

**Getting Started with Your AT-GPIB/TNT+,
the NI-488.2™ Software for Windows, and the
GPIB Analyzer**

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Federal Communications Commission

This device complies with Part 15 of the Federal Communications Commission (FCC) Rules for a Class B digital device. A Class B device is distinguishable from a Class A device by the appearance of an FCC ID number located on the Class B device.

Canadian Department of Communications

This device complies with the limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications (DOC).

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le ministère des communications du Canada.

Instructions to Users

These regulations are designed to provide reasonable protection against interference from the equipment to radio and television reception in residential areas.

There is no guarantee that interference will not occur in a particular installation. However, the chances of interference are much less if the equipment is installed and used according to this instruction manual.

If the equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, one or more of the following suggestions may reduce or eliminate the problem.

- Operate the equipment and the receiver on different branches of your AC electrical system.
- Move the equipment away from the receiver with which it is interfering.
- Reorient or relocate the receiver's antenna.
- Be sure that the equipment is plugged into a grounded outlet and that the grounding has not been defeated with a cheater plug.

Notice to user: Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the equipment under the FCC Rules.

If necessary, consult National Instruments or an experienced radio/television technician for additional suggestions. The following booklet prepared by the FCC may also be helpful: *How to Identify and Resolve Radio-TV Interference Problems*. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock Number 004-000-00345-4.

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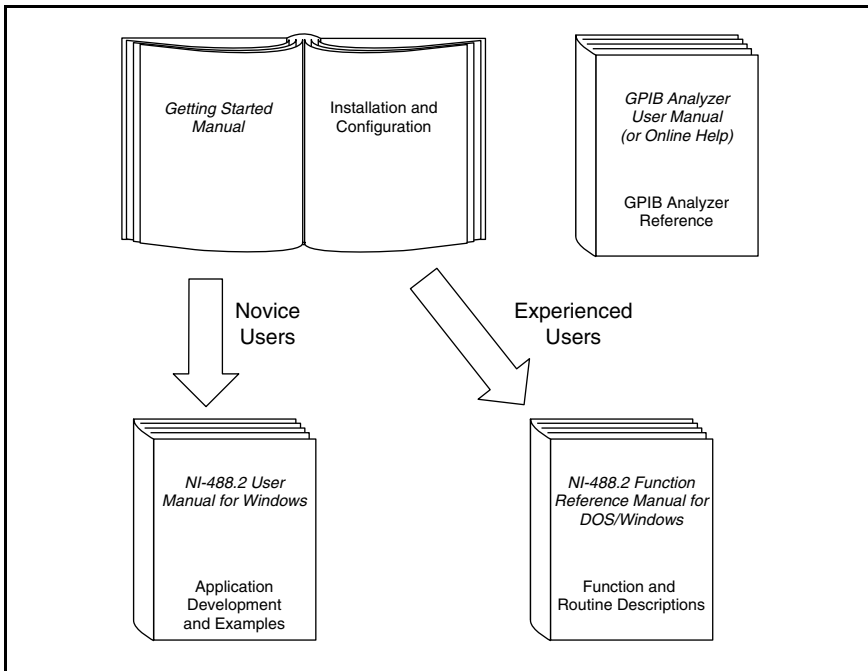
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About This Manual

This manual contains instructions to help you install and configure the National Instruments AT-GPIB/TNT+ interface board, the NI-488.2 software for Windows, and the GPIB analyzer. The NI-488.2 software and the GPIB analyzer are intended for use with Windows version 3.x. This manual assumes that you are already familiar with Windows.

How to Use the Manual Set



Use this getting started manual to install and configure your AT-GPIB/TNT+ board, the NI-488.2 software for Windows, and the GPIB analyzer.

Use the *NI-488.2 User Manual for Windows* to learn the basics of GPIB and how to develop an application program. The user manual also contains debugging information and detailed examples.

Use the *NI-488.2 Function Reference Manual for DOS/Windows* for specific NI-488 function and NI-488.2 routine information, such as format, parameters, and possible errors.

monospace	Text in this font denotes text or characters that are to be literally input from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, directories, programs, subprograms, subroutines, device names, functions, variables, field names and filenames.
bold monospace	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
Windows	Windows refers to Microsoft Windows version 3.x.
IEEE 488 and IEEE 488.2	IEEE 488 and IEEE 488.2 refer to the ANSI/IEEE Standard 488.1-1987 and the ANSI/IEEE Standard 488.2-1992, respectively, which define the GPIB.

Abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms are listed in the *Glossary*.

Related Documentation

The following documents contain information that you may find helpful as you read this manual.

- ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*
- ANSI/IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols, and Common Commands*
- *Microsoft Windows User's Guide*, Microsoft Corporation

Customer Communication

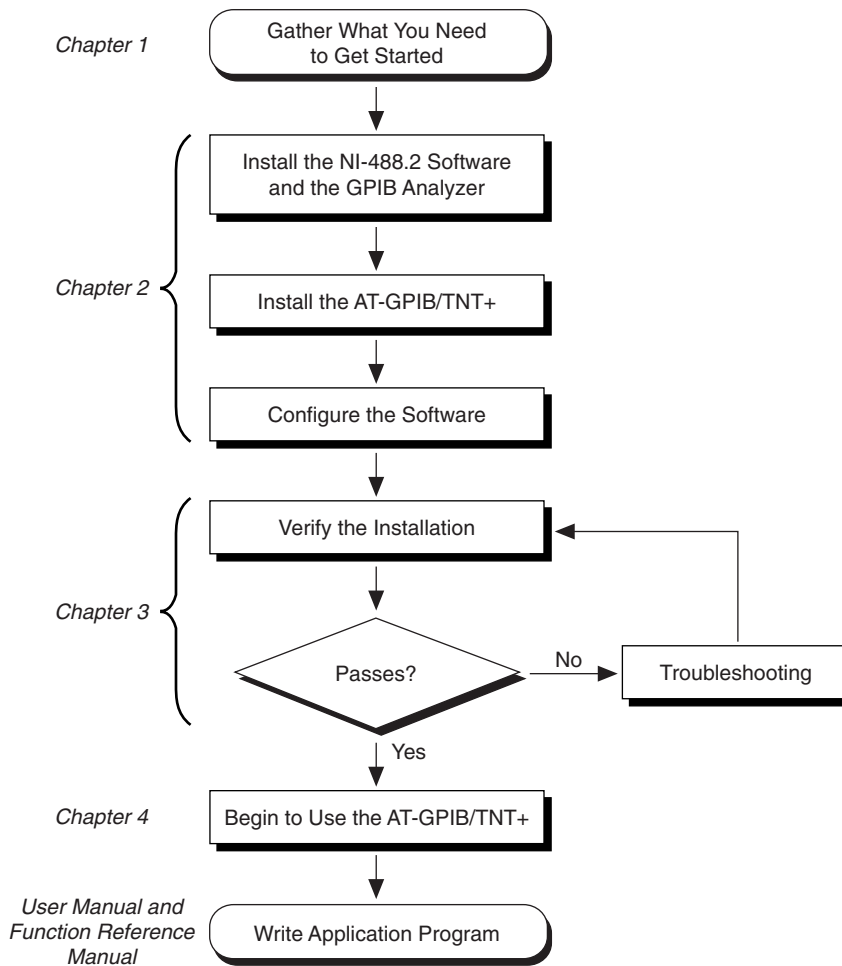
National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are in Appendix D, *Customer Communication*, at the end of this manual.

