XCT

EXtended Can Tool

User Manual

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Version History

Version	Notification of change	Date	Name
2.0	Initial version (based on XCT software version 1.6.12)	23.09.2013	H. Holbein
2.1	Application examples for an XCT project & *Meaning of the individual Bytes* in section *Discrete display mode* added	14.01.2014	H. Holbein
2.2	Application examples IDS added, section Replay window added	20.05.2014	H. Holbein
2.3	Documentation based on XCT version 1.8.10 preliminary version	20.10.2020	M. Wetzel

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1 Introduction

XCT is an advanced, window-oriented toolset for tracking, creating and manipulating field bus data messages. The tool is especially designed for the CAN bus, which is heavily used in modern automotive and aviation projects.

The XCT tool is not only a simple monitor to display raw CAN messages but has a wide range of features especially for the use in today's aviation projects:

- Support of CANaerospace protocol (Designed by Stock Flight Systems)
- Support of ARINC-825 protocol
- Support of Node Services
- Support of Data Up/Download Services
- Support of profile databases (CANaerospace, ARINC-825, Raw)

1.1 Help on this help

Conventions

23 11 23 11 These two arrows are to indicate how to get to the respective XCT program feature described in the text.

➥ These arrows followed by a green text mark hyperlinks.

Unless otherwise noted, the *CAN* protocol is used for common examples in this document.

1.1.1 Basic terms

This section explains some basic terms used in the XCT program.

Project (file)

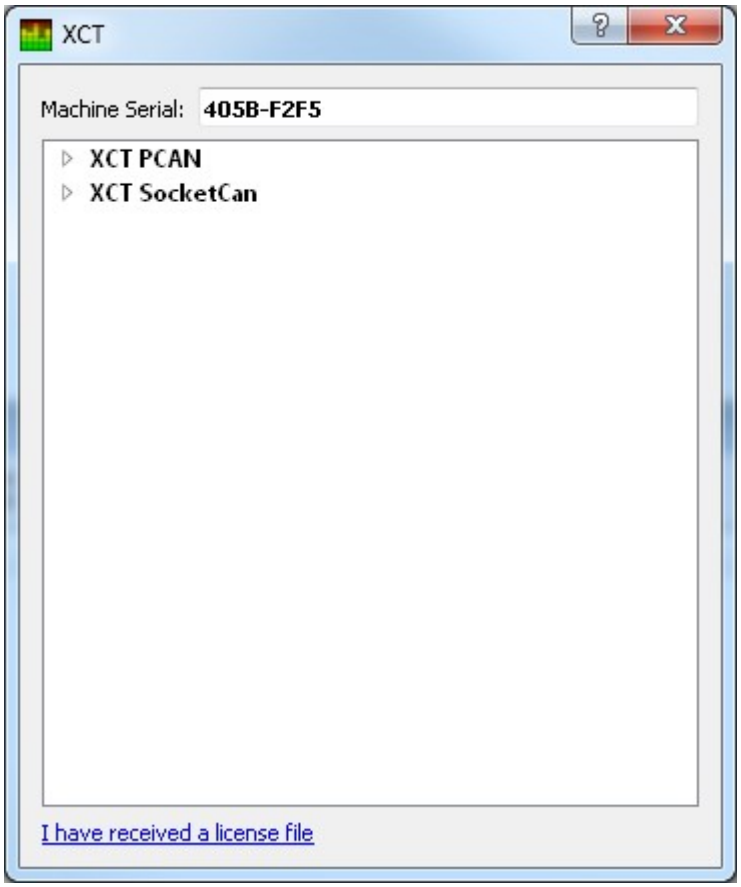
A project is a collection of different elements provided by the XCT program (e.g. Interface definitions, active Object windows, loaded *Profiles*; see further below).

Usually a project includes all elements that are necessary for testing all features of a complete CAN node (e.g an instrument or panel).

default.xct	All information about a project are stored in a project file (file name *.xct; see *default.xct* further below). When starting the XCT program, it automatically loads the project file *default.xct*. Having made any changes to the default project the current project settings are automatically stored in the *default.xct* file without any warning if you exit the XCT program. If you, however, open an existing project file or start a new project, a warning message appears. Having started a new project the existing *default.xct* file will be **overwritten without any warning** if you exit the program.
Profile	The ARINC 825 communication profile specifies the network traffic and constitutes the basis for interpretation of all data (or parameters) on the network. The Communication Profile files use the XML style to improve viewing and editing of ARINC 825 Profiles with modern editors. The file name suffix for Profile files is .pro or .xml.

1.2 License

The software does not need a license manager or dongle to operate. Depending on your configuration, the software will enable/disable some features (e.g. ARINC-825 support) by reading a license file. You will receive the license file separately from the XCT tool and need to import the license via the Help/License menu. If you want to request a license for a specific driver, send your machine serial id to your supplier of XCT, you will receive a license file and may import it into XCT:



1.3 Software Requirements

The XCT tool is available for the following platforms:

Operating System	Remarks
Windows 2000	
Windows XP	
Windows Vista	
Windows 7	
Windows 8	
Windows 10	
Linux x86 64 Bit	Ubuntu 16.04 Ubuntu 18.04

MacOS 64 Bit	MacOS High Sierra 10.13.6 or higher

Please note that the listed platforms concerns the XCT tool itself, not the available CAN device drivers. Depending of the platform, different CAN devices may be available.

1.4 Installation

1.4.1 Unix/Linux Installation

Download the installation file from

http://www.wetzel-technology.de/files/XCT

Be sure the file is executable:

```
chmod ugo+x XCT.1.8.10.Ubuntu.16.04.run
```

run the installation script:

```
./XCT.1.8.10.Ubuntu.16.04.run
```

Select the installation path, default is your home directory ~/XCT
The XCT binary can be found in InstallationDirectory/bin. The XCT tool can be started by typing

```
./XCT
```

1.4.2 Windows Installation

Download the installation file from

http://www.wetzel-technology.de/files/XCT

Unzip the installation file and run the file XCT.msi

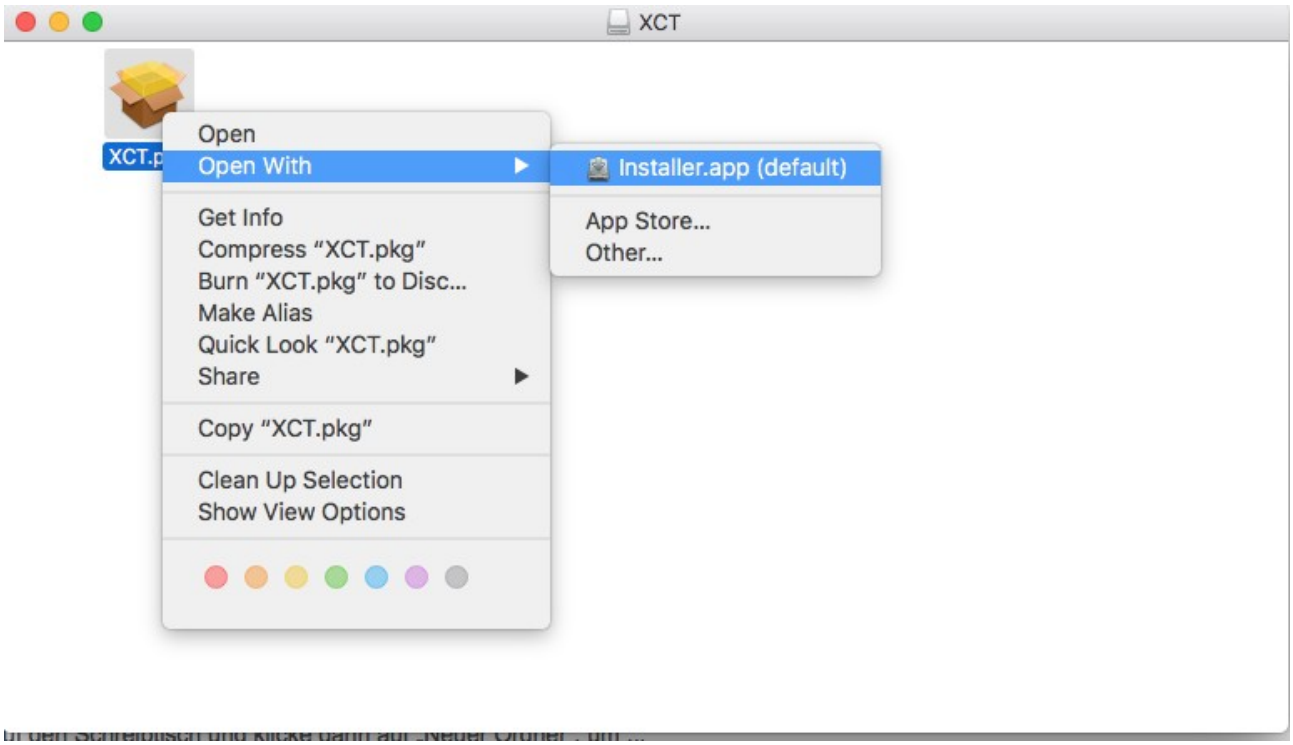
Maybe Windows is reporting an already newer version of XCT, in this case please deinstall the previous XCT version manually under the windows system settings.

1.4.3 MacOS Installation

Download the installation file from

http://www.wetzel-technology.de/files/XCT

Open the .dmg file from the download area or Finder:

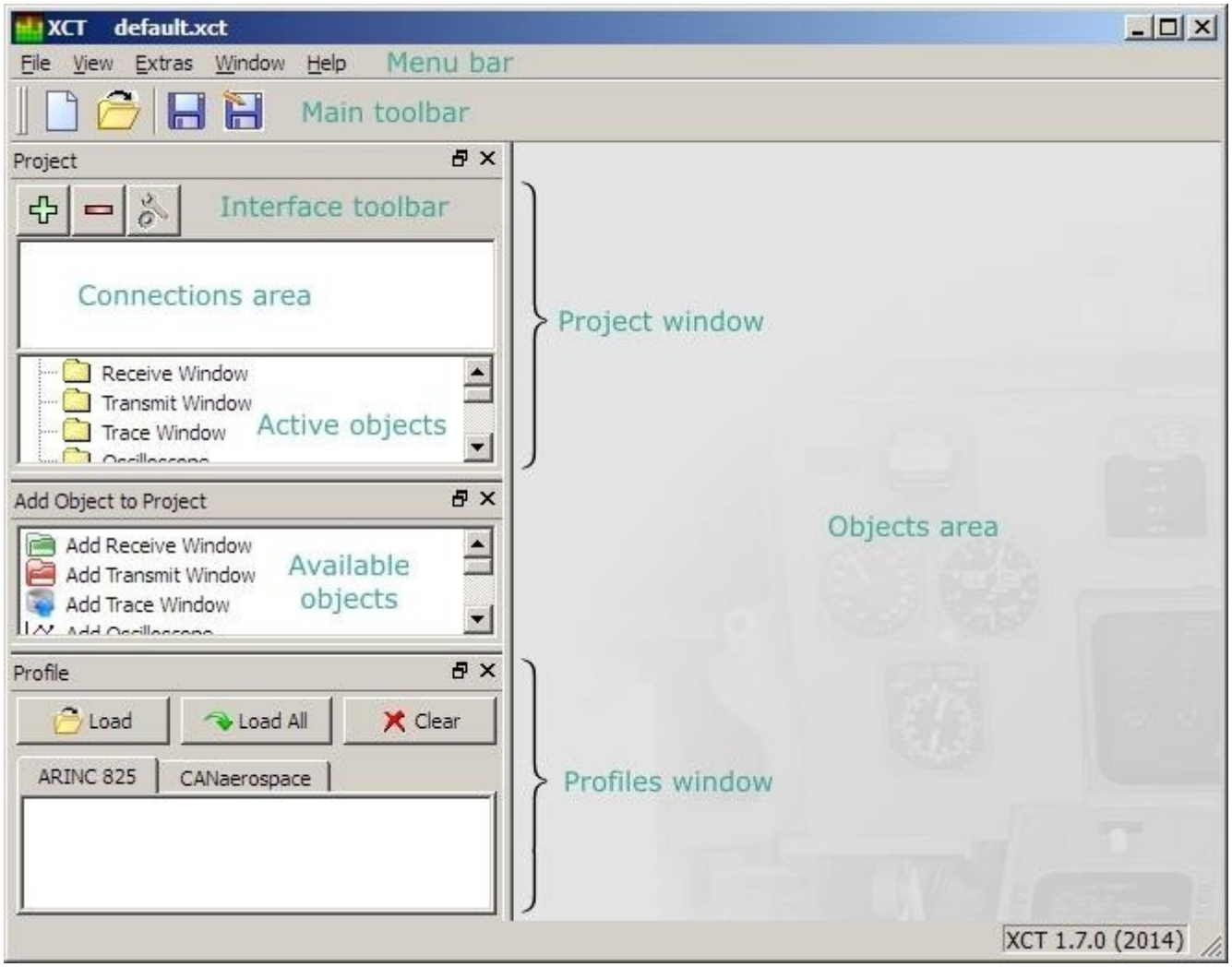


Right click on the file XCT.pkg and select “Open With – Installer.app”

Follow the installation instructions

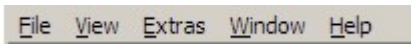
2 Main screen

The following figure shows the empty main screen of the XCT program. This (empty) window appears after having started a new project.

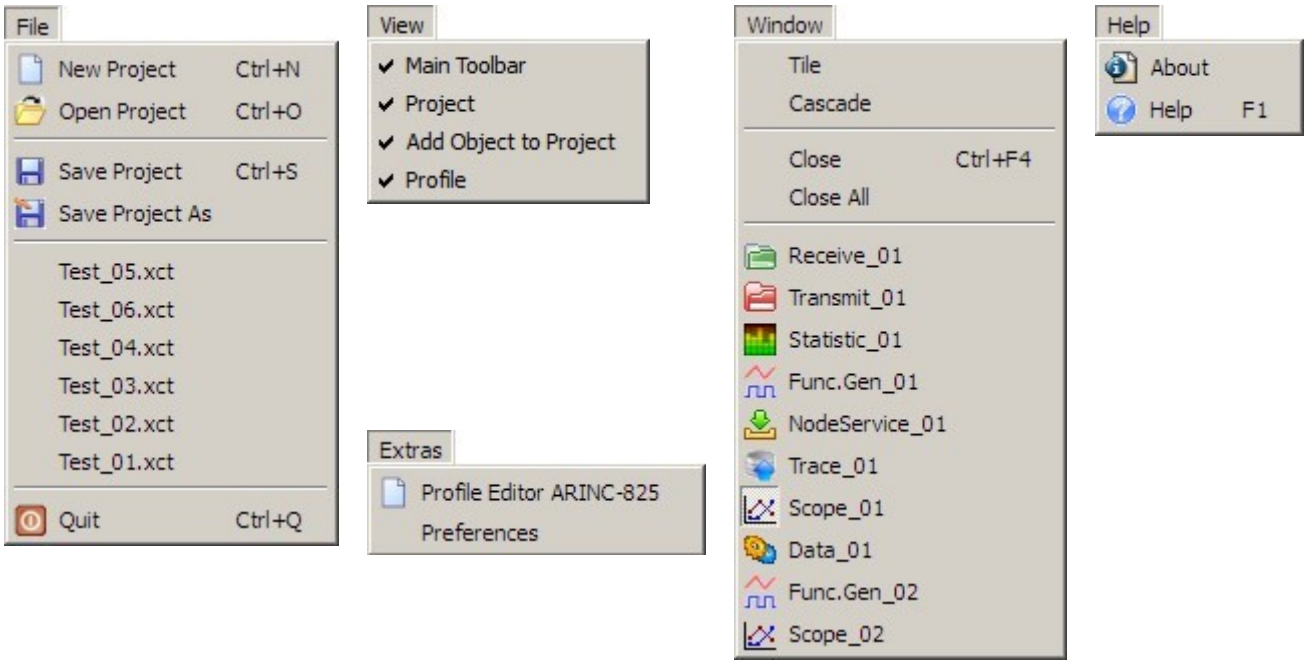


When starting the XCT program, it automatically loads the project file *default.xct* (details see section Basic terms). The various areas and subwindows (e.g. ➥ Objects area) are configured according to the definitions in this file.

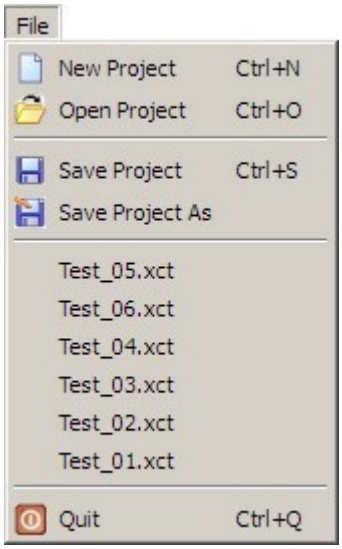
2.1 Menu bar



The following figure gives an overview of all available menu commands.



2.1.1 File menu



New Project

This menu command shows an empty program window after a warning message, if the current project has been modified but not yet saved.

Answer the warning message with [Yes] or [No], to start a new project.

Select [Cancel] to return to the current project.

> An active *Oscilloscope* window automatically causes modification of the project.

The following actions are not considered as modifications of a project:

moving of existing object windows,
activating/deactivating of already defined connections.

Open Project

This menu command opens the standard dialog to open a file (after a warning message, if the current project has been modified but not yet saved; see *New Project*).

The default path is set to the *bin* folder of the *XCT* installation and the data type is set to *.xct (extension for XCT project files).

Save Project

The current project will be saved.

Save Project As

This menu command opens the standard dialog to save a file. The default path is set to the *bin* folder of the *XCT* installation and the data type is set to *.xct (extension for XCT project files).

Recent Projects

From this list you can select one of the six projects recently saved.

Quit

Exits the program (after a warning message, if the current project has been modified but not yet saved; see *New Project*).

2.1.2 View menu

With the commands of this menu you can activate / deactivate the following elements of the program window.

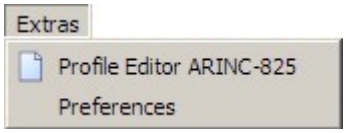
Main toolbar

Project window

Add Object to Project

Profiles window

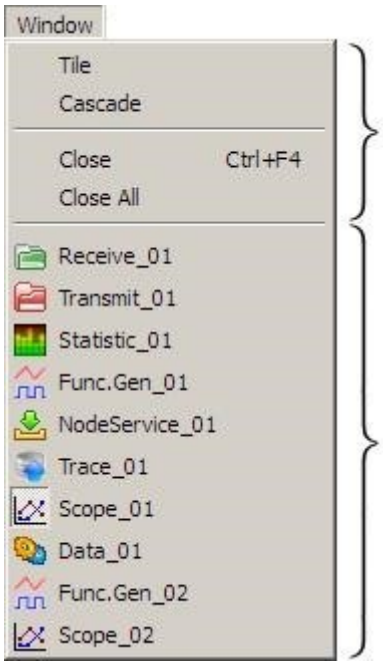
2.1.3 Extras menu



Opens the Profile Editor ARINC-825

Opens the Preferences dialog

2.1.4 Window menu

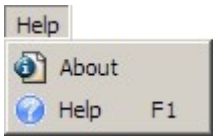


Standard menu commands

List of all created object windows.

Click on an entry in this list to bring the respective object window in the foreground.

2.1.5 Help menu



Standard menu commands

2.2 Main toolbar

The main toolbar provides the following menu commands (also accessible via the File menu):

New Project,

Open Project,

Save Project and Save Project as

2.3 Project window

2.3.1.1 Interface toolbar

This button adds a new interface to the current project.

The following buttons are available only, if the selected entry is detached (not open).

This button removes the previously selected interface from the *Connections area* **without any warning**.

This button opens the Interface Properties dialog in order to define the properties for the interface previously selected in the *Connections area*.

2.3.1.2 Connections area

The *Connections area* shows the currently defined interface connections and their status.

Name The first column shows the names of the connections. If a new interface has been added, *unnamed* is displayed in the name column.

A **simple (left)** mouse click on a name selects the respective connection in order to trigger an action with one of the interface toolbar buttons.

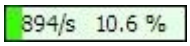
A **double-click** on a name of the connection opens the Interface Properties dialog.

Bus open / Bus detached This column shows the status of the connections.

A simple (left) mouse click on the status of a connection changes the status.

BUS status

This area shows the current BUS utilization of the respective interface:



- first parameter: number of messages per second,
- second parameter: BUS utilization rate in %,
- intensive green bar: visualization of the bus utilization rate.

The color of this visualization bar continuously changes from

yellow to orange to red depending on the BUS utilization rate.

A double-click on the BUS status area of an open BUS connection opens the BUS status window showing more detailed information.

2.3.1.3 Active objects area

The *Active options area* shows all object windows currently defined in the project.

A **double-click** on the name of an indicated object window (e.g. *Receive_01* in the figure above) brings the window in the foreground of the objects area.

A **simple left mouse click** on the name of an indicated object window selects the object for further actions.

A **simple left mouse click on an already selected name** marks the name itself so you can overwrite the current name by a new one.

A **right-click** opens a context menu with the following menu commands:

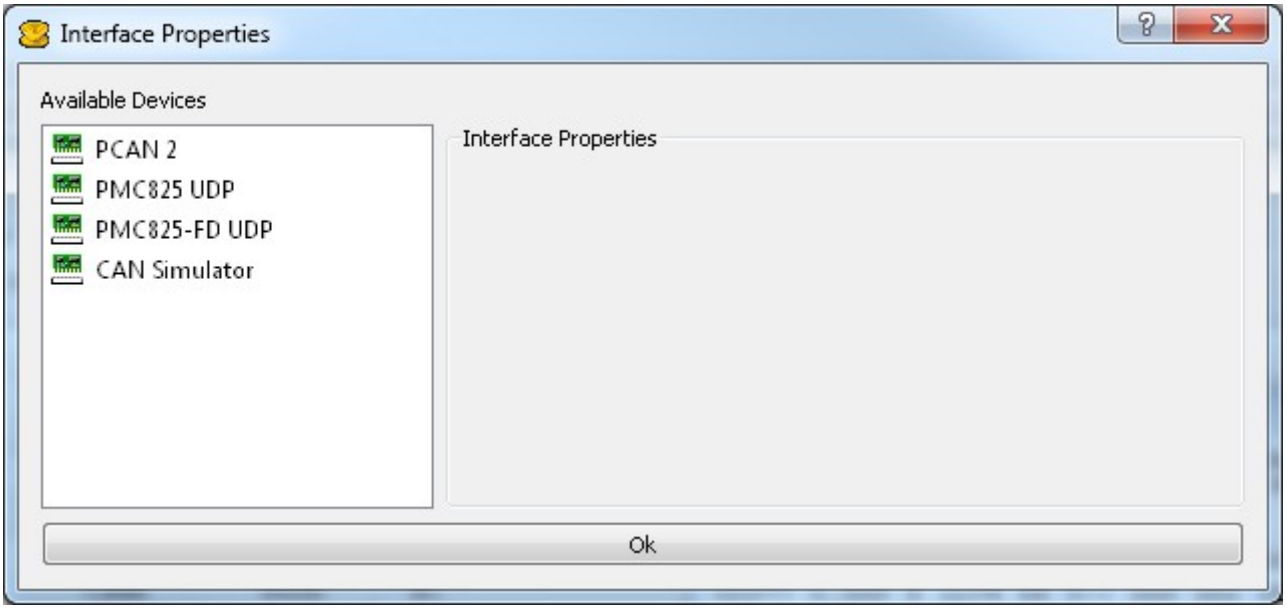
Rename Marks the name itself so you can overwrite the current name by a new one.

Delete Removes the respective window from the project according to the settings in the Preferences dialog (*When closing a dialog* of the section General / Application).

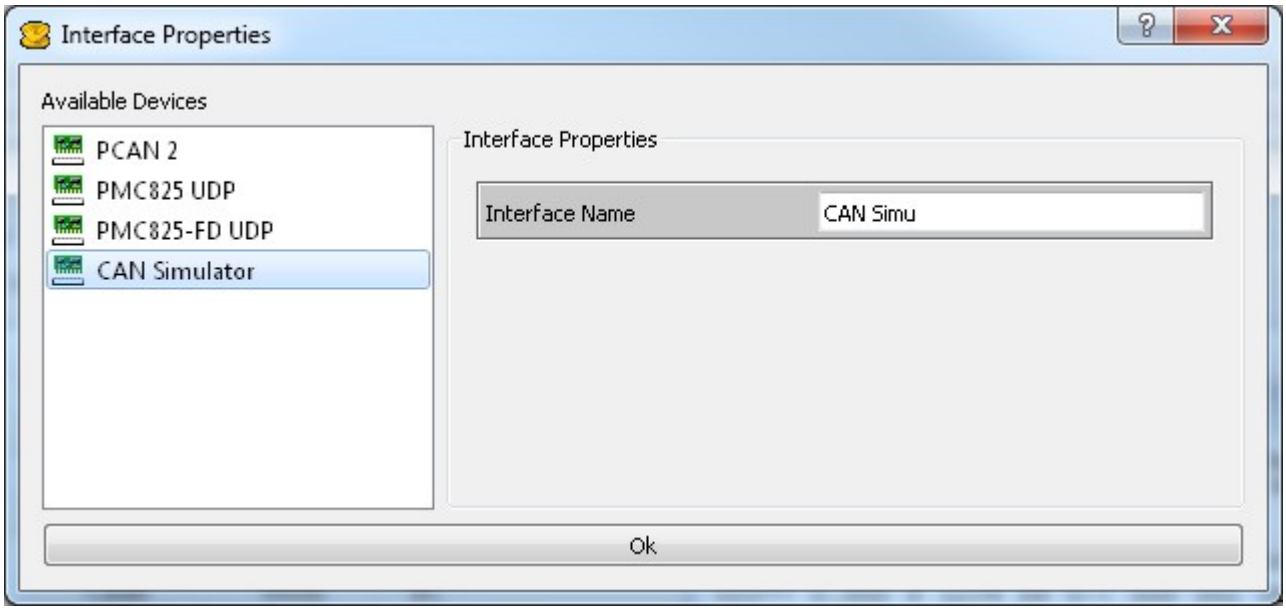
2.3.2 Interface Properties dialog

23 23
11 11 Accessible via the button of the Interface toolbar or a double-click on a name in the Connections area of the Project window.
For a new interface (with the designation *unnamed* in the *Connections area*), the following virgin *Interface Properties* dialog appears.

