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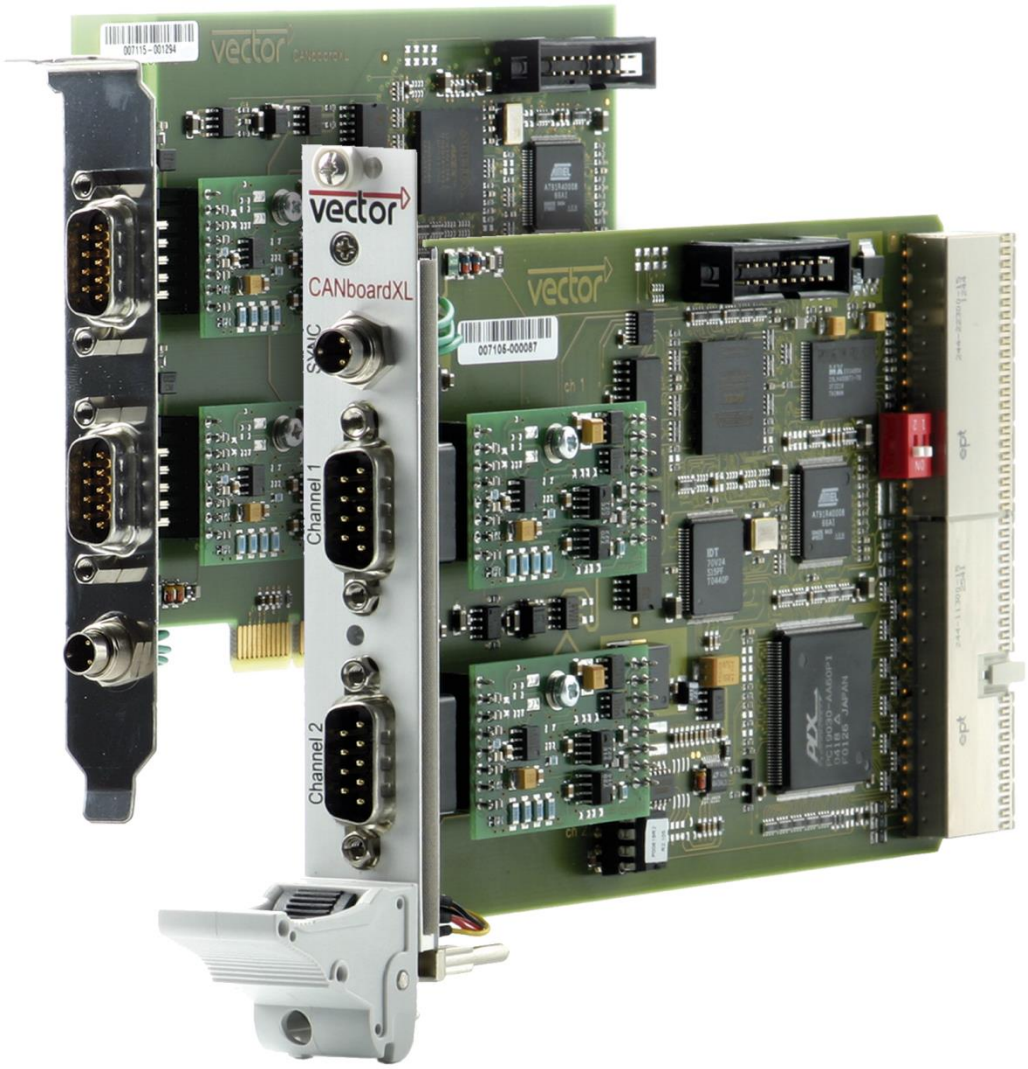
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Manual

CANboardXL Interface Family

Version 4.2

English

Imprint

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D-70499 Stuttgart

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Table of contents

1 Introduction 2

1.1 Safety Instructions and Hazard Warnings 3
1.1.1 Proper Use and Intended Purpose 3
1.1.2 Hazards 3
1.1.3 Disclaimer 3

1.2 About this User Manual 4
1.2.1 Certification 5
1.2.2 Warranty 5
1.2.3 Registered Trademarks 5

2 CANboardXL Interface Family 6

2.1 Introduction 7

2.2 Connectors 8
2.2.1 D-SUB9 9
2.2.2 External Sync Connector 9
2.2.3 Internal Sync Connector (CANboardXL PCIe only) 9

2.3 Driver Installation 10

2.4 Time Synchronization 10

2.5 Accessories 11

2.6 Technical Data 11

3 Hardware Installation 12

3.1 General Notes 13

3.2 CANboardXL and CANboardXL PCIe 13

3.3 CANboardXL pxi 13

3.4 Replacing Piggybacks 14

4 Common Features 16

4.1 Time Synchronization 17
4.1.1 General Information 17
4.1.2 Software Sync 19
4.1.3 Hardware Sync 20

5 Driver Installation 22

5.1 Minimum Requirements 23

5.2 Hints 24

5.3 Vector Driver Setup 25

5.4 Vector Hardware Configuration 27

5.5 Loop Tests 29
5.5.1 CAN 29
5.5.2 FlexRay 32
5.5.3 MOST 33
5.5.4 Ethernet 34

1 Introduction

In this chapter you find the following information:

1.1	Safety Instructions and Hazard Warnings Proper Use and Intended Purpose Hazards Disclaimer	page 3
1.2	About this User Manual Certification Warranty Registered Trademarks	page 4

1.1 Safety Instructions and Hazard Warnings



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

1.1.1 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 and/or BroadR-Reach.

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

1.1.2 Hazards



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

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

1.1.3 Disclaimer



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

1.2 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
Microsoft	Legally protected proper names and side notes.
`Source Code`	File name and source code.
Hyperlink	Hyperlinks and references.
<CTRL>+<S>	Notation for shortcuts.

Symbol	Utilization
	Here you can obtain supplemental information.
	This symbol calls your attention to warnings.
	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.

1.2.1 Certification

Certified Quality Management System

Vector Informatik GmbH has ISO 9001:2008 certification. The ISO standard is a globally recognized standard.

1.2.2 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.

1.2.3 Registered Trademarks

Registered trademarks

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2 CANboardXL Interface Family

In this chapter you find the following information:

2.1	Introduction	page 7
2.2	Connectors D-SUB9 External Sync Connector Internal Sync Connector (CANboardXL PCIe only)	page 8
2.3	Driver Installation	page 10
2.4	Time Synchronization	page 10
2.5	Accessories	page 11
2.6	Technical Data	page 11

2.1 Introduction

CANboardXL for PCI, PCIe and PXI

The CANboardXL is available in three variants that have identical functionalities

- PCI card for installation in desktop PCs
- PCI express card for installation in desktop PCs
- Compact PCI/PXI backplane card for installation in industrial PCs

Each card has two CAN controllers which can send and receive CAN messages with 11 bit and 29 bit identifiers as well as remote frames without restrictions. Additionally, the CANboardXL is able to detect and generate error frames on the bus.

Configuration

The CANboardXL interface family can be configured with the **Vector Hardware Config** tool (**Windows | Start | Settings | Control Panel | Vector Hardware**). Further details on the tool can be found in the separate installation instructions at the end of this manual.

Bus types

Various transceivers are available to interface the CANboardXL to a particular type of bus. These CAN and LIN transceivers are available as plug-in boards (Piggybacks) and can be mounted on the CANboardXL. For information on installing transceivers please refer to chapter Replacing Piggybacks on page 14. A list of available Piggybacks is included in the accessories manual on the driver CD in `\Documentation\Accessories`.

