# Getting Started with Your GPIB-SCSI-A and the NI-488M™ Software for Silicon Graphics Challenge Servers Running IRIX 5.x/6.x

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**National Instruments Corporate Headquarters**
6504 Bridge Point Parkway
Austin, TX 78730-5039
(512) 794-0100
Technical support fax: (800) 328-2203
(512) 794-5678

**Branch Offices:**
Australia 03 9 879 9422, Austria 0662 45 79 90 0, Belgium 02 757 00 20,
Canada (Ontario) 519 622 9310, Canada (Québec) 514 694 8521,
Denmark 45 76 26 00, Finland 90 527 2321, France 1 48 14 24 24,
Germany 089 741 31 30, Hong Kong 2645 3186, Italy 02 48301892,
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This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual, may cause interference to radio and television reception. This equipment has been tested and found to comply with the following two regulatory agencies:

## Federal Communications Commission

This device complies with Part 15 of the Federal Communications Commission (FCC) Rules for a Class A digital device. Operation is subject to the following two conditions:

1. This device may not cause harmful interference in commercial environments.

2. This device must accept any interference received, including interference that may cause undesired operation.

## Canadian Department of Communications

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

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

## Instructions to Users

These regulations are designed to provide reasonable protection against harmful interference from the equipment to radio reception in commercial areas. 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.

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

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

- Operate the equipment and the receiver on different branches of your AC electrical system.
- Move the equipment away from the receiver with which it is interfering.
- Reorient or relocate the receiver's antenna.
- Be sure that the equipment is plugged into a grounded outlet and that the grounding has not been defeated with a cheater plug.

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

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

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# About This Manual

This manual contains instructions for installing and configuring the National Instruments GPIB-SCSI-A Controller and NI-488M software for use with Silicon Graphics Challenge servers running IRIX 5.x/6.x. This manual is meant to be used with the *NI-488M Software Reference Manual*.

## Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, lists what you need to get started and optional equipment you can order, gives instructions for inspecting your GPIB-SCSI-A, and briefly describes the hardware and the NI-488M software.
- Chapter 2, *Hardware Configuration and Installation*, describes how to configure the GPIB-SCSI-A and how to connect the GPIB-SCSI-A to the Silicon Graphics computer.
- Chapter 3, *Software Installation and Configuration*, lists all the files available on the distribution tape, and contains step-by-step instructions for installing and configuring your NI-488M software, verifying the installation of your NI-488M software, and getting started with your GPIB application program.
- Appendix A, *Hardware Specifications*, lists the electrical, environmental, and physical specifications of the GPIB-SCSI-A.
- Appendix B, *Additional Driver Information*, includes additional information about this version of the NI-488M driver.
- Appendix C, *Troubleshooting*, suggests some areas to check if you have problems installing the GPIB-SCSI-A or the NI-488M software.
- Appendix D, *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 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 the names of light-emitting diodes (LEDs). |
| *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 and sections of code. This font is also used for the proper names of paths, directories, programs, device names, functions, variables, and filenames. |
| **`bold monospace`** | Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. |
| IEEE 488 and IEEE 488.2 | IEEE 488 and IEEE 488.2 refer to the ANSI/IEEE Standard 488.1-1987, and ANSI/IEEE Standard 488.2-1987, which define the GPIB. |

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

## Related Documentation

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

- *GPIB-SCSI-A User Manual*, National Instruments Corporation
- ANSI X3.131-1986, *Small Computer System Interface (SCSI)*
- 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*
- *Deskside POWER CHALLENGE™ and CHALLENGE™ L Owner's Guide*, Silicon Graphics Inc., Mountain View, CA 94039 (Document Number 007-1732-030)

## 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.

# Chapter 1
# Introduction

This chapter lists what you need to get started and optional equipment you can order, gives instructions for inspecting your GPIB-SCSI-A, and briefly describes the hardware and the NI-488M software.

## What You Need to Get Started

- ❑ One of the following boxes:
  - GPIB-SCSI-A, 100 to 120 VAC
  - GPIB-SCSI-A, 220 to 240 VAC

- ❑ One of the following power cords:
  - U.S.A. standard power cord
  - Switzerland power cord
  - Australian power cord
  - Universal European power cord
  - North American power cord
  - U.K. power cord

- ❑ Standard 50-pin SCSI-1 terminator

- ❑ External SCSI single-ended cable
  GPIB-SCSI-A (50-pin SCSI-1) to SCSI-2 (68-pin high density)

- ❑ The following software media:
  *NI-488M Distribution Tape for the GPIB-SCSI-A and the Silicon Graphics Challenge Servers Running IRIX 5.x/6.x*

## Optional Equipment

You can call National Instruments to order the following optional equipment.

- Rack-mount kit
  - Single (one unit)
  - Dual (two units)

- Shielded GPIB cables*
  - GPIB Type X1 cables (1 m, 2 m, 4 m, or 8 m)
  - GPIB Type X2 cables (1 m, 2 m, 4 m, or 8 m)

  * To meet FCC emission limits for a Class A device, you must use a shielded (Type X1 or X2) GPIB cable. Operating this equipment with a non-shielded GPIB cable may cause interference to radio and television reception in commercial areas.

## Inspection

Before you install the GPIB-SCSI-A, inspect the shipping container and its contents for damage. Retain the packaging material for possible inspection or for reshipment.

If the equipment appears to be damaged, do not attempt to operate it. Contact National Instruments for instructions. If the damage appears to have been caused in shipment, file a claim with the carrier.

