

Fieldbus

Getting Started with Your PCI-FBUS and the NI-FBUS™ Software

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Depending on where it is operated, this Class A product could be subject to restrictions in the FCC rules. (In Canada, the Department of Communications (DOC), of Industry Canada, regulates wireless interference in much the same way.) Digital electronics emit weak signals during normal operation that can affect radio, television, or other wireless products.

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.

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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 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).

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Federal Communications Commission

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Canadian Department of Communications

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

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Readers in the European Union (EU) must refer to the manufacturer's Declaration of Conformity (DoC) for information* pertaining to the CE marking compliance scheme. The manufacturer includes a DoC for most hardware products except for those bought from OEMs. In addition, DoCs are usually not provided if compliance is not required, for example electrically benign apparatus or cables.

To obtain the DoC for this product, click **Declarations of Conformity Information** at ni.com/hardref.nsf/. This Web site lists the DoCs by product family. Select the appropriate product family, followed by your product, and a link to the DoC appears in Adobe Acrobat format. Click the Acrobat icon to download or read the DoC.

* 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 contains instructions on how to install and configure the National Instruments PCI-FBUS board and the NI-FBUS software. The PCI-FBUS board is intended for use in PCs equipped with PCI slots.

The NI-FBUS software is intended for use with Windows 2000/NT/XP because Windows 9x is less robust than Windows 2000/NT/XP. This manual is written for users already familiar with their Windows operating system.

How To Use the Manual Set

Use the *Foundation Fieldbus Overview* to learn the basics of Fieldbus. The *Foundation Fieldbus Overview* also includes tutorials to lead you through developing a simple Fieldbus application.

Use this getting started manual to install and configure your PCI-FBUS board and the NI-FBUS software. To install your PCI-FBUS board in the Windows 2000/NT/XP system environment, use the *Installation Guide: Foundation Fieldbus Hardware and NI-FBUS Software for Windows 2000/NT/XP*.

If you are using the NI-FBUS Configurator, use the *NI-FBUS Configurator User Manual* to install and use the NI-FBUS Configurator software.

If you are using the NI-FBUS Communications Manager Application Programmer Interface (API), use the *NI-FBUS Communications Manager User Manual* to learn how to use the NI-FBUS Communications Manager API for your application. Use the *NI-FBUS Communications Manager Function Reference Manual* to look up specific information about NI-FBUS Communications Manager functions, such as syntax and error messages.

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 tip, which alerts you to advisory information.



This icon denotes a note, which alerts you to important information.



This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

PCI-FBUS

In this manual, the term *PCI-FBUS* refers to the dual-port PCI-FBUS/2 board, unless otherwise indicated.

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.

Fieldbus

The generic term *Fieldbus* refers to any bus that connects to field devices. This includes Foundation Fieldbus, CAN, DNET, and Profibus. In this manual, the term *Fieldbus* refers specifically to the Foundation Fieldbus.

italic

Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font 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 also is used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.

monospace bold

Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

monospace italic

Italic text in this font denotes text that is a placeholder for a word or value that you must supply.

NI-FBUS software

In this manual, the term *NI-FBUS software* refers to either the NI-FBUS Communications Manager or NI-FBUS Configurator software.

Platform

Text in this font denotes a specific platform and indicates that the text following it applies only to that platform.

Related Documentation

The following contain information you might find helpful as you read this manual.

General Fieldbus Web sites

- Fieldbus Foundation—responsible for the definition of the Foundation Fieldbus specification. www.fieldbus.org
- Relcom, Inc.—Wiring and test equipment for Foundation Fieldbus. www.relcominc.com/fieldbus
- Fieldbus, Inc.—Device developers and Foundation Fieldbus consulting. www.fieldbusinc.com

Fieldbus system development documentation

- Fieldbus Foundation resources
 - *Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire Medium*
- Relcom Fieldbus resources online
 - Wiring Design and Installation Guide
 - Online Tutorial
 - FAQ
 - Sample Fieldbus Topologies
- *Fieldbus Standard for Use in Industrial Control Systems, Part 2, ISA-S50.02.1992*

Fieldbus device development documentation

- *Developing Your First Foundation Fieldbus Device*, available from the Fieldbus, Inc. Web site at www.fieldbusinc.com
- *Foundation Specification: 31.25 kbit/s Physical Layer Profile for the Foundation Fieldbus Physical Layer Specifications*
- *Function Block Application Process, Part 1*
- *Function Block Application Process, Part 2*
- IEC Standard 1158-2 and ISA Standard ISA S50.02

Introduction

This chapter lists what you need to get started and includes a brief description of the PCI-FBUS board and the NI-FBUS software.

What You Need to Get Started

To install your NI-FBUS software, you need the following items:

- PCI-FBUS board
- Installation disks
- Windows 2000/NT/XP installed on your computer

Hardware Description

The PCI-FBUS is a plug-in board that handles communication between a network-configurable device that complies with the Fieldbus Foundation H1 specification and a PC that has a PCI slot. The PCI-FBUS uses an Intel 386EX embedded processor, shared memory, and an interrupt to communicate with its driver. The PCI-FBUS supports the Fieldbus H1 transfer rate of 31.25 Kbits/s.

In this manual, the term *PCI-FBUS* refers to the dual-port PCI-FBUS/2 board, unless otherwise indicated.

Software Description

Your kit includes either the NI-FBUS Communications Manager software or the NI-FBUS Configurator software. Depending on the system you purchase, you may receive both disks. If this is the case, you should use the NI-FBUS Configurator software.

The NI-FBUS Communications Manager software is used by the interface boards to communicate over the bus. Additionally, it provides a high-level API that allows advanced users to interface with the National Instruments Foundation Fieldbus communication stack and hardware.

The NI-FBUS Configurator is the most commonly used software of the two. In addition to providing the functionality of the NI-FBUS Communications Manager in a graphical format, it includes additional functionality to allow you to configure a Fieldbus network. It can automatically generate the schedule for the network and configure field devices and hosts to transmit and receive alarms and trends.

NI-FBUS Interface Configuration Utility

The NI-FBUS Interface Configuration Utility lets you view and change the hardware configuration parameters for your Fieldbus interfaces. In Windows 2000/NT/XP, you also can edit your hardware configuration parameters and add and delete interfaces.

