Getting Started with Your EISA-GPIB and the NI-488.2M™ Software for HP 9000 Series 700

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- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
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About This Manual

This manual contains instructions to help you install and configure the National Instruments EISA-GPIB interface board and the NI-488.2 multitasking software (NI-488.2M) driver for the HP-UX operating system, version 9.01 and higher. The hardware and software are intended for use on an HP 9000 Series 700 workstation. This manual is meant to be used with the *NI-488.2M Software Reference Manual*.

This manual assumes that you are already familiar with the HP 9000 Series 700 workstation and the HP-UX operating system.

Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, explains how to use this manual, lists what you need to get started, and briefly describes the EISA-GPIB hardware and the NI-488.2M software.
- Chapter 2, *Hardware Configuration and Installation*, contains instructions to help you configure and install your EISA-GPIB board in an HP 9000 Series 700 workstation that has at least one EISA slot.
- Chapter 3, *Software Installation and Configuration*, contains instructions for installing and configuring your NI-488.2M software in the HP-UX kernel.
- Chapter 4, *Installation Verification and Troubleshooting*, describes how to verify the software installation and how to troubleshoot problems. It also lists some common questions and answers.
- Chapter 5, *Using Your NI-488.2M Software*, describes the `ibic` utility and lists some programming considerations for NI-488.2M, and describes the use of alternative driver interfaces, such as HP SICL.
- Appendix A, *Hardware Specifications*, describes the physical characteristics of the EISA-GPIB board and the recommended operating conditions.
- 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 a description of the terms, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols, that this manual uses.

Conventions Used in This Manual

This manual uses the following conventions.

bold italic	Bold italic text denotes a note, caution, or warning.
`bold monospace`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
`italic monospace`	Italic text in this font denotes that you must supply the appropriate words or values in the place of these items.
`monospace`	Text in this font denotes text or characters that you literally input from the keyboard. This font also denotes sections of code, programming examples, syntax examples, the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, extensions, and statements and comments taken from program code.
HP-UX	HP-UX refers to the HP-UX operating system on an HP 9000 Series 700 computer.
NI-488.2M	NI-488.2M refers to the NI-488.2M software for HP-UX.

The *Glossary* lists abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms.

Related Documentation

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

- *NI-488.2M Software Reference Manual*
- ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*
- ANSI/IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols, and Common Commands*
- *E/ISA Configuration Guide for HP-UX, HP 9000 Series 700 Computers*
- *HP-UX Driver Development Guide, HP 9000 Series 300/400/700*

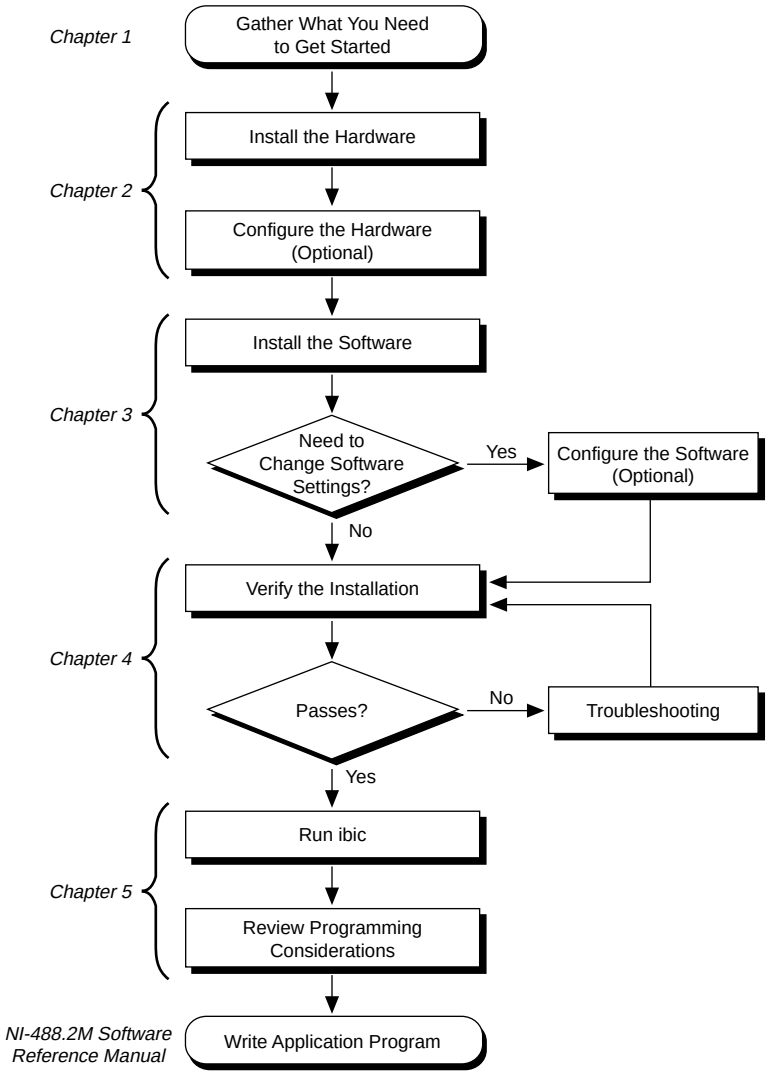
Customer Communication

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 explains how to use this manual, lists what you need to get started, and briefly describes the EISA-GPIB hardware and the NI-488.2M software.