## Hardware Description

The GPIB-SCSI-A is a high-performance interface product that transparently handles data transfers between the SCSI and the GPIB. It is an 8-bit microcomputer that operates as a full-function IEEE 488/SCSI Controller. It can turn any computer with a SCSI port into a GPIB Talker/Listener/Controller or can make any device on the SCSI bus look like a GPIB device.

The GPIB-SCSI-A has all the software and logic required to implement the physical and electrical characteristics of the ANSI/IEEE Standard 488.2-1987 and the ANSI Standard X3T9.2. It is able to interpret and execute commands that you send to it over the GPIB or SCSI ports and perform all necessary GPIB-to-SCSI protocol conversions.

## Software Description

The NI-488M software is a comprehensive package consisting of a multitasking driver and programs that transform a Silicon Graphics Challenge server (hereafter referred to as *Silicon Graphics computer*) running IRIX 5.x/6.x into a GPIB Controller with complete communications and bus management capabilities. The NI-488M software includes the following items:

- NI-488M driver for GPIB-SCSI-A (`gpib.o`)
- C language interface (`cib.c`)
- Automatic installation program (`instgpib`)
- Installation tests (`ibtsta` and `ibtstb`)
- Interactive control program (`ibic`)
- Interactive configuration program (`ibconf`)

# Chapter 2
# Hardware Configuration and Installation

This chapter describes how to configure the GPIB-SCSI-A and how to connect the GPIB-SCSI-A to the Silicon Graphics computer.

## Configure the Hardware

The GPIB-SCSI-A is shipped from the factory with a 100 to 120 VAC or 220 to 240 VAC power supply. Before you configure the GPIB-SCSI-A, verify that the voltage specified on the bottom panel label matches the voltage that is supplied in your area.

**Caution:** ***Operating the GPIB-SCSI-A at any voltage other than the one specified on the bottom panel label could damage the unit. Replacement fuses must be the proper type and rating. See Appendix A,*** *Hardware Specifications****, for fuse information.***

The GPIB-SCSI-A is shipped from the factory configured to operate in SCSI (S) mode. Optional parity checking on the SCSI port is disabled. The GPIB-SCSI-A is set at SCSI ID 5 and primary GPIB address 0. Additionally, the GPIB-SCSI-A kit is shipped from the factory with a SCSI terminator installed. To determine if you need to remove it, refer to the *Using SCSI Terminating Resistors* section in this chapter.

**Note:** ***The switch settings available for configuration with this kit are the SCSI ID and the GPIB address, which are controlled by SW1. You do not need to change the switch settings for SW2, which controls the mode of operation.***

The SCSI ID factory default setting of the GPIB-SCSI-A is 5. If SCSI ID 5 is used by another SCSI device in your system, select an unused SCSI ID and set the appropriate switch to that SCSI ID number (refer to *Configuration Switch Settings for SW1* later in this chapter).

SCSI ID 0 is used by the Silicon Graphics central processing unit, and cannot be used by the GPIB-SCSI-A.

You can use the `hinv` command to inventory the hardware for your Silicon Graphics computer. For example, after entering `hinv`, you might see the following messages:

```
Disk Drive: unit 1 on SCSI controller 0
CDROM: unit 7 on SCSI controller 0
```

These messages reveal that SCSI IDs 1 and 7 are used by the disk drive and CD-ROM drive, respectively, and are not available. Refer to Appendix B, *Additional Driver Information*, for the output of the `hinv` command for the GPIB-SCSI-A.

## Configuration Switch Settings for SW1

The DIP switch at location SW1 on the rear panel is used to configure the power-on primary GPIB address and SCSI ID of the GPIB-SCSI-A.

Figure 2-1 shows the rear panel of the GPIB-SCSI-A.

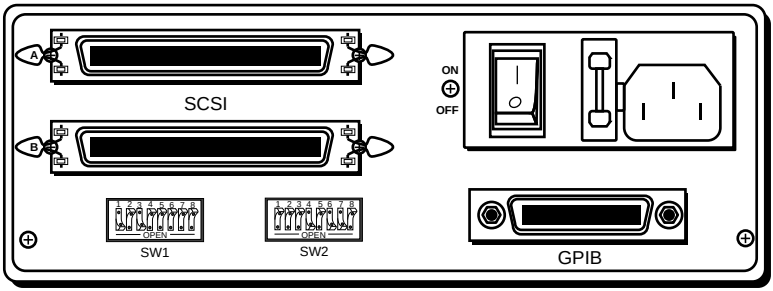


Figure 2-1. GPIB-SCSI-A Rear Panel

Figure 2-2 shows the default configuration of DIP switch SW1. Switches 1 through 3 are ON, OFF, ON, respectively, to select the SCSI ID of 5. Switches 4 through 8 are OFF to indicate that the GPIB primary address of the GPIB-SCSI-A is 0.

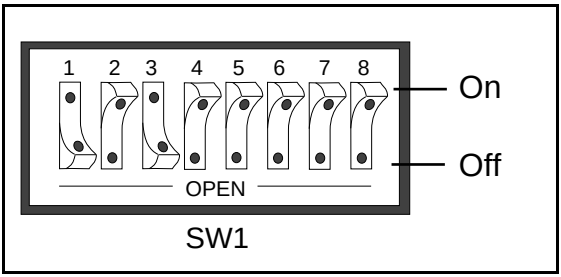


Figure 2-2. SW1 Default Mode Switch Settings

Tables 2-1 and 2-2 show the possible configurations of the eight switches and what each configuration indicates. The factory default settings are in ***bold italic***.

