User Manual

Protocol Monitor

CANvision®

User Manual

CANvision® - Protocol monitor

Version: 1.9

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Revision Overview

Date	Revision	Change(s)
2015-10-29	0	First version
2015-11-06	1	Pictures corrected
2016-05-26	2	New client SAE J1939
2017-08-09	4	Spelling error correction, new company name, logo without claim
2017-10-23	5	CAN/CANopen FD support, renewed CANvision client "CAN Transmit"
2018-01-26	6	Ordering information
2018-04-24	7	Licensing, Trial mode
2019-02-08	8	Changes to scope of delivery
2019-03-29	9	Support Kvaser CAN interfaces, minor improvements

Note:

To use the CANvision® - Protocol Monitor, and for proper understanding of this manual, general knowledge of the field bus systems CAN, CANopen, DeviceNet and/or SAE J1939 are required.

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1 Overview

The CANvision® - Protocol Monitor is a high-performance tool for the development, start-up, monitoring and service of CAN networks. Due to its modular basic concept according to the client/server principle this tool enables easy handling and can simply be expanded.

Therefore, the CAN interface must not necessarily be locally available – remote controlled servers provide the CAN interfaces for all clients. Thereby, the CANvision® - Protocol Monitor is not coupled to interfaces of a specific manufacturer, but supports the CAN hardware of GEMAC, IXXAT, PEAK, Vector and Kvaser.

Licensing is carried out via a USB copy protection dongle. The software can be installed at numerous PCs. To use the software, easily plug the copy protection dongle into a free USB port.

CANvision® - Protocol Monitor

- Support of various CAN interfaces (GEMAC, IXXAT, PEAK, Vector, Kvaser)
- Simultaneous use of numerous CAN interfaces possible
- Display of bus load, as well as transmission, reception and error conditions
- Adjustable filter and trigger conditions
- Single and cyclic transmission of CAN messages as well as sequences (transmission lists)
- Storage and export of recorded CAN messages
- Share CAN interfaces on the network (automatic detection via Bonjour service)
- Integrated symbolic decoding of CAN messages
- Import of DBC files via free of charge CAN symbol editor

A CANopen-Module, which is available optionally, supports the analysis of CANopen based systems. This module interprets all received telegrams according to the CANopen specification.

Optional CANvision Client: „CANopen Receive"

- Interpretation of all received messages as SDO, PDO, NMT, Sync, Timestamp, Heartbeat and Emergency objects, as well as display of the PDO contents
- Filtering according to object types and Node-IDs
- Standards: CiA 301, 302, 1301 (CANopen FD)
- Profiles: 401, 402, 404, 405, 406, 408, 410, expandable
- Import of EDS and DCF files
- Configurable formatting and display color
- Message display in "Scroll" or "Overwrite" mode

Optional CANvision Client: „SAE J1939 Receive"

- Interpretation of all received messages with source address, parameter group (PGN) and the individual signals (SPN)
- Support for transport protocol and diagnostic messages
- Additional decoding of the extensions used by ISOBUS and NMEA 2000
- Filtering according to source address, PGN and SPN
- Configurable formatting and display color

2 Start-up

2.1 System requirements

To ensure the correct installation of the CANvision® application software, your PC or notebook should meet the following minimum requirements and possess one of the operating systems listed below:

Hardware:

- Processor: at least 2,0 GHz (2,4 GHz dual core recommended)
- At least 512 MB RAM (1 GB recommended)
- Graphics card with 24-bit color depth (32-bit recommended)
- Resolution: 1,024x768 pixels or higher
- CD/DVD ROM drive
- Free USB port (for USB dongle)

Supported operating systems[1]:

- Microsoft Windows® Vista (32 bit and 64 bit)
- Microsoft Windows® 7 (32 bit and 64 bit)
- Microsoft Windows® 8.1 (32 bit and 64 bit)
- Microsoft Windows® 10 (32 bit and 64 bit)

Supported CAN hardware / interfaces

- GEMAC CAN-Bus Tester 2
- IXXAT VCI (e.g. USB-to-CAN, PC-I 04/PCI)
- PEAK PCAN (e.g. PCAN-USB, PCAN-PCI)
- Vector XL (e.g. VN1600, CANboardXL)
- Kvaser (e.g. USBcan Light, Pro)

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1 Microsoft and Windows® are registered trade marks of Microsoft Corporation in the USA and in other countries.

2.2 Installing the software

The PC software is available in German and English and can be downloaded from our website www.gemac-fieldbus.com. The installation sets up the CANvision® application software on your system and installs the USB driver required by the CAN-Bus Tester 2.

Note:

To install the USB driver, you must possess administrator rights. Only the device driver for the operation of the GEMAC CAN-Bus Tester 2 is included. For any other drivers of supported CAN hardware, contact the appropriate manufacturer.

3 Functions and Operation
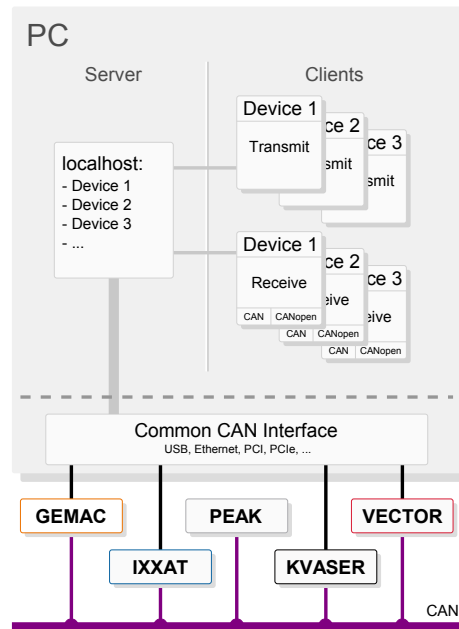
3.1 General notes on operation

Figure 1: Software structure

As to be seen in Fig. 1 the CANvision® Protocol Monitor is a modular-designed software package with *CAN-vision Server* as the central element. In addition to management and configuration of the devices connected to the PC, this server switches the data traffic between the client applications and the Common CAN Inter-face (CCI).

The CCI itself is a driver layer that provides a standard software interface for a number of the CAN inter-faces currently available on the market from different manufacturers. Client applications can be started for the send and receive directions for CAN interfaces recognized by the server as connected.

Help

When designing the CANvision® Protocol Monitor, special attention was devoted to a clear structure and a self-explanatory graphical user interface. For many elements of the user interface, a detailed explanation is displayed when the mouse pointer is moved over the control element concerned ("tool tip" or status text).

This manual is also supplied in electronic form and can be called up both via the help function and with the F1 key.

