Getting Started with Your GPIB-ENET and the NI-488.2M™ Software for OSF/1

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This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual, may cause interference to radio and television reception. This equipment has been tested and found to comply with the following two regulatory agencies:

Federal Communications Commission

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

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

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

Canadian Department of Communications

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

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

Instructions to Users

These regulations are designed to provide reasonable protection against harmful interference from the equipment to radio reception in commercial areas. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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

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

•   Operate the equipment and the receiver on different branches of your AC electrical system.

- Move the equipment away from the receiver with which it is interfering.

- Reorient or relocate the receiver's antenna.

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

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

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

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About This Manual

This manual contains instructions for installing and configuring the National Instruments GPIB-ENET and NI-488.2M multitasking software driver for use with a DEC Alpha AXP workstation running the OSF/1 operating system. This manual is meant to be used with the *NI-488.2M Software Reference Manual*.

The material in this manual assumes that you have knowledge of the DEC Alpha AXP running under OSF/1 and have super-user privilege. This manual also assumes that you are familiar with Ethernet and Internet networks.

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 GPIB-ENET hardware and the NI-488.2M software.

*   Chapter 2, *Configuring and Installing the Hardware*, gives instructions for configuring the GPIB-ENET.

*   Chapter 3, *Installing and Configuring the Software*, explains how to configure your network and host, and how to install and configure your NI-488.2M software.

*   Chapter 4, *Verification and Troubleshooting*, describes how to verify the hardware and software installation and troubleshoot problems.

*   Chapter 5, *Using Your NI-488.2M Software*, describes the ibic utility and lists some programming considerations.

*   Appendix A, *Hardware Specifications*, lists the electrical, environmental, and physical characteristics of the GPIB-ENET and the recommended operating conditions.

*   Appendix B, *GPIB-ENET 8-Bit DIP Switch*, describes how each of the DIP switches on the back panel can affect the operation of the GPIB-ENET.

*   Appendix C, *GPIB-ENET Configuration Utilities,* contains information on the IPassign, Update, and IPsetup utilities for the GPIB-ENET.

*   Appendix D, *READY LED Signaling,* describes how to interpret the **READY** LED error codes.

- Appendix E, *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	Bold text denotes the name of a light-emitting diode (LED).
italic	Italic text denotes emphasis, a cross reference, an introduction to a key concept, or an important note.
bold italic	Bold italic text denotes a note, caution, or warning.
`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. It also denotes sections of code, programming examples, syntax examples, the proper names of disk drives, paths, directories, programs, device names, functions, variables, utilities, filenames, and statements and comments taken from program code.
<>	Angle brackets enclose the name of a key on the keyboard—for example, <Delete>.
-	A hyphen between two or more key names enclosed in angle brackets denotes that you should simultaneously press the named keys—for example, <Shift-Return>.
IEEE 488 and IEEE 488.2	IEEE 488 and IEEE 488.2 refer to the ANSI/IEEE Standard 488.1-1987 and the ANSI/IEEE Standard 488.2-1987, respectively, which define the GPIB.

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:

- ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*

- ANSI/IEEE Standard 488.2-1987, *IEEE Standard Codes, Formats, Protocols, and Common Commands*

- ANSI/IEEE Standard 802.3-1988, *Information Processing Systems, Local Area Networks, Part 3*

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 E, *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 GPIB-ENET hardware and the NI-488.2M software.

How to Use This Manual

Chapter 1	(Gather What You Need to Get Started)
Chapter 2	[Configure and Install the Hardware]
Chapter 3	[Install and Configure the Software]
Chapter 4	[Verify the Installation] → < Passes? > — No → [Troubleshooting]
Chapter 5	Yes ↓ [Run Interactive Control Utility] → [Review Programming Considerations]
Software Reference Manual	(Write Application Program)
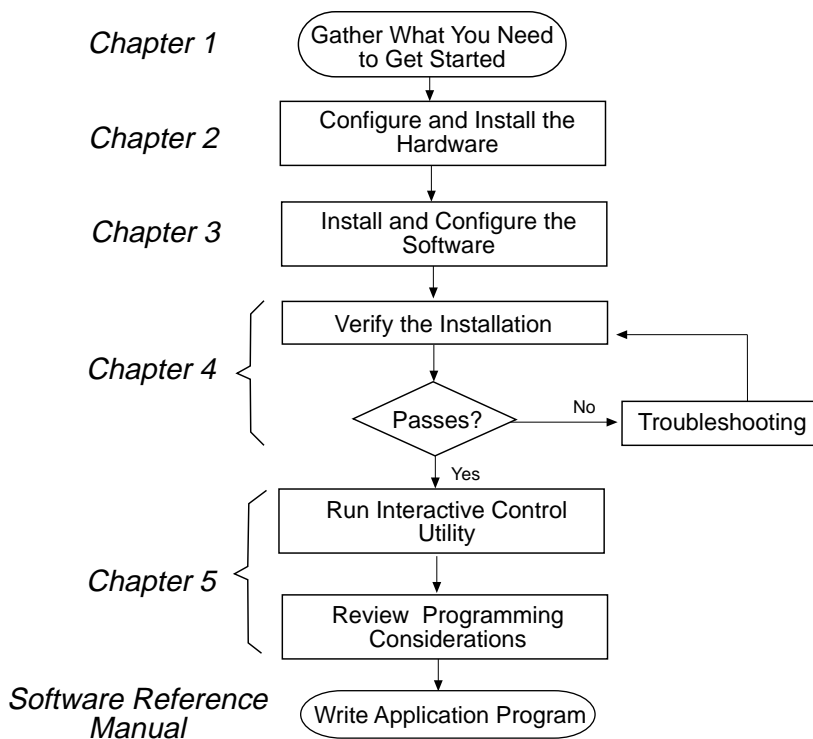
What You Need to Get Started

❏ One of the following boxes, which comes in your kit:
     GPIB-ENET - 10Base-T Version (100-120 VAC)
     GPIB-ENET - 10Base-T Version (220-240 VAC)
     GPIB-ENET - Coax Version (100-120 VAC)
     GPIB-ENET - Coax Version (220-240 VAC)