Table 2-1. Configuration Parameters for SW1 Switches 1 through 3

| **Switches** | | | **Indication** |
|---|---|---|---|
| **1** | **2** | **3** | |
| OFF | OFF | OFF | SCSI ID of 0 |
| OFF | OFF | ON | SCSI ID of 1 |
| OFF | ON | OFF | SCSI ID of 2 |
| OFF | ON | ON | SCSI ID of 3 |
| ON | OFF | OFF | SCSI ID of 4 |
| ***ON*** | ***OFF*** | ***ON*** | ***SCSI ID of 5*** |
| ON | ON | OFF | SCSI ID of 6 |
| ON | ON | ON | SCSI ID of 7 |

Table 2-2. Configuration Parameters for SW1 Switches 4 through 8

| Switches 1 | 2 | 3 | | | Indication |
|---|---|---|---|---|---|
| ***OFF*** | ***OFF*** | ***OFF*** | ***OFF*** | ***OFF*** | ***GPIB Primary address 0*** |
| OFF | OFF | OFF | OFF | ON | GPIB Primary address 1 |
| OFF | OFF | OFF | ON | OFF | GPIB Primary address 2 |
| OFF | OFF | OFF | ON | ON | GPIB Primary address 3 |
| OFF | OFF | ON | OFF | OFF | GPIB Primary address 4 |
| OFF | OFF | ON | OFF | ON | GPIB Primary address 5 |
| OFF | OFF | ON | ON | OFF | GPIB Primary address 6 |
| OFF | OFF | ON | ON | ON | GPIB Primary address 7 |
| OFF | ON | OFF | OFF | OFF | GPIB Primary address 8 |
| OFF | ON | OFF | OFF | ON | GPIB Primary address 9 |
| OFF | ON | OFF | ON | OFF | GPIB Primary address 10 |
| OFF | ON | OFF | ON | ON | GPIB Primary address 11 |
| OFF | ON | ON | OFF | OFF | GPIB Primary address 12 |
| OFF | ON | ON | OFF | ON | GPIB Primary address 13 |
| OFF | ON | ON | ON | OFF | GPIB Primary address 14 |
| OFF | ON | ON | ON | ON | GPIB Primary address 15 |
| ON | OFF | OFF | OFF | OFF | GPIB Primary address 16 |
| ON | OFF | OFF | OFF | ON | GPIB Primary address 17 |
| ON | OFF | OFF | ON | OFF | GPIB Primary address 18 |
| ON | OFF | OFF | ON | ON | GPIB Primary address 19 |
| ON | OFF | ON | OFF | OFF | GPIB Primary address 20 |
| ON | OFF | ON | OFF | ON | GPIB Primary address 21 |
| ON | OFF | ON | ON | OFF | GPIB Primary address 22 |
| ON | OFF | ON | ON | ON | GPIB Primary address 23 |
| ON | ON | OFF | OFF | OFF | GPIB Primary address 24 |
| ON | ON | OFF | OFF | ON | GPIB Primary address 25 |
| ON | ON | OFF | ON | OFF | GPIB Primary address 26 |
| ON | ON | OFF | ON | ON | GPIB Primary address 27 |
| ON | ON | ON | OFF | OFF | GPIB Primary address 28 |
| ON | ON | ON | OFF | ON | GPIB Primary address 29 |
| ON | ON | ON | ON | OFF | GPIB Primary address 30 |
| ON | ON | ON | ON | ON | GPIB Primary address 0 |

## Configuration Switch Settings for SW2

The DIP switch at location SW2 on the rear panel (see Figure 2-1) is used to configure the mode of operation for the GPIB-SCSI-A. These switch settings should *not* be changed for use with the Silicon Graphics computer.

Make sure that these switches are set as shown in Figure 2-3. If they are not, set these switches as indicated.

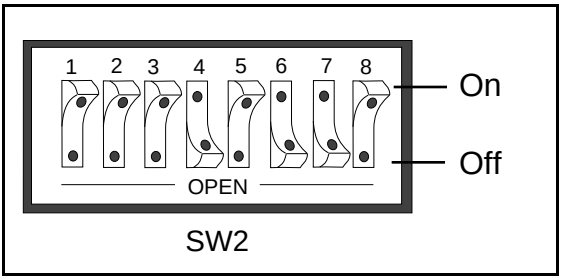


Figure 2-3. SW2 Default Mode Switch Settings

Table 2-3 and the subsequent paragraph describe the factory default configurations of the eight switches.

Table 2-3. Factory Default Configurations for SW2

| Switch | Position | Indication |
|---|---|---|
| 8 | OFF | Operating in S (SCSI) mode. |
| 7 | ON | GPIB-SCSI-A will neither notice nor report SCSI parity errors. |
| 6 | ON | GPIB-SCSI-A will buffer data during data transfer commands. |
| 5 | OFF | GPIB-SCSI-A will complete all data requests to the count specified. |
| 4 | ON | Double buffering is enabled. |
| 1-3 | OFF | Reserved and should remain OFF. |

# Connect the Hardware

The following are general instructions for connecting the GPIB-SCSI-A to the Silicon Graphics computer.

## Configuring the SCSI Controller

The GPIB-SCSI-A is an external SCSI device. The SCSI controller to which it is connected must be configured for single-ended operation.

## Daisy-Chaining

There are two methods for connecting the GPIB-SCSI-A to the Silicon Graphics computer. One method is connecting the GPIB-SCSI-A directly to the computer by using a cable with the proper connectors at each end. The other method is *daisy-chaining*. Daisy-chaining is connecting more than one SCSI device to a host. It allows a single port on the host to serve a variable number of devices.