The NI-FBUS Interface Configuration Utility helps you to configure the following information:

- Logical name for each port on your Fieldbus board; you can access the port using the interface name
- Device description information
 - Base directory for device description files
 - Location of the standard text dictionary

You need to import device descriptions if you use the NI-FBUS Communications Manager to communicate with devices that have manufacturer-specific blocks or parameters.

- Fieldbus communication parameters for each Fieldbus interface

In Windows 2000/NT/XP, the NI-FBUS Configuration Utility (`fbconf.exe`) helps you to configure the number of boards.



Caution Although the NI-FBUS Interface Configuration Utility can be used to set certain low-level network software parameters, you should *not* modify the **Advanced** parameters without good reason. If you must modify parameters for certain devices, the device manufacturer will recommend settings. Modifying these parameters can have an adverse affect on data throughput rates. If settings are incorrectly modified, some devices might disappear off the bus.

Choosing Configuration Software

Foundation Fieldbus links must be configured. Only with configuration software can you do things like set device addresses, clear devices, and download, which is necessary if you are setting up a system for the first time. Your configuration software must match the interface board your

computer is using to connect to the bus. National Instruments offers the NI-FBUS Configurator with a National Instruments Foundation Fieldbus interface board to let you configure your Fieldbus links.

Interface boards and configuration software are sold separately because multiple interface boards can reside in the same computer. The NI-FBUS Configurator, by default, is licensed for use on one machine, with up to four Fieldbus links (or segments). If you have more than four links (four ports on the boards), you need to purchase a link upgrade for each link in excess of four. To do so, download the order form from ni.com/fieldbus.



Note The connection to one interface port on the interface board is viewed as one link by the NI-FBUS Configurator, regardless of how many links might actually be joined by repeaters (important for software licensing of the NI-FBUS Configurator).

If you want to use the board to read and write values only and not configure, and you are a programmer, you can make calls to the API in the NI-FBUS Communications Manager. In that case you do not need the NI-FBUS Configurator. This is possible only if you have already used third-party hardware and configuration software to configure the link.

Table 1-1 describes the National Instruments Fieldbus software.

Table 1-1. National Instruments Fieldbus Software

Software Application	Short Name	Description	File Name
NI-FBUS Communications Manager	NIFB process	“The Blue Box.” This must be running for you to use your PCI-FBUS board as a Fieldbus interface to communicate between the board and the bus.	<code>nifb.exe</code>
NI-FBUS Interface Configuration Utility	Interface Config	Used to configure your PCI-FBUS board.	<code>fbconf.exe</code>
NI-FBUS Configurator	NI-FBUS Configurator	Used to configure the devices on the bus, set the parameters for control loops, and other Fieldbus configuration tasks.	<code>fcs.exe</code>

Table 1-1. National Instruments Fieldbus Software (Continued)

Software Application	Short Name	Description	File Name
NI-FBUS Dialog System	NI-FBUS Dialog	Used to view the devices on the bus and manually read and write parameter values. Not for configuration.	nifbdlg.exe
Server Explorer	Server Explorer	Lets you configure the attributes of the communication resource, device, and items of your network, and the groups and items of your OPC server.	serverexplorer.exe

Optional Fieldbus Network Tools

Your kit includes either the NI-FBUS Communications Manager software, NI-FBUS Configurator software, or both. In addition, you can order LabVIEW DSC, and/or Lookout from National Instruments. If you have not already done so, you can also order the NI-FBUS Configurator.

LabVIEW DSC helps you perform data acquisition and analysis, create a human-machine interface (HMI), or develop an advanced supervisory control application in a graphical development environment.

LabVIEW DSC includes real-time process monitoring, historical trending, alarm and event reporting, online configuration, and PLC connectivity.

Lookout helps you create graphical representations on a computer screen of real-world devices such as switches, dial gauges, chart recorders, pushbuttons, knobs, sliders, and meters. After linking these images to your field instruments, you can configure Lookout to generate alarms, log data to disk, animate custom graphics, print reports, automatically adjust setpoints, historically trend information, warn operators of malfunctions, and so on.

Installation and Configuration

Install the Software

(Windows 2000/NT/XP) Complete the following steps to install your NI-FBUS software.



Note Install the software before you install your PCI-FBUS hardware.



Caution If you are reinstalling the NI-FBUS software over an existing version, write down your board configuration and any port configuration parameters you changed from their defaults. Reinstalling may cause you to lose any existing board and port configuration information.

1. Log in as `Administrator` or as a user that has Administrator privileges.
2. Insert the NI-FBUS version 3.0 or later CD-ROM.
3. Select **Start»Run**.
4. In the **Run** dialog box, type the following:
`x:\setup`
where `x` is the letter of the drive containing the NI-FBUS version 3.0 or later CD-ROM.
5. The interactive setup program takes you through the necessary steps to install the software.
6. At the end of the setup, an **Add New Board** dialog box may appear. If you have not yet installed your board, click on **Cancel**. You will install your board in a later step.

The installation program copies `nifb.dll` and `drvintf.dll` into your `\System32` directory, and it copies the `nifb.sys` driver into the `\drivers` directory. The installation program also adds information to the Windows registry.

Continue to the *Install the PCI-FBUS Board* section to install your board.

Install the PCI-FBUS Board



Note Before you install your board, double-check to make sure the settings on your board match the resources you have chosen.

1. Shut down your operating system and power off your computer. Keep the computer plugged in so that it remains grounded while you install the PCI-FBUS board.
2. Remove the top cover or access port of the I/O channel.
3. Remove the expansion slot cover on the back panel of the computer.
4. As shown in Figure 2-1, insert the PCI-FBUS board into any unused PCI slot with the Fieldbus connector sticking out of the opening on the back panel. Make sure all pins are inserted an equal depth into the connector. Although it might be a tight fit, do *not* force the board into place.

