# GPIB

## GPIB-120B User Manual

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**Worldwide Technical Support and Product Information**

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All Class A products display a simple warning statement of one paragraph in length regarding interference and undesired operation. The FCC rules have restrictions regarding the locations where FCC Class A products can be operated.

Consult the FCC Web site at `www.fcc.gov` for more information.

### FCC/DOC Warnings

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual and the CE marking Declaration of Conformity*, may cause interference to radio and television reception. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC).

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

### Class A

#### Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at their own expense.

#### Canadian Department of Communications

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

### Compliance with EU Directives

Users in the European Union (EU) should refer to the Declaration of Conformity (DoC) for information* pertaining to the CE marking. Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

* The CE marking Declaration of Conformity contains important supplementary information and instructions for the user or installer.

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# About This Manual

This manual describes how to install, configure, and operate the National Instruments GPIB-120B.

## Conventions

The following conventions appear in this manual:

| | |
|---|---|
| » | The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box. |
|  | This icon denotes a note, which alerts you to important information. |
| **bold** | Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names. |
| GPIB-120B | GPIB-120B refers to a National Instruments GPIB isolator/expander that expands and isolates the GPIB up to a maximum of 2500 VDC. |
| 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 488.2-1992, respectively, which define the GPIB. |
| *italic* | Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply. |
| `monospace` | Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions. |

# Related Documentation

The following documents contain information that you might find helpful as you read this manual:

- ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*
- ANSI/IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols, and Common Commands*

1

# Introduction

This chapter contains a description of the GPIB-120B, lists what you need to get started and optional equipment you can order, and explains how to unpack the GPIB-120B.

## Description of the GPIB-120B

The GPIB-120B is a high-speed bus isolator/expander with the following features:

- It is transparent to user software.
- It electrically isolates two GPIB systems from each other and from the power supply.
- It expands the GPIB to interface up to 28 devices.
- It extends the GPIB by effectively doubling the 20 m cable limit.
- It has optional rack or din-rail mount hardware accessories.

The high-speed GPIB-120B bus isolator/expander connects two GPIB (IEEE 488) bus systems in a functionally transparent manner.

The two bus systems are electrically isolated from each other. The two bus systems are also isolated from the power supply. Isolation is maintained up to 2500 VDC (withstand 5s). Isolating an instrument or group of instruments from an IEEE 488 bus Controller can eliminate ground loop noise and induced common-mode noise, which may cause measurement problems in both analog and digital systems. The two isolated bus systems are physically separate, as shown in Figure 1-1; however, the devices logically appear to be located on the same bus, as shown in Figure 1-2.

