APEX WAVES

COMPREHENSIVE SERVICES

We offer competitive repair and calibration services, as well as easily accessible documentation and free downloadable resources.

SELL YOUR SURPLUS

We buy new, used, decommissioned, and surplus parts from every NI series. We work out the best solution to suit your individual needs.

〰️ Sell For Cash   〰️ Get Credit   〰️ Receive a Trade-In Deal

OBSOLETE NI HARDWARE IN STOCK & READY TO SHIP

We stock **New, New Surplus, Refurbished,** and **Reconditioned** NI Hardware.

Bridging the gap between the manufacturer and your legacy test system.

📞 1-800-915-6216

🌐 www.apexwaves.com

✉️ sales@apexwaves.com

Request a Quote

✉️ **CLICK HERE**

AT-MIO-16

GPIB

Getting Started with Your AT-GPIB/TNT and the NI-488.2M™ Software for OS/2

Internet Support

support@natinst.com
E-mail: info@natinst.com
FTP Site: ftp.natinst.com
Web Address: http://www.natinst.com

Bulletin Board Support

BBS United States: (512) 794-5422
BBS United Kingdom: 01635 551422
BBS France: 01 48 65 15 59

Fax-on-Demand Support

(512) 418-1111

Telephone Support (U.S.)

Tel: (512) 795-8248
Fax: (512) 794-5678

International Offices

Australia 03 9879 5166, Austria 0662 45 79 90 0, Belgium 02 757 00 20,
Canada (Ontario) 905 785 0085, Canada (Québec) 514 694 8521, Denmark 45 76 26 00,
Finland 09 725 725 11, France 01 48 14 24 24, Germany 089 741 31 30,
Hong Kong 2645 3186, Israel 03 5734815, Italy 02 413091, Japan 03 5472 2970,
Korea 02 596 7456, Mexico 5 520 2635, Netherlands 0348 433466,
Norway 32 84 84 00, Singapore 2265886, Spain 91 640 0085, Sweden 08 730 49 70,
Switzerland 056 200 51 51, Taiwan 02 377 1200, United Kingdom 01635 523545

National Instruments Corporate Headquarters

6504 Bridge Point Parkway   Austin, TX 78730-5039   Tel: (512) 794-0100

Important Information

Warranty

The AT-GPIB and AT-GPIB/TNT are warranted against defects in materials and workmanship for a period of two years from the date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

The media on which you receive National Instruments software are warranted not to fail to execute programming instructions, due to defects in materials and workmanship, for a period of 90 days from date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace software media that do not execute programming instructions if National Instruments receives notice of such defects during the warranty period. National Instruments does not warrant that the operation of the software shall be uninterrupted or error free.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. National Instruments will pay the shipping costs of returning to the owner parts which are covered by warranty.

National Instruments believes that the information in this manual is accurate. The document has been carefully reviewed for technical accuracy. In the event that technical or typographical errors exist, National Instruments reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should consult National Instruments if errors are suspected. In no event shall National Instruments be liable for any damages arising out of or related to this document or the information contained in it.

EXCEPT AS SPECIFIED HEREIN, NATIONAL INSTRUMENTS MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S RIGHT TO RECOVER DAMAGES CAUSED BY FAULT OR NEGLIGENCE ON THE PART OF NATIONAL INSTRUMENTS SHALL BE LIMITED TO THE AMOUNT THERETOFORE PAID BY THE CUSTOMER. NATIONAL INSTRUMENTS WILL NOT BE LIABLE FOR DAMAGES RESULTING FROM LOSS OF DATA, PROFITS, USE OF PRODUCTS, OR INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY THEREOF. This limitation of the liability of National Instruments will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against National Instruments must be brought within one year after the cause of action accrues. National Instruments shall not be liable for any delay in performance due to causes beyond its reasonable control. The warranty provided herein does not cover damages, defects, malfunctions, or service failures caused by owner's failure to follow the National Instruments installation, operation, or maintenance instructions; owner's modification of the product; owner's abuse, misuse, or negligent acts; and power failure or surges, fire, flood, accident, actions of third parties, or other events outside reasonable control.

Copyright

Under the copyright laws, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of National Instruments Corporation.

Trademarks

NAT4882®, NI-488®, Turbo488®, NI-488.2™, NI-488.2M™, and TNT4882C™ are trademarks of National Instruments Corporation.

Product and company names listed are trademarks or trade names of their respective companies.

WARNING REGARDING MEDICAL AND CLINICAL USE OF NATIONAL INSTRUMENTS PRODUCTS

National Instruments products are not designed with components and testing intended to ensure a level of reliability suitable for use in treatment and diagnosis of humans. Applications of National Instruments products involving medical or clinical treatment can create a potential for accidental injury caused by product failure, or by errors on the part of the user or application designer. Any use or application of National Instruments products for or involving medical or clinical treatment must be performed by properly trained and qualified medical personnel, and all traditional medical safeguards, equipment, and procedures that are appropriate in the particular situation to prevent serious injury or death should always continue to be used when National Instruments products are being used. National Instruments products are NOT intended to be a substitute for any form of established process, procedure, or equipment used to monitor or safeguard human health and safety in medical or clinical treatment.

FCC/DOC Radio Frequency Interference Class B 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. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC). This equipment has been tested and found to comply with the following two regulatory agencies:

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

Notices 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.*
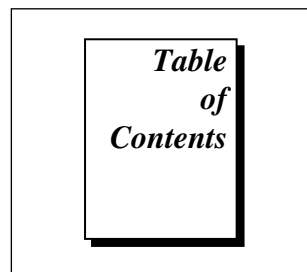
This device complies with the FCC rules only if used with shielded interface cables of suitable quality and construction. National Instruments used such cables to test this device and provides them for sale to the user. The use of inferior or nonshielded interface cables could void the user's authority 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: *Interference to Home Electronic Entertainment Equipment Handbook.* This booklet is available from the U.S. Government Printing Office, Washington, DC 20402.

Canadian Department of Communications

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

About This Manual

Chapter 1
Introduction

Chapter 2
Hardware Configuration and Installation

Chapter 3
Software Installation and Configuration

Chapter 4
Installation Verification

Chapter 5
Using Your NI-488.2M Software

Appendix A
Specifications

Appendix B
Additional Configuration Options

Appendix C
Customer Communication

Glossary

Figures

Tables

This manual contains instructions for installing and configuring the National Instruments AT-GPIB or AT-GPIB/TNT board and the NI-488.2M software for OS/2. The NI-488.2M software package is meant to be used with OS/2 (IBM Operating System/2) version 2.0 or higher.

This manual assumes that you are already familiar with the OS/2 system.

How to Use This Manual Set
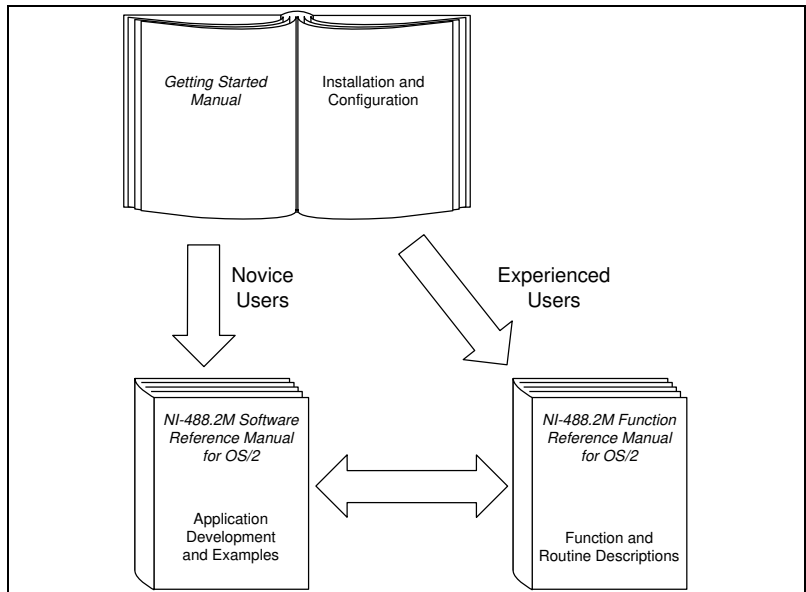
Use this getting-started manual to install and configure your GPIB board and NI-488.2M software for OS/2.

Use the software reference manual if you want to learn the basics of GPIB and how to develop an application program. The software reference manual also contains debugging information and detailed examples.

Use the function reference manual for specific information about each NI-488 function and NI-488.2 routine, such as format, parameters, and possible errors.

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 briefly describes the GPIB board and the NI-488.2M software.

- Chapter 2, *Hardware Configuration and Installation*, contains instructions to help you install and configure the AT-GPIB or AT-GPIB/TNT board.

- Chapter 3, *Software Installation and Configuration*, contains instructions to help you install and configure the NI-488.2M software.

- Chapter 4, *Installation Verification*, describes how you can verify and test the installation of your NI-488.2M software and AT-GPIB/TNT or AT-GPIB board.