Chapter 1

Introduction

This chapter explains how to use this manual, lists what you need to get started, and briefly describes the AT-GPIB/TNT+ board, the GPIB analyzer, and the NI-488.2 software.

How to Use This Manual



What You Need to Get Started

Make sure you have all of the items listed before you attempt to install the AT-GPIB/TNT+ hardware and software.

- AT-GPIB/TNT+ board, which your kit contains
- NI-488.2 Software for Windows. Distribution Disk for the AT-GPIB/TNT+, AT-GPIB/TNT (PnP), EISA-GPIB and AT-GPIB/TNT*, which your kit contains
- GPIB Analyzer Software for Windows 3 for the AT-GPIB/TNT+ and the PCMCIA-GPIB+*, which your kit contains
- Microsoft Windows version 3.x installed on your computer
- MS-DOS version 4.0 or higher installed on your computer
- GPIB cables—single-shielded or double-shielded, Type X1, X2, X4, X5, or X11, which you can order from National Instruments
- Personal computer using at least a 25 MHz 80386 or higher microprocessor (National Instruments recommends a 33 MHz 80486 or higher microprocessor.)
- VGA resolution (or better) video adapter
- Minimum 3 MB of hard disk space
- Minimum 4 MB of RAM
- A math coprocessor is recommended. Systems that contain a math coprocessor include the following: an 80386/80387 combination, an 80486SX/80487 combination, an 80486DX, or a Pentium processor. If your processor does not have a math coprocessor, you can use the software emulator, which your kit contains.

Optional Equipment

Call National Instruments for more information about the following optional equipment.

- Serial or parallel bus extender and cables
- Bus expander/isolator
- GPIB mechanical switch
- GPIB data buffer

AT-GPIB/TNT+ Hardware Overview

The AT-GPIB/TNT+ combines the abilities of the AT-GPIB/TNT and a complete GPIB analyzer into a single board. The AT-GPIB/TNT+ is a low-cost, high-speed alternative to GPIB Controllers and analyzers packaged separately. Because the AT-GPIB/TNT+ supports both the NI-488.2 software and the GPIB analyzer, you can develop your GPIB application and perform low-level GPIB analysis using the same computer.

The AT-GPIB/TNT+ is completely software-configurable and is compliant with the Plug and Play ISA standard. In non-Plug and Play systems, the AT-GPIB/TNT+ can be fully configured through the NI-488.2 software. In Plug and Play systems, the board is fully configured on power-up. The TNT4882C chip on the board combines the circuitry of the NAT4882 ASIC, the Turbo488 ASIC, and GPIB transceivers to create a single-chip IEEE 488.2 interface. The TNT4882C also implements the HS488 high-speed protocol, which increases the maximum data transfer rate of the AT-GPIB/TNT+ up to 3.4 Mbytes/s, when used in an EISA computer. For more information about HS488, refer to Chapter 7, *GPIB Programming Techniques*, in the *NI-488.2 User Manual for Windows*.

You can use standard GPIB cables to connect the AT-GPIB/TNT+ with up to 14 devices. If you want to use more than 14 devices, you can order a bus extender or expander from National Instruments. Refer to Appendix A, *Specifications*, for more information about the AT-GPIB/TNT+ board specifications and recommended operating conditions.

NI-488.2 Software Overview

The NI-488.2 software, along with the AT-GPIB/TNT+ hardware, transforms a general-purpose PC into a GPIB Talker/Listener/Controller with complete communications and bus management capability. The NI-488.2 software includes the following components:

- Device driver (dynamic link library)
- Hardware and software diagnostic tests
- Configuration utilities
- Interactive control program
- Utilities for software development
- Language interface libraries for Microsoft C and Microsoft Visual Basic for Windows
- Example programs that use NI-488 functions and NI-488.2 routines

Refer to Appendix A, *Specifications*, for more information about the NI-488.2 software specifications and recommended operating conditions.

Plug and Play Overview

The term *Plug and Play* refers to an industry standard designed to help you add peripheral boards to a personal computer system. With Plug and Play, you can configure a new add-on board entirely from software, without having to move jumpers or change DIP switches on the board.

In a Plug and Play ready system, the operating system, device drivers, and applications cooperate. Most add-on boards need system resources (DMA channels, interrupts, I/O space) in order to interact with software such as device drivers. A Plug and Play system needs a centralized resource manager to arbitrate the assignment of these system resources. For example, if a Plug and Play ISA board is configured to use DMA channel 5, the centralized resource manager should prevent the assignment of DMA channel 5 to any other card. Windows does not provide a centralized resource manager. However, you can make your system Plug and Play ready in Windows with the Intel Plug and Play Kit for MS-DOS and Windows, which may already be installed on your computer.

For systems that are not Plug and Play ready, National Instruments provides a jumperless configuration. You must choose specific resources for the board using a configuration utility, but you are not required to power down the system and change physical jumper settings on the board.

