FOUNDATION™ Fieldbus

Getting Started with Your USB-8486 and the NI-FBUS™ Software for Windows

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NATIONAL INSTRUMENTS™

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This hardware has been tested and found to comply with the applicable regulatory requirements and limits for electromagnetic compatibility (EMC) as indicated in the hardware's Declaration of Conformity (DoC)[1]. These requirements and limits are designed to provide reasonable protection against harmful interference when the hardware is operated in the intended electromagnetic environment. In special cases, for example when either highly sensitive or noisy hardware is being used in close proximity, additional mitigation measures may have to be employed to minimize the potential for electromagnetic interference.

While this hardware is compliant with the applicable regulatory EMC requirements, there is no guarantee that interference will not occur in a particular installation. To minimize the potential for the hardware to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this hardware in strict accordance with the instructions in the hardware documentation and the DoC[1].

If this hardware does cause interference with licensed radio communications services or other nearby electronics, which can be determined by turning the hardware off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna of the receiver (the device suffering interference).
- Relocate the transmitter (the device generating interference) with respect to the receiver.
- Plug the transmitter into a different outlet so that the transmitter and the receiver are on different branch circuits.

Some hardware may require the use of a metal, shielded enclosure (windowless version) to meet the EMC requirements for special EMC environments such as, for marine use or in heavy industrial areas. Refer to the hardware's user documentation and the DoC[1] for product installation requirements.

When the hardware is connected to a test object or to test leads, the system may become more sensitive to disturbances or may cause interference in the local electromagnetic environment.

Operation of this hardware in a residential area is likely to cause harmful interference. Users are required to correct the interference at their own expense or cease operation of the hardware.

Changes or modifications not expressly approved by National Instruments could void the user's right to operate the hardware under the local regulatory rules.

[1] The Declaration of Conformity (DoC) contains important EMC compliance information and instructions for the user or installer. 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.

Contents

About This Manual

This manual contains instructions on how to install and configure the National Instruments USB-8486 and the NI-FBUS software. The USB-8486 is intended for use in computers equipped with a USB port.

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 USB-8486 and the NI-FBUS software in the Windows system environment. Basic installation instructions also can be found in the *FOUNDATION™ Fieldbus Hardware and NI-FBUS Software for Windows Installation Guide*.

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.
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 and hardware labels.
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.
`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.
USB-8486	In this manual, the term *USB-8486* refers to the NI USB-8486 FOUNDATION™ Fieldbus interface card.

Related Documentation

The following documents contain information that 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

Other related documentation:

- *USB Specification, Release 2.0*, Universal Serial Bus (USB)

1

Introduction

This chapter lists what you need to get started and includes a brief description of the USB-8486 hardware and the NI-FBUS software.

What You Need to Get Started

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

- ❑ USB-8486 hardware
- ❑ Installation CD kit
- ❑ Windows installed on your computer

Hardware Description

The USB-8486 is a USB high-power bus-powered device that is compatible with both USB 2.0 High-Speed and Full-Speed ports. The USB-8486 is a FOUNDATION™ Fieldbus interface device which handles communication between a USB-compatible computer and one or more network-configurable devices that comply with the FOUNDATION™ Fieldbus H1 specification. The USB-8486 uses an embedded processor to integrate FOUNDATION™ Fieldbus H1 Stack and supports the FOUNDATION™ Fieldbus transfer rate of 31.25 kb/s.

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, 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 advanced users can use to interface with the National Instruments FOUNDATION™ Fieldbus communication stack and hardware.

Most users use the NI-FBUS Configurator. 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.

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 (necessary if you are setting up a system for the first time). Your configuration software must match the interface card your computer is using to connect to the bus. National Instruments offers the NI-FBUS Configurator with a National Instruments FOUNDATION™ Fieldbus interface card to let you configure your Fieldbus links.

Interface cards and configuration software are sold separately because multiple interface cards 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 (segments). If you have more than four links (ports on the cards), 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 card is viewed as one link by the NI-FBUS Configurator, regardless of how many links might actually be joined by repeaters. This is important for software licensing of the NI-FBUS Configurator.

If you only want to use the card to read and write values only (not configure) and you are a programmer, you can make calls to the API in the NI-FBUS Communications Manager and 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	This must be running for you to use the USB-8486 as a Fieldbus interface to communicate between the card and the bus.	`nifb.exe`
NI-FBUS Interface Configuration Utility	Interface Config	Used to configure the USB-8486.	`fbconf.exe`
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.	`fcs.exe`
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, the 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 also can 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.

2

Installation and Configuration

Note These installation and configuration instructions only apply for Windows.

Installing the Software

Complete the following steps to install your NI-FBUS software.

