

**Getting Started with Your AT-GPIB/TNT and  
the NI-488.2™ Software for Windows  
Graphics Applications**

**September 1994 Edition**

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# **FCC/DOC Radio Frequency Interference Compliance**

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual, may cause interference to radio and television reception. This equipment has been tested and found to comply with the following two regulatory agencies:

## **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 harmful interference from the equipment to radio 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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Der Detuschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Bestimmungen eingeräumt.

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# About This Manual

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This manual contains instructions to help you install and configure the National Instruments AT-GPIB/TNT or AT-GPIB interface board and the NI-488.2 software for Windows graphics applications. The NI-488.2 software is intended for use with Windows version 3.1 or higher.

This manual uses the term *AT-GPIB/TNT* to refer to a National Instruments GPIB board for the ISA (PC AT) bus equipped with the TNT4882C ASIC. The term *AT-GPIB* refers to a National Instruments GPIB board for the ISA bus equipped with the NAT4882 and Turbo488 ASICs. This manual also uses the term *GPIB board* in cases where the material can apply to either board.

This manual assumes that you are already familiar with the Windows operating system.

## Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, explains how to use this manual, lists what you need to get started and optional equipment you can order, and briefly describes the GPIB hardware and the NI-488.2 software.
- Chapter 2, *Hardware Installation*, contains instructions for installing your GPIB board.
- Chapter 3, *Software Installation*, contains a description of the files on the NI-488.2 distribution disks and instructions for installing your NI-488.2 software.
- Chapter 4, *Installation Verification and Troubleshooting*, describes how to verify the hardware and software installation and how to troubleshoot problems.
- Appendix A, *Changing Hardware Configuration Settings*, contains instructions for changing the configuration settings of your GPIB board.
- Appendix B, *Changing Software Configuration Settings*, contains a description of the GPIB software configuration utility you can use to configure the NI-488.2 software for Windows.
- Appendix C, *Hardware Specifications*, describes the electrical, physical, and environmental characteristics of the GPIB board and the recommended operating conditions.
- Appendix D, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.

- The *Glossary* contains an alphabetical list and a description of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.

## Conventions Used in This Manual

The following conventions are used in this manual.

<b>bold</b>	Bold text denotes menus, menu items, dialog buttons, LEDs, options, or checkboxes.
<i>italic</i>	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
<b><i>bold italic</i></b>	Bold italic text denotes a note, caution, or warning.
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.
<b>bold monospace</b>	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
<i>italic monospace</i>	Italic text in this font denotes that you must supply the appropriate words or values in place of these items.
<>	Angle brackets enclose the name of a key on the keyboard—for example, <PageDown>.
-	A hyphen between two or more key names enclosed in angle brackets denotes that you should simultaneously press the named keys—for example, <Control-Alt-Delete>.
<Enter>	Key names are capitalized.
AT-GPIB/TNT	AT-GPIB/TNT refers to a National Instruments GPIB board for the ISA (PC AT) bus equipped with the TNT4882C ASIC.
AT-GPIB	AT-GPIB refers to a National Instruments GPIB board for the ISA bus equipped with the NAT4882 and Turbo488 ASICs.
GPIB board	GPIB board refers to either the AT-GPIB/TNT or the AT-GPIB board in cases where the material can apply to either board.

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 488.2-1987, 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 488.2-1987, *IEEE Standard Codes, Formats, Protocols, and Common Commands*
- *Microsoft Windows User's Guide*, Microsoft Corporation
- Documentation included with your graphics software

## **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.

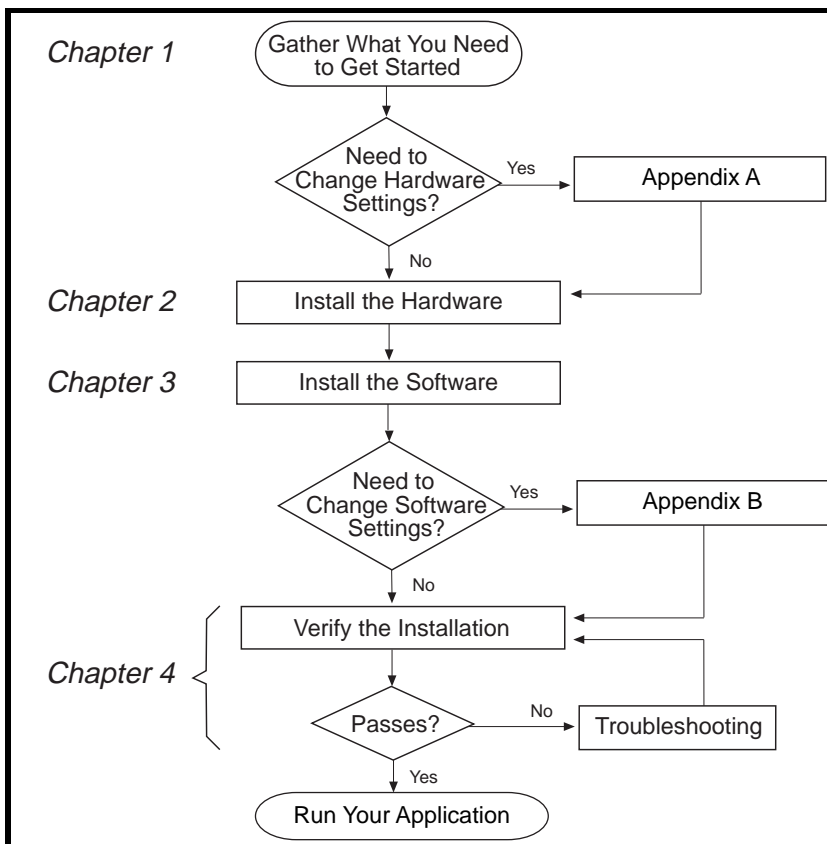
# Chapter 1

## Introduction

---

This chapter explains how to use this manual, lists what you need to get started and optional equipment you can order, and briefly describes the GPIB hardware and the NI-488.2 software.

### How to Use This Manual



## What You Need to Get Started

- ❑ One of the following boards:
  - AT-GPIB/TNT board
  - AT-GPIB/TNT board with keys
  - AT-GPIB board
  - AT-GPIB board with keys
  
- ❑ *NI-488.2 Software for Windows Graphics Applications. Distribution Disk for the EISA-GPIB, AT-GPIB/TNT and the AT-GPIB*
  - 3.5 in. high density (1.44 MB)
  - or
  - 5.25 in. high density (1.2 MB)
  
- ❑ Microsoft Windows version 3.1 or higher installed on your computer

## Optional Equipment

- Shielded GPIB Cables\*
  - Type X1 single-shielded cables (1 m, 2 m, or 4 m)
  - Type X2 double-shielded cables (1 m, 2 m, or 4 m)
  
- GPIB Connector Extender
  
- GPIB-SWITCH Box
  
- GPIB Bus Extenders
  - Parallel – 100 to 120 VAC
  - Parallel – 220 to 240 VAC
  - Fiber-optic – 100 to 120 VAC
  - Fiber-optic – 220 to 240 VAC
  - Coaxial – 100 to 120 VAC
  - Coaxial – 220 to 240 VAC
  
- \* To meet FCC emission limits for a Class B device, you must use a shielded (Type X1 or X2) GPIB cable. Operating this equipment with a non-shielded cable may cause interference to radio and television reception in commercial areas.

## Hardware Description

The AT-GPIB/TNT is an IEEE 488 interface board for PC AT compatible computers. The TNT4882C chip on the board performs the basic IEEE 488 Talker, Listener, and Controller functions, including those required by the most recent GPIB standard, IEEE 488.2. This board can sustain data transfer rates exceeding 1 Mbytes/s. It can also implement a high-speed GPIB protocol (HS488), so that you can have data transfers up to 3.4 Mbytes/s when using the AT-GPIB/TNT in an EISA computer. The AT-GPIB/TNT board is fully software compatible with all versions of AT-GPIB hardware.

The AT-GPIB, equipped with NAT4882 and Turbo488 ASICs, is also an IEEE 488 interface board for PC AT compatible computers. The NAT4882 controller chip performs the basic IEEE 488 Talker, Listener, and Controller functions, including those required by IEEE 488.2. The Turbo488 performance-enhancing chip boosts GPIB read and write transfers to rates exceeding 1 Mbytes/s.

**Note:** *Actual transfer rates depend on your host computer, system configuration, and the types of devices attached to the bus.*

You can use standard GPIB cables to connect the AT-GPIB/TNT with up to 14 instruments. You can connect the AT-GPIB board with up to 13 instruments. If you want to use more than the maximum number of instruments, you can order a bus extender or expander from National Instruments.

Refer to Appendix C, *Hardware Specifications*, for more information about the GPIB hardware specifications and recommended operating conditions.

