PCI/LPCI/PXI-3488

IEEE488 GPIB Interface Card Series

User's Manual

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1 Introduction

ADLINK's PCI-3488, LPCI-3488 and PXI-3488 GPIB controller interface cards, fully compatible with the IEEE488.2 instrumentation control and communication standard, are capable of controlling up to 14 stand-alone instruments via IEEE488 cables. PCI-3488, LPCI-3488 and PXI-3488 are designed to meet the requirements for high performance and maximum programming portability. The 1KB on-board FIFO and a block transfer mode provide up to 1.5 MB/s GPIB transfer rate. With APIs that are compatible with NI* software and VISA support, the PCI-3488, LPCI-3488 and PXI-3488 provide the greatest compatibility with your existing applications and instrument drivers.

Performance

ADLINK's expertise in PCI and PXI interface cards was leveraged when developing these newly designed GPIB interface card. The PCI-3488 supports both 3.3V and 5V PCI buses and can be adapted to most industrial and desktop computers. The LPCI-3488 supports both 3.3V and 5V PCI buses and can be adapted to most industrial and desktop computers. The PXI-3488 is compliant with PXI specification Rev. 2.0 can be adapted to most PXI and CompactPCI system.All ADLINK GPIB interface cards have the on-board 1KB FIFO placed between the GPIB bus and PCI controller to buffer GPIB read/write operations. The FIFO eliminates the gap between the slow GPIB bus (~1.5MB/s) and the fast PCI bus (132MB/s), and dramatically increases overall system performance.

Compatibility

ADLINK's GPIB interface solutions are delivered with complete software support, including a driver API set that is fully binary compatible with NI* GPIB-32.DLL. All programs written based on the GPIB-32.DLL library can be executed with PCI-3488, LPCI-3488 or PXI-3488 without any modification. VISA library is also supported to ensure compatibility with applications utilizing VISA. The ADLINK PCI-3488, LPCI-3488 and PXI-3488 provide the "Plug and Play" compatibility with all your existing applications.

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1.1 Features

PCI-3488

The PCI-3488 IEEE 488 GPIB interface card provides the following advanced features:

- Fully compatible with the IEEE 488 standard
- Supports a 32-bit 3.3V or 5V PCI bus
- Up to 1.5MB/s data transfer rates
- On-board 1KB FIFO for read/write operations
- Provides APIs compatible with NI-488.2*
- Supports industrial-standard VISA Library
- Interactive utility for testing and diagnostics
- Compact, half-size PCB

LPCI-3488

The LPCI-3488 IEEE 488 GPIB interface card provides the following advanced features:

- Fully compatible with the IEEE 488 standard
- Up to 1.5MB/s data transfer rates
- On-board 1KB FIFO for read/write operations
- Provides APIs compatible with NI-488.2*
- Supports industrial-standard VISA Library
- Interactive utility for testing and diagnostics
- Fully correspond to low-profile MD1 PCB

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PXI-3488

The PXI-3488 IEEE 488 GPIB interface card provides the following advanced features:

- PXI specifications Rev. 2.0 compiant
- 3U Eurocard form factor, CompactPCI compliant (PICMG 2.0 R3.0)
- Fully compatible with the IEEE 488 standard
- Up to 1.5MB/s data transfer rates
- On-board 1KB FIFO for read/write operations
- Provides APIs compatible with NI-488.2*
- Supports industrial-standard VISA Library
- Interactive utility for testing and diagnostics

Note: *NI and NI-488.2 are the trademarks of National Instruments Corporation.

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1.2 Specifications

GPIB Bus Properties

- Up to 14 instruments can be connected to one controller
- Maximal 1.5 MB/s data transfer rate
- Cable length
  - 2 meters between each instrument (suggested)
  - 20 meters total cable length
- Data transfer mode: 8 bits parallel
- Handshake: 3 wire handshake, reception of each data byte is acknowledged

Certificates

- EMC/EMI: CE, FCC Class A

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General Specifications

- I/O Connector: IEEE 488 standard 24-pin connector
- Operating temperature: 0 to 55ºC
- Storage temperature: -20 to 80ºC at 10 to 90% humidity
- Relative humidity: 10 to 90%, non-condensing
- Power requirements
  - PCI-3488

+5V	+3.3V
400mA (typical) 750mA (maximum)	400mA (typical) 750mA (maximum)

Table 1-1: Power Requirements (PCI-3488)