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

1. Log in as `Administrator` or as a user that has Administrator privileges.
2. Insert the NI-FBUS program CD.
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 disk (usually `a` or `b`).

   The interactive setup program takes you through the necessary steps to install the software.

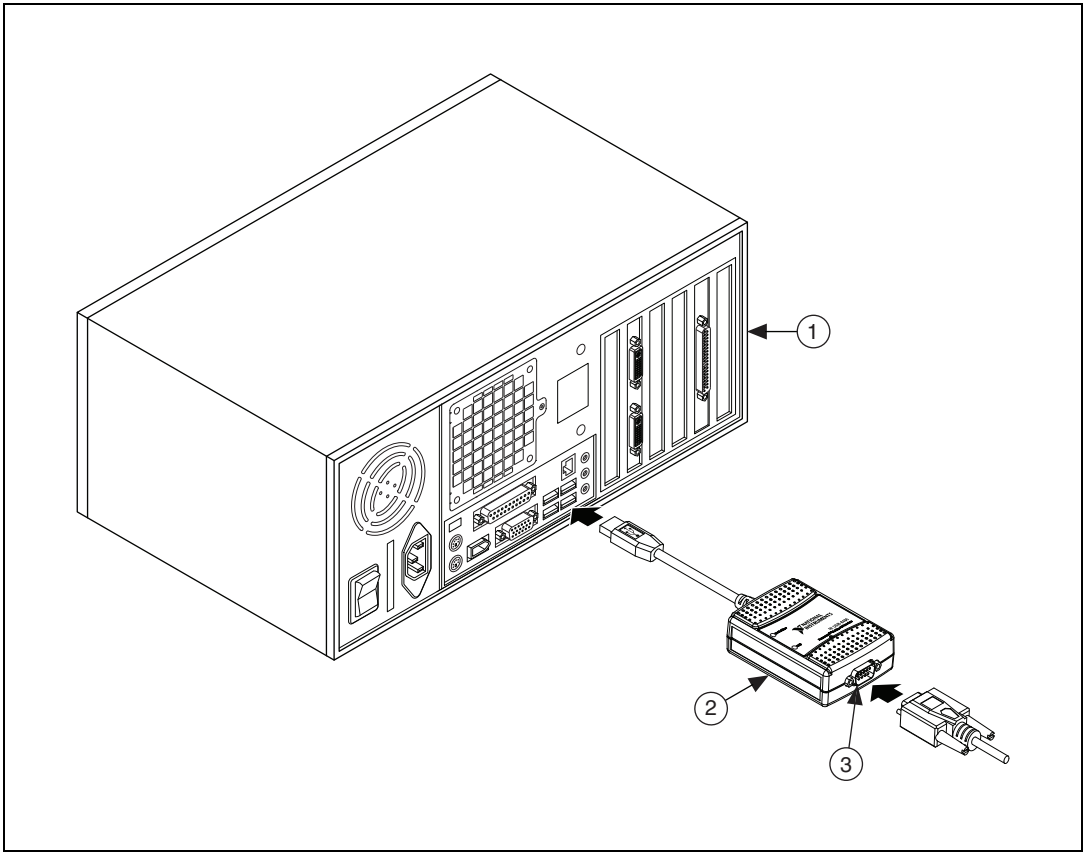
The installation program copies `nifbusb4u.dll` into your `\System32` directory, and it copies the `nifbusb4k.sys` driver into the `\drivers` directory. The installation program also adds information to the Windows Registry.

Continue to the *Installing the Hardware* section to configure and install your card.

