



Fibre Channel Option Card

User's Guide



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Note: Before using this information and the product it supports, read the information in Appendix F, “Warranty information” on page 77 and Appendix G, “Notices” on page 89.

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Safety

Before installing this product, read the Safety Information.

مج، يجب قراءة دات السلامة

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 **Safety Information**
(安全信息)。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

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לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się
z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

安裝本產品之前，請先閱讀「安全資訊」。

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About this book

This *User's Guide* provides step-by-step installation instructions and information required for ongoing use and maintenance of the IBM® Fibre Channel Option card. This manual is written for the installer and user of this equipment and contains the following information:

- **Chapter 1, "Introduction"** provides an introduction to the Fibre Channel Option (FCO) card.
- **Chapter 2, "Installation"** provides procedures for installing the FCO card in the library.
- **Chapter 3, "Configuring the FCO card"** explains how to configure the FCO card.
- **Chapter 4, "Troubleshooting"** provides resolutions to problems that might occur while using the FCO card.
- **Appendix A, "Cabling and device mapping"** contains information on cabling and device mapping for the FCO card.
- **Appendix B, "SAN topologies"** provides illustrated topologies of different library configurations.
- **Appendix C, "Configuring FCO for TCP/IP"** contains information on configuring the FCO card for a TCP/IP network.
- **Appendix D, "Loop ID to AL_PA mapping"** provides information on how a Loop ID value maps to an Arbitrated Loop Physical Address (AL_PA).
- **Appendix E, "Removing the FCO card"** provides procedures for removing the FCO card from the library.
- **Appendix F, "Warranty information"** provides warranty information.
- **Appendix G, "Notices"** contains trademarks and legal notices.

Product registration

Thank you for purchasing this IBM® product. Take a few moments to register your product and provide us with information that will help IBM to better serve you in the future. Your feedback is valuable to us in developing products and services that are important to you, as well as in developing better ways to communicate with you. Register your option on the <http://www.ibm.com/pc/register/> IBM Web site.

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Chapter 1. Introduction

The IBM Fibre Channel Option (FCO) card is a Fibre Channel (FC)-to-Small Computer System Interface (SCSI) bridge that enables connectivity between the 4560SLX Tape Libraries and fibre channel based storage area networks (SANs), either a Fibre Channel Arbitrated Loop (FC-AL) or switched fabric (FC-SW).

This *User's Guide* assumes that you are familiar with the basic functions of your computer system and with Fibre Channel configurations and basic network administration terminology.

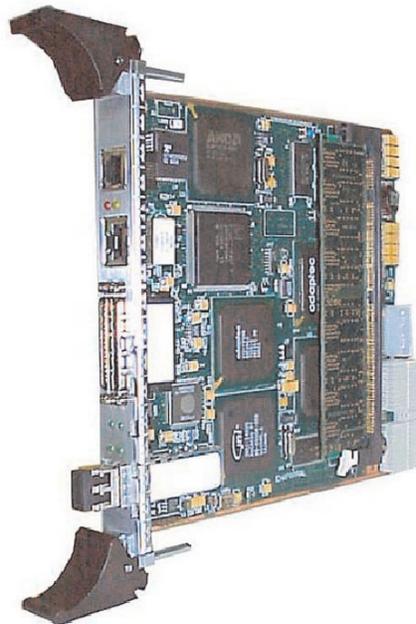


Figure 1. FCO card

FCO card features

The FCO card provides the following product features:

- Single full-duplex auto sensing, 2.125/1.0625 GHz. Fibre Channel host port socket
- FC-AL (Arbitrated Loop) and FC-SW (Switched Fabric) topologies
- Class 3 service
- Private Loop Direct Attach (PLDA) compliant
- SCSI-FCP (SCSI over Fibre Channel)
- Support for up to 128 FC initiators with up to 30 concurrently active threads
- Two independent Wide Ultra 3 Low Voltage Differential (LVD) SCSI back end device channels
- Support of 15 SCSI ID's per back end SCSI device channel
- Addressing of up to 30 Logical Unit Numbers (LUNs)
- One RJ-11 based RS-232 serial port for local FCO management
- One RJ-45 based 10/100BaseT Ethernet port for remote FCO management

- 180+ MB/sec. sustained transfer rate at 2GHz clock rate
- Automatic SCSI device discovery and SCSI-to-FC address mapping
- Retention of SCSI-to-FC addressing during tape drive removal/addition and between power cycles
- Support for Persistent Reserve In and Persistent Reserve Out commands
- Support for Report LUNs command
- Firmware upgrades via RS-232 or Ethernet (RJ-45)
- Warnings and automatic shutdown for out-of-specification temperature and voltages
- Embedded Configuration Application Programming Interface (CAPI) for management and Graphical User Interface (GUI) development
- Extended Copy command available for serverless backup

FCO card status LEDs

LED status lights are on the rear panel of the FCO card, as shown in Figure 2.

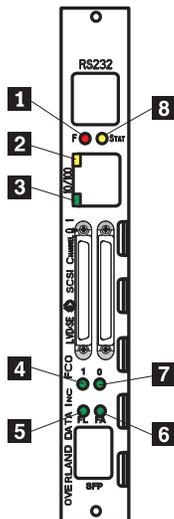


Figure 2. FCO card status LEDs

Table 1 describes the meaning of the status LEDs located on the rear of the FCO card.

Table 1. FCO card status LEDs

Figure legend	LED label	Description	Color	Function
1	F	FCO controller fault LED	Red	Solid on when FCO is power-up and fails any internal diagnostic or detects a critical error
2	-	Ethernet	Yellow	Flashes when Ethernet link is active or busy
3	-	Ethernet	Green	Solid when Ethernet link is connected
4	1	FCO SCSI channel 1 activity	Green	Flashes when bus is active or busy

Table 1. FCO card status LEDs (continued)

Figure legend	LED label	Description	Color	Function
5	FL	Fibre Channel link status	Yellow	Solid when the fibre channel link is connected. Off when the link has been lost.
6	FA	Fibre Channel Activity	Yellow	Flashes when activity is occurring over the Fibre Channel Link
7	0	FCO SCSI channel 0 activity	Green	Flashes when bus is active or busy
8	STAT	FCO controller status LED	Yellow	Solid on when FCO is power-up and passes all internal diagnostics Flashes when FCO: <ul style="list-style-type: none"> • Detects a warning/degraded mode: • Fails to complete power-on self test

Key FCO card fibre and SCSI default settings

Table 2 below lists the key FCO card default settings. The default settings are used to provide basic functionality.

Table 2. FCO card default settings

Setting	Default
Mapping mode	AUTO
Topology	LOOP
FCO card loop ID	SOFT
FCO card LUN	SOFT
FCO card initiator ID (SCSI) on each channel	7
Scan delay	0 seconds
FC link speed	1GB/sec

FCO card alarm thresholds

The alarm conditions make the STATUS light blink and also trigger an event message that displays in the FCO Router Administrator window and in the event log. For information on how to view event logs, see “Displaying the event log” on page 48. Additionally, if the SNMP service is enabled the FCO will generate SNMP traps on the following thresholds.

Table 3 on page 4 shows the temperature and voltage thresholds for each alarm and what to do to resolve the problem.

Table 3. Alarm thresholds

Alarm threshold	What to do when the alarm sounds
<p>On-board temperature</p> <p>Warning: <5°C and >50°C</p> <p>Shutdown: 0°C and 60°C</p>	<ul style="list-style-type: none"> • Check the FCO Router Administrator to confirm what the alarm means. For more information, see “Accessing the FCO Router Administrator” on page 17. • Check that the library fans are running and not obstructed. You can feel if the fans are running by placing your hand on the rear panel of the library near the card cage assembly. • Check the ambient temperature and lower it, if needed. Ambient temperature should be less than 40°C.
<p>VCC voltage</p> <p>Warning: 5V-3.5% and +6.5%</p> <p>Shutdown: 5V-6.5% and +10%</p>	<ul style="list-style-type: none"> • Check the FCO router administrator to confirm what the alarm means. For more information, see “Accessing the FCO Router Administrator” on page 17. • If it is a warning alarm, let the FCO continue to operate. • If it is a shutdown alarm, turn off the power to the FCO and contact your IBM service representative.

Chapter 2. Installation

The following key points are covered in this section:

- Unpacking the FCO card
- Installing the FCO card
- Connecting the FCO
- Powering up the library
- Removing the FCO card

Unpacking the FCO card

Carefully unpack the FCO card and ensure that you have all the parts specified below:

- FCO card
- RS-232 cable (use the same RS-232 cable shipped with the library)

Installing the FCO card

To install the FCO card, complete the following procedure:

1. Carefully insert the FCO card into the upper and lower guide rails of the option bay, as shown in Figure 3.

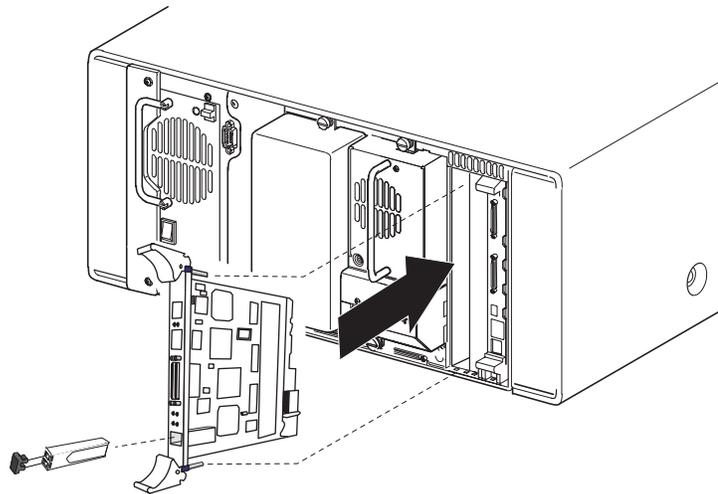


Figure 3. Installing the FCO card

- Note:** Possible damage to the library and FCO card might occur, if the card is inserted into the library controller slot.
2. The SFP socket should be at the bottom of the FCO card.
 3. Slide the FCO card into the option bay. Resistance will be felt when the FCO begins to mate with the library backplane.
 4. To ensure proper connectivity, apply just enough force to seat the FCO card snugly into the library backplane.
 5. Tighten the two captive hold-down screws for the FCO card.

6. Insert a small form-factor pluggable into the SFP socket located on the FCO card. The pluggable is keyed to ensure proper insertion. You can use a longwave SFP (19K1272) or a shortwave SFP (19K1271), which must be performed separately.
7. Add the SCSI interface cables, terminator, 10/100BaseT cable, Ethernet cable, and RS-232 cable as required for your fibre network.
8. Turn on the library.

Note: You can install the FCO card in a variety of topology configurations to meet your needs. Fibre Channel enabled libraries provide a seamless means to take advantage of the topology and speed that a SAN provides. For more information, see Appendix C, “Configuring FCO for TCP/IP” on page 71.

Connecting the FCO card

Installation, configuration, and operation of the FCO card is a simple straight forward procedure. Figure 4 on page 7, Figure 5 on page 8, and Figure 6 on page 9 provide procedures designed to assist you when bringing up the FCO card for the first time.

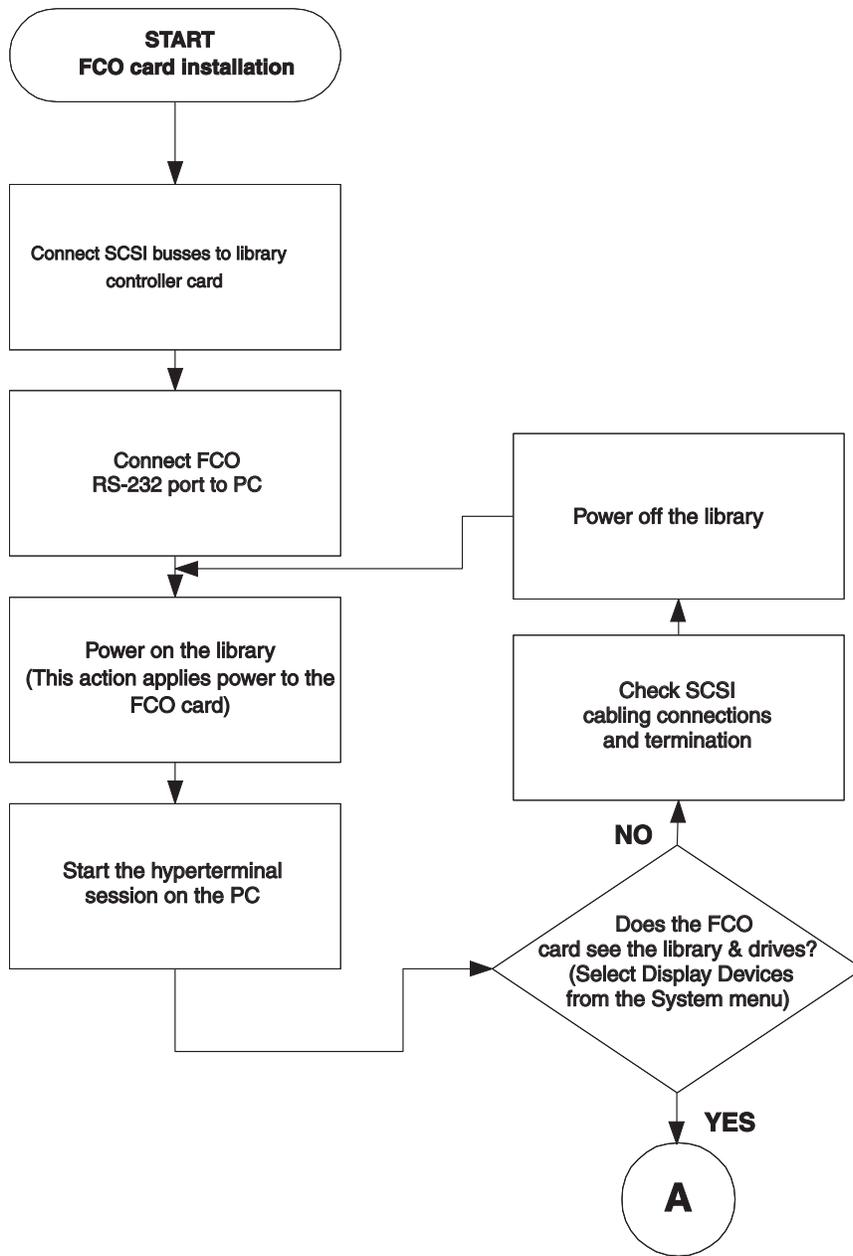


Figure 4. FCO card installation (1 of 3)

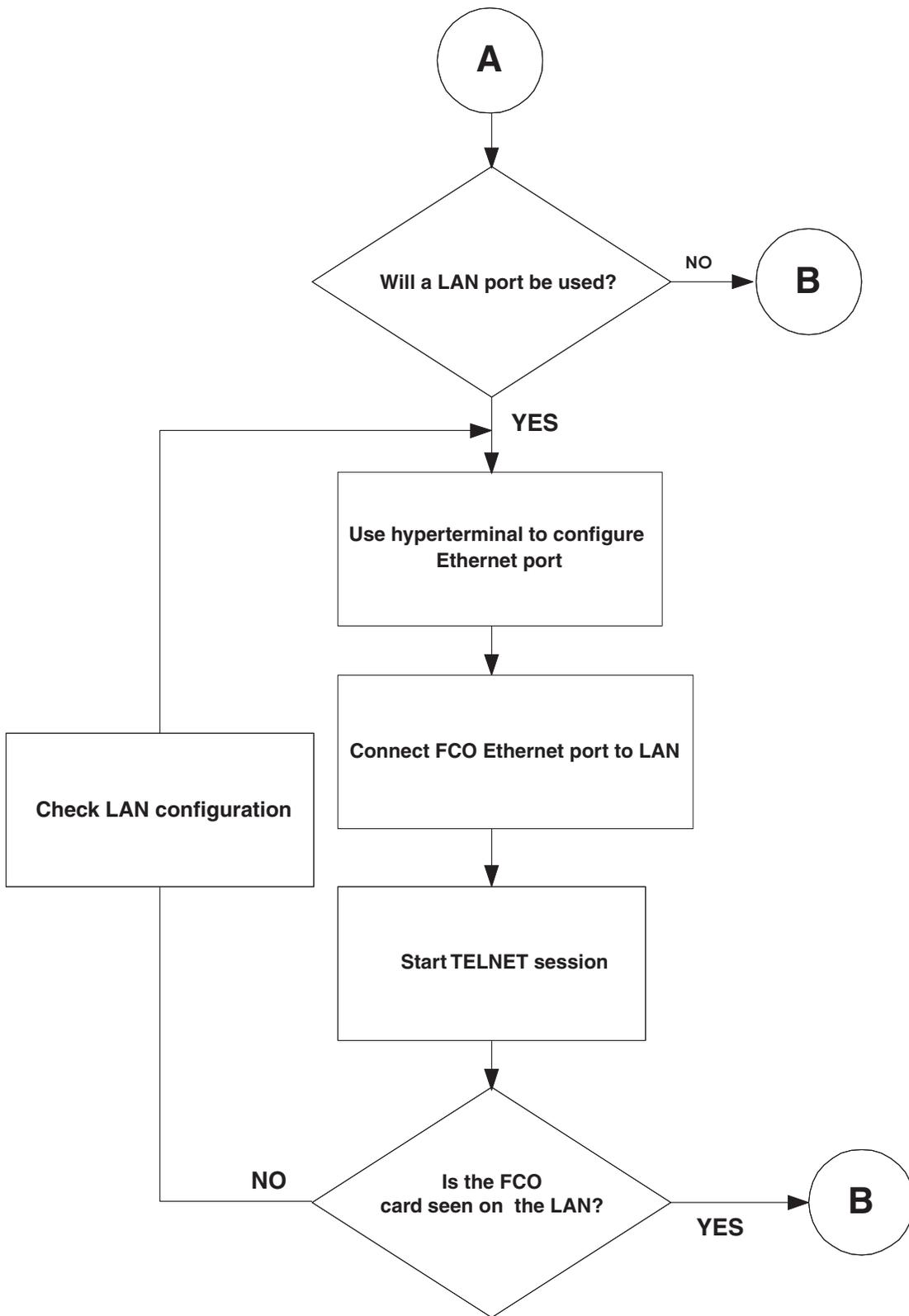


Figure 5. FCO card installation (2 of 3)

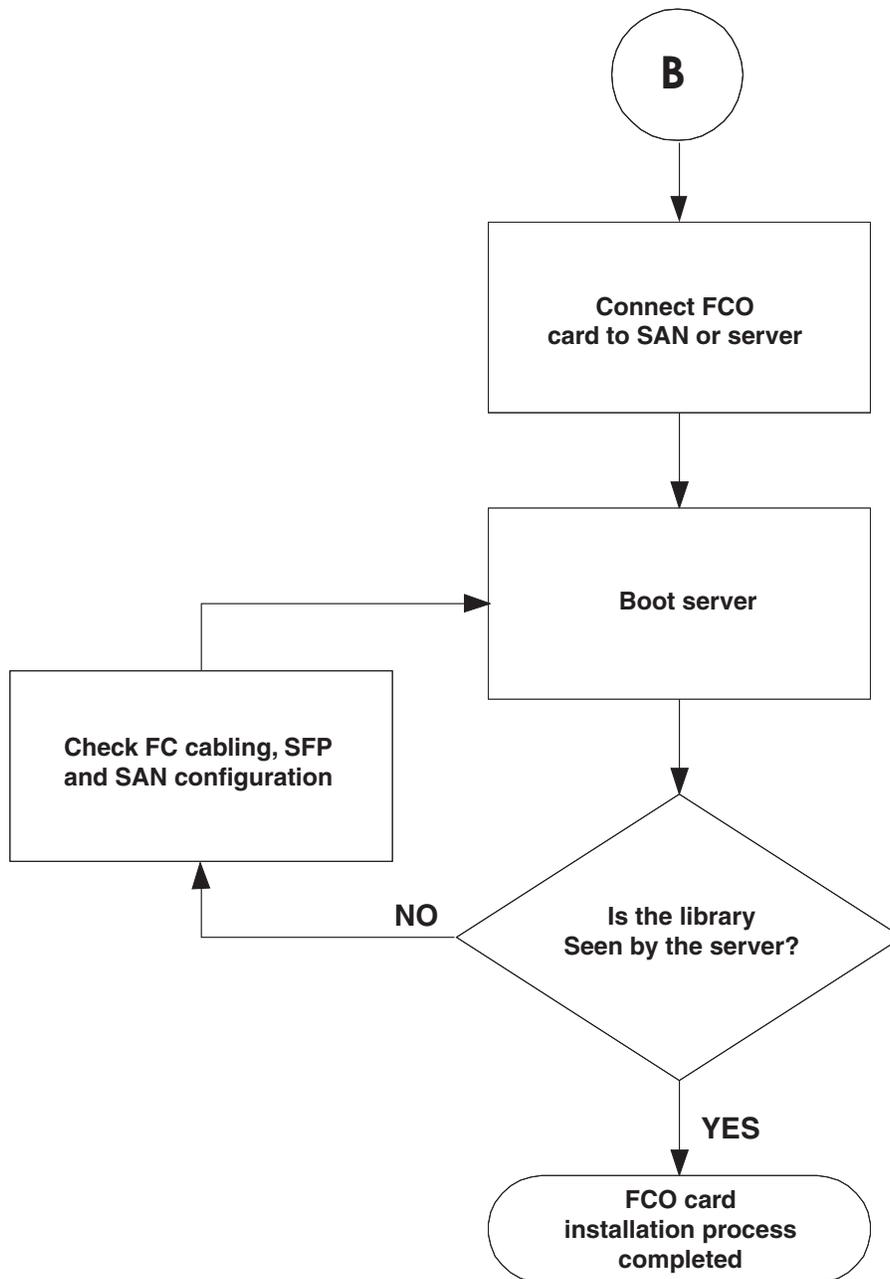
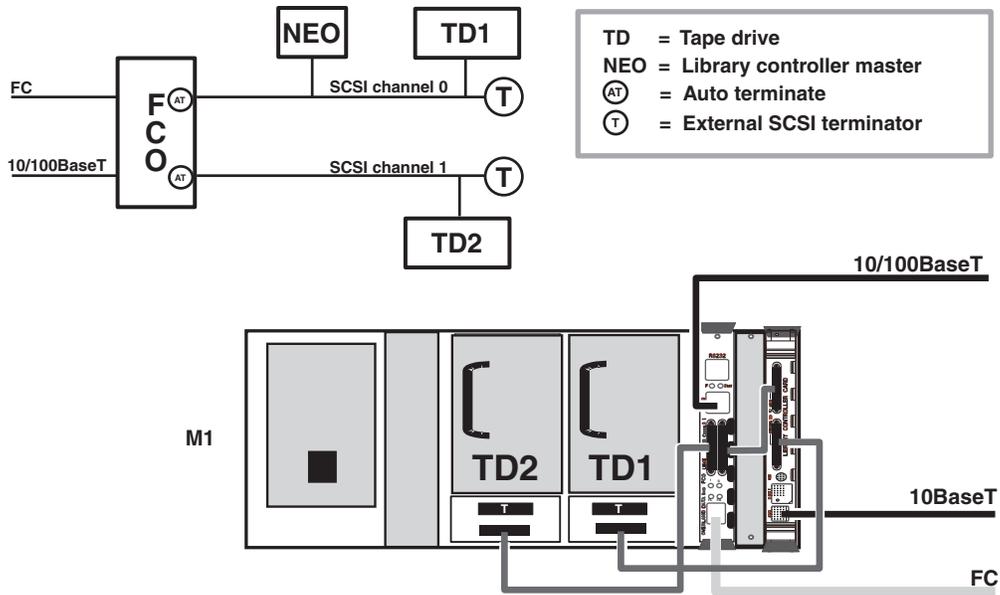


