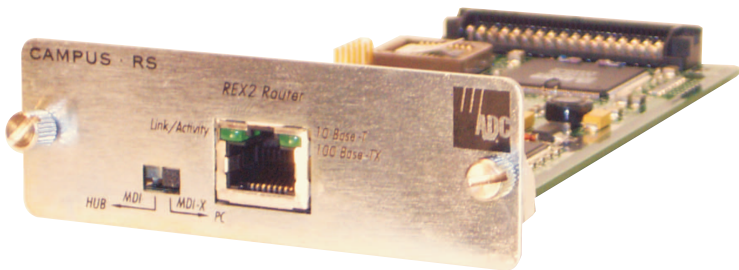


CAMPUS-REX2 RS INTERFACE CARD VERSION 5.1 USER MANUAL



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July 2003

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FCC NOTICE

This unit complies 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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. Testing on older Campus-RS models was performed at 3.072 Mbps. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the situation by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Consult the dealer or an experienced radio or television technician for help.

Any changes or modifications not expressly approved by the grantee of this device voids the user's authority to operate the equipment.

USING THIS MANUAL

This manual provides installation, configuration and management procedures for using the ADC Campus[®] Remote Ethernet eXpress2 (Campus-REX2[®]) RS interface card. It includes procedures to:

- install the card in either a Campus-RS[™] desktop unit (150-1158-01, 150-1158-02, 150-1158-51, or 150-1158-52) or Campus-Star[®] chassis (150-1220-01, 150-1220-02, or 150-1220-51)
- configure the Campus-REX2 using the LCD and buttons
- configure the Campus-REX2 using the command-line interface
- monitor the Campus-REX2 performance
- perform testing on the Campus-REX2
- contact ADC for assistance

DOCUMENT CONVENTIONS

Messages identified by icons shown below may appear in the text.



Notes contain information about special circumstances.



Cautions indicate the possibility of personal injury or equipment damage.



The Electrostatic Discharge (ESD) symbol indicates that a device or assembly is susceptible to damage from electrostatic discharge.

The following conventions are used in this manual:

- This font indicates text that appears on the LCD or terminal.
- Keycaps, such as **ESC**, indicate keys that you press on a terminal keyboard.
- Names in **bold font** indicate buttons on the desktop unit or line unit that you press.

For a list of abbreviations used in this manual, see “Abbreviations” on page 143.

This table describes the manuals and guides in the Campus-RS documentation set.

Document	Description
<i>Campus-Star User Manual</i>	Contains instructions for setting up and using a Campus-Star. The manual includes instructions for installing line units and interface cards into the Campus-Star chassis.
<i>Campus-RS Line Unit User Manual</i>	Describes the features of the Campus-RS line unit and provides installation instructions.
<i>Campus-RS Desktop Unit User Manual</i>	Describes the features of the Campus-RS desktop unit and provides instructions for installing interface cards, and connecting the unit to an HDSL line.
<i>Campus Interface Card User Manuals</i>	Describes the features of the individual Campus interface cards, one card per manual, and contains instructions for configuring and monitoring the system through the cards.

UNPACK AND INSPECT THE SHIPMENT

Upon receiving the Campus-REX2 RS Interface Card:

- 1** Unpack the card and inspect it for signs of damage. If it has been damaged in transit, report the extent of the damage to the transportation company and to your sales representative immediately. Order replacement equipment if necessary.
- 2** Compare the contents of the package against the packing list to ensure a complete and accurate shipment. If the shipment is incomplete or incorrect, contact ADC as described in “Contacting ADC” on page 145.

If you need to store the unit for several days or more before installing it, return it to the original packaging.

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INSTALLING AND ACCESSING THE REX2

1

The Campus-REX2 RS is a 10/100Base-T Ethernet interface card that provides:

- IEEE 802.1d transparent MAC level bridging with Spanning Tree protocol support
- static and dynamic IP Routing
- DHCP relay
- DHCP client
- cHDLC or PPP frame encapsulation options
- FTP server for transferring software upgrades
- VLAN support that accommodates forwarding larger-sized packets
- embedded Simple Network Management Protocol Version 1 (SNMP V1) agent

The following sections provide instruction to install the Campus-REX2 and access it for configuration and management.

For:	See Page:
Installing the Campus-REX2	2
Connecting the Ethernet Line	5
Powering Up and Checking the Connection	7
Setting Up Access to the Campus Unit	8
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The Campus-REX2 can be installed into either a Campus-Star chassis (paired with a Campus-RS or -HRS Line Unit) or into a Campus-RS or -HRS desktop unit. The , installed into either, provides one end of a High-bit-rate Digital Subscriber Line (HDSL) transmission system. When connected to another Campus-RS, Campus-HRS, Campus-T1®, Campus-768®, or Campus-E1® desktop unit or a line unit in another chassis, the Campus system transports digitized voice, data, and video signals over existing copper wire at an HDSL rate specified by the user from a range of rates up to 4.608 Mbps.

When the Campus-REX2 is installed in a Campus-HRS desktop unit or with a Campus-HRS line unit (or older), only T1, E1, and 768 Mbps data rates are supported.

INSTALLING THE CAMPUS-REX2

The following sections describe how to install the Campus-REX2 RS Interface Card into either a:

- Campus desktop unit on page 1-3
- Campus-Star chassis on page 1-4



Ensure that the Campus-REX2 is installed into a Campus-RS or Campus-HRS desktop unit or into a Campus-Star chassis with a Campus-RS or Campus-HRS line unit only. The Campus-REX2 will not operate if it is installed in an earlier version of these Campus products.

Ensure that you read important information on surge protection for HDSL line installation in the line unit or desktop unit manual before installing the Campus-REX2 interface card.

For information about compatibility between the Campus-REX2 and other Campus products, refer to “Product Compatibility” on page 136.

For information about products that comprise a Campus system, refer to “Composition of a Campus-RS System” on page 120.

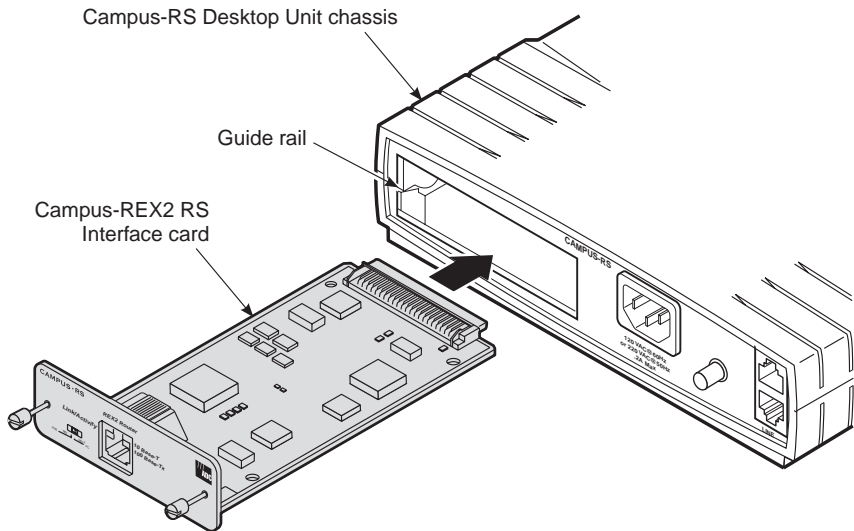
Installing into a Desktop Unit

Install the Campus-REX2 interface card into a Campus-RS or Campus-HRS desktop unit before you install the desktop unit (install power and HDSL cables). Install the Campus-RS desktop unit using the instructions in the *Campus-RS Desktop Unit User Manual*.



Ensure power is off to the desktop unit before you install the Campus-REX2. Installing the card with the power on may cause damage to the desktop unit, the card, or to both.

- 1 Ensure that the desktop unit is not connected to power.
- 2 Slide the Campus-REX2 into the guide rails in the rear of the desktop unit.



- 3 Gently press the card into place until it is seated firmly in the mating connector.
- 4 Secure the card in place using the two captive screws.
- 5 Complete the desktop unit installation using the *Campus-RS Desktop Unit User Manual*.

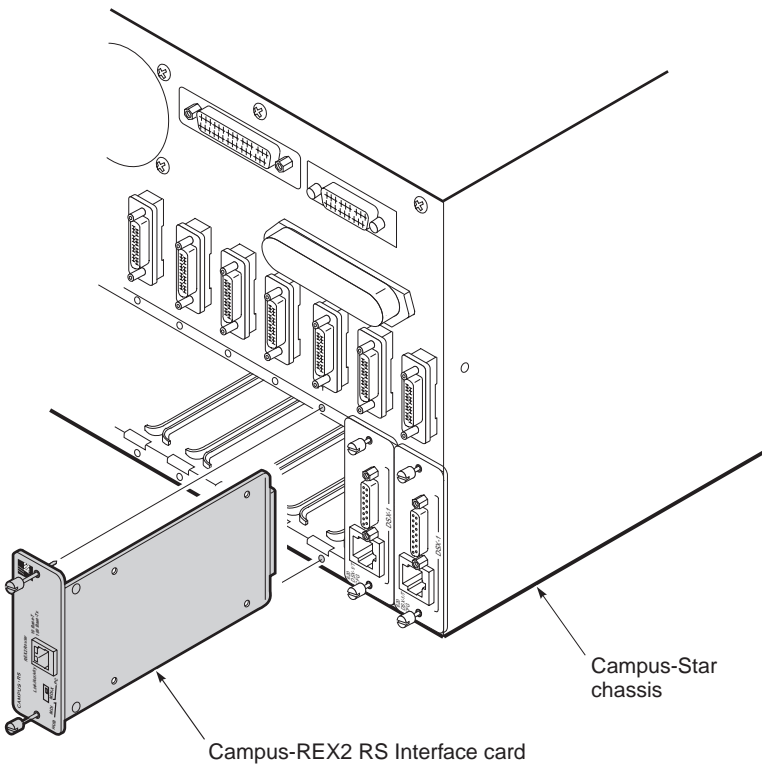
Installing into a Campus-Star Chassis

The Campus-REX2 must be installed into a Campus-Star chassis first, before you install the corresponding Campus-RS or Campus-HRS line unit.



The Campus-REX2 is not hot-swappable. Damage may occur to the Campus-REX2, the line unit, or both if the line unit is installed before you install the Campus-REX2.

- 1 Ensure that a line unit is not installed in the line-unit slot corresponding to the slot where you will install the Campus-REX2.
- 2 Slide the Campus-REX2 into the guide rails of the selected slot at the rear of the Campus-Star chassis.



- 3 Gently press the card into place until it is seated firmly in the mating connector.
- 4 Secure the card in place using the two captive screws.
- 5 Install a Campus-RS line unit and connect it to an HDSL line using the *Campus-RS Line Unit User Manual*. The line unit provides the DSL connection for the interface card.

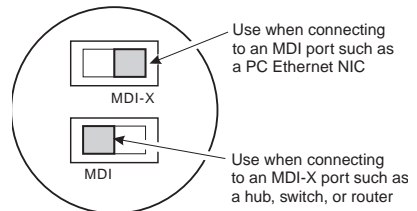
CONNECTING THE ETHERNET LINE

The 10 Base-T and 100 Base-Tx (10/100Base-T) port on the rear panel of the Campus-REX2 connects to a LAN through a hub, repeater, or another router. The port autosenses both the 10/100Base-T port rate and half- or full-duplex mode of the network device to which it connects and matches the configuration.

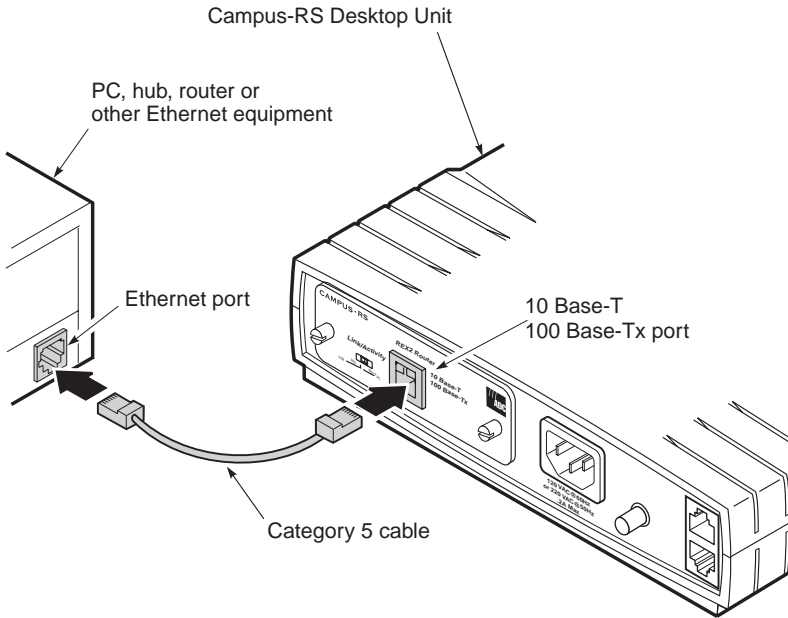
Use a straight-through Category 5 cable to connect the Ethernet port. Set the MDI/MDI-X switch to the appropriate position, dependent on the device to which you are connecting.

- 1 Set the Campus-REX2 MDI/MDI-X switch to one of the following:

- MDI-X when connecting to network equipment such as an Ethernet NIC in a PC or any other equipment that has an MDI port
- MDI when connecting to network equipment such as a hub, switch, or router or any other equipment that has an MDI-X port



- 2 Plug one end of the Category 5 cable into the 10/100Base-T connector on the Campus-REX2 faceplate.



The Campus-REX2 10/100Base-T interface operates in either half- or full-duplex mode which is determined by autosensing its network connection. Both the LCD menu and console menu displays the mode.

- 3 Connect the other end of the Ethernet cable to the local Ethernet equipment (repeater, PC NIC, or other Ethernet device).

POWERING UP AND CHECKING THE CONNECTION

Verify operating status after completing a full installation that includes installing of the Campus-REX2 into a desktop unit or Campus-Star chassis and then completing the installation of the desktop unit or the Campus-Star chassis (including the Line Unit):

- 1** Verify that the power cord is connected to the desktop unit or to the Campus-Star chassis (if you have an AC power supply) and to an external power source. Then verify the powerup of and HDSL connection for that unit as specified in the appropriate user manual.
- 2** If the Campus-REX2 is installed in a desktop unit, press the power button to On. The button is located on the back of the desktop unit.
- 3** Verify that the Link LED on the Campus-REX2 card is green. This indicates that the 10/100Base-T connection is operating correctly. If the Link LED does not light green, check the 10/100Base-T cabling configuration.

If the link LED does not light green, check that the MDI/MDI-X switch is set to the appropriate position.

SETTING UP ACCESS TO THE CAMPUS UNIT

Configure a Campus system through any of the following:

- a PC connected to the desktop unit Console port
- a PC connected to the Campus-Star line unit Console port
- a telnet session to the Campus-REX2 over the Internet or the CMU in a Campus-Star chassis
- the LCD menu and buttons on the desktop unit or CMU front panel
- StarGazer or a comparable EMS using SNMP

A Console port or telnet connection provides access to configuration menus that provide options not available through the LCD menus. Depending on your immediate configuration requirements, you may not need to set up a PC immediately. Use the Console port or a telnet session when you:

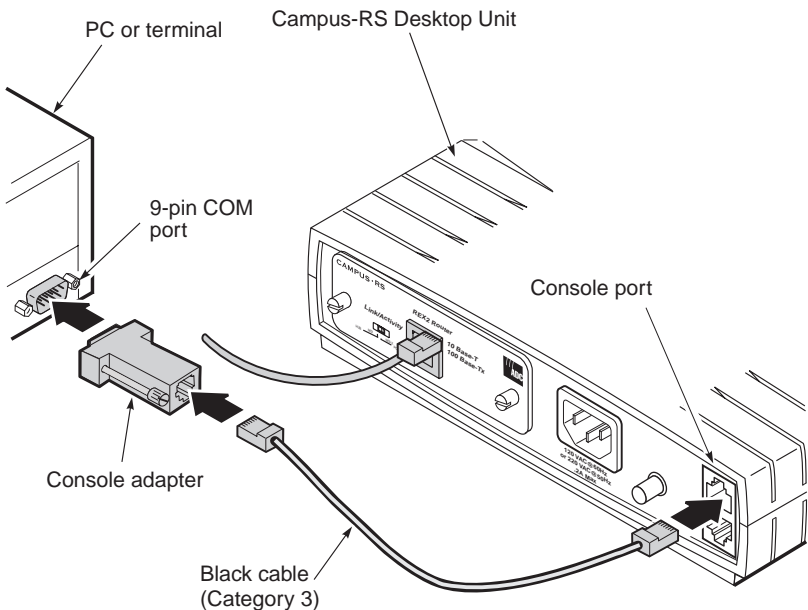
- configure the Campus-REX2 as a router (only some bridging and routing configuration is available using the LCD)
- want to change the HDSL transmission rate and do not want to use the LCD menus
- will set additional configuration options at this time, such as system or REX2
- want to view performance statistics for the HDSL and 10/100Base-T interfaces

If you want to set up a PC at this time, refer to “Setting Up Access to the Campus Unit” on page 8.

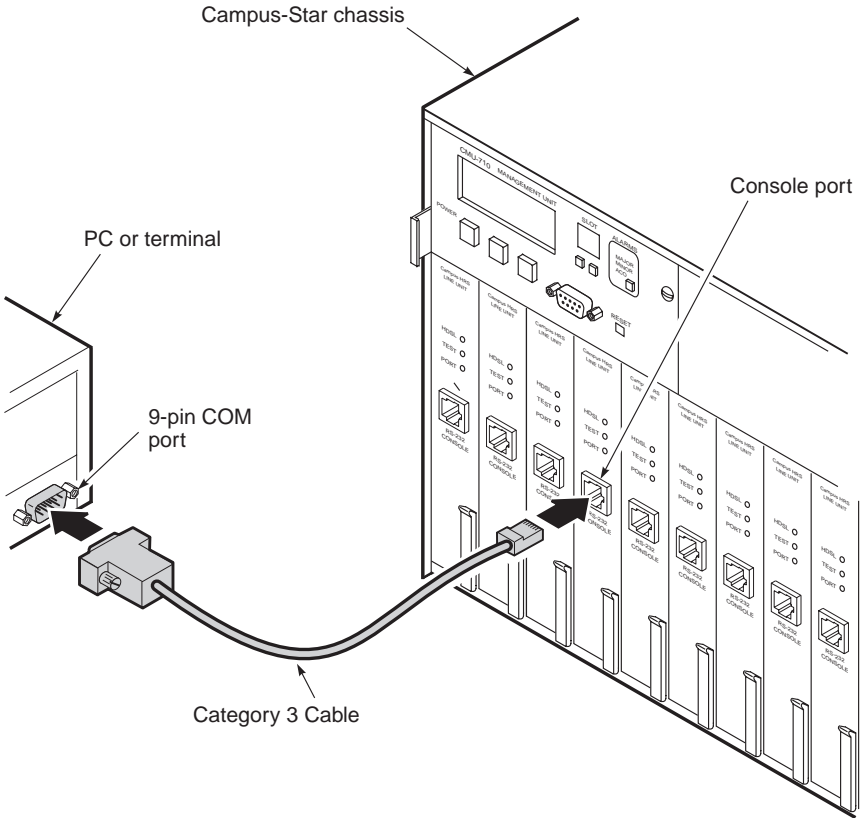
Connecting to the Campus Unit Console Port

Use a terminal or a PC with terminal emulation software (both will be referred to as PC) connected to the Console port to configure Campus system options, manage the unit, and generate system reports. The PC connects to the Console port on the desktop unit, the line unit (in a Campus-Star chassis), or the CMU-810 installed in the Campus-Star chassis.

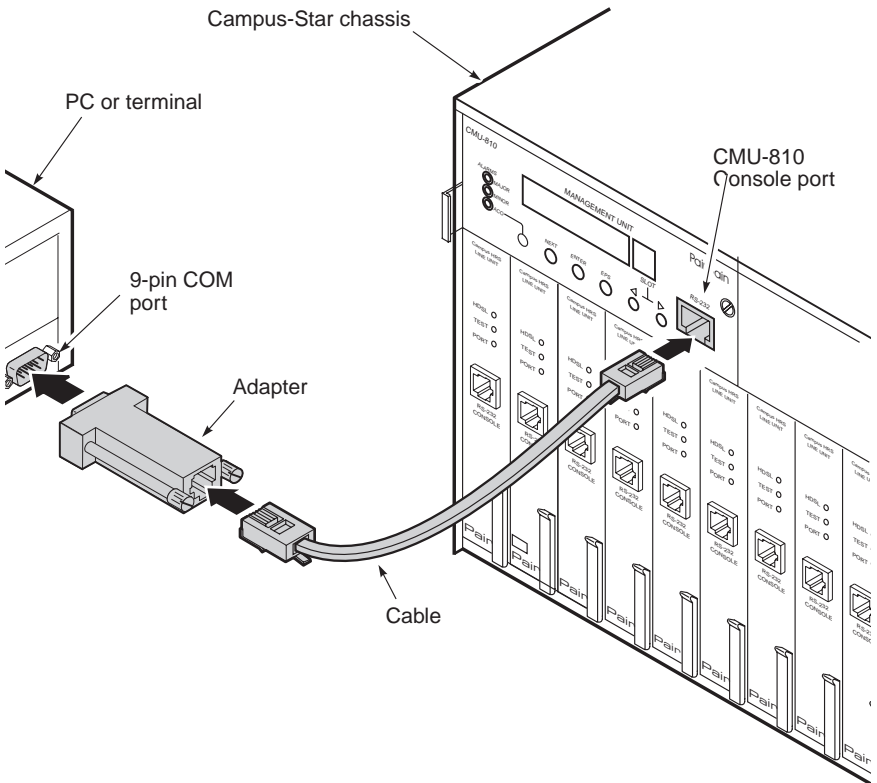
- 1 Connect the Console adapter into the standard 9-pin COM port on the PC and tighten the attached screws.
- 2 Plug one end of the console cable into the PC's COM port or console adapter, then do one of the following:
 - If the Campus-REX2 is installed into a desktop unit, connect the other end of the console cable into the desktop unit Console port.



- If the Campus-REX2 is installed in a Campus-Star chassis, do one of the following:
 - plug the other end of the console cable into the Console port on the front of the line unit



- plug the other end of the console cable into the Console port of the CMU-810 Management unit (when installed), as described in the *Campus-Star with CMU-810 User Manual*



3 Configure the terminal or PC terminal emulation software with the following communications settings:

- 9600 baud
- no parity
- 8 data bits
- 1 stop bit
- no hardware flow control

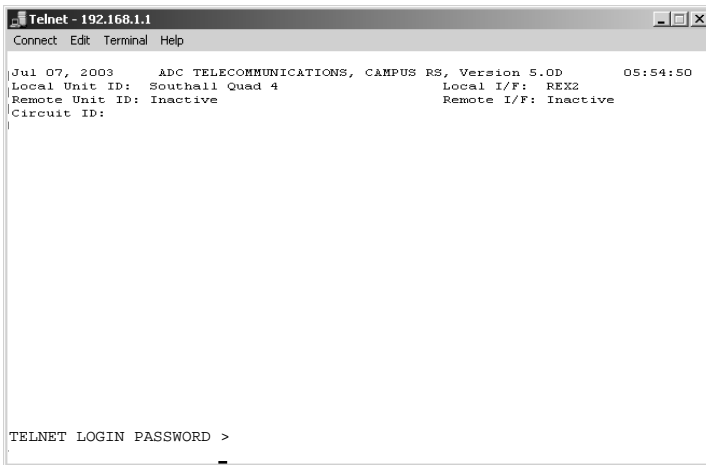
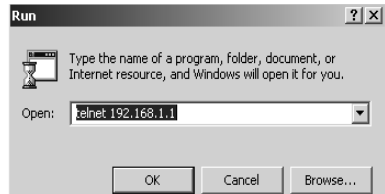
LOGGING IN

Access the Campus-REX2 menus for configuration and management using any of these four logins, which can be concurrently connected:

- a telnet session to the Campus-REX2 (see below)
- a login to the local Campus unit through the Console port (see “Logging In a Local Campus Unit through the Console Port” on page 13)
- a logon from a remote Campus unit through its Main Menu (see “Logging On a Remote Campus Unit” on page 15)
- a login through the CMU in the Campus-Star chassis

Logging In a Campus Unit Using Telnet

Use telnet protocol to access the Campus unit for configuration and management over the Internet. From the Windows Start menu, select Run. Enter the telnet command and the IP address for the Campus-REX2 (default IP address is 192.168.1.1). The timeout for disconnecting a telnet session is five minutes (time frame with no keyboard activity to the Campus unit). The following login screen is displayed:



Enter the configured password (default password is **ENTER**) to log on the Campus-REX2 Main Menu.

