ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *National Instruments PCI-485/8* at our website: ***Click HERE***

Serial

Serial Hardware and Software for Windows User Manual

PCI, PXI™, PCMCIA, and AT Serial Hardware

December 2000 Edition
Part Number 322983A-01

Worldwide Technical Support and Product Information

ni.com

National Instruments Corporate Headquarters

11500 North Mopac Expressway Austin, Texas 78759-3504 USA Tel: 512 794 0100

Worldwide Offices

Australia 03 9879 5166, Austria 0662 45 79 90 0, Belgium 02 757 00 20, Brazil 011 284 5011,
Canada (Calgary) 403 274 9391, Canada (Ottawa) 613 233 5949, Canada (Québec) 514 694 8521,
China (Shanghai) 021 6555 7838, China (ShenZhen) 0755 3904939, Denmark 45 76 26 00,
Finland 09 725 725 11, France 01 48 14 24 24, Germany 089 741 31 30, Greece 30 1 42 96 427,
Hong Kong 2645 3186, India 91805275406, Israel 03 6120092, Italy 02 413091, Japan 03 5472 2970,
Korea 02 596 7456, Mexico 5 280 7625, Netherlands 0348 433466, New Zealand 09 914 0488,
Norway 32 27 73 00, Poland 0 22 528 94 06, Portugal 351 1 726 9011, Singapore 2265886, Spain 91 640 0085,
Sweden 08 587 895 00, Switzerland 056 200 51 51, Taiwan 02 2528 7227, United Kingdom 01635 523545

For further support information, see the *Technical Support Resources* appendix. To comment on the documentation, send e-mail to techpubs@ni.com

© Copyright 1997, 2000 National Instruments Corporation. All rights reserved.

Important Information

Warranty

The serial hardware is warranted against defects in materials and workmanship for a period of one year from the date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

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 THERETOFORE 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

CVI™, LabVIEW™, National Instruments™, ni.com™, and PXI™ are trademarks of National Instruments Corporation.

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

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.

Compliance

FCC/Canada Radio Frequency Interference Compliance*

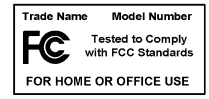
Determining FCC Class

The Federal Communications Commission (FCC) has rules to protect wireless communications from interference. The FCC places digital electronics into two classes. These classes are known as Class A (for use in industrial-commercial locations only) or Class B (for use in residential or commercial locations). Depending on where it is operated, this product could be subject to restrictions in the FCC rules. (In Canada, the Department of Communications (DOC), of Industry Canada, regulates wireless interference in much the same way.)

Digital electronics emit weak signals during normal operation that can affect radio, television, or other wireless products. By examining the product you purchased, you can determine the FCC Class and therefore which of the two FCC/DOC Warnings apply in the following sections. (Some products may not be labeled at all for FCC; if so, the reader should then assume these are Class A devices.)

FCC Class A products only display a simple warning statement of one paragraph in length regarding interference and undesired operation. Most of our products are FCC Class A. The FCC rules have restrictions regarding the locations where FCC Class A products can be operated.

FCC Class B products display either a FCC ID code, starting with the letters **EXN**, or the FCC Class B compliance mark that appears as shown here on the right.



Consult the FCC web site `http://www.fcc.gov` for more information.

FCC/DOC Warnings

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual and the CE Mark Declaration of Conformity**, may cause interference to radio and television reception. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC).

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

Class A

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.

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.

Class B

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.

Canadian Department of Communications

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

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

European Union - Compliance to EEC Directives

Readers in the EU/EEC/EEA must refer to the Manufacturer's Declaration of Conformity (DoC) for information** pertaining to the CE Mark compliance scheme. The Manufacturer includes a DoC for most every hardware product except for those bought for OEMs, if also available from an original manufacturer that also markets in the EU, or where compliance is not required as for electrically benign apparatus or cables.

* Certain exemptions may apply in the USA, see FCC Rules §15.103 **Exempted devices**, and §15.105(c). Also available in sections of CFR 47.

** The CE Mark Declaration of Conformity will contain important supplementary information and instructions for the user or installer.

Contents

About This Manual

Conventions xiii
Related Documentation xiv

Chapter 1
Introduction

How to Use This Manual 1-1
What You Need to Get Started 1-2
Optional Equipment 1-3
Serial Hardware Overview 1-3
PCI Kits 1-3
PXI Kits 1-4
PCMCIA Kits 1-6
AT Kits 1-6
NI-Serial Software Overview 1-8
Time-Saving Development Tools 1-8

Chapter 2
PCI Serial Hardware Installation, Verification, and Configuration

Windows 2000 2-1
Install the Software 2-1
Install the Hardware 2-2
Verify the Installation 2-4
Configure Communication Port Settings 2-5
Windows Me/9*x* 2-9
Install the Software 2-9
Install the Hardware 2-10
Verify the Installation 2-12
Configure Communication Port Settings 2-14
Windows NT 2-18
Install the Software 2-18
Install the Hardware 2-18
Verify the Installation 2-20
Configure Communication Port Settings 2-21

Chapter 3
PXI Serial Hardware Installation, Verification, and Configuration

Windows 2000 3-1
Install the Software 3-1
Install the Hardware 3-2
Verify the Installation 3-4
Configure Communication Port Settings 3-5
Windows Me/9*x* 3-9
Install the Software 3-9
Install the Hardware 3-10
Verify the Installation 3-11
Configure Communication Port Settings 3-13
Windows NT 3-17
Install the Software 3-17
Install the Hardware 3-17
Verify the Installation 3-19
Configure Communication Port Settings 3-20

Chapter 4
PCMCIA Serial Hardware Installation, Verification, and Configuration

Windows 2000 4-1
Install the Software 4-1
Install the Hardware 4-2
Verify the Installation 4-3
Configure Communication Port Settings 4-5
Windows Me/9*x* 4-8
Install the Software 4-8
Install the Hardware 4-9
Verify the Installation 4-10
Configure Communication Port Settings 4-13
Windows NT 4-16
Install the NI-Serial Software 4-16
Install the PCMCIA Serial Hardware 4-17
Verify the Installation 4-18
Configure Communication Port Settings 4-19

Chapter 5
AT Serial Hardware Installation, Verification, and Configuration

Windows 2000 5-1
Install the Software 5-1
Install the Hardware 5-2
Verify the Installation 5-4
Configure Communication Port Settings 5-5
Windows Me/9*x* 5-9
Install the Software 5-9
Install the Hardware 5-10
Verify the Installation 5-12
Configure Communication Port Settings 5-14
Windows NT 5-18
Installing the Microsoft PnP ISA Enabler Driver 5-18
Install the NI-Serial Software 5-19
Install the Serial Hardware 5-19
Verify the Installation 5-21
Configure Communication Port Settings 5-22

Chapter 6
Using Your Serial Hardware

General Programming Requirements 6-1
Advanced Transceiver Control for the PCI/PXI/PCMCIA/AT-485 Boards 6-1
Four-Wire Mode 6-2
Two-Wire Mode: $\overline{\text{DTR}}$ with Echo 6-2
Two-Wire Mode: $\overline{\text{DTR}}$ Controlled 6-2
Two-Wire Mode: $\overline{\text{TXRDY}}$ Auto Control 6-3
Setting the Transceiver Control Mode 6-3
Setting the Transceiver Mode with DeviceIoControl 6-4

Appendix A
Connector Descriptions

Appendix B
Serial Port Information

Appendix C
Uninstalling the Hardware and Software

Appendix D
Troubleshooting and Common Questions

Appendix E
Specifications

Appendix F
Technical Support Resources

Glossary

Index

Figures

Figure 2-1. PCI Serial Board Installation 2-3
Figure 2-2. Device Manager for PCI Serial Board Ports 2-4
Figure 2-3. Port Settings Tab 2-7
Figure 2-4. Advanced Settings Dialog Box 2-8
Figure 2-5. PCI Serial Board Installation 2-11
Figure 2-6. Device Manager Tab for PCI Serial Board Ports 2-13
Figure 2-7. Port Settings Tab 2-16
Figure 2-8. Advanced Port Settings Dialog Box 2-17
Figure 2-9. Installing the PCI Serial Board 2-19
Figure 2-10. niports Configuration Utility 2-21
Figure 2-11. General Port Settings Dialog Box 2-22

Figure 3-1. Installing the PXI Serial Board 3-3
Figure 3-2. Device Manager for PXI Serial Board Ports 3-4
Figure 3-3. Port Settings Tab 3-7
Figure 3-4. Advanced Settings Dialog Box 3-8
Figure 3-5. Installing the PXI Serial Board 3-10
Figure 3-6. Device Manager for PXI Serial Board Ports 3-12
Figure 3-7. Port Settings Tab 3-15
Figure 3-8. Advanced Settings Dialog Box 3-16
Figure 3-9. Installing the PXI Serial Board 3-18
Figure 3-10. niports Configuration Utility 3-20
Figure 3-11. General Port Settings Dialog Box 3-21

Figure 4-1. Inserting a PCMCIA Serial Card 4-3
Figure 4-2. Device Manager for PCMCIA Serial Card Ports 4-4

Figure 4-3. Port Settings Tab 4-6
Figure 4-4. Advanced Settings Dialog Box 4-7
Figure 4-5. Inserting a PCMCIA Serial Card 4-10
Figure 4-6. Device Manager Ports List for PCMCIA Serial Card Correctly Installed 4-11
Figure 4-7. Port Settings Tab 4-14
Figure 4-8. Advanced Port Settings Dialog Box 4-15
Figure 4-9. Inserting a PCMCIA Serial Card 4-17
Figure 4-10. niports Configuration Utility 4-19
Figure 4-11. General Port Settings Dialog Box 4-20
Figure 4-12. Resource Configuration Dialog Box for the PCMCIA-485 4-22
Figure 4-13. Resource Configuration Dialog Box for the PCMCIA-485/2 4-23

Figure 5-1. AT Serial Board Installation 5-3
Figure 5-2. Device Manager for AT Serial Board Ports 5-4
Figure 5-3. Port Settings Tab 5-7
Figure 5-4. Advanced Settings Dialog Box 5-8
Figure 5-5. AT Serial Board Installation 5-11
Figure 5-6. Device Manager Ports List for AT Serial Board Correctly Installed 5-13
Figure 5-7. Port Settings Tab 5-16
Figure 5-8. Advanced Port Settings Dialog Box 5-17
Figure 5-9. AT Serial Board Installation 5-20
Figure 5-10. niports Configuration Utility 5-22
Figure 5-11. General Port Settings Dialog Box 5-23
Figure 5-12. PnP Port Configuration Dialog Box for the AT-232/4 5-25

Figure A-1. DB-9 Connector Pin Locations A-2
Figure A-2. 10-Position Modular Jack Pin Locations A-3
Figure A-3. DB-25 Connector Pin Locations A-4
Figure A-4. Connecting the Cables to Your Four-Port PCI Serial Board A-5
Figure A-5. 68-Pin Connector Pin Locations A-6
Figure A-6. 100-Pin Connector Pin Locations A-8

Figure B-1. Typical Full-Duplex System B-4
Figure B-2. Typical Half-Duplex System B-4
Figure B-3. Multidrop Network Using Terminating Resistors B-5
Figure B-4. Transmission Line Using Bias Resistors B-6
Figure B-5. Straight-Through Cabling in a DTE-to-DCE Interface B-7
Figure B-6. Null-Modem Cabling in a DTE-to-DTE Interface B-7

Figure C-1. Selecting an Interface to Uninstall C-2
Figure C-2. Selecting an Interface to Uninstall C-4
Figure C-3. Selecting an Interface to Uninstall C-5

Figure C-4. Selecting an Interface to Uninstall C-7
Figure C-5. Selecting an Interface to Uninstall C-9
Figure C-6. Selecting an Interface to Uninstall C-10
Figure C-7. Selecting an Interface to Uninstall C-12
Figure C-8. Selecting an Interface to Uninstall C-14
Figure C-9. Selecting an Interface to Uninstall C-16
Figure C-10. Selecting an Interface to Uninstall C-17
Figure C-11. Selecting an Interface to Uninstall C-19
Figure C-12. Selecting an Interface to Uninstall C-21

Figure D-1. Selecting an Interface to Uninstall D-2
Figure D-2. Ports List in Device Manager D-12
Figure D-3. Ports List in Device Manager D-14
Figure D-4. Multi-Function Adapter Class in the Device Manager D-17

Tables

Table 1-1. PXI Board Names and Descriptions 1-5

Table 6-1. Transceiver Control Modes 6-2
Table 6-2. Transceiver Mode Control Bytes 6-4
Table 6-3. DeviceIoControl Function Input Values 6-5

Table A-1. DB-9 Pin Descriptions A-2
Table A-2. 10-Position Modular Jack Pin Descriptions A-3
Table A-3. DB-25 Pin Descriptions A-4
Table A-4. 68-Pin Connector Pin Descriptions A-7
Table A-5. 100-Pin Connector Pin Descriptions A-9

Table B-1. RS-232, RS-422, and RS-485 Features B-1

Table D-1. Standard DOS-Based Addresses D-15

About This Manual

This manual contains instructions to help you install and configure the National Instruments serial hardware and the NI-Serial software for Windows 2000/NT/Me/9*x*. This manual includes information about the following serial hardware:

- PCI-232/2, PCI-232/4, PCI-232/8, PCI-232/16, PCI-485/2, PCI-485/4, and PCI-485/8 boards in both isolated and nonisolated versions
- PXI-8420 (two, four, eight, and 16 port), PXI-8421 (two, four, and eight port), PXI-8422 (two and four port), and PXI-8423 (two and four port)
- PCMCIA-232, PCMCIA-232/2, PCMCIA-232/4, PCMCIA-485, and PCMCIA-485/2
- AT-232/2, AT-232/4, AT-485/2, and AT-485/4 boards in both isolated and nonisolated versions

This manual assumes that you are already familiar with Windows 2000/NT/Me/9*x*.

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.
♦	The ♦ symbol indicates that the following text applies only to a specific product, a specific operating system, or a specific software version.
	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.
AT serial boards	AT serial boards refers to all port versions of the AT serial boards.

bold	Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names.
$\overline{\text{DTR}}$	Signal names with an overscore, such as $\overline{\text{DTR}}$, indicate that the signal is active low.
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.
PCI serial boards	PCI serial boards refers to all port versions of the PCI serial boards.
PCMCIA serial boards	PCMCIA serial boards refers to all versions of the PCMCIA serial boards.
PXI serial boards	PXI serial boards refers to all port versions of the PXI serial boards.

Related Documentation

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

- ANSI/EIA-232-D Standard, *Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*
- EIA/RS-422-A Standard, *Electrical Characteristics of Balanced Voltage Digital Interface Circuits*
- EIA-485 Standard, *Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*
- *Microsoft Win32 Software Developer Kit*, Online Documentation for *Win32 Overviews*, *Win32 Reference*, *Microsoft Programmer's Guide to Windows 98/95*, and *Microsoft Windows NT System Guide*, Microsoft Corporation

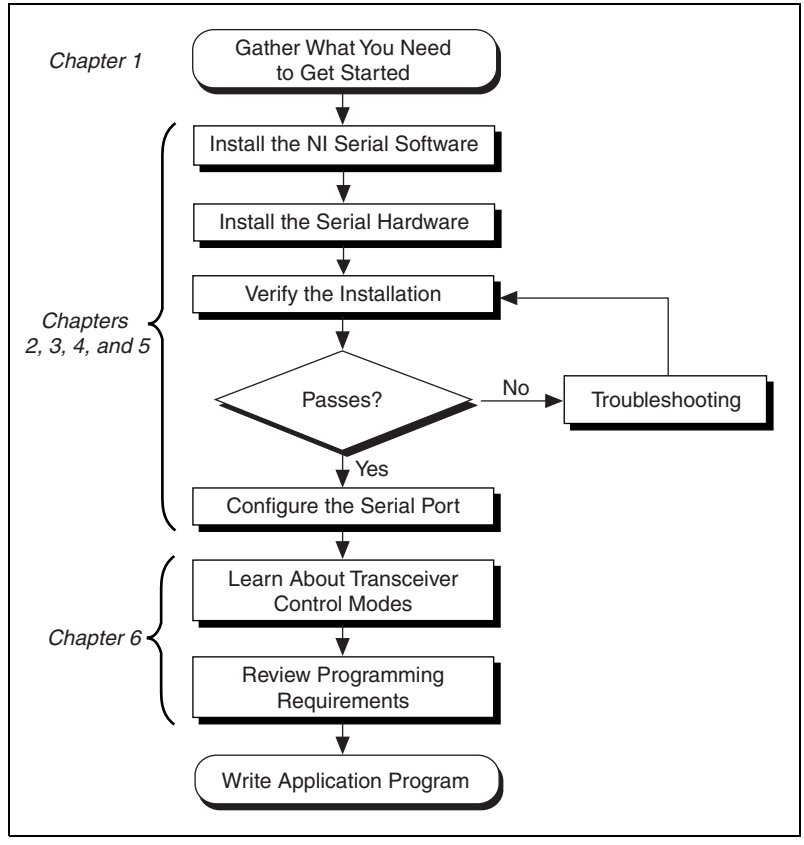
- *NS16550AF Universal Asynchronous Receiver/Transmitter with FIFOs*, National Semiconductor
- *ST16C654 Asynchronous Receiver/Transmitter with FIFOs*, EXAR Corporation

1

Introduction

This chapter explains how to use this manual, lists what you need to get started and optional equipment you can order, and briefly describes the serial hardware and the NI-Serial software.

How to Use This Manual



What You Need to Get Started

Before you install your serial hardware and the NI-Serial software, make sure you have all of the following items:

- ❑ Windows 2000/NT/Me/9*x* installed on your computer
- ❑ One of the following serial boards, which is included in your kit:

PCI Kits

- PCI-232 (two, four, eight, or 16 port)
- PCI-485 (two, four, or eight port)
- PCI-232 isolated (two or four port)
- PCI-485 isolated (two or four port)

PXI Kits

- PXI-8420 (two, four, eight, or 16 port)
- PXI-8421 (two, four, or eight port)
- PXI-8422 (two or four port)
- PXI-8423 (two or four port)

PCMCIA Kits

- PCMCIA-232 (one, two, or four port)
- PCMCIA-485 (one or two port)

AT Kits

- AT-232 (two or four port)
- AT-485 (two or four port)
- AT-232 (two or four port) isolated
- AT-485 (two or four port) isolated

- ❑ CD, *NI-Serial Software for Windows 2000/NT/Me/9x*, which is included in your kit

Optional Equipment

For more information about ordering the following optional equipment, contact National Instruments:

- DB-9 RS-485 termination connector (PCI-485, PCMCIA-485, PXI-8421, PXI-8423, and AT-485 only)
- 10-position modular jack to DB-9 cable (PCI, PXI, and AT four-port boards only)
- 10-position modular jack to DB-25 cable (PCI, PXI, and AT four-port boards only)
- 68-pin to DB-9 adapter cable (PCI and PXI eight-port boards only)
- RS-232 9-pin to 9-pin null modem cable
- RS-232 9-pin to 25-pin null modem cable
- RS-485 9-pin to 9-pin null modem cable
- Breakout box (PCI/PXI-232 16-port board only)

Serial Hardware Overview

PCI Kits

The serial hardware gives you a variety of solutions for serial communication. The PCI-232 boards work with the RS-232 protocols, and the PCI-485 boards work with the RS-422 and RS-485 protocols. You can use the PCI-232 boards for serial communication up to distances of 50 ft. You can connect the PCI-485 boards to up to 31 devices using serial cable lengths up to 4,000 ft.

Additionally, the PCI serial boards are available in a two-port version (PCI-232/2 and PCI-485/2), a four-port version (PCI-232/4 and PCI-485/4), an eight-port version (PCI-232/8 and PCI-485/8), and a sixteen-port version (PCI-232/16). The two-port versions use DB-9 connectors. The four-port versions use 10-position modular jacks to provide all four connections on a single back panel. Optional cable accessories convert the 10-position modular jacks to either DB-9 or DB-25 connectors with standard pinouts. The eight-port versions use adapter cables to convert the 68-pin connector on the board to eight DB-9 connectors. The 16-port version uses a breakout box to convert the 100-pin connector on the board to sixteen DB-9 connectors. Throughout this manual, *PCI serial boards* refers to all versions of the PCI serial boards.

The isolated PCI-232 and PCI-485 boards are designed for applications in harsh environments. Isolated ports provide reliable communication in situations involving ground loops from different ground levels or high common mode voltage induced on the lines in noisy environments. Non-isolated ports may not provide reliable communication in those situations. The isolation between each communication port and the host PC ensures the safe operation of the PC and the devices connected to other ports on the same board, in case of accidental high voltages on communication lines.

The PCI-485 boards support four hardware transceiver control modes for reliable communication with two- and four-wire devices. For more information about transceiver control modes, refer to Chapter 6, *Using Your Serial Hardware*.

All serial hardware uses standard 16550-compatible UARTs (Universal Asynchronous Receiver/Transmitters) for complete compatibility with standard PC COM ports. The serial hardware contains FIFOs (First-In-First-Out) buffers to reduce susceptibility to interrupt latency for faster transmission rates. Full Plug and Play compatibility allows switchless configuration and installation. For more information about the serial hardware specifications and operating conditions, refer to Appendix E, *Specifications*.

PXI Kits

The serial hardware gives you a variety of solutions for serial communication. The RS-232 boards (PXI-8420 and PXI-8422) work with the RS-232 protocols. The RS-485 boards (PXI-8421 and PXI-8423) work with the RS-422 and RS-485 protocols. You can use the RS-232 boards for serial communication up to distances of 50 ft. You can connect the RS-485 boards to up to 31 devices using serial cable lengths up to 4,000 ft.

Additionally, the PXI serial boards are available in a two-port version, a four-port version, an eight-port version (PXI-8420 and PXI-8421 only), and a 16-port version (PXI-8420 only). The two-port versions use DB-9 connectors. The four-port versions use 10-position modular jacks to provide all four connections on a single front panel. Optional cable accessories convert the 10-position modular jacks to either DB-9 or DB-25 connectors with standard pinouts. The eight-port versions use two different adapter cables to convert the 68-pin connector on the board to eight DB-9 connectors. The 16-port version uses a breakout box to convert the 100-pin connector on the board to sixteen DB-9 connectors. Throughout this manual, *PXI serial boards* refers to all versions of the PXI serial boards.

The isolated PXI boards are designed for applications in harsh environments. Isolated ports provide reliable communication in situations involving ground loops from different ground levels or high common mode voltage induced on the lines in noisy environments. Non-isolated ports may not provide reliable communication in those situations. The isolation between each communication port and the host PC ensures the safe operation of the PC and the devices connected to other ports on the same board, in case of accidental high voltages on communication lines.

The RS-485 boards (PXI-8421 and PXI-8423) support four hardware transceiver control modes for reliable communication with two- and four-wire devices. For more information about transceiver control modes, refer to Chapter 6, *Using Your Serial Hardware*.

All serial hardware uses standard 16550-compatible UARTs (Universal Asynchronous Receiver/Transmitters) for complete compatibility with standard PC COM ports. The serial hardware contains FIFOs (First-In-First-Out) buffers to reduce susceptibility to interrupt latency for faster transmission rates. Full Plug and Play compatibility allows switchless configuration and installation. For more information about the serial hardware specifications and operating conditions, refer to Appendix E, *Specifications*.

Table 1-1 lists the PXI serial board numbers and corresponding board descriptions.

Table 1-1. PXI Board Names and Descriptions

PXI Board Name	Description
PXI-8420	RS-232 two port RS-232 four port RS-232 eight port RS-232 16 port
PXI-8421	RS-485 two port RS-485 four port RS-485 eight port
PXI-8422	RS-232 two port isolated RS-232 four port isolated
PXI-8423	RS-485 two port isolated RS-485 four port isolated

PCMCIA Kits

The serial hardware gives you a variety of solutions for serial communications. The PCMCIA-232 interfaces work with the RS-232 protocols, and the PCMCIA-485 interfaces work with the RS-422 and RS-485 protocols. You can use the PCMCIA-232 hardware for serial communication up to distances of 50 ft. You can connect the PCMCIA-485 hardware with up to 31 devices using serial cable lengths up to 4,000 ft.

The PCMCIA-232 is available with one, two, or four ports. The PCMCIA-485 is available in a one-port version or two-port version. All PCMCIA cards come with cables for each port that terminates in a standard DB-9 D-Sub connector. Throughout this manual, references to PCMCIA serial interfaces generally refer to all versions of the interfaces.

The PCMCIA-485 interfaces support four hardware transceiver control modes for reliable communication with two-wire and four-wire devices. Refer to Chapter 6, *Using Your Serial Hardware*, for more information about transceiver control modes.

All of the serial hardware uses standard 16550-compatible UARTs (Universal Asynchronous Receiver/Transmitters) for 100 percent compatibility with standard PC COM ports. The serial hardware contains FIFOs (First-In-First-Out buffers) for reduced susceptibility to interrupt latency and faster transmission rates. Full Plug and Play compatibility gives you the convenience of switchless configuration and installation. Refer to Appendix E, *Specifications*, for more information about the serial hardware specifications and operating conditions.

AT Kits

The serial hardware gives you a variety of solutions for serial communications. The AT-232 boards work with the RS-232 protocols, and the AT-485 boards work with the RS-422 and RS-485 protocols. You can use the AT-232 hardware for serial communication up to distances of 50 ft. You can connect the AT-485 hardware with up to 31 devices using serial cable lengths up to 4,000 ft.

The AT boards are available in three different versions:

- Shared IRQ: All ports on the board share the same IRQ.
- Isolated: All ports on the board are isolated and share the same IRQ.

Additionally, the AT serial boards are available in a two-port version (AT-232/2 and AT-485/2) or a four-port version (AT-232/4 and AT-485/4). The two-port versions use DB-9 connectors. The four-port versions use 10-position modular jacks to provide all four connections on a single back panel. Optional cable accessories convert the 10-position modular jacks to either DB-9 or DB-25 connectors with standard pinouts. Throughout this manual, references to AT serial boards generally refer to all versions of the boards.

The isolated AT-232 and AT-485 boards are designed for applications in harsh environments. Isolated ports provide reliable communication in situations involving ground loops from different ground levels or high common mode voltage induced on the lines in noisy environments. The non-isolated ports may not provide reliable communication in those situations. The isolation between each communication port and the host PC ensures safe operation of the PC and the devices connected to other ports on the same board in case of accidental high voltages on communication lines.

The AT-485 boards support four hardware transceiver control modes for reliable communication with two- and four-wire devices. For more information about transceiver control modes, refer to Chapter 6, *Using Your Serial Hardware*.

All serial hardware uses standard 16550-compatible UARTs (Universal Asynchronous Receiver/Transmitters) for complete compatibility with standard PC COM ports. The serial hardware contains FIFOs (First-In-First-Out) buffers to reduce susceptibility to interrupt latency for faster transmission rates. Full Plug and Play compatibility allows switchless configuration and installation. For more information about the serial hardware specifications and operating conditions, refer to Appendix E, *Specifications*.

NI-Serial Software Overview

The NI-Serial software for Windows 2000/NT/Me/9*x* includes a native Windows 2000/Me/9*x* device driver and Windows NT kernel driver that provide full interrupt-driven, buffered I/O for multiple COM ports. You can obtain a maximum baud rate of either 460.8 KBaud (PCI/PXI-485 kits) or 115.2 KBaud (PCI/PXI/PCMCIA/AT-232 kits). You can also use up to 256 serial ports under Windows 2000 or up to 99 serial ports under Windows NT/Me/9*x*. The NI-Serial software also includes a configuration utility, which is fully integrated into the Windows 2000/Me/9*x* Device Manager and Windows NT Control Panel. For more information about software specifications, refer to Appendix E, *Specifications*.

The NI-Serial software includes the following components:

- Device driver
- Diagnostic utility
- Configuration utility
- Product manuals

Time-Saving Development Tools

Your kit includes the NI-Serial software for Windows 2000/NT/Me/9*x*. In addition, you can order the Measurement Studio or LabVIEW software from National Instruments to speed your application development time and make it easier to communicate with your instruments.

LabVIEW is an easy-to-use, graphical programming environment you can use to acquire data from thousands of different instruments, including IEEE 488.2 devices, VXI devices, serial devices, PLCs, and plug-in data acquisition boards. After you have acquired raw data, you can convert it into meaningful results using the powerful data analysis routines in LabVIEW. LabVIEW also comes with hundreds of instrument drivers, which dramatically reduce software development time, because you do not have to spend time programming the low-level control of each instrument.

Measurement Studio bundles LabWindows/CVI for C programmers, ComponentWorks for Microsoft Visual C++ programmers, and ComponentWorks++ for Microsoft Visual C++ programmers. Measurement Studio is designed for building measurement and automation applications with the programming environment of your choice:

- LabWindows/CVI is an interactive ANSI C programming environment designed for building virtual instrument applications. LabWindows/CVI delivers a drag-and-drop editor for building user interfaces, a complete ANSI C environment for building your test program logic, and a collection of automated code generation tools, as well as utilities for building automated test systems, monitoring applications, or laboratory experiments.
- ComponentWorks for Visual Basic is a collection of ActiveX controls designed for building virtual instrumentation systems. Based on ActiveX technology, ComponentWorks controls are configured through simple property pages. You can use the ComponentWorks GPIB, Serial, and VISA I/O controls and property pages to set up communication with your instruments.
- ComponentWorks++ for Visual C++ takes advantage of integrated C++ libraries and ActiveX to help you build measurement and automation applications. With the ComponentWorks++ instrument classes, you can use the IEEE 488.2 library and VISA, an industry-standard I/O library, to communicate with GPIB, VXI, or Serial devices using the same set of components.

After you install your serial hardware and the NI-Serial software, you can use standard serial I/O functions in LabVIEW and Measurement Studio with your serial interface. If you already have one or more of these applications and want to use them with your serial interface, refer to your product documentation for information about serial I/O functions. For ordering information, contact National Instruments.

2

PCI Serial Hardware Installation, Verification, and Configuration

This chapter describes how to install the NI-Serial software and PCI serial hardware and how to verify the installation. It also describes how to configure the communication port settings.

To begin your installation, see the section of this chapter containing instructions for your operating system (*Windows 2000*, *Windows Me/9x*, or *Windows NT*.)

Windows 2000

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows 2000:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears.
3. Click on the **Add New Programs** button and then the **CD or Floppy** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button.
5. When prompted, click on the **Finish** button to install the program files from the CD.
6. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To exit the setup wizard at any time, click on the **Cancel** button.
7. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows 2000, skip to the next section, *Install the Hardware*. Otherwise, continue to step 8.
8. If your hardware is already installed, restart Windows 2000.

9. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**. When you complete the wizard, continue to the *Verify the Installation* section.

   If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

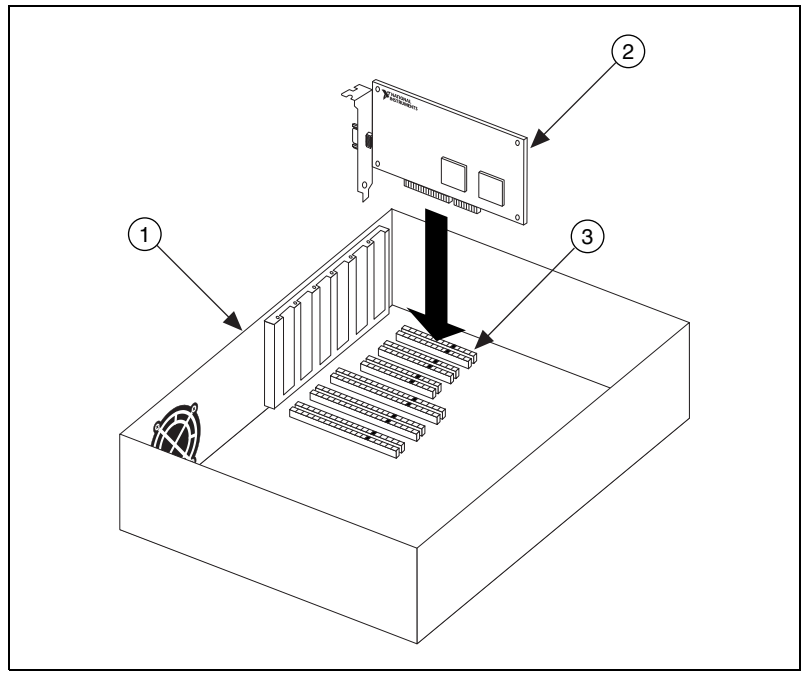
Install the Hardware

Note If you are installing a PCI-485, you might need to adjust the value of the bias resistors, depending on your application. Bias resistors are not available on the eight-port PCI-485. For more information, refer to Appendix B, *Serial Port Information*.

Caution Before you remove your board 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 serial board.

To install your PCI serial board, complete the following steps:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the PCI serial board.
2. Remove the top or side cover of the computer.
3. Find an unused PCI expansion slot in your computer.
4. Remove the corresponding expansion slot cover on the back panel of the computer.
5. Touch a metal part on your chassis to discharge any static electricity.
6. Insert the PCI serial board into the slot with the serial connectors toward the opening on the back panel. Make sure that you insert the board all the way into the slot. The board might seem to click firmly into place, even though it is only part of the way in. Figure 2-1 shows how to install the PCI serial board into an expansion slot.



1 PC 2 PCI Serial Board 3 PCI Slot

Figure 2-1. PCI Serial Board Installation

7. Screw the PCI serial board mounting bracket to the back panel mounting rail of the computer.
8. Replace the cover.
9. Turn on your computer and start Windows 2000.
10. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**.

    If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

To verify the hardware and software installation, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon to display all of the ports.
4. Double-click on the **Multi-function adapters** icon.

   The PCI serial boards are configured as devices belonging to the *multi-function adapters* class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon.

   Figure 2-2 shows the Device Manager tab for serial hardware that is installed properly.

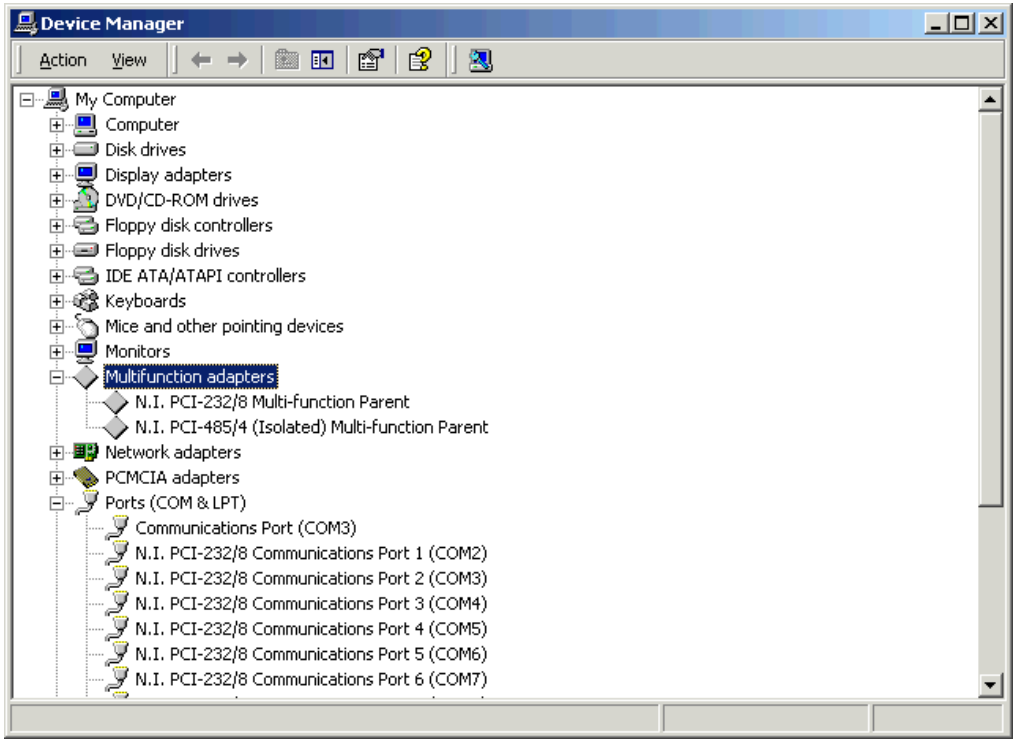


Figure 2-2. Device Manager for PCI Serial Board Ports

5. Verify the hardware resources, as follows:
   a. In the Device Manager under **Multi-function adapters,** double-click on a serial board.
   b. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   c. Repeat steps 5a and 5b until you have verified the resources for each board.
6. (Optional) To determine which physical port is associated with COM*x*, note the Port 1, Port 2, etc. entries next to the COM numbers. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.
7. Run the diagnostic utility, as follows: select **Start»Programs» National Instruments»NI-Serial»Diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.
8. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows 2000 Device Manager. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon.

4. Double-click on the port you want to configure and refer to the following instructions:
   - To view the hardware resources assigned to the serial port, click on the **Resources** tab.
   - To view or change the port settings, click on the **Port Settings** tab. For more information about the settings, refer to the next section, *Port Settings Tab*.
   - To change the RS-485 transceiver mode, or to enable or disable the FIFOs on the serial hardware, in the **Port Settings** tab, click on the **Advanced** button. For more information about the settings, refer to the next section, *Port Settings Tab*.

