

Kvaser Memorator User's Guide



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<http://www.kvaser.com>

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1 About this manual

This manual is intended for those who want to use Kvaser Memorator. It contains information about the hardware, instructions on how to connect it, and so on.

The software for Kvaser Memorator is called *Kvaser Memorator Tools* and is described in detail in its online help.

Note: This manual assumes you are using firmware 2.5 or later.

2 Introduction

This guide is applicable to the variants of Kvaser Memorator listed in Table 1. Since the hardware is essentially the same this guide will refer to the devices as just Kvaser Memorator.

Device	EAN Number
Kvaser Memorator HS/HS	73-30130-00175-6
Kvaser Memorator HS/LS	73-30130-00170-1
Kvaser Memorator HS/SWC	73-30130-00234-0

Table 1: The Kvaser Memorator devices and their EAN numbers

2.1 Kvaser Memorator

Kvaser Memorator makes it possible for you to log data from a CAN bus to a standard MMC or SD-type flash disk. Kvaser Memorator provides a dual channel CAN bus interface through a standard USB interface.

All configurations are done in the Kvaser Memorator Tools application, making it both easy and convenient. Kvaser Memorator has a USB connection and can be used as an ordinary USBcan – two products in one! The logging memory is very easy to replace in the field to send it back home for off-line analysis. The memory is robust, inexpensive and small – about the size of a stamp.

2.2 Triggers

Kvaser Memorator can log continuously, or logging can be triggered by external triggers (rising or falling edge) and/or by messages on the CAN bus (triggered by identifier, data contents or error frames.) Pre- and post-trigger times can be set.

2.3 Filters

To enhance logging performance, Kvaser Memorator can filter out selectable messages to be logged. The identifiers can be picked from a database file, or all messages can be logged.

2.4 Memory cards

Any standard compliant MMC or SD type flash memory cards can be used. The maximum size is currently 1 GB.

2.5 Configuration software in the PC (Kvaser Memorator Tools)

- Configuration of the CAN controller – e.g. bit rate and filters
- Configuration of the trigger conditions
- Configuration of filter for messages to be stored
- The configuration is downloaded via USB
- Convert files logged in Kvaser Memorator to several different formats

2.6 Major features in Kvaser Memorator

- One device for desktop, laptop, and PDA (devices need a USB device port)
- Quick and easy plug-and-play installation
- Supports both 11-bit (CAN 2.0A) and 29-bit (CAN 2.0B active) identifiers
- CAN messages are time-stamped with 10 μ s resolution
- Large on-board RAM buffer for CAN messages
- Supports “listen-only” mode for analyzing tools
- Driver support for major operating systems
- 100% compatible with applications written for Kvaser hardware such as LAPcan, PClcan, and USBcan with Kvaser CANlib
- One MMC connector that accepts MMC or SD devices, with the size ranging from 32 MB up to 1 GB today and even larger to be expected in the future
- One CAN connection ISO11898-2 High speed, 50 kbit/s up to 1 Mbit/s (transceiver Philips TJA1050)
- A second CAN connection which can be either of
 - LS: low-speed CAN - ISO11898-3
 - HS: high-speed CAN - ISO11898-2
 - SWC: single-wire CAN - J2411
- One USB 1.1 connection (12 Mbit/s). Can also be used in USB 2.0 slots
- Power from CAN-bus or from the USB side. Automatically switches power supply between CAN (primary) and USB (secondary), to reduce power drain of laptop battery
- Built-in real time (calendar) clock with battery backup
- Logger status is indicated with four externally visible LEDs

3 Kvaser Memorator hardware

3.1 Hardware installation

The Kvaser Memorator device may be inserted in 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.

For driver installation and firmware update, see the driver installation documentation.

3.2 CAN Channels

The standard Kvaser Memorator has two independent I/O ports (CAN channels) that are seen in Figure 1. In Figure 2 on Page 9, the first channel (channel 1) is marked with "1", whereas the second channel (number 2) is not marked. The CAN connectors are also labeled for easy identification.



