VECTOR

VN0601 ARINC 429 Interface Manual

Version 2.0 | English

Imprint

Vector Informatik GmbH
Ingersheimer Straße 24
D-70499 Stuttgart

Contents

1 Introduction

In this chapter you find the following information:

1.1 About this User Manual

Conventions

In the two following charts you will find the conventions used in the user manual regarding utilized spellings and symbols.

Style	Utilization
bold	Blocks, surface elements, window- and dialog names of the software. Accentuation of warnings and advices. **[OK]** Push buttons in brackets **File|Save** Notation for menus and menu entries
`Source Code`	File name and source code.
Hyperlink	Hyperlinks and references.
<CTRL>+<S>	Notation for shortcuts.

Symbol	Utilization
	This symbol calls your attention to warnings.
	Here you can obtain supplemental information.
	Here you can find additional information.
	Here is an example that has been prepared for you.
	Step-by-step instructions provide assistance at these points.
	Instructions on editing files are found at these points.
	This symbol warns you not to edit the specified file.

1.1.1 Warranty

Restriction of warranty

We reserve the right to change the contents of the documentation and the software without notice. Vector Informatik GmbH assumes no liability for correct contents or damages which are resulted from the usage of the documentation. We are grateful for references to mistakes or for suggestions for improvement to be able to offer you even more efficient products in the future.

1.1.2 Registered Trademarks

Registered trademarks

All trademarks mentioned in this documentation and if necessary third party registered are absolutely subject to the conditions of each valid label right and the rights of particular registered proprietor. All trademarks, trade names or company names are or can be trademarks or registered trademarks of their particular proprietors. All rights which are not expressly allowed are reserved. If an explicit label of trademarks, which are used in this documentation, fails, should not mean that a name is free of third party rights.

- Windows, Windows 7, Windows 8.1, Windows 10 are trademarks of the Microsoft Corporation.

1.2 Important Notes

1.2.1 Safety Instructions and Hazard Warnings

Caution!
In order to avoid personal injuries and damage to property, you have to read and understand the following safety instructions and hazard warnings prior to installation and use of this interface. Keep this documentation (manual) always near the interface.

1.2.1.1 Proper Use and Intended Purpose

Caution!
The interface is designed for analyzing, controlling and otherwise influencing control systems and electronic control units. This includes, inter alia, bus systems like CAN, LIN, K-Line, MOST, FlexRay, Ethernet, BroadR-Reach and/or ARINC 429.

The interface may only be operated in a closed state. In particular, printed circuits must not be visible. The interface may only be operated (i) according to the instructions and descriptions of this manual; (ii) with the electric power supply designed for the interface, e.g. USB-powered power supply; and (iii) with accessories manufactured or approved by Vector.

The interface is exclusively designed for use by skilled personnel as its operation may result in serious personal injuries and damage to property. Therefore, only those persons may operate the interface who (i) have understood the possible effects of the actions which may be caused by the interface; (ii) are specifically trained in the handling with the interface, bus systems and the system intended to be influenced; and (iii) have sufficient experience in using the interface safely.

The knowledge necessary for the operation of the interface can be acquired in work-shops and internal or external seminars offered by Vector. Additional and interface specific information, such as „Known Issues“, are available in the „Vector KnowledgeBase“ on Vector´s website at www.vector.com. Please consult the „Vector KnowledgeBase“ for updated information prior to the operation of the interface.

1.2.1.2 Hazards

Caution!
The interface may control and/or otherwise influence the behavior of control systems and electronic control units. Serious hazards for life, body and property may arise, in particular, without limitation, by interventions in safety relevant systems (e.g. by deactivating or otherwise manipulating the engine management, steering, airbag and/or braking system) and/or if the interface is operated in public areas (e.g. public traffic, airspace). Therefore, you must always ensure that the interface is used in a safe manner. This includes, inter alia, the ability to put the system in which the interface is used into a safe state at any time (e.g. by „emergency shutdown“), in particular, without limitation, in the event of errors or hazards.

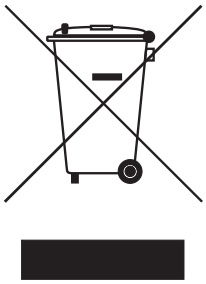
Comply with all safety standards and public regulations which are relevant for the operation of the system. Before you operate the system in public areas, it should be tested on a site which is not accessible to the public and specifically prepared for performing test drives in order to reduce hazards.

1.2.2 Disclaimer

Caution!
Claims based on defects and liability claims against Vector are excluded to the extent damages or errors are caused by improper use of the interface or use not according to its intended purpose. The same applies to damages or errors arising from insufficient training or lack of experience of personnel using the interface.

1.2.3 Disposal of Vector Hardware

Please handle old devices responsibly and observe the environmental laws applicable in your country. Please dispose of the Vector hardware only at the designated places and not with the household waste.



Within the European Community, the Directive on Waste Electrical and Electronic Equipment (WEEE Directive) and the Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS Directive) apply.

For Germany and other EU countries, we offer free take-back of old Vector hardware.

Please carefully check the Vector hardware to be disposed of before shipping. Please remove all items that are not part of the original scope of delivery, e.g. storage media. The Vector hardware must also be free of licenses and must no longer contain any personal data. Vector does not perform any checks in this regard. Once the hardware has been shipped, it cannot be returned to you. By shipping the hardware to us, you have relinquished your rights to the hardware.
Before shipping, please register your old device via:

https://www.vector.com/int/en/support-downloads/return-registration-for-the-disposal-of-vector-hardware/

2 VN0601 Network Interface

In this chapter you find the following information:

2.1 Introduction

General information

The VN0601 is a compact and powerful interface for ARINC 429 bus systems. The interface conveniently utilizes a PC connection via USB 2.0, it does not require an external power supply, and it has analog/digital interfaces for acquiring other measurement parameters. The VN0601 gives developers of networked electronic units in aircrafts (Line Replaceable Units or LRUs) a flexible and high-performance interface solution for testing and bus analysis.

Highlights

Main features of the VN0601 interface are:

- 4x ARINC 429 TX channel
- 4x ARINC 429 RX channel
- Support of high-speed and low-speed communication
- 1x analog Input
- 2x digital input
- 1x digital output
- Support of the Vector XL API
- Robust housing
- No external power supply required (USB-powered)

2.2 Accessories

Reference
Information on available accessories can be found in the separate accessories manual on our website.

2.3 Examples of Usage

2.3.1 Analyzing Traffic of Multiple Lines

Description

The VN0601 can be used for traffic analyzing tasks. In this setup, the interface receives data simultaneously from two different ARINC lines, each having its own transmitting LRU. The lines are not influenced by the VN0601.