3.1.1 Data storage

All settings of *CANvision Server* are saved in a document with the file extension *".cms"*. The document can be opened either by double-clicking on the file in the Windows® Explorer or by dragging the file to the pro-gram window (drag & drop). The client applications each possess their own file format.
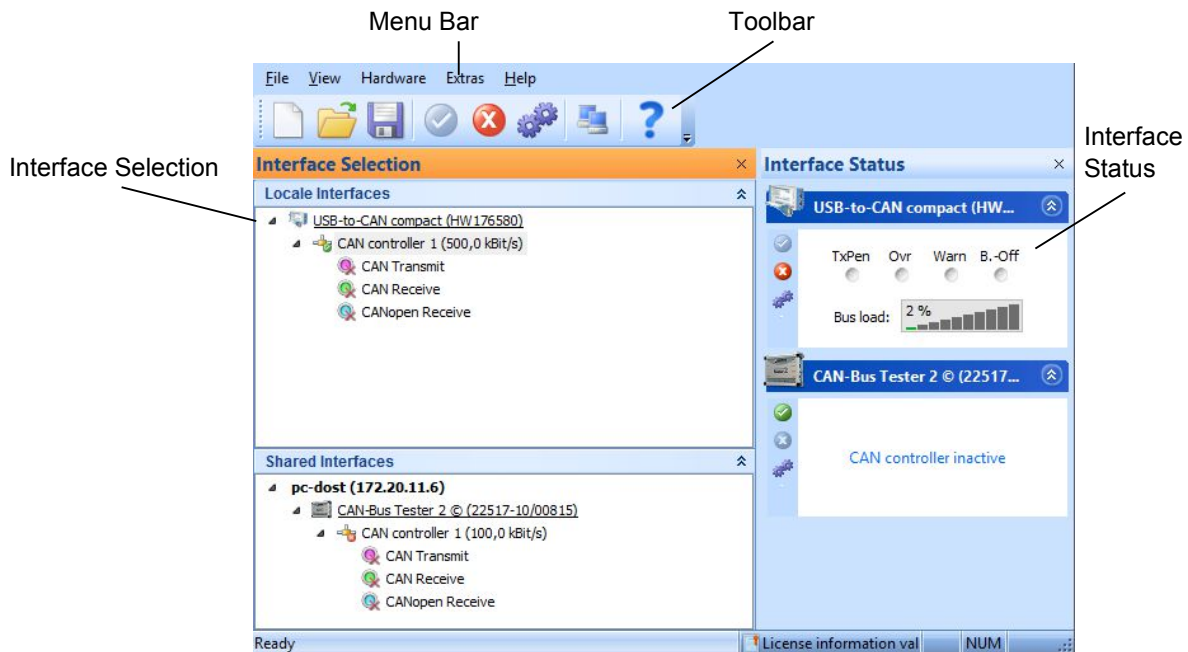
3.2 CANvision Server

Figure 2: CANvision Server user interface

The graphical user interface of *CANvision Server* (Fig. 2) provides both a menu bar and a toolbar and is divided into the views *"Interface Selection"* and *"Interface Status"*. Using drag & drop, the toolbar and all views can be arranged freely in the program window or else undocked and displayed as separate windows. The current layout of the window is saved automatically and is restored when the program is next started.

3.2.1 Menu bar

The menu bar comprises the main menus "*File*", "*View*", "*Hardware*", "*Tools*" and "*Help*". The *"File"* menu can be used to open and save configuration data. The *"View"* menu can be used to modify the layout of the window. The *"Hardware"* menu provides functions for controlling the selected CAN controller (start, stop and setup). The setting dialog for network functionality can be found in the menu *"Tools"*. The last menu item *"Help"* provides access to the electronic manual, as well as program and driver information and the licensing.

3.2.2 Toolbar

For convenient operation,*CANvision Server* possesses a toolbar at the top of the program window (Fig. 3). The toolbar provides quick access to the most important menu functions.

Figure 3: Toolbar

	New	Opens a new document (Ctrl+N).
	Open...	Opens an existing document (Ctrl+O).
	Save	Saves the current document with its existing name or - if the document has not yet been given a name - with a new name (Ctrl+S).
	Start	Activates the CAN controller
	Stop	Deactivates the CAN controller
	Settings	Opens a dialog for configuring the selected CAN controller
	Network	Opens a dialog for changing the Network Settings
	Info	Displays program, manufacturers and driver information

3.2.3   View "*Interface Selection*"

This view displays all detected CAN interfaces and the related CAN controllers in a hierarchical list. If you right-click on a CAN controller, this displays a context menu from which the selected CAN controller can be started or stopped and configured. After changing the configuration settings, any active configurations are automatically stopped for a short moment and subsequently restarted with updated settings.

Each CAN controller in the list possesses several entries for client applications (Section 3.3 „CANvision Clients"). These entries can be called by double-clicking with the left mouse button or by way of a further context menu.
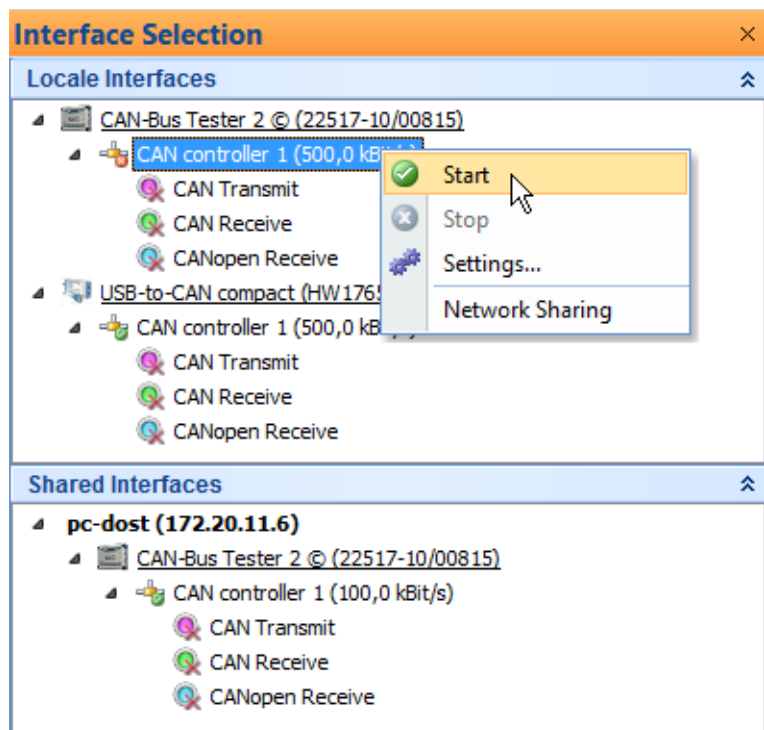

Figure 4: *"Interface Selection"* **with context menu**

3.2.4 View "*Interface Status*"

This view displays the status of the selected CAN controller. An online analysis is only possible after the CAN hardware has been started. In addition to the bus traffic load, the transmit, receive and error states are displayed here by way of status LEDs.

Each status window displays the following information:

Error Type	LED State	Description
Transmit pending (TxPen)	off	All messages sent, the transmit buffer is empty.
	yellow	There are unacknowledged messages in the send buffer of the CAN controller.
Data overrun (Ovr)	off	No error
	yellow	A data overflow in the receive buffer of the CAN controller has occurred.
Warning level (Warn)	off	No error
	yellow	The overflow of an error counter of the CAN controller has occurred .
Bus Off state (B.Off)	off	No error
	red	The CAN controller is in the state "Bus off".

Table 1: Transmission, reception and error conditions

When a data overrun occurs for the first time, the appropriate LED lights up permanently; it only goes out when the CAN controller is reset. If the "Bus Off" LED is lit, the CAN controller is no longer participating in the network communication. In this case, the CAN hardware must be stopped and restarted to reset this state. The bus traffic load is only displayed if this is supported by the CAN interface.

3.2.5 Network

The CANvision® Protocol Monitor provides remote network access to the CAN hardware connected to a different PC. To this end, CANvision Server must be started on the other PC, network detection must be activated, and the CAN hardware must be released for the network. The released interfaces will then be available on all the other CANvision servers started on the network. The receive client may be started as often as desired, whereas the transmit clients may only be opened once.

