

# *Fieldbus*

---

**Getting Started With Your  
HSE Linking Device and  
the NI-FBUS™ Software**

## **Worldwide Technical Support and Product Information**

ni.com

### **National Instruments Corporate Headquarters**

11500 North Mopac Expressway Austin, Texas 78759-3504 USA Tel: 512 683 0100

### **Worldwide Offices**

Australia 1800 300 800, Austria 43 0 662 45 79 90 0, Belgium 32 0 2 757 00 20, Brazil 55 11 3262 3599,  
Canada (Calgary) 403 274 9391, Canada (Montreal) 514 288 5722, Canada (Ottawa) 613 233 5949,  
Canada (Québec) 514 694 8521, Canada (Toronto) 905 785 0085, Canada (Vancouver) 514 685 7530,  
China 86 21 6555 7838, Czech Republic 420 2 2423 5774, Denmark 45 45 76 26 00,  
Finland 385 0 9 725 725 11, France 33 0 1 48 14 24 24, Germany 49 0 89 741 31 30, Greece 30 2 10 42 96 427,  
India 91 80 51190000, Israel 972 0 3 6393737, Italy 39 02 413091, Japan 81 3 5472 2970,  
Korea 82 02 3451 3400, Malaysia 603 9131 0918, Mexico 001 800 010 0793, Netherlands 31 0 348 433 466,  
New Zealand 1800 300 800, Norway 47 0 66 90 76 60, Poland 48 0 22 3390 150, Portugal 351 210 311 210,  
Russia 7 095 238 7139, Singapore 65 6226 5886, Slovenia 386 3 425 4200, South Africa 27 0 11 805 8197,  
Spain 34 91 640 0085, Sweden 46 0 8 587 895 00, Switzerland 41 56 200 51 51, Taiwan 886 2 2528 7227,  
Thailand 662 992 7519, United Kingdom 44 0 1635 523545

For further support information, refer to the *Technical Support and Professional Services* appendix. To comment on the documentation, send email to [techpubs@ni.com](mailto:techpubs@ni.com).

# Important Information

---

## Warranty

The media on which you receive National Instruments software are warranted not to fail to execute programming instructions, due to defects in materials and workmanship, for a period of 90 days from date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace software media that do not execute programming instructions if National Instruments receives notice of such defects during the warranty period. National Instruments does not warrant that the operation of the software shall be uninterrupted or error free.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. National Instruments will pay the shipping costs of returning to the owner parts which are covered by warranty.

National Instruments believes that the information in this document is accurate. The document has been carefully reviewed for technical accuracy. In the event that technical or typographical errors exist, National Instruments reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should consult National Instruments if errors are suspected. In no event shall National Instruments be liable for any damages arising out of or related to this document or the information contained in it.

EXCEPT AS SPECIFIED HEREIN, NATIONAL INSTRUMENTS MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S RIGHT TO RECOVER DAMAGES CAUSED BY FAULT OR NEGLIGENCE ON THE PART OF NATIONAL INSTRUMENTS SHALL BE LIMITED TO THE AMOUNT THEREOF PAID BY THE CUSTOMER. NATIONAL INSTRUMENTS WILL NOT BE LIABLE FOR DAMAGES RESULTING FROM LOSS OF DATA, PROFITS, USE OF PRODUCTS, OR INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY THEREOF. This limitation of the liability of National Instruments will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against National Instruments must be brought within one year after the cause of action accrues. National Instruments shall not be liable for any delay in performance due to causes beyond its reasonable control. The warranty provided herein does not cover damages, defects, malfunctions, or service failures caused by owner's failure to follow the National Instruments installation, operation, or maintenance instructions; owner's modification of the product; owner's abuse, misuse, or negligent acts; and power failure or surges, fire, flood, accident, actions of third parties, or other events outside reasonable control.

## Copyright

Under the copyright laws, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of National Instruments Corporation.

## Trademarks

FieldPoint™, LabVIEW™, Lookout™, National Instruments™, NI™, ni.com™, and NI-FBUS™ are trademarks of National Instruments Corporation.

Product and company names mentioned herein are trademarks or trade names of their respective companies.

## Patents

For patents covering National Instruments products, refer to the appropriate location: **Help»Patents** in your software, the `patents.txt` file on your CD, or `ni.com/patents`.

## WARNING REGARDING USE OF NATIONAL INSTRUMENTS PRODUCTS

(1) NATIONAL INSTRUMENTS PRODUCTS ARE NOT DESIGNED WITH COMPONENTS AND TESTING FOR A LEVEL OF RELIABILITY SUITABLE FOR USE IN OR IN CONNECTION WITH SURGICAL IMPLANTS OR AS CRITICAL COMPONENTS IN ANY LIFE SUPPORT SYSTEMS WHOSE FAILURE TO PERFORM CAN REASONABLY BE EXPECTED TO CAUSE SIGNIFICANT INJURY TO A HUMAN.

