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GPIB

Getting Started with Your SB-GPIB/TNT and NI-488.2™ for Solaris

NATIONAL INSTRUMENTS™

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Compliance

FCC/Canada Radio Frequency Interference Compliance*

Determining FCC Class

The Federal Communications Commission (FCC) has rules to protect wireless communications from interference. The FCC places digital electronics into two classes. These classes are known as Class A (for use in industrial-commercial locations only) or Class B (for use in residential or commercial locations). Depending on where it is operated, this product could be subject to restrictions in the FCC rules. (In Canada, the Department of Communications (DOC), of Industry Canada, regulates wireless interference in much the same way.)

Digital electronics emit weak signals during normal operation that can affect radio, television, or other wireless products. By examining the product you purchased, you can determine the FCC Class and therefore which of the two FCC/DOC Warnings apply in the following sections. (Some products may not be labeled at all for FCC; if so, the reader should then assume these are Class A devices.)

FCC Class A products only display a simple warning statement of one paragraph in length regarding interference and undesired operation. Most of our products are FCC Class A. The FCC rules have restrictions regarding the locations where FCC Class A products can be operated.

FCC Class B products display either a FCC ID code, starting with the letters **EXN**, or the FCC Class B compliance mark that appears as shown here on the right.



Consult the FCC web site `http://www.fcc.gov` for more information.

FCC/DOC Warnings

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual and the CE Mark Declaration of Conformity**, may cause interference to radio and television reception. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC).

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

Class A

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications

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

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

Class B

Federal Communications Commission

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canadian Department of Communications

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

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

Compliance to EU Directives

Readers in the European Union (EU) must refer to the Manufacturer's Declaration of Conformity (DoC) for information** pertaining to the CE Mark compliance scheme. The Manufacturer includes a DoC for most every hardware product except for those bought for OEMs, if also available from an original manufacturer that also markets in the EU, or where compliance is not required as for electrically benign apparatus or cables.

To obtain the DoC for this product, click **Declaration of Conformity** at `ni.com/hardref.nsf/`. This website lists the DoCs by product family. Select the appropriate product family, followed by your product, and a link to the DoC appears in Adobe Acrobat format. Click the Acrobat icon to download or read the DoC.

* Certain exemptions may apply in the USA, see FCC Rules §15.103 **Exempted devices**, and §15.105(c). Also available in sections of CFR 47.

** The CE Mark Declaration of Conformity will contain important supplementary information and instructions for the user or installer.

Conventions

The following conventions are used in this manual:



This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

italic

Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.

`monospace`

Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.

Contents

Chapter 1
Introduction

What You Need to Get Started 1-1
GPIB Hardware Overview 1-1
NI-488.2 Overview 1-2

Chapter 2
Installation

Installing the GPIB Hardware 2-1
Installing NI-488.2 2-3
Configuring the Software with ibconf (Optional) 2-3
Removing NI-488.2 (Optional) 2-4

Chapter 3
Installation Verification

Chapter 4
Using NI-488.2 with Solaris

Introduction to ibic 4-1
Programming Considerations 4-2

Appendix A
Common Questions

Appendix B
Specifications

Appendix C
Technical Support Resources

Glossary

Index

1

Introduction

This chapter explains how to use this manual, lists what you need to get started, and briefly describes the SB-GPIB/TNT and NI-488.2 for Solaris.

What You Need to Get Started

- ❑ Solaris version 2.5.1 or higher installed on your Sun SPARC system.
- ❑ One of the following boards:
  - SB-GPIB
  - SB-GPIB/TNT
- ❑ *NI-488.2 for Solaris and SB-GPIB/TNT, Version 2.x* CD
- ❑ Super-user privilege
- ❑ One of the following shielded GPIB cables, which you can purchase from National Instruments:
  - Type X1 single-shielded cables (1, 2, or 4 m)
  - Type X2 double-shielded cables (1, 2, or 4 m)



Caution To meet FCC emission limits for this device, you *must* use a shielded (Type X1 or X2) GPIB cable. Operating this equipment with a non-shielded cable may interfere with radio and television reception.

GPIB Hardware Overview

The SB-GPIB/TNT board, equipped with a TNT4882C ASIC, is compatible with all revisions of the IEEE 488 standard, including ANSI/IEEE Standard 488.2-1987. 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 devices up to 3.4 Mbytes/s when using the SBus direct virtual memory access (DMVA) transfers.