Installing the Hardware

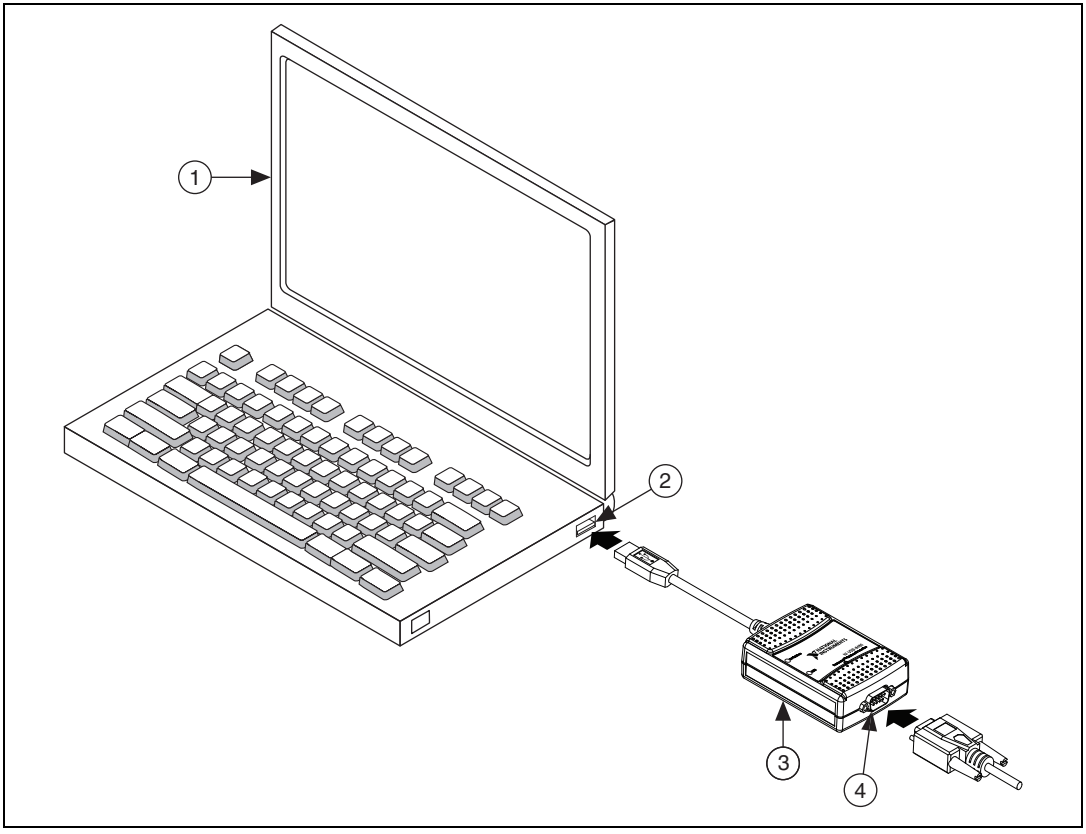
Cautions Operate the USB-8486 only as described in operating instructions.

Do *not* unplug the USB-8486 when the software is running.



1 Desktop PC	2 USB-8486	3 DB-9 Connector

Figure 2-1. Connecting the USB-8486 to a Desktop PC



1 Portable Computer	2 USB Port	3 USB-8486	4 DB-9 Connector

Figure 2-2. Connecting the USB-8486 to a Portable PC

To install the USB-8486, complete the following steps.

1. Power on the computer and allow the operating system to boot.
2. Insert the USB-8486 into an available USB port on the system, as shown in Figure 2-1 or Figure 2-2.
3. Connect the USB-8486 to the Fieldbus network. Refer to the *NI-FBUS Hardware and Software User Manual* for more information about the connectors.
4. Launch the Interface Configuration Utility.
5. Right-click the USB-8486 to enable.
6. Close the Interface Configuration Utility and start the NI-FBUS Communications Manager or NI-FBUS Configurator.

Note Use a USB 2.0 high power port to ensure proper bus powering. For a desktop PC, it is usually a rear USB port.

Setting the Communication Parameters and Interface Name

Complete the following steps to use the NI-FBUS Interface Configuration utility to set the Fieldbus communication parameters and interface name.

1. Start the NI-FBUS Interface Configuration utility by selecting **Start»Programs»National Instruments FBUS»Interface Configuration Utility**.
2. Select the port you want to edit, and click the **Edit** button.

   The NI-FBUS Interface Configuration utility displays the default interface name and some configuration information.
3. Enter an interface name for the port, or use the default name. The interface name is for local use on the PC.
4. Enter a unique tag in the **Device Tag** field, or use the default device tag. The device tag is the name visible on the Fieldbus to the other devices.
5. 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, choose **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, choose **Visitor Address**. Over a long period of time, using a visitor address could break VCR endpoints and cause `VCR_FULL_ERROR` errors.
   c. If you want third-party Fieldbus configuration software to assign an address to your interface over the Fieldbus, choose **Default Address**. You should only choose to use 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.

6. Select a Device Type. You should choose to use **Link Master Device**.
7. Make sure that **NI-FBUS** is selected for **Usage**. 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.

8. Click **OK**, and then click **OK** again to exit the configuration utility.
9. Restart the NIFB process to make the changes you made in the NI-FBUS Interface Configuration utility take effect.
10. Replace the top cover on your computer, if you have not done so already.

Testing the Installation

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

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

If NI-FBUS does not start up successfully, refer to Appendix C, *Troubleshooting and Common Questions*.

Changing or Deleting Existing Interface Information

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»Utilities» Interface Configuration Utility**.
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 installation and configuration instructions earlier in this chapter.