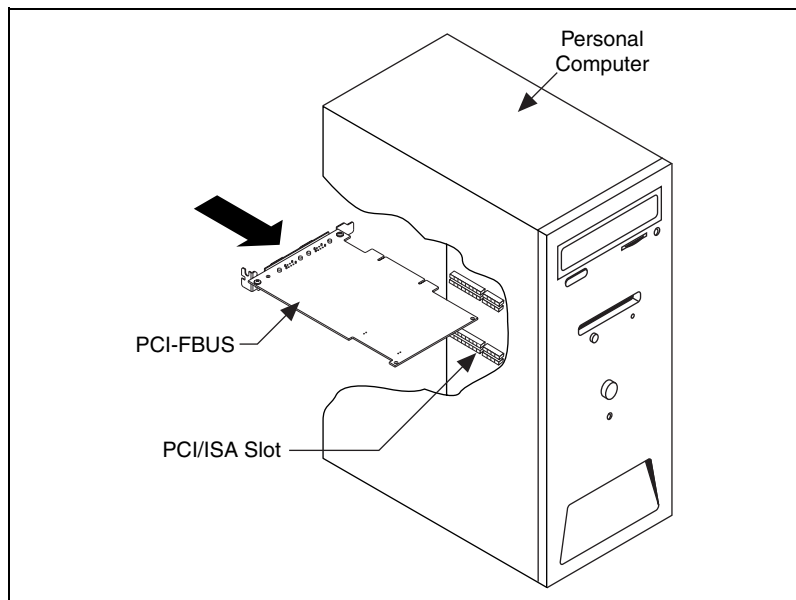


Figure 2-1. Installing the PCI-FBUS Board

5. Screw the mounting bracket of the PCI-FBUS board to the back panel rail of the computer.

6. Keep the top cover or access port off until you have verified that your resources are non-conflicting, as described in the *Set the NI-FBUS Software to Use Your PCI-FBUS Board* section.
7. Power on your computer.
8. Launch the Interface Configuration Utility. Find the PCI-FBUS board and right-click to **Enable**.
9. Close the Interface Configuration Utility and start the NI-FBUS Communications Manager or NI-FBUS Configurator.

Proceed to the *Set the NI-FBUS Software to Use Your PCI-FBUS Board* section.

Set the NI-FBUS Software to Use Your PCI-FBUS Board



Note You can only connect one PCI-FBUS port to a link or Fieldbus.

Set the Communication Parameters and Interface Name

Use the NI-FBUS Interface Configuration Utility to set the Fieldbus communication parameters and interface name.

1. Start the NI-FBUS Interface Configuration Utility. Select **Start» Programs»National Instruments»NI-FBUS»Interface Configuration**.
2. Select the port you want to edit, and click the **Edit** button.
3. The NI-FBUS Interface Configuration Utility displays the default interface name and some configuration information.
4. Enter an interface name for the port or use the default name. The interface name is for local use on the PC.
5. Enter a unique tag in the **Device Tag** field or use the default device tag. The device tag is the name on the Fieldbus visible to the other devices.

6. Your interface must be given either a fixed or visitor device address for you to start using NI-FBUS. This address must be unique on the link to which the interface is connected.
 - a. To assign a fixed address to your Fieldbus interface, select **Fixed Address** and enter a value in the range 0x10 to 0xF7.
 By convention, the lower addresses starting at 0x10 are usually used for interface boards and link masters. Upper addresses, starting at 0xF7 and working down, are generally used for other devices. Using a lower address for your interface will reduce the likelihood that the interface will conflict with another device on the bus.
 - b. If you want your interface to be a temporary device that you do not intend to connect to the Fieldbus for an extended time, select **Visitor Address**. Over a long period of time, using a visitor address could break VCR endpoints and cause a `VCR_FULL_ERROR`.
 - c. If you want third-party Fieldbus configuration software to assign an address to your interface over the Fieldbus, select **Default Address**. You should only select a default address when you want third-party configuration software to assign a permanent address. A device at a default address cannot be communicated with until a permanent address has been assigned by the configuration software.
7. Select a Device Type. You should select **Link Master Device**.
8. Make sure that **NI-FBUS** is selected for **Usage**, unless you will be using the board in conjunction with the NI-FMON software.

If you are using this interface as a bus monitor, the other interface (if this is a two-port board) cannot be used for NI-FBUS. This means that you must have another link master on the link—either another PCI-FBUS board, or a device with link master capabilities. Refer to the *Optional Fieldbus Network Tools* section of Chapter 1, *Introduction*, for more information.

NI-FBUS assigns default values for other network communication parameters.



Caution Do *not* modify the **Advanced** parameters without good reason. If you must modify parameters for certain devices, the device manufacturer will recommend settings. Modifying these parameters can have an adverse affect on data throughput rates. If settings are incorrectly modified, some devices might disappear off the bus.

9. Click **OK**, then click **OK** again to exit the configuration utility.
10. Restart the NIFB process by selecting **Start»Programs»National Instruments»NI-FBUS»NIFB** for the changes you made in the NI-FBUS Interface Configuration Utility to take effect.
11. **(Windows NT)** If you change or delete the interface configuration, you must stop and restart the NI-FBUS Communications Manager `nifb.exe` so that the new configuration will take effect. You can start or stop the driver by selecting **Start»Settings»Control Panel»NI-FBUS**, and clicking the **Stop/Start** button.
12. Replace the top cover on your computer, if you have not done so already.

Test the Installation

(Windows 2000/XP) Start the NIFB process by selecting **Start»Programs»National Instruments»NI-FBUS»NIFB**. The NIFB process must be running in the background to use any Fieldbus application.

(Windows NT) To make sure that your NI-FBUS software is installed correctly and is working properly, complete the following steps:

1. After you configure your installation, restart Windows. You must restart your computer before you can use the NI-FBUS software.
2. Start the kernel-mode device driver NIFB by selecting **Start»Settings»Control Panel»NI-FBUS** and clicking the **Start** button.



Tip You can have the device driver start automatically when your computer boots. Refer to Chapter 3, *Start the NIFB Process*, for instructions.

3. Start the NIFB process selecting **Start»Programs»National Instruments»NI-FBUS»NIFB**.

On successful startup, the NIFB displays a message saying that the process started up successfully, the title bar of the NIFB window changes to **NI-FBUS (running)**, and a blue box icon appears on the Windows taskbar. It may take a few minutes for NIFB to start up and for this message to display.

