Kvaser USBcan II User's Guide

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2 Introduction

Since 1985, Kvaser has turned its full attention towards Controller Area Network and associated technologies. Based in Sweden, Kvaser develops and manufactures innovative and high performance PC interfaces for the global market.

2.1 Scope of this Document

This manual is applicable to the Kvaser products found in **Table 1**. Since the hardware is essentially the same this guide will refer to all these devices as just **USBcan II**.

Please note the product names have been changed from USBcan II -S, -D to USBcan II -HS, -HS/HS, -HS/LS, etc due the new product variants with support for Low-Speed and Single Wire CAN.

Device	Product Number	Description
USBcan HS Rugged	733-0130-00180-0	One High Speed CAN channel
USBcan HS/HS Rugged	733-0130-00181-7	Two High Speed CAN channels
USBcan II-HS	733-0130-00158-9	One High Speed CAN channel
USBcan II-HS/HS	733-0130-00159-6	Two High Speed CAN channels
USBcan II-HS/LS	733-0130-00174-9	One High Speed and one Low-Speed CAN channel
USBcan II HS/SWC	733-0130-00231-9	One High Speed and one Single Wire CAN channel
USBcan HS Mototron	733-0130-00178-7	One High Speed CAN channel
USBcan HS/HS Mototron	733-0130-00179-4	Two High Speed CAN channels

Table 1. The USBcan devices and their product numbers.

Note: This manual is **not** applicable to the following **obsolete** Kvaser products:

Device	Product Number	Replacement Products
USBcan S	733-0130-00134-3	USBcan II-HS
USBcan D	733-0130-00135-0	USBcan II-HS/HS

2.2   General Description

Kvaser USBcan II provides a dual channel CAN bus interface with a standard USB interface - one device for desktop and laptop.

The Kvaser USBcan II device is a USB 1.1 device. It also works with USB 2.0 in full-speed mode, i.e. 12 Mbit/s. It contains the powerful M16C micro-controller from Mitsubishi with two built-in CAN controllers. Kvaser USBcan II handles CAN messages with 11 bit (CAN 2.0A) as well as 29 bit (CAN 2.0B) identifiers. Remote frames can be sent and received without restrictions. It detects and generates error frames on the CAN bus. Kvaser USBcan II provides two completely independent CAN channels with two separate connectors. The CAN bus transceivers are integrated into the device.

All Kvaser USBcan II devices are also 100% compatible with applications using Kvaser's CANlib (i.e. applications written for LAPcan, LAPcan II, PCIcan, PCIcan II, PCcan, the old USBcan, etc.) It enables you to run any applications using Kvaser CANlib API on any Kvaser products, without the need of editing the code and recompile it. Example of supported PCI, PC/104-Plus, USB and PCMCIA interfaces:

- Kvaser PCIcanx II
- Kvaser PCIcanx
- Kvaser PC104+
- Kvaser PCIcan II
- Kvaser PCIcan
- Kvaser PCcan
- Kvaser Leaf Professional / SemiPro / Light
- Kvaser Memorator II
- Kvaser Memorator
- Kvaser LAPcan II
- Kvaser LAPcan

2.3   Kvaser USBcan II features

The Kvaser **USBcan II** is an improved version of the USBcan device. It is fully compatible with the USBcan but features:

- Improved performance
- Light-weight plastic casing
- Powered from either CAN bus or USB
- Large on-board RAM buffer for CAN-messages.
- Automatically switches power supply between CAN (primary) and USB (secondary), to reduce power drain of laptop battery.
- The second CAN connection can be ordered for High-Speed, Low Speed or Single Wire CAN.

USBcan II

The Kvaser **USBcan Rugged** differs from the USBcan II proper in the following respects:

- Rugged zinc housing
- IP54 classed
- Fault tolerant electrical CAN interface
- Very good EMI performance
- Fixed USB cable[1] with type "A" plug

USBcan Rugged

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[1] The length is around 1 ft (30 cm). Please contact us for different lengths.