❏ One of the following power cords, which comes in your kit:
     U.S.A. standard power cord
     Switzerland power cord
     Australian power cord
     Universal European power cord
     North American power cord
     U.K. power cord

❏ One of the following distribution media, which comes in your kit:
     3.5 in. *NI-488.2M Distribution Disk for GPIB-ENET and DEC Alpha OSF/1*
     NI-488.2M Distribution Tape for GPIB-ENET and DEC Alpha OSF/1

❏ OSF/1 version 3.0 or higher installed on your computer

❏ Ethernet Cables, which you can purchase from National Instruments
     Twisted Pair (10Base-T) Cables (1 m, 5 m, or 10 m)
     Coax (10Base-2) Cables (1 m, 5 m, or 10 m)
     AUI (10Base-5) Cables (1 m, 5 m, or 10 m)

❏ Shielded GPIB Cables*, which you can purchase from National Instruments
     Type X1 single-shielded cables (1 m, 2 m, or 4 m)
     Type X2 double-shielded cables (1 m, 2 m, or 4 m)

*   To meet FCC emission limits for this 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.

Optional Multiple-Computer Software License

A multiple-computer software license is available so that one or more hosts on a single
physical network may access one or more GPIB-ENET boxes. Contact National
Instruments for more information regarding the license.

Hardware Description

The GPIB-ENET transparently handles data transfers between an Ethernet-based TCP/IP host and the GPIB. With the GPIB-ENET, multiple hosts can share a set of GPIB instruments or a single host can control several GPIB systems.

The GPIB-ENET converts a computer equipped with an NI-488.2M driver and an Ethernet port into a GPIB Talker/Listener/Controller. The GPIB-ENET is powered by an internal 100-120 VAC or 220-240 VAC supply.

The GPIB-ENET has all the firmware and logic required to implement the physical and electrical characteristics of all versions of the ANSI/IEEE 488 standard, including ANSI/IEEE Standard 488.2-1987, and ANSI/IEEE Standard 802.3. The GPIB-ENET interprets and executes commands that you send to it over an Ethernet link and performs all necessary Ethernet-to-GPIB protocol conversions. For detailed hardware specifications, refer to Appendix A, *Hardware Specifications*.

Figure 1-1 shows the seven light-emitting diodes (LEDs) on the GPIB-ENET top panel. The LEDs show the current status of the GPIB-ENET. Table 1-1 describes each LED.
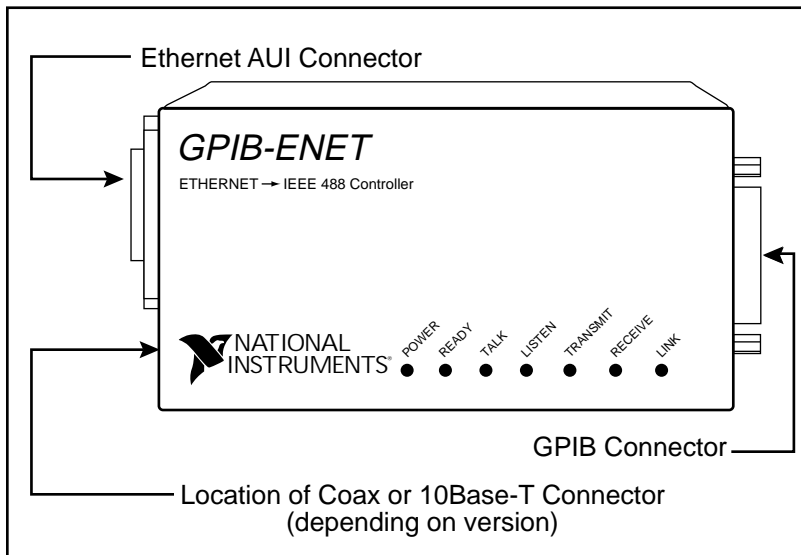
Figure 1-1. GPIB-ENET Top Panel and LEDs

Table 1-1. LED Descriptions

LED	Indication
POWER	Indicates that power has been supplied to the unit and the ON/OFF switch is in the ON position.
READY	Indicates the functional state of the GPIB-ENET. When the GPIB-ENET is powered on, this LED flashes and then becomes steady when the box is ready for operation. Continuous flashing indicates an error has occurred.
TALK	Indicates that GPIB-ENET is configured as a GPIB Talker.
LISTEN	Indicates that GPIB-ENET is configured as a GPIB Listener.
TRANSMIT	Indicates that the GPIB-ENET is transmitting onto the Ethernet network.
RECEIVE	Indicates that the GPIB-ENET is receiving Ethernet network traffic.
LINK	Indicates that the GPIB-ENET has detected a twisted pair (10Base-T) link. For GPIB-ENET coax and AUI options, this LED is not used and remains OFF.

Software Description

The NI-488.2M software and GPIB hardware transform a Digital Equipment Corporation Alpha workstation into a GPIB Talker/Listener/Controller that has complete communications and bus management capability. The NI-488.2M software includes the following components:

• NI-488.2M Language Interface Library

• Software diagnostic test

• Configuration utilities

• Interactive control program

For a list of the actual files included on the distribution media, refer to the *Install the Software* section of Chapter 3, *Installing and Configuring the Software*.

Chapter 2
Configuring and Installing the Hardware

This chapter gives instructions for configuring and installing the GPIB-ENET.

Configure the GPIB-ENET Operating Characteristics

The GPIB-ENET has a two-position slide switch that you use to configure the network interface connector of the box. The GPIB-ENET also has an 8-bit DIP switch used to configure the operating characteristics. The switches are located on the back panel of the GPIB-ENET, as shown in Figure 2-1.
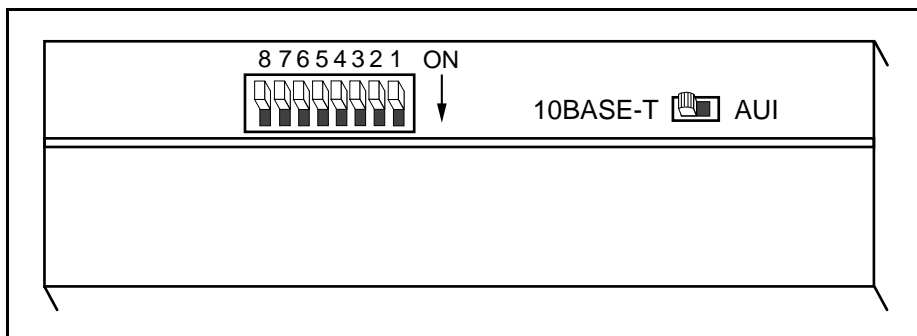
Figure 2-1. GPIB-ENET Back Panel Switches