For maximum flexibility, National Instruments provides the `ni-pnp` utility, which checks the configuration of your National Instruments Plug and Play boards, regardless of which type of system you have (jumperless or Plug and Play ready).

ni-pnp Utility Overview

The `ni-pnp` utility is a small program which runs each time your computer is rebooted. It collects information about all of the National Instruments Plug and Play boards in your system. It then creates a list of these interfaces, which is used by the NI-488.2 driver, the GPIB analyzer driver, and the GPIB software configuration utility. In systems that are Plug and Play ready, `ni-pnp` simply retrieves the current configuration of each interface. In systems without Plug and Play system software, `ni-pnp` performs the actual configuration of each interface. It relies on the resource settings made with the GPIB software configuration utility to assign resources to the boards. After the configuration of each board is determined, `ni-pnp` provides this information to the NI-488.2 driver and the GPIB analyzer driver. `ni-pnp` relieves the drivers from the job of finding and configuring Plug and Play boards.

GPIB Analyzer Software Description

The bus analyzer portion of the AT-GPIB/TNT+ is a Windows application called the GPIB analyzer. The GPIB analyzer was created using the National Instruments LabWindows[®]/CVI development environment. You can use the GPIB analyzer to

capture, monitor, and participate in bus activity on the GPIB. You can also use the analyzer to troubleshoot a variety of IEEE 488 hardware and software problems. The GPIB analyzer can help you solve GPIB communication problems, such as addressing inconsistencies, protocol violations, and simple bus timeout conditions.

The analyzer software consists of the following components.

- GPIB analyzer application
- GPIB analyzer device drivers (dynamic link library and virtual device driver)
- GPIB analyzer online help
- LabWindows/CVI Run-Time System (used by the GPIB analyzer)
- Math coprocessor emulator (available for use if your computer does not have a math coprocessor)

For more information on how to use the GPIB analyzer, refer to the analyzer online help or the *GPIB Analyzer User Manual*.

Optional Programming Tools

Your kit includes the NI-488.2 software for Windows. In addition, you can order the LabWindows/CVI or LabVIEW software from National Instruments. LabWindows/CVI and LabVIEW include instrument driver libraries that make it easier to communicate with your GPIB instruments.

LabWindows/CVI is an interactive ANSI C development environment for building test and measurement and instrument control systems. It includes interactive code-generation tools and a graphical editor for building custom user interfaces. It also includes built-in libraries for IEEE 488.2, VXI, RS-232 control, and plug-in data acquisition. When you order LabWindows/CVI, you also get more than 300 complete instrument drivers, which are modular, source-code programs that handle the communication with your instrument so that you do not have to learn the programming details.

LabVIEW is a complete programming environment that departs from the sequential nature of traditional programming languages and features a graphical programming environment. It includes all the tools needed for instrument control, data acquisition, analysis, and presentation. LabVIEW also includes an extensive instrument driver library.

For more information about LabWindows/CVI and LabVIEW, contact National Instruments.

LabWindows/CVI and the GPIB Analyzer

The GPIB analyzer uses the LabWindows/CVI Run-Time System for its graphical interface. The easy-to-use LabWindows/CVI development environment, advanced graphical capabilities, and ability to generate stand-alone executables made LabWindows/CVI the perfect tool for the development of the GPIB analyzer.

You may already have the LabWindows/CVI Run-Time System installed on your computer for other purposes. In that case, the GPIB analyzer installer will only reinstall the LabWindows/CVI Run-Time System if the version that comes with the GPIB analyzer is newer than the version that is already installed on your computer.

LabWindows/CVI requires floating-point capability for its graphical interfaces. If you are using a computer without floating-point hardware (an 80386 processor without 80387, or an 80486SX without 80487), the GPIB analyzer installation program installs a virtual device driver that emulates floating-point capability. The virtual device driver, which is included with your National Instruments kit, is called WEMU387.386. It has been extensively tested with the GPIB analyzer and LabWindows/CVI, but is not guaranteed to work with other applications that require floating-point capability.

Chapter 2

Installation and Configuration

This chapter contains instructions to help you install and configure your NI-488.2 software, AT-GPIB/TNT+, and the GPIB analyzer.

Install Your NI-488.2 Software

Complete the following steps to run the software installation program.

1. Insert the GPIB analyzer distribution disk into an unused drive.
2. Choose **Run...** from the **File** menu in the **Program Manager** window and type the following command into the dialog box:

```
x:\setup
```

where *x* is the letter of the drive containing the distribution disk (usually a or b).

The software installation begins with the dialog box shown in Figure 2-1.

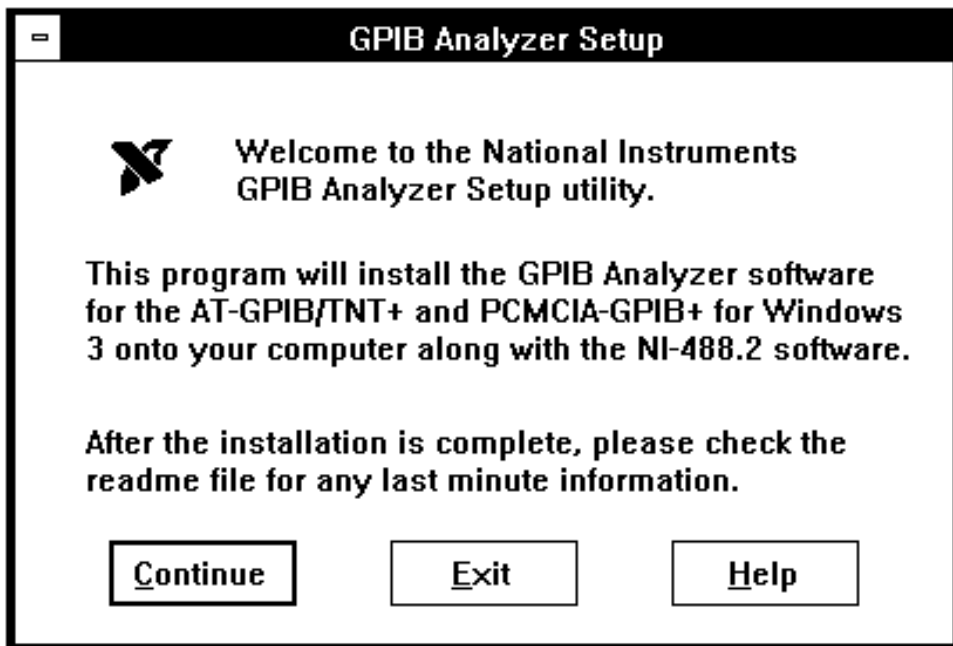


Figure 2-1. Software Installation Dialog Box

The interactive setup program takes you through the necessary steps to install the NI-488.2 software and the GPIB analyzer. For help during the installation, press the **Help** button. You can exit the setup program at any time by pressing the **Exit** button.