3   Kvaser USBcan II Installation

The Kvaser USBcan II is Plug and Play. Kvaser provide installation packages for major operating systems, where each installation package contains all drivers for all Kvaser hardware. You have two options to locate the appropriate installation package: the Kvaser web site, www.kvaser.com, or the Kvaser CD that is shipped with your product. We do recommend that you install the drivers before you connect the Kvaser USBcan II or any other Kvaser product to your desktop or laptop. For detailed driver and hardware installation instructions as well as firmware upgrades, please visit the Kvaser web site.

3.1   The USB connector

The Kvaser USBcan II device may be connected to any free USB socket that is present on the host computer. You don't have to switch the power off before inserting or removing the device. It is good practice though to exit all applications using the CAN hardware before removing the USBcan II.

You may use any high-quality standard USB cable to connect the device to the computer. The USB cable that is included with the delivery is ca. 0.5 meters long. You can use USB cables up to 5 meters (as specified by the USB standard.)

For **USBcan II** proper (all units in plastic housing) you need a USB cable with a type "B" plug in one end and a type "A" plug in the other end.

If you want a longer cable for your **USBcan Rugged**, you can use an extension cable with a type "A" receptacle in one end and a type "A" plug in the other end. Do *not* extend the cable to more than 5 meters.

4   The Kvaser USBcan II hardware

This chapter describes the Kvaser USBcan II hardware.

4.1   Powering the USBcan II

You can supply power to the USBcan II in two different ways:

1. Through the USB connector
2. Through the CAN connector on channel 1

The USBcan II will use power from the CAN connector as its primary supply, that is, if you supply power on both the USB connector and on the CAN connector, the USBcan II will use the power from the CAN connector.

If you power the USBcan II through the CAN connector, you must supply 9 – 30 V DC.

If you power the USBcan II through the USB connector, you must supply 5 V DC, as per the USB specification.

4.2   Reference power

For USBcan II -HS/LS, -HS/SWC, you must also supply a reference voltage – the battery voltage – (V_{BAT}) on CAN channel 2, see Table 8 and Table 9.

4.2.1   USBcan II HS/LS
It is used by the transceiver to detect whether CAN_H and/or CAN_L are shorted to the system voltage. The reference voltage is dependent on your system and must be in the interval 5 – 27 V DC.

4.2.2   USBcan II HS/SWC
The reference voltage is used as a reference voltage when transmitting and receiving WAKEUP frames. It **must** be connected to ensure proper behaviour of the transceiver. The maximum input voltage range is 6 – 27V. Operation above 12V is not recommended.

4.3 The CAN Channels

The standard USBcan II has two independent I/O ports (CAN channels) depicted in Figure 1. The first channel, Channel 1, is marked with '1'; the second, Channel 2, is not marked. See Figure 2.
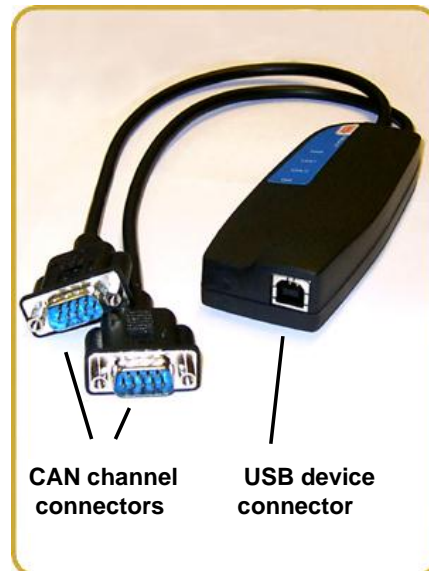

Figure 1. Connectors on the USBcan II.

Figure 2. The channels on the USBcan II (channel 2 is not marked).

4.4   The LEDs

The LED's have somewhat different meaning on the different hardware. See Table 2 for USBcan II or Table 3 for USBcan Rugged.

Figure 3. USBcan II LED configuration.

Device	LED 1 (Green)	LED 2 (Yellow)	LED 3 (Yellow)	LED 4 (Red)
USBcan II with dual CAN channels	Power ON (The device is connected to the computer).	CAN traffic on channel 1.	CAN traffic on channel 2.	Error Frame or Device Error. Some kind of error has occurred, check the driver status to find out what is wrong.
USBcan II with single CAN channel	Power ON (The device is connected to the computer).	CAN traffic on channel 1.	N/A	Error Frame or Device Error. Some kind of error has occurred, check the driver status to find out what is wrong.
All USBcan II	Slow flash: Waiting for USB connection with the PC. (firmware version 2.4 and newer)			

Table 2. The USBcan II LED configuration (see Figure 3.)