## Using SCSI Terminating Resistors

Because of its high-speed capabilities, the SCSI bus is sensitive to the electrical characteristics of the SCSI cabling. When a signal is sent through the SCSI bus, it bounces back and creates echoes along the cabling. Any devices in the middle of the daisy-chained SCSI bus receive these signal echoes. Placement of terminating resistor packs can prevent echoes and ensure proper termination of a signal. Proper termination is essential to the devices connected on a SCSI bus. Read the documentation for each device to find out what kind of termination it provides.

If your GPIB-SCSI-A is located at the end of a daisy-chained SCSI bus, you can prevent echoes by leaving the terminating resistor pack installed on one of the ports on the rear panel of the GPIB-SCSI-A. Also ensure that the device at the other end of the SCSI bus (for example, the SCSI host in Figure 2-4) has a terminating resistor installed. But remove the terminating resistor packs on all devices except for the two at each end because SCSI signals are not reliably passed along the SCSI bus after they reach a device with a terminator.

**Caution:** ***Never connect more than two sets of terminating resistors on a SCSI bus because more than two sets may overload the signals and generate errors.***

Figure 2-4 shows where to install terminating resistors when the GPIB-SCSI-A is located at the end of a SCSI system.

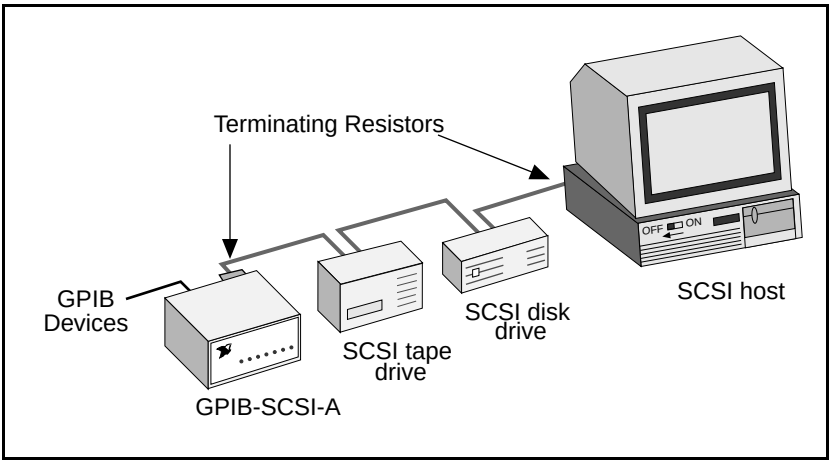


Figure 2-4. Terminating Resistors for GPIB-SCSI-A at End of SCSI Bus

If your GPIB-SCSI-A is not located at the end of the SCSI bus, remove the terminating resistor pack from the rear panel of the GPIB-SCSI-A. Ensure that all devices in the middle of the daisy-chained bus (for example, the SCSI disk drive and the GPIB-SCSI-A in Figure 2-5) do *not* have terminating resistors installed. The devices at each end of the SCSI bus should have terminating resistors installed.

Figure 2-5 shows where to install terminating resistors when the GPIB-SCSI-A is *not* located at the end of a SCSI system.

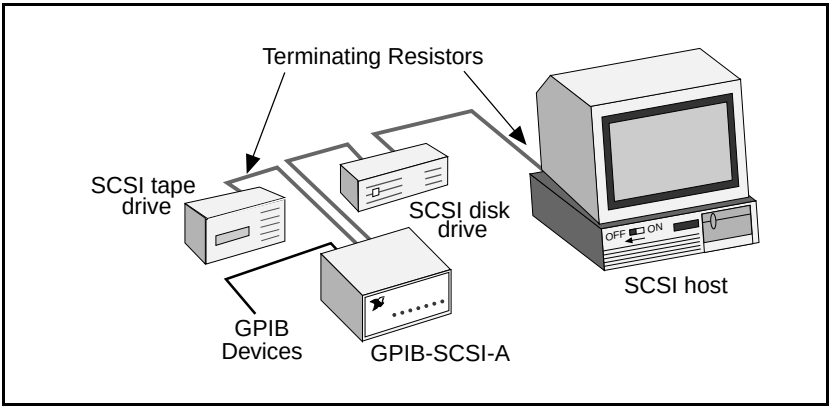


Figure 2-5. Terminating Resistors for GPIB-SCSI-A Not at End of SCSI Bus

## Connection Steps

There are three basic steps to connecting the GPIB-SCSI-A.

1. Shut down your system.
2. Connect the cables.
3. Switch on your GPIB-SCSI-A and power on your system.

### Step 1. Shut Down the System

Complete the following steps to shut down your system:

1. Select **`System Shutdown`** from the Toolchest in the upper left corner of your screen and reply `yes` to the prompt.
2. Turn off your computer when the shutdown procedure has completed.
3. Unplug the power cord from the power outlet.

### Step 2. Connect the Cables

**Caution:** ***Never connect or disconnect SCSI cables when ANY device (computer, tape drive, GPIB-SCSI-A, and so on) is powered on. Doing so can cause fuses to blow inside the GPIB-SCSI-A and inside other SCSI devices that supply termination power (TERMPWR) to the SCSI bus.***

Complete the following steps to connect the cables:

1. Connect the SCSI cable to the GPIB-SCSI-A and securely fasten it. Connect the other end to your SCSI system. Be sure to use only shielded SCSI cables. Total cable length in your SCSI system should be less than 6 m, and terminating resistors should be installed on both ends, as described earlier in this chapter.

