Kvaser Hybrid CAN/LIN User's Guide

Copyright 2023 Kvaser AB, Mölndal, Sweden
https://www.kvaser.com

Printed Wednesday 13th September, 2023

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.

(This page is intentionally left blank.)

Contents

1 About this manual

This manual is intended for Kvaser Hybrid CAN/LIN 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 Hybrid CAN/LIN.

2.1 Welcome to Kvaser Hybrid CAN/LIN

Figure 1: Kvaser Hybrid CAN/LIN

Kvaser Hybrid CAN/LIN is a single channel interface where the channel can be opened either as CAN or LIN. The Kvaser Hybrid CAN/LIN is compatible with applications that use Kvaser's CANlib and LINlib.

This guide applies to Kvaser Hybrid CAN/LIN devices using at least firmware and driver versions listed in Table 1. For minimum compatible firmware and driver versions of Kvaser Hybrid CAN/LIN see Table 9 on Page 15.

Device	Product Number	Firmware	Driver (Windows/Linux)
Kvaser Hybrid CAN/LIN	73-30130-01284-4	v3.29	v5.41 (kcany/mhydra)

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

2.2 Major features

- Hybrid USB CAN/LIN interface.
- Supports both LIN master and LIN slave mode
- Supports LIN 1.3 to 2.2
- LIN reference voltage detection
- Supports CAN FD, up to 5 Mbit/s (with correct physical layer implementation).
- Supports both 11-bit (CAN 2.0A) and 29-bit (CAN 2.0B active) identifiers.
- Powered through the USB connector.
- 100% compatible with applications written for other Kvaser CAN hardware with Kvaser CANlib and Kvaser LINlib.
- Fully compatible with J1939, CANopen, NMEA 2000® and DeviceNet.
- Quick and easy plug-and-play installation.

2.3 Interface

Kvaser Hybrid CAN/LIN provides a CAN/LIN bus interface through a standard USB 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 Hybrid CAN/LIN hardware

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

3.1 Hardware installation

For the Kvaser Hybrid CAN/LIN to communicate with the host computer, a compatible version of the Kvaser driver and firmware must be installed.

After the driver has been installed on the host computer, the firmware may then be downloaded and installed on the Kvaser Hybrid CAN/LIN.

The latest version of the driver and firmware can be downloaded from www.kvaser.com/download.

The driver is installed by running the file `kvaser_drivers_setup.exe`.

The Kvaser Hybrid CAN/LIN 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 information on how to upgrade the firmware, see Section 4.5, Updating the firmware, on Page 15.

3.2 USB connector

The Kvaser Hybrid CAN/LIN has a standard USB type "A" connector.

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

Connect the device to your computer using any high quality USB 2.0 certified cable. The maximum total USB cable length is 5 m (∼ 16 ft).

As USB cables become longer they are more sensitive to EMI, because they make a longer antenna that can pick up more noise. These issues can be mitigated by using higher quality cables with better shielding. Thicker cables tend to be better than thin ones, and braided shielding tends to be more reliable than only foil. Furthermore, longer cables may introduce signal degradation and timing issues that, if necessary, can be mitigated using shorter cable segments combined with hubs that amplify the signal and handle delays on a per-cable basis.

3.3 CAN/LIN channel

The Kvaser Hybrid CAN/LIN has one CAN/LIN channel in a 9-pin D-SUB CAN connector (see Figure 3). See Section 4.3, CAN/LIN connector, on Page 13 for pinout information.

Figure 3: CAN/LIN connector on Kvaser Hybrid CAN/LIN

3.4 Power supply

The Kvaser Hybrid CAN/LIN is powered from the USB port. You also need to apply a reference voltage to the LIN reference power pin when running the channel in LIN mode. See Section 4.3, CAN/LIN connector, on Page 13 for pinout information.

3.5 LED Indicators

The Kvaser Hybrid CAN/LIN has a single power LED as well as one traffic LED and one Informational LED for the CAN/LIN channel as shown in Figure 4 on

Page 9. Their functions are described in Section 4.1, Definitions of LED states and colors, on Page 10.

Figure 4: LEDs on the Kvaser Hybrid CAN/LIN.

3.6 Troubleshooting

Use "Kvaser Device Guide" in the Control Panel to verify that the computer can communicate with the Kvaser Hybrid CAN/LIN. If the firmware version shown is all zeros, there are communication problems. If the LEDs are not flashing or do not light up at all, check the power supply.

3.7 Limitations in LINlib functionality

The following limitations apply to the Kvaser Hybrid CAN/LIN:

- The API call `linSetupIllegalMessage()` is not supported.
- The fields `synchEdgeTime` and `byteTime` in the `struct LinMessageInfo` is not used.