## Software Description

Your kit includes NI-488.2 software, which National Instruments has developed for use with the GPIB board. It is comprehensive software that transforms your PC AT compatible computer into a GPIB Controller with complete communications and bus management capability.

The kit includes DOS and Windows versions of the NI-488.2 software. This manual describes the NI-488.2 software for Windows. If you want to use the NI-488.2 software for DOS, refer to the manual *Getting Started with Your AT-GPIB/TNT and the NI-488.2 Software for DOS Graphics Applications*.

# Chapter 2

## Hardware Installation

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This chapter contains instructions for installing your GPIB board.

**Warning:** *Several components on your GPIB board can be damaged by electrostatic discharge. 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.*

### Default Hardware Configuration

The GPIB board default settings are suitable for most PC AT compatible computer systems. However, if the default settings conflict with another device in your system, you must reconfigure the hardware.

Table 2-1 shows the default settings for the switches and jumpers on the GPIB board.

Table 2-1. Hardware Default Settings

GPIB Board Setting	Default
Base I/O Address (hex)	2C0
DMA Channel	5
Interrupt Line (IRQ)	11

If you need to modify the default settings of the GPIB board, refer to Appendix A, *Changing Hardware Configuration Settings*. Otherwise, proceed to the next section for installation instructions.

### Install the Hardware

Keep in mind the following naming conventions as you read through the rest of this manual.

- *AT-GPIB/TNT* refers to a National Instruments GPIB board for the ISA (PC AT) bus equipped with the TNT4882C ASIC.



- *AT-GPIB* refers to a National Instruments GPIB board for the ISA bus equipped with the NAT4882 and Turbo488 ASICs.
- *GPIB board* refers generically to either the AT-GPIB/TNT or AT-GPIB board in cases where the material can apply to either board.

Perform the following steps to install the GPIB board:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the GPIB board.
2. Remove the top cover or access port of the I/O channel.
3. Remove the expansion slot cover on the back panel of the computer.
4. Insert the GPIB board into any unused 16-bit ISA or EISA slot with the GPIB connector sticking out of the opening on the back panel, as shown in Figure 2-1. It might be a tight fit, but do not force the board into place. You can install the AT-GPIB/TNT in an 8-bit slot, if necessary. When you use an 8-bit slot, you must disable DMA and use only interrupt request lines 3, 4, 5, 6, 7, or None.

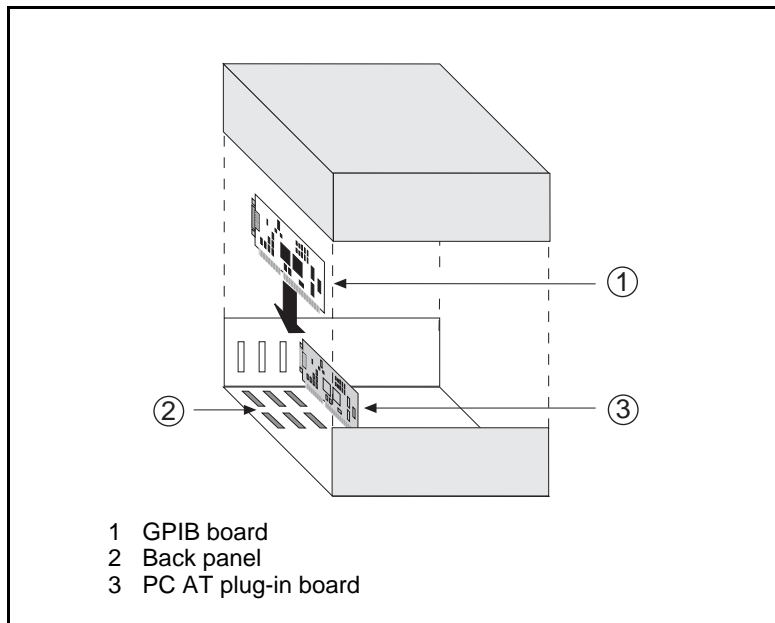


Figure 2-1. Installing the GPIB Board

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

## **Note to EISA Users**

If you have an EISA bus-based computer, you can use the EISA configuration files included on your NI-488.2 distribution disk to give the EISA configuration utility information about your GPIB board. Follow the instructions that came with your computer to copy the appropriate EISA configuration file to your EISA configuration disk. Then, run your EISA configuration program, which uses the information in the configuration file to help you select appropriate settings for the GPIB hardware. After the EISA configuration program determines the settings, you must manually set the DIP switches and jumpers on the GPIB hardware to match the selections.

# Chapter 3

## Software Installation

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This chapter contains a description of the files on the NI-488.2 distribution disks and instructions for installing your NI-488.2 software.

### NI-488.2 Software Components

The NI-488.2 software for Windows includes the following components.

- `setup.exe` is a menu-driven program that installs the NI-488.2 software and updates `system.ini`, the Windows system configuration file.
- `gpib.dll` is a 16-bit dynamic link library that implements the NI-488 and NI-488.2 functions.
- `gpib.ini` is the GPIB configuration information file that describes the default configuration of the NI-488.2 software. It is accessed and modified by the GPIB software configuration utility.
- The Hardware Diagnostic Test, `ibdiag.exe`, is a program that you can use to test the GPIB hardware and ensure that it is functioning properly.
- The Software Diagnostic Test, `ibtest.exe`, is the Windows NI-488.2 software installation test.
- GPIB Information, `gpibinfo.exe`, is a utility you can use to obtain information about your GPIB hardware and software, such as the version of the NI-488.2 software and the type of interface board you are using.
- The GPIB software configuration utility, `ibconf.cpl`, is a control panel applet that is installed in the Windows System directory. It is used to configure the NI-488.2 software for Windows. Like other control panel applets, it is located in the Control Panel, which is in the **Main** group of the **Program Manager**.
- The GPIB software configuration utility help file, `ibconf.hlp`, is a Windows help file that gives information about the GPIB software configuration utility. This file is also installed in the Windows System directory.
- Win16 Interactive Control, `wibic.exe`, is an interactive communication utility that you can use to communicate with GPIB devices from the keyboard. You can also use the Win16 Interactive Control utility to troubleshoot problems.
- The interactive control help file, `wibic.hlp`, is a Windows help file that gives information about the Interactive Control utilities.

- GPIB Spy, `gpibspy.exe`, is the GPIB application monitor program. It is a debugging tool that you can use to monitor the NI-488.2 calls made by your Windows applications.
- The GPIB Spy help file, `gpibspy.hlp`, is a Windows help file that gives information about the GPIB Spy application monitor program.
- `nivgpibd.386`, the National Instruments virtual GPIB device, allows the driver to perform DMA transfers.
- `gpib-32.dll` is a 32-bit translation dynamic link library that handles the 32-bit to 16-bit translation to allow Win32s GPIB applications to communicate with the 16-bit `gpib.dll`.
- `gpib-16.dll` is a 16-bit translation dynamic link library.
- Win32s Interactive Control, `wibic32.exe`, is a Win32s version of the Win16 Interactive Control program described earlier. Microsoft Win32s is an operating system extension that allows Win32 applications to run under Microsoft Windows version 3.1 and higher.
- Read Me (`readme.txt`) is a documentation file that contains the latest updates and corrections to the manual when appropriate.
- The EISA configuration files for the AT-GPIB, the AT-GPIB/TNT, and the EISA-GPIB are in the root directory of the installation disk. They are not copied by the installation program. These files should be used only if you have an EISA computer.

## Install the Software

After you have installed and configured the hardware, you are ready to install the NI-488.2 software. Complete the following steps to run the software installation program.

1. Insert the NI-488.2 software for Windows 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 screen shown in Figure 3-1.



Figure 3-1. Software Installation Screen

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

3. After the installation is complete, restart Windows.

Most applications can use the default configuration of the software. However, if you have changed any hardware configuration settings, or if your application requires you to change the default parameters of the NI-488.2 software, refer to Appendix B, *Changing Software Configuration Settings*. Otherwise, do not change the default configuration of the software.

When you have finished installing your software, refer to Chapter 4, *Installation Verification and Troubleshooting*, for instructions on verifying the hardware and software installation.

# Chapter 4

## Installation Verification and Troubleshooting

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

### 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 board does not conflict with anything else in your system.

Follow these steps to run the Hardware Diagnostic Test:

1. Disconnect any GPIB cables.
2. Double-click on the **Hardware Diagnostic Test** icon in the **NI-488.2 GPIB Software** group in the **Program Manager**.

If the Hardware Diagnostic Test completes with no errors, your hardware is functioning properly. Proceed to the section *Run the Software Diagnostic Test*, later in this chapter, to verify the software installation. If the Hardware Diagnostic Test returns an error message, refer to the next section for troubleshooting instructions.

### Troubleshooting Hardware Diagnostic Test Error Messages

First verify that all GPIB cables are disconnected and make sure that the switch and jumper settings on the hardware match the values you entered for the Hardware Diagnostic Test.