- Chapter 5, *Using Your NI-488.2M Software,* includes a brief explanation of the `ibic` utility and discusses programming considerations for your NI-488.2M software.

- Appendix A, *Specifications*, describes the electrical, physical, and environmental characteristics of the AT-GPIB/TNT and AT-GPIB boards and the recommended operating conditions.

- Appendix B, *Additional Configuration Options*, contains information about hardware settings used by many other PC AT plug-in interface boards and adapters that may be in your system.

- Appendix C, *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 the terms, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols, that this manual uses.

Conventions Used in This Manual

The following conventions are used in this manual:

☞	This icon to the left of bold italicized text denotes a note, which alerts you to important information.
⚠	This icon to the left of bold italicized text denotes a caution, which advices you of precautions to take to avoid injury, data loss, or a system crash.
bold	Bold text denotes the names of menus, menu items, or dialog box buttons or options.
bold italic	Bold italic text denotes a note or caution.
`bold monospace`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
`italic monospace`	Italic lowercase text in this font denotes that you must supply the appropriate words or values in the place of these items.
`monospace`	Lowercase text in this font denotes text or characters that you literally input from the keyboard. It also denotes sections of code, programming examples, and syntax examples. This font also denotes the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, variables, filenames, and extensions, and for statements and comments taken from program code.
<>	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>.
IEEE 488 and IEEE 488.2	IEEE 488 and IEEE 488.2 refer to the ANSI/IEEE Standard 488.1-1987 and the ANSI/IEEE Standard 488.2-1992, respectively, which define the GPIB.

GPIB board	GPIB board refers generically to either the National Instruments AT-GPIB or the National Instruments AT-GPIB/TNT board. Chapter 1, *Introduction*, describes these boards in detail.
NI-488.2M	NI-488.2M refers to the NI-488.2M software for OS/2, unless otherwise noted.
NI-488 and NI-488.2	NI-488 and NI-488.2 refer to the NI-488 functions and NI-488.2 routines for OS/2.
OS/2	OS/2 refers to IBM OS/2 version 2.0 or higher, unless otherwise noted.

Related Documentation

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

- *NI-488.2M Function Reference Manual for OS/2*

- *NI-488.2M Software Reference Manual for OS/2*

- *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*

- *OS/2 Using the Operating System, International Business Machines*

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 C, *Customer Communication*, at the end of this manual.

Introduction

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

How to Use This Manual

```
Chapter 1        ( Gather What You Need
                     to Get Started )
                           │
                           ▼
                 ┌─────────────────────────────┐
                 │ Configure the Hardware (Optional) │
Chapter 2        └─────────────────────────────┘
                           │
                           ▼
                 ┌─────────────────────────────┐
                 │     Install the Hardware    │
                 └─────────────────────────────┘
                           │
                           ▼
                 ┌─────────────────────────────┐
                 │     Install the Software    │
                 └─────────────────────────────┘
                           │
                           ▼
                       ╱ Need to ╲        Yes   ┌─────────────────────┐
Chapter 3            ╱ Change Software ╲ ──────▶│ Configure the Software │
                     ╲ Settings? ╱             └─────────────────────┘
                       ╲       ╱                        │
                           │ No                         │
                           ▼                            │
                 ┌─────────────────────────────┐ ◀──────┤
                 │     Verify the Installation │ ◀───────┤
                 └─────────────────────────────┘         │
                           │                             │
                           ▼                             │
Chapter 4              ╱         ╲      No   ┌─────────────────────┐
                     ╱  Passes?   ╲ ───────▶│    Troubleshooting   │
                     ╲           ╱          └─────────────────────┘
                       ╲       ╱
                           │ Yes
                           ▼
                 ┌─────────────────────────────┐
                 │         Run ibic            │
                 └─────────────────────────────┘
Chapter 5                  │
                           ▼
                 ┌─────────────────────────────┐
                 │   Review Programming         │
                 │   Considerations             │
                 └─────────────────────────────┘
Software Reference         │
Manual, Function           ▼
Reference Manual  ( Write Application Program )
```

What You Need to Get Started

❑ One of the following boards:
   AT-GPIB
   AT-GPIB/TNT

❑ 3.5 in. NI-488.2M Distribution Disk for AT-GPIB & OS/2

❑ OS/2 version 2.0 or higher installed on your computer

Hardware Description

The AT-GPIB board, equipped with NAT4882 and Turbo488 ASICs, uses the NI-488.2M software to transform any ISA or EISA bus computer into a fully functional IEEE 488.2 Talker/Listener/Controller that has complete communications and bus management capability. The NAT4882 controller chip is fully compatible with the IEEE 488.2 standard. The Turbo488 performance-enhancing ASIC boosts GPIB read and write transfers to rates exceeding 1.3 MB/s.

The AT-GPIB/TNT board, equipped with the TNT4882C ASIC, also uses the NI-488.2M software to transform any ISA or EISA bus computer into a fully functional GPIB Talker/Listener/Controller that has complete communications and bus management capability. The TNT4882C chip combines the circuitry of the NAT4882 ASIC, the Turbo488 performance-enhancing ASIC, and GPIB transceivers to create a single-chip IEEE 488.2 Talker/Listener/Controller interface, which increases the maximum data transfer rate of the AT-GPIB/TNT to 1.6 MB/s.

The AT-GPIB/TNT board is fully compatible with all versions of AT-GPIB hardware. 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 A, *Specifications,* for more information about the GPIB hardware specifications and operating conditions.

Software Description

The NI-488.2M software package for OS/2 consists of a multitasking driver and utilities that transform a PC AT running OS/2 into a GPIB Controller with complete communications and bus management capabilities. The NI-488.2M package includes the following components:

❑ NI-488.2M driver

❑ Installation program

❑ Diagnostics

❑ Interactive GPIB control program

❑ Interactive configuration utility

❑ 16-bit and 32-bit C language interfaces

❑ OS/2 API function interface

❑ Sample programs that use NI-488 functions, NI-488.2 routines, and API calls

Because the NI-488.2M driver is completely compatible with the ANSI/IEEE Standard 488.2-1987, it is compatible with both IEEE 488 and IEEE 488.2 instruments. The NI-488.2M driver runs on National Instruments NAT4882/Turbo488-based GPIB hardware, such as the AT-GPIB, and on TNT4882C-based hardware, such as the AT-GPIB/TNT.

The NI-488.2M driver, `gpib.sys`, is a memory-resident program that exists in RAM. It is loaded as a device in the OS/2 configuration file, `config.sys`.

Hardware Configuration and Installation
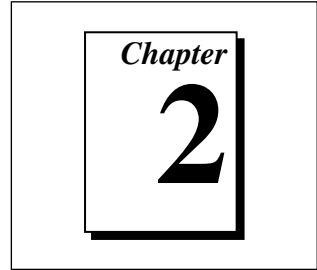
This chapter contains instructions to help you install and configure the AT-GPIB or AT-GPIB/TNT board.

⚠ **Caution:** *Electrostatic discharge can damage several components on your GPIB board. To avoid electrostatic damage when you handle the board, touch the antistatic plastic package to a metal part of your computer chassis before you remove the board from the package.*

Install the Hardware

You can install the GPIB board in any 16-bit expansion slot (AT-style) in your computer. The GPIB board does *not* work if you install it in an 8-bit expansion slot (PC-style). Consult the user manual or technical reference manual of your personal computer for specific instructions and warnings.

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 in an unused 16-bit slot with the IEEE 488 receptacle sticking out of the opening on the back panel. It may be a tight fit, but do not force the board into place.

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.
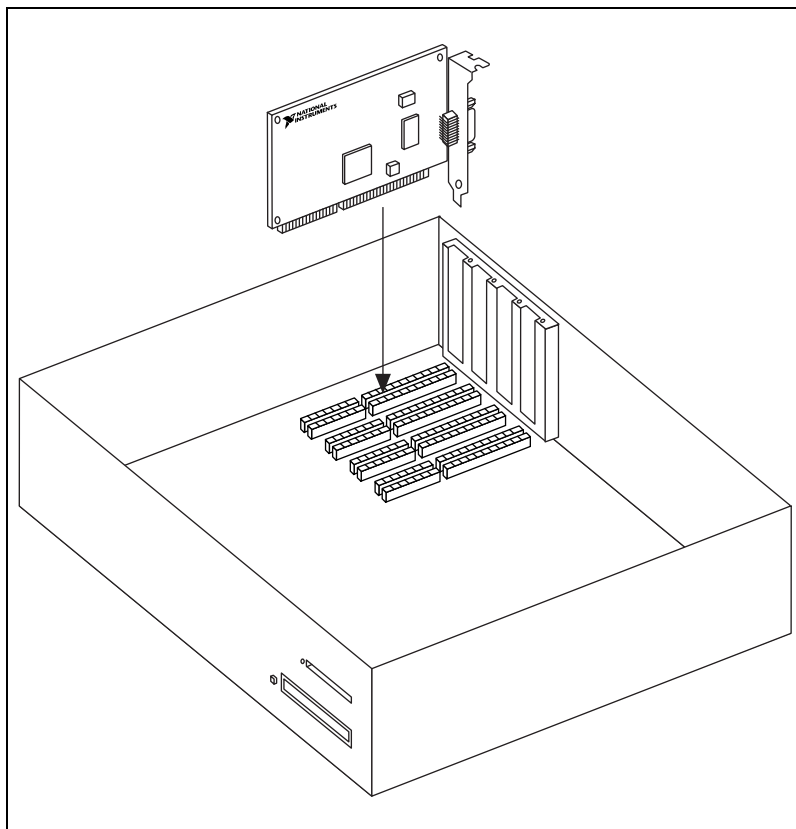
Figure 2-1. Installing the GPIB Board

Configure the Hardware (Optional)

The GPIB default settings for the base I/O address, interrupt line, and direct memory access (DMA) channel are suitable for many PC AT computer systems. However, if you know the GPIB default settings will conflict with another device in your system, follow the instructions in this section in order to change them.

