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Getting Started with Your PC/104-GPIB and the NI-488.2™ Software for Windows

May 1997 Edition

Part Number 370916A-01

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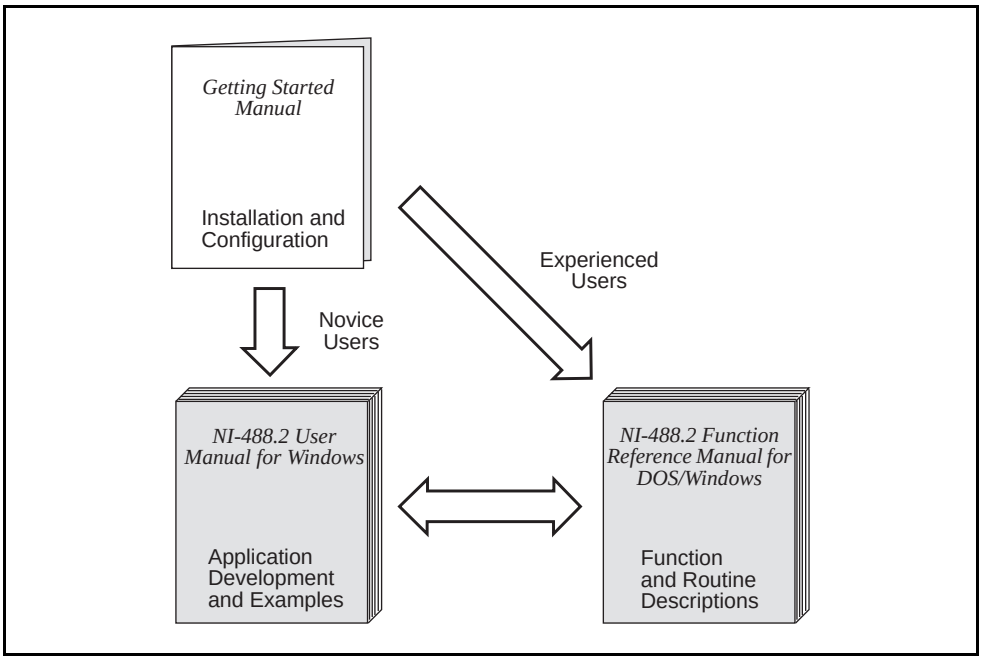
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About This Manual

This manual contains instructions to help you install and configure the National Instruments PC/104-GPIB interface board and the NI-488.2 software for Windows. The interface board is intended for use in a PC/104-based system. The NI-488.2 software is intended for use with Windows version 3.1 or higher.

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

How to Use the Manual Set



Use this getting started manual to install and configure your PC/104-GPIB and the NI-488.2 software for Windows.

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

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

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 PC/104-GPIB and the NI-488.2 software.
- Chapter 2, *Hardware Configuration and Installation*, contains instructions to help you configure and install your PC/104-GPIB.
- Chapter 3, *Software Installation and Configuration*, contains instructions to help you install and configure your NI-488.2 software.
- Chapter 4, *Installation Verification and Troubleshooting*, describes how to verify the hardware and software installation and how to troubleshoot problems.
- Chapter 5, *Using Your NI-488.2 Software*, introduces the Win16 Interactive Control utility and lists some programming considerations.
- Appendix A, *Hardware Specifications*, describes the characteristics of the PC/104-GPIB and the recommended operating conditions.
- 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 terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.

Conventions Used in This Manual

The following conventions are used in this manual.

bold	Bold text denotes menus, menu items, dialog buttons, or options.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
bold italic	Bold italic text denotes a note, caution, or warning.
`monospace`	Text in this font denotes text or characters that are to be literally input from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, directories, programs, subprograms, subroutines, device names, functions, variables, field names and filenames.

`italic monospace`	Italic text in this font denotes that you must supply the appropriate words or values in place of these items.
`bold monospace`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
< >	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 488.2-1987, respectively, which define the GPIB.

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

Related Documentation

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

- ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*
- ANSI/IEEE Standard 488.2-1987, *IEEE Standard Codes, Formats, Protocols, and Common Commands*
- *Microsoft Windows User's Guide,* Microsoft Corporation
- *PC/104 Specification,* Version 2.1

