LPCIe/LPCI/USB-3488A

IEEE488 GPIB Interface Card Series

User's Manual



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LEADING EDGE COMPUTING

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Revision History

Revision	Release Date	Description of Change(s)
2.0	2009-10-13	Initial release
2.5	2014-12-12	LPCIe version added
2.6	2023-03-13	LPCIe, USB PCB revisions

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Preface

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Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.


NOTE:

Additional information, aids, and tips that help users perform tasks.


CAUTION:

Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.


WARNING:

Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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1 Introduction

1.1 Overview

ADLINK's LPCIe/LPCI/USB-3488A GPIB controller interface cards are fully compatible with the IEEE488.2 instrumentation control and communication standard and are capable of controlling up to 14 stand-alone instruments via IEEE488 cables. The LPCIe/LPCI/USB-3488A are designed to meet the requirements for high performance and maximum programming portability. They were developed using ADLINK's intellectual property in FPGAs which incorporates the GPIB controller, provides reliable GPIB bus control capability, and supports a transfer rate up to 1.5 MB/s. With APIs that are compatible with National Instruments software and VISA support, the LPCIe/LPCI/USB-3488A offer the best compatibility with your existing applications and instrument drivers.

Performance

ADLINK takes advantage of our proven expertise in PCI/PCIe interface cards when developing these GPIB interface cards. The LPCIe/LPCI-3488A, in the low-profile PCI form factor, can adapt to most industrial and desktop computers. A 2 KB FIFO between the GPIB bus (approx. 1.2 MB/s) and PCI controller buffers GPIB read/write operations. The ADLINK USB-3488A is further equipped with 32 KB FIFO to the read/write operations, for maximum transfer rates exceeding 1.5 MB/s.

Compatibility

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

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1.2 Features

LPCIe/LPCI-3488A

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

- PCI Express 1.1 compatibility (LPCIe-3488A)
- Supports 32-bit 3.3 V or 5 V PCI bus (LPCI-3488A)
- Fully compatible with IEEE 488.1 and 488.2 standard
- Up to 1.2 MB/s data transfer
- 2 kB onboard FIFO for read/write operations
- APIs provided compatible with NI-488.2 driver software
- Supports industrial-standard VISA Library
- Interactive utility for testing and diagnostics

USB-3488A

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

- USB 2.0 compatible
- Fully compatible with IEEE 488.1 and 488.2 standard
- Easy GPIB connectivty for laptops
- 2 meter USB cable included for instrument connection
- No external power required
- Up to 1.5 MB/s data transfer
- 32 kB onboard FIFO for read/write operations
- APIs provided compatible with NI-488.2 driver software
- Supports industrial-standard VISA Library
- Interactive utility for testing and diagnostics

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1.3 Specifications

GPIB Bus Properties

- Up to 14 instruments can be connected to one controller
- Maximum 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

Certifications

- EMC/EMI: CE, FCC Class A

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
  - LPCI-3488A

+5 V
250 mA (typical) 300 mA (max.)

  - LPCIe-3488A

+3.3V	+12V
90 mA (max.) 80 mA (typ.)	150 mA (max.) 100 mA (typ.)

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- USB-3488A

+5V
190 mA (typical) 500 mA (maximum)

- Dimensions (not including connectors):
  - LPCI-3488A: 120 (L) x 64 (H) mm
  - LPCIe-3488A: 119.7 (L) x 68.9 (H) mm
  - USB-3488A : 81.6 (L) x 61.5 (W) x 27.8 (H) mm
- Vibration Test
  - USB-3488A
    - Operating: 1 G 3 axes
    - non-operating: 2.5 G 3 axes

1.4 Software Support

The ADLINK LPCIe/LPCI/USB-3488A GPIB interface cards provide a device driver package: ADL-GPIB for Windows XP*/7/8/10/11 and Linux. The ADL-GPIB driver package also provides a diagnostic utility to test GPIB interface cards, as well as programming samples and source code examples for Microsoft Visual C++. The ADL-GPIB driver package can be found on the ADLINK web-site. Please refer to Software Installation for detailed software installation instructions.

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


NOTE:

* Windows XP driver will no longer be updated.

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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 Package Contents

LPCIe/LPCI-3488A

The LPCIe/LPCI-3488A includes the following items:

- LPCIe/LPCI-3488A

USB-3488A

The USB-3488A includes the following items:

- USB-3488A with built-in 2m cable

If any of these items are missing or damaged, contact your ADLINK dealer. Please save the shipping materials and carton to ship or store the product if needed.

