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

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Part Number 370879A-01

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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.

Bescheinigung des Herstellers/Importeurs

Hiermit wird bescheinigt, daß die AT-GPIB in Übereinstimmung mit den Bestimmungen der Vfg. 1046/1984 funk entstört ist.

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

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 DOS graphics applications. The NI-488.2 software is intended for use with MS-DOS (version 3.0 or higher) or equivalent.

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 DOS.

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 disk 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 instructions for using the `ibconf` utility to change the default board and device characteristics of the NI-488.2 software for DOS.

* 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.

italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
bold italic	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.
`bold monospace`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
`italic monospace`	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 and IEEE 488.2 refer to the ANSI/IEEE Standard
IEEE 488.2   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 MS-DOS 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
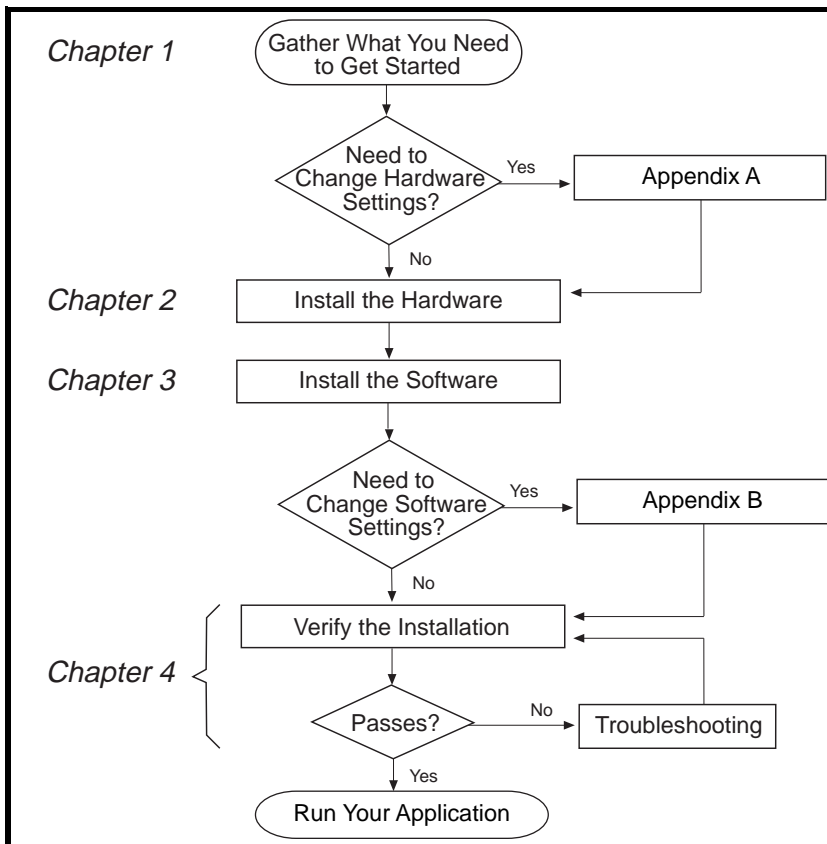
What You Need to Get Started

❑   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 DOS 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)

❑   MS-DOS (version 3.0 or higher) or equivalent 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. The NI-488.2 software 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 DOS. If you want to use the NI-488.2 software for Windows, refer to the manual *Getting Started with Your AT-GPIB/TNT and the NI-488.2 Software for Windows Graphics Applications*.

Chapter 2
Hardware Installation

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.

1 GPIB board
2 Back panel
3 PC AT plug-in board
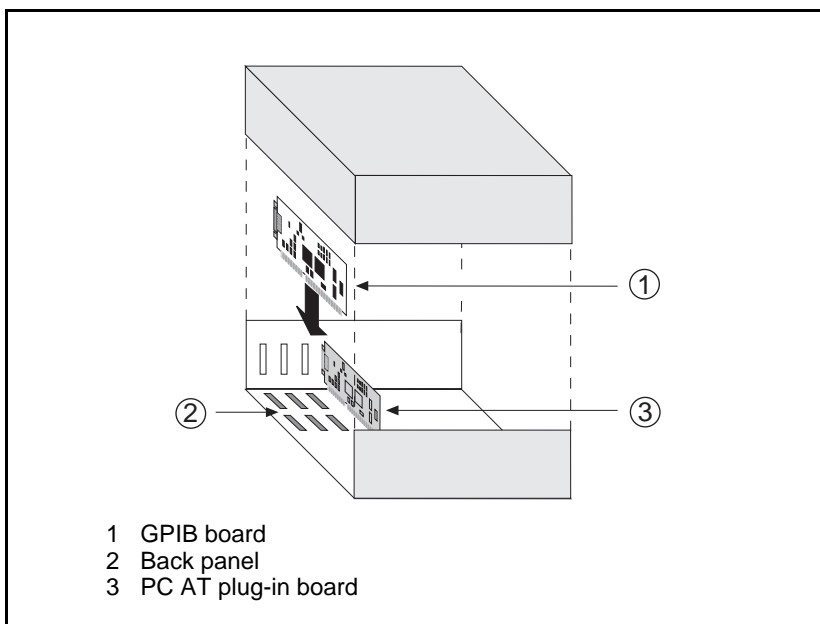
Figure 2-1. Installing the GPIB Board

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

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

NI-488.2 Software Components

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

- `install.exe` is a menu-driven program that installs the NI-488.2 software and updates `config.sys`, the DOS system configuration file.

- `gpib.com` is the NI-488.2 device driver for DOS, which is loaded at system startup. *Driver* is a term used by National Instruments to refer to a loadable device driver.