Figure 4. USBcan Rugged. LED configuration.

Device	LED 1 (Red, denoted 'CAN')	LED 2 (Red, denoted 'PWR')
USBcan HS/HS Rugged	CAN traffic on either channel.	Power ON (The device is connected to the computer).
USBcan HS Rugged	CAN traffic on channel 1.	Power ON (The device is connected to the computer).

Table 3. The USBcan Rugged LED configuration (see Figure 4.)

4.5 Technical data

All technical specifications are listed here.

4.5.1 Specifications common to USBcan II and USBcan Rugged

CAN channels	2 (CAN 2.0A and 2.0B active)
CAN Transceivers	TJA 1050 (ISO 11898 compliant) **Optional**: TJA 1054 or AU5790 (only channel 2)
CAN Controller	Built into the M16C
Microcontroller	Mitsubishi M16C/6N, 256 kB Flash and 10 kB RAM.
Bit rate, CAN bus	50 kbit/s to 1 Mbit/s (all high-speed channels) 20 kbit/s to 125 kbit/s (low-speed channel on USBcan II HS/LS)
Timestamp resolution	10 µs
Error Frame Detection	Yes
Error Frame Generation	Yes
Error Counters Reading	Yes
Silent Mode	Yes
Hardware requirements	IBM PC AT or 100% compatible; USB 1.1 host socket (USB 2.0 works in 1.1 mode).
USB interface	USB 1.1, and USB 2.0 in full-speed (12 Mbit/s) mode. The USBcan II acts as an USB DEVICE.
USB speed	12 Mbit/s (so-called *full speed*)
Power consumption	5V and ca. 130mA if powered from the USB side. Ca. 850mW (9 – 30 V DC) if powered from the CAN bus connector.
Software requirements[2]	Windows XP or later. (For other operating systems, see Kvaser web or contact Kvaser support.)
Configuration	Done by software (Plug & Play)

Table 4. Technical specifications for USBcan II and USBcan Rugged.

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[2] Contact us for other operating systems.

4.5.2   Additional technical specifications for USBcan II

Dimensions (W*L*H)	46 mm * 115 mm * 22 mm (1.8 x 4.5 x 0.9 in.)
Housing	Black plastic.
USB cable length	Use any standard USB cable. The cable included with the shipment is approximately 0.5 meter (1.6 ft.) long.
USB connector	USB standard type "B" receptacle.
CAN cable length	Approximately 30 cm (1 ft.)
Operating temperature	-40 ºC ... +85 ºC
Storage temperature	-40 ºC ... +85 ºC
Relative Humidity	0% ... 85% (non condensing.)

Table 5. Additional technical specifications for USBcan II.

4.5.3   Additional technical specifications for USBcan Rugged

Dimensions (W*L*H)	70 mm * 130 mm * 30 mm
Housing	Cast zinc.
USB cable length	The USB cable is fixed and is ca 25 cm long. You can extend it by using any standard USB extension cable.
USB connector	Standard USB type "A" plug.
CAN cable length	Approximately 30 cm (1 ft.)
Operating temperature	-40 ºC ... +85 ºC
Storage temperature	-40 ºC ... +85 ºC
Relative Humidity	0% ... 85% (non condensing.)
Mounting devices	Two mounting holes (diameter 5 mm). Two 3M® Dual Lock™ strips on back side.

Table 6. Additional technical specifications for USBcan Rugged.