(2) IN ANY APPLICATION, INCLUDING THE ABOVE, RELIABILITY OF OPERATION OF THE SOFTWARE PRODUCTS CAN BE IMPAIRED BY ADVERSE FACTORS, INCLUDING BUT NOT LIMITED TO FLUCTUATIONS IN ELECTRICAL POWER SUPPLY, COMPUTER HARDWARE MALFUNCTIONS, COMPUTER OPERATING SYSTEM SOFTWARE FITNESS, FITNESS OF COMPILERS AND DEVELOPMENT SOFTWARE USED TO DEVELOP AN APPLICATION, INSTALLATION ERRORS, SOFTWARE AND HARDWARE COMPATIBILITY PROBLEMS, MALFUNCTIONS OR FAILURES OF ELECTRONIC MONITORING OR CONTROL DEVICES, TRANSIENT FAILURES OF ELECTRONIC SYSTEMS (HARDWARE AND/OR SOFTWARE), UNANTICIPATED USES OR MISUSES, OR ERRORS ON THE PART OF THE USER OR APPLICATIONS DESIGNER (ADVERSE FACTORS SUCH AS THESE ARE HEREAFTER COLLECTIVELY TERMED "SYSTEM FAILURES"). ANY APPLICATION WHERE A SYSTEM FAILURE WOULD CREATE A RISK OF HARM TO PROPERTY OR PERSONS (INCLUDING THE RISK OF BODILY INJURY AND DEATH) SHOULD NOT BE RELIANT SOLELY UPON ONE FORM OF ELECTRONIC SYSTEM DUE TO THE RISK OF SYSTEM FAILURE. TO AVOID DAMAGE, INJURY, OR DEATH, THE USER OR APPLICATION DESIGNER MUST TAKE REASONABLY PRUDENT STEPS TO PROTECT AGAINST SYSTEM FAILURES, INCLUDING BUT NOT LIMITED TO BACK-UP OR SHUT DOWN MECHANISMS. BECAUSE EACH END-USER SYSTEM IS CUSTOMIZED AND DIFFERS FROM NATIONAL INSTRUMENTS' TESTING PLATFORMS AND BECAUSE A USER OR APPLICATION DESIGNER MAY USE NATIONAL INSTRUMENTS PRODUCTS IN COMBINATION WITH OTHER PRODUCTS IN A MANNER NOT EVALUATED OR CONTEMPLATED BY NATIONAL INSTRUMENTS, THE USER OR APPLICATION DESIGNER IS ULTIMATELY RESPONSIBLE FOR VERIFYING AND VALIDATING THE SUITABILITY OF NATIONAL INSTRUMENTS PRODUCTS WHENEVER NATIONAL INSTRUMENTS PRODUCTS ARE INCORPORATED IN A SYSTEM OR APPLICATION, INCLUDING, WITHOUT LIMITATION, THE APPROPRIATE DESIGN, PROCESS AND SAFETY LEVEL OF SUCH SYSTEM OR APPLICATION.

# Contents

---

## About This Manual

How To Use the Manual Set .....	vii
Conventions .....	viii
Related Documentation.....	ix

## Chapter 1

### Introduction

What You Need to Get Started .....	1-1
Hardware Description .....	1-1
Software Description .....	1-1
NI-FBUS Interface Configuration Utility .....	1-2
Choosing Configuration Software.....	1-2
Optional Fieldbus Network Tools.....	1-4

## Chapter 2

### Installation and Configuration

Installing the Software .....	2-1
Installing the HSE Linking Device .....	2-2
Setting the NI-FBUS Software to Use Your HSE Linking Device .....	2-3
Setting the Ethernet Interface .....	2-3
Setting the HSE Linking Device .....	2-5
Setting the H1 Port Communication Parameters and Interface Name .....	2-7
Testing the Installation.....	2-8
Changing or Deleting Existing Interface Information.....	2-8
Importing Device Descriptions .....	2-9

## Chapter 3

### Starting the NIFB Process

Beginning to Use Your NI-FBUS Software .....	3-1
--	-----

## Appendix A

### Troubleshooting and Common Questions

**Appendix B**  
**Technical Support and Professional Services**

**Glossary**

**Index**

# About This Manual

---

This manual contains instructions on how to install and configure the NI-FBUS software with HSE Linking Device. The HSE Linking Device is an HSE device used to attach H1 links to the High Speed Ethernet.

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 assumes that you are already familiar with your Windows operating system.

## How To Use the Manual Set

---

Refer to 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.

Refer to this getting started manual to install and configure the NI-FBUS software with your HSE linking device.