Connectors

The CANboardXL has the following connectors:

- Two D-SUB9 connectors for independent CAN and LIN operation
- Binder connector (type 711) for synchronization
- Internal sync connector (CANboardXL PCIe only)

2.2 Connectors

CANboardXL (PCI)

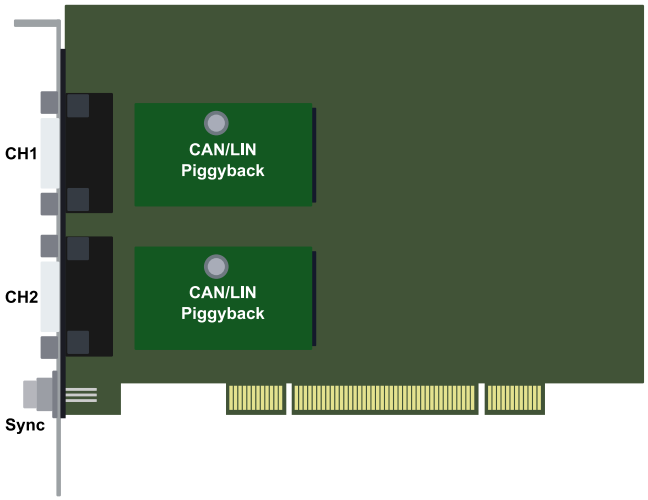


Figure 1: CH1/2 and sync at CANboardXL

CANboardXL PCIe

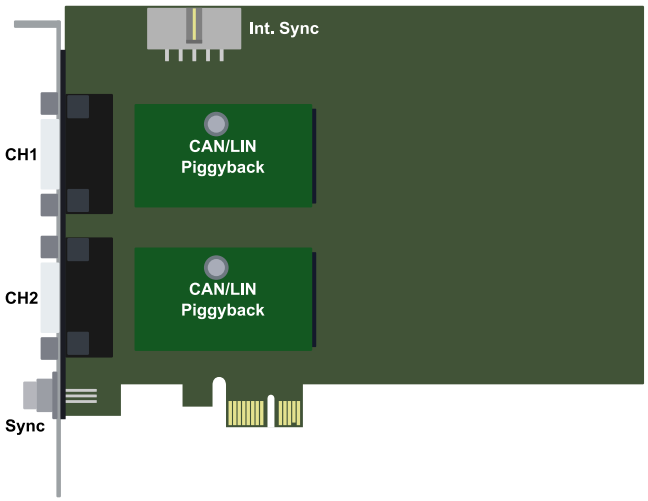


Figure 2: CH1/2, external and internal sync at CANboardXL PCIe

CANboardXL pxi

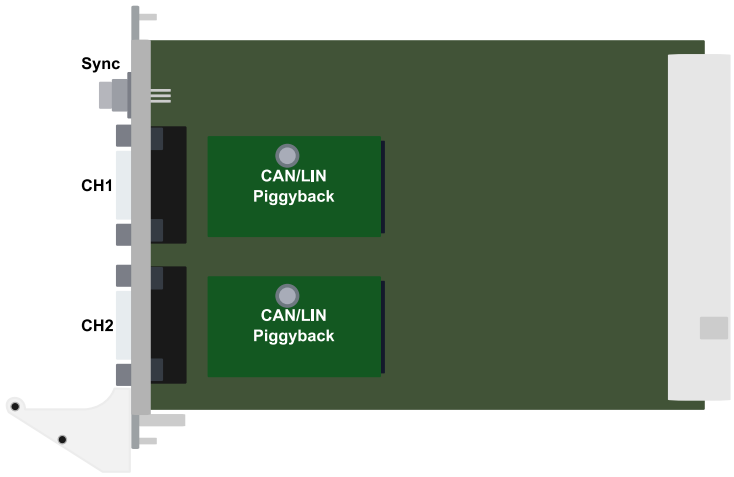


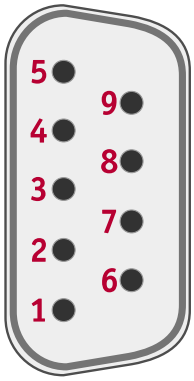
Figure 3: CH1/2 and sync at CANboardXL pxi

2.2.1 D-SUB9

The pin assignments at the D-SUB9 connectors depend on the inserted Piggybacks. Please refer to the accessories manual on the driver CD.

The general CAN pin assignment is as follows:

Pin	Assignment
1	Not connected
2	CAN Low
3	GND
4	Piggyback dependent
5	Shield
6	Not connected
7	CAN High
8	reserved
9	Piggyback dependent



2.2.2 External Sync Connector

Each CANboardXL variation provides a sync connector (Binder type 711) that can be used for time synchronization of different Vector devices (see section Time Synchronization on page 17).

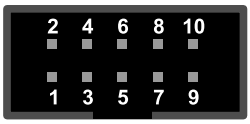
Pin	Assignment
1	Not connected
2	Synchronization line (low active)
3	GND



2.2.3 Internal Sync Connector (CANboardXL PCIe only)

The CANboardXL PCIe can also be synchronized via the internal 10-pin connector (angled) next to the Piggyback socket. For synchronization a ribbon cable with a 10-pin standard connector is required (see section Time Synchronization on page 17).

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



2.3 Driver Installation

Note: Information on the driver installation process can be found in section Driver Installation on page 22.

2.4 Time Synchronization

Note: General information on time synchronization can be found in section Time Synchronization on page 17.

Synchronization by sync connector (CANboardXL PCIe)

Multiple CANboardXL PCIe can be synchronized either by the Binder connector outside the PC housing or by the internal sync connector. The internal sync connector is a 10-pin connector (90° angled) and available next to the Piggyback slots. The synchronization is done with a ribbon cable and a 10-pin standard socket.

Time synchronization through PXI backplane

Additional to the synchronization described above, the CANboardXL pxi supports time synchronization through the PXI backplane.

Figure 4 depicts the switches which control the synchronization between the cards.

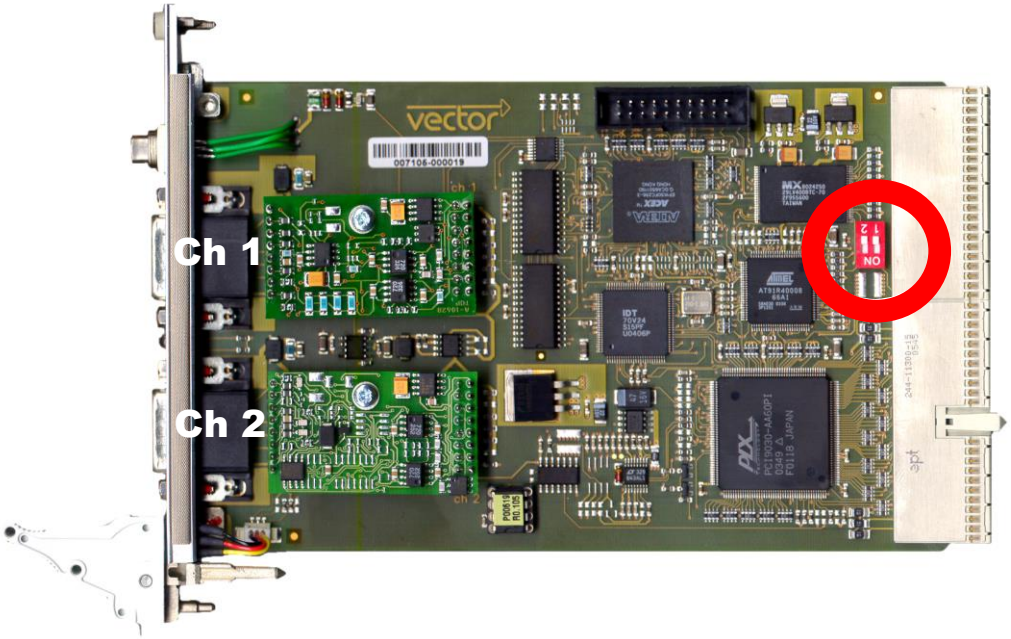


Figure 4: Channel 1 and 2 on CANboardXL pxi

In position **ON**, the synchronization is active. The right and left end of the synchronization line, which is built with multiple CANboardXL pxi cards, has to be cut off. The cut off of the right end is done with switch 2, the cut off of the left end with switch 1.

Example Time synchronization with three CANboardXL pxi:

CANboardXL pxi	Switch 1	Switch 2
1 (left)	OFF	ON
2 (middle)	ON	ON
3 (right)	ON	OFF

2.5 Accessories



Reference: Further information on the available accessories can be found in the separate accessories manual on the driver CD in `\Documentation\Accessories`.