To enable network detection, check the appropriate box in the *"Network"* window under *"Tools"* (Fig. 5). CAN interfaces available to the network are detected automatically by way of the *"Bonjour"* service which is installed together with the program.
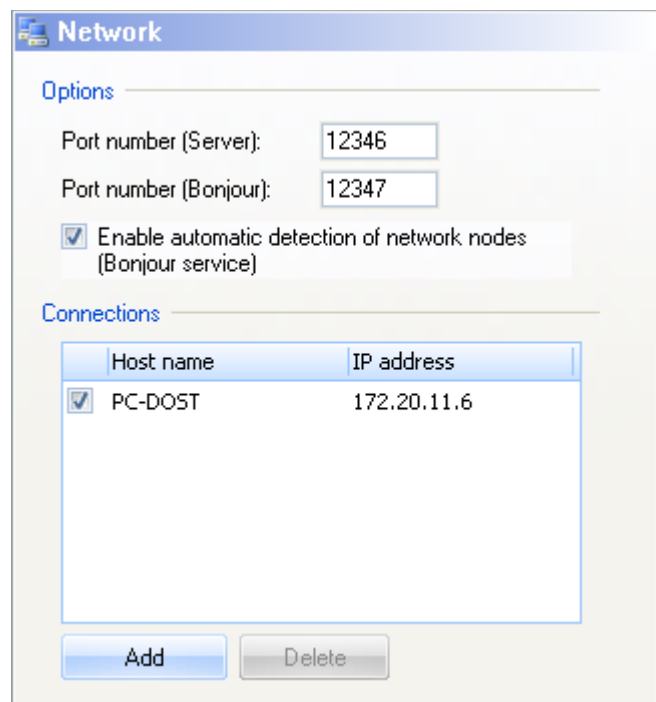

Figure 5: Network configuration

Should the functions of this service be deactivated by your administrator or otherwise not be possible due to your particular network configuration (e.g. exceeding of subnet limits), the desired connections may also be

established manually. To this end, click on the *"Add"* button in the network dialog and specify the IP address of the node to which you wish to establish a connection. To remove a selected entry from the list, click on *"Delete"*.

Once the connection to a CANvision server has been established successfully, its name and IP address are displayed in the interface selection. To allow access to the CAN hardware which is managed by this server, it must be released for the network. This can be done either by way of the context menu or in the setup dialog of the appropriate CAN controller.

Fig. 6 shows an example configuration where the CAN interface no. 3 is visible to the network by way of IP address 192.168.0.1. This network includes another PC (address: 192.168.0.2) with a CANvision server started. This server will find the server with the shared interface no. 3 at 192.168.0.1 and will display it in its own interface selection. Now the user of this PC may open and use a transmit and receive window for the CAN interface.
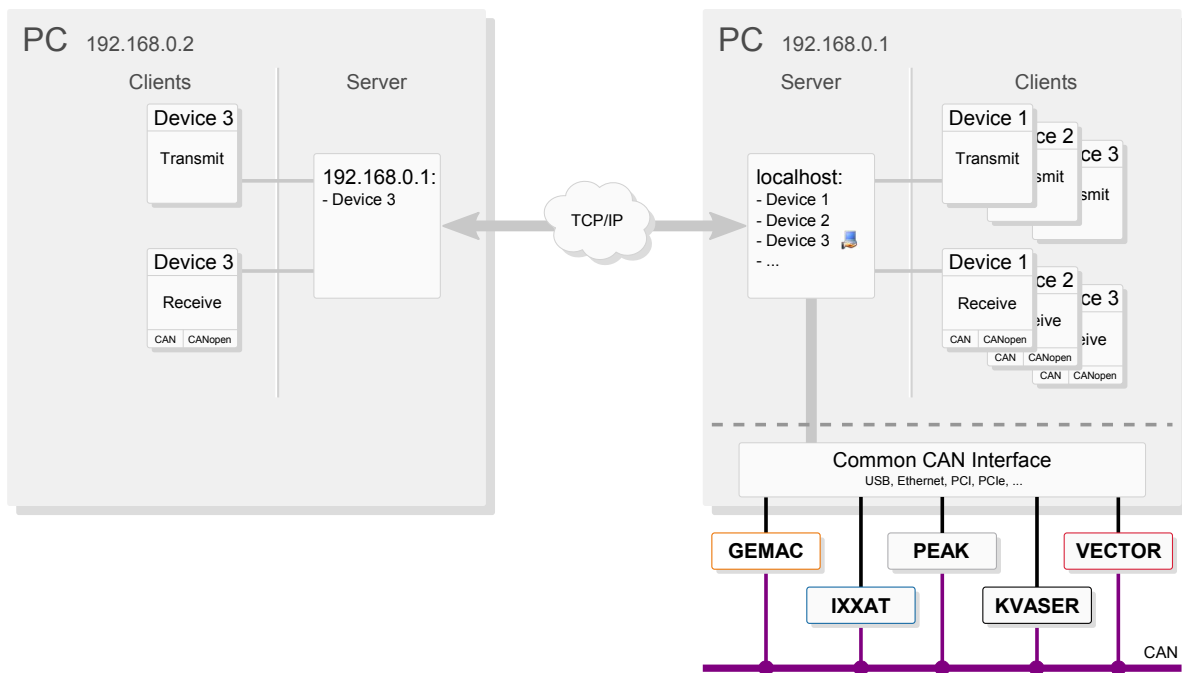

Figure 6: Access to shared CAN interfaces on the network

3.2.6 Licensing

To be able to use the software completely, a USB license dongle must be connected to a free USB port of the PC. This dongle is provided with the starter set.

To activate clients, load a corresponding license file of type *.cmslic* onto the USB license dongle in the info dialog (Fig. 7). This dialog can be found under the menu item *"Help → Info..."*.

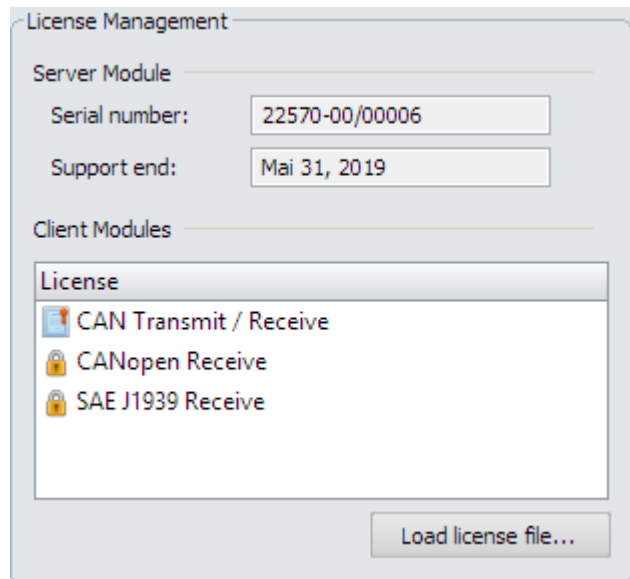To purchase additional program licenses, please contact your dealer.

Figure 7: License information within the info dialog

3.2.7 Support extension

In addition, the USB license dongle defines a support period within which software updates can be obtained free of charge. Once this period has expired, no newer program versions with the current license can be used. Program versions that were created prior to the end of the support period can continue to be used without limitations.

For information on extension of the support period, contact your dealer.

3.2.8 Trial versions

It is possible to test all not licensed client modules during the first **5 minutes** after each start of the program. Only in the receive clients a hint is inserted every ten lines and the saving of documents is disabled.

After the trial time has expired, the client modules are locked and you need an appropriate license to use them permanently.
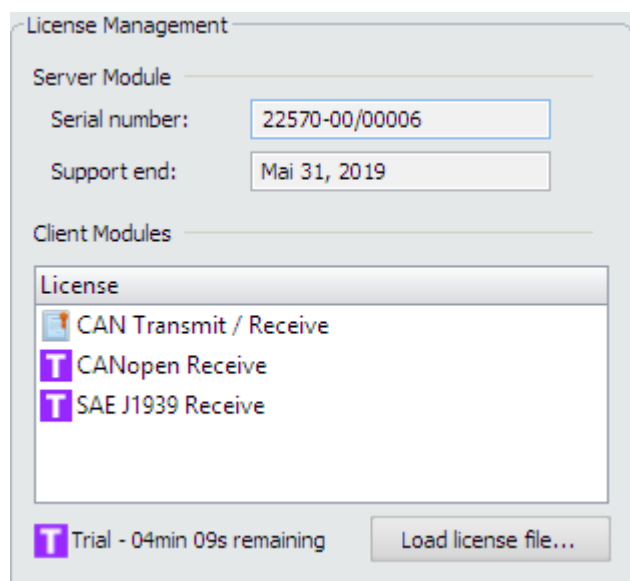
Figure 8: Trial-Modus

3.3 CANvision Clients

For each detected CAN controller multiple clients for sending and receiving are available. For easy identification of the client window open the associated CAN controller is displayed in the status bar. The position and size of all windows is automatically saved and restored at the next program start.