Figure 6. FCO card installation (3 of 3)

Connecting to the SCSI channels

To connect devices to the SCSI channels, complete the following procedure:

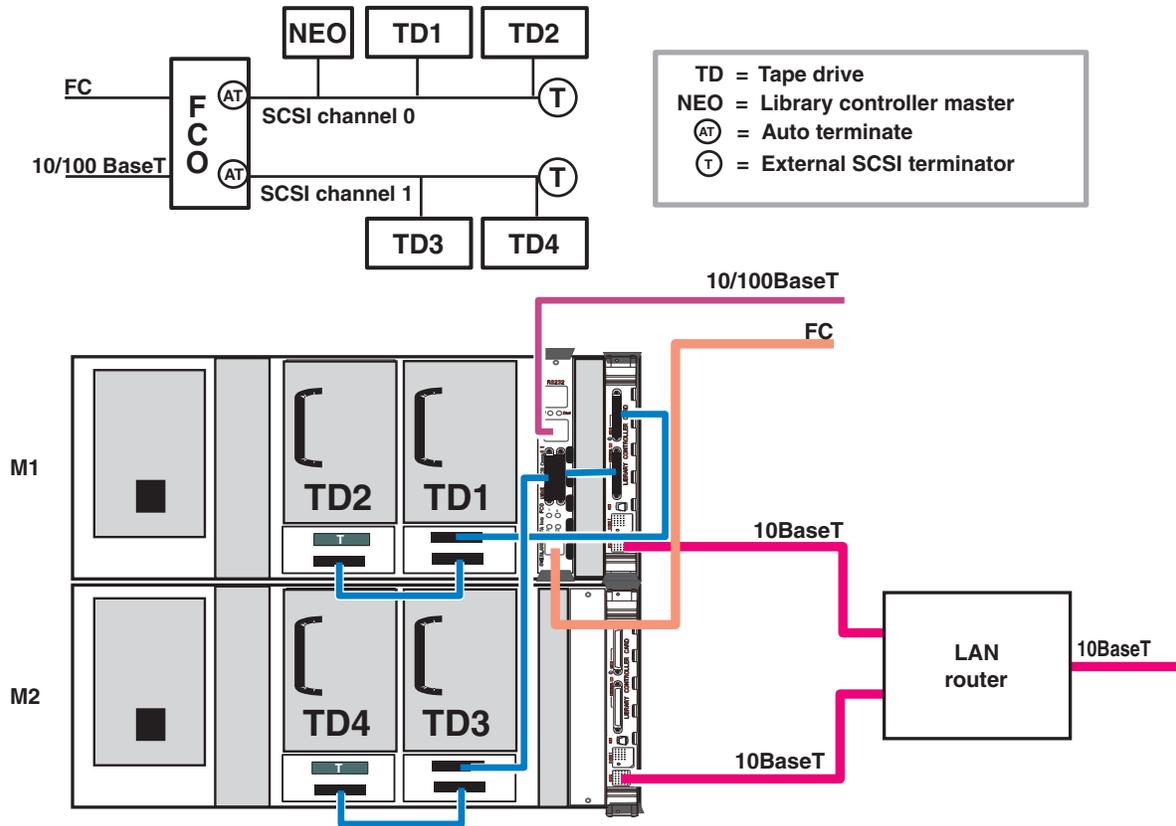
1. Turn off the library.
2. Based on the number of libraries you are configuring, use one of the following drawings.



LUN mapping as seen through the FC port:

FCO SCSI channel	FCO LUN number	Device SCSI ID	Device
0	0	1	Tape drive 1
0	1	6	Library controller card
1	2	2	Tape drive 2
N/A	3		FCO card

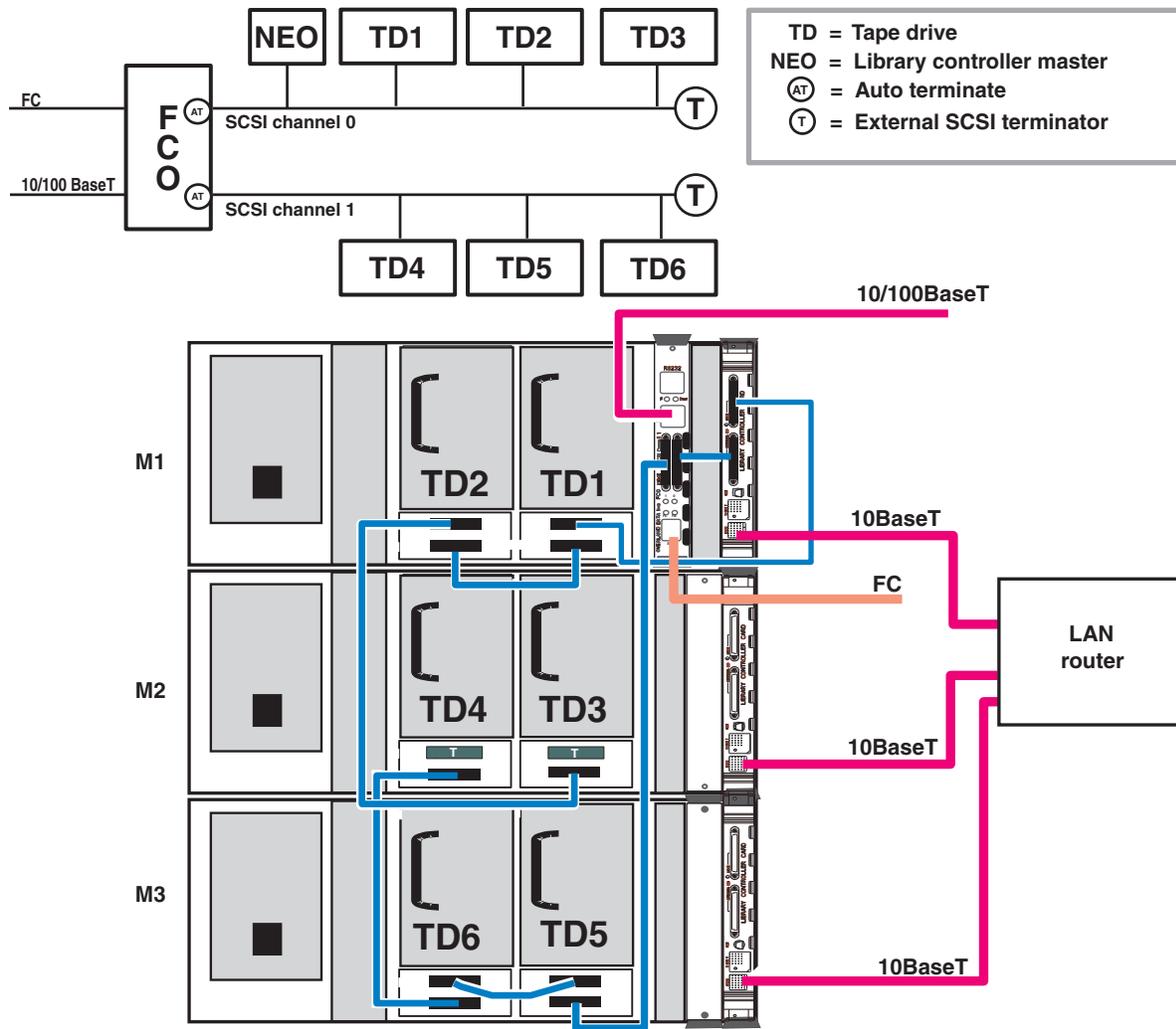
Figure 7. Single library FCO address mapping



LUN mapping as seen through the FC port:

FCO SCSI channel	FCO LUN number	Device SCSI ID	Device
0	0	0	Library controller card
0	1	1	Tape drive 1
0	2	2	Tape drive 2
1	3	3	Tape drive 3
1	4	4	Tape drive 4
N/A	5	N/A	FCO card

Figure 8. Two libraries FCO address mapping



LUN mapping as seen through the FC port:

FCO SCSI channel	FCO LUN number	Device SCSI ID	Device
0	0	0	Library controller card
0	1	1	Tape drive 1
0	2	2	Tape drive 2
0	3	3	Tape drive 3
1	4	4	Tape drive 4
1	5	5	Tape drive 5
1	6	6	Tape drive 6
N/A	7	N/A	FCO card

Figure 9. Three libraries FCO address mapping

- Termination is required for proper operation. The FCO card provides Auto termination for one end of each of its dual SCSI buses.

Connecting to the RS-232 port

The RS-232 port is used to update the firmware, configure, and monitor the FCO using a VT-100/ANSI terminal emulator. Configure the RS-232 port in your terminal emulator software using the following settings:

- Baud rate: 9600, 19200, 38400, 57600, or 115200

Note: 115200 is best for downloading firmware updates.

- Data Bits: 8
- Stop Bits: 1
- Parity: None
- Flow Control: None

To connect to the RS-232 port, complete the following procedure:

1. Using the RS-232 cable that came with the library, connect the RJ-12 end of the cable into the RJ-11 serial connector on the FCO card.
2. Connect the other end of the RS-232 cable (DB-9) to the COM port on the computer that will monitor and configure the FCO card.

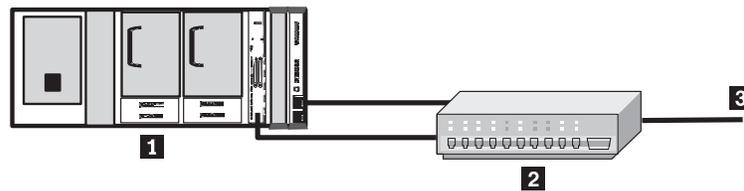
Connecting to the Ethernet port

The Ethernet (10/100BaseT) port is used to configure and manage the FCO card. This configuration option is used when you need to remotely manage the FCO equipped library through your LAN, as shown in Figure 10 and Figure 11 on page 14.

To connect to the Ethernet port, complete the following procedure:

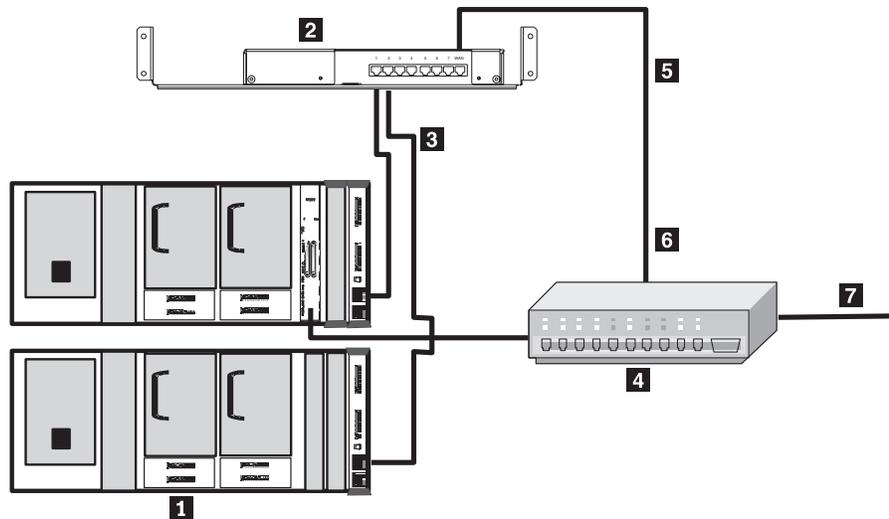
1. Connect one end of the Ethernet cable to the Ethernet port on the FCO card.
2. Connect the other end of the Ethernet cable to a network hub, router, or other network connection.

Note: The FCO Ethernet port does not connect behind the Ethernet router used for multiple module libraries.



- 1** Library
- 2** Hub
- 3** LAN

Figure 10. Single module FCO ethernet connection



- 1** Library
- 2** Router
- 3** Private LAN
- 4** Hub
- 5** WAN
- 6** Public LAN
- 7** LAN

Figure 11. Multi module FCO ethernet connection

Connecting to the Fibre Channel Port

The FCO card with SFP (Small Form Factor Pluggable transceiver) is designed to be directly attached to the IBM supported Fibre channel hub, switch, or host bus adapter (HBA).

To connect to the Fibre Channel port, complete the following procedure:

1. Turn off the library.
2. Insert the SFP into the SFP socket on the VFCO card. The SFP is keyed and can only be inserted one way, as shown in Figure 12 on page 15.

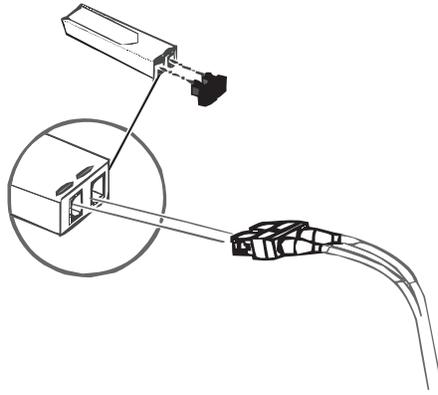


Figure 12. Small form factor pluggable

3. Be sure that the SFP locks into place.
4. Connect one end of the Fibre Channel cable to the SFP.
5. Connect the other end of the Fibre Channel cable to a server HBA or to an arbitrated loop hub or fabric switch.

Powering up the library

After you have made all of the SCSI Fibre Channel and RS-232 connections, you are ready to power up the library and all devices connected to it. For best results use a multi stage power up procedure as follows:

1. Power on the FCO equipped library.
2. Wait for the library to boot.
3. Verify all SCSI devices (Master Library Controller and tape drives) are visible to the FCO card using its RS-232 port. The FCO card will by default assign unique LUN numbers to all SCSI devices attached to its backend SCSI busses.

Chapter 3. Configuring the FCO card

This section provides step-by-step instructions for configuring the FCO card into your specific network fabric. The following key points are covered in this section:

- Accessing the FCO router administrator
- Changing additional FCO configurations
- Rebooting the FCO
- Configuring and displaying SCSI device information
- Displaying FCO information
- Upgrading firmware

In addition, you can use the Flash Utility to update the FCO firmware.

Accessing the FCO Router Administrator

You can display and change a variety of settings using the FCO Router Administrator. Using the Router Administrator for FCO, you can:

- Select Host Port (Fibre Channel) Topology and Speed
- Change the FCO card loop ID
- Change the FCO card LUN
- Change the initiator ID for each channel
- Set the SCSI channel speed
- Change SCSI channel scan delay
- Set date and time
- Restore the defaults

You can access the FCO Router Administrator using the RS-232 serial port or Ethernet port connections on the FCO. You must connect a computer with terminal emulator software, such as Hyper Terminal, to the serial port or Telnet when using the Ethernet port.

Navigating the FCO Router Administrator

You can navigate the FCO Router Administrator using your keyboard. Table 4 below describes the primary navigation and selection methods:

Table 4. Router administrator navigation

Navigation	Selections
Select a menu item	Press ↑ and ↓ and press Enter. or Press the letter that is a different color (or highlighted) in a menu item (hot key) and press Enter.
Return to the previous menu or screen without saving your changes	Press Esc or ←.
Scroll through the available choices for a setting	Press ↑ and ↓.

Note: After a few seconds of inactivity, the FCO Router Administration times out and returns to the Rotating Status screen.

Changing the screen display

After you have accessed the FCO Router Administrator, you can change the screen display using a combination of keystrokes, as shown on the System Menu. Table 5 lists the keystrokes required to change various screen displays.

Table 5. Changing the screen display

Select	Function
Ctrl-A	Toggles between ANSI and VT100 character sets (use VT100 for legacy systems)
Ctrl-B	Toggles between black, white, and color screen
Ctrl-E	Toggles between the event log, hardware information, and configuration information screens
Ctrl-H	Displays Help screen
Ctrl-R	Refreshes screen
Ctrl-Z	Escapes or quits menu

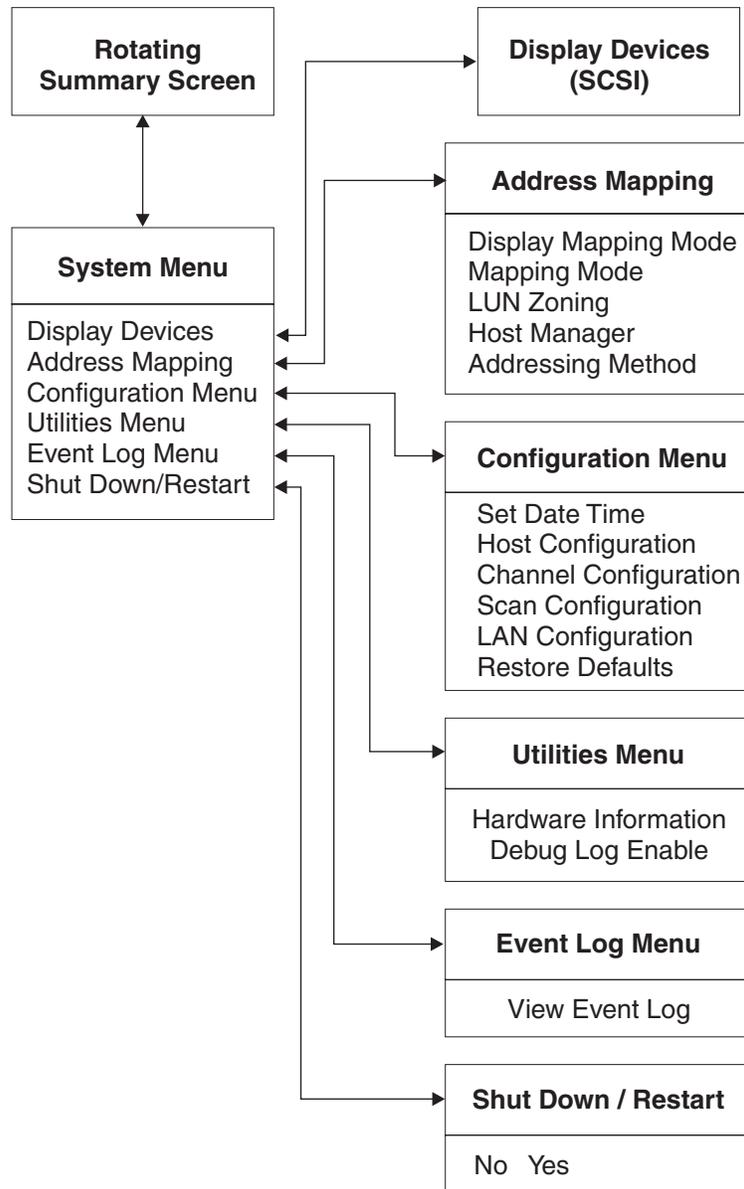


Figure 13. FCO Menu map

Accessing the FCO Router Administrator RS-232 serial port

You can access the FCO Router Administrator using the RS-232 serial port.

To access the FCO Router Administrator using the RS-232 serial port, complete the following procedure:

1. From the computer connected to the FCO card, start your terminal emulation software.

Be sure that your terminal emulation software is set to use the correct COM port on your computer. For more details on how the FCO can auto detect the baud rate, see "Terminal emulator and COM port problems" on page 55.

