Installing the GPIB-1014 and the NI-488M™ Software in Sun Workstations

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Contents

About This Manual

This manual describes the steps necessary to install National Instruments GPIB-1014 series interface board and NI-488M software for SunOS into Sun Workstations. For specific information about the GPIB-1014 series board, refer to the user manual that came with your board.

The material in this manual is intended for users who have super-user privilege (logged in as `root`). This manual assumes that all the software needed for adding device drivers is already installed. This manual also assumes that the user has already received a GPIB-1014-1S or GPIB-1014D-1S board along with a user manual.

Note: ***Throughout this manual, the term GPIB-1014 may refer to either a GPIB-1014 or GPIB-1014D type board.***

Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, lists what you need to get started and briefly describes the GPIB-1014 hardware and NI-488M software.
- Chapter 2, *Hardware and Software Installation,* contains step-by-step instructions for installing, configuring, and verifying the installation of your NI-488M software and GPIB-1014.
- Appendix A, *Troubleshooting,* helps you troubleshoot problems.
- Appendix B, *Customer Communication,* contains forms you can use to request help from National Instruments or to comment on our products and manuals.
- The *Glossary* contains an alphabetical list and 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 throughout this manual.

italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
bold italic	Bold italic text denotes a note, caution, or warning.
`monospace`	Lowercase text in this font denotes text or characters that are to be literally input from the keyboard, sections of code, programming examples, and

	syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, variables, filenames, and extensions, and for statements and comments taken from program code.
italic monospace	Italic lowercase text in this font denotes that you must supply the appropriate words or values in the place of these items.
GPIB-1014	GPIB-1014 is used throughout this manual to refer to the GPIB-1014-1S or GPIB-1014D-1S interface board.
UNIX	UNIX is used throughout this manual to refer to the SunOS 4.x UNIX operating system.

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

Related Documentation

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

- *GPIB-1014 User Manual*, National Instruments Corporation, part number 320030-01
- Sun System manuals for the SunOS 4.x operating system

Customer Communication

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

Chapter 1
Introduction

This chapter lists what you need to get started and briefly describes the NI-488M software and GPIB-1014 hardware.

What You Need to Get Started

You will need the following items to install the NI-488M software and GPIB-1014.

- ❑ One of the following software media:
  - Streaming tape for the NI-488M software for SunOS
  - 9 track tape for the NI-488M software for SunOS
- ❑ SunOS operating system installed on your computer
- ❑ Super-user privilege
- ❑ *GPIB-1014 User Manual*

Software Description

The NI-488M software consists of a device driver that is accessed by high-level and low-level functions. It is installed within the system as a SunOS device driver. With the NI-488M software, several tasks can concurrently access one GPIB interface board, as long as the tasks are communicating with different devices.

Hardware Description

The GPIB-1014 has complete IEEE 488 Talker/Listener/Controller capability. It uses DMA transfers to perform GPIB transfers up to 500 kbytes/s, and it transfers unlimited data block lengths using full 24-bit addressing.

Chapter 2
Hardware and Software Installation

This chapter contains step-by-step instructions for installing, configuring, and verifying the installation of your NI-488M software and GPIB-1014 board.

NI-488M Software Components

The distribution medium is in `tar` format. The file structure of the distribution medium is as follows:

```
SUN3s        SUN4s        install_gpib
```

Each Sun directory contains the following files, which are automatically installed by the interactive installation program, `install_gpib`.

- `gpib*.o` One or more NI-488M drivers depending on the Sun machine and SunOS operating system, where `*` depends on the Sun machine and SunOS operating system
- `cib.c` C language library
- `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

Install the Software

Follow these procedures to install your 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.
3. Copy the distribution files from the distribution medium to your directory by entering the following command:

   ```
   tar xvf /dev/rst8
   ```

Automatic Installation

To automatically install your NI-488M software, run the program `install_gpib`. The program prompts you for the information it needs to install your NI-488M software. Then skip to step 4. *Turn the System Off,* which appears later in this chapter.

Manual Installation

Follow these steps to manually install your NI-488M software.

1. Install the Utility Files

a. Copy the file `ugpib.h` to `/usr/include/sys/ugpib.h`.

b. If you have a Sun-3 computer, copy the file `gpib3.o` to `/sys/sun3/OBJ/gpib.o`. If you have a Sun-4 computer, copy the file `gpib4.o` to `/sys/sun4/OBJ/gpib.o`.

c. Copy the files `ibic` and `ibconf` to a directory in the command search path (for example, `/bin` or `/usr/bin`).

