

**Getting Started with Your GPIB-1014  
Series Board and the NI-488M™  
Software for Motorola UNIX**

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- The limits for a Class A computing device, in accordance with the specifications in Part 15 of U.S. Federal Communications Commission (FCC) Rules. Operation is subject to the following two conditions:
  - This device may not cause harmful interference.
  - This device must accept any interference received, including interference that may cause undesired operation.
- The limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications (DOC).

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

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 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.
- Relocate the equipment with respect to the receiver.
- Reorient the receiver's antenna.

- Be sure that the equipment is plugged into a grounded outlet and that the grounding has not been defeated with a cheater plug.

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

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

# Preface

---

This manual contains instructions for installing and configuring the National Instruments GPIB-1014 series interface boards and the NI-488M multitasking software for use with the Motorola UNIX Operating System. This manual is meant to be used with the National Instruments IEEE 488 Multitasking UNIX Device Driver reference (*NI-488M Software Reference Manual*, part number 320062-01).

The material in this manual is for users who have extensive knowledge of the Motorola UNIX operating system and have super-user privilege. This manual also assumes that the user has already received a GPIB-1014 series interface board along with a user manual.

## Organization of This Manual

This manual is organized as follows:

Chapter 1, *Introduction*, briefly describes the GPIB-1014 series interface boards and the NI-488M software, and lists the contents of your NI-488M kit and optional equipment.

Chapter 2, *Installation and Configuration*, lists all the files located on the distribution medium, and contains step-by-step instructions for configuring and installing the NI-488M software and GPIB-1014 series interface boards, and verifying the software installation.

Appendix A, *Troubleshooting*, suggests areas to check if you still have problems installing the GPIB-1014 series boards and/or the NI-488M software after following the procedures described in Chapter 2, *Installation and Configuration*.

Appendix B, *Customer Communication*, contains forms for you to complete to facilitate communication with National Instruments concerning our products.

## Conventions Used in This Manual

The following conventions are used throughout this manual.

|               |   |
|---------------|---|
| enter         | Reserved to mean that the commands immediately succeeding the word must be typed into the computer, and then executed by pressing the <Return> key on the keyboard.   |
| GPIB-1014     | Refers to any National Instruments VME-to-IEEE 488 interface board including the GPIB-1014, GPIB-1014D, GPIB-1014DP, and GPIB-1014P.  |
| <i>italic</i> | Italic text denotes emphasis, a cross reference, or an introduction to a key concept.   |
| 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. |
| Motorola UNIX | Refers to the SYS/V68 release 3 version 5.1 Operating System.   |

## Abbreviations

The following abbreviations for units of measure are used in this manual:

|        |                     |
|--------|---------------------|
| A      | amperes             |
| Hz     | hertz               |
| in.    | inches              |
| kbytes | 1,024 bytes         |
| M      | megabytes of memory |
| M-     | mega- ( $10^6$ )    |
| m      | meters              |



## **Acronyms**

The following acronyms are used in this manual:

|      |  |
|------|--|
| ANSI | American National Standards Institute            |
| DMA  | direct memory access                             |
| GPIB | General Purpose Interface (IEEE 488) bus         |
| IEEE | Institute of Electrical and Electronic Engineers |
| I/O  | input/output                                     |
| PIO  | programmed input/output                          |
| RAM  | random-access memory                             |
| VDC  | volts direct current                             |

**Note:** References in this manual to IEEE 488 are referring to the ANSI/IEEE Standard 488.1-1987 which defines the GPIB.

## **Related Documentation**

This manual is to be used with the following documentation:

- *GPIB-1014 User Manual*, National Instruments Corporation (Part Number 320030-01)
- *GPIB-1014D User Manual*, National Instruments Corporation (Part Number 320140-01)
- *GPIB-1014DP User Manual*, National Instruments Corporation (Part Number 320049-01)
- *GPIB-1014P User Manual*, National Instruments Corporation (Part Number 320026-01)
- ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*
- *SYSTEM V/68 Release 3 System Administrator's Reference Manual* (For more information on Motorola UNIX documentation, contact the Literature Distribution Center, 616 West 24th Street, Tempe Arizona 85282.)