Note Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

5. To save your changes, click on the **OK** button. To exit without saving the changes, click on the **Cancel** button.

Port Settings Tab

In the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of a field. When you click on the arrow button, a list of valid values for that field appears and you can select the desired setting from the list. Figure 2-3 shows the **Port Settings** tab.

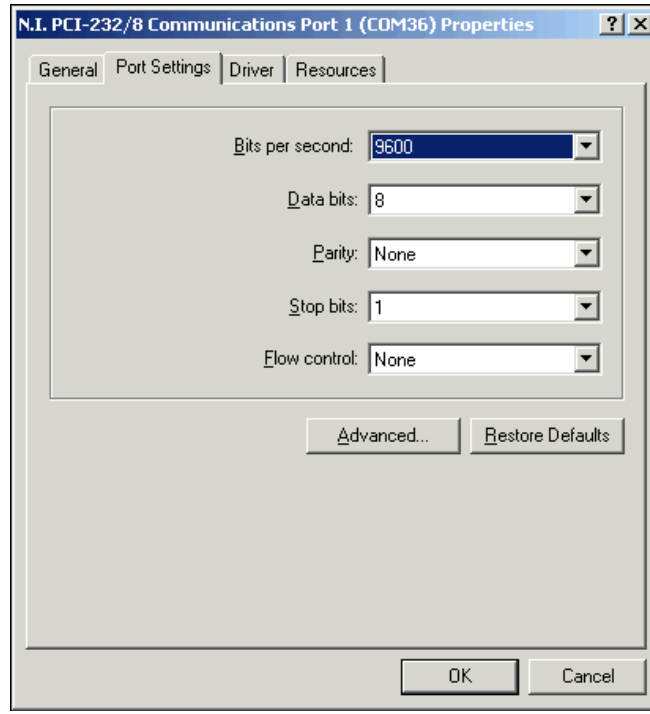


Figure 2-3. Port Settings Tab

Advanced Settings

To view or change the advanced settings, click on the **Advanced** button. Figure 2-4 shows the **Advanced Settings** dialog box.

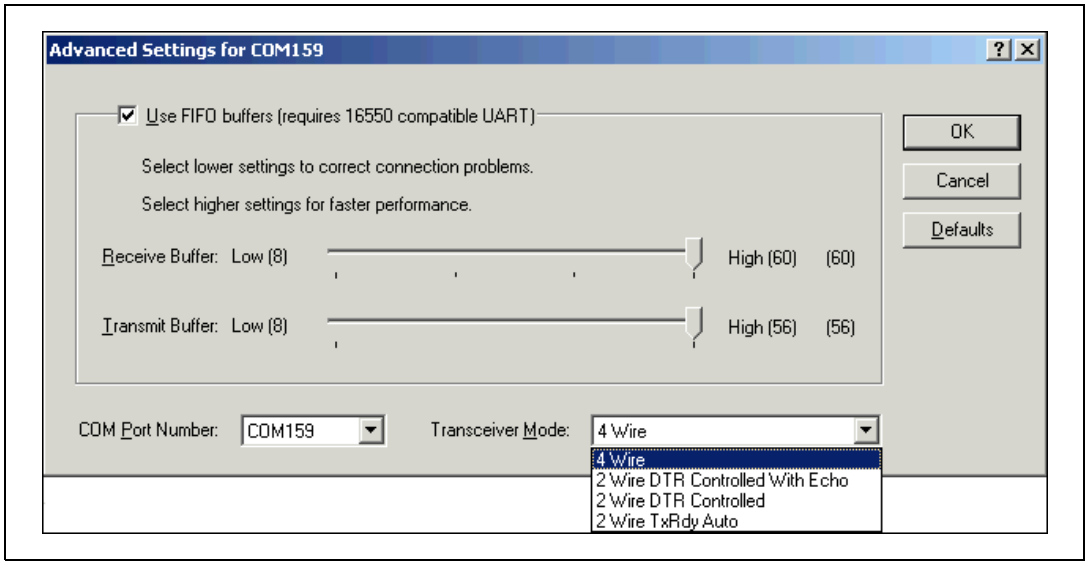


Figure 2-4. Advanced Settings Dialog Box

The following sections describe the advanced settings options.

Transceiver Mode

This field shows the transceiver mode in use, and applies only to PCI-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The **Receive Buffer** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit Buffer** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive Buffer** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive Buffer** value is above your data sizes, your system is less efficient. Therefore, set the **Receive Buffer** value below your data sizes.

Restore Defaults

To reset the fields to their default values at any time, click on the **Restore Defaults** button.

Windows Me/9*x*

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows Me/9*x*:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears.
3. Click on the **Install** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD, and click on the **Next** button.
5. When prompted, click on the **Finish** button to install the program files from floppy disks or CD-ROM.
6. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To exit the setup wizard at any time, click on the **Cancel** button.
7. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows Me/9*x*, skip to the next section, *Install the Hardware*. Otherwise, continue to step 8.

8. If your hardware is already installed, restart Windows Me/9*x*.
9. Windows Me/9*x* should automatically detect your hardware and display one or more **New Hardware Found** dialog boxes. Your operating system (Windows Me/9*x*) may show the **Windows Default Driver** option. If so, make sure the **Windows Default Driver** is selected and click on the **OK** button. If the **Windows Default Driver** option is not shown, the installation continues automatically. When you finish, continue to the *Verify the Installation* section.

   If no **New Hardware Found** dialog box appears, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

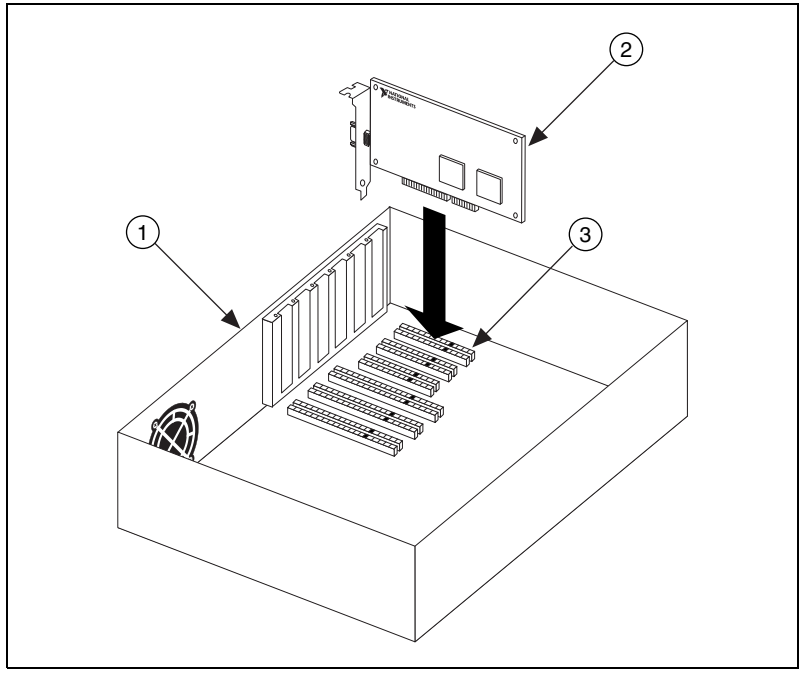
Install the Hardware

Note If you are installing a PCI-485, you might need to adjust the value of the bias resistors, depending on your application. Bias resistors are not available on the eight-port PCI-485. For more information, refer to Appendix B, *Serial Port Information*.

Caution Before you remove your board 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 serial board.

To install your PCI serial board, complete the following steps:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the PCI serial board.
2. Remove the top or side cover of the computer.
3. Find an unused PCI expansion slot in your computer.
4. Remove the corresponding expansion slot cover on the back panel of the computer.
5. Touch a metal part on your chassis to discharge any static electricity.
6. Insert the PCI serial board into the slot with the serial connectors toward the opening on the back panel. Make sure that you insert the board all the way into the slot. The board might seem to click firmly into place, even though it is only part of the way in. Figure 2-5 shows how to install the PCI serial board into an expansion slot.



1 PC 2 PCI Serial Board 3 PCI Slot

Figure 2-5. PCI Serial Board Installation

7. Screw the PCI serial board mounting bracket to the back panel mounting rail of the computer.
8. Replace the cover.
9. Turn on your computer and start Windows Me/9*x*.
10. Windows Me/9*x* should automatically detect your hardware and display one or more **New Hardware Found** dialog boxes. Your operating system (Windows Me/9*x*) may show the **Windows Default Driver** option. If so, make sure the **Windows Default Driver** is selected and click on the **OK** button. If the **Windows Default Driver** option is not shown, the installation continues automatically.

    If no **New Hardware Found** dialog box appears, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

Before you verify the installation, keep in mind that the serial ports built into your computer are typically named from COM1 to COM4. Windows Me/9*x* typically issues port names to the ports on NI serial hardware starting with COM5, COM6, and so on. If not enough resources are available to assign to all the NI serial ports, the port with the higher COM*x* name is not configured.

To verify the hardware and software installation, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Ports (COM & LPT)** icon to display all of the ports.
4. Double-click on the **Multi-function adapters** icon.

   The PCI serial boards are configured as devices belonging to the *multi-function adapters* class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon.

Figure 2-6 shows the Device Manager tab for serial hardware that is installed properly.

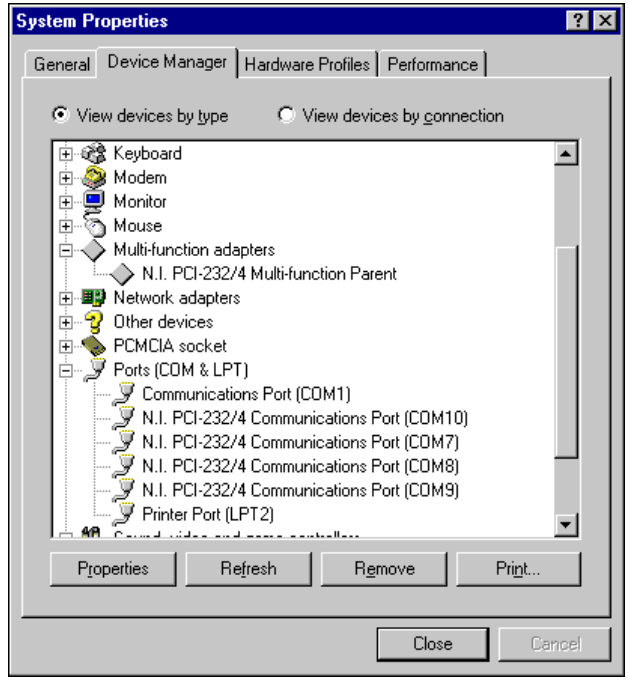


Figure 2-6. Device Manager Tab for PCI Serial Board Ports

5. Verify the hardware resources, as follows:
   a. In the **Device Manager** tab, under **Multi-function adapters,** double-click on a serial board.
   b. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   c. Repeat steps 5a and 5b until you have verified the resources for each board.

6. (Optional) To determine which physical port is associated with COM*x*, complete the following steps:
   a. In the **Device Manager** tab, under **Ports (COM & LPT)**, double-click on the serial port (COM*x*).
   b. Click on the **Port Settings** tab to display the serial number of the serial hardware and the physical port number starting at 1. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.
7. Run the diagnostic utility, as follows: select **Start»Programs» National Instruments Serial»Diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.
8. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows Me/9*x* Device Manager. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Ports (COM & LPT)** icon.

Note If you want your serial ports to use the names COM1, COM2, COM3, or COM4, refer to the *Common Questions* section of Appendix D, *Troubleshooting and Common Questions*.

4. Double-click on the port you want to configure and refer to the following instructions:
   - To view the hardware resources assigned to the serial port, click on the **Resources** tab.
   - To view or change the port settings, click on the **Port Settings** tab. For more information about the settings, refer to the next section, *Port Settings Tab*.
   - To change the RS-485 transceiver mode, or to enable or disable the FIFOs on the serial hardware, in the **Port Settings** tab, click on the **Advanced** button. For more information about the settings, refer to the next section, *Port Settings Tab*.



Note Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

5. To save your changes, click on the **OK** button. To exit without saving the changes, click on the **Cancel** button.

Port Settings Tab

In the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of a field. When you click on the arrow button, a list of valid values for that field appears and you can select the desired setting from the list. Figure 2-7 shows the **Port Settings** tab.

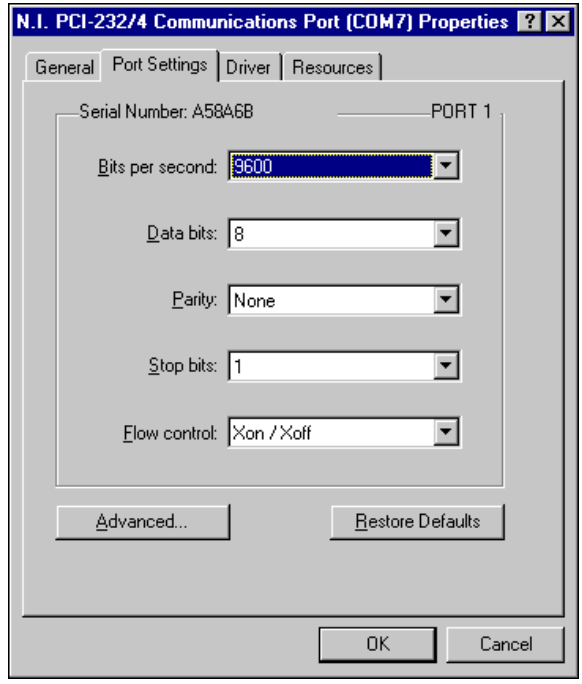


Figure 2-7. Port Settings Tab

Advanced Port Settings

To view or change the advanced port settings, click on the **Advanced** button. Figure 2-8 shows the **Advanced Port Settings** dialog box.

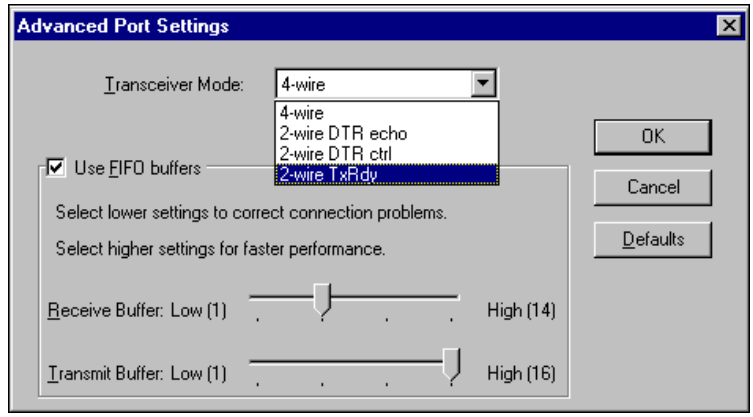


Figure 2-8. Advanced Port Settings Dialog Box

The following sections describe the advanced port setting options.

Transceiver Mode

This field shows the transceiver mode in use, and applies only to PCI-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The **Receive Buffer** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit Buffer** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive Buffer** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive Buffer** value is above your data sizes, your system is less efficient. Therefore, set the **Receive Buffer** value below your data sizes.

Restore Defaults

To reset the fields to their default values at any time, click on the **Restore Defaults** button.

Windows NT

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows NT:

1. Log in as `Administrator` or as a user who has `Administrator` privileges.
2. Select **Start»Settings»Control Panel**.
3. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears.
4. Click on the **Install** button.
5. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD, and click on the **Next** button.
6. When prompted, click the **Finish** button to install the program files.
7. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To exit the setup wizard at any time, click on the **Cancel** button.

Note The setup wizard backs up the Windows NT serial driver `serial.sys` to `serial.bak` and then overwrites `serial.sys`. You can find `serial.sys` in the `WinNT\system32\drivers` directory.

8. If your hardware is already installed, restart Windows NT and continue to the *Verify the Installation* section.

The software installation is complete. Continue to the next section, *Install the Hardware*.

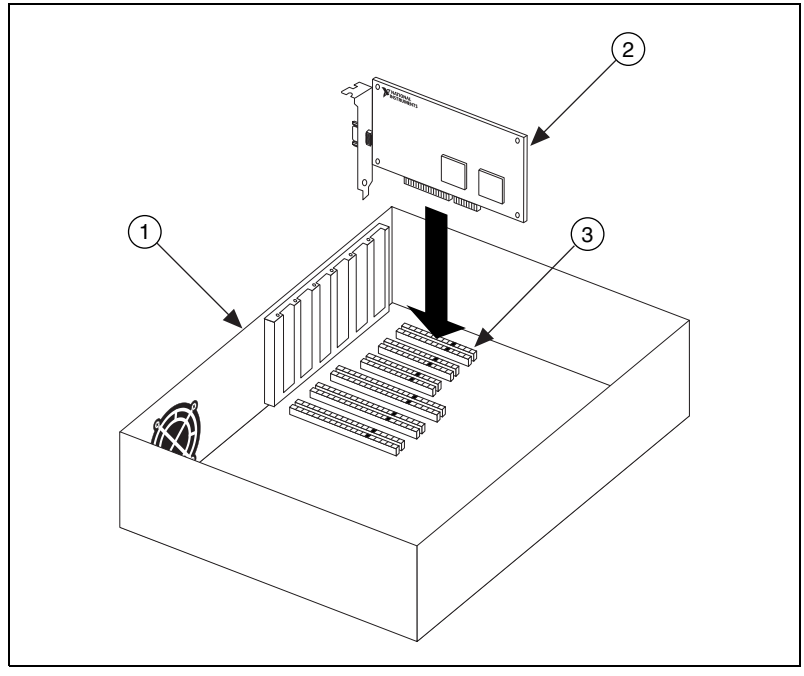
Install the Hardware

Note If you are installing a PCI-485, you might need to adjust the value of the bias resistors, depending on your application. Bias resistors are not available on the eight-port PCI-485. For more information, refer to Appendix B, *Serial Port Information*.

Caution Before you remove your board 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 serial board.

To install your PCI serial board, complete the following steps:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the PCI serial board.
2. Remove the top or side cover of the computer.
3. Find an unused PCI expansion slot in your computer.
4. Remove the corresponding expansion slot cover on the back panel of the computer.
5. Touch a metal part on your chassis to discharge any static electricity.
6. Insert the PCI serial board into the slot with the serial connectors toward the opening on the back panel. Make sure that you insert the board all the way into the slot. The board might seem to click firmly into place, even though it is only part of the way in. Figure 2-9 shows how to install the PCI serial board into an expansion slot.



1 PC 2 PCI Serial Board 3 PCI Slot

Figure 2-9. Installing the PCI Serial Board

7. Screw the PCI serial board mounting bracket to the back panel mounting rail of the computer.
8. Replace the cover.
9. Turn on your computer and start Windows NT.

The hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

To verify the hardware and software installation, complete the following steps:

1. Determine which physical port is associated with COM*x*, as follows:
   a. Select **Start»Settings»Control Panel** and double-click on the **niports** icon.

      A list of installed National Instruments ports with their logical COM*x* names appears. If your interface is not on this list, refer to Appendix D, *Troubleshooting and Common Questions*.

   b. Select the COM port that you want to verify and click on the **Settings** button.

      The **General Port Settings** dialog box displays the serial number of the serial hardware and the physical port number starting at 1. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.
2. Run the diagnostic utility, as follows: select **Start»Programs»National Instruments Serial»diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.
3. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows NT Control Panel. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **niports** icon. A list of installed National Instruments ports appears, as shown in Figure 2-10.

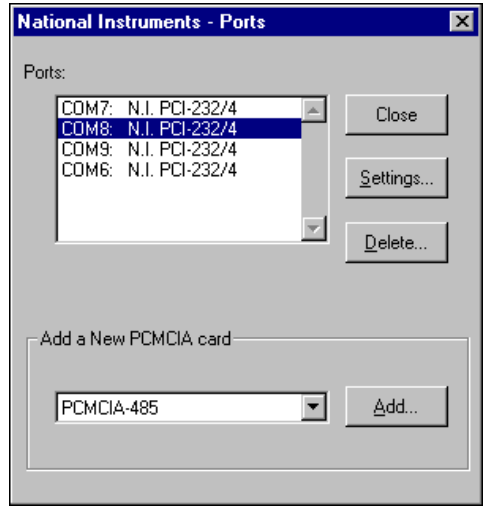


Figure 2-10. niports Configuration Utility

2. Select the port that you want to configure and refer to the following instructions:
   - To remove hardware information about the port from Windows NT, click on the **Delete** button. You should do this before you remove your hardware.
   - To view or change the port settings, click on the **Settings** button. For more information about the settings, refer to the next section, *General Port Settings*.
   - In the **General Port Settings** dialog box, click on the **Resources** button to view the resources for the port.

General Port Settings

The following sections describe the options you can set in the **General Port Settings** dialog box, shown in Figure 2-11.

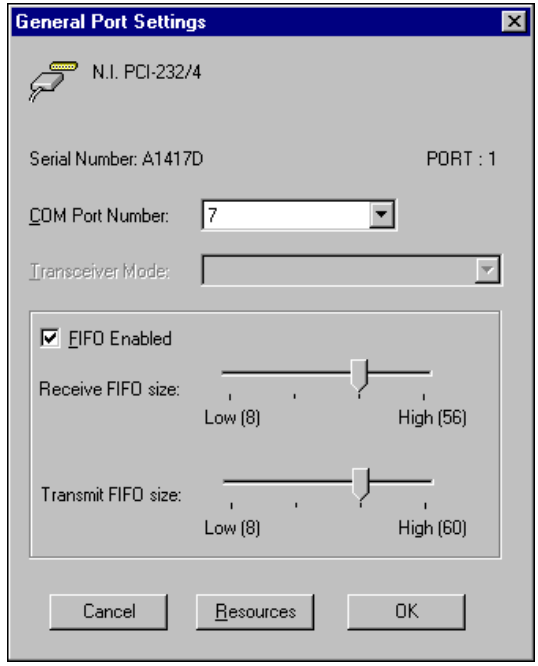


Figure 2-11. General Port Settings Dialog Box

COM Port Number

You can use the **COM Port Number** control to change the logical COM*x* name of the selected port.

Transceiver Mode

The **Transceiver Mode** list box shows the transceiver mode in use, and applies only to PCI-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

FIFO Enabled

You can use the **FIFO Enabled** checkbox to enable or disable the FIFO buffers on the selected port. FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver.

FIFO Buffer Size

The **Receive FIFO size** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit FIFO size** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive FIFO size** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive FIFO size** value is above your data sizes, your system is less efficient. Therefore, set the **Receive FIFO size** value below your data sizes.

Resources

To view the resource configuration dialog box for the selected port, click on the **Resources** button. You cannot change these resources; they are automatically assigned.

3

PXI Serial Hardware Installation, Verification, and Configuration

This chapter describes how to install the NI-Serial software and PXI serial hardware and how to verify the installation. It also describes how to view or change the communication port settings.

To begin your installation, see the section of this chapter containing instructions for your operating system (*Windows 2000*, *Windows Me/9x*, or *Windows NT*.)

Windows 2000

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows 2000:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears.
3. Click on the **Add New Programs** button and then the **CD or Floppy** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button.
5. When prompted, click on the **Finish** button to install the program files from the CD.
6. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To exit the setup wizard at any time, click on the **Cancel** button.
7. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows 2000, skip to the next section, *Install the Hardware*. Otherwise, continue to step 8.
8. If your hardware is already installed, restart Windows 2000.

9. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**. When you complete the wizard, continue to the *Verify the Installation* section.

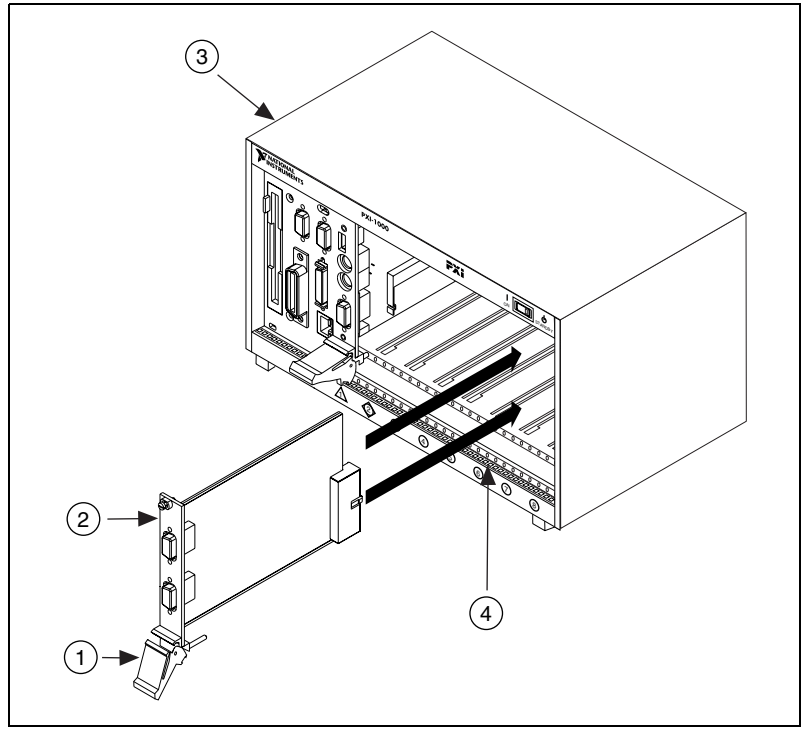
   If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

Install the Hardware

Caution Before you remove your board 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 serial board.

To install your PXI serial board, complete the following steps:

1. Turn off your PXI or CompactPCI chassis. Keep the chassis plugged in so that it remains grounded while you install the PXI serial board.
2. Find an unused PXI or CompactPCI 5 V peripheral slot.
3. Remove the corresponding filler panel.
4. Touch a metal part on your chassis to discharge any static electricity.
5. Insert the PXI serial board into the 5 V slot. Use the injector/ejector handle to fully inject the device into place. Figure 3-1 shows how to install the PXI serial board into a PXI or CompactPCI chassis.



1	Injector/Ejector Handle (In Down Position)	3	PXI Chassis
2	PXI Serial Board	4	Injector/Ejector Rail

Figure 3-1. Installing the PXI Serial Board

6. Screw the PXI serial board front panel to the front panel mounting rail of the PXI or CompactPCI chassis.
7. Turn on your PXI or CompactPCI chassis and start Windows 2000.
8. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**.

   If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

To verify the hardware and software installation, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon to display all of the ports.
4. Double-click on the **Multi-function adapters** icon.

   The PXI serial boards are configured as devices belonging to the *multi-function adapters* class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon.

   Figure 3-2 shows the Device Manager tab for serial hardware that is installed properly.

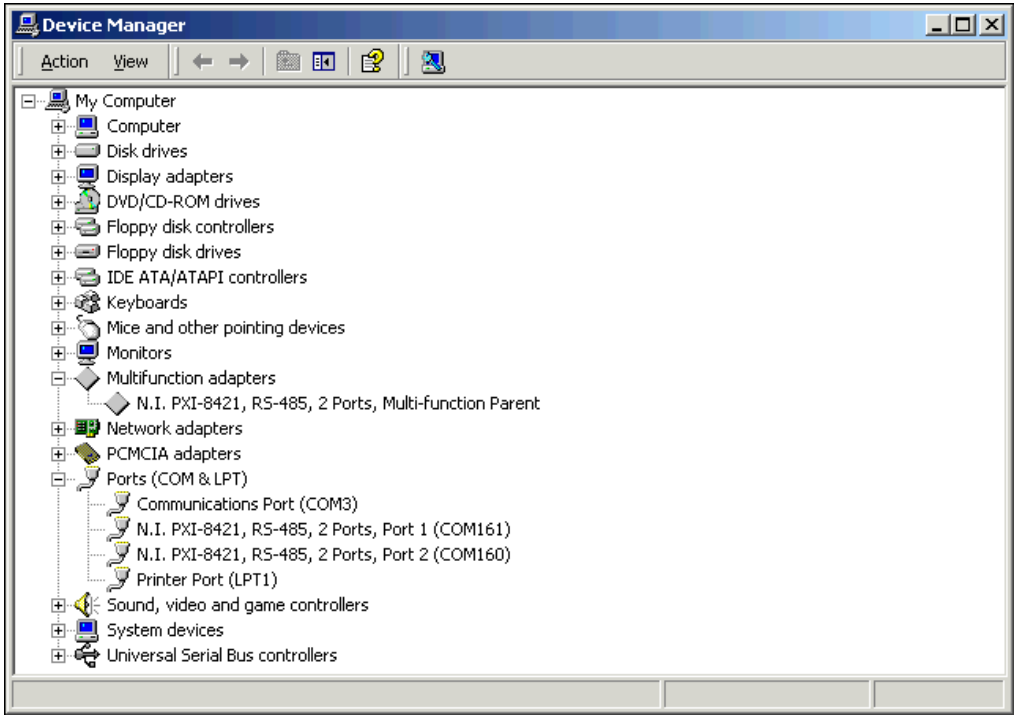


Figure 3-2. Device Manager for PXI Serial Board Ports

5. Verify the hardware resources, as follows:
   a. In the Device Manager under **Multi-function adapters,** double-click on a serial board.
   b. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   c. Repeat steps 5a and 5b until you have verified the resources for each board.
6. (Optional) To determine which physical port is associated with COM*x*, note the Port 1, Port 2, etc. entries next to the COM numbers. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.
7. Run the diagnostic utility, as follows: select **Start»Programs» National Instruments»NI-Serial»Diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.
8. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows 2000 Device Manager. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon.

4. Double-click on the port you want to configure and refer to the following instructions:
   - To view the hardware resources assigned to the serial port, click on the **Resources** tab.
   - To view or change the port settings, click on the **Port Settings** tab. For more information about the settings, refer to the next section, *Port Settings Tab*.
   - To change the RS-485 transceiver mode, or to enable or disable the FIFOs on the serial hardware, in the **Port Settings** tab, click on the **Advanced** button. For more information about the settings, refer to the next section, *Port Settings Tab*.

Note Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

5. To save your changes, click on the **OK** button. To exit without saving the changes, click on the **Cancel** button.

Port Settings Tab

In the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of a field. When you click on the arrow button, a list of valid values for that field appears and you can select the desired setting from the list. Figure 3-3 shows the **Port Settings** tab.

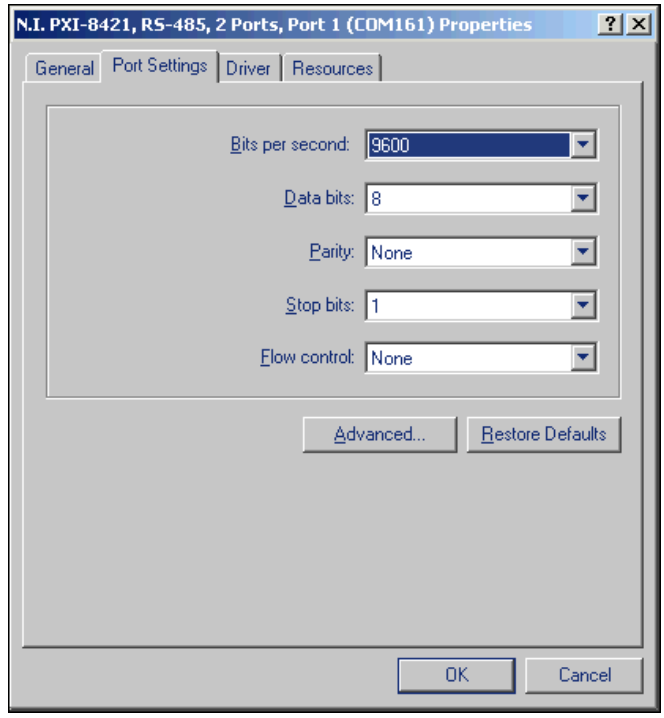


Figure 3-3. Port Settings Tab

Advanced Settings

To view or change the advanced settings, click on the **Advanced** button. Figure 3-4 shows the **Advanced Settings** dialog box.

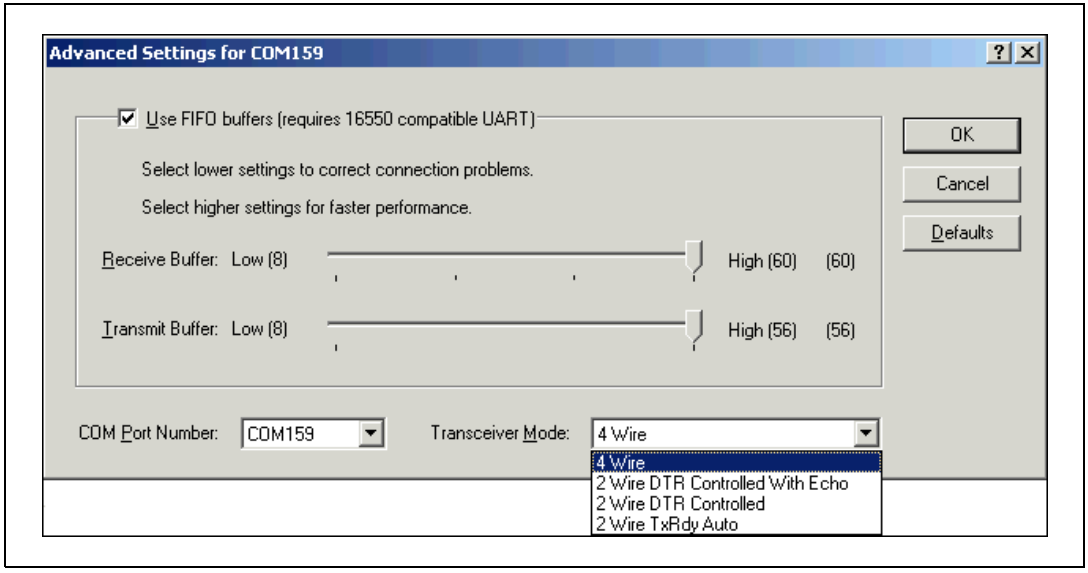


Figure 3-4. Advanced Settings Dialog Box

The following sections describe the advanced settings options.

Transceiver Mode

This field shows the transceiver mode in use, and applies only to RS-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The **Receive Buffer** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit Buffer** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive Buffer** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive Buffer** value is above your data sizes, your system is less efficient. Therefore, set the **Receive Buffer** value below your data sizes.

Restore Defaults

To reset the fields to their default values at any time, click on the **Restore Defaults** button.

Windows Me/9*x*

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows Me/9*x*:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears.
3. Click on the **Install** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To go back and change values where appropriate, click on the **Back** button. To exit the setup wizard at any time, click on the **Cancel** button.
5. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows Me/9*x*, skip to the next section, *Install the Hardware*. Otherwise, continue to step 6.
6. If your hardware is already installed, restart Windows Me/9*x*.

   Windows Me/9*x* should automatically detect your hardware and display one or more **New Hardware Found** dialog boxes. Make sure that **Windows Default Driver** is selected and click on the **OK** button. When you finish, continue to the *Verify the Installation* section.

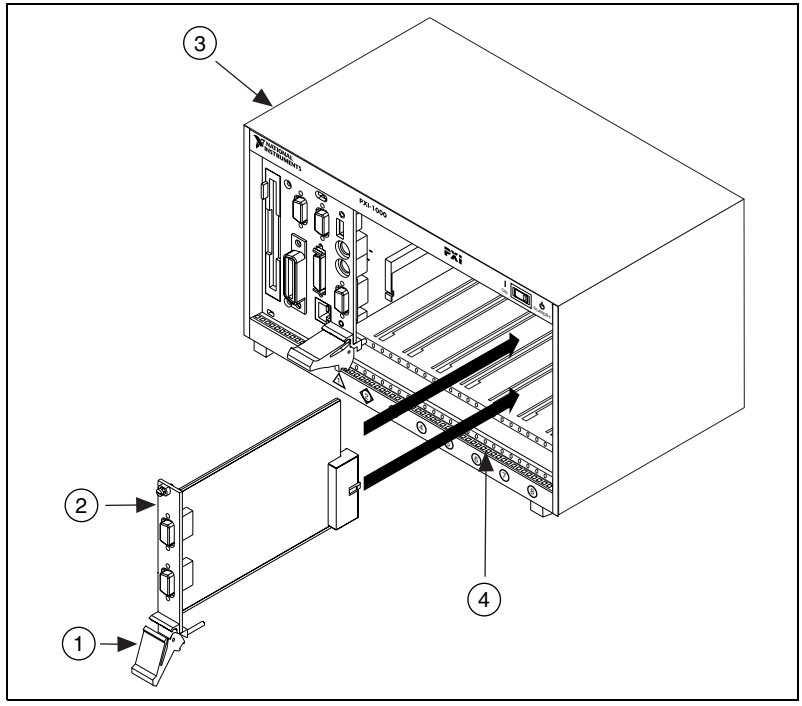
   If no **New Hardware Found** dialog box appears, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

Install the Hardware

Caution Before you remove your board 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 serial board.

To install your PXI serial board, complete the following steps:

1. Turn off your PXI or CompactPCI chassis. Keep the chassis plugged in so that it remains grounded while you install the PXI serial board.
2. Find an unused PXI or CompactPCI 5 V peripheral slot.
3. Remove the corresponding filler panel.
4. Touch a metal part on your chassis to discharge any static electricity.
5. Insert the PXI serial board into the 5 V slot. Use the injector/ejector handle to fully inject the device into place. Figure 3-5 shows how to install the PXI serial board into a PXI or CompactPCI chassis.



