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Kvaser PC104+ User's Guide



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http://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 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.

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1 Table of contents

Kvaser PC104+ User's Guide **1**

1 Table of contents **3**

2 Introduction **4**
2.1 Scope of this document 4
2.2 General Description 5
2.3 PC104+ Features 5

3 Kvaser PC104+ Hardware **6**
3.1 Schematics 6
3.2 Technical Specification 7
3.3 Isolated CAN Drivers 9
3.4 Stack-Through Connector 9
3.5 Inner and Outer Shield 9
3.6 Protection against over voltage 9

4 Kvaser PC104+ Installation **11**
4.1 Install Hardware 11
4.2 Updated Drivers and Device Firmware 11
4.3 Setting the I/O Address Range 11
4.4 Setting the Interrupt 11
4.5 Setting the Board Number Switch 12
4.6 The CAN Channels 13
4.7 CAN Bus Termination 15
4.8 LED Indicators 15
4.9 Motherboard Power Supply 15
4.10 Do's and Don'ts 15

5 Software Support **16**

6 Disposal and Recycling Information **17**

7 Legal Information **18**
7.1 Electromagnetic compability 18
7.2 RoHS compliance statement 18
7.3 About this manual 18
7.4 Trademarks and patents 18

8 Document Revision History **19**

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 for the following Kvaser products:

Product Name	Product Number[1]	Description
Kvaser PC104+ HS/HS	00336-1	Two channels CAN interface with IDC Headers CAN connectors.
Kvaser PC104+ HS/HS	00352-1	Two channels CAN interface with DSUB CAN connectors.

[1] The full part numbers 733-0130-*nnnnn-n* are usually written *nnnnn-n*. You can use either number when ordering.

2.2 General Description

The Kvaser PC104+ board is an interface between the PCI bus of a PC/104+ system and the CAN bus. Compact and self-stacking, it complies with the flexible PC/104-Plus specification. You can with benefit use several Kvaser PC104+ boards on the same PC/104+ system.

The powerful M16C microcontroller from Renesas, with two built-in CAN controllers, provides accurate time stamping and high data throughput of CAN messages. Kvaser PC104+ supports 11 bit (CAN 2.0A) as well as 29 bit (CAN 2.0B) identifiers. Remote frames can be transmitted and received without restrictions. Kvaser PC104+ can detect and generate error frames on the CAN bus. Kvaser PC104+ offers two completely independent CAN channels with separate connectors. The CAN bus transceivers are integrated into the device.

Kvaser offers excellent software support. All Kvaser products utilize the common and user friendly Application Programming Interface, Kvaser CANlib API. 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 PC104+ Features

- PC/104-Plus compliant
- Stack-through connector
- Communicates with the PC through fast DPRAM
- M16C CAN controller from Renesas
- High performance on board microcontroller
- On board message buffer
- CAN 2.0 A and CAN 2.0 B (active)
- Supports “Silent Mode”
- Two completely independent CAN channels
- ISO11898-2 compliant transceivers
- DC/DC power supply to galvanically isolated bus drivers – no need for extra external power supply
- High-speed isolator circuits between CAN circuits and CAN drivers
- Supports bit rates from 20 kbit/s up to 1 Mbit/s
- Extended temperature range of -40˚ - +85˚
- Plug and play installation

3 Kvaser PC104+ Hardware

This chapter describes the hardware properties of the Kvaser PC104+ board.

3.1 Schematics

The connectors and switches on the Kvaser PC104+ board are shown below in Figure 1.