If you change any GPIB hardware setting from the default, record the new setting on the *GPIB Hardware and Software Configuration Form* in Appendix C, *Customer Communication*, so you can refer to it when you install and configure the software.

Hardware Default Settings

Table 2-1 shows the factory settings and available configurations for the switches and jumpers on the GPIB board.

Table 2-1. Factory Default Settings and Available Configurations

Board Setting	Default	Available
Base I/O Address (hex)	2C0	100 to 3E0
DMA Channel	5	5, 6, 7, and Not Used
Interrupt Line (IRQ)	11	3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, and Not Used

Use the configuration jumpers and switches on the GPIB board to change the settings that could cause a conflict in your system. Figure 2-2 shows the location of the AT-GPIB configuration jumpers and switches.

1	Product Name and Revision Letter	5	Interrupt Level
2	Assembly Number	6	Base I/O Address (U25)
3	Serial Number	7	Shield Ground (W1)
4	DMA Channel		
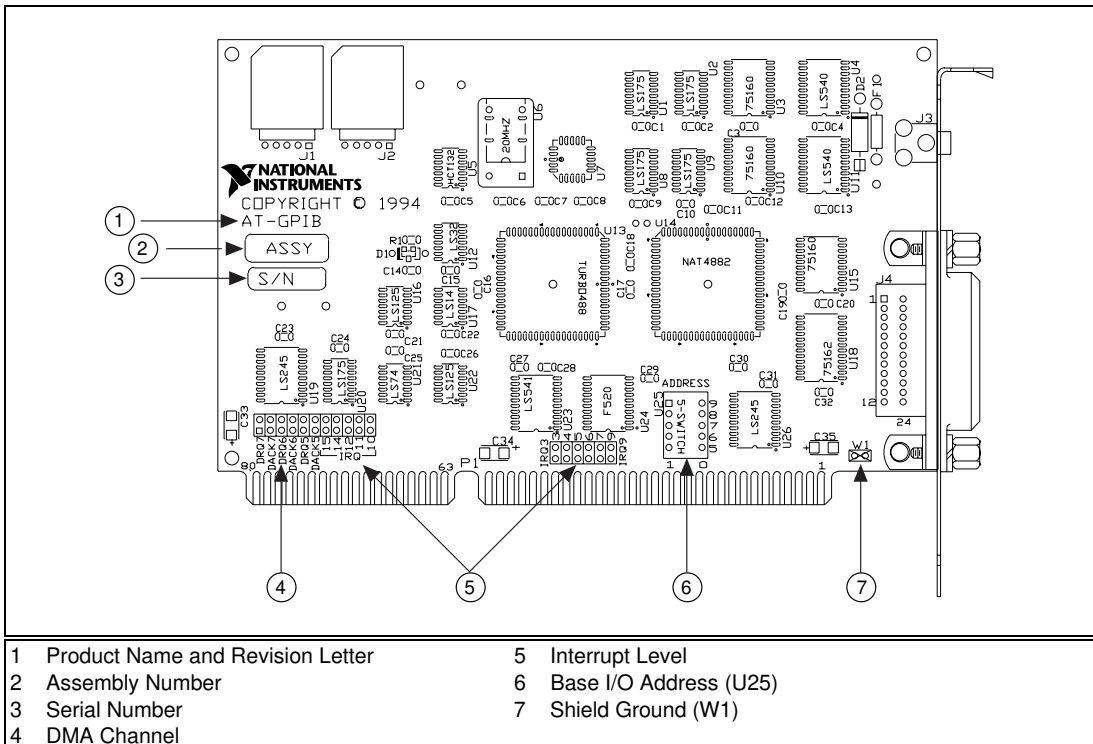
Figure 2-2. AT-GPIB Parts Locator Diagram

Figure 2-3 shows the location of the configuration jumpers and switches on the AT-GPIB/TNT board.

1	Product Name, Revision Letter, and Assembly Number	4	DMA Channel
2	Base I/O Address (SW1)	5	Interrupt Level
3	Serial Number	6	Shield Ground (W3)

Figure 2-3. AT-GPIB/TNT Parts Locator Diagram

Selecting the Base I/O

PC AT computers have a segment of memory reserved for input and output. This segment is called the I/O address space. Locate the base I/O address switch at U25 on your AT-GPIB board or SW1 on your AT-GPIB/TNT board. Refer to the parts locator diagram, Figure 2-2 or 2-3, respectively.

The switches are set at the factory for base I/O address 2C0 hex. The GPIB board uses the I/O address space 2C0 through 2DF hex with this setting. If you install more than one GPIB board in your computer, you must configure each board to use a unique base I/O address.

Table 2-2 shows the default GPIB board base I/O addresses for the NI-488.2M software.

Table 2-2. Default Base I/O Addresses

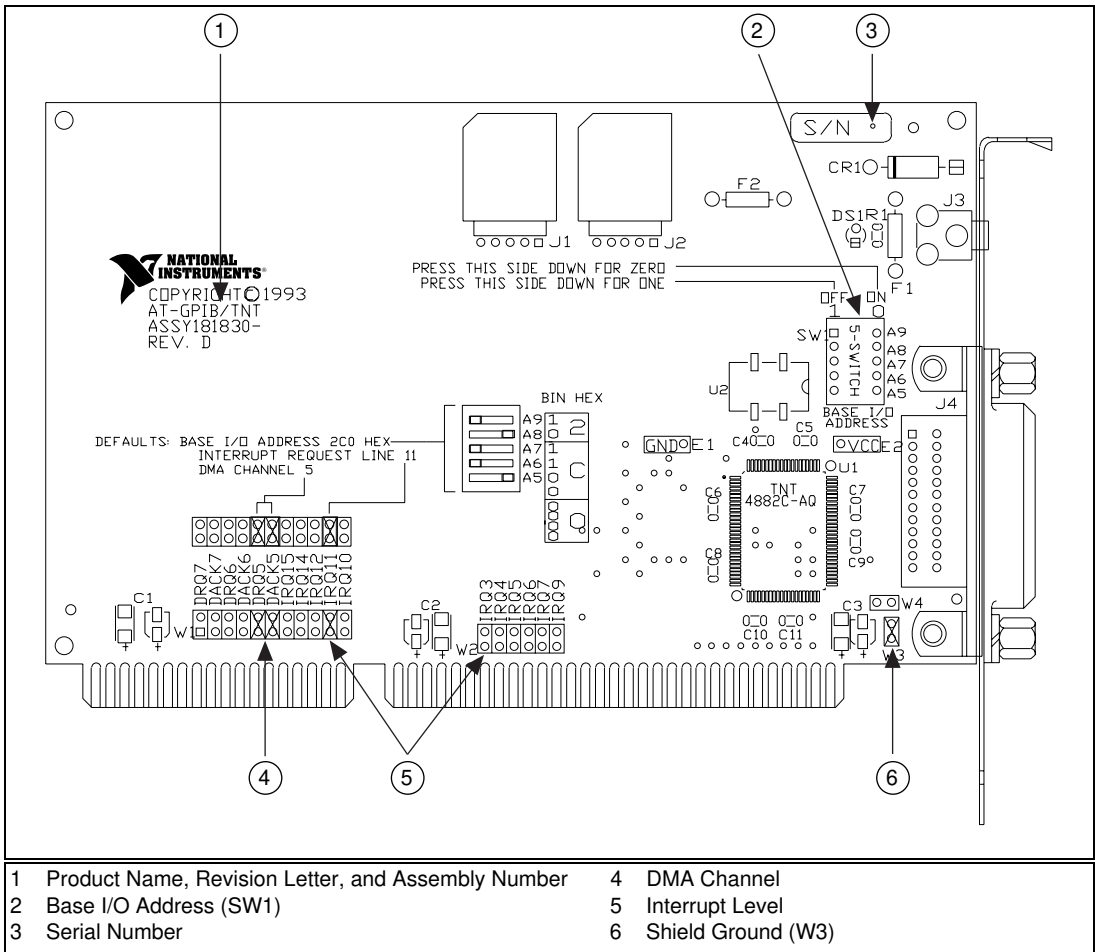| Board	Base Address
GPIB0	2C0
GPIB1	2E0
GPIB2	2E0
GPIB3	2E0

Verify that other equipment in your computer is not using the default GPIB base address. Refer also to Appendix B, *Additional Configuration Options*, to determine whether the GPIB base address you want to use is identical to the I/O address that another PC AT plug-in interface board and adapter may be using in your system. If any other device uses this address, change the base I/O address of either the GPIB board or the other device.

