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NB-GPIB

Getting Started with Your NB-GPIB and the NI-488.2™ Software for the Macintosh

May 1992 Edition

Part Number 320496-01

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National Instruments Corporate Headquarters

6504 Bridge Point Parkway

Austin, TX 78730-5039

(512) 794-0100

(800) IEEE-488 (toll-free U.S. and Canada)

Technical support fax: (512) 794-5678

Branch Offices:

Australia 03 879 9422, Belgium 02 757 00 20, Canada 519 622 9310, Denmark 45 76 73 22, France 1 48 65 33 70,
Germany 089 714 50 93, Italy 02 48301892, Japan 03 3788 1921, Netherlands 01720 45761, Norway 03 846866,
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 - This device may not cause harmful interference.
 - This device must accept any interference received, including interference that may cause undesired operation.
- The limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications (DOC).

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- 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.
- Relocate the equipment with respect to the receiver.
- Reorient 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.

Preface

This manual contains instructions for installing and configuring the National Instruments NB-GPIB interface board and the NI-488.2 software for the Macintosh. This manual is meant to be used with the National Instruments IEEE 488 for Macintosh reference (*NI-488.2 Software Reference Manual for the Macintosh*, part number 320363-01).

Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, contains a picture of the NB-GPIB interface board, lists the contents of your kit and optional equipment, contains instructions for inspecting your NB-GPIB, and gives descriptions of the NB-GPIB hardware and the NI-488.2 software.
- Chapter 2, *Installation*, contains instructions for configuring and installing your NB-GPIB interface board, installing the NI-488.2 software, and verifying the software installation.
- Appendix A, *Hardware Verification*, contains instructions for running the hardware verification program, IBDIAG.
- Appendix B, *Hardware Specifications*, specifies the electrical, environmental, and physical characteristics of the NB-GPIB.
- Appendix C, *Troubleshooting*, suggests some areas to check if you have problems installing the NB-GPIB board or the NI-488.2 software after going through the procedures described in Chapter 2, *Installation*, and Appendix A, *Hardware Verification*.
- Appendix D, *Customer Communication*, contains forms for you to complete to facilitate communication with National Instruments concerning our products.

Conventions Used in This Manual

Throughout this manual, the following conventions are used to distinguish elements of text:

- | | |
|---------------|---|
| bold | Bold text denotes menus, menu items, or dialog box buttons or options. |
| <i>italic</i> | Italic text denotes emphasis, a cross reference, or an introduction to a key concept. |
| monospace | Text in this font denotes the names of commands, files, icons, and utilities. |

Abbreviations

The following abbreviations are used in this manual:

A	amperes
C	Celsius
Hz	hertz
in.	inches
kbytes	1,000 bytes
M	megabytes
M	mega- (10^6)
m	meters

Acronyms

The following acronyms are used in this manual:

ANSI	American National Standards Institute
ASIC	application-specific integrated circuit
EMI	electromagnetic interference
FCC	Federal Communications Commission
FIFO	first-in-first-out
GPIB	General Purpose Interface Bus
IEEE	Institute for Electrical and Electronic Engineers
I/O	input/output
RAM	random-access memory
RTSI	Real-Time System Integration
VDC	volts direct current

IEEE 488 refers to the ANSI/IEEE Standard 488.1-1987 which defines the GPIB

IEEE 488.2 refers to the ANSI/IEEE Standard 488.2-1987 which defines the GPIB

NI-488.2 refers to the NI-488.2 software for the Macintosh unless otherwise noted

Related Documents

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*.
- *NI-488.2 Software Reference Manual for the Macintosh*, part number 320363-01.

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are in Appendix D, *Customer Communication*, at the end of this manual.

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Chapter 1

Introduction

This chapter contains a picture of the NB-GPIB interface board, lists the contents of your kit and optional equipment, contains instructions for inspecting your NB-GPIB, and gives descriptions of the NB-GPIB hardware and the NI-488.2 software.

Figure 1-1 shows the NB-GPIB interface board.