If NI-FBUS does not start up successfully, the base memory address, IRQ line, or Fieldbus network address is incorrect. If the NIFB process does not start up successfully, refer to Appendix B, *Troubleshooting and Common Questions*.

Changing or Deleting Existing Interface Information

(Windows 2000/NT/XP) To change or delete information about any interface that you have already entered, complete the following steps:

1. Select **Start»Programs»National Instruments»NI-FBUS»Interface Configuration**.
2. Click the **Board x** icon, where x refers to the board number of the interface you want to change or delete.
3. Click the **Edit** button. You can edit the interface configuration information that you entered earlier, or click **Delete** to delete this interface entirely.

Interfaces are numbered beginning with zero. If you delete an interface, the NI-FBUS Interface Configuration Utility renumbers all the remaining interfaces. For example, if you delete **Board0**, it appears that you deleted the last interface, because all the remaining interface numbers are decreased by one automatically.

Table 2-1. Board Renumbering

Original Address	Address after Deleting Board1
Board0	Board0
Board1	(deleted)
Board2	Board1
Board3	Board2

Run the NI-FBUS Interface Configuration Utility once to make sure the interface has been removed.

To reinstall the interface, refer to the [Install the Software](#) and the [Set the NI-FBUS Software to Use Your PCI-FBUS Board](#) sections.

Import Device Descriptions

The device description files contain information about the types of blocks and parameters supported by your Fieldbus device, along with online help describing the uses of given parameters. If your Fieldbus device uses manufacturer-specific device description files, you must import the device description files (shipped with the device or available from the device manufacturer). To do so, complete the following steps:

1. Insert the device description disk or CD (if supplied by your Fieldbus device manufacturer) into the disk drive of the host computer.
2. Select **Start»Programs»National Instruments»NI-FBUS»Interface Configuration** to run the Interface Configuration Utility.
3. Click the **DD Info** button. The **DD Info** dialog box appears.
4. If the base directory field is blank, enter a base directory. The base directory you enter here will be where NI-FBUS looks for all device descriptions. Do not change the base directory after you have started importing device descriptions. If you do, NI-FBUS will not be able to find the device descriptions you previously imported. Your device description files will automatically be placed in the appropriate manufacturer ID subdirectory under this base directory.

Your base directory will include one folder for each different manufacturer for which you have imported a device description. For example, if you import the device description for the National Instruments FP-3000 device, you will find a folder named `4e4943`. This is the National Instruments Foundation Fieldbus device manufacturer ID number.

The next layer of folders is the device type. For example, the FP-3000 has a device type ID number of `4005`.

Underneath this layer of directories you will find the individual device description files (`.ffo` and `.sym`).

5. If necessary, click the **Browse** button to select the standard text dictionary, provided with NI-FBUS. The text dictionary has a `.dct` extension.
6. Click the **Import DD** button. The **Import DD** dialog box appears.

- Click the **Browse** button and go to the .ffo device description file path. Click **Open**. Typically, the device description for your Fieldbus device is supplied on a disk from the manufacturer. For each device, there are two device description files, one that ends in .ffo and one that ends in .sym. Select the .ffo file, and the corresponding .sym file will be imported automatically. The file name will be in the form *Digit Digit Digit Digit.ffo* (for example, 0101.ffo).



Note If you are importing device descriptions for multiple devices, you might see that they can have the same filenames. Each file contains information about the device and its manufacturer, and will be placed appropriately in the hierarchy under the base directory.

- Click **OK**. A window will appear that gives the full path to which the .ffo and .sym files were copied.
- Click **OK**.

For more information on device descriptions, refer to the *Device Descriptions* section of the *Foundation Fieldbus Overview* document.

Fieldbus Cable Connector Pinout

If you want to make your own Fieldbus cable, make sure that it uses pins 6 and 7 for the Fieldbus signals, as shown in Figure 2-2. Also make sure that it follows the specification in the *Fieldbus Standard for Use in Industrial Control Systems, Part 2, ISA-S50.02.1992*. The connector pinout of the PCI-FBUS is shown in Figure 2-2.

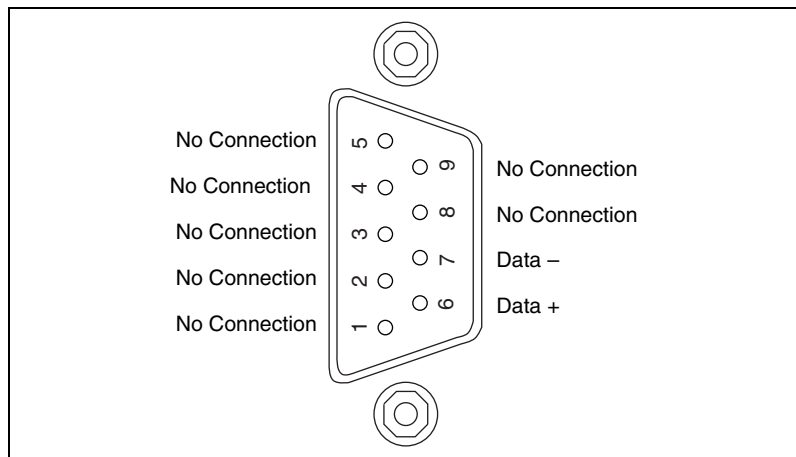


Figure 2-2. Fieldbus Connector Pinout for the PCI-FBUS

Install and Wire Your Fieldbus Devices

What you need:

- Cable compliant with the *Fieldbus Standard for Use in Industrial Control Systems, Part 2, ISA-S50.02.1992*
- Terminator(s) with capacitor and resistor of appropriate size

Refer to the documentation that came with your device for complete instructions on how to install and wire your Fieldbus devices.

Termination

You must terminate your wiring in compliance with the Foundation Fieldbus specification. Foundation Fieldbus requires a resistor and a capacitor in parallel. You must place termination appropriately on the network, which will depend on your network topology. Refer to the *Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire Medium* document or the Relcom, Inc. *Wiring Design and Installation Guide* document.

Replacing Devices

NI-FBUS is capable of dynamic device replacement. There is no need to restart NI-FBUS if a device on the link has its application changed but its device ID remains the same.