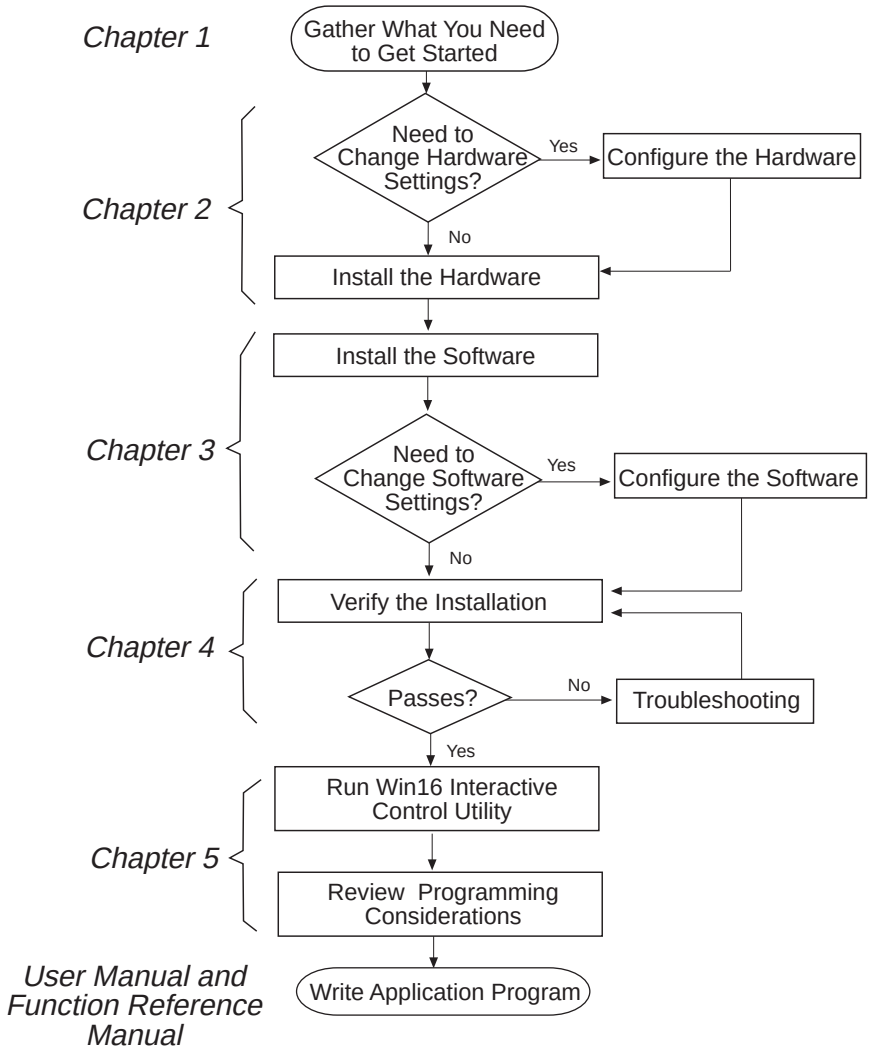
Customer Communication

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 PC/104-GPIB and the NI-488.2 software.

How to Use This Manual



What You Need to Get Started

- ❑ One of the following modules:
  - 16-bit PC/104-GPIB
  - 8-bit PC/104-GPIB

- ❑ PC/104 installation kit:
  - Four standoffs
  - Four screws
  - Four hex nuts
  - 20 in. GPIB connection ribbon cable

- ❑ 3.5 in. high density (1.44 MB) distribution disk:
  NI-488.2 Software for Windows and the AT-GPIB/TNT+, AT-GPIB/TNT (PnP), EISA-GPIB and AT-GPIB/TNT

- ❑ Microsoft Windows version 3.1 or higher installed on your system

Hardware Description

The *PC/104 Specification* defines a compact version of the PC AT bus that is optimized for embedded systems applications. Unlike ISA boards that are installed in a fixed computer backplane, PC/104 modules are stacked, one on top of the other. Modules are available in 8-bit and 16-bit versions, which correspond to the PC and PC AT bus implementations, respectively.

The PC/104-GPIB, equipped with a TNT4882C ASIC, transforms any PC/104 system into a full-functioning GPIB Talker/Listener/Controller. 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. The TNT4882C also implements the HS488 high-speed protocol, which increases the maximum data transfer rate of the PC/104-GPIB up to 1.6 Mbytes/s. For more information about HS488, refer to Chapter 7, *GPIB Programming Techniques*, in the *NI-488.2 User Manual for Windows.*

The PC/104-GPIB is functionally identical to the AT-GPIB/TNT and can run any NI-488.2 driver software for the AT-GPIB/TNT. The PC/104-GPIB is available in an 8-bit version and a 16-bit version. The 16-bit version can be plugged into an 8-bit stack if DMA transfers are disabled. The PC/104-GPIB is equipped with a 20 in. ribbon cable terminated with a panel-mount GPIB connector. You can use standard GPIB cables to connect the PC/104-GPIB with up to 14 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, *Hardware Specifications*, for more information about the GPIB hardware specifications and recommended operating conditions.

Software Description

The PC/104-GPIB uses the NI-488.2 driver software for the AT-GPIB/TNT. The NI-488.2 software for Windows includes a Windows dynamic link library, language interface libraries, and debugging and development utilities. The NI-488.2 software and GPIB hardware transform a PC/104 system into a GPIB Talker/Listener/Controller that has complete communications and bus management capability.

ni-pnp Utility Overview

The `ni-pnp` utility is a small program that runs each time you reboot your system. It collects information about National Instruments interfaces in your system. In EISA systems, `ni-pnp` queries the EISA BIOS to obtain the current configuration of each National Instruments interface that is installed. In systems that are Plug and Play ready, `ni-pnp` simply retrieves the current configuration of each interface. In systems without Plug and Play system software, `ni-pnp` performs the actual configuration of each interface. `ni-pnp` does not select the resources to assign to interfaces. If your system does not assign resources, you must run the GPIB software configuration utility to assign resources to the GPIB interfaces. After the configuration of each interface is determined, `ni-pnp` provides this information to the NI-488.2 driver.

Optional Programming Environments

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

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

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

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

Chapter 2
Hardware Configuration and Installation

This chapter contains instructions to help you configure and install your PC/104-GPIB.

Warning: ***Some components on your PC/104-GPIB can be damaged by electrostatic discharge. To avoid such damage in handling the module, touch the antistatic plastic package to a metal part of your computer chassis before removing the module from the package.***

The PC/104-GPIB default settings are suitable for most PC/104 systems. However, if the default settings conflict with another device in your system or if you need to install more than one PC/104-GPIB, you must reconfigure the hardware. If you already have PC/104-GPIB modules installed in your system, you can run the GPIB Information utility to determine how the modules are configured. For more information about the GPIB Information utility, refer to Chapter 4, *Debugging Your Application*, in the *NI-488.2 User Manual for Windows.*

Table 2-1 shows the default settings for the switches and jumpers on the PC/104-GPIB.

Table 2-1. Hardware Default Settings

PC/104-GPIB Setting	Default
Base I/O Address (hex)	2C0
DMA Channel	5
Interrupt Line (IRQ)	11

To modify the default settings of the PC/104-GPIB, refer to the *Configure the Hardware* section of this chapter. If you do not need to reconfigure the PC/104-GPIB, refer to the *Install the Hardware* section.

Install the Hardware

The PC/104-GPIB is available in two versions: stackthrough 16-bit and stackthrough 8-bit. 16-bit modules have two PC/104 connectors and 8-bit modules have one PC/104 connector. Verify that you have the correct version for your system.

Note: ***For 8-bit operation, you must disable DMA and use only interrupt request lines 3, 4, 5, 6, 7, or None.***

Perform the following steps to install the PC/104-GPIB. In this section, the term *parent board* generically refers to either the parent system or the adjacent PC/104 module onto which the PC/104-GPIB is to be stacked.