Figure 1: Connections on Kvaser Memorator



Figure 2: The channels on Kvaser Kvaser Memorator (channel 2 is not marked)

3.3 Power supply

Kvaser Memorator can be powered both from the CAN side and from the USB side. To operate Kvaser Memorator in LOGGER mode, you must supply power on the CAN side. To operate Kvaser Memorator in CONFIG or USBCAN mode, it is sufficient to supply power from the USB side.

You supply power on the CAN side on CAN channel 1. Supplying power on CAN channel 2 is meaningless, but it will not hurt the device.

Use pin 9 for V+ and pin 3 for ground.

You can feed it with 8 V–40 V DC. The power requirement is around 1 W (maximum).



IMPORTANT: Kvaser Memorator HS/LS and HS/SWC must be supplied with both power on the CAN channel 1, as described, and a reference voltage on channel 2. The reference voltage is typically the battery or system voltage. The reference voltage input does not draw any current.

3.4 Flash disks

You can use MultiMediaCard (MMC) and Secure Digital (SD) disks with your Kvaser Memorator.

The following disk sizes are supported and have been tested:

Type	Size
MMC	32 MB, 64 MB
SD	32 MB, 64 MB, 128 MB, 256 MB, 512 MB, 1 GB

Table 2: Supported sizes



IMPORTANT: not all disks follow the MMC or SD standard. When in doubt, consult our web site for a list of recommended disk types.

Insert the disk upside down into Kvaser Memorator (see Figure 3) Do not apply excessive force. The disk should slide smoothly in its socket. When fully inserted, only 1 – 2 mm (0.05 – 0.1 inch) of it is projecting from Kvaser Memorator.

You don't have to switch off the power to insert or remove the disk.



Figure 3: How to insert a memory card

3.5 LED indicators

The LED indicators (see Figure 4 on Page 11) have somewhat different meaning depending on which mode your Kvaser Memorator is in. There are three modes:

1. USBCAN mode – the device acts as a CAN interface and no logging is performed
2. CONFIG mode – the device is being configured
3. LOGGER mode – the device suspends USB communication and is logging CAN traffic to the flash disk

The different modes are described in detail in Section 4.1, The different run modes, on Page 14.



Figure 4: Kvaser Memorator LED indicators

PWR (Green)	CAN I (Yellow)	CAN II (Yellow)	ERR (Red)	Meaning
steady				Power ON (The device is connected to the computer)
	short flash			CAN traffic on channel 1
		short flash		CAN traffic on channel 2
			short flash	Error frame on either channel
			steady	Self test failed, wrong bit rate, CAN bus transceiver failure
slow flash				Waiting for USB connection with the PC

Table 3: LED indicators in USBCAN mode

PWR (Green)	CAN I (Yellow)	CAN II (Yellow)	ERR (Red)	Meaning
			slow blink in "running light" sequence	CONFIG mode
			short flashes	Disk activity such as disk formatting
slow flash				Waiting for USB connection with the PC

Table 4: LED indicators in CONFIG mode

PWR (Green)	CAN I (Yellow)	CAN II (Yellow)	ERR (Red)	Meaning
	all LEDs are flashing slowly			Disk is missing or other fatal error
	short flash			CAN traffic on channel 1
		short flash		CAN traffic on channel 2
	slow blink			CAN 1 is error passive
		slow blink		CAN 2 is error passive
	two short blinks			CAN 1 is bus off
		two short blinks		CAN 2 is bus off
			short flash	Error frame on either CAN channel
slow blink				Logger mode, trigger passive
fast blink				Logger mode, trigger active
			slow blink	Disk is full
			fast blink	Special disk activity, such as formatting, is in progress
			long blink + short blink	Logger configuration is missing or corrupt
			two short blinks	Disk error
			fast blink	During scanning for the end of the logger file

Table 5: LED indicators in LOGGER mode



When removing the power supply for Kvaser Memorator during logging to disk, Kvaser Memorator has to close the still open disk file when restarted. Closing a file involves scanning the file to find the end it. During scanning the file to find the end, Kvaser Memorator ERR (the red one) to indicate what is going on.

3.6 External trigger

Kvaser Memorator can be set up to trig on an external event. There are two ways to create such an external event:

- Connect a switch from pin 4 on CAN channel 1 to ground, which can be found on pin 3 on the same connector. See Figure 6 on Page 13.
- Connect a signal between 0 and 5 V to pin 4 on CAN channel 1.

