Kvaser PCIcanx User's Guide

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http://www.kvaser.com

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2 Introduction

2.1 Scope of this document

This document describes the following variants of the PCIcanx board:

Product Name	Item Number	Description
PCIcanx HS	00332-3	One channel CAN interface
PCIcanx HS/HS	00331-6	Two channel CAN interface
PCIcanx 4xHS	00330-9	Four channel CAN interface
	00471-9 00454-2 00505-1	OEM versions

2.2 General Description

The Kvaser PCIcanx board connects up to four CAN networks to a PC using the PCI bus. The Kvaser PCIcanx board is designed to fit in both PCI-X and PCI bus systems and provides the user with excellent software support through Kvaser CANlib. Fully software compatible with the Kvaser PCIcan boards, i.e. 100% compatible with applications written for the Kvaser PCIcan boards using Kvaser CANlib API.

2.3 PCIcanx features

- Up to four independent CAN channels
- High Speed CAN (ISO 11898-2)
- Supports bit rates up to 1 Mbit/s
- Fits in PCI-X and PCI slots (See chapter 5.1)
- Communicates with the PC through Direct I/O
- Onboard buffers to off load the PC
- Supports CAN 2.0 A and 2.0 B (active)
- DC/DC power supply to galvanically isolated bus drivers
- High-speed isolator circuits between CAN circuits and CAN drivers
- Fully software compatible with PCIcan-HS, -HS/HS, -4xHS
- Quick and easy plug and play installation
- Extended temperature range of -40˚C - +85˚C
- Interfaces the CAN bus with DSUB connector(s)

3 Technical Specifications

The technical specifications for the PCIcan boards are listed in Table 1 – Table 3.

Table 1. Kvaser PCIcanx 4xHS

General	
Size	PCI-bus PC card, Full height, short length, Approximately. 98x121 mm (3.9x4.84 inch)
PCI card	Compliant with the PCI Local Bus Specification v2.3
PCI bus interfaces	PCI-X and PCI slots (See chapter 5.1)
PCI bus speed	32 bit, 33 MHz transfer rate
CAN bus connector	25-pin DSUB, female (See chapter 5.4)
Power consumption	PCIcanx 4xHS: max 400 mA @ 5 V
Operating systems	Windows XP or later. (For other operating systems, see Kvaser web or contact Kvaser support.)
CAN Controllers and Oscillator Frequency	
CAN controllers: 4 x SJA1000	
CAN Clock frequency: 16 MHz Option – Possible to specify CAN oscillator frequency per channel, contact our Sales Department for an inquiry.	
CAN Bus Driver(s)	
Drivers	Texas SN65HVD251; compliant with the ISO 11898-2 standard.
Voltage feed	The drivers are galvanically separated from the power supply on the PC by on-board DC/DC converters.
Grounding	The ground of the CAN drivers is available at the 25-pin DSUB connector.
Shielding	The shield of the CAN drivers is not connected to the 25-pin DSUB connector
Other Features	
• High-speed isolator circuits between CAN circuits and drivers. • Temperature range: -40˚C - +85˚C	

Table 2. Kvaser PCIcanx HS/HS

General	
Size	PCI-bus PC card Full height, short length, Approximately. 98x121 mm (3.9x4.84 inch)
PCI card	Compliant with the PCI Local Bus Specification v2.3
PCI bus interfaces	PCI-X and PCI slots (See chapter 5.1)
PCI bus speed	32 bit, 33 MHz transfer rate
CAN bus connector	2 x 9-pin DSUB, male (See chapter 5.4)
Power consumption	PCIcanx HS/HS: max 200 mA @ 5 V
CAN Controllers and Oscillator Frequency	
CAN controllers: 2 x SJA1000	
CAN Clock frequency: 16 MHz Option – Possible to specify CAN oscillator frequency per channel, contact our Sales Department for an inquiry.	
CAN Bus Driver(s)	
Drivers	Texas SN65HVD251; compliant with the ISO 11898-2 standard.
Voltage feed	The drivers are galvanically separated from the power supply on the PC by on-board DC/DC converters.
Grounding	The ground of the CAN driver is available at the 9-pin DSUB connector.
Shielding	The shield of the CAN driver is available at the 9-pin DSUB connector.
Other Features	
• High-speed isolator circuits between CAN circuits and drivers. • Temperature range: -40˚C - +85˚C	

