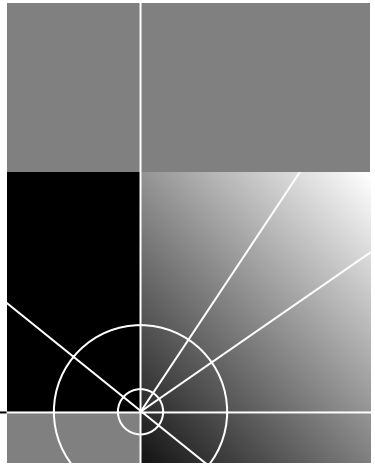
# Using the PathBuilder™ S5xx Switch



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## Electromagnetic Compatibility Information

**Classes**
Various national agencies (in the United States, The Federal Communications Commission (FCC)) govern the levels of electromagnetic emissions from digital devices. Electromagnetic emissions can interfere with radio and television transmission. To reduce the risk of harmful interference these agencies have established requirements for manufacturers of digital devices.

The manufacturer of a digital device must test and label a product to inform an end-user of the maximum emission level from the product when used in accordance with its instructions. The emission levels encountered are classified as Class A or Class B. A system that meets the Class A requirement can be marketed for use in an industrial or a commercial area. A system that meets the more stringent Class B requirement can be marketed for use in a residential area in addition to an industrial or a commercial area.

The end user is generally held responsible for ensuring that her system is suitable for its environment as stated in the above paragraph and bears the financial responsibility for correcting any harmful interference.

**Modifications**
Modifications or changes made to this device, and not approved by 3Com, may void the authority granted by the FCC, or other such agency, to operate this equipment.

**Shielded Cables**

Connections between 3Com equipment and other equipment and peripherals must be made using shielded cables in order to maintain compliance with FCC, and other agency, electromagnetic frequency emissions limits. This statement does not apply to the 10BASE-T cables.

**Federal Communications Commission Notice**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can create radio frequency energy and, if not installed and used inaccordance with the instruction manual, may cause harmful interference to radio communications. 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 and correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

In order to meet FCC Class B limits, this equipment must be used only with cables which comply with IEEE 802.3.

The user may find the following booklet prepared by the Federal Communication Commission helpful:

*How to Identify and Resolve Radio-TV Interference Problems*

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

**FCC Part 68 Statement**

This equipment complies with Part 68 of the Federal Communications Commission (FCC) rules. On the product is a label that contains the FCC registration number for this device. If requested, this information must be provided to the telephone company.

This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant. See installation instructions for details.

If this device causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. The telephone company may request that you disconnect the equipment until the problem is resolved.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of this equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment or for repair or warranty information, please follow the applicable procedures explained in the "Technical Support" section of this manual.

FCC Registration Number See label on product

Required Connector (USOC) RJ-49

Service Order Code (SOC) 6.OY

Facility Interface Code (FIC) 02IS5

**Canadian Notice**

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the users' satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the inside wiring associated with a single line individual service may be extended by means of a certified connector assembly. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make electrical ground connections by themselves, but should contact the appropriate inspection authority or an electrician, as appropriate.

**Japanese Notice**

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

## CE Notice

Marking by the symbol CE0560X indicates compliance of this equipment to the EMC Directive 89/336/EEC, the Low Voltage Directive 73/23/EEC amended by 93/68/EEC and the Telecom Terminal Equipment and Satellite Earth Stations Directive 98/13/EEC. Such marking is indicative that this equipment meets or exceeds the following technical standards:

- EN 55022 - "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment."
- EN 50082-1 - "Electromagnetic compatibility - Generic immunity standard Part 1: Residential, commercial, and light industrial."
- EN60950 (1992) - Safety of information technology equipment, including electrical business equipment.
- CTR 1 - "Attachment requirements for terminal equipment to be connected to circuit switched data networks and leased circuits using a CCITT Recommendation X.21 interface, or at an interface physically, functionally and electrically compatible with CCITT Recommendation X.21 but operating at any data signalling rate up to, and including, 1 984 kbit/s"
- CTR 2 - "Attachment requirements for Data Terminal Equipment (DTE) to connect to Packet Switched Public Data Networks (PSPDNs) for CCITT Recommendation X.25 interfaces at data signalling rates up to 1 920 kbit/s utilizing interfaces derived from CCITT Recommendations X.21 and X.21 bis"
- CTR 4 - "Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN primary rate access"
- CTR 12 - "Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U) Attchment requirements for terminal equipment"
- CTR 13 - "2048 kbit/s digital structured leased lines (D2048S); Attachment requirements for terminal equipment interface"
- CTR 24 - "34 Mbit/s digital unstructured and structured leased lines (D34U and D34S); Attachment requirements for terminal equipment interface"
- A "Declaration of Conformity" in accordance with the above standards has been made and is on file at 3Com Corporation.

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## 3COM CORPORATION LIMITED WARRANTY

# ABOUT THIS GUIDE

This guide includes complete hardware installation, basic software configuration information, and cabling information for the PathBuilder™ switch.

This guide is intended for the following audience:

- Experienced network administrators who are configuring the central site as well as the remote office
- Experienced system integrators

*If release notes are shipped with your product and the information there differs from the information in this guide, follow the instructions in the release notes.*

Most user guides and release notes are available in Adobe Acrobat Reader Portable Document Format (PDF) or HTML on the 3Com World Wide Web site:

**http://www.3com.com/**

## Conventions

Table 1 lists notice icons that are used throughout this guide.

**Table 1** Notice Icons

| Icon | Notice Type | Alerts you to... |
|---|---|---|
|  | Information note | Important features or instructions |
|  | Caution | Risk of personal safety, system damage, or loss of data |
|  | Warning | Risk of severe personal injury |

**Table 2** Text Conventions

| Convention | Description |
|---|---|
| `Screen displays` | This typeface represents information as it appears on the screen. |
| `Syntax` | Evaluate the syntax provided and supply the appropriate values. Placeholders for values you must supply appear in angle brackets. Example:<br>Enable RIPIP using:<br>`SETDefault !<port> -RIPIP CONTrol = Listen`<br>In this example, you must supply a port number for <port>. |
| **`Commands`** | Enter the command exactly as shown in text and press the Return or Enter key. Example:<br>To remove the IP address, enter:<br>**`SETDefault !0 -IP NETaddr = 0.0.0.0`**<br>  <br>*This guide always gives the full form of a command in uppercase and lowercase letters. However, you can abbreviate commands by entering only the uppercase letters and the appropriate value. Commands are not case-sensitive.* |
| The words "enter" and "type" | When you see the word "enter" in this guide, you must type something, and then press Return or Enter. Do not press Return or Enter when an instruction simply says "type." |
| Keyboard key names | If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example:<br>Press Ctrl+Alt+Del |
| Words in *italics* | Italics are used to:<br>■ Emphasize a point.<br>■ Denote a new term at the place where it is defined in the text.<br>■ Identify menu names, menu commands, and software button names. Examples:<br>From the *Help* menu, select *Contents*.<br>Click *OK*. |

## Year 2000 Compliance

For information on Year 2000 compliance and 3Com products, visit the 3Com Year 2000 Web page:

**`http://www.3com.com/products/yr2000.html`**

# 1 Overview of the PathBuilder Switch

This chapter provides an overview of the PathBuilder™ switch and describes how it is used in a network.

## Using the PathBuilder Switch in Your Network

The PathBuilder switch maintains connectivity among small, midsize, and large branch offices and the corporate LAN.

The PathBuilder switch provides the ability to connect to a wide variety of WAN services and serves as a WAN aggregation point. It accommodates extensive virtual port tunneling capabilities with encryption, data compression, and high-speed processing.

When used at a central site, the PathBuilder switch supplies high-speed, scalable performance for WAN concentration, virtual private network (VPN) tunnel termination, and efficient bandwidth utilization. For more information about VPN configurations, see Chapter 5.

The PathBuilder switch concentrates T1/E1 or T3/E3 internet traffic at the central site, which enables the creation and maintenance of multiple secure tunnels through the public network to many remote locations simultaneously.

User authentication and internet firewall options can be configured on the PathBuilder switch. Or, when the traffic load is high, these services can be off-loaded onto other devices, which allows the PathBuilder switch to function solely as the primary tunnel switch for your enterprise.

In addition, the PathBuilder switch is supported by extensive statistics-based network management facilities in the Transcend® application.

## Using Ethernet LAN Interfaces

All models of the PathBuilder switch provide connection to two Ethernet LANs using either 10BASE-T or 100BASE-TX Ethernet.

### Using Flex-WAN Serial and Ultra-WAN CSU/DSU Interfaces

The PathBuilder switch is available with five different serial WAN interface options:

- The model S580 PathBuilder switch has eight high-speed multifunction Flex-WAN serial connectors that provide connection to industry-standard V.35, RS-232, RS-449, RS-530, or X.21 Data Communications Equipment (DCE) or Data Terminal Equipment (DTE) serial devices. You can buy Flex-WAN cables separately from 3Com. See "Flex-WAN Serial Connectors and Serial Cables" on page 90 for more information about the Flex-WAN cables.
- The model S593 and S595 PathBuilder switches have two T3/E3 WAN interfaces. Each interface can be connected to either an external CSU/DSU via an HSSI connector, or directly to a T3/E3 line via a BNC connector.
- The model S590 PathBuilder switch has four high-speed multifuntion Flex-WAN serial interfaces and four Ultra-WAN CSU/DSU interfaces supporting PRI, channelized, and unstructured connectivity on a per connector basis at T1 and E1 line rates.
- The model S598 and S599 PathBuilder switches have eight or four high-speed multifuntion Ultra-WAN CSU/DSU interfaces supporting PRI, channelized, and unstructured connectivity on a per connector basis at T1 and E1 line rates.

### Using ATM Interfaces

The model S574 and model S578 PathBuilder switches have two interface modules, each with an OC3 UNI connector supporting two types of optical fiber cables; single-mode and multi-mode, and one set of transmit (Tx) and receive (Rx) coaxial connectors. Only one interface type will be active on each module.

***WARNING:*** *Optical Safety. Under normal viewing conditions there is no hazard from the Transmit LED. It is recommended however that the LED is not viewed through any magnifying device while it is powered on. It is advisable that the fiber TX port and fiber cable ends are never viewed directly when powered on.*

## Telco Services

To use the PathBuilder WAN functionality, you must buy lines and services from a telecommunications company (Telco). Services include but are not limited to dial-up lines, leased lines, and packet-switched services.

*Dial-up* lines allow you to dial your destination when necessary and hang up when you no longer need the connection. A *leased* line is always available between two locations. Dial-up lines use the Point-to-Point Protocol (PPP). Leased lines typically use either PPP, Frame Relay, or X.25.

*Packet-switched* services, like Frame Relay, use a combination of leased or dial-up lines with Telco-owned switching. Typical protocols used over packet-switched services are Frame Relay, X.25, and SMDS.

Table 3 and Table 4 describe the dial-up, leased, and packet-switched services supported by the PathBuilder S5xx series switches.

**Table 3** Dial-Up and Leased Line Services

| Telco Line | Protocol | Serial Device Requirements | Data Transfer Rate |
|---|---|---|---|
| **Dial-Up Lines:** | | | |
| Plain Old Telephone Service (POTS) | PPP | Modem | Up to 115 Kbps |
| ISDN | PPP | Terminal Adapter | Up to 128 Kbps |
| ISDN/PRI | PPP | None (on S590/S598 only) | 2.048 Mbps/1.544 Mbps |
| **Leased Lines:** | | | |
| E1 | Frame Relay, PPP | CSU/DSU (not needed on S590/S598 Ultra-WAN connectors) | 2.048 Mbps |
| T1 | Frame Relay, PPP | CSU/DSU (not needed on S590/S598 Ultra-WAN connectors) | 1.544 Mbps |
| Fractional T1 | Frame Relay, PPP | CSU/DSU (not needed on S590/S598 Ultra-WAN connectors) | Up to 31 channels at 56/64 Kbps each |
| E3 | Frame Relay, PPP | CSU/DSU (not needed on S593/S595 BNC connectors) | 34.368 Mbps |
| T3 | Frame Relay, PPP | CSU/DSU (not needed on S593/S595 BNC connectors) | 44.736 Mbps |
| Digital Data Service (DDS) | PPP | CSU/DSU | Up to 64 Kbps |

**Table 4** Packet-Switched Services

| Packet-Switched Services/Protocol | Telco Line | Serial Device Requirements | Data Transfer Rate |
|---|---|---|---|
| X.25 | POTS | Modem | Up to 115 Kbps |
| Frame Relay | Leased line | CSU/DSU (not needed on Ultra-WAN and BNC connectors) | Up to T3/E3 |
| SMDS | Leased line | CSU/DSU | Up to T3/E3 |

### Using PPP on Dial-Up and Leased Lines

All dial-up and many leased lines use PPP. If you want to use multiple PPP lines or channels to connect to the same destination, you can bundle them together using Multilink PPP.

### Using Packet-Switched Network Services

You can use packet-switched services with your PathBuilder S5xx series switch instead of dial-up or leased lines to leverage the Telco-owned switching infrastructure.

Frame Relay provides a packet-switched network that transfers data between DTEs, which can be routers, bridges, and host computers, by creating virtual circuits and using DCEs to transfer the data to its destination.

Frame Relay has been designed to work within complex internetworking environments with extensions referred to as the *local management interface* (LMI).

LMI provides information about all devices that are accessible on the Frame Relay network by listing all *data link connection identifiers* (DLCIs) connecting the local system with the remote ones. The LMI improves reliability between the DTE and DCE through frequent exchange of keepalive packets that contain status information.

## IBM Legacy Networks

Each serial interface can be attached directly with a Flex-WAN cable to IBM legacy equipment like mainframes and automatic teller machines. See Table 5 for supported IBM protocols.

**Table 5** Supported IBM Protocols

| Service Protocol | Async (Polled) | BSC | HDLC | QLLC | SDLC |
|---|---|---|---|---|---|
| APPN | No | Yes (converted protocol) | No | Yes (converted protocol) | Yes (both native and converted protocol) |
| ATUN | Yes | No | No | No | No |
| Bridging | No | Yes (converted protocol) | No | Yes (converted protocol) | Yes (converted protocol) |
| BSC | No | Yes (both native and converted protocol) | No | No | No |
| DLSw | Yes (used as transport for native protocol) | Yes (used as transport for native protocol) | Yes (used as transport for native protocol) | Yes (used as transport for native protocol) | Yes (used as transport for native protocol) |
| QLLC | No | No | No | Yes (both native and converted protocol) | No |
| SDLC | No | No | No | No | Yes (both native and converted protocol) |
| SHDLC | No | No | Yes | Yes | Yes |
| SNA (BSC LU definitions) | No | Yes (converted protocol) | No | No | Yes (converted protocol) |
| SR | No | Yes (converted protocol) | No | Yes (converted protocol) | Yes (converted protocol) |
| X.25 | No | No | Yes | Yes (converted protocol) | Yes |

## Hardware Features

This section describes the hardware features of the PathBuilder switch.

### Back and Front Panels

Figure 1 shows the back panel of the PathBuilder switch.

**Figure 1** Back Panel

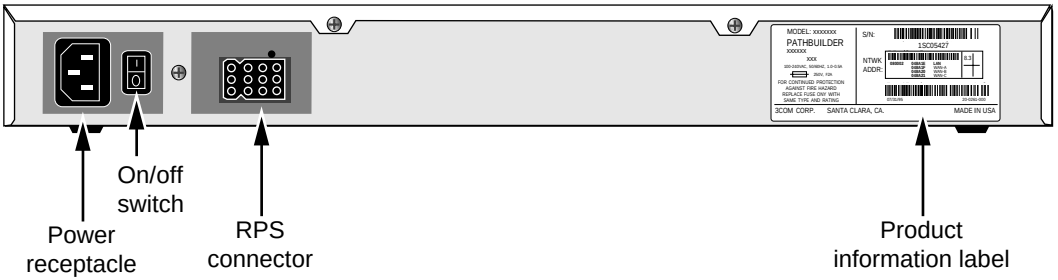



Figure 2 shows the front panel of the model S500 PathBuilder switch.

Figure 3 shows the front panel of the model S574 and model S578 PathBuilder switch.

Figure 4 shows the front panel of the model S580 PathBuilder switch.

Figure 5 shows the front panel of the model S590 PathBuilder switch.

Figure 6 shows the front panel of the model S593/S595 PathBuilder switch.

Figure 7 shows the front panel of the model S598 PathBuilder switch.

Figure 8 shows the front panel of the model S599 PathBuilder switch.

**Figure 2** Front Panel (model S500)

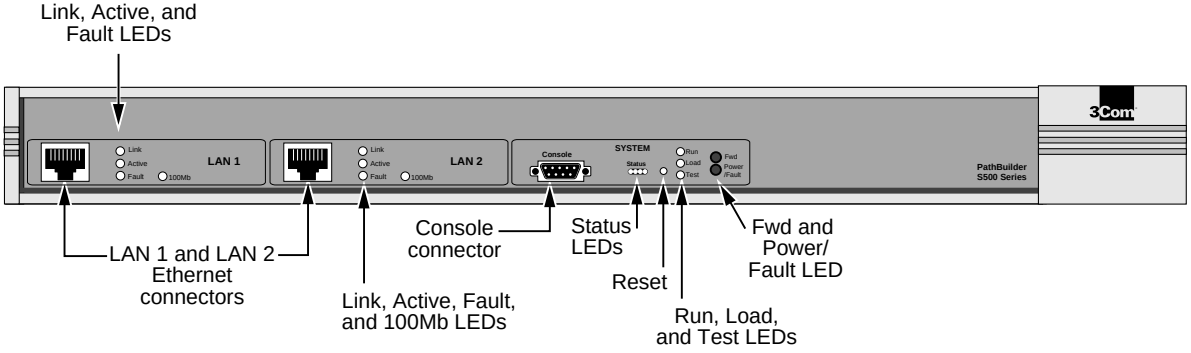



**Figure 3** Front Panel (model S574 and S578)

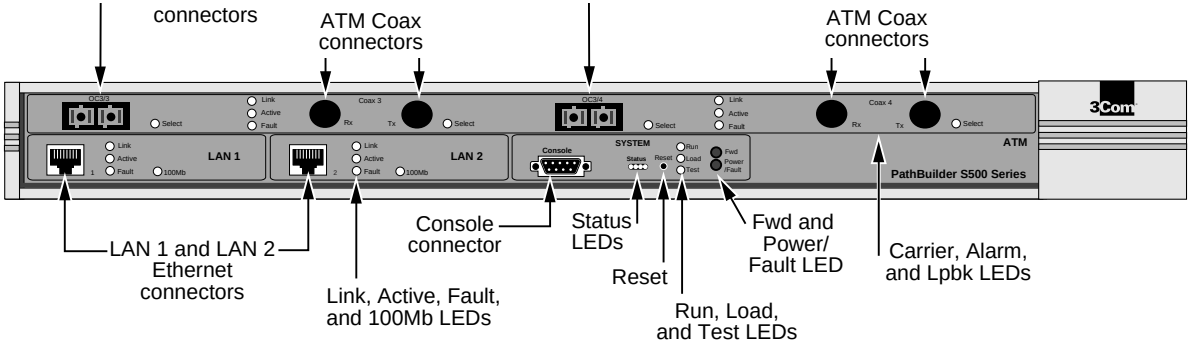



**Figure 4** Front Panel (model S580)

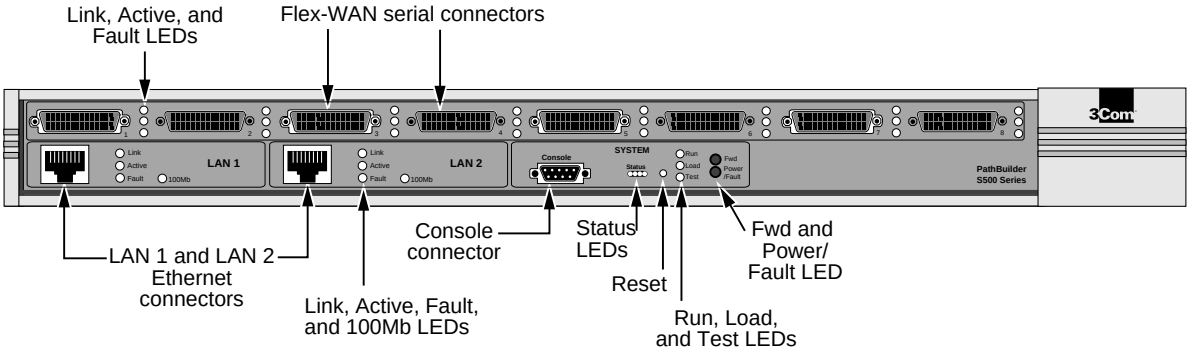


**Figure 5** Front Panel (model S590)

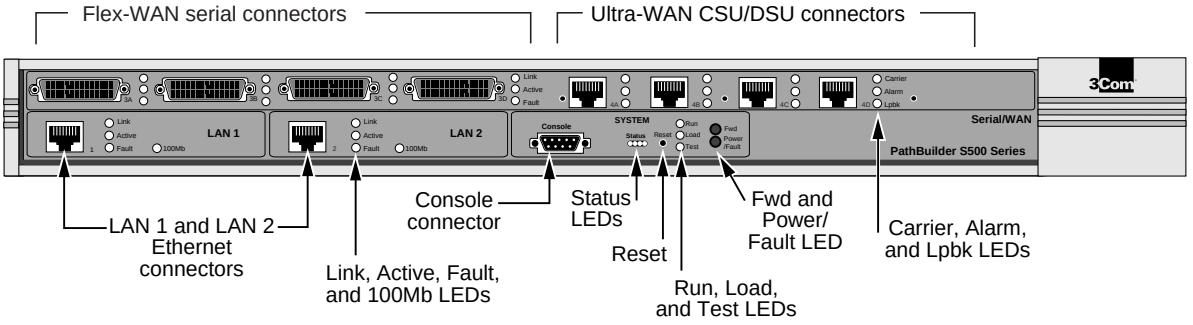



**Figure 6** Front Panel (model S593/S595)

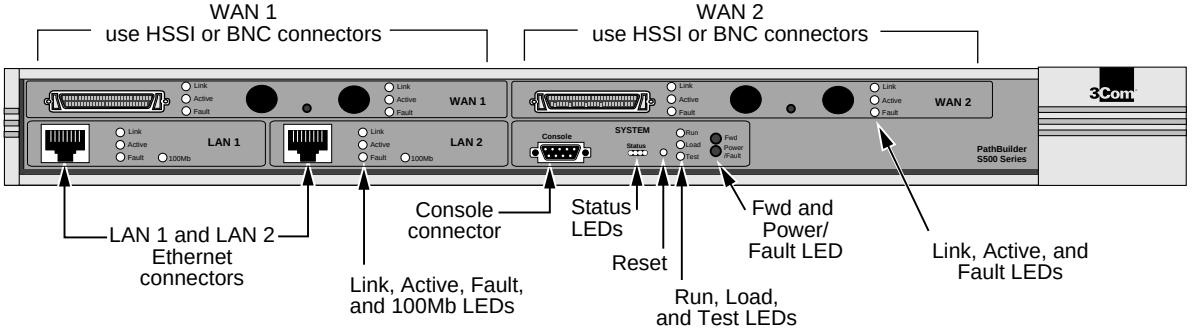



**Figure 7** Front Panel (model S598)

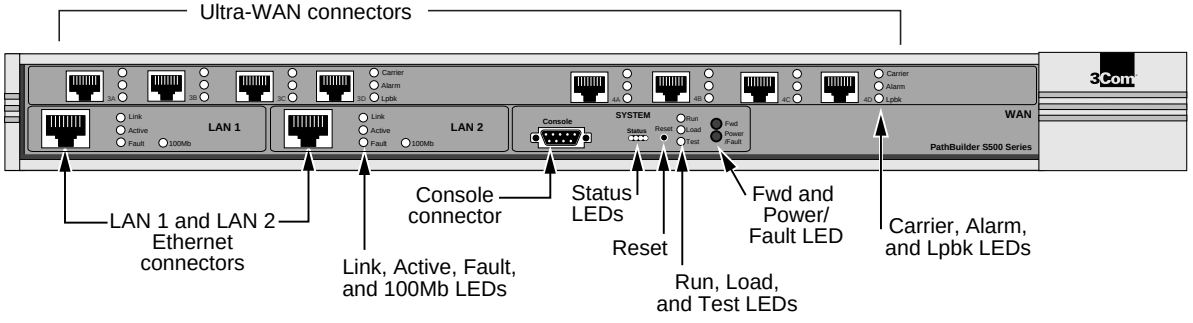
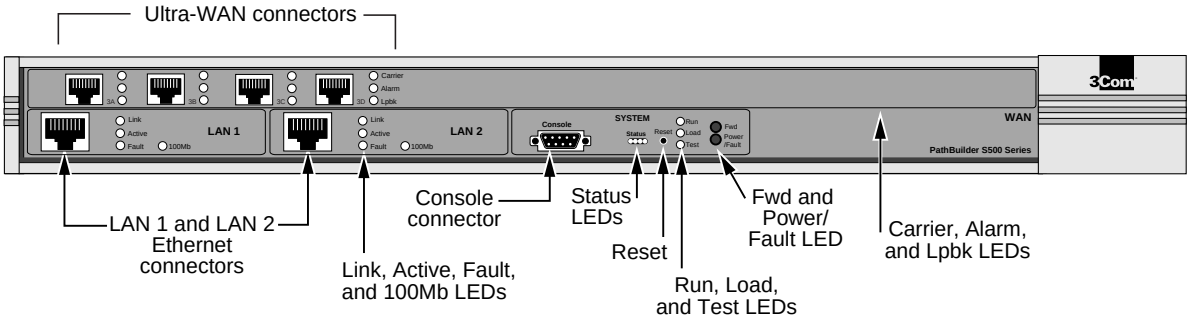
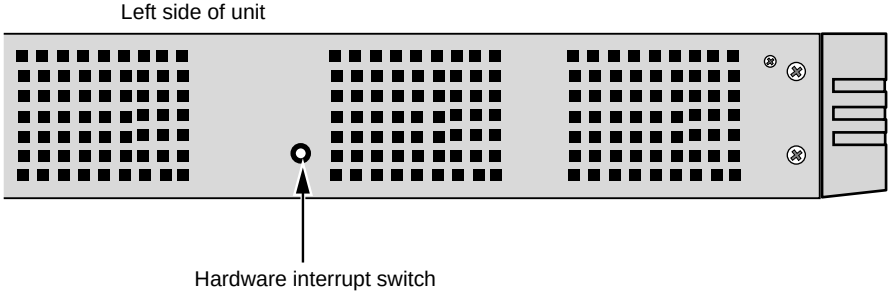


**Figure 8** Front Panel (model S599)




**Hardware Interrupt Switch**

The hardware interrupt switch is located on the left side of the switch (when facing the front panel). Press the switch with a nonconductive object, such as a plastic stylus, to activate the monitor firmware utility.




***WARNING:*** *Use only a nonconductive object, such as a plastic stylus, to press the hardware interrupt switch. Do not use the tip of a pencil. Graphite particles from the pencil may cause you to receive an electric shock and may damage components on the motherboard.*

**Reset Button**

Pressing the Reset button resets the switch. The reset button is on the front panel.

# 2 INSTALLING THE HARDWARE

This chapter describes how to install your PathBuilder switch.

## Required Equipment

Table 6 lists the items you receive in the shipping carton and items you need to provide.

**Table 6** Equipment Received and Equipment Needed

| | |
|---|---|
| **Shipping carton contents** | ■ PathBuilder switch<br>■ Power cable<br>■ Rack-mount kit<br>■ Software CD-ROM*<br>■ Documentation and documentation CD-ROM |
| **What you need to provide** | ■ Interface module (available from 3Com — optional)<br>■ 10BASE-T or 100BASE-TX network cables<br>■ Flex-WAN cables (available from 3Com). See "Flex-WAN Serial Connectors and Serial Cables" on page 90 for more information about ordering Flex-WAN cables.<br>■ ATM cables — optical fiber for OC3 connectors or 75-ohm coaxial cables for Coax (DS3/E3) connectors<br>■ Terminal, PC, or modem and cable |

* The software is preinstalled in the flash memory drive of the switch and automatically loads when you turn on the power. The software CD-ROM is for software recovery purposes only.

**WARNING:** *To eliminate cable noise emission in excess of FCC regulations, part 15, subpart J, and EN55022B, all interconnection cables should be equipped with shielded connectors, the backshells of which must completely surround the cable shield.*

For more information on cables, see Appendix C.

## Mounting the Switch

You can mount your switch on a tabletop, stack several switches with brackets, or mount the switch in a rack.

### Environmental Requirements

Table 7 provides the environmental requirements of the PathBuilder switch.

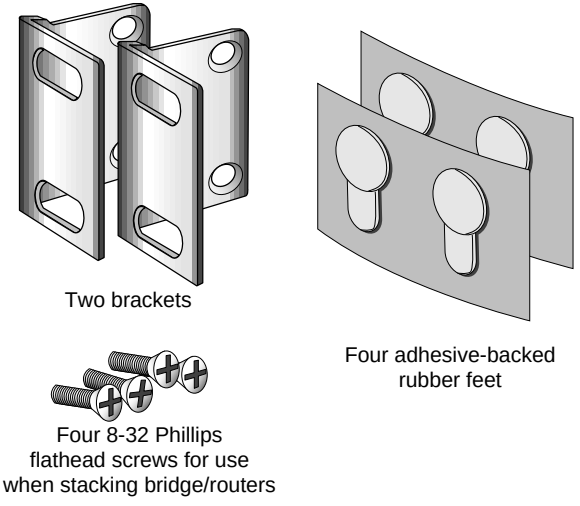
**Table 7** Environmental Requirements

| Parameter | Minimum Requirement | Maximum Requirement |
|---|---|---|
| **Temperature** | | |
| Operating | 5 °C | 40 °C |
| Nonoperating | -40 °C | 75 °C |
| **Altitude** | | |
| Operating | | 15,000 ft |
| Nonoperating | | 40,000 ft |
| **Relative Humidity** | | |
| Operating | 10% noncondensing | 90% noncondensing |
| Nonoperating | 10% noncondensing | 90% noncondensing |

### Mounting Kit

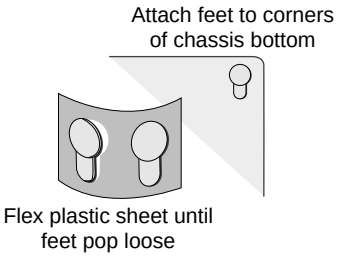
The mounting kit contains the hardware shown in Figure 9.

**Figure 9** Mounting Kit Contents



**Installing on a Tabletop**

If you plan to install your switch on a tabletop, attach the rubber feet as shown.

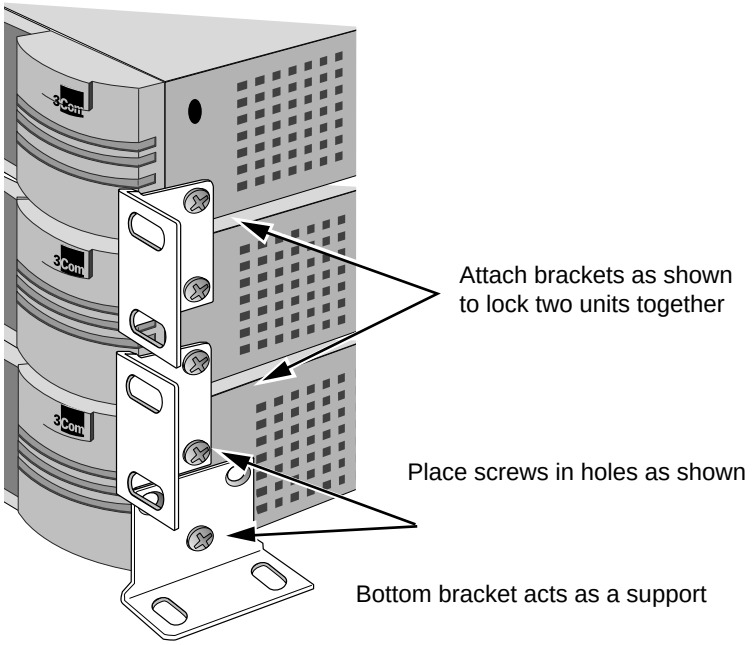



**Stacking with Brackets**

See Figure 10 to securely stack several switches on a tabletop.

***CAUTION:*** *Do not restrict air flow around the sides and back of the switch.*

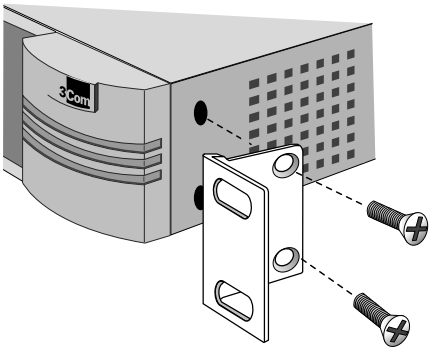
**Figure 10** Stacking switches



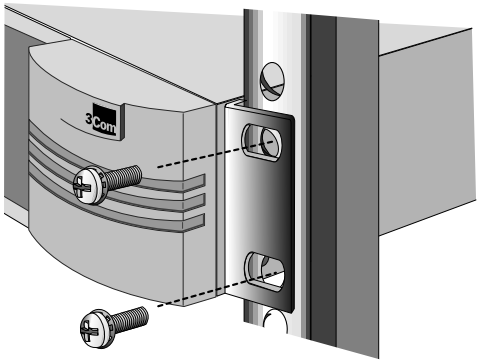
**Installing in a Rack** To install the switch in a rack, follow these steps:

***CAUTION:*** *Do not restrict air flow around the sides and back of the switch.*

1 Secure the rack-mount brackets to each side of the chassis using two flathead screws per bracket.



2 Hold the chassis between the poles of the rack and attach the brackets to the rack using panhead screws (you must provide these screws). Tighten each screw securely.



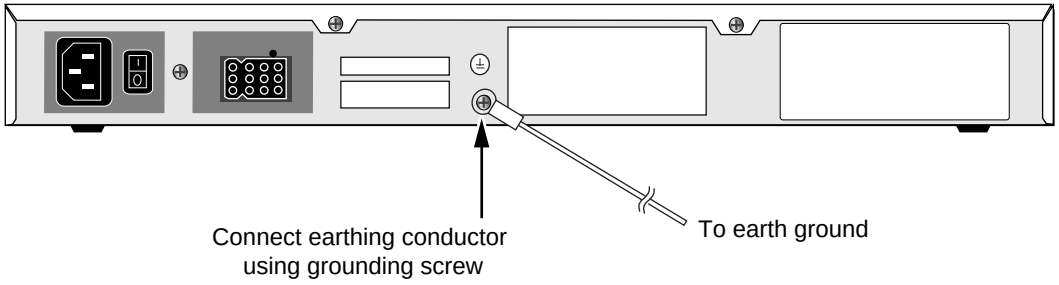
***CAUTION:*** *Using fewer than two screws to secure the brackets to the rack may cause the switch to fall and sustain damage not covered by the warranty.*

## Cabling the Connectors

The PathBuilder switch has two Ethernet interfaces, and a number of Flex-WAN serial interfaces, Ultra-WAN CSU/DSU, T3/E3 WAN, and/or ATM interfaces, depending on the model. This section describes how to cable each interface on your switch.