2.6 Technical Data

PC interface	CANboardXL: PCI CANboardXL PCIe: PCI Express CANboardXL pxi: Compact PCI/PXI
Channels	2 independent channels for CAN, LIN and J1708
Transceiver	Piggybacks
CAN controller	2 Phillips SJA 1000
Max. baudrate	1 Mbit/s
Time stamp accuracy	1 µs
Error frame	Detection and generation
Power consumption	1 W for CANboardXL/pxi without Piggybacks 2.5 W for CANboardXL PCIe without Piggybacks
Configuration	Plug & Play
Dimensions	PCI: approx. 155 mm x 135 mm x 20 mm PCIe: approx. 145 mm x 105 mm x 17 mm PXI: approx. 210 mm x 135 mm x 20 mm
Weight	PCI: approx. 210 g without Piggybacks PCIe: approx. 210 g without Piggybacks PXI: approx. 350 g without Piggybacks
Temperature range	PCI: Operation: -20 °C...65 °C PCIe: Operation: 0 °C...65 °C PXI: Operation: -20 °C...75 °C Transport and storage: -40 °C... 85 °C
Relative humidity	15 %...95 %, not condensing
Software requirements	Windows 7 (SP1), 32 bit or 64 bit Windows 8.1, 32 bit or 64 bit
Hardware requirements	IBM PC AT or 100 % compatible; CANboardXL: 1x PCI slot CANboardXL PCIe: 1x PCIe slot CANboardXL pxi: 1x Compact PCI slot

3 Hardware Installation

In this chapter you find the following information:

3.1	General Notes	page 13
3.2	CANboardXL and CANboardXL PCIe	page 13
3.3	CANboardXL pxi	page 13
3.4	Replacing Piggybacks	page 14

3.1 General Notes



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 PCI slot. This can damage your CANboardXL when it is inserted into the slot.



Caution: Do not force the CANboardXL into the slot. Make sure that the connectors of the card's PCI 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!



Note: Do not touch the bottom and the topside of the PCBs (CANboardXL main board and Piggybacks).

3.2 CANboardXL and CANboardXL PCIe



1. Turn off the computer and all peripheral devices.
2. Unplug the power cord.
3. Touch a metal plate on your computer to ground yourself and to discharge any static electricity.
4. Open the case and remove the metal brackets from an unused slot.
5. Align the CANboardXL with the PCI slot (CANboardXL PCIe with the PCIe slot) and press the card gently but firmly into the slot.
6. Close the computer cover.
7. Plug in the power cord.

3.3 CANboardXL pxi



1. Turn off the computer and all peripheral devices.
2. Unplug the power cord.
3. Touch a metal plate on your computer to ground yourself and to discharge any static electricity.
4. Align the CANboardXL pxi with the slot and press the card gently but firmly into the slot.
5. The CANboardXL pxi has to be fixed again with the screws.

3.4 Replacing Piggybacks

1. Turn off the computer and all peripheral devices.
2. Unplug the power cord.
3. Touch a metal plate on your computer to ground yourself and to discharge any static electricity.
4. Open the case and unplug the CANboardXL.

Note: Each of the Piggybacks is fixed with a screw.

5. Detach the screw with the screw protection and remove the Piggyback **carefully**.
6. Plug in the alternative Piggyback.

CANboardXL

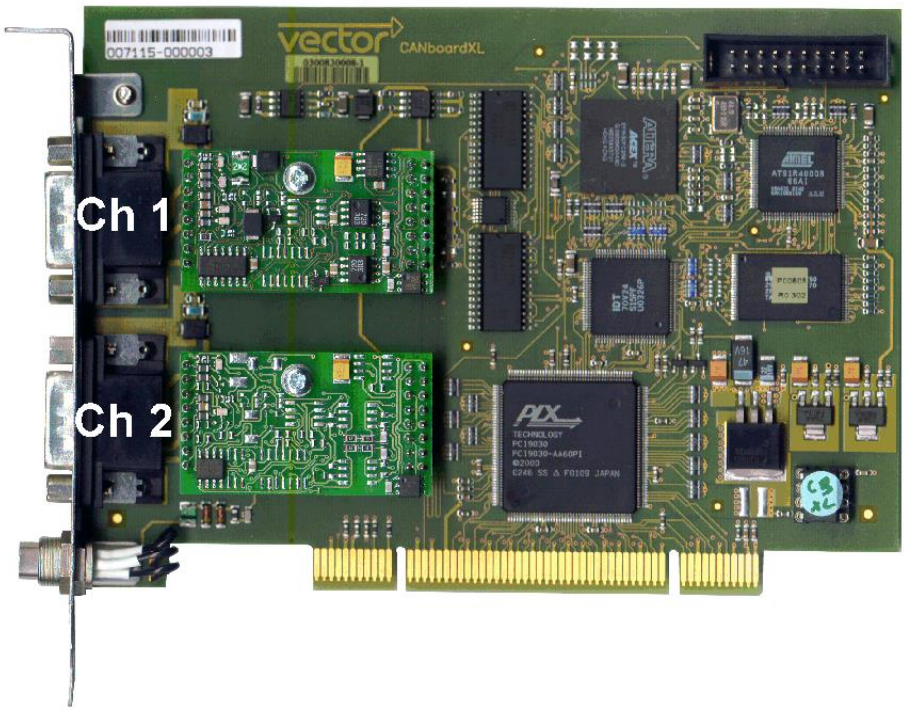


Figure 5: Channel 1 and 2 on CANboardXL

CANboardXL pxi

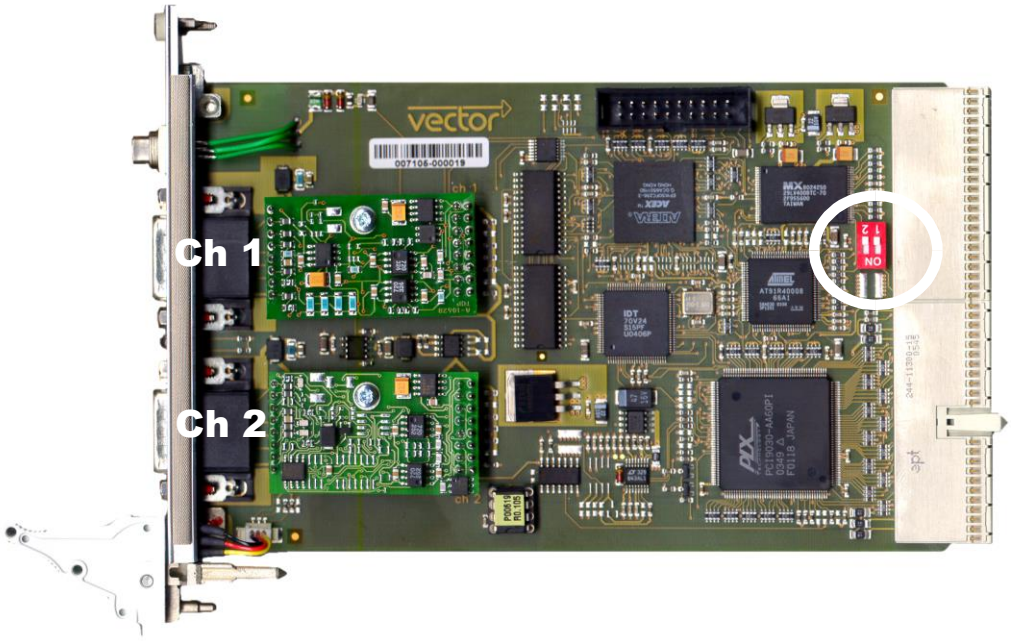


Figure 6: Channel 1 and 2 on CANboardXL pxi

Info: The two-row connector and the one-row connector must fit and must not be displaced laterally.

7. The Piggyback has to be fixed again with the screw and the screw protection.
8. Firmly insert the card into the selected slot. Push down to ensure the card is fully seated.
9. Close the computer cover.
10. Plug in the power cord.

