VECTOR

Accessories for Network Interfaces

CAN / LIN / IO / J1708 / MOST / FlexRay

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Contents

1 Introduction

In this chapter you find the following information:

1.1 About this User Manual

Conventions

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

Style	Utilization
bold	Blocks, surface elements, window- and dialog names of the software. Accentuation of warnings and advices. **[OK]** Push buttons in brackets **File|Save** Notation for menus and menu entries
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
	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.

1.2 Important Notes

1.2.1 Safety Instructions and Hazard Warnings

Caution!
This accessory is designed for the operation of a Vector interface which may control and/or otherwise influence the behavior of control systems and electronic control units. The operation of such interface may lead to serious hazards for life, body and property. In order to avoid personal injuries and damage to property, you have to read and understand the safety instructions and hazard warnings which are applicable for the interface prior to its installation and use. Keep this documentation (manual) and the documentation of the interface always near the interface.

1.2.2 Certification

Certified Quality Management System

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

1.2.3 Warranty

Restriction of warranty

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

2 Accessories Finder

In this chapter you find the following information:

2.1 Accessories for CANboardXL (PCI, PCIe, PXI)

Bus transceiver
- CAN-/LINpiggies (see section Compatibility on page 39)

Cables and connectors
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

2.2 Accessories for CANcardXL

Bus transceiver
- CAN-/LINcabs (see section Compatibility on page 39)
- IOcab 8444opto (see section Compatibility on page 39)

Cables and connectors
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- SyncBox XL (page 138)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

2.3 Accessories for CANcardXLe

Bus transceiver
- CAN-/LINcabs (see section Compatibility on page 39)
- TWINcabs (see section Compatibility on page 39)
- IOcab 8444opto (see section Compatibility on page 39)

Cables and connectors
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- SyncBox XL (page 138)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

2.4 Accessories for CANcaseXL

Bus transceiver
- CAN-/LINpiggies (see section Compatibility on page 39)

Cables and connectors
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)
- Banana Plug <> Binder 3-Pin (page 111)

Power supply
- Vector Power Supply 12V/1.25A (page 126)
- Car Power Supply Cable 12V with Binder (page 128)

Miscellaneous
- Fix Kit 32mm Device (page 143)

2.5 Accessories for CANcaseXL log

Bus transceiver
- > CAN-/LINpiggies (see section Compatibility on page 39)

Cables and connectors
- > CANcable0 (page 99)
- > CANcable1 (page 99)
- > CANcableA (page 100)
- > CANcable TnT (page 100)
- > CANcable TnT Term (page 100)
- > CANcable Y (page 101)
- > CANterm 120 (page 103)
- > CANcable Set Pro (page 103)
- > SYNCcableXL (page 136)
- > SYNCcable50 (page 136)
- > Multi SYNCbox (page 137)
- > Connection Cable Binder Type 711 (page 110)
- > Banana Plug <> Binder 3-Pin (page 111)

Power supply
- > Vector Power Supply 12V/1.25A (page 126)
- > Car Power Supply Cable 12V with Binder (page 128)

Miscellaneous
- > Fix Kit 32mm Device (page 143)

2.6 Accessories for VN0601

Cables and connectors
- > VNcable DSUB37 (page 117)
- > Terminal Block DSUB37 (page 118)
- > SYNCcableXL (page 136)
- > SYNCcable50 (page 136)
- > Multi SYNCbox (page 137)
- > Connection Cable Binder Type 711 (page 110)

2.7 Accessories for VN1610

Cables and connectors
- > CANcable0 (page 99)
- > CANcable1 (page 99)
- > CANcableA (page 100)
- > CANcable TnT (page 100)
- > CANcable Y (page 101)
- > CANcable 2Y (page 102)
- > CANterm 120 (page 103)
- > CANcable Set Pro (page 103)

2.8 Accessories for VN1611

Cables and connectors
- > CANcable0 (page 99)
- > CANcable1 (page 99)
- > CANcableA (page 100)
- > CANcable TnT (page 100)
- > CANcable Y (page 101)
- > CANcable 2Y (page 102)
- > CANterm 120 (page 103)
- > CANcable Set Pro (page 103)

2.9 Accessories for VN1630A

Bus transceiver
- > CAN-/LINpiggies (see section Compatibility on page 39)

Cables and connectors
- > CANcable0 (page 99)
- > CANcable1 (page 99)
- > CANcableA (page 100)
- > CANcable TnT (page 100)
- > CANcable Y (page 101)
- > CANcable 2Y (page 102)
- > CANterm 120 (page 103)
- > CANcable Set Pro (page 103)
- > SYNCcableXL (page 136)
- > SYNCcable50 (page 136)
- > Multi SYNCbox (page 137)
- > Connection Cable Binder Type 711 (page 110)

Miscellaneous
- > Fix Kit 32mm Device (page 143)

2.10 Accessories for VN1640A

Bus transceiver	> CAN-/LINpiggies (see section Compatibility on page 39)
Cables and connectors	> CANcable0 (page 99) > CANcable1 (page 99) > CANcableA (page 100) > CANcable TnT (page 100) > CANcable Y (page 101) > CANterm 120 (page 103) > CANcable Set Pro (page 103) > SYNCcableXL (page 136) > SYNCcable50 (page 136) > Multi SYNCbox (page 137) > Connection Cable Binder Type 711 (page 110)
Miscellaneous	> Protection Kit 1040 (page 145)

2.11 Accessories for VN2610

Cables and connectors	> Fiber Optic Cable (page 104) > Fiber Optic Cable Coupling (page 105) > SYNCcableXL (page 136) > SYNCcable50 (page 136) > Multi SYNCbox (page 137) > Connection Cable Binder Type 711 (page 110) > Banana Plug <> Binder 3-Pin (page 111)
Power supply	> Vector Power Supply 12V/1.25A (page 126) > Car Power Supply Cable 12V with Binder (page 128)
Miscellaneous	> Fix Kit 32mm Device (page 143)

2.12 Accessories for VN2640

Cables and connectors
- > Fiber Optic Cable (page 104)
- > Fiber Optic Cable Coupling (page 105)
- > ECL cable (page 104)
- > SYNCcableXL (page 136)
- > SYNCcable50 (page 136)
- > Multi SYNCbox (page 137)
- > Connection Cable Binder Type 711 (page 110)
- > Banana Plug <> Binder 3-Pin (page 111)

Power supply
- > Vector Power Supply 12V/1.25A (page 126)
- > Car Power Supply Cable 12V with Binder (page 128)

Miscellaneous
- > Fix Kit 32mm Device (page 143)

2.13 Accessories for VN3300

Bus transceiver
- > FRpiggies (see section Compatibility on page 39)

Cables and connectors
- > FRcable A (page 106)
- > FRcable AB (page 106)
- > FRterm (page 107)
- > FRcable Set (page 107)
- > SYNCcableXL (page 136)
- > SYNCcable50 (page 136)
- > Multi SYNCbox (page 137)
- > Connection Cable Binder Type 711 (page 110)

2.14 Accessories for VN3600

Bus transceiver
- > FRpiggies (see section Compatibility on page 39)

Cables and connectors
- > FRcable A (page 106)
- > FRcable AB (page 106)
- > FRterm (page 107)
- > FRcable Set (page 107)
- > SYNCcableXL (page 136)
- > SYNCcable50 (page 136)
- > Multi SYNCbox (page 137)
- > Connection Cable Binder Type 711 (page 110)
- > Banana Plug <> Binder 3-Pin (page 111)

Power supply
- > Vector Power Supply 12V/1.25A (page 126)
- > Car Power Supply Cable 12V with Binder (page 128)

Miscellaneous
- > Fix Kit 32mm Device (page 143)

2.15 Accessories for VN5610A

Cables and connectors

- BRcable 2Y (page 109)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable Y (page 101)
- CANcable 2Y (page 102)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)
- Banana Plug <> Binder 3-Pin (page 111)
- Cable Lemo/Banana Plugs (page 124)

Power supply

- Vector Power Supply 12V/1.25A (page 126)
- Car Power Supply Cable 12V with Binder (page 128)

Miscellaneous

- Fix Kit 32mm Device (page 143)

2.16 Accessories for VN5640

Cables and connectors

Power supply

2.17 Accessories for VN7570

Bus transceiver

- FRpiggies (see section Compatibility on page 39)
- CAN-/LINpiggies (see section Compatibility on page 39)
- IOpiggy 8642 (see section Compatibility on page 39)

Cables and connectors

- Breakout Box D62Y9 (page 109)
- VNcable DSUB62 for Breakout Box (page 114)
- VNcable DSUB62 A (page 114)
- VNcable DSUB62 B (page 115)
- VNcable D62Y9 (page 116)
- FRcable A (page 106)
- FRcable AB (page 106)
- FRterm (page 107)
- FRcable Set (page 107)
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

2.18 Accessories for VN7572

Bus transceiver

- FRpiggies (see section Compatibility on page 39)
- CAN-/LINpiggies (see section Compatibility on page 39)
- IOpiggy 8642 (see section Compatibility on page 39)

Cables and connectors

- Breakout Box D62Y9 (page 109)
- VNcable DSUB62 for Breakout Box (page 114)
- VNcable DSUB62 A (page 114)
- VNcable DSUB62 B (page 115)
- VNcable D62Y9 (page 116)
- FRcable A (page 106)
- FRcable AB (page 106)
- FRterm (page 107)
- FRcable Set (page 107)
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

2.19 Accessories for VN7600

Bus transceiver	> FRpiggies (see section Compatibility on page 39) > CAN-/LINpiggies (see section Compatibility on page 39)
Cables and connectors	> FRcable A (page 106) > FRcable AB (page 106) > FRterm (page 107) > FRcable Set (page 107) > CANcable0 (page 99) > CANcable1 (page 99) > CANcableA (page 100) > CANcable TnT (page 100) > CANcable TnT Term (page 100) > CANcable Y (page 101) > CANterm 120 (page 103) > CANcable Set Pro (page 103) > SYNCcableXL (page 136) > SYNCcable50 (page 136) > Multi SYNCbox (page 137) > Connection Cable Binder Type 711 (page 110) > Banana Plug <> Binder 3-Pin (page 111)
Power supply	> Vector Power Supply 12V/1.25A (page 126) > Car Power Supply Cable 12V with Binder (page 128)
Miscellaneous	> Protection Kit 1040 (page 145)

2.20 Accessories for VN7610

Cables and connectors
- FR/CANcable 2Y (page 108)
- FRcable A (page 106)
- FRcable AB (page 106)
- FRterm (page 107)
- FRcable Set (page 107)
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)

2.21 Accessories for VN8810

Cables and connectors
- OBDcable VN88 (page 121)
- OBDcable VN88A (page 122)
- Breakout Box VN88 (page 123)
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- SyncBox XL (page 138)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

Power supply
- Vector Power Supply ODU MINI-SNAP (page 127)
- Vehicle Input <> ODU MINI-SNAP (page 128)
- ODU Connector / Bunch Plugs (page 129)
- Power Adapter OBDII – ODU Mini Snap (page 129)

Miscellaneous
- 2.4 & 5 GHz Antenna SMA-R Std. (page 144)
- 2.4 & 5.2 GHz Antenna SMA-R Asia (page 144)

2.22 Accessories for VN8910A

Cables and connectors
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

Power supply
- Vector Power Supply ODU MINI-SNAP (page 127)
- Vehicle Input <> ODU MINI-SNAP (page 128)
- ODU Connector / Bunch Plugs (page 129)

2.23 Accessories for VN8912

Cables and connectors
- SYNCcableXL (page 136)
- SYNCcable50 (page 136)
- Multi SYNCbox (page 137)
- Connection Cable Binder Type 711 (page 110)

Power supply
- Vector Power Supply ODU MINI-SNAP (page 127)
- Vehicle Input <> ODU MINI-SNAP (page 128)
- ODU Connector / Bunch Plugs (page 129)

2.24 Accessories for VN8950

Bus transceiver
- CAN-/LINpiggies (see section Compatibility on page 39)
- IOpiggy 8642 (see section Compatibility on page 39)

Cables and connectors
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)

2.25 Accessories for VN8970

Bus transceiver

- FRpiggies (see section Compatibility on page 39)
- CAN-/LINpiggies (see section Compatibility on page 39)
- IOpiggy 8642 (see section Compatibility on page 39)

Cables and connectors

- FRcable A (page 106)
- FRcable AB (page 106)
- FRterm (page 107)
- FRcable Set (page 107)
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANcable 2Y (page 102)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)

2.26 Accessories for VN8972

Bus transceiver

- FRpiggies (see section Compatibility on page 39)
- CAN-/LINpiggies (see section Compatibility on page 39)
- IOpiggy 8642 (see section Compatibility on page 39)

Cables and connectors

- FRcable A (page 106)
- FRcable AB (page 106)
- FRterm (page 107)
- FRcable Set (page 107)
- CANcable0 (page 99)
- CANcable1 (page 99)
- CANcableA (page 100)
- CANcable TnT (page 100)
- CANcable TnT Term (page 100)
- CANcable Y (page 101)
- CANcable 2Y (page 102)
- CANterm 120 (page 103)
- CANcable Set Pro (page 103)

3 Transceiver - Products

In this chapter you find the following information:

3.1 Piggybacks

Properties

A Piggyback implements the interconnection of the network interface to a specific bus (e. g. CAN/LIN/IO/FlexRay) by the use of various transceivers. The Piggyback is inserted in the network interface and can be replaced according to the bus requirements (please take note of the instructions in the network interface user manual).

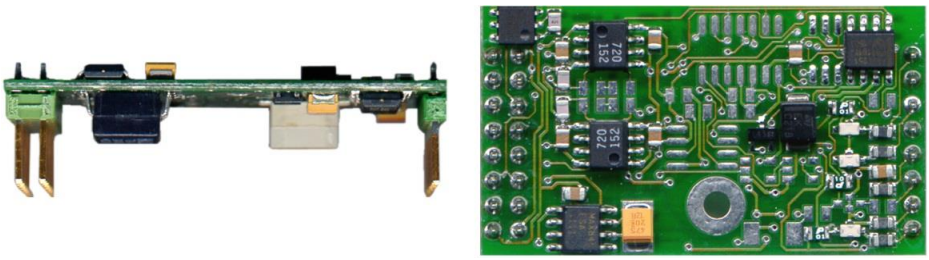


Figure 1: Piggyback

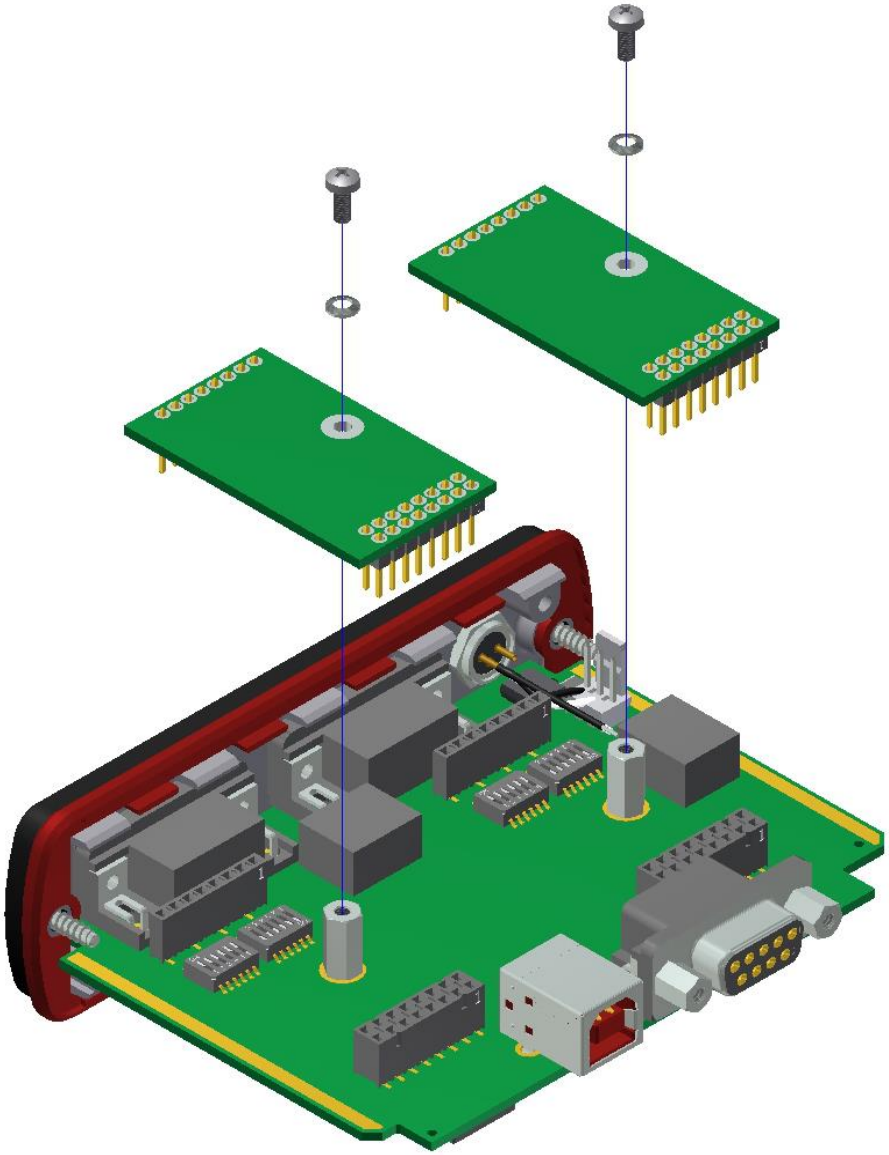


Figure 2: Example with VN1630A

3.1.1 CAN High-Speed

CANpiggy	Transceiver	Description	Part no.
251	82C251	Without galvanic isolation.	22015
251mag	82C251	Magnetically decoupled.	22040
251opto	82C251	Optically decoupled.	*
1040mag	TJA1040	Magnetically decoupled. Useful for partially powered networks.	22084
1041Amag	TJA1041A	Magnetically decoupled, wake-up capable.	22082
1041Aopto	TJA1041A	Optically decoupled, wake-up capable.	*
1050	TJA1050	Without galvanic isolation.	*
1050mag	TJA1050	Magnetically decoupled.	22083
1050opto	TJA1050	Optically decoupled.	*
1051cap	TJA1051	Capacitively decoupled. Suitable for 2 Mbit/s CAN and for CAN FD up to 8 Mbit/s.	22122
1057Gcap	TJA1057G	Capacitively decoupled. Suitable for 2 Mbit/s CAN and for CAN FD up to 8 Mbit/s.	22070

* discontinued

3.1.2 CAN Low-Speed (fault tolerant)

CANpiggy	Transceiver	Description	Part no.
1054	TJA1054	Without galvanic isolation.	*
1054opto	TJA1054	Optically decoupled. Switchable terminating resistor.	*
1054mag	TJA1054	Magnetically decoupled. Switchable terminating resistor.	22085
1055cap	TJA1055	Capacitively decoupled. Switchable terminating resistor.	22069

* discontinued

3.1.3 LIN

LINpiggy	Transceiver	Description	Part no.
7269mag	TLE7269	Magnetically decoupled. Compatible to LIN2.x physical layer (12 V and 24 V). Provides dominant and recessive stress functionality.	22093

3.1.4 Single Wire CAN

CANpiggy	Transceiver	Description	Part no.
5790opto c	AU5790	Optically decoupled. 100 Ω resistance can be activated automatically upon switching over to high-speed mode. External power supply required.	*
7356cap	NCV7356	Capacitively decoupled. 100 Ω resistance can be activated automatically upon switching over to high-speed mode. External power supply required.	22244

* discontinued

3.1.5 Truck & Trailer CAN

CANpiggy	Transceiver	Description	Part no.
10011opto	B10011S	Optically decoupled. External power supply required.	22031

3.1.6 Digital/Analog IO

IOpiggy	Transceiver	Description	Part no.
8642	-	For the VN8900 interface family. Used for generation and measurement of analog and digital signals (see section IOpiggy 8642 on page 88).	22208

3.1.7 J1708

J1708piggy	Transceiver	Description	Part no.
65176opto	SN65176B	Optically decoupled.	22060

3.1.8 FlexRay

FRpiggy	Transceiver	Description	Part no.
1080	2x TJA1080 (Ch A and B)	Without galvanic isolation.	*
1080Amag	2x TJA1080A (Ch A and B)	Magnetically decoupled.	22096
1082cap	2x TJA1082 (Ch A and B)	Capacitively decoupled. With trigger feature.	22099

* discontinued

FRpiggyC	Transceiver	Description	Part no.
1082cap	2x TJA1082 (Ch A and B)	Compact FRpiggy. Capacitively decoupled. With trigger feature.	22121

3.2 Cabs

Properties

Cabs are designed for use with CANcardXL/CANcardXLe and implement the interconnection of the network interface to a specific bus (e. g. CAN/LIN/IO) by the use of various transceivers. Cabs are connected to CANcardXL/CANcardXLe and can be changed according to the bus requirements.

Cab with one D-SUB connector

Figure 3: Cab with a single channel

Technical data

Channels	1
Housing	ABS plastic
Dimensions	100 mm x 16 mm x 16 mm (4.0 x 0.6 x 0.6 in)
Cable length	Approx. 30 cm (1 ft.) at both ends
Weight	Approx. 100 g (3.5 oz.)
Connectors	PC side: 15-pin plug-type connector to CANcardXL/XLe Bus side: D-SUB9 connector per DIN 41652

3.2.1 CAN High-Speed

CANcab	Transceiver	Description	Part no.
251	82C251	Without galvanic isolation.	22003
251mag	82C251	Magnetically decoupled.	22049
251opto	82C251	Optically decoupled.	22008
251fibre	PCA82C251	Two wire fiber optic cable.	22058
1040mag	TJA1040	Magnetically decoupled. Useful for partially powered networks.	22080
1041Amag	TJA1041A	Magnetically decoupled, wake-up capable.	22078
1041Aopto	TJA1041A	Optically decoupled, wake-up capable.	*
1050	TJA1050	Without galvanic isolation.	*
1050mag	TJA1050	Magnetically decoupled.	22079
1050opto	TJA1050	Optically decoupled.	*

* discontinued

3.2.2 CAN Low-Speed (fault tolerant)

CANcab	Transceiver	Description	Part no.
1054	TJA1054	Without galvanic isolation.	*
1054opto	TJA1054	Optically decoupled. Switchable terminating resistor.	*
1054mag	TJA1054	Magnetically decoupled. Switchable terminating resistor.	22081

* discontinued

3.2.3 LIN

LINcab	Transceiver	Description	Part no.
7269mag	TLE7269	Magnetically decoupled. Compatible to LIN2.x physical layer (12 V and 24 V). Provides dominant and recessive stress functionality.	22094

3.2.4 Single Wire CAN

CANcab	Transceiver	Description	Part no.
5790c	AU5790	Without galvanic isolation. 100 Ω resistance can be activated automatically upon switching over to high-speed mode. External power supply required.	*
5790opto c	AU5790	Optically decoupled. 100 Ω resistance can be activated automatically upon switching over to high-speed mode. External power supply required.	22051

* discontinued

3.2.5 Truck & Trailer CAN

CANcab	Transceiver	Description	Part no.
10011opto	B10011S	Optically decoupled. External power supply required.	22055

3.2.6 Digital/Analog IO

IOcab	Transceiver	Description	Part no.
8444opto	-	Used for generation and measurement of analog and digital signals(see section IOcab 8444-opto on page 71).	22067

3.2.7 J1708

J1708cab	Transceiver	Description	Part no.
65176opto	SN65176B	Optically decoupled.	22056

3.3 TWINcabs

Properties

The TWINcab merges two Cabs in one and is designed for use with CANcardXLe. One TWINcab offers two channels. The channel numbers are either 1/3 or 2/4 depending on the used connector on the CANcardXLe. If two TWINcabs on one CANcardXLe are being used, four channels are available at the same time.

Note
The TWINcabs cannot be used with CANcardXL.

TWINcab with two D-SUB connectors

Figure 4: Example TWINcab with 2x CAN

Technical data

Channels	2
Housing	ABS plastic
Dimensions	110 mm x 35 mm x 17 mm (4.3 x 1.3 x 0.67 in)
Cable length	Approx. 30 cm (1 ft.) at both ends
Weight	Approx. 105 g (3.75 oz)
Connectors	PC side: 15-pin plug-type connector to CANcardXLe Bus side: 2x D-SUB9 connector per DIN 41652
Insulation voltage	50 V

3.3.1 CAN High-/Low-Speed (fault tolerant)

TWINcab	Transceiver	Description	Part no.
2x 1041Amag	2x TJA1041A	Magnetically decoupled.	22086
1x 1041Amag 1x 1054A	1x TJA1041A 1x TJA1054A	Magnetically decoupled. With one high-speed and one low-speed transceiver. Wakeup-capable.	22092

3.3.2 LIN

TWINcab	Transceiver	Description	Part no.
2x 7269mag	2x TLE7269	Compatible to LIN2.x physical layer (12 V and 24 V). Provides dominant and recessive stress functionality.	22088

3.4 Other Designs

Cab	Transceiver	Description	Part no.
EVA	User-specific	Evaluation kit: Mounting of the CANcab user-specifically with bus transceivers using pre-assembled breadboards (see section CANcab EVA on page 68).	22009

3.5 Compatibility

Transceiver

Suitable transceivers for your network interface can be found in the following table.