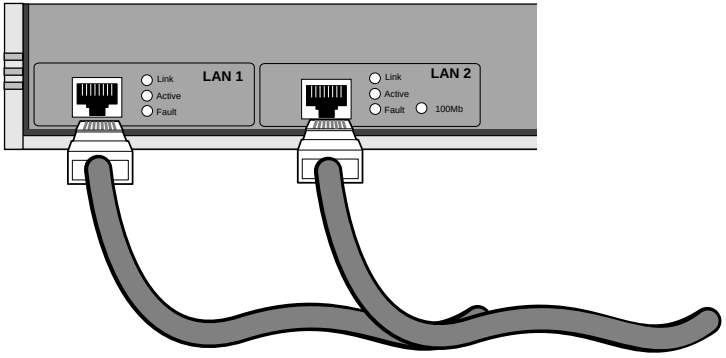
*Some network topologies require that a grounding stud, separate from the AC ground, be provided on the chassis of the networking equipment. If this is required, ground the PathBuilder S574 ATM tunnel switch by attaching a permanently connected protective earthing conductor using a minimum 18 gauge wire with a UL-listed ring lug to a reliably connected earth ground (see Figure 11).*

**Figure 11** Grounding the PathBuilder S574 ATM Tunnel Switch




### Cabling the LAN Connectors

You can cable one or two Ethernet connectors using either 10BASE-T or 100BASE-TX cabling.

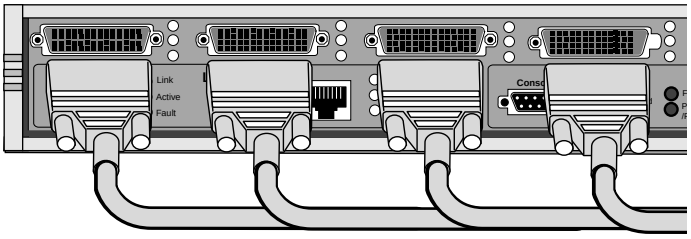



10BASE-T or 100BASE-TX cables

For more information about Ethernet connectors and cables, see "LAN Connector and Cables" on page 85.

### Cabling the Flex-WAN Serial Connectors

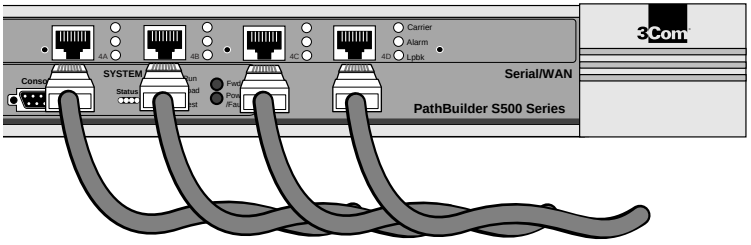
The model S580 and S590 PathBuilder switches have Flex-WAN serial connectors. Order the appropriate Flex-WAN cable from 3Com for your serial device. See "Flex-WAN Serial Connectors and Serial Cables" on page 90 for more information about the Flex-WAN cables.




Flex-WAN cables

### Cabling the Ultra-WAN CSU/DSU Connectors

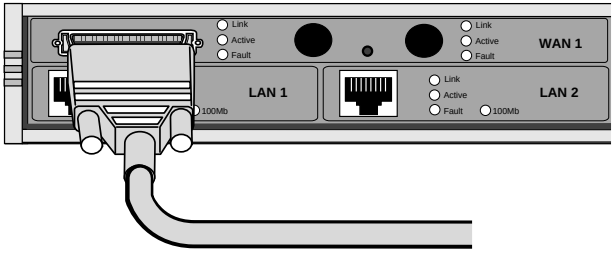
The models S590 and S598 PathBuilder switch have Ultra-WAN CSU/DSU connectors. You can cable one or more of these connectors using RJ-48C connectors. See "Ultra-WAN CSU/DSU Connector and RJ-48C Cables" on page 103 for more information about the Ultra-WAN CSU/DSU cables.




RJ-48C cables

### Cabling the HSSI T3/E3 Connectors

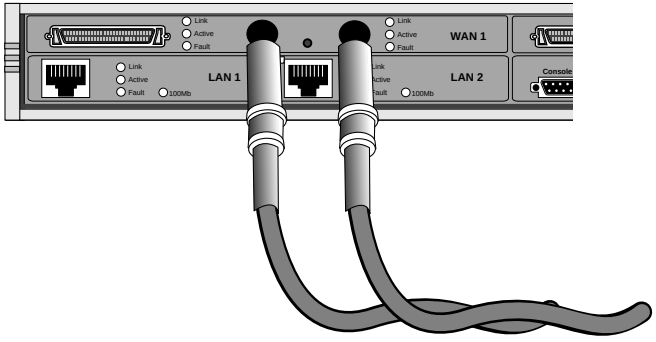
The model S593 PathBuilder switch has two T3/E3 connectors per interface. You can connect using either high-speed serial interface (HSSI) cables or BNC cables. See "High-speed Serial Interface (HSSI) Cables" on page 105 for more information about the HSSI cables.




HSSI cable

### Cabling the Coax T3/E3 (BNC) Connectors

You can cable one or two WAN connectors using either the HSSI cables shown above or the coax T3/E3 (BNC) cables shown here.




T3/E3 (BNC) cables

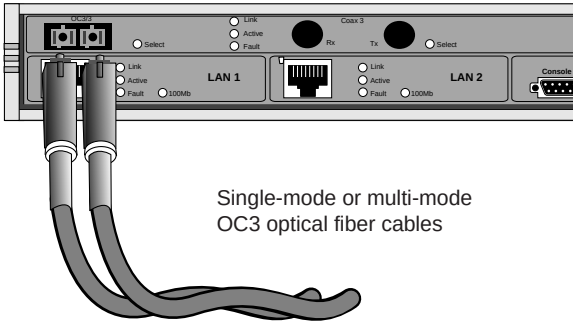
## Cabling the ATM Connectors

You can cable the ATM connections using either single-mode or multi-mode optical fiber cables for the OC3 connectors or 75-ohm coaxial cables for the Coax (DS3/E3) connectors.

*Either the OC3 or Coax (DS3/E3) connectors can be used, but not at the same time.*

### Cabling the ATM OC3 Connectors

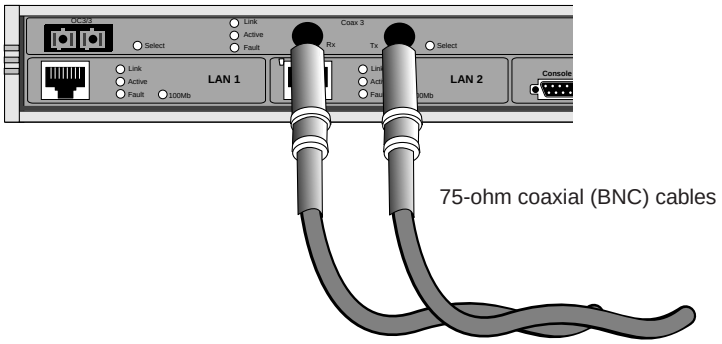
You can cable one or two OC3 connectors using single-mode or multi-mode OC3 optical fiber cables as shown here.




***WARNING:*** *Optical Safety. Under normal viewing conditions there is no hazard from the Transmit LED. It is recommended however that the LED is not viewed through any magnifying device while it is powered on. It is advisable that the fiber TX port and fiber cable ends are never viewed directly when powered on.*

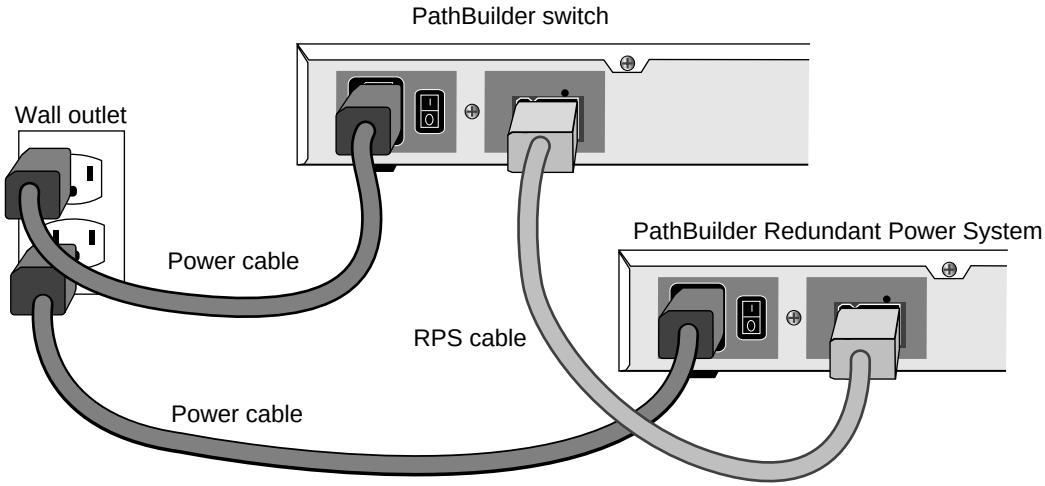
### Cabling the ATM Coax (DS3/E3) Connectors

You can cable the ATM Coax (DS3/E3) connectors using two 75-ohm coaxial (BNC) cables as shown here.




## Attaching a Redundant Power System

You can attach your PathBuilder switch to a PathBuilder Redundant Power System (RPS).




For full power supply redundancy, attach one end of the RPS cable to the rear panel on the switch and the other end to the RPS. Then attach one

end of the power cord to the rear panel on the switch and the other end to a power outlet.

In this configuration, the internal supply provides power. If the internal supply fails or is switched off, or if there is a power failure, the RPS is activated and the switch reboots.

To reset a switch in this configuration, turn the power off, wait 5 seconds and turn it back on. The switch switches to the RPS, then switches back to the internal supply to reboot.

***CAUTION:*** *For system susceptibility protection, always leave the AC cord attached to the switch and to a power outlet.*

*Internal power supply failure is rare. If it occurs, the power switch on your switch will not operate. To reboot, unplug the RPS cable and then plug it back in. Replace your switch with another switch that has a functioning internal power supply as soon as possible. Contact your 3Com representative to replace your switch.*

## Connecting a PC, Terminal, or Modem

Connect a PC running a terminal emulation program, a terminal, or a modem to the console port on the PathBuilder switch to configure the switch software and review startup and system operation messages.

To connect a PC, terminal, or modem to the switch, follow these steps:

1. Obtain a cable to connect the device to the console port on the switch. See "Console Connector and Cables" on page 83 for cable pinouts.

   The console port is a 9-pin male connector.

   For the PC, use a 9-pin female to 9-pin female null modem-type cable.

   For the terminal, use a 9-pin female to 25-pin null modem-type cable.

   For the modem, use a 9-pin female to 25-pin male straight-through-type cable.

2. Connect one end of the cable to the console port on the PathBuilder switch and the other end to the serial port on the back of your device.

**3** Verify that configurable parameters of your device match the configuration settings of the console port specified in Table 8.

**Table 8** Console Port Configuration Settings

| Characteristic | Setting |
|---|---|
| Baud rate | 9600 |
| Databits | 8 |
| Parity | None |
| Stop bits | 1 |
| DTR | Ignored |
| Duplex | Full |
| Echo | Off |
| Flow control | X-on/X-off |

**4** Turn on the device.

## Shutting Down

If your PathBuilder switch is not connected to an RPS, turn off the power by pressing the off (0) side of the power switch on the back panel. If your system is connected to an RPS, turn off the power by unplugging the RPS cable from the system and then pressing the off (0) side of the power switch.

# 3 LOGGING ON AND PERFORMING ADMINISTRATIVE TASKS

This chapter describes the following:

- Starting up the system
- Logging on
- User interfaces
- Performing basic administrative tasks

Table 9 summarizes the administrative tasks described in this chapter and indicates whether performing each task is required, recommended, or optional.

**Table 9** Administrative Task Summary

| Task | Status of Task |
|---|---|
| Changing the Root Password | Required |
| Changing the Default Console Port Baud Rate | Do only if you want to attach a terminal with a baud rate other than 9600. |
| Adding User Accounts | Optional |
| Setting the Time and Date | Recommended |
| Setting System Information | Required |
| Setting Up Security Access | Recommended |
| Setting up SNMP Management | Recommended |

For more information on each of the commands and parameters used in this chapter, see *Reference for Enterprise OS Software*.

## Starting the System

To start up your PathBuilder switch, plug one end of the power cord into the rear panel of the switch and the other end into your power outlet. Press the toggle switch to the On position.

## Verifying Successful Startup

The startup process takes a few seconds. When the startup process has successfully completed, the LEDs on the front panel should be on or off as described in Table 10.

*For serial LEDs to display properly, a serial device must be cabled to the PathBuilder switch and powered on.*

If the LEDs on your switch appear different from those shown in Table 10, the switch may have a problem. See Appendix E for more information.

**Table 10** LED Status at Successful Startup

| LED | Status |
|---|---|
| **LAN** | |
| Link | On |
| Active | On or blinking |
| Fault | Off |
| **Flex-WAN SERIAL** | |
| Link | On |
| Active | On |
| Fault | Off |
| **Ultra-WAN CSU/DSU *** | |
| Carrier | Off |
| Alarm | Off |
| Lpbk | Off |
| **T3/E3** | |
| Link | On |
| Active | On |
| Fault | Off |
| **ATM OC3/Coax (DS3/E3)** | |
| LInk | On |
| Active | On |
| Fault | Off |
| **SYSTEM** | |
| Status | All off |
| Fwd | Off or blinking |
| Power/Fault | Green |
| Run | On |

**Table 10** LED Status at Successful Startup

| LED | Status |
|---|---|
| Load | Off |
| Test | Off |

* During normal startup sequencing, the CSU/DSU LEDs periodically flash on and off. When the startup sequencing is complete, these LEDs remain off. When you have completed configuring the CSU/DSU interfaces and the interfaces are operational, these LEDs remain on.

## Logging On to the System

When your switch starts up, it takes a few seconds to complete the initialization process. While the switch is initializing, various messages will appear on your terminal. The switch has finished booting when the following message is displayed:

```
System Initialized and Running
```

To log on, follow these steps:

**1** Press any key on the keyboard.

The following prompt is displayed:

```
NetLogin:
```

**2** Enter:

**root**

Root is the default account name. The following prompt is displayed:

```
Password:
```

**3** Press the Return key.

Pressing the Return key enters a null string, which is the default local password. The Network Manager prompt is displayed:

```
Enterprise OS #
```

## Configuring an IP Address

Before you can access the PathBuilder switch over one of the 10/100 Ethernet interfaces, you must assign an IP address and an IP route entry.

**1** To assign an IP address, use:

```
SETDefault -IP !<portnumber> NETaddr = <IPaddress> <subnet mask>
```

For example, to set the IP address to 555.666.777.888 and the subnet mask to 255.255.253.0 on LAN port 1, enter:

**SETDefault -IP !1 NETaddr = 555.666.777.888 255.255.252.0**

2 To assign an IP route to a gateway, use:

```
Add -IP ROUte <gateway IP address> <!metric>
```

- For example, to set an IP route to gateway 111.222.333.444, enter:

```
SETDefault -IP ROUte 111.222.333.444 1
```

## Choosing the User Interface

This section describes how to access the menu-driven and command-line user interfaces. Detailed information for both types of interfaces is provided so that you can choose the one that best suits your needs.

After you have configured the IP address of the PathBuilder switch, you can access the user interface using one of the following methods:

- Telnet to the switch from a device (for example, a workstation) on the same extended network or internetwork.
- Use the embedded HTTP server, Web Link, which provides performance and health monitoring graphs, task-based configuration, and diagnostics.
- Use Transcend Network Control Services, which provides extensive management capabilities for use from a network management station.
- Use Simple Network Management Protocol (SNMP) to view and configure a subset of the parameters from a remote host. For information on preparing the switch to run SNMP, see *Using Enterprise OS Software*.

### Deciding Which Interface to Use

After you have accessed the user interface, you need to decide whether to use the menu-driven or the command-line interface.

- If you are unsure of the command syntax, use the menu-driven interface.

  For more information about the MEnu command, see *Reference for Enterprise OS Software*. For information on how to use the menu-driven interface, see the next section.

- If you know the exact syntax, enter the command at the system prompt.

  The syntax for each command and parameter is described in *Reference for Enterprise OS Software*.

- If you are using Netscape 4.5 or Internet Explorer 4.0 or later versions of these web browsers, you can use Web Link, a web-based configuration and monitoring tool, to configure and manage your switch. For more information on how to use Web Link, see *Using Enterprise OS Software*.

**Using Menus**

The MEnu command allows you to:

- Display a list of available services.
- Choose a service and display the list of parameters available for that service.
- Display a list of parameters in the current service.
- Choose a parameter and display the commands used with it.
- Check the active and default values of a parameter.
- Display the online help syntax of a parameter.
- Enter the new value of a parameter.

The following prerequisites and notes apply when you use the menu-driven interface:

- You must have Network Manager privilege.
- You cannot access some parameters; for example, you cannot alter the number of lines on the screen, or change privilege level.

To use the menu-driven interface, follow these steps:

1. Log on as root or as a user with Network Manager privilege.
2. If you have not selected a particular service, enter:

   ```
   MEnu
   ```

   The Main menu is displayed.
3. Select the desired service.

   For example, selecting 1 from the Main menu displays a menu for the SYS Service.
4. Select the parameter you want to configure.

   For example, if you selected 27 from the SYS Service menu, information for that parameter is displayed.

   The first part of the screen displays the value of the parameter. The second part lists the commands from which you can choose.

5 To escape out of a menu, press the Return key, which takes you to the previous menu level.

For example, if you are at the Main menu and you press the Return key, you will return to the command-line interface.

### Using the Command-line Interface

To use the command-line interface, follow these steps:

1 Log on as root or as a user with Network Manager privilege.

2 Type the command name. For a complete list of commands, enter a question mark (?).

If your command does not require a service name, parameter, or values, skip to step 3. If your command requires more modification, continue to step a.

**a** If the command has additional options, such as a port or path number, include it after the command name.

When you include a specific port or path number in the command, that command focuses on that particular port or path. If the port or path number is not included, the command provides information on all ports or paths.

For more information on ports, paths, or commands, see *Reference for Enterprise OS Software*.

**b** If the command is modified by a parameter, type the service name (if necessary), the parameter name, and values.

The service part of the command focuses the action of the command on a particular service of the system.

In some cases, you may not need to enter the service name. For example, if a parameter is unique to a particular service, the service need not be specified as part of the command.

The parameter is the object of the action of the command. If two or more services have parameters of the same name, you must include the service name in the syntax so the command can be executed successfully.

The value part of the command specifies how you want the parameter to be set. Values include numerics, strings, or addresses depending on the parameter.

3 Press the Return key after typing the complete command.

The software includes online help for commands, services, parameters, and syntax. The syntax style that appears in the online help is the full form syntax; it contains full names and visual cues for entering commands. You can also enter commands using an abbreviated version of the syntax style.

### Using Web Link

When you use Web Link, PathBuilder switch configuration tools are dynamically generated HTML pages that are based on an internal menu system. Using Web Link you can perform protocol service configuration following standardized step-by-step procedures or on an individual service per parameter basis. Help for all service configuration is presented on-line. Web Link also provides Java graphs for high-level health and low-level protocol and interface statistics. Diagnostics are also available.

See the Using Web Link Network Management Tools chapter in *Using Enterprise OS Software* for instructions on how to set up IP routing and access Web Link.

### Using Transcend

The Transcend Network Control Services application provides excellent tools for managing groups of tunnel switches. See the Transcend documentation for further information.

## Changing the Root Password

The default root password is a null string, which is generated by pressing the Return key.

You should specify a new password immediately after you log on for the first time. Changing the root password prevents unauthorized users from accessing and executing software commands and parameters.

The root user has two privilege levels and passwords: Network Manager and User. The User privilege enables only a subset of software commands. You should assign passwords for both levels. If you log in as root and enter the Network Manager password, you have Network Manager privilege. If you log in as root with the User password, you have User privilege.

*You might log on with the User password if you only want to examine parameters and statistics. If you want to change the privilege level without logging off, use:*

```
SET -SYS PRIvilege = User | NetMgr
```

The following guidelines exist when changing a password:

- You must be logged on as root with Network Manager privilege.
- You must define the Network Manager password before you define the User password.
- You must clear the User password before you clear the Network Manager password.

To change the password for both privilege levels, enter:

```
SysPassWord
```

A menu is displayed.

Follow the menu to set the Network Manager password and then the User password.

***CAUTION:*** *You should set both the Network Manager and the User password. If the User password is not set, any unauthorized user can logon with User level privilege.*

## Changing the Default Console Port Baud Rate

To attach a terminal with a baud rate other than 9600, follow these steps:

1. At the Network Manager prompt (Enterprise OS #), enter:

   ```
   SysconF
   ```

   The System Configuration menu is displayed.

2. Select the Console Port option.

   A submenu displays the console port baud rate options.

3. Select the baud rate you want to use.

4. Set the terminal baud rate to match the baud rate configured for the console port.

***CAUTION:*** *Do not reset the switch before changing the terminal baud rate. After the switch resets, the new baud rate is used and you will not be able to access the system software to enter any commands at the default 9600 baud rate.*

5. After you change the terminal baud rate, reset the switch.

   The new console port baud rate does not become effective until you have reset the switch.

## Adding User Accounts

You can add user accounts when logged in as "root" with Network Manager privileges.

To add a user account, log on as root and use:

```
AddUser [<username>]
```

If you do not specify a username, you will be prompted for one. Specify the privilege and password at the prompts.

Delete an account using:

```
DELeteUser [<username>]
```

To force a user password to expire, use:

```
EXPire [<username>]
```

To manage multiple users and see all user accounts, enter:

**UserManage**

Any user can change their password by entering:

**PassWord**

## Setting the Time and Date

3Com recommends setting the time and date. Use:

```
SET –SYS DATE = <YYYY/MM/DD HH:MM[:ss]>
```

Enter the time in 24-hour-clock format. For example, to set the date and time to January 10, 1996, 2:40 p.m., enter:

**SET –SYS DATE = 1996/1/10 14:40**

*You can use the Network Time Protocol (NTP) service to synchronize the computer clock in a distributed network.*

## Setting System Information

You should set the system name to identify this unit to SNMP management stations. You can also set the location and contact so that other system administrators can contact you for information.

*Use the Web Link system configuration screens to set these values from a browser.*

To set the system name, location, and contact, follow these steps:

1. (Required) Assign a name to the switch using:

   ```
   SETDefault -SYS SysNAMe = "<string>"
   ```

   For example, to set the system name to Engineering.SanJose, enter:

   ```
   SETDefault -SYS SysNAMe = "Engineering.SanJose"
   ```

2. (Optional) Specify the system location using:

   ```
   SETDefault -SYS SysLOCation = "<string>"
   ```

   For example, to set the system location to SecondFloor.Lab, enter:

   ```
   SETDefault -SYS SysLOCation = "SecondFloor.Lab"
   ```

3. (Optional) Identify the contact person managing the switch using:

   ```
   SETDefault -SYS SysCONtact = "<string>"
   ```

   For example, to identify John Smith as the system contact and (408)555-1111 as the phone number at which to reach him, enter:

   ```
   SETDefault -SYS SysCONtact = "John Smith (408) 555-1111"
   ```

   If the system contact is specified, users can obtain this information using the SHow -SYS SysCONtact command.

## Setting Up Security Access

To allow system administrator-only read/write access to files, use these commands and parameters:

- The SNMP Service parameter COMmunity modifies the list of communities and managers with read/write access to the device. By default, any application can read the SNMP MIBs. To provide write access for Transcend upgrade and configuration management, a community and manager(s) must be configured. For information on how to use the COMmunity parameter, see *Reference for Enterprise OS Software.*

- The SysLog feature generates a log message on a network management workstation that captures configuration changes and events for monitoring switches. For more information on this feature, see *Using Enterprise OS Software*.
- The -SYStem service parameters TelnetMgr and WebLinkMgr let you set up a list of allowed Telnet and Web Link managers. Both the Telnet and Web Link shared this list of allowed managers. Adding or changing a member of this list using one of the TelnetMgr parameter to change the list of allowed managers for telnet changes the list of allowed managers for Web Link as well.

# 4 BASIC CONFIGURATION OF PORTS, PATHS, AND CONNECTORS

This chapter contains conceptual information about ports, paths, and connectors and contains basic configuation procedures for each of the interfaces on your PathBuilder switch.

*The models S590, S598 and S599 PathBuilder switches have Ultra-WAN connectors, which need to be configured (in addition to port and path configuration) before they are shown in the port and path configuration displays.*

## Paths, Ports, and Connectors

Ports and paths are the fundamental interface syntax on the switch. This section defines ports, paths, and connectors and explains how they are numbered.

The fundamental difference between paths and ports is that the path is the *physical* interface and the port is the *logical* interface in the software that is mapped to the physical path.

- A *connector* is the physical interface itself.
- A *path* is a connection on the physical interface that connects a switch to a physical network medium such as Ethernet, a T1/E1 line, or a serial line. Each path is associated with a connector.
- A *port* is the logical interface used by the protocol software to represent a connection to a network.
- All connectors, by default, carry one path each. This default can be changed on Ultra-WAN connectors such that an Ultra-WAN connector carries multiple paths, as is required in ISDN PRI operation.

By default, each path is assigned to one port. For example, all network traffic received on physical path 1 is treated by the software as arriving on logical port 1, and all traffic that the software transmits through logical port 1 passes through physical path 1.

A path that is assigned at system initialization time to a port is a *static* path. A path that is assigned to a port when a dial call is placed is a *dynamic* path.

## Multiple Port and Path Bindings

Multiple paths can be assigned to a port and multiple ports can be assigned to a path as described in Table 11.

**Table 11** Port and Path Options

| Option | Description |
|---|---|
| Multiple paths per port: dynamic paths | A dynamic path is not assigned to any one port, but is available in a dial pool. A dial pool enables you to dial multiple destinations, use bandwidth-on-demand, and failover to another line without having to reserve specific paths for a port. A port may require multiple paths from the dial pool. |
| Multiple paths per port: static paths | Use multiple static paths on the same port:<br>■ To use a path for disaster recovery, dial-on-demand, failover, or bandwidth-on-demand. |
| Multiple ports per path: virtual ports | A virtual port can be assigned to a path or to a SysCallerID that represents a remote site. |

## Dynamic Paths

Ports running MLP can use a dial pool of available paths. A dial pool enables you to dial multiple destinations, use bandwidth-on-demand, and failover to another line without having to reserve specific paths for a port. A dial pool is created when you unbind a path from its port by using:

```
SETDefault !<path> -PATH DialCONTrol = DYNamic
```

## Virtual Ports

To configure multiple ports over one path, you create *virtual ports*. A virtual port can be assigned to a static path, or for PPP as using in a virtual private network (VPN), it can be assigned to the SysCallerID of a remote site. SysCallerID virtual ports use paths in a dial pool and are not associated to any one path.

A virtual port functions the same way as a nonvirtual port does, that is, as a logical interface that represents a connection to a network.

## Port/Path Services and Syntax

Path and port parameters have their own dedicated service type indicators, that are used in commands that change the setting of these parameters.

Path parameters use the Path Service and port parameters use the Port Service.

Table 12 lists the path and port numbering syntax rules that are used for default naming for PathBuilder S5xx series switches.

**Table 12** PathBuilder Path/Port Syntax Rules

| Interface | Path/Port Syntax | Syntax Description |
|---|---|---|
| LAN connectors | <n> | n = 1 or 2 |
| FlexWAN Serial connectors | <nm> | n = 3 or 4 |
| | | m = a, b, c, or d |
| Ultra-WAN CSU/DSU connectors* | <nm.p> | n = 3 or 4 |
| | | m = a, b, c, or d |
| | | p = 1, 2, ...30 |
| T3/E3 connectors | <n> | n = 3 or 4 |
| ATM connectors | <n> | n = 3 or 4 |

* The Ultra-WAN CSU/DSU interfaces on the model S590/S598/S599 PathBuilder switches support multi-path ISDN PRI dial, as well as single-path leased unstructured operation.

## Connector Services and Syntax for Ultra-WAN Interfaces

Connector parameters do not have a dedicated service type indicator; they use the Path Service type indicator. Table 13 lists the Ultra-WAN connector syntax rules for the model S590/S598/S599 PathBuilder switch.

**Table 13** PathBuilder S590 Connector Syntax Rules

| Interface | Connector Syntax | Syntax Description |
|---|---|---|
| Ultra-WAN CSU/DSU Connectors | <4m> and <3m> | m=a, b, c, or d |

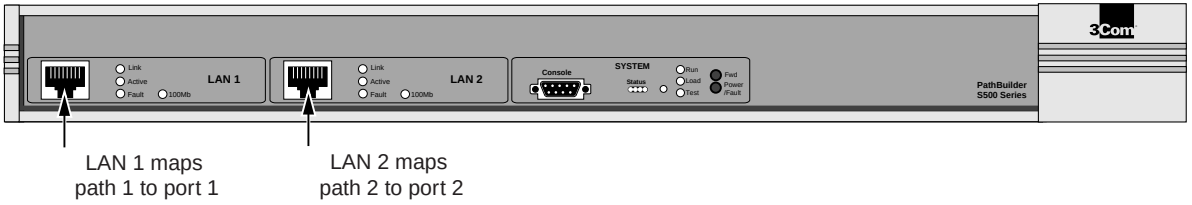
## Path and Port Numbering

This section provides the default port and path number mapping for the PathBuilder switch.

### Model S500

Figure 12 shows the path/connector to port number mappings for the model S500 PathBuilder switch.

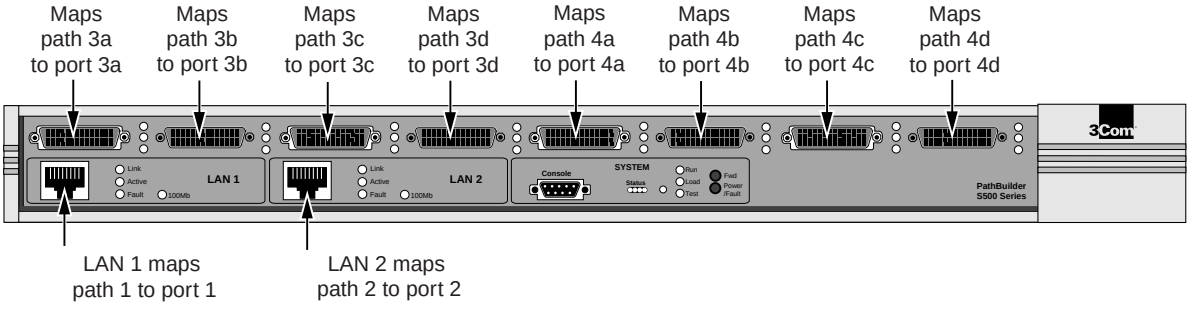
**Figure 12** Model S500 PathBuilder Switch Path to Port Mappings




### Model S580

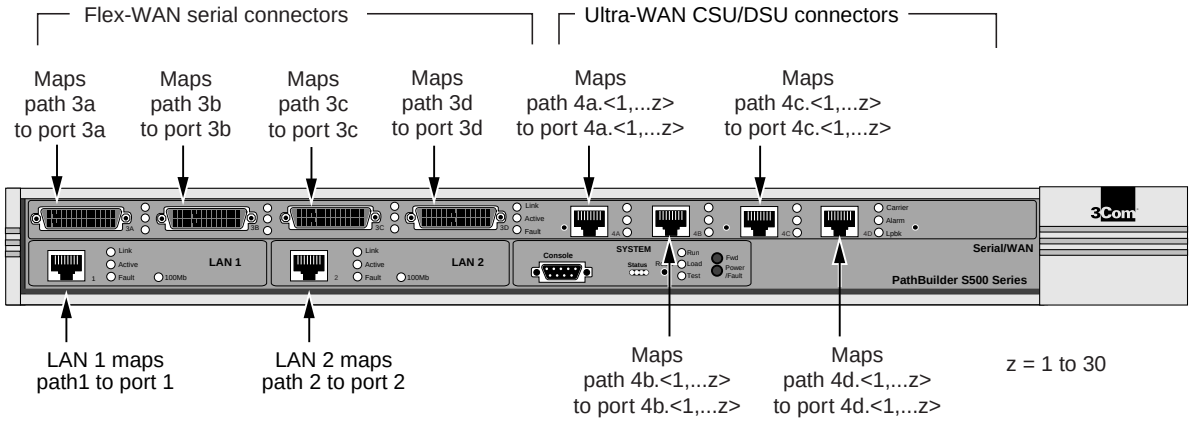
Figure 13 shows the path/connector to port number mappings for the model S580 PathBuilder switch.

**Figure 13** Model S580 PathBuilder Switch Path to Port Mappings



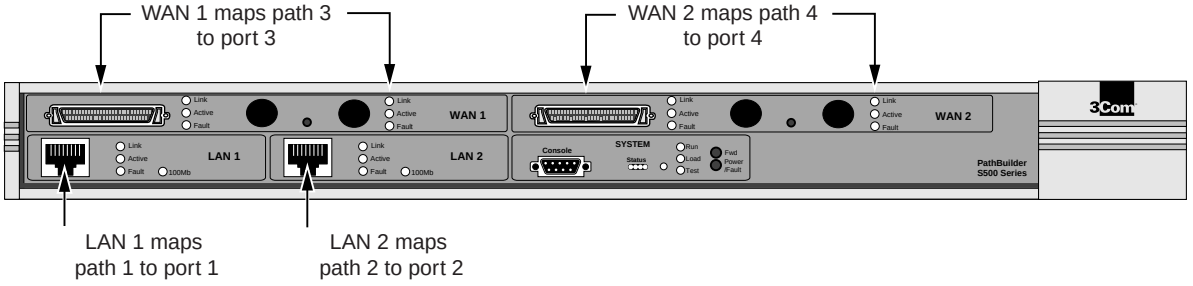
**Model S590** Figure 14 shows the path/connector to port number mappings for the model S590 PathBuilder switches.