Table 3. Kvaser PCIcanx HS

General	
Size	PCI-bus PC card, low profile, short length Approximately 48x121 mm (1,92x4,84 inc)
PCI card	Compliant with the PCI Local Bus Specification v2.3
PCI bus interfaces	PCI-X and PCI slots (See chapter 5.1)
PCI bus speed	32 bit, 33 MHz transfer rate
CAN bus connector	9-pin DSUB, male (See chapter 5.4)
Power consumption	PCIcanx HS: max 100 mA @ 5 V
CAN Controller and Oscillator Frequency	
CAN controller: 1 x SJA1000	
CAN Clock frequency: 16 MHz Option – Possible to specify CAN oscillator frequency, contact our Sales Department for an inquiry.	
CAN Bus Driver	
Driver	Texas SN65HVD251; compliant with the ISO 11898-2 standard.
Voltage feed	The driver is galvanically separated from the power supply on the PC by on-board DC/DC converter.
Grounding	The ground of the CAN driver is available at the 9-pin DSUB connector.
Shielding	The shield of the CAN driver is available at the 9-pin DSUB connector.
Other Features	
• High-speed isolator circuits between CAN circuits and drivers. • Temperature range: -40˚C - +85˚C	

4 Schematics

A block diagram for all product versions of the Kvaser PCIcanx boards is shown in Figure 1.

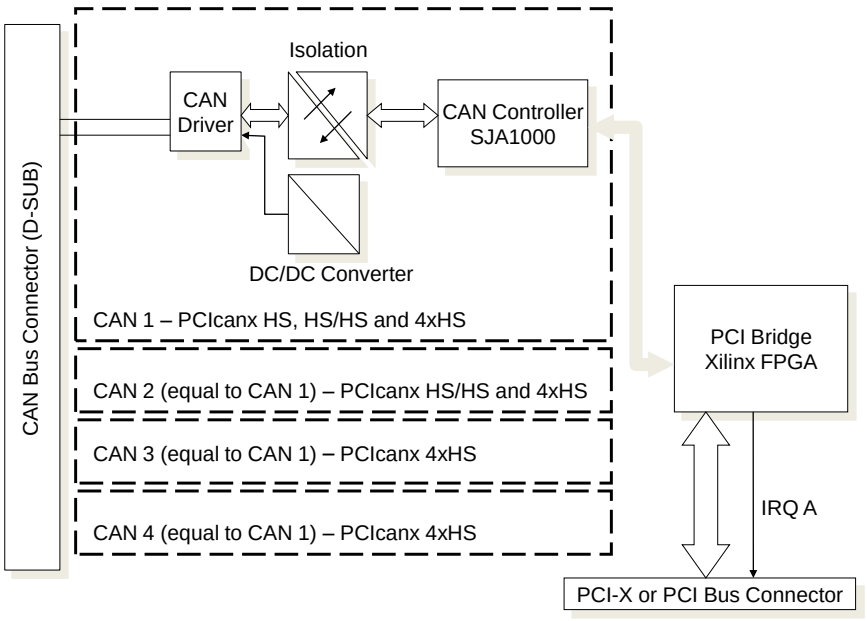

Figure 1 Block diagram for the Kvaser PCIcanx boards.

5 The PCIcanx Hardware

For quick and easy installation, all Kvaser PCIcanx boards are plug-and-play boards.

