



VN4610 Manual

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Imprint

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Contents

1 Introduction	5
1.1 About this User Manual	6
1.1.1 Warranty	7
1.1.2 Registered Trademarks	7
1.2 Important Notes	8
2 VN4610 802.11p/CAN/GNSS Interface	9
2.1 Scope of Delivery	10
2.2 Introduction	10
2.3 Accessories	12
3 Examples of Usage	13
3.1 General Use Cases	14
4 Device Description	15
4.1 Connectors Bus Side	16
4.2 Connectors USB Side	17
4.3 LEDs	20
4.4 Technical Data	21
5 Getting Started	22
5.1 Driver Installation	23
5.1.1 General Information	23
5.1.2 Installation Instructions	23
5.2 Command Line	25
5.3 Vector Driver	26
5.3.1 Prerequisites	26
5.3.2 Options and Actions	26
5.4 Remarks	29
5.5 Vector Hardware Manager	30
5.5.1 Hardware Configuration	30
5.5.2 Tool Location and Help	30
5.6 Loop Tests	31
5.6.1 CAN	32
6 Time Synchronization	34

6.1 General Information	35
6.2 Software Sync	37
6.2.1 General Information	37
6.2.2 Configuration	37
6.3 Hardware Sync	38
6.3.1 General Information	38
6.3.2 Configuration	39
6.4 Precision Time Protocol Sync	40
6.4.1 General Information	40
6.4.2 Supported Features	40
6.4.3 Network Topology	41
6.4.4 Configuration	41
6.5 GNSS Sync	42
6.5.1 General Information	42
6.5.2 Configuration	42
7 Vehicle Electrics and Ground/Earth	43
7.1 General Information	44
7.2 Vehicle Battery Only (Closed System)	45
7.3 External Power Supplies (Test Bench)	46
8 Important Notes - Details	47
8.0.1 Safety Instructions and Hazard Warnings	48
8.0.2 Disclaimer	50
8.0.3 Disposal of Vector Hardware	51
9 Wichtige Hinweise	52
9.0.1 Sicherheits- und Gefahrenhinweise	53
9.0.2 Haftungsausschluss	55
9.0.3 Entsorgung von Vector Hardware	56

1 Introduction

In this chapter you find the following information:

1.1 About this User Manual	6
1.1.1 Warranty	7
1.1.2 Registered Trademarks	7
1.2 Important Notes	8

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, Windows 11 are trademarks of the Microsoft Corporation.

1.2 Important Notes

**WARNING!**

We provide our important notes and safety instructions in several languages, including English (EN) and German (DE). For more details, see the relevant section:

- ▶ EN: [Important Notes - Details](#)
- ▶ DE: [Wichtige Hinweise](#)

2 VN4610 802.11p/CAN/GNSS Interface

In this chapter you find the following information:

2.1 Scope of Delivery	10
2.2 Introduction	10
2.3 Accessories	12

2.1 Scope of Delivery

Contents

The delivery includes:

- ▶ 1x VN4610 802.11p/CAN/GNSS Interface
- ▶ 2x 5.9 GHz DSRC antenna (part no. 07204)
- ▶ 1x GNSS antenna (part no. 07205)
- ▶ 1x Power supply (part no. 05024)
- ▶ 1x USB 2.0 cable (part no. 05011)

2.2 Introduction

About the VN4610

The VN4610 is a powerful interface with USB PC connection for accessing IEEE 802.11p and CAN FD networks. The dedicated short range communication (DSRC) is based on the IEEE802.11p standard, which transmits/receives frames in the 5.9 GHz frequency range. The VN4610 supports the unfiltered receiving and sending of IEEE 802.11p frames used for the implementation of Car2x/V2x applications. It is possible to synchronize the received radio frames with CAN FD messages. The built-in GNSS receiver supplies the absolute UTC time and current position.



Figure 1: VN4610 802.11p/CAN Interface (bus side)

Overview of Advantages

- ▶ Sending/receiving frames according to IEEE 802.11p
- ▶ Two configurable IEEE 802.11p WLAN channels
- ▶ Unfiltered forwarding of IEEE 802.11p data packets to the application
- ▶ Adjustable communication parameters such as radio channel selection, bandwidth, transmission power, modulation type and protocol format LPD/EPD

- ▶ Two CAN High-Speed channels (CAN / CAN FD capable)
- ▶ GNSS receiver provides current position and time
- ▶ Precise time stamp based on GNSS time
- ▶ VN4610 and CANoe.Car2x/CANalyzer.Car2x are optimally matched to each other
- ▶ Synchronization with several interfaces and with other bus systems (Ethernet, CAN, LIN, FlexRay, ...)
- ▶ Robust housing, power supply and temperature range ideal for automotive and industrial applications
- ▶ IO port with digital/analog in/out
- ▶ Ethernet with IEEE802.3: 100BASE-TX and 1000BASE-T
- ▶ Multi-application support (simultaneous operation of different applications on one channel, e. g. CANoe and CANape)
- ▶ High time stamp accuracy
- ▶ Time synchronization of multiple devices and with other bus systems (CAN, LIN, FlexRay, MOST, Ethernet)
- ▶ Software time synchronization
- ▶ Hardware time synchronization
- ▶ GNSS time synchronization to absolute UTC time
- ▶ Time synchronization according to PTP IEEE 1588 v2
- ▶ Connection to host PC via USB 2.0
- ▶ LEDs indicating status and activities
- ▶ External power supply, galvanically isolated

2.3 Accessories



Reference

Information on available accessories can be found in the separate accessories manual on our [website](#).

3 Examples of Usage

In this chapter you find the following information:

3.1 General Use Cases	14
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3.1 General Use Cases

Analysis

The VN4610 forwards all received radio frames of the two radio channels unfiltered to the test tool for analysis. Therefore, frames can also be analyzed which would be rejected by a ECU due to timing, geo information or protocol errors caused by Car2x/V2x. Since the time stamps of the messages on the bus channels are synchronized in time, latency measurements can also be carried out.

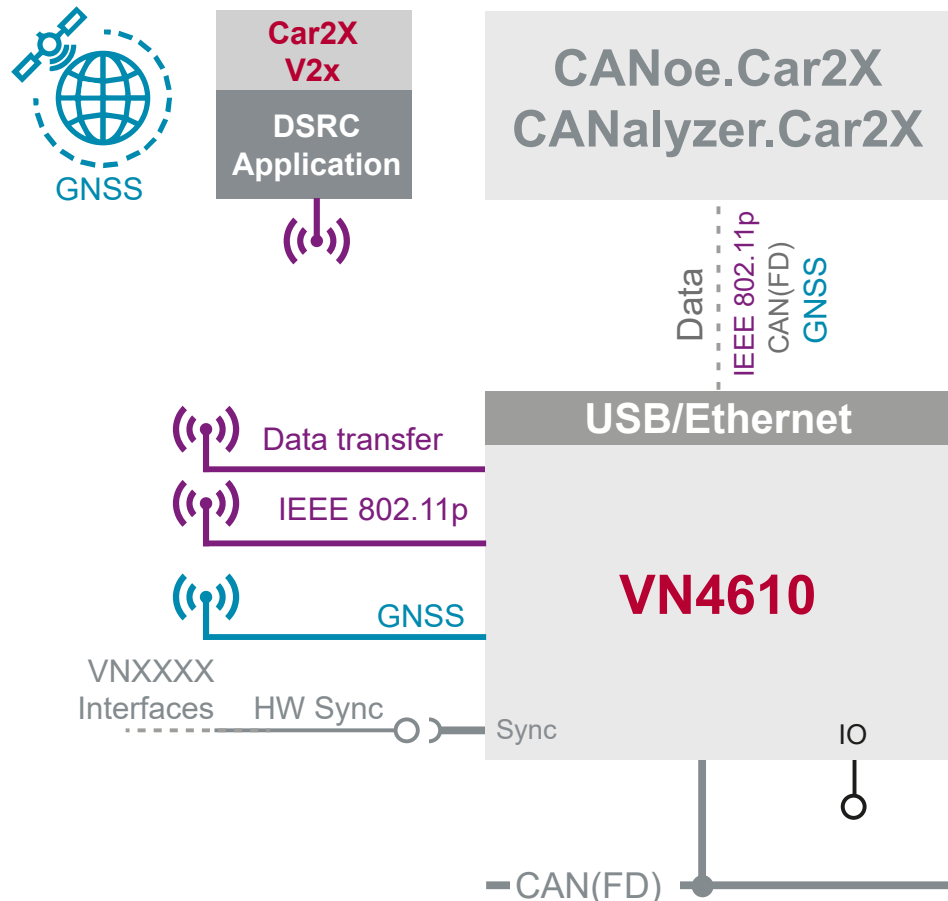


Figure 2: General use cases

Simulation/ Stimulation

CANoe.Car2x together with the VN4610 offers a perfectly coordinated solution for creating an environment stimulation for testing Car2x/V2x applications. The VN4610 sends the transmitted frames, whereby the communication parameters can be easily and individually configured for the different tests.

GNSS Receiver

The VN4610 provides precise position, time and speed information that can be used by the application as test stimulus or for documentation. In addition, the absolute GNSS timestamps can be used to synchronize recordings of distributed measurements for subsequent analysis. Additionally, the VN4610 can act as IEEE 1588 time master and provide the GNSS time in a network (in a future release).

Time synchronization

The VN4610 enables precise time synchronization with PTP according to IEEE1588 standard. The device can be configured e. g. as PTP timeTransmitter with UTC time base, which is provided by the built-in GNSS receiver.