The following functions are available in all clients:

Status LED on the CAN controller:

Green: The CAN controller is activated; transmit and receive are possible.

Yellow: The CAN controller has reached or exceeded its warning limit.

Red: The CAN controller has been turned off (is in "Bus Off").

Gray: The CAN controller is deactivated.

Starting/stopping the CAN controller, Stop/continue receiving:

	Start CAN Controller	Activates the CAN controller (F5).
	Stop CAN Controller	Deactivates the CAN controller (F6)
	Stop / Continue Receiving	Reception of frames in the receive clients can be paused and continued respectively. The CAN controller remains active.

3.3.1 CANvision Client "CAN Transmit"

The CANvision client *"CAN Transmit"* serves to transmit CAN messages either once or cyclically. For this purpose, you can define your own CAN messages in a list. The client can be called via the CANvision server for every listed CAN controller.
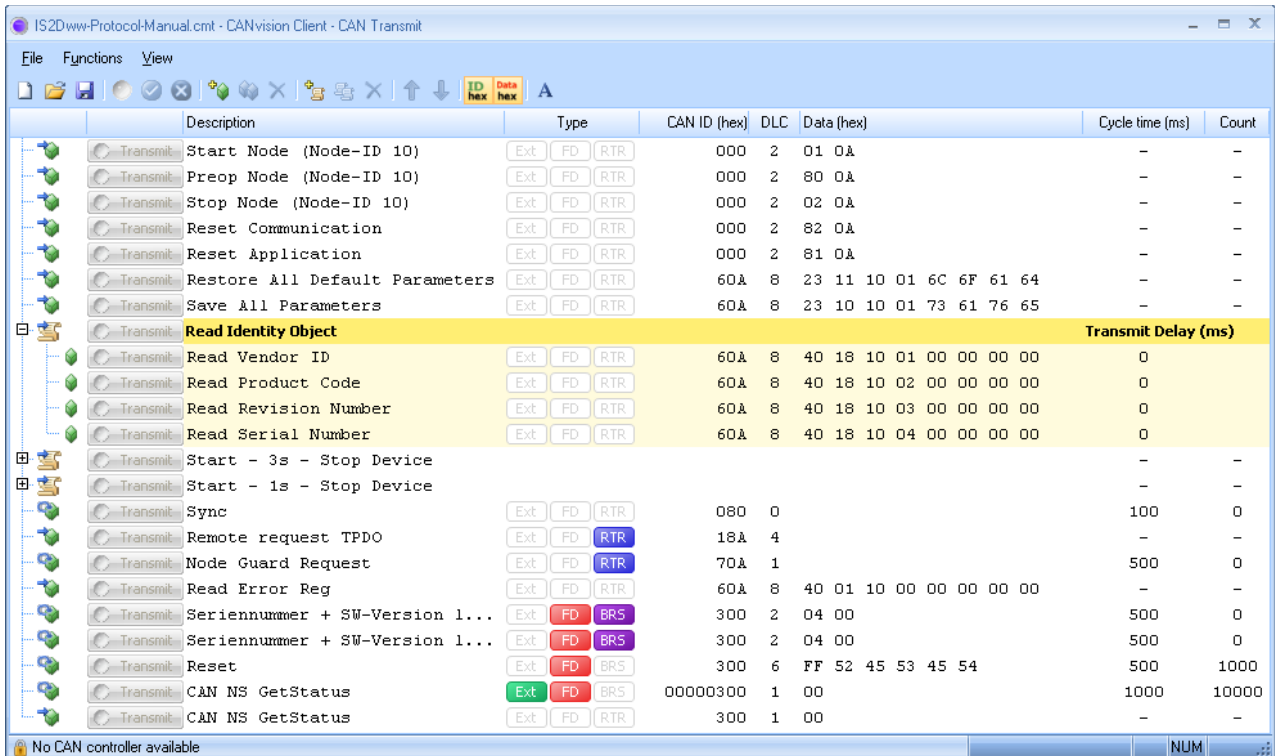

Figure 9: Client "CAN Transmit"

3.3.1.1   Functions

The following functions are provided by the menu and by the toolbar of the "CAN Transmit" menu:

	New	Opens a new "CAN Transmit" document (Ctrl+N).
	Open...	Opens an existing "CAN Transmit" document (Ctrl+O).
	Save	Saves the current "CAN Transmit" document with its existing name or - if the document has not yet been given a name - with a new name (Ctrl+S).
	Create Message or Sequence	Creates a new CAN message or a sequence at the current position (Ins).
	Duplicate Message or Sequence	Duplicates a selected CAN message or a selected sequence (Ctrl + Ins).
	Delete Message	Deletes the selected CAN message (Del).

	Message Move Up	Moves a selected CAN message in the list one place up (Shift+Arrow Up).
	Message Move Down	Moves a selected CAN message in the list one place down (Shift+Arrow Down).
	Switch ID display	enabled: display hexadecimal disabled: display decimal
	Switch data display	enabled: display hexadecimal disabled: display decimal
	Font...	Opens a dialog to setup the font in the view "Messages".

3.3.1.2 Messages

The following properties can be used to define a CAN message:

Cycle	The CAN message is transmitted once. The CAN message is transmitted cyclically with the set cycle time (10 ms ... 60,000 ms). Up to max. 16 CAN messages can be defined as "cyclically".
Description	Additional description of a CAN message.
Type	Set the properties of the message Ext CAN ID according to standard protocol, 11-bit (0x000...0x7FF) Ext CAN ID according to extended protocol, 29-bit (0x00000000...0x1FFFFFFF) RTR Sets the frame type as "Data frame" RTR Sets the frame type as "Remote frame" FD CAN FD message (only with supported hardware) BRS CAN FD message with set bitrate switch
CAN ID	Identifier of the CAN message to be transmitted
ID-Name	Name of the CAN ID. This name can be used by all other CAN messages with the same CAN ID.
DLC	Number of data bytes to be sent
Data	Used to enter the data to be transmitted. The number of bytes entered is used for the data length code (DLC), irrespective of the selected frame type (RTR).
Cycle time	Interval in ms with which a CAN message is transmitted repeatedly. (only at)
Cycle count	Number of cyclically transmitted messages. 0 for unlimited transmission. (only at)

Selecting the "*Transmit*" button transmits the appropriate CAN message either once or repeatedly. Selecting the button once more deactivates the cyclic transmission of a CAN message.

3.3.1.3   Sequences

With the aid of sequences, it is possible to send several CAN messages with a defined time interval once or cyclically. A sequence can contain a maximum number of 100 CAN messages.

The following properties are available for the definition of a sequence:

Cycle	The sequence is transmitted once.
	The sequence is transmitted cyclically with the set cycle time (10 ms ... 60,000 ms).
	A maximum of one sequence can be sent at a time.
Description	Additional description of a sequence.
Cycle time	Interval in ms with which a sequence is transmitted repeatedly. (only at)
	If the cycle time is less than the duration of all messages in this sequence, including the transmission delay, the sequence is canceled and starts from the beginning.
Cycle count	Number of counts for the cyclically transmitted sequence.
	0 for unlimited transmission. (only at)
Transmit delay	When the sequence is opened, a transmission delay in ms can be entered for each message within a sequence.

Selecting the "*Transmit*" button transmits the appropriate sequence either once or repeatedly. Selecting the button once more deactivates the cyclic transmission of a sequence.

3.3.2 CANvision Receive Clients

The both CANvision receive clients „CAN Receive", „CANopen Receive" and „SAE J1939 Receive" can be started via the CANvision server.