Note If one USB-8486 is unplugged and you want to use other interfaces in the system, delete this USB-8486 from the Interface Configuration Utility before running the NIFB process.

Importing 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»Utilities» Interface Configuration Utility** to run the Interface Configuration utility.
3. Click the **DD Info** button. The **DD Info** dialog box opens.

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. Otherwise, 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 device description. For example, if you import the device description for a National Instruments FOUNDATION™ Fieldbus device, you will find a folder called `4e4943`. This is the manufacturer ID number for National Instruments FOUNDATION™ Fieldbus devices.

The next layer of folders is the device type. Underneath this layer of directories you will find the individual device description files (`.ffo/.ff5` and `.sym/sy5`).

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 opens.
7. Click the **Browse** button, browse to the `.ffo/.ff5` device description file path, and 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` or `.ff5` and one that ends in `.sym` or `sy5`. Select the `.ffo/.ff5` file, and the corresponding `.sym/.sy5` file will be imported automatically. The file name will be in the form *`Digit Digit Digit Digit`*`.ffo/.ff5` (for example, `0101.ffo` or `0101.ff5`).

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.

8. Click **OK**. A window opens that gives the full path to where the `.ffo/.ff5` and `.sym/sy5` files were copied.
9. Click **OK**.

For more information on device descriptions, refer to the *The Role of Device Descriptions* section of the *FOUNDATION™ Fieldbus Overview* document.

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Starting the NIFB Process

The NIFB process must be running any time you want to use your USB-8486 as a Fieldbus interface to communicate between the device and the bus.

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

Beginning to Use Your NI-FBUS Software

If you are using the NI-FBUS Communications Manager, refer to the *NI-FBUS Communication Manager User Manual* for information on using your software. If you are using the NI-FBUS Configurator, refer 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 USB-8486 is configured as a basic device, a link master device must be present on this link before NI-FBUS will start up.

A

Specifications

This appendix describes the electrical, physical, and environmental characteristics of the USB-8486 hardware and the recommended operating conditions.

Bus Interface

USB ..... USB 2.0 High-Speed or Full-Speed[1]

FOUNDATION™ Fieldbus ..... Standard H1 interface[2]

Power Requirement

USB High-power Bus-powered Device

Working Mode Current ..... 300 mA maximum (full temperature range)
180 mA typical (at 25 °C)

Suspend Current ..... 2.5 mA maximum (full temperature range)

Physical

Dimensions ..... 7.87 × 6.35 × 2.54 cm (3.1 × 2.5 × 1.0 in.)

Weight ..... 165 g (5.82 oz)

Captive USB cable length ..... 2 m

I/O connector

- USB ..... Standard series A plug
- FOUNDATION™ Fieldbus H1 Interface ..... 9-pin male D-Sub

[1] Using the USB-8486 in full-speed mode reduces device performance.

[2] Galvanically isolated.

Environment

Operating Environment

Ambient temperature .....0 to 55 °C

Relative humidity .....10 to 90%, noncondensing (tested in accordance with IEC-60068-2-1, IEC-60068-2-2, EC-60068-2-56)

Altitude .....2,000 m

Pollution Degree 2 (IEC-60664-1:2007)

Indoor use only.

Storage Environment

Ambient temperature .....–20 to 70 °C

Relative humidity .....5 to 95%, noncondensing (tested in accordance with IEC-60068-2-1, IEC-60068-2-2, EC-60068-2-56)

Safety

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 60950-1, EN 60950-1
- UL 60950-1, CSA 60950-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note For EMC declarations and certifications, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this device with shielded cables and accessories.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the Declaration of Conformity (DoC) for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit `ni.com/environment/weee`.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

B

Pinout Information

This appendix contains information about the pinout of the Fieldbus connector.

The USB-8486 hardware has a 9-pin male D-SUB (DB-9) connector for the H1 port.

Figure B-1 shows the male DB-9 connector pinout.

