MAX TNT Hardware Installation Guide

Ascend Communications, Inc.
Part Number: 7820-0546-003
For software version 7.0.0

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- For the latest information about the Ascend product line, visit our site on the World Wide Web:

  `http://www.ascend.com`

- For software upgrades, release notes, and addenda to this manual, visit our FTP site:

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Important safety instructions

The following safety instructions apply to the MAX TNT:

1 Product installation should be performed by trained service personnel only.

2 Read and follow all warning notices and instructions marked on the product or included in the manual.

3 The maximum recommended ambient temperature for MAX TNT models is 104° Fahrenheit (40° Celsius). Take care to allow sufficient air circulation or space between units when the MAX TNT is installed in a closed or multirack assembly, because the operating ambient temperature of the rack environment might be greater than room ambient.

4 Slots and openings in the cabinet are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these slots and openings must not be blocked or covered.

5 Installation of the MAX TNT in a rack without sufficient air flow can be unsafe.

6 If the unit is installed in a rack, the rack should safely support the combined weight of all equipment it supports. A fully loaded redundant-power MAX TNT weighs 130 lbs (58.97 kg). A fully loaded single-power MAX TNT weighs 30 lbs (13.6 kg).

7 The connections and equipment that supply power to the MAX TNT should be capable of operating safely with the maximum power requirements of the MAX TNT. In the event of a power overload, the supply circuits and supply wiring should not become hazardous. The input rating of the MAX TNT is printed on its nameplate.

8 Models with AC power inputs are intended for use with a three-wire grounding type plug—a plug that has a grounding pin. This is a safety feature. Equipment grounding is vital to ensure safe operation. Do not defeat the purpose of the grounding type plug by modifying the plug or using an adapter.

9 Before installation, use an outlet tester or a voltmeter to check the AC receptacle for the presence of earth ground. If the receptacle is not properly grounded, the installation must

not continue until a qualified electrician has corrected the problem. Similarly, in the case of DC input power, check the DC ground(s).

10 If a three-wire grounding type power source is not available, consult a qualified electrician to determine another method of grounding the equipment.

11 Models with DC power inputs must be connected to an earth ground through the terminal block Earth/Chassis Ground connectors. This is a safety feature. Equipment grounding is vital to ensure safe operation.

12 Before installing wires to the MAX TNT unit's DC power terminal block, verify that these wires are not connected to any power source. Installing live wires (that is, wires connected to a power source) is hazardous.

13 Connect the equipment to a 48 VDC supply source that is electrically isolated from the AC source. The 48 VDC source should be reliably connected to earth ground.

14 Install only in restricted-access areas in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA 70.

15 Do not allow anything to rest on the power cord, and do not locate the product where persons will walk on the power cord.

16 Do not attempt to service this product yourself. Opening or removing covers can expose you to dangerous high voltage points or other risks. Refer all servicing to qualified service personnel.

17 General purpose cables are provided with this product. Special cables, which might be required by the regulatory inspection authority for the installation site, are the responsibility of the customer.

18 When installed in the final configuration, the product must comply with the applicable Safety Standards and regulatory requirements of the country in which it is installed. If necessary, consult with the appropriate regulatory agencies and inspection authorities to ensure compliance.

19 A rare phenomenon can create a voltage potential between the earth grounds of two or more buildings. If products installed in separate buildings are *interconnected*, the voltage potential might cause a hazardous condition. Consult a qualified electrical consultant to determine whether or not this phenomenon exists and, if necessary, implement corrective action before interconnecting the products.

In addition, if the equipment is to be used with telecommunications circuits, take the following precautions:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- Avoid using equipment connected to telephone lines (other than a cordless telephone) during an electrical storm. There is a remote risk of electric shock from lightning.
- Do not use a telephone or other equipment connected to telephone lines to report a gas leak in the vicinity of the leak.

Warning: To reduce the risk of fire, communication cable conductors must be 26 AWG or larger.

Avertissement: Afin de reduire les risques d'incendie, les fils conducteurs du cable de communication doivent etre d'un calibre minimum de 26 AWG (American Wire Gauge), cest-a-dire d'un minimum de 0,404 mm.

Warnung: Um Feuerrisiken zu reduzieren, müssen die Kommunikationskabel-Anschlüße 26 AWG oder größer sein.

Contents

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Introduction

1

This introduction covers the following topics:

What is in this guide

This guide describes how to install and configure the MAX TNT chassis, including multishelf systems. It then explains how to install and configure the MAX TNT slot cards for both LAN and WAN access. After you have finished using this guide, you can continue with the *MAX TNT Network Configuration Guide* to perform more advanced configuration of your unit. If you are experiencing problems with your unit, or need to perform maintenance on it, see the *MAX TNT Adminstration Guide*.

Depending on how you are going to set up your unit, and the types of cards you have purchased, you might need information from only a few chapters, or from many chapters.

Table 1-1 presents the tasks explained in this manual and the chapters that describe them.

Table 1-1. Configuration tasks

Task	Chapter or Appendix
Installing the chassis, understanding the status-indicator lights, and powering on.	Chapter 2, “Installing the MAX TNT Chassis”
Basic configuration of the MAX TNT, including the system date and time, IP address, DNS information, and basic security.	Chapter 3, “Performing Basic Configuration”
Installing a multishelf system. A MAX TNT multishelf system allows several MAX TNT units to act as one logical unit.	Chapter 4, “Installing a Multishelf System”

Table 1-1. Configuration tasks (continued)

Task	Chapter or Appendix
Installing and configuring slot cards	Slot-card chapters for the cards you have purchased.
Configuring call routing to direct incoming and outgoing calls to the proper LAN or WAN interface	Chapter 17, “Call Routing in the MAX TNT”
Provisioning the MAX TNT WAN lines	Appendix A, “Provisioning the Switch.”
Configuring the ADSL COE and CPE voice splitter	Appendix B, “Configuring the ADSL Voice Splitter.”
Using technical specifications	Appendix C, “MAX TNT General Specifications,”and Appendix D, “MAX TNT Cabling and Connector Specifications.”

What you should know

This guide attempts to provide a conceptual framework sufficient to enable an administrator who is not an expert in a particular network technology to configure the unit accurately. But it does not start from the beginning with any network management topic. Following are the general areas in which it is helpful have some existing knowledge when configuring the related MAX TNT network capabilities:

- Dial-in LAN connections such as PPP and multilink PPP
- Connection cost management and accounting
- Modems
- Frame Relay
- IP routing
- DNS
- OSPF routing (if applicable)
- Multicast (if applicable)
- Packet structure and formats (for defining filters)
- Network security

Related publications

Additional information is available in the other guides in the MAX TNT documentation set. If you need more background information than these guides provide, many external references are readily available on the Web or in technical bookstores. You will find a partial list of such references below.

MAX TNT documentation set

The MAX TNT documentation set consists of the following manuals:

- *The Ascend Command Line Interface*. Shows how to use the MAX TNT command-line interface effectively.
- *MAX TNT Adminstration Guide*. Contains troubleshooting and administrative information.
- MAX TNT *Hardware Installation Guide* (this manual). Shows how to install the MAX TNT hardware and configure its shelf controller and slot cards for a variety of supported uses. Describes how calls are routed through the system. Includes the MAX TNT technical specifications and some administrative information.
- *MAX TNT Glossary.* Defines networking terms and concepts used in the MAX TNT documentation.
- *MAX TNT Network Configuration Guide*. Describes how to use the command-line interface to configure WAN connections and other related features.
- *MAX TNT RADIUS Configuration Guide*. Describes how to use install and configure RADIUS.
- *MAX TNT Reference Guide*. An alphabetic reference to all MAX TNT profiles, parameters, and commands.

Related RFCs

RFCs are available on the Web at http://ds.internic.net.

Information about PPP connections

For information about PPP connections and authentication, you might want to download one or more of the following:

- RFC 1332: *The PPP Internet Protocol Control Protocol (IPCP)*
- RFC 1618: *PPP over ISDN*
- RFC 1638: *PPP Bridging Control Protocol (BCP)*
- RFC 1661: *The Point-to-Point Protocol (PPP)*
- RFC 1662: *PPP in HDLC-like Framing*
- RFC 1877: *PPP Internet Protocol Control Protocol Extensions for Name Server Addresses*
- RFC 1934: *Ascend's Multilink Protocol Plus (MP+)*
- RFC 1962: *The PPP Compression Control Protocol (CCP)*
- RFC 1974: *PPP Stac LZS Compression Protocol*
- RFC 1989: *PPP Link Quality Monitoring*
- RFC 1990: *The PPP Multilink Protocol (MP)*
- RFC 1994: *PPP Challenge Handshake Authentication Protocol (CHAP)*
- RFC 2125: *The PPP Bandwidth Allocation Control Protocol (BACP)*
- RFC 2153: *PPP Vendor Extensions*

Information about IP routers

RFCs that describe the operation of IP routers include:

- RFC 1256: *ICMP Router Discovery Messages*
- RFC 1393: *Traceroute Using an IP Option*
- RFC 1433: *Directed ARP*
- RFC 1519: *Classless Inter-Domain Routing (CIDR): An Address Assignment and Aggregation Strategy*
- RFC 1582: *Extensions to RIP to Support Demand Circuits*
- RFC 1787: *Routing in a Multi-provider Internet*
- RFC 1812: *Requirements for IP Version 4 Routers*
- RFC 2002: *IP Mobility Support*
- RFC 2030: *Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI*

Information about OSPF routing

For information about OSPF routing, see:

- RFC 1245: *OSPF protocol analysis*
- RFC 1246: *Experience with the OSPF protocol*
- RFC 1583: *OSPF Version 2*
- RFC 1586: *Guidelines for Running OSPF Over Frame Relay Networks*
- RFC 1587: *The OSPF NSSA Option*
- RFC 1850: *OSPF Version 2 Management Information Base*

Information about multicast

For information about multicast, see:

- RFC 1458: *Requirements for Multicast Protocols*
- RFC 1584: *Multicast Extensions to OSPF*
- RFC 1949: *Scalable Multicast Key Distribution*

Information about firewalls and packet filtering

RFCs that describe firewalls and packet filters include:

- RFC 1579: *Firewall-Friendly FTP*
- RFC 1858: *Security Considerations for IP Fragment Filtering*

Information about general network security

RFCs pertinent to network security include:

- RFC 1244: *Site Security Handbook*
- RFC 1281: *Guidelines for the Secure Operation of the Internet*
- RFC 1636: *Report of IAB Workshop on Security in the Internet Architecture*
- RFC 1704: *On Internet Authentication*

Information about external authentication

For information about RADIUS and TACACS authentication, see:

- RFC 2138: *Remote Authentication Dial-In User Service (RADIUS)*
- RFC 1492: *An Access Control Protocol, Sometimes Called TACACS*

ITU-T recommendations

ITU-T recommendations (formerly CCITT) are available commercially. You can order them at http://www.itu.ch/publications/.

Related books

The following books are available in technical bookstores.

- *Routing in the Internet*, by Christian Huitema. Prentice Hall PTR, 1995. Recommended for information about IP, OSPF, CIDR, IP multicast, and mobile IP.
- *SNMP, SNMPV2 and RMON: Practical Network Management*, by William Stallings. Addison-Wesley, 1996. Recommended for network management information.
- *Enterprise Networking: Fractional T1 to Sonet Frame Relay to Bisdn*, by Daniel Minoli. Artech House, 1993. Recommended as a WAN reference.
- *TCP/IP Illustrated*, volumes 1&2, by W. Richard Stevens. Addison-Wesley, 1994.

Documentation conventions

Table 1-2 shows the documentation conventions used in this guide.

Table 1-2. Documentation conventions

Convention	Meaning
`Monospace text`	Represents text that appears on your computer's screen, or that could appear on your computer's screen.
`Boldface mono-space text`	Represents characters that you enter exactly as shown (unless the characters are also in ***`italics`***—see *Italics*, below). If you could enter the characters, but are not specifically instructed to, they do not appear in boldface.
Italics	Represent variable information. Do not enter the words themselves in the command. Enter the information they represent. In ordinary text, italics are used for titles of publications, for some terms that would otherwise be in quotation marks, and to show emphasis.
[ ]	Square brackets indicate an optional argument you might add to a command. To include such an argument, type only the information inside the brackets. Do not type the brackets unless they appear in bold type.

Table 1-2. Documentation conventions (continued)

Convention	Meaning
|	Separates command choices that are mutually exclusive.
>	Points to the next level in the path to a parameter. The parameter that follows the angle bracket is one of the options that appears when you select the parameter that precedes the angle bracket.
Key1-Key2	Represents a combination keystroke. To enter a combination keystroke, press the first key and hold it down while you press one or more other keys. Release all the keys at the same time. (For example, Ctrl-H means hold down the Control key and press the H key.)
Press Enter	Means press the Enter, or Return, key or its equivalent on your computer.
Note:	Introduces important additional information.
 Caution:	Warns that a failure to follow the recommended procedure could result in loss of data or damage to equipment.
 **Warning:**	Warns that a failure to take appropriate safety precautions could result in physical injury.

Installing the MAX TNT Chassis

2

This chapter covers the following topics:

Installation overview

This chapter explains how to install a single shelf MAX TNT. If you are installing a multishelf system, read this chapter and Chapter 3, “Performing Basic Configuration,” before installing your system.

Table 2-1 lists the sections describing installation tasks you might need to perform, and provides a brief description of each.

Table 2-1. MAX TNT installation overview

Section	Description
“Before you begin” on page 2-3	Explains what you need before installing the MAX TNT.
“Power requirements” on page 2-3	Explains the MAX TNT power requirements.
“Checking the package contents” on page 2-4	Helps you verify that you have all the necessary hardware.
“Understanding the back panel” on page 2-5	Describes the elements of the MAX TNT back panel.
“Understanding the shelf-controller back panel” on page 2-6	Describes the MAX TNT shelf controller, which controls the slot cards and contains lights that indicate overall system status.
“Verifying the rotary switch setting and PCMCIA card” on page 2-8	Describes the multishelf rotary switch and the PCMCIA card. The PCMCIA card must be installed for the MAX TNT to boot.
“Rack mounting the MAX TNT” on page 2-10	Describes how to install the MAX TNT in a rack.
“Installing a slot card” on page 2-13	Explains how to install a slot card into the MAX TNT chassis.
“Installing high-output power supplies” on page 2-15	Explains how to install high output power supplies into the MAX TNT chassis. If you have Series56 II Digital Modem cards, you might need to install high output power supplies.
“Connecting the MAX TNT to the LAN” on page 2-19	Explains how to connect the MAX TNT shelf-controller Ethernet port to the LAN.
“Connecting a workstation to the serial port” on page 2-20	Explains how to connect a PC to MAX TNT serial port to perform first time configuration. After assigning an IP address and gateway to the MAX TNT, you can configure it remotely through Telnet.
“Powering on the MAX TNT” on page 2-21	Explains how to power on the MAX TNT and check the PCMCIA card file system to diagnose potential problems with booting up.
“Where to go next” on page 2-22	Explains where to go after installing the MAX TNT chassis.

Before you begin

Before you install the MAX TNT, make sure you have the following:

- Phillip-head screwdriver to install the MAX TNT slot cards.
- Antistatic wrist straps and mats.
- Suitable location with adequate power.
- At least one active T1 or E1 line set up for bidirectional calling. (Bidirectional calling allows you to test the MAX TNT hardware by having the MAX TNT dial out on one channel and answer on another channel.)
- Local workstation with VT100 terminal-emulation software. (You must assign an IP address through a connection to the serial port of the MAX TNT. Later, you can use Telnet to configure the system.)
- Workstation on a different subnet, from which you can Ping the MAX TNT to verify the configuration.
- IP address for the MAX TNT.
- Default gateway for the MAX TNT, if your setup requires one.

Power requirements

The MAX TNT allows you to freely mix and match the various types of slot cards, with few restrictions. Use the following information to help determine your power requirements:

- The most power consumed by any of the MAX TNT cards is 40 watts, dual-height or single-height. Therefore you can plan for 640 watts for a fully-loaded MAX TNT shelf.
- For ac power, provide power via two dedicated 120 VAC 20 A outlets with a dedicated ground.
- If you are installing Series56 II Digital Modem cards, you should verify that you have high-output power supplies installed in the MAX TNT. For more information, see “Installing high-output power supplies” on page 2-15.
- If you are installing new slot cards in the MAX TNT you must have a version of system software that supports the new cards. For information on the software version required for a particular card, see the MAX TNT release notes.

Checking the package contents

The MAX TNT package contents vary, depending on the base unit and slot cards you order. The first step after opening the package is to verify that you have the system you ordered. Figure 2-1 shows a standalone MAX TNT shelf. A multishelf system combines multiple interleaved shelves in a chassis.

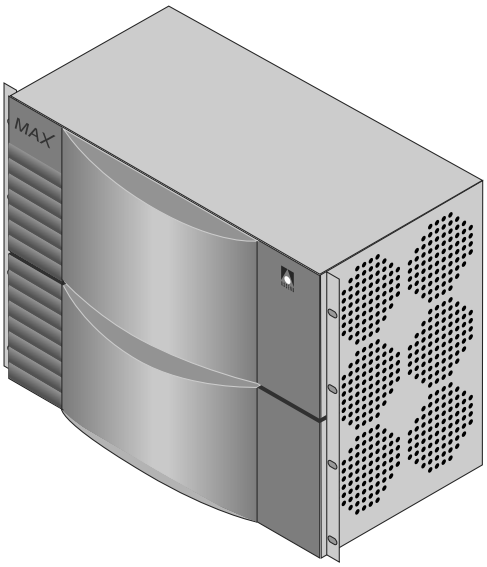

Figure 2-1. Standalone shelf front panel

Verify that the package also contains the following items:

- Power cable.
- Personal Computer Memory Card International Association (PCMCIA) cards.
- Rack mounting kit for mounting the MAX TNT in a 19- or 23-inch rack.
- Any slot cards you ordered with the system. If you ordered them separately, check the separate packaging.

If you are missing any items, contact your MAX TNT distributor.

Understanding the back panel

Figure 2-2 shows the back panel of a standalone shelf. The shelf controller is always slot 17. The remaining slots are numbered 1 through 16. (For information about installing a slot card in a slot, see the chapter about the card, later in this manual.)

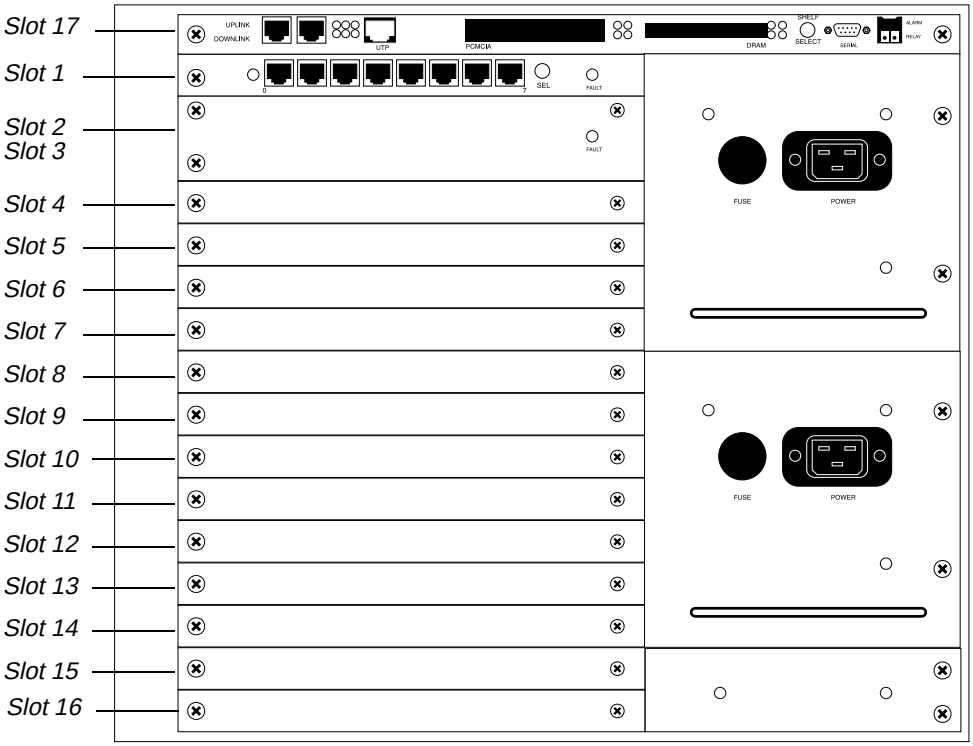

Figure 2-2. Back panel of the MAX TNT

Understanding the shelf-controller back panel

Before you begin installing the hardware, you need some understanding of the ports and other items on the MAX TNT shelf controller. Figure 2-3 shows the location and Table 2-2 describes the function of each element on the shelf controller.

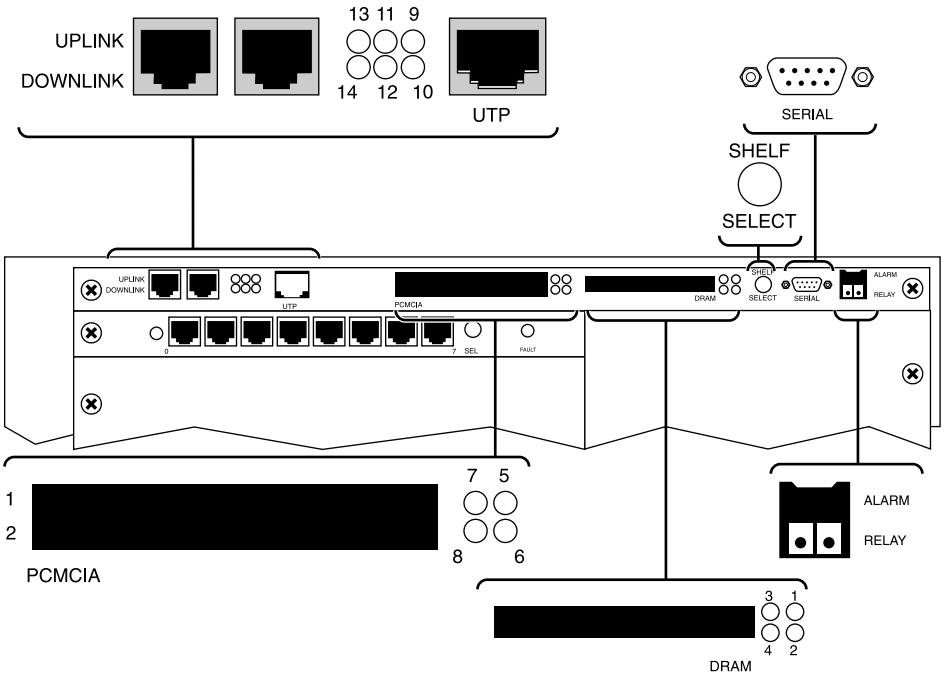

Figure 2-3. MAX TNT shelf-controller back panel

Table 2-2. Description of shelf-controller back panel items

Back panel item	Description
Uplink/Downlink	Ports for intershelf communications.
UTP port	Ethernet port to connect Unshielded Twisted-Pair (UTP) Ethernet LAN cable to the MAX TNT.
Serial port	Serial console port for MAX TNT management.
PCMCIA slots	Two flash PCMCIA slots, labeled 1 and 2.
DRAM upgrade slot	PCMCIA slot for DRAM upgrades.
Shelf-Select rotary switch	This switch is used for MAX TNT multishelf configurations. Each shelf in a multishelf system must have its rotary switch set to a unique number. (For information about configuring a multishelf system, see Chapter 4, “Installing a Multishelf System.”)

The lights on the shelf-controller back panel

The lights (also called LEDs) on the MAX TNT back panel can be helpful if you experience a problem, especially if it occurs shortly after power on. Figure 2-4 shows the location of the lights on the back panel, and Table 2-3 describes them.

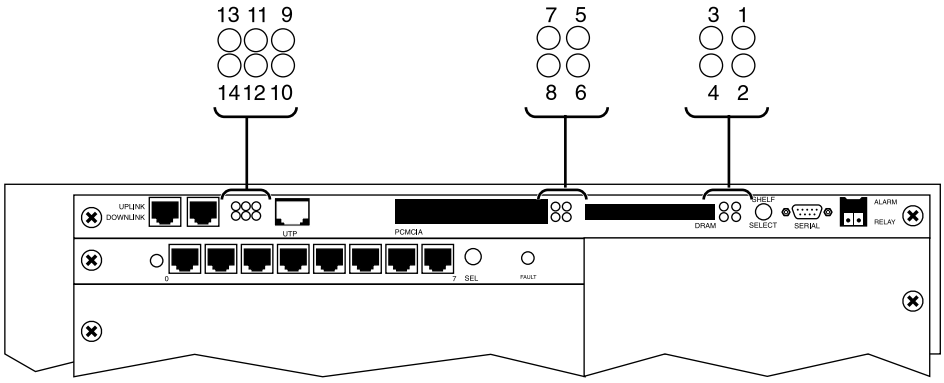

Figure 2-4. Location of the MAX TNT lights

Table 2-3. MAX TNT lights

Lights	Description
1	Green. On when the unit has power.
2	Green. On for any functioning shelf in a multishelf system, whether it is configured as master or slave.
3	Yellow. Behaves as follows: • On after you reset the unit • Off after the unit passes Power-On Self Test (POST) and is running • Blinks if a fatal error has occurred
4	Yellow. This is the multishelf alarm light. If the master shelf goes down (if, for example, the multishelf cable is removed), this light goes on, on each slave shelf, after about nine seconds. Note that on the master shelf, this alarm light does not go on.
5	Green. On when Power Supply A is installed and working.
6	Green. On when Power Supply B is installed and working.
7	Yellow. On when Power Supply A is installed and a fault occurs.
8	Yellow. On when Power Supply B is installed and a fault occurs.
9	Green. On when an Ethernet 10Base-T link has been established.
10	Green. On when an Ethernet AUI link has been established.

Table 2-3. MAX TNT lights (continued)

Lights	Description
11	Green. On when the Ethernet link is active.
12	Green. On when the Ethernet link is active and link integrity has been confirmed.
13	Green. On when there is Ethernet activity between MAX TNT shelves.
14	Yellow. On when an Ethernet collision occurs.

Verifying the rotary switch setting and PCMCIA card

Make sure the switch is not set to 0. Figure 2-5 shows an acceptable setting. (In a multishelf system, each shelf must have a unique setting.)

Caution: If the rotary switch is set to 0, the MAX TNT will not operate correctly.

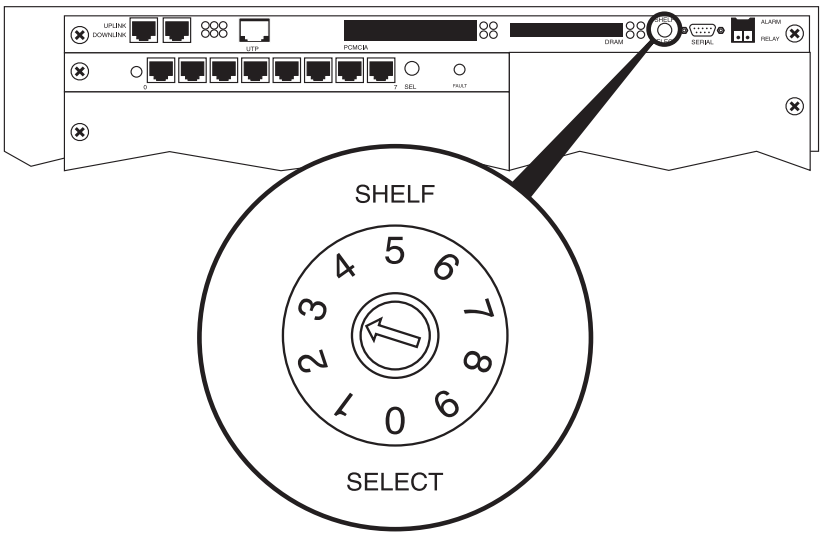

Figure 2-5. Verifying the rotary switch setting

Also, make sure the PCMCIA card is inserted in the first PCMCIA slot.

Caution: Do not remove the PCMCIA flash card while the MAX TNT is running. Doing so can damage the card and require its replacement.

Guidelines for installing MAX TNT units in a rack or cabinet

Keep the following information in mind when installing MAX TNT units in a rack or cabinet.

- The rack should safely support the combined weight of all equipment it contains. A fully loaded redundant-power MAX TNT weighs 130 lbs (58.97 kg).
- Installation of the MAX TNT in a rack without sufficient air flow can be unsafe.
- You must install the MAX TNT exhaust shields to ensure that hot air from one MAX TNT is not being blown into adjacent units. See “Installing MAX TNT exhaust shields” on page 2-12.
- You need not concern yourself with air gaps between MAX TNT shelves on a rack, because the MAX TNT fans sufficiently cool each shelf.
- Racks with open sides are recommended because the MAX TNT fans vent on the side of the unit.
- Slots and openings in the cabinet are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these slots and openings must not be blocked or covered.
- Install the MAX TNT exhaust shields on the exhaust side of the MAX TNT unit (on the left as viewed from the front). The exhaust shields redirect hot air from MAX TNT units so that it is not being blown into adjacent units. (For information on installing exhaust shields, see “Installing MAX TNT exhaust shields” on page 2-12.)
- Ensure adequate cooling in the room.
  - The maximum recommended ambient temperature for MAX TNT models is 104° Fahrenheit (40° Celsius). Take care to allow sufficient air circulation or space between units when the MAX TNT is installed in a closed or multirack assembly, because the operating ambient temperature of the rack environment might be greater than room ambient.
  - In enclosed racks make sure there are openings in the floor underneath each cabinet to allow the air conditioning up into the cabinet.
  - Exhaust fans at the top of the cabinet are recommended but not required. At a minimum the cabinets must be ventilated at the top.

Rack mounting the MAX TNT

Before installing the MAX TNT in a rack, you must install the MAX TNT rack ears as illustrated in Figure 2-6. These rack ears should come with your unit. If you do not receive them, contact your Ascend reseller. Apply 7 to 8 in/lbs of torque to each screw.

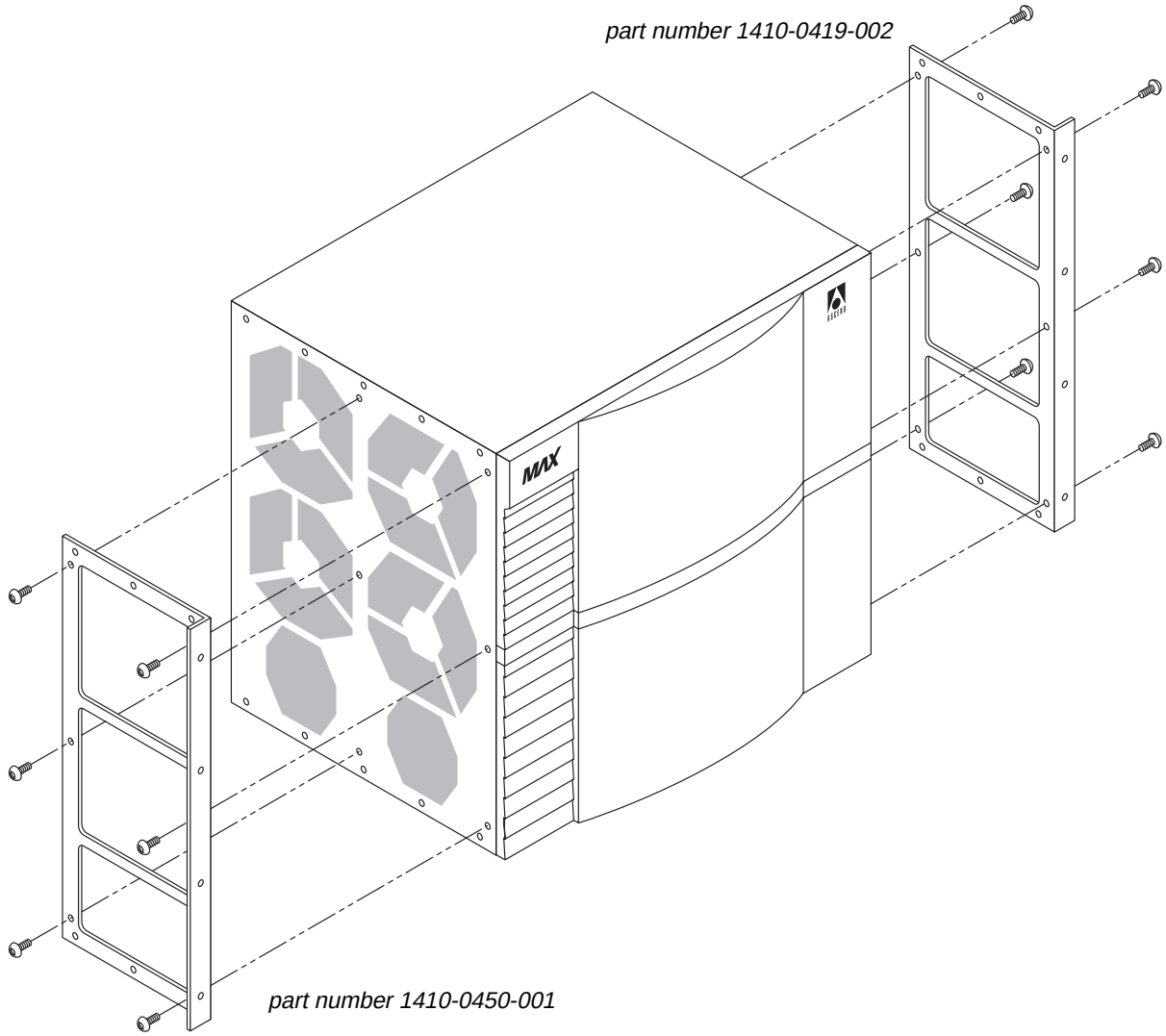

Figure 2-6. Installing the MAX TNT rack ears

You can mount the MAX TNT in either a 19- or 23-inch rack. A single MAX TNT shelf has the dimensions shown in Figure 2-7.

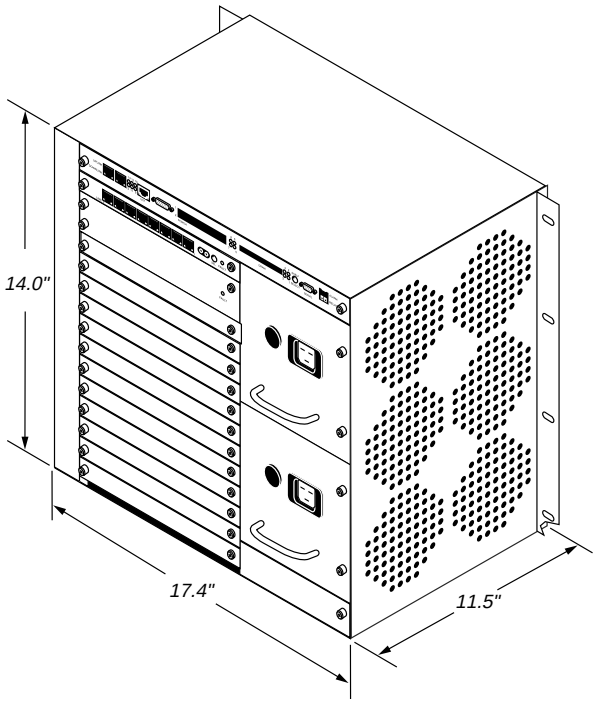

Figure 2-7. MAX TNT dimensions

Insert the unit in the rack and secure it as shown in Figure 2-8. If you need more information, refer to the instructions that came with your rack.

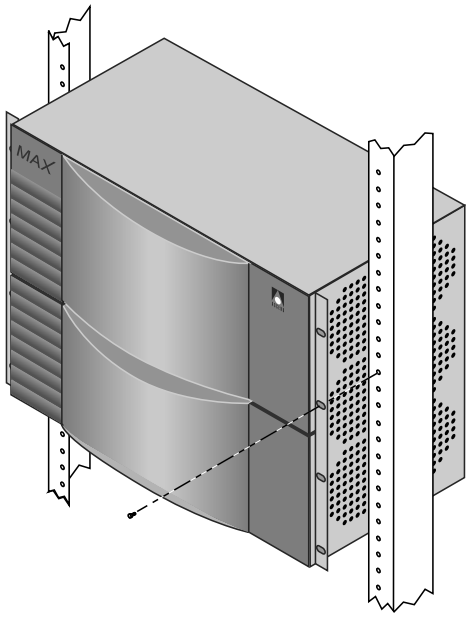

Figure 2-8. Mounting the MAX TNT in a rack

Installing MAX TNT exhaust shields

There are two different MAX TNT exhaust shields; 0800-0464-00*x* for racks and 0800-0492-00*x* for cabinets (where *x* represents a digit subject to change). The exhaust shields redirect hot air from MAX TNT units so that it is not being blown into adjacent units. Figure 2-9 illustrates how to install the exhaust shields in a rack. Figure 2-10 illustrates how to install the exhaust shields in a cabinet.

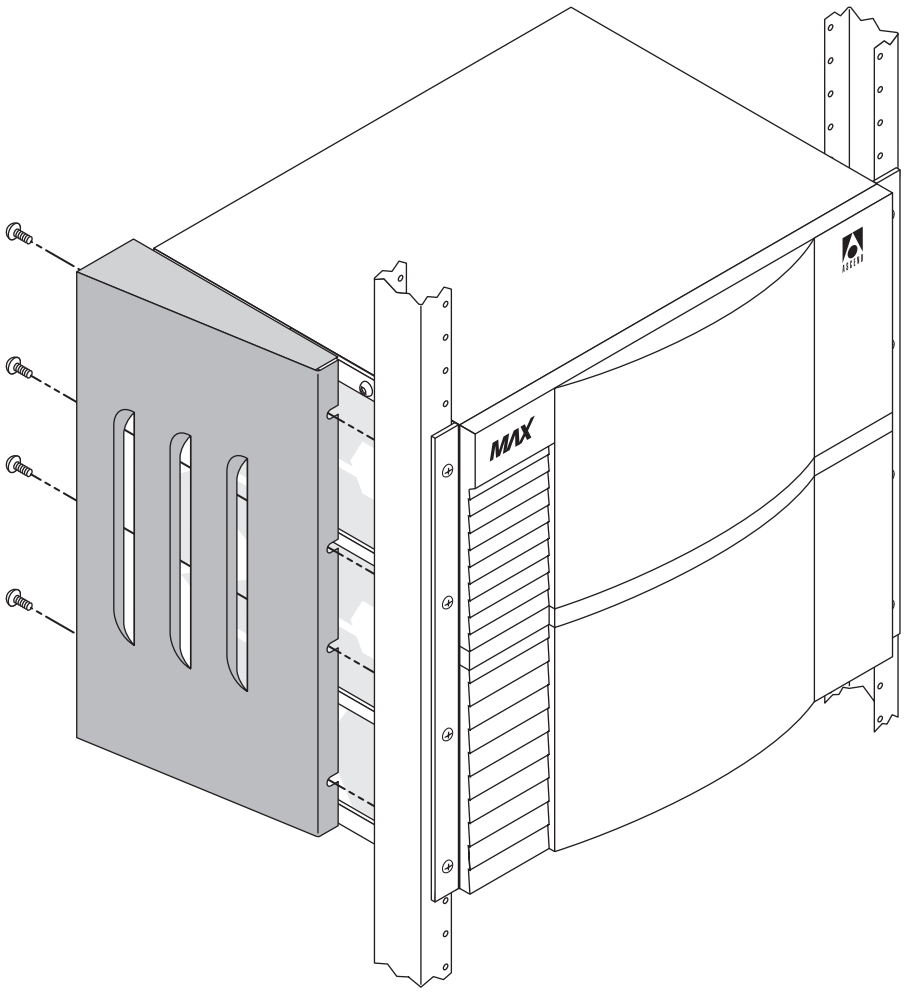

Figure 2-9. Exhaust shield installed in a rack

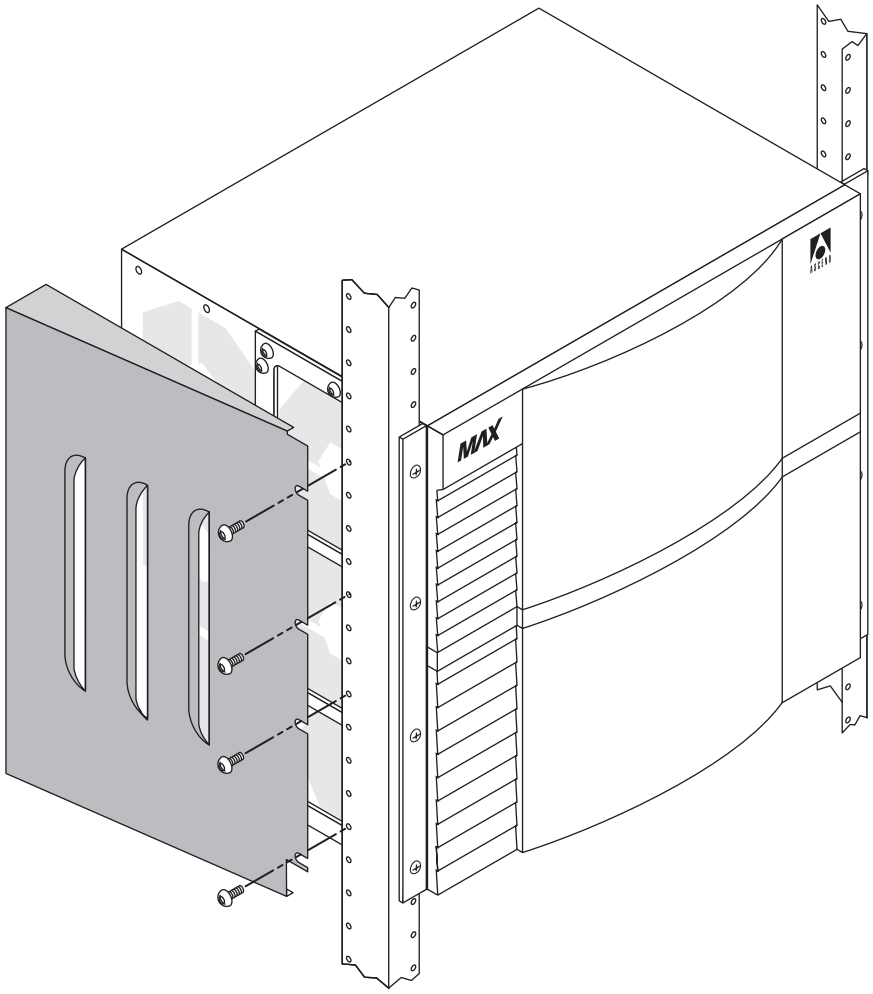

Figure 2-10. Exhaust shield installed in a cabinet

Installing a slot card

Note: All MAX TNT slot cards are supported *only* in MAX TNT units. You must install any MAX TNT slot card in a MAX TNT unit that supports that specific slot card.

Before installing a slot card, make sure that the software running on the system supports the card. This is particularly important if you have a new card. You must first upgrade your system software, then install the card. If you do not upgrade the system software first, the card may not function properly.

Refer to the release notes for information on software required for a particular slot card. For information about loading software on the MAX TNT and recovering from a failed slot card installation, see the *MAX TNT Adminstration Guide.*

If your MAX TNT package includes slot cards that are not already installed in your MAX TNT, insert the cards now. Proceed as follows:

1 Hold the slot card with the panel facing you and the lock screw on the left, and insert the card into the open slot as shown in Figure 2-11.

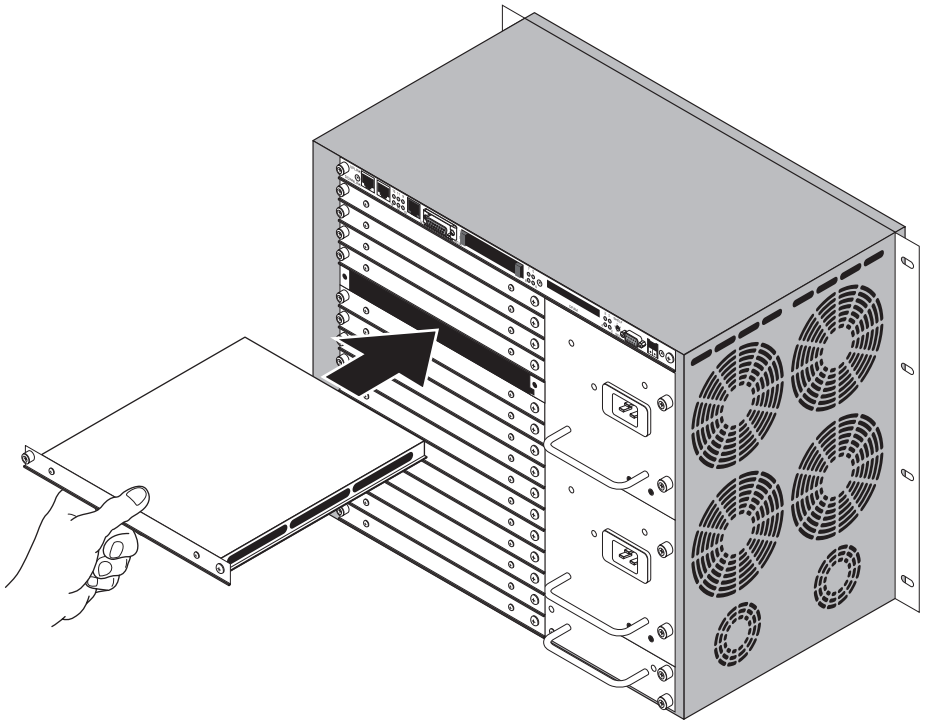

Figure 2-11. Inserting a slot card into a MAX TNT

2 Push the card along the internal card guides until the jackscrew on the right side of the card panel is seated in the hole in the MAX TNT back panel. The panel of the slot card should touch the back panel of the MAX TNT.

Caution: Do not force the slot card into the slot. Doing so can damage the card or slot connector.

3 Tighten the lock screw on the left side of the card, as shown in Figure 2-12.

All MAX TNT slot cards are hot-swappable, meaning that you can safely insert or remove cards while the MAX TNT power is on.

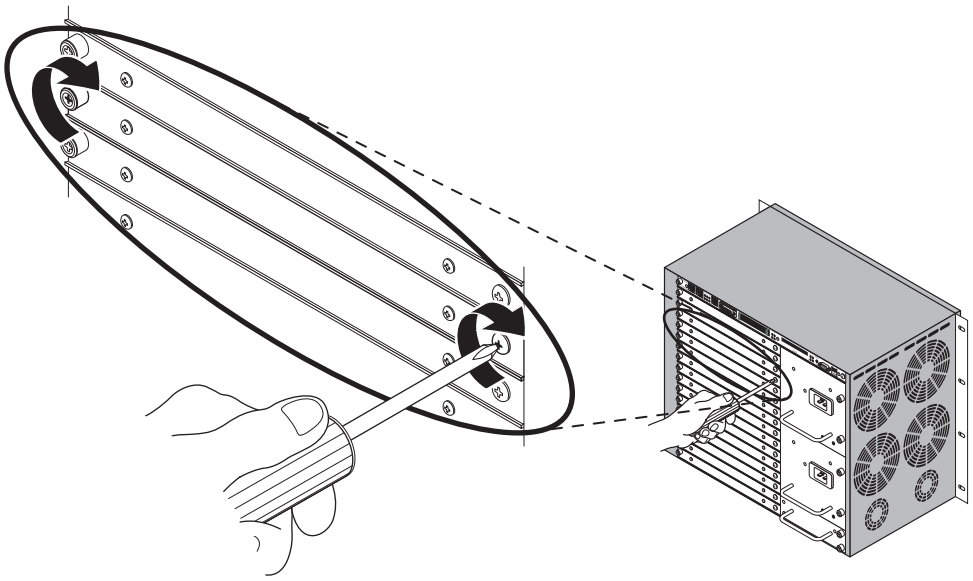

Figure 2-12. Tightening slot card lock screws

Installing high-output power supplies

If you have purchased a new MAX TNT, it includes high output power supplies. If you have an older MAX TNT and want to install Series56 II Digital Modem cards, you might need to replace the existing power supplies with the high-output power supplies.

Caution: Read this section in its entirety before installing Series56 II cards or high-output power supplies. Improper installation of the MAX TNT power supplies could damage the unit.

Before you begin

Before installing the high-output power supply, consider the following:

- The high-output power supply cannot be hot-swapped with existing power supplies. You must power down the MAX TNT to replace the power supplies.
- The high-output power supply cannot be used in redundant configurations with existing power supplies. Attempting to mix-and-match different power supplies will invalidate associated warranties.
- The high-output power supply is 100% plug-in compatible with the existing MAX TNT power supplies. However, the high-output power supply is not compatible with the old power supply, so new power supplies must be installed in pairs.
- The capacitor card installed beneath the power supplies provides redundancy to existing MAX TNT power supplies. Although this card is not used for the high-output power supplies, this card must be left in place when installing a high-output power supply, as it provides EMI protection. If you have a new MAX TNT unit, there is a plate in this space for EMI purposes.

Identifying the high output power supply

New MAX TNT units will have the high-output power supplies pre-installed. Figure 2-13 shows how to identify the new high-output acpower supply.

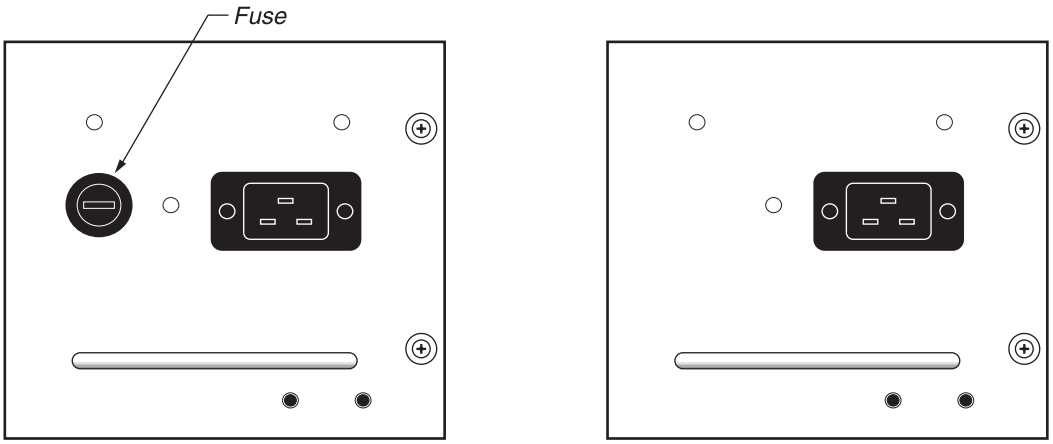

Figure 2-13. Identifying the high-output ac power supply

Figure 2-14 shows how to identify the new high-output dc power supply.

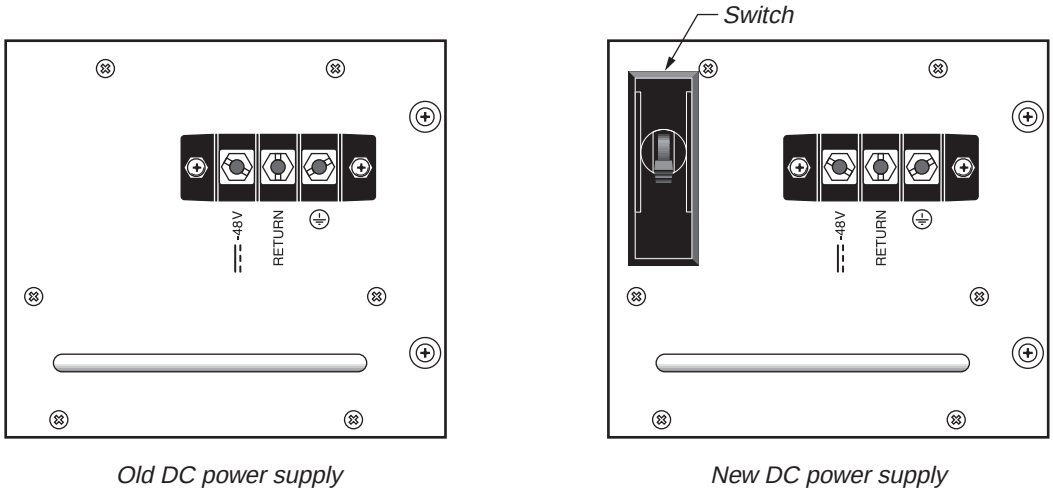

Figure 2-14. Identifying the high-output dc power supply

Installing a high-output power supply

To install a high-output power supply, proceed as follows:

1 Power down the MAX TNT.

2 If you have a dc power supply unit, remove the terminal block wires.

3 Unscrew the power supply units from the MAX TNT chassis as shown in Figure 2-15.

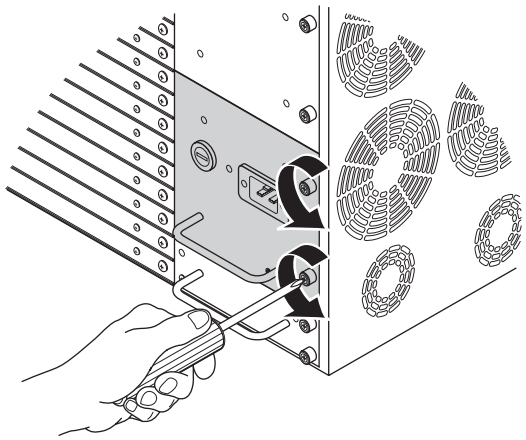

Figure 2-15. Unscrewing the power supply

Warning: Do not remove the power supply capacitor card located below the MAX TNT power supplies. Doing so will disrupt airflow within the MAX TNT chassis.

4 Remove the existing power supplies as shown in Figure 2-16.

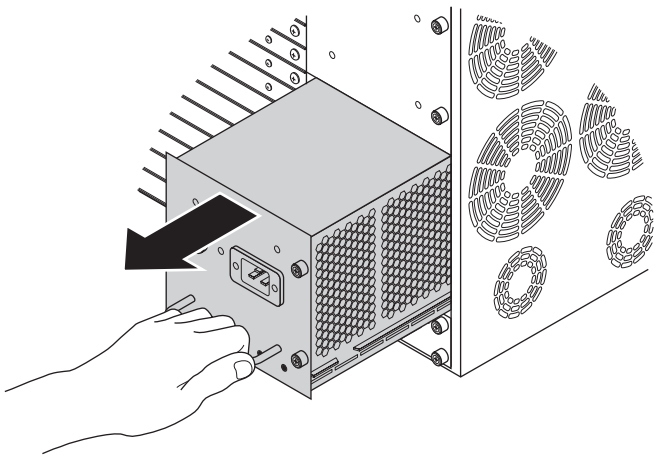

Figure 2-16. Removing the power supply

5 Gently insert the new power supply as shown in Figure 2-17.

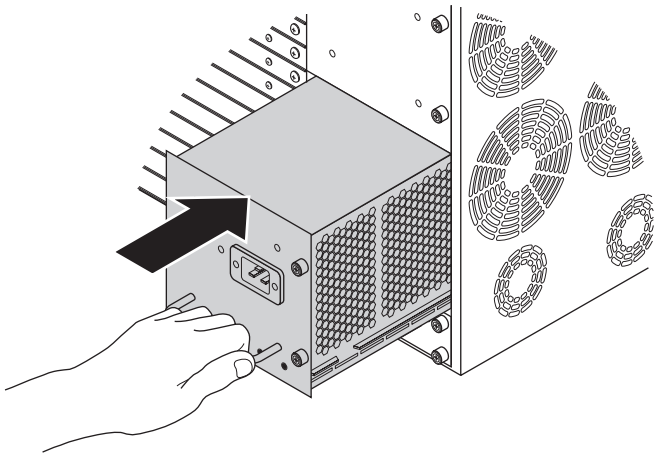

Figure 2-17. Inserting the power supply

6 Tighten the power supply lockscrews as shown in Figure 2-18.

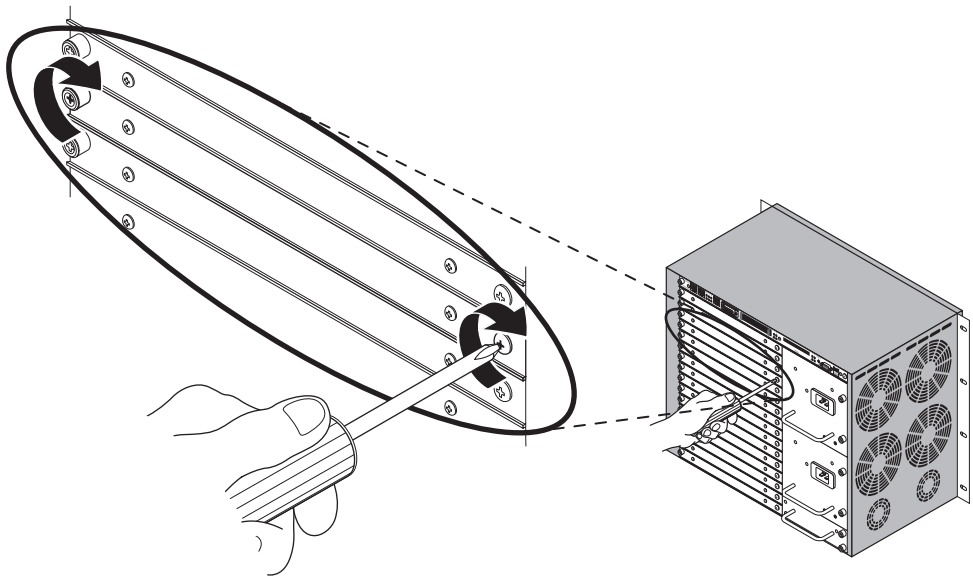

Figure 2-18. Tightening the power supply lockscrews

7 If you have a redundant power supply, repeat steps 2 through 6 for the remaining power supply.

Connecting the MAX TNT ac power supply

To connect the ac power supply, plug the power cord into the MAX TNT power supply socket.

Warning: Models with ac power inputs are intended for use with a three-wire grounding type plug—a plug that has a grounding pin. This is a safety feature. Equipment grounding is vital to ensure safe operation. Do not defeat the purpose of the grounding type plug by modifying the plug or using an adapter.

Connecting the MAX TNT dc power supply

The MAX TNT dc power supply requires 3 inputs: -48 Vdc, Return (-48 Vdc return) and earth/chassis ground. -48V and Return are isolated from ground.

Solid copper (12 AWG) should be used to connect the power supply terminal block ground to the facility's ground. If the MAX TNT is fed from an isolated supply, you must supply a solid ground to earth via copper rods. This ground must be less than 5 Ohms.

A single drop to all MAX TNT units on one rack is acceptable. An example of wiring the terminal block is shown in Figure 2-19.

Warning: Before installing wires to the MAX TNT unit's dc power terminal block, verify that these wires are not connected to any power source and that the MAX TNT power supply switch is in the Off (down) position. Installing live wires (that is, wires connected to a power source) is hazardous.

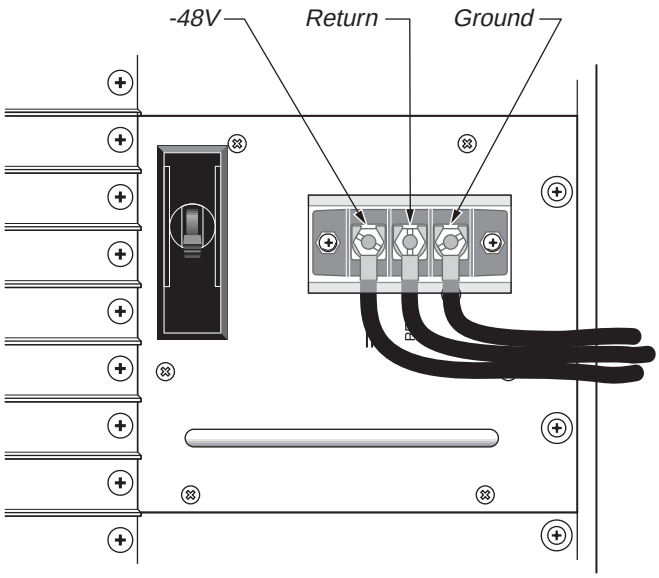

Figure 2-19. Connecting to dc power

Connecting the MAX TNT to the LAN

All MAX TNT systems have an Ethernet port on the shelf controller. This Ethernet port is designed for out-of-band management and light traffic loads. It is not intended to be the primary Ethernet interface for the system. If your MAX TNT will be routing heavy Ethernet traffic, use an Ethernet card.

If you do not need a LAN interface, skip this section and proceed to "Connecting a workstation to the serial port" on page 2-20.

To connect the MAX TNT to your LAN, plug Ethernet LAN cables into one of the unit's Ethernet ports. Figure 2-20 shows the Ethernet LAN cable connected to the shelf-controller Ethernet interface for out-of-band management.

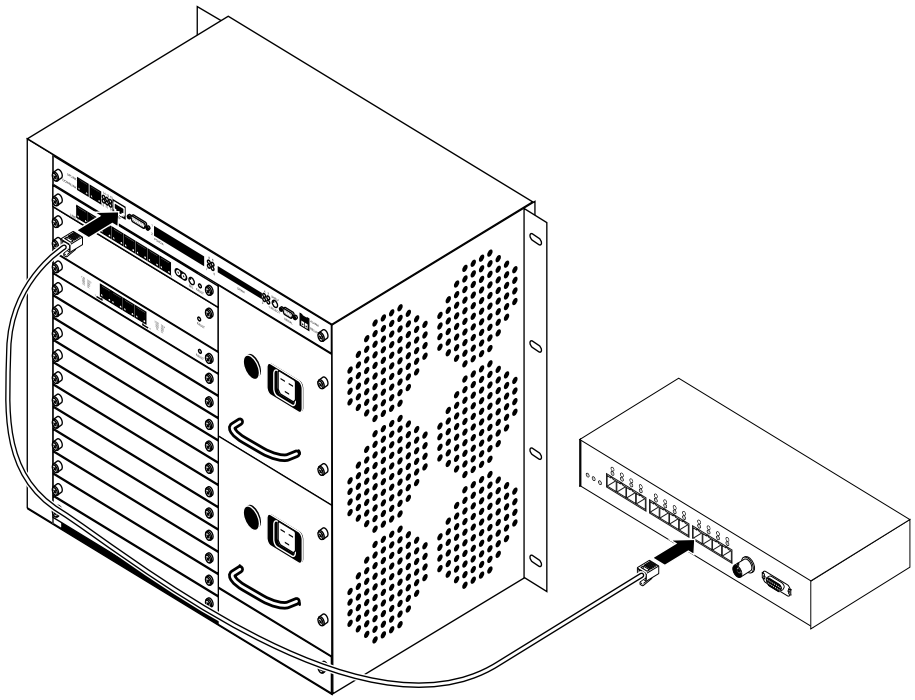

Figure 2-20. Connecting Ethernet cable

Connecting a workstation to the serial port

To perform the initial configuration of the MAX TNT, you must connect a cable to the MAX TNT serial port.

1 Connect a serial cable from your workstation to the MAX TNT as shown in Figure 2-21.

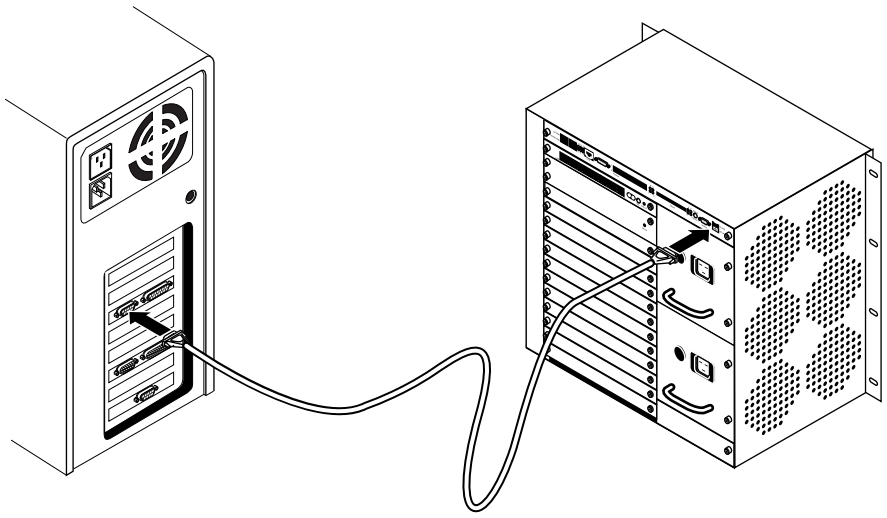

Figure 2-21. Connecting a serial cable to the MAX TNT

2 Set the terminal-emulation package in your communications software as follows:

- 9600 bps
- Direct connection
- 8 data bits
- No parity
- 1 stop bit
- No flow control

Powering on the MAX TNT

To power on the MAX TNT:

1. Position yourself so that you can watch the lights on the back panel while you view the monitor display.
2. Turn on the power to the unit. For ac power supplies, plugging in the power cord supplies power. For dc power supplies, flip the power switch to the On (up) position.
3. After a few minutes, the terminal emulator should display the following messages (if it does not, press Ctrl-L to refresh the screen):

```
        *** TNT, unconfigured unit***
The system date is: Thu Aug 27 12:34:39 1998
If incorrect, please enter the proper value using this com-
mand:
date yymmddhhmm
Please configure these profiles:
SYSTEM
IP-GLOBAL
IP-INTERFACE
LOG
SERIAL
for your operating environment.
TNT>
```

4. Check the PCMCIA flash-card file system to verify that there are no errors on the card or in its contents:

```
admin>fsck 1
ffs check in progress for card 1...
Dir 1 not in use

Dir 2 has magic, version 2, size 16, sequence 0xa
Using dir entry: 2, total data blocks: 0x40, directory size: 16

shelf-controller:(0xfe)

    reg   good  1228008 (0x12bce8) Sep 23 18:08

8t1-card:(0x00)

    reg   good   195368 (0x02fb28) Sep 23 18:08

4ether-card:(0x10)

    reg   good   176597 (0x02b1d5) Sep 23 18:08

48modem-card:(0x01)
```

```
    reg   good   690472 (0x0a8928) Sep 23 18:09
t3-card:(0x06)
    reg   good   224620 (0x036d6c) Sep 23 18:09
4swan-card:(0x03)
    reg   good   423878 (0x0677c6) Sep 23 18:09
10-unchan-t1-card:(0x05)
    reg   good   508874 (0x07c3ca) Sep 23 18:09
hdlc2-card:(0x21)
    reg   good   637813 (0x09bb75) Sep 23 18:09
csmx-card:(0x31)
    reg   good   798139 (0x0c2dbb) Sep 23 18:10
flash card 1 fsck: good.
```

Where to go next

To perform the initial configuration of the MAX TNT, see Chapter 3, “Performing Basic Configuration.”

Performing Basic Configuration

3

This chapter covers the following topics:

Introduction

Table 3-1 lists the sections describing the tasks you should perform for the MAX TNT basic configuration. The table includes a brief description of each task and lists the commands and parameters you will use.

For information about more advanced configuration of your MAX TNT, see the *MAX TNT Network Configuration Guide*.

Table 3-1. Basic MAX TNT configuration tasks

Section	Description of task6	Related commands or parameters
“Setting the system date” on page 3-2	Specify the date and time for the MAX TNT system clock.	Date
“Setting the system name” on page 3-3	Specify the name of the MAX TNT. This name is used for authentication.	System profile > Name
“Setting the log level” on page 3-3	Specify the level of event information the MAX TNT displays at the console.	Log profile > Save-level

Table 3-1. Basic MAX TNT configuration tasks (continued)

Section	Description of task6	Related commands or parameters
"Configuring the shelf-controller IP address" on page 3-4	Typically, the shelf-controller IP address that you specify is used as the IP address for the MAX TNT system as a whole.	IP-Interface profile > IP-address
"Configuring a default gateway" on page 3-4	Designate a default gateway so that the MAX TNT can forward packets for which it has no route.	IP-Route > gateway-address
"Configuring basic DNS information" on page 3-5	Specify a Domain Name System (DNS) server so that you can use names instead of IP addresses to reach IP hosts.	IP-global profile > Domain-name IP-global profile > DNS-primary-server IP-global profile > DNS-secondary-server
"Pinging the MAX TNT from a local host" on page 3-5	After configuring the MAX TNT with its basic settings, you can use Ping to verify that it is communicating on the network.	Ping
"Recommended basic security measures" on page 3-6	Before making the MAX TNT accessible to users, you should configure some basic security on the unit.	User > Password Serial > Auto-Logout Serial > User IP-global profile > Must-Accept-Address-Assign IP-global profile >Ignore-ICMP-Redirects SNMP profile

Setting the system date

If the system date displayed on your screen is incorrect, set the correct date and time with the Date command. For example, to set the date and time to October 22, 1997, 8:50 in the morning:

```
admin> date 9710220850
```

The format for setting the date and time is:

yymmddhhmm

Enter the hour in military (24-hour) time.

Setting the system name

You can assign the MAX TNT a system name of up to 24 characters. Because the system name is used for authenticating connections, you should probably keep it relatively simple and use only standard characters.

Here is an example of how to set the MAX TNT system name:

```
admin> read system
SYSTEM read
admin> list
name = ""
system-rmt-mgmt = no
use-trunk-groups = no
idle-logout = 0
parallel-dialing = 5
single-file-incoming = yes
admin> set name = tnt01
admin> write
```

Setting the log level

While you are configuring the MAX TNT, you might want to increase the log level to display messages that are of interest only when debugging configuration settings. First display the current settings, then enter a new one.

To display the system-wide event-logging parameters, use the Read and List commands:

```
admin> read log
LOG read
admin> list
save-level = info
save-number = 100
syslog-enabled = no
host = 0.0.0.0
facility = local0
```

To change the log level, specify an option for the Save-Level parameter:

```
admin> set save-level = [none|emergency|alert|criti-
cal|error|warning|notice|info|debug]
admin> write
```

(If your local network supports a Syslog server, you can configure the server's IP address and the Syslog facility number by setting the Host and Facility parameters in this profile.)

Configuring the shelf-controller IP address

All MAX TNT systems have an Ethernet port on the shelf controller. This Ethernet port is designed for out-of-band management and light traffic loads. It is not intended to be the primary Ethernet interface for the system. If your MAX TNT will be routing heavy Ethernet traffic, use an Ethernet card.

To assign an IP address to the Ethernet interface of the MAX TNT shelf controller, use the Read and List commands to display the shelf's IP-Interface profile, and then set the IP-Address parameter. For example:

```
admin> read ip-interface {{1 controller 1 } 0 }
IP-INTERFACE/{ { shelf-1 controller 1 } 0 } read
admin> list
interface-address* = { { shelf-1 controller 1 } 0 }
ip-address = 0.0.0.0/0
2nd-ip-address = 0.0.0.0/0
rip-mode = routing-off
..
..
admin> set ip-address = 10.2.3.4/24
admin> write
```

After you assign the MAX TNT host name and IP address, you might need to modify the host information on your local DNS server to include the MAX TNT.

Configuring a default gateway

If the MAX TNT does not have a route for the destination address of a packet, it forwards the packet to the default router. Most sites use the default router (such as a GRF router or a UNIX host running the route daemon) to distribute routing tasks among devices. If you do not configure a default route, the MAX TNT drops packets for which it has no route.

You configure the default route in the IP-Route profile. The name of the default IP-Route profile is always Default, and its destination is always 0.0.0.0.

To configure the default route, first Read and List the default IP-Route profile, then set the Gateway-Address parameter. For example:

```
admin> read ip-route default
IP-ROUTE/default read
admin> list
name* = default
dest-address = 0.0.0.0/0
gateway-address = 0.0.0.0
metric =1
cost =1
preference = 100
third-party = no
ase-type = type-1
ase-tag = c0:00:00:00
private-route = no
```

```
active-route = no
admin> set gateway-address = 10.2.3.17
admin> set active-route=yes
admin> write
IP-ROUTE/default written
```

Configuring basic DNS information

The example in this section uses the domain name *abc.com* and sets the IP address of the primary Domain Name System (DNS) server on the local network. Setting this basic information enables you to access IP hosts by name instead of by IP address.

Here is an example that shows how to configure the DNS information:

```
admin> read ip-global
IP-GLOBAL read
admin> list
domain-name = ""
dns-primary-server = 0.0.0.0
dns-secondary-server = 0.0.0.0
netbios-primary-ns = 0.0.0.0
netbios-secondary-ns = 0.0.0.0
must-accept-address-assign = no
pool-base-address = [ 0.0.0.0 0.0.0.0 ]
..
..
admin> set domain-name = abc.com
admin> set dns-primary-server = 10.1.2.3
admin> set dns-secondary-server = 10.24.112.57
admin> write -f
```

Pinging the MAX TNT from a local host

After you configure the MAX TNT for IP network access, go to an IP host on the local network and use the Ping command to verify that the unit can communicate on the network. For example:

```
host-1% ping 10.2.3.4
```

or, if the MAX TNT is integrated into your DNS system:

```
host-1% ping tnt01
```

Recommended basic security measures

The MAX TNT is shipped from the factory with all its security features set to defaults that enable you to configure and set up the unit without any restrictions. Before you make the MAX TNT generally accessible, you should change the default security settings to protect the configured unit from unauthorized access.

Before bringing the MAX TNT online, at least consider the following important security measures:

- Changing the Admin password
- Securing the serial port
- Assigning a Telnet password
- Requiring callers to accept dynamic IP addresses
- Ignoring ICMP redirects
- Disabling directed broadcasts
- Configuring SNMP access to the MAX TNT

For more details about security, see the *MAX TNT Network Configuration Guide*.

Changing the Admin password

A user who knows the password to the Admin level can perform any operation on the MAX TNT, including changing the configuration. The Admin password is set to `Ascend` by default, and you should assign a secret password immediately.

Following is an example of changing the Admin password:

```
default> auth admin
Password: Ascend

admin> read user admin
USER/admin read

admin> set password = secret

admin> write
USER/admin written
```

Note that the Allow-Password permission is set to No in the Admin login. While this protects the unit's passwords, it also prevents the Save command from storing passwords in a configuration file. To save passwords in a configuration file, you can set Allow-Password to Yes in the Admin profile, or you can create another User profile for the purpose of backing up the unit and set Allow-Password to Yes in that profile.

Securing the serial port

By default, when users connect to the serial port on the shelf controller, they are logged in with the Admin User profile. To secure the serial port with a username and password, proceed as follows:

1 Read the Serial profile:

```
admin>read serial { 1 17 2}
```

2 Set the User profile to null:

```
admin>set user =
```

3 Set Auto-Logout to Yes:

```
admin>set auto-logout = yes
```

This automatically logs out the current User profile if DTR is lost on the serial port.

4 Write the profile:

```
admin>write
```

Now users connecting to the serial port must supply a valid username and password for access to the MAX TNT through the serial port.

Assigning a Telnet password

Ascend recommends that you assign a Telnet password, which can be up to 21 characters in length, to prevent unauthorized Telnet sessions. A user who opens a Telnet session to the MAX TNT will be prompted to supply this password.

Following is an example of assigning a Telnet password:

```
admin> read ip-global
IP-GLOBAL read
admin> set telnet-password = SDwiw87
admin> write
IP-GLOBAL written
```

All users attempting to access the MAX TNT unit via Telnet are prompted for the Telnet password. They are allowed three tries, each with a 60-second time limit, to enter the correct password. If all three tries fail, the connection attempt times out.

Requiring acceptance of the pool address

During PPP negotiation, a caller could reject the IP address offered by the MAX TNT and present its own IP address for consideration. For security reasons, you might want to set the Must-Accept-Address-Assign parameter to Yes to ensure that the MAX TNT terminates such a call:

```
admin> read ip-global
IP-GLOBAL read
admin> set must-accept-address-assign = yes
admin> write
IP-GLOBAL written
```

If you enforce acceptance of the assigned address, the Answer-Defaults profile must enable dynamic assignment, the caller's configured profile must specify dynamic assignment, and the caller's PPP dial-in software must be configured to acquire its IP address dynamically. For more details, see the *MAX TNT Network Configuration Guide*.

Ignoring ICMP redirects

ICMP was designed to find the most efficient IP route to a destination. ICMP redirect packets are one of the oldest route-discovery methods on the Internet. They are also one of the least secure, because it is possible to counterfeit ICMP redirects and change the way a device routes packets. The following commands configure the MAX TNT to ignore ICMP redirect packets:

```
admin> read ip-global
IP-GLOBAL read

admin> set ignore-icmp-redirects = yes

admin> write
IP-GLOBAL written
```

Disabling directed broadcasts

Denial-of-service attacks known as “smurf” attacks typically use ICMP Echo Request packets with a spoofed source address and the direction of packets to IP broadcast addresses. These attacks are intended to cause degraded network performance, possibly to the point that the network becomes unusable.

To prevent the MAX TNT router from being used as an intermediary in this type of denial-of-service attack launched from another network, you should disable the MAX TNT from forwarding directed broadcasts it receives from another network. The following example shows how to disable directed broadcasts that are not generated locally on all IP interfaces of a MAX TNT with a four-port Ethernet card in shelf 1, slot 12:

```
admin> read ip-int {{1 c 1} 0}
IP-INTERFACE/{ { shelf-1 controller 1 } 0 } read

admin> set directed-broadcast-allowed = no

admin> write
IP-INTERFACE/{ { shelf-1 controller 1 } 0 } written

admin> read ip-int {{1 12 1} 0}
IP-INTERFACE/{ { shelf-1 slot-12 1 } 0 } read

admin> set directed-broadcast-allowed = no

admin> write
IP-INTERFACE/{ { shelf-1 slot-12 1 } 0 } written

admin> read ip-int {{1 12 2} 0}
IP-INTERFACE/{ { shelf-1 slot-12 2 } 0 } read

admin> set directed-broadcast-allowed = no

admin> write
IP-INTERFACE/{ { shelf-1 slot-12 2 } 0 } written

admin> read ip-int {{1 12 3} 0}
IP-INTERFACE/{ { shelf-1 slot-12 3 } 0 } read

admin> set directed-broadcast-allowed = no

admin> write
IP-INTERFACE/{ { shelf-1 slot-12 3 } 0 } written

admin> read ip-int {{1 12 4} 0}
IP-INTERFACE/{ { shelf-1 slot-12 4 } 0 } read

admin> set directed-broadcast-allowed = no
```

```
admin> write
IP-INTERFACE/{ { shelf-1 slot-12 4 } 0 } written
```

Configuring SNMP access to the unit

For SNMP access, an SNMP manager must be running on a host on the local IP network, and the MAX TNT must be able to find that host by means of either a static route or RIP. In addition to these restrictions, the MAX TNT has its own SNMP password security (community strings), which you should set up to protect the MAX TNT from being reconfigured from an unauthorized SNMP station.

Overview of SNMP security

The SNMP profile contains SNMP-readable information related to the unit itself and to its SNMP security. There are two levels of security:

- Community strings, which must be known by the community of SNMP managers who need access to the box.
- Address security, which excludes SNMP access unless it is initiated from a specified IP address.

Following are the parameters related to SNMP security:

```
SNMP
   enabled = no
   read-community = public
   read-write-community = write
   enforce-address-security = no
   read-access-hosts = [ 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 ]
   write-access-hosts = [ 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 ]
   contact = ""
   location = ""
   queue-depth = 0
```

Enabling SNMP in the MAX TNT

If you leave the Enabled parameter in the SNMP profile set to No (the default), SNMP utilities cannot access the MAX TNT. The following commands enable SNMP on a unit:

```
admin> read SNMP
SNMP read

admin> set enabled = yes

admin> write
SNMP written
```

Setting community strings

You can specify up to 32 characters as the Read-Write-Community string. The following example changes the default community strings:

```
admin> read snmp
SNMP read
```

```
admin> list
enabled = yes
read-community = ******
read-write-community = *****
enforce-address-security = no
read-access-hosts = [ 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 ]
write-access-hosts = [ 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 ]
contact = ""
location = here
queue-depth = 0

admin> set read-community = private

admin> set read-write-community = secret

admin> write
SNMP written
```

Setting up address security

If the Enforce-Address-Security parameter is set to No (its default value), any SNMP manager that presents the right community name will be allowed access. If the parameter is set to Yes, the MAX TNT checks the source IP address of the SNMP manager and allows access only to those IP addresses listed in the Read-Access-Host and Write-Access-Host arrays. Each array can include up to five host addresses.

The following commands enforce address security and specify a trusted address for both read and write access:

```
admin> read snmp
SNMP read

admin> list
enabled = no
read-community = public
read-write-community = write
enforce-address-security = no
read-access-hosts = [ 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 ]
write-access-hosts = [ 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 ]
contact = ""
location = ""

admin> set enforce-address-security = yes

admin> set read-access 1 = 10.2.3.4

admin> set write-access 2 = 10.2.56.123

admin> write
SNMP written
```

Where to go next

If you are configuring a multishelf system, go to Chapter 4, “Installing a Multishelf System.”

Otherwise, proceed to the appropriate chapters to configure your MAX TNT slot cards.

Installing a Multishelf System

4

This chapter covers the following topics:

Introduction

In a MAX TNT multishelf system, you can connect and configure multiple MAX TNT units to act a single logical unit. When you configure a MAX TNT as multishelf system, you configure one of the shelf controllers as a master shelf controller and the others as slaves. The master shelf controller is responsible for maintaining the routing tables and for managing each of the slot cards in the system. The slave controllers simply forward messages between the slot cards and the master shelf controller. (With the current release of system software, if the master shelf goes down, so does the entire multishelf system.)

This section explains each of the following general steps required to configure a multishelf system:

1 Make sure that the rotary switch on each system is set to a unique number.

2 Plug in the multishelf cables.

3 Designate master and slave shelf controllers.

4 Reset each shelf and check the multishelf lights.

You must be running software version 1.3A or later to configure a multishelf system. For information about loading system software, see the *MAX TNT Adminstration Guide*.

Setting the rotary switch on each shelf

You must set the rotary switch on each shelf to a number between 1 and 9, which must be unique within the MAX TNT multishelf system. The numbers you set do not have to be sequential.

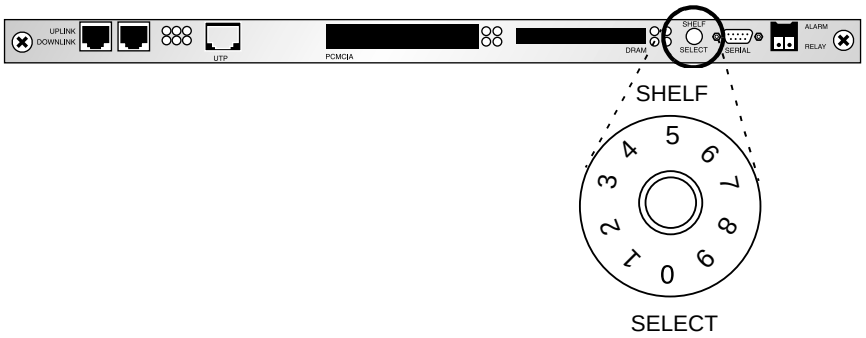

Figure 4-1. Setting the rotary switch to a unique number

Caution: Do not select zero as the shelf number. If a shelf is set to zero, it does not work.

Plugging in the multishelf cables

You must use the cable provided by Ascend (part number 2510-0290-*xxx*, where *xxx* represents digits subject to change) to connect the multishelf ports in a multishelf system. The multishelf ports are located at the far left of the shelf controller, as shown in Figure 4-2.

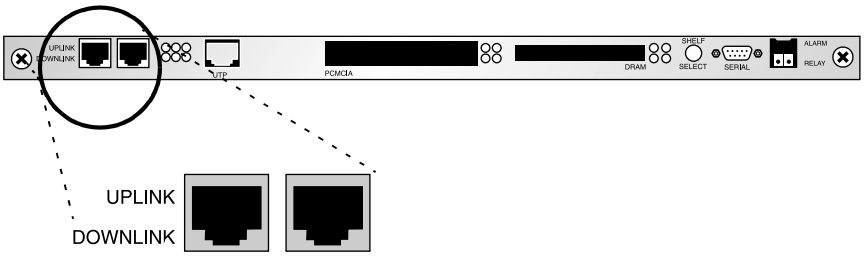

Figure 4-2. Multishelf ports

Figure 4-3 shows the correct way to connect the multishelf cables.

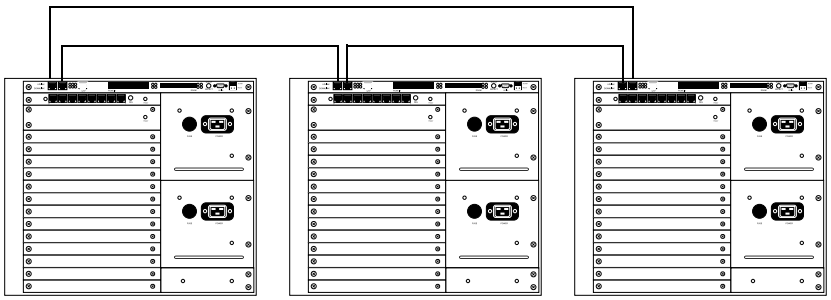

Figure 4-3. Cabling a multishelf system

The cables must always connect downlink to uplink and vice versa, as shown in Figure 4-4.

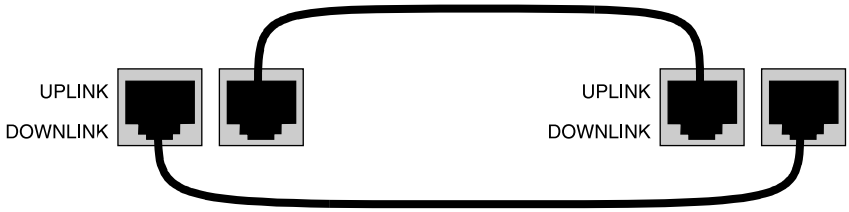

Figure 4-4. Connecting the multishelf ports

Designating master and slave shelf controllers

Multishelf systems require that you designate a single shelf as the master and the rest as slaves. The Master-Shelf-Controller parameter specifies the shelf number designated as master for the multishelf system. This is the number you set on the master shelf's rotary switch (as shown in Figure 4-1 on page 4-2). All shelves must agree about which shelf is the master.

The Master-Shelf-Controller parameter is not applicable in a profile in which Shelf-Controller-Type is set to Master. You set this parameter for slave shelves only.

For example, for a three-shelf system in which the master shelf rotary switch is set to 3, configure the System profile for shelf 3 as follows:

```
admin> read system
SYSTEM read
admin> set shelf-controller-type = master
admin> write
SYSTEM written
```

And configure the System profile for each slave shelf as follows:

```
admin> read system
SYSTEM read
admin> set shelf-controller-type = slave
admin> set master-shelf-controller = 3
admin> write
SYSTEM written
```

Resetting the shelves and checking the status lights

After configuring the master and slave shelf controllers, reset each shelf in the multishelf system by entering the Reset command for each shelf in the system:

```
admin> reset
```

During a reset, the MAX TNT clears active connections and runs its Power-On Self Test (POST), just as it would if the unit were power-cycled.

When the shelves come up again, the multishelf LED should be lit.

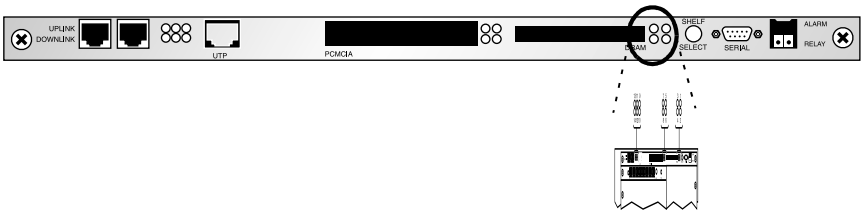

Figure 4-5. Multishelf status lights

Table 4-1 describes the multishelf status lights. For a complete description of the MAX TNT status lights, see “Understanding the shelf-controller back panel” on page 2-6.

Table 4-1. Multishelf status lights

Light	Description
2	Green. On for any functioning shelf in a multishelf system, whether it is configured as master or slave.
4	Yellow. This is the multishelf alarm light. If the master shelf goes down (for example, if the multishelf cable is removed), this light goes on, after about nine seconds, on each slave shelf. Note that on the master shelf, this alarm light does not go on.
13	Green. On when there is Ethernet activity between MAX TNT shelves.

Where to go next

Depending on which slot cards you have purchased, proceed to the appropriate chapters to install and configure the slot cards.

Configuring Ethernet Cards

5

This chapter covers the following topics:

Introduction

This chapter explains how to install and configure the Ethernet card in the MAX TNT. For information about configuring IP routing, see the *MAX TNT Network Configuration Guide*.

The following Ethernet cards available for the MAX TNT:

- 10 Mbps Ethernet card with four 10Mbps ports
- 10/100 Mbps Ethernet card with four 10Mbps ports and one 100Mbps port
- 10/100 Mbps Ethernet-2 card with three 10Mbps ports and one 100Mbps port

10 Mbps Ethernet card

The 10 Mbps Ethernet card is single-height, with four 10Base-T Ethernet interfaces. This card provides full 10 Mbps access to up to four Ethernet networks.

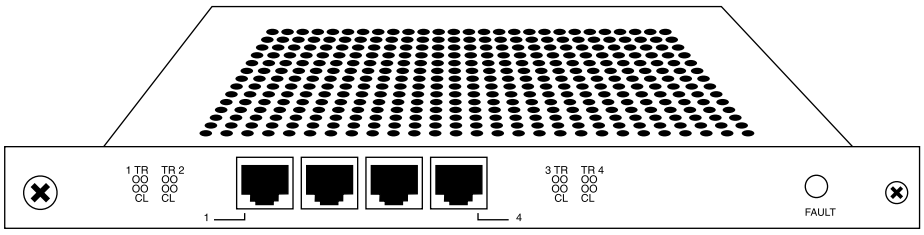

Figure 5-1. 10 Mbps Ethernet card

10/100 Mbps Ethernet card

The 10/100 Mbps Ethernet card is single-height, with four 10Base-T Ethernet interfaces and one 100Base-T Ethernet interface. This card provides full 10 Mbps access to up to four Ethernet networks and 100 Mbps access for a single Ethernet network.

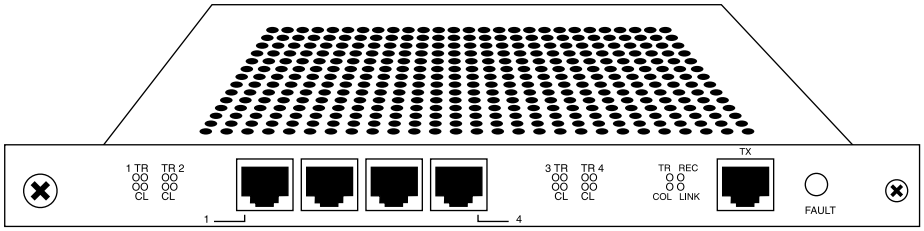

Figure 5-2. 10/100 Mbps Ethernet card

Full-duplex 10/100 Mbps Ethernet-2 slot card

The MAX TNT Ethernet-2 slot card is single-height, with three 10 BaseT ports and one full duplex 100BaseT port. If you are replacing an older Ethernet card with the new Ethernet-2 card, you must create new Ethernet profiles for the Ethernet-2 card. For details, see "Upgrading to the Ethernet-2 card" on page 5-2.

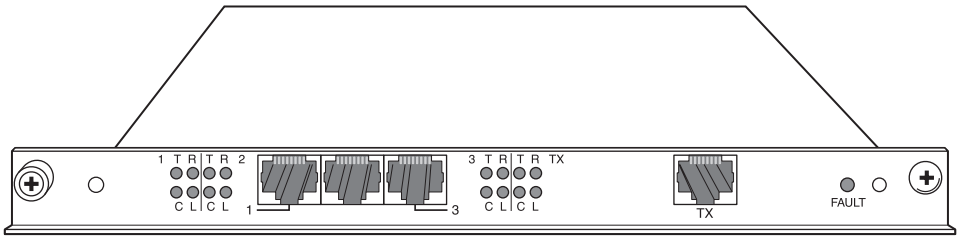

Figure 5-3. 10/100 Mbps Ethernet-2 card

Installing the Ethernet card

You install Ethernet cards in the same way you install other MAX TNT slot cards. For information about installing MAX TNT slot cards, see "Installing a slot card" on page 2-13.

Upgrading to the Ethernet-2 card

To upgrade from an existing 10Mbps or 10/100Mbps Ethernet card to an Ethernet-2 card, proceed as in the following example:

1. Remove the existing Ethernet card.
2. Enter the Slot command with the `-r` option to remove the existing Ethernet profiles. For example, if the Ethernet card was in slot 1:

```
admin> slot -r 1
slot 1 removed
```

3 Install the Ethernet-2 card.

4 Configure Ethernet profiles for the new card as explained in the following sections of this chapter.

Overview of Ethernet configuration

Each of the Ethernet cards provides multiport Ethernet routing capabilities. The configuration of each port on the card is identical to the configuration of the Ethernet port on the shelf controller. (For complete information about configuring the Ethernet ports for routing, see the *MAX TNT Network Configuration Guide*.)

All MAX TNT systems have an Ethernet port on the shelf controller. This Ethernet port is designed for out-of-band management and light traffic loads. It is not intended to be the primary Ethernet interface for the system. If your MAX TNT will be routing heavy Ethernet traffic, use an Ethernet card.

Table 5-1 lists the sections describing common tasks you might have to perform to configure an Ethernet card. The table includes some descriptive information about each task, and lists the associated parameters and commands. (For complete information about the associated parameters, see the *MAX TNT Reference Guide*.)

To configure the shelf-controller Ethernet port see “Performing Basic Configuration” on page 3-1.

Table 5-1. Ethernet card configuration tasks

Section	Description of task	Associated parameters and commands
“Understanding the Ethernet-related profiles” on page 5-4	The MAX TNT creates Ethernet and IP-Interface profiles for each Ethernet port.	N/A
“Understanding names in the interface table” on page 5-5	Each Ethernet port has a unique name in the interface table.	N/A
“Configuring the duplex mode on the 100 Mbps Ethernet port” on page 5-4	You can configure the 100 Mbps Ethernet port on the Ethernet-2 card to full duplex.	Duplex-Mode

Understanding the Ethernet-related profiles

The MAX TNT creates the following profiles when it detects an Ethernet port:

- Ethernet profile
- IP-Interface profile
- SNMP profiles (Admin-State and a Device-State profile)

For an explanation of SNMP profiles, see the *MAX TNT Adminstration Guide*.

Ethernet profile

The MAX TNT creates a default Ethernet profile for each Ethernet port it detects, including the shelf controller. The Ethernet profile specifies the link-layer configuration for the port.

For example, when you display the Ethernet profiles, if an Ethernet card installed in slot 4, you might see a screen similar to the following:

```
admin>dir ethernet
      5  08/06/1998 17:03:48  { shelf-1 controller 1 }
      5  08/06/1998 17:11:46  { shelf-2 slot-1 1 }
      5  08/06/1998 17:11:46  { shelf-2 slot-1 2 }
      5  08/06/1998 17:11:46  { shelf-2 slot-1 3 }
      5  08/06/1998 17:11:46  { shelf-2 slot-1 4 }
```

If the 10/100 Mbit Ethernet-2 card is installed, the 100 Mbit Ethernet port shows up as port 4.

IP-Interface profile

The MAX TNT creates a default IP-Interface profile for each Ethernet port it detects, including the shelf controller. You can create multiple IP interfaces for each physical Ethernet port, but the default IP-Interface profile must have an IP address, or the other IP-Interface profiles for the same port will not function. For information about configuring IP-Interface profiles, see the *MAX TNT Network Configuration Guide*.

Configuring the duplex mode on the 100 Mbps Ethernet port

The Duplex-Mode parameter in the Ethernet profile allows you to set the physical Ethernet interface of the 100BaseT port on the Ethernet-2 card to full-duplex or half-duplex mode. Full-duplex mode (the default) provides increased throughput, but half-duplex mode enables operation with older equipment that does not support full duplex.

The following example sets the port to half-duplex mode:

```
admin> read ethernet { 1 7 4 }
ETHERNET/{ shelf-1 slot-7 4 } read

admin> list
[in ETHERNET/{ shelf-1 slot-7 4 }]
```

```
interface-address* = { shelf-1 slot-7 4 }
link-state-enabled = no
enabled = yes
ether-if-type = utp
bridging-enabled = no
filter-name = ""
duplex-mode = full-duplex

admin> set duplex-mode = half

admin> write
ETHERNET/{ shelf-1 slot-7 4 } written
```

Understanding names in the interface table

The interface table entries associated with an Ethernet card have the following components:

`ie` *`shelf-slot-item`*

For example, a four-port Ethernet card in slot 13 appears as four entries in the interface table, one for each Ethernet interface:

```
admin> netstat -in
Name     MTU  Net/Dest          Address          Ipkts   Ierr   Opkts  Oerr
ie0      1500 192.168.6.0/24    192.168.6.122    2188408   27    1802    0
lo0      1500 127.0.0.1/32      127.0.0.1              0    0       0    0
rj0      1500 127.0.0.2/32      127.0.0.2              0    0       0    0
bh0      1500 127.0.0.3/32      127.0.0.3              0    0       0    0
ie1-13-1 1500 10.122.71.0/24    10.122.71.1       820642    0  819054    0
ie1-13-2 1500 10.122.72.0/24    10.122.72.1       819053    0  820642    0
ie1-13-3 1500 10.122.73.0/24    10.122.73.1       819602    0  900819    0
ie1-13-4 1500 10.122.74.0/24    10.122.74.1       900818    0  819602    0
```

Configuring Modems and HDLC Cards

6

This chapter covers the following topics:

Series56 Digital Modem card

Each MAX TNT Series56 Digital Modem card provides forty-eight V.34 and V.90-compatible digital modems, which can receive or place analog and digital calls. The card can support analog or cellular connections at speeds of up to 56 Kbps. It enables remote users with a modem and an analog or cellular line to dial into the MAX TNT via T1 access lines. The Series56 Digital Modem card is dual-height, meaning that it occupies two MAX TNT expansion slots.

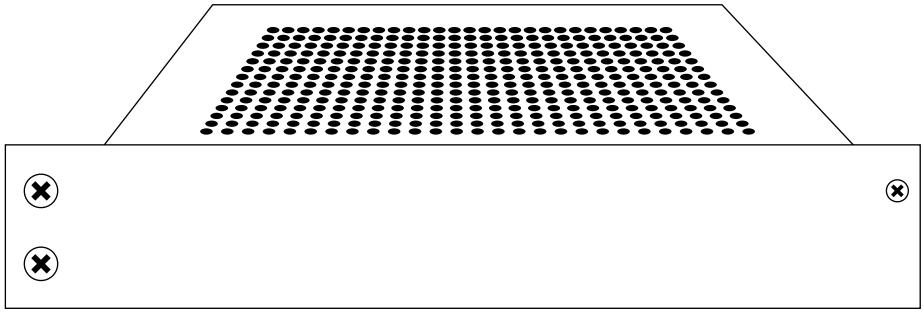

Figure 6-1. Series56 Digital Modem card

Series56 II Digital Modem card

The Series56 II cards provide 48 modems in a single-height slot card that can terminate both modem and HDLC calls. Note, however, that the Series56 II cards can only process calls that use a single DS0. This differs from existing HDLC cards, which can process datastreams that span multiple DS0s of the same T1 or E1 interface. Frame Relay connections cannot use the Series56 II card. They must use HDLC cards. Series56 II ports appear in the output of both the HDLC and Modem commands.

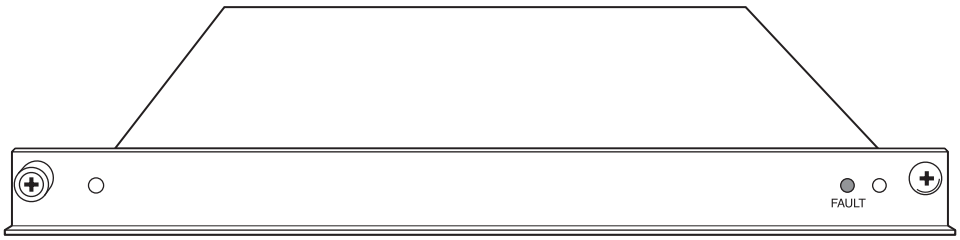

Figure 6-2. Series56 II Digital Modem card

Caution: The Series56 II cards consume more power than existing modem cards. You might need to install high output power supplies if you install Series56 II cards. For details on installing high output power supplies, see Chapter 2, “Installing the MAX TNT Chassis.”

Digital Modem card

Each MAX TNT Digital Modem card provides forty-eight V.34 Digital modems, which can receive or place analog and digital calls. The card can support analog or cellular connections at speeds of up to 33.6 Kbps. It enables remote users with a modem and an analog or cellular line to dial into the MAX TNT via T1 access lines. The V.34 Digital Modem card is dual-height, meaning that it occupies two MAX TNT expansion slots.

Analog Modem card

Each MAX TNT Analog Modem card provides 36 analog modems, which can receive analog calls. The card can support analog or cellular connections at speeds of up to 33.6 Kbps. It enables remote users with a modem and an analog line to dial into the MAX TNT via analog lines. The Analog Modem card is dual-height, meaning that it occupies two MAX TNT expansion slots.

Note that the Analog Modem card does not support outbound calls or call routing.

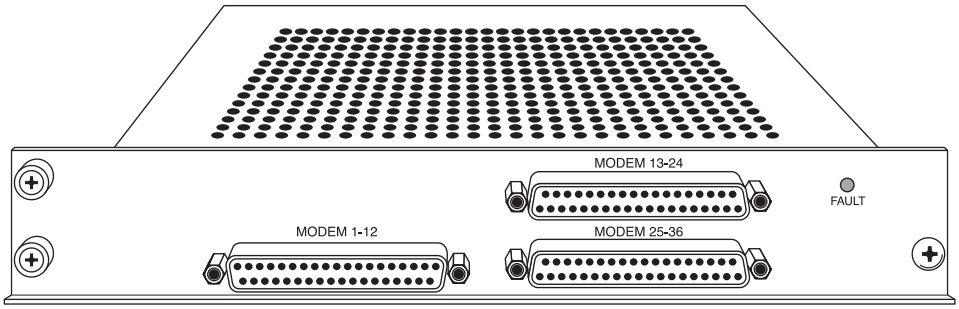

Figure 6-3. Analog Modem card

Guidelines for installing Series56 II cards

Note: If your MAX TNT supports single-channel nailed Frame Relay connections, you should install Series56 II cards in lower numbered slots in the MAX TNT than HDLC cards. Doing so will help minimize possible delays in establishing single-channel Frame Relay connections. For further information, see “Series56 II modem cards and Frame Relay connections” on page 6-8.

Although Series56 II cards are compatible with existing Series56 cards and can be installed in the same chassis, the Series56 II cards consume more power. If you install more than 12 Series56 II cards in the MAX TNT, you must replace the existing power supply with a new high-output power supply. However, Ascend recommends that if you install any Series56 II cards, you should replace the existing power supply with a new high-output power supply.

If you are using both Series56 II and existing modem cards and choose not to install a high-output power supply, see Table 6-1 for a list of supported configurations.

Table 6-1. Supported Series56 II configurations with existing power supplies

Number of Series56 II cards	Number of existing modem cards
1	1 to 6
2	1 to 6
3	1 to 5
4	1 to 5
5	1 to 4
6	1 to 4
7	1 to 3
8	1 to 3
9	1 or 2
10	1 or 2
11	1
12	1
13	0
14	0

Installing modem cards

Caution: The Series56 II cards consume more power than existing modem cards. You might need to install high output power supplies if you install Series56 II cards. For information about installing high output power supplies, see Chapter 2, “Installing the MAX TNT Chassis.”

You install modem cards in the same way you install other MAX TNT slot cards. For information about installing MAX TNT slot cards, see “Installing a slot card” on page 2-13.

Overview of configuring modem cards

Typically, digital modems do not require any configuration. Depending on your network setup, however, there might be situations that require you to change how the modems operate. When you make a change to the modem configuration, it applies to all the modems in the MAX TNT. You can configure the MAX TNT modems in the Terminal-Server profile.

Table 6-2 lists the sections describing common tasks you might have to perform to configure the modems. The table also includes brief descriptions of the tasks and lists the associated parameters.

For complete information about the associated parameters, see the *MAX TNT Reference Guide*.

Table 6-2. Modem configuration tasks

Section	Description of task	Associated parameters
"Specifying negotiation settings" on page 6-6	Some analog modem calls might require changes to the digital modems default behavior in order to successfully complete negotiation.	V42/MNP Max-Baud-Rate Modem-Transmit-Level Cell-Mode-First Cell-Level 7-Even
"Specifying modem modulation for 56K modem cards" on page 6-6	You might need to change the modulation of Series56 modems from the default of V.90. For example, in some cases, V.32 and V.34 modems do not successfully complete modem training after reception of the V.8bis tone from the MAX TNT Series56 modems. Configuring V.34 modulation can help this problem.	Modem-Mod
"Configuring an additional AT answer string for modem calls" on page 6-7	You might need to modify the AT answer strings the MAX TNT sends to its modems. You can do this by specifying an extra answer string in the MAX TNT CLI.	AT-Answer-String
"Series56 II Call-Route profiles" on page 6-7	Because the Series56 II card can terminate both modem and HDLC calls, the MAX TNT creates two call route profiles for each channel on the card; one for a digital call and one for a modem call.	N/A

Specifying negotiation settings

Calls from analog modems are directed first to the MAX TNT digital modems, where the connection must be negotiated before being directed to by the terminal-server software. Options in the Terminal-Server > Modem-Configuration subprofile allow you to modify how the MAX TNT digital modems negotiate a connection.

To specify changes in how the negotiation occurs:

1. Read the Terminal-Server profile into the editing buffer:

```
admin> read terminal-server
TERMINAL-SERVER read
```

2. List the parameters in the Modem-Configuration subprofile. For example:

```
admin> list modem-configuration
v42/mnp = will-v42
max-baud-rate = 33600-max-baud
modem-transmit-level = -13-db-mdm-trn-level
cell-mode-first = no
cell-level = -18-db-cell-level
7-even = no
```

3. Modify the parameters as required.

For information about the parameters, see the *MAX TNT Reference Guide*.

Specifying modem modulation for 56K modem cards

The Modem-Mod parameter in the Terminal-Server profile allows you to specify what modem modulation MAX TNT Series56 modems use. The possible settings are K56-Modulation, V34-Modulation, and V90-Modulation (the default).

To support the ITU-T standard V.8bis (Voice Call Ready), a 56K modem in the MAX TNT normally sends a tone at the beginning of modem training. This is commonly referred to as CRe and is a dual tone (1375 Hz + 2002 Hz) followed by a single tone at 400 Hz with a combined duration of approximately 500 ms. Although V.8bis is designed not to interfere with V.32bis modem negotiation, some V.32 and V.34 modems do not successfully complete modem training after reception of the V.8bis tone.

Note that if you configure the Series56 modems to use V.34 modulation, they never exceed the speeds used by V.34 modems (33.6Kbps), and they do not send the V.8bis tone.

To configure modem modulation for calls coming in to 56K modem cards, proceed as in the following example:

```
admin> read terminal-server
TERMINAL-SERVER read

admin> set modem-configuration modem-mod = v34-modulation

admin> write
TERMINAL-SERVER write
```

Configuring an additional AT answer string for modem calls

The AT-Answer-String parameter in the Terminal-Server profile enables you to specify extra AT commands in the answer string of the system's modem configuration.

The answer string is the last of four strings sent to the modem upon answering a call. This means that commands entered in this string might overwrite settings specified elsewhere. For example, if the Max-Baud-Rate parameter sets the maximum baud rate and the AT-Answer-String parameter specifies a different baud rate, it will overwrite the configured maximum baud rate.

Following is the relevant parameter, which is shown with its default setting:

```
[in TERMINAL-SERVER:modem-configuration]
AT-answer-string = ""
```

The value of this parameter must be valid AT commands, up to 36 characters. Do not begin the string with AT. An AT is automatically appended to the beginning of this string, before it is send to the modem. Also, do not include an A (answer) or a D (dial) command anywhere in the string. An A command is automatically appended to the end of this string and a D command in the answer string will cause the call to fail.

Note: Be very careful when entering AT commands in this parameter. The system does not prevent you from entering incorrect strings.

The following example sets the AT-Answer-String parameter to S37=11, which causes the following string to be sent to the modem:

```
ATS37=11A
```

When the modem receives this string, it forces a V.32bis 14400 connection.

```
admin> read terminal-server
TERMINAL-SERVER read

admin> set modem AT-answer-string = S37=11

admin> write
TERMINAL-SERVER written
```

Series56 II Call-Route profiles

When you install a Series56 II card, the MAX TNT creates two call route profiles for each channel on the card; one for a digital call and one for a modem call. For example:

```
admin >callroute -d
  device     #  source        type          tg sa phone
1:14:01/0   0 0:00:00/0  voice-call-type    0  0
1:14:01/0   1 0:00:00/0  digital-call-type  0  0
1:14:02/0   0 0:00:00/0  voice-call-type    0  0
1:14:02/0   1 0:00:00/0  digital-call-type  0  0
1:14:03/0   0 0:00:00/0  voice-call-type    0  0
1:14:03/0   1 0:00:00/0  digital-call-type  0  0
```

```
1:14:04/0   0 0:00:00/0  voice-call-type    0  0
1:14:04/0   1 0:00:00/0  digital-call-type  0  0
1:14:05/0   0 0:00:00/0  voice-call-type    0  0
1:14:05/0   1 0:00:00/0  digital-call-type  0  0
.
```

Note that in the MAX TNT Call-Route profiles, `voice-call-type` refers only to a modem call.

Series56 II modem cards and Frame Relay connections

If the MAX TNT has a Frame Relay datalink that uses a single nailed channel, you should install Series56 II card in lower numbered slots than the HDLC cards.

The MAX TNT attempts to allocate the call to each available channel of the Series56 II cards before it reaches the HDLC card. Because Series56 II cards do not support Frame Relay connections, up to 48 call rejects for each Series56 II card could occur before a successful call is established on the HDLC card. No system messages are reported during the interval.

The MAX TNT automatically creates two Call-Route profiles when you first install a Series56 II card into a MAX TNT; one for voice call type (a modem call) and one for digital calls. If you only want the Series56 II card to answer modem calls, delete the digital call type profile. When you do this, the Series56 II cards will not attempt to answer Frame Relay calls.

If you want to have the Series56 II answer HDLC calls, then no matter where you install the Series56 II card, you might experience delays as it tries to answer single channel nailed Frame Relay calls. Installing an HDLC card on a lowered number slot, before any Series56 II card, will help because the HDLC card should answer the Frame Relay call first. However, if all the channels in the HDLC card are used, or have been used before, the MAX TNT will look for the next available channel, which might be one of those in the Series56 II card.

Hybrid Access card

Each ISDN call, and each channel of a nailed session, requires an HDLC channel to process the HDLC-encapsulated data received from or destined to a WAN interface. Because the MAX TNT base system does not provide any HDLC resources, you might need to install a Hybrid Access card in your unit. Keep in mind, that the Series56 II cards also provide up to 48 HDLC channels per card.

The following cards require HDLC channels:

- Eight-port E1 card
- Eight-port T1 card
- IDSL card
- T3 card

The following cards do not require HDLC channels:

- ATM DS3 card (because it does not require HDLC resources)
- E1 FrameLine card (because it provides its own HDLC resources)

- RADSL card (because it does not require HDLC resources)
- SDSL card (because it does not require HDLC resources)
- Serial WAN card (because it provides its own HDLC resources)
- T1 FrameLine card (because it provides its own HDLC resources)
- Unchannelized DS3 card (because it provides its own HDLC resources)
- Unchannelized E1 card (because it provides its own HDLC resources)
- V.34, Series56 Digital Modems, and Analog Modem cards (because these types of calls do not require HDLC resources)

Installing the Hybrid Access cards

You install Hybrid Access cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Configuring T1 Cards

7

This chapter covers the following topics:

Introduction to T1

A T1 line supports 24 64-Kbps channels, each of which can transmit and receive data or digitized voice. The line uses framing and signaling to achieve synchronous and reliable transmission. The most common configurations for T1 lines are ISDN Primary Rate Interface (PRI) and nailed or unchannelized T1, including fractional T1. (For information about provisioning your T1 line for use with the MAX TNT, see Appendix A, "Provisioning the Switch.")

ISDN PRI

In North America and Japan, a T1/PRI line typically supports 23 B channels and one D channel. But if Network Facility Associated Signaling (NFAS) is in use, more than one ISDN PRI line on a single T1 card can share a single D channel. PRI configurations are used to receive multiple, simultaneous ISDN calls from analog-modem and digital-services dial-in traffic. Another common use of T1/PRI is to connect a Private Branch Exchange (PBX) to a central office switch.

Unchannelized T1

Unchannelized T1 lines can be used for nailed connections such as to a Frame Relay network. In such cases the configuration is static, and the MAX TNT treats the T1 line as if it were a single connection at a fixed speed, without individual channels.

Typically, when you pay your telephone company for a leased (nailed) line, you pay more for higher bandwidth. Anything in the range of 0 bps to 1.544 Mbps can be delivered on a T1 line, and provisioned at some 64K fraction of the full T1 bandwidth.

Channelized line-side vs. trunk-side T1

When a call enters the telephone network from the MAX TNT, it should enter the central office (CO) switch on the trunk side via an ISDN PRI or a channelized T1 line. ISDN PRI lines always enter the trunk side of the switch, while calls coming in on a channelized T1 line enter either the line side or the trunk side.

T1 lines that terminate on the line side of the switch undergo an additional analog-to-digital conversion, reducing the data transfer rate. Some service providers and carriers have agreements to ensure that a T1 will always enter the trunk side of the CO switch, but in most cases, there is no such agreement. The only way to guarantee a digital connection is to have the call from the MAX TNT enter the CO on the trunk side of the switch over an ISDN PRI or a trunk-side T1 line.

The MAX TNT T1 card is illustrated in Figure 7-1.

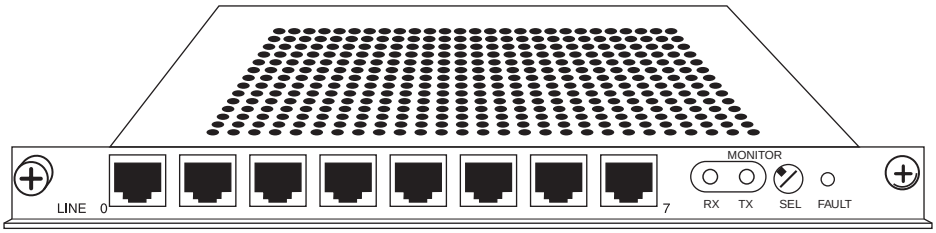

Figure 7-1. MAX TNT T1 card

Installing the T1 card

You install T1 cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Connecting the MAX TNT T1 line to the WAN

If your MAX TNT T1/PRI ports have internal channel service units (CSUs), connect them to the demarcation point, which is where the T1/PRI line’s metallic interface connects to other equipment. Otherwise, you must install external CSUs or other network (WAN) interface equipment between the MAX TNT and the demarcation point.

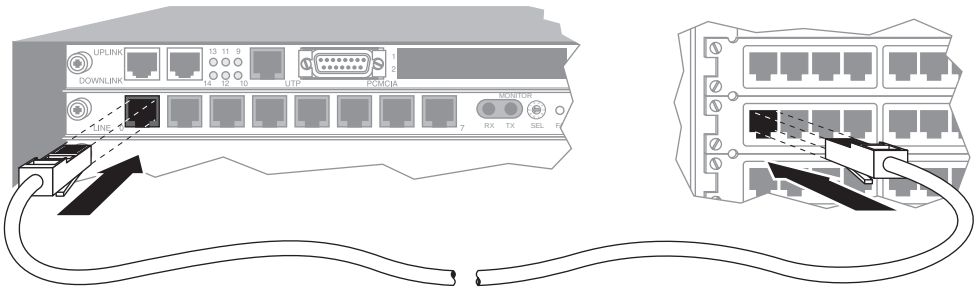

Figure 7-2. Connecting your T1 line

Inform your service provider that the equipment is connected, so they can bring up the line.

Monitoring the T1 line with bantam jacks

Each T1 card provides transmit and receive bantam jacks to monitor the status of the T1 lines. The Tx line carries what the MAX TNT transmits to the network. The Rx line carries what the MAX TNT receives from the network. The bantam jacks do not interfere with the signal either coming into or going out of the MAX TNT.

To monitor the T1 lines:

1 Select the line to monitor by setting the select switch on the T1 card.

2 Plug in bantam jacks.

Overview of T1 configuration

Table 7-1 lists the sections describing common tasks you might have to perform to configure a T1 line. The table includes a brief description of each task and lists the parameters you will use.

(For information about administering the T1 card, including such tasks as specifying FDL and displaying the status of the lines, see the *MAX TNT Adminstration Guide*.)

For complete information about the associated parameters, see the *MAX TNT Reference Guide*.

Table 7-1. T1 line configuration tasks

Section	Description of task	Associated parameters
"Making a profile the working profile" on page 7-6	Before you can edit a profile, you must make it the working profile.	N/A
"Assigning names to T1 line profiles" on page 7-8	Assign a name to the T1 profile.	Name
"Enabling a line" on page 7-8	Make a line available for use.	Enabled
"Specifying the framing and encoding" on page 7-8	Each T1 line requires framing and encoding. Framing specifies the format for the sequence of bits sent on the line. Encoding affects the way data is represented by the digital signals on the line.	Frame-Type Encoding
"Configuring ISDN PRI signaling" on page 7-9	You must specify the type of network switch providing ISDN service on a T1 PRI line.	Switch-Type
"Configuring overlap receiving on PRI lines" on page 7-9	T1 or E1 PRI lines with overlap receiving enable the MAX TNT to gather the complete called-number from the network switch via a series of Information messages, enabling the use of features such as called-number authentication.	Signaling-Mode Overlap-Receiving PRI-Prefix-Number Trailing-Digits T302-Timer
"Configuring inband robbed-bit signaling" on page 7-11	If the lines uses inband signaling, change the signaling mode to robbed bit and specify the type of robbed bit signaling to use. You can also specify that the MAX TNT process the numbers dialed for use with Dialed Number Identification Service (DNIS) and Calling Number Identification (CLID) authentication.	Signaling-Mode Robbed-Bit-Mode Collect-Incoming-Digits DSP-DTMF-Input-Sample-Count

Table 7-1. T1 line configuration tasks (continued)

Section	Description of task	Associated parameters
"Configuring NFAS signaling" on page 7-13	Specify NFAS signaling if you want two or more PRI lines to share a D channel.	Switch-Type NFAS-ID NFAS-Group-ID
"Configuring T1 R1 and R1-Modified (Taiwan) with ANI and called number" on page 7-15	R1 is a multi-frequency inband signaling system that uses a set of register signals known as MFR1 tones as addressing signals. R1 signaling may optionally be used with Automatic Number Identification (ANI) which is similar to Caller ID (CLID).	Signaling-Mode R1-Use-ANIR R1-First-Digit-Timer R1-ANIR-Delay R1-ANIR-Timer R1-Modified
"Configuring clocking" on page 7-16	Set Clock-Source to specify whether the T1 line can be used as the master clock source for synchronous connections. Also specify the priority of the T1 lines to be used for clocking.	Clock-Source Clock-Priority
"Configuring the front end transceiver" on page 7-17	Set the front end type of the T1 transceiver to CSU or DSX (digital system cross-connect), depending on the type of device the MAX TNT connects to.	Front-End-Type DSX-Line-Length CSU-Build-Out
"Configuring channel usage" on page 7-17	Specify how each of the 24 channels of a T1 line is to be used.	Channel-Usage
"Assigning phone numbers to switched channels" on page 7-18	Typically, you need specify only the rightmost digits needed to distinguish one number from another. These are called add-on numbers.	Phone-Number
"Configuring trunk groups" on page 7-19	A trunk group is a group of channels that has been assigned a number.	Trunk-Group
"Configuring nailed channels" on page 7-20	You must assign a nailed channel to a group to make it available for use. The group number can be referenced in a Connection or Frame-Relay profile to specify a permanent leased connection using that group of nailed channels.	Nailed-Group

Table 7-1. T1 line configuration tasks (continued)

Section	Description of task	Associated parameters
"Configuring specialized options" on page 7-22	Typically, the D channel of a PRI line uses normal data. However, for some connections, you might need to invert the data to avoid transmitting a pattern that the connection cannot handle Most installations use the default for the Idle-Mode setting, which determines what pattern the D channel looks for to specify the idle indicator.	Data-Sense Idle-Mode
Chapter 17, "Call Routing in the MAX TNT"	Set up call routing, which the MAX TNT uses to determine where to route incoming and outgoing calls. This information is deprecated in the MAX TNT. The preferred way to set up call-routing is to put all call-routing information in one place: a Call-Route profile. If you do not use Call-Route profiles, specify the physical address of a device to which calls received on this channel should be routed.	Default-Call-Type Call-by-Call-Service Shelf Slot Item

Making a profile the working profile

When the MAX TNT system detects that a T1 card has been installed, it creates a default T1 profile for each of the eight lines on the card.

In the following display example, the Dir command shows eight default T1 profiles created for a card installed in slot 2:

```
admin> dir t1
   305  12/11/1996 15:58:20  { shelf-1 slot-2 2 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 4 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 5 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 6 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 7 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 8 }
   320  12/20/1996 20:55:31  { shelf-1 slot-2 3 }
   317  01/08/1997 09:58:55  { shelf-1 slot-2 1 }
```

By default, the line is not enabled, which means that it is not available for use. Its default signaling method is inband, typically used for channelized connections.

To configure a T1 profile, first make it the working profile by reading it into the edit buffer. For example:

```
admin> read t1 {1 2 1}
T1/{ shelf-1 slot-2 1 } read
```

Once you have read in a profile, it remains the working profile until you read in another profile. You can use the set command to change one or more of the profile's parameters.

To save your configuration changes, use the Write command. For example,

```
admin> write
T1/{ shelf-1 slot-2 1} written
```

To list the parameters in a T1 profile, use the List command, as in the following example:

```
admin> list
[in T1/{ shelf-1 slot-6 4 }]
name = ""
physical-address* = { shelf-1 slot-6 4 }
line-interface = { no d4 ami eligible low-priority inband +
```

The following example shows the parameters in a T1 profile:

```
[in T1/{ shelf-1 slot-6 4 }:line-interface]
enabled = no
frame-type = d4
encoding = ami
clock-source = eligible
clock-priority = low-priority
signaling-mode = inband
robbed-bit-mode = wink-start
default-call-type = digital
switch-type = att-pri
nfas-group-id = 0
nfas-id = 0
incoming-call-handling = internal-processing
call-by-call = 0
data-sense = normal
idle-mode = flag-idle
FDL = none
front-end-type = dsx
DSX-line-length = 1-133
CSU-build-out = 0-db
overlap-receiving = no
pri-prefix-number = ""
trailing-digits = 2
t302-timer = 10000
channel-config = [ { unused-channel 9 "" { any-shelf any-slot +
maintenance-state = no
input-sample-count = one-sample
sendDisc-val = 0
hunt-grp-phone-number-1 = ""
hunt-grp-phone-number-2 = ""
hunt-grp-phone-number-3 = ""
collect-incoming-digits = no
r1-use-anir = no
r1-first-digit-timer = 340
```

```
r1-anir-delay = 350
r1-anir-timer = 200
r1-modified = no
```

Assigning names to T1 line profiles

In a T1 profile, the Name parameter enables you to assign the profile a name. The name can include up to 16 characters. It is displayed after the line's physical address in the Dir command output. For example:

```
admin> read t1 {1 12 0}
admin> set name = T1 Trunk
admin> write
T1/{ shelf-1 slot-12 0 } written
admin> dir T1
17  04/17/1997 19:00:02  { shelf-1 slot-12 0 }  "T1 Trunk"
```

For T1 lines, the Line Status window displays the first eight characters of the name if one has been assigned. For example:

```
T1 Trunk 1/12/0  LA la  la  la  la  la  la  la
```

If the name is longer than eight characters, the last character displayed is a plus-sign (+).

Enabling a line

By default each T1 line is disabled. To enable the T1 line, read its profile to make it the working profile, then set the Line Interface subprofile's Enabled parameter to Yes, as in the following example:

```
admin> read t1 {1 2 1}
T1/{ shelf-1 slot-2 1 } read
admin> set line enabled = yes
admin> write
T1/{ shelf-1 slot-2 1 } written
```

Specifying the framing and encoding

You must specify the framing and the encoding for each T1 line. If you are using ISDN, you must specify the extended superframe (ESF) format, which consists of 24 consecutive frames, separated by framing bits. If the line is not configured for ISDN signaling, use D4 framing (also known as the superframe format), which is the default.

The T1 Encoding value sets the layer-1 line encoding used for the physical links, which affects the way in which data is represented by the digital signals on the line. The default, Alternate Mark Inversion (AMI) encoding, is often used, although Bipolar with 8-Zero Substitution (B8ZS) Encoding might be required if the line is configured for ISDN signaling. If set to None, encoding is similar to AMI, but without density enforcement.

Your T1 service provider must provide the correct framing and encoding values for your lines.

To specify the framing and encoding, set the Frame-Type and Encoding parameters:

```
admin> read t1 {1 2 1}
T1/{ shelf-1 slot-2 1 } read
admin> set line frame-type = [esf|d4]
admin> set encoding = [ami|b8zs|none]
admin> write
T1/{ shelf-1 slot-2 1} written
```

Configuring ISDN PRI signaling

When you set the signaling mode to ISDN, you must set channel 24 as the D channel. Note that ISDN signaling often requires ESF framing and B8ZS encoding.

For ISDN signaling you must also specify the type of switch providing T1/PRI service to your MAX TNT. Obtain the information from your ISDN carrier. (For example, if your carrier is AT&T, the switch type is ATT-PRI.)

Configure ISDN PRI service as follows:

```
admin> read t1 {1 2 1}
T1/{ shelf-1 slot-2 1 } read
admin> set line frame-type = esf
admin> set line encoding = b8zs
admin> set line signaling-mode = isdn
admin> set line switch-type = switchtype
admin> set line channel 24 channel-usage=d-channel
admin> write
T1/{ shelf-1 slot-2 1} written
```

To see a complete list of switch types supported on the MAX TNT, refer to the MAX TNT online help or the *MAX TNT Reference Guide*.

Configuring overlap receiving on PRI lines

Overlap receiving affects the procedure of establishing an incoming call received on a T1 or E1 PRI line in the MAX TNT. With overlap receiving, the MAX TNT can gather the complete called-number from the network switch via a series of Information messages, enabling the use of features such as called-number authentication.

The Q.931 specification states that either En-Bloc Receiving or overlap receiving can be used to handle an incoming call. With En-Bloc Receiving, the Setup message received from the network switch must contain all information required to process the call. With overlap receiving, the Setup message may contain incomplete called number information, with the remainder of the call information (if any) sent in one or more additional Information messages after the network switch receives a Setup Acknowledge message from the called unit.

Following are the relevant parameters, which are shown with sample settings:

```
[in T1/{ shelf-1 slot-5 1 }:line-interface]
signaling-mode = isdn-nfas
overlap-receiving = yes
pri-prefix-number = 3069
```

```
trailing-digits = 2
t302-timer = 10000
[in E1/{ shelf-1 slot-12 1 }:line-interface]
signaling-mode = isdn
overlap-receiving = yes
pri-prefix-number = 3069
trailing-digits = 2
t302-timer = 10000
```

The overlap receiving parameters are described

Parameter	Specifies
Signaling-Mode	Type of signaling on the T1 or E1 line. It must specify ISDN (or ISDN-NFAS, for T1) to use overlap receiving. If it is set to any other value, Overlap-Receiving does not apply.
Overlap-Receiving	Enables/disables overlap receiving for incoming calls on the PRI line. If set to No (the default), the PRI-Prefix-Number, Trailing-Digits, and T302-Time parameters do not apply for overlap receiving.
PRI-Prefix-Number	A portion of the line's phone number to be used when matching the called-party number in the Setup message from the network switch. The reason for specifying this number is to enable the MAX TNT to quickly determine when the called-party number is complete when overlap receiving is in use. It uses this number and the specified number of trailing digits to recognize that the called-party number is complete, even if the caller did not include a Sending Complete code (for example, by dialing the pound-sign). Typically, the PRI prefix is an ISDN-subscriber number, which may include an area code or an area and country code combination (which must be separated from the ISDN-subscriber number by a hyphen). With this additional information, the MAX TNT will look for just the first match of PRI-Prefix-Number against the called party number in the Setup message (first with area code, and if that fails, then without area code). The default null value disables the T302-Timer optimization.
Trailing-Digits	Number of digits required to follow the prefix number for the MAX TNT to consider the called number complete. Callers can indicate Sending Complete by a method such as dialing the pound-sign (#). If a caller did not indicate Sending Complete and the MAX TNT could not determine whether the called-number was complete, the MAX TNT would wait until the T302 timer expires even if the caller has dialed all the required digits. The Trailing-Digits setting enables the MAX TNT to reset the timer when the specified number of digits has been received. Trailing-Digits can specify a value from 1 to 6. The default value is 2.

Parameter	Specifies
T302-Timer	Number of msecs the system waits for additional called number information for an incoming call. The valid range is from 100 to 30000 (.10 second and 30 seconds). The default is 10000 (10 seconds). The MAX TNT begins collecting the trailing digit information, and for each call Setup message from the switch that does *not* include "Sending Complete Information Element," it starts the T302 timer (the Setup Ack timer). The MAX TNT stops the timer when it receives a message that includes "Sending Complete Information Element." The MAX TNT assumes there are no more trailing digit digits to collect when the T302 timer stops or expires.

The following example enables overlap receiving on an E1 PRI line:

```
admin> read e1 {1 16 7}
E1/{ shelf-1 slot-16 7 } read

admin> set signaling-mode = isdn

admin> set overlap-receiving = yes

admin> set pri-prefix-number = 049-228-555

admin> set trailing-digits = 4

admin> set t302-timer = 5000
```

With this configuration, if a caller dials 049-228-555-1212, the MAX TNT matches the prefix, finds four trailing digits, and immediately begins processing the call. It may use called-number authentication (if applicable) before establishing a session. Similarly, if a local caller dials 555-1212, the MAX TNT fails the first match, tries without the country code and fails again, tries without the area code, and succeeds. It then finds four trailing digits and begins processing the call.

Configuring inband robbed-bit signaling

When the line is configured for inband signaling, the MAX TNT does not receive bearer-capability information from the carrier. Therefore, it does not know when a call is voice-service or digital-service. Inband lines assume for call-routing purposes that all calls are digital calls. You can change this default by setting the Default-Call-Type parameter.

Trunk-side T1 lines should use wink-start call control, which is the default. It enables the switch to seize the trunk by going off hook after receiving a 200 msec wink.

Line-side T1 lines should use loop-start call control. Regardless of the type of call control mechanism you choose, the switch should not forward dialed digits to the MAX TNT. Doing so disrupts the handshaking process during multichannel calls.

On lines configured for inband signaling, you must specify that the MAX TNT process the calling and called DTMF digits if you want to use Dialed Number Identification Service (DNIS) and Calling Number Identification (CLID) authentication or accounting. (On lines configured for PRI signaling this information is presented as part of the call setup message and does not require special configuration on the MAX TNT.)

To configure the MAX TNT to process the DTMF digits in a call, use the Collect-Incoming-Digits and DSP-DTMF-Input-Sample-Count parameters in a T1 profile.

The Collect-Incoming-Digits parameter enables the MAX TNT to process the DTMF digits in a call. The DSP-DTMF-Input-Sample-Count parameter specifies the number (one or two) of Goertzel input samples the MAX TNT computes in order to decode a DTMF digit. A setting of Two-Samples creates a more accurate result.

To configure a T1 line for inband (robbed-bit) signaling, proceed as in the following example:

1 Read in the T1 profile:

```
admin> read t1 {1 2 1}
T1/{ shelf-1 slot-2 1 } read
```

2 List the Line-Interface subprofile:

```
admin> list line
enabled=no
frame-type=d4
encoding=ami
clock-source=eligible
clock-priority=middle-priority
signaling-mode=inband
robbed-bit-mode=wink-start
..
..
```

3 Enable the line:

```
admin> set enabled = yes
```

4 Specify inband signaling:

```
admin> set signaling-mode = inband
```

5 Specify the Robbed-Bit-Mode:

```
admin> set robbed-bit-mode = wink-start
```

6 If you are using DNIS or CLID authentication, specify that the MAX TNT should process the DTMF digits and the sample size used to decode the digits:

```
admin> set collect-incoming-digits = yes
admin> set dsp-dtmf-input-sample-count = one-sample
```

7 Write the profile to save the changes:

```
admin> write
T1/{ shelf-1 slot-2 1 } written
```

Configuring NFAS signaling

A group of T1 lines configured for NFAS signaling shares a D channel. One line in the group is configured with a primary D channel, and another line is configured with a secondary D channel. The secondary D channel is used only if the primary line goes down or receives a signal commanding a change to the other D channel. All lines within an NFAS group must reside on the same slot card. Your service provider must supply you with the NFAS ID numbers for your line.

The MAX TNT supports multiple NFAS groups on a single card. An NFAS group contains a minimum of two PRIs. A T1 card supports up to four NFAS groups, and a T3 card supports up to 14 NFAS groups. To configure a NFAS group, you must set the NFAS-Group-ID parameter. Lines with the same NFAS-Group-ID value are in the same NFAS group.

Configuring a single NFAS group

To configure two T1 lines for NFAS, proceed as in the following example, in which the administrator configures ports 3 and 4 of the card in slot 2 of shelf 1:

```
admin> read t1 {1 2 3}
T1/{ shelf-1 slot-2 3 } read

admin> set line enabled = yes
admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 0
admin> set channel 24 channel = nfas-primary
admin> write
T1/{ shelf-1 slot-2 3 } written

admin> read t1 {1 2 4}
T1/{ shelf-1 slot-2 4 } read

admin> set line enabled = yes
admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 1
admin> set line channel 24 channel = nfas-secondary-d
admin> write
T1/{ shelf-1 slot-2 4 } written
```

Configuring multiple NFAS groups

To configure multiple NFAS groups, you must first obtain an NFAS ID for each DS1 from your service provider and an NFAS Group ID for each group of PRI lines that shares a D channel. Within an NFAS group, all PRIs share the same NFAS-Group-ID value and have unique NFAS-ID values.

Telcos often use NFAS-ID=0 for the PRI with the primary D-Channel, and NFAS-ID=1 for the PRI with the secondary D-Channel. You must set both the NFAS-Group-ID parameter and the NFAS-ID parameter for each DS1.

In the following example, an administrator configures two NFAS groups on a T1 card. Each group contains four DS1s. The example uses the NFAS group IDs 1 and 2, but the actual values you use depend on how your lines are provisioned:

```
admin> read t1 {1 2 1}
T1/{ shelf-1 slot-2 1 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 0
admin> set line nfas-group-id = 1
admin> set channel 24 channel = nfas-primary
admin> write
T1/{ shelf-1 slot-2 1 } written

admin> read t1 {1 2 2}
T1/{ shelf-1 slot-2 2 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 1
admin> set line nfas-group-id = 1
admin> set line channel 24 channel = nfas-secondary
admin> write
T1/{ shelf-1 slot-2 2 } written

admin> read t1 {1 2 3}
T1/{ shelf-1 slot-2 3 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 2
admin> set line nfas-group-id = 1
admin> write
T1/{ shelf-1 slot-2 3 } written

admin> read t1 {1 2 4}
T1/{ shelf-1 slot-2 4 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 3
admin> set line nfas-group-id = 1
admin> write
T1/{ shelf-1 slot-2 4 } written
```

The following commands configure NFAS group 2, which contains lines 5 through 8:

```
admin> read t1 {1 2 5}
T1/{ shelf-1 slot-2 5 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 0
admin> set line nfas-group-id = 2
admin> set channel 24 channel = nfas-primary
admin> write
T1/{ shelf-1 slot-2 5 } written

admin> read t1 {1 2 6}
T1/{ shelf-1 slot-2 6 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 1
admin> set line nfas-group-id = 2
admin> set line channel 24 channel = nfas-secondary
```

```
admin> write
T1/{ shelf-1 slot-2 6 } written

admin> read t1 {1 2 7}
T1/{ shelf-1 slot-2 7 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 2
admin> set line nfas-group-id = 2
admin> write
T1/{ shelf-1 slot-2 7 } written

admin> read t1 {1 2 8}
T1/{ shelf-1 slot-2 8 } read

admin> set line signaling-mode = isdn-nfas
admin> set line nfas-id = 3
admin> set line nfas-group-id = 2
admin> write
T1/{ shelf-1 slot-2 8 } written
```

Configuring T1 R1 and R1-Modified (Taiwan) with ANI and called number

R1 is a multi-frequency inband signaling system that uses a set of register signals known as MFR1 tones as addressing signals. Each address (phone number) is preceded by a KP pulse and followed by an ST pulse denoting end of addressing.

R1 signaling may optionally be used with Automatic Number Identification (ANI) which is similar to Caller ID (CLID). When it is in use, you can specify whether to send an Automatic Number Id Request (ANIR) to the switch. If you specify that the unit should send an ANIR to the switch, you can also specify how long it waits before sending the request, and how long the ANIR signal lasts.

The following parameters enable R1 signaling on T1 lines and specify the timing of certain signals from the switch. These parameters are shown with their default settings:

```
[in T1/{ any-shelf any-slot 0 }:line-interface]
signaling-mode = inband
r1-use-anir = no
r1-first-digit-timer = 240
r1-anir-delay = 350
r1-anir-timer = 200
r1-modified = no
```

Parameter	Specifies
Signaling-Mode	For T1 R1 signaling, you must set Signaling-Mode to R1-Inband.
R1-Use-ANIR	Enables/disables ANI processing (CLID). It is set to No by default. If set to Yes, the system performs ANI processing on incoming calls.

Parameter	Specifies
R1-First-Digit-Timer	Time in milliseconds to wait for the first digit from the switch after sending the KP pulse. The default setting is 340 msecs. The valid range is from 0 to 1000.
R1-ANIR-Delay	Time in milliseconds to wait before sending the ANIR signal after receipt of the ST pulse from the switch. The default setting is 350 msecs. The valid range is from 300 to 2000.
R1-ANIR-Timer	Duration in milliseconds of the ANIR signal. The default setting is 200 msecs. The valid range is from 180 to 400.
R1-Modified	Enables/disables a modified version R1 signaling that is required in Taiwan. It is set to No by default, which indicates regular R1 signaling (described in the ITU recommendation Q.310- 332). MAX TNT systems located in Taiwan should set this parameter to Yes.

Following is an example that shows how to configure R1-Modified signaling (Taiwan) with ANIR in a T1 profile:

```
admin> read t1 { 1 5 1}
T1/{ shelf-1 slot-5 1 } read

admin> set line signal = r1-inband

admin> set line r1-use-anir = yes

admin> set line r1-first-digit-timer = 360

admin> set line r1-anir-delay = 360

admin> set line r1-anir-timer = 220

admin> set line r1-modified = yes

admin> write
T1/{ shelf-1 slot-5 1 } written
```

Configuring clocking

You can configure the MAX TNT to use any of the T1 lines as a master clock source for synchronous connections for an entire multishelf system. In synchronous transmission, both the sending device and the receiving device must maintain synchronization in order to determine where one block of data ends and the next begins.

From the T1 lines configured as eligible clock sources, the MAX TNT chooses a clock source on the basis of priority. If multiple T1 lines are configured as eligible clock sources and have an equal clock priority, MAX TNT chooses one of them at random. Once chosen as the clock source, the line used until it becomes unavailable or a higher priority source becomes available.

If there are no eligible external sources, the system uses an internal clock generated from the master shelf controller. Using the internal clock is generally not recommended.

The Clock-Source diagnostic command displays the current master clock source and any available clock source. Sources with layer 2 up, which are preferred, are marked with an asterisk.

To specify a clock source and set a priority, proceed as follows:

```
admin> set clock-source = eligible
admin> set clock-priority = high-priority
admin> write
```

Configuring the front end transceiver

The front-end type of the T1 transceiver may be CSU or DSX.

If you are connecting the MAX TNT to a DSX, set the Front-End-Type to DSX. With this setting you must also specify the length of the physical T1 line in feet. The value should reflect the longest line length you expect to encounter in your installation, up to a maximum of 655 feet.

If you are not connecting the MAX TNT to a DSX, set Front-End-Type to CSU. You might also have to set a line buildout value to specify the amount of attenuation, in decibels, the MAX TNT should apply to the line. If the MAX TNT is too close to a repeater, you need to add some attenuation to reduce the strength of the signal. Ask your service provider whether you need attenuation and, if so, how much.

To specify DSX settings, proceed as in the following example:

```
admin> set front-end-type=dsx
admin> set dsx-line-length = 1-133
admin> write
```

To specify CSU settings, proceed as in the following example:

```
admin> set front-end-type=csu
admin> set csu-build-out=7.5-db
admin> write
```

Configuring channel usage

You must specify how each of the 24 channels of a T1 line is to be used. By default, T1 channels are configured as switched. (If you are going to set up the lines for NFAS, see “Configuring NFAS signaling” on page 7-13 for additional channel-configuration information.)

You can configure each of the 24 channels of a T1 line for one of the following uses:

- `unused-channel`—Channel is unused. Send the single idle code defined for this channel.
- `switched-channel`—A switched channel, which will be robbed-bit or D-channel, depending on how the line is configured at a higher level.

- `nailed-64-channel`—Clear-channel 64K circuit. Does not require any setup information.
- `d-channel`—Channel is used for ISDN D channel signaling directed at the appropriate controller for the physical interface.
- `nfas-primary-d-channel`—The Primary D channel for a group of T1 lines with the same NFAS ID. All other channels on the NFAS line must be set to `switched-channel`, `nailed-64-channel`, or `unused-channel`. Within an NFAS group, only one line should be configured to provide the primary ISDN D channel.
- `nfas-secondary-d-channel`—The secondary D channel for a group of T1 lines with the same NFAS ID. All other channels on the NFAS line must be set to switched-channel, nailed-64-channel, or unused-channel. Within an NFAS group, only one line should be configured to provide the secondary (backup) D channel.

To specify the channel usage:

1 List the Line-Interface parameters:

```
admin> list line-interface
```

2 Set the Channel-Usage parameter for the first channel:

```
admin> set channel 1 channel-usage=[unused-channel |
switched-channel |nailed-64-channel| d-channel| nfas-pri-
mary-d-channel| nfas-secondary-d-channel]
admin> write
```

Assigning phone numbers to switched channels

Channel assignments typically specify add-on numbers, not full phone numbers. Add-on numbers include only the rightmost digits needed to distinguish one number from another. For example, if a line is assigned 23 numbers, all of which begin with *212-555-*, the add-on number is the unique set of digits to the right of these common digits.

The most common reason multichannel calls fail to add channels properly is that the calling unit cannot use the add-on numbers it receives. To avoid this problem, make sure that the add-on numbers you assign all have the same number of digits.

When a caller initiates a multi-channel call, it first dials the base channel and then requests additional numbers for dialing the additional channels. When it receives add-on numbers, the caller integrates them with the number it dialed for the base channel as follows:

- If the add-on number has fewer digits than the dialed number, the caller pads the add-on number with the leftmost digits that are included in the dialed number but not in the add-on number. For example, if the add-on number is 6532 and the dialed-number is 9-212-555-1212, the caller uses 9-212-555-6532 to dial the next channel.
- If the add-on number has more digits than the dialed number, the caller discards extra digits in the add-on numbers, starting with the leftmost digit.
- If the add-on number has the same number of digits as the dialed number, the entire add-on number is used. For example, if 6532 is the add-on number and 6588 is the dialed number, the caller uses 6532 to dial the next channel.

To assign add-on numbers to the channels of a T1 line, proceed as in the following example:

```
admin> list line channel
channel-config[1]={switched-channel 9 "" {any-shelf any-slot 0} 0 }
channel-config[2]={switched-channel 9 "" {any-shelf any-slot 0} 0 }
channel-config[3]={switched-channel 9 "" {any-shelf any-slot 0} 0 }
 ...
channel-config[24]={switched-channel 9 "" {any-shelf any-slot 0} 0}
admin> set 1 phone = 60
admin> set 2 phone = 61
admin> set 3 phone = 62
admin> set 4 phone = 63
admin> set 5 phone = 64
```

In a hunt group, a group of channels is assigned the same phone number. When a call comes in on that number, the MAX TNT uses the first available channel to which the number is assigned. Because channels in a hunt group share a common phone number, the add-on numbers in the profile are all the same.

The following example shows how to configure two groups of 4 channels with hunt groups:

```
admin> set 6 phone = 70
admin> set 7 phone = 70
admin> set 8 phone = 70
admin> set 9 phone = 70
admin> set 10 phone = 72
admin> set 11 phone = 72
admin> set 12 phone = 72
admin> set 13 phone = 72
admin> write
```

Configuring trunk groups

Like nailed channels that have been assigned a group number, switched channels in a trunk group can be referenced from a Connection profile and Call-Route profile to direct outbound calls to use that specific bandwidth. Trunk groups also serve a variety of other purposes, such as separating lines supplied by different carriers so those lines can be used as backup for each other if one switch becomes unavailable. The decision to use trunk groups is a global one. Once you have enabled the use of trunk groups, *every* switched channel must be assigned a trunk group number or it will not be available for outbound calls.

Trunk groups limit the number of channels available to multichannel calls, because only channels within the same trunk group can be aggregated.

To enable trunk groups, open the System profile and set use-trunk-groups to Yes, as in the following example:

```
admin> read system
SYSTEM read
admin> list
name = ""
system-rmt-mgmt = yes
use-trunk-groups = no
idle-logout = 0
```

```
parallel-dialing = 2
single-file-incoming = yes
analog-encoding = a-law
sessionid-base = 0
admin> set use-trunk-groups = yes
admin> write
```

Then assign the channels of each T1 line to a trunk group, as in the following example:

```
admin> list line channel 1
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set trunk-group = 4
admin> list .. 2
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set trunk-group = 4
admin> list .. 3
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set trunk-group = 4
admin> write
```

Note: Command history is very useful for repeating commands. Press the Up-Arrow to redisplay the command, and then press Enter. (For more information, see *The Ascend Command Line Interface*.)

Configuring nailed channels

The number of nailed channels must be the same at both ends of the connection. For example, if there are 5 nailed channels at the local end, there must be 5 nailed channels at the remote end. However, channel assignments do not have to match. For example Channel 1 might be switched at the local end and nailed at the remote end.

Note that channels in a nailed group must be contiguous on the T1 line.

When you configure Connection profiles to use the leased connection, you must specify the Nailed-Group number in the Telco-Options subprofile.

To configure a nailed channel, proceed as in the following example:

```
admin> list line channel 1
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set channel = nailed
admin> set nailed = 3
admin> list .. 2
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set channel = nailed
admin> set nailed = 3
admin> write
```

Configuring a back-to-back T1 connection

For diagnostic purposes, you might sometimes want to configure a back-to-back T1 connection between ports on two MAX TNT or other Ascend units. In the T1 profile for one end of the line you want to connect with a back-to-back connection, specify the following values:

- Signaling-Mode set to inband (the default)
- Robbed-Bit-Mode set to Wink-Start (the default)
- Clock-Source set to Eligible (the default)

In T1 profile for the other end of the line, specify the following values:

- Signaling-Mode set to inband (the default)
- Robbed-Bit-Mode set to Inc-W-200 or Inc-W-400
- Clock-Source set to Eligible (the default)

Connect the 2 ports with a T1-crossover cable. You can now configure Connection profiles between the units and dial over the connection as you would over the WAN. (For information about configuring Connection profiles, see the *MAX TNT Network Configuration Guide*.)

Specifying analog encoding for MAX TNT codecs

Codecs connected to T1 use a different encoding standard for digitized analog data than codecs connected to E1. The default for T1 is U-Law, the default for E1 is A-Law.

To specify the analog encoding, proceed as in the following example:

1 Open the System profile:

```
admin> read system
```

2 Specify the analog encoding for all the codecs in the MAX TNT:

```
admin> set analog-encoding = u-law
```

3 Write the System profile to save the changes:

```
admin> write
SYSTEM written
```

Configuring specialized options

The settings described in this section are not normally used. Depending on your configuration, however, you might need to change the default values.

Typically, the D channel of a PRI line uses normal data. However, for some connections, you might need to invert the data to avoid transmitting a pattern that the connection cannot handle. Inversion changes 1s to 0s and 0s to 1s. Both sides of the connection must agree to use inverted data.

Idle mode determines whether the D channel looks for a flag pattern (01111110) or a mark pattern (11111111) as the idle indicator. The default setting, Flag-Idle, is usually correct.

To set these options, use the Data-Sense and Idle-Mode parameters:

```
admin> set data-sense = [normal|inv]
admin> set idle-mode = [mark-idle|flag-idle]
admin> write
```

Sample T1 configuration

This section provides an example of how to configure a T1 card. The example uses the following setup:

- The card is in shelf 1, slot 2.
- All lines use PRI signaling.
- Switch type is NTI-PRI.
- The line is connected to a DSX and is less than 100 feet long. It therefore uses the default settings for Front-End-Type and DSX-Line-Length.
- All the channels are switched (the default), with the exception of the channel 24, which is set for D Channel signaling.
- All the channels are assigned to trunk group 9 (the default).
- The Default-Call-Type is digital (the default), so all calls received on this card are routed to the HDLC card.
- The rest of the line parameters are left at their default values.

To configure the T1 card as in this example:

1 Create a new T1 profile:

```
admin> new t1
T1/{ any-shelf any-slot 0 } read
```

2 Set the physical address for the first T1 line:

```
admin> set physical-address ={ 1 2 1}

This applies the changes to the T1 line in the specified
slot.
```

3 List the contents of the line profile:

```
admin> list line-interface
enabled = no
frame-type = d4
encoding = ami
clock-source = eligible
clock-priority = middle-priority
signaling-mode = inband
robbed-bit-mode = wink-start
default-call-type = digital
switch-type = att-pri
nfas-id = 0
call-by-call = 0
data-sense = normal
idle-mode = flag-idle
FDL = none
front-end-type = dsx
DSX-line-length = 1-133
CSU-build-out = 0-db
channel-config = [ { switched-channel 9 "" { any-shelf
any-slot 0 } 0 } { switc+
maintenance-state = no
sendDisc-val = 0
```

4 Enable the line:

```
admin> set enabled =yes
```

5 Set the frame type:

```
admin> set frame-type = esf
```

6 Set the line encoding:

```
admin> set encoding = b8zs
```

7 Set the signaling mode:

```
admin> set signaling-mode =isdn
```

8 Set the switch type:

```
admin> set switch-type =nti-pri
```

9 Next, assign all the channels to trunk group 7:

```
admin> set channel 1 trunk-group=7
```

10 Press the up-arrow key or Ctrl-P to redisplay the Set command you just entered.

11 Use the Left Arrow or Control-B to change the channel number and trunk group for all the channels.

12 Change the channel usage of channel 24 to D Channel, because this channel carries the signaling for the PRI line.

```
admin> set channel 24 channel-usage=d-channel
```

13 Write the profile to commit your changes:

```
admin> write
T1/{ shelf-1 slot-2 2 } written
```

Because the T1 lines are all configured similarly, you can write the changes to the rest of the lines by setting the physical address and then writing the same profile for each of the lines:

```
admin> set physical-address = { 2 1 2}
admin> write
T1/{ shelf-1 slot-1 2} written
admin> set physical-address = { 2 1 3}
admin> write
T1/{ shelf-1 slot-1 3} written
```

Continue until you have configured all the lines.

Default Call-Route profiles

When the MAX TNTMAX TNT system detects that a T1 card has been installed, it creates one default Call-Route profile associated with the card. For example:

```
admin> dir call-r
     9  12/11/1996 15:58:08  { { { any-shelf any-slot 0 } 0 } 0 }
    13  01/06/1997 17:17:10  { { { shelf-1 slot-2 0 } 0 } 0 }
```

This default Call-Route profile routes outbound trunk calls to any line on the card. To handle inbound modem and LAN-session traffic, you should configure specific call routes. For details, see Chapter 17, “Call Routing in the MAX TNT.”

Configuring E1 Cards

8

This chapter covers the following topics:

Introduction to E1

An E1 line supports 32 64-Kbps channels, each of which may be used to transmit and receive data or digitized voice. The line uses framing and signaling to achieve synchronous and reliable transmission. The most common configurations for E1 lines are PRI and unchannelized. (For information about provisioning your E1 line for use with the MAX TNT, see Appendix A, “Provisioning the Switch.”)

ISDN Primary Rate Interface (PRI)

In Europe, an E1/PRI line typically supports 30 B channels and one D channel. But if NFAS signaling is in use, more than one ISDN PRI line on a single card can share a single D channel. PRI configurations are used to receive multiple, simultaneous ISDN calls from analog-modem and digital-services dial-in traffic. Another common use of E1/PRI lines is to connect a Private Branch Exchange (PBX) to a central office switch.

Nailed or unchannelized E1

An unchannelized E1 line may be used for nailed connections such as to a Frame Relay network. In such cases the configuration is static, and the MAX TNT treats the E1 line as if it were a single connection at a fixed speed, without individual channels.

Typically, when you pay your telephone company for a leased (nailed) line, you pay more for higher bandwidth. Anything in the range of 0 bps to 2.048 Mbps may be delivered on an E1 line, and provisioned at some 64K fraction of the full E1 bandwidth.

The MAX TNT E1 card is illustrated in Figure 8-1.

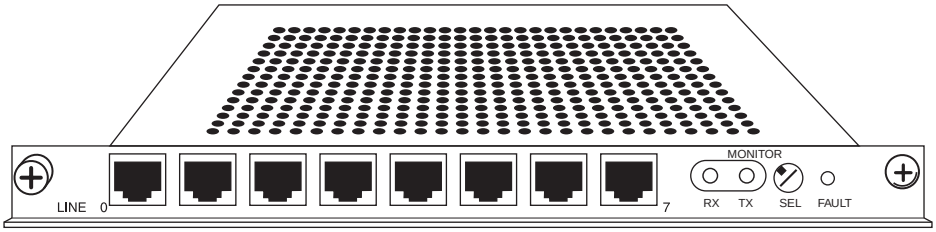

Figure 8-1. MAX TNT T1 card

Installing the E1 card

You install E1 cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Note: All MAX TNT slot cards, including the E1 cards, are supported *only* in MAX TNT units. You must install any MAX TNT slot card in a MAX TNT unit that supports that specific slot card.

Connecting the MAX TNT E1 line to the WAN

When connecting your E1 line, keep the following points in mind:

- Use cable that is specifically constructed for transmission of E1/PRI signals (CCITT G700 series recommended).
- The MAX TNT can connect to any DPNSS access point on a PBX or directly to E1 digital services. The MAX can also connect to G.704 framed leased (nonswitching) services for 75 ohm connections.
- When installing the E1 line, the screen of the transmit and receive coaxial cable must be earthed at one end of the line only. Links (jumpers) are provided on the MAX to earth the coaxial screens. The default position of the grounding links on the network line interface, when used with coaxial cable adapters, is on the transmit side (Tx) for 1680 Kbps network operations.
- The maximum distance between the E1/PRI WAN interface equipment and the MAX TNT should not introduce attenuation of more than 6 dB, when measured at half the maximum data rate (1024 Kbps). Also, the cable must have a root F characteristic.

Connect the MAX TNT port either directly to the E1 line or through other network interface equipment. See Figure 8-2 for an example.

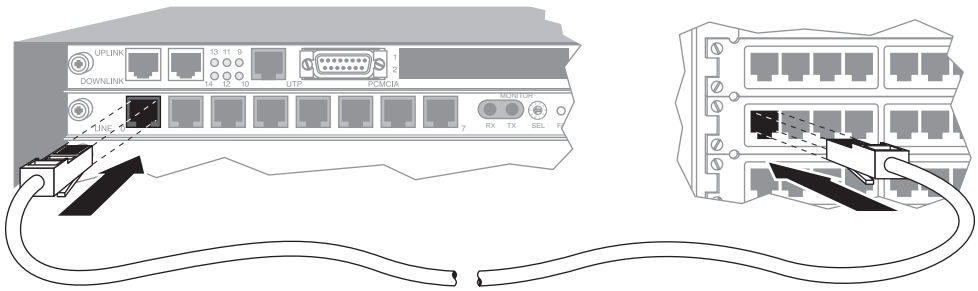

Figure 8-2. Connecting your E1 line

Inform your service provider that the equipment is connected, so they can bring up the line.

Monitoring the E1 line with bantam jacks

Each E1 card provides transmit and receive bantam jacks to monitor the status of the E1 lines. The Tx line carries what the MAX TNT transmits to the network. The Rx line carries what the MAX TNT receives from the network. The bantam jacks do not interfere with the signal either coming into or going out of the MAX TNT.

To monitor the E1 lines:

1 Select the line to monitor by setting the select switch on the E1 card.

2 Plug in bantam jacks.

Overview of E1 configuration

Table 8-1 lists the sections describing common tasks you might have to perform to configure an E1 line. The table includes a brief description of each task, and lists the parameters you will use.

For complete information about the associated parameters, see the *MAX TNT Reference Guide*.

Table 8-1. E1-line configuration tasks

Section	Description of task	Associated parameters
"Understanding configuration requirements" on page 8-6	Before configuring your E1 line, gather the necessary information from your E1 service provider.	N/A
"Making a profile the working profile" on page 8-6	Before you can edit a profile, you must make it the working profile.	N/A
"Assigning a name to E1 line profiles" on page 8-8	Assign a name to the E1 profile.	Name
"Enabling a line" on page 8-8	Make a line available for use.	Enabled
"Configuring a back-to-back connection" on page 8-9	A back-to-back connection lets you connect two MAX TNT units to one another over a crossover E1 cable.	Back-to-Back
"Specifying the framing" on page 8-9	Framing specifies how the bits are sent on the line.	Frame-Type
"Specifying E1 signaling" on page 8-9	Specify the type of signaling used for your E1 line.	Signaling-Mode
"Configuring ISDN PRI signaling" on page 8-10	You must specify the type of network switch providing ISDN service on an E1 PRI line.	Switch-Type
"Configuring E1 R1 signaling" on page 8-11	R1 is an inband signaling protocol that uses a set of register signals known as MFR1 tones as addressing signals.	Signaling-Mode Switch-Type
"Configuring E1 R2 signaling" on page 8-11	Specify R2 signaling and specify R2-specific configuration options.	Signaling-Mode Number-Complete Group-B-Signal Group-II-Signal Answer-Delay

Table 8-1. E1-line configuration tasks (continued)

Section	Description of task	Associated parameters
"Configuring DPNSS signaling" on page 8-13	Specify DPNSS signaling and associated options.	Signaling-Mode Layer3-End Layer2-End NL-Value Loop-Avoidance
"Configuring clocking" on page 8-14	Set Clock-Source to specify whether the E1 line can be used as the master clock source for synchronous connections. Also specify the priority of the E1 lines to be used for clocking.	Clock-Source Clock-Priority
"Configuring the front end E1 transceiver" on page 8-15	Set the front end type of the E1 transceiver to Long-Haul or Short-Haul, depending on the type of termination your line uses.	Front-End-Type
"Configuring channel usage" on page 8-15	Specify how each of the E1 channels are to be used.	Channel-Usage
"Assigning phone numbers to switched channels" on page 8-15	Typically, you need specify only the rightmost digits needed to distinguish one number from another. These are called add-on numbers.	Phone-Number
"Configuring trunk groups" on page 8-15	A trunk group is a group of channels that has been assigned a number.	Trunk-Group
"Configuring nailed channels" on page 8-17	You must assign a nailed channel to a group to make it available for use. The group number can be referenced in a Connection or Frame-Relay profile to specify a permanent leased connection using that group of nailed channels.	Nailed-Group

Table 8-1. E1-line configuration tasks (continued)

Section	Description of task	Associated parameters
Chapter 17, "Call Routing in the MAX TNT"	Set up call routing, which the MAX TNT uses to determine where to route incoming and outgoing calls. This information is deprecated in the MAX TNT. The preferred way to set up call-routing is to put all call-routing information in one place: a Call-Route profile. If you do not use Call-Route profiles, specify the physical address of a device to which calls received on this channel should be routed.	Default-Call-Type Call-by-Call-Service Shelf Slot Item

Understanding configuration requirements

You need the following information from your E1/PRI service provider:

- The phone numbers assigned to your E1/PRI interface, channel-by-channel
- Nailed-up channels (also called private WAN), if any
- Unused channels, if any
- Switch type (or emulation)—DPNSS only
- Switch layers 2 and 3 configuration—DASS 2 and DPNSS only (A/B end, X/Y end)
- Rate adaption protocol—DASS 2 and DPNSS only (X.30 and V.110)

Note: The MAX TNT cannot receive multichannel calls using MP encapsulation unless all channels of the call share a common phone number (namely, a hunt group). You can request that your service provider supply you with a hunt group.

Making a profile the working profile

When the MAX TNT system detects that an E1 card has been installed, it creates a default E1 profile for each of the eight lines on the card.

In the following display example, the Dir command shows eight default E1 profiles created for a card installed in slot 2:

```
admin> dir e1
   305  12/11/1996 15:58:20 { shelf-1 slot-2 2 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 4 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 5 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 6 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 7 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 8 }
   320  12/20/1996 20:55:31  { shelf-1 slot-2 3 }
   317  01/08/1997 09:58:55  { shelf-1 slot-2 1 }
```

By default, a line is not enabled, which means that it is not available for use. Its default signaling method is inband, typically used for channelized connections.

To configure an E1 profile, make it the working profile by reading it into the edit buffer. For example:

```
admin> read e1 {1 2 1}
E1/{ shelf-1 slot-2 1 } read
```

Once you have read in a profile, it remains the working profile until you read in another profile.

To save your configuration changes, use the Write command. For example,

```
admin> write
E1/{ shelf-1 slot-2 1} written
```

To list the parameters in an E1 profile, use the List command, as in the following example:

```
admin> list
physical-address* = { shelf-1 slot-2 1 }
line-interface = { yes esf b8zs eligible middle-priority
isdn wink-star+
```

The following example shows the parameters in an E1 profile, with sample settings:

```
[in E1/{ shelf-1 slot-15 5 }]
name = ""
physical-address* = { shelf-1 slot-15 5 }
line-interface = { no none g703 eligible middle-priority +
back-to-back = false

[in E1/{ shelf-1 slot-15 5 }:line-interface]
enabled = yes
t-online-type = none
frame-type = g703
clock-source = eligible
clock-priority = middle-priority
signaling-mode = isdn
default-call-type = digital
switch-type = net5-pri
incoming-call-handling = reject-all
front-end-type = short-haul
overlap-receiving = no
pri-prefix-number = ""
trailing-digits = 2
t302-timer = 10000
channel-config = [ { unused-channel 9 "" { any-shelf +
layer3-end = x-side
layer2-end = b-side
nl-value = 64
loop-avoidance = 7
number-complete = end-of-pulsing
group-b-answer-signal = signal-b-6
group-b-busy-signal = signal-b-3
group-ii-signal = signal-ii-2
```

```
input-sample-count = one-sample
answer-delay = 200
caller-id = no-caller-id
hunt-grp-phone-number-1 = ""
hunt-grp-phone-number-2 = ""
hunt-grp-phone-number-3 = ""
collect-incoming-digits = no
r1-use-anir = no
r1-first-digit-timer = 340
r1-anir-delay = 350
r1-anir-timer = 200
r1-modified = no

[in E1/{ shelf-1 slot-15 5 }:line-interface:channel-con +
channel-usage = unused-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 1
```

Assigning a name to E1 line profiles

In an E1 profile, the Name parameter enables you to assign the profile a name. The name can include up to 16 characters. After you assign it, it is displayed after the line's physical address in the Dir command output. For example:

```
admin> read e1 {1 12 0}
admin> set name = E1 Trunk
admin> write
E1/{ shelf-1 slot-12 0 } written
admin> dir e1
17  04/17/1997 19:00:02  { shelf-1 slot-12 0 }  "E1 Trunk"
```

For E1 lines, the Line Status window displays either the name (if assigned) or the physical address. If the name is longer than eight characters, the last character displayed is a plus-sign (+).

Enabling a line

By default each E1 line is disabled. To enable an E1 line, read its profile to make it the working profile, then set Enabled to Yes, as in the following example:

```
admin> read e1 {1 2 1}
E1/{ shelf-1 slot-2 1 } read
admin> set line enabled = yes
admin> write
E1/{ shelf-1 slot-2 1 } written
```

Configuring a back-to-back connection

For diagnostics, you can configure DASS-2 or DPNSS lines in a back-to-back connection. A crossover cable connects an E1 port of one MAX TNT to an E1 port of another MAX TNT. No switch is required, and the connection is entirely local. One MAX TNT should be set up for DTE operation, and the other for DCE operation.

To specify a back-to-back connection, set the Back-to-Back parameter in the E1 profile:

```
admin> read e1 {1 2 1}
E1/{ shelf-1 slot-2 1 } read
admin> set back-to-back = [true|false]
admin> write
E1/{ shelf-1 slot-2 1 } written
```

Specifying the framing

The E1 framing mode may be G703 (G.704 with CRC4, the standard framing mode used by most E1 ISDN and DASS2 providers) or 2DS (G.704 without CRC4, a variant of G.703 required by most E1 DPNSS providers in the U.K.). If the line is not configured for ISDN signaling, you can use the D4 format, also known as the superframe.

Your E1 service provider must provide the correct framing values for your lines.

To specify the framing, set the Frame-Type parameter:

```
admin> read e1 {1 2 1}
E1/{ shelf-1 slot-2 1 } read
admin> set line frame-type = [G703|2DS|D4|ESF]
admin> write
E1/{ shelf-1 slot-2 1 } written
```

Specifying E1 signaling

An E1 line's signaling mode can be any of the following:

- ISDN
- DPNSS (DPNSS or DASS 2 signaling)
- Channel Associated Signaling (CAS). CAS signaling modes include:
  - E1-R2-Signaling (R2 signaling)
  - E1-Argentina-Signaling
  - E1-Brazil-Signaling
  - E1-Chinese-Signaling (R2 signaling used in China)
  - E1-Czech-Signaling
  - E1-India-Signaling
  - E1-Korean-Signaling (R2 signaling used in Korea)
  - E1-Malaysia-Signaling

- E1-Metered-Signaling (metered R2 signaling, used in Brazil and South Africa)
- E1-Philippine-Signaling
- E1-P7-Signaling (R2 P7)
- R1-Inband

In the E1 profile Line-Interface subprofile, configure E1 signaling as follows:

```
admin> read e1 {1 2 1}
E1/{ shelf-1 slot-2 1 } read
admin> set line signaling-mode = signalingmode
admin> write
E1/{ shelf-1 slot-2 1 } written
```

where *signalingmode* is one of the modes listed above. If you are using one of the CAS signaling modes, you must also set the Switch-Type parameter to CAS.

For more information on the E1 signaling parameters, see the *MAX TNT Reference Guide*.

Configuring ISDN PRI signaling

For ISDN signaling you must also specify the type of switch providing E1/PRI service to your MAX TNT. Obtain the information from your ISDN carrier.

When you set the signaling mode to ISDN, you must also set channel 17 as the D channel. Note that ISDN signaling often requires ESF framing and B8ZS encoding.

Configure ISDN PRI service as in the following example:

```
admin>read e1 {1 15 5}
E1/{ shelf-1 slot-15 5 } read

admin>list
[in E1/{ shelf-1 slot-15 5 }]
name = ""
physical-address* = { shelf-1 slot-15 5 }
line-interface = { no none g703 eligible middle-priority
isdn +
back-to-back = false

admin>list line-interface
[in E1/{ shelf-1 slot-15 5 }:line-interface]
enabled = no
t-online-type = none
frame-type = g703
clock-source = eligible
clock-priority = middle-priority
signaling-mode = isdn
default-call-type = digital
switch-type = net5-pri
..
..

admin> set frame-type = esf
admin> set signaling-mode = isdn
```

```
admin> set switch-type = switchtype
admin> set channel 17 channel-usage=d-channel
admin> write
```

To see a complete list of switch types supported on the MAX TNT, see the MAX TNT command line interface online help or the *MAX TNT Reference Guide*.

Configuring E1 R1 signaling

R1 is an inband signaling protocol that uses a set of register signals known as MFR1 tones as addressing signals. Each address (phone number) is preceded by a KP pulse and followed by an ST pulse denoting the end of addressing.

The R2 signaling option must be hash-code enabled on the system in order for R1 signaling to work. If one or more E1 lines on an E1 card is configured for R1 signaling, no other line on the card can use R2 signaling.

Following are the parameters relevant to R1 signaling, shown with sample values:

```
[in E1/{shelf-1 slot-13 1}:line-interface]
signaling-mode = r1-inband
switch-type = cas
```

All other line signaling parameters can be left in their default setting. The following example specifies R1 signaling on an E1 line in shelf 1, slot 13:

```
admin> read e1 {1 13 1}
E1/{ shelf-1 slot-13 1 } read

admin> set line signaling-mode = r1-inband

admin> set switch-type = cas

admin> write
E1/{ shelf-1 slot-13 1 } written
```

Configuring E1 R2 signaling

R2 signaling is an ITU-T standardized signaling protocol, which can be used on E1 digital trunks for switched circuits. It uses a combination of A/B bit manipulation, in channel 16 of the E1 frame (line signaling), and in-band MF tone generation and detection (register signaling). The relevant specifications are in ITU-T recommendations Q.400 to Q.490. R2 signaling is widely implemented in international markets where ISDN PRI is not yet available. The default bandwidth for data calls coming in over E1 channels using R2 signaling is 64K.

To configure R2 signaling, you might need to set some or all of the following parameters:

Parameter	Specifies
Switch-Type	Type of switch the MAX TNT connects to. For R2 signaling, you must set Switch-Type to Switch-CAS. When the line is configured for Channel Associated Signaling (CAS), the MAX TNT does not receive bearer-capability information from the carrier. So it does not really know when a call is voice-service or digital-service. Inband lines assume for call-routing purposes that all calls are digital calls.
Answer-Delay	How many milliseconds the MAX TNT should delay before answering an R2 call.
Number-Complete	How many digits will be considered a complete number on an incoming call using R2 signaling. You can specify End-of-Pulsing to indicate that the MAX TNT should keep on receiving digits until the caller stops sending them, or you can specify a fixed number of digits (up to 10). In all cases, the digits received before the call is answered are considered the called number for call-routing purposes.
Group-B-Answer-Signal	Replaces the Group-B-Signal parameter found in earlier releases. It specifies the group-B signal that the MAX TNT sends before answering a call, and can be set to a value from Signal-B-1 to Signal-B-15. The default is Signal-B-6, which is the recommended setting for E1_R2 Israeli signaling.
Group-B-Busy-Signal	Group-B-Busy-Signal specifies the group-B signal that the MAX TNT sends as a busy signal. When the MAX TNT does not have sufficient resources to handle the call correctly (for example, if all of its modems are busy), it sends the group-B signal specified by this parameter. It can be set to a value from Signal-B-1 to Signal-B-15. The default is Signal-B-3, which is the recommended setting for E1_R2 Israeli signaling.
Group-II-Signaling	The Group II signal that is sent in the course of an outgoing call, immediately after acknowledgment by the called end that all necessary address digits have been received. It is used for outgoing call configuration.
Caller-ID	Enables or disables the use of caller ID for R2 calls. You must specify one the following signaling modes to enable the MAX TNT to process CLID information received from the switch: • E1-Argentina-Signaling • E1-Brazil-Signaling • E1-Chinese-Signaling • E1-India-Signaling • E1-Malaysia-Signaling • E1-Philippine-Signaling For details about configuring CLID authentication in a Connection profile, see the *MAX TNT Network Configuration Guide*.

To configure the line for R2 signaling, proceed as in the following example:

```
admin> read e1 {1 2 2}
E1/{ shelf-1 slot-2 2 } read

admin> list line
enabled=no
frame-type=g703
clock-source=eligible
clock-priority=middle-priority
signaling-mode=isdn
switch-type=net5-pri
front-end-type=short-haul
channel-config=[ { unused-channel 9 "" { any-shelf any-slot+
..
..
admin> set line enabled = yes
admin> set line frame-type = 2DS
admin> set line signaling-mode = e1-r2-signaling
admin> set line switch-type = switch-cas
admin> set line number-complete = end-of-pulsing
admin> set line group-b-signal = signal-b-6
admin> set line group-ii-signal = signal-ii-2
admin> set line answer-delay = 200
admin> set line caller-id = get-caller-id
admin> write
E1/{ shelf-1 slot-2 2 } written
```

Configuring DPNSS signaling

When you are connecting to a DASS 2 or DPNSS switch, you must set the following parameters:

- Layer3-End specifies CCITT Layer 3. It must be set to X-Side (its default value).
- Layer2-End specifies CCITT Layer 2. It must be set to B-Side (its default value).
- NL-Value must be set to 64 (its default value).
- Loop-avoidance must be set to 7 (its default value).

Contact the carrier for more details. (These settings are not required for ISDN signaling.)

In the following example, an administrator configures DPNSS signaling using a Mercury switch (a variant of DPNSS). The specified framing mode, 2DS, is a variant of G.703 required by most E1 DPNSS providers in the U.K. To configure an E1 line for DPNSS signaling, proceed as in the following example:

```
admin> read e1 {1 2 2}
E1/{ shelf-1 slot-2 2 } read
admin> set enabled = yes
admin> set signaling-mode = e1-dpnss-signaling
admin> set switch = mercury-dpnss
admin> set frame-type = 2ds
admin> set layer3-end = x-side
admin> set layer2-end = b-side
admin> set nl-value = 64
```

```
admin> set loop-avoidance = 7
admin> write
```

Configuring overlap receiving on PRI lines

Overlap receiving affects the procedure of establishing an incoming call received on a T1 or E1 PRI line in the MAX TNT. With overlap receiving, the MAX TNT can gather the complete called-number from the network switch via a series of Information messages, enabling the use of features such as called-number authentication. For information about configuring overlap receiving on PRI lines, see “Configuring overlap receiving on PRI lines” on page 7-9.

Configuring clocking

You can configure the MAX TNT to use any of the E1 lines as a master clock source for synchronous connections for an entire multishelf system. In synchronous transmission, both the sending device and the receiving device must maintain synchronization in order to determine where one block of data ends and the next begins.

From the E1 lines configured as eligible clock sources, the MAX TNT chooses a clock source on the basis of priority. If multiple E1 lines are configured as eligible clock sources and have an equal clock-priority, MAX TNT chooses one of them at random. Once chosen as the clock source, the line is used until it becomes unavailable or a higher priority source becomes available.

If there are no eligible external sources, the system uses an internal clock generated from the master shelf controller. Using the internal clock is generally not recommended.

The Clock-Source diagnostic command displays the current master clock source. If you execute the command on the shelf controller, it tells which slot (if any) is being used as the clock source. If you execute it on an E1 card, it tells which line is used.

To specify a clock source and set a priority, proceed as follows after reading in the line’s E1 profile:

```
admin> set clock-source = eligible
admin> set clock-priority = high-priority
admin> write
```

Configuring the front end E1 transceiver

The front-end type of the E1 transceiver may be short haul or long haul. Long haul is only for lines using 120 ohm termination.

Specify the front end settings as follows, after reading in the line's E1 profile:

```
admin> set front-end-type=[short-haul|long-haul]
admin> write
```

Configuring channel usage

You must specify how each of the 32 channels of an E1 line is to be used. By default, E1 channels are configured as switched. Each of the 32 channels of an E1 line can be configured for one of the following uses:

- Unused-Channel—Channel is unused. Send the single idle code defined for this channel.
- Switched-Channel—Switched channel, using either robbed-bit or D-channel signaling, depending on how the line is configured at a higher level.
- Nailed-64-Channel—A clear-channel 64K circuit. Does not require any setup information.
- D-Channel. Channel—16 (channel 17 in the MAX TNT interface) is used for ISDN D-channel signaling directed at the appropriate controller for the physical interface.

To specify the channel usage:

1 List the Line-Interface parameters:

```
admin> list line-interface
```

2 Set the Channel-Usage parameter for the first channel:

```
admin> set channel 1 channel-usage=[unused-chan-
nel|switched-channel |nailed-64-channel|d-channel]
admin> write
```

Assigning phone numbers to switched channels

Assigning phone number to switched E1 channels is no different that assigning them to switched T1 channels. See "Assigning phone numbers to switched channels" on page 7-18.

Configuring trunk groups

Like nailed channels that have been assigned a group number, switched channels in a trunk group can be referenced from a Connection profile and Call-Route profile to direct outbound calls to use that specific bandwidth. Trunk groups also serve a variety of other purposes, such as separating lines supplied by different carriers so those lines can be used as backup for each other if one switch becomes unavailable. The decision to use trunk groups is a global one. Once you have enabled the use of trunk groups, *every* switched channels must be assigned a trunk group number or it will not be available for outbound calls.

Trunk groups limit the number of channels available to multichannel calls, because only channels within the same trunk group can be aggregated.

To enable trunk groups, open the System profile and set Use-Trunk-Groups to Yes, as in the following example:

```
admin> read system
SYSTEM read

admin> list
name = ""
system-rmt-mgmt = yes
use-trunk-groups = no
idle-logout = 0
parallel-dialing = 2
single-file-incoming = yes
analog-encoding = a-law
sessionid-base = 0
admin> set use-trunk-groups = yes
admin> write
```

Then assign the channels of each E1 line to a trunk group, as in the following example:

```
admin> read e1 {1 1 1}
E1/{ shelf-1 slot-1 1 } read

admin> list line channel 1
[in E1/{ shelf-1 slot-15 1 }:line-interface:channel-con +]
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set trunk-group = 4

admin> list .. 2
[in E1/{ shelf-1 slot-15 1 }:line-interface:channel-con +]
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set trunk-group = 4

admin> list .. 3
[in E1/{ shelf-1 slot-15 1 }:line-interface:channel-con +]
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set trunk-group = 4

..
..
admin> write
```

Note: Command history is very useful for repeating commands. Press the Up-Arrow key to redisplay the command, and then press Enter. (For more information, see *The Ascend Command Line Interface*.)

Configuring nailed channels

The number of nailed channels must be the same at both ends of the connection. For example, if there are five nailed channels at the local end, there must be five nailed channels at the remote end. However, channel assignments do not have to match. For example, Channel 1 may be switched at the local end and nailed at the remote end. Channels in a nailed group must be contiguous on the E1 line.

When you configure Connection profiles to use the leased connection, you must specify the Nailed-Group number in the Telco-Options subprofile.

To configure a nailed channel, proceed as in the following example:

```
admin> list line channel 1
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set channel = nailed
admin> set nailed = 3
admin> list .. 2
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
admin> set channel = nailed
admin> set nailed = 3
admin> write
```

Specifying analog encoding for MAX TNT codecs

Codecs connected to T1 use a different encoding standard for digitized analog data than do codecs connected to E1. The default for T1 is U-Law, the default for E1 is A-Law.

To specify the analog encoding, proceed as in the following example:

1. Open the System profile:

   ```
   admin> read system
   ```

2. Specify the analog encoding for all the codecs in the MAX TNT:

   ```
   admin> set analog-encoding = a-law
   ```

3. Write the System profile to save the changes:

   ```
   admin> write
   SYSTEM written
   ```

Default Call-Route profiles

When the MAX TNT system detects that an E1 card has been installed, it creates one default Call-Route profile associated with the card. For example:

```
admin> dir call-r
     9  12/11/1996 15:58:08  { { { any-shelf any-slot 0 } 0 }
0 }
    13  01/06/1997 17:17:10  { { { shelf-1 slot-2 0 } 0 } 0 }
```

This default Call-Route profile routes outbound trunk calls to any line on the card. To handle inbound modem and LAN-session traffic, you should configure specific call routes. For details, see Chapter 17, “Call Routing in the MAX TNT.”

Configuring T3 Cards

9

This chapter covers the following topics:

Introduction

The MAX TNT T3 card is a communications circuit composed of seven DS2s, each of which includes four DS1s, each of which in turn is composed of 24 DS0s, for a total of 672 DS0 channels.

On the T3 card, DS2 #1 includes DS1 lines 1-4, DS2 #2 includes DS1 lines 5-8, and so on. Each DS1 is similar to a T1 line, except that on the T3 card, a DS1 only functions if the DS2 and DS3 of which it is a component are up and in frame.

You can think of the T3 card as 28 T1 lines, because it provides 28 independently configurable DS1 lines. Each of the DS1 lines has the same capabilities as the DS1 lines on a T1 card. Use of SNMP for DS1-level management and status monitoring of the T3 card is the same as for the eight-port T1-card. No SNMP or status monitoring is currently available at the DS3 level.

The MAX TNT T3 card is illustrated in Figure 9-1.

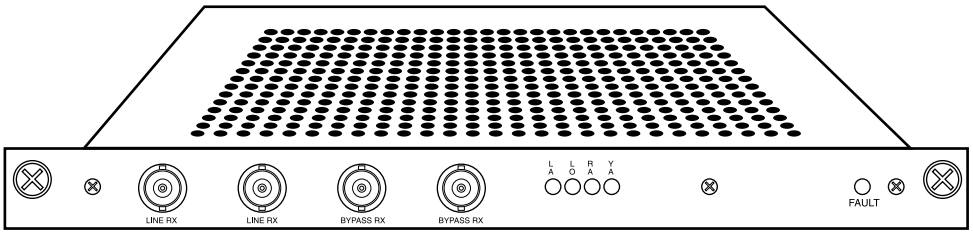

Figure 9-1. T3 card

Installing the T3 card

You install T3 cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Connecting the MAX TNT T3 card to the WAN

Connect the T3 line to the T3 card with two 75 ohm coaxial cables (RG 59/U). To provide for redundant operation, the T3 card has a second pair of BNC jacks that can be used to connect to a second T3 card or other Data Terminal Equipment (DTE).

When the T3 card is not powered or is in the reset state, the Line Rx and Line Tx signals are electrically connected to the Bypass Rx and Bypass Tx jacks, respectively. When the T3 card passes POST, a relay switch connects the Line jacks to the card’s T3 transceiver.

Inform your service provider that the equipment is connected, so they can bring up the line.

Interpreting a T3 card’s status lights

All status lights except LA are lit upon power-up or reset and remain so until the card passes POST. If no LEDs are lit, the T3 interface is either disabled or is receiving an Alarm Indication Signal (AIS) or Idle Signal.

Table 9-1 explains the T3-card status lights.

Table 9-1. T3-card status lights

Light	Description
LA	Green. Indicates the T3 interface is enabled and has not detected any error conditions.
RA	Red. Indicates the T3 interface is experiencing loss of receive signal.
LO	Red. Indicates the T3 interface is out of frame alignment.
YA	Yellow. Indicates the T3 interface has detected Far End Receive Failure indication transmitted from the other side.

Table 9-1. T3-card status lights (continued)

Light	Description
FAULT	Yellow. Behaves as follows: • On after you reset the unit. • Off after the unit passes Power-On Self Test (POST) and is running. • Blinks if a fatal error has occurred.

Overview of T3 configuration

Table 9-2 lists the sections describing common tasks you might have to perform to configure a T3 line. The table includes a brief description of each task and lists the parameters you will use.

(This chapter only describes the specifics that apply to a T3 card. For information about configuring T1 profiles, see Chapter 7, "Configuring T1 Cards.")

For complete information about the associated parameters, see the *MAX TNT Reference Guide*.

Table 9-2. T3-line configuration tasks

Section	Description of task	Associated parameters
"Understanding T3 configuration requirements" on page 9-4	Although you configure the T3 card similarly to the port T1 card, there are important differences you should understand before configuring the card.	Clock-Source Clock-Priority NFAS-ID FDL Front-End-Type DSX-Line-Length CSU-Buildout
"Understanding T3-card profiles" on page 9-4	The MAX TNT creates a single T3 profile and 28 T1 profiles for each T3 card in the system.	N/A
"Assigning a name to a T3 profile" on page 9-6	Assign a name to the T3 profile.	Name
"Enabling a line" on page 9-6	Make a line available for use.	Enabled
"Configuring the T3 physical link" on page 9-7	Before you configure the T1 profiles that make up the T3 card, you must first configure the T3 physical line parameters in the T3 profile.	Physical-Address Enabled Frame-Type Line-Length

Table 9-2. T3-line configuration tasks (continued)

Section	Description of task	Associated parameters
"Configuring clocking" on page 9-7	Any of the T1 lines associated with a T3 card can be configured as the clock source for the MAX TNT system.	Clock-Source Clock-Priority

Understanding T3 configuration requirements

Configuring the T3 card is very similar to configuring the eight-port T1 card, but with some important differences. Table 9-3 lists the differences.

Table 9-3. Differences between T3-card configuration and T1-card configuration

Parameter	Difference
NFAS-ID	The T3 card supports up to 14 NFAS groups. An NFAS group may be composed of up to 28 lines, subject to the limitations of the switch. NFAS is configured in the same way as for the eight-port T1 card.
FDL	The DS1-level FDL services supported by the T3 card are the same as for the eight-port T1 card. DS3-level FDL capabilities such as the Far-End Alarm and Control Channel (FEAC) and Path Maintenance Data Link are currently unsupported. (For information on specifying FDL, see the *MAX TNT Adminstration Guide*.)
Front-End-Type DSX-Line-Length CSU-Build-Out	Ignored in T1 profiles that apply to the T3 card.

Understanding T3-card profiles

When the MAX TNT first detects the presence of a T3 card, it creates the following profiles for each card:

- One T3 profile
- One Call-Route profile
- 28 T1 profiles (one for each DS1 on the T3 card)

T3 profile

When the MAX TNT first detects the presence of a T3 card, it creates a default T3 profile for the card. For example, after installing a T3 card installed in slot 7, you could verify the creation of a T3 profile as follows:

```
admin> dir t3
7  03/21/1997 21:12:03  { shelf-1 slot-7 0 }
```

The following example shows the parameters in a T3 profile, with sample settings:

```
t3 { shelf-N slot-N N }
   physical-address* = { shelf-N slot-N N }
   enabled = yes
   application = m13
   line-length = 1-255
```

Call-Route profile

At the same time that it creates a T3 profile, the MAX TNT creates one default Call-Route profile that routes outbound trunk calls to any line on the card. You can display the Call-Route profile as shown in the following example:

```
admin> dir call-r
     9  02/28/1997 10:54:38  { { { any-shelf any-slot 0 } 0 } 0 }
    13  02/28/1997 10:54:49  { { { shelf-1 slot-8 0 } 0 } 0 }
    13  02/28/1997 10:54:49  { { { shelf-1 slot-11 0 } 0 } 0 }
    13  02/28/1997 10:54:49  { { { shelf-1 slot-16 0 } 0 } 0 }
    13  02/28/1997 10:54:49  { { { shelf-1 slot-13 0 } 0 } 0 }
    13  03/21/1997 10:18:40  { { { shelf-1 slot-7 0 } 0 } 0 }
```

T1 profiles

The MAX TNT also creates twenty-eight T1 profiles for the T3 interface. You use these profiles to configure parameters for each of the DS1s that make up the T3.

The following example shows the parameters in a T1 profile, with sample settings:

```
T1 { shelf-N slot-N N }
    name=
    physical-address* = { shelf-N slot-N N }
    line-interface
     enabled = no
     frame-type = d4
     encoding = ami
     clock-source = eligible
     clock-priority = middle-priority
     signaling-mode = inband
     robbed-bit-mode = wink-start
     default-call-type = digital
     switch-type = att-pri
     nfas-id = 0
     call-by-call = 0
     data-sense = normal
     idle-mode = flag-idle
     FDL = none
     front-end-type = dsx
```

```
DSX-line-length = 1-133
CSU-build-out = 0-db
maintenance-state = no
channel-config N
  channel-usage = switched-channel
  trunk-group = 9
  phone-number = ""
  call-route-info = { any-shelf any-slot 0 }
 nailed-group = 0
```

These T1 profiles are identical to those created for the DS1s on an eight-port T1 card.

Assigning a name to a T3 profile

In a T3 profile, the Name parameter enables you to assign the profile a name of up to 16 characters. It is displayed after the line's physical address in the Dir command output. For example:

```
admin> read t3 {1 12 0}
admin> set name = T3 Trunk
admin> write
T3/{ shelf-1 slot-12 0 } written
admin> dir T3
17  04/17/1997 19:00:02  { shelf-1 slot-12 0 }  "T3 Trunk"
```

For T3 lines, the Line Status window displays the first eight characters of the name if one has been assigned. For example:

```
"T3 Trunk"  1/15/00 LA la  la  la  la  la  la  la
```

If the name is longer than eight characters, the last character displayed is a plus-sign (+).

Enabling a line

By default each DS3 line is disabled. When the DS3 interface is disabled, it transmits the DS3 Idle Signal to the far end.

To enable a T3 line, read its profile to make it the working profile, then set the Line-Interface subprofile's Enabled parameter to Yes, as in the following example:

```
admin> read t3 {1 2 1}
T3/{ shelf-1 slot-2 1 } read
admin> set enabled = yes
admin> write
T3/{ shelf-1 slot-2 1 } written
```

Configuring the T3 physical link

You must specify a frame type and the length of the lines that connect the MAX TNT T3 card to the DSX-3 cross-connect. The line length should reflect the longest line length you expect to encounter in your installation. For a direct connection, double the value.

To configure the T3 card's physical link, read its profile into the edit buffer, and enter the following commands:

```
admin> set frame-type = [m13|c-bit-parity]
admin> set line-length = [0-225|226-450]
admin> write
```

Configuring clocking

For DS1 transmission, the T3 card uses the same system-wide PLL synchronous clock source used by the eight-port T1 cards. Any of the T3 T1 lines can serve as the clock source for the MAX TNT system.

(For information about specifying a clock source, see "Configuring clocking" on page 7-16.)

Configuring Serial WAN Cards

10

This chapter covers the following topics:

Introduction

The MAX TNT has 4 V.35 serial ports, which can be used for nailed Frame Relay connections. The SWAN card can support up to 120 Frame Relay PVCs. A serial WAN port provides a V.35/RS-449 WAN interface that is typically used for connecting to a Frame Relay switch. The clock speed received from the link determines the serial WAN data rate. The maximum acceptable speed is 8 Mbps. The clock speed at the serial WAN port has no effect on the bandwidth of other WAN interfaces in the MAX.

The MAX TNT Serial WAN (SWAN) card is illustrated in Figure 10-1.

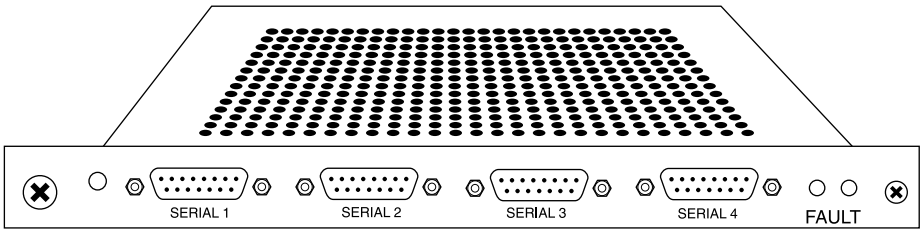

Figure 10-1. SWAN card

Installing the SWAN card

You install SWAN cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Note: All MAX TNT slot cards, including the SWAN cards, are supported *only* in MAX TNT units. You must install any MAX TNT slot card in a MAX TNT unit that supports that specific slot card.

Connecting the MAX TNT serial WAN line to the WAN

To connect the SWAN card to the WAN:

1. Using the Ascend Serial WAN cable (part number 2510-0260-*xxx*, where *xxx* are digits subject to change), connect the 60 pin D connector to the SWAN card.
2. Connect the other end to the V.35 port on a Frame Relay switch or to your WAN interface.

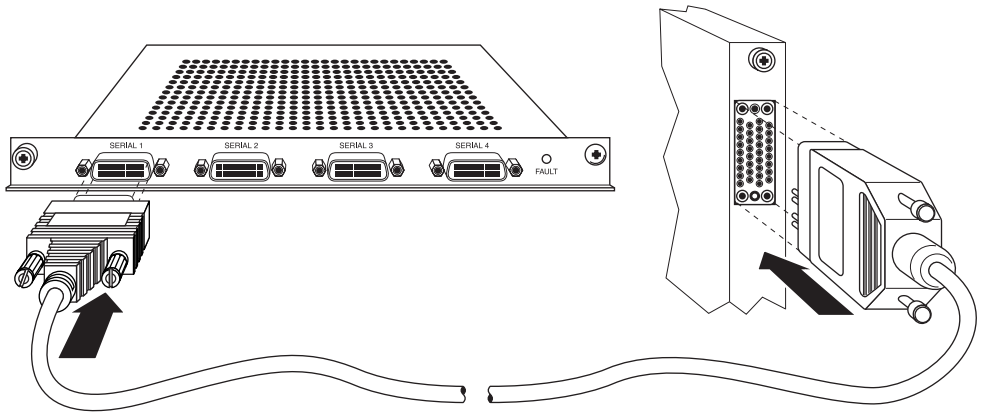

Figure 10-2. Connecting the SWAN card to the WAN

Inform your service provider that the equipment is connected, so they can bring up the line.

Reading the SWAN card status light

The SWAN card has a single status light. It is yellow while the card is powering up or in the event of a failure. It is off when the card is operating normal.

Overview of SWAN configuration

Table 10-1 lists the sections describing common tasks you might have to perform to configure a SWAN line. The table includes a brief description of each task and lists the parameters you will use.

For complete information about the associated parameters, see the *MAX TNT Reference Guide*.

Table 10-1.SWAN-card configuration tasks

Section	Description of task	Associated parameters
"Understanding SWAN-card configuration requirements" on page 10-3	Explains important configuration information you should understand before you configure the SWAN card.	N/A
"Making a profile the working profile" on page 10-4	Before you can edit a profile, you must make it the working profile.	N/A
"Assigning a name to a Serial WAN profile" on page 10-5	Assign a name to the SWAN profile.	Name
"Enabling a line" on page 10-5	Make a line available for use.	Enabled
"Specifying a nailed group" on page 10-5	The nailed group is used to assign a Frame Relay connection to a SWAN line.	Nailed-Group
"Specifying the SWAN internal clock speed" on page 10-6	The SWAN slot card can generate a transmit internal clock based on the clock speed of its Serial Communication Adapter (SCA) chips.	Clock-Mode Divider Exp

Understanding SWAN-card configuration requirements

Table 10-2 provides important configuration information you might need before configuring your SWAN card.

Table 10-2.SWAN card configuration

Element	Explanation
Connections	The SWAN card currently supports only nailed Frame Relay connections.
Call routing information	Call routing information for the SWAN card is currently ignored.
Trunk groups	Trunk groups are not currently implemented for the SWAN card.

Table 10-2.SWAN card configuration

Element	Explanation
Activation	The Activation parameter tells the MAX which signals control the data flow through the serial WAN port. The DCE to which the serial WAN port is connected (for example, a Frame Relay switch) determines how to set the serial WAN port Activation value. Flow control is always handled by the Clear To Send (CTS) signal. Currently, the Activation parameter supports only one value: Static.

Making a profile the working profile

When the MAX TNT system detects that a SWAN card has been installed, it creates a default SWAN profile for each of the lines on the card.

In the following example, the Dir command displays default SWAN line profiles created for a card installed in slot 2:

```
admin> dir SWAN
   305  12/11/1996 15:58:20  { shelf-1 slot-2 1 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 2 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 3 }
   305  12/11/1996 15:58:20  { shelf-1 slot-2 4 }
```

By default, the line is not enabled, which means that it is not available for use. Its default signaling method is inband, typically used for channelized connections.

To list the parameters in a SWAN profile, use the List command, as in the following example:

```
admin> list
name = ""
physical-address* = { any-shelf any-slot 0 }
enabled = no
line-config = { 0 0 static { any-shelf any-slot 0 } }
```

Following is an example of a SWAN profile, with its parameters set to sample values:

```
SWAN { shelf-N slot-N N }
name = 1:14:2
physical-address* = { shelf-1 slot-14 2 }
enabled = no
line-config
   trunk-group = 0
   nailed-group = 2
   activation = static
   call-route-info
      shelf = any-shelf
      slot = any-slot
      item-number = 0
```

```
clocking
   clock-mode = external-clock
   divider = 1
    exp = 2
```

Assigning a name to a Serial WAN profile

In a SWAN profile, the Name parameter enables you to assign the profile a name of up to 16 characters. By default, the name displays the address of the card as *shelf*:*slot*:*item*. Note that the MAX TNT uses only the physical address to identify the serial WAN line.

The name is displayed after the line's physical address in the Dir command output. For example:

```
admin> read SWAN {1 12 0}
admin> set name = SWAN1
admin> write
SWAN/{ shelf-1 slot-12 0 } written
admin> dir SWAN
17  04/17/1997 19:00:02  { shelf-1 slot-12 0 }  "SWAN1"
```

For serial WAN lines, the Line Status window displays the first eight characters of the name if one has been assigned. If the name is longer than eight characters, the last character displayed is a plus-sign (+).

Enabling a line

By default each serial WAN line is disabled. To enable a serial WAN line, read its profile to make it the working profile, then set Enabled to Yes, as in the following example:

```
admin> read SWAN {1 2 1}
SWAN/{ shelf-1 slot-2 1 } read
admin> set enabled = yes
admin> write
SWAN/{ shelf-1 slot-2 1 } written
```

Specifying a nailed group

The Nailed-Group parameter assigns a nailed group number to the serial WAN line. The setting, which must also be specified in a Frame-Relay profile, directs the Frame Relay connection to use this line.

To specify a nailed group, proceed as in the following example:

```
admin> read SWAN {1 2 1}
SWAN/{ shelf-1 slot-2 1 } read
admin> set line nailed-group= 5
admin> write
SWAN/{ shelf-1 slot-2 1 } written
```

Specifying the SWAN internal clock speed

The SWAN slot card can generate a transmit or receive internal clock based on the clock speed of its Serial Communication Adapter (SCA) chips. The maximum clock speed is 5.55 MHz.

To generate an internal clock for a SWAN line, you configure the following parameters:

Parameter	Description
Clock-Mode	Specifies whether the SWAN card generates an internal clock. External-Clock (the default) specifies the SWAN line receives clock from an external source. Internal-Clock specifies the SWAN line generates its own clock. If set to External-Clock, none of the other parameters in the Clocking profile apply.
Divider	The number by which the SCA internal clock speed, 16.667 MHz, is divided to calculate the internal clock speed. Valid values are from 1 to 256.
Exp	The exponent which is used to calculate the internal clock speed. Valid values are from 0 to 9.

The formula the SWAN card uses to generate its internal clock is:

clock speed (MHz) = (16.667 / `divider`) / (2 to the `exp` power)

The following example shows how to configure an internally generated clock speed:

1 Read the SWAN profile:

```
admin>read swan {1 13 2}
SWAN/{ shelf-1 slot-13 2 } read
```

2 List the profile:

```
admin>list
[in SWAN/{ shelf-1 slot-13 2 }]
name = 1:13:2
physical-address* = { shelf-1 slot-13 2 }
enabled = yes
line-config = { 0 61 static { any-shelf any-slot 0 } { exte +
```

3 List the Line-Config profile

```
admin>list line-config
[in SWAN/{ shelf-1 slot-13 2 }:line-config]
trunk-group = 0
nailed-group = 61
activation = static
call-route-info = { any-shelf any-slot 0 }
clocking = { external-clock 1 2 }
```

4 List the Clocking subprofile:

```
admin>list clocking
[in SWAN/{ shelf-1 slot-13 2 }:line-config:clocking]
clock-mode = external-clock
```

```
divider = 1
exp = 2
```

5 Specify the Divider and exponent to use for calculating the clock speed:

```
admin>set divider=4
admin>set exp=2
```

6 Write the profile:

```
admin>write
```

This example sets the internally generated clock to 1.042 Mhz. (That is, $(16.667/4)/2^2$=1.042.)

Sample serial WAN configuration

This section provides an example of how to configure a SWAN card. Refer to the *MAX TNT Network Configuration Guide* for complete information about configuring the MAX TNT serial WAN lines.

The general steps involved in configuring a SWAN card are:

- Configure the SWAN card itself
- Configure a Frame Relay profile
- Configure a Connection profile

Configuring the SWAN card

The following example illustrates the procedure for configuring a SWAN card installed in shelf 1, slot 15:

1 Open the SWAN profile and list its contents.

```
admin> read swan { 1 15 4 }
SWAN/{ shelf-1 slot-15 4 } read

admin> list
name = 1:15:4
physical-address* = { shelf-1 slot-15 4 }
enabled = no
line-config = { 0 0 static { any-shelf any-slot 0 } }
```

2 Enable the line.

```
admin> set enabled = yes
```

3 List the Line-Config subprofile.

```
admin> list line-config
trunk-group = 0
nailed-group = 0
activation = static
call-route-info = { any-shelf any-slot 0 }
```

4 Assign a nailed-group number. This number will be referenced in a Frame-Relay profile to direct the datalink to use this line.

```
admin> set nailed-group = 60
```

5 Write the profile.

```
admin> write
SWAN/{ shelf-1 slot-15 4 } written
```

Configuring the Frame-Relay profile

This section shows how to create a Frame-Relay profile that uses the sample serial WAN line configured in the preceding section. For more details of Frame Relay configuration, see the *MAX TNT Network Configuration Guide*.

To configure the Frame-Relay profile:

1 Create a new Frame-Relay profile and list its contents:

```
admin> new frame frswan1
FRAME-RELAY/frswan1 read
```

```
admin> list
fr-name* = frswan1
active = no
nailed-up-group = 32769
nailed-mode = ft1
called-number-type = 2
switched-call-type = 64k-clear
phone-number = ""
billing-number = ""
transit-number = ""
Link-Mgmt = none
call-by-call-id = 0
n391-val = 6
n392-val = 3
n393-val = 4
t391-val = 10
t392-val = 15
MRU = 1532
fr-type-val = dte
dceN392-val = 3
dceN393-val = 4
fr-Link-Up = no
```

2 Activate the datalink:

```
admin> set active = yes
```

3 Specify the serial WAN line's nailed-group value in the Nailed-Up-Group parameter. The two values must match:

```
admin> set nailed-up-group = 60
```

4 Write the Frame-Relay profile:

```
admin> write
FRAME-RELAY/frswan1 written
```

Configuring the Connection profile

To configure a Connection profile that makes use of the nailed Frame Relay link:

1 Create a Connection profile and list its contents.

```
admin> new conn m41
CONNECTION/m41 read

admin> list
station* = m41
active = no
encapsulation-protocol = mpp
called-number-type = national
dial-number = ""
clid = ""
ip-options = { yes yes 10.5.249.154/29 0.0.0.0/0 7 100 255 no
no 0 0.0.+
bridging-options = { 0 no }
session-options = { "" "" no 120 no-idle 120 "" 0 }
telco-options = { ans-and-orig no off 1 no no 56k-restric+
ppp-options = { no-ppp-auth "" "" stac 1524 no 600 600 }
mp-options = { 1 1 2 }
mpp-options = { "" quadratic transmit 1 1 15 5 10 70 }
fr-options = { "" 16 "" no "" 16 }
tcp-clear-options = { "" 0 no "" 256 20 }
usrRad-options = { global 0.0.0.0 1646 "" 1 acct-base-10 }
calledNumber = ""
```

2 Activate the profile and specify Frame Relay encapsulation:

```
admin> set active = yes

admin> set encapsulation = frame-relay
```

3 List the FR-Options subprofile:

```
admin> list fr-options
frame-relay-profile = ""
dlci = 16
circuit-name = ""
fr-direct-enabled = no
fr-profile = ""
fr-dlci = 16
```

4 Specify the name of the Frame-Relay profile that uses the serial WAN line:

```
admin> set frame-relay-profile = frswan1
```

5 Assign the appropriate DLCI:

```
admin> set dlci = 102
```

6 Write the profile:

```
admin> write
CONNECTION/m41 written
```

Configuring FrameLine Cards

11

This chapter covers the following topics:

Introduction

The MAX TNT FrameLine card provides 10 unchannelized T1 lines, each of which can be used for one nailed connection. Associated with each T1 line is a Serial Communications Adapter (SCA), which is responsible for receiving and transmitting HDLC frames. Because there is only one SCA per line, only one PPP or Frame Relay link (possibly with multiple DLCIs) can be active per line.

Unlike other slot cards (such as the T1, modem, or HDLC), call routing profiles are not used for the FrameLine card and are ignored if they exist. The data pathway is directed to an on-board SCA device and cannot be routed to another host card. All packetization of data occurs locally.

Overview of supported features

This section describes the FrameLine card's support for the following protocols:

- PPP
- Frame Relay
- Routing protocols
- SNMP

PPP

The FrameLine card supports PPP as follows:

- Only one PPP session per line.
- Bandwidth per session is 1-24 DS0 channels.
- Channels need not be contiguous.

- MP/MPP is not supported. The connection profile must specify only PPP.
- User authentication is by local profile or RADIUS.
- STAC compression is not supported.

Frame Relay

The FrameLine card supports Frame Relay as follows:

- Only 1 Frame Relay link, possibly containing multiple DLCIs, can be active per line.
- Bandwidth per link is 1-24 DS0 channels.
- Channels need not be contiguous.
- Up to 240PVCs are supported per card.

Routing protocols

The FrameLine card only supports IP routing.

RADIUS

The FrameLine card supports the same RADIUS accounting and authentication as the digital modem cards.

SNMP

The FrameLine card supports SNMP as follows:

- DS1 status/management is the same as for the eight-port T1 card.
- The FrameLine card support the accounting MIB for session information.

The MAX TNT FrameLine card is illustrated in Figure 11-1.

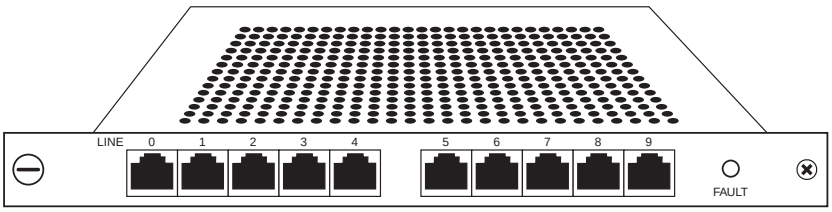

Figure 11-1. FrameLine card

Installing the FrameLine card

You install FrameLine cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

The FrameLine card has a single LED, which functions identically to the LED for the eight-port T1 card.

Overview of FrameLine configuration

Configuring the FrameLine card is similar to T1-card configuration, but keep the following points in mind:

Configuring the FrameLine card is very similar to configuring the eight-port T1 card, with these important differences:

- Signaling-Mode must be set to inband.
- The FrameLine card can only be used for nailed Frame Relay or PPP links.
- You must set Channel-Usage to either Unused-Channel or Nailed-64-Channel.
- If Channel-Usage is Nailed-64-Channel and you are using nailed channels, the Nailed-Group setting must be unique to the line. That is, two different T1 lines cannot share a nailed group.
- Unlike the T1 card, channels in the same nailed group do not have to be contiguous. That is, DS0 channels 1 and 3 can be in the same nailed group, with channel 2 unused.
- The following T1 profile parameters are not applicable for the FrameLine card:
  - Call-by-Call
  - Channel-Usage
  - Default-Call-Type
  - Data Sense
  - FDL
  - Idle-Mode
  - Maintenance-State
  - NFAS-ID
  - Robbed-Bit-Mode
  - SendDisc-Val
  - Switch-Type

For information about configuring T1 profiles, see Chapter 7, “Configuring T1 Cards.”

Configuring the clock source

The FrameLine card uses the same system-wide PLL synchronous clock source for DS1 transmission as do the eight-port T1 and E1 cards. Any of the lines can serve as the clock source for the MAX TNT. To configure the FrameLine card’s clock source, use the same parameters (Clock-Source and Clock-Priority), that you use for other cards.

Note, however, that all 10 lines must use the same clock source. Clocking on a per-line basis is not supported. The clock source can be one of the 10 lines, or a line on another slot card, or it can be internally generated from the shelf controller.

In addition, if the system clock source is from one of the 10 lines, it affects the timing on the TDM backplane, because TDM timing is based on the clock source. This is true even though the FrameLine card does not use the TDM backplane.

Installing DSL Cards

12

This chapter covers the following topics:

For information about configuring DSL connections and sample DSL connections, see Chapter 16, “Configuring DSL Connections.”

IDSL overview

Note: The MAX TNT must have software version 1.3Ai2 or later to support IDSL. Refer to the MAX TNT release notes for information about obtaining and loading MAX TNT software.

IDSL is part of a broad range of Ascend MultiDSL™ offerings that let you implement DSL technologies immediately. Because IDSL uses the same 2B1Q signalling used by ISDN, existing ISDN U-interface devices—such as terminal adapters (TAs) or Ascend Pipelines—can connect to a MAX TNT with an IDSL line card without modification.

IDSL supports high-bandwidth applications such as remote access, Internet or intranet access, and telecommuting. This integrated solution provides centralized line terminations to single-pair copper wires for transmission of full duplex data at 128 Kbps and at distances of up to 18,000 feet.

The IDSL MAX TNT™ provides a separate network that does not congest the “voice network” with data traffic. In this way, the MAX TNT replaces a switch for data traffic. The IDSL line card also provides some of the functionality of a switch for monitoring line quality and troubleshooting the line. As subscriber requirements change, you can use the same platform to add other MultiDSL technologies such as SDSL and ADSL.

By installing the IDSL line card into the MAX TNT, you can cost-effectively support a wide range of analog, ISDN, Frame Relay and IDSL services on a single, manageable platform.

The IDSL line card provides the following features:

- ISDN BRI (2B1Q) signaling
- 2 DB37 connectors, each providing 16 IDSL sessions for a total of 32 sessions
- 128Kbps user bit rate over a two-wire subscriber loop
- Line Termination (LT) mode

- No switch required
- Point-to-point
- Support for both switched channels and nailed channels (including Ascend's SuperDigital 128)
- Support for maintenance functions including BRI-U interface monitoring commands, loopback, and out-of-band management

IDSL supports many of the same configuration options as other types of connections, such as nailed and switched sessions, PPP, MP and MPP encapsulation, and incoming and outgoing voice calls.

ADSL overview

Note: The MAX TNT must run software version 1.3Ai2 or later to support the ADSL-CAP card and software version 7.0.0 to support the ADSL-DMT card. See the MAX TNT release notes for information about obtaining and loading MAX TNT software.

Asymmetric Digital Subscriber Line (ADSL) supports high-bandwidth applications such as remote access, Internet or intranet access, and telecommuting. The MAX TNT supports both Carrierless Amplitude Modulation (CAP) and Discrete Multitone (DMT) standards. Both standards support rate adaption, which enables the MAX TNT to detect the noise level on the line and automatically adjust the data transfer rate for optimum performance.

The MAX TNT ADSL cards also support the MultiDSL voice splitter. The voice splitter solution works in conjunction with Ascend DSLPipes to integrate Plain Old Telephone Service (POTS) with ADSL data. For information about installing the RADSL voice splitter, see Appendix B, "Configuring the ADSL Voice Splitter."

The ADSL-CAP card supports the following asymmetric transfer rates:

Upstream rate	Downstream rate	Distance
544 Kbps	640 Kbps	17,000 feet (5.18 km)
1.088 Mbps	2.560 Mbps	12,000 feet (3.66 km)
1.088 Mbps	7.168 Mbps	10,000 feet (3.05 km)

The ADSL-DMT card supports the following maximum asymmetric transfer rates:

Wire gauge (AWG)	Upstream rate	Downstream rate	Distance
24	704kbps	3040kbps	17,000 feet (5.18 km)
26	192kbps	512kbps	17,000 feet (5.18 km)
24	896kbps	7584kbps	12,000 feet (3.66 km)
26	640kbps	3904kbps	12,000 feet (3.66 km)

24	928kbps	9248kbps	10,000 feet (3.05 km)
26	736kbps	6976kbps	10,000 feet (3.05 km)

SDSL overview

Note: The MAX TNT must have software version 1.3Ai2 or later to support SDSL. The MAX TNT must have software version 2.1.14 or later or 7.0 or later to support the SDSL-HS card. See the MAX TNT release notes for information about obtaining and loading MAX TNT software.

The SDSL card supports symmetric data transfer rates of 768 Kbps for a distance of up to 12,000 feet (3.7 km) over a single pair of copper wires.

The SDSL-HS data card expands on features offered in the 16-port SDSL card. The SDSL-HS data card provides high port density, with 24 SDSL lines per card. The card supports high speed symmetric data transfer, with rates up to 1.5 Mbps and distances to 14,000 feet, through a single pair of copper wires. At reduced data transfer rates, the card supports distances over 18,000 feet. The SDSL-HS data card has an SDSL chip and board layout that differ from the 16-port SDSL card and that provide high speed, multi-rate capabilities. The 16-port SDSL card cannot be upgraded to the SDSL-HS technology.

The SDSL-HS card is compatible with the DSLPipe products but must be set to 768K to work properly with the DSLPipe-S, or to 400, 784 or 1168K to work with the DSLPipe-2S.

SDSL supports Frame Relay and Point-to-Point protocol (PPP). You configure Frame Relay or PPP connections on an SDSL connection in the same way you configure them on a T1 or serial WAN interface.

The SDSL-HS card supports the following symmetric transfer rates

Wire gauge (AWG)	Data transfer rate	Distance
24	400 Kbps	18,000 feet (5.5 km)
26	400 Kbps	14,500 feet (4.4 km)
24	784 Kbps	18,000 feet (5.5 km)
26	784 Kbps	13,000 feet (3.96 km)
24	1.168 Mbps	16,000 feet (4.88 km)
26	1.168 Mbps	11,000 feet (3.35 km)
24	1.5 Mbps	13,000 feet (3.96 km)
26	1.5 Mbps	10,000 feet (3.05 km)

Note: The data transfer rates presented in the table above are approximations. Actual data transfer rates depend on line loop quality and can vary.

For complete details of configuring authentication or Frame Relay and PPP connections on your MAX TNT, see the *MAX TNT Network Configuration Guide*.

Installing DSL cards

Note: All MAX TNT slot cards, including the DSL cards, are supported *only* in MAX TNT units. You must install any MAX TNT slot card in a MAX TNT unit that supports that specific slot card.

The IDSL card is illustrated in Figure 12-1. Note that the IDSL card is double-height, meaning it occupies two slots in the MAX TNT.

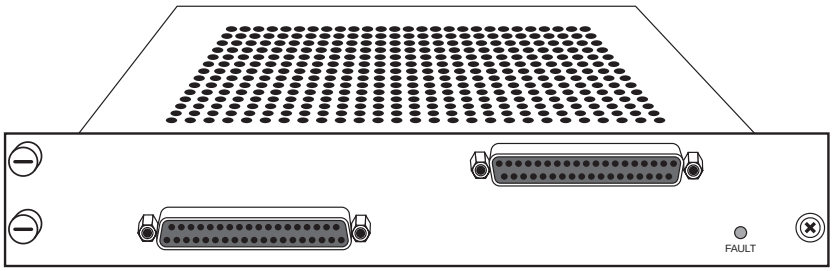

Figure 12-1. MAX TNT IDSL card

The ADSL-CAP card is illustrated in Figure 12-2.

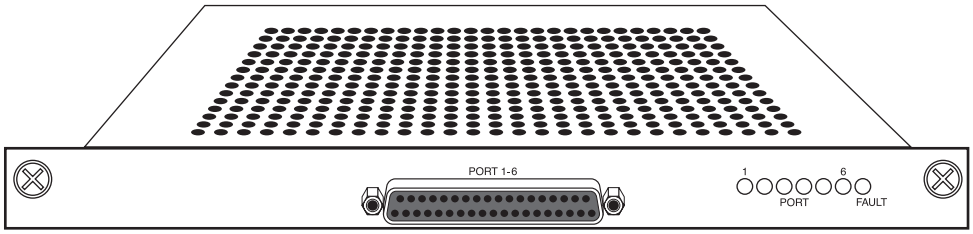

Figure 12-2. MAX TNT ADSL-CAP card

The ADSL-DMT card is illustrated in Figure 12-3.

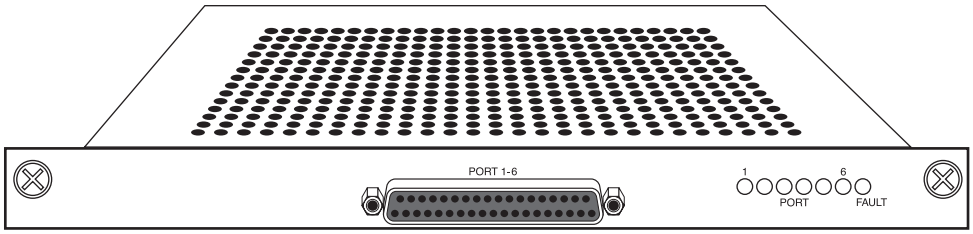

Figure 12-3. MAX TNT ADSL-DMT card

The SDSL card is illustrated in Figure 12-4.

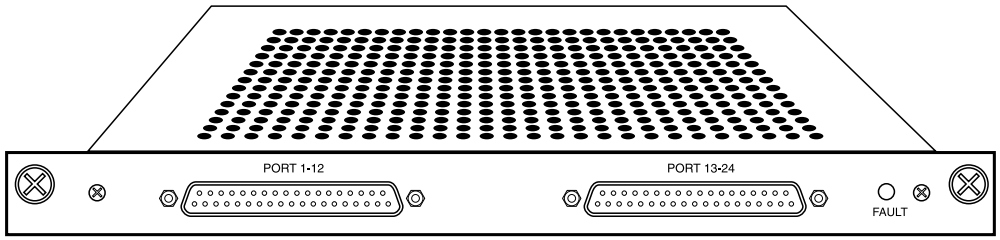

Figure 12-4. MAX TNT SDSL card

The SDSL-HS card is illustrated in Figure 12-5.

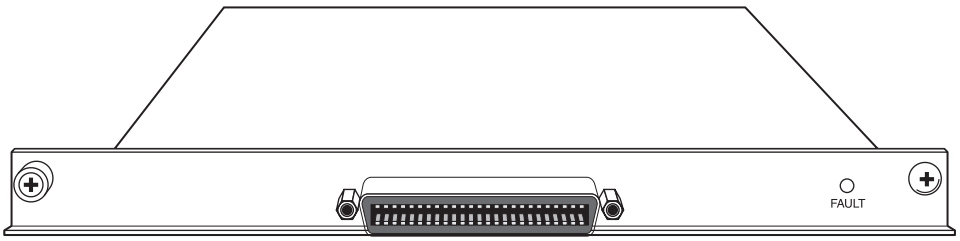

Figure 12-5. SDSL-HS card

You install DSL cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Configuring ATM DS3 Slot Cards

13

This document covers these topics:

Introduction

The MAX TNT ATM DS3 card is an 44.736 Mbps communications circuit that can be used to either route ATM traffic or perform layer 2 switching between ATM and Frame Relay networks.

Figure 13-1 shows an example ATM DS3 setup.

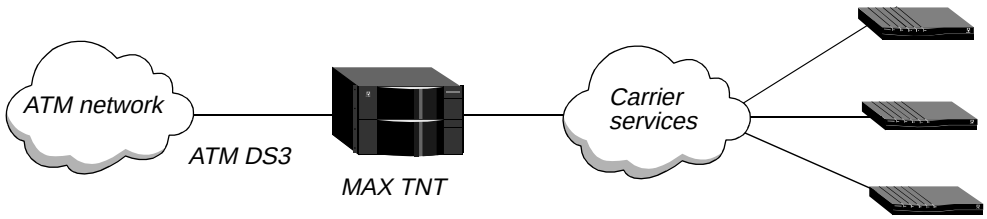

Figure 13-1. Example ATM DS3 setup

Overview of supported features

The following list summarizes the capabilities of the ATM DS3 card:

- One unchannelized DS3 port with integrated CSU/DSU
- Layer 3 routing between ATM networks

- Layer 2 PVC switching between ATM and Frame Relay networks
- Support for RFC 1483 (Multiprotocol Encapsulation over ATM Adaptation Layer 5)
- Protocol conversion between ATM (RFC 1483) and Frame Relay (RFC 1490) data
- ATM Forum UNI 3.1 support
- Frame Relay Forum FRF.8 PVC mapping between ATM and Frame Relay networks
- Operations, Administration and Maintenance (OAM) F4/F5 support
- No interim link management interface (ILMI) support

The MAX TNT ATM DS3 card is illustrated in Figure 13-2.

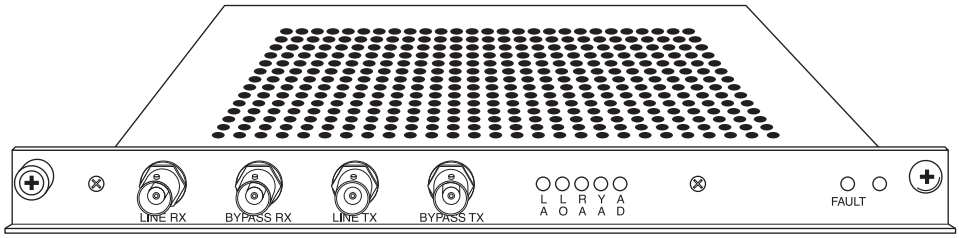

Figure 13-2. ATM DS3 card

Installing the ATM DS3 card

You install ATM DS3 cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Connecting the ATM DS3 card to the WAN

Connect the T3 line to the ATM DS3 card LINE RX and LINE TX ports using two 75 Ohm coaxial cables (RG 59/U).

Inform your service provider that the equipment is connected, so they can bring up the line.

Connecting redundant ATM DS3 cards

You can install 2 ATM DS3 cards to provide for redundancy. If the primary card fails, either due to a failure to boot up or because it is in a fault state, the secondary line card takes over. After installing the cards, configure line profiles in each card as explained in “Configuring a redundant connection” on page 13-5.

Figure 13-3 illustrates a redundant connection.

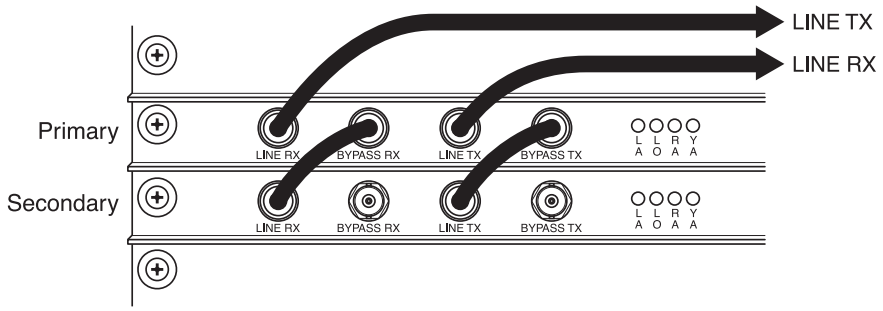

Figure 13-3. ATM DS3 redundant configuration

Interpreting a ATM DS3 card's status lights

All status lights except LA are lit upon power-up or reset and remain so until the card passes POST. If no LEDs are lit, the DS3 interface is either disabled or is receiving an Alarm Indication Signal (AIS) or Idle Signal.

Table 13-1 explains the ATM DS3 card status lights.

Table 13-1.ATM-DS3 card status lights

Lights	Description
LA	Green. Indicates the DS3 interface is enabled and has not detected any error conditions.
RA	Red. Indicates the DS3 interface is experiencing loss of receive signal.
LO	Red. Indicates the DS3 interface is out of frame alignment.
YA	Yellow. Indicates the DS3 interface has detected Far End Receive Failure indication transmitted from the other side.
FAULT	Yellow. Behaves as follows: • On after you reset the unit. • Off after the unit passes Power-On Self Test (POST) and is running. • Blinks if a fatal error has occurred.

Overview of ATM DS3 configuration

Table 13-2 lists the sections describing common tasks you might have to perform to configure the ATM card. The table includes a brief description of each task, and lists the parameters you will use.

For complete information about the associated parameters, see the *MAX TNT Reference Guide*.

Table 13-2.ATM-DS3 line configuration tasks

Task	Description of task	Associated parameters
"ATM-DS3 profile" on page 13-4.	The MAX TNT creates a single ATM DS3 profile when you install the ATM DS3 card, which you use to configure the card.	N/A
"Configuring the ATM DS3 physical link" on page 13-5.	Configure the ATM DS3 physical line, including activating the line and assign it to a nailed group.	Activation Enabled Framer-Mode High-TX-Output Nailed-Group Name
"Connecting redundant ATM DS3 cards" on page 13-2.	The ATM DS3 card supports a redundant configuration. If the primary card fails the secondary line card takes over.	Activation Enabled Framer-Mode High-TX-Output Nailed-Group Name
"Sample configurations" on page 13-6.	Provides examples of how to configure routed ATM and switched ATM-to-Frame Relay connections.	N/A

ATM-DS3 profile

When the MAX TNT first detects the presence of an ATM DS3 card, it creates a default ATM-DS3 profile for the card. The following example shows the parameters in a ATM DS3 profile, with the default settings:

```
admin> read atm-ds3 { 1 7 1}
ATM-DS3/{ shelf-1 slot-7 1 } read
name = ""
physical-address* = { shelf-1 slot-7 1 }
enabled = no
line-config
  trunk-group = 0
  nailed-group = 0
```

```
activation = static
call-route-info = { any-shelf any-slot 0 }
loopback = no-loopback
high-tx-output = no
framer-mode = C-BIT-PLCP
```

Note that Call-Route profiles do not apply to the ATM DS3 card.

Configuring the ATM DS3 physical link

Currently, the ATM DS3 card only supports C-Bit-PLCP framing and Static activation. You must, however, enable the line, specify the length of the cables connecting the card to the WAN interface, and specify a nailed group. The MAX TNT uses the nailed group to route traffic between physical interfaces.

The Name parameter enables you to optionally assign the profile a name of up to 16 characters. It is displayed after the line's physical address in the Dir command output.

By default each ATM DS3 line is disabled. When the DS3 interface is disabled, it transmits the DS3 Idle Signal to the far end.

To assign the line a name and enable it, proceed as in the following example:

1 Read the ATM-DS3 profile:

```
admin> read ds3-atm {1 3 1}
DS3-ATM/{ shelf-1 slot-3 1 } read
```

2 Assign the DS3 line a name, if desired:

```
admin> set name = atm-la
```

3 Enable the line:

```
admin> set enabled = yes
```

4 If the DS3 line cable length is longer than 255 feet, set High-TX-Output to Yes, otherwise, leave it at its default value.

5 Write the profile to save your changes:

```
admin> write
ATM-DS3/{ shelf-1 slot-3 1 } written
```

Configuring a redundant connection

If you have installed 2 cards in a redundant configuration, as explained in "Connecting redundant ATM DS3 cards" on page 13-2, proceed as in the following example to configure the line profiles for the cards:

1 Enable DS3-ATM port on the primary card:

```
admin>read ds3-atm {1 2 1}
```

2 Enable the line:

```
admin> set enabled = yes
```

3 If the DS3 line cable length is longer than 255 feet, set High-TX-Output to Yes, otherwise, leave it at its default value.

4 Specify a nailed group number to use for this line:

```
admin> set line-config nailed-group=100
```

5 Write the profile to save your changes:

```
admin> write
ATM-DS3/{ shelf-1 slot-2 1 } written
```

Next, configure the line profile for the secondary ATM-DS3 card as in the following example:

1 Enable DS3-ATM port on the primary card:

```
admin>read ds3-atm {1 3 1}
```

2 Enable the line:

```
admin> set enabled = yes
```

3 If the DS3 line cable length is longer than 255 feet, set High-TX-Output to Yes, otherwise, leave it at its default value.

4 Specify a nailed group number to use for this line:

```
admin> set line-config nailed-group =100
```

5 Write the profile to save your changes:

```
admin> write
ATM-DS3/{ shelf-1 slot-3 1 } written
```

Finally, create a Connection profile for the line that uses the same nailed group assigned to the ATM DS3 card ("Sample configurations," next, provides examples of how to configure ATM DS3 connections.)

If the primary card goes down, the MAX TNT will switch over to the secondary card and re-establish the link.

Sample configurations

You can configure two different types of connections for the ATM DS3 card, a routed connection that uses ATM-encapsulation, or a switched connection between ATM and Frame Relay networks. This section provides a sample configuration for each.

Configuring a routed ATM connection

You can set up a routed connection between an ATM CPE and an ATM network. To configure this connection, you must perform the following general steps:

- Activate the ATM DS3 card and specify a nailed group. The MAX TNT uses the nailed group to route traffic received on an interface to the ATM DS3 card.
- Configure a Connection profile on the MAX TNT for the remote ATM device. This connection profile must specify ATM encapsulation, the Virtual Path Identifier (VPI) and Virtual Channel Identifiers (VCI) as defined by the ATM service provider, and the nailed group configured in the ATM DS3 profile.

Figure 13-4 illustrates an example routed ATM connection.

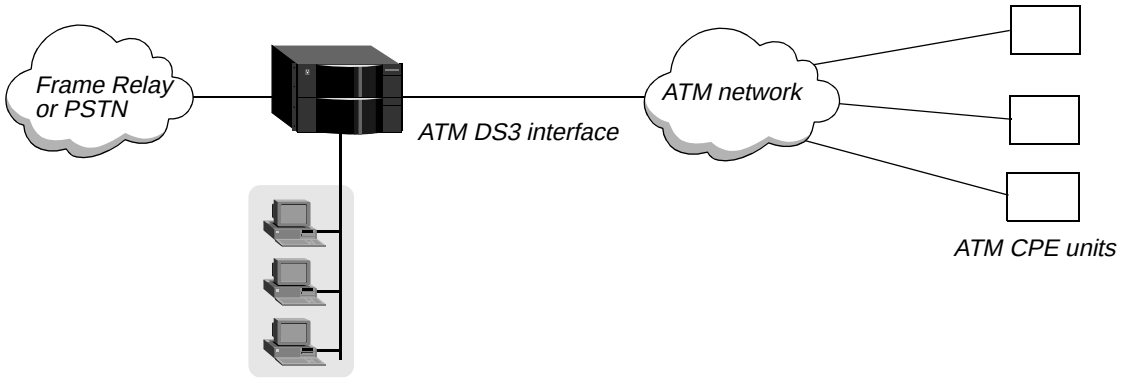

Figure 13-4. Routed ATM connection

Configuring the ATM card

To configure the ATM card, proceed as in the following example:

1 Open the ATM-DS3 profile:

```
admin> read atm-ds3 {1 2 1}
DS3-ATM/{ 1 2 1 } read
```

2 Assign a name to the line, if desired:

```
admin> set name = atm-sf
```

3 Activate the line:

```
admin> set enabled = yes
```

4 Assign a nailed group:

```
admin> set line nailed-group=5
```

5 Write the profile:

```
admin> write
ATM-DS3/{ shelf-1 slot-2 1 } written
```

Configuring the Connection profile for the remote device

To configure the Connection profile, proceed as in the following example:

1 Create a new Connection profile:

```
admin> new connection atm-cpe
CONNECTION/atm-cpe read
```

2 Activate the profile:

```
admin> set active = yes
```

3 Specify ATM encapsulation:

```
admin> set encapsulation=atm
```

4 Specify the IP address of the remote device:

```
admin> set ip-options remote-address=192.168.2.1
```

5 Specify the call-type:

```
admin> set telco-options call-type=ft1
```

6 Specify the ATM VPI/VCI for the remote device. Your ATM service provider should give you these values:

```
admin> set atm-options vpi=12
admin> set atm-options vci=42
```

7 Write the profile:

```
admin> write
CONNECTION/atm-cpe written
```

Configuring a switched ATM connection

In this sample configuration, remote users connect to the MAX TNT over an ADSL connection using Frame Relay as the transport protocol. The MAX TNT provides these users access to an ATM network by converting the Frame-Relay encapsulated data to ATM-encapsulated data, and vica versa.

Configuring a switched ATM connection is similar to configuring a Frame Relay circuit connection. You create a circuit between the incoming port (in this example, an ADSL port) and the ATM DS3 line.

Figure 13-4 illustrates an example switched ATM-Frame Relay connection.

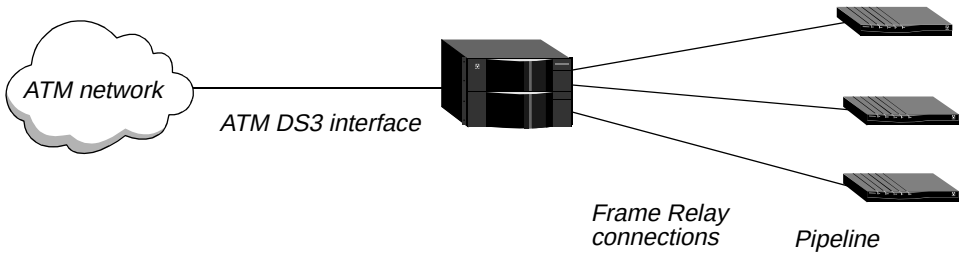

Figure 13-5. Switched ATM-Frame Relay connection

To configure this connection, you must perform the following general steps:

- Activate the ATM DS3 card and specify a nailed group. The MAX TNT uses the nailed group to route traffic received on an interface to the ATM DS3 card. The nailed group must be unique for each active WAN interface.
- Configure an ADSL line profile and assign it to a different nailed group.
- Configure a Frame Relay profile that points to the ADSL interface.
- Configure a Connection profile on the MAX TNT for the remote device that specifies the following settings:
  - ATM-Frame-Relay-Circuit encapsulation.
  - The nailed group configured in the ADSL profile.
  - The name of the Frame Relay profile.
  - The name of the Frame Relay circuit between the ADSL port and ATM DS3 port.

- Configure a Connection profile on the MAX TNT for the ATM network that specifies the following settings:
  - ATM-Frame-Relay-Circuit encapsulation.
  - The nailed group configured in the ATM-DS3 profile.
  - The name of the Frame Relay profile.
  - The name of the Frame Relay circuit between the ATM DS3 port and the ADSL port.

Configuring the ATM card

To configure the ATM card, proceed as in the following example:

1 Open the ATM-DS3 profile:

```
admin> read atm-ds3 {1 2 1}
DS3-ATM/{ 1 2 1 } read
```

2 Assign a name to the line:

```
admin> set name = atm-ds3-sf
```

3 Activate the line:

```
admin> set enabled = yes
```

4 Assign a nailed group:

```
admin> set line nailed-group=5
```

The Connection profile for the ATM network must specify this number.

5 Write the profile:

```
admin> write
ATM-DS3/{ shelf-1 slot-2 1 } written
```

Configuring the ADSL profile

The ADSL profile configures the physical link to the remote device. To configure the ADSL profile, proceed as in the following example:

1 Read in the ADSL profile.

```
admin> read adsl-cap {1 11 1}
```

2 Enable the port:

```
admin> set enabled=yes
```

3 Assign this port to a nailed group:

```
admin> set line nailed-group=1
```

4 Write the profile:

```
admin> write
```

Configuring the Frame Relay profile

The Frame Relay profile configures the Frame Relay DCE interface between the MAX TNT and the Frame Relay network. This profile is used to connect to the remote device.

To configure the Frame Relay profile:

1 Create a new Frame Relay profile:

```
admin> new frame-relay fr7-1
```

2 Enable the profile:

```
admin> set active=yes
```

3 Specify a DCE Frame Relay interface:

```
admin> set link-type=dce
```

4 Specify the same nailed group number you configured in the ADSL profile:

```
admin> set line nailed-up-group=1
```

5 Write the profile:

```
admin> write
```

Configuring the Connection profile for the remote device

The remote device Connection profile configures one endpoint of the ATM-to-Frame Relay circuit connection. To configure the Connection profile, proceed as in the following example:

1 Create a new Connection profile:

```
admin> new connection con-cpe
CONNECTION/con-cpe read
```

2 Activate the profile:

```
admin> set active = yes
```

3 Specify Frame-Relay circuit encapsulation:

```
admin> set encapsulation=frame-relay-circuit
```

4 Specify the call-type:

```
admin> set telco-options call-type=ft1
```

5 Specify the same nailed group number you configured in the ADSL profile:

```
admin> set telco-options nailed-groups=1
```

6 Specify the Frame Relay profile used for this connection, a DLCI, and a circuit name.

```
admin> set fr-options frame-relay-profile=fr7-1
admin> set fr-options dlci=54
admin> set fr-options circuit-name=adsl-atm
```

7 Write the profile:

```
admin> write
CONNECTION/con-cpe written
```

Configuring the Connection profile for the ATM network

The ATM network Connection profile configures the other endpoint of the ATM-to-Frame Relay circuit connection. To configure the Connection profile, proceed as in the following example:

1 Create a new Connection profile:

```
admin> new connection con-atm
CONNECTION/con-cpe read
```

2 Activate the profile:

```
admin> set active = yes
```

3 Specify ATM Frame-Relay circuit encapsulation:

```
admin> set encapsulation=atm-frame-relay-circuit
```

4 Specify the call-type:

```
admin> set telco-options call-type=ft1
```

5 Specify the same nailed group number you configured in the ATM DS3 profile:

```
admin> set telco-options nailed-group=5
```

6 Specify the Frame Relay circuit name used for this connection:

```
admin> set fr-options circuit-name=adsl-atm
```

7 Specify the ATM VPI/VCI for the remote device. Your ATM service provider should give you these values:

```
admin> set atm-options vpi=12
admin> set atm-options vci=42
```

8 Write the profile:

```
admin> write
CONNECTION/con-cpe written
```

Configuring E1 FrameLine Cards

14

This chapter covers the following topics:

Introduction

The MAX TNT E1 FrameLine card provides 10 E1 FrameLine lines, each of which can be used for one nailed connection. Associated with each E1 line is a Serial Communications Adapter (SCA), which is responsible for receiving and transmitting HDLC frames. Because there is only one SCA per line, only one PPP or Frame Relay link (possibly with multiple DLCIs) can be active per line.

Unlike other slot cards (such as the E1, modem, or HDLC), call routing profiles are not used for the E1 FrameLine card and are ignored if they exist. The data pathway is directed to an on-board SCA device and cannot be routed to another host card. All packetization of data occurs locally.

Overview of supported features

This section describes the E1 FrameLine card's support for the following protocols:

- PPP
- Frame Relay
- Routing protocols
- SNMP

PPP

The E1 FrameLine card supports PPP as follows:

- Only one PPP session per line.
- Bandwidth per session is 1-31 DS0 channels. Channel 1 is not available.
- Channels need not be contiguous.
- MP/MPP is not supported. The connection profile must specify only PPP.
- User authentication is by local profile or RADIUS.
- STAC compression is not supported.

Frame Relay

The E1 FrameLine card supports Frame Relay as follows:

- Only 1 Frame Relay link, possibly containing multiple DLCIs, can be active per line.
- Bandwidth per link is 1-31 DS0 channels. Channel 1 is not available.
- Channels need not be contiguous.
- Up to 120 PVCs are supported per card.

Routing protocols

The E1 FrameLine card only supports IP routing.

SNMP

The E1 FrameLine card supports SNMP as follows:

- DS1 status/management is the same as for the eight-port E1 card.
- The E1 FrameLine card support the accounting MIB for session information.

The MAX TNT E1 FrameLine card is illustrated in Figure 14-1.

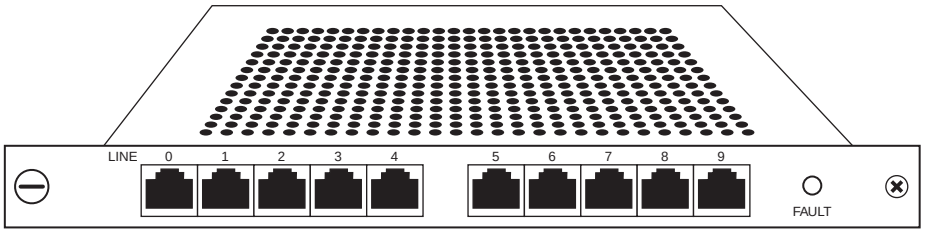

Figure 14-1. E1 FrameLine card

Installing the E1 FrameLine card

You install E1 FrameLine cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Note: All MAX TNT slot cards, including the E1 FrameLine cards, are supported *only* in MAX TNT units. You must install any MAX TNT slot card in a MAX TNT unit that supports that specific slot card.

The E1 FrameLine card has a single LED, which functions identically to the LED for the eight-port E1 card.

Overview of E1 FrameLine configuration

Configuring the E1 FrameLine card is similar to E1-card configuration, but keep the following points in mind:

The E1 FrameLine card has the following configuration restrictions:

- Signaling-mode must be set to E1-No-Signaling.
- Frame-Type must be set to G703
- T-Online-Type must be set to None
- Channel-Usage for channel must be set to Unused-Channel.
- For all other channels, Channel-Usage must be set to either Unused-Channel or Nailed-64-Channel.
- Channel 17 is usable.
- You cannot have the same nailed-group on 2 different E1 lines.
- Unlike the E1 card, channels in the same nailed group do not need to be contiguous. That is channels 1 and 3 can be in same nailed group with channel 2 unused.

Only the following E1 profile parameters are applicable for the E1 FrameLine card:

- Enabled
- T-Online-Type
- Frame-Type
- Signaling-Mode
- Channel-Usage
- Nailed-Group

For complete information on configuring E1 lines, refer to Chapter 8, “Configuring E1 Cards.”

Example configuration

When you install the E1 FrameLine card, the MAX TNT creates 10 E1 profiles. The following is the default line-interface configuration:

```
enabled = no
t-online-type = none
frame-type = g703
```

```
clock-source = eligible
clock-priority = low-priority
signaling-mode = e1-no-signaling
default-call-type = digital
switch-type = net5-pri
front-end-type = short-haul
overlap-receiving = no
pri-prefix-number = ""
trailing-digits = 2
t302-timer = 10000
layer3-end = x-side
layer2-end = b-side
nl-value = 64
loop-avoidance = 7
number-complete = end-of-pulsing
group-b-answer-signal = signal-b-6
group-b-busy-signal = signal-b-3
group-ii-signal = signal-ii-2
answer-delay = 200
caller-id = no-caller-id
hunt-grp-phone-number-1 = ""
hunt-grp-phone-number-2 = ""
hunt-grp-phone-number-3 = ""
```

To configure the E1 FrameLine card:

```
admin> read E1 {1 2 2}
UE1/{ shelf-1 slot-2 2 } read

admin> set enabled=yes

admin> list channel 1
channel-usage = unused-channel
trunk-group = 9
phone-number = ““
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0

admin> set channel-usage=nailed-64-channel

admin> set nailed-group = 3

admin> list .. 2
channel-usage = unused-channel
trunk-group = 9
phone-number = ““
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0

admin> set channel-usage=nailed-64-channel

admin> set nailed-group = 3
```

Continue configuring the rest of the channels similarly. When you have finished, write the profile:

```
admin> write
UE1/{ shelf-1 slot-2 2 } written
```

Administrative profiles

In addition to the E1 profile described in the previous section, the following administrative profiles apply to the E1 FrameLine card:

- Admin-State profile
- Device-State profile
- Slot-Info profile
- T1-Status profile

This section explains the changes to these profiles to support the E1 FrameLine card.

Admin-State profile

When you install the E1 FrameLine card, the MAX TNT creates 20 admin-state profiles; 10 are associated with the E1 lines and 10 associated with the SCA devices which do HDLC framing. Profiles are retained during card resets. The MAX TNT deletes these profiles if you install a different type of card into a slot. You can also delete the profiles using the Slot command with the `-r`.

The profile index is { shelf slot N }

- N = 1-10 identifies a E1 line on the card.
- N = 11-20 identifies a SCA on the card.
- SCA 11 is associated with line 1, SCA 12 with line 2, and so on.

Device-State profile

The MAX TNT creates a device-state profile for each DS0 and each SCA when the card enters the up state.

You use the DS0-related profiles the same as the eight-port E1 card profiles.

You use the SCA related profiles similar to the modem card *except* that setting the reqd-state to down-reqd-state when a call is active on that SCA has no affect.

The profile index is { { shelf slot *N* } *M* }

- N = 1-10 identifies a line on the card.
- N = 11-20 identifies a SCA on the card.
- M is the DS0 channel number. Its range is [1..32]. Note that for an SCA, M is always 0.

Administrative commands and status information

You can maintain the E1 FrameLine card as you do the eight-port E1 card:

- The Dircode and Show commands display the E1 FrameLine loads as `10-unchan-E1-card`.
- You can view the status of the SCAs with the HDLC command.
- The line status is identical to the line status for the eight-port E1 card.

- You can view the errors on each line by opening a session to the card and using the E1-Stats command.

For more information about diagnostics on the E1 FrameLine card, see the *MAX TNT Adminstration Guide*.

Configuring the clock source

The E1 FrameLine card uses the same system-wide PLL synchronous clock source for DS1 transmission as do the eight-port T1 and E1 cards. Any of the lines can serve as the clock source for the MAX TNT. To configure the E1 FrameLine card's clock source, use the same parameters (Clock-Source and Clock-Priority), that you use for other cards.

Note, however, that all 10 lines must use the same clock source. Clocking on a per-line basis is not supported. The clock source can be one of the 10 lines, or a line on another slot card, or it can be internally generated from shelf controller.

In addition, if the system clock source is from one of the 10 lines, it affects the timing on the TDM backplane, because TDM timing is based on the clock source. This is true even though the E1 FrameLine card does not use the TDM backplane.

Configuring Unchannelized DS3 Slot Cards 15

This document covers these topics:

Introduction

The MAX TNT unchannelized DS3 card (UDS3) is an 44.736 Mbps communications circuit. that can be used to concentrate incoming traffic and direct it to a Frame Relay switch. Figure 15-1 shows an example UDS3 set up.

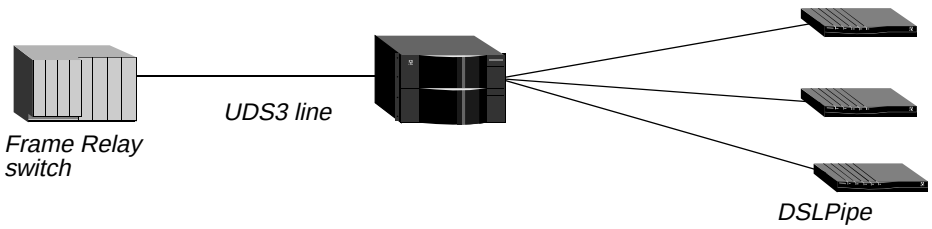

Figure 15-1. Example UDS3 set up

Overview of supported features

The UDS3 card provides support for the following

- One Frame Relay link, possibly containing multiple DLCIs, can be active per line.
- IP and IPX routing
- Layer 2 frame relay switching

- The DS3 MIB (RFC 1407).

The MAX TNT UDS3 card is illustrated in Figure 15-2.

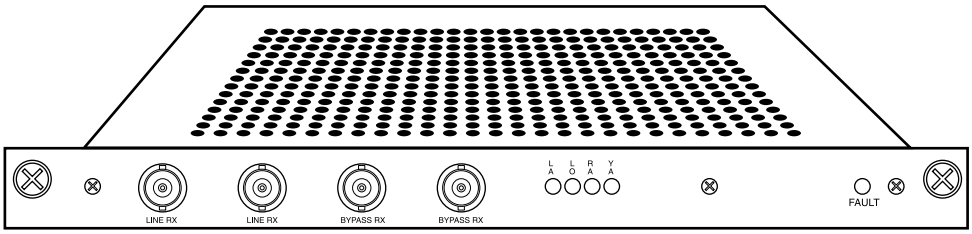

Figure 15-2. UDS3 card

Installing the UDS3 card

You install UDS3 cards in the same way you install other MAX TNT slot cards. For instructions, see “Installing a slot card” on page 2-13.

Connecting the MAX TNT UDS3 card to the WAN

Connect the T3 line to the UDS3 card with two 75 Ohm coaxial cables (RG 59/U). To provide for redundant operation, the UDS3 card has a second pair of BNC jacks that can be used to connect to a second UDS3 card or other Data Terminal Equipment (DTE).

When the UDS3 card is not powered or is in the reset state, the Line RX and Line TX signals are electrically connected to the Bypass RX and Bypass TX jacks, respectively. When the UDS3 card passes POST, a relay switch connects the Line jacks to the card’s T3 transceiver.

Inform your service provider that the equipment is connected, so they can bring up the line.

Interpreting a UDS3 card’s status lights

All status lights except LA are lit upon power-up or reset and remain so until the card passes POST. If no LEDs are lit, the DS3 interface is either disabled or is receiving an Alarm Indication Signal (AIS) or Idle Signal.

Table 15-1 explains the UDS3 card status lights.

Table 15-1.UDS3-card status lights

Lights	Description
LA	Green. Indicates the DS3 interface is enabled and has not detected any error conditions.
RA	Red. Indicates the DS3 interface is experiencing loss of receive signal.
LO	Red. Indicates the DS3 interface is out of frame alignment.

Table 15-1.UDS3-card status lights (continued)

Lights	Description
YA	Yellow. Indicates the DS3 interface has detected Far End Receive Failure indication transmitted from the other side.
FAULT	Yellow. Behaves as follows: • On after you reset the unit. • Off after the unit passes Power-On Self Test (POST) and is running. • Blinks if a fatal error has occurred.

Overview of UDS3 configuration

Table 15-2 lists the sections describing common tasks you might have to perform to configure a UDS3 line. The table includes a brief description of each task, and lists the parameters you will use.

For complete information about the associated parameters, see the *MAX TNT Reference Guide*.

Table 15-2.UDS3 line configuration tasks

Task	Description	Associated parameters
"Using the DS3 profile" on page 15-3.	The MAX TNT creates a single UDS3 profile when you install the UDS3 card, which you use to configure the card.	N/A
"Assigning a name and enabling the UDS3 line" on page 15-4.	Assign a name and enable the UDS3 line.	Name Enabled
"Configuring the DS3 physical link" on page 15-4.	The UDS3 card only supports C-Bit-parity framing and B3ZS encoding.	Activation Line-Type Line-Coding Loopback

Using the DS3 profile

When the MAX TNT first detects the presence of a UDS3 card, it creates a default UDS3 profile for the card. For example, after installing a UDS3 card in slot 7, you could verify the creation of a UDS3 profile as follows:

```
admin> dir uds3
7  03/21/1997 21:12:03  { shelf-1 slot-7 0 }
```

The following example shows the parameters in a UDS3 profile, with sample settings:

```
admin> read uds3 { 1 7 1}
UDS3/{ shelf-1 slot-7 1 } read
```

```
admin> list
name =  1:7:1
physical-address* = { shelf-1 slot-7 1 }
enabled = yes
line-config = { 0 131 static { any-shelf any-slot 0 } c-bit-parity+
  trunk-group = 0
  nailed-group = 131
  activation = static
  call-route-info = { any-shelf any-slot 0 }
  line-type = c-bit-parity
  line-coding = b3zs
  loopback = no-loopback
```

Assigning a name and enabling the UDS3 line

In a UDS3 profile, the Name parameter enables you to assign the profile a name of up to 16 characters. It is displayed after the line's physical address in the Dir command output.

By default each UDS3 line is disabled. When the DS3 interface is disabled, it transmits the DS3 Idle Signal to the far end.

To assign the line a name and enable it, proceed as in the following example:

```
admin> read uds3 {1 2 1}
UDS3/{ shelf-1 slot-2 1 } read
admin> set name = uds3-LA
admin> set enabled = yes
admin> write
UDS3/{ shelf-1 slot-2 1 } written
```

Configuring the DS3 physical link

The UDS3 card only supports C-Bit-Parity framing and B3ZS encoding.

Configuring DSL Connections

16

This chapter covers the following topics:

Introduction

You configureDSL connections in much the same way you configure ISDN or modem connections. DSL connections can be configured as switched or nailed PPP, MP, or MPP, or as Frame Relay-encapsulated connections. You can also use your existing authentication methods, such as RADIUS, to authenticate DSL users, by using PPP protocols in conjunction with PAP or CHAP. You can do this either when the units are first turned on or by setting an inactivity timer.

Any ISDN TA or router (such as an Ascend Pipeline) that supports ISDN BRI (2B1Q) signalling can be connected over an IDSL connection. ADSL and SDSL connections require Ascend DSLPipe units on the remote end.

DSL connections require the following general configuration on the MAX TNT:

- The DSL port in the line profile
- A Connection profile for the remote device
- For Frame Relay connections, a Frame Relay profile

In addition to standard routing connections, you can configure the following DSL-specific capabilities:

- DSLPipe plug and play
- IDSL voice support

Note: Ascend recommends that you only enable DSL ports that are in use. This results in better system performance. (By default, DSL ports are disabled.)

Configuring switched connections

A DSL physical link is always up, but a PPP session can be established and terminated based on data activity, just as it is for ISDN or PSTN calls. Each PPP session initiates negotiations, followed by authentication and accounting. Switched connections can provide per session authentication as well as accounting information typically used for client billing.

From the service provider perspective, a DSL connection is handled exactly like an ISDN or PSTN call. The MAX TNT checks the Answer-Defaults profile, applies authentication methods, and establishes the PPP session. After some inactivity PPP session is dropped, again generating accounting information. DSLPipe units initiate all switched ADSL and SDSL connections and the MAX TNT handles them as regular incoming PPP calls. Note that Frame Relay connections must be nailed.

You configure the DSLPipe for a switched connection in a similar way to other Pipeline switched connections, with the following important differences:

- Set the Chan Usage parameter in the Configure profile to Switch/Unused (for ADSL or SDSL connections) or Switch/Switch (for IDSL connections)
- Set the Dial # parameter in the Configure profile to the DSL port number, which in the case of a single DSLPipe is always 1.

To configure a switched connection on the MAX TNT for an incoming connection from a DSLPipe, you must set the Call-Type parameter to Off in the Connection profile for the DSLPipe. For example:

```
admin> read connection dslpipe-1
CONNECTION/dslpipe-1 read

admin> set telco call-type = off

admin> write
CONNECTION/dslpipe-1 read
```

For more information about configuring switched connections on the MAX TNT, see the *MAX TNT Network Configuration Guide*.

Configuring nailed connections

In a nailed connection, the MAX TNT and the remote unit always assume the connection is up and do not attempt to verify the line is operational.

A nailed connection does not record accounting or authentication information after the session is established and therefore cannot be used to bill for DSL service as if it were a call on an ISDN network or the PSTN.

Nailed connections are typically used for Frame Relay connections, but PPP can also be used. Voice calls are not supported over a nailed connection.

You specify whether a ADSL or SDSL connection is nailed by:

- Specifying a nailed group number in the ADSL or SDSL profile
- Setting Call-Type to FT1 in the Connection profile for the nailed connection

You specify whether an IDSL connection is nailed by:

- Specifying a nailed group number in the IDSL profile
- Setting Channel-Usage to Nailed-64-Channel in the IDSL profile
- Setting Call-Type to FT1 in the Connection profile for the nailed connection

You configure the DSLPipe for a nailed connection in a similar way to other Pipeline nailed connections:

- In the Configure profile, set Chan Usage to Leased/Unused
- In the Connection profile for the MAX TNT, set Call Type to Nailed in the Telco Options submenu
- In the Connection profile for the MAX TNT, specify a Group number in the Telco Options submenu

"Sample configurations" on page 16-19, provides examples of configuring nailed DSL connections.

Configuring data transfer rates

You can configure DSL upstream and downstream rates in the line profiles for each card, and in Connection or RADIUS profiles. The data transfer rates in the line profiles apply to the port. The data rate limits in Connection or RADIUS profiles apply only to sessions using that particular profile.

Configuring session rate limits enables you allocate portions of a DSL connection's bandwidth to particular users. For information, see "Configuring per session data transfer rates" on page 16-6.

Table 16-1 describes the parameters that determine the data transfer rates on the MAX TNT. For detailed information about these parameters, see the *MAX TNT Reference Guide*.

Table 16-1.DSL data rate configuration parameters

Parameter	**Cards it applies to**
SDSL line profile	
Data-Rate-Mode	SDSL
Max-Rate	24 port SDSL only
ADSL-CAP or ADSL-DMT line profile	
Data-Rate-Mode	ADSL-CAP, ADSL-DMT
Max-Up-Stream-Rate	ADSL-CAP, ADSL-DMT
Max-Down-Stream-Rate	ADSL-CAP, ADSL-DMT

Table 16-1.DSL data rate configuration parameters (continued)

Parameter	Cards it applies to
Connection profile > Session-Options	
Ses-ADSL-Dmt-Up-Rate	ADSL-DMT
Ses-ADSL-Dmt-Down-Rate	ADSL-DMT
Ses-ADSL-Cap-Up-Rate	ADSL-CAP
Ses-ADSL-Cap-Down-Rate	ADSL-CAP
Ses-Rate-Mode	ADSL-CAP, ADSL-DMT, SDSL
Ses-Rate-Type	ADSL-CAP, ADSL-DMT, SDSL
Ses-SDSL-Rate	SDSL
Rx-Data-Rate-Limit	SDSL
Tx-Data-Rate-Limit	SDSL

Configuring data transfer rates for ADSL lines

The Max-Down-Stream-Rate parameter in the ADSL-DMT and ADSL-CAP line profiles specify the maximum down-stream rate that the transceiver supports. If loop quality is poor, the transceiver chooses the lower rates, and good loop quality causes the transceiver to choose the higher rates. If the loop quality is very poor, the transceiver will not train at all, and will be unable to connect to the remote side. In that case, the administrator must specify a lower maximum down-stream rate, because the transceiver does not cross rate boundaries.

For example, if the transceiver is configured for 1088000bps and the loop quality is so poor that the transceiver will not connect to the remote side, the transceiver does not automatically adjust the down-rate into the 952000bps range. The administrator needs to configure the Max-Down-Stream-Rate to the lower rate.

Note: For more information about the Max-Downstream-Rate parameter, see the *MAX TNT Reference Guide*. Note that although the Max-Upstream-Rate parameter appears in the ADSL-CAP and ADSL-DMT profiles, it is not currently supported.

To configure the maximum data rate for an ADSL connection, proceed as in the following example:

1 Read in the ADSL-CAP or ADSL-DMT profile:

```
admin> read adsl-cap {2 3 2}
ADSL-CAP/{ shelf-2 slot-3 2 } read
```

2 Enable the line:

```
admin>set enabled=yes
```

3 List the Line-Config profile:

```
admin> list line-config
[in ADSL-CAP/{ shelf-2 slot-3 2 }:line-config]
trunk-group = 0
nailed-group = 1
activation = static
```

```
call-route-info = { any-shelf any-slot 0 }
data-rate-mode = autobaud
max-up-stream-rate = 1088000
max-down-stream-rate = 2560000
```

4 Specify a maximum downstream rate:

```
admin> set max-down-stream-rate=5120000
```

5 Write the profile:

```
admin> write
```

Configuring data transfer rates for SDSL lines

The 16-port SDSL card only supports a maximum symmetric data transfer rate of 784Kbps. You can, however, configure the 24-port SDSL-HP card maximum data rate using the Max-Rate parameter in the SDSL line profile. The Max-Rate parameter supports the following values:

- 144000
- 272000
- 400000
- 528000
- 784000
- 1168000
- 1552000

To configure the data rate for the 24-port SDSL card, proceed as in the following example:

1 Open the SDSL profile:

```
admin>read sdsl {2 1 7}
SDSL/{ shelf-2 slot-1 7 } read
```

2 Enable the line:

```
admin>set enabled=yes
```

3 List the Line-Config profile:

```
admin> list line-config
[in SDSL/{ shelf-2 slot-1 7 }:line-config]
trunk-group = 0
nailed-group = 1
activation = static
call-route-info = { any-shelf any-slot 0 }
data-rate-mode = singlebaud
max-rate = 784000
unit-type = coe
```

4 Specify a maximum rate:

```
admin> set max-rate=1552000
```

5 Write the profile:

```
admin> write
```

Configuring per session data transfer rates

The DSL cards support configuring per-session data transfer rates for individual DSLPipe (CPE) user sessions.

There are two different methods you can use to configure the per-session data transfer rates for DSL connections: modem rate control and data-rate limits.

In modem rate control, the MAX TNT initially establishes a CPE session at the maximum available data rate. If the CPE specifies a lower data rate, the MAX TNT terminates the session, then reestablishes it at the rate specified by the CPE . The next time the CPE initiates a connection, the MAX TNT does not retrain if the initial rate is the same or lower than the rate used previously for that CPE.

In data-rate limit, you specify transmit and receive data rate limits that apply to logical sessions on the DSL line. Data-rate limits enable multiple individual sessions on each DSL line.

The Connection profile parameters for configuring per-session data rates are described below.

Parameter/RADIUS attribute	**Specifies**
Ses-Rate-Type/ Ascend-Dsl-Rate-Type (92)	Type of DSL connection to rate control. Disabled (the default) means that modem rate control is not active for the connection. Currently, Disabled and ADSL-CAP settings are the only supported options.
Ses-Rate-Mode/ Ascend-Dsl-Rate-Mode (97)	Per-session DSL data rate mode. The default setting, Autobaud, specifies that the MAX TNT should train up to a set data rate. If a DSL modem cannot train to this data rate, it will connect at the closest rate to which it can train (the modem's ceiling rate). Currently Autobaud is the only supported option.
Ses-ADSL-CAP-Up-Rate/ Ascend-DSL-Upstream-Limit (98)	Per-session ADSL-CAP upstream data rate. Not currently supported.
Ses-ADSL-CAP- Down-Rate/ Ascend-DSL-Downstream-Limit (99)	Per-session ADSL-CAP downstream data rate. The following rates (in bps) are supported: 7168000 (the default), 6272000, 5120000, 4480000, 3200000, 2688000, 2560000, 2240000, 1920000, 1600000, 1280000, 960000, 640000.
Ses-ADSL-DMT-Up-Rate/ N/A	Not currently supported.
Ses-ADSL-DMT- Down-Rate/ N/A	Not currently supported.

Parameter/RADIUS attribute	Specifies
Rx-Data-Rate-Limit/ N/A	Maximum data rate in kbps per second to be received across the connection. The default 0 (zero) disables the data rate limit feature. The valid range is from 0 to 64000. If the specified number is larger than the actual bandwidth provided by the line, the connection behaves as if the data rate limit were disabled, except that additional computations are performed unnecessarily.
Tx-Data-Rate-Limit/ N/A	Maximum data rate in kbps per second to be transmitted across the connection. The default 0 (zero) disables the data rate limit feature. The valid range is from 0 to 64000. If the specified number is larger than the actual bandwidth provided by the line, the connection behaves as if the data rate limit were disabled, except that additional computations are performed unnecessarily.

For more information about these parameters, see the *MAX TNT Reference Guide*.

Configuring per-session data rates using modem rate control

In the following example, the CPE session will be initially established at the maximum line rate configured in the ADSL-CAP profile. After the session has been established, the MAX TNT determines that this session has a maximum downstream rate of 7168000. It then re-establishes the connection using the specified rate.

```
admin> read conn adslpipe-1
CONNECTION/adslpipe-1 read
admin> set session ses-rate-type = adsl-cap
admin> set session ses-adsl-cap-down-rate = 7168000
admin> write
CONNECTION/adslpipe-1 written
```

Following is a comparable RADIUS profile:

```
adslpipe-1 Password = "pipepw", User-Service = Framed-User
    Framed-Protocol = PPP,
    Framed-Address = 10.2.3.31
    Framed-Netmask = 255.255.255.0
    Ascend-Dsl-Rate-Type = Rate-Type-AdslCap
    Ascend-Dsl-Rate-Mode = Rate-Mode-AutoBaud
    Ascend-Dsl-Downstream-Limit = adslcap-dn-7168000
```

Configuring per-session data rate limits

You can configure transmit and receive data rate limits for individual connections that use the CAP-ADSL, SDSL, and unchannelized DS3 cards. ISPs can use these configuration parameters to limit bandwidth for a connection according to the rate charged for the account.

Note: If the parameters are set for a connection that does not use these cards, the system ignores the settings.

To configure an SDSL per-session data rate, proceed as in the following example:

1 Read in a Connection profile

```
admin> read connection sdsl-1

CONNECTION/sdsl-1 read
```

2 List the Session-Options profile:

```
admin> list session-options

[in CONNECTION/sdsl-1:session-options]
..
..
..
rx-data-rate-limit = 0
tx-data-rate-limit = 0
```

3 Specify a maximum receive rate:

```
admin> set rx-data-rate-limit=64000
```

4 Specify a maximum transmit rate:

```
admin> set tx-data-rate-limit=64000
```

5 Write the profile:

```
admin> write
```

Sample log session showing rate control negotiation

The following log messages show an incoming call from the user named `adslpipe-1`. The connection is authenticated via RADIUS, and after establishing the LAN session, the MAX TNT reads the data rates:

```
LOG info, Shelf 1, Controller, Time: 16:47:11--
 [1/7/1/1] Incoming Call [MBID 18]

LOG info, Shelf 1, Controller, Time: 16:47:11--
 [1/7/1/0] Assigned to port [MBID 18]

LOG info, Shelf 1, Controller, Time: 16:47:11--
 [1/7/1/1] Call Connected [MBID 18]

LOG info, Shelf 1, Slot 7, Time: 16:47:14--
 [1/7/1/0] LAN session up: <adslpipe-1> [MBID 18]
[adslpipe-1]

LOG notice, Shelf 1, Slot 7, Time: 16:47:14--
 Line 1 (radius) profile adslpipe-1
```

```
 from <autobaud,1088000,2560000>
 to   <autobaud,952000,7168000>

LOG notice, Shelf 1, Slot 7, Time: 16:47:14--
 Line 1 (radius) profile adslpipe-1 operation rates
 <autobaud,1088000,2560000>
```

The MAX TNT then terminates the call and re-establishes it using the configured data rates:

```
LOG notice, Shelf 1, Slot 7, Time: 16:47:14--
 Reconfigure Line 1 (radius) profile adslpipe-1 .....

LOG notice, Shelf 1, Slot 7, Time: 16:47:14--
 Line 1 OOS

LOG warning, Shelf 1, Controller, Time: 16:47:14--
 [1/7/1/1] Call Disconnected [MBID 18]

LOG info, Shelf 1, Controller, Time: 16:47:14--
 [1/7/1/0] Call Terminated [MBID 18]

LOG notice, Shelf 1, Slot 7, Time: 16:47:14--
 Line 1 INS

LOG info, Shelf 1, Slot 7, Time: 16:47:14--
 [1/7/1/0] LAN session down: <adslpipe-1> [MBID 18]
[adslpipe-1]

LOG warning, Shelf 1, Slot 7, Time: 16:47:14--
 [1/7/1/0] STOP: 'adslpipe-1'; cause 185.; progress 60.;
host 200.200.200.1 [MBID 18] [adslpipe-1]

LOG notice, Shelf 1, Slot 7, Time: 16:47:30--
 Line 1 up

LOG info, Shelf 1, Controller, Time: 16:47:34--
 [1/7/1/1] Incoming Call [MBID 19]

LOG info, Shelf 1, Controller, Time: 16:47:34--
 [1/7/1/0] Assigned to port [MBID 19]

LOG info, Shelf 1, Controller, Time: 16:47:34--
 [1/7/1/1] Call Connected [MBID 19]

LOG info, Shelf 1, Slot 7, Time: 16:47:39--
 [1/7/1/0] LAN session up: <adslpipe-1> [MBID 19]
[adslpipe-1]

LOG notice, Shelf 1, Slot 7, Time: 16:47:39--
 Line 1 (radius) profile adslpipe-1
 from <autobaud,1088000,2560000>
 to   <autobaud,952000,7168000>
```

```
LOG notice, Shelf 1, Slot 7, Time: 16:47:39--
 Line 1 (radius) profile adslpipe-1 successfully retrained
 <autobaud,952000,7168000>
```

Configuring DSLPipe Plug & Play

Plug & Play enables a DSLPipe to obtain its configuration through the MAX TNT by using the Dynamic Host Configuration Protocol (DHCP) and Trivial File Transfer Protocol (TFTP). The DSLPipe ships with the Plug & Play feature enabled, so it requires absolutely no configuration provided that the MAX TNT and servers have been configured properly.

How Plug & Play works

When the DSLPipe unit initially comes up, it uses factory default settings that enable it to forward a DHCP request to a MAX TNT which sends the request to a DHCP server. The connection between the MAX TNT and the DSLPipe is a nailed Frame Relay-encapsulated connection configured for bridging.

The DHCP server returns an IP address, netmask, the path to a more detailed configuration file, and a TFTP server hostname. The MAX TNT forwards the DHCP response to the requesting DHCP client.

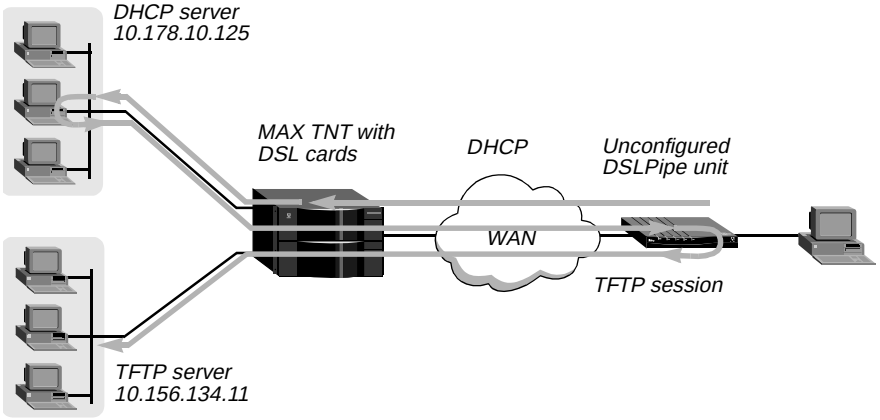

Figure 16-1. DSLPipe unit obtaining its configuration (Plug & Play)

The DSLPipe unit uses the minimal configuration it obtains via DHCP to access the specified TFTP server and a configuration file, which is identified by a filename that matches the unit's serial number. After downloading the file, the DSLPipe begins using the configuration.

For this feature to work, the network administrator must set up the DHCP and TFTP servers, as described in the next sections. In addition, the DHCP server must be configured to access DNS, so the client can access the specified TFTP server by name.

For details about the MAX TNT requirements, see "Configuring the MAX TNT" on page 16-12.

DHCP server requirements

The following sample configuration shows required DHCP settings for a Pipeline 130 unit acting as a DHCP server. Other DHCP server implementations may have additional requirements. This example shows only the DHCP-related settings in the Ethernet Mod Config profile:

```
20-B00 Mod Config
 DHCP Spoofing...
   DHCP Spoofing=Yes
   DHCP PNP Enabled=Yes
   Renewal Time=10
   Become Def. Router=No
   Dial if Link Down=No
   Always Spoof=Yes
   Validate IP=No
   Maximum no reply wait=10
   IP Group 1=10.10.10.1/16
   Group 1 count=10
   IP group 2=0.0.0.0/0
   Group 2 count=0
   Host 1 IP=0.0.0.0/0
   Host 1 Enet=000000000000
   Host 2 IP=0.0.0.0/0
   Host 2 Enet=000000000000
   Host 3 IP=0.0.0.0/0
   Host 3 Enet=000000000000
   TFTP Host Name=host-1.abc.com
   Boot File Path=/tftpboot/config
```

For a Pipeline unit to operate as a DHCP server, DHCP Spoofing and Always Spoof must be set to Yes. To enable the server to return an IP address, netmask, path to a more detailed configuration file, and TFTP server name, configure the following parameters:

- Set the IP Group 1 parameter and Group 1 Count parameters to represent a valid IP address pool.
- Set the TFTP Host Name parameter to the hostname of the TFTP server on which the DSLPipe configurations reside.
- Set the Boot File Path parameter to the directory on the TFTP server that contains the DSLPipe configurations.

For details on the other settings, see the documentation for the unit.

TFTP server requirements

In this sample configuration, the TFTP server uses the `/tftpboot/config` directory to store configuration files. This is consistent with the DHCP configuration shown in the preceding section, which passes the following pathname to the DSLPipe client:

```
/tftpboot/config
```

The filename of a DSLPipe configuration file must match the unit's serial number. DSLPipe serial numbers are located on a label on the bottom of the unit and in the 00-100 status window.

DSLPipe default configuration

In its default configuration, the DSLPipe is configured as follows:

In this menu:	These are the defaults:
Configure	Route=None Bridge=Yes My Name=DSLPipe
Ethernet > Connections	Station=DSLPipe Active=Yes Encaps=FR
Ethernet > Connections > Encaps Options	FR Prof = DSLframe DLCI=16
Ethernet > Frame Relay	Name=DSLframe Active=Yes FR Type=DTE Link Mgmt=T1.617D

Configuring the MAX TNT

DSLPipe Plug & Play support requires the following configuration on the MAX TNT:

- BOOTP Relay enabled
- A nailed DSL connection to the DSLPipe
- A Frame Relay profile that makes use of the DSL line
- A Connection profile for each DSLPipe unit

This sections does not include the MAX TNT IP and DNS configurations, which are required for Plug & Play to work. For details about configuring IP routing and DNS, see the *MAX TNT Network Configuration Guide*.

Configuring BOOTP Relay

The MAX TNT must be set up for BOOTP Relay to support Plug & Play in DSLPipe units. When you enable BOOTP Relay, the MAX TNT can forward DHCP request packets to a DHCP server and forward DHCP responses back to the requesting client.

If more you specify more than one DHCP server, the MAX TNT uses the first server until it becomes unavailable. Once it starts using the second DHCP server, it continues using that server until it becomes unavailable, at which time it switches back to using the first server again.

To enable BOOTP Relay, proceed as in the following example:

1 Read the IP-Global profile:

```
admin> read ip-global
IP-GLOBAL read
```

2 List the BOOTP-Relay profile:

```
admin> list bootp-relay
[in IP-GLOBAL:bootp-relay]
active = no
bootp-servers = [ 0.0.0.0 0.0.0.0 ]
```

3 Activate BOOTP Relay:

```
admin> set active=yes
```

4 Specify a DHCP server using the BOOTP-Servers setting. For example:

```
admin> set bootp-servers 1 =192.168.7.62
```

5 If necessary, specify a second DHCP server. For example:

```
admin> set bootp-servers 2 =192.168.7.72
```

6 Write the IP-Global profile to save your changes:

```
admin> write
IP-GLOBAL written
```

Configuring the SDSL profile

In the following example procedure, the network administrator configures an SDSL line in slot 3 of the MAX TNT unit:

1 Read in the SDSL profile. For example, if the SDSL card is installed in shelf 1, slot 11, and the remote DSLPipe is connected to port 1:

```
admin> read sdsl {1 3 1}
SDSL/{ shelf-1 slot-3 1 } read
```

2 List the profile:

```
admin> list
[in SDSL/{ shelf-1 slot-3 1 }]
name = ""
physical-address* = { any-shelf any-slot 0 }
enabled = no
line-config = { 0 1 static { any-shelf any-slot 0 } 144000 coe }
```

3 Enable the port:

```
admin> set enabled=yes
```

4 Assign this port to a nailed group:

```
admin> set line-config nailed-group=101
```

The Frame Relay profile you will create next locates this port by the nailed group number. The nailed group must be unique for each active WAN interface.

5 Write the profile:

```
admin> write
SDSL/{ shelf-1 slot-3 1 } written
```

Configuring a Frame Relay profile

In the following example, the administrator creates a Frame Relay profile to be used by the Connection profile to connect to the DSLPipe:

To configure the Frame Relay profile:

1. Create a new Frame Relay profile:

   ```
   admin> new frame-relay fr
   ```

2. Enable the profile:

   ```
   admin> set active=yes
   ```

3. Assign the Frame Relay profile to a nailed-up group:

   ```
   admin> set nailed-up-group=101
   ```

   This must be the same as the SDSL nailed group number you configured in the SDSL profile. The nailed group must be unique for each active WAN interface.

4. Specify the type of link management used for the connection:

   ```
   admin> set link-mgmt = ansi-t1.617d
   ```

   This is the default for the DSLPipe.

5. Specify the type of link:

   ```
   admin> set link-type = dce
   ```

6. Write the profile:

   ```
   admin> write
   FRAME-RELAY/fr written
   ```

Configuring a Connection profile

This example Connection profile uses the Frame Relay profile configured in the previous section to reach the DSLPipe.

1. Create a new Connection profile:

   ```
   admin> new connection dslpipe
   CONNECTION/dsl-pipe read
   ```

2. Activate the profile:

   ```
   admin> set active = yes
   ```

3. Specify Frame Relay as the encapsulation used on the link:

   ```
   admin> set encapsulation-protocol = frame-relay
   ```

4. Specify the IP address that will be assigned to the DSLPipe unit:

   ```
   admin> set ip-options remote-address = 11.10.10.1/16
   ```

5. Specify that only nailed channels are used on this link:

   ```
   admin> set telco-options call-type = ft1
   ```

6. Specify the name of the Frame Relay profile the Connection profile should use:

   ```
   admin> set fr-options frame-relay-profile = fr
   ```

7. Specify the Frame Relay DLCI used for the connection:

   ```
   admin> set fr-options dlci = 16
   ```

   This is the DSLPipe unit's and the MAX TNT default.

8. Write the profile:

   ```
   admin> write
   CONNECTION/dslpipe read
   ```

Configuring IDSL voice connections

In this example (see Figure 16-2), a Pipeline connected via an IDSL line is a configured for incoming and outgoing voice calls. The connection is a switched 128Kbps MPP connection that allows the Pipeline to drop a data channel when it receives an incoming voice call, and bring the second data channel up again when the voice call is over. Voice calls are not supported over nailed connections.

This example uses an Ascend Pipeline, but you can configure any ISDN U-interface device, such as a terminal adapter (TA), similarly.

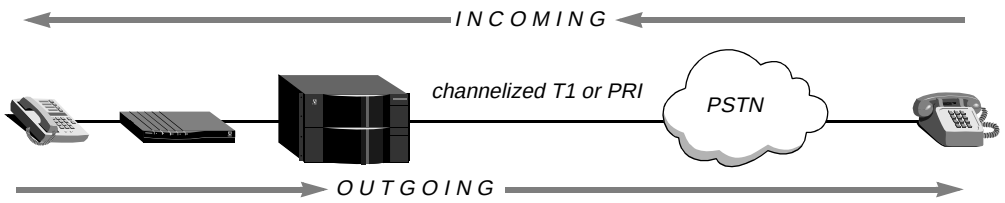

Figure 16-2. Incoming and outgoing voice calls

Incoming calls

Incoming IDSL voice calls require that the Central Office (CO) switch support Dialed Number Identification Service (DNIS). DNIS allows the MAX TNT to route incoming calls to the Pipeline or IDSN TA. The MAX TNT does this by comparing the DNIS number it receives to Answer-Number settings in its IDSL profiles. When the Pipeline receives this incoming call, it routes the call to a particular phone on the basis of its own port assignments.

Outgoing calls

Outgoing calls require that you configure the MAX TNT to use trunk groups and that the ISDN TA or remote router (such as a Pipeline 75) support En-Bloc Sending.

Trunk groups assign MAX TNT T1 or E1 channels to groups that are identified by a number. When a user on the IDSL line prefaces the phone number dialed with the trunk group number, the MAX TNT sends the call out on a channel in the trunk group.

With En-Bloc Sending, the Setup message the MAX TNT forwards to the PSTN switch contains all information required to process the call, including the dialed number.

When a user dials out from an analog device connected to the analog port of the Pipeline or an ISDN TA, the trunk group number must be the first digit of the phone number. (This is similar to dialing from locations where you dial with an initial digit to get an outside line before entering the phone number.)

In addition, the user must terminate the phone number with the # key. The Pipeline then sends a Q.931 En-Bloc Setup packet to the MAX TNT. The MAX TNT forwards the Setup message to the PSTN switch, which sets up the call.

Configuring the MAX TNT

To configure the MAX TNT for incoming and outoging voice calls, you must configure the following:

- An IDSL profile
- A Connection profile for the remote device
- Trunk groups so the MAX TNT can send outgoing calls to the PSTN

Configuring the IDSL profile

To configure the MAX TNT IDSL profile, proceed as in the following example:

1 Read the IDSL profile the remote user is connected to. For example:

```
admin> read idsl {1 7 29}
IDSL/{ shelf-1 slot-7 29 } read
```

2 List the IDSL profile:

```
admin> list
name = 1:7:29
line-interface = { no [ { switched-channel 1 } { switched-channel +
physical-address* = { shelf-1 slot-7 29 }
```

3 List the Line-Interface profile:

```
admin> list line-interface
[in IDSL/{ shelf-1 slot-7 29 }:line-interface]
enabled = no
channel-config = [ { switched-channel 1 } { switched-channel 1 } ]
answer-number-1 = ""
answer-number-2 = ""
clock-source = eligible
```

4 Enable the line:

```
admin> set enabled = yes
```

5 Specify the unique portion of the phone number for the analog device attached to the Pipeline. The MAX TNT uses this number to route all calls it receives with this number to the device. For example, if a phone connected to a Pipeline unit has the number 510-555-1234, set the Answer-Number-1 parameter to the following value:

```
admin> set answer-number-1=5105551234
```

6 If there are two analog devices attached to the Pipeline, configure the second IDSL channel with the appropriate phone number. For example:

```
admin> set answer-number-2=5105551235
```

7 Write the profile to save your changes:

```
admin> write
IDSL/{ shelf-1 slot-7 29 } written
```

Configuring a Connection profile for the remote device

To configure a Connection profile for the Pipeline:

1 Create a new Connection profile for the Pipeline:

```
admin> new connection pipeline
```

2 Activate the profile:

```
admin> set active=yes
```

3 Set the encapsulation to MPP to allow the Pipeline to drop a data channel when it receives a voice call:

```
admin> set encapsulation-protocol=mpp
```

4 List the IP-Options profile:

```
admin> list ip-options
[in CONNECTION/pipeline:ip-options (new)]
ip-routing-enabled = yes
vj-header-prediction = yes
remote-address = 0.0.0.0/0
local-address = 0.0.0.0/0
..
..
```

5 Specify the Pipeline IP address:

```
admin> set remote-address=192.1.2.1/24
```

6 List the Telco-Options profile:

```
admin> list.. telco-options
[in CONNECTION/pipeline:telco-options (new)]
answer-originate = ans-and-orig
callback = no
call-type = off
nailed-groups = 1
ft1-caller = no
force-56kbps = no
data-service = 56k-clear
..
..
```

7 Specify that the connection does not use nailed channels:

```
admin> set call-type=off
```

8 Set the data service:

```
admin> set data-service=64K-clear
```

9 Write the Connection profile:

```
admin> write
```

Configuring trunk groups

To enable the MAX TNT to recognize outgoing voice traffic and route it appropriately, you must use trunk groups. Note that when you enable trunk groups, you must configure every channel on the MAX TNT that will be used for outgoing calls with a trunk group.

To create trunk groups on the MAX TNT for IDSL outgoing calls:

1 Read the System profile:

```
admin> read system
SYSTEM read
```

2 Enable trunk groups:

```
admin> set use-trunk-groups = yes
```

3 Write the profile:

```
admin> write
SYSTEM written
```

4 Next, assign trunk groups to the lines used for placing outgoing calls. For example, to use T1 lines for outgoing calls, first read in the T1 profile:

```
admin> read t1 {1 1 1}
T1/{ shelf-1 slot-1 1 } read
```

5 List the Channel-Config subprofile :

```
techpubs-lab-25> list line-interface channel-config
[in T1/{ shelf-1 slot-1 1 }:line-interface:channel-config]
channel-config[1] = { switched-channel 9 "" { any-shelf any-slot +
channel-config[2] = { switched-channel 9 "" { any-shelf any-slot +
channel-config[3] = { switched-channel 9 "" { any-shelf any-slot +
channel-config[4] = { switched-channel 9 "" { any-shelf any-slot +
channel-config[5] = { switched-channel 9 "" { any-shelf any-slot +
..
..
```

6 Assign each T1 channel to a trunk group. For example:

```
admin> set 1 trunk = 5
admin> set 2 trunk = 5
admin> set 3 trunk = 5
admin> set 4 trunk = 5
admin> set 5 trunk = 5
admin> set 6 trunk = 5
admin> set 7 trunk = 5
admin> set 8 trunk = 5
admin> set 9 trunk = 5
admin> set 10 trunk = 5
..
..
```

This trunk group number must be prepended to the number dialed by users dialing out from the Pipeline.

7 Write the T1 profile:

```
admin> write
T1/{ shelf-1 slot-1 1 } written
```

Configuring the Pipeline

When configuring a remote ISDN device to attach to the IDSL line card, always select ATT 5ESS Point-to-Point as the switch type. The IDSL line card can only emulate the ATT 5ESS Point-to-Point switch. (If you are connecting using a Pipeline, you can specify an `IDSL` switch type. This selection emulates an ATT 5ESS Point-to-Point switch with En-Bloc dialing support, which is required for IDSL voice calls.)

Before you configure the Pipeline, make sure the PC connected to the Pipeline has an IP address on the same subnet as the Pipeline, and that the IP address of the Pipeline is configured as the default gateway for the PC.

Configuring the Configure profile

The Pipeline Configure profile allows you to set up the basic parameters for a connection. To configure the Pipeline Configure profile:

1. From the Main Edit menu, select Configure.
2. Specify the following values:
   - `Switch Type=`**`IDSL`**
   - `Chan Usage=`**`Switch/Switch`**
   - `My Num A=`**`55105554444`**
   - `My Name=`**`buffer`**
   - `My Addr=`**`192.1.2.1/24`**
   - `Rem Name=`**`bufferstnt`**
   - `Rem Addr=`**`192.1.1.1/24`**
   - `Route=`**`IP`**
3. Exit and save the Configure profile.
4. Open Ethernet > Connections > `bufferstnt`
5. Set Encaps to MPP:

   `Encaps=`**`MPP`**

   MPP enables the Pipeline to drops one channel of a data call to answer the voice instead of sending a busy signal. See the Pipeline documentation for details.
6. Exit and save the Connection profile.

Sample configurations

This section provides some example DSL configurations, including:

- An IDSL Frame Relay connection
- An ADSL nailed PPP connection
- An SDSL Frame Relay configuration using interface-based routing
- An SDSL Frame Relay configuration using system-based routing

Sample Frame Relay IDSL configuration

In Figure 16-3, a Pipeline connects, over a 128Kbps nailed Frame Relay connection, a single user to a MAX TNT. It uses system-based routing. This example uses an Ascend Pipeline, but you can configure any ISDN U-interface device, such as a terminal adapter (TA), similarly. You must also assign that channel a group number using the Nailed-Group parameter. The Connection profile for the remote device then references the assigned group number in its Nailed-Group setting, to direct the connection to use the IDSL nailed channel.

Note that this configuration does not support voice calls. For information on configuring and IDSL connection to support voice, see “Configuring IDSL voice connections” on page 16-15.

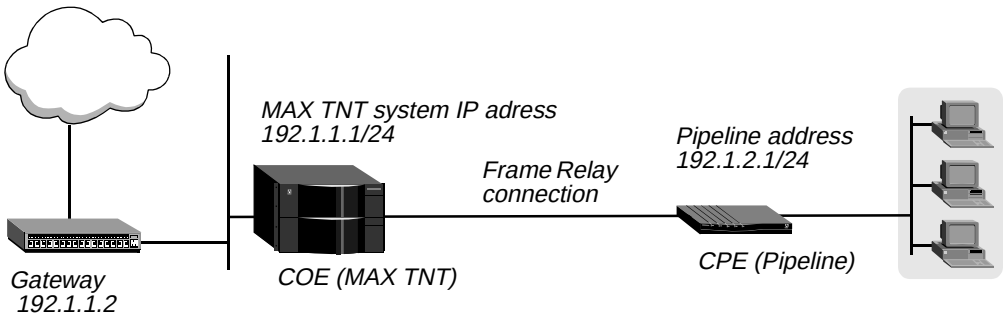

Figure 16-3. IDSL connection with a Pipeline

Configuring the MAX TNT

This example assumes the MAX TNT has already been configured with the following information:

- IP address of 192.1.1 4/24
- System name of `idsltnt`

To configure the MAX TNT for this example you must configure the following:

- A Connection profile for the remote device
- An IDSL profile
- A Frame Relay profile
- A static route to the gateway

Configuring a Connection profile for the remote device

To configure a Connection profile for the remote device:

1 Create a Connection profile for the Pipeline:

```
admin> new connection pipeline
```

2 Activate the profile:

```
admin> set active=yes
```

3 Set the encapsulation:

```
admin> set encapsulation-protocol=frame-relay
```

4 List the IP-Options profile:

```
admin> list ip-options
```

5 Enable IP routing for this Connection profile:

```
admin> set ip-routing-enabled=yes
```

6 Specify the Pipeline IP address:

```
admin> set remote-address=192.1.2.1/24
```

7 List the FR-Options profile:

```
admin> list .. fr-options
```

8 Specify the name of the Frame Relay profile:

```
admin> set frame-relay-profile=idsltnt-fr
```

9 Specify the Frame Relay DLCI:

```
admin> set dlci=16
```

10 List the Telco options profile:

```
admin> list .. telco-options
```

11 Set the data service:

```
admin> set data-service=64K-clear
```

12 Specify that the connection uses nailed channels:

```
admin> set call-type=ft1
```

13 Write the Connection profile:

```
admin> write
```

Configuring the IDSL profile

To configure the MAX TNT IDSL profile, proceed as in the following example:

1 Read the IDSL profile the remote user is connected to. For example:

```
admin> read idsl {1 7 18}
IDSL/{ shelf-1 slot-7 18 } read
```

2 Enable the line:

```
admin> set line enabled = yes
```

3 List the configuration for the first channel:

```
admin> list line channel 1
[in IDSL/{ shelf-1 slot-7 18 }:line-interface:channel-con +
channel-usage = switched-channel
nailed-group = 0
```

4 Specify that the connection is nailed:

```
admin> set channel-usage = nailed-64-channel
```

5 Specify the nailed group. This group is referenced in the Connection profile for the remote device so the MAX TNT knows which interface to use for the connection:

```
admin> set nailed-group = 10
```

6 Configure the second channel as nailed and assign it the same group number. For example:

```
admin> list .. 2
[in IDSL/{ shelf-1 slot-7 18 }:line-interface:channel-con +
channel-usage = switched-channel
nailed-group = 0

admin> set channel-usage = nailed-64-channel

admin> set nailed-group = 10
```

7 Write the profile to save your changes:

```
admin> write
IDSL/{ shelf-1 slot-7 18 } written
```

Configuring the Frame Relay profile

To configure the Frame Relay profile:

1. Create a new Frame Relay profile:

   ```
   admin> new frame-relay idsltnt-fr
   ```

2. Enable the profile:

   ```
   admin> set active=yes
   ```

3. Assign the Frame Relay profile to a nailed-up group:

   ```
   admin> set line nailed-up-group=10
   ```

   This must be the same as the IDSL nailed group number you configured in the IDSL profile. The nailed group must be unique for each active WAN interface.

4. Write the profile:

   ```
   admin> write
   ```

Configuring a static route to the gateway

To configure a static route to the gateway:

1. Read in the IP-Route Default profile:

   ```
   admin> read ip-route default
   ```

2. Enter the address of the Gateway on the local LAN to the remote network.

   ```
   set gateway-address = 192.1.1.2
   ```

3. Write the profile:

   ```
   admin> write
   ```

Configuring the Pipeline

Note: When configuring a remote ISDN device to attach to the IDSL line card, always select ATT 5ESS Point-to-Point as the switch type. The IDSL line card can only emulate the ATT 5ESS Point-to-Point switch. (On a Pipeline, you can specify an `IDSL` switch type. This selection emulates an ATT 5ESS Point-to-Point switch with En-Bloc dialing support, which can be used for IDSL voice calls.)

Before you configure the Pipeline, make sure the PC connected to the Pipeline has an IP address on the same subnet as the Pipeline, and that the IP address of the Pipeline is configured as the default gateway for the PC.

Configuring the Configure profile

The Pipeline Configure profile allows you to set up the basic parameters for a connection. To configure the Pipeline Configure profile:

1. From the Main Edit menu, select Configure.
2. Specify the following values:
   - `Switch Type=`**`IDSL`**
   - `Chan Usage=`**`Leased/Unused`**

- My Name=**pipeline**
- My Addr=**192.1.2.1/24**
- Rem Name=**idsltnt**
- Rem Addr=**192.1.1.1/24**
- Route=**IP**

3 Exit and save the Configure profile.

Configuring the Frame Relay profile

The Frame Relay profile defines the physical link used by the Connection profile to connect to the MAX TNT. To configure the Frame Relay profile:

1 Open the Ethernet > Frame Relay > *any profile*

2 Specify the following values:

- Name=**idsl-fr**
- Active=**Yes**
- Call Type=**Nailed**
- Nailed Grp=**1**

3 Exit the Frame Relay profile and save your changes.

Note that the Pipeline uses the following nailed group numbers:

- 1 is the first B channel
- 2 is the second B channel

Configuring the Connection profile

You must configure other, specialized options in the Connection profile for the IDSLTNT, including the name of the Frame Relay profile and the nailed group assigned to it. To do this, proceed as in the following example:

1 Open Ethernet > Connections > idsltnt

2 Specify Frame Relay encapsulation:

Encaps=**FR**

3 Open the Encaps Options submenu.

4 Specify name of the Frame Relay profile used by this connection and a DLCI.

- FR Prof=**idsl-fr**
- DLCI=**16**

5 Exit and save the Connection profile.

Sample ADSL nailed PPP connection

In Figure 16-4, a DSLPipe connects to a MAX TNT ADSL card over a nailed PPP connection. The ADSL card is in slot 7, and the DSLPipe is connected to port 3 of the ADSL card. The DSLPipe IP address is 10.10.73.1/24. The MAX TNT IP address is 104.178.115.163/24. This example uses ADSL, but you can configure an SDSL connection similarly.

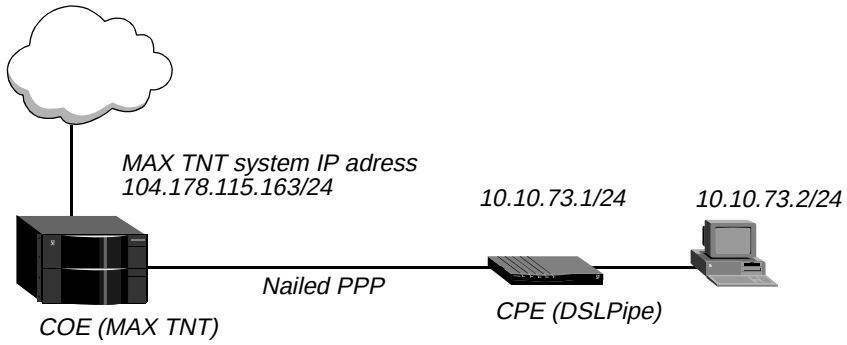

Figure 16-4. Sample ADSL PPP connection

Configuring the ADSL profile

To configure the ADSL profile in this example:

1 Read in the ADSL profile:

```
admin> read adsl-cap {1 7 3}
```

2 Enable the port:

```
admin> set enabled=yes
```

3 List the contents of the Line-Config profile:

```
admin> list line-config

[in ADSL-CAP/{ shelf-1 slot-7 3 }:line-config]
trunk-group = 0
nailed-group = 0
activation = static
call-route-info = { any-shelf any-slot 0 }
max-down-stream-rate = 7168000
```

4 Assign this port to a nailed group:

```
admin> set nailed-group=73
```

This nailed group points to the Connection profile you will create later. The nailed group must be unique for each active WAN interface.

5 Specify the maximum downstream rate:

```
admin> set max-down-stream-rate=7168000
```

6 Write the profile:

```
admin> write
```

Configuring the Connection profile

To configure the Connection profile in this example:

1. Create a new Connection profile:

   ```
   admin> new connection dslpipe
   ```

2. Enable the profile:

   ```
   admin> set active=yes
   ```

3. Set the encapsulation type to PPP:

   ```
   admin> set encapsulation-protocol=ppp
   ```

4. List the IP-Options submenu:

   ```
   admin> list ip-options

   [in CONNECTION/dslpipe:ip-options]
   ip-routing-enabled = yes
   vj-header-prediction = yes
   remote-address = 0.0.0.0/0
   local-address = 0.0.0.0/0
   ..
   ..
   ```

5. Set the IP address of the DSLPipe connecting to the MAX TNT:

   ```
   admin> set remote-address=10.10.73.1/24
   ```

6. Verify that IP routing is enabled (the default) for this Connection profile:

   ```
   admin> set ip-routing-enabled = yes
   ```

7. Verify that VJ header prediction is not enabled for this Connection profile:

   ```
   admin> set vj-header-prediction = no
   ```

8. List the PPP-Options submenu:

   ```
   admin> list .. ppp-options

   [in CONNECTION/dslpipe:ppp-options]
   send-auth-mode = no-ppp-auth
   send-password = ""
   recv-password = ""
   link-compression = stac
   mru = 1524
   lqm = no
   lqm-minimum-period = 600
   lqm-maximum-period = 600
   split-code-dot-user-enabled = no
   ```

9. Specify the authentication mode the MAX TNT requests for the outgoing call:

   ```
   admin> set send-auth-mode = pap-ppp-auth
   ```

10. Specify the password the MAX TNT sends to the DSLPipe:

    ```
    admin> set send-password = pap
    ```

11. Specify the password the MAX TNT expects to receive from the DSLPipe:

    ```
    admin> set recv-password = pap
    ```

12. List the Telco-Options submenu:

```
admin> list .. telco-options

[in CONNECTION/dslpipe:telco-options]
answer-originate = ans-and-orig
callback = no
call-type = off
nailed-groups = 1
ft1-caller = no
force-56kbps = no
data-service = 56k-clear
..
..
```

13 Specify the call type:

```
admin> set call-type= ft1
```

14 Specify the nailed group to use for this Connection profile:

```
admin> set nailed-groups = 73
```

15 Write the profile:

```
admin> write
```

Configuring the DSLPipe

To configure the DSLPipe in this example:

1 From the Main Edit menu, select Configure.

2 Specify the following values:

- `Chan Usage=Leased/Unused`
- `My Name=`**`dslpipe`**
- `My Addr=`**`10.10.73.1/24`**
- `Rem Name=`**`max-tnt`**
- `Rem Addr=`**`104.178.115.163/24`**
- `Route=`**`IP`**
- `Bridge=`**`No`**

3 From the Main Edit menu, select Ethernet > Connections > `max-tnt`.

4 Specify the following values:

- `Active=`**`Yes`**
- `Encaps=`**`PPP`**
- `Bridge=`**`No`**
- `Route IP=`**`Yes`**

5 Open the Encaps Options submenu.

6 Specify the following values:

- `Send Auth=`**`PAP`**
- `Send PW=`**`PAP`**
- `Recv PW=`**`PAP`**

- `Link Comp=`**`None`**
- `VJ Comp=`**`No`**

7 Open the Telco Options submenu.

8 Specify the following values:

- `Call Type=`**`Nailed`**
- `Group=`**`1`**

9 Exit the Connection profile and save your changes.

Sample SDSL Frame Relay configuration using numbered interfaces

This section describes a common SDSL application. In this example, the SDSL line is a leased connection over a single pair of wires, using Frame Relay as the transport protocol (see Figure 16-5). The example uses interface-based routing on a point-to-point link. Each side of the connection is assigned a unique address that applies only to the connection.

This example uses SDSL, but you can configure a ADSL connection similarly.

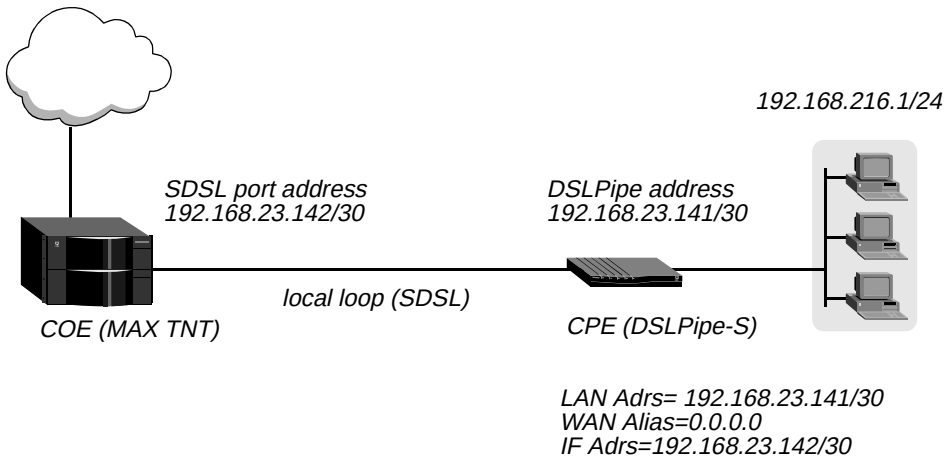

Figure 16-5. Example SDSL setup with interface-based routing

Configuring an SDSL connection requires the following general steps:

- Configuring the Connection profile
- Configuring an IP-Route profile
- Configuring the SDSL profile
- Configuring the Frame-Relay profile
- Configuring the DSLPipe-S

Configuring the Connection profile

To configure the Connection profile:

1 Create a new Connection profile:

```
admin> new connection sdsl-pipeline
```

2 Enable the profile:

```
admin> set active=yes
```

3 Specify the encapsulation type as Frame Relay:

```
admin> set encapsulation-protocol=frame-relay
```

4 List the IP-Options submenu:

```
admin> list ip-options

[in CONNECTION/sdsl-pipeline:ip-options]
ip-routing-enabled = yes
vj-header-prediction = yes
remote-address = 0.0.0.0/0
local-address = 0.0.0.0/0
..
..
```

5 Set the IP address of the DSLPipe-S connecting to the MAX TNT:

```
admin> set remote-address=192.168.23.141/30
```

6 Set the IP address of the MAX TNT SDSL port:

```
admin> set local-address=192.168.23.142/30
```

7 List the submenu for Frame Relay options:

```
admin> list .. fr-options

[in CONNECTION/sdsl-pipeline:fr-options]
frame-relay-profile = ""
dlci = 16
circuit-name = ""
fr-direct-enabled = no
fr-direct-profile = ""
fr-direct-dlci = 16
```

8 Link this Connection profile to the Frame-Relay profile you will create in the next section:

```
admin> set frame-relay-profile=fr-prof-1
```

9 Set the DLCI to the same value as the DSLPipe-S:

```
admin> set dlci=16
```

10 Open the Telco-Options subprofile:

```
admin> list .. telco-options

[in CONNECTION/sdsl-pipeline:telco-options]
answer-originate = ans-and-orig
callback = no
call-type = off
nailed-groups = 1
ft1-caller = no
force-56kbps = no
data-service = 56k-clear
..
..
```

11 Specify that the that the connection only uses nailed channels by setting Call-Type to FT1 (fractional T1):

```
admin> set call-type=ft1
```

12 Write the profile:

```
admin> write
```

Configuring the IP-Route profile

Next, in order to properly route traffic to machines on the DSLPipe unit's local area network:

1 Create a new IP Routing profile:

```
admin> new ip-route sdsl-pipeline
```

2 Set the address to route equal to the Pipeline's local area network address:

```
admin> set dest-address=192.168.216.1/24
```

3 Set the gateway to the interface address assigned to the DSLPipe:

```
admin> set gateway-address=192.168.23.141
```

4 Write the profile:

```
admin> write
```

Configuring the SDSL profile

To configure the SDSL profile:

1 Read in the SDSL profile. For example, if the SDSL card is installed in slot 11 of shelf 1 and the remote DSLPipe-S is connected to port 1:

```
admin> read sdsl {1 11 1}
```

2 Enable the port:

```
admin> set enabled=yes
```

3 List the contents of the Line-Config profile:

```
admin> list line-config

[in SDSL/{ shelf-1 slot-11 1 }:line-config]
trunk-group = 0
nailed-group = 1
activation = static
call-route-info = { any-shelf any-slot 0 }
max-rate = 144000
unit-type = coe
```

4 Assign this port to a nailed group:

```
admin> set nailed-group=1
```

This nailed group points to the Frame-Relay profile you will create later. The nailed group must be unique for each active WAN interface.

5 Write the profile:

```
admin> write
```

Configuring the Frame-Relay profile

To configure the Frame-Relay profile:

1. Create a new Frame-Relay profile:

   `admin> new frame-relay fr-prof-1`

2. Enable the profile:

   `admin> set active=yes`

3. Assign the Frame-Relay profile to a nailed-up group:

   `admin> set nailed-up-group=1`

   This must be the same as the SDSL nailed group number you configured in the SDSL profile. The nailed group must be unique for each active WAN interface.

4. Write the profile:

   `admin> write`

Configuring the DSLPipe-S

This section provides an example of configuring the SDSL Pipeline (DSLPipe-S). For complete information about configuring the DSLPipe-S, see the documentation that came with your Pipeline unit.

Before you configure the Pipeline, make sure that:

- The PC connected to the Pipeline has an IP address on the same subnet as the Pipeline.
- The IP address of the Pipeline is configured as the default gateway for the PC.

To configure the Pipeline:

1. From the Main Edit menu, select Configure.
2. Specify the following values:
   - `Chan Usage=`**`Leased/Unused`**
   - `My Name=`**`sdsl-pipeline`**
   - `My Addr=`**`192.168.216.1/24`**
   - `Rem Name=`**`max-tnt`**
   - `Rem Addr=`**`192.168.23.142/30`**
   - `Route=`**`IP`**
3. Exit and save the Configure profile.
4. From the Main Edit menu, select Ethernet > Connections > `max-tnt`.
5. Specify the following values:
   - `Active=`**`Yes`**
   - `Encaps=`**`FR`**
   - `Route IP=`**`Yes`**
6. Open the Encaps Options submenu.
7. Specify the following values:
   - `FR Prof=`**`Frame Relay`**

- DLCI=**16**

8 Open the IP options submenu.

9 Specify the following values:

- LAN Adrs=**192.168.23.142/30**
- WAN Alias=**0.0.0.0**
- IF Adrs=**192.168.23.141/30**

10 Exit the Connection profile and save your changes.

Next, set up the Frame-Relay profile.

1 Open the Ethernet > Frame Relay > Frame Relay profile.

2 Specify the following values:

- Name=**Frame Relay**
- Active=**Yes**
- Call Type=**Nailed**

3 If your Pipeline supports it, set LinkUp to Yes:

- LinkUp=**Yes**

  Note that this parameter does not appear in recent versions of Pipeline software.

4 Exit the Frame-Relay profile and save your changes.

Sample SDSL Frame Relay configuration using system-based routing

This section describes a common SDSL application. In this example, the SDSL line is a leased connection over a single pair of wires, using Frame Relay as the transport protocol (see Figure 16-5). The example uses system-based routing. In system-based routing each system has an IP address. The system routes traffic based on the destination address in packets and the next hop system.

This example uses SDSL, but you can configure an ADSL connection similarly.

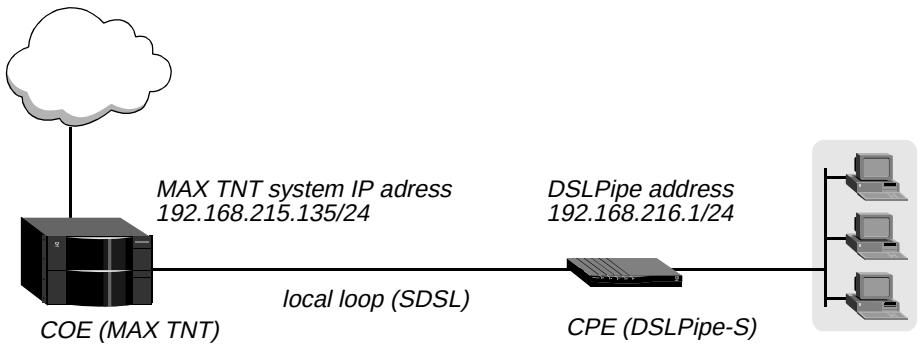

Figure 16-6. Example SDSL setup with system-based routing

Configuring an SDSL connection requires the following general steps:

- Configuring the Connection profile

- Configuring the SDSL profile
- Configuring the Frame-Relay profile
- Configuring the DSLPipe-S

Configuring the Connection profile

To configure the Connection profile:

1 Create a new Connection profile:

```
admin> new connection sdsl-pipeline
```

2 Enable the profile:

```
admin> set active=yes
```

3 Specify the encapsulation type as Frame Relay:

```
admin> set encapsulation-protocol=frame-relay
```

4 List the IP-Options submenu:

```
admin> list ip-options

[in CONNECTION/sdsl-pipeline:ip-options]
ip-routing-enabled = yes
vj-header-prediction = yes
remote-address = 0.0.0.0/0
local-address = 0.0.0.0/0
..
..
```

5 Set the IP address of the DSLPipe-S connecting to the MAX TNT:

```
admin> set remote-address=192.168.216.1/24
```

6 List the submenu for Frame Relay options:

```
admin> list .. fr-options

[in CONNECTION/sdsl-pipeline:fr-options]
frame-relay-profile = ""
dlci = 16
circuit-name = ""
fr-direct-enabled = no
fr-direct-profile = ""
fr-direct-dlci = 16
```

7 Link this Connection profile to the Frame-Relay profile you will create in the next section:

```
admin> set frame-relay-profile=fr-prof-1
```

8 Set the DLCI to the same value as the DSLPipe-S:

```
admin> set dlci=16
```

9 Open the Telco-Options subprofile:

```
admin> list .. telco-options

[in CONNECTION/sdsl-pipeline:telco-options]
answer-originate = ans-and-orig
callback = no
call-type = off
nailed-groups = 1
ft1-caller = no
```

```
force-56kbps = no
data-service = 56k-clear
..
..
```

10 Specify that the that the connection only uses nailed channels by setting Call-Type to FT1 (fractional T1):

```
admin> set call-type=ft1
```

11 Write the profile:

```
admin> write
```

Configuring the SDSL profile

To configure the SDSL profile:

1 Read in the SDSL profile. For example, if the SDSL card is installed in slot 11 of shelf 1 and the remote DSLPipe-S is connected to port 1:

```
admin> read sdsl {1 11 1}
```

2 Enable the port:

```
admin> set enabled=yes
```

3 List the contents of the Line-Config profile:

```
admin> list line-config

[in SDSL/{ shelf-1 slot-11 1 }:line-config]
trunk-group = 0
nailed-group = 1
activation = static
call-route-info = { any-shelf any-slot 0 }
max-rate = 144000
unit-type = coe
```

4 Assign this port to a nailed group:

```
admin> set nailed-group=1
```

This nailed group points to the Frame-Relay profile you will create later. The nailed group must be unique for each active WAN interface.

5 Write the profile:

```
admin> write
```

Configuring the Frame-Relay profile

To configure the Frame-Relay profile:

1 Create a new Frame-Relay profile:

```
admin> new frame-relay fr-prof-1
```

2 Enable the profile:

```
admin> set active=yes
```

3 Assign the Frame-Relay profile to a nailed-up group:

```
admin> set nailed-up-group=1
```

This must be the same as the SDSL nailed group number you configured in the SDSL profile. The nailed group must be unique for each active WAN interface.

4 Write the profile:

```
admin> write
```

Configuring the DSLPipe-S

This section provides an example of configuring the SDSL Pipeline (DSLPipe-S). For complete information about configuring the DSLPipe-S, see the documentation that came with your Pipeline unit.

Before you configure the Pipeline, make sure that:

- The PC connected to the Pipeline has an IP address on the same subnet as the Pipeline.
- The IP address of the Pipeline is configured as the default gateway for the PC.

To configure the Pipeline:

1 From the Main Edit menu, select Configure.

2 Specify the following values:

- `Chan Usage=`**`Leased/Unused`**
- `My Name=`**`sdsl-pipeline`**
- `My Addr=`**`192.168.216.1/24`**
- `Rem Name=`**`max-tnt`**
- `Rem Addr=`**`192.168.215.135/24`**
- `Route=`**`IP`**

3 Exit and save the Configure profile.

4 From the Main Edit menu, select Ethernet > Connections > `max-tnt`.

5 Specify the following values:

- `Active=`**`Yes`**
- `Encaps=`**`FR`**
- `Route IP=`**`Yes`**

6 Open the Encaps Options submenu.

7 Specify the following values:

- `FR Prof=`**`Frame Relay`**
- `DLCI=`**`16`**

8 Exit the Connection profile and save your changes.

Next, set up the Frame-Relay profile.

1 Open the Ethernet > Frame Relay > Frame Relay profile.

2 Specify the following values:

- `Name=`**`Frame Relay`**
- `Active=`**`Yes`**
- `Call Type=`**`Nailed`**

3 If your Pipeline supports it, set LinkUp to Yes:

- `LinkUp=`**`Yes`**

  Note that this parameter does not appear in recent versions of Pipeline software.

4. Exit the Frame-Relay profile and save your changes.

Call Routing in the MAX TNT

17

This chapter covers the following topics:

How call routing works in the MAX TNT

When the MAX TNT receives a call on a network port (such as a T1 or E1 channel), it performs the following series of actions:

1 Receive the call.

2 If appropriate, authenticate by means of CLID or DNIS.

3 Answer the call.

4 Route the call to a host port (a digital modem or HDLC channel) for processing.

5 Find the caller's profile, locally or in RADIUS, and authenticate.

6 Build the session and pass the data stream to the appropriate software module or host.

Similarly, when the MAX TNT dials out, it places the outbound call by routing it to a network port. This chapter describes how the MAX TNT routes calls and how to configure Call-Route profiles to control how this routing occurs.

How the MAX TNT routes calls it receives

Calls are always received and placed on network ports, such as T1 or E1 channels. In some cases, the MAX TNT forwards a call to a Frame Relay switch or to a network host without processing the call or handling its encapsulation. In all other cases, when the MAX TNT receives a call, that call must be routed to a host port, such as a digital modem or HDLC channel, for encapsulation processing before being forwarded to the router or terminal-server software.

High-level Data Link Control (HDLC) processing removes encapsulation from high-speed incoming data calls such as those from ISDN terminal adapters. The HDLC module removes the call's link encapsulation and then passes the data stream to the bridge/router.

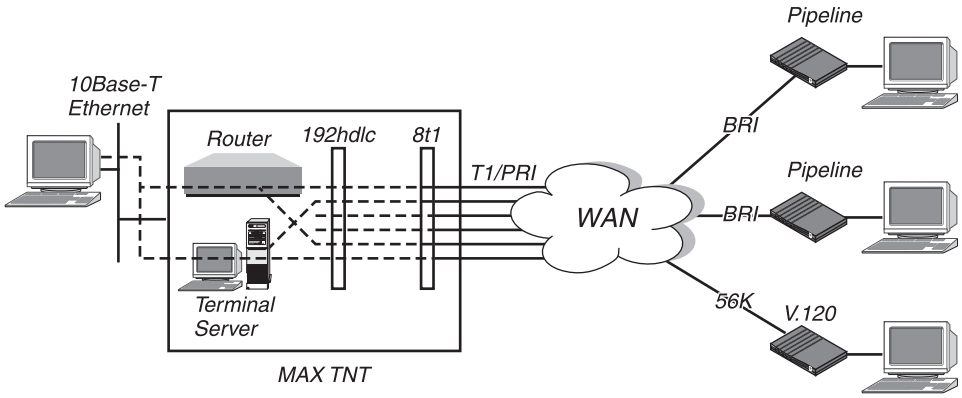

Figure 17-1. Routing inbound calls to an HDLC channel

Digital-modem processing handles asynchronous-data calls initiated by analog modems. A digital modem accepts an incoming call as a PCM (Pulse Coded Modulation) encoded digital stream, which contains a digitized version of the analog data sent by a modem. The digital modem also converts outgoing data to be sent across the WAN to an analog modem.

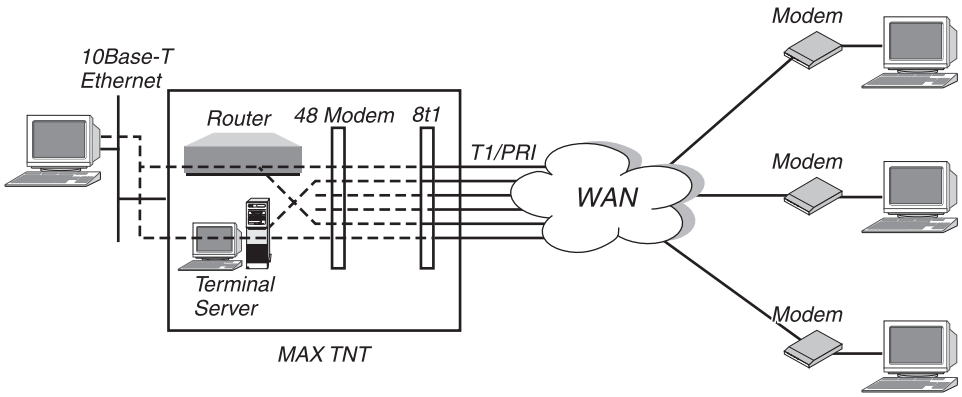

Figure 17-2. Routing inbound calls to a digital modem

What's new in MAX TNT call routing

This section compares call routing in Ascend MAX products released prior to the MAX TNT to the new call-routing method provided in the MAX TNT Call-Route profiles.

The old call routing method

In Ascend products released prior to the MAX TNT, call routing was specified in Line profiles (for network ports) and Ethernet, Modem, and other profiles (for host ports).

For example, in a Modem profile, you would enter Answer numbers to specify that a call to one of the numbers is to be directed to the moderms you are configuring in the profiles.

```
V.34 Modem
   Mod Config
      Ans 1#=1212
```

In a T1 Line profile, you would specify the slot and port at which to receive calls arriving on a given channel. For example:

```
Net/T1
   Line Config
      Line 1...
         Ch 1 Slot=3
         Ch 1 Prt/Grp=4
```

The problem with this method of call routing was that you had to open several different profiles to determine how a call would be routed.

A new parameter that mimics the old method

For users accustomed to the old method, the MAX TNT provides the Call-Route-Info parameter in T1 and E1 profiles to mimic the old call-routing method. For example:

```
admin> read t1 {1 2 1}
T1/{ shelf-1 slot-2 1 } read

admin> list line channel 1
channel-usage = switched-channel
trunk-group = 9
phone-number = ""
call-route-info = { any-shelf any-slot 0 }
nailed-group = 0
```

As you can see in the example, the Call-Route-Info parameter combines the old Ch *n* Slot and Ch *n* Prt/Grp parameters.

The Call-Route-Info parameter is deprecated. The preferred method of call routing is to use Call-Route profiles. However, if you specify both methods, the Call-Route-Info settings take precedence.

The new MAX TNT call-routing method

The new method for call routing in the MAX TNT places all call-routing information in one place: Call-Route profiles. The Preferred-Source parameter in a Call-Route profile is a mirror-image of the deprecated Call-Route-Info parameter. Instead of configuring a T1 profile to send calls to a specified modem you configure a modem to receive calls from a specified T1 channel.

For example, here is a Call-Route profile for a modem card in slot 6:

```
admin> read call-route {{{1 6 0} 0} 0}
CALL-ROUTE/{ { { shelf-1 slot-6 0 } 0 } 0 } read

admin> list
index* = { { { shelf-1 slot-6 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { 1 2 1 } 1 }
call-route-type = voice-call-type
```

In this example, the Preferred-Source parameter essentially tells the modem card in slot 6 to receive calls from {{ 1 2 1} 1} (the address of the T1 channel).

Default call routing

The MAX TNT creates a default Call-Route profile for the system itself and for each slot card when it first detects the presence of the card. For example, suppose the system has the following cards installed:

```
admin> show
Shelf 1 ( master ):
    ( Slot 1 empty )
    { shelf-1 slot-2 0 }       UP       8t1-card
    { shelf-1 slot-3 0 }       UP       hdlc2-card
    ( Slot 4 empty )
    ( Slot 5 empty )
    { shelf-1 slot-6 0 }       UP       48modem-card
    ( Slot 7 empty )         OCCUPIED
    ( Slot 8 empty )
    ( Slot 9 empty )
    ( Slot 10 empty )
    ( Slot 11 empty )
    { shelf-1 slot-12 0 }      UP       4/1ether-card
    ( Slot 13 empty )
    ( Slot 14 empty )
    ( Slot 15 empty )
    ( Slot 16 empty )
```

The system creates the following default Call-Route profiles:

```
admin> dir call-route
     9  12/11/1996 15:58:08  { { { any-shelf any-slot 0 } 0 }
0 }
    13  12/11/1996 15:58:20  { { { shelf-1 slot-2 0 } 0 } 0 }
    13  12/11/1996 15:58:21  { { { shelf-1 slot-6 0 } 0 } 0 }
    19  12/20/1996 20:57:07  { { { shelf-1 slot-3 0 } 0 } 0 }
```

The most general case: A system default

The “system” default is the most general default Call-Route profile. It simply stops the MAX TNT from dropping calls for which it has no specified route. The system default Call-Route profile looks like this:

```
admin> get call-route {{{0 0 0} 0} 0}
index* = { { { any-shelf any-slot 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { any-shelf any-slot 0 } 0 }
call-route-type = any-call-type
```

This profile specifies routing any call to any device in the system. Such a route is not very useful, and the system expects to find something more specific in its call-routing database. The system default would only be used if no specific routes exist.

General routes for trunk calls

Following is the default Call-Route profile for the T1 card in our example:

```
admin> get call-route {{{1 2 0} 0} 0}
index* = { { { shelf-1 slot-2 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { any-shelf any-slot 0 } 0 }
call-route-type = trunk-call-type
```

The `trunk-call-type` setting is used for outbound call-routing for trunk calls and trunk-to-trunk switching. This T1 default Call-Route profile specifies that any trunk call can be routed to the T1 card in shelf 1, slot 2.

Note: Call-Route profiles of this type are also used for incoming Multilink Plus (MP+) calls. When the MAX TNT receives an add-channel request from the calling side, it searches the call-routing database for available channels. If these Call-Route profiles are deleted, incoming MP+ calls will not connect properly.

General routes for voice and data calls

Following is the default Call-Route profile for the modem card (slot 6) in the example:

```
admin> get call-route {{{1 6 0} 0} 0}
index* = { { { shelf-1 slot-6 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { any-shelf any-slot 0 } 0 }
call-route-type = voice-call-type
```

This profile specifies that voice calls are to be routed to the modem card in slot 6.

Similarly, here is the default Call-Route profile for the HDLC card (slot 3):

```
admin> get call-route {{{1 3 0} 0} 0}
index* = { { { shelf-1 slot-3 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { any-shelf any-slot 0 } 0 }
call-route-type = digital-call-type
```

This default Call-Route profile for the installed HDLC card specifies that digital calls are to be routed to the HDLC card address.

How the MAX TNT gathers information about a call

When the MAX TNT receives a call, it gathers the following information about it:

- Trunk group on which the call came in (if trunk groups are in use)
- Phone number on which the call came in
- Line or channel on which the call came in
- Bearer capability of the call (if the line uses ISDN signaling)

If the network port supports ISDN signaling, the MAX TNT is able to ascertain the bearer capability (voice or data) of the call and use that information to route the call to a modem (if a voice-service call) or HDLC channel (if a data call). If the line is configured for inband signaling, all calls are assumed to be digital unless the T1 profile sets the default call-type to voice.

Figure 17-3 shows the MAX TNT receiving a call on a T1 PRI line, gathering information, comparing the gathered information to its call-routing database, and routing the call to a host port.

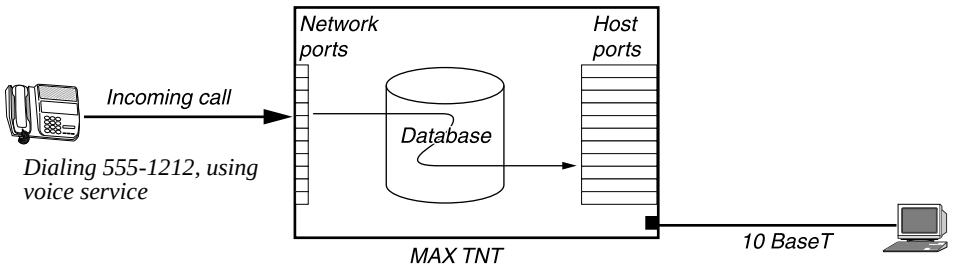

Figure 17-3. Information the MAX TNT can obtain from a received call

The information obtained from the call matches up with a Call-Route profile as shown in Table 17-1:

Table 17-1.How a call matches up with a Call-Route profile

Information in a call (Figure 17-3)	Information in a Call-Route profile
trunk-group = 6 phone-number = 555-1212 source = channel 3, line #1 call-type = voice	index* = { { { shelf-1 slot-3 0 } 0 } 0 } trunk-group = 6 phone-number = 555-1212 preferred-source = { { shelf-1 slot-2 1 } 3 } call-route-type = voice-call-type

The Index parameter contains the address to which the call is routed if the call's information matches the settings in the profile.

How the MAX TNT matches the call to a Call-Route profile

To match a call to a Call-Route profile, the MAX TNT starts with a list of all possible destinations in the system. It uses the following algorithm to remove certain destinations from consideration.

1 Remove ports that are currently in use.

If a port is currently in use, the MAX TNT does not consider it as a possible destination for the call.

2 Sort the remaining ports.

The MAX TNT sorts the remaining list of call-routing entries by parameter in the following order:

- Trunk-Group number (sorted in descending order; for example, 9–4)
- Subaddress number (sorted in descending order; for example, 9–1)
- Phone-Number (empty phone numbers last)
- Destination-Address (zero components sorted after nonzero components)
- Source-Address (zero components sorted after nonzero components)
- Routing-Type (Any-Call-Type last)

3 Sort again considering use count.

After sorting in this order, the MAX TNT considers use count, placing devices that have been used less frequently ahead of those that have been used more frequently.

4 Compare parameters in Call-Route profiles, in the sorted order:

- Trunk-Group number
- Subaddress number
- Phone-Number
- Destination-Address
- Source-Address
- Routing-Type

With each comparison pass, the MAX TNT identifies nonmatching profiles, and removes them from consideration as possible destinations for the call. That is, each comparison pass narrows the list of possible destinations. The MAX TNT routes the call to the best match, which is the port that matches the most components without use of zero-addresses (the system address, for example). If multiple devices equally match the call's parameters the MAX TNT routes the call to the first entry that matches the call's parameters.

Note: If the list becomes empty at any point, the MAX TNT drops the call. Depending on the type of call, the signaling being used, and the configuration of the central office switch, dropping the call might result in the switch returning a busy indication to the caller. If the caller receives a busy indication on a voice line, the indication originates from the central office switch equipment, not from the MAX TNT.

Trunk-Group comparison

The first pass compares trunk-group information gathered from the call to the trunk-group numbers in Call-Route profiles. If the call contains a trunk-group number, the MAX TNT does not consider profiles with nonmatching trunk-group numbers.

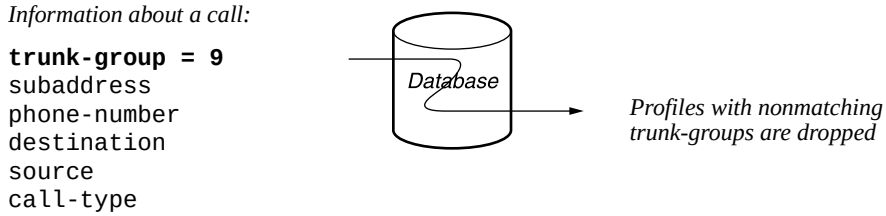

Figure 17-4. Comparing the trunk group to call-route entries

Profiles that specify a matching trunk-group number or a trunk group of zero remain in the list for the next comparison pass. For example, if the input trunk group is 9, profiles with a trunk group of 0 or 9 remain in the list.

Subaddress numbers comparison

If the call contains a subaddress as part of the phone number (for example, the *3* in 510-555-1212, 3) , the MAX TNT compares that subaddress to the Phone-Number parameters in its call routing database and rejects all profiles that specify a different subaddress.

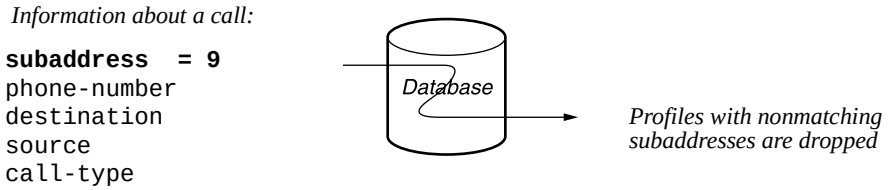

Figure 17-5. Comparing the subaddress to call-route entries

Only profiles that specify the same subaddress as the one presented by the call remain in the list, unless the MAX TNT finds *no* profiles with a matching subaddress. In that case, it keeps profiles with no subaddress specification in the list, and uses them in the next comparison pass.

For example, if the input subaddress is 9, only devices that specify a subaddress of 9 in the Phone-Number parameter remain in the list. Profiles with specifications such as the following would remain in the list:

```
phone-number = 9,
phone-number = 9,555-1212
```

If no devices specify the subaddress 9, only devices with no subaddress specification remain in the list. For example:

```
phone-number = 555-1212
phone-number = 777-9898
```

Phone-Number comparison

The MAX TNT compares the phone number on which the call was received to the Phone-Number parameters in its call-routing database and rejects all profiles with nonmatching phone numbers.

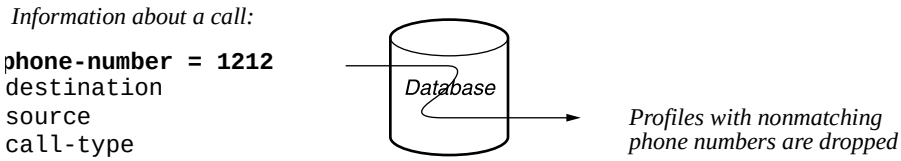

Figure 17-6. Comparing the phone number to call-route entries

To match, the profile's phone number must be smaller than or equal to the input number, and its digits must match the add-on digits of the input number. For example, if the calling switch sent the following number to the MAX TNT:

```
555-1212
```

profiles with the following phone numbers (for example) would remain in the list:

```
phone-number=1212
phone-number=555-1212
phone-number=12
```

As with subaddress routing, if the MAX TNT finds no matching phone numbers, it drops the profiles that have other, nonmatching numbers, but retains the profiles that have a null phone-number specification.

Destination address comparison

The next comparison uses destination-address information specified in the Call-Route-Info parameter of the channel configuration, if the network port configuration has an assigned value for that parameter. (For more information, see "A new parameter that mimics the old method" on page 17-3.)

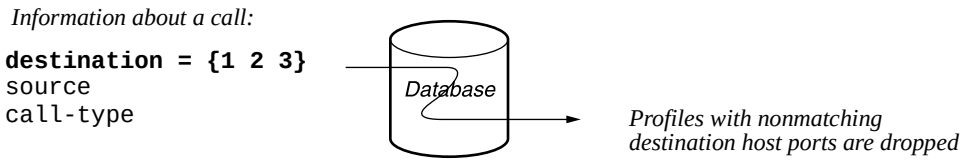

Figure 17-7. Comparing the Call-Route-Info value to call-route entries

By default, the Call-Route-Info parameter specifies the system address { any-shelf any-slot 0 }. If a call comes in on a channel that specifies a host port address instead, the MAX TNT excludes all profiles whose index does not match that address.

The MAX TNT uses the most specific address match. For example, if the channel Call-Route-Info address is { 1 5 1 }, the MAX TNT uses the entry for { 1 5 1 }, if one exists. If there is no entry for { 1 5 1 }, it uses the entry for { 1 5 0 }. If there is no entry for { 1 5 0 }, it uses the entry for { 1 0 0 }. If it does not find an entry in the call-routing database for { 1 0 0 }, the MAX TNT uses the default call-route, which has the system address, { 0 0 0 }.

Source address comparison

Next, the MAX TNT compares the device address of the line and channel on which the call was received to the preferred-source addresses in its call routing database, and rejects all profiles with nonmatching preferred-source addresses.

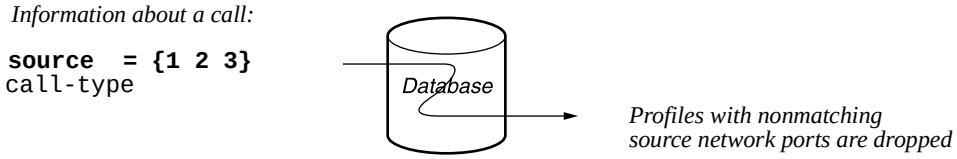

Figure 17-8. Comparing the source channel to call-route entries

The default preferred-source address { 0 0 0 } matches all calls.

Routing-type comparisons

For all profiles that remain as possible route destinations after the preceding comparison passes, the MAX TNT compares the type of the incoming call to the Call-Route-Type setting in its call-routing database.

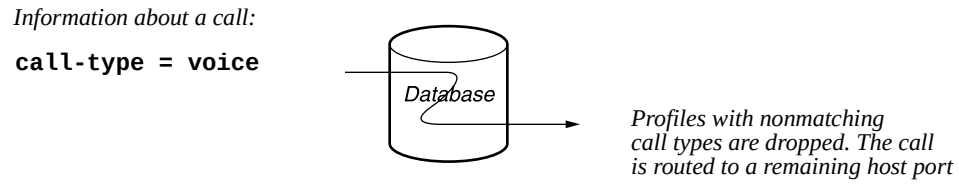

Figure 17-9. Comparing the call type to call-route entries

Call type is information that the MAX TNT can detect about any call it receives. The information might indicate the bearer capability of the call, or it might be related to characteristics of the calling device. For example, analog modems place voice-service calls. ISDN modems and Ascend ISDN devices generally place data-service (digital) calls, but in some cases can place data-over-voice calls.

The MAX TNT excludes all profiles whose routing type does not match the characteristics of the calling device or the bearer capability of the call. For example, if the incoming call uses voice service, all profiles that specify digital-call-type are removed from consideration. Only profiles that specify voice-call-type or any-call-type remain in the list.

Note: For T1 lines that use inband signaling, bearer-capability is not known. All calls that terminate on a T1 and use inband signaling are assumed to be digital calls unless the T1 profile sets the default call-type to voice.

Setting global call-management options

The System profile contains several system-wide settings that affect aspects of how the MAX TNT manages calls. The following example shows the related parameters:

```
name = ""
system-rmt-mgmt = yes
use-trunk-groups = no
idle-logout = 0
parallel-dialing = 2
single-file-incoming = yes
analog-encoding = u-law
sessionid-base = 0
t-online = no
t-online-most-avail-chan = no
call-routing-sort-method = item-first
digital-call-routing-sort-method = slot-first
shelf-controller-type = standalone
master-shelf-controller = 1
perm-conn-upd-mode = all
```

Working with Call-Route profiles

The default Call-Route profiles are just starting points, representing the unit's best guesses about how you want to configure things. You can modify or delete the default profiles, and you can create any number of Call-Route profiles to specify exactly how calls are routed within the system.

Each destination can be associated with several call routes, so it is important to understand how the system sorts through the information it has about a call and matches that information to the best-match Call-Route profile.

Following are the Call-Route parameters:

```
CALL-ROUTE
   index* = { { { any-shelf any-slot 0 } 0 } 0 }
   trunk-group = 0
   phone-number = ""
   preferred-source = { { any-shelf any-slot 0 } 0 }
   call-route-type = any-call-type
```

(For details about each parameter, see the *MAX TNT Reference Guide*.)

Understanding the Call-Route parameters

This section provides basic information about the parameters in a Call-Route profile. For more detail, see "How the MAX TNT matches the call to a Call-Route profile" on page 17-6.

Index

The Index field, which identifies the profile, contains the address of the device that is to receive the calls whose call information matches the profile.

The Index field also contains an entry number in the following format:

{{{*shelf slot port*} *logical-item* } *entry* }

A zero in any field matches any value of the corresponding type.

If you have only one Call-Route profile for the specified address, leave the entry number zero. When you specify the same address in more than one Call-Route profile, you must assign a nonzero entry number to distinguish the entries from one another in the database. You can assign any number, as long as it is unique for each entry. The entry numbers do not have to be sequential.

Trunk-Group

The Trunk-Group value is the trunk-group number, if any, associated with the device. That is, calls received on the specified trunk group are to be routed to the device at the address in the Index field.

Phone-Number

The Phone-Number value is the number on which the MAX TNT answers the call, as received from the calling switch. Calls that come in on this number are to be routed to the address in the index field. For ISDN service, the phone number may contain a subaddress. Incoming calls can include a subaddress number as part of the phone number. For example, the caller would dial 510-555-1212,3 where 3 is the subaddress number. If you specify a subaddress as part of the phone number, it makes the phone number much more specific. Only calls that specify that subaddress will match this parameter.

Preferred-Sourcel

The Preferred-Source value is the address of a network port, such as a T1 or E1 channel. Calls received at the specified channel are to be routed to the address in the Index field.

Call-Route-Type

Call-Route-Type specifies the type of call. Calls of the specified type are to be routed to address in the Index field. You have the following choices:

- Any-Call-Type
- Voice-Call-Type (Voice bearer calls, not including 3.1 Khz audio)
- Digital-Call-Type (Enables routing of general digital calls, including 3.1 Khz audio bearer channel calls, to a host device. 3.1 Khz audio calls are voice-bearer as far as the MAX TNT is concerned, and are routed to a modem, not an HDLC controller.
- Trunk-Call-Type (Trunk calls). See Trunk-Call-Type for routing calls to trunk devices.

Example of call-routing configuration

The profile in this example routes calls to modem #8 on a digital modem card installed in slot 7. To identify the calls to route to the modem, the profile specifies the phone number on which the calls are received and the type of call.

```
admin> new call-route
CALL-ROUTE/{ { { shelf-1 any-slot 0 } 0 } 0 } read

admin> list
index* = { { { shelf-1 any-slot 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { any-shelf any-slot 0 } 0 }
call-route-type = any-call-type

admin> set index = {{{1 7 1} 8 } 0}

admin> set phone = 1212

admin> set call-route = voice-call-type

admin> write
CALL-ROUTE/{ { { shelf-1 slot-7 1 } 8 } 0 } written
```

Working with the call-routing database

When the system resets, the MAX TNT creates its call-routing database by sorting the list of all installed devices. (During active use, the sort order depends on system activity, but the initial sort determines the order in which the MAX TNT first uses host channels.)

To specify the initial order in which the MAX TNT sorts device addresses, you set the Call-Routing-Sort-Method parameter (for analog calls) or the Digital-Call-Routing-Sort-Method parameter (for digital calls) in the System profile. Both parameters have the same options, Slot-First and Item-First.

Sorting calls by slot

The Slot-First setting causes all channels of a modem or HDLC card (including MP or MPP calls) to be grouped together. This forces a single card to be completely full before the MAX TNT starts using another card. With this option, the MAX TNT sorts in the following order:

shelf, slot, item, logical-item

Slot-First is the default for the Digital-Call-Routing-Sort-Method parameter. This setting improves system performance for MP or MP+ calls by concentrating the channels of a call on one HDLC card. (Distributing calls across cards for bundled channels creates extra processing overhead.)

Sorting calls by item

The Item-First setting causes the channels of different modem and HDLC cards to be interspersed, which provides more load balancing across all cards even after a system reset. With this option, the MAX TNT sorts in the following order:

item, shelf, slot, logical-item

Item-First is the default for the Call-Routing-Sort-Method parameter, which means that analog calls are distributed evenly across multiple host cards.

Example of a Call-Route profile

This example shows how to create Call-Route profiles that route calls received on a configured T1 line to a digital modem:

1 Use the Show command to verify that both the T1 and modem cards are up:

```
admin> show
Shelf 1 ( standalone ):
    { shelf-1 slot-1 0 }       UP       8t1-card
    { shelf-1 slot-2 0 }       UP       48modem-card
    { shelf-1 slot-3 }         OCCUPIED
    { shelf-1 slot-4 0 }       UP       48modem-card
    { shelf-1 slot-5 }         OCCUPIED
    { shelf-1 slot-15 0 }      UP       4/1ether-card
```

```
    { shelf-1 slot-16 0 }      UP       hdlc2-card
```

If the modem card is still in POST state (it takes 90-120 seconds to come up), wait for it to come up before you proceed.

2 Display a list of the Call-Route profiles:

```
admin> dir call-route
     9  08/29/1996 15:04:33  { { { any-shelf any-slot 0 } 0 } 0 }
    13  08/29/1996 15:04:42  { { { shelf-1 slot-3 0 } 0 } 0 }
    17  09/03/1996 11:22:09  { { { shelf-1 slot-12 2 } 0 } 0 }
    13  09/11/1996 12:54:53  { { { shelf-1 slot-13 0 } 0 } 0 }
    13  09/19/1996 10:03:28  { { { shelf-1 slot-15 0 } 0 } 0 }
    13  09/19/1996 11:00:14  { { { shelf-1 slot-16 0 } 0 } 0 }
    13  09/19/1996 11:07:58  { { { shelf-1 slot-14 0 } 0 } 0 }
    13  09/24/1996 11:20:30  { { { shelf-1 slot-11 0 } 0 } 0 }
    25  09/24/1996 14:35:12  { { { shelf-1 slot-3 1 } 1 } 0 }
    13  09/24/1996 18:31:24  { { { shelf-1 slot-12 0 } 0 } 0 }
```

3 Display the contents of the system default Call-Route profile:

```
admin> get call-route {{{0 0 0}0}0}
index* = { { { any-shelf any-slot 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { any-shelf any-slot 0 } 0 }
call-route-type = any-call-type
```

4 Display the call-routing database for host ports:

```
admin> callroute -ah

  device     #  source        type          tg sa phone
 1:12:01/0   0 0:00:00/0  voice-call-type    0  0
 1:12:02/0   0 0:00:00/0  voice-call-type    0  0
 ...
```

The display includes each modem that passed POST.

5 Create a new call-routing entry for the second modem on the modem slot card, and add a phone number.

```
admin> new call-route
CALL-ROUTE/{ { { shelf-1 any-slot 0 } 0 } 0 } read

admin> set index = {{{1 12 2 }0}0}

admin> set phone = 4812

admin> write
CALL-ROUTE/{ { { shelf-1 slot-12 2 } 0 } 0 } written
```

6 Display the call-routing database:

```
admin> callroute -ah

 device     #  source        type          tg sa phone
 1:12:02/0   0 0:00:00/0  any-call-type      0  0 4812
 1:12:01/0   0 0:00:00/0  voice-call-type    0  0
 ...
```

The new entry is more specific than the others because it has a phone number, so it is sorted to the top of the list. Notice that the general entry for modem 2 has been deleted,

because general entries for a device are not included when more specific call routing entries exist.

7 Recreate the general entry to route any voice call to modem 2, without removing the entry that specifies a phone number.

```
admin> new call-route
CALL-ROUTE/{ { { shelf-1 any-slot 0 } 0 } 0 } read

admin> set index = {{{1 12 2 }0}1}

admin> set call = any

admin> write
CALL-ROUTE/{ { { shelf-1 slot-12 2 } 0 } 1 } written
```

8 Display the call-routing database:

```
admin> callroute -ah

  device     #  source        type          tg sa phone
 1:12:02/0   0 0:00:00/0  any-call-type      0  0 4812
 1:12:01/0   0 0:00:00/0  voice-call-type    0  0
 ...
 1:12:48/0   0 0:00:00/0  voice-call-type    0  0
 1:12:02/0   1 0:00:00/0  any-call-type      0  0
```

Modem 2 is listed twice, as the first and last entry.

9 Modify the generic entry for slot 12 to specify `any-call-type` instead of `voice-call-type`. This allows incoming calls from a T1 line using robbed-bit signaling to be routed to these modems.

```
admin> read call-route {{{1 12 0}0}0}
CALL-ROUTE/{ { { shelf-1 slot-12 0 } 0 } 0 } read

admin> list
index* = { { { shelf-1 slot-12 0 } 0 } 0 }
trunk-group = 0
phone-number = ""
preferred-source = { { any-shelf any-slot 0 } 0 }
call-route-type = voice-call-type

admin> set call = any

admin> write
CALL-ROUTE/{ { { shelf-1 slot-12 0 } 0 } 0 } written
```

10 Display the call-routing database:

```
admin> callroute -a

  device     #  source        type          tg sa phone
 1:12:02/0   0 0:00:00/0  any-call-type      0  0 4812
 1:12:01/0   0 0:00:00/0  any-call-type      0  0
 1:12:02/0   1 0:00:00/0  any-call-type      0  0
 ...
```

All entries should have a Type of `any-call-type` and modem 2 should appear in the list twice.

(For details about each parameter, see the *MAX TNT Reference Guide*.)

Ascend SS7 Gateway (ASG)

18

This chapter covers the following topics:

The ASG interface to the MAX TNT is a system extension, which may or may not be enabled on your system. Check the Base profile settings to verify whether a particular feature is enabled.

Signaling System 7 (SS7) is an internationally standardized general-purpose common-channel signaling system designed for use over a variety of digital circuit-switched networks. At the physical layer, it uses T1/T3 or E1/E3 for data traffic and separate TDM circuits for signaling information.

Overview of the Ascend SS7 Gateway (ASG) solution

In its initial release, the ASG is designed to decrease the congestion on the Public Switched Telephone Network (PSTN) caused by users connecting to the Internet. Figure 18-1 illustrates the Ascend SS7 Carrier Signaling solution, which combines the ASG and MAX TNT remote access concentrators.

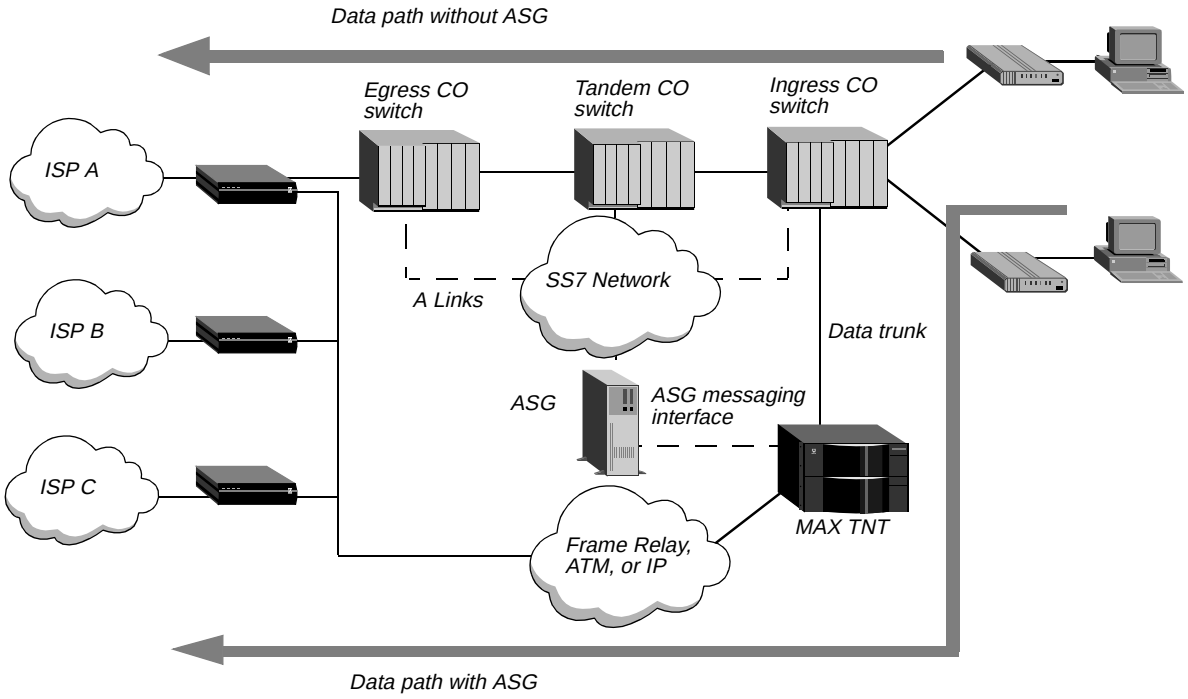

Figure 18-1. The Ascend ASG implementation

The MAX TNT is connected to the ingress central office (CO) switch via InterMachine Trunks (IMTs) and to the ASG by means of dual-link (primary/secondary) TCP/IP links. The ASG is connected to the SS7 network by A (access) links. The ASG and the MAX TNT together act as a switch that routes calls intended for ISPs directly to the MAX TNT, thus avoiding the PSTN tandem or transit switches and interoffice trunks.

SS7 interface between the ASG and the MAX TNT

TCP/IP is the transport service used to carry control messages between the ASG and the MAX TNT. The Ascend Call Protocol Transport (CPT) uses a TCP/IP socket on both the ASG and MAX TNT.

The ASG side CPT is the server, which listens for the socket connection and keeps track of the mapping between a MAX TNT unit and its socket. The MAX TNT side CPT is the client, which initiates a socket connection and handles connection establishment, connection recovery, and link selection.

Incoming calls

In Figure 18-1 the ingress CO switch processes the incoming call based on the called number, then identifies the MAX TNT as the destination for the call. The SS7 network sends an Initial Address Message (IAM) to the ASG. The ASG informs the TNT that a call will be coming in on one of the IMT channels from the CO switch. The message from the CO switch contains the calling and called party number, the Circuit Identification Code (CIC), and the Destination

Point Code (DPC). The ASG sends an Address Complete Message (ACM) to the SS7 network acknowledging that it has received the relevant information to route the call.

The ASG then sends a setup message and the CIC code to the MAX TNT to establish a path between the ingress switch and the MAX TNT. The MAX TNT sets up the path and then sends a connect message to ASG, so ASG can make the proper updates to its resource management database. For a T1 network, the ASG then sends an Answer Message (ANM) to the SS7 network.

Once the path is set up, the MAX TNT accepts the call, off-loading the Internet call from the PSTN to the data network. The data network used to off-load the call could be a Frame Relay, ATM network, or an IP network.

Call continuity

Call continuity is a test performed at the time of call setup or during testing to check if the physical link between the CO switch and the MAX TNT is available. The CO switch informs the ASG, which then informs the TNT that it will conduct a continuity test on the circuit. During a call continuity test, the central office switch sends a tone down the physical path to the MAX TNT and receives a tone back from the MAX TNT indicating the continuity of the path.

Redundant links

You can set up redundant TCP/IP links between the MAX TNT and the ASG (Figure 18-2). If the primary link fails, the secondary link takes over. Once the secondary link is activated, it remains active until it fails, at which time the primary link is attempted again.

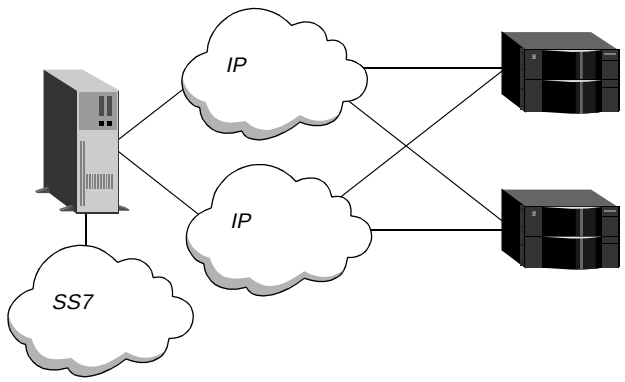

Figure 18-2. ASG redundant links

Note: For a redundant connection, each TCP/IP link must be on a separate subnet. You should also configure the links to use separate Ethernet card to provide a higher level of fault tolerance.

Configuring the MAX TNT to interoperate with the ASG

For every MAX TNT that interoperates with the ASG, you must configure the following:

- IP interface to the ASG.

- ASG messaging interface (SS7 profile).
- T1 line settings for SS7.
- Connection profiles for each call the MAX TNT answers (see the *MAX TNT Network Configuration Guide*).

Configuring an IP interface to the ASG

For information about configuring LAN and WAN IP interfaces, see the *MAX TNT Network Configuration Guide*. That guide also describes standard methods you can use to isolate the interface, such as making the route private or applying a route filter to the interface, to be certain that only the SS7 messages cross the link between the MAX TNT and the ASG.

Configuring the SS7 profile

The ASG and MAX TNT communicate over a TCP/IP link. The messaging interface can be a single or dual TCP connection between the MAX TNT and ASG. When the messaging interface initializes, it opens TCP connections to the specified addresses and ports of the ASG. The MAX TNT keeps the TCP connections open as long as the unit is up and the ASG messaging interface is enabled. Following are the parameters (shown with default settings) for configuring the messaging interface:

```
[in SS7-GATEWAY]
enabled = no
primary-ip-address = 0.0.0.0
primary-tcp-port = 0
secondary-ip-address = 0.0.0.0
secondary-tcp-port = 0
bay-id = ""
system-type = IASCTNT1B
device-id = 0
```

Parameter	Specifies
Enabled	Enables/disables the interface. When set to No (the default), the interface is disabled. When set to Yes, the interface is enabled if the Primary-IP-Address and Primary-TCP-Port also have valid values. Changing the setting from Yes to No closes the signaling links but does not disconnect active SS7 calls.
Primary-IP-Address Primary-TCP-Port	IP address and TCP port to use as the primary ASG interface. These settings are required to enable the messaging interface.
Secondary-IP-Address Secondary-TCP-Port	IP address and TCP port to use as the secondary ASG interface. Typically, the primary and secondary address and port configurations point to the two Ethernet interfaces of the ASG.
Bay-ID	Does not apply to the ASG.
System-Type	Does not apply to the ASG.
Device-ID	Must be set to 0 (zero) for use with the ASG.

The following commands configure the SS7 profile for a single TCP connection to the ASG:

```
admin> read ss7-gateway
SS7-GATEWAY read
admin> set enabled = yes
admin> set primary-ip-address = 10.168.8.130
admin> set primary-tcp-port = 5000
admin> set secondary-ip-address = 0.0.0.0
admin> set secondary-tcp-port = 0
admin> write
SS7-GATEWAY written
```

Note: For the link to become active, the ASG must have a matching entry for the MAX TNT. For information about configuring the ASG, see the documentation that came with the unit.

Configuring T1 lines as SS7 data trunks

To configure T1/E1 lines fort SS7, you must set the following parameters, shown with sample settings:

[in T1/{ shelf-1 slot-1 7 }:line-interface]
signaling-mode = ss7-data-trunk
incoming-call-handling = internal-processing

Parameter	Usage for SS7 data trunks
Signaling-Mode	Must be set to SS7-Data-Trunk. A line configured as an SS7 data trunk carries no signaling, so it provides 24 (T1) or 32 (E1) 64-kbps channels. When you specify SS7-Data-Trunk signaling, the line is registered with the ASG and the ASG takes control of the line, telling the MAX TNT when to bring calls up or down.
Incoming-Call-Handling	Must be set to Internal-Processing. Specifies how the MAX TNT processes incoming calls on this line.

Example of configuring a T3 profile

To configure lines of a T3 card as SS7 data trunks, you must first configure the T3 profile as in the following example:

```
admin> read t3 {1 1 1}
T3/{ shelf-1 slot-1 0 } read
admin> set enabled = yes
admin> set frame-type = m13
admin> set line-length = 0-225
admin> write
T3/{ shelf-1 slot-1 1 } written
```

After configuring the T3 line, configure the individual T1 lines that constitute the T3 line as explained in the next section.

Example of configuring a T1 data trunk

The following commands configure a T1 line as an SS7 data trunk, enabling the ASG to control the line:

```
admin> read t1 {1 1 7}
T1/{ shelf-1 slot-1 7 } read
admin> set line-interface enabled = yes
admin> set line-interface signaling-mode = ss7-data-trunk
admin> set line-interface incoming-call-handling = inter-
nal-processing
admin> write
T1/{ shelf-1 slot-1 7 } written
```

Line status indicators for SS7 data lines

Lines configured for SS7 are marked with a 7 in the Line Status window. In the following example, the MAX TNT has 8 T1 lines in shelf-1, slot 1, and all are configured for SS7:

```
 0 Connections, 0 Sessions  | TNT02 Status
                            |  Serial number: 1234567       Version: 7.0.0
                            |
                            |   Rx Pkt:      12520
                            |   Tx Pkt:      16549
                            |      Col:          7
                            |
                              | 11/03/1998  18:07:51   Up:    0 days, 05:14:38
                               ____________________________________________
                             | "T3 Tru+ 1/01/00 LA la  la  la  la  la  la  la
                              |         1/01/01 LA 7******** ******** --------
                              |         1/01/02 LA 7******** ***----- --------
                              |         1/01/03 LA 7-------- -------- --------
                              |         1/01/04 LA 7******** *------- --------
                              |         1/01/05 LA 7-------- -------- --------
                              |         1/01/06 LA 7******** -------- --------
                              |         1/01/07 LA 7---***-- ****---- --------
 [ Next/Last Line: <up/dn arw>, Next/Last Page: <pg up/dn>, Exit: <esc> ]
```

Each line is identified by its interface address in shelf/slot/line format, and reports a two-character code indicating the line's link status, a single-character code indicating channel status (for an SS7 data trunk, this character code is always 7), and a single-character code indicating channel status.

Following are the link-status codes:

Link-status code	Description
LA (link active)	The line is active and physically connected
LS (UDS3 lines)	Loss of Signal. No signal has been detected.

Link-status code	Description
LF (UDS3 lines)	Loss of Frame. A signal is present but is not valid for framing.
NT	The E1 line is active and configured as network-side equipment.
TE	The E1 line is active and configured as user-side equipment.
RA (red alarm)	The line is unconnected, improperly configured, experiencing a very high error rate, experiencing a loss-of-receive-signal, or is not supplying adequate synchronization.
YA (yellow alarm)	The MAX TNT is receiving a Yellow Alarm pattern, an indication that the other end of the line cannot recognize the signals the MAX TNT is transmitting.
DF (d-channel fail)	The D channel for a PRI line is not currently communicating.
1S (all ones)	A keep-alive (also known as a Blue Alarm) signal is being sent from the PRI network to the MAX TNT to indicate that the line is currently inoperative.
ID (idle—DS3 only)	The DS3 interface has detected an Idle Signal transmitted from the other side. This generally indicates that the line is provisioned but is not in use.
WF (wrong framing—DS3 only)	The DS3 interface has detected that the other side is using a framing format that differs from the one the local DS3 interface is configured for (C-bit-parity or M13).

Following are the channel-status codes:

Channel-status code	Description
.	The channel is not available because the line is disabled, has no physical link, does not exist, or because the channel configuration specifies that it is unused. On E1 lines, this can also mean that the channel is reserved for framing.
*	The channel is connected in a current call.
-	The channel is currently idle (but in service).
b	The channel is a backup NFAS D channel (T1 PRI only).
c	The channel is currently not available because it is in the process of clearing the most recent call, or because it is in the process of sending echo cancellation tones to receive a call (inband signaling on T1 only).
d	The MAX TNT is dialing from this channel for an outgoing call.
r	The channel is ringing for an incoming call.
m	The channel is in maintenance/backup mode. This state is applicable to SS7-data and PRI trunks.
n	The channel is nailed.

Channel-status code	Description
o	The channel is out of service. This state is applicable to SS7-data and PRI trunks.
s	The channel is an active D channel (ISDN only).

For complete details about the Line Status window, see the *MAX TNT Reference Guide*.

Provisioning the Switch

A

This appendix provides the information necessary for properly provisioning a switch for T1/EI or T1/E1 PRI access to the WAN. It contains the following sections:

Provisioning the switch for T1 access

If you use an inband signaling line, the T1 circuit at the Point-of-Presence (POP) must support the translations listed in Table A-1 for compatibility with the MAX TNT.

Table A-1. T1 access provisioning information

Translation	Optional or required
Two-state DTMF (Dual-Tone Multifrequency) dialing	Required for outdial.
Outgoing wink start	Required for outdial.
Incoming immediate seizure	Optional for a switch.
Incoming wink start	Optional for a switch.
Incoming digits suppressed	Required.
Answer supervision	Required.
Switched data	Required. No voice/digital loss plan is allowed.

Four-state A-bit signaling, four-state B-bit signaling, and pulse dialing are not supported.

What you need from your T1 service provider

Request the following information about your T1 interface from your WAN provider:

- Type of signaling (inband or ISDN D-channel)

- Type of line encoding (B8ZS or AMI)
- Type of framing (ESF or D4)
- Each phone number assigned to the line, on a channel-by-channel or service-by-service basis
- Number of nailed-up channels, if any
- Number of unused channels, if any
- Types of call-by-call services (also called NSF identifiers) on the switched channels
- Type of line provisioning (B channel, H0 channel, H11 channel, or multirate)
- D-channel assignment
- NFAS ID number (if the T1 PRI line is provisioned for NFAS)

Also, keep in mind the following points:

- In general, ESF framing and B8ZS line encoding are both recommended for T1 applications. In addition, channel 24 must be the D channel, except for applications using Network Facility Associated Signaling (NFAS).
- Applications that require NFAS must be connected to an AT&T or Northern Telecom switch provisioned with NFAS.
- The MAX TNT can receive multichannel calls using MP encapsulation only if all channels of the call share a common phone number (namely, a hunt group). You can request that your service provider supply you with a hunt group.

What you need from your E1 service provider

Request the following information about your E1 interface from your WAN provider:

- The phone numbers assigned to your E1 interface, channel-by-channel
- Nailed-up channels (also called private WAN), if any
- Unused channels, if any
- Switch type (or emulation)—DPNSS only
- Switch layers 2 and 3 configuration—DASS 2 and DPNSS only (A/B end, X/Y end)
- Rate adaption protocol—DASS 2 and DPNSS only (X.30)

Note: The MAX TNT can receive multichannel calls using MP encapsulation only if all channels of the call share a common phone number (namely, a hunt group). You can request that your service provider supply you with a hunt group.

Configuring the ADSL Voice Splitter

B

This appendix covers following topics:

Introduction

Because the majority of homes have only a single two-wire connection between the telephone company's central office, and that pair is already in use for voice services, finding a way to integrate voice and data services over that existing single pair of wires is the obvious way to maintain cost-effective service.

The MultiDSL voice splitter solution works in conjunction with Ascend DSLPipes to integrate Plain Old Telephone Service (POTS) with ADSL data. The MultiDSL voice splitter consists of the following components:

- The DSLVSP—a standalone splitter for the customer premises side
- The DSLVSO—a rack-mountable version for the central office

ADSL operates in the 26 KHz to 1.2 MHz frequency spectrum. Voice calls operate between 300 Hz and 3,400 Hz. Because these frequency spectrums do not overlap, ADSL can integrate data and voice onto a single pair of wires. ADSL voice splitters simply filter out the ADSL data frequency and permit only the voice frequencies to reach the voice (PSTN) switch at the central office.

Figure B-1 shows a sample central office ADSL voice splitter setup.

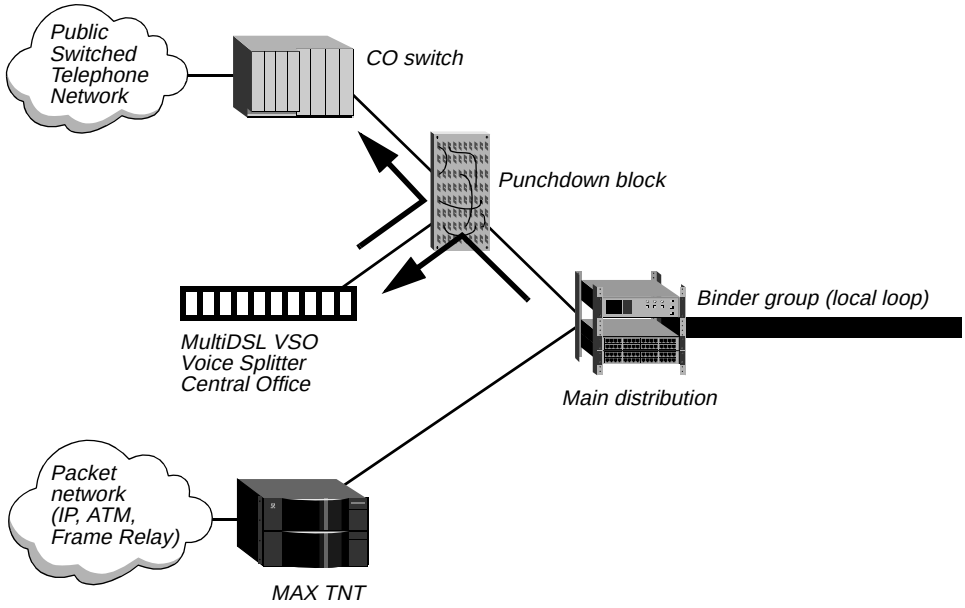

Figure B-1. Example of central office ADSL voice splitter set up

The connection between the MAX TNT unit's ADSL line card and the main distribution frame does not require a voice splitter at the central office, because the ADSL line card ignores the voice-frequency spectrum and uses only the data spectrum.

DSLVSP for customer premises

The customer premises end of the voice splitter, the DSLVSP (Figure B-2), is installed at the demarcation point where the telephone company's local loop ends and the inside wiring for telephones begins. Note that the DSLVSP for the customer premise is only available with the DSLPipe-C.

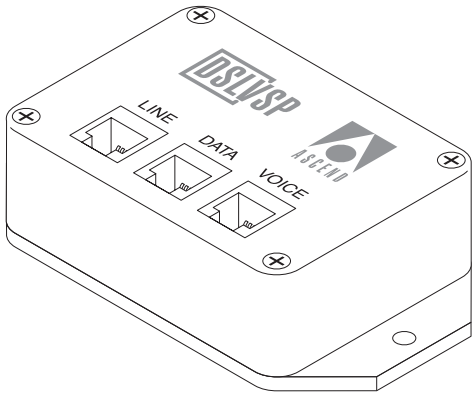

Figure B-2. DSLVSP

DSLVSO for the central office

The DSLVSO central office voice splitter (Figure B-3) consists of a rack and up to 24 voice splitter modules per rack.

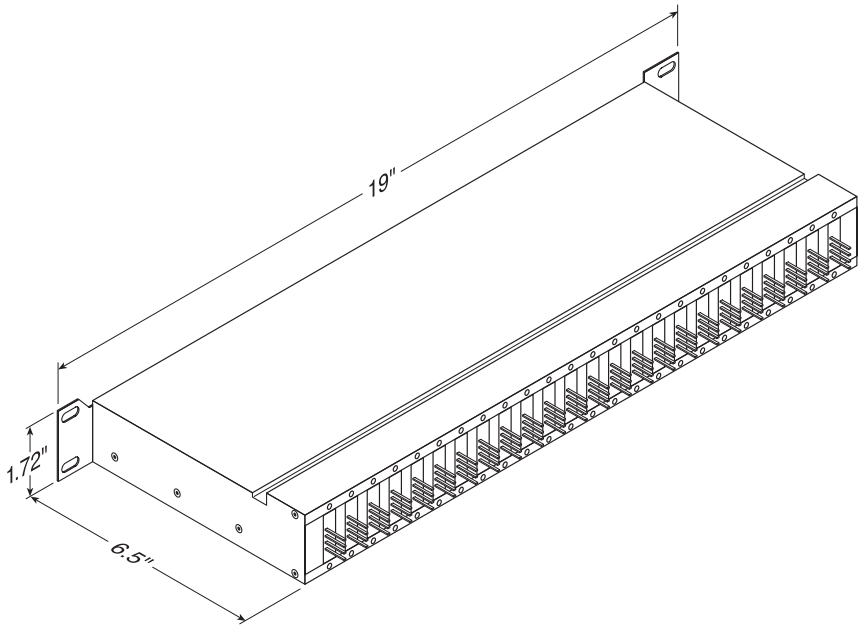

Figure B-3. DSLVSO dimensions

The rear of the rack contains pins for wiring up to 48 pairs of wires to a punch block. Of the 48 pairs, 24 are used for the incoming signals from the main distribution frame. The other 24 pairs of wires are for connecting to the central office voice switch. Figure B-4 illustrates the pins.

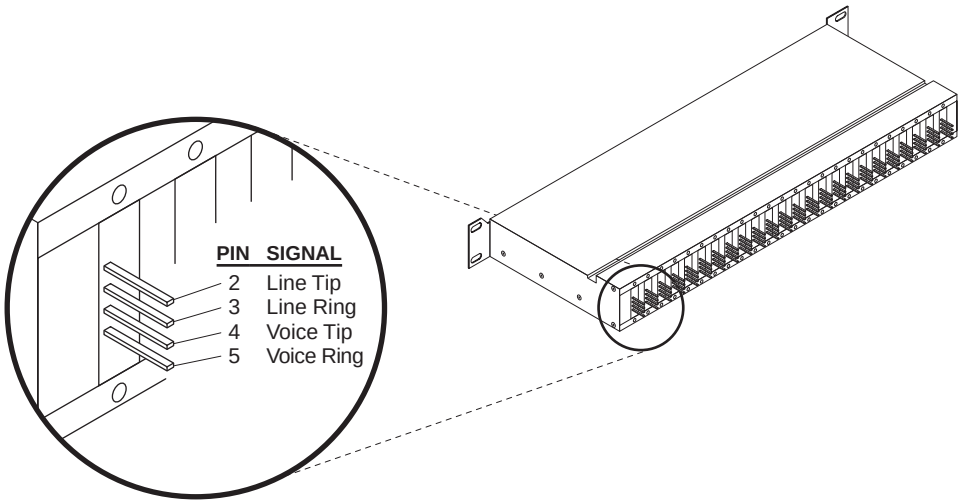

Figure B-4. DSLVSO rack pins

Installing the DSLVSP

The DSLVSP has three RJ-11 connectors, each of which use pins 3 and 4:

- The connector labeled Line connects to the line providing the local loop to the central office.
- The connector labeled Voice connects to the telephone wires within the residence, which normally extend to every room for a phone connection.
- The connector labeled Data connects to the second pair of wires, which connects to the Ascend DSLPipe-C customer premises ADSL equipment for the data connection.

Figure B-5 illustrates a typical wiring setup.

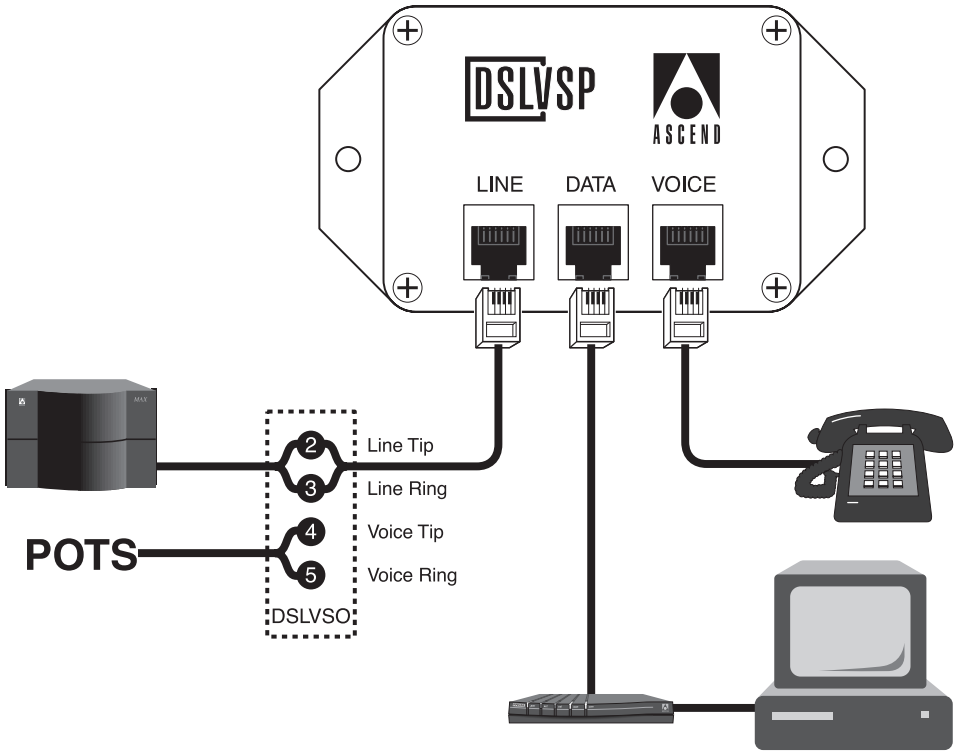

Figure B-5. Example of ADSL voice splitter wiring

Specifications

The ADSL voice splitter specifications are as follows:

Voice port impedance	600 ohms (US) 900 ohms (International)
Line port impendance	600 ohms (US) 900 ohms (International)
Low pass frequency	8 KHz (US) 20 KHz (International)
Maximum loop current	100 mA (US) 100 mA (International)

The DSLVSO has a low pass frequency of 8 KHZ (US) or 20 KHz (International).

MAX TNT General Specifications

C

This appendix presents the general specifications for the MAX TNT. See Appendix D, "MAX TNT Cabling and Connector Specifications," for cabling requirements and connector specifications.

Battery

The MAX TNT shelf controller contains an internal 3V lithium battery. The normal operating life of this battery exceeds five years.

Only trained engineers authorized by Ascend should open the MAX TNT shelf controller for testing, maintenance, installation, or any other purpose. Furthermore, only trained engineers should replace MAX TNT components.

Warning: The battery can explode if incorrectly replaced. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

ATTENTION: IL Y A DANGER D'EXPLOSION S'IL Y A REMPLACEMENT INCORRECT DE LA BATTERIE. REMPLACER UNIQUEMENT AVEC UNE BATTERIE DU MÉME TYPE OU D'UN TYPE RECOMMANDEÉ PAR LE CONSTRUCTEUR. METTRE AU RÉBUT LES BATTERIES USAGÉES CONFORMÉMENT AUX INSTRUCTIONS DU FABRICANT.

Power requirements

Table C-1 lists the MAX TNT source-power requirements.

Table C-1. MAX TNT source-power requirements

Element	Value
Voltage	90–240 VAC; -40 to -60DC
Phase	Single
Frequency	47–63 Hz
Power	200W (nominal)–1200W (maximum)
AC Fuse (5 x 20 mm)	16 Amps
DC Fuse (0.25 x 1.25 inches)	25 Amps

Table C-1. MAX TNT source-power requirements (continued)

Element	Value
Maximum AC current	16 Amps at 115 VAC. At power up, for approximately 0.1 seconds, the MAX TNT power supply has an in-rush current of approximately 260 Amps at 240 VAC or 130 Amps at 115 VAC.
Maximum DC current	25 Amps

Note that the maximum allowable delay between a power cutoff and supplying power from a second source is 20 msec (0.020 seconds).