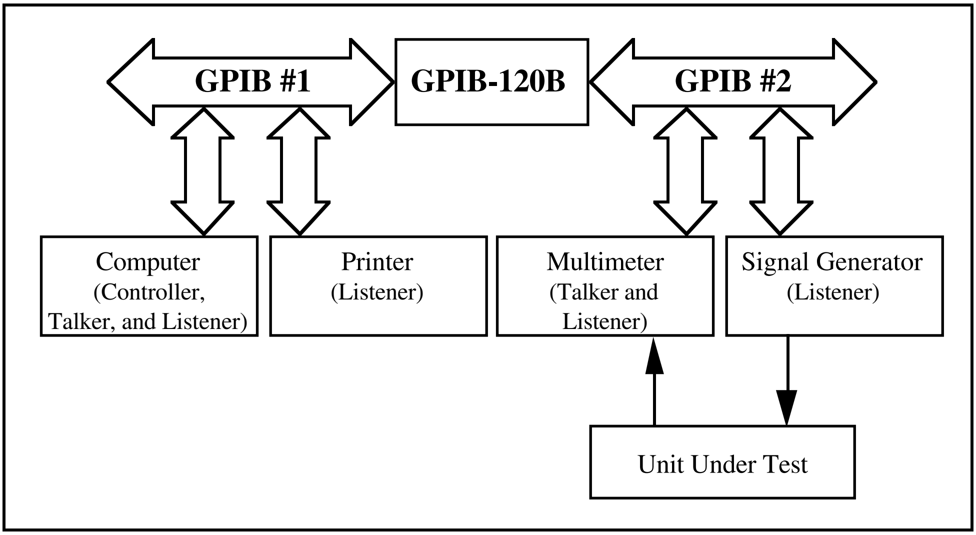


**Figure 1-1.** Typical GPIB-120B Expansion System (Physical Configuration)

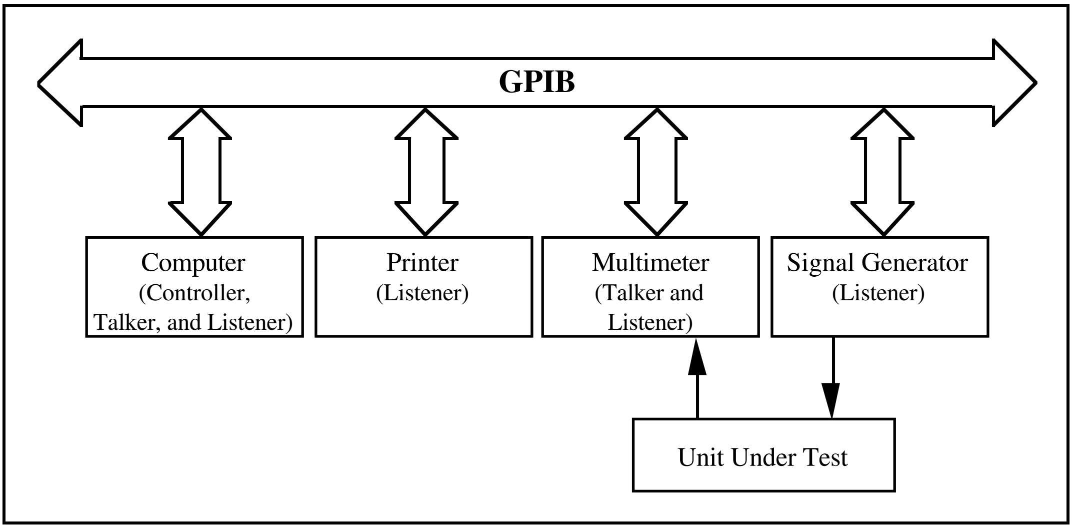


**Figure 1-2.** Typical GPIB-120B Expansion System (Logical Configuration)

With the GPIB-120B, it is possible to overcome the following two configuration restrictions imposed by the ANSI/IEEE Standard 488.1-1987:

- An electrical loading limit of 15 devices per contiguous bus.
- A cable length limit of 20 m total per contiguous bus or 2 m times the number of devices on the bus, whichever is smaller.

With each GPIB-120B, you can add up to 14 additional devices to the bus. The GPIB-120B appears as a device load on each side of the expansion; therefore, one GPIB-120B increases the maximum load limit from 15 devices to 28 devices. The cable length limit for the system is also increased an additional 4 m to 20 m, depending on the number of devices on that side of the expansion.

All signal expansion is bidirectional, meaning that Controllers, Talkers, and Listeners can be on either side of the expander. The GPIB-120B light-emitting diodes (LEDs) indicate the location of the System Controller, Active Controller, and Source Handshaker, with respect to the two sides of the expansion.

Because the GPIB-120B is a functionally transparent expander, the same GPIB communications and control programs that work with an unexpanded system can work unmodified with an expanded system.

# What You Need to Get Started

- ❑ GPIB-120B
- ❑ 10-18 VDC 9 W Power Supply
- ❑ Standard GPIB cables to connect both sides of the GPIB-120B to buses on either side.

## Optional Equipment

You can contact National Instruments to order any of the following optional equipment.

- Rack-Mount Kit
- Din Rail Mount Kit

- Shielded GPIB cables[1]
  - Type X1 single-shielded GPIB cables (1 m, 2 m, or 4 m)
  - Type X2 double-shielded GPIB cables (1 m, 2 m, or 4 m)

## Unpacking Your GPIB-120B

Follow these steps when unpacking your GPIB-120B.

1. Verify that the package you received contains the following.
   - GPIB-120B Isolator/Expander
   - 12VDC power supply
   - Power cord appropriate for your location
2. Inspect the shipping container and contents for damage. If the container is damaged and the damage appears to have been caused in shipment, file a claim with the carrier. If the equipment is damaged, do not attempt to operate it. Contact National Instruments for instructions. Retain the shipping material for possible inspection by carrier or reshipment of the equipment.
3. Verify that the voltage you will be using is in the input range of your power adapter. The GPIB-120B ships with a power adapter capable of working with an input AC voltage between 100 V and 240 V. This adapter provides 12 VDC to the GPIB-120B. This adapter can be replaced as long as the replacement provides the GPIB-120B with a DC voltage between 10 VDC and 18 VDC. and has appropriate safety certification marks for country of use. See Appendix C, *Specifications*, for more information.

[1] To meet FCC emission limits for this Class A device, you must use a shielded (Type X1 or X2) GPIB cable. Operating this equipment with a non-shielded cable may cause interference to radio and television reception in commercial areas.

# 2

# Hardware Overview

This chapter describes your GPIB isolator/expander.

## GPIB-120B LEDs

The GPIB-120B has seven light-emitting diodes (LEDs). The POWER LED on the left-hand side of the isolator/expander is lit whenever you power on the GPIB-120B.

For each bus, an LED indicates the status of the System Controller, Active Controller, or Source Handshake state, as shown in Figure 2-1.

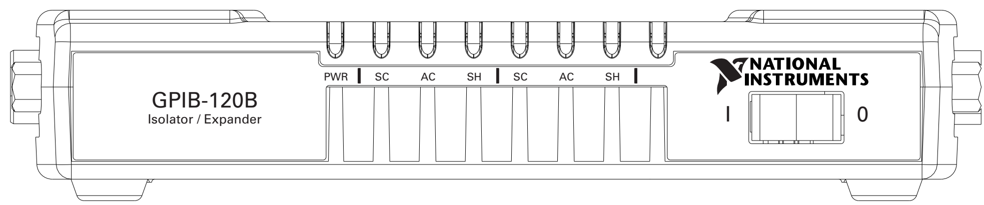


**Figure 2-1.** Front View GPIB-120B

### Power On (PWR)

When you power on the GPIB-120B, all circuitry is cleared to an initialized state. The isolation/expansion system is fully operational when you power on the GPIB-120B and your instruments are connected. Where there is GPIB activity, it is recommended that you keep at least two-thirds of the devices on both buses powered on.

### System Controller Detection (SC)

After you power on, Bus A and Bus B System Controller states are false. If a GPIB device on Bus A asserts IFC or REN, the Bus A System Controller state becomes true and the Bus B System Controller state becomes false.

If a GPIB device on Bus B asserts IFC or REN, the Bus B System Controller state becomes true and the Bus A System Controller state becomes false.