2. Connect the GPIB cable to the GPIB-SCSI-A and tighten the thumb screws on the connector. Connect the other end to your GPIB system. Be sure to use only shielded GPIB cables. Total cable length in your GPIB system should be less than 20 m, with a maximum separation of 4 m between any two devices. You should have no more than 15 devices in a GPIB system, and at least two-thirds of those devices must be powered on.

3. Plug in the power cord into an AC outlet of the correct voltage.

### Step 3. Switch On Your GPIB-SCSI-A and Power On Your System

Complete the following steps to switch on your GPIB-SCSI-A and power on your system:

1. Switch on your GPIB-SCSI-A by using the rocker switch on the rear panel. The **POWER** LED should come on immediately and the **READY** indicator on the front panel should come on after the GPIB-SCSI-A has passed its power-on self-test, indicating the unit is ready for operation.

   If the **READY** indicator does not come on within 10 s after the unit is powered on, recheck all connections and switch settings and retry the power-on sequence. If the **READY** light still fails to come on, refer to Appendix D, *Customer Communication*, fill out the forms, and contact National Instruments.

2. Plug the power cords of the Silicon Graphics computer and any other SCSI equipment into a power outlet and power on all devices.

# Chapter 3
# Software Installation and Configuration

This chapter lists all the files available on the distribution tape, and contains step-by-step instructions for installing and configuring your NI-488M software, verifying the installation of your NI-488M software, and getting started with your GPIB application program.

Refer to Appendix B, *Additional Driver Information*, to see more information about this version of the NI-488M driver.

## Step 1. Prepare to Install the Software

Before installing the NI-488M software, note the following:

- You must have super-user privileges.
- The NI-488M distribution tape is in `TAR` format.

### Organization of the NI-488M Distribution Tape

At the top level directory, the following files/directories are present.

| | |
|---|---|
| `README_FIRST` | Release Notes |
| `instgpib` | Software installation program |
| `IRIX`*xxx* | One or more subdirectories containing the driver software for IRIX version *xxx*. For example, the subdirectory labeled `IRIX53XFS` would contain the driver software for IRIX 5.3 with XFS. |

At the next level, each of the `IRIX`*xxx* subdirectories is organized as follows:

| | |
|---|---|
| `README` | Release Notes |
| `gpib.o` | NI-488M driver for GPIB-SCSI-A |
| `cib.c` | C language interface |
| `ugpib.h` | Include file for user programs |

| | |
|---|---|
| `ibtsta` | Installation test part A |
| `ibtstb` | Installation test part B |
| `ibic` | Interactive control utility |
| `ibconf` | Software configuration utility |
| `Patches` | Subdirectory containing any required IRIX patches (*optional*) |

# Step 2. Install the Software

Follow these procedures to install the NI-488M software.

## Set Up a Working Directory

1. Log on as super-user (`root`).

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

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

## Install the Driver

You can install the software automatically or manually.

### Installing the Driver Automatically

The interactive program `instgpib` installs the driver for you when you follow these steps.

1. Copy the installation program `instgpib` from the NI-488M distribution tape to the working directory by entering the following command:

```
tar xvf /dev/tape instgpib
```

   where `/dev/tape` is the default name of the tape drive and could be different on your system.

2. Enter the following command to run the program in your working directory:

   ```
   ./instgpib
   ```

3. Follow the instructions on the screen to complete the installation.

## Installing the Driver Manually

To install the software manually, you must install the utility files, the C library, and the driver, as well as build a new IRIX kernel. The following procedures contain step-by-step instructions for installing the driver manually.

### Copy the Driver Files

Depending on the version of the IRIX operating system installed on your machine, select the appropriate `IRIX`*xxx* subdirectory on the NI-488M distribution tape and copy the files to the working directory. For example, if the operating system installed is IRIX 6.0.1 with XFS, you would enter the following command:

```
tar xvf /dev/tape IRIX601XFS
```

where `/dev/tape` is the default name of the tape drive and could be different on your system.

### Install the Utility Files

Complete the following steps to install the utility files.

1. Change to the directory containing the driver software. For example, if you are installing the driver for IRIX 6.0.1 with XFS, enter the following command:

   ```
   cd IRIX601XFS
   ```

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

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

3. Copy the files `ibic`, `ibconf`, `ibtsta`, and `ibtstb` to a directory in the command search path. For example, to copy to `/usr/bin`, enter the following commands:

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

Install the C Library

You must compile the file `cib.c` and convert it to a library, because the *NI-488M Software Reference Manual* assumes you have created a library for the C language interface. To create a C language library, enter the following commands:

```
cc -c -xansi cib.c
ar r /usr/lib/libgpib.a cib.o
```

(if you are installing the driver for IRIX 5.x)

or

```
cc -c -xansi cib.c
ar r /usr/lib64/libgpib.a cib.o
```

(if you are installing the driver for IRIX 6.x)

Alternatively, you can add `cib.o` to an existing library or include `cib.o` during the link phase of each compile operation.

Create a Device Special File

Each device on the IRIX system needs its own device special file in the `/dev` directory.

1. Enter the following command to create a device special file for device `gpib0`:

```
mknod  /dev/gpib0  c  32  255
```

where 32 and 255 are the major and minor device numbers, respectively.

2. List all the device special files prefixed `dev` by entering the following command:

   ```
   ls -l /dev/dev*
   ```

Remove the files `/dev/dev1` through `/dev/dev16`, if present. Otherwise, proceed to the next section, *Build a New IRIX Kernel*.

## Build a New IRIX Kernel

To build a new IRIX kernel with the NI-488M driver installed, complete the following steps.

