Fieldbus

Getting Started with Your AT-FBUS and the NI-FBUS™ Software for Windows 95

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Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

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.**

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Canadian Department of Communications

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

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About This Manual

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Begin to Use the NI-FBUS Communications Manager

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This manual contains instructions on how to install and configure the National Instruments AT-FBUS interface board and the NI-FBUS Communications Manager software for Windows 95. The AT-FBUS board is intended for use in PCs equipped with 16-bit ISA slots. The NI-FBUS Communications Manager software is intended for use with Windows 95. This manual assumes that you are already familiar with Windows 95.

How to Use the Manual Set

Use this getting started manual to install and configure your AT-FBUS board and the NI-FBUS Communications Manager software for Windows 95.

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

Use the *NI-FBUS Communications Manager User Manual for Windows 95 and Windows NT* to learn how to use the NI-FBUS Communications Manager interface for your application.

If you are using the NI-FBUS Configurator, use the *NI-FBUS Configurator User Manual* to install the NI-FBUS Configurator software for Windows 95.

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, *Installation and Configuration*, contains instructions for installing and configuring the NI-FBUS software for Windows 95 and the AT-FBUS board.

- Chapter 3, *Begin to Use the NI-FBUS Communications Manager*, helps you get started using the NI-FBUS Communications Manager software for Windows 95.

- 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.

☞   This icon to the left of bold italicized text denotes a note, which alerts you to important information.

⚡   This icon to the left of bold italicized text denotes a warning, which advices you of precautions to take to avoid being electrically shocked.

AT-FBUS	In this manual, the term *AT-FBUS* refers to both the single-port AT-FBUS board and the dual-port AT-FBUS/2 board, unless otherwise indicated.
bold	Bold text denotes the names of menus, menu items, parameters, dialog boxes, dialog box buttons or options, icons, windows, Windows 95 tabs, or LEDs.
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. This font also denotes text for which you supply the appropriate word or value, as in Windows 3.*x*.
`italic monospace`	Italic text in this font denotes that you must supply the appropriate words or values in the place of these items.
`monospace`	Text in this font denotes text or characters that you should literally 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 for statements and comments taken from programs.
paths	Paths in this manual are denoted using backslashes (\) to separate drive names, directories, folders, and files.

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-S50.02.1992*
- *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
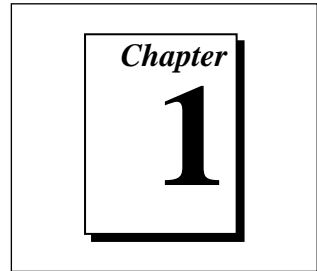
This chapter lists what you need to get started and includes a brief description of the AT-FBUS board and the NI-FBUS software.

What You Need to Get Started

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

❑ AT-FBUS plug-in board

❑ Cable compliant with the *Fieldbus Standard for Use in Industrial Control Systems, Part 2, ISA-S50.02.1992*

❑ Installation disks

❑ Windows 95 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.

The single-port AT fieldbus interface is called the *AT-FBUS* and the dual-port AT fieldbus interface is called the *AT-FBUS/2*. In this manual, the term *AT-FBUS* refers to both the single-port AT-FBUS board and the dual-port AT-FBUS/2 board, unless otherwise indicated.

Software Description

Your kit includes either the NI-FBUS Communications Manager software or NI-FBUS Configurator software. The NI-FBUS Communications Manager software for Windows 95 is a high-level API you can use to interface with the National Instruments FOUNDATION Fieldbus (FF) communication stack and hardware. The NI-FBUS Communications Manager hides the low-level protocol details of interface boards, Virtual Communication Relationships (VCRs), connections, addresses, and Object Dictionary (OD) indices. The NI-FBUS Communications Manager 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.

