

## USB-to-CAN<sup>v2</sup>

Compact | Embedded | Automotive | Professional

### USER MANUAL

4.01.0280.20000 EN 2.4 ENGLISH



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# Important User Information

## Liability

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# 1 User Guide

Please read the manual carefully. Make sure you fully understand the manual before using the product.

## 1.1 Target Audience

This manual addresses trained personnel. Trained personnel are all persons who are familiar with the installation and use. Only ESD trained staff is authorized to install the interface. The contents of the manual must be made available to any person authorized to use or operate the product.

## 1.2 Related Documents

Document	Author
Installation Guide <i>VCI Driver</i>	HMS

## 1.3 Document History

Version	Date	Description
2.0	December 2016	Revised and edited in new design
2.1	March 2017	Minor corrections, added note on USB specification and extension cable
2.2	May 2017	Minor corrections, added trademark information
2.3	October 2017	Minor corrections, changes in chapter LIN interface
2.4	August 2018	Added information about resistor in LIN mode, target audience and intended use

## 1.4 Trademark Information

IXXAT® is a registered trademark of HMS Industrial Networks AB. All other trademarks mentioned in this document are the property of their respective holders.

## 1.5 Conventions

Instructions and results are structured as follows:

- ▶ instruction 1
- ▶ instruction 2
  - ➔ result 1
  - ➔ result 2

Lists are structured as follows:

- item 1
- item 2


**Bold typeface** indicates interactive parts such as connectors and switches on the hardware, or menus and buttons in a graphical user interface.

```
This font is used to indicate program code and other
kinds of data input/output such as configuration scripts.
```

This is a cross-reference within this document: [Conventions, p. 4](#)


This is an external link (URL): [www.hms-networks.com](http://www.hms-networks.com)

Safety advice is structured as follows:


	<p>Cause of the hazard!</p> <p>Consequences of not taking remediate action.</p> <p>How to avoid the hazard.</p>
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Safety signs and signalwords are used dependent on the level of the hazard.


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 *This is additional information which may facilitate installation and/or operation.*

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	<p>This instruction must be followed to avoid a risk of reduced functionality and/or damage to the equipment, or to avoid a network security risk.</p>
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	<p><b>Caution</b></p> <p>This instruction must be followed to avoid a risk of personal injury.</p>
---	--

	<p><b>WARNING</b></p> <p>This instruction must be followed to avoid a risk of death or serious injury.</p>
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## 2 Safety Instructions

### 2.1 Information on EMC



Risk of interference to radio and television if used in office or home environment!  
The product is a class B device.

Use exclusively included accessories or HMS accessories that are intended for use with the device. Use exclusively shielded cables.

Make sure that the shield of the interface is connected with the device plug and the plug on the other side.

### 2.2 General Safety Notes

- ▶ Protect product from moisture and humidity.
- ▶ Protect product from too high or too low temperature (see [Technical Data, p. 16](#)).
- ▶ Protect product from fire.
- ▶ Do not throw, drop or try to bend the product.
- ▶ Do not paint the product.
- ▶ Do not modify or disassemble the product. Service must be carried out by HMS Industrial Networks.
- ▶ Do not use modified products.
- ▶ Store products in dry and dust-free place.

### 2.3 Intended Use

The interfaces are used to connect computer systems to CAN and LIN networks. The USB-to-CAN<sup>V2</sup> Embedded is intended for installation in computer systems with closed housing. The USB-to-CAN<sup>V2</sup> Compact, Professional and Automotive are intended for the connection to a computer via the USB interface.

### 3 Scope of Delivery

Included in the scope of delivery:

- USB-to-CAN<sup>V2</sup> interface
- only version professional and automotive: 2 x RJ45 to D-Sub 9 adapter cable
- only version embedded: internal USB cable
- CD with driver, programming examples, CAN bus monitor and software design guide
- Installation Guide *VCI Driver*
- User Manual *USB-to-CAN<sup>V2</sup>*

The following equipment can be ordered separately:

- CAN bus termination
- RJ45 to D-Sub 9 adapter cable



## 4 Product Description

The USB-to-CAN<sup>V2</sup> is an active USB interface which enables the user to monitor and control up to two CAN high-speed channels, one CAN low-speed channel, and a LIN channel, depending on the variant.