  - LPCI-3488

+5V	+3.3V
400mA (typical) 750mA (maximum)	400mA (typical) 750mA (maximum)

Table 1-2: Power Requirements (LPCI-3488)

  - PXI-3488

+5V	+3.3V
400mA (typical) 750mA (maximum)	400mA (typical) 750mA (maximum)

Table 1-3: Power Requirements (PXI-3488)

- Dimensions (not including connectors):
  - PCI-3488: 135mm x 107mm
  - LPCI-3488: 120mm x 64mm
  - PXI-3488: 160mm x 100mm

1.3 Software Support

ADLINK PCI-3488, LPCI-3488 and PXI-3488 GPIB interface cards provide a device driver package – ADL-GPIB for Windows 98/NT/2000/XP/2003.

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The ADGPIB driver package also provides a diagnostic utility to test your GPIB interface cards, as well as programming samples and source codes for Microsoft Visual C++. You can find the ADL-GPIB driver package in the associated All-in-one CD. Please refer to Section 2.6 for detailed software installation instructions.

For other OS supports, please contact ADLINK for more information.

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2 Installation

This chapter outlines the contents of package, describes unpacking information, and describes how to install the hardware and software.

2.1 Contents of Package

The package includes the following items:

- PCI-3488 or LPCI-3488, or PXI-3488
- ADLINK All-in-one Compact Disc
- This User's Manual
- Additional low-profile bracket (LPCI-3488 only)

If any of these items are missing or damaged, contact your ADLINK dealer. Save the shipping materials and carton in to ship or store the product in the future.

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2.2 Unpacking

PCI-3488, LPCI-3488 and PXI-3488 contain electro-static sensitive components that can be easily be damaged by static electricity.

Therefore, these modules should be handled on a grounded anti-static mat. The operator should be wearing an anti-static wrist-band, grounded at the same point as the anti-static mat.

Inspect the module for obvious damage. Shipping and handling may cause damage to the module. Be sure there are no shipping and handling damage on the module before continuing.

You are now ready to install your PCI/LPCI/PXI-3488.

Note: DO NOT APPLY POWER TO THE CARD IF IT HAS BEEN DAMAGED.