Setup

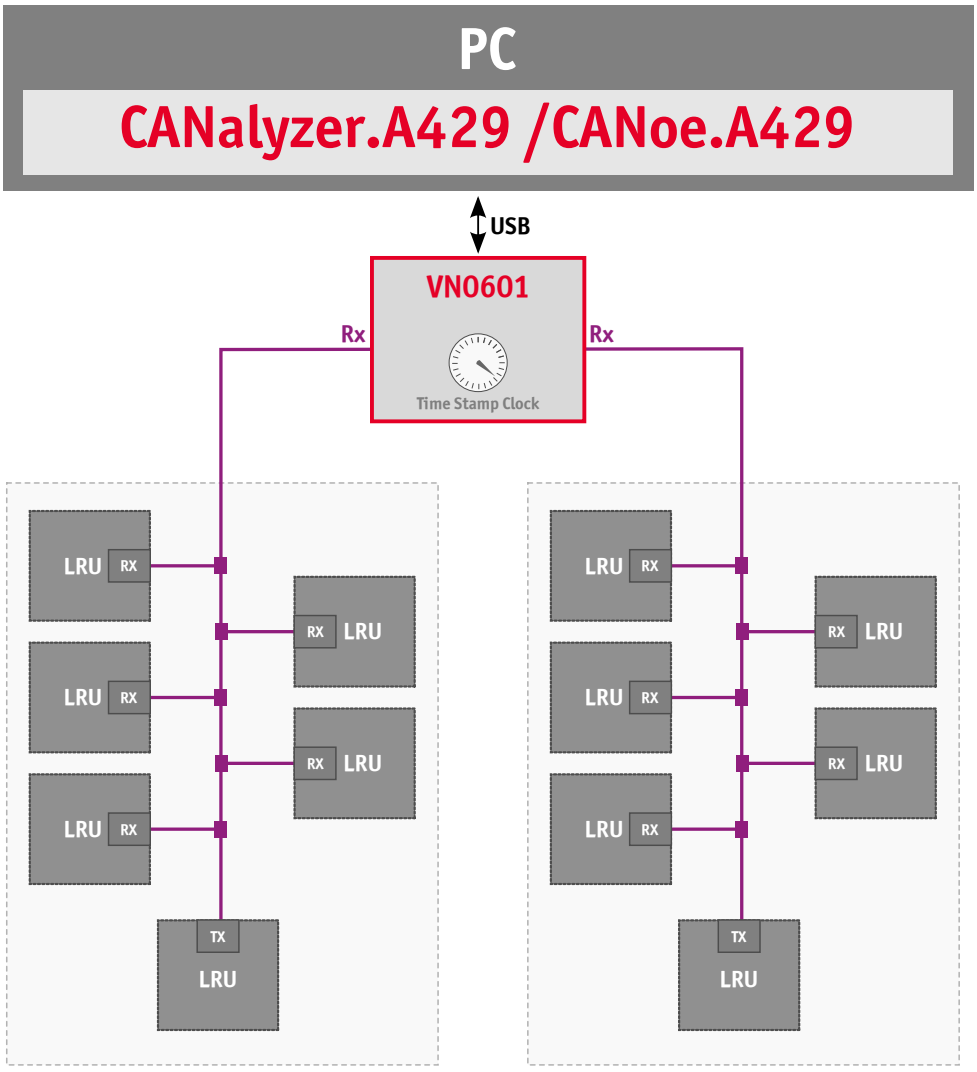


Figure 1: Analyzing traffic of multiple ARINC lines

2.3.2 Transmitting and Monitoring

Description

If no transmitting LRU is active or available, the missing TX LRU can be simulated with CANoe.A429 while the traffic can be monitored as usual.

Setup

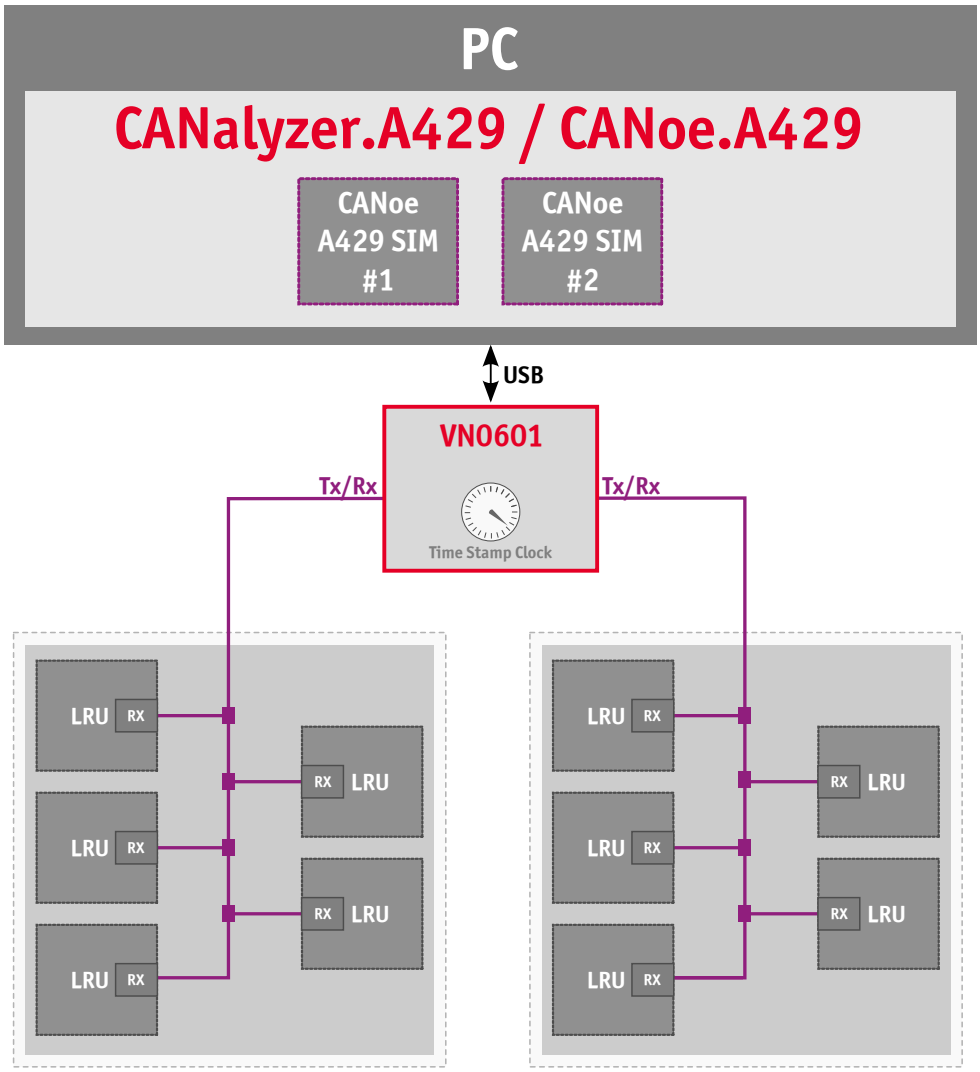


Figure 2: Transmitting and monitoring

2.3.3 In-line Data Modification

Description

For testing purposes, certain RX LRUs can be disconnected from the TX LRU. In this remaining part of the line, the TX data is simulated in CANoe.A429.

