Controller Area Network (CAN) Interfaces

NI CAN Series 2 Interfaces for PCI, PXI, and PCMCIA

- Hardware timing and synchronization with NI data acquisition, vision, and motion devices
- 100% bus load; for up to 1 Mb/s
- ISO 11898-compliant for standard (11-bit) and extended (29-bit) arbitration IDs
- Philips SJA1000 CAN controller
- Available in high-speed, low-speed/fault-tolerant, and single-wire versions
- Hardware timestamping
- Intel 80386EX microprocessor for timed CAN frame transfer
- Optical isolation up to 500 V
- Import Vector database files with NI-CAN

Operating Systems
- Windows 2000/NT/XP/Me/98
- LabVIEW Real-Time

Recommended Software
- LabVIEW
- LabWindows/CVI

Other Compatible Software
- C/C++
- Visual Basic 6

Application Software (included)
- Bus monitor utility

Driver Software (included)
- NI-CAN



Overview

CAN interfaces meet the physical and electrical requirements for in-vehicle automotive networks based on CAN. All CAN interfaces include NI-CAN device driver software, with which you can import CAN channels from Vector database files or create them in an easy-to-use utility and program using a high-level API. With a National Instruments CAN interface and NI-CAN software, you can use a desktop, industrial, or notebook PC running Windows for a variety of CAN applications, including automotive testing and diagnostics, prototype design, factory automation, and machine control.

CAN Bus and Analog Data Synchronization

Recent advances in automotive test applications demand tighter integration of CAN and other measurement devices. In many applications, you need to synchronize the physical parameters measured in time to correlate the data. You can program this synchronization in software, but OS latency sometimes introduces unacceptable delays for certain automotive test applications. National Instruments CAN, data acquisition, vision, and motion boards for PCI are equipped to share timing and triggering signals. In a system, a CAN board can share timing and triggering signals with data acquisition, image acquisition, or motion control boards, basing their actions on these signals. Determinism is maintained between the trigger signal and the desired response because timing and triggering signals are handled in hardware. The host PC software interacts only to retrieve the data once it is acquired or to write new data.

Synchronization is available for PXI, PCI, and PCMCIA-CAN devices. For PXI modules, the timing signals are shared in the PXI trigger bus on the backplane; therefore, you do not need additional cables to take advantage of synchronization. For PCI boards, you can use a RTSI bus cable to share the signals. For PCMCIA-CAN, a synchronization cable connects external timing and triggering signals to the card to achieve synchronization between PCMCIA-CAN and PCMCIA, USB, or PCI data acquisition hardware.

LabVIEW Real-Time Compatibility

PCI and PXI CAN hardware works with LabVIEW Real-Time running on a PC or a PXI controller for deterministic control. You can download your existing NI LabVIEW application to the target without specialized real-time OS programming knowledge. The real-time performance and synchronization mean you can use a standard PC or PXI chassis for applications such as rapid control prototyping, hardware-in-the-loop testing, and data logging.

Common Hardware

All National Instruments Series 2 CAN devices use the Intel 80386EX microprocessor to handle communications directly on the interface device. The 80386EX provides a dedicated environment for reliable, high-performance CAN communications protocol stack execution. Because acquisition and transmission timing occur on the board, CAN frames are not lost due to OS activity such as hard drive access, mouse movements, or virus scans. The physical layer of all National Instruments CAN devices fully conforms to the ISO 11898 physical layer specification for CAN and is optically isolated to 500 V. You can interface to the CAN bus using a 9-pin male D-Sub (DB9) connector. The Philips SJA1000 CAN controller implements typical ISO 11898 CAN functionality and offers additional functionality to aid in system development, such as listen-only mode, sleep/wakeup mode, error counter access, and self-reception (echo) mode.

NATIONAL INSTRUMENTS™

Controller Area Network (CAN) Interfaces

High-Speed CAN Hardware

High-speed CAN interfaces can communicate with devices using transfer rates up to 1 Mb/s. Typical high-speed devices include antilock brake systems, engine control modules, and emissions systems.

Low-Speed/Fault-Tolerant CAN Hardware

Low-speed/fault-tolerant CAN interfaces can communicate with devices up to 125 kb/s and offer transceivers with fault-tolerant capabilities. Typical low-speed/fault-tolerant devices in an automobile include comfort devices such as seat and mirror adjusters.

Single-Wire CAN Hardware

Single-wire CAN interfaces can communicate with devices at rates up to 33.3 kb/s (88.3 kb/s in high-speed mode). Typical single-wire devices within an automobile include comfort devices such as seat and mirror adjusters.