## **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.

# Contents

---

## Chapter 1

|                                    |     |
|------------------------------------|-----|
| <b>Introduction</b> .....          | 1-1 |
| What Your Kit Should Contain ..... | 1-1 |
| Optional Equipment .....           | 1-2 |
| Software Description .....         | 1-2 |

## Chapter 2

|  |     |
|--|-----|
| <b>Installation and Configuration</b> .....      | 2-1 |
| Step 1. Prepare for Software Installation .....  | 2-1 |
| Step 2. Install the Software.....                | 2-1 |
| Set Up a Working Directory.....                  | 2-1 |
| Install the Utility Files .....                  | 2-2 |
| Install the C Library .....                      | 2-2 |
| Install the NI-488M Driver .....                 | 2-3 |
| Step 3. Configure and Install the Hardware ..... | 2-5 |
| A. Unpack Your GPIB-1014 .....                   | 2-5 |
| B. Configure the GPIB-1014 Series Board .....    | 2-5 |
| Configure the GPIB-1014 or GPIB-1014D .....      | 2-6 |
| Configure the GPIB-1014P or GPIB-1014DP .....    | 2-6 |
| C. Install the GPIB-1014 Series Board.....       | 2-6 |
| Step 4. Verify the Software Installation .....   | 2-7 |
| Step 5. Configure the Software .....             | 2-8 |
| ibconf Example .....                             | 2-8 |
| Exiting ibconf.....                              | 2-9 |

## Appendix A

|                              |     |
|------------------------------|-----|
| <b>Troubleshooting</b> ..... | A-1 |
|------------------------------|-----|

## Appendix B

|                                     |     |
|-------------------------------------|-----|
| <b>Customer Communication</b> ..... | B-1 |
|-------------------------------------|-----|

# Chapter 1

## Introduction

---

This chapter briefly describes the GPIB-1014 series interface boards and the NI-488M software, and lists the contents of your NI-488M kit and optional equipment.

The GPIB-1014 series boards are full-function IEEE 488 interfaces for systems that have a VMEbus and that run the Motorola UNIX operating system. The interface boards included in this series are the GPIB-1014, GPIB-1014D, GPIB-1014P, and GPIB-1014DP.

The GPIB-1014 uses DMA transfers to achieve data transfer rates up to 500 kbytes/sec. The GPIB-1014D also uses DMA transfers and has two independent GPIB ports.

The GPIB-1014P controls IEEE 488 compatible instruments using programmed I/O. The GPIB-1014DP also uses programmed I/O and has two independent GPIB ports.

## What Your Kit Should Contain

Your NI-488M driver kit should contain the following components:

| Component  | Part Number |
|--|-------------|
| NI-488M Distribution Tape for GPIB-1014 Series<br>Motorola UNIX System V/68 Driver and C Interface   | 460754-13   |
| <i>Getting Started with Your GPIB-1014 Series Board<br/>and the NI-488M Driver for Motorola UNIX</i> | 320509-01   |
| <i>NI-488M Software Reference Manual</i>   | 320062-01   |

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

**Note:** This kit does not include an interface board. You need a GPIB-1014 series board to complete the hardware and software installation.

## Optional Equipment

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

| Equipment  | Part Number |
|--|-------------|
| Double Shielded Cables*:   |             |
| GPIB Type X2 Cable – 1 m   | 763061-01   |
| GPIB Type X2 Cable – 2 m   | 763061-02   |
| GPIB Type X2 Cable – 4 m   | 763061-03   |
| <p>* To meet FCC emission limits for this Class A device, you must use a shielded (Type X1 or X2) GPIB cable. Operating this equipment with a non-shielded cable may cause interference to radio and television reception in commercial areas.</p> |             |

## Software Description

The NI-488M software is a comprehensive package of programs and drivers that transforms any computer running the Motorola UNIX operating system into a GPIB Controller with complete communications and bus management capabilities. The NI-488M software also includes a C language interface and an interactive control utility, `ibic`.

# Chapter 2

## Installation and Configuration

---

This chapter lists all the files located on the distribution medium, and contains step-by-step instructions for configuring and installing the NI-488M software and the GPIB-1014 series interface boards, and verifying the software installation.

### Step 1. Prepare for Software Installation

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

- You must have super-user privilege.
- The distribution medium is in `tar` format.