Configure the Slide Switch

Your GPIB-ENET has two network interface connectors: a 15-pin AUI connector and either a 10Base-T Ethernet connector or a coax Ethernet connector. Use the slide switch to select which of the two connectors the GPIB-ENET uses. The default switch setting is either 10Base-T or coax. Figure 2-2 depicts the default setting for the different types of GPIB-ENET boxes.
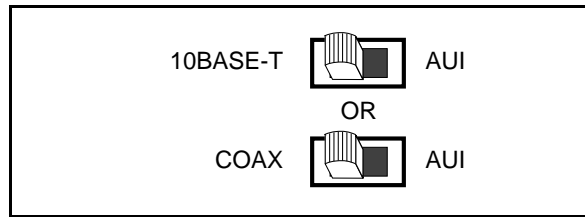
Figure 2-2. Default Switch Setting for Ethernet Port Configuration

If you want to use the AUI connector, change the switch setting to match the appropriate setting in Figure 2-3.
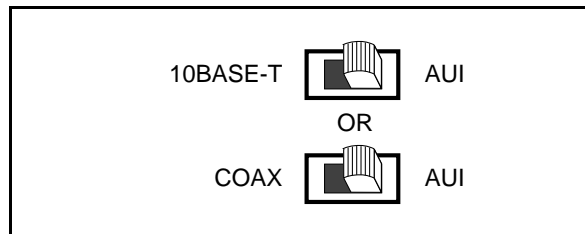
Figure 2-3. Switch Setting for AUI Ethernet Port Configuration

Configure the DIP Switch

The 8-bit DIP switch selects the operating mode of the GPIB-ENET. The GPIB-ENET is shipped to you with the DIP switch set for normal operation mode. In normal operation mode, all the switches are in the OFF position. Most users want to use the GPIB-ENET in normal operation mode. Do not change the DIP switch settings unless you run a GPIB-ENET utility that prompts you to change them. For information about using the 8-bit DIP switch, refer to Appendix B, *GPIB-ENET 8-Bit DIP Switch*.

Connect the Cables

If you do not have both a GPIB cable and Ethernet cable, contact National Instruments for ordering information.

The GPIB-ENET is shipped from the factory with either a 100-120 VAC or 220-240 VAC power supply. Before you configure your GPIB-ENET, verify that the voltage rating listed on the bottom of the box matches the voltage that is supplied in your area.

Warning: *Operating the GPIB-ENET at any voltage other than the one specified could damage the unit.*

1. Connect one end of the Ethernet cable to the GPIB-ENET and securely fasten it. Connect the other end of the Ethernet cable to your Ethernet network. Be sure to follow all IEEE 802.3 cabling restrictions.

2. Connect one end of the GPIB cable to the GPIB-ENET and tighten the thumb screws on the connector. Connect the other end of the GPIB cable to your GPIB system. Be sure to follow all IEEE 488.1 cabling restrictions and use only shielded GPIB cables.

3. Plug the power cord into an AC outlet of the correct voltage, but do *not* power on the GPIB-ENET at this time.

Chapter 3
Installing and Configuring the Software

This chapter explains how to configure your network and host, and how to install and configure your NI-488.2M software.

Configure the Network

The following steps explain how to set up the GPIB-ENET on your network:

The Internet Protocol (IP) address is the address that TCP/IP-based networks use to route information to the appropriate network and host. When you first install a GPIB-ENET in a network, or if the IP address for the GPIB-ENET changes, the GPIB-ENET IP address must be configured.

1. Note the Ethernet address from the bottom panel label of the GPIB-ENET.

    The Ethernet address is not the same thing as the IP address. All devices on an Ethernet network are assigned a physical address, the Ethernet address, so that they can communicate with each other. The identification label on the bottom panel of the GPIB-ENET contains various information, including the Ethernet address. See Figure 3-1 for a picture of the GPIB-ENET identification label.
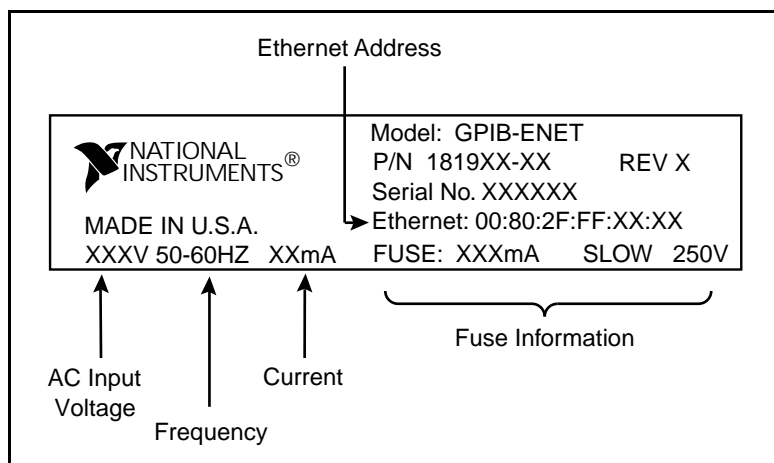

Figure 3-1. GPIB-ENET Bottom Panel Identification Label

2. Contact your network administrator to use the GPIB-ENET on your network.

    Your network administrator assigns a unique, valid IP address to your GPIB-ENET. At this time, you or your system administrator should also assign a fully-qualified official hostname to the GPIB-ENET—for example, `gpib0.natinst.com`. Your network administrator can also tell you whether the GPIB-ENET should have its IP address configured automatically or manually. A Reverse Address Resolution Protocol (RARP) server on the network automatically configures the GPIB-ENET with an IP address when you power on the GPIB-ENET; once your network administrator has configured your network RARP server, you can use automatic configuration. If a RARP server is not available, you can configure the IP address manually using the `IPassign` utility. Once you configure the IP address, it is stored in the GPIB-ENET so that you do not need to reassign it every time you power on the box.