**Figure 14** Model S590 PathBuilder Switch Path to Port Mappings



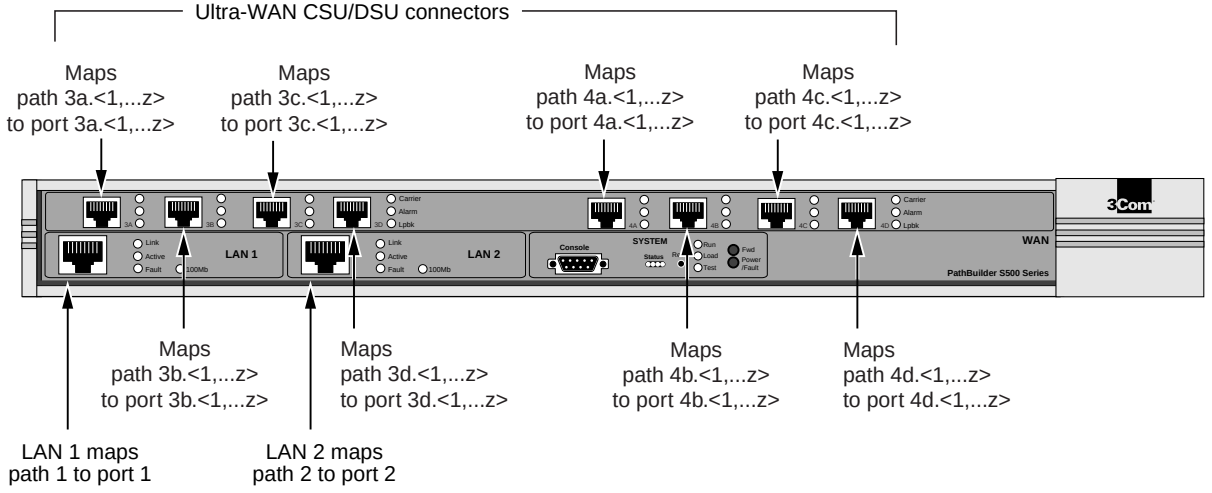

**Model S593/S595** Figure 15 shows the path/connector to port number mappings for the model S593 and S595 PathBuilder switches.

**Figure 15** Model S593/S595 PathBuilder Switch Path to Port Mappings



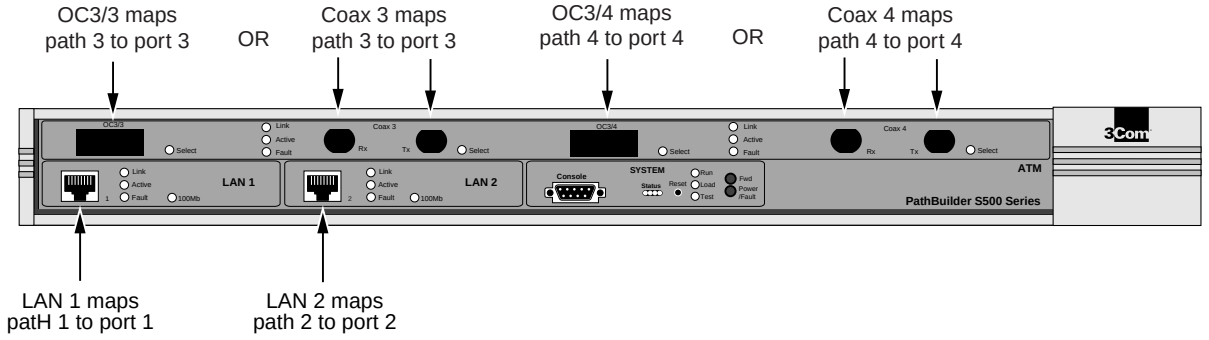
**Model S598 and S599** Figure 16 shows the path/connector to port number mappings for the model S598 and S599 PathBuilder switches.

**Figure 16** Model S598 and S599 PathBuilder Switch Path to Port Mappings




**Model S574 and S578** Figure 17 shows the path/connector to port number mappings for the model S574 and S578 PathBuilder switches.

**Figure 17** Model S574 and S578 PathBuilder Switch Path to Port Mappings



## Configuring Ethernet Paths and Ports

By default, the Ethernet paths and ports are enabled.

The software automatically detects the following settings:

- **Baud** — 10 Mbps or 100 Mbps
- **Duplex** — full or half

## Configuring Flex-WAN Serial Interfaces with DCEs

This section describes how to configure the Flex-WAN serial interfaces when connected to external modems or CSU/DSUs.

Before beginning this procedure, complete the following tasks:

- Cable the Flex-WAN serial interface and connect it to the telephone network.
- Log on to the system with Network Manager privilege.

The Flex-WAN serial interface automatically detects the following settings:

- **Clock** — internal or external
- **Connector type** — RS-232, V.35, X.21, RS-449, or RS-530

To configure the Flex-WAN serial interface with a DCE, follow these steps:

1. The default baud rate for the Flex-WAN serial interface is 64 Kbps. If you need to change the baud rate, use:

   ```
   SETDefault !<path> -PATH Baud = <kbps> (1.2-2048)
   ```

2. The default device type is Modem. Specify the external device type attached to the Flex-WAN cable using:

   ```
   SETDefault !<path> -PATH ExDevType = [Modem | Bri | Sw56 | Async]
   ```

3. If you have changed any of the default settings, re-enable the path to make sure all settings on the path take effect using:

   ```
   SETDefault !<path> -PATH CONTrol = Enabled
   ```

## Configuring Flex-WAN Serial Interfaces with DTEs

This section describes how to configure the Flex-WAN serial interfaces when connecting directly to IBM legacy equipment.

Before beginning this procedure, complete the following tasks:

- Attach the Flex-WAN cable to the Flex-WAN serial interfaces and the line equipment (either DCE or DTE).
- Log on to the system with Network Manager privilege.

The Flex-WAN serial interface automatically detects the following settings:

- **Line type** — leased
- **Clock** — internal or external
- **Connector type** — RS-232, V.35, X.21, or RS-449

To configure the Flex-WAN serial interface with a DTE, follow these steps:

1 The default baud rate for the serial Flex-WAN interface is 64 Kbps. If you need to change the baud rate, use:

```
SETDefault !<path> -PATH Baud = <kbps> (1.2-2048)
```

2 Set the owner of the port using:

```
SETDefault !<port> -PORT OWNer = BSC | ATUN | SHDLC | SDLC
```

See *Using Enterprise OS Software* for more information about IBM legacy protocols.

## Configuring the Ultra-WAN CSU/DSU Interfaces

The Ultra-WAN CSU/DSU interfaces can be configured in a variety of ways. There is no default configuration for these interfaces.

Initially, these interfaces can be configured to connect to T1 or E1 lines. Secondly, they can also be configured to run ISDN PRI dial, single-path leased, or multiple-path leased (channelized). The parameters used to configure these interfaces are known as connector-level path parameters. These parameters are reviewed in the following configuration examples, and they are also listed in the configuration file example in Appendix G. The example ASCII configuration templates are provided on the Enterprise OS 11.3.1 documentation CD-ROM for you to modify to meet the requirements of your installation. Also see Appendix G for a copy of these configuration templates.

Before beginning any of the procedures in this section, complete the following tasks:

- Attach a RJ-48C cable between the Ultra-WAN CSU/DSU interface and an appropriate telco switch or external CSU.
- Log on to the system with Network Manager privileges.

## Configuring a CSU/DSU Interface for ISDN PRI Dial Service

This section describes how to configure Ultra-WAN CSU/DSU interface for ISDN PRI dial service.

To configure the Ultra-WAN CSU/DSU interface, follow these steps:

**1** Set the FrameMode as appropriate for your setup:

```
SETDefault !<path> -PAth FrameMode = T1_SF | T1_ESF | E1_CRC4 |
E1_NOCRC
```

where <path> = 4A, 4B, 4C, or 4D.

The FrameMode parameter allows you to specify the frame mode. The allowable values are the following:

| | |
|---|---|
| T1_SF | Superframe format T1. |
| T1_ESF | Extended Superframe format T1. |
| E1_CRC4 | CRC-active E1. |
| E1_NOCRC | E1 without an active CRC. |

**2** Set the connector type as appropriate for your setup using:

```
SETDefault !<path> -PAth CONNector = E1_Pri |T1_Pri
```

where <path> = 4A, 4B, 4C, or 4D.

**3** Set the Switch Type as appropriate for your setup using:

```
SETDefault !<path> -PAth SwitchType = ETSI | ATT5ESS | ATT4ESS |
 DMS100 | DMS250 | NTT | NI2
```

The SwitchType parameter specifies the type of switch to which your ISDN line is connected.

**4** Set the LineEncoding as appropriate for your setup using:

```
SETDefault !<path> -PAth LineENCoding = B8ZS | AMI | HDB3
```

where <path> = 4A, 4B, 4C, or 4D.

The LineENCoding parameter specifies the transmission encoding method for a serial line. The coding method you specify for the serial line

must match the attached communication device. AMI or B8ZS should be used for T1 connectors and HDB3 should be used for E1 connectors. NRZ and NRZI are not valid options on Ultra-WAN interfaces.

5 Set the LineDistance as appropriate for your setup using:

```
SETDefault !<path> -PAth LineDistance = LH1|LH2|LH3|LH4|SH1|SH2|
 SH3|SH4|SH5|SH7
```

The LineDistance parameter determines the supported long haul (LH) or short haul (SH) line distance. For T1 lines, long haul and short haul settings are supported. Further granularity is provided in units of dB for long haul, and in units of feet for short haul.

For E1 lines, only short haul is supported. Use SH7 for E1 lines.

| | | |
|---|---|---|
| LH1 | T1 | 0 dB |
| LH2 | T1 | 7.5 dB |
| LH3 | T1 | 15 dB |
| LH4 | T1 | 22.5 dB |
| SH1 | T1 | 0-133 feet |
| SH2 | T1 | 133-266 feet |
| SH3 | T1 | 266-399 feet |
| SH4 | T1 | 399-533 feet |
| SH5 | T1 | 533-655 feet |
| SH7 | E1 | G.703 120 Ohm |

6 Enable the connector using:

```
SETDefault !<path> -PAth ConnControl = Enabled
```

*Connector parameter settings are not applied until the connector is enabled.*

## Configuring a CSU/DSU Interface for Single Path, Unstructured Service

This section describes how to configure Ultra-WAN CSU/DSU interface for single path, unstructured service.

To configure the Ultra-WAN CSU/DSU interface, follow these steps:

**1** Set the FrameMode as appropriate for your setup:

```
SETDefault !<path> -PAth FrameMode = T1_SF | T1_ESF | E1_CRC4 |
E1_NOCRC
```

where <path> = 4A, 4B, 4C, or 4D.

The FrameMode parameter allows you to specify the frame mode. The allowable values are the following:

| | |
|---|---|
| T1_SF | Superframe format T1. |
| T1_ESF | Extended Superframe format T1. |
| E1_CRC4 | CRC-active E1. |
| E1_NOCRC | E1 without an active CRC. |

**2** Set the connector type as appropriate for your setup using:

```
SETDefault !<path> -PAth CONNector = E1_Unstructured
|T1_Unstructured
```

where <path> = 4A, 4B, 4C, or 4D.

**3** Set the LineEncoding as appropriate for your setup using:

```
SETDefault !<path> -PAth LineENCoding = B8ZS | AMI | HDB3
```

where <path> = 4A, 4B, 4C, or 4D.

The LineENCoding parameter specifies the transmission encoding method for a serial line. The coding method you specify for the serial line must match the attached communication device. AMI or B8ZS should be used for T1 connectors and HDB3 should be used for E1 connectors. NRZ and NRZI are not valid options on Ultra-WAN interfaces.

**4** Set the LineDistance as appropriate for your setup using:

```
SETDefault !<path> -PAth LineDistance = LH1|LH2|LH3|LH4|SH1|SH2|
 SH3|SH4|SH5|SH7
```

The LineDistance parameter determines the supported long haul (LH) or short haul (SH) line distance. For T1 lines both long haul and short haul settings are supported. Further granularity is provided in units of dB for long haul, and in units of feet for short haul.

For E1 lines, only short haul is supported. Use SH7 for E1 lines.

| | | |
|---|---|---|
| LH1 | T1 | 0 dB |
| LH2 | T1 | 7.5 dB |
| LH3 | T1 | 15 dB |
| LH4 | T1 | 22.5 dB |
| SH1 | T1 | 0-133 feet |
| SH2 | T1 | 133-266 feet |
| SH3 | T1 | 266-399 feet |
| SH4 | T1 | 399-533 feet |
| SH5 | T1 | 533-655 feet |
| SH7 | E1 | G.703 120 Ohm |

**5** Enable the connector, using:

```
SETDefault !<path> -PAth ConnControl = Enabled
```

*Connector parameter settings are not applied until the connector is enabled.*

### Configuring a CSU/DSU Interface for Multiple Path, Channelized Service

This section describes how to configure Ultra-WAN CSU/DSU interface for multiple path, channelized service.

To configure the Ultra-WAN CSU/DSU interface, follow these steps:

**1** Set the FrameMode as appropriate for your setup:

```
SETDefault !<path> -PAth FrameMode = T1_SF | T1_ESF | E1_CRC4 |
E1_NOCRC
```

where <path> = 4A, 4B, 4C, or 4D.

The FrameMode parameter allows you to specify the frame mode. The allowable values are the following:

| | |
|---|---|
| T1_SF | Superframe format T1. |
| T1_ESF | Extended Superframe format T1. |
| E1_CRC4 | CRC-active E1. |
| E1_NOCRC | E1 without an active CRC. |

**2** Set the connector type as appropriate for your setup using:

```
SETDefault !<path> -PAth CONNector = E1_Channelized
|T1_Channelized
```

where <path> = 4A, 4B, 4C, or 4D.

**3** Set the LineEncoding as appropriate for your setup using:

```
SETDefault !<path> -PAth LineENCoding = B8ZS | AMI | HDB3
```

where <path> = 4A, 4B, 4C, or 4D.

The LineENCoding parameter specifies the transmission encoding method for a serial line. The coding method you specify for the serial line must match the attached communication device. AMI or B8ZS should be used for T1 connectors and HDB3 should be used for E1 connectors. NRZ and NRZI are not valid options on Ultra-WAN interfaces.

**4** Set the LineDistance as appropriate for your setup using:

```
SETDefault !<path> -PAth LineDistance = LH1|LH2|LH3|LH4|SH1|SH2|
 SH3|SH4|SH5|SH7
```

The LineDistance parameter determines the supported long haul (LH) or short haul (SH) line distance. For T1 lines both long haul and short haul settings are supported. Further granularity is provided in units of dB for long haul, and in units of feet for short haul.

For E1 lines, only short haul is supported. Use SH7 for E1 lines.

| | | |
|---|---|---|
| LH1 | T1 | 0 dB |
| LH2 | T1 | 7.5 dB |
| LH3 | T1 | 15 dB |
| LH4 | T1 | 22.5 dB |
| SH1 | T1 | 0-133 feet |
| SH2 | T1 | 133-266 feet |
| SH3 | T1 | 266-399 feet |
| SH4 | T1 | 399-533 feet |
| SH5 | T1 | 533-655 feet |
| SH7 | E1 | G.703 120 Ohm |

**5** Enable the connector, using:

```
SETDefault !<path> -PAth ConnControl = Enabled
```

*Connector parameter settings are not applied until the connector is enabled.*

## Configuring the High-Speed T3 Interface

This section describes how to configure the high-speed T3/E3 ports for HSSI, T3-CBIT or M13, and E3 modes of operation.

To configure the high-speed T3 interface for HSSI operation, follow these steps:

1. Set the connector type for HSSI operation using:

```
SETDefault !<path> -PAth CONNector = HSSI
```

2. Set the T3/E3 frame mode using:

```
SETDefault !<path> -PAth T3E3FrmMode = HSSI
```

To configure the high-speed T3/E3 interface for T3 operation, follow these steps:

1. Set the connector type for T3 operation using:

```
SETDefault !<path> -PAth CONNector = BNC
```

2. Set the T3/E3 frame mode using:

```
SETDefault !<path> -PAth T3E3FrmMode = M13 (or CBit)
```

3. Set the line build output option using:

```
SETDefault <!path> -PAth T3LineBdout = HIGH
```

To configure the high-speed E3 interface for HSSI operation, follow these steps:

1. Set the connector type for E3 operation using:

```
SETDefault !<path> -PAth CONNector = BNC
```

2. Set the T3/E3 frame mode using:

```
SETDefault !<path> -PAth T3E3FrmMode = E3
```

For more information about the Path Service parameters and settings, see the Path Service parameters chapter in *Reference for Enterprise OS Software*.

## Configuring the ATM Interfaces

This section describes how to configure the ATM interfaces. Using virtual ports, ATM interfaces can be configured to receive data using permanent virtual circuits (PVCs), LAN Emulation (LANE), and PPP over ATM.

The parameters used to configure these interfaces are reviewed in the following configuration examples, and they are also listed in the configuration file example in Appendix H. The example ASCII configuration templates are provided on the Enterprise OS 11.3.1 documentation CD-ROM for you to modify to meet the requirements of your installation. Also see Appendix H for a copy of these configuration templates.

To configure PVCs (MPATM), follow these steps:

*There are 14 predefined traffic shapers available for the PVC. Traffic shaper 1 is the default traffic shaper. The traffic shaper parameters (peak rate, average rate, burst) can be reconfigured in the ATM service if required.*

**1** Reconfigure traffic shapers using:

```
SETDefault -ATM TrafficShaper = <shaperid> <peak> <avg> <burst>
[High | Low]
```

**2** Configure the virtual circuit identifier (VCID) using:

```
ADD !<vport> -ATM PermVirCircuit <vcid> <vpi>.<vci> [ LLCSNAP | [
NULL IP | IPX | PPP ] ] [<shaperid>]
```

A PVC requires the association of a unique virtual circuit identifier (VCID) to the ATM service provider's VPI.VCI. The PVC supports either LLCSNAP, NULL IP or NULL IPX encapsulation. A MPATM virtual port can be configured with multiple PVCs.

**3** Configure the virtual port as MPATM using:

```
ADD !<vport> -POrt VirtualPort <path> MPATM
```

The virtual port owner must be configured as MPATM. All PVCs configured for the <vport> are bound to the virtual port. Data received on the PVC will be tagged as received on the virtual port.

To configure LAN Emulation, follow these steps:

**1** Set LAN Emulation on a virtual port using:

```
SETDefault !<vport> -ATMLE ElanName = "string"
```

Each emulated LAN is configured on one virtual port.

**2** Configure the virtual port as either Ethernet LAN Emulation or Token Ring LAN emulation using:

```
ADD !<vport> -POrt VirtualPort <path> ETHATM
ADD !<vport> -POrt VirtualPort <path> TRATM
```

PPP over ATM can be configured to terminate at the router or configured to support VPN tunnel switching.

To configure PPP over ATM to terminate at the router, follow these steps:

1 Configure the virtual circuit identifier (VCID) using:

```
ADD !<vport> –ATM PermVirCircuit <vcid> <vpi>.<vci> [ LLCSNAP | [
NULL IP | IPX | PPP ] ] [<shaperid>]
```

A PPP session is configured as one PVC on one virtual port. A PVC requires the association of a unique virtual circuit identifier (VCID) to the ATM service provider's VPI.VCI. The PVC supports either LLCSNAP or NULL PPP.

2 Configure the virtual port as PPPATM using:

```
ADD !<vport> –POrt VirtualPort <path> PPATM VCID <vcid>
```

The virtual port owner must be configured as PPPATM. The PVC configured for the virtual port is bound to the virtual port. Data received on the PVC will be tagged as received on the virtual port and passed to PPP.

To configure PPP over ATM to support VPN tunnel switching, follow these steps:

*To configure PPP over ATM to support VPN tunnel switching, the virtual path is configured (not the virtual port). The PPP over ATM virtual path is bound to the tunnel switch virtual port when the VPN tunnel switch is set up.*

1 Configure the PVC to be used for the virtual path using:

```
ADD !<path> –ATM PermVirCircuit <vcid> <vpi>.<vci> CSNAP | [ NULL
IP | IPX | PPP ] ]
```

2 Configure the virtual path using:

```
ADD –PAth VirtualPath <path> PPATM VCID <vcid>
```

3 Complete the configuration of the tunnel client, tunnel switch, and tunnel terminator.

Completing the configuration of the tunnel client, tunnel switch and tunnel terminator requires the configuration of:

- the VPN network. See *Configuring Virtual Private Networks* in *Using Enterprise OS Software*.

- the authentication protocol to be used. See *PPP Service Parameters* in *Reference for Enterprise OS Software*.
- the local and remote user ID and password. See *PPP Service Parameters* in *Reference for Enterprise OS Software*.
- the dial number list. See *Port Service Parameters* in *Reference for Enterprise OS Software*.

For more information about the ATM, ATMLE, Path and Port Service parameters and settings, see the appropriate chapters in *Reference for Enterprise OS Software*.

## Where To Go From Here

If you have a leased line, see *Using Enterprise OS Software* to configure bridging, IP, and IPX routing.

For dial-up, see *Using Enterprise OS Software* to complete your port and path configuration.

# 5 CONFIGURING AND MONITORING VIRTUAL PRIVATE NETWORKS

This chapter describes virtual private networking and how to use a PathBuilder switch with Enterprise OS software to configure and monitor a virtual private network (VPN).

## Remote Access Alternatives

VPNs are a cost-effective alternative for providing remote access or remote office connectivity to a central site.

Typically a company is required to use dedicated leased lines, packet-switching services, and/or direct dialup connections to enable remote users and remote offices to connect to a central site. A VPN provides a less expensive method of providing this connectivity.

The internet service provider (ISP) is an important element in of a VPN. By providing local access for any remote user or remote office, the ISPs network replaces the leased lines, packet-switching services, and direct dialup connections. Instead of directly managing remote access WAN lines a company can outsource this responsibility to an ISP, resulting in fewer WAN issues to track and potentially significant cost savings.

### Using Tunnels

To ensure security and multiprotocol support, a tunnel is created to the central site. Tunneling allows you to encapsulate IP and non-IP packets, to provide security using IPsec, and to obtain access to the central site network through a firewall.

A tunnel can be set up in one of two ways:

- From the ISP to the central site. This configuration is used to connect individual remote users to a central site.
- From a remote site to the central site. This configuration is used to connect a remote office to a central site.

### ISP to Central Site Tunneling

The ISP must have tunnel-enabled access servers, like the Total Control™ hub, if the remote clients cannot support the tunneling protocol.

In this configuration, the tunnel set up proceeds as follows:

- First the remote user dials into the ISP's access server.
- The access server recognizes (based on a user ID, for instance, or on the user's choice from a menu) that this connection should be tunneled to the central site.
- The access server establishes the tunnel with the central site.
- The remote user then establishes a session directly with the central site via the tunnel, just as if the two were directly attached.

  While this configuration has the advantage that no special software is required on the remote user, the remote user can dial only into properly equipped access servers.

### Remote User to Central Site Tunneling

In this configuration, the remote user (the client), such as an OfficeConnect® NETBuilder® bridge/router or an appropriately configured personal computer, supports the tunneling protocol. The ISP does not have to support tunneling in any way.

The remote user dials the ISP, but once the connection is set up, the remote user and the central site establish the tunnel, using authentication based on a user ID and password and perhaps on a digital certificate.

The remote user and the central site may also negotiate encryption. Once the tunnel is established, communications proceed as if the ISP were not mediating the connection.

## Creating a VPN for Individual Remote Users

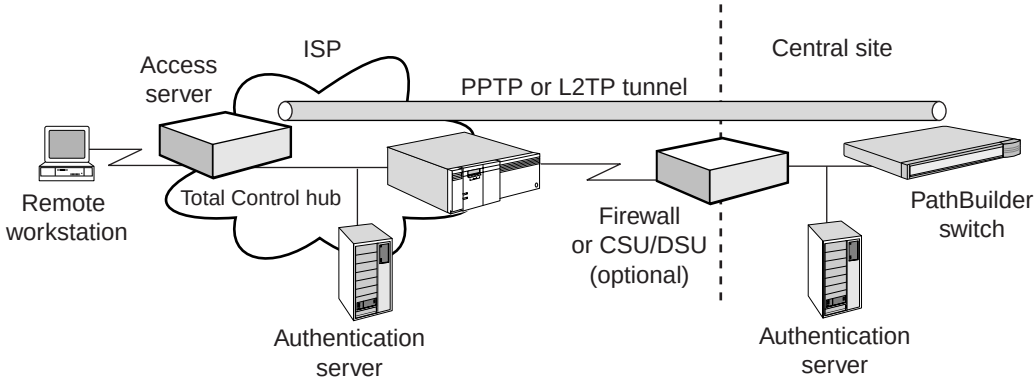
In place of setting up multiple remote access servers at the central site, VPNs allow remote users to dial a local ISP. Using a VPN for remote access is particularly useful if you have remote users at a great distance from the central site. For example, users in Europe can call a local number instead of dialing in to the central site in New York.

The following two examples show remote access VPN configurations.

**Example 1** In Figure 18, the ISP is configured to create a tunnel from the ISP's access server to the central site.

*This method can also be used for a remote office if you do not want to configure tunneling on the bridge/router at the remote office.*

**Figure 18** ISP to Central Site Tunnel




The connection process typically follows this order:

- The remote user (the client) dials the ISP.
- The ISP assigns an IP address to the remote user client.
- The ISP checks its authentication server for the user, and creates a PPTP (or L2TP) tunnel to the central site based on authentication data.
- The central site checks its authentication server to verify that this user can access the network and forwards the data.

*No special configuration is required on the remote user computer except the configuration required to dial into the ISP's access server.*

At the central site, follow these steps:

1. Configure the L2Tunnel Service (see the Configuring L2Tunnel Connections chapter in *Using Enterprise OS Software*) to enable the PathBuilder switch as a tunnel terminator.
2. Configure the firewall device (if present), or the PathBuilder switch, to allow tunnel traffic through (see the Building Internet Firewalls chapter in *Using Enterprise OS Software*).

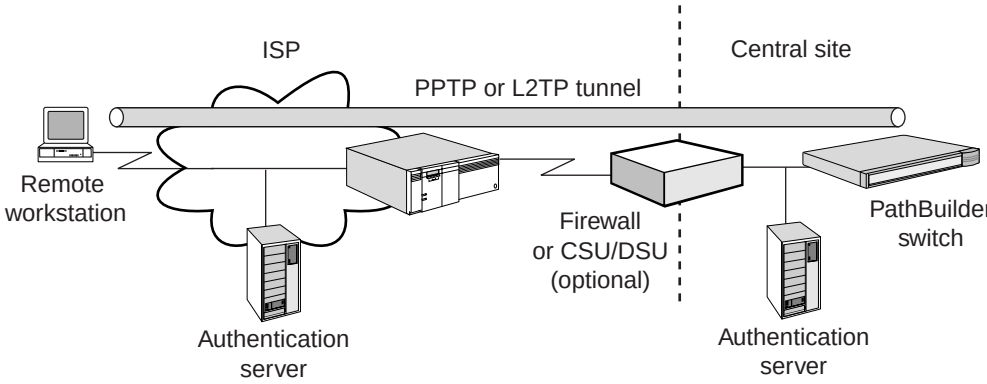
3 Configure the RAS service to allow authentication of the user by a server, such as a RADIUS server (see the Configuring Remote Access Services chapter in *Using Enterprise OS Software*).

*The firewall and RAS functions can also be configured on the PathBuilder switch. The configuration example in Figure 18 shows these services being performed on separate devices, for purposes of clarity.*

**Example 2** In Figure 19, the remote workstation is configured to create a tunnel directly to the central site.

Refer to the documentation for your workstation or consult your operating system vendor for instructions on how to configure your workstation as the remote PPTP/L2TP client.

**Figure 19** Remote Workstation to Central Site Tunnel




The connection process typically follows this order:

- The remote client dials the ISP.
- The ISP assigns an IP address to the client.
- The remote client sends data to the IP address of the central site.
- The Windows 95/NT workstation client creates a PPTP tunnel to the central site based on authentication data.
- The central site checks its authentication server to verify that this user can access the network and forwards the data.

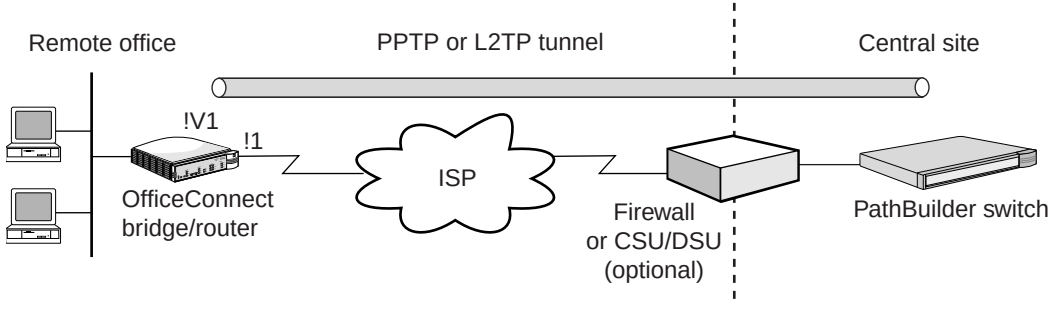
At the central site, follow these steps:

1. Configure the L2Tunnel service (see the Configuring L2Tunnel Connections chapter in *Using Enterprise OS Software*) to enable the PathBuilder switch as a tunnel terminator.
2. Configure the firewall device if present, or the PathBuilder switch, to allow tunnel traffic through (see the Building Internet Firewalls chapter in *Using Enterprise OS Software*).
3. Configure the RAS service to allow authentication of the user by a server, such as a RADIUS server (see the Configuring Remote Access Services chapter in *Using Enterprise OS Software*).
4. Enable PPP encryption to allow encryption keys to be used by MPPE (see the Configuring Wide Area Networking Using PPP chapter in *Using Enterprise OS Software*).

## Creating a VPN for a Remote Office

You can create a VPN to connect a remote office PathBuilder switch to the central site through the ISP using tunneling protocols such as the point-to-point tunneling protocol (PPTP). Figure 20 shows a typical configuration. In this configuration, the tunnel is established between the remote office and the central site. The ISP provides access to the shared network but does not interact in the tunneling setup.

**Figure 20** Remote Office Tunnel




The connection process typically follows this order:

- The remote office OfficeConnect NETBuilder bridge/router dials the ISP.
- The ISP assigns an IP address to the remote office bridge/router.

- The remote office OfficeConnect NETBuilder bridge/router sends data to the IP address of the central site.
- The data is encrypted using IPsec.
- A PPTP/L2TP tunnel is created between the remote site and the central site, and the data is forwarded through the firewall of the central site.
- The data is decrypted by the central site.

### On the Remote Office OfficeConnect Bridge/Router

On the OfficeConnect NETBuilder bridge/router, follow these steps:

1. Configure dial-up to the ISP (see the Configuring Port Bandwidth Management chapter in *Using Enterprise OS Software*) or virtual leased line configuration (see the Configuring L2Tunnel Connections chapter in *Using Enterprise OS Software*).

   The ISP assigns an IP address to the client, or you configure an IP address that is applicable to the ISP's network using the IP service (see the Configuring IP Routing and Configuring Network Address Translation chapter in *Using Enterprise OS Software*).

2. Create a virtual port specifying the SysCallerID (SCID) of the central site PathBuilder switch (see the Configuring Port Bandwidth Management chapter in *Using Enterprise OS Software*).

3. Add a dial number list to the virtual port specifying the IP Address of the central site and the type PPTP (see the Configuring Port Bandwidth Management chapter in *Using Enterprise OS Software*).

4. Configure the L2Tunnel Service (see the Configuring L2Tunnel Connections chapter in *Using Enterprise OS Software*) to enable the bridge/router as a tunnel initiator.

5. Configure IPSec on the virtual port specifying the same profile contents and key at the central site (see the Configuring IPSec chapter in *Using Enterprise OS Software*).

   After the remote site dials the ISP, any data that is sent to the IP address of the central site creates a PPTP tunnel between the two sites.

### On the Central Site PathBuilder Switch

At the central site, follow these steps:

1. Configure the L2Tunnel Service (see the Configuring L2Tunnel Connections chapter in *Using Enterprise OS Software*) to enable the PathBuilder switch as a tunnel terminator.
2. Configure the firewall device if present, or the PathBuilder switch to allow tunnel traffic through (see the Building Internet Firewalls chapter in *Using Enterprise OS Software*).
3. Configure IPSec specifying the same profile contents and key as the remote site (see the Configuring IPSec chapter in *Using Enterprise OS Software*).

## Monitoring VPN Performance

You have several options for monitoring the performance of your VPN. You can use the Web Link application, the Secure VPN Manager application, or InfoVista.

### Web Link Health Monitor

The Health Monitor is a part of the Web Link, the web-based network management application for NETBuilder products. The Health Monitor provides Java graphs that present performance data in a graphical form.

In addition to system performance graphs, interface performance graphs, and protocol performance graphs, path Performance graphs indicate the performance of the physical interface bandwidth usage. Total IPX packets and IPX packets per interface graphs appear in the protocol performance graph group.

### Secure VPN Manager

Transcend Secure VPN Manager is a graphical web-based network management tool that presents key information about your virtual private network (VPN). Secure VPN Manager provides the assistance necessary to monitor the VPN tunnels terminated by the NETBuilder bridge/router or the PathBuilder S5xx series of devices. Current and historical data is collected, which allow administrators to perform the following functions:

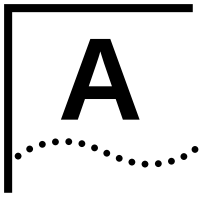
- Quality of service analysis
- Tunnel usage analysis
- Tunnel security analysis
- Capacity utilization analysis

These analyses are possible through the monitoring of the VPN tunnel between two 3Com routers, such as an OfficeConnect NETBuilder bridge/router located at a company's branch office and a NETBuilder II® bridge/router located at headquarters.

**InfoVista**

InfoVista is a comprehensive, flexible Service Level Management and conformance solution for Information Technology (IT) organizations, telcos, outsourcers, and network service providers. As an enterprise-oriented solution, InfoVista renders a uniform view of service level achievements across every component within an information system. Unlike other more narrowly focused products, InfoVista collects and interprets data from every facet of the IT infrastructure, including network, device, applications, and systems.

InfoVista collects data from standard and nonstandard devices, such as servers, workstations, and applications, and measures and reports on user-selected metrics required for Service Level Agreement conformance. Its easy-to-use interface enables IT managers and nontechnical users alike to analyze resource activity and trends, anticipate future demands, and prepare customized Quality of Service reports for distribution to customers.



# SERIAL DEVICES

## Dial Serial Device Requirements

Serial devices using the V.25bis command set over a PathBuilder switch must support:

- High-level data link control (HDLC) with NRZ.
- CRN command.
- 8 (data bits), N (no parity), and 1 (stop bit) if a parity option is provided.
- V.25bis addressed mode.
- Synchronous data and DTE connection. The PathBuilder switch does **not** support an asynchronous serial connection.