Select the device the XCT is connected to from the *Available Devices* list in order to define the associated parameters (see the following sections).



2.3.2.1 CAN simulator

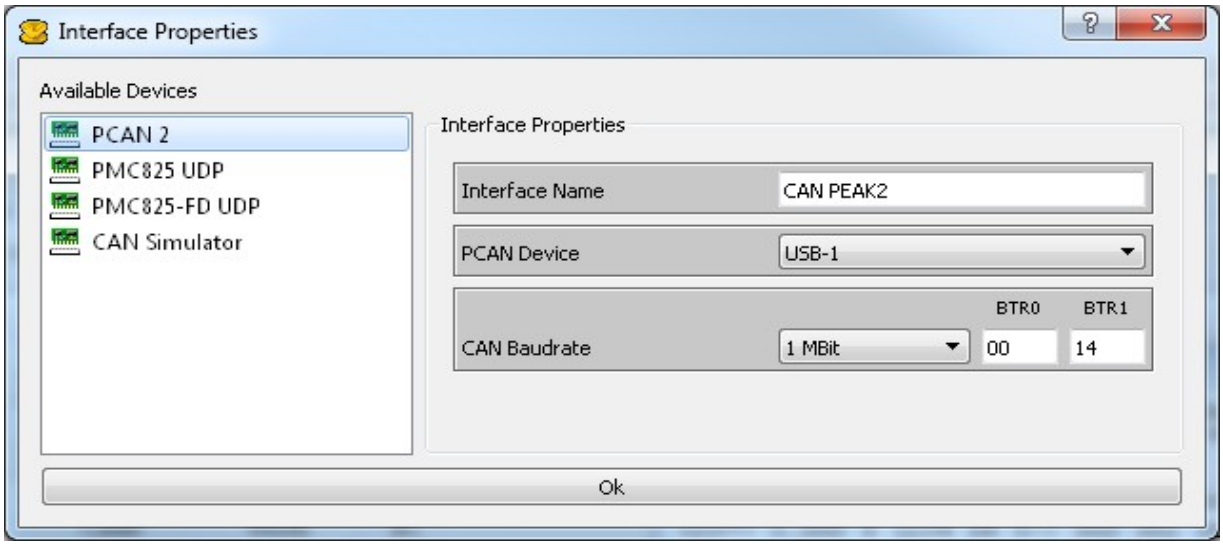


Interface name Enter any meaningful name for the interface.

This name appears in the Connections area of the XCT tool.

The CAN simulator currently has no configurable parameters.

2.3.2.2 PCAN 2



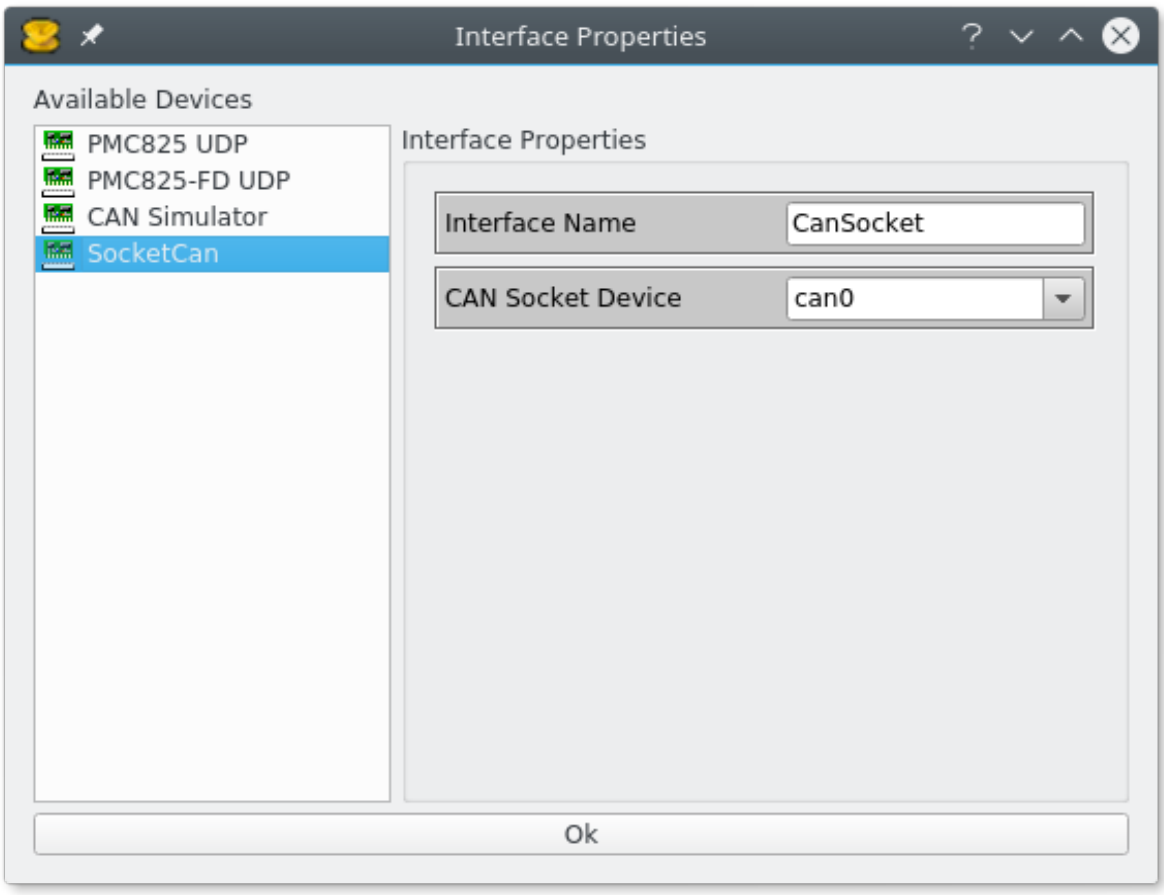
Interface name Enter any meaningful name for the interface. This name appears in the Connections area of the XCT tool.

PCAN Device Select a PCAN device from the drop-down list box. The device names available in the drop-down list box have been configured in the `NetStat` utility of the PCAN during installation.

CAN Baudrate Select the baudrate of the connected CAN bus from the dropdown list box.

BTR0 / BTR1 Alternatively to the selection of a baud rate the bus timing registers BTR0 and BTR1 can be set directly in these text boxes.

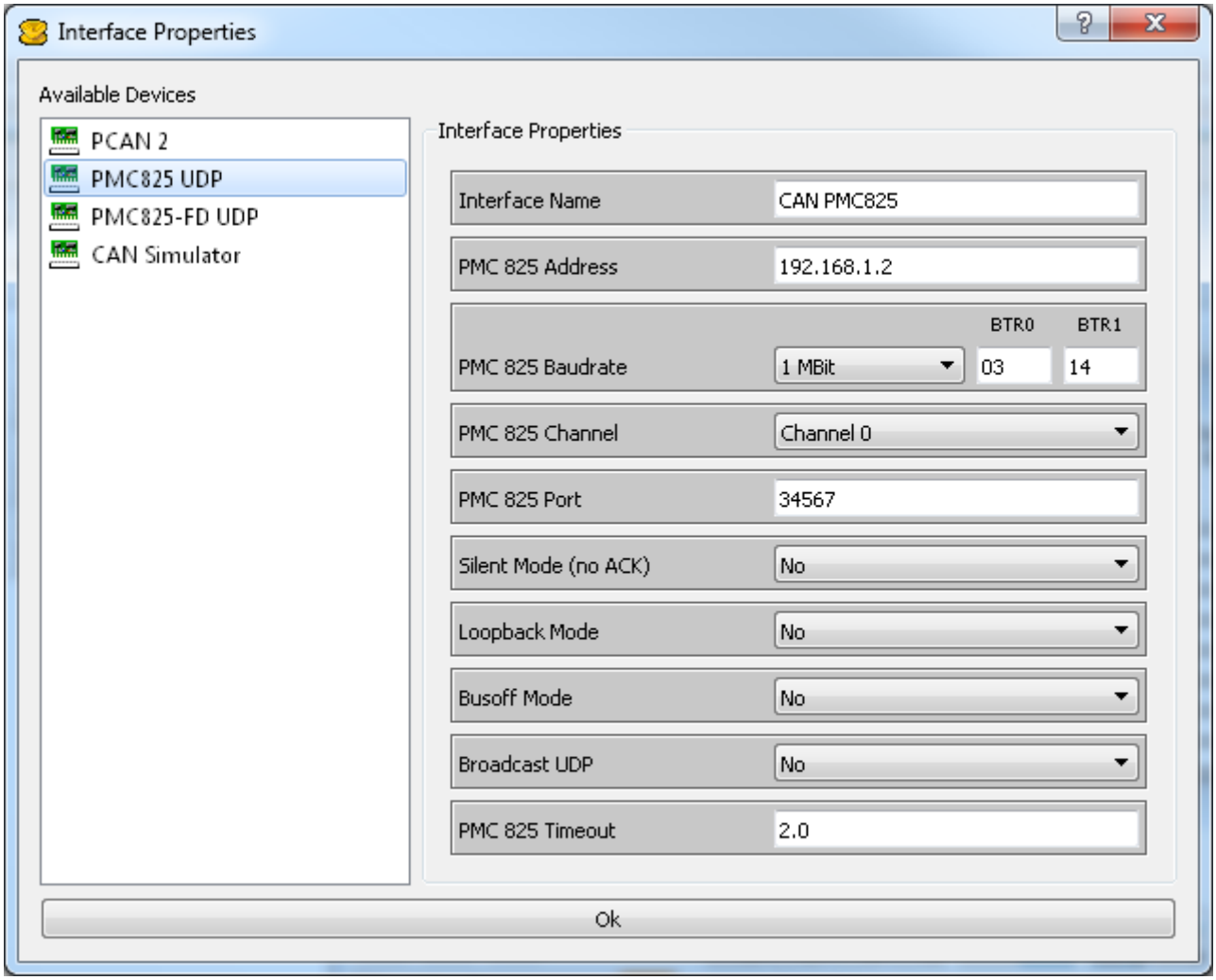
2.3.2.3 SocketCan



Interface name Enter any meaningful name for the interface. This name appears in the Connections area of the XCT tool.

Can Socket Device Select the device to use for the SocketCan interface, e.g. can0 or vcan0

2.3.2.4 PMC825 UDP



Interface name Enter any meaningful name for the interface. This name appears in the Connections area of the XCT tool.

PMC825 Address Enter the local address of the PMC825 module.

PMC825 CAN Baudrate Select the baudrate of the connected CAN bus from the drop-down list box.

BTR0 / BTR1 Alternatively to the selection of a baud rate the bus timing registers BTR0 and BTR1 can be set directly in these text boxes.

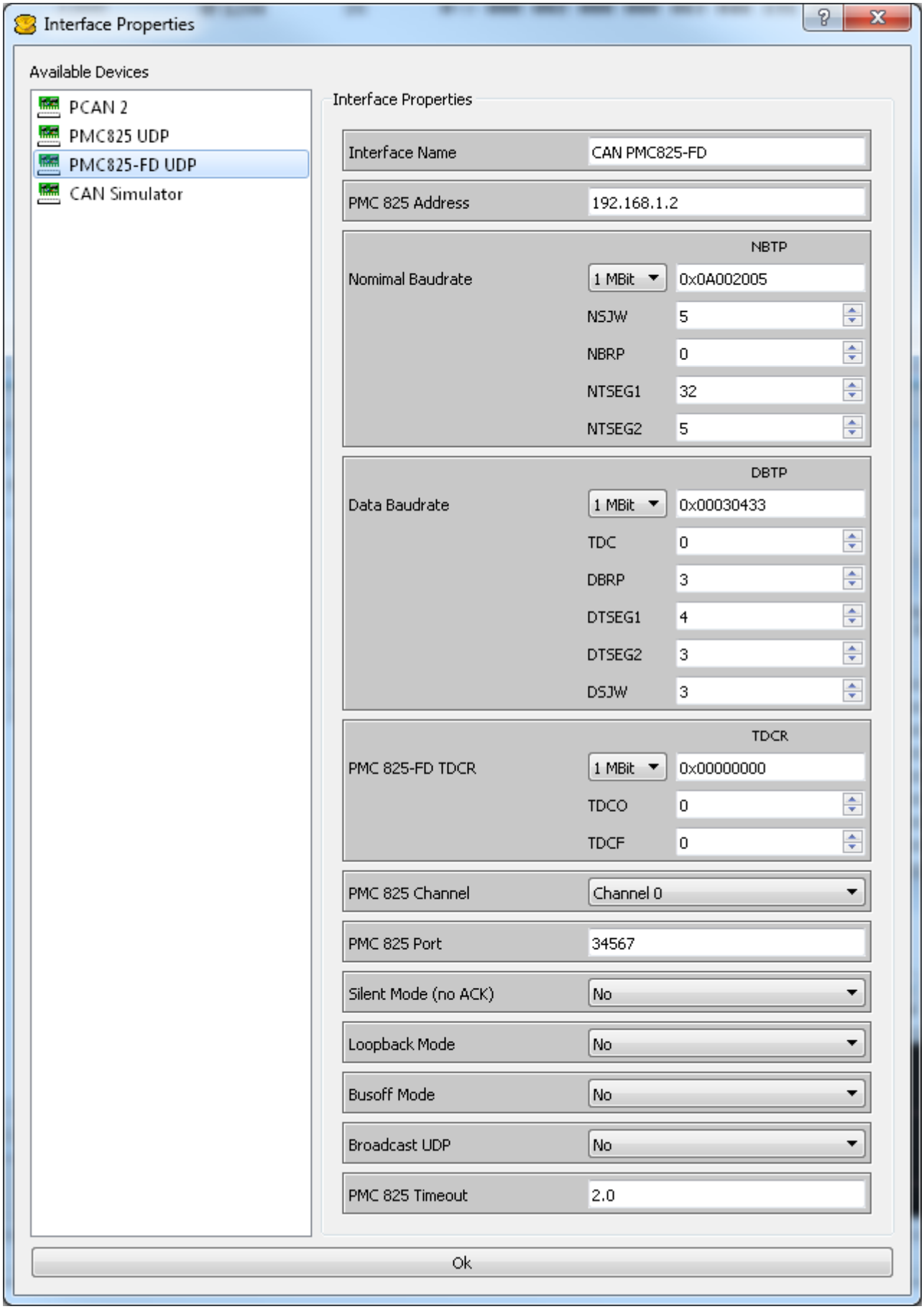
PMC825 Channel Select the CAN channel on the PMC825 board from the drop-down list box.

Currently 4 channels are available, 0..3.

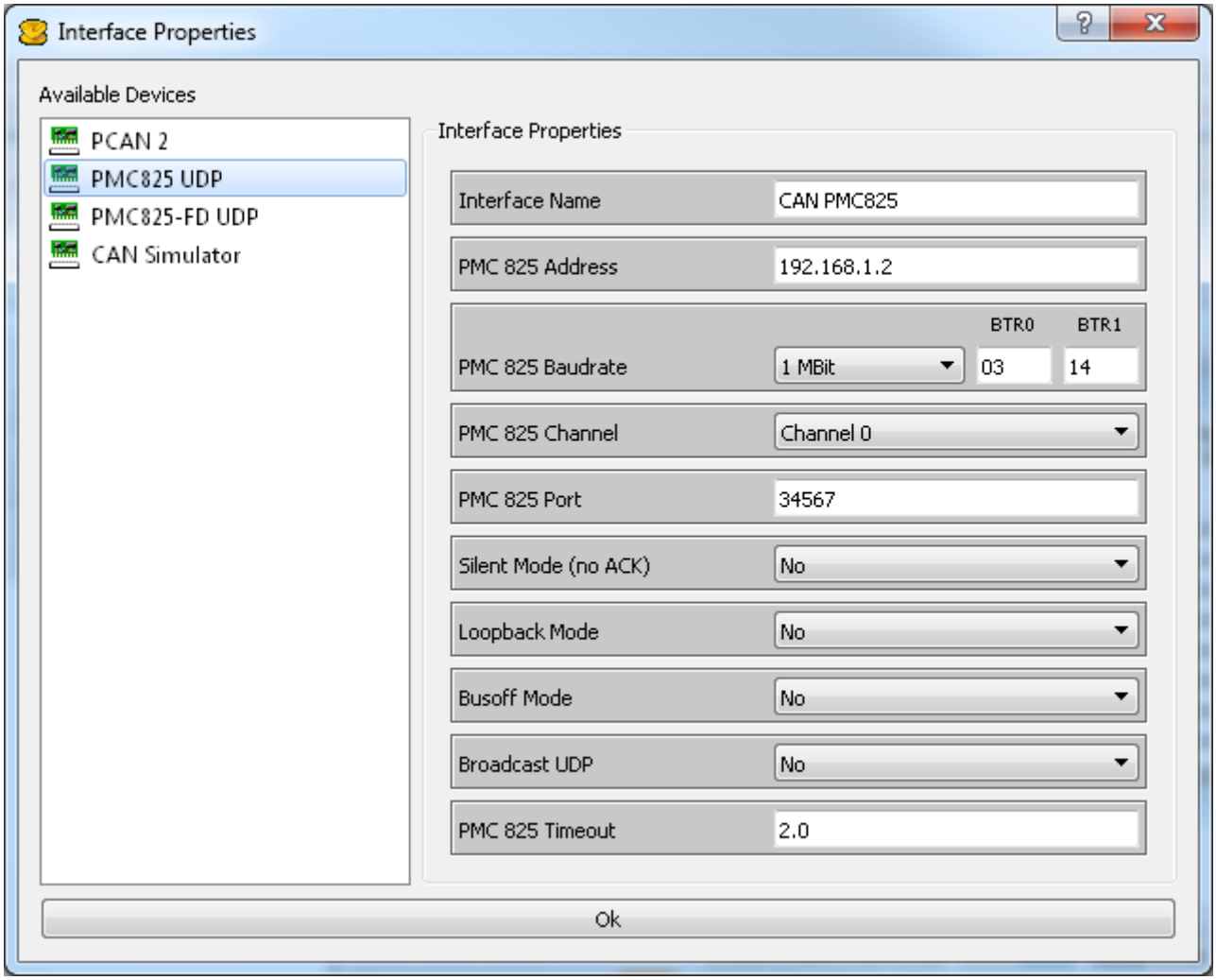
Changing the channel automatically sets the

	configured PMC825 port to the default!
PMC825 Port	Indicates the base UDP port used for communication with the PMC825 board. The port on the PMC module can be set by changing the configuration file on the SD card. There are always 2 ports used, one for XCT->PMC and one for PMC->XCT communication. The second port is always the defined port + 1.
Silent Mode (no ACK)	Set this parameter to *Yes* if the PMC CAN module shall sent ACK on received CAN messages.
Loopback Mode	Select *Yes* to set the CAN chip to loopback mode (receive messages sent by itself).
Busoff Mode	Select *Yes* to set the CAN transceiver to BUS OFF.
Broadcast UDP	If this parameter is set to *Yes*, the PMC825 board is configured to use broadcast UDP sockets for sending messages to the host. This enables listening of more than one XCT tools on the same board/channel.

2.3.2.5 PMC825-FD UDP



2.3.2.6 PMC825 UDP



Interface name Enter any meaningful name for the interface. This name appears in the Connections area of the XCT tool.

PMC825 Address Enter the local address of the PMC825 module.

PMC825 CAN Baudrate Select the baudrate of the connected CAN bus from the drop-down list box.

BTR0 / BTR1 Alternatively to the selection of a baud rate the bus timing registers BTR0 and BTR1 can be set directly in these text boxes.

PMC825 Channel Select the CAN channel on the PMC825 board from the drop-down list box.

Currently 4 channels are available, 0..3.

Changing the channel automatically sets the

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PMC825 Port	Indicates the base UDP port used for communication with the PMC825 board. The port on the PMC module can be set by changing the configuration file on the SD card. There are always 2 ports used, one for XCT->PMC and one for PMC->XCT communication. The second port is always the defined port + 1.
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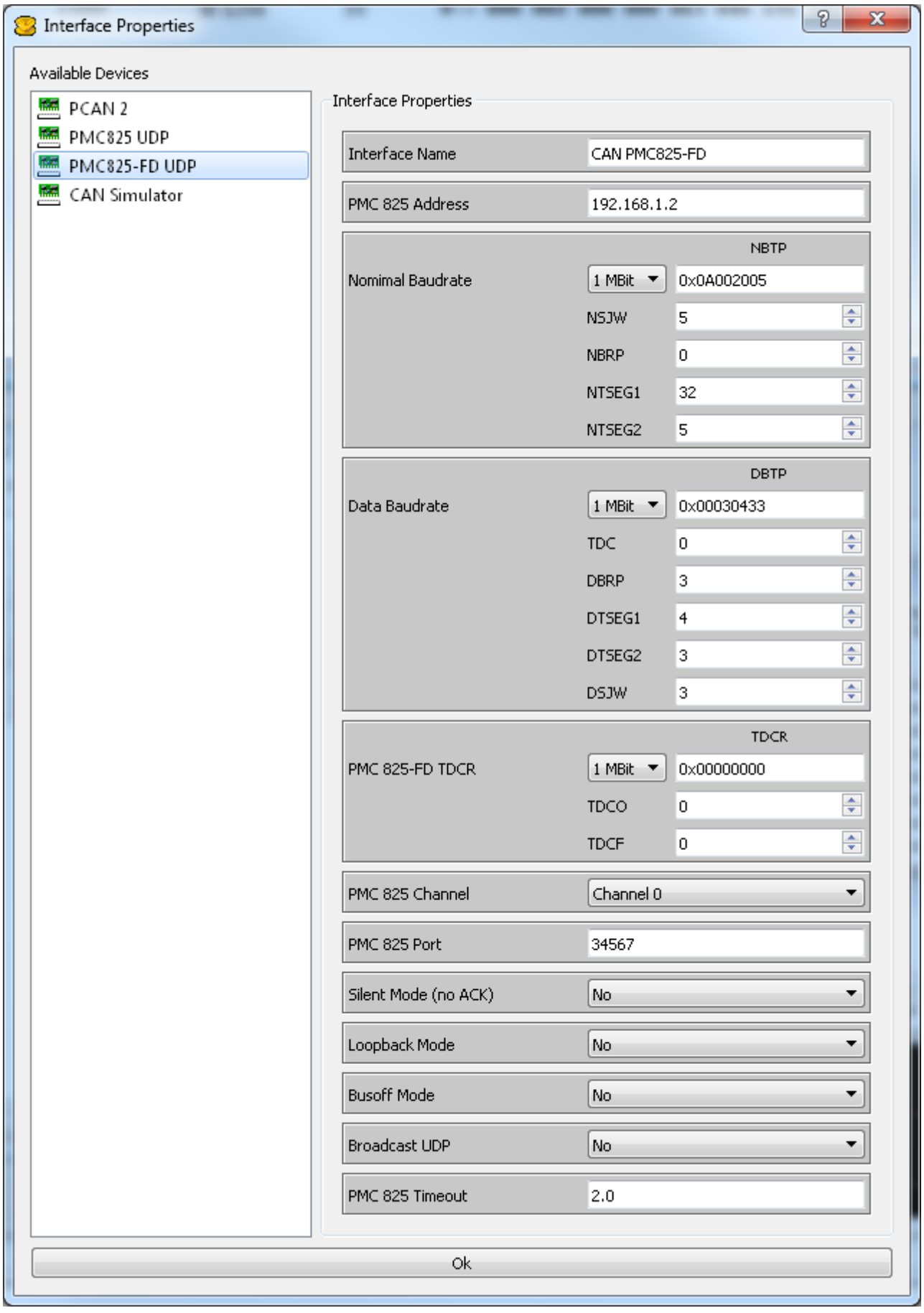
Loopback Mode	Select *Yes* to set the CAN chip to loopback mode (receive messages sent by itself).
Busoff Mode	Select *Yes* to set the CAN transceiver to BUS OFF.
Broadcast UDP	If this parameter is set to *Yes*, the PMC825 board is configured to use broadcast UDP sockets for sending messages to the host. This enables listening of more than one XCT tools on the same board/channel.