If you change the GPIB board address, use the ibconf utility to make a corresponding change to the NI-488.2M software. For more information about ibconf, refer to the *Configure the Software with ibconf (Optional)* section in Chapter 3, *Software Installation and Configuration*. Also, make a note of your new setting on the *GPIB Hardware and Software Configuration Form* in Appendix C, *Customer Communication*.

All possible base I/O addresses are multiples of 0x20 hex between 0x100 and 0x3E0. Table 2-3 lists the possible switch settings, the corresponding base I/O addresses, and the I/O address space used for each setting. The default setting is in ***bold italics***.

Table 2-3. Possible Base I/O Address Switch Settings

| Switch Setting | | | | | Base I/O | I/O Address Space |
A9	A8	A7	A6	A5	Address (hex)	Used (hex)
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
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

Press down on the OFF side 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 for the corresponding address bit. Refer to Figure 2-4 for an example of the base I/O address switch settings. Each address selection shows how the base I/O address was calculated from the switch positions.
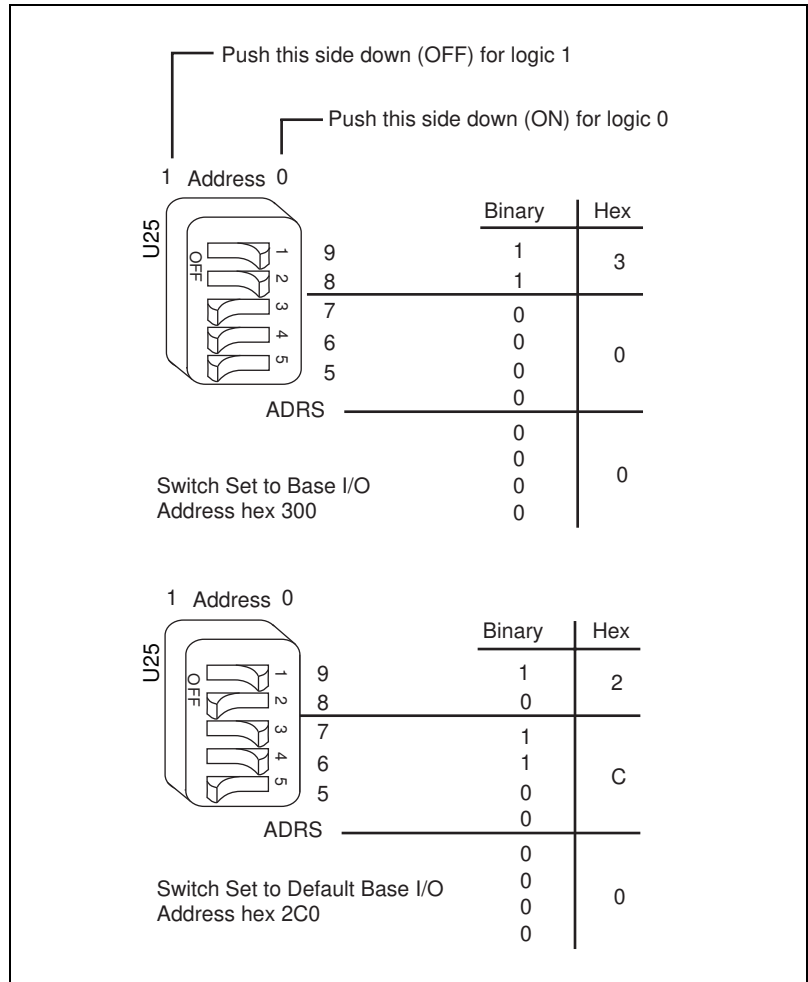

Figure 2-4. Base I/O Address Switch Settings

Selecting the Interrupt Request Line

PC AT 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-488.2M software use interrupts to get service from the CPU when necessary. As a result, the CPU can service other processes in the OS/2 multitasking environment.

The interrupt line is selected by the position of a jumper on one of two jumper locations that are above the I/O slot edge connector on the GPIB board. Figures 2-2 and 2-3 show the location of the two jumper sets you can use to make your interrupt request line selection.

The GPIB board uses interrupt line 11 by default. If you install more than one GPIB board in your computer, you must configure each board to use a unique interrupt request line. Table 2-4 shows the default GPIB board interrupt request levels for the NI-488.2M software.

Table 2-4. Default Interrupt Request Levels

Board	IRQ
GPIB0	11
GPIB1	10
GPIB2	10
GPIB3	10

Verify that other equipment in your computer is not using the default interrupt request line. Refer also to Appendix B, *Additional Configuration Options*, to determine whether the interrupt request line you want to use is identical to the interrupt line that another PC AT plug-in interface board and adapter may be using in your system. If any other device uses the same interrupt request line, you must change the interrupt request line that either the GPIB board or the other device uses.

If you change the interrupt request line, use the ibconf utility to make a corresponding change to the NI-488.2M software. For more information about ibconf, refer to the *Configure the Software with ibconf (Optional)* section in Chapter 3, *Software Installation and Configuration*. Also, make a note of your new setting on the *GPIB Hardware and Software Configuration Form* in Appendix C, *Customer Communication*.

The GPIB board can use one of 11 interrupt lines on the PC AT I/O channel. The interrupt lines that the GPIB board can use are IRQ3, 4, 5, 7, 9, 10, 11, 12, and 15.

☞ **Note:**   *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 need to change the interrupt line, place the jumper on the appropriate pins to enable a different interrupt line. For lines 10, 11, 12, or 15, use the jumper set shown in Figure 2-5. As mentioned previously, you should *not* select IRQ14. Figure 2-5 shows the default setting, IRQ11.
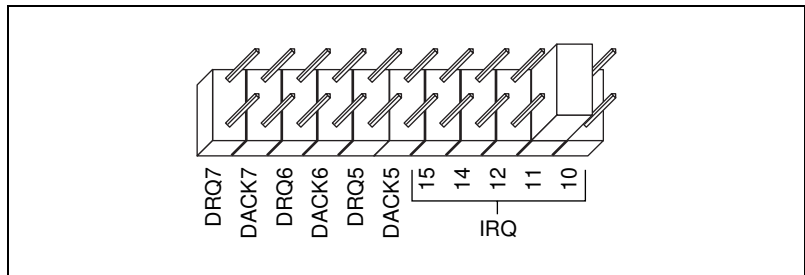

Figure 2-5. Interrupt Jumper Setting for IRQ11 (Default Setting)

For interrupt lines 3, 4, 5, 7, and 9, use the jumper set shown in Figure 2-6. As mentioned previously, you should *not* select IRQ6. Figure 2-6 shows the selection of IRQ5.
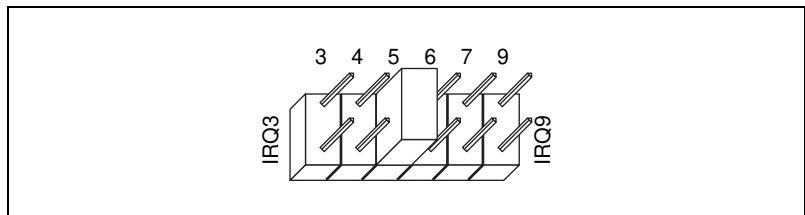

Figure 2-6. Interrupt Jumper Setting for IRQ5

If you do not want to use interrupts, you must logically disable interrupt levels on the GPIB board: run ibconf, select NONE for the interrupt level, and restart the computer. You do not need to move any jumpers. However, you may want to move or remove the jumper just to remind yourself that you are disabling interrupts. You can store the jumper on the board in the position shown in Figure 2-7.
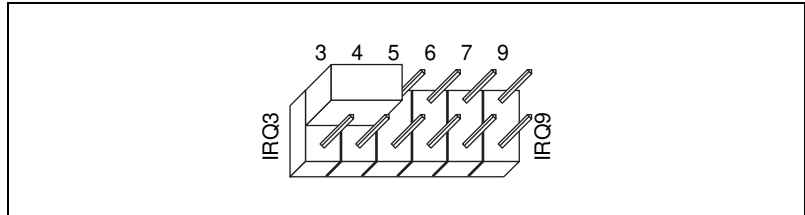
Figure 2-7. Interrupt Jumper Setting for Physically Disabling Interrupts

Selecting the DMA Channel

DMA refers to data transfers directly to or directly from devices such as the GPIB board and the computer memory. Your GPIB hardware and the NI-488.2M software are designed to perform DMA. Data transfers using DMA are significantly faster than programmed I/O data transfers that require the use of the CPU.

The GPIB board is set at the factory to use DMA channel 5. See Figure 2-2 or 2-3 for DMA channel location.

