IXXAT®

USB-to-CAN^{V2}

compact | embedded | automotive | professional

HMS *Connecting Devices*™

Important User Information

Liability

Every care has been taken in the preparation of this document. Please inform HMS Industrial Networks of any inaccuracies or omissions. The data and illustrations found in this document are not binding. We, HMS Industrial Networks, reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and therefore should not be considered as a binding description of the range of functions (neither for future product versions). HMS Industrial Networks assumes no responsibility for any errors that may appear in this document.

There are many applications of the described product. Those responsible for the use of this device must ensure that all the necessary steps have been taken to verify that the applications meet all performance and safety requirements including any applicable laws, regulations, codes, and standards.

HMS Industrial Networks will under no circumstances assume liability or responsibility for any problems that may arise as a result from improper use or use that is not in accordance with the documented features of this product.

The examples and illustrations in this document are included solely for illustrative purposes.

Intellectual Property Rights

HMS Industrial Networks has intellectual property rights relating to technology embodied in the product described in this document. These intellectual property rights may include patents and pending patent applications in the USA and other countries.

Trademark Acknowledgements

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

Table of Contents

1   User Guide

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

1.1   Related Documents

Document	Author
VCI Installation Guide	HMS

1.2   Document History

Version	Date	Description
2.0	December 2016	Revised and edited in new design

1.3   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.

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

> **ⓘ** *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 and Dangers

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.
>
> Make sure shield of interface is connected with device plug and plug on other side.
>
> Use exclusively shielded cables.

2.2   General Safety Notes

▶   Protect product from moisture and humidity.

▶   Protect product from too high or too low temperature (see *Technical Data, p. 13*).

▶   Protect product from fire.

▶   Don't throw, drop or try to bend the product.

▶   Don't paint the product.

▶   Don't modify or disassemble the product. Service must be carried out by HMS Industrial
    Networks.

▶   Don't use modified products.

▶   Store products in dry and dust-free place.

3   Scope of Delivery

Included in the scope of delivery:

- USB-to-CAN^{V2} interface

- only version professional and automotive: 2 x RJ45 to Sub-D9 adapter cable

- only version embedded: internal USB cable

- CD with driver, programming examples, CAN bus monitor and software design guide

- *VCI Installation Manual*

- *USB-to-CAN^{V2} User Manual*

The following equipment can be ordered separately:

- CAN bus termination

- RJ45 to Sub-D9 adapter cable

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 (Sub-D9 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
- optional galvanic CAN bus isolation
- fieldbus connection:
    - compact: Sub-D9 or RJ45
    - embedded: Sub-D9

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
- galvanic CAN bus isolation (both CAN channels are on the same potential)
- fieldbus connection: 2 x RJ45
- 2 x RJ45 to Sub-D9 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,
  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
  switch-able via software
- galvanic fieldbus isolation (all fieldbus channels are on the same potential)
- fieldbus connection: 2 x RJ45
- 2 x RJ45 to Sub-D9 adapter cable

5   Installation

5.1   Installing the Software

For the operation of the interface a driver is needed.

Windows

▶   Install VCI driver (see Installation manual VCI).

Linux and Real-Time Operating Systems

▶   Observe information about supported operating systems and interfaces on
         www.ixxat.com.

5.2   Installing the Hardware

5.2.1   Connecting USB

!	Malfunction caused by extension cable!
	Don't use an extension cable.

!	Insufficient power supply!
	Connect 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. 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 VCI driver is installed.

▶   Plug USB connector in 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 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 power supply is correctly connected and of 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 driver is installed.

▶ Turn off computer.

▶ Pull power cord.

▶ Open computer case according to instructions of computer manufacturer.

▶ Mount bracket with embedded board in suitable slot.

▶ Plug small plug of the USB cable in USB connector of the embedded board.

▶ Plug USB connector in suitable slot on the computer main board.

▶ Close computer case.