4 Appendices

In this section you will find technical information about the Kvaser Hybrid CAN/LIN and its connectors.

4.1 Definitions of LED states and colors

The Kvaser Hybrid CAN/LIN has three types of LEDs; Power, Traffic and Info. These are dual colored as shown in Table 2. A device with multiple channels has one Traffic LED for each channel. When the device has more than one channel a space and digit is added on the label, CH 1, CH 2 etc. The red Traffic LEDs are also used to indicate errors by using all red Traffic LEDs simultaneously.

LED	Label	Color
Power	PWR	Green/Yellow
Traffic	CH	Yellow/Red
Info	INFO	Green/Yellow

Table 2: The different type of LEDs.

The following definitions is used to describe the state of an LED:

Off The LED is off and no light is emitted.

Flash The LED is lit up for a very short time. A single flash may be hard to see and a continuous set of flashes will look the same as On.

Slow Blink The LED is repeatedly turned On and Off. The On and Off phase is equal in time.

Fast Blink The LED is repeatedly turned On and Off but with a higher frequency than Slow Blink. The On and Off time is still equal.

On The LED is constantly emitting light.

Slow Waver This is a variant of Slow Blink but instead of being Off, a second color is On. This is only possible with a dual colored LED.

Fast Waver The LED is alternating between two colors as in Slow Waver but using a higher frequency.

Running This means that all LEDs are lit, one at the time, in sequence with every color available i.e. "Power green->Power yellow->Traffic 1 yellow->Traffic 1 red->Traffic 2 yellow->Traffic 2 red->. . . "

As an example, "Slow Waver (Green/Yellow)" means that the LED is slowly blinking by alternating between green and yellow.

The Kvaser Hybrid CAN/LIN has three LEDs as shown in Figure 4 on Page 9. Their functions are shown in Table 3 on Page 11.

LED	Function	Description
PWR (Green)	Power	Steady light when unit is powered and working.
CH (Yellow)	CAN RxTx	Status for the CAN/LIN channel
INFO (Green)	LIN Mode	In use as LIN
INFO (Yellow)	LIN Mode	LIN reference voltage is available

Table 3: LEDs on the Kvaser Hybrid CAN/LIN.

4.1.1 Interface mode

The device is in Interface mode when connected to the host computer via USB. If the Power LED is showing a steady green light, the device is in Interface mode and working correctly. When connected to the computer for the first time, the Power LED will blink slowly in yellow until the driver is installed and the device has received a USB configuration.

When in Interface mode, if the Power LED is yellow for an extended period, something is wrong. Please see Table 4.

The power should never be removed when firmware update is in progress.

Power LED	Traffic LED	Description
Slow Blink (Yellow)	All off (-)	Waiting for USB configuration
Slow Waver (Green/Yellow)	Slow Waver (Yellow/Red)	Firmware configuration error[1]
Slow Waver (Green/Yellow)	All Slow Blink (Yellow)	Power problem[2]

Table 4: Yellow Power LED shows problems in Interface mode.

4.1.2 CAN and LIN usage

Kvaser Hybrid CAN/LIN is ready to be operated as either a CAN or LIN interface when connected to the host computer without further configuration. You can use the same CANlib and LINlib API calls as with other Kvaser interfaces, use CANlib for CAN and LINlib for LIN related usage. Both libraries are included in the Kvaser CANlib SDK, see Section 2.4, Additional software and documentation, on Page 6.

4.1.3 CAN interface mode

When Kvaser Hybrid CAN/LIN is used as a CAN interface, the traffic LED is used as described in Table 5 on Page 12.

[1] This should not normally happen. If it does, please contact Kvaser support.
[2] This indicates low power supply, such as using an unpowered USB hub.

Traffic LED	Description
Off (-)	Idle, no CAN traffic
Flash (Yellow)	CAN message received or sent
Flash (Red)	Error frame received
All Fast Blink (Yellow)	Firmware update is in progress
Fast Blink (Red)	CAN channel is error passive
On (Red)[3]	CAN overrun

Table 5: Traffic LED shows CAN bus status in CAN Interface mode.

4.1.4 LIN interface mode

When Kvaser Hybrid CAN/LIN is used as a LIN interface, the traffic LED is used as described in Table 6.

Traffic LED	Description
Off (-)	Idle, no CAN traffic
Flash (Yellow)	Internal activity or LIN message received or sent
All Fast Blink (Yellow)	Firmware update is in progress

Table 6: Traffic LED shows LIN bus status in LIN Interface mode.