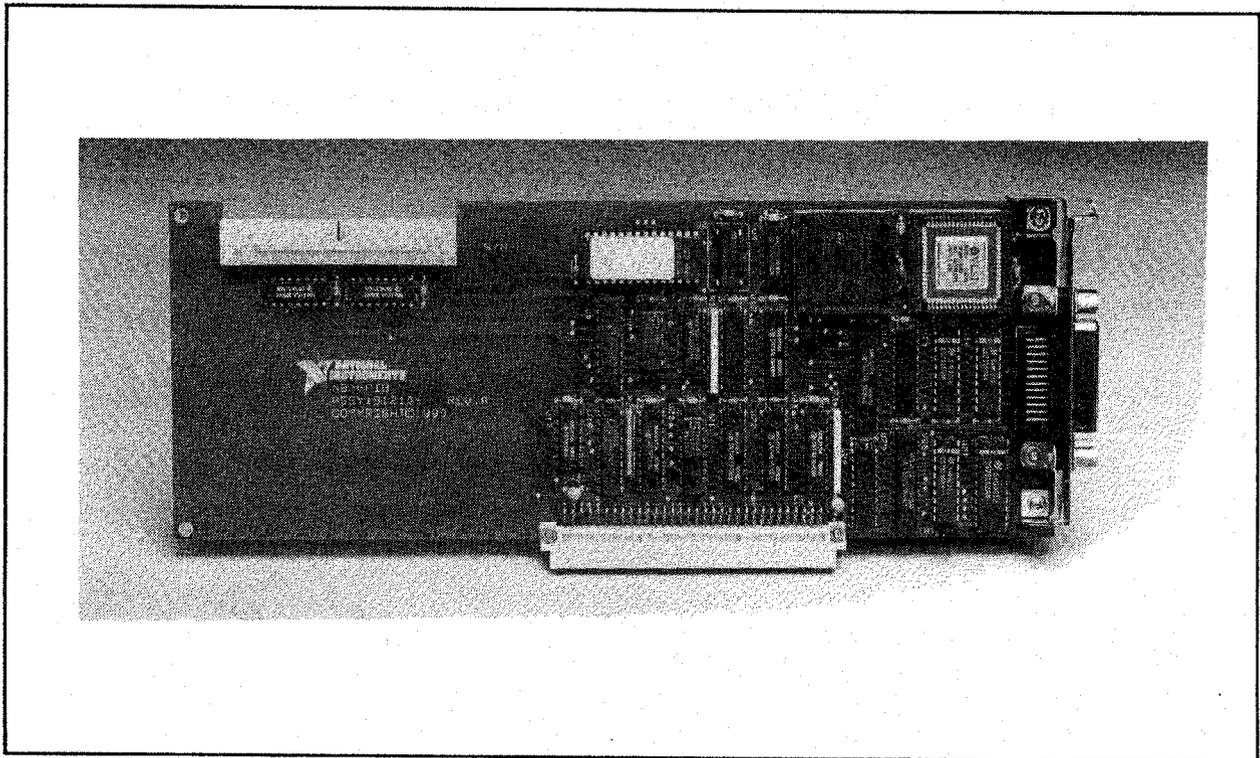


Figure 1-1. NB-GPIB

What Your Kit Should Contain

Your kit should contain the following components:

Component	Part Number
NB-GPIB interface board with GPIB extension connector	181210-01
3.5 in. NI-488.2 Distribution Disks for the Macintosh, QuickBASIC, C & HyperTalk Interfaces, Disks 1 and 2	422153-37 422847-37
3.5 in. Macintosh Hardware Verification disk	422207-33
<i>Getting Started with Your NB-GPIB and the NI-488.2 Software for the Macintosh</i>	320496-01
<i>NI-488.2 Software Reference Manual for the Macintosh</i>	320363-01

Make sure each item is in your kit. If any item is missing, contact National Instruments.

Optional Equipment

You can call National Instruments to order the following optional equipment to go with your kit:

Component	Part Number
NB-DMA2800 interface board	180785-01
RTSI Bus Cables for:	
2 boards	180523-02
3 boards	180523-03
4 boards	180523-04
5 boards	180523-05
Single-Shielded GPIB Cables*:	
Type X1 Cable – 1 m	763001-01
Type X1 Cable – 2 m	763001-02
Type X1 Cable – 4 m	763001-03
Type X1 Cable – 8 m	763001-04
Double-Shielded GPIB Cables*:	
Type X2 Cable – 1 m	763061-01
Type X2 Cable – 2 m	763061-02
Type X2 Cable – 4 m	763061-03
Type X2 Cable – 8 m	763061-04
* To meet FCC emission limits for this Class B device, you must use a shielded (Type X1 or X2) GPIB cable. Operating this equipment with a non-shielded cable may cause interference to radio and television reception in residential areas.	

Unpacking Your NB-GPIB

Follow these steps when unpacking your NB-GPIB.

1. Verify that the pieces contained in the package you received match the kit parts list given earlier in this chapter.

Caution: Do *not* remove the board from its plastic bag at this point.

2. Notice that your NB-GPIB board is shipped packaged in an antistatic plastic bag to prevent electrostatic damage to the board. Several components on the board can be damaged by electrostatic discharge. To avoid such damage in handling the board, touch the plastic bag to a metal part of your computer chassis before removing the board from the bag.
3. Remove the board from the bag and inspect the board for loose components or any other sign of damage. Notify National Instruments if the board appears damaged in any way. Do *not* install a damaged board into your computer.

