Important User Information

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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 who are familiar with CAN, CAN FD, 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

<table>
<thead>
<tr>
<th>Document</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Guide</td>
<td>HMS</td>
</tr>
<tr>
<td>VCI Driver</td>
<td>HMS</td>
</tr>
</tbody>
</table>

1.3 Document History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>January 2017</td>
<td>First release</td>
</tr>
<tr>
<td>1.1</td>
<td>February 2017</td>
<td>Minor corrections, added FCC compliance statement and info about USB specification and extension cable</td>
</tr>
<tr>
<td>1.2</td>
<td>April 2018</td>
<td>Added trademark information, changes in chapter LIN interface</td>
</tr>
<tr>
<td>1.3</td>
<td>August 2018</td>
<td>Added information about resistor in LIN mode, target audience and intended use</td>
</tr>
<tr>
<td>1.4</td>
<td>June 2019</td>
<td>Layout changes</td>
</tr>
</tbody>
</table>

1.4 Trademark Information

Ixxat® is a registered trademark of HMS Industrial Networks. 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.

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. 14).
► 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, CAN-FD and LIN networks. The USB-to-CAN\[sup\]FD\[/sup\] Embedded is intended for installation in computer system with closed housing. The USB-to-CAN\[sup\]FD\[/sup\] Compact 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\[sup\]FD\[/sup\] interface
- only variant automotive: 2 x RJ45 to D-Sub 9 adapter cable
- only variant embedded: slot bracket and internal USB cable
- CD with driver, programming examples, canAnalyser and software design guide
- VCI Driver Installation Guide
- USB-to-CAN\[sup\]FD\[/sup\] User Manual

The following equipment can be ordered separately:

- CAN bus termination
- RJ45 to D-Sub 9 adapter cable
## 4 Product Description

The USB-to-CAN\textsuperscript{FD} is an active USB interface which enables the user to monitor and control up to two ISO CAN FD or non-ISO CAN FD or CAN High Speed channels and a LIN channel, depending on the variant.

### 4.1 USB-to-CAN\textsuperscript{FD} Compact/Embedded

- USB 2.0 Hi-Speed (480 MBit/s)
- 1 x CAN FD interface with three operation modes:
  - ISO CAN FD according ISO 11898-2
  - non-ISO CAN FD
  - CAN high-speed according ISO 11898-2
- galvanic CAN bus isolation
- fieldbus connection:
  - compact: D-Sub 9 or RJ45
  - embedded: D-Sub 9
- variant embedded: slot bracket and internal USB cable
4.2 **USB-to-CAN\(^{FD}\) Automotive**

- USB 2.0 Hi-Speed (480 MBit/s)
- 2 x CAN FD interface with three operation modes:
  - ISO CAN FD according ISO 11898-2
  - non-ISO CAN FD
  - CAN high-speed according ISO 11898-2
- Operation mode can be set for each port individually.
- 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. The USB-to-CAN® is only supported by VCI V4 or newer.

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.

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 MΩ resistor and a 10 nF capacitor. The shields of the CAN connectors of the variant automotive are connected directly together.

USB-to-CAN® Compact/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 the 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.
USB-to-CAN® 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 recommend type.

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

![Standard wire assignments 1x5 header connector female](image)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red: +5 V/voltage +/VCC</td>
</tr>
<tr>
<td>2</td>
<td>White: D-/data-/USB-</td>
</tr>
<tr>
<td>3</td>
<td>Green: D+/data+/USB+</td>
</tr>
<tr>
<td>4</td>
<td>Black: GND/voltage-/ground</td>
</tr>
<tr>
<td>5</td>
<td>Black: S-GND/over current/shielding</td>
</tr>
</tbody>
</table>

- Make sure that the driver is installed.
- Turn off the computer.
- Pull the power cord.
- Open the computer case according to the instructions of the computer manufacturer.
- Mount the slot bracket with embedded board in 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 connector on the computer main board.
- Close the computer case.
  → Hardware installation is complete.
5.2.2 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. The shields of the CAN connectors of the variant automotive are connected directly together.

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

<table>
<thead>
<tr>
<th>Pin Allocation USB-to-CAN™ Compact/Embedded</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal</strong></td>
</tr>
<tr>
<td>CAN high</td>
</tr>
<tr>
<td>CAN low</td>
</tr>
<tr>
<td>CAN GND</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin Allocation USB-to-CAN™ Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RJ45, Pin No.</strong></td>
</tr>
<tr>
<td>CAN high</td>
</tr>
<tr>
<td>CAN low</td>
</tr>
<tr>
<td>CAN GND</td>
</tr>
<tr>
<td>LIN</td>
</tr>
<tr>
<td>VBATLIN</td>
</tr>
</tbody>
</table>

► If necessary install bus termination (see CAN Bus Termination, p. 13).
► Observe the pin allocation.
► Connect the CAN fieldbus connector to the CAN fieldbus.
► Start canAnalyser on the computer.
► In canAnalyser adjust the USB-to-CAN™ properties according to fieldbus characteristics:

- To activate CAN FD, activate the checkbox **Use CAN FD format**.
- To use ISO CAN FD frames, activate the checkbox **Use ISO conform frame**.
- To use non-ISO CAN FD frames, deactivate the checkbox **Use ISO conform frame**.

ISO CAN FD frames and non-ISO CAN FD frames are incompatible!

- Select predefined CAN FD bitrate in drop-down list **Bitrate**.

With a predefined CAN FD bitrate the CAN FD standard bit timing and the CAN FD fast bit timing are specified and bit rate switching is enabled.

► Define the CAN messages to be transmitted in the transmit window of the canAnalyser.
► To transmit CAN messages with flexible data rate, activate the boxes **FDF** and **Fast**.