Setup

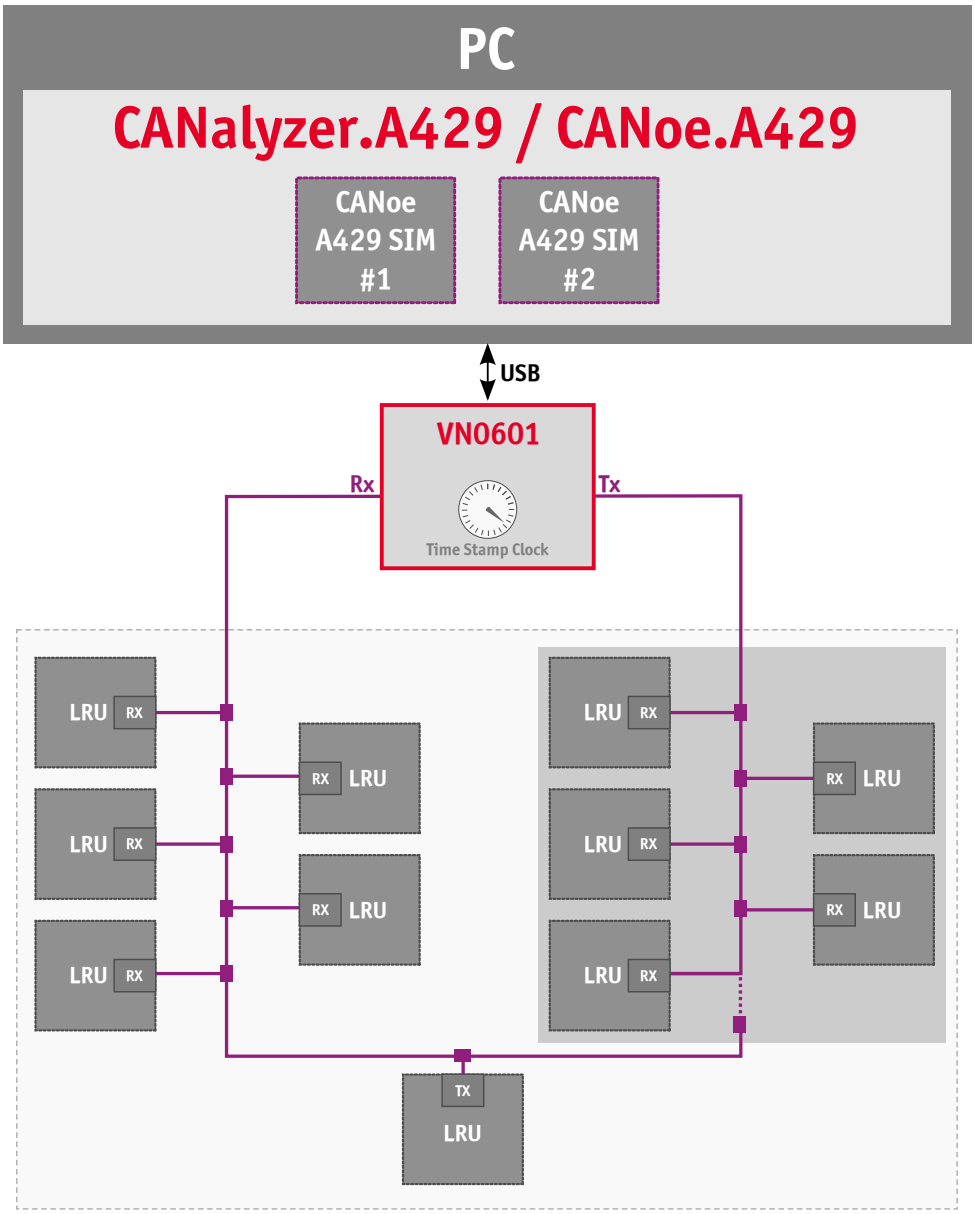


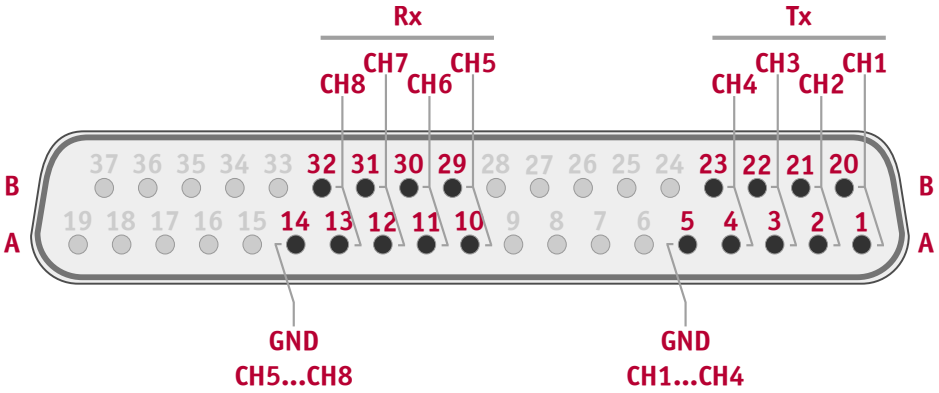
Figure 3: In-line Data Modification

2.4 Device Description

2.4.1 D-SUB37 Pin Assignment (ARINC 429)

CH1...8

The VN0601 has a D-SUB37 connector (male) that provides up to eight ARINC 429 channels (four TX / four RX). The pin assignment is as follows:



TX channels

Pin	Assignment	Pin	Assignment
1	CH1 A	20	CH1 B
2	CH2 A	21	CH2 B
3	CH3 A	22	CH3 B
4	CH4 A	23	CH4 B
5	GND CH1...CH4	24...28	Reserved. Do not use.
6...9	Reserved. Do not use.		

RX channels

Pin	Assignment	Pin	Assignment
10	CH5 A	29	CH5 B
11	CH6 A	30	CH6 B
12	CH7 A	31	CH7 B
13	CH8 A	32	CH8 B
14	GND CH5...CH8	33...37	Reserved. Do not use.

2.4.2 D-SUB9 Pin Assignment (IO)

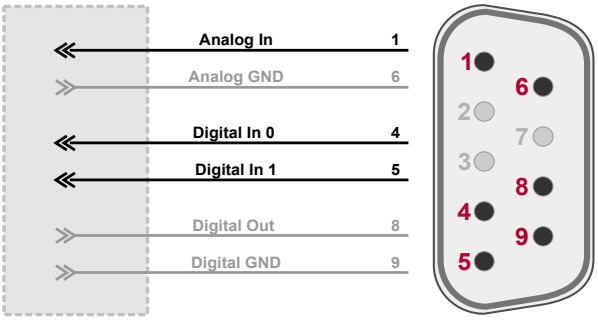
CH9

The VN0601 has a D-SUB9 connector (female) that provides digital and analog input/outputs.

Digital/analog IO

The pin assignment for CH9 is as follows:

Pin	Assignment
1	Analog input
2	Not connected
3	Not connected
4	Digital input 0
5	Digital input 1
6	Analog GND
7	Not connected
8	Digital output
9	Digital GND



Internal interconnection of digital input 0/1

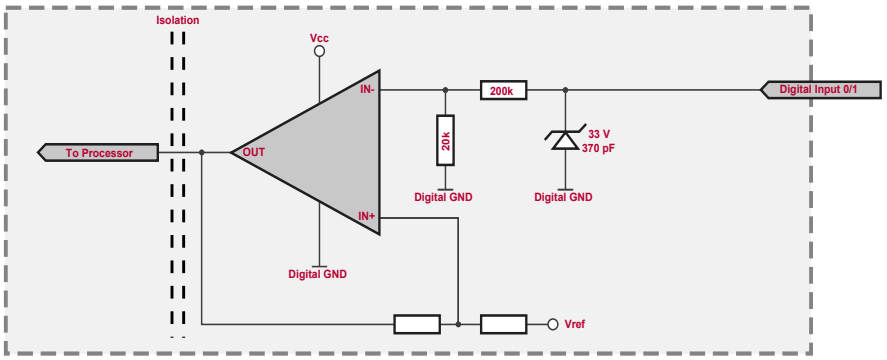


Figure 4: Digital input 0/1

Internal interconnection of digital output

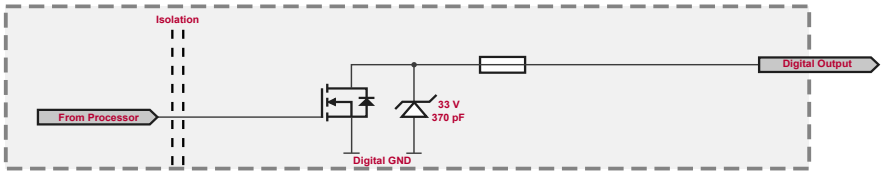


Figure 5: Digital output

Internal interconnection of analog input

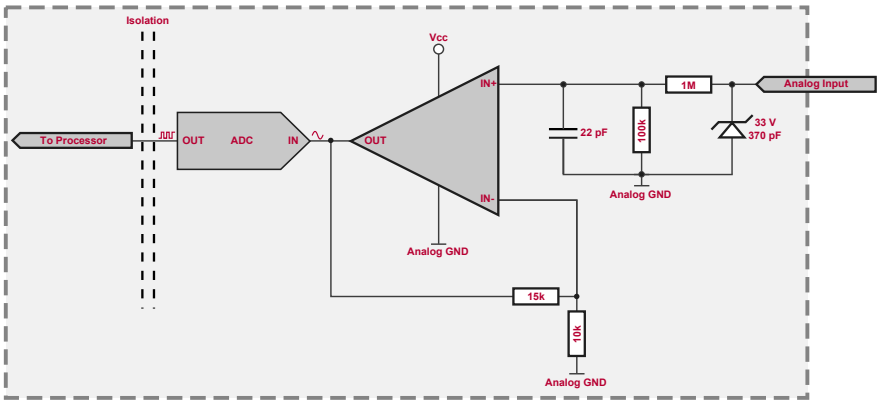


Figure 6: Analog input

Extended measuring range of the analog input

In normal operation, voltages up to 18 V can be applied and measured at the analog input. The cutoff frequency f_c (-3 dB) for AC voltages is approx. 7.2 kHz.