- `ibdiag.exe` is a program that tests the hardware settings on your GPIB board. It ensures that the board is properly installed and that the hardware is accessible.

- `ibtest.exe` is a program that tests the installation of the NI-488.2 software.

- `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.

- `ibconf.exe` is a software configuration program that changes the configuration parameters of the NI-488.2 device driver for DOS (`gpib.com`).

- `ibic.exe` is an interactive communication program that you can use to communicate with GPIB devices from the keyboard. You can also use `ibic` to troubleshoot problems.

- `appmon.exe` is the GPIB applications monitor program. It is a debugging tool that you can use to monitor the NI-488.2 calls made by your DOS applications.

- `ibtrap.exe` is a program you can use to configure the applications monitor.

- `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

Complete the following steps to run the software installation program.

1. Insert the NI-488.2 software for DOS distribution disk into an unused drive.

2. Begin the software installation by entering the following command:

    ```
    x:\install
    ```

    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.

```
┌──────────────────────────────────────────────────────────────────────┐
│  ┌────────────────────┐            ┌──────────────────────────────────┐│
│  │National Instruments│            │EISA-GPIB/AT-GPIB GRAPHICS DOS Installation││
│  └────────────────────┘            └──────────────────────────────────┘│
│                                                                        │
│      ┌──────────────────────────────────────────────────────┐         │
│      │     The destination directory that will be used for   │         │
│      │     the GPIB installation and your boot drive are given│        │
│      │     below.  You should edit them to match your system's│        │
│      │     configuration.                                     │         │
│      │                                                        │         │
│      │   Destination directory:                               │         │
│      │   ┌──────────────────────────────────────────────────┐│         │
│      │   │c:\at-gpib                                         ││         │
│      │   └──────────────────────────────────────────────────┘│         │
│      │   Boot drive:                                          │         │
│      │   ┌────┐                                               │         │
│      │   │c:  │                                               │         │
│      │   └────┘                                               │         │
│      └──────────────────────────────────────────────────────┘         │
│                                                                        │
│             Use the arrow keys or tab to select a field,               │
│                   then enter the new information.                      │
│                  Press ENTER to continue, ESC to exit                  │
└──────────────────────────────────────────────────────────────────────┘
```

Figure 3-1. Software Installation Screen

3. Enter the destination directory where you want to install the NI-488.2 software and press <Enter> to begin the installation.

    You can press the escape key <Esc> at any time to abort the installation.

4. After the installation is complete, reboot your computer.

    If the installation is successful, the driver displays a banner message on your screen when DOS loads the driver.

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

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

Run the Hardware Diagnostic Program

To verify and test the hardware installation, run the `ibdiag` hardware diagnostic program that came with your NI-488.2 software. `ibdiag` 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 `ibdiag`:

1. Disconnect any GPIB cables.

2. Go to the directory where the software is installed (for example, `c:\at-gpib`).

3. Enter the following command:

    `ibdiag`

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

Troubleshooting ibdiag 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 `ibdiag`.

Using Single-Cycle DMA

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

Correcting Hardware Settings

Follow these steps to troubleshoot `ibdiag` error messages.

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

    Run `ibdiag` 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 `ibdiag` fails again, one of the following situations is occurring:

    *   The base address that you entered at the `ibdiag` prompt 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 `ibdiag` 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 `ibdiag` 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 `ibdiag` fails, one of the following situations is occurring:

    *   The interrupt request line that you entered at the `ibdiag` prompt 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 `ibdiag` 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 `ibdiag` fails, one of the following situations is occurring:

    *   The DMA channel that you entered at the `ibdiag` prompt 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 Program

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

Follow these steps to run `ibtest`:

1.   Disconnect any GPIB cables.

2.   Go to the directory where the software is installed (for example, `c:\at-gpib`).

3.   Enter the following command:

    ```
    ibtest
    ```

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

Troubleshooting ibtest Error Messages

The following sections explain common error messages generated by `ibtest`.

- The `ibtest` program 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 `ibconf` 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.*

- `ibtest` displays the following message:

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

  If this message appears, make sure that the GPIB driver is installed. Check that the following line is in your `config.sys` file:

  `device = ` *`drive`*`:\`*`path`*`\gpib.com`

  where *`drive`* is the drive where the NI-488.2 software is installed (usually `c:`) and *`path`* is the path of the directory in which you have installed NI-488.2 software (for example, `at-gpib`).

- `ibtest` displays the following message:

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

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

  – The `Use this GPIB interface` field in `ibconf` might be set to `no` for board `gpib`*x*. If you want to use the board, you must set this field to `yes`.

  – The board might not be properly installed and configured. Refer to Chapter 2, *Install the Hardware*, and Appendix A, *Changing Hardware Configuration Settings*, for detailed instructions.

  – The software and hardware settings do not match. You can run `ibconf` to check the current configuration of the software. Refer to Appendix B, *Changing Software Configuration Settings*, for information on `ibconf`.

- `ibtest` 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 unsafe to access 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.

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.

What do I do if `ibdiag` or `ibtest` 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 `ibic`?

You can use ibic to test and verify instrument communication, troubleshoot problems, and develop your application program.

What information should I have before I call National Instruments?

