Fieldbus

Getting Started with Your AT-FBUS and the NI-FBUS™ Software for Windows NT

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Federal Communications Commission

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

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

> **This device complies with the FCC rules only if used with shielded interface cables of suitable quality and construction. National Instruments used such cables to test this device and provides them for sale to the user. The use of inferior or nonshielded interface cables could void the user's authority to operate the equipment under the FCC rules.**

If necessary, consult National Instruments or an experienced radio/television technician for additional suggestions. The following booklet prepared by the FCC may also be helpful: *Interference to Home Electronic Entertainment Equipment Handbook.* This booklet is available from the U.S. Government Printing Office, Washington, DC 20402.

Canadian Department of Communications

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

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

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This manual contains instructions for installing and configuring the
National Instruments AT-FBUS interface board and the NI-FBUS
software for Windows NT. The interface board is intended for use in
personal computers equipped with 16-bit ISA slots. The NI-FBUS
software is intended for use with Windows NT. This manual assumes that
you are already familiar with the Windows NT operating system.
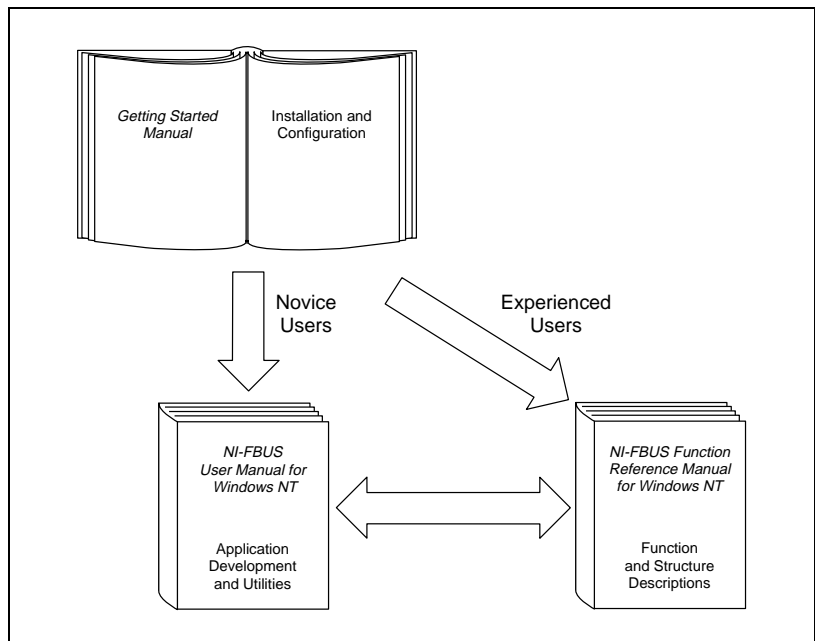
How to Use the Manual Set

Use this getting started manual to install and configure your AT-FBUS board and the NI-FBUS software for Windows NT.

Use the *NI-FBUS Function Reference Manual for Windows NT* to look up specific information about NI-FBUS functions, such as input and output parameters, syntax, and error messages.

Use the *NI-FBUS User Manual for Windows NT* to learn how to use the NI-FBUS interface for your application.

Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, lists what you need to get started and includes a brief description of the AT-FBUS board and the NI-FBUS software.

- Chapter 2, *Hardware Installation and Configuration*, contains instructions for installing and configuring your AT-FBUS board.

- Chapter 3, *Software Installation and Configuration*, contains instructions for installing and configuring your NI-FBUS software for Windows NT.

- Chapter 4, *Begin to Use the NI-FBUS Software*, helps you get started using the NI-FBUS software for Windows NT.

- Appendix A, *Specifications,* describes the electrical, physical, and environmental characteristics of the AT-FBUS hardware and the recommended operating conditions.

- Appendix B, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.

- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.

Conventions Used in This Manual

This manual uses the following conventions:

»   The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options» Substitute Fonts** directs you to pull down the **File** menu, select the **Page Setup** item, select **Options**, and finally select the **Substitute Fonts** options from the last dialog box.

bold   Bold text denotes menus, menu items, or dialog box buttons or options.

bold italic   Bold italic text denotes a note, caution, or warning.

italic   Italic text denotes emphasis, a cross reference, or an introduction to a key concept.

`monospace`   Text in this font denotes text or characters that are to be literally input 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, variables, filenames, and extensions, and for statements and comments taken from programs.

NI-FBUS   In this manual, the term *NI-FBUS* refers to the NI-FBUS Communications Manager.

Related Documentation

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

- *Fieldbus Standard for Use in Industrial Control Systems, Part 2, ISA-50.02.1992*

- *Fieldbus Foundation Specification*

- *Fieldbus Foundation System Management Services*

- *Function Block Application Process, Part 1*

- *Function Block Application Process, Part 2*

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are in Appendix B, *Customer Communication*, at the end of this manual.