▷ Hardware installation is complete.

5.2.3   Connecting CAN Fieldbus

The assignment of the fieldbus connectors (Sub-D9 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. 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 shields of the CAN cables directly to ground.*

Pin Allocation of USB-to-CAN^{V2} Compact and Embedded

	Pin No.	
Signal	**Sub-D9**	**RJ45**
CAN-High	7	1
CAN-Low	2	2
GND	3, 6	3, 7

Pin Allocation of USB-to-CAN^{V2} Professional

	RJ45, Pin No.		Adapter cable
Signal	**CAN 1**	**CAN 2**	**Sub-D9, 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^{V2} Automotive

	RJ45, Pin No.		Adapter cable
Signal	**CAN 1**	**CAN 2**	**Sub-D9, 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$_{LIN}$	-	8	9

▶   If necessary install bus termination (see).

▶   Observe pin allocation.

▶   Connect CAN fieldbus connector to CAN fieldbus.

▶   Start CAN bus monitor on the computer.

▶   In CAN bus monitor adjust USB-to-CAN^{V2} properties according to fieldbus characteristics.

▶   Start 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 LIN Fieldbus

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

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.

▶   To use LIN interface as LIN master 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*).

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

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

The USB LED reflects the status of 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.

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 error warning or 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 ISO11898-3 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

ℹ️ *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.
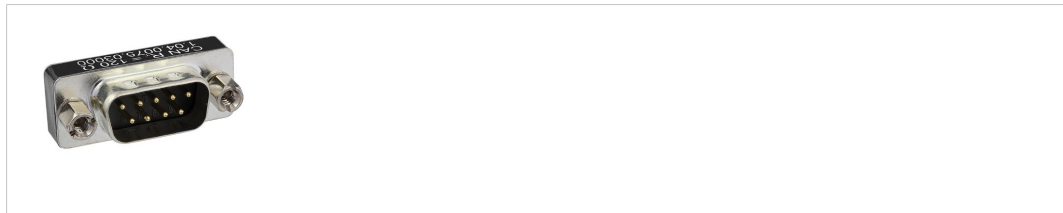

Fig. 6   CAN bus termination resistor

▶   For ordering information see www.ixxat.com.

7.2 Adapter Cable

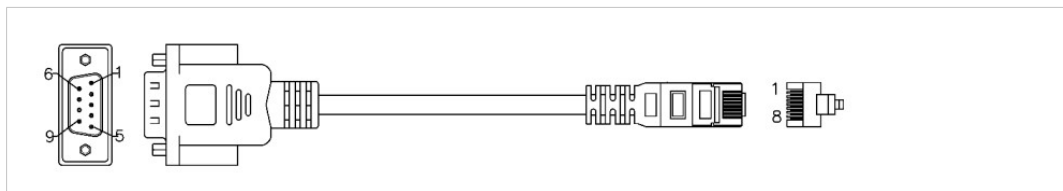HMS Industrial Networks offers a RJ45 to Sub-D9 adapter cable.

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/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 - 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, $R_{TH}=R_{TL}=4.7$ 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 device is correctly connected to USB port.

▶ Check power supply.

▶ Make sure that device and driver are correctly initialized.

Device is not working.

Adapter cable is not according to specification.

▶ Use adapter cable according to specification.

Extension cable is used.

▶ Remove extension cable.

Device is not initialized.

▶ Initialize device with CAN bus monitor (see *Connecting CAN Fieldbus, p. 10*).

10   Cleaning

▶   Disconnect device from power supply.

▶   Remove dirt with soft, chemical untreated, dry cloth.

11   Support/Return Hardware

Observe the following information in the support area on 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.

▶   If required use support phone contacts on www.ixxat.com.

11.2   Return Hardware

▶   Fill in the form for warranty claims and repair on 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.

▶   Return hardware.

12   Disposal

▶   Dispose of product according to national laws and regulations.

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

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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 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.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.

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