How to Use This Manual



What You Need to Get Started

- ❑ EISA-GPIB board
- ❑ NI-488.2M Distribution Medium for the EISA-GPIB/AT-GPIB and HP-UX
- ❑ HP-UX operating system version 9.01 or higher installed on your computer
- ❑ Super-user privilege

Hardware Description

The EISA-GPIB board, which uses the TNT4882C ASIC, transforms any HP 9000 Series 700 workstation equipped with an EISA bus into a full-functioning GPIB Talker/Listener/Controller. The TNT4882C chip combines the circuitry of the NAT4882 ASIC, the Turbo488 performance-enhancing ASIC, and GPIB transceivers to create a single-chip IEEE 488.2 Talker/Listener/Controller interface. The TNT4882C also implements the HS488 high-speed protocol, which increases the maximum data transfer rate of the EISA-GPIB in an HP workstation up to 5.6 Mbytes/s.

You can use standard GPIB cables to connect the EISA-GPIB with up to 14 instruments. If you want to use more than the maximum number of instruments, you can order a bus extender or expander from National Instruments. Refer to Appendix A, *Hardware Specifications*, for more information about the EISA-GPIB hardware specifications and recommended operating conditions.

Software Description

The NI-488.2M software and GPIB hardware transform any HP 9000 Series 700 workstation having at least one EISA slot, and running HP-UX release 9.01 (or higher), into a GPIB Talker/Listener/Controller with complete communications and bus management capabilities. The NI-488.2M software includes a driver; an interactive control program; several utility programs for installing, configuring, and testing the driver; and a C language interface for use with user-developed applications.

Chapter 2
Hardware Configuration and Installation

This chapter contains instructions to help you configure and install your EISA-GPIB board into an HP 9000 Series 700 workstation that has at least one EISA slot.

Warning: ***Electrostatic discharge can damage several components on your EISA-GPIB board. To avoid such damage when you handle the board, touch the antistatic plastic package to a metal part of your computer chassis before you remove the board from the package.***

Before you install the GPIB board, consider the following:

- You must have super-user privilege.
- You must load the contents of the NI-488.2M distribution medium onto the hard drive of your HP workstation. The distribution medium is in `tar` format.

Load the Distribution Medium

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
   ```

3. Insert the NI-488.2M distribution medium into the appropriate drive and copy the files from the distribution medium to this directory using the `tar` command. For example, to copy the files from a floppy disk, enter the following command:

   `tar xvf <`*`floppy device`*`>`

   where *`<floppy device>`* is the pathname of your floppy disk drive, as represented in the following example:

   ```
   tar xvf /dev/rfloppy/c20ld3s0
   ```

   Examine the contents of the `/dev/rfloppy` and `/dev/rdsk` directories for the names of devices defined in your system. If you are not sure about which device to use, refer to your HP documentation, or ask your system administrator for assistance.

Install the Hardware

Follow these steps to install the EISA-GPIB board:

1. Copy the EISA-GPIB board configuration file from the appropriate OS subdirectory in the NI-488.2M working directory (`/usr/gpib/HPUX*`) to your system's EISA configuration directory. On an HP-UX 9.*x* system, the EISA configuration directory is `/etc/eisa`. On an HP-UX 10.*x* system, the EISA configuration directory is `/sbin/lib/eisa`. The name of the configuration file is `!NICC50`*x*`.CFG`, where *x* is a revision number. For example, if the working directory contains the file `!NICC502.CFG`, enter the following commands on an HP-UX 9.*x* system:

   ```
   cd /usr/gpib/HPUX9
   cp \!NICC502.CFG /etc/eisa
   ```

   The configuration file should remain in the `eisa` configuration directory as long as the GPIB board is installed in the system.

   Note: ***The working directory contains additional configuration files for use with other GPIB interface boards. These files are not used for the EISA-GPIB installation.***

2. Enter the following command to halt the system, then power off the system.

   ```
   /etc/shutdown -h
   ```

3. Insert the EISA-GPIB board into an unused EISA slot. Make sure that you insert the board all the way into the slot. Sometimes the board seems to click firmly into place, even though it is only part of the way in.

   Note: ***Some HP 9000 Series 700 computers support one or more EISA slots as standard equipment, but others support EISA only as an installable option. For detailed installation instructions and warnings about your particular EISA configuration, refer to the manuals that came with your system.***

4. Power on the system. As the system boots, the EISA-GPIB board is automatically configured from the information contained in the `!NICC50x.CFG` file.

After you install the NI-488.2M software, the software automatically configures itself to use the interrupt and DMA settings configured on the hardware. If you are installing one EISA-GPIB, the software assigns it as `gpib0`. If you are installing more than one board, the board in the lowest-numbered slot is `gpib0`, the board in the next lowest-numbered slot is `gpib1`, and so on. You can override these assignments using the NI-488.2 configuration program `ibconf`. `ibconf` is described in Chapter 3, *Software Installation and Configuration*.

Configuring the Hardware (Optional)

Follow the instructions in this section to change or view the hardware configuration settings of the EISA-GPIB that were assigned automatically by the system.

Selecting the Interrupt Request Line

The EISA-GPIB can use any of the following interrupt request lines (IRQs): IRQ3, IRQ4, IRQ5, IRQ6, IRQ7, IRQ9, IRQ10, IRQ11, IRQ12, IRQ14, and IRQ15.

If, for some reason, you must change the board IRQ to something other than that assigned by the system, run the system configuration program, `eisa_config`, and reconfigure the board IRQ in the system configuration.

1. Enter the following command at the `EISA:` prompt to obtain a list of the IRQ choices of the GPIB board:

   `show board` *`slotnum`*

   where *`slotnum`* should be replaced by the actual slot number that your board occupies.

2. Enter the following command at the `EISA:` prompt:

   `change` *`slotnum`* `F2` *`choicenum`*

   where *`slotnum`* should be replaced by the actual slot number that your board occupies, `F2` is the function number of the function `EISA-GPIB Interrupt Request Level`, and *`choicenum`* should be replaced with the actual choice number of the preferred IRQ (for example, CH1 is the choice number for IRQ11).

3. Exit the program by entering `q`. Then enter `s` to save the change to the configuration file of the system.

For details on how to use the `change` and `show board` commands in `eisa_config`, refer to Chapter 3, *Configuring E/ISA Boards Interactively*, in the *E/ISA Configuration Guide for HP-UX, HP 9000 Series 700 Computers*.

Record the new setting of the IRQ on the *Hardware and Software Configuration Form* in Appendix B, *Customer Communication*.

Selecting the DMA Channel

Direct memory access (DMA) refers to data transfers between devices, such as the GPIB board and computer memory, without the active participation of the CPU. Your GPIB hardware and the NI-488.2M software are designed to perform DMA. In most cases, data transfers that use DMA are significantly faster than programmed I/O transfers, which use more CPU time.

The EISA-GPIB board supports DMA channels 0, 1, 2, 3, 4, 5, 6, and 7. DMA can also be disabled for programmed I/O operation.

If, for some reason, you must change the DMA channel of the board to something other than that assigned automatically by the system, run the system configuration program, `eisa_config`, and reconfigure the DMA channel of the board in the system configuration.

1. Enter the following command at the `EISA:` prompt to obtain a list of the DMA channel choices of the GPIB board:

   `show board` *`slotnum`*

   where *`slotnum`* should be replaced by the actual slot number that your board occupies.

2. Enter the following command at the `EISA:` prompt:

   `change` *`slotnum`* `F1` *`choicenum`*

   where *`slotnum`* should be replaced by the actual slot number that your board occupies, `F1` is the function number of the function `EISA-GPIB DMA Channel`, and *`choicenum`* should be replaced with the actual choice number of the preferred DMA channel (for example, CH1 is the choice number for DMA channel 5).

3. Exit the program by entering `q`. Then enter `s` to save the change to the configuration file of the system.

For details on how to use the `change` and `show board` commands in `eisa_config`, refer to Chapter 3, *Configuring E/ISA Boards Interactively*, in the *E/ISA Configuration Guide for HP-UX, HP 9000 Series 700 Computers*.

Record the new setting of the DMA channel on the *Hardware and Software Configuration Form* in Appendix B, *Customer Communication*.

Removing the Board (Optional)

Follow these steps to remove a currently installed GPIB board:

1. Change to the `eisa` configuration directory. For example, on an HP-UX 9.*x* system, enter the following command:

   `cd /etc/eisa`

2. Run the system `EISA` configuration program by entering the following command:

   `/etc/eisa_config`

3. Type the following command at the `EISA:` prompt to remove the GPIB board installed at slot *n*:

   ```
   remove n
   ```

4. Exit the program by entering `q`, then enter `s` to save the change to the system configuration file.

5. Shut down the system with the following command, then power off the system:

   ```
   /etc/shutdown -h
   ```

6. Remove the board.

   Note: ***For detailed installation instructions and warnings about your particular EISA configuration, refer to the manuals that came with your system.***

7. Power on the system.

Chapter 3
Software Installation and Configuration

This chapter contains instructions for installing and configuring your NI-488.2M software in the HP-UX kernel.

Software Components

The NI-488.2M working directory contains the following subdirectories and files:

- `HPUX10` is the directory containing files specific to HP-UX 10.*x*.
- `HPUX9` is the directory containing files specific to HP-UX 9.*x*.
- The `README` file contains additional documentation (optional).
- `instgpib` is an automatic driver installation script.

Each of the `HPUX*` directories contains the following subdirectories and files:

- `!NICC00x.CFG` is the AT-GPIB board configuration file.
- `!NICC30x.CFG` is the AT-GPIB/TNT board configuration file.
- `!NICC50x.CFG` is the EISA-GPIB board configuration file.
- `Alt_interfaces` contains alternative NI-488.2M driver interfaces.
- The `README` file contains additional documentation (optional).
- `cib.c` is the C language interface library.
- `cib.h` is the private include file for `cib.c`.
- `ib_hpux.o` is the NI-488.2M driver for the GPIB interface board.
- `ibconf` is the NI-488.2M driver configuration utility.
- `ibic` is the Interface Bus Interactive Control utility.
- `ibtsta` is the software installation test, part A.
- `ibtstb` is the software installation test, part B.
- `instgpib` is an OS-specific driver installation script.
- `ugpib.h` is the include file for user application programs.

For more information on the contents of the `Alt_interfaces` directories, refer to the *Using Alternative Driver Interfaces* section of Chapter 5, *Using Your NI-488.2M Software*.

Note: ***The NI-488.2M driver supports versions of the National Instruments AT-GPIB interface board as well as the EISA-GPIB. The AT-GPIB configuration files included in the software distribution are not used for the EISA-GPIB installation.***

Install the NI-488.2M Software

Before you install the software, consider the following:

- You must have super-user privilege.
- You should have already loaded the contents of the NI-488.2M distribution medium into a working directory on your hard drive (for example, `/usr/gpib`) during hardware installation. See Chapter 2, *Hardware Configuration and Installation*.

You can install the NI-488.2M software either automatically or manually, as described in the following sections. For most users, the automatic installation method is suitable. However, if your system has non-standard configuration requirements, or you have installed other NI-488.2M products (for example, a GPIB-ENET) on your system, then you should use the manual installation method so you can customize the NI-488.2M installation as needed.

Automatic Installation

To automatically install the NI-488.2M software, go to your working directory (`/usr/gpib`) and enter the following command:

```
./instgpib
```

The program prompts you for the information it needs to install the driver and utilities.

If the automatic installation fails, `instgpib` displays the error encountered during the installation.

Manual Installation for HP-UX 9.*x*

To manually install the NI-488.2M software under HP-UX 9.*x*, go to your working directory (`/usr/gpib`) and complete the following steps:

1. Change to the `HPUX9` subdirectory by entering the following command:

   ```
   cd HPUX9
   ```

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, `/usr/bin`) by entering the following commands:

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

4. Install the C library by compiling the file `cib.c` and converting its object file, `cib.o`, into a library. This procedure is necessary if you are compiling your application with the `-lgpib` option, as described in Chapter 5, *Using Your NI-488.2M Software*. 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
   ```

   Alternatively, you can add `cib.o` to an existing library or include `cib.o` during the link phase of each compile operation. Refer to Chapter 5 for more information.

5. Change to the `/etc/conf` directory by entering the following command:

   ```
   cd /etc/conf
   ```

6. Make a backup copy of your current system configuration description file (for example, `/etc/conf/dfile`) by entering the following command:

   ```
   cp dfile dfile.old
   ```

7. Add the NI-488.2M driver to the `dfile` file by editing `/etc/conf/dfile`. Find the line containing `* Drivers and Subsystems`. Below this line, add the name of the NI-488.2M driver, `ib`.

8. Make a backup copy of the `/etc/master` file, which lists all possible device drivers, by entering the following command:

   ```
   cp /etc/master /etc/master.old
   ```

9. Include the NI-488.2M driver in the master file by editing `/etc/master`. Find the line shown below:

   ```
   ** Reserved for Third Party and User Drivers.
   ```

   Below this line, you should find one or more lines in the following six-field format:

   ```
   **        ---       -       -       -1      N
   ```

   In the preceding line, *N* is a number not equal to `-1`. Choose one of those lines and replace its first four fields with the following:

   ```
   ib        ib        1       1F8
   ```

   so that the line reads as follows:

   ```
   ib        ib        1       1F8     -1      N
   ```

   The value for *N* is the major number of the GPIB board. You should make a note of the value of *N* for later use.

10. Generate the files used to create a new kernel containing the NI-488.2M driver by entering the following command:

    ```
    /etc/config dfile
    ```

    The files generated are `config.mk`, a make file that you use to generate a new HP-UX kernel, and `conf.c`, a C file that links in the NI-488.2M driver.

11. Add the NI-488.2M driver to the HP-UX kernel by copying it into a standard library:

    ```
    ar rv libusrdrv.a /usr/gpib/HPUX9/ib_hpux.o
    ```

12. Build a new kernel by entering the following command:

    ```
    make -f config.mk
    ```

    This builds a new HP-UX kernel, named `hp-ux`, in your current directory, which should be `/etc/conf`. This new kernel contains the NI-488.2M driver.

13. Install the new kernel by entering the following commands in order:

    ```
    cp /hp-ux /SYSBCKUP
    cp ./hp-ux /hp-ux
    ```

The backup of the previous kernel is saved as `SYSBCKUP` under the root directory (/).

14. Create the device node for the NI-488.2M driver by entering the following commands in order:

```
cd /dev
mknod gpib c N 50
```

where *N*, which you recorded in Step 9, is the major number of the GPIB board.

15. Reboot the system by entering the following command:

```
sync;sync;/etc/reboot
```

Manual Installation for HP-UX 10.*x*

Caution: ***If your system is running HP-UX 10.10, you must first obtain the OS patch*** `PHKL_7381` ***from Hewlett-Packard and install it on your system before you try to install the NI-488.2M driver. You can get*** `PHKL_7381` ***from the HP SupportLine World Wide Web server or by calling HP customer support. Refer to your Hewlett-Packard documentation for HP customer support numbers and World Wide Web site URLs. If you do not install the patch*** `PHKL_7381` ***or its equivalent before you install the NI-488.2M driver, an unrecoverable system panic might occur when you reboot your system.***

To manually install the NI-488.2M software under HP-UX 10.*x*, go to your working directory (`/usr/gpib`) and complete the following steps:

1. Change to the `HPUX10` subdirectory by entering the following command:

```
cd HPUX10
```

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, `/usr/bin`) by entering the following commands:

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

4. Install the C library by compiling the file `cib.c` and converting its object file, `cib.o`, into a library. This procedure is necessary if you are compiling your application with the `-lgpib` option, as described in Chapter 5, *Using Your NI-488.2M Software*. 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
   ```

   Alternatively, you can add `cib.o` to an existing library or include `cib.o` during the link phase of each compile operation. Refer to Chapter 5 for more information.

5. Change to the `/stand` directory by entering the following command:

   ```
   cd /stand
   ```

6. Make a backup copy of your current system configuration description file (for example, `/stand/system`) by entering the following command:

   ```
   cp system system.old
   ```

7. Add the NI-488.2M driver to the system file by editing `/stand/system`. After any initial comments at the top of the file (comments are lines beginning with an asterisk, such as `* Drivers and Subsystems`), add a line containing the name of the NI-488.2M driver, `ib`.

8. Change to the `/usr/conf/master.d` directory by entering the following command:

   ```
   cd /usr/conf/master.d
   ```

9. Make a backup copy of the `core-hpux` file, which defines the characteristics of installed device drivers, by entering the following commands:

   ```
   mkdir ../master.d.bak
   cp core-hpux ../master.d.bak/core-hpux.old
   ```

10. Edit `/usr/conf/master.d/core-hpux` to include the NI-488.2M driver by adding the following lines as described.

    a. Locate the section in the file beginning with the label `$DEVICE`. Within this section should be a block of lines beginning with the comment:

       ```
       ** Reserved for Third Party and User Drivers.
       ```

Below this comment, you should find one or more lines in the following six-field format:

```
*          ---        -        -        -1       N
```

In the preceding line, *N* is a number not equal to -1. Choose one of these lines and replace its first four fields with the following:

```
ib         ib         1        1F8
```

so that the line reads as follows:

```
ib         ib         1        1F8      -1       N
```

The value of *N* is the major number of the GPIB board. You should make a note of the value of *N* for later use.

b. Locate the section in the file beginning with the label `$DRIVER_LIBRARY`. After any initial comments at the beginning of this section, add the following line:

```
ib         libgpibdrv.a
```

c. Locate the section in the file beginning with the label `$LIBRARY`. After any initial comments at the beginning of this section, add the following line:

```
libgpibdrv.a  0
```

11. Change to the `/usr/conf/lib` directory by entering the following command:

```
cd /usr/conf/lib
```

12. Create a library for the NI-488.2M driver by entering the following command:

```
ar r libgpibdrv.a /usr/gpib/HPUX10/ib_hpux.o
```

13. Change to the `/stand/build` directory by entering the following command:

```
cd /stand/build
```

14. Generate the files used to create a new kernel containing the NI-488.2M driver by entering the following command:

```
/usr/sbin/config -m /usr/conf/master.d -s /stand/system
```

The files generated are `config.mk`, a `make` file that you can use to generate a new HP-UX kernel, and `conf.c`, a C file that links in the NI-488.2M driver.

15. Build a new kernel by entering the following command:

    ```
    make -f config.mk
    ```

    This builds a new HP-UX kernel, named `vmunix_test`, in your current directory, `/stand/build`. This new kernel contains the NI-488.2M driver.

16. Install the new kernel by entering the following commands in order:

    ```
    cd ..
    cp vmunix vmunix.old
    cp build/vmunix_test vmunix
    ```

17. Create the device node for the NI-488.2M driver by entering the following commands in order:

    ```
    cd /dev
    mknod gpib c N 50
    ```

    where *N*, which you recorded in step 10, is the major number of the GPIB board.

18. Reboot the system by entering the following commands in order:

    ```
    cd /
    sync;sync;reboot
    ```

Configure the Software with ibconf

If you installed the software manually, you must run the software configuration utility `ibconf` (you must have super-user privilege). `ibconf` creates the remaining device nodes that the driver needs. If you used the automatic installation procedure, running `ibconf` is optional.

`ibconf` 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 commands and options.

Note: ***You cannot use*** `ibconf` ***to configure the DMA channel or the interrupt jumper setting on the EISA-GPIB board. You can, however, change the slot number assigned to each logical GPIB board. To configure the DMA and interrupt, use the EISA configuration utility that came with your computer. For more information, refer to the*** *Configuring the Hardware (Optional)* ***section in Chapter 2,*** *Hardware Configuration and Installation****.***

Follow these steps to run `ibconf`:

1. Enter the following command at the command prompt:

   `ibconf [file]`

   where *file* can be any HP-UX kernel file with the NI-488.2M driver installed. For HP-UX 9.*x*, the default kernel file is `/hp-ux`. For HP-UX 10.*x*, the default kernel file is `/stand/vmunix`.

   If you have given your HP-UX kernel file a name other than those shown, use the file option to give the whole path name of the HP-UX kernel. For example, if the kernel name is `/hp-ux.new`, enter the following command:

   ```
   ibconf /hp-ux.new
   ```

2. Use the control keys, as instructed on the screen, to select different fields and view corresponding help information.

3. Make any necessary changes.

4. Exit `ibconf` by pressing <CTRL-O>, and save your changes by typing a `y`. 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.

If you did not make any changes to the configuration settings or if you only renamed devices, you do *not* have to restart the system. However, if you made any changes to the configuration settings, you must restart the system to run on the new kernel. Restart the system by entering the following command:

```
sync;sync;/etc/reboot
```

For more information on using `ibconf`, refer to Chapter 2, *Installation and Configuration of NI-488.2M Software*, in the *NI-488.2M Software Reference Manual.*

Removing the NI-488.2M Driver (Optional)

You may want to remove the NI-488.2M driver at some time. You must remove the driver manually.

The following procedures describe how to manually remove the NI-488.2M driver. These procedures are similar to the procedures to manually install the driver (see the *Manual Installation* sections, earlier in this chapter). The only difference is that instead of adding the NI-488.2M driver information to the current system configuration description files, you must remove the driver information from those files.

Manual Removal for HP-UX 9.*x*

Complete the following steps to remove the NI-488.2M driver from the HP-UX 9.*x* kernel:

1. Change to the `/etc/conf` directory by entering the following command:

   ```
   cd /etc/conf
   ```

2. Edit your current system configuration description file (for example, `/etc/conf/dfile`) to remove the name of the NI-488.2M driver `ib`.

3. Edit file `/etc/master` and replace the following line:

   ```
   ib          ib          1         1F8       -1        N
   ```

   with the following:

   ```
   **          ---         -         -         -1        N
   ```

   where *N* is the major number you chose for the GPIB board.

4. Generate the new files used to create a new kernel not containing the NI-488.2M driver by entering the following command:

   ```
   /etc/config dfile
   ```

5. Build the new kernel by entering the following command:

   ```
   make -f config.mk
   ```

   This builds a new HP-UX kernel, named `hp-ux`, in your current working directory, which should be `/etc/conf`. The new kernel does not contain the NI-488.2M driver.

6. Install the new kernel by entering the following commands in order:

   ```
   cp /hp-ux /SYSBCKUP
   cp ./hp-ux /hp-ux
   ```

   The backup of the previous kernel is saved as `SYSBCKUP` under the root directory (/).

7. Reboot the system to use the new kernel by entering the following command:

   ```
   sync;sync;/etc/reboot
   ```

Manual Removal for HP-UX 10.*x*

Complete the following steps to remove the NI-488.2M driver from the HP-UX 10.*x* kernel:

1. Change to the `/stand` directory by entering the following command:

   ```
   cd /stand
   ```

2. Edit your current system configuration file (for example, `/stand/system`) to remove the name of the NI-488.2M driver `ib`.

3. Edit the file `/usr/conf/master.d/core-hpux` to remove all references to the NI-488.2M driver by modifying the following lines as described.

   a. Replace the following line:

   ```
   ib          ib          1         1F8       -1        N
   ```

   with the following:

   ```
   *           ---         -         -         -1        N
   ```

   where *N* is the major number you chose for the GPIB board.

   b. Remove the following lines:

   ```
   ib          libgpibdrv.a

   libgpibdrv.a    0
   ```

4. Change to the `/stand/build` directory by entering the following command:

   ```
   cd /stand/build
   ```

5. Generate the files used to create a new kernel not containing the NI-488.2M driver by entering the following command:

   ```
   /usr/sbin/config -m /usr/conf/master.d -s /stand/system
   ```

6. Build the new kernel by entering the following command:

   ```
   make -f config.mk
   ```

   This builds a new HP-UX kernel, named `vmunix_test`, in your current directory, `/stand/build`. The new kernel does not contain the NI-488.2M driver.

7. Install the new kernel by entering the following commands in order:

```
cd ..
cp vmunix vmunix.old
cp build/vmunix_test vmunix
```

8. Reboot the system by entering the following commands in order:

```
cd /
sync;sync;reboot
```

Chapter 4
Installation Verification and Troubleshooting

This chapter describes how to verify the software installation and how to troubleshoot problems. It also lists some common questions and answers.

Run the Software Installation Test

The software installation test has two parts: `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 analyzer, such as the National Instruments 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
   ```

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

   ```
   ibtstb
   ```

   If no error occurs, the NI-488.2M driver is installed correctly. If an error occurs, refer to the next section for troubleshooting information.

Troubleshooting Error Messages

If `ibtsta` fails, the program generates common error messages that appear on your screen. These error messages explain what went wrong when you ran `ibtsta` and describe how you can correct the errors. For example, the following message might appear on your screen if you forgot to disconnect all your GPIB cables:

```
The fact that the ENOL error was not received when expected
indicates the possible presence of other devices on the bus.

Please disconnect ALL GPIB cables from the GPIB board,
then run this test again.
```

If you are still unable to run `ibtsta` and/or `ibtstb` successfully after you have followed the suggestions provided by the error messages, fill out the forms in Appendix B, *Customer Communication*, and contact National Instruments for assistance.

Common Questions

What should I do if `ibtsta` or `ibtstb` fails with an error?

Refer to the troubleshooting sections of this chapter for specific information about what might cause these tests to fail.

When would I use `ibic`?

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

How do I use the NI-488.2M language interface?

For information about using the NI-488.2M C language interface, refer to the *NI-488.2M Software Reference Manual*.

How can I determine what version of NI-488.2M driver is installed?

To determine the version of the driver installed in the currently running kernel, run `ibtsta`. To determine the version of the driver installed in the default kernel boot file (or any other kernel file), run `ibconf` and refer to the upper right-hand corner of the "Device Map" screen.

What information should I have before I call National Instruments?

When you call National Instruments, you should have the results of the diagnostic tests. Also, make sure you have filled out the configuration form in Appendix B, *Customer Communication*.

Chapter 5
Using Your NI-488.2M Software

This chapter describes the `ibic` utility and lists some programming considerations for NI-488.2M, and describes the use of alternative driver interfaces, such as HP SICL.

Introduction to ibic

The Interface Bus Interactive Control utility, `ibic`, comes with your NI-488.2M software. You can use `ibic` to enter NI-488.2 functions interactively and to display the results of the function calls automatically. Without writing an application, you can use `ibic` to do the following:

- Verify GPIB communication with your device quickly and easily.
- Learn the usage of the NI-488 functions and NI-488.2 routines before you write your application.
- Become familiar with the commands of your device.
- Receive data from your GPIB device.
- Troubleshoot problems with your application.

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

Programming Considerations

Once you have installed the NI-488.2M driver and successfully verified its installation, you are ready to proceed with the development of your NI-488.2M application.

As you begin developing your NI-488.2M application, consider the following:

- Your application program must include the following header file:

  ```
  <sys/ugpib.h>
  ```

- The file `cib.c` is the interface between your C language application program and the operating system entry points to the NI-488.2M driver. The NI-488 functions and NI-488.2 routines available in `cib.c` are described briefly in Chapter 3,

Understanding the NI-488.2M Software, in the *NI-488.2M Software Reference Manual*. The NI-488 functions and NI-488.2 routines are described in more detail in Chapter 4, *NI-488.2M Software Characteristics and Routines*, and in Chapter 5, *NI-488M Software Characteristics and Functions*, in the *NI-488.2M Software Reference Manual*. To use the NI-488 functions and NI-488.2 routines, you must compile `cib.c` and include the resulting object file (`cib.o`) during the link phase each time you compile your application, as shown in the following example:

```
cc my_appl.c cib.o
```

Alternatively, you can compile your application and link it to the C language library, `libgpib.a` (created when you installed the software) as shown in the following example:

```
cc my_appl.c -L/usr/lib -lgpib
```

- For information about creating the C language library `libgpib.a`, refer to the *Manual Installation* sections in Chapter 3 of this manual.