Logging In a Local Campus Unit through the Console Port

You previously set up the terminal communication settings (Step 3 on page 1-11) for your PC to access the Campus unit. From your terminal emulation software or your terminal, do the following:

- 1 Press the **SPACEBAR** on the PC keyboard several times until the baud rate is established and the Login Password screen is displayed as shown below.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Inactive      Remote I/F: Inactive
Circuit ID:

LOGIN PASSWORD >
```

If the system does not respond when you attempt to log on, ensure that hardware flow control is turned off in the terminal emulation software on the PC or for the terminal.

- 2 Press **ENTER** (default password) to log on. If a password was previously configured, type that password then press **ENTER**. The Main Menu is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:
Remote Unit ID: Inactive      Local I/F: REX2
Circuit ID:                  Remote I/F: Inactive

                                MAIN MENU

1) SYSTEM STATUS
2) REX2 CONFIGURATION AND STATUS
3) SYSTEM CONFIGURATION
4) MAINTENANCE
5) REMOTE LOGON

                                (L)ogout

ENTER CHOICE>
```

Once you are logged into the Campus unit through the console port, there is no timeout defined for the session. You will stay connected until you either log out or the Campus unit detects a disconnected console cable (DTR signal changes to inactive).

Logging On a Remote Campus Unit

Log on the remote Campus unit which is at the far end of the HDSL connection from the local Campus unit you are logged into. The remote Campus unit is accessed through the Main Menu of the local Campus unit:

- 1 From the Main Menu of the local Campus-REX2, type **5** then press **ENTER**. The following message is displayed:

```
Enter <ESC><ESC> to Exit Remote Login Mode.
Remote Login, Please wait. . . . .
```

You can exit from this function or from the remote login by pressing **ESC** twice. The following logon screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:  Southhall Quad 4      Local I/F:  REX2
Remote Unit ID:  Central                Remote I/F: REX2
Circuit ID:     Southeast line 421

REMOTE_LOGON PASSWORD >
```

The menu header changes to indicate the remote unit ID as the local unit, and local unit ID as the remote. This shows that the terminal program is physically connected to the local unit, but is configuring as if it were connected to the remote unit.

If the remote unit is also a Campus-REX2, the screens and procedures on the Remote Main Menu are identical to those on the Local Main Menu, except the REMOTE LOGON option is not available. If the remote unit is not a Campus-REX2, the screens support that remote interface card (see the appropriate interface card user manual for a description of the screens and configuration options).

LOGGING OFF

From the Main Menu, type **L** then press **ENTER** to logout of the unit menus. If the Main Menu is not the current menu, type **R** or **M** (when available) then press **ENTER** to return to the Main Menu where you can logout as described above. The logout procedure is the same whether you are connected to the console port or through a telnet session.

USING THE MENUS

The bottom of each menu screen identifies all of the keys you can use on that screen. Several keys operate identically on all of the menu screens:

To:	Do this:
Access menu items	Type the number of the item then press ENTER .
Return to the previous menu	Type R then press ENTER .
Return to the Main Menu	Type M then press ENTER when the menu is more than one level below the Main Menu.
Clear or update status information	<ul style="list-style-type: none">Type C then press ENTER to clear or reset the information on a status screen.Type U then press ENTER to update the information on a status screen.

Configure options as described below:

For this option type:	Do this:
Select a value from a list of predefined values	<ol style="list-style-type: none">Type the number of the option then press ENTER. The option setting changes to the next value in the list and the screen redraws.Repeat the first step until the option is set to the preferred value.
Type in required information	<ol style="list-style-type: none">Type the number of the option then press ENTER. The screen prompts you for information.Type the information in the format requested then press ENTER.

When you have selected or entered configuration changes for some parameters such as bridging or routing, you must save those changes for them to be permanent (saved if power to the Campus-REX2 is cycled). Type **R** from a configuration screen until you return to the root for that configuration and then save the changes. For example, the REX2 Configuration and Status screen is the root for REX2 configuration.

OPERATING WITH DEFAULT VALUES

Campus-REX2 can be operated using its default settings which include:

- HDSL Operating Mode set to Standard Mode
- Standard Mode HDSL Rate set to T1
- network protocol set to bridge, with the encapsulation format set to cHDLC
- Spanning Tree protocol disabled
- Timing Source set to Internal

Set other configurable options to customize the Campus system to your network requirement as described in the following chapters. The LAN port has a default IP address assigned (192.168.1.1) that you can change to fit your IP networking scheme.

CONFIGURING HDSL PARAMETERS

2

Campus units have a default HDSL configuration to operate in Standard Mode with a T1 (1.544 Mbps) HDSL Rate. This default configuration is compatible with other Campus-RS and Campus-HRS products (including the Campus-T1 desktop units and line units) if you choose to operate them in their default configuration.

For:	See Page:
Configuring HDSL Parameters	20
Configuring HDSL Alarms	26

You can also configure the HDSL parameters through the LCD menus. See “Using the LCD for Configuration and Management” on page 7-97 for instructions on using the LCD panel. To view system performance and other status information, see “Monitoring and Testing the Campus System” on page 5-73.



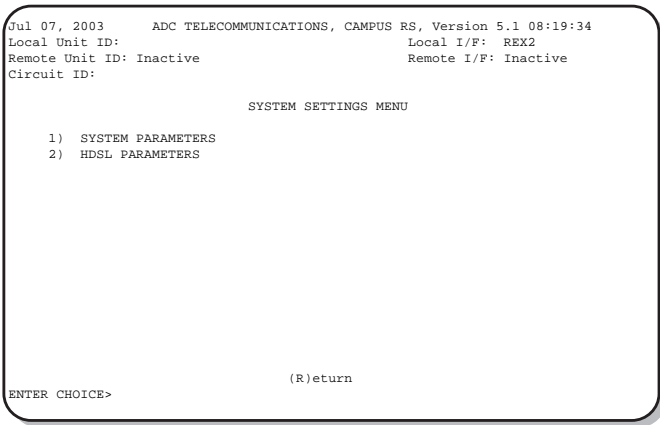
Changes to the HDSL operating mode or transmission rate are not automatically made to the remote unit. These changes must be made at both the local and remote units for the HDSL link to be re-established. If the remote unit is not easily accessible, you can follow the instructions in “Logging On a Remote Campus Unit” on page 1-15 to use a PC for a remote logon (if an HDSL link is up) and make the preferred change. When you change the HDSL settings on the remote unit, the HDSL link is lost; it is re-established when you make the identical change(s) on the local unit.

CONFIGURING HDSL PARAMETERS

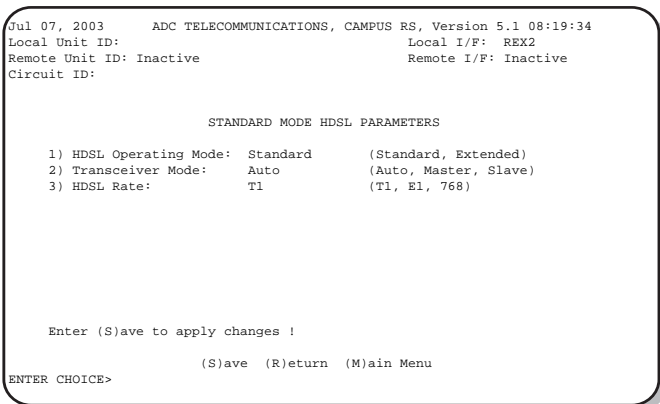
Access the HDSL configuration screen, then configure parameters.

Accessing HDSL Configuration

From the Main Menu (page 14), type **3** then press **ENTER** to access the System Settings Menu.



From the System Settings Menu, type **2** then press **ENTER** to access the HDSL Parameters screen. From this screen, you can configure or change values. Standard Mode is the default HDSL Parameters screen.



Selecting HDSL Parameters

You can use the default HDSL setting for your Campus-RS unit (when also using the default settings on the remote unit to which this unit connects) which are:

- standard for the HDSL operating mode
- auto for the transceiver mode (determines which device is the master or slave)
- T1 for the HDSL rate

If you want to change any of these parameters, select one of the following sections based on the HDSL operating mode you will use. Campus-RS offers these two HDSL operating modes:

- Standard mode (page 22) provides compatibility between a Campus-RS product and an earlier Campus product (legacy Campus) that has a HDSL interface including T1, E1, or 768:
 - for T1, the maximum transmission rate is 1.544 Mbps over 2 pairs
 - for E1, the maximum transmission rate is 2.048 Mbps over 2 pairs
 - for 768, the transmission rate is 768 kbps over 1 pair
- Extended mode (page 23) provides a fractional rate selection between the HDSL interfaces of two Campus-RS products. The rate is selectable as follows:
 - for 1 pair in 64 kbps increments, starting at 128 kbps up to 2.304 Mbps
 - for 2 pair in 128 kbps increments, starting at 256 kbps up to 4.608 Mbps

Using Standard Mode

Standard mode is the default configuration for the HDSL operating mode. When standard mode is selected, only three HDSL rates (T1, E1, and 768) are available. You can select any of the three options for transceiver mode, however.

- 1 From the HDSL Parameters menu, type **1** then press **ENTER** if the HDSL Operating Mode is set to Extended. Standard is now displayed as the HDSL Operating Mode.



It is recommended that you leave the Transceiver Mode option set to Auto unless you require that a particular end of the HDSL connection be the Master or Slave.

Also, this value cannot be changed if the HDSL link is up.

- 2 To change the Transceiver Mode, type **2** then press **ENTER**. The Transceiver Mode changes to the next setting. Repeat until the preferred setting is selected:
 - Master initiates the HDSL link. The other Campus unit must be set to Slave or Auto.
 - Slave waits for the other Campus unit to initiate the HDSL link. The other unit must be set to Master or Auto.
 - Auto (default) automatically switches between Master and Slave until an HDSL link is established.

The Transceiver Mode option determines the hierarchy of the two Campus units when attempting to establish an HDSL link.

- 3 To change the HDSL Rate, type **3** then press **ENTER**. The HDSL Rate changes to the next setting. Repeat until the HDSL Rate is set to the preferred setting of T1 (default), E1, or 768.
- 4 Type **S** to save and apply HDSL changes as prompted by:
Enter (S)ave to apply changes !
- 5 To exit the menu, type **R** (go back one screen) or **M** (return to the Main Menu).

Using Extended Mode

With Extended mode, the HDSL link can comprise either one or two loops with a rate selection in 64 (1 pair) or 128 (2 pair) kbps increments. The transmission rate between two Campus-RS products is up to 4.608 Mbps with two pair or 2.304 Mbps with one pair. Both the one loop network or two loop network operate only in full-duplex transmission.

- 1 From the HDSL Parameters menu, type **1** then press **ENTER**. The HDSL Operating Mode options changes from Standard to Extended as shown below.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:           Local I/F: REX2
Remote Unit ID: Inactive      Remote I/F: Inactive
Circuit ID:

                EXTENDED MODE HDSL PARAMETERS

1) HDSL Operating Mode:  Extended      (Standard, Extended)
2) Transceiver Mode:    Auto          (Auto, Master, Slave)
3) HDSL Loop Mode:      2 Loops       (1 Loop, 2 Loops)*
4) HDSL Rate:           256

*Note:
  1 Loop = single loop, full duplex
  2 Loops = two loops, full duplex

Enter (S)ave to apply changes !

                (S)ave (R)return (M)ain Menu
ENTER CHOICE>

```



It is recommended that you leave the Transceiver Mode option set to Auto unless you require that particular ends of the HDSL connection be the Master and Slave.

Also, this value cannot be changed if the HDSL link is up.

- 2 To change the Transceiver Mode, type **2** then press **ENTER**. The Transceiver Mode changes to the next setting. Repeat until the preferred setting is selected:
 - Master initiates the HDSL link. The other Campus unit must be set to Slave or Auto.
 - Slave waits for the other Campus unit to initiate the HDSL link. The other unit must be set to Master or Auto.
 - Auto (default) automatically switches between Master and Slave until an HDSL link is established.

The Transceiver Mode option determines the hierarchy of the two Campus units when attempting to establish an HDSL link.

- 3 To change the HDSL Loop Mode from 1 Loop (default) to 2 Loop, type **3** then press **ENTER**.
- 4 To select an HDSL Rate, type **4** then press **ENTER**. The Select HDSL Rate screen that is displayed is dependent on whether you selected 1 Loop or 2 Loop for the HDSL Loop Mode. The minimum and maximum rates are:
 - for 1 Loop, 128 kbps is the minimum and 2304 Mbps is the maximum selected in 64 kbps increments; the default is 128 kbps
 - for 2 Loop, 256 kbps is the minimum and 4608 Mbps is the maximum selected in 128 kbps increments; the default is 256 kbps

Choose a rate from one of the following:

- For 1 Loop, the Select HDSL Low Rate screen is displayed. To select a rate, type a number from 2 to 36 then press **ENTER**.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:
Remote Unit ID: Inactive      Local I/F: REX2
Circuit ID:                  Remote I/F: Inactive

                          SELECT HDSL LOW RATE

Current HDSL Rate: 128
Current Loop Mode: 1 Loop

 1) N/A                    13) 832 kbps           25) 1600 kbps
 2) 128 kbps              14) 896 kbps           26) 1664 kbps
 3) 192 kbps              15) 960 kbps           27) 1728 kbps
 4) 256 kbps              16) 1024 kbps          28) 1792 kbps
 5) 320 kbps              17) 1088 kbps          29) 1856 kbps
 6) 384 kbps              18) 1152 kbps          30) 1920 kbps
 7) 448 kbps              19) 1216 kbps          31) 1984 kbps
 8) 512 kbps              20) 1280 kbps          32) 2048 kbps
 9) 576 kbps              21) 1344 kbps          33) 2112 kbps
10) 640 kbps              22) 1408 kbps          34) 2176 kbps
11) 704 kbps              23) 1472 kbps          35) 2240 kbps
12) 768 kbps              24) 1536 kbps          36) 2304 kbps

                          (R)return (M)ain Menu

ENTER CHOICE>

```

- For 2 Loop, the Select HDSL High Rate screen is displayed. To select a rate, type a number from 2 to 36 then press **ENTER**.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:
Remote Unit ID: Inactive      Local I/F: REX2
Circuit ID:                  Remote I/F: Inactive

                          SELECT HDSL HIGH RATE

Current HDSL Rate: 256
Current Loop Mode: 2 Loops

 1) N/A                    13) 1664 kbps          25) 3200 kbps
 2) 256 kbps              14) 1792 kbps          26) 3328 kbps
 3) 384 kbps              15) 1920 kbps          27) 3456 kbps
 4) 512 kbps              16) 2048 kbps          28) 3584 kbps
 5) 640 kbps              17) 2176 kbps          29) 3712 kbps
 6) 768 kbps              18) 2304 kbps          30) 3840 kbps
 7) 896 kbps              19) 2432 kbps          31) 3968 kbps
 8) 1024 kbps             20) 2560 kbps          32) 4096 kbps
 9) 1152 kbps             21) 2688 kbps          33) 4224 kbps
10) 1280 kbps             22) 2816 kbps          34) 4352 kbps
11) 1408 kbps             23) 2944 kbps          35) 4480 kbps
12) 1536 kbps             24) 3072 kbps          36) 4608 kbps

                          (R)return (M)ain Menu

ENTER CHOICE>

```

5 Type **R** to exit the menu. (Typing **M** will return you to the Main Menu.)

6 Type **S** to save and apply HDSL changes as prompted by:

Enter (S)ave to apply changes !

CONFIGURING HDSL ALARMS

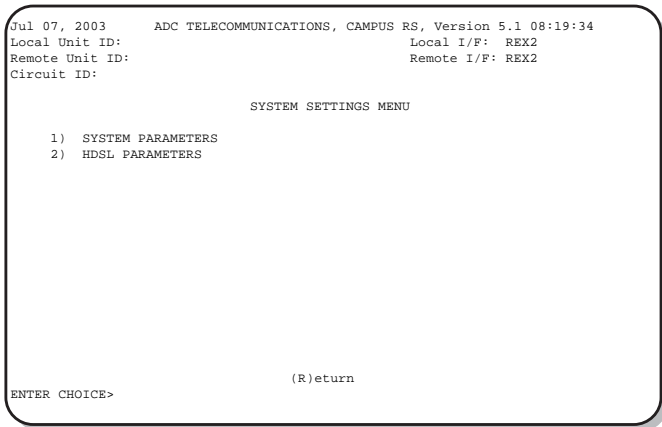
You can configure options for four types of alarms:

- HDSL ES Alarm Threshold determines the number of errored seconds that must occur to trigger an alarm.
- HDSL Margin Alarm Threshold determines the margin, in dB, that triggers an alarm.
- Alarm on Local I/F LOS lets you enable or disable the local Loss of Signal alarm.
- Alarm on Remote I/F LOS lets you enable or disable the remote Loss of Signal alarm.

Access the configuration screen, then set the options.

Accessing HDSL Alarms Configuration

- 1 From the Main Menu (page 14), type **3** then press **ENTER** to access the System Settings Menu.



- 2 From the System Settings Menu, type **1** then press **ENTER**. The System Parameters screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID:  Remote I/F: REX2
Circuit ID:

                        SYSTEM PARAMETERS

1) CHANGE SYSTEM TIME
2) CHANGE SYSTEM DATE
3) CHANGE UNIT ID
4) CHANGE CIRCUIT ID
5) CHANGE UNIT PASSWORD
6) HDSL ES Alarm Threshold: Disabled (Disabled, 17, 170)
7) HDSL Margin Alarm Threshold: Disabled
8) Local Data Port LOS Alarm: Disabled (Disabled, Enabled)
9) Remote Data Port LOS Alarm: Disabled (Disabled, Enabled)

10) RESTORE FACTORY DEFAULTS

                        (R)return (M)ain Menu

ENTER CHOICE>

```

Setting HDSL Alarms

The default setting for all alarming is Disabled. Completing the following steps to either select a value or to enable the alarm reporting.

- 1 To select an HDSL ES Alarm Threshold (Disabled is the default), type **6** then press **ENTER** to select one of the following as the ES threshold:
 - 17 errored seconds occurring in a 24-hour period
 - 170 errored seconds occurring in a 24-hour period

An alarm is generated when the defined threshold for HDSL errored seconds is exceeded, indicating a deterioration in performance. An errored second is one in which one or more block errors (CRC anomalies) or LOSW defects occur within the threshold interval.

- 2 To configure the HDSL Margin Alarm Threshold:
 - a Type **7** then press **ENTER**.
 - b At the prompt, enter a value between 1 and 25 decibels (dB) then press **ENTER**.

Enter Margin alarm threshold value (1-25dB), or "D" to disable>**6**

An alarm is generated when the defined threshold for HDSL Margin is exceeded. Margin indicates the signal to noise ratio at a receiver point.

- 3 To enable the Local Data Port LOS Alarm, type **8** then press **ENTER**.
When enabled, an alarm is generated when a loss of signal is detected at the data port on the local Campus unit. (To disable this alarm, repeat the procedure).
- 4 To enable the Remote Data LOS Alarm, type **9** then press **ENTER**.
When enabled, an alarm is generated when a loss of signal is detected at the data port on the local Campus unit. (To disable this alarm, repeat the procedure).

The new HDSL alarm settings take effect immediately after entered and a save command is not required.

CONFIGURING THE REX2

3

The Campus-REX2 RS is a 10/100Base-T Ethernet interface card that provides connectivity for LAN services. The Campus-REX2, as its default configuration, provides IEEE 802.1d transparent MAC level bridging. You can change the default configuration to routing and set the appropriate IP parameters for the LINE and LAN. Also, you can set up parameters for SNMP management.

You can use the Campus-REX2 with its default settings that include bridge mode, cHDLC encapsulation, and Spanning Tree protocol set to disabled. If, however, you require to change any of these parameters for implementing your network, use the procedures in this chapter.

For:	See Page:
Accessing the REX2 Configuration and Status Screen	30
Configuring the Campus-REX2 as a Bridge	30
Configuring the Campus-REX2 as a Router	44
Configuring the Campus-REX2 for SNMP Management	60

You can also configure SNMP parameters which provide a way to manage the Campus-REX2 system over a network.

Some of the bridging parameters can also be configured through the LCD menu. See “Using the LCD for Configuration and Management” on page 97 for instruction. For an overview of bridges, routers, and other network management concepts, see “Internetworking and Management Overview” on page 119.

The Campus-REX2 supports forwarding larger-sized VLAN frames. There is no configuration required to pass VLAN traffic with frame sizes between 64 and 1536 bytes.

ACCESSING THE REX2 CONFIGURATION AND STATUS SCREEN

From the Main Menu (page 1-14), type **2** then press **ENTER** to access the REX2 Configuration and Status screen.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Remote I/F: REX2
Circuit ID:

                REX2 CONFIGURATION AND STATUS

LAN STATUS:     100BaseT, Full Duplex, Up
LINE STATUS:   Standard, Auto, T1, Up
MAC ADDRESS:   00:20:A7:01:02:08

                1) Network Protocol:   Bridge      (Bridge, Router)
                2) Encapsulation:     cHDLC      (cHDLC, PPP)
                3) Timing Source:     Internal   (Internal, HDSL)
                4) BRIDGE CONFIGURATION
                5) BRIDGE STATISTICS
                6) SNMP CONFIGURATION

                (R)return

ENTER CHOICE>
```

CONFIGURING THE CAMPUS-REX2 AS A BRIDGE

A bridge moves information across a network from a source to a destination at the link layer (of an OSI reference model). The information is sent to a physical address known as a Media Access Control (MAC) address. See “MAC-Level Bridging and Spanning Tree Protocol” on page 124 for more information about bridging.

This section describes how to configure the bridge (default setting) options found on the screen shown above for the Campus-REX2, including:

- “Configuring Bridge Protocol, Encapsulation and Timing” on page 31
- “Configuring Bridge Features” on page 32
 - “Configuring Spanning Tree Protocol” on page 33
 - “Configuring the Bridge Unit IP” on page 38
- “Saving the Bridge Configuration” on page 40
- “Accessing the Bridge and ARP Tables” on page 41

Configuring Bridge Protocol, Encapsulation and Timing

The Campus-REX2, as a default configuration, bridges Ethernet frames.

- 1 Type **1** then press **ENTER** if bridge is not selected.
- 2 To change the packet encapsulation, type **2** then press **ENTER**. Select an Encapsulation option:
 - cHDLC for Campus-REX2 to another Campus-REX2 application
 - PPP when the remote Campus unit has a synchronous interface card such as a V.35 or when connecting to Ethernet equipment from another manufacturer
- 3 To change the timing source, type **3** then press **ENTER**. Select a timing source setting:
 - Internal (default setting) which takes its timing from an internal oscillator
 - HDSL which takes its timing from the HDSL link

The Timing Source option determines the source of circuit timing on the HDSL link. The proper setting of the Timing Source option depends upon the interface card of the remote Campus unit:

- If the Campus-REX2 is connected to a Campus unit with another Campus-REX2, leave the Timing Source option set to Internal. Set the other end (remote) of the connection to HDSL; the Campus system will not operate properly if both units are set to HDSL.
- If the Campus-REX2 is connected to a Campus unit with a synchronous interface card, such as a Fractional V.35 card, the timing source depends on the setting of the Primary Timing Source option of the remote unit:
 - Set the Timing Source to HDSL if the remote unit is set to Internal or Data Port.
 - Set the Timing Source to Internal if the remote unit is set to HDSL.

See the *Campus-RS Fractional Interface Card User Manual* for information on the Primary Timing Source option.

- If the Campus-REX2 is connected to a Campus unit with a Campus CSU/DS-1 or CSU/DSX-1 interface card, set the Timing Source option to Internal.

Configuring Bridge Features

This section provides procedures for configuring bridging features such as filter aging and Spanning Tree Protocol. And, although a bridge does not require an IP address, you will set up IP configuration for the unit so that you can access it for management using SNMP, telnet, or FTP.