	Transceiver	CANcardXL	CANcardXLe	CANboard XL / CANcaseXL	VN1600 Interface Family	VN3300 / VN3600	VN7570	VN7572	VN7600	VN8950	VN8970	VN8972
Design		Cab	Cab/ Twin	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy
CAN High-Speed	251	X	X	X	X	-	-	-	X	-	-	-
	251opto	X	X	X	-	-	O	O	X	O	O	O
	251mag	X	X	X	X	-	X	X	X	X	X	X
	251fibre	X	X	-	-	-	-	-	-	-	-	-
	1040mag	X	X	X	X	-	X	X	X	X	X	X
	1041opto	X	X	X	-	-	O	O	X	O	O	O
	1041Aopto	X	X	X	-	-	O	O	X	O	O	O
	1041Amag	X	X	X	X	-	X	X	X	X	X	X
	1050	X	X	X	O	-	-	-	X	-	-	-
	1050opto	X	X	X	-	-	O	O	X	O	O	O
	1050mag	X	X	X	X	-	X	X	X	X	X	X
	1051cap	-[2]	-[2]	X	X	-	X	X	X	X	X	X
	1057Gcap	-[2]	-[2]	X	X	-	X	X	-[3]	X	X	X
CAN Low-Speed	1054	X	X	X	O	-	-	-	X	-	-	-
	1054opto	X	X	X	-	-	O	-	X	O	O	-
	1054mag	X	X	X	X	-	X	-	X	X	X	-
	1055cap	-[2]	-[2]	X	X	-	X	X	-[3]	X	X	X
Single Wire CAN	5790c	X	X	X	O	-	-	-	O	-	-	-
	5790opto c	X	X	X	X	-	X	O	X	X	X	O
	7356cap	-[2]	-[2]	X	X	-	X	X	X	X	X	X
Truck & Trailer CAN	10011opto	X	X	X	-	-	X	X	X	X	X	X
LIN	6258opto	X	X	X	-	-	-	-	-	-	-	-
	6259opto	X	X	X	-	-	-	-	-	-	-	-
	6259mag	X	X	X	X	-	X	X	-	X	X	X
	7259mag	X	X	X	X	-	X	X	-	X	X	X
	7269mag	X	X	X	X	-	X	X	-	X	X	X
FlexRay	1080	-	-	-	-	X	-	-	X	-	-	-
	1080mag	-	-	-	-	X	-	-	X	-	X	-
	1080Amag	-	-	-	-	X	-	-	X	-	X	-
	1082cap	-	-	-	-	X	X[1]	X[1]	X	-	X	X[1]

Design

Miscellaneous

Transceiver	CANcardXL	CANcardXLe	CANboard XL / CANcaseXL	VN1600 Interface Family	VN3300 / VN3600	VN7570	VN7572	VN7600	VN8950	VN8970	VN8972
	Cab	Cab/ Twin	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy	Piggy
8444opto	X	X	-	-	-	-	-	-	-	-	-
8642	-	-	-	-	-	X	X	-	X	X	X
J1708 65176opto	X	X	X	X	-	X	X	-	X	X	X

Cab Cab (see section Cabs on page 33)
Twin TWINcab (see section TWINcabs on page 36)
Piggy Piggyback (see section Piggybacks on page 29)

X supported
O not recommended
(mags/caps have better propagation delays and less current consumption)
- not supported

1 Compact FlexRay Piggybacks only
2 Piggyback only
3 supported with a future driver update

Reference
Please refer to our Vector KnowledgeBase for the latest list:
https://vector.com/kbp/entry/219/.

4 Transceiver - Technical Data

In this chapter you find the following information:

4.1 D-SUB Pin Assignment

Primary pin assignment

The following table shows the pin assignment of the network interface's D-SUB connector, when a Cab/Piggyback is used individually or, if the D-SUB has a double pin assignment, used as the primary channel.

		Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
CAN High-Speed	251	-	CAN L	GND	-	Shield	-	CAN H	-	-
	251opto	-	CAN L	VB-	-	Shield	-	CAN H	-	-
	251mag	-	CAN L	VB-	-	Shield	-	CAN H	-	-
	251fibre	-	CAN L	VB-	-	Shield	-	CAN H	-	VB+
	1040mag	-	CAN L	VB-	Split	Shield	-	CAN H	-	-
	1041Aopto	-	CAN L	VB-	Split	Shield	-	CAN H	-	(VB+)
	1041Amag	-	CAN L	VB-	Split	Shield	-	CAN H	-	(VB+)
	1050	-	CAN L	GND	-	Shield	-	CAN H	-	-
	1050opto	-	CAN L	VB-	-	Shield	-	CAN H	-	-
	1050mag	-	CAN L	VB-	-	Shield	-	CAN H	-	-
	1051cap	-	CAN L	VB-	-	Shield	-	CAN H	-	-
	1057Gcap	-	CAN L	VB-	-	Shield	-	CAN H	-	-
CAN Low-Speed	1054	-	CAN L	GND	-	Shield	-	CAN H	-	(VBatt)
	1054opto	-	CAN L	VB-	-/RT1	Shield	-	CAN H	-/RT2	(VB+)
	1054mag	-	CAN L	VB-	-/RT1	Shield	-	CAN H	-/RT2	(VB+)
	1055cap	-	CAN L	VB-	RT1	Shield	-	CAN H	-	(VB+)
Single Wire CAN	5790c	-	-	GND	R100	Shield	-	CAN	-	VBatt
	5790opto c	-	-	VB-	R100	Shield	-	CAN	-	VB+
	7356cap	-	-	VB-	R100	Shield	-	CAN	-	VB+
Truck & Trailer CAN	10011opto	-	CAN L	VB-	-	Shield	-	CAN H	-	Vs
LIN	7269mag	-	-	VB-	Pdis	Shield	-	LIN	-	(VB+)
FlexRay	1080Amag	-	BM A	VB-	BM B	Shield	-	BP A	BP B	-
	1082cap	Trig	BM A	VB-	BM B	Shield	-	BP A	BP B	-
J1708	65176opto	-	A	VB-	-	Shield	-	B	-	-
IO	8444opto	see section IOcab 8444opto on page 71								
	8642	see section IOpiggy 8642 on page 88								

Details

Pin	Description
-	Reserved, e. g. for the secondary pin assignment of built-in transceivers in a network interface (e. g. VN1630 CH1/CH3, CH2/4).
CAN H	CAN High.
CAN L	CAN Low.
GND	Ground.
VB-	Electrically decoupled ground.
VB+	Positive supply voltage for electrically decoupled Cabs/Piggybacks. For voltage range see technical data of the according transceiver.

Details

Pin	Description
(VB+)	VB+ optional.
Vs	Positive supply voltage for Truck & Trailer CAN.
Shield	Shield.
VBatt	Positive supply voltage for Cabs/Piggybacks without galvanic isolation. For voltage range see technical data of the according transceiver.
(VBatt)	VBatt optional.
R100	If a single-wire CANcab/CANpiggy is operated in a high-speed network, a terminating resistor must be placed in the network between CAN High and GND/VB-. In high-speed mode, the CANcab/CANpiggy connects such a resistor (100 Ohm) in the circuit when a shunt is placed between pin 7 (CAN High) and pin 4 (R100).
Pdis	Power disable. If pin 4 (Pdis) is connected to pin 3 (VB-), the internal power supply is disabled. In this case an external power supply is required at pin 9 (VB+).
RT1	**Only CANcab 1054mag, CANpiggy 1055cap:** If this pin is connected to pin 3 (VB-), the internal terminating resistor is reduced to 500 Ohm. Note: Also valid for CANpiggy 1054mag when used with VN8970 or VN1600 interface family.
RT2	**Only CANpiggy 1054mag:** If this pin is connected to pin 3 (VB-), the internal terminating resistor is reduced to 500 Ohm. Note: Not valid for VN8970 or VN1600 interface family. See RT1.
Trig	Trigger (see user's manual for further details).
BP	Bus plus.
BM	Bus minus.

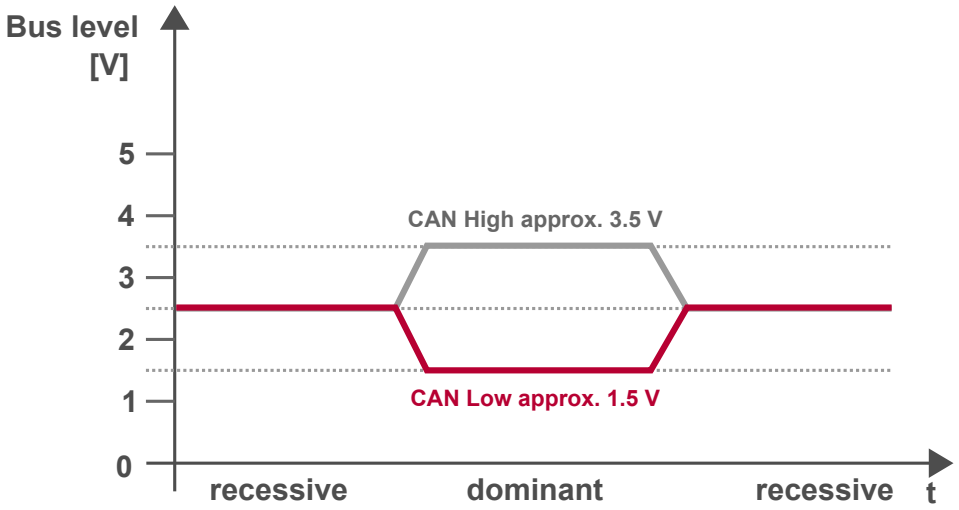
4.2 CAN High-Speed

4.2.1 General Information

Properties

High-speed Cabs and Piggybacks are fully compatible to the ISO 11898-2 standard and may be implemented for transmission rates up to 2 Mbit/s.

Bus level



Test setup

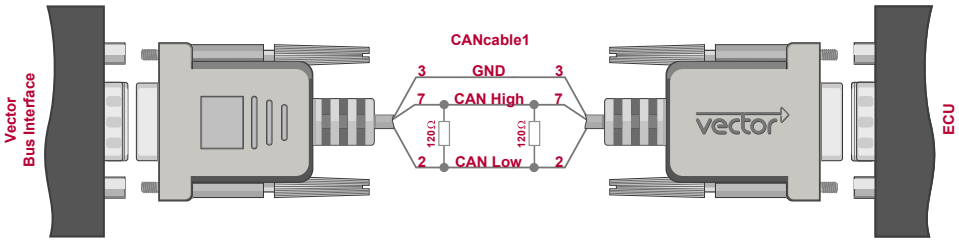


Figure 5: Connection between network interface and ECU e. g. via CANcable1

4.2.2 251

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 30 mA (typ.)
Transceiver	PCA82C251
Maximum baudrate	Up to 2 Mbit/s

4.2.3 251opto

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 60 mA (typ.)
Transceiver	PCA82C251
Maximum baudrate	1 Mbit/s
Isolation	Optical: HCPL-0720-500 or compatible
Insulation voltage	50 V

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

4.2.4 251mag

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 60 mA (typ.)
Transceiver	PCA82C251
Maximum baudrate	Up to 2 Mbit/s
Isolation	Magnetically: ADuM 1100
Insulation voltage	50 V

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

4.2.5 251fibre

Note
The 251fibre is only available as Cab.

Technical data

Voltage supply	PC side: by Vector network interface Bus side: external supply 6 V…36 V DC
Current consumption	PC side: 50 mA at 250 kBit/s Bus side: 50 mA (typ.)
Transceiver	PCA82C251 or compatible
Maximum baudrate	500 kbit/s
Optocoupler	HCPL-0720-500 or compatible (typ. delay time approx. 30 ns)
Fiber optic connector	HP type HFBR 0508
Fiber optic coupler	HP HFBR1528/HFBR2528
Total delay time	360 ns (typ.) + 2 x 5 ns/m fiber LWL
Dimensions	76 mm x 30 mm x 22 mm (approx. 3 x 1.2 x 0.9 in)
Weight	150 g
Housing	Black anodized aluminum
Maximal length	25 m (1 mm POF), at 500 kbit/s (85% sampling point) 50 m (200 µm HCS), at 250 kbit/s (85% sampling point)

Hardware

The CANcab 251fibre consists of two separate components, which are interconnected by a two-conductor fiber-optic cable. One component is connected to the CANcardXL via the I/O connector, and the other component is connected to the CAN bus via a D-SUB9 connector. The CANcab 251fibre is connected via a HFBR-0508 (optical couplers: HP modules HFBR-1528/HFBR-2528).

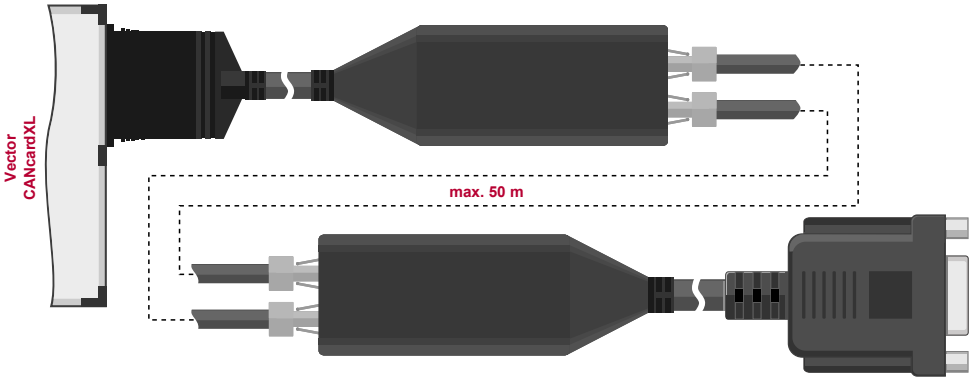


Figure 6: Connecting CANcab 251fibre to CANcardXL

Bus-side voltage supply

The CANcab 251fibre has to be externally supplied via pin 9.

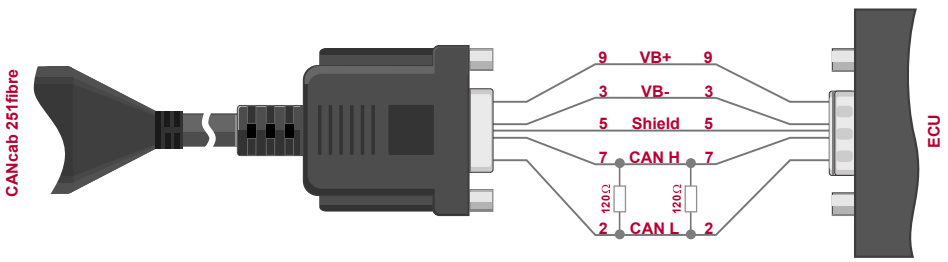


Figure 7: Connecting CANcab 251fibre to ECU

4.2.6 1040mag

Technical data

Voltage supply	By Vector network interface
Transceiver	TJA1040
Maximum baudrate	1 Mbit/s
Minimal baudrate	40 kbit/s
Isolation	Magnetically: ADuM 1100
Insulation voltage	50 V
Further properties	No unwanted error frames are generated (e. g. during shutdown)

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

4.2.7 1041Aopto

Technical data

Voltage supply	By Vector network interface or external 12 V…18 V DC
Transceiver	TJA1041A
Maximum baudrate	1 Mbit/s
Minimal baudrate	40 kbit/s
Isolation	Optical: HCPL-0720-500 or compatible (typ. delay time approx. 30 ns)
Insulation voltage	50 V

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

External voltage supply

An external voltage supply is possible via pin 9 at the D-SUB9 connector. The under voltage error detection of the transceiver is not possible in this case. This applies to both V_{Batt} and V_{CC}.

Split termination

The concept of the split termination is depicted in the figure below. In normal mode, this terminates the common mode signals via a capacitor to ground at the center tap point of the two 60 Ohm resistors. This is an attempt to achieve a kind of stabilization of the recessive bus voltage of approx. 2.5 V. In all other modes, pin 4 is high impedance, and therefore the split termination is deactivated. The recommended capacitance value of capacitor C_{Split} is 4.7 nF.

The series resistance in the split line that is recommended for some applications is not needed here, since a lost ground may be caused only by a defect in the CANcab/-CANpiggy.

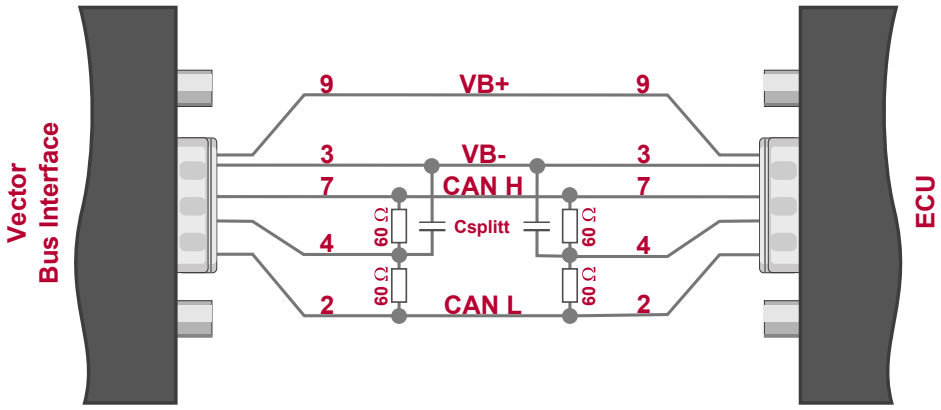


Figure 8: Setup example with external voltage supply and split termination

Programming of the normal and sleep Mode

The CANcab/CANpiggy 1041Aopto/mag supports both normal mode and sleep mode.

Switching between these modes is either done with the **xlCANSetChannelTransceiver** function of the XL Driver Library or with the CAPL function **setCanCabsMode**. Regarding this function it should be noted that the channel number is the logical channel number used by CANalyzer or CANoe according to the allocation in the Vector Hardware Configuration.

The **setCanCabsMode** function has four parameters: ntype, nchannel, nmode and nflags each of type long. For high-speed CANcabs/CANpiggies the following values are valid:

setCanCabsMode

ntype	Meaning
0	Reserved and must be set to 0

nchannel	Meaning
0…n	CAN channel to be set

nmode	Meaning
0	NORMAL
1	SLEEP

nflags	Meaning
1	AUTOWAKEUP, only together with SLEEP

Example

The following example shows how to switch the CANcab/CANpiggy 1041A-opto/mag to standby mode with CANalyzer/CANoe and a CAPL program.

```
variables
{
}

on key '1'
{
   write ("CAN1 High-Speed: Normal Mode");
   setCanCabsMode(0, 1, 0, 0);
}

on key '2'
{
   write ("CAN1 High-Speed: Sleep Mode");
   setCanCabsMode(0, 1, 1, 1);
}

on key '3'
{
   write ("CAN2 High-Speed: Normal Mode");
   setCanCabsMode(0, 2, 0, 0);
}

on key '4'
{
   write ("CAN2 High-Speed: Sleep Mode");
   setCanCabsMode(0, 2, 1, 1);
}
```

4.2.8 1041Amag

Technical data

Voltage supply	By Vector network interface or external 12 V…18 V DC
Transceiver	TJA1041A
Maximum baudrate	1 Mbit/s
Minimal baudrate	40 kbit/s
Isolation	Magnetically: ADuM 1100
Insulation voltage	50 V
Further properties	No unwanted error frames are generated (e. g. during shutdown)

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

Reference
Programming of the normal/sleep mode see section 1041Aopto on page 49.

4.2.9 1050

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 30 mA (typ.)
Transceiver	TJA1050
Maximum baudrate	1 Mbit/s

4.2.10 1050opto

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 60 mA (typ.)
Transceiver	TJA1050
Maximum baudrate	1 Mbit/s
Isolation	Optical: HCPL-0720-500 or compatible
Insulation voltage	50 V

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

4.2.11 1050mag

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 60 mA (typ.)
Transceiver	TJA1050
Maximum baudrate	1 Mbit/s
Isolation	Magnetically: ADuM 1100
Insulation voltage	50 V
Further properties	No unwanted error frames are generated (e.g. during shutdown)

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

4.2.12 1051cap

Note
This transceiver is available as Piggyback only.

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 60 mA (typ.)
Transceiver	TJA1051
Maximum baudrate	CAN High-Speed: 2 Mbit/s CAN FD: up to 8 Mbit/s
Further properties	No unwanted error frames are generated (e.g. during shutdown)

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

4.2.13 1057Gcap

Note
This transceiver is available as Piggyback only.

Technical data

Voltage supply	By Vector network interface
Transceiver	TJA1057G
Maximum baudrate	CAN High-Speed: 2 Mbit/s CAN FD: up to 8 Mbit/s
Further properties	No unwanted error frames are generated (e.g. during shutdown)

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

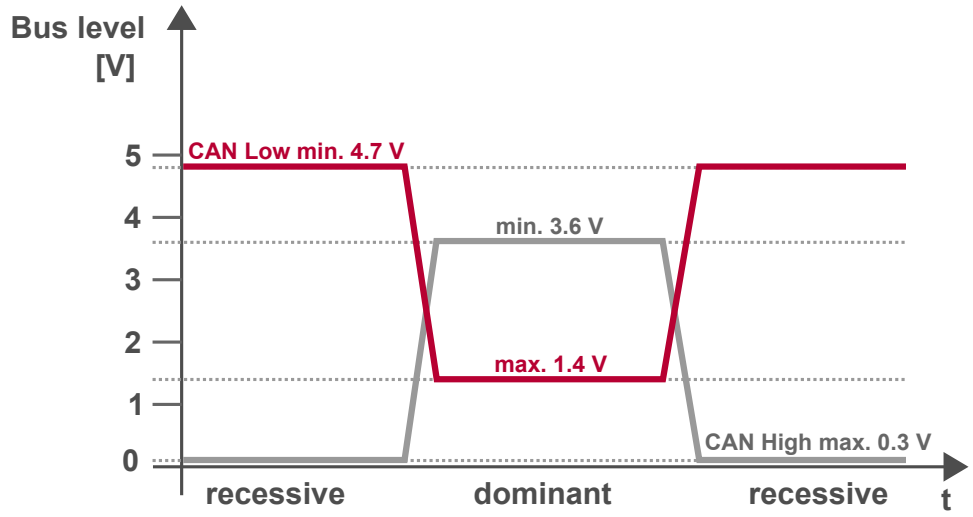
4.3 CAN Low-Speed (fault tolerant)

4.3.1 General Information

Properties

The low-speed CANcabs/CANpiggies are fully compatible to the ISO 11898-3 standard and can be implemented for transmission rates of up to 125 kbit/s.

Bus level in normal mode



Bus level in standby / sleep mode

> **CAN Low**
Approx. voltage supply

> **CAN High**
Approx. 0 V

Note

The voltage value of CAN Low depends on many factors and may fluctuate significantly in practice.

If all bus nodes are in sleep mode, the transceivers connect CAN Low to V_{Batt} via the terminating resistance RTL. Since the transceivers have different supply voltages, this results in cross currents between the CAN nodes via the terminating resistors. In sleep mode, this can lead to false readings when measuring supply currents.

Test setup

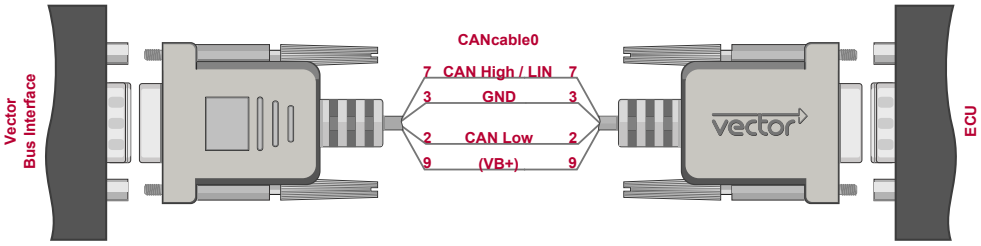


Figure 9: Connection between network interface and ECU e. g. via CANcable0

4.3.2 1054

Technical data

Voltage supply	By Vector network interface or external 12 V…18 V DC
Current consumption	Approx. 20 mA (typ.)
Transceiver	TJA1054
Maximum baudrate	125 kbit/s
Minimal baudrate	40 kbit/s

Programming of normal/sleep modes

The 1054 (mag/opto) supports both normal mode and sleep mode.

It is possible to toggle between the modes either with the **xlCANSetChannelTransceiver** function of the XL Driver Library or with the CAPL function **setCanCabsMode**. Regarding this function, it should be noted that the channel number is the logical channel number used by CANalyzer or CANoe according to the allocation in the Vector Hardware Configuration.

The **setCanCabsMode** function has four parameters: ntype, nchannel, nmode and nflags each of type long. For low-speed CANcabs/CANpiggies the following values are valid:

setCanCabsMode

ntype	Meaning
0	Reserved and must be set to 0

nchannel	Meaning
0…n	CAN channel to be set

nmode	Meaning
0	NORMAL
1	SLEEP

nflags	Meaning
1	AUTOWAKEUP, only with SLEEP

Example
The following example shows how to switch the CANcab/CANpiggy 1054(mag/-opto) to standby mode with CANalyzer/CANoe and a CAPL program.

```
variables
{
}

on key '1'
{
   write ("CAN1 Low-Speed: Normal Mode");
   setCanCabsMode(0, 1, 0, 0);
}

on key '2'
{
   write ("CAN1 Low-Speed: Sleep Mode");
   setCanCabsMode(0, 1, 1, 1);
}

on key '3'
{
   write ("CAN2 Low-Speed: Normal Mode");
   setCanCabsMode(0, 2, 0, 0);
}

on key '4'
{
   write ("CAN2 Low-Speed: Sleep Mode");
   setCanCabsMode(0, 2, 1, 1);
}
```

4.3.3 1054opto

Technical data

Voltage supply	By Vector network interface or external 12 V…18 V DC
Current consumption	Approx. 60 mA (typ.)
Transceiver	TJA1054
Maximum baudrate	125 kbit/s
Minimal baudrate	40 kbit/s
Isolation	Optical: HCPL-0720-500 or compatible
Insulation voltage	50 V
Further properties	Switchable terminating resistor (see section 1054mag on page 56)

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

External voltage supply

The bus-side voltage can be supplied by an external voltage source. This is especially recommended if current measurements are performed on the ECU while the CAN bus is in sleep mode.

Reference
Programming of the normal/sleep mode see section 1054 on page 54.

4.3.4 1054mag

Technical data

Voltage supply	By Vector network interface or external 12 V…18 V DC
Current consumption	Approx. 60 mA (typ.)
Transceiver	TJA1054
Maximal baudrate	125 kbit/s
Minimal baudrate	40 kbit/s
Isolation	Magnetically: ADuM 1100
Insulation voltage	50 V
Further properties	No unwanted error frames are generated (e.g. during shutdown). Switchable terminating resistor.

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

External voltage supply

The bus-side voltage can be supplied by an external voltage source. This is especially recommended if current measurements are performed on the ECU while the CAN bus is in sleep mode.

Switchable terminating resistors

The 1054opto/mag has an internal switchable terminating resistor.
Via parallel connection, the terminating resistor is reduced from 4.7 kOhm to 500 Ohm. This is useful in applications where only a few ECUs exist in the network.