For measurements above 18 V (max. 50 V), an external series resistor has to be applied to the analog input. The series resistor R_{ext} depends on the input voltage U_{input} and can be calculated as follows:

$$R_{ext}\,[kOhm] = [(U_{input} * 0.61111) - 11] * 100$$
$$with\ 18\,V < U_{input} \leq 50\,V$$

The cutoff frequency for AC voltages is also affected by the external series resistor:

$$f_c\left[Hz\right] = \frac{1}{2.33 * 10^{-6} * R_{ext}\,[kOhm]}$$

Examples

	24 V	32 V	36 V	48 V
R_{ext}	367 kΩ	856 kΩ	1100 kΩ	1833 kΩ
R_{ext} (E96)	374 kΩ (24.12 V)	866 kΩ (32.17 V)	1100 kΩ (36.00 V)	1870 kΩ (48.60 V)
f_c (-3 dB)	1148 Hz	496 Hz	390 Hz	230 Hz

2.4.3 Synchronization

Sync connector

The VN0601 has a sync connector (Binder type 711) which can be used for time synchronization of different Vector devices (see section Time Synchronization on page 29). **The sync connector is not intended to connect a power supply.**

Pin	Assignment
1	Not connected
2	Synchronization line
3	Ground

2.4.4 LEDs

CH1 … CH4 (Tx)

Color	Description
Green	► On: no traffic. ► Flashing: data frames have been sent correctly.
Red	Transmit error.
Off	No running measurement.

CH5 … CH8 (Rx)

Color	Description
Green	► On: no traffic. ► Flashing: data frames have been received correctly.
Red	Receive error.
Off	No running measurement.

Status

Color	Description
Green	► On: running measurement. ► Flashing: Device is ready for operation.
Orange	Initializing driver. Please wait.
Red	Error. Device not working.

2.4.5 Technical Data

ARINC 429 channels	4x TX 4x RX
Baud rates	Low-speed: 12 ...14.5 kb/s High-speed: 100 kb/s
Transceiver	TX: Holt HI-8596 RX: Holt HI-8454
Analog input	10 bit Input 0 V...18 V Voltage tolerance up to 50 V (with series resistor) Sampling rate up to 1 kS/s
Digital input	Range 0 V...32 V Schmitt trigger high 2.7 V, low 2.2 V Hysteresis 0.5 V Input frequencies up to 1 kHz
Digital output	Open Drain External supply up to 32 V Output frequency up to 1 kHz Current max. 500 mA Short circuit / over voltage protected
Time stamps	Resolution: 15.625 ns Accuracy (in device): 1 µs Accuracy software sync: typ. 50 µs Accuracy hardware sync: typ. 1 µs
PC interface	USB 2.0
Power supply	USB
Power consumption	2.5 W
Temperature range (ambient temperature of the device)	Operation: -40 °C...+65 °C Storage: -40 °C...+85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Weight	Approx. 250 g
Dimensions (LxWxH)	Approx. 91 mm x 109 mm x 35 mm
Operating system requirements	Windows 10 (64 bit)

3 Getting Started

In this chapter you find the following information:

3.1 Driver Installation

General information

The Vector Driver Setup allows the installation or the removal of Vector devices.

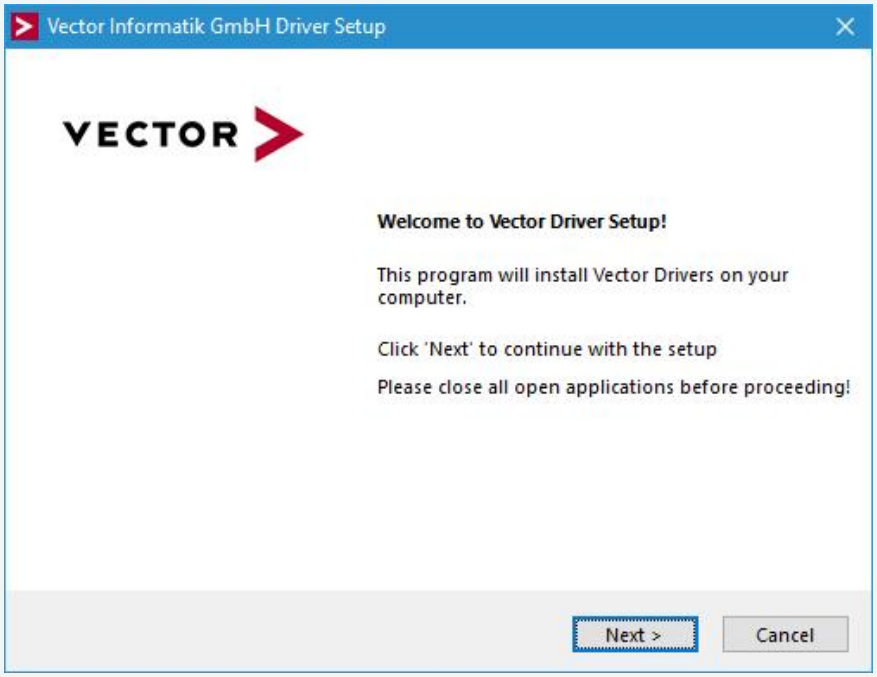
Note

Please note that you will need **Administrator Rights** for the following steps.

Step by Step Procedure

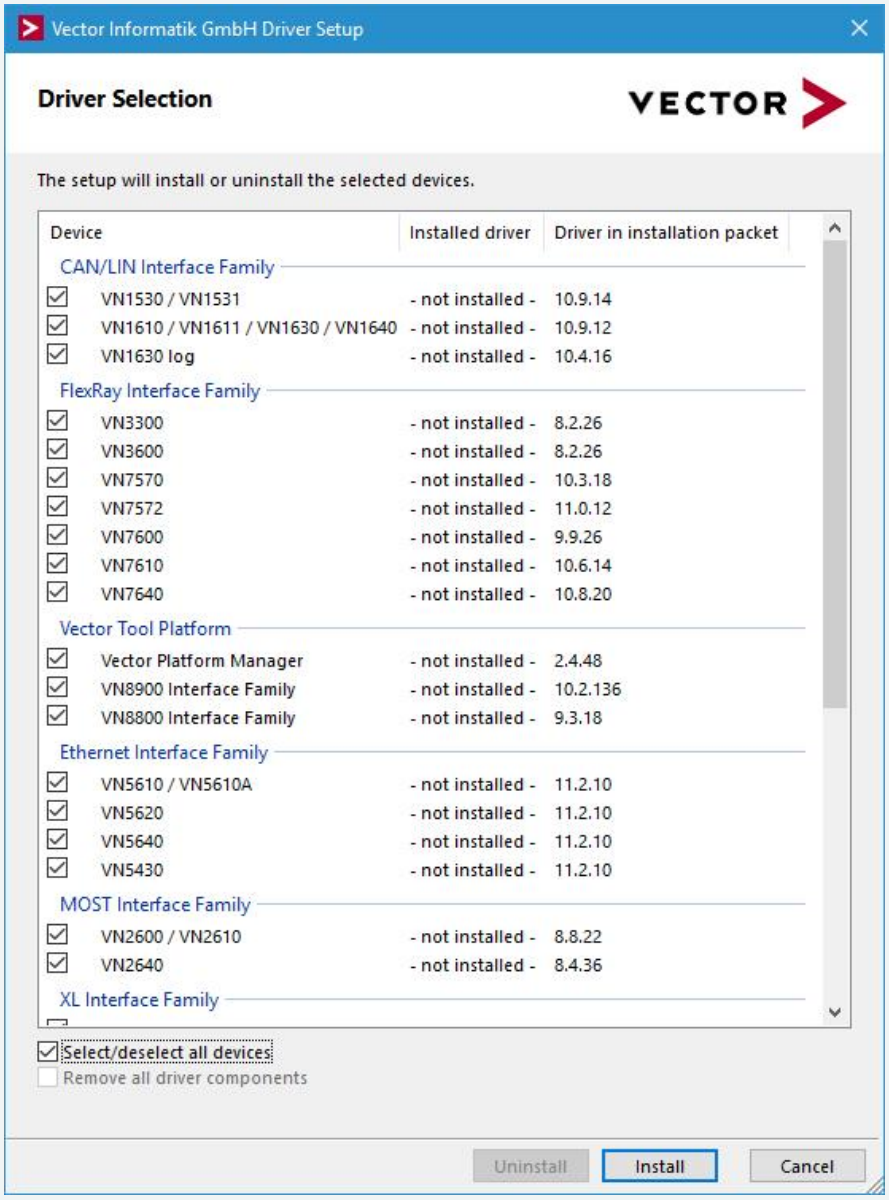
1. Execute the driver setup from `\Drivers\Setup.exe` before the device is connected to the PC with the included USB cable.

   If you have already connected the device to the PC, the **Windows found new Hardware** wizard appears. Close this wizard and then execute the driver setup.