Introduction

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

What You Need to Get Started

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

❑   AT-FBUS plug-in board

❑   NI-FBUS Installation Diskettes

❑   Windows NT version 3.51 or 4.0 installed on your computer

Hardware Description

The AT-FBUS is a plug-in board that handles communication between a network-configurable device that complies with the Fieldbus Foundation H1 specification and a PC AT-compatible computer that has 16-bit ISA slots. The AT-FBUS uses the Intel 386EX embedded processor, shared memory, and an interrupt to communicate with its driver. The AT-FBUS supports the fieldbus transfer rate of 31.25 kb/s.

Software Description

The NI-FBUS software for Windows NT is a high-level API you can use to interface with the National Instruments FOUNDATION Fieldbus (FF) communication stack and hardware. NI-FBUS hides the low-level protocol details of interface boards, Virtual Communication

Relationships (VCRs), connections, addresses, and Object Dictionary (OD) indices. NI-FBUS interfaces to the Fieldbus Messaging Specification (FMS) for you so you can use fieldbus communication protocols with only a general knowledge of the fieldbus architecture. The NI-FBUS software includes the following components:

- Windows Dynamic Link Libraries (DLLs)
- Static library for linking with the NI-FBUS process
- NI-FBUS process executable file
- Binary image of the Fieldbus Foundation communication stack
- NI-FBUS Dialog utility
- NI-FBUS Configuration utility
- Windows NT kernel-mode driver
- C language include files

Optional Fieldbus Network Tools

Your kit includes the NI-FBUS software for Windows NT. In addition, you can order the NI-FBUS Monitor and the Fieldbus Network Configuration utility.

The NI-FBUS Monitor is a good system for monitoring and debugging fieldbus data traffic. The NI-FBUS Monitor symbolically decodes data packets from the fieldbus, monitors the live list, and performs statistical analysis of packets. You can use the NI-FBUS Monitor to debug device and host applications. To order the NI-FBUS Monitor, contact National Instruments.

The Fieldbus Network Configuration utility allows you to easily configure a fieldbus network. The Fieldbus Network Configuration utility also provides a graphical environment for you to configure function block linkages, and to set data values and tags. It can automatically generate the schedule for the network, and can configure field devices and hosts to transmit and receive alarms and trends. Contact National Instruments for availability information.

Hardware Installation
and Configuration
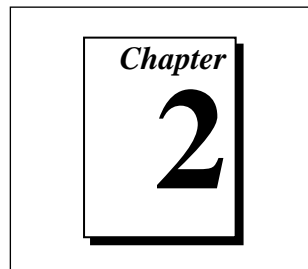
This chapter contains instructions for installing and configuring your
AT-FBUS board.

Warning: ***Before you remove the card from the package, touch the antistatic plastic
package to a metal part of your system chassis to discharge electrostatic
energy, which can damage several components on your PCMCIA-FBUS
card.***

Evaluate the Hardware Settings

Table 2-1 shows the default hardware settings for the AT-FBUS board.

Table 2-1. Hardware Default Settings

AT-FBUS Board Setting	Default
Base Memory Address (hex)	D0000 (physical)
Interrupt Line (IRQ)	11

The AT-FBUS board default settings are suitable for most
PC AT-compatible computer systems. However, if the default settings
conflict with another device in your system, or if you need to install more
than one AT-FBUS board, you must reconfigure the hardware.

To modify the default settings of the AT-FBUS board, refer to the
Configure the Hardware (Optional) section of this chapter. If you do not
need to reconfigure the board, proceed to the next section, *Install the
Hardware*.

Install the Hardware

Perform the following steps to install the AT-FBUS board:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the AT-FBUS board.