3.3.2.1 Functions of both clients

The following functions are provided by the menu and the toolbar:

|		
	New	Opens a "Receive clients" document (Ctrl+N).
	Open...	Opens an existing "Receive clients" document (Ctrl+O).
	Save	Saves the current "Receive clients" document with its existing name (Ctrl+S).
	Delete list	Deletes all received messages from the list
	Filter	Sets a filter for the CAN messages to be received ("Hide/unhide CAN messages)
	Trigger	Activation of a trigger on the CAN-ID or data fields with adjustable amount of telegrams after trigger (F10)
	Scroll	Displays the messages in the order in which they were received
	Overwrite	Displays the received messages sorted by their CAN ID/Object type/PGN.
	Time stamp, relative	Displays the time stamp relative to the time stamp of the message received previously
	Most recent	Shows the most recent message in the list.
	Font...	Opens a dialog to setup the font for the receive windows.
	Search	Opens the "*Search*" dialog. Allows searching the ID- or the data field (Ctrl+F)
	Continue search	Searches for the next term specified by "*Search*" (F3)
	Search backwards	Searches for the previous term specified by "*Search*" (Shift+F3)

3.3.2.2 Filter

The "Filter..." command in the "Settings" dialog enables the configuration of a filter[2] for CAN messages. There are two lists for filtered and accepted identifiers. You can choose a complete identifier group by way of the masks or else perform a direct selection of the identifiers to be filtered.
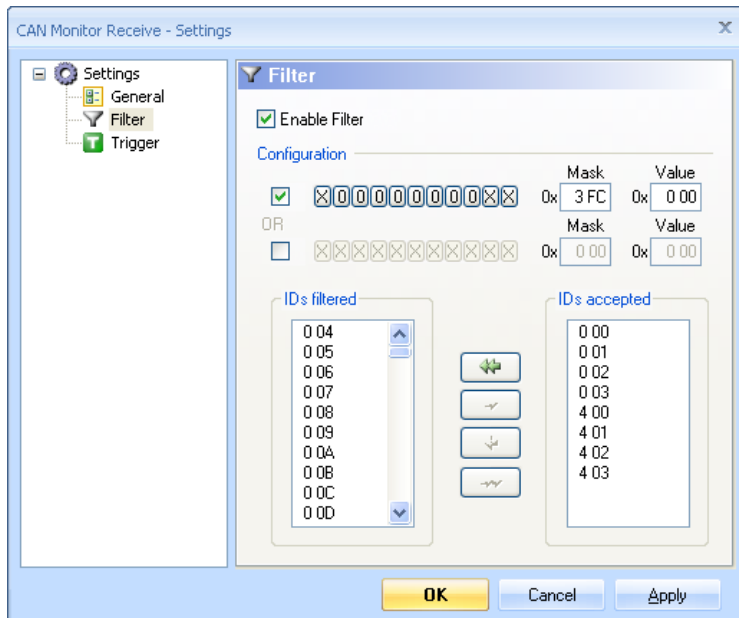
Figure 10: Receive clients - Filter dialog

A maximum of two OR'd masks is provided to select an identifier group. Each bit in the identifier masks can be assigned to one of the following values:

- X - Bit is not relevant
- 0 - Bit is relevant and must be "0"
- 1 - Bit is relevant and must be "1"

The selection can be performed either using the appropriate buttons or by entering the appropriate hexadecimal values for Mask and Value. The bit value "1" in the Mask field means that this bit is relevant, while bit value "0" means that this bit need not be used for filtering. In the Value field, you specify the bit value which the relevant bits in the Mask field must assume to be accepted by the filter.

For the direct selection, the relevant identifiers can be highlighted in the lists and moved between the groups of filtered or accepted IDs. Direct selection will deactivate the filtering of identifier groups.

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2   The filter is available for 11 bit identifier only

3.3.2.3   Trigger

The command "Trigger..." can be found in the "Settings" dialog and allows the user to configure a trigger on CAN-IDs (standard or extended) or on any data field.

Parts of the data field can be masked. Parts with "X" are irrelevant for the trigger function. In Figure 12 all messages containing a 02hex as the second data byte are being triggered.

Additionally, the user can configure the number of frame messages after the trigger point and the behavior after their reception:

- "stop receiving" stops the recording of the message frames in the receive window
- "stop CAN controller" deactivates the CAN controller. All sending action in the client "CAN Transmit" will be stopped.
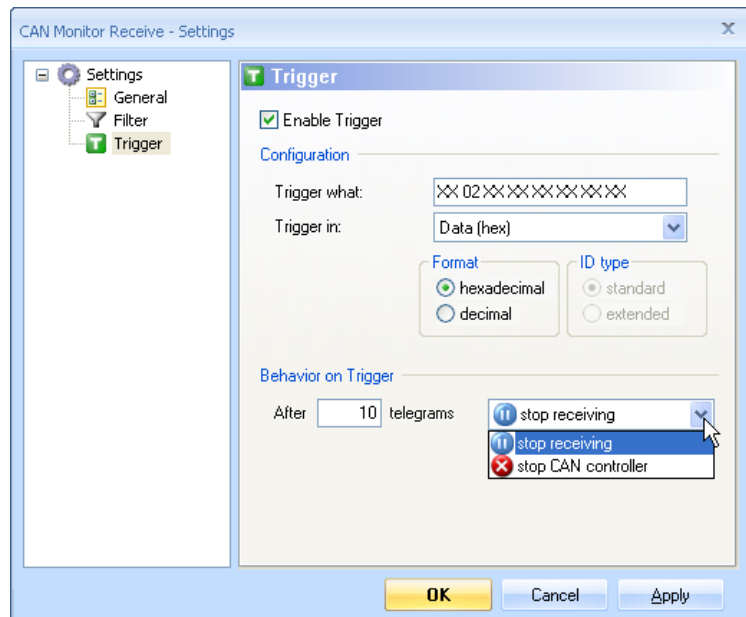
Figure 11: Receive clients - Trigger options

3.3.3   CANvision Client "CAN Receive"

The following additional functions are provided by the menu and the toolbar:

	Symbolic Decoding	Activates symbolic decoding for all received CAN messages.

	Switch ID display	enabled:	display hexadecimal
		disabled:	display decimal

	Switch data display	enabled:	display hexadecimal
		disabled:	display decimal

The following message property (type) is additional available to the transmit client:

Type   SR   Identification of self-transmitted messages

The CANvision client "*CAN Receive*" serves to receive and display CAN messages. There are two modes of display:

"Scroll" mode: Presentation of the CAN messages in the order in which they are received (Figure 12)

Figure 12: Client: CAN Receive - "Scroll" mode

"Overwrite" mode: Presentation of the received CAN messages sorted by their CAN ID. (Figure 13)

Figure 13: Client: CAN Receive - "Overwrite" mode

Symbolic Decoding:

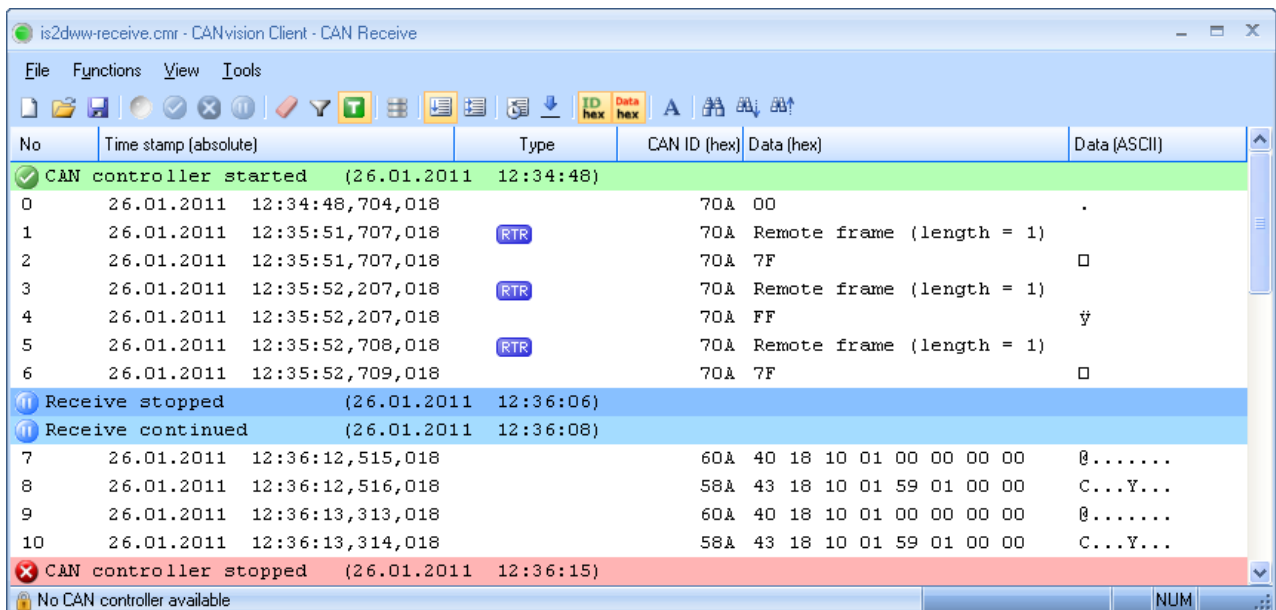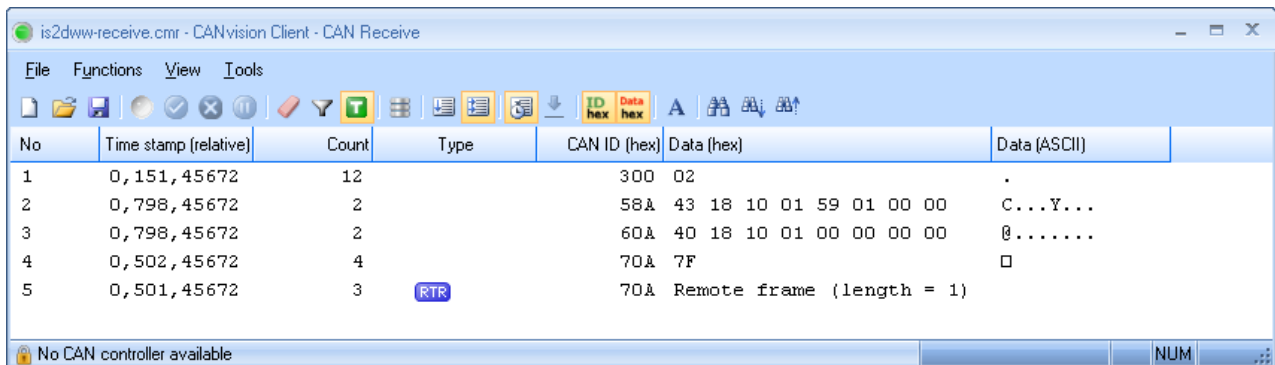CAN messages can be displayed as a symbol to relieve their interpretation. Their representation is adapted via a symbol file. If symbolic representation is selected, the CAN IDs are displayed by their symbolic names. The sequences of bits of a CAN message are marked as signals with names. These signals can display the raw data transmitted by CAN either in decimal or hexadecimal format or - if requested - convert them automatically and show them as a physical value with its unit. With the descriptions of the values (Enums) certain variables can be displayed alphanumerically. Different definitions of the data can be determined in a CAN ID by multiplexers.

For decoding the messages, the CAN-Bus Tester 2 uses a symbol file. Symbol files can be created by using the free of charge symbol editor **CANsymEdit**. Select one symbol file to be used for the representation.

A detailed description of the creation of symbol files is available in the user manual of the symbol editor.
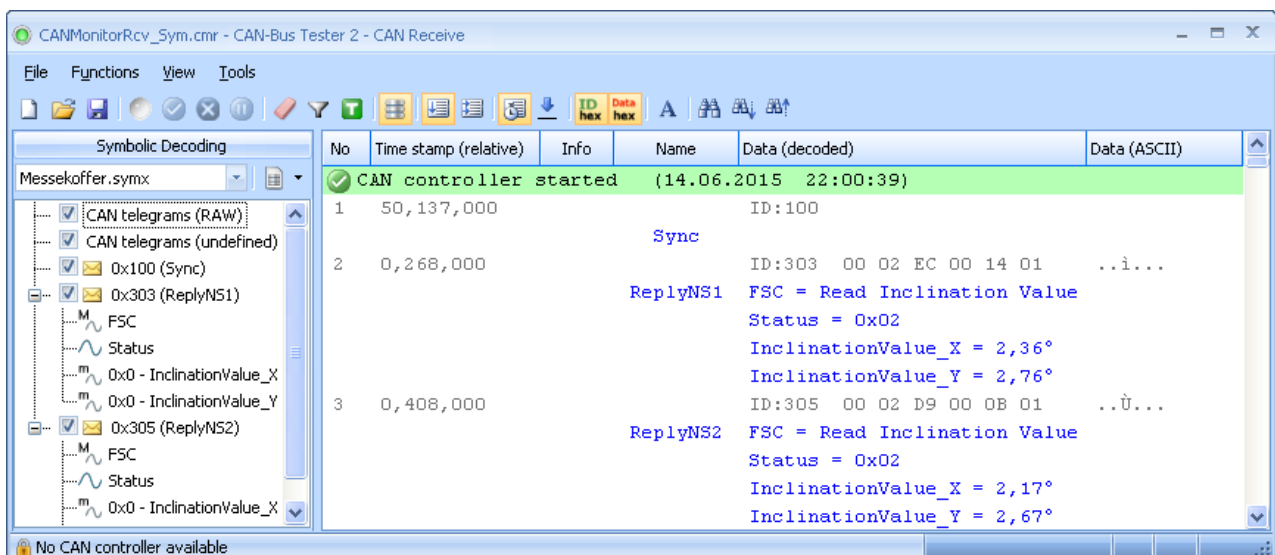

Figure 14: Client: CAN Receive - Symbolic decoding

3.3.4 CANvision Client "CANopen Receive"

License note:

Receiving of CANopen messages is only available if the corresponding software license is supported by the connected USB dongle. (see Section 3.2.6 „Licensing").

The CANvision client "CANopen Receive" serves as a monitoring tool for the analysis of CANopen-based systems. It interprets all received messages according to the CANopen specification. The messages are recognized as SDO, PDO, NMT, Sync, Time stamp, heartbeat and emergency objects and interpreted accordingly.

The following additional function is provided by the menu and the toolbar:

	Raw data	Shows the undecoded CAN messages.
	Undefined data	Shows undecodable messages according to the CANopen specification message. (mixed bus systems)
	Buffered SDO transfer	Shows the multi-part SDO transfer as overall access or as single messages. (CANopen only)

There are two modes of display:

- Mode Scroll: Presentation of the CANopen mess. in the order in which they are received
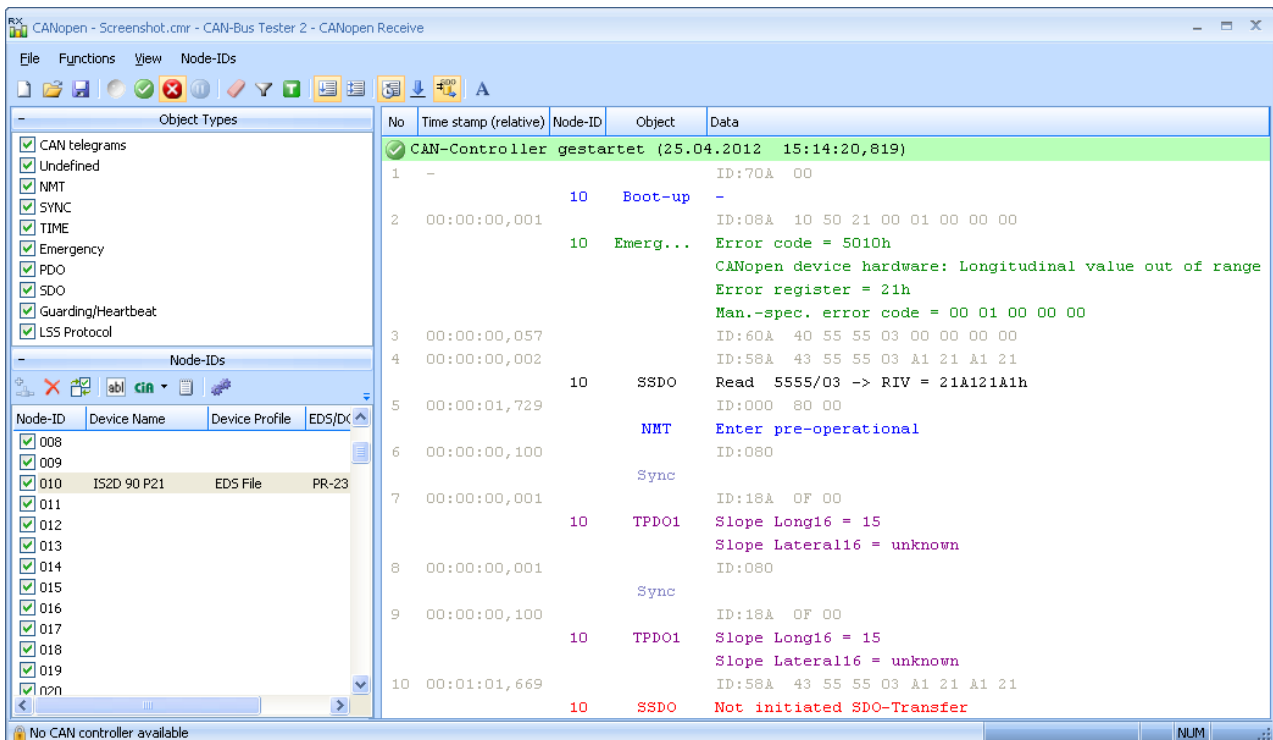- Mode Overwrite: Presentation of the received CANopen messages sorted by object type.

Figure 15: Client: CANopen Receive

Filter configuration:

The filtering of the CANopen messages can be done for object types and node number (Node-ID) by check-ing the appropriate checkboxes.

Node configuration:

The basis for the interpretation of CAN messages is the device description of the individual CANopen nodes. This description can be done for each device/node (Node-ID) by loading the corresponding EDS / DCF file. If no file is available, the device description can be made by selecting the device profile. In addition a manual configuration of each node number is also possible. (Figure 16)
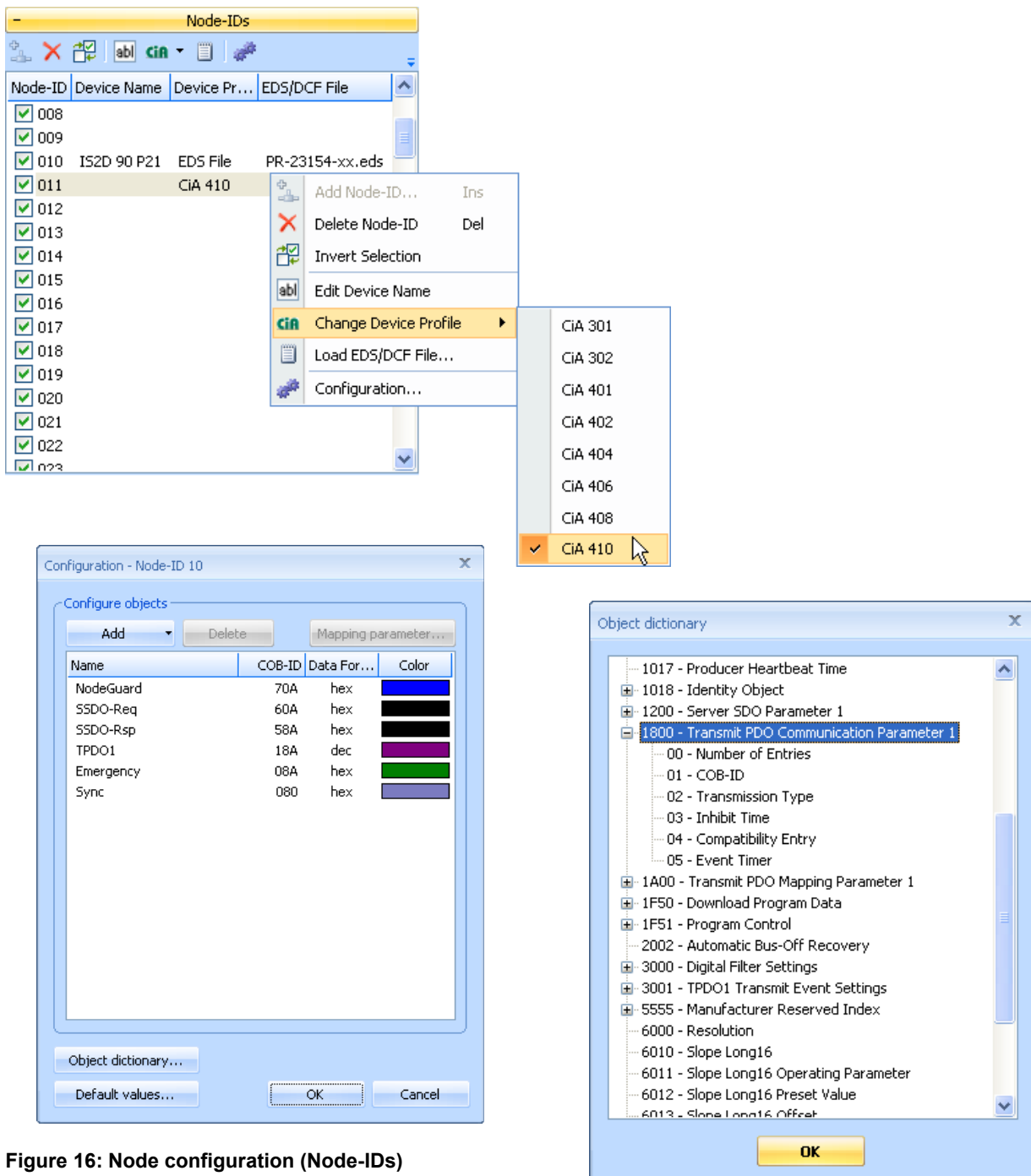

Figure 16: Node configuration (Node-IDs)

3.3.5 CANvision Client "SAE J1939 Receive"

License note:

Receiving of SAE J1939 messages is only available if the corresponding software license is supported by the connected USB dongle. (see Section 3.2.6 „Licensing").

The module "SAE J1939 Receive" serves as a monitoring tool for the analysis of SAE J1939-based systems. It interprets all received messages according to the SAE J1939 specification. The messages are decoded and displayed with there source address, Parameter Group and the individual signals (Suspect Parameter) with name, value and unit. A comprehensive filter function limits the representation a to the desired information. The complete deposited SAE J1939 database is also available via a search engine, so that PGN and SPN can be looked up at any time.