2. Install the C Library

Compile and convert the file `cib.c` into a library file as demonstrated in the following steps. This is necessary because the information in the *NI-488M Software Reference Manual* assumes that a library has already been created for the C language interface.

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

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

3. Load the NI-488M Driver for SunOS 4.x

The following steps build a new SunOS 4.x UNIX kernel with the NI-488M driver installed.

a. Change to `/sys/sun` directory and edit the file `conf.c`. Find the block of function definitions preceding the character device table *cdevsw* and add the following lines:

```
#include "ib.h"
#if NIB > 0
int ibopen(), ibclose(), ibread(), ibwrite(), ibioctl();
#else
#define ibopen    nodev
#define ibclose   nodev
#define ibread    nodev
#define ibwrite   nodev
#define ibioctl   nodev
#endif
```

The file `ib.h` is automatically created by the system in Step f, discussed later in this chapter. The file `ib.h` will contain the single line:

```
#define NIB x
```

where `x` is the number of GPIB-1014 boards configured in the UNIX kernel.

b. At the end of the character device table *cdevsw*, located in the file `conf.c`, add the following lines:

```
{ ibopen, ibclose, ibread, ibwrite,  /*xx*/
  ibioctl, nodev, seltrue,    0,
  0,
},
```

Note: ***This table has the same structure as the character device table*** *cdevsw* ***in*** `/usr/include/sys/conf.h`.

Each device in the system has a major device number. To determine the major device number of the GPIB-1014 board, choose the number after the largest device number currently in your system. All GPIB-1014 boards and devices use the same device number. In this example, the major device number is `xx`, as shown in the comment `/*xx*/` previously.

c. Use the following command, replacing *xx* with your major device number from Step a, to create a special node for device `gpib0`:

```
mknod /dev/gpib0 c xx 255
```

d. If you have a Sun-3 computer, change to `/sys/sun3/conf`. If you have a Sun-4 machine, change to `/sys/sun4/conf`. Edit the file `files`. Add the line:

```
sundev/gpib.c  optional ib device-driver
```

e. Create a configuration file named `GPIB` by copying an existing configuration. `GENERIC` is the default generic Sun configuration file. If you already have a local configuration different from `GENERIC`, copy it instead.

```
cp GENERIC GPIB
```

f. Edit the file `GPIB` and add the following line to the end of the file:

```
device ib0 at vme16d16 ? csr 0x2000 priority 2 vector ibintr 0xC8
```

This line indicates a GPIB controller is at VME address 0x2000, interrupt level 2, and interrupt vector 0xC8. The GPIB-1014 uses addresses 0x2000 through 0x2200. If any of these addresses is already in use, select a different base address. For an additional GPIB controller, add another line similar to the one above. The device name would be `ib1`, the interrupt level can stay the same but the VME address and the interrupt vector would have to change.

g. Create the new system and be sure to save the old version of `/vmunix` as shown in the following example.

```
config GPIB
cd ../GPIB
make
cp /vmunix /vmunix.old
cp vmunix /vmunix
```

4. Turn the System Off

1. Halt the system by entering the following command:

```
halt
```

2. Shut down the system and turn the power off.

Now proceed to the next section to configure and install the hardware.

Configure and Install the Hardware

The GPIB-1014 board should be Revision D.2 or higher for Sun-3 computers. The GPIB-1014 board should be Revision F or higher for Sun-4 computers. The GPIB-1014D board should be revision C.3 or higher for either Sun-3 or Sun-4.

Refer to Chapter 3 of the *GPIB-1014 User Manual* for more detailed instructions about the following steps.

1. Configure the board for the following setup:

   - Privileged access upon power up
   - The same base address as in the software configuration

2. With the power off, remove the panel from the rear of the computer.

3. Plug the GPIB-1014 into an empty slot. This slot should be higher than 6 (7 through 12) if the computer has 12 slots.

   Note: ***The GPIB-1014 must be installed in a VME slot without the P2 connector wired.***

4. Open the front hatch of the Sun and remove all jumpers for this slot.

5. Re-attach the front and rear panels.

Verify the Software Installation

Restart your computer. The following message should appear on the screen:

```
ib0 at vme16d16 csr 0x2000 pri 2 vector 0xc8
```

If it does not appear, check that the GPIB-1014 address jumper settings are the same as specified in *Configure the Software*.