Software-Selectable CAN Hardware

You can configure the software-selectable CAN interface for high-speed, low-speed/fault-tolerant, or single-wire CAN. Multiple-transceiver hardware offers the perfect solution for applications that require a combination of communications standards.

NI-CAN Communications Software

National Instruments ships CAN devices with NI-CAN software for Windows 2000/NT/XP/Me/98. NI-CAN software includes device drivers that you can use for application development and firmware that runs on the embedded Intel 80386EX microprocessor. The NI-CAN device drivers are full 32-bit drivers designed for Windows 2000/NT/XP/Me/98. These device drivers are compatible with NI LabVIEW and LabWindows/CVI as well as standard programming environments such as Microsoft Visual C/C++, Borland C/C++, and Visual Basic 6. The firmware implements time-critical features provided by the NI-CAN software. NI-CAN software provides flexible yet easy-to-use functions for configuration and I/O on CAN.

The Intel 80386EX microprocessor on an NI-CAN interface provides the operating environment for the CAN protocol communications stack. CAN specifies timing requirements to ensure reliable, deterministic bus operation. In a typical system, a National Instruments CAN interface must provide the necessary system responsiveness. Because the majority of the CAN protocol executes on the embedded Intel 80386EX microprocessor on NI CAN interfaces, you can achieve improved response to incoming messages. Embedded CAN protocol stack execution also results in more deterministic network performance because the onboard microprocessor is dedicated to CAN communication activities.

CAN Programming

With NI-CAN software, you can import CAN channel database files that use the Vector format (.dbc). A CAN frame can contain multiple values. By importing scaling information from the database files, you can easily convert these values into channels with engineering units (such as °C or kPa). You can either import the scaling information directly into an application or into Measurement & Automation Explorer (MAX), where you can edit channels. Alternatively, you can configure channels directly in MAX.

NI-CAN software provides two different application programming interfaces (APIs) – channel and frame, with which you can develop applications customized to your test and simulation requirements. The channel API provides access to the CAN bus in easy-to-use engineering units, using channels. Therefore, it is recommended for customers who are new to NI-CAN. The channel API simplifies multiple device integration and synchronization. With the frame API, which provides lower-level access to the CAN bus, you can read and write raw frames on the network. The frame API is recommended for users that require low-level access to the CAN bus.

Controller Area Network (CAN) Interfaces

NI-CAN Features in Measurement & Automation Explorer

Test Panel

You can communicate with a specific CAN channel without programming using Test Panel, a simple debugging tool to experiment with CAN channels. Using a graphical interface, the tool reads CAN data in engineering units and plots or writes to the device.

Bus Monitor

To quickly monitor all CAN bus traffic, use the Bus Monitor, a utility that provides an easy-to-use interface to view all CAN traffic and log it to disk. It also provides options to control, display, and view bus statistics.

NI Spy

NI Spy gives you an easy way to monitor the NI-CAN API calls your application makes without having to recompile or rebuild. Use it to verify that your application is working properly, troubleshoot problems with your application, or verify the communication with your CAN device. NI Spy dynamically captures and displays all NI-CAN API calls made by any applications running in the system.

Physical Layer

The CAN physical layer connects the CAN controller to the physical bus wires. The boards contain the PCI and PXI physical layers. They are powered internally (from the boards) via a DC-DC converter, and optically isolated up to 500 V. This isolation protects your NI-CAN hardware and the PC it is installed in from being damaged by high-voltage spikes on the CAN bus.

For PCMCIA-CAN cards, the physical layer is implemented inside the cable. The cables can be powered either internally (from the host computer) via an onboard DC-DC converter, or externally (from the CAN bus) via a voltage regulator. PCMCIA-CAN physical layer cables are included with PCMCIA interfaces.

Connector

PCI-CAN and PXI-846x interfaces have a 9-pin male D-Sub (DB9) connector for each port. The 9-pin D-Sub connector follows the pinout recommended by CiA DS 102. Figure 2 shows the 9-pin D-Sub connector pinout for high-speed and low-speed/fault-tolerant interfaces. PCMCIA-CAN cables have both a 9-pin male D-Sub and Combicon-style pluggable screw terminal connector for each port.[1]

[1]As shown in Figure 3 on page 4.

Note: See the NI CAN hardware and software reference manual for pinouts for single-wire and software-selectable interfaces.