If you install more than one GPIB board in your computer, you must configure each board to use a unique DMA channel. Table 2-5 shows the default DMA channels for the NI-488.2M software.

Table 2-5. Default DMA Channels

Board	DMA
GPIB0	5
GPIB1	6
GPIB2	6
GPIB3	6

☞ **Note:** *DMA channels 5, 6, and 7 are the three 16-bit channels on the PC AT I/O channel. The GPIB board does not use and cannot be configured to use the 8-bit DMA channels on the PC AT I/O channel.*

Verify that other equipment in your computer is not using the default DMA channel. Refer also to Appendix B, *Additional Configuration Options*, to determine whether the DMA channel you want to use is identical to the DMA channel that another PC AT plug-in interface board and adapter may be using in your system. If any other device uses the same DMA channel, you must change the DMA channel that either the GPIB board or the other device uses.

If you change the DMA channel, use the ibconf utility to make a corresponding change to the NI-488.2M software. For more information about ibconf, refer to the *Configure the Software with ibconf (Optional)* section in Chapter 3, *Software Installation and Configuration*. Also, make a note of your new setting on the *GPIB Hardware and Software Configuration Form* in Appendix C, *Customer Communication*.

The GPIB board can use DMA channels 5, 6, and 7. Each DMA channel consists of two signal lines, as shown in Table 2-6.

Table 2-6. DMA Channels for the GPIB

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

You must position two jumpers to select a DMA channel. The DMA Acknowledge and DMA Request lines that you have selected must have the same numeric suffix for proper operation. Figure 2-8 displays the jumper position for selecting DMA channel 7.
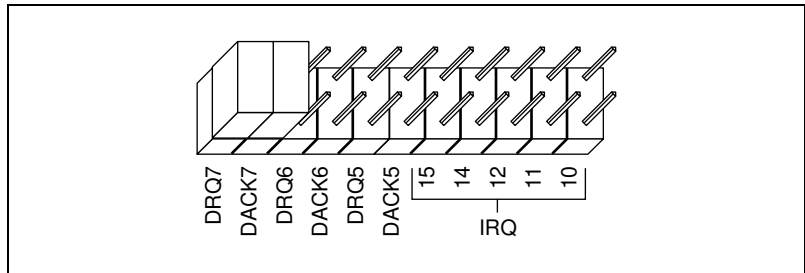
Figure 2-8. DMA Channel Jumper Setting for DMA Channel 7

Using Programmed I/O for GPIB Transfers

As an alternative, you can use programmed I/O GPIB transfers if you do not want to use DMA. To use programmed I/O, you need to logically disable DMA on the GPIB board: run ibconf, then select NONE for the DMA channel. You do not need to move any jumpers. However, you may want to move or remove the jumpers just to remind yourself that you are disabling DMA. You can store the jumpers on the board in the positions shown in Figure 2-9.
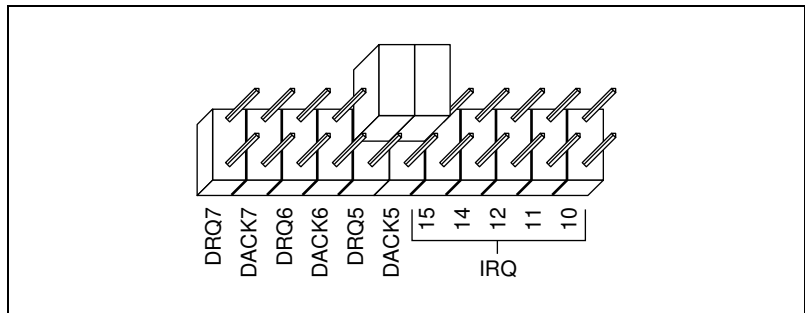
Figure 2-9. DMA Jumper Setting for No DMA Channel

Setting the Shield Ground Configuration

Connecting the GPIB logic ground to its shield ground minimizes EMI emissions. 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.

If your application requires that logic ground be disconnected from shield ground, remove the jumper (W3 for the AT-GPIB/TNT and W1 for the AT-GPIB) and place it across only one of the jumper pins. Remember to

Configuration Form in Appendix C, *Customer Communication*. Jumper settings for logic ground that is connected and disconnected from shield ground are shown in Figure 2-10.

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

Figure 2-10. Ground Configuration Jumper Settings

Software Installation and Configuration
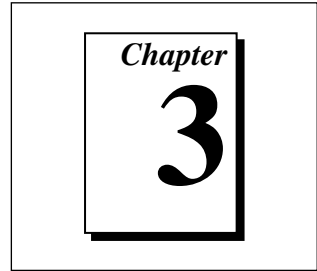
This chapter contains instructions to help you install and configure the NI-488.2M software.

Prepare to Install the Software

This section summarizes the contents of the NI-488.2M distribution disk. You should review this material to gain an understanding of the files and programs that make up your software package.
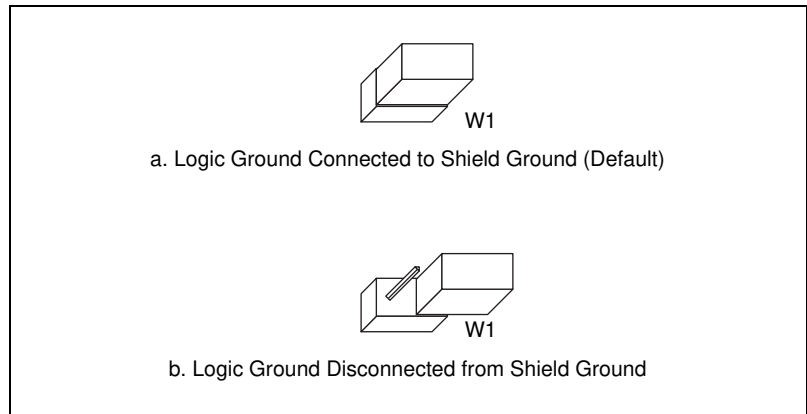
NI-488.2M Driver and Driver Utilities

The NI-488.2M driver and driver utilities consist of the following files:

- `readme.doc` is a documentation file containing important information that the manuals about the NI-488.2M software do not discuss.

- `gpib.sys` is the software driver file that the OS/2 operating system loads at system startup.

- `install.cmd` is an OS/2 command file that performs the installation. It does not modify your `config.sys` file.

- `gpib.ddp` is a device driver profile. The OS/2 command `ddinstal` uses this file to control the installation process.

- `ibic.exe` is an interactive control program that you use to communicate with the GPIB devices interactively using NI-488 functions and NI-488.2 routines. `ibic.exe` helps you learn the functions, program your instrument or other GPIB devices, and develop NI-488.2M application programs.

- `ibconf.exe` is a software configuration program that you can use to change the configuration parameters that the NI-488.2M driver uses.

- `ibtest.exe` is a software installation test program.

Language-Related Files

In addition to the NI-488.2M driver and utilities, the distribution disk also contains the following language-related files:

- `readme.doc` is a documentation file that contains information about the language interfaces.

- `ni488.dll` is a 32-bit IBM C language interface dynamic link library (DLL) file.

- `nibor.dll` is a 32-bit Borland C language interface DLL file.

- `ni488_16.dll` is a 16-bit Microsoft C language interface DLL file.

- `ni488.lib` is an import library for the 32-bit IBM C language interface that you must link with your IBM C applications.

- `nibor.lib` is an import library for the 32-bit Borland C language interface that you must link with your Borland C application.

- `ni488_16.lib` is an import library for the 16-bit Microsoft C language interface that you must link with your Microsoft C applications.

- `decl.h` is a 32-bit include file. It contains NI-488 functions and NI-488.2 routine prototypes and various predefined constants.

- `decl_16.h` is a 16-bit include file. It contains NI-488 functions and NI-488.2 routine prototypes and various predefined constants.

Example Program Files

The distribution disk contains the following example program files:

- `simple.c` is a C program that illustrates basic communication between a computer and a GPIB device.

- `clr_trg.c` is a C program that illustrates how to clear or trigger GPIB devices.

- `asynch.c` is a C program that illustrates how to perform asynchronous I/O.

- `rqs.c` is a C program that illustrates device requests using NI-488 functions.

- `easy4882.c` is a C program that illustrates basic communication with IEEE 488.2 compliant devices using NI-488.2 routines.

- `eos.c` is a C program that shows the use of the end-of-string character.

- `rqs4882.c` is a C program that illustrates serial polls using NI-488.2 routines.

- `ppoll.c` is a C program that illustrates parallel polls using NI-488.2 routines.

- `non_cic.c` is a C program that illustrates communication when the GPIB board is not the Controller.

API-Related Files

The distribution disk contains the following API-related files:

- `readme.api` is a documentation file that contains information about the OS/2 API functions.

- `nicode.h` is a C language declaration file that contains definitions of API Control function codes and other GPIB-related constant and structure definitions.

- `nictl_32.h` is a C language declaration file that contains a macro definition. You can use this definition in place of the `DosDevIOCtl` definition for applications that use 32-bit compilers.