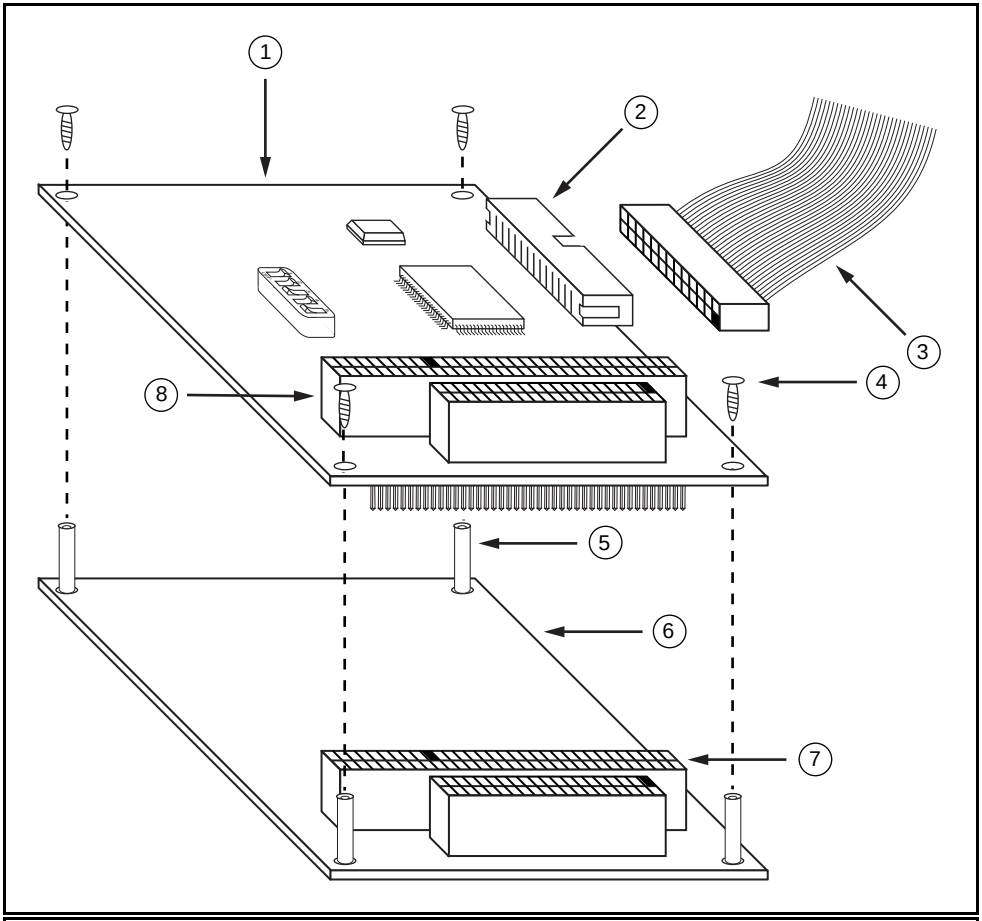
1. Power off your PC/104 system. Keep the system plugged in so that it remains grounded while you install the PC/104-GPIB.

2. Mount the provided standoffs to the parent board before installing the PC/104-GPIB. You may need to install the provided hex nuts to the bottom side of the parent board to secure the standoffs in place. Notice that the parent board may have only two mounting holes for the standoffs instead of four; in this case, only two standoffs are needed.

3. Plug the PC/104-GPIB into the parent board. The PC/104 header is keyed so that it fits in only one direction. Do not force the PC/104 connector into place.

   After the PC/104-GPIB has been plugged in, ensure proper contact by gently pressing down at the PC/104 connector region of the PC/104-GPIB until the module is level with respect to the parent board.

4. Fasten the PC/104-GPIB to the standoffs with the 4-40 screws that are provided. Refer to Figure 2-1.



1	PC/104-GPIB	5	Standoff
2	GPIB connection	6	Parent board
3	GPIB ribbon cable	7	PC/104 connector
4	Screw	8	PC/104 header

Figure 2-1. Installing the PC/104-GPIB

5. Plug the GPIB ribbon cable into the GPIB connection header on the PC/104-GPIB. The header is keyed so that it fits in only one direction. Do not force the GPIB ribbon cable connector into place. The GPIB ribbon cable is 20 in. long and terminated with a panel-mount GPIB connector that can be mounted for easy access in your system.

   Note: ***If you plan to perform HS488 high-speed protocol transfers, you must configure the NI-488.2 software for the amount of GPIB cable length in your system. The 20 in. GPIB ribbon cable must be added to your total GPIB cable length.***

6. Check the installation.

7. Power on your system.

After you have installed your PC/104-GPIB, you are ready to install the NI-488.2 software. Refer to Chapter 3, *Software Installation and Configuration*.

Configure the Hardware (Optional)

