Kvaser PCIEcan 1xCAN v3 User's Guide

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https://www.kvaser.com

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1 About this manual

This manual is intended for Kvaser PCIEcan 1xCAN v3 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 PCIEcan 1xCAN v3.

2.1 Welcome to Kvaser PCIEcan 1xCAN v3

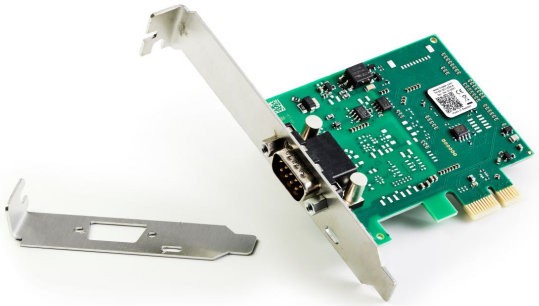

Figure 1: Kvaser PCIEcan 1xCAN v3

Kvaser PCIEcan 1xCAN v3 is a small, yet advanced, real time CAN interface that handles transmission and reception of standard and extended CAN messages on the bus with a high time stamp precision. The Kvaser PCIEcan 1xCAN v3 is compatible with applications that use Kvaser's CANlib.

This guide applies to Kvaser PCIEcan 1xCAN v3 devices using at least firmware and driver versions listed in Table 1. For minimum compatible firmware and driver versions of Kvaser PCIEcan 1xCAN v3 see Table 4 on Page 11.

Device	Product Number	Firmware	Driver (Windows/Linux)
Kvaser PCIEcan 1xCAN v3	73-30130-01433-6	v1.4	v5.52 (kcanf/kvpciefd)

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

2.2 Major features

- PCI Express CAN interface.
- Supports CAN FD, up to 8 Mbit/s.
- Quick and easy plug-and-play installation.
- Supports both 11-bit (CAN 2.0A) and 29-bit (CAN 2.0B active) identifiers.
- 100 % compatible with applications written for other Kvaser CAN hardware with Kvaser CANlib.
- High-speed CAN connection (compliant with ISO 11898-2), up to 1 Mbit /s.
- Fully compatible with J1939, CANopen, NMEA 2000® and DeviceNet.
- Supports silent mode for analysis tools – listen to the bus without interfering.
- Supports simultaneous usage of multiple Kvaser interfaces.
- Kvaser software-based TimeSync – time synchronization with a host-referenced clock source (see Section 4.5, Software-based TimeSync, on Page 11 for more details).
- Support for SocketCAN.
- Low profile board, includes low and high profile brackets.

2.3 Interface

Kvaser PCIEcan 1xCAN v3 provides a CAN bus interface through a standard PCI Express x1 interface.

2.4 Additional software and documentation

The Kvaser CANlib SDK includes everything you need in order to develop software applications interacting with Kvaser CAN and LIN hardware. The SDK contains full documentation and many sample programs, written in C, C++, C#, Delphi, Python and Visual Basic. Kvaser CAN and LIN hardware is built around the same common software API. Applications developed using one device type will run without modification on other device types.

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

3 Kvaser PCIEcan 1xCAN v3 hardware

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

3.1 Hardware installation

The Kvaser PCIEcan 1xCAN v3 may be inserted in any free PCI Express slot on the host computer. You do need to switch the power off before inserting or removing the device.

3.2 CAN channels

The Kvaser PCIEcan 1xCAN v3 has a single CAN channel with a 9-pin male D-SUB CAN connector (see Figure 2). See Section 4.2, CAN connectors, on Page 9 for pinout information.

Figure 2: CAN connector on Kvaser PCIEcan 1xCAN v3

3.3 Power supply

The Kvaser PCIEcan 1xCAN v3 is powered from the PCI Express connector.

3.4 LED Indicators

The Kvaser PCIEcan 1xCAN v3 has one yellow LED indicator that indicates the bus state (on/off) with a steady light for on and no light for off.

Figure 3: LED on the Kvaser PCIEcan 1xCAN v3.