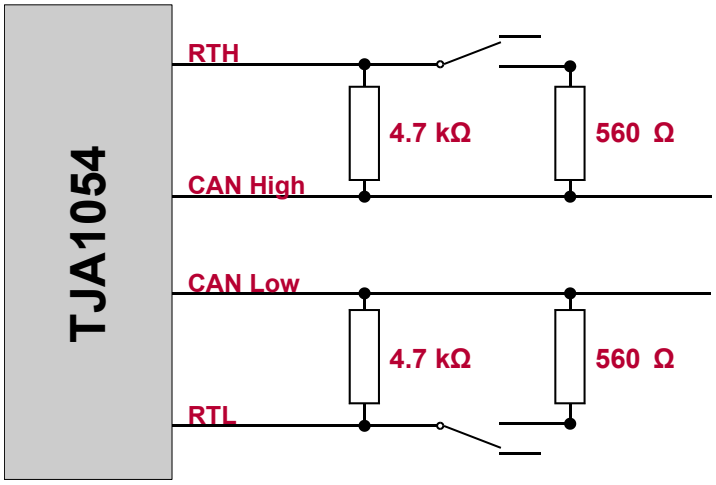


Figure 10: Switching terminating resistors

To enable the terminating resistor, pin 4 or pin 8 of the D-SUB9 connector has to be connected to ground (see details on RT1/RT2 on page 43). If pin 4 or pin 8 is not connected to ground, the value of the terminating resistor is 4.7 kOhm.

Reference
Programming of the normal/sleep mode see section 1054 on page 54.

4.3.5 1055cap

Note
This transceiver is available as Piggyback only.

Technical data

Voltage supply	By Vector network interface or external 12 V…18 V DC
Transceiver	TJA1055
Maximal baudrate	125 kbit/s
Minimal baudrate	40 kbit/s
Further properties	No unwanted error frames are generated (e.g. during shutdown). Switchable terminating resistor

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

External voltage supply

The bus-side voltage can be supplied by an external voltage source. This is especially recommended if current measurements are performed on the ECU while the CAN bus is in sleep mode.

Switchable terminating resistors

The 1055cap has an internal switchable terminating resistor.
Via parallel connection, the terminating resistor is reduced from 4.7 kOhm to 500 Ohm. This is useful in applications where only a few ECUs exist in the network.

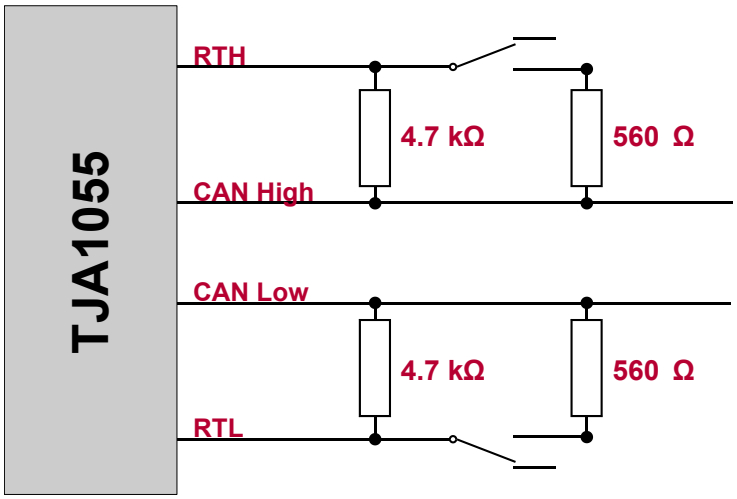


Figure 11: Switching terminating resistors

To enable the terminating resistor, pin 4 of the D-SUB9 connector has to be connected to ground (see details on RT1 on page 39). If pin 4 is not connected to ground, the value of the terminating resistor is 4.7 kOhm.

Reference
Programming of the normal/sleep mode see section 1054 on page 54.

4.4 LIN

4.4.1 General Information

Properties

The LINcab/LINpiggy conforms to the LIN standard (Local Interconnect Network) and is specified for transmission rates of up to 20 kbit/s in normal mode as well as 115 kbit/s in flash mode.

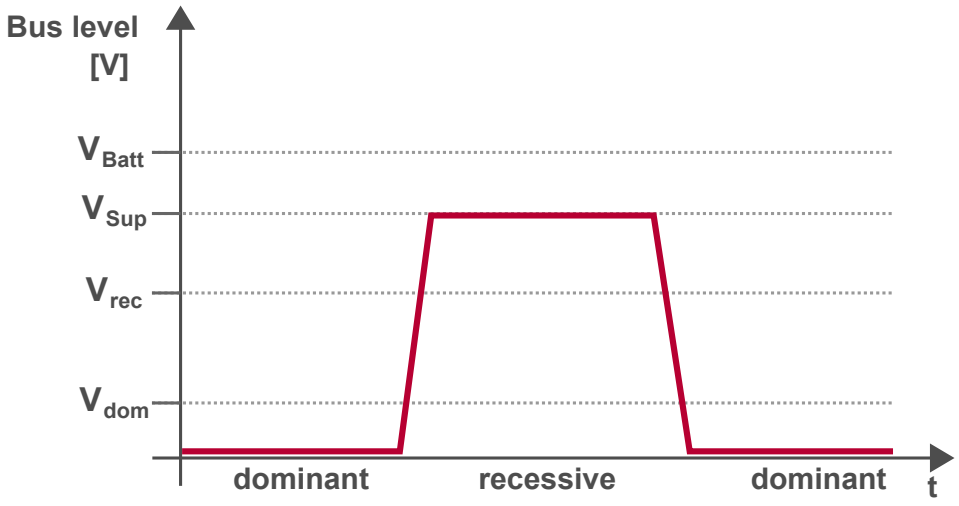
The LIN bus communicates over a single-wire bus and is based on a master-slave concept. Consequently, no arbitration or collision management is needed in the slave nodes.

LIN communication principle:

- The LIN master generates the message header and places it on the bus. The message header consists of the sync break, sync field and ID field.
- The addressed LIN slave node places its message response on the bus after the message header. The message response is composed of 0...7 data bytes and a checksum field.
- The individual bytes of a message are transmitted according to the conventional UART protocol (1 start bit, 8 data bits, and 1 stop bit).

Bus level

The following figure depicts the voltage levels on the LIN bus. V_{Batt} is the supply voltage of the ECU that is LIN master. The bus voltage can be changed to the recessive case (V_{Sup}) by means of filter elements and dynamic voltage changes in the supply voltage of the master ECU.

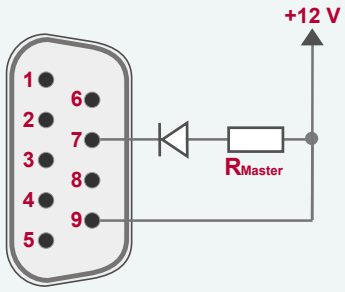


Bus-side voltage supply

Since the recessive level on the bus depends on the supply voltage of the master, it is advisable to operate the LINcab/LINpiggy 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.

Connecting pin 4 (Pdis) with pin 3 (VB-) of the D-SUB of the network interface disables the internal voltage supply of the LINcab/LINpiggy. This makes it possible to perform measurements on the LIN bus, even with an external supply below 12 V.

Note
If an external master resistor and an external voltage supply are being used at the D-SUB9 connector of the LINcab/LINpiggy, a diode should be connected in series (see figure below). Otherwise the LINcab/LINpiggy would be supplied by the LIN bus over the external master resistor, if the external voltage supply was broken. This damping diode is necessary according to the LIN specification.



4.4.2 7269mag

Technical data

Voltage supply	By Vector network interface or external 12 V…36 V DC
Current consumption	30 mA (typ.)
Transceiver	TLE7269
Maximal baudrate	Normal mode: 20 kbit/s Flash mode: 115 kbit/s* *Depending on the bus physics, the maximum data rate can be up to 330 kbit/s, see notes in the network interface manuals.
Isolation	Magnetically: ADuM 1100
Insulation voltage	50 V
Bus termination	Mastermode: 1 kOhm Slavemode: 30 kOhm

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the LIN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

Properties

The 7269mag transceiver is designed for 24 V applications. In addition, it has a time out counter, which avoids a constant dominant level on the LIN bus in error cases. The minimum switch off time of the transceiver is 6 ms.

Stress functionality

The stress functionality of the LINcab/TWINcab and LINpiggy enables you to disturb the LIN bus by dominant or recessive disturbing bits. The disturbing bits can be any length.

Note
Recessive disturbing sequences have no current limitation, but dominant disturbing bits are protected by a 100 mA fuse.

In case of dominant disturbing bits the LINcab/TWINcab/LINpiggy 7269mag has a protection against thermal overloads. The LINcab/TWINcab/LINpiggy must be externally supplied to use recessive disturbing mode.

Minimal baudrate

Due to the dominant timeout (6…20 ms) of the TLE7269, it may not be possible to

transmit a LIN header at baudrates below 5 kbit/s with the maximum break-field of 30 bits (minimum 13 bits):

Baudrate = [1/(minimal Timeout [ms]/Break-Field-Length [bit]] * 1000
Baudrate = [1/(6 ms/30 bit)] * 1000
Baudrate = 5000 bits/seconds

Therefore dominant sequences longer than 6 ms (e. g. for LIN headers below 5 kbit/s) are created using the LINcab's/LINpiggy's integrated transistor circuitry.

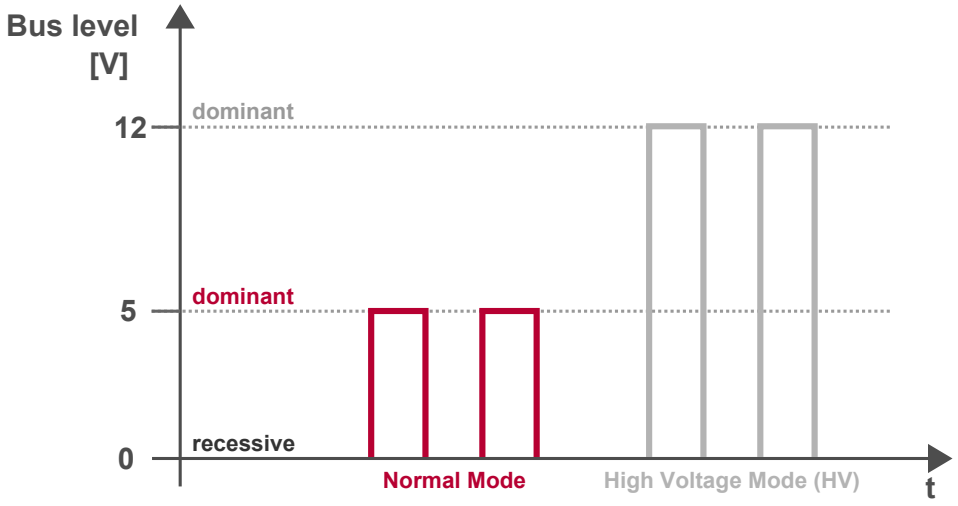
Flash mode

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

4.5 Single Wire CAN

4.5.1 General Information

Bus Levels



Bus communication

To establish communications between the individual network nodes, VB+ has to be connected to pin 9, GND/VB- to pin 3 and CAN to pin 7 at the D-SUB connector.

If the Single Wire CANcab/CANpiggy is operated in a high-speed network, a terminating resistor must be available between CAN High and GND/VB-. In high-speed mode, such a resistor (100 Ohm) is enabled by the CANcab/CANpiggy if pin 7 (CAN High) is connected to pin 4 (R100).

The resistor is disabled, if the CANcab/CANpiggy switches back to normal mode. To implement higher impedance terminating resistances, another resistor (RR) may also be added instead of a direct connection between CAN High and R100. The total resistance is RR +100 Ohm.

4.5.2 5790c

Technical data

Voltage supply	External 12 V…18 V DC
Transceiver	AU5790
Maximal baudrate	Low-speed: 40 kbit/s High-speed: 100 kbit/s

External voltage supply

The CANcab/CANpiggy has to be operated with an external voltage supply. This voltage is used as the level for the dominant state of the wake-up message.

Programming transceiver modes

The Single Wire CAN transceiver supports normal mode, high-speed mode and sleep mode.

Switching the transceiver modes is either done by the **xlCANSetChannelTransceiver** function of the XL Driver Library or by the CAPL function **setCanCabsMode**. Regarding this function it should be noted that the channel number used by CANalyzer or CANoe is the logical channel number. Furthermore, it is not possible to set the mode explicitly for one channel while preserving the mode of the other channel; modes must always be set for both channels.

The **setCanCabsMode** function has four parameters: ntype, nchannel, nmode and nflags each of type long. For Single Wire CANcabs/CANpiggies the following values are valid:

setCanCabsMode

ntype	Meaning
0	Reserved and must be set to 0

nchannel	Meaning
0…n	CAN channel to be set

nmode	Meaning
0	NORMAL
1	SLEEP
2	HIVOLTAGE
3	HISPEED

nflags	Meaning
1	AUTOWAKEUP, only with SLEEP
2	HIGHPRIO, only CANcab 5790c, 1 = clear send buffer

Transmission rate

For normal data exchange, normal mode is used with a transmission rate of up to 40 kbit/s. The high-speed mode is available for transmission rates up to 100 kbit/s, for example for flash programming. However, in this mode the number of bus nodes is limited. The high-voltage mode is needed to send the high-voltage wakeup message (12 V). The transceiver's transmitter is deactivated in sleep mode. Additionally, there is a high priority flag which clears all send buffers.

Example
Example of a CAPL program for sending a high-voltage wakeup message on CAN channel 1. CAN channel 2 is unused in normal mode.

```
variables
{
    message 0x100 msg;
}

on start
{
    msg.CAN = 1;
    msg.DLC = 0;
}

on key 'w'
{
    // Switch transceiver of channel 1 in high-voltage mode,
    // transceiver of channel 2 in normal mode.
    setCanCabsMode(0, 1, 2, 0);
    setCanCabsMode(0, 2, 0, 0);

    // Send message.
    output(msg);

    // After wake-up message switch transceivers of both channels
    // back to normal mode.
    setCanCabsMode(0, 1, 0, 0);
    setCanCabsMode(0, 2, 0, 0);
}

on message *
{
    output(this);
}
```

4.5.3 5790opto c

Technical data

Voltage supply	External 12 V…18 V DC
Transceiver	AU5790
Maximal baudrate	Low-speed: 40 kbit/s High-speed: 100 kbit/s
Optocoupler	HCPL-0720-500 or compatible (typ. Delay time approx. 30 ns)
Insulation voltage	50 V

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

External voltage supply

The CANcab/CANpiggy has to be operated with an external voltage supply. This voltage is used as the level for the dominant state of the wake-up message.

Reference
Programming of the normal/sleep mode see section 5790c on page 61.

4.5.4 7356cap

Note
This transceiver is available as Piggyback only.

Technical data

Voltage supply	External 12 V…18 V DC
Transceiver	NCV7356
Maximum baudrate	Low-speed: 40 kbit/s High-speed: 100 kbit/s
Further properties	No unwanted error frames are generated (e.g. during shutdown)

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

External voltage supply

The CANcab/CANpiggy has to be operated with an external voltage supply. This voltage is used as the level for the dominant state of the wake-up message.

Reference
Programming of the normal/sleep mode see section 5790c on page 61.

4.6 J1708

4.6.1 General Information

Properties

These transceivers enable access to serial networks according SAE standard J1708 respective J1587 and is used predominantly in commercial vehicles. Typical applications of the J1708 network are diagnostic and process data communication.

4.6.2 65176opto

Technical data

Voltage supply	By Vector network interface
Current consumption	Approx. 200 mA
Transceiver	SN65176B
Maximal baudrate	9.6 kbit/s
Isolation	Optical: HCPL-0720-500 or compatible
Bus termination	yes, 2 x 4.7 kOhm

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

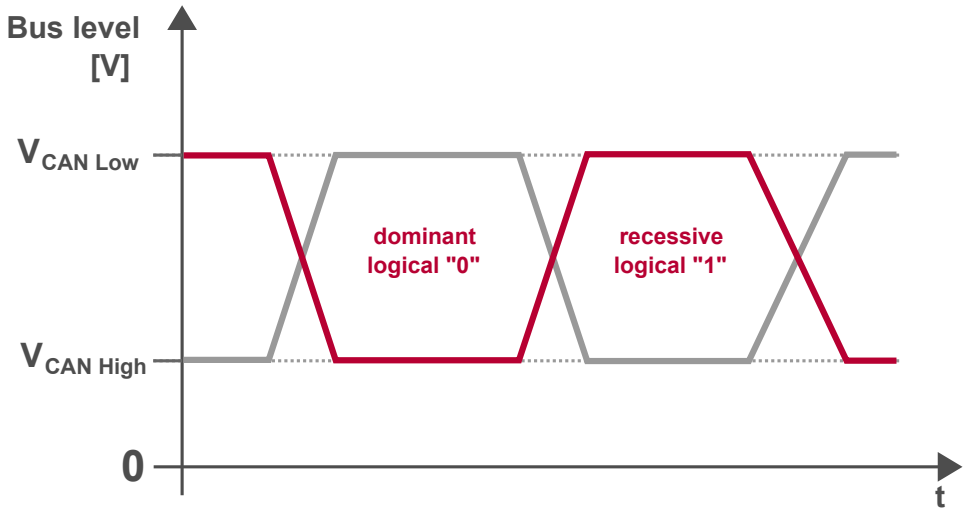
4.7 Truck & Trailer CAN

4.7.1 General Information

Properties

The Truck & Trailer CANcab/CANpiggy is compatible with the ISO 11992-1 standard and has been developed for CAN low-speed applications in the commercial vehicle area. The maximum transmission speed is 250 kbit/s. The possible single-wire modes for this transceiver are only supported by the XL Driver Library.

Bus level



Recessive state

The recessive state is described by the following voltage relation:

V_S: bus side voltage

$V_{CAN\_H} = 1/3\ V_S$

$V_{CAN\_L} = 2/3\ V_S$

Dominant state

For the dominant levels this relation applies:

$V_{CAN\_H} = 2/3\ V_S$

$V_{CAN\_L} = 1/3\ V_S$

Differential voltage

This yields the following differential voltage:

$V_{diff} = V_{CAN\_L} - V_{CAN\_H}$

$V_{diff} = 1/3\ V_S$ recessive state

$V_{diff} = -1/3\ V_S$ dominant state

4.7.2 10011opto

Technical data

Voltage supply	External 16 V…32 V DC
Current consumption	120 mA (typ.)
Transceiver	B10011S
Maximal baudrate	250 kbit/s
Isolation	Optical: HCPL-0720-500 or compatible
Insulation voltage	50 V

Galvanic isolation

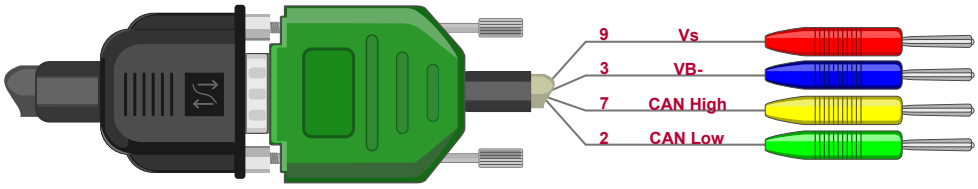
With this transceiver, the network interface is electrically isolated from the CAN bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

Connection cable

The following connection cables can be used with the 10011opto:

> CANcable TnT (page 100)
> CANcable TnT Term (page 100)

Test setup with CANcable TnT



Hardware

The CANcable TnT has a D-SUB9 connector and four bunch plugs to connect to an external voltage supply and the CAN bus.

According to ISO 11992-1, a Truck & Trailer CAN system consists of two nodes, which should be terminated. If the Vector network interface is used together with the CANcab/CANpiggy 10011opto to observe bus traffic between two real ECUs, the CANcable TnT should be used, since both ECUs already have a terminating resistor. If only one real ECU is connected to the CANcab/CANpiggy 10011opto, the CANcable TnT Term should be used.

Bus-side voltage supply

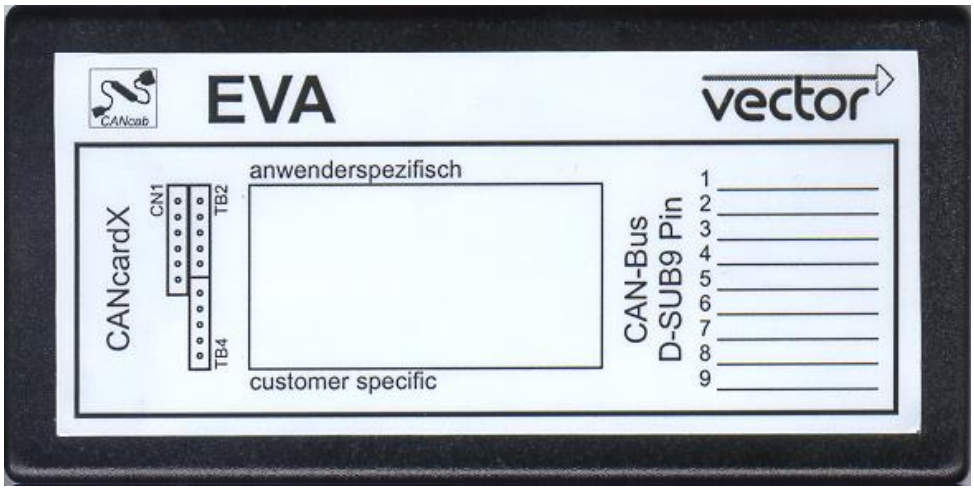
The CANcab/CANpiggy 10011opto has to be operated with an external voltage supply. ISO 11992-1 specifies at least 16 V supply voltage (V_S) for 24 V systems.

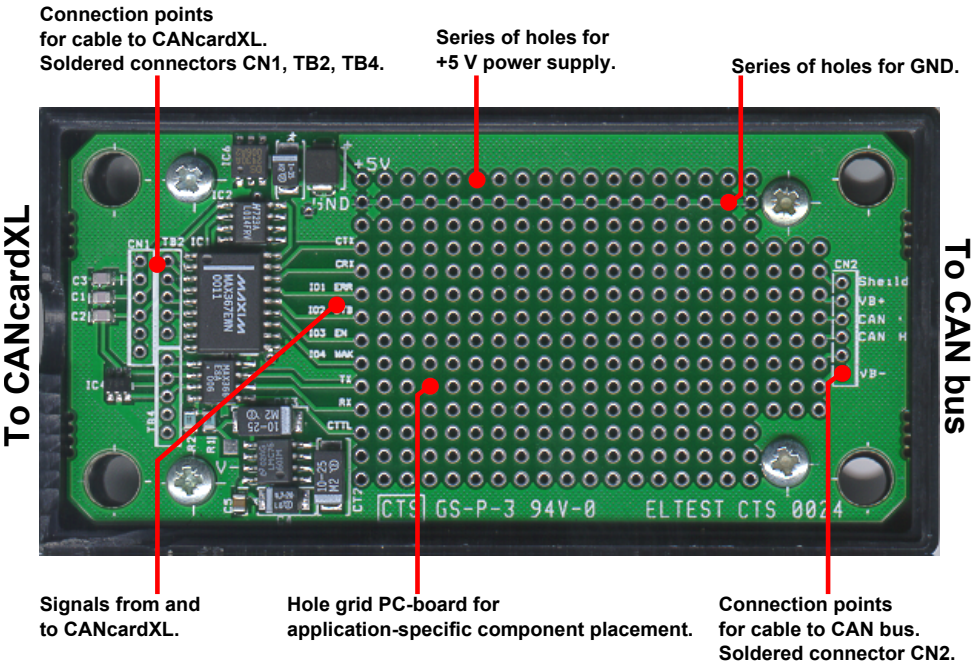
4.8 Special Design

4.8.1 CANcab EVA

General

The CANcab EVA is an evaluation kit which can be used to customize the connection setup between the CANcardXL/CANcardXLe and the CAN bus. For this purpose the PCB can be populated with specific bus transceivers.





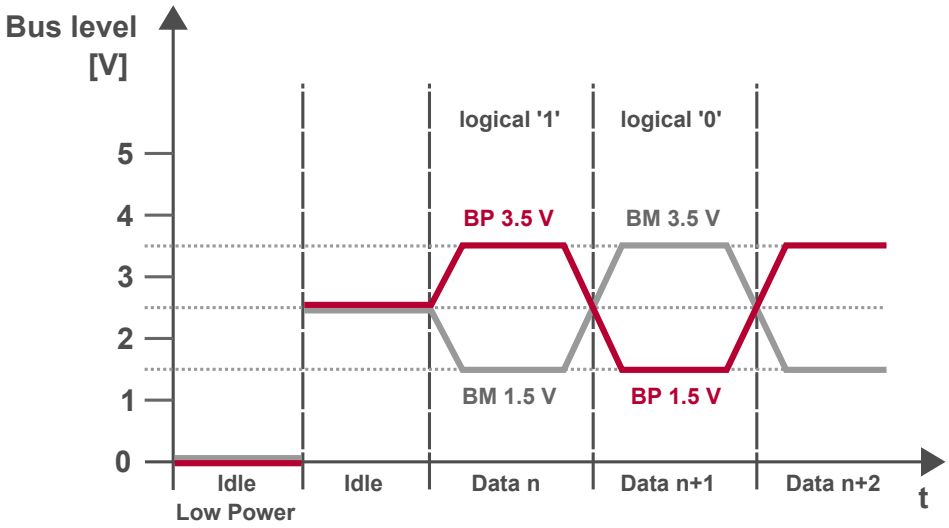
4.9 FlexRay

4.9.1 General Information

Properties

The FlexRay transceivers are compatible to the *FlexRay Communications System Electrical Physical Layer Specification Version 2.1 Rev. A* and can be used with 10 Mbit/s per channel (A/B).

Bus level



4.9.2 1080Amag

Note
This transceiver is available as Piggyback only.

Technical data

Voltage supply	By Vector network interface
Transceiver	TJA1080A
Baudrate	10 Mbit/s

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the FlexRay bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

4.9.3 1082cap

Note
This transceiver is available as Piggyback only.

Technical data

Voltage supply	By Vector network interface
Transceiver	TJA1082
Baudrate	10 Mbit/s
Further properties	Trigger

Galvanic isolation

With this transceiver, the network interface is electrically isolated from the FlexRay bus. The transceivers' voltage supply is electrically isolated via a DC/DC converter.

Trigger

The FlexRay interface family offers a pin for dedicated trigger applications (see the according pin assignment). The configuration of the trigger and its action is set in the application (e. g. CANoe). The following picture depicts the internal circuit of the trigger pin.