4 Device Description

In this chapter you find the following information:

4.1 Connectors Bus Side	16
4.2 Connectors USB Side	17
4.3 LEDs	20
4.4 Technical Data	21

4.1 Connectors Bus Side

Device connectors



Figure 3: Connectors on the bus side

► Antenna 1/2 (CH1/CH2)

The VN4610 has two 802.11p channels which can be used to transmit and receive data packages. Please attach the provided antennas before using these channels.

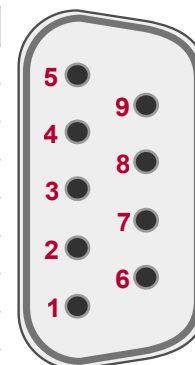
► GNSS (CH5)

This channel can be used to receive GNSS time and position.

► D-SUB9 (CH3/CH4)

The VN4610 has two D-SUB9 connectors for CAN/CAN FD. The channels are electrically isolated. The pin assignment is as follows:

Pin	Assignment
1	Not connected
2	1057G CAN Low
3	GND
4	Not connected
5	Not connected
6	Not connected
7	1057G CAN High
8	Not connected
9	Not connected



4.2 Connectors USB Side

Device connectors

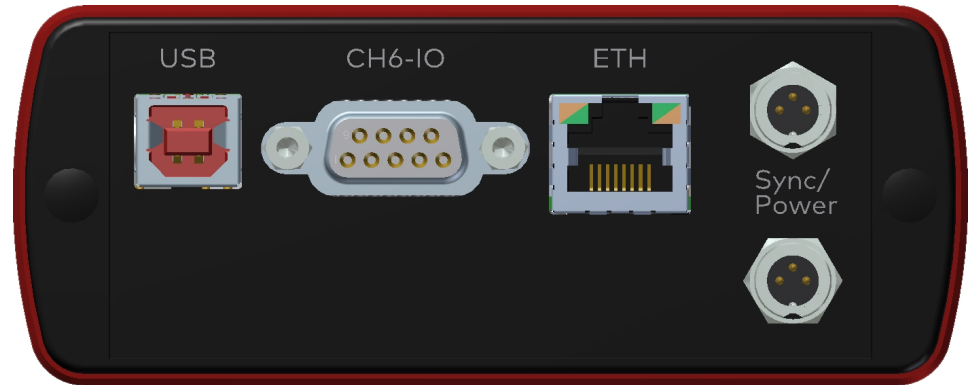


Figure 4: Connectors on the USB side

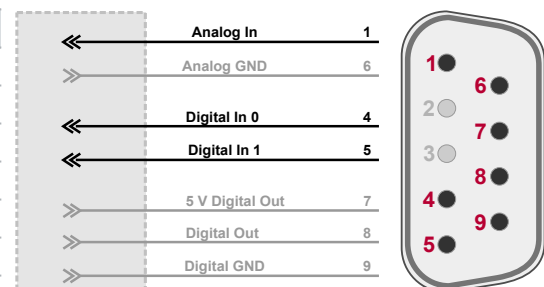
► USB

Connect your PC and the VN4610 over USB to install and to use the device with measurement applications (CANoe, CANalyzer). Use the USB 2.0 compliant cable found in the delivery (USB extension cables may generate faults between the PC and the device). Connect the device directly to a USB port at your PC or use a USB hub with its own power supply (self-powered).

► D-SUB9 (CH6)

The VN4610 has a D-SUB9 connector for dedicated digital input/output tasks. The pin assignment 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	5 V digital output
8	Digital output
9	Digital GND



Internal interconnection of digital input 0/1

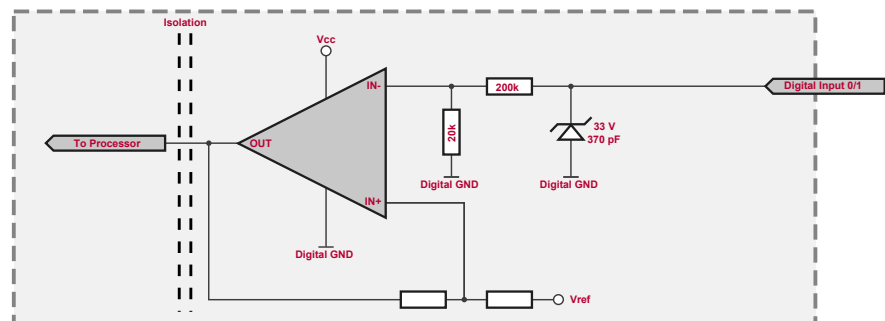


Figure 5: Digital input 0/1

Internal
interconnection of
digital output

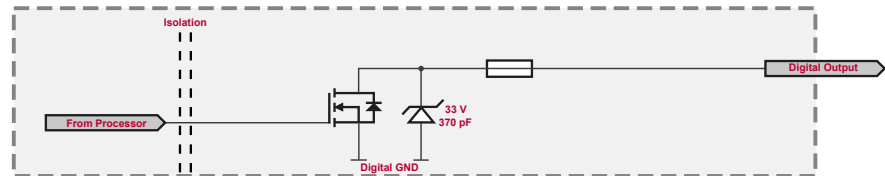


Figure 6: Digital output

Internal
interconnection of
analog input

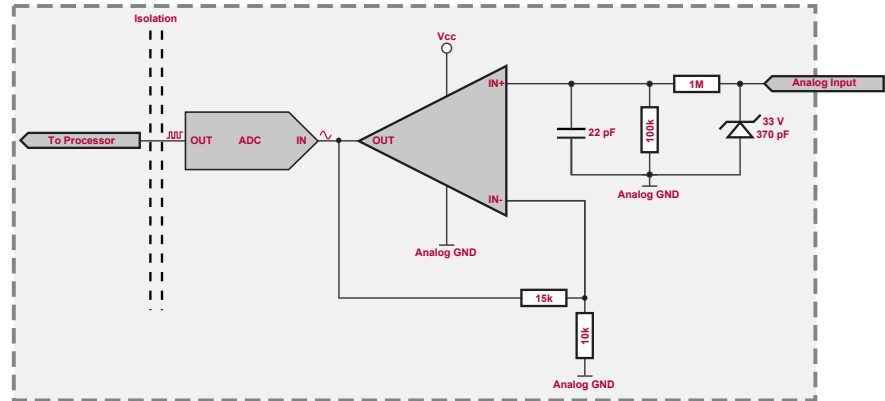


Figure 7: Analog input

Internal
interconnection of
5 V digital output

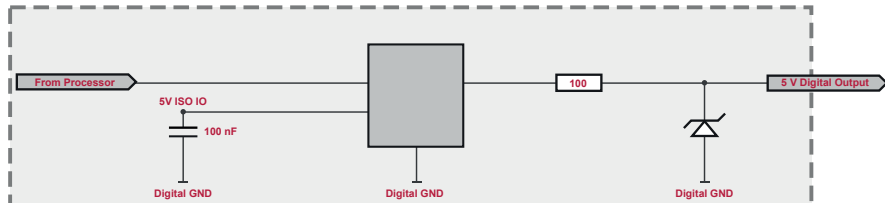


Figure 8: 5 V digital output

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:

$$R_{ext} [k\Omega] = [(U_{input} * 0.61111) - 11] * 100$$

with $18 V < U_{input} \leq 50 V$

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

$$f_c [Hz] = \frac{1}{2.33 * 10^{-6} * R_{ext} [k\Omega]}$$

Examples

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

Device connectors (continued)

► Ethernet (RJ45)

Connect your PC and the VN4610 via this Ethernet port to install the device and use it together with measurement applications (CANoe, CANalyzer).

► Power/Sync (Binder connector)

The VN4610 has two power/sync connectors (Binder type 711) which can be used for time synchronization of different Vector devices (see section [Time Synchronization](#) on page 34) or for power. It does not matter which connector is used to supply the device. For proper operation of the VN4610, an external power supply is required.

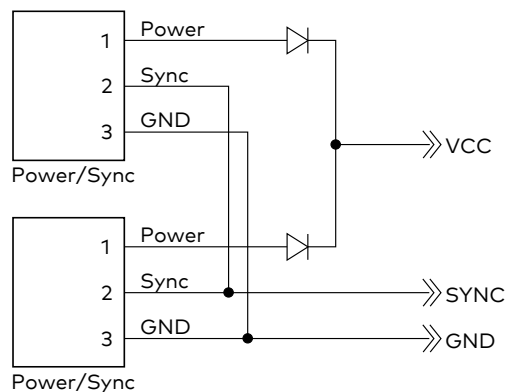


Figure 9: Internal wiring of the power/sync connector

Pin	Assignment
1	Power supply (typ. 12 V)
2	Synchronization line
3	Ground



4.3 LEDs

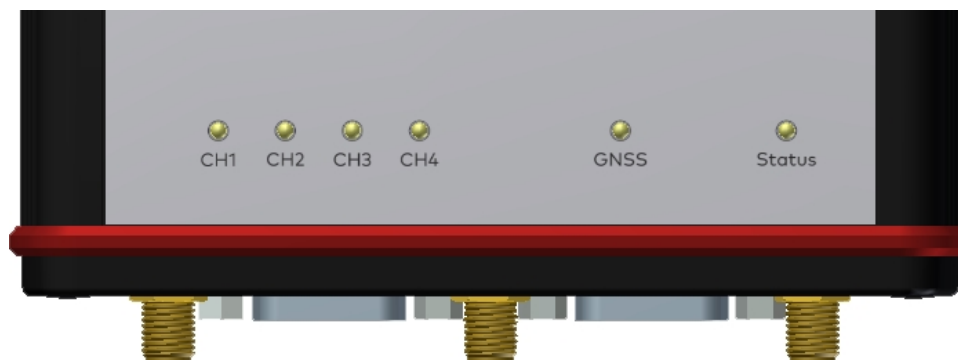


Figure 10: LEDs of the VN4610

► CH1/CH2

Multicolored channel LEDs indicating the WiFi activity.