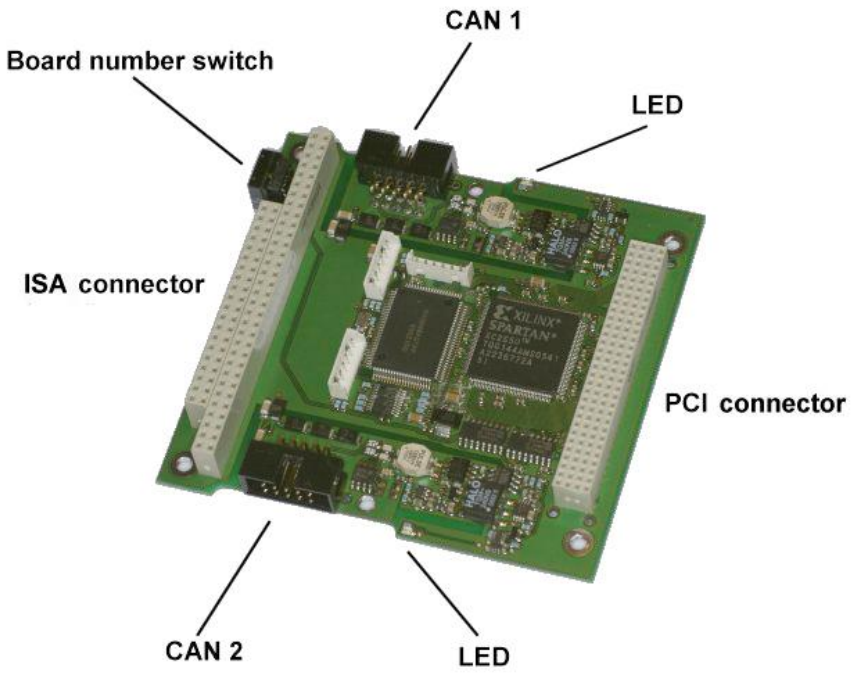


Figure 1: Connectors and switches on the Kvaser PC104+

3.2 Technical Specification

The technical specification for the two product versions of the Kvaser PC104+ board presented in Table 1 and Table 2.

Table 1. Kvaser PC104+ with IDC Headers CAN connectors.

PC interface	PC/104-Plus.
Stack-through connector	Yes
Voltage Signaling	Supports 5 V and 3.3 V
Required Supply Voltages	5 V and 3.3 V
PCI bus rate	32 bit, 33 MHz
Galvanic Isolation	Yes
Number of CAN channels	2
CAN 2.0A and 2.0B active	Yes
CAN connectors	2 x 10 pin IDC Male Headers.
CAN Transceivers	High Speed CAN, ISO 11898-2 compliant.
CAN Controller	Built into the M16C, ISO 11898-1 compliant.
Microcontroller	Renesas M16C/6N, 256 kB Flash and 10 kB RAM.
Bit rate, CAN bus	20 kbit/s to 1 Mbit/s
Timestamp resolution	1 µs
Error Frame Detection	Yes
Error Frame Generation	Yes
Error Counters Reading	Yes
Silent Mode	Yes
Hardware requirements	Industrial computer with a free PC104+ slot.
Power consumption	Approximately 1 W @ 200 mA
Software requirements[2]	Windows XP or later. (For other operating systems, see Kvaser web or contact Kvaser support.)
Configuration	Done by software via Plug & Play
Dimensions (W*L)	91 x 96 mm (approx. 3.6 x 3.8 in.)
Operating temperature	-40 ºC ... +85 ºC
Storage temperature	-40 ºC ... +85 ºC
Relative Humidity	0% ... 85% (non condensing.)

[2] Contact us for other operating systems.