5.1 PCI-X and PCI slots

The universal design of the Kvaser PCIcanx boards makes them suitable for both PCI-X and PCI slots. Although, the board works in PCI-X as well as PCI slots, it is not a PCI-X product. Hence, it operates in PCI mode in all slots. Major features of the Kvaser PCIcanx board:

- Legacy compliant with PCI Local Bus Specification v2.3
- Support for PCI-X Specification v 1.0 and higher versions
- Universal 3.3 V and 5 V keyed board connector
- Supports 3.3 V and 5 V supply voltage
- Operates at a bus frequency of 33 MHz

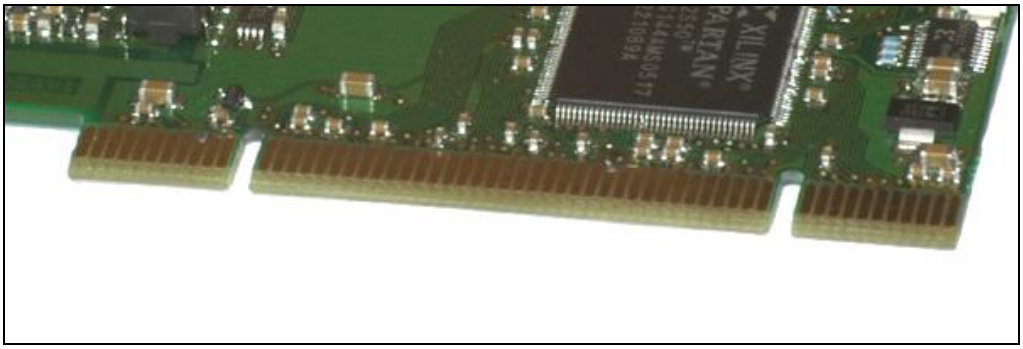

Figure 2. The 3.3 Volt and 5 Volt keyed board connector.

Here is a list of supported PCI-X and PCI slots:

- 3.3 V, 64 bit
- 3.3 V, 32 bit
- 5 V, 64 bit
- 5 V, 32 bit.

To summarize, the Kvaser PCIcanx boards can be used in any PCI-X and PCI slots. Just keep in mind - all cards on a common bus can only run as fast as the slowest card. For example if there is a 33 MHz card in slot 1 and a 66 MHz card in slot 2, both cards will run at 33 MHz. The performance degradation can be avoided by separating the Kvaser PCIcanx board (33 MHz / 32-Bit) and other PCI and PCI-X devices using different bus segments.

Note – not all motherboard vendors comply with the industry standards for PCI-X and PCI slots. Kvaser AB cannot assume any responsibility for that.

5.2 The Isolated CAN Driver

Kvaser's PCIcanx cards for CAN systems feature up to four CAN controllers. Each CAN-driver SN65HVD251 is isolated both from the CAN controller and all other CAN drivers. 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-driver 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.

Due to human safety, the voltage should never at any part of the PCIcanx board be more than +/- 50 Volt from the PC-computer chassis ground. Note that the PCIcanx will not secure this condition itself. If any DSUB pin has an external voltage in the range below +/-500 Volt from chassis ground this will also be the true voltage at this pin.

Each CAN-driver circuit is protected from short time over voltage like ESD and accidental short cuts to high voltage. An over voltage beyond +/-500 Volt, on any used DSUB pin, will cause a rapid shortcut to ground. If the applied over voltage do have a high energy source some PCB wires may burn away in that case.

5.3 CAN Bus Termination

There are no terminating resistors onboard the standard PCIcanx board. However, there is room available to mount terminating resistors onboard all product versions. These terminating resistors can also serve as a load between the CAN bus wires; this is needed for the ISO 11898-2 compliant bus drivers to work properly. Please contact our Support Team for detailed instructions.