1. Change to the `/var/sysgen/system` directory by entering the following command:

   ```
   cd /var/sysgen/system
   ```

2. Use the editor of your choice to create a file called `gpib.sm`, and enter the following line into the file:

   ```
   INCLUDE:gpib
   ```

3. Copy the file `gpib.o` from the driver software directory to the `/var/sysgen/boot` directory. For example, if the driver is being installed for IRIX 6.0.1 with XFS system, you would enter the following command:

   ```
   cp /usr/gpib/IRIX601XFS/gpib.o /var/sysgen/boot
   ```

   where `/usr/gpib/IRIX601XFS` is the driver software directory created in the *Copy the Driver Files* step in this chapter.

4. Use the editor of your choice to create a file called `gpib` in the `/var/sysgen/master.d` directory, and enter the following lines into the file:

   ```
   *FLAGP     PREFIX     SOFT    #DEV    DEPENDENCIES
   scp        ib         32      -       scsi
   ```

5. Save the current version of the kernel by entering the following command:

   ```
   cp /unix /unix.bak
   ```

6. Depending on the version of IRIX you are running, you might need to install certain patches on the system so that the driver functions correctly. Check the directory containing the driver software to see if a subdirectory called `Patches` is present. If it is present, you must install the supplied patches on the system as described in the following steps. If it is not present, skip to step 7.

   a. Change to the `Patches` subdirectory by entering the following command.

      ```
      cd Patches
      ```

   b. Install the patches using the `inst` command as follows:

      ```
      inst -f <base name of the patch>
      ```

      Repeat this step for each of the patches in the directory. For further assistance with installing the patches, contact Silicon Graphics Technical Support.

7. Run the `lboot` utility by entering the following command:

   ```
   lboot -u /unix.install
   ```

8. Reboot the system by entering the following command:

   ```
   reboot
   ```

   When you reboot, the system replaces the current kernel `/unix` with the new kernel found in `/unix.install`.

The following message about the GPIB-SCSI-A appears on your screen to confirm that the software is installed correctly. Refer to Appendix B, *Additional Driver Information*, for more information about boot messages.

```
National Instruments <GPIB-SCSI-A> Installed
```

**Note:** ***If you upgrade your operating system, you must reinstall the NI-488M software.***

# Step 3. Configure the Software with ibconf

This step is *not* required if the driver is installed automatically using `instgpib`, but *is required* if the driver was installed manually. You can skip to step 4, *Verify the Installation*, if you installed the driver automatically.

`ibconf` is a self-explanatory utility with help screens that you can use to inspect and modify the default software parameters. You must have super-user privilege to run `ibconf`. If you changed the default settings of the GPIB-SCSI-A, such as the GPIB primary address, you must make a corresponding change to the default parameters shown in `ibconf`. `ibconf` creates all the device special files needed by the software.

For more detailed information about `ibconf`, refer to the *NI-488M Software Reference Manual*.

1. Enter the following command to run `ibconf`.

   `ibconf [irix_kernel]`

   where *`irix_kernel`* is optional and can be any IRIX kernel with the driver for the GPIB-SCSI-A installed. The default IRIX kernel is `/unix`. For example, to configure the IRIX kernel `/unix` with the driver for the GPIB-SCSI-A, enter the following command:

   ```
   ibconf
   ```

   To run `ibconf` when the kernel being started is named `/unix.new`, enter the following command:

   ```
   ibconf /unix.new
   ```

2. After you make any necessary changes, save the current configuration by entering `y` before exiting `ibconf`. Even if you have not made any changes to the configuration settings, you should still enter a `y` to have `ibconf` create the special device files `gpib*` and `dev*` in the `/dev` directory.

3. Reboot the system. This completes the software installation and configuration procedures.

# Step 4. Verify the Installation

The NI-488M distribution disk includes two software installation tests: `ibtsta` and `ibtstb`.

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

  **Note**: ***The first*** `ibfind` ***might exhibit a delay of several seconds. This delay is due to operating system constraints with respect to scanning the SCSI bus for the existence of a GPIB-SCSI-A box. Also you might notice several messages scrolling on the console window as the*** `ibfind` ***command is being processed. These messages are printed by the operating system as a result of the failed SCSI inquiry commands and are NOT the result of*** `ibfind` ***failure. See Appendix B,*** *Additional Driver Information*, ***for more information.***

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

Complete the following steps to verify the software installation.

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

   ```
   ibtsta
   ```

   If you boot with an IRIX kernel named something other than `/unix`, enter the full pathname when prompted.

2. If `ibtsta` completes with no errors and a bus analyzer is available, you can also run `ibtstb`. Connect the bus analyzer to the GPIB-SCSI-A Controller, and then run `ibtstb` by entering the following command:

   ```
   ibtstb
   ```

If an error occurs in `ibtsta` or `ibtstb`, refer to Appendix C, *Troubleshooting*.

If no error occurs, the NI-488M driver is installed correctly.

## Step 5. Develop Your Application

Once the driver software has been installed and verified successfully, you are ready to proceed with development of your GPIB-SCSI-A application software. As you begin developing your program, remember these points:

- The first `ibfind` will exhibit a delay of several seconds. This delay is due to operating system constraints with respect to scanning the SCSI bus for the existence of a GPIB-SCSI-A box.

- The file `cib.c` is the interface between your C language application program and the operating system entry points to the NI-488M GPIB-SCSI-A driver. To use the NI-488M functions, you must either compile `cib.c` and include the resulting object file during the link phase of each application compile operation, or link the GPIB library `libgpib` as shown in the following examples.

  ```
  cc test.c cib.o
  ```

  or

  ```
  cc test.c -lgpib
  ```

- Your application program must include `<sys/ugpib.h>`.