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2.2 Unpacking

The LPCIe/LPCI/USB-3488A modules contain electrostatically sensitive components that can be easily be damaged by static electricity.

Therefore, they should be handled on a grounded anti-static mat. The operator should be wearing an anti-static wristband, 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 is no shipping and handling damage on the module before continuing.



NOTE:

Do not apply power to the card if it has been damaged.

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2.3 Mechanical Drawings

LPCI-3488A

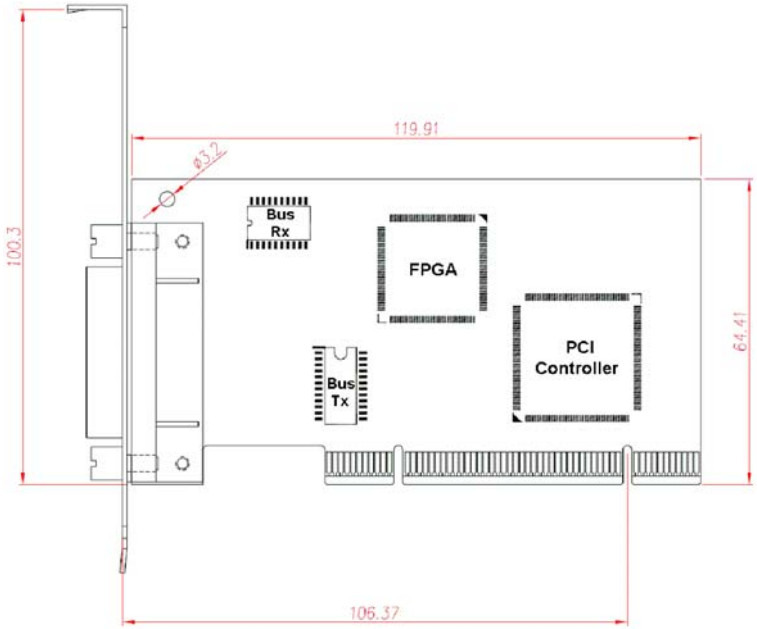


Figure 2-1: PCB Layout of the LPCI-3488A

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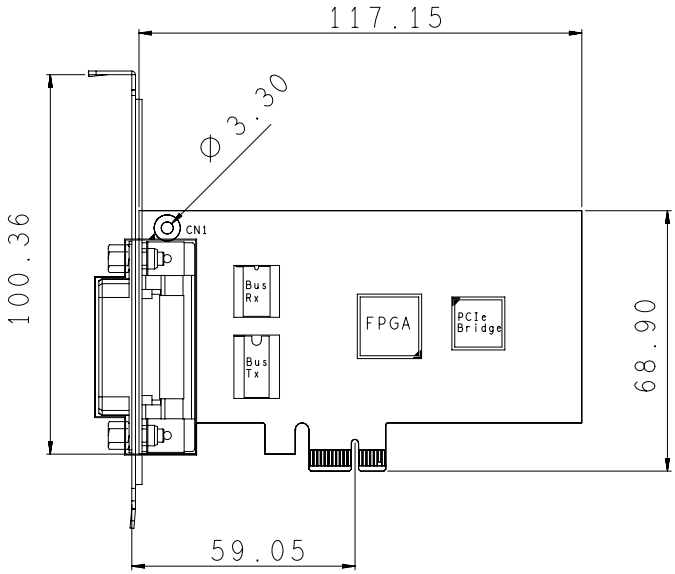