If you are using the National Instruments FBUS-HSE/H1 Linking Device as your HSE linking device, to install the HSE linking device, refer to the *Installation Guide: FBUS-HSE/H1 LD Fieldbus Network Module Linking Device* and the *FBUS-HSE/H1 Linking Device (LD) User Manual*.

If you are using an HSE linking device from a third-party vendor, refer to the installation guide or user manual provided from the vendor to install your HSE linking device.

If you are using the NI-FBUS Configurator, refer to 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), refer to the *NI-FBUS Communications Manager User Manual* to learn how to use the NI-FBUS Communications Manager API for your application. Refer to 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.

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, which includes H1 and HSE 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 is also 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 <i>NI-FBUS software</i> refers to either the NI-FBUS Communications Manager or NI-FBUS Configurator software.
<b>Platform</b>	Text in this font denotes a specific platform and indicates that the text following it applies only to that platform.

## 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.
  - `fieldbus.org`

### 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 `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 HSE Linking Device and the NI-FBUS software.

## What You Need to Get Started

---

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

- HSE linking device
- Installation disks
- Ethernet adapter installed on your computer
- Windows 2000/NT/XP installed on your computer

## Hardware Description

---

Foundation Fieldbus includes both H1 (31.25 kbit/s) and High Speed Ethernet (100 Mbit/s) specifications. HSE Linking Device is an HSE (high-speed Ethernet) device used to integrate H1 fieldbus segments into the HSE backbone from an Ethernet-based network. The HSE Linking Device provides standard UDP/TCP access to H1 field devices.

## 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 or linking device 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 H1 and/or HSE 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 can also 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 or linking device; 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

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

Interface boards, linking devices and configuration software are sold separately because multiple interface boards can reside in the same computer and multiple HSE linking devices can be accessed through the ethernet network. By default, the NI-FBUS Configurator is licensed for use on one machine, with up to four Fieldbus links (segments). If you have more than four links (ports on the boards or linking devices), 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](http://ni.com/fieldbus).



**Note** The connection to one interface port on the interface board or linking devices 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 want to use the board or linking device to read and write values only (but not configure) and you are a programmer, you can make calls to the API in the NI-FBUS Communications Manager and would not need the NI-FBUS Configurator. This would be possible only if you already have 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 HSE linking device as a Fieldbus interface to communicate between the linking device and the bus.	<code>nifb.exe</code>
NI-FBUS Interface Configuration Utility	Interface Config	Used to configure your HSE link and HSE linking device.	<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 the 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.

---

# Installation and Configuration

---

## Installing the Software

---

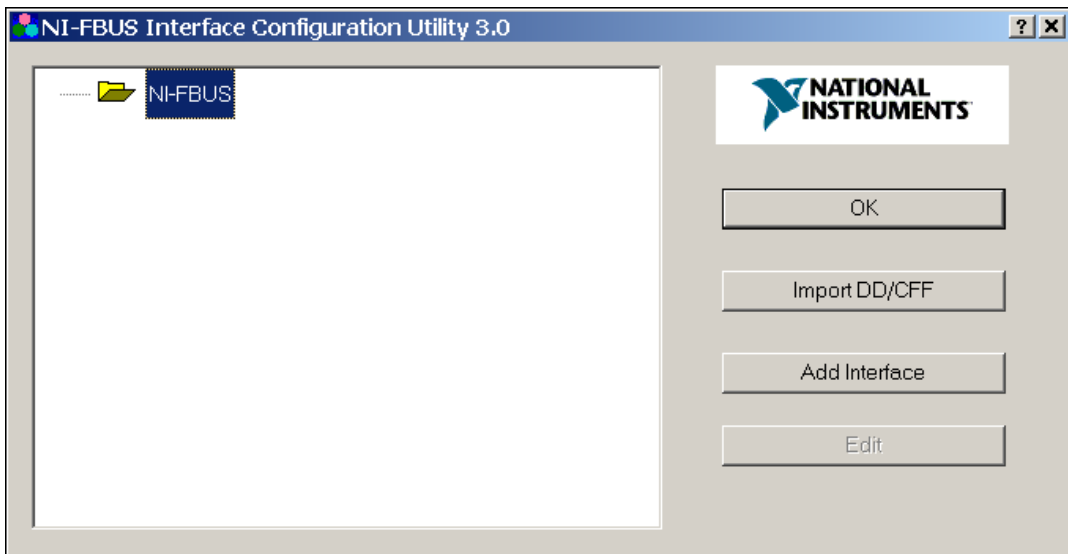
(Windows 2000/NT/XP) Complete the following steps to install your NI-FBUS software:



**Caution** If you are reinstalling the NI-FBUS software over an existing version, write down your board configuration and any port configuration parameters you changed from the default settings. 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 installation disk 1 or your NI-FBUS program CD.
3. Select **Start»Run**.
4. In the Run dialog box, enter `x:\setup`, where `x` is the letter of the drive containing the disk (usually `a` or `b`).
5. The interactive setup program takes you through the necessary steps to install the software.
6. At the end of the setup, the installer starts the NI-FBUS Interface Configuration Utility as shown in Figure 2-1. If you have not yet installed your HSE linking device, click **OK** to return. You will install your HSE linking device in a later step.