2.3.2.7 PMC825-FD UDP



Interface name	Enter any meaningful name for the interface. This name appears in the Connections area of the XCT tool.
PMC825 Address	Enter the local address of the PMC825 module.
Nominal Baudrate	Select the nominal baudrate of the connected CAN bus from the drop-down list box. Currently only 1 Mbit is available as predefined register value. If you need to support another baudrate, you need to fill the single registers manually with the correct values.
NSJW	The NSJW bits of the NBTP (Nominal Bit Timing & Prescaler Register) register. See M_CAN Controller Area Network Users Manual from BOSCH for more informations.
NSJW	The NBRP bits of the NBTP register.
NTSEG1	The NTSEG1 bits of the NBTP register.
NTSEG2	The NTSEG2 bits of the NBTP register.
Data Baudrate	Select the data baudrate of the connected CAN bus from the drop-down list box. Currently only 1 Mbit is available as predefined register value. If you need to support another baudrate, you need to fill the single registers manually with the correct values.
TDC	The TDC bits of the DBTP (Data Bit Timing & Prescaler Register) register. See M_CAN Controller Area Network Users Manual from BOSCH for more informations.
DBRP	The DBRP bits of the DBTP register.
DTSEG1	The DTSEG1 bits of the DBTP register.
DTSEG2	The DTSEG2 bits of the DBTP register.
DSJW	The DSJW bits of the DBTP register.
PMC 825-FD TDCR	Select the baudrate of the connected CAN bus from the drop-down list box for the TDCR register. Currently only 1 Mbit is available as predefined register value. If you need to support another baudrate, you need to fill the single registers manually with the correct values.
TDC0	The TDC0 bits of the TDCR register.

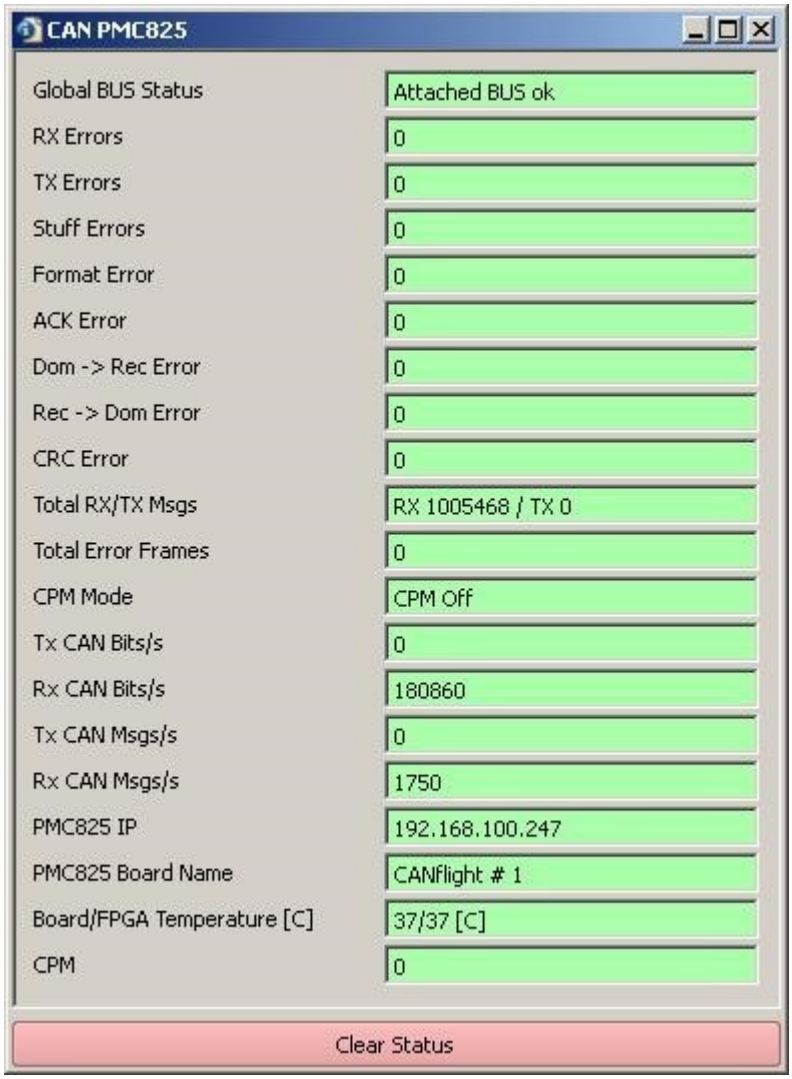
TDCF	The TDCF bits of the TDCR register.
PMC825 Channel	Select the CAN channel on the PMC825 board from the drop-down list box. Currently 4 channels are available, 0..15. Changing the channel automatically sets the configured PMC825 port to the default!
PMC825 Port	Indicates the base UDP port used for communication with the PMC825 board. The port on the PMC module can be set by changing the configuration file on the SD card. There are always 2 ports used, one for XCT->PMC and one for PMC->XCT communication. The second port is always the defined port + 1.
Silent Mode (no ACK)	Set this parameter to *Yes* if the PMC CAN module shall sent ACK on received CAN messages.
Loopback Mode	Select *Yes* to set the CAN chip to loopback mode (receive messages sent by itself).
Busoff Mode	Select *Yes* to set the CAN transceiver to BUS OFF.
Broadcast UDP	If this parameter is set to *Yes*, the PMC825 board is configured to use broadcast UDP sockets for sending messages to the host. This enables listening of more than one XCT tools on the same board/channel.
PMC 825 Timeout	The timeout for the PMC 825 board to answer to requests. If there is no answer received during the timout time, XCT considers the module as disconnected.

2.3.3 BUS status window

23 23
11 11 Accessible by a double-click on the BUS status area of an open BUS connection (➥ *Connections area* of the Project window).

The appearance of this window (number of indicated status information) depends on the selected device for the respective interface (↪ Interface Properties dialog).

The following example shows the window for the PMC825.



Most of the dialog items are self-explanatory. In the following you will find additional explanations for some items.

Global BUS Status *Attached BUS OK*
If the respective BUS works properly the message *Attached BUS OK* appears on a green background.

Detached

The respective BUS is detached.
Click on the status indication of the respective connection in the Connections area to open the connection.

Passive
The respective BUS has been deactivated because of an error in the transmitted CAN message.

. . . Errors Indication of the number of recognized errors. For details about the various error types see the documentation of the respective CAN protocol.

The number of detected messages is indicated on an orange background.

Total RX/TX This field shows the total number of received messages (RX) and transmitted messages (TX) since the respective BUS has been opened.

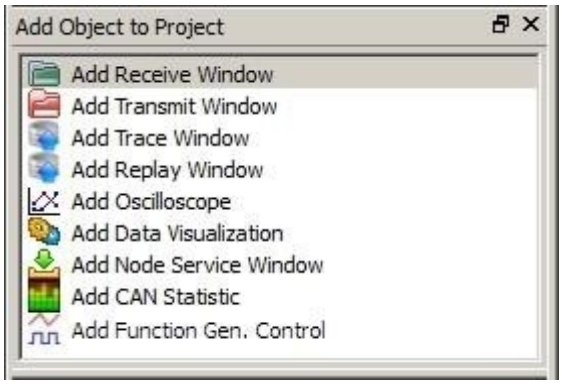
CPM Mode Current mode of the special CPM feature.

CPM CPM is a special real-time CAN Playback Module.

This button resets the indicated error messages and counters.

2.4 Add Object to Project window

The *Add Object to Project* window shows all available object types.

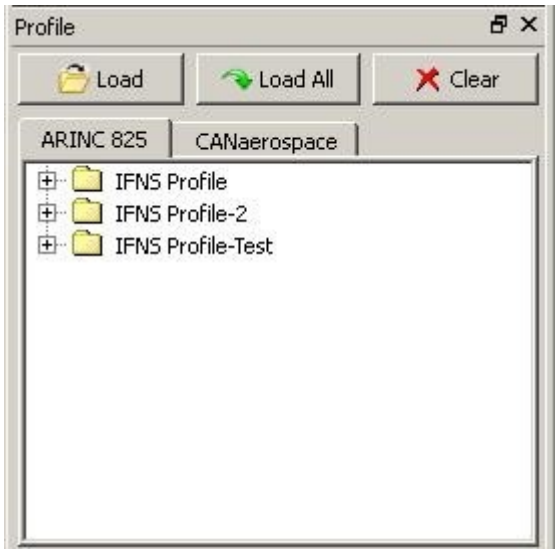


A double-click on an entry in this window opens a new object window in the objects area.

For a description of the individual object windows see chapter Object windows.

2.5 Profiles window

The Profiles window shows the currently loaded profiles. When the program starts, all profile files (*.pro) stored in the *\bin* folder of the XCT installation are automatically loaded.



Whenever one ore more profiles are loaded all profiles are checked for inconsistencies within the individual profile and conflicts between the various profiles (➥ Profile Check Result window).

This button opens the standard dialog to open a file. The default settings of the dialog are ..\bin for the path and *.pro, *.xml for the data type.

This button loads all profile files (*.pro) stored in the *\bin* folder of the XCT installation.

This button deletes **all loaded** profiles from the profiles window without any warning message.

Tabs for the selection of the available protocols.

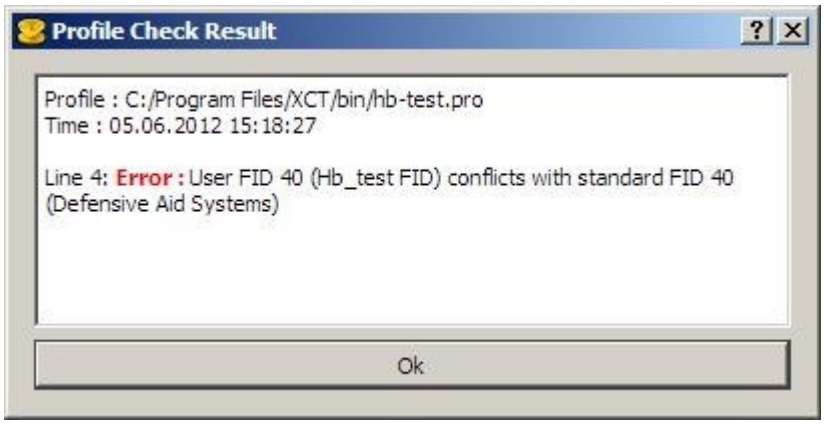
The area below the respective tabs shows names of the loaded profiles. Double-click a profile name or the little + symbol indicate the parameters defined for the respective profile (➥ Profile Editor).

The indicated profile names are not the filenames of the respective profile but the names defined in the *Profile Info* section of the profile (➥ Profile Editor).

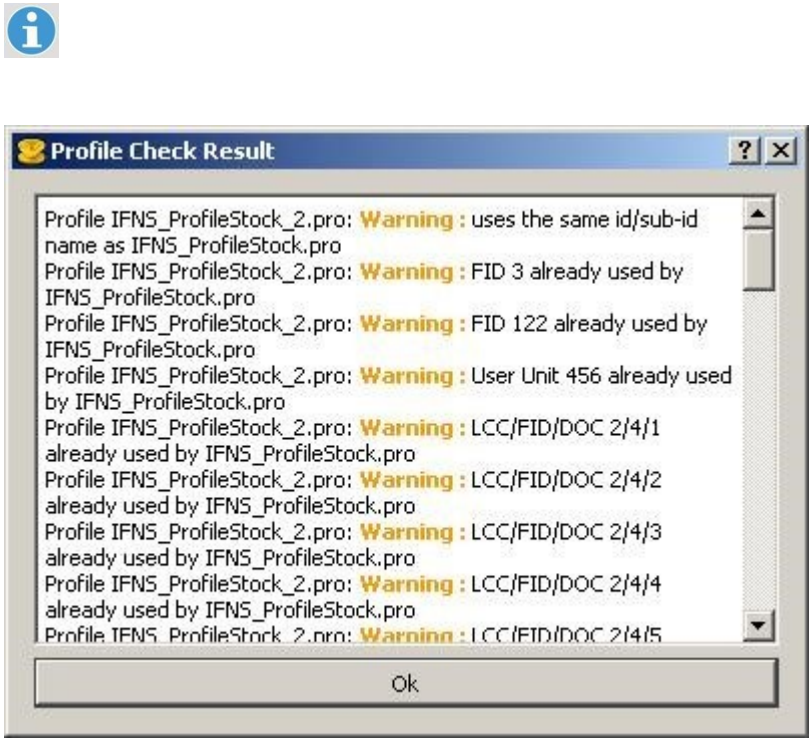
2.5.1 Profile Check Result window

23 23
11 11 This window appears, if any inconsistency or conflict has been detected while loading a profile in the Profiles window or the Profile editor.

When loading a profile in the profile editor only conflicts with the respective specification (e.g. *ARINC 825 Specification*) are displayed as shown in the following figure.



If you are loading more than one profile in the Profiles window additionally crosschecks between all profiles are performed and the result is displayed (see following example).



The [OK] button closes the window.

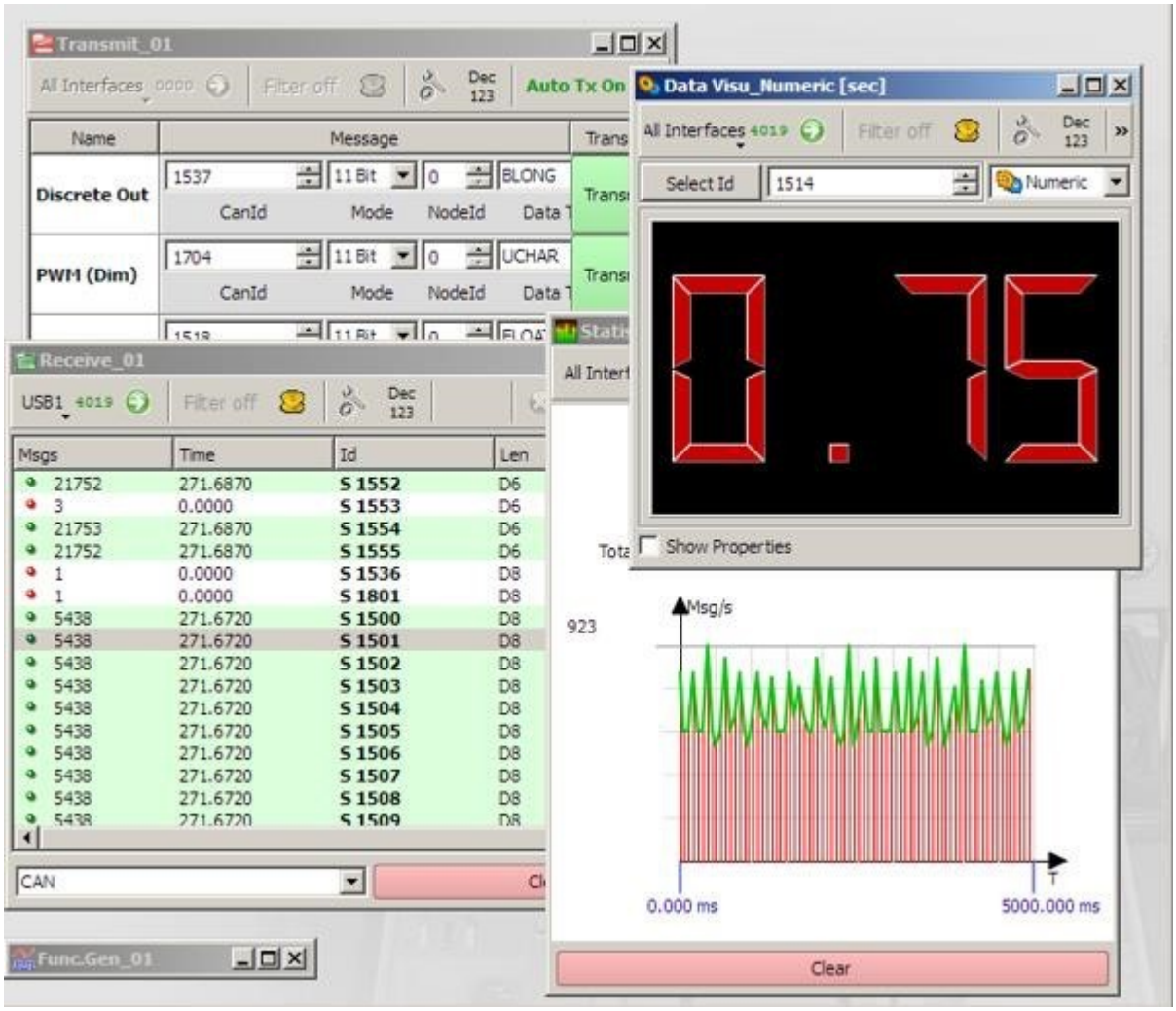
If you want to save the check results you can use the standard copy-and-paste function in order to transfer the text to a word processing program (see following example).

Profile : C:/Program Files/XCT/bin/hb-test.pro Time : 05.06.2012 15:18:27

Line 4: **Error :** User FID 40 (Hb_test FID) conflicts with standard FID 40 (Defensive Aid Systems)

2.6 Objects area

The following figure shows an example of the objects area with various open object windows.

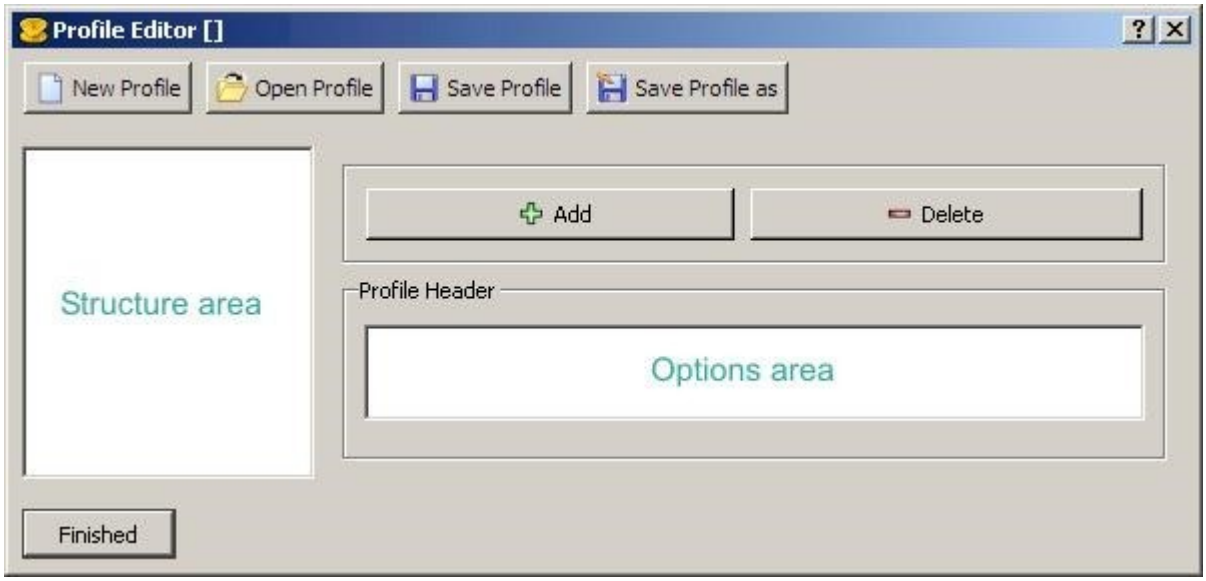


3 Profile Editor ARINC-825

23 11 23 11 Accessible via the Extras – Profile Editor ARINC-825 menu command.

This editor is designed to edit existing or create new profiles according to the ARINC 825 specifications.

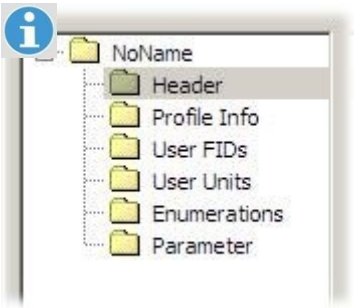
The *Profile Editor* turns up as shown in the following figure when it was opened the first time after the XCT program has been launched. Otherwise the structure of the last loaded profile is indicated (➥ Structure area.



Editor buttons

New Profile

This button generates the basic structure (see figure on the right) for creating a new profile (➥ Structure area).



Open Profile

This button opens the standard dialog to open a file (after a warning message, if the currently loaded profile has been modified but not yet saved).

The default path is set to the *bin* folder of the *XCT* installation and the data type is set to *.pro (extension for profile files).

Save Profile

In case the currently open profile is a new profile (initialised by the [New Profile] button) this button has the same function as the [Save Profile as] button.

In case the currently open profile is an already existing profile (loaded by the [Open Profile] button) the profile is saved anew (even if no changes has been made).

Save Profile as

This button opens the standard dialog to save a file (with a new name).

The default path is set to the *bin* folder of the *XCT* installation and the data type is set to *.pro (extension for profile files).

Finished

This button closes the profile editor.

If any the currently open profile has been changed a warning message appears.

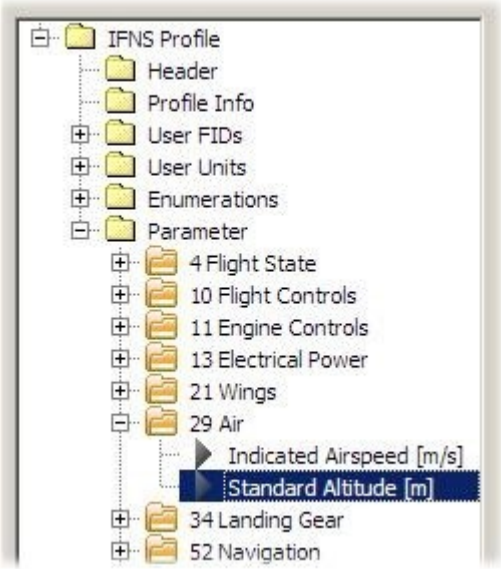
The text of the following buttons varies depending on the currently selected section in the structure area.

This button adds a new category, value or parameter to the currently selected section or category.

This button deletes the selected entry, **including all subordinate entries without any warning**.

Sections (e.g. *Parameter*) cannot be deleted.
The [– Delete] button is greyed if a section is selected.

Structure area



The profile structure is organised as a folder structure with the following hierarchical levels:

Level 0: Profile name (e.g. *IFNS Profile* – as defined in the section *Profile Info*, not the file name)

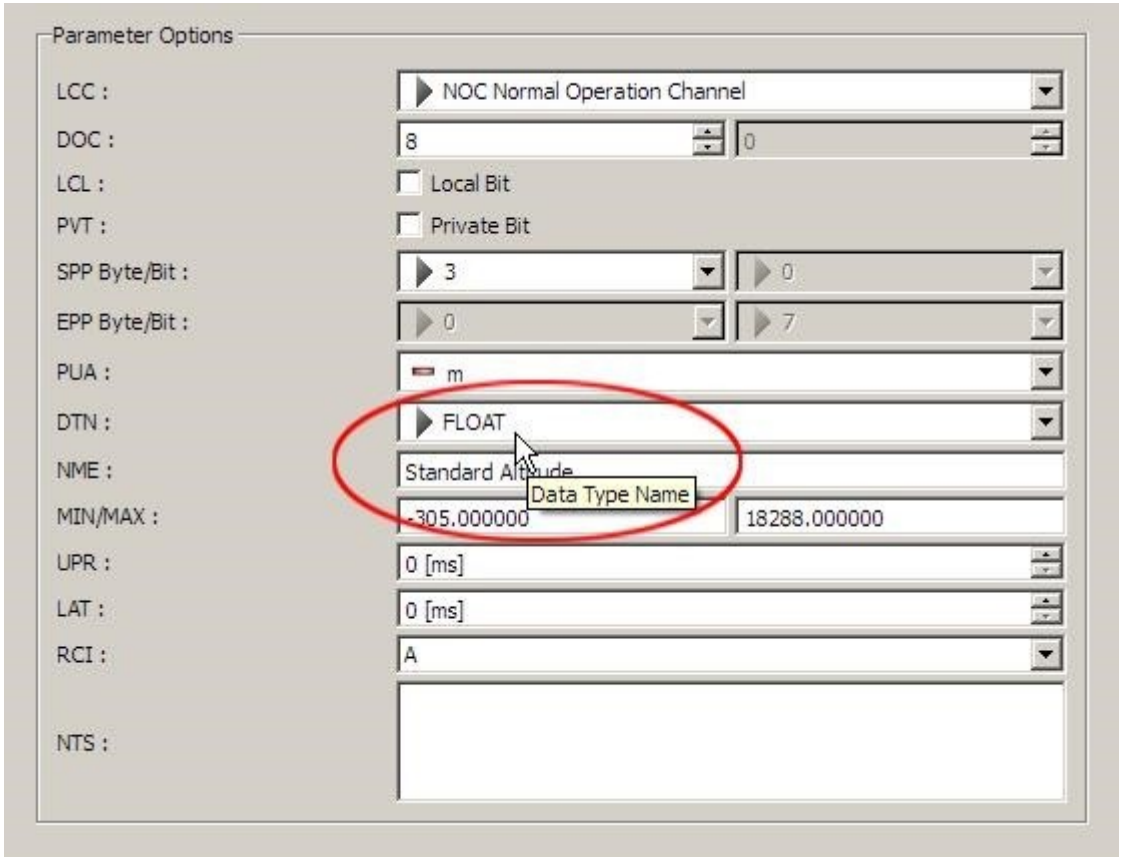
Level 1: Sections (e.g. *Parameter*)

Level 2: Categories (e.g. *29 Air*)

Level 3: Values / Parameters (e.g. *Standard Amplitude [m]*)

Options area

The appearance of this area varies depending on the currently selected entry in the Structure area. The figure below shows the options area for parameters (entry of level 3 is selected as shown in the figure depicted in the *Structure area*).



