Kvaser U100-X2 User's Guide

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https://www.kvaser.com

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We believe that the information contained herein was accurate in all respects at the time of printing. Kvaser AB cannot, however, assume any responsibility for errors or omissions in this text. Also note that the information in this document is subject to change without notice and should not be construed as a commitment by Kvaser AB.

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1 About this manual

This manual is intended for Kvaser U100-X2 users. This document contains a description of the hardware's properties and general instructions for connecting the device to a computer.

2 Introduction

This section will describe the functions and features of the Kvaser U100-X2.

2.1 Welcome to Kvaser U100-X2

Figure 1: Kvaser U100-X2

Kvaser U100-X2 is a small, yet powerful, CAN to USB interface. It provides real-time transmission and reception of standard and extended CAN messages on the bus with a high timestamp precision, and is compatible with applications that use Kvaser's CANlib.

This guide applies to Kvaser U100-X2 devices using at least firmware and driver versions listed in Table 1. For minimum compatible firmware and driver versions of Kvaser U100-X2 see Table 6 on Page 13.

Device	Product Number	Firmware	Driver (Windows/Linux)
Kvaser U100-X2	73-30130-01267-7	v3.24	v5.36 (kcany/mhydra)

Table 1: Firmware and driver versions needed to support all functionality present in this guide.

2.2 Major features of Kvaser U100-X2

- USB CAN interface.
- Powered through the USB connector.
- Supports CAN FD, up to 8 Mbit/s.
- Supports both 11-bit (CAN 2.0A) and 29-bit (CAN 2.0B active) identifiers.
- Lightweight robust housing made of glass fibre reinforced polyamide overmolded with TPE.
- Intuitive LED UI.
- Reinforced galvanic isolation. Tested according to EN 60335-1:2012 paragraph 13 with 5000 VAC rms applied for 60 seconds.
- Industrial grade temperature range, –40 °C to +85 °C.
- 20 000 msg/s, each timestamped with a resolution of 100 µs.
- Fully compatible with applications written for other Kvaser CAN hardware with Kvaser CANlib.
- Support for SocketCAN.
- Fully compatible with J1939, CANopen, NMEA 2000® and DeviceNet.
- IP67 rated housing.

3 Kvaser U100-X2 hardware

In this section you can read more about the CAN channels, power supply and LED indicators.

3.1 Hardware installation

The Kvaser U100-X2 may be inserted in any free USB socket on the host computer. You do not need to switch the power off before inserting or removing the device. For the Kvaser U100-X2 to communicate with the host computer, a compatible version of the Kvaser driver and firmware must be installed.

The driver is installed by running the file `kvaser_drivers_setup.exe`. For instructions on how to update the firmware, see Section 3.8, Updating the firmware, on Page 13. The latest version of the driver and firmware can be downloaded from www.kvaser.com/download.

The firmware is downloaded and installed directly on the Kvaser U100-X2 and the driver is installed on the host computer. After the driver has been installed on the host computer, the firmware may then be downloaded and installed on the Kvaser U100-X2.

3.2 USB connection

The USB connector for the Kvaser U100-X2 is a standard USB type "A" connector (see Figure 2).

Figure 2: A standard USB type "A" connector.

3.3 CAN connection

The Kvaser U100-X2 has one CAN channel.

The CAN connector for the Kvaser U100-X2 is the 5-pole M12 plug (see Figure 3 on Page 8) which has the pinning described in Table 2 on Page 8.

Figure 3: M12 5-pole CAN connector.

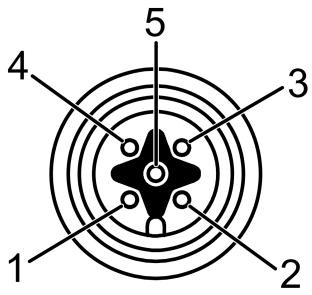

Figure 4: M12 5-pole CAN connector pinout.

M12 pin number	Function
1	Shield
2	Not connected
3	GND
4	CAN_H
5	CAN_L

Table 2: M12 5-pole pin configuration.

3.4 CAN bus termination

Every CAN bus must be terminated with a 120 Ohm resistor at each end of the bus. The Kvaser U100-X2 does not contain any CAN bus termination, because their inclusion could cause severe disturbance in a system which is already correctly terminated.

For laboratory or testing use, the exact value of the termination resistors is not always critical. Sometimes a single terminator is sufficient. For production, proper termination is essential. If you see error frames on the bus, you should check the termination.

To save yourself a lot of trouble, always terminate the CAN bus properly.

3.5 Power supply

The Kvaser U100-X2 is powered through the USB connector. Make sure the USB power source can supply enough current (500 mA). If using a USB hub, choose an externally powered one to be safe.

