USB-to-CAN^{V2}

Compact | Embedded | Automotive | Professional

USER MANUAL

Important User Information

Disclaimer

The information in this document is for informational purposes only. Please inform HMS Networks of any inaccuracies or omissions found in this document. HMS Networks disclaims any responsibility or liability for any errors that may appear in this document.

HMS Networks reserves the right to modify its products in line with its policy of continuous product development. The information in this document shall therefore not be construed as a commitment on the part of HMS Networks and is subject to change without notice. HMS Networks makes no commitment to update or keep current the information in this document.

The data, examples and illustrations found in this document are included for illustrative purposes and are only intended to help improve understanding of the functionality and handling of the product. In view of the wide range of possible applications of the product, and because of the many variables and requirements associated with any particular implementation, HMS Networks cannot assume responsibility or liability for actual use based on the data, examples or illustrations included in this document nor for any damages incurred during installation of the product. Those responsible for the use of the product must acquire sufficient knowledge in order to ensure that the product is used correctly in their specific application and that the application meets all performance and safety requirements including any applicable laws, regulations, codes and standards. Further, HMS Networks will under no circumstances assume liability or responsibility for any problems that may arise as a result from the use of undocumented features or functional side effects found outside the documented scope of the product. The effects caused by any direct or indirect use of such aspects of the product are undefined and may include e.g. compatibility issues and stability issues.

Table of Contents

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 who are familiar with CAN, LIN and the applicable standards. 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 *VCI Driver*	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
2.5	March 2019	Layout changes
2.6	June 2019	New disclaimer, rebranding
2.7	December 2021	VCI support pages, restrictions for not galvanically isolated versions, and UKCA compliancy information added

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

Safety advice is structured as follows:

> **!**   Cause of the hazard!
>
> Consequences of not taking remediate action.
>
> How to avoid the hazard.

Safety signs and signalwords are used dependent on the level of the hazard.

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

> **!**   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.

> ⚠ **Caution**
> This instruction must be followed to avoid a risk of personal injury.

> ⚠ **WARNING**
> This instruction must be followed to avoid a risk of death or serious injury.

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 Instructions

► Protect product from moisture and humidity.

► Protect product from too high or too low temperature (see *Technical Data, p. 15*).

► Protect product from fire.

► Do not paint the product.

► Do not modify or disassemble the product. Service must be carried out by HMS Industrial Networks.

► 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^{V2} Embedded is intended for installation in computer systems with closed housing. The USB-to-CAN^{V2} Compact, Professional and Automotive are intended for the connection to a computer via the USB interface.

Product versions that are not galvanically isolated are only allowed to operate inside buildings in CAN networks of maximally 30 m length (order number 1.01.0281.11001).

3 Scope of Delivery

Included in the scope of delivery:

• USB-to-CAN^{V2} interface

• only version professional and automotive: 2 x RJ45 to D-Sub 9 adapter cable

• Installation Guide *VCI Driver*

• User Manual *USB-to-CAN^{V2}*

The following equipment can be ordered separately:

• CAN bus termination

• RJ45 to D-Sub 9 adapter cable

Drivers for Windows, Linux and real-time operating systems, including programming examples, CAN bus monitor and software design guides are available on www.ixxat.com/support.

4 Product Description

The USB-to-CAN^{V2} 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^{V2} Compact and Embedded

