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

October 1994 Edition

Part Number 320808A-01

Limited Warranty

The AT-GPIB/TNT is 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.

FCC/DOC Radio Frequency
Interference Compliance

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

Federal Communications Commission

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

Canadian Department of Communications

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

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

Instructions to Users

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

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

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

- Operate the equipment and the receiver on different branches of your AC electrical system.

- Move the equipment away from the receiver with which it is interfering.

- Reorient or relocate the receiver's antenna.

- Be sure that the equipment is plugged into a grounded outlet and that the grounding has not been defeated with a cheater plug.

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

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

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.

Contents

Chapter 5
Using Your NI-488.2M Software

Appendix A
Hardware Specifications

Appendix B
Customer Communication

Glossary

Figures

Tables

About This Manual

This manual contains instructions to help you install and configure the National Instruments AT-GPIB or AT-GPIB/TNT interface board and the NI-488.2 multitasking software (NI-488.2M) driver for the LynxOS operating system, version 2.1 and higher. The hardware and software are intended for use on personal computers equipped with an Intel 386 or an Intel 486 processor and an ISA-compatible bus. This manual is meant to be used with the *NI-488.2M Software Reference Manual*.

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

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

Organization of This Manual

This manual is organized as follows:

*   Chapter 1, *Introduction*, explains how to use this manual, lists what you need to get started, and briefly describes the AT-GPIB/TNT and AT-GPIB interface boards and the NI-488.2M software.

*   Chapter 2, *Hardware Configuration and Installation*, contains instructions to help you configure and install your GPIB board.

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

*   Chapter 4, *Installation Verification and Troubleshooting*, describes how to verify the software installation and how to troubleshoot problems.

*   Chapter 5, *Using Your NI-488.2M Software*, describes the ibic utility and lists some programming considerations.

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

*   Appendix B, *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

This manual uses the following conventions.

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`	Lowercase text in this font denotes text or characters that you literally input from the keyboard. This font also denotes sections of code, programming examples, syntax examples, the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, variables, filenames, extensions, and statements and comments taken from program code.
`bold monospace`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
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 (PC AT) bus equipped with the NAT4882 and Turbo488 ASICs.
GPIB board	GPIB board refers generically to either the AT-GPIB/TNT or AT-GPIB board in cases where material can apply to either board.
NI-488.2M	NI-488.2M refers to the NI-488.2M software for LynxOS.
LynxOS	LynxOS refers to the LynxOS operating system from Lynx Real-Time Systems, Inc., which runs on computers equipped with an Intel 386 or an Intel 486 processor.

The *Glossary* lists abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms.

Related Documentation

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

*   *NI-488.2M Software Reference Manual,* National Instruments Corp.

*   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*

*   *LynxOS User's Manual, Volumes 1 and 2,* Lynx Real-Time Systems, Inc.

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

Chapter 1
Introduction

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

How to Use This Manual
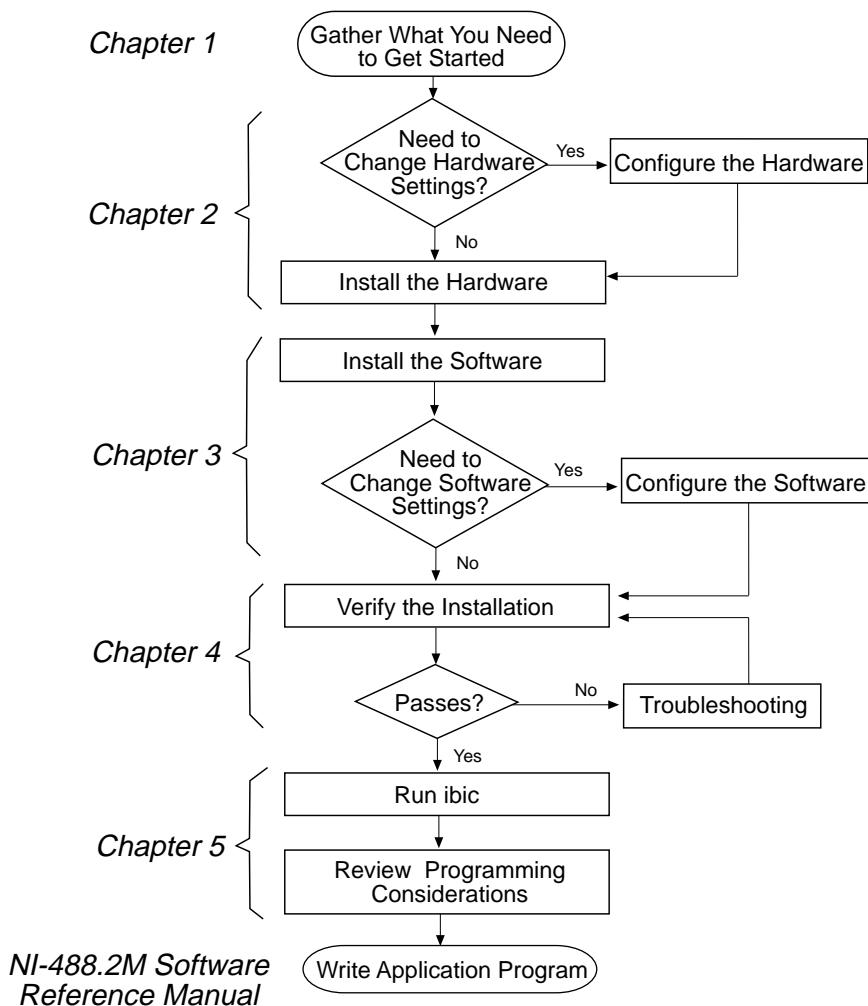
What You Need to Get Started

