry Up or Move Entry Down buttons to establish the required download order.

Alternatively the user may delete or explicitly add entries to the list of configuration data. The Add Entry button opens a dialog that allows the user to specify an index and sub index, both in hexadecimal representation, the object value, and finally indicate the length of the object entry in bytes as decimal number. Data specified in the Data field are by default interpreted as hexadecimal numbers, the format may however be changed using the Display Format control. CANopen Device Manager always converts the value specified in the Data field to the smallest possible data type. If the data length specified for the particular object indicates more bytes than the specified parameter value would require, CANopen Device Manager expands the value, depending on the data type and the value, to the required data length using padding bytes with either 00<sub>h</sub> or FF<sub>h</sub>.



Add Entry	
Index (hex)	6200
Sub Index (hex)	01
Data Length (bytes)	1
Data	FF
Display Format	Hexadecimal

The user may save a modified device configuration file under a different file name using the Save As... button.

## 10.2 Firmware Update

CANopen Device Manager supports download of firmware files using the program download mechanism as described in [CiA 302-3](#). This functionality is only enabled if the selected node has been scanned and the required object dictionary entries 1F50<sub>h</sub> and 1F51<sub>h</sub> have been detected. The corresponding user interface components are depicted in the figure below.

To start the firmware update process it is first required to stop the current CANopen device application and activate the CANopen boot loader on the target device. Clear Program will erase the corresponding sector in the Flash memory of the target device. The application has to be stopped or the clear operation will fail. Now select the file containing the new device firmware and start the download process using the Update Program button. Depending on the file size this operation may require several minutes. The CANopen device application can be then reactivated using the Start Program button. The Program Identification textbox displays the content of object 1F56<sub>h</sub> - Program software identification on the target device. To upload the current content of the program software identification object to press the update button .

 Note that it is the responsibility of the user to verify that the firmware data downloaded to the target is built for this particular CANopen device.

Download Firmware

File Name  
C:\Users\Public\Documents\IXXAT\CANopen Device Mar ... Download

Vendor-ID 00000004 Stop Program

Product Code 01020080 Clear Program

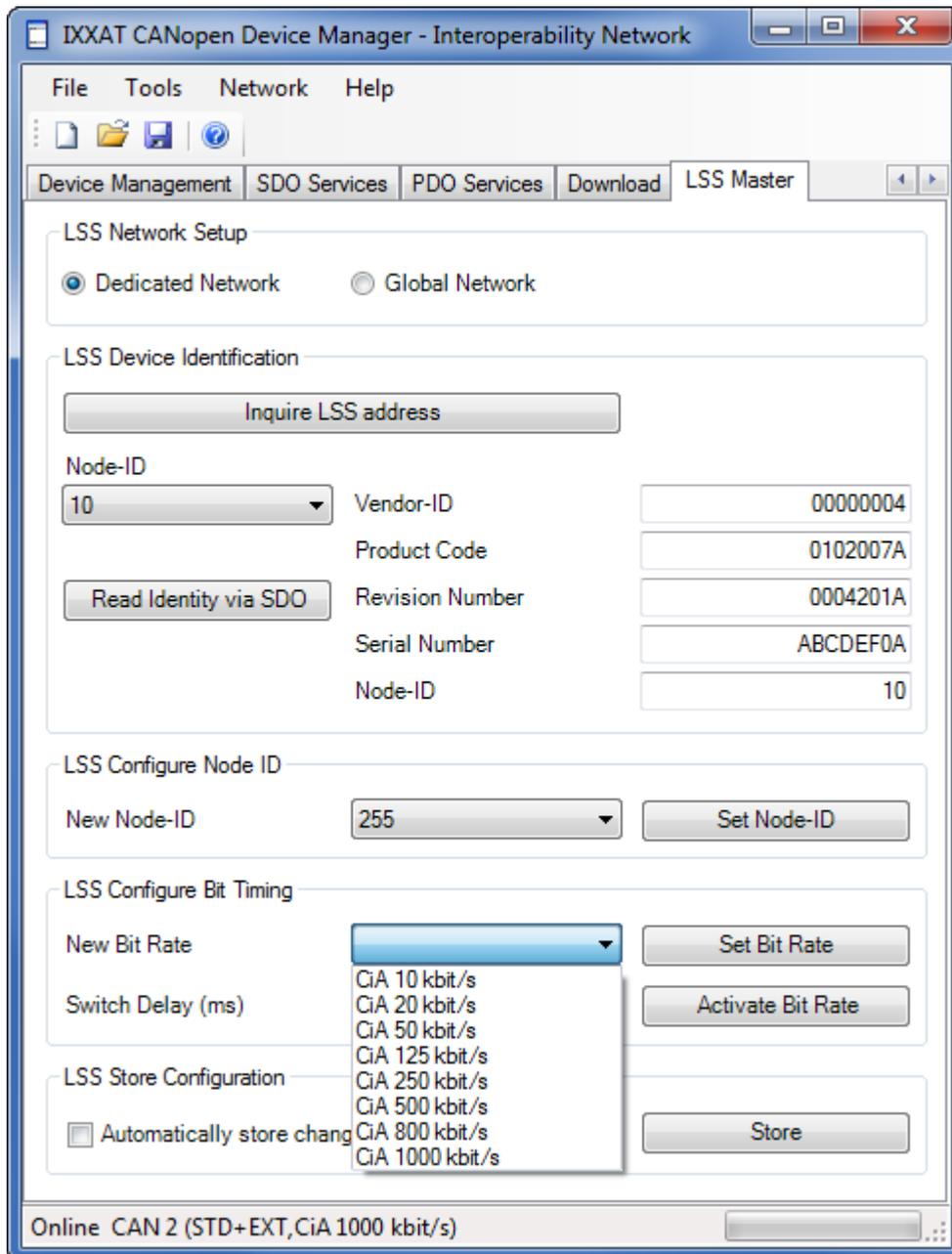
Program Identification A40DE5F0  Reset Program