- For information about choosing a programming method, developing your application, or compiling and linking, refer to the *NI-488.2M Software Reference Manual*. The software reference manual contains detailed information about each NI-488 function and NI-488.2 routine.

Using Alternative Driver Interfaces

For the best performance, reliability, and portability in new GPIB application development, you should use the functions and routines of the NI-488.2M C language interface described in the previous section.

You might already have applications that were written for older or less portable GPIB standards. Such applications include C programs written for Hewlett-Packard's Standard Instrument Control Library (SICL) and programs written in HP BASIC. National Instruments recommends that you modify these programs, whenever possible, to use the NI-488.2M interface. However, many older applications, with little or no modification, can run with the NI-488.2M driver if you use one of the alternative language interfaces provided on the distribution medium.

To use an alternative language interface, go to the GPIB working directory you created in Chapter 2, *Hardware Configuration and Installation*, when you loaded the distribution medium. Go to the appropriate `HPUX*` subdirectory, depending on the version of HP-UX you are running. The `HPUX*` directory contains a directory named `Alt_interfaces`. The `Alt_interfaces` directory contains subdirectories named after the alternative language interfaces supported for your version of HP-UX. You can

find instructions for installing and using the alternative interfaces in the respective `README` files of the directories for each interface. For example, an `Alt_interfaces` directory might contain the following files and directories:

`Alt_interfaces`	Top-level alternative interfaces directory
`GPIB11`	Files specific to the National Instruments GPIB11 interface
`README`	Installation and configuration instructions
(Names of interface files)	National Instruments GPIB11 interface files
`SICL`	Files specific to Hewlett-Packard's SICL interface
`README`	Installation and configuration instructions
(Names of interface files)	HP SICL interface files

For more information on an alternative programming method, such as function behavior and syntax, refer to the documentation for the GPIB driver that your application was developed with.

Appendix A
Hardware Specifications

This appendix describes the characteristics of the EISA-GPIB board and the recommended operating conditions.

Table A-1. Electrical Characteristics

Characteristic	Specification
Maximum GPIB Transfer Rates	
IEEE 488 Handshake	1.5 Mbytes/s*
HS488 Handshake	5.6 Mbytes/s*
Power Requirement	+5 VDC 300 mA
* Actual speed may vary considerably from speed shown because of instrumentation capabilities.	

Table A-2. Physical Characteristics

Characteristic	Specification
Dimensions	11.4 cm by 16.5 cm (4.5 in. by 6.5 in.)
I/O Connector	IEEE 488 Standard 24-Pin

Table A-3. Environmental Characteristics

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

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.

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: (512) 794-5678

Branch Offices	**Phone Number**	**Fax Number**
Australia	03 9 879 9422	03 9 879 9179
Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	519 622 9310	
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	90 527 2321	90 502 2930
France	1 48 14 24 24	1 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	95 800 010 0793	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	01635 523545	01635 523154

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 _____

National Instruments software product _____

Version _____

Configuration _____

(continues)

The problem is _____

_____

_____

_____

_____

_____

_____

_____

List any error messages _____

_____

_____

_____

_____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

_____

_____

_____

_____

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

- EISA-GPIB Board and Revision Number _____
- NI-488.2M Software Revision Number on Distribution Disk _____
- Board Settings:

	Slot Number	Interrupt Level	DMA Channel
`gpib0`	_____	_____	_____
`gpib1`	_____	_____	_____
`gpib2`	_____	_____	_____
`gpib3`	_____	_____	_____

Other Products

- Computer Make and Model _____
- Microprocessor _____
- Clock Frequency _____
- Type of Monitor Card Installed _____
- HP-UX Platform and Version _____
- Application Programming Language (BASIC, C, and so on) _____

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 EISA-GPIB and the NI-488.2M ™ Software for HP 9000 Series 700**

Edition Date: **June 1996**

Part Number: **320806B-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 _____

_____

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Glossary

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

°	degrees
%	percent
A	amperes
ASIC	application-specific integrated circuit
C	Celsius
CPU	central processing unit
DACK	DMA Acknowledge
DRQ	DMA Request
DMA	direct memory access
EISA	Extended Industry Standard Architecture
EMI	electromagnetic interference
FCC	Federal Communications Commission
GPIB	General Purpose Interface Bus
hex	hexadecimal
I/O	input/output
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
IRQ	interrupt request
ISA	Industry Standard Architecture
m	meters
MB	megabytes of memory
PC	personal computer
s	seconds
URL	uniform resource locator
VDC	volts direct current