## Active Controller Detection (AC)

After you power on, Bus A and Bus B Active Controller states are false. If a GPIB device on Bus A asserts ATN, the Bus A Active Controller state becomes true and the Bus B Active Controller state becomes false.

If a GPIB device on Bus B asserts ATN, the Bus B Active Controller state becomes true and the Bus A Active Controller state becomes false.

## Source Handshake Detection (SH)

A device is considered a source handshaker if it is an active Controller sourcing command bytes or if it is a Talker sourcing data bytes.

After you power on, Bus A and Bus B Source Handshake states are false.

If a GPIB device on Bus A asserts DAV, the Bus A Source Handshake state becomes true and the Bus B Source Handshake state becomes false.

If a GPIB device on Bus B asserts DAV, the Bus B Source Handshake state becomes true and the Bus A Source Handshake state becomes false.

# Data Transfer Modes

The GPIB-120B isolator/expander has two data transfer modes—unbuffered mode and buffered mode. The data transfer mode determines how data is transmitted across the expansion. The switch on the back of the GPIB-120B sets the operation mode of the GPIB isolator/expander. The default switch setting is for unbuffered transfer mode.

## Selecting a Data Transfer Mode

To select a data transfer mode, refer to the following descriptions of each mode.

## Unbuffered Mode

In unbuffered mode, each data byte is transmitted using the GPIB double-interlocked handshaking protocol. For long data streams, transfers are slower than transfers using buffered mode. However, the GPIB isolator/expander is transparent in unbuffered mode.

## Buffered Mode

In buffered mode, the GPIB isolator/expander uses FIFO (first-in-first-out) buffers to buffer data between the remote and local sides of the isolation barrier. For long data streams, the data throughput is much higher than with unbuffered mode.

However, a few applications may not operate properly in buffered mode. For example, a GPIB device on the local side of the isolator/expander is addressed to talk, another device on the remote side is addressed to listen. When the Talker sources data bytes, the GPIB isolator/expander accepts the data bytes and stores them in a FIFO buffer. At the same time, the GPIB isolator/expander reads data from the FIFO buffer and sources data bytes to the Listener. If the FIFO buffer contains data, the number of bytes sourced by the Talker differs from the number of bytes accepted by the Listener. Therefore, there could be situations in which the talker will assume the listener has accepted data which the listener has not yet received because it is still in the FIFO buffer. If this situation is unacceptable for your application, you must use unbuffered mode, in which the 3-wire interlocked behavior of GPIB is maintained.

Buffered mode applies only to data transfers. GPIB command bytes are not stored in the FIFO buffers; they are transmitted using the GPIB double-interlocked handshaking protocol.

## Setting the Data Transfer Mode

To use buffered mode, set the switch to the ON position, as shown in Figure 2-2. To use unbuffered mode, set the switch to the OFF position.

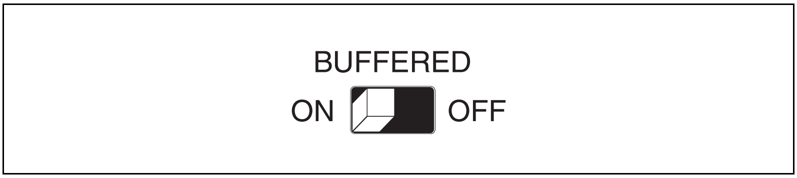


**Figure 2-2.** Switch Setting for Buffered Mode

**Note** The placement of the switch to select buffered or unbuffered mode is recessed to avoid unintentional toggling during operation of the GPIB-120B. To flip the switch, a flathead screwdriver or similar tool may be required.

Verify that the switch on your GPIB isolator/expander is in the desired position before powering on the unit.

# Data Direction Control

Bus B sends the data lines to Bus A if the Bus B Source Handshake state is true or if a Controller on Bus A is conducting a parallel poll.

Bus A sends the data lines to Bus B if the Bus A Source Handshake state is true or if a Controller on Bus B is conducting a parallel poll.

# Parallel Poll Detection

Controllers can conduct parallel polls on Bus A or Bus B and devices on both Bus A and Bus B can respond to parallel polls.

If a Controller on Bus A conducts a parallel poll, the parallel poll detection circuitry on side B conducts a parallel poll on Bus B. The result of the parallel poll is driven on the data lines of Bus A.

If a Controller on Bus B conducts a parallel poll, the parallel poll detection circuitry on side A conducts a parallel poll on Bus A. The result of the parallel poll is driven on the data lines of Bus B.

See the *Parallel Poll Operation* section in in this chapter for important information about conducting parallel polls with the GPIB-120B.

# Parallel Poll Operation

According to IEEE 488, devices must respond to a parallel poll within 200 ns after the Controller-In-Charge (CIC) asserts the Identify (IDY) message—Attention (ATN) and End or Identify (EOI). The CIC waits at least 2 μs before reading the Parallel Poll Response (PPR). In some cases, a remote device on an expanded system cannot respond to parallel polls this quickly because of propagation delays across the expander and the longer cables.

When the GPIB-120B notices that a GPIB controller is conducting a parallel poll, it sends a message to the secondary side to initiate a parallel poll. The parallel poll on the secondary side is of the same duration as the poll on the primary side, but delayed by the time it takes to get the message to the secondary side. In the GPIB-120B this time is approximately 400ns. When the poll on the primary side finishes, a message is sent to finish it on the secondary side, where the poll finishes about 400ns later. Therefore, if the secondary side of the GPIB-120B waited until the end of its parallel poll to send the result of the poll to the primary side, it would be after the primary side poll has ended. Thus the controller would miss the responses of the devices on the secondary side.