2. Press Ctrl-r. One of the following rotating status screens appear.

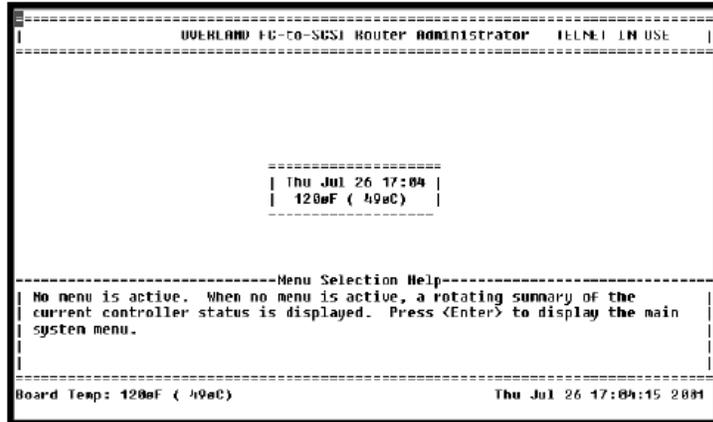


Figure 14. FCO Rotating Status screen

3. Press Enter.
The System Menu screen appears.

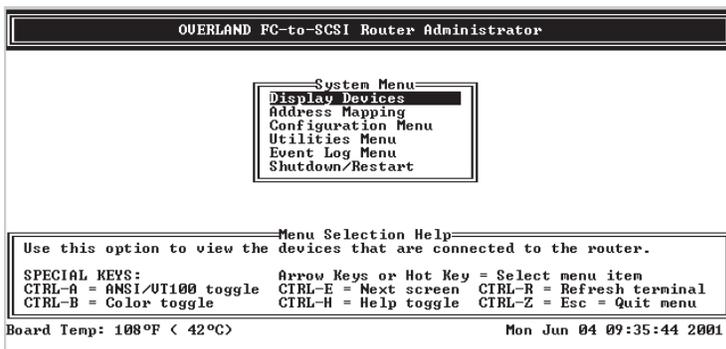


Figure 15. System Menu screen

You can now perform all of the functions described in this chapter. All steps in this chapter start from the System Menu.

If an alarm condition has occurred, you will see a message about the problem. This message will also be stored in the event log. For complete menu details, see “Changing additional FCO configurations” on page 27.

Accessing the FCO Router Administrator using Ethernet port

Note: Use the RS-232 port to configure and verify the Ethernet port setting before attempting to access the Ethernet port. For more information, see “Configuring the FCO network settings” on page 22.

You can access the FCO Router Administrator using the Ethernet port with the Telnet utility (Windows[®] 95, Windows 98, Windows NT[®], and Windows 2000 users). Before you can access the FCO Router Administrator, you must set up your computer for TCP/IP. For more information, see Appendix C, “Configuring FCO for TCP/IP” on page 71.

Note: If you try to connect more than one Telnet session at a time, you will receive an error message that a Telnet session is already opened, and your extra connections to the host will be disconnected.

To access the FCO Router Administrator using the Ethernet port and the Telnet utility, complete the following procedure:

1. At the DOS or UNIX[®] prompt, type telnet and press Enter.

Note: You must set your Telnet terminal preferences for the FCO card connection.

2. Using the Terminal menu, select **Preferences**.
3. Select the **VT100 Arrows** option, **VT-100/ANSI** emulation, and **terminal** font.
4. Select **OK**.
5. Type the IP address, or, using the Connect menu, select the FCO card IP address from the menu (if present).
6. Press Enter. The Enter Password screen appears.
7. Type your password and press Enter.

If there is no default password, just press Enter. You will be greeted by the same two rotating screens as shown in Figure 16.

8. Press Enter again to access the System Menu screen.

The System Menu screen is your entry point into the FCO Extensive Menu System.

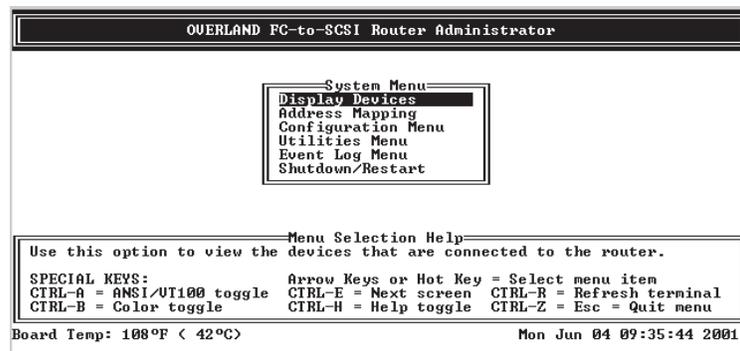


Figure 16. System Menu screen

Configuring the FCO network settings

When you access the FCO card using the RS-232 port, you must configure the FCO card for use on the LAN. To configure the FCO network settings, complete the following procedure:

1. From the System menu, select **Configuration Menu**.

The Configuration Menu screen appears.

```
=====
| OVERLAND FC-to-SCSI Router Administrator TELNET IN USE |
=====
|
|          =====System Menu=====
|          | D===Configuration Menu===
|          | A| Set Date/Time
|          | B| Host Configuration
|          | U| Channel Configuration
|          | E| Scan Configuration
|          | S| LAN Configuration
|          | R| Restore Defaults
|          |
|          =====Menu Selection Help=====
|          | View and modify Ethernet settings (if applicable).
|          |
|          =====
| Board Temp: 118°F ( 48°C) Thu Jul 26 19:12:51 2001 |
=====
```

Figure 17. Configuration Menu screen

2. From the Configuration menu, select **Lan Configuration**.

The LAN Configuration Menu screen appears.

```
=====
| OVERLAND FC to SCSI Router Administrator TELNET IN USE |
=====
|
|          =====System Menu=====
|          | D===Configuration Menu===
|          | A| S===LAN Configuration===
|          | B| H| IP Settings
|          | U| C| FTP Settings
|          | E| S| Telnet Settings
|          | S| L| SNMP Settings
|          | R| Contact Settings
|          |
|          =====Menu Selection Help=====
|          | Ethernet settings for LAN connectivity (if applicable).
|          |
|          =====
| NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE |
=====
```

Figure 18. LAN Configuration Menu screen

3. From the LAN Configuration menu, select the network value that needs to be modified. If modifications are made to the LAN configuration, use the “Reset LAN Board” option to restart the LAN port. This will not cause a reboot of the FCO, simply a restart of the LAN port.

TCP/IP Configuration screen

Table 6 on page 23 lists the parameter values that are set by the manufacturer. Some of these values may need to change prior to adding the FCO equipped library to an existing LAN.


```

=====
OVERLAND FC to SCSI Router Administrator TELNET IN USE
=====

=====System Menu=====
| D===Configuration Menu===
| A| S===LAN Configuration===
| G| H| I=====FTP Settings=====
| U| C| F| Login
| E| S| T| Password
| S| L| S| FW Upload Enable
===| R| C=====
====| Reset LAN Board |
=====

-----Menu Selection Help-----
| Select the login name you would like to use for FTP (for uploading new
| Ethernet firmware).
|
-----

NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE

```

Figure 20. FTP Settings screen

```

=====
OVERLAND FC to SCSI Router Administrator TELNET IN USE
=====

=====System Menu=====
| D===Configuration Menu===
| A| S===LAN Configuration===
| G| H| I=====Telnet Settings=====
| U| C| F| Password
| E| S| T| Timeout
| S| L| S=====
===| R| C| Contact Settings |
====| Reset LAN Board |
=====

-----Menu Selection Help-----
| Select the password you would like to use for TELNET (for remote LAN
| management).
|
-----

Board Temp: 113°F ( 45°C)                               Fri Jul 27 13:47:08 2001

```

Figure 21. Telnet Settings screen

```

=====
OVERLAND FC to SCSI Router Administrator TELNET IN USE
=====

=====System Menu=====
| D===Configuration Menu===
| A| S===LAN Configuration===
| G| H| I=====SNMP Settings=====
| U| C| F| Set Trap Host
| E| S| T| Traps Enable
| S| L| S| Read Community
===| R| C| Write Community
====| R| C| Event Filter
====| R| C| Trap Filter
=====

-----Menu Selection Help-----
| Set the IP address of the SNMP host that is capable of receiving Traps.
|
-----

Board Temp: 117°F ( 47°C)                               Thu Jul 26 20:40:26 2001

```

Figure 22. SNMP Configuration screen

This menu allows you to set the SNMP trap host, enable the traps, read or write to the SNMP community (refer to your LAN system administrator for assistance in reading or writing to SNMP community), and set filters.


```

OVERLAND FC-to-SCSI Router Administrator TELNET IN USE

-----System Menu-----
| D===Configuration Menu===
| A| S===LAN Configuration===
| G| H| I=====SNMP Settings=====
| U| C| F| Set Trap Host
==Enter Write Community==
| private|
|-----|
|====| R| Event Filter
|====| Trap Filter
|-----|

-----Menu Selection Help-----
| Set the SNMP Write password.
|-----|

Board Temp: 111°F ( 44°C)                               Fri Jul 27 22:04:09 2001

```

Figure 26. Write Community screen

```

OVERLAND FC-to-SCSI Router Administrator TELNET IN USE

-----Event Filter-----
| D=| *INFORMATIONAL |nu====
| A| | WARNING      |ation====
| G| | ERROR        |ttings=====
| U|=====st
| E| S| I| Traps Enable
| S| | S| Read Community
==| R| C| Write Community
==| R| | Event Filter
==| | Trap Filter
|-----|

-----Menu Selection Help-----
| Select the lowest level of events you would like SNMP MIB to report.
|-----|

NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE

```

Figure 27. Event Filter screen

```

OVERLAND FC to SCSI Router Administrator TELNET IN USE

-----Trap Filter-----
| D=| INFORMATIONAL |nu====
| A| | *WARNING      |ation====
| G| | ERROR        |ttings=====
| U|=====st
| E| S| I| Traps Enable
| S| | S| Read Community
==| R| C| Write Community
==| R| | Event Filter
==| | Trap Filter
|-----|

-----Menu Selection Help-----
| Select the lowest level of traps you would like SNMP MIB to report.
|-----|

Board Temp: 111°F ( 44°C)                               Fri Jul 27 22:08:46 2001

```

Figure 28. Trap Filter screen

The Contact Settings screen menu, Figure 29 on page 27, enables you to configure information that will be passed back as part of an Management Information Block (MIB).

```

=====OVERLAND FC to SCSI Router Administrator TELNET IN USE=====
|
|
|====System Menu=====
| D===Configuration Menu===
| A| S===LAN Configuration====
| G| H| I===Contact Settings=====
| U| C| F| System Name
| E| S| T| System Contact
| S| L| S| System Location
|==| R| G| System Information
|====R=====
|
|-----Menu Selection Help-----
| Enter the system name you would like to see via SNMP MIB.
|
|-----
| NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE
|

```

Figure 29. Contact Settings screen

```

=====OVERLAND FC to SCSI Router Administrator TELNET IN USE=====
|
|
|====Reset LAN Board====
| D| Are you sure? |nu====
| A| *NO |ation----
| G| YES
| U|-----
| E| S| Telnet Settings
| S| L| SNMP Settings
|==| R| Contact Settings
|====Reset LAN Board====
|
|-----Menu Selection Help-----
| Confirm that you want to execute the selected action. Select "Yes" to
| execute the action or "No" to cancel the action.
|
|-----
| NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE
|

```

Figure 30. Reset LAN Configuration screen

Changing additional FCO configurations

In addition to using the FCO Router Administrator to configure network settings, you can use it to change the following FCO configuration settings:

- Custom configure the Fibre Channel interface
 - SAN topology type (loop or fabric)
 - SAN data rate (1Gbit or 2Gbit)
 - SAN loop ID (soft or 0-125)
 - LUN value for FCO card (soft, none or 00-31)
- Change the FCO SCSI ID
- Set the date and time
- Change the scan delay
- Restore the default settings

When you change the settings for the FCO card, you will be shown the default settings marked with an asterisk and you will be asked to confirm your changes. The text 'Are you sure?' will be displayed. The default answer is *NO. This prevents accidental changes made to the router.

Changing Fibre Channel interface settings

You should be sure that the FCO card Fibre Channel interface setting is correct for your topology. Access to the Fibre Channel settings is achieved by selecting **Host Configuration** from the Configuration menu. Figure 31 on page 29 will guide you through the configuration selections for the host Fibre Channel port.

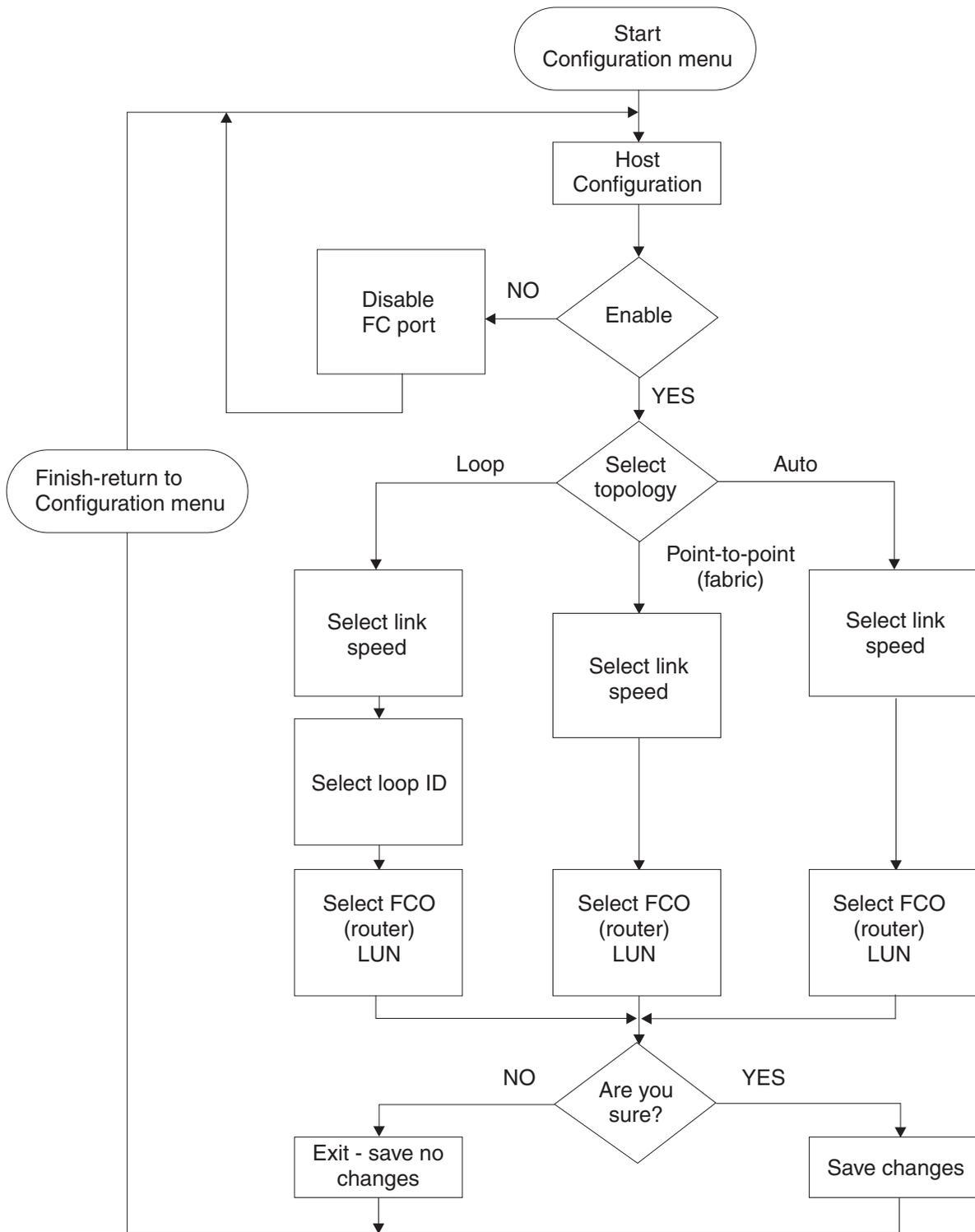


Figure 31. Fibre channel configuration flowchart

To access the Fibre Channel settings, complete the following procedure:

1. From the System menu, select **Configuration Menu** and press Enter. The Configuration Menu screen appears.

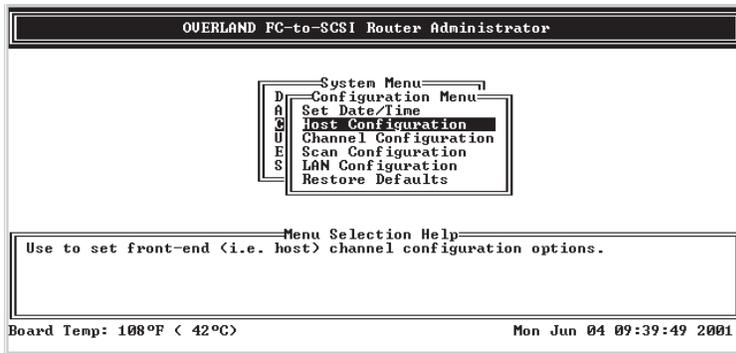


Figure 32. Configuration Menu screen

2. Select **Host Configuration** and press Enter.
The Host Configuration screen appears.

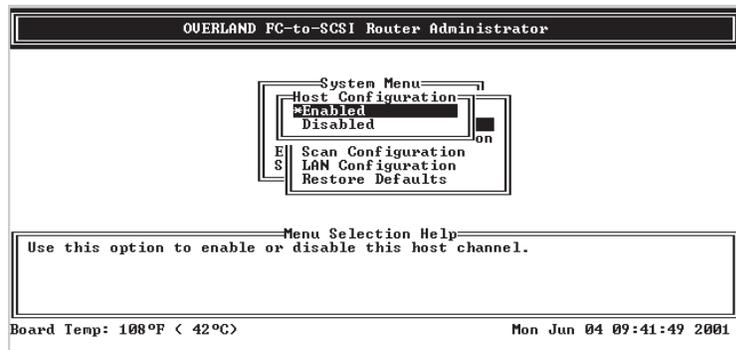


Figure 33. Host Configuration screen

3. Select **Enabled** or **Disabled** and press Enter.
The Host Configuration Topology Option screen appears.

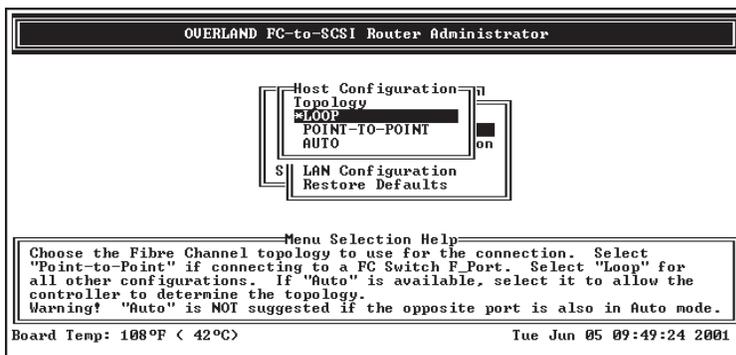


Figure 34. Host Configuration Topology Option screen

4. Select the topology that matches your configuration and press Enter.
The topology options are:
 - **LOOP**—This option is used for all configurations, except when the router is connected to a switch F-port. The default setting is LOOP.
The LOOP ID can be set in two ways, by:
 - Selecting a Loop ID from 0 to 125.

- Selecting **soft**.

This option should be used if you do not care if the router loop ID changes when you power up and down. The FC Loop initialization will determine the Loop ID.

- **POINT-TO-POINT**—Select this option if you are using the FCO card with a Switch or Fabric.
- **AUTO**—This option enables the FCO card controller to determine the topology.

Note: AUTO is not suggested if the opposite port is also in the Auto mode.

After selecting the topology, the Host Configuration Link Speed screen appears.

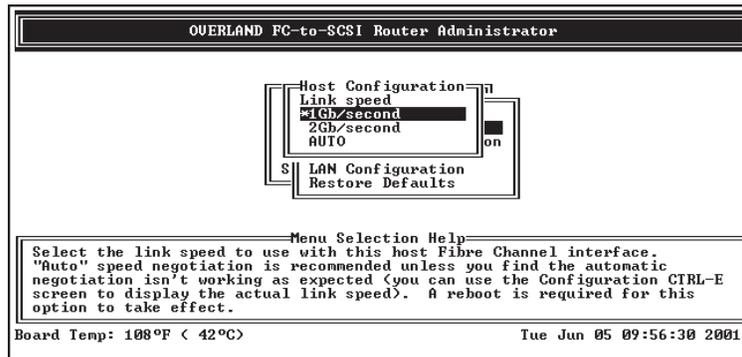


Figure 35. Host Configuration Link Speed screen

5. Select the desired link speed to use with the host Fibre Channel interface and press Enter.

The link speed options are:

- **1gb/second**—This option is used with the host Fibre Channel interface.
- **2gb/second**—This option is used with the host Fibre Channel interface.
- **AUTO**—This option enables speed negotiation. It is recommended unless you find the automatic negotiation is not working as expected. View the Configuration screen (CTRL-E) to see the actual link speed.

If you select **Loop**, the Loop ID screen appears.