Table 2. Kvaser PC104+ with 9Pin DSUB CAN connectors

PC interface	PC/104-Plus.
Stack-through connector	Yes
Voltage Signaling	Supports 5 V and 3.3 V
Required Supply Voltages	5 V and 3.3 V
PCI bus rate	32 bit, 33 MHz
Galvanic Isolation	Yes
Number of CAN channels	2
CAN 2.0A and 2.0B active	Yes
CAN connectors	2 x 9 pin DSUB
CAN Transceivers	High Speed CAN, ISO 11898-2 compliant.
CAN Controller	Built into the M16C, ISO 11898-1 compliant.
Microcontroller	Renesas M16C/6N, 256 kB Flash and 10 kB RAM.
Bit rate, CAN bus	20 kbit/s to 1 Mbit/s
Timestamp resolution	1 µs
Error Frame Detection	Yes
Error Frame Generation	Yes
Error Counters Reading	Yes
Silent Mode	Yes
Hardware requirements	Industrial computer with a free PC104+ slot.
Power consumption	Approximately 1 W @ 200 mA
Software requirements[3]	Windows XP or later. (For other operating systems, see Kvaser web or contact Kvaser support.)
Configuration	Done by software via Plug & Play
Dimensions (W*L)	91 x 96 mm (approx. 3.6 x 3.8 in.)
Operating temperature	-40 ºC ... +85 ºC
Storage temperature	-40 ºC ... +85 ºC
Relative Humidity	0% ... 85% (non condensing.)

[3] Contact us for other operating systems.

3.3 Isolated CAN Drivers

Each CAN transceiver is isolated from the CAN controller and all other CAN transceivers. The CAN driver will get the necessary power from the PCI bus via an isolated DC/DC convert. The isolation between the CAN controller and the CAN transceiver has a delay of maximum 50 ns in each direction. This will reduce the possible cable length with 20 meter compared to having no isolation.

3.4 Stack-Through Connector

The PC/104-Plus specification establishes a standard for the use of a high speed PCI bus in embedded applications. The Kvaser PC104+ modules are self-stacking and do not require a card cage or other interconnect support. In addition, the modules are also stackable with standard PC/104 modules.

Note: the ISA bus connector is just a passive pass-through connector on the Kvaser PC104+ board. The board communicates entirely on the PCI bus and the ISA bus connector is not connected to the electrical circuitry on the board.

3.5 Inner and Outer Shield

There are two shield connections to this board: the inner and outer shield. The inner shield, pin 5 at DSUB and pin 9 at IDC, is the EMC filter shield ground. This shield ground must be kept within +/- 50 Volt from CAN GND. If the CAN GND has a voltage above +/- 30 Volt compared to the inner shield, the CAN GND and the inner shield will be shorted together. For EMC performance it is best if inner shield and CAN GND is shorted together. The reason to keep them separated is to make it possible to have inner shield connected to the metallic cover of the electronic device and still have CAN GND floating, but limited to +/- 30 Volt from the shield.

The outer shield is the normal shield that should be connected to the shield of the CAN bus cable. It is connected to IDC pin 10. The intention is then to connect this wire to the DSUB metallic housing at the entrance in the metallic housing or the cable shield at the external connector. For the boards with DSUB CAN connectors, this outer shield is connected to the metal housing of the DSUB. The outer shield can have a voltage +/- 540 Volt from CAN GND and +/- 270 Volt from internal ground. If the voltage increase above those levels will the current flow increase up to 200 ampere. There is no current limit, so high current energies will burn away a component or the wire. ESD and high voltage noise will by this function be discharged to ground and prevent users from getting sparks when touching the isolated wires.

Inner shield is AC shorted to outer shield via a 10 nF capacitor. Also the outer shield is AC-shorted to internal ground. This will reduce the slew rate in the change of the CAN GND level relative to internal ground.

3.6 Protection against over voltage

The CAN bus interface do have a protection against over voltage at the CANH and CANL signals. If the voltage will increase above 28 Volt will there be a current flow from CANH and CANL to ground. An increased voltage level will cause the CANH and CANL to be shorted to ground and the current flow can increase to 100 ampere or more. The current flow will after a few milliseconds be reduced to 200 mA. The same is true if there is an over voltage between CANH and CANL. This part will prevent the CAN bus driver interface to break down due to

ESD, sparks and shortcut to power supply. A continues over voltage at the interface will break down the protection device. It is the energy that breaks down the device. 30 kV during 10 microseconds is less damaging than 32 Volt over few seconds.

4 Kvaser PC104+ Installation

For easy installation, all Kvaser PC104+ boards are Plug & Play. For best results, install the device drivers first. Follow the instructions on the Kvaser CD to do so. Important – you must read this entire chapter before installing your Kvaser PC104+ board.