2. Remove the top cover or access port of the I/O channel.

3. Remove the expansion slot cover on the back panel of the computer.

4. Insert the AT-FBUS board into any unused 16-bit ISA slot, as shown in Figure 2-1, with the fieldbus connector sticking out of the opening on the back panel. It might be a tight fit, but do not force the board into place.
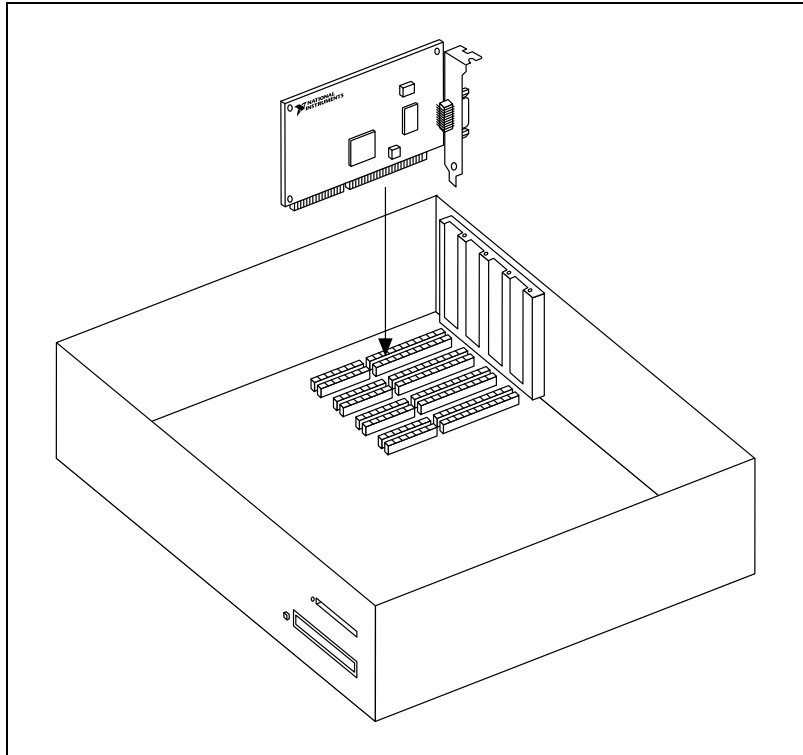
Figure 2-1. Installing the AT-FBUS Board

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

6. Check the installation.

7. Replace the top cover or access port to the I/O channel.

8. Connect the AT-FBUS to the fieldbus network.

   If you want to make your own fieldbus cable, make sure that it uses pins 6 and 7 for the fieldbus signals, as specified in the *Fieldbus Standard for Use in Industrial Control Systems, Part 2, ISA-550.02.1992*. See Figure 2-2 for the connections of the AT-FBUS.
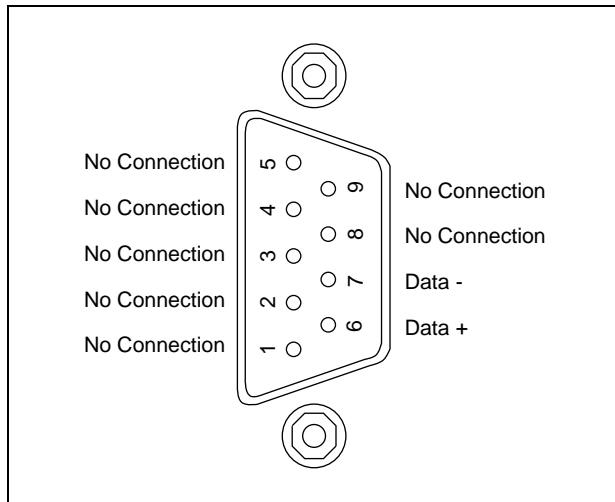
Figure 2-2. Fieldbus Connector Pinout for the AT-FBUS

9. Turn on your computer.

After you have installed your board, and you are ready to install the NI-FBUS software, refer to Chapter 3, *Software Installation and Configuration*, for instructions on installing the software.

Configure the Hardware (Optional)

Follow the instructions in this section if you need to change the hardware default settings of the AT-FBUS board. Refer to the beginning of this chapter for reasons to change the default settings of your AT-FBUS board.

After you install the NI-FBUS software, you must configure your software settings to match your new hardware settings; refer to the *Configure and Test the Installation* section in Chapter 3, *Software Installation and Configuration*, for information about configuring the software.

Figure 2-3 shows the location of the switches and jumpers on the AT-FBUS board.