The installation program copies `nifb.dll` into the `\System32` directory. The installation program also adds information to the Windows Registry.



**Figure 2-1.** The NI-FBUS Interface Configuration Utility

Continue to the *Installing the HSE Linking Device* section to configure and install your HSE linking device.

## Installing the HSE Linking Device

---

If you are using a National Instruments FBUS-HSE/H1 Linking Device as your HSE linking device, refer to the *Installation Guide: FBUS-HSE/H1 LD Fieldbus Network Module Linking Device* and the *FBUS-HSE/H1 Linking Device (LD) User Manual* for installation instructions.

If you are using an HSE linking device from a third-party vendor, refer to the documentation provided by the vendor to install your HSE linking device.

# Setting the NI-FBUS Software to Use Your HSE Linking Device

---

After you have configured and installed your HSE linking device, you are ready to set the NI-FBUS software.

To do this, you first must set the Ethernet interface. The Ethernet interface is an HSE interface that accesses an HSE linking device or HSE field device.

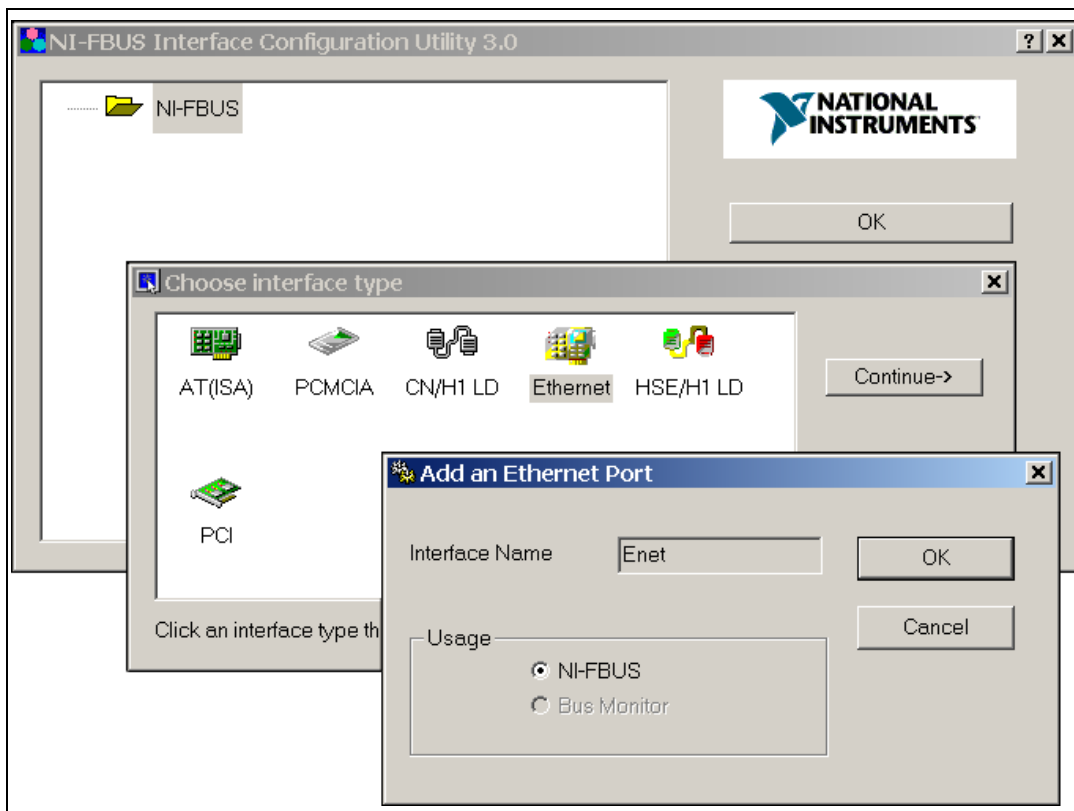


**Note** You can connect only one NI-FBUS port to a link or Fieldbus segment.

## Setting the Ethernet Interface

Use the NI-FBUS Interface Configuration Utility to add, view, or change your Ethernet interface.

1. Start the NI-FBUS Interface Configuration Utility. Select **Start» Programs»National Instruments»NI-FBUS»Interface Configuration Utility**.
2. In the Interface Config window, select the icon of the Ethernet board you want to change and click **Edit**. If you are adding the Ethernet interface, click **Add Interface**.
3. Choose **Ethernet** as the **Interface Type**. The NI-FBUS Interface Configuration Utility displays the Ethernet interface name and some configuration information as shown in Figure 2-2. You cannot change the name for the Ethernet interface. Click **OK**.