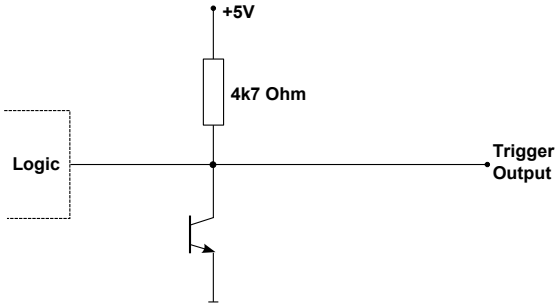


Figure 12: Trigger output

Output

The application's trigger releases a falling edge on the trigger pin. By using external pull up resistors, the maximum allowed load is 5 mA.

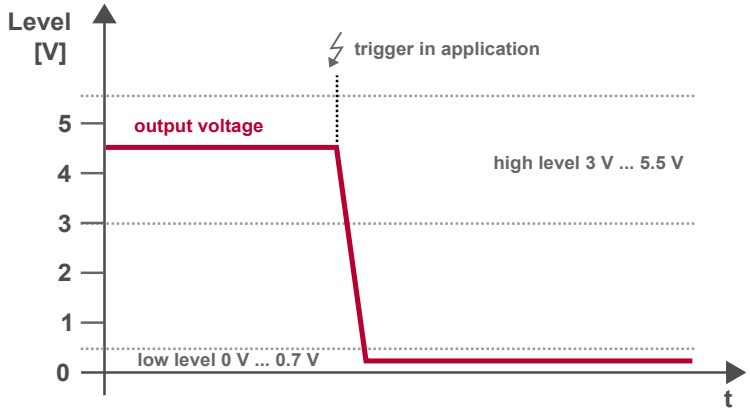


Figure 13: Trigger output

5 IOcab 8444opto

In this chapter you find the following information:

5.1 Introduction

System requirements

The IOcab can be connected to the **CANcardXL** or to the **CANcardXLe** only. Other interface cards are not supported.

The IOcab is supported by:

- CANoe Version 5.0 SP2 or higher
- CANape Version 5.0 SP2 or higher
- XL Driver Library 5.0 or higher

Functional description

The IOcab 8444opto was specifically developed for measurement and control applications in the CAN, LIN and MOST environments. It is used in automotive development applications and in industrial automation and related areas.

The IOcab offers these features:

- 8x digital input
- 4x digital output
- 4x analog input
- 4x analog output
- 1x analog comparator
- 1x PWM (pulse width modulation) output
- 2x Capture input (only one input can be used at the same time)

as well as

- highly-precise acquisition and stimulation over all inputs and outputs
- synchronization of CAN, LIN, MOST, and FlexRay messages.

The time stamp generated at each measurement point makes it possible to achieve precise time correlation between a measurement point and messages on different bus systems.

Electrical isolation has been integrated in the IOcab to protect the connected computer and to avoid measurement errors. This decoupling method electrically isolates the PC from all signals of the D-SUB15 connector. However, there is no electrical isolation between the various signals of the D-SUB15 connector. The shielding (shell of the D-SUB15 socket) is connected to PC ground.

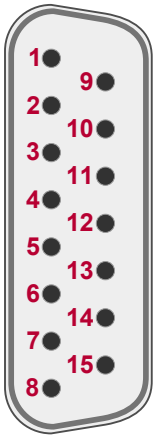
Connectors and pin assignments

The IOcab is connected to the PC with a CANcardXL/XLe via a 15-pin flat-cable connector. The user can access the digital and analog inputs and outputs of the IOcab via the 15-pin D-SUB connector.

The pin assignment of the D-SUB15 plug connector is as follows:

Pin assignment

Pin	Name	Description	
1	DIO0	Digital	Input 0/Output 0
2	DIO2	Digital	Input 2/Output 1
3	DIO4	Digital	Input 4/Output 2/Capture In 2
4	DIO6	Digital	Input 6/Output 3
5	DPWM	Digital	PWM Out/Capture In 1
6	AGND	Reference ground for Analog In/Out	
7	AIO1	Analog	Input 1/Output 1
8	AIO3	Analog	Input 3/Output 3/Comp.Trigger
9	DIO1	Digital	Input 1/Output 0
10	DIO3	Digital	Input 3/Output 1
11	DIO5	Digital	Input 5/Output 2
12	DIO7	Digital	Input 7/Output 3
13	DGND	Reference ground for Digital Input and PWM	
14	AIO0	Analog	Input 0/Output 0
15	AIO2	Analog	Input 2/Output 2
		Shield	Shielding PC ground



Shielding

AGND and DGND are routed separately for shielding reasons, but are directly connected (low frequency) in IOcab 8444opto.

5.2 Digital Inputs and Outputs

Implementation

The digital outputs are implemented in the IOcab by semiconductor switches, which can interconnect two D-SUB15 plug connector pins. This allows the user to connect both Vcc (high-side switches) and GND (low-side switches).

Note
The digital outputs themselves cannot supply any power; rather they only switch a voltage that has been externally applied. The internal protective circuitry of the digital outputs only protects the circuit from electrostatic discharge.

When connecting inductive loads, the IOcab must be externally protected from high inductive voltages (e. g. free-wheeling diodes) to prevent damage. Continuous short circuiting of multiple digital outputs results in a risk of thermal overload.

Circuit interconnections

In this arrangement the digital inputs and outputs utilize the same IO pins on the D-SUB15 plug connector. Figure 15 shows their circuit interconnections:

Circuit diagram of digital inputs and outputs

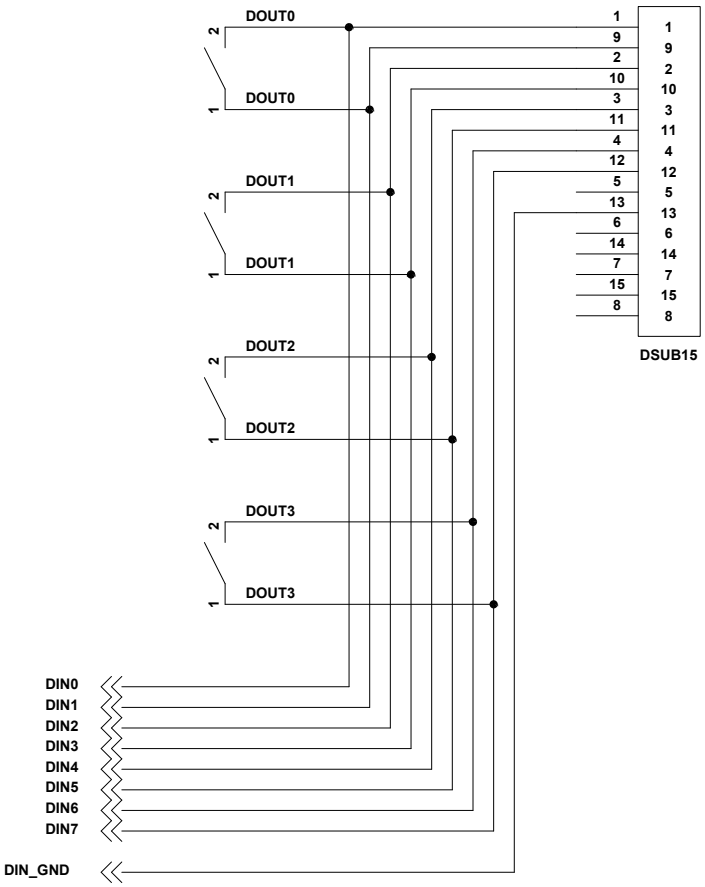


Figure 14: Digital inputs and outputs

Trigger events

With this circuit, when a digital output is used and the internal output switch is closed, two digital input or output lines are always shorted together. Nevertheless, all digital inputs are read-back capable, whereby for example precise switching time points can be defined by the trigger functionality of the inputs.

The voltages at DIN0…DIN7 always reference DGND and can be read by the user in response to a trigger event, cyclically or by polling.

5.2.1 Important Notes on Real Time Capability of Digital Outputs

Switching delays of photo MOS relays

The IOcab 8444opto possesses at the digital outputs photo MOS relays and is not capable for real time applications (e. g. serial communication) due to their switching on and off delays. The following example explains these facts.

Asymmetrical output

The figure below shows a possible scenario where the digital output is controlled by an application (e. g. CANoe). The times for pulse high and pulse low are symmetrically each with 50 ms (20 Hz). The switching-on delay $\Delta t1$ of the photo MOS relay in this example is approx. 870 µs, but the switching-off delay $\Delta t2$ is only 460 µs. This causes a shorter pulse high time than pulse low. The digital output is asymmetrical.

Pulse offset at the digital output

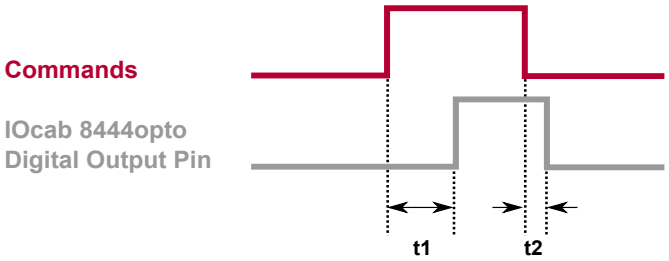


Figure 15: Pulse offset

Latencies

Besides the named delays, additional latencies could occur during the communication between the application and IOcab firmware. Each command is acknowledged inside the IOcab. Afterwards, the IOcab firmware passes the next available command to the digital output. If the acknowledgement is missing, all incoming commands are rejected except the last one, which is buffered in a special register. When the missing acknowledgement is received, the last buffered state is written to the digital output.

Note

Too fast command sequences may not be properly handled, so that complete pulses could be lost on the digital output (see next figure).

To avoid missing pulses, we recommend a maximum switching frequency of 20 Hz. Switching frequencies above 20 Hz could cause sporadic or frequently pulse losses. This behavior is affected due the chosen PC configuration, the operating system and the PC load respectively.

Section Digital PWM Output / Capture Inputs on page 79 explains a way how to generate a PWM directly with the IOcab.

Missing pulse at the digital output

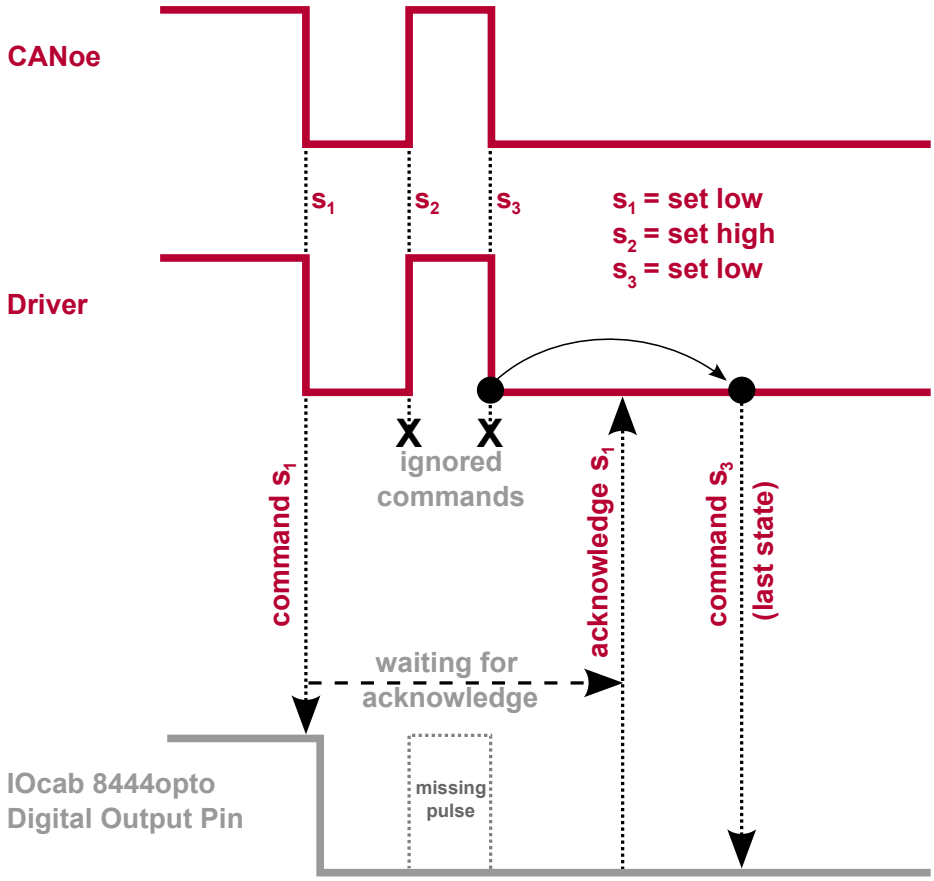


Figure 16: Missing pulses

5.3 Analog Inputs and Outputs

Analog pins

All functions of the analog inputs and outputs AIO0…AIO3 of the IOcab 8444opto share four pins of the D-SUB15 connector. For each of the four analog pins, there is an output driver that can be activated or deactivated. If the output driver of an analog pin is deactivated, an external applied voltage can be measured over the associated analog inputs. If the output driver of an analog pin has been activated, it drives the voltage configured for the output. To protect the output driver, a diode was placed in series with it which isolates the driver from an external applied voltage. The voltage drop of the diode is compensated by the output driver. However, it is not possible for the output to draw a current in this way.

Although the outputs are protected against short circuit, the IOcab 8444opto can skip into an internal error state. After the short circuits have been corrected, the IOcab must be reinitialized.

Note
The analog output driver can be destroyed in input or output mode if a negative voltage is applied to AIO0…AIO3 (V_{AIO0}…V_{AIO3} < V_{AGND}) and must be avoided!

Measurement ranges

Two measurement ranges, **H**(igh) and **L**(ow), are available at AIO0 and AIO1 for the measurement of voltages. In the **L** measurement range voltages from 0 to 8.192 Volt can be measured and in the **H** measurement range voltages from 0 to 32.768 Volt. AIO2 and AIO3 may only be used with the **H** measurement range. Measurement ranges are selected during configuration. It is not possible to measure the voltage of an analog pin in both measurement ranges simultaneously.

Conversion of an analog input signal takes approx. 44 µs. Since conversion of all activated analog inputs is sequentially performed, a delay is associated with the conversion that depends on the number of activated channels. The time stamp of a measurement always references the time point of the trigger event or measurement start on the lowest activated channel.

Circuit connections of analog inputs and outputs

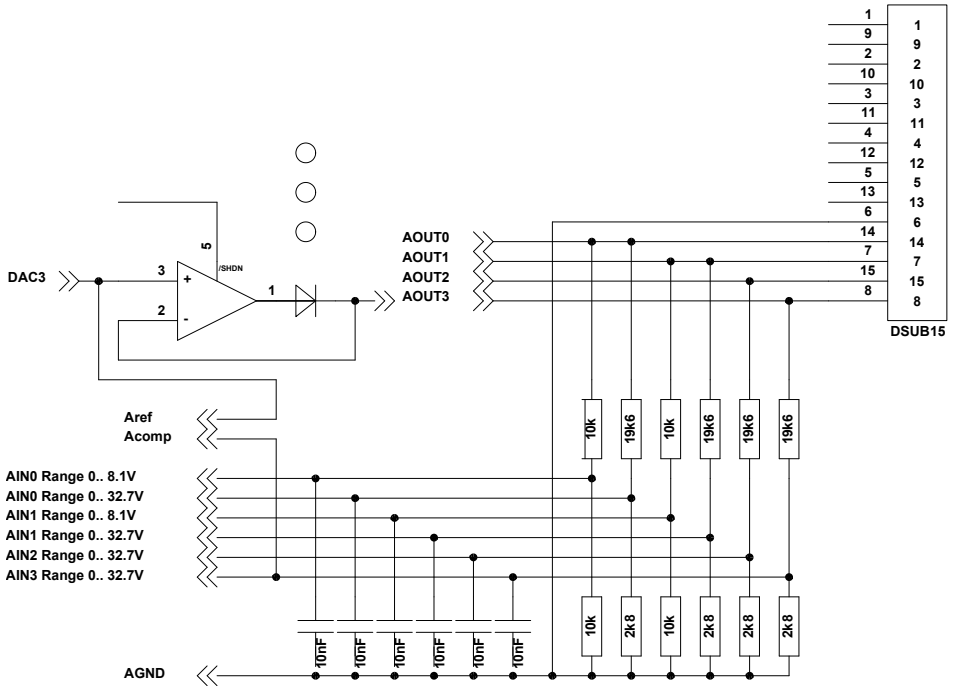


Figure 17: Analog inputs and outputs

Comparator

AIO3 also has the option of initiating a measurement, in parallel to a running measurement, by means of an internal analog comparator that triggers when an upper and/or lower configurable trigger threshold has been exceeded.

The comparator's output value can also be polled by the application while the comparator function is activated.

The measurement of voltage changes always involves a delay when using the analog input circuitry. This also applies to the analog comparator. The jump delay can be calculated by the following formula:

$$\Delta t = -\tau \cdot \ln\left(1 - \frac{V_{Comp} - V_B}{V_{AIN3} - V_B}\right)$$

Δt	Time delay of the comparator
τ	24.5 x 10^{-6} s
V_{Comp}	Preset trigger voltage of the comparator
V_{AIN3}	Input voltage
V_B	Starting voltage from which a jump is made to VAIN3

Delay

As an example consider a voltage jump from 10 V to 24 V with a trigger threshold of 12 V. This would result in a delay of

$$\Delta t = -24.5 \cdot 10^{-6} s \cdot \ln\left(1 - \frac{12\,V - 10\,V}{24\,V - 10\,V}\right) = 3.78\ \mu s$$

5.4 Digital PWM Output / Capture Inputs

General notes

D-SUB15 pin 5 (DPWM) can be used to generate pulse width modulated signals. As an alternative either this pin (DPWM) or pin 10 (DIO4) can be used to measure frequencies (capture mode), whereby the two Capture Inputs differ from one another in their thresholds and voltage ranges. The required function and channel are selected in the configuration. It is not possible to use both the PWM and capture mode and both Capture Inputs simultaneously. At a pin only one mode is selectable at a time.

Circuit interconnections of PWM and capture functions

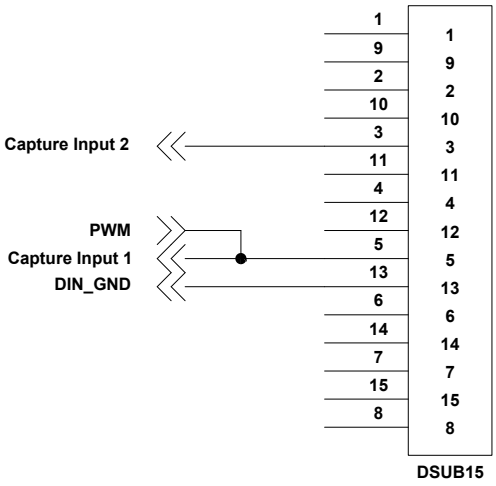


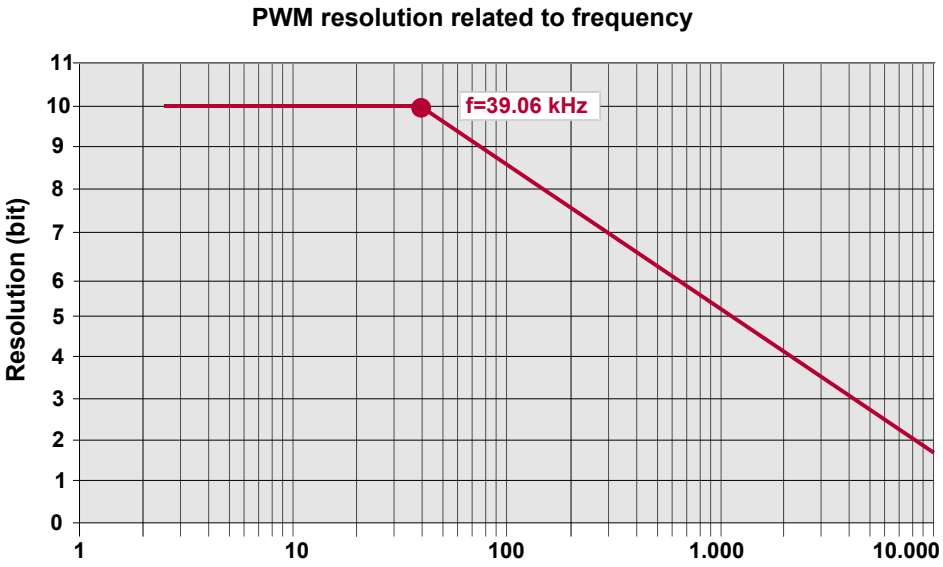
Figure 18: PWM and Capture

PWM or frequency generator

The IOcab 8444opto can be used for PWM or frequency generator, which generates frequencies from 40 Hz to 500 Hz and from 2.4 kHz to 100 kHz. The maximum frequency is essentially limited by the pin's output protection circuit.

The pulse width may be set between 0.0 % and 100.0 %. The resolution of the pulse width depends on the frequency; this dependency is shown in the following graph:

PWM resolution as a function of frequency



Capture mode

In capture mode both the pulse and pause times of a signal can be simultaneously determined for a signal at the DPWM pin or DIO4 pin of the D-SUB15 connector. One of the three possible measurement ranges must be selected before measurement. Pulse and pause times between 5 µs and 50 ms can be measured over the Capture

Inputs. This corresponds to a maximum input frequency of 100 kHz at a pulse width of 50 %.

Note
If the IOcab is used in capture mode even if there is no signal connected to the capture input, the capture measurement is canceled by a timeout after 500 ms. In this period of time no other measurement is executed.

5.5 Data Logging

Trigger, polling and cyclic measurement

All measurements can be initiated by three different events:

- measurement on trigger,
- measurement on polling or
- cyclic measurement.

However, only one of the methods listed above may be configured for a specific measurement. One of the following two events may be enabled in the configuration and used as the trigger source:

- level change (H→L and L→H) at DIO0...DIO3
- triggering of the analog comparator

“Measurement on polling“ represents a polling procedure in which a measurement is not initiated until a request for measurement is received from the application. Then the requested data are polled and transferred. With cyclic measurement interval times between 1 ms and 65 seconds may be used. If this time expires the required signals are automatically measured and transferred to the application.

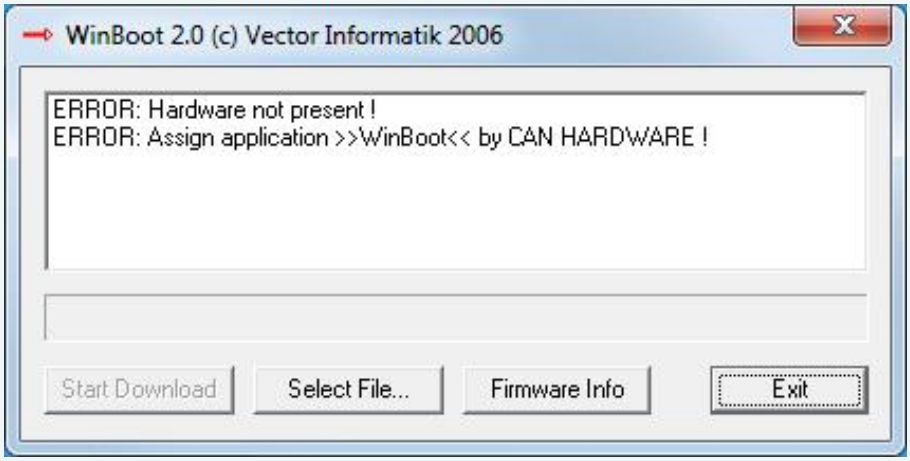
5.6 Firmware Update

Programming firmware

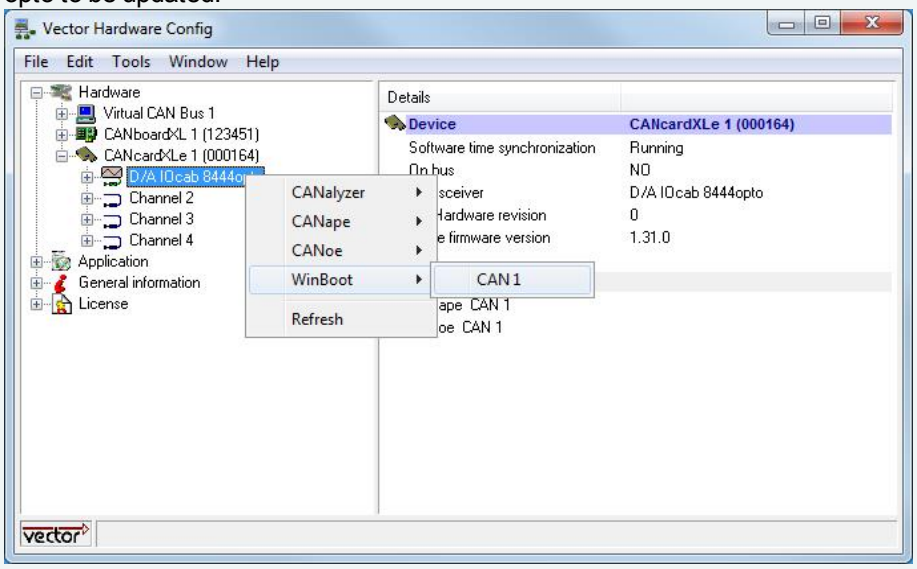
The firmware of the control processor in the IOcab 8444opto may be updated to the latest revision level at any later time.