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2.3 Mechanical Drawing

PCI-3488

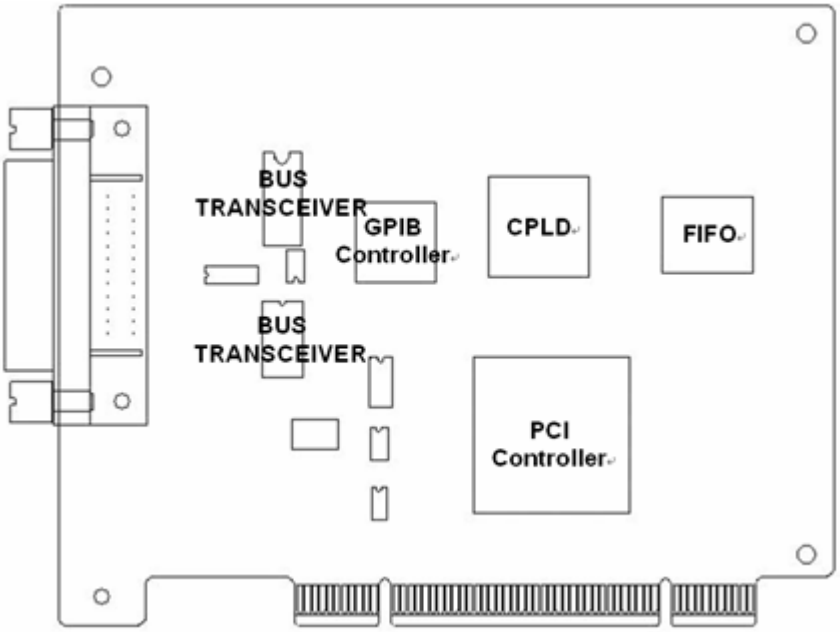


Figure 2-1: PCI-3488 PCB Layout

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LPCI-3488

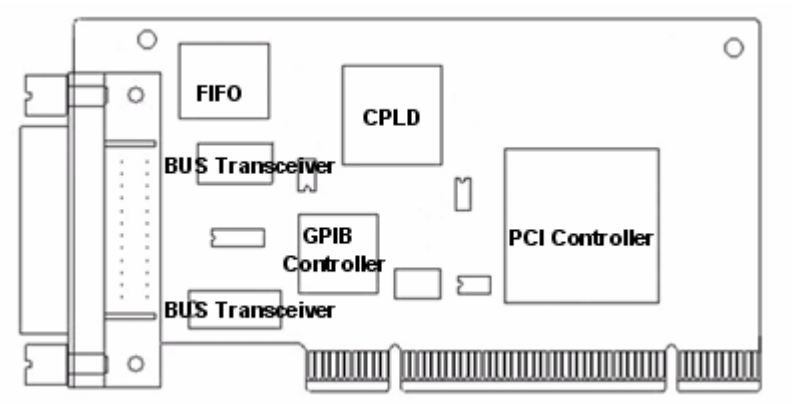


Figure 2-2: LPCI-3488 PCB Layout

PXI-3488

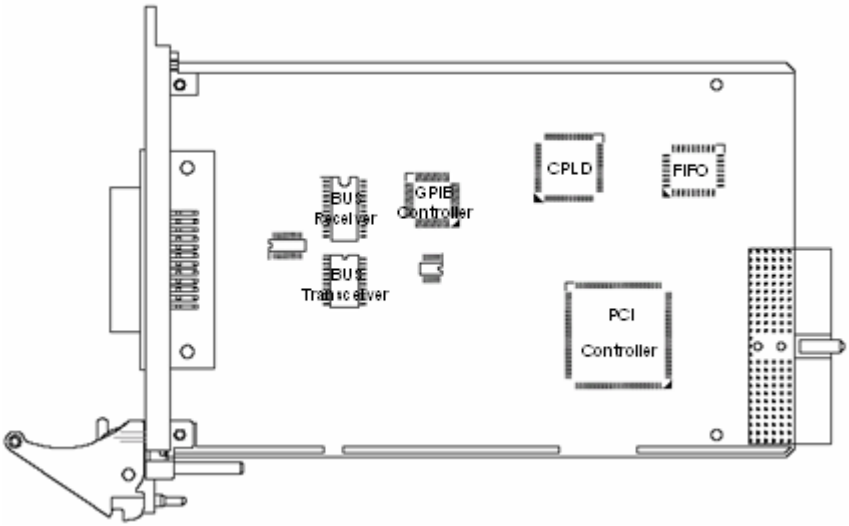


Figure 2-3: PXI-3488 PCB Layout

The ADLINK PXI-3488 is packaged in a Eurocard form factor compliant with PXI Specifications measuring 160 mm in length and 100 mm in height (not including connectors). IEEE 488 standard

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24-pin connector is located at the front panel and the J1 IEC connectors in the rear are used to link the chassis backplane. With its modular, rugged, and high shock resistant mechanical features, the IEEE488 GPIB Interface module functions exceptionally well in any harsh environment application.

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2.4 PCI Configuration

Plug and Play

As a plug and play component, the card requests an interrupt number via its PCI controller. The system BIOS responds with an interrupt assignment based on the card information and on known system parameters. These system parameters are determined by the installed drivers and the hardware load seen by the system.

Configuration

The board configuration is done on a board-by-board basis for all PCI/PXI boards on your chassis. Because configuration is controlled by the system and software, there is no jumper setting required for base-address, DMA, and interrupt IRQ.

The configuration is subject to change with every boot of the system as new boards are added or removed.

Troubleshooting

If your system doesn't boot or if you experience erratic operation with your PXI/PCI board in place, it's likely caused by an interrupt conflict (perhaps the BIOS Setup is incorrectly configured). In general, the solution, once you determine it is not a simple oversight, is to consult the BIOS documentation that comes with your system.

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2.5 Hardware Installation

Installation Procedures (PCI/LPCI-3488)

Please follow the instructions to install the PCI-3488 or LPCI-3488 in your computer.

1. Turn off your computer
2. Turn off all accessories (printer, modem, monitor, etc.) connected to your computer.
3. Open your computer case.
4. Select a 32-bit PCI slot. PCI slot are short than ISA or EISA slots, and are usually white or ivory.
5. Before handling the PCI cards, discharge any static buildup on your body by touching the metal case of the computer. Hold the edge and do not touch the components.
6. Position the board into the PCI slot you selected.
7. Secure the card in place at the rear panel of the system.
8. Put your computer's case back on.

Turn on your computer, and install the software follow below software install instruction.