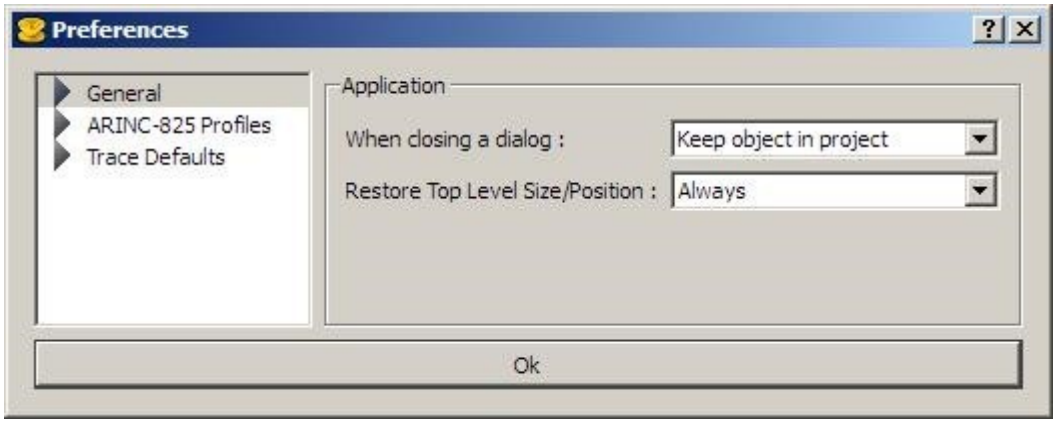
Detailed information about the meaning of the parameters etc you will find in the *ARINC SPECIFICATION 825-2*.

Move the mouse cursor over a dialog item in the *Parameter Options* area to get a plain text description of the respective item (e.g. *Data Type Name* for *DTN – FLOAT* in the example above).

4 Preferences dialog

23 23
11 11 Accessible via the Extras – Preferences menu command.

Select one of the entries from the list to the left. The associated settings are displayed on the right side of the dialog.



General / Application

When closing a dialog The options of this drop-down list box determine the effect of the [X] button in the title bar of the Object windows. as described below.

Keep object in project

The object window will only be hidden but not removed from the project. You can recall a hidden object window by double-clicking the respective entry in the Active objects area.

Remove object from project

The object window will be removed from the project **without any warning message.**

Ask User

When closing an object dialog (e.g. with the [X] button in the dialog title bar) a query window with the following options appears:

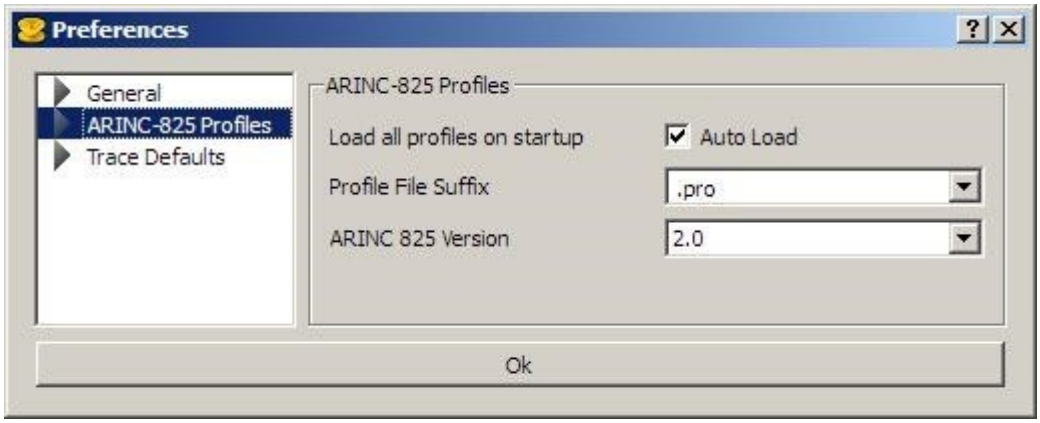
[No] The object window will only be hidden but not removed from the project (same as *Keep object in project* option).

[Yes] The object window will be removed from the project **without any warning message.**

[Cancel] The query window is closed and the object window remains unchanged in the objects area.

Restore Top Level size/Position This parameter determines the size and position of the XCT main screen.

ARINC-825 Profiles



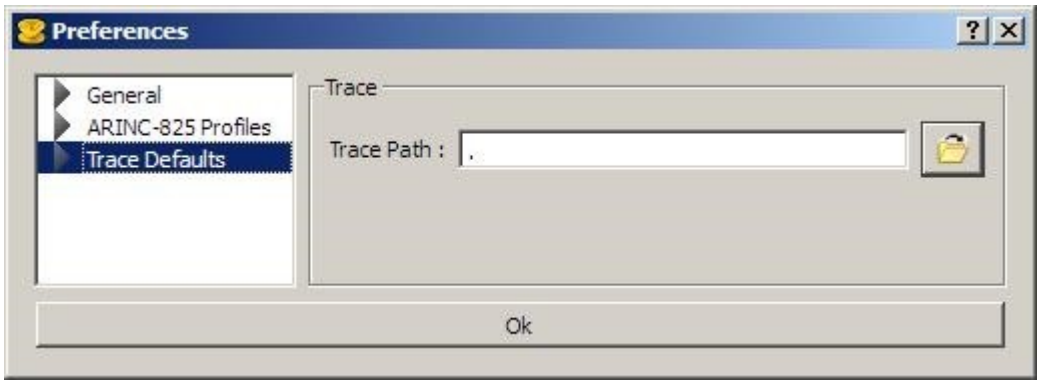
Load all profiles on startup If this checkbox is active all profile files (with the file suffix selected from the drop-down list box below) that are stored in the *\bin* subfolder of the XCT installation, are automatically loaded. Usually you can maintain the default setting *.pro.*

The XCT program performs a profile check for all loaded files and automatically shows all detected inconsistencies and conflicts in the Profile Check Result window.

Profile File Suffix Select the file suffix that should be used for the *Auto Load* feature from this drop-down list box.

ARINC 825 Version Select the applicable version number from this drop-down list box (default 2.0).

Trace Defaults



Trace Path This text box shows the current path to the folder where the trace files (automatically generated by the Trace window) are stored.

The default setting is the root directory.

Enter a suitable destination folder in the text box or press the folder button right of the text box in order to select a folder from the standard *Search folder* dialog. The installation default setting is the *\bin* subfolder of the XCT installation.

5 Object windows

The XCT tool provides the following object types:

- Receiving messages
- Transmitting messages
- Tracing of all BUS messages
- Replaying recorded BUS message sequences
- Viewing of BUS signals on a digital oscilloscope
- Visualization of BUS messages
- Performing node services
- Visualization of BUS message statistics
- Function Generator for BUS signals (only available with a specially programmed hardware)

The individual objects can be defined in separate object windows.

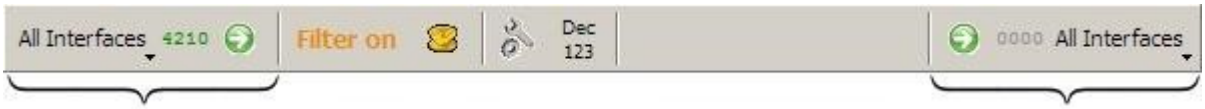
The following sections describe the properties of the various object windows.

5.1 Object tool bars

Most of the object windows have a specific tool bar below the title bar. The tools in these tool bars are available in almost all object windows. Some of them are available only at certain states of the project window and are greyed, some are available only in certain object windows.

The following sections describe the tools that are available in several project windows. Additional tools only used in the Transmit window or in the CAN Statistic window are explained in the respective sections.

5.1.1.1 Common object tools



Interface control **Input** Interface control **Output**

5.1.1.2 Interface control Input / Output

The basic functions of the interface control elements for Input and Output are identically (apart from the message direction).

Display: Shows the current interface selection.

Button: Press this button to open a drop-down menu where you can select one of the currently defined interfaces or *All interfaces*.

Via the selected interface(s) the associated object window receives or sends its messages.

Display of the number of all messages received or sent since the respective window has been created.

Display: Input / output enabled (default setting)

Button: Stops the continuous interrogation of the selected input interface(s) or disable the transmission of output messages via the selected output interface(s).

Display: Input / output disabled

Button: Starts the continuous interrogation of the selected input interface(s) or enable the transmission of output messages via the selected output interface(s).

5.1.1.3 Filter on/off

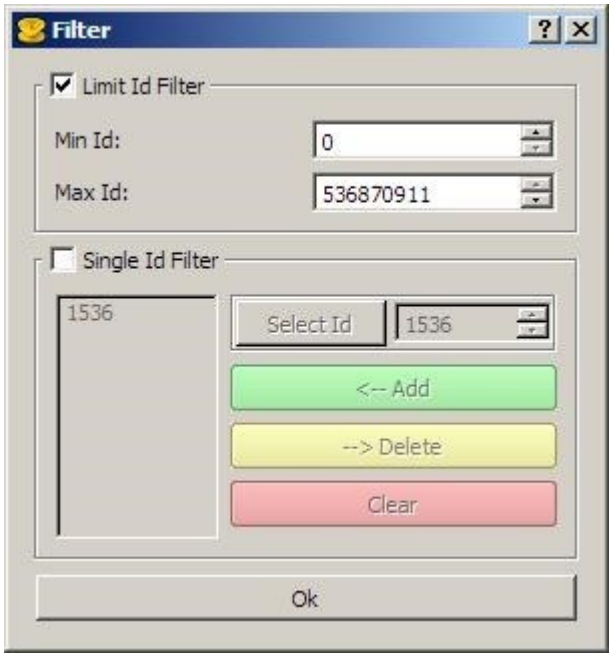
Button: Deactivates the Id filter option.

Button: Activates the Id filter option.

The button text shows the current status of the filter option (see the following section *Filter setting*).

5.1.1.4 Filter setting

This button opens the following dialog where you can define Id filter options.



Limit Id Filter If this check box is active (default setting) you can define a range of Ids for the continuous interrogation. The Ids, entered in the text boxes *Min Id* and *Max Id* are part of the defined range.

Single Id Filter If this check box is active you can define individual Ids for the filter (see following details).

The [Select Id] button opens the Select Message dialog which offers various possibilities for selecting an

Id. After having closed the *Select Message* dialog, the selected Id is added to the *Single Id Filter* list.

Alternatively, you can enter an Id directly in the text box or change the displayed Id with the little arrow keys.

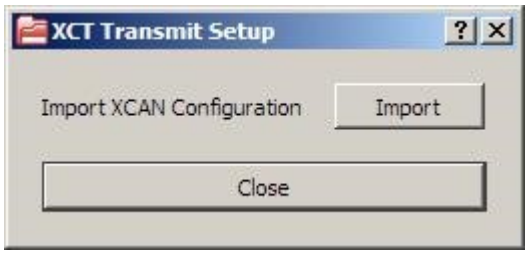
This button adds an Id, entered in the text box, to the *Single Id Filter* list.

This button removes the previously selected Id from the *Single Id Filter* list **without any warning**.

This button removes all Ids from the *Single Id Filter* list **without any warning**.

5.1.1.5 XCAN import

This button opens the following dialog where you can import the transmit configuration defined with the XCAN-Tool (previous version of the XCT program).



The [Import] button opens the standard dialog to open a file.

Navigate to the folder, where the configuration files (.xct) of the XCAN-Tool are stored (default setting is the *bin* folder of the *XCAN* installation) and select the desired .xct file.

A double-click on the desired file or the [Open] button loads the XCAN configuration in the current Transmit window.

5.1.1.6 Decimal/Hex display

Display: The numerical values of the messages are displayed in **decimal** notation (default setting).

Button: Switches to **hexadecimal** notation.

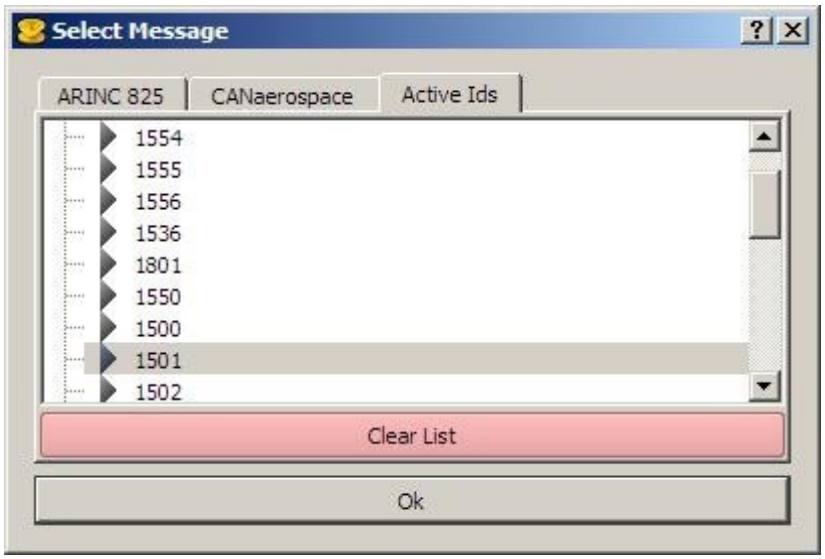
Display: The numerical values of the messages and Ids are displayed in **hexadecimal** notation.

Button: Switches to **decimal** notation.

5.1.2 Select Message dialog

Accessible via the [Select Id] button of various dialogs or windows (e.g. Data Visualization window or Filter dialog).

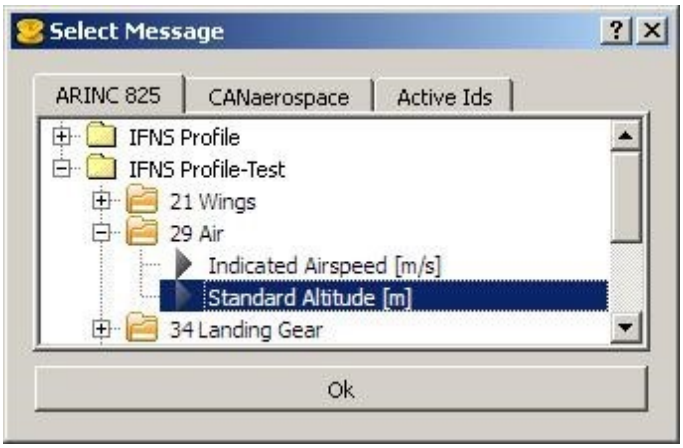
The appearance of the *Select Message* dialog depends on the actually loaded profile (➥ Profiles window).



Active Ids The *Active Ids* tab always lists all currently available Ids (independently of the selected bus protocol or loaded profile (see figure above). Only the Id format varies.

ARINC 825
CANaerospace

These tabs are empty if no profile for the respective protocol is loaded (➥ Profiles window). The example below shows the ARINC 825 tab in case, two profiles (*IFNS Profile* and *IFNS Profile-Test*) are loaded.



The profiles are organised as a folder structure.

Navigate to the desired profile item (e.g. *Standard Altitude [m]* in the example above) in order to select the associated Id.

Ok Press the [OK] button to close the *Select Message* dialog and

select the (associated) Id or add it to an Id list.

Alternatively double-click the respective Id or profile item.

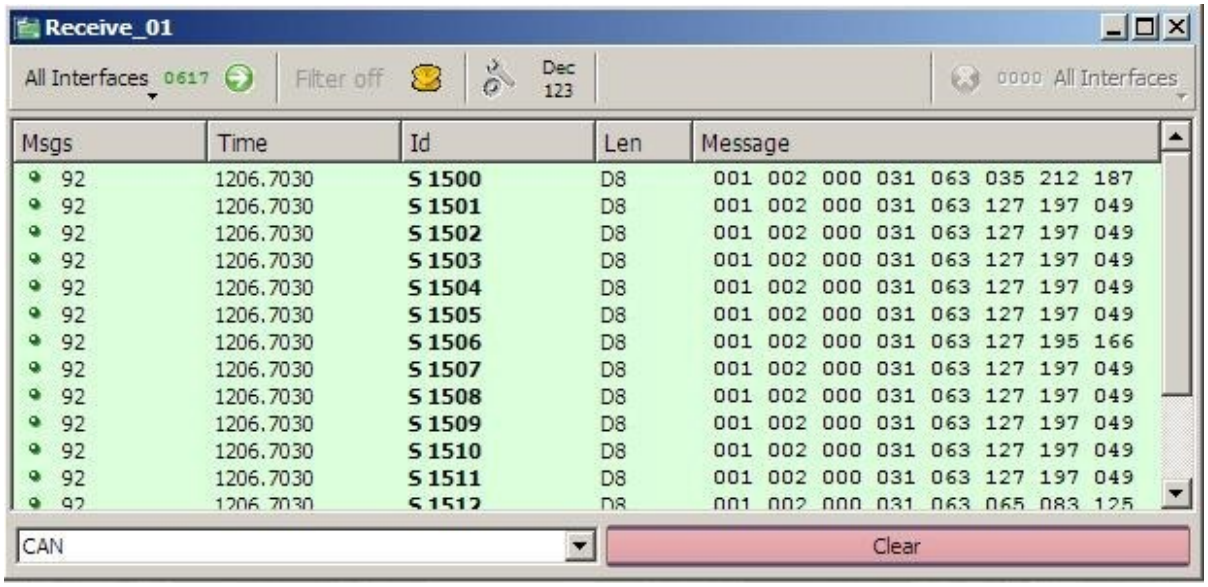
Clear List This button removes all Ids, which are presently sending no

messages, from the *Active Ids* list.

5.2 Receive window

The *Receive* window turns up as shown in the following example.

Click on the items within the window to get more information about the respective items.



Object tool bar

Details about the toolbar options see Object tool bars.

5.2.1.1 Message area (Receive)

The message area permanently shows the messages received via the selected interface(s) (see Interface control Input / Output of the object tool bar).

If a profile has been loaded (Profiles window) for the selected protocol (see the following section *Protocol select list*) the messages are interpreted according to the loaded profile and indicated in plain text.

The number and meaning of the indicated columns depends on the currently selected protocol (see *Protocol select list* further below).

A double-click on any CAN message launches the Data Visualization window for the respective CAN Id.

5.2.1.2 Protocol select list (Receive)

From this drop-down list box you can select one of the following protocols:

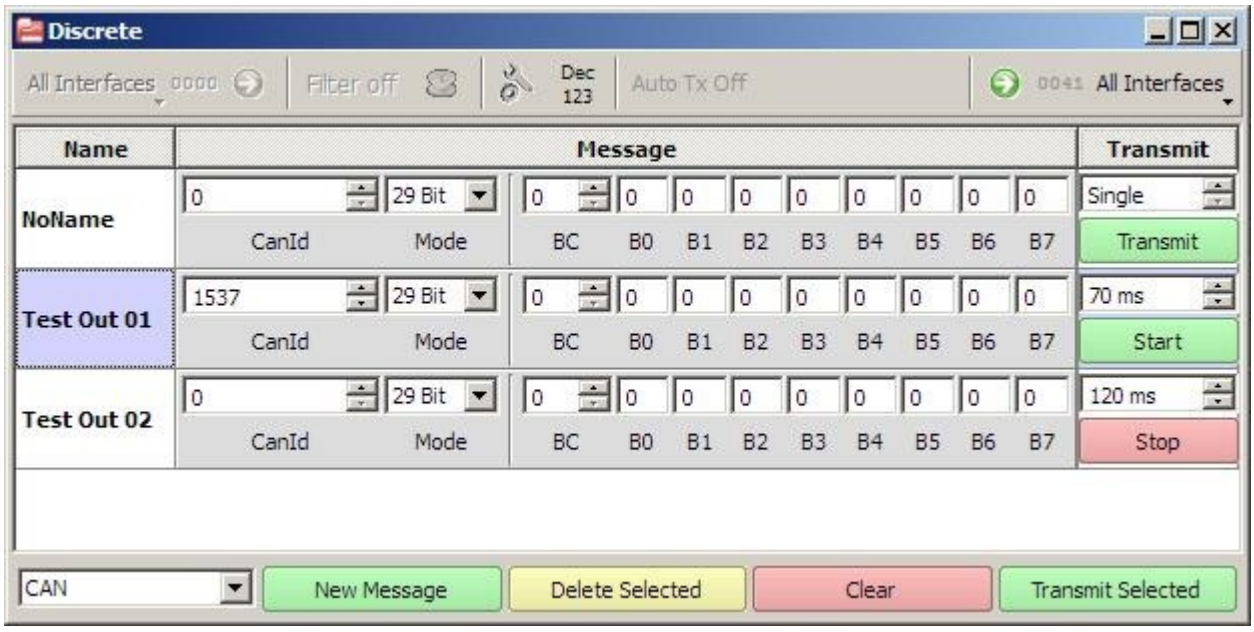
- CAN
- CANaerospace
- ARINC 825 Raw
- ARINC 825 Profile

The selection in this drop-down list box affects the number and meaning of the indicated columns within the *Message area* (see further above). For further details see the specifications of the respective bus protocols (e.g. *CANaerospace Interface specification*) and the customer documentation for the individual product.

5.2.1.3 Clear button (Receive)

This button deletes **all** messages. The message counter (*Msgs*, first column of the message area) is reset to zero.

5.3 Transmit window



5.3.1.1 Object tool bar

Details about the common object tools see Object tool bars.

Besides these common object tools the toolbar of the *Transmit* window provides the following button.

5.3.1.2 Auto transmission

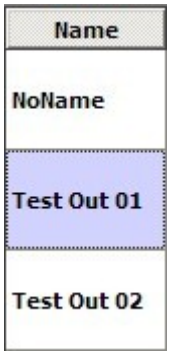
Auto Tx On Display: Auto transmission mode is active, i.e. as soon as any message parameter is changed, the message is immediately sent using the modified parameters.

Button: Deactivates the auto transmission mode.

Auto Tx Off Display: Auto transmission mode is not active, i.e. messages are only transmitted if one of the buttons [Transmit] or [Transmit Selected] is pressed.

Button: Activates the auto transmission mode.

5.3.1.3 Message names



In this column you can assign names to individual message items.

Having added a new message to the *Transmit* window, *NoName* is indicated as default name.

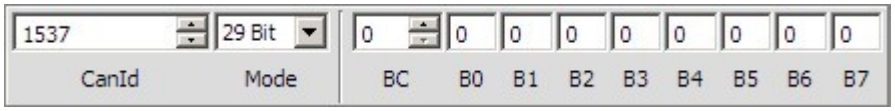
Double-click the current name (e.g. *NoName* in case of a new message) and overwrite it by a new name. (It is not necessary to delete the old name before typing the new name.)

A **simple mouse click** on a message line (name or any position within a message item) selects the respective message (in the example on the left the message *Test Out 01* is selected) for further operations (e.g. deleting or transmitting the selected message – see buttons [Delete Selected] and [Transmit Selected] of the Control buttons further below).

You can use the standard shortcuts for multiple line selection ([⇧] + left mouse button or [Ctrl] + left mouse button).

5.3.1.4 Message items (example)

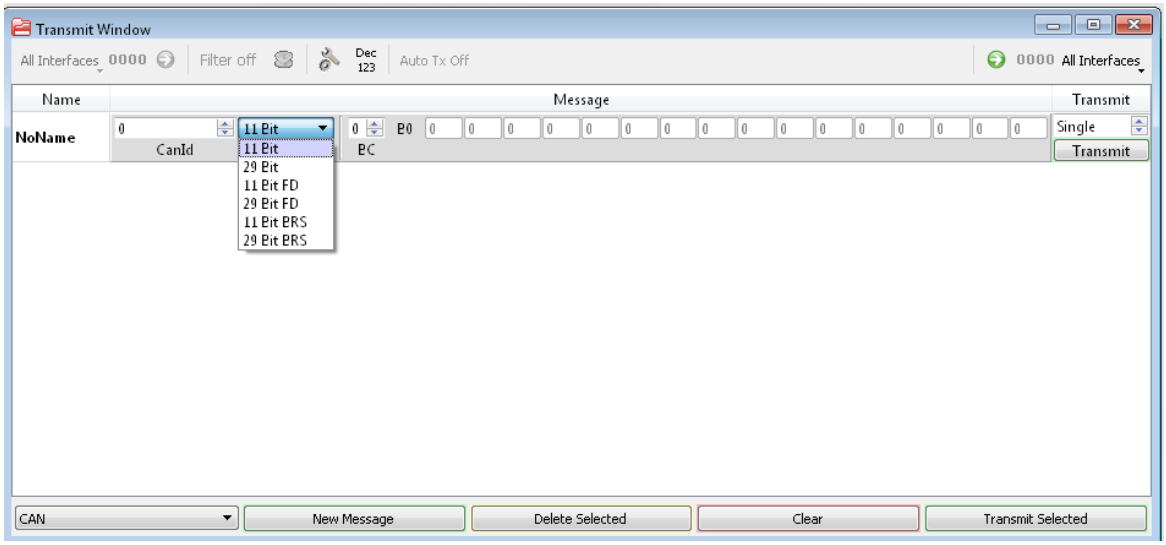
The appearance of the individual message items depends on the currently selected protocol type (see *Protocol select list* further below).



The example above shows the set of parameters that has to be defined for sending a message to a certain node using the common CAN protocol.