Serial devices using the DTR command set over a PathBuilder switch RS-232 interface must support:

- DTR State to Dial: HIGH.
- DTR State Hangup: Low.
- DTR State Answer: HIGH.
- Synch Data Xmt (synchronous data and DTE connection). The PathBuilder switch does **not** support an asynchronous serial connection.
- Auto Answer mode.
- User-stored phone number.

# B

# TECHNICAL SUPPORT

3Com provides easy access to technical support information through a variety of services. This appendix describes these services.

Information contained in this appendix is correct at time of publication. For the most recent information, 3Com recommends that you access the 3Com Corporation World Wide Web site.

## Online Technical Services

3Com offers worldwide product support 24 hours a day, 7 days a week, through the following online systems:

- World Wide Web site
- 3Com Knowledgebase Web Services
- 3Com FTP site
- 3Com Bulletin Board Service (3Com BBS)
- 3Com Facts℠ Automated Fax Service

## World Wide Web Site

To access the latest networking information on the 3Com Corporation World Wide Web site, enter this URL into your Internet browser:

**http://www.3com.com/**

This service provides access to online support information such as technical documentation and software, as well as support options that range from technical education to maintenance and professional services.

## 3Com Knowledgebase Web Services

This interactive tool contains technical product information compiled by 3Com expert technical engineers around the globe. Located on the World Wide Web at **http://knowledgebase.3com.com**, this service gives all 3Com customers and partners complementary, round-the-clock access to technical information on most 3Com products.

### 3Com FTP Site

Download drivers, patches, software, and MIBs across the Internet from the 3Com public FTP site. This service is available 24 hours a day, 7 days a week.

To connect to the 3Com FTP site, enter the following information into your FTP client:

- Hostname: **ftp.3com.com**
- Username: **anonymous**
- Password: **<your Internet e-mail address>**

*You do not need a user name and password with Web browser software such as Netscape Navigator and Internet Explorer.*

### 3Com Bulletin Board Service

The 3Com BBS contains patches, software, and drivers for 3Com products. This service is available through analog modem or digital modem (ISDN) 24 hours a day, 7 days a week.

#### Access by Analog Modem

To reach the service by modem, set your modem to 8 data bits, no parity, and 1 stop bit. Call the telephone number nearest you:

| Country | Data Rate | Telephone Number |
|---|---|---|
| Australia | Up to 14,400 bps | 61 2 9955 2073 |
| Brazil | Up to 28,800 bps | 55 11 5181 9666 |
| France | Up to 14,400 bps | 33 1 6986 6954 |
| Germany | Up to 28,800 bps | 4989 62732 188 |
| Hong Kong | Up to 14,400 bps | 852 2537 5601 |
| Italy | Up to 14,400 bps | 39 2 27300680 |
| Japan | Up to 14,400 bps | 81 3 5977 7977 |
| Mexico | Up to 28,800 bps | 52 5 520 7835 |
| P.R. of China | Up to 14,400 bps | 86 10 684 92351 |
| Taiwan, R.O.C. | Up to 14,400 bps | 886 2 377 5840 |
| U.K. | Up to 28,800 bps | 44 1442 438278 |
| U.S.A. | Up to 53,333 bps | 1 847 262 6000 |

### Access by Digital Modem

ISDN users can dial in to the 3Com BBS using a digital modem for fast access up to 64 Kbps. To access the 3Com BBS using ISDN, call the following number:

**1 847 262 6000**

**3Com Facts Automated Fax Service**

The 3Com Facts automated fax service provides technical articles, diagrams, and troubleshooting instructions on 3Com products 24 hours a day, 7 days a week.

Call 3Com Facts using your Touch-Tone telephone:

**1 408 727 7021**

## Support from Your Network Supplier

If you require additional assistance, contact your network supplier. Many suppliers are authorized 3Com service partners who are qualified to provide a variety of services, including network planning, installation, hardware maintenance, application training, and support services.

When you contact your network supplier for assistance, have the following information ready:

- Product model name, part number, and serial number
- A list of system hardware and software, including revision levels
- Diagnostic error messages
- Details about recent configuration changes, if applicable

If you are unable to contact your network supplier, see the following section on how to contact 3Com.

## Support from 3Com

If you are unable to obtain assistance from the 3Com online technical resources or from your network supplier, 3Com offers technical telephone support services. To find out more about your support options, call the 3Com technical telephone support phone number at the location nearest you.

When you contact 3Com for assistance, have the following information ready:

- Product model name, part number, and serial number
- A list of system hardware and software, including revision levels
- Diagnostic error messages
- Details about recent configuration changes, if applicable

Here is a list of worldwide technical telephone support numbers:

| Country | Telephone Number | Country | Telephone Number |
|---|---|---|---|
| **Asia, Pacific Rim** | | | |
| Australia | 1 800 678 515 | P.R. of China | 10800 61 00137 or |
| Hong Kong | 800 933 486 | | 021 6350 1590 |
| India | +61 2 9937 5085 | Singapore | 800 6161 463 |
| Indonesia | 001 800 61 009 | S. Korea | |
| Japan | 0031 61 6439 | From anywhere in S. Korea: | 00798 611 2230 |
| Malaysia | 1800 801 777 | From Seoul: | (0)2 3455 6455 |
| New Zealand | 0800 446 398 | Taiwan, R.O.C. | 0080 611 261 |
| Pakistan | +61 2 9937 5085 | Thailand | 001 800 611 2000 |
| Philippines | 1235 61 266 2602 | | |
| **Europe** | | | |
| From anywhere in Europe, call: | +31 (0)30 6029900 phone<br>+31 (0)30 6029999 fax | | |
| **Europe, South Africa, and Middle East** | | | |
| From the following countries, you may use the toll-free numbers: | | | |
| Austria | 0800 297468 | Netherlands | 0800 0227788 |
| Belgium | 0800 71429 | Norway | 800 11376 |
| Denmark | 800 17309 | Poland | 00800 3111206 |
| Finland | 0800 113153 | Portugal | 0800 831416 |
| France | 0800 917959 | South Africa | 0800 995014 |
| Germany | 0800 1821502 | Spain | 900 983125 |
| Hungary | 00800 12813 | Sweden | 020 795482 |
| Ireland | 1800 553117 | Switzerland | 0800 55 3072 |
| Israel | 1800 9453794 | U.K. | 0800 966197 |
| Italy | 1678 79489 | | |
| **Latin America** | | | |
| Argentina | AT&T +800 666 5065 | Mexico | 01 800 CARE (01 800 2273) |
| Brazil | 0800 13 3266 | Peru | AT&T +800 666 5065 |
| Chile | 1230 020 0645 | Puerto Rico | 800 666 5065 |
| Colombia | 98012 2127 | Venezuela | AT&T +800 666 5065 |
| **North America** | 1 800 NET 3Com<br>(1 800 638 3266)<br>Enterprise Customers:<br>1 800 876-3266 | | |

## Returning Products for Repair

Before you send a product directly to 3Com for repair, you must first obtain an authorization number. Products sent to 3Com without authorization numbers will be returned to the sender unopened, at the sender's expense.

To obtain an authorization number, call or fax:

| Country | Telephone Number | Fax Number |
|---|---|---|
| Asia, Pacific Rim | + 65 543 6500 | + 65 543 6348 |
| Europe, South Africa, and Middle East | + 31 30 6029900 | + 31 30 6029999 |
| Latin America | 1 408 326 2927 | 1 408 326 3355 |
| From the following countries, you may call the toll-free numbers; select option 2 and then option 2: | | |
| Austria | 0800 297468 | |
| Belgium | 0800 71429 | |
| Denmark | 800 17309 | |
| Finland | 0800 113153 | |
| France | 0800 917959 | |
| Germany | 0800 1821502 | |
| Hungary | 00800 12813 | |
| Ireland | 1800553117 | |
| Israel | 1800 9453794 | |
| Italy | 1678 79489 | |
| Netherlands | 0800 0227788 | |
| Norway | 800 11376 | |
| Poland | 00800 3111206 | |
| Portugal | 0800 831416 | |
| South Africa | 0800 995014 | |
| Spain | 900 983125 | |
| Sweden | 020 795482 | |
| Switzerland | 0800 55 3072 | |
| U.K. | 0800 966197 | |
| U.S.A. and Canada | 1 800 NET 3Com (1 800 638 3266)<br>Enterprise Customers: 1 800 876 3266 | 1 408 326 7120 (not toll-free) |

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# C

# CONNECTORS AND CABLES

This chapter describes each connector and the cables that can be used with each connector on the PathBuilder switch. Pinout information for cables is also provided.

## Console Connector and Cables

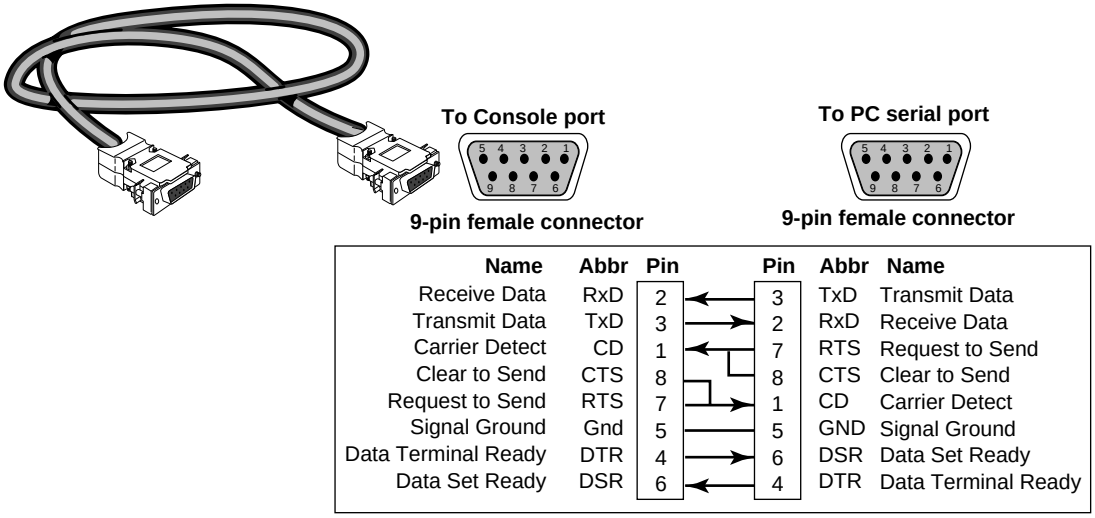
You can connect a PC running a terminal emulation program, a terminal, or a modem to the Console connector on the PathBuilder switch.

***WARNING:*** *To eliminate cable noise emission in excess of FCC Part 15, Subpart J, and EN55022 B, this device cable should be shielded and have connectors with metallic backshells.*

### PC Cable

Figure 21 shows the pinouts for a 9-pin female to 9-pin null modem-type cable.

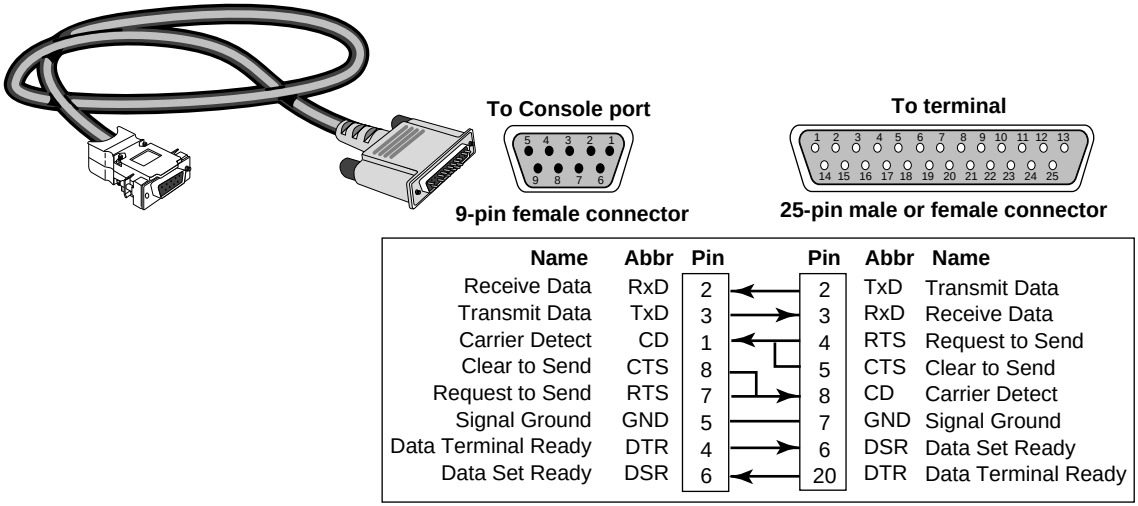
**Figure 21** 9-pin to 9-pin PC Cable (Null Modem-Type)




| Name | Abbr | Pin | | Pin | Abbr | Name |
|---|---|---|---|---|---|---|
| Receive Data | RxD | 2 | ← | 3 | TxD | Transmit Data |
| Transmit Data | TxD | 3 | → | 2 | RxD | Receive Data |
| Carrier Detect | CD | 1 | ← | 7 | RTS | Request to Send |
| Clear to Send | CTS | 8 | | 8 | CTS | Clear to Send |
| Request to Send | RTS | 7 | → | 1 | CD | Carrier Detect |
| Signal Ground | Gnd | 5 | — | 5 | GND | Signal Ground |
| Data Terminal Ready | DTR | 4 | → | 6 | DSR | Data Set Ready |
| Data Set Ready | DSR | 6 | ← | 4 | DTR | Data Terminal Ready |

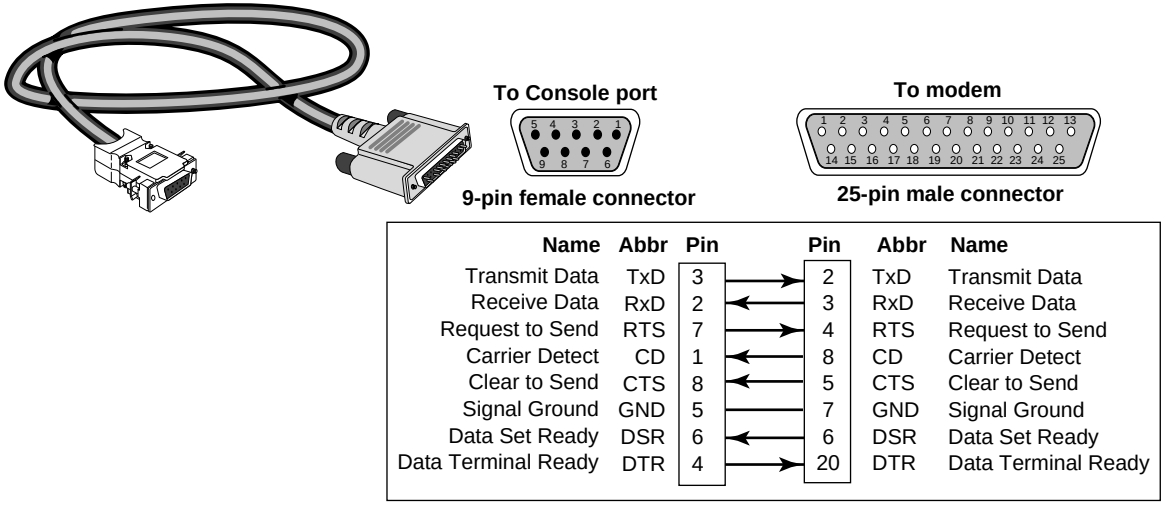
**Terminal Cable** Figure 22 shows the pinouts for a 9-pin female to 25-pin null modem-type cable.

**Figure 22** 9-pin to 25-pin Terminal Cable (Null Modem-Type)




**Modem Cable** Figure 23 shows the pinouts for a 9-pin female to 25-pin male straight-through-type cable.

**Figure 23** 9-pin to 25-pin Modem Cable (Straight-Through-Type)

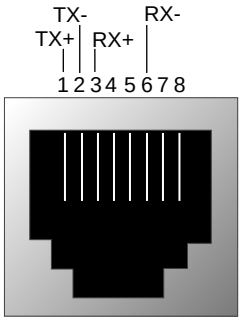


## LAN Connector and Cables

The two Ethernet connectors, labeled LAN 1 and LAN 2, can be cabled using either 10BASE-T or 100BASE-TX cabling.

The following figure shows the pinouts of the LAN 1 and LAN 2 connectors (RJ-45). The connector bodies connect the cable shield to chassis ground.

**Figure 24** Ethernet Connector




**RJ-45 female (shielded)**

### 10BASE-T Cabling

Table 14 lists supported 10BASE-T cable types and emissions classes.

**Table 14** 10BASE-T Cable Types and Emissions Compliance

| | | Emissions Compliance* | |
|---|---|---|---|
| **Cable Type** | | **FCC and VCCI Class A** | **EN55022 Class B** |
| **UTP**† | 100 ohm: | | |
| | Category 3 | yes | no |
| | Category 4 | yes | no |
| | Category 5 | yes | no |
| **Shielded TP**† | 100 ohm: | | |
| | Category 3 | yes | yes |
| | Category 4 | yes | yes |
| | Category 5 | yes | yes |

* Shielding of all cable types should be terminated 360 degrees at the cable plug.

† All UTP compliance testing was accomplished using cables built with Stewart Connector Co. connector, part number 940 SP-36-08-08.

### Cabling Standards

Cabling should be installed in accordance with the following standards:

- EIA/TIA-568 – Commercial building telecommunications wiring standard
- TSB-36 – Additional cable specifications for unshielded twisted pair cables
- IBM cabling guidelines

## 100BASE-TX Cabling

Table 15 lists supported 100BASE-TX cable types and emissions classes.

**Table 15** Cable Support and Emissions Compliance

| | | Emissions Compliance* | |
|---|---|---|---|
| **Cable Type** | **Connectors** | **FCC Class A VCCI Class A** | **EN55022 Class B VDE Class B** |
| Category 5 UTP | Category 5 RJ-45 (including jacks) | Yes | No |
| Category 5 shielded UTP | Category 5 RJ-45 (including jacks) | Yes | Yes |

* Shielding of all cable types should be terminated 360º at the cable plug.

The three types of Fast Ethernet interfaces are:

- **TX** — Runs over Category 5 UTP and Category 5 shielded UTP.
- **FX** — Runs over fiber. FX does **not** connect to the PathBuilder switch, but you can use FX in your network between appropriate devices.
- **T4** — Runs over Category 3 or better UTP or shielded UTP. T4 does **not** connect to the PathBuilder switch, but you can use T4 in your network between appropriate devices.

Follow the steps in the next section to design a valid Fast Ethernet network.

### Creating a Valid Network

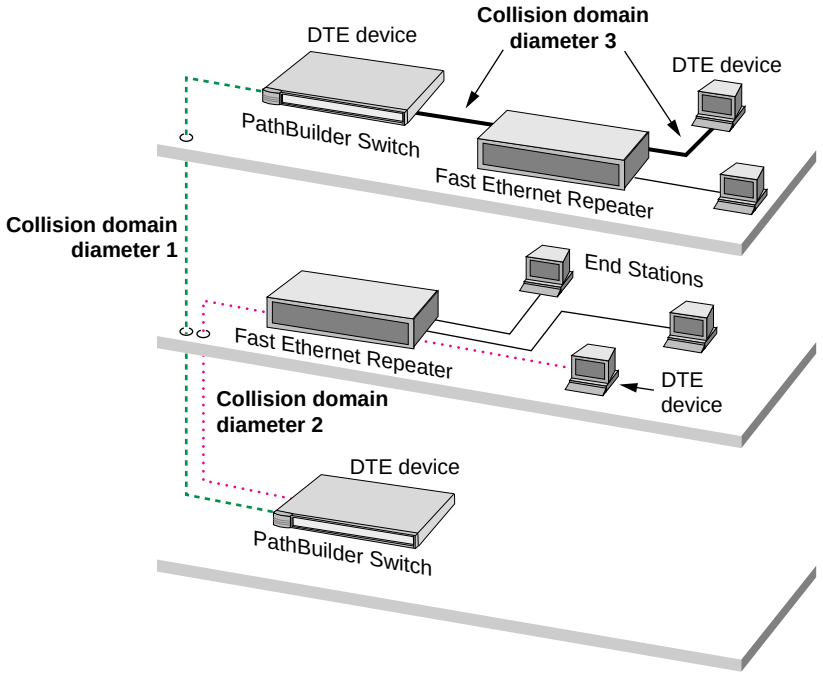
A Fast Ethernet network consists of *collision domain diameters* formed by cabling and/or repeaters between two DTE devices. A *DTE device* is a bridge/router, switch, or end station that contains a media access controller (MAC). Repeaters usually do not contain a MAC.

To create a valid collision domain diameter, you must adhere to the following maximum cable span lengths along with the collision domain diameter guidelines in Table 15:

- **UTP (running TX or T4)** — Maximum cable span length is ≤100 m.
- **Fiber (running FX)** — Maximum cable span length is ≤412 m.

Figure 25 shows examples of collision domain diameters.

**Figure 25** Collision Domain Diameter Examples




To determine a valid collision domain diameter, follow these steps:

1. Determine which interfaces will be used: TX, FX, or T4.
2. Add up the combined length of all cabling to be used.
3. Determine which class of repeaters, if any, are used in the collision domain diameter.
4. Determine the maximum cable length by referring to Table 16, which contains cabling and repeater guidelines for three scenarios shown in Figure 26, Figure 27, and Figure 28.

For expanded guidelines, refer to the IEEE Standard 802.3.

**Figure 26** Collision Domain Diameter with No Repeater

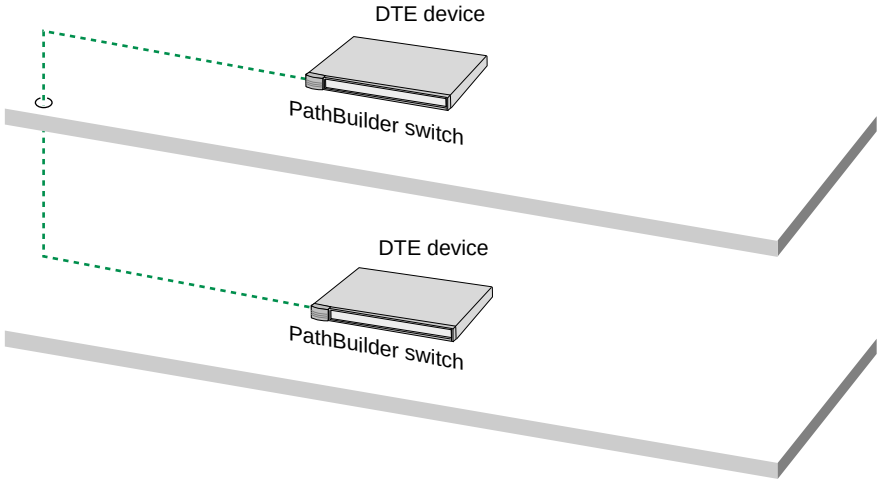



**Figure 27** Collision Domain Diameter with One Repeater

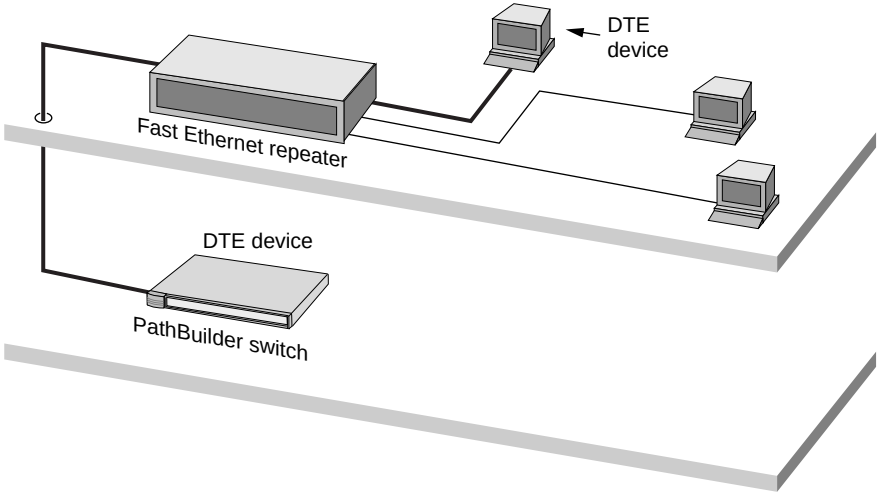


**Figure 28** Collision Domain Diameter with Two Repeaters

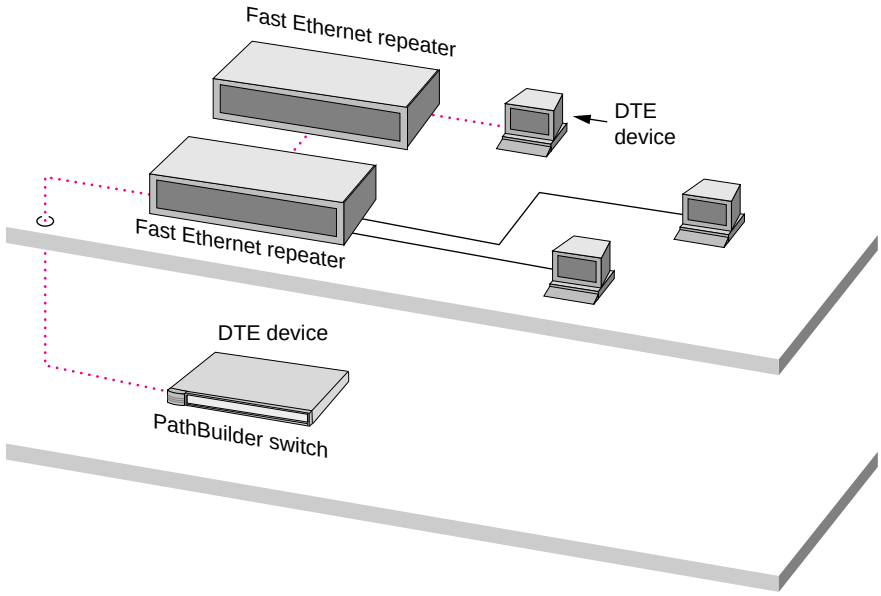



**Table 16** Maximum Cable Length in Example Collision Domain Diameters

| | **Maximum Combined Cable Length, by Interface** | | | |
|---|---|---|---|---|
| **Scenario** | **TX and/or T4** | **FX Only** | **FX & TX** | **FX & T4** |
| No Repeaters (see Figure 26) | **100 m** | **412 m** | not applicable | not applicable |
| One Class 1 repeater* (see Figure 27) | **200 m** — 100 m *max.* on each side of the repeater | **272 m** | **260.8 m**<br>100 m *max.* TX<br>Remaining length of FX | **231 m**<br>100 m *max.* T4<br>Remaining length of FX |
| One Class 2 repeater† (see Figure 27) | **200 m** — 100 m *max*. on each side of the repeater | **320 m** | **308.8 m**<br>100 m *max.* TX<br>Remaining length of FX | **304 m**‡<br>100 m *max.* T4<br>Remaining length of FX |
| Two Class 2 repeaters (see Figure 28) | **205 m** — 100 m *max*. per cable span | **228 m** | **216.2 m**<br>105 m *max.* total TX, 100 m *max.* per TX cable span<br>Remaining length of FX | **263.3 m**‡<br>105 m *max.* total T4, 100 m *max.* per T4 cable span<br>Remaining length of FX |

* A high-delay repeater as specified in IEEE 802.3 standards. A Class 1 repeater usually connects dissimilar media, for instance, UTP to fiber.

† A low-delay repeater as specified in IEEE 802.3 standards. A Class 2 repeater usually connects similar media, for instance, UTP to UTP.

‡ This scenario is unlikely, because Class 2 repeaters do not usually connect FX to T4.

## Flex-WAN Serial Connectors and Serial Cables

The Flex-WAN serial connectors on the switch can be connected to DTE and DCE devices with the following interfaces:

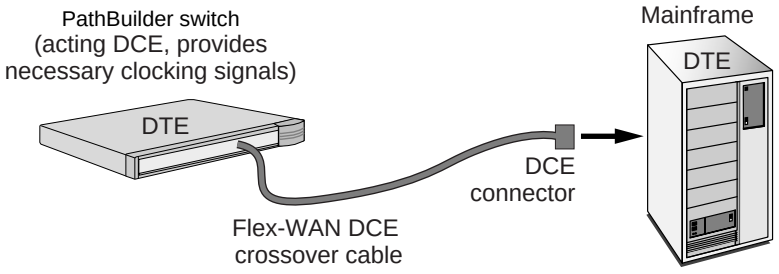
- RS-232
- V.35
- X.21
- RS-449
- RS-530 (DCE only)

DTEs include mainframes and automatic teller machines. DCEs include modems and CSU/DSUs.

A DCE must always connect to a DTE, and vice versa. If you need to connect a DTE to a DTE, or a DCE to a DCE, you can use a crossover cable between the two devices.

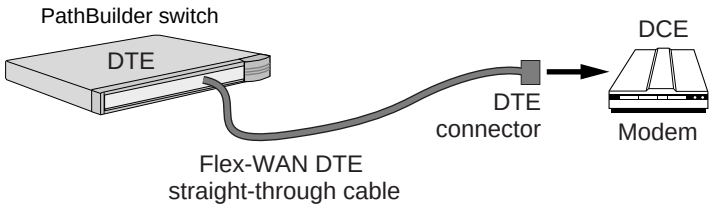
For example, a PathBuilder switch is a DTE. To connect the switch to another DTE, such as a mainframe, use a crossover Flex-WAN DCE cable. The DCE cable has a DCE connector on the end that connects to the mainframe (see Figure 29).

**Figure 29** Connecting the Switch to a DTE Using a DCE Cable



To connect the switch to a DCE, such as a modem, use a straight-through Flex-WAN DTE cable. The DTE cable has a DTE connector on the end that connects to the modem (see Figure 30).

**Figure 30** Connecting the Switch to a DCE Using a DTE Cable




Flex-WAN cables can be purchased from 3Com. Table 17 lists each Flex-WAN cable and part number. Cable pinouts are provided in the following sections.

**Table 17** Flex-WAN Cables

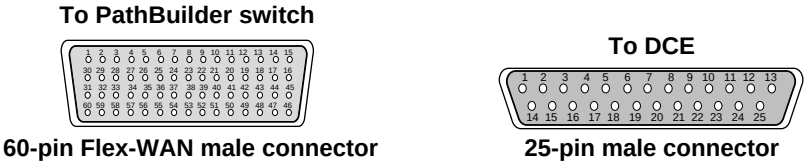
| Cable Length | Cable Type | Part Number | Pinouts |
|---|---|---|---|
| **4 ft.** | **RS-232 DTE** (straight-through cable to connect to a DCE) | 3C89002 | page 93 |
| | **RS-232 DCE** (crossover cable to connect to a DTE) | 3C89004 | page 94 |
| | **V.35 DTE** (straight-through cable to connect to a DCE) | 3C89006 | page 95 |
| | **V.35 DCE** (crossover cable to connect to a DTE) | 3C89008 | page 96 |
| | **X.21 DTE** (straight-through cable to connect to a DCE) | 3C89010 | page 97 |
| | **X.21 DCE** (crossover cable to connect to a DTE) | 3C890012 | page 98 |
| | **RS-449 DTE** (straight-through cable to connect to a DCE) | 3C890014 | page 99 |
| | **RS-449 DCE** (crossover cable to connect to a DTE) | 3C890016 | page 100 |
| | **RS-530 DTE** (straight-through cable to connect to a DCE) | 3C890018 | page 100 |
| | **V.35 extended shroud DTE** (straight-through cable to connect to a DCE)* | 3C890020 | page 95 |
| | **V.35 extended shroud DCE** (crossover cable to connect to a DTE)* | 3C89022 | page 96 |
| **10 ft.** | **RS-232 DTE** (straight-through cable to connect to a DCE) | 3C89001 | page 93 |
| | **RS-232 DCE** (crossover cable to connect to a DTE) | 3C89003 | page 94 |
| | **V.35 DTE** (straight-through cable to connect to a DCE) | 3C89005 | page 95 |
| | **V.35 DCE** (crossover cable to connect to a DTE) | 3C89007 | page 96 |
| | **X.21 DTE** (straight-through cable to connect to a DCE) | 3C89009 | page 97 |
| | **X.21 DCE** (crossover cable to connect to a DTE) | 3C890011 | page 98 |
| | **RS-449 DTE** (straight-through cable to connect to a DCE) | 3C890013 | page 99 |
| | **RS-449 DCE** (crossover cable to connect to a DTE) | 3C890015 | page 100 |
| | **RS-530 DTE** (straight-through cable to connect to a DCE) | 3C890017 | page 100 |
| | **V.35 extended shroud DTE** (straight-through cable to connect to a DCE)* | 3C890019 | page 95 |
| | **V.35 extended shroud DCE** (crossover cable to connect to a DTE)* | 3C890021 | page 96 |

* The V.35 extended shroud cable is required for some equipment, particularly IBM legacy equipment.

## RS-232 DTE Cable Pinouts

This cable connects the switch to an RS-232 DCE.

**Figure 31** Flex-WAN and RS-232 DTE Connectors




**60-pin Flex-WAN male connector** **25-pin male connector**

**Table 18** RS-232 DTE Cable Pinouts

| **Flex-WAN Connector** | | | **RS-232 DTE Connector** | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair*** |
| DCD/LL | 33 | ← | 8 | DCD | 1 |
| DSR/DTR | 34 | ← | 6 | DSR | 2 |
| CTS/RTS | 35 | ← | 5 | CTS | 3 |
| RxD/TxD | 36 | ← | 3 | RxD | 4 |
| TxC/Nil | 37 | ← | 15 | TxC | 5 |
| RxC/TxCE | 38 | ← | 17 | RxC | 6 |
| TxCE/TxC | 39 | → | 24 | TxCE | 7 |
| TxD/RxD | 41 | → | 2 | TxD | 8 |
| RTS/CTS | 42 | → | 4 | RTS | 9 |
| DTR/DSR | 43 | → | 20 | DTR | 10 |
| LL/DCD | 44 | → | 18 | LTST | 11 |
| Circuit Ground | 45 | - | 7 | Circuit Ground | 12 |
| Shield Ground | 46 | Cable Shield | 1 | Shield Ground | - |
| Shorting Group 1 | 50<br>51<br>52 | - | - | - | - |

* Unused twisted wires of a twisted pair should be connected to Shield Ground. In this cable this is one wire of each of the twisted pairs 1 to 12.

## RS-232 DCE Cable Pinouts

This cable connects the switch to an RS-232 DTE.