#### Using Single-Cycle DMA

The GPIB board normally uses demand-mode DMA. If your computer cannot use demand-mode DMA, the Hardware Diagnostic Test prints a message telling you to use single-cycle DMA. You can select single-cycle DMA by configuring the software using the GPIB software configuration utility. Refer to Appendix B, *Changing Software Configuration Settings*, for more information.

## Correcting Hardware Settings

Follow these steps to troubleshoot Hardware Diagnostic Test error messages.

1. Make sure you are using a valid base I/O address.

Run the Hardware Diagnostic Test again. When it prompts you for values, enter your base I/O address, but enter <N> for both the interrupt request line and the DMA channel. If the test fails again, one of the following situations is occurring:

- The base address that you entered when prompted does not match the switch settings of the board. Check the switch settings again.
- A GPIB cable is connected to the board. Remove all GPIB cables before running the Hardware Diagnostic Test again.
- Another board or built-in device in your computer is using the same address space. Change the base I/O address of your GPIB board and repeat this step using the new setting.
- The board is defective or is not compatible with your computer. Complete the forms in Appendix D, *Customer Communication*, and contact National Instruments.

2. Make sure you are using a valid interrupt request line.

Run the Hardware Diagnostic Test again. When it prompts you for values, enter the valid base I/O address as determined in Step 1, the interrupt request line, and <N> for the DMA channel. If the test fails, one of the following situations is occurring:

- The interrupt request line that you entered when prompted does not match the jumper setting of the board. Check the jumper setting again.
- Another board or built-in device in your computer is using the same interrupt request line. Change the interrupt request line of the GPIB board and repeat this step using the new setting.
- The board is defective or is not compatible with your computer. Complete the forms in Appendix D, *Customer Communication*, and contact National Instruments.

3. Make sure you are using a valid DMA channel.

Run the Hardware Diagnostic Test again. When it prompts you for values, enter the valid base I/O address and interrupt request line as determined in Steps 1 and 2, and enter the current DMA channel. If the test fails, one of the following situations is occurring:

- The DMA channel that you entered when prompted does not match the jumper setting of the board. Check the jumper setting again.
- Another board or built-in device in your computer is using the same DMA channel. Change the DMA channel of the GPIB board and repeat this step using the new setting.
- The board is defective or is not compatible with your computer. Complete the forms in Appendix D, *Customer Communication*, and contact National Instruments.

## Run the Software Diagnostic Test

To verify and test the hardware and software installation, run the Software Diagnostic Test that came with your NI-488.2 software. The Software Diagnostic Test is an NI-488.2 application that makes calls to the driver just as your application does.

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**.

If the Software Diagnostic Test completes with no errors, you have installed the NI-488.2 software correctly and you are ready to run your Windows GPIB application. If it returns an error message, refer to the next section for troubleshooting instructions.

## Troubleshooting Software Diagnostic Test Error Messages

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

- The Software Diagnostic Test locks up your computer. This situation can occur if the GPIB board under test is configured to use an incorrect interrupt level. You can either reconfigure the hardware to use a different interrupt level or use the GPIB software configuration utility to disable the use of interrupts. For detailed instructions, refer to Appendix A, *Changing Hardware Configuration Settings*, and Appendix B, *Changing Software Configuration Settings*.



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

- The Software Diagnostic Test displays the following message:

**File Error: Cannot find GPIB.DLL**

If this message appears, gpib.dll is not in the Windows directory. Press the **Close** button. The Software Diagnostic Test displays the following error message when it fails:

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

To correct the problem, make sure that gpib.dll is located in the Windows system directory (usually c:\windows\system).

If you are unable to locate gpib.dll, you should reinstall the NI-488.2 software.

- The Software Diagnostic Test displays the following message:

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

First make sure that gpib.dll is in the Windows system directory (usually c:\windows\system). If it is, make sure that gpib.ini is located in the Windows directory (usually c:\windows).

If you are unable to locate gpib.dll or gpib.ini, you should reinstall the NI-488.2 software.

- The Software Diagnostic Test displays the following message:

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

If this message appears, you could have one of the following situations:

- The Use this Board field in the GPIB software configuration utility might be unchecked for board gpibx. If you want to use the board, you must check this field.
- The board might not be properly installed and configured. Refer to the *Configure the Hardware* section in Chapter 2, *Hardware Configuration and Installation*, for detailed instructions.
- The software and hardware settings do not match. You can run the GPIB software configuration utility to check the current configuration of the software.

- The Software Diagnostic Test displays the following message:

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

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

Usually, this message appears because a GPIB cable is connected to the board. Disconnect all GPIB cables before trying the test again.

## Common Questions

### **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, you must install the NI-488.2 software for Windows.

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

Yes, there is nothing wrong with installing 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 GPIB Information utility. It returns information about the GPIB boards currently configured for use in your system.

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

Run the GPIB Information utility. If you run the utility without specifying any parameters, it returns information about the version of the NI-488.2 software currently installed.

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

Refer to the troubleshooting sections of this chapter 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 and to troubleshoot problems.

**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 the GPIB Information utility. Also, make sure you have filled out the configuration form in Appendix D, *Customer Communication*.

# Appendix A

## Changing Hardware Configuration Settings

---

This appendix contains instructions for changing the configuration settings of your GPIB board.

The GPIB board default settings are suitable for most PC AT compatible computer systems. However, if the default settings conflict with another device in your system or if you need to install more than one GPIB board, you must reconfigure the hardware.

The default settings for the switches and jumpers on the GPIB board are:

- Base I/O Address (hex): 2C0
- DMA Channel: 5
- Interrupt Line (IRQ): 11

Figure A-1 shows the location of the configuration jumpers and switches on the AT-GPIB/TNT board.

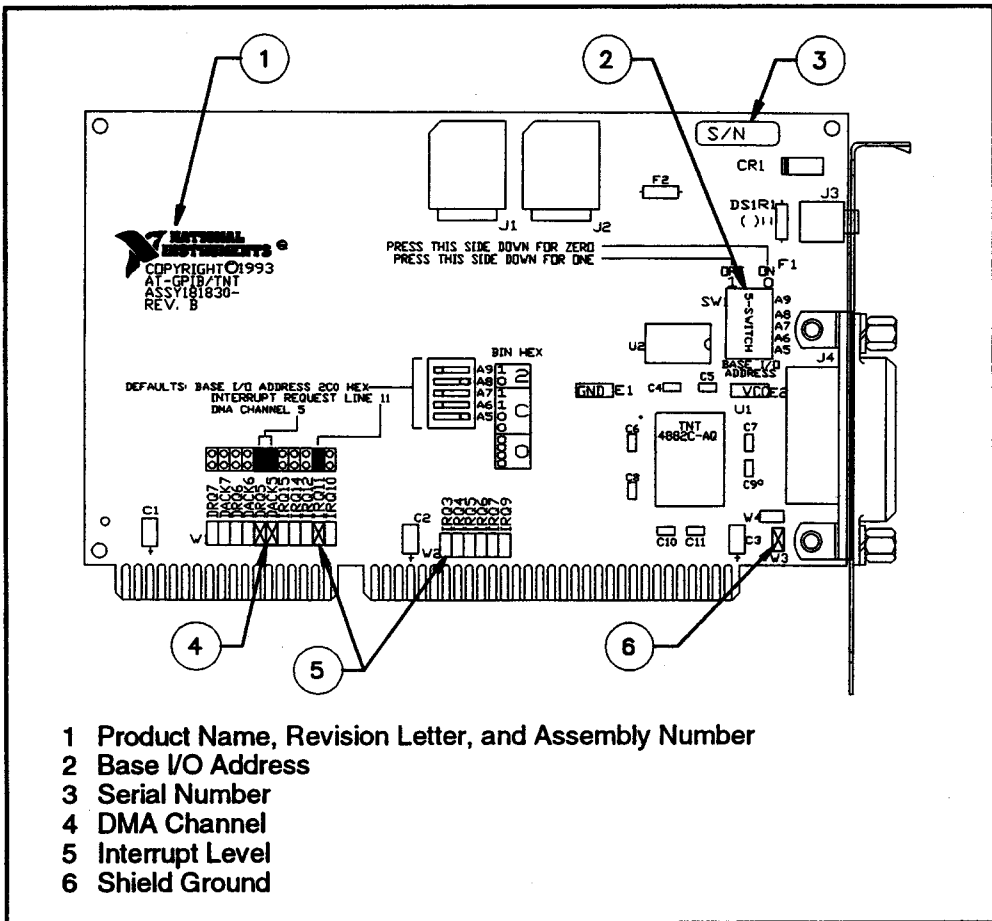


Figure A-1. AT-GPIB/TNT Parts Locator Diagram

Figure A-2 shows the location of the configuration jumpers and switches on the AT-GPIB board.

