Getting Started with Your MC-GPIB and the NI-488M™ Software for the IBM RISC System/6000

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Federal Communications Commission

This device complies with Part 15 of the Federal Communications Commission (FCC) Rules for a Class B digital device. A Class B device is distinguishable from a Class A device by the appearance of an FCC ID number located on the Class B device.

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 B 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 interference from the equipment to radio and television reception in residential 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 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.

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Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Bestimmungen eingeräumt.

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About This Manual

This manual contains instructions for installing and configuring the National Instruments MC-GPIB interface board and the NI-488M multitasking software driver for use with the IBM AIX Operating System. This package is intended for use on an IBM RISC System/6000 workstation. 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 briefly describes the hardware and the NI-488M software.

- Chapter 2, *Hardware Installation*, explains how to install the MC-GPIB board into your IBM RISC System/6000 workstation.

- Chapter 3, *Software Installation and Configuration*, lists the programs and files located on the distribution diskette, explains how to install and configure your NI-488M software, and describes how to verify the hardware and software installation. This chapter also contains information about unloading the software and using your NI-488M software with your application program.

- Appendix A, *Hardware Specifications*, describes the electrical, environmental, and physical characteristics of the MC-GPIB board and the recommended operating conditions.

- Appendix B, *Hardware Configuration*, describes how to check your board settings and how to change the configuration of the shield ground jumper.

- Appendix C, *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.

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, 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.
`bold monospace`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
`italic monospace`	Italic text in this font that you must supply the appropriate words or values in place of these items.
< >	Angle brackets enclose the name of a key on the keyboard—for example, <Shift>.
IEEE 488	IEEE 488 refers to the ANSI/IEEE Standard 488.1-1987, which defines the GPIB.

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

Related Documentation

The following document contains information that you may find helpful as you read this manual.

- ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*
- *IBM AIX for RISC System/6000 Kernel Extensions and Device Support Programming Concepts*

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 C, *Customer Communication*, at the end of this manual.

Chapter 1
Introduction

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

What You Need to Get Started

- ❑ One of the following boards, which comes in your kit:
  MC-GPIB Interface Board
  MC-GPIB Interface Board with Keys

- ❑ 3.5 in. *NI-488M Distribution Diskette for MC-GPIB and IBM AIX RISC System/6000 Driver and C Interface*, which comes in your kit

- ❑ Super-user privilege

- ❑ Shielded GPIB cables*, which you can order from National Instruments:
  Type X1 single-shielded cable – 1 m, 2 m, or 4 m
  Type X2 double-shielded cable – 1 m, 2 m, or 4 m

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

Hardware Description

The MC-GPIB board is an IEEE 488 interface for IBM PS/2 and compatible computers that have Micro Channel plug-in slots. Standard IEEE 488 cables connect the MC-GPIB board to up to 14 instruments. If you need
to connect more than 14 instruments, you can use a National Instruments IEEE 488 extender or expander, or you can install more than one MC-GPIB board in your computer.

Software Description

The NI-488M software is a comprehensive set of programs and drivers that transforms an AIX-based IBM RISC System/6000 workstation into a GPIB Controller with complete communication and bus management capabilities. The NI-488M software also comes with a C language interface and an interactive control program.

Chapter 2
Hardware Installation

This chapter explains how to install the MC-GPIB board into your IBM RISC System/6000 workstation.

Warning: ***Several components on the MC-GPIB board can be damaged by electrostatic discharge. To avoid such damage in handling the board, touch the antistatic plastic package to a metal part of your computer chassis before removing the board from the package.***

Perform the following steps to install the MC-GPIB board. Consult the manual that came with your computer for specific instructions and warnings.

1. Turn off your computer.

2. Unplug the power cord.

3. Remove the expansion slot cover on the system unit.

4. Insert the MC-GPIB board into an unused slot with the GPIB connector sticking out of the opening on the back panel, as shown in Figure 2-1. Make a note of the slot number(s) of the MC-GPIB board(s) you install.