5.4 D-SUB connector

The D-SUB connector(s) are mounted on a bracket and connects to the metallic housing of the PC. The pinning of the 25-pin DSUB connector is listed in table 4.1, and the pinning of the 9-pin DSUB connector is listed in table 4.2

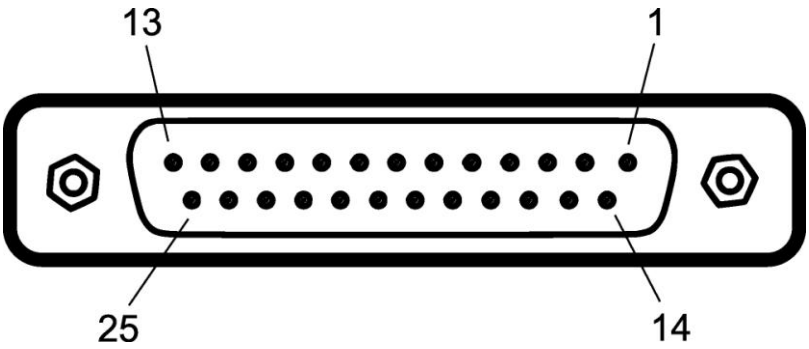

Table 4. 25-pin DSUB connector for Kvaser PCIcanx 4xHS.

Pin	Function
1	Ground to CAN driver #1
2	Ground to CAN driver #2
14	Ground to CAN driver #3
15	Ground to CAN driver #4
5, 6	CAN-L for CAN #1
18, 19	CAN-H for CAN #1
7, 8	CAN-L for CAN #2
20, 21	CAN-H for CAN #2
9, 10	CAN-L for CAN #3
22, 23	CAN-H for CAN #3
11, 12	CAN-L for CAN #4
24, 25	CAN-H for CAN #4
All other pins are not connected.	

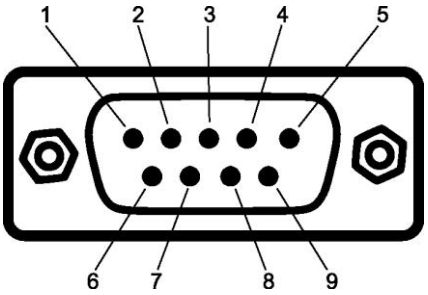

Table 5. 9-pin DSUB connector for Kvaser PCIcanx HS, HS/HS. (Per channel)

Pin	Function
1	(Not connected)
2	CAN-L
3	Signal ground
4	(Not connected)
5	Shield
6	(Not connected)
7	CAN-H
8	(Not connected)
9	(Not connected)

5.5 The LED indicators

The PCIcanx HS and PCIcan HS/HS boards have LED indicators, one per channel. They are visible through a hole in the mounting bracket. The LEDs indicates CAN bus activity and will emit a short pulse whenever a CAN message is received or transmitted.

6 Software Development Information

This section is intended for those who want to program the PCIcanx card directly. Normally, you would choose to use the supporting device drivers available for the PCIcanx card. Refer to the “CANLIB Software Development Kit” documentation for further information on these device drivers from a programmer’s point of view. Please note that this board is fully software compatible with the Kvaser PCIcan boards.

6.1 Additional Documentation

This document includes all information you need to use the circuits on the card. However, the circuits themselves are not described here so information about these must be obtained from the suppliers. See the list of references on page 15. General knowledge about the PCI bus is also assumed.

6.2 A note on the different PCIcanx versions

PCIcanx 4xHS has four CAN controllers. PCIcanx HS/HS has two CAN controllers and PCIcanx HS has one controller. This chapter describes primarily PCIcanx 4xHS; if you have one of the other cards, just disregard the circuits and switches that are not on your card. Differences between the different members of the PCIcan family are explicitly noted wherever they occur.

6.3 The PCI bus controller

All PCIcanx boards use the same PCI controller, which is a Xilinx FPGA with PCI core. The PCI controller is responsible for address decoding and interrupt steering.

The initialization of the PCI controller is outside the scope of this manual. Typically, it is carried out by the operating system and/or the BIOS. There are a few registers you have to set up in the driver; these are described below.

6.4 Address decoding

The PCI controller can decode up to 5 different address areas, three of which are used by the PCIcanx.