3. Make a note of the IP address configured for the GPIB-ENET hardware. You must use this IP address when you configure your host computer and the NI-488.2M software.

Configure the Host

If your system administrator cannot add your GPIB-ENET to an existing `rarpd` service, follow these instructions to start the `rarpd` server on your DEC Alpha station. If your subnet does not support the `rarpd` daemon, and you cannot or do not want to enable the `rarpd` daemon for security or other reasons, refer to Appendix C for instructions on running the `IPassign` utility, then skip to *Step 3. Modify the etc/hosts System File*.

Note: *To complete these steps, you must log on to the DEC Alpha with super-user privileges.*

Step 1. Enable the rarpd daemon

Make sure the Packetfilter driver (PACKETFILTER) is installed in the UNIX kernel. The default UNIX kernel shipped with the OSF/1 operating system does not include the Packetfilter driver. If you need to build a kernel with the Packetfilter driver, enter the following command:

```
doconfig
```

The `doconfig` utility lists a set of options, including the Packetfilter option. After you build the new kernel, make sure it is renamed `/vmunix`, so that it becomes the default booting kernel. For more information, refer to the `man` pages by entering the command `man doconfig`.

Note: *You do not need to reboot your computer at this time.*

Change the system startup configuration so that the `rarpd` daemon is started each time the computer boots. Create a sample script file by entering the following command:

```
echo "/usr/sbin/rarpd" > /sbin/rc3.d/S99rarpd
```

Note: *If any file in the* `/sbin/rc3.d` *directory starts with the prefix* `S99`*, then choose another prefix such as* `S98rarpd`*.*

Step 2. Modify the /etc/ethers System File

The `rarpd` daemon uses the `/etc/ethers` file to associate an Ethernet address with an official host name. If the `/etc/ethers` file does not exist, you must create it at this time. You must edit the `/etc/ethers` file and add an entry for the GPIB-ENET. Create the entry in the following format.

```
Ethernet-address    official-host-name
```

`Ethernet-address` is the address shown on the label of the GPIB-ENET box in the format "`x:x:x:x:x:x`", where `x` is a hex number between 00 and ff. For more information on the Ethernet address, refer to the *Configure the Network* section earlier in this chapter. `official-host-name` is the name you or your network administrator chose for the GPIB-ENET and should be a fully qualified hostname, which includes your domain-name extension.

The following is an example `/etc/ethers` entry.

```
20:22:24:26:28:30    gpib0.natinst.com
```

For more information about `/etc/ethers`, refer to the `man` pages for ethers (4) or contact your network administrator.

Step 3. Modify the /etc/hosts System File

You must edit the `/etc/hosts` file and add an entry for the GPIB-ENET. Create the entry in the following format.

```
Internet-address  official-host-name  aliases
```

`Internet-address` is the IP address you assign to the GPIB-ENET, `official-host-name` is the name you or your network administrator chose for the GPIB-ENET and should be a fully qualified hostname, which includes your domain-name extension, and `aliases` is any other name(s) you want to associate with the box. You should add at least one alias to the entry because the software configuration utility, `ibconf`, uses this alias to locate the GPIB-ENET. The default configuration expects the alias `gpib0` for the first GPIB-ENET, `gpib1` for the second GPIB-ENET, `gpib2` for the third GPIB-ENET, and so on.

The following is an example `/etc/hosts` entry.

`130.164.1.212 gpib0.natinst.com   gpib0`

where `gpib0.natinst.com` is the official-host-name and `gpib0` is the default alias that `ibconf` uses. If you use an alias other than the default, you must change the alias in `ibconf` to match the alias you are using.

For more information about `/etc/hosts`, refer to the `man` pages for hosts (4) or contact your network administrator.

Step 4. Reboot the System

Reboot your system for the changes to take effect.

Step 5. Switch on Your GPIB-ENET

Warning: *Operating the GPIB-ENET at any voltage other than the one specified could damage the unit.*

The GPIB-ENET is shipped from the factory with either a 100-120 VAC or 220-240 VAC power supply. Before operating your GPIB-ENET, verify that the voltage rating listed on the bottom of the box matches the voltage that is supplied in your area.

To assign the IP address manually, refer to Appendix C, *GPIB-ENET Configuration Utilities*, and run the `IPassign` utility.

For automatic IP address assignment using a RARP server, power on the GPIB-ENET. The **POWER** LED comes on immediately. The **READY** LED flashes while the GPIB-ENET completes its power-on self tests and the IP address is assigned.

The power-on self tests take about 10 seconds to complete, then the box obtains its IP address. The time required for the IP address assignment is highly dependent on your network and the configuration of your GPIB-ENET. If the **READY** LED does not become steady after 1 minute, refer to the *Troubleshooting Hardware Problems* section of Chapter 4, *Verification and Troubleshooting*.

Once the **READY** LED remains steady, the unit is ready to operate and you can configure the software.

Step 6. Configure Subnet Information

Before the GPIB-ENET is fully functional, you should configure it with proper subnet information. Your GPIB-ENET may work properly even if you skip this step, but National Instruments recommends that you configure information about the subnet. This information includes the broadcast IP address and netmask to use on the subnet and up to

four router IP addresses. Refer to Appendix C, *GPIB-ENET Configuration Utilities*, and run the `IPsetup` utility.

Install the Software

The NI-488.2M distribution medium contains the following files and utilities:

*   `cib.o` is the C language interface library.

*   `ugpib.h` is the include file for user programs.

*   `gpibrc` is the NI-488.2M configuration file.

*   `ibtsta` is the installation test file.

*   `ibic` is the interactive control utility.

*   `ibconf` is the software configuration utility.

*   `Update` is a utility that updates the GPIB-ENET firmware.

*   `IPassign` is a utility that assigns an IP address to the GPIB-ENET.

*   `GPIBENET.bin` is the GPIB-ENET firmware.

*   `IPsetup` is a utility to configure subnet information.

Perform the following steps to install the NI-488.2M software:

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

2. Run the system utility `setld` to install the software. The commands you enter depend on whether you are installing from tape or disk.