Figure 2-2: PCB Layout of the LPCIe-3488A

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USB-3488A

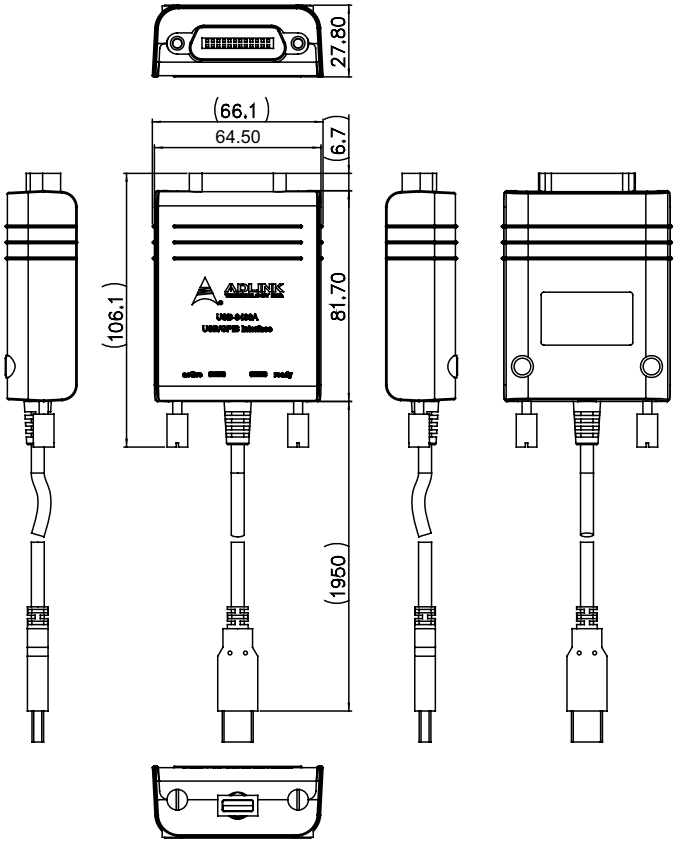


Figure 2-3: Layout of the USB-3488A

The USB-3488A GPIB interface provides a direct connection between the USB port on a desktop or laptop computer to GPIB instrument. With the USB-3488A GPIB interface and its USB Plug and Play feature, GPIB instruments can be connected and disconnected without having to shut down the computer. No external power supplies are necessary. The USB-3488A GPIB interface is equipped with a 2 meter USB 2.0 compliant cable.

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2.4 PCI/PCIe Configuration

Plug and Play

As a plug-and-play component, the card requests an interrupt number via its PCI/PCIe 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 is acknowledged by the system.

Configuration

Board configuration is accomplished on a board-by-board basis for all PCI/PCIe boards in the 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 the system doesn't boot or you experience erratic operation with the PCI/PCIe board in place, it's likely caused by an interrupt conflict (perhaps the BIOS settings are 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

LPCIe/LPCI-3488A Installation Procedures

Please follow the instructions to install the LPCIe/LPCI-3488A in your system.

1. Turn off the computer
2. Turn off all accessories (printer, modem, monitor, etc.) connected to the computer.
3. Open the computer case.
4. For LPCI-3488A, select a 32-bit PCI slot.
   For LPCIe-3488A, select a PCIe x1 slot.
5. Before handling the PCI/PCIe cards, discharge any static buildup on your body by touching the metal case of the computer. Hold the edge of the board and do not touch the components.
6. Position the board into the selected PCIe/PCI slot.
7. Secure the card in place at the rear panel of the system.
8. Replace the computer case cover.

Turn on the computer, and install the software according to the instructions in Software Installation.

USB-3488A Installation Procedures

Please follow the instructions to connect the USB-3488A to the computer or notebook.

1. Connect USB-3488A to any USB 2.0 port
2. After several seconds, the "Ready" LED become Green, USB-3488A is ready for work.

if you use USB-3488A with a USB Hub, we suggest you to have an independent power for the Hub.

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Cabling

The following connection configuration can ensure that the GPIB throughput achieves optimal performance. These configurations include the number of instruments and cable distances:

- Cable lengths should be no longer than 4 meters (2 meter lengths maximum is suggested).
- The total GPIB BUS distance should be less than 20 meters.
- The total number of devices must less than 15 (including computer itself), and at least two-thirds (2/3) of the devices are powered on.

Devices can be connected in a linear configuration, star configuration, or combination of the two, as shown.