To solve this problem, the secondary side of the GPIB-120B samples the state of the bus every 600ns during parallel polls, and sends that data back to the primary side. Therefore, taking the start of the poll on the primary side as time 0, the state of the secondary bus is sent to the primary side at times 600ns, 1200ns, 1800ns and so on, and again when the poll actually ends.

For slow devices or topologies in which a device on the secondary bus responds to the parallel poll after the last data packet was sent to the primary side, the controller would miss the response from this device. If you encounter this situation, you must configure your controller to conduct parallel polls longer than 2μs.

# 3

# Configuring and Using Your Hardware

This chapter describes how to configure and use your GPIB-120B.

## Connecting the GPIB-120B

To connect the GPIB-120B, follow the steps below.

1. Make sure that the power switch on the isolator/expander is in the off (0) position.
2. Plug the utility power cord of your 12 VDC power supply into an acceptable electrical outlet (100–240 VAC). Plug the other end of the power cord into the power supply. Connect the 12 VDC output of the power supply into the rear panel of the GPIB-120B.
3. Link your GPIB instrument(s), board(s), and other device(s) to the GPIB-120B with appropriate cables (type X1 or X2).
4. Verify the switch is in the data transfer mode required for your application. Refer to the *Setting the Data Transfer Mode* section in Chapter 2, *Hardware Overview*.
5. Move the power switch to the on (1) position.

# A

# GPIB Basics

This appendix describes the basic concepts of GPIB, including its physical and electrical characteristics, and configuration requirements.

The ANSI/IEEE Standard 488.1-1987, also known as General Purpose Interface Bus (GPIB), describes a standard interface for communication between instruments and controllers from various vendors. It contains information about electrical, mechanical, and functional specifications. GPIB is a digital, 8-bit parallel communications interface with data transfer rates of 1 Mbyte/s and higher, using a three-wire handshake. The bus supports one System Controller, usually a computer, and up to 14 additional instruments. The ANSI/IEEE Standard 488.2-1992 extends IEEE 488.1 by defining a bus communication protocol, a common set of data codes and formats, and a generic set of common device commands.

## Types of Messages

Interconnected GPIB devices communicate by passing messages through the interface system, including device-dependent messages and interface messages.

- Device-dependent messages, also called *data* or *data messages*, contain device-specific information, such as programming instructions, measurement results, machine status, and data files.
- Interface messages, also called *commands* or *command messages*, manage the bus itself. Interface messages initialize the bus, address and unaddress devices, and set device modes for remote or local programming.

  The term *command* as used here does not refer to device instructions, which are also called commands. Those device-specific instructions are data messages.

# Talkers, Listeners, and Controllers

GPIB devices can be Talkers, Listeners, or Controllers. A Talker sends out data messages. Listeners receive data messages. The Controller, usually a computer, manages the flow of information on the bus. It defines the communication links and sends GPIB commands to devices.

Some devices are capable of playing more than one role. A digital voltmeter, for example, can be a Talker and a Listener. If your system has a National Instruments GPIB interface and software installed, it can function as a Talker, Listener, and Controller.

The GPIB is like a typical computer bus, except that the typical computer has circuit cards interconnected via a backplane bus, whereas the GPIB has standalone devices interconnected via a cable bus.

The role of the GPIB Controller is similar to the role of the CPU of a computer, but a better analogy is to the switching center of a city telephone system. The switching center (Controller) monitors the communications network (GPIB). When the center (Controller) notices that a party (device) wants to make a call (send a data message), it connects the caller (Talker) to the receiver (Listener).

The Controller addresses a Talker and a Listener before the Talker can send its message to the Listener. After the message is transmitted, the Controller may unaddress both devices.

Some bus configurations do not require a Controller. For example, one device may always be a Talker (called a Talk-only device) and there may be one or more Listen-only devices.

A Controller is necessary when the active or addressed Talker or Listener must be changed. The Controller function is usually handled by a computer.

With the GPIB interface board and its software your personal computer plays all three roles.

- Controller—to manage the GPIB
- Talker—to send data
- Listener—to receive data

# Controller-In-Charge and System Controller

You can have multiple Controllers on the GPIB, but only one Controller at a time can be the active Controller, or Controller-In-Charge (CIC). The CIC can be either active or inactive (standby). Control can pass from the current CIC to an idle Controller, but only the System Controller, usually a GPIB interface, can make itself the CIC.

# GPIB Signals and Lines

Devices on the bus communicate by sending messages. Signals and lines transfer these messages across the GPIB interface, which consists of 16 signal lines and 8 ground return (shield drain) lines. The 16 signal lines are discussed in the following sections.

## Data Lines

Eight data lines, DIO1 through DIO8, carry both data and command messages.

## Handshake Lines

Three hardware handshake lines asynchronously control the transfer of message bytes between devices. This process is a three-wire interlocked handshake, and it guarantees that devices send and receive message bytes on the data lines without transmission error. Table A-1 summarizes the GPIB handshake lines.

**Table A-1.** GPIB Handshake Lines

| Line | Description |
|---|---|
| NRFD (not ready for data) | Listening device is ready/not ready to receive a message byte. Also used by the Talker to signal high-speed GPIB transfers. |
| NDAC (not data accepted) | Listening device has/has not accepted a message byte. |
| DAV (data valid) | Talking device indicates signals on data lines are stable (valid) data. |

## Interface Management Lines

Five hardware lines manage the flow of information across the bus. Table A-2 summarizes the GPIB interface management lines.