2. Click **[Next]** in the driver setup dialog. The initialization process starts.

3. In the driver selection dialog, select your devices to be installed (or to be uninstalled).



4. Click **[Install]** to execute the driver installation, or **[Uninstall]** to remove existing drivers.
5. A confirmation dialog appears. Click **[Close]** to exit. After successful installation, the device is ready for operation and can be connected to the PC with the included USB cable.

4 Vector Hardware Configuration

In this chapter you find the following information:

4.1 General Information

Executing Vector Hardware Config

After the successful driver installation, you will find the configuration application **Vector Hardware** in the Control Panel (see below). The tool gives you information about the connected and installed Vector devices. There are also several settings that can be changed.

Figure 7: Icon in Control Panel

Control Panel Windows 7

- Category view
  Windows Start | Control Panel | Hardware and Sound,
  click **Vector Hardware** in the list.
- Symbols view
  Windows Start | Control Panel,
  click **Vector Hardware** in the list.

Control Panel Windows 8.1

- Category view
  <Windows key>+<X> | Control Panel | Hardware and Sound,
  click **Vector Hardware** in the list.
- Symbols view
  <Windows key>+<X> | Control Panel,
  click **Vector Hardware** in the list.

Control Panel Windows 10

- Category view
  <Windows key>+<X> | Control Panel | Hardware and Sound,
  click **Vector Hardware** in the list.
- Symbols view
  <Windows key>+<X> | Control Panel,
  click **Vector Hardware** in the list.

4.2 Tool Description

4.2.1 Introduction

Vector Hardware Config

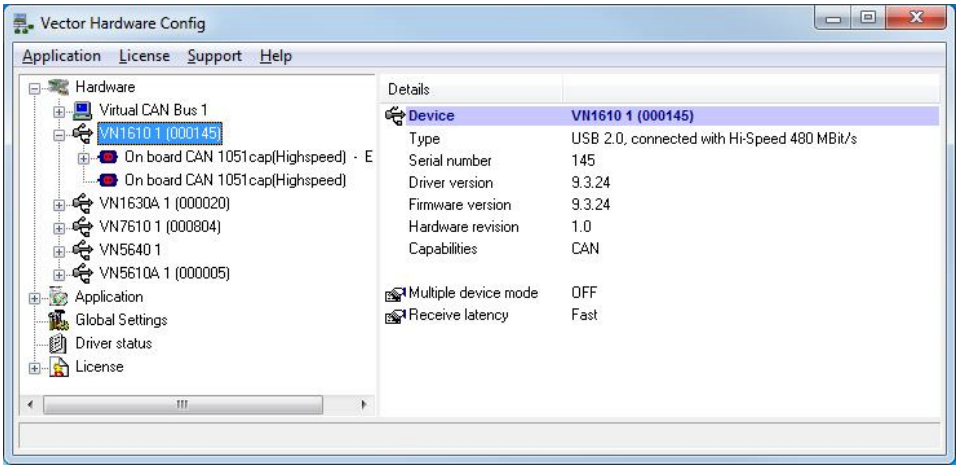


Figure 8: General view of Vector Hardware Config

Logical and physical channels

Vector Hardware Config enables the channel configuration between installed Vector devices and applications. Applications use so-called logical channels which are hardware independent and have to be assigned to real hardware channels.

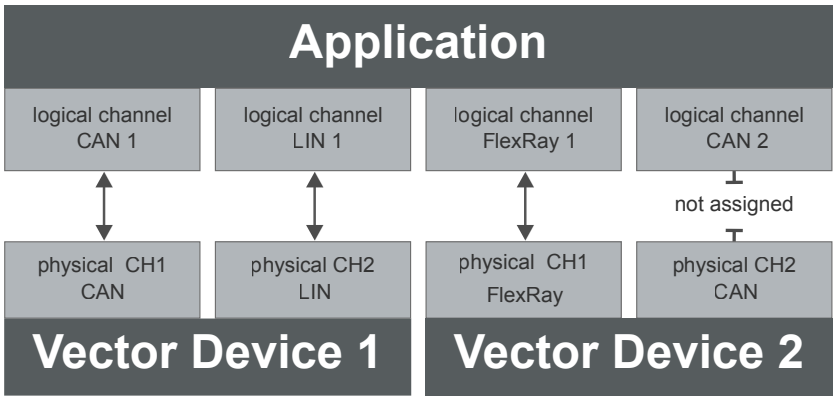


Figure 9: Concept of channel assignments

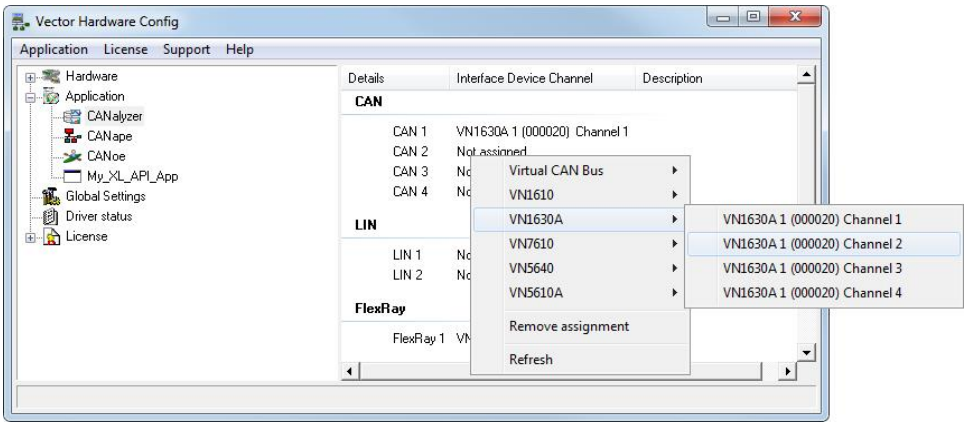


Figure 10: Channel assignment in Vector Hardware Config

4.2.2 Tree View

Accessing Vector devices

The tool is split into two windows. The left window has a tree view and lets you access the installed Vector devices, the right window displays the details of the selection. The following nodes are available in the tree view:

Hardware

The **Hardware** section lists the installed Vector devices. Each device item has physical channels which can be assigned to any number of logical channels (e. g. CANalyzer CAN 1). A logical channel can be assigned to only one physical channel.

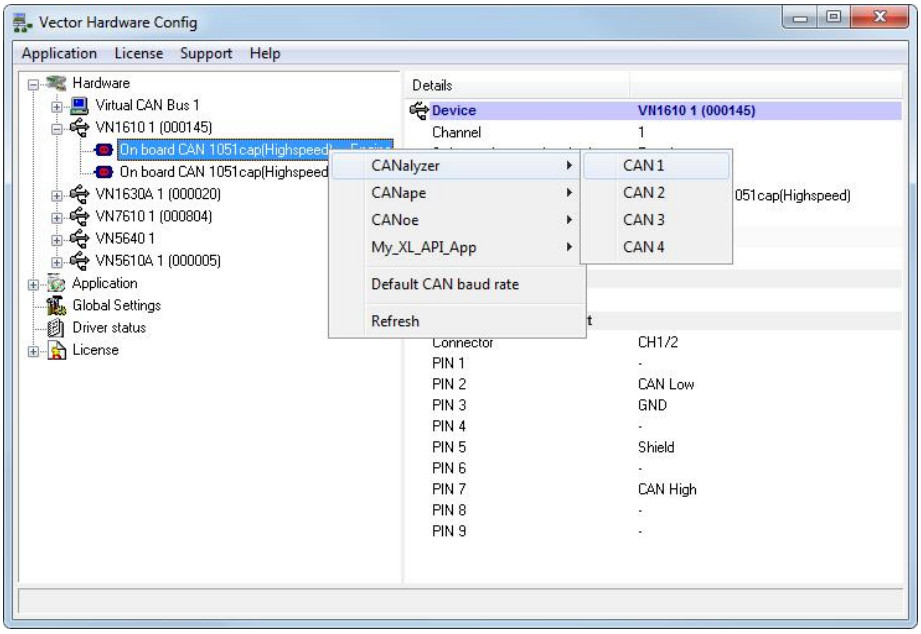


Figure 11: Hardware

Application

In **Application**, all available applications are displayed in a tree view. According to each application, the assignments of logical and physical channels are displayed in the right part of the window. If no assignment exists, the information **Not assigned** appears. The assignment can be edited via a right-click.