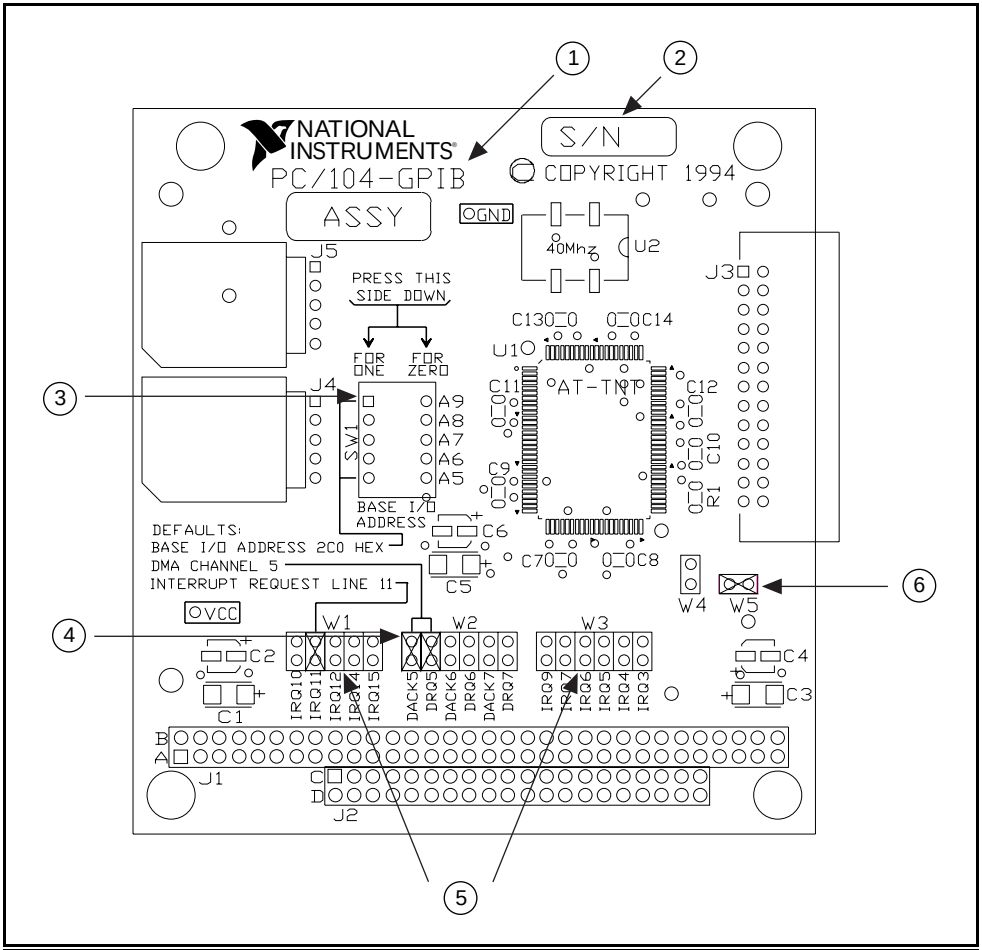
Follow the instructions in this section to change the hardware default settings of the PC/104-GPIB before you install it. The default settings are suitable for most PC/104 systems.

Note: ***If the default settings conflict with another device in your system, if you are installing the PC/104-GPIB in an 8-bit stack, or if you need to install more than one PC/104-GPIB, you must reconfigure the hardware.***

The default settings for the switches and jumpers on the PC/104-GPIB are as follows:

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

Figure 2-2 shows the location of the configuration jumpers and switches on the PC/104-GPIB.



1	Product Name and Assembly Number
2	Serial Number
3	Base I/O Address
4	DMA Channel
5	Interrupt Levels
6	Shield Ground

Figure 2-2. PC/104-GPIB Parts Locator Diagram

Selecting the Base I/O Address

PC/104 compatible computers have a segment of address space reserved for input and output. This segment is referred to as the I/O address space. The base I/O address of a PC/104 module such as the PC/104-GPIB is the first position in the I/O address space occupied by the PC/104 module.

By default, the PC/104-GPIB is configured to use base I/O address 2C0 hex. With this setting, the module 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 PC/104-GPIB, 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 PC/104-GPIB, each module 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. The default settings are in ***bold italics***.

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

Switch Setting					Base I/O Address (hex)	I/O Address Space Used (hex)
A9	**A8**	**A7**	**A6**	**A5**		
0	1	0	0	0	100	100 to 11F
0	1	0	0	1	120	120 to 13F
0	1	0	1	0	140	140 to 15F
0	1	0	1	1	160	160 to 17F
0	1	1	0	0	180	180 to 19F
0	1	1	0	1	1A0	1A0 to 1BF
0	1	1	1	0	1C0	1C0 to 1DF
0	1	1	1	1	1E0	1E0 to 1FF
1	0	0	0	0	200	200 to 21F
1	0	0	0	1	220	220 to 23F
1	0	0	1	0	240	240 to 25F
1	0	0	1	1	260	260 to 27F
1	0	1	0	0	280	280 to 29F

(continues)

Table 2-2. Possible Base I/O Address Switch Settings (Continued)

Switch Setting A9	A8	A7	A6	A5	Base I/O Address (hex)	I/O Address Space Used (hex)
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 PC/104-GPIB. Refer to the parts locator diagram, Figure 2-2.

3. Change the switch settings to configure the PC/104-GPIB to the new base I/O address.

   Press down on the side marked 1 to select a binary value of 1 for the corresponding address bit. Press down on the 0 side of the switch to select a binary value of 0. Refer to Figure 2-3 for an example of the switch settings and corresponding base I/O addresses.