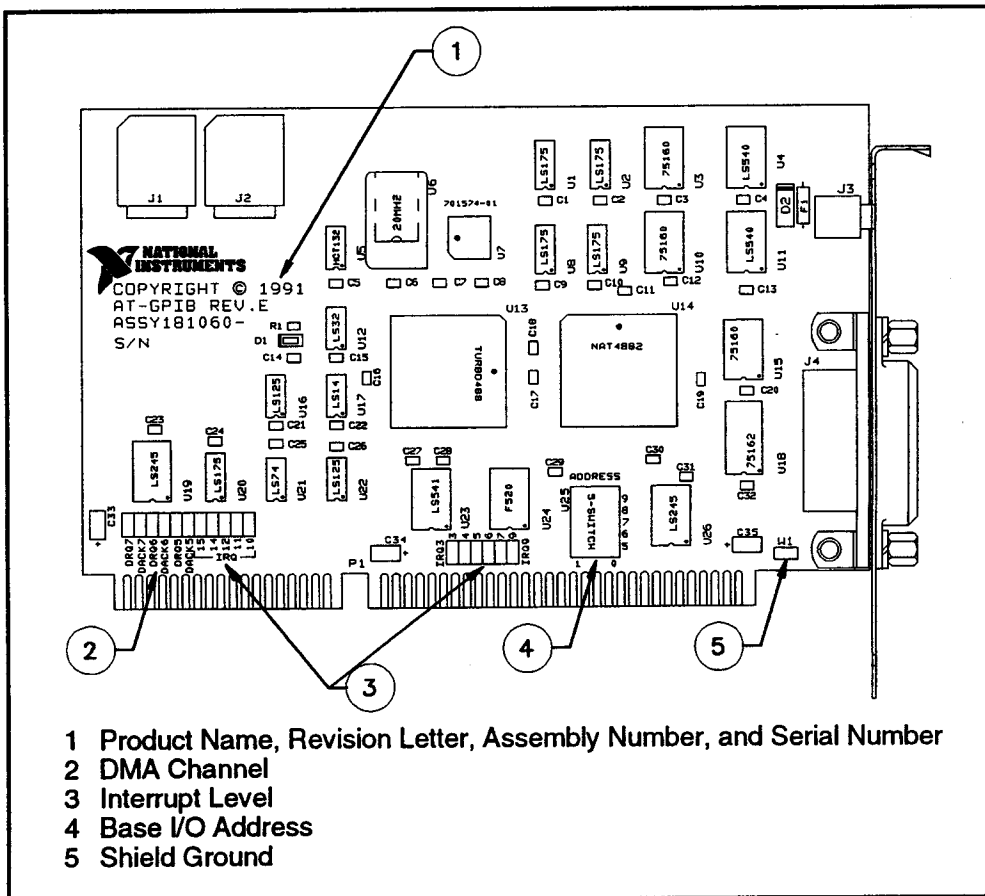


Figure A-2. AT-GPIB Parts Locator Diagram

### Selecting the Base I/O Address

PC AT compatible computers have a 64 KB I/O address space. The base I/O address of a PC AT plug-in board such as the GPIB board is the first position in the I/O address space occupied by the plug-in interface board.

By default, the GPIB board is configured to use base I/O address 2C0 hex. With this setting, the board uses the I/O address space 2C0 hex through 2DF hex. If this address range is already in use by another device or if you are installing more than one board, follow these steps to reconfigure the base I/O address setting.

## 1. Choose a new base I/O address setting.

You can configure the base I/O addresses to any setting between 0x100 and 0x3E0 that is a multiple of 0x20 hex. If you are installing more than one GPIB board, each board must use a unique base I/O address. You should not configure a base I/O address of less than 0x100 for the board, because this portion of the address space is reserved for your computer's system board.

Table A-1 lists the possible switch settings, the corresponding base I/O addresses, and the I/O address space used for each setting.

Table A-1. Possible Base I/O Address Switch Settings

Switch Setting					Base I/O Address (hex)	I/O Address Space Used (hex)
A9	A8	A7	A6	A5		
0	1	0	0	0	100	100 to 11F
0	1	0	0	1	120	120 to 13F
0	1	0	1	0	140	140 to 15F
0	1	0	1	1	160	160 to 17F
0	1	1	0	0	180	180 to 19F
0	1	1	0	1	1A0	1A0 to 1BF
0	1	1	1	0	1C0	1C0 to 1DF
0	1	1	1	1	1E0	1E0 to 1FF
1	0	0	0	0	200	200 to 21F
1	0	0	0	1	220	220 to 23F
1	0	0	1	0	240	240 to 25F
1	0	0	1	1	260	260 to 27F
1	0	1	0	0	280	280 to 29F
1	0	1	0	1	2A0	2A0 to 2BF
1	0	1	1	0	2C0	2C0 to 2DF
1	0	1	1	1	2E0	2E0 to 2FF
1	1	0	0	0	300	300 to 31F
1	1	0	0	1	320	320 to 33F
1	1	0	1	0	340	340 to 35F
1	1	0	1	1	360	360 to 37F
1	1	1	0	0	380	380 to 39F

(continues)

Table A-1. Possible Base I/O Address Switch Settings (Continued)

Switch Setting					Base I/O Address (hex)	I/O Address Space Used (hex)
A9	A8	A7	A6	A5		
1	1	1	0	1	3A0	3A0 to 3BF
1	1	1	1	0	3C0	3C0 to 3DF
1	1	1	1	1	3E0	3E0 to 3FF

2. Locate the base I/O address switch at SW1 on your AT-GPIB/TNT board or at U25 on your AT-GPIB board. Refer to the appropriate parts locator diagram, Figure A-1 or A-2.
3. Change the switch settings to configure the GPIB board to the new base I/O address.

Press down on the side marked OFF to select a binary value of 1 for the corresponding address bit. Press down on the ON side of the switch to select a binary value of 0. Refer to Figure A-3 for an example of the switch settings and corresponding base I/O addresses.



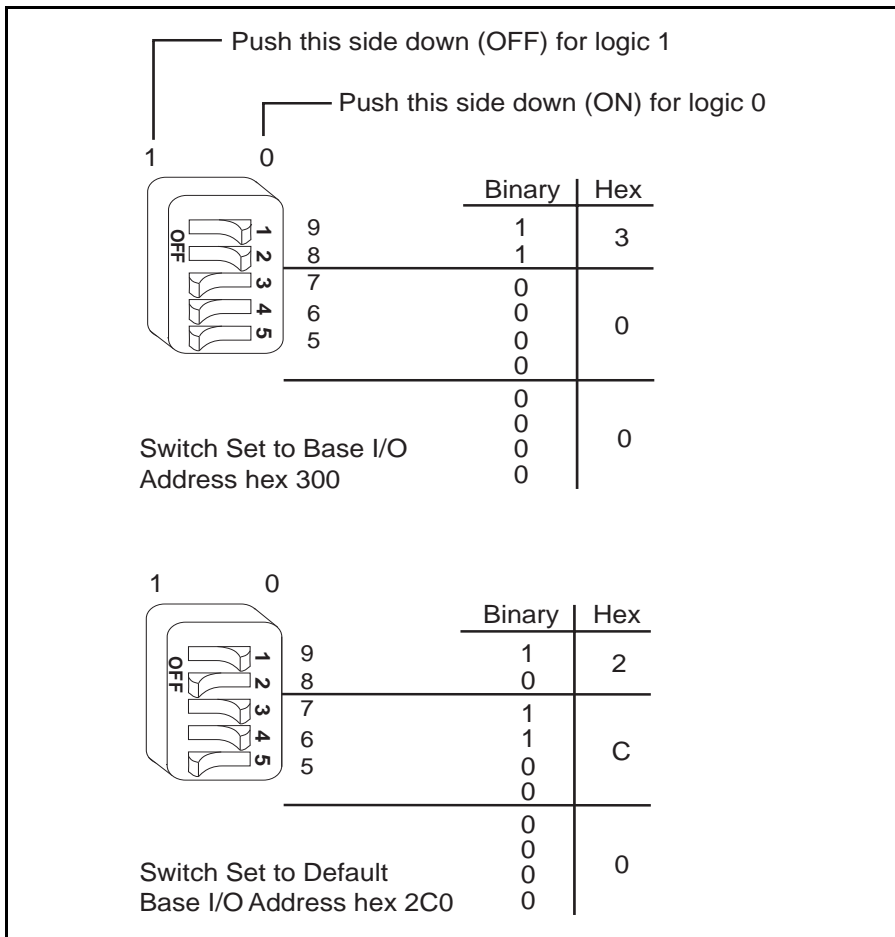


Figure A-3. Base I/O Address Switch Settings

- Record your new setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix D, *Customer Communication*.
- Remember that after you install the NI-488.2 software, you must use the GPIB software configuration utility to configure your software settings to match your new hardware settings. Refer to Appendix B, *Changing Software Configuration Settings*, for more information.