Hardware Description

The NB-GPIB is a high-performance plug-in board for the Apple Macintosh NuBus computers. With a design that combines the National Instruments NAT4882 and Turbo488 ASICs, the NB-GPIB is a high-speed IEEE 488.2 Controller. The NAT4882 chip performs the basic IEEE-488 Talker, Listener, and Controller functions as well as all of the IEEE 488.2 Controller functions. The Turbo488 increases the performance of the NB-GPIB by combining two 16-byte FIFOs with circuitry to pack and unpack 16-bit accesses from the NuBus to 8-bit transfers across the GPIB. Programmed I/O data transfer rates can sustain a maximum rate of 800 kbytes/sec for both read and write operations. The actual rate depends on your instrumentation capabilities.

Standard GPIB cables connect the NB-GPIB with up to 13 instruments. If more than 13 instruments are required, you can use the National Instruments GPIB extenders or GPIB expander/isolator to add additional instruments to the system.

Software Description

National Instruments has developed two software packages for use with the NB-GPIB: NI-488.2 for the Macintosh and LabVIEW. Both programs simplify the job of programming the NB-GPIB to function as an IEEE 488.2 Controller with complete communication and bus management capabilities.

- NI-488.2 software is part of your NB-GPIB kit. It is a comprehensive package of software for transforming the Macintosh into a GPIB Controller with complete communications and bus management capability. The NI-488.2 software package also comes with an interactive debugger and the Microsoft QuickBASIC, Macintosh Programmer's Workshop (MPW) C and THINK C, and HyperTalk language interfaces.
- LabVIEW (part number 776141-01) is a software system with interactive graphics, state-of-the-art user interface concepts, and a powerful new graphical programming language. You must order LabVIEW separately.

Chapter 2

Installation

This chapter contains instructions for configuring and installing your NB-GPIB interface board, installing the NI-488.2 software, and verifying the software installation.

If your NB-GPIB does not function properly after you perform the steps in this chapter, follow the instructions in Appendix A, *Hardware Verification*, to test your hardware.

Configure the Shield Ground Jumper

The NB-GPIB is shipped from the factory with the jumper (W1) set to connect the logic ground of the NB-GPIB to its shield ground. This configuration minimizes the EMI emitted from a Macintosh computer equipped with an NB-GPIB.

Figure 2-1 shows the location of the shield ground jumper (W1).

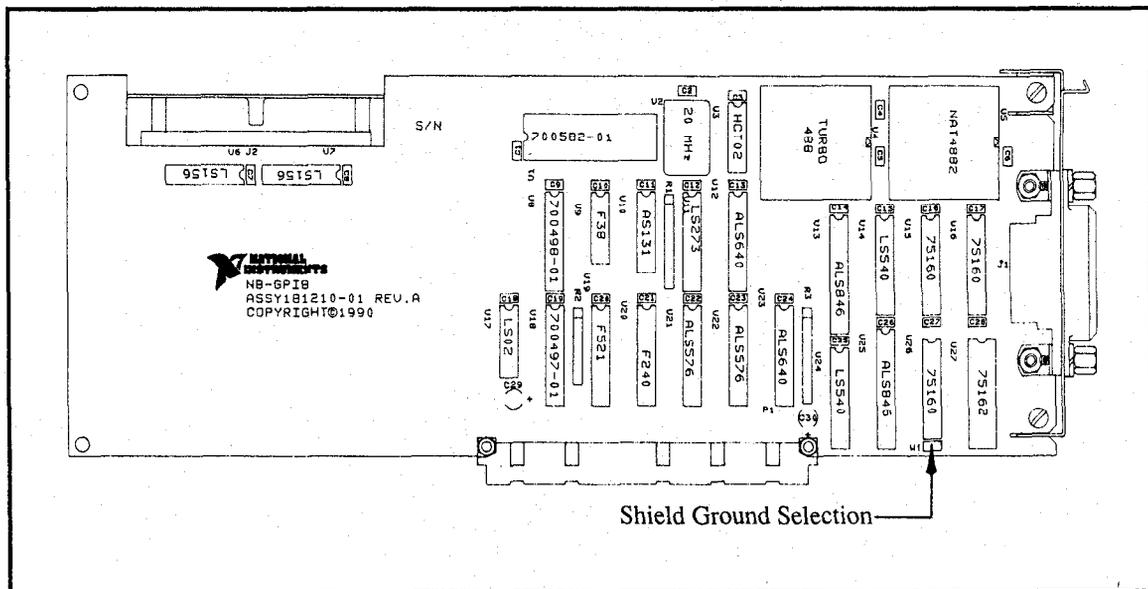


Figure 2-1. NB-GPIB Parts Locator Diagram

If your application requires that logic ground be disconnected from shield ground, remove the jumper and place it across only one of the jumper pins. Jumper settings for logic ground connected and disconnected from shield ground are shown in Figure 2-2.

Note: The NB-GPIB was tested to meet FCC emission limits for a Class B device with jumper W1 set to connect logic ground to shield ground. Removing this jumper may cause EMI emissions to exceed the limits for a Class B device.