Start the NIFB Process

The NIFB process must be running any time you want to use your PCI-FBUS board as a Fieldbus interface to communicate between the board and the bus.

(Windows 2000/XP)

1. Start the NIFB process by selecting **Start»Programs»National Instruments»NI-FBUS»NIFB**.

(Windows NT) If the NIFB kernel-mode driver has not already been started, you must do so manually.

1. Start the NIFB kernel-mode driver by selecting **Start»Settings»Control Panel»NI-FBUS** and clicking the **Start** button.
2. Start the NIFB process by selecting **Start»Programs»National Instruments»NI-FBUS»NIFB**.



Note You also can start the driver by entering `net start nifb` at the command prompt.

If you receive the message **System error 31 has occurred**, the cause is most likely an interrupt or memory address conflict. Set the device to poll mode or change the memory address value.

Configure NIFB to Load at System Startup

If the driver and the process start up successfully, you can configure the kernel-mode driver (**for Windows NT**) and NIFB process to start automatically when you boot or restart your computer.



Note To do this on a Windows NT machine, you must be running Windows NT 4.0 or later.

(Windows 2000/XP) Place a shortcut to `nifb.exe` in your **Startup** folder.

(Windows NT) Select **Start»Settings»Control Panel»NI-FBUS**. Click the **StartUp** button. Select **Automatic**. Then, place a shortcut to `nifb.exe` in your **StartUp** folder.

Begin to Use Your NI-FBUS Software

If you are using the NI-FBUS Communications Manager, proceed to the *NI-FBUS Communication Manager User Manual* for information on using your software. If you are using the NI-FBUS Configurator, proceed to the *NI-FBUS Configurator User Manual* for information on using your software.

If NI-FBUS is unable to connect to and initialize an interface device, and you decide to continue NI-FBUS startup, NI-FBUS will not try to reconnect to that interface again. This is true of all interface types supported by this software.

If a PCI-FBUS interface is configured as a basic device, a link master device must be present on this link before NI-FBUS will start up.

Specifications

This appendix describes the electrical, physical, and environmental characteristics of the PCI-FBUS hardware and the recommended operating conditions.

Power Requirement

PCI-FBUS/2 820 mA Typical

Physical

Dimensions..... 10.67 by 17.46 cm
(4.2 by 6.88 in.)

I/O connector..... DB-9 DSUB
(1 per Fieldbus link)

Operating Environment

Ambient temperature..... 0 to 55 °C

Relative humidity 10 to 90%, noncondensing

Storage Environment

Ambient temperature..... -20 to 70 °C

Relative humidity 5 to 95%, noncondensing

Safety

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

- IEC 60950, EN 60950
- UL 1950, UL 60950
- CAN/CSA C22.2 No. 60950



Note For UL and other safety certifications, refer to the product label or to ni.com.

Electromagnetic Compatibility

EmissionsEN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

ImmunityEN 61326-1:1997/ +A2:2001,
Table 1

CE, C-Tick and FCC Part 15 (Class A) Compliant



For EMC compliance, operate this device with shielded cabling.

CE Compliance

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

Low-Voltage Directive (safety)73/23/EEC

Electromagnetic Compatibility
Directive (EMC)89/336/EEC



Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, click **Declarations of Conformity** at ni.com/hardref.nsf/.

Troubleshooting and Common Questions

This appendix describes how to troubleshoot common problems that occur while getting started with Fieldbus.

Error Messages

Utility could not access or locate the registry.

- If using Windows 2000/NT/XP, make sure you are logged in to Windows with administrator privileges.
- Your registry entries for NI-FBUS may have been deleted or corrupted. Uninstall the NI-FBUS software, then reinstall the software as described in the *Install the Software* section of Chapter 2, *Installation and Configuration*.

Board cannot be found.

- Select **Start»Programs»National Instruments»NI-FBUS»Interface Configuration**. Make sure your board appears under the list of interfaces.
- Make sure the PCI-FBUS driver is started.
 - **(Windows 2000/XP)** Select **Start»Settings»Control Panel»System»Hardware»Device Manager**. Select **National Instruments FieldBus Interfaces»PCI-FBUS/2**, right-click, and select **Properties**. Make sure there are no conflicts.
 - **(Windows NT)** Select **Start»Settings»Control Panel»Devices»NIFB**. Click the **Start** button. To avoid manual startup in the future, click **Startup** and select **Automatic**.

VCR_FULL_ERROR.

Delete the board from the Interface Configuration Utility, then reinstall.

NIFB Problems

When using the PCI-FBUS board with Windows 2000/NT/XP, NIFB returns an error message stating that the board cannot be found.

- Select **Start»Programs»National Instruments»NI-FBUS»Interface Configuration**. Make sure your board appears under the list of interfaces.
- Make sure the PCI-FBUS driver is started.
 - **(Windows 2000/XP)** Select **Start»Settings»Control Panel»System»Hardware»Device Manager**. Select **National Instruments FieldBus Interfaces»PCI-FBUS/2**, right-click, and select **Properties**. Make sure there are no conflicts.
 - **(Windows NT)** Select **Start»Settings»Control Panel»Devices»NIFB**. Click the **Start** button. To avoid manual startup in the future, click **Startup** and select **Automatic**.

When a Fieldbus device is connected to the bus, the NIFB process often hangs when the title bar reads Waiting for Startup Completion. If I disconnect the cables, it starts fine.

This is probably due to a device address conflict. In the NI-FBUS Interface Configuration Utility, make sure that the interface is not at the same address as anything else on the link. You also can temporarily give the interface a visitor address to troubleshoot this problem.

The NIFB process hangs, does not start up, or never shows that it is running.

- The Fieldbus network address is not unique. Remove the cable from the board. Restart the NIFB process. If it runs successfully, there is probably a Fieldbus network address conflict. If you have FP-3000 network modules on the bank, powering off the modules and then powering on will cause them to look on the bus for available addresses and change addresses if necessary. If this does not solve the problem, you can try to change the board address. In the Interface Configuration Utility, select the port and click **Edit**. Make sure that the port does not have an address that conflicts with another device on the bus. You also can set the interface to a visitor address. In this case, the board will find and take an unused address. If this corrects the problem, find and change the address of one of the conflicting devices. Return the board to a fixed address.