❑   AT-GPIB/TNT board
      or
      AT-GPIB board

❑   3.5 in. *NI-488.2M Distribution Disk for the AT-GPIB/TNT and LynxOS*

❑   LynxOS operating system version 2.1 or higher installed on your computer

❑   Super-user privilege

Hardware Description

AT-GPIB/TNT
The AT-GPIB/TNT board is equipped with the TNT4882C ASIC, which combines the
circuitry of the NAT4882 ASIC, the Turbo488 performance-enhancing ASIC, and the
GPIB transceivers. The AT-GPIB/TNT transforms any PC AT compatible computer into
a full-functioning GPIB Talker/Listener/Controller. The TNT4882C ASIC also
implements the HS488 high-speed protocol. 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. If you want to use more than 14 instruments, you can order a bus extender
or expander from National Instruments. Refer to Appendix A, *Hardware Specifications,*
for AT-GPIB/TNT specifications.

AT-GPIB
The AT-GPIB board is equipped with NAT4882 and Turbo488 ASICs. It also transforms
any PC AT compatible computer with 16-bit slots into a full-functioning IEEE 488.2
Talker/Listener/Controller. The NAT4882 controller chip is fully compatible with the
IEEE 488.2 standard. The Turbo488 performance-enhancing ASIC boosts GPIB read
and write transfer rates.

You can connect the AT-GPIB board with up to 13 instruments. If you want to use more
than 13 instruments, you can order a bus extender or expander from National
Instruments. Refer to Appendix A, *Hardware Specifications,* for AT-GPIB
specifications.

Software Description

The NI-488.2M software includes a driver, an interactive control program, several utility
programs, and a C language interface. The NI-488.2M software and GPIB hardware
transform any PC AT compatible computer with at least one ISA slot running LynxOS
into a GPIB Talker/Listener/Controller with complete communications and bus
management capabilities.

Chapter 2
Hardware Configuration and Installation

This chapter contains instructions to help you configure and install your GPIB board. You must have super-user privelege to install the board in a LynxOS-based computer.

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.*

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. You can verify the configuration settings of previously installed GPIB boards by looking at the file /sys/devices/ibinfo.c.

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

To modify the default settings of the GPIB board, refer to the *Configure the Hardware* section of this chapter. If you do not need to reconfigure the board, refer to the *Install the Hardware* section.

Install the Hardware

Keep in mind the following naming conventions as you read through 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 (PC AT) 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. Log on to the computer as `root`.

2. Shut down your system by entering the following command:

    `sync;sync;reboot -ah`

3. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the GPIB board.

4. Remove the top cover or access port of the I/O channel.

5. Remove the expansion slot cover on the back panel of the computer.

6. Insert the GPIB board into any unused 16-bit ISA 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, or 7.

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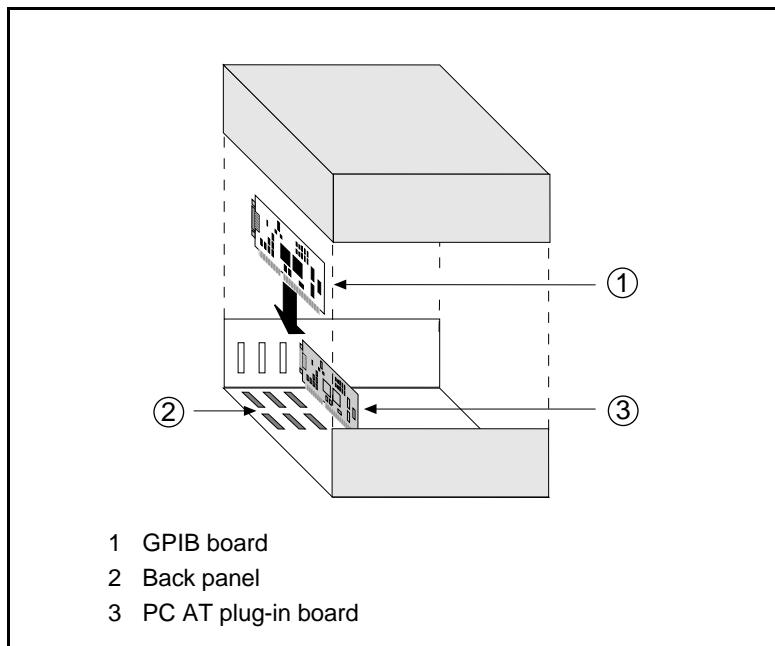
Figure 2-1. Installing the GPIB Board

7. Screw the mounting bracket of the GPIB board to the back panel rail of the computer.

8. Check the installation.

9. Replace the top cover or access port to the I/O channel.

10. Turn on your computer.

After you have installed your board, you are ready to install the NI-488.2 software. Refer to Chapter 3, *Software Installation and Configuration*.