1	Injector/Ejector Handle (In Down Position)	3	PXI Chassis
2	PXI Serial Board	4	Injector/Ejector Rail

Figure 3-5. Installing the PXI Serial Board

6. Screw the PXI serial board front panel to the front panel mounting rail of the PXI or CompactPCI chassis.
7. Turn on your PXI or CompactPCI chassis and start Windows Me/9*x*.
8. Windows Me/9*x* should automatically detect your hardware and display one or more **New Hardware Found** dialog boxes. Make sure that **Windows Default Driver** is selected and click on the **OK** button.

   If no **New Hardware Found** dialog box appears, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

Before you verify the installation, keep in mind that the serial ports built into your computer are typically named from COM1 to COM4. Windows Me/9*x* typically issues port names to the ports on NI serial hardware starting with COM5, COM6, and so on. If not enough resources are available to assign to all the NI serial ports, the port with the higher COM*x* name is not configured.

To verify the hardware and software installation, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Ports (COM & LPT)** icon to display all of the ports.
4. Double-click on the **Multi-function adapters** icon.

   The PXI serial boards are configured as devices belonging to the *multi-function adapters* class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon.

Figure 3-6 shows the Device Manager tab for serial hardware that is installed properly.

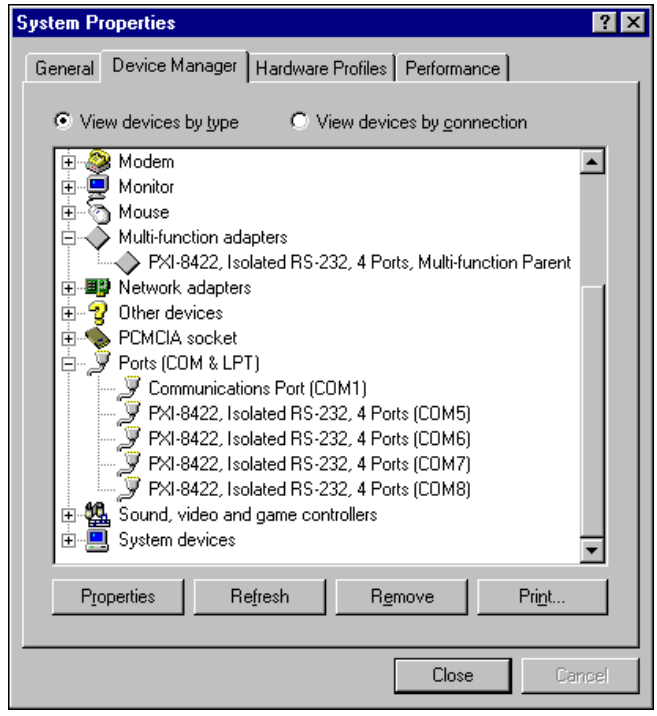


Figure 3-6. Device Manager for PXI Serial Board Ports

5. Verify the hardware resources, as follows:
   a. In the **Device Manager** tab, under **Multi-function adapters,** double-click on a serial board.
   b. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   c. Repeat steps 5a and 5b until you have verified the resources for each board.

6. (Optional) To determine which physical port is associated with COM*x*, complete the following steps:
   a. In the **Device Manager** tab, under **Ports (COM & LPT)**, double-click on the serial port (COM*x*).
   b. Click on the **Port Settings** tab to display the serial number of the serial hardware and the physical port number starting at 1. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.
7. Run the diagnostic utility, as follows: select **Start»Programs»National Instruments Serial»diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.
8. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows Me/9*x* Device Manager. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Ports (COM & LPT)** icon.

Note If you want your serial ports to use the names COM1, COM2, COM3, or COM4, refer to the *Common Questions* section of Appendix D, *Troubleshooting and Common Questions*.

4. Double-click on the port you want to configure and refer to the following instructions:
   - To view the hardware resources assigned to the serial port, click on the **Resources** tab.
   - To view or change the port settings, click on the **Port Settings** tab. For more information about the settings, refer to the next section, *Port Settings Tab*.
   - To change the RS-485 transceiver mode, or to enable or disable the FIFOs on the serial hardware, in the **Port Settings** tab, click on the **Advanced** button. For more information about the settings, refer to the next section, *Port Settings Tab*.



Note Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

5. To save your changes, click on the **OK** button. To exit without saving the changes, click on the **Cancel** button.

Port Settings Tab

In the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of a field. When you click on the arrow button, a list of valid values for that field appears and you can select the desired setting from the list. Figure 3-7 shows the **Port Settings** tab.

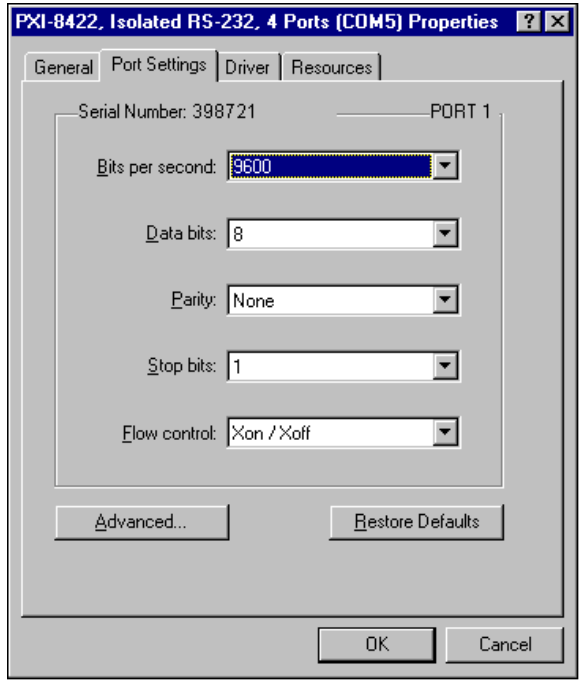


Figure 3-7. Port Settings Tab

Advanced Port Settings

To view or change the advanced port settings, click on the **Advanced** button. Figure 3-8 shows the **Advanced Port Settings** dialog box.

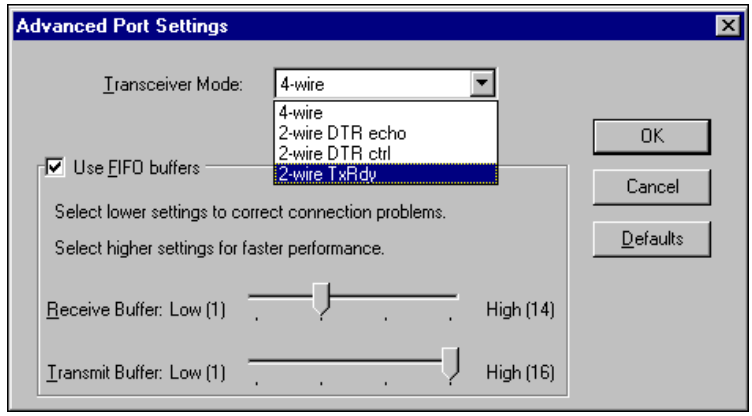


Figure 3-8. Advanced Settings Dialog Box

The following sections describe the advanced settings options.

Transceiver Mode

This field shows the transceiver mode in use, and applies only to RS-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The **Receive Buffer** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit Buffer** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive Buffer** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive Buffer** value is above your data sizes, your system is less efficient. Therefore, set the **Receive Buffer** value below your data sizes.

Restore Defaults

To reset the fields to their default values at any time, click on the **Restore Defaults** button.

Windows NT

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows NT:

1. Log in as `Administrator` or as a user who has `Administrator` privileges.
2. Select **Start»Settings»Control Panel**.
3. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears.
4. Click on the **Install** button.
5. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x,* and click on the **Next** button. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To go back and change values where appropriate, click on the **Back** button. To exit the setup wizard at any time, click on the **Cancel** button.

Note The setup wizard backs up the Windows NT serial driver `serial.sys` to `serial.bak` and then overwrites `serial.sys`. You can find `serial.sys` in the `WinNT\system32\drivers` directory.

6. If you your hardware is already installed, restart Windows NT and continue to the *Verify the Installation* section.

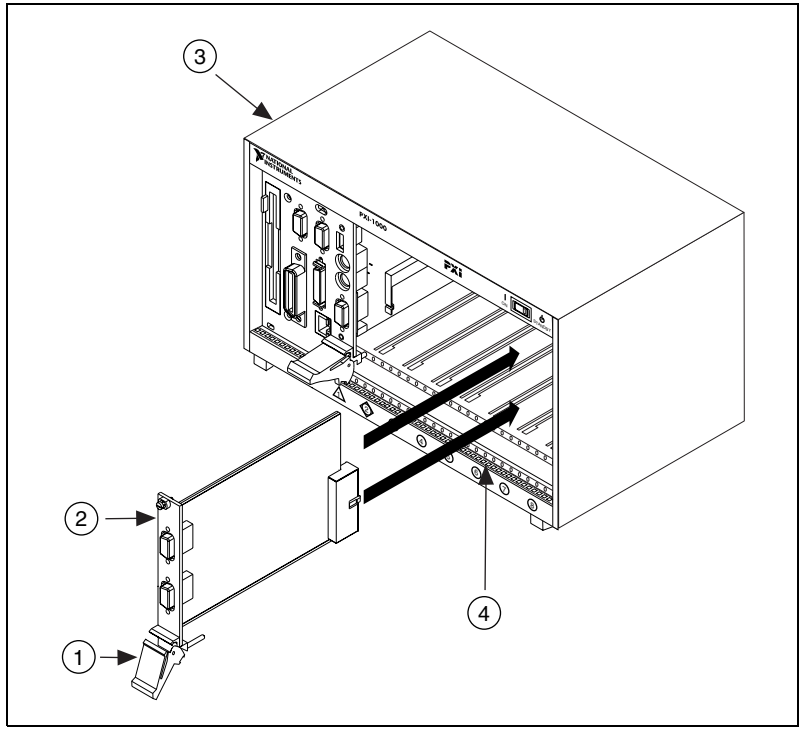
The software installation is complete. Continue to the next section, *Install the Hardware*.

Install the Hardware

Caution Before you remove your board 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 serial board.

To install your PXI serial board, complete the following steps:

1. Turn off your PXI or CompactPCI chassis. Keep the PXI or CompactPCI chassis plugged in so that it remains grounded while you install the PXI serial board.
2. Find an unused PXI or CompactPCI 5 V peripheral slot.
3. Remove the corresponding filler panel.
4. Touch a metal part on your chassis to discharge any static electricity.
5. Insert the PXI serial board into the 5 V slot. Use the injector/ejector handle to fully inject the device into place. Figure 3-9 shows how to install the PXI serial board into a PXI or CompactPCI chassis.



1	Injector/Ejector Handle (In Down Position)	3	PXI Chassis
2	PXI Serial Board	4	Injector/Ejector Rail

Figure 3-9. Installing the PXI Serial Board

6. Screw the PXI serial board front panel to the front panel mounting rail of the PXI or CompactPCI chassis.
7. Turn on your PXI or CompactPCI chassis and start Windows NT.

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

To verify the hardware and software installation, complete the following steps:

1. Determine which physical port is associated with COM*x*, as follows:
   a. Select **Start»Settings»Control Panel** and double-click on the **niports** icon.

      A list of installed National Instruments ports with their logical COM*x* names appears. If your interface is not on this list, refer to Appendix D, *Troubleshooting and Common Questions*.

   b. Select the COM port that you want to verify and click on the **Settings** button.

      The **General Port Settings** dialog box displays the serial number of the serial hardware and the physical port number starting at 1. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.
2. Run the diagnostic utility, as follows: select **Start»Programs»National Instruments Serial»diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.
3. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows NT Control Panel. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **niports** icon. A list of installed National Instruments ports appears, as shown in Figure 3-10.

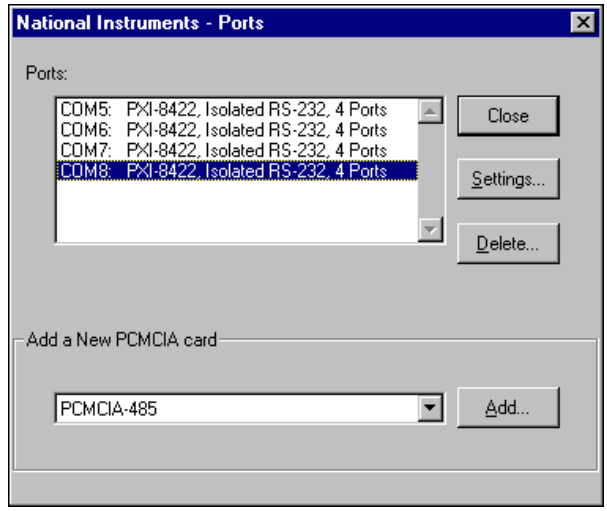


Figure 3-10. niports Configuration Utility

2. Select the port that you want to configure and refer to the following instructions:
   - To remove hardware information about the port from Windows NT, click on the **Delete** button. You should do this before you remove your hardware.
   - To view or change the port settings, click on the **Settings** button. For more information about the settings, refer to the next section, *General Port Settings*.
   - In the **General Port Settings** dialog box, click on the **Resources** button to view the resources for the port.

General Port Settings

The following sections describe the options you can set in the **General Port Settings** dialog box, shown in Figure 3-11.

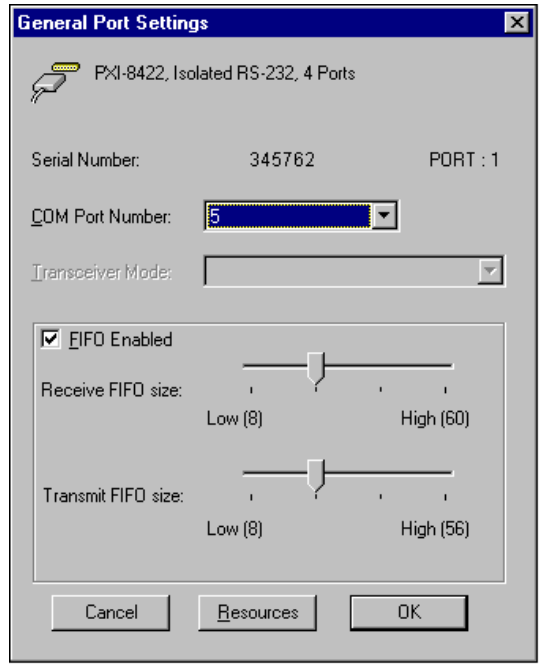


Figure 3-11. General Port Settings Dialog Box

COM Port Number

You can use the **COM Port Number** control to change the logical COM*x* name of the selected port.

Transceiver Mode

The **Transceiver Mode** list box shows the transceiver mode in use, and applies only to RS-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

FIFO Enabled

You can use the **FIFO Enabled** checkbox to enable or disable the FIFO buffers on the selected port. FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver.

FIFO Buffer Size

The **Receive FIFO size** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit FIFO size** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive FIFO size** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive FIFO size** value is above your data sizes, your system is less efficient. Therefore, set the **Receive FIFO size** value below your data sizes.

Resources

To view the resource configuration dialog box for the selected port, click on the **Resources** button. You cannot change these resources; they are automatically assigned.

4

PCMCIA Serial Hardware Installation, Verification, and Configuration

This chapter describes how to install the NI-Serial software and PCMCIA serial hardware and how to verify the installation. It also describes how to view or change the communication port settings.

To begin your installation, see the section of this chapter containing instructions for your operating system (*Windows 2000*, *Windows Me/9x*, or *Windows NT*.)

Windows 2000

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows 2000:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears.
3. Click on the **Add New Programs** button and then the **CD or Floppy** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button.
5. When prompted, click on the **Finish** button to install the program files from the CD.
6. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To exit the setup wizard at any time, click on the **Cancel** button.
7. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows 2000, skip to the next section, *Install the Hardware*. Otherwise, continue to step 8.

8. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**. When you complete the wizard, continue to the *Verify the Installation* section.

   If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

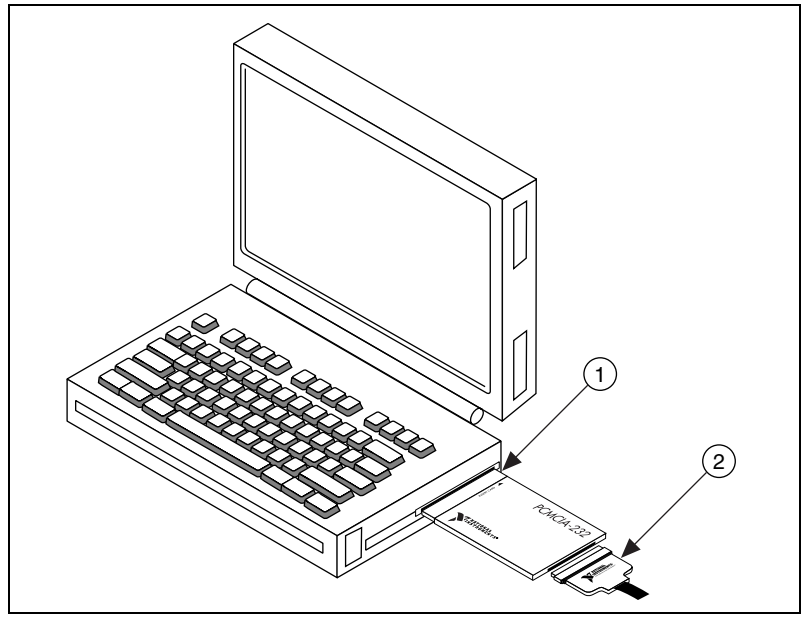
Install the Hardware

To install the PCMCIA-232 or PCMCIA-485 in your computer, first start Windows 2000. If the card is not already inserted, insert it into a free PC Card (PCMCIA) socket the same way you insert a disk into a floppy drive. The card has no jumpers or switches to set, and you do not need to shut down the system before you insert it.

Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**.

If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

Figure 4-1 shows how to insert a PCMCIA serial card and how to connect the cable.



1	PCMCIA Socket	2	PCMCIA Serial Cable

Figure 4-1. Inserting a PCMCIA Serial Card

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

To verify the hardware and software installation, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon to display all of the ports.
4. Double-click on the **Multi-function adapters** icon.

   The PCMCIA serial cards are configured as devices belonging to the *multi-function adapters* class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon.

Figure 4-2 shows the Device Manager tab for serial hardware that is installed properly.

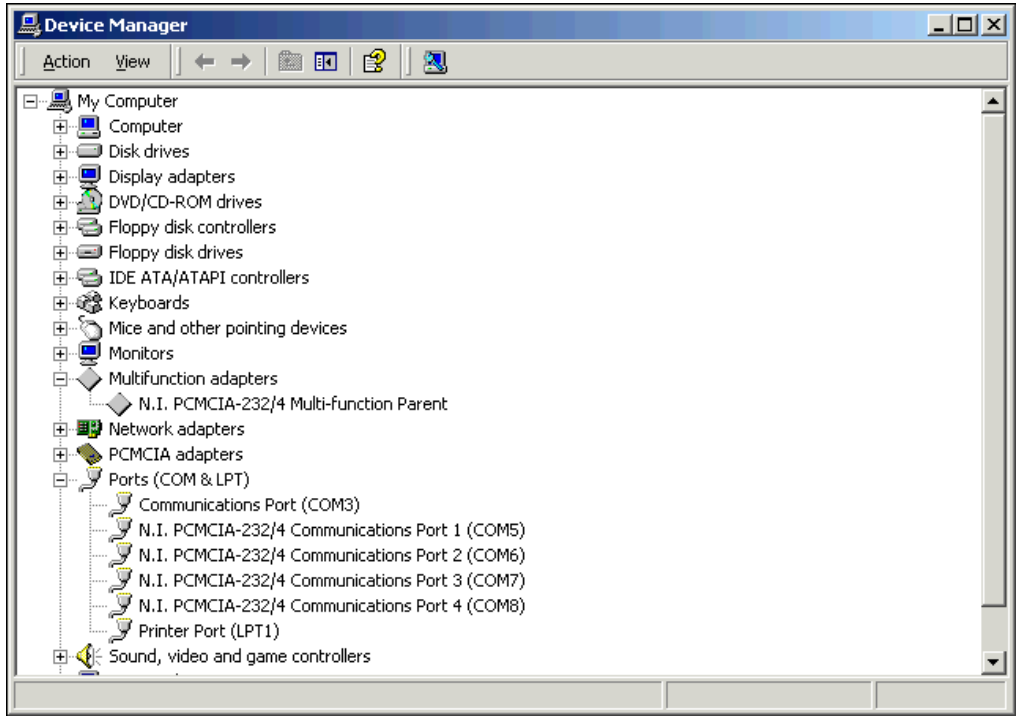


Figure 4-2. Device Manager for PCMCIA Serial Card Ports

5. Verify the hardware resources, as follows:
   a. In the Device Manager under **Multi-function adapters,** double-click on a serial card.
   b. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   c. Repeat steps 5a and 5b until you have verified the resources for each board.
6. (Optional) To determine which physical port is associated with COM*x*, note the Port 1, Port 2, etc. entries next to the COM numbers. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.

7. Run the diagnostic utility, as follows: select **Start»Programs» National Instruments»NI-Serial»Diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.

8. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows 2000 Device Manager. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon.
4. Double-click on the port you want to configure and refer to the following instructions:
   - To view the hardware resources assigned to the serial port, click on the **Resources** tab.
   - To view or change the port settings, click on the **Port Settings** tab. For more information about the settings, refer to the next section, *Port Settings Tab*.
   - To change the RS-485 transceiver mode, or to enable or disable the FIFOs on the serial hardware, in the **Port Settings** tab, click on the **Advanced** button. For more information about the settings, refer to the next section, *Port Settings Tab*.



Note Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

5. To save your changes, click on the **OK** button. To exit without saving the changes, click on the **Cancel** button.

Port Settings Tab

In the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of a field. When you click on the arrow button, a list of valid values for that field appears and you can select the desired setting from the list. Figure 4-3 shows the **Port Settings** tab.

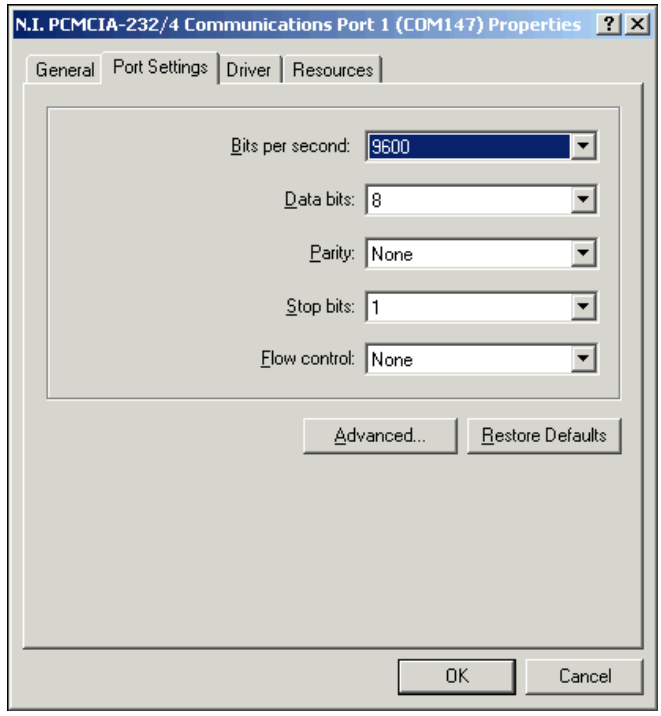


Figure 4-3. Port Settings Tab

Advanced Settings

To view or change the advanced settings, click on the **Advanced** button. Figure 4-4 shows the **Advanced Settings** dialog box.

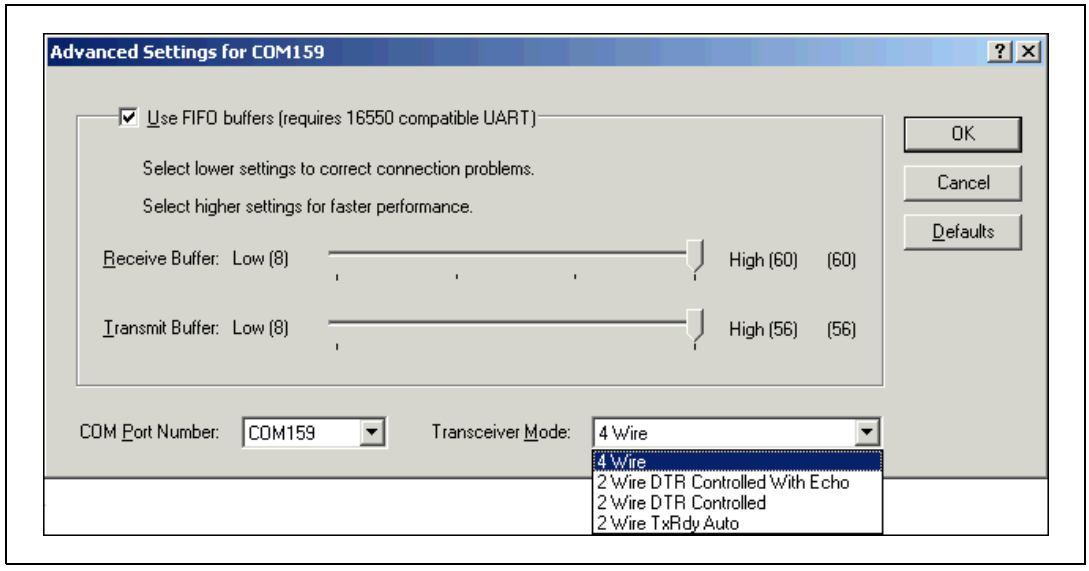


Figure 4-4. Advanced Settings Dialog Box

The following sections describe the advanced settings options.

Transceiver Mode

This field shows the transceiver mode in use, and applies only to PCMCIA-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The **Receive Buffer** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit Buffer** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive Buffer** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive Buffer** value is above your data sizes, your system is less efficient. Therefore, set the **Receive Buffer** value below your data sizes.

Restore Defaults

To reset the fields to their default values at any time, click on the **Restore Defaults** button.

Windows Me/9*x*

Install the Software

Install the NI-Serial software for Windows Me/9*x* before you install the hardware:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs** dialog box appears.
3. Click on the **Install** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button to proceed. The software installation wizard begins.

   The setup wizard guides you through the necessary steps to install the NI-Serial software. You can go back and change values where appropriate by clicking on the **Back** button. You can exit the setup where appropriate by clicking on the **Cancel** button.

5. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows Me/9*x*, skip to the next section, *Install the Hardware*. Otherwise, continue to Step 6.
6. If your hardware is already installed, restart Windows Me/9*x*.

   Windows Me/9*x* should automatically detect your hardware and display one or more **New Hardware Found** dialog boxes. When you finish, continue to the *Verify the Installation* section.

   If no **New Hardware Found** dialog box appears, refer to the section *Forcing Windows to Detect Your Hardware* in Appendix D, *Troubleshooting and Common Questions*.

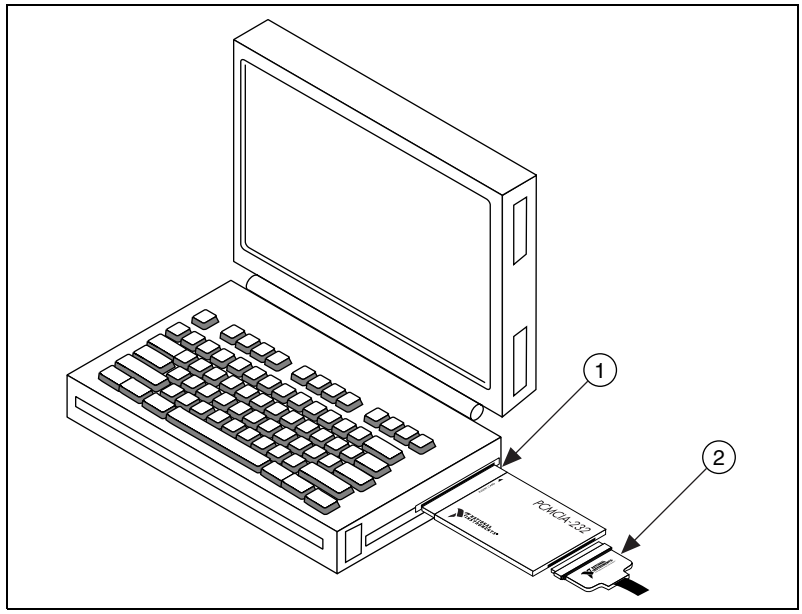
Install the Hardware

To install the PCMCIA-232 or PCMCIA-485 in your computer, first start Windows Me/9*x*. If the card is not already inserted, insert it into a free PC Card (PCMCIA) socket the same way you insert a disk into a floppy drive. The card has no jumpers or switches to set, and you do not need to shut down the system before you insert it.

Windows Me/9*x* automatically displays one or more **New Hardware Found** dialog boxes when it detects and configures a PC Card.

If the **New Hardware Found** dialog box does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

Figure 4-5 shows how to insert a PCMCIA serial card and how to connect the cable.



1 PCMCIA Socket	2 PCMCIA Serial Cable

Figure 4-5. Inserting a PCMCIA Serial Card

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

When you begin to verify the installation, keep in mind that the serial ports built into the computer are typically named from COM1 to COM4. Windows Me/9*x* typically issues port names to the ports on NI serial hardware starting with COM5, COM6, and so on. If not enough resources are available to assign to all the NI serial ports, the port with the higher COM*x* name is left unconfigured.

Double-click on the **System** icon in the Control Panel. In the **System Properties** window that appears, select the **Device Manager** tab, and click on the **View devices by type** button at the top of the page. If necessary, double-click on the **Ports (COM & LPT)** icon to view all of the ports.

The two-port and four-port PCMCIA cards are configured as devices belonging to the "multi-function adapters" class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon. If you have installed one of these interfaces, double-click on the **Multi-function adapters** icon as well as the **Ports (COM & LPT)** icon.

If a circled exclamation point appears through the port icon, the serial port is not installed properly. A problem with the port could have occurred because Windows Me/9*x* could not acquire resources for the port, or because an interrupt request resource conflict exists. If no circled exclamation point appears, the serial hardware is installed correctly. Figure 4-6 shows an example of NI serial hardware that is installed properly.

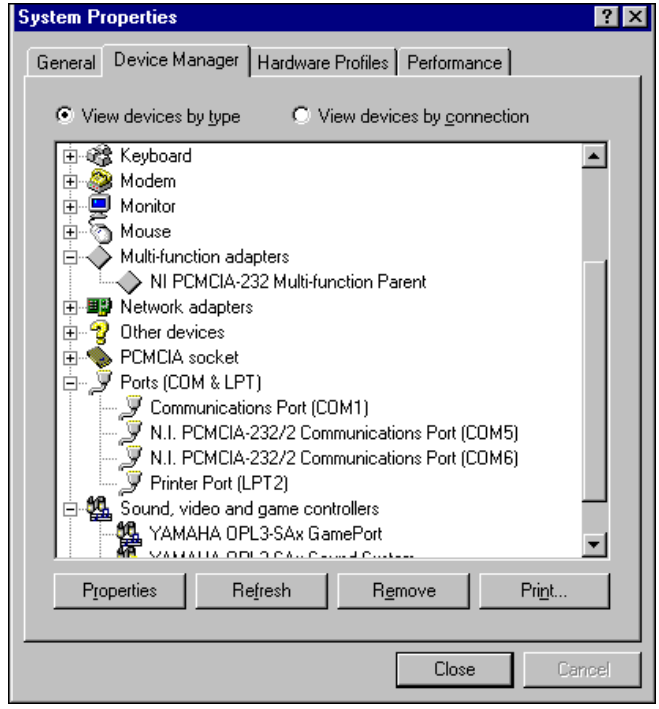


Figure 4-6. Device Manager Ports List for PCMCIA Serial Card Correctly Installed

Verify the Hardware Resources

For every port of the newly installed serial interface, double-click on the name of the serial port in the Device Manager. Then, click on the **Resources** tab. If the resources were assigned correctly, the **Resources** page shows which resources are assigned to your serial ports.

If Windows Me/9*x* did not assign any resources to the port, the **Resources** page shows only a **Set Configuration Manually** button. Click on the **Set Configuration Manually** button and try to assign conflict-free resources to your serial hardware. For instructions, refer to the *Selecting Conflict-Free Resources* section of Appendix D, *Troubleshooting and Common Questions*. You might have to free an interrupt request level so that one can be assigned to your serial hardware. For instructions, refer to the section *Freeing an Interrupt Request Level* in Appendix D, *Troubleshooting and Common Questions*.

When you have finished verifying the hardware resources, proceed to the next section.

Determine Which Physical Port Is Associated with COMx

For every port of the newly installed serial interface, double-click on the name of the serial port in the Device Manager. Then, click on the **Port Settings** tab. The top of this page displays the serial number of the serial hardware, and the physical port number starting at 1.

When you have finished verifying the driver installation and physical port, proceed to the next section.

Run the Diagnostic Test

To verify and test the installation, run the diagnostic program that came with your NI-Serial software. The diagnostic program verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

To run the test, select the **diagnostics** item under **Start»Programs» National Instruments Serial**.

If the diagnostic test completes with no failures, your serial hardware and software are installed properly. If it fails, refer to Appendix D, *Troubleshooting and Common Questions*, for troubleshooting instructions.

After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated with the Windows Me/9*x* Device Manager. You can use it to examine or modify the configuration of the serial port.

Follow these steps to configure the serial port. Repeat the configuration procedure for each serial port in your system.

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon. The **System Properties** window appears.
2. Select the **Device Manager** tab, and click on the **View devices by type** button at the top of the page.
3. Double-click on the **Ports (COM & LPT)** icon.
4. Double-click on the name of the port you want to configure.

You can now view or change information about your serial port in the following ways:

- Click on the **Resources** tab to view information about the hardware resources assigned to the serial port.
- Click on the **Port Settings** tab to view information about the software configuration for the serial port. Refer to the next section, *Port Settings Tab*, for more information.
- On the **Port Settings** tab, click on the **Advanced** button to change the RS-485 transceiver mode and to enable or disable the FIFOs on the serial hardware. Refer to the next section, *Port Settings Tab*, for more information.



Note If you use two-wire $\overline{\text{TXRDY}}$ mode, FIFOs must be enabled. Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

After you have selected the serial port parameters for the current port, click on the **OK** button to save the changes or click on the **Cancel** button to exit the dialog box without saving changes.

Port Settings Tab

On the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of the setting. When you click on the arrow button, a list of valid values for that setting appears. Select the desired setting from the list. Figure 4-7 shows the **Port Settings** tab.

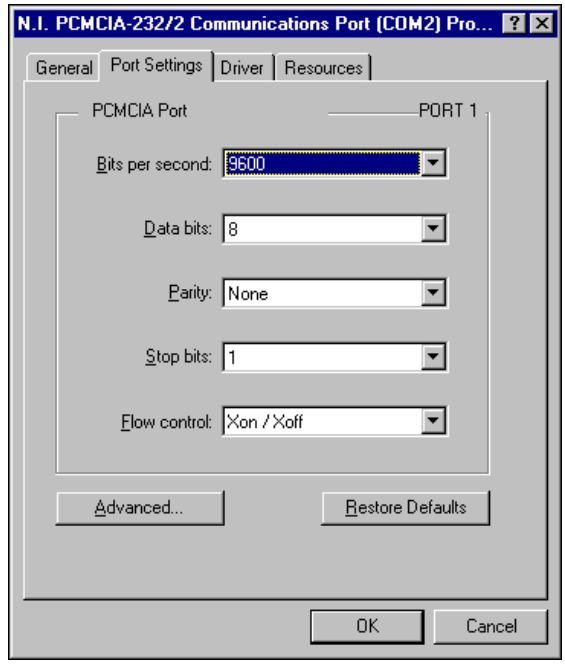


Figure 4-7. Port Settings Tab

Advanced Port Settings

You can view or change the advanced port settings by clicking on the **Advanced** button on the **Port Settings** tab. Figure 4-8 shows the **Advanced Port Settings** dialog box.

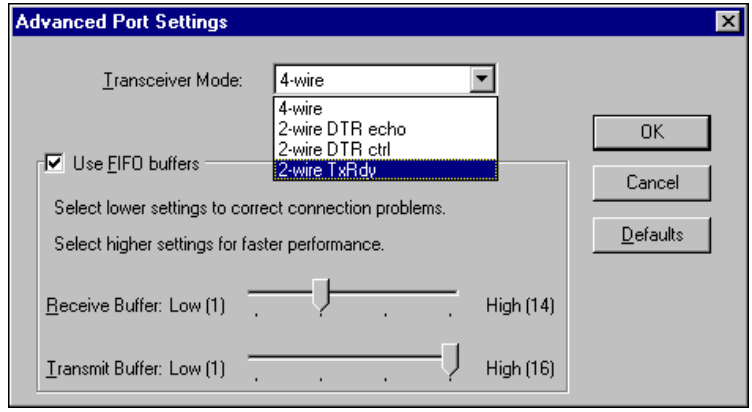


Figure 4-8. Advanced Port Settings Dialog Box

The following sections describe the advanced settings options.

Transceiver Mode

This field shows the transceiver mode in use, and applies only to PCMCIA-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The **Receive Buffer** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit Buffer** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive Buffer** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive Buffer** value is above your data sizes, your system is less efficient. Therefore, set the **Receive Buffer** value below your data sizes.