For a description of the NI-FBUS Configurator software, refer to the next section, *Optional Fieldbus Network Tools.*

The NI-FBUS Communications Manager software and NI-FBUS Configurator software include the following components:

- NI-FBUS Communications Manager process executable file
- Binary image of the Fieldbus Foundation communication stack
- NI-FBUS Interface Configuration utility
- Windows 95 device driver

The NI-FBUS Communications Manager software also includes the following components not included with the NI-FBUS Configurator software:

- Windows Dynamic Link Libraries (DLLs) for linking with the NI-FBUS Communications Manager process
- Static library for linking with the NI-FBUS Communications Manager process
- NI-FBUS Dialog utility
- C language include files

☞   **Note:**   *Because of some bug fixes and specification changes, the*
communication stack that the NI-FBUS Communications Manager uses
is not compatible with the communication stack in a Round Card using a
National Instruments Device Developer Kit Release previous to
Version 2.0. If you are using National Instruments Round Card software
previous to Version 2.0, you need to upgrade your software to
Version 2.0. Contact National Instruments for ordering information.

Optional Fieldbus Network Tools

Your kit includes either the NI-FBUS Communications Manager
software or NI-FBUS Configurator software for Windows 95. In
addition, you can order the NI-FBUS Monitor, BridgeVIEW, and/or
Lookout from National Instruments. If you have not already done so, you
can also order the NI-FBUS Configurator.

The NI-FBUS Monitor helps you monitor and debug fieldbus data traffic.
It 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.

The NI-FBUS Configurator helps you configure a fieldbus network. It
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.

BridgeVIEW helps you perform data acquisition and analysis, create a
man-machine interface (MMI), or develop an advanced supervisory
control application in a graphical development environment.
BridgeVIEW 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
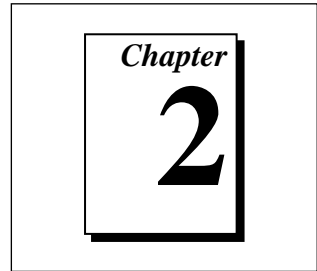
This chapter contains instructions for installing and configuring the NI-FBUS software for Windows 95 and the AT-FBUS board.

Install the Software

Complete the following steps to run the software installation program:

1. Insert installation disk 1 into an unused drive.

2. Select **Start»Run**.

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

   `x:\setup`

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

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

   By default, the installation program installs the software into the `nifbus` directory. You can change this directory if you want to install the software into a different directory.

   The installation program copies `nifb.dll` and `drvintf.dll` into your Windows directory, and it copies the `nifb.vxd` device driver into the `System` directory. The installation program also adds information to the Windows 95 Registry.

Continue to the next section to install and configure the hardware.

Configure the Hardware

⚠ ⚡   **Warning:**   ***Before you remove the AT-FBUS 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 the board.***

Evaluating the Default Settings

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

Table 2-1. Default Settings

Type of Setting	Default
Memory Base Address (hex)	0D0000 (physical)
Interrupt Line (IRQ)	11

The default settings are suitable for most computer systems. However, if these default settings conflict with another device in your system, or if you need to install more than one fieldbus interface, you must change the default settings before you install the interface.

If you have to change the settings, continue to the following sections to locate resources for your fieldbus interface. If the default settings will work in your system, skip to the *Install the Hardware* section, later in this chapter.

Locating Conflict-Free Resources

To locate conflict-free resources in Windows 95, complete the following steps:

1. To use the Device Manager, select **Start»Settings»Control Panel»System**. Click on the **Device Manager** tab.

2. Select the **Computer** and click on the **Properties** button. The **Computer Properties** dialog box appears. You can use any resources that do *not* appear in this window.

If you cannot find a free IRQ line, you can configure your fieldbus interface to operate in polled mode, without an IRQ line. In polled mode,

the NI-FBUS Communications Manager polls your board periodically. When you reach the *Configure the Software* section, you can configure your fieldbus interface to use polled mode.

When you find acceptable resources, write them down, so you can configure the hardware and software settings to match. Proceed to the next section, *Changing the Hardware Settings (Optional)*.

Changing the Hardware Settings (Optional)