**Table A-2.** GPIB Interface Management Lines

| Line | Description |
|---|---|
| ATN (attention) | Controller drives ATN true when it sends commands and false when it sends data messages. |
| IFC (interface clear) | System Controller drives the IFC line to initialize the bus and make itself CIC. |
| REN (remote enable) | System Controller drives the REN line to place devices in remote or local program mode. |
| SRQ (service request) | Any device can drive the SRQ line to asynchronously request service from the Controller. |
| EOI (end or identify) | Talker uses the EOI line to mark the end of a data message. Controller uses the EOI line when it conducts a parallel poll. |

# Physical and Electrical Characteristics

Devices are usually connected with a cable assembly consisting of a shielded 24-conductor cable with both a plug and receptacle connector at each end, as shown in Figure A-1. With this design, you can link devices in a linear configuration, a star configuration, or a combination of the two configurations. Figure A-2 shows the linear and star configurations.

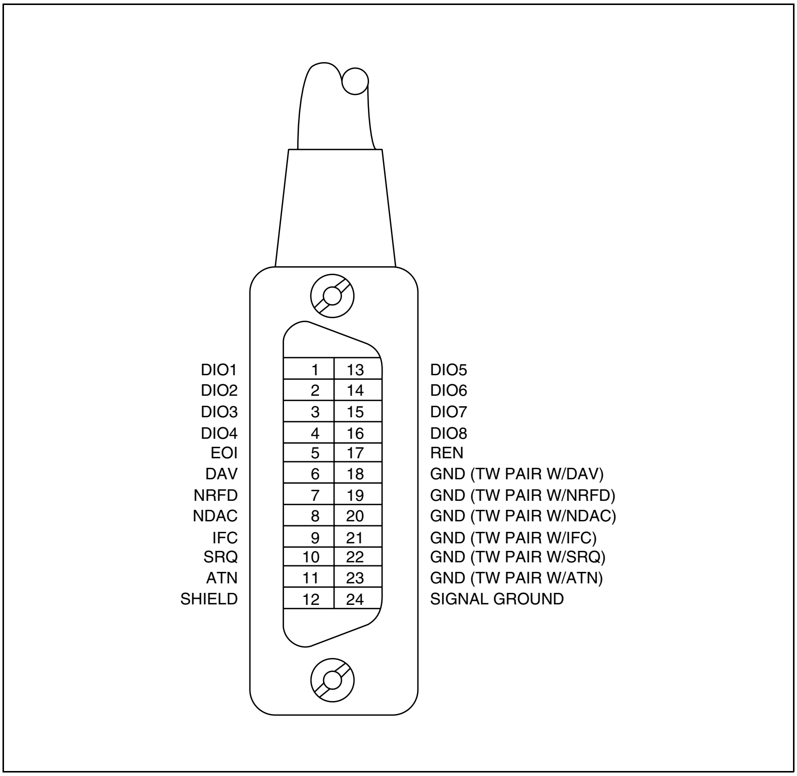


**Figure A-1.** GPIB Connector and the Signal Assignment

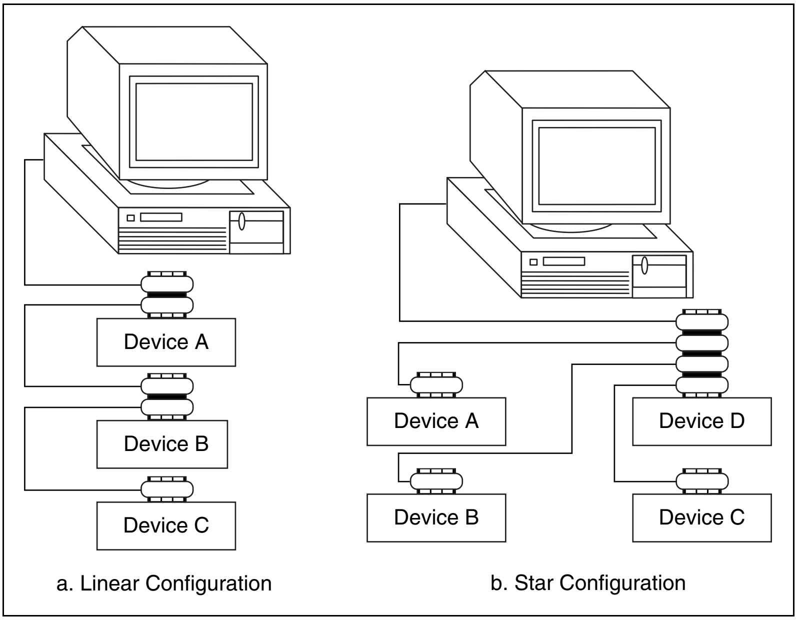


**Figure A-2.** Linear and Star System Configuration

The standard connector is the Amphenol or Cinch Series 57 *Microribbon* or *Amp Champ* type. For special interconnection applications, use an adapter cable using a non-standard cable and/or connector.

The GPIB uses negative logic with standard TTL (transistor-transistor logic) level. For example, when DAV is true, it is a TTL low level (≤ 0.8 V), and when DAV is false, it is a TTL high level (≥ 2.0 V).

# Configuration Requirements

To achieve the high data transfer rate that the GPIB was designed for, you must limit the number of devices on the bus and the physical distance between devices. The following restrictions are typical:

- A maximum separation of 4 m between any two devices and an average separation of 2 m over the entire bus.
- A maximum total cable length of 20 m.
- A maximum of 15 devices connected to each bus, with at least two-thirds powered on.