Address area #	Type	Size (bytes)	Used for
0	I/O	128	Xilinx registers (“AMCC S5920”)
1	I/O	128	SJA1000 circuits
			0 – 0x1f: SJA1000 #1
			0x20 – 0x3F: SJA1000 #2
			0x40 – 0x5F: SJA1000 #3
			0x60 – 0x7F: SJA1000 #4
2	I/O	16	Xilinx registers

Address area number 1, the one used for the SJA1000’s, is further subdivided into four areas of 32 bytes each; one for each (possible) SJA1000.

There is no actual AMCC S5920 in the PCIcanx, but the first address area is set up to be compatible with the Kvaser PCIcan cards.

6.5 Interrupts

The PCIcanx uses one PCI bus interrupt, INTA#. It is asserted whenever one or more SJA1000's have their interrupts active. To reset an active interrupt, read the interrupt status register in all present SJA1000s – the interrupt of the corresponding SJA1000 will then automatically clear.

To check the status of the interrupt line, test the INTERRUPT ASSERTED bit (number 23) in the INTCSR register in the "S5920".

To enable or disable interrupts from the PCIcanx, use the ADD-ON INTERRUPT PIN ENABLE (bit 13) in the INTCSR register in the "S5920".

6.6 Registers in the Xilinx

The Xilinx FPGA implements a few registers.

Address offset	Register	Usage
0 – 6		Reserved, do not use
7	VERINT	Bit 7 - 4 contains the revision number of the FPGA configuration. 15 is the first revision, 14 is the next, and so on.

The current FPGA revision number is 13 (which is read from the VERINT register as 1110xxxx). Future revisions (12, 11, 10, …) will remain compatible with revision 13.

6.7 PCI Configuration Data

The following data are configured automatically into the Xilinx FPGA PCI controller when power is applied to the card.

Item	Value
Vendor Id	0x10e8
Device Id	0x8406 (for all PCIcan boards)
Revision Id	0
Class Code	0xffff00 (means: no base class code defined for device)
Subsystem Vendor Id	0
Subsystem Device Id	0

6.8 Configuration of the SJA1000

Refer to the SJA1000 data sheet for all details on how to program the SJA1000. You need to know the following:

- RX1 is connected to ground.
- TX1 is not connected.
- CLKO is not connected.
- Setting the OCR register to 0xDA is a good idea. This means “normal output mode”, push-pull and the correct polarity.
- In the CDR register, you should set CBP to 1. You will probably also want to set the clock divider value to 0 (meaning divide-by-2), the Pelican bit, and the clock-off bit (you have no need for CLKOUT anyway.)

The only way to find out how many SJA1000 a PCIcanx card has, is to try to access them one after the other.

7 Support

The PCIcanx boards are supported by drivers routines and program examples for Windows, Linux etc. The software and its documentation are available from our web site, and are 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.

8 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

9 References

Philips	SJA1000 Stand-Alone CAN Controller. Preliminary Specification. 1997 Nov 04. Also available on the web.
Shanley, T., and Anderson, D.	*PCI system architecture*, fourth edition. MindShare, Inc. ISBN 0-201-30974-2.

More CAN information is found on http://www.kvaser.com and has many links to other sites with CAN information. You can also download new versions of the software for PCIcanx there.

10 Legal Information

10.1 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.

10.2 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.)

10.3 About this manual

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10.4 Trademarks and patents

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11 Document revision history

Revision	Date	Changes
1	2005-12	Original revision
2	2006-11-10	New layout - no major changes.
3	2007-09-12	Correction of misprints in section 2.1.
4	2008-05-13	Documented the LED indicators. Various other editorial changes. Updated WEEE, RoHS and patent information.
5	2008-12-03	Added OEM part numbers. Minor editorial changes.
6	2010-12-17	Removed faulty statement that PCIcan 4xHS does not have LED indicators.
7	2011-01-14	Updated supported OS list
8	2011-09-12	Updated disposal information
9	2012-09-03	Improved PCI access documentation. Minor corrections.