3. After the installation is complete, restart Windows.
4. After you have installed your software, you might need to modify the configuration of the driver. If you are not using any Plug and Play system software, you *must* run the GPIB software configuration utility after you have installed the hardware.

Install the AT-GPIB/TNT+ Hardware

Warning: *Electrostatic discharge can damage several components on your AT-GPIB/TNT+ board. To avoid such damage in handling the board, touch the antistatic plastic package to a metal part of your computer chassis before removing the board from the package.*

Perform the following steps to install the AT-GPIB/TNT+ board:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the AT-GPIB/TNT+ board.
2. Remove the top cover (or other access panels) to give yourself access to the computer expansion slots.
3. Find an unused 16-bit ISA expansion slot in your computer.
4. Remove the corresponding slot cover on the back panel of the computer.
5. Insert the AT-GPIB/TNT+ board into the slot with the GPIB connector sticking out of the opening on the back panel, as shown in Figure 2-2. It might be a tight fit, but do not force the board into place.

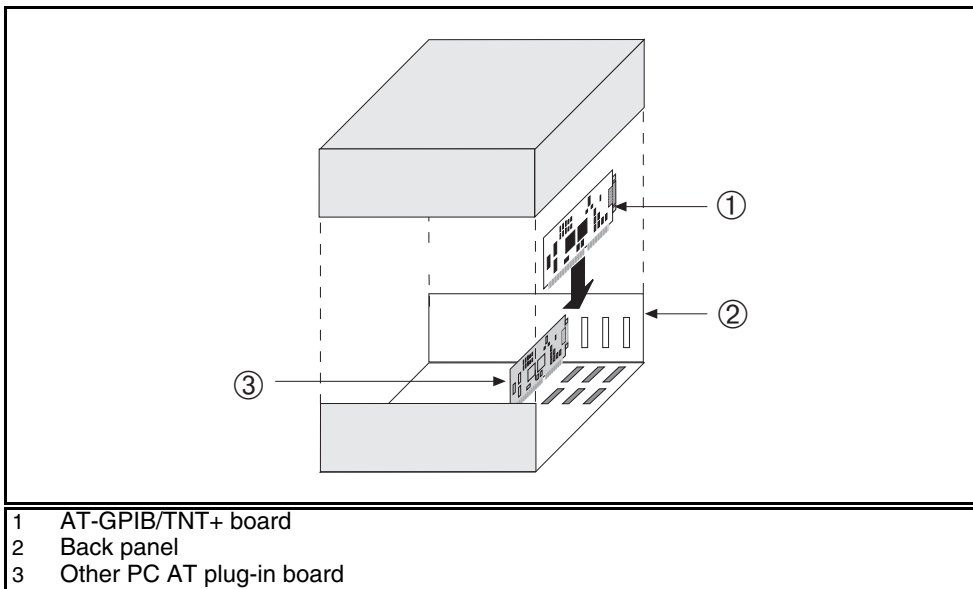


Figure 2-2. Installing the AT-GPIB/TNT+ Board

6. Screw the mounting bracket of the AT-GPIB/TNT+ board to the back panel rail of the computer.
7. Replace the top cover or access port to the I/O channel.
8. Turn on your computer.

Configure Your NI-488.2 Software and GPIB Analyzer Resources

If you installed the version of the NI-488.2 software that was included with your kit instead of using NI-488.2 software you might already have, you can use the GPIB software configuration utility to examine or modify the configuration of the NI-488.2 driver and GPIB analyzer drivers.

Types of Systems

If your system is Plug and Play ready, you do not need to run the GPIB software configuration utility unless you are using more than one AT-GPIB/TNT+ board in your system. If you are using more than one board, you can use the GPIB software configuration utility to associate each logical reference to a board, GPIB x , with a particular board, as identified by its serial number.

If you are using a jumperless system, you must run the GPIB software configuration utility to assign resources for each AT-GPIB/TNT+ board in the system.

Using the GPIB Software Configuration Utility

To run the GPIB software configuration utility, double-click on the **GPIB** icon in the **Control Panel**, which is located in the **Main** group of the **Program Manager**.

To configure a board, double-click on the board name and select a serial number and the appropriate resources. Repeat this process for each board you need to configure. To take advantage of all the capabilities of the AT-GPIB/TNT+, you or the Plug and Play software must assign an I/O address, DMA channel, and IRQ level to the GPIB Controller portion of the board, and a similar, separate set of resources to the GPIB analyzer portion of the board. The AT-GPIB/TNT+ needs two sets of resources, because it performs the functions of two boards. You can use the online help if you have any questions about the process of configuring resources for the AT-GPIB/TNT+. For more information about the GPIB software configuration utility, refer to the *NI-488.2 User Manual for Windows*.

If you plan to use the HS488 high-speed protocol, you must specify in the GPIB software configuration utility the total length of GPIB cable in your system.

Using the GPIB Analyzer Configuration Utility

If you installed the GPIB analyzer, but chose not to install the version of the NI-488.2 software included with your kit, and you need to configure the GPIB analyzer to use specific resources, you must use the GPIB analyzer configuration utility.

To run the GPIB analyzer configuration utility, double-click on the **GPIB Analyzer** icon in the **Control Panel**, which is located in the **Main** group of the **Program Manager**. Enter the appropriate values into the dialog box and then click on the **OK** button to configure resources for the GPIB analyzer. You can use the online help if you have any questions.

Chapter 3

Verify the Installation

This chapter describes how to verify the hardware and software installation.

Run the Hardware Diagnostic Test

To verify and test the hardware installation, run the Hardware Diagnostic Test that came with your NI-488.2 software. The test verifies that your hardware is functioning properly and that the configuration of your AT-GPIB/TNT+ does not conflict with anything else in your system. It tests all resources assigned to both the GPIB analyzer and the GPIB Controller portions of the AT-GPIB/TNT+.

To run the test, disconnect any GPIB cables and then double-click on the **Hardware Diagnostic Test** icon in the **GPIB Analyzer Software** group in the **Program Manager**.

The test asks if you want to test the board listed or another board. If you have more than one board, the test asks you if you want to test all AT-GPIB boards in the system or if you want to test each AT-GPIB board individually. The Hardware Diagnostic Test uses the resources you chose with the software configuration utility to test the installed GPIB boards.