Internally, pin 4 on CAN channel 1 has a pull-up to +5 V. See Figure 5 on Page 13.

If the external trigger is set to trig on falling edge the trigger is activated when the pin 4 is connected to ground and if trigger is set to trig on rising edge the trigger is activated when the pin 4 is disconnected from ground.

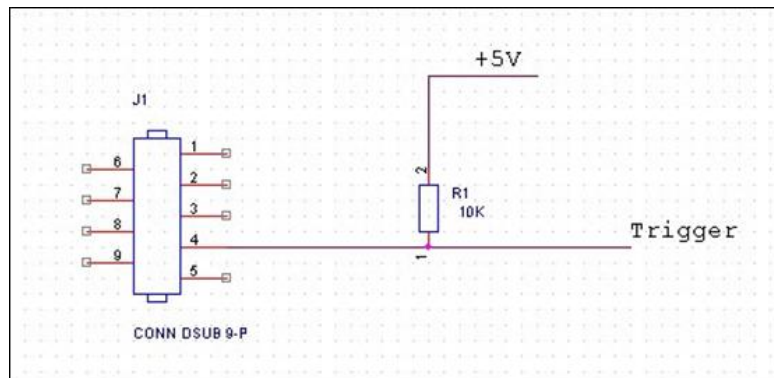


Figure 5: The trigger signal inside Kvaser Memorator

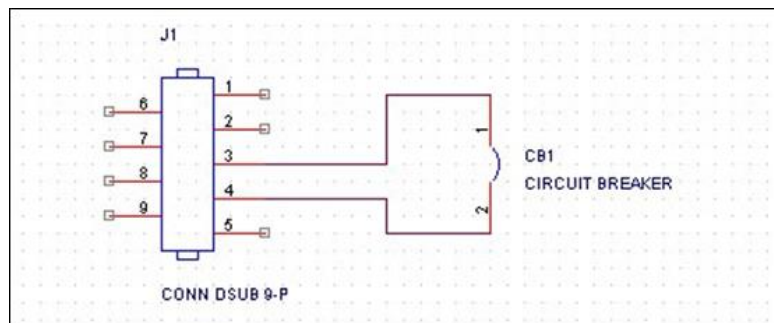


Figure 6: How to connect an external trigger switch



Note: the trigger input is debounced by the firmware. A pulse of shorter length than approximately 30 ms will not be detected.

4 How to use Kvaser Memorator

4.1 The different run modes

Kvaser Memorator can operate in three different modes.

- **USBCAN mode** Kvaser Memorator acts as a CAN interface to the PC, identical to the USBcan II. Flash disk operations are suspended. To operate in USBCAN mode,
 - connect the USB cable.
- **LOGGER mode** Kvaser Memorator acts as a stand-alone logger. CAN traffic is logged to the flash disk. USB communication is suspended. To operate in LOGGER mode,
 - insert a formatted flash disk,
 - supply external power on CAN 1,
 - if using the HS/LS or HS/SWC versions, connect the reference voltage to CAN 2
 - and remove the USB cable.
- **CONFIG mode** Kvaser Memorator is being configured via USB from the PC. CAN operations are suspended. To operate in CONFIG mode,
 - insert a flash disk (it need not be formatted), and
 - insert the USB cable.
 - connect to Kvaser Memorator in the configuration software Kvaser Memorator Tools.

4.2 How to disconnect Kvaser Memorator from a CAN system

You can remove the device from a running system at any time without risk of damaging anything, but if you follow the following guidelines the time required to extract the data from the disk will be greatly reduced. This is because the firmware will have to some potentially time consuming post-processing if it is interrupted in the wrong moment.

1. If possible, connect the Kvaser Memorator to a PC/laptop via a USB cable while it is logging. When the USB cable is connected the logging will immediately be terminated in an orderly fashion.
2. If it is impossible or inconvenient to connect a USB cable, you should instead

- (a) Disconnect the power from CAN 1.
 - (b) Reconnect power to CAN 1 for a few seconds, until the green light starts flashing again.
 - (c) Disconnect the power, permanently this time.
3. If you can't do any of the above, you should remove the whole Kvaser Memorator and move it to the PC where you will read the data. You may move just the flash disk, but it can take some time to extract the data.