- `nictl_16.h` is a C language declaration file that contains a macro definition. You can use this definition in place of the `DosDevIOCtl` definition for applications that use 16-bit compilers.

- `dsamp_32.c` is a 32-bit C sample program that uses API device-level functions.

- `dsamp_16.c` is a 16-bit C sample program that uses API device-level functions.

- `bsamp_32.c` is a 32-bit C sample program that uses API board-level functions.

- `bsamp_16.c` is a 16-bit C sample program that uses API board-level functions.

Install the Software

You can install the NI-488.2M software in either of the following ways:

- Using the OS/2 system installation utility ddinstal

- Using the install command found on the NI-488.2M distribution disk

The following sections describe the two installation methods.

Install the Software by Using ddinstal

ddinstal.exe is an OS/2 system utility program you can use to install an external device driver. The program accesses the gpib.ddp device driver profile file for information about installing the NI-488.2M software.

Step 1. Prepare to Install the Software

The partition you are using for installation must have approximately 590 KB of free space in order to hold a copy of the software that is contained on the NI-488.2M distribution disk.

Step 2. Run ddinstal

Start your computer and complete the following steps.

1. Enter ddinstal at the OS/2 command prompt to install the software.

2. You are prompted to select the source directory and the destination directory. The source directory indicates the floppy drive where you inserted the NI-488.2M distribution disk. The destination directory refers to the drive where you want to install the software. If you want to change either of these directories, click on the **Change** button. Select new directories and press the **Set** button. After you select the source and destination directories, click on the **Install** button.

3. You are prompted to select a device. Press the spacebar, then press the <Enter> key or click on the **OK** button.

ddinstal creates a directory named at-gpib on the destination drive and copies the files from the NI-488.2M distribution disk into this directory.

`ddinstal` automatically adds the following statement to the
`config.sys` file:

`DEVICE=`y`:\AT-GPIB\GPIB.SYS`

where y is the letter of the destination drive.

When the installation is complete, click on the **Exit** button to exit
`ddinstal`. You are prompted to perform a shutdown of the system and
restart the computer before the changes can take effect. Press the **OK**
button, but perform Step 3 to edit your system configuration file before
proceeding to Step 4 to shut down and restart the computer.

Step 3. Edit Your System Configuration File

Before you use the software, you must include the pathname of the
language interface DLL file in your library path. Include the pathname
to the `LIBPATH` statement in your `config.sys` file:

y`:\at-gpib\c`

where y is the letter of the destination drive.

Step 4. Restart Your Computer

After `ddinstal` installs the device driver, you are prompted to restart
the computer. You must perform this step to complete the installation of
the NI-488.2M driver. To restart the computer, you must shutdown the
system. Refer to the *OS/2 Using the Operating System* manual for
instructions on how to perform a shutdown.

If the software is installed correctly, the following information appears,
including the current version number and version date:

National Instruments AT-GPIB NI-488.2M Version 2.*x*
Driver for OS/2

Version Date : *xx/xx/xx*

Copyright 199*x* National Instruments Corporation

Install the Software by Using install

You can use the install command as an alternative method of installing the NI-488.2M software. The install command is located on the NI-488.2M distribution disk.

Step 1. Prepare to Install the Software

The hard disk must have approximately 590 KB of free space to hold a copy of the software contained on the NI-488.2M distribution disk.

Step 2. Run install

Run the install program according to the instructions in the following paragraphs.

Accessing install

Start the computer, switch to an OS/2 command prompt, then insert the NI-488.2M distribution disk in your disk drive. Enter the letter of the disk drive where the NI-488.2M distribution disk is inserted, enter a colon, then press <Enter>. To install the NI-488.2M software, enter the following command:

```
install y:
```

where *y* is the letter of the destination drive where you want to install the software.

Running install

The install command creates the at-gpib directory, if required, and copies the files from the NI-488.2M distribution disk to the directory you selected in the previous step.

If the **insufficient disk space** message appears, abort the installation by pressing <Control-Break>. Increase the free space on your destination drive by moving or deleting some files and running install again.

Step 3. Edit Your System Configuration File

To install the GPIB device driver, you must include the name of the drive in a device statement in the system configuration file, `config.sys`. Include the name of the drive by entering the following line in your `config.sys` file:

```
device=y:\at-gpib\gpib.sys
```

where *y* is the letter of the drive where the driver is installed. The file `gpib.sys` is the name of the NI-488.2M driver.

Before you use the software, you must include the pathname of the language interface DLL file in your library path. Include the pathname by adding the following line to the `LIBPATH` statement in your `config.sys` file:

```
y:\at-gpib\c
```

where *y* is the letter of the destination drive.

Step 4. Restart Your Computer

You must perform this step to complete the installation of the GPIB device driver. To restart the computer, you must shutdown the system. Refer to the *OS/2 Using the Operating System* manual for instructions on how to perform a shutdown.

If the software is installed correctly, the following information appears, including the current version number and version date:

```
National Instruments AT-GPIB NI-488.2M Version 2.x
Driver for OS/2

Version Date : xx/xx/xx

Copyright 199x National Instruments Corporation
```

This message does not appear if you did not edit your system configuration file, as described in the previous step, before you perform a shutdown of the system.

Configure the Software with ibconf (Optional)

You can use `ibconf`, a screen-oriented, interactive utility, to view or modify the default configuration parameters of the NI-488.2M software or the GPIB interface board and/or the devices connected to it. You must use `ibconf` if you have made any changes to the GPIB hardware settings.

You can use `ibconf` to *interactively* edit the memory-resident driver, the driver file on your disk, or your configuration data file—depending on which you select. To modify and query the board and device characteristics *dynamically*, use the `ibconfig` and `ibask` functions in your application. Refer to Chapter 1, *NI-488 Functions*, of the *NI-488.2M Function Reference Manual for OS/2* for more information on the `ibconfig` and `ibask` functions.

To run `ibconf`, change to the directory where the NI-488.2M software is installed (the default is `at-gpib`) and enter the following command:

```
ibconf
```

The `ibconf` utility scans either the file or memory-resident driver you select and displays device and board characteristics. Before you exit the program, it checks for situations that might cause problems, such as the following:

- GPIB addressing conflict between a device and its access board
- Timeouts set to `NONE` on a device or board
- GPIB board not present at the base address
- Interrupt levels set the same for two or more boards

If `ibconf` encounters any of these situations, the program alerts you and gives you the option of re-entering or exiting `ibconf`. To disable automatic checking of the above situations when starting `ibconf`, enter the following command:

```
ibconf -e
```

If you want the changes you made in `ibconf` to take effect without having to restart your computer, select `yes` in the `Copy changes to memory-res?` field of the output selection level of `ibconf`. However, if you change the interrupt request line, device name, or *in use* status of a board, you must save these changes to the driver file on your disk and restart your computer for those changes to take effect.

After you have made any necessary changes, exit ibconf by pressing the <F9> function key or the <Esc> key. The program first asks if it should **Save configuration?** before exiting. Type a y response to save the changes to the memory-resident driver, driver file, or a configuration file—depending on where you want to save the changes.

For more information about ibconf, refer to the *NI-488.2M Software Reference Manual for OS/2.*

Chapter

4

Installation Verification

This chapter describes how you can verify and test the installation of your NI-488.2M software and AT-GPIB/TNT or AT-GPIB board. Refer also to Chapter 4, *Debugging Your Application*, of the *NI-488.2M Software Reference Manual for OS/2* for more information.

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-488.2M software. The ibtest program is an NI-488.2M application that makes calls to the driver just as your application does.

Disconnect any GPIB cables and run ibtest by entering the following command:

```
ibtest
```

If ibtest completes with no errors, you have installed the NI-488.2M software correctly.

The remainder of this section discusses common situations or error messages that ibtest generates. If any of these problems or error messages appear, take the recommended action.

☞ **Note:** *In the following paragraphs,* GPIB*x* *refers to board* GPIB0*,* GPIB1*,* GPIB2*, or* GPIB3*, as appropriate.*

Presence Test of Driver

The following message appears in response to any of four situations:

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

- The `ibtest` program always tries to test for four GPIB boards. In most cases, you have fewer than four boards installed in your computer. The above message appears when `ibtest` tries to test a board that does not exist. You can ignore this message when it applies to a nonexistent board.

- The GPIB driver might not be installed. To correct this situation, make certain that the line `device=y:\at-gpib\gpib.sys`—where *y* refers to the letter of the drive where the NI-488.2M software is installed—is in your `config.sys` file, then reboot.

- The **Use this GPIB Interface** field in `ibconf` might be set to **NO** for board GPIB*x*. If you want to use this board, you must set this field to **YES**.

- GPIB*x* might be configured to use the same interrupt level that is already used by another device in the system. This situation would cause a conflict that would prevent the driver from installing GPIB*x*. Try a different interrupt level and make certain that the hardware and software are configured to use the same level.

Presence Test of GPIB Board

The following error message appears if GPIB*x* is not installed or if it is not configured at the base I/O address that the driver expects:

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

Check that the board is properly installed in your computer and run `ibconf` to make certain that the driver is configured to use the same base I/O address as the board.