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Installation Procedures (PXI-3488)

Please follow the instructions to install PXI-3488 into your PXI chassis.

1. Turn off your system.
2. Align the module's edge with the card guide in the PXI chassis.
3. Slide the module into the chassis, until resistance is felt from the PXI connector
4. Push the ejector upwards and fully insert the module into the chassis.
5. Once inserted, a "click" can be heard from the ejector latch.
6. Tighten the screw on the front panel.

Turn on your computer, and install the software follow below software install instruction.

Cabling

Following connection configuration could guarantees the GPIB throughput achieve optimal value. The configurations include instrument number and cable distance:

The longest distance between two devices is 4 meter. And the average GPIB BUS distance between all devices should be less than 2 meter.

The total GPIB BUS distance should be less than 20 meter.

The total device number must less than 15 (including computer itself), and at least 2-3 devices are in power-on status.

Users can connection devices in a linear configuration, star configuration or combination the two configurations. Below figures shows linear connection and star connection.

Note: At star connection, the total current load will be less if the cable connection on individual instrument is less than three.

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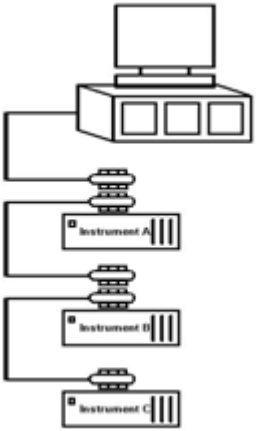


Figure 2-4: Linear Connection Configuration (PCI/LPCI-3488)

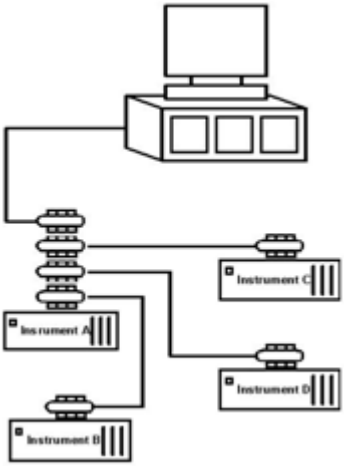


Figure 2-5: Star Connection Configuration (PCI/LPCI-3488)

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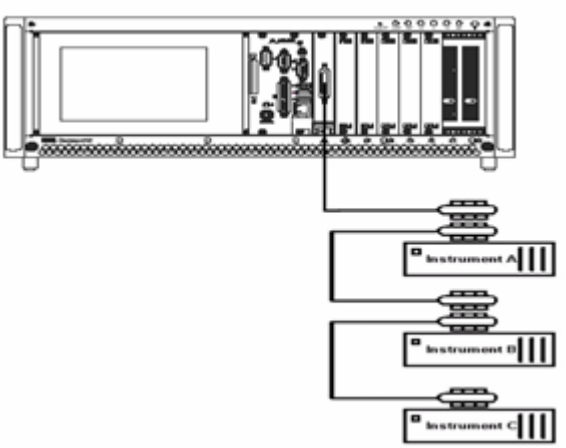


Figure 2-6: Linear Connection Configuration (PXI-3488)

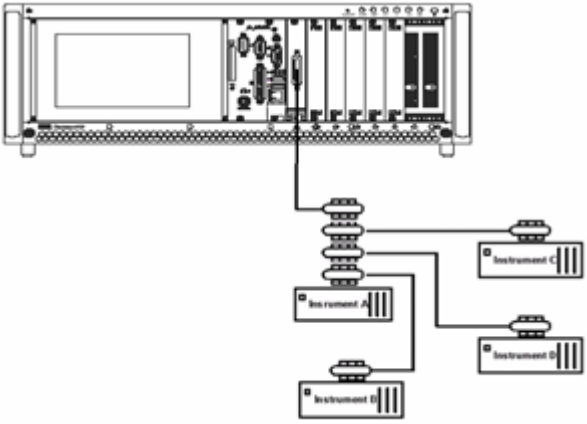


Figure 2-7: Star Connection Configuration (PXI-3488)

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2.6 Software Installation

ADLINK GPIB interface cards are delivered with the ADL-GPIB driver package which supports Windows 98/NT/2000/XP/2003. The ADL-GPIB is designed to be fully compatible with your current applications. It provides APIs and a binary-compatible gpib-32.dll for users originally using LabVIEW*, LabWindow/CVI*, VC++, VB, and Delphi. ADLINK GPIB interface cards also support VISA to be adequate to most available instrument drivers. Please visit ADLINK website to download the latest version of ADL-GPIB.