Configure the Hardware (Optional)

Follow the instructions in this section to change the hardware default settings of the 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 Request Line (IRQ): 11

Figure 2-2 shows the location of the configuration jumpers and switches on the AT-GPIB/TNT board.
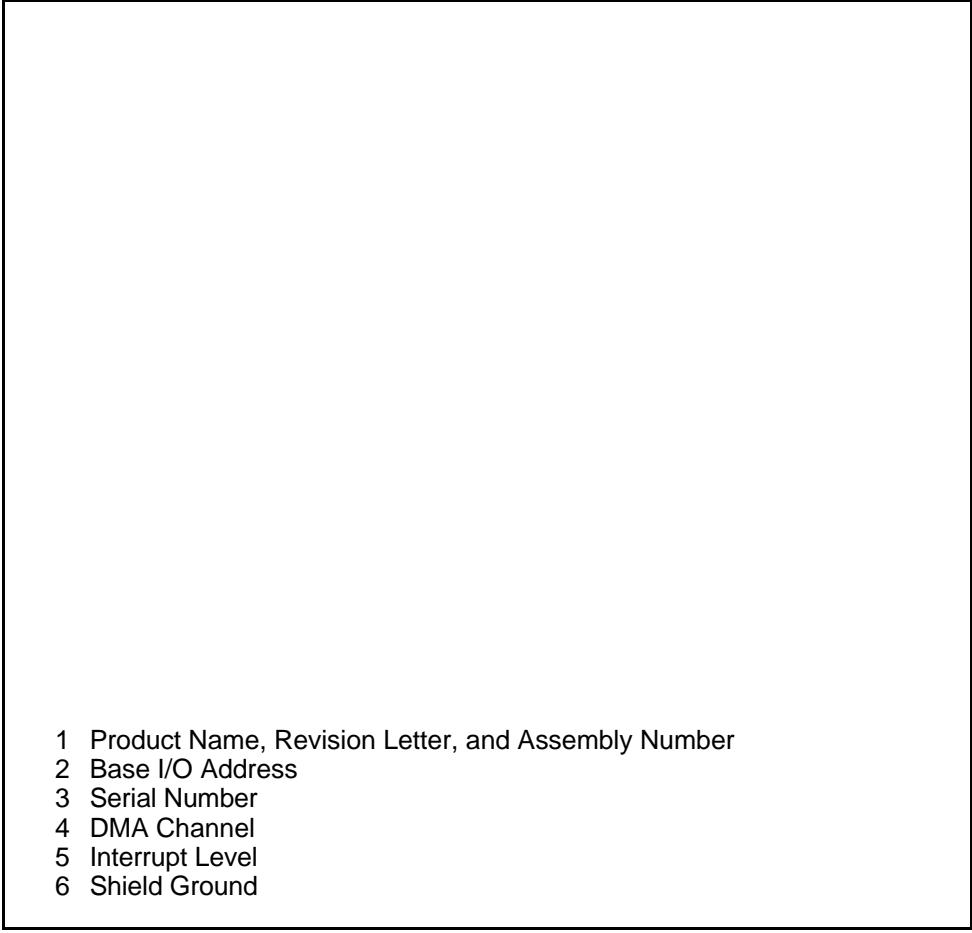
1 Product Name, Revision Letter, and Assembly Number
2 Base I/O Address
3 Serial Number
4 DMA Channel
5 Interrupt Level
6 Shield Ground

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

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

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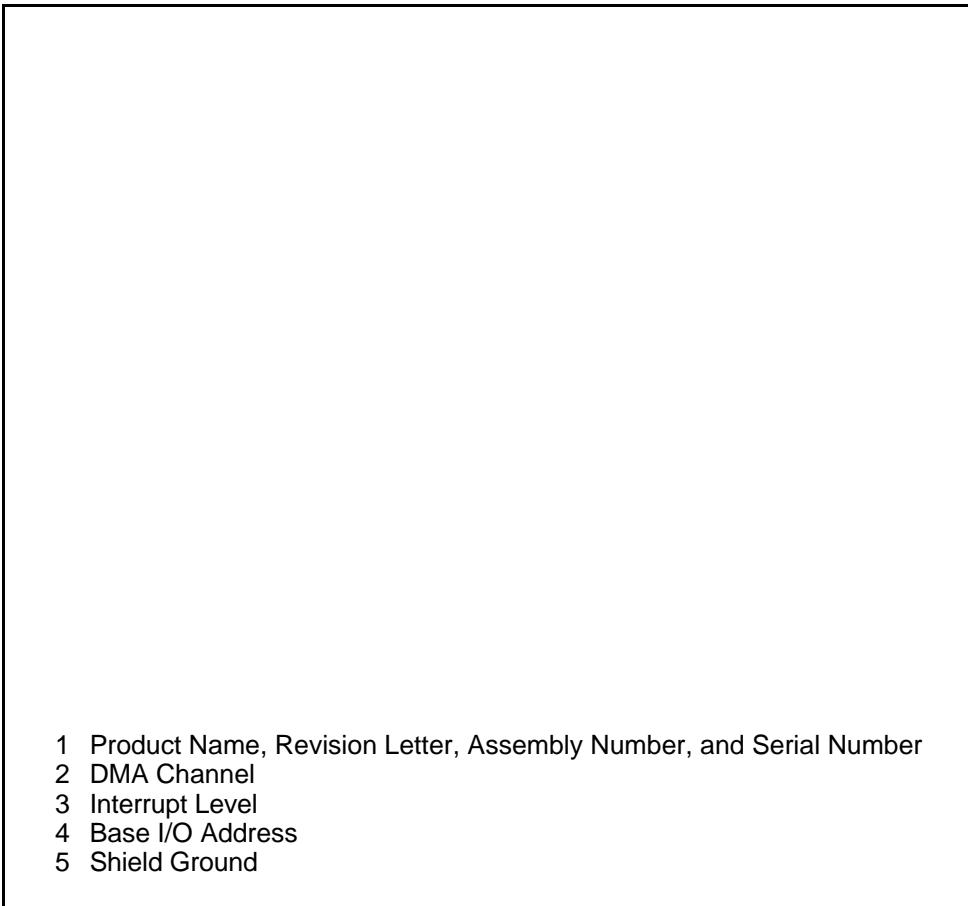
Figure 2-3. AT-GPIB Parts Locator Diagram