4 Common Features

In this chapter you find the following information:

4.1	Time Synchronization General Information Software Sync Hardware Sync	page 17

4.1 Time Synchronization

4.1.1 General Information

Time stamps and events

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

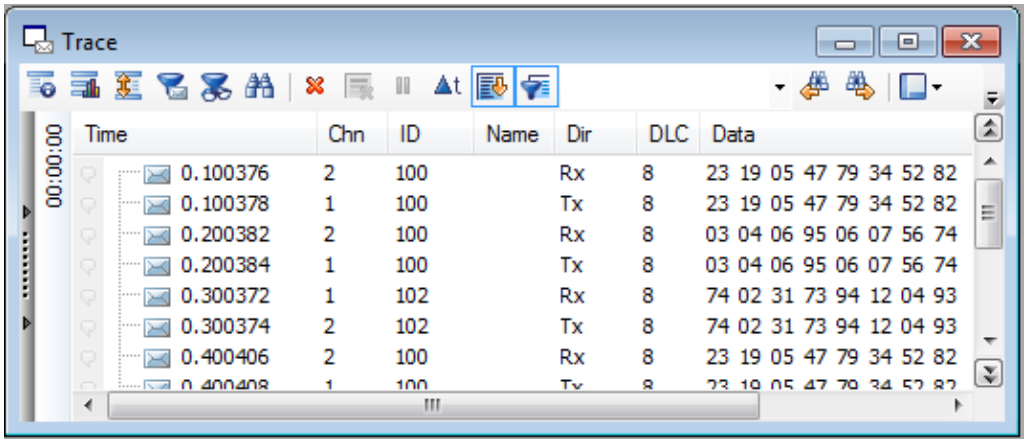


Figure 1: Time stamps of two CAN channels in CANalyzer

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.

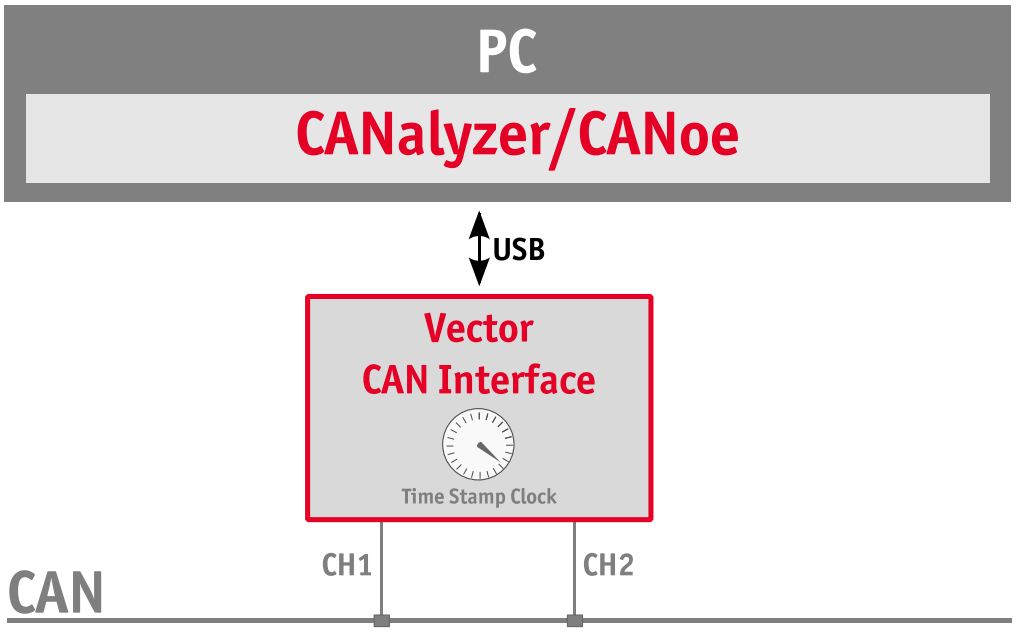


Figure 2: Common time stamp clock for each channel

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.

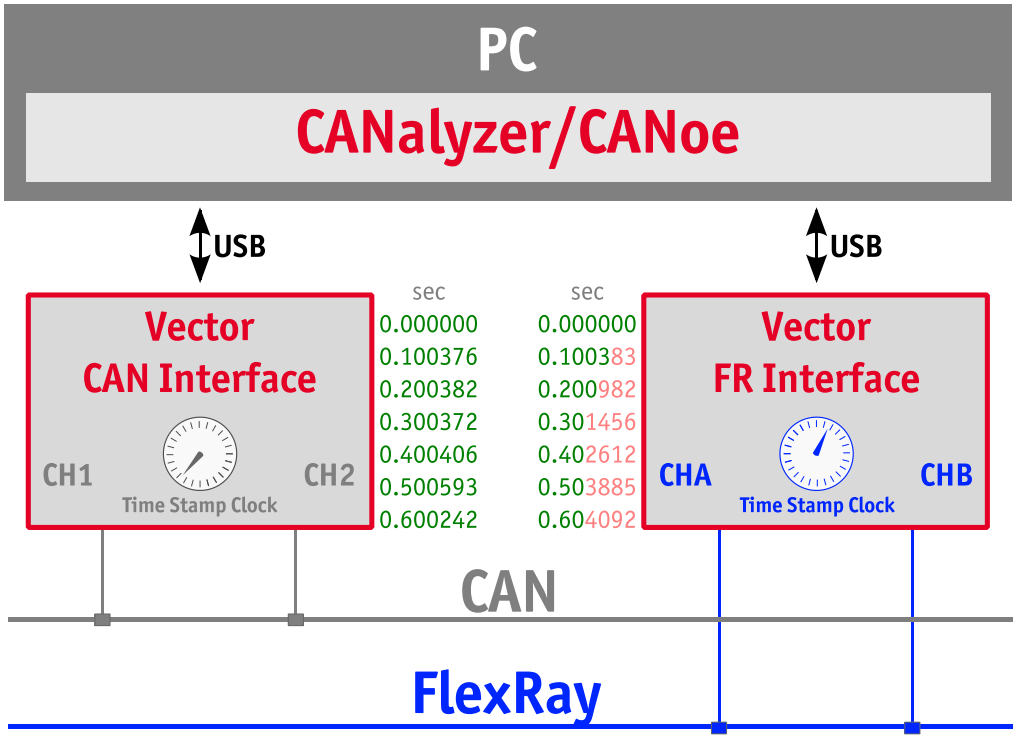


Figure 3: Example of unsynchronized network interfaces. Independent time stamps drift apart.

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

Note: The accuracy of the **software sync** is typically in range of **100 µs**.

Note: The accuracy of the **hardware sync** is typically in range of **1 µs**.

4.1.2 Software Sync

Synchronization by software

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

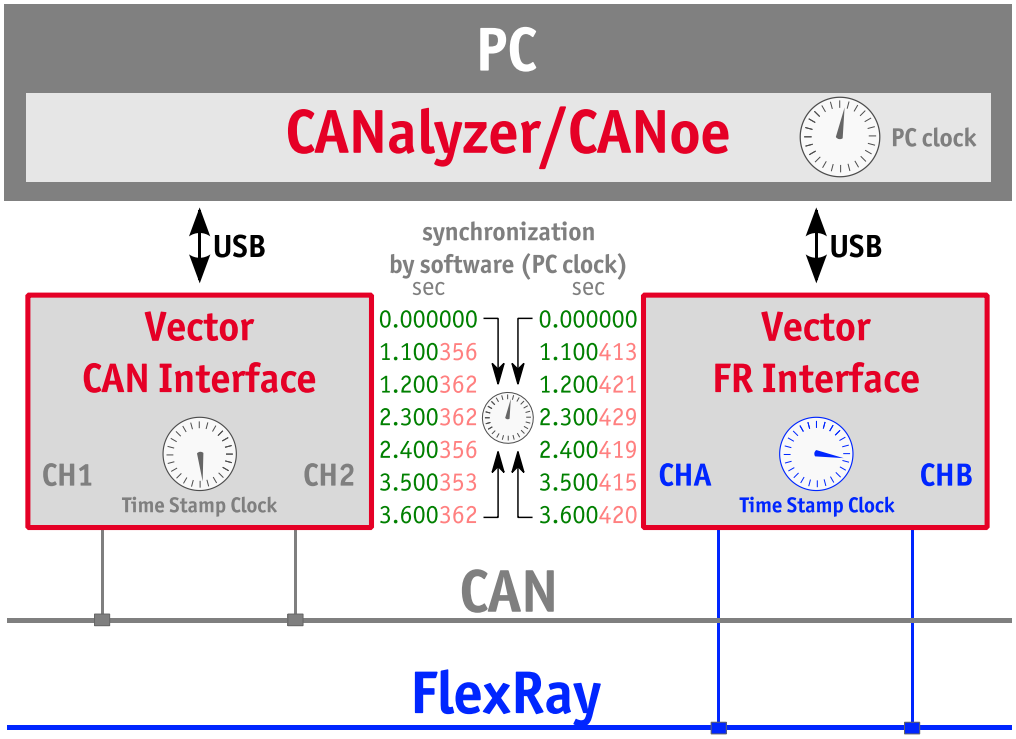


Figure 4: Time stamps of devices are synchronized to the PC clock (accuracy in range of 100 µs)