Step by Step Procedure
Follow these instructions to update the IOcab 8444opto:

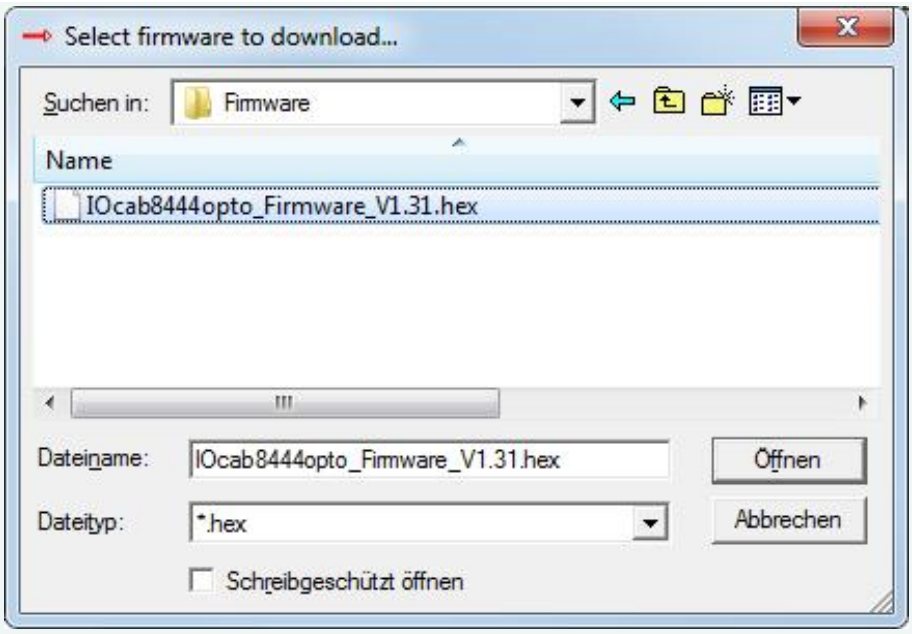
1. Connect the IOcab8444 with an inserted CANcardXL/XLe.
2. Open the folder `\Firmware Update\IOcab8444opto\WinBoot` on the Vector Driver Disk.
3. Start `WinBoot.exe`. On the first execution you may get the following error message:



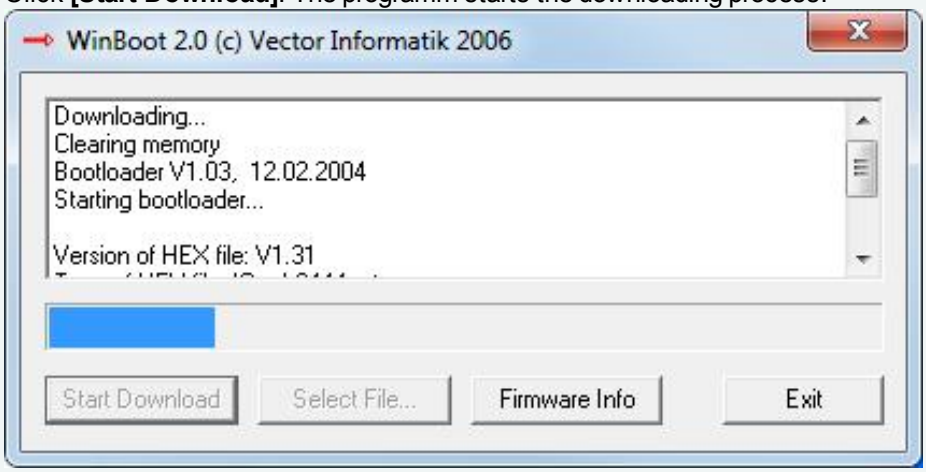
4. Open **Vector Hardware Config** and assign **WinBoot|CAN1** to the IOcab 8444-opto to be updated.



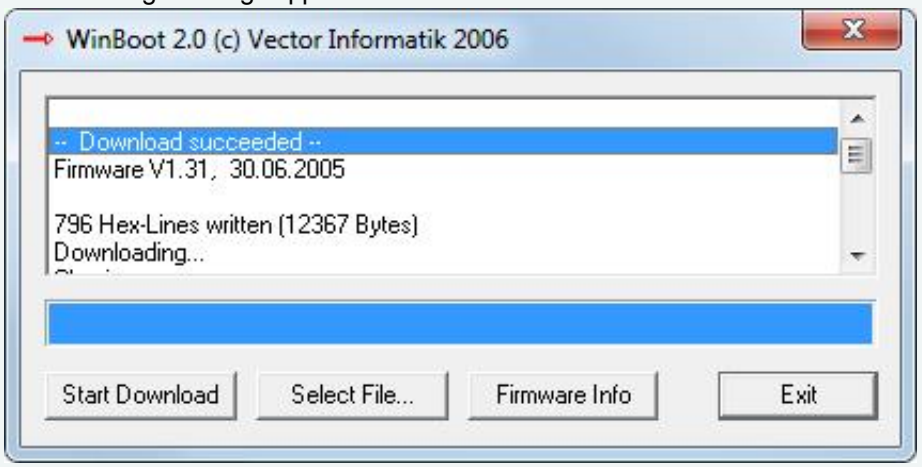
5. Start `WinBoot.exe` again. The IOcab 8444opto can be accessed now.
6. Click **[Select File...]** and open the hex file in folder `\Firmware Update\IOcab8444opto\Firmware`.



7. Click **[Start Download]**. The programm starts the downloading process.



8. The following message appears:



9. Click **[Exit]** and close WinBoot.

5.7 Technical Data

Supply voltage	By Vector CANcardXL/XLe; +5 V
Current consumption	Typ. 180 mA; max. 200 mA
Electrical isolation	Max. 50 V, between PC and IO only; not between IOs DGND and AGND are internally connected
Time stamp precision	2 µs

Digital Inputs	
Number of inputs	8
Max. input voltage[1]	-36 V … 36 V (DIO0…DIO7 related to DGND)
Max. difference voltage[1]	36 V (DIO0…DIO7 related to DIO0…DIO7)
Input voltage LOW	-36 V … 2.5 V (DIO0…DIO3 related to DGND) -36 V … 1.4 V (DIO4…DIO7 related to DGND)
Input voltage HIGH	6.2 V … 36 V (DIO0…DOI3 related to DGND) 5.9 V … 36 V (DIO4…DIO7 related to DGND)
DIO0…DIO3	Switching threshold typ.: 4.0 V
DIO4…DIO7	Switching threshold typ.: 2.0 V and 4.7 V; Schmitt-Trigger
Protection circuits	By suppressor diodes 36 V, 70 mW
Input resistance	>200 kΩ (DIO0…DIO3) >40 kΩ (DIO4…DIO7)
Input capacitance	~ 25 nF at pin

Digital Outputs	
Number of outputs	4
Max. input voltage[1]	-36 V … 36 V (DIO0…DIO7 related to DGND)
Max. difference voltage[1]	36 V (DIO0…DIO7 related to DIO0…DIO7)
Current loading	- 200 mA …+200 mA (e.g. DIO0 referenced to DIO1)
Protection circuits	Short circuit by resetable fuses overvoltage by 36 V suppressor diodes
ON resistance	<5 Ω
Switching times	Typ.: 0.5 ms, max.: 3 ms

[1] If the range exceeds the device may be destroyed.

PWM Output	
Number of outputs	1
Frequency range	2 ranges: 40 Hz … 500 Hz; 2.5 kHz …100 kHz
Timing accuracy	For frequency range 40 Hz … 500 Hz: The timing accuracy of the software PWM depends on the number of measurements defined by the user (trigger, cyclic measurement and polling). Best results can be reached if no measurement is defined and no output is changed. For frequency range 2.5 kHz …100 kHz: < 1%
Duty cycle	0.0% … 100.0% (Resolution < 5%)
Resolution	Up to 10 Bit
Voltage reference	DGND
Protection circuits	By suppressor diode, 500 mW
Output voltage LOW	0 V … 0.6 V
Output voltage HIGH	3.8 V … 5.5 V
Output resistance	~320 Ω

Capture Inputs	
Number of inputs	2
Minimum pulse/pause length	5 µs
Maximum pulse/pause length	50 ms
Accuracy	±1%
Input characteristic	Schmitt Trigger
DPWM – Input	
Max. input voltage[1]	-6 V … 12 V (DPWM related to DGND)
Input voltage LOW	-6.0 V … 1.0 V
Input voltage HIGH	4.0 V … 12 V
Switching threshold typ.	1.4 V and 3.2 V
DIO4 – Input	
Max. input voltage[1]	-36 V … 36 V (DIO4 related to DGND)
Max. difference voltage[1]	36 V (DIO4 related to DIO0…DIO7)
Input voltage LOW	-36 V … 1.4 V
Input voltage HIGH	5.9 V … 36 V
Switching threshold typ.	2.0 V and 4. 7V

Analog Inputs	
Number of inputs	4
Max. input voltage[1]	0 V … 36 V (AIN0… AIN3 related to AGND)
Measurement range	AIN0, AIN1: 2 ranges, 0 … 8.192 V, 0 … 32.768 V AIN2, AIN3: 1 ranges, 0 … 32.768 V
Resolution	10 bit in all measurement ranges
Measuring accuracy	±1.5%
Input resistances	0 V … 10 V: 8 kΩ (AIO0 and AIO1) 10 V … 36 V: 4.7 kΩ (AIO0 and AIO1) AIO2 and AIO3: 0 V … 36 V: 8 kΩ

[1] If the range exceeds the device may be destroyed.

Analog Inputs	
Sampling rate	1 kHz; 3 kHz over XL Driver Library
Conversion time	~ 44 µs per channel
Limit frequency of input filter	Range 0 … 8.192 V:3.1 kHz Range 0 … 32.768 V:6.4 kHz
Time stamp precision	2 µs plus delay of input filter
Protection circuits	By suppressor diodes 36 V, 70 mW, no polarity protection.

Analog Outputs	
Number of outputs	4
Max. back voltage[1]	V_{AIN0}…V_{AIN3} > V_{AGND}: 0 V … 36 V V_{AIN0}…V_{AIN3} < V_{AGND}: not allowed
Output voltage range	0 … 4.096 V
Resolution	12 Bit
Function	Open emitter with input resistors as pull-down resistors
Accuracy	±1.5%
Current load capacity	+0 … +5 mA (-0 to -5 mA not possible, open emitter)
Circuit protection	Short circuit (AIO0…AIO3 related to AGND): any length of time, max. current: 11 mA[1] per output by suppressor diodes 36 V

Analog Comparator	
Number of comparators	1
Trigger threshold	0 V … 32.768 V, configurable, 10 bit resolution
Function	May be used as trigger or statically polled
Input characteristic	See Analog Input AIO3.

Acquisition Methods	
Trigger	One Trigger, DIN0, DIN1, DIN2, DIN3 or analog comparator
Cyclic measurement	Measurement interval configurable: 1 ms to 65 sec.
Polling / querying	By application

[1] If the range exceeds the device may be destroyed.

6 IOpiggy 8642

In this chapter you find the following information:

6.1 General Information

Introduction

The IOpiggy 8642 is a plug-in board (Piggyback) that is ideal for measurements and outputs of digital or analog signals. This plug-in board can be used with the following Vector devices:

- **VN7570 / VN7572 FlexRay/CAN/LIN/IO network interface**
  Measurement lines accessible via D-SUB62 connector.
- **VN8950 CAN/LIN module**
  Measurement lines accessible on channel 5 via D-SUB15 connector.
- **VN8970 / VN8972 FlexRay/CAN/LIN module**
  Measurement lines accessible on channel 9 via D-SUB15 connector.

Signal lines

The IOpiggy 8642 offers a total of thirteen signal lines. Depending on the configuration, the maximum selectable IO lines are:

- 8x digital input
- 6x digital output
- 4x analog input
- 2x analog output
- 2x PWM output
- 1x PWM input
- 1x analog comparator

Note
The lines may be operated as either input or output. Mixed operation of one line is not possible. Mixed configuration of different lines is allowed.

The configuration is performed in your measurement application (e. g. CANoe). You can define your own measurement condition there for each defined measurement group. When a condition is fulfilled, the related signal values of the measurement group are acquired and passed to the application.

Measurement group 1	Measurement group 2	Measurement group 3
Digital In 0...3	Analog In 0...3	Capture
↯Measurement Condition	↯Measurement Condition	↯Measurement Condition

The following measurement conditions are available for selection:

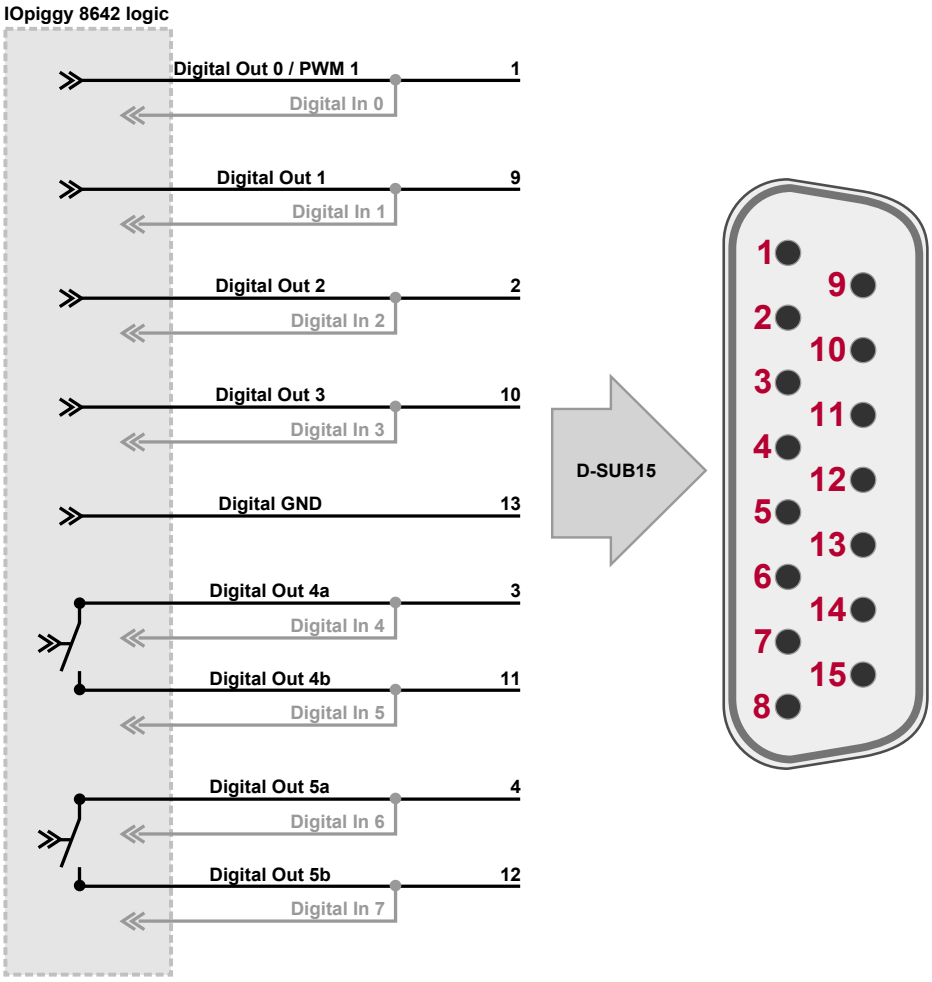
- Periodic measurement
- Selective polling in the measurement application
- Measurement by level changes (trigger)
  (High → Low and Low → High) at the digital outputs
- Measurement on triggering of the analog comparator
  (see section Analog Comparator on page 93)

6.2 Digital Inputs and Outputs

Description

All digital signal lines can be used as either an input or output. This can be configured in the measurement application (e. g. CANoe). The following diagram illustrates the switching logic:

Switching logic for digital signals



Inputs

The switching threshold can be defined over a range of 0 V … 20 V for all eight digital inputs (Digital In 0…7) with a constant hysteresis of 1 V.

Outputs

You can operate the digital outputs in three different modes. They are configured in your measurement application.

> **Push-Pull (only Digital Out 0…3)**
The LOW state corresponds to digital GND, and the HIGH state corresponds to the internal output voltage defined (by software). To prevent short circuits, you should never interconnect two push-pull outputs. Since the push driver loads the internal supply, the push output delivers less current than the pull input can take.

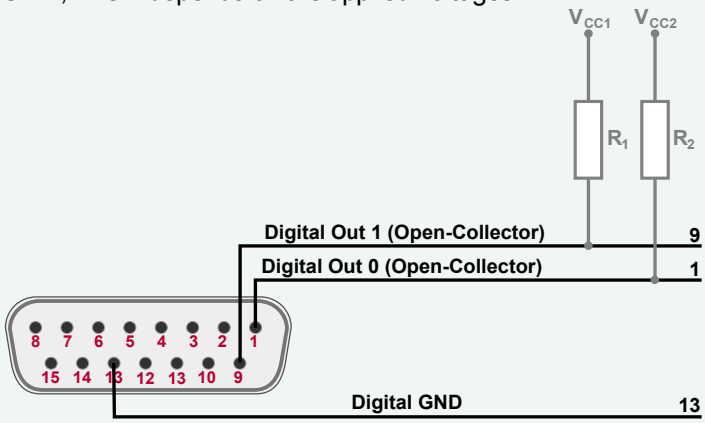
> **Open-Collector (only Digital Out 0…3)**
The LOW state corresponds to digital GND, and the HIGH state corresponds to the external voltage applied via a pull-up resistor. The current rating of the Open-Collector output is higher than that of the Push-Pull outputs.

> **MOS switch (only Digital Out 4a/4b and 5a/5b)**
Floating switch for switching external signals. The signals to be switched are connected to the a/b lines provided. Suitable for all signals between 0 V and 36 V.

Note
The digital outputs 4a/4b and 5a/5b of the IOpiggy 8642 are realized as switching outputs through photo-MOS relays. The relays have an activation delay of 550 µs and a deactivation delay of 100 µs at 25°C. The limit frequency of the relays indicates the damping of the signal to be switched (the signal forms can be changed).

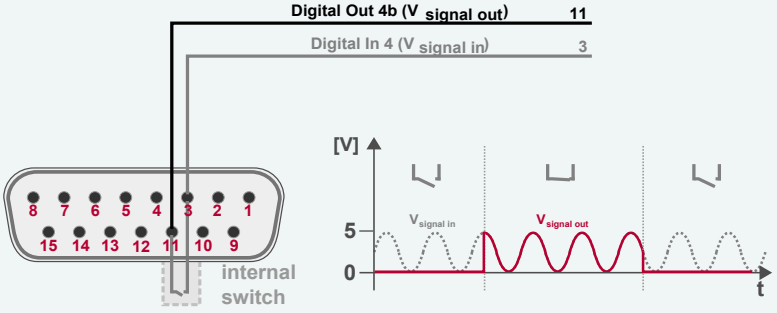
Example

Digital output in Open-Collector mode
Digital Out 0 and 1 are configured as Open-Collector outputs. Afterwards, a constant voltage can be applied via a pull up resistor. While LOW is defined with Digital GND, HIGH depends on the applied voltages.



Example

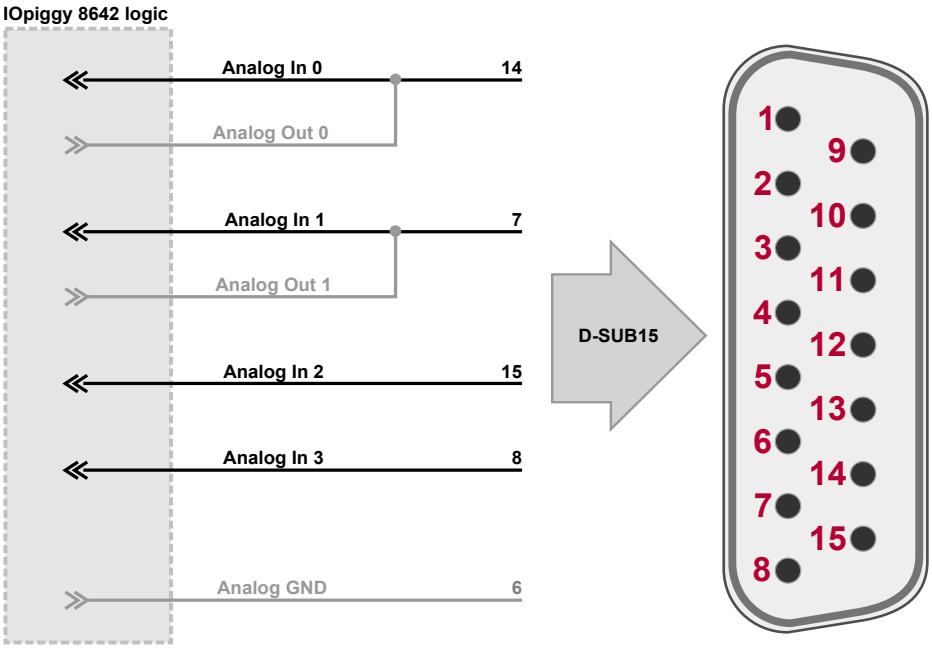
Digital output with external signal source
This example involves toggling a sinusoidal source voltage $V_{signal\ in}$ on and off arbitrarily. In the example, this is done by applying $V_{signal\ in}$ to Digital In 4. The voltages can now be toggled on and off at Digital Out 4b via the internal switch. The measurement application controls switching.



6.3 Analog Inputs and Outputs

Description

The IOpiggy 8642 has four analog inputs. Optionally, the first two inputs (A0 and A1) can be used as analog outputs. This can be configured in the measurement application (e. g. CANoe). The following diagram illustrates the switching logic:



Inputs

You can operate the analog inputs in the following mode:

> **Single-Ended (Analog In 0 … 3)**
The common reference potential for measurement of the voltages is Analog GND. Four independent signal lines are available for this.

Outputs

A voltage between 0 V and 12 V can be output. An analog output can drive a maximum current of 10 mA (at 5 V) and 6 mA (at 12 V) respectively.

6.4 PWM Outputs (PWM0/PWM1)

Description

The IOpiggy 8642 has PWM generators at pin 1 (PWM 1) and at pin 5 (PWM 0), which are operated at a common frequency. The configurable frequency range is between 0.02 Hz and 20 kHz. The two PWM duty cycles are configured in the measurement application and may be set independently over the range 0.0 % to 100.0 %. The duty cycle resolution is 8 bits over the entire frequency range.

6.5 PWM Input (PWM0)

Description

You can use the PWM input to measure the duty cycle of a PWM signal.
The minimum pulse width is 1 µs. This yields a maximum input frequency of 100 kHz (at a 50 % duty cycle).

6.6 Analog Comparator

Description

The analog comparator is permanently connected to Analog Input 0 and enables trigger-controlled measurements. A threshold is defined in the measurement application for this purpose. If the upper or lower threshold limit is exceeded, this triggers a single measurement at the configured measurement groups (see section General Information on page 89).

The trigger can be configured for three cases:

- Trigger when upper limit exceeded
- Trigger when lower limit exceeded
- Trigger on either upper or lower limit violation

6.7 D-SUB15 Pin Assignment

Pin	Pinout 1	Pinout 2	Pinout 3	Pinout 4
1	Digital In 0	Digital Out 0[1]	Digital Out 0[2]	PWM 1
2	Digital In 2	Digital Out 2[1]	Digital Out 2[2]	-
3	Digital In 4	Digital Out 4a[3]	-	-
4	Digital In 6	Digital Out 5a[3]	-	-
5	PWM 0	Capture	-	-
6	**Analog GND**			
7	Analog In 1	Analog Out 1	-	-
8	Analog In 3	-	-	-
9	Digital In 1	Digital Out 1[1]	Digital Out 1[2]	-
10	Digital In 3	Digital Out 3[1]	Digital Out 3[2]	-
11	Digital In 5	Digital Out 4b[3]	-	-
12	Digital In 7	Digital Out 5b[3]	-	-
13	**Digital GND**			
14	Analog In 0	Analog Out 0	-	-
15	Analog In 2	-	-	-

[1] Push-Pull

[2] Open-Drain

[3] a/b line: switched by PhotoMOS relais, external signal at a is switched to b.