The underlying reason for all this is that Kvaser Memorator continuously stores some information in an on-board battery backed memory. This information is used to minimize the startup time next time the power is applied. If you follow the advice above, you are ensuring that the firmware uses this information to finalize the disk writing cleanly.

4.3 Kvaser Memorator Tools

To be able to create a configuration and write the created configuration to the Kvaser Memorator, first put the Kvaser Memorator in configuration mode, that is, insert a disk and connect the USB cable. Start Kvaser Memorator Tools and press the Connect button in the Target menu. If the LEDs on Kvaser Memorator are flashing in a "running light" pattern, the device is in configuration mode.

Kvaser Memorator Tools make it possible to create different configurations for the Kvaser Memorator. The main window has got four sections – one for information about the device, one for the configuration of the CAN channels, one for configuring the trigger conditions and one for disk management and information, and for reading the log files.

For further information about Kvaser Memorator Tools please refer to the application's online help.

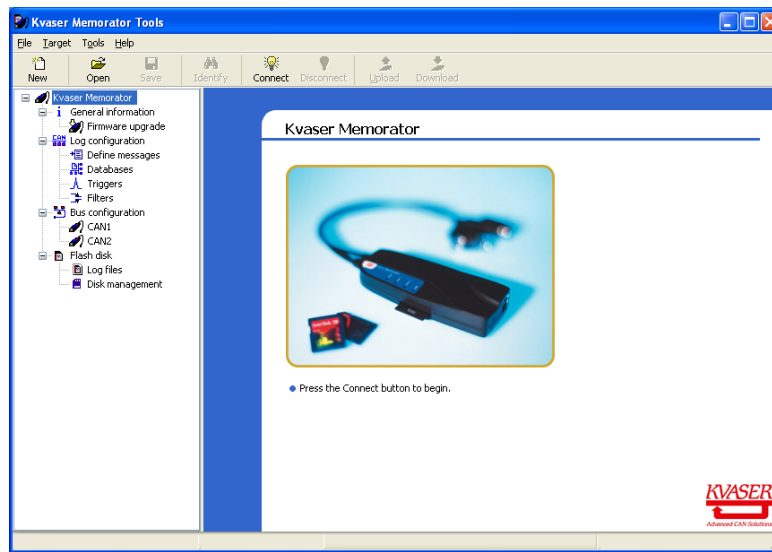


Figure 7: Kvaser Memorator Tools

4.4 Disk management

- Handle the disks with care. They are robust, but better safe than sorry.
- Never copy any files to the flash disk using an ordinary flash disk reader together with Windows Explorer or any such tool.
- Avoid removing a disk when a trigger is active. Doing so will not result in a corrupt or damaged disk, however, some potentially time consuming post-processing will have to be done, either in the PC or by Kvaser Memorator next time you insert the disk.
- If you need to remove a disk when a trigger is active, try to connect the USB cable to a running PC first. When Kvaser Memorator discovers the active USB connection, it will stop logging and close its log file in an orderly fashion.

4.5 Troubleshooting

- Use “CAN Hardware” in the Control Panel to verify that the computer really can talk to Kvaser Memorator. Read out the firmware version. If it's all zeroes, there is some communication problem.
- Verify that the disk is formatted. If in doubt, reformat it using Kvaser Memorator Tools.
- Reload the saved configuration from your hard disk to Kvaser Memorator Tools and download it again to the logger to ensure it is really written.

- If configuration fails, verify that Kvaser Memorator is in CONFIG mode when you run the Kvaser Memorator Tools. You can see this by looking at the LEDs – they should flash in a “running light” fashion and the Kvaser Memorator icon in the main tree view in Kvaser Memorator Tools should not be covered with a red ring.
- If the LEDs are flashing or glowing, compare the pattern with the table in Section 3.5, LED indicators, on Page 10.
- If the LEDs are not flashing or glowing at all, check the power supply.