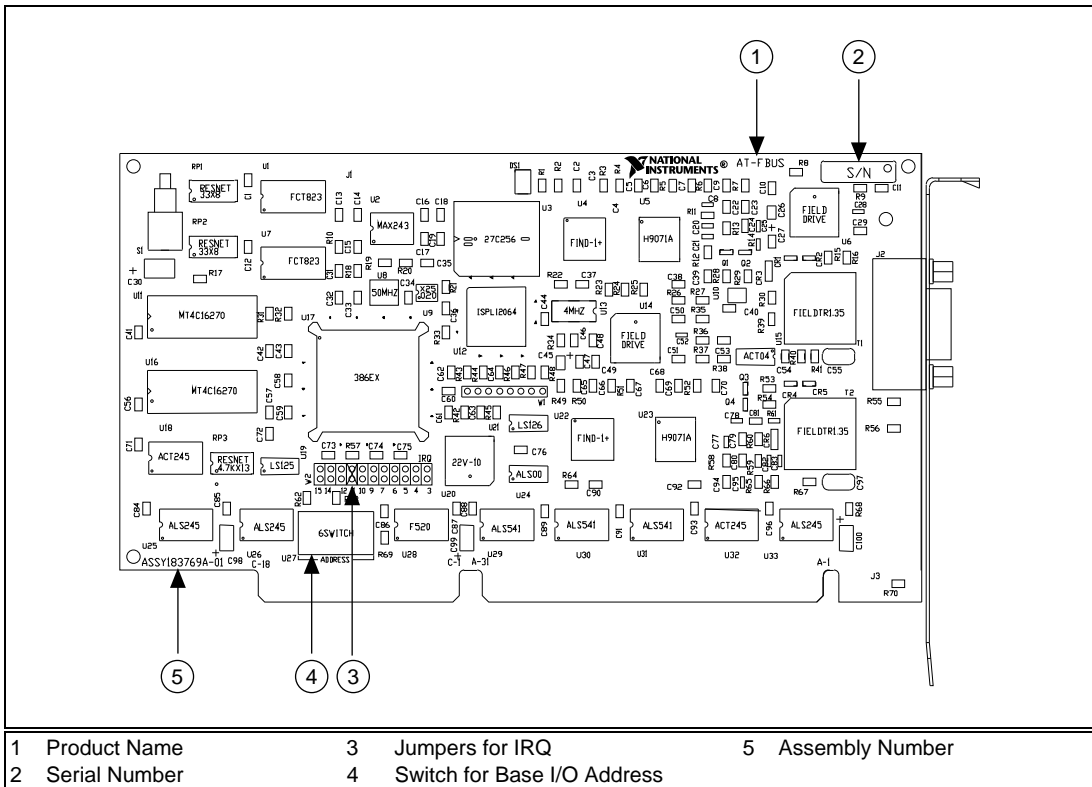| 1	Product Name	3	Jumpers for IRQ	5	Assembly Number
2	Serial Number	4	Switch for Base I/O Address		

Figure 2-3. AT-FBUS Parts Locator Diagram

Locate Conflict-Free Resources for Your AT-FBUS

To select conflict-free resources, you can use the Microsoft utility Windows NT Diagnostics, which displays a list of the I/O port addresses, interrupt levels, and DMA channels that are currently being used in your system. Assign resources this utility does not list as used to your fieldbus interface.

Selecting the Base Memory Address

The AT-FBUS board is a memory-mapped device, which means that the driver software can use the AT-FBUS memory registers as if they were standard memory. The base memory address of the AT-FBUS is the first position in the total memory address space occupied by the AT-FBUS.

The AT-FBUS is configured to use memory base memory address D0000 hex by default. With this setting, the board uses the memory space from D0000 hex through D4000 hex. If this address range is already used by another device, or if you are installing more than one board, complete the following numbered steps to reconfigure the base memory address setting. If you are installing more than one AT-FBUS board, each board must use a unique base memory address. Your computer's conventional DRAM and all other devices cannot use the memory space you assign to the AT-FBUS board.

1. Choose a new memory base address.

    You can configure the AT-FBUS to use lower or upper memory. Lower memory is the memory residing in the first megabyte of address space. Upper memory is any memory that resides above the first megabyte. Because the AT bus can only access the first 16 MB of address space, and the AT-FBUS must have a unique base address in memory, you must have 8 MB or less of DRAM in your machine to place the AT-FBUS in upper memory. If these conditions are met, you must locate the AT-FBUS above your conventional memory and below the 16 MB upper limit for addresses.

    Table 2-2 lists the possible switch settings, the corresponding memory base address, and the memory space used for each setting. The default setting is in bold italic.

Table 2-2. Memory Base Address Switch Settings

		Switch Setting				
SW1	**SW2**	**SW3**	**SW4**	**SW5**	**SW6**	**Base Address**
ON	ON	OFF	ON	ON	OFF	0C0000
ON	ON	OFF	ON	OFF	OFF	0C4000
ON	ON	OFF	OFF	ON	OFF	0C8000
ON	ON	OFF	OFF	OFF	OFF	0CC000
ON	*ON*	*ON*	*ON*	*ON*	*OFF*	*0D0000*
ON	ON	ON	ON	OFF	OFF	0D4000
ON	ON	ON	OFF	ON	OFF	0D8000
ON	ON	ON	OFF	OFF	OFF	0DC000
ON	OFF	OFF	ON	ON	OFF	0E0000
ON	OFF	OFF	ON	OFF	OFF	0E4000
ON	OFF	OFF	OFF	ON	OFF	0E8000
ON	OFF	OFF	OFF	OFF	OFF	0EC000
ON	OFF	ON	ON	ON	OFF	0F0000
ON	OFF	ON	ON	OFF	OFF	0F4000
ON	OFF	ON	OFF	ON	OFF	0F8000
ON	OFF	ON	OFF	OFF	OFF	0FC000
OFF	ON	OFF	ON	ON	OFF	8C0000
OFF	ON	OFF	ON	OFF	OFF	8C4000
OFF	ON	OFF	OFF	ON	OFF	8C8000
OFF	ON	OFF	OFF	OFF	OFF	8CC000
OFF	ON	ON	ON	ON	OFF	8D0000
OFF	ON	ON	ON	OFF	OFF	8D4000
OFF	ON	ON	OFF	ON	OFF	8D8000
OFF	ON	ON	OFF	OFF	OFF	8DC000
OFF	OFF	OFF	ON	ON	OFF	8E0000
OFF	OFF	OFF	ON	OFF	OFF	8E4000