There are two software installation tests: `ibtsta` and `ibtstb`. `ibtsta` checks for a correct node `/dev/gpib0` and correct access to the device driver. `ibtstb` checks for correct Direct Memory Access (DMA) and interrupt operation. It requires a GPIB bus analyzer and can be omitted if an analyzer is not available.

To run `ibtsta`, change to `/usr/gpib` and run `ibtsta` using the following command:

```
ibtsta
```

If `ibtsta` completes with no errors, and a bus analyzer is available, run `ibtstb` using the following command:

```
ibtstb
```

Configure the Software

After you have started the new kernel successfully, run the software configuration utility `ibconf`. This is a screen-oriented utility that you can use to inspect and modify the default software parameters. `ibconf` is self-explanatory with help screens to explain all commands and options. `ibconf` also creates all other special files needed by your NI-488M software.

Run `ibconf` with the following command:

```
ibconf /vmunix
```

where `/vmunix` can be any UNIX kernel with the NI-488M driver installed. Refer to the *NI-488M Software Reference Manual* for more details.

The field *dma mode* is defined by the following byte:

	x	HLD	x	x	x	x	x	x
bit:	7	6	5	4	3	2	1	0

where *HLD* denotes Cycle Steal With Hold mode, and the `x` bits denote "don't care values". Refer to the *GPIB-1014 User Manual* for more information. Notice that the byte defined above does not correspond to an actual hardware register.

Note: ***Avoid setting the HLD bit. Setting this bit selects the Cycle Steal With Hold mode, which may conflict with other DMA devices in the system. This conflict can crash the system during DMA operations. To avoid this problem, use the default mode, Cycle Steal Without Hold (HLD bit clear).***

Appendix A
Troubleshooting

This appendix helps you troubleshoot problems.

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

Hardware

- Make sure the GPIB-1014 board is Revision D.2 or higher for a Sun-3 computer, and Revision F or higher for a Sun-4 computer. The GPIB-1014D board should be revision C.3 or higher for either Sun-3 or Sun-4.
- Make sure the GPIB-1014 is positioned securely in its slot.
- Check the jumper setting on the board, and make sure that it is set to the correct VME base address.
- Make sure all the jumpers for the GPIB-1014 board slot are removed.

Software

- Make sure that you have extracted the files from the correct directory (depending on your computer and operating system).
- If you have a Sun-3 computer, copy the file `gpib3.o` to `/sys/sun3/OBJ/gpib.o`. If you have a Sun-4 computer, copy the file `gpib4.o` to `/sys/sun4/OBJ/gpib.o`.
- In the `/sys/sun/conf.c` file, the major device number chosen should be unique.
- The major device number chosen above should be the one used for creating the node for `gpib0`.

Appendix B
Customer Communication

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

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Germany	089/741 31 30	089/714 60 35
Italy	02/48301892	02/48301915
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Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
Spain	(91) 640 0085	(91) 640 0533
Sweden	08-730 49 70	08-730 43 70
Switzerland	056/20 51 51	056/20 51 55
U.K.	0635 523545	0635 523154

Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Include additional pages if necessary.

Name _____

Company _____

Address _____

_____

Fax (___) _____ Phone (___) _____

Computer brand _____ Model _____ Processor _____

Operating system _____

Speed _____MHz RAM _____MB Display adapter _____

Mouse _____yes _____no Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Revision _____

Configuration _____

The problem is _____

_____

_____

_____

_____

List any error messages _____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

_____

GPIB-1014 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

- NI-488M Software Version Number on Distribution Medium: _____
- GPIB-1014 Revision: _____
- Hardware Settings:

	Base I/O Address	Interrupt Request Line	DMA Channel
GPIB-1014	_____	_____	_____

- Software Settings:

	Base I/O Address	Interrupt Vector Number	DMA Channel
gpib0	_____	_____	_____

Other Products

- Application Programming Language/Version: _____
- Computer Make and Model: _____
- Microprocessor: _____
- Clock Frequency: _____
- Type of Video Board Installed: _____
- Type of other boards installed and their respective hardware settings:

Board Type	Base I/O Address	Interrupt Level	DMA Channel
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

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.

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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.

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Glossary

DMA	direct memory access
FCC	Federal Communications Commission
GPIB	General Purpose Interface (IEEE 488) bus
Hz	hertz
IEEE	Institute of Electrical and Electronic Engineers
I/O	input/output
kbytes	1,000 bytes
MB	megabytes of memory
RAM	random-access memory
s	seconds
VME	Virtual Machine Environment