6.8 Technical Data

Supply voltage	By base unit
Power consumption	Typ. 0.5 W, max. 1.25 W

Digital Inputs	
Number	8x TTL with variable switching threshold and fixed switching hysteresis.
Input voltage	0 V … 36 V
Switching hysteresis	1000 mV ± 10%, configurable threshold 0 V … 20 V
Switching time	300 … 500 ns
Input resistance	1.33 MOhm

Digital Outputs	
Number	6
Output voltage	Push-Pull: 5 V or 12 V (for all digital outputs collectively) OC: 0 V … 36 V MOS switch: -36 V … +36 V
Current carrying capacity at inactive analog outputs	Push: max. 80 mA at 5 V or max. 24 mA at 12 V (for all digital outputs collectively) OC/Pull:100 mA MOS switch:450 mA
Output current	Max. 400 mW
Protection circuit	Push: Current monitoring circuit on overload OC/Pull: Short circuit by self-resetting fuse MOS switch: Short circuit by self-resetting fuse
On resistance	External signals: max. 2.5 Ohm (MOS)
Output capacitance	External signals: 1.5 pF (MOS)
Switching time	Internal: 500 ns External signals typ. activation delay: 550 µs at 25°C typ. deactivation delay: 100 µs at 25°C

Analog Inputs	
Number of inputs	4 single-ended
Measurement range	Single-ended: 0 V … 36 V
Input resistance	Single-ended: 1 MOhm
Resolution	12 bit
Accuracy	0.1% of the measured value +/- 20 mV
Sampling rate	Max. 1 kHz

Analog Outputs	
Number of outputs	2
Voltage range	0 V … 12 V
Accuracy	2 %
Resolution	12 bit
Conversion time	9 µs
Current carrying capacity at inactive digital outputs	Max. 10 mA at 5 V and 6 mA at 12 V
Output resistance	~ 290 Ohm

PWM Outputs (PWM0 / PWM1)	
Number of outputs	2, both with the same frequency and with variable duty cycles
Frequency range	0.02 Hz … 20 kHz at 8 bit
Resolution	8 bit
Levels	Low: 0 V High: 5 V or 12 V (collectively with digital outputs)
Current carrying capacity	**PWM0** Push: max. 80 mA at 5 V or max. 24 mA at 12 V (for all digital outputs collectively) **PWM0/PWM1** Pull: max. 100 mA
Protection circuit	PWM0 Push: Current monitoring circuit on overload
Output resistance	< 100 Ohm

PWM Input (PWM0)	
Number of inputs	1
Pulse / pause times	Min: 5 µs
Precision	±1%
TTL Levels	LOW: 0 V … < V_{HIGH} (0 V … 0.7 V) HIGH: > V_{LOW} … < V_{REF} (1.7 V … 3.3 V)
Input voltage	0 V … 36 V

7 Cables and Connectors

In this chapter you find the following information:

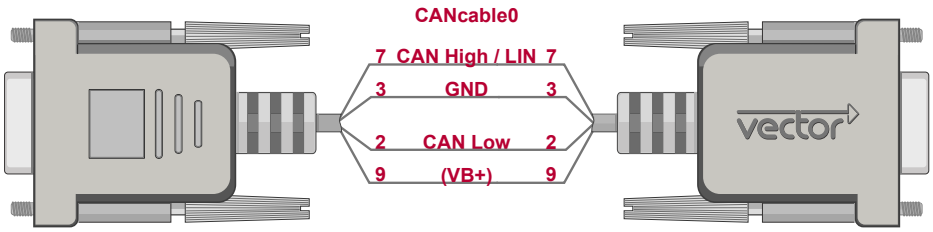
7.1 CAN/LIN

7.1.1 CANcable0

Low-speed cable

Description	CAN/LIN connection cable Note: When using with devices that have a primary and a secondary D-SUB9 pin assignment, only the primary channel is accessible.
Length	0.3 m
Connectors	2x female D-SUB9 connectors
Properties	Without terminating resistors
Part number	05002

Setup

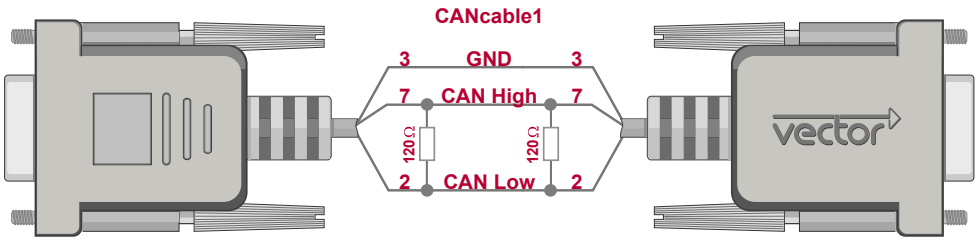


7.1.2 CANcable1

High-speed cable

Description	CAN connection cable Note: When using with devices that have a primary and a secondary D-SUB9 pin assignment, only the primary channel is accessible.
Length	0.3 m
Connectors	2x female D-SUB9 connectors
Properties	Two parallel 120 Ohm terminating resistors
Part number	05001

Setup

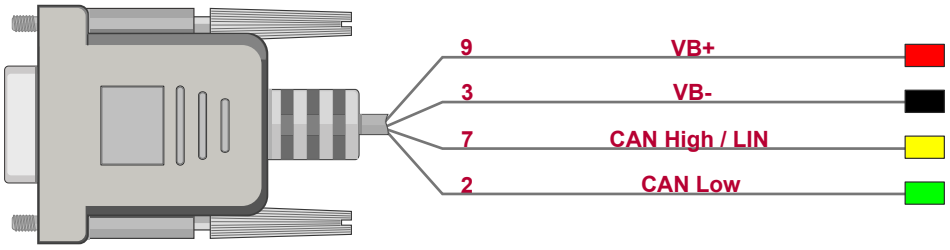


7.1.3 CANcableA

All-purpose cable

Description	CAN/LIN connection cable
Length	0.5 m
Connectors	1x female D-SUB9 connector 4x stripped wires
Part number	Included in CANcable Set Pro (part number 05060)

Setup

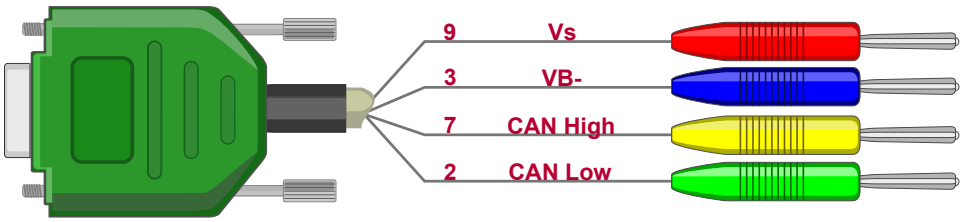


7.1.4 CANcableTnT

Truck & Trailer CAN

Description	Connection cable for Truck & Trailer (ISO 11992) and CAN
Length	1.5 m
Connectors	1x female D-SUB9 connector 4x bunch plugs
Properties	Without terminating resistor
Part number	05016

Setup

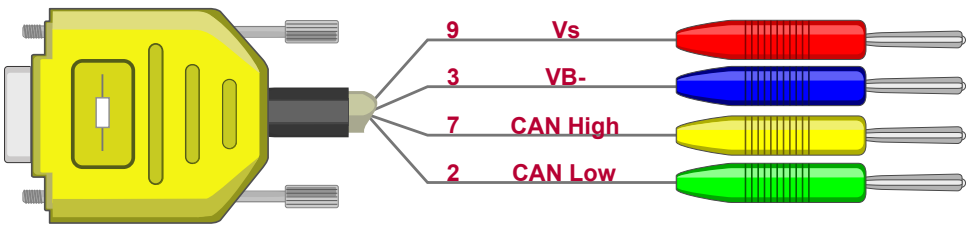


7.1.5 CANcableTnT Term

Truck & Trailer CAN

Description	Connection cable for Truck & Trailer (ISO 11992)
Length	1.5 m
Connectors	1x female D-SUB9 connector 4x bunch plugs
Properties	With terminating resistors
Part number	05015

Setup

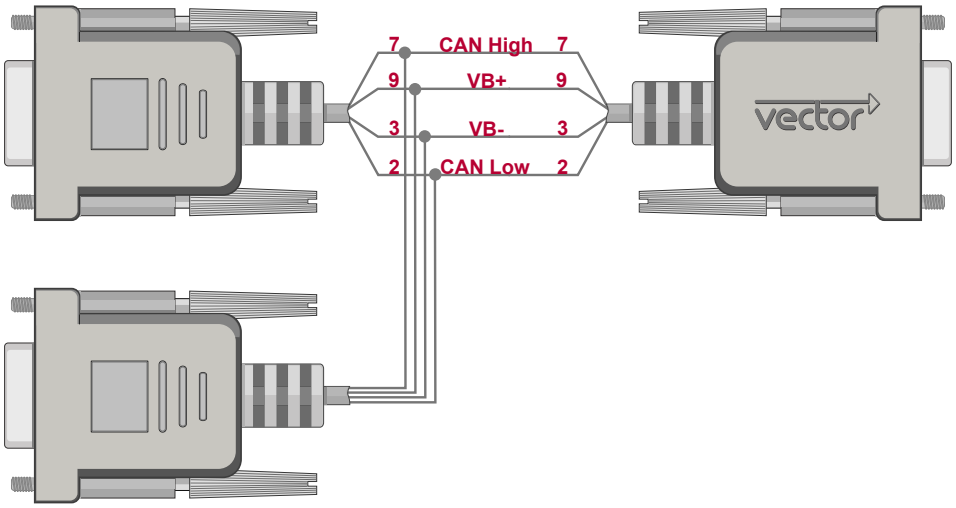


7.1.6 CANcableY

Extension cable

Description	Y extension cable for CAN or LIN
Length	2 m (overall length)
Connectors	3x female D-SUB9 connectors
Properties	Including gender changer
Part number	Included in CANcable Set Pro (part number 05060)

Setup

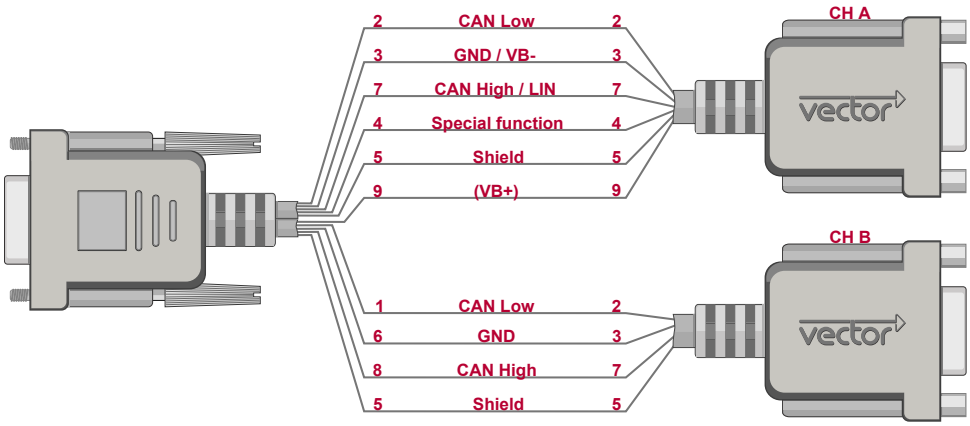


7.1.7 CANcable 2Y

Y cable

Description	Y cable for Vector CAN/LIN interfaces with D-SUB9 double assignment (VN1600 interface family, VN8970 etc.). Splits the double assignment into two separate D-SUB9 connectors (CH A and CH B). Examples: > **VN1610** CH1/2 → Channel 1 (CH A) and 2 (CH B) > **VN1630** CH1/3 → Channel 1 (CH A) and 3 (CH B) CH2/4 → Channel 2 (CH A) and 4 (CH B) > **VN8970** CH1/5 → Channel 1 (CH A) and 5 (CH B) CH2/6 → Channel 2 (CH A) and 6 (CH B) CH3/7 → Channel 3 (CH A) and 7 (CH B) CH4/8 → Channel 4 (CH A) and 8 (CH B) The pin assignments of the D-SUB9 connectors CH A and CH B depend on the used bus transceivers inside the interface (see section D-SUB Pin Assignment on page 43).
Length	0.3 m
Connectors	1x female D-SUB9 connector 2x male D-SUB9 connectors
Part number	05075

Setup

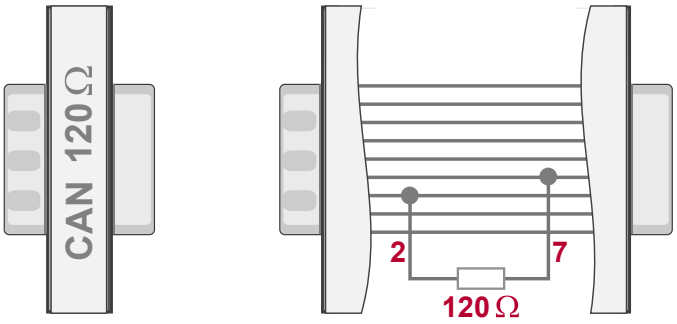


7.1.8 CANterm 120

Terminating resistor

Description	CAN adapter for high-speed CAN buses Note: When using with devices that have a primary and a secondary D-SUB9 pin assignment, only the primary channel is accessible.
Connectors	1x female D-SUB9 connector 1x male D-SUB9 connector
Properties	One 120 Ohm terminating resistor
Part number	05004

Setup



7.1.9 CANcable Set Pro

Description	Cable set for CAN/LIN incl.: > 1x CANcable0 > 1x CANcableY > 2x CANcableA > 2x CANterm 120 > 2x Gender changer male/male > 1x Gender changer female/female
Part number	05060

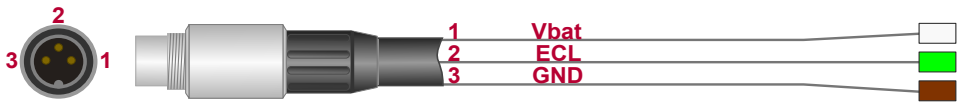
7.2 MOST

7.2.1 ECL Cable

ECL

Description	ECL cable for VN2640
Length	1.5 m
Connectors	1x male 3-pin Binder connectors (type 711) 3x stripped wires
Part number	30014

Setup



7.2.2 Fiber Optic Cable

Description	The devices of the VN2600 Family can be connected with the MOST bus by using the Vector MOST fiber optic cable.
Length	1 m
Connectors	1x Standard MOST 2+0 connector 2x POF fiber optic cables 2x HFBR 4531 connector
Minimum bending radius	The minimum bending radius of the POF fiber optic cables used is 50 mm. Bending radii less than 50 mm can cause permanent damage to the fibers.
Part number	22041

Direction arrows are printed on the fiber optic cables for better distinction. These indicate the beam direction of the light.

7.2.3 Fiber Optic Cable Coupling

Coupling

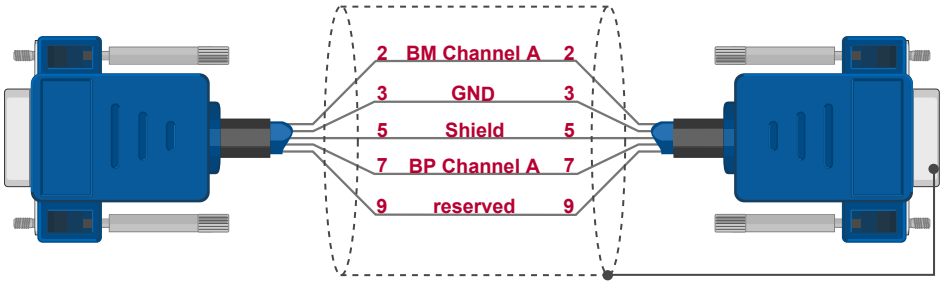
Description	The MOST fiber optic cable can be connected to other HFBR connectors with the included HFBR coupling. For this, the fiber ends are just stuck into the couplings. To release the connection, just pull out the connectors.
Part number	22042

7.3 FlexRay

7.3.1 FRcable A

Description	Cable for connection of a FlexRay Interface to the FlexRay bus (Channel A)
Length	1 m
Connectors	2x D-SUB9 connectors (female)
Properties	Provides only channel A at the FlexRay interface
Part number	Included in FRcable Set (part number 05062)

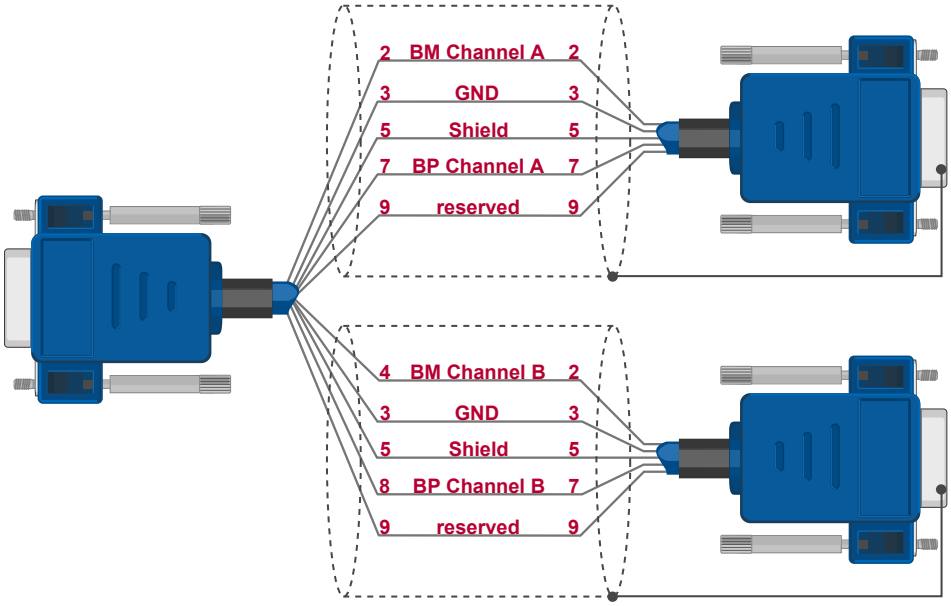
Setup



7.3.2 FRcable AB

Description	Cable for connection of a FlexRay Interface to the FlexRay bus (Channel A and B)
Length	1 m
Connectors	3x D-SUB9 connectors (female)
Properties	Provides channel A and B at the FlexRay interface. The pin assignment of both single ended connectors is identical and suitable for replacement of an existing FlexCard configuration.
Part number	Included in FRcable Set (part number 05062)

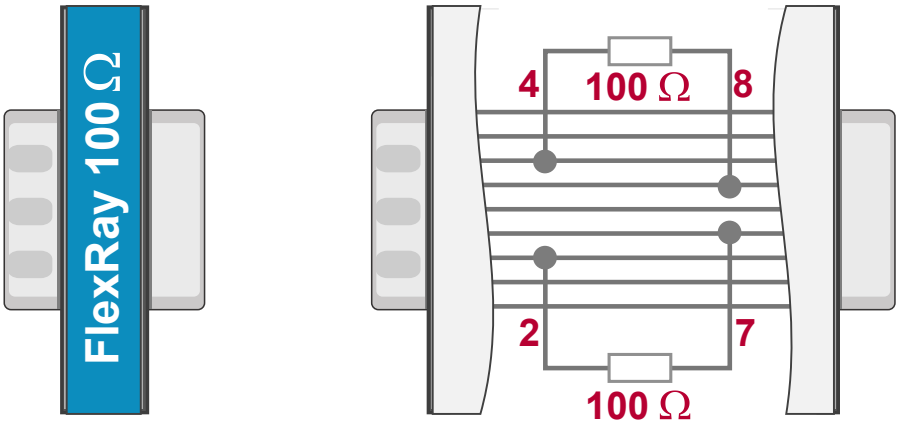
Setup



7.3.3 FRterm

Description	FlexRay adapter for termination of a FlexRay cluster (channel A and B). Pin assignment suited for VN3300/VN3600/VN7600/VN8970.
Connectors	1x D-SUB9 connector (female) 1x D-SUB9 connector (male)
Properties	2x 100 Ohm terminating resistor
Part number	05057

Setup



7.3.4 FRcable Set

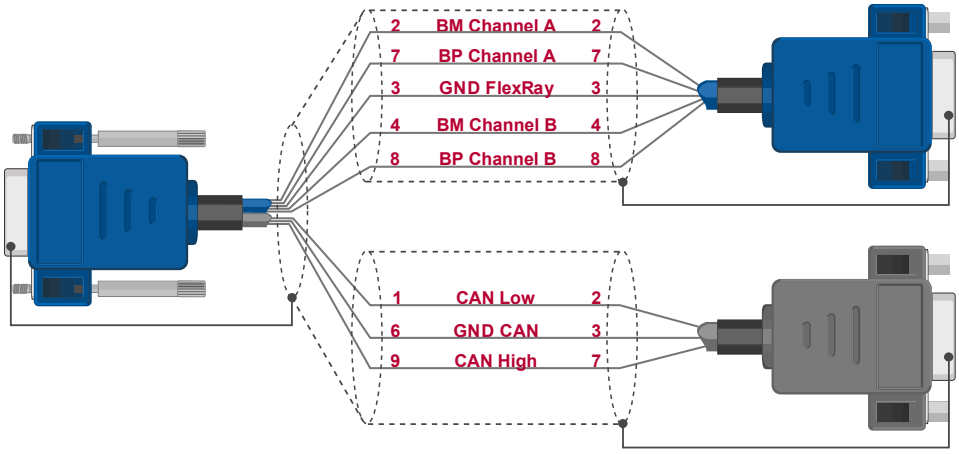
Description	Cable set for FlexRay incl.: > 1x FRcable A > 1x FRcable AB > 2x FRterm
Part number	05062

7.3.5 FR/CANcable 2Y

Y cable

Description	Y cable for Vector FR/CAN interfaces with D-SUB9 double assignment (e. g. VN7610). Splits the double assignment into two separate D-SUB9 connectors.
Length	0.3 m
Connectors	1x female D-SUB9 connector 2x male D-SUB9 connectors
Part number	05099

Setup



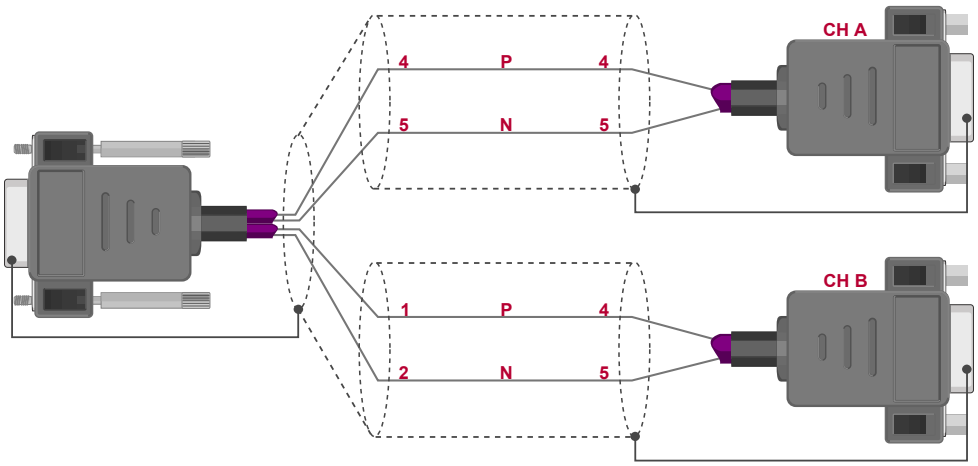
7.4 BroadR-Reach

7.4.1 BRcable 2Y

Y cable

Description	Y cable for VN5600 interfaces with D-SUB9 double assignment. Splits the double assignment into two separate D-SUB9 connectors (CH A and CH B), each with a separate BroadR-Reach channel.
Length	0.36 m (overall length)
Connectors	1x female D-SUB9 connector 2x male D-SUB9 connectors
Part number	05103

Setup



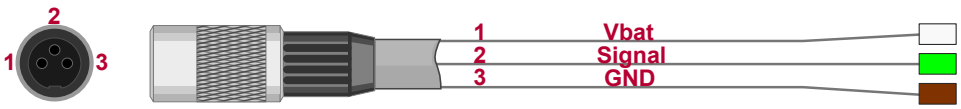
7.5 Miscellaneous

7.5.1 Connection Cable Binder Type 711 (3-pin)

All-purpose cable

Description	Connection cable for time synchronization at Vector devices
Length	1.5 m
Connectors	1x female 3-pin Binder connector (type 711) 3x stripped wires
Part number	30011

Setup

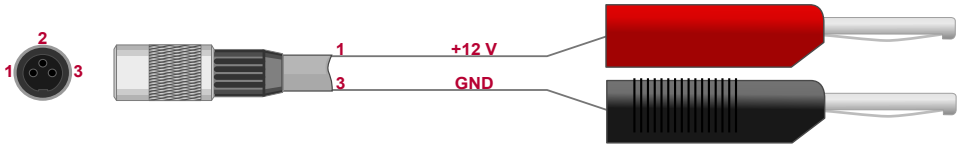


7.5.2 Banana Plug <> Binder 3-Pin

Power cable

Description	Power cable for Vector devices
Length	1.5 m
Connectors	1x female 3-pin Binder connector (type 711) 2x banana plugs (4 mm)
Part number	30012

Setup



7.5.3 Breakout Box D62Y9

Breakout box

Description	Breakout box for VN7570 and VN7572 (requires VNcable DSUB62 or VNcable DSUB62 A)
Dimensions	165 mm x 52 mm x 69 mm (W x H x D), incl. rubber feet and connectors
Weight	580 g
Connectors	1x D-SUB62 (female) 8x D-SUB9 (male) 1x D-SUB15 (female)
Properties	Can be mounted with 4x M4 screws
Part number	05090

CH1...CH8

Assignment for Piggybacks					Assignment for On-board CAN				
D-SUB62				D-SUB9	D-SUB62				D-SUB9
CH1	CH2	CH3	CH4	CH1…CH4	CH5	CH6	CH7	CH8	CH5…CH8
45	47	50	53	(1)*	-	-	-	-	(1) N.C.
22	3	28	9	(2)*	12	13	14	15	(2) CAN Low
1	25	7	31	(3)*	54	55	56	57	(3) GND
23	4	29	10	(4)*	-	-	-	-	(4) N.C.
6	6	6	6	(5)*	6	6	6	6	(5) Shield
2	26	8	32	(6)*	-	-	-	-	(6) N.C.
24	5	30	11	(7)*	33	34	35	36	(7) CAN High
43	27	48	51	(8)*	-	-	-	-	(8) N.C.
44	46	49	52	(9)*	-	-	-	-	(9) N.C.

* Depends on the inserted Piggyback in VN7570/VN7572.
N.C. Not connected

CH9

Assignment for IOpiggy 8642					
D-SUB62	**D-SUB15**	**Pinout 1**	**Pinout 2**	**Pinout 3**	**Pinout 4**
16	9	Digital In 1	Digital Out 1[1]	Digital Out 1[2]	-
17	10	Digital In 3	Digital Out 3[1]	Digital Out 3[2]	-
18	11	Digital In 5	Digital Out 4b[3]	-	-
19	12	Digital In 7	Digital Out 5b[3]	-	-
20	13	Digital GND			
37	1	Digital In 0	Digital Out 0[1]	Digital Out 0[2]	PWM 1
38	2	Digital In 2	Digital Out 2[1]	Digital Out 2[2]	-
39	3	Digital In 4	Digital Out 4a[3]	-	-
40	4	Digital In 6	Digital Out 5a[3]	-	-
41	5	PWM 0	Capture	-	-
58	6	Analog GND			
59	14	Analog In 0	Analog Out 0[1]	-	-
60	7	Analog In 1	Analog Out 1[1]	-	-
61	15	Analog In 2	-	-	-
62	8	Analog In 3	-	-	-

[1] Push-Pull
[2] Open-Drain
[3] a/b line: switched by PhotoMOS relais, external signal at a is switched to b.

7.5.4 VNcable DSUB62

Breakout box cable

Description	Connection cable with D-SUB62 connectors for Breakout Box D62Y9, VN7570 and VN7572
Length	0.5 m (cable only) 0.6 m (overall length)
Connectors	1x D-SUB62 (male) 1x D-SUB62 (female)
Part number	05087

7.5.5 VNcable DSUB62 A

Breakout box cable

Description	Connection cable with D-SUB62 connectors for Breakout Box D62Y9, VN7570 and VN7572
Length	1.2 m (cable only) 1.3 m (overall length)
Connectors	1x D-SUB62 (male) 1x D-SUB62 (female)
Part number	05093

7.5.6 VNcable DSUB62 B

Connection cable

Description	Connection cable with D-SUB62 connector and open end
Length	2 m (overall length)
Connectors	1x D-SUB62 (female) 62x wires
Part number	05095

Pin assignment

	Pin	Color		Pin	Color
TP	1 44	dark brown brown-white	TP	19 40	grey grey-black
TP	2 45	red red-black	TP	20 41	grey-red blue-grey
TP	3 5	red-white red-blue	TP	22 24	grey-yellow grey-green
TP	4 27	orange orange-black	TP	23 43	white white-black
TP	6 62	red-orange orange-green	TP	25 46	white-red white-light blue
TP	7 49	orange-white grey-white	TP	26 47	yellow-white white-light green
TP	8 50	yellow yellow-black	TP	28 30	pink pink-black
TP	9 11	red-yellow yellow-blue	TP	29 48	pink-red pink-blue
TP	10 51	yellow-white light yellow-black	TP	31 52	pink-white pink-yellow
TP	12 33	green green-black	TP	32 53	light green light green-black
TP	13 34	green-white light green-blue	TP	54 55	light green-yellow light green-green
TP	14 35	green-blue light green-red	TP	56 57	light blue light blue-black
TP	15 36	blue blue-white	TP	58 59	light blue-red light blue-blue
TP	16 37	blue-red violet-red	TP	60 61	light blue-yellow light blue-green
TP	17 38	violet violet-white		21 42	not connected not connected
TP	18 39	violet-green violet-blue			

TP = twisted pair

7.5.7 VNcable D62Y9

Y cable

Description	Adapter cable for VN7570 and VN7572
Length	approx. 0.5 m (overall length) approx. 0.4 m without connectors
Connectors	1x D-SUB62 (female) 1x D-SUB15 (female) 8x D-SUB9 (male)
Part number	05088

CH1...CH8

Assignment for Piggybacks					Assignment for On-board CAN				
D-SUB62				D-SUB9	D-SUB62				D-SUB9
CH1	CH2	CH3	CH4	CH1…CH4	CH5	CH6	CH7	CH8	CH5…CH8
45	47	50	53	(1)*	-	-	-	-	(1) N.C.
22	3	28	9	(2)*	12	13	14	15	(2) CAN Low
1	25	7	31	(3)*	54	55	56	57	(3) GND
23	4	29	10	(4)*	-	-	-	-	(4) N.C.
6	6	6	6	(5)*	6	6	6	6	(5) Shield
2	26	8	32	(6)*	-	-	-	-	(6) N.C.
24	5	30	11	(7)*	33	34	35	36	(7) CAN High
43	27	48	51	(8)*	-	-	-	-	(8) N.C.
44	46	49	52	(9)*	-	-	-	-	(9) N.C.