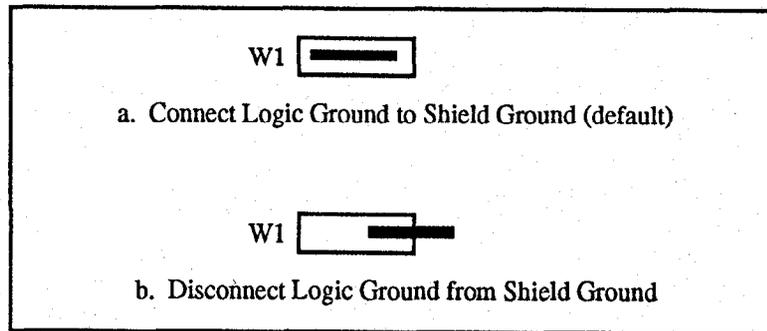


Figure 2-2. Ground Configuration Jumper Settings

Install the Hardware

Follow these steps to install your NB-GPIB board.

Note: Do not complete Steps 8 through 10 if you are going to run the hardware verification program.

1. Turn off your computer.
2. Unplug the power cord.
3. Remove the GPIB extension connector from the NB-GPIB by unscrewing the thumb screws located on each side of the connector, as shown in Figure 2-3.

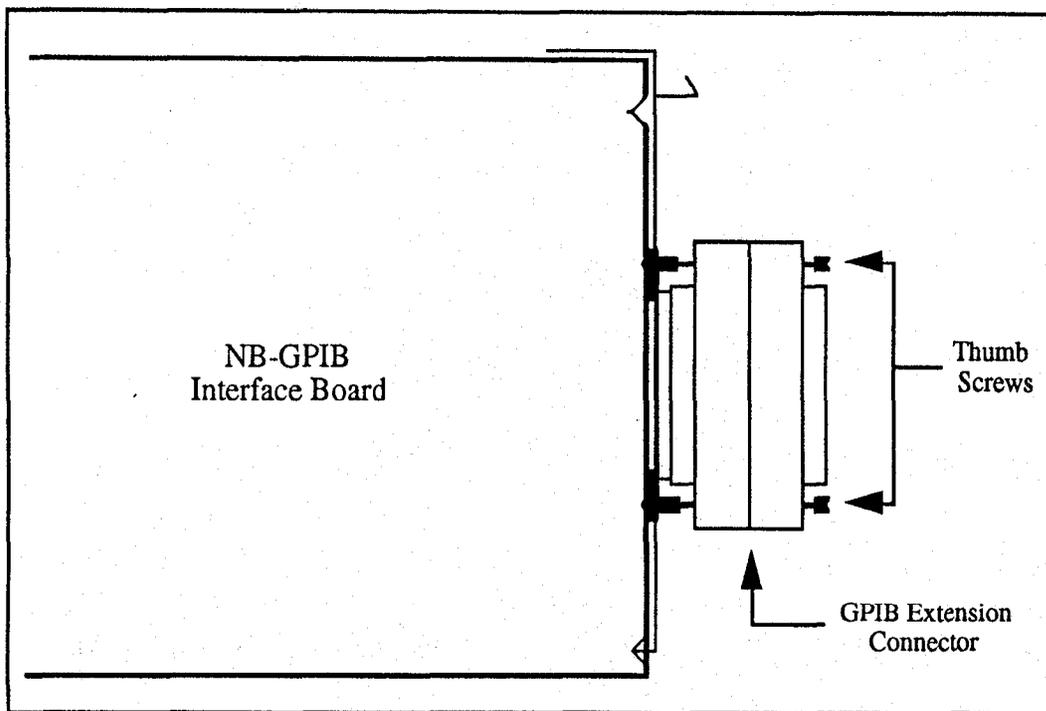


Figure 2-3. The GPIB Extension Connector

4. Install the NB-GPIB interface board according to the instructions in the manual that came with your computer. You can install the board into any slot. Figure 2-4 shows the NB-GPIB interface board installed in the fourth slot of the Macintosh as viewed from the back of the computer.