Color	Description
Green	Data frames have been sent or received correctly.
Red	Transmission errors during sending or receiving.

WiFi: The flashing frequency depends on the bus load.

► CH3/CH4

Multicolored channel LED indicating the bus activity.

Color	Description
Green	Data frames have been sent or received correctly.
Orange	CAN: Error frames have been sent or received.
Red	CAN: Bus off.

CAN: The flashing frequency depends on the bus load.

► GNSS

Multicolored channel LED indicating the GNSS activity.

Color	Description
Green	► On: SAT fix within the specified accuracy settings achieved. ► Flashing: SAT fix without reaching the specified accuracy settings.
Red	► On: No Satellite signal. ► Flashing: Satellite signal too weak.

► Status

Multicolored channel LED indicating the status.

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

4.4 Technical Data

802.11p channels	NXP SAF5100 depending on modulation type up to 27 Mbit/s
GNSS channel	uBlox NEO-M8U, supports GPS, GLONASS, Beidou, Galileo; up to 3 systems at the same time
CAN/CAN FD channel	2x NXP TJA1057G CAN up to 2 Mbit/s. CAN FD up to 8 Mbit/s.
Ethernet channel	IEEE 100BASE-TX/1000BASE-T
Analog input	10 bit Input 0 V...18 V ($R_i = 1.1\text{ M}\Omega$) Voltage tolerance up to 30 V
Digital input	Range 0 V...32 V Schmitt trigger high 2.8 V, low 2.3 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
5 V digital output	5 V TTL output signal on D-SUB9 connector, pin 7. GND reference of the signal is digital GND on pin 9.
Time stamps	Accuracy (within one device): 1 μs Accuracy software sync: typ. 50 μs Accuracy hardware sync: typ. 1 μs
PC interface	USB 2.0 / Ethernet IEEE 100BASE-TX/1000BASE-T
Time synchronization	PTP IEEE 1588 v2
Average response time	250 μs
Input voltage	6 V ... 50 V DC
Power consumption	Approx. 7 W
Temperature range (ambient temp. of the device)	Operation: -40 °C ... +60 °C Storage: -40 °C ... +85 °C
Relative humidity of ambient air	15 %...95 %, non-condensing
Dimensions (LxWxH)	Approx. 111 mm x 157 mm x 45 mm without antennas
Weight	Approx. 610 g
Housing	Robust aluminium housing
Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)

5 Getting Started

In this chapter you find the following information:

5.1 Driver Installation	23
5.1.1 General Information	23
5.1.2 Installation Instructions	23
5.2 Command Line	25
5.3 Vector Driver	26
5.3.1 Prerequisites	26
5.3.2 Options and Actions	26
5.4 Remarks	29
5.5 Vector Hardware Manager	30
5.5.1 Hardware Configuration	30
5.5.2 Tool Location and Help	30
5.6 Loop Tests	31
5.6.1 CAN	32

5.1 Driver Installation

5.1.1 General Information

**WARNING!**

Do not operate the device without antennas! To avoid physical damage to the device, please attach the provided antennas to the device before operation!

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

**Note**

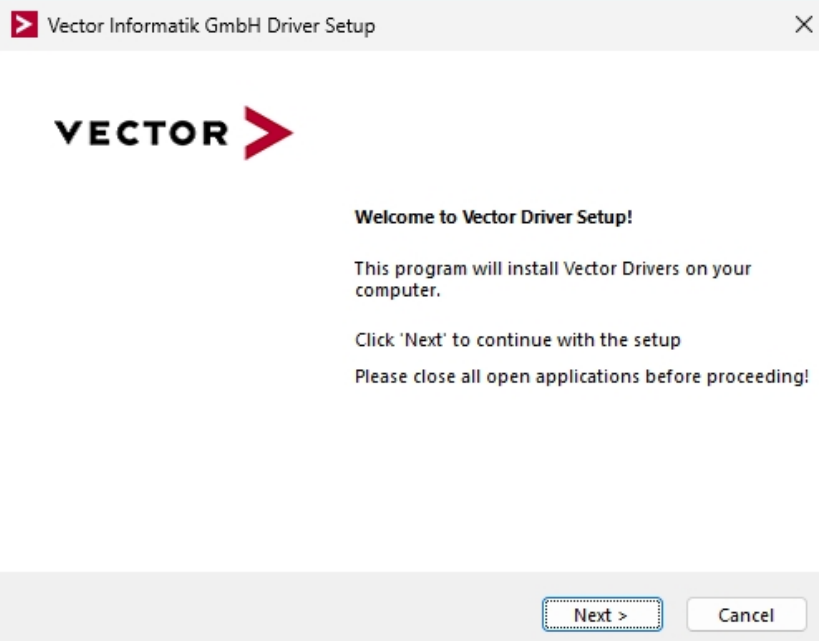
Please note that you will need **Administrator Rights** for the following steps.

5.1.2 Installation Instructions

**Step by Step Procedure**

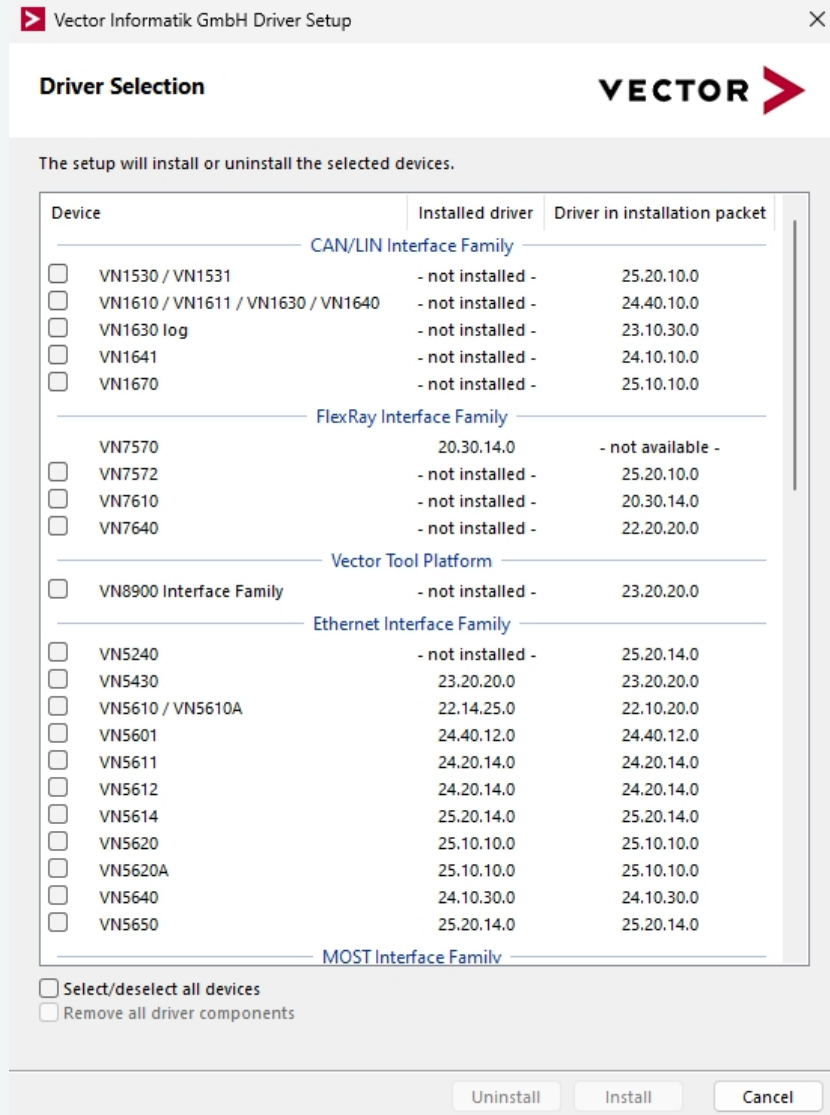
1. Execute the driver setup `\Drivers\Setup.exe` before the device is connected to the computer with the included USB cable.

If you have already connected the device to the computer, 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 computer with the included USB cable and powered by supplying external voltage (e. g. with an appropriate cable offered by Vector).

5.2 Command Line

Command line installation is an important feature for administration purposes when new drivers need to be installed or updated in the background without user interaction.

This section describes how to use the command line for

▶ [Vector drivers](#)

5.3 Vector Driver

5.3.1 Prerequisites

Prerequisites

Administrative rights are required to use the `setup.exe` command line tool. If the device is not connected to the computer during installation, a pre-installation to the Windows Driver Store is performed. If the device is connected to the computer for the first time, the device driver installation must be completed. The requirements and actual behavior of this process varies between Windows operating systems (see section [Remarks](#) on page 29).

5.3.2 Options and Actions

The `setup.exe` can be found on the Vector Driver Disk and provides a command line interface as follows:

```
setup.exe [option] [action]
```

5.3.2.1 Options

Option	Command	Description
Silent mode	/s	Executes the driver setup in silent mode. No user interaction is required. This command cannot be used with uncertified Vector drivers. Use with the <code>/installCert</code> option under Windows 7/8 and above.
No virtual driver	/nv	Does not install any virtual driver (Virtual CAN Bus).
Update only	/uo	The setup is forced to install only a newer version of a driver located in the folder <code>\Drivers</code> .
Vector DLLs only	/dongleDLLsOnly	Use this option to install only the Vector Keyman API DLLs. The WIBU service of the dongle manufacturer will not be installed. Attention: This option is only valid if you actually install the Vector Keyman driver. This means using action: <code>/i keyman</code> .
Install certificate	/installCert	This option installs the Vector driver certificate in the local certificate store under trusted publishers. Use this option in conjunction with the <code>/s</code> option to silently install the Vector drivers under Windows 7/8 and above.
No CodeMeter runtime service	/ncmr	Does not install the WIBU service.