The SB-GPIB board also is compatible with all revisions of the IEEE 488 standard, including the IEEE 488.2 standard. The NAT4882 chip performs the basic IEEE 488 Talker, Listener, and Controller functions. The Turbo488 chip enhances the performance of the SB-GPIB board. With the Turbo488 chip and the SBus DVMA transfers, data rates for both read and write operations can exceed 1 Mbytes/s.

You can install the GPIB board in any SBus master slot. Standard GPIB cables can connect the GPIB board with up to 14 devices. If you need to connect to more than 14 devices, you can add them to your system using an IEEE 488 extender or expander, such as the National Instruments GPIB-130, GPIB-120A, or GPIB-140A. Refer to Appendix B, *Specifications*, for more information about the GPIB hardware specifications and recommended operating conditions.

NI-488.2 Overview

NI-488.2 for Solaris consists of a loadable driver and utilities that transform a Sun SPARC system running Solaris into an IEEE 488.2 (GPIB) Controller with complete communications and bus management capabilities.

NI-488.2 includes the following components:

- C language interface
- Software diagnostic utility
- Interactive control utility
- Interactive configuration utility

NI-488.2 supports up to four SB-GPIB/TNT and/or SB-GPIB boards installed in a Sun SPARC system, and is completely compatible with both IEEE 488 and IEEE 488.2 instruments.

2

Installation

This chapter describes how to install NI-488.2 for Solaris and the SB-GPIB/TNT or SB-GPIB into your Sun SPARC system. The NI-488.2 software included in this kit is intended for use with Sun SPARC systems running Solaris 2.5.1 or higher.

Installing the GPIB Hardware

Before you install your GPIB controller, consult the manual that came with your workstation for specific instructions and warnings. You must have super-user privileges to install the hardware and software.



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

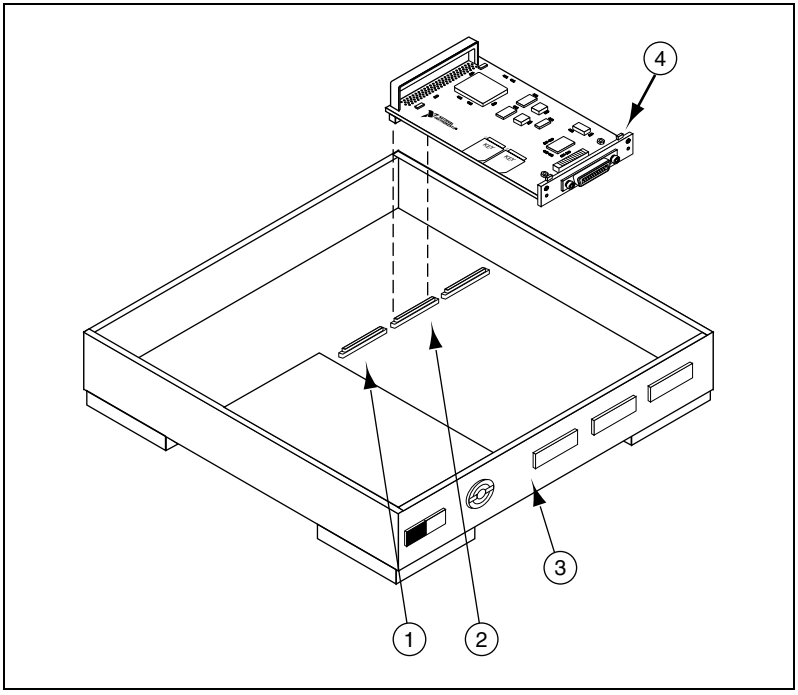
Complete the following steps to install the GPIB board.

1. Log on as super-user. To become a superuser, type `su root` and enter the root password.
2. Shut down your system by typing the following commands at the command line prompt:

   ```
   cd /
   sync
   shutdown
   ```

3. Turn off your computer after it has shut down. Keep the computer plugged in so that it remains grounded while you install the GPIB board.
4. Remove the top cover of the system unit.
5. Remove the GPIB connector extender (if your board came with one) by loosening the thumbscrews.
6. Find an unused DVMA master slot in your computer.

7. Insert the GPIB board into the slot with the GPIB connector sticking out of the opening on the back panel, as shown in Figure 2-1. Do *not* insert the board into a slave-only physical slot if you are using DVMA; only programmed I/O transfers are possible in slave-only slots. Refer to the documentation for your Sun SPARC system for information about DVMA master and DVMA slave slots.
8. Replace the system unit cover.
9. Reinstall the GPIB connector extender you removed in Step 5 if you have problems connecting the GPIB cable to the connector on the board due to space restraints.
10. Turn on your computer. The GPIB interface board is now installed.