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

Figure 2-1 shows the location of the switches, jumpers, and two connectors on the AT-FBUS/2 board. If you are using the single-port AT-FBUS, your board has only the top connector.
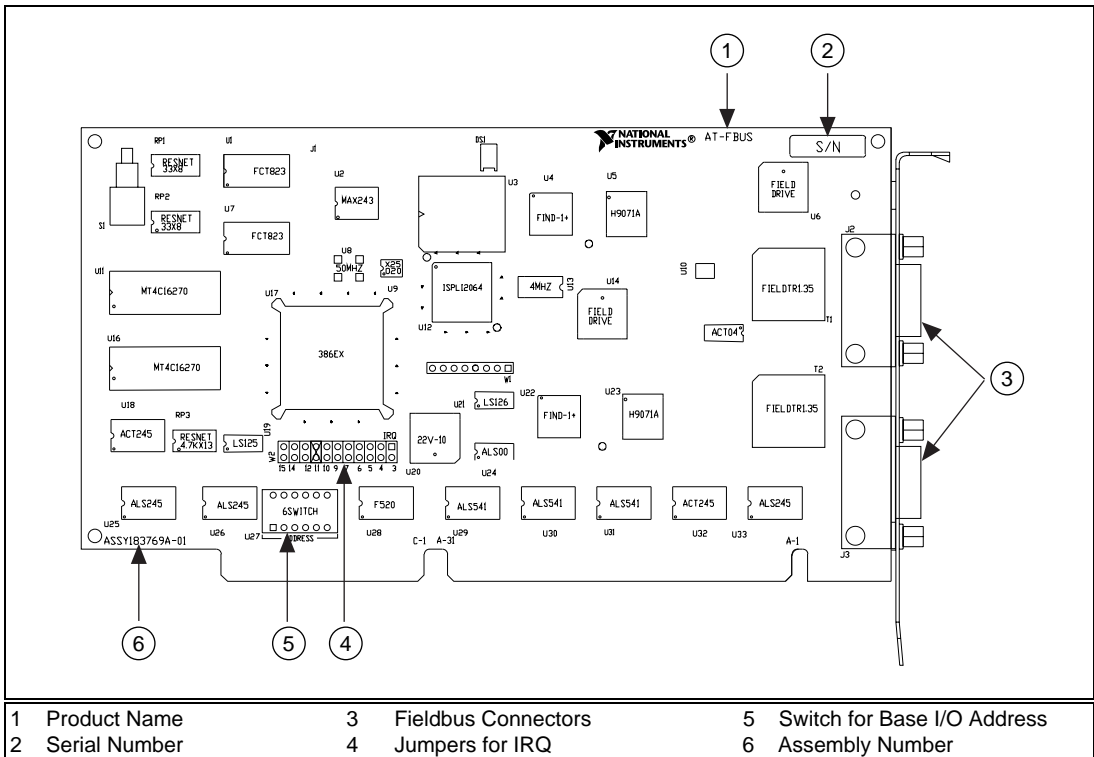

| 1 | Product Name | 3 | Fieldbus Connectors | 5 | Switch for Base I/O Address |
| 2 | Serial Number | 4 | Jumpers for IRQ | 6 | Assembly Number |

Figure 2-1. AT-FBUS/2 Parts Locator Diagram

Selecting the Memory Base 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 memory base 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 address D0000 hex by default. With this setting, the board uses the memory space from D0000 hex through D3FFF hex. If this address range is already used by another device, or if you are installing more than one board, complete the following steps to reconfigure the memory base address setting. If you are installing more than one AT-FBUS board, each board must use a unique memory base 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 you want to locate your AT-FBUS above 1 MB and you have 8 MB or less, 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. ***Bold italic*** denotes the default setting.

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

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

SW1	SW2	SW3	SW4	SW5	SW6	Base Address
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
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

The header row spans: **Switch Setting** over SW1–SW6.

2. Locate the memory base address switch on your AT-FBUS board. Refer to Figure 2-1, *AT-FBUS/2 Parts Locator Diagram.*

3. Change the switch settings to configure the AT-FBUS board to the new memory base address as shown in Table 2-2. See Figure 2-2 for an example of the switch settings. Figure 2-2 shows the default memory base address setting, 0D0000 hex.
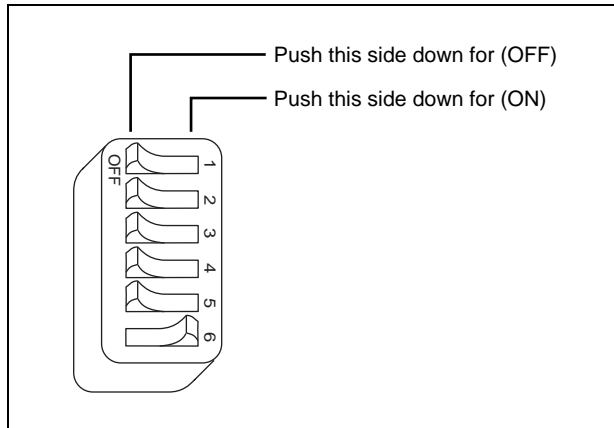

Figure 2-2. Default Memory Base Address Switch Setting

4. Record your new settings 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 Fieldbus software use interrupts to get service from the CPU when necessary.

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, the NI-FBUS Communications Manager periodically polls your board.

By default, the AT-FBUS board uses interrupt request line 11. Figure 2-3 shows the setting for IRQ11.
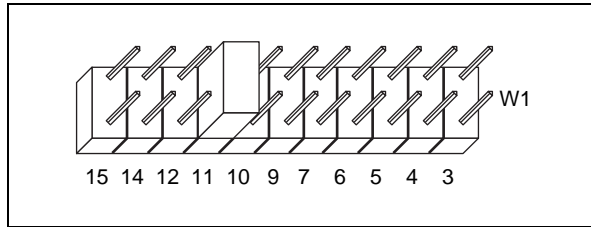
Figure 2-3. Interrupt Jumper Setting for IRQ11

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.

☞   **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.

2. Find the jumpers that set the interrupt request line. Refer to Figure 2-1, *AT-FBUS/2 Parts Locator Diagram.* 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.

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 settings on the *Hardware and Software Configuration Form* in the Appendix B, *Customer Communication*, for future reference.

Proceed to the next section, *Install the Hardware*, to install the AT-FBUS board.

Install the Hardware

To install the AT-FBUS board, complete the following steps:

1. Shut down your operating system and power off your computer. Keep the computer plugged in so that it remains grounded while you install the 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. As shown in Figure 2-4, insert the AT-FBUS board into any unused 16-bit ISA slot 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.
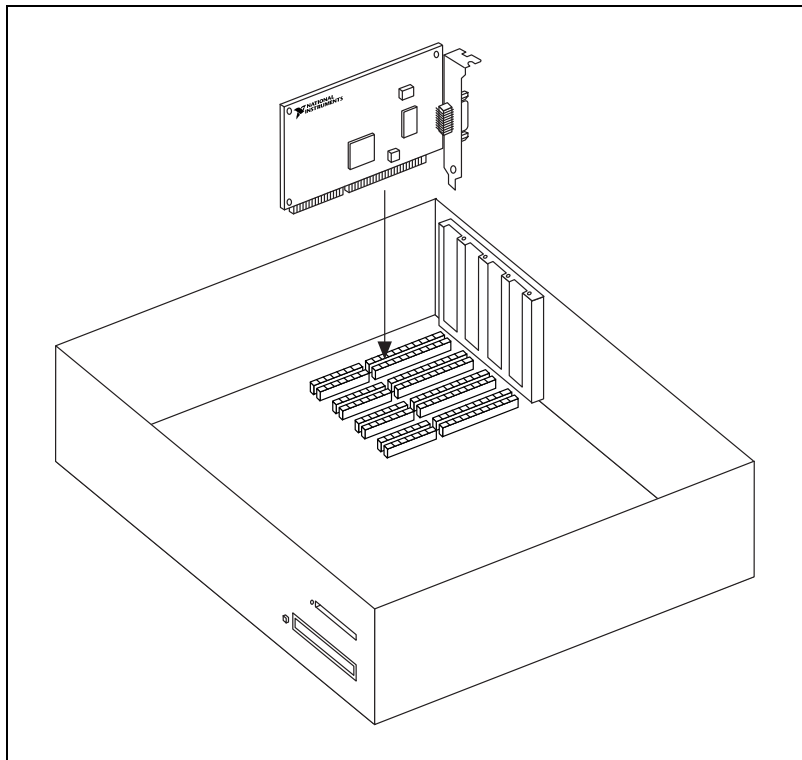
Figure 2-4. Installing the AT-FBUS Board

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-S50.02.1992*. Refer to Figure 2-5 for the connector pinout of the AT-FBUS.

Figure 2-5. Fieldbus Connector Pinout for the AT-FBUS

☞   **Note:**   *On the AT-FBUS/2, the top connector is port 1 and the lower connector is port 2.*

9. Power on your computer.

Proceed to the next section, *Configure the Software*.

Configure the Software

If you are installing an AT-FBUS board, the physical settings on the board must match the software settings you configure. 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.
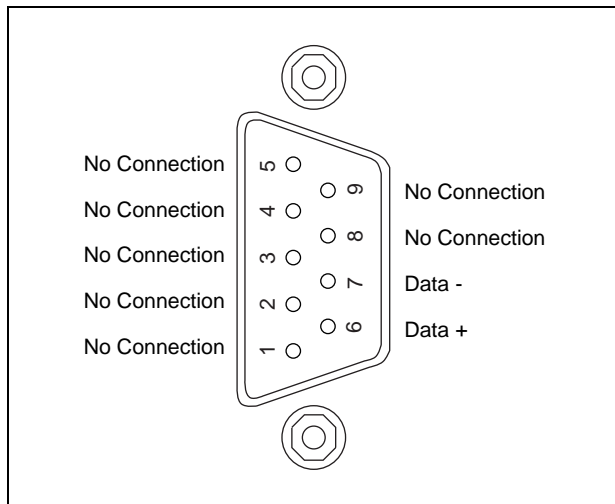
Configuring Resources in Windows 95

In Windows 95, you must use the Add New Hardware Wizard to add your AT-FBUS, and the Device Manager to configure resources for the AT-FBUS.

1. To open the Add New Hardware Wizard, select **Start»Settings»Control Panel»Add New Hardware**. Click on the **Next** button.

2. In the dialog box that appears, select **No** to keep Window 95 from trying to detect the hardware automatically, and then click on the **Next** button.

3   Select **Other Devices** from the **Hardware Types** list that appears.

4. In the dialog box that appears, select National Instruments in the **Manufacturers** list on the left. In the **Models** box, select **AT-FBUS 1 Port** or **AT-FBUS 2 Port**. Click on the **Next** button, twice in a row.

5. Click on the **Finish** button.

6. To use the Device Manager, select **Start»Settings»Control Panel»System**. Click on the **Device Manager** tab.

7. Select the AT-FBUS board and click on the **Properties** button. The **AT-FBUS Properties** dialog box appears.

8. Click on the **Resources** tab.

9. Configure resources for your AT-FBUS board. Select a setting from the **Setting based on:** list. Basic Configurations 1 and 3 do not use an interrupt request line. Make sure to match the settings of the jumper and switches on your AT-FBUS board.

    If necessary, you can change a setting in one of the Basic Configurations by double-clicking on the setting in the **Resource settings:** list. The **Conflicting device list:** window shows if there are any conflicts with the resources you choose.

10. After you have selected nonconflicting resources, click on the **OK** button on two successive dialog boxes to save your changes.

Configure the Communication Parameters and Interface Name

Use the NI-FBUS Interface Configuration utility to configure the Fieldbus communication parameters and interface name.

1. Start the NI-FBUS Interface Configuration utility by selecting **Start»Programs»NI-FBUS»Interface Config**.

2. In the **Interface Config** window, select the port you want to configure and click on the **Edit** button.

3. Enter an interface name for the port.

4. Make sure that **NI-FBUS** is selected for **Usage**.

5. Click on the **OK** button.

6. Assign a unique address to each of your fieldbus interfaces. Your interface must be at a fixed address or a visitor address for you to start using the NI-FBUS Communications Manager.

   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**.

7. Assign a unique physical device tag to each of your fieldbus interfaces. 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.

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

Configuring the Link Active Schedule File

If you are using the NI-FBUS Configurator or if you do not want to do scheduling or use publishers and subscribers, continue to Chapter 3, *Begin to Use the NI-FBUS Communications Manager*. 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 Communications Manager User Manual for Windows 95 and Windows NT*, and then test the NI-FBUS Communications Manager software installation, as described in the next section.

Using the NI-FBUS Interface Configuration Utility after Installation

You should use the NI-FBUS Interface Configuration utility, `fbconf.exe`, after installation in the following cases:

- To change the resource settings to avoid hardware conflicts
- To view or change your software configuration settings

To run the utility, select **Start»Programs»NI-FBUS»Interface Config**.

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

- Logical name for each fieldbus interface (port); you can access the port using the logical name
- Device Description (DD) information
    - Base directory for DDs
    - Location of the standard text dictionary

    You need to change this DD information only if you use the NI-FBUS Communications Manager 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

Using the NI-FBUS Interface Configuration utility, you can view (but not change) the following:

- Number of interfaces
- Base address of each interface
- IRQ of each interface

To change the base address or IRQ settings, which are known as *resources* in Windows 95, you must use the Windows 95 Device Manager, as described in the *Changing the Resources to Eliminate Conflicts* section, later in this chapter.

Test the Installation

To make sure that your NI-FBUS Communications Manager software is installed correctly and is working properly, start the NI-FBUS Communications Manager process by selecting **Start»Programs»NI-FBUS»Nifb**.

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

If the NI-FBUS Communications Manager does not start up successfully, the base address, the IRQ line, or your network address is incorrect. Start the NI-FBUS Interface Configuration utility by selecting **Start»Programs»NI-FBUS»Interface Config**, and make sure that your network address is unique. You can also check the Windows 95 Device Manager to see if Windows 95 has detected any problems or conflicts in the resources assigned to your AT-FBUS. The Device Manager displays an exclamation mark (!) on the icon of any AT-FBUS that has resource conflicts.

Changing the Resources to Eliminate Conflicts

☞   **Note:**   *If you do not suspect you have resource conflicts, proceed to Chapter 3, Begin to Use the NI-FBUS Communications Manager.*

If you discovered resource conflicts when testing the installation, you need to change your base address or IRQ settings, which are known as resources in Windows 95. To change these settings, use the Windows 95 Device Manager as follows:

1. Double-click on the **System** icon under **Start»Settings»Control Panel**.

2. Click on the **Device Manager** tab.

3. Locate your board under the heading **Fieldbus Adapters**.

4. Click on the name of the board, then click on the **Properties** button.

5. Use the **Resources** tab to view or edit the resources assigned to the board.

If you cannot find a nonconflicting IRQ, you may select a base address only. If you do not use an IRQ, you must use the NI-FBUS Interface

Configuration utility to set the board to polled mode. To run the utility, select **Start»Programs»NI-FBUS»Interface Config**.

☞ **Note:**   *After you change the resource settings, make sure to move the hardware jumper and switches to match. See the* Changing the Hardware Settings *section, earlier in this chapter, for information on changing the hardware settings.*

Begin to Use the NI-FBUS Communications Manager
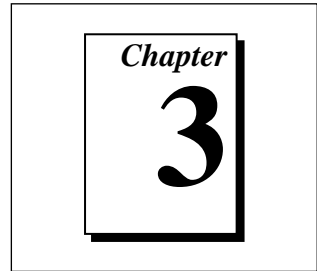
This chapter helps you get started using the NI-FBUS Communications Manager software for Windows 95.

Starting the NI-FBUS Communications Manager

The `nifb` process must be running in order to run an application that uses the NI-FBUS Communications Manager. Start the `nifb` process by selecting **Start»Programs»NI-FBUS»Nifb**.

If the NI-FBUS Communications Manager does not start up, and displays the message **Unable to download stack to board *X***, you might have a memory base address conflict. Refer to the *Selecting the Memory Base Address* section in Chapter 2, *Installation and Configuration*, for instructions on how to reconfigure your board to use a different memory base address.

If the process and the driver start up successfully, you can add the **NIFB** shortcut to the **StartUp** folder so that the NI-FBUS Communications Manager starts automatically when you boot or restart your computer. Consult your Microsoft Windows 95 online help for information on adding programs to the **StartUp** folder.

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

Writing and Compiling Your Application

☞   **Note:**   *If you are using the NI-FBUS Configurator and you are not developing an the NI-FBUS Communications Manager application, this section does not apply to you.*

When you compile your the NI-FBUS Communications Manager application, consider the following items:

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

- You must specify the `include` directory under the NI-FBUS install directory in your project settings.

- You must link your program with either the `nifb.lib` or `nifb_bor.lib` import library. National Instruments created `nifb.lib` using Microsoft Visual C/C++ version 4.0, and `nifb_bor.lib` using Borland C 4.51. Borland C users should link with `nifb_bor.lib`.

- 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

☞   **Note:**   *The NI-FBUS Dialog Utility is not included with the NI-FBUS Configurator.*

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 the NI-FBUS Communications Manager API.

You can run the NI-FBUS Dialog utility by selecting **Start»Programs»NI-FBUS»NIFBus Dialog**. When you open the NI-FBUS 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 NI-FBUS Dialog utility displays an icon for each descriptor you open: session, link, physical device, Virtual Field Device (VFD), and block. Click the right mouse button on an icon to view a 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 *the NI-FBUS Communications Manager User Manual for Windows 95 and Windows NT* for examples of how to use the NI-FBUS Dialog utility.

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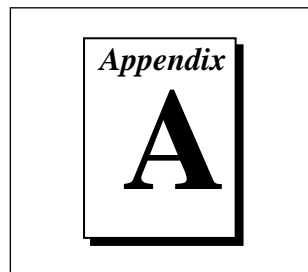
This appendix describes the electrical, physical, and environmental characteristics of the AT-FBUS hardware and the recommended operating conditions.

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

Characteristic	Specification
Power Requirement: 　AT-FBUS 　AT-FBUS/2	 750 mA Typical 820 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 (1 per fieldbus channel)

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 B Certified

Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve technical problems and a form you can use to comment on the product documentation. When you contact us, we need the information on the Technical Support Form and the configuration form, if your manual contains one, about your system configuration to answer your questions as quickly as possible.

National Instruments has technical assistance through electronic, fax, and telephone systems to quickly provide the information you need. Our electronic services include a bulletin board service, an FTP site, a Fax-on-Demand system, and e-mail support. If you have a hardware or software problem, first try the electronic support systems. If the information available on these systems does not answer your questions, we offer fax and telephone support through our technical support centers, which are staffed by application engineers.

Electronic Services

Bulletin Board Support

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: 01 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 list below 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
Australia	03 9879 5166	03 9879 6277
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	09 725 725 11	09 725 725 55
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	5 520 2635	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

Hardware Type (AT-FBUS or AT-FBUS/2) and Revision _____

Interrupt Level of Hardware _____

Base I/O Address of Hardware _____

Fieldbus Software and Version _____

Other Products

Computer Make and Model _____

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 95*

Edition Date: July 1997

Part Number: 321536A-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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Thank you for your help.

Name _____

Title _____

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Austin, TX 78730-5039

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

Symbols

°   Degrees.

A

A   Amperes.

AI   Analog Input. A type of function block.

API   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 which are not predetermined.

AT-compatible   Compatible with the 16-bit Industry Standard Architecture.

B

b	Bits.
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 VFD.
B	Bytes.

C

C	Celsius.
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.
CPU	Central processing unit.

D

Data Link Layer (DLL)	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.
descriptor	A number returned to the application by the NI-FBUS Communications Manager, used to specify a target for future NI-FBUS calls.
Device Description (DD)	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. Device IDs must be unique to the device; no two devices can have the same device ID.
DMA	Direct Memory Access.

DRAM	Dynamic Random Access Memory. Memory that requires electricity and refreshing to hold data.

E

EMI	Electromagnetic interference.

F

fieldbus	An all-digital, two-way communication system that connects control systems to instrumentation.
Fieldbus Foundation	An organization that developed a fieldbus network specifically based upon the work and principles of the ISA/IEC standards committees.
Fieldbus Messaging Specification (FMS)	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 (FF)	The communications network that the Fieldbus Foundation created.

H

hex	Hexadecimal.

I

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

ISO	International Organization for Standardization. A technical standards organization that creates international technical standards for computers and communications. The ISO is composed of national standards organizations in 89 countries. The American National Standards Institute (ANSI) represents the United States in the ISO.

L

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.

M

m	Meters.

O

Object Dictionary (OD)	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.
octet	A single 8-bit value.

P

parameter	One of a set of network-visible values that makes up a function block.
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.

S

s	Seconds.
session	A connection between your application and an NI-FBUS entity.
shared memory	Computer memory shared between two or more microprocessors.
static library	A library of functions/subroutines that you must link to your application as one of the final steps of compilation, as opposed to a Dynamic Link Library, which links to your application at run time.
System Management Configuration	Configuration parameters that set up device identification and network time distribution.

V

VCR	Preconfigured or negotiated connections between virtual field devices on a network.
Virtual Field Device (VFD)	A model for remotely viewing data described in the Object Dictionary.