Devices which only support CAN 2.0 (CAN high-speed) destroy CAN FD telegrams!

Only use CAN FD format in networks purely using CAN FD devices or with CAN 2.0 devices unplugged or switched to standby.
Start canAnalyser communication.

- Received CAN messages are shown in the receive window of the canAnalyser.
- CAN LED is green flashing with each CAN message.

### 5.2.3 Connecting the LIN Fieldbus

**LIN functionality is only available on USB-to-CAN® automotive variant with LIN interface.**

**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 see *Technical Data, p. 14*) to pin VBATLIN (see *Pin Allocation USB-to-CAN® Automotive, p. 10*).

To ensure successful transmission of LIN messages:

- Connect the 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™.

### LED Arrays of the Different Variants

<table>
<thead>
<tr>
<th></th>
<th>Compact</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB</td>
<td></td>
<td>USB</td>
</tr>
<tr>
<td>CAN</td>
<td></td>
<td>CAN1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAN2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LIN</td>
</tr>
</tbody>
</table>

6.1 USB LED

The USB LED reflects the status of the USB communication.

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

6.2 CAN LED

The CAN LEDs reflect the status of the CAN communication (CAN 1 and CAN 2).

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

6.3 LIN LED

- **Important:** LIN functionality is exclusively available on USB-to-CAN™ automotive.

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>No communication</td>
<td>No communication on LIN bus or device not connected to LIN bus.</td>
</tr>
<tr>
<td>Green flashing</td>
<td>Communication present</td>
<td>LED is triggered with each message.</td>
</tr>
<tr>
<td>Red flashing</td>
<td>Communication with errors</td>
<td>On transmission or reception of a LIN message an error was detected.</td>
</tr>
</tbody>
</table>
7 Additional Components

7.1 CAN Bus Termination

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

For ordering information see www.ixxat.com.

7.2 Adapter Cable

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

For ordering information see www.ixxat.com.
## 8 Technical Data

### 8.1 Compact/Embedded/Automotive

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB interface</td>
<td>USB 2.0, Hi-Speed (480 MBit/s)</td>
</tr>
<tr>
<td>Microcontroller/RAM/Flash</td>
<td>32 Bit/192k Byte/512 kByte</td>
</tr>
<tr>
<td>CAN controller/clock frequency</td>
<td>IFI CAN_FD IP/80 MHz</td>
</tr>
<tr>
<td>Dimensions</td>
<td>80 x 50 x 22 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 100 g</td>
</tr>
<tr>
<td>Power supply</td>
<td>Via USB, 5 V DC/300 mA</td>
</tr>
<tr>
<td>Galvanic isolation</td>
<td>800 V DC/500 V AC for 1 min</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20 to +70 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 to +80 °C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>10 to 95 %, non condensing</td>
</tr>
<tr>
<td>Housing material (compact/automotive)</td>
<td>ABS plastic</td>
</tr>
<tr>
<td>Protection class (compact/automotive)</td>
<td>IP40</td>
</tr>
</tbody>
</table>

**ISO CAN FD and non-ISO CAN FD, ISO 11898–2**

- CAN FD bitrates: 250/500 kbit/s arbitration rate with 500 to 10000 kbit/s data rate (predefined), user defined bitrate is possible.
- CAN FD transceiver: Microchip MCP2562FDT
- CAN bus termination: None

**CAN high-speed, ISO 11898–2**

- CAN bitrates: 10 kbit/s to 1 Mbit/s
- CAN transceiver: Microchip MCP2562FDT
- CAN bus termination: None

**LIN**

- LIN bitrates: Max. 20 kbit/s
- LIN transceiver: NXP TJA1020
- LIN VBAT,LIN: 8 to 18 V DC, 12 V DC typical
# Troubleshooting

## USB LED is off after installation.

<table>
<thead>
<tr>
<th>No communication</th>
<th>▶ Make sure that the device is correctly connected to the USB port.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▶ Check the power supply.</td>
</tr>
<tr>
<td></td>
<td>▶ Make sure that device and driver are correctly initialized.</td>
</tr>
<tr>
<td></td>
<td>▶ Make sure that the correct driver version is installed (VCI V4 or higher).</td>
</tr>
</tbody>
</table>

## Device is not working.

<table>
<thead>
<tr>
<th>Adapter cable is not according to specification.</th>
<th>▶ Use an adapter cable according to the specification.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB extension cable is used.</td>
<td>▶ Remove the USB extension cable.</td>
</tr>
<tr>
<td></td>
<td>▶ According to the USB specification connect the interface directly or via an active USB hub to the computer.</td>
</tr>
<tr>
<td>Device is not initialized.</td>
<td>▶ Initialize the device with canAnalyser (see Connecting the CAN Fieldbus, p. 10).</td>
</tr>
<tr>
<td>Device is attached via non-self powered USB hub.</td>
<td>▶ Only use USB 2.0 hi-speed hubs with separate power supply.</td>
</tr>
</tbody>
</table>
10  Cleaning

► Disconnect the device from the 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:

• 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

► 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.
A  Regulatory Compliance

A.1  EMC Compliance (CE)


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.

<table>
<thead>
<tr>
<th>Product name</th>
<th>USB-to-CAN®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Compact/Automotive/Embedded</td>
</tr>
<tr>
<td>Responsible party</td>
<td>HMS Industrial Networks Inc</td>
</tr>
<tr>
<td>Address</td>
<td>35 E. Wacker Dr, Suite 1700 Chicago, IL 60601</td>
</tr>
<tr>
<td>Phone</td>
<td>+1 312 829 0601</td>
</tr>
</tbody>
</table>

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.