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High-Performance GPIB Interfaces for PCI and PXI

NI PCI-GPIB, NI PXI-GPIB, NI PCI-GPIB/LP, NI PCI-GPIB+, NI PCI-8232, NI PXI-8232

- Completely IEEE 488.2 compatible
- FIFO buffers to decouple GPIB transfers from PCI transfers
- Maximum GPIB transfer rates
  - More than 1.5 Mbytes/s (IEEE 488.1)
  - More than 7.7 Mbytes/s (HS488)
- Universal PCI/PXI connector for operation in 5 V and 3.3 V slots
- PCI-GPIB+ adds GPIB analyzer functionality
- PCI-8232, PXI-8232 add Gigabit Ethernet controller functionality

Operating Systems
- Windows 2000/NT/XP/Me/9x
- Mac OS 9.x/8.x/7.x
- Solaris

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio

Driver Software (included)
- NI-488.2
- GPIB Analyzer Software (Windows only)

Driver Development Kit
- NI-488DDK
  - For any operating system
  - Examples included for DOS, Tru64 UNIX (Digital UNIX), HP-UX, IRIX, VxWorks



Overview

The National Instruments GPIB controllers for PCI and PXI combine high-performance hardware with a complete suite of development tools to get your applications up and running fast.

The National Instruments PCI-MITE and TNT family ASICs make the PCI-GPIB a maximum-performance IEEE 488.2 interface for the PCI bus. The PCI-MITE, a complete PCI interface, is compliant with PCI Specification 2.1. The hardware is completely software configurable and compatible with the Plug and Play standard for easy hardware installation. The TNT chip performs the basic IEEE 488 Talker, Listener, and Controller functions required by all versions of IEEE 488, including IEEE 488.2. The PCI-GPIB can sustain data transfer rates of more than 1.5 Mbytes/s using the IEEE 488.1 3-wire interlocked handshake. The PCI-GPIB also implements the high-speed IEEE 488.1 non-interlocked handshake (HS488) for benchmarked data transfers at more than 7.7 Mbytes/s.

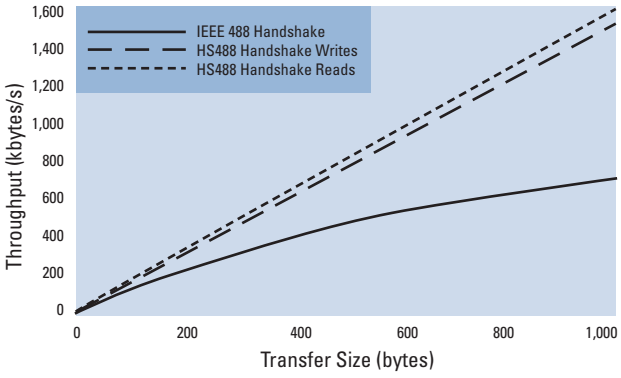


Figure 1. NI PCI/PXI GPIB Controller Data Transfer Benchmarks (Small Data Blocks)

The PCI-GPIB/LP is a low-profile IEEE 488 interface for computers that accept boards of this size. The PCI-GPIB/LP is functionally equivalent to the high-performance PCI-GPIB and maintains compatibility for both 3.3 V and 5 V PCI slots.

The PXI-GPIB is a low-cost, high-performance IEEE 488 interface for PXI, the standard for PCI-based modular instrumentation that uses the PCI bus in a rugged Eurocard configuration.

Because PXI is electrically a superset of desktop PCI with a different physical configuration, the PXI-GPIB module has the same functionality and performance as a PCI-GPIB board. The PXI-GPIB is available with NI-488.2 for Windows 2000/NT/XP/Me/9x and Solaris.

The PCI-GPIB+ interface combines the PCI-GPIB with a GPIB protocol analyzer. The NI PCI-8232 and PXI-8232 interfaces include PCI-GPIB functionality as well as an Intel 10/100/1000 BaseT Ethernet port. These combination devices save slots in your system while providing the full performance and functionality of their individual components.

