

VN1500 Interface Family Manual

Version 2.2 | English

Imprint

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1 Introduction

In this chapter you find the following information:









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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.
	Warning of damages by electrostatic discharge (ESD = Electrostatically Sensitive Device).
	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

**Caution!**

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 VN1500 Interface Family

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2.1 Introduction

General information

The devices of the VN1500 family offer a future-proof and powerful solution for development, simulation, test, measurement or calibration of CAN, LIN, K-Line, J1708 and SENT networks via FPGA-based communication controllers. With this, new features can be added in the field via software and FPGA updates.

Depending on the VN1500 interface, built-in transceivers as well as exchangeable CAN/LIN, J1708 and SENT transceivers can be used. The exchangeable transceivers are available as plug-in boards (Piggybacks) and are inserted in the VN1500. A list of compatible Piggybacks can be found in the [accessories manual](#) or on our [website](#).

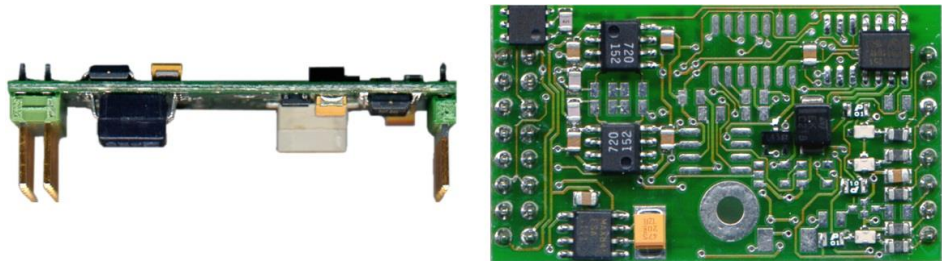


Figure 1: Piggyback

2.2 Accessories



Reference

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

2.3 VN1530

2.3.1 Main Features

VN1530 features

The main features of the VN1530 interface are:

- ▶ 4x onboard CAN / CAN FD channel
- ▶ 2x channel for CAN / CAN FD, LIN, K-Line, J1708 and SENT, configurable via Piggybacks
- ▶ Optimized PCIe architecture providing
 - Very high receive and transmit performance
 - Low latency
 - Low host CPU load
- ▶ Operating temperature range: -40 °C...+65 °C
- ▶ Synchronization of multiple devices and other bus systems like CAN / CAN FD, LIN, FlexRay, MOST, Ethernet
 - Software time synchronization
 - Hardware time synchronization
- ▶ Support of CAN Transport Protocol (TP) acceleration
- ▶ Support of up to sixteen VN1530 devices in one computer
 - Device identification LED
- ▶ Licensor: provides Vector licenses
- ▶ Support of customer applications via the free XL Driver Library (XL-API)

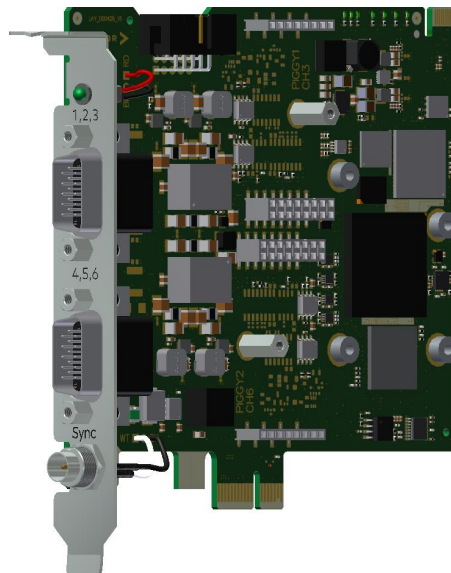


Figure 2: VN1530 CAN/LIN Interface

2.3.2 Bus Configuration

Piggybacks for CH3 and CH6

The VN1530 offers two Piggyback plug-in locations (CH3/CH6). Depending on requirements, electrically decoupled CAN FD, CAN High-Speed, CAN Low-Speed, LIN, J1708 or SENT transceivers may be used. In addition, four electrically decoupled onboard CAN 1057G transceivers are available (CH1/CH2 and CH4/CH5).



Reference

A list of compatible Piggybacks can be found in the accessories manual or on our website.

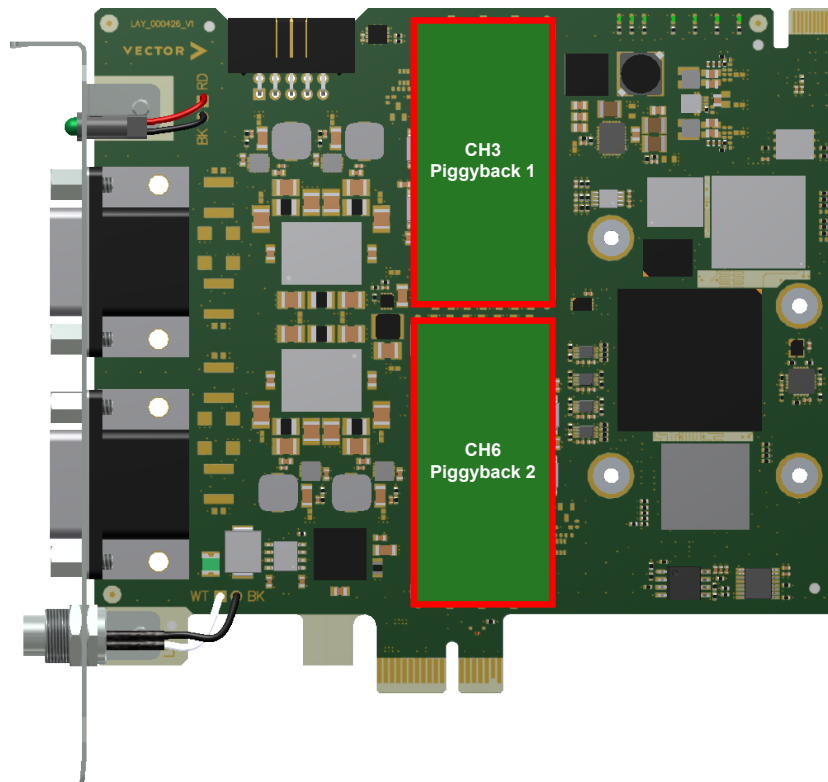


Figure 3: Piggyback plug-in locations

Channel Configurations					
Onboard		Piggyback	Onboard		Piggyback
CH1	CH2	CH3	CH4	CH5	CH6
CAN	CAN	CAN	CAN	CAN	CAN
CAN	CAN	CAN	CAN	CAN	SENT
CAN	CAN	CAN	CAN	CAN	LIN/K-Line
CAN	CAN	SENT	CAN	CAN	LIN/K-Line
CAN	CAN	LIN	CAN	CAN	LIN/K-Line
CAN	CAN	CAN	CAN	CAN	-
CAN	CAN	SENT	CAN	CAN	-
CAN	CAN	-	CAN	CAN	LIN

J1708 should be handled like CAN.