**Figure 32** Flex-WAN and RS-232 DCE Connectors


**60-pin Flex-WAN male connector** **25-pin female connector**

**Table 19** RS-232 DCE Cable Pinouts

| Flex-WAN Connector | | | RS-232 DCE Connector | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair*** |
| DCD/LL | 33 | ← | 18 | LTST | 1 |
| DSR/DTR | 34 | ← | 20 | DTR | 2 |
| CTS/RTS | 35 | ← | 4 | RTS | 3 |
| RxD/TxD | 36 | ← | 2 | TxD | 4 |
| RxC/TxCE | 38 | ← | 24 | TxCE | 5 |
| TxCE/TxC | 39 | → | 15 | TxC | 6 |
| Nil/RxC | 40 | → | 17 | RxC | 7 |
| TxD/RxD | 41 | → | 3 | RxD | 8 |
| RTS/CTS | 42 | → | 5 | CTS | 9 |
| DTR/DSR | 43 | → | 6 | DSR | 10 |
| LL/DCD | 44 | → | 8 | DCD | 11 |
| Circuit Ground | 45 | - | 7 | Circuit Ground | 12 |
| Shield Ground | 46 | Cable Shield | 1 | Shield Ground | - |
| Shorting Group 1 | 50 | - | - | - | - |
| | 51 | | | | |

* Unused twisted wires of a twisted pair should be connected to Shield Ground. In this cable this is one wire of each of the twisted pairs 1 to 12.

## V.35 DTE Cable Pinouts

This cable connects the switch to a V.35 DCE.

**Figure 33** Flex-WAN and V.35 DTE Connectors

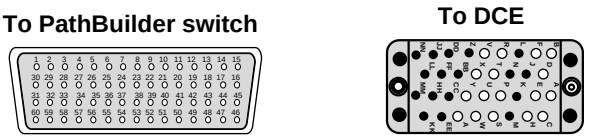



**Table 20** V.35 DTE Cable Pinouts

| Flex-WAN Connector | | | V.35 DTE Connector | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair*** |
| SD/RD- | 17 | → | Q | SD- | 1 |
| SD/RD+ | 18 | → | P | SD- | |
| SCTE/SCT- | 19 | → | W | SCTE- | 2 |
| SCTE/SCT+ | 20 | → | U | SCTE+ | |
| TxC/RxC- | 23 | ← | AA | SCT- | 3 |
| TxC/RxC+ | 24 | ← | Y | SCT+ | |
| RxC/TxCE- | 25 | ← | X | SCR- | 4 |
| RxC/TxCE+ | 26 | ← | V | SCR+ | |
| RxD/TxD- | 27 | ← | T | RD- | 5 |
| RxD/TxD+ | 28 | ← | R | RD+ | |
| DCD/LL | 33 | ← | F | RLSD | 6 |
| DSR/DTR | 34 | ← | E | DSR | 7 |
| CTS/RTS | 35 | ← | D | CTS | 8 |
| RTS/CTS | 42 | → | C | RTS | 9 |
| DTR/DSR | 43 | → | H | DTR | 10 |
| LL/DCD | 44 | → | K | LT | 11 |
| Circuit Ground | 45 | - | B | Ground | 12 |
| Shield Ground | 46 | Cable Shield | A | Shield Ground | - |
| Shorting Group 1 | 48<br>49 | - | - | - | - |
| Shorting Group 2 | 50<br>51<br>52 | - | - | - | - |
| Shorting Group 3 | 53<br>54<br>55<br>56 | - | - | - | - |

* Unused twisted wires of a twisted pair should be connected to Shield Ground. In this cable this is one wire of each of the twisted pairs 6 to 12.

## V.35 DCE Cable Pinouts

This cable connects the switch to a V.35 DTE.

**Figure 34** Flex-WAN and V.35 DCE Connectors


**Table 21** V.35 DCE Cable Pinouts

| Flex-WAN Connector | | | V.35 DCE Connector | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair*** |
| SD/RD- | 17 | → | T | RD- | 1 |
| SD/RD+ | 18 | → | R | RS- | |
| SCTE/SCT- | 19 | → | AA | SCT- | 2 |
| SCTE/SCT+ | 20 | → | Y | SCT+ | |
| Nil/SCR- | 21 | → | X | SCR- | 3 |
| Nil/SCR+ | 22 | → | V | SCR+ | |
| RxC/TxCE- | 25 | ← | W | SCTE- | 4 |
| RxC/TxCE+ | 26 | ← | U | SCTE+ | |
| RxD/TxD- | 27 | ← | S | SD- | 5 |
| RxD/TxD+ | 28 | ← | P | SD+ | |
| DCD/LL | 33 | ← | K | LT | 6 |
| DSR/DTR | 34 | ← | H | DTR | 7 |
| CTS/RTS | 35 | ← | D | RTS | 8 |
| RTS/CTS | 42 | → | C | CTS | 9 |
| DTR/DSR | 43 | → | E | DSR | 10 |
| LL/DCD | 44 | → | F | RLSD | 11 |
| Circuit Ground | 45 | - | B | Ground | 12 |
| Shield Ground | 46 | Cable Shield | A | Shield Ground | - |
| Shorting Group 1 | 48<br>49 | - | - | - | - |
| Shorting Group 2 | 50<br>51 | - | - | - | - |
| Shorting Group 3 | 53<br>54<br>55<br>56 | - | - | - | - |

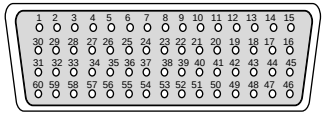
* Unused twisted wires of a twisted pair should be connected to Shield Ground. In this cable this is one wire of each of the twisted pairs 6 to 12.

## X.21 DTE Cable Pinouts

This cable connects the switch to an X.21 DCE.

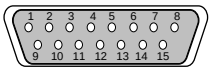
**Figure 35** Flex-WAN and X.21 DTE Connectors

**To PathBuilder switch**




**60-pin Flex-WAN male connector**

**To DCE**




**15-pin male connector**

**Table 22** X.21 DTE Cable Pinouts

| Flex-WAN Connector | | | X.21 DTE Connector | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair*** |
| CTS/RTS+ | 1 | ← | 5 | Indicate+ | 1 |
| CTS/RTS- | 2 | ← | 12 | Indicate- | |
| RTS/CTS+ | 9 | → | 3 | Control+ | 2 |
| RTS/CTS- | 10 | → | 10 | Control- | |
| TxD/RxD+ | 11 | → | 2 | Transmit+ | 3 |
| TxD/RxD- | 12 | → | 9 | Transmit- | |
| Circuit Ground | 15 | - | 8 | Control GND | 4 |
| RxC/TxCE- | 25 | ← | 13 | Timing- | 5 |
| RxC/TxCE+ | 26 | ← | 6 | Timing+ | |
| RxD/TxD- | 27 | ← | 11 | Receive- | 6 |
| RxD/TxD+ | 28 | ← | 4 | Receive+ | |
| Shield Ground | 46 | Cable Shield | 1 | Shield Ground | - |
| Shorting Group 1 | 47<br>48 | - | - | - | - |
| Shorting Group 2 | 51<br>52 | - | - | - | - |

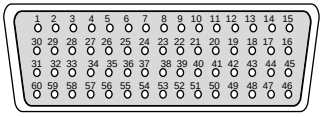
* Unused twisted wires of a twisted pair should be connected to Shield Ground. In this cable this is one wire of twisted pair 4.

## X.21 DCE Cable Pinouts

This cable connects the switch to an X.21 DTE.

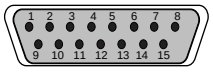
**Figure 36** Flex-WAN and X.21 DCE Connectors

**To PathBuilder switch**




**60-pin Flex-WAN male connector**

**To DTE**




**15-pin female connector**

**Table 23** X.21 DCE Cable Pinouts

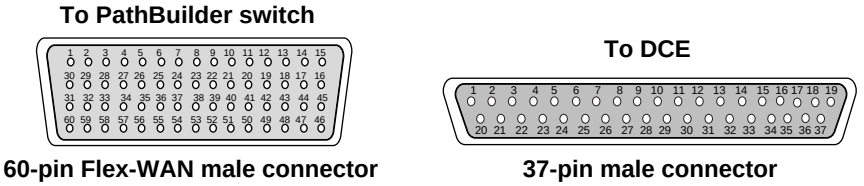
| Flex-WAN Connector | | | X.21 DCE Connector | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair*** |
| CTS/RTS+ | 1 | ← | 1 | Control+ | 1 |
| CTS/RTS- | 2 | ← | 2 | Control- | |
| RTS/CTS+ | 9 | → | 5 | Indicate+ | 2 |
| RTS/CTS- | 10 | → | 12 | Indicate- | |
| TxD/RxD+ | 11 | → | 4 | Receive+ | 3 |
| TxD/RxD- | 12 | → | 11 | Receive- | |
| Circuit Ground | 15 | - | 8 | Control GND | 4 |
| TxC/RxC- | 23 | ← | 13 | Timing- | 5 |
| TxC/RxC+ | 24 | ← | 6 | Timing+ | |
| RxD/TxD- | 27 | ← | 9 | Transmit- | 6 |
| RxD/TxD+ | 28 | ← | 2 | Transmit+ | |
| Shield Ground | 46 | Cable Shield | 1 | Shield Ground | - |
| Shorting Group 1 | 47<br>48 | - | - | - | - |

* Unused twisted wires of a twisted pair should be connected to Shield Ground. In this cable this is one wire of twisted pair 4.

## RS-449 DTE Cable Pinouts

This cable connects the switch to an RS-449 DCE.

**Figure 37** Flex-WAN and RS-449 DTE Connectors




**60-pin Flex-WAN male connector** **37-pin male connector**

**Table 24** RS-449 DTE Cable Pinouts

| **Flex-WAN Connector** | | | **RS-449 DTE Connector** | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair** |
| CTS/RTS+ | 1 | ← | 9 | CS+ | 1 |
| CTS/RTS- | 2 | ← | 27 | CS- | |
| DSR/DTR+ | 3 | ← | 11 | DM+ | 2 |
| DSR/DTR- | 4 | ← | 29 | DM- | |
| DCD/DCD+ | 5 | ← | 13 | RR+ | 3 |
| DCD/DCD- | 6 | ← | 31 | RR- | |
| DTR/DSR+ | 7 | → | 12 | TR+ | 4 |
| DTR/DSR- | 8 | → | 30 | TR- | |
| RTS/CTS+ | 9 | → | 7 | RS+ | 5 |
| RTS/CTS- | 10 | → | 25 | RS- | |
| TxD/RxD+ | 11 | → | 4 | SD+ | 6 |
| TxD/RxD- | 12 | → | 22 | SD- | |
| TxCE/TxC+ | 13 | → | 17 | TT+ | 7 |
| TxCE/TxC- | 14 | → | 35 | TT- | |
| Circuit Ground | 15 | - | 19 | SGRC | 8 |
| Circuit Ground | 16 | - | 20 | SGRC | |
| TxC/RxC- | 23 | ← | 23 | ST- | 9 |
| TxC/RxC+ | 24 | ← | 5 | ST+ | |
| RxC/TxCE- | 25 | ← | 26 | RT- | 10 |
| RxC/TxCE+ | 26 | ← | 8 | RT+ | |
| RxD/TxD- | 27 | ← | 24 | RD- | 11 |
| RxD/TxD+ | 28 | ← | 6 | RD+ | |
| LL/DCD | 44 | → | 10 | LLSC | 12 |

**Table 24** RS-449 DTE Cable Pinouts (continued)

| Flex-WAN Connector | | | RS-449 DTE Connector | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair** |
| Circuit Ground | 45 | – | 37 | Circuit Ground | |
| Shield Ground | 46 | Cable Shield | 1 | Shield Ground | - |
| Shorting Group 1 | 48<br>49 | - | - | - | - |
| Shorting Group 2 | 51<br>52 | | | | - |

## RS-449 DCE Cable Pinouts

This cable connects the switch to an RS-449 DTE.

**Figure 38** Flex-WAN and RS-449 DCE Connectors

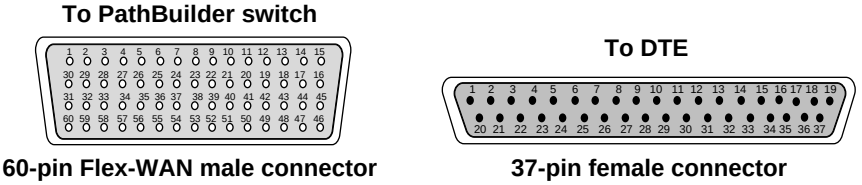



**Table 25** RS-449 DCE Cable Pinouts

| Flex-WAN Connector | | | RS-449 DCE Connector | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair** |
| CTS/RTS+ | 1 | ← | 7 | RS+ | 1 |
| CTS/RTS- | 2 | ← | 25 | RS- | |
| DSR/DTR+ | 3 | ← | 12 | TR+ | 2 |
| DSR/DTR- | 4 | ← | 30 | TR- | |
| DCD/DCD+ | 5 | ← | 13 | RR+ | 3 |
| DCD/DCD- | 6 | ← | 31 | RR- | |
| DTR/DSR+ | 7 | → | 11 | DM+ | 4 |
| DTR/DSR- | 8 | → | 29 | DM- | |
| RTS/CTS+ | 9 | → | 9 | CS+ | 5 |
| RTS/CTS- | 10 | → | 27 | CS- | |
| TxD/RxD+ | 11 | → | 6 | RD+ | 6 |
| TxD/RxD- | 12 | → | 24 | RD- | |
| TxCE/TxC+ | 13 | → | 5 | ST+ | 7 |

**Table 25** RS-449 DCE Cable Pinouts (continued)

| **Flex-WAN Connector** | | | **RS-449 DCE Connector** | | |
|---|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** | **Twisted Pair** |
| TxCE/TxC- | 14 | → | 23 | ST- | |
| Circuit Ground | 15 | - | 19 | SGRC | 8 |
| Circuit Ground | 16 | - | 20 | SGRC | |
| TxC/RxC- | 23 | ← | 26 | RT- | 9 |
| TxC/RxC+ | 24 | ← | 8 | RT+ | |
| RxC/TxCE- | 25 | ← | 35 | TT- | 10 |
| RxC/TxCE+ | 26 | ← | 17 | TT+ | |
| RxD/TxD- | 27 | ← | 22 | SD- | 11 |
| RxD/TxD+ | 28 | ← | 4 | SD+ | |
| Nil/LL | 29 | ← | 10 | LLSC | 12 |
| Circuit Ground | 30 | - | 37 | Ground | |
| Shield Ground | 46 | Cable Shield | 1 | Shield Ground | - |
| Shorting Group 1 | 48<br>49 | - | - | - | - |

## RS-530 DTE Cable Pinouts

This cable connects the switch to an RS-530 DCE.

**Figure 39** Flex-WAN and RS-530 DTE Connectors

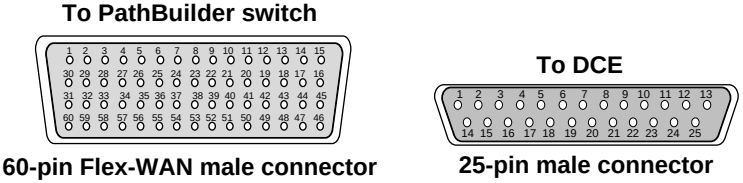



**Table 26** RS-530 DTE Cable Pinouts

| Flex-WAN Connector | | | RS-530 DTE Connector | |
|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** |
| CTS/RTS+ | 1 | ← | 5 | CTS+ |
| CTS/RTS- | 2 | ← | 13 | CTS- |
| DSR/DTR+ | 3 | ← | 6 | DSR+ |
| DSR/DTR- | 4 | ← | 22 | DSR- |
| DCD/DCD+ | 5 | ← | 8 | DCD+ |
| DCD/DCD- | 5 | ← | 10 | DCD- |
| DTR/DSR+ | 7 | → | 20 | DTR+ |
| DTR/DSR- | 8 | → | 23 | DTR- |
| RTS/CTS+ | 9 | → | 4 | RTS+ |
| RTS/CTS- | 10 | → | 19 | RTS- |
| TxD/RxD+ | 11 | → | 2 | TxD+ |
| TxD/RxD- | 12 | → | 14 | TxD- |
| TxCE/TxC+ | 13 | → | 24 | TxCE+ |
| TxCE/TxC- | 14 | → | 11 | TxCE- |
| TxC/RxC- | 23 | ← | 12 | TxC- |
| TxC/RxC+ | 24 | ← | 15 | TxC+ |
| RxC/TxCE- | 25 | ← | 9 | RxC- |
| RxC/TxCE+ | 26 | ← | 17 | RxC+ |
| RxD/TxD- | 27 | ← | 16 | RxD- |
| RxD/TxD+ | 28 | ← | 3 | RxD+ |
| LL/DCD | 44 | ← | 18 | LL |
| Circuit Ground | 45 | - | 7 | Circuit Ground |

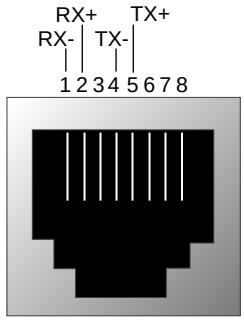
**Table 26** RS-530 DTE Cable Pinouts (continued)

| Flex-WAN Connector | | | RS-530 DTE Connector | |
|---|---|---|---|---|
| **Signal** | **Pin** | **Direction** | **Pin** | **Signal** |
| Shield Ground | 46 | Cable Shield | 1 | Shield Ground |
| Shorting Group 1 | 47<br>48<br>49 | - | - | - |

## Ultra-WAN CSU/DSU Connectors and CSU/DSU Cables

The following figure shows the pinout of each Ultra-WAN connector.

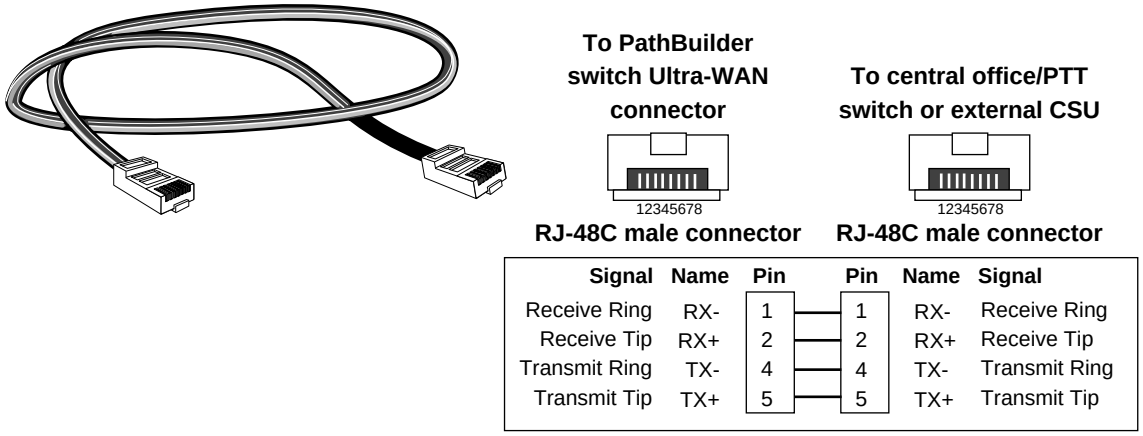
**Figure 40** Ultra-WAN Connector




**RJ-48C female (shielded)**

You can use a RJ-48C cable to connect the PathBuilder Ultra-WAN interface to a central office/PTT switch or to an external CSU.

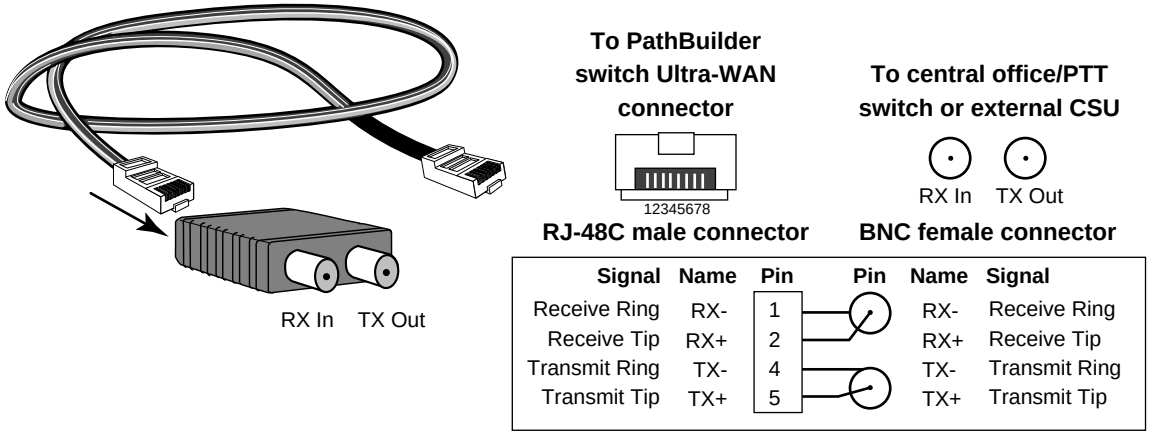
**Figure 41** Ultra-WAN CSU/DSU Connector and RJ-48C Cables




## Ultra-WAN Connectors and Line Converters for 75 ohm Systems

For systems that require single-ended a 75 ohm coax cable interface and converter cable is available.

**Figure 42** 75 ohm coax cable interface and converter cable

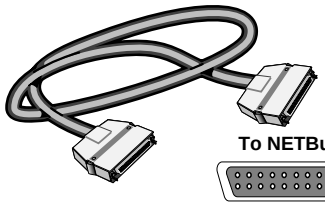



*Patton User Guide may provide different pinouts based on BNC connector sex.*

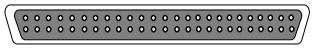
## High-speed Serial Interface (HSSI) Cables

You can use the WAN 1 and WAN 2 connectors and a HSSI cable to connect a PathBuilder switch to a CSU/DSU device.

**Figure 43** HSSI Cable

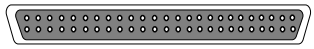


**To NETBuilder II HSSI module**



**50-pin male connector**

**To CSU/DSU**



**50-pin male connector**

| Signal | Name | Pin | | Pin | Name | Signal |
|---|---|---|---|---|---|---|
| Signal Ground | SG | 26, 1 | — | 1, 26 | SG | Signal Ground |
| Receive Signal Element Timing | RT | 27, 2 | — | 2, 27 | RT | Receive Signal Element Timing |
| DCE Available | CA | 28, 3 | — | 3, 28 | CA | DCE Available |
| Receive Data | RD | 29, 4 | — | 4, 29 | RD | Receive Data |
| Looback Request | LR | 30, 5 | — | 5, 30 | LR | Looback Request |
| Transmit Signal Element TIming | TT | 31, 6 | — | 6, 31 | TT | Transmit Signal Element Timing |
| Signal Ground | SG | 32, 7 | — | 7, 32 | SG | Signal Ground |
| DTE Available | TA | 33, 8 | — | 8, 33 | TA | DTE Available |
| Terminal Timing | TT | 34, 9 | — | 9, 34 | TT | Terminal Timing |
| Loopback Circuit A | LA | 35, 10 | — | 10, 35 | LA | Loopback Circuit A |
| Send Data | SD | 36, 11 | — | 11, 36 | SD | Send Data |
| Loopback Circuit B | LB | 37, 12 | — | 12, 37 | LB | Loopback Circuit B |
| Signal Ground | SG | 38, 13 | — | 13, 38 | SG | Signal Ground |
| 5 ancillary to DCE | | 39, 14 | — | 14, 39 | | 5 ancillary to DCE |
| | SG | 40, 15 | — | 15, 40 | SG | |
| | | 41, 16 | — | 16, 41 | | |
| | SG | 42, 17 | — | 17, 42 | SG | |
| | | 43, 18 | — | 18, 43 | | |
| Signal Ground | | 44, 19 | — | 19, 44 | | Signal Ground |
| 5 ancillary to DCE | | 45, 20 | — | 20, 45 | | 5 ancillary to DCE |
| | | 46, 21 | — | 21, 46 | | |
| | | 47, 22 | — | 22, 47 | | |
| | | 48, 23 | — | 23, 48 | | |
| | | 49, 24 | — | 24, 49 | | |
| Signal Ground | | 50, 25 | — | 25, 50 | | Signal Ground |

# D

# CUSTOMIZING YOUR SOFTWARE

This appendix provides information and procedures to help you customize your software.

## Naming Paths and Ports

To assign a name to your path and port, use:

```
SETDefault !<path> -PATH NAme = "<string>"
SETDefault !<port> -PORT NAme = "<string>"
```

For example, to assign the name Floor_1 to path 1 and the name Bldg_1 to port 1, enter:

```
SETDefault !1 -PATH NAme = "Floor_1"
SETDefault !1 -PORT NAme = "Bldg_1"
```

## Path and Port Naming Restrictions

The following restrictions exist for the -PATH and -PORT NAme parameter:

- The name string can contain a maximum of eight characters, the first of which must be alphabetic.
- No blank spaces are allowed in the name string. The only non-alphanumeric characters allowed are the asterisk (*), the underscore (_), the period (.), the dash (-), and the at sign (@).
- Names must be unique within their type. For example, a path name cannot be the same as an existing path name, but it can be the same as an existing port or virtual port name.
- Alphabetic characters are stored and displayed as entered. Names are not case-sensitive when compared on entry with previously entered names. For example, port2 and PORT2 are evaluated as the same name.

When you define the name parameter, these error messages may be returned:

```
Rejected name - Contains invalid character(s)
Rejected name - Null string not allowed
Rejected name - It is already in use
Rejected name - Must start with alphabetic character
```

## Working with Dial Number Lists

This section describes how to configure and customize your dial number list for dial-up lines.

### Adding a Phone Number

To allow your bridge/router to dial out, configure the dial number list using:

```
ADD !<portlist> -POrt DialNoList "<phone no>" [Baud = <1.2–16000>]
[Type = Modem | Bri | Sw56 | PPTP | Async ] [Pos = <1-xx>]
```

Enter this command for each phone number you want to add to the dial list. If you do not specify a position, the number will be added to the end of the list.

If you are using a dial pool, you may want to have several phone numbers specifying different types (modem, BRI, or Switched 56) or baud rates so if the first number fails on a 28.8 Kbps modem, for instance, the second number is used for a 64 Kbps ISDN line.

*Switched 56 operation is not supported on CSU/DSU ports. An external switched 56 device needs to be connected to the serial ports to support Switched 56 operation.*

You can use hyphens (-) in your phone number. For ISDN, the phone number includes a dial prefix, country code, and area code and possibly a subaddress. If you specify a subaddress, you must separate the phone number from the subaddress with a semicolon (;).

You can configure up to 16 phone numbers per port.

### Redialing When the Connection Fails

You can specify the number of times the software attempts to redial the remote system if the call attempt fails using:

```
SETDefault !<port> -PORT DialRetryCount = <number> (0–255)
```

If the first dial attempt fails to bring the path up, the software tries the call again using the same phone number. The call attempts continue until the dial retry count is reached.

### Dialing the Same Phone Number Multiple Times

You can configure the dial number list to dial the same number repeatedly by adding multiple copies of the number. This step is required so that you can use multilink PPP. Add a different letter after each phone number to distinguish the duplicate entries by entering:

```
ADD !V1 -PORT DialNoList "123-4567"
```

```
ADD !V1 -PORT DialNoList "123-4567a"
ADD !V1 -PORT DialNoList "123-4567b"
```

The bridge/router dials 123-4567 three times.

### Positioning a Phone Number

To insert a phone number into a specific position in the dial number list, enter the Pos (Position) keyword with a nonzero number after the dial string.

For example, to insert a phone number for port 4 into position 2 of the dial number list that contains 10 phone numbers, enter:

```
ADD !4 -PORT DialNoList "510-555-7000" Pos = 2
```

The software inserts the new phone number into position 2. The phone number that was previously in position 2 is now in position 3. If the phone number already exists in the dial number list, it will be moved to position 2. You also can include the Baud and Type keywords in any order when inserting phone numbers into the dial number list.

### Editing an Existing Phone Number

You can change the position in the list, change the baud rate, and change the device type. To change anthing else you must delete and re-add the entry.

For example, if port 3 has already been assigned 612-345-3989 in position 2 with a baud rate of 64 kbps, you can change the baud rate by entering:

```
ADD !3 -PORT DialNoList "612-345-3989" Pos = 2 Baud = 14.4
```

Because the dial string is case-sensitive, make sure to match it exactly to successfully edit an existing string when characters other than numbers are used.

### Deleting a Phone Number

To remove a phone number from the dial number list, use:

```
DELete !<port> -PORT DialNoList "<phone no>"
```

The phone number is case-sensitive and must be matched exactly.

# E TROUBLESHOOTING

This appendix contains the following sections:

- Using the Monitor Utility
- Normal LED Meanings
- Error LED Meanings
- Performing Loopback Tests on the Flex-WAN Serial and Ultra-WAN CSU/DSU Interfaces
- Response to Loopback Assertions from Link Partner on Flex-WAN Serial and Ultra-WAN CSU/DSU Interfaces
- Performing T3/E3 Loopback Tests
- Performing a Memory Dump

## Using the Monitor Utility

If your PathBuilder switch is unable to boot from the software, you can attach a console to the console port and access the firmware monitor utility.

*If your operating system does not supply a TFTP or BootP server, you can use 3Com's. These servers are supplied with the Upgrade Management Utilities. See Upgrading Enterprise OS Software for information about installing and using these server applications.*

To access the monitor utility from the software, enter:

```
MONitor
```

***CAUTION:*** *The monitor utility stops the normal routing/switching operation of the PathBuilder switch, and you must reset the PathBuilder switch to exit the firmware.*

The following commands are available from the monitor utility:

### Boot

*Syntax* `BT [<filename> [<boot_drive:path>]]`

*Description* The BT command allows you to reboot or to override the default boot path configured in the firmware by the monitor or by the SysconF command in the software. If you enter a new boot drive or path, the firmware parameter is updated to reflect the new path.

If you do not enter a filename or a configuration file directory, the system attempts to boot using the boot.ppc file referenced by the boot directory in the primary boot source. If there is an error, a message is sent to the console and you are returned to the monitor utility.

Errors include:

- The file does not exist.
- The file has the wrong format.
- The file has a bad checksum.

### Configure Flash Load

*Syntax* `CL`

*Description* The CL command allows you to configure the following settings to identify a TFTP server for downloading a boot image:

```
1. Client
2. Server
3. Gateway
4. Subnet Mask
5. Boot Filename
6. Port Selection
7. Baud Rate
8. Duplex Mode
```

### Clear PID

*Syntax* `CP`

*Description* The CP command erases the Product ID (PID) except for the MAC address.

**CAUTION:** The CP command erases the PID except for the MAC address. You should only do this if advised by 3Com technical support.

### Display Files

*Syntax* `DF [<subdir>]`

*Description* The DF command displays information about files on a file system or in a specified directory. It also displays the available free space in the file system.

### Dump

*Syntax* `DU`

*Description* The DU command performs a memory dump to a TFTP server specified in the CL command. See "Performing a Memory Dump" later in this appendix to configure a memory dump in the software and to set up the TFTP server.

### Flash Load

*Syntax* `FL <Drive:path/><filename>`

*Description* The FL command formats the flash memory, uses TFTP to copy the image, SYS, and Web Link files from the location identified in by CL command to the flash drive.

***CAUTION:*** *The Flash Load command will reformat the a: drive. Back up all configuration files before issuing the Flash Load command or the content of these file will be lost during the reformatting operation.*

To restore the device to factory defaults, follow these steps:

1. Insert the software CD-ROM into the CD-ROM drive on the PC.
2. Configure the PC TFTP server to refer to the drive containing the software. For example, you could enter the following:

   **`E:/IMAGFE/PB/SW/CF/1121/SYS`**

3. Issue the FL command to retrieve the directory containing the software.

   The "SYS" file is loaded, which contains all the files required for complete restoration.

*If you do not have a PC or if the TFTP server will not access the CD-ROM drive, use the UpgradeLink install screen to copy the Enterprise OS software from the CD-ROM to your hard disk.*

When using Flash Load to recover a system, the image is always written to A:/primary/boot.ppc. If the system primary boot source config directory parameters were set to boot from another area, the BT command will fail because it will try to boot from the other area. Use the bt A:/primary/boot.ppc command to boot the system. Reset the boot pointers using the SF command. See Appendix F for more information.

### Help

*Syntax*

```
H
```

or

```
?
```

*Description* The Help command lists all available commands in the boot monitor along with syntax parameters.

### Repeat Last Command

*Syntax*

```
!
```

*Description* The ! command repeats the last command entered.

### Self Test

*Syntax*

```
ST
```

*Description* The ST command sets the self-test action to one of the following options:

```
1. Quick
2. Full
```

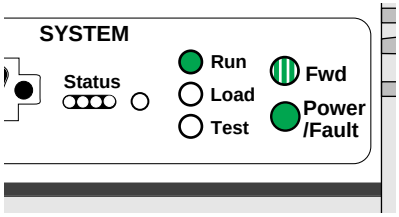
## Normal LED Meanings

This section describes the normal operation of the PathBuilder switch LEDs.

### System LEDs

The following figure describes the system LEDs.

Normal operation




**Power /Fault** Lights green when unit has power. Lights amber if there is a problem with power. When unlit, power to unit is off.

**Fwd** Flashes green each time a packet is forwarded between two ports.

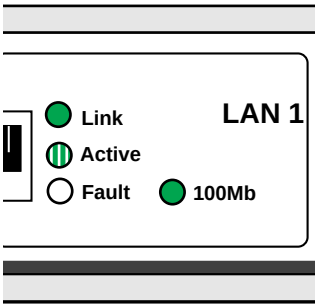
**Run** Lights green when the software has successfully loaded and is running.

**Load** Unlit in normal operation. Flashes green during startup to indicate system is loading software. Lights amber when there is a load problem.

**Test** Unlit in normal operation. Lights amber during startup to indicate system is running self-tests.

**Status** Provides additional status for the Run, Load, and Test LEDs.

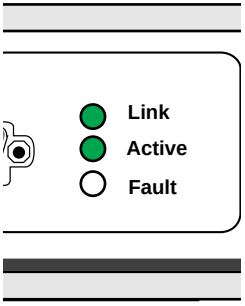
**LAN LEDs** The following figure describes the LAN LEDs.




Normal operation

| | |
|---|---|
| **Link** | Lights green when the path is up. |
| **Active** | Flashes green when a packet is detected on the LAN. |
| **Fault** | Lights amber when an error is detected or the self-test has failed. |
| **100Mb** | Lights green when 100BASE-TX Ethernet is in use. |

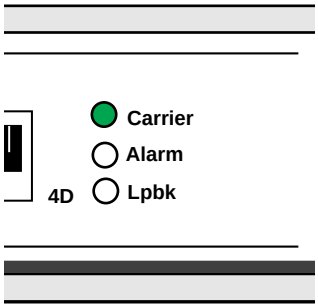
**Flex-WAN Serial LEDs** The following figure describes the Flex-WAN serial LEDs.