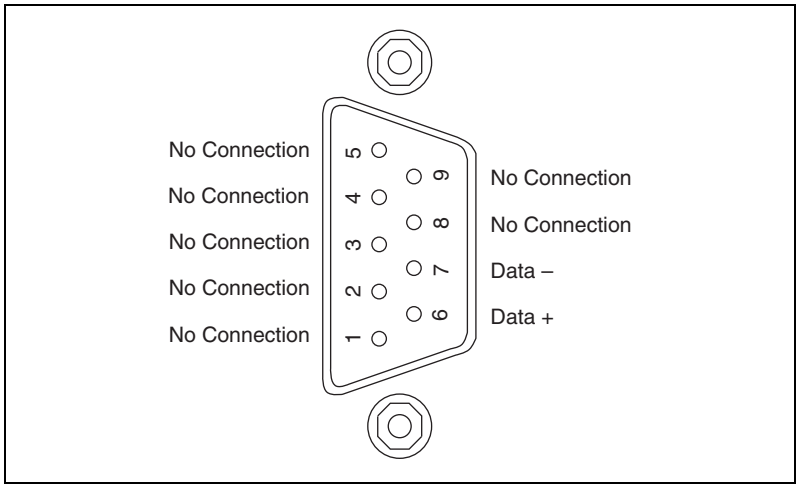


Figure B-1. Male DB-9 Connector Pinout

The pinout of the USB-8486 uses pins 6 and 7 of the connector for the Fieldbus signals as specified in the *Fieldbus Standard for Use in Industrial Control Systems, Part 2, ISA-S50.02.1992*.

9-Pin D-SUB (DB-9) Cable Information

A 2-meter cable has been included in your kit which converts the 9-pin D-SUB connector to three wire pigtails.

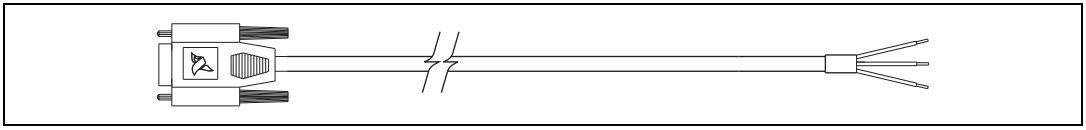


Figure B-2. DB-9 Cable for the USB-8486

Figure B-3 shows the pinout of the 9-pin D-SUB female connector so you can make your own cable if you need a longer cable than the one provided in your kit.

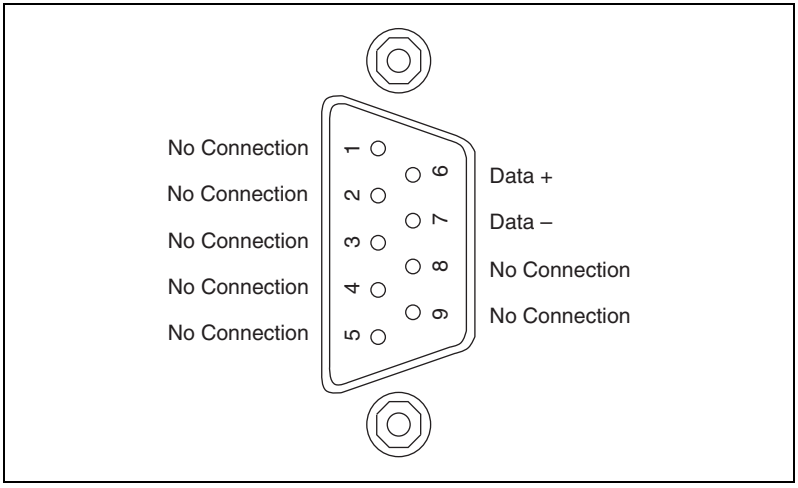


Figure B-3. Pinout for 9-Pin D-SUB Female Connector of the DB-9 Cable

Table B-1 provides the cable pigtail "pinout".

Table B-1. Information for Cable Pigtails

Signal	Color	Size
Data +	Red	22 AWG
Data –	Black	22 AWG
Shield	Green	22 AWG

All of the signals on the three wire pigtails provide a direct corresponding connection to the 9-pin D-SUB.

C

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.

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

NIFB could not locate any usable Fieldbus boards.

Stop the card, remove it, then reinsert it.

Board cannot be found.

- Select **Start»Programs»National Instruments»NI-FBUS»Utilities»Interface Configuration Utility**. Make sure your card appears under the list of interfaces.
- Make sure the kernel-mode driver is started. To start the driver, select **Start»Programs»National Instruments»NI-FBUS»NI-FBUS Communications Manager**. Click the **Start** button. To avoid manual startup in the future, click **Startup** and select **Automatic**.

When using the USB-8486, Nifb returns an error message stating that the configured board does not exist.

Ensure that the USB-8486 has not been unplugged.

- If you want to use the USB-8486 again, complete the following steps.
  1. Connect the USB-8486 to an available USB port on the system.

2. Select **Start»Programs»National Instruments»NI-FBUS» Utilities»Interface Configuration Utility**.

3. Right-click the USB-8486 to enable it.

- If you want to use other interfaces in the system without this USB-8486, complete the following steps.

  1. Select **Start»Programs»National Instruments»NI-FBUS» Utilities»Interface Configuration Utility**.

  2. Right-click the USB-8486 to delete it.

VCR_FULL_ERROR

Delete the card from the Interface Configuration utility, then reinstall.