4.2 Technical data

In Table 7 on Page 13 you will find the technical specifications of Kvaser Hybrid CAN/LIN.

[3]The red Traffic LED indicating overrun will stay on until the device goes bus off.

CAN/LIN Channels	1 (Configurable as CAN or LIN)
CAN Transceivers	TJA1051T/E (Compliant with ISO 11898-2)
Galvanic isolation	Yes
CAN Bit Rate	50 kbit/s to 1 Mbit/s
CAN FD Bit Rate	Up to 5 Mbit/s (with correct physical layer implementation)
CAN/LIN Controller	Kvaser CAN/LIN IP in FPGA
LIN Transceivers	TJA1021T/20
LIN Bit Rate	1 - 20 kbit/s
Time stamp resolution	50 µs
CAN Max message rate	20000 msg/s
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
Host OS	Windows (7 or later), Linux.
Power consumption	max 195 mA
Hardware configuration	Done by software (Plug & Play).
Dimensions	35 x 165 x 17 mm for body incl. strain relief
Weight	120 g
Operating temperature	−40 °C to +85 °C
Storage temperature	−40 °C to +85 °C
Relative humidity	0 % to 85 % (non-condensing.)

Table 7: Technical Specifications.

4.3 CAN/LIN connector

Kvaser Hybrid CAN/LIN devices that use the 9-pin D-SUB connector (see Figure 5) have the pinning described in Table 8 on Page 14.

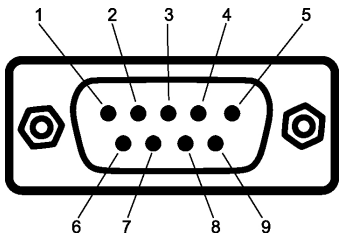

Figure 5: The D-SUB 9 connector pin numbers

D-SUB 9	CAN Function	LIN Function
1	Not connected	Not connected
2	CAN_L channel	Not connected
3	GND	GND
4	Not connected	Not connected
5	Shield	Shield
6	Not connected	Not connected
7	CAN_H channel	LIN_BUS channel
8	Not connected	Not connected
9	Not connected	Reference Voltage

Table 8: Pin configuration of the 9-pin D-SUB connector.

The Reference Voltage (pin 9) is only used as voltage reference and power to the LIN transceiver. The Kvaser Hybrid CAN/LIN itself (including CAN transceiver) is powered through the USB connector. The Reference Voltage (pin 9) must be connected to a voltage supply in the range of 6 V to 27 V (absolute maximum rating is 40V) to ensure proper behaviour of the transceiver. The Kvaser Hybrid CAN/LIN will automatically switch the internal pull-up resistor from (typical) 160 kΩ to 1 kΩ when going from slave mode to master mode.

4.4 CAN bus termination

Every CAN bus must be terminated with a 120 Ω resistor at each end of the bus. The Kvaser Hybrid CAN/LIN 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 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.

4.5 Updating the firmware

For the Kvaser Hybrid CAN/LIN 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 Hybrid CAN/LIN 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 Hybrid CAN/LIN" 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 Hybrid CAN/LIN are listed in Table 9.

Device	Min. Firmware Version	Min. Driver Version
Kvaser Hybrid CAN/LIN	v3.28	v5.40

Table 9: Minimum compatible driver and firmware versions of Kvaser Hybrid CAN/LIN.

5 Safety Instructions

5.1 Intended Use

Kvaser interfaces are used to connect computer systems to CAN buses. The Kvaser Hybrid CAN/LIN 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
Advanced CAN Solutions

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 Hybrid CAN/LIN

Object of the declaration (identification of apparatus allowing traceability):
Product: Kvaser Hybrid CAN/LIN
Type: 73-30130-01284-4

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

EN IEC 63000 (2018)

Signed for and on behalf of:

Mölndal	2022-01-24	
Place of issue	Date of issue	Claes Haglund, Supply Chain and Quality Director

7.2 FCC Regulatory Compliance

Federal Communications Commission (FCC) Compliance Information Statement

IDENTIFICATION OBJECT:
Product: Kvaser Hybrid CAN/LIN
Type: 73-30130-01284-4

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

7.3 Patents, Copyrights and Trademarks

All trademarks are the property of their respective owner. Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

Adobe, the Adobe logo, and Reader are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States and/or other countries.

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_98230_hybrid_can_lin:

Revision	Date	Changes
1.0	2021-10-25	Initial version
1.1	2022-01-24	Updated EU Declaration of Conformity.
1.2	2022-04-01	Minor textual changes, added galvanic isolation info to Technical data table.
1.3	2023-02-14	Updated the Technical data table and firmware and driver information. Added section about intended use.