Normal operation

| | |
|---|---|
| **Link** | Lights green when the path is up. |
| **Active** | Lights green when there is a physical connection to a serial device such as a CSU/DSU or modem. |
| **Fault** | Unlit in normal operation. Lights amber if an error in the frames is detected. |

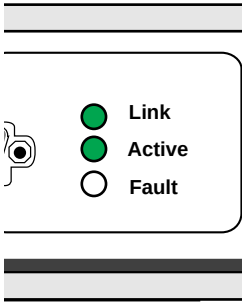
**Ultra-WAN CSU/DSU LEDs** The following figure describes the Ultra-WAN CSU/DSU LEDs.




Normal operation

| | | |
|---|---|---|
| **Carrier** | Lights green when frame synchronization to an E1 or T1 frame structure is achieved. |
| **Alarm** | Lights amber if an AIS, RAI, or FEBE condition exists. |
| **Lpbk** | Lights amber if a connector-level loopback is in progress. |

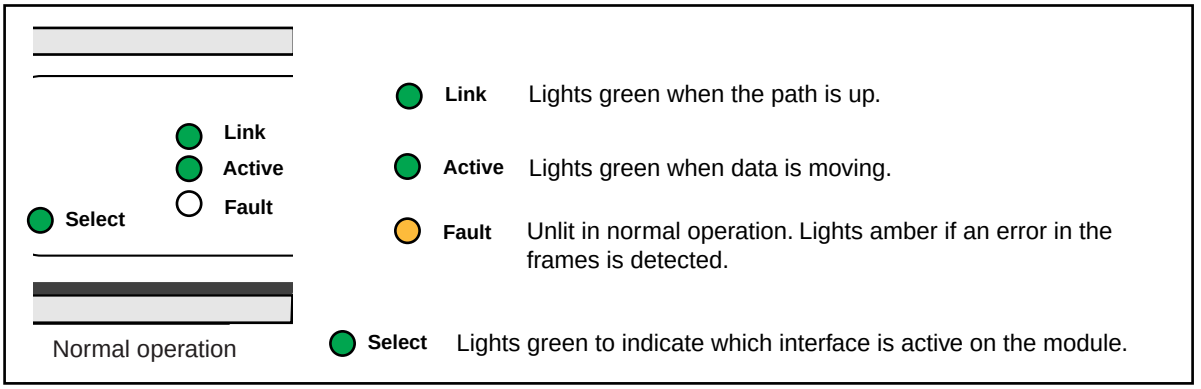
**T3/HSSI Serial LEDs** The following figure describes the T3/HSSI serial LEDs.




Normal operation

| | |
|---|---|
| **Link** | Lights green when the path is up. |
| **Active** | Lights green when there is a physical connection to a serial device such as a CSU/DSU or modem. |
| **Fault** | Unlit in normal operation. Lights amber if an error in the frames is detected. |

**ATM LEDs** The following figure describes the ATM LEDs.

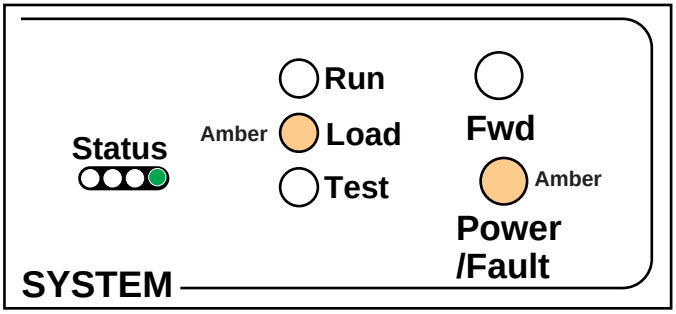



## Error LED Meanings

This section describes the error modes of the PathBuilder switch LEDs.

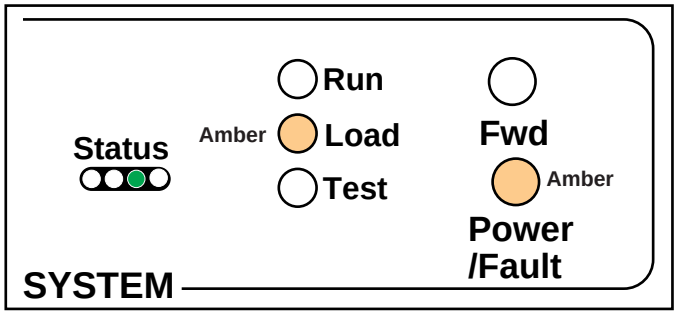
**Troubleshooting During the Load Phase**

If the Load and Power/Fault LEDs in the System area light amber, a problem occurred during the system software load phase. Compare your System LEDs with the following examples and follow the instructions for troubleshooting.



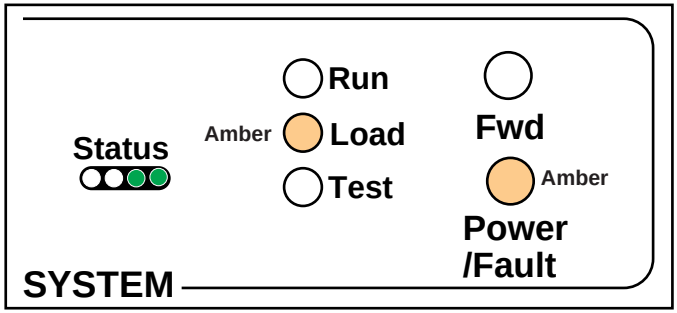

Meaning: The file system is empty.

Action: Reload the software. See Appendix F.




Meaning: Possible read-only memory corruption; cannot seek file.

Action: Reload the software. See Appendix F.




Meaning: The software image file has been deleted or the boot source and image names do not match.

Action: Follow these steps:

**1** At the monitor prompt, enter:

```
DF <path>
```

The default path is:

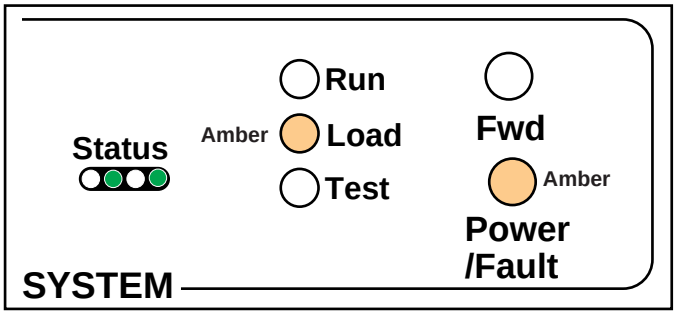
```
DF /primary
```

The image is called boot.ppc.

**2** If the image has been deleted, reload the software using Appendix F.

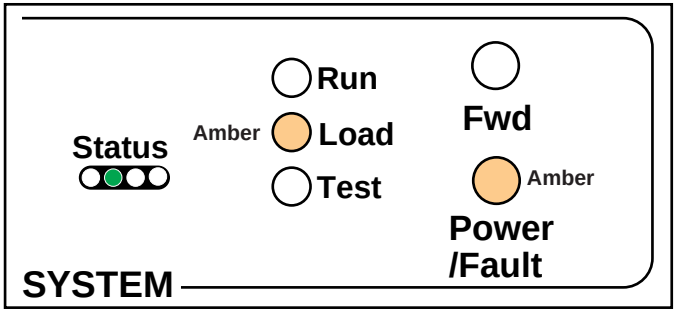
**3** If the image has a different name or is in a different directory, boot from the image using:

```
BT [<path>]<filename>
```



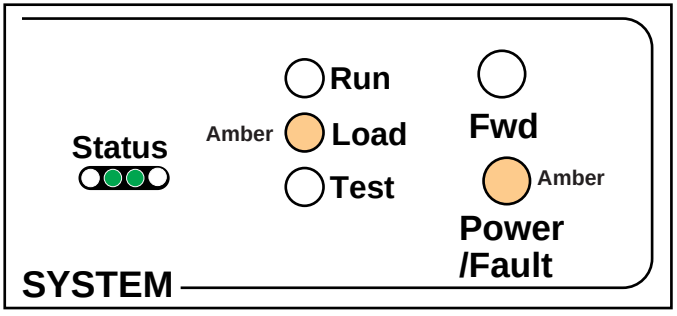

Meaning: File too large.

Action: Check to see if the file is larger than available memory. Turn the power off and then on again to retry the system software load. If the load is unsuccessful, contact your network supplier.



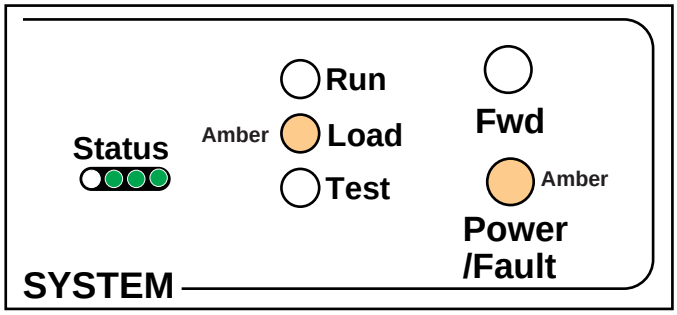

Meaning: File read or decompression error.

Action: Reload the software. See Appendix F.



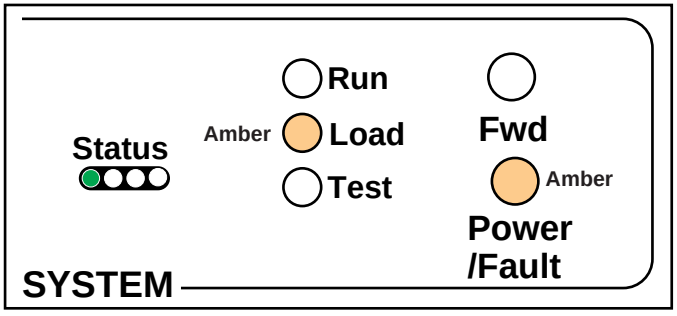

Meaning: File checksum error.

Action: Reload the software. See Appendix F.



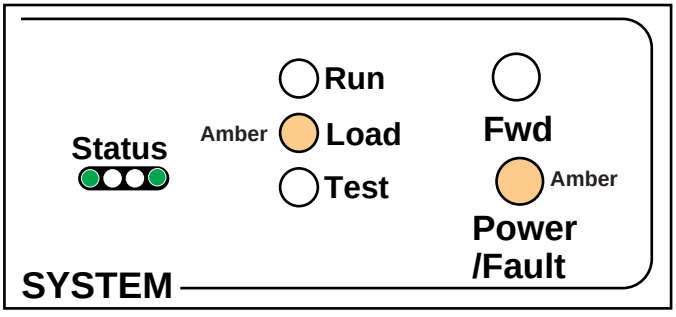

Meaning: Unspecified fatal error.

Action: Reload the software. See Appendix F.




Meaning: Unable to transmit BOOTP request.

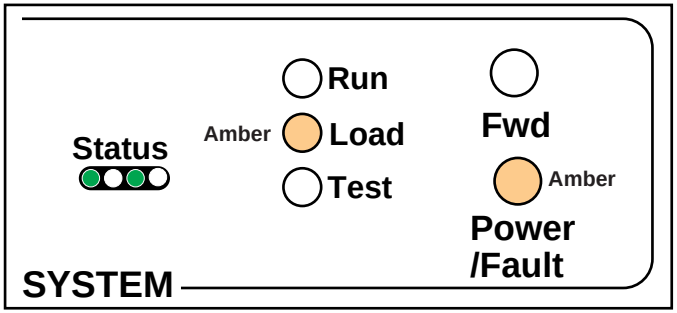
Action: Check cable connections. The PathBuilder switch may not be connected correctly to the Ethernet network.




Meaning: No response to BOOTP request. The BOOTP server may not be present or is incorrectly configured.

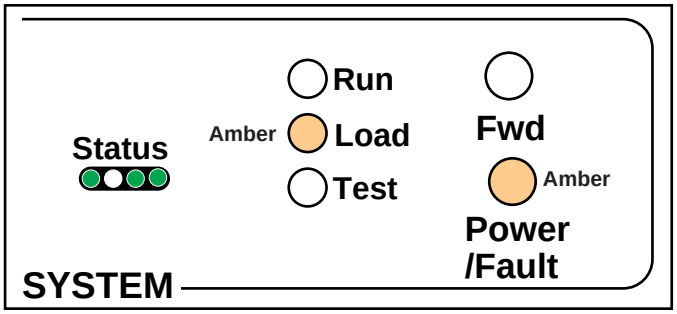
Action: Check Trivial File Transfer Protocol (TFTP)/BOOTP server configuration and verify the media access control (MAC) address of the PathBuilder switch. Turn the power off and

then on again to retry the system software load. If the load is unsuccessful, see Appendix F to reload the system software.




Meaning: No response from the TFTP server to Address Resolution Protocol (ARP) request. The TFTP server is not present or may be incorrectly configured.

Action: Check the TFTP server configuration and verify the MAC address of the PathBuilder switch. Turn the power off and then on again to retry the system software load. If the load is unsuccessful, contact your network supplier for assistance.

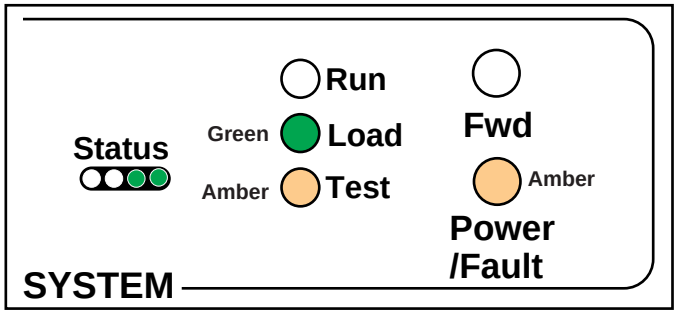



Meaning: No response to TFTP request. The TFTP server is not present, the incorrect file was downloaded, or the file is incorrectly configured.

Action: Make sure the MAC address is initialized correctly. Turn the power off and then on again to retry the system software load. If the load is unsuccessful, contact your network supplier for assistance.

### Troubleshooting During the Test Phase

When the software load is complete, the system begins the test phase. If the Test LED lights amber, a problem occurred during the system test phase.



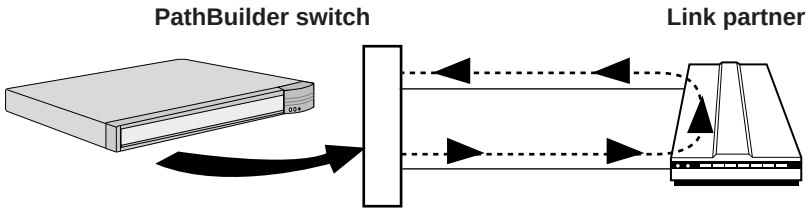

Meaning: EEPROM checksum test failed.
Action: Contact your network supplier.

## Performing Loopback Tests on the Flex-WAN Serial and Ultra-WAN CSU/DSU Interfaces

This section describes how to perform path-based, transmit-to-receive loopback tests on Flex-WAN serial interfaces and Ultra-WAN CSU/DSU interfaces.

Figure 44 shows the data flow that occurs when a Tx to Rx loopback test is performed between the PathBuilder switch and an appropriate link partner. A modem CSU/DSU link partner is required in this configuration for Flex-WAN loopbacks. A central office/PTT switch interface or CSU link partner is required in this configuration for Ultra-WAN loopbacks.

**Figure 44** Tx to Rx Loopback Testing Data Flow




Before running the loopback test, complete the following tasks:

- Attach a console or Telnet to your PathBuilder switch.

- For Flex-WAN serial interfaces, place the modem or CSU/DSU in local loopback test mode. For information, see the documentation that accompanies your modem or CSU/DSU.
- For Ultra-WAN CSU/DSU interfaces, ensure that the central office/PTT switch is configured for loopback in the manner shown for the "link partner" in Figure 44. If you are interfacing to an external CSU, place the CSU in the local loopback test mode.
- Verify the path and port number of the WAN interface you are testing by referring to Figure 12, Figure 13, or Figure 14 in the "Basic Configuration of Ports, Paths, and Connectors" chapter.

To perform the loopback test, follow these steps:

1 For Flex-WAN interfaces, set the line type to Leased using:

```
SETDefault !<path> -PATH LineType = Leased
```

For UltraWAN interfaces, set the connector type to either E1 Unstructured or T1 Unstructured using:

```
SETDefault !<path> -PATH CONNector = E1_U
```

or

```
SETDefault !<path> -PATH CONNector = T1_U
```

2 Set the port owner of the Flex-WAN serial interface you are testing to LoopBack using:

```
SETDefault !<port> -PORT OWNer = LoopBack
```

3 Select the loopback test mode by entering:

```
DLTest TestMode LoopBack
```

4 Specify the number of seconds that the test should run using:

```
DLTest TestDuration <seconds>
```

If you do not enter a value, the test will run indefinitely. However, use caution when running the test for a specified duration. The test ends abruptly as soon as the time duration expires, and a discrepancy between the number of packets transmitted and the number received may result.

5 Start the loopback test by entering:

```
DLTest START
```

If the number of received packets equals or approximately equals the number of transmitted packets, your serial line has passed the loopback

test. If your serial line does not pass the test, verify that your PathBuilder switch is cabled correctly and that the software is configured correctly. Also, check the number of packets transmitted and the number of errors by entering:

```
DLTest STATistics
```

6 Stop the loopback test by entering:

```
DLTest Abort
```

7 Restore the owner of the wide area port you are testing from loopback to your protocol using:

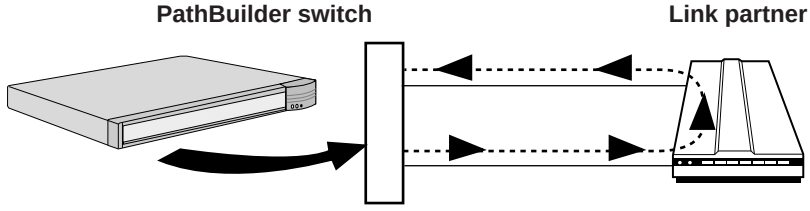
```
SETDefault !<port> -PORT OWNer = PPP | FrameRelay | SMDS | Auto
```

*Failure to perform this step causes the port associated with the Flex-WAN serial or Ultra-WAN CSU/DSU interface to remain in loopback mode preventing connectivity through the port. Performing diagnostics on the port will reveal only that the port is down.*

### Configuring a RX to TX Loopback via the Command Line on the Ultra-WAN CSU/DSU Interface

This section describes how to configure an Ultra-WAN CSU/DSU interface, for receive-to-transmit loopback as shown in Figure 45.

**Figure 45** RX to TX Loopback Testing Data Flow




Before running the T1/E1 loopback test, attach a console or Telnet to your PathBuilder switch.

To configure the Ultra-WAN CSU/DSU interface for RX to TX loopback, follow these steps:

1 Disable all of the paths on the interface by using:

```
SETDefault !<path> -PATH ConnControl=Disable
```

2 Start a loopback test by entering one of the following commands.

- To receive data from the network and loopback data to the network without performing any framing or deframing, configure a remote line loopback by entering:

```
LPBCK !<path> -PATH RMLnLpbck
```

- To receive data from the network, extract the payload from the frames, and then reframe the payload and loop back the data to the network, configure a remote payload loopback by entering:

```
LPBCK !<path> -PATH RmPyldLpbck
```

3. The loopback is now enabled and will remain enabled until explicitly ended. To end a loopback in progress, use:

```
LPBCK !<path> -PA STOP
```

*Failure to perform this step causes the port to remain in loopback mode preventing connectivity through the port. Performing diagnostics on the port will reveal only that the port is down.*

4. Enable the path using:

```
SETDefault !<path> -PATH ConnControl=Enable
```

## Response to Loopback Assertions from Link Partner on Flex-WAN Serial and Ultra-WAN CSU/DSU Interfaces

This section describes the PathBuilder switch response to various link partner loopback assertions.

### Response to Local Loopback Assertion on a Flex-WAN Serial Interface

If the PathBuilder switch is connected to a DTE that asserts a local loopback signal, the PathBuilder switch displays:

```
Path x Detected DTE Loopback ON, switching to echo mode
```

The PathBuilder switch in echo mode transmits the received data back to the DTE.

When the signal is removed, the PathBuilder switch displays:

```
Path x Detected DTE Loopback OFF, switching to normal mode
```

### Response to a Loopback Assertion via Inbound BoP and MoP Messages on an Ultra-WAN CSU/DSU Interface

If the PathBuilder is connected to the T1 central office switch that supports BoP (bit-oriented protocol) or MoP (message-oriented protocol) messaging, this central office switch can send a loopback request via these messages to the PathBuilder switch.

Upon receipt of such a loopback request message, the PathBuilder switch displays one of the following messages, depending on the loopback requested:

```
engaging line loopback
```

or

```
engaging payload loopback
```

The PathBuilder switch then loops the received T1 data stream back to the transmit side, out to the central office switch.

Upon receipt of a loopback terminate message, the PathBuilder switch displays:

```
terminating remote-initiated loopback
```

The Pathbuilder switch then terminates the loopback.

## Performing T3/E3 Loopback Tests

This section describes the steps required to perform various types of loopback tests for a T3/E3 interface.

Before running the T3/E3 loopback test, attach a console or Telnet to your PathBuilder switch.

To perform a loopback test on the T3/E3 interface, follow these steps:

1. Disable the path using:

   ```
   SETDefault !<path> -PA Control=Disable
   ```

2. Start a loopback test by entering one of the following commands.

   a. To start an internal HSSI loopback test, use:

   ```
   DS3Lpbk !<path> -PA HSSIIntrnl
   ```

   b. To start an loopback test to an external device in HSSI mode, use:

   ```
   DS3Lpbk !<path> -PA HSSIPassive
   ```

   c. To start an internal T3 framer loopback test, use:

```
DS3Lpbk !<path> –PA T3Intrnl
```

**d** To start a loopback test to an external device in T3 mode, use:

```
DS3Lpbk !<path> –PA T3Passive
```

**e** To start an internal E3 framer loopback test, use:

```
DS3Lpbk !<path> –PA E3Intrnl
```

**f** To start a loopback test to an external device in E3 mode, use:

```
DS3Lpbk !<path> –PA E3Passive
```

**g** To start receiving and looping back data from the network by entering one of the following commands.

- To receive and loop back data from the network without performing any framing or deframing, use:

  ```
  DS3Lpbk !<path> –PA Network1
  ```

- To receive and loopback data from the network after performing any necessary deframing and framing (framing and deframing applicable in T3/E3 mode), use:

  ```
  DS3Lpbk !<path> –PA Network2
  ```

**3** An example of successful loopback output appears as follows:

```
[4] EnterpriseOS # ds3lpbk !4 HSSIPassive
[5] EnterpriseOS # T3 Interface; Self Tests passed –slot 4
Tues Dec 8 12:29:17 1998 Loopback for WAN slot B successful
```

An example of failed loopback output appears as follows:

```
[4] EnterpriseOS # ds3lpbk !4 T3Passive
[5] EnterpriseOS #
Tues Dec 8 11:15:16 1998 Loopback for WAN slot B failed
```

**4** To abort any loopback test in progress, use:

```
DS3Lpbk !<path> –PA DS3LbkStop
```

*Failure to perform this step causes the port to remain in loopback mode preventing connectivity through the port. Performing diagnostics on the port will reveal only that the port is down.*

**5** Enable the path using:

```
SETDefault !<path> –PA Control=Enable
```

## Performing a Memory Dump

If a PathBuilder switch unexpectedly stops functioning, it performs a memory dump. A memory dump provides a view of the internal state of the system, which can help Technical Support determine the cause of the failure.

*If your operating system does not come with a TFTP server, you can use 3Com's. The 3Com TFTP server is provided with the Upgrade Management Utilities on the software CD-ROM. See Upgrading Enterprise OS Software for more information.*

By default, the system performs a partial dump to available flash memory. If you want a full dump to a TFTP server on the local Ethernet network, you must have the following items available:

- IP addresses and subnet masks of the PathBuilder switch, TFTP server, and possibly, the gateway leading to the network segment where the TFTP server is located
- A TFTP server on the local Ethernet network
- Authorization to write to the TFTP server
- 160 MB of available disk space on the TFTP server
- The PathBuilder switch configured to dump to the TFTP server

The procedure to obtain a memory dump involves setting up destination IP addresses and a file to hold the memory dump information. The PathBuilder switch uses the IP addresses to transmit the memory dump in a file across the network to a TFTP server.

*Notice to users with UNIX TFTP servers: Some UNIX TFTP servers do not have the capability to create files if they do not exist, but can overwrite an existing file. Therefore, you must first create a file with the expected dump file name on the UNIX TFTP server. The procedure for creating such a file is described in "Creating Files for the Memory Dump" on page 131.*

### Configuring the Dump Destination

The Dump Destination parameter selects where the contents of PathBuilder switch memory are stored in case of a crash.

1. Attach a console or Telnet to your PathBuilder switch.
2. At the Enterprise OS # prompt, enter:

```
SysconF
```

3 Select Dump Configuration Menu from the System Configuration menu. The default parameters are shown in bold:

```
1. Port Selection              LAN1
2. Baud Rate                   Auto Baud
3. Duplex Mode                 Auto Duplex
4. Dump Destination            No Full Dump
```

4 Select Dump Destination.

The following options are available:

```
1. No Full Dump
2. Network
```

5 If you select No Full Dump, the system performs a partial dump to the FPROM. You do not have to complete the rest of this procedure.

6 If you want a full dump to the network, select Network.

The following options must be configured for Network:

```
1. Client
2. Server
3. Gateway
4. Remote File Server (not applicable)
5. Subnet Mask
6. Dump Destination Directory
```

7 Set the IP addresses for the client, server, gateway, and subnet mask.

- **a** Select Client and enter the IP address associated with the Ethernet port of the PathBuilder switch.
- **b** Return to the Dump Destination menu and select Server and enter the IP address associated with the TFTP server.
- **c** If necessary, select Gateway from the Dump Destination menu and enter the IP address of the default gateway leading to the network on which the TFTP server resides.
- **d** If subnet masks are in use, select Subnet Mask from the Dump Destination menu and enter the subnet mask associated with the IP network attached to the Ethernet port.

8 Select Dump Destination Directory on the Dump Destination menu to configure the location on the TFTP server to which the dump file will go.

The default destination is /dump.

9 Enter the target directory on the TFTP server.

Usually, the target directory is the default TFTP directory. For example, if the TFTP directory is /home/TFTPdir, and the target directory configured on the PathBuilder switch is /dump, then the actual target directory is /home/TFTPdir/dump. Make sure this directory exists on the TFTP server, as it will not be created by the PathBuilder switch, or the TFTP process when a TFTP transfer is initiated.

**10** Type Q repeatedly to exit the System Configuration menus and return to the Enterprise OS # prompt.

### Obtaining the MAC Address

You need to obtain the media access control (MAC) address of the PathBuilder switch. This is necessary because the system creates several dump files on the TFTP server named dmXXXXXX.<EXT>, where XXXXXX are the last six characters of the MAC address of the motherboard of the PathBuilder switch. <EXT> can be .s0x, .pdm, .qw1, or .qw2 depending on the type of file.

To display the MAC addresses, follow these steps:

**1** At the Enterprise OS # prompt, enter:

```
SysInfo
```

**2** Record the MAC address for port 1 when it is displayed. You will use this number in the next procedure.

### Creating Files for the Memory Dump

Some UNIX TFTP servers do not have the capability to create files if they do not exist, but can overwrite an existing file. Therefore, you must first create a set of files with the expected dump file names on the UNIX TFTP server.

Before beginning this procedure, make sure the TFTP server is running. On a UNIX system, the ps command with appropriate arguments provides a listing of the current processes. See the documentation pertaining to the IP stack on the TFTP server if you have any problems.

#### Partial Dump File

To create the partial dump file, follow these steps:

**1** On a UNIX TFTP server, create files with the name dmXXXXXX.pdm, where XXXXXX is the last six characters of the MAC address of the motherboard of the PathBuilder switch.

For example, if the last six characters of the MAC address of the PathBuilder switch are 06BA6A, enter:

```
touch dm06BA6A.pdm
```

2 Ensure that all users have permission to write to the target directory and filename. To determine this on a UNIX system, enter:

```
ls -a
```

3 To change write access permissions on a file or directory, enter:

```
chmod 666 dm06BA6A.pdm
```

If a system crash occurs, the system performs a partial dump and outputs an ASCII text file to the file named dm06BA6A.pdm. If QuadWan modules are included in the PathBuilder switch model, this file includes debug information for the QuadWan modules.

See the UNIX system documentation if you have any problems.

### QuadWan Dump Files

To create the dump files for QuadWan modules, follow these steps:

1 On a UNIX TFTP server, create two files with the names dmXXXXXX.qw1 and dmXXXXXX.qw2, where XXXXXX is the last six characters of the MAC address of the motherboard of the PathBuilder switch.

For example, if the last six characters of the MAC address of the PathBuilder switch are 06BA6A, enter:

```
touch dm06BA6A.qw1
touch dm06BA6A.qw2
```

2 Ensure that all users have permission to write to the target directory and filename. To determine this on a UNIX system, enter:

```
ls -a
```

3 To change write access permissions on a file or directory, enter:

```
chmod 666 dm06BA6A.qw1
chmod 666 dm06BA6A.qw2
```

If a system crash occurs, the system performs a dump and outputs QuadWan information to these files.

See the UNIX system documentation if you have any problems.

### Full Dump Files

To create the files for a PathBuilder switch motherboard full dump, follow these steps:

1. On a UNIX TFTP server, create files with the names dmXXXXXX.s01 through dmXXXXXX.s11, where XXXXXX is the last six characters of the MAC address of the motherboard of the PathBuilder switch.

   For example, if the last six characters of the MAC address of the PathBuilder switch are 06BA6A, enter:

   ```
   touch dm06BA6A.s01
   touch dm06BA6A.s02
   touch dm06BA6A.s03
   touch dm06BA6A.s04
   touch dm06BA6A.s05
   touch dm06BA6A.s06
   touch dm06BA6A.s07
   touch dm06BA6A.s08
   touch dm06BA6A.s09
   touch dm06BA6A.s10
   touch dm06BA6A.s11
   ```

2. Ensure that all users have permission to write to the target directory and filename. To determine this on a UNIX system, enter:

   ```
   ls –a
   ```

3. To change write access permissions on a file or directory, enter:

   ```
   chmod 666 dm06BA6A.s01
   chmod 666 dm06BA6A.s02
   chmod 666 dm06BA6A.s03
   chmod 666 dm06BA6A.s04
   chmod 666 dm06BA6A.s05
   chmod 666 dm06BA6A.s06
   chmod 666 dm06BA6A.s07
   chmod 666 dm06BA6A.s08
   chmod 666 dm06BA6A.s09
   chmod 666 dm06BA6A.s10
   chmod 666 dm06BA6A.s11
   ```

   If a system crash occurs, the system performs a dump and outputs PathBuilder switch motherboard information to these files. Each file contains a maximum of 15 megabytes of information.

   See the UNIX system documentation if you have any problems.

### Verifying the TFTP Process

To verify that a TFTP transfer can occur from the PathBuilder switch to the TFTP server, follow these steps:

1. Obtain a listing of the files on the PathBuilder switch to select one to transfer using:

   ```
   df <directory>
   ```

2. If you are using a UNIX TFTP server, create a zero byte file with the name of the file you selected, and with the proper permissions, using:

   ```
   touch <filename>
   chmod 666 <filename>
   ```

3. Transfer the selected file from the PathBuilder switch to the TFTP server using:

   ```
   COpy [<device>:]<src_filename> [<device>:][<dest_filename>]
   ```

   For example, to copy a source file named system to destination /dump/ using the TFTP server at IP address 139.88.132.192, enter:

   **COpy a:/primary/system 139.88.132.192:/dump/system**

4. Verify that the file was transferred to the correct location on the TFTP server.

### Verifying the Memory Dump Procedure

To verify that the memory dump process works, simulate a failure of the PathBuilder switch. At the Enterprise OS # prompt, enter:

**su dm BBBBBBBB**

The system responds with the following information:

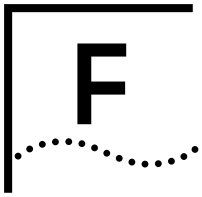
```
PANIC Trap 3 (ILLEGAL DATA ADDR)
pc=0060CC7C lr=0060CC68 srr1=00009032 dar=DDDDDDDD dsisr=04000000

Stack traceback:
 006944FC  0060CC7C  005F65FC  005E8148  005E80EC  00000000

Dumping memory to network ... Dumping to file -
</dvlp/tftpboot/seema/dm27F92A.>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.pdm> to server
129.213.200.110

Beginning transfer      129 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.qw1>
```

```
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.qw1> to server
129.213.200.110

Beginning transfer     8193 ... done

Dumping to file - </dvlp/tftpboot/seema/dm27F92A.qw2>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.qw2> to server
129.213.200.110

Beginning transfer     8193 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s01>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s01> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s02>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s02> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s03>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s03> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s04>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s04> to server
129.213.200.110
```

```
Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s05>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s05> to server
129.213.200.110

Beginning transfer    30721 ... done

Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s06>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s06> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s07>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s07> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s08>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s08> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s09>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.

tftp write of file </dvlp/tftpboot/seema/dm27F92A.s09> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s10>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.
```

```
tftp write of file </dvlp/tftpboot/seema/dm27F92A.s10> to server
129.213.200.110

Beginning transfer    30721 ... done
Dumping to file - </dvlp/tftpboot/seema/dm27F92A.s11>
Station Address - 08000227F92A
Trying LAN L1 ... 10BaseT connection detected.


tftp write of file </dvlp/tftpboot/seema/dm27F92A.s11> to server
129.213.200.110

Beginning transfer    20480 ... done
Do you want to enter monitor ? reply y/n within 5 seconds :

Resetting System ...

3Com Corporation PathBuilder - MON Version 10019I (Bank B)
163840 Kilobyte(s) of RAM installed.
16384 Kilobyte(s) of Flash installed on drive A
No Flash installed on drive B
Quad T1 WAN i/o card present in PCI slot A.
Quad T1 WAN i/o card present in PCI slot B.
Watchdog Timer test passed.
General purpose timer test passed.
RTC test passed.
Memory tests (QUICK) passed.
Ethernet(10/100) internal loopback test passed.
Station Address - 08000227F92A
HIFN dma loopback tests passed.
l2cache test passed
Cache snoop test passed.
Self Tests Passed

System boot in progress ... Primary then Secondary

Loading file A:/primary/boot.ppc
```

If you receive a similar display, your switch is configured correctly to obtain a memory dump. The display may be different depending on the number and names of the files required to dump the PathBuilder switch information. If you receive a different display, try these procedures again. Contact 3Com Technical Support for additional assistance.



# RELOADING THE SYSTEM SOFTWARE

This chapter describes how to reload your system software if the following conditions occur:

- The boot image has been accidentally deleted or corrupted.
- The device is unable to boot.