5.3.2.2 Actions

Action	Command	Description
Install	/i <driver name>	Installs the specified driver from the driver source path. The driver name is the name of the device (e. g. <code>vn1630</code>). Lower case and

Action	Command	Description
		upper case will be ignored.
Install all	/i all	Installs all available interface drivers from the driver source path. Note: The following drivers are not automatically installed with the all option: Vector Keyman VN8900 Ethernet driver (vnlpClient). They must be installed explicitly.
Install all and Vector Keyman	/i all keyman	Installs all available interface drivers from the driver source path and the Vector Keyman.
Install all and Vector Keyman	/i all keyman	Installs all available interface drivers from the driver source path and the Vector Keyman.
Uninstall	/u <driver name>	Removes (uninstalls) the specified driver from the system. The driver name is the name of the device (e. g. vn1630). Lower case and upper case will be ignored.
Uninstall all	/u all	Removes (uninstalls) all interface drivers and driver components from the system. This action removes everything except for the Vector Keyman and the VN8900 Ethernet driver (vnlpClient).
Uninstall all and Vector Keyman	/u all keyman	Removes (uninstalls) all available interface drivers from the system including the Vector Keyman.
Info	/info <file name>	Creates a new file containing information about the drivers, which are available in this installation package (e. g. the version number).
Install Vector Keyman	/i keyman	Installs only the Vector Keyman.
Install virtual driver and driver components only	/i virtual	Installs the virtual driver and the driver components only.
Uninstall Vector Keyman	/u keyman	Uninstalls the Vector Keyman.
Uninstall the virtual driver and driver components	/u virtual	Uninstalls the virtual driver and the driver components only.
No automatic update	/noAutoUpdate <driver name>	Disables automatic updating of software running on the device when a driver is installed on the host system. The driver name is the name of the device (e. g. vx1161.41). Lower case and upper case will be ignored. If the specified driver does not support this feature, the action is silently ignored.
No automatic update all	/noAutoUpdate all	Disables automatic updating of software running on the device when a driver is installed on the host system for all drivers that support this feature.

5.3.2.3 Return Values

When executing `setup.exe` in command line mode, the following values may be returned:

Return Value	Description
0	The operation was successful.
1	The installation was not successful.
2	The uninstallation was not successful.
3	Restart of the system is required.
4	Command <code>/info</code> could not be executed.
5	User attempted to install/uninstall an unknown driver or component.
6	The setup process was interrupted because the XLAPI DLL is still being used by another process.

5.3.2.4 Examples

Action	Command
<code>setup.exe /s /installCert /i all</code>	Installs all interface drivers silently. Except for the Vector USB dongle, the Vector Keyman and the VN8900/VN8810 Ethernet drivers.
<code>setup.exe /s /installCert /i all vnipcclient vnipc18800</code>	Installs all interface drivers silently including the VN8900/VN8810 Ethernet drivers.
<code>setup.exe /s /installCert /i all keyman</code>	Installs all interface drivers silently including the Vector Keyman.
<code>setup.exe /s /installCert /i vn1630</code>	Installs the driver for VN1630(A) silently.
<code>setup.exe /s /i keyman</code>	Installs the driver for the Vector Keyman silently.
<code>setup.exe /s /dongleDLLsOnly /i keyman</code>	Installs only the Vector Keyman API-DLLs silently. The CodeMeter runtime is not installed.
<code>setup.exe /s /dongleDLLsOnly /u keyman</code>	Uninstalls only the Vector Keyman API-DLLs silently. The CodeMeter runtime is not uninstalled.
<code>setup.exe /s /u vn1630</code>	Uninstalls the VN1630 driver from the system silently.
<code>setup.exe /info "Drivers.txt"</code>	Example output of <code>Drivers.txt</code> <pre>[Common] version=0x703001e root=C:\Drivers\ file1=setup.exe file2=DIFxAPI.dll file3=.\CommonFiles [CANboardXL] version=0x7030012 path=.\CANboardXL</pre>

5.4 Remarks

► Windows 10 (64 bit) / Windows 11 (64 bit)

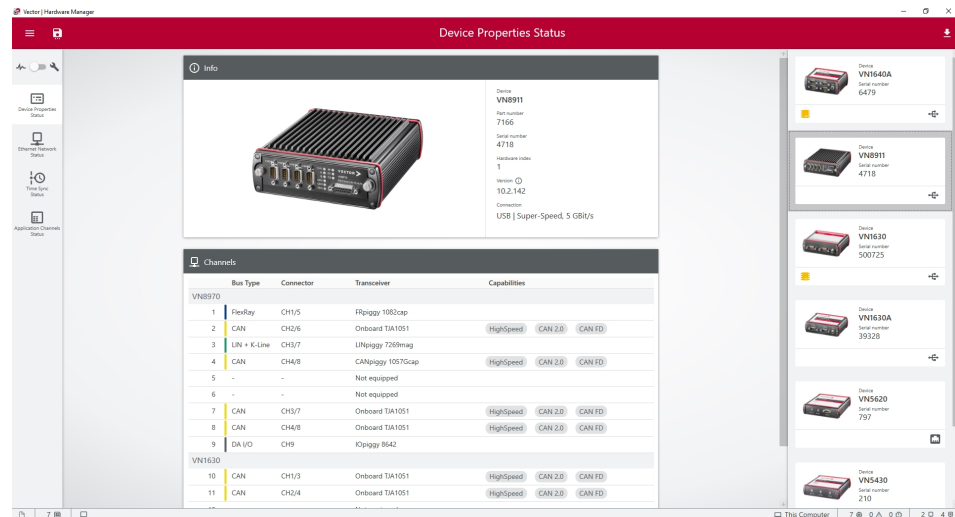
- Recommended installation command:
`setup.exe /installCert /s /i all`
- Recommended uninstallation command:
`setup.exe /s /u all`
- It is not possible to install the drivers from a network drive.
- It is possible to pre-install the drivers, if the hardware is currently not connected. In this case, the installation of the driver automatically completes after connecting the device.
- In order to use the silent mode (/s), the Vector certificate must be added to the trusted publishers. The Vector certificate can be added silently during the first installation by specifying the `/installCert` option. Any future installation of a Vector certified driver can be installed silently then.
- The Vector certificate can also be added to the trusted publishers during the first installation by hitting the checkbox **Always trust content from this publisher**. This installs the Vector certificate locally. Any future installation of a Vector certified driver can be installed silently then.

5.5 Vector Hardware Manager

5.5.1 Hardware Configuration

General information

The **Vector Hardware Manager** is the successor of the Vector Hardware Config tool and a newly developed configuration and diagnostic tool for your installed Vector devices. It is strongly needed to set up your Vector devices for use with your Vector applications (e. g. CANoe, CANalyzer, CANape, ...).



5.5.2 Tool Location and Help

After successful driver installation (see page 23) of your Vector device, you will find the Vector Hardware Manager in the Windows Start menu or in the installation folder:

C:\Program Files (x86)\Vector Hardware Manager\vHardwareManager.exe



Reference

Details, tips and instructions for the Vector Hardware Manager can be found in the supplied help.

- ▶ You can open the help by pressing **<F1>** in the Vector Hardware Manager or
- ▶ directly via:
C:\Program Files (x86)\Vector Hardware Manager\Help01\HTML5\VectorHardwareManager.htm
- ▶ The most recent version of the help is also available online:
<https://help.vector.com/VectorHardwareManager/index.php>

For a brief introduction, we recommend reading the sections **Basic Concept** and **Quick Start Guide**. Furthermore, we have provided additional information for you in the section **Tips and Tutorials**.

5.6 Loop Tests

Operation test

The test described here can be performed to check the functional integrity of the driver and the device. This test is identical for **Windows 10** / **Windows 11** and independent of the used application.

5.6.1 CAN

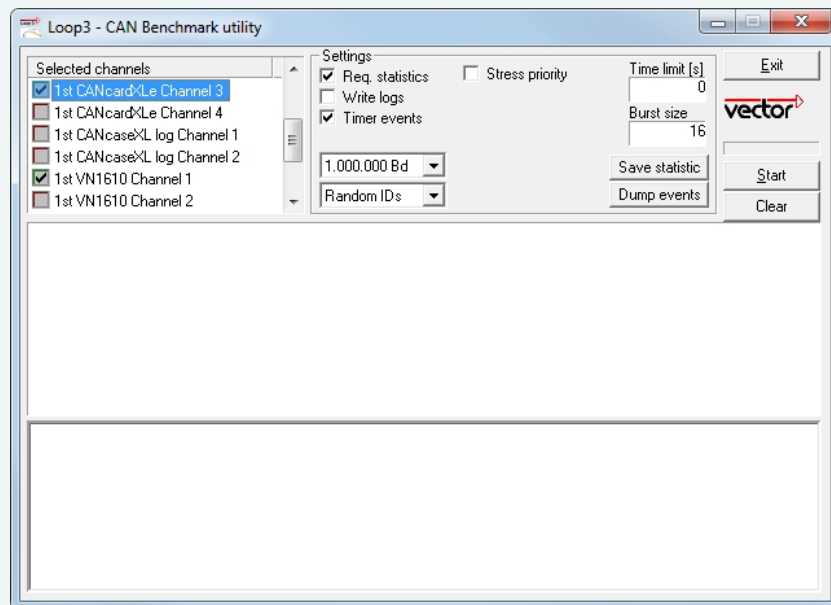
Device test

The operating test for CAN requires either two high-speed or two low-speed transceivers and can be executed as follows:



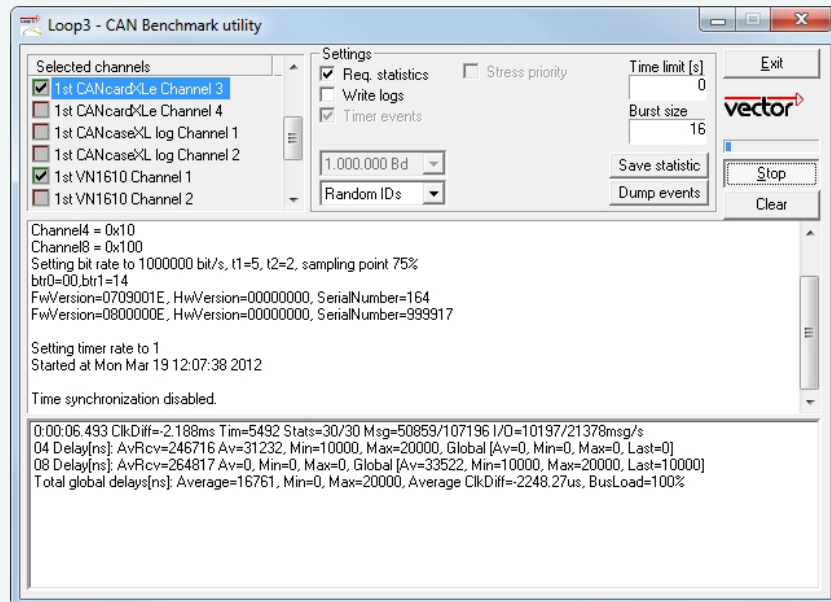
Step by Step Procedure

1. Connect two CAN channels with a suitable cable.
If two high-speed transceivers are being used, we recommend our **CANcable1** (**CANcable0** for low-speed transceivers).
2. Start `\Drivers\Common\Loop3.exe` from the **Vector Driver Setup**.
This program accesses the Vector devices and transmits CAN messages.

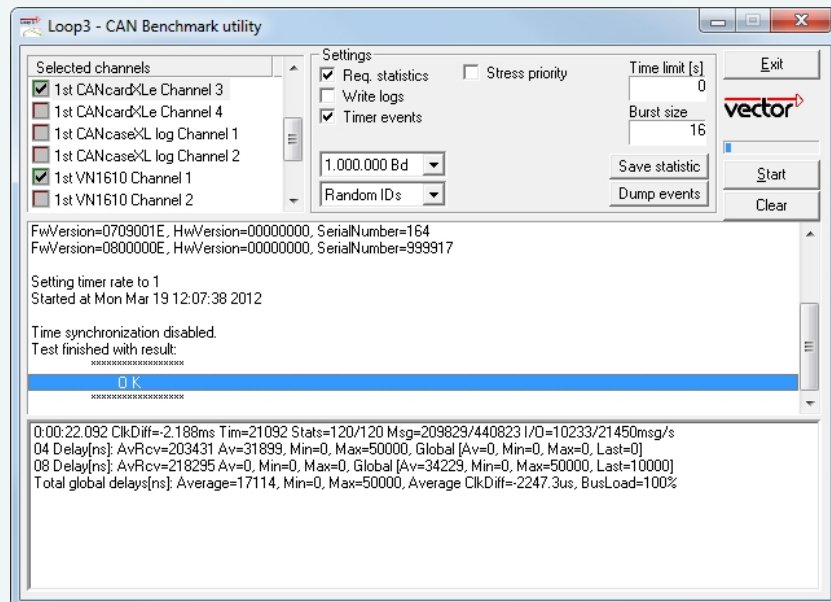


3. Select the connected CAN channels of the device(s) to be tested.

4. Set the appropriate baudrate depending on the transceiver being used (high-speed max. 1,000,000 Bd, low-speed max. 125,000 Bd).
5. Click **[Start]**.
6. You will see statistical data in the lower part of the window if the system has been configured properly.



7. The test procedure can be terminated with the **[Stop]** button. An **OK** should appear in the upper part of the window.



6 Time Synchronization

In this chapter you find the following information:

6.1 General Information	35
6.2 Software Sync	37
6.2.1 General Information	37
6.2.2 Configuration	37
6.3 Hardware Sync	38
6.3.1 General Information	38
6.3.2 Configuration	39
6.4 Precision Time Protocol Sync	40
6.4.1 General Information	40
6.4.2 Supported Features	40
6.4.3 Network Topology	41
6.4.4 Configuration	41
6.5 GNSS Sync	42
6.5.1 General Information	42
6.5.2 Configuration	42

6.1 General Information

Time stamps and events

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

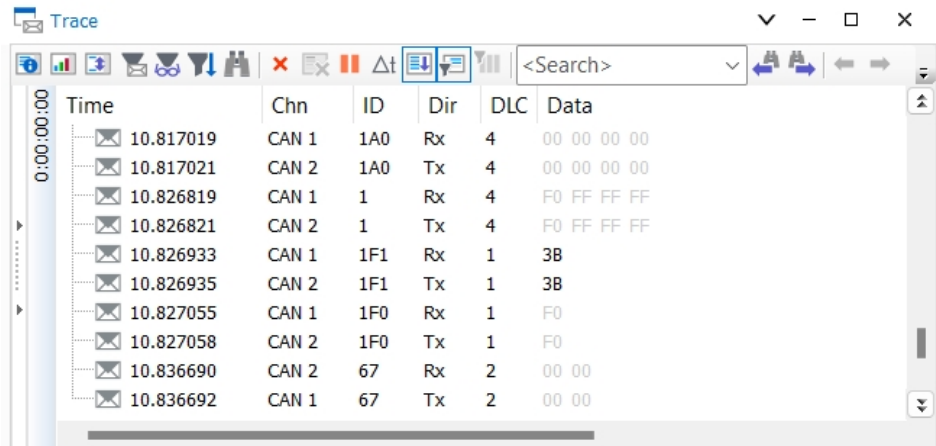


Figure 11: Time stamps of two CAN channels in CANoe

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.

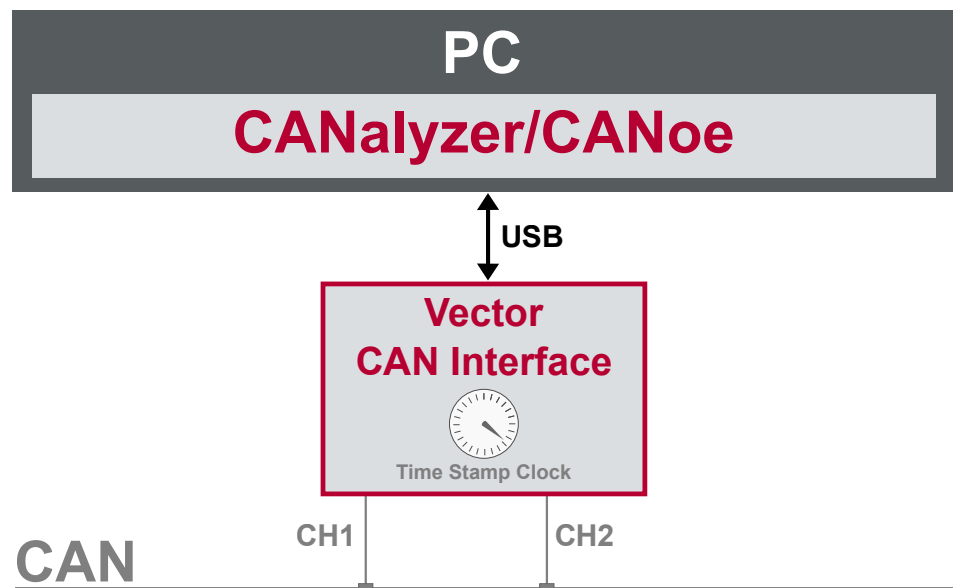


Figure 12: Common time stamp clock for each channel

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.

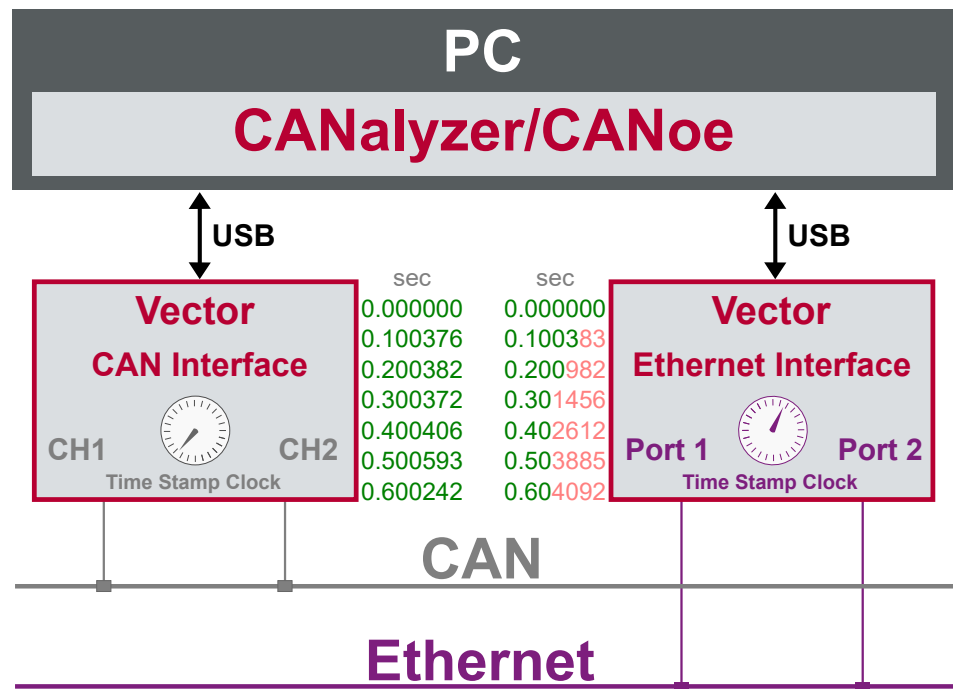


Figure 13: Example of unsynchronized network interfaces. Independent time stamps drift apart

To compensate for these time stamp deviations between the Vector network interfaces, the time stamps can be either synchronized by software, hardware, PTP or GNSS (capability depends on the Vector device).