4.1 Install Hardware

For driver installation and firmware update, see the driver installation documentation on the Kvaser CD. To install the hardware, follow these steps:

- Power down the computer.
- For your personal safety, unplug the computer from mains.
- Touch the metal chassis of the computer before you remove the Kvaser PC104+ from its protective antistatic plastic bag.
- Insert the board anywhere in a PC/104-Plus stack.
- Power up the computer.

4.2 Updated Drivers and Device Firmware

Updated drivers and device firmware is available from our web site, http://www.kvaser.com.

4.3 Setting the I/O Address Range

The computer's BIOS is responsible for allocating an address range for use by the card. This is normally done when the computer starts. The address range can normally not be adjusted.

4.4 Setting the Interrupt

The computer's BIOS is responsible for allocating the interrupt vector. Normally you can't change this allocation, although some computer BIOS's will let you do so.

Note that it is perfectly normal for PCI devices to share a single interrupt in the PC. Kvaser PC104+ will work without problems when sharing the interrupt with other PCI devices.

4.5 Setting the Board Number Switch

You can stack up to four Kvaser PC104+ devices on a PC/104 system, but each board must have a unique slot address. The board number switch for that purpose, see Figure 2. This switch can be set to 0, 1, 2 and 3 programming the board to be located at slot 1, 2, 3 or 4 respectively. Do not use the other switch values. The physical location of the board in the stack does not matter; the slot number is given by the board number switch, and every board connected must have a unique slot number compared to all other installed boards.

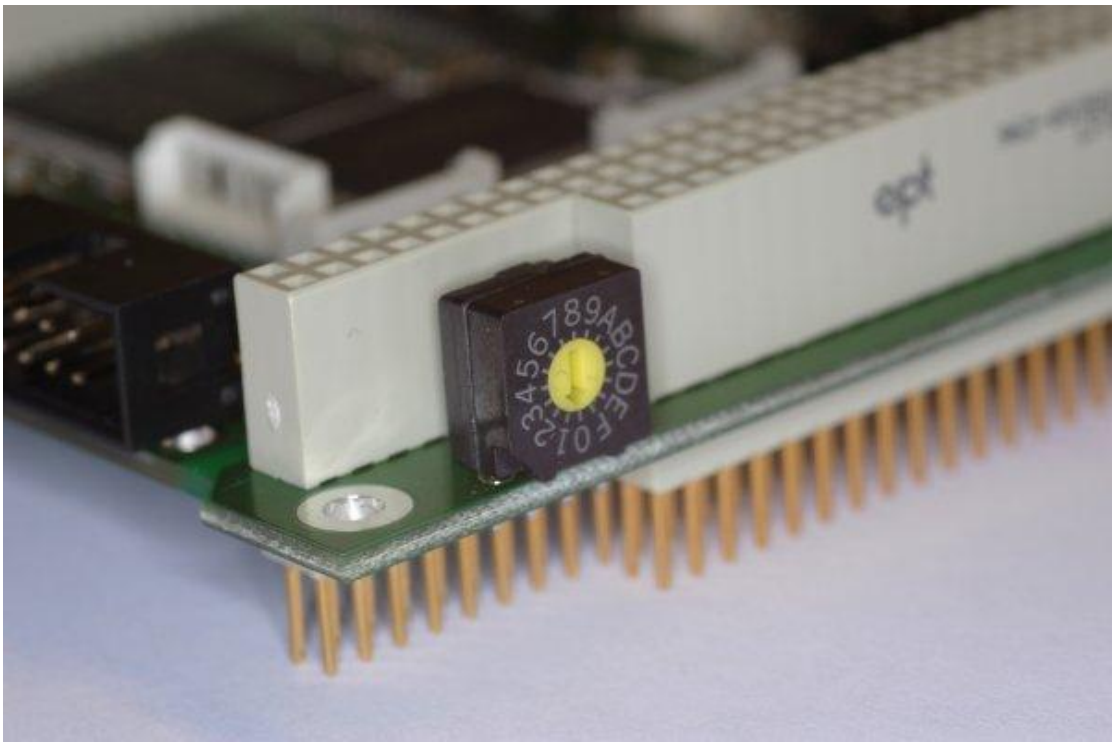


Figure 2: The board number switch.