4.6 CAN Channel Transceivers

The standard USBcan II has two high-speed (HS) channels with TJA 1050 drivers. As an option the second CAN channel can be shipped with a Low-Speed or Single Wire CAN transceiver, i.e. with a TJA 1054 or AU5790, respectively. The two CAN channels have 9-pin male D-SUB connectors. The CAN bus is connected to the D-SUB connector, see Figure 5. The D-SUB pin configuration for the HS, LS and SWC CAN channel is presented in Table 7, Table 8 and Table 9, respectively.
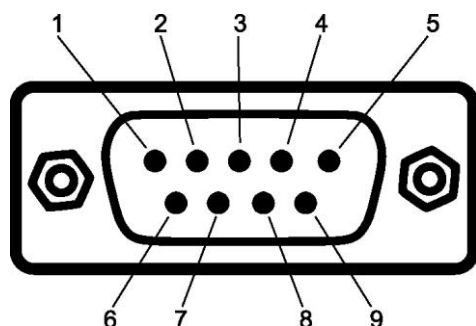

Figure 5. The D-SUB connector pin numbers on a CAN channel.

The HS CAN channels (TJA 1050) have the following pin configuration: (Pins 2, 3, 4, 7 and 9 are protected by auto reset fuses.)		
D-SUB pin number	**Color code**	**Function**
1	N/A	Not connected.
2	Green	CAN_L
3	Brown	GND
4	Orange	Reserved, do not connect
5	Black	Shield
6	N/A	Not connected.
7	Red	CAN_H
8	N/A	Not connected.
9	Yellow	Power, not needed

Table 7. D-SUB Pin configuration of the HS channel (TJA 1050).

The *optional* **LS CAN channel (TJA 1054)** has the following pin configuration:
(Pins 2, 3, 7 and 9 are protected by auto reset fuses.)

D-SUB pin number	Color code	Function
1	N/A	Not connected.
2	Green	CAN_L
3	Brown	GND
4	Orange	Reserved, do not connect
5	Black	Shield
6	N/A	Not connected.
7	Red	CAN_H
8	N/A	Not connected.
9	Yellow	Reference voltage (Battery voltage, V_{BAT}) to TJA 1054.

Table 8. D-SUB Pin configuration of the LS channel (TJA 1054).

The *optional* **SWC CAN channel (AU5790)** has the following pin configuration:
(Pins 2, 3, 7 and 9 are protected by auto reset fuses.)

D-SUB pin number	Color code	Function
1	N/A	Not connected.
2	Green	Not connected.
3	Brown	GND
4	Orange	Reserved for the 180 Ohm terminating resistor required in high speed mode.
5	Black	Shield
6	N/A	Not connected.
7	Red	CAN_H
8	N/A	Not connected.
9	Yellow	Reference voltage (Battery voltage, V_{BAT}) to TJA 1054.

Table 9. D-SUB Pin configuration of the SWC channel (AU5790)

4.7 Do's and Don'ts

- **Do** connect the ground pin on the D-SUB to the ground of your CAN bus.

- If you power the device through the CAN connector, **do** connect the power to pin 9 on **channel 1.**

- If you are using USBcan II -HS/LS, -HS/SWC, **do** connect V_{BAT} to pin 9 on CAN **channel 2**.

- **Don't** extend the USB cable to more than 5 meters (you can use USB hubs if you have to.)

- **Don't** go below 50 kbit/s on the high-speed CAN bus – the TJA 1050 transceiver will not handle that.

- If you are using USBcan II HS/LS, **don't** go above 125 kbit/s on the **low-speed** channel.

- In case of trouble, **do** verify that you have **at least one terminator on the CAN bus** unless you are using the LS channelSoftware Support

The Kvaser USBcan II boards are supported by drivers routines and program examples for Windows, Linux, etc[3]. The software and its documentation are available from our web site, and not further documented here.

Kvaser CANKing - a free-of-charge and general-purpose interactive CAN bus monitor can be download from our web site.

Please visit our homepage http://www.kvaser.com to find software updates, hints and tips and other helpful information. You are always welcome to contact our Support Team - support@kvaser.com.

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[3] Contact us for other operating systems.

5   Legal Information

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NOTE
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

6 Document Revision History

Date	Version	Changes
2002-10-16	1	No major
2003-04-07	2	No major
2003-07-02	3	No major
2003-11-14	4	No major
2004-06-07	5	No major
2006-03-28	6	Layout changes
2006-11-10	7	Layout changes
2008-12-03	8	Revised chapter 5 "Legal information". Added max recommended operating reference voltage for the SWC channel; it is 12V.
2011-01-14	9	Updated supported OS list
2011-04-19	10	Updated USB cable length from 1 meter to 0.5 meters.