3.5 Troubleshooting

Use "Kvaser Device Guide" in the Control Panel to verify that the computer can communicate with the Kvaser PCIEcan 1xCAN v3. If the firmware version shown is all zeros, there are communication problems.

4 Appendices

In this section you will find technical information about the Kvaser PCIEcan 1xCAN v3 and its connectors.

4.1 Technical data

In Table 2 below you will find the technical specifications of Kvaser PCIEcan 1xCAN v3.

CAN Channels	1
CAN Transceivers	MCP2561FD (Compliant with ISO 11898-2)
CAN Controller	Kvaser CAN IP in FPGA
Galvanic isolation	Yes
CAN Bit Rate	20 kbit/s to 1 Mbit/s
CAN FD Bit Rate	Up to 8 Mbit/s
Time stamp resolution	1 µs
Max message rate	20000 msg/s per channel
Error Frame Detection	Yes
Error Frame Generation	Yes
Silent mode	Yes
Kvaser t programming	No
Kvaser CANtegrity	No
Host interface	PCI Express
Host OS	Windows (7 or later), Linux.
Power consumption	Typically 700 mW idle plus max 150 mW per channel, i.e. max 850 mW for a single channel interface. Only uses 3.3 V.
Hardware configuration	Done by software.
Dimensions	Low profile, 86 x 69 mm
Weight	48 g
Operating temperature	−40 °C to +85 °C
Storage temperature	−40 °C to +85 °C
Relative humidity	0 % to 85 % (non-condensing.)

Table 2: Technical Specifications.

4.2 CAN connectors

Kvaser PCIEcan 1xCAN v3 devices that use the 9-pin D-SUB connector (see Figure 4 on Page 10) have the pinning described in Table 3 on Page 10.

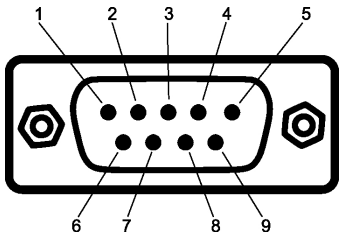

Figure 4: The D-SUB 9 connector pin numbers

D-SUB pin number	Function
1	Not connected
2	CAN_L
3	GND
4	Not connected
5	Not connected
6	Not connected
7	CAN_H
8	Not connected
9	Not connected

Table 3: Configuration of the 9-pin D-SUB

4.3 CAN bus termination

Every CAN bus must be terminated with a 120 Ohm resistor at each end of the bus. The Kvaser PCIEcan 1xCAN v3 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.

4.4 Updating the firmware

For the Kvaser PCIEcan 1xCAN v3 to communicate with the host computer, compatible versions of the Kvaser CANlib (including driver) and firmware or SocketCAN Device Drivers must be installed.

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

Connect the Kvaser PCIEcan 1xCAN v3 to your host computer.

For Linux based operating systems, instructions for how to update the firmware when using Kvaser CANlib can be found in the README in the kvflash directory. The corresponding instructions for SocketCAN are found in the kvflash-mmap directory. Read and follow the README carefully. Note: when updating PCIEcan, a complete shutdown of the computer is required in order to power cycle the device.

Use the example utility 'listChannels' in Kvaser CANlib to check the current firmware version.

If your computer is running Windows, start the update.exe application. A window opens showing the Firmware Update Instructions; read and follow those carefully.

To check the current firmware version for a computer running Windows, open "Kvaser Device Guide" which can be found in the Control Panel. Select "Kvaser PCIEcan 1xCAN v3" 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 PCIEcan 1xCAN v3 are listed in Table 4.

Device	Min. Firmware Version	Min. Driver Version
Kvaser PCIEcan 1xCAN v3	v1.0	v5.41

Table 4: Minimum compatible driver and firmware versions of Kvaser PCIEcan 1xCAN v3.

4.5 Software-based TimeSync

Kvaser PCIEcan 1xCAN v3 supports Kvaser software-based TimeSync. The feature enables the interface onboard clock to be aligned with a host-referenced clock source such that timestamps from events and messages are consistent and comparable across devices referencing the same clock source.