- 1 To configure the bridge, from the REX2 Configuration and Status screen type **4** then press **ENTER**. The Bridge Configuration screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Remote I/F: REX2
Circuit ID:

                          BRIDGE CONFIGURATION

1) Bridge Filter Age (sec):   300           (10 - 100000)
2) SPANNING TREE CONFIGURATION
3) BRIDGE TABLE
4) ARP TABLE

UNIT IP  5) IP Configuration:   Static       (Static, DHCP Client)
6) IP Address: 192.168. 1. 1
   Subnet Mask: 255.255.255. 0
7) Default Gateway: 0 .0 .0 .0

                                (R)eturn (M)ain Menu

ENTER CHOICE>
```

The bridge and Address Resolution Protocol (ARP) tables are dynamically built and can be accessed from this screen. See “Viewing the Bridge Table” on page 41 and “Viewing the ARP Table” on page 42 for more information.

- 2 To set the bridge filter age, type **1** then press **ENTER**. Enter the filter age time in seconds from 10 to 100000 (300 is the default) at the prompt:

```
Enter New Bridge Filter Age in Seconds : 1000
```

The bridge filter age indicates the time in seconds in which a MAC address entry is eliminated from the bridging table if it is not relearned.

- 3 If you want to enable Spanning Tree Protocol, continue to “Configuring Spanning Tree Protocol” on page 33.

Configuring Spanning Tree Protocol

Complete this section if you want to enable Spanning Tree Protocol (STP). Spanning Tree Protocol is disabled as a default configuration. See “About Spanning Tree Protocol” on page 124 for more information about the protocol.

- 1 From the Bridge Configuration screen (page 3-32), type **2** then press **ENTER**. The Spanning Tree Configuration screen is displayed.
- 2 To enable Spanning Tree Protocol, type **1** then press **ENTER**. (You can also change the Spanning Tree option to Disabled when Enabled is selected by typing **1**.)

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Remote I/F: REX2
Circuit ID:

                SPANNING TREE CONFIGURATION

UNIT   1) Spanning Tree Protocol:  Enabled      (Disabled, Enabled)
        2) Bridge Priority:        32768        (0 - 65535)
        3) Max Age (sec):          20           (6 - 40)
        4) Hello Time (sec):       2            (1 - 10)
        5) Forward Delay (sec):    15           (2 - 30)

PORTS  6) LAN Port Priority:        128          (0 - 255)
        7) LAN Port Cost:          100          (0 - 65535)
        8) Line Port Priority:     128          (0 - 255)
        9) Line Port Cost:         648          (0 - 65535)

        10) SPANNING TREE STATUS

                (R)return (M)ain Menu

ENTER CHOICE>

```

Item 10 which allows you to view Spanning Tree Status is available only when Spanning Tree Protocol is enabled.

- 3 To set the Bridge Priority, type **2** then press **ENTER**. At the prompt, enter a value for the bridge priority between 0 and 65535 (default value is 32768):

Enter New Bridge Priority : **24000**

The bridge priority is set relative to other bridges in the same bridged LAN. The spanning tree priority indicates how centrally located this bridge is in its network. A lower number indicates a more centrally located bridge.

- 4** Set the maximum age, the hello time, and the forward delay using the following procedures. These values are related. If you choose incorrect values, an error message displays

```
Value entered is not within constraints:  
2 * (Forward Delay - 1) >= Max Age > 2 * (Hello  
Time + 1)
```

- a** To set the maximum age, type **3** then press **ENTER**. At the prompt, enter a value in seconds. This value indicates the maximum age for Spanning Tree information in the bridging table before it is discarded. The valid range is 6 to 40 seconds (default value is 20 seconds):

```
Enter New Max Age : 30
```

- b** To set the hello time, type **4** then press **ENTER**. At the prompt, enter a time interval in seconds at which the Campus-REX2 should send Spanning Tree Protocol packets (BPDUs). The valid range is 1 to 10 seconds (the default value is 2 seconds):

```
Enter New Hello Time : 4
```

- c** To set the forward delay, type **5** then press **ENTER**. At the prompt, enter a time interval in seconds that should be waited until the state of an interface can change. The valid range is 2 to 30 seconds (the default value is 15 seconds):

```
Enter New Forward Delay : 30
```

This delay prevents interface states from changing so rapidly that Spanning Tree Protocol cannot keep up with the current network topology and therefore cannot efficiently manage bridging.

- 5** To set the LAN port priority, type **6** then press **ENTER**. At the prompt, enter a value for the LAN port priority between 0 and 255 (the default value is 128):

```
Enter New LAN Port Priority : 50
```

Port priorities are set relative to other ports on the same bridge. The Line is the other port on this bridge.

- 6 To set the LAN port cost, type **7** then press **ENTER**. At the prompt, enter a value for the LAN port cost between 0 and 65535 (the default value is 100):

```
Enter New LAN Port Cost : 1000
```

This represents the cost for a packet to travel to the root in the current Spanning Tree configuration. This value is 0 if your bridge is the root device. The lower the transmission rate is for the LAN (10 or 100 Mbps), the higher you should configure its cost. When ports have the same path cost, port priority is considered.

- 7 To set the Line port priority, type **8** then press **ENTER**. At the prompt, enter a value for the Line port priority between 0 and 255 (the default value is 128):

```
Enter New Line Port Priority : 65
```

Port priorities are set relative to other ports on the same bridge. When the ports simultaneously request access to the network, this priority level determines the order in which the ports get access. The LAN is the other port on this bridge.

- 8 To set the Line port cost, type **9** then press **ENTER**. At the prompt, enter a value for the Line port cost between 0 and 65535 and 648 is the default value.

```
Enter New Line Port Cost : 1250
```

This represents the cost for a packet to travel to the root in the current Spanning Tree configuration. This value is 0 if your bridge is the root device. The lower the transmission rate is for the Line (HDSL rate from 64 kbps to 4.608 Mbps), the higher is its cost. When ports have the same path cost, port priority is considered.

- 9 Type **R** to return to the Bridge Configuration screen (page 3-32) from which you can configure other bridge parameters. (Typing **M** will return you to the Main Menu.)
- 10 If you are changing only Spanning Tree Protocol parameters, go to “Saving the Bridge Configuration” on page 40 to save your changes.

Viewing Spanning Tree Status

Access the Spanning Tree Status screen to view the configured parameters as well as information about both the bridge Line and the LAN ports. From the Bridge Configuration screen (page 3-32), type **2** then press **ENTER** to access the Spanning Tree Configuration screen. Item 10 which allows you to view Spanning Tree Status is available only when Spanning Tree Protocol is enabled.

- 1 To view Spanning Tree status, from the Spanning Tree Configuration screen type **1+0** then press **ENTER**.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID:  Remote I/F: REX2
Circuit ID:

                SPANNING TREE STATUS

Root Bridge:    00:20:A7:01:02:08 (this unit)
Root Port:      0
Root Bridge Priority: 32768
Root Path Cost: 0
Root Max Age (sec): 20
Root Hello Time (sec): 2
Root Forward Delay (sec): 15
Time since last Topology Change (sec): 25883
Number of Topology Changes: 4

                LAN                                LINE
Port State:     listening                          listening
Designated Bridge: 00:20:A7:01:02:08                00:20:A7:01:02:08
Designated Port ID: 1                              2
Designated Port Cost: 0                            0

(R)eturn (M)ain Menu
ENTER CHOICE>
```

This screen displays configured parameters and statistics for Spanning Tree Protocol. Spanning Tree Status indicates the following:

- Root Bridge indicates the MAC address of the root bridge. You are notified when the Campus-REX2 is designated the root bridge.
- Root Port, Root Bridge Priority, and Root Path Cost indicates the calculated values for each of these functions for the Campus-REX2 after the resolution of Spanning Tree (resolves network topology).
- Root Max Age indicates the reported maximum age for Spanning Tree information before it is discarded.
- Root Hello Time is the reported time interval in seconds when the Campus-REX2 sends Spanning Tree Protocol packets (BPDUs).

- Time since last topology change indicates the time in seconds since Spanning Tree last changed its topology.
- Number of topology changes indicates the total number of times that Spanning Tree changed its topology.

The following indicates information about each Spanning Tree port on this bridge (see ANSI/IEEE Standard 802.1D for definitions):

- Port state for the LAN and Line ports indicates one of the following:
 - disabled
 - blocking
 - listening
 - learning
 - forwarding
 - Designated Bridge lists the MAC address of these bridge ports.
 - Designated Port ID assigns a number for each port on this bridge (Line and LAN).
 - Designated Port Cost shows the calculated cost for each port on this bridge.
- 2 Type **R** to return to the Bridge Configuration screen (page 3-32) or type **M** to return to the Main Menu.

Configuring the Bridge Unit IP

The Unit IP configuration sets up the way that the bridge receives its IP configuration (statically or dynamically) and then provides fields where the IP address, subnet mask, and default gateway are entered.

- 1 To configure the Unit IP information, from the REX2 Configuration and Status screen type **4** then press **ENTER**. The Bridge Configuration screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:
Remote Unit ID:  Local I/F: REX2
Circuit ID:      Remote I/F: REX2

                          BRIDGE CONFIGURATION

1) Bridge Filter Age (sec): 300          (10 - 100000)
2) SPANNING TREE CONFIGURATION
3) BRIDGE TABLE
4) ARP TABLE

UNIT IP  5) IP Configuration:           Static      (Static, DHCP Client)
6) IP Address:                          192.168.  1.  1
   Subnet Mask:                          255.255.255.  0
7) Default Gateway:                       0.  0  .0  .0

                                (R)eturn (M)ain Menu
ENTER CHOICE>
```



A DHCP server should be set up and active on your LAN prior to enabling DHCP client for the Campus-REX2 LAN port.

- 1 To select a dynamic IP configuration for the bridge, type **5** then press **ENTER** to select DHCP Client. Static is the default configuration.

When set to DHCP Client, the Campus-REX2 LAN port automatically receives IP configuration (IP address, subnet mask, and default gateway) from a DHCP server on the LAN and displays this configuration in those respective fields on the screen.

When the IP Configuration is set to static, enter the IP address, subnet mask, and default gateway for the Campus-REX2 LAN port as described in steps 2 and 3.

- 2 If you choose static IP configuration, type **6** then press **ENTER**. At the prompt, enter the local IP address and subnet mask for the Campus-REX2 LAN port.

```
Required format is nnn.nnn.nnn.nnn
Enter IP Address: 10.0.0.1
Enter Subnet Mask (<CR> only=default Mask
255.0.0.0): 255.0.0.0
```

This parameter must be set for the Campus-REX2 to respond to an application (such as SNMP, telnet, and FTP) that uses the IP protocol. The subnet mask allows the Campus-REX2 to determine if a host, such as an SNMP management station or trap receiver, is on the same local subnet. If it is, the Campus-REX2 can send messages directly to the host; if not, messages must be sent through a default router. This must be set for the Campus-REX2 to respond to applications that use the IP protocol.

- 3 If you choose static IP configuration, type **7** then press **ENTER** to configure the default gateway. At the prompt, enter the IP address of the default gateway through which the Campus-REX2 can reach a host (SNMP station or trap receiver) on another network. The default value for this parameter is 0.0.0.0.

```
Required format is nnn.nnn.nnn.nnn
Enter Default Gateway: 192.150.10.50
```

Saving the Bridge Configuration

Save all configuration you have completed for the REX2 bridge.



Do not remove power to the Campus unit or disconnect the Line and LAN side network connections when upgrading software or saving configuration.

- 1 Type **R** and press **ENTER** until you return to the REX2 Configuration and Status screen (page 3-30).

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:                               Local I/F: REX2
Remote Unit ID:                              Remote I/F: REX2
Circuit ID:

                                REX2 CONFIGURATION AND STATUS

LAN STATUS: 100BaseT, Full Duplex, Up
LINE STATUS: Standard, Auto, T1, Up
MAC ADDRESS: 00:20:A7:01:02:08

1) Network Protocol:  Bridge      (Bridge, Router)
2) Encapsulation:    cHDLC       (cHDLC, PPP)
3) Timing Source:   Internal     (Internal, HDLSL)
4) BRIDGE CONFIGURATION
5) BRIDGE STATISTICS
6) SNMP CONFIGURATION
7) SAVE REX2 CONFIGURATION

WARNING: Configuration change(s) will be lost if not saved before
        resetting or powering unit down.

                                (R)return
ENTER CHOICE>
```

- 2 Type **7** to save changes. The following message is displayed to show that the save in progress:

```
WARNING: Do not power off unit or remove LAN
or Line connection.
```

```
Saving REX2 configuration; Please wait...
```

The following message is displayed when the save is completed:

```
REX2 configuration saved
Hit Any Key to Continue
```

Accessing the Bridge and ARP Tables

The bridge table shows MAC addresses that are dynamically learned by the Campus-REX2 (see “Viewing the Bridge Table” on page 41). The ARP table shows the MAC address associated with each IP address with which the bridge is communicating. The ARP table can be accessed from either the bridge or router configuration screen (see “Viewing the ARP Table” on page 42).

Viewing the Bridge Table

The bridge table contains a maximum of 2045 entries. These entries are aged out of the table in the time frame that you enter when “Configuring Spanning Tree Protocol” on page 33.

- 1 From the Main Menu (page 1-14), type **2** then press **ENTER** to access the REX2 Configuration and Status screen. Ensure Bridge is selected.
- 2 From the REX2 Configuration and Status screen, type **4** then press **ENTER**. The Bridge Configuration screen is displayed.
- 3 From the Bridge Configuration screen, type **3** then press **ENTER**. The Bridge Table is displayed.

```

BRIDGE TABLE
Total entries: 57
MAC ADDRESS      STATUS  AGE(sec)
00:00:23:00:12:02 learned  5
00:00:23:00:12:03 learned  5
00:00:23:00:12:01 learned  6
00:00:23:00:12:06 learned  5
00:00:23:00:12:07 learned  5
00:00:23:00:12:04 learned  5
00:00:23:00:12:05 learned  5
00:00:23:00:12:0A learned  5
00:00:23:00:12:0B learned  5
00:00:23:00:12:08 learned  5
00:00:23:00:12:09 learned  5
00:00:23:00:12:0E learned  4
00:00:23:00:12:0F learned  4
00:00:23:00:12:0C learned  4
00:00:23:00:12:0D learned  4
00:00:23:00:12:12 learned  4

(P)revious (N)ext (F)ind (E)ntire table
(U)date table (C)lear table
(R)return (M)ain Menu
TABLE>

```

4 Enter any of the following:

- **P** to access the previous screen of the table
- **N** to access the next screen of the table
- **F** to find a specific table entry; the user is prompted to specify a MAC address for the destination device:

Required format is nn:nn:nn:nn:nn:nn

Enter Destination MAC Address:

- **E** to display all entries in a table without pages; this provides you the capability to capture this information to a file using a terminal emulation software (such as HyperTerminal or ProComm)
- **U** to refresh or update the table entries
- **C** to clear all entries from the table

Viewing the ARP Table

The ARP table can be accessed through either the Bridge or the Router configuration screens. An ARP table lists MAC addresses that are bound to IP addresses. The ARP table can contain a maximum of 60 entries with a fixed expiration time of 300 seconds. The ARP table entries are sorted by the IP address.

- 1** From the Main Menu (page 1-14), type **2** then press **ENTER** to access the REX2 Configuration and Status screen. Either Bridge or Router can be selected.
- 2** From the REX2 Configuration and Status screen, type **4** then press **ENTER**. Either the Bridge Configuration screen or Router Configuration screen is displayed.

3 Do one of the following:

- From the Bridge Configuration screen, type **4** then press **ENTER**. The ARP Table is displayed.
- From the Router Configuration screen, type **6** then press **ENTER**. The ARP Table is displayed.

```

                                ARP TABLE
MAC ADDRESS      IP ADDRESS      PORT
00:00:00:00:00:01 156.10.0.1 LAN
00:00:00:00:00:03 156.10.0.3 LAN
00:00:00:00:00:04 156.10.0.4 LAN
00:00:00:00:00:06 156.10.0.6 LAN
00:00:00:00:00:07 156.10.0.7 LAN
00:00:00:00:00:09 156.10.0.9 LAN
00:00:00:00:00:0B 156.10.0.11 LAN
00:00:00:00:00:0C 156.10.0.12 LAN
00:00:00:00:00:0F 156.10.0.15 LAN
00:00:00:00:00:11 156.10.0.17 LAN
00:00:00:00:00:12 156.10.0.18 LAN
00:00:00:00:00:14 156.10.0.20 LAN
00:00:00:00:00:15 156.10.0.21 LAN
00:00:00:00:00:18 156.10.0.24 LAN
00:00:00:00:00:19 156.10.0.25 LAN
00:00:00:00:00:1B 156.10.0.27 LAN

(P)previous (N)ext (F)ind (E)ntire table
(U)update table (C)lear table
(R)return (M)ain Menu
TABLE>

```

4 Enter any of the following:

- **P** to access the previous screen of the table
- **N** to access the next screen of the table
- **F** to find a specific table entry; the user is prompted to specify an IP address for the destination device:

Required format is nnn.nnn.nnn.nnn

Enter Destination IP Address: **156.10.0.28**

- **E** to display all entries in a table without pages; this provides you the capability to capture this information to a file using a terminal emulation software (such as HyperTerminal or ProComm)
- **U** to refresh or update the table entries
- **C** to clear all entries from the table

CONFIGURING THE CAMPUS-REX2 AS A ROUTER

A router moves information across a network from a source to a destination at the network layer (of an OSI reference model). The information is sent to an IP address. The router can dynamically learn routes for forwarding data, in addition to providing the configuration for up to 32 static paths for routed data. See “IP Routing” on page 126 for more information about routing.

From the Main Menu (page 1-14), type **2** then press **ENTER** to access the REX2 Configuration and Status screen.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID:  Remote I/F: REX2
Circuit ID:

                REX2 CONFIGURATION AND STATUS

LAN STATUS:     100BaseT, Full Duplex, Up
LINE STATUS:    Standard, Auto, T1, Up
MAC ADDRESS:    00:20:A7:01:02:08

1) Network Protocol: Bridge      (Bridge, Router)
2) Encapsulation:  cHDLC        (cHDLC, PPP)
3) Timing Source:  Internal      (Internal, HDSL)
4) BRIDGE CONFIGURATION
5) BRIDGE STATISTICS
6) SNMP CONFIGURATION

                (R)eturn

ENTER CHOICE>
```

This section describes how to configure the routing options found on this screen for the Campus-REX2, including:

- “Configuring Routing Protocol, Encapsulation and Timing” on page 45
- “Configuring Routing Features” on page 46
 - “Configuring the IP Addresses” on page 47
 - “Configuring RIP” on page 49
 - “Configuring and Deleting Static IP Routes” on page 51
- “Configuring DHCP Services” on page 53
- “Saving the Router Configuration” on page 55
- “Accessing the Routing Tables” on page 56

Configuring Routing Protocol, Encapsulation and Timing

The Campus-REX2, as a default configuration, is set to bridge data. You can, however, change this setting for the Campus-REX2 to be a router. In the following procedures, you can set up the router encapsulation and timing source.



You can only configure the Campus-REX2 as a router through connection to the Console port or a Telnet session. Most router options are not configurable through the LCD menus.

- 1 Type **1** then press **ENTER** to select Router as the Network Protocol.
- 2 To change the packet encapsulation, type **2** then press **ENTER**. Select an Encapsulation option:
 - cHDLC for Campus-REX2 to another Campus-REX2 application
 - PPP when the remote Campus unit has a synchronous interface card such as a V.35 or when connecting to Ethernet equipment from another manufacturer
- 3 To change the timing source, type **3** then press **ENTER**. Select a timing source setting:
 - Internal (default setting) which takes its timing from an internal oscillator
 - HDSL which takes its timing from the HDSL link

The Timing Source option determines the source of circuit timing on the HDSL link. The proper setting of the Timing Source option depends upon the interface card of the remote Campus unit:

- If the Campus-REX2 is connected to a Campus unit with another Campus-REX2, leave the Timing Source option set to Internal. Set the other end (remote) of the connection to HDSL; the Campus system will not operate properly if both units are set to HDSL.

- If the Campus-REX2 is connected to a Campus unit with a synchronous interface card, such as a Fractional V.35 card, the timing source depends on the setting of the Primary Timing Source option of the remote unit:
 - Set the Timing Source to HDSL if the remote unit is set to Internal or Data Port.
 - Set the Timing Source to Internal if the remote unit is set to HDSL.See the *Campus-RS Fractional Interface Card User Manual* for information on the Primary Timing Source option.
- If the Campus-REX2 is connected to a Campus unit with a Campus CSU/DS-1 or CSU/DSX-1 interface card, set the Timing Source option to Internal.

Configuring Routing Features

This section provides procedures for configuring routing features such as LAN and Line IP addresses and subnet masks, RIP configuration for dynamic routing, static routing configuration, and DHCP services. See “IP Routing” on page 126 for more information about the routing implementation for the Campus-REX2.

To configure the router, from the REX2 Configuration and Status screen type **4** then press **ENTER**. The Router Configuration screen is displayed.

```
May 05, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 4.6D      15:07:12
Local Unit ID:
Remote Unit ID: Inactive
Circuit ID:
Local I/F: REX2
Remote I/F: Inactive

ROUTER CONFIGURATION

1) IP ADDRESS CONFIGURATION
2) RIP CONFIGURATION
3) STATIC ROUTE CONFIGURATION
4) DYNAMIC ROUTE TABLE
5) STATIC ROUTE TABLE
6) ARP TABLE
7) DHCP SERVICES

(R)eturn (M)ain Menu

ENTER CHOICE>
```

The Dynamic Route (created by RIP) and ARP tables are dynamically built and can be accessed from this screen. The Static Route table is built from routes that you manually configure. For information about these routing tables, see:

- “Viewing the Dynamic Routing Table” on page 59
- “Viewing the ARP Table” on page 42
- “Managing the Static Routing Table” on page 57

Configuring the IP Addresses

You can configure IP addresses and subnet masks for both the Line and LAN ports as well as configure a default gateway for packets to be routed to the Internet if the next hop cannot be identified. See “Campus-REX2 IP Addresses” on page 129 for more information.

- 1 To configure the IP address and subnet masks, type **1** then press **ENTER**. The IP Address Configuration screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Remote I/F: REX2
Circuit ID:

IP ADDRESS CONFIGURATION

1) LAN IP Address:      192.168.  1.  1
   LAN Subnet Mask:    255.255.255.  0
2) Line IP Address:    0.  0.  0.  0
   Line Subnet Mask:    255.  0.  0.  0
3) Default Gateway:    0.  0.  0.  0

(R)return (M)ain Menu

ENTER CHOICE>

```

- 2 To set the LAN IP address and subnet mask, type **1** then press **ENTER**. At the prompt, enter the LAN IP address and subnet mask for the Campus-REX2 LAN port.

Required format is nnn.nnn.nnn.nnn

Enter LAN IP Address: **10.0.0.1**

Enter Subnet Mask (<CR> only=default Mask
255.0.0.0): **255.0.0.0**

- 3 To set the Line IP address and subnet mask, type **2** then press **ENTER**. At the prompt, enter the Line IP address and subnet mask for the Campus-REX2 Line port.

```
Required format is nnn.nnn.nnn.nnn
Enter Line IP Address: 192.150.10.20
Enter Subnet Mask (<CR> only=default Mask
255.255.255.0): 255.255.255.0
```

This value is the Campus-REX2 WAN port IP address. The Line IP address cannot be on the same subnet as the LAN port IP address.

- 4 To configure the default gateway, type **3** then press **ENTER**. At the prompt, enter the IP address of the default gateway through which the Campus-REX2 forwards datagrams if it does not have a valid entry for the destination in its routing table. The default value for this parameter is 0.0.0.0.