Selecting the Base I/O Address

PC AT compatible computers have a segment of memory reserved for input and output. This segment is referred to as the 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.

    Table 2-2 lists the possible switch settings, the corresponding base I/O addresses, and the I/O address space used for each setting.

Table 2-2. 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

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 2-2
     or 2-3.

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 2-4 for an example of the switch settings and
     corresponding base I/O addresses.
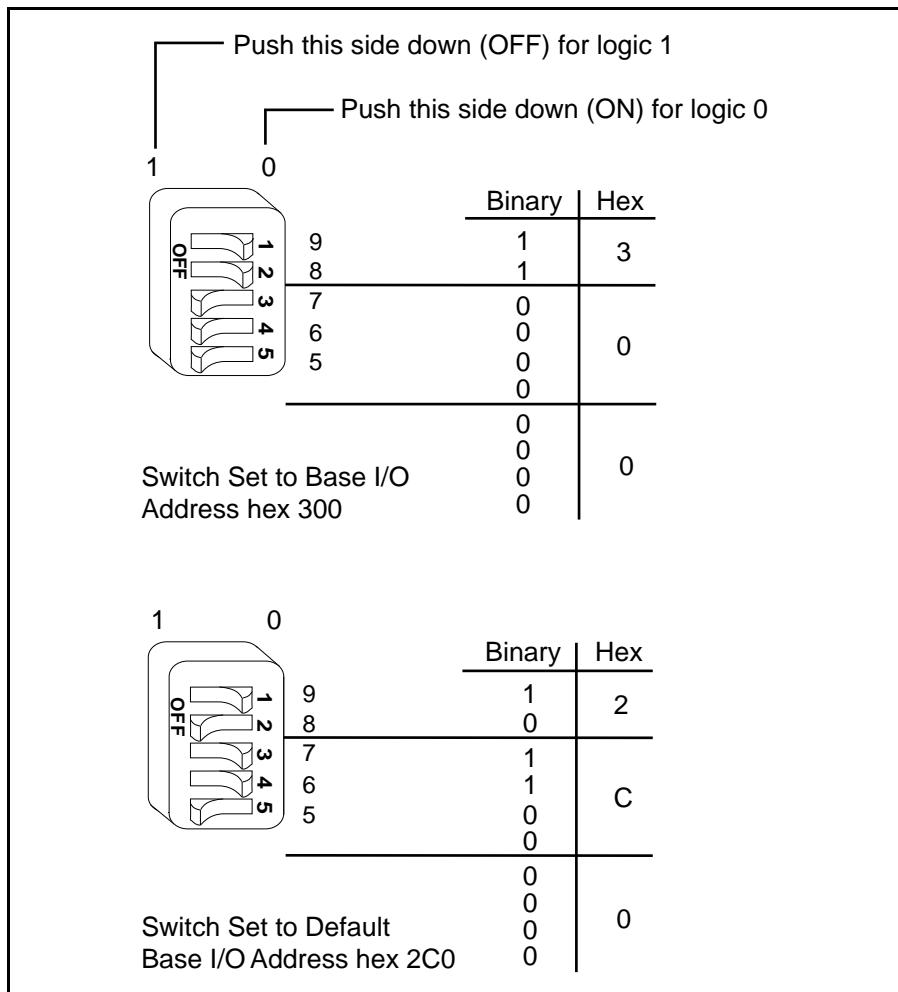
Figure 2-4. Base I/O Address Switch Settings

4. Record your new setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix B, *Customer Communication*. Remember to select these new settings when you install the NI-488.2M software, so that your software and hardware settings match.

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-488.2M software use interrupts to get service from the CPU when necessary.

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

1. Choose a new IRQ setting.

   If you install the GPIB board in a 16-bit ISA slot, you can configure it to use any of the following interrupt lines: IRQ3, 4, 5, 7, 9, 10, 11, 12, or 15. In this case, do not use IRQ6 or IRQ14. IRQ6 is used by the diskette drive controller and IRQ14 is used by the hard disk drive controller on most PC ATs. Depending on the system configuration, various devices can also use other IRQs. In particular, the Adaptec SCSI controller (if present) normally uses IRQ11. Select an IRQ that does not conflict with any other installed devices.

   If you install the AT-GPIB/TNT board in an 8-bit (PC-style) slot, the interrupt lines available to you are 3, 4, 5, 6, and 7. You cannot install the AT-GPIB board into an 8-bit slot.

   If you are installing more than one GPIB board, each board must use a unique IRQ level.

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 approprate parts locator diagram, Figure 2-2 or 2-3.

3. Change the jumper settings to configure the GPIB board to the new IRQ level.

   To use IRQ10, 11, 12, or 15, use the jumper block shown in Figure 2-5. To use IRQ3, 4, 5, 7, or 9, use the jumper block shown in Figure 2-6.