If the following message appears:

Board passed the hardware diagnostics

then the Hardware Diagnostic Test completed with no errors; your hardware and is functioning properly. If the test returns an error message, refer to Appendix B, *Troubleshooting*, for troubleshooting instructions. If the test is successful, select **Exit** from the **File** menu to exit the Hardware Diagnostic Test, and then proceed to the Software Diagnostic Test.

Run the Software Diagnostic Test

After you have run the Hardware Diagnostic Test, verify and test the NI-488.2 software installation by running the Software Diagnostic Test that came with your NI-488.2 software. The Software Diagnostic Test is a Windows application that requires no user interaction.

The Software Diagnostic Test does not test the GPIB analyzer. The GPIB analyzer is tested when it starts up, but not when you run the Software Diagnostic Test.

Follow these steps to run the Software Diagnostic Test:

1. Disconnect any GPIB cables.
2. Double-click on the **Software Diagnostic Test** icon in the **NI-488.2 GPIB Software** group in the **Program Manager**.
3. Press <Return> to start the test.

The Software Diagnostic Test displays the word “Finished” in the lower left corner of the screen when it finishes. If the Software Diagnostic Test completes with no errors, you have installed the NI-488.2 software correctly. If it returns an error message, refer to Appendix B, *Troubleshooting*, for troubleshooting instructions. Select **Exit** from the **File** menu to exit the Software Diagnostic Test.

Chapter 4

Begin to Use the AT-GPIB/TNT+

This chapter gives a brief explanation of the various elements of the NI-488.2 software and the GPIB analyzer.

Using the NI-488.2 Software

Using the Win16 Interactive Control Utility

You can use the interactive control utility to enter NI-488 functions and NI-488.2 routines interactively and see the values returned by the function calls. Without writing an application, you can use the utility to do the following:

- Verify GPIB communication with your device quickly and easily.
- Learn the NI-488 functions and NI-488.2 routines before you write your application.
- Become familiar with the commands of your device.
- Receive data from your GPIB device.
- Troubleshoot problems with your application.

For more information about the Win16 Interactive Control utility, refer to the *NI-488.2 User Manual for Windows*.

Using GPIB Spy

GPIB Spy is a GPIB application monitor for Windows applications. It monitors the NI-488 and NI-488.2 calls made to the NI-488.2 driver for Windows, and it records and displays information about the calls. You can use the GPIB Spy application to locate and analyze errors in your application or in the configuration of the NI-488.2 software.

When to Use GPIB Spy Instead of the GPIB Analyzer

Because the GPIB Spy utility monitors the calls to the NI-488.2 driver, you can use it only to debug data transfers in NI-488.2 applications running on the same machine as the AT-GPIB/TNT+. If you want to view all GPIB calls made to the NI-488.2 driver, you should use GPIB Spy. GPIB Spy does not show all bus events and does not monitor the assertion and unassertion of bus lines. If you want to view all events on the bus, see details of the activity on the bus (such as which lines are asserted), or analyze

applications running on other computers, you should use the GPIB analyzer. The GPIB Analyzer does not monitor the GPIB calls you make.

For more information about GPIB Spy, see Chapter 6, *GPIB Spy*, in the *NI-488.2 User Manual for Windows*.

General Programming Considerations

As you begin developing your NI-488.2 application, remember the following points:

- You must link the language interface library with your compiled source code.
- You must include the header file in your source code.

For information about choosing a programming method, developing your application, or compiling and linking, refer to the *NI-488.2 User Manual for Windows*. For detailed information about each NI-488 function and NI-488.2 routine, refer to the *NI-488.2 Function Reference Manual for DOS/Windows*. For release notes, refer to the `ReadMe` file included with your NI-488.2 and GPIB analyzer software.

Using the GPIB Analyzer

To start the GPIB analyzer, double click on the **GPIB Analyzer** icon in the **GPIB Analyzer Software** group of the **Program Manager**.

The bus analysis hardware of the AT-GPIB/TNT+ includes the ability to analyze all GPIB activity. This hardware is accessed using a Windows application called the GPIB analyzer. Because the GPIB analyzer monitors the actual GPIB signals, it provides the best mechanism for debugging and optimizing a GPIB system. Whether or not you use the NI-488.2 capabilities of the AT-GPIB/TNT+, you can use the GPIB analyzer to do the following:

- Verify that an NI-488.2 application is communicating on the bus as expected.
- Determine if a GPIB device is properly conforming to the protocol and, if it is not, find possible solutions.
- Analyze performance of a GPIB system and determine how each device affects performance.
- Resolve timeout problems related to nonresponsive GPIB devices.
- Determine the cause of missing bytes in a data stream.

- Resolve problems related to standard IEEE 488 3-wire handshaking or the new high-speed HS488 handshaking protocols.
- Debug bus problems by manually controlling GPIB signal lines.

You can find information on how to use the GPIB analyzer in the *GPIB Analyzer User Manual* and the online help. You can open the online help by using the **Help** menu within the analyzer program. The *GPIB Analyzer User Manual* provides complete information on the GPIB analyzer.

Appendix A

Specifications

This appendix describes the physical characteristics of the AT-GPIB/TNT+ hardware and software, along with the recommended operating conditions.

Hardware

Table A-1. AT-GPIB/TNT+ Hardware Characteristics

Characteristic	Specification
Dimensions	10.67 by 16.51 cm (4.2 by 6.5 in.)
Power Requirement (From PC AT I/O channel)	+5 VDC 460 mA Typical 850 mA Maximum
I/O Connector	IEEE 488 Standard 24-pin
Operating Environment Component Temperature Relative Humidity	0° to 40° C 10% to 90%, Noncondensing
Storage Environment Temperature Relative Humidity	-20° to 70° C 5% to 90%, Noncondensing
EMI	FCC Class B Certified

Software

Table A-2. NI-488.2 Software Characteristics for the AT-GPIB/TNT+

Characteristic	Specification
Maximum GPIB Transfer Rates 3-Wire (IEEE 488) High Speed (HS488) In ISA Computer In EISA Computer	1.5 Mbytes/s* 1.6 Mbytes/s* 3.4 Mbytes/s*
* Actual speed may vary considerably from speed shown due to system and instrumentation capabilities.	

Appendix B

Troubleshooting

This appendix describes how to troubleshoot problems.