### 4.1 USB-to-CAN<sup>V2</sup> Compact and Embedded



Fig. 1 USB-to-CAN<sup>V2</sup> compact (D-Sub 9 and RJ45)

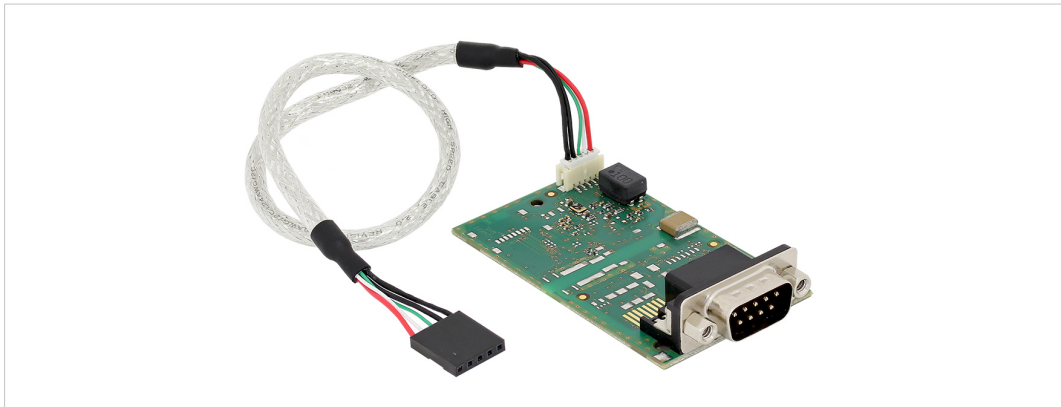


Fig. 2 USB-to-CAN<sup>V2</sup> embedded

- USB 2.0 Hi-Speed (480 MBit/s)
- 1 x CAN high-speed channel according to ISO 11898-2
- optional galvanic CAN bus isolation
- fieldbus connection:
  - compact: D-Sub 9 or RJ45
  - embedded: D-Sub 9

## 4.2 USB-to-CAN<sup>V2</sup> Professional



**Fig. 3** USB-to-CAN<sup>V2</sup> professional

- USB 2.0 Hi-Speed (480 MBit/s)
- 2 x CAN high-speed channels according to ISO 11898-2
- galvanic CAN bus isolation (both CAN channels are on the same potential)
- fieldbus connection: 2 x RJ45
- 2 x RJ45 to D-Sub 9 adapter cable

## 4.3 USB-to-CAN<sup>V2</sup> Automotive



**Fig. 4** USB-to-CAN<sup>V2</sup> automotive

- USB 2.0 Hi-Speed (480 MBit/s)
- 2 x CAN high-speed channels according to ISO 11898-2, CAN 1 can be switched between high- and low-speed (ISO 11898-3) via software
- 1 x LIN interface V1.3 and V2.0/2.1, Master/Slave mode and LIN frame format switchable via software
- galvanic fieldbus isolation (all fieldbus channels are on the same potential)
- fieldbus connection: 2 x RJ45
- 2 x RJ45 to D-Sub 9 adapter cable

## 5 Installation

### 5.1 Installing the Software

For the operation of the interface a driver is needed.

#### Windows

- ▶ Install the VCI driver (see Installation Guide *VCI Driver*).

#### Linux and Real-Time Operating Systems

- ▶ Observe information about supported operating systems and interfaces on [www.ixxat.com](http://www.ixxat.com).

### 5.2 Installing the Hardware

#### 5.2.1 Connecting USB



**Malfunction caused by extension cable!**

According to the USB specification connect the interface directly or via an active USB hub to the computer. Do not use an extension cable.



**Insufficient power supply!**

Connect the interface directly to the computer or to self-powered hubs to ensure sufficient power supply.

The shield of the USB cable is connected to ground using a 100 nF capacitor. The shield of the CAN connector is connected to CAN ground via a 1 M $\Omega$  resistor and a 10 nF capacitor. USB\_shield is connected to CAN\_shield via a 4.7 nF capacitor. The shields of the CAN connectors of the variants *professional* and *automotive* are connected directly together.

For non galvanic decoupled interfaces, fieldbus ground and computer ground are at the same potential.

#### USB-to-CAN<sup>v2</sup> Compact/Professional/Automotive

Connector:

- USB cable with plug type A
  - Assignment corresponds to USB 2.0 standard.
- 
- ▶ Make sure that the VCI driver is installed.
  - ▶ Plug the USB connector in the USB port of computer.
    - ➔ Windows automatically finds and installs the hardware.
    - ➔ USB LED is green.