HS488

The GPIB controllers for PCI and PXI can use HS488, the high-speed GPIB protocol patented by National Instruments and approved by the IEEE in ANSI/IEEE Standard 488.1-2003. HS488 increases the maximum data transfer rate of ANSI/IEEE Standard 488.1-1987 to 8 Mbytes/s and is a superset of the IEEE 488.1 protocol that attempts to conduct data transfers with the new high-speed non-interlocked handshake. If any active listener is not capable of HS488 transfers, the protocol automatically uses the IEEE 488.1 3-wire interlocked handshake protocol. Maximum data transfer rates obtainable using HS488 depend on the host computer architecture and system

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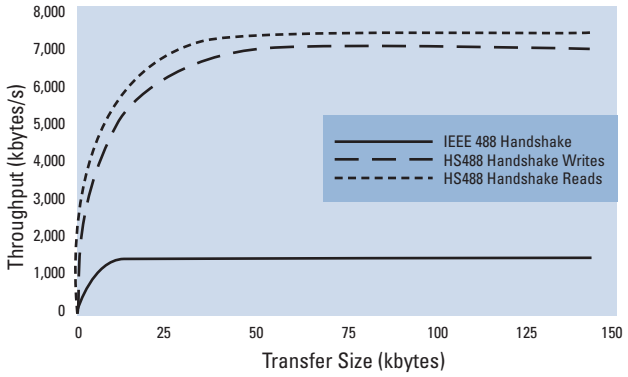


Figure 2. NI PCI/PXI GPIB Controller Data Transfer Benchmarks

configuration. The PCI family of controllers has transfer rates of more than 7.7 Mbytes/s.

The TNT family of ASICs completely and transparently handles the HS488 protocol without additional circuitry. Because HS488 is a superset of IEEE 488.1, you can mix existing GPIB devices with devices that are high-speed capable without changing your application programs. The TNT ASICs can implement high-speed data transfers automatically. Thus, devices that have a TNT chip can transparently communicate using HS488 if the corresponding Talker or Listener can also use HS488.

Transfer Rates

The NI PCI/PXI GPIB Controller software and hardware provide maximum performance even when the data block is small. Figures 1 and 2 describe typical performance. Actual obtainable data transfer rates depend on host computer, operating system, system configuration, and device capability.

Hardware

The key functional components of the NI PCI/PXI GPIB family include the PCI-MITE and the TNT family of ASICs.

PCI-MITE Single-Chip PCI Interface

The PCI interface logic is integrated in the PCI-MITE ASIC, a high-performance, single-chip PCI interface. The PCI-MITE implements all PCI-defined configuration registers and additional control and status registers. To provide access to the onboard registers, the onboard ROM, and the TNT ASIC, the PCI-MITE decodes the address and control signals of the PCI bus.

The PCI-MITE provides bus mastering using a sophisticated DMA Controller to enhance overall performance during data transfers. The DMA Controller automatically provides several modes of operation, including link chaining, to maximize data transfer performance.

TNT ASIC Family

The TNT family of ASICs is comprised of the first maximum-performance single-chip IEEE 488.2 Talker, Listener, and Controller interfaces with integrated IEEE 488.1 compatible transceivers. The TNT ASICs also implement the HS488 mode of operation for high-speed GPIB data transfers. The transfer functions implement Automatic Handshake Holdoff on the last byte of a GPIB read and Automatic END transmission on the last byte of a GPIB write. Because these functions are performed in hardware, you save significant CPU time relative to performing the same functions in software. The TNT family includes a basic ASIC and a new ASIC that also includes all the features and performance of the PCI-MITE.

Combination GPIB Controller and Gigabit Ethernet Port

Use the National Instruments PCI-8232 or PXI-8232 when you need to control GPIB instruments and add a network connection in your system. These boards combine a GPIB controller and a Gigabit Ethernet port in a single device, adding network functionality to your GPIB controller. You receive the same high-performance GPIB interface and Ethernet interface in one combination device while saving a slot in your computer or PXI chassis.