**Figure 2-2.** Add the Ethernet Interface



**Note** Only one Ethernet interface can be added in the NI-FBUS software. If one Ethernet interface already exists in the interface list, the interface type **Ethernet** will be prohibited, and you cannot add a new Ethernet interface.

4. If you click **Edit**, the NI-FBUS Interface Configuration Utility displays the network communication information for the Ethernet interface
5. Change the network communication parameter settings to the settings you want.



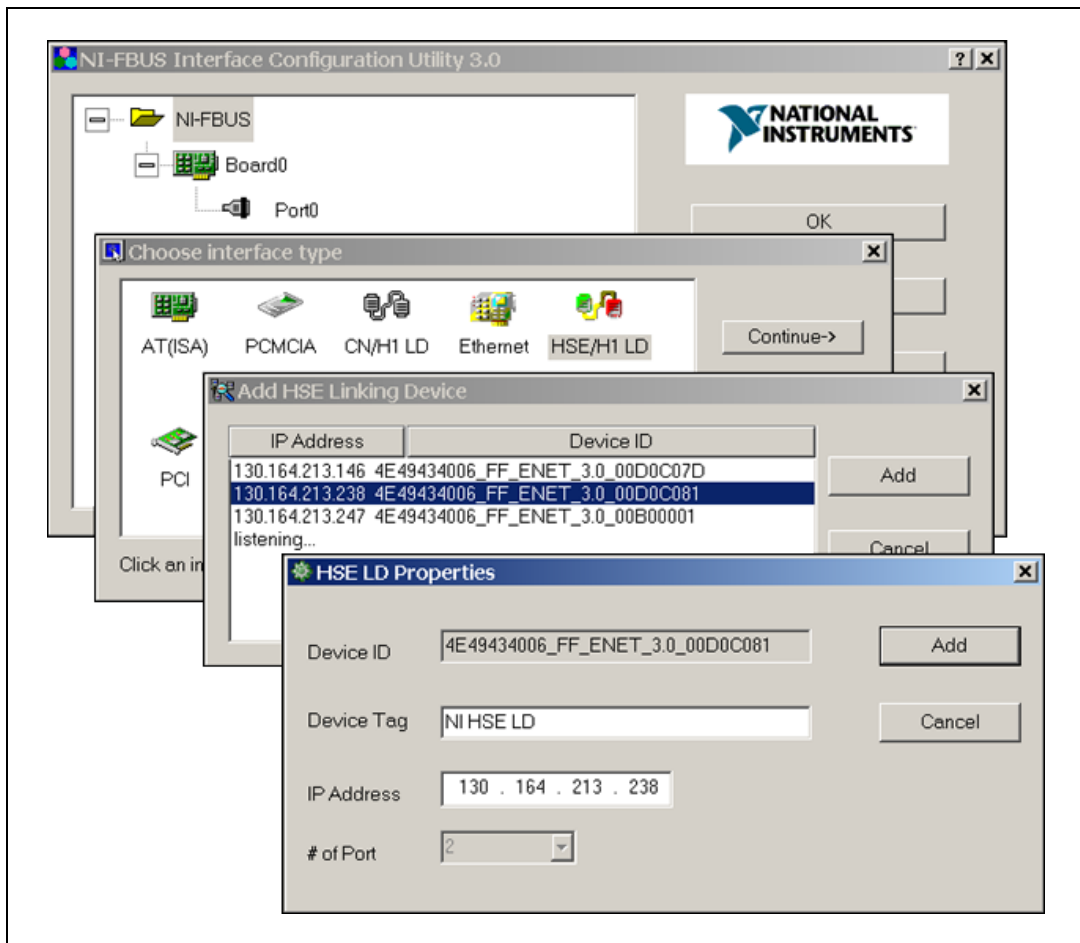
**Caution** Do *not* modify the network communication parameters without good reason. If settings are incorrectly modified, the NI-FBUS software might not work well.

6. After verifying the information you just entered, click **OK**.

## Setting the HSE Linking Device

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 Utility**.
2. In the Interface Config window, select the icon of the HSE Linking Device you want to change and click **Edit**. If you are adding the HSE linking device, click **Add Interface**.
3. Choose **HSE/H1 LD** as the **Interface Type**. The NI-FBUS Interface Configuration Utility listens on the Ethernet network and lists the found HSE linking devices with their IP addresses and Device IDs.
4. Select the HSE linking device you want to add, and click **Add**.
5. The NI-FBUS Interface Configuration Utility displays the device ID, device tag, IP address, and port number of the linking device as shown in Figure 2-3.