```
Required format is nnn.nnn.nnn.nnn
Enter Default Gateway: 192.150.10.50
```

This parameter provides the default gateway through which packets are routed to the internet if the next hop IP address IP address cannot be identified. You can also configure the default gateway in the static routing table by entering a destination IP address of 0.0.0.0 with a subnet mask of 0.0.0.0 and then enter the IP address for the default gateway.

- 5 Type **R** then press **ENTER** to return to the Router Configuration screen (page 3-46). (Typing **M** will return you to the Main Menu.)
- 6 If you are only changing IP addresses or Default Gateway parameters, go to “Saving the Router Configuration” on page 55 to save your changes.

Configuring RIP

From this screen, you can configure the parameters for Routing Information Protocol (RIP) to allow the propagation of routing information. Both the Unit (REX2 card) and Ports (LAN and Line) can be configured. See “Dynamic Routing” on page 129 for more information about using RIP.

- 1 To configure RIP, from the Router Configuration screen type **2** then press **ENTER**. The RIP Configuration screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID:  Remote I/F: REX2
Circuit ID:

                                RIP CONFIGURATION

UNIT  1) RIP Host Routes:      Enabled  (Disabled, Enabled)
      2) RIP Poison Reverse:   Enabled  (Disabled, Enabled)
      3) RIP2 Authentication:  Disabled (Disabled, Enabled)
      4) CHANGE RIP2 PASSWORD

PORTS 5) LAN RIP Receive:      None     (None, RIP1, RIP2, Both)
      6) LAN RIP Send:         None     (None, RIP1, RIP2*, RIP1c*)
      7) Line RIP Receive:     None     (None, RIP1, RIP2, Both)
      8) Line RIP Send:        None     (None, RIP1, RIP2*, RIP1c*)
      9) DYNAMIC ROUTE TABLE

      *Note:
          RIP2 Send = send RIP2 multicast messages
          RIP1c Send = send RIP2 broadcast messages

                                (R)return (M)ain Menu

ENTER CHOICE>

```

- 2 To configure RIP for the Unit (Campus-REX2), do the following:
 - a To enable RIP Host Routes, type **1** then press **ENTER**. When enabled, Campus-REX2 accepts host routes in RIP updates.
 - b To enable RIP Poison Reverse, type **2** then press **ENTER**. When enabled, this gateway (REX2) indicates to its neighbor gateways that one of the gateways is no longer connected. It does this by setting the number of hops to the disconnected gateway to an infinite number of hops (16, for example).
 - c To enable RIP2 authentication, type **2** then press **ENTER**. RIPv2 uses a plain-text password for authentication that you will set when you change the RIP2 authentication password.
 - d To change the RIP2 authentication password, type **2** then press **ENTER** (RIP2 authentication must be enabled). Enter a text string of up to 16 characters (including alphanumeric or symbols) at the prompt:

Maximum length is 16 characters.

Enter New RIP2 Password : **rex2route**

- 3** To configure RIP for the LAN and Line ports, do the following:
 - a** To select the version of RIP packets that will be received by the LAN port, type **5** then press **ENTER**. Repeat until the preferred RIP version is selected:
 - None indicates that a RIP version is not selected.
 - RIP1 indicates that only RIPv1 packets will be received by the LAN port.
 - RIP2 indicates that only RIPv2 packets will be received by the LAN port.
 - Both indicates that both RIPv1 and RIPv2 packets will be received by the LAN port.
 - b** To select the version of RIP packets that will be sent by the LAN port, type **6** then press **ENTER**. Repeat until the preferred RIP version is selected:
 - None indicates that a RIP version is not selected.
 - RIP1 indicates that only RIPv1 packets will be sent by the LAN port.
 - RIP2 indicates that RIPv2 multicast packets will be sent by the LAN port.
 - RIP1c indicates the RIPv2 broadcast messages will be sent by the LAN port.
 - c** To select the version of RIP packets that will be received by the Line port, type **7** then press **ENTER**. Repeat until the preferred RIP version is selected:
 - None indicates that a RIP version is not selected.
 - RIP1 indicates that only RIPv1 packets will be received by the Line port.
 - RIP2 indicates that only RIPv2 packets will be received by the Line port.
 - Both indicates that both RIPv1 and RIPv2 packets will be received by the Line port.

- d** To select the version of RIP packets that will be sent by the Line port, type **8** then press **ENTER**. Repeat until the preferred RIP version is selected:
- None indicates that a RIP version is not selected.
 - RIP1 indicates that only RIPv1 packets will be sent by the LAN port.
 - RIP2 indicates that RIPv2 multicast packets will be sent by the LAN port.
 - RIPC indicates the RIPv2 broadcast messages will be sent by the LAN port.
- 4** To view the routing table that is dynamically created by RIP, type **9** then press **ENTER**. For information about the Dynamic Route Table, go to page 3-59).
- 5** Type **R** then press **ENTER** to return to the Router Configuration screen (page 3-46). (Typing **M** will return you to the Main Menu.)
- 6** If you are only changing RIP configuration parameters, go to “Saving the Router Configuration” on page 55 to save your changes.

Configuring and Deleting Static IP Routes

Static IP routes define a fixed and manually configured path for data sent by the Campus-REX2 to a destination host. This table contains a maximum of 32 explicit routes. Each route comprises a destination network, subnet mask, and hop count.

You can add static routes by selecting either:

- Add Static Route as described in this section
- Static Route Table (see “Managing the Static Routing Table” on page 57) and using the (A)dd route command

When you enter a static IP address that is a specific host interface, you must enter 255.255.255.255 as the subnet mask to include that specific host interface in the static routing table.

You can also configure the default gateway in the static routing table by entering a destination IP address of 0.0.0.0 with a subnet mask of 0.0.0.0 and then entering the IP address for the default gateway.

- 1 From the Router Configuration screen, type **3** then press **ENTER**. The Static Route Configuration screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID:  Remote I/F: REX2
Circuit ID:

                STATIC ROUTE CONFIGURATION

1) ADD STATIC ROUTE
2) DELETE STATIC ROUTE
3) STATIC ROUTE TABLE

                (R)eturn (M)ain Menu

ENTER CHOICE>
```

- 2 To add a static route, type **1** then press **ENTER**. Enter the IP address, subnet mask, and gateway IP address at the prompt for the destination host to which packets will be sent.

```
Required format is nnn.nnn.nnn.nnn
Enter Destination IP Address: 192.128.128.60
Enter Destination IP Subnet Mask: 255.255.255.0
Enter Gateway IP Address: 192.128.128.65
Enter Hop Count: 3
```

The following message is displayed:

```
Route added
Hit Any Key to Continue
```

- 3 To delete a static route, type **2** then press **ENTER**. Enter the IP address at the prompt for the destination host you want to delete.

```
Required format is nnn.nnn.nnn.nnn
Enter Destination IP Address: 192.128.128.60
```

If you do not remember the IP address for the destination you want to delete, go to Step 4 to view the Static Route Table.

- 4 To manage the Static Route Table, type **3** then press **ENTER**. The Static Route Table is displayed. You can also add static routes on this screen (see “Managing the Static Routing Table” on page 57).
- 5 Type **R** then press **ENTER** to return to the Router Configuration screen (page 3-46). (Typing **M** will return you to the Main Menu.)
- 6 If you are only adding a static route, go to “Saving the Router Configuration” on page 55 to save your changes.

Configuring DHCP Services

When the Campus-REX2 is configured for DHCP relay, it forwards DHCP requests from devices connected to the Campus-REX2 LAN port to a DHCP server which can be on the LAN or WAN side of the network.

You can enter IP addresses for a primary (required) and secondary (optional) DHCP server. The Campus-REX2 will attempt to send a DHCP relay to the primary DHCP server first, and then will relay to the secondary server if the primary is not available. For more information, see “DHCP” on page 134.

- 1 From the Router Configuration screen (page 3-46), type **7** then press **ENTER**. The DHCP Services screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Inactive      Remote I/F: Inactive
Circuit ID:

                                DHCP SERVICES

1) Service:           None           (None, Relay)

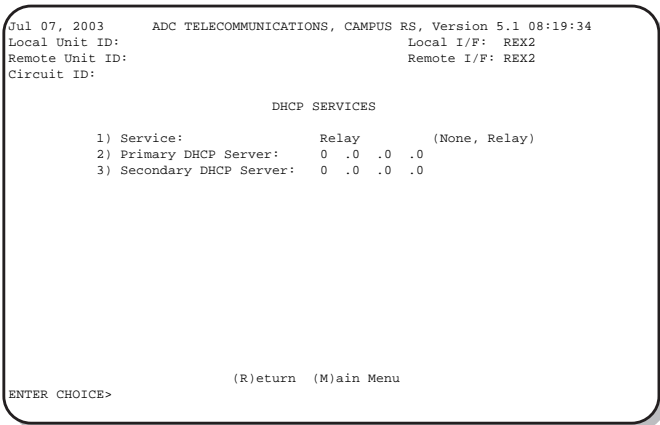
                                (R)return (M)ain Menu

ENTER CHOICE>

```

The default configuration is that no DHCP services (None) are provided by the Campus-REX2.

- To select DHCP Relay, type **1** then press **ENTER**. The following fields, 2 and 3, are added to the screen as shown below.



- To enter the IP address for the primary DHCP server to which the Campus-REX2 relays requests, type **2** then press **ENTER**. At the prompt, enter the IP address.

Required format is nnn.nnn.nnn.nnn
Enter Primary DHCP Server:10.0.0.26

To delete a DHCP server, enter the IP address 0.0.0.0. If the primary DHCP server is deleted and a valid secondary DHCP server is defined, the secondary DHCP server automatically becomes the primary DHCP server.

- To enter the IP address for the secondary DHCP server to which the Campus-REX2 relays requests, type **3** then press **ENTER**. At the prompt, enter the IP address.

Required format is nnn.nnn.nnn.nnn
Enter Secondary DHCP Server:192.150.0.54

To delete a DHCP server, enter the IP address 0.0.0.0. If the primary DHCP server is deleted and a valid secondary DHCP server is defined, the secondary DHCP server automatically becomes the primary DHCP server.

- Type **R** then press **ENTER** to return to the Router Configuration screen (page 3-46). (Typing **M** will return you to the Main Menu.)

- 6 If you are only changing DHCP configuration, go to “Saving the Router Configuration” on page 55 to save your changes.

Saving the Router Configuration



Do not remove power to the Campus unit or disconnect the Line and LAN side network connections when upgrading software or saving configuration.

- 1 Type **R** and press **ENTER** until you return to the REX2 Configuration and Status screen (page 3-30).

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:      Local I/F: REX2
Remote Unit ID:    Remote I/F: REX2
Circuit ID:

                REX2 CONFIGURATION AND STATUS

LAN STATUS: 100BaseT, Full Duplex, Up
LINE STATUS: Standard, Auto, T1, Down
MAC ADDRESS: 00:20:A7:01:02:08

1) Network Protocol: Router      (Bridge, Router)
2) Encapsulation:   cHDLC        (cHDLC, PPP)
3) Timing Source:   Internal      (Internal, HDSL)
4) ROUTER CONFIGURATION
5) ROUTER STATISTICS
6) SNMP CONFIGURATION
7) SAVE REX2 CONFIGURATION

WARNING: Configuration change(s) will be lost if not saved before
        resetting or powering unit down.

                (R)eturn
ENTER CHOICE>

```

- 2 Type **7** to save changes. The following message is displayed to show that the save is in progress:

```
WARNING: Do not power off unit or remove LAN
or Line connection.
```

```
Saving REX2 configuration; Please wait...
```

The following message is displayed when the save is completed:

```
REX2 configuration saved
```

```
Hit Any Key to Continue
```

Accessing the Routing Tables

The Campus-REX2 has two separate routing tables. One table shows routes that were statically configured (“Managing the Static Routing Table” on page 57) and offers the capability of configuring additional static routes. The other table shows IP addresses that were dynamically learned by RIP (“Viewing the Dynamic Routing Table” on page 59).

Do the following to access the Router Configuration screen:

- 1 From the Main Menu (page 1-14), type **2** then press **ENTER** to access the REX2 Configuration and Status screen. Ensure Router is selected.
- 2 From the REX2 Configuration and Status screen, type **4** then press **ENTER**. The Router Configuration screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Remote I/F: REX2
Circuit ID:

                    ROUTER CONFIGURATION

1) IP ADDRESS CONFIGURATION
2) RIP CONFIGURATION
3) STATIC ROUTE CONFIGURATION
4) DYNAMIC ROUTE TABLE
5) STATIC ROUTE TABLE
6) ARP TABLE
7) DHCP SERVICES

                    (R)eturn (M)ain Menu

ENTER CHOICE>
```

Managing the Static Routing Table

The entries in this routing table were configured by a user (entered statically). This table contains a maximum of 32 entries. You can manage entries or you can also add new entries from this screen. The destination shown on this screen is for a host route, but not for a specific host device.

You can also configure the default gateway in the static routing table by entering a destination IP address of 0.0.0.0 with a subnet mask of 0.0.0.0 and then entering the IP address for the default gateway (see page 3-48).

The Static Route Table can be accessed from both the Router Configuration and the Static Route Configuration screens.

1 Do one of the following to access the Static Route Table:

- From the Router Configuration screen, type **5** then press **ENTER**.
- From the Static Route Configuration screen, type **3** then press **ENTER**. The Static Route Table is displayed.

STATIC ROUTE TABLE			
DESTINATION	SUBNET MASK	GATEWAY ADDRESS	HOP
192.128.128. 60	255.255.255.252	192.150. 10. 50	1
168.120.100. 12	255.255.255.252	192.150. 10. 50	1
172.100.200. 25	255.255.255.255	192.150. 10. 50	1

(P)revious (N)ext (F)ind (E)ntire table
 (C)lear table (A)dd route (D)elete route
 (R)eturn (M)ain Menu

TABLE>

2 Manage the Static Route Table, including adding or deleting table entries, by entering any of the following:

- **P** to access the previous screen of the table entries
- **N** to access the next screen of the table entries
- **F** to find a specific table entry; the user is prompted to specify an IP address for the destination device:

```
Required format is nnn.nnn.nnn.nnn
```

```
Enter Destination IP Address: 172.100.200.60
```

- **E** to display all entries in a table without pages; this provides you the capability to capture this information to a file using a terminal emulation software such as HyperTerminal or ProComm
- **C** to clear all entries from the table
- **A** to add static route table entries (also see “Configuring and Deleting Static IP Routes” on page 51) and the following prompt is displayed:

```
Required format is nnn.nnn.nnn.nnn
```

```
Enter Destination IP Address: 192.128.128.60
```

```
Enter Destination IP Subnet Mask: 255.255.255.0
```

```
Enter Gateway IP Address: 192.150.10.50
```

```
Enter Hop Count: 3
```

The following message is displayed:

```
Route added
```

```
Hit Any Key to Continue
```

- **D** to delete a static route table entry (also see “Configuring and Deleting Static IP Routes” on page 51) and the following prompt is displayed:

```
Required format is nnn.nnn.nnn.nnn
```

```
Enter Destination IP Address: 192.128.128.60
```

3 Type **R** then press **ENTER** to return to the Router Configuration screen (page 3-46). (Typing **M** will return you to the Main Menu.)

4 If you added or deleted static route entries, go to “Saving the Router Configuration” on page 55 to save your changes.

Viewing the Dynamic Routing Table

The entries in this routing table were dynamically learned by RIP. This table contains a maximum of 2048 entries. It is accessible from both the Router Configuration and RIP Configuration screens.

- 1 From the Router Configuration screen, type **4** then press **ENTER**. Or, from the RIP Configuration screen, type **9** then press **ENTER**. The Dynamic Route Table is displayed.

DYNAMIC ROUTE TABLE						
Total entries: 52						
DESTINATION	SUBNET MASK	GATEWAY ADDRESS	HOP	TIMEOUT(sec)	PORT	
60 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
59 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
58 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
57 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
56 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
55 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
54 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
53 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
52 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
51 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
50 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
49 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
48 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
47 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	
46 .0 .0 .0	255.0 .0 .0	156.10 .18 .90	2	155	LAN	

(P)revious (N)ext (F)ind (E)ntire table
(U)ppdate table (C)lear table
(R)eturn (M)ain Menu

TABLE>

- 2 Enter any of the following:

- **P** to access the previous screen of the table entries
- **N** to access the next screen of the table entries
- **F** to find a specific table entry; the user is prompted to specify an IP address for the destination device:

Required format is nnn.nnn.nnn.nnn

Enter Destination IP Address: **51.0.0.0**

- **E** to display all entries in a table without pages; this provides you the capability to capture this information to a file using a terminal emulation software such as HyperTerminal or ProComm
- **U** to refresh or update the table entries
- **C** to clear all entries from the table

CONFIGURING THE CAMPUS-REX2 FOR SNMP MANAGEMENT

SNMP protocol provides a way for HP OpenView or an Element Management System (EMS) such as StarGazer to manage the Campus-REX2 system over a network. A Campus-RS Management Unit (CMU), installed into a Campus-Star chassis, provides SNMP management for components in the chassis and for management of elements attached to the chassis (desktop units or units in other Campus-Star chassis). The EMS can directly manage a Campus-REX2 that is in a desktop unit or a Campus-Star chassis.

You can also set the Campus-REX2 to perform authentication error trap generation. To enable this feature, do the following:

- Set the Authentication Trap Status to Enabled or Disabled.
- Enter an IP Address for each Trap Receiver.
- Enter a community string for each Trap Receiver.

Accessing the SNMP Configuration

- 1 From the Main Menu (page 1-14), type **2** then press **ENTER** to access the REX2 Configuration and Status screen.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Central              Remote I/F: REX2
Circuit ID: Southeast line 421

                          REX2 CONFIGURATION AND STATUS

LAN STATUS: 100BaseT, Full Duplex, Up
LINE STATUS: Standard, Auto, T1, Up
MAC ADDRESS: 00:20:A7:01:02:08

1) Network Protocol: Bridge      (Bridge, Router)
2) Encapsulation:   cHDLC        (cHDLC, PPP)
3) Timing Source:   Internal     (Internal, HDSL)
4) BRIDGE CONFIGURATION
5) BRIDGE STATISTICS
6) SNMP CONFIGURATION
7) SAVE REX2 CONFIGURATION

WARNING: Configuration change(s) will be lost if not saved before
resetting or powering unit down.
(R)eturn

ENTER CHOICE>
```


- 2 For the REX2 Configuration and Status screen, type **6** then press **ENTER**. The SNMP Configuration screen is displayed.

```

Jan 01, 1970      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1      18:05:29
Local Unit ID:                                     Local I/F: REX2
Remote Unit ID:                                    Remote I/F: REX
Circuit ID:

                                SNMP CONFIGURATION

1) Unit Name:
2) Location:
3) Contact:
4) SNMP Read Only Community String:      public
5) SNMP Read/Write Community String:     private
6) Authentication Trap Status:          Enabled      (Enabled, Disabled)
7) Trap Receiver 1 IP Address:          0. 0. 0. 0
8) Trap Receiver 1 Community String:     trap receiver 1
9) Trap Receiver 2 IP Address:          0. 0. 0. 0
10) Trap Receiver 2 Community String:    trap receiver 2
11) Trap Receiver 3 IP Address:         0. 0. 0. 0
12) Trap Receiver 3 Community String:    trap receiver 3

                                (R)return (M)ain Menu
ENTER CHOICE>

```

- 3 Continue with the following sections to enter the required parameters and enable authentication error trap generation.

Entering SNMP Parameters

On this screen, you configure parameters that identify this SNMP-managed device. Also, these SNMP parameters must be set to manage the Campus-REX2 over an SNMP network:

- SNMP Read Only Community String provides the authentication string used for SNMP read-only operations (see Step 4)
- SNMP Read Write Community String provides the authentication string used for SNMP read-write operations (see Step 5)

To set SNMP parameters, enter the following information on the SNMP Configuration screen.

- 1 To enter a Unit Name, type **1** then press **ENTER**. At the prompt, enter up to 32 characters (use any ASCII character) that identifies for SNMP management this Campus unit.

Maximum length is 32 characters.

Enter Unit Name: **REX2_Southall**

- 2 To enter a Location, type **2** then press **ENTER**. At the prompt, enter up to 32 characters (use any ASCII character) that indicates the location of this Campus unit.

Maximum length is 32 characters.

Enter Location: **Southall_Room_421**

- 3 To enter a contact name, type **3** then press **ENTER**. At the prompt, enter up to 32 characters (use any ASCII character) that indicates the person who can be contacted for management of this Campus unit.

Maximum length is 32 characters.

Enter Contact: **John Doe**

- 4 To enter the Read Only Community String, type **4** then press **ENTER**. At the prompt, enter up to 32 characters that provides a name for the SNMP community on the Campus-REX2 that provides read-only capability. Public is commonly used.

Maximum length is 32 characters.

Enter SNMP Read Only Community String: **Public**

- 5 To enter the Read/Write Community String, type **5** then press **ENTER**. At the prompt, enter up to 32 characters that provides a name for the SNMP community on the Campus-REX2 that provides read and write capability. Private is commonly used.

Maximum length is 32 characters.

Enter SNMP Read/Write Community String: **Private**

Enabling Authentication Error Trap Generation

An authentication trap is sent out by the Campus-REX2 when it reviews a request that isn't properly authenticated. For example, the request has a community string that doesn't match the community string configured for the Campus-REX2.



The authentication trap status is enabled as a default.

Authentication Trap Status is enabled by default. If you want to disable it, type **5** then press **ENTER**.

Configuring Trap Receivers

The Campus-REX2 sends traps to devices on the network, which you configure as trap receivers, when events or alarms occur. The following are traps that the Campus-REX2 can issue:

- coldStart
- warmStart
- linkDown
- linkUp
- authenticationFailure

Configure the trap receivers as follows:

- 1 Do the following to enter an IP address and a community string for each of three trap receivers that you can configure:

- a To enter the IP address for a device on the network that will receives traps issued by Campus-REX2, type **7** , **9**, or **1+1** then press **ENTER**. At the prompt, enter the IP address:

Required format is nnn.nnn.nnn.nnn

Enter Trap Receiver x IP Address: **172.150.100.12**

- b To enter the community string for a device on the network that will receives traps issued by Campus-REX2, type **8**, **1+0**, or **1+2** then press **ENTER**. At the prompt, enter the community string that can be up to 64 ASCII characters:

Maximum length is 64 characters.

Enter Trap Receiver 1 Community String: **rcvr1**

- 2 Repeat Step 1 for each trap receiver you want to configure.
- 3 Type **R** to return until you return to the Bridge or Router Configuration screen.
- 4 If you are changing only SNMP parameters, go to “Saving the Bridge Configuration” on page 40 or “Saving the Router Configuration” on page 55 to save your changes.

MANAGING SYSTEM PARAMETERS

4

This chapter describes how to configure system operating parameters for the Campus-REX2 including time and date, identification of the unit and circuit, and a configuration password. You can reset configurable operating parameters to their default values in the chapter. Also, you can view information about the product.

For:	See Page:
Accessing System Configuration	66
Setting the Time and Date	67
Identifying the Unit and Circuit	67
Setting a Password	69
Restoring Default Values	70
Viewing Product Information	72

HDSL alarm parameters are configured in the section for “Configuring HDSL Parameters.” See “Configuring HDSL Alarms” on page 26.

ACCESSING SYSTEM CONFIGURATION

From the Main Menu (page 1-14), type **3** then press **ENTER** to access the System Settings Menu.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Inactive      Remote I/F: Inactive
Circuit ID:

                        SYSTEM SETTINGS MENU

1) SYSTEM PARAMETERS
2) HDSL PARAMETERS

(R)eturn
ENTER CHOICE>
```

From the System Settings Menu, type **1** then press **ENTER** to access the System Parameters screen. From this screen, you can enter the number (1—10) for the systems parameter you want to configure or change its value.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:   Local I/F: REX2
Remote Unit ID: Inactive      Remote I/F: Inactive
Circuit ID:

                        SYSTEM PARAMETERS

1) CHANGE SYSTEM TIME
2) CHANGE SYSTEM DATE
3) CHANGE UNIT ID
4) CHANGE CIRCUIT ID
5) CHANGE UNIT PASSWORD
6) HDSL ES Alarm Threshold: Disabled (Disabled, 17, 170)
7) HDSL Margin Alarm Threshold: Disabled
8) Local Data Port LOS Alarm: Disabled (Disabled, Enabled)
9) Remote Data Port LOS Alarm: Disabled (Disabled, Enabled)
10) RESTORE FACTORY DEFAULTS

(R)eturn
ENTER CHOICE>
```

SETTING THE TIME AND DATE

The time and date parameters provide a common time and date stamp for system functions such as alarm indications or performance monitoring histories.

- 1 To set the time, type **1** then press **ENTER**.
- 2 At the prompt, type the time in a 24-hour format as shown below then press **ENTER**.