Fig. 1   USB-to-CAN^{V2} compact (D-Sub 9 and RJ45)
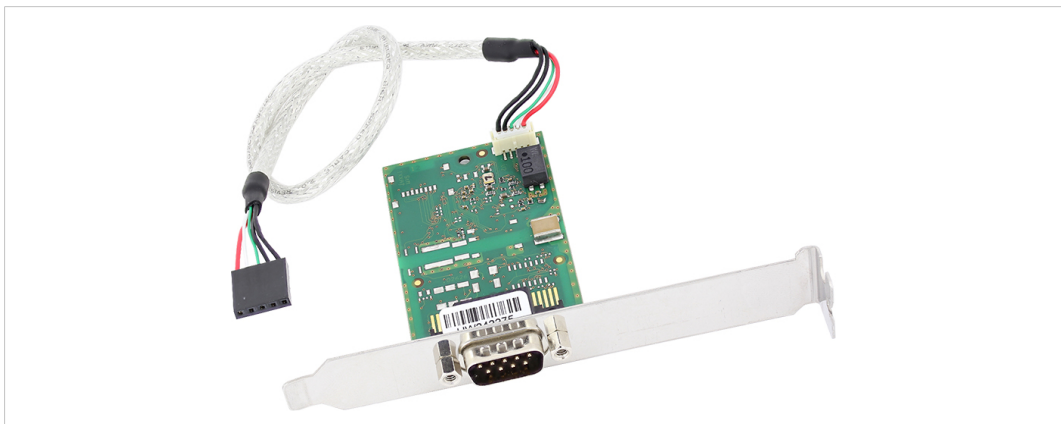

Fig. 2   USB-to-CAN^{V2} embedded

- USB 2.0 Hi-Speed (480 MBit/s)
- 1 x CAN high-speed channel according to ISO 11898-2: 2016
- optional galvanic CAN bus isolation
- fieldbus connection:
    - compact: D-Sub 9 or RJ45
    - embedded: D-Sub 9

4.2 USB-to-CAN^{V2} Professional

Fig. 3 USB-to-CAN^{V2} professional

- USB 2.0 Hi-Speed (480 MBit/s)

- 2 x CAN high-speed channels according to ISO 11898-2: 2016

- 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^{V2} Automotive

Fig. 4 USB-to-CAN^{V2} automotive

- USB 2.0 Hi-Speed (480 MBit/s)

- 2 x CAN high-speed channels according to ISO 11898-2: 2016,
  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

> ⓘ *The VCI driver is constantly improved and expanded! Check if a newer version is available on www.ixxat.com/driver-windows.*

▶ Download the latest VCI driver from www.ixxat.com/driver-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/driver-linux and www.ixxat.com/driver-real-time.

5.2 Installing the Hardware

5.2.1 Connecting USB

> ❗ Connection disturbance possible if extension cable or longer cable is used!
>
> HMS recommends connecting the interface directly with the included cable or via an active USB hub to the computer according to the USB specification.

> ❗ 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 MΩ 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^{V2} 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^V2 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

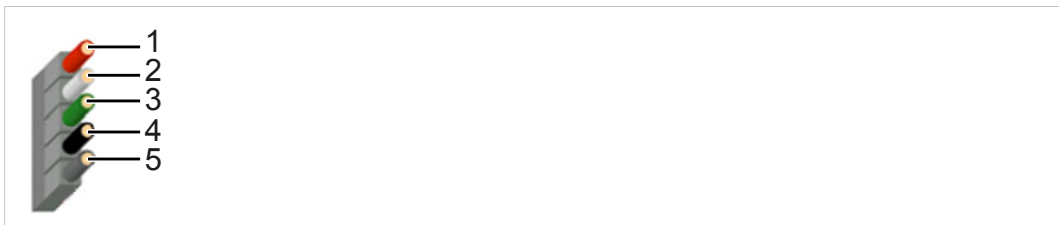• Assignment corresponds to PC standard for internal USB devices.

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 MΩ 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.

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

Pin Allocation of USB-to-CAN�V² Compact and Embedded		
	Pin No.	
Signal	**RJ45**	**D-Sub 9**
CAN high	1	7
CAN low	2	2
CAN GND	3, 7	3, 6

Other pins are not connected.

Pin Allocation of USB-to-CAN�V² Professional			
	RJ45, Pin No.		**Adapter cable**
Signal	**CAN 1**	**CAN 2**	**D-Sub 9, Pin No.**
CAN high	1	1	7
CAN low	2	2	2
CAN GND	3, 7	3, 7	3, 6

Other pins are not connected.

Pin Allocation of USB-to-CAN�V² Automotive			
	RJ45, Pin No.		**Adapter cable**
Signal	**CAN 1**	**CAN 2**	**D-Sub 9, Pin No.**
CAN high	1	1	7
CAN low	2	2	2
CAN GND	3, 7	3, 7	3, 6
CAN high LS	4	-	4
CAN low LS	5	-	1
LIN	-	6	5
VBAT$_{LIN}$	-	8	9

▶ If necessary install a bus termination (see *CAN Bus Termination, p. 14*).