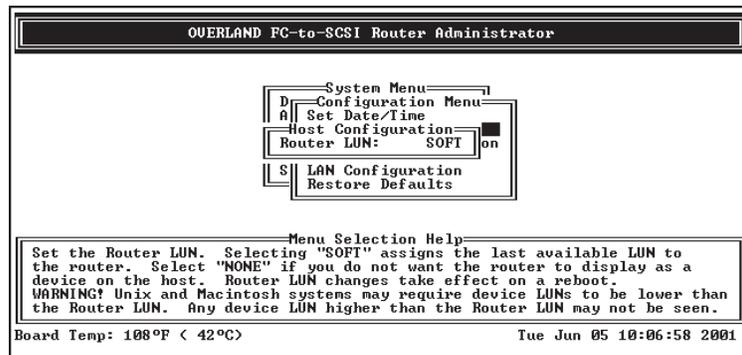


Figure 36. Loop ID screen

6. Select the Fibre Channel loop ID that the FCO will use in a loop configuration by selecting the arrows and press Enter.

The Loop ID options are:

- SOFT

Use this setting if you do not care if the FCO Loop ID changes when you power down and power up. This setting lets the FC loop initialization process determine the Loop ID.

- Any number between 0 and 125

Select a specific number if you want the Loop ID to stay the same after you power down and power up. The FCO Router Administrator cannot tell you which Loop IDs are available. To be sure that you have successfully assigned the Loop ID you want, check the Loop ID after you reboot the FCO. If the FCO cannot get the specified Loop ID during the loop initialization process, it will try to get a soft address.

During the Fibre Channel Arbitrated Loop (FC-AL) initialization process, a unique Arbitrated Loop Physical Address (AL_PA) value is assigned to each port on the Loop. Not all of the 256 hex values are allowed as AL_PA values per FC-AL, so Loop IDs are used to represent the 125 addresses that the FCO can use. See Appendix A, "Cabling and device mapping" on page 59 for more details on how the value selected for the Loop ID will correspond to AL_PA.

FCO (router) LUN

The next screen to be displayed is the Router LUN Configuration menu. This menu is used to assign a LUN (Logical Unit Number) to the FCO card.

In normal operation most input/output (I/O) is passed through the FCO card to the LUNs occupied by the library and tape drives. However, in some cases, (for example, serverless backup), the host might want to talk to the FCO as a target LUN. The FCO card LUN is used by host systems and/or applications software that want to communicate to the FCO card processor.

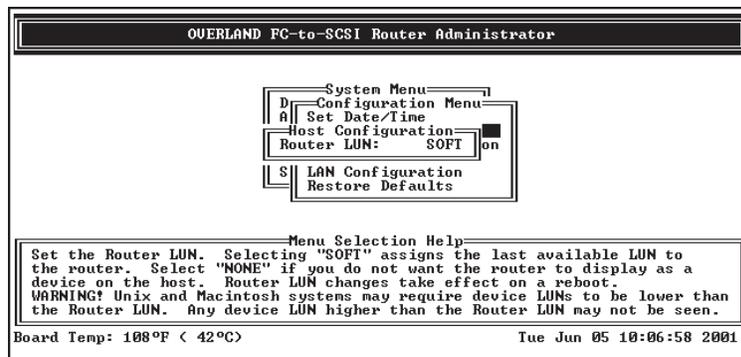


Figure 37. Router LUN Configuration screen

You can change the FCO FC LUN for specific needs. The options for setting the FC LUN are:

- SOFT

Use this setting if you do not care if the FCO FC LUN changes when new tape drives are added to the back end. This setting assigns the last available FC LUN to the FCO.

- Any number between 00 and 63

Select a specific number if you want the FCO FC LUN to stay the same when you add new devices and after you power down and power up.

- NONE

Use this setting if you do not want the FCO to display as a device on the host.

Note: Please check with IBM before changing these values.

Use the arrows to choose an LUN value to be assigned to the FCO card then press Enter.

You will be asked to confirm your host Fibre Channel port selections (topology, link speed etc.). If you answer "NO," no changes will be made to the host Fibre Channel configuration. If you answer "YES," the new values will be saved in NOVRAM. The new Fibre Channel values will not take affect until the FCO card is rebooted.

Note: If you change the topology, Loop ID, or FCO LUN, you must reboot the FCO for the change to take effect. For information on how to reboot the FCO, see "Rebooting the FCO" on page 40.

Changing the FCO SCSI Channel configuration

In most cases you will not need to alter the FCO's two back end (library side) SCSI busses from their default configuration that is shipped from the factory. The parameters that you can alter are:

- Initial SCSI Bus Speed—160 MB/sec, 80 MB/sec, 40 MB/sec; The default is 160 MB/sec.
- Domain Validation—enabled, disabled; The default is enabled.
- Initiator (FCO) SCSI ID—7, 0-15; The default is 7.

These settings are independent for both FCO SCSI channels (0 and 1). For normal use with the library no changes are required to these parameters. However, if you need to modify the FCO SCSI bus behaviors, Figure 38 on page 34 will help you navigate through the five menus that you might use to change the characteristics of the FCO independent SCSI busses.

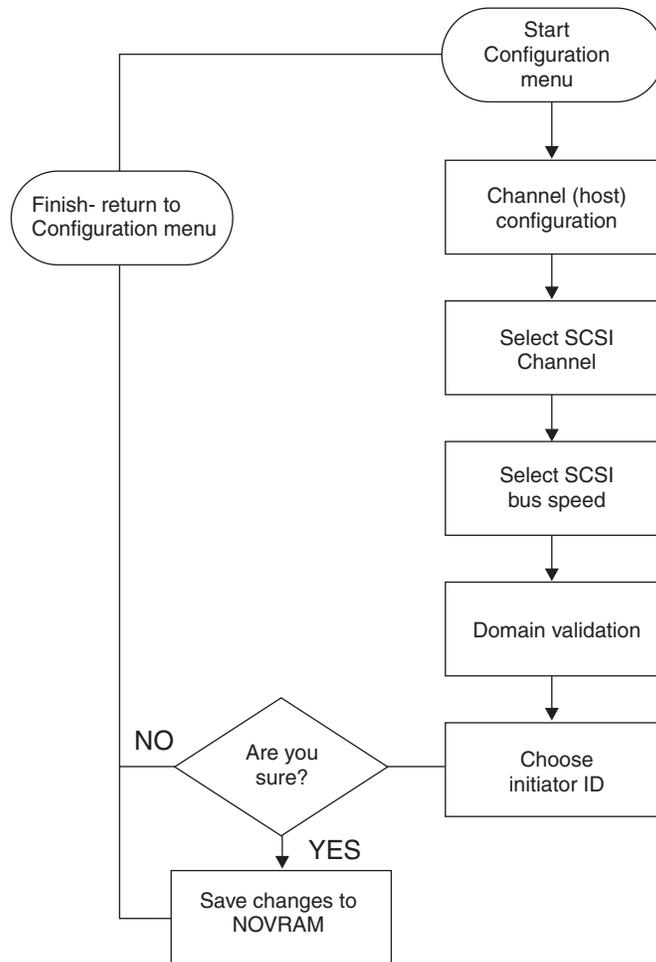


Figure 38. FCO SCSI Configuration flowchart

To change the FCO SCSI Channel configuration, complete the following procedure:

1. From the System menu, select the **Configuration Menu** and press Enter.
The Configuration Menu screen appears.

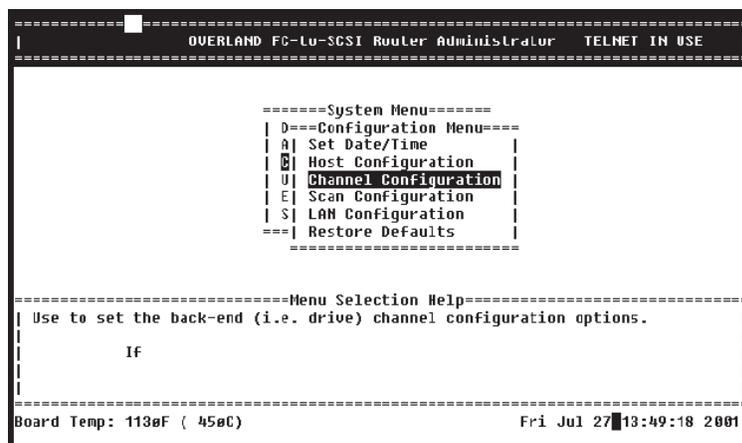


Figure 39. Configuration Menu screen

2. Select **Channel Configuration**.

The Channel Select Menu screen appears.

```
=====
OVERLAND FC-to-SCSI Router Administrator  TELNET IN USE
=====

-----System Menu-----
| 0==Configuration Menu==
--Channel Configuration--
| Channel: 0
|-----on-----
| E| Scan Configuration
| S| LAN Configuration
==| Restore Defaults
=====

-----Menu Selection Help-----
| Select the backend channel number that you wish to configure.
=====

Board Temp: 113aF ( 45aC)                               Fri Jul 27 13:50:39 2001
```

Figure 40. Channel Select Menu screen

3. Select **SCSI channel 0** or **SCSI channel 1** by using the arrow keys and press Enter.

The Bus Speed Menu screen appears.

```
=====
OVERLAND FC to SCSI Router Administrator  TELNET IN USE
=====

=====Channel: 0=====
| D=| Bus speed | nu====
| A| 160 MB/second |
| B| 80 MB/second | n
| U| 40 MB/second | tion
| E|=====n
| S| LAN Configuration
==| Restore Defaults
=====

-----Menu Selection Help-----
| Select the maximum bus speed. A slower bus speed may be helpful when
| enclosure hardware is not capable of supporting the default speed.
| WARNING! If you have drives that are not Ultra-160 capable and you
| experience disk channel problems, then set the bus speed to 80MB/s. Not all
| pre-Ultra-160 drives can handle the Ultra-160 bus speed negotiation.
=====

NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE
```

Figure 41. Bus Speed Menu screen

4. Use the arrow keys to select the bus speed and press Enter.

Note: The Bus Speed menu enables you to set the maximum rate at which the selected SCSI bus will initialize to. Tape drives that run at slower SCSI speed such as the SDLT (80 MB/sec.) or DLT 8000 (20 MB/sec.) will automatically negotiate with the FCO for the correct burst rate at which they run.

The Disable Domain Validation Menu screen appears.

```

=====
OVERLAND FC-to-SCSI Router Administrator TELNET IN USE
=====

-----Channel: 0-----
| Disable Domain Validation? |
| *NO                          |
| YES                          |
=====
| E| Scan Configuration      |
| S| LAN Configuration      |
==>| Restore Defaults        |
=====

-----Menu Selection Help-----
| Use this option to disable SCSI Domain Validation. It is used to determine |
| a reliable data transfer rate between the router and a SCSI device. Domain |
| validation should normally be enabled, since it helps to guarantee good data |
| transfers. Only disable Domain Validation if you have devices that cannot |
| support it, or if you experience Domain Validation Failures.              |
=====
NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE

```

Figure 42. Disable Domain Validation Menu screen

5. Select **YES** or **NO** by using the arrow keys and press Enter.

Note: The Domain Validation option enables you to disable the SCSI messaging system the FCO card uses for negotiating the bus speed for the back end SCSI busses. All current tape drive technology shipping with the library supports Domain Validation. No change is required for normal operation.

The Initiator ID Menu screen appears.

```

=====
OVERLAND FC to SCSI Router Administrator TELNET IN USE
=====

-----System Menu-----
| D==Configuration Menu== |
| A| Set Date/Time        |
| -----Channel: 0----- |
| | Initiator ID: 7 |tion |
| -----n                 |
| | S| LAN Configuration  |
| ==>| Restore Defaults    |
=====

-----Menu Selection Help-----
| Select the controller's initiator ID for this backend channel. For SCSI, |
| this is a SCSI ID. For Fibre Channel, this is the Fibre Channel loop ID. |
=====
NOTE: LOCAL SERIAL TERMINAL IS READ-ONLY BECAUSE TELNET IS IN USE

```

Figure 43. Initiator ID Menu screen

6. Select the initiator ID, using the arrow keys and press Enter.

Note: The Initiator ID option enables you to change the SCSI ID occupied by the FCO card on the selected SCSI bus. The default ID setting is 7, which is the highest priority on the SCSI bus. No change is required for normal operation.

The Confirm Modifications screen appears.

```

=====
OVERLAND FC to SCSI Router Administrator TELNET IN USE
=====
-----Channel: 0-----
| D=| Are you sure? |enu===
| A| NO          |
| C| YES         |
| U|             |on
| E| Scan Configuration
| S| LAN Configuration
==| Restore Defaults
=====

-----Menu Selection Help-----
| Confirm that you want to execute the selected action. Select "Yes" to
| execute the action or "No" to cancel the action.
|
=====
Board Temp: 111°F ( 44°C)                               Sat Jul 28 14:45:01 2001

```

Figure 44. Confirm Modifications screen

Changing the FCO date (Real Time Clock)

To set the FCO date, complete the following procedure:

1. From the System menu, select **Configuration Menu** and press Enter.
The Configuration Menu screen appears.

```

=====
OVERLAND FC-to-SCSI Router Administrator TELNET IN USE
=====
-----System Menu-----
| D==Configuration Menu==
| A| Set Date/Time
| C| Host Configuration
| U| Channel Configuration
| E| Scan Configuration
| S| LAN Configuration
==| Restore Defaults
=====

-----Menu Selection Help-----
| Set current system date or time.
|
=====
Board Temp: 111°F ( 44°C)                               Sat Jul 28 15:38:24 2001

```

Figure 45. Configuration Menu screen

2. Select **Set Date/Time** and press Enter.
The Set Date/Time screen appears.

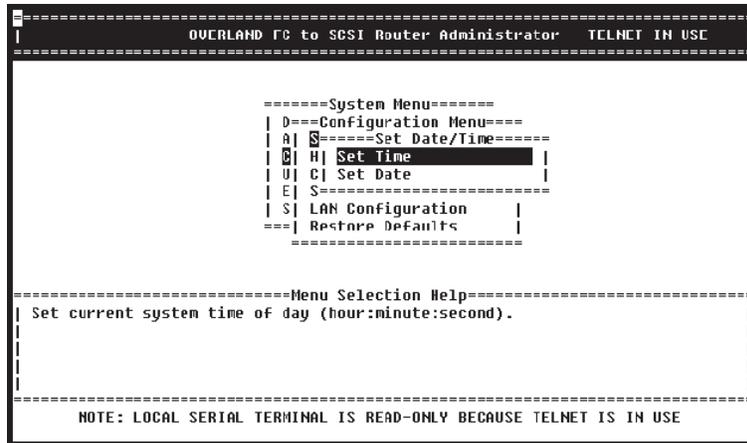


Figure 46. Set Date/Time screen

3. Select **Set Date** and press Enter.
The Set Date screen appears.

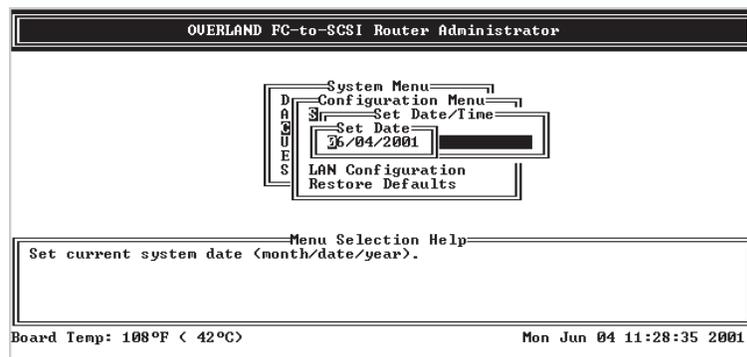


Figure 47. Set Date screen

4. Type the date in the following format: MM/DD/YYYY. The system confirms that you want to make the change.
5. Select **Yes** and press Enter to make the changes. The system confirms that the changes are made.
6. Press Enter to return to the Configuration menu.

Changing the FCO time (real time clock)

To set the FCO time, complete the following procedure:

1. From the System menu, select **Configuration Menu** and press Enter. The Configuration Menu screen appears.
2. Select **Set Date/Time** and press Enter. The Set Date/Time screen appears.
3. Select **Set Time** and press Enter.
The Set Time screen appears.

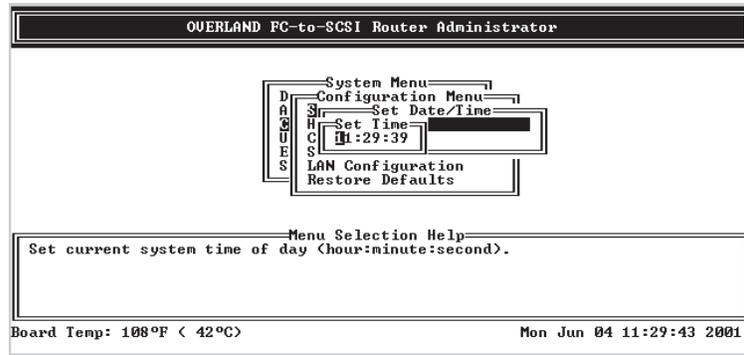


Figure 48. Set Time screen

4. Type the time in the following format: hh:mm:ss. The system confirms that you want to make the change.
5. Select **Yes** and press Enter to make the changes. The system confirms that the changes are made.
6. Press Enter to return to the Configuration menu.

Changing the FCO SCSI scan delay

You can control how long the FCO waits before scanning its two SCSI channels for the library robotics and tape drives. You might want to change this setting if you have devices that take longer to come ready than the FCO card.

To change the scan delay, complete the following procedure:

1. From the System menu, select **Configuration Menu** and press Enter. The Configuration Menu screen appears.
2. Select **Scan Configuration** and press Enter. The Scan Configuration screen appears.

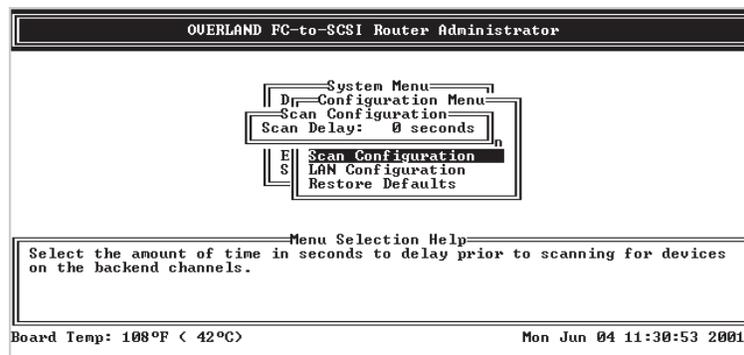


Figure 49. Scan Configuration screen

3. Select the number of seconds you want the FCO card to wait and press Enter. You can select any number between 0 and 255. The system confirms that you want to make the changes.
4. Type **Yes** and press Enter to make the changes. The system confirms that the changes are made.
5. Press Enter to return to the Configuration menu.

Notes:

1. The FCO default scan delay is set at 0 seconds. Please consult with IBM technical support before change from the default scan delay.
2. When using DLT8000 tape drives in an FCO configuration, set the Scan Delay to 30 seconds to ensure proper operation.

Restoring the default settings

You can restore all of the FCO default settings. You may want to do this if the FCO is not working properly and you cannot determine why. This lets you then change the settings that are critical to your configuration, specifically the topology.

See “Key FCO card fibre and SCSI default settings” on page 3 for a table of the default settings.

To restore the default settings, complete the following procedure:

1. From the System menu, select **Configuration Menu** and press Enter. The Configuration Menu screen appears.
2. Select **Restore Defaults** and press Enter.

The Restore Defaults window opens. The selected option is marked with an asterisk (*) next to it.

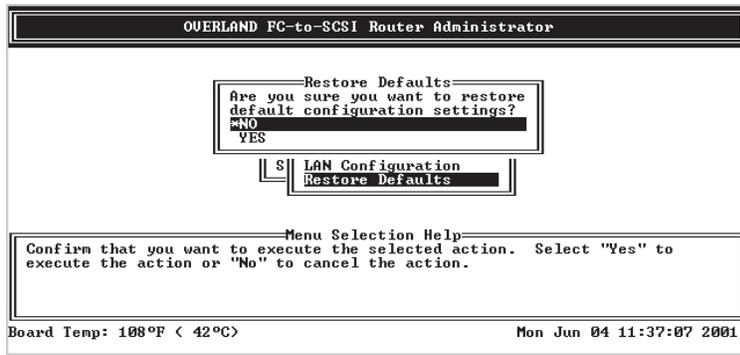


Figure 50. Restore Default screen

3. Select **Yes** and press Enter to make the change. The system confirms that the changes are made.
4. Press Enter to return to the Configuration menu.

Note: Restoring default settings will not affect controller LUN and LAN configurations.

Rebooting the FCO

You must reboot the FCO after you change the topology, Loop ID, or FCO card LUN. You should also reboot the FCO when you connect new devices.

To reboot the FCO, complete the following procedure:

1. From the System menu, select **Shutdown/Restart** and press Enter.
The system confirms that you want to shut down.
2. Select **Yes** and press Enter.

The system confirms that it has shut down.

3. Press Enter to reboot.

The system performs its self-test. When you see the Router Administrator initial screen, the FCO card is ready. For more information, see “Accessing the FCO Router Administrator” on page 17.

4. If you are connected Telnet, disconnect and reconnect the Telnet session.

Configuring and displaying SCSI device information

You can change and display information about the devices connected to the FCO using the Router Administrator.

Note: Changing device information should be done on an application specific basis. Check with IBM technical support prior to making any device changes.