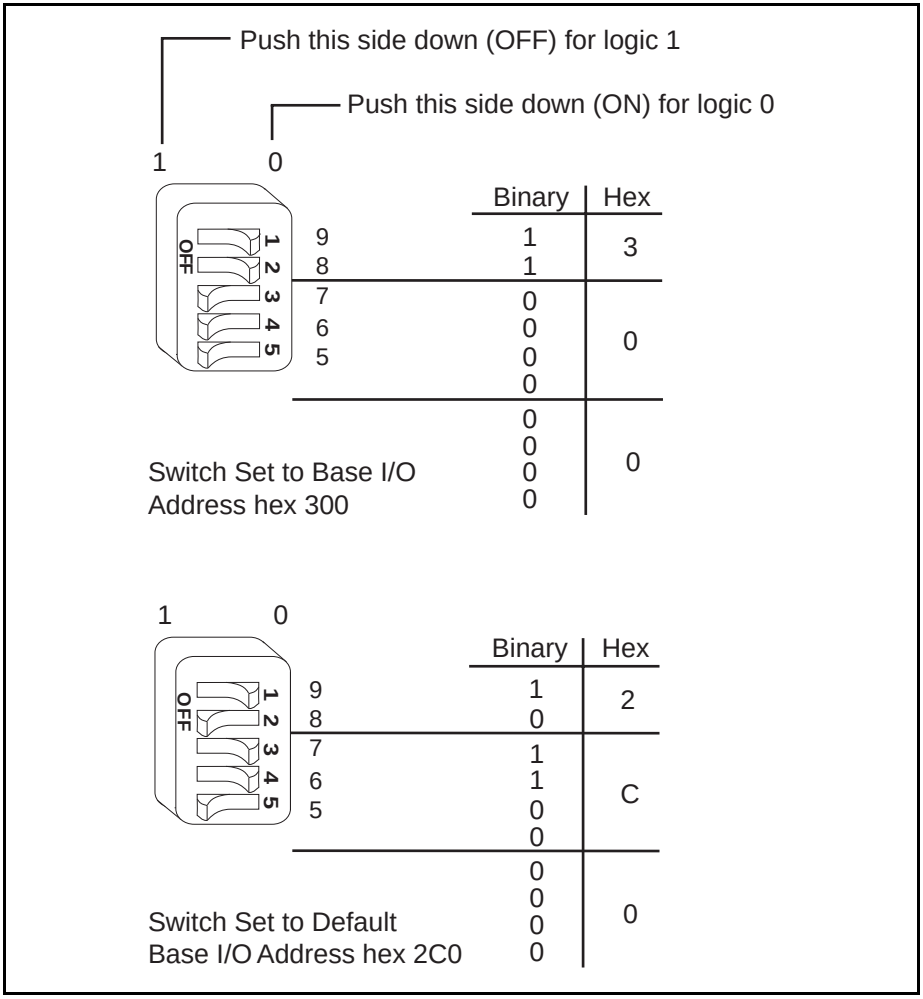


Figure 2-3. Base I/O Address Switch Settings

4. Record your new setting on the *PC/104-GPIB Hardware and Software Configuration Form* in Appendix B, *Customer Communication*.

5. Remember that after you install the NI-488.2 software, you must use the GPIB software configuration utility to configure your software settings to match your new hardware settings. Refer to the *Configure the Software* section in Chapter 3, *Software Installation and Configuration*, for more information.

Selecting the Interrupt Request Line

PC/104 compatible computers have a series of interrupt lines available to devices. Devices use interrupts to get immediate service from the CPU for asynchronous events. Your GPIB hardware and the NI-488.2 software use interrupts to get service from the CPU when necessary.

By default, the PC/104-GPIB is configured to use interrupt request line 11. If this is not an acceptable setting, if you are installing the PC/104-GPIB in an 8-bit stack, or if you are installing more than one PC/104-GPIB, follow these steps to reconfigure the interrupt request line:

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

   If you are installing the PC/104-GPIB in a 16-bit stack, you can configure it to use any of the following interrupt lines: IRQ3, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, or None. You may not want to select interrupt lines 6 or 14 because interrupt line 6 is typically used by the diskette drive controller and interrupt line 14 is used by the hard disk drive controller on most systems.

   If you are installing the PC/104-GPIB in an 8-bit stack, the only interrupt lines available to you are 3, 4, 5, 6, 7, or None.

   If you are installing more than one PC/104-GPIB, each module must either use a unique IRQ level or not use interrupts at all.

2. Find the jumpers at W1 and W3 that set the interrupt request line. The jumpers are located on the lower edge of your PC/104-GPIB. Refer to the parts locator diagram, Figure 2-2.

3. Change the jumper settings to configure the PC/104-GPIB to the new interrupt request line.

   To use lines 10, 11, 12, 14, or 15, use the jumper block shown in Figure 2-4. To use interrupt lines 3, 4, 5, 6, 7, or 9, use the jumper block shown in Figure 2-5. To disable interrupts, use the jumper setting shown in Figure 2-6.

Figure 2-4 shows the setting for IRQ11.

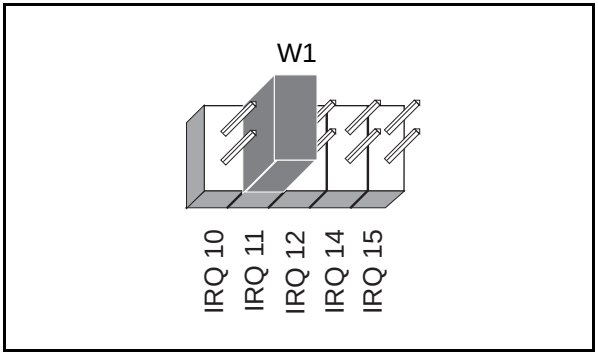


Figure 2-4. Interrupt Jumper Setting for IRQ11 (Default Setting)

Figure 2-5 shows the setting for IRQ5.

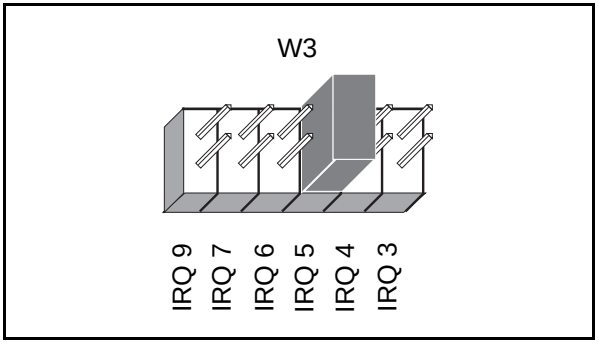


Figure 2-5. Interrupt Jumper Setting for IRQ5

If you do not want to use interrupts, you can disable interrupt levels on the PC/104-GPIB by setting the jumper as shown in Figure 2-6.

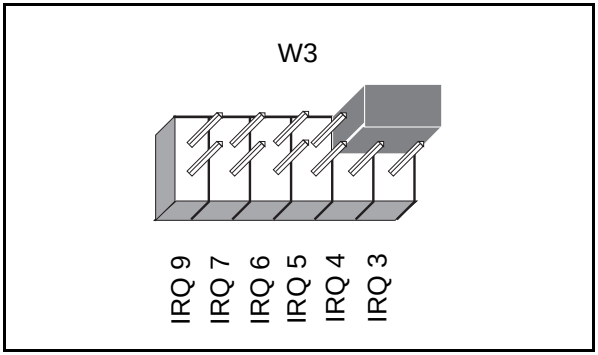


Figure 2-6. Jumper Setting for Disabling Interrupts

4. Record your new setting on the *PC/104-GPIB Hardware and Software Configuration Form* in Appendix B, *Customer Communication*.