When you call National Instruments, you should have the results of the diagnostic tests ibdiag and ibtest and the output from GPIBInfo. 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.
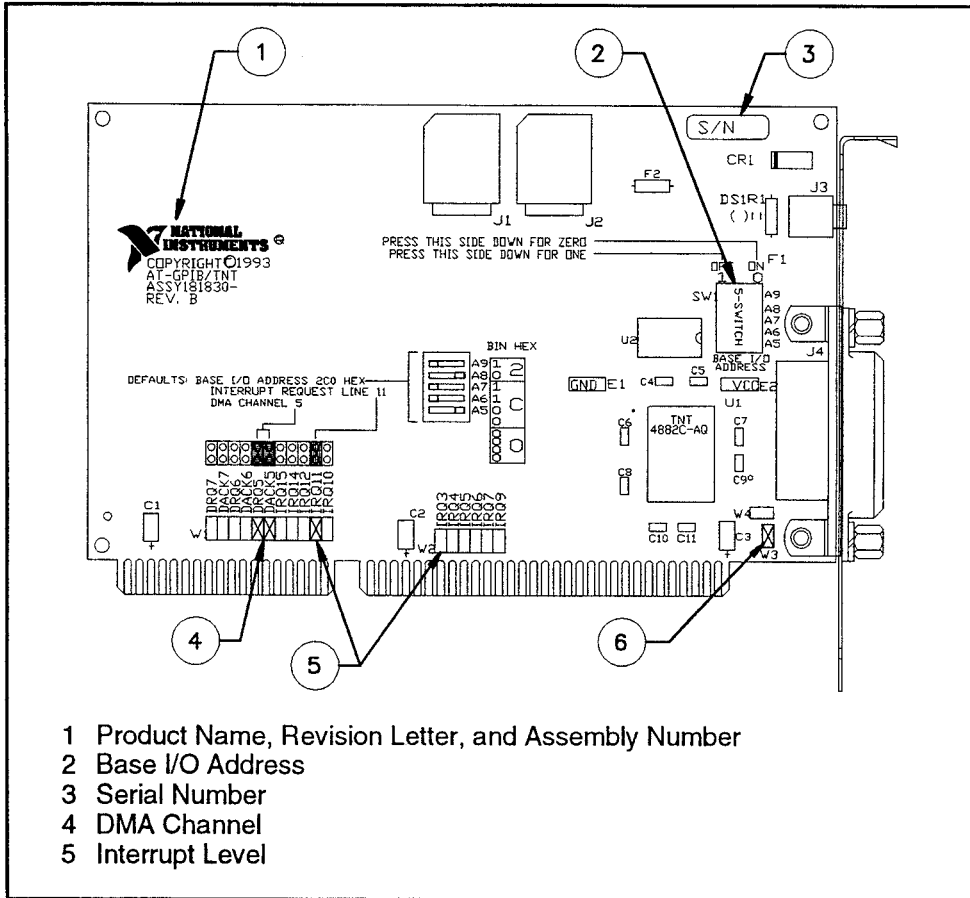
Figure A-1. AT-GPIB/TNT Parts Locator Diagram

1 Product Name, Revision Letter, and Assembly Number
2 Base I/O Address
3 Serial Number
4 DMA Channel
5 Interrupt Level

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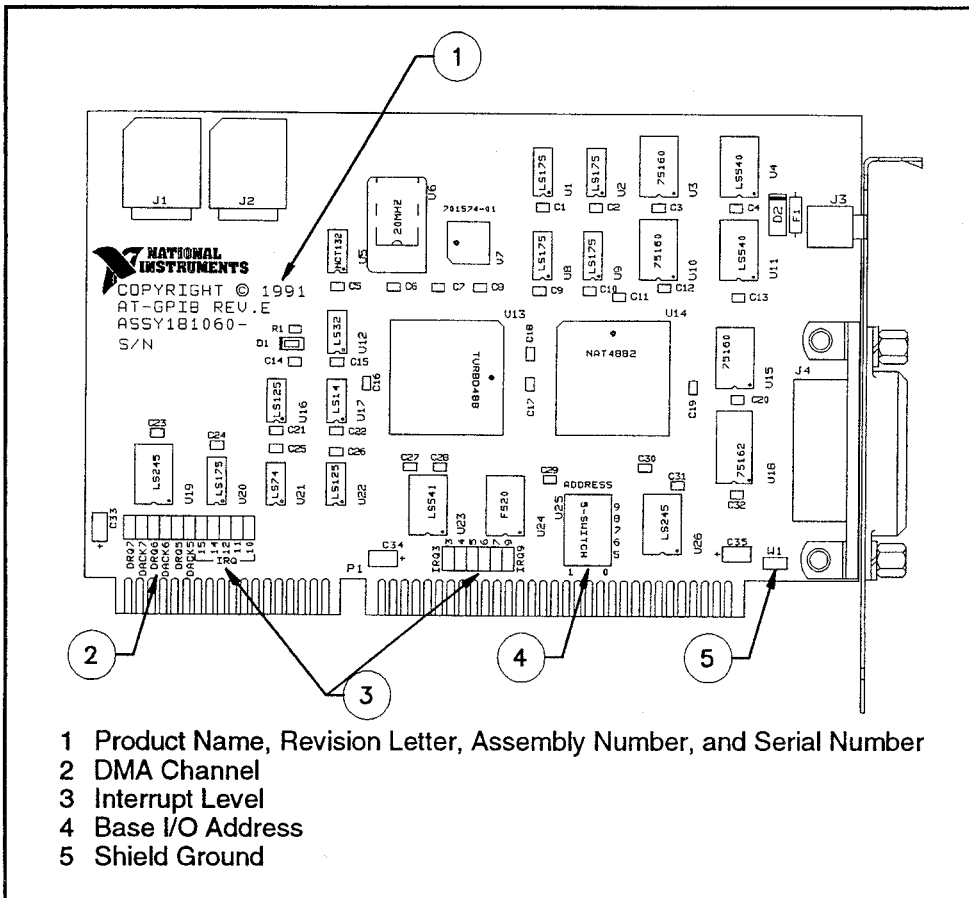
Figure A-2. AT-GPIB Parts Locator Diagram

1 Product Name, Revision Letter, Assembly Number, and Serial Number
2 DMA Channel
3 Interrupt Level
4 Base I/O Address
5 Shield Ground

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.