5.3.1.5 Mode Options

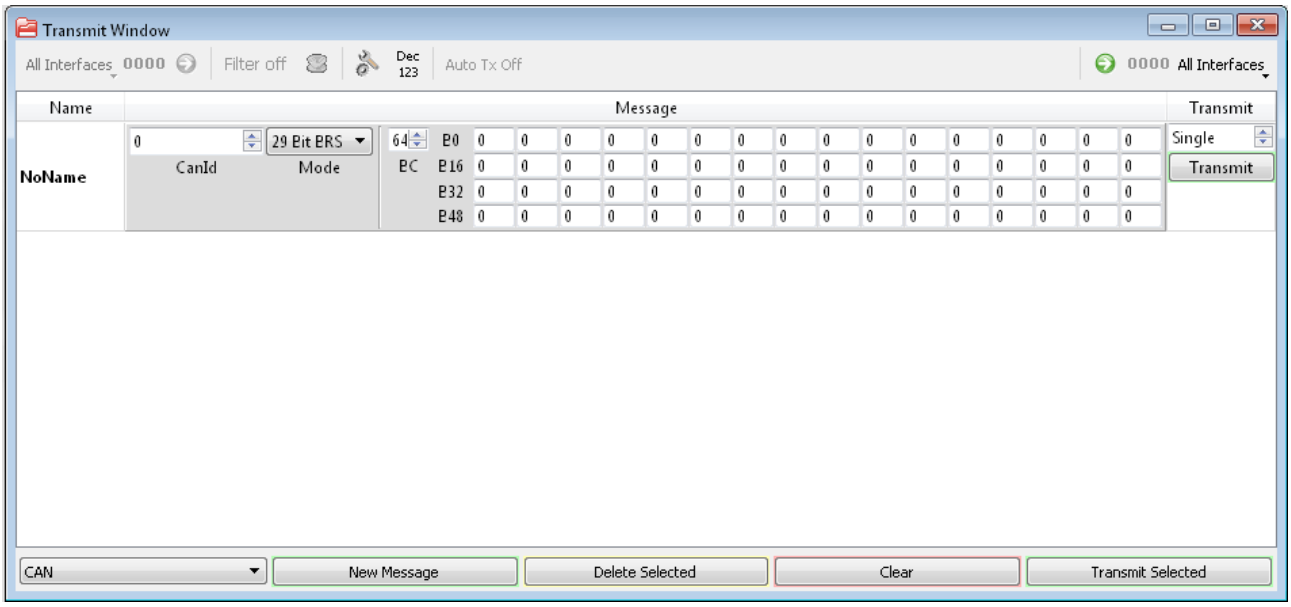
XCT provides different modes for transmitting messages. These modes can be selected by the "Mode" pulldown menu:



The folowing modes are available:

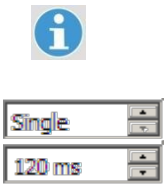
Mode	Description
11 Bit	Standard CAN 11 Bit messsage
29 Bit	Extended CAN 29 Bit message
11 Bit FD	Standard 11 Bit CAN FD message, up to 64 Databytes are possible
29 Bit FD	Extended 29 Bit CAN FD message, up to 64 Databytes are possible
11 Bit BRS	Standard 11 Bit CAN FD message, up to 64 Databytes are possible, Bit Rate Switch BRS is enabled
29 Bit BRS	Extended 29 Bit CAN FD message, up to 64 Databytes are possible, Bit Rate Switch BRS is enabled

With CAN FD enabled, up to 64 data bytes can be transmitted in a single CAN frame. With BRS enabled, the controller is able to switch between 2 different data rates for nominal and data bit timing.



The image shows the transmit window for 64 data bytes.

5.3.1.6 Transmit options



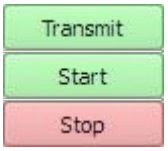
Repetition time

You can define the repetition time for the transmission using the controls shown on the left. The current setting influences the appearance of the button underneath the control (see further below).

Single (default setting)
If *Single* is selected, the green [Transmit] button (shown below) is displayed.
Pressing this button the message defined in the respective message item is transmitted once.

You can switch to the *Single* transmission mode either by (repeatedly) pressing the little down arrow (right of the text field) or by entering 0 (zero) into the text field.

xxx ms
You can define any time for a repeated transmission by entering any numeric value into the text field or by pressing (repeatedly) the little up arrow (right of the text field).
In this case the green [Start] button (shown below) is displayed.



Press the [Transmit] button of a message line to send the respective message only once.

Press the [Start] button of a message line to start the repeated transmission of the message according to the current repetition time setting.

The red [Stop] button appears.

Press the [Stop] button to finish the transmission of the respective message.

5.3.1.7 Protocol select list (Transmit)

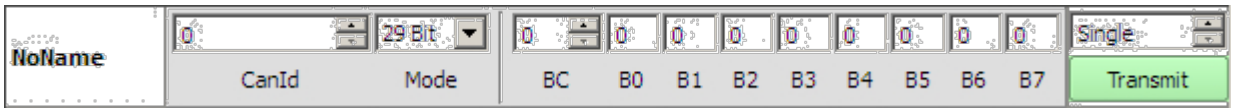
From this drop-down list box you can select one of the following protocols:

- CAN
- CANaerospace
- ARINC 825 Raw

The selection in this drop-down list box affects the available parameters of the individual message items (see further above). For further details see the specifications of the respective bus protocols (e.g. *CANaerospace Interface specification*) and the customer documentation for the individual product.

5.3.1.8 Control buttons

This button adds a new message item to the object window (see figure below).



For details about the parameter settings for the different message types see *Protocol select list* further above.

This button deletes the selected message item(s) from the object window after having confirmed a warning message with [Yes].

This button deletes **all** messages items from the object

window after having confirmed a warning message with [Yes].

Press the [Transmit Selected] button to send all messages that are currently selected in the *Transmit* window.

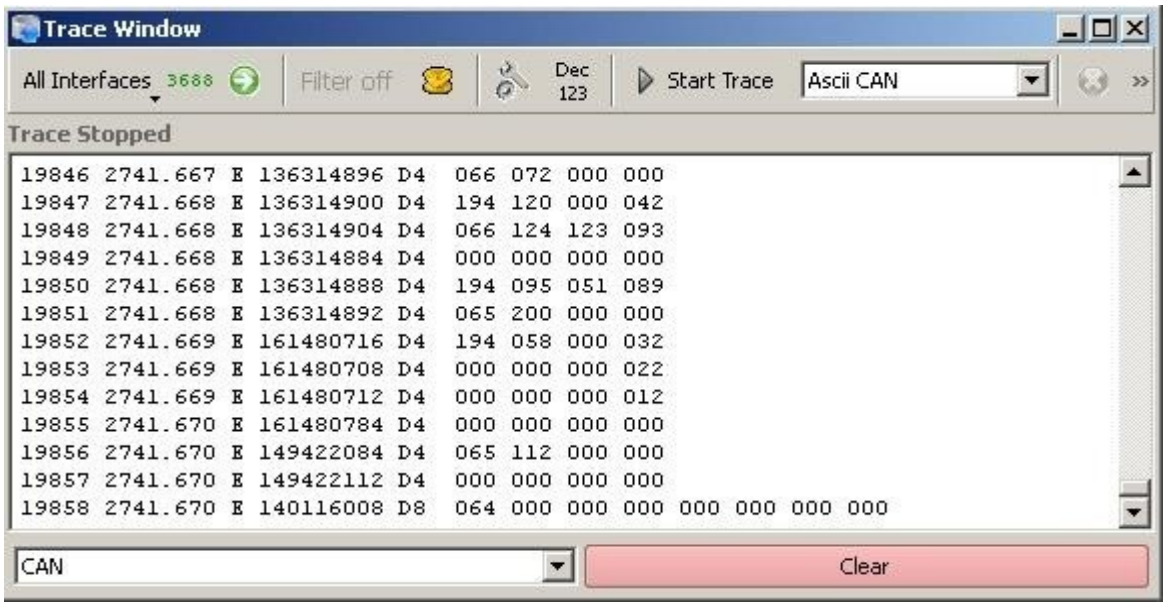
The messages are transmitted consecutively according to their order (top down) in the *Transmit* window.

5.4 Trace window

The *Trace* window displays all incoming CAN messages without overwriting messages with the same identifier. This allows recording all CAN messages and storing them in dedicated files for post recording analysis or a replay of the recorded CAN messages (Replay window).

The current software version only supports trace files in ASCII CAN format for a later replay (Trace format selection further below).

The *Trace Window* turns up as shown in the following example.

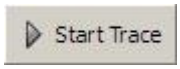


5.4.1.1 Object tool bar

Details about the common object tools see Object tool bars.

Besides these common object tools the toolbar of the *Trace* window provides the following button.

5.4.1.2 Start / Stop Trace



Display: Trace mode is not active.

Start trace mode.

Button:

Display: Trace mode is active, i.e. all incoming messages are recorded.

Button: Stops the trace mode. The recorded messages are stored in a trace record file (see following section *Trace mode status*).

5.4.1.3 Trace mode status

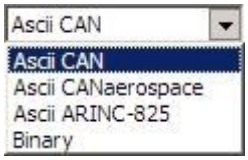
The line below the object tool bar shows the current status of the trace mode (*Trace Stopped* or *Trace Active*).

While the trace mode is active this line additionally shows the following information (see figure below):

- total number of recorded messages (followed by a slash).
- current size of the trace record file (after the slash).
- path and name of the file where the recorded messages will be stored after the trace mode has been stopped.

You can change the default setting for the trace record file path in the Preferences dialog (➥ Trace Defaults). The base file name is automatically generated. The extension depends on the currently selected Trace format (see following section).

5.4.1.4 Trace format selection



From this drop-down list box you can select the format that is used for the trace record file.

The choice also determines the file name extension:

- .xca for all *Ascii* formats
- .xcb for *Binary*

5.4.1.5 Message area (Trace)

The message area permanently lists the messages received via the selected interface(s) (see Interface control Input / Output of the object tool bar). If the buffer for the incoming messages has reached its maximum (about 20 000 messages, see first column of the list) no more messages are appended to the list. A tracing, however, can be started even if this limit has been exceeded.

If a profile has been loaded (➥ Profiles window) for the selected protocol (see the following section *Protocol select list*) the messages are interpreted according to the loaded profile and indicated in plain text.

The number and meaning of the indicated columns depends on the currently selected protocol (see *Protocol select list* further below).

5.4.1.6 Protocol select list (Trace)

From this drop-down list box you can select one of the following protocols:

- CAN
- CANaerospace
- ARINC 825

The selection in this drop-down list box affects the number and meaning of the indicated columns within the *Message area* (see further above). For further details see the specifications of the respective bus protocols (e.g. *CANaerospace Interface specification*) and the customer documentation for the individual product.

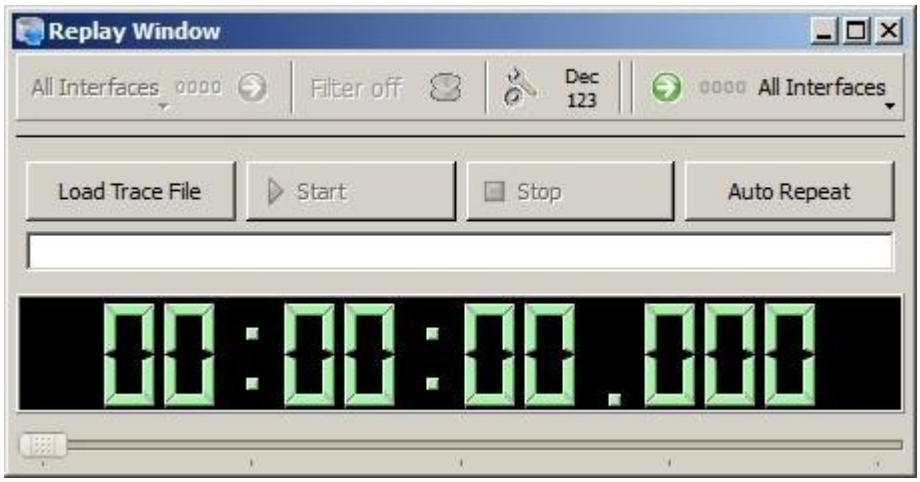
5.4.1.7 Clear button (Trace)

This button deletes **all** messages. The message counter (first column of the message area) is reset to zero.

5.5 Replay window

The *Replay* window is used to load, replay and send CAN messages, previously recorded and saved by the *Trace* window again to the CAN bus. The time intervals between the individual CAN messages during tracing are exactly reproduced by Replay. With this function, you can record full test routines and replay reproducible.

The *Replay* window turns up as shown in the following example.



5.5.1.1 Replay control buttons

Load Trace File This button opens the standard dialog to open a file.

The path is set to the *Trace Path* defined in the section Trace Defaults of the Preferences dialog and the file filter to .xca.

Start This button starts the currently loaded trace file and activates the [Stop] button. The button text changes to [Pause] (see below).

The [Start] button is greyed if no trace file is loaded.

Pause This button pauses the currently running Replay of the loaded trace file and reactivates the [Start] button in order to continue the interrupted Replay.

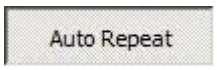
The button appears only while a Replay is running.

Stop This button terminates the currently running Replay of the loaded trace file and reactivates the [Start] and the [Load Trace File] buttons in order to start the loaded Replay file anew or to load a new Replay file.

The [Stop] button is greyed if no Replay is running.

Auto Repeat If this button appears as shown on the left, the *Auto Repeat* mode is **not** active, i.e. the transmission of CAN messages stops at the end of the loaded Replay file.

Press this button to activate the *Auto Repeat* mode.



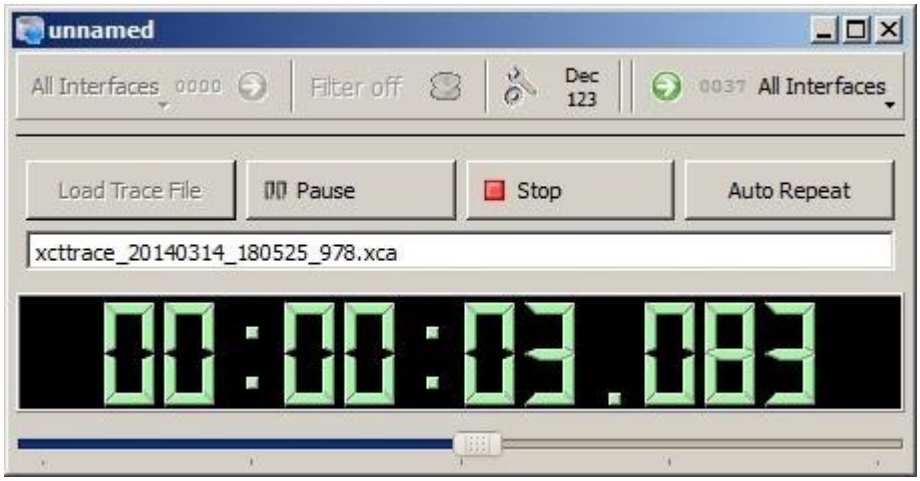
If this button appears as shown on the left, the *Auto Repeat* mode is active, i.e. if the end of the loaded Replay file has been reached, the transmission of the CAN messages restarts again and again from the beginning of the loaded Replay file.

Press this button to deactivate the *Auto Repeat* mode.

You can also activate or deactivate the *Auto Repeat* mode while a Replay is running.

5.5.1.2 Replay display elements

The following figure shows the appearance of the Replay window while a trace file is being replayed.



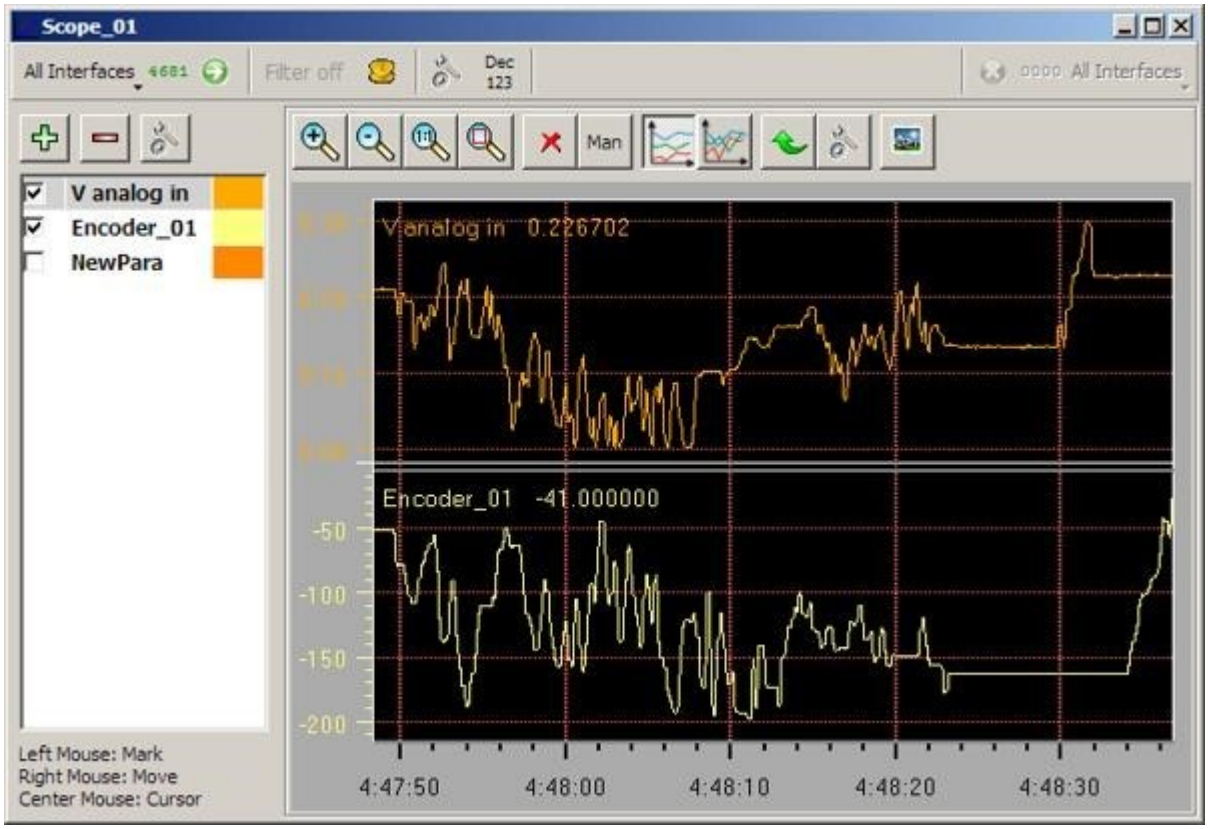
- Within the field below the control buttons the currently loaded trace file is shown.
- The digital display indicates the current time position of the replayed file with a resolution of 1/1000 second.
- The slider at the bottom of the dialog box shows the current point in time of the Replay relative to the total duration of the trace file.

5.6 Oscilloscope

The scope window allows displaying CAN messages representing analog or digital parameters in a graphical V(t) diagram.

Up to sixteen parameters per scope window can be overlaid or displayed separately. All parameters are color coded and may be given user-defined names for an easy identification.

Click on the items within the window to get more information about the respective items.



Object tool bar

Details about the toolbar options see Object tool bars.

5.6.1.1 Scope toolbar – channels section

This button adds a new scope channel to the scope window.

This button removes the previously selected scope channel from the scope window **without any warning**.

This button opens the Select Parameters dialog where you can define the parameters for the channel previously selected.

Please do not confuse this button with the same looking button in the display section of the scope toolbar (see further below).

5.6.1.2 Scope toolbar – display section

Zoom in stepwise.

Zoom out stepwise.

Reset zoom factor to the default setting after having used one of the other zoom options.

Zoom to a time window **previously** dragged with the mouse (see *Left mouse button* of the Mouse options in the display area.

Delete all displayed graphs.

Display: Auto display mode is active i.e., all channels are continuously sampled.

Button: Press this button to switch to manual mode.

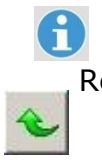
Display: Manual mode is active i.e., the current display of the graphs is frozen; the continuous sampling goes on in the background and will be indicated if you switch back to Auto display mode.

Button: Press this button to switch to auto display mode.

Select split mode, i.e., all channels are indicated one below the other.

The "pressed button" icon indicates that split mode is active.

Select mixed mode, i.e., all channels are indicated in one coordinate system with a common Y-axis. The "pressed button" icon indicates that mixed mode is active.



Resets all scope settings to default values, i.e.:

- zoom 1:1,
- all graphs deleted,
- auto mode active,
- split mode active,
- range is set to 60 sec.

This button opens the Oscilloscope Setup dialog where you can define the common oscilloscope display settings e.g. background color, grid on/off.

Please do not confuse this button with the same looking button in the channels section of the scope toolbar (see further above).

This button takes a snapshot of the current scope display and opens the standard dialog for saving a file. The file type is preset to .bmp.

5.6.1.3 Channels area

Columns in the *Channels area*:

Checkboxes – Names – Graph colors

Checkboxes Activate (deactivate) the checkboxes to display (hide) the respective graph in the scope display area.

Names Names of the defined channels/graphs (*NewPara* = default name after having added a new channel). The names can be edited in the Select Parameter dialog accessible via the button of the Scope toolbar – channels section.

Graph colors Selected color of the respective graph. The color can be defined in the Select Parameter dialog accessible via the button of the Scope toolbar – channels section.

Mouse option in the channels area

Double-click (left or right mouse button)

A double-click on a name or graph color field opens the Select Parameter dialog (same as the button of the Scope toolbar – channels section).

5.6.1.4 Display features

The legends of the individual graphs show the names (of the graphs), the current value of the input signal assigned to the respective channel and its unit. The names and units can be edited in the Select Parameter dialog accessible via the button of the Scope toolbar – channels section.

Y-axis scale Input voltage of the respective channel.

X-axis scale Time scale indicating the time that has been elapsed since the scope window has been opened.

5.6.1.5 Mouse options in the display area

Left mouse button

Use the left mouse button to define a time window that should be zoomed. Proceed as follows:

- Press the left mouse button at a time coordinate, hold it pressed and move the mouse to a second time coordinate to span a time window within the display area.
- Release the mouse button.

- Zoom the spanned time window to the size of the display area with the button.

Right mouse button

Use the right mouse button to move the display area along the time axis. This way you can display the complete history since you have cleared the display with the button.

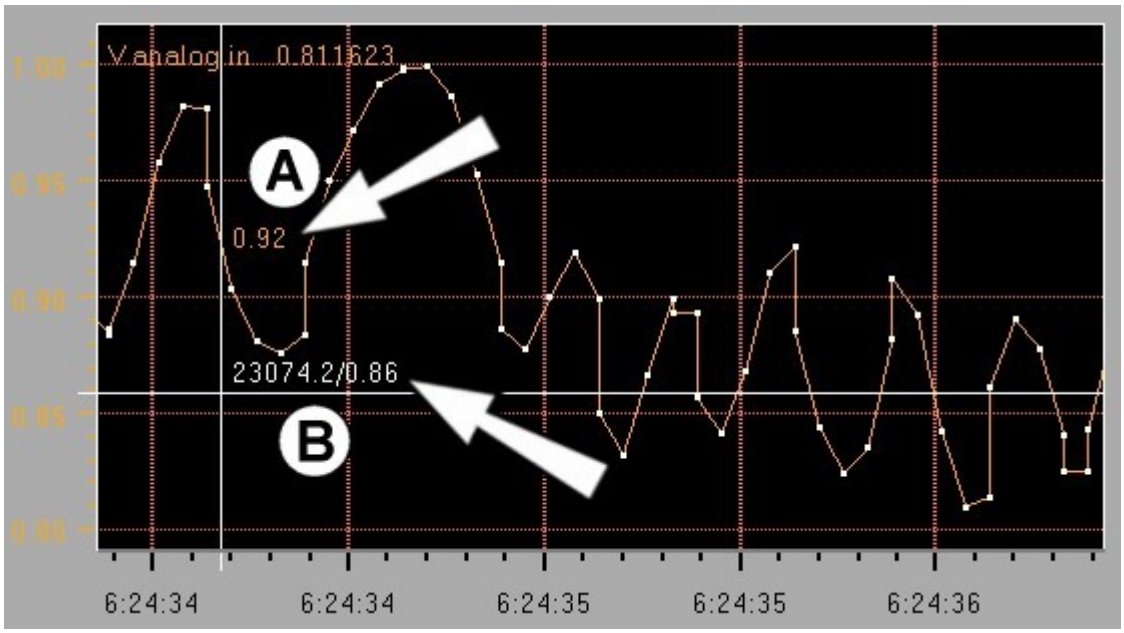
If the right mouse button is pressed, the display mode is automatically set to *Manual*.

Center mouse button

Use the center mouse button to superimpose a cursor which shows the X- and Y-coordinates of the intersection between the graph and the Xcoordinate of the cursor symbol (see following figure).

Proceed as follows:

- Press the center mouse button at any position within the display area, hold it pressed and move the mouse horizontally to the **time coordinate**, you want to analyze. The current coordinate values are indicated.
- **Do not release** the mouse button. The coordinate values are only displayed as long as the center mouse button is steadily pressed.



(A) **Y-coordinate** = value of the graph at the time the cursor is currently positioned on the time coordinate. The Y-position of the cursor is not relevant for this value.

(B) **Cursor coordinates** = current coordinates of the cursor:

The first value shows the time in seconds since the scope window has been opened (time coordinate).