Troubleshooting ni-pnp Error Messages

The `ni-pnp.exe` program should be located in the root directory of your boot drive, usually `C:\`. It should be run from your `autoexec.bat` file, so that `ni-pnp` executes every time your system is started. `ni-pnp` normally produces very little output when it is run, displaying only the name of each National Instruments interface board it detects. Most errors that `ni-pnp` might detect are handled transparently. If `ni-pnp` finds an error from which it cannot recover, it displays a message and describes the best method for fixing the problem.

Some possible problems that `ni-pnp` might report include boards with unassigned resources and boards for which resource conflicts exist. If `ni-pnp` encounters a board with no assigned resources, it displays the following message:

This interface has no assigned resources.

If this message appears, you must run the GPIB software configuration utility and assign resources to the board. If `ni-pnp` detects an I/O address conflict, it displays the following message:

I/O Address Conflict.

If this message appears, you must run the GPIB software configuration utility and change the base I/O address for the board.

You can run `ni-pnp` in a verbose output mode. In this mode, `ni-pnp` displays more information about each interface, including its assigned resources. To run `ni-pnp` in verbose mode, change to the directory which contains `ni-pnp.exe`. This is the root of the boot drive (usually `C:\`). Run `ni-pnp` with the verbose output flag by entering the following text: `ni-pnp /v`.

Another, more serious error can also occur on systems that are not Plug and Play ready. Since `ni-pnp` must assign resources to the boards, it must first perform the Plug and Play ISA isolation sequence. The isolation sequence is a method by which all Plug and Play boards can be detected. It is possible, although rare, that this isolation sequence might lock up your computer. If this occurs, restart your computer. `ni-pnp` will then detect that your computer was locked up and display an error message describing the problem. `ni-pnp` can enter a fail-safe detection mode in which it records each I/O port before testing that port. If your computer locks up while testing a port in this mode, `ni-pnp` will exclude that I/O port from future testing. If you know that you do not have

any National Instruments Plug and Play boards in your system, you can configure `ni-pnp` so that it does not attempt to detect any Plug and Play boards. `ni-pnp` will prompt you to choose between entering the fail-safe mode or disabling the detection of Plug and Play boards.

Troubleshooting Hardware Diagnostic Test Error Messages

Resource Conflicts

In this section the term *resource* refers to an ISA interrupt level, a DMA channel, or a base I/O address range. A resource conflict occurs if the AT-GPIB/TNT+ is assigned a resource that some other device in the system is using. Resource conflicts cause most Hardware Diagnostic Test errors. Your system will not work properly if a resource conflict exists, so you should resolve all conflicts before using your AT-GPIB/TNT+.

Interrupt Conflicts

You may configure the AT-GPIB/TNT+ to use two ISA interrupt levels. Both the GPIB Controller and the GPIB analyzer need an exclusive interrupt level. An interrupt conflict occurs if another plug-in board (or a device on the computer motherboard) is configured to use one of these ISA interrupt levels. To resolve an interrupt conflict, you must do one of the following:

- Change the interrupt level the GPIB Controller or the GPIB analyzer uses.
- Change the interrupt level the other plug-in board uses.
- Configure the GPIB Controller portion of the AT-GPIB/TNT+ not to use interrupts. (You cannot configure the GPIB analyzer not to use interrupts, it requires an interrupt level.)

Refer to the section later in this appendix entitled *How to Resolve Hardware Diagnostic Test Errors*.

DMA Conflicts

You may configure the AT-GPIB/TNT+ to use two ISA DMA channels. The use of DMA transfers by the GPIB Controller or the GPIB analyzer is optional. If the NI-488.2 software or the GPIB analyzer are configured to use DMA transfers, they each need an exclusive DMA channel. A DMA conflict occurs if another plug-in board (or a device on the computer motherboard) is configured to use one of these DMA channels. To resolve a DMA conflict, you must do one of the following:

- Change the DMA channels the AT-GPIB/TNT+ uses.
- Change the DMA channel the other plug-in board uses.
- Configure the GPIB Controller or the GPIB analyzer not to use DMA transfers.

Refer to the section later in this appendix entitled *How to Resolve Hardware Diagnostic Test Errors*.

I/O Address Range Conflicts

The AT-GPIB/TNT+ uses 32 contiguous I/O addresses for the GPIB Controller, and 16 contiguous I/O addresses for the GPIB analyzer. The lowest address the AT-GPIB/TNT+ uses is the *base address*. For example, if the base address for the GPIB Controller is 2C0 (hex), the AT-GPIB/TNT+ uses all 32 addresses in the range 2C0 through 2DF (hex). An I/O address range conflict exists if another plug-in board (or a device on the computer motherboard) is configured to use any address in the I/O address ranges the GPIB Controller or the GPIB analyzer is using. To resolve an I/O range conflict, you must do one of the following:

- Change the base address the GPIB Controller is using.
- Change the base address the GPIB analyzer is using.
- Change the I/O range the other plug-in board is using.

How to Resolve Hardware Diagnostic Test Errors

1. Check to see if any GPIB cables are connected to your board. If any GPIB cables are connected to your AT-GPIB/TNT+ board, disconnect the cables and run the Hardware Diagnostic Test again.

2. Note which error message the Hardware Diagnostic Test displays. The most common error messages are as follows:

```
<<< Base I/O Address Conflict >>>
```

```
<<< Interrupt Level Conflict >>>
```

```
<<< DMA Channel Conflict >>>
```

```
<<< Error Reading NI-PNP.INI >>>
```

If the error occurs in reading `ni-pnp.ini`, try rebooting, and then run the test again. If that doesn't work, try reinstalling the software, and then run the test again. If a resource conflict exists, write down the exact resource tested. For example, if a DMA resource conflict exists, note which DMA channel (5, 6, or 7) was tested.

3. Run the `ni-pnp` utility in verbose mode to determine what software configures the Plug and Play circuitry of your AT-GPIB/TNT+.
4. If `ni-pnp` reports **Intel Configuration Manager Version x.xx Found**, refer to the next section, *Resolving Conflicts with the Intel Configuration Utility*. Otherwise, continue with step 5.
5. Run the GPIB configuration utility to change the resources your AT-GPIB/TNT+ is using. If the Hardware Diagnostic Test indicated that your AT-GPIB/TNT+ failed the test because of a base I/O address conflict, change the base I/O address location of your AT-GPIB/TNT+ in the GPIB software configuration utility. Similarly, if the Hardware Diagnostic Test indicated an interrupt level conflict or DMA channel conflict, change the appropriate setting in the GPIB software configuration utility. For more information about the configuration utility, refer to Chapter 2, *Installation and Configuration*.
6. Save the new GPIB software configuration utility settings.
7. Reboot the computer
8. Run the Hardware Diagnostic Test again and go back to step 1.