The NI PCI-8232 and PXI-8232 take advantage of the industry-leading performance of the Intel 82540EM Gigabit Ethernet Controller, which is compatible with 10BaseT, 100BaseTX, and 1000BaseT networks. The PCI-8232 and PXI-8232 automatically connect at the highest available speed. Based on Intel high-performance technology, these Ethernet controllers maintain peak performance as your network environment evolves and increase the performance of demanding desktop applications by using their duplex capability. The boards also implement Auto-MDI negotiation, which allows the Ethernet port to link using both crossover and straight-through cables.

Combination GPIB Controller and Analyzer

The National Instruments PCI-GPIB+ combines a PCI-GPIB controller and a complete GPIB analyzer on a single board. The PCI-GPIB+ is a low-cost, high-speed alternative to separate GPIB controller and analyzer products.

The GPIB analyzer portion of the PCI-GPIB+ can capture and monitor HS488 activity up to the full 8 Mbytes/s rate. You can use the

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High-Performance GPIB Interfaces for PCI and PXI

built-in GPIB analyzer for troubleshooting a variety of IEEE 488 software and hardware problems. It can alleviate many of the difficulties associated with GPIB communication, such as addressing inconsistencies, protocol violations, and simple bus timeout conditions.

The PCI-GPIB+, in addition to including industry-standard NI-488.2, comes with an easy-to-use graphical analyzer application. You can use the PCI-GPIB+ to monitor, capture, and participate in bus activity on the GPIB at high speeds. You can capture GPIB activity according to user-specified GPIB criteria. Furthermore, user-specified GPIB events can trigger the capture. You can view captured GPIB information in multiple windows in the analyzer application or save it for later viewing. The GPIB Analyzer software displays the real-time status of the GPIB, including the 16 GPIB control and data lines.

NI-488DDK

NI-488DDK is a driver development kit, a comprehensive source code package for developing applications for operating systems other than those for which NI offers a standard NI-488.2 driver. NI-488DDK consists of more than 20 board-level functions provided in source code to give you a head start when you must design your own GPIB driver. Because NI-488DDK, a subset of our NI-488.2, uses the same syntax, migration of applications from the NI-488DDK to NI-488.2 is straightforward.

Ordering Information

GPIB Controller for PCI

NI PCI-GPIB and NI-488.2 for
- Windows 2000/XP/Me/98 778032-01
- Windows 2000/XP/Me/98 (with 2 m X2 GPIB cable) 778032-51
- Windows NT 777073-01
- Windows NT (with 2 m X2 GPIB cable) 777073-51
- Windows 95 777158-01
- Windows 95 (with 2 m X2 GPIB cable) 777158-51
- Mac OS[1] 777075-01
- Mac OS[1] (with 2 m X2 GPIB cable) 777075-51
- Solaris 777462-01
- Solaris (with 2 m X2 GPIB cable) 777462-51

[1]Includes XA adapter (See page 707)

GPIB Controller for Low-Profile PCI

NI PCI-GPIB/LP and NI-488.2 for
- Windows 2000/XP/Me/98 (with 2 m X13 cable) 778255-01
- Windows NT (with 2 m X13 cable) 778769-01

GPIB Controller for PXI

NI PXI-GPIB and NI-488.2 for
- Windows 2000/XP/Me/98 778039-01
- Windows NT 777398-01
- Windows 95 777399-01
- Solaris 778247-01

NI PXI-GPIB and NI-488DDK 777431-02

For additional operating systems, contact National Instruments

Combination GPIB Controller and Analyzer for PCI

NI PCI-GPIB+, NI-488.2, and GPIB Analyzer Software for
- Windows 2000/XP/Me/98 778033-01
- Windows 2000/XP/Me/98 (with 2 m X2 GPIB cable) 778033-51
- Windows NT 777560-01
- Windows NT (with 2 m X2 GPIB cable) 777560-51