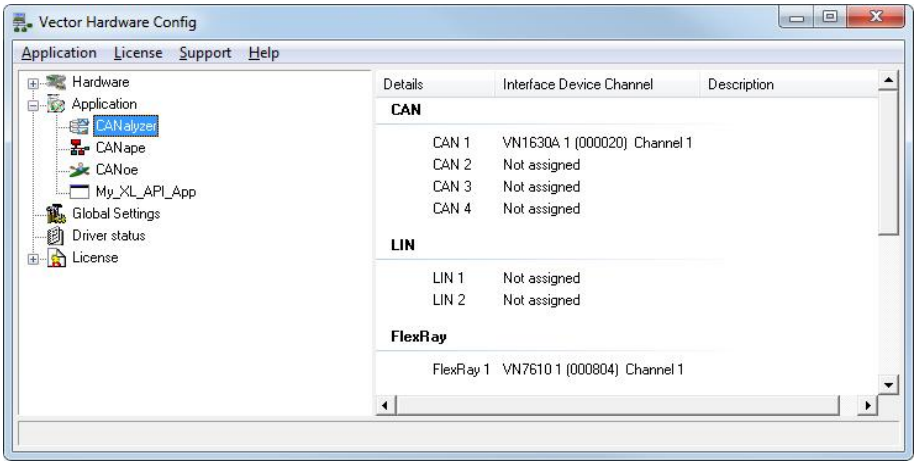


Figure 12: Application

Global settings

Global settings contains global device configuration possibilities, e. g. software time synchronization, GNSS time synchronization, transmit queue size, configuration flags or the number of virtual CAN devices.

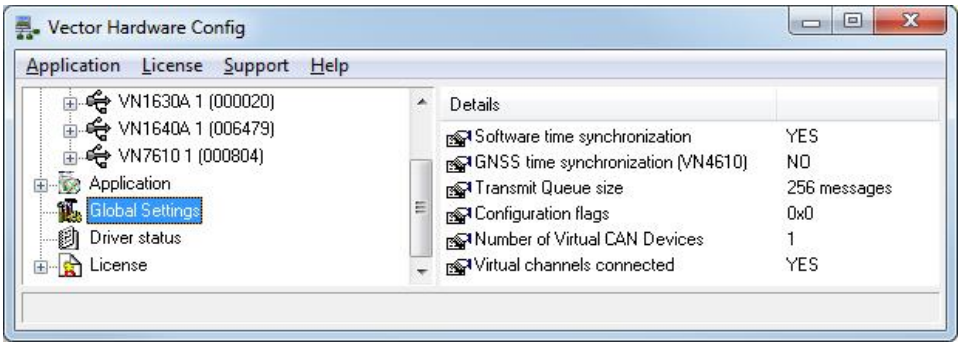


Figure 13: Global settings

Driver status

Driver status offers an overall status information of devices and applications currently in use. You can see whether the channels are connected to the bus (online/offline) and whether the time synchronization is activated or not (Time-Sync-On/Time-Sync-Off).

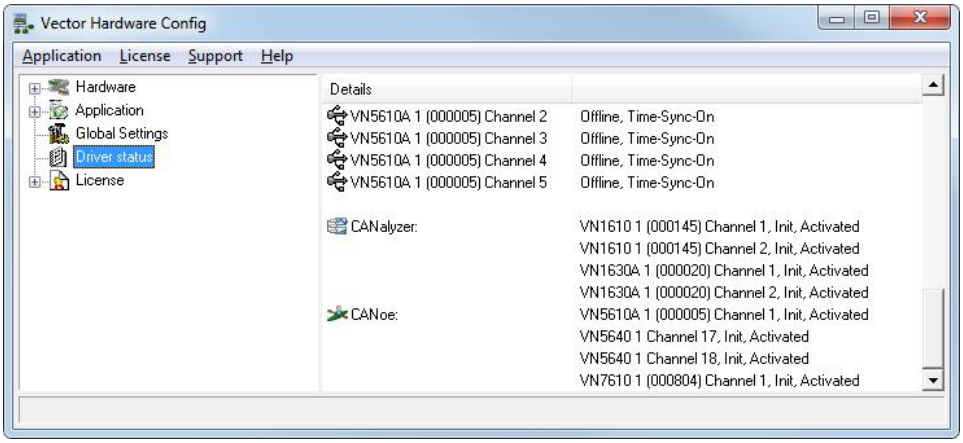


Figure 14: Driver status

License

The **License** section contains information on all current available licenses (Vector bus devices, Vector License USB dongle devices).

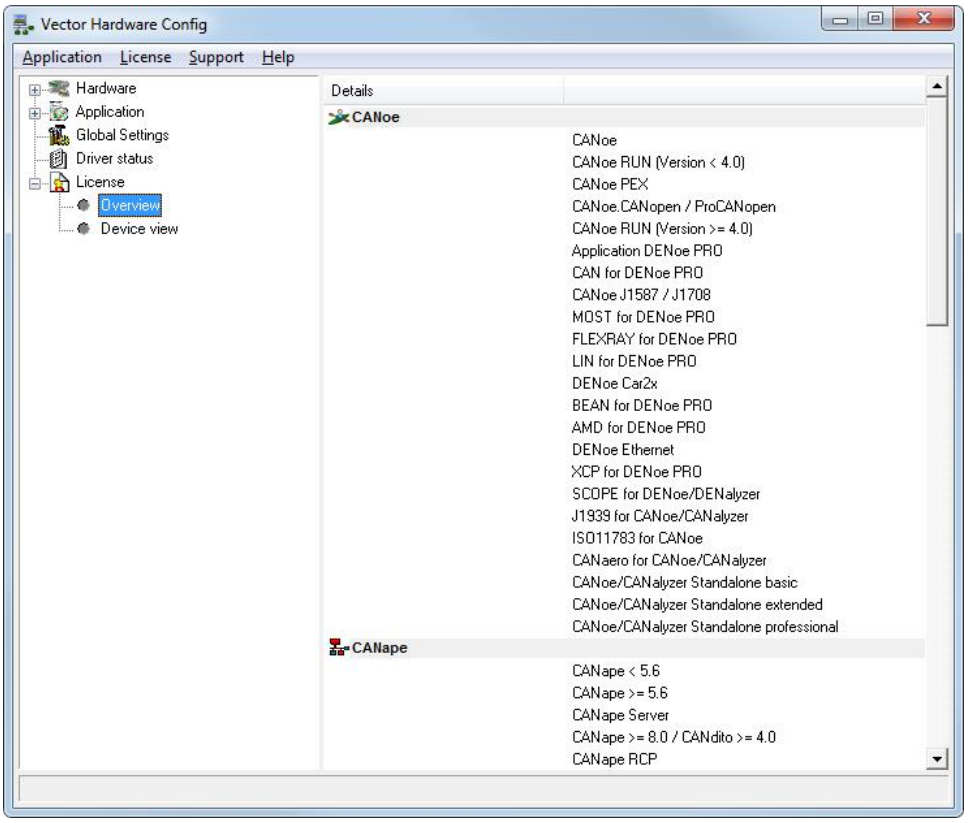


Figure 15: License

Reference

You will find a detailed description of **Vector Hardware Config** in the online help **(Help | Contents)**.

5 Time Synchronization

In this chapter you find the following information:

5.1 General Information

Time stamps and events

Time stamps are useful when analyzing incoming or outgoing data or event sequences on a specific bus.