    If you are installing from tape, insert the distribution tape into the tape drive and enter the following command:

    `/usr/sbin/setld -l /dev/rmt0h`

If you are installing from disk, insert the distribution disk into the disk drive and enter the following commands:

```
mkdir /tmp/gpibenet
cd /tmp/gpibenet
tar xvf   /dev/rzxc
/usr/sbin/setld -l .
cd ..
rm -r gpibenet
```

where `/dev/rzxc` is the special file for your floppy disk drive. `x` is an integer equal to the SCSI bus index multiplied by 8 and added to the SCSI ID value. If you do not know the name of your floppy disk special file, ask your system administrator.

Configure the Software

The GPIB software configuration utility, `ibconf`, is an interactive utility that you can use to examine or modify the configuration of the driver.

To run `ibconf`, enter the following command:

```
ibconf
```

`ibconf` displays a list of all the GPIB interfaces and device names. You can use the online help if you have any questions. For more information about `ibconf`, refer to the *NI-488.2M Software Reference Manual*. Make sure that the box name of each GPIB-ENET in `ibconf` matches the alias assigned in the `/etc/hosts` file.

After you have configured the software, you are ready to verify the installation. Refer to Chapter 4, *Verification and Troubleshooting*.

Chapter 4
Verification and Troubleshooting

This chapter describes how to verify the hardware and software installation and troubleshoot problems.

Verify the Hardware Installation

When you power on your GPIB-ENET, the **POWER** LED comes on immediately. The **READY** LED flashes while it completes its power-on self-tests. When the tests complete successfully and the IP address is assigned, the **READY** LED remains steady, indicating that the unit is ready to operate.

The power-on self-tests take about 10 seconds to complete. The time required for the IP address assignment is highly dependent on your network and the configuration of your GPIB-ENET. If the **POWER** LED does not come on immediately or the **READY** LED continues to flash for more than one minute, refer to the following section, *Troubleshooting Hardware Problems*. Otherwise, proceed to the *Verify the Software Installation* section, later in this chapter.

Troubleshooting Hardware Problems

Warning: *The GPIB-ENET contains circuitry that operates with hazardous voltages. Do not attempt to open and service the box. Refer servicing to qualified personnel.*

- Verify that all cables are securely connected to the GPIB-ENET.

- Verify that the GPIB-ENET is powered on. If the unit is powered on and plugged into an outlet of the proper voltage, yet you see no LED activity, check the condition of the fuse.

Warning: *For continued protection against fire, replace the fuse with only the same type and rating of fuse. See Appendix A, Hardware Specifications, for fuse specifications.*

- Verify that the Ethernet port configuration slide switch is set to the correct Ethernet port. Refer to the *Configure the Slide Switch* section of Chapter 2 for more information.

- Verify that the DIP switch settings are configured properly for your setup. Refer to the *Configure the DIP Switch* section of Chapter 2, and also to Appendix B, for more information.

- Verify that your IP address is valid and that the network is set up to recognize the IP address properly.

- If you configured the IP address manually using the `IPassign` utility, verify that you have followed the steps in Appendix C correctly.

- If the **READY** LED continues to flash for more than one minute, you have a problem with your setup. If the **READY** LED is flashing quickly, the GPIB-ENET is unable to obtain its IP address from the network. In this case, check with your network administrator to verify your IP address and make sure that you recorded the Ethernet address correctly. If the **READY** LED is blinking slowly, the GPIB-ENET has an internal error. In this case, refer to Appendix D, *READY LED Signaling*, to determine which error is being reported and contact National Instruments.

Verify the Software Installation

To test the software installation, and to verify that the software and hardware communicate properly, run the software diagnostic test `ibtsta` that came with your NI-488.2M software.

Follow these steps to run `ibtsta`:

1. Complete all hardware and software installation and configuration.

2. Disconnect any GPIB cables.

3. Enter the following command:

    ibtsta

If `ibtsta` completes with no errors, you have installed the NI-488.2M software correctly.

Common Questions

My driver is not communicating with the GPIB-ENET. What should I do?

Make sure that the GPIB-ENET is configured and installed properly. Refer to Chapter 2 for hardware configuration and installation. Refer to Chapter 3 for software installation and configuration.

To isolate the problem, try to *ping* your GPIB-ENET to make sure it is recognizable on the network. `ping` is a network utility that sends a packet to a device/host on the network, then waits for it to be echoed back, which indicates an active device/host.

Use one of the following commands:

```
ping <IPaddress>
ping <alias>
```

where *IPaddress* is the IP address assigned to your GPIB-ENET, and *alias* is the name assigned to your GPIB-ENET in the /etc/hosts file. If ping fails, the GPIB-ENET may not be properly configured. Refer to Chapter 2, *Configuring and Installing the Hardware*, and Chapter 3, *Installing and Configuring the Software*, for detailed configuration instructions. If you are still unable to communicate with the GPIB-ENET, contact National Instruments.

My I/O worked with a board interface, but it times out when I use the GPIB-ENET interface. What should I do?

Network communication is slower than straight cable communication. You might need to raise the default **Timeout** value using ibconf.

The Update utility reports a checksum error. What should I do?

Run the Update utility again. Your imagefile might be corrupted. If the same message appears when you run the utility again, try reinstalling your NI-488.2M software and then running the Update utility again.

I powered off my GPIB-ENET before recording the flashing READY LED pattern. What should I do?

Try to duplicate the error before calling National Instruments for assistance. Recording the **READY** LED pattern is not critical to the operation of your GPIB-ENET, but it saves you time and helps Product Support diagnose the problem quickly and accurately.

How many GPIB-ENET boxes can I configure for use with my NI-488.2M software?

The GPIB-ENET software for OSF/1 can be configured to communicate with up to eight GPIB-ENET boxes.

How many devices can I configure for use with my GPIB-ENET and NI-488.2M software?

The GPIB-ENET software for OSF/1 provides a total of 44 logical devices for applications to use.

When should I use the ibic utility?

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

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

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

What information should I have before I contact National Instruments?

When you contact National Instruments, you should provide the results of `ibtsta`. Also, make sure you have filled out the configuration form in Appendix E, *Customer Communication*.

Chapter 5
Using Your NI-488.2M Software

This chapter describes the `ibic` utility and lists some programming considerations.

Introduction to the ibic Utility

You can use the interactive control utility to enter NI-488 functions and NI-488.2 routines interactively and display the results of the function calls automatically. Without writing an application, you can use the utility to do the following:

- Verify GPIB communication with your device quickly and easily.

- Learn 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 the `ibic` utility, refer to the *NI-488.2M Software Reference Manual.*

General Programming Considerations

As you begin developing your GPIB application, remember the following points:

- You must link the language interface library with your compiled source code. Include the `cib.o` object file during the link phase of each application compile operation or link the GPIB library `libgpib` as shown by the following examples:

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

  or

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

- You must include the header file `<sys/ugpib.h>` in your source code.

For information about choosing a programming method, developing your application, NI-488.2 functions, or compiling and linking, refer to the *NI-488.2M Software Reference Manual*.

Appendix A
Hardware Specifications

This appendix lists the electrical, environmental, and physical characteristics of the GPIB-ENET and the recommended operating conditions.

Table A-1. Electrical Characteristics

Characteristic	Specification
Power Supply Unit	100 to 120 VAC, 50 to 60 Hz or 220 to 240 VAC, 50 to 60 Hz
Maximum Current Requirement	100 to 120 VAC 110 mA 220 to 240 VAC 55 mA
Fuse Rating and Type	100 to 120 VAC 300 mA, UL/CSA approved 220 to 240 VAC 500 mA, IEC approved

Table A-2. Environmental Characteristics

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

Table A-3. Physical Characteristics

Characteristic	Specification
Overall Case Size (Dimensions)	8.89 cm by 14.35 cm by 4.11 cm (3.5 in by 5.65 in. by 1.62 in.)
Case Material	All metal enclosure
Weight	0.41 kg (0.9 lb)

Appendix B
GPIB-ENET 8-Bit DIP Switch

This appendix describes how each of the DIP switches on the back panel can affect the operation of the GPIB-ENET.

The 8-bit DIP switch is located on the back panel of the GPIB-ENET, as shown in Figure B-1. The DIP switches are used to set the operation mode of the GPIB-ENET. The GPIB-ENET is shipped to you with the DIP switches set for normal operation mode; all the switches are in the OFF position.
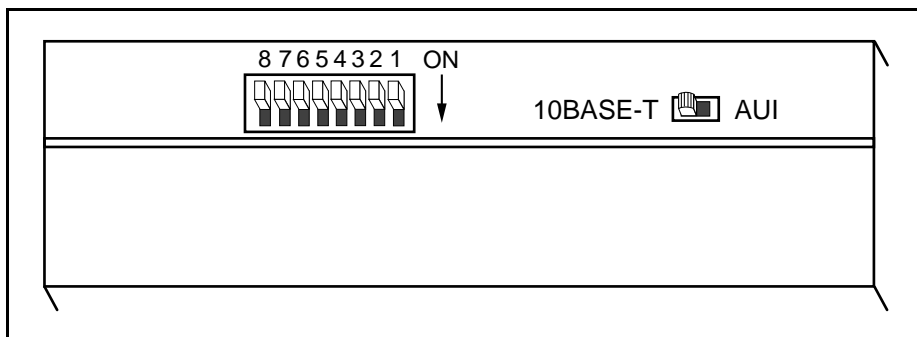
Figure B-1. GPIB-ENET Back Panel Switches

Table B-1 shows the possible configurations of the GPIB-ENET DIP switches and what each configuration indicates. The entries in **bold italic** text represent the default settings.

Table B-1. DIP Switch Settings for Modes of Operation

Switch	Position	Indication
8	ON	Extended Factory Test
	OFF	*Normal Operation*
7	ON	Modify Mode
	OFF	*Normal Operation*
6	ON	Use Stored IP Address
	OFF	*Obtain IP Address*
5	ON	Manual IP Assignment
	OFF	*Automatic IP Assignment*
4-1	*OFF*	*These switches are reserved and should remain OFF.*

Switch 8 selects the Extended Factory Test mode and should remain OFF for normal operating mode. When this switch is ON, the GPIB-ENET performs extended tests which require special connections to the GPIB and Ethernet ports. Without these connections, the GPIB-ENET cannot pass the extended factory tests.

Switch 7 selects the Modify Mode and should remain OFF for normal operating mode. The firmware controlling the GPIB-ENET is stored in an electrically erasable memory. When this switch is ON, you can reprogram the firmware memory from the Ethernet network using the `Update` utility, or you can modify the subnet information using the `IPsetup` utility. Refer to Appendix C, *GPIB-ENET Configuration Utilities*, for more information.

Switch 6 indicates how the GPIB-ENET IP address is determined when it is powered on. If switch 6 is OFF, the GPIB-ENET expects to receive its IP address from the network. If switch 6 is ON, the GPIB-ENET retrieves the IP address that is stored in nonvolatile memory.

Switch 5 selects the method by which IP addresses are configured in the GPIB-ENET. When switch 5 is OFF, the GPIB-ENET issues Reverse Address Resolution Protocol (RARP) requests each time it is powered on. The GPIB-ENET continues to issue RARP requests until a valid RARP reply is received. If switch 5 is ON, the GPIB-ENET does not issue RARP requests. In most networks, the GPIB-ENET can use RARP to have its address automatically configured; however, there are some networks which, for security or other reasons, do not use RARP. In this case, you must configure the IP address of the GPIB-ENET using `IPassign`. Refer to Appendix C, *GPIB-ENET Configuration Utilities*, for more information on `IPassign`. Regardless of the method by which an IP address is obtained, the GPIB-ENET stores the address in nonvolatile memory. Note that if switch 6 is ON, the setting of switch 5 is ignored.

Switches 1-4 are reserved for future expansion and should remain OFF.

Appendix C
GPIB-ENET Configuration Utilities

This appendix contains information on the `IPassign`, `Update`, and `IPsetup` utilities for the GPIB-ENET.

IPassign Utility

Use the `IPassign` utility to manually configure the IP address of your GPIB-ENET. Once you configure the IP address, it is stored in nonvolatile memory in the GPIB-ENET. You only need to run the `IPassign` utility when the box is new or when you decide to reconfigure your network in a way that changes the IP address of the GPIB-ENET.

The `IPassign` utility must be run on a machine that is connected to the same subnet as the GPIB-ENET you are configuring.