SDO Block Transfer (Download) Start Program

## 11 LSS Master Services

### Overview

CANopen layer setting services, or short LSS, may be used to inquire or to change settings of the physical and the data link layer of a CANopen device. The parameters that may be changed or inquired include the node-ID of the CANopen device, the bit timing parameters, and the LSS address (inquired only) which is equivalent to the CANopen identity object at index 1018<sub>h</sub>.



## Network Definition

The LSS plug-in module differentiates between two possible network installations. The targeted LSS capable CANopen device may be installed either in a dedicated, peer-to-peer network with only one CANopen device and CANopen Device Manager present, or coexisting with other devices in a larger network. Depending on the kind of network installation CANopen Device Manager only offers services that are considered safe in the corresponding network installation. Modification of bit timing parameters by CANopen Device Manager is only possible in a dedicated network as these parameters would affect all devices in the network and would render a network inoperable if not used with care.

## LSS Address

Executing LSS services in a global network typically requires a unique address to access a specific device. This address is independent of the node-ID of the device as LSS works independent of the CANopen application layer and communication profiles specified in [CiA 301](#). According to [CiA 305](#) the LSS address consists of four components, the vendor-ID, product code, revision number and serial number, all coded as UNSIGNED32 values. The LSS address of a device is displayed in the corresponding text boxes. The node-ID is not part of the LSS address and is displayed for information only.

CANopen Device Manager provides three approaches to set or get the LSS address of a device.

- If the node is already configured the address can be read from object 1018<sub>h</sub> using the SDO upload service. Select the node-ID in the corresponding control and click the Read Identity via SDO button. The LSS address that is returned by the device will be displayed in the corresponding text fields.
- Use the Inquire LSS address services to read the LSS address from an unconfigured device that does not have a node-ID in the valid range from 1 to 127. This functionality is only available in a dedicated network between the device and CANopen Device Manager. It implemented as a sequence of the Switch mode Configuration state protocol followed by Inquire identity vendor-ID, Inquire identity product-code, Inquire identity revision-number, and Inquire identity serial-number protocols.
- Alternatively the LSS address may be directly specified by the user in the corresponding text fields. CANopen Device Manager interprets the indicated values as hexadecimal numbers. Please consult the documentation provided by the device manufacturer to obtain the correct values.

## 11.1 Configuration of Local Layer Settings

### Configuration of the Node-ID

The LSS master supports configuration of the node-ID of a LSS capable CANopen device. This operation is supported in dedicated, peer-to-peer and in global networks. Note that for correct operation in global networks a fully specified LSS address is required. The new node-ID is selected from the corresponding user interface control and is set by pressing the Set Node-ID button.

## Configuration of the Bit-Timing Parameters

Setting new bit-timing parameters is only supported in dedicated peer-to-peer networks between the targeted LSS device and CANopen Device Manager. This service does therefore not require the specification of an explicit LSS address for the device. Setting the bit-timing parameters of a device is performed in two steps. First a new bit rate has to be selected and written to the device using the Set Bit Rate button. At this point the device has received the new parameters, but still operates at the old bit rate. To activate the new bit rate, the user has to specify a switch delay in milliseconds. The switch delay defines a time interval after transmission of the request in which the CANopen device shall not generate any traffic before performing the actual switch over of the bit timing parameters and a second time interval after the switch until the device resumes full communication. Note that the new bit rate is not automatically set on the CAN interface used by CANopen Device Manager. The user has to explicitly update the interface configuration to be able to communicate with the CANopen device again. For further details on the change bit timing parameters protocol consult CiA 305.