For detailed configuration and usage, see Section 4.5.1 Kvaser Timesync Details.

4.5.1 Kvaser Timesync Details

Software-based TimeSync is supported through Linux PTP. The driver exposes a device PTP Hardware Clock (PHC) as `/dev/ptpX` in Linux. This PHC can be disciplined to a clock source using, e.g., `phc2sys`. Drift correction is handled by `phc2sys`, the default servo update interval can typically be set to 1 second.

The software path is: Clock source -> phc2sys -> PHC (/dev/ptpX) -> Driver -> Disciplined timestamps

The driver does not perform drift compensation on its own. Time alignment requires running LinuxPTP user-space tools.

Following is an example of using `phc2sys` to discipline the device's exposed PHC to the host system clock `CLOCK_REALTIME`.

Load the driver and verify that the PHC device exists:

```
ls /dev/ptp*
```

Debug PHC access:

```
sudo phc_ctl -l7 /dev/ptpN
```

Discipline one PHC to host system clock:

```
sudo phc2sys -mq -O0 -s CLOCK_REALTIME -c /dev/ptpN
```

Discipline multiple PHCs to host system clock:

```
sudo phc2sys -mq -O0 -s CLOCK_REALTIME -c /dev/ptpN -c /dev/ptpM
```

Use external PPS/EXTTS reference instead of `CLOCK_REALTIME`:

```
sudo ts2phc -mq -s /dev/ptp1 -c /dev/ptpM
```

4.5.2 Automatic startup configuration

For automatic start when a Kvaser PHC appears, create the following systemd service file:

/etc/systemd/system/kvaser-timesync@.service

```
[Unit]
Description=Synchronize Kvaser device clock %I to system clock
Documentation=man:phc2sys
BindsTo=dev-%i.device
After=dev-%i.device

[Service]
Type=simple
ExecStart=/usr/sbin/phc2sys -O0 -s CLOCK_REALTIME -c /dev/%I
Restart=on-failure

[Install]
WantedBy=multi-user.target
```

And create the udev rules in */etc/udev/rules.d/99-kvaser-ptp.rules*:

```
ACTION=="add", SUBSYSTEM=="ptp", DRIVERS=="kvpciefd",
TAG+="systemd", ENV{SYSTEMD_WANTS}="kvaser-timesync@$kernel.service"
```

For SocketCAN, replace `kvpciefd` with `kvaser_pciefd`.

4.5.3 CANlib considerations

Disable automatic bus-on time zeroing before synchronization (`canIOCTL_SET_BUSON_TIME_AUTO_RESET`). If using CANlib time domains, apply offsets only after clocks are already synchronized.

5 Safety Instructions

5.1 Intended Use

Kvaser interfaces are used to connect computer systems to CAN buses. The Kvaser PCIEcan 1xCAN v3 is intended for connection to a computer via an available PCI Express slot.

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 PCIEcan 1xCAN v3

Object of the declaration (identification of apparatus allowing traceability):
Product: Kvaser PCIEcan 1xCAN v3
Type: 73-30130-01433-6

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 61000-6-2 (2019)

EN 61000-6-3 (2007 + A1:2011)

EN IEC 63000 (2018)

Signed for and on behalf of:

Mölndal	2022-11-17	
Place of issue	Date of issue	Kent Lennartsson, Research Manager

7.2 FCC Regulatory Compliance

KVASER

Federal Communications Commission (FCC) Compliance Information Statement

IDENTIFICATION OBJECT:
Product: Kvaser PCIEcan 1xCAN v3
Type: 73-30130-01433-6

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.
23881 Via Fabricante, Suite 503
Mission Viejo, CA 92691

Internet contact: support@kvaser.com

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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_98257_pciecan_1xcan_v3:

Revision	Date	Changes
1.0	2023-02-06	Initial version.
1.1	2023-08-30	Updated corresponding driver version in the Introduction section.
1.2	2024-01-23	Added firmware update instructions for Linux based operating systems.
1.3	2024-03-15	Updated Kvaser logo.
1.4	2026-05-05	Added section about Software-based TimeSync.