Incorrect Interrupt Level

The `ibtest` program outputs dots, then hangs if the GPIB board under test is installed but configured to use an incorrect interrupt level. Run `ibconf` to configure the driver to use the correct interrupt level.

GPIB Cables Connected

The following error message appears if a GPIB cable is connected to the board when you run `ibtest`:

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

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

Disconnect all GPIB cables before trying the test again.

Examine the GPIB Installation Information File

The NI-488.2M software creates an information file in the root directory of the disk that contains OS/2. This file, `gpibinst.inf`, summarizes the state of the NI-488.2M driver after it has been loaded at boot time.

The NI-488.2M driver checks for the following problems at startup and stores the results of its examination in the installation information file. If any of these messages appear, take the corresponding action as recommended:

> **Warning: You are using a 488.1 board. Please contact National Instruments for upgrade information.**

The NI-488.2M software is compatible with only the National Instruments IEEE 488.2 hardware having the NAT4882/Turbo488 chip combination. Contact National Instruments for hardware upgrade information if you have an IEEE 488.1 board.

> **Warning: There is NO board at the given base address.**

The driver alerts you with this message if no GPIB board is installed or if the GPIB board is not configured at the base I/O address that the driver expects. Install a GPIB board in your computer and run ibconf to make sure that the driver is configured to use the same base I/O address that the board is using.

`Interrupt conflicts. Try a different interrupt level.`

If another device uses the same interrupt level that the NI-488.2M driver is configured to use, the NI-488.2M driver does not load. Try a different interrupt level and make sure that the hardware and software are configured to use the same interrupt level.

Using Your NI-488.2M Software
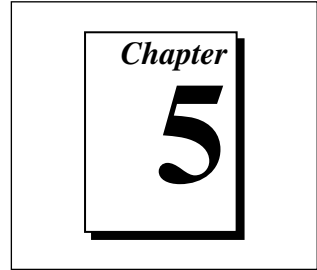
This chapter includes a brief explanation of the `ibic` utility and discusses programming considerations for your NI-488.2M software.

Introduction to ibic

The `ibic` (Interface Bus Interactive Control) utility is included with your NI-488.2M software. You can use `ibic` to enter NI-488 functions and NI-488.2 routines interactively and to display the results of the function call automatically. Without writing an application, you can use `ibic` to accomplish any of the following:

- Verify GPIB communication with your device quickly and easily

- Learn the syntax of the NI-488 functions and NI-488.2 routines before writing your application

- Become familiar with the commands of your device

- Receive data from your GPIB device

For more information about `ibic`, refer to the *NI-488.2M Software Reference Manual for OS/2*.

Programming Considerations

The NI-488.2M software contains 32-bit compatible C language interfaces and a 16-bit compatible C language interface. Two 32-bit C language interfaces are included with the NI-488.2M software. The 32-bit IBM C language interface consists of a DLL called `ni488.dll`, an import library called `ni488.lib`, and an include file called `decl.h`. The 32-bit Borland C language interface consists of a DLL called `nibor.dll`, an import library called `nibor.lib`, and an include file called `decl.h`. The 16-bit Microsoft C version 6.0 language interface contains a DLL called `ni488_16.dll`, an import library called

`ni488_16.lib`, and an include file called `decl_16.h`. The import library is used to reference the DLL for the NI-488 functions and NI-488.2 routines and needs to be linked with your compiled GPIB application.

Before you attempt to compile and link an NI-488.2M application, verify that the `LIBPATH` configuration command in the `config.sys` file includes the full pathname of the DLL you are using (`ni488.dll` or `nibor.dll`). For example, if the DLL you are using is in a directory `d:\at-gpib\c`, the `LIBPATH` configuration command may appear as follows:

```
LIBPATH =.;D:\OS2\DLL;D:\OS2\MDOS;D:\;d:\at-gpib\c;
```

Also verify that the `SET LIB` configuration command in the `config.sys` file includes the full pathname of the import library you are using (`ni488.lib`, `nibor.lib`, or `ni488_16.lib`). For example, if the import library is in a directory `d:\at-gpib\c`, the `LIBPATH` configuration command may appear as follows:

```
SET LIB = D:\TOOLKT20\OS2LIB;D:\CSET2\LIB;d:\at-gpib\c;
```

Refer to the *NI-488.2M Software Reference Manual for OS/2* and the *NI-488.2M Function Reference Manual for OS/2* for a more detailed description of programming considerations, programming examples, and function syntax.

Using the 32-Bit C Language Interface

Complete the following steps to compile and link an NI-488.2M application using IBM C (32-bit C compiler) for OS/2.

1. Include the following C statement at the beginning of your application program:

   ```
   #include "decl.h"
   ```

2. Compile your application program by using the following command:

   ```
   icc /c cprog.c
   ```

3. Use the following command to link your compiled program with the NI-488.2M 32-bit IBM C language interface:

   ```
   link386 /NOI cprog.obj,,,ni488.lib;
   ```

Complete the following steps to compile and link an NI-488.2M application using Borland C (32-bit C compiler) for OS/2.

1. Include the following C statement at the beginning of your application program:

   ```
   #include "decl.h"
   ```

2. Compile your application program using the following command:

   ```
   bcc /c cprog.c
   ```

3. Use the following command to link your compiled program with the NI-488.2M 32-bit Borland C language interface:

   ```
   tlink /c /Toe c02.obj cprog.obj,,,os2.lib
   c2mti.lib nibor.lib;
   ```

Using the 16-Bit C Language Interface

Complete the following steps to compile and link an NI-488.2M application using Microsoft C 6.0 (16-bit C compiler) for OS/2.

1. Include the following C statement at the beginning of your application program:

   ```
   #include "decl_16.h"
   ```

2. Compile your application program by using the following C command:

   ```
   cl /c cprog.c
   ```

3. Use the following command to link your compiled program with the NI-488.2M 16-bit Microsoft C version 6.0 language interface:

   ```
   link /NOI cprog.obj,,,ni488_16.lib;
   ```

Specifications
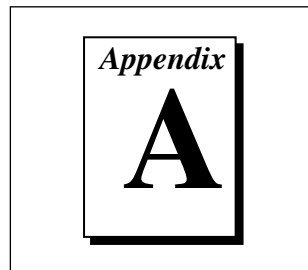
This appendix describes the electrical, physical, and environmental characteristics of the AT-GPIB and AT-GPIB/TNT boards and the recommended operating conditions.

Table A-1. Electrical Characteristics for the AT-GPIB

Characteristic	Specification
Maximum GPIB Transfer Rates: 3-Wire (IEEE 488)	 1.3 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 due to system and instrumentation capabilities.	

Table A-2. Electrical Characteristics for the AT-GPIB/TNT

Characteristic	Specification

Maximum GPIB Transfer Rate:
 	
   3-Wire (IEEE 488)
   High Speed (HS488)
	
	1.3 Mbytes/s*
	1.6 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 due to system and instrumentation capabilities.	

Table A-3. Physical Characteristics for the AT-GPIB and AT-GPIB/TNT

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

Table A-4. Environmental Characteristics for the AT-GPIB and AT-GPIB/TNT

Characteristic	Specification

Operating Environment:
 	
  Component Temperature
  Relative Humidity
	0° to 55° C
	10% to 90%, noncondensing

Storage Environment:
 	
  Temperature
  Relative Humidity
	−20° to 70° C
	5% to 90%, noncondensing

EMI	FCC Class B Certified

Additional Configuration Options
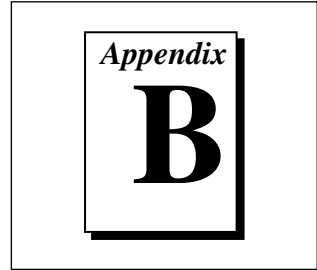
This appendix contains information about hardware settings used by many other PC AT plug-in interface boards and adapters that may be in your system. You can use this information in conjunction with the material in Chapter 2, *Hardware Configuration and Installation*, to avoid potential conflicts with the default hardware settings used by the GPIB board.

A conflict can result in a variety of problems. It might prevent the computer from starting or it might cause erratic behavior after the computer has been running.

In its default settings, the GPIB board uses base I/O address 2C0 (hex), interrupt line 11, and DMA Channel 5. If these settings conflict with the settings of any other devices in your system, you need to decide whether to change the settings on the GPIB board or on the other devices. Many of the other devices cannot be reconfigured, meaning that you will have to modify the settings of the GPIB board.

Record any new settings on the *GPIB Hardware and Software Configuration Form* in Appendix C, *Customer Communication*.

Base I/O Address Options

Before you change the default setting of the base I/O address of the GPIB board, you must first ensure that the new address is not already used by any other equipment installed in your computer.

The *Selecting the Base I/O Address* section of Chapter 2, *Hardware Configuration and Installation*, describes how to change the switch settings. Remember that if you change the GPIB board's address, you must also use the ibconf utility to make a corresponding change to the NI-488.2M software.