CAN Device Simulator

The National Instruments CAN Device Simulator, when communicating with NI CAN and data acquisition (DAQ) hardware on a PC, provides a tool to demonstrate the concepts of CAN communication, DAQ, and CAN/DAQ synchronization.

The NI CAN Device Simulator has a function generator, one high-speed CAN interface, one high-speed CAN monitor connector, a 68-pin DAQ connector, access to the DAQ interface TRIG1, TRIG2, and FREQOUT pins, and digital input switches.



Figure 1. NI CAN Device Simulator

Controller Area Network (CAN) Interfaces

CAN Interfaces and Ordering Information

Model	Version	Transceiver	Ports	Max Transfer Rate (kb/s)	LabVIEW Real-Time Support	Part Number
PCI						
PCI-CAN	High-speed	TJA1041	1	1000	✓	777357-01
PCI-CAN/2	High-speed	TJA1041	2	1000	✓	777357-02
PCI-CAN/LS	Low-speed/fault-tolerant	TJA1054A	1	125	✓	778007-01
PCI-CAN/LS2	Low-speed/fault-tolerant	TJA1054A	2	125	✓	778007-02
PCI-CAN/SW	Single-wire	AU5790	1	83.333 (in high-speed mode)	✓	778795-01
PCI-CAN/SW2	Single-wire	AU5790	2	83.333 (in high-speed mode)	✓	778795-02
PCI-CAN/XS	Software-selectable	TJA1041, TJA1054A, AU5790, EXT[1]	1	1000	✓	778782-01
PCI-CAN/XS2	Software-selectable	TJA1041, TJA1054A, AU5790, EXT[1]	2	1000	✓	778782-02
PXI						
PXI-8460/1	Low-speed/fault-tolerant	TJA1054A	1	125	✓	778008-01
PXI-8460/2	Low-speed/fault-tolerant	TJA1054A	2	125	✓	778008-02
PXI-8461/1	High-speed	TJA1041	1	1000	✓	777707-01
PXI-8461/2	High-speed	TJA1041	2	1000	✓	777707-02
PXI-8463/1	Single-wire	AU5790	1	83.333 (in high-speed mode)	✓	778780-01
PXI-8463/2	Single-wire	AU5790	2	83.333 (in high-speed mode)	✓	778780-02
PXI-8464/1	Software-selectable	TJA1041, TJA1054A, AU5790, EXT[1]	1	1000	✓	778783-01
PXI-8464/2	Software-selectable	TJA1041, TJA1054A, AU5790, EXT[1]	2	1000	✓	778783-02
PCMCIA						
PCMCIA-CAN	High-speed	TJA1041	1	1000	–	777499-01
PCMCIA-CAN/2	High-speed	TJA1041	2	1000	–	777499-02
PCMCIA-CAN/LS	Low-speed/fault-tolerant	TJA1054A	1	125	–	778054-01
PCMCIA-CAN/LS2	Low-speed/fault-tolerant	TJA1054A	2	125	–	778054-02
PCMCIA-CAN/HSLS	High-speed/low-speed/fault-tolerant	TJA1041, TJA1054A	2	1000/125	–	778266-01

[1]Software-selectable interfaces contain three transceivers as well as an EXT connection. With this, you can bypass the standard transceivers and connect to your own.

PCMCIA Transceiver Dongles and Ordering Information

Model	Version	Transceiver	Ports	Min Transfer Rate (kb/s)	Max Transfer Rate (kb/s)	Internally Powered	Part Number
(HS)	High-speed	TJA1041	1	40	1000	✓	191010A-01
(HS/HS)	High-speed	TJA1041	2	40	1000	✓	191006A-01
(LS)	Low-speed/fault-tolerant	TJA1054A	1	5	125	✓	191011A-01
(LS/LS)	Low-speed/fault-tolerant	TJA1054A	2	5	125	✓	191008A-01
(SW)	Single-wire	AU5790	1	5	83.333 (in high-speed mode)		191012A-01
(HS/LS) Combo	High-speed/low-speed/fault-tolerant	TJA1041, TJA1054A	2	40/5	1000	✓	191007A-01
(HS/SW) Combo	High-speed/single-wire	TJA1041, AU5790	2	40/5	1000	HS only	191009A-01

Ordering Information

CAN Device Simulator
- U.S. 120 VAC 779189-01
- Universal Euro 240 VAC 779189-02

RTSI Bus Cables
- 2 boards 776249-02
- 3 boards 776249-03
- 4 boards 776249-04
- 5 boards 776249-05
- Extended, 5 boards.....777562-05

PCMCIA synchronization cable 188791-01

BUY NOW!