*USB interface supports hot plug!*

*It is possible to plug or unplug the device during operation.*

## 5.2.2 Connecting the USB-to-CAN<sup>V2</sup> Embedded



Risk of ESD damages caused by improper handling!

Use ESD protective measures to avoid equipment damage.

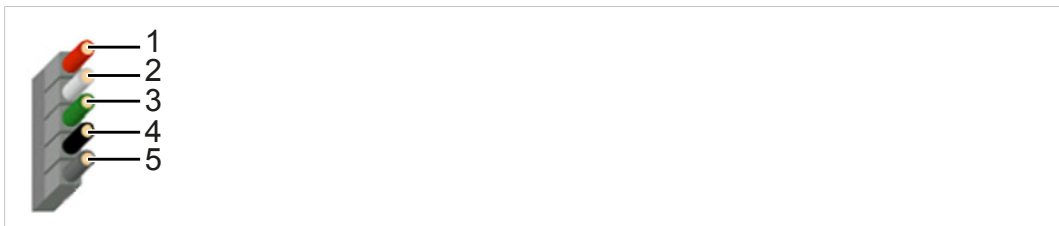


Damage of the equipment because of reverse polarity or wrong type of power supply!

Make sure that the power supply is correctly connected and of the recommend type.

Connector:

- USB cable with 5 pin female connector
- Assignment corresponds to PC standard for internal USB devices.



**Fig. 5 Standard wire assignments 1x5 header connector female**

1	Red: +5 V/voltage +/VCC
2	White: D-/data-/USB-
3	Green: D+/data+/USB+
4	Black: GND/voltage-/ground
5	Black: S-GND/over current/shielding

- ▶ Make sure that the driver is installed.
- ▶ Turn off the computer.
- ▶ Pull the power cord.
- ▶ Open the computer case according to instructions of the computer manufacturer.
- ▶ Mount the bracket with the embedded board in the suitable slot.
- ▶ Plug the small plug of the USB cable in the USB connector of the embedded board.
- ▶ Plug the USB connector in the suitable slot on the computer main board.
- ▶ Close the computer case.
  - ➔ Hardware installation is complete.

### 5.2.3 Connecting the CAN Fieldbus

The assignment of the fieldbus connectors (D-Sub 9 and RJ45) is in accordance to CiA 303-1.

The shield of the CAN connector is connected to CAN ground via a 1 M $\Omega$  resistor and a 10 nF capacitor. USB\_shield is connected to CAN\_shield via a 4.7 nF capacitor. The shields of the CAN connectors of the variants *professional* and *automotive* are connected directly together.

For non galvanic decoupled interfaces, fieldbus ground and computer ground are at the same potential.



*For best noise immunity connect the shields of the CAN cables directly to the ground.*

#### Pin Allocation of USB-to-CAN<sup>v2</sup> Compact and Embedded

Signal	Pin No.	
	D-Sub 9	RJ45
CAN high	7	1
CAN low	2	2
GND	3, 6	3, 7

#### Pin Allocation of USB-to-CAN<sup>v2</sup> Professional

Signal	RJ45, Pin No.		Adapter cable
	CAN 1	CAN 2	D-Sub 9, Pin No.
CAN high	1	1	7
CAN low	2	2	2
GND	3, 7	3, 7	3, 6

#### Pin Allocation of USB-to-CAN<sup>v2</sup> Automotive

Signal	RJ45, Pin No.		Adapter cable
	CAN 1	CAN 2	D-Sub 9, Pin No.
CAN high	1	1	7
CAN low	2	2	2
GND	3, 7	3, 7	3, 6
CAN high LS	4	-	4
CAN low LS	5	-	1
LIN	-	6	5
VBAT <sub>LIN</sub>	-	8	9

- ▶ If necessary install a bus termination (see [CAN Bus Termination, p. 15](#)).
- ▶ Observe pin allocation.
- ▶ Connect the CAN fieldbus connector to the CAN fieldbus.
- ▶ Start the CAN bus monitor on the computer.
- ▶ In the CAN bus monitor adjust USB-to-CAN<sup>v2</sup> properties according to the fieldbus characteristics.
- ▶ Start the CAN bus monitor communication.
  - ➔ Received CAN messages are shown in the receive window of the CAN bus monitor.
  - ➔ CAN LED is green flashing with each CAN message.