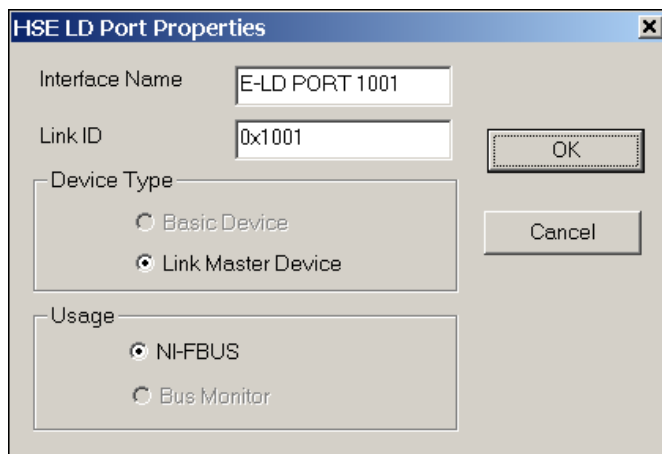
**Figure 2-3.** Add the HSE Linking Device

6. If the **Device Tag** field is blank, enter a unique tag. The device tag is the name visible on the HSE Fieldbus to other devices.
7. After verifying the information you just entered, click **OK** or **Add**. The dialog box for entering port information for the Fieldbus interface appears.
8. Click **OK**.

## Setting the H1 Port 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 Utility**.
2. Select the port you want to edit, and click **Edit**.
3. The NI-FBUS Interface Configuration Utility displays the default interface name and some configuration information as shown in Figure 2-4.



**Figure 2-4.** HSE Linking Device Port Properties

4. Enter an **Interface Name** for the port, or use the default name. The interface name is for local use on the PC. It must be unique within a PC, but the same linking device may be referenced by different interface names in different PCs.
5. Enter a unique link ID in the **Link ID** field, or use the default link ID. The default link ID is read from the HSE linking device, or is assigned by the NI-FBUS if the link ID read from the HSE linking device is invalid. The valid link ID number starts from 0x1001. When NIFB is starting up, it will set the link ID of the H1 port as the link ID number you set here, and set the H1 address as 0x10.



**Caution** Do not modify the link ID parameter without good reason. If the link ID is incorrectly modified, this port on the HSE linking device might not work well with NI-FBUS software on other PCs.

6. Select a Device Type. You should select **Link Master Device**.
7. Make sure that **NI-FBUS** is selected for **Usage**.
8. Click **OK**.
9. Repeat steps 2 through 8 for each port on the HSE linking device.
10. Click **OK** again to exit the configuration utility.
11. Restart the NIFB process by selecting **Start»Programs»National Instruments»NI-FBUS»NI-FBUS Communications Manager** for the changes you made in the NI-FBUS Interface Configuration Utility take effect.

## Testing the Installation

---

Start the NIFB process by selecting **Start»Programs»National Instruments»NI-FBUS»NI-FBUS Communications Manager**. The NIFB process must be running in the background to use a Fieldbus application.

On successful startup, the NIFB displays a message confirming successful process startup, 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 this message to display.

If NI-FBUS does not start up successfully, the configuration for the Ethernet interface or the HSE linking device might be incorrect. If the NIFB process does not start up successfully, refer to Appendix A, [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»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 **Edit**. You can edit the interface configuration information that you entered earlier, or you can click **Delete** to delete this interface entirely.

Interfaces are numbered beginning with zero. If you delete an interface, the NI-FBUS Interface Configuration Utility rennumbers 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

To reinstall the interface, refer to the installation and configuration instructions earlier in this chapter.