Combination GPIB Controller and Gigabit Ethernet Port for PCI

NI PCI-8232 and NI-488.2 for
- Windows 2000/XP/Me/98 778742-01
- Windows NT 778743-01

Combination GPIB Controller and Gigabit Ethernet Port for PXI

NI PXI-8232 and NI-488.2 for
- Windows 2000/XP/Me/98 778658-01
- Windows NT 778659-01

Software Only

NI-488.2 778599-01
NI-488.2 and analyzer 778599-01
NI-488DDK 777430-01

Cables

GPIB X2 cable (double-shielded)
- 1 m 763061-01
- 2 m 763061-02
- 4 m 763061-03
- 8 m 763061-04

GPIB X13 cable (for PCI-GPIB/LP)
- 1 m 183285-01

Ethernet CAT 5 twisted-pair cable (E1 Cable)
- 1 m 182219-01
- 5 m 182219-05
- 10 m 182219-10

Ethernet CAT 5 shielded cable (E5 Cable)
- 1 m 189174-01
- 5 m 189174-05
- 10 m 189174-10

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Visit ni.com/info and enter pcigpib, pxigpib, gpibplus, pxi8232, and/or pci8232.

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High-Performance GPIB Interfaces for PCI and PXI

Specifications

IEEE 488 Compatibility

IEEE 488.1 and IEEE 488.2 compatible

Capability Code	Description
SH1	Source Handshake
AH1	Acceptor Handshake
T5, TE5	Talker, Extender Talker
L3, LE3	Listener, Extender Listener
SR1	Service Request
PP1, PP2	Local/Remote Parallel Poll
RL1	Remote/Local
C1, C2, C3, C4, C5	Controller
E1, E2	Three-state bus drivers with automatic switch to open collector during parallel poll

Maximum IEEE 488 Bus Transfer Rates

IEEE 488 interlocked handshake ..... 1.5 Mbytes/s
IEEE 488 non-interlocked
(HS488) handshake ..... 7.7 Mbytes/s
(Actual rates depend on system configuration and instrument capabilities.)

GPIB Analyzer Performance

Sampling rate ..... 20 MHz
Timestamp resolution ..... 50 ns

Ethernet Performance

10BaseT ..... 10 Mb/s, full-duplex
100BaseTX ..... 100 Mb/s, full-duplex
1000BaseT ..... 1000 Mb/s, full-duplex

Power Requirements

PCI-GPIB, PXI-GPIB, PCI-GPIB/LP (183617x-01-based board)
+5 VDC ..... 1.5 W typical, 2.25 W maximum
PCI-GPIB, PXI-GPIB (188513x-01-based board)
+3.3 VDC ..... 0.4 W typical, 0.6 W maximum
PCI-GPIB+
+5 VDC ..... 2.5 W typical, 3.75 W maximum
PCI-8232
+5 VDC ..... 4.4 W typical, 5.8 W maximum
PXI-8232
+3.3 VDC ..... 3.0 W typical, 4.0 W maximum
PCI signaling level ..... Universal

Physical Dimensions

PCI (183617x-01-based board) ..... 13.3 by 10.7 cm (5.3 by 4.2 in.)
PCI (188513x-01-based board) ..... 12.0 by 6.44 cm (4.72 by 2.54 in.)
PCI (Low Profile) ..... 12.0 by 6.44 cm (4.72 by 2.54 in.)
PXI ..... 16 by 10 cm (6.3 by 3.9 in.)

I/O Connectors

GPIB ..... IEEE 488 standard 24 pin
Ethernet RJ45

Operating Environment

Ambient temperature ..... 0 to 55 °C
Relative humidity ..... 10 to 90%, noncondensing

Storage Environment

Ambient temperature ..... -20 to 70 °C
Relative humidity ..... 5 to 95%, noncondensing

Compliance

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