```
ENTER NEW TIME (FORMAT HH:MM:SS) : 16:34:09
```

The system displays this new time on System Parameters screen.

- 3 To set the date, type **2** then press **ENTER**.
- 4 At the prompt, type two numbers for the day, two number for the month, and the four-digit year, separated by slashes (/), then press **ENTER**.

```
ENTER NEW DATE (FORMAT MM/DD/YYYY) : 04/30/2003
```

The system displays this new date on System Parameters screen as Apr 30, 2003.

System and date take effect immediately after the values are entered and a save command is not required.

IDENTIFYING THE UNIT AND CIRCUIT

A Campus system supports two different identifiers:

- The Unit ID indicates an individual Campus unit which can be either a desktop unit with an interface card or each interface card and line card combination in a Campus-Star chassis.
- The Circuit ID identifies the HDSL circuit between local and remote units and is the same for both.

Do the following to set or change these identifiers.

- 1 From the System Parameters menu, type **3** then press **ENTER**. At the prompt, enter the Unit ID using a unique identifier up to 32 characters.

```
Maximum length is 32 characters.
```

```
ENTER NEW UNIT ID: Southall Quad 4
```

- 2 Type **4** then press **ENTER**. At the prompt, enter a unique identifier for this HDSL circuit, up to 64 characters.

Maximum length is 64 characters.

ENTER NEW CIRCUIT ID: **Southeast line 421**

The unit and circuit IDs are displayed as shown below. To configure or change the unit and circuit IDs for the Campus unit at the other end of the HDSL connection, access it using either telnet or the remote log on (see “Logging In” on page 12).

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4          Local I/F: REX2
Remote Unit ID: Central                 Remote I/F: REX2
Circuit ID: Southeast line 421

                                SYSTEM PARAMETERS

1) CHANGE SYSTEM TIME
2) CHANGE SYSTEM DATE
3) CHANGE UNIT ID
4) CHANGE CIRCUIT ID
5) CHANGE UNIT PASSWORD
6) HDSL ES Alarm Threshold: Disabled (Disabled, 17, 170)
7) HDSL Margin Alarm Threshold: Disabled
8) Local Data Port LOS Alarm: Disabled (Disabled, Enabled)
9) Remote Data Port LOS Alarm: Disabled (Disabled, Enabled)

10) RESTORE FACTORY DEFAULTS

                                (R)return
ENTER CHOICE>
```

The new Unit and Circuit IDs take effect immediately after the values are entered and a save command is not required.

SETTING A PASSWORD

A password prevents unauthorized access to Campus-REX2 configuration options via console port, TELNET, or remote Campus login. This password also controls access to the Campus-REX2 via FTP as required for software upgrade (see “Upgrading Campus Unit Software” on page 92). You can set a password with any combination of up to ten letters or numbers, but the first character must be a letter. Passwords are case-sensitive.

From the System Parameters menu, type **5** then press **ENTER**. At the prompt, enter a password that contains up to 10 ASCII characters.

```
ENTER NEW PASSWORD (10 characters maximum):  
*****
```

The new password takes effect immediately after it is entered and a save command is not required.



If you forget your password and cannot log onto the Campus-REX2, use the LCD to restore the configuration settings to their factory default values. This removes the password. For more information, see “Restoring the System to Default Values” on page 108.

RESTORING DEFAULT VALUES

You can restore all (any configurable parameter including HDSL and network, for example) of the configuration options to their original factory default values. This is a way to reset configurations you may have changed and want returned to its original settings.

- 1 From the Main Menu, type **3** then press **ENTER**.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:  Southhall Quad 4      Local I/F:  REX2
Remote Unit ID:  Inactive              Remote I/F: Inactive
Circuit ID:     Southeast line 421

                                MAIN MENU

1) SYSTEM STATUS
2) REX2 CONFIGURATION AND STATUS
3) SYSTEM CONFIGURATION
4) MAINTENANCE
5) REMOTE LOGON

                                (L)ogout

ENTER CHOICE>
```

The System Parameters screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:  Southhall Quad 4      Local I/F:  REX2
Remote Unit ID:  Inactive              Remote I/F: Inactive
Circuit ID:     Southeast line 421

                                SYSTEM PARAMETERS

1) CHANGE SYSTEM TIME
2) CHANGE SYSTEM DATE
3) CHANGE UNIT ID
4) CHANGE CIRCUIT ID
5) CHANGE UNIT PASSWORD
6) HDSL ES Alarm Threshold:  Disabled (Disabled, 17, 170)
7) HDSL Margin Alarm Threshold: Disabled
8) Local Data Port LOS Alarm: Disabled (Disabled, Enabled)
9) Remote Data Port LOS Alarm: Disabled (Disabled, Enabled)

10) RESTORE FACTORY DEFAULTS

                                (R)eturn (M)ain Menu

ENTER CHOICE>
```

- 2 To restore all values to the original factory default configuration, type **1+0** then press **ENTER**. At the prompt, enter y to continue restoring all values to the factory default or n to stop the process.

Are You Sure (Y/N) ? **y**

Restoring REX2 factory defaults; Please wait...

REX2 factory defaults restored

Hit Any Key to Continue...

The system restores all configuration options to their default values.

VIEWING PRODUCT INFORMATION

The Product Information screen displays manufacturing information about the Campus-REX2 RS Interface Card. To open the Product Information screen:

- 1 From the Main Menu, type **1** then press **ENTER**. The System Status screen is displayed.
- 2 Type **5** then press **ENTER**. The Product Information screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Central              Remote I/F: REX2
Circuit ID:      Southeast line 421

                        PRODUCT INFORMATION

Firmware Version:      4.6G
PROM Checksum:         5FA1
Hardware Configuration: FF10
                        Desktop
                        AC

                        (R)eturn (M)ain Menu

ENTER CHOICE>
```

The Product Information screen displays the following information:

- the version number of the Campus-REX2 software (this also is displayed in the heading of all the terminal screens)
- the PROM checksum, a hexadecimal number used to verify unit PROMs
- the hardware version of the Campus-REX2 RS Interface Card

MONITORING AND TESTING THE CAMPUS SYSTEM

5

For:	See Page:
Monitoring HDSL Performance	75
Monitoring Current System Status	75
Viewing 24-Hour Performance History	76
Viewing Seven-Day Performance History	77
Viewing Local Alarm History	79
Viewing Ethernet Statistics	80
Viewing Bridge Statistics	81
Viewing Router Statistics	83
Performing Tests	85
Resetting the Campus Unit	89

You can also view this information through the LCD menus. See “Using the LCD for Configuration and Management” on page 7-97 for instructions on using the LCD panel.

MONITORING HDSL PERFORMANCE

Status for HDSL performance is accessed from the System Status Menu.

- 1 From the Main Menu, type **1** then press **ENTER**.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Central              Remote I/F: REX2
Circuit ID: Southeast line 421

                                MAIN MENU

1) SYSTEM STATUS
2) REX2 CONFIGURATION AND STATUS
3) SYSTEM CONFIGURATION
4) MAINTENANCE
5) REMOTE LOGON

                                (L)ogout

ENTER CHOICE>
```

The System Status Menu is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Central              Remote I/F: REX2
Circuit ID: Southeast line 421

                                SYSTEM STATUS MENU

1) CURRENT SYSTEM STATUS
2) 24-HOUR HDSL PERFORMANCE HISTORY
3) 7-DAY HDSL PERFORMANCE HISTORY
4) LOCAL ALARM HISTORY
5) PRODUCT INFORMATION

                                (R)eturn

ENTER CHOICE>
```

Refer to the following sections to monitor current system status and view 24-hour and 7-day performance histories.

Monitoring Current System Status

This screen provides information on the current performance of the Campus system including both local and remote HDSL alarms and HDSL performance.

From the System Status Menu, type **1** then press **ENTER**. The Current System Status screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4                      Local I/F: REX2
Remote Unit ID: Central                              Remote I/F: REX2
Circuit ID: Southeast line 421

                                CURRENT SYSTEM STATUS

Local Alarms:
Remote Alarms:
Loopback: None

                                HDSL-A          HDSL-B
                                LOCAL    REMOTE    LOCAL    REMOTE
                                -----    -----
                                mn/cr/mx  mn/cr/mx  mn/cr/mx  mn/cr/mx
Margin (dB):                    na/na/na  na/na/na  na/na/na  na/na/na
Pulse Attn (dB):                00       00       00       00
24 Hour ES:                     00000    00000    00000    00000
24 Hour UAS:                    05671    00000    05671    00000
Last Cleared:                   None

                                (U)pdate (C)lear
                                (R)return (M)ain Menu

ENTER CHOICE>

```

The Current System Status screen provides the following information:

- Local Alarms indicates the current local alarm status.
- Remote Alarms indicates the current remote alarm status.
- Loopback indicates the current loopback status. If no loopback is active, the status is none.
- Margin indicates the minimum (mn), current (cr), and maximum (mx) HDSL margin value, measured in dB, relative to the signal-to-noise ratio required for a Bit Error Rate (BER) of 10^{-7} .
- Pulse Attenuation (Attn) indicates the decrease in amplitude of the transmitted signal as measured at the HDSL receiver (in decibels).
- 24 Hour ES indicates the number of errored seconds over the last 24 hours.
- 24 Hour UAS indicates the number of unavailable seconds over the last 24 hours.
- Last Cleared indicates the date and time when the error counter was last cleared.

The information on the Current System Status menu does not update automatically. To update this information, type **U** then press **ENTER**.

To clear the 24 Hour ES and 24 Hour UAS counters, type **C** then press **ENTER**.

Viewing 24-Hour Performance History

This screen displays historical HDSL information for the last 24 hours and is presented in 15-minute increments.

From the System Status Menu, type **2** then press **ENTER**. The 24 Hour HDSL Performance History screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southhall Quad 4      Local I/F: REX2
Remote Unit ID: Central                Remote I/F: REX2
Circuit ID: Southeast line 421

                24 HOUR HDSL PERFORMANCE HISTORY

                HDSL-A                      HDSL-B
                LOCAL      REMOTE          LOCAL      REMOTE
                ES/UAS     ES/UAS         ES/UAS     ES/UAS
                -----
11:00          000/000    000/000        000/000    000/000
11:15          000/000    000/000        000/000    000/000
11:30          000/000    000/000        000/000    000/000
11:45          000/000    000/000        000/000    000/000
12:00          000/000    000/000        000/000    000/000
12:15          000/000    000/000        000/000    000/000
12:30          000/000    000/000        000/000    000/000
12:45          000/000    000/000        000/000    000/000
Current        000/000    000/000        000/000    000/000

                (P)revious (N)ext (U)ppdate
                (R)eturn  (M)ain Menu

ENTER CHOICE>
```

The 24 Hour HDSL Performance History screen provides the following information:

- HDSL-A represents a single pair or the first pair (or loop) of a two-pair implementation (dependent on how HDSL was implemented for your Campus system. HDSL-B represents the second pair (or loop) of a two-pair implementation.
- Local indicates the Campus unit into which you are logged for management. Remote indicates the Campus unit at the other end of the HDSL connection from the local unit.
- ES/UAS indicates the total number of errored seconds and unavailable seconds that occurred during this 15-minute time frame.

Do the following if you want to view more history:

- To view the next page of the report, type **N** then press **ENTER**.
- To view the previous page, type **P** then press **ENTER**.

To update information on this screen, type **U** then press **ENTER**.



Performance history information is lost when power is removed from the Campus unit.

Viewing Seven-Day Performance History

This screen displays historical HDSL information for the last seven days. When a date ends with an asterisk (*), it indicates a time period beginning at midnight and up to the current time.

From the System Status Menu, type **3** then press **ENTER**. The 7 Day HDSL Performance History screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Central              Remote I/F: REX2
Circuit ID: Southeast line 421

              7 DAY HDSL PERFORMANCE HISTORY

              HDSL-A                      HDSL-B
              LOCAL      REMOTE          LOCAL      REMOTE
              ES/UAS     ES/UAS         ES/UAS     ES/UAS
              -----
May 24      00000/00000  00000/00000  00000/00000  00000/00000
May 25      00000/00000  00000/00000  00000/00000  00000/00000
May 26      00000/00000  00000/00000  00000/00000  00000/00000
May 27      00000/00000  00000/00000  00000/00000  00000/00000
May 28      00000/00000  00000/00000  00000/00000  00000/00000
May 29      00000/00000  00000/00000  00000/00000  00000/00000
May 30      00000/00000  00000/00000  00000/00000  00000/00000
May 31*     00000/00000  00000/00000  00000/00000  00000/00000

*Since Midnight

              (U)pdate
              (R)eturn (M)ain Menu

ENTER CHOICE>

```

The 7 Day HDSL Performance History screen provides the following information:

- HDSL-A represents a single pair or the first pair (or loop) of a two-pair implementation (dependent on how HDSL was implemented for your Campus system). HDSL-B represents the second pair (or loop) of a two-pair implementation.
- Local indicates the Campus unit into which you are logged for management. Remote indicates the Campus unit at the other end of the HDSL connection from the local unit.
- ES/UAS indicates the total number of errored seconds and unavailable seconds that occurred during this day.

To update information on this screen, type **U** then press **ENTER**.



Performance history information is lost when power is removed from the Campus unit.

Viewing Local Alarm History

This screen displays alarm history information. From the System Status Menu, type **4** then press **ENTER**. The Local Alarm History screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:
Remote Unit ID: Inactive      Local I/F: REX2
Circuit ID:                  Remote I/F: Inactive

                                LOCAL ALARM HISTORY

Type          Current      First              Last              Count
-----
HDSL Link,    ACTIVE      Dec 09, 1999-04:30:03  Nov 31, 1999-12:21:01  1
ES,           HDSL-A     OFF                 0
ES,           HDSL-B     OFF                 0
Margin,       HDSL-A     OFF                 0
Margin,       HDSL-B     OFF                 0
LOS,         Port       OFF                 0

Last Cleared: None

(S)witch to Remote Alarm History
(U)update (C)lear
(R)return (M)ain Menu

ENTER CHOICE>

```

This screen shows alarm history of the local unit. If the HDSL line uses two loops, the screen includes information for both loops. The screen includes information on the following alarms:

- Errored seconds (ES) for HDSL loop A (first pair) and HDSL loop B (second pair, when applicable)
- Margin for HDSL loop A (first pair) and HDSL loop B (second pair, when applicable)
- Loss of Signal (LOS) for the HDSL port

To view remote alarm history, type **S** then press **ENTER**.

To update the information, type **U** then press **ENTER**.

To clear the information, type **C** then press **ENTER**.



Alarm history information is lost when power is removed from the Campus unit.

VIEWING ETHERNET STATISTICS

The REX2 Statistics screen provides a count of valid Ethernet packets received and forwarded by the Ethernet and HDSL ports.

From the Main Menu, type **2** then press **ENTER**.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:                               Local I/F: REX2
Remote Unit ID: Inactive                      Remote I/F: Inactive
Circuit ID:

                                MAIN MENU

1) SYSTEM STATUS
2) REX2 CONFIGURATION AND STATUS
3) SYSTEM CONFIGURATION
4) MAINTENANCE
5) REMOTE LOGON

                                (L)ogout

ENTER CHOICE>
```

The REX2 Configuration and Status screen is displayed; bridge protocol is the default.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:                               Local I/F: REX2
Remote Unit ID:                               Remote I/F: REX2
Circuit ID:

                                REX2 CONFIGURATION AND STATUS

LAN STATUS: 100BaseT, Full Duplex, Up
LINE STATUS: Standard, Auto, T1, Down
MAC ADDRESS: 00:20:A7:01:02:08

1) Network Protocol:   Bridge      (Bridge, Router)
2) Encapsulation:     cHDLC      (cHDLC, PPP)
3) Timing Source:     Internal    (Internal, HDSL)
4) BRIDGE CONFIGURATION
5) BRIDGE STATISTICS
6) SNMP CONFIGURATION
7) SAVE REX2 CONFIGURATION

WARNING: Configuration change(s) will be lost if not saved before
        resetting or powering unit down.
        (R)return

ENTER CHOICE>
```

Viewing Bridge Statistics

From the REX2 Configuration and Status screen with Bridge selected as the network protocol, type **5** then press **ENTER**.

The Bridge Statistics screen is displayed.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:
Remote Unit ID: Inactive          Local I/F: REX2
Circuit ID:      Southeast line 421      Remote I/F: Inactive

                                BRIDGE STATISTICS

UNIT      Entries Learned: 1          Creation Failures: 0

PORTS
Frames:      LAN TX      LINE RX      LAN RX      LINE TX
Multicasts:  0000000000  0000000000  000000893   000000840
Bridge Frames: 0000000000  0000000000  000000525   000000000
Discards:    -----  0000000000  0000000000  -----
Errors:      0000000000  0000000000  0000000000  0000000000
Undersized:  -----  0000000000  0000000000  -----
Oversized:   -----  0000000000  0000000000  -----
Ex. Delay:   0000000000  -----  -----  0000000000
Ex. Collisions: 0000000000  -----  -----  0000000000

                                (R)eturn (M)ain Menu (U)pdate (C)lear
ENTER CHOICE>

```

The following information is displayed for the unit:

- Entries learned indicates the number of entries learned on a port and that are added to the bridging table.
- Creation failures indicates the number of entries not added to the bridging table because the table was full.

The following information is displayed for the LAN and Line ports (for transmit and receive directions):

Statistic	Description	Monitored Port	
		LAN	Line
Rx Frames	The number of received frames.	•	•
Tx Frames	The number of transmitted frames.	•	•
Rx Multicasts	The number of multicast frames received.	•	•
Tx Multicasts	The number of multicast frames transmitted.	•	•
Rx Discards	The number of received frames that have been discarded (filtered).	•	•
Rx Errors	The number of frames received in error from both the input and output buffers (such as CRC errors, alignment errors, and dribbling bit errors).	•	•
Tx Errors	The number of frames transmitted in error from both the input and output buffers (such as CRC errors, alignment errors, and dribbling bit errors).	•	•
Rx Undersized	The number of frames received that are smaller than the Ethernet minimum of 64 bytes.	•	•
Rx Oversized	The number of frames received that exceed the MTU size of 1536 bytes.	•	•
Tx Excessive Delay	Frames discarded due to excessive queuing time.	•	•
Tx Excessive Collisions	The number of excessive collision events that have occurred, that is. frames dropped because of 16 consecutive collisions.	•	•

To update the statistics, type **U** then press **ENTER**.

To clear the counters, type **C** then press **ENTER**.

Viewing Router Statistics

From the REX2 Configuration and Status screen with Router selected as the network protocol, type **5** then press **ENTER**.

```

Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4          Local I/F: REX2
Remote Unit ID: Central                  Remote I/F: REX2
Circuit ID: Southeast line 421

                                ROUTER STATISTICS

UNIT          RIP Entries: 0          Static Entries: 0

PORTS         LAN TX          LINE RX          LAN RX          LINE TX
Frames:       0000000000 0000000000 0000000362     0000000315
Multicasts:  0000000000 0000000000 0000000000     0000000000
Errors:       0000000000 0000000000 0000000000     0000000000
Undersized:  ----- 0000000000 0000000000     -----
Oversized:   ----- 0000000000 0000000000     -----
Ex. Delay:   0000000000 ----- ----- 0000000000
Ex. Collisions: 0000000000 ----- ----- 0000000000

                                (R)return (M)ain Menu (U)pdate (C)lear
ENTER CHOICE>

```

The following information is displayed for the unit:

- RIP Entries indicates the number of entries learned on a port and that are added to the routing table.
- Static Entries indicates the number of entries added to the static routing table through manual configuration.

The following information is displayed for the LAN and Line ports (for transmit and receive directions):

Statistic	Description	Monitored Port	
		LAN	Line
Rx Frames	The number of received frames.	•	•
Tx Frames	The number of transmitted frames.	•	•
Rx Multicasts	The number of multicast frames received.	•	•
Tx Multicasts	The number of multicast frames transmitted.	•	•
Tx Errors	The number of frames transmitted in error from both the input and output buffers (such as CRC errors, alignment errors, and dribbling hit errors).	•	•
Rx Errors	The number of frames received in error from both the input and output buffers (such as CRC errors, alignment errors, and dribbling hit errors).	•	•
RX Undersized	The number of frames received that are smaller than the Ethernet minimum of 64 bytes.	•	•
Rx Oversized	The number of frames received that exceed the MTU size.	•	•
Tx Excessive Delay	Indicates excessive delay that occurred for transmitted packets.	•	•
Tx Excessive Collisions	The number of excessive collision events that have occurred, that is. frames dropped because of 16 consecutive collisions.	•	•

To update the statistics, type **U** then press **ENTER**.

To clear the counters, type **C** then press **ENTER**.

PERFORMING TESTS

The Campus-REX2 offers tests you can run to check the HDSL datapath (loopbacks). Access to the test is from the Diagnostics screen.

- 1 From the Main Menu, type **4** then press **ENTER**.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Central              Remote I/F: REX2
Circuit ID: Southeast line 421

                                MAIN MENU

1) SYSTEM STATUS
2) REX2 CONFIGURATION AND STATUS
3) SYSTEM CONFIGURATION
4) MAINTENANCE
5) REMOTE LOGON

                                (L)ogout

ENTER CHOICE>
```

The Maintenance screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Inactive            Remote I/F: Inactive
Circuit ID: Southeast line 421

                                MAINTENANCE

1) DIAGNOSTICS
2) RESET REX2

                                (R)eturn

ENTER CHOICE>
```

- 2 To access the Diagnostics screen, type **1** then press **ENTER**. The Diagnostics screen is displayed.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID: Southall Quad 4      Local I/F: REX2
Remote Unit ID: Central              Remote I/F: REX2
Circuit ID: Southeast line 421

                                DIAGNOSTICS

1) LOOPBACK

                                (R)eturn (M)ain Menu
ENTER CHOICE>
```

Performing Loopback Testing

Loopbacks provide testing for the HDSL data communication path between the Campus unit, the remote unit, and the remote host equipment. Loopback tests can be run only when one end of the HDSL connection (either the local or the remote) is a Campus-REX2 or Campus-REX (both ends cannot be Campus-REX2 or Campus-REX).

The following section describes how to set up, run, and terminate loopback tests.

Configuring Loopbacks



If both the local and remote Campus units have a Campus-REX2 RS Interface Card, no loopbacks are supported between the two units.

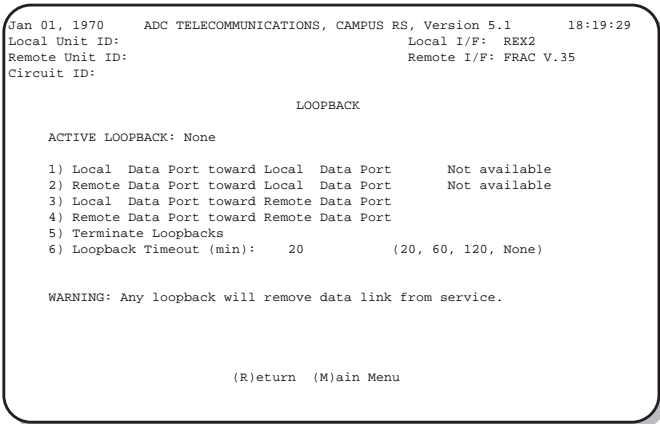
The Campus-REX2 supports the following types of loopbacks between a Campus-REX2 and another Campus unit that contains a synchronous interface card such as V.35 or DSX-1:

- The Remote to Remote loopback tests the remote data port.
- The Local to Remote loopback tests the remote data port, the entire data path inside the remote Campus unit, the HDSL line, the HDSL transceivers of both units, and most of the internal data path inside the local unit. This loopback does not test the local data port drivers and receivers.

Once a loopback condition has been initiated, it remains in effect until it is cleared. You may also set a loopback timeout to clear the loopback automatically after a set period of time has elapsed.

All loopback options are accessed through the Loopback Settings menu. To open this menu:

- 1 From the Diagnostics screen, type **1** then press **ENTER**. The Loopback screen is displayed.



- 2 To initiate a loopback condition, type the number (1 or 2) that corresponds to the loopback then press **ENTER**. The Loopback screen displays the new loopback status.
- 3 To clear a loopback condition, type **3** then press **ENTER**. The system disables the loopback and the Loopback Settings menu is displayed.



If you set the loopback timeout to NONE, a loopback runs until you clear it manually or turn the unit off.

- 4 To select a loopback timeout, type **4** then press **ENTER**. Continue until you select the timeout (20, 60, or 120 minutes or none which disables the timeout) you want for this test. The default is 20 minutes.

The loopback timeout determines the amount of time before a loopback clears automatically.

RESETTING THE CAMPUS UNIT

You can issue a reset for the Campus unit which causes it to complete a soft reboot. Use this function when one of the following occurs:

- The Port LED flashes green and the REX2 Module Not Ready message is displayed when trying to access the REX2 interface. This indicates that the Campus desktop or line unit is not communicating with the REX2 card for more than 1 minute after power-up was indicated.
- HDSL, REX2, or system configuration changes have been made, but not saved, and you want to revert to the previously saved configuration.
- The REX2 is not functioning properly as indicated by excessive LAN errors or Not available displayed for configuration values.

During the reset, the Port and HDSL LEDs on the desktop unit flash.

It is not required that you reset the REX2 after a configuration change or when you complete a save function.

- 1 From the Main Menu, type **4** then press **ENTER**.