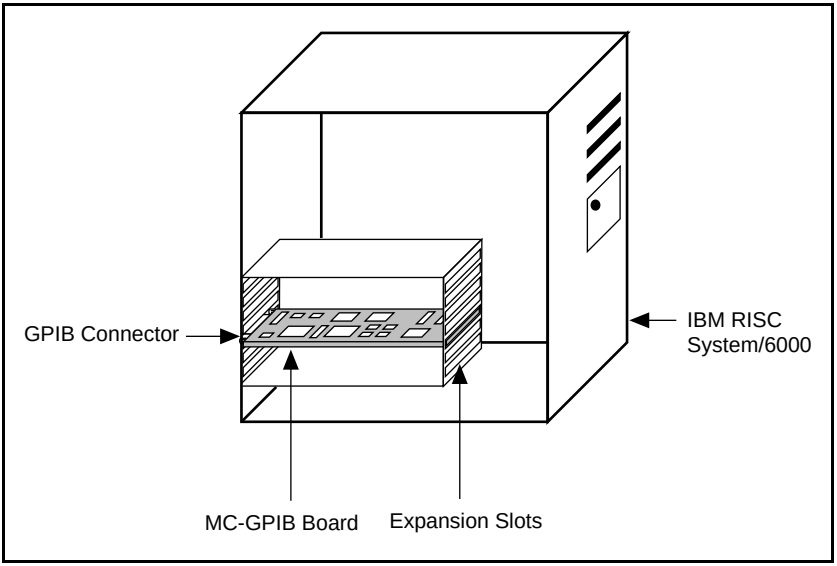

Figure 2-1. Installing the MC-GPIB

5. Screw the mounting bracket of the MC-GPIB board to the back panel rail of the computer.

6. Replace the system unit cover.

7. Plug in the power cord.

8. Turn on your computer.

The MC-GPIB board is now installed.

For information about checking the hardware settings or changing the shield ground configuration, refer to Appendix B, *Hardware Configuration.*

Chapter 3
Software Installation and Configuration

This chapter lists the programs and files located on the distribution diskette, explains how to install and configure your NI-488M software, and describes how to verify the hardware and software installation. This chapter also contains information about unloading the software and using your NI-488M software with your application program.

Step 1. Prepare for Installation

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

- You must have super-user privilege.
- The MC-GPIB board must be installed before you install the NI-488M software. If you have not installed your MC-GPIB board, refer to Chapter 2, *Hardware Installation*, for instructions on how to install the board.
- The *NI-488M Distribution Diskette for MC-GPIB and IBM AIX RISC System/6000 Driver and C Interface* is in `tar` format. This diskette is referred to as the NI-488M distribution diskette throughout the remainder of this manual.

The files contained on the NI-488M distribution diskette are as follows:

`cib.c`	C language library
`cib.h`	Include file for the 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
`gpibdd`	NI-488M device driver for IBM AIX
`gpib_add`	Script for installing/adding GPIB device driver
`gpib_delete`	Script for uninstalling GPIB device driver
`gpib.stanza`	GPIB information file

`cfggpib`	Configuration file used by the system
`ibdiag`	Hardware installation test utility

Step 2. Install the NI-488M Software

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

A. Set Up a Working Directory

1. Log on as `root`.

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

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

3. Copy the files from the NI-488M distribution diskette to this directory by entering the following `tar` command:

```
tar -xvf /dev/fd0
```

B. 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
```

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

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

C. Install the C Library

Install the C library by compiling and converting the file `cib.c`. 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 rv /usr/lib/libgpib.a cib.o
ranlib /lib/libgpib.a
```

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

Step 3. Load the NI-488M Driver

The NI-488M driver for AIX is a loadable device driver. It can be installed automatically or manually. For easy installation, use the automatic installation steps.

Automatic Installation

To install the NI-488M driver for AIX automatically, run the install script by entering the following command:

`gpib_add` *a* [*b c d*]

where *a* is the slot number of your MC-GPIB board, and *b*, *c*, and *d* are the slot numbers of the second, third, and fourth MC-GPIB boards, respectively, if applicable.

If the automatic installation fails, use the manual installation steps.

Manual Installation

To install the driver manually, complete the following steps.

1. Enter the following commands:

```
cp gpibdd /etc/drivers
cp cfggpib /etc/methods
odmadd gpib.stanza
```

2. For each MC-GPIB board installed, enter the following commands:

```
mkdev -c adapter -s mca -t gpib -p bus0 -w x
```

   where *x* is the slot number of the MC-GPIB board.

If the hardware and software are installed correctly, and one MC-GPIB board is installed, the following message appears on the screen.