2.3.3 Connectors Bus Side

Device connectors



Figure 4: VN1530 with D-SUB15 connectors and sync

► 2x D-SUB15 (CH1...CH6)

The VN1530 has two D-SUB15HD connectors. Each connector provides two onboard CAN/CAN FD channels as well as an optional channel via a CAN, LIN, J1708 or SENT Piggyback. The pin assignment is as follows:

Connector 1 Channel	Connector 2 Channel	Pin	Assignment
1	4	5	Vcc
		10	GND
		14	CAN Low
		15	CAN High
2	5	3	CAN Low
		4	CAN High
		9	GND
		13	Vcc
3	6	1	CAN Low / J1708 B*
		6	CAN High / LIN / J1708 A / SENT*
		7	GND*
		8	Vcc*
		11	Special function / Pdis*
-	-	2	Not connected
		12	Not connected

* via CAN, LIN, J1708 or SENT Piggyback

► Binder connector (Sync)

This connector (Binder type 711) can be used for time synchronization of different Vector devices (see section [Time Synchronization](#) on page 34). **The sync connector is not intended to connect a power supply.**

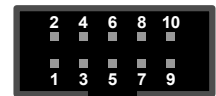
Pin	Assignment
1	Not connected
2	Synchronization line
3	Ground



► **10-pin connector (internal hardware sync)**

The angled 10 pin onboard sync connector can be used for time synchronization of different PCIe devices, e. g. VN1530, VN1531 or VN7572. For synchronization, a ribbon cable with a 10-pin standard connector is required.

Pin	Assignment
1	GND
2...8	Reserved. Do not connect.
9	Synchronization line (low active)
10	Internal sync supply (output 5 V, 35 mA)



Note

Forwarding a synchronization pulse from the external to the internal sync connector and vice versa is not possible. The only simultaneous usage of the internal and external connector is if the device acts as a synchronization master which generates sync pulses.

2.3.4 LED

Description

The VN1530 has a LED that can be used for device identification when using multiple VN1500 devices. The LED can be twinkled via the Vector Hardware Manager (on the **Device Properties** page in **Status** mode, you can find the LED icon in the right sidebar next to the corresponding device).

2.3.5 Device Preparation

General information

With the onboard transceivers, the device can be operated without additional Piggybacks. If you want to extend the channels for specific bus types (see section [Bus Configuration](#) on page 12), one or more Piggybacks have to be inserted before the device installation.



Reference

Please find a list of compatible Piggybacks in section "Transceiver Compatibility" in the separate accessories manual on our [website](#).

2.3.5.1 Replacing Piggybacks



Caution!

Please follow these instructions if no Piggyback is inserted or if another Piggyback needs to be inserted.



Caution!

Ensure an ESD safe working environment during disassembly and assembly. Avoid touching the top, bottom or connectors of the boards during this process to avoid ESD damage.



Step by Step Procedure

1. Detach the screw with the screw protection and remove the Piggyback carefully.

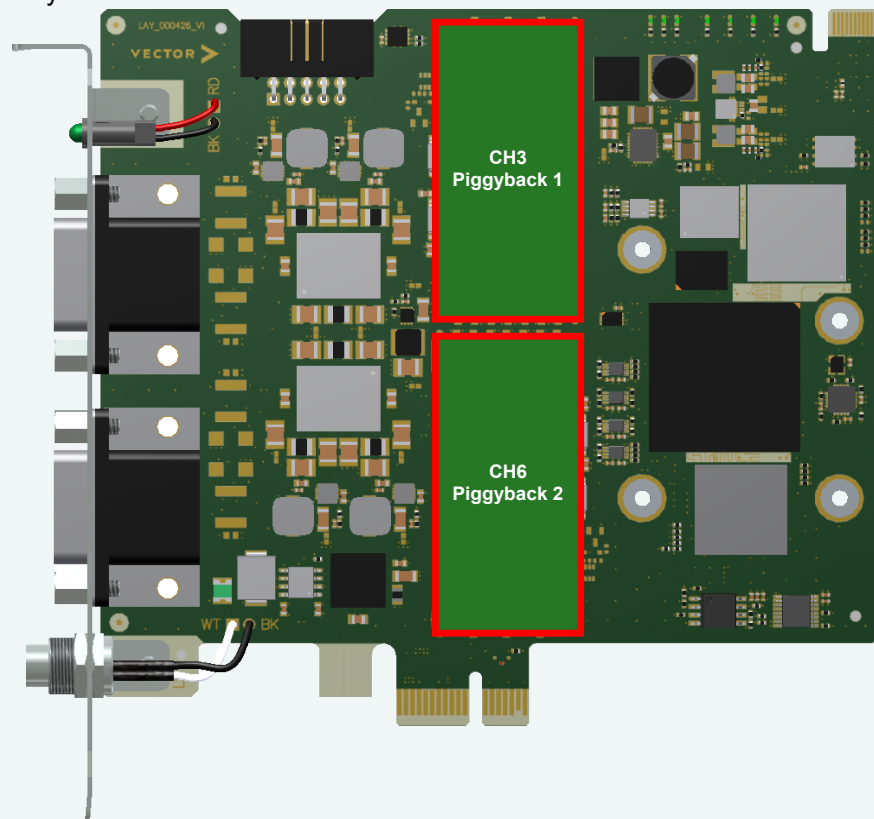


Figure 5: Piggyback plug-in locations

2. Insert the replacement Piggyback. The connectors must fit and must not be displaced laterally.
3. The Piggyback has to be fixed again with the screw and the screw protection.

2.3.5.2 Device Installation

**Caution!**

Turn off the main power supply and disconnect your computer's power cord. Otherwise systems using an ATX power supply unit with soft power off may still be powering the PCIe slot. This can damage your PCIe card when it is inserted into the slot.

**Caution!**

Do not force the VN1530 into the slot. Make sure that the connectors of the card's PCIe connector are aligned with the bus connector on the motherboard before you insert the card into the slot. If it does not fit properly, gently remove it and try again.

**Note**

Please observe all safety precautions prescribed by your PC manufacturer for card installation!

**Step by Step Procedure**

1. Install the drivers as described in section [Driver Installation](#) on page 28.
2. Turn off the computer and all peripheral devices.
3. Unplug the power cord from the wall outlet.
4. Touch a metal plate on your computer to ground yourself to discharge any static electricity.
5. Remove the computer cover and the metal brackets from an unused slot.
6. Align the VN1530 with the PCIe slot and press it gently but firmly into the slot.
7. Replace the computer cover.
8. Plug in the power cord.
9. Turn on the computer.

2.3.6 Technical Data

CAN channels	<p>4x CAN/CAN FD onboard</p> <ul style="list-style-type: none"> - NXP TJA1057G - electrically decoupled <p>2x configurable via CANpiggybacks</p> <p>Bitrates</p> <ul style="list-style-type: none"> - CAN: up to 1 MBit/s (up to 2 MBit/s depending on wiring and transceivers) - CAN FD: up to 5 MBit/s (up to 8 MBit/s depending on wiring and transceivers)
LIN channels	<p>Max. 2 (configurable via Piggybacks),</p> <p>Bitrates</p> <ul style="list-style-type: none"> - Normal-Mode: up to 20 kBit/s - Flash-Mode: up to 115.2 kBit/s (depending on wiring higher bitrates are possible)
K-Line channels	<p>Max. 1 at channel 6 (with LINpiggy 7269mag)</p>
J1708 channels	<p>Max. 2 at channel 3/6 (configurable via Piggybacks)</p>
SENT channels	<p>Max. 1 at channel 3/6 (with SENSORpiggy SENT)</p>
Time stamps	<p>Accuracy (within one device): 1 μs Accuracy software sync: typ. 10 μs Accuracy hardware sync: typ. 1 μs</p>
Host PC connection	<p>PCIe Gen1 x1</p>
Power consumption	<p>4.5 W</p>
Temperature range (ambient temperature of VN1530)	<p>Operating: -40 °C...+65 °C Shipping and storage: -40 °C...+85 °C</p>
Relative humidity of ambient air	<p>15 %...95 %, non-condensing</p>
Dimensions (LxWxH)	<p>Approx. 132 mm x 127 mm x 22 mm (with mounted Piggybacks)</p>
Weight	<p>Approx. 105 g (without Piggybacks)</p>
Operating system requirements	<p>Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)</p>
Software requirements	<p>CANoe/CANalyzer V11 SP3 or higher For SENT: CANoe/CANalyzer V12 or higher</p>