Resolving Conflicts with the Intel Configuration Utility

If a resource conflict exists, the Intel software does not have the resource information for a legacy (jumped) ISA board in your system. It is therefore free to assign a resource that is already used to the AT-GPIB/TNT+. To resolve the resource conflict, complete the following steps:

1. Run the Intel ISA Configuration Utility (ICU).
2. Modify the configuration of the AT-GPIB/TNT+. For example, if the Hardware Diagnostic Test error message noted in step 2 in the *How to Resolve Hardware Diagnostic Test Errors* section indicates an interrupt conflict on interrupt level 11, configure that AT-GPIB/TNT+ to use another available interrupt level.
3. Try to determine which other plug-in board is using the conflicting resource. Consult the documentation that came with the other plug-in boards.
4. Depending on whether you can determine which other plug-in board is using the conflicting resource, complete the following steps:
 - a. If you can determine which plug-in board is using the conflicting resource, add the board information to the ICU system configuration. After you add the board information, skip to step 5.
 - b. If you cannot determine which plug-in board is using the conflicting resource, you need to add an *Unknown* board to the system configuration.
 - c. When the dialog box asks if you have a configuration file for this unknown board, respond “No.”
 - d. For Card Name, enter “Unknown.”
 - e. Assign the conflicting resources to the board. For example, if the Hardware Diagnostic Test error message noted in step 2 above indicates an interrupt conflict on interrupt level 11, assign interrupt level 11 to the “Unknown” board.
5. Save the changes and exit the ICU.
6. Reboot the computer and run the Hardware Diagnostic Test again.

If you still have problems after completing these steps, you may have other conflicts to resolve. Repeat these steps until you have resolved all of the conflicts.

Troubleshooting Software Diagnostic Test Error Messages

The following sections explain common error messages the Software Diagnostic Test generates.

Note: *In the following paragraphs, gpibx refers to board gpib0, gpib1, gpib2, or gpib3 as appropriate.*

Test for Presence of Software Components

The Software Diagnostic Test checks for the presence of `ni-pnp.ini`, `gpib.ini`, and `gpib.dll`.

If the `ni-pnp.ini` file is not found in the root of the boot drive, the following error message is displayed:

```
An unexpected ERROR occurred:  
Unable to locate NI-PNP.INI  
Try reinstalling the NI-488.2 software.
```

If the `gpib.ini` file is not found in the Windows directory, the following error message is displayed:

```
An unexpected ERROR occurred:  
Unable to locate GPIB.INI in the Windows directory: C:\WINDOWS.  
Try reinstalling the NI-488.2 software.
```

If the `gpib.dll` file is not found in either the Windows or the Windows System directory, the following error message is displayed:

```
An unexpected ERROR occurred:  
Unable to locate GPIB.DLL in the Windows or Windows system  
directory.  
Try reinstalling the NI-488.2 software.
```

If any of these messages appears, you must reinstall the NI-488.2 software.

Test for Presence of Driver

The Software Diagnostic Test displays the following message when it fails because of a general error in the NI-488.2 driver:

```
<<< No handler present for GPIBx. >>>
```

If this message appears, you should run the Hardware Diagnostic Test to verify that the NI-488.2 software is configuring the AT-GPIB/TNT+ correctly. If the Hardware Diagnostic Test completes successfully, you should reinstall the NI-488.2 software.

Test for Presence of Board

The following error message appears if the board `gpibx` is not installed or if the software is not configured properly:

```
<<<  No board present for GPIBx.  >>>
```

If this message appears, the problem might be one of the following:

- The board might not be properly configured. Run the GPIB software configuration utility to verify the hardware settings. Refer to *Configure Your NI-488.2 Software and GPIB Analyzer Resources* in Chapter 2, *Installation and Configuration*, for more information.
- The board might not be properly installed. Refer to *Install the AT-GPIB/TNT+ Hardware* in Chapter 2, *Installation and Configuration*, for detailed instructions.

GPIB Cables Connected

The following error message appears if a GPIB cable is connected to the AT-GPIB/TNT+ when you run the Software Diagnostic Test:

```
Call(25) 'ibcmd " " failed, ibsta (0x134) not what was expected  
(0x8130)
```

```
Call(25) 'ibcmd " " failed, expected ibsta (0x100) to have the  
ERR bit set.
```

Disconnect all GPIB cables before trying the test again.

Appendix C

Common Questions

This appendix lists common questions and answers.

Which NI-488.2 software (DOS or Windows) do I need to install?

If you want to run a GPIB application under DOS, install the NI-488.2 software for DOS. If you want to run a GPIB application in Windows, install the NI-488.2 software for Windows. If you want to use the GPIB analyzer, install the GPIB analyzer. You can install any one, all, or any combination of the software mentioned. The GPIB analyzer only runs in Windows, so if you want to use the analyzer, you need to install the NI-488.2 software for Windows. If you have a previous version of the NI-488.2 software installed, you do not have to reinstall it, whether you want to use the GPIB analyzer or not.

Can I have the NI-488.2 software for DOS and Windows drivers installed at the same time?

Yes, you can install both. However, it is better not to use them at the same time.

How can I determine which type of GPIB board I have installed?

Run the GPIBInfo utility. If you run GPIBInfo without specifying any parameters, it returns information about the GPIB boards currently configured for use in your system. If you know the base I/O address of a GPIB interface board, you can enter it as a parameter for specific information. For example, GPIBInfo 2C0 returns information about the GPIB board at base I/O address 2C0. For more information about GPIBInfo, refer to the *NI-488.2 User Manual for Windows*.

How can I determine which version of the NI-488.2 software I have installed?

Run the GPIBInfo utility. If you run GPIBInfo without specifying any parameters, it returns information about the version of the NI-488.2 software currently installed. For more information about GPIBInfo, refer to the *NI-488.2 User Manual for Windows*.

How can I determine which version of the GPIB analyzer I have installed?

Within the GPIB analyzer, choose **About** from the **Help** menu of the main window.

How can I determine if the Intel Plug and Play software is installed on my computer?