Note If you want your serial hardware ports to use the names COM1, COM2, COM3, or COM4, refer to the *Common Questions* section of Appendix D, *Troubleshooting and Common Questions*.

Restore Defaults

To reset the fields to their default values at any time, click on the **Restore Defaults** button.

Windows NT

Install the NI-Serial Software

Install the NI-Serial software for Windows NT before you install the hardware.

1. Log on as `Administrator` or as a user who has `Administrator` privileges.
2. Select **Start»Settings»Control Panel**.
3. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs** dialog box appears.
4. Click on the **Install** button.
5. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button to proceed. The software installation wizard begins.

   The setup wizard guides you through the necessary steps to install the NI-Serial software. You can go back and change values where appropriate by clicking on the **Back** button. You can exit the setup where appropriate by clicking on the **Cancel** button.

Note This installation backs up the Microsoft Windows NT serial driver `serial.sys` to `serial.bak` and then overwrites `serial.sys`. You can find `serial.sys` in the Windows NT`...\system32\drivers` directory.

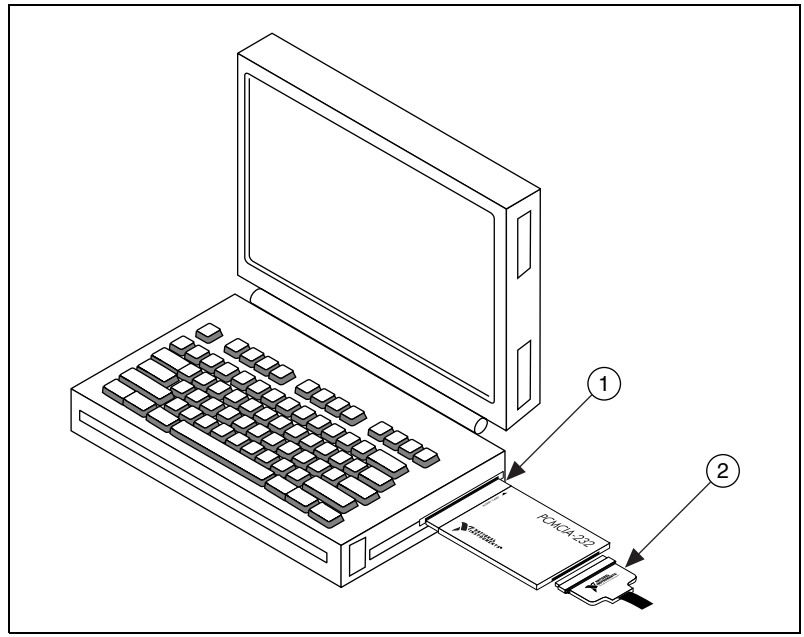
The software installation is complete. Proceed to the next section, *Install the PCMCIA Serial Hardware*.

Install the PCMCIA Serial Hardware

Complete the following steps to install the PCMCIA-232 or PCMCIA-485 in your computer:

1. Shut down the computer.
2. Insert the card into a free PC Card (PCMCIA) socket the same way you insert a disk into a floppy drive. The card has no jumpers or switches to set.
3. Power on the computer and start Windows NT.

Figure 4-9 shows how to insert a PCMCIA serial card and how to connect the cable.



1	PCMCIA Socket	2	PCMCIA Serial Cable

Figure 4-9. Inserting a PCMCIA Serial Card

Proceed to the next section, *Select Resources for the PCMCIA Card*.

Select Resources for the PCMCIA Card

Complete the following steps to select resources for your PCMCIA card.

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **niports** icon.
3. Select the PCMCIA card you just installed from the **Add a New PCMCIA Card** list, and click on the **Add** button.
4. In the **Resource Configuration** dialog box, select nonconflicting base I/O address and IRQ settings for your port/card, and click on **OK**.

   For more information on selecting resources for your port/card, refer to the *Resource Settings* section.
5. Exit **niports** and restart the computer.

After you have selected resources for your PCMCIA card, proceed to the next section, *Verify the Installation*.

Verify the Installation

Determine Which Physical Port Is Associated with COMx

Select **Start»Settings»Control Panel**, and double-click on **niports**. A list showing installed National Instruments ports with their logical COM*x* names appears. If your interface is not on the list, refer to Appendix D, *Troubleshooting and Common Questions*.

Select the COM port you want and click on the **Settings** button to display the **General Port Settings** dialog box for that port. This dialog box displays the physical port number starting at 1.

When you have finished verifying the driver installation and physical port, proceed to the next section, *Run the Diagnostic Test*.

Run the Diagnostic Test

To verify and test the installation, run the diagnostic program that came with your NI-Serial software. The diagnostic program verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

To run the test, select the **diagnostics** item under **Start»Programs» National Instruments Serial**.

If the diagnostic test completes with no failures, your serial hardware and software are installed properly. If it fails, refer to Appendix D, *Troubleshooting and Common Questions*, for troubleshooting instructions.

After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated with the Windows NT Control Panel. You can use it to examine or modify the configuration of the serial port.

Follow these steps to configure the serial port.

1. Select **Start»Settings»Control Panel** and double-click on the **niports** icon. A list of National Instruments ports appears, as shown in Figure 4-10.

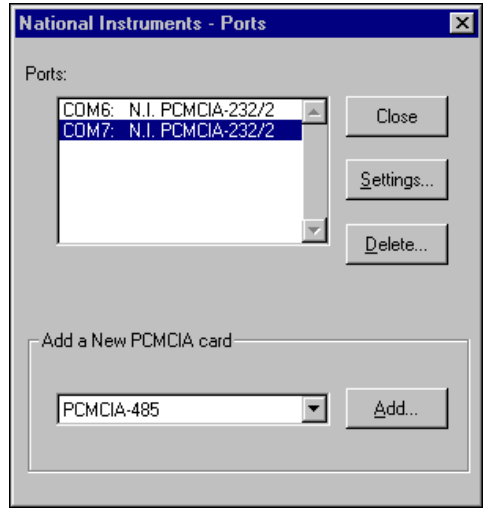


Figure 4-10. niports Configuration Utility

2. Select the port you are interested in.
3. Click on the **Settings** button to view or configure the port settings. Refer to the next section, *General Port Settings*, for more information.
4. Click on the **Resources** button in the **General Port Settings** dialog box to view or configure the resources for the port. Refer to the *Resource Settings* section, for more information.

5. Click on **Delete** to remove hardware information about the port from Windows NT. You should do this before you physically remove your PCMCIA card.
6. Click on **Add** to configure resources for a new PCMCIA card.

General Port Settings

This section describes the options you can set in the **General Port Settings** dialog box, shown in Figure 4-11.

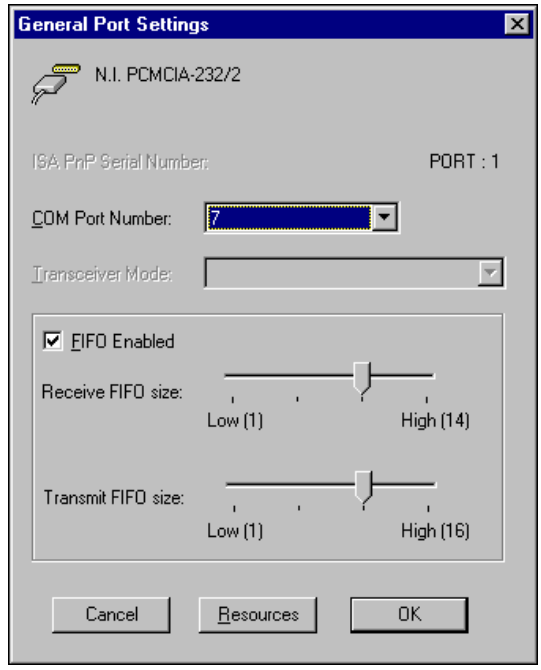


Figure 4-11. General Port Settings Dialog Box

COM Port Number

You can use the **COM Port Number** control to change the COM*x* name of the port selected.

Transceiver Mode

The transceiver mode selection shows the transceiver mode in use, and applies only to PCMCIA-485 cards. Refer to Chapter 6, *Using Your Serial Hardware*, for more information about transceiver modes. If you use two-wire $\overline{\text{TXRDY}}$ mode, FIFOs must be enabled.

FIFO Enabled

You can use the **FIFO Enabled** control to enable or disable the FIFO buffers on the serial port. FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver.

FIFO Buffers

The FIFO buffer control is available by clicking on the **Advanced** button on the **Port Settings** tab. FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The receive FIFO trigger denotes the number of characters received in the FIFO before the PC is interrupted to read the data. The transmit FIFO trigger denotes the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. Consider the following points when selecting FIFO settings:

- You can select larger FIFO settings to reduce the number of interrupts and therefore minimize system overhead.
- If transfer rates are high, you can lower receive FIFO settings to reduce the number of interrupts and therefore prevent overrun errors due to interrupt latency.
- If data transfer sizes are small, selecting receive FIFO settings just above data sizes can reduce efficiency, so select lower settings.

Resources

Click on the **Resources** button to display the resource configuration dialog box for the port. For more information on resource configuration, refer to the next section, *Resource Settings*.

Resource Settings

The following sections explain the resource configuration options for each serial interface.

PCMCIA-232, PCMCIA-485, PCMCIA-232/4

Figure 4-12 shows the resource configuration dialog box for a PCMCIA-485. The PCMCIA-232 and PCMCIA-232/4 dialog boxes are similar.

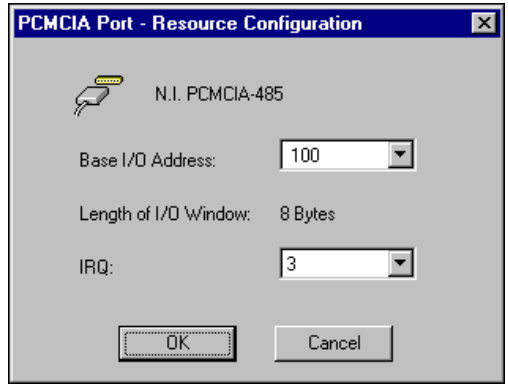


Figure 4-12. Resource Configuration Dialog Box for the PCMCIA-485

Base I/O Address: The base I/O address assigned to the port.

IRQ: The IRQ assigned to the port.

Length: The size (in bytes) of the I/O window.

For the PCMCIA-232 and PCMCIA-485, the length is 8 (the size of the I/O window for one port).

For the PCMCIA-232/4, the length is 32 bytes (the size of the I/O window for four ports).

PCMCIA-232/2, PCMCIA-485/2

These cards require two base I/O settings, one for each port, and they share an IRQ.

Figure 4-13 shows the resource configuration dialog box for a PCMCIA-485/2. The PCMCIA-232/2 dialog box is similar.

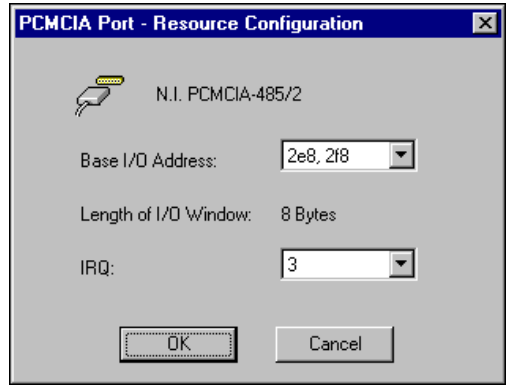


Figure 4-13. Resource Configuration Dialog Box for the PCMCIA-485/2

Base I/O Address: The base I/O addresses assigned to the two ports.

IRQ: The IRQ shared by the two ports.

Length: The size of each I/O window (in bytes).

Note When you select resources for the PCMCIA cards, use the Microsoft Windows NT diagnostics utility to make sure that the resources have not been assigned to any other device. This utility displays a list of I/O port addresses and IRQ levels that are currently being used in your system.

5

AT Serial Hardware Installation, Verification, and Configuration

This chapter describes how to install the NI-Serial software and AT serial hardware and how to verify the installation. It also describes how to view or change the communication port settings.

To begin your installation, see the section of this chapter containing instructions for your operating system (*Windows 2000*, *Windows Me/9x*, or *Windows NT*.)

Windows 2000

Install the Software

Before you install your serial hardware, complete the following steps to install the NI-Serial software for Windows 2000:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** appears.
3. Click on the **Add New Programs** button and then the **CD or Floppy** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button.
5. When prompted, click on the **Finish** button to install the program files from the CD.
6. The setup wizard begins. The setup wizard guides you through the necessary steps to install the NI-Serial software. To exit the setup wizard at any time, click on the **Cancel** button.
7. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows 2000, skip to the next section, *Install the Hardware*. Otherwise, continue to step 8.
8. If your hardware is already installed, restart Windows 2000.

9. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**. When you complete the wizard, continue to the *Verify the Installation* section.

   If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

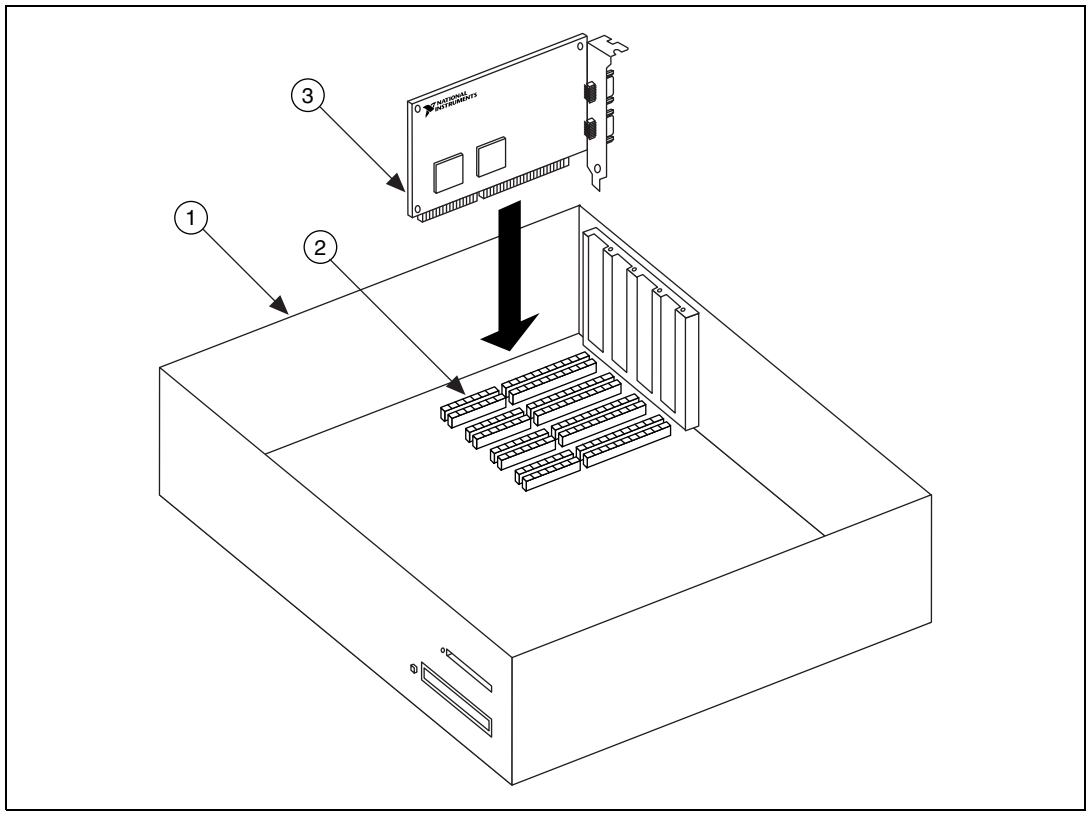
Install the Hardware

Note If you are installing a AT-485, you might need to adjust the value of the bias resistors, depending on your application. For more information, refer to Appendix B, *Serial Port Information*.

Caution Before you remove your board 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 serial board.

To install your AT serial board, complete the following steps:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the AT serial board.
2. Remove the top or side cover of the computer.
3. Find an unused AT expansion slot in your computer.
4. Remove the corresponding expansion slot cover on the back panel of the computer.
5. Touch a metal part on your chassis to discharge any static electricity.
6. Insert the AT serial board into the slot with the serial connectors toward the opening on the back panel. Make sure that you insert the board all the way into the slot. The board might seem to click firmly into place, even though it is only part of the way in. Figure 5-1 shows how to install the AT serial board into an expansion slot.



1 PC	2 AT Socket	3 AT Serial Card

Figure 5-1. AT Serial Board Installation

7. Screw the AT serial board mounting bracket to the back panel mounting rail of the computer.
8. Replace the cover.
9. Turn on your computer and start Windows 2000.
10. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**.

    If the Found New Hardware Wizard does not appear, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

To verify the hardware and software installation, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon to display all of the ports.
4. Double-click on the **Multi-function adapters** icon.

   The AT serial boards are configured as devices belonging to the *multi-function adapters* class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon.

   Figure 5-2 shows the Device Manager tab for serial hardware that is installed properly.

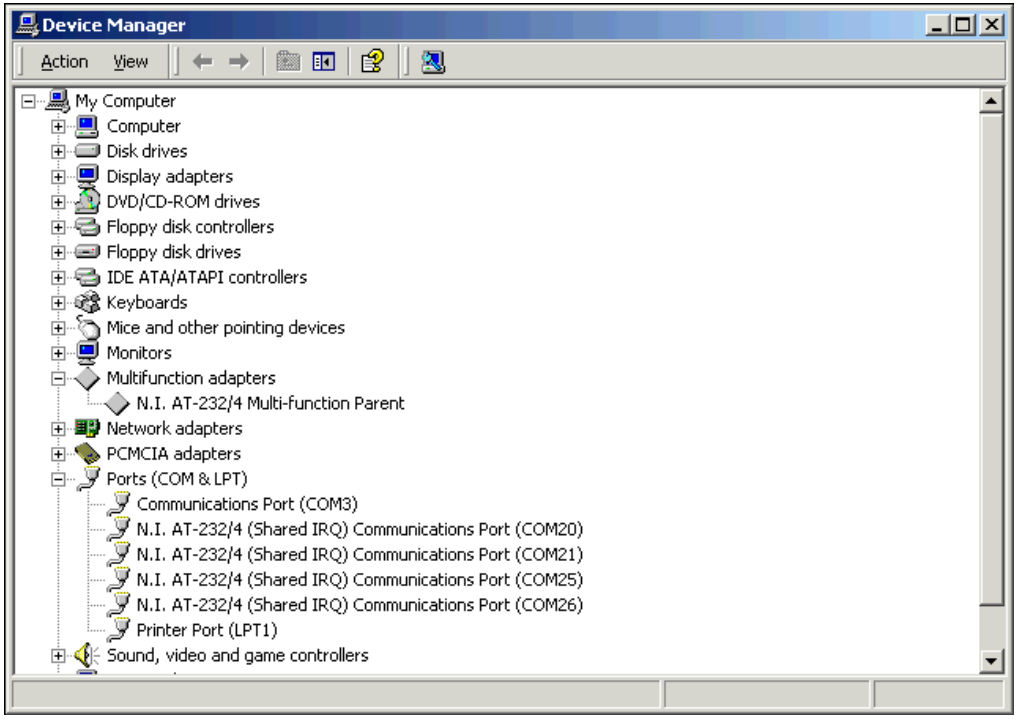


Figure 5-2. Device Manager for AT Serial Board Ports

5. Verify the hardware resources, as follows:
   a. In the Device Manager under **Multi-function adapters,** double-click on a serial board.
   b. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   c. Repeat steps 5a and 5b until you have verified the resources for each board.
6. (Optional) To determine which physical port is associated with COM*x*, note the Port 1, Port 2, etc. entries next to the COM numbers. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.
7. Run the diagnostic utility, as follows: select **Start»Programs» National Instruments»NI-Serial»Diagnostics**.

   The diagnostic utility verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

   If the test is successful, your serial hardware and software are installed properly. If the test fails, refer to Appendix D, *Troubleshooting and Common Questions*, to troubleshoot the problem.
8. After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows 2000 Device Manager. You can use it to view or change the configuration of your serial ports.

To configure a serial port, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon.

4. Double-click on the port you want to configure and refer to the following instructions:
   - To view the hardware resources assigned to the serial port, click on the **Resources** tab.
   - To view or change the port settings, click on the **Port Settings** tab. For more information about the settings, refer to the next section, *Port Settings Tab*.
   - To change the RS-485 transceiver mode, or to enable or disable the FIFOs on the serial hardware, in the **Port Settings** tab, click on the **Advanced** button. For more information about the settings, refer to the next section, *Port Settings Tab*.

Note Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

5. To save your changes, click on the **OK** button. To exit without saving the changes, click on the **Cancel** button.

Port Settings Tab

In the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of a field. When you click on the arrow button, a list of valid values for that field appears and you can select the desired setting from the list. Figure 5-3 shows the **Port Settings** tab.

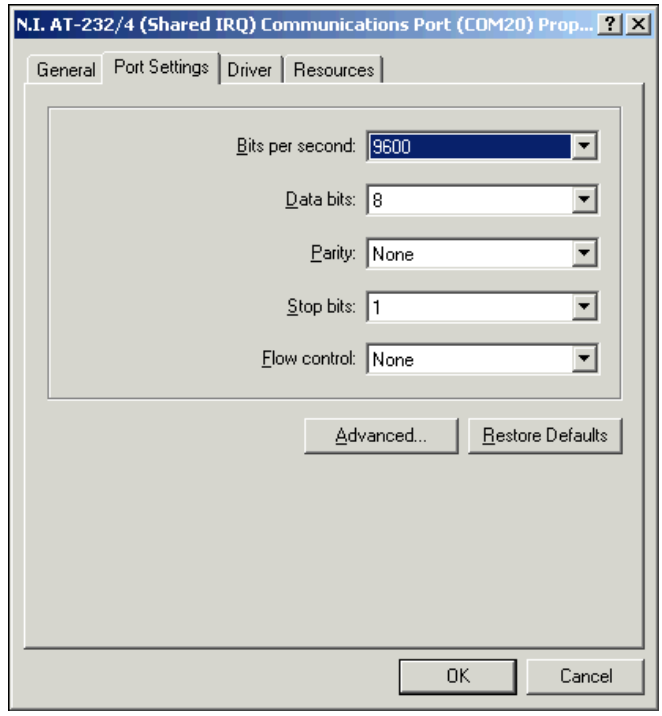


Figure 5-3. Port Settings Tab

Advanced Settings

To view or change the advanced settings, click on the **Advanced** button. Figure 5-4 shows the **Advanced Settings** dialog box.

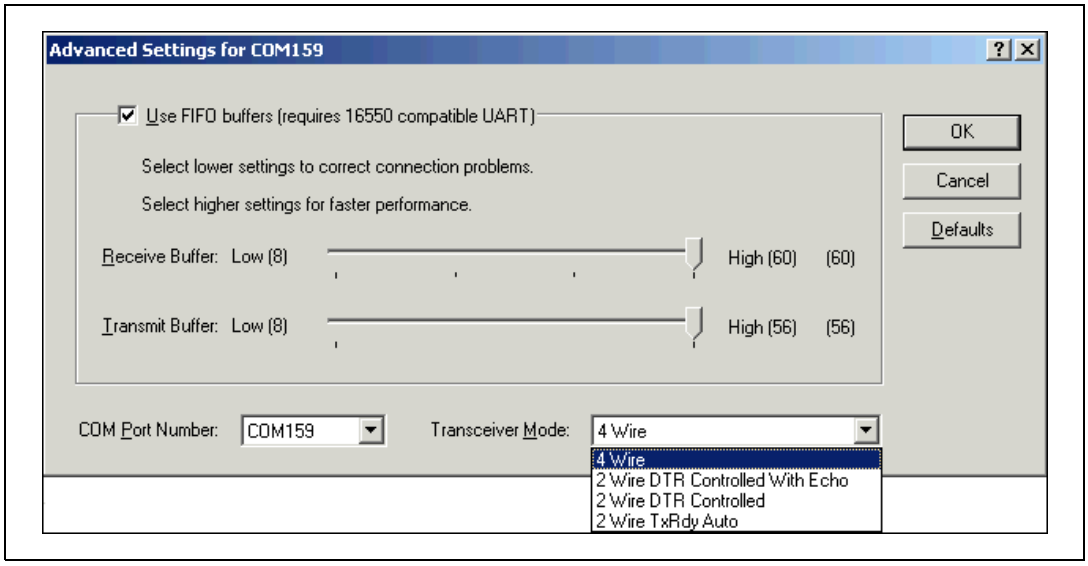


Figure 5-4. Advanced Settings Dialog Box

The following sections describe the advanced settings options.

Transceiver Mode

This field shows the transceiver mode in use, and applies only to AT-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The **Receive Buffer** control sets the number of characters received in the FIFO before the PC is interrupted to read the data. The **Transmit Buffer** control sets the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. When you configure FIFO settings, consider the following points:

- You can select larger FIFO buffer sizes to reduce the number of interrupts your PC receives and therefore minimize system overhead.
- If transfer rates are high, you can lower the **Receive Buffer** value to prevent overrun errors due to interrupt latency.
- If your data transfer sizes are small and your **Receive Buffer** value is above your data sizes, your system is less efficient. Therefore, set the **Receive Buffer** value below your data sizes.

Restore Defaults

To reset the fields to their default values at any time, click on the **Restore Defaults** button.

Windows Me/9*x*

Install the Software

Install the NI-Serial software for Windows Me/9*x* before you install the hardware.

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs** dialog box appears.
3. Click on the **Install** button.
4. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD, and click on the **Next** button to proceed. The software installation wizard begins.

   The setup wizard guides you through the necessary steps to install the NI-Serial software. You can go back and change values where appropriate by clicking on the **Back** button. You can exit the setup where appropriate by clicking on the **Cancel** button.

5. If you need to install your hardware, or if this is your first time to install the NI-Serial software for Windows Me/9*x*, skip to the next section, *Install the Hardware*. Otherwise, continue to Step 6.
6. If your hardware is already installed, restart Windows Me/9*x*.

   Windows Me/9*x* should automatically detect your hardware and display one or more **New Hardware Found** dialog boxes, but you must make sure **Windows Default Driver** is selected and click on **OK**. When you finish, continue to the *Verify the Installation* section.

   If no **New Hardware Found** dialog box appears, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

Install the Hardware

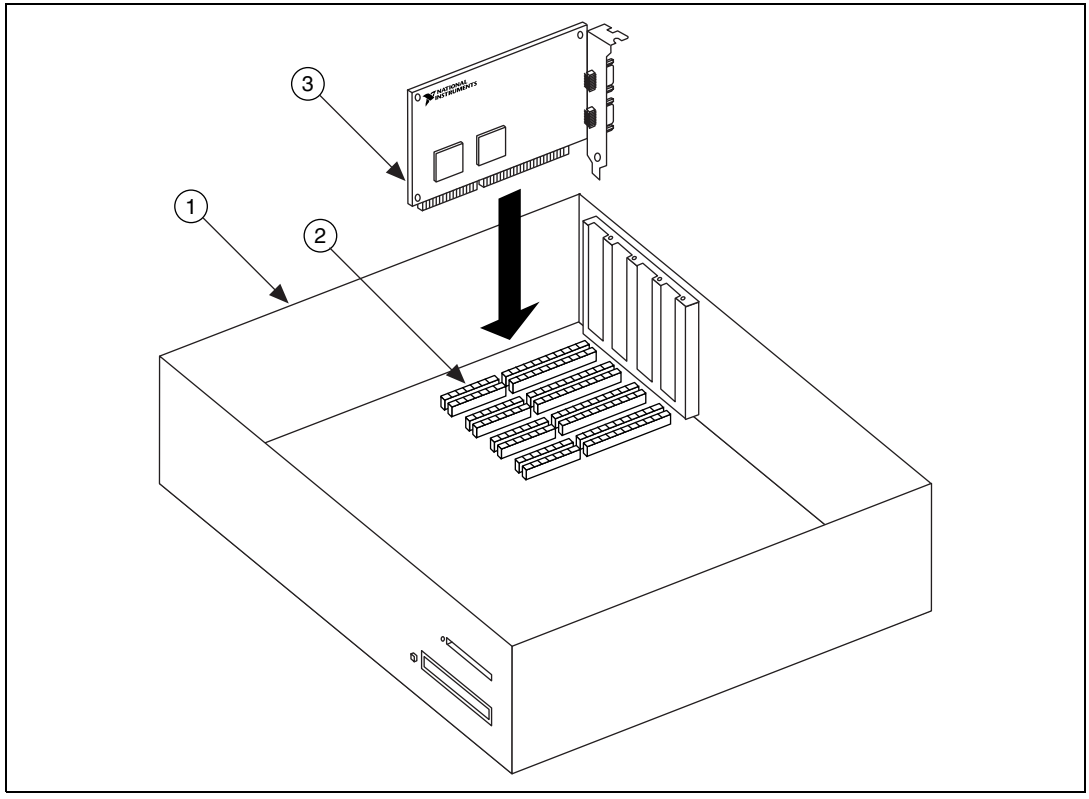
This section describes how to install your AT serial hardware.

Note If you are installing a AT-485, you might need to adjust the value of the bias resistors, depending on your application. For more information, refer to Appendix B, *Serial Port Information*.

Caution Before you remove your board 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 serial board.

To install your AT serial board, complete the following steps:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the AT serial board.
2. Remove the top or side cover of the computer.
3. Find an unused AT expansion slot in your computer.
4. Remove the corresponding expansion slot cover on the back panel of the computer.
5. Touch a metal part on your chassis to discharge any static electricity.
6. Insert the AT serial board into the slot with the serial connectors toward the opening on the back panel. Make sure that you insert the board all the way into the slot. The board might seem to click firmly into place, even though it is only part of the way in. Figure 5-5 shows how to install the AT serial board into an expansion slot.



1 PC	2 AT Socket	3 AT Serial Card

Figure 5-5. AT Serial Board Installation

7. Screw the AT serial board mounting bracket to the back panel mounting rail of the computer.
8. Replace the cover.
9. Turn on your computer and start Windows Me/9*x*.
10. Watch for Windows Me/9*x* to display one or more **New Hardware Found** dialog boxes. In the dialog box, select **Windows Default Driver** and click on **OK**.

    If no **New Hardware Found** dialog box appears, refer to the *Forcing Windows to Detect Your Hardware* section in Appendix D, *Troubleshooting and Common Questions*.

The serial hardware installation is complete. Continue to the next section, *Verify the Installation*.

Verify the Installation

When you begin to verify the installation, keep in mind that the serial ports built into the computer are typically named from COM1 to COM4. Windows Me/9*x* typically issues port names to the ports on NI serial hardware starting with COM5, COM6, and so on. If not enough resources are available to assign to all the NI serial ports, the port with the higher COM*x* name is left unconfigured.

Double-click on the **System** icon in the Control Panel. In the **System Properties** window that appears, select the **Device Manager** tab, and click on the **View devices by type** button at the top of the page. If necessary, double-click on the **Ports (COM & LPT)** icon to view all of the ports.

The shared IRQ AT serial boards are configured as devices belonging to the "multi-function adapters" class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon. If you have installed one of these interfaces, double-click on the **Multi-function adapters** icon as well as the **Ports (COM & LPT)** icon to look at the ports resources. To modify the hardware resources, double-click on the **Multi-Function adapters** icon.

If a circled exclamation point appears through the port icon, the serial port is not installed properly. A problem with the port may have occurred because Windows Me/9*x* could not acquire resources for the port, or because an interrupt request resource conflict exists. If no circled exclamation point appears, the serial hardware is installed correctly. Figure 5-6 shows an example of NI serial hardware that is installed properly.

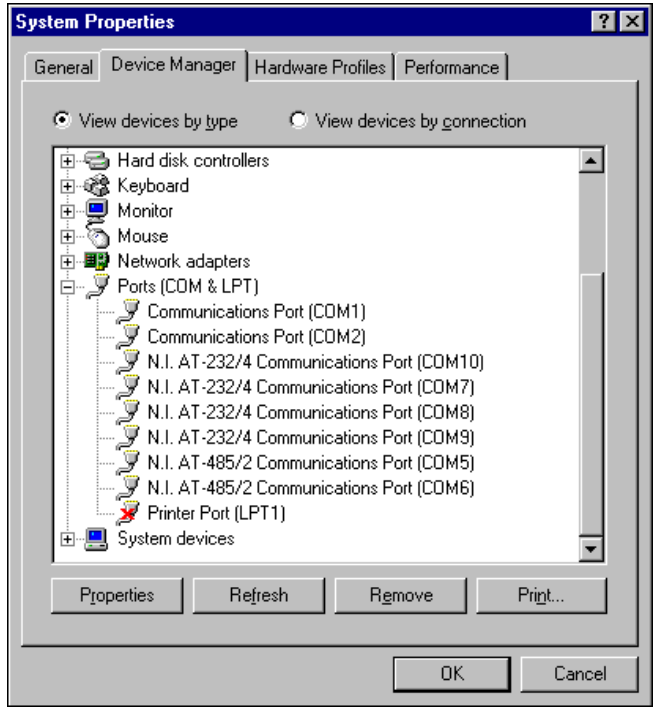


Figure 5-6. Device Manager Ports List for AT Serial Board Correctly Installed

Verify the Hardware Resources

For every port of the newly installed serial interface, double-click on the name of the serial port in the Device Manager. Then, click on the **Resources** tab. If the resources were assigned correctly, the **Resources** page shows which resources are assigned to your serial ports.

If Windows Me/9*x* did not assign any resources to the port, the **Resources** page shows only a **Set Configuration Manually** button. Click on the **Set Configuration Manually** button and try to assign conflict-free resources to your serial hardware. For instructions, refer to the *Selecting Conflict-Free Resources* section of Appendix D, *Troubleshooting and Common Questions*. You may have to free an interrupt request level so that one can be assigned to your serial hardware. For instructions, refer to the *Freeing an Interrupt Request Level* section in Appendix D, *Troubleshooting and Common Questions*.

When you have finished verifying the hardware resources, proceed to the next section.

Determine Which Physical Port Is Associated with COMx

For every port of the newly installed serial interface, double-click on the name of the serial port in the Device Manager. Then, click on the **Port Settings** tab. The top of this page displays the serial number of the serial hardware, and the physical port number starting at 1. On all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.

When you have finished verifying the driver installation and physical port, proceed to the next section.

Run the Diagnostic Test

To verify and test the installation, run the diagnostic program that came with your NI-Serial software. The diagnostic program verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

To run the test, select the **diagnostics** item under **Start»Programs» National Instruments Serial**.

If the diagnostic test completes with no failures, your serial hardware and software are installed properly. If it fails, refer to Appendix D, *Troubleshooting and Common Questions*, for troubleshooting instructions.

After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated into the Windows Me/9*x* Device Manager. You can use it to view or change the configuration of your serial ports.

Follow these steps to configure the serial port. Repeat the configuration procedure for each serial port in your system.

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon. The **System Properties** window appears.
2. Select the **Device Manager** tab, and click on the **View devices by type** button at the top of the page.

3. Double-click on the **Ports (COM & LPT)** icon.
4. Double-click on the name of the port you want to configure.

You can now view or change information about your serial port in the following ways:

- To view the hardware resources assigned to the serial port, click on the **Resources** tab.
- To view or change the port settings, click on the **Port Settings** tab. For more information about the settings, refer to the next section, *Port Settings Tab*.
- To change the RS-485 transceiver mode, or to enable or disable the FIFOs on the serial hardware, in the **Port Settings** tab, click on the **Advanced** button. For more information about the settings, refer to the next section, *Port Settings Tab*.

Note If you use two-wire TXRDY mode, FIFOs must be enabled. Transceiver modes apply to RS-485 interfaces only. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

5. To save your changes, click on the **OK** button. To exit without saving the changes, click on the **Cancel** button.

Port Settings Tab

On the **Port Settings** tab, you can change any of the settings by clicking on the arrow button to the right of the setting. When you click on the arrow button, a list of valid values for that setting appears. Select the desired setting from the list. Figure 5-7 shows the **Port Settings** tab.

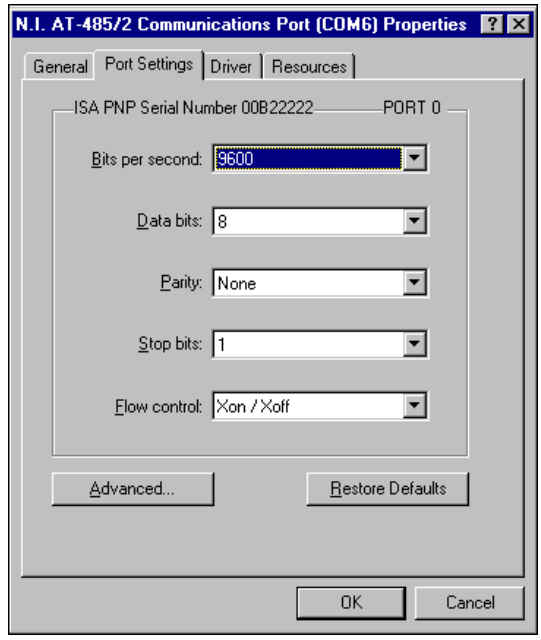


Figure 5-7. Port Settings Tab

Advanced Port Settings

You can view or change the advanced port settings by clicking on the **Advanced** button on the **Port Settings** tab. Figure 5-8 shows the **Advanced Port Settings** dialog box.