2.4 VN1531

2.4.1 Main Features

VN1531 features

The main features of the VN1531 interface are:

- ▶ 4x onboard LIN channel
 - Stress functionality, supports disturbance of the LIN bus by dominant or recessive disturbing bits
 - Flash mode support
- ▶ 2x channel for CAN / CAN FD, LIN, K-Line, J1708 and SENT, configurable via Piggybacks
- ▶ Optimized PCIe architecture providing
 - Very high receive and transmit performance
 - Low latency
 - Low host CPU load
- ▶ Operating temperature range: -40 °C...+65 °C
- ▶ Synchronization of multiple devices and other bus systems like CAN / CAN FD, LIN, FlexRay, MOST, Ethernet
 - Software time synchronization
 - Hardware time synchronization
- ▶ Support of CAN Transport Protocol (TP) acceleration
- ▶ Support of up to sixteen VN1531 devices in one PC
 - Device identification LED
- ▶ Licensor: provides Vector licenses
- ▶ Support of customer applications via the free XL Driver Library (XL-API)

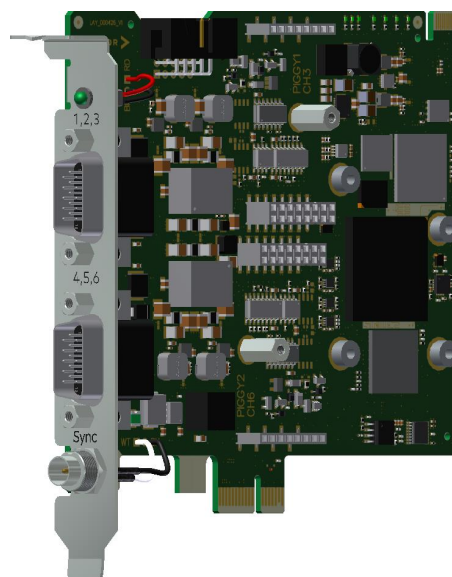


Figure 6: VN1531 LIN/CAN Interface

2.4.2 Onboard LIN Channels

Bus-side voltage supply

The onboard LIN channels provide an internal supply voltage. Since the recessive level on the bus depends on the supply voltage of the master, it is advisable to operate the onboard LIN channel with an external supply voltage that is also used by the other bus nodes. This prevents cross currents between the individual nodes on the LIN bus.

An externally applied supply voltage is used by the onboard LIN channels if it has a higher level than the 12 V internal supply voltage; if the external supply voltage has a smaller level than the internal supply voltage, the internal supply voltage is used. To force the onboard LIN channels to use the external supply voltage even if it has a lower level than the internal supply voltage, the pin Pdis has to be connected to the GND pin of the same channel.

Properties

The onboard LIN channels are designed for usage in 12 V passenger car and 24 V truck LIN networks. They provide a time limitation to prevent constant dominant level on the LIN bus (dominant timeout of the transceiver). The minimum switch off time of the onboard LIN channels is 6 ms.

Minimal baudrate

Due to the dominant timeout (6...20 ms) of the transceiver, it may not be possible to transmit a LIN header at very low baudrates. Therefore intended dominant sequences longer than 6 ms are created using the onboard channel's integrated transistor circuitry.

Stress functionality

The stress functionality of the onboard LIN channels enable the disturbance of the LIN bus by dominant or recessive disturbing bits. The disturbing bits can be any length.



Note

The recessive disturbing unit is protected by a 550 mA fuse, the dominant disturbing unit by a 100 mA fuse.

In case of dominant disturbing bits, the onboard LIN channels have a protection against thermal overloads. The onboard LIN channels must be externally supplied to use recessive disturbing mode.

Flash mode

The flash mode enables higher data transmission rates which can be used for programming microcontrollers e. g. during ECU production. This is possible by an increased slew rate of the transceiver, which may also affect EMC properties.

2.4.3 Bus Configuration

Piggybacks for CH3 and CH6

The VN1531 offers two Piggyback plug-in locations (CH3/CH6). Depending on requirements, electrically decoupled CAN FD, CAN High-Speed, CAN Low-Speed, LIN, J1708 or SENT transceivers may be used. In addition, four electrically decoupled onboard LIN 7269 transceivers are available (CH1/CH2 and CH4/CH5).



Reference

A list of compatible Piggybacks can be found in the accessories manual or on our website.

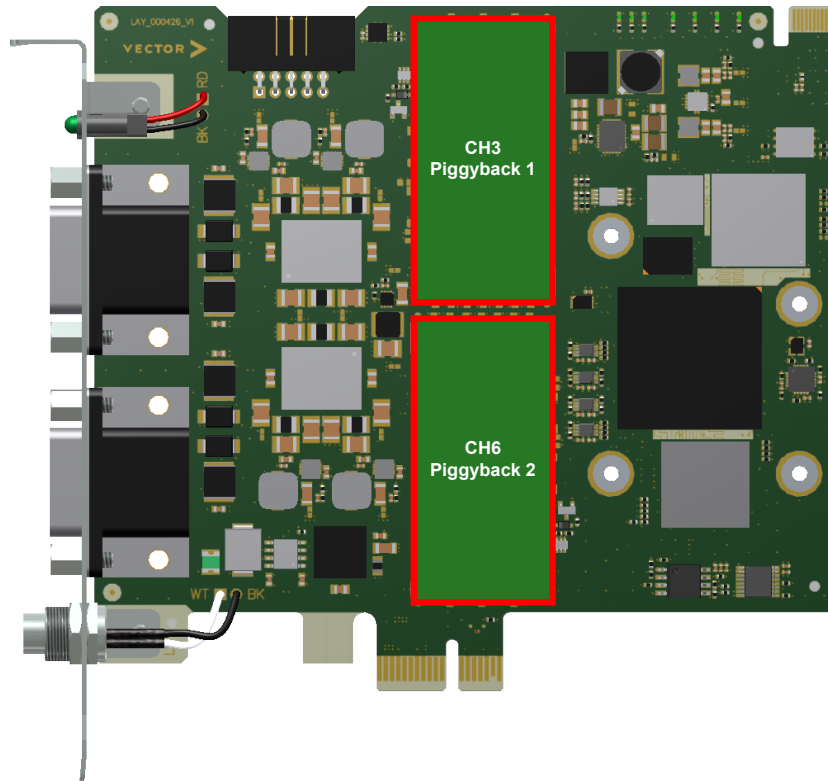


Figure 7: Piggyback plug-in locations

Channel Configurations					
Onboard		Piggyback	Onboard		Piggyback
CH1	CH2	CH3	CH4	CH5	CH6
LIN	LIN	LIN	LIN	LIN/K-Line	LIN
LIN	LIN	LIN	LIN	LIN/K-Line	CAN
LIN	LIN	LIN	LIN	LIN/K-Line	SENT
LIN	LIN	CAN	LIN	LIN/K-Line	CAN
LIN	LIN	CAN	LIN	LIN/K-Line	SENT
LIN	LIN	LIN	LIN	LIN/K-Line	-
LIN	LIN	-	LIN	LIN/K-Line	CAN
LIN	LIN	-	LIN	LIN/K-Line	SENT

J1708 should be handled like CAN.

2.4.4 Connectors Bus Side

Device connectors

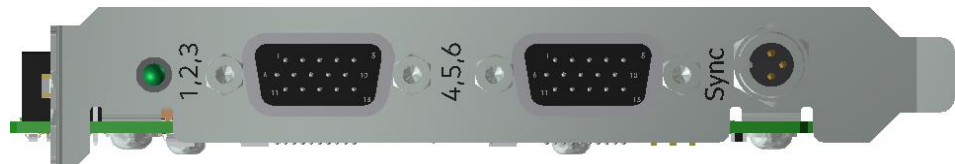


Figure 8: VN1531 with D-SUB15 connectors and sync

► 2x D-SUB15 (CH1...CH6)

The VN1531 has two D-SUB15HD connectors. Each connector provides two onboard LIN channels as well as an optional channel via a CAN, LIN, J1708 or SENT Piggyback. The pin assignment is as follows:

Connector 1 Channel	Connector 2 Channel	Pin	Assignment
1	4	5	Vcc
		10	GND
		14	Pdis
		15	LIN
2	5	3	Pdis
		4	LIN
		9	GND
		13	Vcc
3	6	1	CAN Low / J1708 B*
		6	CAN High / LIN / J1708 A / SENT*
		7	GND*
		8	Vcc*
		11	Special function / Pdis*
-	-	2	Not connected
		12	Not connected

* via CAN, LIN, J1708 or SENT Piggyback



Caution!

Please note when using the LIN signal **Pdis** via VNcable 3Y: While Pdis of the Piggyback channel is available on the corresponding D-SUB9 connector at pin 4, Pdis of the onboard channel is available on the corresponding D-SUB9 connector at pin 2.

► Binder connector (Sync)

This connector (Binder type 711) can be used for time synchronization of different Vector devices (see section Time Synchronization on page 34). **The sync connector is not intended to connect a power supply.**

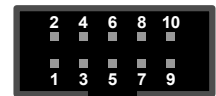
Pin	Assignment
1	Not connected
2	Synchronization line
3	Ground



► **10-pin connector (internal hardware sync)**

The angled 10 pin onboard sync connector can be used for time synchronization of different PCIe devices, e. g. VN1530, VN1531 or VN7572. For synchronization, a ribbon cable with a 10-pin standard connector is required.

Pin	Assignment
1	GND
2...8	Reserved. Do not connect.
9	Synchronization line (low active)
10	Internal sync supply (output 5 V, 35 mA)



Note

Forwarding a synchronization pulse from the external to the internal sync connector and vice versa is not possible. The only simultaneous usage of the internal and external connector is if the device acts as a synchronization master which generates sync pulses.

2.4.5 LED

Description

The VN1531 has a LED that can be used for device identification when using multiple VN1500 devices. The LED can be twinkled via the Vector Hardware Manager (on the **Device Properties** page in **Status** mode, you can find the LED icon in the right sidebar next to the corresponding device).

2.4.6 Device Preparation

General information

With the onboard transceivers, the device can be operated without additional Piggybacks. If you want to extend the channels for specific bus types (see section [Bus Configuration](#) on page 20), one or more Piggybacks have to be inserted before the device installation.



Reference

Please find a list of compatible Piggybacks in section "Transceiver Compatibility" in the separate accessories manual on our [website](#).

2.4.6.1 Replacing Piggybacks



Caution!

Please follow these instructions if no Piggyback is inserted or if another Piggyback needs to be inserted.



Caution!

Ensure an ESD safe working environment during disassembly and assembly. Avoid touching the top, bottom or connectors of the boards during this process to avoid ESD damage.



Step by Step Procedure

1. Detach the screw with the screw protection and remove the Piggyback carefully.

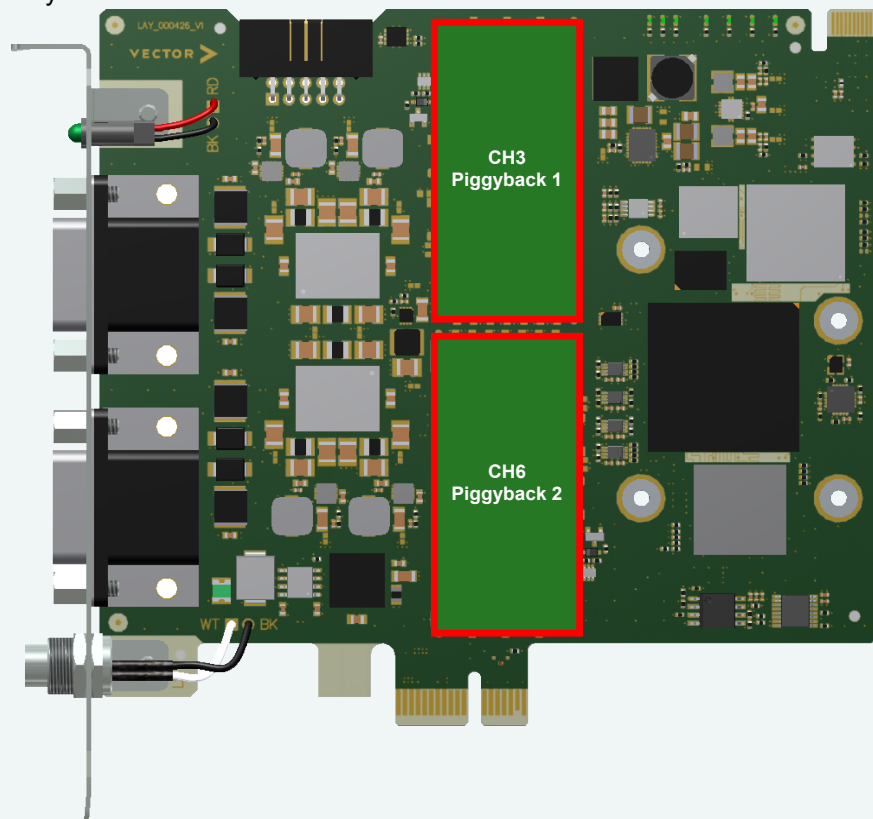


Figure 9: Piggyback plug-in locations

2. Insert the replacement Piggyback. The connectors must fit and must not be displaced laterally.
3. The Piggyback has to be fixed again with the screw and the screw protection.

2.4.6.2 Device Installation

**Caution!**

Turn off the main power supply and disconnect your computer's power cord. Otherwise systems using an ATX power supply unit with soft power off may still be powering the PCIe slot. This can damage your PCIe card when it is inserted into the slot.

**Caution!**

Do not force the VN1531 into the slot. Make sure that the connectors of the card's PCIe connector are aligned with the bus connector on the motherboard before you insert the card into the slot. If it does not fit properly, gently remove it and try again.

**Note**

Please observe all safety precautions prescribed by your PC manufacturer for card installation!

**Step by Step Procedure**

1. Install the drivers as described in section [Driver Installation](#) on page 28.
2. Turn off the computer and all peripheral devices.
3. Unplug the power cord from the wall outlet.
4. Touch a metal plate on your computer to ground yourself to discharge any static electricity.
5. Remove the computer cover and the metal brackets from an unused slot.
6. Align the VN1531 with the PCIe slot and press it gently but firmly into the slot.
7. Replace the computer cover.
8. Plug in the power cord.
9. Turn on the computer.

2.4.7 Technical Data

LIN channels	<p>Piggyback channels:</p> <ul style="list-style-type: none"> - 2x configurable via LINpiggies - for technical specification please refer to the corresponding manual <p>Onboard channels:</p> <ul style="list-style-type: none"> - 4x LIN - support of LIN V2.1 - transceiver: TLE7269 - electrically decoupled <p>External supply voltage:</p> <ul style="list-style-type: none"> - normal operation (incl. recessive disturbing mode): 8 V ... 36 V - extended range: 0 V ... 36 V <p>Bus termination:</p> <ul style="list-style-type: none"> - Master mode: 1 kOhm - Slave mode: typ. 30 kOhm <p>Bitrates</p> <ul style="list-style-type: none"> - Normal-Mode: up to 20 kBit/s - Flash-Mode: up to 115.2 kBit/s (depending on wiring higher bitrates are possible)
CAN channels	<p>Max. 2 (configurable via Piggybacks)</p> <p>Bitrates</p> <ul style="list-style-type: none"> - CAN: up to 1 MBit/s (up to 2 MBit/s depending on wiring and transceivers) - CAN FD: up to 5 MBit/s (up to 8 MBit/s depending on wiring and transceivers)
K-Line channels	<p>Max. 1 at channel 5 (with onboard LIN transceiver TLE7269)</p>
J1708 channels	<p>Max. 2 at channel 3/6 (configurable via Piggybacks)</p>
SENT channels	<p>Max. 1 at channel 6 (with SENSORpiggy SENT)</p>
Time stamps	<p>Accuracy (within one device): 1 µs Accuracy software sync: typ. 10 µs Accuracy hardware sync: typ. 1 µs</p>
Host PC connection	<p>PCIe Gen1 x1</p>
Power consumption	<p>4.5 W</p>
Temperature range (ambient temperature of VN1531)	<p>Operating: -40 °C...+65 °C Shipping and storage: -40 °C...+85 °C</p>
Relative humidity of ambient air	<p>15 %...95 %, non-condensing</p>
Dimensions (LxWxH)	<p>Approx. 132 mm x 127 mm x 22 mm (with mounted Piggybacks)</p>
Weight	<p>Approx. 108 g (without Piggybacks)</p>

Operating system requirements	Windows 10 (x64, 64 bit) Windows 11 (x64, 64 bit)
Software requirements	CANoe/CANalyzer V11 SP3 or higher For SENT: CANoe/CANalyzer V12 or higher

3 Getting Started

In this chapter you find the following information:

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3.1 Driver Installation

3.1.1 General Information

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

**Note**

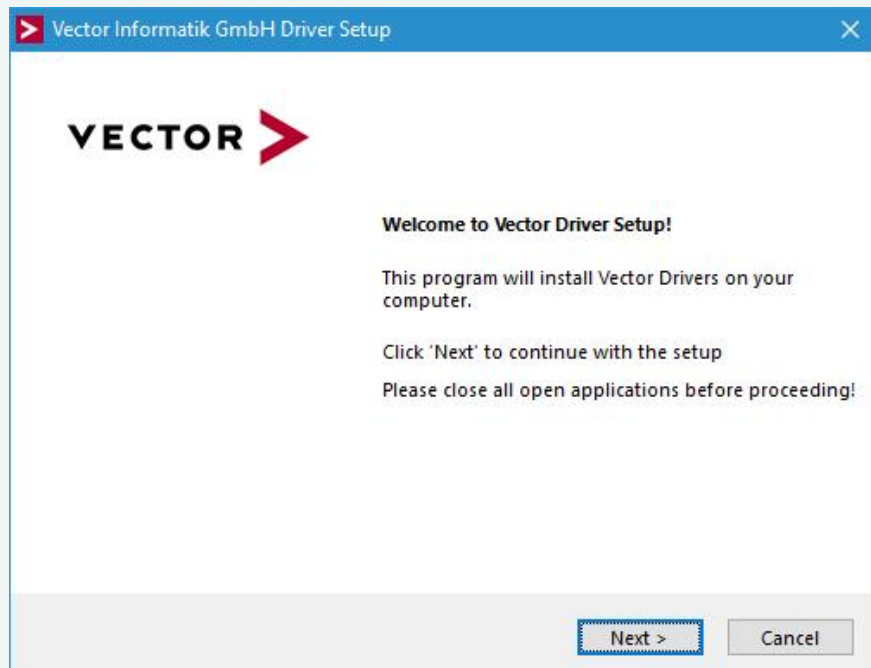
Please note that you will need **Administrator Rights** for the following steps.

3.1.2 Installation Instructions

**Step by Step Procedure**

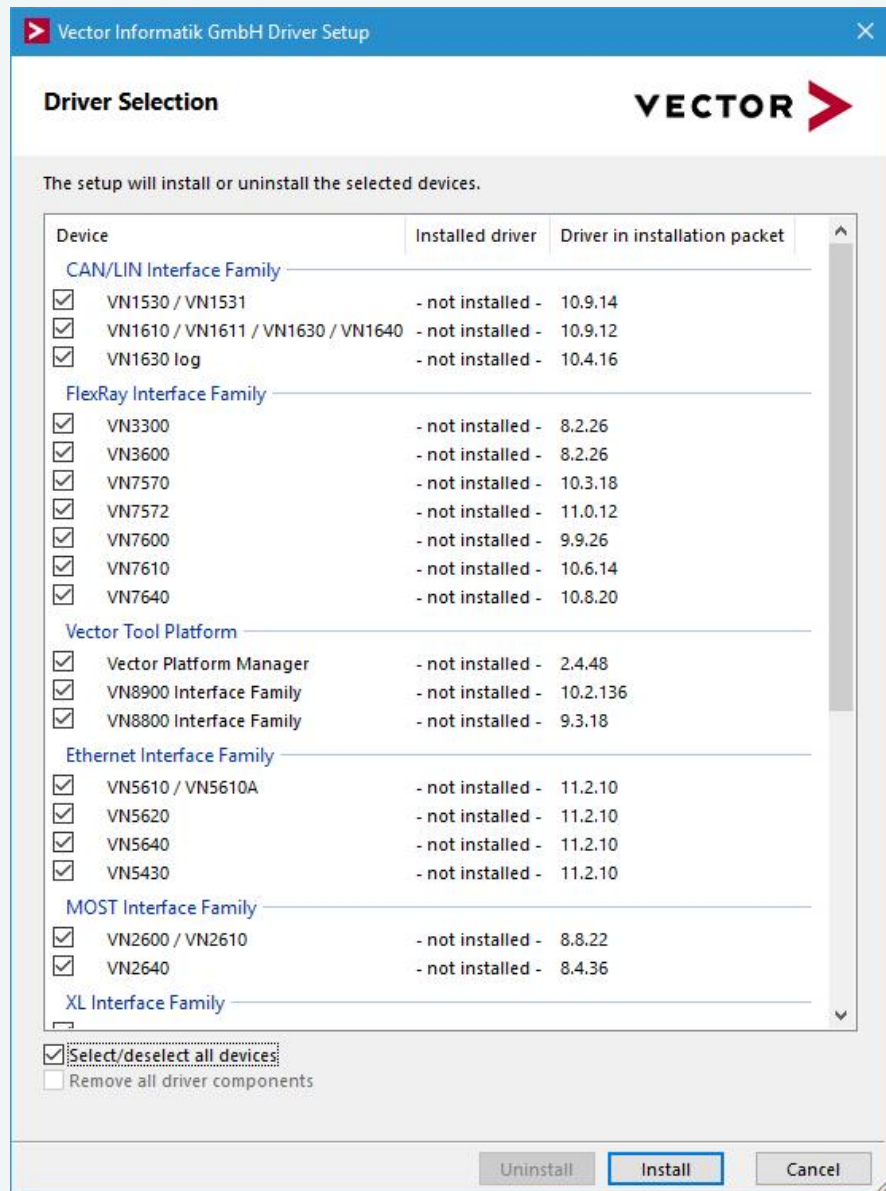
1. Execute the driver setup `\Drivers\Setup.exe` before the card is inserted into the PC.

If you have already inserted the card, 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.

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



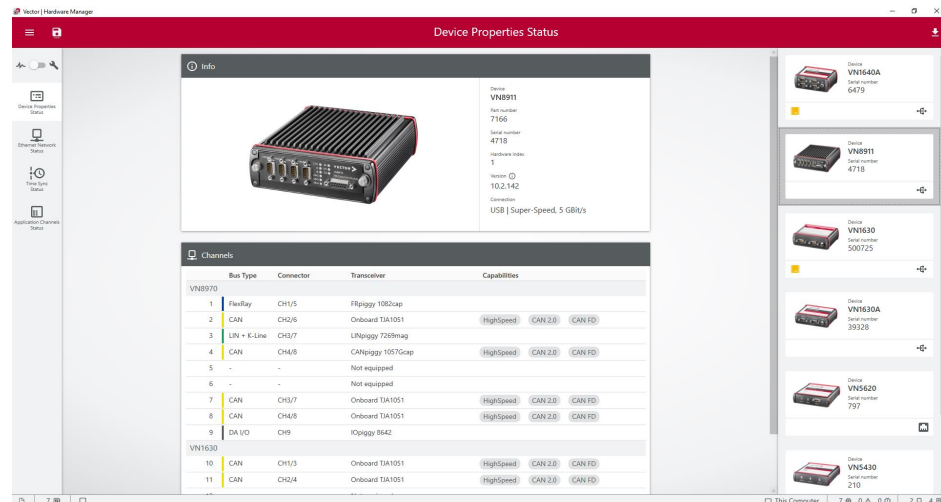
- Click **[Install]** to execute the driver installation, or **[Uninstall]** to remove existing drivers.
- A confirmation dialog appears. Click **[Close]** to exit. After successful installation, the card is ready for operation and can be inserted into the PC.
Note: Please find further details on PCI/PXI or PCIe card installation in this manual.

3.2 Vector Hardware Manager

3.2.1 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, XL API applications, ...).



3.2.2 Tool Location and Help

After successful driver installation 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`

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**.

3.3 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.

3.3.1 CAN

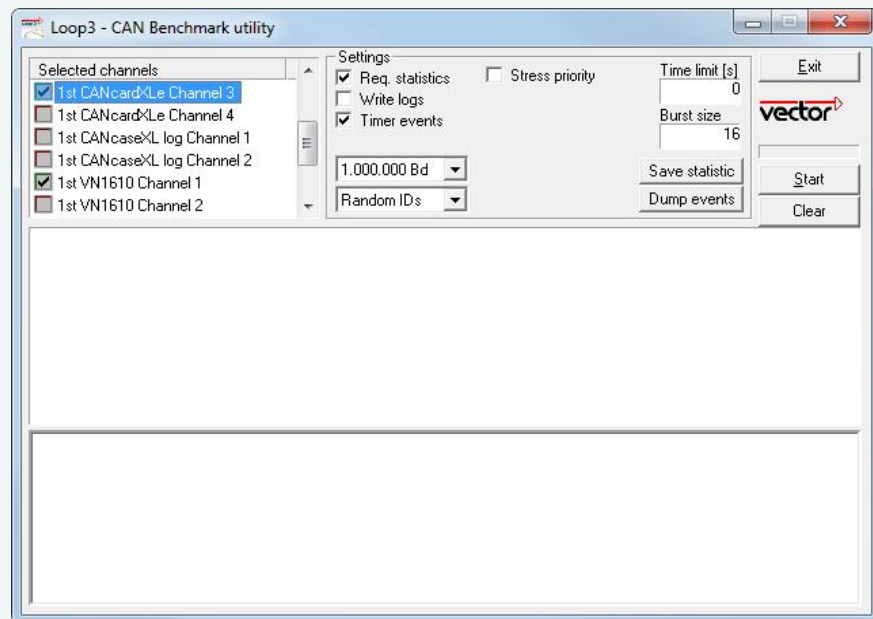
Device test

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



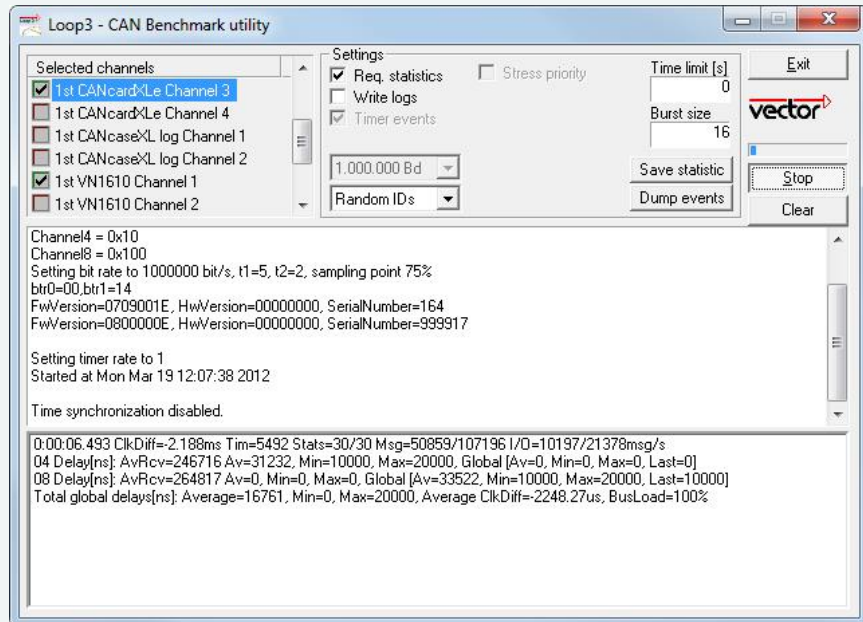
Step by Step Procedure

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.

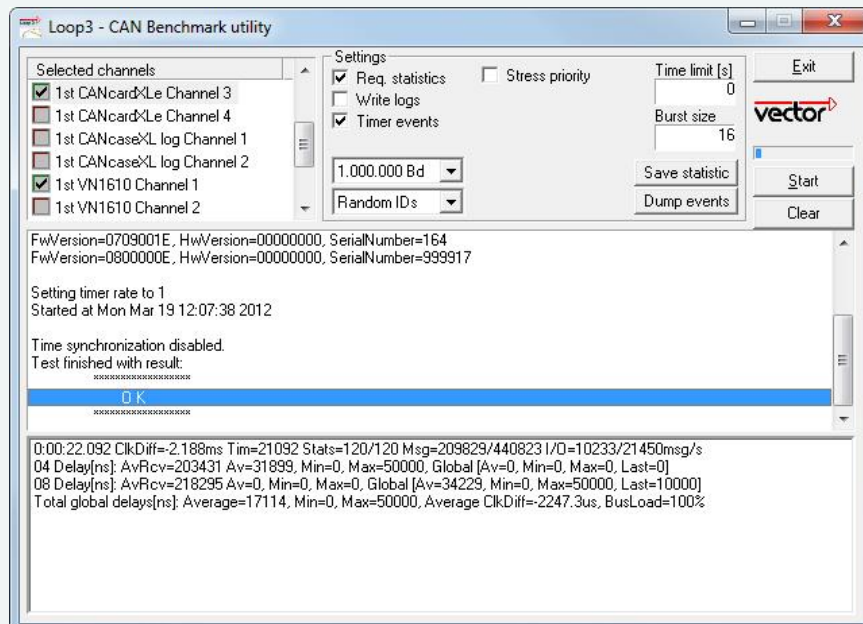


3. Select the connected CAN channels of the device(s) to be tested.

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.