NIFB Problems

When using the USB-8486, Nifb returns an error message stating that the board cannot be found.

- Select **Start»Programs»National Instruments»NI-FBUS»Utilities»Interface Configuration Utility**. Make sure your card appears under the list of interfaces.
- Make sure the kernel-mode driver is started. To start the driver, select **Start»Programs»National Instruments»NI-FBUS»NI-FBUS Communications Manager**. 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 card. Restart the NIFB process. If it runs successfully, there is probably a Fieldbus network address conflict. If this does not solve the problem, you can try to change the card's 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 card 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 card to a fixed address.

- Check for multiple copies of `nifb.dll` on the machine. If multiple copies are found, NI-FBUS was incorrectly reinstalled. Uninstall NI-FBUS, search for any remaining copies of `nifb.dll`, delete them, then reinstall the software.
- You can check the Windows Device Manager to see if Windows has detected any problems or conflicts in the resources assigned to your card. Your card(s) will appear under the **Fieldbus Adapters** category. The Device Manager displays an exclamation mark (**!**) on the icon of any card that has resource conflicts.
- Check how many cards are showing up in the Interface Configuration utility. Make sure that this matches the number of cards in the system. Also check that the number of ports match the physical hardware (one port versus two port cards).
- Link masters do not always get along together if you have another link master on the link. Try setting the card to be a basic device in the Interface Configuration utility.

  If a USB-8486 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 information about Basic and Link Master devices, refer to the *Fieldbus Overview* document.

Interface Configuration Problems

When using the NI-FBUS Interface Configuration utility, the error message utility could not access or locate the registry appears.

- Make sure you are logged in to Windows with Administrator privileges.
- Your registry entries for NI-FBUS may have been deleted or corrupted. Uninstall, then reinstall the NI-FBUS software as described in the *Installing the Software* section of Chapter 2, *Installation and Configuration*.
- For the USB-8486, removing third-party card manager software also has been known to correct such problems.

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

Select **Edit** for the extra card. In the next window, select **Delete**.

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

Add New Hardware Problems

In Add New Hardware on Windows, there is no category for Fieldbus.

The category **Fieldbus Adapters** will not appear under the type of hardware listing in **Add New Hardware** unless you restart the computer twice after installing the software. After you install your first card, it will always show up.

Resolving Resource Conflicts

Use a Visitor Address

Using a visitor address is a good way to troubleshoot an address conflict since the card 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»Utilities»Dialog**.
3. Right-click **Open Descriptors** and choose **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 by selecting **Read Object** from **Open Descriptors»Session»Interface Name»Device Name»VFD Name»Resource Block Name**.
6. Select the **Read by Name** radio button and enter *MANUFAC_ID* as the name. Click the **Read** button. Write down the hexidecimal number found in parenthesis (0x*number*) in Table C-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 through 9 for each device, then close the NI-FBUS Dialog utility.

Table C-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. 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 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 import them properly by clicking **DD Info** and using the **Import DD** button in the Interface Configuration utility.
15. Repeat steps 12 through 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 from the bus.

In the NI-FBUS Interface Configuration utility, click the **Advanced** button on the dialog box for the port you want to configure. Figure C-1 shows the **Advanced Stack Configuration** dialog box.

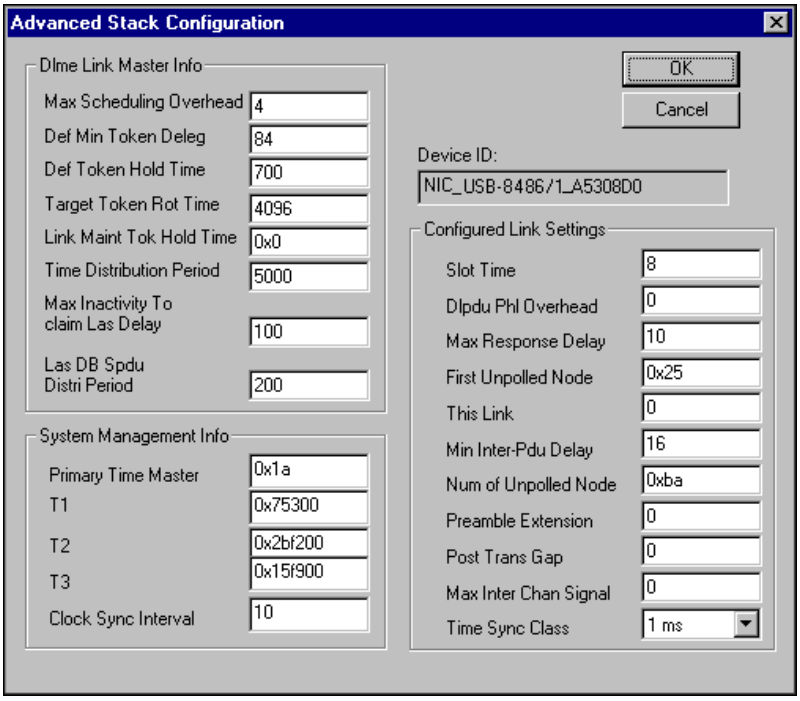


Figure C-1. Advanced Stack Configuration Dialog Box

The parameters involved in setting addresses are T1 and T3. These parameters represent delay time values that your card 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.