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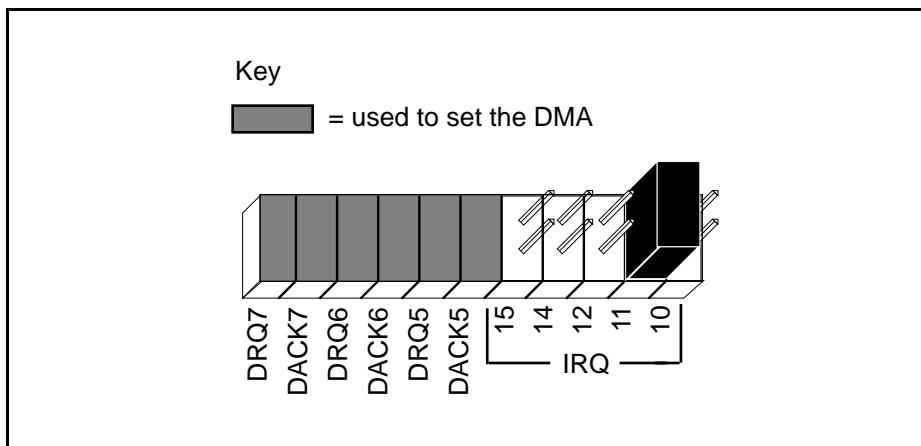
Figure 2-5. Interrupt Jumper Setting for IRQ11 (Default Setting)

Figure 2-6 shows the setting for IRQ5.
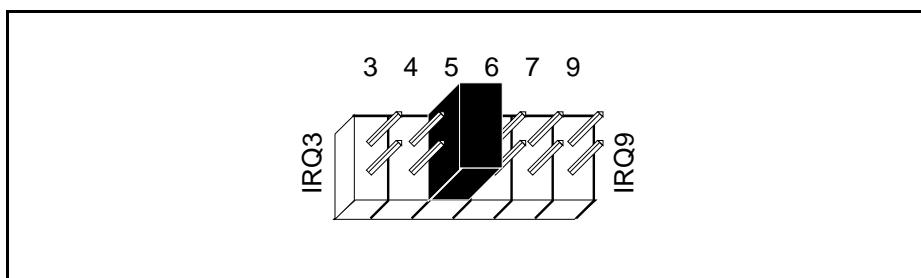
Figure 2-6. Interrupt Jumper Setting for IRQ5

4. Record your new setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix B, *Customer Communication*. Remember to select these new settings when you install the NI-488.2M software, so that your software and hardware settings match.

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-488.2M 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 2-8, 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. Notice that the Adaptec SCSI controller (if present) normally uses DMA channel 5. Select a DMA channel that does not conflict with any other installed devices.

2.   Locate the jumpers that select the DMA channel. Refer to the appropriate parts locator diagram, Figure 2-2 or 2-3.

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 2-3.

Table 2-3. DMA Channels

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

Figure 2-7 shows the jumper position for selecting DMA channel 5.
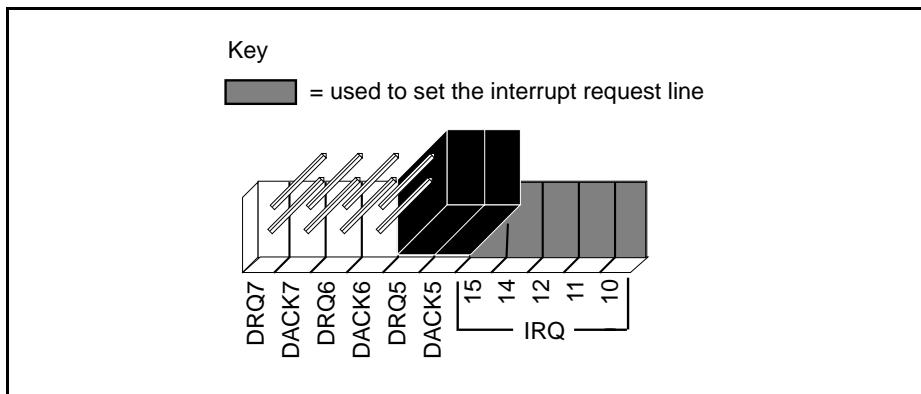
Figure 2-7. DMA Channel Jumper Setting for DMA Channel 5 (Default)

4.   Record your new setting on the *GPIB Board Hardware and Software Configuration Form* in Appendix B, *Customer Communication*. Remember to select these new settings when you install the NI-488.2M software, so that your software and hardware settings match.

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 2-8.
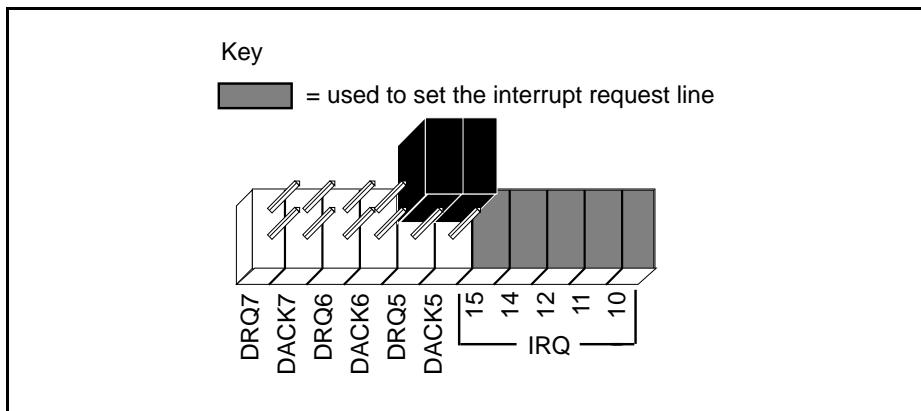
Figure 2-8. DMA Jumper Setting for No DMA Channel

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 2-2 to locate the shield ground jumper W3 on the AT-GPIB/TNT board. If you are using the AT-GPIB board, refer to Figure 2-3 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 2-9.