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

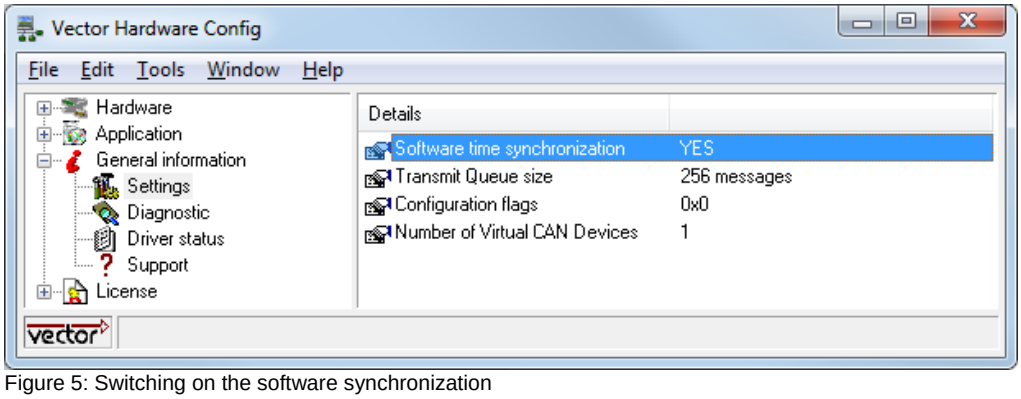


Figure 5: Switching on the software synchronization

➔ **YES**
The software time synchronization is active.

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

4.1.3 Hardware Sync

Synchronization by hardware

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

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

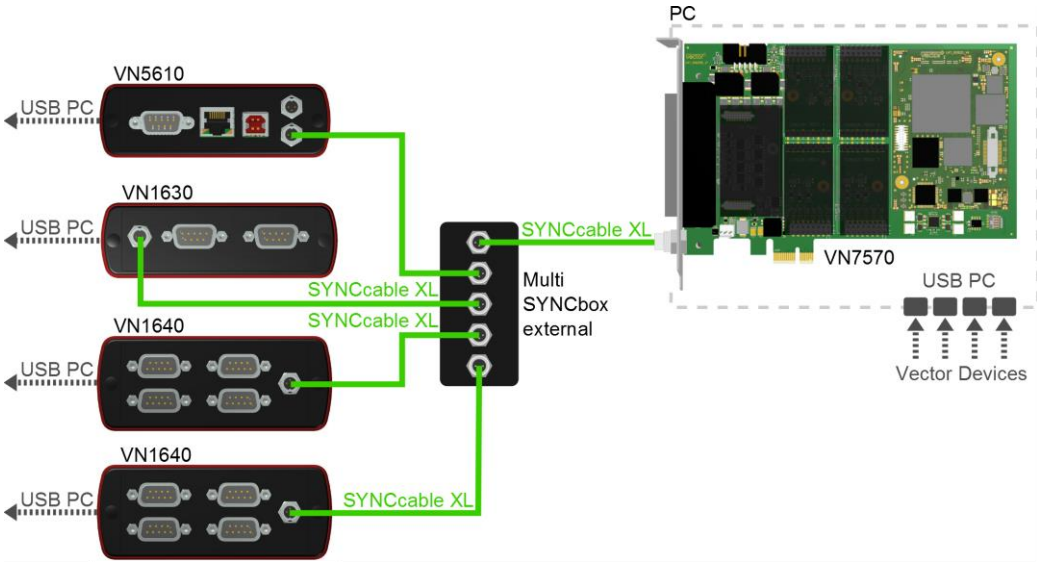


Figure 6: Example of a time synchronization with multiple devices

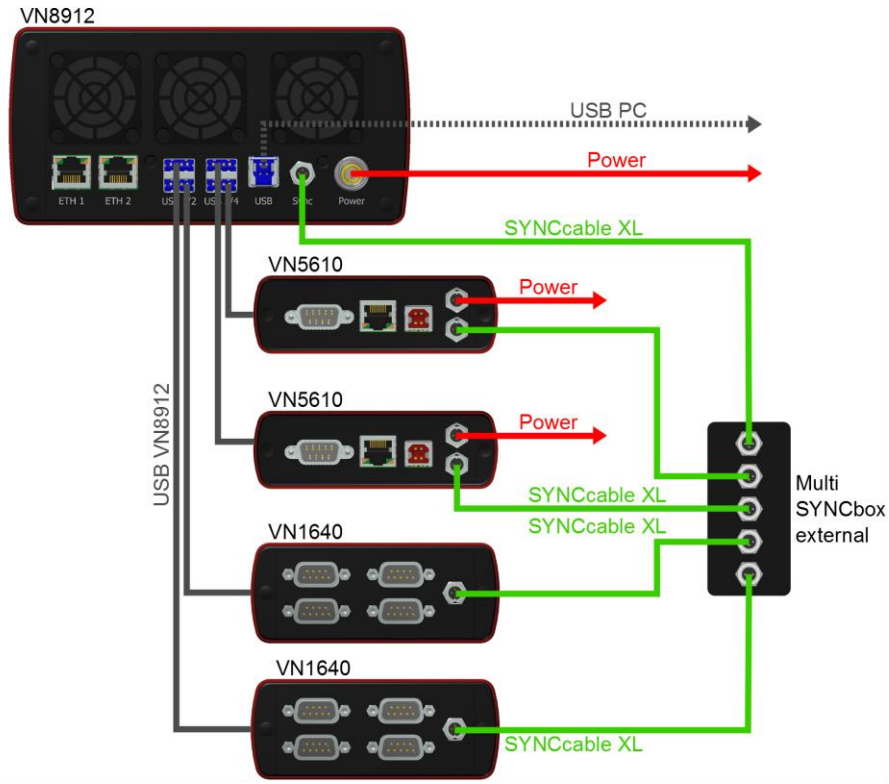


Figure 7: Example of a time synchronization with VN8912 and additional devices

At each falling edge on the sync line which is initiated by the application, the Vector network interface generates a time stamp that is provided to the application. This allows the application to calculate the deviations between the network interfaces and to synchronize the time stamps to a common time base (master clock) which is defined by the application.