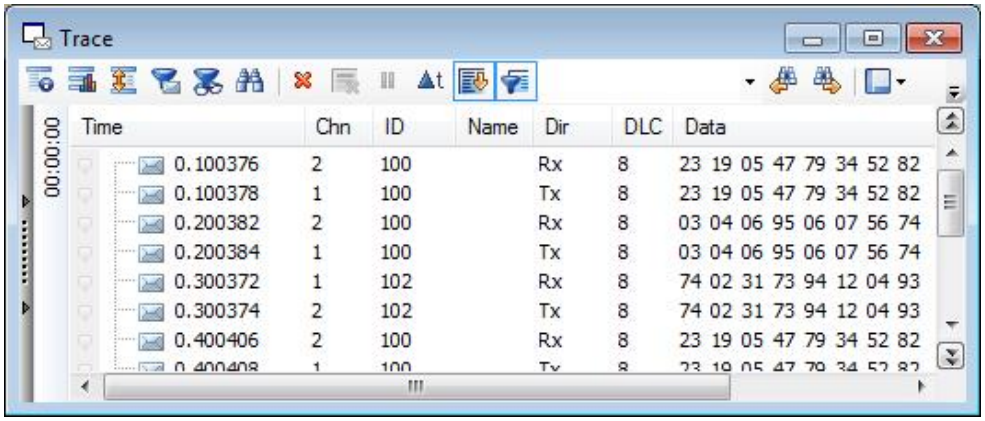


Figure 16: Time stamps of two CAN channels in CANalyzer

Generating time stamps

Each event which is sent or received by a Vector network interface has an accurate time stamp. Time stamps are generated for each channel in the Vector network interface. The base for these time stamps is a common hardware clock in the device.

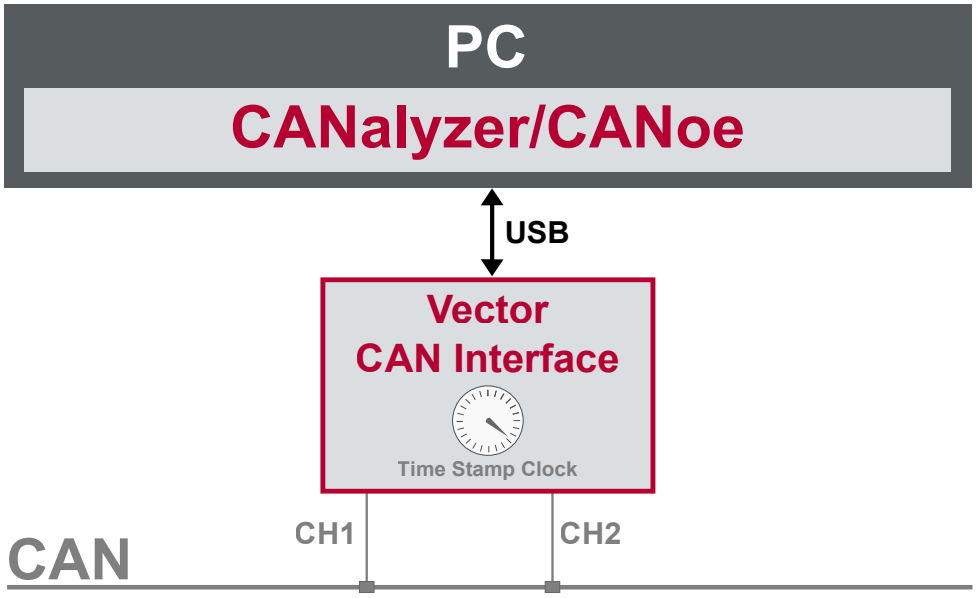


Figure 17: Common time stamp clock for each channel

If the measurement setup requires more than one Vector network interface, a synchronization of all connected interfaces and their hardware clocks is needed.

Due to manufacturing and temperature tolerances, the hardware clocks may vary in speed, so time stamps of various Vector devices drift over time.

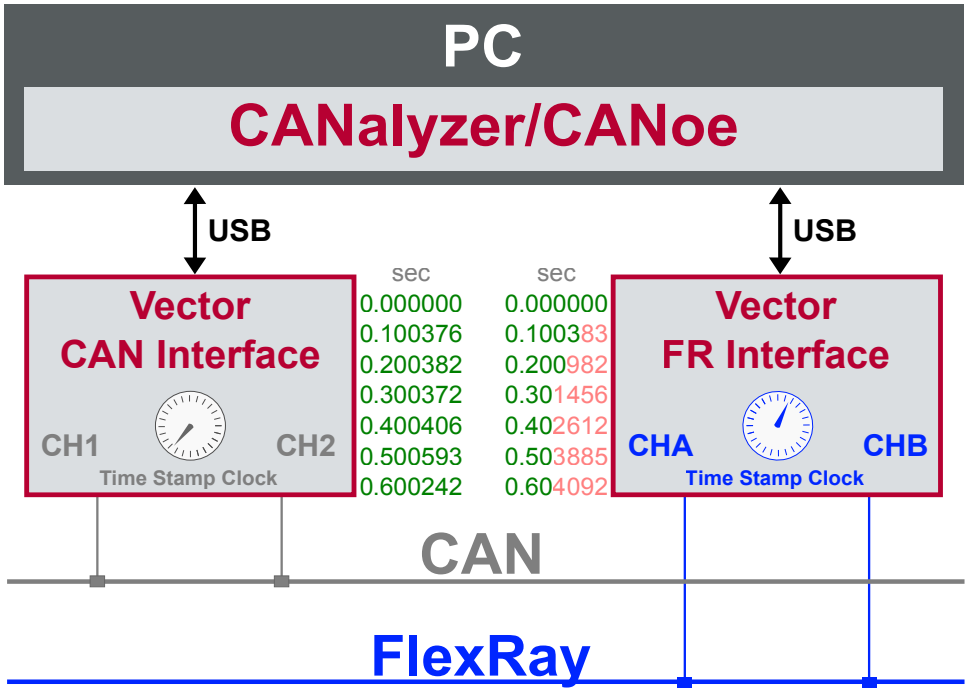


Figure 18: Example of unsynchronized network interfaces. Independent time stamps drift apart

To compensate for these time stamp deviations between the Vector network interfaces, the time stamps can be either synchronized by software or by hardware (see next section).

Note
The accuracy of the software and hardware sync depends on the interface. Further information on specific values can be found in the technical data of the respective devices.

5.2 Software Sync

Synchronization by software

The software time synchronization is driver-based and available for all applications without any restrictions. The time stamp deviations from different Vector network interfaces are calculated and synchronized to the common PC clock. For this purpose no further hardware setup is required.

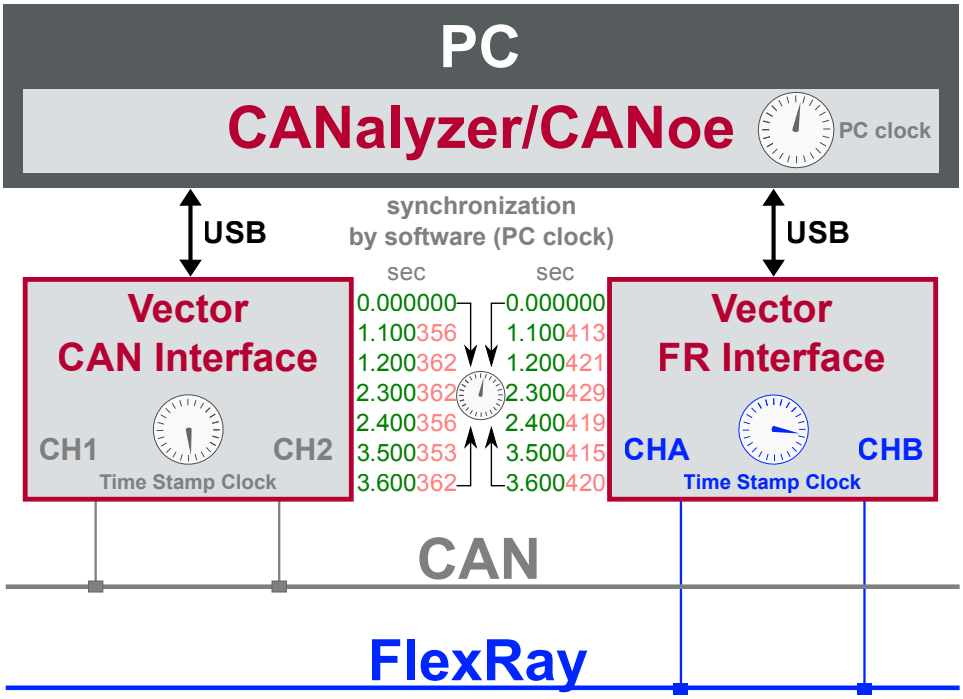


Figure 19: Time stamps of devices are synchronized to the PC clock

The setting of the software time synchronization can be changed in the **Vector Hardware Config** tool in **General information | Settings | Software time synchronization**.