In this section, we'll illustrate the procedure to install ADLGPIB driver package and show how

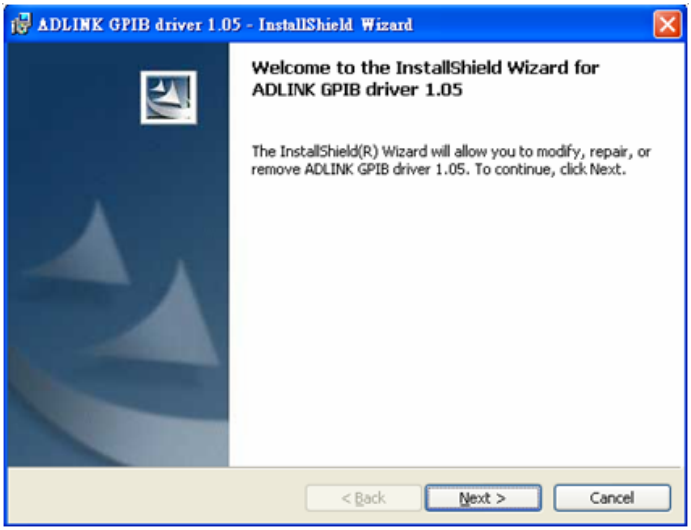
*LabVIEW and LabWindow/CVI are the trademarks of National Instruments Corporation.

Driver installation

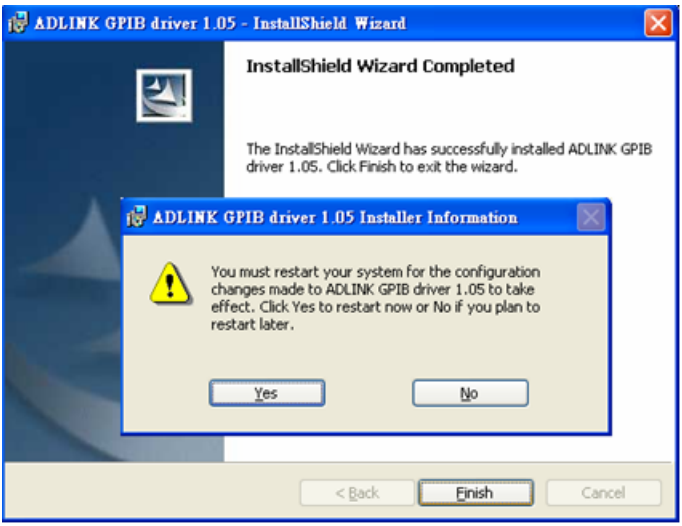
For Windows 98/NT/2000/XP/2003 users:

1. Insert the ADLINK ALL-In-One CD.
2. Execute x:\Software Package\ADLGPIB\Setup.exe to launch the setup program. (x: denotes your CD-ROM drive). A InstallShield® wizard appears to guide you finish the setup procedure.

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3. Reboot your system to complete setup

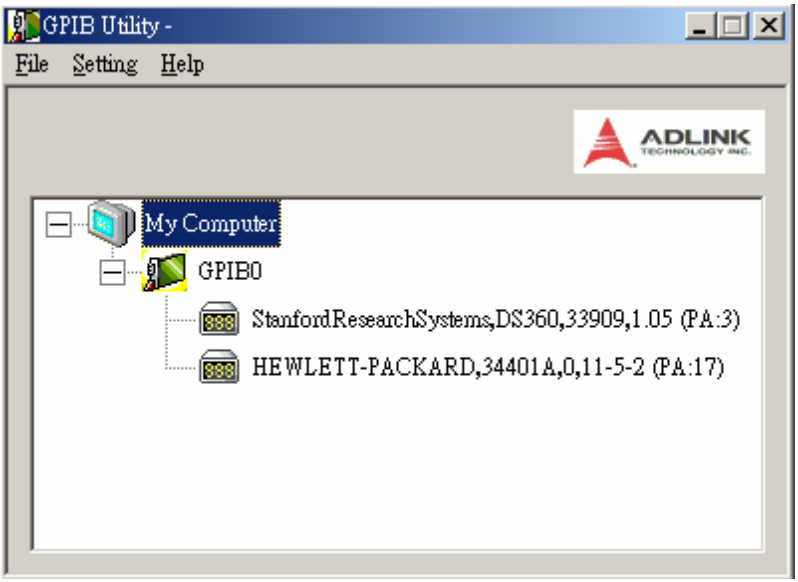


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Using the ADLIINK GPIB Utility