Table B-1 lists some of the I/O addresses used by other PC AT plug-in interface boards and adapters. This list is not complete, but it might help you determine possible address conflicts.

Table B-1. Base I/O Addresses Used by Other PC AT Devices

I/O Address Range (Hex)	Device
100 to 1EF	
1F0 to 1F8	IBM PC AT Fixed Disk
200 to 20F	PC and PC AT Game Controller, reserved
208	LIM Expanded Memory Card
210 to 217	PC Expansion Unit
210 to 213	AT-DIO-24
218	LIM Expanded Memory Card
219 to 21E	
21F	Reserved
220 to 23F	AT-MIO-16
240 to 25F	AT-DIO-32F
248	LIM Expanded Memory Card
258	LIM Expanded Memory Card
260 to 27F	Lab-PC+ (default)
259 to 267	
268	LIM Expanded Memory Card
269 to 277	
278 to 27F	AT Parallel Printer Port 2
280 to 29F	WD EtherCard+ (default)
2A0 to 2A7	
2A8	LIM Expanded Memory Card
2A9 to 2AF	
2B0 to 2DF	PC, AT EGA (alternate)
2B8	LIM Expanded Memory Card
2B9 to 2BF	
2C0 to 2DF	AT-GPIB board 0 (default)
2E0 to 2FF	AT-GPIB board 1 (default)
2E1	IBM GPIB Adapter 0, GPIB-PCIIA 0 (base)

Table B-1. Base I/O Addresses Used by Other PC AT Devices (Continued)

I/O Address Range (Hex)	Device
2E2 to 2E3	IBM Data Acquisition Adapter 0
2E4 to 2E7	
2E8	LIM Expanded Memory Card
2E9 to 2F7	
2F8 to 2FF	PC, AT Serial Port 2 (COM2)
300 to 31F	PC, AT Prototype card
300 to 30F	3Com EtherLink (default)
320 to 32F	IBM PC/XT Fixed Disk Controller
330 to 347	
348 to 357	DCA 3278
358 to 35F	
360 to 363	PC Network (low address)
364 to 367	Reserved
368 to 36B	PC Network (high address)
36C to 36F	Reserved
370 to 377	
378 to 37F	PC, AT Parallel Printer Port 1
380 to 38C	SDLC Communications
380 to 389	Bisynchronous (BSC) Communications (alternate)
390 to 393	Cluster Adapter 0
394 to 39F	
3A0 to 3A9	Bisynchronous (BSC) Communications (primary)
3AA to 3AF	
3B0 to 3BF	Monochrome Display/Parallel Printer Adapter 0
3C0 to 3CF	Enhanced Graphics Adapter, VGA
3D0 to 3DF	Color/Graphics Monitor Adapter, VGA
3E0 to 3EF	
3F0 to 3F7	Diskette Controller
3F8 to 3FF	Serial Port 1 (COM1)

Interrupt Request Line Options

Before you change the default setting of the GPIB interrupt request line, you must first ensure that the new level is not already used by any other equipment installed in your computer.

☞ **Note:** *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.*

The *Selecting the Interrupt Request Line* section of Chapter 2, *Hardware Configuration and Installation*, describes how to change the switch settings. Remember that if you change the GPIB interrupt request line, you must also use the ibconf utility to make a corresponding change to the NI-488.2M software.

Table B-2 lists some of the interrupt request lines used by other PC AT plug-in interface boards and adapters. This list is not complete, but it might help you determine possible interrupt request line conflicts.

Table B-2. Interrupt Request Lines Used by Other PC AT Devices

IRQ	Device
15	Reserved
14	Fixed Disk Controller
13	Coprocessor
12	AT-DIO-32F (default)
11	AT-DIO-32F (default) AT-GPIB board 0 (default)
10	AT-MIO-16 (default) AT-GPIB board 1 (default)
9	PC Network (default) PC Network Alternate (default)
8	Real Time Clock
7	Parallel Port 1 Data Acquisition and Control (default) IBM GPIB Adapter (default) GPIB-PCIIA (default)

Table B-2. Interrupt Request Lines Used by Other PC AT Devices (continued)

IRQ	Devices
6	Diskette Controller Fixed Disk and Diskette Drive
5	Parallel Port 2 AT-DIO-24 (default) Lab-PC+ (default)
4	Serial Port 1 BSC BSC Alternate SDLC
3	Serial Port 2 BSC BSC Alternate Cluster (Primary) PC Network (default) PC Network Alternate (default) SDLC WD EtherCard+ (default) 3Com EtherLink (default)
2	IRQ8-15 Chain (from Interrupt Controller 2)
1	Keyboard Controller Output Buffer Full
0	Timer Channel 0 Output

DMA Channel Options

Before you change the default setting of the GPIB DMA channel, you must first ensure that the new channel is not already used by any other equipment installed in your computer.

The GPIB board is set at the factory to use DMA channel 5. Channels 5, 6, and 7 are the three 16-bit channels on the PC AT I/O channel. The GPIB board cannot be configured to use the 8-bit DMA channels (1, 2, or 3).

The *Selecting the DMA Channel* section of Chapter 2, *Hardware Configuration and Installation*, describes how to change the switch settings. Remember that if you change the GPIB DMA channel, you must

also use the `ibconf` utility to make a corresponding change to the NI-488.2M software.

Table B-3 lists some of the DMA channels used by other PC AT plug-in interface boards and adapters. This list is not complete, but it might help you determine possible DMA channel conflicts.

Table B-3. 16-Bit DMA Channels Used by Other PC AT Devices

DMA	Device
7	AT-MIO-16 (default)
6	AT-MIO-16 (default) AT-GPIB board 1 (default) AT-DIO-32F (default)
5	AT-DIO-32F (default) AT-GPIB board 0 (default)
4	Cascade for DMA Controller # 1 (channels 0-3)

Appendix

C

Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve technical problems and a form you can use to comment on the product documentation. When you contact us, we need the information on the Technical Support Form and the configuration form, if your manual contains one, about your system configuration to answer your questions as quickly as possible.

National Instruments has technical assistance through electronic, fax, and telephone systems to quickly provide the information you need. Our electronic services include a bulletin board service, an FTP site, a fax-on-demand system, and e-mail support. If you have a hardware or software problem, first try the electronic support systems. If the information available on these systems does not answer your questions, we offer fax and telephone support through our technical support centers, which are staffed by application engineers.

Electronic Services

Bulletin Board Support

National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call (512) 795-6990. You can access these services at:

United States: (512) 794-5422
    Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
    Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 01 48 65 15 59
    Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as `anonymous` and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.

Fax-on-Demand Support

Fax-on-Demand is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access Fax-on-Demand from a touch-tone telephone at (512) 418-1111.

E-Mail Support (currently U.S. only)

You can submit technical support questions to the applications engineering team through e-mail at the Internet address listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

support@natinst.com

Telephone and Fax Support

National Instruments has branch offices all over the world. Use the list below to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.

	Telephone	Fax
Australia	03 9879 5166	03 9879 6277
Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	905 785 0085	905 785 0086
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	09 725 725 11	09 725 725 55
France	01 48 14 24 24	01 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Israel	03 5734815	03 5734816
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	5 520 2635	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
United Kingdom	01635 523545	01635 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 _____

Title _____

Company _____

Address _____

_____

Fax (____) _____   Phone (____) _____

Computer brand _____   Model _____   Processor _____

Operating system (include version number) _____

Clock 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 Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use 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.

National Instruments Products

GPIB Board and Revision Number

— AT-GPIB/TNT Board Revision   _____

or

— AT-GPIB Board Revision   _____

NI-488.2M Software for OS/2 Revision Number on Disk   _____

Programming Language Interface Version   _____

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   _____

OS/2 Version   _____

Application Programming Language (Microsoft C, and so on)   _____

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-488.2M™ Software for OS/2*

Edition Date: June 1997

Part Number: 370949A-01

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

_____
_____
_____
_____
_____
_____
_____

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

_____
_____
_____
_____
_____
_____
_____

Thank you for your help.

Name _____

Title _____

Company _____

Address _____

_____

Phone (____) _____ Fax   (_____) _____

Mail to: Technical Publications   **Fax to:**   Technical Publications
National Instruments Corporation   National Instruments Corporation
6504 Bridge Point Parkway   (512) 794-5678
Austin, TX 78730-5039

Prefix	Meaning	Value
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}

°	degrees
%	percent
A	amperes
ANSI	American National Standards Institute
API	Application Program Interface
ASIC	Application Specific Integrated Circuit
C	Celsius
CPU	central processing unit
DACK	DMA acknowledge line
DLL	dynamic link library
DMA	direct memory access
DRQ	DMA request line
EMI	electromagnetic interference
FCC	Federal Communications Commission
GPIB	General Purpose Interface (IEEE 488) Bus
hex	hexadecimal
Hz	hertz
I/O	input/output
ibic	Interface Bus Interactive Control
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
IRQ	interrupt request line
MB	megabytes of memory

OS/2	IBM Operating System/2
PC	personal computer
RAM	random-access memory
s	seconds
VDC	volts direct current