Logic Ground Connected to Shield Ground (Default)

Logic Ground Disconnected from Shield Ground
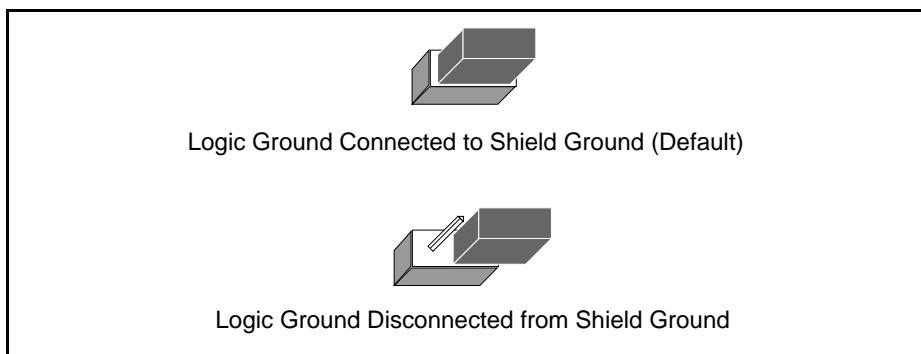
Figure 2-9. Ground Configuration Jumper Settings

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

Now that you have properly configured the hardware, return to the *Install the Hardware* section at the beginning of this chapter for the installation instructions.

Chapter 3
Software Installation and Configuration

This chapter contains instructions to help you install and configure your NI-488.2M software.

Before you install the software, consider the following:

- You must have super-user privilege.

- The NI-488.2M distribution disk is in `tar` format.

- If you have the default module of the National Instruments *ESP-488 for LynxOS* device driver (`esp488.o`) installed on your system, you must remove the ESP-488 driver before installing the NI-488.2M driver. Other ESP-488 driver modules (for example, `esp488_2.o`) can safely coexist with the NI-488.2M driver as long as the drivers are not configured to control the same GPIB board(s).

NI-488.2M Software Components

The NI-488.2M distribution disk contains the following files:

- `cib.c` is the C language interface library.

- `cib.h` is the private include file for `cib.c`.

- `ib.cfg` is the LynxOS configuration file for the NI-488.2M driver.

- `ib_lynxos.o` is the NI-488.2M driver for the GPIB board.

- `ibconf` is the software configuration utility.

- `ibic` is the interface bus interactive control utility.

- `ibinfo.c` is the GPIB board configuration file for manual software installation.

- `ibinfo.h` is the private include file for `ibinfo.c`.

- `ibtsta` is the software installation test, part A.

- `ibtstb` is the software installation test, part B.

- `instgpib` is the automatic install script for the driver.

- `ugpib.h` is the include file for user programs.

Load the Distribution Disk

1. Log on to the system as super user by typing `root`.

2. Create a working directory (for example, `/usr/gpib`) and change to that directory by entering the following commands:

    ```
    mkdir /usr/gpib
    cd /usr/gpib
    ```

3. Insert the NI-488.2M distribution disk and copy the files from the distribution disk to this directory by entering the `tar` command:

    ```
    tar xvf /dev/rfd1440.0
    ```

Install the NI-488.2M Software

You can install the NI-488.2M software either automatically or manually, as described in the following sections.

Automatic Installation

To automatically install the NI-488.2M software, go to your working directory (`/usr/gpib`) and enter the following command:

```
./instgpib
```

The program prompts you for the information it needs to install the driver and utilities.

If the automatic installation fails, `instgpib` displays the error encountered during the installation.

Manual Installation

To manually install the NI-488.2M software, go to your working directory (`/usr/gpib`), and complete the following steps:

1. Copy the file `ugpib.h` to `/usr/include/sys` by entering the following command:

    ```
    cp ugpib.h /usr/include/sys
    ```

2. Copy the files `ibic`, `ibconf`, `ibtsta`, and `ibtstb` to a directory in the command search path (for example, `/usr/bin`) by entering the following commands:

```
cp ibic /usr/bin
cp ibconf /usr/bin
cp ibtsta /usr/bin
cp ibtstb /usr/bin
```

3. Install the C library by compiling the file `cib.c` and converting its object file
    `cib.o` into a library. This procedure is necessary if you are compiling your
    application with the `-lgpib` option, as described in Chapter 5, *Using Your
    NI-488.2M Software*. To compile the file `cib.c` and create a C language library,
    enter the following commands:

    ```
    gcc -c cib.c
    libr rv /usr/lib/libgpib.a cib.o
    ```

    Alternatively, you can add `cib.o` to an existing library or include `cib.o` during
    the link phase of each compile operation. Refer to Chapter 5 for specific
    information.