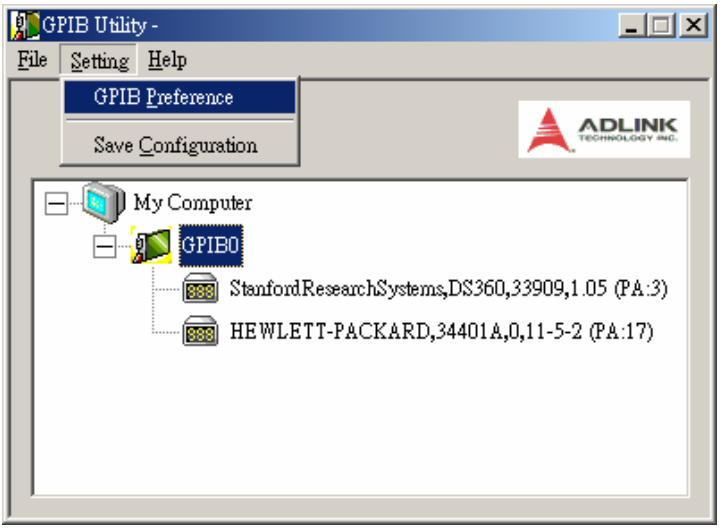
The ADLGPIB driver package also provides a utility program – ADLINK GPIB Utility to let you diagnose and verify your GPIB connections. You can find the GPIB Utility in x:\ADLINK\ADLGPIB\Utility\GPIB Utility.exe. Here are the illustrations of using ADLINK GPIB Utility.

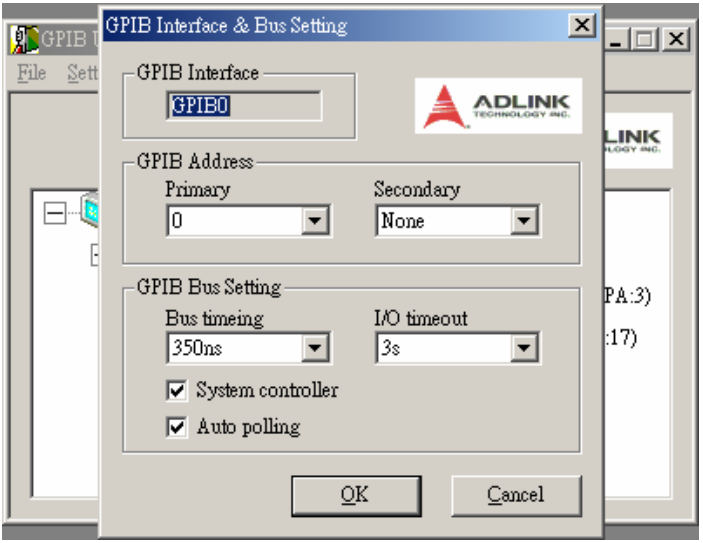
1. Launch the GPIB Utiltu.exe. A window appears to show all your GPIB interfaces and instruments



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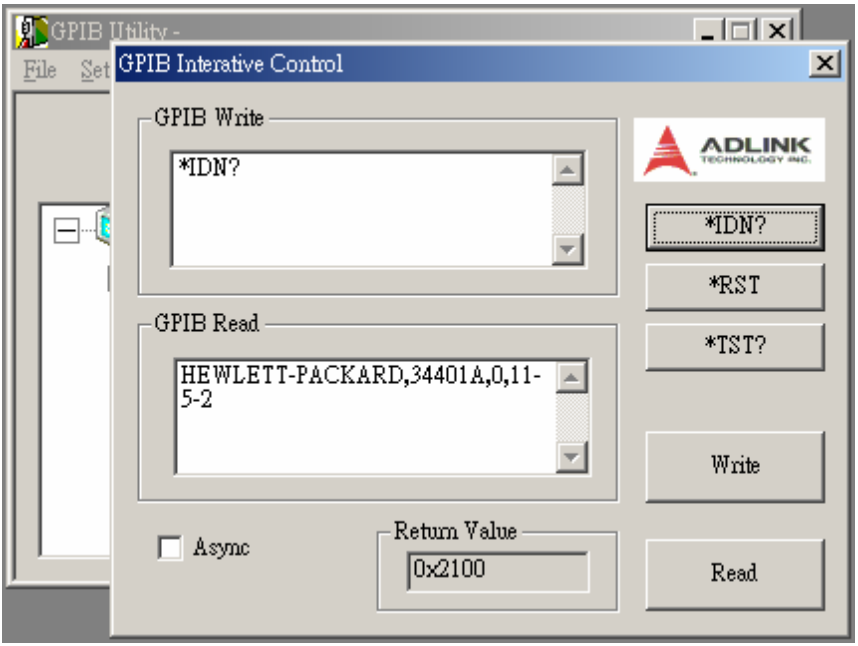
2. Click on a GPIB interface (GPIB0/GPIB1…) and select “Setting” -> “GPIB Preference”. A “GPIB Interface & Bus Setting” dialog appears to let you configure your GPIB interface.





