

High-Performance GPIB Interfaces for PCI and PXI

NI PCI-GPIB, NI PXI-GPIB, NI PCI-GPIB/Low-Profile (LP), NI PCI-GPIB+, NI PCI-8232, NI PXI-8232

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

Operating Systems

- Windows Vista (32- and 64-bit)/XP/2000/Me/9x/NT
- Mac OS X/Classic
- Solaris (SPARC), Solaris x86, and Linux®

Recommended Software

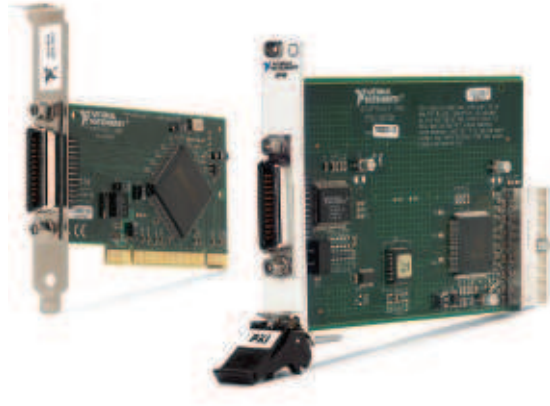
- LabVIEW
- LabWindows™/CVI
- Measurement Studio

Driver Software (included)

- NI-488.2
- GPIB analyzer software (Windows only)

Driver Development Kit

- NI-488DDK
 - For any OS
 - Examples included for DOS, Tru64 UNIX (Digital UNIX), HP-UX, IRIX, VxWorks



Overview

The NI 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 NI 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

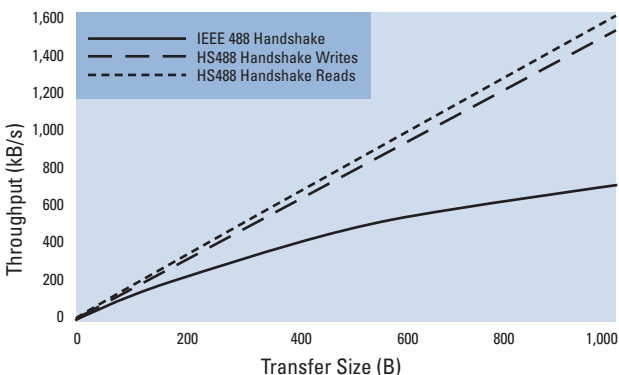


Figure 1. NI PCI/PXI GPIB Controller Data Transfer Benchmarks (Small Data Blocks)

IEEE 488.2. The PCI-GPIB can sustain data transfer rates of more than 1.5 MB/s using the IEEE 488.1 three-wire interlocked handshake. It also implements the high-speed IEEE 488.1 noninterlocked handshake (HS488) for benchmarked data transfers at more than 7.7 MB/s.

The NI 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 and 5 V PCI slots.

The NI 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 Vista (32- and 64-bit)/XP/2000/NT/Me/9x, Solaris (SPARC), and Solaris x86.

The NI 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 10/100/1000BASE-T Ethernet port. These combination devices save slots in your system while providing the full performance and functionality of their individual components.

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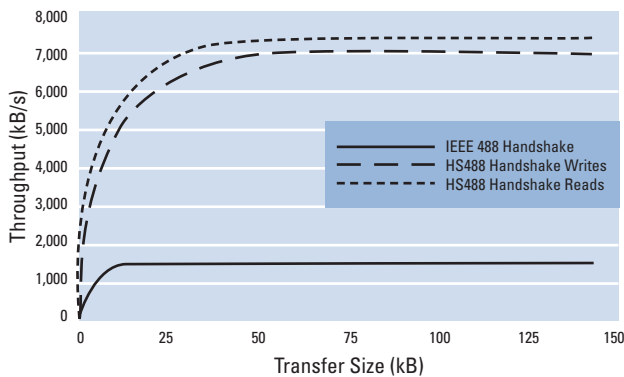


Figure 2. NI PCI/PXI GPIB Controller Data Transfer Benchmarks

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 MB/s and is a superset of the IEEE 488.1 protocol that attempts to conduct data transfers with the new high-speed noninterlocked handshake. If any active listener is not capable of HS488 transfers, the protocol automatically uses the IEEE 488.1 three-wire interlocked handshake protocol. Maximum data transfer rates obtainable using HS488 depend on the host computer architecture and system configuration. The PCI family of controllers has transfer rates of more than 7.7 MB/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

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. It 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 offers 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 includes 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 with all the features and performance of the PCI-MITE.