- The NI-488M functions are compatible with any other NI-488M functions used with other National Instruments products, except for the following functions. These functions are not supported by the NI-488M software for the GPIB-SCSI-A:

  `ibdma`

  `ibsgnl`

# Appendix A
# Hardware Specifications

This appendix lists the electrical, environmental, and physical specifications of the GPIB-SCSI-A.

Table A-1. Electrical Characteristics

| Characteristic | Specification |
|---|---|
| Power Supply Unit | 100 to 120 VAC ± 10%, 50 to 60 Hz, or<br>220 to 240 VAC ± 10%, 50 to 60 Hz |
| Current Requirement | 100 to 120 VAC, 90 mA<br>220 to 240 VAC, 45 mA |
| Fuse Rating and Type | 100 to 120 VAC, 200 mA UL/CSA approved<br>220 to 240 VAC, 125 mA IEC approved |

Table A-2. Environmental Characteristics

| Characteristic | Specification |
|---|---|
| Operating Temperature | 0° to 40° C |
| Storage Temperature | -20° to 70° C |
| Relative Humidity | 10% to 90% noncondensing conditions |
| EMI | FCC Class A Verified |

Table A-3. Physical Characteristics

| **Characteristic** | **Specification** |
|---|---|
| Overall Case Size | 190.2 by 74.5 by 250.9 mm<br>(7.489 by 2.934 by 9.88 in. ) |
| Case Material | All metal enclosure |
| Rack Mounting | Single or dual kits available |
| Weight | 1.81 kg (4 lb) |

# Appendix B
# Additional Driver Information

This appendix includes additional information about this version of the NI-488M driver.

- Depending on the version of IRIX you are running, you might need to install certain patches on the system so that the driver functions correctly. Refer to the README file in the appropriate driver software directory to check if you need to install any patches.

- The GPIB driver works by exchanging messages (called *SCSI commands*) with the internal SCSI controller, like *scip* or *wd95*, in order to communicate with the GPIB-SCSI-A. Refer to the `README_FIRST` file in the NI-488M distribution to see all the SCSI controllers with which the GPIB driver works correctly. The driver is only guaranteed to work with the SCSI controllers listed in the `README_FIRST` file.

  In the following discussion, it is assumed that the GPIB driver can be used with two SCSI controllers, *scip* and *wd95*. The differences in the behavior of the driver, when connected to *scip* and *wd95*, are as follows.

  Physically, the SCSI ports of these controllers may look alike. To verify which SCSI controller the GPIB-SCSI-A is connected to, run `ibic` and enter the following GPIB command at the `ibic` prompt:

  ```
  ibfind gpib0
  ```

  A number of messages similar to the following messages may scroll on the console window when this command is being processed. The GPIB-SCSI-A is connected to the controller for which *no* such message is output.

Consider the following example.

```
"wd95_0d1: does not respond (selection timeout)"
"wd95_0d2: does not respond (selection timeout)"
....
"wd95_0d5: does not respond (selection timeout)"
....
"wd95_1d7: does not respond (selection timeout)"
"scip4d1: does not respond (selection timeout) "
"scip4d2: does not respond (selection timeout) "
....
"scip2d1: does not respond (selection timeout) "
....
"scip2d4: does not respond (selection timeout) "
"scip2d6: does not respond (selection timeout) "
```

In this example, the GPIB-SCSI-A is at SCSI ID 5 and is connected to a *scip* controller which is at SCSI ID 2. If the same GPIB-SCSI-A were connected to a *wd95* controller at SCSI ID 0, the following message would have been *missing*:

```
"wd95_0d5: does not respond (selection timeout)"
```

Note, however, that the functionality of the driver is the same irrespective of the SCSI controller to which the GPIB-SCSI-A is connected.

- The `hinv` command *does* print information about the GPIB-SCSI-A. This is unlike earlier versions of the driver in which the `hinv` command did not print any information about the GPIB-SCSI-A.

  However, due to certain incompatibilities between the GPIB-SCSI-A firmware and the IRIX operating system, messages similar to the following message may be printed out one or more times in the output of `hinv`, depending on the SCSI controller the GPIB-SCSI-A is connected to and the version of IRIX you are running:

  ```
  "Unknown type 31: unit 5, lun 7 on SCSI controller
  2"
  ```

  *Messages similar to this one might be printed for each* `lun` *1 through 7.*

  ```
  "Unknown type 31: unit 5 on SCSI controller 2"
  ```

In the preceding example, the GPIB-SCSI-A is at SCSI ID 5 and is connected to a *scip* Controller at SCSI ID 2.

If a GPIB-SCSI-A at SCSI ID 5 were connected to a *wd95* SCSI controller at SCSI ID 0, a single line similar to the following, or multiple lines as shown in the preceding example, would be the output of the `hinv` command for GPIB-SCSI-A, depending on the version of IRIX you are running.

```
"Unknown type 31: unit 5 on SCSI controller 0"
```

- If the GPIB-SCSI-A is connected to a *wd95* controller, you *may* notice several messages similar to the following message (depending on which version of IRIX you are running). The messages would appear during the boot process, after the GPIB driver is installed:

  ```
  "wd95_0d5: sense key 0x0 (No sense) asc 0x0 asq 0x0"
  ```

  In the preceding example, a GPIB-SCSI-A at SCSI ID 5 is connected to a *wd95* controller at SCSI ID 0. Despite such messages, the driver itself should be completely functional.

  When a GPIB-SCSI-A is connected to a *scip* controller, such messages do not appear during the boot process.