## Selecting the Interrupt Request Line

PC AT compatible computers have a series of interrupt lines available to devices. Devices use interrupts to get immediate service from the CPU for asynchronous events. Your GPIB hardware and the NI-488.2 software use interrupts to get service from the CPU when necessary.

By default, the GPIB board is configured to use interrupt request line 11. If this is not an acceptable setting or if you are installing more than one board, follow these steps to reconfigure the interrupt request line:

1. Choose a new interrupt request line (IRQ) setting.

When installed in a 16-bit ISA slot, you can configure the GPIB board to use any of the following interrupt lines: IRQ3, 4, 5, 7, 9, 10, 11, 12, 15, or None. Do not use interrupt line 6 or interrupt line 14. Interrupt line 6 is used by the diskette drive controller and interrupt line 14 is used by the hard disk drive controller on most PC ATs.

If you have installed the AT-GPIB/TNT board in an 8-bit (PC-style) slot, the only interrupt lines available to you are 3, 4, 5, 6, 7, or None. The AT-GPIB board can be installed only in a 16-bit slot.

If you are installing more than one GPIB board, each board must either use a unique IRQ level or not use interrupts at all.

2. Find the jumpers that set the interrupt request line. The jumpers are located on the lower edge of your GPIB board. Refer to the appropriate parts locator diagram, Figure A-1 or A-2.
3. Change the jumper settings to configure the GPIB board to the new interrupt request line.

To use lines 10, 11, 12, or 15, use the jumper block shown in Figure A-4. To use interrupt lines 3, 4, 5, 7, or 9, use the jumper block shown in Figure A-5. To disable interrupts, use the jumper setting shown in Figure A-6.

Figure A-4 shows the setting for IRQ11.

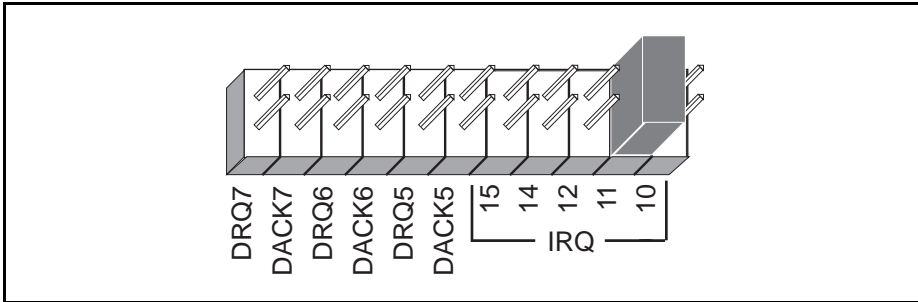


Figure A-4. Interrupt Jumper Setting for IRQ11 (Default Setting)

Figure A-5 shows the setting for IRQ5.

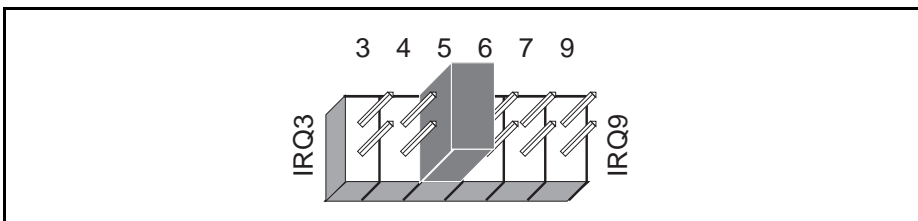


Figure A-5. Interrupt Jumper Setting for IRQ5

If you do not want to use interrupts, you can disable interrupt levels on the GPIB board by setting the jumper as shown in Figure A-6.

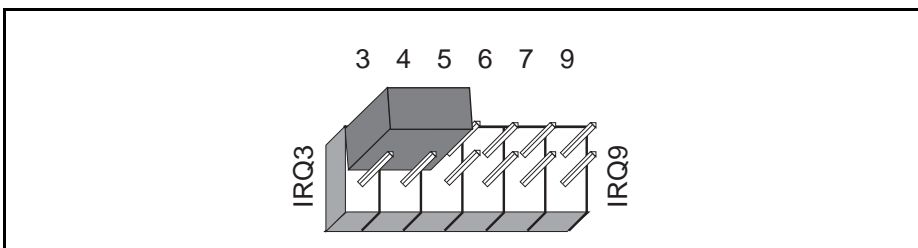


Figure A-6. Jumper Setting for Disabling Interrupts

4. Record your new setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix D, *Customer Communication*.
5. Remember that after you install the NI-488.2 software, you must use the GPIB software configuration utility to configure your software settings to match your new hardware settings. Refer to Appendix B, *Changing Software Configuration Settings*, for more information.

### Note to EISA Users

If you have an EISA bus-based system and have registered your GPIB board with the EISA system configuration utility, then you must run the EISA system configuration utility again and change your board's interrupt level parameter in the EISA registry to agree with the actual setting. Follow the directions that came with your EISA computer.

## Selecting the DMA Channel

Direct memory access (DMA) refers to data transfers directly to or directly from devices such as the GPIB board and computer memory. Your GPIB hardware and the NI-488.2 software are designed to perform DMA. In most cases, data transfers using DMA are significantly faster than programmed I/O transfers, which use more CPU time.

By default, the GPIB board is configured to use DMA channel 5. If this is not an acceptable setting or if you are installing more than one board, follow these steps to reconfigure the DMA channel.

**Note:** *If you have installed the AT-GPIB/TNT board in an 8-bit (PC-style) slot, you must disable DMA, because DMA channels 5, 6, and 7 are 16-bit DMA channels. Refer to Figure A-8, which shows how to set the DMA jumpers for no DMA. The AT-GPIB board can be installed only in a 16-bit slot.*

1. Choose a new DMA channel setting.

You can use channel 5, 6, or 7. If you are installing more than one GPIB board, each board must either use a unique DMA channel or must not use DMA at all.

2. Locate the jumpers that select the DMA channel. Refer to the appropriate parts locator diagram, Figure A-1 or A-2.
3. Change the jumper settings to configure the GPIB board to the new DMA channel. To select a new DMA channel, you must set both the DMA Acknowledge and DMA Request lines, as shown in Table A-2.

Table A-2. DMA Channels

DMA Channel	Signal Lines	
	DMA Acknowledge	DMA Request
5	DACK5	DRQ5
6	DACK6	DRQ6
7	DACK7	DRQ7

Figure A-7 shows the jumper position for selecting DMA channel 7.

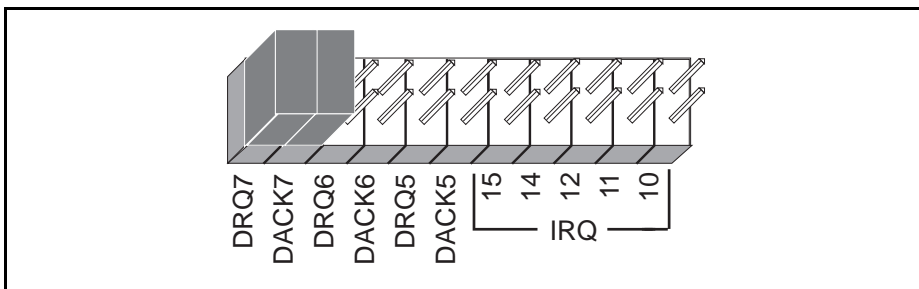


Figure A-7. DMA Channel Jumper Setting for DMA Channel 7

- Record your new setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix D, *Customer Communication*.
- Remember that after you install the NI-488.2 software, you must use the GPIB software configuration utility to configure your software settings to match your new hardware settings. Refer to Appendix B, *Changing Software Configuration Settings*, for more information.

#### Note to EISA Users

If you have an EISA bus-based system and have registered your GPIB board with the EISA system configuration utility, then you must run the EISA system configuration utility again and change your board's DMA channel parameter in the EISA registry to agree with the actual setting. Follow the directions that came with your EISA computer.

## Using Programmed I/O for GPIB Transfers

As an alternative to DMA transfers, you can use programmed I/O. To use programmed I/O, you should disable DMA for the GPIB board by moving the jumpers as shown in Figure A-8.

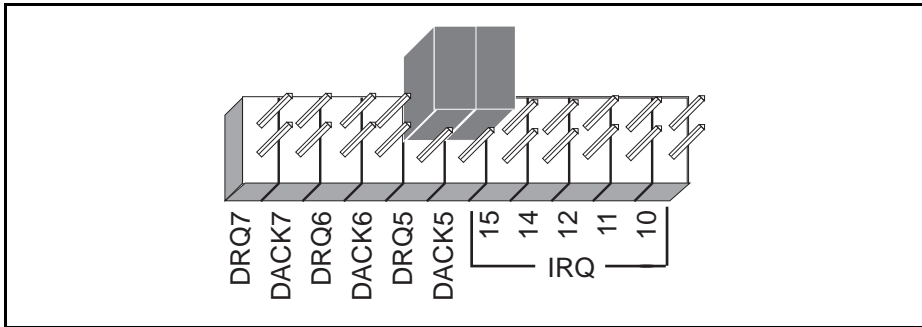


Figure A-8. DMA Jumper Setting for No DMA Channel

## Setting the Shield Ground Configuration

The GPIB board is set at the factory with the jumper in place to connect the logic ground of the GPIB board to its shield ground. This configuration minimizes EMI emissions.