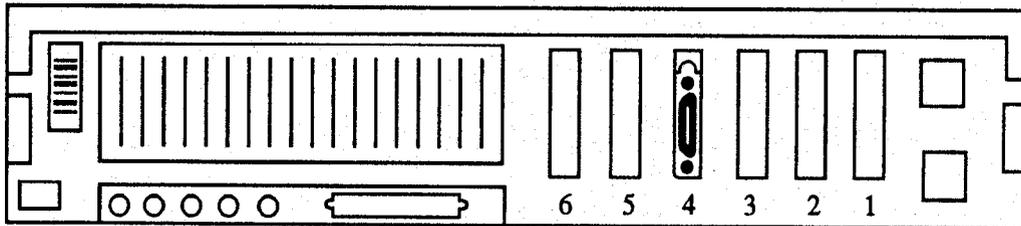


Figure 2-4. The NB-GPIB Installed in the Fourth Slot of the Macintosh

5. Connect the GPIB extension connector, removed in Step 3, to the NB-GPIB interface board through the slot in the Macintosh NuBus backplane.
 6. Push the GPIB extension connector in until it is secure.
 7. Tighten the thumb screws on each side of the GPIB extension connector.
- Note:** If you want to run the hardware verification diagnostics for the NB-GPIB, skip to Step 11 and then refer to Appendix A, *Hardware Verification*. Do *not* connect the GPIB cables to the NB-GPIB interface board or your device before running the hardware verification program. If you do not want to verify the installation, continue with Step 8.
8. Align the GPIB cable with the GPIB extension receptacle.
 9. Push the GPIB cable in until it is secure.
 10. Tighten the thumb screws on each side of the GPIB cable connector.
 11. Install the power cord.
 12. Turn your computer back on.

The NB-GPIB hardware installation is complete.

Install the Software

The NI-488.2 software is distributed in compressed form on two disks. Installing the entire package requires about 1 Megabyte of space on your hard disk and takes about five minutes.

If you are using the National Instruments LabVIEW 2 or NI-DAQ application packages, a Handler INIT file might already be installed in your system. If so, the NI-488.2 Installer program replaces it.

Note: Installation of the new Handler INIT file causes any previous software settings to return to their default state. Be sure to note the settings before installing the new software.

Install the NI-488.2 software by completing the following steps.

Step 1. Install the NI-488.2 Files and Folders

Caution: Virus detection software may prevent the installer from copying important files to the System Folder. You must disable or bypass any virus prevention software before attempting the installation procedure.

1. Insert disk 1 of the NI-488.2 software distribution disk set and double-click on the NI-488.2 Installer icon.

The installer creates a folder named NI-488.2 to contain NI-488.2 files and folders. If you want to name the folder something else, click on the **Change Folder** button in the opening dialog box to get a standard file dialog box.

2. Click on the **Install** button to install the entire NI-488.2 package. If you want to install only part of the package, click on the **Use Custom Install** button and select the items to install. You might be prompted to insert other disks to complete the process.

After installation of the entire package, the NI-488.2 Folder should contain the items shown in Figure 2-5. If you are running System 7.0 or later, the NB Handler INIT file is placed in the Control Panels Folder in the System Folder. If you are running System 6 or earlier, the NB Handler INIT file is installed in the System Folder. NB-Boards, a hardware verification application, appears with the NB Handler INIT file if your Macintosh system has NuBus slot management capabilities.

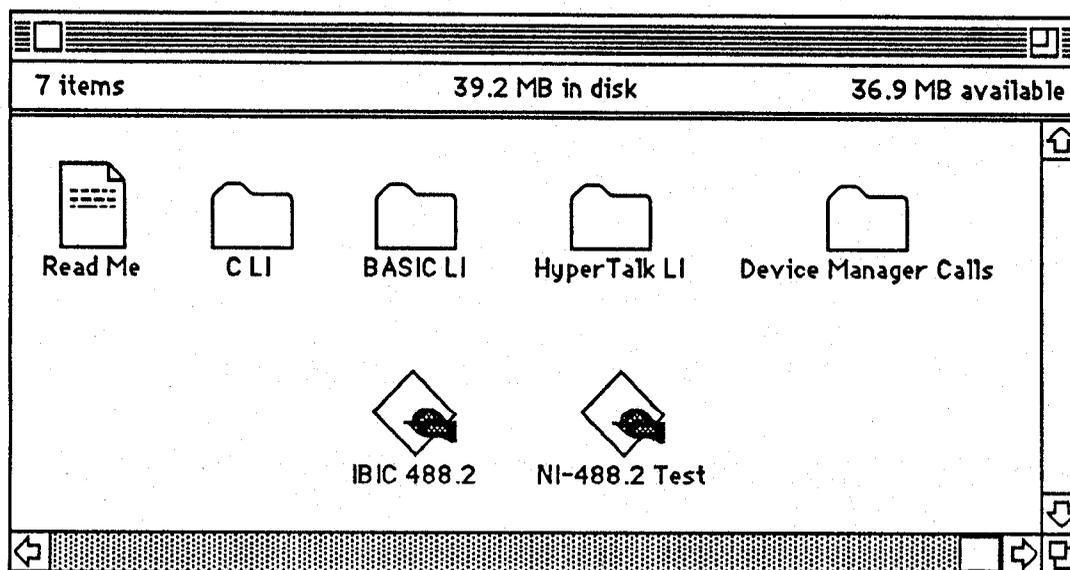


Figure 2-5. File and Folder Organization after Installation

A new control panel, **NB Handler INIT**, is installed on your computer. The **NB Handler INIT** control panel is actually a configuration utility which you can use to examine and change the software settings for your board. You can activate the configuration utility by selecting **Control Panels** from the  menu and double-clicking on the **NB Handler INIT** icon.