## Store Configuration

Modifications applied to the local layer parameters typically affect only the values in volatile memory. They are thus lost during a power cycle of the device. To permanently store the current settings in non-volatile memory use the Store button which will request execution of the LSS store configured parameters service.

Use the Automatically store changes checkbox to enable the explicit execution of the LSS store configuration service after each configuration operation.

## 12 References

- [CiA 301](#) – CANopen application layer and communication profile, version 4.2.0
- [CiA 302-1](#) – CANopen additional application layer functions – Part 1: General definitions, version 4.1.0
- [CiA 302-2](#) – CANopen additional application layer functions – Part 2: Network management, version 4.1.0
- [CiA 302-3](#) – CANopen additional application layer functions – Part 3: Configuration and program download, version 4.1.0
- [CiA 302-4](#) – CANopen additional application layer functions – Part 4: Network variables and process image, version 4.1.0
- [CiA 305](#) – Layer setting services (LSS) and protocols, version 3.0.0
- [CiA 306](#) – CANopen electronic data sheet specification, version 1.3.0
- [CiA 311](#) – CANopen device description - XML schema definition, version 1.1.0
- [CiA 401](#) – CANopen device profile for generic I/O modules, version 3.0.0
- [CiA 402-1](#) – CANopen drives and motion control device profile – Part 1: General definitions, version 3.0.0
- [CiA 402-2](#) – CANopen drives and motion control device profile – Part 2: Operation modes and application data, version 3.0.0
- [CiA 402-3](#) – CANopen drives and motion control device profile – Part 3: PDO mapping, version 3.0.0
- [CiA 404](#) – CANopen device profile for measuring devices and closed-loop controllers, version 1.3.0
- [CiA 406](#) – CANopen device profile for encoders, version 3.2.0
- [CiA 408](#) – CANopen profile for fluid power technology proportional valves and hydrostatic transmissions, version 1.5.2
- [CiA 410](#) – CANopen device profile for inclinometer, version 1.3.0
- [EN 50325-4:2002](#) – Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces – Part 4: CANopen
- [IEC 61800-7-1:2007](#) – Adjustable speed electrical power drive systems – Part 7-1: Generic interface and use of profiles for power drive systems – Interface definition
- [IEC 61800-7-201:2007](#) – Adjustable speed electrical power drive systems – Part 7-201: Generic interface and use of profiles for power drive systems – Profile type 1 specification
- [IEC 61800-7-301:2007](#) – Adjustable speed electrical power drive systems – Part 7-301: Generic interface and use of profiles for power drive systems – Mapping of profile type 1 to network technologies
- [ISO 11898-2](#) – Road vehicles – Controller area network (CAN) – Part 2: High-speed medium access unit
- [ISO 11898-3](#) – Road vehicles – Controller area network (CAN) – Part 3: Low-speed, fault-tolerant, medium-dependent interface

## 13 Glossary

### C

**CAN**

Controller Area Network

**CAN-ID**

CAN identifier

**CiA**

**CAN in Automation e.V.**

**COB**

Communication Object

**COB-ID**

COB identifier

**Concise DCF**

Concise DCF. Specified in [CiA 302-3](#)

**CRC**

Cyclic redundancy check

### D

**DCF**

Device Configuration File. Specified in [CiA 306](#)

### E

**EDS**

Electronic Data Sheet

Electronic device description format as specified in [CiA 306](#)

### F

**FSA**

Finite state automaton

### L

**LSS**

Layer Setting Services, specified in [CiA 305](#)

### M

**MPDO**

Multiplex PDO

### N

**NMT**

Network Management

**NMT error control**

Node guarding, heartbeat

**NMT node control**

NMT command to reset, start, or stop the CANopen device. Triggers state transitions in the NMT FSA

**Node-ID**

Unique node identifier with a valid range from 1 to 127

**P****PDO**

Process Data Object

**R****RPDO**

Receive PDO

**RTR**

Remote transmission request

**S****SDO**

Service Data Object

**SYNC**

Synchronization object

**T****TPDO**

Transmit PDO

**U****USB**

Universal Serial Bus

**V****VCI**

Virtual Communication Interface. Common driver architecture that allows the use of all IXXAT CAN interface modules, regardless of the of the PC interface technology

**X****XDD**

XML based device description format according to [CiA 311](#) – CANopen device description – XML schema definition

## 14 Support Addresses

### Support:

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**UK & Eire**

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The IXXAT CANopen Device Manager is developed and maintained by IXXAT Automation GmbH in Germany. IXXAT Automation GmbH is a member of the HMS group. HMS Industrial Networks is a world leading supplier of industrial network technology. HMS develops and manufactures products used for interfacing automation devices to industrial networks.

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