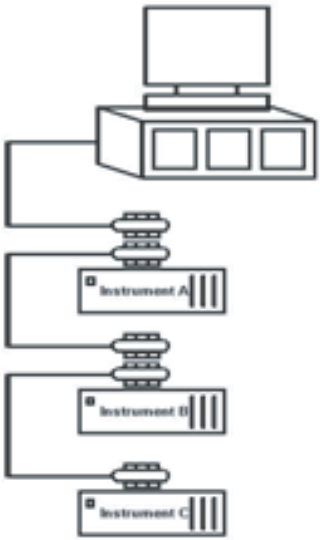


Figure 2-4: LPCIe/LPCI-3488A Linear Connection Configuration

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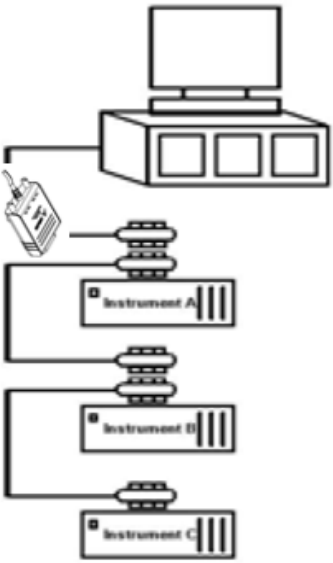


Figure 2-5: USB-3488A Linear Connection Configuration

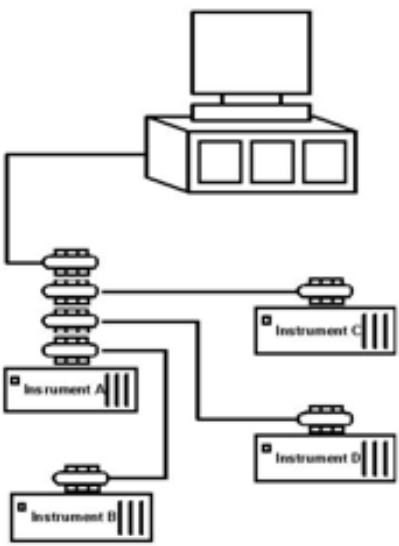


Figure 2-6: LPCIe/LPCI-3488A Star Connection Configuration

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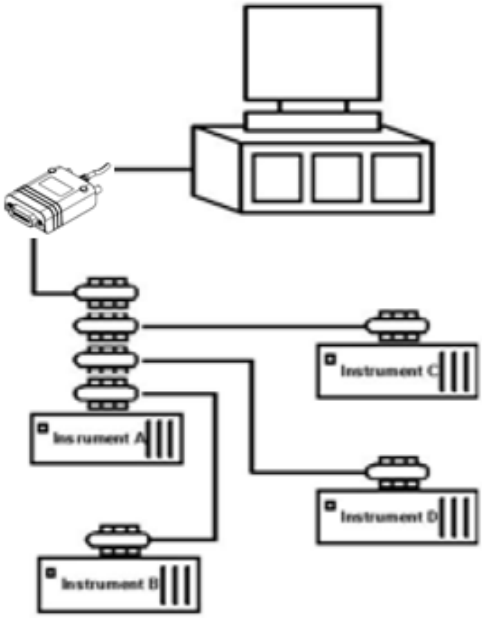


Figure 2-7: USB-3488A Star Connection Configuration

NOTE:

For a star connection, the total current load will be less in the presence of fewer than three cable connections on an individual instrument.

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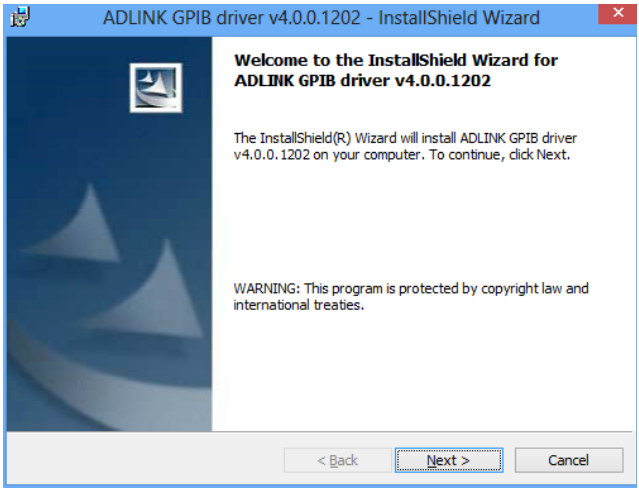
2.6 Software Installation

ADLINK GPIB interface cards are equipped with an ADL-GPIB driver package for Windows XP/7/8/10/11. The ADL-GPIB is designed to be fully compatible with your current applications and includes APIs and a binary-compatible gpib-32.dll for users using LabVIEW, VC++, VB, and Delphi. ADLINK GPIB interface cards also adequately support VISA to work with most available instrument drivers. Please visit the ADLINK website (www.adlink-tech.com) to download the latest version of ADL-GPIB.