Table 2-2. Memory Base Address Switch Settings (Continued)

		Switch Setting				
SW1	SW2	SW3	SW4	SW5	SW6	Base Address
OFF	OFF	OFF	OFF	ON	OFF	8E8000
OFF	OFF	OFF	OFF	OFF	OFF	8EC000
OFF	OFF	ON	ON	ON	OFF	8F0000
OFF	OFF	ON	ON	OFF	OFF	8F4000
OFF	OFF	ON	OFF	ON	OFF	8F8000
OFF	OFF	ON	OFF	OFF	OFF	8FC000

2. Locate the base memory address switch on your AT-FBUS board. Refer to Figure 2-3, *AT-FBUS Parts Locator Diagram.*

3. Change the switch settings to configure the AT-FBUS board to the new base memory address as shown in Table 2-2.

4. Record your new setting on the *Hardware and Software Configuration Form* in Appendix B, *Customer Communication*, for future reference.

Selecting the Interrupt Request Line

PC AT-compatible computers have a series of interrupt lines available to devices. Devices use interrupts to get immediate service from the CPU for asynchronous events. Your AT-FBUS board and the NI-FBUS software use interrupts to get service from the CPU when necessary.

By default, the AT-FBUS board is configured to use interrupt request line 11. If this is not an acceptable setting or if you are installing more than one board, complete the following steps to reconfigure the interrupt request line.

If there are no interrupt request lines available in your system, you can configure the AT-FBUS not to use interrupts by removing the jumper completely. If you remove the jumper, NI-FBUS periodically polls your board.

☞   **Note:**   ***The AT-FBUS cannot use an interrupt line that another device in your system is already using.***

1. Choose a new interrupt request line (IRQ) setting.

   You can configure the AT-FBUS board to use any of the following interrupt lines: IRQ3, 4, 5, 6, 7, 9, 10, 11, 12, 14, or 15.

   If you are installing more than one AT-FBUS board, each board must be configured to use a unique IRQ level. The AT-FBUS requires the use of interrupts to work with your NI-FBUS software properly.

2. Find the jumpers that set the interrupt request line. The jumpers are located on the lower edge of your AT-FBUS board. The number on the board under each pair of pins corresponds to an AT bus interrupt level. Refer to Figure 2-3, *AT-FBUS Parts Locator Diagram.*

3. Change the jumper settings to configure the AT-FBUS board to the new interrupt request line. Place the jumper on the pair of pins directly above the number of the interrupt level you want.

4. Record your new setting on the *Hardware and Software Configuration Form* in Appendix B, *Customer Communication*, for future reference.

Software Installation and Configuration
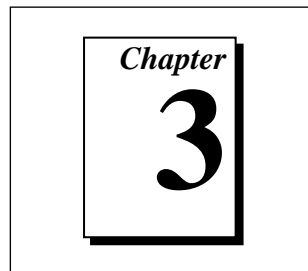
This chapter contains instructions for installing and configuring your NI-FBUS software for Windows NT.

Install the Software

After you have installed and configured the hardware, you are ready to install the NI-FBUS software. Complete the following steps to run the software installation program:

1. Log in as `Administrator` or as a user that has Administrator privileges.

2. Insert the NI-FBUS software distribution disk into an unused drive.

3. In the **Run...** dialog box, type the following:

   `x:\setup`

   where x is the letter of the drive containing the distribution disk (usually `a` or `b`).

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

   By default, the installer uses the `nifbus` directory to install the software. You can change the directory if you want to install the NI-FBUS software somewhere else.

   The installer copies `nifb.dll` and `drvintf.dll` into your Windows directory, and it copies the `nifb.sys` kernel driver into the `drivers` directory. The installer also adds information to the Windows NT Registry.

   After it copies the software components to the appropriate directories, the installer starts the NI-FBUS Configuration utility. You must provide hardware information and other configuration

information for the NI-FBUS Configuration utility. You should follow the procedure to add an AT board. Refer to the *Configuring Software Settings* section in this chapter for help.