Push this side down (OFF) for logic 1

Push this side down (ON) for logic 0

1   0

	Binary	Hex
9	1	3
8	1	
7	0	
6	0	0
5	0	
	0	
	0	
	0	0
	0	

Switch Set to Base I/O
Address hex 300

1   0

	Binary	Hex
9	1	2
8	0	
7	1	
6	1	C
5	0	
	0	
	0	
	0	0
	0	

Switch Set to Default
Base I/O Address hex 2C0

Figure A-3. Base I/O Address Switch Settings
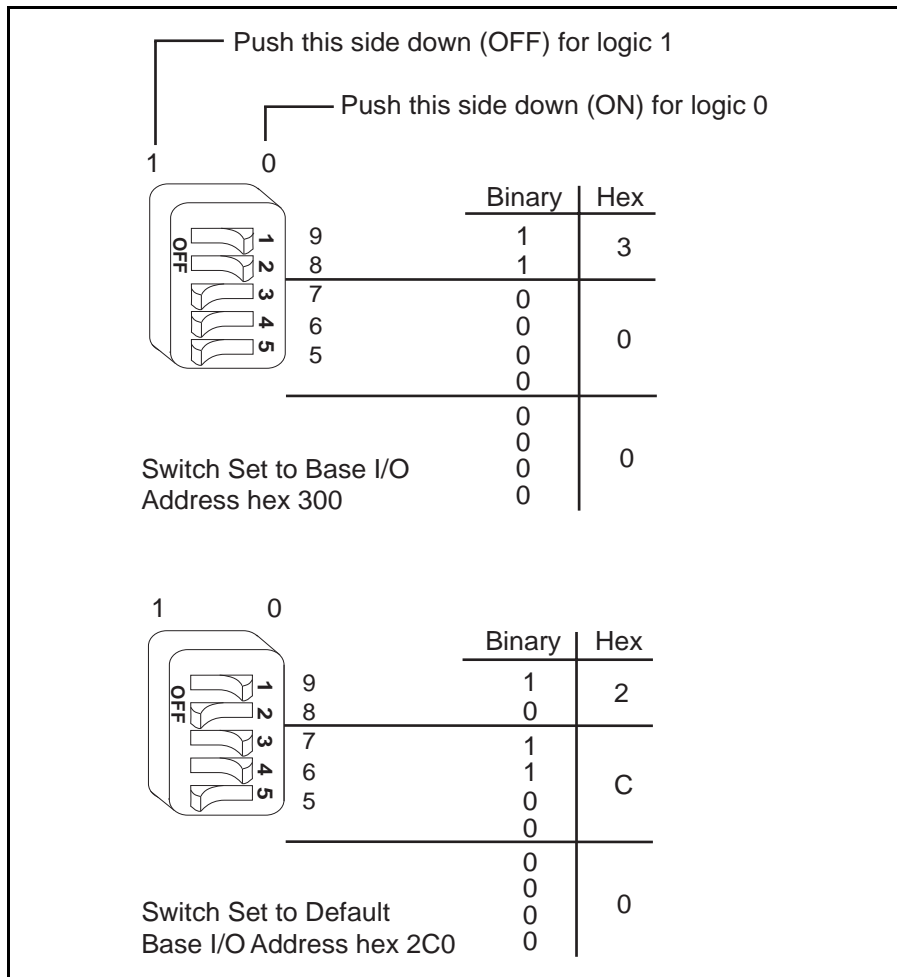
4. Record your new setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix D, *Customer Communication*.

5. Remember that after you install the NI-488.2 software, you must use the `ibconf` utility to configure your software settings to match your new hardware settings. Refer to Appendix B, *Changing Software Configuration Settings*, for information on `ibconf`.

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.
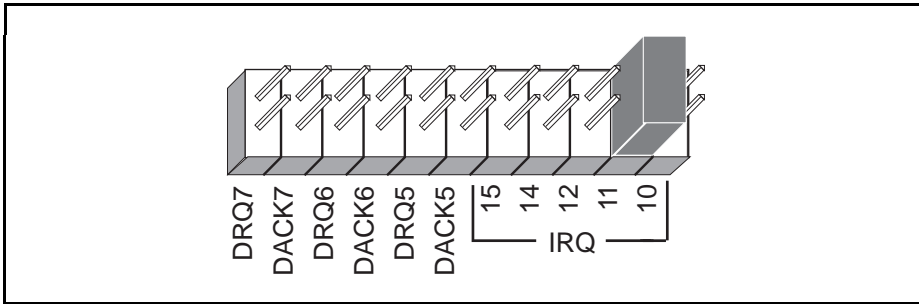
Figure A-4 shows the setting for IRQ11.

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

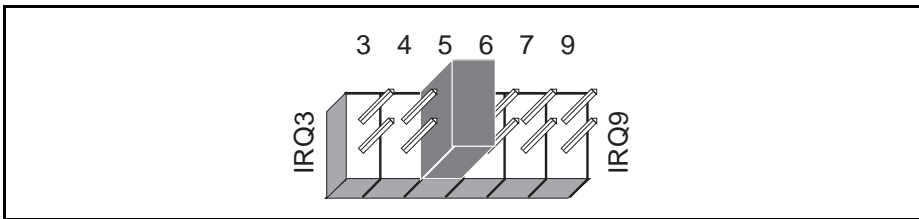Figure A-5 shows the setting for IRQ5.