5. Remember that after you install the NI-488.2 software, you must use the GPIB software configuration utility to configure your software settings to match your new hardware settings. Refer to the *Configure the Software* section in Chapter 3, *Software Installation and Configuration*, for more information.

Selecting the DMA Channel

Direct memory access (DMA) refers to data transfers directly to or directly from devices such as the PC/104-GPIB and system memory. Your GPIB hardware and the NI-488.2 software are designed to perform DMA. In most cases, data transfers using DMA are significantly faster than programmed I/O transfers, which use more CPU time.

By default, the PC/104-GPIB is configured to use DMA channel 5. If this is not an acceptable setting, if you are installing the PC/104-GPIB in an 8-bit stack, or if you are installing more than one PC/104-GPIB, follow these steps to reconfigure the DMA channel.

Note: ***If you are installing the PC/104-GPIB in an 8-bit stack, 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.***

1. Choose a new DMA channel setting.

   You can use channel 5, 6, or 7. If you are installing more than one PC/104-GPIB, each module must either use a unique DMA channel or must not use DMA at all.

2. Locate the jumpers at W2 that select the DMA channel. Refer to the parts locator diagram, Figure 2-2.

3. Change the jumper settings to configure the PC/104-GPIB 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

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

Figure 2-7 shows the jumper position for selecting DMA channel 7.

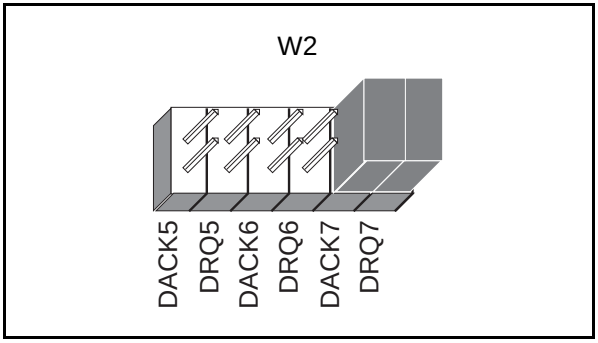


Figure 2-7. DMA Channel Jumper Setting for DMA Channel 7

4. Record your new setting on the *PC/104-GPIB Hardware and Software Configuration Form* in Appendix B, *Customer Communication*.

5. Remember that after you install the NI-488.2 software, you must use the GPIB software configuration utility to configure your software setting to match your new hardware settings. Refer to the *Configure the Software* section in Chapter 3, *Software Installation and Configuration*, for more information.

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 PC/104-GPIB by moving the jumpers as shown in Figure 2-8.

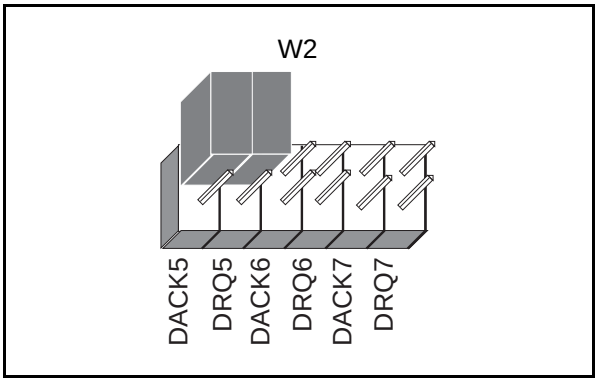


Figure 2-8. DMA Jumper Setting for No DMA Channel

Setting the Shield Ground Configuration

The PC/104-GPIB is set at the factory with the jumper in place to connect the logic ground of the PC/104-GPIB to its shield ground. This configuration minimizes EMI emissions.

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 W5 on the PC/104-GPIB.

2. Remove the jumper and place it across only one of the jumper pins, as shown in Figure 2-9.

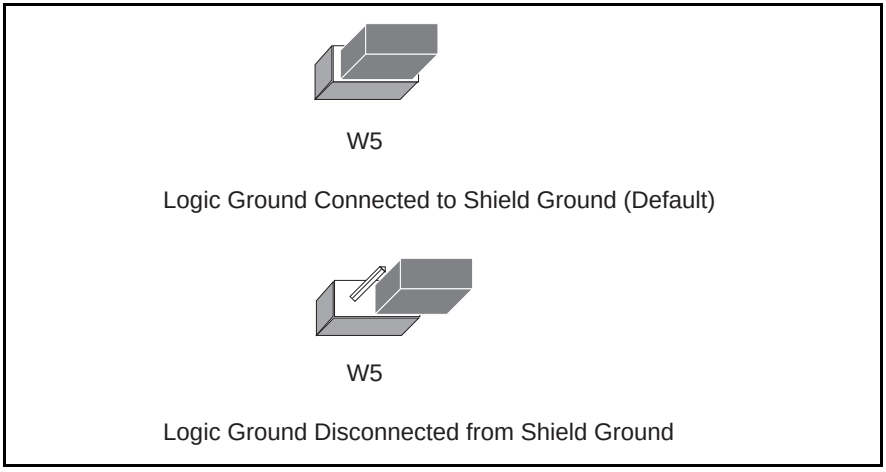


Figure 2-9. Ground Configuration Jumper Settings

3. Record the jumper setting on the *PC/104-GPIB 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-488.2 software.

NI-488.2 Software Components

The PC/104-GPIB is functionally equivalent to the AT-GPIB/TNT and is packaged with the NI-488.2 software for the AT-GPIB/TNT. The software includes the following components:

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

For a detailed list of files, refer to the *NI-488.2 User Manual for Windows*.