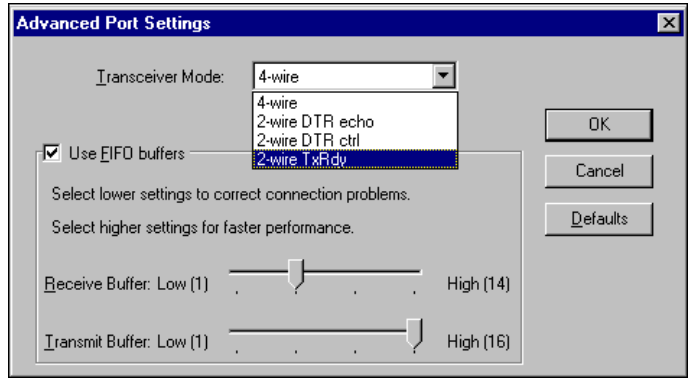


Figure 5-8. Advanced Port Settings Dialog Box

The following sections describe the advanced settings options.

Transceiver Mode

The transceiver mode selection is available by clicking on the **Advanced** button on the **Port Settings** tab. It shows the transceiver mode in use, and applies only to AT-485 boards. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Hardware*.

Use FIFO Buffers

The FIFO buffer control is available by clicking on the **Advanced** button on the **Port Settings** tab. FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The receiver FIFO trigger denotes the number of characters received in the FIFO before the PC is interrupted to read the data. The transmit FIFO trigger denotes the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. Consider the following points when selecting FIFO settings:

- You can select larger FIFO settings to reduce the number of interrupts and therefore minimize system overhead.
- If transfer rates are high, you can lower receive FIFO settings to prevent overrun errors due to interrupt latency.
- If data transfer sizes are small, selecting receive FIFO settings just above data sizes can reduce efficiency, so select lower settings.



Note If you want your serial hardware ports to use the names *COM1*, *COM2*, *COM3*, or *COM4*, refer to the *Common Questions* section of Appendix D, *Troubleshooting and Common Questions*.

Windows NT

Installing the Microsoft PnP ISA Enabler Driver

When you install an AT board, you must install the PnP ISA Enabler Driver.

The AT serial hardware is Plug and Play. Windows NT 4.0 does not support Plug and Play. In order for Windows NT to detect and install the Plug and Play hardware, you must install the PnP ISA Enabler driver included on your Windows NT 4.0 CD-ROM. Complete the following steps to install the driver:

1. Locate the `Pnpisa.inf` file in the `Drvlib\Pnpisa\X86` folder on the Windows NT 4.0 CD-ROM.
2. Right-click on the `Pnpisa.inf` file, then select **Install** on the menu that appears.
3. Restart the computer.

Install the NI-Serial Software

Install the NI-Serial software for Windows NT before you install the hardware. Make sure that you have already installed the PnP ISA Enabler driver as described in the previous section.

1. Log on as `Administrator` or as a user who has `Administrator` privileges.
2. Select **Start»Settings»Control Panel**.
3. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs** dialog box appears.
4. Click on the **Install** button.
5. When prompted, insert the *NI-Serial Software for Windows 2000/NT/Me/9x* CD and click on the **Next** button to proceed. The software installation wizard begins.

   The setup wizard guides you through the necessary steps to install the NI-Serial software. You can go back and change values where appropriate by clicking on the **Back** button. You can exit the setup where appropriate by clicking on the **Cancel** button.

Note This installation backs up the Microsoft Windows NT serial driver `serial.sys` to `serial.bak` and then overwrites `serial.sys`. You can find `serial.sys` in the Windows NT`.....\system32\drivers` directory.

The software installation is complete. Proceed to the next section, *Install the Serial Hardware*.

Install the Serial Hardware

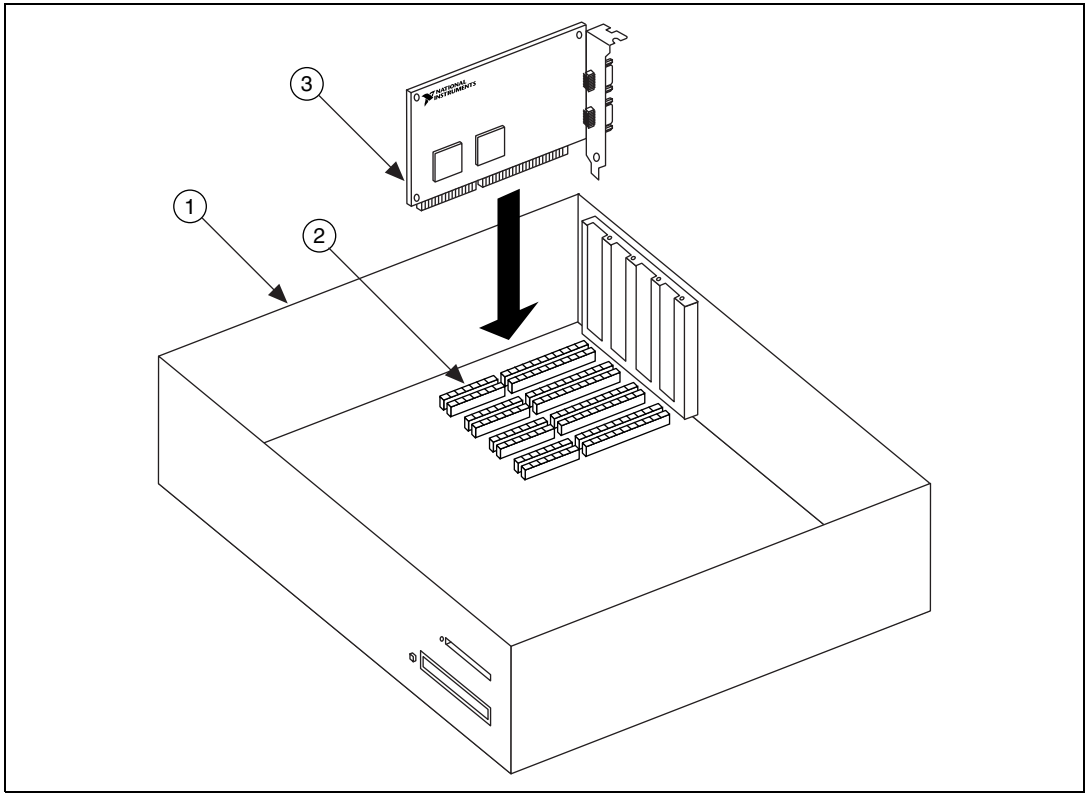
This section describes how to install your AT serial board.

Note If you are installing an AT-485, you might need to adjust the value of the bias resistors, depending on your application. For more information, refer to Appendix B, *Serial Port Information*.

Caution Electrostatic discharge can damage several components on your board. To avoid such damage in handling the board, touch the antistatic plastic package to a metal part of your computer chassis before removing the board from the package.

Complete the following steps to install your AT serial board:

1. Turn off your computer. Keep the computer plugged in so that it remains grounded while you install the AT serial board.
2. Remove the top or side cover of the computer.
3. Remove the expansion slot cover on the back of the computer.
4. Insert the AT serial board into an unused slot with the serial connectors sticking out of the opening on the back panel. Make sure that you insert the board all the way into the slot. The board may seem to click firmly into place, even though it is only part of the way in. Figure 5-9 shows the installation of an AT serial board.



1 PC	2 AT Socket	3 AT Serial Card

Figure 5-9. AT Serial Board Installation

5. Screw the mounting bracket of the AT serial board to the back panel rail of the computer.
6. Replace the cover, and turn on your computer.

7. Windows NT displays one or more **New Hardware Found** dialog boxes, depending on your serial hardware. In each dialog box, make sure that **Windows Default Driver** is selected, and click on **OK**.
8. The serial configuration software displays a **PnP Port Configuration** dialog box. Select a nonconflicting base I/O address and IRQ setting for the port/card, and click on **OK**. For more information on selecting resources for your post/card, refer to the *Resource Settings* section.
9. After you have selected the resources for all ports, choose to restart the computer when the system prompts you.

The serial hardware installation is now complete.

Verify the Installation

Determine Which Physical Port Is Associated with COMx

Select **Start»Settings»Control Panel**, and double-click on **niports**. A list showing installed National Instruments ports with their logical COM*x* names appears. If your interface is not on the list, refer to Appendix D, *Troubleshooting and Common Questions*.

Select the COM port you want and click on the **Settings** button to display the **General Port Settings** dialog box for that port. This dialog box displays the serial number of the serial hardware and the physical port number starting at 1. On all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.

When you have finished verifying the driver installation and physical port, proceed to the next section, *Run the Diagnostic Test*.

Run the Diagnostic Test

To verify and test the installation, run the diagnostic program that came with your NI-Serial software. The diagnostic program verifies that your serial driver is installed properly, that the configuration of your hardware does not conflict with anything else in your system, and that the serial driver can communicate with your hardware correctly.

To run the test, select the **diagnostics** item under **Start»Programs» National Instruments Serial**.

If the diagnostic test completes with no failures, your serial hardware and software are installed properly. If it fails, refer to Appendix D, *Troubleshooting and Common Questions*, for troubleshooting instructions.

After you verify the hardware and software installation, connect the cables. See Appendix A, *Connector Descriptions*, for information about cable connections.

Configure Communication Port Settings

The serial configuration utility is fully integrated with the Windows NT Control Panel. You can use it to examine or modify the configuration of the serial port.

Follow these steps to configure the serial port.

1. Select **Start»Settings»Control Panel** and double-click on the **niports** icon. A list of National Instruments ports appears, as shown in Figure 5-10.

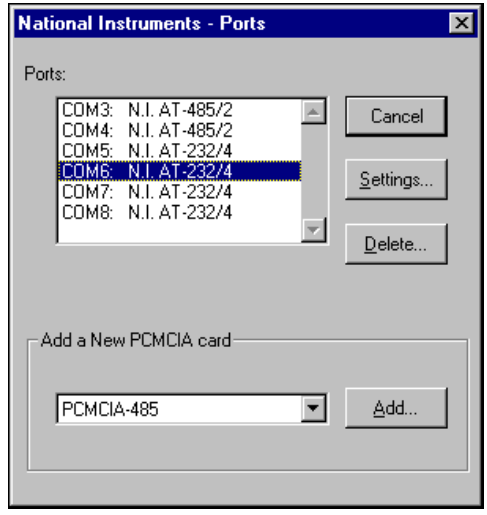


Figure 5-10. niports Configuration Utility

2. Select the port you are interested in.
3. Click on the **Settings** button to view or configure the port settings. Refer to the next section, *General Port Settings*, for more information.

4. Click on the **Resources** button in the **General Port Settings** dialog box to view or configure the resources for the port. Refer to the *Resource Settings* section, later in this chapter, for more information.
5. Click on **Delete** to remove hardware information about the port from Windows NT. You should do this before you remove the serial interface from the system.

General Port Settings

This section describes the options you can set in the **General Port Settings** dialog box, shown in Figure 5-11.

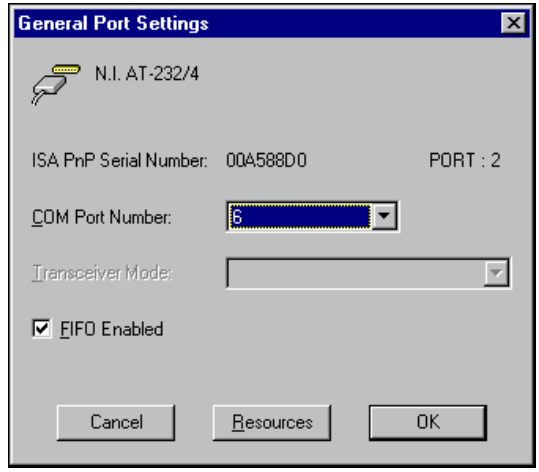


Figure 5-11. General Port Settings Dialog Box

COM Port Number

You can use the **COM Port Number** control to change the COM*x* name of the port selected.

Transceiver Mode

The transceiver mode selection shows the transceiver mode in use, and applies only to AT-485 boards. Refer to Chapter 6, *Using Your Serial Hardware*, for more information about transceiver modes. If you use two-wire $\overline{\text{TXRDY}}$ mode, FIFOs must be enabled.

FIFO Enabled

You can use the **FIFO Enabled** control to enable or disable the FIFO buffers on the serial port. FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver.

FIFO Buffer Size

FIFO buffers are present on the 16550-compatible UARTs—one for the transmitter and one for the receiver. The receiver FIFO trigger denotes the number of characters received in the FIFO before the PC is interrupted to read the data. The transmit FIFO trigger denotes the maximum number of bytes written to the FIFO in a block when the PC is interrupted to write the data. Consider the following points when selecting FIFO settings:

- You can select larger FIFO settings to reduce the number of interrupts and therefore minimize system overhead.
- If transfer rates are high, you can lower receive FIFO settings to reduce the number of interrupts and therefore prevent overrun errors due to interrupt latency.
- If data transfer sizes are small, selecting receive FIFO settings just above data sizes can reduce efficiency, so select lower settings.

Resources

Click on the **Resources** button to display the resource configuration dialog box for the port. For more information on resource configuration, refer to the next section, *Resource Settings*.

Resource Settings

The following sections explain the resource configuration options for each serial interface.

AT Boards (Shared IRQ)

Figure 5-12 shows the **PnP Port Configuration** dialog box for an AT-232/4 with shared IRQ. The dialog boxes for other shared IRQ AT boards are similar.

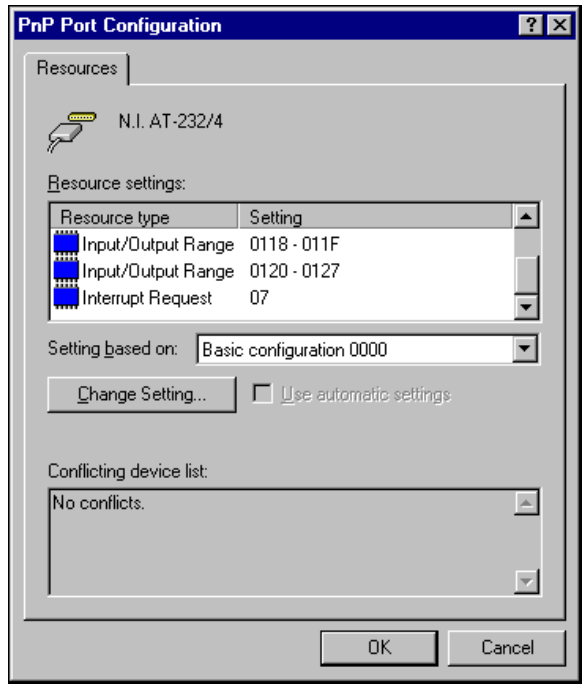


Figure 5-12. PnP Port Configuration Dialog Box for the AT-232/4

Each shared IRQ AT board requires multiple base I/O settings (one for each port) and one IRQ that is shared between the ports.

Input/Output Range: Each **Input/Output Range** listing displays the I/O address ranges assigned to the corresponding port on the board.

Interrupt Request: The IRQ shared between the ports on the board.

Note The niports utility informs you if your resources conflict with the resources of any other interface in the system. It does not check for conflicts with ports on the same board. Make sure to assign base I/O addresses that do not conflict with those assigned to another port on the same board.

Note If you are unable to change the base I/O address by double-clicking on the Input/Output Range control, select a different Basic Configuration in the Setting based on: control.

AT Boards (Non-Shared IRQ)

Each port on the board requires one I/O window and one IRQ.

Input/Output Range: The base I/O address range assigned to the port.

IRQ: The IRQ assigned to the port.

6

Using Your Serial Hardware

This chapter describes how to set the hardware transceiver control mode for your RS-485 interfaces and lists some general programming requirements.

General Programming Requirements

The NI-Serial software is fully integrated into the standard Windows communications software. NI serial ports are used like any other Windows communications (COM) port. Windows has standard communication functions for use within either Win16 or Win32 applications.

When you develop your application, remember that you must use the standard Microsoft Windows serial communication functions. For information about Microsoft Windows serial communication functions, refer to the *Win32 Software Development Kit* and to the *Win32 Overviews and Win32 Reference* online help.

If you have LabVIEW or Measurement Studio and want to use it with your serial hardware, refer to your LabVIEW or Measurement Studio documentation for information about serial I/O functions.

Advanced Transceiver Control for the PCI/PXI/PCMCIA/AT-485 Boards

Note Transceiver modes apply only to the PCI/PXI/PCMCIA/AT-485 boards.

The RS-485 boards support four modes of hardware transceiver control. You can use hardware flow control to enable and disable your transmitters and receivers so that they function on different bus topologies. Table 6-1 lists the status of the transmitters and receivers under each of the transceiver control modes.

Table 6-1. Transceiver Control Modes

Mode	Transmitter	Receiver
Four-wire mode	Always enabled	Always enabled
Two-wire mode: $\overline{\text{DTR}}$ with echo	Enabled with $\overline{\text{DTR}}$ unasserted	Always enabled
Two-wire mode: $\overline{\text{DTR}}$ controlled	Enabled with $\overline{\text{DTR}}$ unasserted	Enabled with $\overline{\text{DTR}}$ asserted
Two-wire mode: $\overline{\text{TXRDY}}$ auto control	Enabled with $\overline{\text{TXRDY}}$ asserted	Enabled with $\overline{\text{TXRDY}}$ unasserted

Note Signal names with an overscore, such as $\overline{\text{DTR}}$, indicate that the signal is active low.

Four-Wire Mode

Use the four-wire mode for most full-duplex systems. In this mode, the transmitter and receiver are always enabled. This mode is the default.

Two-Wire Mode: $\overline{\text{DTR}}$ with Echo

Use this mode in half-duplex systems where the $\overline{\text{DTR}}$ (Data Terminal Ready) line must control the transmitter. In the $\overline{\text{DTR}}$-with-echo mode, the transmitter is tri-stated when the $\overline{\text{DTR}}$ signal of the UART (Universal Asynchronous Receiver/Transmitter) is asserted. To transmit, your application must first clear the $\overline{\text{DTR}}$ bit to enable the transmitter. After the data is fully transmitted, your application once again sets the $\overline{\text{DTR}}$ bit to disable the transmitter. Because the receiver is always enabled in this mode, you not only receive packets from other devices, you also receive the packets sent from your transmitter.

Two-Wire Mode: $\overline{\text{DTR}}$ Controlled

This mode is similar to the two-wire, $\overline{\text{DTR}}$-with-echo mode. Use this mode in half-duplex systems where the $\overline{\text{DTR}}$ line must control the transmitter. Although this mode uses the same method as the $\overline{\text{DTR}}$-with-echo mode to control the transmitter, the hardware automatically disables the receiver whenever the transmitter is enabled. Thus, you do not receive the packets sent from your transmitter.

Two-Wire Mode: $\overline{\text{TXRDY}}$ Auto Control

In this mode, the serial hardware transparently enables the transmitter and receiver in a two-wire system. Use this mode to remove the burden of flow control from your application. By connecting the transmitter to the $\overline{\text{TXRDY}}$ (Transmit Ready) line, the hardware enables the transmitter for each byte to be transmitted. Also, the hardware disables the receiver whenever the transmitter is enabled, so you do not receive the packets sent from your transmitter.

Note When you are communicating with a two-wire device, National Instruments recommends that you use the two-wire $\overline{\text{TXRDY}}$ auto control mode. Because this mode handles the transmitter/receiver enabling for a two-wire connection in your hardware, it reduces the software overhead required to perform this operation in your application program.

For more information about serial communication in two- or four-wire modes, refer to the *Serial Communication Issues* section in Appendix B, *Serial Port Information*.

Setting the Transceiver Control Mode

Windows 2000

To set the transceiver control mode, use the Windows 2000 Device Manager. For instructions on how to use the Device Manager, refer to the chapter with installation instructions for your hardware platform. The mode you select in the Device Manager is automatically configured when you open a port on a serial interface.

Windows Me/9*x*

To set the transceiver control mode, use the Windows Me/9*x* Device Manager. For instructions on how to use the Device Manager, refer to chapter with installation instructions for your hardware platform. The mode you select in the Device Manager is automatically configured when you open a port on a serial interface.

You can also set the hardware transceiver control mode from within a DOS application. For each port you want to control, write the control byte for the mode you want to select to the scratch register of the UART. Table 6-2 shows the control bytes for each mode.

Table 6-2. Transceiver Mode Control Bytes

Transceiver Mode	Control Byte
Four-wire mode	0x00
Two-wire mode: $\overline{\text{DTR}}$ with echo	0x01
Two-wire mode: $\overline{\text{DTR}}$ controlled	0x02
Two-wire mode: $\overline{\text{TXRDY}}$ auto control	0x03

The scratch register is located at offset 7 from the base address of the port. For example, if COM2 were located at base address 0x3F8, and you want to set the board to two-wire mode with $\overline{\text{DTR}}$ control, you would write a 0x02 to address 0x3FF. The board would immediately switch to the two-wire mode with $\overline{\text{DTR}}$ control.

Windows NT

To set the transceiver control mode, use the serial configuration utility. For instructions on how to use the utility, refer to chapter with installation instructions for your hardware platform. The mode you select in the configuration utility is automatically configured when you open a port on a serial interface.

Setting the Transceiver Mode with DeviceIoControl

The NI-Serial software extends the `DeviceIoControl` Windows function for programming the transceiver control mode. To program the transceiver control mode using `DeviceIoControl`, complete the following steps:

1. Add the following lines to your source code:

```
#include <winioctl.h>

#define IOCTL_SERIAL_SET_TRANSCEIVER_MODE
CTL_CODE(FILE_DEVICE_SERIAL_PORT,37,
METHOD_BUFFERED,FILE_ANY_ACCESS)
```

2. Use the Win32 function `DeviceIoControl`, as follows:
   a. Use the defined control code value listed in step 1 to set the transceiver mode.
   b. Use the input buffer values (unsigned long) listed in Table 6-3 for programming different transceiver modes.

Table 6-3. DeviceIoControl Function Input Values

Transceiver Mode	DeviceIoControl Function Input Value
Four-wire mode	128
Two-wire mode: $\overline{\text{DTR}}$ with echo	129
Two-wire mode: $\overline{\text{DTR}}$ controlled	130
Two-wire mode: $\overline{\text{TXRDY}}$ auto control	131

For example, to set $\overline{\text{TXRDY}}$ two-wire auto control mode, use the following code:

Windows 2000

```
ULONG TranceiverMode = 131;
ULONG dummy;
DeviceIoControl(hDevice,
IOCTL_SERIAL_SET_TRANSCEIVER_MODE,(PVOID)
&TransceiverMode,sizeof(ULONG),NULL,0,&dummy,NULL);
```

Windows NT/Me/9x

```
ULONG TranceiverMode = 131;
DeviceIoControl(hDevice,
IOCTL_SERIAL_SET_TRANSCEIVER_MODE,(PVOID)
&TransceiverMode,sizeof(ULONG),lpOutBuffer,
nOutBufferSize,lpBytesReturned,lpOverlapped);
```

A

Connector Descriptions

Connecting Cables

For the PCMCIA serial cards and two-port PCI, PXI, and AT serial boards, you can use the standard DB-9 connector found on most serial cables. To use the DB-9 connector with the four-port serial boards, you need the 10-position modular jack to DB-9 cable, which is available from National Instruments. You can also use a DB-25 connector with the four-port serial boards by ordering the 10-position modular jack to DB-25 converter cable from National Instruments. The eight-port serial boards include a pig tail cable adapter, providing eight standard DB-9 connectors. The 16-port boards include a break out box, providing 16 standard DB-9 connectors.



Note To achieve the specified isolation voltage for four-port isolated PCI or AT serial boards, use *only* the 10-position modular jack to DB-9 cable included in your four-port isolated PCI or AT serial board kit.

For more information about cable connectors, see the connector descriptions in this appendix.

Connecting Two-Wire Devices

The PCI-485, PCMCIA-485, RS-485 PXI (PXI-8421 and PXI-8423), and AT-485 boards are designed to work with either two- or four-wire devices. If you are using a two-wire device, refer to the device documentation for specific wiring instructions.

In general, half-duplex networks use a single twisted pair of wires for communication in both directions, so you must connect both the transmitter and the receiver at each end of the same pair of wires. For example, to connect an RS-485 data acquisition device to a port on your board using half-duplex communication, you need a single twisted pair of wires. At the board, connect the TXD+ and RXD+ signals (pins 8 and 4 on a DB-9 connector, pins 5 and 20 on a DB-25 connector) together and to one wire. Connect the other end of this wire to both the TXD+ and RXD+ signals on the data acquisition device. Use the same method to connect the TXD– and RXD– signals (pins 9 and 5 on a DB-9 connector, pins 22 and 7 on a DB-25 connector) to the second wire.

For information about setting the transceiver mode for two-wire communication, refer to Chapter 6, *Using Your Serial Hardware*. For more information about duplex architectures, refer to Appendix B, *Serial Port Information*.

DB-9 Connector

Figure A-1 and Table A-1 give the pin locations and descriptions of the DB-9 connector, the 10-position modular jack to DB-9 cable, the cable adapter for the eight-port board, and the DB-9 connectors to the 16-port breakout box.

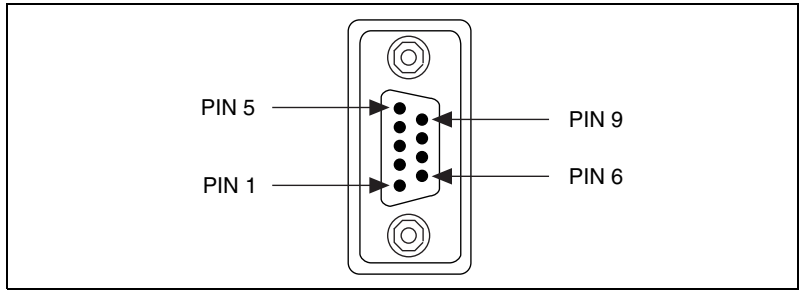


Figure A-1. DB-9 Connector Pin Locations

Table A-1. DB-9 Pin Descriptions

DB-9 Pin	232 Signal	485 Signal
1	DCD*	GND
2	RXD	CTS+ (HSI+)
3	TXD	RTS+ (HSO+)
4	DTR*	RXD+
5	GND	RXD–
6	DSR*	CTS– (HSI–)
7	RTS	RTS– (HSO–)
8	CTS	TXD+
9	RI*	TXD–

* These signals are not supported by the isolated 232 boards or ports 9-16 of the RS-232 sixteen-port board.

Modular Jack Connector

Figure A-2 and Table A-2 give the pin locations and descriptions of the 10-position modular jack.

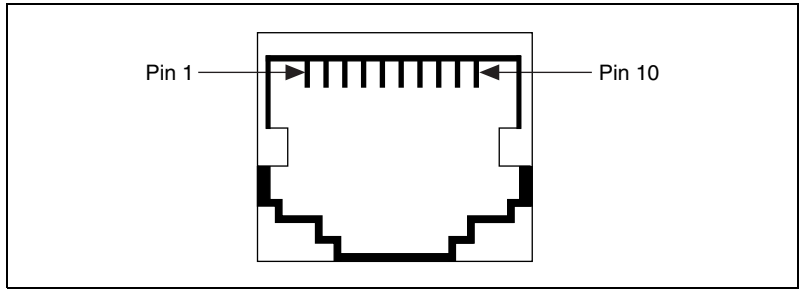


Figure A-2. 10-Position Modular Jack Pin Locations

Table A-2. 10-Position Modular Jack Pin Descriptions

10-Position Modular Jack Pin	232 Signal	485 Signal
10	DCD*	GND
9	RXD	CTS+ (HSI+)
8	TXD	RTS+ (HSO+)
7	DTR*	RXD+
6	GND	RXD–
5	DSR*	CTS– (HSI–)
4	RTS	RTS– (HSO–)
3	CTS	TXD+
2	RI*	TXD–
1	No Connect	No Connect

* These signals are not supported by the isolated 232 ports.

DB-25 Connector

Figure A-3 and Table A-3 give the pin locations and descriptions of the DB-25 connector, which is on the optional 10-position modular jack to DB-25 cable.

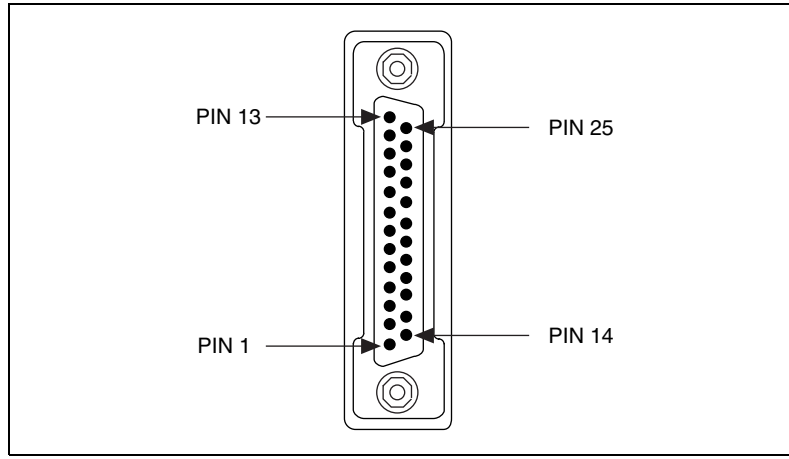


Figure A-3. DB-25 Connector Pin Locations

Table A-3. DB-25 Pin Descriptions

DB-25 Pin	232 Signal	485 Signal
2	TXD	RTS+ (HSO+)
3	RXD	CTS+ (HSI+)
4	RTS	RTS– (HSO–)
5	CTS	TXD+
6	DSR*	CTS– (HSI–)
7	GND	RXD–
8	DCD*	GND
20	DTR*	RXD+
22	RI*	TXD–

Pins not listed in this table are No Connect.

* These signals are not supported by the isolated 232 ports.

Figure A-4 shows how to connect the cables when you install a four-port PCI serial board.

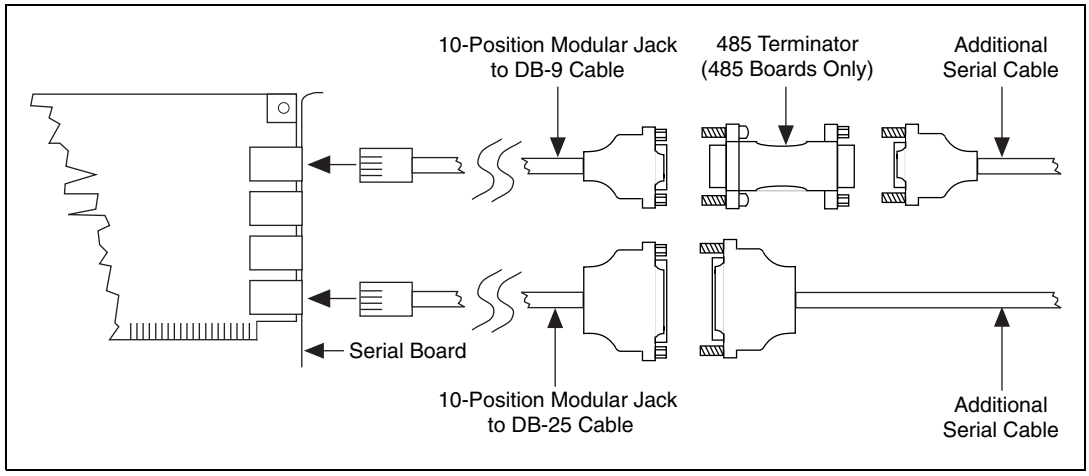


Figure A-4. Connecting the Cables to Your Four-Port PCI Serial Board

68-Pin Connector

Figure A-5 and Table A-4 give the pin locations and descriptions of the 68-pin connector.

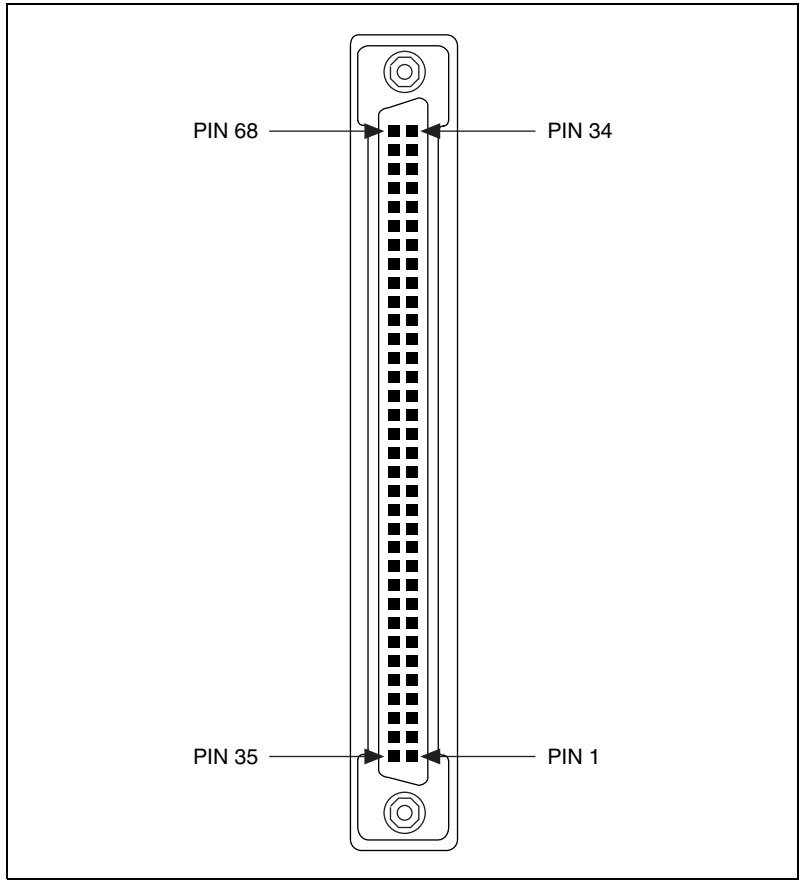


Figure A-5. 68-Pin Connector Pin Locations

Table A-4. 68-Pin Connector Pin Descriptions

68-Pin Connector Port								485 Signal	485 D-Sub 9 Connector	232 Signal	232 D-Sub 9 Connector
1	2	3	4	5	6	7	8				
66	57	49	40	32	23	15	6	RXD–	5	DCD	1
68	59	51	42	34	25	17	8	CTS+	2	RXD	2
65	56	48	39	31	22	14	5	RTS+	3	TXD	3
64	55	47	38	30	21	13	4	RXD+	4	DTR	4
60	60	43	43	26	26	9	9	GND	1	GND	5
63	54	46	37	29	20	12	3	CTS–	6	DSR	6
62	53	45	36	28	19	11	2	RTS–	7	RTS	7
61	52	44	35	27	18	10	1	TXD+	8	CTS	8
67	58	50	41	33	24	16	7	TXD–	9	RI	9

100-Pin Connector

Figure A-6 and Table A-5 give the pin locations and descriptions of the 100-pin connector.

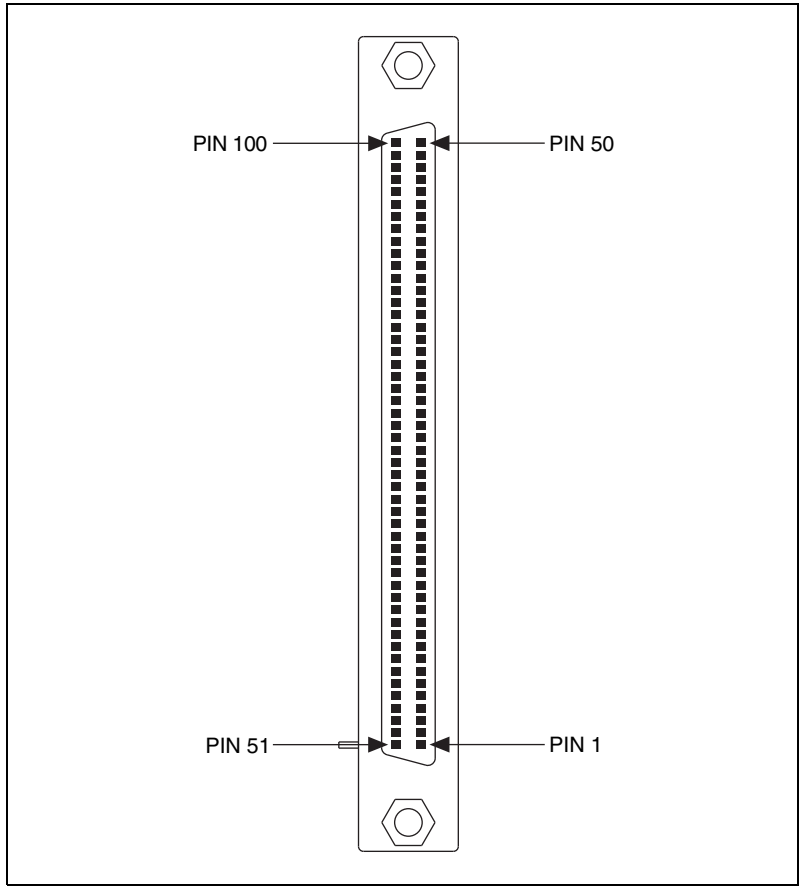


Figure A-6. 100-Pin Connector Pin Locations

Table A-5. 100-Pin Connector Pin Descriptions

100-Pin Connector Port																232 Signal	232 D-Sub 9 Connector
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**		
2	46	6	42	10	38	14	34	—	—	—	—	—	—	—	—	DCD*	1
3	47	7	43	11	39	15	35	18	32	20	30	22	28	24	26	RXD	2
4	48	8	44	12	40	16	36	19	33	21	31	23	29	25	27	TXD	3
5	49	9	45	13	41	17	37	—	—	—	—	—	—	—	—	DTR*	4
1	1	1	1	50	50	50	50	51	51	51	51	100	100	100	100	GND	5
52	96	56	92	60	88	64	84	—	—	—	—	—	—	—	—	DSR*	6
53	97	57	93	61	89	65	85	68	82	70	80	72	78	74	76	RTS	7
54	98	58	94	62	90	66	86	69	83	71	81	73	79	75	77	CTS	8
55	99	59	95	63	91	67	87	—	—	—	—	—	—	—	—	RI*	9

* These signals are not supported on ports 9-16 of the 16-port PCI and PXI serial boards.