For complete product specifications, pricing, and accessory information, call (800) 813 3693 (U.S. only) or go to **ni.com/can**.

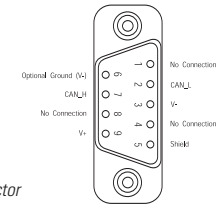


Figure 2. DB9 Connector

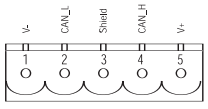


Figure 3. Combicon-Style Connector

Controller Area Network (CAN) Interfaces

Specifications

Power Requirements for PCI, PXI, or PCMCIA I/O Channel, +5 VDC (±5%)

Device	Typical Current (mA)
PCI-CAN (1 port)	800
PCI-CAN/2 (2 ports)	850
PCI-CAN/LS (1 port)	800
PCI-CAN/LS2 (2 ports)	900
PCI-CAN/SW (1 port)	750
PCI-CAN/SW2 (2 ports)	850
PCI-CAN/XS (1 port)	800
PCI-CAN/XS2 (2 ports)	900
PXI-8460/1 (1 port)	800
PXI-8460/2 (2 ports)	850
PXI-8461/1 (1 port)	800
PXI-8461/2 (2 ports)	850
PXI-8463/1 (1 port)	800
PXI-8463/2 (2 ports)	850
PXI-8464/1 (1 port)	850
PXI-8464/2 (2 ports)	900
PCMCIA-CAN (HS)	405
PCMCIA-CAN/2 (HS/HS)	465
PCMCIA-CAN (LS)	405
PCMCIA-CAN/2 (LS/LS)	465
PCMCIA-CAN (SW)	405
PCMCIA-CAN/2 (HS/LS)	465
PCMCIA-CAN/2 (HS/SW)	465

Physical

Dimensions

- PCI ..... 20.7 by 11.18 cm (8.150 by 4.4 in.)
- PXI ..... 16.0 by 10.0 cm (6.3 by 3.9 in.)
- PCMCIA..... Type II PC Card

I/O Connections

- PCI and PXI ..... DB9 male per channel
- PCMCIA..... DB9 male and Combicon-style pluggable screw terminals

Operating Environment

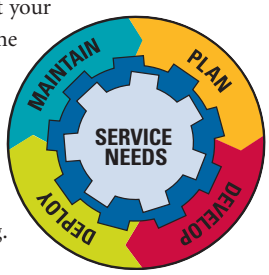
- Ambient temperature..... 0 to 55 °C
- Relative humidity ..... 5 to 95%, noncondensing

Noise Emission

- PCI, PXI, and PCMCIA..... FCC Class A Verified

NI Services and Support

NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit ni.com/services.



Training and Certification

NI training is the fastest, most certain route to productivity with our products. NI training can shorten your learning curve, save development time, and reduce maintenance costs over the application life cycle. We schedule instructor-led courses in cities worldwide, or we can hold a course at your facility. We also offer a professional certification program that identifies individuals who have high levels of skill and knowledge on using NI products. Visit ni.com/training.

Professional Services

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

NATIONAL INSTRUMENTS™
Certified Alliance Partner

OEM Support

We offer design-in consulting and product integration assistance if you want to use our products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Local Sales and Technical Support

In offices worldwide, our staff is local to the country, giving you access to engineers who speak your language. NI delivers industry-leading technical support through online knowledge bases, our applications engineers, and access to 14,000 measurement and automation professionals within NI Developer Exchange forums. Find immediate answers to your questions at ni.com/support.

We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit ni.com/ssp.

Hardware Services

NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with ni.com/pxiadvisor.

Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit ni.com/calibration.

Repair and Extended Warranty

NI provides complete repair services for our products. Express repair and advance replacement services are also available. We offer extended warranties to help you meet project life-cycle requirements. Visit ni.com/services.

NATIONAL INSTRUMENTS™

ni.com • (800) 813 3693
National Instruments • info@ni.com

© 2005 National Instruments Corporation. All rights reserved. CVI, LabVIEW, National Instruments, National Instruments Alliance Partner, NI, NI-CAN, ni.com, NI-DAQ, RTSI, and SCXI are trademarks of National Instruments. Other product and company names listed are trademarks or trade names of their respective companies.
A National Instruments Alliance Partner is a business entity independent from NI and has no agency, partnership, or joint-venture relationship with NI.

2005_5388_151_101_D