The following additional functions are provided by the menu and the toolbar:

Raw data	Raw data	Shows the undecoded CAN messages.
Unde fined	Undefined data	Shows undecodable messages according to the SAE J1939 specification message. (mixed bus systems)

There are two modes of display:

- Mode Scroll: Presentation of the SAE J1939 messages in the order in which they are received
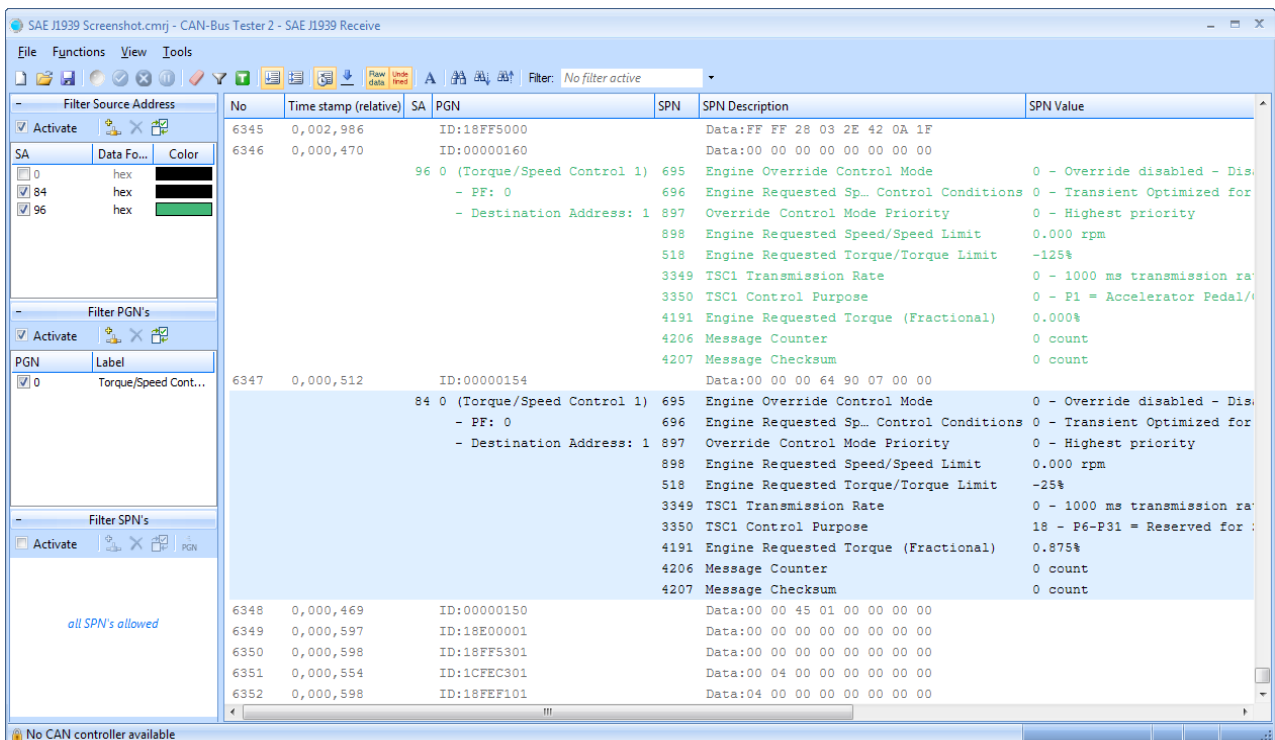- Mode Overwrite: Presentation of the received SAE J1939 messages sorted by object type.

Figure 17: Client: SAE J1939 Receive

Filter configuration:

The filtering of the SAE J1939 messages can be done for Source address, Parameter Group (PGN) and the individual signals (Suspect Parameter - SPN) by checking the appropriate checkboxes.
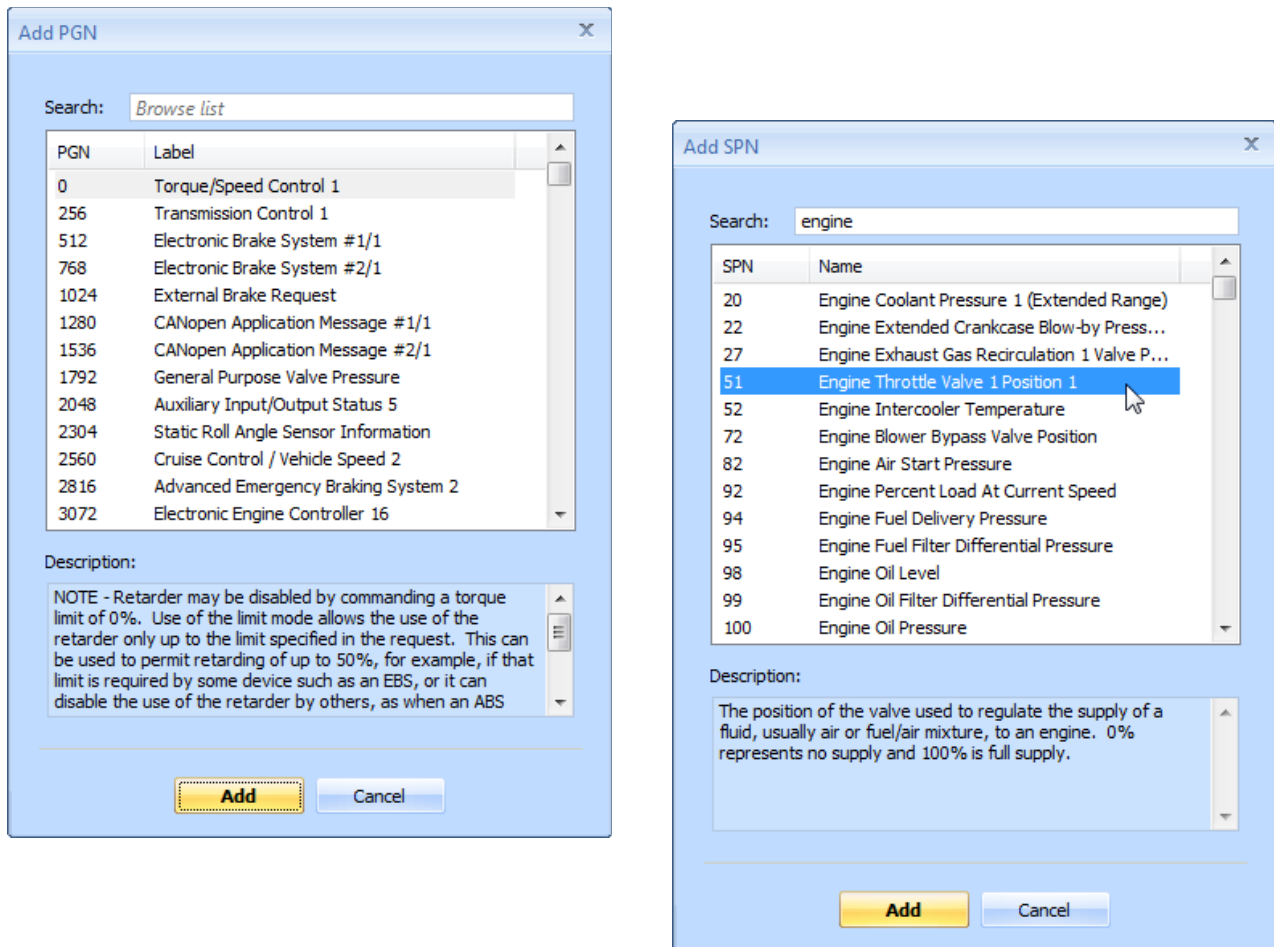

Figure 18: SAE J1939 filter configuration (PGN, SPN)

4 Ordering Information

Product	Description	Article number
CANvision® - Protocol Monitor Starter set	CANvision® - Protocol Monitor USB license dongle User manual (German/English) 1 Year Support extension	PR-22570-00
Support extension 1 Year	Entitles you to install / use of all published software updates within the support period. (included with the purchase of PR-22570-00 for the first year)	SW-22570-00
CANvision Client „CAN Transmit/Receive"	License key for ● CANvision Client CAN Transmit/Receive	SW-22570-10
CANvision Client „CANopen Receive"	License key for ● CANvision Client CANopen Receive	SW-22570-11
CANvision Client „SAE J1939 Receive"	License key for ● CANvision Client SAE J1939 Receive	SW-22570-12

Table 2: Ordering information

5 Notes