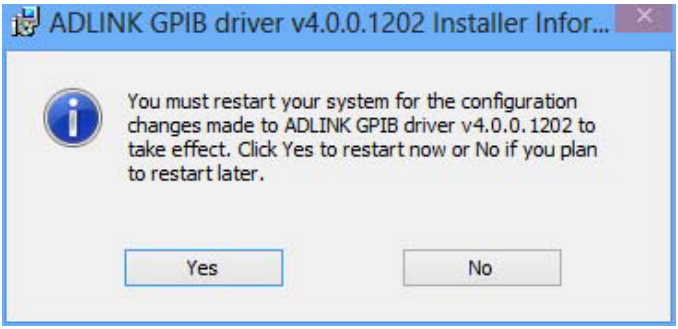
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Driver Installation

1. Download ADL-GPIB.exe from Adlink website.
2. Execute ADL-GPIB.exe to launch the setup program.



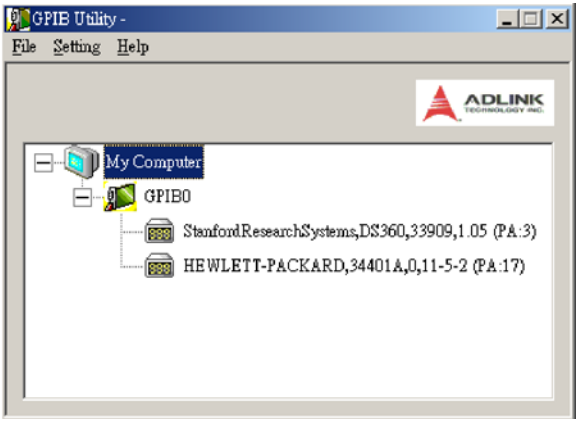
3. Reboot the system to complete setup



Using the ADLINK GPIB Utility

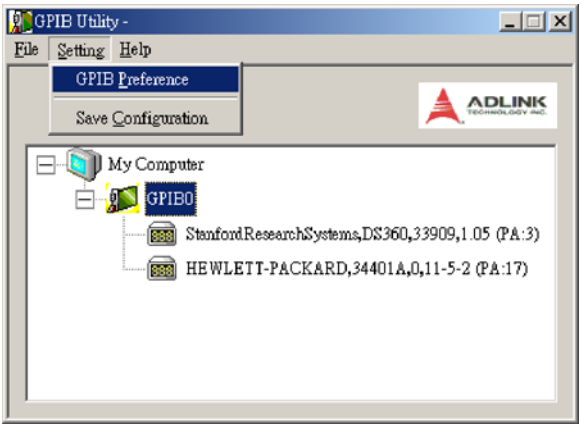
NOTE: The ADL-GPIB driver package also provides the ADLINK GPIB Utility to diagnose and verify GPIB connections, located at x:\ADLINK\ADL-GPIB\Utility\GPIB Utility.exe

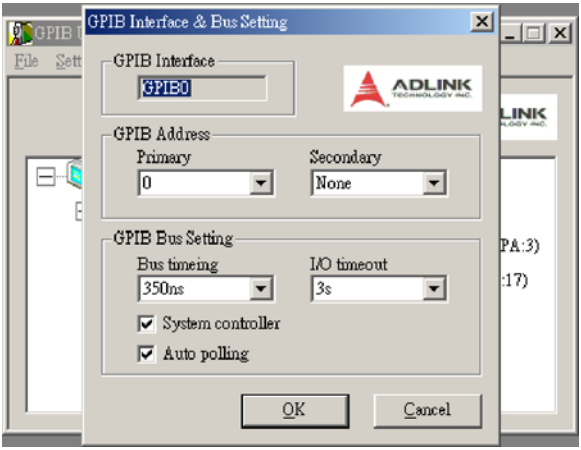
1. Launch GPIB Utility.exe. A window appears showing all installed GPIB interfaces and instruments