3.6 LED Indicators

A Kvaser U100-X2 device has two traffic LED bars where part of each LED bar is also used as a status area. The TX LED Bar has a status area towards the USB end of the bar, and the RX LED bar has a status area towards the CAN end of the bar. This is shown in Figure 5.

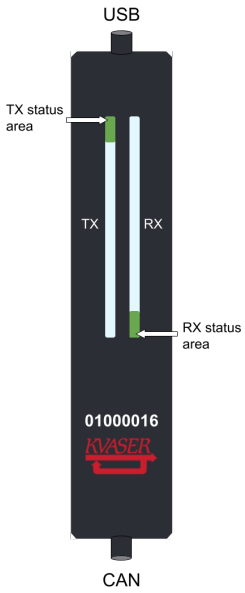

Figure 5: The TX and RX LED bars on the Kvaser U100-X2 include status areas.

Different colors are used for different types of information and different blink patterns define the current state, see Table 3 and Table 4 on Page 11.

Color	Information type
Yellow	Traffic
Green	Status
Red	Error
White	Alert
Blue	System

Table 3: Different types of information.

State	Definition
Off	The indicator is off and no light is emitted.
Slow Blink	The indicator is repeatedly turned on and off. The on and off phases are equal in time.
Fast Blink	The indicator is repeatedly turned on and off but with a higher frequency than Slow Blink. The on and off times are still equal.
On	The indicator is constantly emitting light.
Dynamic	The indicator is moving and/or increasing/decreasing in size.

Table 4: Definitions of the indicator states.

3.7 Interface mode

The device is in interface mode when connected to a computer via USB. If the status area is presenting a steady white light, the device is in interface mode, working correctly and ready to be used. When connected to a computer for the first time, the status area will Fast Blink with blue light until the Kvaser Drivers are installed and the device has automatically received a USB configuration. The status area will change from white to green when going bus on. Table 5 summarises the information shown in interface mode.

Description	Status area	LED bar
Power is on	On (White)	-
Waiting for USB configuration	Fast Blink (Blue)	-
CAN channel is bus on	On (Green)	-
CAN channel traffic	On (Yellow)	Dynamic (Yellow)
Error frame	-	Dynamic (Red)
CAN channel is error passive	Fast Blink (Red)	-
CAN overrun	On (Red)	-
Firmware update	Slow Blink (Blue)	-
Locate hardware	Slow Blink (White)	Slow Blink (White)

Table 5: LED inidications in interface mode.

The Kvaser U100-X2 has one TX LED Bar and one RX LED Bar. Each LED Bar has a status area, the TX LED Bar has a status area towards the USB end of the bar, and the RX LED bar has a status area towards the CAN end of the bar. This is shown in Figure 5 on Page 10.

The TX LED bar lit area grows from the USB end of the LED bar towards the CAN end of the bar as CAN TX traffic is increased. Likewise, the RX LED bar lit area grows from the CAN end of the LED bar towards the USB end of the bar as the message rate of the received traffic is increased, see Figure 6 on Page 12. In this example the unit is transmitting data, which shows a yellow TX status area. No CAN traffic is received and thus the RX status area is green.

The combined area lit by the TX LED bar and the RX LED bar is proportional to the current bus load, e.g. Figure 6 on Page 12 shows only transmitting CAN messages

Figure 6: The TX LED bar lights up from the USB side to the CAN side of the unit, while the RX LED bar lights up from the CAN side to the USB side of the unit.

at 50% bus load. Figure 7 on Page 12 shows two different bus load conditions. The image on the left shows the unit transmitting and receiving data corresponding to 50% bus load in each direction for a total of 100% bus load. The image on the right shows the unit transmitting data corresponding to 100% bus load.

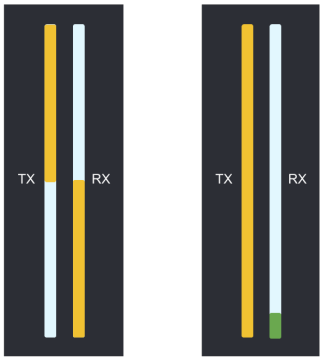

Figure 7: The yellow-lit area of the LED bars is proportional to the bus load. Both images indicate a bus load of 100%.

3.8 Updating the firmware

For the Kvaser U100-X2 to communicate with the host computer, compatible versions of the Kvaser CANlib (including driver) and firmware must be installed.

The latest versions of firmware and drivers can be downloaded for free at www.kvaser.com/download.

Connect the Kvaser U100-X2 to your host computer with the USB cable and start the update.exe application. A window opens showing the Firmware Update Instructions; read and follow those carefully.