```
Jul 07, 2003      ADC TELECOMMUNICATIONS, CAMPUS RS, Version 5.1 08:19:34
Local Unit ID:  Southall Quad 4      Local I/F:  REX2
Remote Unit ID:  Inactive             Remote I/F:  Inactive
Circuit ID:     Southeast line 421

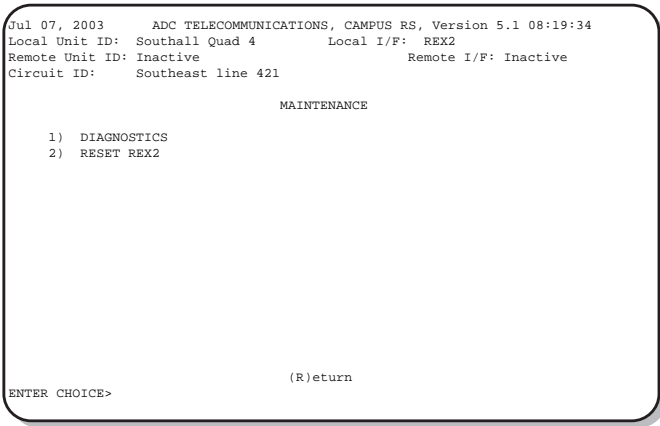
                                MAIN MENU

1)  SYSTEM STATUS
2)  REX2 CONFIGURATION AND STATUS
3)  SYSTEM CONFIGURATION
4)  MAINTENANCE
5)  REMOTE LOGON

                                (L)ogout

ENTER CHOICE>
```

The Maintenance screen is displayed.



- 2 To reset the Campus unit, type **3** then press **ENTER**. At the prompt, enter **y** to continue restoring all values to the factory default values or **n** to stop the process.

WARNING: Unsaved configuration change(s) will be lost.

Are You Sure (Y/N) ? **y**

REX2 reset in progress; Please wait...

REX2 has been reset

Hit Any Key to Continue...

MANAGING SOFTWARE

6

This chapter describes how to perform general management of the Campus unit software, including both upgrading software and recovery of software in the event of a file system failure.

For:	See Page:
Upgrading Campus Unit Software	92
Recovering Software	95

UPGRADING CAMPUS UNIT SOFTWARE

This section describes how to upgrade the software on your Campus-REX2. To upgrade, you will use FTP on your Windows- or Unix/Linux-based PC to transfer the new software to the Campus-REX2. A file containing the new software is supplied with the name `carex2_Vx.y.tar`, where `x.y` is the software release version. When you upgrade software, the configured parameters for HDSL, system, and REX2 are not affected by the upgrade.

Prior to updating software, ensure the following has been completed:

- The Campus-REX2 is configured with a LAN IP address (see “Configuring the REX2” on page 29.)
- You can successfully 'ping' the configured LAN IP address of the Campus-REX2.
- You have access to the file containing the upgrade software (`carex2_Vx.y.tar`) from the PC that you used to perform the 'ping'.



Do not remove power to the Campus unit or disconnect the Line and LAN side network connections when upgrading software or saving configuration.

Upgrade the Campus-REX2 software as follows:

- 1 Open a DOS window (Windows-based PC) or command shell (Unix/Linux-based PC).
- 2 Change directory to a directory where you will copy the file containing the upgrade software (carex2_Vx.y.tar) and subsequently execute the FTP commands below. For example:

```
c:\> cd \campus\rex2\upgrade\v5.1
```

- 3 Copy the upgrade software file (carex2_Vx.y.tar) to this directory.
- 4 At the DOS prompt, start FTP using the configured LAN IP address of the Campus-REX2. For example:

```
c:\campus\rex2\upgrade\v5.1> ftp 192.168.1.1
```

A message indicating successful connection to the LAN IP address follows. If this does not occur, verify that you have correctly entered the LAN IP address

- 5 FTP then prompts for a user name and password to connect FTP to the Campus-REX2. For example:

```
User (192.168.1.1:(none)): admin
```

Password: admin (or previously configured REX2 password; see "Setting a Password" on page 69)

When FTP is successfully connected to the Campus-REX2, FTP displays the "ftp>" prompt.

- 6 At the FTP prompt, set the file type that FTP will use to transfer the upgrade software file, as follows:

```
ftp> bin
```

- 7 At the FTP prompt, enter the command to transfer the upgrade software file (carex2_Vx.y.tar) to the Campus-REX2, for example:

```
ftp> put carex2_v5.1.tar
```

If the transfer is successful, a "Store complete" message is displayed, along with transfer statistics. If the transfer is unsuccessful, one or more error messages may be displayed, and the FTP connection is terminated. In the case of a failed transfer, verify that the upgrade software filename has been entered correctly.

- 8 At the FTP prompt, enter the command to permanently save the upgrade software to flash memory in the Campus-REX2, and restart the Campus-REX2 with the new software, as follows:

```
ftp> quote site update
```

On a Windows-based PC, you may also use the command **literal site update**. This command may take a few seconds before returning to the FTP prompt. When the command completes, FTP, as well as Campus-REX2 console and LCD, display messages indicating that the upgrade is in progress. As indicated by the FTP message, the save-and-restart operation may take up to 1 minute to complete.

- 9 At the FTP prompt, enter the command to exit FTP.