Note

The accuracy of the software, hardware, PTP or GNSS sync depends on the interface. Further information on specific values can be found in the technical data of the respective devices.

6.2 Software Sync

6.2.1 General Information

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.

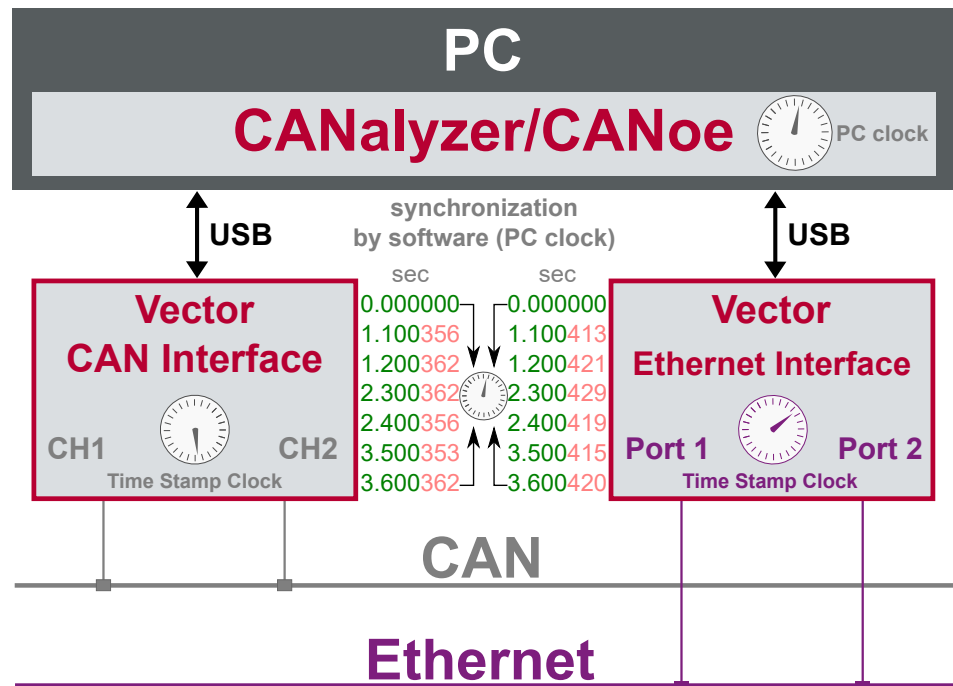


Figure 14: Time stamps of devices are synchronized to the PC clock



Note

Software time synchronization may lead to an increased latency for all connected Vector network interfaces. If a use case requires low latency, deactivate this option and use another synchronization mechanism.

6.2.2 Configuration

Vector Hardware Manager

Use the software synchronization if at least one device has no hardware sync connector. Also to synchronize the device clock to the computer time, use the software synchronization (legacy).



Reference

Further details and tips on the time sync configuration can be found in the [Vector Hardware Manager](#) help in section **User Interface | Navigation Rail | Time Sync**.

6.3 Hardware Sync

6.3.1 General Information

Synchronization by hardware

A more accurate time synchronization of multiple devices is provided by the hardware synchronization. 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).

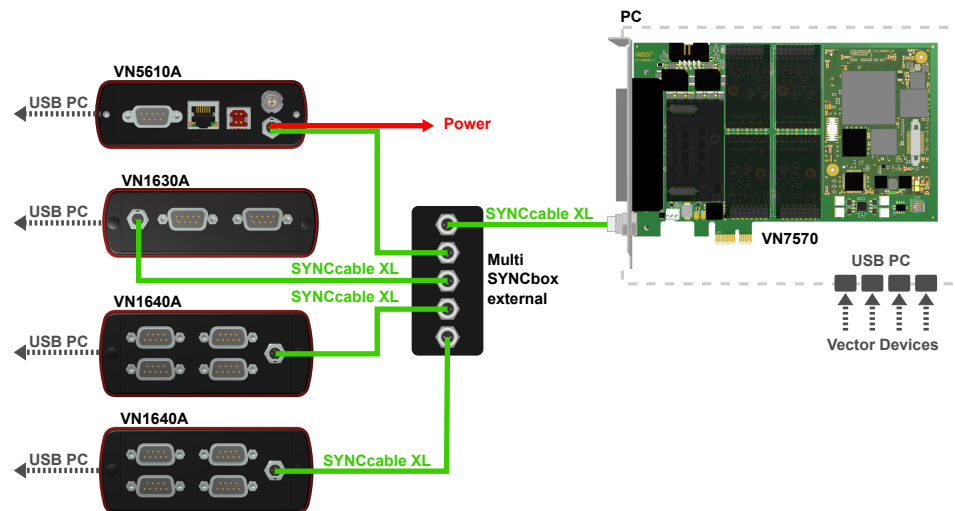


Figure 15: Example of a time synchronization with multiple devices

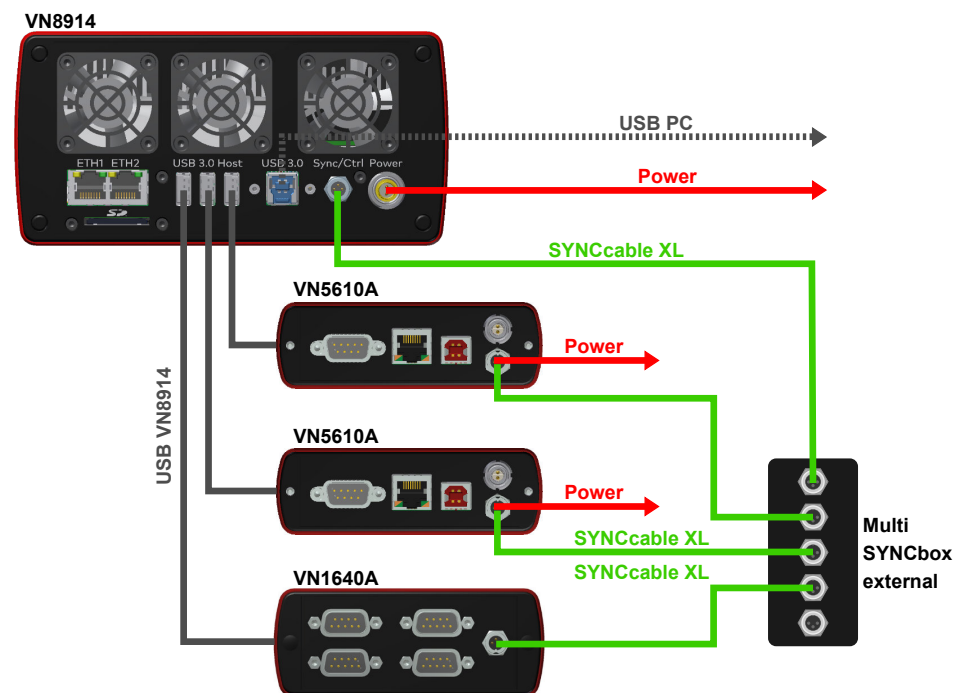


Figure 16: Example of a time synchronization with VN8914 and additional devices

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

driver to calculate the deviations between the network interfaces and to synchronize the time stamps to a common time base (master clock) which can be defined by the user.

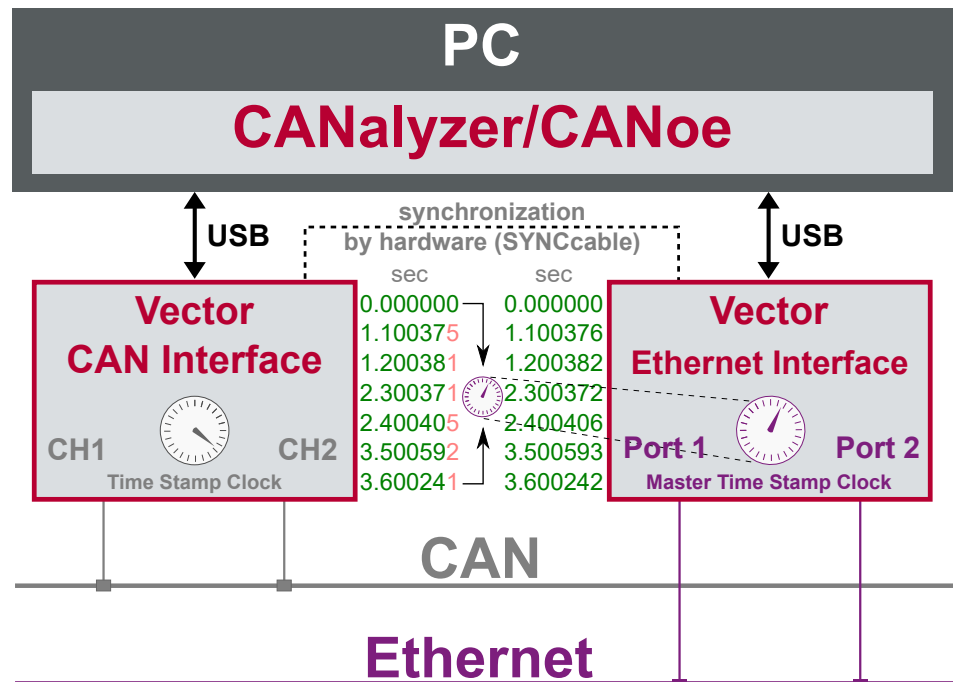


Figure 17: Time stamps are synchronized to the master clock

6.3.2 Configuration

Vector
Hardware Manager

Use hardware synchronization if at least one device is connected with USB or PCIe to the PC and all devices are hardware sync capable. One device should be configured as master and all other devices as slaves. Therefore, all devices must be interconnected with SYNCcableXL and Multi SYNCbox external or SYNCbox active.