5 Appendices

5.1 Technical data

CAN channels	2 (CAN 2.0A and 2.0B active)
CAN Transceivers	TJA 1050 (ISO 11898-2 compliant), Optional for channel 2: TJA 1054 (low-speed CAN), Optional for channel 2: AU5790 (SWC)
CAN Controller	Built into the M16C
Microcontroller	Mitsubishi M16C/6N, 256 kB Flash and 10 kB RAM.
Bit rate	50 kbit/s ¹ to 1 Mbit/s for HS, 10 kbit/s ² to 125 kbit/s for LS, and 10 kbit/s up to 125 kbit/s for SWC.
Timestamp resolution	10 µs
Error Frame Detection	Yes, both channels
Error Frame Generation	Yes, in USBCAN mode
PC interface	USB 1.1 host, compatible with USB 2.0 (USB 2.0 works in 1.1 mode)
Power consumption	~5 V and 130 mA if powered from the USB and ~850 mW if powered from the CAN bus.
External power	Pin 9 (V+) and pin 3 (GND) on CAN channel 1. Allowed voltage is 8 – 40 V DC.
Reference voltage	Needed for the LS and SWC options. Connect battery voltage to pin 9 in CAN 2.
Software requirements	Windows XP or later. (For other operating systems, see Kvaser web or contact Kvaser support.)
Hardware configuration	Done by software (Plug & Play)
Dimensions (W x L x H)	46 mm x 115 mm x 22 mm
Operating temperature	-25 °C to +85 °C
Weight	120 g including cables and connectors
Storage temperature	-35 °C to +85 °C
Relative Humidity	0% to 85% (non condensing.)
External trigger	Available on pin 4 on CAN channel 1. The input is protected by a self-healing fuse and has a 10 kΩ pull-up to +5 V. The firmware can detect both rising and falling edges. The allowed voltage is 0 – 5 V DC.

Table 6: Technical specification of Kvaser Memorator

5.2 Disk capacity

Each CAN message occupies 16 bytes in the log file. The following table gives some approximate values of the capacity for various disk sizes.

¹Dominant time out in TJA1050 at 250 µs to 750 µs

²Dominant time out in TJA1054 at 0.75 ms to 4 ms

Disk size	Approximate capacity	Time to fill the disk (at 500 msgs/s)
32 MB	2 000 000 messages	1 h
64 MB	4 000 000 messages	2 h
128 MB	8 000 000 messages	4 h
256 MB	16 000 000 messages	8 h
512 MB	32 000 000 messages	16 h
1 GB	64 000 000 messages	32 h

Table 7: Approximate capacity values

5.3 Disk structure

You can use an external card reader to read the files on the flash disk. Kvaser Memorator Tools can read the log data directly via the external card reader, so you don't need to copy the files to your hard disk.

1. Place the card in the card reader
2. Run the Memorator Professional Tool
3. Press the *Connect* button
4. In the *Connect Dialog* check the “*Use a device other than a Kvaser Memorator*” checkbox and press *Next*
5. Select the radio button titled “*External SD/MMC card reader*” and press *Next*
6. Browse for the card reader drive location and press *Next*
7. Select a format version and press *Next*
8. Press *Finish* and the card will be connected to the Kvaser Memorator Tools
9. Now it is possible to work with the card in the same way as if it is connected to a Kvaser Memorator



NOTE: It is essential that the flash disks be formatted using Kvaser Memorator Tools. You must not copy any files to the disk using an ordinary flash disk writer. This is because the tool will create two special files on the disk. These files must be contiguous and the structure and position of them must be determined by the firmware, or the data logging will fail.

Kvaser Memorator Tools will create the following two files on the flash disk when formatting it:

- LOGDATA.KMF
- PARAM.LIF

The file LOGDATA.KMF will by default occupy nearly the whole disk regardless of whether the file contains any logging data or not, and PARAM.LIF will occupy the rest of the disk.

5.4 CAN Channel Transceivers

The standard Kvaser Memorator has two high-speed (HS) channels with TJA 1050 drivers. As an option the second CAN channel (only the second channel, i.e. channel 1 is always HS) can be delivered with a low-speed (LS) or single-wire CAN (SWC) driver.

The two CAN channels have 9-pin D-SUB connectors with the pinning described below. The D-SUB pin configuration of these is somewhat different for HS, LS, and SWC, and is also slightly different between channel 1 and 2 (see Table 8 and Table 9 on Page 21).