Run the `ni-pnp` utility in verbose mode by passing a `/v` flag when you run it. If the Intel Configuration Manager is installed, `ni-pnp` prints out the following error message:

```
Intel Configuration Manager version x.xx Found
```

Will `ni-pnp` work on a system that comes with the Intel Plug and Play software pre-installed?

Yes, `ni-pnp` is designed to configure National Instruments Plug and Play boards if the Intel software is not installed and to check the configuration of boards if the Intel software is installed.

What do I do if one of the diagnostic tests fails with an error?

Refer to the troubleshooting instructions in Appendix B, *Troubleshooting*, for specific information about what might cause these tests to fail.

When should I use the Win16 Interactive Control utility?

You can use the Win16 Interactive Control utility to test and verify instrument communication, troubleshoot problems, and develop your application program. For more information, refer to Chapter 5, *Interactive Control Program*, in the *NI-488.2 User Manual for Windows*.

How do I use an NI-488.2 language interface?

For information about using NI-488.2 language interfaces, refer to Chapter 3, *Developing Your Application*, in the *NI-488.2 User Manual for Windows*.

How do I use the GPIB analyzer?

You can use the analyzer to capture, monitor, and participate in GPIB activity and to help solve problems with IEEE 488 hardware or software. For help on using the analyzer, consult the extensive online help within the analyzer itself or the *GPIB Analyzer User Manual*.

Should I run the GPIB analyzer on its own computer?

You do not have to run the GPIB analyzer on its own computer. Because the AT-GPIB/TNT+ is an NI-488.2 interface, you can develop your NI-488.2 application and use the GPIB analyzer in the background on the same computer.

Can I use the GPIB analyzer without using the NI-488.2 portion of the AT-GPIB/TNT+?

You can choose not to install the NI-488.2 software when you install the GPIB analyzer. You can use the GPIB analyzer to debug any GPIB interface without the presence of the NI-488.2 software.

Can I use the GPIB analyzer for debugging if I am not using the AT-GPIB/TNT+ in my application?

You can use the GPIB analyzer for applications that use other IEEE 488.2 interface boards. For example, you could install the GPIB analyzer on a machine that uses a GPIB-ENET and the NI-488.2 software, and then use the analyzer to debug applications for the GPIB-ENET.

What information should I have before I call National Instruments?

When you call National Instruments, you should have the results of the diagnostic tests and the output from `GPIBInfo` and `ni-pnp /v`. Also, make sure you have filled out the configuration form in Appendix D, *Customer Communication*.

Appendix D

Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve technical problems you might have as well as a form you can use to comment on the product documentation. Filling out a copy of the *Technical Support Form* before contacting National Instruments helps us help you better and faster.

National Instruments provides comprehensive technical assistance around the world. In the U.S. and Canada, applications engineers are available Monday through Friday from 8:00 a.m. to 6:00 p.m. (central time). In other countries, contact the nearest branch office. You may fax questions to us at any time.

Corporate Headquarters

(512) 795-8248

Technical support fax: (800) 328-2203
(512) 794-5678

Branch Offices	Phone Number	Fax Number
Australia	03 9 879 9422	03 9 879 9179
Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	519 622 9310	519 622 9311
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 71 11
Finland	90 527 2321	90 502 2930
France	1 48 14 24 24	1 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Italy	02 48301892	02 48301915
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	95 800 010 0793	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	01635 523545	01635 523154

Technical Support Form

Technical support is available at any time by fax. Include the information from your configuration form. Use additional pages if necessary.

Name _____

Company _____

Address _____

Fax (___) _____ Phone (___) _____

Computer brand _____

Model _____ Processor _____

Operating system _____

Speed _____MHz RAM _____MB

Display adapter _____

Mouse _____yes _____no

Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____

Revision _____

Configuration _____

National Instruments software product _____

Version _____

Configuration _____

(continues)

The problem is _____

List any error messages _____

The following steps will reproduce the problem _____

AT-GPIB/TNT+ Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Update this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration.

National Instruments Products

- AT-GPIB/TNT+ Board Revision _____
- NI-488.2 Software Revision Number on Distribution Disk(s) _____
- GPIB Analyzer Version Number from **About** Box _____
- Programming Language Interface Revision _____
- Information from `ni-pnp /v` _____
- NI-488.2 Resources

	Base I/O Address	Interrupt Level	DMA Channel
gpib0	_____	_____	_____
gpib1	_____	_____	_____
gpib2	_____	_____	_____
gpib3	_____	_____	_____

- GPIB Analyzer Resources

	Base I/O Address	Interrupt Level	DMA Channel
gpib0	_____	_____	_____

Other Products

- Computer Make and Model _____
- Microprocessor _____
- Floating-Point Support _____
- Clock Frequency _____
- Type of Monitor Card Installed _____
- Windows Version _____
- Application Programming Language (BASICA, Microsoft C, and so on) _____

- Intel Plug and Play Software Installed (yes or no) _____
- Other Boards in System _____
- Base I/O Address of Other Boards _____
- Interrupt Level of Other Boards _____
- DMA Channels of Other Boards _____

Glossary

Prefix	Meaning	Value
m-	milli-	10^{-3}
c-	centi-	10^{-2}
k-	kilo-	10^3
M-	mega-	10^6

°	degrees
%	percent
A	amperes
AC	alternating current
ANSI	American National Standards Institute
ASIC	application-specific integrated circuit
base I/O address	lowest of the 32 contiguous I/O addresses used by the AT-GPIB/TNT+ board
BIOS	Basic Input/Output System
C	Celsius
CPU	central processing unit
DIP	dual inline package
DMA	direct memory access
EISA	Extended Industry Standard Architecture
EMI	electromagnetic interference
FCC	Federal Communications Commission
GPIB	General Purpose Interface Bus
hex	hexadecimal
Hz	hertz
I/O	input/output
IEEE	Institute of Electrical and Electronic Engineers
in.	inches

Glossary

IRQ	interrupt request
ISA	Industry Standard Architecture
jumperless	describes configuration of a Plug and Play ISA board in a non-Plug and Play system—such configuration is accomplished entirely from software, but the user must still choose specific system resources for the board
KB	kilobytes of memory
legacy ISA board	ISA board whose system resources are chosen by changing physical DIP switches or jumpers on the board
m	meters
MB	megabytes of memory
PC	personal computer
PnP	plug and play
RAM	random-access memory
resource	hardware settings used by devices in a computer system, including ISA interrupt level, DMA channel, and base I/O address
s	seconds
VDC	volts direct current