To check the current firmware version, open "Kvaser Device Guide" which can be found in the Control Panel. Select "Kvaser U100-X2" in the tree view to the left, and click on the channel. The firmware revision information now appears in the right half of the window.

The absolute minimum firmware and driver versions needed in order to use Kvaser U100-X2 are listed in Table 6.

Device	Min. Firmware Version	Min. Driver Version
Kvaser U100-X2	v3.22.578	v5.31

Table 6: Minimum compatible driver and firmware versions of Kvaser U100-X2.

3.9 Technical data

In Table 7 below you will find the technical specifications of Kvaser U100-X2.

CAN Channels	1
CAN Connector	5-pole M12 plug
CAN Transceivers	ADM3055E (Compliant with ISO 11898-2)
CAN Controller	Built into the processor
Galvanic isolation	Yes, reinforced. Tested according to EN 60335-1:2012 paragraph 13 with 5000 VAC rms applied for 60 seconds
CAN Bit Rate	10 kbit/s to 1 Mbit/s
CAN FD Bit Rate	Up to 8 Mbit/s
Time stamp resolution	100 µs
Max message rate	20 000 msg/s per channel
Error Frame Detection	Yes
Error Frame Generation	No
Silent mode	No
Kvaser MagiSync	No
Kvaser *t* programming	No
Kvaser CANtegrity	No
Host interface	USB 2.0, standard USB type "A" connector
Host OS	Windows (7 or later), Linux
Power consumption	Typical 250 mA
Dimensions	38 x 128 x 26 mm for body
Cable length	USB 1.0 m, CAN 0.3 m
Weight	160 g including connectors
Operating temperature	−40 °C to +85 °C
Storage temperature	−40 °C to +85 °C
Relative humidity	0 % to 85 % (non-condensing)
IP Rating Housing	IP67
IP Rating CAN connector	IP67 Mated
IP Rating USB connector	IP40 Mated

Table 7: Technical Specifications

4 Troubleshooting

Use "Kvaser Device Guide" in the Control Panel to verify that the computer can communicate with the Kvaser U100-X2. If the firmware version shown is all zeros, there are communication problems. If the LED Bar or the status indication is not flashing or does not light up at all, check the power supply.

5 Safety Instructions

5.1 Intended Use

Kvaser interfaces are used to connect computer systems to CAN buses. The Kvaser U100-X2 is intended for connection to a computer via the USB port.

5.2 Usage Warning

WARNING FOR ALL USERS

WARNING! - YOUR USE OF THIS DEVICE MUST BE DONE WITH CAUTION AND A FULL UNDERSTANDING OF THE RISKS!

THIS WARNING IS PRESENTED TO INFORM YOU THAT THE OPERATION OF THIS DEVICE MAY BE DANGEROUS. YOUR ACTIONS CAN INFLUENCE THE BEHAVIOR OF A CAN-BASED DISTRIBUTED EMBEDDED SYSTEM, AND DEPENDING ON THE APPLICATION, THE CONSEQUENCES OF YOUR IMPROPER ACTIONS COULD CAUSE SERIOUS OPERATIONAL MALFUNCTION, LOSS OF INFORMATION, DAMAGE TO EQUIPMENT, AND PHYSICAL INJURY TO YOURSELF AND OTHERS. A POTENTIALLY HAZARDOUS OPERATING CONDITION IS PRESENT WHEN THE FOLLOWING TWO CONDITIONS ARE CONCURRENTLY TRUE: THE PRODUCT IS PHYSICALLY INTERCONNECTED TO A REAL DISTRIBUTED EMBEDDED SYSTEM; AND THE FUNCTIONS AND OPERATIONS OF THE REAL DISTRIBUTED EMBEDDED SYSTEM ARE CONTROLLABLE OR INFLUENCED BY THE USE OF THE CAN NETWORK. A POTENTIALLY HAZARDOUS OPERATING CONDITION MAY RESULT FROM THE ACTIVITY OR NON-ACTIVITY OF SOME DISTRIBUTED EMBEDDED SYSTEM FUNCTIONS AND OPERATIONS, WHICH MAY RESULT IN SERIOUS PHYSICAL HARM OR DEATH OR CAUSE DAMAGE TO EQUIPMENT, DEVICES, OR THE SURROUNDING ENVIRONMENT.