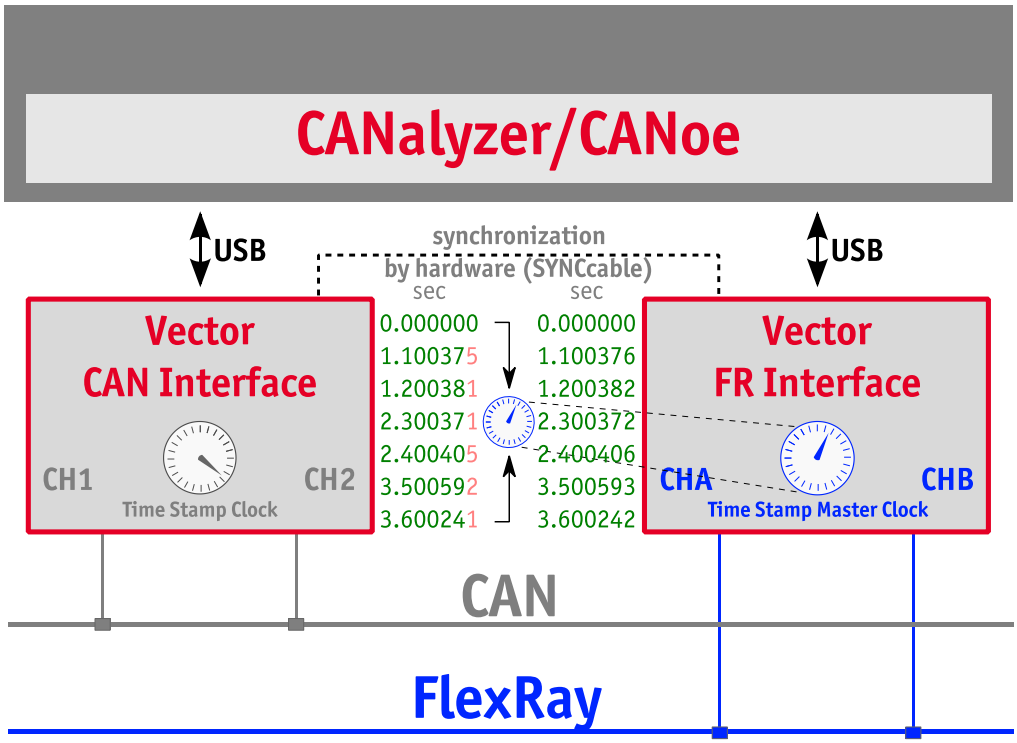


Figure 8: Time stamps are synchronized to the master clock (accuracy in range of 1 µs)

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

5 Driver Installation

In this chapter you find the following information:

5.1	Minimum Requirements	page 23
5.2	Hints	page 24
5.3	Vector Driver Setup	page 25
5.4	Vector Hardware Configuration	page 27
5.5	Loop Tests CAN FlexRay MOST Ethernet	page 29

5.1 Minimum Requirements

Hardware

CPU	Pentium 4 or higher
Memory	512 MB or more
Network interface	CANcardXL : PCMCIA CANcardXLe : ExpressCard 54 CANboardXL PCI : PCI CANboardXL PCIe : PCI Express x1 CANboardXL pxi : Compact PCI/PXI CANcaseXL : USB CANcaseXL log : USB VN1610 : USB VN1611 : USB VN1630A : USB VN1640A : USB VN2610 : USB VN2640 : USB VN3300 : PCI VN3600 : USB VN5610 : USB VN7570 : PCI Express x1 VN7572 : PCI Express x1 VN7600 : USB VN7610 : USB VN8910A : USB VN8912 : USB

Software

Operating system	Windows 7 (32/64 bit) Windows 8.1 (32/64 bit)
Driver version	8.x
Measurement application	The devices can be run with several applications from Vector (e. g. CANoe, CANalyzer) or with measurement applications from other companies. The devices require a related license. Applications based on the Vector XL Driver Library can be run without a license.

5.2 Hints



Note: Many desktop PCs have power managers which block the CPU for a specific time. This impairs accuracy of the time system. If your application has stringent timing requirements (e. g. time-driven sending of messages or time-driven evaluations), you have to deactivate these power managers. Power management settings may be contained in the BIOS setup or on the Control Panel of Windows 7 / Windows 8.1 (e. g. Power options).

No further mention will be made of the power manager in this document.



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

5.3 Vector Driver Setup

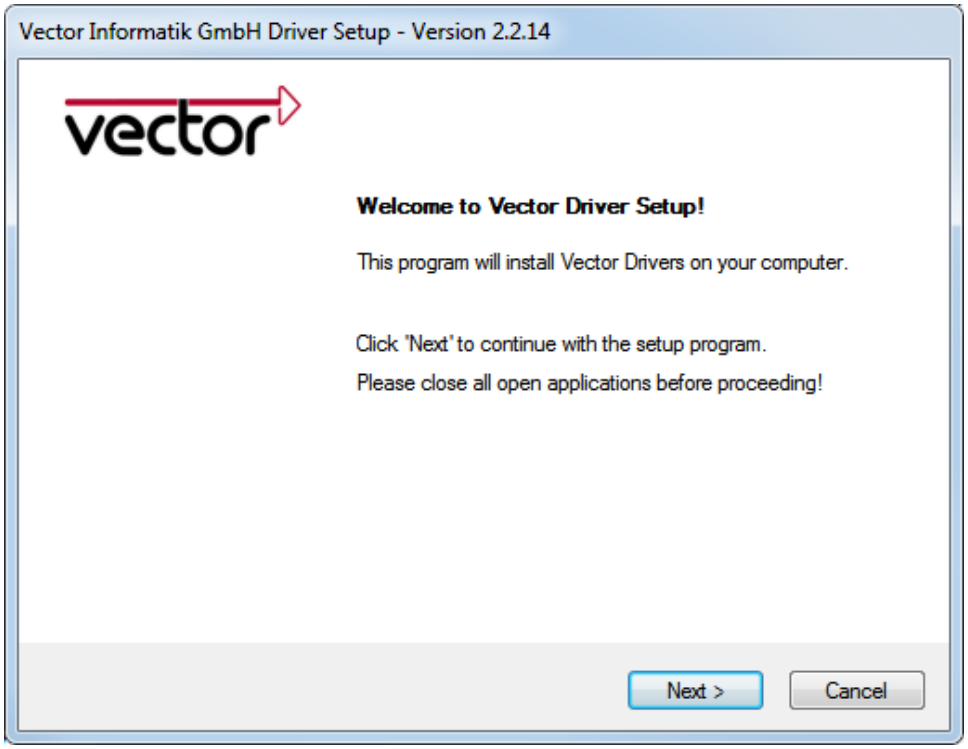
General information

The Vector Driver Disk offers a driver setup which allows the installation or the removal of Vector devices.



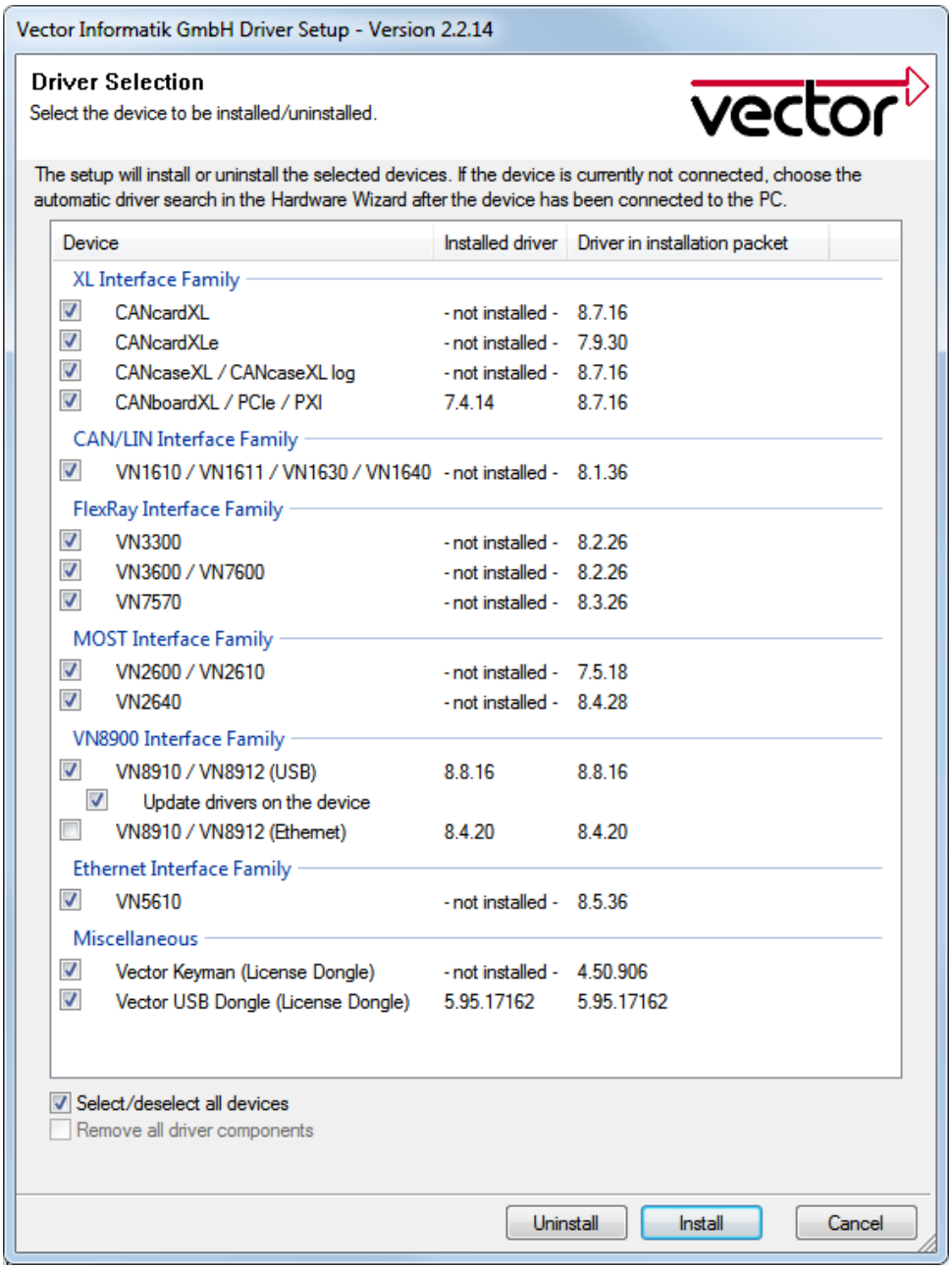
1. Execute the driver setup from the autostart menu or directly from `\Drivers\Setup.exe` before the device is inserted or connected to the PC with the included USB cable.