Following is a list of the SCSI device information that you can change and display:

- Change the mapping mode (AUTO or FIXED)
- Change device address
- Set up LUN zoning
- Display the devices attached to the FCO card
- Display the FC-to-SCSI address map

The FCO card provides a bridging function between the Fibre channel SAN based hosts and the LVD SCSI based library with tape drives. The FCO in addition to bridging between Fibre channel and SCSI also provides mapping between its Fibre Channel Port (front end) and devices attached to its SCSI (back end) channels. The simplified diagram below illustrates this relationship.

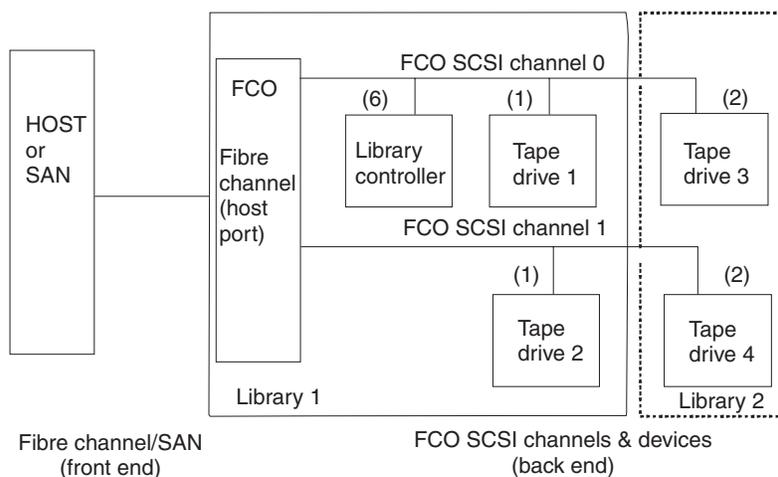


Figure 51. FCO SCSI channels/devices (back end)

To the Fibre Channel/SAN front end, the FCO equipped library appears as a Fibre channel port at a given port ID. Devices on a SAN (Loop or Fabric) like SCSI, uses a two level addressing scheme (Target ID, LUN for SCSI). In the case of Fibre, we have the Port ID and LUNs. The Port ID for loops can be set in one of two ways. The first is a Soft ID, which is assigned each time the device is powered up or reset on the loop (much like the DHCP function in networking). A hard Port ID can also be assigned to the FCO card.

The Library Controller along with its resident tape drives are identified to the FCO card by means of their respective SCSI Target IDs (SCSI Target IDs for tape drives are assigned automatically by the library following a power up).

Following a power up, the FCO card, by default, automatically maps back end SCSI IDs to front end Fibre Channel Port LUNs if the Addressing Mode is left in Auto. The FCO card offers tremendous customizable flexibility when it comes to mapping backend SCSI IDs to front end Port LUNs.

This section describes the Menu systems used to display and alter the Device mapping performed by the FCO card.

To display or alter device mapping performed by the FCO card, select **Address Mapping** from the System menu and press Enter.

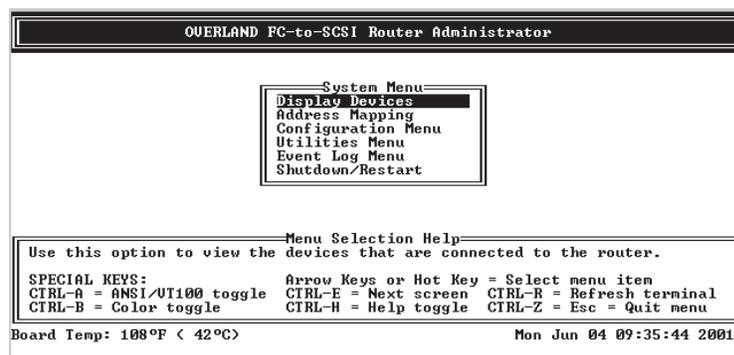


Figure 52. System Menu screen

The Address Mapping menu is now displayed. You may use the UP/DOWN arrow keys to select the Address function you want to perform, followed by pressing Enter to access the next sub menu. If you select the **Display Address Map** option and press Enter, you are taken to the Display Address Map screen.

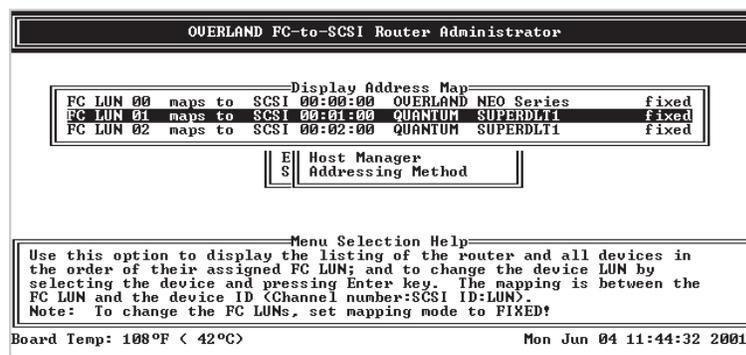


Figure 53. Address Mapping screen

Note: If you were attached to the multi-module library with several more drives, an additional listing for each additional drive would appear. In this example a single module library controller with a single SDLT drive were both connected to SCSI channel 0.

The Display Address Map screen has four key fields that convey the current map that FCO card uses when responding to a host request. The key fields are:

- FC LUN field
- SCSI Address field
- SCSI Device field
- Device Addressing Mode field

FC LUN field

The FC LUN field indicates the FC LUN under the FC PORT ID (XX) the attached SCSI device would be accessed. In this example, if a host wanted to issue a “Move Media” command to the library, it would send the command to Port ID XX, LUN 1. If the Host wanted to send a “Rewind” command to the SuperDLT1 drive it would send the command to Port ID XX, LUN 00.

Note: The FC LUN may be changed for devices that are in the Fixed mode of addressing.

SCSI Address field

The SCSI Address field displays the SCSI Channel, SCSI Target ID, and LUN occupied by the device on the FCO back end SCSI busses. In this example, the Library Controller resides at Channel 00, Target ID 06, LUN 00 of the FCO’s backend system.

SCSI Device field

The SCSI Device field displays the Inquiry data that is returned by the device at the SCSI address listed in the SCSI Address field. In this example, the library resides on SCSI channel 0, Target ID 6, and LUN 00.

Addressing Mode field

The Addressing Mode field displays the current addressing scheme applied by the FCO card to the SCSI device attached to it. When a device is in the Auto mode, a device FC LUN value may change as SCSI devices are added or removed and a reboot of the FCO card occurs.

The Addressing Mode field is a very important field. To perform any of the enhanced addressing features such as LUN Masking, or FC LUN to Device remapping those devices must be in the fixed mode of operation. This will also alter the behavior of the Display Address Map menu. Devices in the Fixed Mode enable you to edit the FC LUN field from the Display Address Map menu while devices in the Auto mode are displayed.

Note: With the HOT SWAP capability of the library, it is strongly recommended that devices be configured for the Fixed mode of Addressing providing consistent mapping back to the host system and backup software.

Changing the mapping mode (AUTO or FIXED)

You can change how the FCO maps the addresses of the devices on the SCSI channels to FC LUNs. The options for the mapping mode are:

Note: These options affect both SCSI channels on the FCO card.

- **AUTO**—This option lets the FCO assign an FC LUN to each device anytime you power up the FCO. The FCO maps sequentially as it scans the channels and discovers devices (devices are discovered by channel, lowest SCSI ID and LUN

first). Devices are mapped to FC LUNs, starting from LUN 0 to LUN 63 (64 LUNs are supported). The default setting is AUTO.

- **FIXED**—This option locks the current mapping for each device. This reserves the devices' same FC LUN over power cycles (SCSI channel:target:LUN combination), even when you power down and power up the FCO. The FCO also retains the mapping, if the devices are added, moved, or removed. The FIXED mode is recommended for environments where device configuration may change and a FIXED mapping from the application to the target devices is required. Devices added after selecting FIXED will be automatically mapped to an available FC LUN.

For example, a tape drive would map to the same FC LUN if the tape drive at a particular SCSI channel:target:LUN is replaced with a tape drive at the same SCSI channel:target:LUN.

To change the mapping mode:

1. From the System menu, select **Address Mapping** and press Enter.
The Address Mapping screen appears.

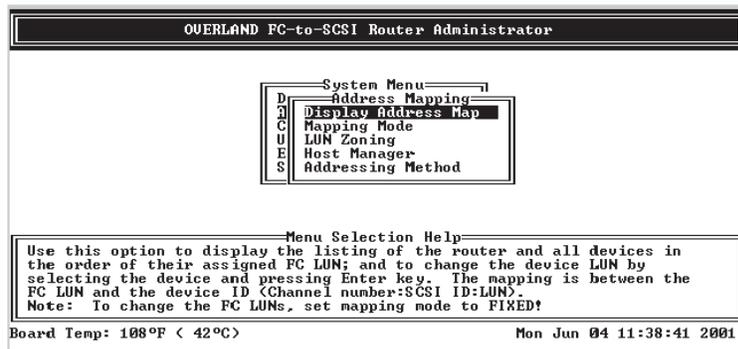


Figure 54. Address Mapping screen

2. Select **Mapping Mode** and press Enter.

The Mapping Mode screen displays. The current setting is marked with an asterisk (*) next to it.

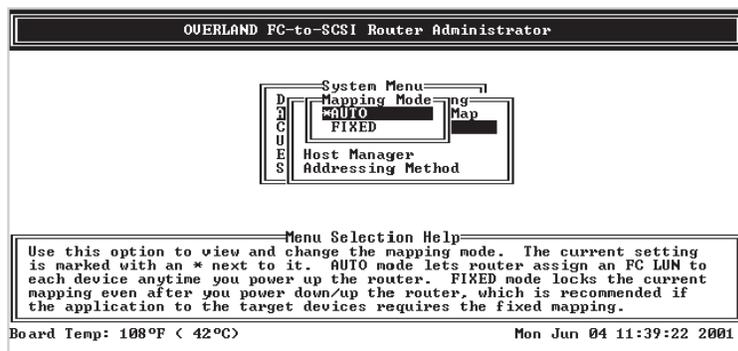


Figure 55. Mapping Mode screen

3. Select the option you want and press Enter.

- **AUTO**—This option lets the FCO assign the FC LUN to each device anytime you power up the FCO card.

- **FIXED**—This option tells the FCO to keep the same FC LUN as currently assigned for each device. This reserves the same FC LUN for each device, even when you power down and power up the FCO. The FCO retains the FC LUN, even if the device is no longer connected.

The system confirms that the changes are made.

4. Press Enter to return to the Address Mapping screen.

Changing device addresses (FC LUNs)

You can change the FC LUN for any device connected to the FCO. You can only change the FC LUNs when the address mapping mode is set to **FIXED**. As long as you stay in **FIXED** mode, all FC LUNs you change will be retained even if the device or FCO is powered off and back on or if the tape drives or library robotics are removed and reconnected.

You can set the FC LUN for devices to any number between 00 and 63 by selecting the FC LUN that you want the device to map to. You cannot select the same FC LUN as the FCO's LUN.

When in **FIXED** mode, the FCO will discover any new devices or existing devices that were removed and reconnected to a different location. These newly discovered devices will be in **AUTO** mode and will be assigned an FC LUN by the FCO. You can change these FC LUNs by following the steps below.

If you assign an FC LUN that is already in use, the FC LUNs for the two devices are swapped. For example, if device A has LUN 01 and device B has LUN 03, and you assign 03 to device A, the LUN for device B becomes 01.

For additional information about address mapping, see Appendix A, “Cabling and device mapping” on page 59.

To change the device FC LUNs, complete the following procedure:

1. Set the address mode to **FIXED**. For more information, see “Changing the mapping mode (AUTO or FIXED)” on page 43.
2. From the System menu, select **Address Mapping** and press Enter. The Address Mapping screen appears.
3. Select **Display Address Map** and press Enter. The Display Address Map screen appears.

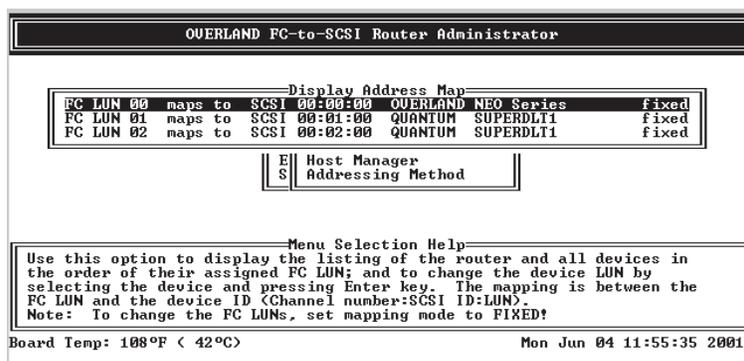


Figure 56. Display Address Map screen

4. Select the device whose LUN you want to change and press Enter. The Change Address Map screen displays. The text inside the angle brackets < > shows the current FC LUN.

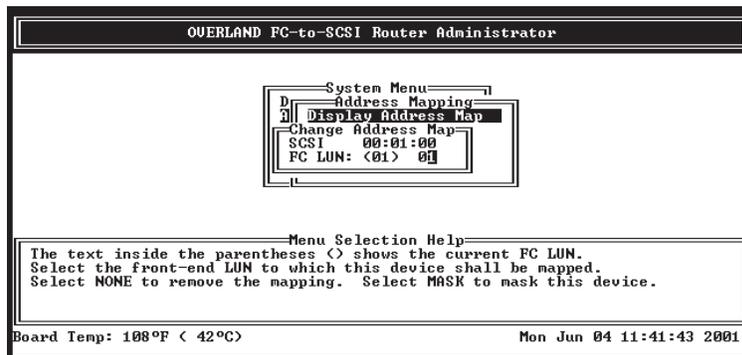


Figure 57. Change Address Map screen

5. Select the FC LUN number you want to use for this device and press Enter. You can select any number between 00 and 63. The system confirms that you want to make the changes.
6. Select **Yes** and press Enter to make the changes. The system confirms that the changes are made.
7. Press Enter to return to the Address Mapping screen.

Displaying the devices connected to the FCO

You can display a list of the SCSI devices connected to the FCO. Currently, the list only includes the first 15 devices on each channel. To display a list of all devices, see “Displaying the FC-to-SCSI address map” on page 47.

The list includes the following information for each device:

- SCSI channel number (0 or 1)
- SCSI ID (0-15)
- LUN (normally 00)
- Device type number (from the SCSI inquiry data)
- Bytes 8 through 31 of the standard SCSI inquiry data, which normally includes:
 - Vendor ID
 - Product ID

To display the devices connected to the FCO card, complete the following procedure:

1. From the System menu, select **Display Devices**. Press Enter. The Display Devices screen appears.

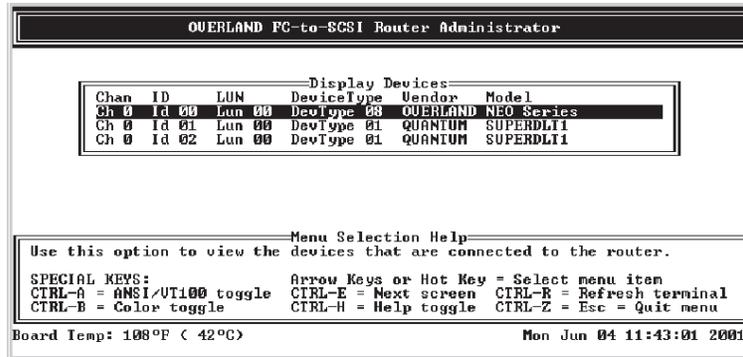


Figure 58. Display Devices screen

2. Press Esc to return to the System menu.

Displaying the FC-to-SCSI address map

You can display the FC-to-SCSI address map for all of the SCSI devices connected to the FCO. The address map includes the following information for each device:

- FC LUN
- Device ID (Channel number:SCSI ID:LUN)
- Bytes 8 through 35 of the standard SCSI inquiry data, which normally includes:
 - Vendor ID
 - Product ID
- Mapping mode

The address map lists devices in ascending order based on the FC LUN, including the FCO itself if it has an FC LUN assigned to it. For additional information about address mapping, see Appendix A, “Cabling and device mapping” on page 59.

To display the address map, complete the following procedure:

1. From the System menu, select **Address Mapping** and press Enter. The Address Mapping screen appears.
2. Select **Display Address Map** and press Enter. The Display Address Map screen appears.

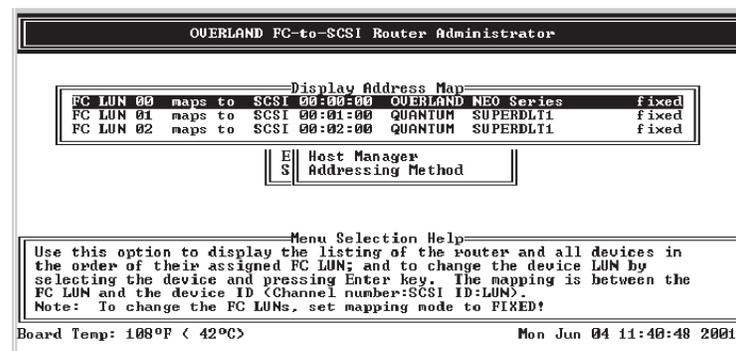


Figure 59. Display Address Map screen

3. Press Esc to return to the Address Mapping screen.

Displaying FCO information

You can display important information about the FCO using the Router Administrator, including:

- Event log
- Hardware and configuration information
- FCO's LUN

Displaying the event log

The FCO event log contains important information about the status of the FCO. Below is a list of the events included in the log.

- Restore defaults
- Config changed
- Cntrl params set
- FCO shutdown
- Power up
- Firmware update
- Temperature warning
- Temperature failure (this leads to a shutdown of FCO which is logged as a shutdown)
- Voltage warning
- Voltage failure (this leads to a shutdown of FCO which is logged as a shutdown)

You should check the log regularly. The event log stores the most recent 400 events. Events are numbered from 001 to 999. The numbering wraps back to 001 after reaching 999.

Note: If you are having a problem with the FCO, check the event log before calling technical support. Event messages may let you resolve the problem without calling.

You can view the event log two ways:

- One event at a time, with the most recent event first.
- Full page of events at a time.

You can also capture the text to a file, as described in "Event Log file capture" on page 57.

To display one event at a time:

1. From the System menu, select **Event Log Menu** and press Enter.
The Event Log Menu screen displays.



Figure 60. Event Log Menu screen

2. Select **View Event Log** and press Enter.
The Event Log screen displays the last event that occurred.

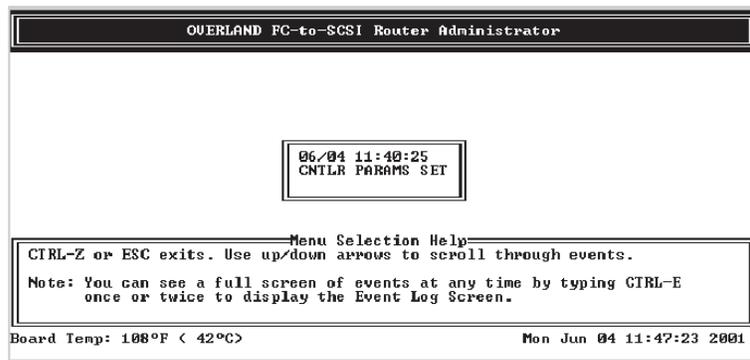


Figure 61. Event Log screen

3. Press **↑** to see the previous event.
You can continue to view earlier events by pressing **↑**.
4. Press **Esc** to return to the Event Log menu.

To display a full page of events:

1. From anywhere in the FCO Router Administrator, press **Ctrl-e**.
The first screen of events from the event log displays.

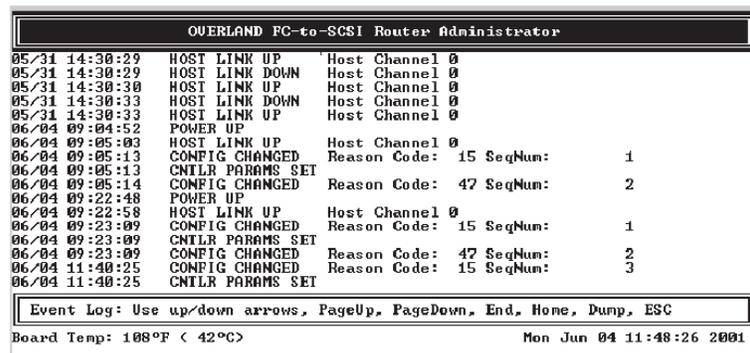


Figure 62. Screen of events

2. Press **d** to page down or **u** to page up in the log.
3. Press Esc to return to where you started from.

Displaying hardware and configuration information

You can display the FCO hardware and configuration information. This is where you can see what version of the firmware you have. IBM technical support personnel might request this information.