Figure 2-6 shows a possible configuration for the NB-GPIB interface board. The **Auto** box is selected by default and assigns `gpib0` (bus number 0) to the appropriate slot. If no **X** appears in the **System Slots** box which corresponds to `gpib0`, follow the instructions in Appendix A, *Hardware Verification*, to verify that the board is operating correctly.

Figure 2-6. Example Configuration for the NB-GPIB

Step 2. Restart Your Macintosh

The NI-488.2 software is loaded every time the Macintosh is started or restarted. Restart the Macintosh by selecting **Restart** from the **Special** menu. The NI-488.2 software for the Macintosh displays the National Instruments icon momentarily in the lower left corner of the screen to indicate that the interface software is being installed. If the National Instruments icon does not appear on your screen, repeat the installation procedure before continuing to *Verifying the Software Installation*.

Verify the Software Installation

This step verifies that the software is installed and functioning with the NB-GPIB board. First disconnect all GPIB cables from the NB-GPIB, then double-click on the NI-488.2 Test icon in the NI-488.2 Folder.

If no error messages appear on the screen, the installation is complete. If error messages do appear on the screen, select **Restart** from the **Special** menu, and double-click on the NI-488.2 Test icon. If the test fails again, reinstall the NI-488.2 software from the distribution disk, restart your Macintosh, and double-click on the NI-488.2 Test icon.

If any one of the software installation steps fails, you might have to change a software setting. Refer to the *Configuring the Software* section of this chapter. If the software settings are correct and the verification still fails, carefully note all error information on the *NB-GPIB Hardware and Software Configuration Form* in Appendix D, and contact National Instruments.

If the verification test is successful, you are ready to write your own application program. Refer to the *NI-488.2 Software Reference Manual for the Macintosh* for example programs.

Configure the Software (Optional)

The default settings for the software work for most applications and devices. However, you might want to change a device name or primary address. Also, if more than one GPIB interface or external box is installed, you might want to associate a device with a particular interface.

You can examine and adjust the configuration of the software using the **NB Handler INIT** control panel, which is actually a GPIB configuration utility. Refer to Chapter 2, *Configuring the NI-488.2 Software*, in the *NI-488.2 Software Reference Manual for the Macintosh* for more information on running the utility and for information about the configurable software parameters.

Appendix A

Hardware Verification

This appendix contains instructions for running the hardware verification program, IBDIAG.

The IBDIAG program is contained on the 3.5 in. Macintosh Hardware Verification disk that came with your NB-GPIB kit. This program is used to verify that the hardware is installed correctly and that it is in good working condition. Use the following steps to run the program.

Preparation

Caution: Disconnect *all* GPIB cables from your Macintosh NuBus computer before running the hardware verification program.

1. Turn on your Macintosh computer.
2. Insert the hardware verification disk. When startup completes, the disk icon called Hardware Verification, as shown in Figure A-1, appears on the screen.

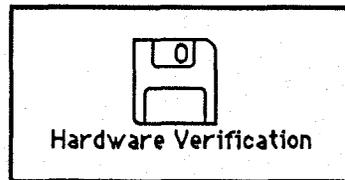


Figure A-1. Hardware Verification Icon

3. Double-click on the Hardware Verification icon. The IBDIAG icon appears on the screen.

Run the IBDIAG Program

1. Double-click on the IBDIAG icon, which is shown in Figure A-2.



Figure A-2. IBDIAG Icon

A test window appears on the screen, as shown in Figure A-3.

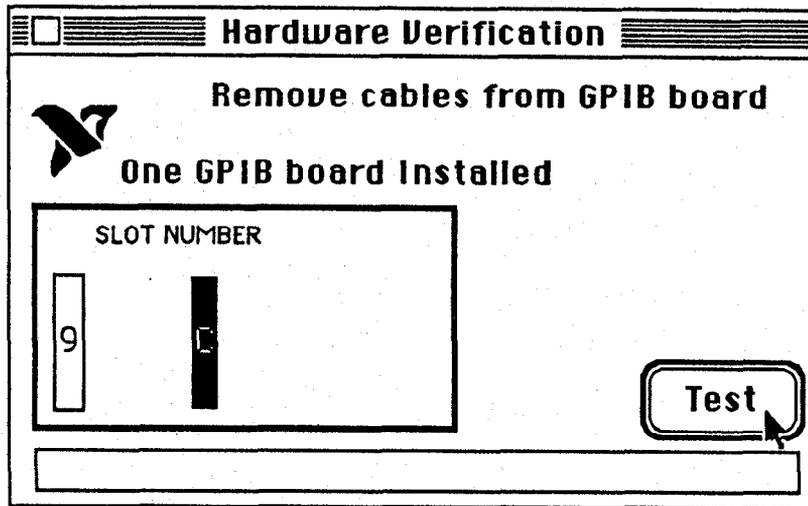


Figure A-3. Test Window

The slot indicators show the Macintosh slots that have boards installed. A slot indicator highlighted in black shows the slot number of an NB-GPIB board which can be tested.