4. After the installation is complete, restart Windows NT. You must restart your computer before you can use the NI-FBUS software.

Installation Directory Structure

The installer puts the software components in the following directory structure:

`utils`

`nifbdlg.exe`—An interactive dialog utility for NI-FBUS

`fbconf.exe`—A utility to install AT-FBUS boards, assign base addresses, IRQ lines, and other configuration information

`binaries`

`ffstack.bin`—A binary image of the FF communication stack

`nifb.exe`—The NI-FBUS process, which must be running for your application using the NI-FBUS API to run

`libs`

`nifb.lib`—The static library that you should link with your application

`includes`

A list of 16 include files; you need to include only `nifbus.h` in your application; `nifbus.h` includes the other include files for you

`samples`

`nifbtest.c`—An example program that uses many of the NI-FBUS functions

`nifbdd.c`—An example program that uses device description services

`nifb_mt.c`—A multi-threaded example program that uses NI-FBUS functions

`sched.ini`—An example Link Active Schedule file

`data`

Icon files and other data files that NI-FBUS accesses

Your kit also contains two DLLs and a Windows NT device driver. The installer copies the DLLs `nifb.dll` and `drvintf.dll` into the Windows NT directory. The installer copies the driver `nifb.sys` into the `drivers` directory.

Configure and Test the Installation

You should use the NI-FBUS Configuration utility if you are adding or removing a fieldbus interface, if the software settings do not match your AT-FBUS physical settings, or to view or change your software configuration settings. When you install the NI-FBUS software, the installer launches the NI-FBUS Configuration utility. You should follow the procedure to add an ISA board.

Configure the NI-FBUS Software

Introduction to the NI-FBUS Configuration Utility

The NI-FBUS Configuration utility (`fbconf.exe`) helps you to configure the following information:

- Hardware information
    - Number of boards
    - Base address of each board
    - IRQ line assigned to each board
- Logical name for each fieldbus interface (port). You can use this information to access the port using the logical name
- Device Description (DD) information
    - Base directory for device descriptions
    - Location of the standard text dictionary

        You need to change these only if you use NI-FBUS to communicate with devices that have manufacturer-specific blocks or parameters, meaning that you have device-manufacturer-supplied DDs.
- Fieldbus communication parameters for each fieldbus interface

You can use the NI-FBUS Configuration utility at any time to change, add, and delete configuration information for your fieldbus interfaces.

Configuring Software Settings

☞ **Note:** ***Before you configure your NI-FBUS software, you must know the base address and IRQ settings of your AT-FBUS hardware. To read your base address from your board switch settings, use Table 2-2. To read your IRQ line from your board, look at the number printed on the board under the jumper.***

To view or change your base address or IRQ settings, follow these steps.

1. To start the NI-FBUS Configuration utility, do one of the following:

    - If you are using Windows NT 3.51, double-click on the **fbconf** icon, which is part of the NI-FBUS program group, created in your Program Manager during installation.

    - If you are using Windows NT 4.0, select **Start»Programs»NI-FBUS»NI-FBUS Config**.

    - To use the command prompt, enter the command `fbconf.exe` to start the NI-FBUS Configuration utility executable, which is located in the `utils` subdirectory of your NI-FBUS installation directory.

2. In the NI-FBUS Configuration utility window, select the icon of the board you want to change and click on the **Edit** button.

3. Choose **ISA** as the **Bus Type**. Before you change the settings in the NI-FBUS Configuration utility, it selects the default base address and IRQ line.

4. Change the settings if your AT-FBUS board is set for a different base address or IRQ line. These settings must match the settings on your hardware.

    If you have configured your AT-FBUS not to use interrupts, enter zero for the IRQ line, and check the polled mode checkbox.

To change your default interface name or communication parameters, do the following: Open the NI-FBUS Configuration utility, select the icon of the port you want to change, and click on the **Edit** button. The NI-FBUS Configuration utility displays the default logical interface name and some configuration information. You might want the logical interface name in your application to be independent of the actual hardware you are using. You can change these settings if necessary.

Configuring Fieldbus Communication Parameters

You must assign a unique address and a unique physical device tag to each of your fieldbus interfaces. Your interface must be at a fixed address or a visitor address for you to start using NI-FBUS.

To assign addresses and tags using the NI-FBUS Configuration utility, start the utility as described in step 1 of the previous section, click on the port you want to edit, and click on the **Edit** button.

If you want to assign a fixed address to your fieldbus interface, choose **Fixed Address** and enter a value in the range 0x10 to 0xF7. 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**. If you want a fieldbus network configuration utility to assign an address to your interface over the fieldbus, choose **Default Address**.

Enter a unique tag at the **Device Tag** prompt. You may leave this empty if you have set the address to **Default Address** and you want a fieldbus network configuration utility to assign a tag over the fieldbus.