# Appendix C
# Troubleshooting

This appendix suggests some areas to check if you have problems installing the GPIB-SCSI-A or the NI-488M software.

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

## Hardware

**Warning**: ***The GPIB-SCSI-A contains circuitry that operates with hazardous voltages. Refer service requirements to qualified personnel.***

- Make sure the GPIB-SCSI-A Controller is securely connected to the SCSI cable.
- If the GPIB-SCSI-A is the last device on the SCSI bus, make sure that you have placed the terminating resistor pack on one of the SCSI ports on the rear panel of the GPIB-SCSI-A to terminate the SCSI bus. (See *Using SCSI Terminating Resistors* in Chapter 2 for more information.)
- Check the DIP switch settings on the GPIB-SCSI-A Controller. Make sure that SW1 is set to the correct SCSI ID, and the correct GPIB primary address. SW2 should not be changed from its factory default setting. (See *Configure the Hardware* in Chapter 2 for more information.)
- Make sure that the GPIB-SCSI-A is powered on.
- Make sure that the total cable length in the SCSI system does not exceed 6 m.
- Make sure that the total cable length in the GPIB system does not exceed 20 m.
- If the **POWER** LED is not lit, check the fuse.

**Warning**: ***Replacement fuses must be the proper type and rating. See Appendix A,*** *Hardware Specifications****, for fuse information.***

## Software

- Make sure that the SCSI ID of the GPIB-SCSI-A is not used by any other device.

- Record any error messages that appear in `/usr/adm/SYSLOG`.

- If `lboot` reports the following error, you need to free up some disk space from your hard drive.

  ```
  /var/sysgen/root/usr/bin/ld:
  Fatal error in writing to final object file (No space
  left on device)
  Fatal error in writing to final object file (No space
  left on device)
  lboot: ld returned 256--failed
  ```

  Look for unnecessary files or core files first. If you are unsure of which files you can safely delete, consult with the expert on Silicon Graphics computers in your organization, or contact Silicon Graphics customer support. If you still need more room, you may remove your `unix.bak` file before trying `lboot` again.

# Appendix D
# Customer Communication

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

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

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

| **Branch Offices** | **Phone Number** | **Fax Number** |
|---|---|---|
| Australia | 03 9 879 9179 | 03 9 879 9422 |
| Austria | 0662 45 79 90 19 | 0662 45 79 90 0 |
| Belgium | 02 757 03 11 | 02 757 00 20 |
| Denmark | 45 76 71 11 | 45 76 26 00 |
| Finland | 90 502 2930 | 90 527 2321 |
| France | 1 48 14 24 14 | 1 48 14 24 24 |
| Germany | 089 714 60 35 | 089 741 31 30 |
| Hong Kong | 2686 8505 | 2645 3186 |
| Italy | 02 48301915 | 02 48301892 |
| Japan | 03 5472 2977 | 03 5472 2970 |
| Korea | 02 596 7455 | 02 596 7456 |
| Mexico | 5 202 2544 | 5 520 3282 |
| Netherlands | 03480 30673 | 03480 33466 |
| Norway | 32 84 86 00 | 32 84 84 00 |
| Singapore | 2265887 | 2265886 |
| Spain | 91 640 0533 | 91 640 0085 |
| Sweden | 08 730 43 70 | 08 730 49 70 |
| Switzerland | 056 20 51 55 | 056 20 51 51 |
| Taiwan | 02 737 4644 | 02 377 1200 |
| U.K. | 01635 523154 | 01635 523545 |

# Technical Support Form

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

Name _____

Company _____

Address _____

_____

Fax ( ___ ) _____ Phone ( ___ ) _____

Computer brand _____

Model _____ Processor _____

Operating system _____

Speed _____MHz RAM _____MB

Display adapter _____

Mouse _____yes _____no

Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____

Revision _____

Configuration _____

(continues)

National Instruments software product _____

Version _____

Configuration _____

The problem is _____

_____

_____

_____

_____

_____

_____

_____

List any error messages _____

_____

_____

_____

_____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

_____

_____

_____

_____

# GPIB-SCSI-A Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Update this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration.

## National Instruments Products

- GPIB-SCSI-A Model _____
- NI-488M Software Version Number on Distribution Medium _____
- SW1 Switch Setting _____
- SW2 Switch Setting _____
- Terminating Resistor Pack Installed (yes or no) _____

## Other Products

- Application Programming Language _____
- IRIX Version _____
- Other SCSI devices in System and SCSI ID of each _____

  _____

  _____

# 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 GPIB-SCSI-A and the NI-488M™ Software for Silicon Graphics Challenge Servers Running IRIX 5.x/6.x**

Edition Date: **September 1995**

Part Number: **321026A-01**

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

(continues)

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for your help.

Name _____

Title _____

Company _____

Address _____

Phone ( _____ ) _____

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

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

# Glossary

| Prefix | Meaning | Value |
|---|---|---|
| m- | milli- | $10^{-3}$ |
| k- | kilo- | $10^{3}$ |
| M- | mega- | $10^{6}$ |

| | |
|---|---|
| o | degrees |
| % | percent |
| | |
| A | amperes |
| ANSI | American National Standards Institute |
| C | Celsius |
| CSA | Canadian Standards Association |
| DIP | dual inline package |
| DMA | direct memory access |
| EMI | electromagnetic interference |
| FCC | Federal Communications Commission |
| g | grams |
| GPIB | General Purpose Interface Bus |
| Hz | hertz |
| IEC | International Electrotechnical Commission |
| 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) |
| UL | Underwriters Laboratories |
| V | volts |
| VAC | volts alternating current |
| VDC | volts direct current |