```
ftp> bye
```

As noted previously, the Campus-REX2 unit will restart automatically.

- 10 After the Campus-REX2 unit has restarted with the new software, you may log in to the Campus-REX2 console as described in “Logging In” on page 12.



The actual screen may differ based on the operating system that you use.

RECOVERING SOFTWARE

This recovery process returns the Campus-REX2 to a working state after a file system failure. If, upon bootup of the Campus-REX2, it is determined that the file system is corrupted, the unit performs the process described below. The potential for file system failure occurs if the unit loses power during a code upgrade or during a configuration save.

For the recovery to occur, you must have the following installed and available to the Campus-REX2:

- A BOOTP server must be configured and available to respond to the MAC address of the Campus-REX2 with the following information:
 - IP address and subnet mask
 - Gateway IP address, if required
 - TFTP server IP address
 - recovery image filename
- A TFTP server must be active and available and contain the recovery image file (name provided to Campus-REX2 by BOOTP server).

The Campus-REX2 automatically performs the following when recovering software:

- 1** After internal processing, the Campus-REX2 sends a BOOTP request out both the LINE and LAN interfaces. These requests are transmitted until a reply is received.
- 2** After the BOOTP response is received by the Campus-REX2, it attempts to download code from the TFTP server (TFTP server IP address provided to Campus-REX2 by BOOTP server).
- 3** After the new image is downloaded, the Campus-REX2 automatically boots the new image.

Your Campus-REX2 is now in a normal operating state and you can manage it as appropriate.

USING THE LCD FOR CONFIGURATION AND MANAGEMENT

7

This chapter describes how to use the LCD to set the Campus-REX2 configuration options.

For:	See Page:
Navigating the LCD Menus	98
Setting the HDSL Parameters	99
Configuring the Campus-REX2	103
Restoring the System to Default Values	108
Viewing and Configuring Alarms	109
Configuring Loopbacks	113
Viewing System Information	115
Viewing Status Information	115

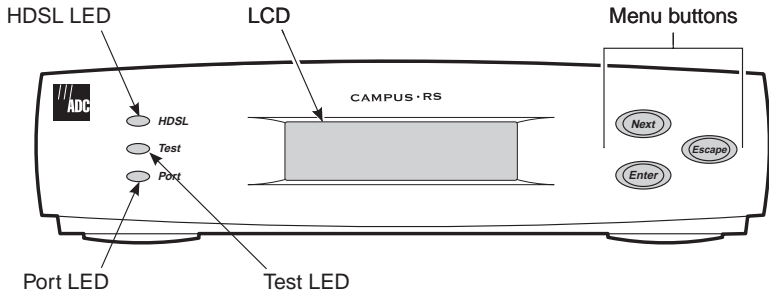
The steps in this section use the menu buttons and LCD on the front of the desktop unit or the Campus-Star Campus Management Unit (CMU) to configure the Campus-REX2. With the default settings, the Campus-REX2 is set to operate:

- with the HDSL Operating Mode set to Standard Mode
- with the Standard Mode HDSL Rate set to T1
- as a bridge, with the encapsulation format set to cHDLC and Spanning Tree protocol disabled
- with the Timing Source set to Internal

Depending on the requirements of your network, you may be able to use the default settings for one or more of these options.

NAVIGATING THE LCD MENUS

Use the LCD and the menu buttons on the desktop unit or CMU to navigate the menus and configure the Campus-RS system. The illustration below shows the LCD and menu buttons on the desktop unit. See the *Campus-Star Chassis User Manual* for the location of the LCD and menu buttons on the CMU.



The following table describes how to use the menu buttons to move through the menus and select items.

Button	Function
Next	Scrolls to the next LCD menu or option at the same level of the menu structure
Enter	Selects the displayed LCD menu or option
Escape	Returns to the previous LCD menu selection

Instructions for setting individual configuration options are included with each option. The basic procedure is:

- 1 Press **Escape** until CAMPUS RS I/F: REX2 is displayed.
- 2 Press **Next** until the preferred menu name is displayed.
- 3 Press **Enter** to access the menu options.
- 4 Press **Next** until the preferred option name is displayed.
- 5 Press **Enter** to access the settings for the option.

- 6 Press **Next** until the preferred setting is displayed.
- 7 Press **Enter** to select and save the preferred option.
- 8 Press **Escape** several times to return to the top of the menu structure (CAMPUS RS I/F: REX2).

When a parameter is preceded by an equal (=) sign, it indicates that it has selectable parameters that you can configure.

SETTING THE HDSL PARAMETERS

The Campus-REX2 is set to operate in Standard Mode with a T1 (1.544 Mbps) HDSL Rate. This is compatible with other Campus-RS products and with Campus-T1 desktop units and line units. If this is the preferred setting for your system, proceed to “Configuring the Campus-REX2” on page 103. Otherwise, follow the steps in this section to adjust the HDSL transmission rate.



Changes to the HDSL operating mode or transmission rate are not automatically made to the remote unit. These changes must be made at both the local and remote units for the HDSL link to be re-established. If the remote unit is not easily accessible, you can follow the instructions in “Logging On a Remote Campus Unit” on page 15 to use an PC for a remote logon (if an HDSL link is up) and make the preferred change. When you change the HDSL settings for the remote unit, the HDSL link is lost; it is re-established when you make the identical change(s) to the local unit.

You can use the default HDSL setting for your Campus-RS unit (when also using the default settings on the remote unit to which this unit connects) which are:

- standard for the HDSL operating mode
- auto for the transceiver mode (determines which device is the master or slave)
- T1 for the HDSL rate

If you want to change any of these parameters, select one of the following sections based on the HDSL operating mode you will use. Campus-RS offers these two HDSL operating modes:

- Standard mode (below) provides compatibility between a Campus-RS product and an earlier Campus product (legacy Campus) that has a HDSL interface including T1, E1, or 768:
 - for T1, the maximum transmission rate is 1.544 Mbps over 2 pairs
 - for E1, the maximum transmission rate is 2.048 Mbps over 2 pairs
 - for 768, the transmission rate is 768 kbps over 1 pair
- Extended mode (page 101) provides a fractional ($n \times 64$) rate selection between the HDSL interfaces of two Campus-RS products. The rate is selectable as follows:
 - for 1 pair in 64 kbps increments, starting at 128 kbps up to 2.304 Mbps
 - for 2 pair in 128 kbps increments, starting at 256 kbps up to 4.608 Mbps

Accessing LCD HDSL Configuration

To access the menu to configure the HDSL parameters, do the following:

- 1 Press **Escape** until `Campus RS I/F: REX2` is displayed.
- 2 Press **Next**. `HDSL LINK CONFIG & STATUS` is displayed.
- 3 Press **Enter**. `OPERATING MODE` is displayed.

Continue with one of the following sections, depending on whether you are using Standard Mode or Extended Mode.

Configuring Standard Mode

Set HDSL configuration for Standard Mode using the following procedure.

- 1 To select the Operating Mode, do one of the following:
 - If the mode is set to Standard, go to Step 2.
 - If the mode is not set to Standard, press **Enter**, then press **Next** until the LCD displays `STANDARD`, then press **Enter**. The Operating Mode changes to `OPERATING MODE=Standard`.

- 2 To select the transceiver mode:
 - a Press **Next** until XCVR Mode is displayed.
 - b Press **Enter**.
 - c Press **Next** until your choice is displayed:
 - Master initiates the HDSL link. The other Campus unit must be set to Slave or Auto.
 - Slave waits for the other Campus unit to initiate the HDSL link. The other unit must be set to Master or Auto.
 - Auto (default) automatically switches between Master and Slave until an HDSL link is established.

The Transceiver Mode option determines the hierarchy of the two Campus units when attempting to establish an HDSL link.

- d Press **Enter**.
- 3 To select the HDSL rate:
 - a Press **Next** until HDSL RATE is displayed.
 - b Press **Enter**.
 - c Press **Next** until your setting choice of T1 (default), E1, or 768 is displayed.
 - d Press **Enter**.

To continue setting up the system, proceed to “Configuring the Campus-REX2” on page 103.

Configuring Extended Mode Parameters

Set the Extended Mode parameters using the following procedure.

- 1 To select the Operating Mode, do one of the following:
 - If the mode is set to EXTENDED, go to Step 2.
 - If the mode is not set to EXTENDED, press **Enter**, then press **Next** until the LCD displays EXTENDED, then press **Enter**. The Operating Mode changes to OPERATING MODE=Extended.



It is recommended that you leave the Transceiver Mode option set to Auto unless you require that a particular end of the HDSL connection be the Master or Slave.

Also, this value cannot be changed if the HDSL link is up.

- 2 To select the transceiver mode:
 - a Press **Next** until `XCVR Mode` is displayed.
 - b Press **Enter**.
 - c Press **Next** until your choice is displayed:
 - `Master` initiates the HDSL link. The other Campus unit must be set to `Slave` or `Auto`.
 - `Slave` waits for the other Campus unit to initiate the HDSL link. The other unit must be set to `Master` or `Auto`.
 - `Auto` (default) automatically switches between `Master` and `Slave` until an HDSL link is established.

The Transceiver Mode option determines the hierarchy of the two Campus units when attempting to establish an HDSL link.

- d Press **Enter**.
- 3 To configure `LOOP MODE`, do the following:
 - a Press **Next** to display `LOOP MODE`.
 - b Press **Enter**.
 - c Press **Next** to change the setting from 1 Loop (default) to 2 Loop, then press **Enter**. The LCD displays `LOOP MODE=2 Loops`.
 - 4 To configure `HDSL RATE`, do the following:
 - a Press **Next** to display `HDSL RATE`.
 - b Press **Enter**.

- c Press **Next** until the HDSL transmission rate you want to set is displayed, then press **Enter**. The HDSL Rate that is displayed is dependent on whether you selected 1 Loop or 2 Loop for the Loop Mode. The minimum and maximum rates are:
- for 1 Loop, 128 kbps is the minimum and 2304 Mbps is the maximum selected in 64 kbps increments; the default is 128 kbps
 - for 2 Loop, 256 kbps is the minimum and 4608 Mbps is the maximum selected in 128 kbps increments; the default is 256 kbps

To continue setting up the system, proceed to “Configuring the Campus-REX2” on page 103.

CONFIGURING THE CAMPUS-REX2

Through the Campus-REX2 LCD, the `Network Protocol` (bridge or router) is selectable. The LCD indicates which network protocol is selected either by its default configuration or through a change made to the interface through the LCD or through the console port, telnet, or SNMP. For both bridge and router `Network Protocol`, the timing source and encapsulation can be selected.

The LCD also provides information about the network protocol that is currently configured for the Campus-REX2 such as:

- when in router mode:
 - router configuration including IP addresses for both the Line and LAN ports, RIP configuration, and the DHCP service configuration
 - router statistics including frames transmitted and received by the Line and LAN ports
- when in bridge mode:
 - bridge configuration including the unit IP addresses and filter age (Spanning Tree Protocol, which is under this menu selection, can be enabled)
 - bridge statistics including frames transmitted and received by the Line and LAN ports and error frames

For an overview of bridges, routers, and other network management concepts, see “Internetworking and Management Overview” on page 119.

Accessing LCD REX2 Configuration

For both bridge and router Network Protocol, the timing source and encapsulation can be selected. For bridge mode only, Spanning Tree Protocol can be enabled (default configuration is disabled). Use the following procedures to set these parameters.

- 1 Press **Escape** until `Campus RS I/F: REX2` is displayed.
- 2 Press **Next** twice. `REX2 CONFIG & STATUS` is displayed.
- 3 Press **Enter**. `Configure REX2 Settings` is displayed.
- 4 Press **Enter** and continue with the following sections.

Configuring REX2 Parameters

For both bridge and router Network Protocol, you can select the timing source and encapsulation. You can then configure the specific parameters for either bridge mode or router mode. Use the following procedures to set these parameters.

Set the Timing Source

The Timing Source option determines the source of circuit timing on the HDSL link and applies to both bridge and router modes. The LCD navigation to get to this submenu was provided in the section “Accessing LCD REX2 Configuration” on page 104.

- 1 To select the Timing Source, do one of the following:
 - If the mode is set to `Timing Source`, go to Step 2.
 - If the mode is not set to `Timing Source`, press **Next** until the LCD displays `Timing Source`, then press **Enter**. The Operating Mode changes to `Timing Source=Internal`.
- 2 Press **Enter**. The LCD displays the current Timing Source setting (`Internal` is the default).
- 3 Press **Next** until the preferred Timing Source setting is displayed, then press **Enter**. The LCD displays the new Timing Source setting. Select from the following setting options:

- Internal (default setting) which takes its timing from an internal oscillator
- HDSL which takes its timing from the HDSL link

The Timing Source option determines the source of circuit timing on the HDSL link. The proper setting of the Timing Source option depends upon the interface card of the remote Campus unit:

- If the Campus-REX2 is connected to a Campus unit with another Campus-REX2, leave the Timing Source option set to Internal. The other end of the connection can be set to HDSL; the Campus system will not operate properly if both units are set to HDSL.
- If the Campus-REX2 is connected to a Campus unit with a synchronous interface card, such as a Fractional V.35 card, the timing source depends on the setting of the Primary Timing Source option of the remote unit:
 - Set the Timing Source to HDSL if the remote unit is set to Internal or Data Port.
 - Set the Timing Source to Internal if the remote unit is set to HDSL.

See the *Campus-RS Fractional Interface Card User Manual* for information on the Primary Timing Source option.

- If the Campus-REX2 is connected to a Campus unit with a Campus CSU/DS-1 or CSU/DSX-1 interface card, set the Timing Source option to Internal.

Setting the Encapsulation

This section describes how to configure the Encapsulation type for data sent by the Campus-REX2. The LCD navigation to get to this submenu was provided in the section “Accessing LCD REX2 Configuration” on page 104.

1 To select the Encapsulation, do one of the following:

- If the mode is set to `Encapsulation`, go to Step 2.
- If the mode is not set to `Encapsulation`, press **Next** until the LCD displays `Encapsulation`, then press **Enter**. The Operating Mode changes to `Encapsulation=cHDLC`.

- 2 Press **Enter**. The LCD displays the current Encapsulation setting (cHDLC is the default).
- 3 Press **Next** until the preferred Encapsulation setting is displayed, then press **Enter**. Choose from these setting options:
 - cHDLC for Campus-REX2 to another Campus-REX2 application
 - PPP when the remote Campus unit has a synchronous interface card such as a V.35 or when connecting to Ethernet equipment from another manufacturer

Setting Bridge Configuration

When the network protocol is set to bridge, you can configure the parameters indicated in the sections below. Parameters such as the Unit IP must be configured through the terminal screens.

Enabling Spanning Tree. Complete this section if you want to enable Spanning Tree Protocol (STP) when bridge protocol is selected. Spanning Tree Protocol is disabled as a default configuration. See “About Spanning Tree Protocol” on page 124 for more information about the protocol. The LCD navigation to get to this submenu was provided in the section “Accessing LCD REX2 Configuration” on page 104.

- 1 Press **Next** until you select Bridge Configuration, then press **Enter**.
- 2 Press **Next** until you select Spanning Tree, then press **Enter**.
- 3 Press **Next** to select Enabled, then press **Enter**.

Viewing Unit IP. Complete this section to view the Unit IP address. The LCD navigation to get to this submenu was provided in the section “Accessing LCD REX2 Configuration” on page 104.

- 1 Press **Next** until you select Bridge Configuration, then press **Enter**.
- 2 Press **Next** until you select Unit IP, then press **Enter**.

The Unit IP address is displayed. If you have not changed the IP address through the terminal screens, then the default IP address of 192.168.1.1 is displayed.

Setting Router Configuration

When the network protocol is set to router, you can view the parameters indicated in the sections below. Parameters such as the LINE and LAN IP must be configured through the terminal screens.

Viewing Line and LAN IP Addresses. Complete this section to view the IP addresses. The addresses must be configured through the terminal screens. The LCD navigation to get to this submenu was provided in the section “Accessing LCD REX2 Configuration” on page 104.

1 Press **Next** until you select Router Configuration, then press **Enter**.

2 Press **Next** until you select Port IP Settings, then press **Enter**.

The LAN IP address is displayed. If you have not changed the IP address through the terminal screens, then the default IP address of 192.168.1.1 is displayed.

3 Press **Next** to view the LAN subnet mask.

4 Press **Next** to view the LINE IP address.

5 Press **Next** to view the LINE subnet mask.

6 Press **Escape** to return to the Router Configuration menu.

Viewing RIP Configuration. Complete this section to view the configured parameters for RIP. The LCD navigation to get to this submenu was provided in the section “Accessing LCD REX2 Configuration” on page 104.

1 Press **Next** until you select Router Configuration, then press **Enter**.

2 Press **Next** until you select RIP Configuration, then press **Enter**.

3 Press **Next** to view the configured parameters for:

- LAN RIP Send
- LAN RIP Rcv (receive)
- LINE RIP Send
- LINE RIP Rcv (receive)
- RIP Host Route
- Poison reverse
- RIP 2 auth

- 4 To change the parameter, press **Enter** when the parameter is displayed (the current setting of this parameter displays on a separate screen).
- 5 Press **Next** until the desired (new) setting is displayed, then press **Enter**.
- 6 Press **Escape** to return to the Router Configuration menu.

Viewing DHCP Service. Complete this section to view the configured parameter for DHCP service. These parameters must be configured through the terminal screens. The LCD navigation to get to this submenu was provided in the section “Accessing LCD REX2 Configuration” on page 104.

- 1 Press **Next** until you select Router Configuration, then press **Enter**.
- 2 Press **Next** until you select DHCP Service, then press **Enter**.
None is the default configuration. You can select DHCP Relay through the terminal screen. The configured value is displayed.
- 3 Press **Escape** to return to the Router Configuration menu.

Saving the REX2 Configuration

If you have changed the Campus-REX2 Bridge or Router configuration, you can save this configuration. To save the configuration:

- 1 Press **Next** until `Press ENTER to save REX2 config` is displayed.
- 2 Press **Enter**. `REX2 CONFIG SAVE IN PROGRESS` is displayed.
- 3 After a pause, `REX2 CONFIG SAVE COMPLETE` is displayed.
- 4 Press **Next** to return to the previous screen.

RESTORING THE SYSTEM TO DEFAULT VALUES

You can restore all of the configuration options to their factory default values. To return the system configuration options to their default values:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Enter**. `S/W VERSN` and `S/WCKSUM` is displayed.
- 3 Press **Next** six times. `Press ENTER to factory reset` is displayed.
- 4 Press **Enter**. The system configuration options return to the default values.

VIEWING AND CONFIGURING ALARMS

To determine if there is an active alarm condition:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Next** three times. `ALARM CONFIG & STATUS` is displayed.
- 3 Press **Enter**. The LCD displays these Alarm types:
 - Current Alarms HDSL
 - HDSL Link Alarms Config and Status
 - Local I/F Alarms Config and Status
 - RMT I/F Alarms Config and Status

If a specific indicator does not display, there is no alarm in that area of the system.

The following sections describe how to view specific alarm information for the HDSL, local, and remote ports, and how to configure thresholds.

HDSL Alarms

This section describes how to view and configure alarms on the HDSL line.

Viewing Current Alarms

If the `CURRENT ALARMS` display indicates an HDSL alarm, you can determine the alarm type:

- 1 From the `CURRENT ALARMS` display, press **Next**. `HDSL LINK ALARMS CONFIG & STATUS` is displayed.
- 2 Press **Enter**. The current status of three alarms is displayed:
 - `LINK` shows whether the HDSL link is on or off
 - `ES` shows whether the errored seconds threshold has been exceeded on the local unit, remote unit, or both
 - `MARGIN` shows whether the margin threshold has been exceeded on the local unit, remote unit, or both

Configuring Alarm Thresholds

Alarm thresholds determine the level at which an alarm condition is reached. There are two types of HDSL alarm thresholds:

- Link ES threshold determines the number of errored seconds that must occur to trigger an alarm. This threshold can be set to 17 or 170 errored seconds. You can also disable this alarm.
- Margin threshold determines the margin, in dB, that triggers an alarm. This threshold can be set anywhere between 1 dB and 25 dB, in 1 dB increments. You can also disable this alarm.

To set the alarm thresholds:

- 1 From the CURRENT ALARMS display, press **Next**. HDSL LINK ALARMS is displayed.
- 2 Press **Enter**. The current HDSL alarm status is displayed.
- 3 Press **Next**. HDSL ES THRESHLD is displayed.
- 4 Press **Enter**.
- 5 Press **Next** to scroll through the settings for the ES threshold until the preferred setting is displayed.
- 6 Press the **Enter** button to select the preferred setting. HDSL ES THRESHLD is displayed.
- 7 Press **Next**. MARGIN THRESHLD is displayed.
- 8 Press **Enter**.
- 9 Press **Next** to scroll through the settings for the margin threshold until the preferred setting is displayed.
- 10 Press **Enter** to select the preferred setting. MARGIN THRESHLD is displayed.

Viewing 24-Hour HDSL Alarm History

You can view the number of HDSL alarm conditions that have occurred over the past 24 hours. The LCD displays 24-hour information for the following alarms:

- local errored seconds (LOCAL ES)
- remote errored seconds (REMOTE ES)
- local unavailable seconds (LOCAL UAS)
- remote unavailable seconds (REMOTE UAS)

You may also view the time when the counter was last cleared and clear the counter.

To view the HDSL alarm history:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Next**. `HDSL LINK CONFIG & STATUS` is displayed.
- 3 Press **Enter**, then press **Next** until `PERFORMANCE STATUS` is displayed.
- 4 Press **Enter**, then press **Next** to scroll through the alarm history is displayed.
- 5 To reset the counter, press **Next** until `Press ENTER to clear error cnts` is displayed, then press **Enter**.

Local Alarms

Loss of Signal (LOS) alarms can occur on the local unit. This section describes how to view and configure this alarm.

Viewing Current Alarms

If the `CURRENT ALARMS` display indicates a local alarm, you can determine the alarm type:

- 1 From the `CURRENT ALARMS` display, press **Next** twice. `LOCAL I/F ALARMS CONFIG & STATUS` is displayed.
- 2 Press **Enter**. The current status of the local alarm is displayed.

Configuring the Alarm

To enable or disable the local Loss of Signal alarm:

- 1 From the CURRENT ALARMS display, press **Next** twice. LOCAL I / F ALARMS CONFIG & STATUS is displayed.
- 2 Press **Enter**. The current status of the local alarm is displayed.
- 3 Press **Next**. LOC LOSS OF SIG ALM is displayed.
- 4 Press **Enter**.
- 5 Press **Next** to scroll through the settings for the alarm.
- 6 Press **Enter** to select the preferred setting. LOC LOSS OF SIG ALM is displayed.

Remote Alarms

Loss of Signal (LOS) alarms can occur on the remote unit. This section describes how to view and configure this alarm.

Viewing Current Alarms

If the CURRENT ALARMS display indicates a remote alarm, you can determine the alarm type:

- 1 From the CURRENT ALARMS display, press **Next** three times. RMT I / F ALARMS CONFIG & STATUS is displayed.
- 2 Press **Enter**. The current status of the remote alarm is displayed.

Configuring the Alarm

To enable or disable the remote Loss of Signal alarm:

- 1 From the CURRENT ALARMS display, press **Next** three times. RMT I / F ALARMS is displayed.
- 2 Press **Enter**. The current status of the remote alarm is displayed.
- 3 Press **Next**. LOSS OF SIG ALM is displayed.

- 4 Press **Enter**.
- 5 Press **Next** to scroll through the settings for the alarm.
- 6 Press **Enter** to select the preferred setting. RMT LOSS OF SIG ALM is displayed.

CONFIGURING LOOPBACKS

Loopbacks provide a way to test the data communication path between the Campus unit, the remote unit, and the remote host equipment. The Campus-REX2 supports two types of loopbacks:

- Local to Remote loopbacks test the remote data port, the data path inside the remote Campus unit, the HDSL line, the HDSL transceivers of both units, and most of the internal data path inside the local unit. This loopback does not test the local data port drivers and receivers.
- Remote to Remote loopbacks test the remote data port and a small portion of the remote interface card.



If both the local and remote units have a Campus-REX2 or Campus-REX interface card, no loopbacks are supported.

Once a loopback condition has been initiated, it remains in effect until cleared. You may also set a loopback timeout to clear the loopback automatically after a set period of time has elapsed.

You manage loopbacks through the **DIAGNOSTICS** menu:

- 1 Press **Escape** until **CAMPUS RS I/F: REX2** is displayed.
- 2 Press **Next** four times. **DIAGNOSTICS** is displayed.
- 3 Press **Enter**. **LOOPBACK MODE** is displayed.

The following sections describe how to initiate and clear loopbacks, and to set a loopback timeout.

Initiating a Loopback

To initiate a loopback condition:

- 1 From the LOOPBACK MODE display, press **Enter**.
- 2 Press **Next** to scroll through the loopback options until the preferred loopback condition is displayed.
- 3 Press **Enter** to initiate the loopback. LOOPBACK MODE is displayed.

Clearing a Loopback

To clear a loopback condition:

- 1 From the LOOPBACK MODE display, press **Enter**.
- 2 Press **Next** to scroll through the loopback options until NONE is displayed.
- 3 Press **Enter** to clear the loopback. LOOPBACK MODE is displayed.

Setting the Loopback Timeout

The loopback timeout determines the amount of time before a loopback clears automatically. To set a loopback timeout:

- 1 From the LOOPBACK MODE display, press **Next**. LOOPBACK TIMEOUT is displayed.
- 2 Press **Enter** to access the loopback timeout options.
- 3 Press **Next** to scroll through the options until the preferred setting appears.



If you set the loopback timeout to NONE, loopbacks run until you clear them manually or turn the unit off.

- 4 Press **Enter** to select the option and return to the LOOPBACK TIMEOUT display.

VIEWING SYSTEM INFORMATION

Through the LCD menu you can view the following product information (with the option name in parentheses):

- firmware version and PROM checksum (S/W REV and S/W CKSUM)
- hardware configuration information (H/W CONFIG)
- local unit ID (LOCAL UNIT ID)
- remote unit ID (REMOTE UNIT ID)
- remote interface card type (REMOTE I/F)
- circuit ID (CIRCUIT ID)

You cannot change any of this information through the LCD. Use an ASCII terminal to set the local and remote unit IDs, and the circuit ID. See “Identifying the Unit and Circuit” on page 67.

To view the system information:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Enter** to view the firmware version and PROM checksum.