Reference

Further details and tips on the time sync configuration can be found in the Vector Hardware Manager help in section **User Interface | Navigation Rail | Time Sync**.

6.4 Precision Time Protocol Sync

6.4.1 General Information

Overview

The Precision Time Protocol (PTP) is a protocol used to synchronize clocks through a computer network. On a local area network, it achieves a synchronization accuracy in the sub-microsecond range, making it suitable for measurement and control systems.



Note

The PTP feature can only be used on the Ethernet host ports of these devices. Therefore, it can only be used, if the device is connected via Ethernet host port to the PC.

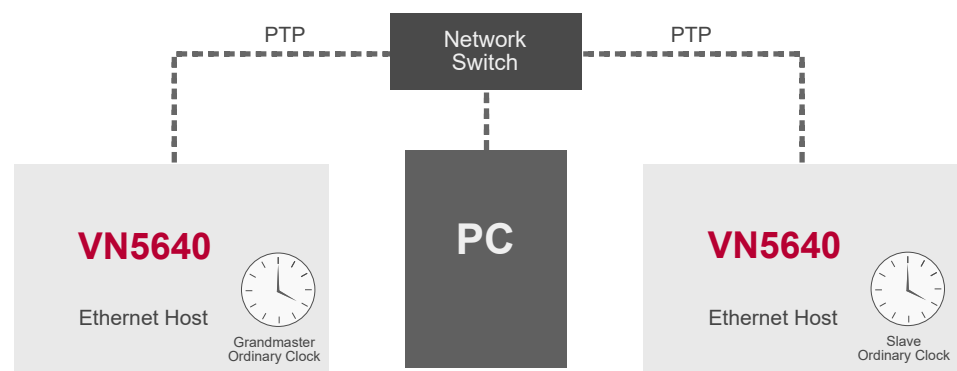


Figure 18: Setup example

6.4.2 Supported Features

Vector network interfaces support time synchronization with IEEE 1588-2008 standard. The following IEEE 1588 features are supported:

IEEE1588 Features	VN Device Support
Clock Types	
Ordinary Clock Master	X
Ordinary Clock Slave	X
Synchronization	
2-step clock	X
E2E	X
Best TimeTransmitter Clock Algorithm (BTCA)	X
Transport	
PTP over UDP with IPv4	X
PTP over UDP with IPv6	-
Multicast Master/Slave	X
Unicast Master/Slave	-
Synchronization accuracy	
1 μ s	X

6.4.3 Network Topology

Network switches

To achieve a maximum accuracy, PTP needs transparent clock support in network equipment. Therefore, a PTP transparent clock capable network switch is strongly suggested.

6.4.4 Configuration

Vector Hardware Manager

Use the PTP synchronization if all devices are connected via Ethernet host port to the PC and one device is configured as master and all other devices are configured as slaves.



Reference

Further details and tips on the time sync configuration can be found in the Vector Hardware Manager help in section **User Interface | Navigation Rail | Time Sync**.

6.5 GNSS Sync

6.5.1 General Information

Synchronization by GNSS

This device supports time synchronization via GNSS, i. e. the internal time stamp clock of the device is synchronized to the GNSS master time.

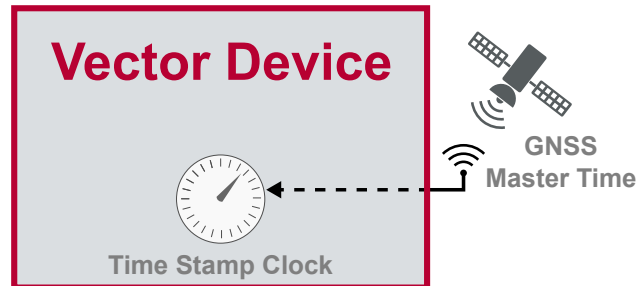


Figure 19: Time stamps are synchronized to GNSS master time

You can use this GNSS synchronization to provide the time to other Vector devices by using PTP time synchronization, hardware time synchronization or software time synchronization. In this case, the GNSS synchronized device has to be configured as time master.

6.5.2 Configuration

Vector Hardware Manager

The setting of the GNSS time synchronization can be changed in the **Vector Hardware Manager**.



Reference

Further details and tips on the time sync configuration can be found in the Vector Hardware Manager help in section **User Interface | Navigation Rail | Time Sync**.

7 Vehicle Electrics and Ground/Earth

In this chapter you find the following information:

7.1 General Information	44
7.2 Vehicle Battery Only (Closed System)	45
7.3 External Power Supplies (Test Bench)	46

7.1 General Information

**WARNING!**

When using Vector devices, ensure that the power supply and earthing are correct. Failure to do so may result in damage to the vehicle electronics or the Vector devices due to overvoltage. Two typical scenarios are described below.

7.2 Vehicle Battery Only (Closed System)

In this scenario, the individual Vector devices are powered directly from the vehicle battery. A third device is powered via USB (e. g. from a notebook in battery mode or from the vehicle battery) or via PCIe (card mounted in a computer and powered from the vehicle battery). The system is therefore closed.

The common reference ground is the chassis, which is connected to the negative terminal of the vehicle battery. Vector devices that have a functional earth connection (FE) must also be connected to the reference ground.

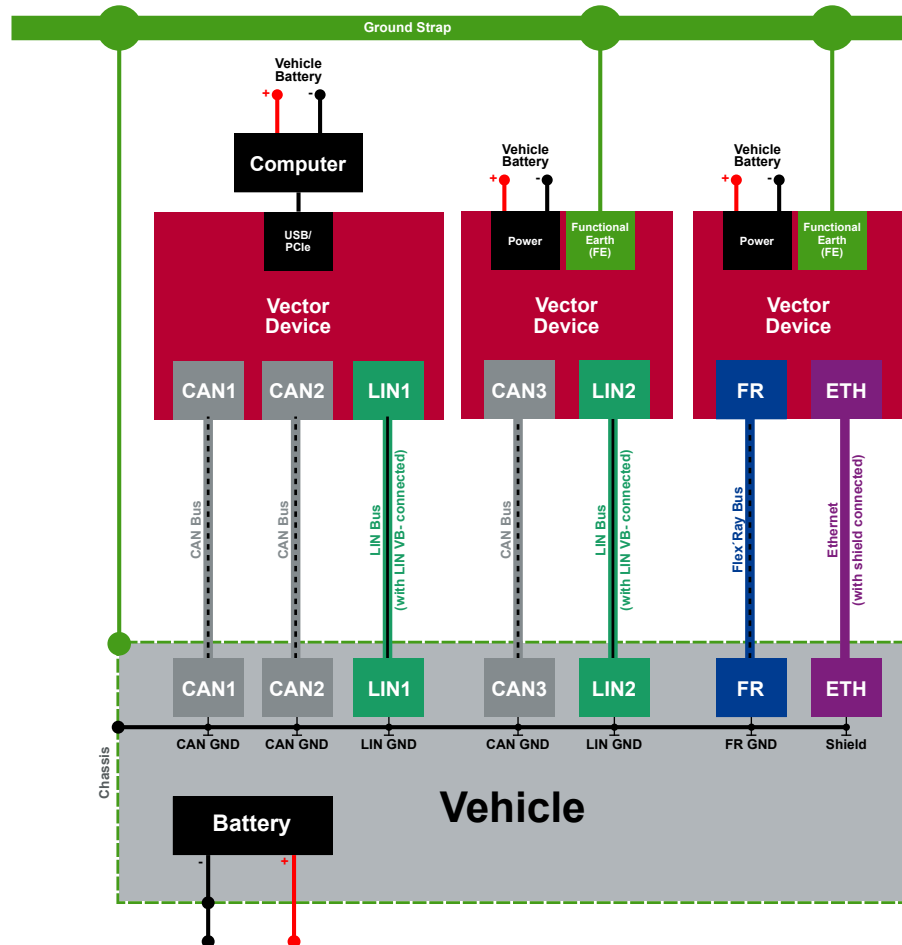


Figure 20: Vector devices powered by vehicle battery

The individual GNDs of the ECUs (in this example CAN, LIN, FlexRay) are connected to the chassis on the vehicle side. The shielding of the Ethernet connections is also connected to the chassis.

In this scenario, LIN VB- must be connected in the LIN signal path (LIN always requires VB- to be connected). For CAN and FlexRay it is recommended to connect all signal GNDs via their connectors (CAN GND, FlexRay VB-) to have the same reference ground from the vehicle battery.

7.3 External Power Supplies (Test Bench)

In this scenario, the individual Vector devices are powered by individual power supplies. A third device is powered via USB or PCIe. This is a typical test bench scenario.

The common reference ground is earth, which is also connected to the chassis and to the negative terminal of the vehicle battery. Vector devices that have a functional earth connection (FE) must also be connected to the reference ground.