For high-speed operation, the following restrictions apply:

- All devices in the system must be powered on.
- Cable lengths must be as short as possible with up to a maximum of 15 m of cable for each system.
- There must be at least one equivalent device load per meter of cable.

If you want to exceed these limitations, you can use a bus expander to increase the number of device loads. You can order bus expanders from National Instruments.

# B

# Multiline Interface Messages

This appendix lists the multiline interface messages and describes the mnemonics and messages that correspond to the interface functions.

The multiline interface messages are commands defined by the IEEE 488 standard. The messages are sent and received with ATN asserted. The interface functions include initializing the bus, addressing and unaddressing devices, and setting device modes for local or remote programming. For more information about these messages, refer to the ANSI/IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*.

**Table B-1.** Multiline Interface Messages

| Hex | Dec | ASCII | Message |
|---|---|---|---|
| 00 | 0 | NUL | — |
| 01 | 1 | SOH | GTL |
| 02 | 2 | STX | — |
| 03 | 3 | ETX | — |
| 04 | 4 | EOT | SDC |
| 05 | 5 | ENQ | PPC |
| 06 | 6 | ACK | — |
| 07 | 7 | BEL | — |
| 08 | 8 | BS | GET |
| 09 | 9 | HT | TCT |
| 0A | 10 | LF | — |
| 0B | 11 | VT | — |
| 0C | 12 | FF | — |
| 0D | 13 | CR | — |
| 0E | 14 | SO | — |
| 0F | 15 | SI | — |
| 10 | 16 | DLE | — |
| 11 | 17 | DC1 | LLO |
| 12 | 18 | DC2 | — |
| 13 | 19 | DC3 | — |
| 14 | 20 | DC4 | DCL |
| 15 | 21 | NAK | PPU |
| 16 | 22 | SYN | — |
| 17 | 23 | ETB | — |
| 18 | 24 | CAN | SPE |
| 19 | 25 | EM | SPD |
| 1A | 26 | SUB | — |
| 1B | 27 | ESC | — |
| 1C | 28 | FS | — |
| 1D | 29 | GS | — |
| 1E | 30 | RS | — |
| 1F | 31 | US | CFE |

| Hex | Dec | ASCII | Message |
|---|---|---|---|
| 20 | 32 | SP | MLA0 |
| 21 | 33 | ! | MLA1 |
| 22 | 34 | " | MLA2 |
| 23 | 35 | # | MLA3 |
| 24 | 36 | $ | MLA4 |
| 25 | 37 | % | MLA5 |
| 26 | 38 | & | MLA6 |
| 27 | 39 | ' | MLA7 |
| 28 | 40 | ( | MLA8 |
| 29 | 41 | ) | MLA9 |
| 2A | 42 | * | MLA10 |
| 2B | 43 | + | MLA11 |
| 2C | 44 | , | MLA12 |
| 2D | 45 | - | MLA13 |
| 2E | 46 | . | MLA14 |
| 2F | 47 | / | MLA15 |
| 30 | 48 | 0 | MLA16 |
| 31 | 49 | 1 | MLA17 |
| 32 | 50 | 2 | MLA18 |
| 33 | 51 | 3 | MLA19 |
| 34 | 52 | 4 | MLA20 |
| 35 | 53 | 5 | MLA21 |
| 36 | 54 | 6 | MLA22 |
| 37 | 55 | 7 | MLA23 |
| 38 | 56 | 8 | MLA24 |
| 39 | 57 | 9 | MLA25 |
| 3A | 58 | : | MLA26 |
| 3B | 59 | ; | MLA27 |
| 3C | 60 | < | MLA28 |
| 3D | 61 | = | MLA29 |
| 3E | 62 | > | MLA30 |
| 3F | 63 | ? | UNL |

**Table B-1.** Multiline Interface Messages (Continued)

| Hex | Dec | ASCII | Message |
|---|---|---|---|
| 40 | 64 | @ | MTA0 |
| 41 | 65 | A | MTA1 |
| 42 | 66 | B | MTA2 |
| 43 | 67 | C | MTA3 |
| 44 | 68 | D | MTA4 |
| 45 | 69 | E | MTA5 |
| 46 | 70 | F | MTA6 |
| 47 | 71 | G | MTA7 |
| 48 | 72 | H | MTA8 |
| 49 | 73 | I | MTA9 |
| 4A | 74 | J | MTA10 |
| 4B | 75 | K | MTA11 |
| 4C | 76 | L | MTA12 |
| 4D | 77 | M | MTA13 |
| 4E | 78 | N | MTA14 |
| 4F | 79 | O | MTA15 |
| 50 | 80 | P | MTA16 |
| 51 | 81 | Q | MTA17 |
| 52 | 82 | R | MTA18 |
| 53 | 83 | S | MTA19 |
| 54 | 84 | T | MTA20 |
| 55 | 85 | U | MTA21 |
| 56 | 86 | V | MTA22 |
| 57 | 87 | W | MTA23 |
| 58 | 88 | X | MTA24 |
| 59 | 89 | Y | MTA25 |
| 5A | 90 | Z | MTA26 |
| 5B | 91 | [ | MTA27 |
| 5C | 92 | \ | MTA28 |
| 5D | 93 | ] | MTA29 |
| 5E | 94 | ^ | MTA30 |
| 5F | 95 | _ | UNT |