4.6 The CAN Channels

The Kvaser PC104+ has two independent CAN channels located as seen in Figure 1.

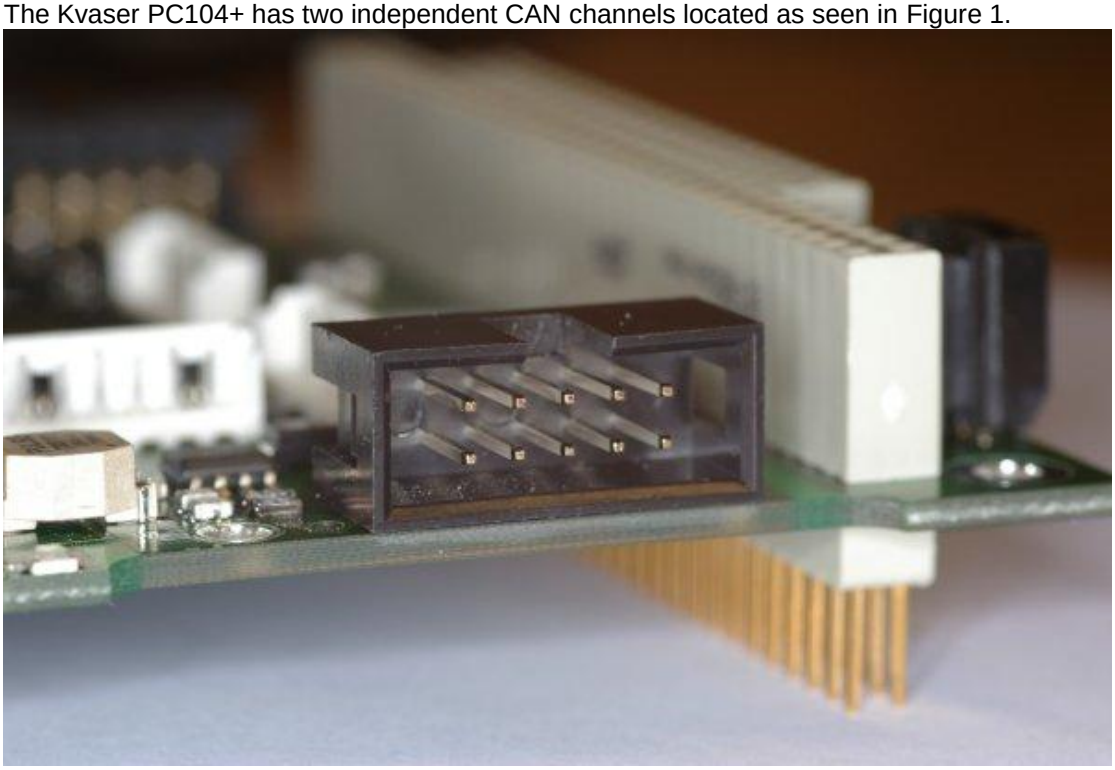


Figure 3: One of the CAN connectors on a PC104+ HS/HS board with IDC male headers.

Depending on product variant, the CAN channels have either 10 pin IDC male header connectors, as seen in Figure 3, or 9 pin DSUB connectors.

4.6.1 10 pin IDC Male Header Connector

The pin numbering of the IDC male header is seen in Figure 4 (when viewed as in Figure 3) and the functions of the pins are listed in Table 3 below. The pin numbering is chosen so you can use DSUB connectors by mounting them (the IDC type) on a piece of flat ribbon cable and connect to the Kvaser PC104+ board.

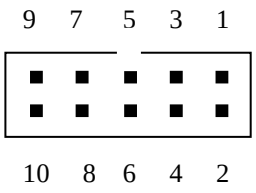


Figure 4. The IDC connector pin numbers on a CAN channel.