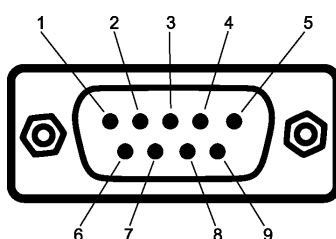


Figure 8: The D-SUB connector pin numbers on a CAN channel.

D-SUB number	pin	Color code	Function
1		N/A	Not connected
2		Green	CAN_L
3		Brown	GND
4		Orange	External trigger input (channel 1 only)
5		Black	Shield
6		N/A	Not connected
7		Red	CAN_H
8		N/A	Not connected
9		Yellow	Power supply (channel 1 only)

Pins 2, 3, 4, 7 and 9 are protected by auto reset fuses

Table 8: D-SUB pin configuration of the HS channel (TJA 1050)

D-SUB number	pin	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 for TJA 1054 (must be connected)

Pins 2, 3, 4, 7 and 9 are protected by auto reset fuses

Table 9: D-SUB Pin configuration of the optional LS channel (TJA 1054)

D-SUB number	pin	Color code	Function
1		N/A	Not connected
2		Green	Not connected
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 for AU5790 (must be connected)

Pins 2, 3, 4, 7 and 9 are protected by auto reset fuses

Table 10: D-SUB Pin configuration of the optional SWC channel



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

5.5 Technical Data for LS Option

Transceiver type	Philips TJA1054
Current consumption	20 mA (average)
Maximum bus speed	125 kbit/s
Built-in termination, RTH	4.7 k Ω
Built-in termination, RTL	4.7 k Ω
Reference voltage (on pin 9)	5 – 27 V DC

Table 11: Technical Data for LS Option



The termination resistors RTH and RTL are optimized for bus analyzing tools. This means that they do not load the bus enough to ensure proper signal levels if there are no other “real” nodes on the bus.

5.6 Technical Data for SWC Option

Transceiver type	Philips AU5790
Current consumption	20 mA (average)
Maximum bus speed	125 kbit/s in high-speed mode, 50 kbit/s in normal mode. The mode is settable from the configuration software.
Reference voltage (on pin 9)	6 – 27 V DC

Table 12: Technical Data for SWC Option

5.7 Updating the firmware

Connect Kvaser Memorator to your PC with the USB cable. A flash disk may be present but it is not needed. Double-click on the file `update.bat`. It is also possible to update the Kvaser Memorator firmware directly from the configuration software Kvaser Memorator Tools (see the built-in help for more information).



Figure 9: The firmware update file

A black console window opens. Press the return key to start programming. The progress is printed on the screen, and typically looks like this:

```
Firmware programmer for USBcan Rev B, USBcan II, Kvaser Memorator,
  PCIcan II, etc.
Copyright 2002 KVASER AB, Sweden -- http://www.kvaser.com
Using firmware file 'memorator_p030a_nodebug.img'
Loading image file 'memorator_p030a_nodebug.img'...
Binary data: size=37198, start_addr=0xc0018, load_addr=0xc0000
Firmware data:
  Build string: V1.5.0 (Dec 07 2002 12:41:37)
  HAL:          DIANA_C
  Variant:      MEMORATOR
  Image type:   FIRMWARE
Erasing...
Download started: #####
Download complete.
Starting compare: #####
Compare finished.
```

No error messages should appear. If you see error messages, try to disconnect and reconnect the device, and then perform the operation again.

To verify that the firmware is updated,

- (CANlib 3.7 or older) double-click on “CAN Hardware” in the Control Panel. Then select “USBcan II” (Kvaser Memorator is listed as an USBcan II), and press the “Hardware Info” button. You can then see the firmware version in the popup window.
- (CANlib 3.8 or later) double-click on “Kvaser Hardware” in the Control Panel. Select “Kvaser Memorator” in the tree view to the left, and click on either channel. The firmware revision information appears in the right half of the window.

5.8 Overrun

Under heavy load, high bit rates and long bursts of messages, Kvaser Memorator can lose messages. If this happens Kvaser Memorator Tools will display a message about this when the file is extracted. Some of the file formats, that support such a feature, will also indicate where the overrun occurred. (See help section in Kvaser Memorator Tools for details about file formats.)

To avoid losing important messages during logging, filters can be used. This will decrease the load on Kvaser Memorator and ensure that important information is not lost.