You can display the hardware and configuration information two ways:

- Hardware information only
- Hardware and configuration information

Table 7. Configuration information

Group	Field	What displays	Field	What displays
HOST	Topology	Loop or Point-to-Point based on the topology set in the FCO Router Administrator. If set to Loop, the FCO is attached to the public loop (FCO is attached to the FL-port of a switch) or a private loop.		
	Node WWN	FC World Wide Name for node		
	Port WWN	FC World Wide Name for node		
	FC Addr	24-bit FC address or None	AL_PA, if the topology is LOOP.	Currently assigned value or None if the FC link is not active
	Loop ID, if the topology is LOOP	SOFT or a specific number as set in the FCO Router Administrator	Current	Currently assigned value if the topology is LOOP, or inactive if the FC link is not active
	VIA FCO card LUN	SOFT, NONE, or specific number as set in the FCO Router Administrator	Current	Currently assigned value or inactive if the FCO LUN is set to NONE
CHAN 0	Initiator ID	SCSI ID of FCO card on channel 0 as set in the FCO Router Administrator	Ultra/U3	Hardware runs as Ultra3
	Termination	Hardware setting: ON	Term Power	FCO supplies termination power
CHAN 1	Initiator ID	SCSI ID of FCO card on channel 1 as set in the FCO Router Administrator	Ultra/U3	Hardware runs as Ultra3
	Termination	Hardware setting: ON	Term Power	FCO supplies termination power
VIA FCO	Alarm	ENABLED or DISABLED as set in the FCO Router card Administrator		

Table 7. Configuration information (continued)

Group	Field	What displays	Field	What displays
CAPI	Version	Version of the Configuration Application Programming interface		
FC LIB	Version	Version of the FC library		

To display hardware information only:

1. From the System menu, select **Utilities Menu** and press Enter.
The Utilities Menu screen appears.

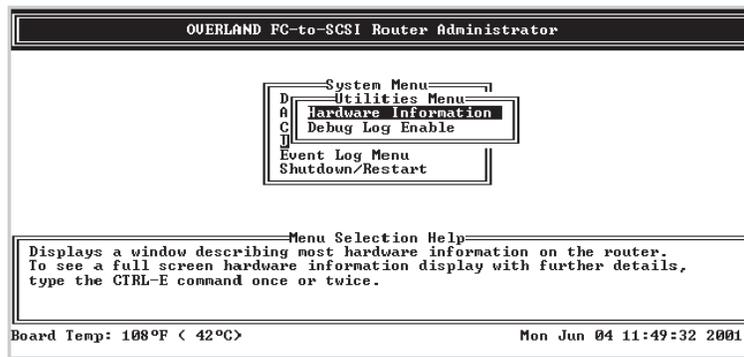


Figure 63. Utilities Menu screen

2. Select **Hardware Information** and press Enter.
The Hardware Information screen appears.

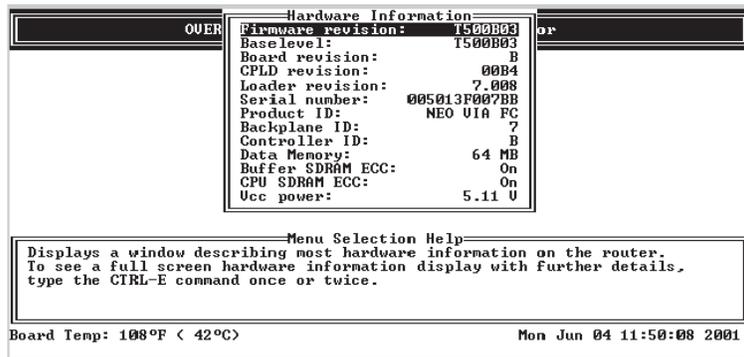


Figure 64. Hardware Information screen

3. Press Esc to return to the Configuration menu.

To display hardware and configuration information:

1. From anywhere in the FCO Router Administrator, press Ctrl-e.
The first screen of events from the event log appears.
2. Press Ctrl-e again.
The Hardware Information screen appears.

```

OVERLAND FC-to-SCSI Router Administrator
Firmware revision: T500B03          LAN Connection: Installed
Baselevel: T500B03                LAN Hardware Status: Up
Board revision: B                  LAN Firmware Revision: v2.0
CPLD revision: 00B4               LAN Firmware Version: M200BETA
Loader revision: 7.008            LAN Firmware Build Time: May 7 2001 11:00
Serial Number: 005013F007BB      Ethernet Physical Address: 00-50-13-f0-07-bb
Product ID: NEO V1A FCO          IP Address: 192.168.010.233
Backplane Type ID: ?             Default IP Address: 192.168.010.233
GPIO Bits: FF                    Subnet Mask: 255.255.255.000
Controller ID: A Primary         Default Mask: 255.255.000.000
Data Memory: 64 MB              Gateway: 000.000.000.000
Buffer SDRAM ECC: On            SNMP Trap Host: 000.000.000.000
CPU SDRAM ECC: On               DHCP: Disabled
                                FTP Firmware Upload: Enabled
                                UCC: 5.11 U                    Telnet timeout: 0 minutes
                                2.5U(A): 2.50 U                SNMP Traps: Disabled
                                2.5U(B): 2.49 U                SNMP Event Filter: INFO
                                BUFFER: 3.28 U
HW Info: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC
Board Temp: 108°F < 42°C                      Mon Jun 04 11:53:14 2001

```

Figure 65. Hardware Information screen

3. Press Ctrl-e again.
The Configuration Information screen displays.

```

OVERLAND FC-to-SCSI Router Administrator
HOST Active Port      FC Speed: 1Gb/s      Current = 1Gb/s
Topology: Loop       Current = Private Loop
GBIC Receive Status: Signal present
Node WVN = 1000005013F007BB
Port WVN = 2000005013F007BB
Loop ID: 1
FC Addr = 0000E8     AL_PA = E8
Router LUN: NONE     Inactive      [Host Errors = 0]
CHAN 0 Initiator ID: 7
Bus Speed: 160
Domain Validation: Enabled
CHAN 1 Initiator ID: 7
Bus Speed: 160
Domain Validation: Enabled
ROUTER Scan Delay: 0 Active ExtCopy Jobs = 0
MappingMd: FIXED AddrMethod: PDA
StandAlone = 1 DualPort = 0
CFG Info: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC
Board Temp: 108°F < 42°C                      Mon Jun 04 11:54:11 2001

```

Figure 66. Configuration Information screen

4. Press Esc to return to where you started from.

Upgrading firmware

You can upgrade the firmware for the FCO and the Ethernet port in the FCO.

Information regarding the latest release of firmware and firmware updates is available from the IBM Web site <http://www.pc.ibm.com/support/> then search for "4560SLX".

Chapter 4. Troubleshooting

Resolutions to common problems you may encounter are described in this chapter. This section describes troubleshooting using the RS-232 serial port.

The following key points are covered in this chapter:

- Problems during bootup
- Restoring the default configuration through the Flash Utility
- Terminal emulator and COM port problems
- Device SCSI channel problems
- FCO is not responding
- Using the Loader Diagnostics menu
- Using the Loader Utility menu
- Event logs
- Event log file capture
- Voltage and temperature errors and warnings

Problems during bootup

The following section describes problems you might encounter during Power On Self-Test (POST) or during bootup and explains how to resolve those problems.

FCO onboard memory test

When this failure occurs, it means the internal CPU memory failed. Replace the FCO to correct the problem.

System hangs at loading bridge during Flash Loader Menu

Reflash the firmware to ensure you are using the latest version. For more information, see “Upgrading firmware” on page 52. If you cannot update the firmware or if the updated firmware does not correct the problem, replace the FCO.

Single POST diagnostic test fails

Use the information in Table 8 to find solutions to a particular diagnostic failure. First confirm any failure that you encounter by running the individual test from the Diagnostics menu. For more information, see “Using the Loader Diagnostics menu” on page 56.

Table 8. POST diagnostic errors and solutions

Diagnostic Failure	Solutions
Default hardware register	Replace the FCO.
Default chip set register	Replace the FCO.
Voltage/temperature	<ul style="list-style-type: none">• Check for thermal problems in the environment.• Check for any airflow obstruction around the library intake and exhaust vents.• Replace the FCO.

Table 8. POST diagnostic errors and solutions (continued)

Diagnostic Failure	Solutions
Local DRAM memory test	Replace the DIMM.
LVDS BIST	Replace the FCO.
PCI configuration verification	Replace the FCO.
SCSI device scratch RAM	Replace the FCO.
I ² C chip	Replace the FCO.
Buffer memory	Replace the FCO.
Programmable interval timer	Replace the FCO.
Real-time clock chip	Replace the FCO.
Fibre Channel interface test	<ul style="list-style-type: none"> • Check the firmware to make sure it matches the hardware configuration. If you need to update the firmware, see “Upgrading firmware” on page 52. • Replace the FCO.

Restoring the default configuration through the Flash Utility

You can clear the FCO configuration and restore all FCO default settings without accessing the FCO Router Administrator. You may want to do this if the FCO is not working properly or the FCO hangs after the “All diagnostic tests passed” message, as shown on the following screen.

```

Local DRAM memory test           passed.
LVDS Device 6 Function 0 BIST    passed
LVDS Device 2 Function 0 BIST    passed
LVDS Device 6 Function 1 BIST    passed
LVDS Device 2 Function 1 BIST    passed
PCI configuration verification test passed.
SCSI device scratch RAM check     passed.
I2C chip test                     passed.
64MegBit technology detected:
Rows = 12 Cols = 9
DimmBanks = 1, DeviceBanks = 4
ECC Enabled
SDRAM Size = 64 MegaBytes
Buffer memory test               passed.
Programmable interval timer test  passed.
Real time clock chip tests        passed.
Fibre Channel chip tests          passed.

Searching for FC Chips...
  Found a Rio Rev 1.....
  Found a Rio Rev 1.....
Fibre Channel interface tests     passed.

All diagnostic tests passed.
  
```

Figure 67. FCO diagnostic message

Restoring the default configuration

To restore the default configuration, complete the following procedure:

1. After powering on the system, hold down the space bar to prevent the system from rebooting.

The Flash Utility Menu screen appears.

```
Flash Utility
Local Memory Test Passed.
Configuration OK.
FLASH LOADER v6.011 - Nov 17 2000 11:36:59
Select Protocol
1. FAST BINARW
2. KERMIT
3. XMODEM

4. Run diagnostics
5. Run controller
6. Utility Menu
X. Reboot
-
```

Figure 68. Flash Utility Menu screen

2. Select **6. Utility Menu** and press Enter.
The Utility Menu screen appears.
3. From the Utility Menu, select **2. Clear Configuration** and press Enter.
4. The system confirms that you want to make the change. Enter **Y** to confirm and press Enter to clear the configurations.
5. The system confirms that the changes are made.
6. Type **q** to quit the Utility menu.
7. Select **5. Run Bridge** to verify the configurations have been cleared.

Terminal emulator and COM port problems

This section provides solutions for terminal emulator and COM port problems.

Screen continuously displays erroneous characters

The likely cause of this problem is a baud rate mismatch between the terminal emulator and the FCO card. Set the terminal emulator to the default baud rate (115,200 bps). If you still get garbage characters, complete the following procedure:

1. Turn off the power to the FCO card.
2. Press the spacebar of your terminal emulator.
3. Turn on the power while continuing to press the spacebar. This will allow the FCO card to auto-detect the baud rate setting.
4. When the Flash Utility appears, select **5. Run Bridge** to continue to boot the FCO card.

Note: Some terminal emulators do not immediately change to the new baud rate settings. In this case, you have to exit and restart the emulator to use the new settings.

No display on the terminal emulator

The probable cause of this problem is that your terminal emulator software is not configured correctly.

Screen is updated, but does not respond

If the screen is updated, but does not respond, complete the following procedure:

1. Verify that all the cables are connected properly.
For the COM port settings, see “Connecting to the RS-232 port” on page 13.
2. Verify that the correct COM port is enabled and configured.

3. Verify that your terminal emulator software is configured properly.
4. Contact your IBM service representative.

Screen looks correct, clock not updating

If your clock is not updating, check that the FCO library is still powered on. If you are using XON/XOFF, press Ctrl-q.

Menu boxes appear incorrect

If your screen updates and the menus appear correct, but the boxes around the menus look incorrect, try a different font in your terminal emulator program, such as Hyper Terminal. If you cannot find a font that looks correct, set the ASCII display to **Yes** in the Display options item of the Configuration menu.

Device SCSI channel problems

If some of the drives connected to the FCO device channels are not displayed during bootup or the FCO during display of connected drives and never reaches the Router Administrator screen, complete the following procedure:

1. Check your library or FCO cabling documentation to be sure that the device is properly configured.
2. Check termination and SCSI ID assignment.

FCO is not responding

If the library with FCO card is turned on and connected, but is not working properly and its power LED lights are not lit, replace the FCO card.

Using the Loader Diagnostics menu

A set of diagnostics is run each time you boot the FCO. You can run each test individually to confirm any errors.

To run an individual test, complete the following procedure:

1. While booting the FCO, hold down the spacebar. The Loader menu appears.
2. Select **4. Run diagnostics**.
3. Select **1. Configure all PCI devices**.
4. Enter the number or letter of the particular test you want to run.
5. Use the information in Table 8 on page 53 to find solutions to a particular diagnostic failure.

Diagnostics hangs at “loading diagnostics”

If the diagnostics hangs at “loading diagnostics,” update the firmware. For more information, see “Upgrading firmware” on page 52.

Using the Loader Utility menu

You can use the Loader Utility menu to initialize the FCO card if it had a previous configuration. For example, you can use this to restore the default settings when the FCO card hangs and you cannot access the FCO Router Administrator.

To run the Loader Utility menu, complete the following procedure:

1. While booting the FCO, hold down the spacebar. The Loader menu appears.

2. Select **6. Utility Menu**.
3. Enter the number of the utility you want to run.

Event logs

You can view events one at a time or view an entire screen of events.

Viewing events one at a time

To view events one at a time, complete the following procedure:

1. Select **Event Log Menu** from the System menu.
2. Select **View Event Log** from Event Log menu.

```

=====
|                                     OVERLAND FC-to-SCSI Router Administrator                                     |
=====
07/03 11:27:22  POWER UP
07/03 11:27:37  FW UPDATE DONE  T500          T500R02
07/03 11:27:37  DEFAULT CONFIG
07/03 11:27:37  HOST LINK UP      Host Channel 0
07/03 11:27:46  CONFIG CHANGED   Reason Code: 15 SeqNum: 1
07/03 11:27[4619HCNTRL PARAMS SET
07/03 11:27:46  CONFIG CHANGED   Reason Code: 47 SeqNum: 2
19/03 21:28:55  POWER UP
07/03 11:29:07  HOST LINK UP      Host Channel 0
07/03 11:32:44  CONFIG CHANGED   Reason Code: 15 SeqNum: 1
07/03 11:32:44  CNTRL PARAMS SET
07/03 11:32:44  CONFIG CHANGED   Reason Code: 47 SeqNum: 2
07/25 19:27:02  POWER UP
07/25 19:27:24  CONFIG CHANGED   Reason Code: 15 SeqNum: 1
07/25 19:27:24  CNTRL PARAMS SET
07/25 19:27:25  CONFIG CHANGED   Reason Code: 47 SeqNum: 2
07/25 19:49:52  CONFIG CHANGED   Reason Code: 47 SeqNum: 3
=====
| Event Log: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC |
=====
Board Temp: 1110F ( 440C)                                     Fri Jul 27 15:20:21 2001
09

```

Figure 69. Event Log Menu screen

Note: Event numbers restart at 000 after 999 events have been logged.

3. Use the ↑ and ↓ keys to browse through the list of events.

Viewing a screen of events

To view a screen of events, complete the following procedure:

1. Type **Ctrl-e** to switch screens until the Event Log screen appears (the text “Event Log” is located in the lower left corner of the screen).
2. Use this screen to view multiple events simultaneously.
 - The ↑ and ↓ keys allow you to scroll.
 - **u** moves the screen up a page.
 - **d** moves the screen down a page.
 - **e** moves to the last event at the end of the list.
 - **h** moves to the first event at the beginning of the list.
 - **p** dumps the entire Event Log to the screen. This is used for capturing an Event Log file. For more information on capturing an Event Log file, see “Event Log file capture”.

Event Log file capture

To capture the Event Log file, complete the following procedure:

Note: Hyperterm is used as an example terminal in the following procedure.

1. With Hyperterm up and running as your RS-232 interface terminal, press Ctrl-e until Event Log is displays.
2. Select **Transfer** from the menu bar at the top.
3. Select **Capture Text**.
4. Type the path and file name.
5. Select **Start**.
6. Type p on the keyboard to begin the capture.
7. Select **Transfer** from the menu bar at the top.
8. Select **Capture Text**.
9. Select **Stop**.

Your file can now be attached to an e-mail message to be sent to customer support.

Voltage temperature errors and warnings

Most voltage and temperature errors occur due to environmental conditions. For a list of alarm thresholds, see "FCO card alarm thresholds" on page 3.

Appendix A. Cabling and device mapping

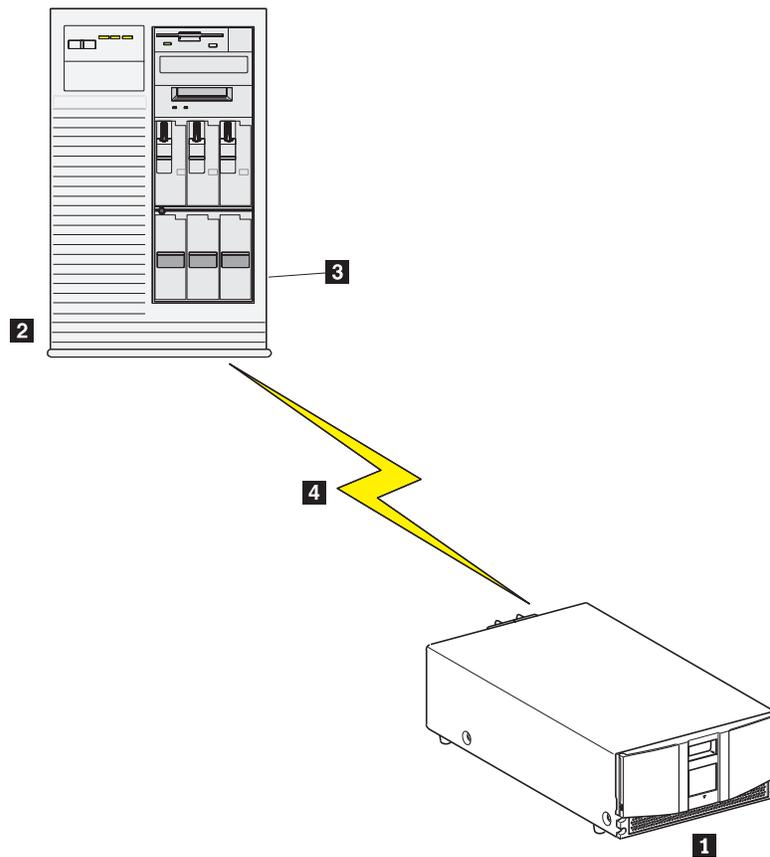
Devices attached to the FCO card are discovered during power on. The FCO defaults to AUTO mapping mode, which automatically maps the library and tape drives at each power on. The FCO maps devices sequentially as it scans the channels and discovers the devices (devices are discovered by channel, lowest SCSI ID and LUN first). Devices are mapped to FC LUNs, starting from LUN 0 to LUN 63 (64 LUNs are supported, including an optional FCO LUN).

You can select the FIXED mapping mode to lock the current device mapping so that it does not change during subsequent power on procedures, even if devices are added, moved, or removed. FIXED is recommended for environments where device configuration may change and a fixed mapping from the application to the target devices is required. Devices added after selecting FIXED will be automatically mapped to an available FC LUN. For more information, see “Changing the mapping mode (AUTO or FIXED)” on page 43.

Figure 7 on page 10, Figure 8 on page 11, and Figure 9 on page 12 are examples of how the FCO will map libraries and tape drives (SCSI channel:target:LUN) to FC LUNs.

Appendix B. SAN topologies

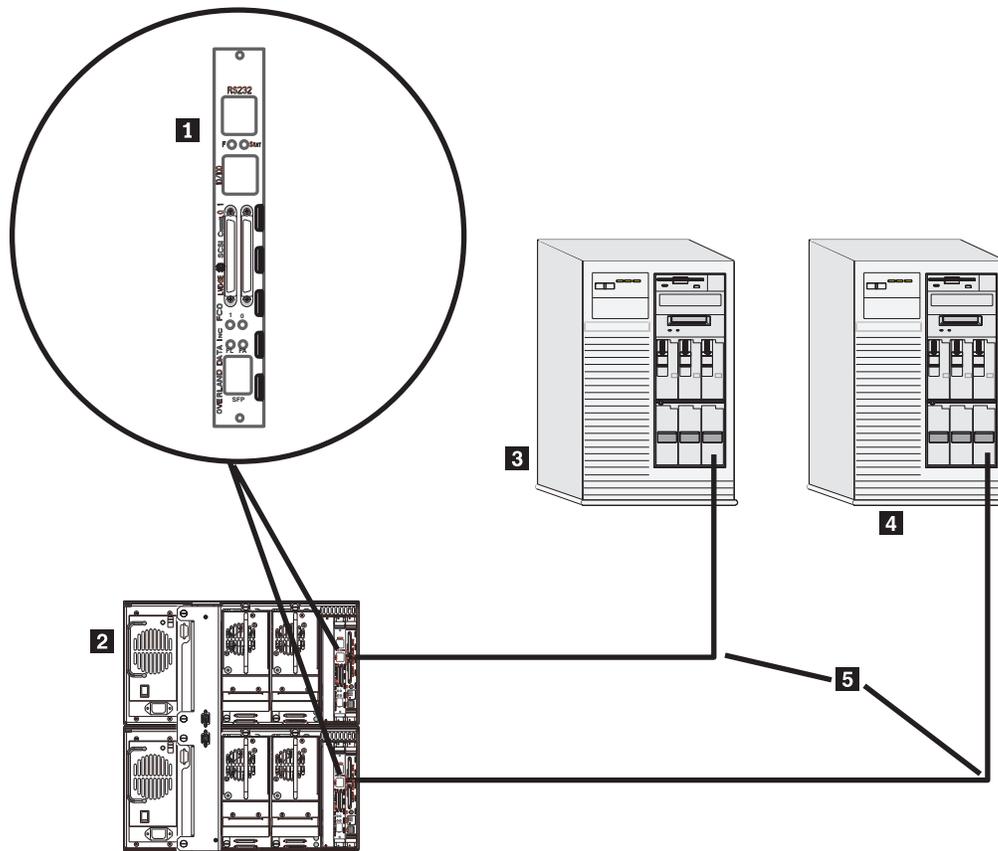
Figure 70 depicts a simple Direct Attach Fibre Channel Arbitrated Loop (FC-AL) between the server and the library.