- 3 Press **Next** to scroll through the remaining options.

VIEWING STATUS INFORMATION

The LCD provides access to the following status information:

- Ethernet information, such as the MAC address and 10/100Base-T status
- Current HDSL margin
- Frame statistics on the LAN (Ethernet) and Line (HDSL) ports

Ethernet Information

You can view the following information about the Ethernet port:

- Link Status
- MAC address
- current 10/100Base-T status

To view Ethernet information:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Next** twice. `REX2 CONFIG & STATUS` is displayed.
- 3 Press **Enter**. `CONFIGURE REX2 SETTINGS` is displayed.
- 4 Press **Next** twice to view the status of the LAN link.
- 5 Press **Next** to view the status of the LAN link.
- 6 Press **Next** to view the `MAC ADDRESS`.

HDSL Margin

You can view the current HDSL loop margin values, measured in dB, for the local and remote HDSL loop. The listed values represent the margin relative to a signal-to-noise ratio required for a Bit Error Rate (BER) of 10^{-7} . A margin value greater than zero indicates a performance of better than 10^{-7} . The system provides a minimum margin of 6 dB, which translates to a performance of 10^{-10} BER or better.

To view the HDSL margin:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Next**. `HDSL LINK CONFIG & STATUS` is displayed then press **Enter**.
- 3 Press **Next** until `MARGIN` is displayed.

PORT STATISTICS

You can view Bridge and Router Port Statistics for the LAN (Ethernet) and Line (HDSL) ports:

- number of frames received and transmitted
- number of multicast frames received and transmitted
- number of errored frames received and transmitted
- number of undersized frames received
- number of oversized frames received
- number of excessive delay events for transmitted frames
- number of excessive collision events for transmitted frames
- number of bridge frames received and transmitted (Bridge only)
- number of frames received that were discarded (Bridge only)

Bridge Port Statistics

To view the Bridge Port Statistics:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Next** until `REX2 CONFIG & STATUS` is displayed.
- 3 Press **Enter**. `CONFIGURE REX2 SETTINGS` is displayed.
- 4 Press **Enter**. `NETWORK PROTOCOL = Bridge` is displayed (if not, you must change the setting to `Bridge` to view Bridge Port Statistics).
- 5 Press **Next** until `Bridge STATISTICS` is displayed.
- 6 Press **Enter**. `FRAMES` is displayed.
- 7 Press **Enter** to display the first screen of statistics.
- 8 Press **Next** to display the second screen of statistics (if any).
- 9 Press **Escape** to return to the statistics title screen.
- 10 Press **Next** to advance to the remaining statistic items, displayed in order: `MULTICASTS`, `BRIDGE FRAMES`, `DISCARDS`, `ERRORS`, `UNDERSIZED`, `OVERSIZED`, `EX. DELAY`, and `EX. COLLISIONS`. Repeat steps 7-9 as desired to display the statistics.
- 11 To clear the statistics, press **Next** until `Press ENTER to Clear Statistics` is displayed. Press **Enter** to reset all statistics to zero.

Router Port Statistics

To view the Router Port Statistics:

- 1 Press **Escape** until `CAMPUS RS I/F: REX2` is displayed.
- 2 Press **Next** until `REX2 CONFIG & STATUS` is displayed.
- 3 Press **Enter**. `CONFIGURE REX2 SETTINGS` is displayed.
- 4 Press **Enter**. `NETWORK PROTOCOL = Bridge` is displayed (if not, you must change the setting to `Bridge` to view Bridge Port Statistics).
- 5 Press **Next** until `Bridge STATISTICS` is displayed.
- 6 Press **Enter**. `FRAMES` is displayed.
- 7 Press **Enter** to display the first screen of statistics.
- 8 Press **Next** to display the second screen of statistics (if any).
- 9 Press **Escape**. `FRAMES` (or the appropriate statistic title screen) is displayed.
- 10 Press **Next** to advance to the desired statistic item, displayed in order: `MULTICASTS`, `ERRORS`, `UNDERSIZED`, `OVERSIZED`, `EX. DELAY`, and `EX. COLLISIONS`. Repeat steps 7-9 as desired to display the statistics for the item.
- 11 To clear the statistics, press **Next** until `Press ENTER to Clear Statistics` is displayed. Press **Enter** to reset all statistics to zero.

INTERNETWORKING AND MANAGEMENT OVERVIEW

8

This chapter provides an overview of internetworking and network management concepts used by the Campus-REX2.

You can configure the Campus-REX2 as a bridge to forward Ethernet data based on MAC addresses, or as a router to route Ethernet data based on IP addresses. You can also configure parameters for management and encapsulation protocols.

For:	See Page:
Composition of a Campus-RS System	120
Application	121
MAC-Level Bridging and Spanning Tree Protocol	124
IP Routing	126
Management Protocols	132
MIB and Trap Support	133
DHCP	134
Encapsulation Protocols	135
Product Compatibility	136

COMPOSITION OF A CAMPUS-RS SYSTEM

Campus-RS products accommodate a wide range of network interfaces and access speeds in a single platform solution. A Campus-RS system comprises these primary elements:

- **Campus-RS desktop unit**—The desktop unit provides a DSL (WAN) interface that connects to a line unit (DSL interface) in a Campus-Star chassis or back-to-back with another desktop unit DSL interface. You can then install any of the customer interface cards listed on page 120 for the customer-side network connection.
- **Campus-Star chassis**—This chassis or concentrator provides aggregation for up to 14 DSL line connections. Each line connection is made using a DSL line unit that connects to a DSL line unit in another Star Chassis or to the DSL interface of a desktop unit. You can then install any one of the customer interface cards listed below to complement each DSL line unit in the chassis for the customer-side network connection.

You can install a Campus-RS Management Unit (CMU) into the chassis for SNMP management of components in the chassis and for management of elements attached to the chassis.

- **Customer interface cards**—For connection to the customer network for voice, video, and data, the following interface cards are available to install into the desktop unit or the Campus-Star chassis:
 - serial data interfaces such as RS-449, RS-530, RS-530A, V.35, and X.21 for connections to a router or other data equipment (with this customer interface card, the maximum DSL line connection rate can be up to 4.608 Mbps)
 - flex interface with two serial data ports for RS-449, RS-530, RS-530A, V.35, or X.21 interfaces and one DSX-1 voice interface (with this customer interface card, the maximum DSL line connection rate can be up to 1.544 Mbps)
 - CSU/DSU interface (with this customer interface card, the maximum DSL line connection rate can be up to 1.544 Mbps)
 - G.703 (E1) interface (with this customer interface card, the maximum DSL line connection rate can be up to 2.048 Mbps)
 - 10/100Base-T bridge/router interface (with this customer interface card, the maximum DSL line connection rate can be up to 4.6 Mbps)

APPLICATION



The Campus-REX2 must be installed into a Campus-RS or Campus-HRS desktop unit or with a Campus-RS or Campus-HRS line unit. It cannot be installed in an older Campus desktop unit or with an older Campus line unit.

The Campus system, implementing Campus-REX2 interface cards, provides a connection between geographically distributed Ethernet Local Area Networks (LANs) in a campus environment. The Campus-REX2 performs transparent 802.3 MAC bridging or IP routing. You can use existing telephone-grade copper wiring as the HDSL transmission medium.

When installed in a Campus-RS desktop unit or Campus-Star chassis, the Campus-REX2 functions as a remote bridge or IP router. You can use the Campus-REX2 to extend subnetworks to remote sites within a campus. Or, for sites separated by greater distances, you can use the Campus-REX2 to connect them through a public T1/E1 Wide Area Network (WAN). See “Point-to-Point LAN Extension” and “LAN Connections Over a WAN” on page 123 for more information.

Campus-REX2 software provides complete main bridging tasks of learning, forwarding, filtering, and hashing/buffer management, 802.1d Spanning Tree protocol, 802.3 drivers, packet sequencing, segmentation and reassembly, and other local tasks.

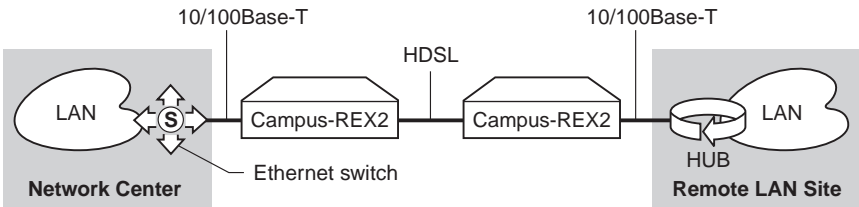


The Campus-REX2 10/100Base-T interface operates in either half- or full-duplex mode which is determined by autosensing its network connection. Both the LCD menu and console menu displays the mode.

The Campus-REX2 performs full-bandwidth filtering on the 10/100Base-T port and forwarding at the selected transmission rate.

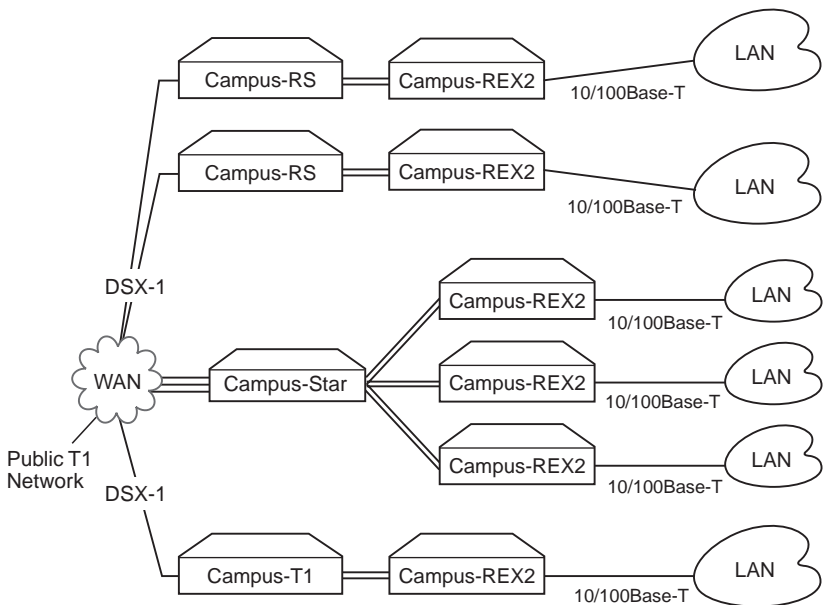
Point-to-Point LAN Extension

As organizations move or change, LANs also evolve and may become fragmented or physically separated. The Campus-REX2 provides a lower-cost alternative to other LAN-extension solutions. The Campus-REX2 provides a built-in 10/100Base-T LAN interface that eliminates the need for other internetworking devices while providing 30 times the performance of other sub-rate wireless connectivity options, as shown in the following figure.



LAN Connections Over a WAN

When LANs are distributed over a large physical area (such as within a metropolitan area) or cabling is not available between sites, you can lease appropriate unloaded copper pairs from a local carrier for LAN connectivity. For transport over public networks, you can connect the public T1 network (DSX-1 signal) to the LAN through desktop units with CSU/DSX-1 interface cards and the Campus-REX2 in a desktop unit. This application, as shown in the following figure, simplifies access to public high-speed WANs for LAN connectivity to remote sites.



MAC-LEVEL BRIDGING AND SPANNING TREE PROTOCOL

The following sections describe the MAC-level bridge and the Spanning Tree algorithm function.

About MAC-Level Bridging

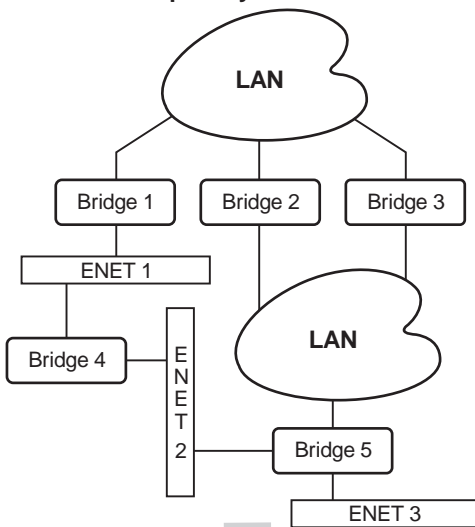
A bridge moves information across an internetwork from a source to a destination at the link layer (of an OSI reference model). The information is sent to a physical address known as a Media Access Control (MAC) address.

The Campus-REX2 provides transparent Ethernet MAC-level bridging. It is a completely self-contained bridge with a CPU, memory subsystems (RAM, Flash, etc.), an Ethernet controller and Ethernet drivers, and other glue logic. It provides complete main bridging tasks of learning, forwarding, filtering, and hashing/buffer management. Additionally, it offers 802.1d Spanning Tree protocol, packet encapsulation (through cHDLC or PPP framing), and other local tasks.

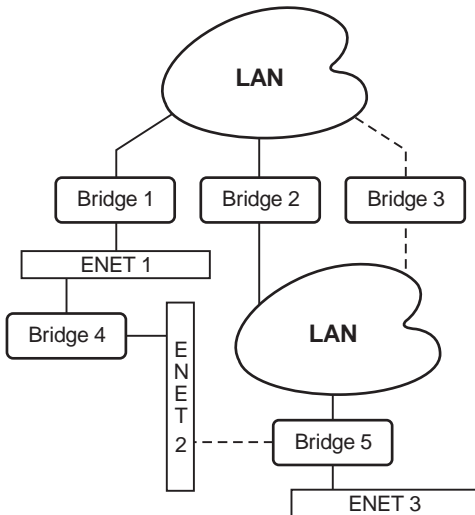
About Spanning Tree Protocol

Spanning Tree protocol creates a logical topology to overlay a physical network. This overlay disables all loops in the data path. Enabling Spanning Tree ensures a unique, primary path from any node on a network to any other node. Also, if the primary path is lost, Spanning Tree creates a new primary path by enabling links in the physical network that were previously disabled in creating the active topology. The following figure shows an example of Spanning Tree.

Example Physical Network*



**Loop-free Topology
Using Spanning Tree Protocol**



*This physical configuration is valid only when used with Spanning Tree to eliminate loops.

To enable or disable Spanning Tree, see “Configuring Spanning Tree Protocol” on page 33. The following elements are required for managing the Spanning Tree active topology:

- assigning a priority to each bridge relative to all bridges within the bridged LAN
- assigning a priority to each bridge port relative to all ports on a bridge
- assigning a path cost to each port

IP ROUTING

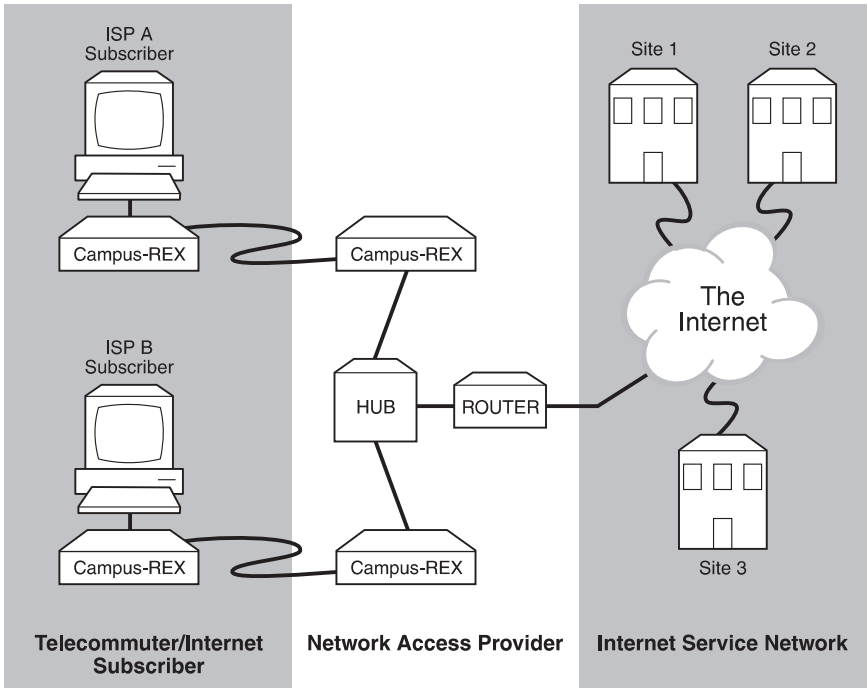
The Campus-REX2 offers both dynamic and static routing.

Static Routing

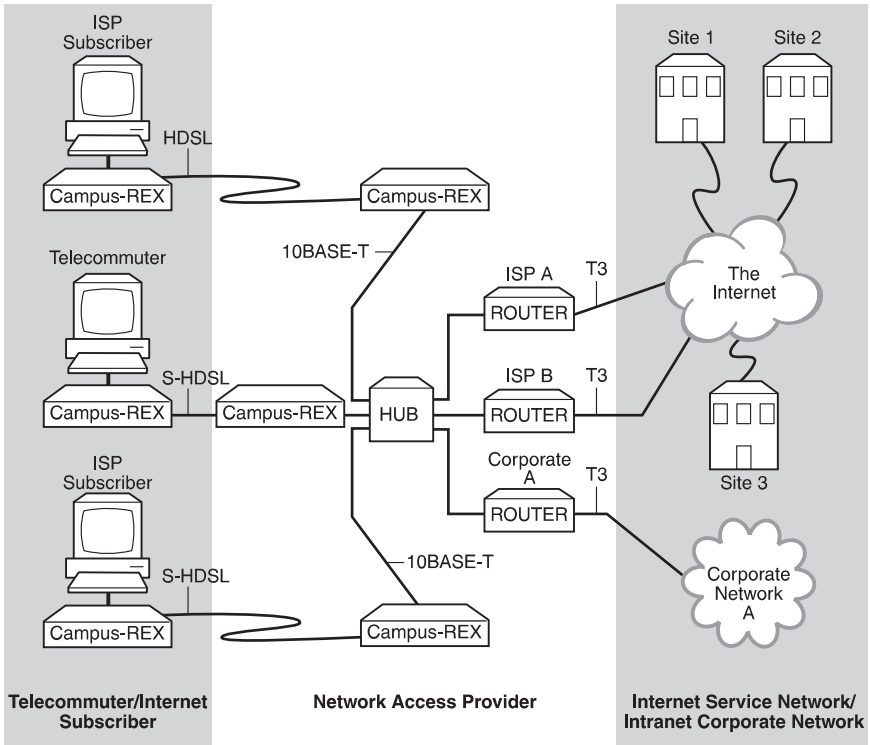
Through the static IP routing feature, you can configure the Campus-REX2 as an IP router with statically programmed route entries. You can enable this function as a security feature to prevent eavesdropping and to provide broadcast filtering, as well as to specify multiple destination gateways. When static IP routing is enabled, you can access only specific remote IP subnets or hosts.

Since IP routers make forward or filter decisions based on the network-layer IP address instead of the MAC hardware address, MAC-level broadcast frames are prevented from reaching unwanted destinations in the network.

The following example shows a simple Internet Service Provider (ISP) site that uses the static IP routing feature to filter MAC-level broadcast frames sourced by ISP Subscriber A from reaching ISP Subscriber B. In this example, all frames from Subscriber A and Subscriber B are directed to the router at the Network Access Provider site. From there, frames from both subscribers are forwarded directly to the Internet.



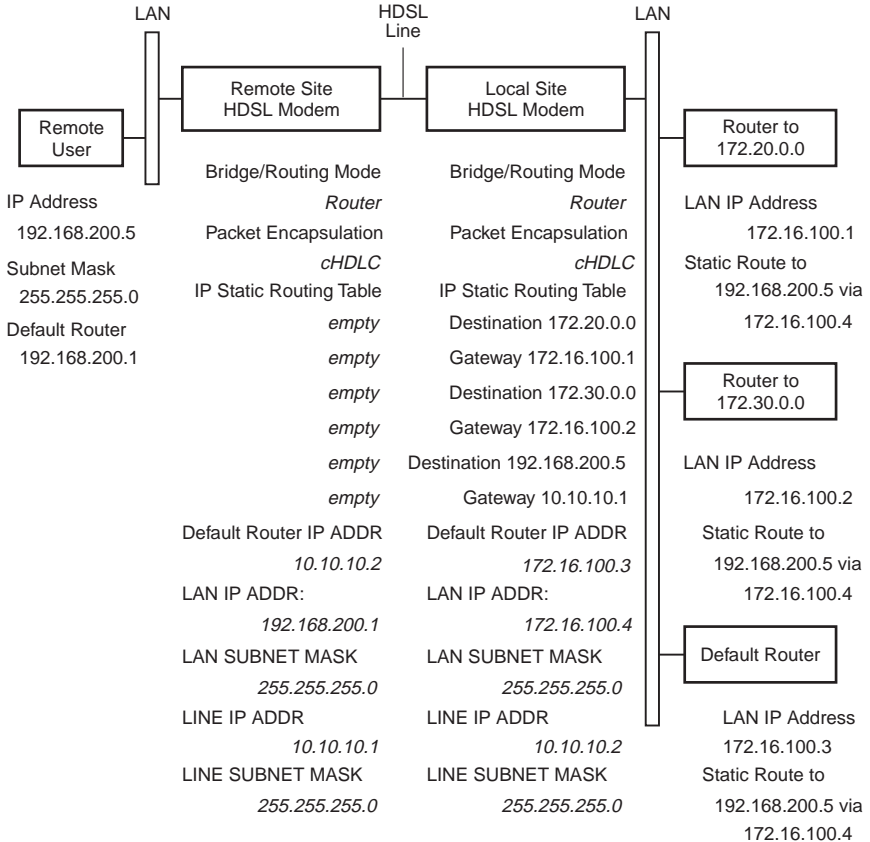
The figure on page 128 shows a more complex example of multiple gateways that use static IP routing to route packets sourced from specific users to different destination gateways. In this example, packets from each subscriber are routed through a common hub to a router dedicated to that subscriber.



Configure a Static Route entry in any of the external routers that may have been specified as a Default Router IP address or as a Gateway address in the Campus-REX2. You may also configure the Campus-REX2 to send periodic route updates using Routing Information Protocol (RIP) so that other external routers can automatically update their routing tables. This implementation prevents other parties from eavesdropping to discover routes to remote sites connected through the HDSL line. The format of this entry varies among different router vendors, but it will typically be in the form of Destination, Mask, and Next Hop Gateway, where:

- destination is the remote IP subnet or host address
- gateway is the LAN IP address of the Campus-REX2 on the same subnet as the external router

The following figure shows an example of a point-to-point HDSL system with hypothetical parameter values.



Dynamic Routing

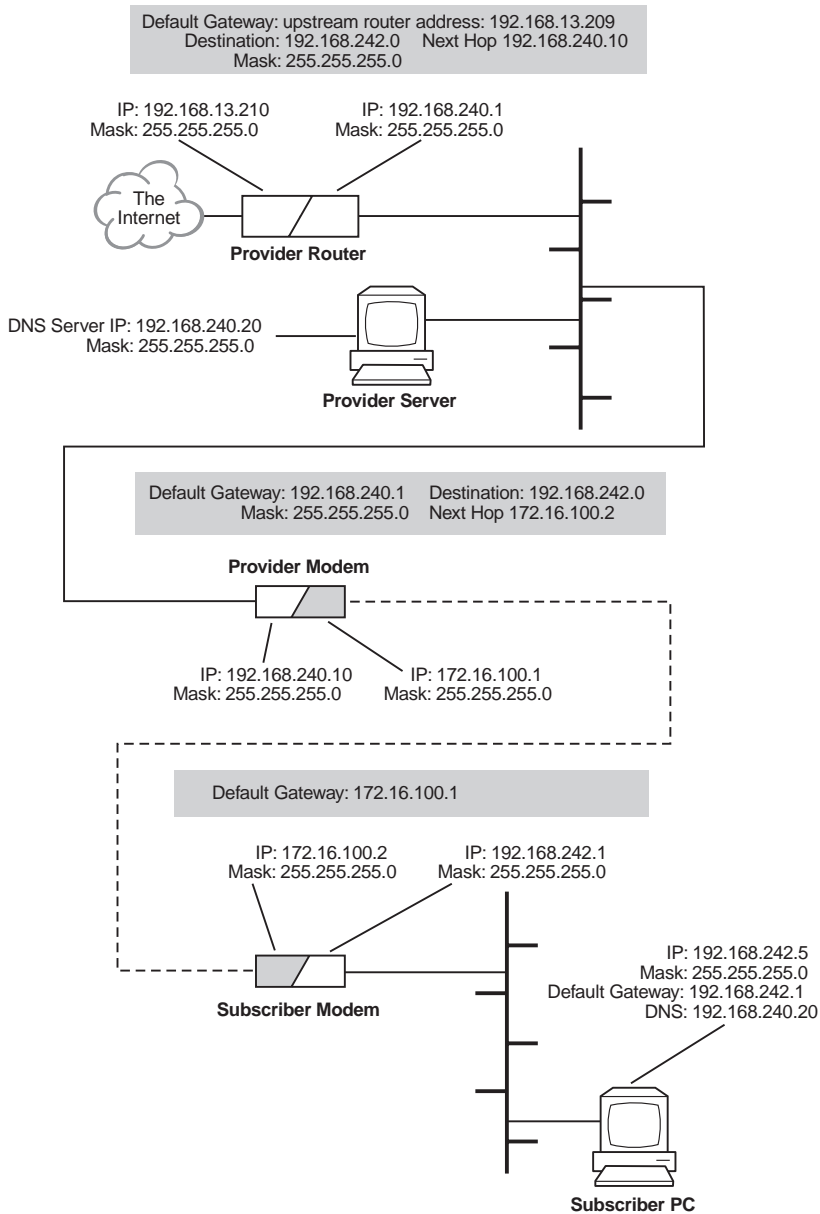
Dynamic Routing uses protocols such as RIP and RIPv2 to automatically learn the route or next hop it must take based on the IP address of the destination contained in the datagram.

Campus-REX2 IP Addresses

Each Campus-REX2 unit has two IP addresses, the LAN address and the Line address. In the figure on page 131, the non-shaded side of the Campus-REX2 indicates the LAN address, which is for the Ethernet (10/100Base-T) connection. The shaded side of the Campus-REX2 is the IP Line address,

which is for the HDSL connection. Note that the IP Line address is different from the LAN addresses. When connecting two Campus-REX2 units point-to-point through HDSL, the IP Line addresses are completely isolated and hidden from the rest of the network. You can assign any subnet to the Line IP addresses.

When routing, data travels one hop at a time. The figure below shows destination and next hop IP addresses. The destination address indicates the network and subnetwork of the next hop. The next hop is the next-stop IP address node. The default gateway is the upstream routing device. Use this example to help you determine/record static IP routing addresses.



MANAGEMENT PROTOCOLS

SNMP is used for remote configuration of system and bridge parameters, monitoring statistics, and performing advanced management. FTP is used for the Campus-REX2 to download system software code.

SNMP

This messaging protocol specifies how to send information between a Network Management Station (NMS) or Element Management System (EMS) and managed devices on a network.

SNMP Functions

Managed devices (such as the Campus-REX2) have agent software or firmware that interprets SNMP requests and responds to them. The EMS communicates with the agents in the managed devices to:

- set configuration options
- read configuration information
- read status parameters

A Management Information Base (MIB) defines these configuration and status parameters (see “MIB and Trap Support” on page 133). The Internet Engineering Task Force (IETF) specifies standard MIBs for certain types of devices, ensuring that any NMS can manage them. Additionally, vendors can issue proprietary MIBs for their devices that provide higher management functionality.

Campus-REX2 SNMP Agent

An agent is software or firmware code resident in managed devices (such as the Campus-REX2, modems, nodes, routers and hubs). Agents translate data on remote networks into code the EMS can read. The EMS uses SNMP as the transport mechanism to communicate with an agent. SNMP uses the standard Internet Protocol (IP) to transport incoming and outgoing messages to the appropriate agent or NMS address. Each SNMP command requires an IP address or NMS from the agent to transport these messages.

The Campus-REX2 provides an SNMP agent that supports several MIBs for the management of the system. The SNMP agent can process datagrams received from both the Ethernet interface (LAN) and the HDSL interface (Line). See “MIB and Trap Support” on page 133 for a list of MIBS that are supported.

Telnet

Telnet is a standard TCP/IP protocol used for remote terminal service. Use telnet protocol to access the Campus unit for configuration and management over the Internet. From the Windows Start menu, select Run. Enter the telnet command and the IP address for the Campus-REX2 (default IP address is 192.168.1.1). The timeout for disconnecting a telnet session is five minutes (time frame with no keyboard activity to the Campus unit).

FTP

File Transfer Protocol is a TCP/IP standard that is used for moving files between devices. Use FTP when you are downloading upgrade software to the Campus unit from a server or other network device.

MIB AND TRAP SUPPORT

Each managed device has configuration, status, and statistical information that defines its functionality and operational capabilities. All of these elements make up the MIB for the device being managed. The MIB defines the kind of information an NMS can retrieve from a managed device and the settings an NMS can control in a managed device.

The Campus-REX2 supports the following MIBs:

- RFC 1213/STD 17, Management Information Base for Network Management of TCP/IP-Based Internets: MIB-II. Covers: system, interfaces, IP, ICMP, UDP, and SNMP groups. The Ethernet interface has the ifIndex value of 1.
- RFC 1215, A Convention for Defining Traps for Use with the SNMP. Covers: ColdStart, linkUp, linkDown, and authenticationFailure traps. Link status traps are sent for events related to Ethernet.

- RFC 1493, Definition of Managed Objects for Bridges. Covers: Base, Spanning Tree, and transparent bridging groups. The Spanning Tree MIB can only be accessed if the Spanning Tree protocol is enabled.
- PG-REX2-MIB, an enterprise specific MIB designed for the agent in the Campus-REX2 for managing the HDSL portion of the unit.

The Campus-REX2 sends traps to devices on the network, which you configured as trap receivers, when events or alarms occur. The following are traps that the Campus-REX2 can issue:

- coldStart
- warmStart
- linkDown
- linkUp
- authenticationFailure

DHCP

Dynamic Host Configuration Protocol (DHCP) is the protocol used by the Campus-REX2 to obtain all necessary configuration information including an IP address. The LAN port can be configured as a DHCP client where it will automatically obtain its configuration information from a DHCP server on the LAN.

The Campus-REX2 can provide DHCP relay services to devices on its LAN. As a DHCP relay agent, the Campus-REX2 can forward requests for IP configuration to a DHCP server for which you configure the IP address.

ENCAPSULATION PROTOCOLS

You can select from two packet encapsulation formats for Ethernet data for the Campus-REX2:

- compressed High-level Data Link Control (cHDLC)
- Point-to-Point Protocol (PPP)

The default setting is cHDLC and should be used in applications with another Campus-REX2. Use PPP only if the remote unit is a synchronous interface card, such as V.35.

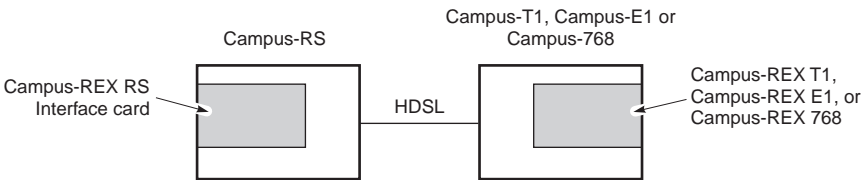
When PPP is selected for bridging mode, the Campus-REX2 runs the Bridging Control Protocol (BCP) RFC 1638. PPP provides interoperability with other product types. cHDLC is a compressed version of the encapsulation protocol and is preferable when there is like equipment (ADC equipment).

PRODUCT COMPATIBILITY

The following sections describe the compatibility among versions of Campus products.

Compatibility with Earlier Campus Products

When mated with a Campus-RS desktop unit or Campus-RS line unit, the Campus-REX2 RS Interface Card is compatible, over the HDSL link, with earlier versions of Campus products, such as the Campus-T1, Campus-E1, and Campus-768, as shown in the following illustration.



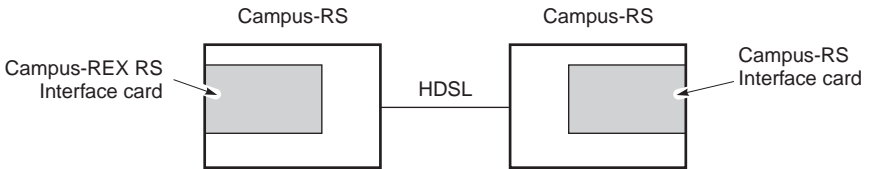
All earlier versions of Campus products are manufactured to operate at a single HDSL transmission rate, while the Campus-RS transmission rate is user-selectable. To support compatibility with earlier Campus Products, the following configuration options must be set on the Campus-REX2:

- Set the HDSL Operating Mode to Standard Mode.
- Set the Standard Mode HDSL Rate to T1, E1, or 768, to match the rate of the earlier product.

For information on setting these options, see “Selecting HDSL Parameters” on page 21.

Compatibility with Campus-RS Products

The Campus-REX2 RS Interface Card is also compatible, over the HDSL link, with another Campus-RS unit, as shown in the following illustration.



When connecting to another Campus-RS desktop unit or line unit, Standard Mode is still supported, providing access to HDSL transmission rates of T1, E1 and 768 kbps. In addition, the Campus-RS system can be configured to support an extended set of HDSL transmission rates, over either one or two HDSL loops.

To support these additional transmission rates, set the following options on the Campus-REX2:

- Set the HDSL Operating Mode to Extended Mode.
- Set the Extended Mode Loop Configuration to 1 Loop or 2 Loops, depending on the physical layout of your HDSL network.
- Set the Extended Mode HDSL Rate to the required setting.

The range of rates available for the HDSL Rate depends on the setting of the Extended Mode Loop Configuration:

- 1 Loop HDSL rate settings are between 128 kbps and 1.152 Mbps, in 64 kbps increments.
- 2 Loop HDSL rate settings are between 256 kbps and 2.304 Mbps, in 128 kbps increments.



Not all of these modes and rates are available if the remote Campus-RS system does not support them. Refer to the remote interface card User Manual to see the HDSL modes and rates supported by the card.

For information on setting these options, see “Selecting HDSL Parameters” on page 21.

Compatibility with Earlier Versions of Campus Products

Campus-RS Desktop and line units are fully compatible with most of the earlier versions of Campus products, including Campus-E1, Campus-T1, and Campus-768. The Campus-RS Desktop and line units are not currently compatible with Campus-384 products.

Furthermore, if a Campus-RS unit is connected over an HDSL link to an earlier Campus product, and if either unit has the HDSL Transceiver (XCVR) Mode set to AUTO, the HDSL link may not operate properly.

When operating the Campus-RS product with an earlier version of the Campus products, to avoid any problems with link startup or operation, it is recommended that the Transceiver Mode be set as follows:

- Campus-RS = MASTER
- Campus E1/T1/768 = SLAVE

If one or both units are already set to AUTO and the HDSL link is active, disconnect the HDSL link, change the settings as recommended, and reconnect the link. This will assure the link integrity on any subsequent startups.



This situation does not apply to a circuit with two Campus-RS units. You may leave the units set to their default setting of AUTO, and they will operate properly.

TECHNICAL REFERENCE



SPECIFICATIONS

Physical

Height	0.7 inches (1.8 cm)
Width	2.8 inches (7.0 cm)
Depth	5.6 inches (14.1 cm)
Weight	4.0 ounces (113.4 gm)

Equipment Interface

Ethernet Port	10/100Base-T, half- or full-duplex (autosensing)
Connector	RJ45C
Encapsulation Format	cHDLC or PPP
Bridging	IEEE 802.1d Transparent Bridging with Spanning Tree Protocol
Routing	Static and Dynamic Routing via RIP

Clock Options

Internal (± 50 ppm), HDSL

Electrical

Power Consumption	3.5W max
-------------------	----------

Environmental

Operating Temperature	0° to 50° C
Relative Humidity	0 to 85%
Electromagnetic Emissions	Per FCC Part 15 Class A, CE
Safety Compliance	UL, CSA, CE

DEFAULT SETTINGS

The following table lists default settings for Campus-REX2 RS Interface Card configuration options:

Parameter	Default
Bridge/Router Settings	
Bridge/Router Mode	Bridge
Encapsulation	cHDLC
Timing Source	Internal
Spanning Tree	Disabled
DHCP	Disabled
HDSL Settings	
HDSL Mode	Standard
HDSL Rate	T1
XCVR Mode	Auto
Loopback Timeout	20 Minutes

ETHERNET PORT

The following table lists the 10/100Base-T interface data signals for both MDI and MDI-X port selection. By selecting the correct position, you can always use a straight-through cable.

MDI Pin (*)	MDI-X Pin	Signal	Description
1	3	TD+	Transmit Data (+)
2	6	TD-	Transmit Data (-)
3	1	RD+	Receive Data (+)
4	4		
5	5		
6	2	RD-	Receive Data (-)
7	7		
8	8		

(*) A 10/100Base-T port on a PC is always configured as an MDI port.

STANDARDS

ISO/IEC/IEEE	
Document Number	Description
ISO/IEC 8802-3: 1993 (E) ANSI/IEEE Std 802.3, 1993 Edition	Information technology - Local and metropolitan area networks – Part3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications
ISO/IEC 10038: 1993 (E) ANSI/IEEE Std 802.1D, 1993 Edition	Information technology – Telecommunications and information exchange between systems – Local area networks – Media access control (MAC) bridges
Digital, Intel, and Xerox Blue Book, 1982	The Ethernet – A Local Area Network, data-link layer and physical layer specifications, Version 2.0

IETF

Document Number	Description
RFC 768	User Datagram Protocol
RFC 791	Internet Protocol
RFC 792	Internet Control Message Protocol
RFC 826	Ethernet Address Resolution Protocol
RFC 951	Bootstrap Protocol (BOOTP)
RFC 1058	Routing Information Protocol
RFC 1157	Simple Network Management Protocol (SNMP)
RFC 1213 / STD 17	Management Information Base for Network Management of TCP/IP-based internets: MIB-II
RFC 1215	Convention for defining traps for use with SNMP
RFC 1332	The PPP Internet Protocol Control Protocol (IPCP)
RFC 1350	The TFTP Protocol (Revision 2)
RFC 1493	Definitions of Managed Objects for Bridges
RFC 1497	BOOTP Vendor Information Extensions [Obsoleted by RFC 1533, RFC 2132]
RFC 1542	Clarifications and Extensions for the Bootstrap Protocol
RFC 1638	PPP Bridging Control Protocol (BCP) [Obsoleted by RFC 2878]
RFC 1661	The Point-to-Point Protocol (PPP)
RFC 1723	RIP Version 2 – Carrying Additional Information
RFC 1724	RIP Version 2 MIB Extensions
RFC 2131	Dynamic Host Configuration Protocol
RFC 2132	DHCP Options and BOOTP Vendor Extensions
RFC 2878	PPP Bridging Control Protocol (BCP) [Obsoletes 1638]

ABBREVIATIONS

B

2B1Q	2 Binary,1 Quaternary
ARP	Address Resolution Protocol
BER	Bit Error Rate
CMU	Campus Management Unit
CTS	Clear to Send
DCE	Data Circuit-Terminating Equipment
DHCP	Dynamic Host Configuration Protocol
DSR	Data Set Ready
DSX-1	DS1 Cross-connect Frame
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
ES	Errored Seconds
FTP	File Transfer Protocol
HDLC	High-level Data Link Control
HDSL	High-bit-rate Digital Subscriber Lines
IP	Internet Protocol
LOS	Loss of Signal
MAC	Media Access Control Protocol

NVRAM	Non-volatile Random Access Memory
POTS	Plain Old Telephone Service
PPP	Point-to-Point Protocol
RD	Receive Data
RIP	Routing Information Protocol
RLSD	Receive Line Signal Detect
RS	Rate Selectable
RTS	Request to Send
SCR	Serial Clock Receive
SCT	Serial Clock Transmit
SD	Send Data
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
STP	Spanning Tree Protocol
TT	Terminal Timing
UAS	Unavailable Seconds
UL	Underwriters Laboratory
VLAN	Virtual Local Area Network

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