**Caution:** *The GPIB board was tested for compliance with FCC standards with the shield ground connected to logic ground. Removing the jumper might cause EMI emissions to exceed any or all of the applicable standards.*

If your application requires that logic ground be disconnected from shield ground, follow these steps:

1. Refer to Figure A-1 to locate the shield ground jumper W3 on the AT-GPIB/TNT board. If you are using the AT-GPIB board, refer to Figure A-2 to locate the shield ground jumper W1.
2. Remove the jumper and place it across only one of the jumper pins, as shown in Figure A-9.

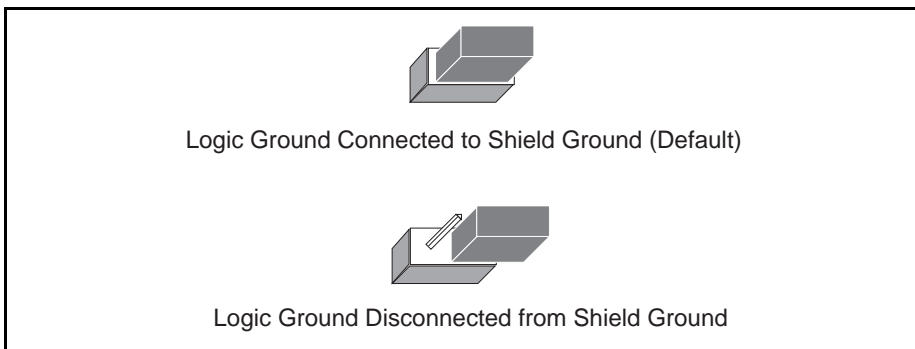


Figure A-9. Ground Configuration Jumper Settings

3. Record the jumper setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix D, *Customer Communication*.

# Appendix B

## Changing Software Configuration Settings

---

This appendix contains a description of the GPIB software configuration utility you can use to configure the NI-488.2 software for Windows.

The GPIB software configuration utility is a screen-oriented, interactive program you can use to change the software configuration parameters of your GPIB interface boards and the GPIB devices connected to them.

If you changed any hardware configuration settings, you must change the software configuration settings to match. Otherwise, do not change the default parameters of the NI-488.2 software unless your graphics application requires you to do so. The default configuration of the NI-488.2 software is suitable for most graphics applications.

### Default Software Configuration

This section lists the default configuration values of the NI-488.2 driver.

- Thirty-two devices with symbolic names `dev1` through `dev32`.
- Four access boards with symbolic names `gpib0`, `gpib1`, `gpib2`, and `gpib3`. You cannot change the access board names.
- Access board `gpib0` is enabled. `gpib1`, `gpib2`, and `gpib3` are disabled.
- The GPIB addresses of the first 16 devices are the same as the device number. For example, `dev1` is at address 1. These 16 devices are assigned to the access board `gpib0`.
- The remaining 16 devices (that is, devices 17 through 32) are assigned to the access board `gpib1`. Their GPIB addresses range from 1 through 16, respectively. For example, `dev17` is at address 1.
- Each GPIB interface board is System Controller for its independent bus and has a GPIB address of 0.
- The END message is sent with the last byte of each data message to a device. No end-of-string (EOS) character is recognized.
- The timeout value on I/O and wait function calls is set for 10 seconds.



- Each GPIB board and device is set to perform I/O transfers using DMA.
- Automatic serial polling is enabled.
- At the end of each NI-488.2 routine, the NI-488.2 driver leaves the bus in its currently addressed state (IEEE 488.2 standard).

## Note to EISA Users

If you have an EISA bus-based system and have registered your GPIB board with the EISA system configuration utility, the GPIB board's hardware parameters (base address, interrupt level, and DMA channel) will not be configurable in the GPIB software configuration utility. In this case, you must run the EISA system configuration utility again to change the hardware characteristics of the board. Follow the instructions that came with your EISA computer. Make sure that the hardware characteristics listed for the board in the EISA registry agree with the physical switch and jumper settings of the board.

## Starting and Exiting the GPIB Software Configuration Utility

The GPIB software configuration utility is a Windows Control Panel applet you can use to view or modify the configuration of your GPIB hardware and software. You can use it to view or modify the GPIB device templates, which provide compatibility with older applications.

When you install the NI-488.2 software for Windows, the installation program places the GPIB software configuration utility into your Control Panel. To start the utility, simply open the Control Panel in the **Main** group of the **Program Manager** and double-click on the icon. The main **GPIB Configuration** dialog box appears containing a list of the GPIB boards and device templates as shown in Figure B-1.

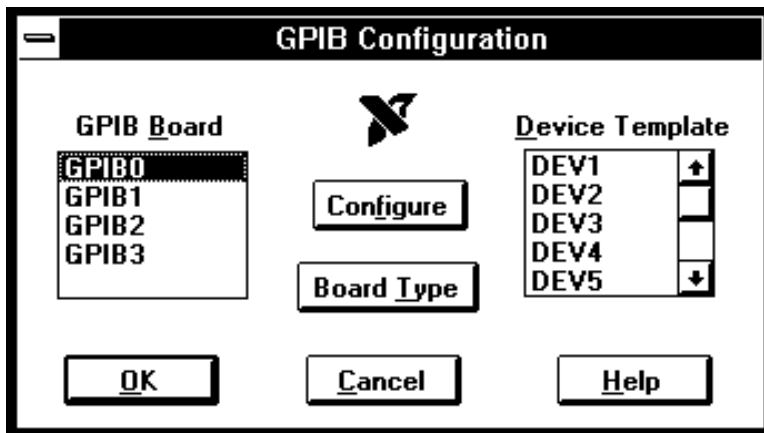


Figure B-1. Main Dialog Box in the GPIB Software Configuration

If at any point you need more help, click on the **Help** button or press the <F1> key. Either of these actions brings up the help screen, which gives you more information about the current dialog box.

After you have finished configuring your GPIB boards and device templates, click on the **OK** button to save the changes and exit. Click the **Cancel** button to exit without saving any of the changes you made.

## Board Configuration

Your modifications will usually be to the GPIB board configurations. To view or modify the configuration of one of your GPIB boards, select the board name in the main **GPIB Configuration** dialog box and click on the **Configure** button. You can also double-click on the board name. The board configuration dialog box appears. If the **Board Type** button is not grayed out, you may need to select a board type before you configure the board.

The board configuration dialog box contains hardware-specific information for your GPIB interface board. Boards such as the AT-GPIB/TNT require several pieces of information to be entered into the GPIB software configuration utility. Figure B-2 shows the board configuration dialog box for the AT-GPIB/TNT.

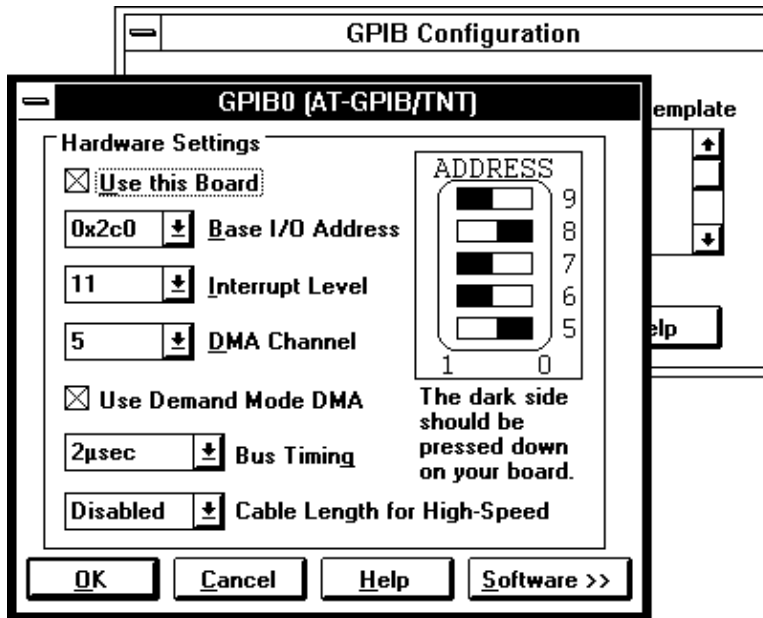


Figure B-2. Board Configuration Dialog

The following configuration items appear in the board configuration dialog box.