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.
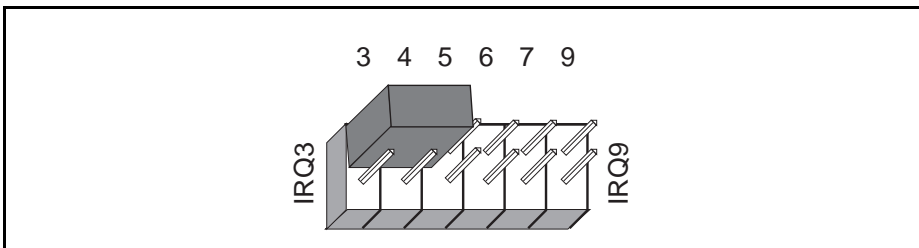

Figure A-6. Jumper Setting for Disabling Interrupts

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 `ibconf` utility to configure your software settings to match your new hardware settings. Refer to Appendix B, *Changing Software Configuration Settings*, for information on `ibconf`.

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

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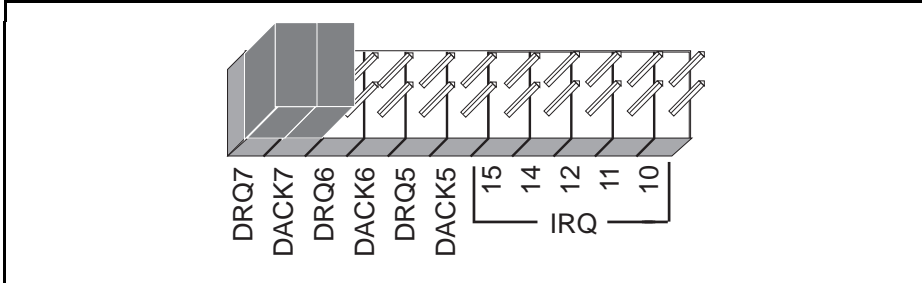
Figure A-7. DMA Channel Jumper Setting for DMA Channel 7

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 `ibconf` utility to configure your software setting to match your new hardware settings. Refer to Appendix B, *Changing Software Configuration Settings*, for information on `ibconf`.

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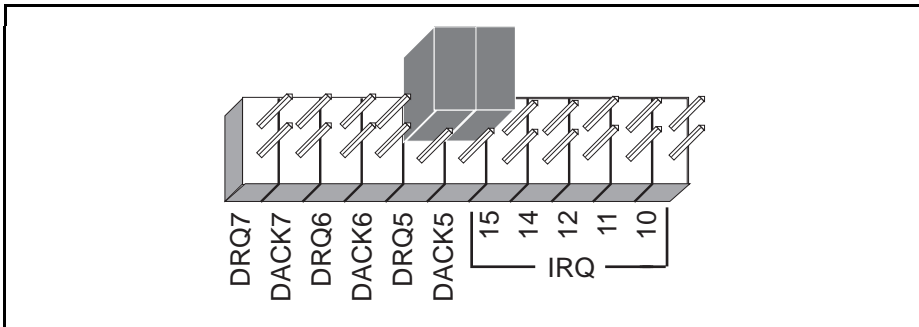
Figure A-8. DMA Jumper Setting for No DMA Channel

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.

Logic Ground Connected to Shield Ground (Default)

Logic Ground Disconnected from Shield Ground
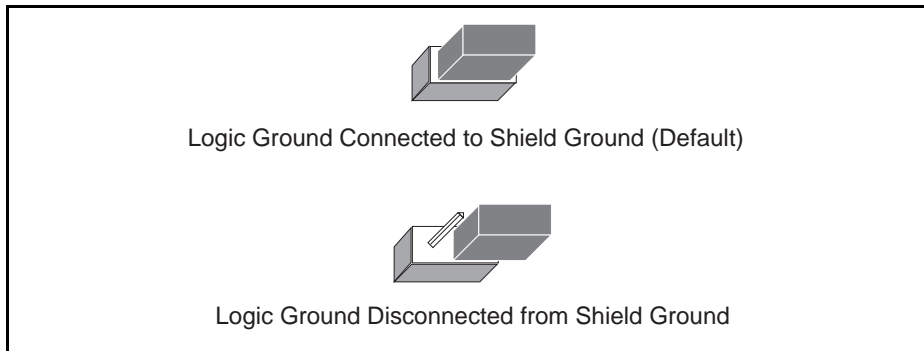
Figure A-9. Ground Configuration Jumper Settings

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 instructions for using the `ibconf` utility to change the default board and device characteristics of the NI-488.2 software for DOS.

The `ibconf` 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 applications 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, `dev` 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 `ibconf`. 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 ibconf

To use `ibconf`, change to the directory that contains the installed NI-488.2 software (for example, `c:\at-gpib`) and enter the following command:

```
ibconf drive:\path\gpib.com
```

where *drive* is the disk drive where the NI-488.2 software is installed and *path* is the path of the directory in which you have installed the NI-488.2 software (for example, `ibconf c:\at-gpib\gpib.com`).

Table B-1 lists the options you can select when you start `ibconf`.

Table B-1. Options for Starting ibconf

ibconf Option	**Action**
driver	Configure a specific driver. `ibconf` configures the given driver file instead of searching for a `gpib.com` file (for example, `ibconf d:\at-gpib\at-gpib.com`).
–h	Help. This option causes `ibconf` to display a summary of options.
–m	Monochrome mode. This option causes `ibconf` to run in monochrome mode even if you have a color monitor.
–vb	Video access through BIOS. This option causes `ibconf` to use the system BIOS routines when writing to the screen. This is slower than the default of direct screen access, but is more compatible with certain nonstandard systems.