NI-FBUS assigns default values for other communication parameters. Click on the **Advanced** button to view or change these parameters.

You do not have to reenter these configuration parameters every time you power up your PC because NI-FBUS saves them. NI-FBUS also saves changes made over the fieldbus.

Configuring the Link Active Schedule File

If you want to do scheduling and use publishers and subscribers, you must configure the Link Active Schedule file. Refer to Appendix A, *Configuring the Link Active Schedule File*, in the *NI-FBUS User Manual for Windows NT*, and then test the NI-FBUS software installation, as described in the next section. If you do not want to do scheduling or use publishers and subscribers, continue to the next section to test the NI-FBUS software installation.

Test the Installation

To make sure that your NI-FBUS software is installed correctly and is working properly, follow these steps:

1. Start the kernel mode device driver `nifb` by entering the following command at the command prompt:

    `net start nifb`

    You can also start `nifb` by locating it in the **Devices** window of the **Control Panel**, double-clicking on the icon, and then clicking on the **Start** button.

2. Start the NI-FBUS process by double-clicking on the **NIFB** icon.

On successful startup, `nifbus` displays a message saying that the process started up successfully, and the title bar of the **nifb** window changes to **NIFB (running)**.

If `nifbus` does not start up successfully, the base address, the IRQ line, or network address is incorrect. Start the NI-FBUS Configuration utility by following the instructions in Step 1 of the *Configuring Software Settings* section, and make sure that the hardware and software settings match. Also, make sure that your network address is unique.

To begin to use NI-FBUS to compile the sample applications or to write your own applications, continue to Chapter 4, *Begin to Use the NI-FBUS Software*. You can also refer to Chapter 2, *Developing Your Application,* in the *NI-FBUS User Manual for Windows NT.* To use NI-FBUS to interact with your devices, refer to Chapter 3, *NI-FBUS Dialog Utility*, in the *NI-FBUS User Manual for Windows NT.*

Begin to Use the NI-FBUS Software
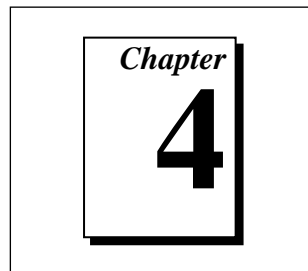
This chapter helps you get started using the NI-FBUS software for Windows NT.

Starting NI-FBUS

The `nifb` process must be running in order to run an application that uses NI-FBUS.

You must start the `nifb` kernel driver manually, as follows. The installer defines the `StartupType` for the driver as `Manual`.

1. Type the following in a command window:

   `net start nifb`

   You can also start the driver from the **Devices** window of the **Control Panel**.

2. Start the `nifb` process by double-clicking on the **NIFB** icon.

If the process and the driver start up are successful, you can configure the `nifb` driver to load at system startup. Change the `StartupType` for the `nifb` driver to **Automatic** through the **Devices** window in the **Control Panel**. If you are using Windows NT 4.0, you can also move the NIFB shortcut to the **Start Up** folder to make it start up automatically when your computer restarts or boots.

Writing and Compiling Your Application

Use the following hints to help you compile your NI-FBUS application:

- You must include the `nifbus.h` header file in your program.

- You must specify the include directory in your project settings.

- You must link your program with the `nifb.lib` import library. National Instruments created this library using Microsoft Visual C/C++ version 4.0.

- You can create a console application using the `nifbtest.c` sample program included in your kit. Create a console application project in your compiler and add `nifbtest.c` and `nifb.lib` to the project. Build the project and execute the resulting application.

Using the NI-FBUS Dialog Utility

Use the NI-FBUS Dialog utility to interact with your devices over the fieldbus by opening descriptors, making single NI-FBUS calls, and viewing the results. You might want to use the NI-FBUS Dialog utility to verify installation and device operation, or to learn the fieldbus API.

You can run the NI-FBUS Dialog utility by double-clicking on the **NIFBus Dialog** icon in your **NI-FBUS** program group. When you open the Dialog utility, a window appears containing a single item called **Open Descriptors**. This is the root of a tree that shows an icon for each of the NI-FBUS descriptors you open using the utility. The area below the icon remains empty until you make an NI-FBUS call to open a descriptor.

The Dialog utility displays an icon for each descriptor, session, link, physical device, Virtual Field Device (VFD), and block you open. Click the right mouse button on an icon to find the list of valid NI-FBUS functions for that descriptor. When you choose a function from that list, a dialog box for that function appears and prompts you for input parameters.

Refer to the *NI-FBUS User Manual for Windows NT* for examples of how to use the NI-FBUS Dialog utility.