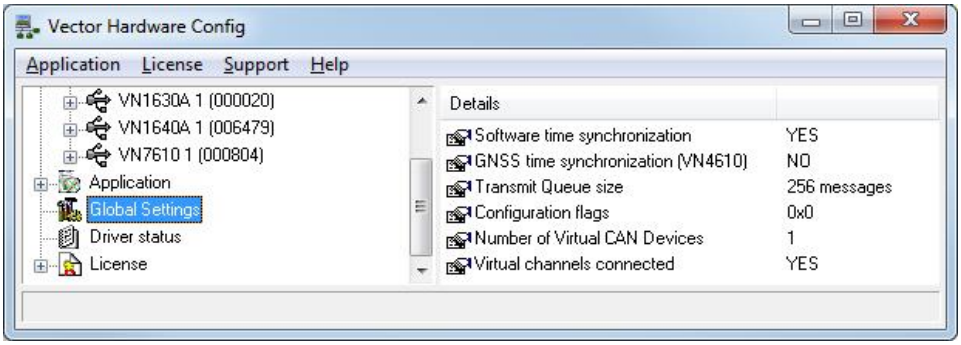


Figure 20: Switching on the software synchronization

- **YES**
  The software time synchronization is active.
- **NO**
  The software time synchronization is not active. Use this setting only if the Vector network interfaces are being synchronized over the sync line or if only a single device is used.

5.3 Hardware Sync

Synchronization by hardware

A more accurate time synchronization of multiple devices is provided by the hardware synchronization which has to be supported by the application (e. g. CANalyzer, CANoe). Two Vector network interfaces can therefore be connected with the SYNCcableXL (see accessories manual, part number 05018).

In order to synchronize up to five devices at the same time, a distribution box is available (see accessories manual, part number 05085).

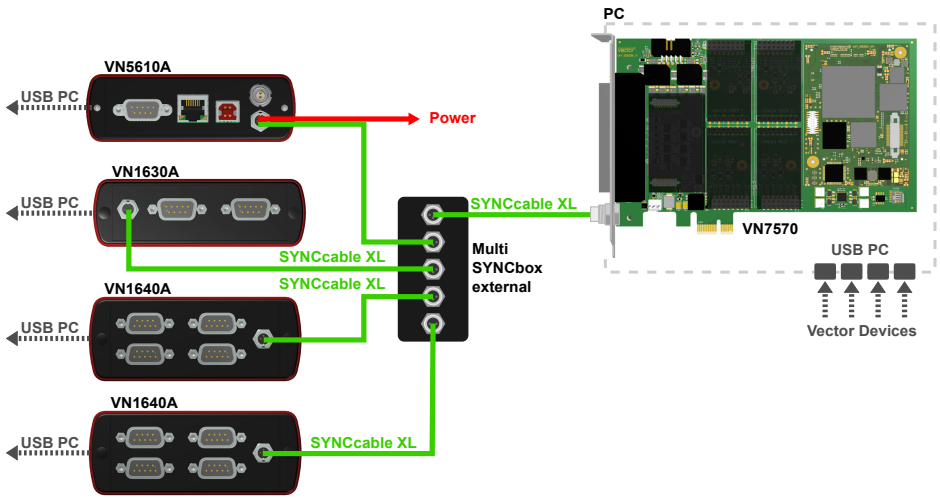


Figure 21: Example of a time synchronization with multiple devices

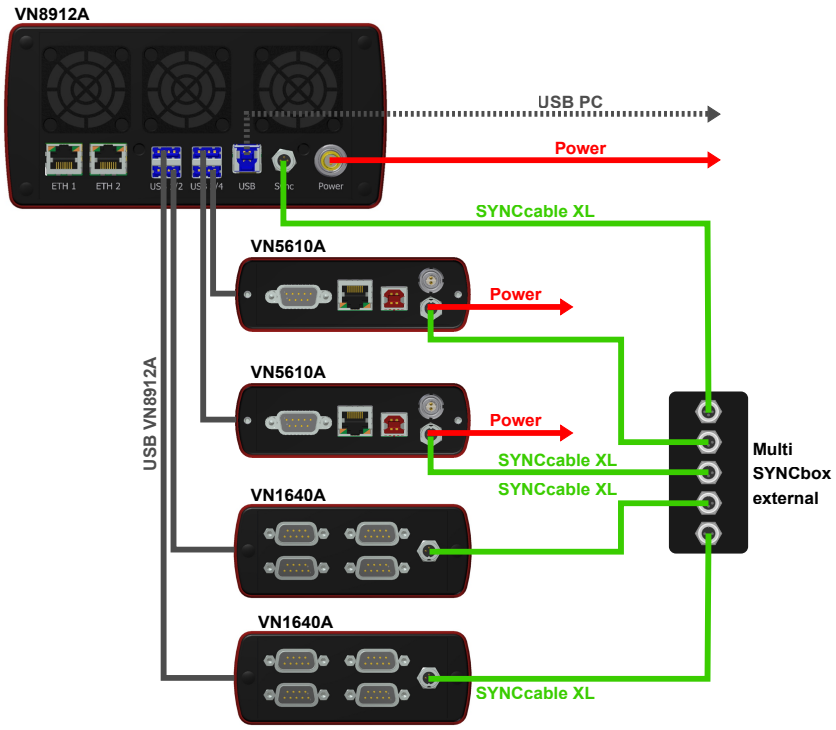


Figure 22: Example of a time synchronization with VN8912A and additional devices

At each falling edge on the sync line which is initiated by the application, the Vector network interface generates a time stamp that is provided to the application. This allows the application to calculate the deviations between the network interfaces

and to synchronize the time stamps to a common time base (master clock) which is defined by the application.

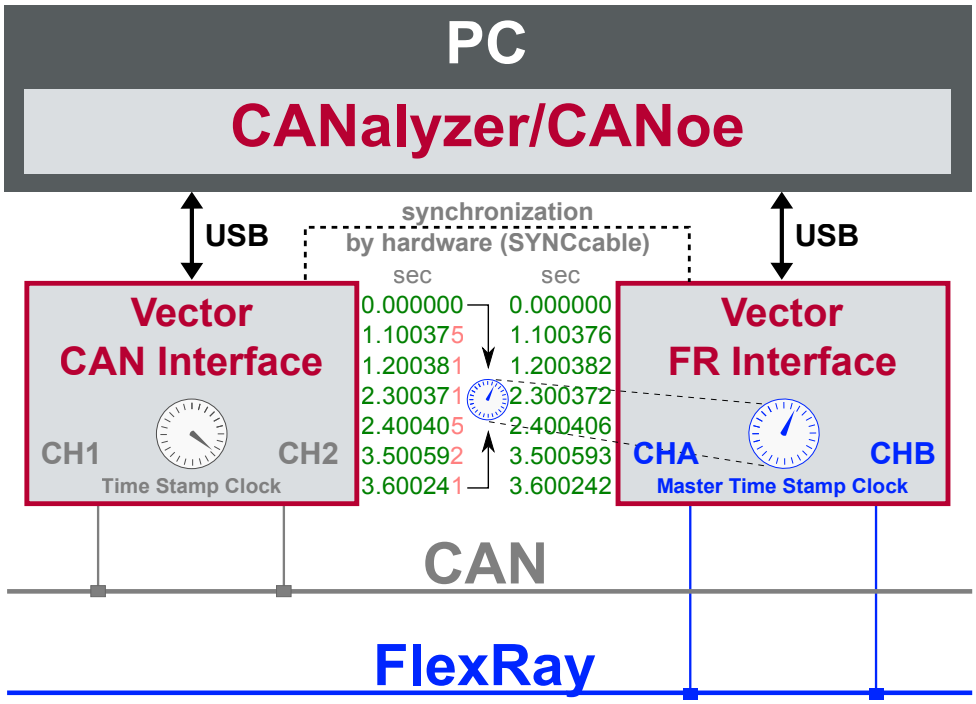


Figure 23: Time stamps are synchronized to the master clock

Note

The hardware synchronization must be supported by the application. For further information please refer to the relevant application manual. Please note that the software synchronization must be disabled (see **Vector Hardware Config | General information | Settings | Software time synchronization**) if the hardware synchronization is used.

VECTOR

Visit our website for:

- News
- Products
- Demo software
- Support
- Training classes
- Addresses