USB-8486 Troubleshooting

The H1 Fieldbus LED flashes red.

The USB-8486 encountered an error during the Power-On Self-Test (P.O.S.T.). Complete the following steps to correct the issue.

1. Remove the USB-8486 from the computer and close NI-FBUS Communications Manager.
2. Connect the USB-8486 to another USB port in the system.
3. Start the NI-FBUS Communication Manager.

If the H1 Fieldbus LED still flashes red, contact National Instruments through the information provided in Appendix D, *Technical Support and Professional Services*.

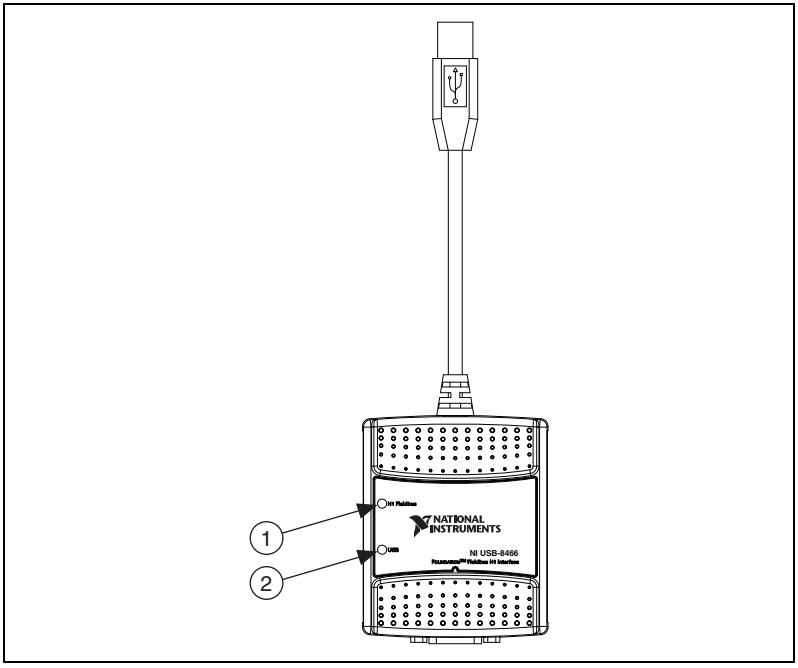
The H1 Fieldbus LED is solid red.

The USB-8486 H1 Fieldbus port encountered a fatal network error. Complete the following steps to correct the issue.

1. Remove the USB-8486 from the computer and close NI-FBUS Communications Manager
2. Re-connect the USB-8486 to the USB port of the system again.
3. Restart the NI-FBUS Communication Manager and check the H1 Fieldbus LED state.

USB-8486 LED Indicators

The USB-8486 has two LED indicators on the front panel, as shown in Figure C-2.



1	H1 Fieldbus Port Status	2	USB Status

Figure C-2. LEDs on the USB-8486

The USB LED is located on the front of the USB-8486, as shown in Figure C-2. It indicates whether the USB-8486 is powered, configured, and operating properly. Table C-2 shows how to interpret the USB LED states.

Table C-2. Interpretation of USB-8486 USB STATUS LED

LED State	Meaning
Off	There is no power on the USB port , the USB-8486 is disabled, or an error has occurred.
Solid green	The USB-8486 is working in USB 2.0 full speed mode.
Solid amber	The USB-8486 is working in USB 2.0 high speed mode.

The H1 Fieldbus port on the USB-8486 has an LED to indicate the functional states of the port. Table C-3 describes each state.

Table C-3. Interpretation of USB-8486 H1 Fieldbus Status LED

LED State	Meaning
Off	The USB-8486 has not been initialized.
Solid green	The Fieldbus port is disconnected from the network or receiving nothing.
Slow flashing green	The Fieldbus port is only receiving/transmitting network maintenance packets.
Fast flashing green	The Fieldbus port is receiving/ transmitting payload traffic packets.
Flashing red	The USB-8486 encountered an error during the P.O.S.T.
Solid red	The Fieldbus port encountered a fatal network error.

