

ESCALA

10/100/1000 Base-TX Ethernet PCI-X Adapter

Installation and Using Guide



REFERENCE
86 A1 17EG 00

ESCALA

10/100/1000 Base-TX Ethernet PCI-X Adapter Installation and Using Guide

Hardware

November 2002

BULL CEDOC
357 AVENUE PATTON
B.P.20845
49008 ANGERS CEDEX 01
FRANCE

REFERENCE
86 A1 17EG 00

The following copyright notice protects this book under Copyright laws which prohibit such actions as, but not limited to, copying, distributing, modifying, and making derivative works.

Copyright © Bull SAS 1992, 2002

Printed in France

Suggestions and criticisms concerning the form, content, and presentation of this book are invited. A form is provided at the end of this book for this purpose.

To order additional copies of this book or other Bull Technical Publications, you are invited to use the Ordering Form also provided at the end of this book.

Trademarks and Acknowledgements

We acknowledge the right of proprietors of trademarks mentioned in this book.

AIX® is a registered trademark of International Business Machines Corporation, and is being used under licence.

UNIX® is a registered trademark in the United States of America and other countries licensed exclusively through the Open Group.

Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries

The information in this document is subject to change without notice. Bull will not be liable for errors contained herein, or for incidental or consequential damages in connection with the use of this material.

Contents

Safety Information.	v
Handling Static-Sensitive Devices.	vii
About This Book	ix
ISO 9000	ix
Related Publications	ix
Trademarks	ix
Chapter 1. Overview	1
Chapter 2. Preparing for Installation	3
Verifying Your Hardware Requirements	3
Verifying Your Software Requirements	3
Checking Prerequisites	3
Chapter 3. Installing the Device Driver Software	5
Verify AIX Software Installation	6
Chapter 4. Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter	9
Installing the Adapter	9
Verifying Adapter Hardware Installation	10
Running Adapter Diagnostics	10
Chapter 5. Connecting to an Ethernet Network	11
Connecting the Network Cables and Adapter	11
Understanding the Adapter LEDs	12
Appendix A. Communications Statements	13
Federal Communications Commission (FCC) Statement	13
European Union (EU) Statement	13
International Electrotechnical Commission (IEC) Statement	14
United Kingdom Telecommunications Safety Requirements	14
Avis de conformité aux normes du ministère des Communications du Canada	14
Canadian Department of Communications Compliance Statement	14
VCCI Statement	14
Electromagnetic Interference (EMI) Statement - Taiwan	15
Radio Protection for Germany	15
Appendix B. Notices	17

Safety Information

DANGER

An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

Before installing or removing signal cables, ensure that the power cables for the system unit and all attached devices are unplugged.

When adding or removing any additional devices to or from the system, ensure that the power cables for those devices are unplugged before the signal cables are connected. If possible, disconnect all power cables from the existing system before you add a device.

Use one hand, when possible, to connect or disconnect signal cables to prevent a possible shock from touching two surfaces with different electrical potentials.

During an electrical storm, do not connect cables for display stations, printers, telephones, or station protectors for communication lines.

Handling Static-Sensitive Devices

Attention: Static electricity can damage this device and your system unit. To avoid damage, keep this device in its anti-static protective bag until you are ready to install it. To reduce the possibility of electrostatic discharge, follow the precautions listed below:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or other printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its anti-static package, touch it to an unpainted metal part of the system unit for at least two seconds. (This drains static electricity from the package and from your body).
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it on its static-protective package. (If your device is an adapter, place it component-side up). Do not place the device on your system unit cover or on a metal table.
- Take additional care when handling devices during cold weather, as heating reduces indoor humidity and increases static electricity.

About This Book

This book provides information about the 10/100/1000 Base-TX Ethernet PCI-X Adapter, as well as how to attach the adapter to a network. Use this book together with your specific system unit and operating system documentation.

ISO 9000

ISO 9000 registered quality systems were used in the development and manufacturing of this product.

Related Publications

The following publications contain related information:

- System unit documentation for information specific to your hardware configuration
- Operating system documentation for information specific to your software configuration
- *PCI Adapter Placement Reference Guide* (for the latest version, you may need to contact your marketing representative)

Trademarks

The following term is a trademark of International Business Machines Corporation in the United States, other countries, or both:

- AIX
- AIX 5L

Other company, product, and service names may be trademarks or service marks of others.

Chapter 1. Overview

The 10/100/1000 Base-TX Ethernet PCI-X Adapter is a high performance, highly integrated, universal Ethernet LAN adapter for PCI-X and PCI systems. The adapter provides 10/100/1000 Mbps connectivity over 4 pairs of standard CAT-5 cable up to 100 meters. It conforms to IEEE 802.3ab 1000 Base-T standard. The adapter runs in standard PCI-X V1.0a compliant systems with 32/64-bit PCI-X Bus Master slots at 66/133 MHz, as well as PCI 2.2 compliant systems with 32/64-bit PCI bus master slots at 33/66 MHz.

The 10/100/1000 Base-TX Ethernet PCI-X Adapter provides the following features:

- Support for 64-bit Direct Bus Mastering on the PCI/PCI-X bus
- Uses a shared memory structure in host memory and copies data directly from and to host memory
- Supports Boot ROM
- Operates in 10/100/1000 Base-T modes
- Supports 1000 Mbps throughput on 4 pairs of standard CAT-5 cabling
- Supports 100 Mbs and 10 Mbps throughput on 2 pairs of standard CAT-5 and CAT-3 cabling
- Full-duplex operation
- IEEE 802.3ab 1000 Base-T compliant
- IEEE 802.3u 100 Base-TX compliant
- IEEE 802.3 10 Base-T compliant
- Supports Dual address cycle for access to 64-bit addresses
- Supports 64-bit addressing for systems with greater than 4 GB of physical memory
- Supports PCI-X split transactions
- Two bi-color LED adapter status indicators for link activity and baud rate, see Figure 1 on page 2.
- RJ-45 UTP Connector for Category-5 Copper Cabling
- Surface mount technology (SMT)

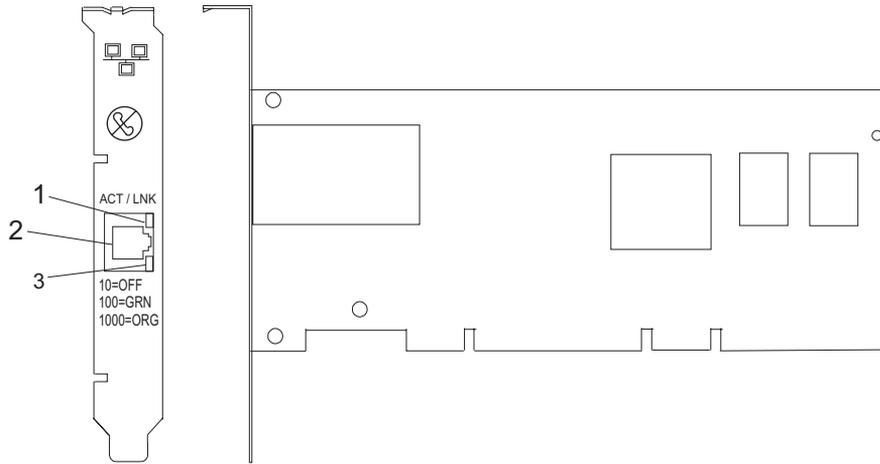


Figure 1. 10/100/1000 Base-TX Ethernet PCI-X Adapter

- 1 ACT/LNK LED
- 2 RJ-45 Connector
- 3 Link Speed LED

Chapter 2. Preparing for Installation

This chapter helps you prepare to install your 10/100/1000 Base-TX Ethernet PCI-X Adapter.

Note: If AIX is not installed on your system unit, install your adapter before you install the operating system (see Chapter 4, “Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter” on page 9 for instructions).

If AIX is operating on your system, install your device driver software before you install the adapter. (See Chapter 3, “Installing the Device Driver Software” on page 5 for instructions.)

Verifying Your Hardware Requirements

The 10/100/1000 Base-TX Ethernet PCI-X Adapter requires the following hardware:

- A wrap plug for the RJ-45 connector, if you are running the total diagnostics package
- Category 5 unshielded twisted pair (UTP) cables for 100/1000 Mbps network attachment

Note: The above cable can be no longer than 100 meters. Including patch cables, this is the maximum allowable cable length from the adapter to the local switch.

Verifying Your Software Requirements

The 10/100/1000 Base-TX Ethernet PCI-X Adapter is supported on AIX 5L for POWER version 5.1.35 with the 5100-03 Recommended Maintenance package (APAR IY32749) or later. Ensure that your operating system supports this adapter before you install it. Contact your support representative for assistance.

Checking Prerequisites

To install the 10/100/1000 Base-TX Ethernet PCI-X Adapter, make sure you have the following on hand:

- The 10/100/1000 Base-TX Ethernet PCI-X Adapter
- The operating system documentation
- The system unit documentation
- The *PCI Adapter Placement Reference* guide
- Wrap plug
- A flat-blade screwdriver
- Base AIX Operating System CD, which includes the device driver, or the AIX device driver CD-ROM
- A registration card

Note: Be sure to retain your proof of purchase as it might be required to receive warranty service.

Chapter 3. Installing the Device Driver Software

This chapter explains how to install device driver software. The device driver is provided for the AIX operating system.

Be sure you have read Chapter 2, “Preparing for Installation” on page 3 to determine:

- If you should install your device driver software first, go to step 1 and continue with this section.
- If you should install your adapter hardware first, go to Chapter 4, “Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter” on page 9. When you install AIX, your adapter device driver automatically installs.

If your *installed* AIX operating system (AIX 5.1.35 or later) supports the 10/100/1000 Base-TX Ethernet PCI-X Adapter and you already have a 10/100/1000 Base-TX Ethernet PCI-X Adapter installed, the device driver is already installed and you can install the adapter. Go to Chapter 4, “Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter” on page 9 for instructions. Otherwise, install the device driver.

To install device driver software, do the following:

1. Turn on the system unit power.
2. Log in as **root** user.
3. Insert the media containing the device driver software (for example; CD-ROM) into the appropriate media device.

If your system does not have a CD-ROM drive, refer to your system documentation for performing a NIM (Network Installation Management) installation.

4. Type the following System Management Interface Tool (SMIT) fast path:
smitty devinst
5. Press Enter. The Install Additional Device Software screen highlights the **INPUT device/directory for software** option.
6. Select or type *your input device*:
 - Press **F4** to display the input device list. Select the *name of the device* (for example; CD-ROM) that you are using and press Enter.
 - OR
 - In the entry field, type the *name of the input device* you are using and press Enter.

The Install Additional Device Software window highlights the **SOFTWARE to install** option.

7. Press **F4** to display the SOFTWARE to install window.
8. Type the following to display the Find window:
/
/
9. Type the following:
devices.pci.14106902

10. Press Enter. The system finds and highlights this device driver software.
11. Press **F7** to select the highlighted device driver software.
12. Press Enter.
13. The INSTALL ADDITIONAL DEVICE SOFTWARE screen displays. The entry fields are automatically updated. Press Enter to accept the information.
14. The ARE YOU SURE window displays. Press Enter to accept the information.
15. The COMMAND STATUS screen displays.
 - The term RUNNING is highlighted to indicate that the installation and configuration command is in progress.
 - When RUNNING changes to OK, scroll to the bottom of the page and locate the Installation Summary.
 - After a successful installation, SUCCESS displays in the Result column of the Installation Summary at the bottom of the page.
16. Remove the installation media from the drive.
17. Press **F10** to exit SMIT.
18. Go to the adapter installation procedure, Chapter 4, “Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter” on page 9.

Verify AIX Software Installation

To verify that the device driver for the 10/100/1000 Base-TX Ethernet PCI-X Adapter is installed, do the following:

1. If necessary, log in as **root** user.
2. At the command line, type:


```
lslpp -l devices.pci.14106902.rte
```
3. Press Enter.

Possible results are as follows:

- If the 10/100/1000 Base-TX Ethernet PCI-X Adapter device driver is installed, the following is an example of the data that displays on your screen:

Fileset	Level	State	Description

Path: /usr/lib/objrepos			
devices.pci.14106902.rte	5.1.35	COMMITTED	...Ethernet... Adapter Software
Path: /etc/objrepos			
devices.pci.14106902.rte	5.1.35	COMMITTED	...Ethernet... Adapter Software

Verify that the filesets **devices.pci.14106902.rte** are installed at the AIX 5.1.35 or later level.

If this information displays but you continue to have problems, go to Chapter 4, “Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter” on page 9.

- If no data displays on your screen, the 10/100/1000 Base-TX Ethernet PCI-X Adapter device driver did not install correctly. Return to Chapter 3, “Installing the

Device Driver Software” on page 5. Return to “Verifying Adapter Hardware Installation” on page 10 and continue with step 1 again.

If you continue to experience problems, it may be necessary to call your system support organization. Refer to your operating system documentation for instructions.

Chapter 4. Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter

This chapter explains how to install the 10/100/1000 Base-TX Ethernet PCI-X Adapter. Before you begin, be sure you have read “Handling Static-Sensitive Devices” on page vii.

Note: Do not remove the 10/100/1000 Base-TX Ethernet PCI-X Adapter from its anti-static package at this time.

Installing the Adapter

To install the adapter, do the following:

1. Be sure you have read Chapter 2, “Preparing for Installation” on page 3 to determine:
 - If you should install your adapter hardware first, go to step 2 and continue with this section.
 - If you should install your device driver software first, go back to Chapter 3, “Installing the Device Driver Software” on page 5. Return here to install your hardware.
2. If your system supports hot-pluggable PCI adapters, refer to your system documentation to install the adapter and return to “Verifying Adapter Hardware Installation” on page 10. If your system does not support hot plugging, continue with the next step.
3. Log in as a **root** user and type:
shutdown

at the system prompt and press Enter. When halt completed displays, turn off the system unit power and unplug the power cord from the wall outlet.

Note: Refer to your system unit documentation for further shutdown information.

4. Remove the covers of your system unit. Follow the instructions provided in your system unit documentation.
5. Install the adapter into an available PCI slot in your system unit. See the instructions in your system unit documentation for installing PCI adapters. Refer to your *PCI Adapter Placement Reference* guide for slot locations.
6. Follow the directions provided in your system unit documentation to reinstall the covers of your system unit.
7. Plug the power cord back into the wall outlet.
8. Turn on the power to your system unit.

Verifying Adapter Hardware Installation

To verify that your system unit recognizes the PCI adapter, do the following:

1. If necessary, log in as **root** user.
2. At the command line, type:

```
lsdev -Cs pci
```
3. Press Enter.

A list of PCI devices displays. If the 10/100/1000 Base-TX Ethernet PCI-X Adapter did install correctly, an Available status indicates that the adapter is installed and ready to use.

If the message on your screen indicates your adapter is DEFINED instead of AVAILABLE, shut down your machine. Verify that the adapter was installed correctly. Go to Chapter 4, “Installing the 10/100/1000 Base-TX Ethernet PCI-X Adapter” on page 9 and return to this section and repeat the verification steps.

Note: If the message on your screen indicates your adapter is DEFINED a second time, it may be necessary to contact your service representative.

If the installed adapter does not appear, continue with “Verify AIX Software Installation” on page 6.

Running Adapter Diagnostics

Diagnostics are provided with the device driver software. If you must run diagnostics, refer to your system unit documentation for instructions.

Chapter 5. Connecting to an Ethernet Network

This chapter explains how to connect the adapter to the UTP network. Refer to your local procedures for information about connecting the 10/100/1000 Base-TX Ethernet PCI-X Adapter to your Ethernet network.

Note: Only one type of network can be attached to the adapter card at one time.

Connecting the Network Cables and Adapter

Before you begin connecting the adapter, make sure you have the hardware listed in “Verifying Your Hardware Requirements” on page 3.

To connect the adapter to an unshielded twisted-pair (UTP) network, do the following:

1. Insert the RJ-45 jack of the UTP cable into the RJ-45 connector on the adapter.
2. Insert the RJ-45 jack of the other end of the UTP cable into the network switch.

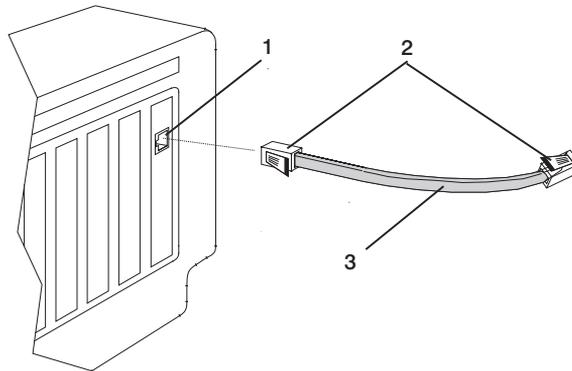


Figure 2. Connecting the Adapter to the Network

1. RJ-45 Connector
2. RJ-45 Jack
3. Unshielded Twisted-Pair (UTP) Cable

Understanding the Adapter LEDs

The LEDs on the 10/100/1000 Base-TX Ethernet PCI-X Adapter provide information about the card's operation status. The LEDs are visible through the card's mounting bracket and, when lit, indicate the following conditions:

LED	Light	Description
Link Speed	Off Green Orange	10 Mbps 100 Mbps 1000 Mbps
Link	Green Off Blinking	Good link No link: could be the result of a bad cable, bad connector, configuration mismatch, or not selected Indicates data activity

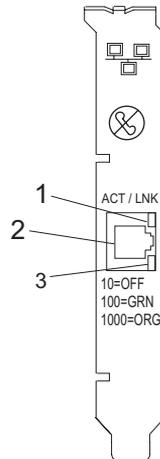


Figure 3. LEDs on the 10/100/1000 Base-TX Ethernet PCI-X Adapter

1. ACT/LNK LED
2. RJ-45 Connector
3. Link Speed LED

Appendix A. Communications Statements

The following statement applies to this product. The statement for other products intended for use with this product appears in their accompanying documentation.

Federal Communications Commission (FCC) Statement

Note: 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.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Neither the provider nor the manufacturer is responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

European Union (EU) Statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. The manufacturer cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of option cards supplied by third parties. Consult with your dealer or sales representative for details on your specific hardware.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22 / European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

International Electrotechnical Commission (IEC) Statement

This product has been designed and built to comply with IEC Standard 950.

United Kingdom Telecommunications Safety Requirements

This equipment is manufactured to the International Safety Standard EN60950 and as such is approved in the UK under the General Approval Number NS/G/1234/J/100003 for indirect connection to the public telecommunication network.

The network adapter interfaces housed within this equipment are approved separately, each one having its own independent approval number. These interface adapters, supplied by the manufacturer, do not use or contain excessive voltages. An excessive voltage is one which exceeds 70.7 V peak ac or 120 V dc. They interface with this equipment using Safe Extra Low Voltages only. In order to maintain the separate (independent) approval of the manufacturer's adapters, it is essential that other optional cards, not supplied by the manufacturer, do not use main voltages or any other excessive voltages. Seek advice from a competent engineer before installing other adapters not supplied by the manufacturer.

Avis de conformité aux normes du ministère des Communications du Canada

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

Canadian Department of Communications Compliance Statement

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

VCCI Statement

<p>この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。</p> <p>VCCI-A</p>

The following is a summary of the VCCI Japanese statement in the box above.

This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may arise. When such trouble occurs, the user may be required to take corrective actions.

Electromagnetic Interference (EMI) Statement - Taiwan

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

The following is a summary of the EMI Taiwan statement above.

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user will be required to take adequate measures.

Radio Protection for Germany

Dieses Gerät ist berechtigt in Übereinstimmung mit Dem deutschen EMVG vom 9.Nov.92 das EG-Konformitätszeichen zu führen.

Der Aussteller der Konformitätserklärung ist die IBM Germany.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse A. Für diese von Geräten gilt folgende Bestimmung nach dem EMVG:

Geräte dürfen an Orten, für die sie nicht ausreichend entstört sind, nur mit besonderer Genehmigung des Bundesministers für Post und Telekommunikation oder des Bundesamtes für Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Störungen zu erwarten sind.

(Auszug aus dem EMVG vom 9.Nov.92, Para.3, Abs.4)

Hinweis

Dieses Genehmigungsverfahren ist von der Deutschen Bundespost noch nicht veröffentlicht worden.

Appendix B. Notices

This information was developed for products and services offered in the U.S.A.

The manufacturer may not offer the products, services, or features discussed in this document in other countries. Consult the manufacturer's representative for information on the products and services currently available in your area. Any reference to the manufacturer's product, program, or service is not intended to state or imply that only that product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any intellectual property right of the manufacturer may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any product, program, or service.

The manufacturer may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to the manufacturer.

The following paragraph does not apply to the United Kingdom or any country where such provisions are inconsistent with local law: THIS MANUAL IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions; therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. The manufacturer may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Information concerning products made by other than the manufacturer was obtained from the suppliers of those products, their published announcements, or other publicly available sources. The manufacturer has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to products made by other than the manufacturer. Questions on the capabilities of products made by other than the manufacturer should be addressed to the suppliers of those products.

Technical publication remarks form

Title :	ESCALA 10/100/1000 Base-TX Ethernet PCI-X Adapter Installation and Using Guide
----------------	--

Reference N° :	86 A1 17EG 00
-----------------------	---------------

Date:	November 2002
--------------	---------------

ERRORS IN PUBLICATION

--

SUGGESTIONS FOR IMPROVEMENT TO PUBLICATION

--

Your comments will be promptly investigated by qualified technical personnel and action will be taken as required.
If you require a written reply, please include your complete mailing address below.

NAME : _____ Date : _____

COMPANY : _____

ADDRESS : _____

Please give this technical publication remarks form to your BULL representative or mail to:

Bull - Documentation D^épt.
1 Rue de Provence
BP 208
38432 ECHIROLLES CEDEX
FRANCE
info@frec.bull.fr

Technical publications ordering form

To order additional publications, please fill in a copy of this form and send it via mail to:

BULL CEDOC
357 AVENUE PATTON
B.P.20845
49008 ANGERS CEDEX 01
FRANCE

Phone: +33 (0) 2 41 73 72 66
FAX: +33 (0) 2 41 73 70 66
E-Mail: srv.Duplicopy@bull.net

CEDOC Reference #	Designation	Qty
-- -- []		
-- -- []		
-- -- []		
-- -- []		
-- -- []		
-- -- []		
-- -- []		
-- -- []		
-- -- []		
-- -- []		
-- -- []		
[] : The latest revision will be provided if no revision number is given.		

NAME: _____ Date: _____

COMPANY: _____

ADDRESS: _____

PHONE: _____ FAX: _____

E-MAIL: _____

For Bull Subsidiaries:

Identification: _____

For Bull Affiliated Customers:

Customer Code: _____

For Bull Internal Customers:

Budgetary Section: _____

For Others: Please ask your Bull representative.

BULL CEDOC
357 AVENUE PATTON
B.P.20845
49008 ANGERS CEDEX 01
FRANCE

REFERENCE
86 A1 17EG 00