To run `IPassign`, follow these steps after you have connected the GPIB-ENET to the network and installed the NI-488.2M software.

1. Make sure you know the Ethernet address of the GPIB-ENET (listed on the bottom panel of the box) and the IP address of your GPIB-ENET (assigned by your network administrator). If you do not know the IP address, refer to the *Configure the Network* section of Chapter 3, *Installing and Configuring the Software*.

2. Power off the GPIB-ENET. Make sure that all of the DIP switches are OFF except for switch 5, which should be ON. This indicates that you want to use `IPassign` to configure the IP address.

3. Power on the GPIB-ENET and wait 10 seconds for the power-on self tests to complete. The **READY** LED will continue to flash.

4. Run `IPassign`. This utility is always invoked with two parameters: an Ethernet address and an IP address. These addresses are entered in standard notation, which for the Ethernet address is six hexadecimal numbers separated by colons. Standard notation for the IP address is four decimal numbers separated by periods. For example, the following numbers program the IP address 130.164.1.1 into the GPIB-ENET located at Ethernet address 00:80:2F:FF:00:10.

    ```
    IPassign  00:80:2F:FF:00:10   130.164.1.1
    ```

5. The utility constructs 10 packets and sends them across the local Ethernet. When the GPIB-ENET successfully receives its IP address, the **READY** LED remains steady. As long as the **READY** LED is not steady, the address has not been configured.

    Because the packets do not form a guaranteed delivery protocol, it is possible (though extremely unlikely) for all 10 packets to get lost in the network and for

the GPIB-ENET not to receive any of them. In this case, repeat Step 4 several times until the GPIB-ENET successfully receives its new IP address, indicated by a steady **READY** LED. If after several attempts, the **READY** LED does not become steady, contact National Instruments for further assistance.

6. When the **READY** LED remains steady, power off the GPIB-ENET. Set DIP switch 5 to the OFF position and switch 6 to the ON position. With the switches in this position, the GPIB-ENET powers on with the IP address stored in nonvolatile memory. For more information on the DIP switch settings, refer to Appendix B, *GPIB-ENET 8-Bit DIP Switch*.

8. Power on the GPIB-ENET and wait for the **READY** LED to come on and remain steady. If the **READY** LED does not become steady, the slow blinking indicates an internal GPIB-ENET error. Refer to Appendix D, *READY LED Signaling*, to determine which error is being reported.

Update Utility

If you have received your NI-488.2M software as an update to your current GPIB-ENET, you need to update the firmware in the GPIB-ENET. Electrically Erasable Programmable Read Only Memory (EEPROM) stores the firmware that controls the GPIB-ENET. You can use the Update utility to upgrade the firmware in the EEPROM. The latest firmware file is called GPIBENET.bin.

Caution: *Because of the potential loss of EEPROM functionality, it is extremely important to follow the instructions in this section. Please read this entire section before attempting to update your firmware.*

If you are directly linked to the Internet, and not just to an isolated network using IP protocols, you can contact the National Instruments GPIB Product Support Department to update your firmware. If you are not on the actual Internet or you want to update the firmware yourself, you can execute Update locally. In either case, pay close attention to the GPIB-ENET **READY** LED, which reports important status codes.

Although you should update your firmware as needed, the number of times you can do so is limited. Therefore, update the firmware only when necessary. Also, notice that there is a time period of about two seconds when the GPIB-ENET runs exclusively in volatile RAM memory with the EEPROMs erased. If the box loses power during this time, it is no longer usable and must be returned to National Instruments for repair. If you are not comfortable with this procedure, call National Instruments for assistance.

Caution: *Because of the potential loss of EEPROM information, do not attempt to update the firmware when your electrical power is in danger; that is, during a weather storm or similar situation. Once you have started the update process, do not switch off power to your GPIB-ENET until you see and record the flashing* **READY** *LED pattern.*

The following steps describe how to update the firmware.

1. Power off the GPIB-ENET and set DIP switch 7 of the DIP switch to the ON position.

2. Power on the GPIB-ENET and wait for the **READY** LED light to remain steady.

3. Run `Update`. This utility is always invoked with two parameters: an imagefile name and a host name. For example, the following command copies the imagefile `GPIBENET.bin` into the EEPROMs of `gpib0.natinst.com`.

    ```
    update GPIBENET.bin gpib0.natinst.com
    ```

4. Wait for the **READY** LED to begin flashing, which signals that the update is complete. Do *not* power off your GPIB-ENET before you see and record the flashing **READY** LED pattern.

    If the programming is successful, the **READY** LED signals a status code of 00, signified by one long flash and one short flash. Other patterns are used to indicate that the EEPROMs did not program properly. If a pattern other than 00 is indicated, refer to Appendix D, *READY LED Signaling*, for more information on recording the flashing pattern.

5. Power off the GPIB-ENET and return DIP switch 7 to the OFF position.

6. Power on the GPIB-ENET and wait for the **READY** LED to remain steady. If the **READY** LED does not remain steady, repeat the update procedure.

IPsetup Utility

Use the `IPsetup` utility to configure the IP characteristics of the specified GPIB-ENET. The IP characteristics include the following:

*   Broadcast IP address—used by an IP device when a packet must go to all devices on the local subnet.

*   Netmask of the local subnet—used by an IP device to determine if the destination of an out-going packet is local (that is, on the same subnet). If the destination is local, no routing is required. If the destination is not local, routing is required.

*   List of router IP addresses—used when an IP device determines that the destination of a packet is not on the local subnet. If routing is required, the best route is chosen dynamically. Up to four default routers can be specified.

Note: *You should not run this utility without assistance from your network administrator.*

The following steps describe how to configure the IP characteristics:

1. Power off the GPIB-ENET, and set DIP switch 7 to the ON position.

2. Power on the GPIB-ENET and wait for the **READY** LED light to remain steady.

3. Run `IPsetup`. This utility takes no command line parameters. All necessary information is obtained during execution.

4. Enter the appropriate information as it is requested. For additional information about each piece of information requested, enter a single question mark (?).

5. Power off the GPIB-ENET, and return DIP switch 7 to the OFF position.

6. Power on the GPIB-ENET and wait for the **READY** LED to remain steady.

Appendix D
READY LED Signaling

This appendix describes how to interpret the **READY** LED error codes.