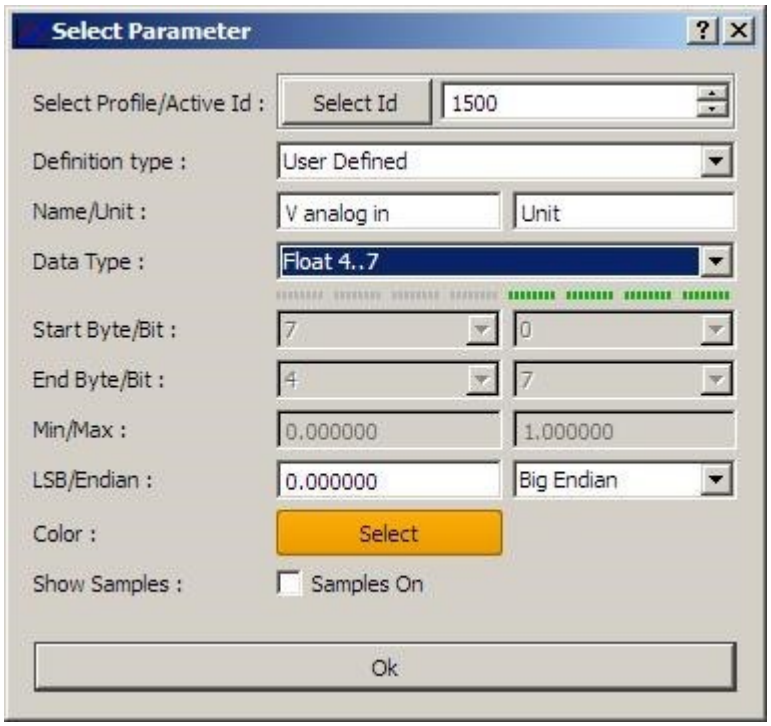
The second value (following the slash) shows the Y-coordinate value of the cursor.

The figure above shows the graph with the activated option *Samples on* of the Select Parameter dialog).

5.6.2 Select Parameter dialog (scope)

23 23
11 11 Accessible via the button of the Scope toolbar – channels section.

In this dialog you can define the parameters for the individual graphs (e.g. graph color) and the associated bus devices (e.g. Id, data type). For common definitions of the scope (e.g. background color, grid) see section Oscilloscope Setup.



Select Id

The [Select Id] button opens the Select Message dialog facilitating the selection of an Id via a loaded profile (➥ Profiles window).

Alternatively, you can enter an Id directly in the text box or change the displayed Id with the little arrow keys.

If a profile is loaded and the Id has been selected via the profile tabs *ARINC 825* or *CANaerospace* of the Select Message dialog the following parameters (with the exception of *Color* and *Show Samples*) are automatically set to the values defined for the respective Id.

Definition Type

Select a applicable option from the drop-down list. The selection affects the available parameters of this dialog.

Name/Unit

Enter any meaningful name for the concerning graph in the left text box and the corresponding unit in the right one. The name and unit are indicated in the area of the respective graph.

Data Type

Select the data type from the drop-down list that is used for the device assigned to the concerning graph by the chosen Id.

The line below the drop-down list shows the number of bits used by the selected data type.

Some of the following parameters may be greyed because they are not used or may not be changed for the selected *Definition type* or *Data type*.

Start Byte/Bit – End Byte/Bit

Min/Max

LSB/Endian

For details about these parameters see the ICD of the respective device or the specifications of the respective BUS protocol (e.g. *CANaerospace Interface specification*).

Color

Press the [Select] button to open the standard color selection dialog to define the color for the graph in the scope area.

Show Samples

If the *Samples on* checkbox is activated the sample coordinates are marked by white dots.

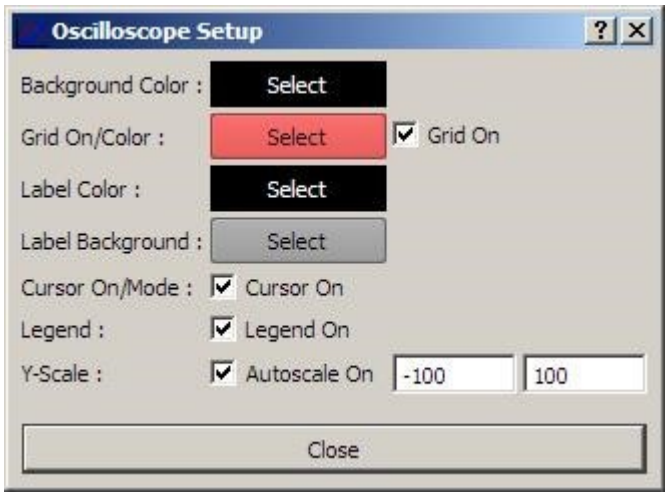
If the sample coordinates are too close together so that the points touch or overlap, the graph does not appear in the selected color, but as a

bold white line.

5.6.3 Oscilloscope Setup dialog

23 23
11 11 Accessible via the button of the Scope toolbar – display section.

In this dialog you can define common settings of the scope (e.g. background color, grid). For the parameters of the individual graphs and the associated bus devices see section Select Parameter dialog (scope).



Most of the parameters in this dialog are self-explanatory. In the following you will find additional explanations for some parameters.

Label Color This parameter defines the color of the graduation lines and coordinate values of the X-axis (time scale).

Cursor On/Mode If this check box is active (default setting) you can use the *Cursor* option (see *Mouse options in the display area – Center mouse button* in the section Display features.

Legend This check box switches on / off the display of the legend in the scope area (see Display features).

Y-Scale If the *Autoscale On* check box is active (default setting) the scaling factor of the Y-axis automatically is adapted to the current signal range of the respective channel.

The scaling factor is basically determined by the signal sequence within the current scope area.

If *Manual mode* is active **and** the amplitude of the signal on the bus exceeds the display range of the signal sequence within the scope area, the scaling factor is adapted according to the amplitude of the current bus signal.

While moving the scope area along the time scale (with the right mouse button) the amplitude of the current bus signal is ignored.

If the *Autoscale On* check box is deactivated, the scale of the Y-axis is determined by the values, entered in the text boxes.

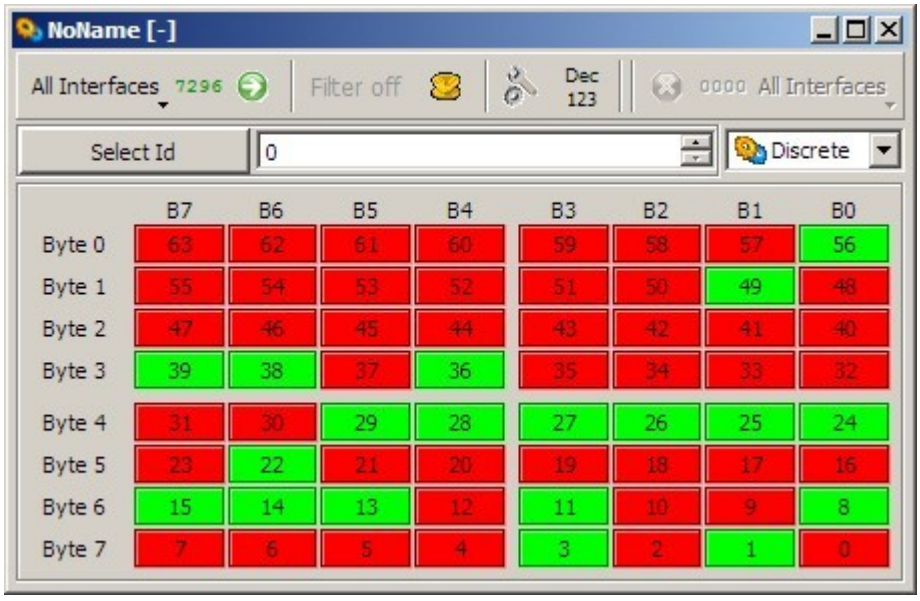
The value in the left text box must be less than the value in the right text box.

5.7 *Data Visualization* window

23 23
11 11 Accessible by double-clicking on *Add Data Visualization* in the Active Objects window or on any CAN message in the Receive window.

The *Data Visualization* window turns up as shown in the following example.

Click on the items within the window to get more information about the respective items.



Object tool bar

Details about the common object tools see Object tool bars.

Select Id (Data Visualization)

The [Select Id] button opens the Select Message dialog which offers various possibilities for selecting an Id. After having closed the *Select Message* dialog, the selected Id is added to the *Single Id Filter* list.

Alternatively, you can enter an Id directly in the text box or change the displayed Id with the little arrow keys. The selected Id is valid for all display modes (see following drop-down list box).

Display modes (Data Visualization)

From this drop-down list box you can select one of the following display modes for the BUS messages:

Discrete display mode (default – see figure on the left)

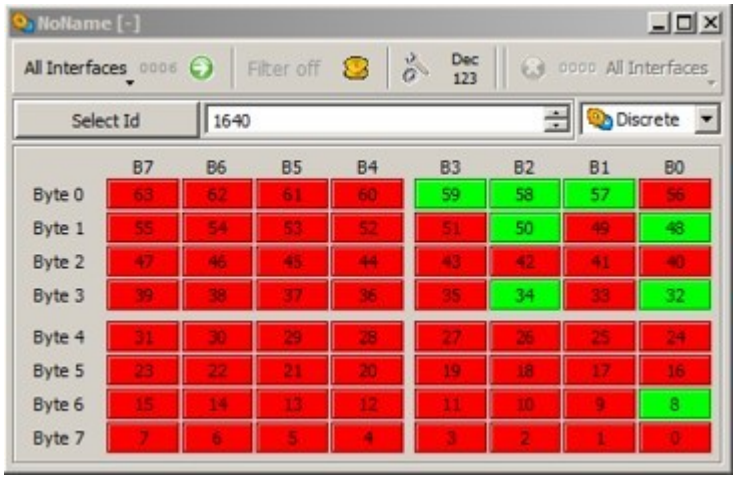
- Dial display mode (appearance like a speedometer)
- Numeric display mode (numeric digital display)

Discrete display mode

The *Discrete* display mode shows the current states of the individual bits for the selected Id.

The CAN ID filter is automatically set to the CAN Id of the CAN message line from which the *Data Visualization* window has been opened.

The green color indicates the active status of the respective bits.



Meaning of the individual Bytes

Byte 0: Node Id
Byte 1: Data type

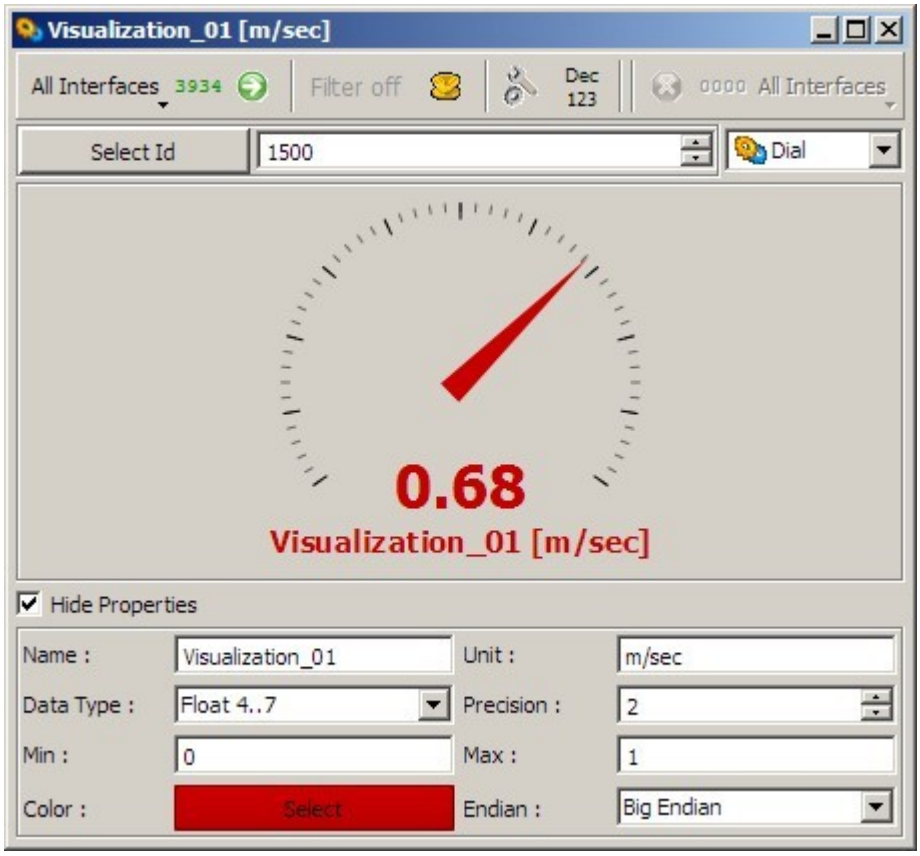
Byte 2: Service code
Byte 3: Message code
(Message Id)
Byte 4 to Byte 7: Message data (data type specific; not

all Bytes are used depending on the selected data type)

For further details see the specifications of the respective bus protocols (e.g. *CANaerospace Interface specification*) and the customer documentation for the individual product.

Dial display mode

The figure below shows an example of the *Dial* display mode.



Hide Properties Use this checkbox to hide or show the properties area in the ***Show Properties*** lower part of the dialog.

Name Enter an appropriate name for message visualized in this window.

The text entered here is displayed in the title bar and underneath the speedometer.

Unit

Enter an appropriate name for the unit of the message that is visualized by the speedometer representation.

The text entered here is displayed in the title bar and underneath the speedometer.

Data Type

From this drop-down list box select the data type of the message currently defined by the Id (see [Select Id] button at the beginning of this section).

Precision

The value in this text box determines the number of decimal places of the numerical display underneath the speedometer.

Min / Max

The value in these text boxes determine the lower and upper limit values for the speedometer representation.

Color

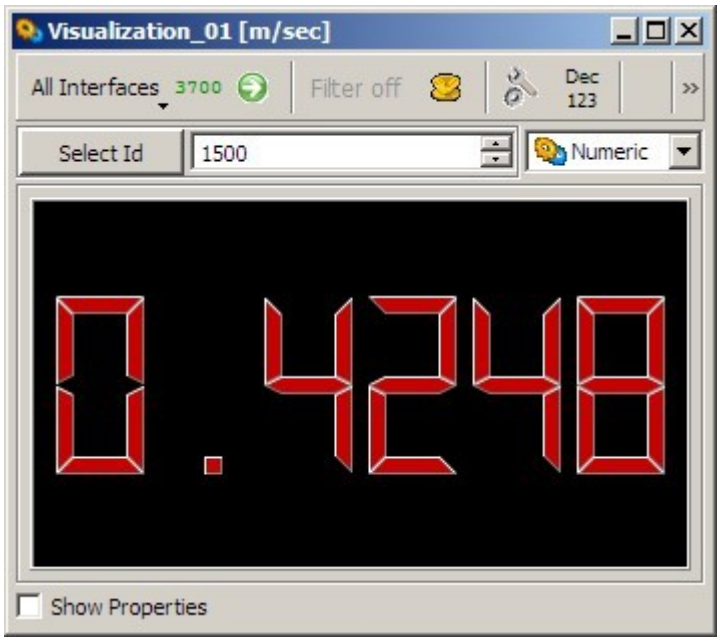
Click on the colored *Select* area to open the standard color selection window, if you want to change the color of the speedometer representation and the numerical display (including name and unit).

Endian

From this drop-down list box select the *Endian* type of the message currently defined by the Id (see [Select Id] button at the beginning of this section).

Numeric display mode

The figure below shows an example of the *Numeric* display mode where the *Properties* area is hidden. The content of the properties area is the same as for the Dial display mode.



5.8 Node Service window

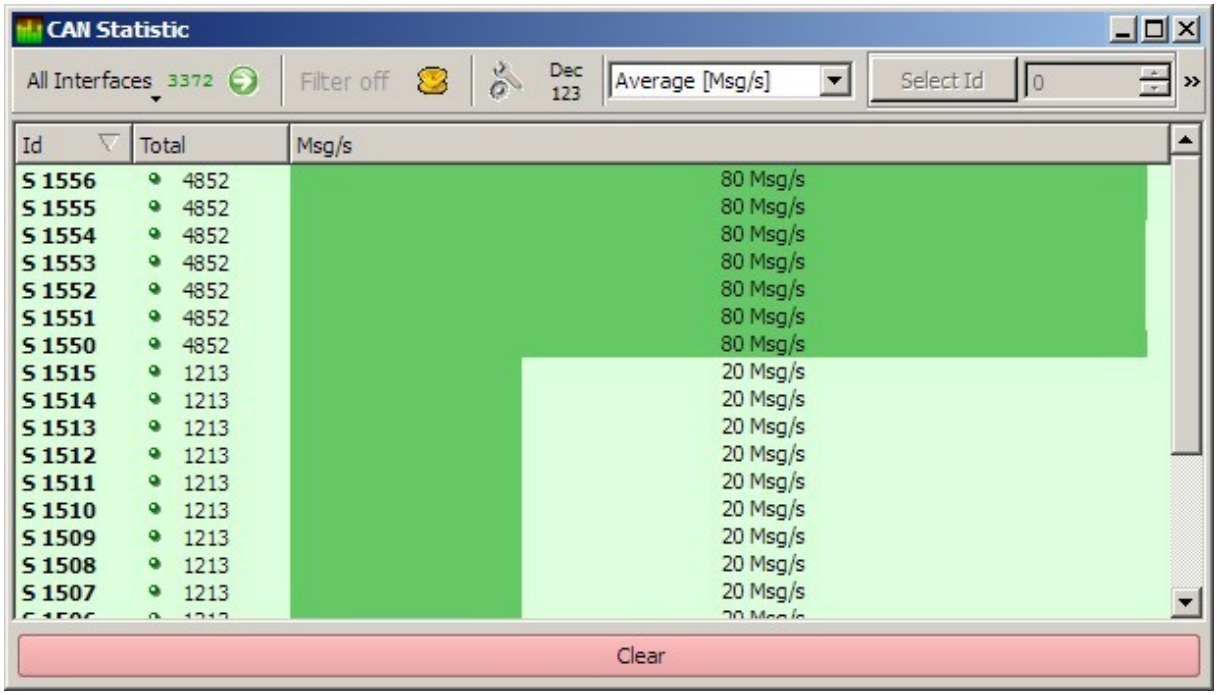
TBD – not yet used in the current program version

5.9 CAN Statistic

23 23
11 11 Accessible by double-clicking on *Add CAN Statistic* in the Active Objects window.

The *CAN Statistic* window turns up as shown in the following example.

Click on the items within the window to get more information about the respective items.



Object tool bar

Details about the toolbar options see Object tool bars.

5.9.1.1 Display mode selection

The *CAN Statistics* object window provides the following modes to display the network traffic:

Average display mode (default – see figure on the left)

Period Time display mode

- Spreading display mode
- Bus Load Total display mode

5.9.1.2 Id selection

This option is available only in Spreading display mode.

The [Select Id] button opens the Select Message dialog which offers various possibilities for selecting an Id.

Alternatively, you can enter an Id directly in the text box or change the displayed ID with the little arrow keys.

5.9.1.3 Average display mode

This mode provides a combined graphic/numeric display of the network traffic showing all received messages and the message frequency (Msg/s) for all Ids.

The display area consists of the following columns.

Id Ids of the received messages.

A double-click on an Id activates the Spreading display mode for the respective Id.

Total Total number of the received messages for the individual Ids since

- the window has been opened or
- the display mode has been changed or
- the message counters have been reset by the [Clear] button.

The colour of the little dot left of the total number indicates whether messages are currently received from the respective Id (green dot) or not (red dot).

Msg/s Average values of received messages per second for the individual Ids.

Green bars Graphic display of the network traffic.

Resets the message counters (column *Total*) of all Ids to

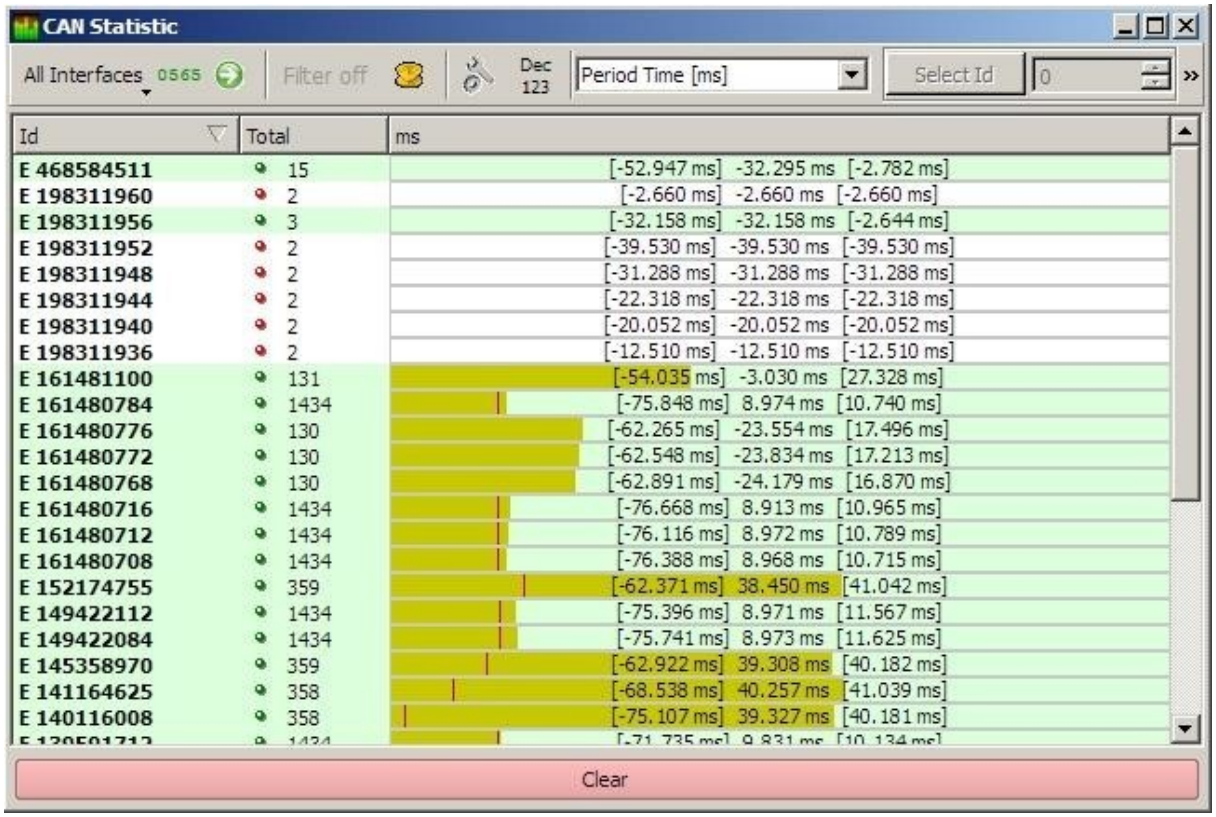
zero.

Click on the various column headings to sort the list by different criteria. A second mouse click on the previously selected column

heading reverses the sort order.

5.9.1.4 Period Time display mode

This mode provides a combined graphic/numeric display of the network traffic showing all received messages and their time intervals [ms].



The display area consists of the following columns.

Id Ids of the received messages.

A double-click on an Id activates the Spreading display mode for the respective Id.

Total Total number of the received messages for the individual Ids since

- the window has been opened or
- the display mode has been changed or
- the message counters have been reset by the [Clear] button.

The colour of the little dot left of the total number indicates whether messages are currently received from the respective Id (green dot) or not (red dot).

ms Time intervals for the messages of the individual Ids ([min. value] average [max. value]).

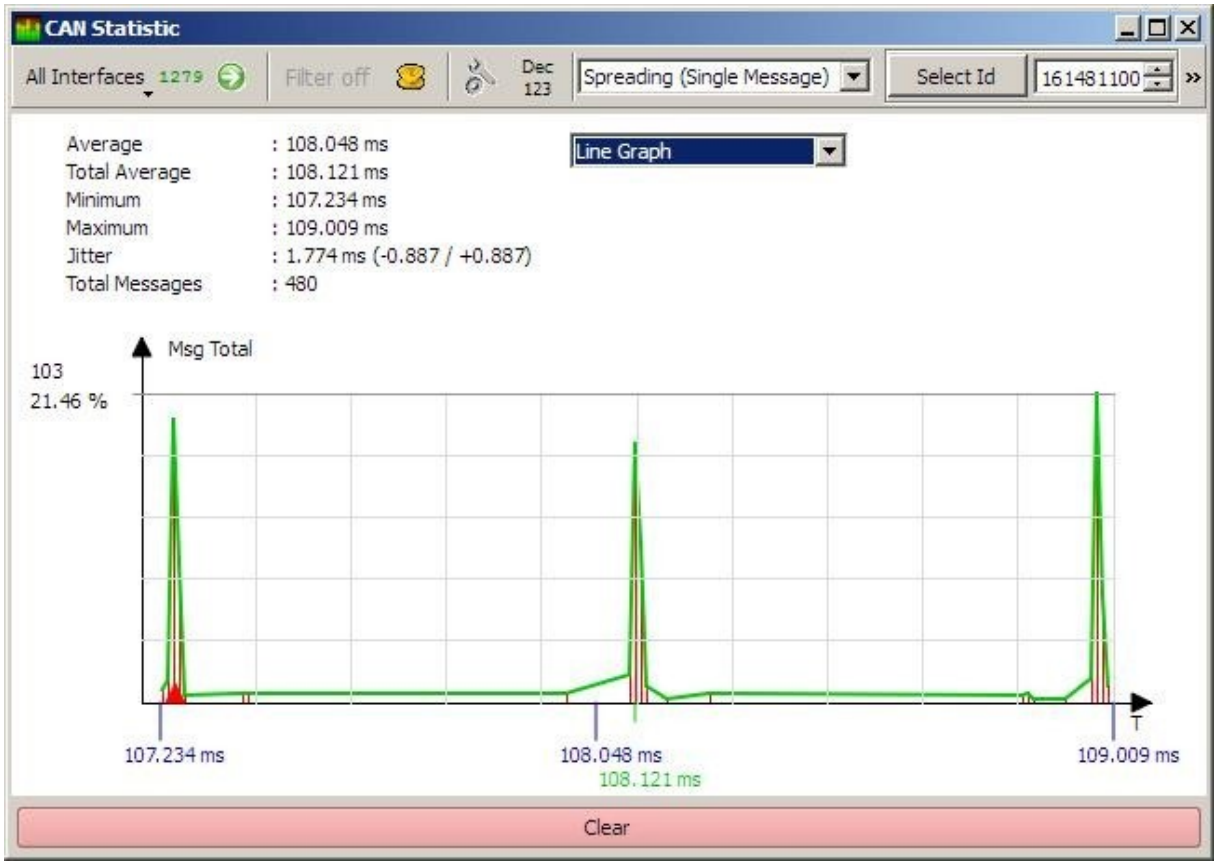
Ocher-colored bars Graphic display of the network traffic.