1	Slot 1	3	Back Panel Rail
2	Slot 2	4	Backplate Adapter

Figure 2-1. Installing the SB-GPIB/TNT or SB-GPIB

Installing NI-488.2

Complete the following steps to install NI-488.2 for Solaris.

1. Insert the NI-488.2 for Solaris installation CD.
2. You must have superuser privilege before you can install NI-488.2 for Solaris. If you are not already a superuser, type `su root` and enter the root password.
3. Add NI-488.2 to the operating system by entering the following command.
   a. On Solaris 2.5.1 or later versions, the CD automatically mounts as soon as you insert the CD. If this feature is disabled on your workstation, you must mount the CD by typing the following command:

```
/usr/sbin/mount -o ro -F hsfs /dev/dsk/c0t6d0s2 /cdrom/cdrom0
```

   b. Enter the following command to add NI-488.2 to your system:

```
/usr/sbin/pkgadd -d /cdrom/cdrom0 NICsbgpib
```

4. Follow the instructions on your screen to complete the installation.

Configuring the Software with ibconf (Optional)

`ibconf` is an interactive utility you can use to examine or modify the configuration of the driver. You might want to run `ibconf` to change the settings of the software parameters. You must have super-user privilege to run `ibconf`.

`ibconf` is largely self explanatory and contains help screens that explain all commands and options. For more information on using `ibconf`, refer to the *NI-488.2M Software Reference Manual*.

Complete the following steps to change the default parameters of your NI-488.2 software. The driver should not be in use while you run `ibconf`.

1. Log on as super-user (`root`).
2. Type the following command to start `ibconf`:

```
ibconf
```

After you have installed and configured the software, you should verify the installation. Refer to Chapter 3, *Installation Verification*.

Removing NI-488.2 (Optional)

If you ever decide to stop using your GPIB board, you can remove NI-488.2 from your system. To remove NI-488.2 from the kernel configuration, you must have super-user privilege and the driver must not be in use. Enter the following command to unload the software:

```
pkgrm NICsbgpib
```

3

Installation Verification

This chapter describes how to verify the software installation.

The software installation test `ibtsta` verifies that the driver is installed correctly. It checks for correct access to the device driver.

Run `ibtsta` by entering the following command:

```
ibtsta
```

If no error occurs in `ibtsta`, NI-488.2 is installed correctly.

If `ibtsta` fails, it displays an error message that explains why the test failed and how you can correct the problem. If you are unable to run `ibtsta` successfully after you have followed the on-screen instructions, refer to Appendix A, *Common Questions*.

4

Using NI-488.2 with Solaris

This chapter helps you get started with NI-488.2 for Solaris.

Introduction to ibic

The NI-488.2 software includes the Interface Bus Interactive Control utility, `ibic`. You can use `ibic` to enter NI-488 functions and IEEE 488.2-style functions (also known as *NI-488.2 routines*) interactively and 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
- Become familiar with the commands of your device
- Receive data from your GPIB device
- Learn new NI-488.2 functions and routines before integrating them into your application
- Troubleshoot problems with your application

Enter the following command to run `ibic`:

```
ibic
```

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

Programming Considerations

Depending on the programming language you use to develop your application, you must include certain files, statements, or global variables at the beginning of your application. For example, you must include the header file `sys/ugpib.h` in your source code if you are using C/C++.

You must link the language interface library with your compiled source code. Link the GPIB C language interface library using one of the following commands, where `example.c` is your application name:

```
cc example.c -lgpib
```
or
```
cc example.c -dy -lgpib
```
or
```
cc example.c -dn -lgpib
```

`-dy` specifies dynamic linking, which is the default method. It links the application to `libgpib.so`. `-dn` specifies static linking in the link editor. It links the application to `libgpib.a`. For more information about compiling and linking, see the `man` pages for `cc` and `ld`.

For information about each NI-488 function and IEEE 488.2-style function, choosing a programming method, developing your application, or compiling and linking, refer to the *NI-488.2M Software Reference Manual*.

A

Common Questions

This appendix answers some common questions you may have about NI-488.2 for Solaris and the SB-GPIB/TNT. Also refer to Appendix B, *Common Errors and Their Solutions*, in the *NI-488.2M Software Reference Manual*.

How do I know that my GPIB board is installed correctly?