## 5.2.4 Connecting the LIN Fieldbus

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*LIN functionality is exclusively available on the USB-to-CAN<sup>v2</sup> automotive.*

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*Power consumption is limited by a 1 k $\Omega$  resistor.*

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The LIN interface can receive and transmit LIN frames according to LIN specification V1.3 and V2.0/2.1. The LIN interface can be configured as LIN master.

A 1 k $\Omega$  pull-up resistor is automatically activated in LIN Master mode and automatically deactivated in LIN Slave mode. External pull-up resistors are not necessary.

- ▶ To use the LIN interface connect a voltage of 12 V DC (voltage range 8 to 18 V DC) to pin VBAT<sub>LIN</sub> (see [Pin Allocation of USB-to-CAN<sup>v2</sup> Automotive, p. 11](#)).











To ensure successful transmission of LIN messages:

- ▶ Connect external voltage before LIN messages are transmitted.
- ▶ Make sure, that the external voltage is not switched off and on during operating in LIN mode.

## 6 Operation

The implemented LEDs vary dependent on the variant of the USB-to-CAN<sup>V2</sup>.

### LED Arrays of the Different Variants

Compact	Professional	Automotive
USB 	USB 	USB 
		CAN1 LS 
CAN 	CAN1 	CAN1 
	CAN2 	CAN2 
		LIN 

### 6.1 USB LED

The USB LED reflects the status of the USB communication.

LED state	Description	Comments
Off	No communication	Device not initialized, check power supply. Device not connected to USB port.
Green	Communication possible	Device is ready for use.
Red flashing	State changes between <i>power saving</i> and <i>active</i>	Changing power state.

### 6.2 CAN LED

The CAN LED reflects the status of CAN communication (CAN 1 and CAN 2).

LED state	Description	Comments
Off	No communication	No communication Device not connected to CAN.
Green flashing	Communication present	LED is triggered with each message.
Red flashing	Controller in error state	Controller is in state <i>error warning</i> or in state <i>error passive</i> , communication is possible.
Red	Bus off	Controller is in state <i>bus off</i> , no communication possible.

### 6.3 CAN1 LS LED



CAN low-speed functionality according to ISO 11898-3 is exclusively available on USB-to-CAN<sup>V2</sup> automotive.

LED state	Description	Comments
Off	CAN high-speed transceiver active	CAN high-speed interface is activated.
Orange (red and green)	CAN low-speed (fault tolerant) transceiver active	CAN low-speed interface is activated.

## 6.4 LIN LED



*LIN functionality is exclusively available on USB-to-CAN<sup>v2</sup> automotive.*

LED state	Description	Comments
Off	No communication	No communication on LIN bus or device not connected to LIN bus.
Green flashing	Communication present	LED is triggered with each message.
Red flashing	Communication with errors	On transmission or reception of a LIN message an error was detected.



## 7 Additional Components

### 7.1 CAN Bus Termination

There is no bus termination resistor for the CAN bus integrated in the interface. HMS Industrial Networks offers a bus termination resistor as a feed through connector.

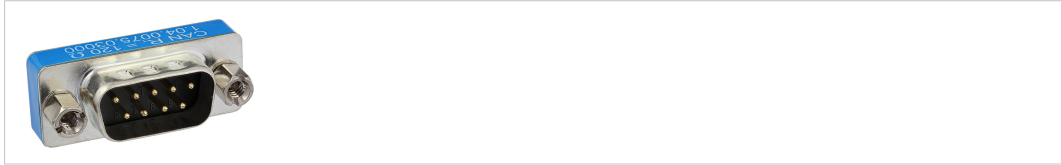


Fig. 6 CAN bus termination resistor

► For ordering information see [www.ixxat.com](http://www.ixxat.com).

### 7.2 Adapter Cable

HMS Industrial Networks offers a RJ45 to D-Sub 9 adapter cable.

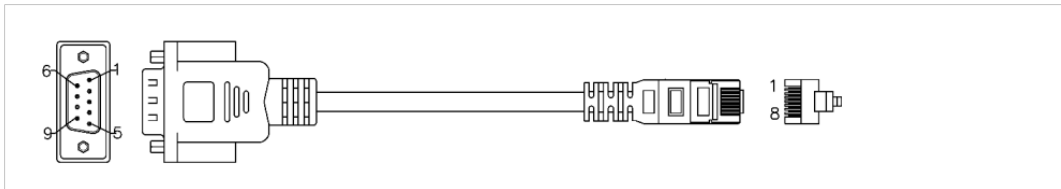


Fig. 7 Adapter cable

► For ordering information see [www.ixxat.com](http://www.ixxat.com).