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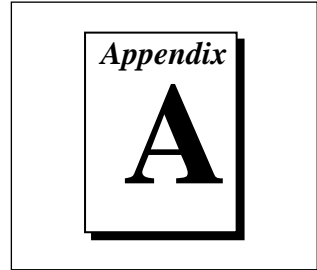
This appendix describes the electrical, physical, and environmental characteristics of the AT-FBUS hardware and the recommended operating conditions.

Table A-1. Electrical Characteristics for the AT-FBUS

Characteristic	Specification
Power Requirement	750 mA Typical

Table A-2. Physical Characteristics for the AT-FBUS

Characteristic	Specification
Dimensions	10.7 by 19.1 cm (4.2 by 7.5 in.)
I/O Connector	DB-9 DSUB

Table A-3. Environmental Characteristics for the AT-FBUS

Characteristic	Specification
Operating Environment:	
Component Temperature Relative Humidity	0° to 70° C 10% to 90%, Noncondensing
Storage Environment:	
Temperature Relative Humidity	-40° to 125° C 5% to 90% Noncondensing
EMI	FCC Class A Verified

Customer Communication

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

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

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National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call (512) 795-6990. You can access these services at:

United States: (512) 794-5422
    Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
    Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 1 48 65 15 59
    Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as `anonymous` and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.

Fax-on-Demand Support

Fax-on-Demand is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access Fax-on-Demand from a touch-tone telephone at (512) 418-1111.

E-Mail Support (currently U.S. only)

You can submit technical support questions to the applications engineering team through e-mail at the Internet address listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

support@natinst.com

Telephone and Fax Support

National Instruments has branch offices all over the world. Use the following list to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.

	Telephone	Fax
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Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	905 785 0085	905 785 0086
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	90 527 2321	90 502 2930
France	01 48 14 24 24	01 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Israel	03 5734815	03 5734816
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	95 800 010 0793	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	01635 523545	01635 523154

Technical Support Form

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

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

Name _____

Company _____

Address _____

_____

Fax (___)_____ Phone (___)_____

Computer brand _____ Model _____ Processor _____

Operating system (include version number) _____

Clock Speed _____MHz RAM _____MB Display adapter _____

Mouse _____yes _____no Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Version _____

Configuration _____

The problem is _____

_____

_____

_____

List any error messages _____

_____

_____

_____

The following steps will reproduce the problem _____

_____

_____

Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

National Instruments Products

Interrupt Level of Hardware _____

Base I/O Address of Hardware _____

Other Products

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Microprocessor _____

Clock Frequency _____

Type of Video Board Installed _____

Operating System _____

Operating System Version _____

Operating System Mode _____

Programming Language _____

Programming Language Version _____

Other Boards in System _____

Base I/O Address of Other Boards _____

DMA Channels of Other Boards _____

Interrupt Level of Other Boards _____

Documentation Comment Form

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

Title: *Getting Started with Your AT-FBUS and the NI-FBUS™ Software for Windows NT*

Edition Date: December 1996

Part Number: 321014B-01

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

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

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Prefix	Meaning	Value
n-	nano-	10^{-9}
μ-	micro-	10^{-6}
m-	milli-	10^{-3}

AI	Analog Input. A type of function block.
asynchronous	Communication that occurs at times which are not predetermined.
AT compatible	Compatible with the 16-bit Industry Standard Architecture.
Communication Stack	Performs the services required to interface the User Application to the Physical Layer.
Data Link Layer	The second lowest layer, layer two in the ISO seven layer model. 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.
descriptor	A number returned to the application by NI-FBUS, used to specify a target for future NI-FBUS calls.
device ID	An identifier for a device that the manufacturer assigns. Device IDs must be unique to the device; no two devices can have the same device ID.
DRAM	Dynamic Random Access Memory. Memory that requires electricity and refreshing to hold data.

Fieldbus Foundation	An organization that developed a fieldbus network specifically based upon the work and principles of the ISA/IEC standards committees.
FMS	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.
FOUNDATION Fieldbus	The communications network that the Fieldbus Foundation created.
IRQ	interrupt request
ISA	Industry Standard Architecture
link	A group of fieldbus devices connected across a single wire pair with no intervening bridges.
Link Active Schedule	A schedule of times in the macrocycle when devices must publish their output values on the fieldbus.
Link Active Scheduler (LAS)	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.
octet	A single 8-bit value.
OD	Object Dictionary. A structure in a device that describes data that can be communicated on the fieldbus. The OD 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.
PC	Personal Computer
physical device	A single device residing at a unique address on the fieldbus.
physical device tag	A user-defined name for a physical device.
System Management Configuration	Configuration parameters that set up device identification and network time distribution.
VCR	Virtual Communication Relationship. Preconfigured or negotiated connections between virtual Field devices on a network.