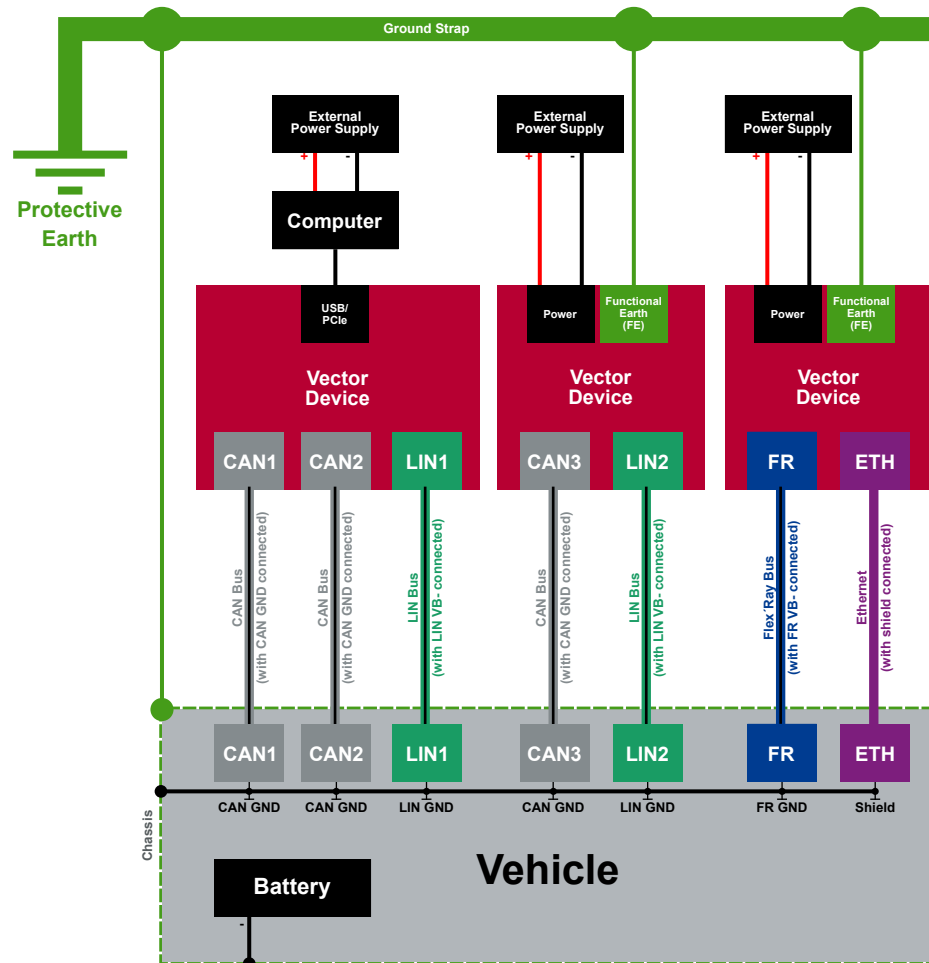


Figure 21: Test bench scenario

The individual GNDs of the ECUs (in this example CAN, LIN, FlexRay) are connected to the chassis on the vehicle side. The shielding of the Ethernet connections is also connected to the chassis.

In this scenario, all signal GNDs must be connected via their connectors (CAN GND, LIN VB-, FlexRay VB-) to have the same reference ground.

8 Important Notes - Details

In this chapter you find the following information:

8.0.1 Safety Instructions and Hazard Warnings	48
8.0.2 Disclaimer	50
8.0.3 Disposal of Vector Hardware	51

8.0.1 Safety Instructions and Hazard Warnings

**WARNING!**

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.

**WARNING!**

Do not operate the device without antennas! To avoid physical damage to the device, please attach the provided antennas to the device before operation!

8.0.1.1 Proper Use and Intended Purpose

**WARNING!**

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.

8.0.1.2 Hazards

**WARNING!**

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.

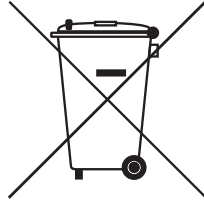
8.0.2 Disclaimer

**WARNING!**

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.

8.0.3 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/>

9 Wichtige Hinweise

In diesem Kapitel finden Sie die folgenden Informationen:

9.0.1 Sicherheits- und Gefahrenhinweise	53
9.0.2 Haftungsausschluss	55
9.0.3 Entsorgung von Vector Hardware	56

9.0.1 Sicherheits- und Gefahrenhinweise

**WARNUNG!**

Um Personen- und Sachschäden zu vermeiden, müssen Sie vor der Installation und dem Einsatz dieses Interfaces die nachfolgenden Sicherheits- und Gefahrenhinweise lesen und verstehen. Bewahren Sie diese Dokumentation (Handbuch) stets in der Nähe dieses Interfaces auf.

**WARNUNG!**

Betreiben Sie das Gerät nicht ohne Antennen! Um physikalische Schäden am Gerät zu vermeiden, bitte die mitgelieferten Antennen vor dem Betrieb anbringen!

9.0.1.1 Sach- und bestimmungsgemäßer Gebrauch

**WARNUNG!**

Das Interface ist für die Analyse, die Steuerung sowie für die anderweitige Beeinflussung von Regelsystemen und Steuergeräten bestimmt. Das umfasst unter anderem die Bussysteme CAN, LIN, K-Line, MOST, FlexRay, Ethernet, BroadR-Reach oder ARINC 429.

Der Betrieb des Interfaces darf nur im geschlossenen Zustand erfolgen. Insbesondere dürfen keine Leiterplatten sichtbar sein. Das Interface ist entsprechend den Anweisungen und Beschreibungen dieses Handbuchs einzusetzen. Dabei darf nur die dafür vorgesehene Stromversorgung, wie z. B. USB-powered, Netzteil, und das Originalzubehör von Vector bzw. das von Vector freigegebene Zubehör verwendet werden.

Das Interface ist ausschließlich für den Einsatz durch geeignetes Personal bestimmt, da der Gebrauch dieses Interfaces zu erheblichen Personen- und Sachschäden führen kann. Deshalb dürfen nur solche Personen dieses Interface einsetzen, welche die möglichen Konsequenzen der Aktionen mit diesem Interface verstanden haben, speziell für den Umgang mit diesem Interface, den Bussystemen und dem zu beeinflussenden System geschult worden sind und ausreichende Erfahrung im sicheren Umgang mit dem Interface erlangt haben.

Die notwendigen Kenntnisse zum Einsatz dieses Interfaces können bei Vector über interne oder externe Seminare und Workshops erworben werden. Darüber hinausgehende und Interface-spezifische Informationen wie z. B. „Known Issues“ sind auf der Vector Webseite unter www.vector.com in der „Vector KnowledgeBase“ verfügbar. Bitte informieren Sie sich dort vor dem Betrieb des Interfaces über aktualisierte Hinweise.

9.0.1.2 Gefahren

**WARNUNG!**

Das Interface kann das Verhalten von Regelsystemen und Steuergeräten steuern und in anderweitiger Weise beeinflussen. Insbesondere durch Eingriffe in sicherheitsrelevante Bereiche (z. B. durch Deaktivierung oder sonstige Manipulation der Motorsteuerung, des Lenk-, Airbag-, oder Bremssystems) und/oder der Einsatz des Interfaces in öffentlichen Räumen (z. B. Straßenverkehr, Luftraum) können erhebliche Gefahren für Leib, Leben und Eigentum entstehen. Stellen Sie daher in jedem Fall eine gefahrfreie Verwendung sicher. Hierzu gehört unter anderem auch, dass das System, in dem das Interface eingesetzt wird, jederzeit, insbesondere bei Auftreten von Fehlern oder Gefahren, in einen sicheren Zustand geführt werden kann (z. B. durch Not-Abschaltung).

Beachten Sie alle sicherheitstechnischen Richtlinien und öffentlich-rechtlichen Vorschriften, die für den Einsatz des Systems relevant sind. Zur Verminderung von Gefahren sollte das System vor dem Einsatz in öffentlichen Räumen auf einem nicht-öffentlich zugänglichen und für Testfahrten bestimmten Gelände erprobt werden.

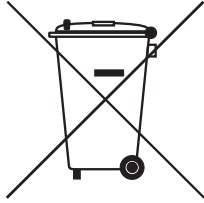
9.0.2 Haftungsausschluss

**WARNUNG!**

Soweit das Interface nicht sach- oder bestimmungsgemäß eingesetzt wird, übernimmt Vector keine Gewährleistung oder Haftung für dadurch verursachte Schäden oder Fehler. Das Gleiche gilt für Schäden oder Fehler, die auf einer mangelnden Schulung oder Erfahrung derjenigen Personen beruhen, die das Interface einsetzen.

9.0.3 Entsorgung von Vector Hardware

Bitte gehen Sie verantwortungsvoll mit Altgeräten um und beachten Sie die in Ihrem Land geltenden Umweltgesetze. Entsorgen Sie die Vector Hardware bitte nur bei den dafür vorgesehenen Stellen und nicht über den Hausmüll.



Innerhalb der Europäischen Gemeinschaft gelten die Richtlinie über Elektro- und Elektronik-Altgeräte (WEEE-Richtlinie) und die Richtlinie zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten (RoHS-Richtlinie).

Für Deutschland und andere EU-Länder bieten wir Ihnen eine kostenlose Rücknahme der alten Vector Hardware an.

Bitte überprüfen Sie die zu entsorgende Vector Hardware vor dem Versand sorgfältig. Bitte entfernen Sie alle Gegenstände, die nicht zum ursprünglichen Lieferumfang gehören, z. B. Speichermedien. Die Vector Hardware muss außerdem frei von Lizenzen sein und darf keine personenbezogenen Daten mehr enthalten. Vector führt keine Kontrollen diesbezüglich durch. Sobald die Hardware versandt wurde, kann sie nicht mehr an Sie zurück geliefert werden. Mit dem Versand der Hardware an uns haben Sie Ihre Rechte an der Hardware abgetreten. Bitte melden Sie vor dem Versand Ihr Altgerät an über:

<https://www.vector.com/de/de/support-downloads/return-registration-for-the-disposal-of-vector-hardware/>



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