| Hex | Dec | ASCII | Message |
|---|---|---|---|
| 60 | 96 | ` | MSA0, PPE |
| 61 | 97 | a | MSA1, PPE, CFG1 |
| 62 | 98 | b | MSA2, PPE, CFG2 |
| 63 | 99 | c | MSA3, PPE, CFG3 |
| 64 | 100 | d | MSA4, PPE, CFG4 |
| 65 | 101 | e | MSA5, PPE, CFG5 |
| 66 | 102 | f | MSA6, PPE, CFG6 |
| 67 | 103 | g | MSA7, PPE, CFG7 |
| 68 | 104 | h | MSA8, PPE, CFG8 |
| 69 | 105 | i | MSA9, PPE, CFG9 |
| 6A | 106 | j | MSA10, PPE, CFG10 |
| 6B | 107 | k | MSA11, PPE, CFG11 |
| 6C | 108 | l | MSA12, PPE, CFG12 |
| 6D | 109 | m | MSA13, PPE, CFG13 |
| 6E | 110 | n | MSA14, PPE, CFG14 |
| 6F | 111 | o | MSA15, PPE, CFG15 |
| 70 | 112 | p | MSA16, PPD |
| 71 | 113 | q | MSA17, PPD |
| 72 | 114 | r | MSA18, PPD |
| 73 | 115 | s | MSA19, PPD |
| 74 | 116 | t | MSA20, PPD |
| 75 | 117 | u | MSA21, PPD |
| 76 | 118 | v | MSA22, PPD |
| 77 | 119 | w | MSA23, PPD |
| 78 | 120 | x | MSA24, PPD |
| 79 | 121 | y | MSA25, PPD |
| 7A | 122 | z | MSA26, PPD |
| 7B | 123 | { | MSA27, PPD |
| 7C | 124 | \| | MSA28, PPD |
| 7D | 125 | } | MSA29, PPD |
| 7E | 126 | ~ | MSA30, PPD |
| 7F | 127 | DEL | — |

| Multiline Interface Message Definitions | | | |
|---|---|---|---|
| DCL | Device Clear | PPE | Parallel Poll Enable |
| GET | Group Execute Trigger | PPU | Parallel Poll Unconfigure |
| GTL | Go To Local | SDC | Selected Device Clear |
| LLO | Local Lockout | SPD | Serial Poll Disable |
| MLA | My Listen Address | SPE | Serial Poll Enable |
| MSA | My Secondary Address | TCT | Take Control |
| MTA | My Talk Address | UNL | Unlisten |
| PPC | Parallel Poll Configure | UNT | Untalk |
| PPD | Parallel Poll Disable | | |

# C

# Specifications

This appendix lists the specifications and characteristics of the GPIB-120B isolator/expander.

## System Configuration

Loading per expansion ........................... Up to 14 additional devices (28 total devices in the expansion system, not including the GPIB-120B on the bus.)

Multiple expansions ............................... Permitted in any combination of star or linear pattern

## Performance Characteristics

Maximum transfer rate

- Buffered mode ................................ > 1.25 Mbytes/s
- Unbuffered mode ............................ > 450 kbytes/s

Interlocked IEEE 488 handshake ........... Maintained across the expansion in unbuffered mode

IEEE 488 capability identification codes

- SH1 ................................................ Complete Source Handshake
- AH1 ................................................ Complete Acceptor Handshake
- T5, TE5 ........................................... Complete Talker
- L3, LE3 ........................................... Complete Listener
- SR1 ................................................. Complete Service Request
- RL1 ................................................ Complete Remote Local
- PP1, 2 ............................................. Complete Parallel Poll
- DC1 ................................................ Complete Device Clear
- DT1 ................................................ Complete Device Trigger
- C1–5 ............................................... Complete Controller
- E2 ................................................... Tri-state GPIB driver

## Operational Characteristics

Operating modes .................................... Buffered or unbuffered (interlocked) mode

## Electrical Characteristics

### GPIB-120B

Isolation
(between ports and between
each port and the power supply) ....... 2500 VDC dielectric withstand, 5 s max

Input voltage range ................................ 10 VDC to 18 VDC

Current consumption @12V .................. 300 mA typical
500 mA maximum

Fuse rating and type ............................... F 2.2A 125V, surface mount

### 12VDC Power Supply

(shipped with GPIB-120B)

Input voltage range ................................ 100 VAC — 240 VAC
47 Hz — 63 Hz

## Environment

Maximum altitude .................................. 2,000 m (at 25 °C ambient temperature)

Pollution Degree .................................... 2

Indoor use only

## Operating Environment

Ambient temperature range .................... 0 to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

**Note** For the GPIB-120B to operate correctly over the entire specified ambient temperature range, stacking the product is not recommended.

Relative humidity range ......................... 10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

## Storage Environment

Ambient temperature range .................... -20 to 70 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

Relative humidity range ......................... 5% to 95% noncondensing (Tested in accordance with IEC-60068-2-56.)Shock and Vibration

## Shock and Vibration

Operational shock .................................. 30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F)

Random vibration

Operating ........................................ 5 to 500 Hz, 0.3 $g_{rms}$

Nonoperating ................................. 5 to 500 Hz, 2.4 $g_{rms}$ (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

# Physical Characteristics

Overall dimensions ................................6.30 × 3.68 × 1.24 in. (16.01 × 9.35 × 3.15 cm)

Case material ..........................................PC-ABS plastic

Weight ....................................................8.64 oz (245 g)