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3. Double click on a connected GPIB instrument. A '"GPIB Interactive control" dialog appears to let you write command strings to your GPIB instrument and read the result.



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3 Operation Theory

This chapter describes the operation theory of GPIB bus and the basic architecture of ADLINK GPIB interface card.

3.1 Connection Configuration

The GPIB bus has 24 lines, which are divided into 16 signal lines and 8 ground return or shield drain lines. The 16 signal lines can be divided into 8-bit parallel data transfer bus and 8 control lines. These 8 control lines contain 5 system management lines and 3 handshake lines.

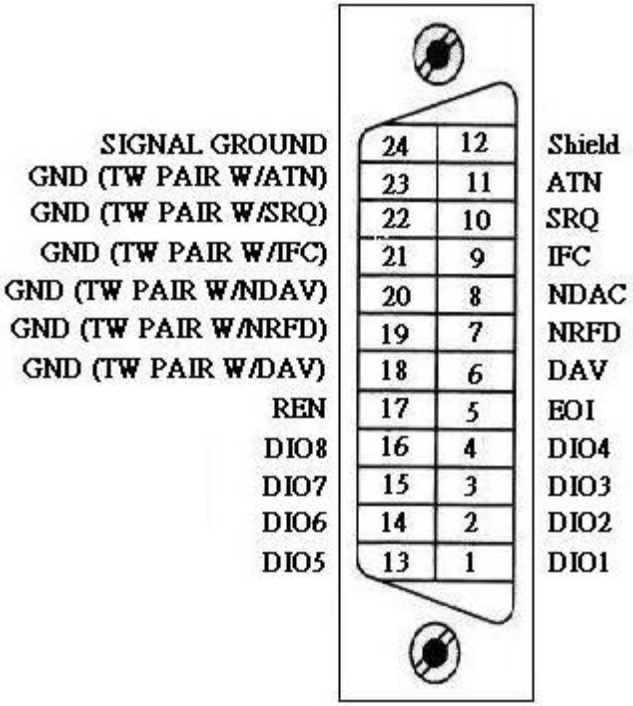


Figure 3-1: Standard GPIB Connector

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GPIB BUS	Type	Function		Pin	
				No.	Description
24 lines	16 signal lines	8 data lines		1	DIO1
				2	DIO2
				3	DIO3
				4	DIO4
				13	DIO5
				14	DIO6
				15	DIO7
				16	DIO8
		8 control lines	5 system management lines	5	EOI
				9	IFC
				10	SRQ
				11	ATN
				17	REN
			3 handshake lines	6	DAV
				7	NRFD
				8	NDAC
	8 ground lines	1 shield drain line		12	SHIELD
		7 ground return lines		18	GND
				19	GND
				20	GND
				21	GND
				22	GND
				23	GND
				24	SIGNAL GROUND

Table 3-1: GPIB Bus

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Data Lines

DIO1 to DIO8 carry both data and command messages. All commands and most data use the 7-bit ASCII code, the 8th bit, DIO8, is either unused or for parity check.

Handshake Lines

These three handshake lines control the transfer of data/messages between devices.

- **DAV** (Data Valid): used to indicate the condition (availability and validity) of information on the DIO signal lines
- **NRFD** (Not Ready For Data): used to indicate the condition of readiness of device(s) to accept data
- **NDAC** (Not Data Accepted): used to indicate the condition of acceptance of data by device

System management lines

These five system management lines manage the flow of control and data bytes across the interface.