Upper and Lower Levels of ibconf

`ibconf` operates at both an upper and a lower level. The upper level consists of the device map, which gives a graphical picture of the GPIB system. The lower level consists of screens describing the individual boards and devices that make up the system.

Upper-Level Device Map

Figure B-1 shows the upper level of `ibconf`.


```
National Instruments          GPIB Device Map         AT-GPIB/TNT Ver 2.5


        ┌─────────┐        • Use the cursor keys or mouse to select board/devices
        │ GPIB0   │        • Use PgUp/PgDn for maps of other boards
        └─ ─ ─ ─ ─┘        • Use the function keys to select an action


        ─○ DEV1        ─○ DEV5         ─○ DEV9         ─○ DEV13

        ─○ DEV2        ─○ DEV6         ─○ DEV10        ─○ DEV14

        ─○ DEV3        ─○ DEV7         ─○ DEV11        ─○ DEV15

        ─○ DEV4        ─○ DEV8         ─○ DEV12        ─○ DEV16



F1: Help   F3: AutoConfig  F4: Rename  F5: (Dis)connect  F8: Edit   F9/Esc: Exit
```
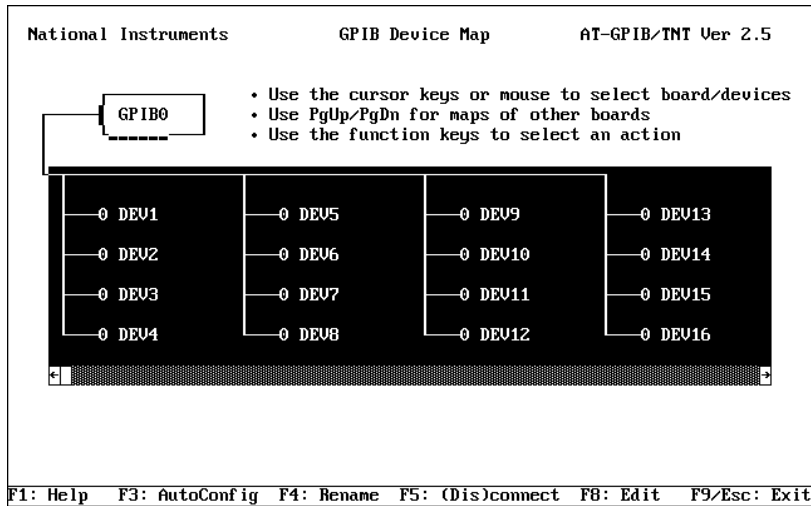
Figure B-1. Upper Level of ibconf

As shown in Figure B-1, the upper-level screen of `ibconf` displays the names of all devices controlled by the driver. It also indicates which devices, if any, are accessed through each interface board. You can move around the map by using the cursor control keys or the mouse.

The following are the most commonly-used options available at the upper level.

- Device maps of the boards

- Help

- Rename

- (Dis)connect

- Edit

- Exit

Device Maps of the Boards	Use <PageUp> or <PageDown> to toggle between the device maps for the different GPIB interface boards. These boards are referred to as *access boards*. The maps show which devices are assigned to each board.
Help	Use the function key <F1> to access the comprehensive, online help feature of ibconf. The help information describes the functions and common terms associated with the upper level of ibconf.
Rename	Use the function key <F4> to rename a device. Move to the device you want to rename by using the cursor control keys. Press the <F4> key and enter the new name of the device. The device name may contain up to eight characters in lowercase or uppercase.

The following restrictions apply when renaming a device:

- Extensions (.xxx) are not allowed.

- As specified by DOS, the device name cannot use the following characters:

```
    .       "       /       \       [       ]       :
    |       <       >       +       =       ;       ,
```

- Do not use the reserved names con or nul for your device.

- Do not give GPIB device names the same names as files, directories, or subdirectories. If you name a GPIB device pltr and your file system contains the file pltr.dat or a subdirectory pltr, a conflict results.

- The access board names gpib0, gpib1, gpib2, and gpib3 are fixed and cannot be changed.

(Dis)connect	Use the function key <F5> to connect or disconnect a device from a particular access board. Move the cursor to the device that you want to connect or disconnect by using the cursor control keys and then press the <F5> key.
Edit	Use the function key <F8> or the <Enter> key to edit or examine the characteristics of a particular board or device. Move to the board or device that you want to edit using the cursor control keys and then press the <F8> key. This step puts you in the lower level of ibconf and lists the characteristics for the particular board or device that you want to edit. To exit the Edit option, press the function key <F9> or <Esc>.
Output GPIB Driver Configuration	When configuring a GPIB driver, a text version of the driver configuration can be written to a disk file. This file contains a description of the current GPIB driver and should be used for information purposes only.

Autoconfigure   Do not use this option unless instructed to do so by your software application. When autoconfiguring a particular GPIB board, `ibconf` finds all of the listening devices and adjusts the device map for the board so that only those devices are connected. It also adjusts the primary and secondary address fields of the devices to match the addresses that responded as Listeners.

                        Caution: *Once you press <F3> to autoconfigure, you cannot undo the new configuration.*

Exit   Use the function key <F9> or <Esc> to exit `ibconf`. If you have made changes, `ibconf` prompts you to save the changes before exiting. For more information, refer to the *Exiting ibconf* section later in this appendix.