Install the Software

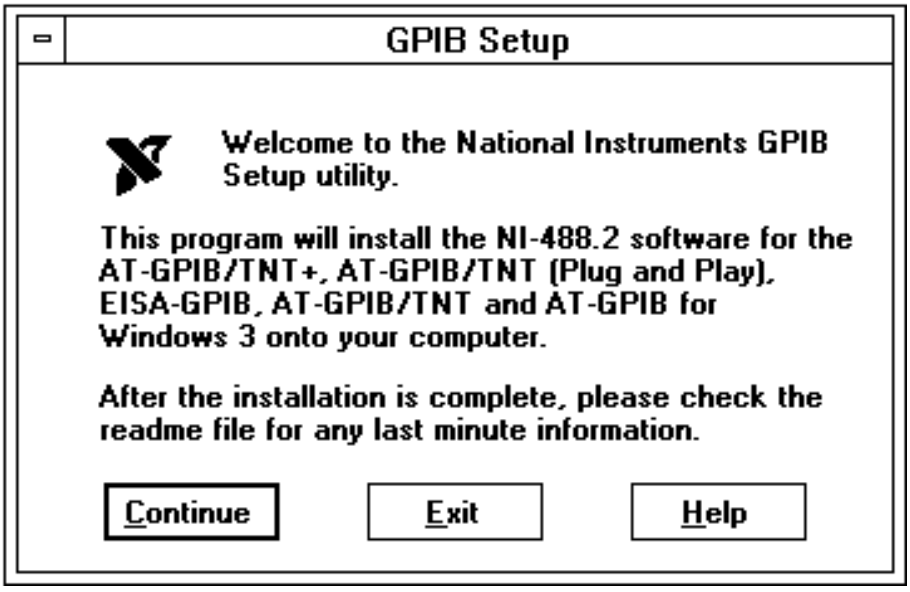
After you have installed and configured the hardware, you are ready to install the NI-488.2 software. Complete the following steps to run the software installation program.

1. Insert the NI-488.2 software for Windows distribution disk into an unused drive.
2. Choose **Run...** from the **File** menu in the **Program Manager** window and type the following command into the dialog box:

   x:\setup

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

The software installation begins with the following screen:



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

3. After the installation is complete, restart your system.

After you have installed your software, you might want to view or modify the driver configuration. If you modified the hardware configuration, if you installed the PC/104-GPIB in an 8-bit stack, or if you installed more than one PC/104-GPIB, you must reconfigure the software. Refer to the next section for instructions on running the GPIB software configuration utility. If you do not need to configure the software, refer to Chapter 4, *Installation Verification and Troubleshooting*, for instructions on verifying the hardware and software installation.

Configure the Software (Optional)

The GPIB software configuration utility is an interactive utility that you can use to examine or modify the configuration of the driver. You can also use it to enable or disable DMA or interrupts.

Note: ***You must run the GPIB software configuration utility if you changed any of the hardware default settings, if you installed the PC/104-GPIB in an 8-bit stack, or if you installed more than one PC/104-GPIB.***

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

The utility displays a list of all the GPIB modules and device names. Double-click on any name to examine or edit it. You can use the online help if you have any questions. For more information about the GPIB software configuration utility, refer to the *NI-488.2 User Manual for Windows.*

If you plan to use the HS488 high-speed protocol, you must specify in the GPIB software configuration utility the amount of GPIB cable length in your system. The 20 in. GPIB ribbon cable must be included in the total length.

After the software is installed and configured, you should verify the installation. Refer to Chapter 4, *Installation Verification and Troubleshooting*.

Chapter 4
Installation Verification and Troubleshooting

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

Troubleshooting ni-pnp Error Messages

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

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

`This interface has no assigned resources.`

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

`I/O Address Conflict.`

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

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

A different, more serious error can also occur on systems that are not Plug and Play ready. Because `ni-pnp` must assign resources to the modules, it must first perform the Plug and Play ISA isolation sequence. The isolation sequence is a method by which all Plug and Play modules can be detected. It is possible, although rare, that this isolation sequence could lock up your system. If this occurs, restart your system. `ni-pnp` then detects that your system was locked up and displays an error message describing the problem. `ni-pnp` can enter a fail-safe detection mode in which it records each I/O port before testing that port. If your system locks up while testing a port in this mode,

`ni-pnp` excludes that I/O port from future testing. If you know that you do not have any National Instruments Plug and Play modules in your system, you can configure `ni-pnp` so that it does not attempt to detect any Plug and Play modules. `ni-pnp` prompts you to choose between entering the fail-safe mode or disabling the detection of Plug and Play modules.

Run the Hardware Diagnostic Test

To verify and test the hardware installation, run the Hardware Diagnostic Test that came with your NI-488.2 software. The test verifies that your hardware is functioning properly and that the configuration of your PC/104-GPIB does not conflict with anything else in your system.

To run the test, double-click on the **Hardware Diagnostic Test** icon in the **NI-488.2 GPIB Software** group in the **Program Manager**.

If the Hardware Diagnostic Test completes with no errors, your hardware is functioning properly. If it returns an error message, refer to the next section for troubleshooting instructions.

Troubleshooting Hardware Diagnostic Test Error Messages

First verify that the switch and jumper settings on the hardware match the values you entered in the Hardware Diagnostic Test.

Using Single-Cycle DMA

The PC/104-GPIB normally uses demand-mode DMA. If your system cannot use demand-mode DMA, the Hardware Diagnostic Test prints a message telling you to use single-cycle DMA. You can select single-cycle DMA by configuring the software using the GPIB software configuration utility. Refer to the *Configure the Software* section of Chapter 3, *Software Installation and Configuration*, for information.

Correcting Hardware Settings

Follow these steps to troubleshoot Hardware Diagnostic Test error messages.

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

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

   - The base address that you entered when prompted does not match the switch settings of the PC/104-GPIB. Check the switch settings again.
   - Another module or built-in device in your system is using the same address space. Change the base I/O address of your PC/104-GPIB and repeat this step using the new setting.
   - The module is defective or cannot operate in your system. Complete the *Technical Support Form* in Appendix B, *Customer Communication*, and contact National Instruments.

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

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

   - The interrupt request line that you entered when prompted does not match the jumper setting of the PC/104-GPIB. Check the jumper setting again.
   - Another module or built-in device in your system is using the same interrupt request line. Change the interrupt request line of the PC/104-GPIB and repeat this step using the new setting.
   - The PC/104-GPIB is installed in an 8-bit stack, and you are using an invalid interrupt request line. If the PC/104-GPIB is installed in an 8-bit stack, you can only use interrupt lines 3, 4, 5, 6, 7, or None. Verify the interrupt line setting.
   - The module is defective or cannot operate in your system. Complete the *Technical Support Form* in Appendix B, *Customer Communication*, and contact National Instruments.