- **EOI** (End or Identify): used (by a talker) to indicate the end of a multiple byte transfer sequence or, in conjunction with ATN (by a controller), to execute a polling sequence
- **IFC** (Interface Clear): used (by a controller) to place the interface system, portions of which are contained in all interconnected devices, in a known quiescent state
- **SRQ** (Service Request): used by a device to indicate the need for attention and to request an interruption of the current sequence of events
- **ATN** (Attention): used (by a controller) to specify how data on the DIO signal lines are to be interpreted and which devices must respond to the data
- **REN** (Remote Enable): used (by a controller) in conjunction with other messages, to enable or disable one or more local controls that have corresponding remote controls.

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3.2 ADLINK GPIB Interface Cards Block Diagram

ADLINK GPIB interface cards have 1KBytes on-board FIFIO to maximize the data transfer rate. Its state-of-the-art state machine in CPLD coordinates the data flow between PCI controller, FIFO and GPIB bus.

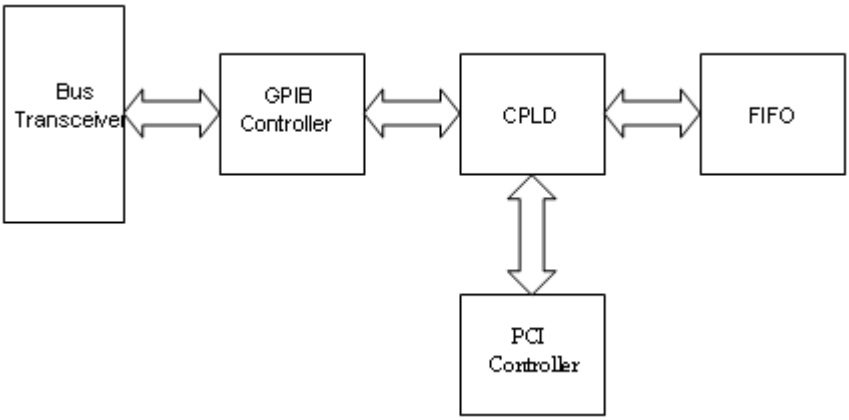


Figure 3-2: ADLINK GPIB Interface Cards Block Diagram

The FIFO can buffer data from master (either from PCI controller or external device) when target is busy. Therefore the efficiency will be significantly improved when transferring large block of data.

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Warranty Policy

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1. Before using ADLINK's products please read the user manual and follow the instructions exactly. When sending in damaged products for repair, please attach an RMA application form which can be downloaded from: http://rma.adlinktech.com/policy/.
2. All ADLINK products come with a limited two-year warranty, one year for products bought in China:
   - The warranty period starts on the day the product is shipped from ADLINK's factory.
   - Peripherals and third-party products not manufactured by ADLINK will be covered by the original manufacturers' warranty.
   - For products containing storage devices (hard drives, flash cards, etc.), please back up your data before sending them for repair. ADLINK is not responsible for any loss of data.
   - Please ensure the use of properly licensed software with our systems. ADLINK does not condone the use of pirated software and will not service systems using such software. ADLINK will not be held legally responsible for products shipped with unlicensed software installed by the user.
   - For general repairs, please do not include peripheral accessories. If peripherals need to be included, be certain to specify which items you sent on the RMA Request & Confirmation Form. ADLINK is not responsible for items not listed on the RMA Request & Confirmation Form.

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3. Our repair service is not covered by ADLINK's guarantee in the following situations:
   - Damage caused by not following instructions in the User's Manual.
   - Damage caused by carelessness on the user's part during product transportation.
   - Damage caused by fire, earthquakes, floods, lightening, pollution, other acts of God, and/or incorrect usage of voltage transformers.
   - Damage caused by unsuitable storage environments (i.e. high temperatures, high humidity, or volatile chemicals).
   - Damage caused by leakage of battery fluid during or after change of batteries by customer/user.
   - Damage from improper repair by unauthorized ADLINK technicians.
   - Products with altered and/or damaged serial numbers are not entitled to our service.
   - This warranty is not transferable or extendible.
   - Other categories not protected under our warranty.
4. Customers are responsible for shipping costs to transport damaged products to our company or sales office.
5. To ensure the speed and quality of product repair, please download an RMA application form from our company website: http://rma.adlinktech.com/policy. Damaged products with attached RMA forms receive priority.

If you have any further questions, please email our FAE staff: service@adlinktech.com.

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