## 8 Technical Data

USB interface	USB 2.0, Hi-Speed (480 MBit/s)
Microcontroller/RAM/Flash	32 Bit/192k Byte/512 kByte
Dimensions	80 x 50 x 22 mm
Weight	Approx. 100 g
Power supply	Via USB, 5 V DC/300 mA
Galvanic isolation	800 V DC/500 V AC for 1 min
Operating temperature	-20 to +70 °C
Storage temperature	-40 to +85 °C
Relative humidity	10 to 95 %, non condensing
Housing material	ABS plastic
Protection class	IP40

### CAN High-Speed, ISO 11898–2

CAN bitrates	10 kbit/s to 1 Mbit/s
CAN transceiver	TI SN65HVD251
CAN bus termination	None

### CAN Low-Speed, ISO 11898–3

CAN bitrates	10 kbit/s to 125 kbit/s
CAN transceiver	NXP TJA1054
CAN bus termination	Low-speed, $R_{TH}=R_{TL}=4.7\text{ k}\Omega$

### LIN

LIN bitrates	Max. 20 kbit/s
LIN transceiver	NXP TJA1020
LIN VBAT <sub>LIN</sub>	8 to 18 V DC, 12 V DC typical

## 9 Troubleshooting

### USB LED is off after installation.

No communication

- ▶ Make sure that the device is correctly connected to the USB port.
- ▶ Check the power supply.
- ▶ Make sure that device and driver are correctly initialized.

### Device is not working.

Adapter cable is not according to specification.

- ▶ Use an adapter cable according to the specification.

Extension cable is used.

- ▶ Remove the extension cable.
- ▶ According to the USB specification connect the interface directly or via an active USB hub to the computer.

Device is not initialized.

- ▶ Initialize the device with the CAN bus monitor (see [Connecting the CAN Fieldbus, p. 11](#)).

## 10 Cleaning

- ▶ Disconnect the device from power supply.
- ▶ Remove dirt with a soft, chemical untreated, dry cloth.

## 11 Support/Return Hardware

Observe the following information in the support area on [www.ixxat.com](http://www.ixxat.com):

- information about products
- FAQ lists
- installation notes
- updated product versions
- updates

### 11.1 Support

- ▶ For problems or support with the product request support at [www.ixxat.com/support](http://www.ixxat.com/support).
- ▶ If required use support phone contacts on [www.ixxat.com](http://www.ixxat.com).

### 11.2 Return Hardware

- ▶ Fill in the form for warranty claims and repair on [www.ixxat.com](http://www.ixxat.com).
- ▶ Print out the Product Return Number (PRN resp. RMA).
- ▶ Pack product in a physically- and ESD-safe way, use original packaging if possible.
- ▶ Enclose PRN number.
- ▶ Observe further notes on [www.ixxat.com](http://www.ixxat.com).
- ▶ Return hardware.

## 12 Disposal

- ▶ Dispose of product according to national laws and regulations.
- ▶ Observe further notes about disposal of products on [www.ixxat.com](http://www.ixxat.com).

# A Regulatory Compliance

## A.1 EMC Compliance (CE)



The product is in compliance with the Electromagnetic Compatibility Directive. More information and the Declaration of Conformity is found at [www.ixxat.com](http://www.ixxat.com).

## A.2 FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

<b>Product name</b>	USB-to-CAN <sup>v2</sup>
<b>Model</b>	compact/professional/automotive/embedded
<b>Responsible party</b>	HMS Industrial Networks Inc
<b>Address</b>	35 E. Wacker Dr, Suite 1700 Chicago , IL 60601
<b>Phone</b>	+1 312 829 0601



Any changes or modifications not expressly approved by HMS Industrial Networks could void the user's authority to operate the equipment.



This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and the receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Changes and Modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under FCC rules.

### A.3 Disposal and recycling



You must dispose of this product properly according to local laws and regulations. Because this product contains electronic components, it must be disposed of separately from household waste. When this product reaches its end of life, contact local authorities to learn about disposal and recycling options, or simply drop it off at your local HMS office or return it to HMS.

For more information, see [www.hms-networks.com](http://www.hms-networks.com).

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