Lower-Level Device/Board Characteristics

The lower level screens of `ibconf` display the currently defined values for characteristics of a device or board such as addressing and timeout information, as shown in Figure B-2. Each entry has extensive online help located to the right of the screen.
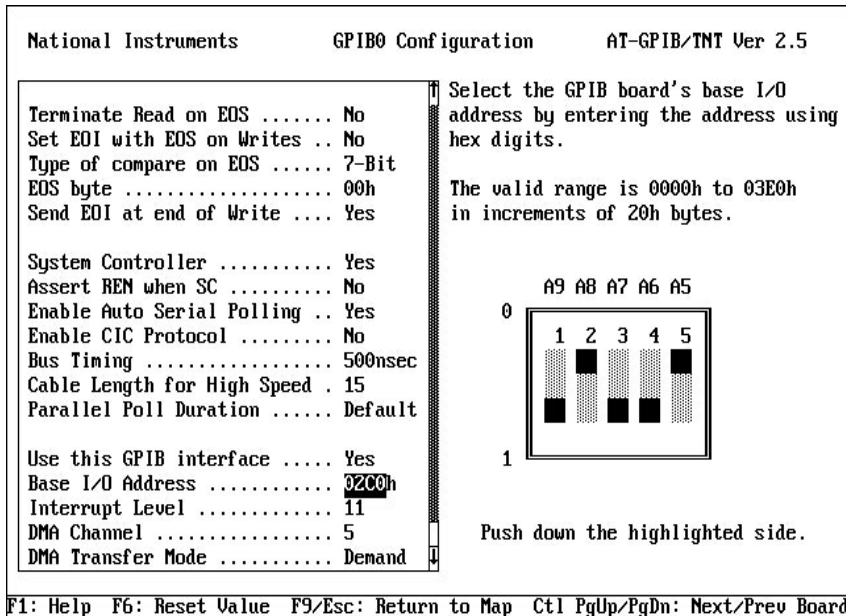

Figure B-2. Lower Level of ibconf

You can access the lower-level screens from the map level of `ibconf` by selecting a board or device and pressing <F8>. You can use the <Up>, <Down>, <PageUp>, and <PageDown> cursor keys to select a characteristic. For your convenience, cursor control keys and function keys are defined at the bottom of your computer screen.

Selecting the configuration settings for each device and board customizes the communications and other options to be used with that board or device. The access board uses these settings either when device functions are called to program the device or when board functions are used to program the board.

The following options are available at the lower level.

- Change Characteristics

- Change Board or Device

- Help

- Reset Value

- Return to Map

Change Characteristics
To change a specific characteristic of a device or a board, move the cursor to, or click the mouse on, the field for that characteristic. You can also use <PageUp>, <PageDown>, <Home>, or <End> to select other characteristics of a device or board. When the cursor is on the characteristic, either use the left/right arrow keys to select between different options or input the option directly from the keyboard. Instructions on the right side of the screen inform you which method is appropriate for the selected characteristic.

Change Board or Device
Use <Control-PageUp> and <Control-PageDown> to change to the next or previous GPIB board or device. For example, if you are editing `dev3` and press <Control-PageUp>, you will then be editing `dev4`.

Help
Use the function key <F1> to access the comprehensive, online help feature of `ibconf`. The help information describes the functions and common terms associated with the lower level of `ibconf`.

Reset Value
Use the function key <F6> to reset a characteristic option to its previous value.

Return to Map
At the lower level, the function key <F9> or <Esc> returns you to the upper-level device map of `ibconf`.

Board and Device Configuration Options

To view detailed information about each characteristic, position the cursor in the field for that characteristic. For information on characteristics specific to a particular driver, check the getting started manual that came with your interface board. The following paragraphs describe the options available in ibconf for the NI-488.2 software for DOS. For additional information, consult the online help associated with each item.

Primary GPIB Address

All devices and boards must be assigned a unique primary address in the range 0 to 30 decimal. The default primary address of all GPIB boards is 0.

The GPIB primary address of any device is set within the device, either with hardware switches or by a software program. The address set within the device must correspond to the address in the memory-resident driver. In the NI-488.2 driver for DOS, the default primary addresses of dev1 through dev16, and dev17 through dev32, are 1 through 32, respectively. Refer to the device documentation for instructions about setting the device address. GPIB boards do *not* have hardware switches to select the GPIB address.

Secondary GPIB Address

Any device or board using extended addressing must be assigned a secondary address in the range hex 60 to hex 7E (96 to 126 decimal), or you can select NONE to disable secondary addressing.

Refer to the device documentation for instructions about secondary addressing. The default setting for this characteristic is NONE for all boards and devices.

Timeout Setting

The timeout value is the approximate length of time that GPIB functions wait for data to be transferred or commands to be sent. The default option for this characteristic is 10 s.

Terminate Read on EOS

Some devices send an EOS byte signaling the last byte of a data message. A yes response in this field causes the GPIB board to terminate a read operation when it receives the EOS byte. The default option for this characteristic is no.

Set EOI with EOS on Writes

A `yes` response in this field causes the GPIB board to assert the EOI line when the EOS byte is detected on a write operation. The default option for this characteristic is `no`.

Type of Compare on EOS

This field specifies the type of comparison to be made with the EOS byte. You can choose whether to compare all eight bits or just the seven least significant bits, which are in ASCII or ISO (International Standards Organization) format. The default option for this characteristic is `7-bit`.

Note: ***This field is meaningful only if a*** `yes` ***response was given for either the*** `Set EOI with EOS on Write` ***field or the*** `Terminate Read on EOS` ***field.***

EOS Byte

Some devices can be programmed to terminate a read operation when a selected character is detected. A linefeed character (hex 0A) is a common EOS byte. The default option for this characteristic is hex 00.

Send EOI at End of Write

Some devices, as Listeners, require that the Talker terminate a data message by asserting the EOI line with the last byte. A `yes` response causes the GPIB board to assert the EOI line on the last data byte. The default option for this characteristic is `yes`.