Clear Resets the message counters (column *Total*) of all Ids to zero.

Click on the various column headings to sort the list by different criteria. A second mouse click on the previously selected column heading reverses the sort order.

5.9.1.5 Spreading display mode

This mode provides a graphic/numeric display of the jitter analysis for the selected ID.



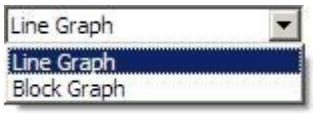
Average Average over a time window of about 0.3 sec; the messages of the last 0.3 sec are only evaluated.

Total Average Average over the total number of messages received during the total current measuring time (started either by opening the *CAN Statistics* window or after having pressed the [Clear] button).

Maximum / Minimum Max. / min values detected during the total current measuring time.

Jitter Total jitter range and in brackets the +/- aberrations from the average value of the jitter.

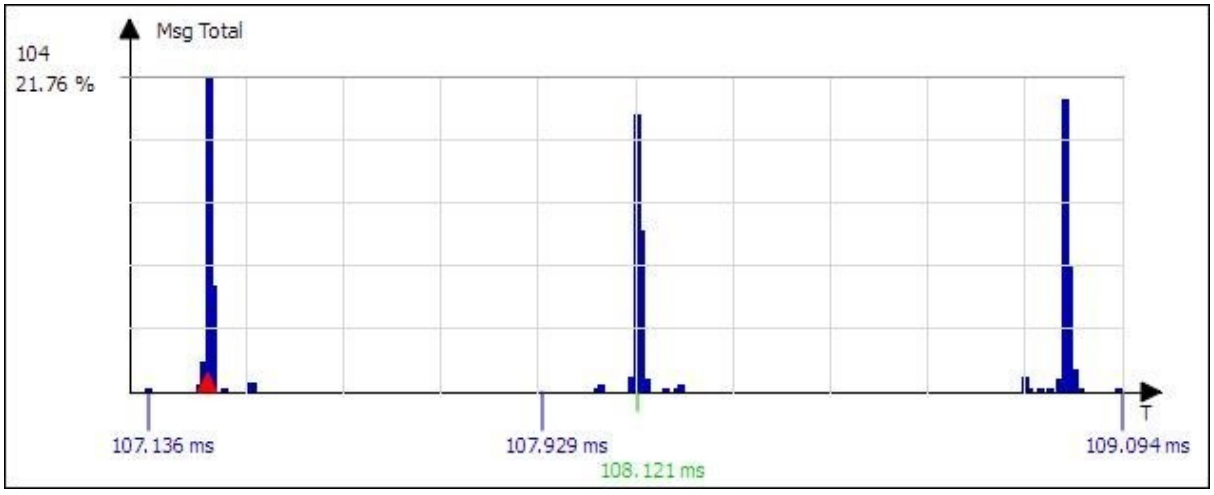
Total Messages Total number of messages received during the total current measuring time.



You can choose two different types of graphical representation:

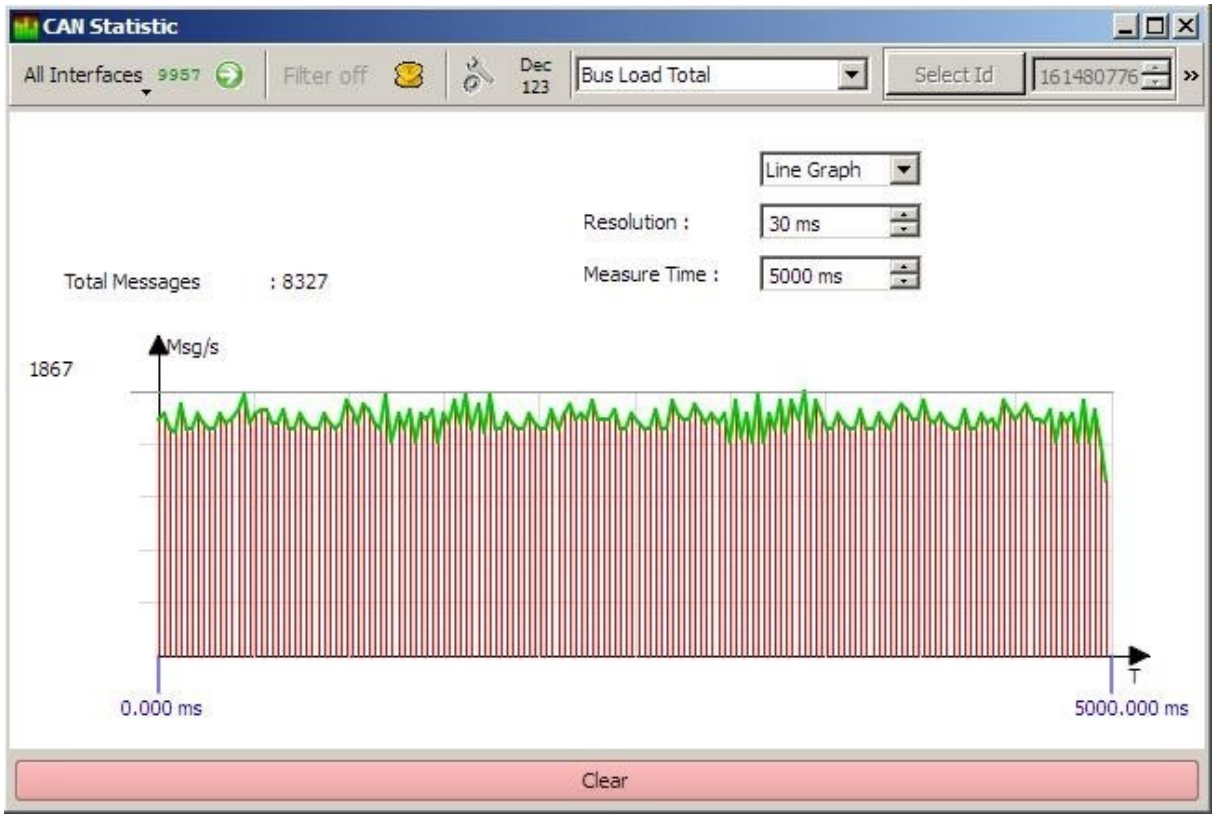
- Line Graph (see figure above) or
- Block Graph (see following figure).

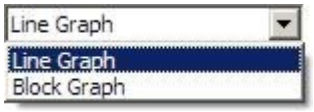
Resets all values to zero and starts a new evaluation.



5.9.1.6 Bus Load Total display mode

This mode provides a graphic/numeric display of the network traffic showing the messages per second based on all received messages.





You can choose two different types of graphical representation:

35/17 Line Graph (see figure above) or 35/17 Block Graph (see figure below).

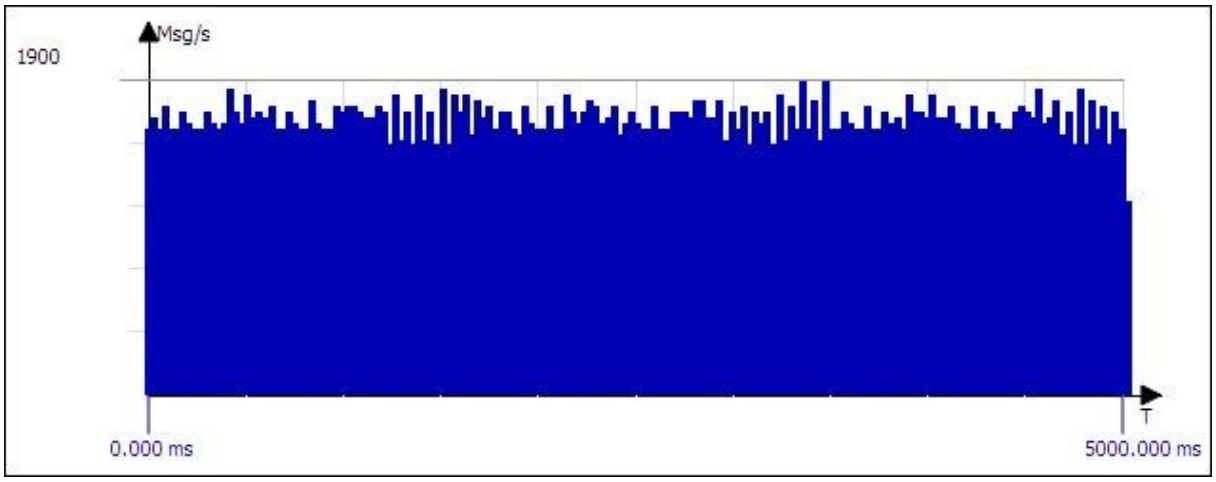
Resolution Time window for the calculation of one measuring point for the graphical representation.

Measure Time Total time for an evaluation period.

Total Messages Total number of messages received during the set *Measure Time*.

***Msg/s* (A)** Maximum value of the calculated message frequency (messages per second).

Resets all values to zero and starts a new evaluation.


Msg/s
1900
0.000 ms
5000.000 ms
T

6 Application examples for an XCT project

6.1 Information needed to define a project

Before starting an XCT project the following preparations are required:

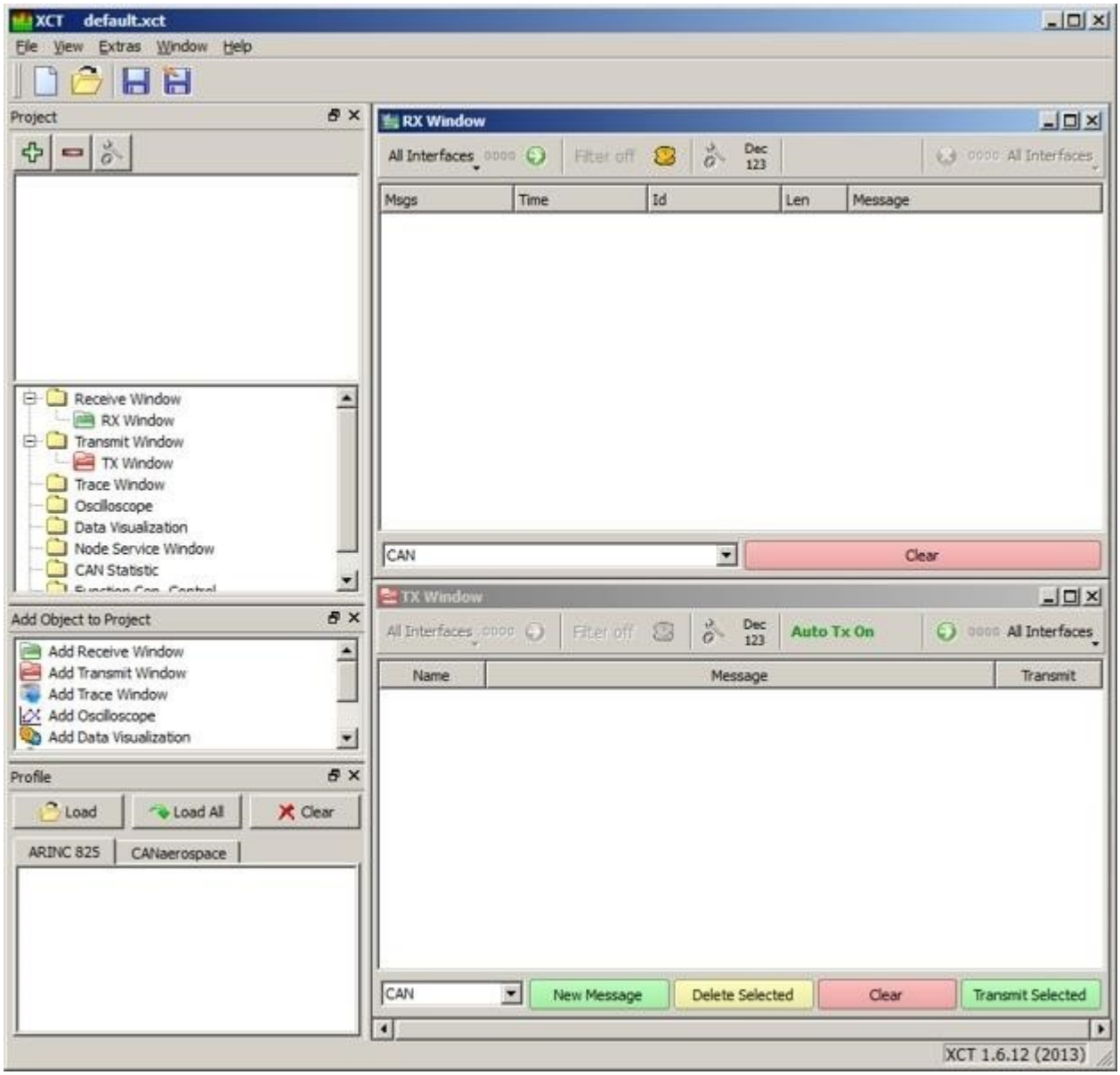
- The ICDs of the items (LRUs) that should be tested must be available.
- The required test equipment (in the examples explained a CANflight module is used) must be connected and configured (the IP addresses of the computer and the CANflight module must be known). For details about the CANflight module see the CANflight User´s manual available via the download area of Stock Flight Systems.
- XCT must be installed.

6.2 Creating a new XCT project

To create an XCT project proceed as follows:

1. Launch XCT.

   ☞ If you are running XCT the first time after installation, the program window appears with the default setting as shown in the following figure. An empty Receive Window (*RX Window*) and an empty Transmit Window (*TX Window*) are already open.



If the XCT has already been used the appearance of the program window depends on the previous history. In this case the following two steps are recommended.

2. Create a new project (button in the Main toolbar).

3. Add a Receive Window and a Transmit window to the new project (Add Object to Project window) in order to get the same initial situation as shown in the figure above.

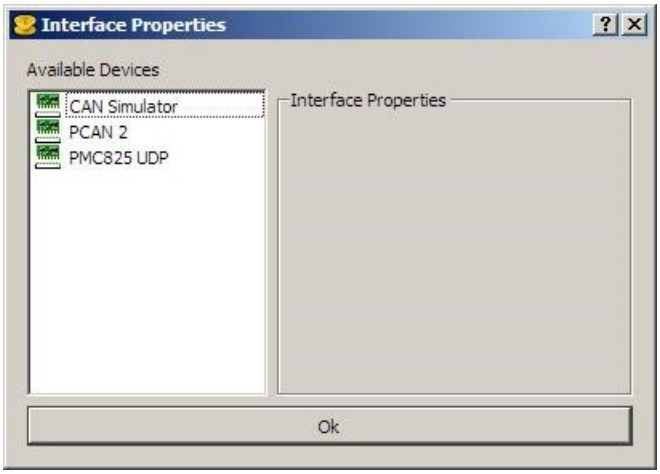
Add the interface that is to be used as follows:

4. Click on the button of the Interface toolbar.

5. Select the *unnamed* interface entry in the Connections Area by a simple mouse click.

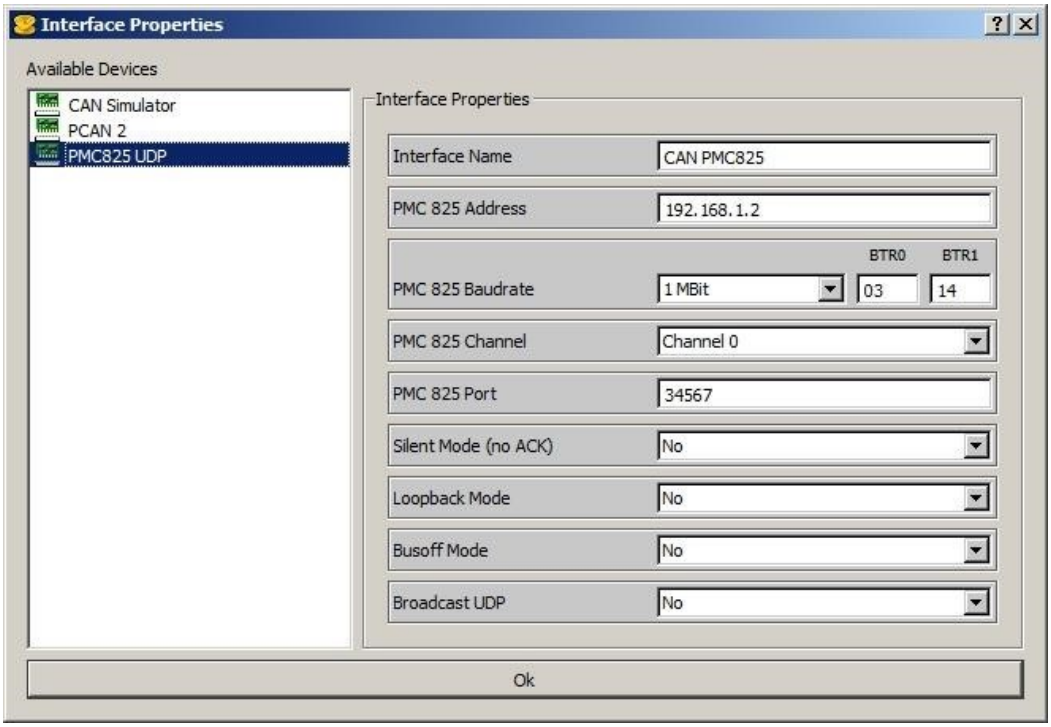
Set the interface properties (in this example a PMC825 Ethernet UDP interface is used to communicate with the CANflight module.) For this:

6. Click on the button of the Interface toolbar to open the *Interface Properties* dialog (see figure below).

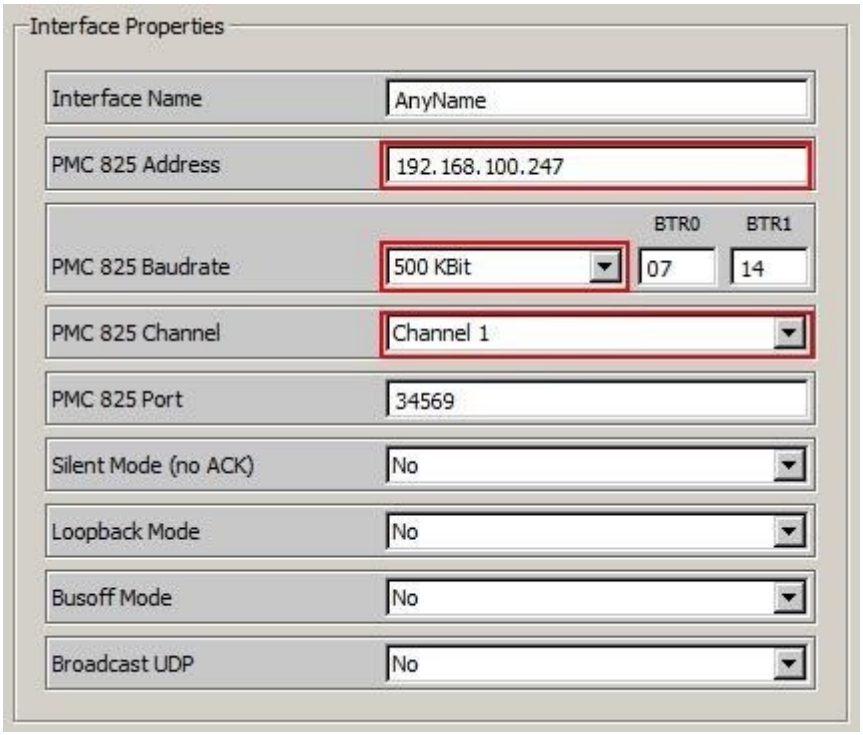


7. Select the *PMC825 UDP* entry of the *Available Devices* by a simple mouse click.

The *Interface Properties* area (on the right of the *Interface Properties* dialog) shows the parameters available for the *PMC825 UDP* interface and their default values (see following figure).

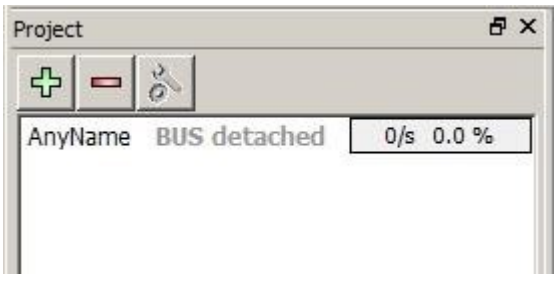


8. Change the following values (according to the system that is to be tested). The red bordered parameter values are important.



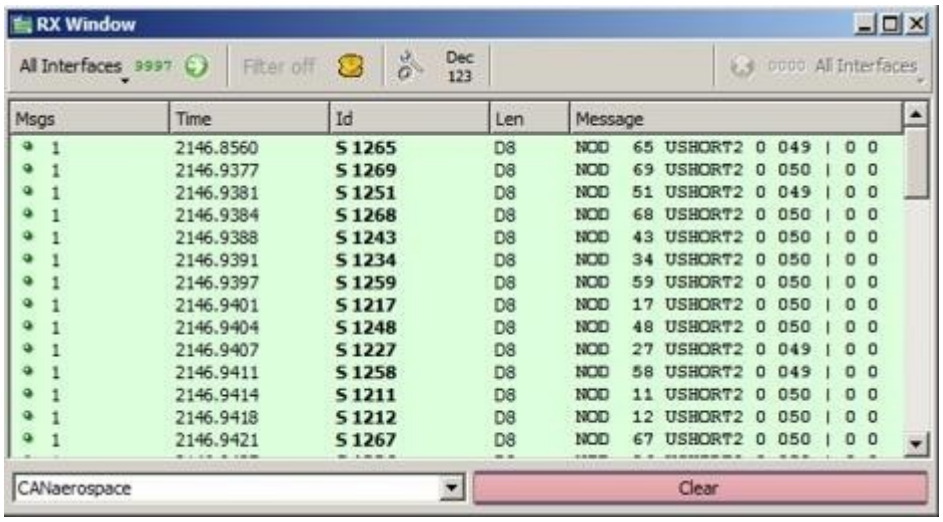
9. Accept the setting with [OK].

The interface entry in the Connections Area shows the previously defined name.



10. Click on ***BUS detached*** in order to open the bus connection. If the bus connection can be established according to the current settings the ***BUS detached*** text changes to ***BUS open*** in green letters (Connections area).

As soon as the bus is open the Message area of the *Receive window* shows as many Heartbeat messages as operational CAN based LRUs (capable to send Heartbeat messages) are currently connected to the bus.



6.2.1.1 Preconditions

Unless otherwise noted, the following preconditions must be fulfilled for the examples given in this sections:

- The CAN Id filter must be disabled (*Filter off* is indicated in the *Object tool bar*; ➥ Filter on/off)
- **or** suitable CAN Ids must be defined in the CAN Id filter setup dialog (➥ Filter setting and Setting of CAN Id filters).

- CANaerospace must be selected from the Protocol select list.
- The display mode must be set to *Dec/123* mode (➥ Decimal/Hex display).

- The correct interface (or *All interfaces*) must be selected (→ Interface control Input / Output).

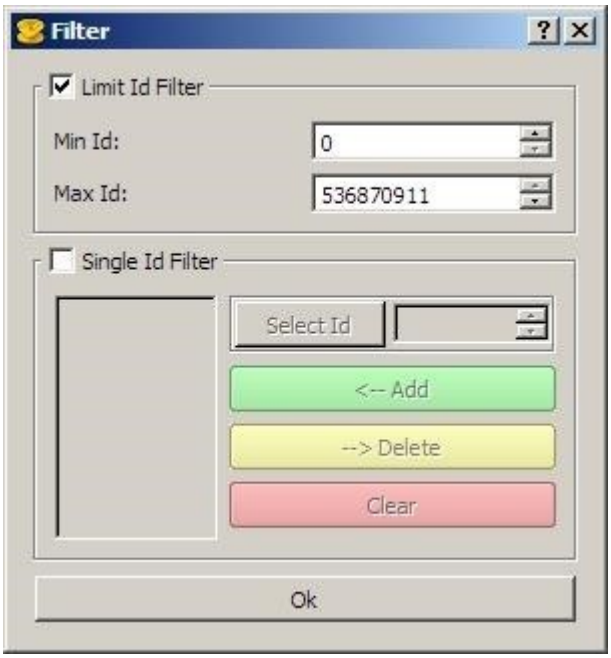
- The currently selected interface(s) must be enabled (in the *Object tool bar*; → Interface control Input / Output).

6.3 Setting of CAN Id filters

If many CAN based LRUs are simultaneous connected to the CAN bus the number of received messages (e.g. Heartbeat messages) may be confusing. In order to avoid this problem, you can set a filter for CAN Id messages as described below.

1. Click on the filter button in the Object tool bar.

→ The Filter dialog appears (the figure below shows the default settings).