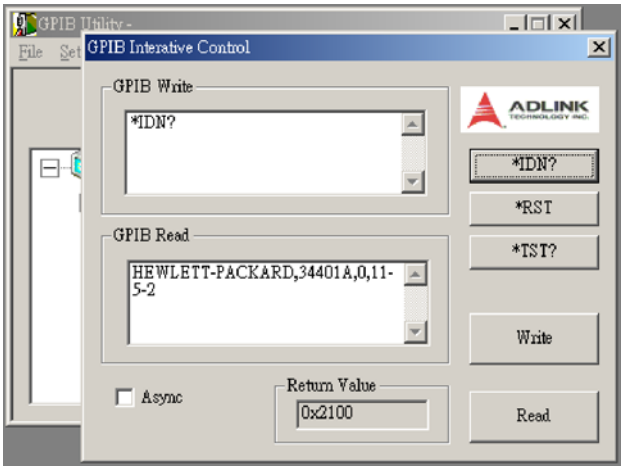
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2. Click on a GPIB interface (GPIB0, GPIB1, etc.) and select "**Setting**" > "**GPIB Preference**". A "*GPIB Interface & Bus Setting*" dialog appears to enable configuration of the GPIB interface.





3. Double click on a connected GPIB instrument. A '"*GPIB Interactive control*" dialog appears to allow write command strings to be inputted into the GPIB instrument and read the result.



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3 Operations

This chapter describes the operation theory of GPIB bus and the basic architecture of ADLINK's GPIB interface cards.

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. The 8 control lines contain 5 system management lines and 3 handshake lines

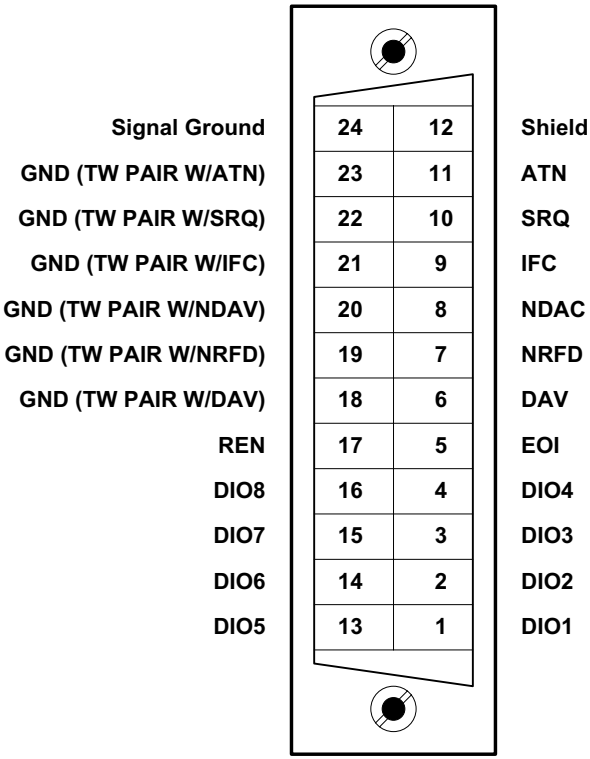


Figure 3-1: Standard GPIB Connector

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GPIB BUS	Type	Function		Pin	
24 lines	16 signal lines	8 data lines		No.	Description
				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 Pin Definitions

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Data Lines

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

Handshake Lines

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

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

System Management Lines

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 multi-byte transfer sequence or used 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 Block Diagrams

ADLINK GPIB Interface Cards

The ADLINK LPCIe-3488A FPGA includes a 2kB FIFO to maximize data transfer rate, coordinating data flow between the PCIe bus, FIFO and GPIB bus.

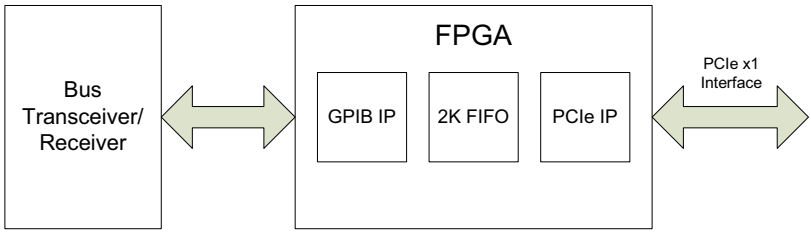


Figure 3-2: LPCIe-3488A Block Diagram

ADLINK's LPCI-3488A GPIB interface card includes a 2 kB FIFO inside the FPGA IP to maximize data transfer rates. Its state-of-the-art state machine in the CPLD coordinates the data flow between the PCI controller, FIFO and GPIB bus.