* Depends on the inserted Piggyback in VN7570/VN7572.
N.C. Not connected

CH9

Assignment for IOpiggy 8642					
D-SUB62	**D-SUB15**	**Pinout 1**	**Pinout 2**	**Pinout 3**	**Pinout 4**
16	9	Digital In 1	Digital Out 1[1]	Digital Out 1[2]	-
17	10	Digital In 3	Digital Out 3[1]	Digital Out 3[2]	-
18	11	Digital In 5	Digital Out 4b[3]	-	-
19	12	Digital In 7	Digital Out 5b[3]	-	-
20	13	Digital GND			
37	1	Digital In 0	Digital Out 0[1]	Digital Out 0[2]	PWM 1
38	2	Digital In 2	Digital Out 2[1]	Digital Out 2[2]	-
39	3	Digital In 4	Digital Out 4a[3]	-	-

CH9

Assignment for IOpiggy 8642					
D-SUB62	**D-SUB15**	**Pinout 1**	**Pinout 2**	**Pinout 3**	**Pinout 4**
40	4	Digital In 6	Digital Out 5a[3]	-	-
41	5	PWM 0	Capture	-	-
58	6	Analog GND			
59	14	Analog In 0	Analog Out 0[1]	-	-
60	7	Analog In 1	Analog Out 1[1]	-	-
61	15	Analog In 2	-	-	-
62	8	Analog In 3	-	-	-

[1] Push-Pull
[2] Open-Drain
[3] a/b line: switched by PhotoMOS relais, external signal at a is switched to b.

7.5.8 VNcable DSUB37

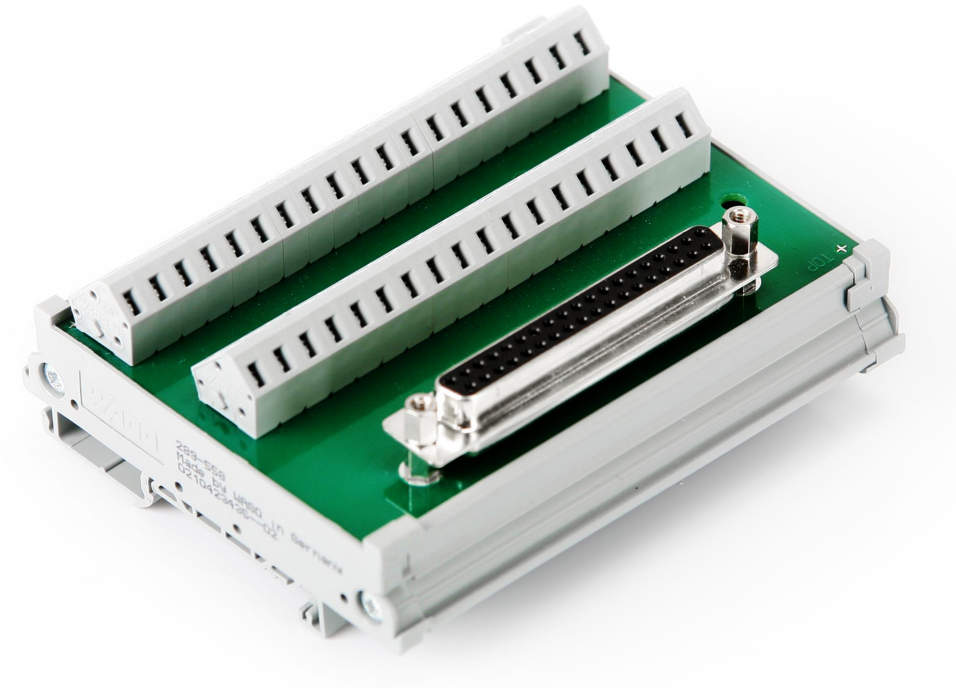
Connection cable

Description	Connection cable with D-SUB37 connectors
Length	1.5 m
Connectors	1x D-SUB37 (male) 1x D-SUB37 (female)
Part number	05097

7.5.9 Terminal Block DSUB37

Terminal block

Description	Terminal block with 37 CAGE CLAMP® connectors to D-SUB37 (requires VNcable DSUB37)
Dimensions	102 mm x 34 mm x 85 mm
Weight	102 g
Connectors	1x row with 19 CAGE CLAMP® connectors 1x row with 18 CAGE CLAMP® connectors 1x D-SUB37 (female)
Part number	05098

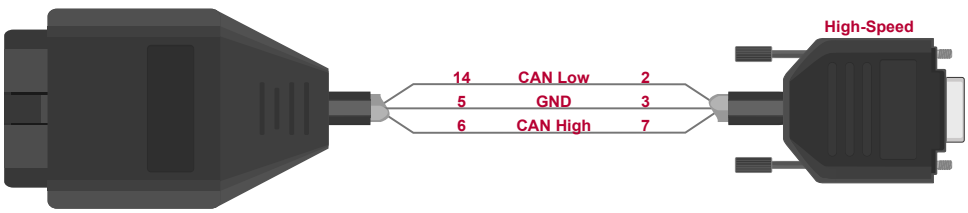


7.5.10 OBDcable CAN

Connection cable

Description	OBD-II to D-SUB9 cable for CAN High-Speed
Length	2 m
Connectors	1x 16-pin OBD-II connector (male) 1x D-SUB9 (female)
Part number	22089

Setup

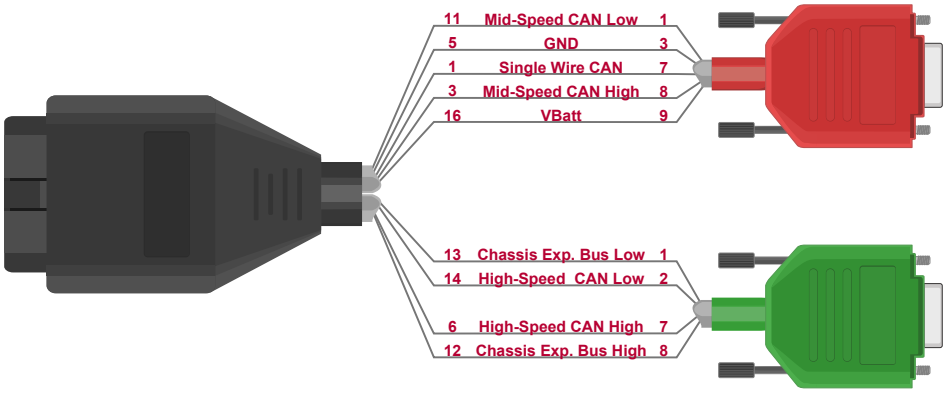


7.5.11 OBDcable OEM GM

Connection cable

Description	OBD-II to D-SUB9 cable (GM specific layout)
Length	2 m
Connectors	1x 16-pin OBD-II connector (male) 2x D-SUB9 (female)
Part number	22247

Setup

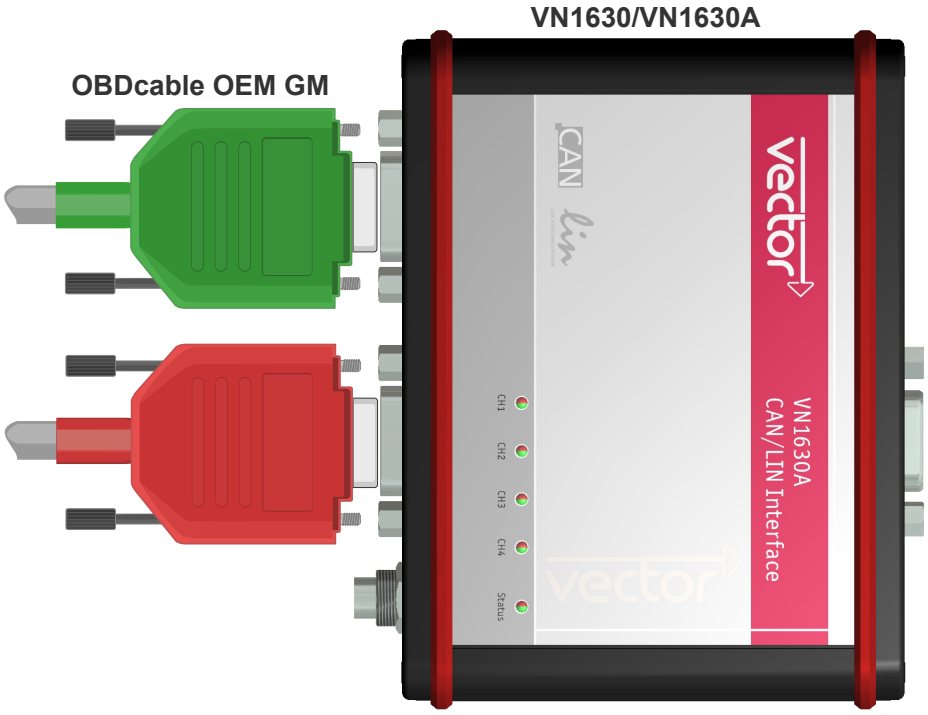


Example of usage

The OBDcable OEM GM is designed for usage with VN1630/VN1630A. Please use the following Piggyback configuration:

- CH1: Single Wire CAN, e. g. CANpiggy 7356cap
- CH2: CAN High-Speed, e. g. CANpiggy 1051cap

Connect the ODBcable OEM GM as follows:

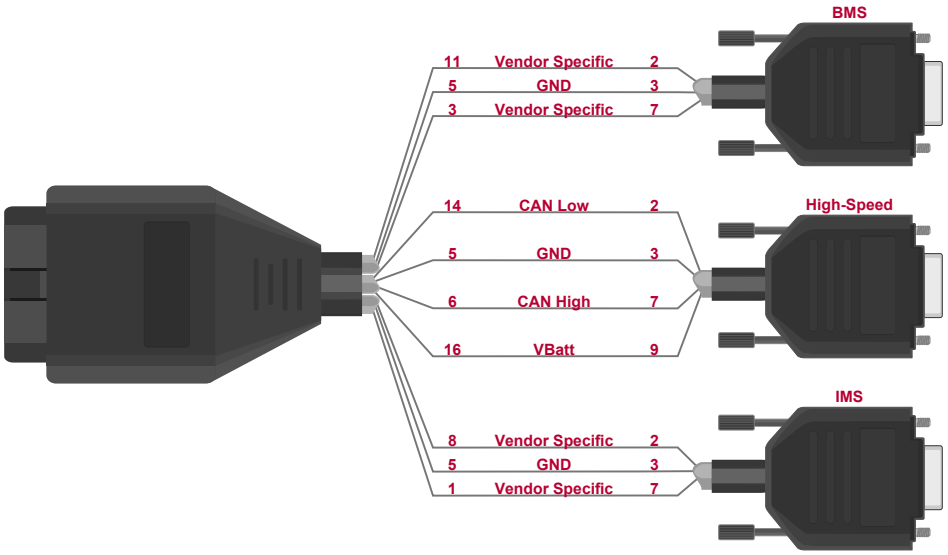


7.5.12 OBDcable OEM01

Connection cable

Description	OBD-II to D-SUB9 cable (for BMS, HS, IMS)
Length	2 m
Connectors	1x 16-pin OBD-II connector (male) 3x D-SUB9 (female)
Part number	22071

Setup



7.5.13 OBDcable VN88

Connection cable

Description	OBD-II to ODU cable for VN8810
Length	1 m (overall length)
Connectors	1x 16-pin OBD-II connector (male), Type B (24 V) 1x 22-pin ODU connector (male)
Temp. range	-40 °C ... +85 °C
Min. bending radius allowed	repeated: 10.9 cm (10 x Ø) single: 5.45 cm (5 x Ø)
Part number	05106

OBD-II Pin	Assignment
1	Not connected
2	Not connected
3	100BaseT RX+
4	Chassis GND
5	Signal GND (LIN / K-Line)
6	CAN High-Speed High
7	LIN/K-Line Data
8	DoIP Activation Line
9	Not connected
10	Not connected
11	100BaseT RX-
12	100BaseT TX+
13	100BaseT TX-
14	CAN High-Speed Low
15	Not connected
16	VBatt, permanent positive voltage, supply voltage for VN8810

Note
The pin assignment of the OBD-II connector is according to option #1 ISO/DIS 13400-4:2015-07.

7.5.14 OBDcable VN88A

Connection cable

Description	OBD-II to ODU cable for VN8810
Length	3 m (overall length)
Connectors	1x 16-pin OBD-II connector (male), Type B (24 V) 1x 22-pin ODU connector (male)
Temp. range	-40 °C ... +85 °C
Min. bending radius allowed	repeated: 10.9 cm (10 x Ø) single: 5.45 cm (5 x Ø)
Part number	05105

OBD-II Pin	Assignment
1	Not connected
2	Not connected
3	100BaseT RX+
4	Chassis GND
5	Signal GND (LIN / K-Line)
6	CAN High-Speed High
7	LIN/K-Line Data
8	DoIP Activation Line
9	Not connected
10	Not connected
11	100BaseT RX-
12	100BaseT TX+
13	100BaseT TX-
14	CAN High-Speed Low
15	Not connected
16	VBatt, permanent positive voltage, supply voltage for VN8810

Note
The pin assignment of the OBD-II connector is according to option #1 ISO/DIS 13400-4:2015-07.

7.5.15 Breakout Box VN88

Breakout box

Description	Breakout box for VN8810
Dimensions	Approx. 290 mm x 112 mm x 45 mm (LxWxH)
Temp. range	-40 °C ... +85 °C
Connectors	2x D-SUB9 (male) 1x D-SUB9 (female) 1x 22-pin ODU connector (male) 1x 2-pin ODU connector (male)
Part number	05107

CAN connector

Pin	Assignment
1, 4, 5, 6, 8, 9	Not connected
2	CAN High-Speed Low
3	CAN GND
7	CAN High-Speed High

LIN connector

Pin	Assignment
1, 2, 4, 5, 6, 8	Not connected
3	LIN GND
7	LIN / K-Line
9	VBatt LIN

Note
LIN requires an external supply voltage of 5 V…36 V DC at pin 9 (VBatt LIN) and pin 3 (LIN GND).

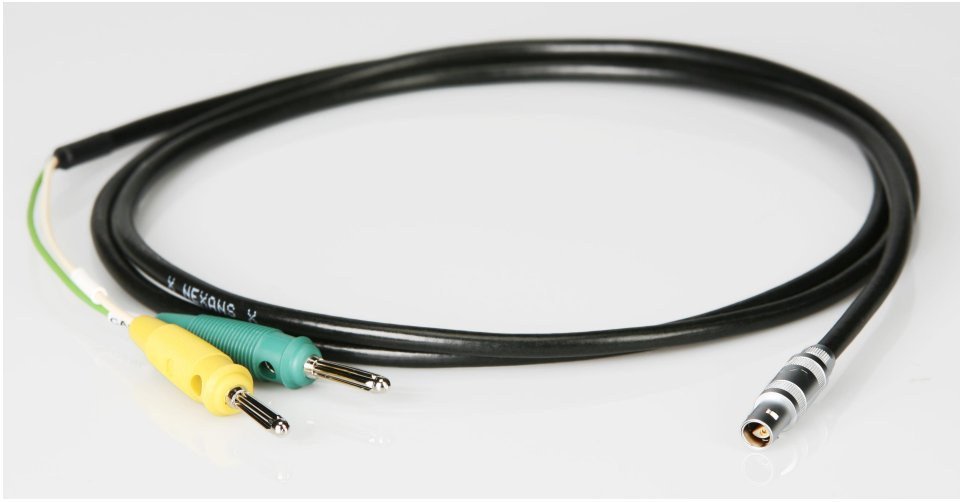
DoIP Act. Line connector

Pin	Assignment
1…6, 8	Not connected
7	DoIP Activation Line
9	GND (of external power supply at ODU connector)

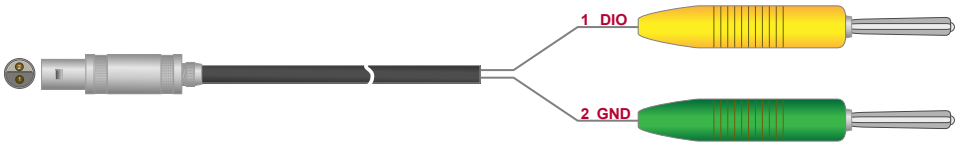
7.5.16 VX1362B CAN Cable Lemo/Banana Plugs 1.5M

Connection cable

Description	Adapter cable for Vector devices
Length	1.5 m
Connectors	1x Lemo connector 2x banana plugs (4 mm)
Part number	22258



Setup



8 Power Supply

In this chapter you find the following information:

8.1 Vector Power Supply Units

8.1.1 Vector Power Supply 12V/1.25A

Power supply unit for Vector devices

Description	Power supply unit with 12 V and 1.25 A, with changeable adapters for USA and Europe (GB adapter on request)
Length	2 m
Connectors	1x adapter for USA 1x adapter for Europe 1x 3-pin Binder connector (type 711)
Part number	05024

8.1.2 Vector Power Supply 12V/2.5A

Power supply unit for Vector devices

Description	Power supply unit with 12 V and 2.5 A, with changeable adapters for USA and Europe (GB adapter on request)
Length	2 m
Connectors	1x adapter for USA 1x adapter for Europe 1x 5-pin Binder connector (type 711)
Part number	05020

8.1.3 Vector Power Supply ODU MINI-SNAP

Power supply unit for Vector devices

Description	Power supply unit with 24 V and 2.5 A
Connectors	1x adapter for Europe 1x ODU S11L0C-P02NPL0-5200
Part number	05068

Connection cable

Description	Connection cable for power supply unit (part number 05068)
Connectors	Adapter for USA/Japan
Part number	05071

Connection cable

Description	Connection cable for power supply unit (part number 05068)
Connectors	Adapter for UK
Part number	05070

8.2 On-Board Power Supply

8.2.1 Car Power Supply Cable 12V with Binder

On-board power supply

Description	On-board power supply cable
Connectors	1x 3-pin connector (Binder type 711) 1x 12 V plug (DIN ISO 4165)
Part number	15023

8.2.2 Vehicle Input <> ODU MINI-SNAP

On-board power supply for VN8900

Description	On-board power supply cable for the VN8900 interface family
Connectors	1x ODU S11L0C-P02NPL0-5200 1x 12 V plug (DIN ISO 4165)
Part number	05076

8.3 Power Supply Cable

8.3.1 ODU Connector / Bunch Plugs

ODU

Description	Two-conductor power supply cable for base units
Length	approx. 2 m
Connectors	1x ODU connector (type S11L0C-P02NPL0-6200) 2x bunch plugs (power supply)
Temperature range	In mobile state: -30 °C … +70 °C In stationary state: -40 °C … +85 °C
Part number	05069

Cable setup

Caution!
The power supply port does not have any overload protection. Whenever the device is powered through this cable, a fuse (slow-acting) must be provided in the supply line.

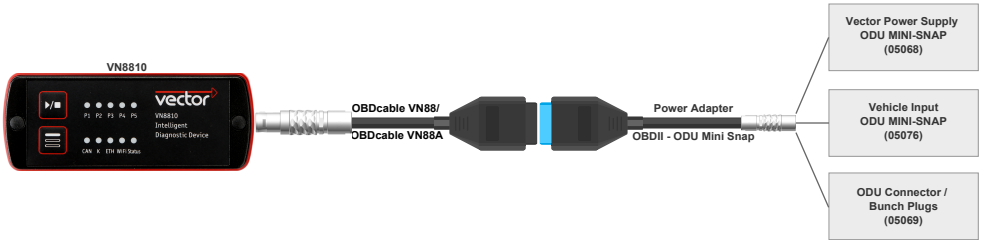
8.3.2 Power Adapter OBDII – ODU Mini Snap

Connection cable

Description	OBD-II/ODU power supply cable for VN8810 (this cable requires OBDcable VN88 or OBDcable VN88A)
Length	approx. 30 cm (overall length)
Connectors	1x 16-pin OBD-II connector (female), Type B (24 V) 1x 2-pin ODU connector (male)
Part number	05104

OBD-II Pin	Assignment	ODU Pin
16	VBatt	1
4	Chassis GND	2

Example of usage



9 Time Synchronization

In this chapter you find the following information:

9.1 Time Synchronization

9.1.1 General Information

Time stamps and events

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

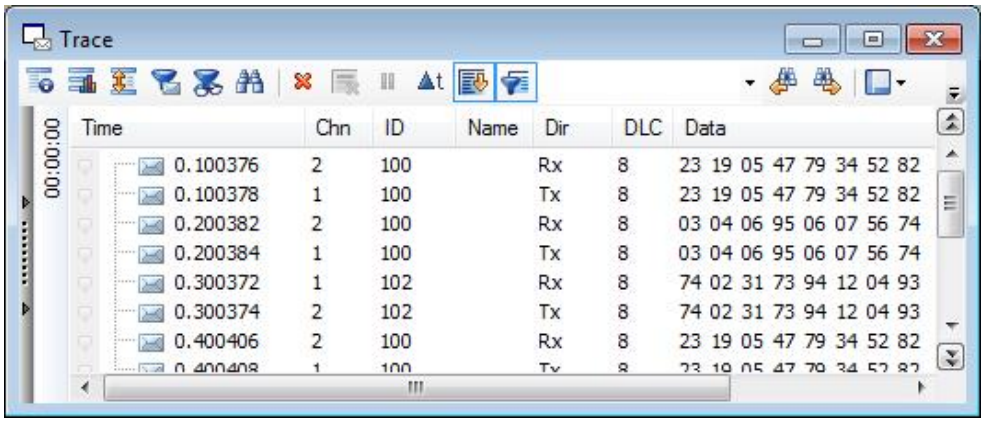


Figure 19: Time stamps of two CAN channels in CANalyzer

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.

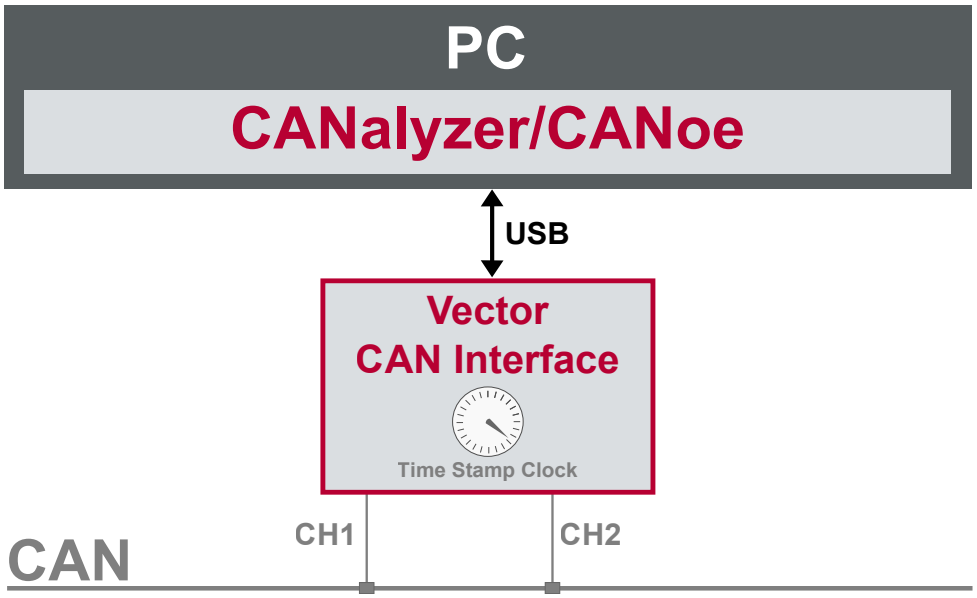


Figure 20: Common time stamp clock for each channel

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.

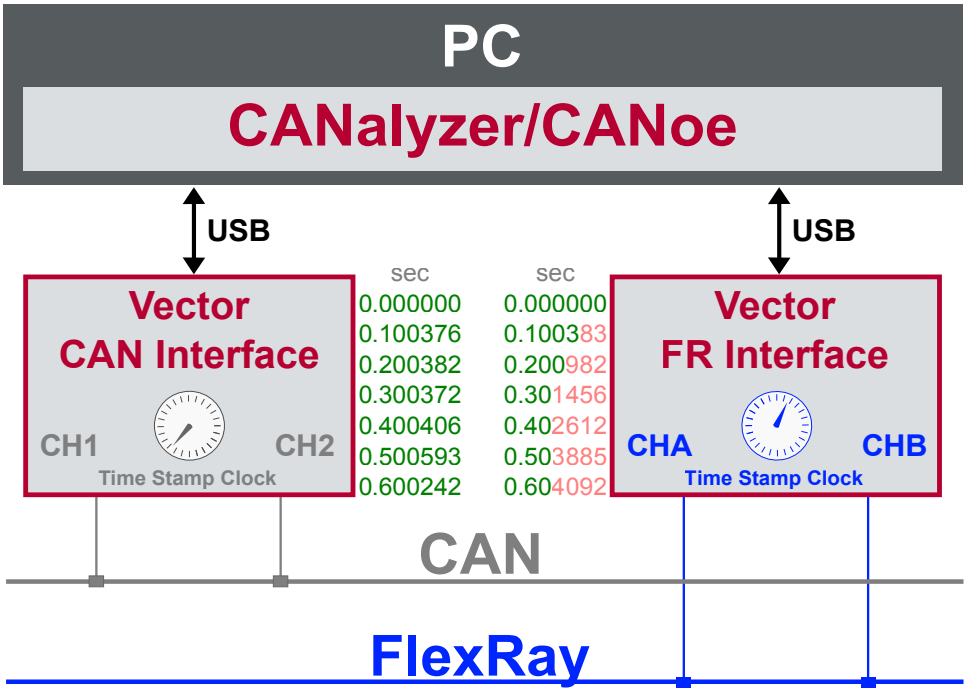


Figure 21: Example of unsynchronized network interfaces. Independent time stamps drift apart

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

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

9.1.2 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.