**Use this Board** Use this item to disable an interface board. If this item is not selected, the NI-488.2 software ignores the board. By default, `gpib0` is enabled and `gpib1`, `gpib2`, and `gpib3` are disabled.

**Bus Timing** Use this item to specify the source handshake T1 delay of the board. This delay determines the minimum amount of time after the data is placed on the bus that the board asserts the GPIB DAV line during a write or command operation. Refer to the ANSI/IEEE Standard 488.1-1987, Section 5.2, for more information about the factors that might affect the choice of the T1 delay. For example, if the total length of the GPIB cable in the system is less than 15 m, the value 350 ns is appropriate. The default setting, 500 ns, should work in all systems.

**Cable Length for High Speed** This field specifies the number of meters of GPIB cable you have in your system. If you use the HS488 high-speed protocol to communicate with HS488-compliant devices, you must specify the total number of meters of GPIB cable in your system. The System Controller, when it initializes the GPIB, must send this information to all HS488 devices so high-speed transfers occur without errors.

- OK** Use this button to keep the configuration as shown and return to the main dialog box.
- Cancel** Use this button to discard any configuration changes made to the board and return to the main dialog box.
- Help** Use this button or the <F1> key to bring up help for this dialog box.
- Software** Use this button to expand the board configuration dialog box. You can then view or modify the board's GPIB characteristics, which you would normally configure in your application program using the `ibconfig` function.
- Base I/O Address** Use this item to select the I/O address of the interface board. It must be set to the same value as the base I/O address selected with the switches on the board.
- To assist you in configuring the interface board properly, the GPIB software configuration utility shows a picture of the base I/O address switch of the board. You should confirm that the switch settings on your interface board match the picture. The switch picture in the GPIB software configuration utility is also an interactive control. You can use your mouse to change the position of the switches in the picture. When you change the position of the switches, the utility updates the number displayed in the Base I/O Address field. Set the switch in the GPIB software configuration utility to look like the switch on your board.
- Interrupt Level** Use this item to select the hardware interrupt level used by your interface board. It must be set to the same value as the interrupt level selected with the jumpers on the board.
- DMA Channel** Use this item to select the hardware DMA channel used by your interface board. It must be set to the same value as the DMA channel selected with the jumpers on the board.
- Use Demand Mode DMA** Use this item to select the DMA transfer mode that the NI-488.2 software uses. When this item is selected, the NI-488.2 software uses demand mode for DMA transfers. When this item is unselected, the NI-488.2 software uses single-cycle DMA. Almost all PC-compatible computers can use demand mode, which is the fastest DMA mode, but some newer computers cannot use demand mode. Before changing this item, use the Hardware Diagnostic Test. It tests the DMA controller in your computer and alerts you if demand mode cannot be used.

## Expanded Board Configuration

If you need to modify the GPIB characteristics of an interface board, click on the **Software** button of the board configuration dialog box. The expanded dialog box appears, containing all of the GPIB characteristics of the board as shown in Figure B-3.

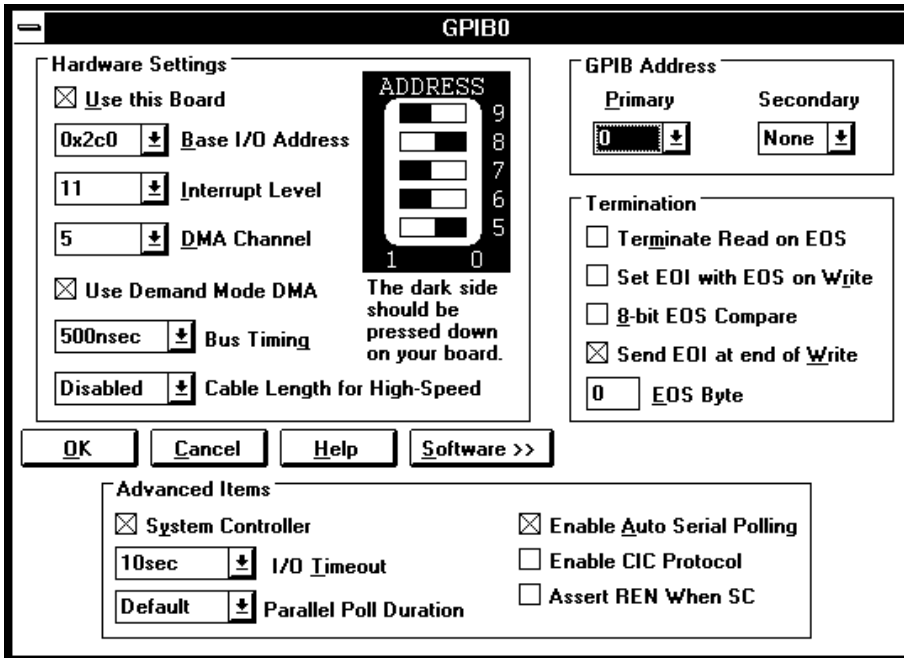


Figure B-3. Expanded Board Configuration

The following configuration items appear in the expanded dialog box.

**GPIB Primary Address** All GPIB boards must be assigned a unique primary address. This address, a number in the range 0 to 30 decimal, is used by the NI-488.2 software to compute the talk and listen addresses of the board. The default primary address of all interface boards is zero.

**GPIB Secondary Address** If extended addressing is needed, the GPIB board should be assigned a unique secondary address. This number must be in the range 96 to 126 decimal. If extended addressing is not required, select **None**.

**Terminate Read On EOS** Some devices send an end-of-string byte to signal the end of a GPIB data transfer. When this field is selected, the NI-488.2 software terminates a read operation when it receives the EOS byte. By default this option is not selected.

**Set EOI with EOS on Write** Some devices expect the GPIB EOI line to be asserted when the EOS byte is transferred. When this field is selected, the NI-488.2 software asserts the GPIB EOI line whenever it sends the EOS byte. By default this option is not selected.

**8-bit EOS Compare** When the GPIB board is configured to use the EOS byte, it can test either seven or eight bits of the EOS byte for a match. When this item is selected, the NI-488.2 software uses all eight bits of the EOS byte when checking for a match. By default this option is not selected.

**Send EOI at end of Write** Many GPIB devices require the GPIB EOI line to be asserted at the end of a data transfer. This signals the device that the transfer has ended. When this item is selected, the NI-488.2 software will assert the EOI line at the end of each data transfer. By default this option is selected.

**EOS Byte** If one or more of the EOS modes are enabled, this value defines the EOS byte. Use a decimal number in the range 0 to 255. The value is used by the NI-488.2 software for all selected EOS operations.

**System Controller** The System Controller in a GPIB system is the device that maintains ultimate control over the bus. When the NI-488.2 software is being used to control a GPIB system, the GPIB interface board should normally be the System Controller. Some situations, such as a network of computers, require that the interface board *not* be the System Controller. By default this option is selected.

**I/O Timeout** Use this option to select the timeout value for all GPIB I/O operations. The timeout value is the approximate length of time that GPIB functions wait for data to be transferred or commands to be sent. It is also the length of time that the `ibwait` function waits for an event before returning. The default timeout period is 10 s.

- Parallel Poll Duration** Use this option to select the length of time the NI-488.2 software waits when conducting a parallel poll. For a normal bus configuration (the Controller and devices on the same bus) use the default duration of 2  $\mu$ s. If you are using a GPIB bus extender in transparent parallel poll mode, you should increase the poll duration to 10  $\mu$ s or more so the bus extender can operate transparently to your applications.
- Enable Auto Serial Polling** Use this option to enable or disable the automatic serial polling of devices when the GPIB Service Request (SRQ) line is asserted. Positive poll responses are stored by the NI-488.2 software and can be retrieved with the `ibrsp` function. This feature usually does not conflict with any device that conforms to the IEEE 488.1 standard. If a conflict exists with a device, do not select this option. By default this option is selected.
- Enable CIC Protocol** If a device-level NI-488 call is made after control has been passed to another device, this protocol causes the interface board to assert SRQ with a serial poll response byte of hex 42 to regain control. If the current Controller recognizes this request and passes control back to the board, the device-level call is executed as usual. If control is not passed back within the timeout period, the ECIC error is returned. If your board needs to regain control but this protocol is disabled, ECIC is returned immediately. By default this option is not selected.
- Assert REN When SC** When this option is selected and the interface board is the System Controller, the GPIB Remote Enable (REN) line is automatically asserted any time a device-level call is made. By default this option is not selected.

## Device Template Configuration

To view or modify the configuration of a GPIB device, select the device name in the main GPIB Configuration dialog box and click on the **Configure** button. You can also double-click on the device name. The device template dialog box appears as shown in Figure B-4.