The `ibtsta` test verifies that both the hardware and software are installed correctly. Run `ibtsta` by entering the following command:

```
ibtsta
```

If no error occurs in `ibtsta`, NI-488.2 is installed correctly.

What do I do if the software verification test fails with an error?

If `ibtsta` fails, make sure that no GPIB cables are connected to the GPIB board. If necessary, remove and reinstall NI-488.2 from the CD. If you already have completed the troubleshooting steps, contact National Instruments.

Why doesn't the GPIB board fit into my workstation?

If you received your board with a GPIB connector extender, remove it before you install the board. If you have a Sun SPARCstation 10 or similar computer, you must remove the backplate adapter on the SBus backplate of the GPIB board before you can install the board.

If you install the board and then have problems connecting the GPIB cable to the connector on the board due to space constraints, replace the connector extender.

Can I use an expansion chassis to load the GPIB board?

Yes. National Instruments has tested several expansion chassis for this purpose.

Can I use NI-488.2 for Solaris with the SB-GPIB (non-TNT) board?

Yes. The board and software are compatible, but you will not be able to use TNT4882C features such as HS488 (high-speed) mode.

Why can't I use DVMA with my GPIB board?

Do not insert the GPIB board into a slave-only physical slot if you want to use DVMA. Only programmed I/O transfers are possible in slave-only slots. Refer to the documentation for your Sun SPARC system for information about DVMA master and DVMA slave slots.

How should I check for errors in my GPIB application?

Examine the value of `ibsta` after each NI-488 or NI-488.2 call. If a call fails, the ERR bit of `ibsta` is set and an error code is stored in `iberr`. For more information about global status variables, refer to the following sections in the *NI-488.2M Software Reference Manual*: the *General Programming Information* section in Chapter 3, *Understanding the NI-488.2 Software*, and Appendix B, *Common Errors and Their Solutions*.

When should I use ibic?

You can use `ibic` to practice communication with your instrument, troubleshoot problems, and develop your application program. For more information about `ibic`, refer to Chapter 6, *ibic*, in the *NI-488.2M Software Reference Manual*.

What is wrong if ibfind returns a –1?

The driver may not be installed correctly, or the nodes may not have been created when the driver was loaded. Try removing and reinstalling NI-488.2 from the CD, as described in Chapter 2, *Installation*.

Also, the file may require read/write privileges you do not have, or you may have renamed a device. Make sure that the device names in your application program match the device names in `ibconf`.

How do I use an NI-488.2 language interface?

For information about using NI-488.2 language interfaces, refer Chapter 4, *Using NI-488.2 with Solaris*. Also refer to the *NI-488.2M Software Reference Manual*.

How do I communicate with my instrument over the GPIB?

Refer to the documentation that came from the instrument manufacturer. The command sequences you use are totally dependent on the specific instrument. The documentation for each instrument should include the GPIB commands you need to communicate with it. In most cases, NI-488 device-level calls are sufficient for communicating with instruments. Refer to Chapter 5, *NI-488M Software Characteristics and Functions*, in the *NI-488.2M Software Reference Manual*, for more information.

What information should I have before I call National Instruments?

Please have the results of the diagnostic test `ibtsta`. You also should have run `ibic` to try to find the source of your problem.

Does this driver work with 64-bit Solaris?

Yes. NI-488.2 for Solaris works with either 32-bit or 64-bit Solaris.

B

Specifications

This appendix lists the electrical, environmental, and physical specifications of the SB-GPIB/TNT and SB-GPIB boards and the recommended operating conditions.

Electrical Characteristics

Input power requirements

SB-GPIB/TNT ..... +5 VDC, 300 mA typical
350 mA maximum

SB-GPIB ..... +5 VDC, 500 mA typical
780 mA maximum

Environmental Characteristics

Temperature

Operating ..... 0 to 55 °C

Storage ..... –20 to 70 °C

Relative humidity

Operating ..... 10 to 90% noncondensing conditions

Storage ..... 5 to 90% noncondensing conditions

EMI ..... FCC Class A Verified

Physical Characteristics

Dimensions..... 8.38 by 14.67 cm (3.3 by 5.78 in.)

I/O Connectors

Connector Type..... IEEE 488 standard 24 pin

Maximum Software Transfer Rates[1]

3-wire (IEEE 488)

SB-GPIB/TNT

GPIB reads .....1.6 Mbytes/s
GPIB writes.....1.4 Mbytes/s

SB-GPIB

GPIB reads .....970 kbytes/s
GPIB writes.....1 Mbytes/s

HS488

SB-GPIB/TNT

GPIB reads .....3.2 Mbytes/s
GPIB writes.....3.2 Mbytes/s

[1] Actual speed may vary considerably from speed shown due to system and instrumentation capabilities.