To reload the software, you must have the software installed on a TFTP server on the LAN. You can optionally use a TFTP/(BootP) server with the TFTP server.

*If your operating system does not come with a TFTP server you can use 3Com's. The 3Com TFTP server is provided with the Upgrade Management Utilities on the software CD-ROM. See Upgrading Enterprise OS Software for more information.*

*If you have used the Upgrade Link Backup facility (or bcmbackup), you can flash load directly from your backup. Simply configure your TFTP (and BootP) server to reference your latest backup instead of the factory CD-ROM software.*

Use Upgrade Link or bcminstall to install the software on your server from the CD-ROM.

The loading procedure in this chapter:

- Looks up the IP address of the server.
- Transfers the boot.ppc, SYS, and Web Link files from the server.

*Configuration files can also be restored if the Enterprise OS backup utilities were used before the system software was reloaded.*

- Creates the A:/primary directory.
- Places the image in the /primary directory.

## Reloading the Software

You must have a console attached to your PathBuilder switch to reload the system software from the backup CD-ROM.

To reload the system software, follow these steps:

1. Reset the switch by turning the power switch off and on again.

   If the boot image has been accidently deleted or corrupted, the switch should go into monitor mode, which is indicated by an angle bracket prompt (>). Go on to the next step.

   If the switch does not go into monitor mode, then contact your network supplier. You do not need to complete the remaining steps.

2. If you are using a TFTP server (without BootP), enter:

   **CL**

   The CL command allows you to configure the following settings:

   ```
   1. Client
   2. Server
   3. Gateway
   4. Subnet Mask
   5. Boot Filename
   6. Port Selection
   7. Baud Rate
   8. Duplex Mode
   ```

   When addressing is configured using the CL command, you do not need to use a BootP server to acquire addresses. If you do not use the CL command, a BootP server must be available on the local LAN with an entry in its database for this device.

   *If you are flash loading from a backup, add the names of any configuration files into the SYS file.*

3. If you are using a TFTP server without BootP, enter:

   ```
   FL <path on the TFTP server/>SYS
   ```

   If you are using a BootP in addition to the TFTP server server, enter:

   **FL**

   The FL uses TFTP to copy the image from the identified server to the flash memory.

   *If you are using BootP instead of locally configured addressing in the CL command, you must not include the filename.*

4 When the flash load is complete, confirm that boot.ppc was copied onto the switch by entering:

```
DF /primary
```

If you do not see boot.ppc, or if there is no /primary directory, contact technical support.

5 To reboot the PathBuilder, enter:

```
BT A:/primary
```

## Load Errors

During the software loading process, some hardware or software conditions can cause the process to fail. For more information about load errors, see Appendix E.

# G

# COMPLETING THE ULTRA-WAN CONFIGURATION

This appendix provides templates for finishing the configuration of the Ultra-WAN connectors.

These templates are also available in a file on the Enterprise OS 11.3.1. documentation CD-ROM and from the following 3Com Support URL:

**http://support.3Com.com/infodeli**

It is recommended that you access the 3Com web site for the latest version of these templates.

## Overview

UltraWAN CSU/DSU connectors are not preconfigured before product shipment.

Due to the significantly different ways these interfaces can be used, you must finish the connector configuration when initially configuring or reconfiguring the model S590, S598 or S599 PathBuilder switch. This appendix provides templates to assist in this configuration.

The commands provided in these templates can be entered manually, used in a configuration script, or inserted into a boot.cfg file and placed in the a:/primary directory of the flash file system on the model S590, S598 or S599 PathBuilder switch. Then, each time the switch is booted with a boot.cfg file, these commands will be executed, providing completely configured Ultra-WAN connectors without further user intervention.

***WARNING:*** *Presence of a boot.cfg file in the boot directory will cause all ccs files to be erased. To avoid this erasure, rename the boot.cfg file after the initial system boot.*

## Example Configuration Templates

```
Example 1.
#########################################################################
#########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# E1 LEASED, SINGLE PATH TEMPLATE
# HOW TO CONFIGURE A SINGLE CONNECTOR
# This example shows how to configure connector 4A. To configure
# connectors other than 4A, substitute the connector name.
# For example, to configure connector 4B, replace 4A with 4B
# in all of the commands shown below

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !4A -PAth FrameMode    = E1_CRC4
SETDefault !4A -PAth CONNector    = E1_Unstructured
SETDefault !4A -PAth LineCoding   = HDB3
SETDefault !4A -PAth LineDistance = SH7
SETDefault !4A -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with the specified path.  Default setting is
#                 for path 4A.1 to map to all 31 timeslots (1 through 31).
#                 If all timeslots will not be used, this parameter setting
#                 will need to be changed via the DELete command, as
#                 shown below.  Note that the ADD command is used to add
#                 back channels.
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on changing these parameter settings are:
#
```

```
#   DELete !4A.1 -PAth ChannelMap 1,2,3,7,12,30
#   ADD !4A.1 -PAth ChannelMap 1,2,3,7,12,30

#   SETDefault !4A.1 -PAth ChannelBaud = CB56K

# Enable Connector
SETDefault !4A -PAth ConnControl = Enable


Example 2.
##########################################################################
##########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# E1 PRI TEMPLATE
# HOW TO CONFIGURE A SINGLE CONNECTOR
# This example shows how to configure connector 4A. To configure
# connectors other than 4A, substitute the connector name, accordingly
# For example, to configure connector 4B, replace 4A with 4B
# in all of the commands shown below

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !4A -PAth FrameMode    = E1_CRC4
SETDefault !4A -PAth CONNector    = E1_Pri
SETDefault !4A -PAth SwitchType   = ETSI
SETDefault !4A -PAth LineCoding   = HDB3
SETDefault !4A -PAth LineDistance = SH7
SETDefault !4A -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   LocalDialNo:      If you want outbound calls to provide a calling
#                     phone number, you will need to set this parameter
#                     for each path that will support outbound calls.
#                     There is no default setting for this parameter.
#
#   (Note that the Rate Adaption path parameter is not applicable for
#   for E1 PRI.  All outbound calls attempt connection only at 64K.)
#
#   Some examples on changing the LocalDialNo parameter setting are:
#
```

```
#   SETDefault !4A.1 -PAth LocalDialNo = "4085551212"
#   SETDefault !4A.5 -PAth LocalDialNo = "4085551212"
#   SETDefault !4A.30 -PAth LocalDialNo = "4085555555"

# Enable Connector
SETDefault !4A -PAth ConnControl = Enable

Example 3.
##########################################################################
##########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# E1 LEASED, CHANNELIZED TEMPLATE
# HOW TO CONFIGURE A SINGLE CONNECTOR
# This example shows how to configure connector 4A. To configure
# connectors other than 4A, substitute the connector name.
# For example, to configure connector 4B, replace !4A with !4B

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !4A -PAth FrameMode    = E1_CRC4
SETDefault !4A -PAth CONNector    = E1_Channelized
SETDefault !4A -PAth LineCoding   = HDB3
SETDefault !4A -PAth LineDistance = SH7
SETDefault !4A -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with each specific path.  Default setting is
#                 no timeslots assigned so that deletions are not required.
#                 Most likely, the timeslots mapping needs to differ from
#                 this default setting.  The sequence of commands given
#                 below will allocate the timeslots on a one-to-one
#                 basis with each of the 31 paths.
ADD !4A.1  -PA ChannelMap  1
ADD !4A.2  -PA ChannelMap  2
ADD !4A.3  -PA ChannelMap  3
ADD !4A.4  -PA ChannelMap  4
ADD !4A.5  -PA ChannelMap  5
ADD !4A.6  -PA ChannelMap  6
ADD !4A.7  -PA ChannelMap  7
```

```
ADD !4A.8  -PA ChannelMap  8
ADD !4A.9  -PA ChannelMap  9
ADD !4A.10 -PA ChannelMap 10
ADD !4A.11 -PA ChannelMap 11
ADD !4A.12 -PA ChannelMap 12
ADD !4A.13 -PA ChannelMap 13
ADD !4A.14 -PA ChannelMap 14
ADD !4A.15 -PA ChannelMap 15
ADD !4A.16 -PA ChannelMap 16
ADD !4A.17 -PA ChannelMap 17
ADD !4A.18 -PA ChannelMap 18
ADD !4A.19 -PA ChannelMap 19
ADD !4A.20 -PA ChannelMap 20
ADD !4A.21 -PA ChannelMap 21
ADD !4A.22 -PA ChannelMap 22
ADD !4A.23 -PA ChannelMap 23
ADD !4A.24 -PA ChannelMap 24
ADD !4A.25 -PA ChannelMap 25
ADD !4A.26 -PA ChannelMap 26
ADD !4A.27 -PA ChannelMap 27
ADD !4A.28 -PA ChannelMap 28
ADD !4A.29 -PA ChannelMap 29
ADD !4A.30 -PA ChannelMap 30
ADD !4A.31 -PA ChannelMap 31
#
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on changing the ChannelBaud parameter setting are:
#
#   SETDefault !4A.1 -PAth ChannelBaud = CB56K
#   SETDefault !4A.22 -PAth ChannelBaud = CB56K


# Enable Connector
SETDefault !4A -PAth ConnControl = Enable

Example 4.
##########################################################################
##########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# T1 LEASED, SINGLE PATH TEMPLATE
# HOW TO CONFIGURE A SINGLE CONNECTOR
```

```
# This example shows how to configure connector 4A. To configure
# connectors other than 4A, substitute the connector name.
# For example, to configure connector 4B, replace 4A with 4B
# in all of the commands shown below

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !4A -PAth FrameMode    = T1_ESF
SETDefault !4A -PAth CONNector    = T1_Unstructured
SETDefault !4A -PAth LineCoding   = B8ZS
SETDefault !4A -PAth LineDistance = LH1
SETDefault !4A -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with the specified path.  Default setting is
#                 for path 4A.1 to map to all 24 timeslots (1 through 24).
#                 If all timeslots will not be used, this parameter setting
#                 will need to be changed via the DELete command, as
#                 shown below.  Note that the ADD command is used to add
#                 back channels.
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on using these commands are as follows:
#
#   DELete !4A.1 -PAth ChannelMap 1,2,3,7,12,30
#   ADD !4A.1 -PAth ChannelMap 1,2,3,7,12,30
#   SETDefault !4A.1 -PAth ChannelBaud = CB56K
ADD !4A.1 -PA ChannelMap  1, 2, 3, 4, 5, 6, 7, 8, 9,10
ADD !4A.1 -PA ChannelMap 11,12,13,14,15,16,17,18,19,20
ADD !4A.1 -PA ChannelMap 21,22,23,24

# Enable Connector
SETDefault !4A -PAth ConnControl = Enable
```

Example 5.

```
#########################################################################
#########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# T1 PRI TEMPLATE
# HOW TO CONFIGURE A SINGLE CONNECTOR
# This example shows how to configure connector 4A. To configure
# connectors other than 4A, substitute the connector name, accordingly
# For example, to configure connector 4B, replace 4A with 4B
# in all of the commands shown below

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !4A -PAth FrameMode    = T1_ESF
SETDefault !4A -PAth CONNector    = T1_Pri
SETDefault !4A -PAth SwitchType   = ATT5ESS
SETDefault !4A -PAth LineCoding   = B8ZS
SETDefault !4A -PAth LineDistance = LH1
SETDefault !4A -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   LocalDialNo:      If you want outbound calls to provide a calling
#                     phone number, you will need to set this parameter
#                     for each path that will support outbound calls.
#                     There is no default setting for this parameter.
#   Rate Adaption:    If you want outbound calls using a given path to
#                     attempt connection only at one rate (56K or 64K),
#                     but not both, then this parameter will need to be
#                     changed from the default setting of AUTO (which,
#                     if necessary, attempts both) to Rate56K, or Rate64K.
#
#   Some examples on changing these parameter settings are:
#
#   SETDefault !4A.1 -PAth LocalDialNo = "4085551212"
#   SETDefault !4A.5 -PAth LocalDialNo = "4085551212"
#   SETDefault !4A.23 -PAth LocalDialNo = "4085555555"
#
#   SETDefault !4A.1 -PAth RateAdaption = "Rate56"
#   SETDefault !4A.5 -PAth RateAdaption = "Rate56"
#   SETDefault !4A.23 -PAth RateAdaption = "Rate56"
#   ........
```

```
# Enable Connector
SETDefault !4A -PAth ConnControl = Enable

Example 6.
##########################################################################
##########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# T1 LEASED, CHANNELIZED TEMPLATE
# HOW TO CONFIGURE A SINGLE CONNECTOR
# This example shows how to configure connector 4A. To configure
# connectors other than 4A, substitute the connector name.
# For example, to configure connector 4B, replace !4A with !4B

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !4A -PAth FrameMode    = T1_ESF
SETDefault !4A -PAth CONNector    = T1_Channelized
SETDefault !4A -PAth LineCoding   = B8ZS
SETDefault !4A -PAth LineDistance = LH1
SETDefault !4A -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with each specific path.  Default setting is
#                 no timeslots assigned so that deletions are not required.
#                 Most likely, the timeslots mapping needs to differ from
#                 this default setting.  The sequence of commands given
#                 below will allocate the timeslots on a one-to-one
#                 basis with each of the 24 paths.
ADD !4A.1 -PA ChannelMap 1
ADD !4A.2 -PA ChannelMap 2
ADD !4A.3 -PA ChannelMap 3
ADD !4A.4 -PA ChannelMap 4
ADD !4A.5 -PA ChannelMap 5
ADD !4A.6 -PA ChannelMap 6
ADD !4A.7 -PA ChannelMap 7
ADD !4A.8 -PA ChannelMap 8
ADD !4A.9 -PA ChannelMap 9
ADD !4A.10 -PA ChannelMap 10
```

```
ADD !4A.11 -PA ChannelMap 11
ADD !4A.12 -PA ChannelMap 12
ADD !4A.13 -PA ChannelMap 13
ADD !4A.14 -PA ChannelMap 14
ADD !4A.15 -PA ChannelMap 15
ADD !4A.16 -PA ChannelMap 16
ADD !4A.17 -PA ChannelMap 17
ADD !4A.18 -PA ChannelMap 18
ADD !4A.19 -PA ChannelMap 19
ADD !4A.20 -PA ChannelMap 20
ADD !4A.21 -PA ChannelMap 21
ADD !4A.22 -PA ChannelMap 22
ADD !4A.23 -PA ChannelMap 23
ADD !4A.24 -PA ChannelMap 24
#
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on changing the ChannelBaud parameter setting are:
#
#   SETDefault !4A.1 -PAth ChannelBaud = CB56K
#   SETDefault !4A.22 -PAth ChannelBaud = CB56K

# Enable Connector
SETDefault !4A -PAth ConnControl = Enable

Example 7.
##########################################################################
##########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# E1 LEASED, SINGLE PATH TEMPLATE
# HOW TO CONFIGURE MULTIPLE CONNECTORS SIMULTANEOUSLY
# This example shows how to configure connectors 4A, 4B, 4C, and 4D
# simultaneously by creating groups of connectors via the
# Instance Group command. To specify which connectors are
# included in this grouping, just add or delete the according references
# in the Instance Group command.  For example, to include only connectors
# 4A and 4C, the command would look like the following:
#        Add -SYS InstanceGRoup E1FAT "!4A, !4C" PAth

# Add Instance Groups to cover all 4 UltraWAN connectors and paths
###### Note: E1FAT is short for E1, LEased, FAT (one) channel
Add -SYS InstanceGRoup E1FAT   "!4A,   !4B,   !4C,   !4D"   PAth
```

```
Add -SYS InstanceGRoup E1FATPA "!4A.1, !4B.1, !4C.1, !4D.1" PAth

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !E1FAT -PAth FrameMode    = E1_CRC4
SETDefault !E1FAT -PAth CONNector    = E1_Unstructured
SETDefault !E1FAT -PAth LineCoding   = HDB3
SETDefault !E1FAT -PAth LineDistance = SH7
SETDefault !E1FAT -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with the specified path.  Default setting is
#                 for path 4A.1 to map to all 31 timeslots (1 through 31)
#                 on connector 4A, 4B.1 to map to all 31 timeslots on
#                 connector 4B, etc.
#                 If all timeslots will not be used, this parameter setting
#                 will need to be changed via the DELete command, as
#                 shown below.  Note that the ADD command is used to add
#                 back channels.
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on changing these parameter settings are:
#
#   DELete !E1FATPA -PAth ChannelMap 1,2,3,7,12,30
#   ADD !E1FATPA -PAth ChannelMap 1,2,3,7,12,30
#   SETDefault !E1FATPA -PAth ChannelBaud = CB56K

# Enable Connectors
SETDefault !E1FAT -PAth ConnControl = Enable
# Assign all timeslots to the connectors
ADD !E1FATPA -PA ChannelMap  1, 2, 3, 4, 5, 6, 7, 8, 9,10
ADD !E1FATPA -PA ChannelMap 11,12,13,14,15,16,17,18,19,20
ADD !E1FATPA -PA ChannelMap 21,22,23,24,25,26,27,28,29,30,31
SETDefault !E1FATPA -PAth Control = Enable
```

```
Example 8.
#########################################################################
#########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# E1 PRI TEMPLATE
# HOW TO CONFIGURE MULTIPLE CONNECTORS SIMULTANEOUSLY
# This example shows how to configure connectors 4A, 4B, 4C, and 4D
# simultaneously by creating an instance group of connectors and paths
# via the :Instance Group command. To specify which connectors are
# included in this grouping, just add or delete the according references
# in the Instance Group command.  For example, to include only connectors
# 4A and 4C, the command would look like the following:
#        Add -SYS InstanceGRoup E1PRI "!4A, !4C" PAth


# Add Instance Groups to cover all 4 UltraWAN connectors and selected paths
###### Note: E1PRI is short for E1, PRI dial
Add -SYS InstanceGroup E1PRI   "!4A   , !4B   , !4C   , !4D   " PAth

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !E1PRI -PAth FrameMode    = E1_CRC4
SETDefault !E1PRI -PAth CONNector    = E1_Pri
SETDefault !E1PRI -PAth SwitchType   = ETSI
SETDefault !E1PRI -PAth LineCoding   = HDB3
SETDefault !E1PRI -PAth LineDistance = SH7
SETDefault !E1PRI -PAth CLock        = External
# Enable Connectors
SETDefault !E1PRI -PAth ConnControl  = Enable


# Add Instance Group to cover all paths on each UltraWAN connector:
###### Note: E1PRI4x is short for E1, PRI dial, all paths on 4x
Add -SYS InstanceGroup E1PRI4A "!4A.1 - !4A.30" PAth
Add -SYS InstanceGroup E1PRI4B "!4B.1 - !4B.30" PAth
Add -SYS InstanceGroup E1PRI4C "!4C.1 - !4C.30" PAth
Add -SYS InstanceGroup E1PRI4D "!4D.1 - !4D.30" PAth

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   LocalDialNo:      If you want outbound calls to provide a calling
```

```
#                     phone number, you will need to set this parameter
#                     for each path that will support outbound calls.
#                     There is no default setting for this parameter.
#
#   (Note that the Rate Adaption path parameter is not applicable for
#   for E1 PRI.  All outbound calls attempt connection only at 64K.)
#
#   Some examples on changing the LocalDialNo parameter setting are:
#
#   SETDefault !E1PRI4A -PAth LocalDialNo = "4085551212"
#   SETDefault !E1PRI4B -PAth LocalDialNo = "4085555555"

Example 9.
########################################################################
########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# E1 LEASED, CHANNELIZED TEMPLATE
# HOW TO CONFIGURE MULTIPLE CONNECTORS SIMULTANEOUSLY
# This example shows how to configure connectors 4A, 4B, 4C, and 4D
# simultaneously by creating groups of connectors and paths via the
# Instance Group command. To specify which connectors and paths are
# included in this grouping, just add or delete the according references
# in the Instance Group command.  For example, to include only
# connectors 4A and 4C, the commands would look like the following:
#        Add -SYS InstanceGRoup E1CHAN "!4A, !4C" PAth
#        Add -SYS InstanceGRoup E1CHAN1 "!4A.1, !4C.1" PAth

# Add Instance Groups to cover all 4 UltraWAN connectors
###### Note: E1CHAN is short for E1, leased, CHANnelized
Add -SYS InstanceGRoup E1CHAN "!4A, !4B, !4C, !4D" PAth

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !E1CHAN -PAth FrameMode    = E1_CRC4
SETDefault !E1CHAN -PAth CONNector    = E1_Channelized
SETDefault !E1CHAN -PAth LineCoding   = HDB3
SETDefault !E1CHAN -PAth LineDistance = SH7
SETDefault !E1CHAN -PAth CLock        = External

# Enable Connectors ( Note: path range instance groups require this 1st )
SETDefault !E1CHAN -PAth ConnControl = Enable

# Add Instance Groups to cover paths on all 4 UltraWAN connectors
```

```
###### Note: E1CHANx is short for E1, leased, CHANNelized, path #x
Add -SYS InstanceGroup E1CHAN1  " !4A.1,  !4B.1,  !4C.1,  !4D.1" PAth
Add -SYS InstanceGroup E1CHAN2  " !4A.2,  !4B.2,  !4C.2,  !4D.2" PAth
Add -SYS InstanceGroup E1CHAN3  " !4A.3,  !4B.3,  !4C.3,  !4D.3" PAth
Add -SYS InstanceGroup E1CHAN4  " !4A.4,  !4B.4,  !4C.4,  !4D.4" PAth
Add -SYS InstanceGroup E1CHAN5  " !4A.5,  !4B.5,  !4C.5,  !4D.5" PAth
Add -SYS InstanceGroup E1CHAN6  " !4A.6,  !4B.6,  !4C.6,  !4D.6" PAth
Add -SYS InstanceGroup E1CHAN7  " !4A.7,  !4B.7,  !4C.7,  !4D.7" PAth
Add -SYS InstanceGroup E1CHAN8  " !4A.8,  !4B.8,  !4C.8,  !4D.8" PAth
Add -SYS InstanceGroup E1CHAN9  " !4A.9,  !4B.9,  !4C.9,  !4D.9" PAth
Add -SYS InstanceGroup E1CHAN10 "!4A.10, !4B.10, !4C.10, !4D.10" PAth
Add -SYS InstanceGroup E1CHAN11 "!4A.11, !4B.11, !4C.11, !4D.11" PAth
Add -SYS InstanceGroup E1CHAN12 "!4A.12, !4B.12, !4C.12, !4D.12" PAth
Add -SYS InstanceGroup E1CHAN13 "!4A.13, !4B.13, !4C.13, !4D.13" PAth
Add -SYS InstanceGroup E1CHAN14 "!4A.14, !4B.14, !4C.14, !4D.14" PAth
Add -SYS InstanceGroup E1CHAN15 "!4A.15, !4B.15, !4C.15, !4D.15" PAth
Add -SYS InstanceGroup E1CHAN16 "!4A.16, !4B.16, !4C.16, !4D.16" PAth
Add -SYS InstanceGroup E1CHAN17 "!4A.17, !4B.17, !4C.17, !4D.17" PAth
Add -SYS InstanceGroup E1CHAN18 "!4A.18, !4B.18, !4C.18, !4D.18" PAth
Add -SYS InstanceGroup E1CHAN19 "!4A.19, !4B.19, !4C.19, !4D.19" PAth
Add -SYS InstanceGroup E1CHAN20 "!4A.20, !4B.20, !4C.20, !4D.20" PAth
Add -SYS InstanceGroup E1CHAN21 "!4A.21, !4B.21, !4C.21, !4D.21" PAth
Add -SYS InstanceGroup E1CHAN22 "!4A.22, !4B.22, !4C.22, !4D.22" PAth
Add -SYS InstanceGroup E1CHAN23 "!4A.23, !4B.23, !4C.23, !4D.23" PAth
Add -SYS InstanceGroup E1CHAN24 "!4A.24, !4B.24, !4C.24, !4D.24" PAth
Add -SYS InstanceGroup E1CHAN25 "!4A.25, !4B.25, !4C.25, !4D.25" PAth
Add -SYS InstanceGroup E1CHAN26 "!4A.26, !4B.26, !4C.26, !4D.26" PAth
Add -SYS InstanceGroup E1CHAN27 "!4A.27, !4B.27, !4C.27, !4D.27" PAth
Add -SYS InstanceGroup E1CHAN28 "!4A.28, !4B.28, !4C.28, !4D.28" PAth
Add -SYS InstanceGroup E1CHAN29 "!4A.29, !4B.29, !4C.29, !4D.29" PAth
Add -SYS InstanceGroup E1CHAN30 "!4A.30, !4B.30, !4C.30, !4D.30" PAth
Add -SYS InstanceGroup E1CHAN31 "!4A.31, !4B.31, !4C.31, !4D.31" PAth

# Add Instance Group to cover all paths on each UltraWAN connector:
###### Note: E1CHAN4x is short for E1, leased, CHANnelized, all paths on 4x
Add -SYS InstanceGroup E1CHAN4A "!4A.1 - !4A.31" PAth
Add -SYS InstanceGroup E1CHAN4B "!4B.1 - !4B.31" PAth
Add -SYS InstanceGroup E1CHAN4C "!4C.1 - !4C.31" PAth
Add -SYS InstanceGroup E1CHAN4D "!4D.1 - !4D.31" PAth

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with each specific path.  Default setting is
```

```
#                 no timeslots assigned so that deletions are not required.
#                 Most likely, the timeslots mapping needs to differ from
#                 this default setting.  The sequence of commands given
#                 below will allocate the timeslots on a one-to-one
#                 basis with each of the 31 paths.
ADD !E1CHAN1  -PA ChannelMap  1
ADD !E1CHAN2  -PA ChannelMap  2
ADD !E1CHAN3  -PA ChannelMap  3
ADD !E1CHAN4  -PA ChannelMap  4
ADD !E1CHAN5  -PA ChannelMap  5
ADD !E1CHAN6  -PA ChannelMap  6
ADD !E1CHAN7  -PA ChannelMap  7
ADD !E1CHAN8  -PA ChannelMap  8
ADD !E1CHAN9  -PA ChannelMap  9
ADD !E1CHAN10 -PA ChannelMap 10
ADD !E1CHAN11 -PA ChannelMap 11
ADD !E1CHAN12 -PA ChannelMap 12
ADD !E1CHAN13 -PA ChannelMap 13
ADD !E1CHAN14 -PA ChannelMap 14
ADD !E1CHAN15 -PA ChannelMap 15
ADD !E1CHAN16 -PA ChannelMap 16
ADD !E1CHAN17 -PA ChannelMap 17
ADD !E1CHAN18 -PA ChannelMap 18
ADD !E1CHAN19 -PA ChannelMap 19
ADD !E1CHAN20 -PA ChannelMap 20
ADD !E1CHAN21 -PA ChannelMap 21
ADD !E1CHAN22 -PA ChannelMap 22
ADD !E1CHAN23 -PA ChannelMap 23
ADD !E1CHAN24 -PA ChannelMap 24
ADD !E1CHAN25 -PA ChannelMap 25
ADD !E1CHAN26 -PA ChannelMap 26
ADD !E1CHAN27 -PA ChannelMap 27
ADD !E1CHAN28 -PA ChannelMap 28
ADD !E1CHAN29 -PA ChannelMap 29
ADD !E1CHAN30 -PA ChannelMap 30
ADD !E1CHAN31 -PA ChannelMap 31
#
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on changing the ChannelBaud parameter setting are:
#
#   SETDefault !E1CHAN13 -PAth ChannelBaud = CB56K
```

```
#   SETDefault !E1CHAN4A -PAth ChannelBaud = CB56K

# Enable paths
SETDefault !4A.1-!4D.31 -PAth CONTrol = Enable

Example 10.
##########################################################################
##########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# T1 LEASED, SINGLE PATH TEMPLATE
# HOW TO CONFIGURE MULTIPLE CONNECTORS SIMULTANEOUSLY
# This example shows how to configure connectors 4A, 4B, 4C, and 4D
# simultaneously by creating groups of connectors via the
# Instance Group command. To specify which connectors are
# included in this grouping, just add or delete the according references
# in the Instance Group command.  For example, to include only connectors
# 4A and 4C, the command would look like the following:
#        Add -SYS InstanceGRoup T1FAT "!4A, !4C" PAth

# Add Instance Groups to cover all 4 UltraWAN connectors and paths
###### Note: T1FAT is short for T1, LEased, FAT (one) channel
Add -SYS InstanceGRoup T1FAT   "!4A,   !4B,   !4C,   !4D"   PAth
Add -SYS InstanceGRoup T1FATPA "!4A.1, !4B.1, !4C.1, !4D.1" PAth

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !T1FAT -PAth FrameMode    = T1_ESF
SETDefault !T1FAT -PAth CONNector    = T1_Unstructured
SETDefault !T1FAT -PAth LineCoding   = B8ZS
SETDefault !T1FAT -PAth LineDistance = LH1
SETDefault !T1FAT -PAth CLock        = External

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with the specified path.  Default setting is
#                 for path 4A.1 to map to all 24 timeslots (1 through 24)
#                 on connector 4A, 4B.1 to map to all 24 timeslots on
#                 connector 4B, etc.
#                 If all timeslots will not be used, this parameter setting
#                 will need to be changed via the DELete command, as
```

```
#                 shown below.  Note that the ADD command is used to add
#                 back channels.
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on using these commands are as follows:
#
#   DELete !T1FATPA -PAth ChannelMap 1,2,3,7,12,23
#   ADD !T1FATPA -PAth ChannelMap 1,2,3,7,12,23
#   SETDefault !T1FATPA -PAth ChannelBaud = CB56K

# Enable Connectors
SETDefault !T1FAT -PAth ConnControl = Enable
# Assign all timeslots to the connectors
ADD !T1FATPA -PA ChannelMap  1, 2, 3, 4, 5, 6, 7, 8, 9,10
ADD !T1FATPA -PA ChannelMap 11,12,13,14,15,16,17,18,19,20
ADD !T1FATPA -PA ChannelMap 21,22,23,24
SETDefault !T1FATPA -PAth Control = Enable

Example 11.
##########################################################################
##########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# T1 PRI TEMPLATE
# HOW TO CONFIGURE MULTIPLE CONNECTORS SIMULTANEOUSLY
# This example shows how to configure connectors 4A, 4B, 4C, and 4D
# simultaneously by creating an instance group of connectors via the
# Instance Group command. To specify which connectors are
# included in this grouping, just add or delete the according references
# in the Instance Group command.  For example, to include only connectors
# 4A and 4C, the command would look like the following:
#        Add -SYS InstanceGRoup T1PRI "!4A, !4C" PAth


# Add Instance Group to cover all 4 UltraWAN connectors
###### Note: T1PRI is short for T1, PRI dial
Add -SYS InstanceGroup T1PRI  "!4A  , !4B  , !4C  , !4D  " PAth

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
```

```
SETDefault !T1PRI -PAth FrameMode    = T1_ESF
SETDefault !T1PRI -PAth CONNector    = T1_PRI
SETDefault !T1PRI -PAth SwitchType   = ATT5ESS
SETDefault !T1PRI -PAth LineCoding   = B8ZS
SETDefault !T1PRI -PAth LineDistance = LH1
SETDefault !T1PRI -PAth CLock        = External

# Enable Connectors
SETDefault !T1PRI -PAth ConnControl = Enable

# Add Instance Group to cover all paths on each UltraWAN connector:
###### Note: T1PRI4x is short for T1, PRI dial, all paths on 4x
Add -SYS InstanceGroup T1PRI4A "!4A.1 - !4A.23" PAth
Add -SYS InstanceGroup T1PRI4B "!4B.1 - !4B.23" PAth
Add -SYS InstanceGroup T1PRI4C "!4C.1 - !4C.23" PAth
Add -SYS InstanceGroup T1PRI4D "!4D.1 - !4D.23" PAth

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   LocalDialNo:      If you want outbound calls to provide a calling
#                     phone number, you will need to set this parameter
#                     for each path that will support outbound calls.
#                     There is no default setting for this parameter.
#   Rate Adaption:    If you want outbound calls using a given path to
#                     attempt connection only at one rate (56K or 64K),
#                     but not both, then this parameter will need to be
#                     changed from the default setting of AUTO (which,
#                     if necessary, attempts both) to Rate56K, or Rate64K.
#
#   Some examples on changing these parameter settings are:
#
#   SETDefault !T1PRI4A -PAth LocalDialNo = "4085551212"
#   SETDefault !T1PRI4B -PAth LocalDialNo = "4085555555"
#
#   SETDefault !T1PRI4A -PAth RateAdaption = "Rate56"
#   SETDefault !T1PRI4B -PAth RateAdaption = "Rate56"

>Example 12.
########################################################################
########################################################################
# ULTRAWAN CONNECTOR CONFIGURATION FILE
# T1 LEASED, CHANNELIZED TEMPLATE
# HOW TO CONFIGURE MULTIPLE CONNECTORS SIMULTANEOUSLY
# This example shows how to configure connectors 4A, 4B, 4C, and 4D
```

```
# simultaneously by creating groups of connectors and paths via the
# Instance Group command. To specify which connectors and paths are
# included in this grouping, just add or delete the according references
# in the Instance Group command.  For example, to include only connectors
# 4A and 4C, the commands would look like the following:
#        Add -SYS InstanceGRoup T1CHAN "!4A, !4C" PAth
#        Add -SYS InstanceGRoup T1CHAN1 "!4A.1, !4C.1" PAth

# Add Instance Groups to cover all 4 UltraWAN connectors
###### Note: T1CHAN is short for T1, leased, CHANnelized
Add -SYS InstanceGRoup T1CHAN "!4A, !4B, !4C, !4D" PAth

# Connector-level path parameter configuration
# The following parameter settings are only typical example settings.
# Your network-specific settings need to be assigned by consulting the
# connector-level path parameter documentation in the document
# "Using the PathBuilder Switch"
SETDefault !T1CHAN -PAth FrameMode    = T1_ESF
SETDefault !T1CHAN -PAth CONNector    = T1_Channelized
SETDefault !T1CHAN -PAth LineCoding   = B8ZS
SETDefault !T1CHAN -PAth LineDistance = LH1
SETDefault !T1CHAN -PAth CLock        = External
# Enable Connectors
SETDefault !T1CHAN -PAth ConnControl  = Enable

# Add Instance Groups to cover paths on all 4 UltraWAN connectors
###### Note: T1CHANx is short for T1, leased, CHANNelized, path #x
Add -SYS InstanceGroup T1CHAN1  "!4A.1,  !4B.1,  !4C.1,  !4D.1 " PAth
Add -SYS InstanceGroup T1CHAN2  "!4A.2,  !4B.2,  !4C.2,  !4D.2 " PAth
Add -SYS InstanceGroup T1CHAN3  "!4A.3,  !4B.3,  !4C.3,  !4D.3 " PAth
Add -SYS InstanceGroup T1CHAN4  "!4A.4,  !4B.4,  !4C.4,  !4D.4 " PAth
Add -SYS InstanceGroup T1CHAN5  "!4A.5,  !4B.5,  !4C.5,  !4D.5 " PAth
Add -SYS InstanceGroup T1CHAN6  "!4A.6,  !4B.6,  !4C.6,  !4D.6 " PAth
Add -SYS InstanceGroup T1CHAN7  "!4A.7,  !4B.7,  !4C.7,  !4D.7 " PAth
Add -SYS InstanceGroup T1CHAN8  "!4A.8,  !4B.8,  !4C.8,  !4D.8 " PAth
Add -SYS InstanceGroup T1CHAN9  "!4A.9,  !4B.9,  !4C.9,  !4D.9 " PAth
Add -SYS InstanceGroup T1CHAN10 "!4A.10, !4B.10, !4C.10, !4D.10" PAth
Add -SYS InstanceGroup T1CHAN11 "!4A.11, !4B.11, !4C.11, !4D.11" PAth
Add -SYS InstanceGroup T1CHAN12 "!4A.12, !4B.12, !4C.12, !4D.12" PAth
Add -SYS InstanceGroup T1CHAN13 "!4A.13, !4B.13, !4C.13, !4D.13" PAth
Add -SYS InstanceGroup T1CHAN14 "!4A.14, !4B.14, !4C.14, !4D.14" PAth
Add -SYS InstanceGroup T1CHAN15 "!4A.15, !4B.15, !4C.15, !4D.15" PAth
Add -SYS InstanceGroup T1CHAN16 "!4A.16, !4B.16, !4C.16, !4D.16" PAth
Add -SYS InstanceGroup T1CHAN17 "!4A.17, !4B.17, !4C.17, !4D.17" PAth
Add -SYS InstanceGroup T1CHAN18 "!4A.18, !4B.18, !4C.18, !4D.18" PAth
Add -SYS InstanceGroup T1CHAN19 "!4A.19, !4B.19, !4C.19, !4D.19" PAth
```

```
Add -SYS InstanceGroup T1CHAN20 "!4A.20, !4B.20, !4C.20, !4D.20" PAth
Add -SYS InstanceGroup T1CHAN21 "!4A.21, !4B.21, !4C.21, !4D.21" PAth
Add -SYS InstanceGroup T1CHAN22 "!4A.22, !4B.22, !4C.22, !4D.22" PAth
Add -SYS InstanceGroup T1CHAN23 "!4A.23, !4B.23, !4C.23, !4D.23" PAth
Add -SYS InstanceGroup T1CHAN24 "!4A.24, !4B.24, !4C.24, !4D.24" PAth

# Add Instance Group to cover all paths on each UltraWAN connector:
###### Note: T1CHAN4x is short for T1, leased, CHANnelized, all paths on 4x
Add -SYS InstanceGroup T1CHAN4A "!4A.1 - !4A.24" PAth
Add -SYS InstanceGroup T1CHAN4B "!4B.1 - !4B.24" PAth
Add -SYS InstanceGroup T1CHAN4C "!4C.1 - !4C.24" PAth
Add -SYS InstanceGroup T1CHAN4D "!4D.1 - !4D.24" PAth

# Path-level path parameter configuration
#   The following parameters may need to be changed from their default
#   settings, based on your specific environment topology:
#
#   ChannelMap:   This parameter specifies the timeslots (i.e. channels)
#                 associated with each specific path.  Default setting is
#                 no timeslots assigned so that deletions are not required.
#                 Most likely, the timeslots mapping needs to differ from
#                 this default setting.  The sequence of commands given
#                 below will allocate the timeslots on a one-to-one
#                 basis with each of the 24 paths.
ADD !T1CHAN1  -PA ChannelMap  1
ADD !T1CHAN2  -PA ChannelMap  2
ADD !T1CHAN3  -PA ChannelMap  3
ADD !T1CHAN4  -PA ChannelMap  4
ADD !T1CHAN5  -PA ChannelMap  5
ADD !T1CHAN6  -PA ChannelMap  6
ADD !T1CHAN7  -PA ChannelMap  7
ADD !T1CHAN8  -PA ChannelMap  8
ADD !T1CHAN9  -PA ChannelMap  9
ADD !T1CHAN10 -PA ChannelMap 10
ADD !T1CHAN11 -PA ChannelMap 11
ADD !T1CHAN12 -PA ChannelMap 12
ADD !T1CHAN13 -PA ChannelMap 13
ADD !T1CHAN14 -PA ChannelMap 14
ADD !T1CHAN15 -PA ChannelMap 15
ADD !T1CHAN16 -PA ChannelMap 16
ADD !T1CHAN17 -PA ChannelMap 17
ADD !T1CHAN18 -PA ChannelMap 18
ADD !T1CHAN19 -PA ChannelMap 19
ADD !T1CHAN20 -PA ChannelMap 20
ADD !T1CHAN21 -PA ChannelMap 21
ADD !T1CHAN22 -PA ChannelMap 22
```

```
ADD !T1CHAN23 -PA ChannelMap 23
ADD !T1CHAN24 -PA ChannelMap 24
#
#   ChannelBaud:  This parameter specifies the baud rate (56K or 64K) of
#                 each timeslot (i.e. channel) mapped to the
#                 specified path.  Default setting is CB64K (64kbits/sec).
#                 This setting can be changed to CB56K (56kbits/sec) for
#                 leased-line paths that require 56kbit/sec operation
#
#   Some examples on changing the ChannelBaud parameter setting are:
#
#   SETDefault !T1CHAN13 -PAth ChannelBaud = CB56K
#   SETDefault !T1CHAN4A -PAth ChannelBaud = CB56K

# Enable all the paths
SETDefault !4A.1-!4D.24 -PAth Control = Enable
```