Combination GPIB Controller and Gigabit Ethernet Port

Use the PCI-8232 or PXI-8232 when you need to control GPIB instruments and add a network connection in your system. These interfaces 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.

NI 8232 devices take advantage of the industry-leading performance of the Intel 82540EM Gigabit Ethernet controller, which is compatible with 10BASE-T, 100BASE-TX, and 1000BASE-T networks. These interfaces automatically connect at the highest available speed. Based on Intel high-performance technology, the NI 8232 Ethernet controllers maintain peak performance as your network environment evolves and increase the performance of demanding desktop applications by using their duplex capability. The devices 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 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 MB/s rate. You can use the built-in GPIB analyzer for troubleshooting a variety of IEEE 488 software and

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hardware problems. It can alleviate many of the difficulties associated with GPIB communication, such as inconsistencies, protocol violations, and simple bus timeout conditions.

The PCI-GPIB+, in addition to including industry-standard NI-488.2 software, 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. 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 NI-488.2, uses the same syntax, migration of applications from the NI-488DDK to NI-488.2 is straightforward.

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Ordering Information

GPIB Controller for PCI

| | |
|--|-----------|
| NI PCI-GPIB and NI-488.2 for | |
| Windows Vista/XP/2000 | 778032-01 |
| Windows Vista/XP/2000 (with 2 m X2 GPIB cable) | 778032-51 |
| Windows NT..... | 777073-01 |
| Windows NT (with 2 m X2 GPIB cable)..... | 777073-51 |
| Windows Me/9x..... | 777158-01 |
| Windows Me/9x (with 2 m X2 GPIB cable)..... | 777158-51 |
| Linux | 778686-01 |
| Linux (with 2 m X2 GPIB cable) | 778686-51 |
| Mac OS X | 779141-01 |
| Mac OS X (with 2 m X2 GPIB cable) | 779141-51 |
| Mac OS ¹ | 777075-01 |
| Mac OS ¹ (with 2 m X2 GPIB cable) | 777075-51 |
| Solaris (SPARC) | 777462-01 |
| Solaris (SPARC) (with 2 m X2 GPIB cable)..... | 777462-51 |
| Solaris x86 | 781022-01 |

¹Includes XA adapter.

GPIB Controller for Low-Profile PCI

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

GPIB Controller for PXI

| | |
|--------------------------------|-----------|
| NI PXI-GPIB and NI-488.2 for | |
| Windows Vista/XP/2000 | 778039-01 |
| Windows NT..... | 777398-01 |
| Windows Me/98 | 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 Vista/XP/2000 | 778033-01 |
| Windows Vista/XP/2000 (with 2 m X2 GPIB cable) | 778033-51 |

Note: Analyzer functionality not supported in Vista (64-bit).

Combination GPIB Controller and Gigabit Ethernet Port for PCI

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

Combination GPIB Controller and Gigabit Ethernet Port for PXI

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

Software Only

| | |
|---|-----------|
| NI-488.2 | 778599-01 |
| NI-488.2 and GPIB analyzer software | 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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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 MB/s |
| IEEE 488 noninterlocked (HS488) handshake..... | 7.7 MB/s |

(actual rates depend on system configuration and instrument capabilities)

GPIB Analyzer Performance

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

Ethernet Performance

| | |
|------------------|------------------------|
| 10BASE-T | 10 Mb/s, full-duplex |
| 100BASE-TX..... | 100 Mb/s, full-duplex |
| 1000BASE-T | 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+ | |
| +3.3 VDC | 0.6 W typical, 1.9 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 (tested in accordance with IEC-60068-2-1, IEC-60068-2-2, and IEC-60068-2-56) |

Storage Environment

| | |
|--------------------------|---|
| Ambient temperature..... | -20 to 70 °C |
| Relative humidity | 5 to 95%, noncondensing (tested in accordance with IEC-60068-2-1, IEC-60068-2-2, and IEC-60068-2-56) |

Shock and Vibration

| | |
|-----------------------|--|
| PXI-GPIB, PXI-8232 | |
| Functional shock..... | 30 g peak, half-sine, 11 ms pulse (tested in accordance with IEC-60068-2-27; test profile developed in accordance with MIL-PRF-28800F) |
| Random vibration | |
| Operating..... | 5 to 500 Hz, 0.3 g _{rms} |
| Nonoperating..... | 5 to 500 Hz, 2.4 grms (tested in accordance with IEC-60068-2-64; nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3) |

Compliance and Safety

Visit ni.com/certification.

NI Services and Support



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Professional Services

Our NI Professional Services team is composed of NI applications and systems engineers 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.

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

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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

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

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.