WITH THIS DEVICE, YOU MAY POTENTIALLY:

- CAUSE A CHANGE IN THE OPERATION OF THE SYSTEM, MODULE, DEVICE, CIRCUIT, OR OUTPUT.
- TURN ON OR ACTIVATE A MODULE, DEVICE, CIRCUIT, OUTPUT, OR FUNCTION.
- TURN OFF OR DEACTIVATE A MODULE, DEVICE, CIRCUIT, OUTPUT, OR FUNCTION.
- INHIBIT, TURN OFF, OR DEACTIVATE NORMAL OPERATION.
- MODIFY THE BEHAVIOR OF A DISTRIBUTED PRODUCT.
- ACTIVATE AN UNINTENDED OPERATION.
- PLACE THE SYSTEM, MODULE, DEVICE, CIRCUIT, OR OUTPUT INTO AN UNINTENDED MODE.

ONLY THOSE PERSONS WHO:
(A) ARE PROPERLY TRAINED AND QUALIFIED WITH RESPECT TO THE USE OF THE DEVICE,
(B) UNDERSTAND THE WARNINGS ABOVE, AND
(C) UNDERSTAND HOW THIS DEVICE INTERACTS WITH AND IMPACTS THE FUNCTION AND SAFETY OF OTHER PRODUCTS IN A DISTRIBUTED SYSTEM AND THE APPLICATION FOR WHICH THIS DEVICE WILL BE APPLIED, MAY USE THE DEVICE.

PLEASE NOTE THAT YOU CAN INTEGRATE THIS PRODUCT AS A SUBSYSTEM INTO HIGHER-LEVEL SYSTEMS. IN CASE YOU DO SO, KVASER AB HEREBY DECLARES THAT KVASER AB'S WARRANTY SHALL BE LIMITED TO THE CORRECTION OF DEFECTS, AND KVASER AB HEREBY EXPRESSLY DISCLAIMS ANY LIABILITY OVER AND ABOVE THE REFUNDING OF THE PRICE PAID FOR THIS DEVICE, SINCE KVASER AB DOES NOT HAVE ANY INFLUENCE ON THE IMPLEMENTATIONS OF THE HIGHER-LEVEL SYSTEM, WHICH MAY BE DEFECTIVE.

6 Disposal and Recycling Information

When this product reaches its end of life, please dispose of it according to your local environmental laws and guidelines.

For information about Kvaser's recycling programs, visit:
https://www.kvaser.com/en/kvaser/recycling-policy.html

7 Legal Acknowledgements

7.1 EU Regulatory Compliance

KVASER **EU Declaration of Conformity (DoC)**

We

Company Name:	Kvaser AB	City:	Mölndal
Postal address:	Aminogatan 25	Telephone number:	+46 31 886344
Postcode:	431 53	E-mail address:	sales@kvaser.com

declare that the DoC is issued under our sole responsibility and belongs to the following product:

Product: Kvaser U100-X2

Object of the declaration (identification of apparatus allowing traceability):
Product: Kvaser U100-X2
Type: 73-30130-01267-7

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:
Electromagnetic Compatibility (EMC) Directive 2014/30/EU (Art. 6)

RoHS recast Directive 2011/65/EU (Art. 4.1)

The following harmonised standards and technical specifications have been applied
(title, date of standard/specification):

EN 55032 (2015 + A11:2020)

EN 55035 (2017 + A11:2020)

EN IEC 63000 (2018)

Signed for and on behalf of:

Mölndal	2022-04-01	
Place of issue	Date of issue	Claes Haglund, Supply Chain and Quality Director

7.2 FCC Regulatory Compliance

KVASER

Federal Communications Commission (FCC) Compliance Information Statement

IDENTIFICATION OBJECT:
Product: Kvaser U100-X2
Type: 73-30130-01267-7

APPLICABLE COMPLIANCE STATEMENTS:
CFR Title 47 Part 15 §15.107, §15.109
This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received,
including interference that may cause undesired operation.

RESPONSIBLE PARTY (IN USA) NAME:
Kvaser Inc.
41650 Gardenbrook Road, Suite 130
Novi, MI 48375

Internet contact: support@kvaser.com

7.3 Patents, Copyrights and Trademarks

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DeviceNet is a trademark of Open DeviceNet Vendor Association, Inc.

NMEA 2000 is the registered trademark of the National Marine Electronics Association, Inc.

For information about Kvaser related CAN patents, see www.kvaser.com/patent.

8 Document Revision History

Version history for document UG_98232_U100-X2:

Revision	Date	Changes
1.0	2021-05-20	Initial version.
1.1	2021-09-09	Dropped mention of Hi-Speed CAN.
1.2	2022-01-24	Added connector types to Technical Data section, updated EU Declaration of Conformity.
1.3	2022-04-01	Minor textual changes, updated EU Declaration of Conformity.
1.4	2023-06-16	Updated text about galvanic isolation.
1.5	2024-03-15	Updated Kvaser logo.
1.6	2025-01-14	Updated the USB connector description. Minor textual changes.