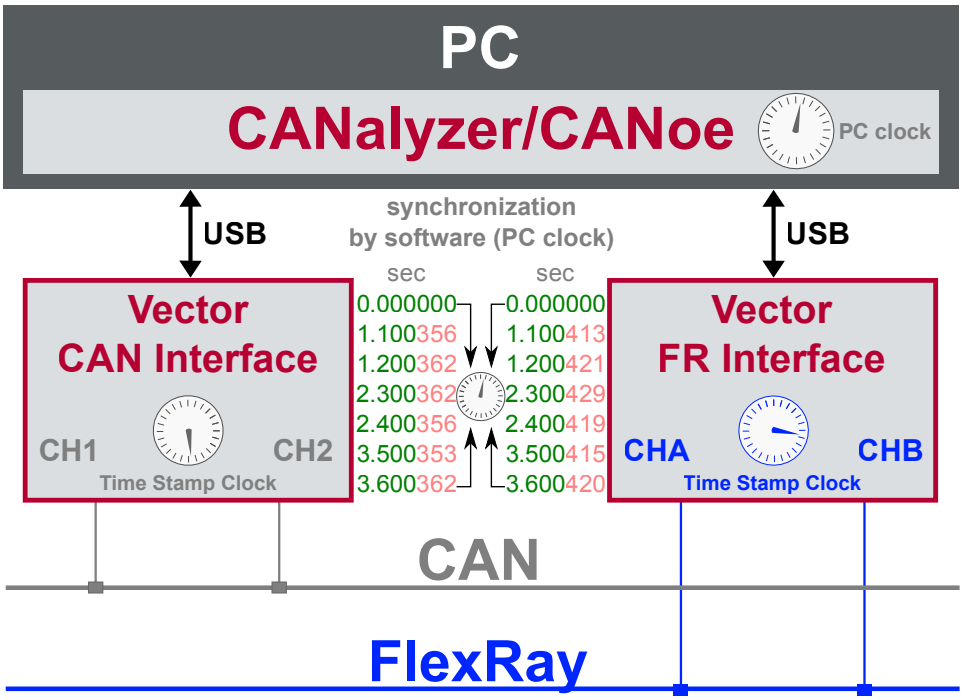


Figure 22: Time stamps of devices are synchronized to the PC clock

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

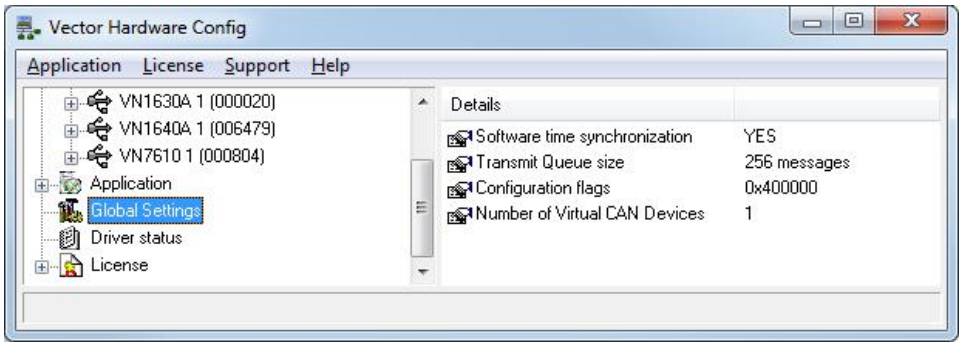


Figure 23: Switching on the software synchronization

> **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.

9.1.3 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 page 136).

In order to synchronize up to five devices at the same time, a distribution box is available (see section Multi SYNCbox External on page 137 and section Multi SYNCbox Internal on page 138).

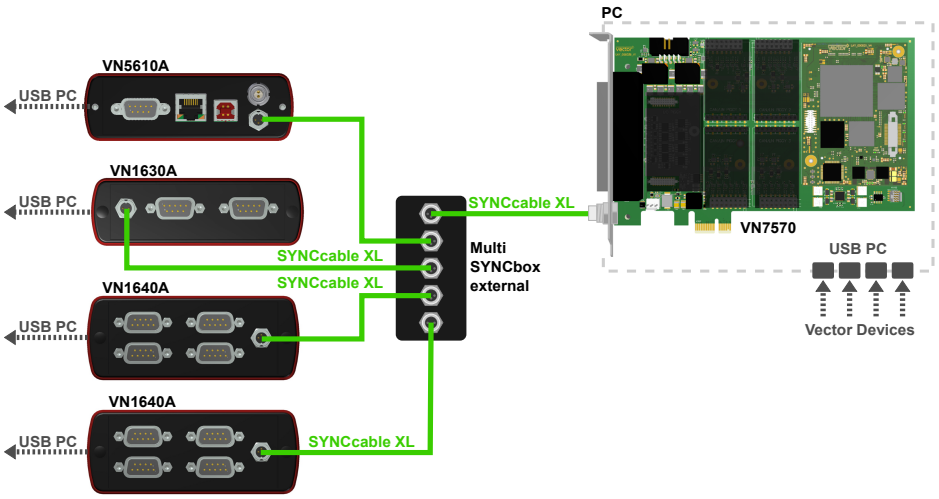


Figure 24: Example of a time synchronization with multiple devices

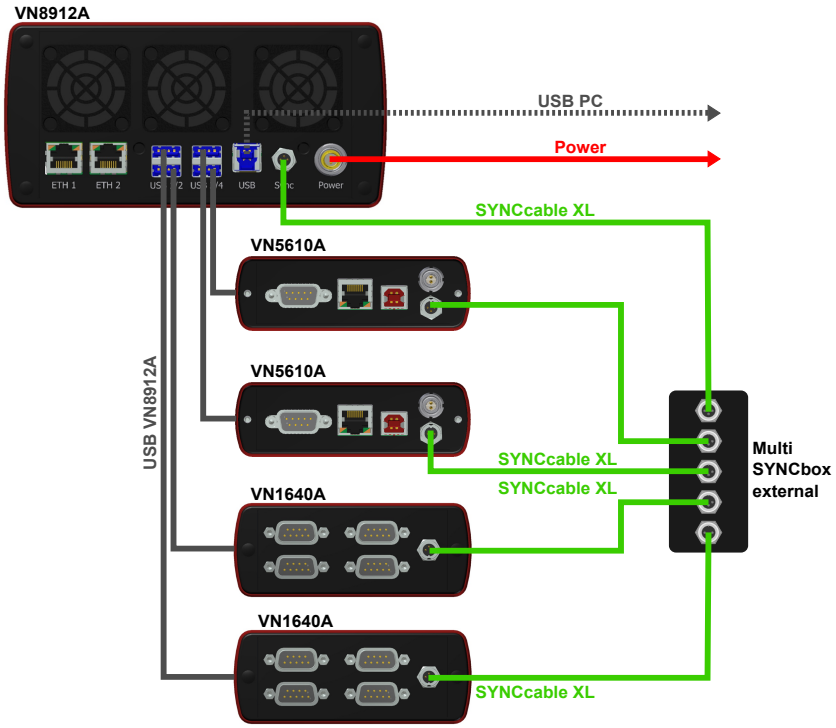


Figure 25: Example of a time synchronization with VN8912 and additional devices

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.

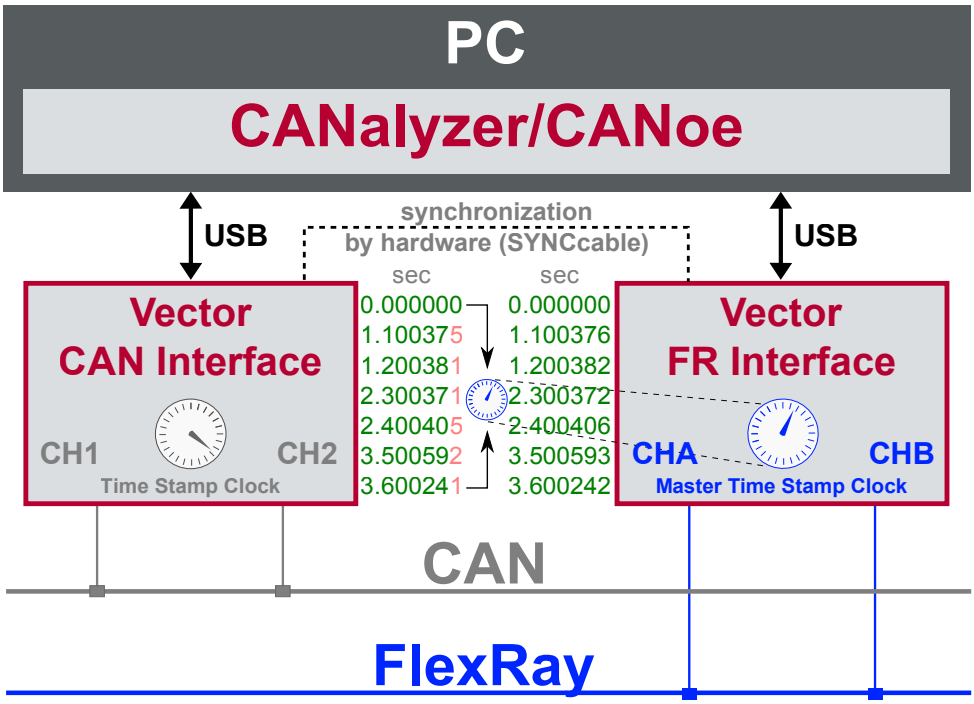


Figure 26: Time stamps are synchronized to the master clock

Note

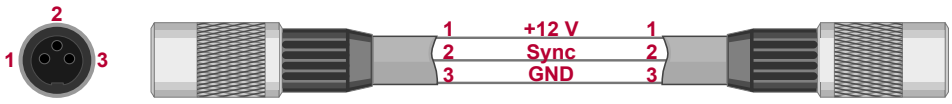
The hardware synchronization must be supported by the application. For further information please refer to the relevant application manual. Please note that the software synchronization must be disabled (see **Vector Hardware Config | General information | Settings | Software time synchronization**)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

9.2 SYNCcableXL

Synchronization cable

Description	Connection cable for time synchronization of Vector devices
Length	2 m
Connectors	2x female 3-pin Binder connectors (type 711)
Part number	05018

Setup

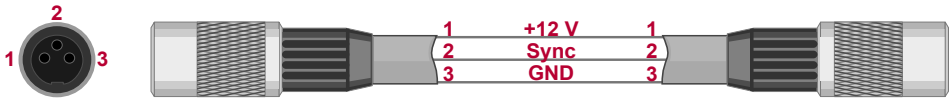


9.3 SYNCcable50

Synchronization cable

Description	Connection cable for time synchronization for Vector devices
Length	0.5 m
Connectors	2x female 3-pin Binder connectors (type 711)
Part number	05083

Setup

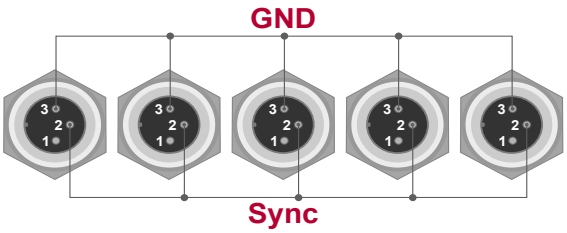


9.4 Multi SYNCbox External

Synchronization distributor

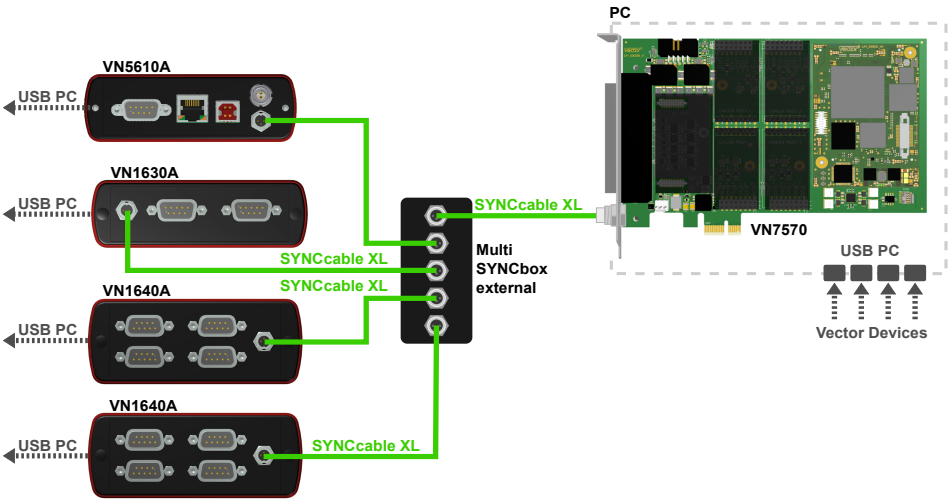
Description	Distributor in plastic case for time synchronization. For up to five Vector devices.
Connectors	5x male 3-pin connectors (Binder type 711)
Part number	05085

Setup



Note
Within the sync system, up to five devices can be synchronized. Cascading of multiple Multi SYNCboxes to increase the number of devices is not possible.

Example

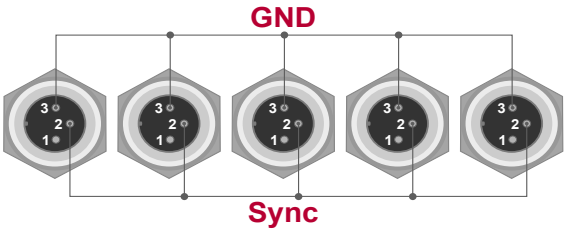


9.5 Multi SYNCbox Internal

Synchronization distributor

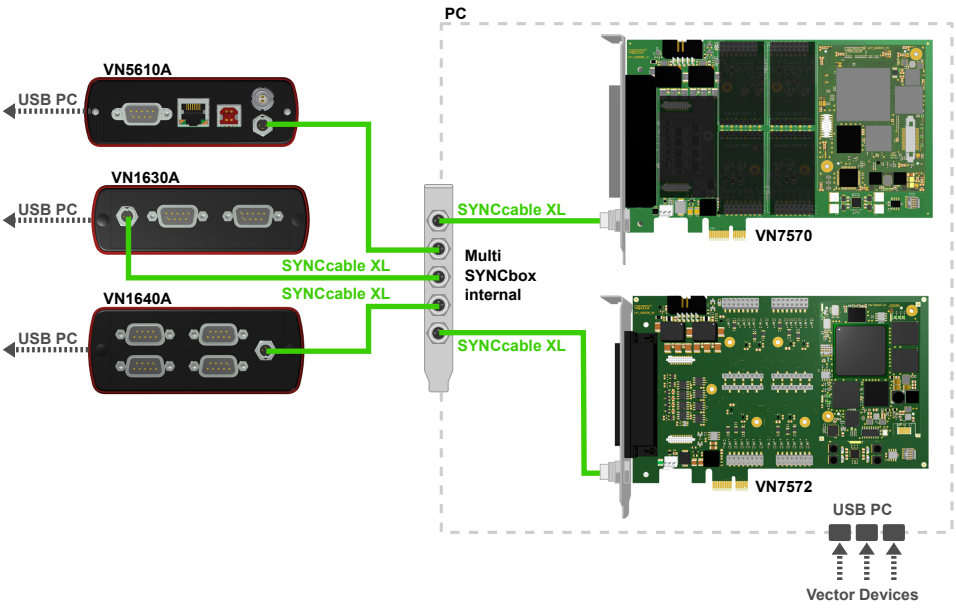
Description	Distributor in PC slot bracket for time synchronization. For up to five Vector devices.
Connectors	5x male 3-pin connectors (Binder type 711)
Part number	05084

Setup



Note
Within the sync system, up to five devices can be synchronized. Cascading of multiple Multi SYNCboxes to increase the number of devices is not possible.

Example



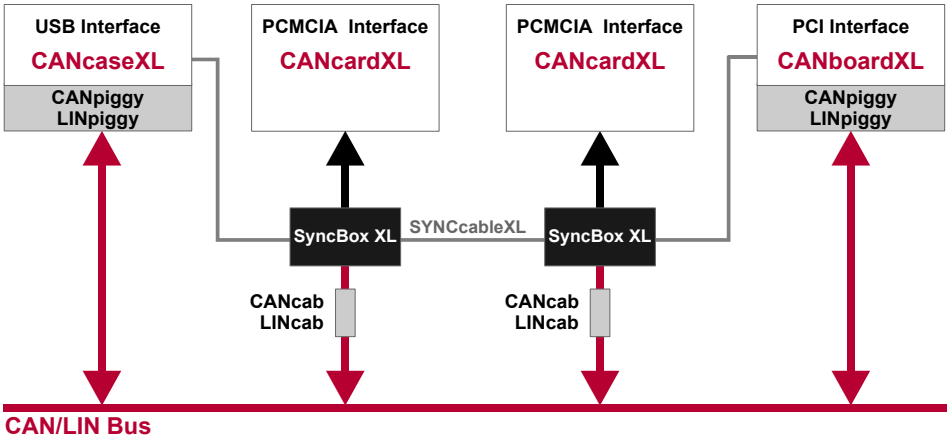
9.6 SyncBox XL

Synchronization

The SyncBox XL is designed to synchronize multiple CANcardXL/XLe among each or

of CANcardXL/XLe with other Vector network interfaces.

Synchronization of different interfaces



Technical data

Housing	ABS plastic
Cable length	Approx. 30 cm to CANcardXL/XLe
Weight	Approx. 100 g
Connectors	PC side: 15-pin plug connector to CANcardXL/XLe Bus side: 15-pin socket to CANcab or LINcab Sync side: 2x 3-pin Binder connectors (type 711)
Part number	22013

10 Miscellaneous

In this chapter you find the following information:

10.1 CardSafe

Protection against mechanical damages

When using notebooks, especially on the test bench or in a test vehicle, the PCMCIA connectors are frequently subjected to mechanical stresses - the consequence is the snapping-off of the connectors. The patented connector fixing provided by Vector Informatik's CardSafe offers effective, sensible protection.

CardSafe consists of a base plate and connector fixing made of robust metal. The base plate is fastened to the underside of the notebook with a belt and does not have to be removed during transport. Elaborate and time-consuming mounting is thus unnecessary.

If cables are connected to the PC card and they should also be protected, the connector fixing is used with a handle on the base plate. By tightening 2 adjustment screws, the connectors are fixed securely. The connector fixing can be unbolted from the notebook easily with a coin when the notebook is being transported.

Part number 05023.

10.2 CANcaseXL log CardFix Kit – SD Card Protection

Prevent insertion and rejection of SD card

The standard delivery of the CANcaseXL log allows the user to insert and remove the SD card from outside. In some situations, for example to prevent thefts, the inserted SD card shall not be removable. The CardFix Kit is an ideal protection solution, because the back side plate with the SD card slot is replaced by a closed plate. Thus the SD card cannot be removed so easily anymore.

Part number 07132.

Note
A detailed instruction is delivered with the kit. However, the modification of your CANcaseXL log can be done by our service.

10.3 Empty Frame for VN8910

Technical data

Description	For use with VN8910 base unit without a slide-in module (e. g. VN8950, VN8970)
Part number	07148

10.4 Fix Kit 32mm Device

Technical data

Description	Fixing Kit containing 4 pcs. of wall brackets for ALUbos housing.
Part number	07139

10.5 2.4 & 5 GHz Antenna SMA-R Std.

Technical data

Description	Standard antenna for EU, USA and other non-Asian countries. Suitable for 2.4 GHz and 5 GHz applications.
Part number	07169

Reference
A suitable antenna for Asian countries can be found section 2.4 & 5.2 GHz Antenna SMA-R Asia on page 144.

10.6 2.4 & 5.2 GHz Antenna SMA-R Asia

Technical data

Description	Standard antenna for Asia. Suitable for 2.4 GHz and 5.2 GHz applications.
Part number	07170

Reference
A suitable antenna for EU, USA and other non-Asia countries can be found section 2.4 & 5 GHz Antenna SMA-R Std. on page 144.

10.7 Protection Kit 1040

Technical data

Description	This protection kit contains two rubber bumpers which replace the standard sealing of housing size 1040.
Part number	05110

Example

Figure 27: Top side

Figure 28: Bottom side

10.7.1 Mounting Instructions

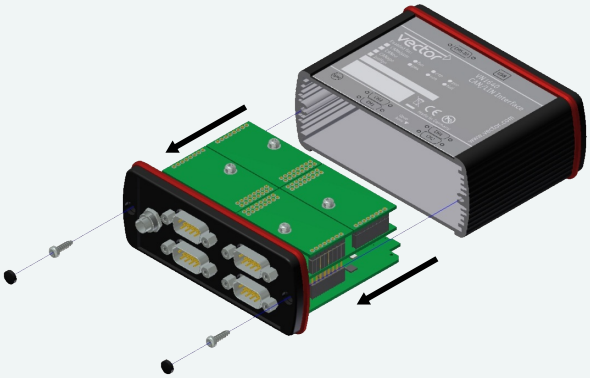
Caution!
To prevent electrical damage during assembly, you should avoid touching the lower and upper sides of the PC boards.

Caution!
Always disconnect the power supply before assembling.

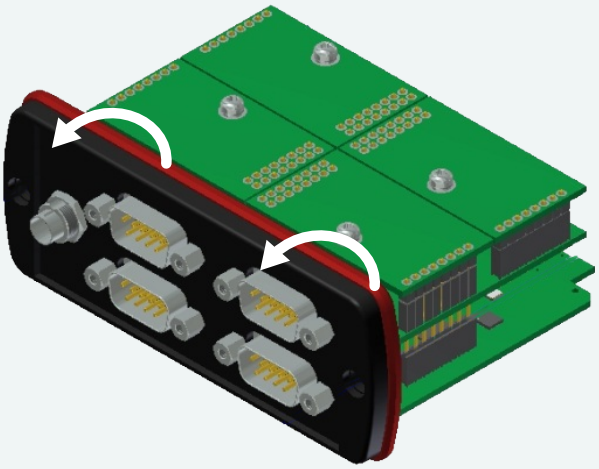
Step by Step Procedure

1. Remove all cables from the device.
2. Loosen the housing screws on the side with the four D-SUB9 connectors. This requires removing the two black decorative caps.

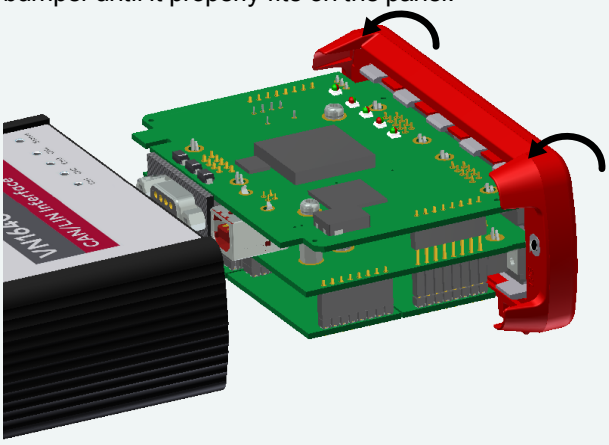
3. Carefully pull the PC-board out of the housing.



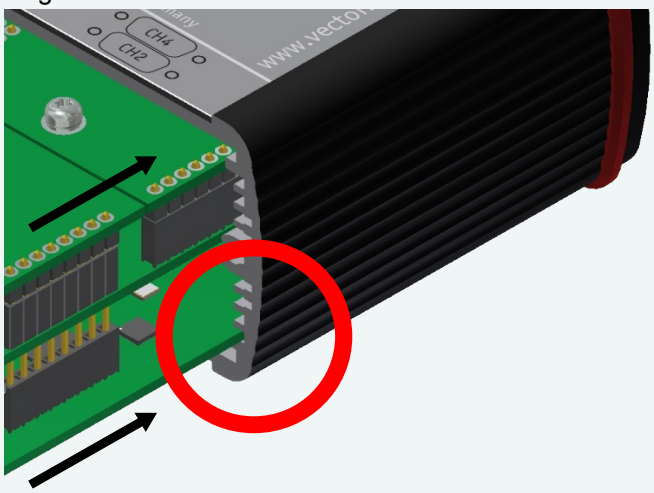
4. Remove the red standard sealing by pulling it over the black panel. Do not pull the sealing over the board to avoid damages on the components!



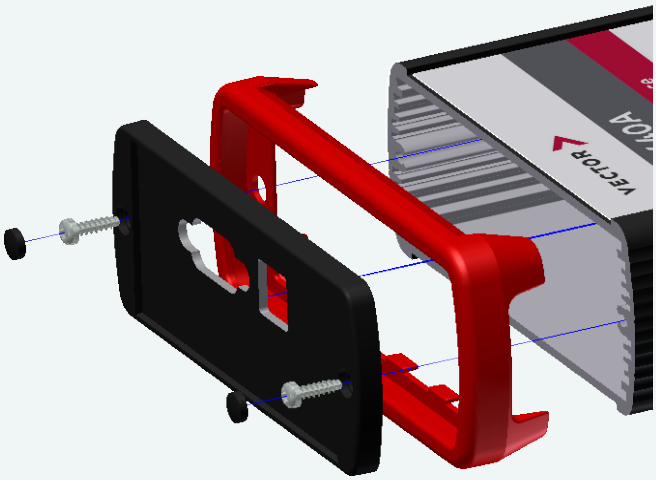
5. Pull the replacement rubber bumper over the black panel. Do not pull the sealing over the board to avoid damages on the components! Adjust the rubber bumper until it properly fits on the panel.



6. Place the board back in the housing. This operation involves placing the housing on a table with its back side (side with the bar code) facing upward. Then insert the board facing upward into the first guide rails. It should be possible to slide the board in the housing up to a few millimeters from the end without forcing it in.



7. Close the housing by applying light pressure and then secure it with the appropriate screw fasteners. The screws should be secure but not excessively tight.
8. Please also attach the two black decorative caps.
9. Repeat the steps with the opposite panel.



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