4. If you changed the default hardware configuration setting or you are installing more
    than one board, edit the NI-488.2M device configuration file `ibinfo.c` and modify
    the software settings to match the hardware settings for each board. The file is
    commented and should be self-explanatory. Save the file, then recompile it to create
    a new device configuration module by entering the following line:

    ```
    cc -c ibinfo.c
    ```

5. Add the device configuration module `ibinfo.o` to the system device library by
    entering the following line:

    ```
    libr r /sys/devlib.a ibinfo.o
    ```

6. Add the NI-488.2M driver module to the system driver library by entering the
    following line:

    ```
    libr r /sys/drivlib.a ib_lynxos.o
    ```

7. Copy the `CONFIG.TBL` include file `ib.cfg` to the kernel configuration directory
    and then change to that directory by entering the following lines:

    ```
    cp ib.cfg /sys/lynx.os
    cd /sys/lynx.os
    ```

8. Edit the file `CONFIG.TBL` and add the following line to the end of the file:

    ```
    I:ib.cfg
    ```

9. Build a new LynxOS kernel and reboot the system by entering the following lines:

    ```
    make install
    sync;sync;reboot -aN
    ```

Configure the Software with ibconf (Optional)

`ibconf` is a screen-oriented utility that you can use to inspect and modify the default software parameters. `ibconf` is largely self-explanatory, with help screens to explain commands and options. You must have super-user privilege to run `ibconf`. For more information on using `ibconf`, refer to Chapter 2, *Installation and Configuration of NI-488.2M Software*, in the *NI-488.2M Software Reference Manual.*

The synopsis of the command is as follows:

```
ibconf file
```

where `file` is optional and can be any LynxOS kernel file with the NI-488.2M driver installed. The default LynxOS kernel file is `/lynx.os.`

Running ibconf

To change the GPIB parameters, type `ibconf` at the command prompt.

If you have given your LynxOS kernel file a name other than `/lynx.os` use the file option to give the entire path name of the kernel. For example, if the kernel name is `/lynx.os.new`, enter the following command:

```
ibconf /lynx.os.new
```

Exiting ibconf

If you made any changes to the board or device settings, save the current configuration by typing `y` before you exit `ibconf`.

This completes the software installation and configuration procedures. If you did not make any changes to the configuration settings or if you only renamed devices, you *do not* have to restart the system. However, if you made any changes to the configuration settings, you must restart the system to run on the new kernel. Restart the system by entering the following command:

```
sync;sync;reboot -a
```

Remove the NI-488.2M Driver (Optional)

If you want to remove the NI-488.2M driver, you must do so manually. Complete the following steps to remove the NI-488.2M driver from the kernel:

1. Log on to the system as super user by typing `root`, then go to the kernel configuration directory by entering the following line:

    ```
    cd /sys/lynx.os
    ```

2. Remove the NI-488.2M device configuration module from the system device library by entering the following line:

    ```
    libr d /sys/devlib.a ibinfo.o.
    ```

3. Remove the NI-488.2M driver module from the system driver library by entering the following line:

    ```
    libr d /sys/drivlib.a ib.lynxos.o
    ```

4. Edit the file `CONFIG.TBL` and delete (or comment out) the following line from the file:

    ```
    I:ib.cfg
    ```

5. Build a new LynxOS kernel and reboot the system by entering the following lines:

    ```
    make install
    sync;sync;reboot -aN
    ```

Chapter 4
Installation Verification and Troubleshooting

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

Run the Software Installation Test Program

The software installation test has two parts: `ibtsta` and `ibtstb`.

- `ibtsta` checks for a correct node `/dev/gpib0` and correct access to the device driver.

- `ibtstb` checks for correct DMA and interrupt operation. `ibtstb` requires a GPIB analyzer and can be omitted if an analyzer is not available.

Complete the following steps to verify the software installation:

1. Run `ibtsta` by entering the following command:

   `ibtsta`

2. If `ibtsta` completes with no errors and a bus analyzer is available, connect the bus analyzer to the GPIB board, then run `ibtstb` by entering the following command:

   `ibtstb`

   If no error occurs, the NI-488.2M driver is installed correctly.

Troubleshooting Error Messages

If `ibtsta` fails, the program generates common error messages that appear on your screen. These error messages explain what went wrong when you ran `ibtsta` and describe how you can correct the errors. For example, the following message might appear on your screen if you forgot to disconnect all your GPIB cables:

The fact that the ENOL error was not received when expected indicates the possible presence of other devices on the bus.

Please disconnect ALL GPIB cables from the GPIB board, then run this test again.

If `ibtstb` fails, or if the results you observe on the bus are not as described in the test, verify that you are following the on-screen instructions correctly and run the test again.

If you are still unable to run `ibtsta` and/or `ibtstb` successfully after you have followed the suggestions provided by the error messages, contact National Instruments for assistance.

Common Questions

What do I do if `ibtsta` or `ibtstb` fails with an error?

Refer to the troubleshooting sections of this chapter for specific information about what might cause these tests to fail.

When would I use `ibic`?

You can use `ibic` to test and verify instrument communication, troubleshoot problems, and develop your application program. For more information about `ibic`, refer to the *NI-488.2M Software Reference Manual*.

How do I use the NI-488.2M language interface?

For information about using the NI-488.2M language interface for C, refer to the *NI-488.2M Software Reference Manual*.

What information should I have before I call National Instruments?