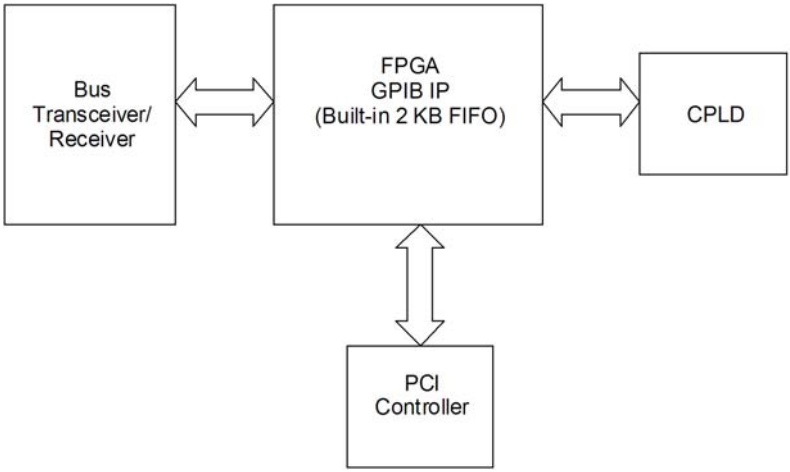


Figure 3-3: LPCI-3488A Block Diagram

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The ADLINK USB-3488A GPIB interface include a 32 KB FIFO to maximize data transfer rates. Its state-of-the-art state machine in the 8051 coordinates the data flow between the USB Bus, FIFO and GPIB bus.

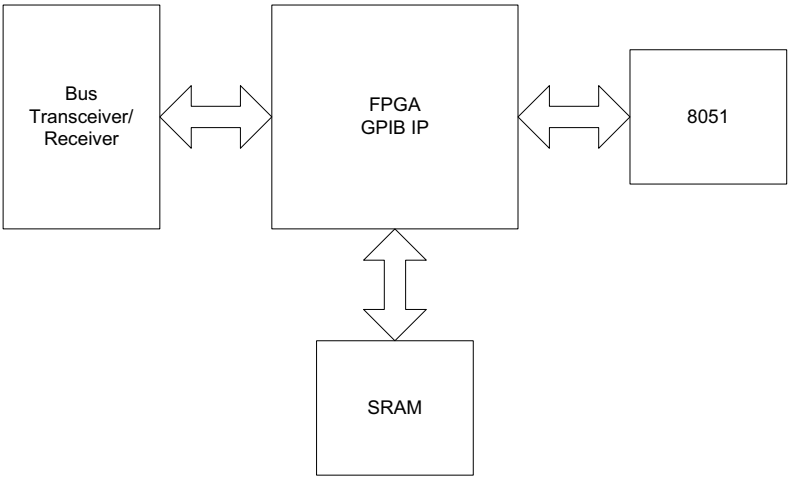


Figure 3-4: USB-3488A Block Diagram

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Important Safety Instructions

For user safety, please read and follow all **instructions**, **WARNINGS**, **CAUTIONS,** and **NOTES** marked in this manual and on the associated equipment before handling/operating the equipment.

- Read these safety instructions carefully.
- Keep this user's manual for future reference.
- Read the specifications section of this manual for detailed information on the operating environment of this equipment.
- When installing/mounting or uninstalling/removing equipment:
  - Turn off power and unplug any power cords/cables.
- To avoid electrical shock and/or damage to equipment:
  - Keep equipment away from water or liquid sources;
  - Keep equipment away from high heat or high humidity;
  - Keep equipment properly ventilated (do not block or cover ventilation openings);
  - Make sure to use recommended voltage and power source settings;
  - Always install and operate equipment near an easily accessible electrical socket-outlet;
  - Secure the power cord (do not place any object on/over the power cord);
  - Only install/attach and operate equipment on stable surfaces and/or recommended mountings; and,
  - If the equipment will not be used for long periods of time, turn off and unplug the equipment from its power source.

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- Never attempt to fix the equipment. Equipment should only be serviced by qualified personnel.
- A Lithium-type battery may be provided for uninterrupted, backup or emergency power.



RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO THEIR INSTRUCTIONS.

- Equipment must be serviced by authorized technicians when:
  - The power cord or plug is damaged;
  - Liquid has penetrated the equipment;
  - It has been exposed to high humidity/moisture;
  - It is not functioning or does not function according to the user's manual;
  - It has been dropped and/or damaged; and/or,
  - It has an obvious sign of breakage.

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Getting Service

Ask an Expert: http://askanexpert.adlinktech.com

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