Table 3. Functions of the pins in the IDC Male Header CAN connector.

IDC header pin number	Function
1	Not connected.
2	Not connected.
3	CAN_L
4	CAN_H
5	GND
6	Not connected.
7	Not connected.
8	Not connected.
9	Inner Shield, read chapter 3.5
10	Outer Shield, read chapter 3.5

4.6.2 9 Pin DSUB Connector

The DSUB pin numbering on a CAN channel is shown in Figure 5 and the functions of the pins are listed in Table 4. Please note that the outer shield is connected to the metal housing for the DSUB CAN connector.

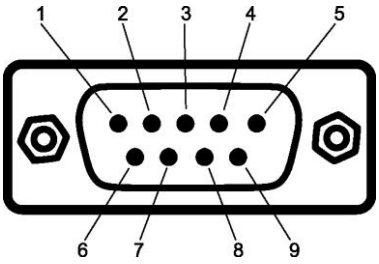


Figure 5. The DSUB connector pin on a CAN channel.

Table 4. Functions of the pins in the DSUB CAN connector

DSUB pin number	Function
1	Not connected.
2	CAN_L
3	GND
4	Not connected.
5	Inner Shield, read chapter 3.5
6	Not connected.
7	CAN_H
8	Not connected.
9	Not connected.
Metal housing	Outer Shield, read chapter 3.5

4.7 CAN Bus Termination

There are no on board CAN bus terminators on the PC104+ board. You must terminate the CAN bus yourself by placing a 120 Ohms resistor between CAN_H and CAN_L at each end of the CAN bus.

Note that without terminators on the CAN bus, the communication may or may not work – it's totally unpredictable. For laboratory use the termination need not be perfect but you will always need some load resistance between CAN_H and CAN_L somewhere on the CAN bus.

4.8 LED Indicators

The on board LEDs indicate the status of the card according to Table 5. For the LED's position on the board, see Figure 1.

Table 5. Meaning of the LED activity on the PC104+ boards.

LED Activity	Meaning of LED Activity
Both LEDs are blinking continuously with a frequency of around 5 Hz	The built-in self-test failed.
Steady light	The card is OK.
Blinking irregularly	The card is OK, and there is activity (transmit or receive) on the CAN bus.

4.9 Motherboard Power Supply

The PCI standard mandates that if a PCI connector on the computer motherboard provides 5 V, it must also provide 3.3 V. However, not all computers follow the standard here. If your Kvaser PC104+ board is not responding after installation, it could be a good idea to check the computer documentation if the PCI slots really are compliant to the PCI standard.

4.10 Do's and Don'ts

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

In case of trouble, **do** verify that you have **at least one terminator on the CAN bus**.

5 Software Support

The Kvaser PC104+ boards are supported by drivers routines and program examples for Windows, Linux, etc[4]. 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.

[4] Contact us for other operating systems.

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:
www.kvaser.com/en/kvaser/environment/recycling

7 Legal Information

7.1 Electromagnetic compability

The equipment has been tested for compliance with the EN 50 081-2:1993 (emission) and the EN 50 082-2:1995 (immunity) standards.

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.

7.2 RoHS compliance statement

This product is manufactured in accordance with directive 2002/95/EC on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS.)

7.3 About this manual

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7.4 Trademarks and patents

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8 Document Revision History

Date	Version	Changes
2005-11-25	1	Initial edition
2006-03-21	2	Reviewed for release.
2006-03-23	3	Released
2006-04-13	4	Chapter 2 and 3 expanded and corrected
2006-11-09	5	Reviewed – no major changes.
2008-12-03	6	Added part number 00491-7. Revised legal section. Minor editorial changes.
2011-01-14	7	Updated supported OS list
2011-09-12	8	Updated disposal information
2012-05-16	9	Removed part number 00491-7
2012-08-31	10	Corrected minimum CAN bit rate. Corrected some references.

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