For more information about error handling, refer to the *Error Messages* section of this appendix.

D

Technical Support and Professional Services

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

- **Support**—Technical support at ni.com/support includes the following resources:
  - **Self-Help Technical Resources**—For answers and solutions, visit ni.com/support for software drivers and updates, a searchable KnowledgeBase, product manuals, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on. Registered users also receive access to the NI Discussion Forums at ni.com/forums. NI Applications Engineers make sure every question submitted online receives an answer.
  - **Standard Service Program Membership**—This program entitles members to direct access to NI Applications Engineers via phone and email for one-to-one technical support as well as exclusive access to on demand training modules via the Services Resource Center. NI offers complementary membership for a full year after purchase, after which you may renew to continue your benefits.

    For information about other technical support options in your area, visit ni.com/services, or contact your local office at ni.com/contact.
- **Training and Certification**—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. 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, National Instruments Alliance Partner 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 electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting `ni.com/certification`.

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
µ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^{3}

Numbers

4–20 mA system — Traditional control system in which a computer or control unit provides control for a network of devices controlled by 4-20 mA signals.

A

Address — Character code that identifies a specific location (or series of locations) in memory.

Alarm — A notification the NI-FBUS Communications Manager software sends when it detects that a block leaves or returns to a particular state.

API — Application Programmer Interface.

Attribute — Properties of parameters.

B

b — Bits.

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 busses are the ISA and PCI buses.

C

C	Celsius.
Cable	A number of wires and shield in a single sheath.
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.
Control strategy	*See* Function Block Application.
Controller	An intelligent device (usually involving a CPU) that is capable of controlling other devices.

D

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 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.
DLL	*See* Dynamic Link Library.
Driver	Device driver software installed within the operating system.
Dynamic Link Library	A library of functions and subroutines that links to an application at run time.

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 Messaging Specification	The layer of the communication stack that defines a model for applications to interact over the Fieldbus. The services FMS provides allow you to read and write information about the OD, read and write the data variables described in the OD, and perform other activities such as uploading/downloading data and invoking programs inside a device.
Fieldbus Network Address	Location of a board or device on the Fieldbus; the Fieldbus node address.
FMS	*See* Fieldbus Messaging Specification.
FOUNDATION™ Fieldbus specification	The communications network specification that the Fieldbus Foundation created.

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.

H

H1	The 31.25 kbit/second type of Fieldbus.
hex	Hexadecimal. A base-16 numbering system which uses 0–9 and A–F.
HMI	Human-Machine Interface. A graphical user interface for the process with supervisory control and data acquisition capability.
Hz	Hertz.

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

Kb	Kilobytes.
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.
LAS	*See* Link Active Scheduler.
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 Schedule	A schedule of times in the macrocycle when devices must publish their output values on the Fieldbus.
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	*See* Control loop.

M

m	Meters.
Manufacturer's identification	An identifier used to correlate the device type and revision with its device description and device description revision.
Menu	An area accessible from the command bar that displays a subset of the possible command choices. In the NI-FBUS Configurator, refers to menus defined by the manufacturer for a given block.
Method	Methods describe operating procedures to guide a user through a sequence of actions.

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, PCMCIA-FBUS, or USB-8486 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	*See* NI-FBUS Configurator.
NI-FBUS process	Process that must be running in the background for you to use your PCI-FBUS, PCMCIA-FBUS, or USB-8486 interface to communicate between the board and the Fieldbus.

O

Object	An element of an object dictionary.
Object Dictionary	A structure in a device that describes data that can be communicated on the Fieldbus. The object dictionary is a lookup table that gives information such as data type and units about a value that can be read from or written to a device.
OD	*See* 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.

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	*See* Programmable Logic Controller.
Poll	To repeatedly inspect a variable or function block to acquire data.
Port	A communications connection on a computer or remote controller.
Program	A set of instructions the computer can follow, usually in a binary file format, such as a `.exe` file.
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.
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.
Sensor	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
Server	Device that receives a message request.
Session	A communication path between an application and the NI-FBUS Communications Manager.
Shield	Metal grounded cover used to protect a wire, component or piece of equipment from stray magnetic and/or electric fields.

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.
Static library	A library of functions/subroutines that you must link to your application as one of the final steps of compilation, as opposed to a Dynamic Link Library, which links to your application at run time.

T

Tag	A name you can define for a block, virtual field device, or device.
Trend	A Fieldbus object that allows a device to sample a process variable periodically, then transmit a history of the values on the network.

U

USB	Universal Serial Bus.
USB-8486	NI USB-8486 FOUNDATION™ Fieldbus interface.

V

V	Volts
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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