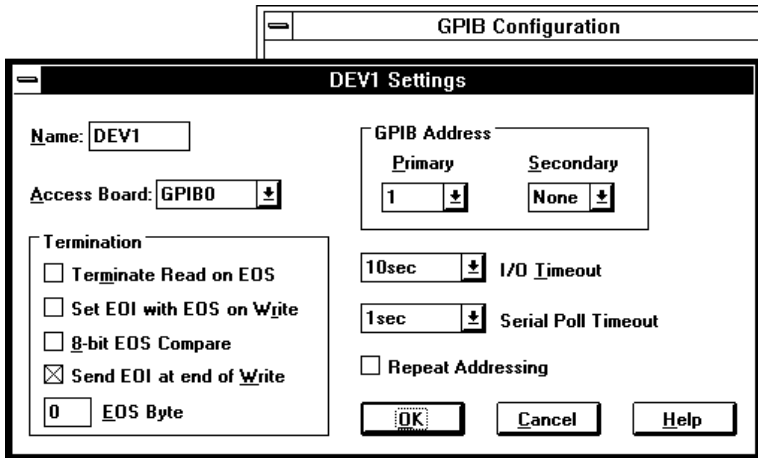


Figure B-4. Device Template Configuration

The device template options are similar to those of the expanded board configuration. The following is a list of the device template configuration options.

- Name** This field contains the symbolic name of the device to which this template refers. This is the name that should be used in the `ibfind` call of the application. This name must be eight characters or less and cannot contain any of the following characters:
- . " / \ [ ] :  
| < > + = ; ,
- You cannot name a device to the same name as an interface board (`gpib0`, `gpib1`, and so on).
- Access Board** Use this option to select which interface board is used to communicate with that particular device. This option contains a list of interface boards to choose from.
- GPIB Primary Address** Each GPIB device must be assigned a unique primary address. This address, a number in the range 0 to 30 decimal, is used by the NI-488.2 software to compute the talk and listen addresses of the device.
- GPIB Secondary Address** If extended addressing is needed, the device should be assigned a unique secondary address. This number must be in the range 96 to 126 decimal. If extended addressing is not required, select **None**.
- Terminate Read On EOS** Some devices send an end-of-string byte to signal the end of a GPIB data transfer. When this field is selected, the NI-488.2 software terminates a read operation when it receives the EOS byte. By default this option is not selected.



<b>Set EOI with EOS on Write</b>	Some devices expect the GPIB EOI line to be asserted when the EOS byte is transferred. When this field is selected, the NI-488.2 software asserts the GPIB EOI line whenever it sends the EOS byte. By default this option is not selected.
<b>8-bit EOS Compare</b>	When the NI-488.2 software is configured to use the EOS byte, it can test either seven or eight bits of the EOS byte for a match. When this item is selected, the NI-488.2 software uses all eight bits of the EOS byte when checking for a match. By default this option is not selected.
<b>Send EOI at end of Write</b>	Many GPIB devices require the GPIB EOI line to be asserted at the end of a data transfer. This signals the device that the transfer has ended. When this item is selected, the NI-488.2 software asserts the EOI line at the end of each data transfer. By default this option is selected.
<b>EOS Byte</b>	If one or more of the EOS modes are enabled, this value defines the EOS byte. Use a decimal number in the range 0 to 255. The value is used by the NI-488.2 software for all selected EOS operations.
<b>I/O Timeout</b>	Use this option to select the timeout value for all GPIB I/O operations. The timeout value is the approximate length of time that GPIB functions wait for data to be transferred or commands to be sent. It is also the length of time that the <code>ibwait</code> function waits for an event before returning. The default timeout period is 10 s.
<b>Serial Poll Timeout</b>	Use this option to select the length of time the NI-488.2 software waits for a serial poll response from the device. The IEEE 488 standard does not specify the length of time a Controller should wait for the response byte. The default value of 1 s works for most devices. If you have problems with serial polls, try using a longer timeout value.
<b>Repeat Addressing</b>	If this option is selected, the NI-488.2 software addresses the device before every read or write operation. Devices are usually not addressed each time a read or write operation is performed, but some older IEEE 488.1 devices require their address to be sent before each operation. By default this option is not selected.

# Appendix C

## Hardware Specifications

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This appendix describes the electrical, physical, and environmental characteristics of the GPIB board and the recommended operating conditions.

Table C-1. Electrical Characteristics of the AT-GPIB/TNT

Characteristic	Specification
Maximum GPIB Transfer Rates	
3-wire (IEEE 488)	1.5 Mbytes/s*
High Speed (HS488)	
In ISA computer	1.6 Mbytes/s*
In EISA computer	3.4 Mbytes/s*
Power Requirement (from PC AT I/O channel)	+5 VDC 50 mA Typical 120 mA Maximum
* Actual speed may vary considerably from speed shown because of system and instrumentation capabilities.	

Table C-2. Electrical Characteristics of the AT-GPIB

Characteristic	Specification
Maximum GPIB Transfer Rate	1.4 Mbytes/s*
Power Requirement (from PC AT I/O channel)	+5 VDC 0.66 A Typical 1.5 A Maximum
* Actual speed may vary considerably from speed shown because of system and instrumentation capabilities.	

Table C-3. Physical Characteristics

Characteristic	Specification
Dimensions	10.67 cm by 16.51 cm (4.2 in. by 6.5 in.)
I/O Connector	IEEE 488 Standard 24-pin

Table C-4. Environmental Characteristics

<b>Characteristic</b>	<b>Specification</b>
Operating Environment	
Component Temperature	0° to 40° C
Relative Humidity	10% to 90%, noncondensing
Storage Environment	
Temperature	-20° to 70° C
Relative Humidity	5% to 90%, noncondensing
EMI	FCC Class B Certified

# Appendix D

## Customer Communication

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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

<b>Branch Offices</b>	<b>Phone Number</b>	<b>Fax Number</b>
Australia	(03) 879 9422	(03) 879 9179
Austria	(0662) 435986	(0662) 437010-19
Belgium	02/757.00.20	02/757.03.11
Denmark	45 76 26 00	45 76 71 11
Finland	(90) 527 2321	(90) 502 2930
France	(1) 48 14 24 00	(1) 48 14 24 14
Germany	089/741 31 30	089/714 60 35
Italy	02/48301892	02/48301915
Japan	(03) 3788-1921	(03) 3788-1923
Mexico	95 800 010 0793	95 800 010 0793
Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
Singapore	22658862265887	
Spain	(91) 640 0085	(91) 640 0533
Sweden	08-730 49 70	08-730 43 70
Switzerland	056/20 51 51	056/20 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	0635 523545	0635 523154

# Technical Support Form

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Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Include 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 \_\_\_\_\_

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The problem is \_\_\_\_\_  
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List any error messages \_\_\_\_\_  
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The following steps will reproduce the problem \_\_\_\_\_  
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\_\_\_\_\_  
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# GPIB Board Hardware and Software Configuration Form

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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

- GPIB Board and Revision Number (for one of the following boards)
  - AT-GPIB/TNT Board Revision \_\_\_\_\_
  - AT-GPIB/TNT Board with Keys Revision \_\_\_\_\_
  - AT-GPIB Board Revision \_\_\_\_\_
  - AT-GPIB Board with Keys Revision \_\_\_\_\_
- NI-488.2 Software Version Number on Disk(s) \_\_\_\_\_
- Shield Ground Connected to Logic Ground (yes or no) \_\_\_\_\_
- Board Settings

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

## Other Products

- Computer Make and Model \_\_\_\_\_
- Microprocessor \_\_\_\_\_
- Clock Frequency \_\_\_\_\_
- Type of Monitor Card Installed \_\_\_\_\_
- Windows Version \_\_\_\_\_
- Windows Graphics Applications \_\_\_\_\_
- Other Boards in System \_\_\_\_\_
- Base I/O Address of Other Boards \_\_\_\_\_
- Interrupt Level of Other Boards \_\_\_\_\_
- DMA Channels of Other Boards \_\_\_\_\_



# Documentation Comment Form

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National Instruments encourages you to comment on the documentation supplied with our products. This information helps us provide quality products to meet your needs.

Title:    **Getting Started with Your AT-GPIB/TNT and the NI-488.2™ Software for Windows Graphics Applications**

Edition Date:    **September 1994**

Part Number:    **370880A-01**

Please comment on the completeness, clarity, and organization of the manual.

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If you find errors in the manual, please record the page numbers and describe the errors.

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Thank you for your help.

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# Glossary

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Prefix	Meaning	Value
n-	nano-	$10^{-9}$
$\mu$ -	micro-	$10^{-6}$
m-	milli-	$10^{-3}$
c-	centi-	$10^{-2}$
M-	mega-	$10^6$

°	degrees
%	percent
A	amperes
AC	alternating current
ANSI	American National Standards Institute
ASIC	application-specific integrated circuit
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
EOS	end of string
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
IRQ	interrupt request
ISA	Industry Standard Architecture
KB	kilobytes of memory
m	meters
MB	megabytes of memory
PC	personal computer
RAM	random-access memory
s	seconds
TLC	talker/listener/controller
VAC	volts alternating current
VDC	volts direct current