- 1** Library with FCO installed
- 2** Server
- 3** Hot bus adapter
- 4** Maximum 10 Km distance

Figure 70. Direct attach FC-AL configuration

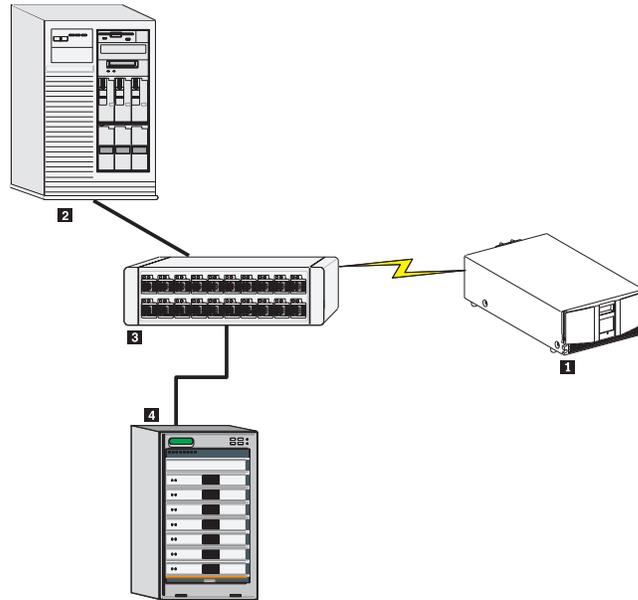
Figure 71 on page 62 diagrams the ability for a multi module library to support a Multi Port/Multi-Server Direct Attach (FC-AL) environment with ease. A full library stack (eight module library) can support up to eight FCO cards.



- 1** FCO
- 2** Multi-module libraries
- 3** UNIX server
- 4** NT server
- 5** Maximum 10 Km distance

Figure 71. Multi service/port direct attach FC-AL

Figure 72 on page 63 depicts a simple expandable FC-AL (Fibre Channel Arbitrated Loop) using a hub to connect both the library and Fibre channel disk to the server.

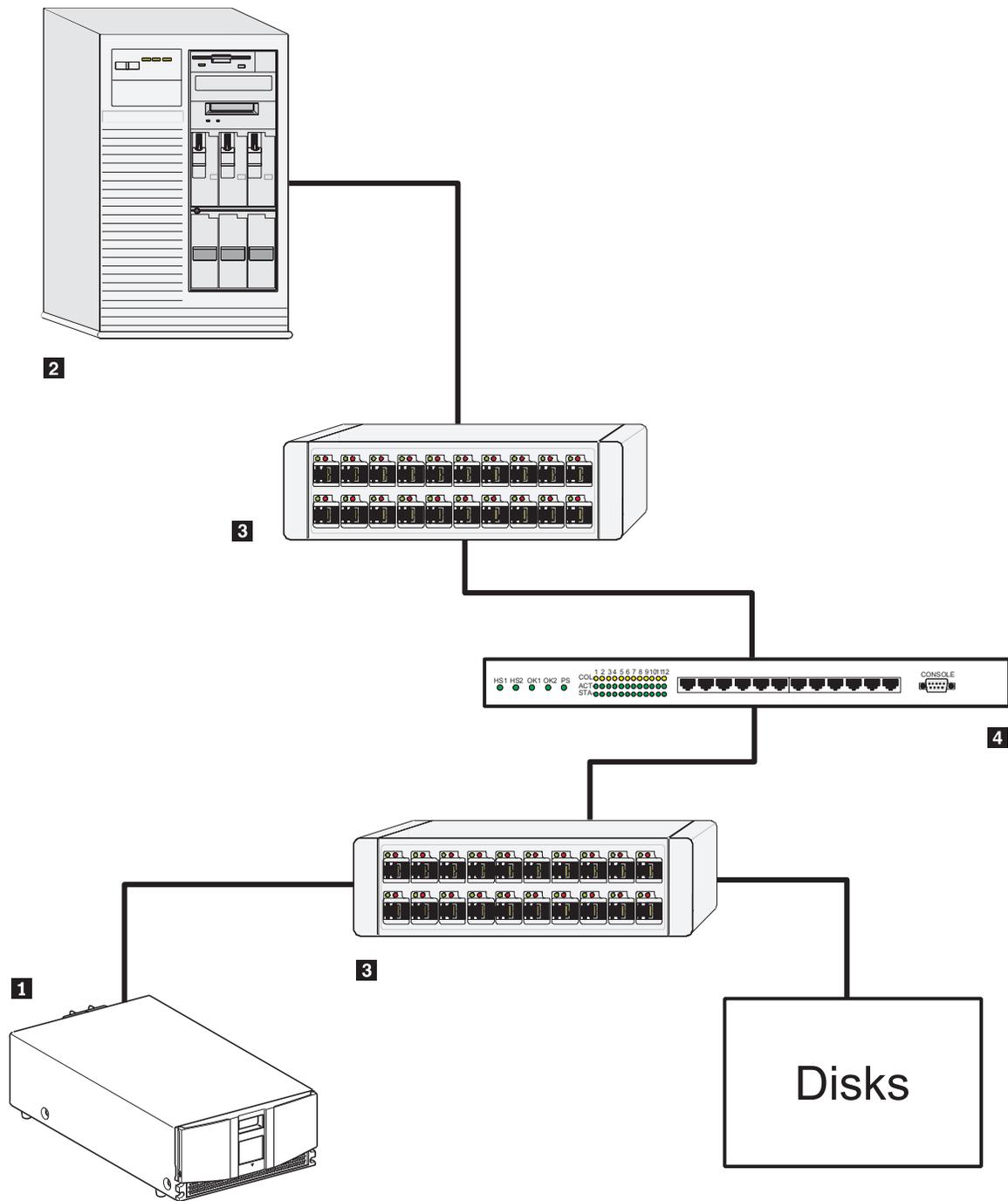


- 1** Library with FCO installed
- 2** Server
- 3** Hub
- 4** Raid

Figure 72. Hub based FC-AL configuration

In the previous three examples the FCO is running in a Private Loop Direct Attach mode of operation.

Figure 73 on page 64 is an example of a Switch Based Public loop where the library resides off of a hub attached by means of a switch to a second FC-AL residing off of another hub connected to a second port on the same switch.⁶²

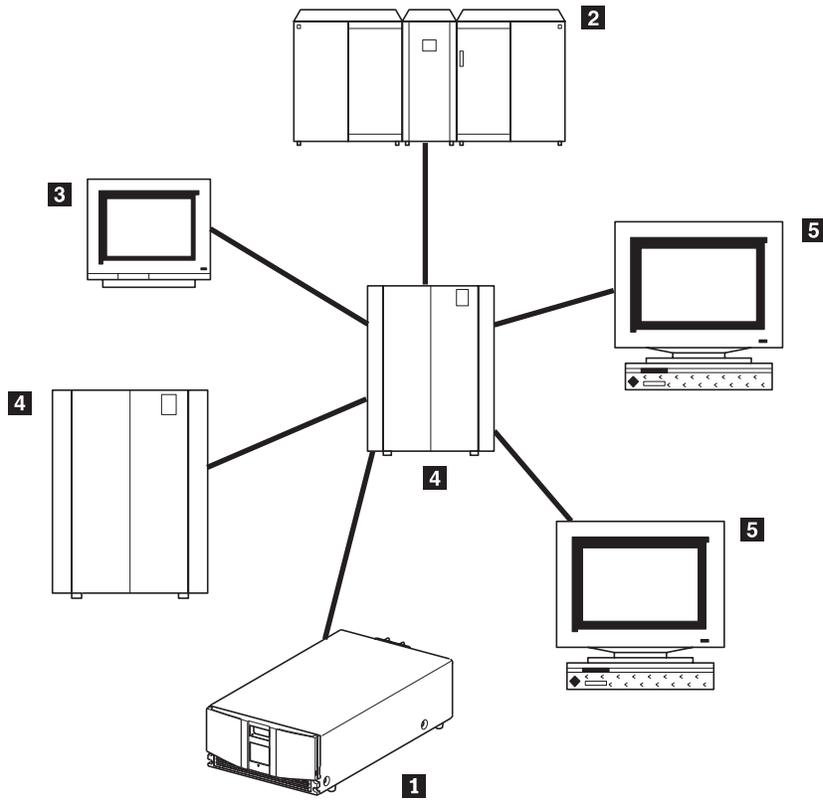


- 1** Library with FCO installed
- 2** Server
- 3** Hub
- 4** Switch

Figure 73. Switched based public FC-AL configuration

The next two figures show the library with FCO card attaching to switch based FC-SF (Fibre Channel Switched Fabric) configuration examples.

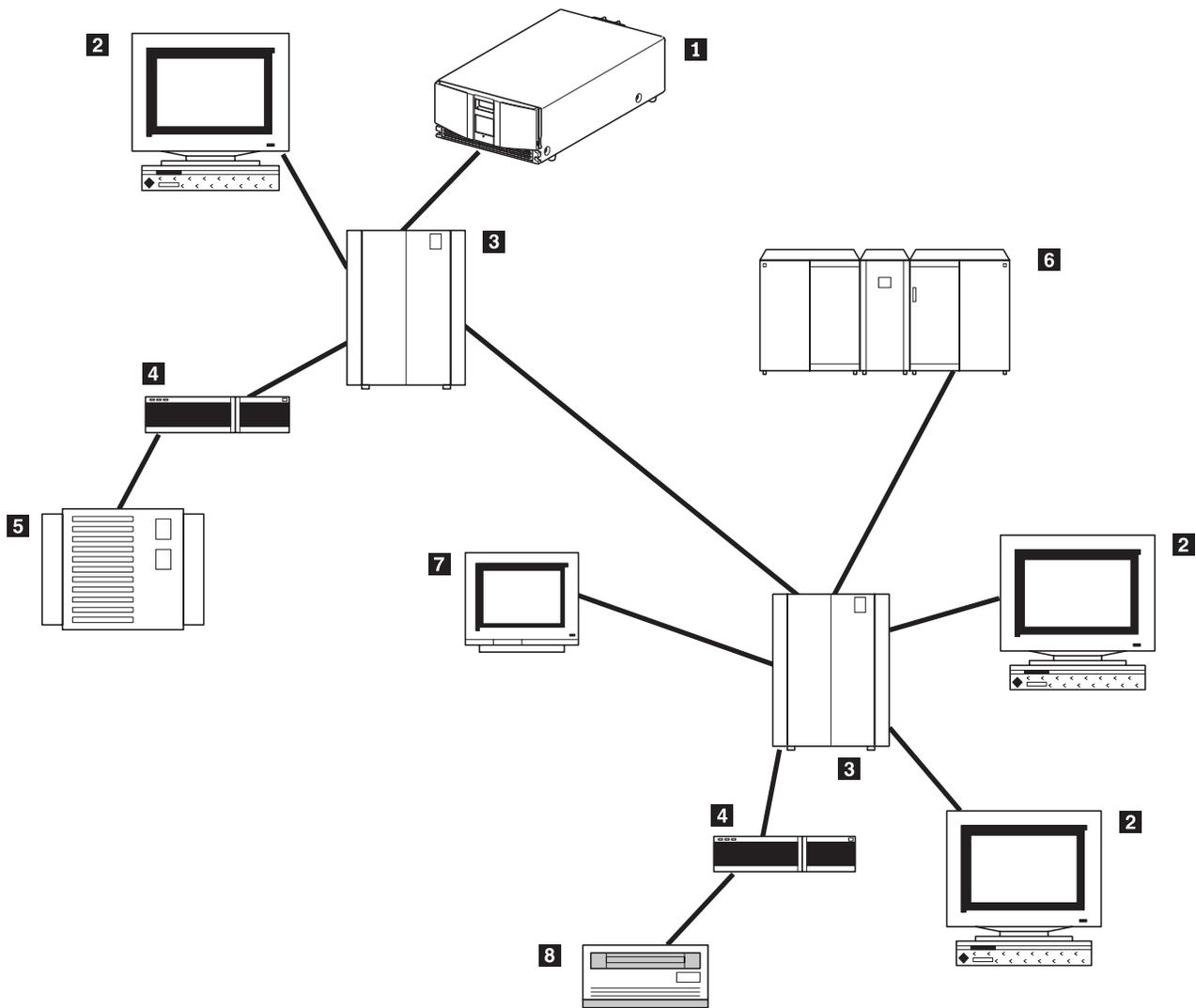
Figure 74 depicts a switched based (FC-SF).



- 1** Library
- 2** Mainframe
- 3** Terminal
- 4** Switch
- 5** Workstation

Figure 74. Switched based FC-SF configuration

Figure 75 on page 66 depicts multiple SANs with fabric (FC-SW).



- 1** Library
- 2** Workstation
- 3** Switch
- 4** Router
- 5** High-speed disk farm
- 6** Mainframe
- 7** Terminal
- 8** Disk drive

Figure 75. Multiple switch based FC-SF configuration

Serverless backup overview

Extended Copy (EC) configuration is a serverless backup that performs backup operations directly from disk to the library without passing the backup data through the server. Figure 76 on page 68 depicts an Extended Copy (EC) Example and Figure 77 on page 69 depicts an arbitrated loop (hub based) Serverless Backup Environment.

As previously mentioned the FCO card supports the Extended Copy command key to serverless backup. In a multi-module library, the FCO card is capable of up to nine concurrent EC commands providing support for up to nine concurrent threads, from nine separate servers to nine separate tape drives attached by a single FCO card.

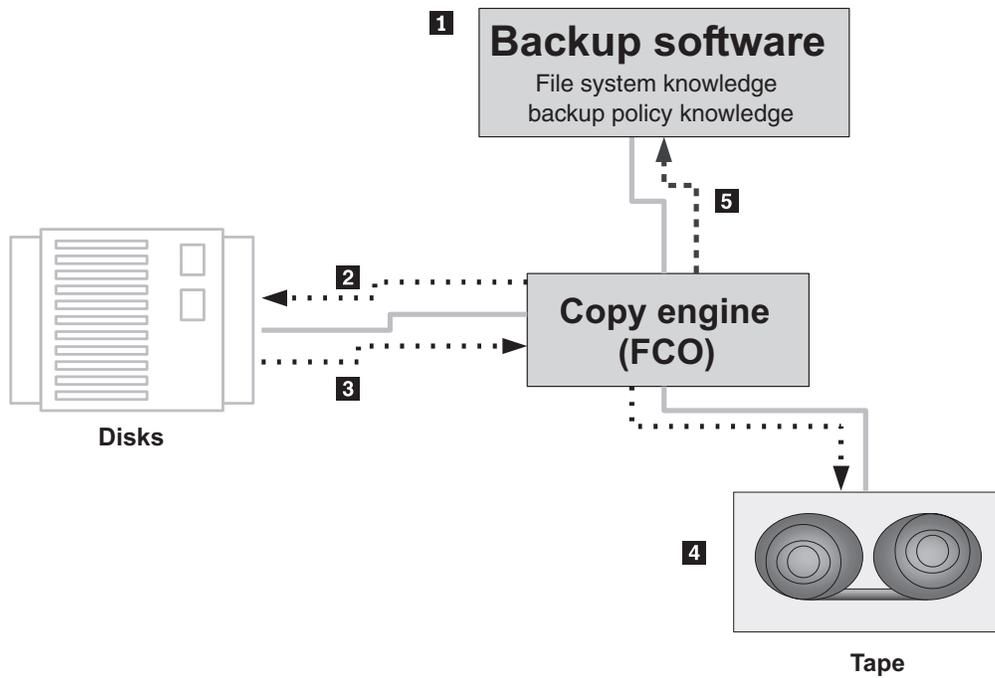
The EC command consists of three primary pieces of information:

- Source addresses
- Destination address
- In-line data

The source addresses tell the FCO where the data that is being copied is physically stored, on what device, and at what physical locations. This information is provided by a backup application which must translate file information into the physical storage locations. The application sends this list of addresses in the order it is to be written to the destination device. The device is often a tape drive in a backup scenario.

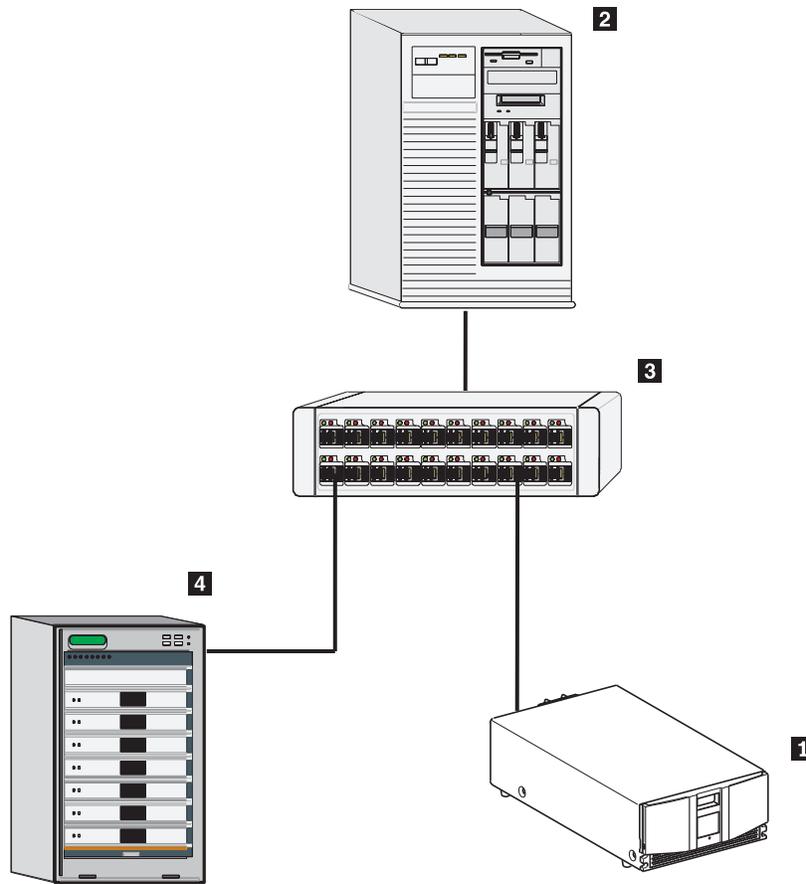
For the destination address, the EC command assumes that any tape device that is being copied to is in the proper location. Therefore, all the FCO card needs to know is its target address, typically a LUN on the SAN. The in-line data is used to allow applications to maintain a specific format, and can be used to write any data that the application may require for restoration.

The EC command, as implemented in the FCO card, requires no administration. Administering an EC environment is most intensive on the application side. The FCO card supports the SNIA Extended Copy Specification (ANSI T10/ 99-143R1). Any questions related to using your FCO card in an EC environment should be directed to the application provider or your reseller. If you are developing EC enabled applications, contact IBM for information on our specific implementation.



- 1** Backup software issues copy commands and descriptor blocks to copy engine.
- 2** Copy engine issues read commands to the disk system.
- 3** Disk system sends requested data to copy engine.
- 4** Copy engine writes data to tape system.
- 5** Copy engine returns completion status.

Figure 76. Extended copy logical flow example



- 1** Library with FCO installed
- 2** Host
- 3** Hub
- 4** Raid

Figure 77. FC-AL configuration for serverless backup

Appendix C. Configuring FCO for TCP/IP

Before you can access the FCO Router Administrator using the Ethernet port, you must set up your FCO for Transmission Control Protocol/Internet Protocol (TCP/IP). The following sections describe the FCO's TCP/IP setup.

A FCO that is part of a TCP/IP network requires three basic IP configuration elements: IP address, subnet mask, and default gateway IP address. The FCO's IP address must be unique to the network in which the FCO resides. If the FCO is part of a publicly routed network (that is, attached to the Internet), the address must be globally unique.

You can configure the FCO's TCP/IP settings using the menus described in "Accessing the FCO Router Administrator using Ethernet port" on page 21. This appendix describes how to configure the TCP/IP settings for the first time starting from the factory set defaults.

You must initially set up your computer with TCP/IP settings that are compatible with the FCO. This lets you access the FCO and configure it. Since you do not want to permanently change your computer's settings, you can use Address Resolution Protocol (ARP) to temporarily set them.

Using Address Resolution Protocol

The ARP configuration method requires no IP address reconfiguration of any computer on the network. The ARP command is available in various forms and sometimes with varying syntax, in UNIX and Windows systems.

All FCO's are shipped with a unique Media Access Control (MAC) hardware address (sometimes referred to as a physical address). MAC addresses have the format "00-50-13-fx-xx-xx," where "x-xx-xx" is unique to each FCO. The FCO MAC address can be found on a label on the FCO.