When you call National Instruments, you should have the results of the diagnostic tests. Also, make sure you have filled out the configuration form in Appendix B, *Customer Communication*.

Chapter 5
Using Your NI-488.2M Software

This chapter describes the `ibic` utility and lists some programming considerations.

Introduction to ibic

The Interface Bus Interactive Control utility, `ibic`, comes with your NI-488.2M software. You can use `ibic` to enter NI-488.2 calls interactively and to display the results of the function calls automatically. Without writing an application, you can use `ibic` to do the following:

*   Verify GPIB communication with your device quickly and easily.

*   Learn the NI-488 functions and NI-488.2 routines before you write your application.

*   Become familiar with the commands of your device.

*   Receive data from your GPIB device.

*   Troubleshoot problems with your application.

For more information about `ibic`, refer to Chapter 6, *ibic*, in the *NI-488.2M Software Reference Manual*.

Programming Considerations

Once you have installed the NI-488.2M driver and successfully verified its installation, you are ready to proceed with the development of your NI-488.2M application software.

As you begin developing your NI-488.2M application, consider the following:

*   Your application program must include the following header file:

    ```
    <sys/ugpib.h>.
    ```

*   The file `cib.c` is the interface between your C language application program and the operating system entry points to the NI-488.2M driver. For a brief description of the NI-488 functions and NI-488.2 routines available in `cib.c`, refer to Chapter 3, *Understanding the NI-488.2M Software*, in the *NI-488.2M Software Reference Manual*. For a more detailed description, refer to Chapter 4, *NI-488.2M Software Characteristics and Routines*, and Chapter 5, *NI-488M Software Characteristics and Functions*, in the *NI-488.2M Software Reference Manual*.

To use the NI-488 functions and NI-488.2 routines, you must compile `cib.c` and include the resulting object file (`cib.o`) during the link phase each time you compile your application, as shown in the following example:

```
cc my_appl.c cib.o
```

Alternatively, you can compile your application and link it to the C language library, `libgpib.a` (created when you installed the software) as shown in the following example:

```
cc my_appl.c -lgpib
```

- For more information on creating the C language library `libgpib.a`, refer to the *Install the C Library* section in Chapter 3, *Software Installation and Configuration*.

- For information about choosing a programming method, developing your application, or compiling and linking, refer to the *NI-488.2M Software Reference Manual*. The software reference manual contains detailed information about each NI-488 function and NI-488.2 routine.

Appendix A
Hardware Specifications

This appendix describes the physical characteristics of the AT-GPIB/TNT board and the AT-GPIB board and the recommended operating conditions of the boards.

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

Characteristic	Specification
Power Requirement (from PC AT I/O channel)	+5 VDC 50 mA Typical 120 mA Maximum

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

Characteristic	Specification
Power Requirement (from PC AT I/O channel)	+5 VDC 0.66 A Typical 1.50 A Maximum

Table A-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 A-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 B
Customer Communication

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

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

Corporate Headquarters
(512) 795-8248
Technical support fax: (800) 328-2203
                           (512) 794-5678

Branch Offices	Phone Number	Fax Number
Australia	(03) 879 9422	(03) 879 9179
Austria	(0662) 435986	(0662) 437010-19
Belgium	02/757.00.20	02/757.03.11
Denmark	45 76 26 00	45 76 71 11
Finland	(90) 527 2321	(90) 502 2930
France	(1) 48 14 24 00	(1) 48 14 24 14
Germany	089/741 31 30	089/714 60 35
Italy	02/48301892	02/48301915
Japan	(03) 3788-1921	(03) 3788-1923
Mexico	95 800 010 0793	95 800 010 0793
Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
Singapore	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

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

Name _____

Company _____

Address _____

_____

Fax (___) _____ Phone (___) _____

Computer brand _____

    Model _____ Processor _____

    Operating system _____

    Speed _____MHz RAM _____MB

    Display adapter _____

    Mouse _____yes _____no

    Other adapters installed _____

    Hard disk capacity _____MB Brand _____

    Instruments used _____

National Instruments hardware product model _____

    Revision _____

    Configuration _____

National Instruments software product _____

    Version _____

    Configuration _____

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

    – AT-GPIB/TNT Board Revision _____

     or

    – AT-GPIB Board Revision _____

*   NI-488.2M Software Revision Number on Disk

    _____

*   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 _____

*   LynxOS Version _____

*   Application Programming Language and Compiler _____

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 LynxOS**

Edition Date: **October 1994**

Part Number: **320808A-01**

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(continues)

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   (_____)   _____

Mail to: Technical Publications
             National Instruments Corporation
             6504 Bridge Point Parkway, MS 53-02
             Austin, TX 78730-5039

Fax to: Technical Publications
             National Instruments Corporation
             MS 53-02
             (512) 794-5678

Glossary

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

°	degrees
%	percent
A	amperes
ANSI	American National Standards Institute
ASIC	application-specific integrated circuit
C	Celsius
CPU	central processing unit
DACK	DMA Acknowledge
DRQ	DMA Request
DMA	direct memory access
EISA	Extended Industry Standard Architecture
EMI	electromagnetic interference
FCC	Federal Communications Commission
GPIB	General Purpose Interface Bus
hex	hexadecimal
I/O	input/output
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
IRQ	interrupt request
ISA	Industry Standard Architecture
m	meters
MB	megabytes of memory
PC	personal computer
s	seconds
VDC	volts direct current