2. Enter meaningful min. and max. values for the CAN Ids according to the specifications given in the respective ICDs (e.g. Min Id = 1500, Max Id = 1800) and confirm with [OK]. For further details see Filter setting.

3. Activate the filter setting with the button in the Object tool bar.

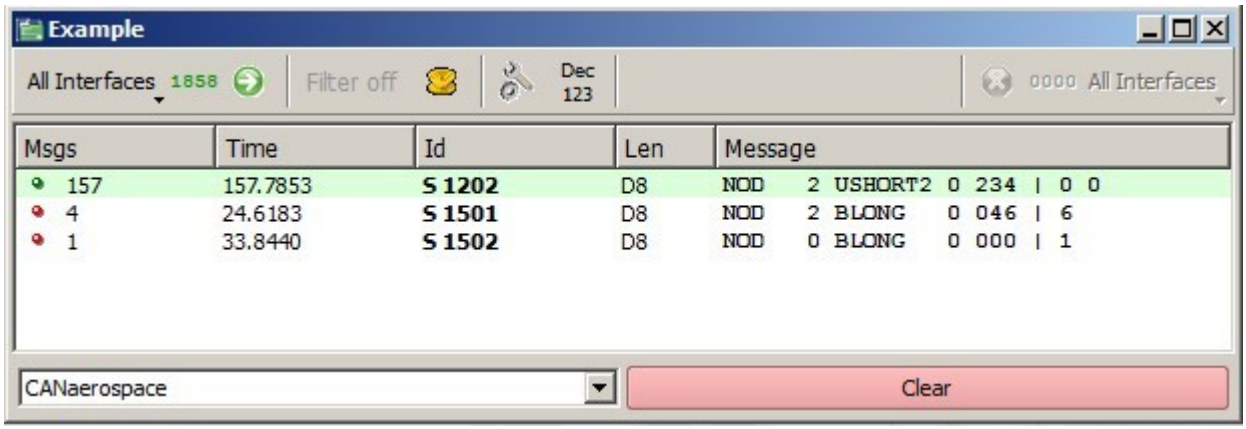
↣ The appearance of the button changes to .
Now only the messages defined within the CAN Id range are indicated.

Note: The button shows the current status of the filter option.

6.4 Receiving messages

All messages appearing on the connected and enabled CAN bus and matching the filter definitions are indicated in the message area of the RX window (see **Preconditions** at the end of section Creating a new XCT project).

Messages sent from the XCT Transmission window also appear in the RX window (if all relevant preconditions are fulfilled).



The individual columns of the message area are described in the following table.

6.4.1.1 Column Meaning

Msgs	Bullet / background color: red / white: no message active green / green: receiving a message

Number:
received messages for the respective CAN Id since the *Receive window* has been opened **or** the [Clear] button has been pressed.

Time Message timestamp:
Time that has elapsed since the respective bus has been opened (unit: seconds, precision: 100 microseconds = 4 decimal places).

Detaching the bus and opening it again resets the time counter.

The [Clear] button **and** the time at which the window has been opened do not influence the time value.

Id CAN Ids of the respective messages (see ICDs of the associated items (LRUs)).

Column	**Meaning**
Len	Message length in Byte (depends on the data type of the respective message e.g. D8 = 8 Byte for data type *BLONG*).
Message	Example of the third line in the figure above (for this example **decimal** notation is selected (Decimal/Hex display):

```
NOD    0    BLONG    0    000 |  1

  |     |        |      |      |       |
  |      |      |      |      |     Message data section (data type
specific)
  |     |        |      |     Message Id (Message code)
  |     |        |     Service code
  |     |       Data type e.g. BLONG for discrete messages
  |    Node Id
Message type e.g. NOD = Normal Operation Data
```

For further details see the specifications of the respective bus protocols (e.g. *CANaerospace Interface specification*) and the customer documentation for the individual product.

6.4.2 Receiving a discrete message

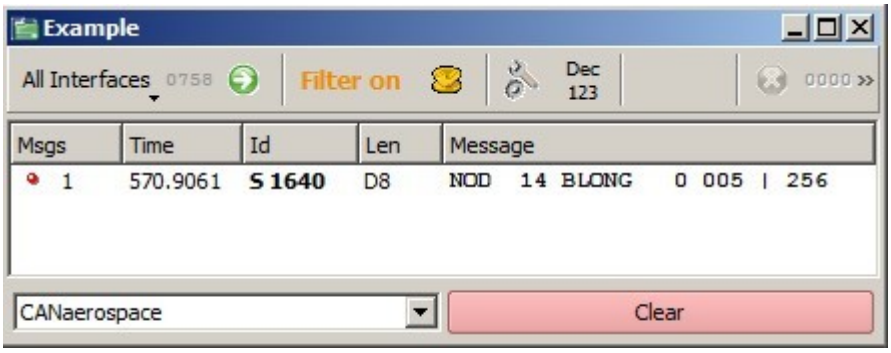
Proceed as follows:

1. Connect a LRU with at least one simple switch to the test system (or select the respective panel from the *Virtual Cockpit*).

2. Make sure that filter setting of the RX window is suitable (Setting of CAN Id filters).

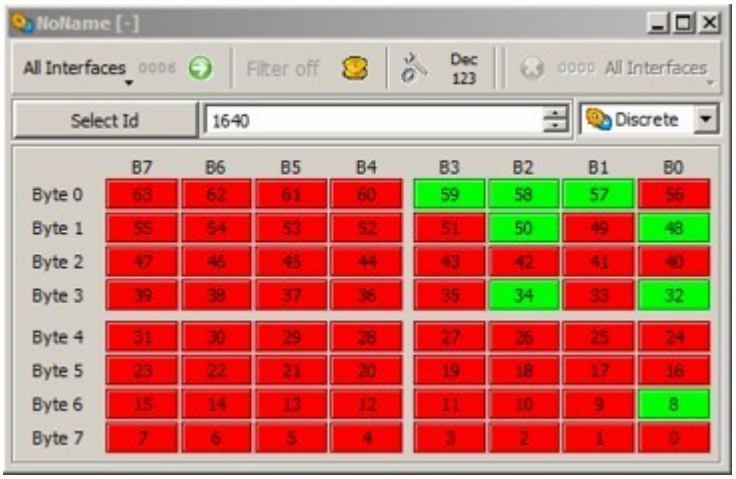
3. If necessary clear the message area of the RX window or open a new RX window.

4. Operate a simple switch on the connected LRU (or of the panel of the *Virtual Cockpit*). A line with the respective CAN message is added to the message area of the RX window (see following figure).



See Receiving messages for explanations of the individual parameters.

5. A double-click on the CAN message line opens the Data Visualization window showing the values of the respective CAN message line in Discrete display mode.



Operating any switch of the panel assigned to the selected CAN Id (see the respective ICD) the current bit status of the switch is indicated by the color of the associated bit field in the data byte area (Byte 4 to Byte 7).

6.4.3 Receiving an analog message

Proceed as follows:

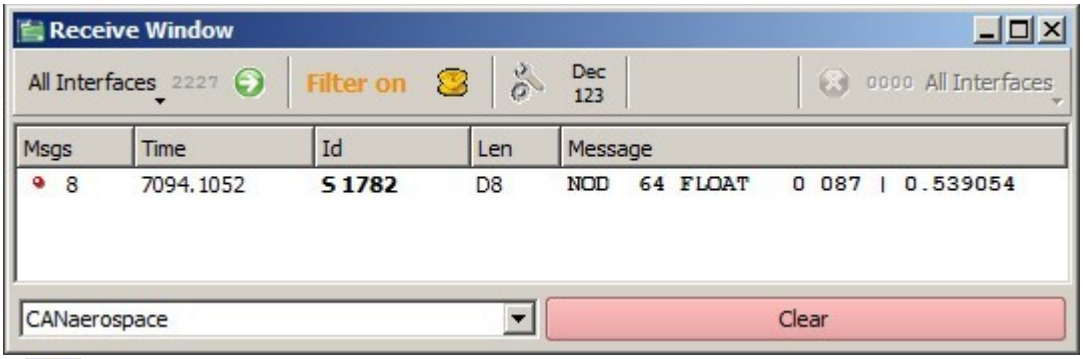
1. Connect a LRU with at least one analog control element (e.g. a potentiometer) to the test system (or select the respective panel from the *Virtual Cockpit*).

2. Make sure that the filter setting of the RX window is suitable (Setting of CAN Id filters).

3. If necessary clear the message area of the RX window or open a new RX window.

4. Operate an analog control element (e.g. a potentiometer) on the connected LRU (or of the panel of the *Virtual Cockpit*).

A line with the respective CAN message is added to the message area of the RX window (see following figure).



See Receiving messages for explanations of the individual parameters.

5. Double-click on the CAN message line opens the Data Visualization window showing the values of the respective CAN message line in Discrete display mode.

6. As analog messages cannot be easily interpreted in *Discrete* display mode, select *Dial* or *Numeric* mode from the Display modes drop-down list box.

Operating the analog control element of the LRU assigned to the selected CAN Id (see the respective ICD) the indicator and/or the numeric value of the *Data Visualization* windows depicted above follows the position of the control element.

The default setting for the permitted range is 0.0 to 1.0. If required, you can set any other range for the speedometer representation via the parameters *Min* and *Max* in the properties area of the *Dial display mode* dialog.

6.5 Sending messages

Messages of any data type (e.g. BLONG for discrete messages or FLOAT for analog messages) can be sent from one *Transmit window* (TX window). For each data type (and, if desired for each CAN Id) you can define an individual message item within one TX window.

Each message item consists of a parameter section and a data section (see figure below). The appearance of the parameter section depends on the currently selected protocol (Protocol select list), the appearance of the data section depends also on the currently selected protocol and additionally on the selected data type (e.g. BLONG).

Parameter section | Data section

6.5.1.1 Parameter section

The meaning of the individual parameters of the parameter section is described in the following table.

6.5.1.2 Parameter Meaning

CanId CAN ID of the individual item of a LRU according to the ICD. A correct input is always required.

Mode Default setting (depending on the currently selected protocol (Protocol select list) can usually be accepted.

NodeId Usually not required for sending messages.

Data Type Required to define the data type for the message (e.g. BLONG for discrete messages or FLOAT for analog messages);

The selected data type influences the appearance of the data section.

Service Service code (0 in the example) and short name if the Service (IDS in the example).

MsgId The Message Id or Message code is used for numbering messages and is usually not required for sending messages.

For further details see the specifications of the respective bus protocols (e.g. *CANaerospace Interface specification*) and the customer documentation for the individual product.

6.5.1.3 Data section

The data sections for discrete and analog messages are described in the following sections (Related topics).

6.5.2 Sending a discrete message

Proceed as follows:

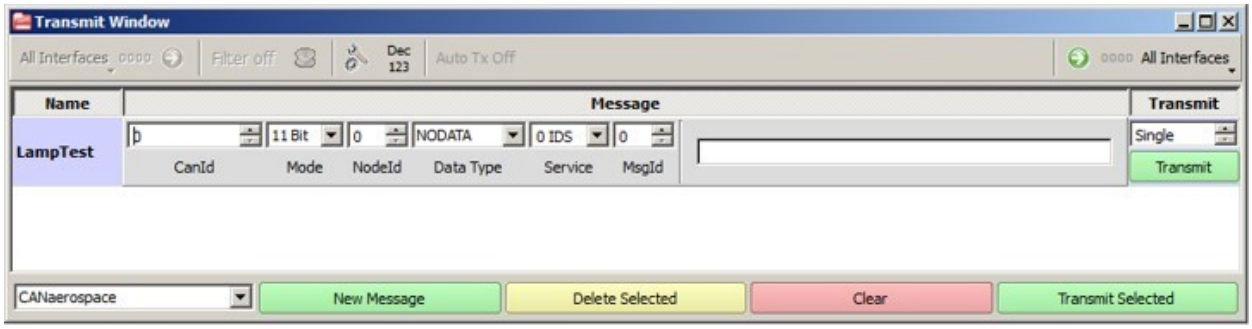
1. Connect a LRU with at least one indicating element (e.g. a lamp) to the test system (or select the respective panel from the *Virtual Cockpit*).

2. Add a *Transmit window* (TX window) to your project, if necessary (Add Object to Project window).

3. For this example make sure that Auto transmission is **not** active.

4. Add a new message item to the TX window and define a meaningful name.

5. The RX window now looks like the following figure



6. Set the parameters of the message line according to the specifications of the respective ICD. Normally the *CAN Id* is sufficient and the *Data Type* has to be set to *BLONG* for discrete messages.

As soon as the *Data Type BLONG* has been selected the message data area shows the input boxes for discrete data input as shown in the figure below.

7. Set the bit number according to the specifications of the respective ICD by activating the respective check box.

A little hook indicates that the respective bit is set to "1".

8. Press the green [Transmit] button right of the data input boxes to send the discrete message to the LRU identified by the CAN Id.

The lamp associated to the bit number that has been activated by the data input boxes lights up.

9. If you activate Auto transmission a message is transmitted immediately after having changed any parameter or data so it is not necessary to press the green [Transmit] button.

10. As an additional feature you can send the message repeatedly in a defined interval by selecting a repetition time (Transmit options).

6.5.3 Sending an analog message

Proceed as follows:

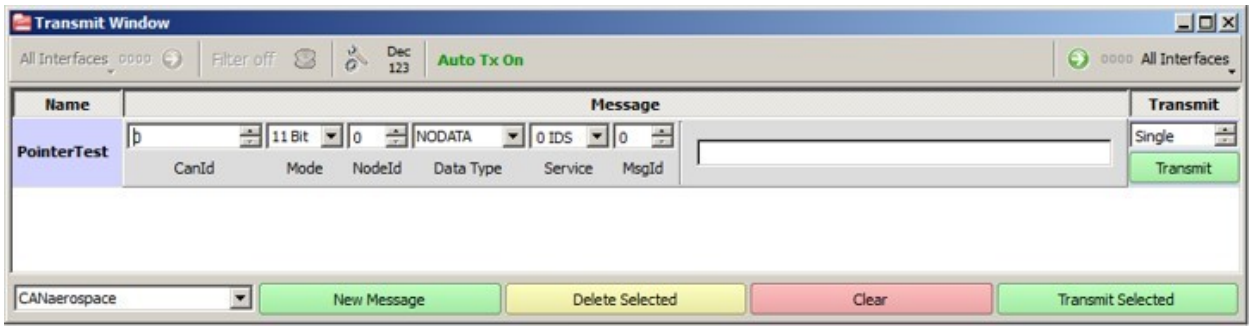
1. Connect a LRU with at least one pointer instrument to the test system (or select the respective panel from the *Virtual Cockpit*).

2. Add a *Transmit window* (TX window) to your project, if necessary (Add Object to Project window).

3. For this example make sure that Auto transmission **is active**.

4. Add a new message item to the TX window and set a meaningful name.

5. The RX window now looks like the following figure



6. Set the parameters of the message line according to the specifications of the respective ICD. Normally the *CAN Id* is sufficient and the *Data Type* has to be set to *FLOAT* for analog messages.

As soon as the *Data Type FLOAT* has been selected the message data area appears like in the figure below.

7. Enter the min. value (left text box) and the max. value (right text box) according to the range defined in the respective ICD.

8. Enter any value within the previously defined limits into the middle text box or move the slider with the mouse above the text boxes.

The pointer of the associated LRU is set to the entered value or follows the movement of the slider.

6.5.4 Sending an ASCII code

Proceed as follows:

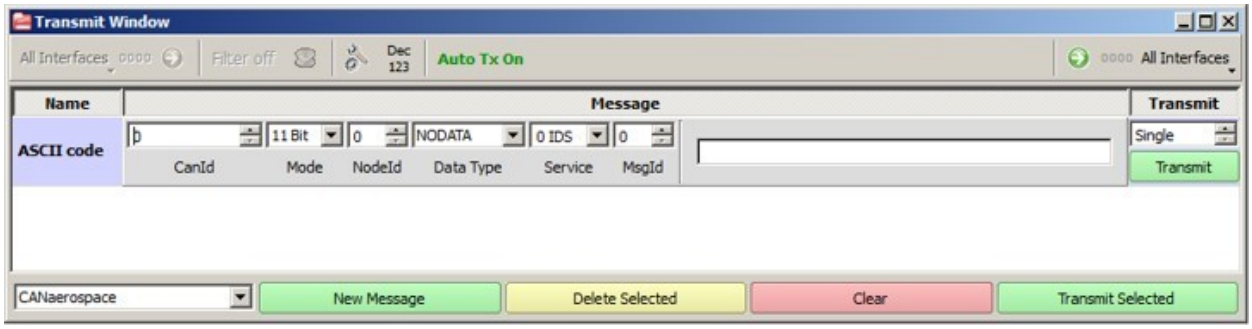
1. Connect a LRU with at least one ASCII display to the test system (or select the respective panel from the *Virtual Cockpit*).

2. Add a *Transmit window* (TX window) to your project, if necessary (Add Object to Project window).

3. For this example make sure that Auto transmission **is active**.

4. Add a new message item to the TX window and set a meaningful name (*ASCII code* in this example).

5. The RX window now looks like the following figure



6. Set the parameters of the message line according to the specifications of the respective ICD. Normally the *CAN Id* is sufficient and the *Data Type* has to be set to *ACHAR_x* for

ASCII codes. _*x* determines the number of characters that can be defined by the respective data type. *ACHAR* without _*x* is used for an ASCII code with only one character.

↬ As soon as the Data Type *ACHAR_x* has been selected the message data area appears like in the figure below.

7. For entering ASCII characters into the text boxes double click into the concerning text box (to highlight the default space character or the character that has been previously been entered) and type in the desired ASCII character via the keyboard.

Depending on the selected data type *ACHAR* or *ACHAR_x* only the respective numbers of text boxes are active.

↬ The currently entered character appears in the ASCII display of the associated LRU.

6.6 Node services

Node services are used for addressing of specific stations for integrity monitoring, data download, time synchronisation etc. For basics about node services see the CANflight User´s manual available via the download area of Stock Flight Systems.

For product specific information about the individual node services see the customer documentation for the individual product (e.g. Master ICD).

All Node Services are implemented on Node Service Channel 0 (Node Service Request CANaerospace identifier = 128, Node Service Response CANaerospace identifier = 129).

Some of the node services explained in the following sections are not necessarily supported by your Hardware.

6.6.1 Node Identification Service (IDS)

Each CANaerospace unit supports at least the Node Identification Service (IDS) on Node Service Channel 0. This makes sure that a CANaerospace network can be scanned for attached units to determine their status, header type and identifier assignment.

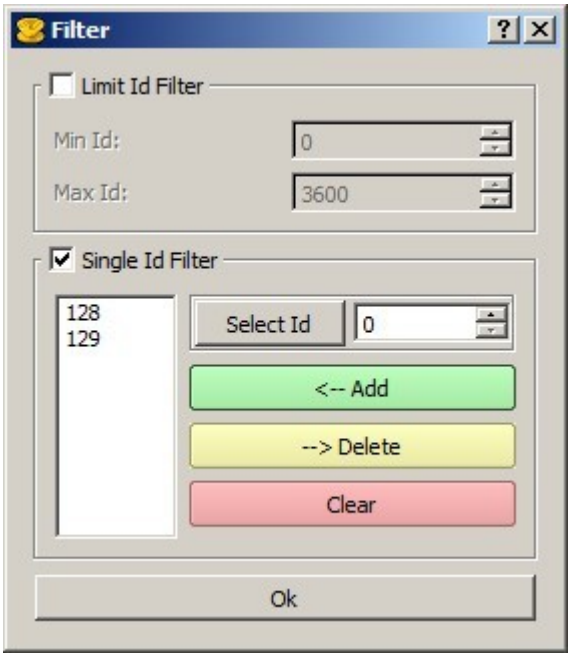
This service returns the hardware/software revision and internal test results (memory test and I/O test).

Procedure

1. Add a *Transmit window* (TX window) and a *Receive window* (RX window) to your project, if necessary (➥ Add Object to Project window).

2. Make sure that ➥ Auto transmission in the TX window **is not active**.

3. For the RX window activate the *Single Id filter* check box and add the Ids 128 and 129 as shown in the figure below (➥ Setting of CAN Id filters) in order to suppress confusing CAN messages (e.g. heartbeat messages).



4. Add a new message item to the TX window and define a meaningful name.

5. Set the CAN parameters of the message item to the following values (see figure below).

CanId 128

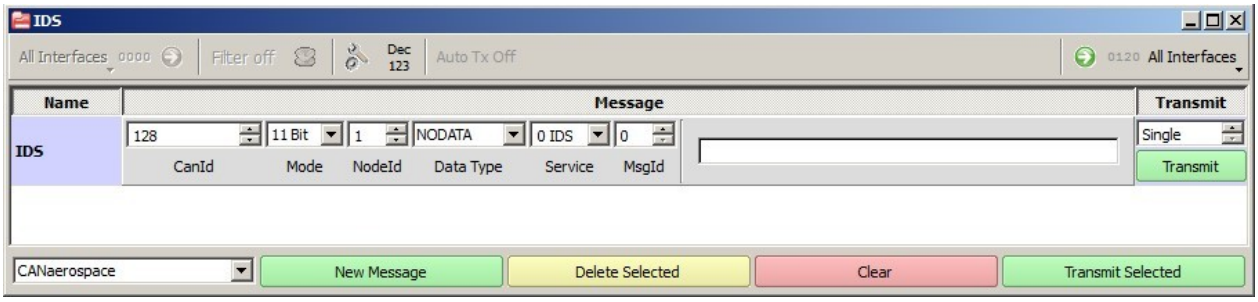
Mode 11 bit

NodeId Node Id of the respective CAN module (*1* in this example).

Data Type NODATA

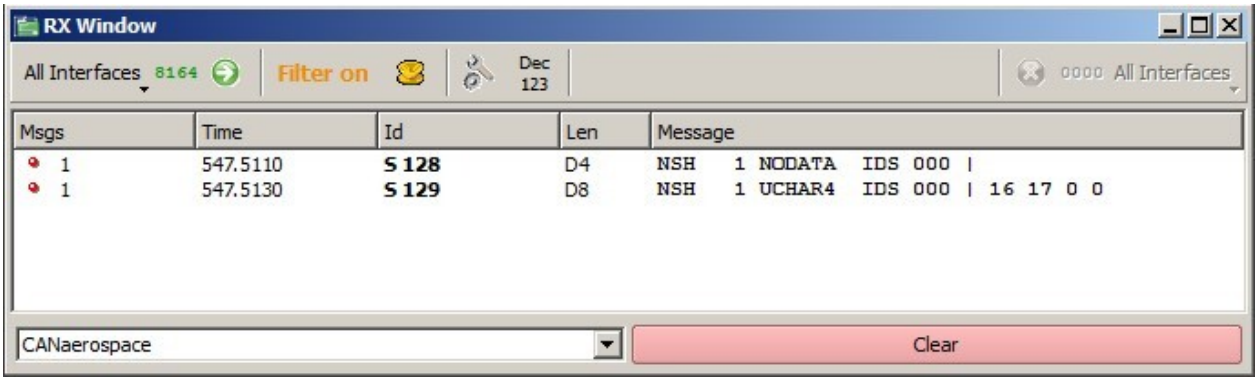
Service 0 IDS

MsgId not required



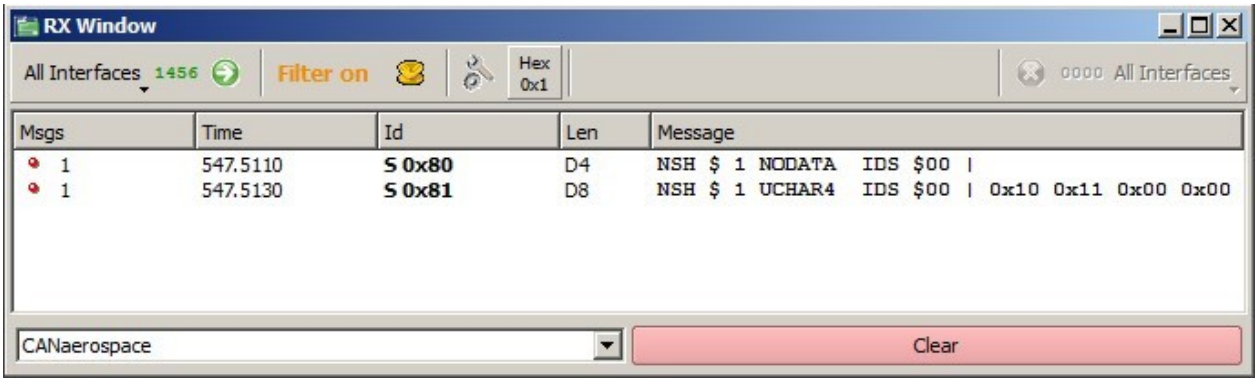
6. Press the [Transmit] button.

The RX window shows two new messages (see following figure).



- The 1st line shows the Node Service Request message previously defined in the TX window.
- The 2nd line shows the Node Service Response message received from the addressed CAN node.
- The numerical values of the messages are displayed in **decimal** notation (default setting).

7. Press the [Dec / 123] button of the Object tool bar to switch the display mode to **hexadecimal** notation (see following figure).



The message data section (following the "|" character) provides the following information:

```
0x10   0x11    0x00   0x00

 |       |        |       |
 |       |        |       I/O test result (0 = OK, -1 = failed)
 |       |        Memory test result (0 = OK, -1 = failed)
 |    Software version e.g. 1.1
Hardware version e.g. 1.0
```