GPIB cable.............................................Type X1 or X2 shielded

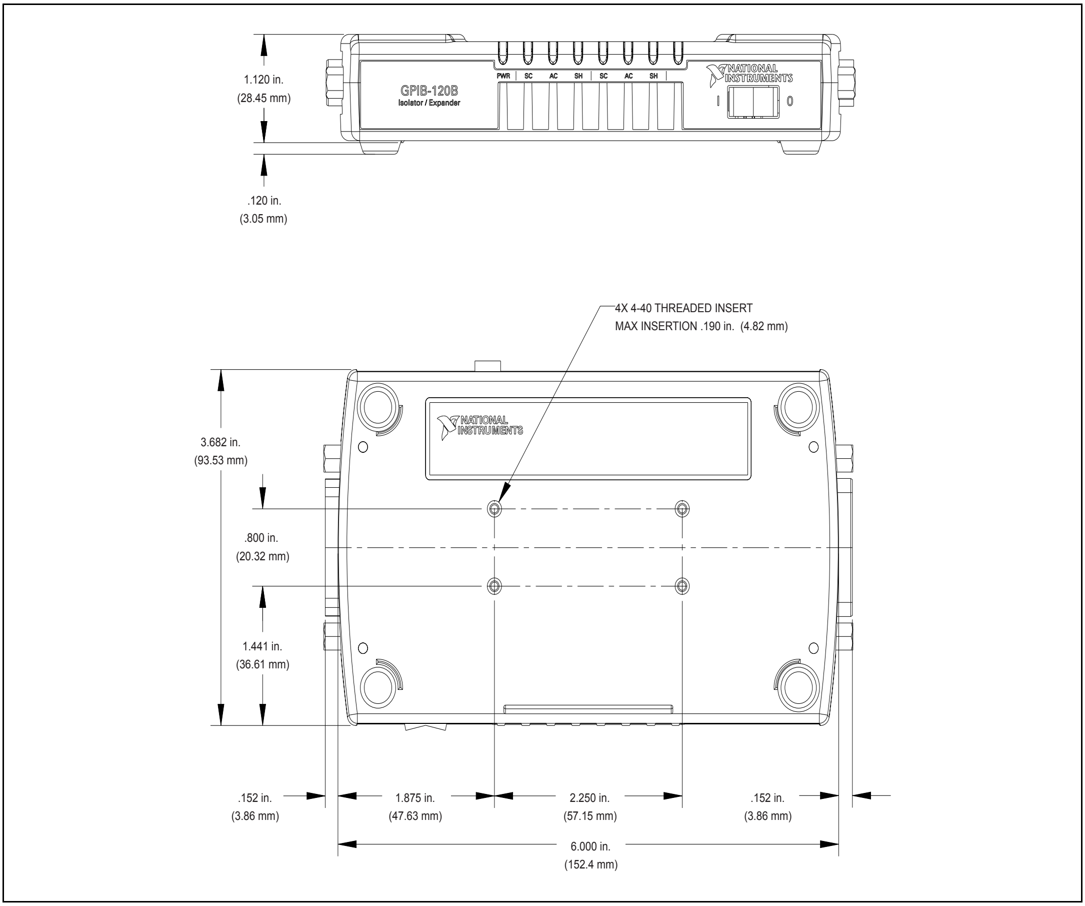


**Figure C-1.** GPIB-120B Dimensions

**Note** The GPIB-120B has threaded inserts for mounting options.

## Safety

This product is designed to meet the requirements of the following standards of safety for information technology equipment:

- IEC 60950-1, EN 60950-1
- UL 60950-1, CAN/CSA-C22.2 No. 60950-1

**Note** For UL and other safety certifications, refer to the product label, or visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

## Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

**Note** For EMC compliance, operate this device according to product documentation.

## CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 73/23/EEC; Low-Voltage Directive (safety)
- 89/336/EEC; Electromagnetic Compatibility Directive (EMC)

**Note** Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

## Waste Electrical and Electronic Equipment (WEEE)

**EU Customers** At the end of their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee.htm`.

# D

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# Glossary

| Symbol | Prefix | Value |
|---|---|---|
| p | pico | $10^{-12}$ |
| n | nano | $10^{-9}$ |
| μ | micro | $10^{-6}$ |
| m | milli | $10^{-3}$ |
| c | centi | $10^{-2}$ |
| k | kilo | $10^{3}$ |
| M | mega | $10^{6}$ |

| | |
|---|---|
| ° | degrees |
| % | percent |
| A | amperes |
| AC | alternating current |
| AHE | HS488 Acceptor Handshake Extended interface function |
| ANSI | American National Standards Institute |
| ASCII | American Standards Code for Information Interchange |
| ASIC | application-specific integrated circuit |
| ATN | Attention |
| C | Celsius |
| CIC | Controller-In-Charge |
| CPU | central processing unit |
| CSA | Canadian Standards Association |
| DAV | data valid |
| dB | decibels |
| DC | direct current |

| | |
|---|---|
| DIO | digital input/output |
| DIP | dual inline package |
| EOI | End or Identify |
| EOS | End of String |
| F | Farads |
| FCC | Federal Communications Commission |
| FIFO | first-in-first-out |
| g | grams |
| GPIB | General Purpose Interface Bus |
| hex | hexadecimal |
| Hz | hertz |
| IDY | Identify |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronic Engineers |
| IFC | Interface Clear |
| in. | inches |
| lb | pounds |
| LED | light-emitting diode |
| m | meters |
| s | seconds |
| SHE | HS488 Source Handshake Extended interface function |
| TTL | transistor-transistor logic |
| UL | Underwriter's Laboratories |
| V | volts |
| VAC | volts alternating current |

# Index

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