The distribution medium should contain the following files:

|                        |                                |
|------------------------|--------------------------------|
| <code>gplib.o</code>   | NI-488M driver                 |
| <code>cib.c</code>     | C language library             |
| <code>ugplib.h</code>  | Include file for user programs |
| <code>ibtsta</code>    | Installation test part A       |
| <code>ibtstb</code>    | Installation test part B       |
| <code>ibic</code>      | Interactive control utility    |
| <code>ibconf</code>    | Software configuration utility |
| <code>gplib1014</code> | Kernel configuration file      |

### Step 2. Install the Software

The following procedures explain how to install the NI-488M software. If you already have a GPIB-1014 series interface board installed, you do *not* need to remove it before installing the software.

#### Set Up a Working Directory

1. Log on as `root`.

2. Create a working directory (for example, `/usr/gpib`) and change to that directory.
3. Copy the distribution files from the NI-488M distribution medium to this directory by entering the following command:

```
tar xvf /dev/rst0
```

## Install the Utility Files

Complete the following steps to install the utility files:

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

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

2. Copy the file `gpib.o` to `/usr/src/uts/m68k/io/gpib.o` by entering the following command:

```
cp gpib.o /usr/src/uts/m68k/io/gpib.o
```

3. Copy the files `ibic` and `ibconf` to a directory in the command search path (for example, `/bin` or `/usr/bin`) by entering the following commands:

```
cp ibic /usr/bin
cp ibconf /usr/bin
```

## Install the C Library

The file `cib.c` should be compiled and converted to a library. This procedure is necessary because the *NI-488M Software Reference Manual* assumes that a library has already been created for the C language interface. To compile the file `cib.c` and create a C language library, enter the following commands:

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

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

## Install the NI-488M Driver

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

### 1. Change the Software Settings

- a. Edit the file `gpib1014` to match the hardware settings. Refer to the user manual that came with your board for the correct hardware settings. In the default configuration, the file `gpib1014` is set up for four boards - two DMA boards and two PIO boards. The default values in the file `gpib1014` are as follows:
  - The default base addresses are:
    - `gpib0 - 0x3000`
    - `gpib1 - 0x3200`
    - `gpib2 - 0x4000`
    - `gpib3 - 0x4200`
  - The default interrupt levels are:
    - `gpib0, gpib1 - 4`
    - `gpib2, gpib3 - 2`
  - The default interrupt vectors are:
    - `gpib0 - 0xD4`
    - `gpib1 - 0xD5`
    - `gpib2 - 0xD7`
    - `gpib3 - 0xD8`
  - The default major device number is 20. The major device number you choose should be unique.
- b. After making changes to the file `gpib1014`, copy it to `/usr/src/uts/m68k/sysgen/descriptions/gpib1014`. The `sysgen` utility uses the `gpib1014` file in this directory when it generates the new kernel.



## 2. Create a Device Node for the Board

Enter the following command to create a special node for device `gpib0`:

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

where `xx` is the same major device number as in the file `gpib1014`.

## 3. Modify the System Parameters

There are two kernel buffers used for DMA. These buffers are system-tunable parameters that are configured by `sysgen`, a utility that generates the new kernel. The default number of buffers is 1. Add an additional buffer for each DMA board. For example, if you have one DMA board, set the buffer value to 2.

Follow these steps if you need to change the number of buffers:

- a. Enter `sysgen` to run the utility.
- b. Position the arrow on the line which reads `Standard Configuration` and type the letter `O`.
- c. Move the arrow next to `Kernel & Paging parameters` and type the letter `O`.
- d. Move the arrow next to `Raw I/O Buffer Number` and type the letter `O`.
- e. Move the arrow onto the line which shows the buffer value, just below the default value.
- f. Type the letter `C` and then enter the correct buffer value.
- g. Type `Q` several times to quit `sysgen`. When prompted, type `Y` to save your changes.

For more information on using `sysgen`, refer to the *SYSTEM V/68 Release 3 System Administrator's Reference Manual*.

#### 4. Build a New Kernel

Install the driver and build a new kernel by entering the following commands:

```
cd /usr/src/uts/m68k/io
ar rv ../cf/lib.io gpib.o
sysgen -gbi
```

### Step 3. Configure and Install the Hardware

The following are general instructions for configuring and installing the GPIB-1014, GPIB-1014D, GPIB-1014P, and GPIB-1014DP interface boards.

#### A. Unpack Your GPIB-1014 Series Board

If you have not already unpacked your board, follow these unpacking steps.

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

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

2. Notice that your GPIB-1014 board is packaged in an antistatic plastic bag to prevent electrostatic damage to the board. Several components on the board can be damaged by electrostatic discharge. To avoid such damage in handling the board, touch the plastic bag to a metal part of your computer chassis before removing the board from the bag.
3. Remove the board from the bag and inspect the board for loose components or any other sign of damage. Notify National Instruments if the board appears damaged in any way. Do *not* install a damaged board into your computer.

#### B. Configure the GPIB-1014 Series Board

The following are general instructions for configuring the hardware. For more detailed information, refer to the *Configuration and Installation* chapter in the user manual that came with your board.

**Configure the GPIB-1014 or GPIB-1014D**

1. Configure the GPIB-1014 or GPIB-1014D board for the following setup:
  - privileged access upon power up
  - the same base address as in the file `gpib1014`.
2. Record the board settings on the configuration form in Appendix B, *Customer Communication*.

**Configure the GPIB-1014P or GPIB-1014DP**

1. Configure the GPIB-1014P or GPIB-1014DP board for the following setup:
  - privileged access upon power up
  - the same VMEbus base address as in the file `gpib1014`.
  - the same interrupt request and priority code as in the file `gpib1014`.
  - the same interrupt status/ID vector as in the file `gpib1014`.
2. Record the board settings on the configuration form in Appendix B, *Customer Communication*.

**C. Install the GPIB-1014 Series Board**

The GPIB-1014 can be installed in any unused expansion slot in your computer. After you change the settings (if needed) and record the settings on the configuration form in Appendix B, *Customer Communication*, you are ready to install the GPIB-1014 series board.

The following steps are general installation instructions. Consult the manual that came with your computer for specific instructions and warnings.

1. Halt the system by entering the command `powerdown -y`.
2. Turn off the power to the system and unplug the power cord.

3. Insert the GPIB-1014 in an unused slot with the IEEE 488 receptacle sticking out of the opening on the back panel. It might be a tight fit, but do not force the board into place.
4. Check that the board is firmly seated in its slot.
5. Plug the power cord into the wall outlet.
6. Turn your computer back on.

The GPIB-1014 interface board is now installed and ready for verification testing.

## Step 4. Verify the Software Installation

This step verifies that the NI-488M software is installed and functioning with the GPIB-1014 series hardware.

Power on the computer. The following message should appear on the screen:

```
National Instruments DMA(PIO) board installed
```

If this message does not appear, check that the base address jumper settings on the board(s) are the same as specified in the file `gpib1014`.

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 DMA and interrupt operation. `ibtstb` requires a GPIB bus analyzer and can be omitted if an analyzer is not available.

Complete the following steps to verify the software installation.

1. Change to `/usr/gpib` and run `ibtsta` by entering this command:

```
ibtsta
```

2. If `ibtsta` completes with no errors, and a bus analyzer is available, connect it to the GPIB, and then run `ibtstb` by entering the following command:

```
ibtstb
```

If an error occurs in `ibtsta` or `ibtstb`, refer to Appendix A, *Troubleshooting*. If no error occurs, the NI-488M software is installed correctly.

## Step 5. Configure the Software

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

If you changed the software default settings in the file `gpib1014`, make a corresponding change to the default parameters shown in `ibconf`.

To run the `ibconf` utility, enter the following command:

```
ibconf [file]
```

where `[file]` is the full pathname of your UNIX kernel if it is different than the default, `/stand/sysV68`. Refer to the *NI-488M Software Reference Manual* for more details.

### ibconf Example

To configure the UNIX kernel with the GPIB-1014 driver installed, enter the following command:

```
ibconf
```

The default UNIX kernel name is `/stand/sysV68`. If you gave your kernel a different name, use the `file` option to give the whole pathname of the UNIX kernel. For example, to run `ibconf` when the kernel being started is named `/stand/sysV68.new`, enter the following command:

```
ibconf /stand/sysV68.new
```

**Exiting `ibconf`**

Save the current configuration by typing `y` before exiting `ibconf`. Even if you did not make any changes to the configuration settings, you should still type a `y` to have `ibconf` create the special device files `gpib*` and `dev*` in the `/dev` directory.

The software should now be installed and configured correctly. Reboot the system to run on the new kernel.

# Appendix A

## Troubleshooting

---

This appendix suggests areas to check if you still have problems installing the GPIB-1014 series board(s) and/or the NI-488M software after following the procedures described in Chapter 2, *Installation and Configuration*.

If you still have problems after following the suggestions in this appendix, complete the *GPIB-1014 Hardware and Software Configuration Form* in Appendix B, *Customer Communication*, and then call National Instruments for technical support.

### Hardware

- Make sure the GPIB-1014 board is positioned securely in its slot.
- Check the jumper setting on the board, making sure that it is set to the correct VME base address.
- Make sure all GPIB cables are connected properly.

### Software

- Make sure the file `gpib.o` is copied to `/usr/src/uts/m68k/io/gpib.o`.
- Make sure the major device number used in the `gpib1014` file is unique.
- Make sure the major device number used for creating the node for `gpib0` matches the major device number in the file `gpib1014`.

# Appendix B

## Customer Communication

---

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

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

### Fax Technical Support

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

(512) 794-5678

### Telephone Technical Support

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

(512) 794-0100

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

### Documentation Comments

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



# Technical Support Fax Form

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Technical support is available at any time by fax at (512) 794-5678. For best results, provide as much information as possible. Include the information from your configuration form. Use additional pages if necessary.

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

Fax (\_\_\_\_) \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_\_

Computer brand \_\_\_\_\_

Model \_\_\_\_\_ Processor \_\_\_\_\_

Operating system \_\_\_\_\_

Speed \_\_\_\_\_MHz RAM \_\_\_\_\_M

Display adapter \_\_\_\_\_

Mouse \_\_\_\_\_yes \_\_\_\_\_no

Other adapters installed \_\_\_\_\_

Hard disk capacity \_\_\_\_\_M Brand \_\_\_\_\_

Instruments used \_\_\_\_\_

National Instruments hardware product model \_\_\_\_\_

Revision \_\_\_\_\_

Configuration \_\_\_\_\_

National Instruments software product \_\_\_\_\_

Version \_\_\_\_\_

Configuration \_\_\_\_\_

(continues)

The problem is \_\_\_\_\_

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List any error messages \_\_\_\_\_

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The following steps will reproduce the problem \_\_\_\_\_

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# 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 Revision/Version Number on Distribution Medium: \_\_\_\_\_
- National Instruments board installed (GPIB-1014, GPIB-1014D, GPIB-1014P, or GPIB-1014DP): \_\_\_\_\_
- Board Revision: \_\_\_\_\_

- Hardware Settings:

|               | Base I/O<br>Address | Interrupt Request<br>Line | DMA<br>Channel |
|---------------|---------------------|---------------------------|----------------|
| 1st GPIB-1014 | _____               | _____                     | _____          |
| 2nd GPIB-1014 | _____               | _____                     | _____          |
| 3rd GPIB-1014 | _____               | _____                     | _____          |
| 4th GPIB-1014 | _____               | _____                     | _____          |

- Software Settings:

|       | Base I/O<br>Address | Interrupt Vector<br>Number | DMA<br>Channel |
|-------|---------------------|----------------------------|----------------|
| gpib0 | _____               | _____                      | _____          |
| gpib1 | _____               | _____                      | _____          |
| gpib2 | _____               | _____                      | _____          |
| gpib3 | _____               | _____                      | _____          |

## Other Products

- Motorola UNIX System Version: \_\_\_\_\_
- 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<br>Address | Interrupt<br>Level | DMA<br>Channel |
|------------|---------------------|--------------------|----------------|
| _____      | _____               | _____              | _____          |
| _____      | _____               | _____              | _____          |
| _____      | _____               | _____              | _____          |

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Title: **Getting Started with Your GPIB-1014 Series Board and the NI-488M™ Software for Motorola UNIX**

Edition Date: **May 1992**

Part Number: **320509-01**

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

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

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