`gpib0 available`

If the hardware and software are installed correctly, and two or more boards are installed, the same message is repeated for each board.

The NI-488M driver for AIX supports four MC-GPIB boards. These boards are referenced by number from your application program as follows:

Reference Number	Board
0	first (`gpib0`)
1	second (`gpib1`)
2	third (`gpib2`)
3	fourth (`gpib3`)

If the manual installation is not successful, a system error message appears on the screen. Make sure that you have entered the correct information in steps 1 and 2 of this section. If a system error still appears on the screen, fill out the forms in Appendix C, *Customer Communication*, and contact National Instruments for technical support.

Step 4. Configure the Software with ibconf

After the software is installed successfully, you can inspect or modify the software parameters by running the configuration utility `ibconf` (you must have super-user privilege). `ibconf` is a screen-oriented utility that is largely self-explanatory, with help screens to explain all commands and options.

To use `ibconf`, enter the following command when you are in the `/usr/gpib/` directory:

```
ibconf
```

To run `ibconf` in other directories, enter the following command:

```
ibconf /etc/drivers/gpibdd
```

After you inspect or modify the software parameters, save the current configuration by typing `y` before exiting `ibconf`.

If you made any changes to the default GPIB parameters, delete the driver using `gpib_delete`, and then install the driver again using `gpib_add`. This completes the software installation and configuration procedures.

Step 5. Verify the Software Installation

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 a correct DMA and interrupt operation. `ibtstb` requires a GPIB analyzer and may 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
   ```

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

   ```
   ibtstb
   ```

If an error occurs in `ibtsta` or `ibtstb`, make sure that you have followed the instructions in Chapter 2. If you still have problems, complete the forms in Appendix C, *Customer Communication*, and contact National Instruments. If no error occurs, the NI-488M driver is installed correctly.

Step 6. Verify the Hardware Installation

The hardware verification test is called `ibdiag`.

Complete the following steps to verify the hardware installation.

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

   ```
   ibdiag
   ```

2. Press <Return> when prompted.

The hardware verification tests may take several minutes. If an error occurs, write down the error message that appears on the screen, fill out the forms in Appendix C, *Customer Communication*, and contact National Instruments.

If no error occurs, type `q` to quit `ibdiag.` The MC-GPIB board is installed correctly.

Unload the NI-488M Driver (Optional)

You can also unload the NI-488M driver for AIX from your system. You can remove the driver automatically or manually.

Automatic Removal

To automatically remove the NI-488M driver for AIX, run the delete script by entering the following command:

```
gpib_delete gpib0 [gpib1 gpib2 gpib3]
```

where `gpib1`, `gpib2`, and `gpib3` are the second, third, and fourth MC-GPIB boards, respectively.

If the driver is removed successfully and you have only one MC-GPIB board installed, the following messages appear on the screen:

```
gpib0 deleted

odmdelete: 4 objects deleted
odmdelete: 1 objects deleted
```

If the driver is removed successfully and you have two or more boards installed, the first line of the message is repeated for each board.

Manual Removal

For manual removal, follow these steps.

1. If you have one MC-GPIB board installed, enter the following commands:

   ```
   rmdev -l gpib0 -d
   odmdelete -o PdAt -q uniquetype=adapter/mca/gpib
   odmdelete -o PdDv -q type=gpib
   rm /etc/drivers/gpibdd
   rm /etc/methods/cfggpib
   ```

2. If you have two or more boards installed, repeat the first line of the above command for each board.

If the driver is removed successfully and you have only one MC-GPIB board installed, the following messages appear on the screen:

```
gpib0 deleted

odmdelete: 4 objects deleted
odmdelete: 1 objects deleted
```

If the driver is removed successfully, and you have two or more boards installed, the first line of the message is repeated for each board.

Using Your NI-488M Software with Your Application Program

After the software has been installed and verified successfully, you are ready to proceed with development of your NI-488M application program.

Remember the following points when developing your application:

- The file `cib.c` is the interface between your C language application program and the operating system entry points to the NI-488M driver. The functions available in `cib.c` are described in detail in the *NI-488M Software Reference Manual*.

- To use the functions described in the *NI-488M Software Reference Manual*, 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.a` at compile time as shown in the following examples.

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

  or

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

- Your application program must include the following header file.

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

Appendix A
Hardware Specifications

This appendix describes the electrical, environmental, and physical characteristics of the MC-GPIB board and the recommended operating conditions.

Table A-1. Electrical Characteristics

Characteristic	Specification
Power Requirement (from Micro Channel)	+5 VDC 1.0 A Typical 1.6 A Maximum

Table A-2. Environmental Characteristics

Characteristic	Specification
Operating Environment	
Component Temperature Relative Humidity	0° to 40° C 5% to 90%, noncondensing
Storage Environment	
Temperature Relative Humidity	-20° to 70° C 5% to 90%, noncondensing
EMI	FCC Class B Certified

Table A-3. Physical Characteristics

Characteristic	Specification
Dimensions	8.9 cm by 29.2 cm (3.5 in. by 11.5 in.)
I/O Connector	IEEE 488 Standard 24-pin

Appendix B
Hardware Configuration

This appendix describes how to check your board settings and how to change the configuration of the shield ground jumper.

Checking Your Hardware Settings

To get information about installed GPIB boards, enter the following command:

```
lsdev -C | grep gpib
```

To check the base I/O address, arbitration level, and interrupt level for a particular GPIB board, enter the following command:

```
lsattr -E -l gpibx
```

where *x* is the number of the installed board (0, 1, 2, or 3).

Shield Ground Configuration

The MC-GPIB board is set at the factory with the jumper in place to connect the logic ground to the shield ground. This configuration minimizes EMI emissions.

Caution: ***The MC-GPIB board was tested for compliance with FCC standards with the shield ground connected to logic ground. Removing the jumper might cause EMI emissions to exceed any or all of the applicable standards.***

If your application requires that logic ground be disconnected from shield ground, follow these steps:

1. Locate the jumper W1 on your MC-GPIB board.

2. Remove the jumper and place it across only one of the jumper pins as shown in Figure B-1.

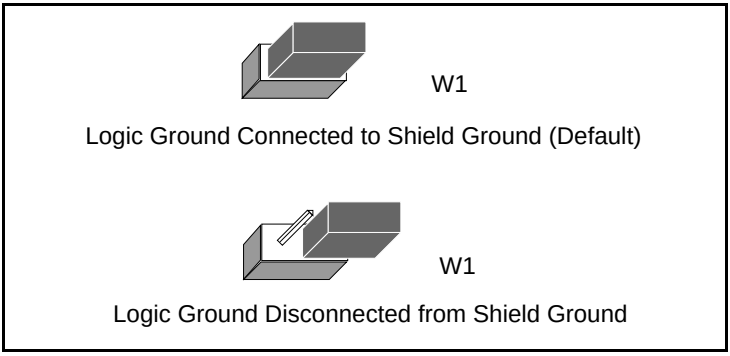

Figure B-1. Ground Configuration Jumper Settings

3. Record your shield ground jumper setting on the *MC-GPIB Hardware and Software Configuration Form* in Appendix C, *Customer Communication*.

Appendix C
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.

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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

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 _____

(continues)

National Instruments software product _____

Version _____

Configuration _____

The problem is _____

_____

_____

_____

_____

_____

_____

_____

List any error messages _____

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The following steps will reproduce the problem _____

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MC-GPIB Hardware and Software Configuration Form

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

National Instruments Products

- NI-488M Software Revision Number on Diskette _____
- Revision Number on MC-GPIB Board _____
- Logic Ground Connected to Shield Ground (yes or no)_____
- Interrupt Level of MC-GPIB Board _____
- Arbitration Level of MC-GPIB Board _____
- Base I/O Address of MC-GPIB Board _____

Other Products

- Computer Make and Model _____
- Application Programming Language and Version _____

Other Boards in System	Base I/O Address Levels	Arbitration Levels	Interrupt Levels
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

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Part Number: **320277B-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.

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Glossary

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

°	degrees
%	percent
A	amperes
C	Celsius
DMA	direct memory access
EMI	electromagnetic interference
FCC	Federal Communications Commission
GPIB	General Purpose Interface Bus
Hz	hertz
IEEE	Institute of Electrical and Electronic Engineers
in	inches
I/O	input/output
m	meters
MB	megabytes of memory
RAM	random-access memory
RISC	Reduced Instruction Set Computer
s	seconds
VDC	volts direct current