## Importing Device Descriptions

---

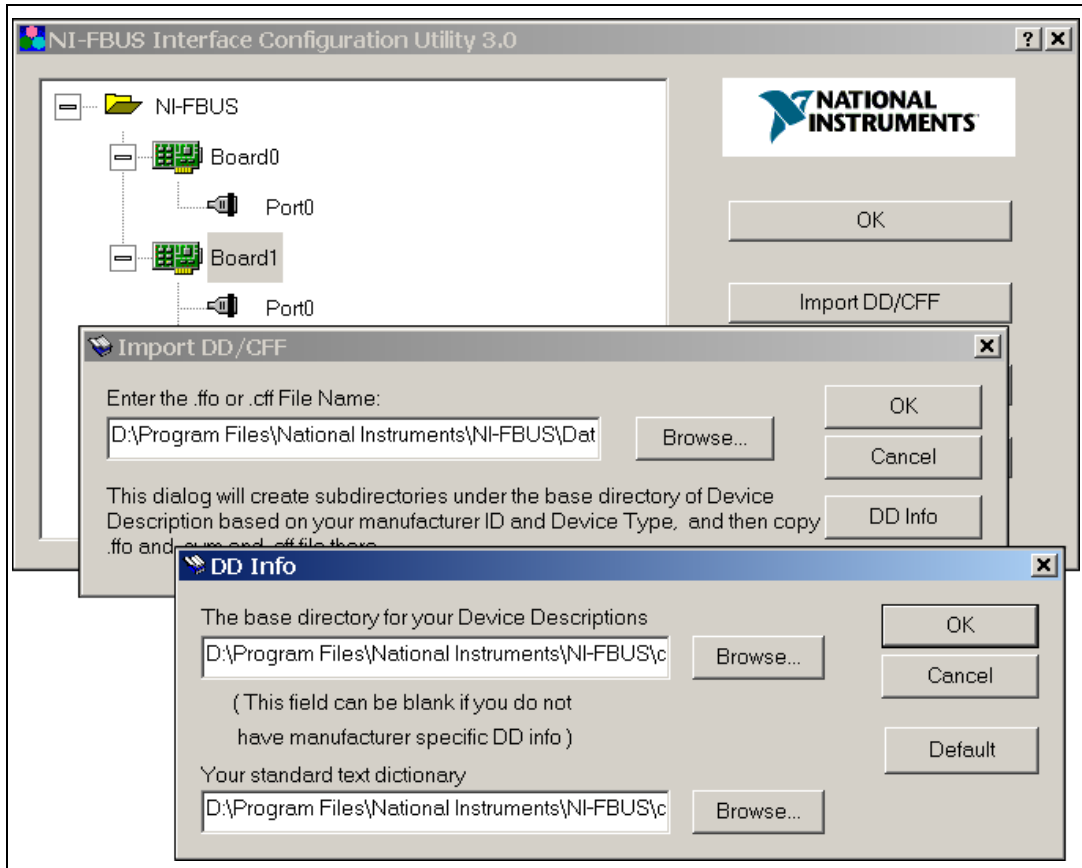
The device description files contain information about the types of blocks and parameters supported by your Fieldbus device, along with online help describing the uses of given parameters. If your Fieldbus device uses manufacturer-specific device description files, you must import the device description 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»Interface Configuration Utility** to run the Interface Configuration Utility.
3. Click **Import DD/CFF**. The Import DD/CFF dialog box appears.
4. Click **Browse**, browse to the `.ffo` 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` 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.

5. Click **OK**. A window appears that gives the full path to which the `.ffo` and `.sym` files were copied.
6. Click **DD Info**. The DD Info dialog box appears as shown in Figure 2-5.



**Figure 2-5.** Import DD file

7. 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 a 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 called 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).

8. If necessary, click **Browse** to select the standard text dictionary, provided with NI-FBUS. The text dictionary has a .dct extension.
9. Click **OK**.

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

---

## Starting the NIFB Process

The NIFB process must be running any time you want to use your HSE linking devices as the Fieldbus interfaces to communicate between the linking device and the bus.

On successful startup, the NIFB displays a message confirming successful process startup, 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 this message to display.

---

## 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.

---

# 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 *Installing the Software* section of Chapter 2, *Installation and Configuration*.

### **The HSE linking device cannot be found.**

- Verify the HSE Linking device settings as described in the *Setting the HSE Linking Device* section of Chapter 2, *Installation and Configuration*.
- Select **Start»Programs»National Instruments»NI-FBUS»Interface Configuration Utility**. Make sure your HSE linking device appears under the list of interfaces.
- Make sure your HSE linking device is online.

## NIFB Problems

---

**When using the HSE Linking device with Windows 2000/NT/XP, Nifb returns an error message stating that the linking device cannot be found.**

- Verify the HSE Linking device settings as described in the *Setting the HSE Linking Device* section of Chapter 2, *Installation and Configuration*.

- Select **Start»Programs»National Instruments»NI-FBUS»Interface Configuration Utility**. Make sure your HSE linking device appears under the list of interfaces.
- Make sure your HSE linking device is online.

**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.

**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 HSE Linking device. 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 them off and then back on will cause them to look on the bus for available addresses and change addresses if necessary.
- Check for multiple copies of `nifb.dll` on the machine. If multiple copies are found, NI-FBUS was incorrectly re-installed. Uninstall NI-FBUS, search for any remaining copies of `nifb.dll`, delete them, then reinstall the software.
- Check how many interface 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).

## Interface Configuration Problems

---

**When using the NI-FBUS Interface Configuration Utility on a Windows 2000/NT 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 *Installing 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.**

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 a number of problems with your system.

## 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 (`ni.fb.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 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. 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 **Read**. Write down the hexadecimal number found in parenthesis (0xnumber) in Table A-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 A-1.** Device Names

Resource Block Parameter	Name
MANUFAC_ID	
DEV_TYPE	
DEV_REV	
DD_REV	

11. In the Interface Configuration Utility, click **DD Info**. 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 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 backward 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 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.

## 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](http://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](http://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](http://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](http://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](http://ni.com/alliance).