You can also display the FCO's MAC address by using the RS-232 port.

To use ARP to resolve addresses:

1. You must first place the MAC address of the FCO being set up into your computer's ARP cache using the command `arp -s IP address 00-50-13-fx-xx-xx`.

In this command, 00-50-13-fx-xx-xx is the FCO's unique MAC address, and IP address is the IP address you or your LAN system administrator have chosen to use as the IP address for the FCO.

This ARP command adds a static MAC- to-IP address binding to your computer. For example, if you wanted to bind the FCO with the factory MAC address of 00-50-13-f0-10-00 to the IP address 169.205.7.22, you should type `arp -s 169.205.7.22 00-50-13-f0-10-00`.

2. After entering the MAC address-to-IP address mapping into your computer's ARP cache, you must issue the command `ping 169.205.7.22` to send a request to the FCO.

If the FCO addressed by the ping command does not respond, check the LAN connection on the FCO. If the ping command addressed to the FCO was

successful, use Telnet to access the FCO using the IP address you just configured (for example, 169.205.7.22). Once connected through Telnet, the FCO's IP address, subnet mask, and default gateway can be set up through menus described in "Configuring the FCO network settings" on page 22.

Dynamic Host Configuration Protocol Configuration

The Dynamic Host Configuration Protocol (DHCP) is a protocol designed to make IP address assignment dynamic and automatic. When a FCO is configured in DHCP mode, it generates a request for an IP address. The address is provided to the FCO and can be used from that point forward. See "Accessing the FCO Router Administrator using Ethernet port" on page 21 for accessing the FCO Router Administrator through the Ethernet port, including enabling DHCP.

In the dynamic address assignment mode, an IP address are leased to a DHCP configured FCO. You should ask your system administrator to configure your network so the FCO can use DHCP, and host name you have assigned to the FCO. "Accessing the FCO Router Administrator using Ethernet port" on page 21 presents configuring the FCO host name and the default host names for which the FCO has been configured.

In the event you configure your FCO to DHCP and do not know which IP address was assigned automatically, you can use ARP to discover which IP address was assigned to the FCO by the DHCP server.

To discover which IP address was assigned to the FCO:

1. Follow the steps above for ARP to bind the FCO MAC address to a temporary static IP address.
2. Use the command `arp -g` to display your computer's the IP-to-MAC address table. This table contains two entries corresponding to the FCO MAC address. One of the entries contains the temporary static IP address you just bound to the FCO MAC address, and the other entry is the DHCP assigned IP address. You can use the DHCP assigned address to access the FCO from any computer on the network.

Simple Network Management Protocol Configuration

Remaining TCP/IP parameters, such as Simple Network Management Protocol (SNMP) traps, can be configured after the TCP/IP configuration is done. Ask your system administrator to configure these parameters according to the requirements of your LAN.

Appendix D. Loop ID to AL_PA mapping

During the Fibre Channel Arbitrated Loop (FC-AL) initialization process, a unique Arbitrated Loop Physical Address (AL_PA) value is assigned to each port on the loop. Not all of the 256 hex values are allowed as AL_PA values per FC-AL, so Loop IDs are used to represent the 125 addresses that the FCO card can use. You can assign a Loop ID to the FCO card. For more information, see “Changing Fibre Channel interface settings” on page 28.

Table 9 shows how a Loop ID value maps to an AL_PA. If you set the Loop ID to SOFT, the FCO card attempts to obtain an available Loop ID, in the following order: 0, 1, 2, etc.

Table 9. Arbitrated loop physical addresses

Loop ID (decimal)	AL_PA (hex)	Loop ID (decimal)	AL_PA (hex)	Loop ID (decimal)	AL_PA (hex)
0	EF	19	CA	38	AA
1	E8	20	C9	39	A9
2	E4	21	C7	40	A7
3	E2	22	C6	41	A6
4	E1	23	C5	42	A5
5	E0	24	C3	43	A3
6	DC	25	BC	44	9F
7	DA	26	BA	45	9E
8	D9	27	B9	46	9D
9	D6	28	B6	47	9B
10	D5	29	B5	48	98
11	D4	30	B4	49	97
12	D3	31	B3	50	90
13	D2	32	B2	51	8F
14	D1	33	B1	52	88
15	CE	34	AE	53	84
16	CD	35	AD	54	82
17	CC	36	AC	55	81
18	CB	37	AB	56	80
57	7C	80	55	103	31
58	7A	81	54	104	2E
59	79	82	53	105	2D
60	76	83	52	106	2C
61	75	84	51	107	2B
62	74	85	4E	108	2A
63	73	86	4D	109	29
64	72	87	4C	110	27

Table 9. Arbitrated loop physical addresses (continued)

Loop ID (decimal)	AL_PA (hex)	Loop ID (decimal)	AL_PA (hex)	Loop ID (decimal)	AL_PA (hex)
65	71	88	4B	111	26
66	6E	89	4A	112	25
67	6D	90	49	113	23
68	6C	91	47	114	1F
69	6B	92	46	115	1E
70	6A	93	45	116	1D
71	69	94	43	117	1B
72	67	95	3C	118	18
73	66	96	3A	119	17
74	65	97	39	120	10
75	63	98	36	121	0F
76	5C	99	35	122	08
77	5A	100	34	123	04
78	59	101	33	124	02
79	56	102	32	125	01

Appendix E. Removing the FCO card

To remove the FCO card, complete the following procedure:

1. Exit the application software and halt the operating system if necessary.
2. Power off the library using the touch screen and then switch the master power switch on the power supply at the rear of the module to the off (0) position.
3. Remove the power cord from the receptacle.
4. Remove the SCSI interface cables, terminator, 10/100 BaseT cable, Ethernet cable, and RS-232 cable.
5. Loosen the two captive hold-down screws.
6. Disconnect the card by spreading the ejector handles apart.
7. Pull the FCO card out of the card cage, as shown in Figure 78.

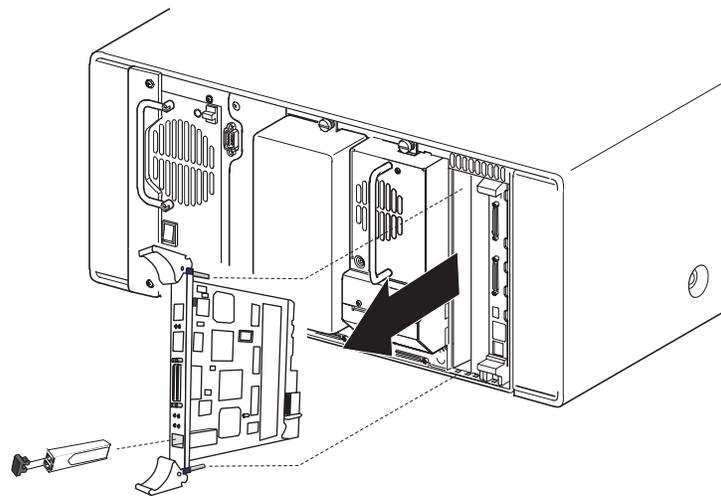


Figure 78. Removing the FCO card

Appendix F. Warranty information

This section contains the warranty period for your product, information about obtaining warranty service and support, and the IBM Statement of Limited Warranty.

Warranty period

The warranty period varies by machine type and country or region.

Contact your place of purchase for warranty service information. Some IBM Machines are eligible for on-site warranty service depending on the country or region where service is performed.

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician.

A warranty period of 3 years on parts and 0 years on labor means that IBM will provide warranty service without charge for:

- parts only, on an exchange basis, in the first, second, and third years of the warranty period. IBM will charge you for any labor it provides in performance of the repair or replacement.

The IBM Machine Warranties Web site at http://www.ibm.com/servers/support/machine_warranties/ contains a worldwide overview of the IBM Statement of Limited Warranty for IBM Machines, a glossary of terms used in the Statement of Limited Warranty, Frequently Asked Questions (FAQ), and links to Product Support Web pages. The IBM Statement of Limited Warranty is available from this Web site in 29 languages in Portable Document Format (PDF).

Machine: Fibre Channel Option Card

Country or region	Warranty period	Service delivery method
All	3 years (parts), 0 years (labor)	CCE (Customer Carry In)

Problem determination

Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician. The service specialist will run diagnostic tests on the hardware and check the software.

Running diagnostics

The IBM service specialist will help you determine whether your equipment is functioning as specified. It might be necessary to isolate the failing xSeries™ or Netfinity® system; IBM component; or both from any active production environment to run diagnostics and perform defect-isolation programs. You are responsible for making the system, IBM component, or both available for running diagnostics and defect-isolation programs.

Checking software

The IBM service specialist will help you ensure that the correct BIOS code, firmware, device drivers, and other supporting IBM software are installed and correctly configured. It might be necessary to manually gather information about the relevant software levels or run IBM-approved utility programs to gather this information. It might be necessary to isolate the failing system from any active production environment to gather this information. You are responsible, with assistance from the service specialist, for gathering this information. The IBM Statement of Limited Warranty does not include on-site assistance with this activity.

Warranty service and support

With the original purchase of an IBM or xSeries system, you have access to extensive service and support. During the IBM Machine warranty period, you may call IBM or your reseller for problem-determination assistance under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service, either on-site or at an IBM service center as determined by IBM.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been shipped from IBM. In those instances, IBM will make Engineering Changes (ECs) available that apply to your hardware.
- **Customer replaceable units (CRUs)** - Some parts of IBM or xSeries systems are designated as customer replaceable units. IBM ships CRUs to you for replacement by you. CRUs include keyboards, monitors, memory, diskette drives, hard disk drives, and mice (this list is not inclusive of all CRUs).

The following items are not covered under warranty service:

- Replacement or use of non-IBM parts. All IBM parts contain a 7-character identification in the format IBM FRU XXXXXXX.
- Identification of software problem sources.
- Installation of customer replaceable units (CRUs).
- Installation and configuration of BIOS code, firmware, or device drivers that are designated as customer installable.

See the IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

Please have the following information ready when you call:

- The machine type and model of your IBM hardware product (if available)
- Serial numbers of your IBM hardware products
- A description of the problem
- The exact wording of any error messages
- Hardware and software configuration information

International Warranty Service

If you travel with your xSeries system or relocate it to a country or region where your system is sold and serviced by IBM or IBM resellers authorized to perform warranty service, International Warranty Service (IWS) is available during the warranty period. Eligible IBM systems are identified by their four-digit machine types.

You can obtain IWS through the service delivery method (such as depot, carry-in, or on-site) provided in the servicing country or region. Service methods and procedures vary by country or region, and some service or parts might not be available in all countries and regions. Service centers in certain countries or regions might not be able to service all models of a particular machine type. In addition, some countries or regions might have fees and restrictions that apply at the time of service.

To determine whether your system is eligible for IWS, go to <http://www.ibm.com/pc/support/> and click **Warranty lookup**.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these services, contact your IBM marketing representative.

IBM Statement of Limited Warranty Z125-4753-06 8/2000

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. The terms of Part 2 replace or modify those of Part 1. The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.

The IBM Warranty for Machines: IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications ("Specifications"). The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded.

Extent of Warranty: The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty: IBM does not warrant uninterrupted or error-free operation of a Machine. Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service: To obtain warranty service for a Machine, contact IBM or your reseller. If you do not register your Machine with IBM, you may be required to present proof of purchase.

During the warranty period, IBM or your reseller, if approved by IBM to provide warranty service, provides without charge certain types of repair and exchange service to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. At its discretion, IBM or your reseller will 1) either repair or exchange the failing Machine and 2) provide the service either at your location or a service center. IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Some parts of IBM Machines are designated as Customer Replaceable Units (called "CRUs"), e.g., keyboards, memory, or hard disk drives. IBM ships CRUs to you for replacement by you. You must return all defective CRUs to IBM within 30 days of your receipt of the replacement CRU. You are responsible for downloading designated Machine Code and Licensed Internal Code updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided:
 - a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides;
 - b. secure all programs, data, and funds contained in a Machine;
 - c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations; and
 - d. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Limitation of Liability: Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other

contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and
2. the amount of any other actual direct damages, up to the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST SAVINGS, EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Governing Law: Both you and IBM consent to the application of the laws of the country in which you acquired the Machine to govern, interpret, and enforce all of your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Part 2 - Country-unique Terms

AMERICAS

BRAZIL

Governing Law: *The following is added after the first sentence:* Any litigation arising from this Agreement will be settled exclusively by the court of Rio de Janeiro.

NORTH AMERICA

Warranty Service: *The following is added to this Section:* To obtain warranty service from IBM in Canada or the United States, call 1-800-IBM-SERV (426-7378).

CANADA

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws in the Province of Ontario.

UNITED STATES

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of the State of New York.

ASIA PACIFIC

AUSTRALIA

The IBM Warranty for Machines: *The following paragraph is added to this Section:* The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other similar legislation and are only limited to the extent permitted by the applicable legislation.

Limitation of Liability: *The following is added to this Section:* Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974 or other similar legislation, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of the State or Territory.

CAMBODIA, LAOS, AND VIETNAM

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of the State of New York.

The following is added to this Section: Disputes and differences arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Singapore in accordance with the rules of the International Chamber of Commerce (ICC). The arbitrator or arbitrators designated in conformity with those rules shall have the power to rule on their own competence and on the validity of the Agreement to submit to arbitration. The arbitration award shall be final and binding for the parties without appeal and the arbitral award shall be in writing and set forth the findings of fact and the conclusions of law.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator.

The two arbitrators appointed by the parties shall appoint a third arbitrator before proceeding upon the reference. The third arbitrator shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the ICC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

The English language version of this Agreement prevails over any other language version.

HONG KONG AND MACAU

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:* laws of Hong Kong Special Administrative Region.

INDIA

Limitation of Liability: *The following replaces items 1 and 2 of this Section:*

1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Limited Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

JAPAN

Governing Law: *The following sentence is added to this Section:* Any doubts concerning this Agreement will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

NEW ZEALAND

The IBM Warranty for Machines: *The following paragraph is added to this Section:* The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: *The following is added to this Section:* Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

PEOPLE'S REPUBLIC OF CHINA (PRC)

Governing Law: *The following replaces this Section:* Both you and IBM consent to the application of the laws of the State of New York (except when local law requires otherwise) to govern, interpret, and enforce all your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Any disputes arising from or in connection with this Agreement will first be resolved by friendly negotiations, failing which either of us has the right to submit the dispute to the China International Economic and Trade Arbitration Commission in Beijing, the PRC, for arbitration in accordance with its arbitration rules in force at the time. The arbitration tribunal will consist of three arbitrators. The language to be used therein will be English and Chinese. An arbitral award will be final and binding on all the parties, and will be enforceable under the Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958).

The arbitration fee will be borne by the losing party unless otherwise determined by the arbitral award.

During the course of arbitration, this Agreement will continue to be performed except for the part which the parties are disputing and which is undergoing arbitration.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES: The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

Warranty Service: If you purchase an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM. If you purchase an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchase an IBM Machine in a Middle Eastern or African country, you may obtain warranty service for that Machine from the IBM entity within the country of purchase, if that IBM entity provides warranty service in that country, or from an IBM reseller, approved by IBM to perform warranty service on that Machine in that country. Warranty service in Africa is available within 50 kilometers of an IBM authorized service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM authorized service provider.

Governing Law: The applicable laws that govern, interpret and enforce rights, duties, and obligations of each of us arising from, or relating in any manner to, the subject matter of this Statement, without regard to conflict of laws principles, as well as Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided, except that in 1) Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Hungary, Former Yugoslav Republic of Macedonia, Romania, Slovakia, Slovenia, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, the laws of Austria apply; 2) Estonia, Latvia, and Lithuania, the laws of Finland apply; 3) Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Djibouti, Democratic Republic of Congo, Equatorial Guinea, France, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Mali, Mauritania, Morocco, Niger, Senegal, Togo, and Tunisia, this Agreement will be construed and the legal relations between the parties will be determined in accordance with the French laws and all disputes arising out of this Agreement or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 4) Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe, this Agreement will be governed by English Law and disputes relating to it will be submitted to the exclusive jurisdiction of the English courts; and 5) in Greece, Israel, Italy, Portugal, and Spain any legal claim arising out of this Statement will be brought before, and finally settled by, the competent court of Athens, Tel Aviv, Milan, Lisbon, and Madrid, respectively.

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA AND GERMANY

The IBM Warranty for Machines: *The following replaces the first sentence of the first paragraph of this Section:* The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this Section:

The minimum warranty period for Machines is six months. In case IBM or your reseller is unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: *The second paragraph does not apply.*

Warranty Service: *The following is added to this Section:* During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Limitation of Liability: *The following paragraph is added to this Section:* The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

The following sentence is added to the end of item 2: IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

EGYPT

Limitation of Liability: *The following replaces item 2 in this Section:* as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

Applicability of suppliers and resellers (unchanged).

FRANCE

Limitation of Liability: *The following replaces the second sentence of the first paragraph of this Section:* In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: *(items 1 and 2 unchanged).*

IRELAND

Extent of Warranty: *The following is added to this Section:* Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: *The following replaces items one and two of the first paragraph of this Section:* 1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and 2. the amount of any other actual direct damages, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section: IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY

Limitation of Liability: *The following replaces the second sentence in the first paragraph: In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than: 1. (unchanged) 2. as to any other actual damage arising in all situations involving nonperformance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim. Applicability of suppliers and resellers (unchanged).*

The following replaces the third paragraph of this Section: Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: (items 1 and 2 unchanged) 3) indirect damages, even if IBM or your reseller is informed of their possibility.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND

Limitation of Liability: *The following is added to this Section: IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.*

UNITED KINGDOM

Limitation of Liability: *The following replaces items 1 and 2 of the first paragraph of this Section:*

1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;
2. the amount of any other actual direct damages or loss, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim;

The following item is added to this paragraph: 3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

Applicability of suppliers and resellers (unchanged).

The following is added to the end of this Section: IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

Appendix G. Notices

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

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UNIX is a registered trademark of The Open Group in the United States and other countries.

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

Electronic emission notices

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. IBM is not 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.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité a la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conform à la norme NMB-003 du Canada.

Deutsche EMV-Direktive (electromagnetische Verträglichkeit)

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 UK, Greenock.

Dieses Gerät erfüllt die Bedingungen der EN 55022 Klasse A. Für diese Klasse 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.

European Union - EMC directive

This product is in conformity with the protection requirements of EU Council Directive 89/336/ECC on the approximation of the laws of the Member States relating to electromagnetic compatibility.

IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

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.

Warning: 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.
--

Union Européenne - Directive Conformité électromagnétique

Ce produit est conforme aux exigences de protection de la Directive 89/336/EEC du Conseil de l'UE sur le rapprochement des lois des États membres en matière de compatibilité électromagnétique.

IBM ne peut accepter aucune responsabilité pour le manquement aux exigences de protection résultant d'une modification non recommandée du produit, y compris l'installation de cartes autres que les cartes IBM.

Ce produit a été testé et il satisfait les conditions de l'équipement informatique de Classe A en vertu de CISPR22/Standard européen EN 55022. Les conditions pour

l'équipement de Classe A ont été définies en fonction d'un contexte d'utilisation commercial et industriel afin de fournir une protection raisonnable contre l'interférence d'appareils de communication autorisés.

Avvertissement : Ceci est un produit de Classe A. Dans un contexte résidentiel, ce produit peut causer une interférence radio exigeant que l'utilisateur prenne des mesures adéquates.

Union Europea - Normativa EMC

Questo prodotto è conforme alle normative di protezione ai sensi della Direttiva del Consiglio dell'Unione Europea 89/336/CEE sull'armonizzazione legislativa degli stati membri in materia di compatibilità elettromagnetica.

IBM non accetta responsabilità alcuna per la mancata conformità alle normative di protezione dovuta a modifiche non consigliate al prodotto, compresa l'installazione di schede e componenti di marca diversa da IBM.

Le prove effettuate sul presente prodotto hanno accertato che esso rientra nei limiti stabiliti per le apparecchiature di informatica Classe A ai sensi del CISPR 22/Norma Europea EN 55022. I limiti delle apparecchiature della Classe A sono stati stabiliti al fine di fornire ragionevole protezione da interferenze mediante dispositivi di comunicazione in concessione in ambienti commerciali ed industriali.

Avvertimento: Questo è un prodotto appartenente alla Classe A. In ambiente domestico, tale prodotto può essere causa di interferenze radio, nel qual caso l'utente deve prendere misure adeguate.

Unione Europea - Directiva EMC (Conformidad electromagnética)

Este producto satisface los requisitos de protección del Consejo de la UE, Directiva 89/336/CEE en lo que a la legislación de los Estados Miembros sobre compatibilidad electromagnética se refiere.

IBM no puede aceptar responsabilidad alguna si este producto deja de satisfacer dichos requisitos de protección como resultado de una modificación no recomendada del producto, incluyendo el ajuste de tarjetas de opción que no sean IBM.

Este producto ha sido probado y satisface los límites para Equipos Informáticos Clase A de conformidad con el Estándar CISPR22 y el Estándar Europeo EN 55022. Los límites para los equipos de Clase A se han establecido para entornos comerciales e industriales a fin de proporcionar una protección razonable contra las interferencias con dispositivos de comunicación licenciados.

Advertencia: Este es un producto de Clase A. En un entorno doméstico este producto podría causar radiointerferencias en cuyo caso el usuario deberá tomar las medidas adecuadas.

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