# H

# COMPLETING THE ATM CONFIGURATION

This appendix provides templates for finishing the configuration of the ATM connectors.

These templates are also available in a file on the Enterprise OS 11.3.1. documentation CD-ROM and from the following 3Com Support URL:

**http://support.3Com.com/infodeli**

It is recommended that you access the 3Com web site for the latest version of these templates.

## Overview

ATM connectors are preconfigured before product shipment.

Due to the significantly different ways these interfaces can be used, you must finish the connector configuration when initially configuring or reconfiguring the model S574 or S578 PathBuilder switch. This appendix provides templates to assist in this configuration.

The commands provided in these templates can be entered manually, used in a configuration script, or inserted into a boot.cfg file and placed in the a:/primary directory of the flash file system on the model S574 or S578 PathBuilder switch. Then, each time the switch is booted with a boot.cfg file, these commands will be executed, providing completely configured Ultra-WAN connectors without further user intervention.

***WARNING:*** *Presence of a boot.cfg file in the boot directory will cause all ccs files to be erased. To avoid this erasure, rename the boot.cfg file after the initial system boot.*

## Example Configuration Templates

Example 1.

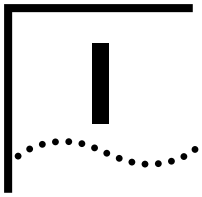
```
#######################################################
#
#       Ethernet LAN Emulation Configuration
#       The configuration is for 2 elans defined for one path (3),
#       and SCORE ATM routing between the two elans.
#
#######################################################
add !v1 -PORT VirtualPort 3 ethatm
add !v2 -PORT VirtualPort 3 ethatm
setd !v1 -ATMLE ElanName="elan50501_0"
setd !v2 -ATMLE ElanName="elan50501_1"
setd !v1 -IP NETaddr=198.18.1.1
setd !v2 -IP NETaddr=198.19.1.1
setd -IP CONTrol=ROute
setd !v1,!v2 -RIPip CONTrol=(TAlk,Listen)
```

Example 2.

```
#######################################################
#
#       TokenRing LAN Emulation Configuration
#       The configuration is for 2 elans defined for one path (3),
#       and SCORE ATM routing between the two elans.
#
#######################################################
add !v1 -PORT VirtualPort 3 tratm
add !v2 -PORT VirtualPort 3 tratm
setd !v1 -ATMLE ElanName="elan50501_2"
setd !v2 -ATMLE ElanName="elan50501_3"
setd !v1 -IP NETaddr=198.18.1.1
setd !v2 -IP NETaddr=198.19.1.1
setd -IP CONTrol=ro
setd !v1,!v2 -RIPip CONTrol=(TAlk,Listen)
setd -BRIDGE CONTrol=(NoAging,Bridge)
```

Example 3.

```
#######################################################
#
#       ATM PVC(RFC1483) Configuration
#       This configuration is for a PVC configured
#       between SCORE ATM and switch/SCORE ATM.
#
#######################################################
add !v1 -PORT VirtualPort 3 mpatm
add !v1 -ATM pvc 1 1.101 llc 7
setd !v1 -IP NETaddr=198.18.1.1
add -IP addr 198.18.1.2 &2
setd -IP CONTrol=ro
setd !v1 -RIPip CONTrol=(TAlk,Listen)
add !v1 -rip atn 198.18.1.2
```



# COMMANDS AND PARAMETERS FOR ULTRA-WAN CSU/DSU INTERFACES

This appendix describes the various commands and parameters related to configuring and checking status on the Ultra-WAN CSU/DSU connectors.

The first section addresses connector-level path command syntax for Ultra-WAN CSU/DSU connectors and how it is different from path command syntax.

The second section explains in detail each of the connector-level path commands and parameters needed to configure or monitor status on an Ultra-WAN connector on a model S590/S598 PathBuilder switch.

The third section lists the new path parameters.

## Connector and Path Level Command Syntax

Connector-level path parameters differ from other path parameters in the level of impact on the system. For connectors carrying only one path, the impact and the usage model is the same for all path parameters. However, for connectors carrying more than one path, the level of impact and the usage models are different. Ultra-WAN CSU/DSU connectors can be configured in single-path and multiple-path modes of operation.

In the multiple-path ISDN PRI dial configuration, connector-level parameter settings effect all paths carried over the specified connector. For example, disabling the connector disables all the paths on that connector.

The path syntax for multiple-path connector configurations on the Ultra-WAN CSU/DSU connectors shown in Table 27.

**Table 27** Path Syntax for Multiple-Path Connectors

| Syntax | Variables | Description |
|---|---|---|
| <3m.p> and <4m.p> | m = a,b,c,or d | Indicates the connector |
| | p = 1 ... z | Indicates the specific path on the connector |
| | z = 1,23, or 30 | Value of z depends on the configuration |

The connector syntax for multiple-path connector configurations on the Ultra-WAN CSU/DSU connectors is listed in Table 28.

**Table 28** Connector Syntax For Multiple-Path Connectors

| Syntax | Variables | Description |
|---|---|---|
| <3m> and <4m> | m = a,b,c or d | Where m indicates the connector |

In the single-path "leased" (i.e. unstructured) configuration, connector-level parameter settings affect only the one path being carried over the connector. The path syntax for single path connector configurations on the Ultra-WAN CSU/DSU connectors is a subset of the multiple path syntax and is shown in Table 29.

**Table 29** Path Syntax for Single Path Connector

| Syntax | Variables | Description |
|---|---|---|
| <3m.1> and <4m.1> | m = a,b,c, or d | Indicates the connector |
| | .1 | Indicates path 1 on that connector |

Specifically, it is <4m.1> where m = a,b,c, or d and indicates the connector, and 1 indicates path 1 on that connector. The connector syntax for single-path connector configurations on the Ultra-WAN CSU/DSU connectors is the same as as the multiple-path syntax, specifically <4m> where m = a,b,c, or d and indicates the connector.

*Connector-level path parameters still use the Path Service, which is specified as part of the SET, SETDefault, ADD, and DELete commands.*

On Flex-WAN interfaces, since there is never more than one path per Flex-WAN connector, the path and connector syntax is equivalent.

Specifically, it is <nm> where n = 3 or 4 (and indicates the connector grouping) and m = a,b,c, or d (and indicates the connector/path).

## Connector-level Path Parameters

This section describes connector-level path parameters applicable to Ultra-WAN CSU/DSU connectors on the model S590/S598 PathBuilder switches.

### CLock

*Syntax*

```
SETDefault !<path> –PAth CLock = External | Internal
SHow [!<path> | !*] –PAth CLock
SHowDefault [!<path> | !*] –PAth CLock
```

*Default* External

*Description* The CLock parameter selects the clock source for the connector transmitter. External is used for normal operation, indicating that the transmit clock will be derived from the receive clock. Internal is for test purposes, or in rare system topologies where the Ultra-WAN CSU/DSU connector needs to source the system clock. When Internal is selected, the transmit clock is derived from an onboard oscillator.

Before changes to this parameter can take effect a "SETDefault !<path> -PATH ConnControl=Enable" command needs to be issued on the corresponding connector.

### CONNector

*Syntax*

```
SETDefault !<path> –PAth CONNector = [E1_Unstructured |
 T1_Unstructured | E1_Pri | T1_Pri | E1_CHannelized |
 T1_CHannelized ]
 SHow [!<path> | !*] –PAth CONNector
SHowDefault [!<path> | !*] –PAth CONNector
```

*Default* none

*Description* The CONNector parameter specifies the connector type for an Ultra-WAN CSU/DSU and Flex-WAN serial interfaces.

Before changes to this parameter can take effect, a "SETDefault !<path> -PAth ConnCONTrol = Enable" command needs to be issued on the corresponding connector.

### ConnConFig

*Syntax* `SHow [!<path>] -PAth ConnConfig`

*Description* The ConnConFig parameter displays the currently configured values for all of the connector configuration parameters associated with the given path. Note that since this display reflects the operational state of the connector, no parameter setting changes made since the last time the ConnControl parameter has explicitly been set to "Enable" will show in this display.

A sample display is shown here:

```
Show !3b -Path ConnConFig
Path !3b   FrameMode = T1_ESF
Path !3b   CONNector = T1_Pri
Path !3b   SwitchType = DMS100
Path !3b   ENCoding = B8ZS
Path !3b   LineDistance = LH1-0db
Path !3b   CLock = External
Path !3b   ConnControl = Enable
```

### ConnControl

*Syntax*
```
SETDefault !<path> -PAth ConnControl = ([Enabled | Disabled]
SHow !<path> -PAth ConnCONTrol
SHowDefault !<path> -PAth ConnControl
```

*Default* Disabled

*Description* The ConnControl parameter enables or disables the specified connector. ConnControl must be explicitly set to Enabled (even if the parameter is currently set to Enabled) to apply any connector configuration changes made since ConnControl was last set to Enabled. A ConnControl setting of Disabled disables all paths assigned to the specified connector, and puts the transmitter in a T1 mode transmitting an AIS "all ones" signal.

ConnControl, when set to Disabled, disables all paths on the specified connector.

### ConnCouNTers

*Syntax* `SHow [!<path>] -PAth ConnCouNTers`

*Description* The ConnCouNTers parameter displays statistics on the T1/E1 line. The statistics are collected in 96 sample intervals (15 minute samples for the

last 24 hour period) and are collected for each Ultra-WAN CSU/DSU interface. The display shows the cumulative number of events since the last FLUSH command or ReBoot command was issued and also the 96 15-minute intervals, in the last 24 hour period.

A partial sample display is shown here:

```
-------------------------------------------------------------------------------
CONNECTOR 4B
TIME SINCE FLUSH/REBOOT(days:hours:mins:secs):  00:02:34:12
-------------------------------------------------------------------------------
               CUMULATIVE STATISTICS SINCE LAST FLUSHED OR REBOOTED+
ES         00010
OOF        00001
CRC        00019K
FERR       00134
BPV        00005
-------------------------------------------------------------------------------
               LAST 24 HOURS STATISTICS IN 15 MINUTE SAMPLES
                 00:15  00:30  00:45  01:00  01:15  01:30  01:45  02:00  02:15
ES      00000  00000  00000  00000  00000  00000  00000  00000  00000
OOF     00000  00000  00000  00000  00000  00000  00000  00000  00000
CRC     00900  00900  00900  00900  00900  00900  00900  00900  00900
FERR    00900  00900  00900  00900  00900  00900  00900  00900  00900
BPV     00000  00000  00000  00000  00000  00000  00000  00000  00000
-------------------------------------------------------------------------------
```

The statistics definitions are as follows:

ES - Errored Second = A second in which a OOF (Out of Frame) or CRC (Cyclic Redundancy Check error) occured and a UAS (UnAvailable Second) has not occured.

OOF - Out Of Frame = A count of the number of times synchronization to the receive T1 or E1 frame was lost.

CRC - Cyclic Redundancy Check error = A count of CRC-Errored T1 or E1 frames in the receive stream, based on CRC checksum calculations.

FERR - Frame bit ERRor = A count of frame bit errors occuring in the receive T1 or E1 framing patterns.

BPV - BiPolar Violation = A count of illegal bipolar violations reported in the line code of receive T1 or E1 signal.

### ConnStatus

*Syntax* `SHow [!<path>] -PAth ConnStatus`

*Description* The ConnStatus parameter displays the receive-side operational status of an Ultra-WAN CSU/DSU connector. The display is structured as follows:

```
CURRENT CONNECTOR 4.1 STATUS
-----------------------------------------------------
LED:
Carrier (Carrier Detect):GREEN (E1/T1 Frame Sync)
Alarm (Yellow/Blue Alarm):OFF (No Yellow or Blue Alarm Active)
Loopback (Any Loopback):Off (No Loopbacks Active)
-----------------------------------------------------
Layer1 Status:Loopback Status:
LOS (Loss of Signal): OFFRemote Payload: OFF
OOF (Red Alarm): OFFRemote Line:OFF
RAI (Yellow Alarm):OFF
AIS (Blue Alarm):OFF
```

The statistics definitions are as follows:

CD (Carrier Detect) LED: GREEN = None of ALOS, LOS, or RLOF active. This LED is GREEN when frame synchronization to an E1 or T1 frame pattern is present.

Alarm (Yellow Alarm) LED: SOLID YELLOW = RYEL, RMYEL, or RAIS. This LED is YELLOW when the remote alarm indication bit (Yellow Alarm) is set or when an AIS pattern is present on the received line signal.

Loopback (Any Loopback): SOLID YELLOW = PLOOP, LOOP, FLOOP, or ALOOP. This LED is YELLOW when any type of loopback is in progress, regardless of whether UI or CO switch initiated.

Remote Payload, Remote Line Loopbacks: ACTIVE when any of these loopbacks is in progress.

LOS (Loss of Signal): ON = RALOS or RLOS. This status is ON when there is no valid encoded signal present.

OOF (Red Alarm): ON = RLOF. This status is ON when a valid encoded signal is present, but there is no frame synchronization to an E1 or T1 frame pattern.

RAI (Yellow Alarm): ON = RYEL or RMYEL. This status is ON when there is frame synchronization to an E1 or T1 frame pattern and the frame's remote alarm indication bit is set.

AIS (Blue Alarm): ON = RAIS. This status is ON when there is a valid encoded signal present, no frame synchronization present, and an all-1's data pattern is being received.

### FrameMode

*Syntax* `SETDefault !<path> -PAth FrameMode = T1_SF | T1_ESF | E1_CRC4 | E1_NOCRC`

*Default* E1_CRC4

*Description* The FrameMode parameter allows you to specify the frame mode.

Before changes to this parameter can take effect a "SETDefault !<path> -PATH ConnControl=Enable" command needs to be issued on the corresponding connector.

*Values*

| | |
|---|---|
| T1_SF | Superframe format T1. |
| T1_ESF | Extended Superframe format T1. |
| E1_CRC4 | CRC-active E1. |
| E1_NOCRC | E1 without an active CRC. |

### LineDistance

*Syntax* `SETDefault !<path> -PAth TILineDistance = LH1|LH2|LH3|LH4|SH1|SH2|SH3|SH4|SH5|SH7`

*Default* SH7

*Description* The LineDistance parameter determines the supported long haul (LH) or short haul (SH) line distance. Long haul values are in units of dB and short haul values are in units of feet. Note that only short haul is supported for E1 lines.

Before changes to this parameter can take effect a "SETDefault !<path> -PATH ConnControl=Enable" command needs to be issued on the corresponding connector.

*Values*

| | | |
|---|---|---|
| LH1 | T1 | 0 dB |
| LH2 | T1 | 7.5 dB |
| LH3 | T1 | 15 dB |
| LH4 | T1 | 22.5 dB |
| SH1 | T1 | 0-133 feet |
| SH2 | T1 | 133-266 feet |
| SH3 | T1 | 266-399 feet |
| SH4 | T1 | 399-533 feet |
| SH5 | T1 | 533-655 feet |
| SH7 | E1 | G.703 120 Ohm |

### Line ENCoding

*Syntax*

```
SETDefault !<path> -PAth LineENCoding = B8ZS | AMI | HDB3
SHow [!<path> | !*] -PAth LineENCoding
SHowDefault [!<path> | !*] -PAth LineENCoding
```

*Default* HDB3

*Description* The Line ENCoding parameter specifies the transmission encoding method for the T1 or E1 line. The coding method you specify for the line must match the attached communication device. B8ZS or AMI should be used for T1 connectors and HDB3 or AMI should be used for E1 connectors.

Before changes to this parameter can take effect, a "SETDefault !<path> -PAth=ConnCONTrol = Enable" command needs to be issued on the corresponding connector.

### SwitchType

*Syntax*

```
SETDefault !<connectorID> -PAth SwitchType = ETSI | ATT5ESS |
 DMS100 | ATT4ESS | DMS250 | NTT | NI2
```

*Default* ETSI

*Description* The SwitchType parameter specifies the type of central office or PTT switch to which the Ultra-WAN CSU/DSU connector interfaces.

ETSI is valid only for E1 lines. ATT5ESS and DMS100 are valid only for T1 lines.

Before changes to this parameter can take effect a "SETDefault !<path> -PATH ConnControl=Enable" command needs to be issued on the corresponding connector.

### WanCounters

*Syntax* `SHow [!<path>] –PAth WanCounters`

*Description* The WanCounters parameter displays statistics conforming to AT&T TR54016. Although these statistics are tailored to T1 ESF lines, they can also be used to monitor status on other types of T1 lines, and E1 lines as well. The statistics are collected in 96 sample intervals (15 min samples over the last 24 hour period) and are collected for each T1/E1 connector.

A partial sample display is shown here:

```
CONNECTOR 4B
TIME SINCE FLUSH/REBOOT (days:hours:mins:secs):  00:02:34:12
--------------------------------------------------------------------------------
               CUMULATIVE STATISTICS SINCE LAST FLUSHED OR REBOOTED+
ES     00001
SES    00019K
UAS    00005
BES    00010
CSS    00020
LOFC   00010
EFS    00245M
--------------------------------------------------------------------------------
               LAST 24 HOURS STATISTICS IN 15 MINUTE SAMPLES
        00:15  00:30  00:45  01:00  01:15  01:30  01:45  02:00  02:15
ES     00000  00000  00000  00000  00000  00000  00000  00000  00000
SES    00000  00000  00000  00000  00000  00000  00000  00000  00000
UAS    00900  00900  00900  00900  00900  00900  00900  00900  00900
BES    00900  00900  00900  00900  00900  00900  00900  00900  00900
CSS    00000  00000  00000  00000  00000  00000  00000  00000  00000
LOFC   00000  00000  00000  00000  00000  00000  00000  00000  00000
EFS    00000  00000  00000  00000  00000  00000  00000  00000  00000
--------------------------------------------------------------------------------
```

The statistics definitions are as follows:

- ES - Errored Second = A second in which a OOF (Out of Frame) or CRC (Cyclic Redundancy Check error) occured and a UAS has not occured.
- SES - Severely Errored Second = A second in which a OOF or greater than 319 CRCs occured and a UAS(see below) has not occured.
- UAS - UnAvailable Second = A second in which all of the previous 10 contiguous one-seconds were all SES, or in which any of the previous

10 contiguous one-seconds were UAS and any of the previous 10 contiguous one-seconds were SES.

- BES - Bursty Errored Second = A second in which more than 1, but less than 320 CRCs occured and a UAS has not occured.
- CSS - Controlled Slip Errored Second = a second in which a CoFA (Change of Frame Alignment) occured.
- LOFC - Loss Of Frame Count = number of times a OOF occurs.
- EFS - Error Free Second = a second in which none of ES, SES, or UAS occured.

## Connector-level Commands

This section describes connector-level configuration and status commands applicable to Ultra-WAN CSU/DSU connectors on a model S590 PathBuilder switch.

### Flush

*Syntax* `FLUSH [!<path>] –PAth ConnCounters`

*Description* This command resets all of the ConnCounters statistics collection, so that collection can begin at a known point in time.

### LPBCK

*Syntax* `LPBCK !<path> –PAth RmLnLpck | RmPyldLpbck | STOP`

*Description* This command allows the receive path of the Ultra-WAN CSU/DSU connector to be looped back to the transmit path. RmLnLpck specifies a remote line loopback. RmPyldLpck specifies a remote payload loopback. Loopback mode runs continuously until the stop setting is issued.

*The LPBCK command has other parameters than those shown here. These other parameters are for factory test only and should not be used.*

## Path Parameters

### ChannelBaud

*Syntax*

```
SETDefault !<path> -PAth ChannelBaud = [ cb56k | cb64k ]
SHow !<path> -PAth ChannelBaud
SHowDefault !<path> -PAth ChannelBaud
```

*Default* cb64k

*Description* The ChannelBaud parameter specifies the baud rate (56kbits/sec or 64kbits/sec) of each timeslot (channel) mapped to the specified path. All timeslots mapped to a given path must be equivalent in baudrate. This parameter is only used on Ultra-WAN CSU/DSU connectors, and only in non-dial configurations.

*Values*

| | |
|---|---|
| cb56k | 56kbits/sec timeslot data throughput rate |
| cb64k | 64kbits/sec timeslot data throughput rate |

### ChannelMap

*Syntax*

```
ADD !<path> -PAth ChannelMap <channel numbers, with commas>
DELete !<path> -PAth ChannelMap <channel numbers, with commas>
SHow !<path> -PAth ChannelMap
SHowDefault !<path> -PAth ChannelMap
```

*Default* Varies depending on connector values
E1_U,T1_U - All timeslots allocated to x.1 path
E1_C, T1_C - No timeslots allocated to any path, an add command must be used to assign timeslots.

*Description* The ChannelMap parameter specifies the timeslots (channels) associated with the specified path. All paths on an Ultra-WAN CSU/DSU connector, except the first (4x.1), have a default assignment of no timeslots. The first path (4x.1) has a factory-configured default assignment of all available timeslots for that connector. This parameter is only used on Ultra-WAN CSU/DSU connectors, and only in non-dial configurations.

*Channel Number Values* 1 through 31 for E1 CONNector settings.

1 through 24 for T1 CONNector settings.

Numbers separated by a comma: 1,2,3,4,5,6

# J

# PERFORMANCE MONITORING AND LOOPBACK SUPPORT ON ULTRAWAN CONNECTORS

This appendix describes the PathBuilder UltraWAN CSU/DSU performance monitoring support capabilities on E1/T1 lines. It addresses the support of ATT TR54016 and ANSI T1.403-1995 based performance monitoring standards, as well as performance information available via the user interface.

## ATT TR54016 Compliance

UltraWAN CSU/DSU connectors support central-office switch-initiated loopback activation and deactivation requests.

Remote Line Loopback activation is supported on T1 ESF lines, via the in-band, framed, 10 second duration pattern of 00001. Remote Line Loopback deactivation is supported via the in-band, framed, 10 second duration patttern of 001.

Remote Payload Loopback activation is supported on T1 ESF lines via the payload loopback activate request Message-oriented Protocol (MOP) being sent over the Facilities Data Link (FDL) channel. Remote Payload Loopback deactivation is supported via the payload loopback deactivate request MOP being sent over the FDL.

Performance Monitoring Statistics Collection and Reporting is supported on T1ESF lines, as described in sections 3 and 4 of the ATT TR54016 standard. Both standard and enhanced parameter reporting is supported. Statistics are collected every second. Statistics are reported, via status MOPs on the FDL, as a response to various statistics request MOPs on the FDL from the central office switch.

## ANSI T1.403-1995 Compliance

UltraWAN CSU/DSU connectors support central-office switch-initiated loopback activation and deactivation requests.

Remote Line Loopback activation is supported on T1SF lines via the in-band, framed, 10 second duration pattern of 00001. Remote Line Loopback deactivation is supported via the in-band, framed, 10 second duration pattern of 001.

Remote Line Loopback activation is supported on T1ESF lines via the line loopback activate request Bit-oriented Protocol (BOP) 0x0EFF pattern being sent over the Facilities Data Link (FDL) channel. Remote Line Loopback deactivation is supported via the payload loopback deactivate request BOP 0x38FF being sent over the FDL.

Remote Payload Loopback activation is supported on T1ESF lines via the payload loopback activate request Bit-oriented Protocol (BOP) 0x14FF pattern being sent over the Facilities Data Link (FDL) channel. Remote Payload Loopback deactivation is supported via the payload loopback deactivate request BOP 0x32FF being sent over the FDL.

Performance Monitoring Statistics Collection and Reporting is supported on T1ESF lines, as described in section 9.4 of the ANSI T1.403-1995 standard. Statistics are collected every second. Statistics are reported, via status MOPs on the FDL, to the central office switch once every second.

## Additional Performance Monitoring Support on the Console Interface

UltraWAN CSU/DSU connectors also support loopback activation and deactivation via the console interface. In this case, in-band, BoP, or MoP activation and deactivation requests are not used or recognized. Instead, a loopback condition is forced on the connector from the Pathbuilder software. Loopbacks support for both E1 and T1 lines is provided. This is especially helpful for E1 lines, since no standards exist for in-band activation and deactivation. See the LPBK command in Appendix H for more detail on how to activate and deactivate a loopback from the console.

Two performance statistics displays are provided to console users. These displays contain the detailed statistics information specified in the AT&T TR54016.

Although these statistics have been defined for reporting on T1 ESF lines, the statistics information is available for both E1 and T1 lines. Once again, this is especially helpful for E1 lines, since no standards exist for in-band reporting of this information to the PTT switch.

The specific display parameters and commands are described next:

### WanCounters

*Syntax* `SHow [!<path>] -PAth WanCounters`

*Default* No Default

*Description* This parameter displays statistics conforming to AT&T TR54016. Although these statistics are tailored towards T1 ESF lines, they can also be usedi to monitor status on other types of T1 lines, and E1 lines, as well. The statistics are collected in 96 sample intervals (15 min samples over the last 24 hour period) and are collected for each Ultra-WAN CSU/DSU interface.

A partial sample display is shown here:

```
CONNECTOR 4B
TIME SINCE FLUSH/REBOOT (days:hours:mins:secs):  00:02:34:12
--------------------------------------------------------------------------------
               CUMULATIVE STATISTICS SINCE LAST FLUSHED OR REBOOTED+
ES     00001
SES    00019K
UAS    00005
BES    00010
CSS    00020
LOFC   00010
EFS    00245M
--------------------------------------------------------------------------------
               LAST 24 HOURS STATISTICS IN 15 MINUTE SAMPLES
        00:15  00:30  00:45  01:00  01:15  01:30  01:45  02:00  02:15
ES     00000  00000  00000  00000  00000  00000  00000  00000  00000
SES    00000  00000  00000  00000  00000  00000  00000  00000  00000
UAS    00900  00900  00900  00900  00900  00900  00900  00900  00900
BES    00900  00900  00900  00900  00900  00900  00900  00900  00900
CSS   00000  00000  00000  00000  00000  00000  00000  00000  00000
LOFC   00000  00000  00000  00000  00000  00000  00000  00000  00000
EFS    00000  00000  00000  00000  00000  00000  00000  00000  00000
--------------------------------------------------------------------------------
```

The statistics definitions are as follows:

ES - Errored Second = A second in which a OOF (Out of Frame) or CRC (Cyclic Redundancy Check error) occured and a UAS has not occured.

SES - Severely Errored Second = A second in which a OOF or greater than 319 CRCs occured and a UAS has not occured.

UAS - UnAvailable Second = A second in which all of the previous 10 contiguous one-seconds were all SES or in which any of the previous 10 contiguous one-seconds were UAS and any of the previous 10 contiguous one-seconds were SES.

BES - Bursty Errored Second = A second in which more than 1, but less than 320 CRCs occured and a UAS (see above) has not occured.

CSS - Controlled Slip Errored Second = a second in which a CoFA (Change of Frame Alignment) occured.

LOFC - Loss Of Frame Count = number of times a OOF occurs.

EFS - Error Free Second = a second in which none of ES, SES, or UAS occured.

### ConnCouNTers

*Syntax* `SHow [!<path>] -PAth ConnCouNTers`

*Default* No Default

*Description* This parameter displays the primitive line statistics of the E1/T1 line. The statistics are collected in 96 sample intervals (15 minute samples for the last 24 hour period) and are collected for each UltraWAN CSU/DSU interface. The display will show the cumulative number of events since the last FLUSH command (see below) or ReBoot command was issued and the 96 15-minute intervals, covering the last 24 hour period.

A partial sample display is shown here:

```
------------------------------------------------------------------------------
CONNECTOR 4B
TIME SINCE FLUSH/REBOOT(days:hours:mins:secs):  00:02:34:12
------------------------------------------------------------------------------
               CUMULATIVE STATISTICS SINCE LAST FLUSHED OR REBOOTED+
ES         00010
OOF        00001
CRC        00019K
FERR       00134
BPV        00005
------------------------------------------------------------------------------
               LAST 24 HOURS STATISTICS IN 15 MINUTE SAMPLES
                 00:15  00:30  00:45  01:00  01:15  01:30  01:45  02:00  02:15
ES      00000  00000  00000  00000  00000  00000  00000  00000  00000
OOF     00000  00000  00000  00000  00000  00000  00000  00000  00000
CRC     00900  00900  00900  00900  00900  00900  00900  00900  00900
FERR    00900  00900  00900  00900  00900  00900  00900  00900  00900
BPV    00000  00000  00000  00000  00000  00000  00000  00000  00000
------------------------------------------------------------------------------
```

The statistics definitions are as follows:

ES - Errored Second = A second in which a OOF (Out of Frame) or CRC (Cyclic Redundancy Check error) occured and a UAS (UnAvailable Second) has not occured. This is the same statistic provided in the WanCounter display. It is not actually a primitive statistic, but is included here for convenience.

OOF - Out Of Frame = A count of the number of times synchronization to the receive T1 or E1 frame was lost.

CRC - Cyclic Reduncy Check error = A count of CRC-Errored T1 or E1 frames in the receive stream, based on CRC checksum calculations.

FERR - Frame Bit ERRor = A count of frame bit errors occuring in the receive T1 or E1 framing patterns.

BPV - Bipolar Violation = A count of illegal bipolar violations reported in the line code of the receive T1 or E1 signal.

### FLUSH

*Syntax* `FLUSH [!<path>] -PAth ConnCouNTers`

*Description* This command resets all of the ConnCouNTers statistics collection, so that collection can begin at a known point in time.

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## W

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