4 Time Synchronization

In this chapter you find the following information:

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4.2 Software Sync	37
4.2.1 General Information	37
4.2.2 Configuration	37
4.3 Hardware Sync	38
4.3.1 General Information	38
4.3.2 Configuration	39

4.1 General Information

Time stamps and events

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

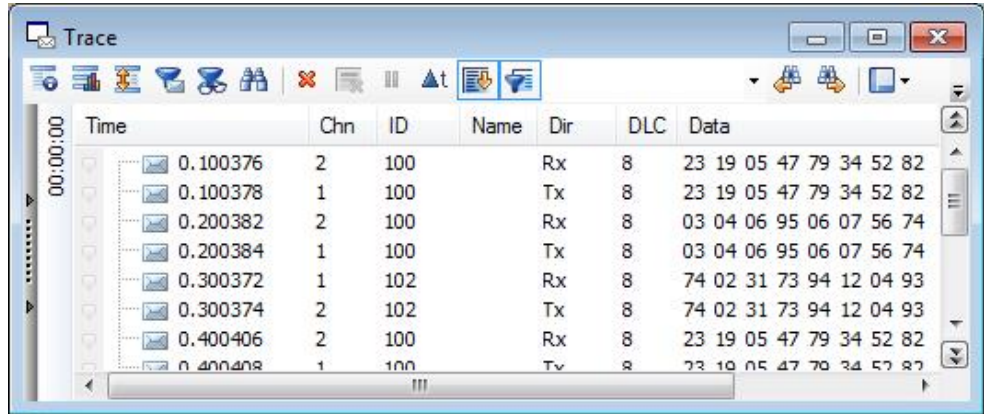


Figure 10: Time stamps of two CAN channels in CANalyzer

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.

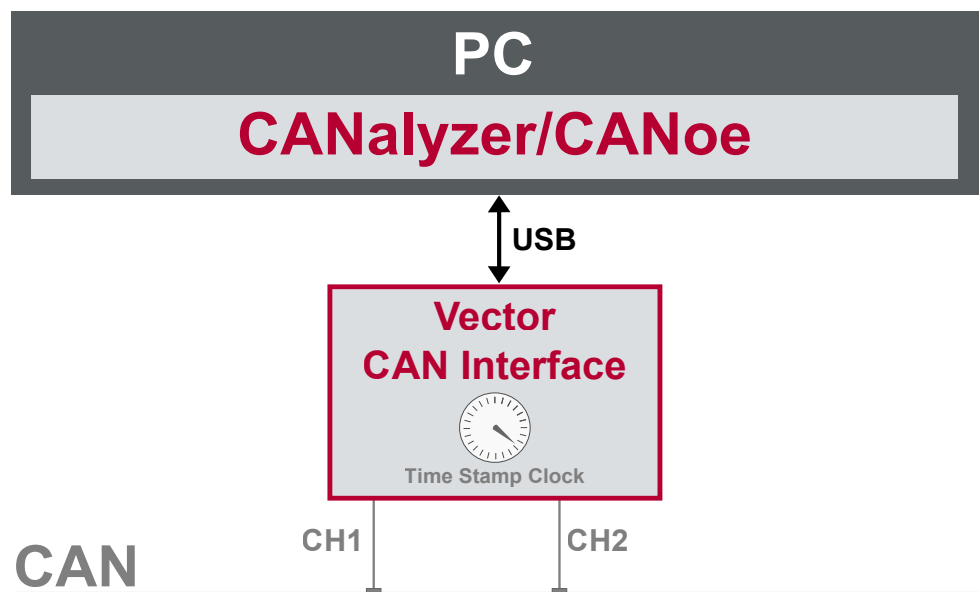


Figure 11: Common time stamp clock for each channel

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.

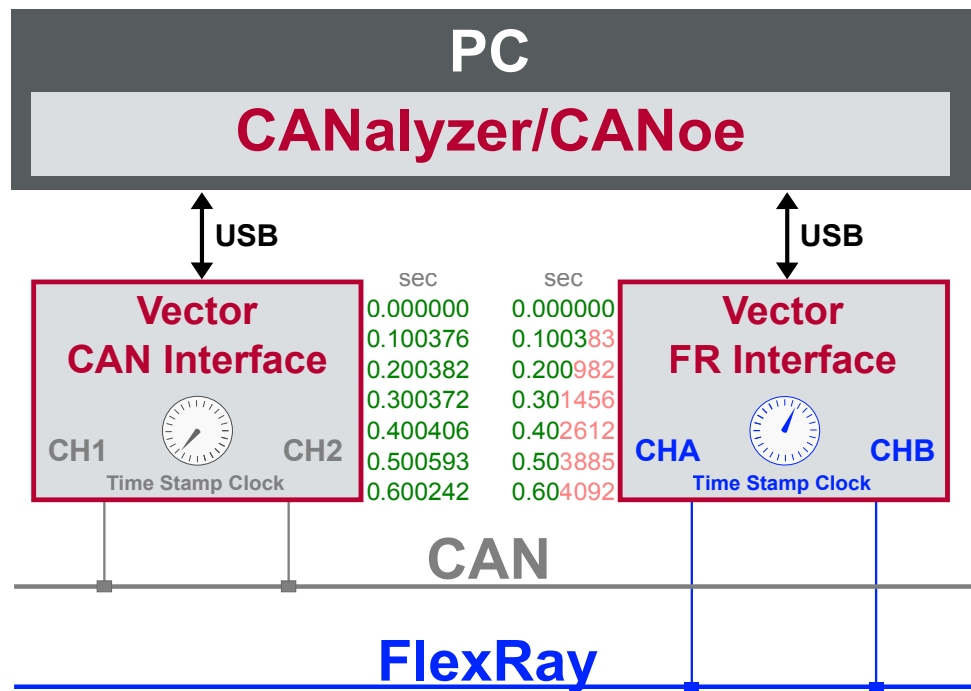


Figure 12: Example of unsynchronized network interfaces. Independent time stamps drift apart

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).

i **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.

4.2 Software Sync

4.2.1 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.

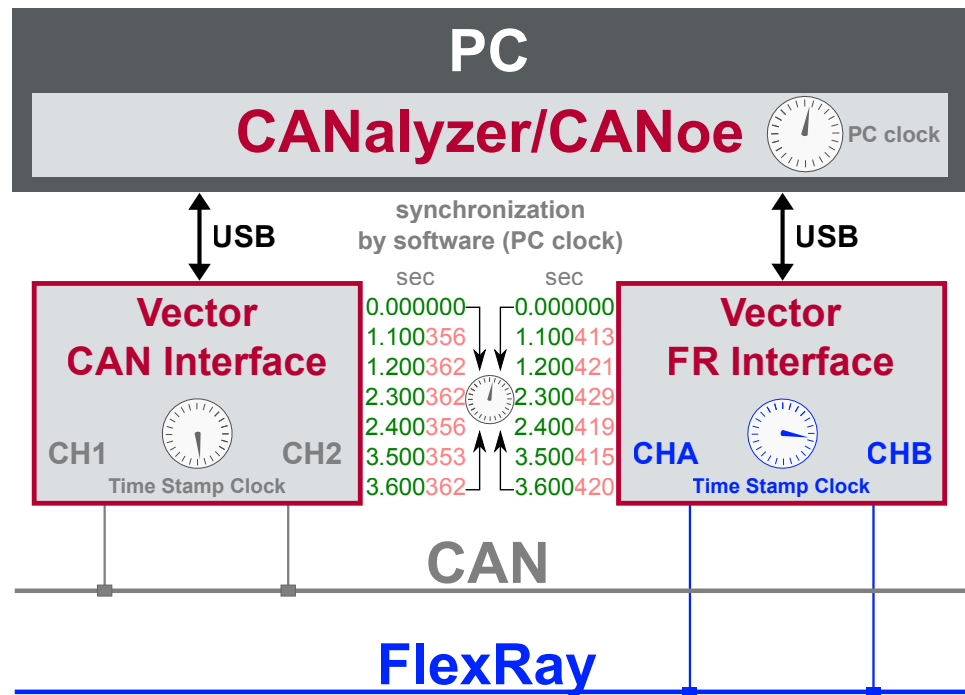


Figure 13: Time stamps of devices are synchronized to the PC clock



Note

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

4.2.2 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**.