- Check for multiple copies of `ni_fb.dll` on the machine. If multiple copies are found, NI-FBUS was incorrectly reinstalled. Uninstall NI-FBUS, search for any remaining copies of `ni_fb.dll`, delete them, then reinstall the software.
- Check how many boards are showing up in the Interface Configuration Utility. Make sure that this matches the number of boards in the system. Also check that the number of ports match the physical hardware (one port versus two port boards).
- Link masters do not always work well together (if you have another link master on the link). Try setting the board to be a basic device in the Interface Configuration Utility.

If an PCI-FBUS interface is configured as a basic device, another link master device must be present on this link before the NI-FBUS process will start up. For more about Basic and Link Master devices, refer to the *Foundation Fieldbus Overview* document.

Interface Configuration Problems

When using the NI-FBUS Interface Configuration Utility on a Windows 2000/NT/XP machine, the error message `utility could not access or locate the registry` appears.

1. Make sure you are logged in to Windows with administrator privileges.
2. Your registry entries for NI-FBUS may have been deleted or corrupted. Uninstall the NI-FBUS software, then reinstall the software as described in the *Install the Software* section of Chapter 2, *Installation and Configuration*.

In the Interface Configuration Utility, I see more boards than what physically exist in the machine.

- ◆ **(Windows 2000/NT/XP)** Select **Edit** for the extra board. In the next window, select **Delete**.



Caution You should *not* attempt to make unguided changes in the Windows registry. Doing so can cause many problems with your system.

Resolving Resource Conflicts

Put the Board in Polled Mode

Putting the board in polled mode is a good way to eliminate one variable. To put the board in polled mode, complete the following steps.

(Windows 2000/NT/XP) Use the Interface Configuration Utility:

1. Select **Start»Programs»National Instruments»NI-FBUS»Interface Configuration**.
2. In the Interface Configuration window, select the icon of the board you want to change and click the **Edit** button. If you are adding a board, click the **Add Interface Device** button.
3. Check the **Polled Mode** checkbox.

Use a Visitor Address

Using a visitor address is a good way to troubleshoot an address conflict since the board will find and take an available address.

Problems Using Manufacturer-Defined Features

NI-FBUS uses identifying information in the actual device to locate the device description for the device. The identifying information includes four resource block parameters: `MANUFAC_ID`, `DEV_TYPE`, `DEV_REV`, and `DD_REV`. If the identifying information is incorrect, NI-FBUS will not be able to locate the device description for the device. When it has located the device description, NI-FBUS matches the block types in the device description with the actual blocks in the device by using the Item ID of the block characteristics record.

If the blocks in the device do not match the blocks in the description, or if there is no appropriate device description for the manufacturer, device type, device revision, and device description revision being returned by the device, then there is a device description mismatch. In either case, NI-FBUS uses only the standard dictionary (`nifb.dct`) and you will be unable to use any manufacturer-supplied functionality.

These parameters can be read from the device resource block. The following procedure will help you troubleshoot a `DD_SIZE_MISMATCH_ERROR` by finding out if there is a device description available on your computer that matches what your device expects.

Complete the following steps to use the NI-FBUS Dialog utility to check device description files.

1. Start the NIFB process. Wait until the process has finished initializing.
2. Select **Start»Programs»National Instruments»NI-FBUS»NI-FBUS Dialog**.
3. Right-click **Open Descriptors** and select **Expand All**.
4. After the expansion is complete, click **Cancel** to close the Expand All window.
5. Right-click the resource block for your device (it should be under **Open Descriptors»Session»Interface Name»Device Name»VFD Name»Resource Block Name**). Select **Read Object**.
6. Select the **Read by Name** radio button and enter `MANUFAC_ID` as the name. Click the **Read** button. Write down the hexadecimal number found in parenthesis (0xnumber) in the name column of Table B-1.
7. Repeat step 6 for the name `DEV_TYPE`.
8. Repeat step 6 for the name `DEV_REV`.
9. Repeat step 6 for the name `DD_REV`.
10. Repeat steps 5–9 for each device, then close the NI-FBUS Dialog utility.

Table B-1. Device Names

Resource Block Parameter	Name
MANUFAC_ID	
DEV_TYPE	
DEV_REV	
DD_REV	

11. In the Interface Configuration Utility, click the **DD Info** button. Write down the base directory specified for device descriptions. Close the Interface Configuration Utility.

12. Use Windows Explorer to view the contents of the base directory specified in the Interface Configuration Utility. The Fieldbus specification defines the directory hierarchy for storing device descriptions. There is a different subdirectory for each device manufacturer. Under the base directory, you should see a directory with the number from step 6 for the first device.
13. Under the appropriate manufacturer directory, there is a directory for each device type that you have from that manufacturer. Check to make sure that you see a directory with the number from step 7.
14. Under the appropriate device type directory, there are the individual device descriptions. The device description file name is a combination of the device revision (the number from step 8) and the device description revision (the number from step 9). The device revision is the first two digits, and the device description revision is the second two digits. For example, if your number from step 8 was 2 and from step 9 was 1, you should see files called `0201.ffo` and `0201.sym`. Device descriptions are backwards compatible. This means that instead of seeing 0201, you might see 0202. This is allowed by the Fieldbus specification. Also, having additional files in this directory is not a problem. The NI-FBUS Configurator will use the most recent device description revision for a given device revision. If you do not have the appropriate `.ffo` and `.sym` files, you must obtain them from the device manufacturer. Be sure to properly import them by clicking **DD Info** and using the **Import DD** button in the Interface Configuration Utility.
15. Repeat steps 12–14 for each device.

The second cause for this problem is when the contents of the file do not accurately describe the device characteristics, even if the device identification information matches the file identification information. This problem is caused when a device manufacturer makes a change to the firmware of the device without incrementing the device revision, in violation of the Foundation Fieldbus recommendation. If this is the case, you must contact your device manufacturer for a resolution.

Configuring Advanced Parameters



Caution Do *not* modify the **Advanced** parameters without good reason. If you must modify parameters for certain devices, the device manufacturer will recommend settings. Modifying these parameters can have an adverse affect on data throughput rates. If settings are incorrectly modified, some devices might disappear off the bus.