System Controller (Board Characteristic Only)

The System Controller in a GPIB system is the device that maintains ultimate control over the bus. A `yes` response would designate System Controller capability. The GPIB board is usually designated as System Controller. The default option for this characteristic is `yes`.

Note: ***You should not have more than one designated System Controller in any GPIB system***.

Assert REN when SC (Board Characteristic Only)

A `yes` response to this field causes Remote Enable (REN) to be asserted automatically whenever the board is placed online, if that the board has System Controller capability. If you give a `no` response, an explicit call to `ibsre` is required to assert REN. The default option for this characteristic is `no`.

Enable Auto Serial Polling (Board Characteristic Only)

This option enables or disables automatic serial polls of devices when the GPIB Service Request (SRQ) line is asserted. The default option for this characteristic is `yes`.

Enable CIC Protocol (Board Characteristic Only)

If this option is enabled and a device-level NI-488 function is called after the board passes control to another device, the board asserts SRQ with a Serial Poll status byte of hex 42. The default option for this characteristic is `no`.

Bus Timing (Board Characteristic Only)

This field determines the minimum amount of time, after the data is placed on the bus, that the board may assert DAV during a write or command operation. If the total length of the GPIB cable length in the system is less than 15 m, the value of 350 ns is appropriate.

Other factors might affect the choice of the T1 delay, although they are unlikely to affect your system setup. Refer to the ANSI/IEEE Standard 488.1-1987, Section 5.2, for more information about these other factors. The default for this option is 500 ns.

Cable Length for High Speed (Board Characteristic Only)

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.

Parallel Poll Duration (Board Characteristic Only)

This field specifies the length of time the driver 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 μs. If you are using a GPIB bus extender in transparent parallel poll mode, you should increase the poll duration to 10 μs so that the bus extender can operate transparently to your applications.

Use This GPIB Interface (Board Characteristic Only)

If you do not want the driver to try to access a board at the selected base address (because you do not have a board in the system), select `no` for this option. When this field is set to `no`, the driver returns the EDVR error as soon as a program tries to access the board. By default, access board `gpib0` is enabled, and `gpib1`, `gpib2`, and `gpib3` are disabled.

Base I/O Address (Board Characteristic Only)

This field specifies the I/O address of the GPIB board. It must be set to the same value as the base I/O address setting for the GPIB board itself. Setting the base I/O address level is explained in Appendix A, *Changing Hardware Configuration Settings*.

DMA Channel (Board Characteristic Only)

This field specifies the DMA channel used by the GPIB board. It must be set to the same value as the DMA channel setting for the GPIB board itself. Setting the DMA channel is explained in Appendix A, *Changing Hardware Configuration Settings*.

Interrupt Jumper Setting (Board Characteristic Only)

This field specifies the interrupt line used by the GPIB board. It must be set to the same value as the interrupt level setting for the GPIB board itself. Setting the interrupt level is explained in Appendix A, *Changing Hardware Configuration Settings*.

Serial Poll Timeout (Device Characteristic Only)

This timeout value controls the length of time the driver waits for a serial poll response from a device. The IEEE 488.1 specification does not specify the length of time a Controller should wait for the response byte. The default value of 1 s should work for most devices. If you have problems with serial polls, try using a longer timeout value.

Enable Repeat Addressing (Device Characteristic Only)

Normally, devices are not addressed each time a read or write operation is performed. If `no` is selected, read or write operations do not readdress the selected device if the same operation was just performed with that device. Avoiding readdressing saves some time when you have several GPIB operations to perform. But it might be a problem for some older IEEE 488.1 devices that require their GPIB address to be sent with each I/O operation. Select `yes` to enable repeat addressing in such a situation. The default option for this characteristic is `no`.

Exiting ibconf

After you have made all your changes, you can exit `ibconf` by pressing <F9> or <Esc>. The program prompts you to save the changes to the disk copy of the driver. Select `yes` to save the changes, `no` to discard the changes, or `cancel` to remain in `ibconf`. If your system has a driver currently loaded, `ibconf` prompts you to save the changes to the currently loaded driver. Select `yes` to modify the loaded driver, `no` to exit without modifying the loaded driver, or `cancel` to remain in `ibconf`. If `ibconf` is unable to update the loaded driver, it displays a final prompt that tells you why and instructs you to restart your computer.

Checking for Errors

`ibconf` checks for possible problems before quitting. It alerts you to situations such as the following:

- GPIB addressing conflict between a device and its access board

- GPIB boards not present in the host machine at the specified address

- Timeouts disabled on a device or board

Saving Changes to the Loaded Driver

You can also have `ibconf` modify the driver that is loaded in memory if the loaded version is compatible with the version being edited. If the loaded version is compatible, a prompt asks you if you want to modify the loaded driver. If you enter `y`, the currently loaded driver is modified with your parameter selections. No prompt appears if `ibconf` cannot find a loaded driver.

If you have changed a board interrupt level or changed a device name to `lpt1`, `lpt2`, `lpt3`, `com1`, or `com2`, `ibconf` does not configure the loaded driver. If you have made and saved changes, and you do *not* modify the driver, you must restart the computer for your changes to take effect.

Appendix C
Hardware Specifications

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

Characteristic	Specification

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

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

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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	2265886 2265887	
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

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 _____

The problem is _____

_____

_____

_____

_____

_____

_____

_____

List any error messages _____

_____

_____

_____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

_____

_____

_____

_____

GPIB Board 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

- 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_____

- 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 _____

- DOS Version _____

- DOS 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

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 DOS Graphics Applications**

Edition Date: **September 1994**

Part Number: **370879A-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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Title _____

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Glossary

Prefix	Meaning	Value
n-	nano-	10^{-9}
μ-	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
ibic	Interface Bus Interactive Control
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