B

Serial Port Information

This appendix describes the RS-232, RS-422, and RS-485 standards and explains some of the issues involved with these types of serial communication.

Table A-1 lists the features of the RS-232, RS-422, and RS-485 standards.

Table B-1. RS-232, RS-422, and RS-485 Features

Feature	RS-232	RS-422	RS-485
Type of transmission lines	Single ended	Differential	Differential
Maximum number of drivers	1	1	32
Maximum number of receivers	1	10	32
Maximum cable length	50 ft	4,000 ft	4,000 ft
Maximum data rate	20 kbytes/s	10 Mbytes/s	10 Mbytes/s
Maximum CMV	± 25 V	±7 V	+12 to –7 V
Driver output	5 to 25 V	2 to 6 V	1.5 to 6 V
Driver load	> 3 kΩ	100 Ω	60 Ω

RS-232

As specified in the ANSI/EIA-232-D Standard, *Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*, RS-232 standardizes serial communication between computers, and between computer terminals and modems. Most applications use the RS-232 standard to interface peripherals to personal computers. RS-232 uses transmission lines in which the state of each signal is represented by referencing the voltage level of a single line to ground. RS-232 was designed for serial communication up to

distances of 50 ft and with data rates up to 20 kbytes/s. However, because of improvements in line drivers and cabling, you can usually increase the actual performance of the bus past the limitations on speed and distance recommended in the specification.

RS-422

As specified in the EIA/RS-422-A Standard, *Electrical Characteristics of Balanced Voltage Digital Interface Circuits*, RS-422 defines a serial interface much like RS-232. However, RS-422 uses balanced (or differential) transmission lines. Balanced transmission lines use two transmission lines for each signal. The state of each signal is represented, not by a voltage level on one line referenced to ground as in RS-232, but rather by the relative voltage of the two lines to each other. For example, the TX signal is carried on two wires, wire A and wire B. A logical 1 is represented by the voltage on line A being greater than the voltage on line B. A logical 0 is represented by the voltage on line A being less than the voltage on line B. Differential voltage transmission creates a signal that is more immune to noise as well as voltage loss due to transmission line effects. Thus, you can use RS-422 for longer distances (up to 4,000 ft) and greater transmission speeds (up to 10 Mbytes/s) than RS-232.

RS-485

As specified in the EIA-485 Standard, *Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*, RS-485 expands on the RS-422 standard by increasing the number of devices you can use from 10 to 32 and by working with half-duplex bus architectures. Unlike the RS-422 standard, RS-485 addresses the issue of using multiple transmitters on the same line. RS-485 defines the electrical characteristics necessary to ensure adequate signal voltages under maximum load, short-circuit protection. RS-485 can also withstand multiple drivers driving conflicting signals at the same time.

Serial Communication Issues

This section explains some serial communication issues, including duplex architectures, termination methods, bias resistors, and types of connecting equipment.

Duplex Architectures

Duplex refers to the means of bandwidth usage in a serial system. The two common means of bi-directional serial communication are full duplex and half duplex. Half-duplex communication involves a transmitter and a receiver connected to each end of the same wire or pair of wires. Because the same transmission line both sends and receives data, devices cannot send data in both directions at the same time. First, one device transmits over the wire(s) to the receiver of the second device. When the first device finishes transmitting, both devices switch the connections from their transmitter to their receiver, or vice versa. The device that was receiving data can then transmit over the line.

In full-duplex communication, the devices use a separate wire (or pair of wires) for simultaneous transmission in each direction. Thus, the devices do not switch between transmitting and receiving.

In a differential serial bus (such as RS-422 or RS-485), a half-duplex system transmits and receives over the same twisted pair of wires. Thus, half-duplex communication is often referred to as *two-wire* communications. Likewise, full-duplex communication is often referred to as *four-wire* communications, because the full-duplex system uses a separate pair of wires for communication in each direction.

Full Duplex

A typical full-duplex multidrop bus architecture involves a master-slave protocol. Only one device, the master, can control access to the bus. All other devices are slaves. Slave devices must wait for the master to give them access to the bus. In a typical full-duplex system, one transmission line connects the bus master transmitter to all of the slave receivers. A second transmission line connects all of the slave transmitters to the bus master receiver. Because each transmission line has two separate wires, a full-duplex system is often referred to as a four-wire system. Figure B-1 shows a typical full-duplex system.

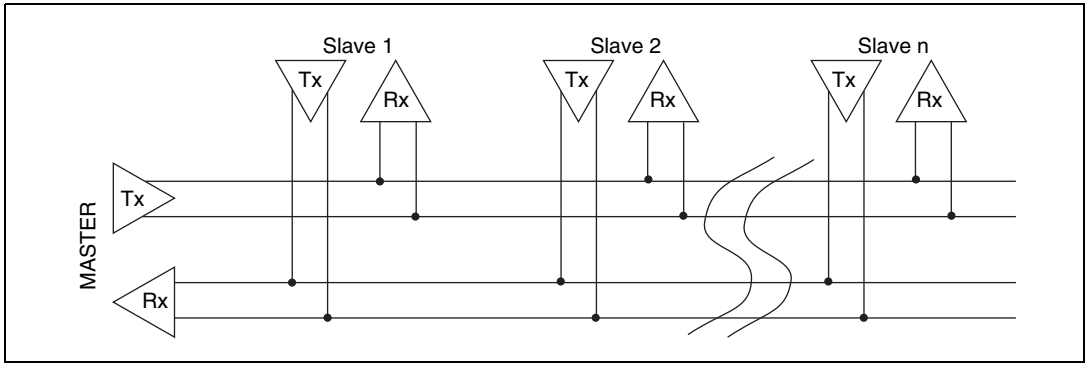


Figure B-1. Typical Full-Duplex System

Half Duplex

A typical half-duplex multidrop bus architecture also involves a master-slave protocol. However, in a half-duplex system, all transmitters and receivers are connected to the same transmission line. A half-duplex system is often referred to as a two-wire system. Figure B-2 shows a typical half-duplex system.

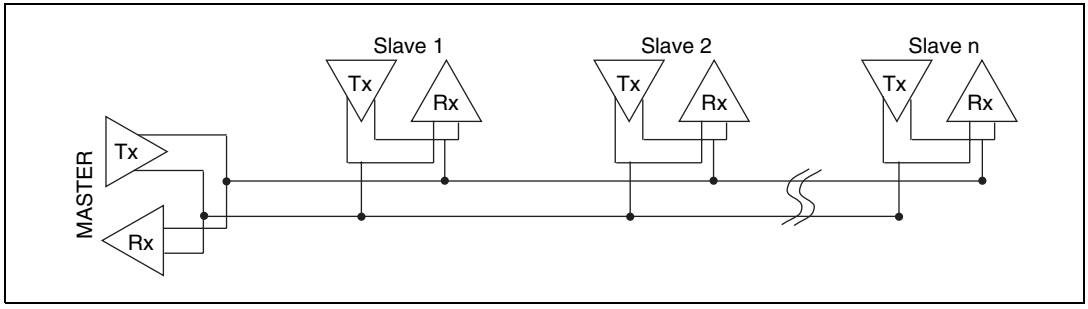


Figure B-2. Typical Half-Duplex System

Termination

Because each differential pair of wires is a transmission line, you must properly terminate the line to prevent reflections. A common method of terminating a two-wire multidrop RS-485 network is to install terminating resistors at each end of the multidrop network. If you daisy-chained multiple instruments together, you need a terminating resistor at only the first and last instruments. The terminating resistor should match the characteristic impedance of the transmission line (typically 100 to 120 Ω). You can order an optional DB-9 RS-485 termination connector that contains embedded terminating resistors for easy termination from National Instruments. For ordering information, contact National Instruments.

Figure B-3 shows a multidrop network using terminating resistors.

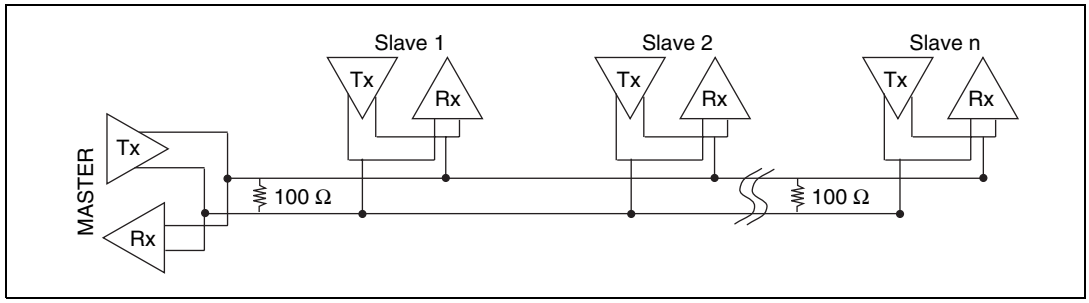


Figure B-3. Multidrop Network Using Terminating Resistors

Bias Resistors

A transmission line enters an indeterminate state if no nodes are transmitting on it. This indeterminate state can cause the receivers to receive invalid data bits from noise picked up on the cable. To prevent a line from receiving these data bits, force the transmission line into a known state. To do so, install two 620 Ω bias resistors at one node on the transmission line; doing so creates a voltage divider that forces the voltage between the differential pair to be greater than 200 mV, the threshold voltage for the receiver. You should install these resistors on only one node.

Note Bias resistors are not available on the eight-port PCI-485 or eight-port PXI-8421.

Figure B-4 shows a transmission line using bias resistors.

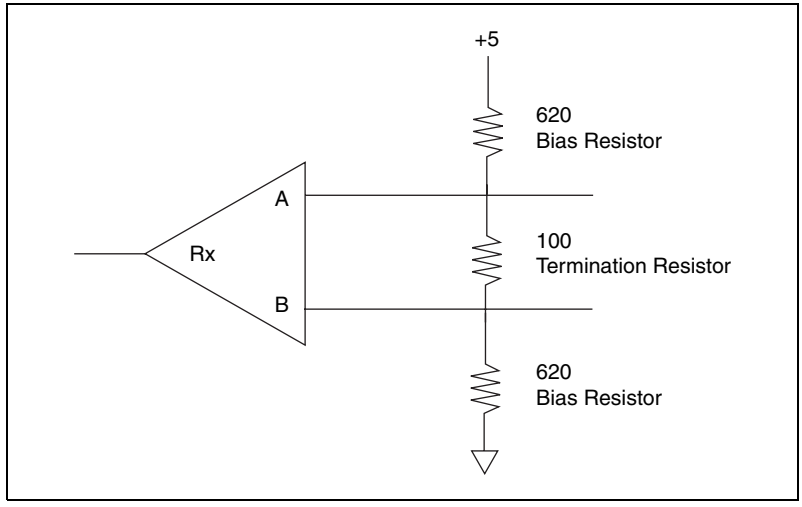


Figure B-4. Transmission Line Using Bias Resistors

On the PCI RS-485 2- and 4-port serial cards, there are four user-configurable bias resistors in front of each connector. These resistors are socketed and pre-loaded with 620 Ω resistors. They are connected to the receive signals of each port to maintain a known state when the bus is idle. The connections are made as follows:

- RXD+ and CTS– are pulled up to VCC
- RXD– and CTS+ are pulled down to GND

Rather than using two 620 Ω resistors at one node, you can increase the value of the resistors and put them at every node. For instance, if there are eight nodes in a system, you can use 4.7 kΩ resistors at each node to effectively achieve the same result.

DTE vs. DCE

In the RS-232 specification, DTE (Data Terminal Equipment) and DCE (Data Communications Equipment)[1] refer to the types of equipment on either end of a serial connection. In general, DTE and DCE refer to computer equipment and modems, respectively. Because the RS-232 specification mainly involves connecting a DTE directly to a DCE and vice versa, the pinouts are defined so that cabling is simple. That is, a cable connected a computer to a modem by wiring pin 1 to pin 1, pin 2 to pin 2, and so on. This method is known as *straight-through* cabling.

Figure B-5 shows straight-through cabling in a DTE-to-DCE interface.

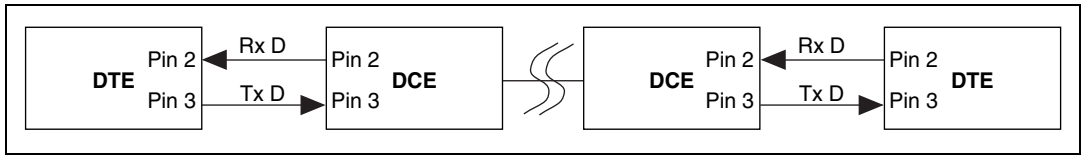


Figure B-5. Straight-Through Cabling in a DTE-to-DCE Interface

Straight-through cabling is still the standard method to connect a modem to your PC. However, because many applications use serial communication to connect two or more DTEs without modems, the cabling becomes more complicated. If two DTEs are wired together using a straight-through cable, one transmitter is connected to the other transmitter, and one receiver is connected to the other receiver. In this setup, no transmissions can occur. Thus, these applications must use a cabling scheme that connects the transmitter on one device to the receiver on the other device and vice versa. This method is known as *null-modem* cabling, because it replaces the two modems that traditional RS-232 applications would require between the two DTEs. To communicate from one serial port to another, use a null-modem cable.

Figure B-6 shows null-modem cabling in a DTE-to-DTE interface.

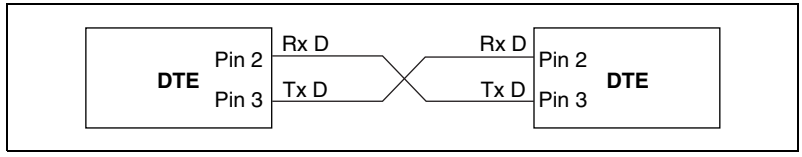


Figure B-6. Null-Modem Cabling in a DTE-to-DTE Interface

[1] In Revision D of the RS-232 specification, a DCE is a Data Circuit-Terminating Equipment.

C

Uninstalling the Hardware and Software

This appendix describes how to uninstall your serial hardware and the NI-Serial software.

To begin your uninstallation, see the section of this appendix containing instructions for your hardware platform and operating system:

PCI Hardware
- Windows 2000 ..... C-2
- Windows Me/9*x* C-3
- Windows NT C-5

PXI Hardware
- Windows 2000 ..... C-7
- Windows Me/9*x* C-8
- Windows NT C-10

PCMCIA Hardware
- Windows 2000 ..... C-12
- Windows Me/9*x* C-13
- Windows NT C-15

AT Hardware
- Windows 2000 ..... C-17
- Windows Me/9*x* C-18
- Windows NT C-20

PCI Hardware

Windows 2000

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Select the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Multi-function adapters** icon.
4. From the **Multi-function adapters** list, right-click on the National Instruments interface that you want to uninstall, as shown in Figure C-1.

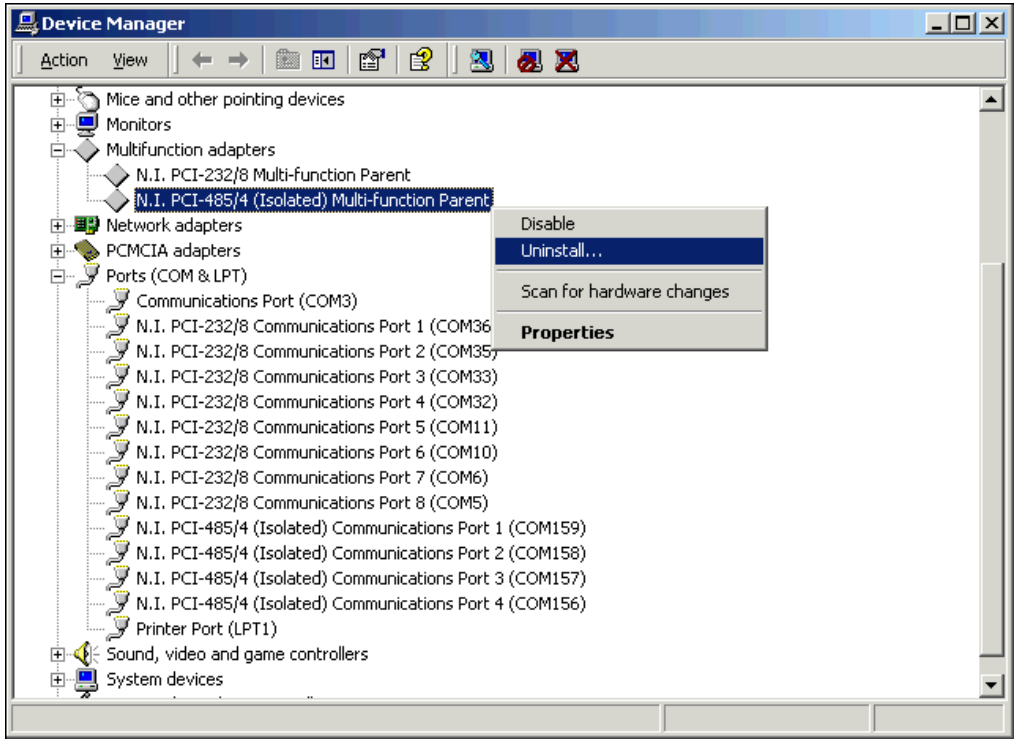


Figure C-1. Selecting an Interface to Uninstall

5. Choose the **Uninstall...** option.
6. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove the hardware information, or click on the **Cancel** button to cancel your request.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears. This dialog box lists the software that you can uninstall.
3. Select **NI-Serial** and click on the **Change/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows 2000, turn off your computer, and physically remove the serial interfaces from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 2, *PCI Serial Hardware Installation, Verification, and Configuration*.

Windows Me/9*x*

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Select the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Multi-function adapters** icon.

4. From the **Multi-function adapters** list, select the National Instruments interface that you want to uninstall, as shown in Figure C-2.

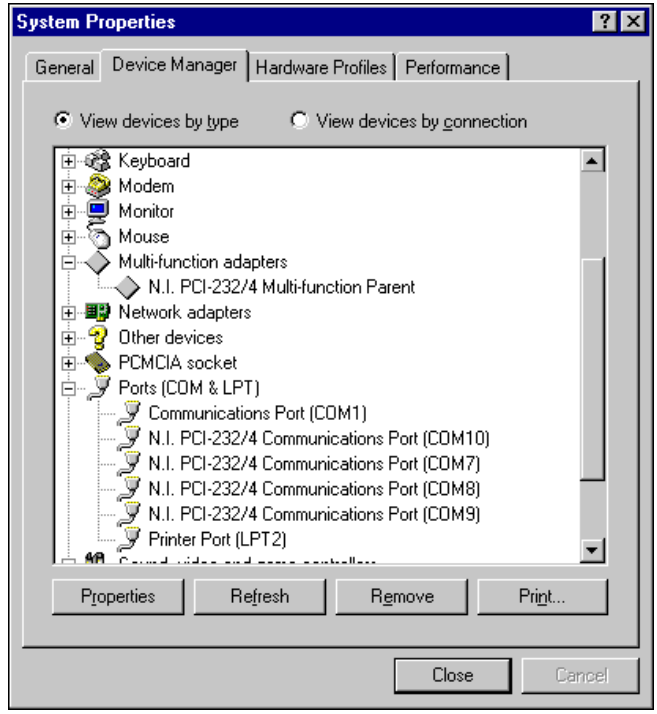


Figure C-2. Selecting an Interface to Uninstall

5. Click on the **Remove** button.
6. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove the hardware information, or click on the **Cancel** button to cancel your request.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The Add/Remove Programs dialog box appears. This dialog box lists the software that you can uninstall.

3. Select the NI-Serial software you want to uninstall, and click on the **Add/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows Me/9*x*, turn off your computer, and physically remove the serial interfaces from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 2, *PCI Serial Hardware Installation, Verification, and Configuration*.

Windows NT

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Log in as `Administrator` or as a user who has `Administrator` privileges.
2. Select **Start»Settings»Control Panel** and double-click on the **niports** icon.
3. From the **Ports** list, select the port of the board you want to uninstall, as shown in Figure C-3.

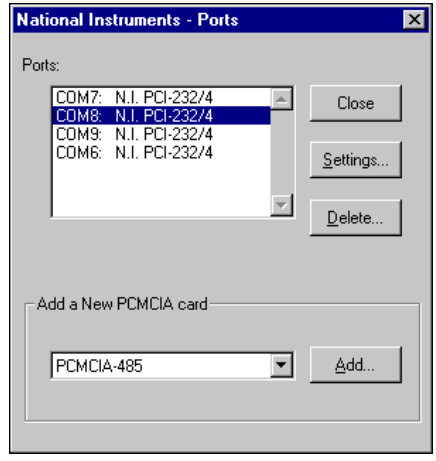


Figure C-3. Selecting an Interface to Uninstall

4. Click on the **Delete** button.
5. Repeat steps 3 and 4 until you have removed every PCI serial port that you want to uninstall.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears. This dialog box lists the software that you can uninstall.
3. Select the NI-Serial software you want to uninstall, and click on the **Add/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows NT, turn off your computer, and physically remove the serial interfaces from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 2, *PCI Serial Hardware Installation, Verification, and Configuration*.

PXI Hardware

Windows 2000

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Select the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Multi-function adapters** icon.
4. From the **Multi-function adapters** list, right-click on the National Instruments interface that you want to uninstall, as shown in Figure C-4.

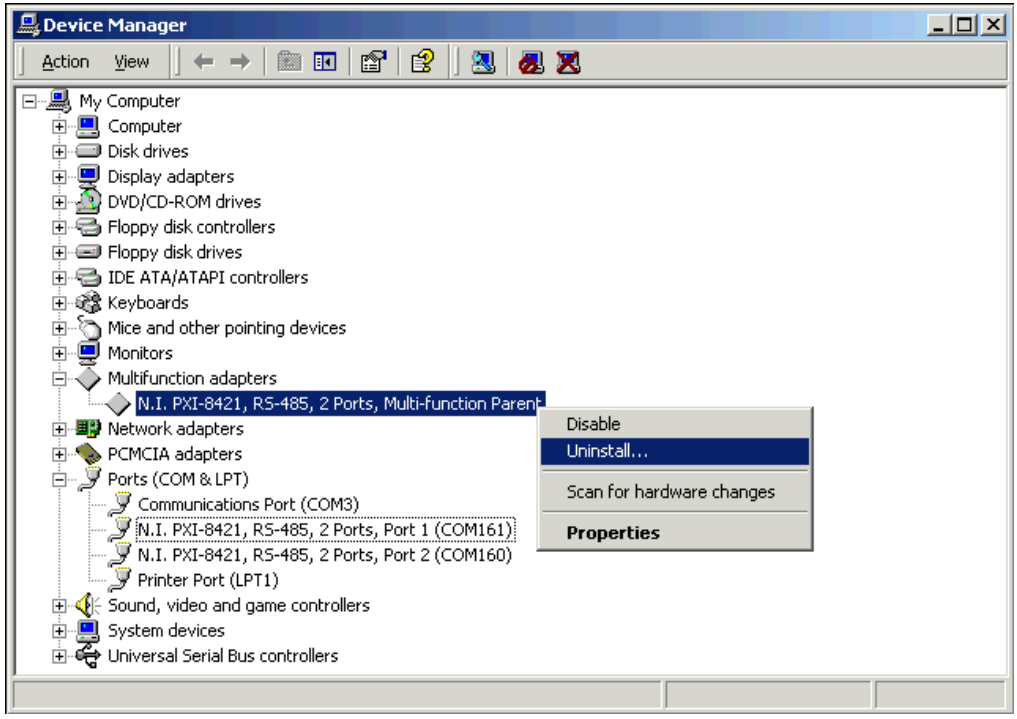


Figure C-4. Selecting an Interface to Uninstall

5. Choose the **Uninstall...** option.
6. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove the hardware information, or click on the **Cancel** button to cancel your request.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears. This dialog box lists the software that you can uninstall.
3. Select **NI-Serial** and click on the **Change/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows 2000, turn off your computer, and physically remove the serial interfaces from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 3, *PXI Serial Hardware Installation, Verification, and Configuration*.

Windows Me/9*x*

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Select the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Multi-function adapters** icon.

4. From the **Multi-function adapters** list, select the National Instruments interface that you want to uninstall, as shown in Figure C-5.

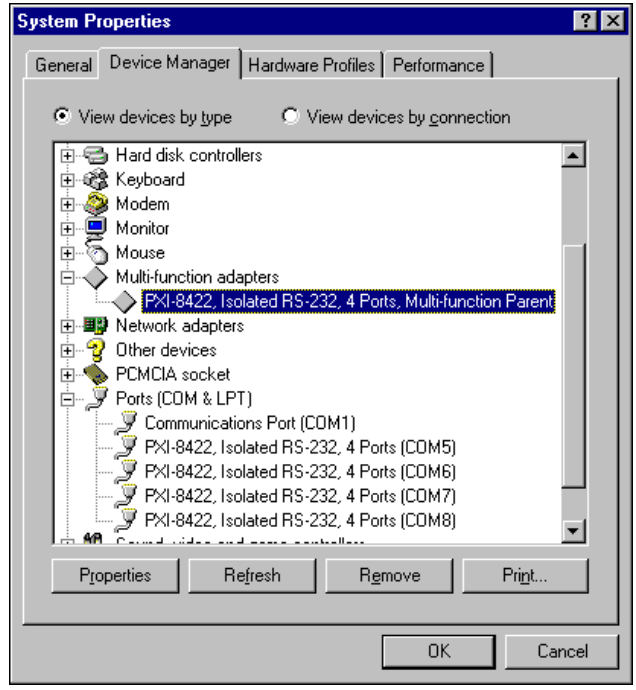


Figure C-5. Selecting an Interface to Uninstall

5. Click on the **Remove** button.
6. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove the hardware information, or click on the **Cancel** button to cancel your request.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears. This dialog box lists the software that you can uninstall.

3. Select the NI-Serial software you want to uninstall, and click on the **Add/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows Me/9*x*, turn off your computer, and physically remove the serial interfaces from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 3, *PXI Serial Hardware Installation, Verification, and Configuration*.

Windows NT

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Log in as `Administrator` or as a user who has `Administrator` privileges.
2. Select **Start»Settings»Control Panel** and double-click on the **niports** icon. From the **Ports** list, select the port of the board you want to uninstall, as shown in Figure C-6.

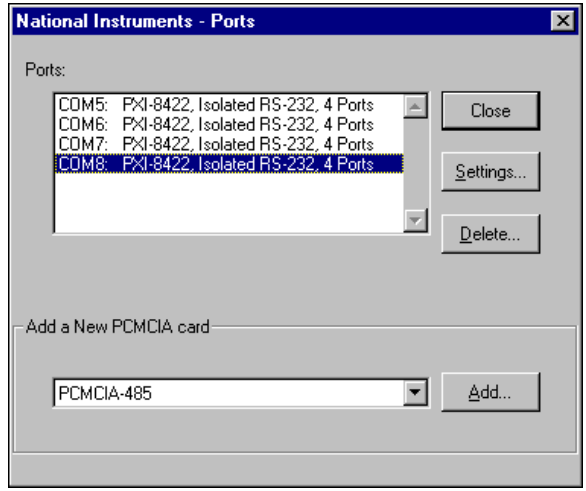


Figure C-6. Selecting an Interface to Uninstall

3. Click on the **Delete** button.
4. Repeat steps 3 and 4 until you have removed every PXI serial port that you want to uninstall.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears. This dialog box lists the software that you can uninstall.
3. Select the NI-Serial software you want to uninstall, and click on the **Add/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows NT, turn off your computer, and physically remove the serial interfaces from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 3, *PXI Serial Hardware Installation, Verification, and Configuration*.

PCMCIA Hardware

Windows 2000

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Select the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Multi-function adapters** icon.
4. From the **Multi-function adapters** list, right-click on the National Instruments interface that you want to uninstall, as shown in Figure C-7.

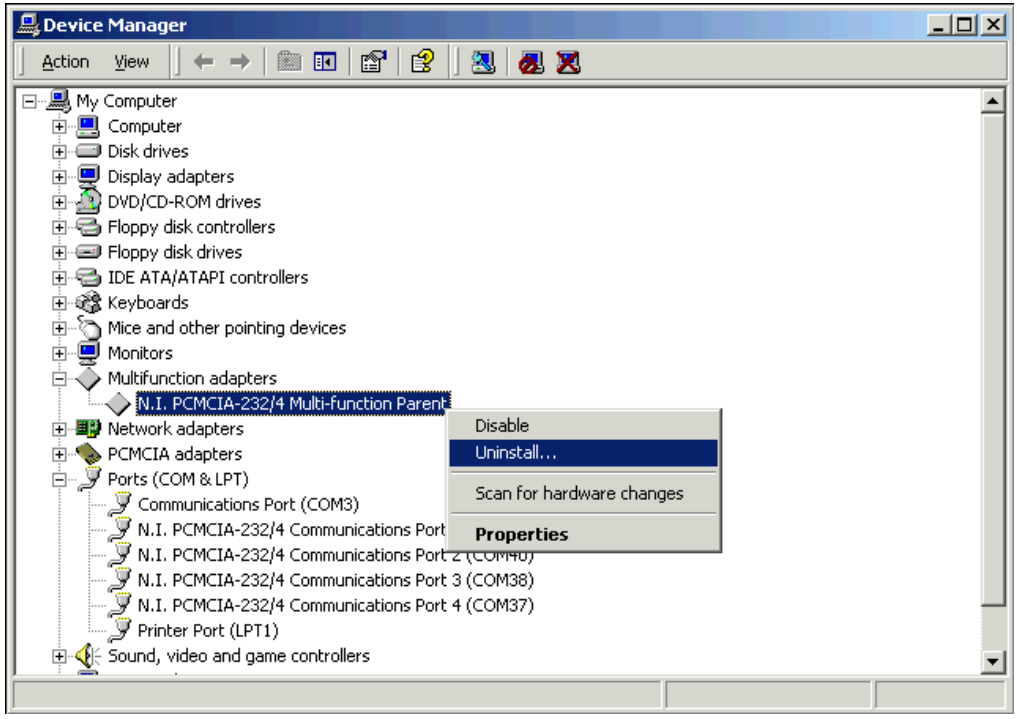


Figure C-7. Selecting an Interface to Uninstall

5. Choose the **Uninstall...** option.
6. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove the hardware information, or click on the **Cancel** button to cancel your request.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears. This dialog box lists the software that you can uninstall.
3. Select **NI-Serial** and click on the **Change/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Remove the PCMCIA serial interface from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 4, *PCMCIA Serial Hardware Installation, Verification, and Configuration*.

Windows Me/9*x*

Uninstall the Hardware

Before physically removing the serial hardware, you must remove the hardware information from the Windows Me/9*x* Device Manager.

Follow these steps to uninstall the hardware:

1. Double-click on the **System** icon under **Start»Settings»Control Panel**. The **System Properties** dialog box appears.
2. Select the **Device Manager** tab.
3. Click on the **View devices by type** button.
4. Double-click on the **Ports (COM & LPT)** icon.

5. Select the National Instruments port to remove from the list of ports, as shown in Figure C-8.

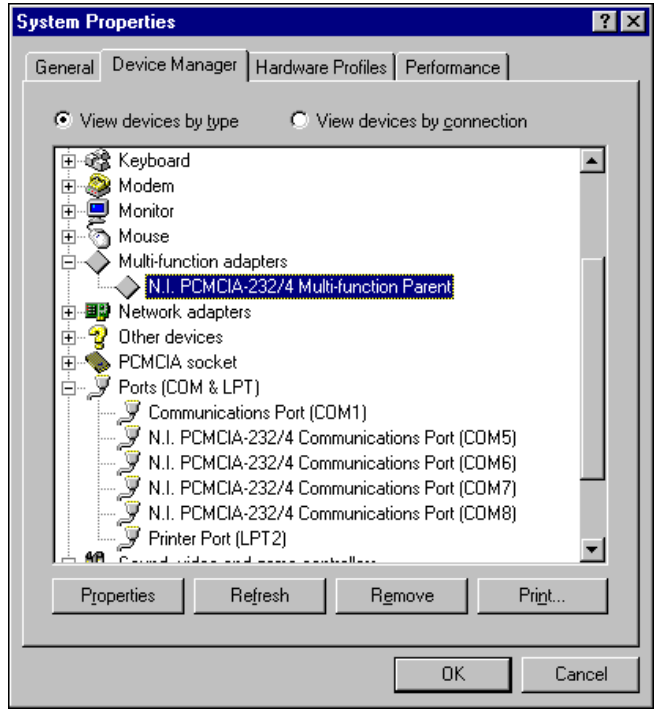


Figure C-8. Selecting an Interface to Uninstall

6. Click on the **Remove** button.

Note To remove ports on two-port and four-port PCMCIA cards from within the Device Manager, you must open the **Multi-function adapters** class, select the name of your interface, and click on the **Remove** button.

7. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove this interface or click on **Cancel** to cancel your request.

Uninstall the Software

Before uninstalling the software, remove all serial port information from the Windows Me/9*x* Device Manager, as described in the previous section. You do not need to shut down Windows Me/9*x* before uninstalling the software.

Complete the following steps to remove the NI-Serial software:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs Properties** dialog box appears. This dialog box lists the software available for removal.
3. Select the serial software you want to remove, and click on the **Add/Remove** button. The uninstall program runs and removes all folders, programs, VxDs, DLLs, and registry entries associated with the NI-Serial software.
4. Remove your PCMCIA card from your computer.

To reinstall the hardware and software, refer to Chapter 4, *PCMCIA Serial Hardware Installation, Verification, and Configuration*.

Windows NT

Uninstall the Hardware

Before physically removing the serial hardware, you must remove the hardware information from the Windows NT Control Panel.

Follow these steps to uninstall the hardware:

1. Double-click on the **niports** icon under **Start»Settings»Control Panel**.
2. Select the port to remove from the list of ports as shown in Figure C-9.

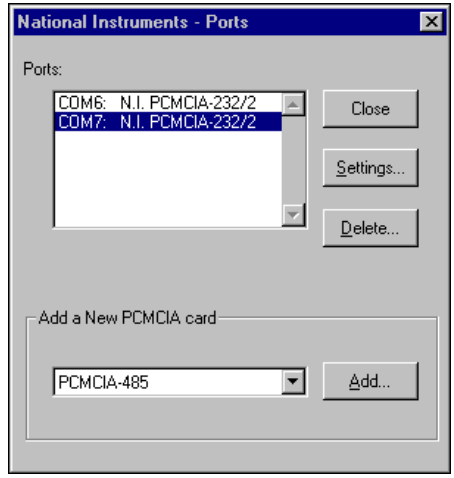


Figure C-9. Selecting an Interface to Uninstall

3. Click on the **Delete** button.

Note For two-port and four-port PCMCIA cards, all ports on the interface are removed.

Uninstall the Software

Before uninstalling the software, remove all serial port information from the Windows NT Control Panel, as described in the previous section. You do not need to shut down Windows NT before uninstalling the software.

Complete the following steps to remove the NI-Serial software:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs Properties** dialog box appears. This dialog box lists the software available for removal.
3. Select the serial software you want to remove, and click on the **Add/Remove** button. The uninstall program runs and removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows NT, power off your computer, and remove your serial interfaces.

To reinstall the hardware and software, refer to Chapter 4, *PCMCIA Serial Hardware Installation, Verification, and Configuration*.

AT Hardware

Windows 2000

Uninstall the Hardware

Before you physically remove the serial hardware from your system, you must remove the hardware information. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Select the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Multi-function adapters** icon.
4. From the **Multi-function adapters** list, right-click on the National Instruments interface that you want to uninstall, as shown in Figure C-10.