In the NI-FBUS Interface Configuration Utility, click the **Advanced** button on the dialog box for the port you want to configure. The **Advanced Stack Configuration** dialog box is shown in Figure B-1.

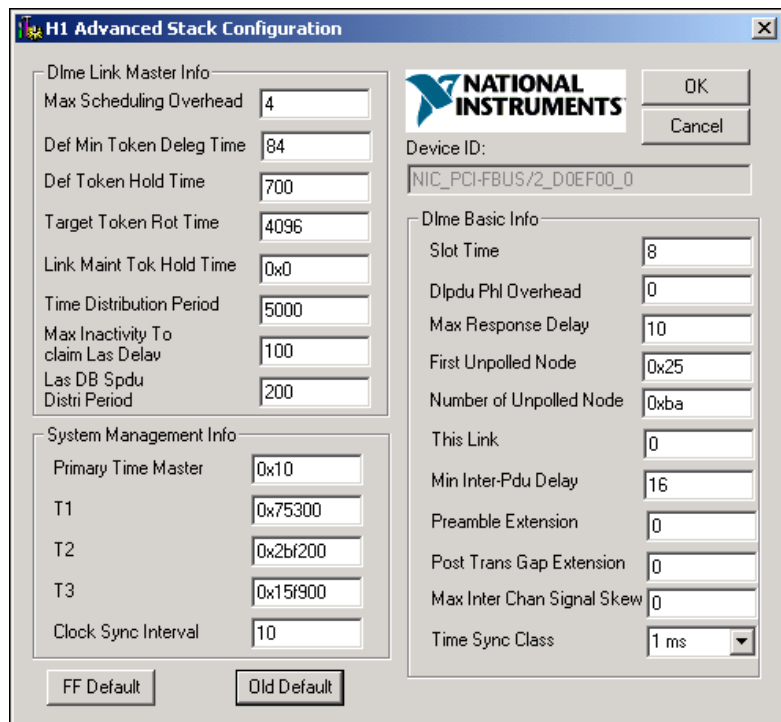


Figure B-1. Advanced Stack Configuration Dialog Box

The parameters involved in setting addresses are T1 and T3. These parameters represent delay time values that your board uses to compensate for the delays inherent in the device and in the set address protocol itself. T1 describes the expected response delay of the device at a given address. T3 describes the expected time for the device to respond at its new address.

Uninstalling the Software

To uninstall your NI-FBUS software, select **Start»Settings»Control Panel»Add/Remove Programs**.

If you are only using the Communications Manager, select **NI-FBUS Communications Manager** to uninstall. If you are using the NI-FBUS Configurator, select **NI-FBUS Configurator**.

The uninstall utility does not remove the NI-FBUS directory itself or any files in the `\Data\Nvm` directory. To completely uninstall the software, manually remove the files in the `\Data\Nvm` directory and the NI-FBUS directory structure.



Technical Support and Professional Services

Visit the following sections of the National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Online technical support resources include the following:
 - **Self-Help Resources**—For immediate answers and solutions, visit our extensive library of technical support resources available in English, Japanese, and Spanish at ni.com/support. These resources are available for most products at no cost to registered users and include software drivers and updates, a KnowledgeBase, product manuals, step-by-step troubleshooting wizards, conformity documentation, example code, tutorials and application notes, instrument drivers, discussion forums, a measurement glossary, and so on.
 - **Assisted Support Options**—Contact NI engineers and other measurement and automation professionals by visiting ni.com/support. Our online system helps you define your question and connects you to the experts by phone, discussion forum, or email.
- **Training**—Visit ni.com/training for self-paced tutorials, videos, and interactive CDs. You also can register for instructor-led, hands-on courses at locations around the world.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, NI Alliance Program members can help. To learn more, call your local NI office or visit ni.com/alliance.
- **Declaration of Conformity (DoC)**—A DoC is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/hardref.nsf.

- **Calibration Certificate**—If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

If you searched ni.com and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of ni.com/niglobal to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Symbol	Prefix	Value
m	milli	10^{-3}
k	kilo	10^3

A

Alarm	A notification the NI-FBUS Communications Manager software sends when it detects that a block leaves or returns to a particular state.
API	<i>See</i> Application Programmer Interface.
Application	Function blocks.
Application Programmer Interface	A message format that an application uses to communicate with another entity that provides services to it.
Asynchronous	Communication that occurs at times that are not predetermined.
AT-compatible	Compatible with the 16-bit Industry Standard Architecture.

B

Bank	The combination of one FieldPoint network module and one or more terminal bases and I/O modules.
Basic device	A device that can communicate on the Fieldbus, but cannot become the LAS.
Block	A logical software unit that makes up one named copy of a block and the associated parameters its block type specifies. The values of the parameters persist from one invocation of the block to the next. It can be a resource block, transducer block, or function block residing within a virtual field device.

Bus The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected. Examples of PC buses are the ISA and PCI buses.

Bus scheduler See [Link Active Scheduler](#).

C

C Celsius.

Cable A number of wires and shield in a single sheath.

Capacitor An electronic component that stores electrical charge. In a computer, capacitors are used in dynamic RAM cells and power supplies.

Channel A pin or wire lead to which you apply or from which you read the analog or digital signal.

Communication stack Performs the services required to interface the user application to the physical layer.

Control loop A set of connections between blocks used to perform a control algorithm.

CPU Central processing unit.

D

Data Link Layer The second-lowest layer in the ISO seven-layer model (layer two). The Data Link Layer splits data into frames to send on the physical layer, receives acknowledgment frames, and re-transmits frames if they are not received correctly. It also performs error checking to maintain a sound virtual channel to the next layer.

DD See [Device Description](#).

Descriptor A number returned to the application by the NI-FBUS Communications Manager, used to specify a target for future NI-FBUS calls.

Device A sensor, actuator, or control equipment attached to the Fieldbus.

Device address A memory address that you use to access a device in a computer system.

Device Description	A machine-readable description of all the blocks and block parameters of a device.
Device ID	An identifier for a device that the manufacturer assigns. No two devices can have the same device ID.
Device tag	A name you assign to a Fieldbus device.
Directory	A structure for organizing files into convenient groups. A directory is like an address showing where files are located. A directory can contain files or subdirectories of files.
DRAM	Dynamic Random Access Memory. Memory that requires electricity and refreshing to hold data.
Driver	Device driver software installed within the operating system.
E	
EMI	Electromagnetic interference.
Event	An occurrence on a device that causes a Fieldbus entity to send the Fieldbus event message.
F	
Field device	A Fieldbus device connected directly to a Fieldbus.
Fieldbus	An all-digital, two-way communication system that connects control systems to instrumentation. A process control local area network defined by ISA standard S50.02.
Fieldbus cable	Shielded, twisted pair cable made specifically for Fieldbus that has characteristics important for good signal transmission and are within the requirements of the Fieldbus standard.
Fieldbus Foundation	An organization that developed a Fieldbus network specifically based upon the work and principles of the ISA/IEC standards committees.
Fieldbus Network Address	Location of a board or device on the Fieldbus; the Fieldbus node address.
Foundation Fieldbus specification	The communications network specification that the Fieldbus Foundation created.
FP-3000	National Instruments network interface module for the FieldPoint I/O system.

Function block	A named block consisting of one or more input, output, and contained parameters. The block performs some control function as its algorithm. Function blocks are the core components you control a system with. The Fieldbus Foundation defines standard sets of function blocks. There are ten function blocks for the most basic control and I/O functions. Manufacturers can define their own function blocks.
Function Block Application	The block diagram that represents your control strategy.

G

Ground	An intentional or accidental conducting path between an electrical system or circuit and the earth or some conducting body acting in place of the earth. A ground is often used as the common wiring point or reference in a circuit.
--------	---

H

H1	The 31.25 kbit/second type of Fieldbus.
HMI	Human-Machine Interface. A graphical user interface for the process with supervisory control and data acquisition capability.

I

I/O	Input/output.
IEC	International Electrotechnical Commission. A technical standards committee which is at the same level as the ISO.
in.	Inches.
IRQ	Interrupt request.
ISA	Industry Standard Architecture.

K

Kbits	Kilobits.
Kernel	The set of programs in an operating system that implements basic system functions.
Kernel mode	The mode in which device drivers run on Windows NT.

L

LabVIEW DSC	The LabVIEW Datalogging and Supervisory Control (DSC) Module builds on the power of LabVIEW for high channel count and distributed applications. It adds easy networking, channel and I/O management, alarm and event management, historical datalogging, real-time trending, and OPC integration to the LabVIEW environment.
Link	A Foundation Fieldbus network is made up of devices connected by a serial bus. This serial bus is called a link (also known as a segment).
Link Active Scheduler	The Fieldbus device that is currently controlling access to the Fieldbus. A device that is responsible for keeping a link operational. The LAS executes the link schedule, circulates tokens, distributes time, and probes for new devices.
Link master device	A device that is capable of becoming the LAS.
Live list	The list of all devices that are properly responding to the Pass Token.
Lookout	National Instruments Lookout is a full-featured object-based automation software system that delivers unparalleled power and ease of use in demanding industrial measurement and automation applications.
Loop	<i>See</i> Control loop .

M

mA	Milliampere.
Mode	Type of communication.

N

Network address	The Fieldbus network address of a device.
Nifb.exe	The NIFB process that must be running in the background for you to use your PCI-FBUS, AT-FBUS, or PCMCIA-FBUS interface to communicate between the board and the Fieldbus.
NI-FBUS API	The NI-FBUS Communications Manager.
NI-FBUS Communications Manager	Software shipped with National Instruments Fieldbus interfaces that lets you read and write values. It does not include configuration capabilities.

NI-FBUS Configurator	National Instruments Fieldbus configuration software. With it, you can set device addresses, clear devices, change modes, and read and write to the devices.
NI-FBUS Fieldbus Configuration System	<i>See</i> NI-FBUS Configurator.
NI-FBUS process	Process that must be running in the background for you to use your PCI-FBUS, AT-FBUS, or PCMCIA-FBUS interface to communicate between the board and the Fieldbus.

O

Object	An element of an object dictionary.
OPC	OLE for Process Control.

P

Parameter	One of a set of network-visible values that makes up a function block.
PC	Personal Computer.
PCI	Peripheral Component Interconnection.
Physical Layer	The layer of the communication stack that converts digital Fieldbus messages from the communication stack to actual physical signals on the Fieldbus transmission medium and vice versa.
PLC	<i>See</i> Programmable Logic Controller.
Poll	To repeatedly inspect a variable or function block to acquire data.
Programmable Logic Controller	A device with multiple inputs and outputs that contains a program you can alter.

R

Repeater	Boost the signals to and from the further link.
Resistor	Component made of material that opposes flow of current and therefore has some value of resistance.

Resource block A special block containing parameters that describe the operation of the device and general characteristics of a device, such as manufacturer and device name. Only one resource block per device is allowed.

Roundcard A hardware interface for developing Foundation Fieldbus-compliant devices.

S

s Seconds.

Segment *See* [Link](#).

Server Device that receives a message request.

Service Services allow user applications to send messages to each other across the Fieldbus using a standard set of message formats.

Session A communication path between an application and the NI-FBUS Communications Manager.

Signal An extension of the IEEE 488.2 standard that defines a standard programming command set and syntax for device-specific operations.

Stack A set of hardware registers or a reserved amount of memory used for calculations or to keep track of internal operations.

T

Tag A name you can define for a block, virtual field device, or device.

Terminator A device used to absorb the signal at the end of a wire.

Trend A Fieldbus object that allows a device to sample a process variable periodically, then transmit a history of the values on the network.

V

VCR *See* [Virtual Communication Relationship](#).

VFD *See* [Virtual Field Device](#).

Virtual Communication
Relationship

Preconfigured or negotiated connections between virtual field devices on a network.

Virtual Field Device

The virtual field device is a model for remotely viewing data described in the object dictionary. The services provided by the Fieldbus Messaging Specification allow you to read and write information about the object dictionary, read and write the data variables described in the object dictionary, and perform other activities such as uploading/downloading data and invoking programs inside a device. A model for remotely viewing data described in the object dictionary.

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