If you searched [ni.com](http://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](http://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

---

## 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.

## 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	<i>See</i> <a href="#">Link Active Scheduler</a> .

## C

C	Celsius.
Cable	A number of wires and shield in a single sheath.
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	<i>See</i> 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.
Driver	Device driver software installed within the operating system.

**E**

**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.

**H**

**H1** The 31.25 kbit/second type of Fieldbus.

**HSE** High Speed Ethernet. The 100 Mbit/second type of Fieldbus.

**HMI** Human-Machine Interface. A graphical user interface for the process with supervisory control and data acquisition capability.

## I

**IEC** International Electrotechnical Commission. A technical standards committee which is at the same level as the ISO.

## K

**Kbits** Kilobits.

**Kernel** The set of programs in an operating system that implements basic system functions.

## 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** See [Control loop](#).

## M

**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 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 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.
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.
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 <a href="#">Link</a> .
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	<i>See</i> Virtual Communication Relationship.
VFD	<i>See</i> 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.

# Index

---

## B

board renumbering (table), 2-9

## C

changing or deleting existing interface  
information, 2-8  
common questions, A-1  
communication parameters, setting the H1  
port, 2-7  
properties (figures), 2-7  
configuration, 2-1  
choosing software, 1-2  
troubleshooting interface problems, A-2  
contacting National Instruments, B-1  
conventions used in the manual, *viii*  
customer  
education, B-1  
professional services, B-1  
technical support, B-1

## D

device descriptions  
importing, 2-9  
import DD file (figure), 2-10  
device names (table), A-4  
diagnostic resources, B-1  
documentation  
conventions used in the manual, *viii*  
how to use the manual set, *vii*  
online library, B-1  
related documentation, *ix*  
drivers  
instrument, B-1  
software, B-1

## E

error messages, A-1  
example code, B-1

## F

Fieldbus  
optional network tools, 1-4  
software (table), 1-3  
frequently asked questions, B-1

## H

hardware, description, 1-1  
help  
professional services, B-1  
technical support, B-1  
how to use manual set, *vii*  
HSE Linking Device  
installation, 2-2  
setting the NI-FBUS software, 2-3  
add the HSE linking device  
(figure), 2-6  
set the Ethernet interface, 2-3  
adding interface (figure), 2-4  
set the linking device, 2-5

## I

import device descriptions, 2-9  
import DD file (figure), 2-10  
installation, 2-1  
HSE Linking Device, 2-2  
testing, 2-8  
instrument drivers, B-1

interface  
    changing or deleting information, 2-8  
    setting H1 port name, 2-7  
    properties (figures), 2-7  
introduction, 1-1

## K

KnowledgeBase, B-1

## L

LabVIEW DSC, 1-4  
Lookout, 1-4

## N

National Instruments  
    customer education, B-1  
    professional services, B-1  
    system integration services, B-1  
    technical support, B-1  
    worldwide offices, B-1  
NIFB, troubleshooting, A-1  
NIFB process, starting, 3-1  
NI-FBUS  
    interface configuration utility, 1-2  
        figure, 2-2  
        HSE Linking Device, 2-5  
    using the software, 3-1  
NI-FBUS Communications Manager, 1-4  
NI-FBUS Configurator, 1-4  
NI-FBUS Monitor, 1-4

## O

online technical support, B-1  
optional Fieldbus network tools, 1-4

## P

phone technical support, B-1  
professional services, B-1  
programming examples, B-1

## R

related documentation, *ix*  
renumbering (table), 2-9

## S

software  
    choosing configuration software, 1-2  
    description, 1-1  
    installation, 2-1  
        NI-FBUS Interface Configuration  
        Utility (figure), 2-2  
    LabVIEW DSC, 1-4  
    Lookout, 1-4  
    National Instruments Fieldbus software  
        (table), 1-3  
    NI-FBUS Communications Manager, 1-4  
    NI-FBUS Configurator, 1-4  
    NI-FBUS Monitor, 1-4  
    setting NI-FBUS software to use HSE  
        Linking Device, 2-3  
    uninstalling, A-5  
    using NI-FBUS software, 3-1  
    using your HSE Linking Device  
        add the HSE linking device  
        (figure), 2-6  
        set the Ethernet interface, 2-3  
            adding interface (figure), 2-4  
        set the linking device, 2-5  
software drivers, B-1  
support, technical, B-1  
system integration services, B-1

## T

- technical support, B-1
- telephone technical support, B-1
- testing the installation, 2-8
- training, customer, B-1
- troubleshooting
  - device names (table), A-4
  - error messages, A-1
  - interface configuration problems, A-2
  - NIFB, A-1
  - uninstalling the software, A-5
  - using manufacturer-defined features, A-3
- troubleshooting resources, B-1

## U

- uninstalling the software, A-5

## W

- Web
  - professional services, B-1
  - technical support, B-1
- what you need to get started, 1-1
- worldwide technical support, B-1