▶ 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�V² 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

ℹ️   *LIN functionality is exclusively available on the USB-to-CAN^{V2} automotive.*

ℹ️   *Power consumption is limited by a 1 kΩ resistor.*

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 kΩ 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$_{LIN}$ (see *Pin Allocation of USB-to-CAN^{V2} Automotive, p. 10*).

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^{V2}.

| LED Arrays of the Different Variants		
Compact	**Professional**	**Automotive**
USB ⬭	USB ⬭	USB ⬭
		CAN1 LS ⬭
CAN ⬭	CAN1 ⬭	CAN1 ⬭
	CAN2 ⬭	CAN2 ⬭
		LIN ⬭

6.1 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 *power saving* and *active*	Changing power state.
Red	No USB driver	Check if correct VCI version is installed.

6.2 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 *error warning* or in state *error passive*, communication is possible.
Red	Bus off	Controller is in state *bus off*, no communication possible.

6.3 CAN1 LS LED

> ℹ️ *CAN low-speed functionality according to ISO 11898-3 is exclusively available on USB-to-CAN^{V2} 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^{V2} 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.

7.2 Adapter Cable

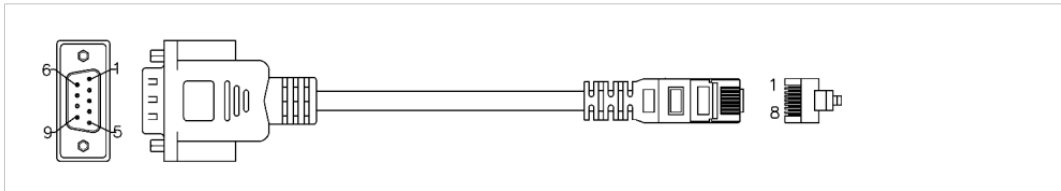HMS Industrial Networks offers a RJ45 to D-Sub 9 adapter cable.

Fig. 7 **Adapter cable**

► For ordering information see www.ixxat.com.

8 Technical Data

USB interface	USB 2.0, Hi-Speed (480 MBit/s)
Microcontroller/RAM/Flash	32 Bit/192 kByte/512 kByte
Dimensions	80 x 50 x 22 mm
Weight	Approx. 100 g
Power supply	Via USB, 5 V DC/300 mA
Galvanic isolation	1000 V DC for 1 s 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: 2016	
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, $R_{TH}=R_{TL}=4.7$ kΩ

LIN	
LIN bitrates	Max. 20 kbit/s
LIN transceiver	NXP TJA1020
LIN VBAT$_{LIN}$	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.

USB LED is red.	
No appropriate USB driver is installed.	► Check if the correct VCI driver version is installed.

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. 10*).

10 Cleaning

► Disconnect the device from power supply.

► Remove dirt with a soft, chemical untreated, dry cloth.

11 Support/Return Hardware

11.1 Support

► To contact support, go to www.ixxat.com/technical-support/contact-technical-support.

► Scroll down and click button **mysupport.hms.se** to register a support case.

11.2 Return Hardware

► On www.ixxat.com/support/product-returns click button **Portal** to access the support portal.

► In the support portal select **Submit Product Return (RMA)**.

► Read the information and click **Create RMA Case**.

► Register a support account and sign in.

► Fill in the form for warranty claims and repair.

► 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.

► Return hardware.

12 Disposal

► Dispose of product according to national laws and regulations.

► Observe further notes about disposal of products on www.ixxat.com.

This page intentionally left blank

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.

A.2   EMC Compliance (UKCA)

The product is in compliance with the Electromagnetic Compatibility Regulations 2016. The Declaration of Conformity is available at www.ixxat.com

A.3   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.

Product name	USB-to-CAN^{V2}
Model	compact/professional/automotive/embedded
Responsible party	HMS Industrial Networks Inc
Address	35 E. Wacker Dr, Suite 1700 Chicago , IL 60601
Phone	+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.4   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.