The MAX TNT configuration profiles are stored in NVRAM. They are not lost when the MAX TNT is turned off.

Note: Use a protected AC power source, or add surge protection between the power source and the MAX TNT.

Environmental requirements

For best results, you should house the MAX TNT in a room with constant temperature and humidity. In general, cooler environments are better. Humidity should be high enough to prevent accumulation of static electricity, but low enough to prevent condensation.

An operating temperature of 32° to 104° Fahrenheit (0° to 40° Celsius) is recommended. Storage temperatures of -40° to 176° Fahrenheit (-71.4° to 80° Celsius) are acceptable.

An operating relative humidity of up to 90% is acceptable.

You can operate the MAX TNT at altitudes of 0 to 14800 ft. (0-4500 m).

The MAX TNT base system (empty with no power supplies) weighs 27.2 lbs (12.34 kg). A fully loaded system with 672 modems (single power supply) weighs 130 lbs (58.97 kg). The MAX TNT has the following dimensions: 14" x 17.4" x 11.5" (35.6 cm x 44.2 cm x 29.2 cm).

Alarm-relay operating specifications

The MAX TNT is equipped with an alarm relay whose contacts are brought out onto the back panel's alarm-relay terminal block. The alarm-relay contacts open during loss of power, during hardware failure, or whenever the MAX TNT is being reset, such as during its power-on self test. During normal operation, the alarm-relay contacts remain closed.

The gauge of the wire wire you use to connect to the MAX TNT alarm relay should be based on the current flow of the circuit that the relay is attached to and the capacity of the alarm relay. Because the MAX TNT alarm relay can carry a maximum of 2 amps, 18–20 AWG wire is adequate.

The alarm relay has the following characteristics:

- Normally closed

- 1 Amp at 30 VDC
- 0.3 Amp at 110 VDC
- 0.3 Amp at 125 VAC

MAX TNT Cabling and Connector Specifications

D

This appendix describes specifications for different facets of the MAX TNT, and discusses cabling requirements. It consists of the following sections:

Serial port specification

The serial port uses a standard DE-9 female connector that conforms to the EIA RS-232 standard for serial interfaces. All MAX TNT models use the RS-232 pinouts listed in Table D-1.

Table D-1. Serial port and cabling pinouts

DE-9 pin number	RS-232 signal name	Function	I/O
1	DCD	Data Carrier Detect	O
2	RD	Serial Receive Data	O
3	SD	Serial Transmit Data	I
4	DTR	Data Terminal Ready	I
5	GND	Signal Ground	
6	DSR	Data Set Ready	O
7	RTS	Request to Send	I
8	CTS	Clear to Send	O

Table D-1. Serial port and cabling pinouts (continued)

DE-9 pin number	RS-232 signal name	Function	I/O
*9	*RI	*Ring Indicator	*O

*Pin 9 is not active (Ring Indication signal not supplied).

Ethernet interface specifications

The MAX TNT Ethernet interfaces support the physical specifications of IEEE l802.3 with Ethernet 2 (Ethernet/DIX) framing. It can support any one of the following Ethernet types:

- Coax (Coaxial): Thin Ethernet and IEEE 802.3 (10Base-2) with a BNC connector.

  Note: The MAX TNT is not equipped with a coax Ethernet interface.
- 10Base-T (Unshielded Twisted Pair): Twisted pair Ethernet and IEEE 802.3 (10Base-T) with an RJ-45 connector.
- 100Base-T (Unshielded Twisted Pair): Twisted pair Ethernet and IEEE 802.3u (100Base-T) with an RJ-45 connector.
- AUI (Attachment Unit Interface): Standard Ethernet and IEEE (10Base-5) with a 15-pin AUI connector.

Required equipment

To install the Ethernet interface, you must have the equipment described in the sections below.

Coax

For a coax connection, you need a BNC T-connector. If your connection is at the end of a cable segment, you need a 50-ohm terminator as well.

To install, attach a LAN BNC T-connector to the BNC port on the back of the MAX TNT. Use a standard 10Base-250-ohm cable, such as RG-58 A/U or RG-58 C/U.

Caution: Breaking the LAN's continuity, by inserting a cable segment or removing either of the 50-ohm terminations, disrupts and disables the Ethernet.

10Base-T/100Base-T

For a 10Base-T or 100Base-T connection, you need a twisted-pair Ethernet cable terminated with RJ-45 modular jacks.

Use an EIA/TIA 568 or IEEE 802.3 10Base-T cable. Some installations require a crossover cable (for example, when connecting directly to the Ethernet port of a PC).

AUI

For an AUI interface, you need the appropriate transceiver and transceiver cable.

T1/PRI interface specifications

This section provides the specifications for the MAX TNT T1/PRI interface and covers cabling requirements.

Warning: To reduce the risk of fire, communication cable conductors must be 26 AWG or larger.

Warning: Afin de reduire les risques d'incendie, les fils conducteurs du cable de communication doivent etre d'un calibre minimum de 26 AWG (American Wire Gauge), cest-a-dire d'un minimum de 0,404 mm.

T1/PRI CSU requirements

Your T1/PRI requirements depend on whether a T1/PRI port on the MAX TNT is equipped with an internal Channel Service Unit (CSU).

Port with internal CSU

If a T1/PRI port on the MAX TNT has an internal CSU, you can connect the port directly to the metallic interface of the WAN. To avoid harming the WAN, you must contact your carrier for approval before installation. Once you install the MAX TNT, you must notify the carrier before disconnecting the MAX TNT from the WAN. If you disconnect or turn off the MAX TNT without prior notification, the carrier might temporarily discontinue your T1/PRI service.

MAX TNT internal CSUs are compatible with wet- and dry-loop T1/PRI lines and with span-powered or wet-loop powered T1/PRI lines.

Port without internal CSU

A T1/PRI port of the MAX TNT that does not have an internal CSU cannot connect directly to the WAN. You must connect the port to other equipment that provides the interface to the WAN (for example, an external CSU). Your carrier determines the correct value for the line buildout setting of the CSU. You configure this parameter during installation. (For more information, see the *MAX TNT Reference Guide*.)

Table D-2 lists CSU specifications.

Table D-2. CSU specifications

Information	Value
CSU Registration	2CZUSA-74421-DE-N
Critical Circuitry Power Source	Dry Loop from local AC power source
Line Capture Frequency	1.544 Mb/s +/- 200 b/s
Line Code	AMI or B8ZS

Table D-2. CSU specifications (continued)

Information	Value
Line Framing	D4 or ESF
Line Input/Output Impedance	100 ohms +/- 5%
Received Signal Level Range	DSX-1 level to -36 DB
Transmitted Signal Level	DSX-1 level into 100 ohms
Line Buildout	0.0, -7.5, -15.0, or -22.5 DB
Pulse Density and Consecutive Zeros Enforcement	In accordance with requirements of AT&T Pub 62411
Line Loopback (LLB) Set Inband Code	(10000) repeating binary pattern
Line Loopback (LLB) Reset Inband Code	(100) repeating binary pattern

T1/PRI cable specifications

The maximum cable distance between the T1/PRI WAN interface equipment and a MAX TNT without CSUs should not exceed 655 feet (200 m). Measure the line length and record it when you install the MAX TNT. You must specify this length when you configure the parameters in the line's profile. (For more information, see the *MAX TNT Reference Guide*.)

Use only cables specifically constructed for transmission of T1/PRI signals. The cables should meet standard T1 attenuation and transmission requirements. The following specifications are recommended:

- 100 ohm
- Two twisted pairs, Category 3 or better

The WAN interface cables and plugs described in the following sections are available for the MAX TNT WAN interfaces.

T1/PRI crossover cable: RJ-48C/RJ-48C

Install the RJ-48C/RJ-48C cable when the WAN transmits on pins 5 and 4 and receives on pins 2 and 1. Figure D-1 and Table D-3 show the pinouts.

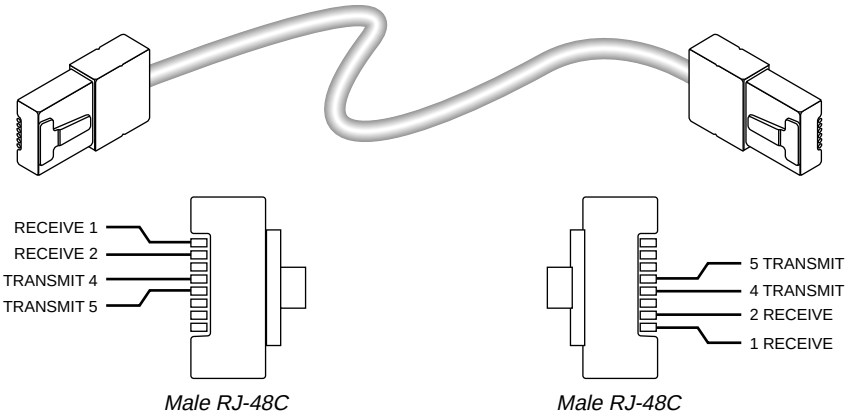

Figure D-1. RJ-48C/RJ-48C crossover cable.

Table D-3.RJ-48C/RJ-48C crossover cable specifications

Pair #	Signal	Male RJ-48C	Male RJ-48C
1	Receive	2 1	5 4
2	Transmit	5 4	2 1

T1/PRI straight-through cable: RJ-48C/RJ-48C

Before installing the RJ-48C/RJ-48C straight-through cable, verify that the WAN transmits on pins 2 and 1 and receives on pins 5 and 4. Figure D-2 and Table D-4 show the pinouts.

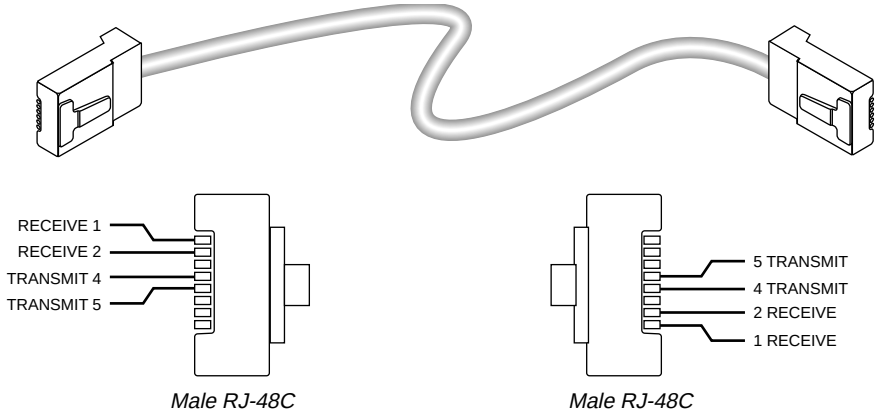

Figure D-2. RJ-48C/RJ-48C straight-through cable specifications

Table D-4.RJ-48C/RJ-48C straight-through cable specifications

Pair #	Signal	Male RJ-48C	Male RJ-48C
1	Receive	1 2	1 2
2	Transmit	5 4	5 4

T1/PRI straight-through cable: RJ-48C/DB-15

Before installing the RJ-48C/DB-15 straight-through cable, verify that the WAN transmits on pins 3 and 11 and receives on pins 1 and 9. Figure D-3 and Table D-5 shows the pinouts.

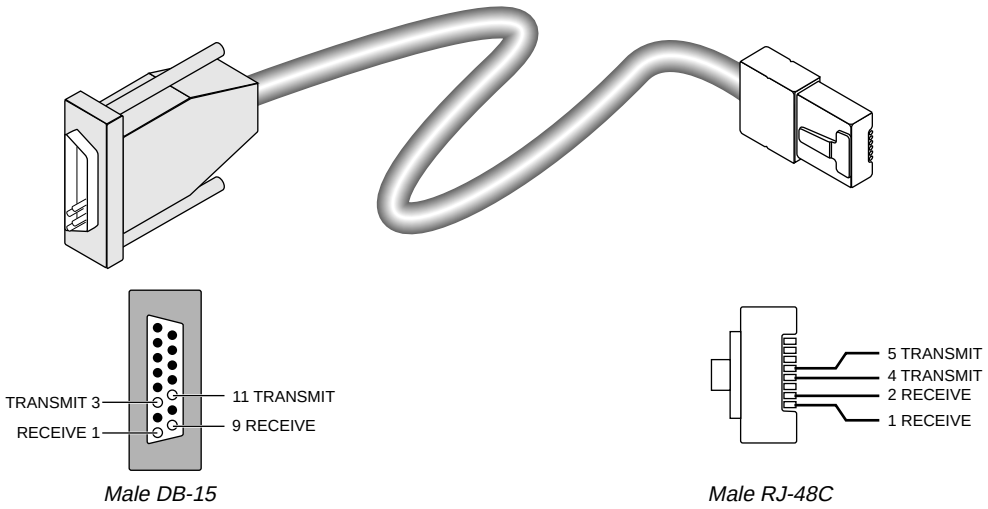

Figure D-3. RJ-48C/DB-15 straight-through cable

Table D-5.RJ-48C/DB-15 straight-through cable specifications

Pair #	Signal	Male RJ-48C	Male DB-15
1	Receive	1 2	3 11
2	Transmit	5 4	1 9

T1/PRI crossover cable: RJ-48C/DB-15

Before installing the RJ-48C/DB-15 cable, verify that the WAN transmits on pins 1 and 9 and receives on pins 3 and 11. Figure D-4 and Table D-6 show the pinouts.

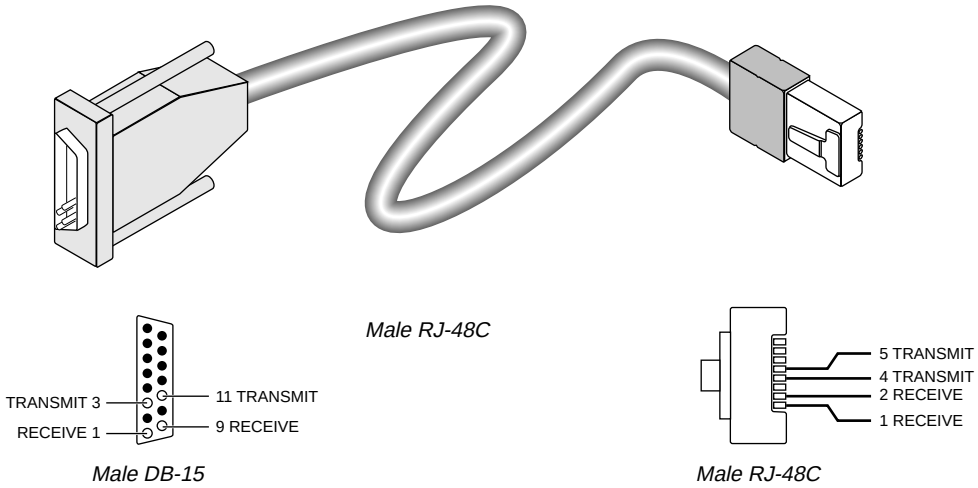

Figure D-4. RJ-48C/DB-15 crossover cable

Table D-6.RJ-48C/DB-15 crossover cable specifications

Pair #	Signal	Male RJ-48C	Male DB-15P
1	Receive	1 2	1 9
2	Transmit	5 4	3 11

T1/PRI straight-through cable: RJ-48C/Bantam

The WAN side of the RJ-48C/Bantam straight-through cable connects to dual bantam jacks. Figure D-5 and Table D-7 show the pinouts.

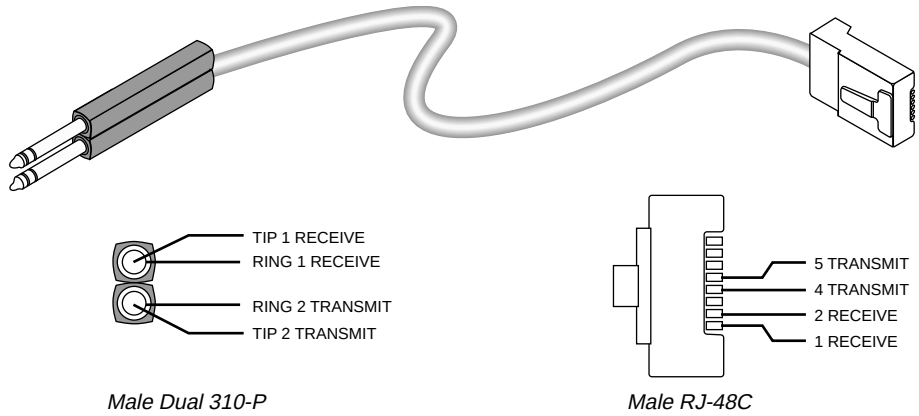

Figure D-5. RJ-48C/Bantam straight-through cable

Table D-7.RJ-48C/Bantam straight-through cable specifications

Pair #	Signal	Male RJ-48	Male Dual 310-P
1	Receive	1 2	Tip 1 Ring 1
2	Transmit	5 4	Tip 2 Ring 2

T1 RJ-48C-Loopback plug

The RJ-48C-Loopback plug loops the transmit signal back to the MAX TNT. Table D-8 shows the pinouts.

Table D-8. RJ-48C-Loopback plug specifications

Pair #	Signal	Male RJ-48C
1	Receive	1 (connects to 5) 2 (connects to 4)
2	Transmit	5 (connects to 1) 4 (connects to 2)

T1/PRI WAN connectors

Table D-9 lists the pins on the T1/PRI WAN port used for Transmit and Receive. The remaining pins are not connected.

Table D-9. Transmit and Receive pins

MAX TNT T1/PRI interface	RJ-48C DTE
Receive (input) pair, Tip (T1) Receive (input) pair, Ring (R1)	Position 2 Position 1
Transmit (output) pair, Tip (T) Transmit (output) pair, Ring (R)	Position 5 Position 4

WAN switched services available to the MAX TNT

The MAX TNT is compatible with both AT&T and Northern Telecom central office switches, and can access all T1/PRI switched digital services offered by AT&T's ACCUNET Switched Digital Services:

- MCI 56 Kkbps and 64 Kbps services
- Sprint Switched 56 Kbps and 64 Kbps services
- MultiRate and GloBanD (and GVPN in CCITT countries) PRI network services

Note: The MAX TNT can only access Switched-56 Kbps services on a T1 access line or a Switched-56 line.

For a listing of the compatible switch types, see the Switch Type parameter in the *MAX TNT Reference Guide*. In addition to connecting to switched circuits, the MAX TNT can connect to nailed-up circuits and to aggregate nailed-up and switched circuits.

Serial WAN cabling specifications

The MAX TNT unit's serial WAN interface supports nailed-up connections to the WAN. Data packets from the MAX TNT bridge/router module can use this interface, but bit streams from devices connected to the MAX TNT serial host ports cannot.

The MAX TNT serial WAN port is compatible with the following two electrical standards:

- V.35
- RS-449/422

In the cable wiring tables that follow, the MAX TNT is the Data Terminal Equipment (DTE) that connects to a Data Circuit-Terminating Equipment DCE) device through its serial WAN port. The MAX TNT receives the Send Timing and Receive Timing clocks from the DCE device.

V.35 cable to WAN

You can connect a V.35 cable to the V.35 port of a DCE device. The V.35 cable has the pinouts described in Table D-10.

Table D-10.V.35 cable pinouts

Pair #	Signal	MAX TNT male DB-44	Host male V.35
1	FGND RI	1 8	A J
2	SD+ SD-	39 40	P S
3	RD+ RD-	30 29	R T
4	ST+ ST-	41 42	Y AA
5	RT+ RT-	32 31	V X
6	TT+ TT-	38 37	U W
7	DTR DSR	6 11	H E
8	DCD SGND	9 25	F B
9	CTS RTS	7 36	D C

Table D-10.V.35 cable pinouts (continued)

Pair #	Signal	MAX TNT male DB-44	Host male V.35
Pair #	Signal	MAX TNT Male DB-44	Host Male V.35

RS-449 cable to WAN

You can connect an RS-449 cable to the RS-449 port of a DCE device. The RS-449 cable has the pinouts described in Table D-11.

Table D-11.RS-449 cable pinouts

Pair #	Signal	MAX TNT male DB-44	Host female DB-37
1	FGND RI	1 8	1 15
2	SD+ SD-	39 40	4 22
3	RD+ RD-	30 29	6 24
4	ST+ ST-	41 42	5 23
5	RT+ RT-	32 31	8 26
9	TT+ TT-	38 37	17 35
8	DTR DSR	6 11	12 11
6	DCD SGND	9 25	13 19, 20, 37*
7	CTS RTS	7 36	9 7

* Pin positions separated by commas are jumped to each other.

Ascend Serial WAN cable

Figure D-6 and Figure D-12 show the pinouts for the Ascend Serial WAN cable (2510-0260-002).

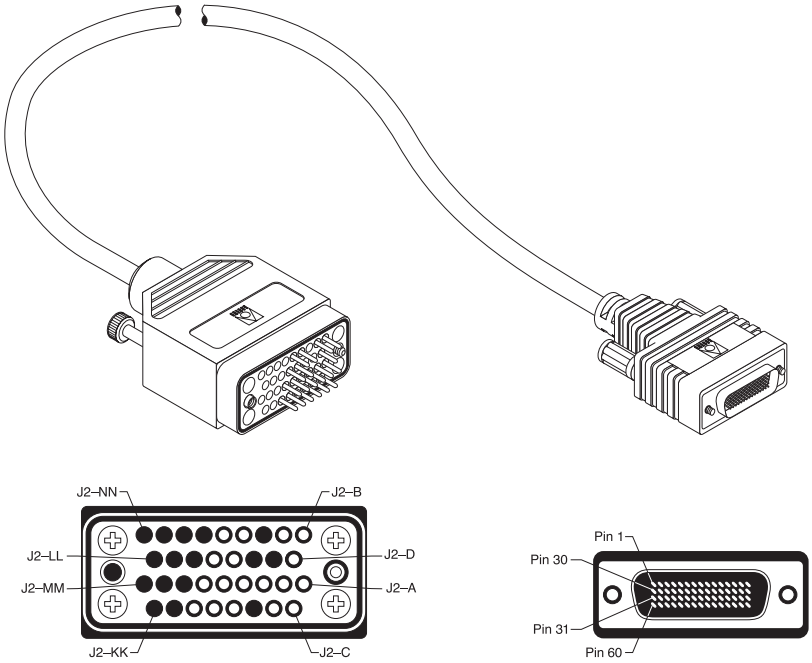

Figure D-6. Serial WAN cable

Table D-12.Serial WAN cable pinouts

J1 Pin	J2 Pin
46	A
42	D
43	E
35	C
34	H
33	F
16	B
44	K
16	B
18	T

Table D-12.Serial WAN cable pinouts (continued)

J1 Pin	J2 Pin
17	R
28	S
27	P
20	X
19	V
26	W
25	U
24	Y
23	AA

IDSL cable specifications

Figure D-7 and Table D-13 show the pinouts for the dual 50-pin telco to triple DB-37 IDSL cable (2510-0311-002).

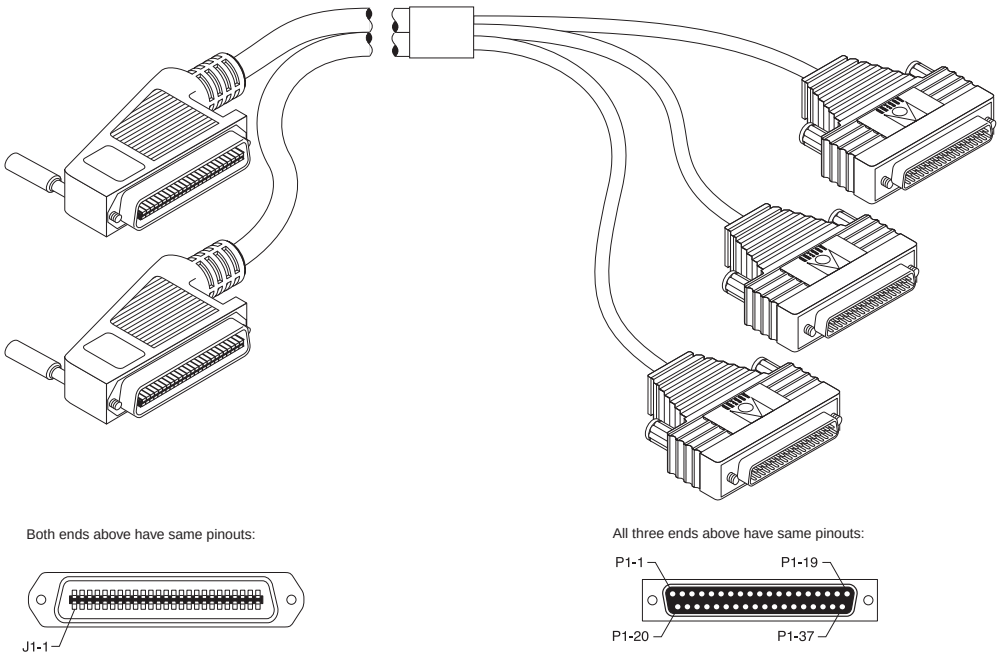

Figure D-7. IDSL dual 50-pin telco to triple DB-37 cable

Table D-13.IDSL cable pinouts

Pair	P1 Pin	P2 Pin	P3 Pin	J1 Pin	J2 Pin	Signal
1	36			1		Tip1
1	37			26		Ring 1
2	18			2		Tip 2
2	19			27		Ring 2
3	16			3		Tip 3
3	17			28		Ring 3
4	14			4		Tip 4
4	15			29		Ring 4
5	12			5		Tip 5
5	13			30		Ring 5
6	10			6		Tip 6
6	11			31		Ring 6
7	8			7		Tip 7
7	9			32		Ring 7
8	6			8		Tip 8
8	7			33		Ring 8
9	4			9		Tip 9
9	5			34		Ring 9
10	2			10		Tip 10
10	3			35		Ring 10
11	1			11		Tip 11
11	20			36		Ring 11
12	21			12		Tip 12
12	22			37		Ring 12
13	23			13		Tip 13

Table D-13.IDSL cable pinouts (continued)

Pair	P1 Pin	P2 Pin	P3 Pin	J1 Pin	J2 Pin	Signal
13	24			38		Ring 13
14	25			14		Tip 14
14	26			39		Ring 14
15	32			15		Tip 15
15	33			40		Ring 15
16	34			16		Tip 16
16	35			41		Ring 16
17		36		17		Tip 17
17		37		42		Ring 17
18		18		18		Tip 18
18		19		43		Ring 18
19		16		19		Tip19
19		17		44		Ring 19
20		14		20		Tip 20
20		15		45		Ring 20
21		12		21		Tip 21
21		13		46		Ring 21
22		10		22		Tip 22
22		11		47		Ring 22
23		8		23		Tip 23
23		9		48		Ring 23
24		6		24		Tip 24
24		7		49		Tip 24
1		4			1	Tip1
1		5			26	Ring 1
2		2			2	Tip 2

Table D-13.IDSL cable pinouts (continued)

Pair	P1 Pin	P2 Pin	P3 Pin	J1 Pin	J2 Pin	Signal
2		3			27	Ring 2
3		1			3	Tip 3
3		20			28	Ring 3
4		21			4	Tip 4
4		22			29	Ring 4
5		23			5	Tip 5
5		24			30	Ring 5
6		25			6	Tip 6
6		26			31	Ring 6
7		32			7	Tip 7
7		33			32	Ring 7
8		34			8	Tip 8
8		35			33	Ring 8
9			36		9	Tip 9
9			37		34	Ring 9
10			18		10	Tip 10
10			19		35	Ring 10
11			16		11	Tip 11
11			17		36	Ring 11
12			14		12	Tip 12
12			15		37	Ring 12
13			12		13	Tip 13
13			13		38	Ring 13
14			10		14	Tip 14
14			11		39	Ring 14
15			8		15	Tip 15

Table D-13.IDSL cable pinouts (continued)

Pair	P1 Pin	P2 Pin	P3 Pin	J1 Pin	J2 Pin	Signal
15			9		40	Ring 15
16			6		16	Tip 16
16			7		41	Ring 16
17			4		17	Tip 17
17			5		42	Ring 17
18			2		18	Tip 18
18			3		43	Ring 18
19			1		19	Tip19
19			20		44	Ring 19
20			21		20	Tip 20
20			22		45	Ring 20
21			23		21	Tip 21
21			24		46	Ring 21
22			25		22	Tip 22
22			26		47	Ring 22
23			32		23	Tip 23
23			33		48	Ring 23
24			34		24	Tip 24
24			35		49	Tip 24

ADSL cabling specifications

Figure D-8 and Figure D-14 show the pinouts for the 50-pin telco to quad DB-37 cable ADSL cable (2510-0305-002).

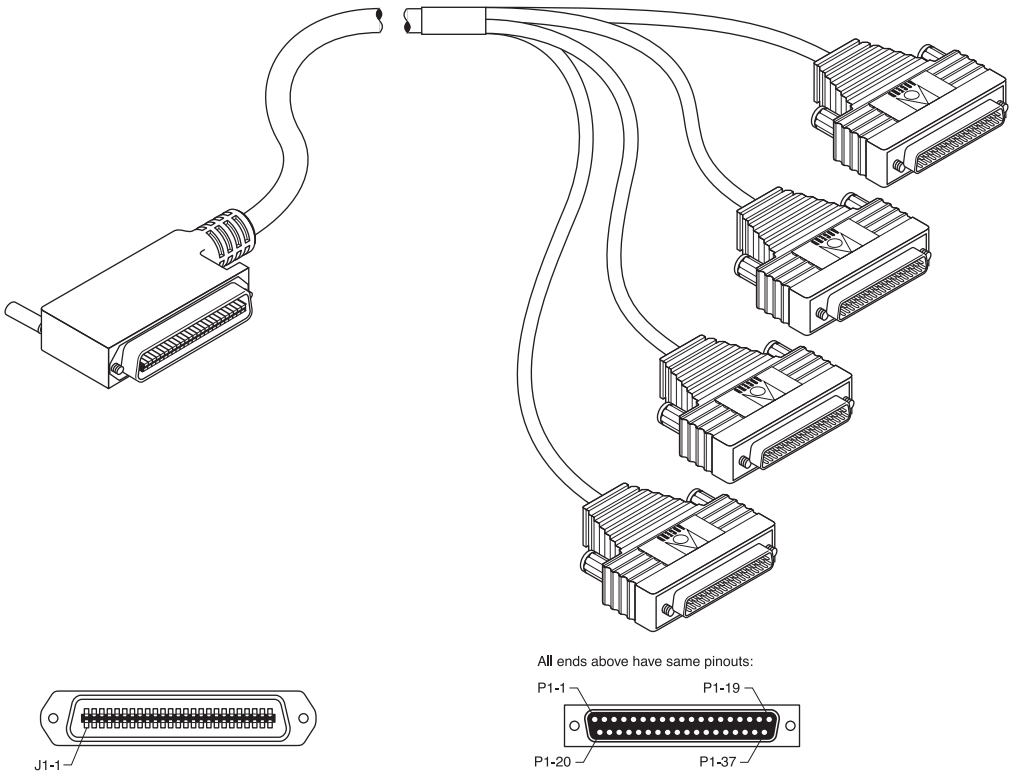

Figure D-8. ADSL 50-pin telco to quad DB-37 cable

Table D-14.ADSL cable pinouts

Pair	P1 Pin	P2 Pin	P3 Pin	P4 Pin	J1 Pin	Signal
1	36				1	Tip1
1	37				26	Ring 1
2	18				2	Tip 2
2	19				27	Ring 2
3	16				3	Tip 3
3	17				28	Ring 3
4	14				4	Tip 4
4	15				29	Ring 4

Table D-14.ADSL cable pinouts (continued)

Pair	P1 Pin	P2 Pin	P3 Pin	P4 Pin	J1 Pin	Signal
5	12				5	Tip 5
5	13				30	Ring 5
6	10				6	Tip 6
6	11				31	Ring 6
7		36			7	Tip 7
7		37			32	Ring 7
8		18			8	Tip 8
8		19			33	Ring 8
9		16			9	Tip 9
9		17			34	Ring 9
10		14			10	Tip 10
10		15			35	Ring 10
11		12			11	Tip 11
11		13			36	Ring 11
12		10			12	Tip 12
12		11			37	Ring 12
13			36		13	Tip 13
13			37		38	Ring 13
14			18		14	Tip 14
14			19		39	Ring 14
15			16		15	Tip 15
15			17		40	Ring 15
16			14		16	Tip 16
16			15		41	Ring 16
17			12		17	Tip 17
17			13		42	Ring 17

Table D-14.ADSL cable pinouts (continued)

Pair	P1 Pin	P2 Pin	P3 Pin	P4 Pin	J1 Pin	Signal
18			10		18	Tip 18
18			11		43	Ring 18
19				39	19	Tip19
19				37	44	Ring 19
20				18	20	Tip 20
20				19	45	Ring 20
21				16	21	Tip 21
21				17	46	Ring 21
22				14	22	Tip 22
22				15	47	Ring 22
23				12	23	Tip 23
23				13	48	Ring 23
24				10	24	Tip 24
24				11	49	Tip 24

SDSL cabling specifications

Figure D-9 and Table D-15 show the pinouts for the 50-pin telco to dual DB-37 SDSL cable (2510-0286-002).

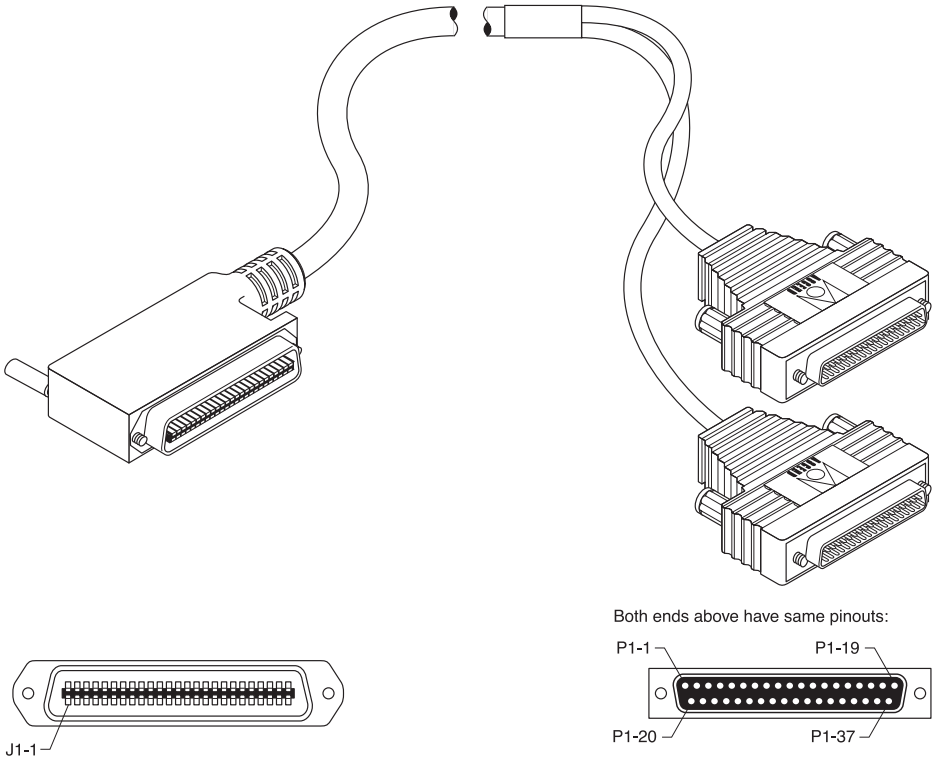

Figure D-9. SDSL 50-pin telco to dual DB-37 cable

Table D-15.SDSL cable pinouts

Pair	P1 Pin	P2 Pin	J1 Pin	Signal
1	36		1	Tip1
1	37		26	Ring 1
2	18		2	Tip 2
2	19		27	Ring 2
3	16		3	Tip 3
3	17		28	Ring 3
4	14		4	Tip 4
4	15		29	Ring 4

Table D-15.SDSL cable pinouts (continued)

Pair	P1 Pin	P2 Pin	J1 Pin	Signal
5	12		5	Tip 5
5	13		30	Ring 5
6	10		6	Tip 6
6	11		31	Ring 6
7	8		7	Tip 7
7	9		32	Ring 7
8	6		8	Tip 8
8	7		33	Ring 8
9	4		9	Tip 9
9	5		34	Ring 9
10	2		10	Tip 10
10	3		35	Ring 10
11	1		11	Tip 11
11	20		36	Ring 11
12	21		12	Tip 12
12	22		37	Ring 12
13		36	13	Tip 13
13		37	38	Ring 13
14		18	14	Tip 14
14		19	39	Ring 14
15		16	15	Tip 15
15		17	40	Ring 15
16		14	16	Tip 16
16		15	41	Ring 16
17		12	17	Tip 17
17		13	42	Ring 17

Table D-15.SDSL cable pinouts (continued)

Pair	P1 Pin	P2 Pin	J1 Pin	Signal
18		10	18	Tip 18
18		11	43	Ring 18
19		8	19	Tip19
19		9	44	Ring 19
20		6	20	Tip 20
20		7	45	Ring 20
21		4	21	Tip 21
21		5	46	Ring 21
22		2	22	Tip 22
22		3	47	Ring 22
23		1	23	Tip 23
23		20	48	Ring 23
24		21	24	Tip 24
24		22	49	Tip 24

The high performance SDSL data card uses a USOC RJ21X 50-pin telco connector. Cable pinouts are shown in the below table.

Table D-16.Cable pinouts for the 50-pin telco connector

Pin	Signal	Pin	Signal
1	1R (channel 1 ring)	26	1T (channel 1 tip)
2	2R	27	2T
3	3R	28	3T
4	4R	29	4T
5	5R	30	5T
6	6R	31	6T
7	7R	32	7T
8	8R	33	8T

Table D-16.Cable pinouts for the 50-pin telco connector (continued)

Pin	Signal	Pin	Signal
9	9R	34	9T
10	10R	35	10T
11	11R	36	11T
12	12R	37	12T
13	13R	38	13T
14	14R	39	14T
15	15R	40	15T
16	16R	41	16T
17	17R	42	17T
18	18R	43	18T
19	19R	44	19T
20	20R	45	20T
21	21R	46	21T
22	22R	47	22T
23	23R	48	23T
24	24R	49	24T
25	-48v (return)	50	-48v

Pins 25 and 50 are only used to provide sealing current. To run sealing current, a 48 volt battery is connected between pins 25 and 50.

Slot card specifications

MAX TNT slot cards include ATM-DS3, UDS3, T3, FrameLine, IDSL, ADSL, and SDSL cards.

ADSL-CAP slot specifications

Table D-17 lists the specifications for the ADSL-CAP card.

Table D-17.ADSL-CAP card specifications

Transfer rate /transmission distance	7.168Mbps/1.088Mbps up to 10,000 feet (3.05 km) 2.560Mbps/1.088Kbps up to 12,000 feet (3.7 km) 640Kbps/544Kbps up to 17,000 feet (5.18 km)
Interfaces per card	6 ports per card, up to 15 cards per system.
Physical connectors	DC-37F. Cable converts this to a 50-pin telco connector.
Connector requirements	Must meet JIS C 5973 standards
Card dimensions	8.8 in high x 10.6 in long (22.35 cm x 26.92 cm)
Card weight	~3 pounds (1.37 kg)
Operating humidity	0-90%, noncondensing
Operating temperature	32-104° F (0-40° C)

ADSL-DMT card specifications

Table D-18 lists the specifications for the ADSL-DMT card.

Table D-18.ADSL-DMT card specifcations

Transfer rate (upstream/downstream) /transmission distance	9248Kbps/928Kbps up to 10,000 feet (3.05 km) 7584Kbps/896Kbps up to 12,000 feet (3.7 km) 3040Kbps/704Kbps up to 17,000 feet (5.18 km)
Interfaces per card	6 ports per card, up to 15 cards per system
Physical connectors	50-pin telco connectors
Connector requirements	Must meet JIS C 5973 standards
Card dimensions	8.8 in high x 10.6 in long (22.35 cm x 26.92 cm)
Card weight	~3 pounds (1.37 kg)
Operating humidity	0-90%, noncondensing
Operating temperature	32-104° F (0-40° C)

ATM DS3 card specifications

Table D-19 lists the specifications for the MAX TNT ATM DS3 card.

Table D-19.ATM DS3 card specifications

Electrical	DSX-3 per ANSI T1.404
Line Build Out	0 to 225 feet, or 226 to 450 feet
Receive Equalization	Based on cable length and transmitter
Line Code	B3ZS
Line Rate	44.736 Mbps +/- 20 ppm
Frame Format	Per ANSI T1.107a (C-Bit Parity)
Alarm Signaling	On DS3 Red Alarm, yellow signal sent on the DS3, AIS sent on DS2s On DS2 Red Alarm, AIS sent on DS1s
Connectors	75 ohm BNC coaxial
Interfaces per card	One unchannelized DS3 port with integrated CSU/DSU. Maximum of two cards per chassis (redundant configuration)
Card dimensions	5.6 in high x 10.7 in long (14.2 cm x 27 cm)
Card weight	~2 pounds (0.9 kg)
Operating humidity	0-90%, non-condensing
Operating temperature	32-104° F (0-40° C)

The ATM DS3 card has a single LED, which functions identically to the LED for the eight-port T1 card.

E1 FrameLine card specifications

Table D-20 lists the specifications for the MAX TNT E1 FrameLine card.

Table D-20.E1 FrameLine card specifications

Electrical	CEPT 2.048Mbps pulse mask per G.703 for twisted pair and coax.
Receive Equalization	Short haul (12dB) and long haul (43dB)
Line Code	HDB3
Line Rate	2.048 Mbps +/- 25ppm

Table D-20.E1 FrameLine card specifications (continued)

Frame Format	Per G.704 FAS with or without CRC4 Multi Frame Alignment. No CAS MFA, or TS16 used for data.
Alarm Signaling	Red Alarm, OOF (FAS). CRC MFA, remote alarm, AIS are not supported.
Connectors	10 RJ45 (120 ohm). Optionally, BNC COAX (75 ohm) with external cable. (This requires that jumpers be configured on the card).

The Unchannelized E1 card has a single LED, which functions identically to the LED for the eight-port E1 card.

FrameLine card specifications

Table D-21 lists the specifications for the MAX TNT FrameLine card.

Table D-21.FrameLine card specifications

Electrical	DSX-1 per ANSI T1.102 (DSX) DS1 per ANSI T1.403, Pub 62411 (CSU)
Line Build Out	0dB, -7.5dB, -15dB, -22.5dB (CSU) 0-133 ft, 133-266 ft, 266-399 ft, 399-533 ft, 533-655 ft (DSX)
Receive Equalization	Based on cable length and transmitter
Line Code	AMI, B8ZS
Line Rate	1.544 Mbps +/- 32 ppm
Frame Format	Per ANSI T1.107a (M23 or C-Bit Parity)
Alarm Signaling	Red Alarm, yellow signal
Connectors	10 RJ45 (100 ohm line)

IDSL card specifications

Table D-22 lists the specifications for the IDSL card.

Table D-22.IDSL card specifications

Transfer rate /transmission distance	128 Kbps (symmetric)
Interfaces per card	32 ports per card
Physical connectors	2 DB-37 connectors
Card weight	~3 pounds (1.37 kg)
Operating humidity	0-90%, noncondensing
Operating temperature	32-104° F (0-40° C)

SDSL card specifications

Table D-23 lists the specifications for the SDSL line card.

Table D-23.SDSL card specifications

Transfer rate	768 Kbps (symmetric)
Transmission distance	12,000 feet (3.7 km)
Interfaces per card	16 ports per card, up to 15 cards per system
Physical connectors	2 DB-37 to 50-pin telco connectors
Connector requirements	Must meet JIS C 5973 standards
Card dimensions	8.8 in high x 10.6 in long (22.35 cm x 26.92 cm)
Card weight	~3 pounds (1.37 kg)
Operating humidity	0-90%, noncondensing
Operating temperature	32-104° F (0-40° C)

Table D-24 lists the specifications for the SDSL-HS card.

Table D-24.SDSL-HS card specifications

Interfaces per card	24 ports per card
Physical connector	USOC RJ21X 50-pin telco connector
Connector requirements	Must meet JIS C5973 standards.
Card dimensions	8.8 inches (22.35 cm.) in height; 10.6 inches (26.92 cm.) in length
Card weight	Approximately 3 pounds (1.37 kg)
Operating humidity	0-90%, noncondensing
Operating temperature	32 to 104 degrees F (0 to 40 degrees C)

T3 slot card specifications

Table D-25 lists the specifications for the MAX TNT T3 card.

Table D-25.T3 card specifications

Electrical	DSX-3 per ANSI T1.404
Line Build Out	0 to 225 feet, or 226 to 450 feet
Receive Equalization	Based on cable length and transmitter
Line Code	B3ZS

Table D-25.T3 card specifications (continued)

Line Rate	44.736 Mbps +/- 20ppm
Frame Format	Per ANSI T1.107a (M23 or C-Bit Parity)
Alarm Signaling	On DS3 Red Alarm, yellow signal sent on the DS3, AIS sent on DS2s
	On DS2 Red Alarm, AIS sent on DS1s
Connectors	75 ohm BNC coaxial (2 line, 2 backup)

Unchannelized DS3 card specifications

Table D-26 lists the specifications for the MAX TNT UDS3 card.

Table D-26.UDS3 card specifications

Electrical	DSX-3 per ANSI T1.404
Line Build Out	0 to 225 feet, or 226 to 450 feet
Receive Equalization	Based on cable length and transmitter
Line Code	B3ZS
Line Rate	44.736 Mbps +/- 20ppm
Frame Format	Per ANSI T1.107a (C-Bit Parity)
Alarm Signaling	On DS3 Red Alarm, yellow signal sent on the DS3, AIS sent on DS2s
	On DS2 Red Alarm, AIS sent on DS1s
Connectors	75 ohm BNC coaxial (2 line, 2 backup)
Interfaces per card	1 port per card, up to 5 cards per system
Card dimensions	5.6 in high x 10.7 in long (14.2 cm x 27 cm)
Card weight	~2 pounds (0.9 kg)
Operating humidity	0-90%, noncondensing
Operating temperature	32-104° F (0-40° C)

The UDS3 card has a single LED, which functions identically to the LED for the eight-port T1 card.

FCC and International Notices

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FCC Part 68

Ascend Communications MAX models MAX-DSX/DSX, MAX-CSU/CSU, and MAX-CSU/DSX have been tested to comply with Part 68 of FCC Rules. Please note the following:

1 Upon request of the telephone company, you should provide the FCC registration number of the equipment that is connected to your line. The MAX unit's registration number for the CSU interface(s) of the MAX-CS/DSU and MAX CSU/DSX is 2CZUSA-74422-XD-N. The MAX unit's registration number for the DSX interface(s) of the MAX DSX/DSX and MAX-CSU/DSX models is 2CZUSA-74421-DE-N.

2 The MAX operates with a 1.544 Mbps digital channel, using RJ48 USOC jacks. The service code is 6.0N. The Facility Interface Code is 04DU9-BN for lines using the Superframe Format (SF); 04DU9-DN for lines using the SF with B8ZS; 04DU9-1SN for lines using Extended Superframe Format (ESF) with B8ZS; and 04DU9-1KN for lines using ESF format with AMI. The MAX connects to the network with eight-pin modular plugs, wired per FCC Part 68, USOC RJ48C.

3 The telephone company must be notified before removal of a MAX connected to 1.544 Mbps digital service. If the telephone company notes a problem, it may temporarily discontinue service and will notify you of the disconnection. (If advance notice is not feasible, you will be notified as soon as possible.) When you are notified, you will be given the opportunity to correct the problem and informed of your right to file a complaint with the FCC.

FCC Part 68 Notice

This Ascend equipment complies with Part 68 of the FCC rules. Located on the equipment is a label that contains, among other information, the FCC registration number. If requested, this information must be provided to the telephone company.

This equipment cannot be used on the telephone company-provided coin service. Connection to Party Line Service is subject to State Tariffs.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

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

If trouble is experienced with this equipment, please contact:

Ascend Communications, Inc.
1701 Harbor Bay Parkway
Alameda, CA 94502

If the trouble is causing harm to the telephone network, the telephone company may request you to remove the equipment from the network until the problem is resolved.

It is recommended that the customer install an AC surge arrestor in the AC outlet to which this device is connected. This is to avoid damage to the equipment caused by local lightening strikes and other electrical surges.

This equipment uses the following USOC jacks and codes:

Model Name	Facility Interface Code	Service Order Code	Jack Type
TNT-SL-CT1	04DU9-BN	6.0N	RJ48C
TNT-SL-CT1	04DU9-DN	6.0N	RJ48C
TNT-SL-CT1	04DU9-1KN	6.0N	RJ48C
TNT-SL-CT1	04DU9-1SN	6.0N	RJ48C
TNT-SL-CT1	04DU9-1ZN	6.0N	RJ48C
TNT-SL-FL10	04DU9-BN	6.0N	RJ48C
TNT-SL-FL10	04DU9-DN	6.0N	RJ48C
TNT-SL-FL10	04DU9-1KN	6.0N	RJ48C
TNT-SL-FL10	04DU9-1SN	6.0N	RJ48C
TNT-SL-FL10	04DU9-1ZN	6.0N	RJ48C

FCC Part 15

Warning: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.

The authority to operate this equipment is conditioned by the requirement that no modifications will be made to the equipment unless the changes or modifications are expressly approved by Ascend.

Canadian Notice

Note: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network

protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's 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 company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situation.

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 such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The *Load Number (LN)* assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop that is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

This equipment does not support line loopbacks.

Warning: THE DIGITAL APPARATUS DOES NOT EXCEED THE CLASS A LIMITS FOR RADIO NOISE EMISSIONS FROM DIGITAL APPARATUS SET OUT IN THE RADIO INTERFERENCE REGULATIONS OF THE CANADIAN DEPARTMENT OF COMMUNICATIONS.

Attention: LE PRESENT APPAREIL NUMERIQUE N'EMET PAS DE BRUITS RADIOELECTRIQUES DEPASSANT LES LIMITES APPLICABLES AUX APPAREILS NUMERIQUES DE LA CLASSE A PRESCRITES DANS LE REGLEMENT SUR LE BROUILLAGE RADIOELECTRIQUE EDICTE PAR LE MINISTERE DES COMMUNICATIONS DU CANADA.

Line Connection and Signaling - CE Notice

The MAX TNT has been approved for connection to the Public Switched Telecommunication Network, using interfaces compatible with CCITT recommendations I.421 (Primary Rate ISDN user access), G.703 (DASS2 user access), and I.420 (Basic Rate ISDN user access). The MAX TNT complies with the following Council Directives:

1. Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain Voltage limits. (The Low Voltage Directive)
2. The Council Directive 89/336/EEC of 3 May 1992 on the approximation of the laws of the member states relating to ElectroMagnetic Compatibility. (The EMC Directive)
3. Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunication terminal equipment. (The Telecom Terminal Equipment Directive)
4. The Council Directive 92/31/EEC of 28 April 1992 amending directive on the approximation of the laws of the member states relating to ElectroMagnetic Compatibility.
5. 93/68/EEC of 22 July 1993 amending the Directives 89/336/EEC, 91/263/EEC and 92/31/EEC. (The Marking Directive)

Manufacturer's Declaration of Conformity

Ascend Communications, Inc., hereby declares that the MAX TNT complies to the requirements of BS7378 part 1: 1991, clause 5.1.8 (No signal condition).

Each of the following situations causes a no signal condition.

- No valid signal going from the MAX TNT to the switch.
- No signal coming into the MAX TNT from the switch.
- No power to the MAX TNT (the unit is powered down).

Warranty

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Product warranty

1. Ascend Communications, Inc. warrants that the MAX TNT will be free from defects in material and workmanship for a period of twelve (12) months from date of shipment.
2. Ascend Communications, Inc. shall incur no liability under this warranty if
   - the allegedly defective goods are not returned prepaid to Ascend Communications, Inc. within thirty (30) days of the discovery of the alleged defect and in accordance with Ascend Communications, Inc.'s repair procedures; or
   - Ascend Communications, Inc.'s tests disclose that the alleged defect is not due to defects in material or workmanship.
3. Ascend Communications, Inc.'s liability shall be limited to either repair or replacement of the defective goods, at Ascend Communications, Inc.'s option.
4. Ascend Communications, Inc. MAKES NO EXPRESS OR IMPLIED WARRANTIES REGARDING THE QUALITY, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE BEYOND THOSE THAT APPEAR IN THE APPLICABLE Ascend Communications, Inc. USER'S DOCUMENTATION. Ascend Communications, Inc. SHALL NOT BE RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL, OR PUNITIVE DAMAGE, INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR DAMAGES TO BUSINESS OR BUSINESS RELATIONS. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES.

Warranty repair

1. During the first three (3) months of ownership, Ascend Communications, Inc. will repair or replace a defective product covered under warranty within twenty-four (24) hours of receipt of the product. During the fourth (4th) through twelfth (12th) months of ownership, Ascend Communications, Inc. will repair or replace a defective product covered under warranty within ten (10) days of receipt of the product. The warranty period for the replaced product shall be ninety (90) days or the remainder of the warranty period of the original unit, whichever is greater. Ascend Communications, Inc. will ship surface freight. Expedited freight is at customer's expense.
2. The customer must return the defective product to Ascend Communications, Inc. within fourteen (14) days after the request for replacement. If the defective product is not returned within this time period, Ascend Communications, Inc. will bill the customer for the product at list price.

Out-of warranty repair

Ascend Communications, Inc. will either repair or, at its option, replace a defective product not covered under warranty within ten (10) working days of its receipt. Repair charges are

available from the Repair Facility upon request. The warranty on a serviced product is thirty (30) days measured from date of service. Out-of-warranty repair charges are based upon the prices in effect at the time of return.

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