Note: For online help, select **About Hardware Verification** from the  menu.

2. Click on the **Test** button to run a series of tests that verify the NB-GPIB hardware installation. A bar graph indicates the progress of the tests, and a message appears above the slot indicators at the completion of all tests.
3. View the test results. Figure A-4 shows the test window that appears if no error was detected. Skip to the *Exit from the IBDIAG Program* section in this chapter if no error was detected.

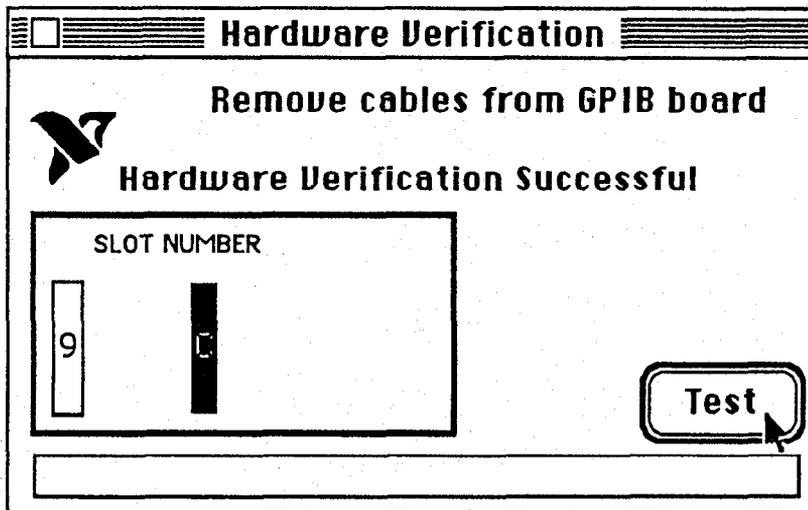


Figure A-4. Hardware Verification Window after Successful Completion of Tests

Figure A-5 shows the Alert Box screen that appears if an error was detected. The Alert Box screen has error information and the option to continue or stop, as shown in Figure A-5.

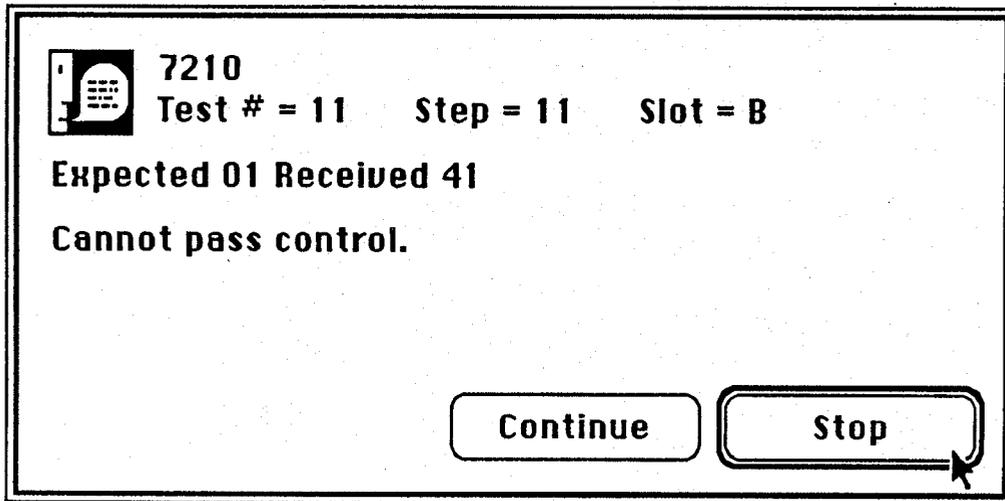


Figure A-5. Alert Box with Error Information

- Record the error information. Whenever an Alert Box screen appears, record the information before clicking on either **Continue** or **Stop**. At the end of the program, if the hardware verification did not complete successfully, a screen displays as shown in Figure A-6.

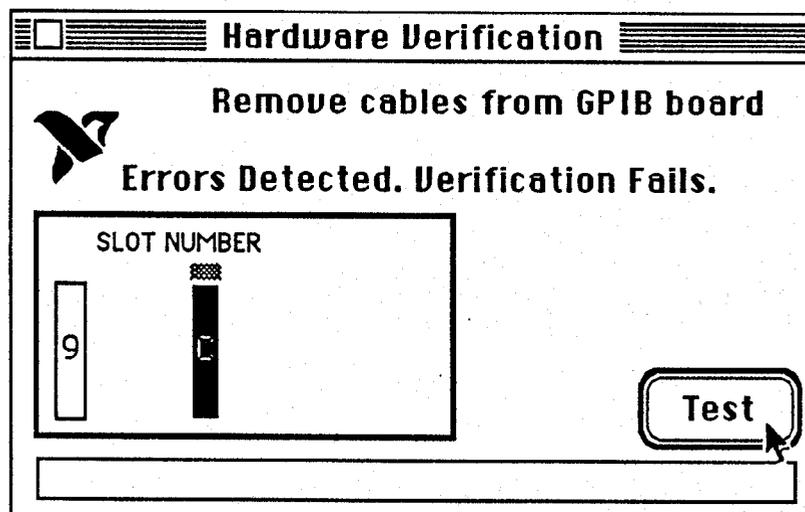


Figure A-6. Hardware Verification Window after Unsuccessful Completion of Tests

- Run the IBDIAG program again. If the program still detects errors, record the errors and then refer to Appendix D, *Customer Communication*, where you will be instructed to fill out some forms before contacting National Instruments.

Exit from the IBDIAG Program

Select **Quit** from the **File** menu.

If the hardware verification program completed without detecting an error, you can finish installing the NB-GPIB hardware. The instructions are located in the *Installing the Hardware* section of Chapter 2. Start with Step 8.

Appendix B

Hardware Specifications

This appendix specifies the electrical, environmental, and physical characteristics of the NB-GPIB.

Table B-1. Electrical Characteristics

Characteristic	Specification
Number of bus loads	2
Turbo488 clock	20 MHz
NAT4882 clock	20 MHz
GPIB Transceivers	NS75160A/75162A
Transfer Rate (programmed I/O)	Up to 800 kbytes/sec typical*
Power Requirement	+5 VDC, 1.25 A maximum

* Actual rates are dependent on instrument capabilities.

Table B-2. Environmental Characteristics

Characteristic	Specification
Operating Temperature	0° to 70° C
Storage Temperature	-55° to 150° C
Relative Humidity	5% to 90% noncondensing conditions
EMI	FCC Class B Verified

Table B-3. Physical Characteristics

Characteristic	Specification
Dimensions	4.0 in. by 12.8 in.
I/O Connector	IEEE 488 standard 24-pin

Appendix C

Troubleshooting

This appendix suggests some areas to check if you have problems installing the NB-GPIB board or the NI-488.2 software after going through the procedures described in Chapter 2, *Installation*, and Appendix A, *Hardware Verification*.

If you still have problems after completing the steps in this appendix, complete the appropriate forms in Appendix D, *Customer Communication*, and then contact National Instruments for technical support.

Hardware

- Check that all GPIB cables are connected properly.
- Make sure that the NB-GPIB is positioned securely in its slot.
- Make sure that any RTSI cables being used are inserted properly.
- If the hardware verification fails, make sure that all GPIB cables are removed from the NB-GPIB.

Software

The **NB Handler INIT** control panel (GPIB configuration utility) should show the following software configuration:

- The **Interface** menu selection should be set to **System Slots**.
- An X should appear in the **System Slots** box which corresponds to the location of your NB-GPIB board.

Appendix D

Customer Communication

For your convenience this appendix contains forms to help you gather the information necessary to help us solve possible technical problems, as well as a form you can use to comment on the product documentation.

By completing these forms before calling National Instruments, you will save yourself time, and our applications engineers will be able to answer your questions more accurately and efficiently. The forms contain the information that the applications engineers need from you to help solve your problem. Briefly jot down the information requested on the line after each item.

Fax Technical Support

If you encounter any technical problems, please complete the fax and configuration forms before requesting technical support by fax. You can contact us by fax at any time at the following number:

(512) 794-5678

Telephone Technical Support

For best service by telephone, please complete the fax and configuration forms, record any error messages, and be available at your computer when you call for technical support. You can use the following numbers between the hours of 8:00 a.m. and 5:30 p.m. (central time) to call the National Instruments applications engineering department:

(512) 794-0100
(800) IEEE-488 (toll-free U.S. and Canada)

Documentation Comments

You can use the *Documentation Comment Form* for your comments about our documents. Please mail or fax it to National Instruments.

Technical Support Fax Form

Technical support is available at any time by fax at (512) 794-5678. For best results, provide as much information as possible. 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 _____ M Display adapter _____

Mouse _____ yes _____ no Other adapters installed _____

Hard disk capacity _____ M 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 _____

NB-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

- NB-GPIB Model and Revision: _____
- NI-488.2 Software Revision Number on Disk: _____
- Shield Ground Jumper Connected (yes or no): _____
- NB Handler INIT control panel settings: _____

Other Products

- Programming Language and Version Number: _____
- Computer Make and Model: _____
- Memory Capacity on Computer: _____
- Clock Frequency: _____
- Operating System Version: _____
- Number of GPIB Devices on Bus: _____
- Other Hardware Devices in System: _____
- Type of Monitor: _____

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 NB-GPIB and the NI-488.2™ Software for the Macintosh**

Edition Date: **May 1992**

Part Number: **320496-01**

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

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

Thank you for your help.

Name _____

Title _____

Company _____

Address _____

Phone (_____) _____

Mail to: **Technical Publications
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