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

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

   - The DMA channel that you entered when prompted does not match the jumper setting of the PC/104-GPIB. Check the jumper setting again.
   - Another module or built-in device in your system is using the same DMA channel. Change the DMA channel of the PC/104-GPIB and repeat this step using the new setting.
   - The PC/104-GPIB is installed in an 8-bit stack, and DMA is enabled. If the PC/104-GPIB is installed in an 8-bit stack, DMA must be disabled. Always select <N> for the DMA channel.
   - The module is defective or cannot operate in your system. Complete the *Technical Support Form* in Appendix B, *Customer Communication*, and contact National Instruments.

Run the Software Diagnostic Test

To verify and test the hardware and software installation, run the Software Diagnostic Test that came with your NI-488.2 software. The Software Diagnostic Test is a Windows application that requires no user interaction.

Follow these steps to run the Software Diagnostic Test:

1. Disconnect any GPIB cables.

2. Double-click on the **Software Diagnostic Test** icon in the **NI-488.2 GPIB Software** group in the **Program Manager**.

If the Software Diagnostic Test completes with no errors, you have installed the NI-488.2 software correctly. If it returns an error message, refer to the next section for troubleshooting instructions.

Troubleshooting Software Diagnostic Test Error Messages

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

Note: ***In the following paragraphs,*** `gpib`***x*** ***refers to module*** `gpib0`, `gpib1`, `gpib2`, ***or*** `gpib3` ***as appropriate.***

Presence Test of Software Components

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

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

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

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

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

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

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

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

Presence Test of Driver

The Software Diagnostic Test displays the following message when it fails because of a mismatch between `gpib.ini` and `gpib.dll`:

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

If this message appears, you should reinstall the NI-488.2 software.

Presence Test of Module

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

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

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

- The module might not be properly configured. Run the GPIB software configuration utility to verify the hardware settings. Refer to the *Configure the Hardware* section of Chapter 2, *Hardware Configuration and Installation*, for more information.
- The module might not be properly installed. Refer to the *Install the Hardware* section of Chapter 2, *Hardware Configuration and Installation*, for more information.

GPIB Cables Connected

The following error message appears if a GPIB cable is connected to the PC/104-GPIB when you run the Software Diagnostic Test:

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

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

Disconnect all GPIB cables before trying the test again.

Common Questions

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

If you want to run a GPIB application under DOS, install the NI-488.2 software for DOS. If you want to run a GPIB application in Windows, you must install the NI-488.2 software for Windows.

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

Yes, there is nothing wrong with installing both. However, it is better not to use them at the same time.

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

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

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

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

When should I use the Win16 Interactive Control utility?

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

How do I use an NI-488.2 language interface?

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

What information should I have before I call National Instruments?

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

Chapter 5
Using Your NI-488.2 Software

This chapter introduces the Win16 Interactive Control utility and lists some programming considerations.

Introduction to the Win16 Interactive Control Utility

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

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

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

General Programming Considerations

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

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

For information about choosing a programming method, developing your application, or compiling and linking, refer to the *NI-488.2 User Manual for Windows*. For detailed information about each NI-488 function and NI-488.2 routine, refer to the *NI-488.2 Function Reference Manual for DOS/Windows*.

Appendix A
Hardware Specifications

This appendix describes the characteristics of the PC/104-GPIB and the recommended operating conditions.

Table A-1. Electrical Characteristics

Characteristic	Specification
Maximum GPIB Transfer Rates 3-wire (IEEE 488) High Speed (HS488)	 1.5 Mbytes/s* 1.6 Mbytes/s*
Power Requirement (from PC/104 I/O channel)	+5 VDC 50 mA Typical 120 mA Maximum
* Actual speed may vary considerably from speed shown because of system and instrumentation capabilities.	

Table A-2. Environmental Characteristics

Characteristic	Specification
Operating Environment Ambient Temperature Relative Humidity	 –40° to 85° C 10% to 90%, noncondensing
Storage Environment Temperature Relative Humidity	 –40° to 85° C 5% to 90%, noncondensing

Table A-3. Physical Characteristics

Characteristic	Specification
Dimensions	9.017 cm by 9.589 cm (3.55 in. by 3.775 in.)
I/O Connector	20 in. ribbon cable terminated with panel-mount IEEE 488 Standard 24-pin

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.

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Technical support fax: (512) 794-5678

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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
U.K.	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 _____

Company _____

Address _____

_____

Fax (___)_____ Phone (___)_____

Computer brand _____

Model _____ Processor _____

Operating system _____

Speed _____MHz RAM _____MB

Display adapter _____

Mouse _____yes _____no

Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____

Revision _____

Configuration _____

National Instruments software product _____

Version _____

Configuration _____

(continues)

The problem is _____

List any error messages _____

The following steps will reproduce the problem _____

PC/104-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. 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

- PC/104-GPIB Model (16-bit or 8-bit) _____
- PC/104-GPIB Revision _____
- NI-488.2 Software Revision Number on Distribution Disk _____
- Programming Language Interface Revision _____
- 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 Video Module Installed _____
- 8-bit or 16-bit Stack _____
- Windows Version _____

- Application Programming Language (Microsoft C, Visual Basic for Windows)_____

  _____

- Other Modules in System _____
- Base I/O Addresses of Other Modules _____
- Interrupt Levels of Other Modules _____
- DMA Channels of Other Modules _____

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 PC/104-GPIB and the NI-488.2™ Software for Windows**

Edition Date: **May 1997**

Part Number: **370916A-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 _____

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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
DMA	direct memory access
FCC	Federal Communications Commission
GPIB	General Purpose Interface Bus
hex	hexadecimal
Hz	hertz
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
I/O	input/output
IRQ	interrupt request
m	meters
MB	megabytes of memory
PC	personal computer
RAM	random-access memory
s	seconds
VDC	volts direct current

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