C

Technical Support Resources

Web Support

National Instruments Web support is your first stop for help in solving installation, configuration, and application problems and questions. Online problem-solving and diagnostic resources include frequently asked questions, knowledge bases, product-specific troubleshooting wizards, manuals, drivers, software updates, and more. Web support is available through the Technical Support section of `ni.com`.

NI Developer Zone

The NI Developer Zone at `ni.com/zone` is the essential resource for building measurement and automation systems. At the NI Developer Zone, you can easily access the latest example programs, system configurators, tutorials, technical news, as well as a community of developers ready to share their own techniques.

Customer Education

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System Integration

If you have time constraints, limited in-house technical resources, or other dilemmas, you may prefer to employ consulting or system integration services. You can rely on the expertise available through our worldwide network of Alliance Program members. To find out more about our Alliance system integration solutions, visit the System Integration section of `ni.com`.

Worldwide Support

National Instruments has offices located around the world to help address your support needs. You can access our branch office Web sites from the Worldwide Offices section of `ni.com`. Branch office Web sites provide up-to-date contact information, support phone numbers, e-mail addresses, and current events.

If you have searched the technical support resources on our Web site and still cannot find the answers you need, contact your local office or National Instruments corporate. Phone numbers for our worldwide offices are listed at the front of this manual.

Glossary

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

°	degrees
%	percent
A	amperes
ANSI	American National Standards Institute
C	Celsius
DIP	dual inline package
DMA	direct memory access
DVMA	direct virtual memory access
EMI	electromagnetic interference
g	grams
GPIB	General Purpose Interface Bus
HS488	high-speed data transfer protocol for IEEE 488
Hz	hertz
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
lb	pounds
LED	light-emitting diode
m	meters
MB	megabytes of memory

RAM	random-access memory
s	seconds
SCSI	Small Computer System Interface (bus)
V	volts
VAC	volts alternating current
VDC	volts direct current

Index

C

cables
    GPIB cable types, 1-1
caution
    electrostatic discharge damage, 2-1
common questions, A-1
configuring
    software, 2-3
connecting more than 14 devices, 1-2
connector types, B-1
conventions used in the manual, *vi*
customer education, C-1

D

DVMA
    installation restrictions, 2-2, A-2

E

electrical characteristics, B-1
environmental characteristics, B-1
error checking, A-2
expansion chassis
    using to load GPIB board, A-1

G

getting started, 1-1
GPIB cables
    disconnecting before running ibtsta, A-1
    single shielded or double shielded, 1-1
GPIB communication, A-3

H

hardware
    installation problems, A-1
    overview, 1-1

I

ibconf
    configuring software, 2-3
ibfind, A-2
ibic
    using, 4-1, A-2
ibtsta
    error messages, 3-1
    failure, A-1
    testing and verifying software installation, 3-1
installation
    verification, 3-1
installing
    GPIB hardware, 2-1
    NI-488.2, 2-3

K

kit contents, 1-1

N

National Instruments Web support, C-1
NI Developer Zone, C-1
NI-488.2
    32-bit and 64-bit Solaris, A-3
    components, 1-2
    configuring with ibconf, 2-3
    error checking, A-2
    function information, 4-2

ibfind error, A-2
ibic, A-2
installing, 2-3
language interfaces, A-2
maximum boards supported, 1-2
overview, 1-2
programming considerations, 4-2
removing, 2-4
verification error, A-1

P

physical characteristics, B-1
power requirements, B-1
programming considerations, 4-2

R

removing the software, 2-4

S

SB-GPIB
installing (figure), 2-2
overview, 1-2
unavailable features versus SB-GPIB/TNT, A-2
SB-GPIB/TNT
installing (figure), 2-2
overview, 1-1
software
installing, 2-3
overview, 1-2
transfer rate (maximum), B-2
specifications
electrical characteristics, B-1
environmental characteristics, B-1
physical characteristics, B-1
software characteristics, B-2
super-user privilege
logging on as super-user, 2-1
system integration, by National Instruments, C-1

T

technical support resources, C-1
troubleshooting
hardware, A-1
NI-488.2, A-1

V

verifying
hardware installation, A-1
verifying software installation, 3-1
voltage rating, B-1

W

Web support from National Instruments, C-1
worldwide technical support, C-2

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