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



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

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



4. Click **[Install]** to execute the driver installation, or **[Uninstall]** to remove existing drivers.

5. A confirmation dialog appears. Click **[Close]** to exit.
If the driver has been installed properly, the device can be inserted or connected to the PC with the included USB cable. The device is ready for operation now.

5.4 Vector Hardware Configuration

Executing Vector Hardware Config

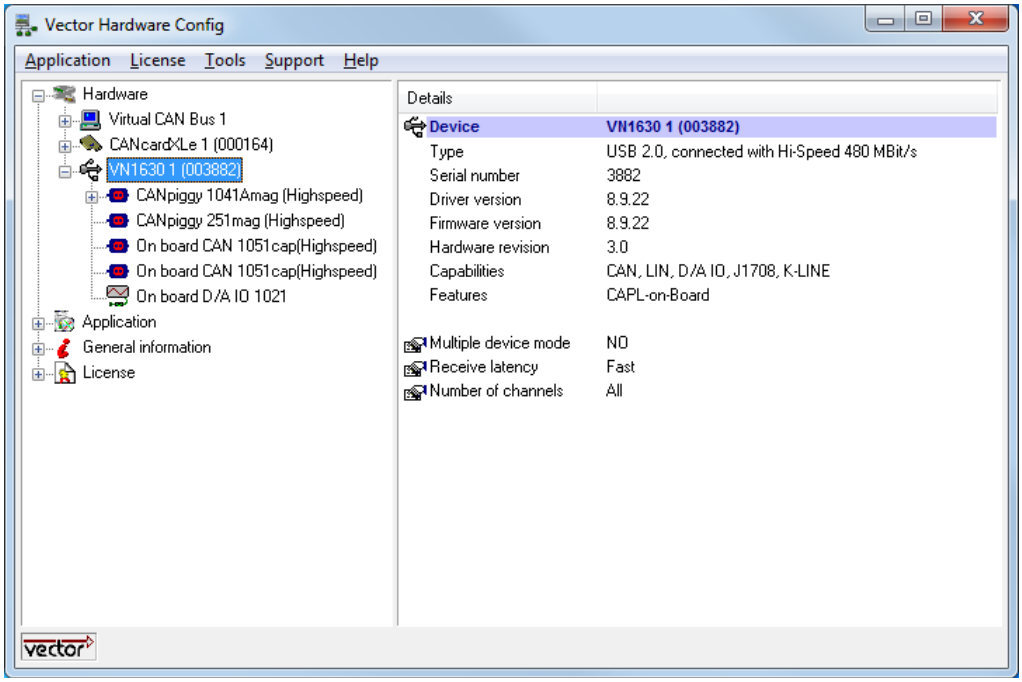
After the successful installation you will find the configuration application **Vector Hardware** in the Control Panel (see below). The tool gives you information about the connected and installed Vector devices. There are also several settings that can be changed.

Control panel Windows 7

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

Control panel Windows 8.1

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



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

Hardware

Each installed Vector device is shown in **Hardware**. Additional details of available channels are shown in a tree view. Status information on the device components and the channels are also shown in this dialog.

Application

In **Application**, all available applications are shown with their configured channels. If you click on an application, all of its channels are displayed in the right pane on the screen.

General information

The **General information** section contains general information on Vector devices and

applications.

License

The **License** section contains information on all current valid licenses.



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

5.5 Loop Tests

Operating 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 7 / Windows 8.1 and independent of the used application.

5.5.1 CAN

Device test

The operating test for CAN can be executed with the following devices:

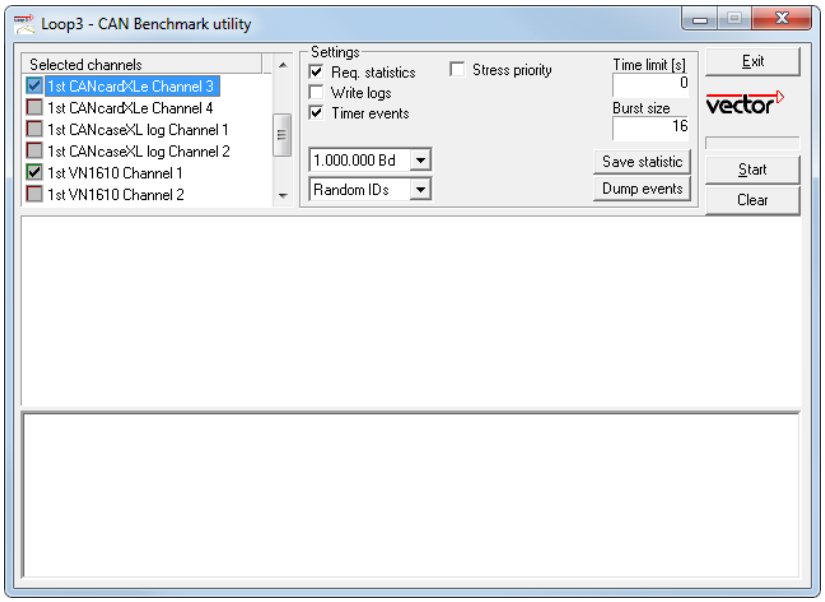
- CANcardXL
- CANcardXLe
- CANcaseXL
- CANcaseXL log
- CANboardXL Family
- VN1610
- VN1630A
- VN1640A
- VN5610
- VN7570
- VN7572
- VN7600
- VN8910A
- VN8912

Loop3.exe

Either two High-Speed or two Low-Speed transceivers are necessary for this functional test:

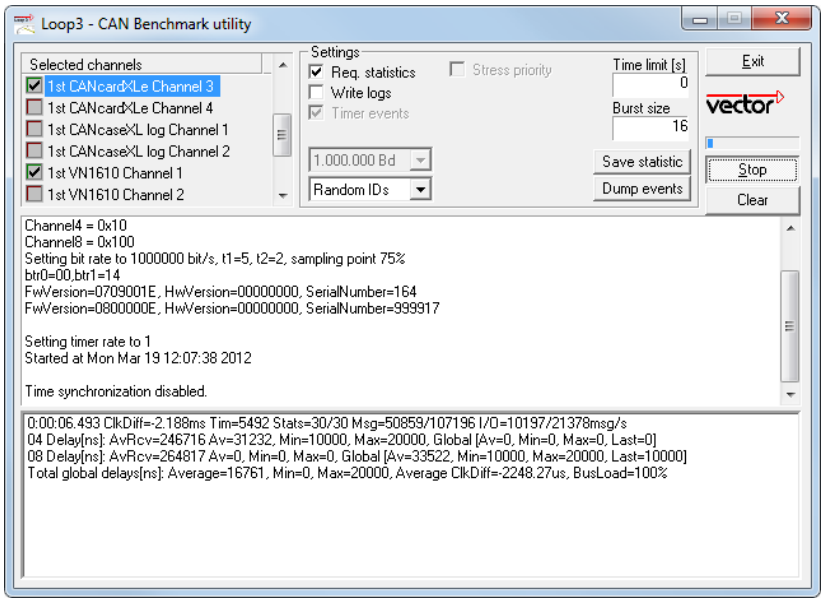


1. Connect two CAN channels with a suitable cable. If two High-Speed transceivers are being used, we recommend our CANcable 1 (CANcable 0 for Low-Speed transceivers).
2. Start `\Drivers\Common\Loop3.exe` from the driver CD.
   This program accesses the Vector devices and transmits CAN messages.
3. Select 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).