4.3 Hardware Sync

4.3.1 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).

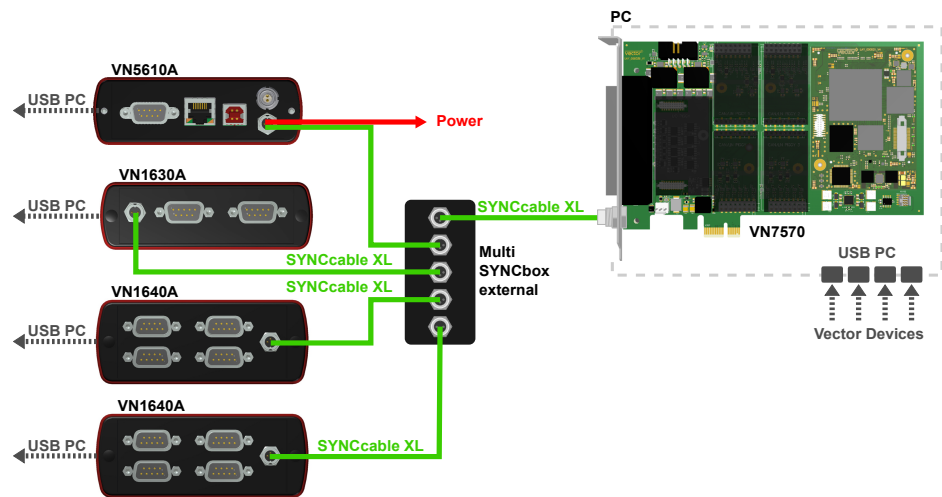


Figure 14: Example of a time synchronization with multiple devices

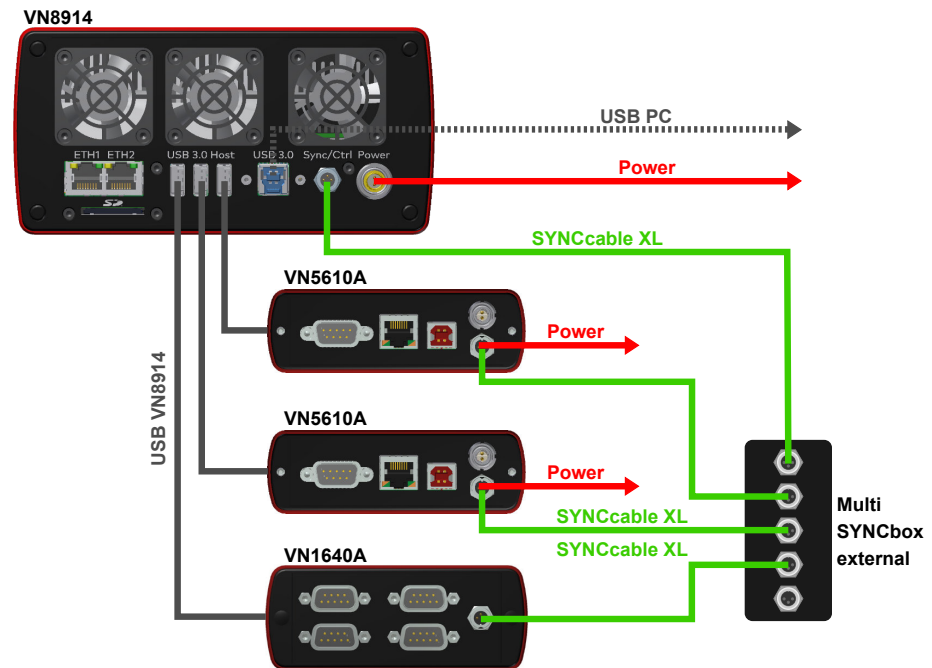


Figure 15: Example of a time synchronization with VN8914 and additional devices

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.

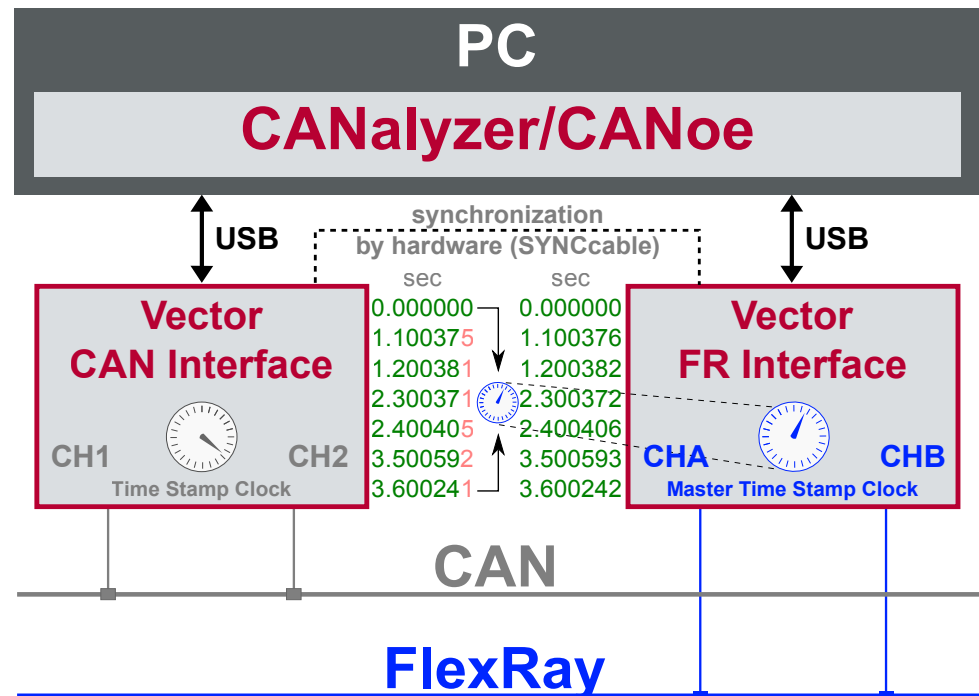


Figure 16: Time stamps are synchronized to the master clock

4.3.2 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**.

5 Important Notes - Details

In this chapter you find the following information:

5.0.1 Safety Instructions and Hazard Warnings	41
5.0.2 Disclaimer	43
5.0.3 Disposal of Vector Hardware	44

5.0.1 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.

5.0.1.1 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.

5.0.1.2 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.

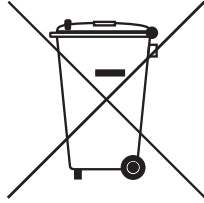
5.0.2 Disclaimer

**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.

5.0.3 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/>

6 Wichtige Hinweise

In diesem Kapitel finden Sie die folgenden Informationen:

6.0.1 Sicherheits- und Gefahrenhinweise	46
6.0.2 Haftungsausschluss	48
6.0.3 Entsorgung von Vector Hardware	49

6.0.1 Sicherheits- und Gefahrenhinweise



Achtung!

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.

6.0.1.1 Sach- und bestimmungsgemäßer Gebrauch



Achtung!

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.

6.0.1.2 Gefahren



Achtung!

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.

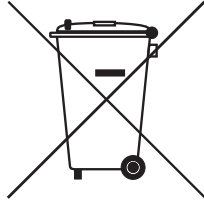
6.0.2 Haftungsausschluss

**Achtung!**

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.

6.0.3 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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