READY LED Overview

The **READY** LED has several purposes on the GPIB-ENET. When you first power on the GPIB-ENET, the **READY** LED flashes quickly while it completes its power-on self-tests. When the tests complete successfully and the IP address is assigned from either nonvolatile memory or the network, the **READY** LED remains steady, indicating that the unit is ready to operate.

During operation, the **READY** LED might begin to blink slowly. This occurs after running the Update utility, when the GPIB-ENET reports status on the operation. Refer to Appendix C, *GPIB-ENET Configuration Utilities*, for more information. At other times, the **READY** LED blinks slowly to alert you of internal GPIB-ENET errors. For assistance in correcting this problem, use this appendix to interpret and record the pattern that the **READY** LED flashes, and then contact National Instruments.

Note: *By recording the* READY *LED status messages before calling National Instruments, you can save yourself time, and the GPIB Product Support Department can answer your questions more accurately and efficiently. Do not switch off power to your GPIB-ENET before recording the flashing* READY *LED pattern.*

READY LED signaling can report up to 100 different errors. The errors are numbered from 0 to 99 and are reported through sequences of **READY** LED flashes.

Step 1. Count the Long Flashes

A 3-second interval, during which the **READY** LED is OFF, separates each repetition of the sequence. The sequence begins with a series of long 1-second flashes—that is, one second ON, one second OFF. These long flashes represent the digit in the tens column. There can be 1 to 10 long flashes, which represent digits 0 through 9. For example, one long flash represents the digit 0 in the tens column, two long flashes represent the digit 1 in the tens column, and 10 long flashes represent the digit 9 in the tens column.

Step 2. Count the Short Flashes

The long flashes are followed by shorter flashes; each short flash lasts about one-fifth of a second. These short flashes represent the digit in the ones column. Again, there can be 1 to 10 flashes, which represent the digits 0 through 9. For example, one short flash represents the digit 0 in the ones column, two short flashes represent the digit 1 in the ones column, and 10 short flashes represent a 9 in the ones column.

Using this method, the **READY** LED flashes the following sequence to represent status message 11.

<three seconds OFF> <two long flashes> <two short flashes> <three seconds OFF>. . .

The **READY** LED flashes the following sequence to represent status message 30.

<three seconds OFF> <four long flashes> <one short flash> <three seconds OFF>. . .

Step 3. Record Your Status Code Number

When you have computed your status code number, record it on the *GPIB-ENET Hardware and Software Configuration Form* in Appendix E, *Customer Communication*, before calling National Instruments.

Table D-1 lists some examples of the long and short flashes and the status codes they report.

Table D-1. Sample **READY** LED Signals and the Corresponding Status Code Numbers

Number of Long Flashes	Number of Short Flashes	Corresponding Status Code Number
1	1	00
2	1	10
5	3	42
1	8	07
3	4	23
10	10	99

Appendix E
Customer Communication

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

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

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

Branch Offices	Phone Number	Fax Number
Australia	(03) 879 9422	(03) 879 9179
Austria	(0662) 435986	(0662) 437010-19
Belgium	02/757.00.20	02/757.03.11
Denmark	45 76 26 00	45 76 71 11
Finland	(90) 527 2321	(90) 502 2930
France	(1) 48 14 24 00	(1) 48 14 24 14
Germany	089/741 31 30	089/714 60 35
Italy	02/48301892	02/48301915
Japan	(03) 3788-1921	(03) 3788-1923
Mexico	95 800 010 0793	95 800 010 0793
Netherlands	03480-33466	03480-30673
Norway	32-848400	32-848600
Singapore	2265886	2265887
Spain	(91) 640 0085	(91) 640 0533
Sweden	08-730 49 70	08-730 43 70
Switzerland	056/20 51 51	056/20 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	0635 523545	0635 523154

Technical Support Form

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

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

Name _____

Company _____

Address _____

_____

Fax (___)_____   Phone (___)_____

Computer brand _____

    Model _____   RAM _____MB

    Processor _____   Speed _____MHz

    Operating system _____

    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 _____

The problem is _____

_____

_____

_____

_____

_____

_____

_____

List any error messages _____

_____

_____

_____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

_____

_____

_____

_____

GPIB-ENET Hardware and Software Configuration Form

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

National Instruments Products

*   GPIB-ENET Hardware Revision _____

*   10Base-T or Coax Version _____

*   AC Input Voltage (100-120 V or 220-240 V) _____

*   NI-488.2M Software Version Number on Distribution Medium _____

*   DIP Switch Settings _____

*   Ethernet Port Configuration Slide Switch Setting _____

*   IP Address _____

*   **READY** LED Signaling Status Code _____

Other Products

*   Computer Model _____

*   Memory Capacity on Computer _____

*   Operating System Version _____

*   Application Programming Language _____

*   Other Ethernet Devices in System _____

*   Other GPIB Devices in System _____

*   Type of Monitor _____

Documentation Comment Form

National Instruments encourages you to comment on the documentation supplied with our products. This information helps us provide quality products to meet your needs.

Title: **Getting Started with Your GPIB-ENET and the NI-488.2M™ Software for OSF/1**

Edition Date: **February 1995**

Part Number: **320915A-01**

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

_____

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(continues)

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

_____

_____

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_____

_____

_____

_____

Thank you for your help.

Name   _____

Title   _____

Company   _____

Address   _____

          _____

Phone   (_____)   _____

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

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

Glossary

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

o	degrees
%	percent
A	amperes
AC	alternating current
ANSI	American National Standards Institute
AUI	attachment unit interface
C	Celsius
CSA	Canadian Standards Association
DIP	dual inline package
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	electromagnetic interference
FCC	Federal Communications Commission
g	grams
GPIB	General Purpose Interface Bus
Hz	hertz
ibic	Interactive Bus Interactive Control
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
IP	Internet Protocol
lb	pounds
LED	light-emitting diode
m	meters
MB	megabytes of memory
RAM	random-access memory
RARP	Reverse Address Resolution Protocol
s	seconds
TCP	Transmission Control Protocol
UL	Underwriters Laboratories
V	volts
VAC	volts alternating current