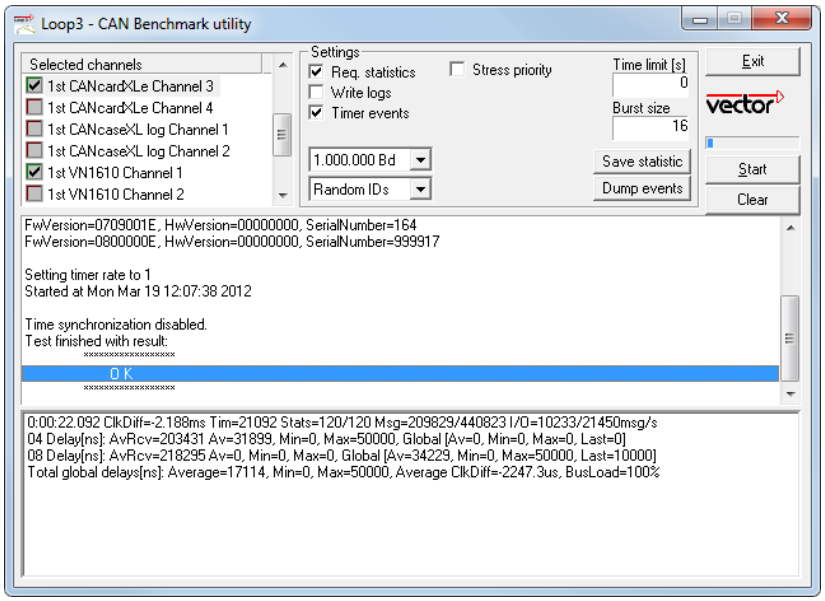


5. Click **[Start]**.
6. You will see statistical data in the lower part of the window if the system has been configured properly.

Loop3 application



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



5.5.2 FlexRay

Device test

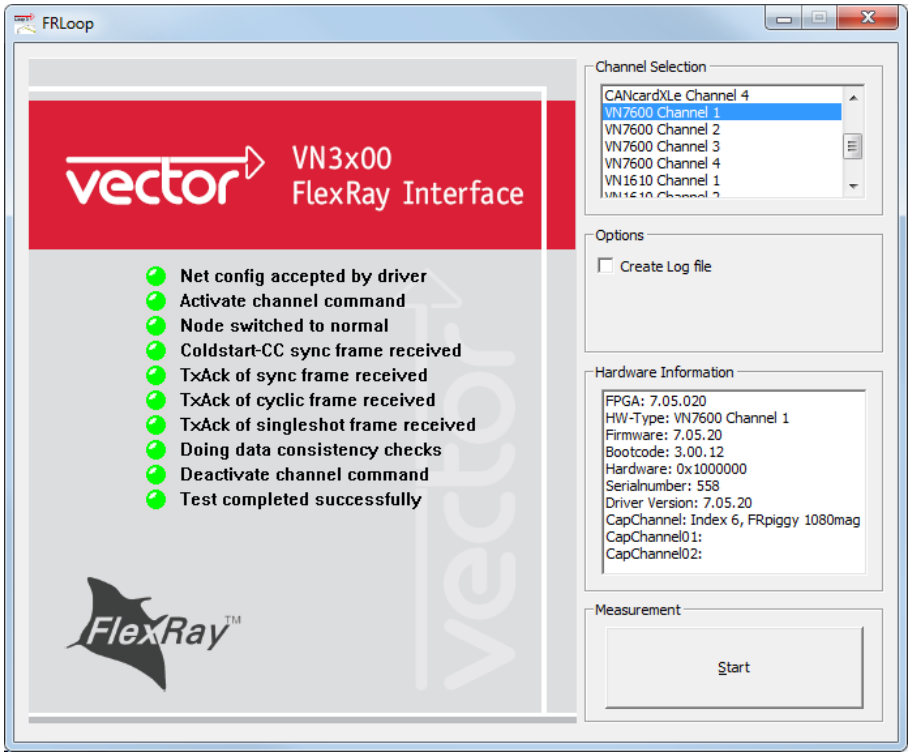
The operating test for FlexRay can be executed with the following devices:

- VN3300
- VN3600
- VN7570
- VN7572
- VN7600
- VN7610
- VN8910A with VN8970
- VN8912 with VN8970/VN8972

FRLoop.exe

This operating test requires an inserted FRpiggy.

1. Remove the FlexRay cable if it is connected.
2. Start `\Drivers\Common\FRLoop.exe` from the driver CD.
3. Execute the test.
4. If no error messages occur, the operating test was successful.



5.5.3 MOST

Device test

The operating test for MOST can be executed with the following devices:

- VN2610
- VN2640

MLoop.exe

This functional test requires a MOST fiber optic cable and a fiber coupler for HFBR connectors.



1. VN2610
   Start `\Drivers\Common\MLoop.exe` from the driver CD

   VN2640
   Start `\Drivers\Common\M150Loop.exe` from the driver CD.
2. Select the VN2610/VN2640 to be tested from the list of detected devices.
3. Click **[Twinkle]** and check if the power LED of the VN2610/VN2640 is blinking at least for one second.
4. Connect the MOST fiber optic cable with the VN2610/VN2640 device, select **Master** mode and check if the program displays the status **Unlock**. Check if red light comes out of the TX fiber of the MOST fiber optic cable.
5. Connect both ends of the fiber with one fiber coupler to a ring and check if the program displays the status **Lock**.
6. Close `MLoop.exe` with **[Exit]**.

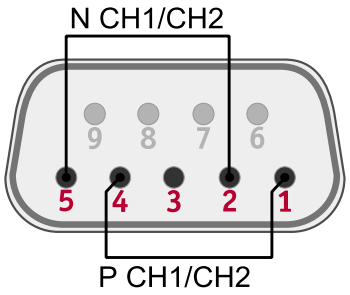
5.5.4 Ethernet

Device test

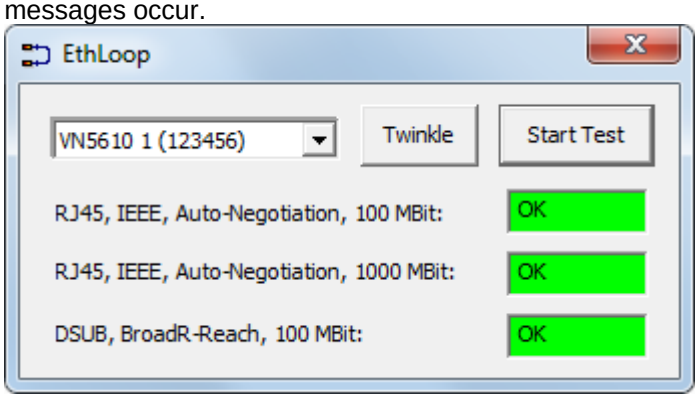
The operating test for Ethernet can be executed with the following devices:

➔ VN5610

1. Connect both Ethernet channels of the VN5610 with an Ethernet cable.
2. Connect both BroadR-Reach channels at the D-SUB9 connector as follows:



3. Start `\Drivers\Common\ETHloop.exe` from the driver CD.
4. Select an installed VN5610 from the list.
5. Press **[Twinkle]** and check if the LED **Status** blinks.
6. Start the test by pressing the button **[Start Test]**. The test is successful if no error messages occur.



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