6 Frequently Asked Questions

Q: How many messages per second can Kvaser Memorator store on the disk?

A: It depends on the flash disk type. Fast disks can typically accommodate 2000 – 4000 messages per second.

Q: How many hours will a 256 MB disk last?

A: It depends on the CAN bus load. See Section 5.2, Disk capacity, on Page 18 to get a feeling for the numbers involved.

Q: Can I use 1 GB disks?

A: Yes. See our web site for a list of recommended disk types.

Q: Can I use any SD/MMC disk?

A: In principle, yes. However, there are many disks that do not conform to the standard. We recommend the disk brand(s) and type(s) we list on our web site.

Q: Can I use an external SD/MMC card reader to read the logged data?

A: Yes, Kvaser Memorator Tools can read data from external disk readers, as well as directly from a connected Kvaser Memorator.

Q: I have logged a lot of data on my Kvaser Memorator and now I'm trying to open the list of files inside Kvaser Memorator Tools, but it seems to hang. What's up?

A: If the Kvaser Memorator was interrupted while it was writing to the disk, it might take a long time to extract the list of files. Please be patient – eventually the list of files will appear. See Section 4.2, How to disconnect Kvaser Memorator from a CAN system, on Page 14 for advice on how to avoid this situation.

7 Disposal and Recycling Information



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

Dispose of batteries according to your local environmental laws and guidelines.

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

8 Legal acknowledgements

8.1 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.



THIS PRODUCT CONTAINS A RECHARGEABLE LI-POL BATTERY THAT MUST BE DISPOSED OF PROPERLY. IT MAY EXPLODE IF DAMAGED OR DISPOSED OF IN FIRE. DO NOT SHORT CIRCUIT.

8.2 EC Regulatory Compliance

The product(s); 73-30130-00175-6, 73-30130-00170-1, is in conformity with the essential requirements of the following regulations and directives:

- DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 (WEEE)
- REGULATION (EC) No. 1907/2006 (REACH), Annex XIV (the 'Candidate list') and Annex XVII ('Restriction of Substances')

The products listed above also complies with DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 (RoHS) and is in conformity with the following standards and/or other normative documents:

Standard	Description
EN 50 581 (2012)	Assessment with respect to restriction of hazardous substances

Table 13: Standards and normative documents for RoHS 2011

The products listed above also complies with DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 (EMC-directive) and is in conformity with the following standards and/or other normative documents:

Standard	Description
EN 55 022 (2006 + A1:2007)	Class B, radiated. IT equipment, commercial emission
EN 55 024 (2010)	IT equipment, commercial immunity

Table 14: Standards and normative documents for EMC 2004

The product(s); 73-30130-00234-0, is in conformity with the essential requirements of the following regulations and directives:

- REGULATION (EC) No. 1907/2006 (REACH), Annex XIV (the 'Candidate list') and Annex XVII ('Restriction of Substances')

The products listed above also complies with DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 (EMC-directive) and is in conformity with the following standards and/or other normative documents:

Standard	Description
EN 55 022 (2006 + A1:2007)	Class B, radiated. IT equipment, commercial emission
EN 55 024 (2010)	IT equipment, commercial immunity

Table 15: Standards and normative documents for EMC 2004

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/her own expense.

8.3 About this manual

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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. Please also note that the information in this document is subject to change without notice and should not be construed as a commitment on the part of Kvaser AB.

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

The products described in this document are protected by U.S. patent 5,696,911.

9 Document revision history

Version history for document UG_98039_memorator:

Revision	Date	Changes
1	2005-03	Older versions
2	2006-11-13	Updated for usage with Memorator Setup Tool
3	2008-12-03	Added paragraph about the external input being debounced. Revised the legal section.
4	2009-09-25	Kvaser Memorator Setup Tool is now known as Kvaser Memorator Tools.
5	2011-01-14	Updated supported OS list
6	2011-09-12	Updated disposal information
	2013-11-28	Changed layout of references, figures.
	2013-12-20	Updated layout of battery warning box
	2014-01-09	Added text regarding external card readers
7	2014-03-18	Reviewed, changed layout, updated compliance text.
8	2014-04-15	Renumbered pages