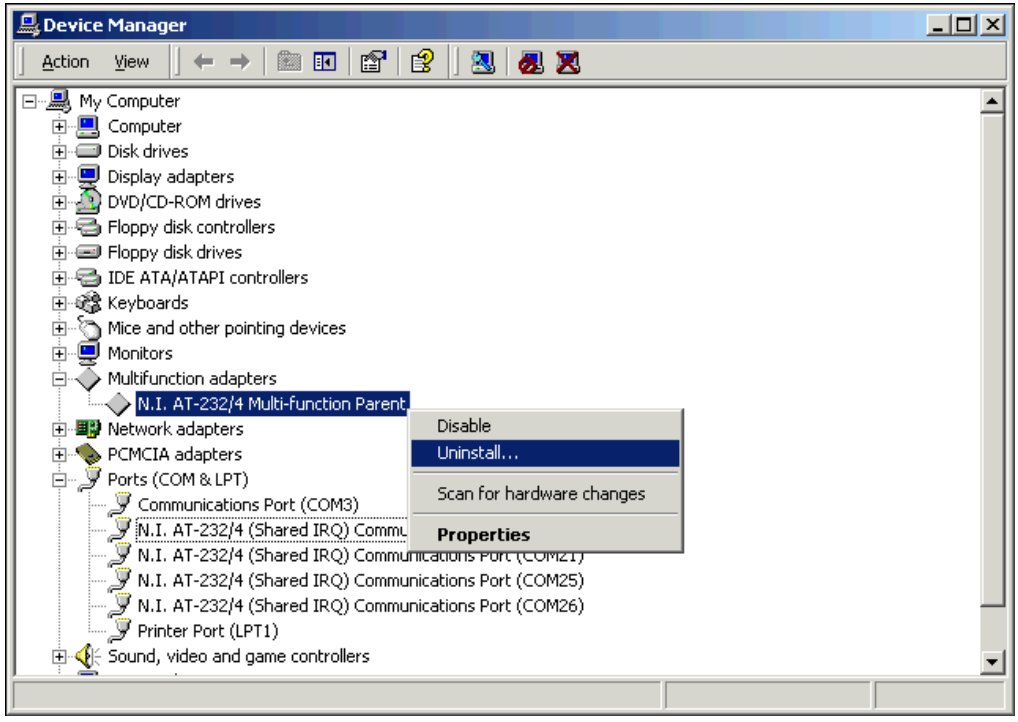


Figure C-10. Selecting an Interface to Uninstall

5. Choose the **Uninstall...** option.
6. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove the hardware information, or click on the **Cancel** button to cancel your request.

Uninstall the Software

Before you uninstall the NI-Serial software, you must remove the hardware information from your system, as described in the previous section.

To uninstall the NI-Serial software, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon. The **Add/Remove Programs** dialog box appears. This dialog box lists the software that you can uninstall.
3. Select **NI-Serial** and click on the **Change/Remove** button. The uninstallation program removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows 2000, turn off your computer, and physically remove the serial interfaces from your system.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 5, *AT Serial Hardware Installation, Verification, and Configuration*.

Windows Me/9*x*

Uninstall the Hardware

Before physically removing the serial hardware, you must remove the hardware information from the Windows Me/9*x* Device Manager.

Follow these steps to uninstall the hardware:

1. Double-click on the **System** icon under **Start»Settings»Control Panel**. The **System Properties** dialog box appears.
2. Select the **Device Manager** tab.
3. Click on the **View devices by type** button.
4. Double-click on the **Ports (COM & LPT)** icon.

5. Select the National Instruments port to remove from the list of ports, as shown in Figure C-11.

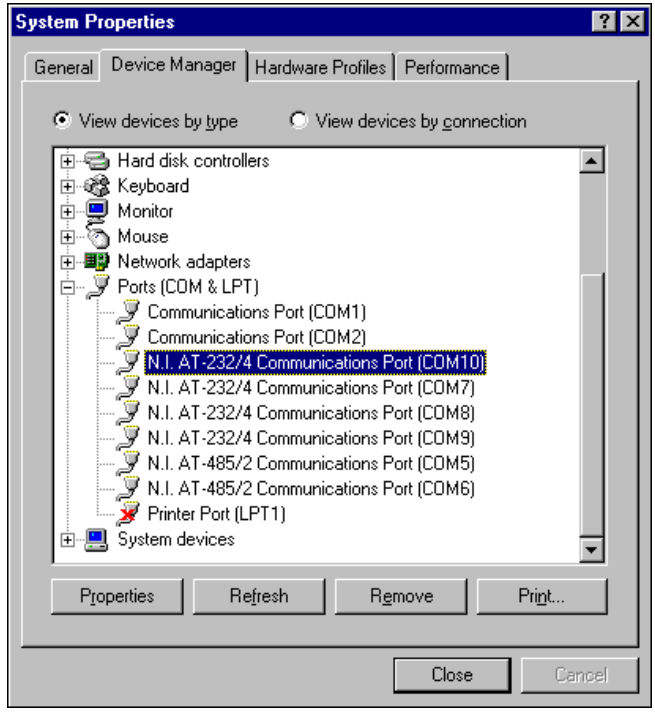


Figure C-11. Selecting an Interface to Uninstall

6. Click on the **Remove** button.

Note To remove ports on shared IRQ AT boards from within the Device Manager, you must open the **Multi-function adapters** class, select the name of your interface, and click on the **Remove** button.

7. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove this interface or click on **Cancel** to cancel your request.

Uninstall the Software

Before uninstalling the software, remove all serial port information from the Windows Me/9*x* Device Manager, as described in the previous section. You do not need to shut down Windows Me/9*x* before uninstalling the software.

Complete the following steps to remove the NI-Serial software:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs Properties** dialog box appears. This dialog box lists the software available for removal.
3. Select the serial software you want to remove, and click on the **Add/Remove** button. The uninstall program runs and removes all folders, programs, VxDs, DLLs, and registry entries associated with the NI-Serial software.
4. Shut down Windows Me/9*x*, turn off your computer, and physically remove the serial interfaces from your system.

To reinstall the hardware and software, refer to Chapter 5, *AT Serial Hardware Installation, Verification, and Configuration*.

Windows NT

Uninstall the Hardware

Before physically removing the serial hardware, you must remove the hardware information from the Windows NT Control Panel.

Follow these steps to uninstall the hardware:

1. Double-click on the **niports** icon under **Start»Settings»Control Panel**.
2. Select the port to remove from the list of ports as shown in Figure C-12.

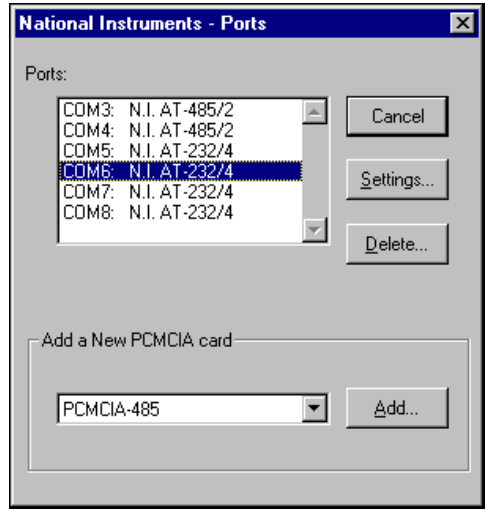


Figure C-12. Selecting an Interface to Uninstall

3. Click on the **Delete** button.

Note For shared IRQ AT boards, all ports on the interface are removed.

Uninstall the Software

Before uninstalling the software, remove all serial port information from the Windows NT Control Panel, as described in the previous section. You do not need to shut down Windows NT before uninstalling the software.

Complete the following steps to remove the NI-Serial software.

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **Add/Remove Programs** icon in the Control Panel to launch the Add/Remove Programs applet. The **Add/Remove Programs Properties** dialog box appears. This dialog box lists the software available for removal.
3. Select the serial software you want to remove, and click on the **Add/Remove** button. The uninstall program runs and removes all folders, utilities, and registry entries associated with the NI-Serial software.
4. Shut down Windows NT, power off your computer, and remove your serial interfaces.

To reinstall the hardware and software, refer to Chapter 5, *AT Serial Hardware Installation, Verification, and Configuration*.

D

Troubleshooting and Common Questions

This appendix describes how to troubleshoot problems and answers some common questions.

To find the information you are looking for, see the section of this appendix for your operating system:

Windows 2000
- Forcing Windows to Detect Your Hardware D-2
- Troubleshooting Diagnostic Messages D-3
- Common Questions D-4

Windows Me/9*x*
- Freeing an Interrupt Request Level D-6
- Selecting Conflict-Free Resources D-7
- Troubleshooting Diagnostic Messages D-9
- Resolving Resource Conflicts with Legacy Boards D-11
- Forcing Windows to Detect Your Hardware D-11
- Common Questions D-14

Windows NT
- Missing Serial Port in the niports List D-18
- Resolving Resource Conflicts D-19
- Troubleshooting Diagnostic Messages D-20
- Common Questions D-22

Windows 2000

Forcing Windows to Detect Your Hardware

If Windows 2000 did not display the Found New Hardware Wizard, it did not detect your hardware. To solve this problem, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Select the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Multi-function adapters** icon.
4. From the **Multi-function adapters** list, right-click on the National Instruments interface that you want to uninstall, as shown in Figure D-1. (This example shows a PCI interface.)

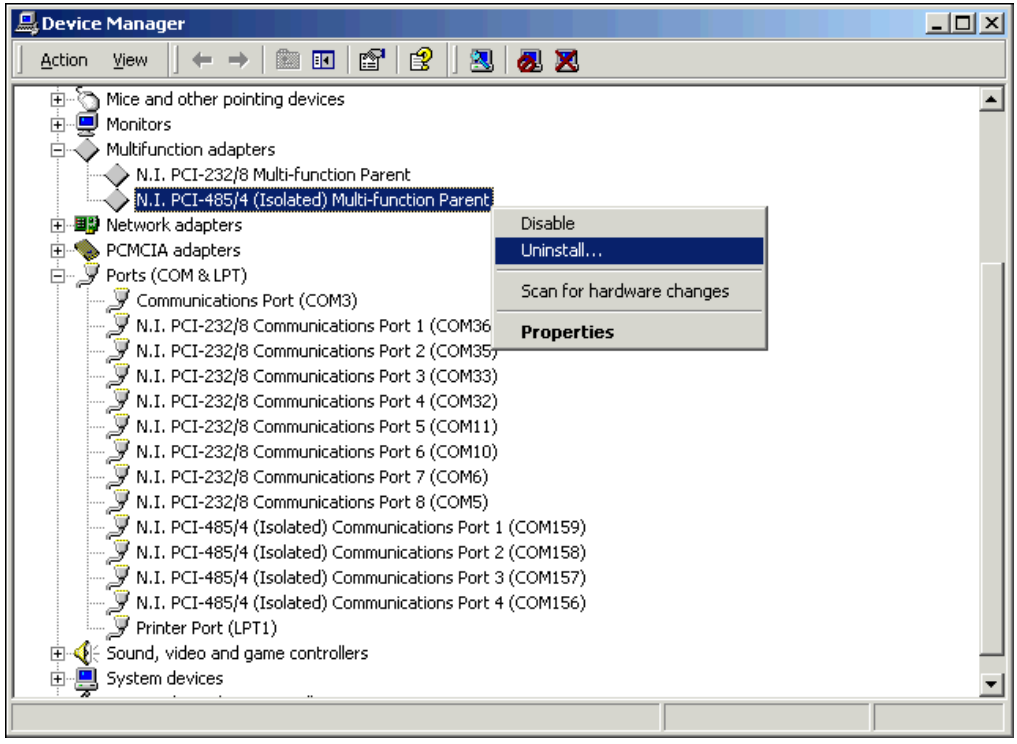


Figure D-1. Selecting an Interface to Uninstall

5. Choose the **Uninstall...** option.
6. In the **Confirm Device Removal** dialog box, click on the **OK** button to remove the hardware information, or click on the **Cancel** button to cancel your request.
7. Click on the **Scan for Hardware Changes** icon at the top of the Device Manager window.
8. Windows 2000 should automatically detect your hardware and display the Found New Hardware Wizard. Complete the wizard by clicking **Next** in each window and then **Finish**.

Troubleshooting Diagnostic Messages

This section lists possible error messages returned by the diagnostic utility, along with solutions.

No National Instruments Serial Port Found or Diagnostic Utility Does Not Show All Installed Ports

If the `No National Instruments serial port found` error message appears or the diagnostic utility does not show all the ports you installed, follow all the steps in the *Forcing Windows to Detect Your Hardware* section above.

Address Test Failed

If the `address test failed, Interrupt test cannot be performed` error message appears, you might have an address conflict with legacy boards in your system. To solve this problem, change the base addresses assigned to your legacy boards and refer to the *Resolving Resource Conflicts with Legacy Boards* section.

Interrupt Test Failed

If the `Interrupt test failed` error message appears, you might have an IRQ conflict with legacy boards in your system. To solve this problem, change the IRQ level assigned to your legacy boards and refer to the next section, *Resolving Resource Conflicts with Legacy Boards*.

Resolving Resource Conflicts with Legacy Boards

Resource conflicts typically occur if your system contains legacy boards that use resources that are not reserved properly. If a resource conflict exists, write down the resource that caused the conflict and refer to the Microsoft Windows 2000 user's guide for instructions on how to use the Device Manager to reserve I/O and IRQ resources for legacy boards.

Common Questions

How can I determine which type of serial hardware I have installed?

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.
3. Double-click on the **Ports (COM & LPT)** icon to display a list of installed ports.

How can I determine which version of the NI-Serial software I have installed?

The **Read Me** file gives the version of the software. To open the file, select **Start»Programs»National Instruments»NI-Serial»Read Me**.

What do I do if the diagnostic test fails with an error?

Refer to the *Troubleshooting Diagnostic Messages* section earlier in this appendix.

How can I determine which port is associated with COM*x*?

To determine which physical port is associated with COM*x*, complete the following steps:

1. In the **Device Manager**, under **Ports (COM & LPT)**, double-click on a serial port.
2. Note the Port 1, Port 2, etc. entries next to the COM numbers. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.

How can I change the COM numbers of my National Instruments serial ports?

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Hardware** tab and click on the **Device Manager** button.

3. Double-click on the **Ports (COM & LPT)** icon.
4. Double-click on the port you want to configure.
5. Click on the **Port Settings** tab.
6. Click on the **Advanced** button. The Advanced Settings dialog box should pop up.
7. Change the COM number in the **COM Port Number** field. (You can use a COM number that is designated as in use, as long as no hardware is actually using that COM number.)

How do I remove information about serial boards from the Device Manager?

Refer to the hardware uninstallation section for your hardware platform in Appendix C, *Uninstalling the Hardware and Software*.

What is the maximum baud rate supported and how can I set it?

The maximum baud rate supported is 460.8 Kbaud for RS-485 and 115.2 Kbaud for RS-232. To set the baud rate, use the **SetCommState** Win32 function and pass the actual value of the baud rate in the **BaudRate** field of the **DCB** structure.

Windows Me/9*x*

Freeing an Interrupt Request Level

To free an interrupt request level for your serial port, you must disable the device that is using the interrupt request level. To view the system-wide allocation of interrupt request resources and remove a device, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab.
3. Double-click on the **Computer** icon and click on the **View Resources** tab.
4. Click on the **Interrupt Request (IRQ)** button. Scan through the list of IRQ settings to determine which devices are using which interrupt request levels.
5. When you locate a device that you are not currently using, click on the **Cancel** button.
6. In the **Device Manager** tab, double-click on the icon for that device.
7. In the **Device usage** field, a checkmark appears to the left of the current configuration, usually **Original Configuration (Current)**. Click on the checkbox to remove the checkmark.
8. Click on the **Resources** tab and make sure that **Use automatic settings** is unchecked.
9. Repeat steps 7 through 9 for each unused device.
10. Click on the **OK** button to save your changes.
11. Restart Windows Me/9*x* to assign resources to your serial port. Then, complete step 6 in the installation verification section of the chapter for your hardware platform.

Selecting Conflict-Free Resources

PCI and PXI Boards

When the Device Manager indicates a conflict with another device, you can usually correct the problem by manually selecting conflict-free resources. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Multi-function adapters** icon.
4. From the **Multi-function adapters** list, double-click on the serial interface that you want to change.
5. Click on the **Resources** tab.
6. Uncheck the **Use automatic settings** checkbox and click on the **Change Setting** button. If the system does not allow you to change the settings, select the configuration that gives you a conflict-free base address and interrupt level from the **Setting based on** list box.
7. Click on the **OK** button to save your changes.

AT Boards

When the Device Manager indicates a conflict with another device, you can usually correct the problem by manually selecting conflict-free resources. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **System** icon.
3. Select the **Device Manager** tab, and click on the **View devices by type** button at the top of the page.
4. Double-click on the **Ports (COM & LPT)** icon. A list of installed ports appears.
5. Double-click on the name of the serial port you want to change, then click on the **Resources** tab.

Note To change the resources of ports on shared IRQ AT boards from within the Device Manager, you must open the **Multi-function adapters** class and double-click on the name of your interface. Use the **Resources** page to change the resources. Any resource changes are automatically reflected to the child devices.

6. Uncheck the **Use automatic settings** checkbox and click on the **Change Setting** button. If the system does not allow you to change the settings, select the configuration that gives you a conflict-free base address and interrupt level from the **Setting based on** list box.
7. Click on the **OK** button to save your changes.

PCMCIA Boards

When the Device Manager indicates a conflict with another device, you can usually correct the problem by manually selecting conflict-free resources. To do so, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Multi-function adapters** icon.
4. From the **Multi-function adapters** list, double-click on the serial interface that you want to change.
5. Click on the **Resources** tab.



Note To change the resources of ports on two-port or four-port PCMCIA cards from within the Device Manager, you must open the **Multi-function adapters** class and double-click on the name of your interface. Use the **Resources** page to change the resources. Any resource changes are automatically reflected to the child devices.

6. Uncheck the **Use automatic settings** checkbox and click on the **Change Setting** button. If the system does not allow you to change the settings, select the configuration that gives you a conflict-free base address and interrupt level from the **Setting based on** list box.
7. Click on the **OK** button to save your changes.

Troubleshooting Diagnostic Messages

This section lists possible error messages returned by the diagnostic utility, along with solutions.

No National Instruments Serial Port Found

If the **`No National Instruments serial port found`** error message appears, complete the following steps:

1. Verify the hardware resources, as follows:
   a. In the **Device Manager** tab, under **Multi-function adapters,** double-click on a serial board.
   b. If a serial board is missing from the **Multi-function adapters** list, reinstall the hardware and software. For instructions on how to do so, refer to the installation and verification chapter for your hardware plaform.
   c. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   d. Check the hardware resources. If they are in conflict, refer to the previous section, *Troubleshooting Diagnostic Messages*.
2. In some versions of Windows Me/9*x*, in the Device Manager, the **Driver** tab shows information about the installed driver. Make sure that the National Instruments serial driver is installed for the port.

   If the serial driver is a Microsoft driver, reinstall the NI-Serial software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
3. Make sure that the National Instruments serial driver is installed, as follows:
   a. Locate the `niserial.vxd` file in the `\Windows\system` directory.
   b. If the `niserial.vxd` file is missing, reinstall the hardware and software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.

Diagnostic Utility Does Not Show All Installed Ports

If the diagnostic utility does not show all the ports you installed, complete the following steps:

1. Verify the hardware resources, as follows:
   a. In the **Device Manager** tab, under **Multi-function adapters,** double-click on a serial board.
   b. If a serial board is missing from the **Multi-function adapters** list, reinstall the hardware and software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
   c. Click on the **Resources** tab. If the resources were assigned properly, the **Resources** tab shows which resources are assigned to your serial ports.
   d. Check the hardware resources. If they are in conflict, refer to the previous section, *Troubleshooting Diagnostic Messages*.
2. In some versions of Windows Me/9*x*, in the Device Manager, the **Driver** tab shows information about the installed driver. Make sure that the National Instruments serial driver is installed for the port.

   If the serial driver is a Microsoft driver, reinstall the NI-Serial software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
3. Physically make sure the correct number of boards/ports are installed.

Address Test Failed

If the **`address test failed, Interrupt test cannot be performed`** error message appears, you might have an address conflict with legacy boards in your system. To solve this problem, change the base addresses assigned to your legacy boards and refer to the *Resolving Resource Conflicts with Legacy Boards* section later in this appendix.

Interrupt Test Failed

If the **`Interrupt test failed`** error message appears, you might have an IRQ conflict with legacy boards in your system. To solve this problem, change the IRQ level assigned to your legacy boards and refer to the next section, *Resolving Resource Conflicts with Legacy Boards*.

Resolving Resource Conflicts with Legacy Boards

Resource conflicts typically occur if your system contains legacy boards that use resources that are not reserved properly. If a resource conflict exists, write down the resource that caused the conflict and refer to the Microsoft Windows Me/9*x* user's guide for instructions on how to use the Device Manager to reserve I/O and IRQ resources for legacy boards.

Forcing Windows to Detect Your Hardware

PCI and PXI Hardware

If Windows Me/9*x* did not display the **New Hardware Found** dialog box, it did not detect your hardware. To solve this problem, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Other Devices** icon. Windows Me/9*x* lists the boards it does not recognize under **Other Devices**.
4. Double-click on the **Multi-function adapters** icon, where Windows Me/9*x* lists the parent devices of the PCI or PXI ports.

5. Select the interface that Windows Me/9*x* did not detect, as shown in Figure D-2. (This example shows a PCI interface.)

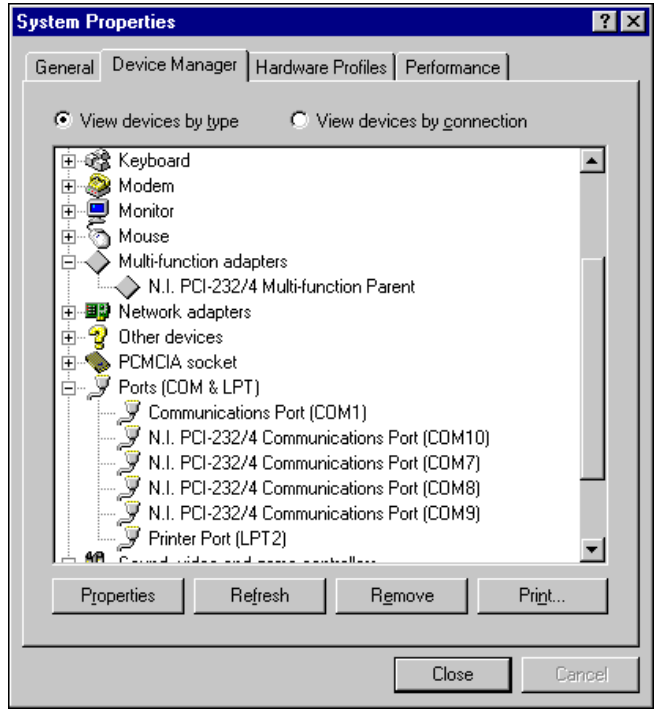


Figure D-2. Ports List in Device Manager

6. Click on the **Remove** button.
7. Click on the **OK** button to remove the serial hardware information.
8. Repeat steps 5 through 7 until you have removed all serial interfaces.
9. Click on the **Refresh** button.
10. Windows Me/9*x* should automatically detect your hardware and display one or more **New Hardware Found** dialog boxes. Your operating system (Windows Me/9*x*) may show the **Windows Default Driver** option. If so, make sure the **Windows Default Driver** is selected and click on the **OK** button. If the **Windows Default Driver** option is not shown, the installation continues automatically.

AT and PCMCIA Hardware

If Windows does not detect your serial hardware correctly, or you have been using your serial hardware with the default Windows Me/9*x* serial driver or an older version of the NI-Serial software, Windows Me/9*x* does not display the **New Hardware Found** dialog box. To fix this problem, follow these steps:

1. Select **Start»Settings»Control Panel**.
2. Double-click on the **System** icon.
3. Select the **Device Manager** tab.
4. Click on the **View devices by type** button.
5. Double-click on the **Ports (COM & LPT)** icon to display a list of all ports that Windows Me/9*x* recognizes.

   If you have already installed the hardware, double-click on **Other Devices** to display where Windows Me/9*x* lists the ports it does not recognize.
6. Select a National Instruments port name from the list of ports that corresponds to a serial port (for example, COM 5, COM 6, COM 7, or COM 8). Figure D-3 shows the **Ports** list in the **Device Manager** with a port selected. (This example shows an AT interface.)

Note To remove ports on shared IRQ cards, you must open the **Multifunction adapter** class, select the name of the interface, and click on the **Remove** button.

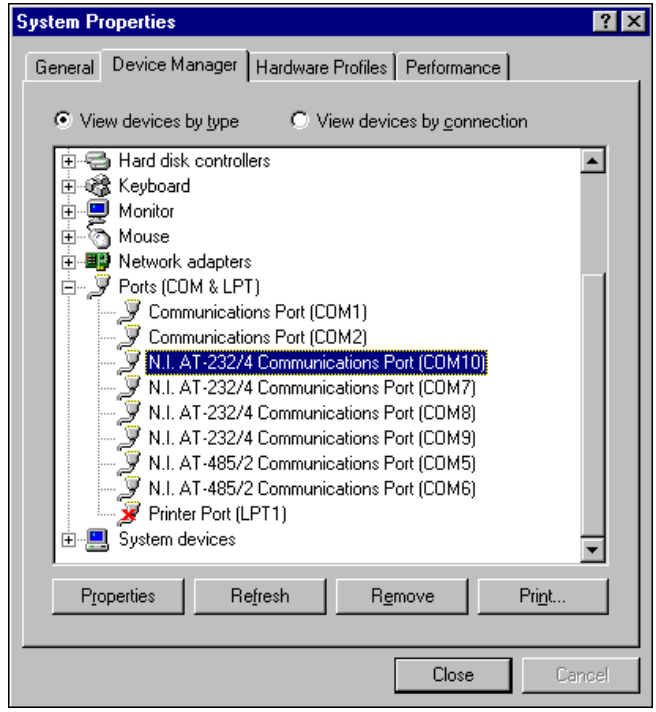


Figure D-3. Ports List in Device Manager

7. Click on the **Remove** button, and click on **OK** to confirm the removal of the serial hardware information.

Repeat steps 6 and 7 until all serial board entries are removed. Then, click on **Refresh** to force Windows Me/9*x* to detect the serial hardware and display the **New Hardware Found** dialog box.

Common Questions

How can I determine which type of serial hardware I have installed?

1. Select **Start»Settings»Control Panel** and double-click on the **System** icon.
2. Click on the **Device Manager** tab and click on the **View devices by type** button.
3. Double-click on the **Ports (COM & LPT)** icon to display a list of installed ports.

How can I determine which version of the NI-Serial software I have installed?

The **Read Me** file gives the version of the software. To open the file, select **Start»Programs»National Instruments Serial»Read Me**.

What do I do if the diagnostic test fails with an error?

Refer to the *Troubleshooting Diagnostic Messages* section earlier in this appendix.

How can I determine which port is associated with COM*x*?

To determine which physical port is associated with COM*x*, complete the following steps:

1. In the **Device Manager** tab, under **Ports (COM & LPT)**, double-click on a serial port.
2. Click on the **Port Settings** tab to display the serial number of the serial hardware and the physical port number starting at 1. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.

How can I change the COM numbers of my National Instruments serial ports?

To name serial ports COM1, COM2, COM3, or COM4, change the base address of the port. To do so, refer to the *Troubleshooting Diagnostic Messages* section earlier in this appendix.

When you change the base address, Windows Me/9*x* automatically converts it to the corresponding COM name listed in Table D-1. You do not need to change the IRQ setting for Windows Me/9*x* to change the name.

Table D-1. Standard DOS-Based Addresses

COM Port	Base Address
COM1	3f8
COM2	2f8
COM3	3e8
COM4	2e8

How do I change the resources assigned to the serial interface?

- PCI and PXI Boards
  The PCI and PXI serial boards are configured as devices belonging to the *multi-function adapters* class. The multi-function parent device is listed under the **Multi-function adapters** icon, and each child device is listed as a port under the **Ports (COM & LPT)** icon.

  To change the resources of serial ports, complete the following steps:

  1. In the **Device Manager** tab, under **Multi-function adapters**, double-click on a serial interface.
  2. Click on the **Resources** tab to change the resources. Your changes are automatically reflected to the child devices under **Ports (COM & LPT)**.

- AT and PCMCIA Boards
  Because the shared IRQ boards are single physical devices that support multiple ports, they are registered as "multi-function adapters" in the Device Manager. Each port is a child device listed under **Ports (COM & LPT)**. Windows Me/9*x* does not allow the resources of the multi-function child devices to be changed directly.

  To change the resources of ports on shared IRQ boards from within the Device Manager, you must open the **Multi-function adapters** class and double-click on the **Multi-function Parent** item that corresponds to your National Instruments serial interface. Use the **Resources** page to change the resources. Any resource changes are automatically reflected to the child devices. Figure D-4 shows the **Multi-function adapters** class in the Device Manager. (This example shows an AT interface.)

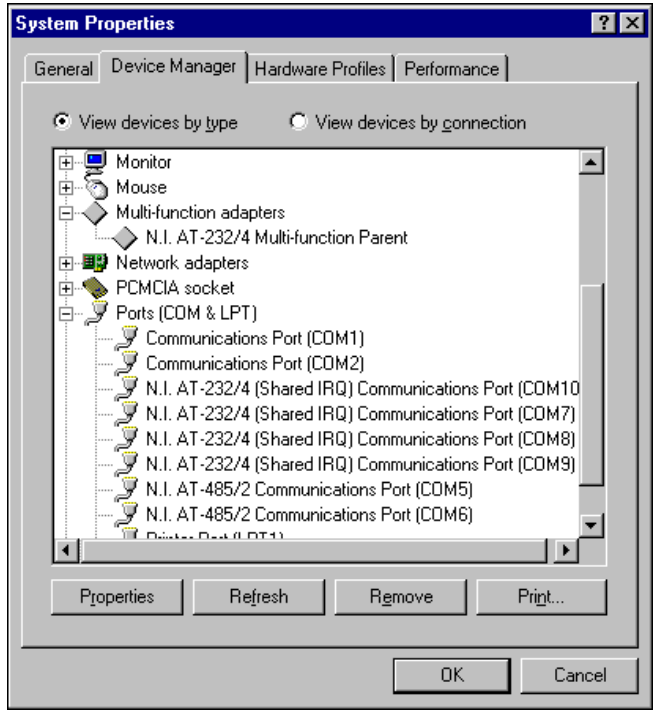


Figure D-4. Multi-Function Adapter Class in the Device Manager

How do I remove information about serial boards from the Device Manager?

Refer to the hardware uninstallation section for your hardware platform and operating system in Appendix C, *Uninstalling the Hardware and Software*.

What is the maximum baud rate supported and how can I set it?

The maximum baud rate supported is 460.8 Kbaud for RS-485 and 115.2 Kbaud for RS-232. To set the baud rate, use the **SetCommState** Win32 function and pass the actual value of the baud rate in the **BaudRate** field of the **DCB** structure.

How many interrupts are required for my serial interface?

If you have a shared IRQ board or an isolated board, you need one interrupt per board. This is the hardware that currently ships with Windows Me/9*x*.

If you have an older non-shared IRQ board, you need as many interrupts as there are ports on the board.

Windows NT

Missing Serial Port in the niports List

PCI and PXI Boards

The serial configuration utility contains configuration information for serial hardware that is installed in your system.

To start the configuration utility, select **Start»Settings»Control Panel** and double-click on the **niports** icon.

If your PCI or PXI serial hardware is missing from this list, complete the following steps:

1. Physically make sure that your board is installed properly.
2. Make sure that the National Instruments serial driver is installed, as follows:
   a. Locate `serial.sys` in the `WinNT\system32\drivers` directory.
   b. Right-click on `serial.sys` and select **Properties**.
   c. Click on the **Version** tab. If the **Company Name** is **Microsoft**, the National Instruments serial driver is not installed properly. To solve this problem, reinstall the NI-Serial software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.

AT Boards

The serial configuration utility **niports** contains configuration information for serial hardware it is aware of that is installed in your system.

To start the configuration utility, select **Start»Settings»Control Panel**, and double-click on the **niports** icon.

If your AT serial board is missing from the list, follow these steps:

1. Make sure the hardware is installed.
2. Make sure you have installed the Microsoft PnP ISA Enabler driver. **niports** cannot recognize the AT boards without the Microsoft PnP ISA Enabler driver. For more information, refer to the *Installing the Microsoft PnP ISA Enabler Driver* section of Chapter 5, *AT Serial Hardware Installation, Verification, and Configuration*.

PCMCIA Boards

The serial configuration utility **niports** contains configuration information for serial hardware it is aware of that is installed in your system.

To start the configuration utility, select **Start»Settings»Control Panel**, and double-click on the **niports** icon.

If serial ports are missing from this list, make sure you selected resources for your PCMCIA card as described in the *Select Resources for the PCMCIA Card* section in Chapter 4, *PCMCIA Serial Hardware Installation, Verification, and Configuration*.

Resolving Resource Conflicts

Resource conflicts occur when your system contains hardware that is configured to use the same resources as your serial interface. The serial driver detects some resource conflicts when it loads. When the driver detects conflicts as it loads, it records an error message describing the conflict.

To resolve a resource conflict, complete the following steps:

1. Select **Start»Programs»Administrative Tools»Event Viewer** to run the Event Viewer and determine which resource is in conflict.
2. Change the resources of the device that caused the conflict.

   To help you select conflict-free resources, you can use the Windows NT Diagnostics utility. This utility displays a list of the I/O port addresses, interrupt levels, and DMA channels that your system is currently using. You can assign resources that are not listed by this utility to your device.

   To run the Windows NT Diagnostics utility, select **Start»Programs»Administrative Tools»Windows NT Diagnostics**.

Troubleshooting Diagnostic Messages

This section lists possible error messages returned by the diagnostic utility, along with solutions.

No National Instruments Serial Port Found

If the **`No National Instruments serial port found`** error message appears, complete the following steps:

1. Verify the hardware resources, as follows:
   a. Select **Start»Settings»Control Panel** and double-click on the **niports** icon.
   b. In the **Ports** list, select a port and click on the **Settings** button.

      If the serial port is missing from the **Ports** list, reinstall the hardware and software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
   c. In the **General Port Settings** dialog box, click on the **Resources** button to view the resources for the port.
   d. Check the hardware resources. If they are in conflict, refer to the previous section, *Resolving Resource Conflicts*.
2. Make sure that the National Instruments serial driver is installed, as follows:
   a. Locate the `serial.sys` file in the `WinNT\system32\drivers` directory.
   b. If the `serial.sys` file is missing, reinstall the hardware and software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
   c. Right-click on the `serial.sys` file and select **Properties**.
   d. Click on the **Version** tab. If the **Company Name** is **Microsoft**, the National Instruments serial driver is not installed properly. To solve this problem, reinstall the NI-Serial software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.

Diagnostic Utility Does Not Show All Installed Ports

If the diagnostic utility does not show all the ports you installed, complete the following steps:

1. Verify the hardware resources, as follows:
   a. Select **Start»Settings»Control Panel** and double-click on the **niports** icon.
   b. In the **Ports** list, select a port and click on the **Settings** button.

      If the serial port is missing from the **Ports** list, reinstall the hardware and software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
   c. In the **General Port Settings** dialog box, click on the **Resources** button to view the resources for the port.
   d. Check the hardware resources. If they are in conflict, refer to the previous section, *Resolving Resource Conflicts*.
2. Make sure that the National Instruments serial driver is installed, as follows:
   a. Locate the `serial.sys` file in the `WinNT\system32\drivers` directory.
   b. If the `serial.sys` file is missing, reinstall the hardware and software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
   c. Right-click on the `serial.sys` file and select **Properties**.
   d. Click on the **Version** tab. If the **Company Name** is **Microsoft**, the National Instruments serial driver is not installed properly. To solve this problem, reinstall the NI-Serial software. For instructions on how to do so, refer to the installation and verification chapter for your hardware platform.
3. Physically make sure the correct number of boards and ports are installed.

Address Test Failed

If the **`address test failed, Interrupt test cannot be performed`** error message appears, you might have an address conflict with legacy boards in your system. To solve this problem, change the base addresses assigned to your legacy boards. For instructions on how to do so, refer to your legacy board documentation.

Interrupt Test Failed

If the `Interrupt test failed` error message appears, you might have an IRQ conflict with legacy boards in your system. To solve this problem, change the IRQ level assigned to your legacy boards. For instructions on how to do so, refer to your legacy board documentation.

Common Questions

How can I determine which type of serial hardware I have installed?

To display a list of installed ports, select **Start»Settings»Control Panel** and double-click on the **niports** icon.

How can I determine which version of the NI-Serial software I have installed?

The **Read Me** file gives the version of the software. To open the file, select **Start»Programs»National Instruments Serial»Read Me**.

What do I do if the diagnostic test fails with an error?

Refer to the *Troubleshooting Diagnostic Messages* section earlier in this appendix.

How can I determine which port is associated with COM*x*?

To determine which physical port is associated with COM*x*, complete the following steps:

1. Select **Start»Settings»Control Panel** and double-click on the **niports** icon.

   A list of installed National Instruments ports with their logical COM*x* names appears. If your interface is not on this list, refer to the *Missing Serial Port in the niports List* section earlier in this appendix.

2. Select a COM port and click on the **Settings** button.

   The **General Port Settings** dialog box displays the serial number of the serial hardware and the physical port number starting at 1. For all serial hardware, PORT1 refers to the top port, PORT2 refers to the next port down, and so on.

How can I change the COM numbers of my National Instruments serial ports?

Refer to the general port settings section in the installation and verification chapter for your hardware platform.

What is the maximum baud rate supported and how can I set it?

The maximum baud rate supported is 460.8 Kbaud for RS-485 and 115.2 Kbaud for RS-232. To set the baud rate, use the **SetCommState** Win32 function and pass the actual value of the baud rate in the **BaudRate** field of the **DCB** structure.

How many interrupts are required for my serial interface?

If you have a shared IRQ card or an isolated serial card, you need one interrupt per card. This is the hardware that currently ships with Windows NT.

If you have an older, non-shared IRQ card, you need as many interrupts as there are ports on the card.

E

Specifications

This appendix describes the characteristics of the serial hardware, the NI-Serial software, along with the recommended operating conditions.

PCI Serial Hardware

Two-Port Boards

Dimensions..... 10.67 by 14.22 cm (4.2 by 5.6 in.)

I/O connector..... DB-9

Power requirement (from PCI channel)

PCI-485/2

+5 VDC..... 350 mA typical
750 mA maximum

PCI-232/2

+5 VDC..... 50 mA typical
100 mA maximum

±12 VDC..... 20 mA typical
200 mA maximum

Isolated Two-Port Boards

Dimensions..... 10.67 by 14.22 cm (4.2 by 5.6 in.)

I/O connector..... DB-9

Isolation voltage

From port to port..... 2000 Vrms/60s

From any port to host computer..... 2000 Vrms/60s

Power requirement (from PCI channel)

PCI-485/2

+5 VDC .....800 mA typical
1300 mA maximum

PCI-232/2

+5 VDC .....400 mA typical
650 mA maximum

Four-Port Boards

Dimensions .....10.67 by 17.27 cm
(4.2 by 6.8 in.)

I/O connector[1].....10-position modular jack

Power requirement (from PCI channel)

PCI-485/4

+5 VDC .....700 mA typical
1300 mA maximum

PCI-232/4

+5 VDC .....70 mA typical
150 mA maximum

±12 VDC .....40 mA typical
400 mA maximum

Isolated Four-Port Boards

Dimensions .....10.67 by 17.27 cm
(4.2 by 6.8 in.)

I/O connector[1].....10-position modular jack

Isolation voltage

From port to port 2000 Vrms/60s

From any port to host computer 2000 Vrms/60s

[1] The four-port PCI serial boards require a cable to convert the 10-position modular jack to either DB-9 or DB-25 connectors.

Power requirement (from PCI channel)

PCI-485/4

+5 VDC..... 1000 mA typical
1500 mA maximum

PCI-232/4

+5 VDC..... 500 mA typical
750 mA maximum

Eight-Port Boards

Dimensions..... 10.67 by14.48 cm
(4.2 by 5.7 in.)

I/O connector[1] ..... 68-position, SCSI type connector

Power requirement (from PCI channel)

PCI-485/8

+5 VDC..... 1100 mA typical
2000 mA maximum

PCI-232/8

+5 VDC..... 100 mA typical
180 mA maximum

±12 VDC..... 80 mA typical
800 mA maximum

16-Port Boards

Dimensions..... 10.67 by17.52 cm
(4.2 by 6.9 in.)

I/O connector[2] ..... 100-position, SCSI type
connector

Power requirement (from PCI channel)

PCI-232/16

+5 VDC..... 250 mA typical
500 mA maximum

---

[1] The eight-port PCI serial boards require a cable, which is included in your kit, to convert the 68-position connector to eight DB-9 connectors.

[2] The 16-port PCI serial boards require a breakout box, which is included in your kit, to separate the 100-position connector to 16 DB-9 connectors.

Environmental Characteristics

Operating environment

- Component temperature .....0 to 70 °C
- Relative humidity .....10 to 90%, noncondensing

Storage environment

- Temperature.....–40 to 120 °C
- Relative humidity .....5 to 90%, noncondensing

EMI.....FCC Class A Verified

Software Characteristics

Maximum serial transfer rate[1]

- RS-485.....460,800 bps
- RS-232.....115,200 bps

[1] Actual speed may vary considerably from speed shown due to system and instrumentation capabilities.

PXI Serial Hardware

Two-Port Boards

Dimensions..... 100 by 160 mm
(3.94 by 6.30 in.)

I/O connector..... DB-9

Power requirement (from PXI channel)

PXI-8420/2

+5 VDC..... 100 mA typical
150 mA maximum

±12 VDC..... 20 mA typical
200 mA maximum

PXI-8421/2

+5 VDC..... 350 mA typical
750 mA maximum

PXI-8422/2

+5 VDC..... 400 mA typical
650 mA maximum

PXI-8423/2

+5 VDC..... 800 mA typical
1300 mA maximum

Four-Port Boards

Dimensions..... 100 by 160 mm
(3.94 by 6.30 in.)

I/O connector[1] ..... 10-position modular jack

Power requirement (from PXI channel)

PXI-8420/4

+5 VDC..... 125 mA typical
200 mA maximum

±12 VDC..... 40 mA typical
400 mA maximum

[1] The four-port PXI serial boards require a cable to convert the 10-position modular jack to either DB-9 or DB-25 connectors.

PXI-8421/4

+5 VDC .....350 mA typical
750 mA maximum

PXI-8422/4

+5 VDC .....500 mA typical
750 mA maximum

PXI-8423/4

+5 VDC .....1000 mA typical
1500 mA maximum

Eight-Port Boards

Dimensions .....100 by 160 mm
(3.94 by 6.30 in.)

I/O connector[1] .....68-position, SCSI type connector

Power requirement (from PXI channel)

PXI-8420/8

+5 VDC .....150 mA typical
250 mA maximum

±12 VDC .....80 mA typical
800 mA maximum

PXI-8421/8

+5 VDC .....1100 mA typical
2000 mA maximum

16-Port Boards

Dimensions .....100 by 160 mm
(3.94 by 6.30 in.)

I/O connector[2] .....100-position, SCSI type connector

Power requirement (from PXI channel)

PXI-8420/16

+5 VDC .....500 mA typical
750 mA maximum

[1] The eight-port PXI serial boards require cables, which are included in your kit, to convert the 68-position connector to eight DB-9 connectors.

[2] The 16-port PCI serial boards require a breakout box, which is included in your kit, to separate the 100-position connector to 16 DB-9 connectors.

Environmental Characteristics

Operating environment

- Component temperature ..... 0 to 70 °C
- Relative humidity ..... 10 to 90%, noncondensing

Storage environment

- Temperature ..... –40 to 120 °C
- Relative humidity ..... 5 to 90%, noncondensing

EMI ..... FCC Class A Verified

Software Characteristics

Maximum serial transfer rate[1]

- RS-485 ..... 460,800 bps
- RS-232 ..... 115,200 bps

[1] Actual speed may vary considerably from speed shown due to system and instrumentation capabilities.

PCMCIA Serial Hardware

Hardware Specifications

Dimensions .....85.6 by 54.0 by 0.5 cm
(3.370 by 2.126 by 0.197 in.)

I/O connector .....Special cable with DB-9 Dsub connector and converter for PC card

Power requirement
(from PCMCIA expansion slot)

- PCMCIA-232 .....+5 VDC 40 mA typical
- PCMCIA-485 .....+5 VDC 100 mA typical
- PCMCIA-232/2 .....+5 VDC 60 mA typical
- PCMCIA-485/2 .....+5 VDC 100 mA typical
- PCMCIA-232/4 .....+5 VDC 60 mA typical

Operating environment

- Component temperature .....0 to 70° C
- Relative humidity .....10 to 90%, noncondensing

Storage environment

- Temperature .....–40 to 120° C
- Relative humidity .....5 to 90%, noncondensing

EMI .....FCC Class A verified

Software Specifications

Maximum serial transfer rate[1] .....115,200 bps

[1] Actual speed may vary considerably from speed shown due to system and instrumentation capabilities.

AT Serial Hardware

Hardware Characteristics

Two-Port AT Serial Boards (Nonisolated)

Dimensions..... 10.67 by 16.51 cm (4.2 by 6.5 in.)

I/O connector..... DB-9

Power requirement (from PC AT I/O channel)

AT-485/2.....	+5 VDC	390 mA typical 510 mA maximum
AT-232/2.....	+5 VDC	260 mA typical 340 mA maximum
AT-485/2 (Shared IRQ).....	+5 VDC	140 mA typical 180 mA maximum
AT-232/2 (Shared IRQ).....	+5 VDC	70 mA typical 100 mA maximum

Two-Port AT Serial Boards (Isolated)

Dimensions..... 10.67 by 18.70 cm (4.2 by 7.4 in.)

I/O connector..... DB-9

Isolation Voltage

From Port to Port 3000 Vrms/60s

From Any Port to Host Computer 2000 Vrms/60s

Power Requirement (from PC AT I/O channel)

AT-485/2 Isolated.....	+5 VDC	220 mA typical 260 mA maximum
AT-232/2 Isolated.....	+5 VDC	160 mA typical 200 mA maximum

Four-Port AT Serial Boards (Nonisolated)

Dimensions .....10.67 by 16.51 cm (4.2 by 6.5 in.)

I/O connector[1] .....10-position modular jack

Power Requirement (from PC AT I/O channel)

AT-485/4	+5 VDC	160 mA typical 200 mA maximum
AT-232/4	+5 VDC	110 mA typical 150 mA maximum
AT-485/4 (Shared IRQ).....	+5 VDC	160 mA typical 200 mA maximum
AT-232/4 (Shared IRQ).....	+5 VDC	110 mA typical 150 mA maximum

Four-Port AT Serial Boards (Isolated)

Dimensions .....10.67 by 25.40 cm (4.2 by 10.0 in.)

I/O connector[2] .....10-position modular jack

Isolation voltage

From Port to Port 3000 Vrms/60s

From Any Port to Host Computer 2000 Vrms/60s

Power Requirement (from PC AT I/O channel)

AT-485/4 Isolated.....	+5 VDC	300 mA typical 360 mA maximum
AT-232/4 Isolated.....	+5 VDC	280 mA typical 320 mA maximum

[1] The four-port AT serial board requires a cable to convert the 10-position modular jack to either DB-9 or DB-25 connectors.

[2] The four-port isolated AT serial board requires cables, which are included in your kit, to convert the 10-position modular jack to a DB-9 connector. Use only the type of cables provided in your kit.

Environmental Characteristics

Operating environment

- Component temperature ..... 0 to 70° C
- Relative humidity ..... 10 to 90%, noncondensing

Storage environment

- Temperature ..... –40 to 120° C
- Relative humidity ..... 5 to 90%, noncondensing

EMI

- AT serial ..... FCC Class B verified
- AT serial isolated ..... FCC Class A verified

Software Characteristics

Maximum serial transfer rate ..... 115,200 bps[1]

[1] Actual speed may vary considerably from speed shown due to system and instrumentation capabilities.

F

Technical Support Resources

Web Support

National Instruments Web support is your first stop for help in solving installation, configuration, and application problems and questions. Online problem-solving and diagnostic resources include frequently asked questions, knowledge bases, product-specific troubleshooting wizards, manuals, drivers, software updates, and more. Web support is available through the Technical Support section of `ni.com`

NI Developer Zone

The NI Developer Zone at `ni.com/zone` is the essential resource for building measurement and automation systems. At the NI Developer Zone, you can easily access the latest example programs, system configurators, tutorials, technical news, as well as a community of developers ready to share their own techniques.

Customer Education

National Instruments provides a number of alternatives to satisfy your training needs, from self-paced tutorials, videos, and interactive CDs to instructor-led hands-on courses at locations around the world. Visit the Customer Education section of `ni.com` for online course schedules, syllabi, training centers, and class registration.

System Integration

If you have time constraints, limited in-house technical resources, or other dilemmas, you may prefer to employ consulting or system integration services. You can rely on the expertise available through our worldwide network of Alliance Program members. To find out more about our Alliance system integration solutions, visit the System Integration section of `ni.com`

Worldwide Support

National Instruments has offices located around the world to help address your support needs. You can access our branch office Web sites from the Worldwide Offices section of `ni.com`. Branch office Web sites provide up-to-date contact information, support phone numbers, e-mail addresses, and current events.

If you have searched the technical support resources on our Web site and still cannot find the answers you need, contact your local office or National Instruments corporate. Phone numbers for our worldwide offices are listed at the front of this manual.

Glossary

Prefix	Meaning	Value
p-	pico-	10^{-12}
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
k-	kilo-	10^{3}
M-	mega-	10^{6}
G-	giga-	10^{9}
t-	tera-	10^{12}

°	degrees
Ω	ohms
%	percent
A	amperes
ANSI	American National Standards Institute
b	bits
B	bytes
baud	bits per second
bps	bits per second
C	Celsius
COM	Computer Output Microform; used in reference to a communication port
CTS	clear to send
DB-*xx*	subminiature D connector, where *xx* is the number of pins

DCD	data carrier detect
DCE	data communications equipment or data circuit-terminating equipment
DLL	dynamic link library
DMA	direct memory access
DSR	data set ready
DTE	data terminal equipment
$\overline{\text{DTR}}$	data terminal ready—the overscore denotes that the signal is active low
duplex	the means of bandwidth usage in a serial system
EIA	Electronic Industries Association
EMI	electromagnetic interference
FCC	Federal Communications Commission
FIFO	First-In-First-Out
ft	feet
GND	ground
HSI	handshake input
HSO	handshake output
Hz	Hertz
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
I/O	input/output
IRQ	interrupt request
ISA	Industry Standard Architecture
Kbaud	kilobits per second
m	meters

MB	megabytes of memory
PC	personal computer
PCI	Peripheral Components Interconnect
RAM	random-access memory
RI	ring indicator
RTS	request to send
RX	receive
$\overline{\text{RXD}}$	receive data—the overscore denotes that the signal is active low
s	seconds
SCSI	Small Computer Systems Interface
TX	transmit
$\overline{\text{TXD}}$	transmit data—the overscore denotes that the signal is active low
$\overline{\text{TXRDY}}$	transmit ready—the overscore denotes that the signal is active low
UART	Universal Asynchronous Receiver/Transmitter
V	volts
VDC	volts direct current
VXI	VME eXtensions for Instrumentation
Win16	describes a 16-bit Windows application
Win32	describes a 32-bit Windows application

Index

Numerics

100-pin connector, A-8
    pin descriptions (table), A-9
    pin locations (figure), A-8
10-position modular jack, A-3
    pin descriptions (table), A-3
    pin locations (figure), A-3
16-port boards specifications
    PCI, E-3
    PXI, E-6
68-pin connector, A-6
    pin descriptions (table), A-7
    pin locations (figure), A-6

A

advanced port settings
    AT, Windows Me/9*x*, 5-17
    dialog box (figure)
        AT, Windows Me/9*x*, 5-17
        PCI, Windows Me/9*x*, 2-17
        PCMCIA, Windows Me/9*x*, 4-15
        PXI, Windows Me/9*x*, 3-16
    PCI, Windows Me/9*x*, 2-17
    PCMCIA, Windows Me/9*x*, 4-15
    PXI, Windows Me/9*x*, 3-16
    transceiver mode
        AT, Windows Me/9*x*, 5-17
        PCI, Windows Me/9*x*, 2-17
        PCMCIA, Windows Me/9*x*, 4-15
        PXI, Windows Me/9*x*, 3-16
advanced settings
    AT, Windows 2000, 5-8
    dialog box (figure)
        AT, Windows 2000, 5-8
        PCI, Windows 2000, 2-8
        PCMCIA, Windows 2000, 4-7
        PXI, Windows 2000, 3-8
    PCI, Windows 2000, 2-8
    PCMCIA, Windows 2000, 4-7
    PXI, Windows 2000, 3-7
    transceiver mode
        AT, Windows 2000, 5-8
        PCI, Windows 2000, 2-8
        PCMCIA, Windows 2000, 4-7
        PXI, Windows 2000, 3-8
    using FIFO buffers, 2-9, 2-17, 3-8, 3-16, 4-8, 4-15, 5-9, 5-18
advanced transceiver control, 6-1
    four-wire mode, 6-2
    setting transceiver control mode, 6-3
    transceiver mode control bytes (table), 6-4
    transceiver mode control modes (table), 6-2
    two-wire mode: $\overline{\text{DTR}}$ controlled, 6-2
    two-wire mode: $\overline{\text{DTR}}$ with Echo, 6-2
    two-wire mode: $\overline{\text{TXRDY}}$ auto control, 6-3
AT serial board installation (figure), 5-3, 5-11, 5-20

B

bias resistors, B-5
    using in transmission line (figure), B-6

C

cable connection, A-1
changing communication port settings
    Windows 2000, 2-5, 3-5, 4-5, 5-5
    Windows NT, 2-21, 3-20, 4-19, 5-22
changing resources assigned to serial interface, D-16
COM port number, 2-22, 3-21, 4-20, 5-23

common questions
changing resources assigned to serial interface, D-16
determining number of interrupts required for a serial interface, D-17, D-23
determining port associated with COM*x*
Windows 2000, D-4
Windows Me/9*x*, D-15
Windows NT, D-22
determining type of serial hardware installed
Windows 2000, D-4
Windows Me/9*x*, D-14
Windows NT, D-22
determining version of NI-Serial software installed
Windows 2000, D-4
Windows Me/9*x*, D-15
Windows NT, D-22
diagnostic test failure
Windows 2000, D-4
Windows Me/9*x*, D-15
Windows NT, D-22
maximum supported baud rate
Windows 2000, D-5
Windows Me/9*x*, D-17
Windows NT, D-23
naming National Instruments serial ports
Windows 2000, D-4
Windows Me/9*x*, D-15
Windows NT, D-22
removing information about serial boards from Device Manager
Windows 2000, D-5
Windows Me/9*x*, D-17
Windows 2000, D-4
Windows Me/9*x*, D-14
Windows NT, D-22
communication port settings
viewing or changing
Windows 2000, 2-5, 3-5, 4-5, 5-5
Windows Me/9*x*, 2-14, 3-13, 4-13, 5-14
Windows NT, 2-21, 3-20, 4-19, 5-22
ComponentWorks, 1-9
ComponentWorks++, 1-9
configuration
resource settings, 5-24
conflict-free resources, D-7
selecting, D-7
connecting cables, A-1
connecting cables to four-port PCI serial board (figure), A-5
connecting two-wire devices, A-1
conventions, *xiii*
customer education, F-1

D

DB-25 connector, A-4
pin descriptions (table), A-4
pin locations (figure), A-4
DB-9
100-pin connector pin descriptions (figure), A-8
100-pin connector pin descriptions (table), A-9
68-pin connector pin descriptions (figure), A-6
68-pin connector pin descriptions (table), A-7
connector, A-2
pin descriptions (table), A-2
pin locations (figure), A-2
DCE vs. DTE, B-7
default restoration, 2-9, 2-18, 3-9, 3-17, 4-8, 4-16, 5-9
determining number of interrupts required for a serial interface, D-23

determining port associated with COM*x*
Windows 2000, D-4
Windows Me/9*x*, 4-12, 5-14, D-15
Windows NT, 4-18, 5-21, D-22
determining type of serial hardware installed
Windows 2000, D-4
Windows Me/9*x*, D-14
Windows NT, D-22
determining version of NI-Serial software installed
Windows 2000, D-4
Windows Me/9*x*, D-15
Windows NT, D-22
development tools for saving time, 1-8
Device Manager for AT serial board ports (figure), 5-4, 5-13
Device Manager for PCI serial board ports (figure), 2-4, 2-13
Device Manager for PCMCIA serial card ports (figure), 4-4, 4-11
Device Manager for PXI serial board ports (figure), 3-4, 3-12
Device Manager ports list (figure), D-12, D-14
DeviceIoControl, 6-4
input values (table), 6-5
setting transceiver mode with, 6-4
diagnostic messages
address test failed
Windows 2000, D-3
Windows Me/9*x*, D-10
Windows NT, D-21
diagnostic utility does not show all installed ports
Windows Me/9*x*, D-10
Windows NT, D-21
interrupt test failed
Windows 2000, D-3
Windows Me/9*x*, D-10
Windows NT, D-22
no National Instruments serial port found
Windows 2000, D-3
Windows Me/9*x*, D-9
Windows NT, D-20
troubleshooting
Windows 2000, D-3
Windows Me/9*x*, D-9
Windows NT, D-20
diagnostic test failure
Windows 2000, D-4
Windows Me/9*x*, D-15
Windows NT, D-22
DOS-based addresses (table), D-15
DTE vs. DCE, B-7
DTE-to-DCE interface, B-7
straight-through cabling in (figure), B-7
DTE-to-DTE interface, B-7
null-modem cabling in (figure), B-7
duplex architectures, B-3
full duplex, B-3
half duplex, B-4

E

eight-port boards specifications
PCI, E-3
PXI, E-6
environmental characteristics
AT, E-11
PCI, E-4
PXI, E-7

F

FIFO buffer size, 2-23, 3-22, 4-21, 5-24
FIFO buffers, 2-9, 2-17, 3-8, 3-16, 4-8, 4-15, 5-9, 5-18
FIFO enabled, 2-22, 3-21, 4-21, 5-24
FIFO buffer size, 2-23, 3-22, 4-21, 5-24

forcing Windows to detect hardware
Windows 2000, D-2
Windows Me/9*x*, D-11
four-port boards
connecting cables to (figure), A-5
isolated four-port boards
AT, E-10
PCI, E-2
specifications
AT, E-10
PCI, E-2
PXI, E-5
four-wire mode, 6-2
freeing an interrupt request level, D-6
full duplex, B-3
full-duplex system (figure), B-4

G

general port settings
AT, 5-23
dialog box (figure), 5-23
transceiver mode, 5-23
COM port number, 2-22, 3-21, 4-20, 5-23
FIFO enabled, 2-22, 3-21, 4-21, 5-24
PCI, 2-22
dialog box (figure), 2-22
transceiver mode, 2-22
PCMCIA, 4-20
dialog box (figure), 4-20
transceiver mode, 4-20
PXI, 3-21
dialog box (figure), 3-21
transceiver mode, 3-21
resources, 2-23, 3-22, 4-21, 5-24
general programming requirements, 6-1
getting started, 1-2
glossary, G-1

H

half duplex, B-4
half-duplex system (figure), B-4
hardware installation
AT, Windows 2000, 5-2
AT, Windows Me/9*x*, 5-10
AT, Windows NT, 5-19
getting started, 1-2
PCI, Windows 2000, 2-2
PCI, Windows Me/9*x*, 2-10
PCI, Windows NT, 2-18
PCMCIA, Windows 2000, 4-2
PCMCIA, Windows Me/9*x*, 4-9
PCMCIA, Windows NT, 4-17
PXI, Windows 2000, 3-2
PXI, Windows Me/9*x*, 3-10
PXI, Windows NT, 3-17
verification
AT, Windows 2000, 5-4
AT, Windows Me/9*x*, 5-12
AT, Windows NT, 5-21
PCI, Windows 2000, 2-4
PCI, Windows Me/9*x*, 2-12
PCI, Windows NT, 2-20
PCMCIA, Windows 2000, 4-3
PCMCIA, Windows Me/9*x*, 4-10
PCMCIA, Windows NT, 4-18
PXI, Windows 2000, 3-4
PXI, Windows Me/9*x*, 3-11
PXI, Windows NT, 3-19
hardware specifications
AT, E-9
PCI, E-1
PCMCIA, E-8
PXI, E-5

I

installation
- AT serial board installation (figure), 5-3, 5-11, 5-20
- determining port associated with COM*x*
  - Windows Me/9*x*, 4-12, 5-14
  - Windows NT, 4-18, 5-21
- getting started, 1-2
- installing the PnP ISA Enabler Driver, 5-18
- PCI serial board installation (figure), 2-3, 2-11, 2-19
- PCMCIA serial card installation (figure), 4-3, 4-10, 4-17
- PXI serial board installation (figure), 3-3, 3-10, 3-18
- running the diagnostic test
  - AT, Windows Me/9*x*, 5-14
  - AT, Windows NT, 5-21
  - PCMCIA, Windows Me/9*x*, 4-12
  - PCMCIA, Windows NT, 4-18
- selecting resources for the PCMCIA card, 4-18
- serial hardware
  - AT, Windows 2000, 5-2
  - AT, Windows Me/9*x*, 5-10
  - AT, Windows NT, 5-19
  - PCI, Windows 2000, 2-2
  - PCI, Windows Me/9*x*, 2-10
  - PCI, Windows NT, 2-18
  - PCMCIA, Windows 2000, 4-2
  - PCMCIA, Windows Me/9*x*, 4-9
  - PCMCIA, Windows NT, 4-17
  - PXI, Windows 2000, 3-2
  - PXI, Windows Me/9*x*, 3-10
  - PXI, Windows NT, 3-17
- serial software
  - Windows 2000, 2-1, 3-1, 4-1, 5-1
  - Windows Me/9*x*, 2-9, 3-9, 4-8, 5-9
  - Windows NT, 2-18, 3-17, 4-16, 5-19
- verification
  - AT, 5-1
  - PCI, 2-1
  - PCMCIA, 4-1
  - PXI, 3-1
- verifying hardware installation, 4-10
  - AT, Windows 2000, 5-4
  - AT, Windows Me/9*x*, 5-12
  - AT, Windows NT, 5-21
  - PCI, Windows 2000, 2-4
  - PCI, Windows Me/9*x*, 2-12
  - PCI, Windows NT, 2-20
  - PCMCIA, Windows 2000, 4-3
  - PCMCIA, Windows Me/9*x*, 4-12
  - PCMCIA, Windows NT, 4-18
  - PXI, Windows 2000, 3-4
  - PXI, Windows Me/9*x*, 3-11
  - PXI, Windows NT, 3-19
- verifying hardware resources
  - AT, Windows Me/9*x*, 5-13
  - PCMCIA, Windows Me/9*x*, 4-12

installing the PnP ISA Enabler Driver, 5-18
interrupt request level, D-6
- freeing, D-6

introduction, 1-1
isolated four-port boards
- AT, E-10
- PCI, E-2

isolated two-port boards
- AT, E-9
- PCI, E-1

L

LabVIEW, 1-8
LabWindows/CVI, 1-9
legacy boards
- resolving resource conflicts with
  - Windows 2000, D-4
  - Windows Me/9*x*, D-11

M

maximum supported baud rate
Windows 2000, D-5
Windows Me/9*x*, D-17
Windows NT, D-23
Measurement Studio, 1-8
missing serial port in the niports list, D-18
modular jack connector, A-3
pin descriptions (table), A-3
pin locations (figure), A-3
multidrop network using terminating resistors (figure), B-5
multi-function adapter class in the Device Manager (figure), D-17

N

naming National Instruments serial ports
standard DOS-based addresses (table), D-15
Windows 2000, D-4
Windows Me/9*x*, D-15
Windows NT, D-22
National Instruments Web support, F-1
NI Developer Zone, F-1
niports configuration utility (figure)
AT, 5-22
PCI, 2-21
PCMCIA, 4-19
PXI, 3-20
null-modem cabling in a DTE-to-DTE interface (figure), B-7
number of interrupts required for a serial interface, D-17

O

optional equipment, 1-3
overview of serial hardware
AT, 1-6
PCI, 1-3
PCMCIA, 1-6
PXI, 1-4
overview of serial software, 1-8

P

PCI serial board installation (figure), 2-3, 2-11, 2-19
PCMCIA card installation (figure), 4-3, 4-10, 4-17
pin descriptions
100-pin connector pin descriptions (figure), A-8
100-pin connector pin descriptions (table), A-9
68-pin connector pin descriptions (figure), A-6
68-pin connector pin descriptions (table), A-7
DB-25
connector, A-4
connector pin descriptions (table), A-4
connector pin locations (figure), A-4
DB-9
100-pin description (table), A-9
68-pin description (table), A-7
connector, A-2
connector pin descriptions (table), A-2
connector pin locations (figure), A-2
PnP port configuration dialog box for the AT-232/4 (figure), 5-25
port settings tab
AT, Windows 2000, 5-7
AT, Windows Me/9*x*, 5-16
options
advanced port settings
AT, Windows Me/9*x*, 5-17
PCI, Windows Me/9*x*, 2-17

PCMCIA, Windows Me/9*x*, 4-15
PXI, Windows Me/9*x*, 3-16
advanced settings
AT, Windows 2000, 5-8
PCI, Windows 2000, 2-8
PCMCIA, Windows 2000, 4-7
PXI, Windows 2000, 3-7
PCI, Windows 2000, 2-6
PCI, Windows Me/9*x*, 2-16
PCMCIA, Windows 2000, 4-6
PCMCIA, Windows Me/9*x*, 4-14
PXI, Windows 2000, 3-6
PXI, Windows Me/9*x*, 3-15
restore defaults button, 2-9, 2-18, 3-9, 3-17, 4-8, 4-16, 5-9
ports list in Device Manager (figure), D-12, D-14
PXI serial board installation (figure), 3-3, 3-10, 3-18
PXI serial board names and descriptions (table), 1-5

R

related documentation, *xiv*
removing information about serial boards from Device Manager
Windows 2000, D-5
Windows Me/9*x*, D-17
resolving resource conflicts, D-19
resolving resource conflicts with legacy boards
Windows 2000, D-4
Windows Me/9*x*, D-11
resource configuration dialog box for the PCMCIA-485 (figure), 4-22
resource configuration dialog box for the PCMCIA-485/2 (figure), 4-23
resource settings, 4-22, 5-24
AT boards (non-shared IRQ), 5-26
AT boards (shared IRQ), 5-25
PCMCIA-232, PCMCIA-485, PCMCIA-232/4, 4-22
PCMCIA-232/2, PCMCIA-485/2, 4-23
restoring defaults, 2-9, 2-18, 3-9, 3-17, 4-8, 4-16, 5-9
RS-232 standard, B-1
features (table), B-1
RS-422 standard, B-2
features (table), B-1
RS-485 standard, B-2
features (table), B-1
running the diagnostic test
AT, Windows Me/9*x*, 5-14
AT, Windows NT, 5-21
PCMCIA, Windows Me/9*x*, 4-12
PCMCIA, Windows NT, 4-18

S

selecting an interface to uninstall (figure)
AT, Windows 2000, C-17
AT, Windows Me/9*x*, C-19
AT, Windows NT, C-21
PCI, Windows 2000, C-2, D-2
PCI, Windows Me/9*x*, C-4
PCI, Windows NT, C-5
PCMCIA, Windows 2000, C-12
PCMCIA, Windows Me/9*x*, C-14
PCMCIA, Windows NT, C-16
PXI, Windows 2000, C-7
PXI, Windows Me/9*x*, C-9
PXI, Windows NT, C-10
selecting conflict-free resources, D-7
selecting resources for the PCMCIA card, 4-18
serial communication issues, B-3
bias resistors, B-5
DTE vs. DCE, B-7
duplex architectures, B-3
termination, B-5

serial hardware
forcing Windows to detect
Windows 2000, D-2
Windows Me/9*x*, D-11
general programming requirements, 6-1
installation
AT, Windows 2000, 5-2
AT, Windows Me/9*x*, 5-10
AT, Windows NT, 5-19
PCI, Windows 2000, 2-2
PCI, Windows Me/9*x*, 2-10
PCI, Windows NT, 2-18
PCMCIA, Windows 2000, 4-2
PCMCIA, Windows Me/9*x*, 4-9
PCMCIA, Windows NT, 4-17
PXI, Windows 2000, 3-2
PXI, Windows Me/9*x*, 3-10
PXI, Windows NT, 3-17
overview
AT, 1-6
PCI, 1-3
PCMCIA, 1-6
PXI, 1-4
selecting an interface to uninstall (figure)
AT, Windows 2000, C-17
AT, Windows Me/9*x*, C-19
AT, Windows NT, C-21
PCI, Windows 2000, C-2, D-2
PCI, Windows Me/9*x*, C-4
PCI, Windows NT, C-5
PCMCIA, Windows 2000, C-12
PCMCIA, Windows Me/9*x*, C-14
PCMCIA, Windows NT, C-16
PXI, Windows 2000, C-7
PXI, Windows Me/9*x*, C-9
PXI, Windows NT, C-10
uninstalling
AT, Windows 2000, C-17
AT, Windows Me/9*x*, C-18
AT, Windows NT, C-20
PCI, Windows 2000, C-2
PCI, Windows Me/9*x*, C-3
PCI, Windows NT, C-5
PCMCIA, Windows 2000, C-12
PCMCIA, Windows Me/9*x*, C-13
PCMCIA, Windows NT, C-15
PXI, Windows 2000, C-7
PXI, Windows Me/9*x*, C-8
PXI, Windows NT, C-10
using, 6-1
serial port information, B-1
serial software
installation
Windows 2000, 2-1, 3-1, 4-1, 5-1
Windows Me/9*x*, 2-9, 3-9, 4-8, 5-9
Windows NT, 2-18, 3-17, 4-16, 5-19
overview, 1-8
uninstalling
Windows 2000, C-3, C-8, C-13, C-18
Windows Me/9*x*, C-4, C-9, C-15, C-20
Windows NT, C-6, C-11, C-16, C-21
setting transceiver control mode, 6-3
setting with DeviceIoControl, 6-4
software characteristics
AT, E-11
PCI, E-4
PCMCIA, E-8
PXI, E-7
software installation
getting started, 1-2
Windows 2000, 2-1, 3-1, 4-1, 5-1
Windows Me/9*x*, 2-9, 3-9, 4-8, 5-9
Windows NT, 2-18, 3-17, 4-16, 5-19
specifications, E-1
16-port boards
PCI, E-3
PXI, E-6
AT, E-9

eight-port boards
PCI, E-3
PXI, E-6
environmental characteristics
AT, E-11
PCI, E-4
PXI, E-7
four-port boards
AT, E-10
PCI, E-2
PXI, E-5
isolated four-port boards
AT, E-10
PCI, E-2
isolated two-port boards
AT, E-9
PCI, E-1
PCI, E-1
PCMCIA, E-8
PXI, E-5
software characteristics
AT, E-11
PCI, E-4
PCMCIA, E-8
PXI, E-7
two-port boards
AT, E-9
PCI, E-1
PXI, E-5
standard DOS-based addresses (table), D-15
straight-through cabling in a DTE-to-DCE interface (figure), B-7
system integration, by National Instruments, F-1

T

technical support resources, F-1
termination, B-5
multidrop network using terminating resistors (figure), B-5
time-saving development tools, 1-8
transceiver control modes (table), 6-2
transceiver mode
AT, Windows 2000, 5-8
AT, Windows Me/9*x*, 5-17
AT, Windows NT, 5-23
PCI, Windows 2000, 2-8
PCI, Windows Me/9*x*, 2-17
PCI, Windows NT, 2-22
PCMCIA, Windows 2000, 4-7
PCMCIA, Windows Me/9*x*, 4-15
PCMCIA, Windows NT, 4-20
PXI, Windows 2000, 3-8
PXI, Windows Me/9*x*, 3-16
PXI, Windows NT, 3-21
setting with DeviceIoControl, 6-4
transceiver mode control bytes (table), 6-4
transmission line using bias resistors (figure), B-6
troubleshooting, D-1
diagnostic messages
Windows 2000, D-3
Windows Me/9*x*, D-9
Windows NT, D-20
forcing Windows to detect your hardware
Windows 2000, D-2
Windows Me/9*x*, D-11
freeing an interrupt request level, D-6
missing serial port in the niports list, D-18
resolving resource conflicts, D-19
resolving resource conflicts with legacy boards
Windows 2000, D-4
Windows Me/9*x*, D-11
selecting conflict-free resources, D-7
two-port boards specifications
AT, E-9
isolated two-port boards
AT, E-9
PCI, E-1

PCI, E-1
PXI, E-5
two-wire devices, A-1
connecting, A-1
typical full-duplex system (figure), B-4
typical half-duplex system (figure), B-4

U

uninstalling serial hardware
AT Windows Me/9*x*, C-18
AT, Windows 2000, C-17
AT, Windows NT, C-20
PCI, Windows 2000, C-2
PCI, Windows Me/9*x*, C-3
PCI, Windows NT, C-5
PCMCIA, Windows 2000, C-12
PCMCIA, Windows Me/9*x*, C-13
PCMCIA, Windows NT, C-15
PXI, Windows 2000, C-7
PXI, Windows Me/9*x*, C-8
PXI, Windows NT, C-10
uninstalling serial software
Windows 2000, C-3, C-8, C-13, C-18
Windows Me/9*x*, C-4, C-9, C-15, C-20
Windows NT, C-6, C-11, C-16, C-21
using FIFO buffers, 2-9, 2-17, 3-8, 3-16, 4-8, 4-15, 5-9, 5-18
using serial hardware, 6-1
using this manual, 1-1

V

verifying hardware installation
AT, Windows 2000, 5-4
AT, Windows Me/9*x*, 5-12
AT, Windows NT, 5-21
PCI, Windows 2000, 2-4
PCI, Windows Me/9*x*, 2-12
PCI, Windows NT, 2-20
PCMCIA, Windows 2000, 4-3
PCMCIA, Windows Me/9*x*, 4-10
PCMCIA, Windows NT, 4-18
PXI, Windows 2000, 3-4
PXI, Windows Me/9*x*, 3-11
PXI, Windows NT, 3-19
verifying hardware resources
AT, Windows Me/9*x*, 5-13
PCMCIA, Windows Me/9*x*, 4-12
viewing or changing communication port settings
Windows 2000, 2-5, 3-5, 4-5, 5-5
Windows Me/9*x*, 2-14, 3-13, 4-13, 5-14
Windows NT, 2-21, 3-20, 4-19, 5-22

W

Web support from National Instruments, F-1
Win32 Overviews and Win32 Reference, 6-1
Win32 Software Development Kit, 6-1
worldwide technical support, F-2

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP