Tenor® DX VoIP MultiPath/Gateway Switch

Product Guide

P/N 480-0049-00-15

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Chapter 3: Installation

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About this Guide

What's included?

This product guide is divided into chapters; each chapter describes a specific topic. The following chapters are included:

- *About this Guide:* Describes what is included in the Product Guide, including typographical conventions.
- *Chapter 1: Overview.* Includes a general overview of the product, including a description of the *Tenor DX's* features and capabilities.
- *Chapter 2: Hardware Components.* Hardware description, including the front and rear panels, as well as LEDs and required cables.
- *Chapter 3: Installation.* Describes how to install the *Tenor DX* unit, including how to connect, power up and assign the IP address.
- *Chapter 4: Getting Started: Tenor Configuration Manager/Tenor Monitor.* This chapter tells you how to use the *Tenor Configuration Manager and Tenor Monitor* to configure/monitor the unit.
- *Chapter 5: Getting Started: Command Line Interface (CLI).* This chapter tells you how to access the CLI and execute commands. A description of each CLI mode is also included.
- *Chapter 6: Call Detail Recording.* Describes the Call Detail Recording (CDR) feature, including how to set up the CDR server and assign a password. In addition, instructions for reading CDR output are also included.
- *Chapter 7: System Alarms.* Describes how to monitor and view alarms via Command Line Interface (CLI). In addition, alarm definitions are also included.
- *Chapter 8: Diagnostics/Maintenance*. Describes how to troubleshoot and monitor the health of the system.
- *Appendix A: Specifications/Approvals:* A list of *Tenor DX* specifications and approvals.
- *Glossary*
- *Index*
- *Warranty/Approvals*

Typographical Conventions

Product Guide Conventions

Certain typographical conventions are used throughout this product guide. See below.

- All commands you enter via keystrokes appear in **bold** (e.g., Press **Enter** or Press **Ctrl-I).**
- All text commands you enter via Telnet session or command line typing appear in *italics* (e.g., type *active).*
- There are three types of special text that are designed to reveal supplemental information: Note, Warning, and Caution. See below.

A **NOTE** provides additional, helpful information. This information may tell you how to do a certain task or just be a reminder for how-to's given in previous sections. (i.e., For a list of valid commands at any time, type *?*)

A **WARNING** provides information about how to avoid harming your VoIP equipment or other equipment (i.e., Do not stack more than 4 units together.)

A **CAUTION** provides information about how to avoid injury to yourself or to others (e.g., Do not install the equipment during a lightning storm).

Finding Help

Refer to the Product Guide for help. The Table of Contents and Index tells you where to find information easily.

Extensive configuration help is available via the *Tenor Configuraton Manager and Tenor Monitor* online help systems or the *Command Line Interface* online help system. See *Chapter 4: Getting Started: Tenor Configuration Manager* for more information.

Chapter 1: Overview

This chapter gives you a general overview of the *Tenor DX* including feature descriptions and capabilities. Specifically, the following topics are covered:

- A description of *Tenor DX*
- Features
- Capabilities
- Call Routing/Management Options
- H.323 Gatekeeper Services

What is the *Tenor DX?*

The *Tenor DX* is a high-density VoIP (Voice over Internet Protocol) H.323/SIP switch that converts voice, fax, and modem data on digital circuit switched trunks, and transmits it over the IP network. The *Tenor DX* integrates a gateway, gatekeeper, border element, intelligent call routing, and supports H.323/SIP, and QoS all in one solution. The gateway converts circuit switched calls to VoIP calls, the gatekeeper performs IP call routing functions, and the border element distributes the call routing directories throughout the network.

With its MultiPath architecture, the *Tenor DX* can intelligently route calls between the PBX, the PSTN, and the IP network to achieve the best combination of cost and quality. It can also route calls over IP to reduce costs, and then transparently "hop off" to the PSTN, to reach off-net locations.

Figure 1-1 Tenor DX VoIP Switch

The *Tenor DX* is available in two configuration types:

- *MultiPath Switch* (intended for PBX and PSTN connectivity)
- *Gateway* (intended for VoIP and PSTN trunk port connectivity).

The *MultiPath Switch* is mainly intended for symmetrical multipath applications. The number of VoIP channels is equal to half the number of PSTN channels.The *MultiPath Switch* configuration enables connectivity between the customer equipment (i.e., PBX), PSTN and VoIP Network. The *Gateway* is mainly intended for trunking applications interfacing between the VoIP network and the circuit switched network (PSTN). The number of VoIP channels equals the number of PSTN channels.

Whichever configuration you choose, the high performance unit provides two 10/100 BaseT connections and one RS-232 serial console port connection. The unit also incorporates an intelligent call routing engine which regulates system resources and configuration while coordinating all voice traffic activity in the unit.

The *Tenor DX* may be managed by the *Tenor Configuration Manager*. Through the *Configuration Manager*, you can configure all options, such as signaling data, trunk groups, dial plans, and call routing numbers. An easy-to-use Java-based installation process enables you to an install the manager and start configuring within minutes.

The unit's simple plug and play embedded system architecture brings VoIP technology to your network without changing your existing telephony infrastructure. Your network stays as is, and the call

type is transparent to the user. This technology boasts superior voice quality without compromising reliability.

The *Tenor DX* is available in the versions listed in Table 2-1.

Table 2-1 Tenor DX MultiPath Switch configurations

Tenor Digital DX MultiPath Configurations	Spans Available (RJ-45 port for T1/E1 connection)	VoIP Channels Supported	Usage
DX2008	2	8 VoIP connections	T1/E1
DX2016	2	16 VoIP connections	T1/E1
DX2024	2	24 VoIP connections	T1
DX2030	2	30 VoIP connections	E1
DX4048	4	48 VoIP connections	2 x T1
DX4060	4	60 VoIP connections	2 x E1
DX6120	6	120 VoIP connections	T1/E1
DX8120	8	120 VoIP connections	T1/E1

Table 2-2 Tenor DX Gateway configurations

Tenor Digital DX Gateway Configurations	Spans Available (RJ-45 port for T1/E1 connection)	VoIP Channels Supported	Usage
DX2048	2	48 VoIP connections	2 x T1
DX2060	2	60 VoIP connections	2 x E1
DX4096	4	96 VoIP connections	4 x T1
DX4120	4	120 VoIP connections	4 x E1

Features

The *Tenor DX*'s specific features are explained below.

Unique Design

Tenor DX packs powerful VoIP features into one compact unit. The system's embedded design enables you to configure the unit directly without depending on another operating system; it can be either placed on a table or mounted in a 19" rack.

With its MultiPath technology, the Tenor can be installed without upgrades to the existing voice or data network. Tenor connects to the data network through a 10/100 Ethernet interface, and to the enterprise and public voice network through multiple T1/E1 or PRI interfaces. In addition, with a wide range of configurations available, it offers the flexibility for you to select a configuration that best matches your needs.

State-of-the-Art GUI Configuration and Network Management

Once the unit is connected, the *Tenor Configuration Manager* makes configuring a *Tenor DX* easy. Through the manager, you are able to set all configuration parameters, such as unit, signaling, and call type features, as well as monitor the unit for alarms, and call information.

In addition, you can configure the unit via *Command Line Interface (CLI*). Through this simple telnet session, you can access all configuration options, including an online help system, built into the CLI, which provides help for all features and functions. Just type *help* at any prompt, and data about that field will be displayed.

SelectNet™ Technology Safety Net

Quality of service is virtually guaranteed. *Tenor DX* 's built-in patented SelectNet™ Technology provides a "safety net," which virtually guarantees that each call going VoIP will not only be routed successfully, but will deliver high voice quality.

SelectNet monitors the IP network performance for VoIP calls. If the performance characteristics become unacceptable—according to the delay, jitter, and packet loss specifications you configure—the *Tenor DX* will switch the call to the PSTN automatically and transparently. The Tenor continuously monitors your data network for jitter, latency and packet loss, and transparently switches customer calls to the PSTN when required.

PacketSaver™ reduces bandwidth consumption

PacketSaver packet multiplexing technology reduces the amount of IP bandwidth required to support multiple calls flowing between two endpoints. PacketSaver minimizes bandwidth usage by aggregating samples from multiple VoIP conversations and packing them into a larger IP packet with a single IP header. The process removes the need to send a bulky IP header with individual voice packets. As a result, it eliminates the transmission of redundant information.

Easy Connect to Console

Plugging a serial cable between the unit's RS-232 port and your PC's console port, will allow local unit management. Through the console connection, you are able to assign an IP address. In addition, if you are directly connected to the unit, you are able to configure the unit via *Command Line Interface (CLI)*.

Powerful System Monitoring

There are many different ways to monitor the health of the unit, including LEDs and alarms. LEDs appear on the front of the unit. The LEDs light up according to operations and alarms the system is experiencing.

Through the *Tenor Monitor* (see *Chapter 4: Getting Started: Tenor Configuration Manager*) and the *Command Line Interface (CLI)* (see *Chapter 5: Getting Started: Command Line Interface (CLI)*), you can view a list of active system alarms, as well as view an alarm history. Each alarm indicates the unit's operational status.

Capabilities

Virtual Tie Line

Tenor DX can emulate a tie trunk. It provides all of the functionality of a tie trunk, including the considerable cost savings, but eliminates the need for a PBX trunk to be configured, or marked as a tie trunk. A traditional tie trunk is a PBX-configured direct connection between two PBXs in separate locations. The tie trunk bypasses the PSTN network.

Your PBX does not need any additional configuration. *Tenor DX* treats all the trunks the same without compromising voice quality.

SNMP Support

The *Tenor DX* supports Simple Network Management Protocol (SNMP), the standard protocol used to exchange network information between different types of networks.

Call Detail Recording

Through the Call Detail Record (CDR) feature, the *Tenor DX* generates a call record at the completion of each call, typically for accounting purposes. A CDR is a string of data that contains call information such as call date and time, call duration, calling party, and called party. *Tenor DX* may store Call Detail Records locally or they can be sent to a CDR server within the network. The CDR contains sufficient information to capture billing data, which can be used to create billing reports using third party billing software.

IVR/RADIUS Support

Interactive Voice Response (IVR) is a feature of the *Tenor DX* that enables you to offer services, such as Pre-paid calling cards and Post-paid accounts, to your customers.

The Tenor uses the RADIUS (Remote Authentication Dial-In User Service), for authenticating and authorizing user access to the VoIP network, including ANI Authentication (Types 1 and 2). The RADIUS is a standard protocol which provides a series of standardized message formats for transmitting and receiving dialed information, account data and authorization codes between the network access gateway and the billing server.

NAT*Access*™

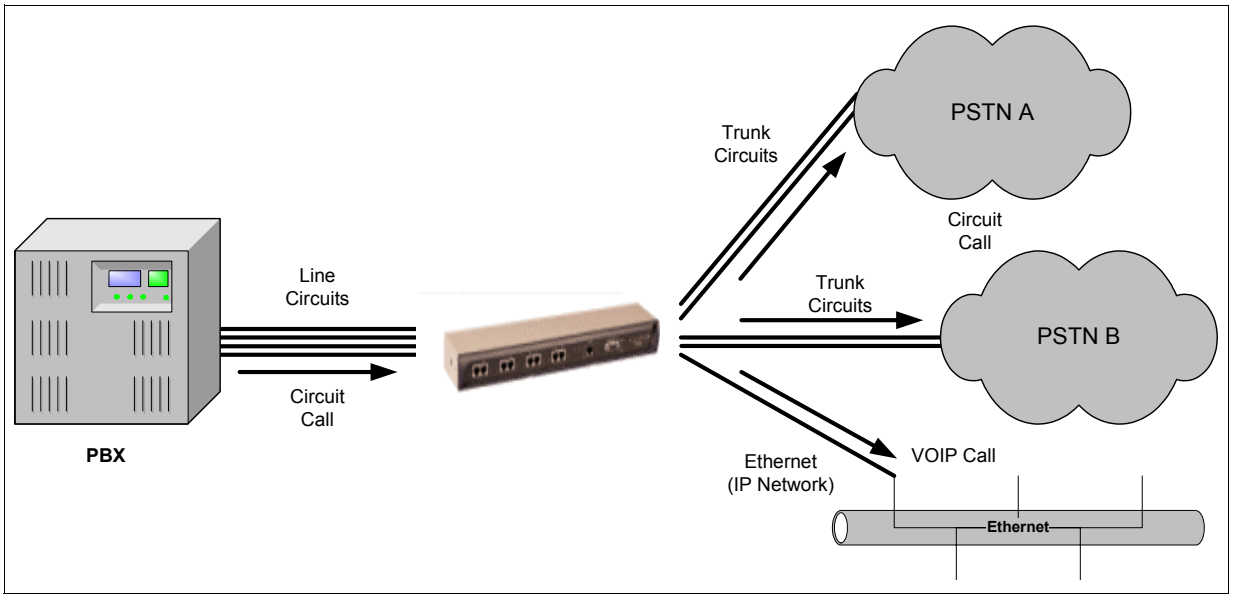
NAT*Access* is an intelligent network address translation technology. It enables VoIP networks with multiple H.323 endpoints to operate behind firewalls equipped with H.323 Network Address Translation (NAT); this provides maximum network security. NAT*Access* simplifies deployment by eliminating the need to place the Tenor on a public IP network. Using NAT*Access* provides easy, secure expansion between multiple VoIP sites. In addition, NAT technology in the Tenor permits the use of private subnets at the same time; in-house calls will never go over the public internet.

Call Routing/Management Options

Call Routing

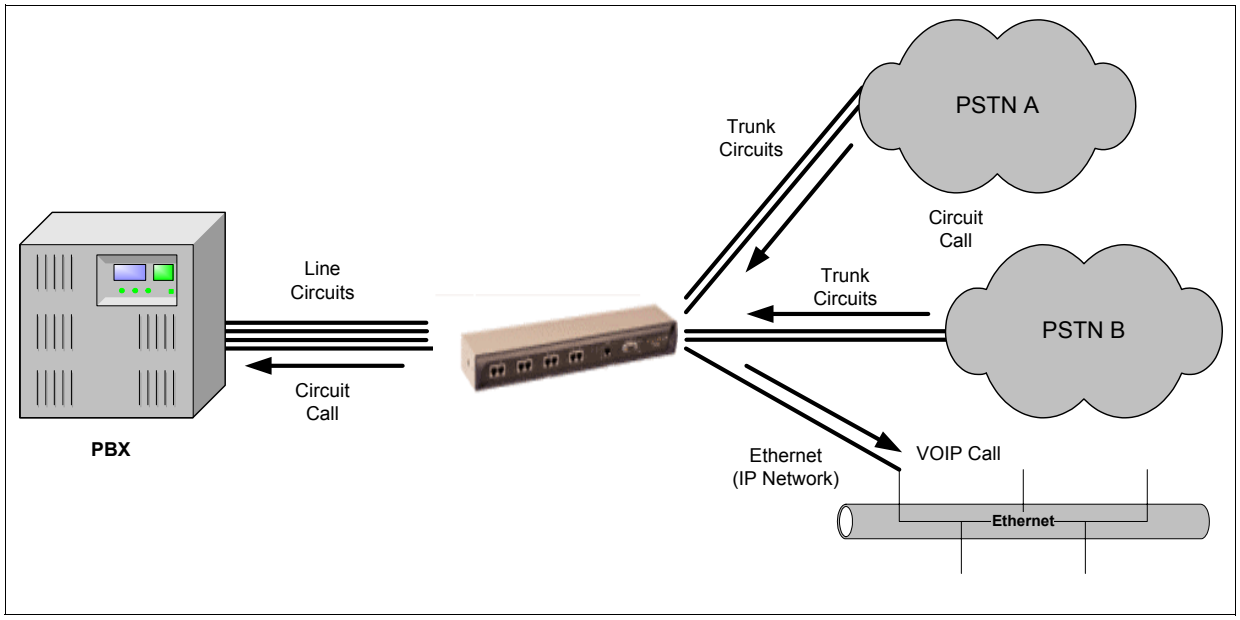
Line Circuit Originated Calls. Calls coming from a Line Circuit may be switched to either the data network as a VoIP call or to a Trunk Circuit typically for connection to another circuit switched network such as the PSTN. The routing decision made by the Tenor is based upon your configuration and the dialed number.

Figure 1-2 Line Circuit Call Routing



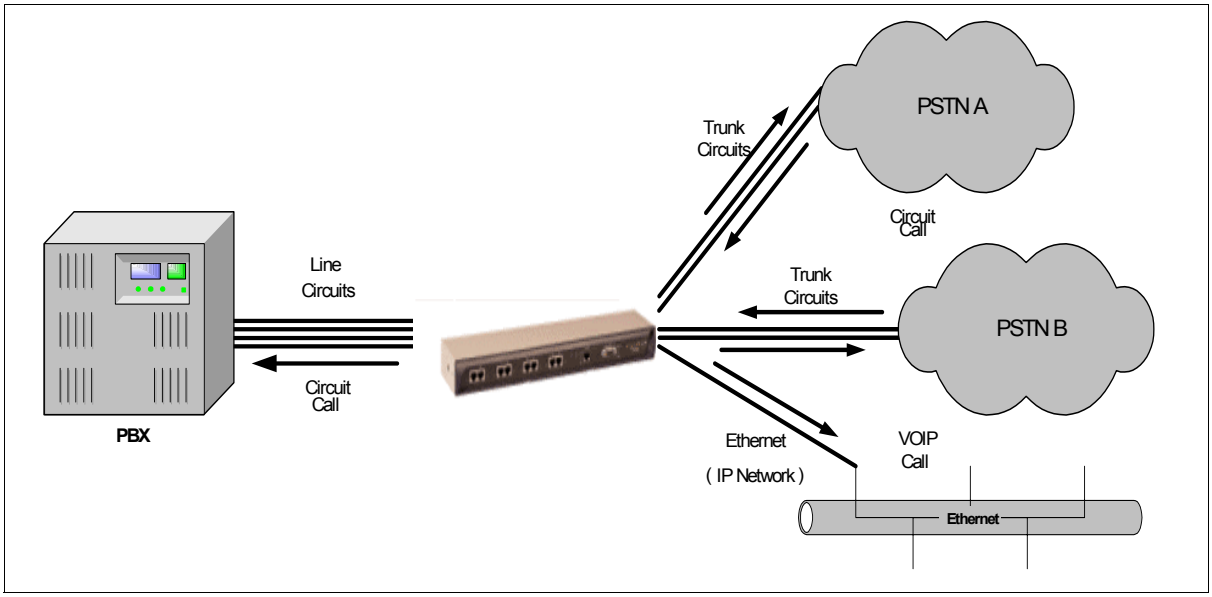
Trunk Circuit Originated Calls. A call coming from a Trunk Circuit may be switched to either the data network as a VoIP call, a Line Circuit, or trunk typically for connection to a termination device on the user's premises such as a PBX. The routing decision made by the *Tenor DX* is based upon your configuration and the dialed number.

Figure 1-3 Trunk Circuit Call Routing



Intra-trunk Routing - "Hairpinning". As a result of intra-trunk routing, incoming calls from a particular Trunk Circuit are switched by *Tenor DX* to be routed back out the same trunk circuit routing group.

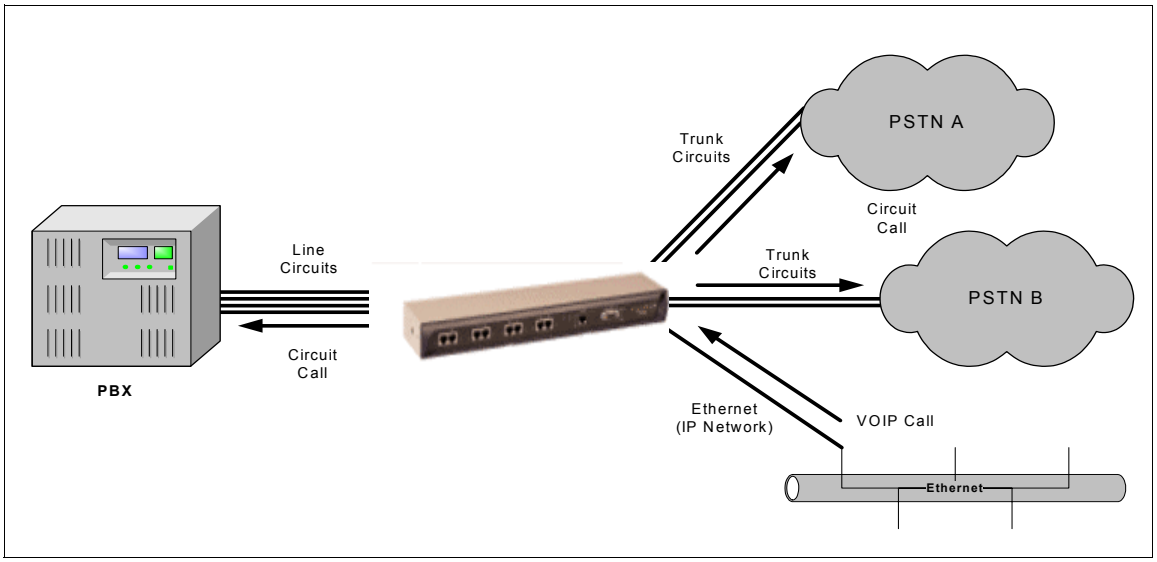
Figure 1-4 Intra-Trunk Routing



Data Network Calls. Calls coming from the data network can be routed to the Line Circuit or Trunk Circuit spans. The Tenor will route calls based upon the dialed number. If the number is configured

as a local phone number, the call will be sent to a Line circuit for termination, otherwise the call is considered a “Hop-Off call” and the Tenor sends it out through a Trunk Circuit span, typically connected to the PSTN.

Figure 1-5 Data Network Call Routing



Routing Table Options

There are four types of routing databases you can configure: Bypass Directory Numbers (BPN), Hunt Local Directory Numbers (Hunt LDN), Hop-Off Directory Numbers (HDN) and Static Routes.

Bypass Directory Numbers. Bypass Directory Numbers (BDN) are telephone numbers that are automatically routed directly from a line circuit to a trunk circuit (PSTN); they will not be routed VoIP. Some examples of bypass numbers include toll-free calls, emergency calls (i.e., 911), or high security calls.

Hunt Local Directory Numbers. A Hunt Local Directory Number (Hunt LDN) is a phone number reachable through local Line Circuits.

Hop-Off Directory Number. A Hop-off PBX call travels over IP, and then “hops” off into the public network (PSTN) on the distant side to reduce or eliminate public toll charges (also known as Leaky Area Map). A Hop-Off Directory Number is routed over the IP to another Tenor location and then out to the Trunk circuit, possibly to the PSTN as a local call.

Static Routes. Static Routes are used between networks and other H.323 devices that are not registered to the network through the Border Element (such as non-Quintum gateways). A static route associates endpoints (as represented by their IP address) with Directory Number patterns.

Call Management Features

Dynamic Call Routing. *Tenor DX*'s intelligent call routing capabilities are state-of-the-art. The unit automatically detects and supports three call types: voice, fax, and modem.

Tenor DX will first identify the call origination site—trunk circuit, line circuit, or IP routing group—and then route the call according to any parameters you have configured in the routing database. Each call may be routed via circuit switched path between any two circuit groups, or compressed and transported via VoIP when connecting to an IP routing group. Trunk circuits are those that typically connect to another circuit switched network such as the PSTN. Line circuits typically connect to a termination device on the user premises, such as a PBX.

Trunk Group Support. The *Tenor DX* supports trunk groups, which are groups of T1 or E1 channels used to connect the Tenor to other carriers (such as local telephone company) or to PBX equipment used for circuit aggregation.

Public/Private Dial Plan Support. The *Tenor DX* supports public and private dial plans. A public dial plan includes numbers which conform to the international dialing plan (E.164) of a country code + city/area code + local number. For a public dial plan, you can define the numbering plan structure for the *Tenor DX* to use for outgoing calls.

A private dial plan does not conform to a public dialing plan (i.e., 3 digit dialing plan); through the *Tenor DX* you are able to configure the unique pattern/dialing plan structure, including number length.

You are able to configure which dial plan to use for incoming and outgoing calls, including whether other options such as hop-off calls, will use a public or private dial plan.

User Programmable Dial Plan Support. The User Programmable Dial Plan Support (UPDP) enables the Tenor to identify a completely customizable set of digit sequences, such as Local, National, International or Private Numbers.

PassThrough support for certain call types. Certain call types can be directly routed to a trunk circuit, without going IP. There are several routing tables you can configure via the *Configuration Manager* to adjust how the *Tenor DX* unit routes these types of "pass through" numbers. For example, you may want to configure 911 as a "bypass number", which means that all 911 calls coming into *Tenor DX* from the line circuit will be routed directly to a Trunk circuit presumably connected to a PSTN. Bypass calls are never routed over IP.

Hop-off PBX Calls. Hop-off numbers are phone number patterns for calls to be routed out through trunks. They are entered in a Hop-off Number Directory and associated with trunks where matching calls should be sent.

Tenor DX supports those hop-off PBX calls where the destination *Tenor DX* is programmed to route the call to the PSTN via Trunk Circuit. (A hop-off PBX call is a toll call which hops through a private network to reduce or eliminate the toll charge.) The destination *Tenor DX* unit is configured with the phone numbers to be "supported" for this feature.

H.323 Gatekeeper Services

The *Tenor DX* unit's built-in H.323 gatekeeper performs IP call routing functions, such as call control and administrative services to another *Tenor DX* unit, or another H.323 endpoint. The gatekeeper's functionality complies with the H.323 industry specifications for voice control and management.

Gatekeeper

A Gatekeeper in an H.323 network provides call control services and other services to H.323 endpoints (i.e., gateways, terminals, and MCUs). The *Tenor DX* has a built-in H.323 gatekeeper which complies to the H.323 industry specifications for voice control and management. The gatekeeper performs call routing functions for calls entering and exiting a site.

The Gatekeeper performs IP call routing functions, such as Call Control Signaling and Call Authorization for Gateways, IP phones, and H.323 terminals. The Gatekeeper communicates with other Gatekeepers through a Border Element. When using a group of *Tenor DX* units, you can assign one unit as the Gatekeeper for the network. We recommend you configure each as its own gatekeeper.

Tenor DX supports gatekeeper to gatekeeper communication using the standard LRQ (Location Request)/LCF (Location Confirm) messaging scheme.

Zone Management

A zone is a group of H.323 defined endpoints controlled by a Gatekeeper. Endpoints can be gateways (i.e., *Tenor DX*), terminals, and/or multipoint conferencing units (MCUs). Endpoints establish control channels with a gatekeeper for registration, admission, and security. Call routing information about the endpoint is sent to the gatekeeper, including: IP address, unit type (gateway, terminal, or MCU) and routing information (such as phone numbers, number patterns, etc.).

A collection of zones is an administrative domain. An administrative domain provides call routing services for its zones through gatekeeper to gatekeeper messages or gatekeeper to border element messages (see below for more information).

Call Registration

When registration from an H.323 endpoint is complete and a call is originated, the call request is sent to the gatekeeper. The call request provides the Gatekeeper with the dialed number and requests the routing information. The gatekeeper confirms the dialed number and supplies the endpoint with the destination IP address. For example, a *Tenor DX*'s gatekeeper will act as the gatekeeper for that zone and all of the other endpoints will register with it.

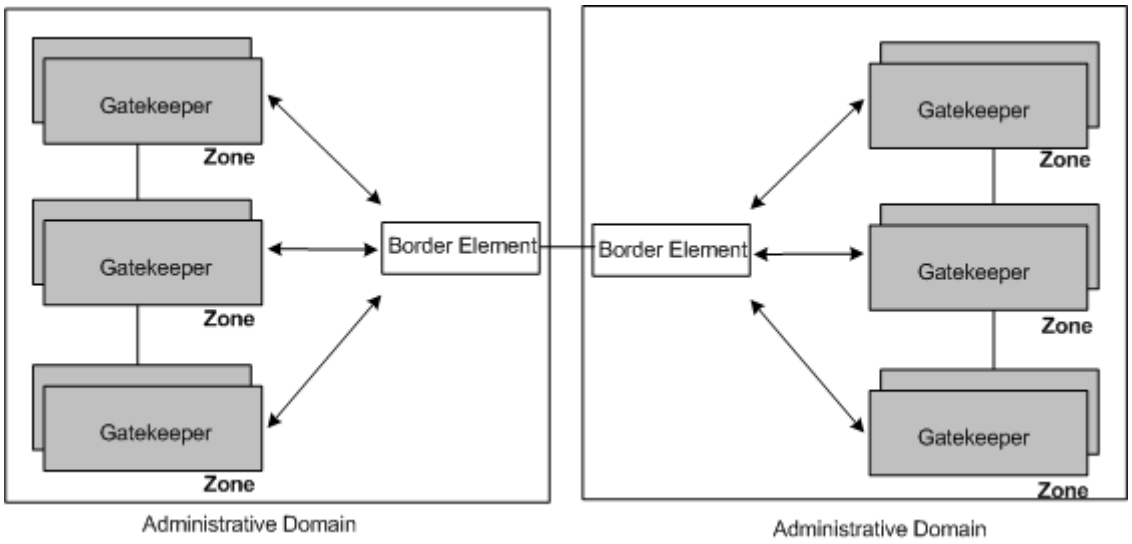
Border Element

The *Tenor DX*'s gatekeeper uses a border element to gain access to the routing database of the administrative domain for the purpose of call completion or any other services that involve communications with other endpoints out of the administrative domain. The border element functionality is built into the *Tenor DX* unit, along with the gateway and gatekeeper.

The primary function of the border element is to collect, manage, and distribute call routing information. A gatekeeper will establish a service relationship with a border element; the gatekeeper provides its zones capabilities and the border element shares call routing capabilities of other zones in the administrative domain. Through the border element, gatekeepers from multiple zones will be able to communicate.

A border element also establishes relationships with other border elements to route between administrative domains. If a gatekeeper cannot resolve an address, it contacts the border element.

In addition, if you are using more than one Tenor unit, you can configure one of the border elements for that zone. The *Tenor DX* unit can use two border elements: primary and secondary. These work together as one entity to provide redundancy and fault tolerance; there are no hierarchal differences.



Call Services

Gatekeepers provide services such as addressing, authorization and authentication of terminals and gateways, bandwidth management, accounting, billing, and charging. Gatekeepers also provide call-routing services. Specifically, the *Tenor DX* Gatekeeper provides the functions which follow:

Address Translation. The gatekeeper translates telephone numbers into IP addresses and vice versa. It performs Alias Address (phone number) to Transport Address (IP address) translation when an endpoint requests service. The Gatekeeper uses a translation table to translate an Alias Address (an address such as an H.323 identifier that a user may not understand) to a transport address. The translation table is updated using Registration messages.

Autodiscovery. The gatekeeper is discovered in one of the following ways: An endpoint sends an IP broadcast called a Gatekeeper Request message (GRQ) message (which includes that correct gatekeeper name) to discover a Gatekeeper OR the endpoint will discover a gatekeeper by its IP address.

Routing. The gatekeeper identifies the IP address of endpoints in its administrative domain. The gatekeeper builds a routing database from information obtained from the border element and also from gateways and H.323 endpoints.

Admissions Control. All H.323 endpoints must register and request permission to enter the gatekeeper's zone; the gatekeeper will confirm or deny access to the network. The gatekeeper authorizes network access and protects the integrity of the network using Admissions Request (ARQ), Admissions Confirmation (ACF) and Admissions Reject (ARJ) messages.

SIP User Agent

SIP (Session Initiation Protocol) is a signaling protocol used to establish a session on an IP network for voice control and management; it is a request-response protocol that closely resembles Hypertext Transfer Protocol (HTTP), which forms the basis of the World Wide Web. SIP re-uses many of the constructs and concepts of Internet protocols such as HTTP and Simple Mail Transfer Protocol (SMTP). The purpose of SIP is only to establish/change/terminate sessions. SIP is not concerned with the content or details of the session.

SIP is Transport layer-independent, which means it can be used with any transport protocol: UDP, TCP, ATM, etc. It is text-based, so it requires no encoding/decoding like H.323. And SIP supports user mobility, using proxies and redirecting requests to your current location.

When configured for SIP the Tenor will act as a SIP User Agent (Endpoint) as defined in IETF RFC3261. Multiple user agents allow for separate agents to be allocated to each SIP call. It will be able to gateway calls to and from the IP network, and Customer Premise Equipment (CPE) such as phones, PBX's, and FAX machines, or the Public Switched Telephone Network (PSTN). The Tenor SIP User Agent will work in conjunction with an external SIP proxy or redirect server to route and connect calls over SIP based networks.

There are three basic components of SIP:

1. User Agent (Endpoint)
   - client element, initiates calls
   - server element, answers calls
2. Network Server (Proxy Server or Redirect Server)
   - name resolution
   - user location
   - redirect and forking
3. Registrar
   - Stores registration information in a location service using a non-SIP protocol.

Chapter 2: Hardware Components

This chapter tells you what is contained in your hardware package. A description of each component is also included.

Specifically, the following topics are covered:

- Hardware Description
- Cables

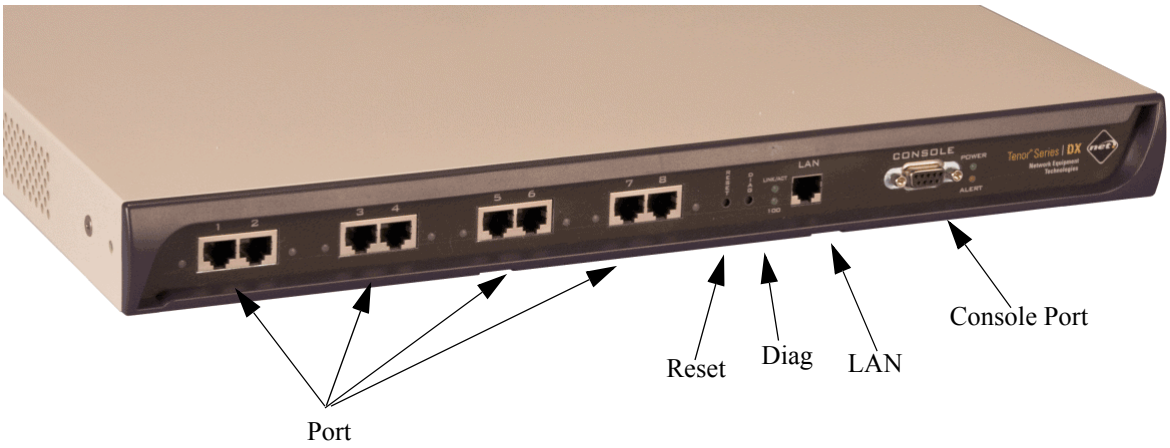
Hardware Description

The *Tenor DX* is a stackable/rack mountable device which provides PSTN and PBX connections (through T1/E1/PRI lines), as well as connections to the Ethernet LAN and a PC. The unit provides eight RJ-45 ports in which you can connect to a PBX or the PSTN.

The unit's front panel includes connection jacks, LEDs, a reset button, and a diagnostics option; the back panel includes a power cord connection site, an on/off switch, and a label.

Front Panel Connections and Reset Options

Figure 2-1 *Tenor DX* Front Panel



- **Ports 1-8.** One RJ-45 jack for each port supports a connection to a line side (PBX) or other customer equipment via upstream T1 or E1 lines, or to the trunk side (PSTN) via downstream T1 or E1 lines.

  Each T1 line provides 24 channels. For each T1 interface, there are two types of signaling supported: Channel Associated Signaling (CAS) and Common Channel Signaling (CCS). For T1 using CAS, channels 1-24 are available; for T1 using CCS, channels 1-23 are available.

  Each E1 line provides 30B (Bearer) channels and 1D (Data) signaling channel. For each E1 interface, there are two types of signaling supported: Channel Associated Signaling (CAS) and Common Channel Signaling (CCS).

  Adjacent port pairs (i.e., 1/2, 3/4, etc.) are configured by default to connect to each other (power off bypass) when the unit is turned off, or when the unit is in Offline mode. This is the preferred method when connecting one of the lines to a PBX, and its adjacent pair to the PSTN. However, if you have adjacent port pairs that are connected to smaller devices (i.e., both going to PSTN) in which you do not want the two ports to be connected to each other in case of power off or offline, you should set the power off bypass = 0. Each pair of ports (1/2, 3/4, 5/6 and 7/8) have their own online/offline and power off bypass control. See the *Tenor Configuration Manager* online help or the *Command Line Interface (CLI)* guide for specific configuration information.

- **Reset.** Enables you to reset the system.
- **Diag**. Enables you to perform software diagnostic procedures.
- **LAN**. 10/100 Base-T Ethernet port. The port provides an RJ-45 jack for an individual connection to a 10/100 Ethernet LAN switch or hub via RJ-45 cable; it is individually configured with a unique IP and MAC address.

Figure 2-2 10/100 BASE-T Ethernet Port Pin Order

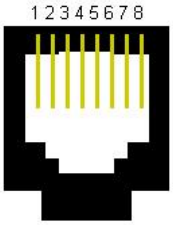


Table 2-1 Input/Output 10/100 Ethernet port

Pin #	Signal	Definition	Color
1	TX +	Transmit Data	White w/orange
2	TX -	Transmit Data	Orange
3	RX +	Receive Data	White w/green
4	RSVD	Reserved	Blue
5	RSVD	Reserved	White w/blue
6	RX -	Receive Data	Green
7	RSVD	Reserved	White w/Brown
8	RSVD	Reserved	Brown

- **Console port.** This RS-232 connector is used for connection to a PC's serial port via DB-9 serial cable at 38400 BPS 8N1, without flow control. The input/output signals are listed in Table 2-2.

Figure 2-3 DB-9 Female Connector Pin Order

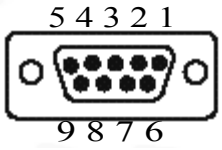


Table 2-2 Serial RS232 DB-9 Connector Pinouts

Pin #	Function	Description
1	DTR	Data Terminal Ready
2	TXD	Transmit Data
3	RXD	Receive Data
4	CD	Carrier Detect
5	GND	Signal Ground
6	N.C.	No Connect

Pin #	Function	Description
7	N.C.	No Connect
8	N.C.	No Connect
9	N.C.	No Connect

Front Panel LEDs

The LEDs display the health of the system. There are different types of LEDs: network, LAN, Alert and Power. For LED definitions, see Table 2-3.

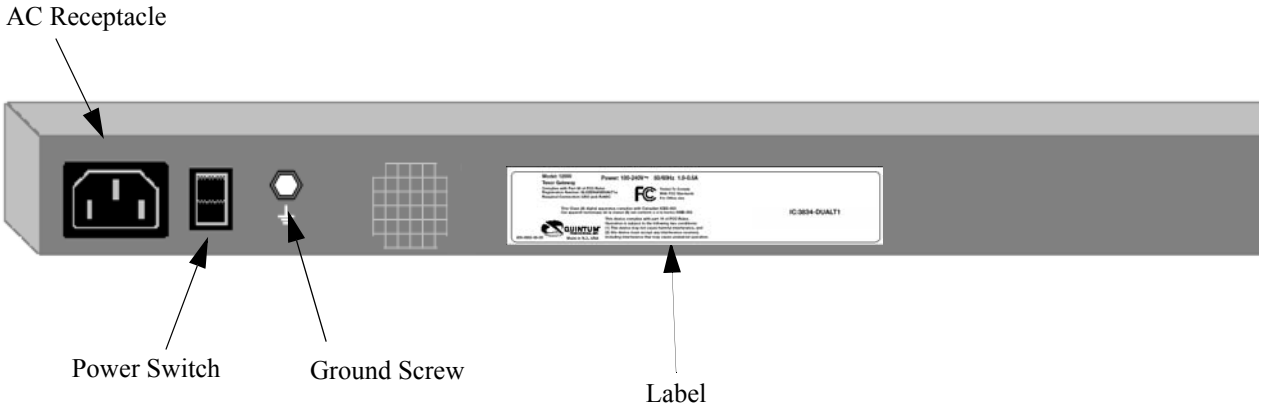
Figure 2-4 Front Panel LEDs

Table 2-3 Front Panel LEDs Definitions

LED	Label	LED Color	Description
Network (PSTN) or PBX	1-8	Red	Receive Path Error Indication. Line is not connected or other receive errors.
		Yellow	Receive Path Error Indication. Line is not connected or other receive errors.
		Green	Indicates B channels are busy.
		Off	The port is empty.
LAN	Link/ACT	Green	On: Link is good. Flashing: Line is working properly and activity is on the line. Off: Link has failed.
	100	Green	On: Activity is being transmitted at 100 Mbps. Off: Activity is being transmitted at 10 Mbps.
Power	Power	Green	On: Indicates power is on. Off: Power is off.

LED	Label	LED Color	Description
Alert	Alert	Amber	Operational Status. Off: *Tenor DX* is working properly. On: One or more diagnostic tests have failed.

Back Panel



- **AC Receptacle.** Receptacle in which to plug in a power cord; the other end will plug into an AC outlet for power.
- **Power Switch.** Switch to turn power on and off.
- **Ground Screw.** An earth ground screw provided to connect to earth ground using a Ground Safety Cable (if your AC power plug only has two prongs and does not have a third, grounded prong).
- **Label**. A label that displays UL, model, and power information.

Cables

The cables listed in Table 2-4 are required to connect a *Tenor DX* to various interfaces. Contact Quintum for ordering information, if necessary.

NOTE: A crossover cable is required when connecting to a Line side (PBX) interface (when supplied by Quintum, this is a red RJ-45 cable). A straight cable is required when connecting to the trunk side (PSTN) interface (when supplied by Quintum, this is a green RJ-45 cable).

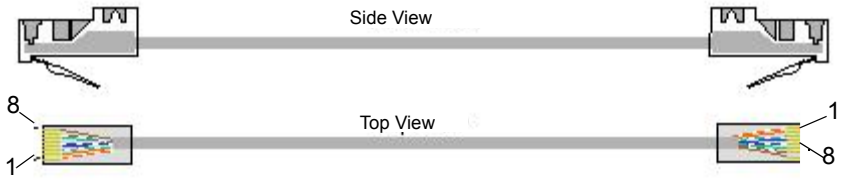
Table 2-4 Cables Supported

Cable	Usage
RJ-45 to RJ-45 Crossover Cable (this cable is red if provided by Quintum)	T1/E1 connection Line Side Side (PBX) interface.
RJ-45 to RJ-45 Straight Through cable (this cable is green if provided by Quintum)	T1/E1 connection to Trunk Side (PSTN) interface.
RJ-45 Ethernet cable (grey or white)	Connection to Ethernet LAN 10/100.
DB-9 Serial RS-232	Connection to PC's asynchronous console port.
Detachable (IEC) AC Power Supply Cord	Connection to AC power jack.

RJ-45 Cables

RJ-45 cable connector pinouts are given in this section to help you identify the proper connector to accommodate your specific networking requirements. The RJ-45 (ISO 8877) connector is the EIA/TIA standard for Unshielded Twisted Pair (UTP) cable; the wiring color codes are UTP Standard Coloring. The pin order is shown in Figure 2-5.

Figure 2-5 RJ-45 Pin Order



RJ-45 Ethernet Cable (10/100)

An RJ-45 (10/100BaseT) straight through shielded cable is used to connect *Tenor DX* to an Ethernet LAN. Cable pinouts are listed in Table 2-5. Color specifications are applicable to the RJ-45 cable provided.

Figure 2-6 RJ-45 (10/100BT) Connector Pinouts

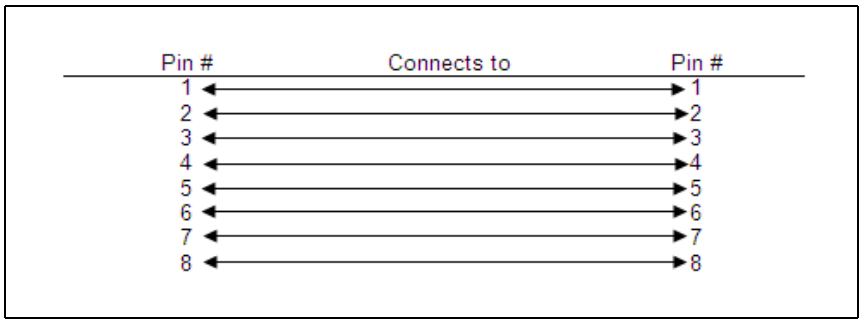


Table 2-5 RJ-45 (10/100BT) Connector Pinouts

Pin #	Signal	Definition	Color
1	TX +	Transmit Data	White w/orange
2	TX -	Transmit Data	Orange
3	RX +	Receive Data	White w/green
4	Unused	Unused	Blue
5	Unused	Unused	White w/blue
6	RX -	Receive Data	Green
7	Unused	Unused	White w/Brown
8	Unused	Unused	Brown

RJ-45 to RJ-45 Straight Cable (T1/E1/PRI WAN to Trunk Side)

An RJ-45 (T1/E1) straight cable is used to connect *Tenor DX* T1/E1 (1-8) port to the Trunk Side (PSTN). Cable pinouts are provided below. If this cable is provided by Quintum, the color is green. The color specifications are applicable to the RJ-45 straight cable provided.

Figure 2-7 RJ-45 (T1/E1/PRI) Connector Pinouts

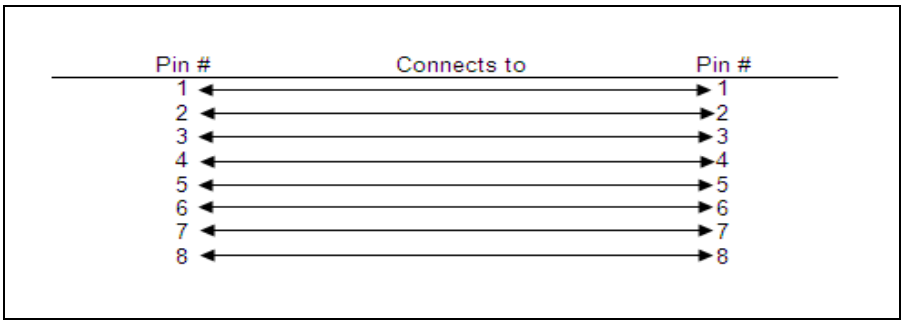


Table 2-6 RJ-45 Connector Pinouts for T1/E1/PRI

Pin #	Signal	Definition	Color
1	RX ring	Receive Ring	White w/orange
2	RX tip	Receive Tip	Orange
3	RSVD	Reserved	White w/green
4	TX ring	Transmit Ring	Blue
5	TX tip	Transmit Tip	White w/blue
6	N.C	No Connect	Green
7	N.C.	No Connect	White w/Brown
8	N.C.	No Connect	Brown

RJ-45 to RJ-45 Crossover Cable (T1/E1/PRI WAN to PBX)

An RJ-45 (T1/E1) crossover cable is used to connect *Tenor DX* T1/E1 (1-8) port to the Line Side (PBX). Cable pinouts are provided below. If this cable is provided by Quintum, the color is red. The color specifications are applicable to the RJ-45 crossover cable provided.

Figure 2-8 RJ-45 Crossover Cable Pinouts

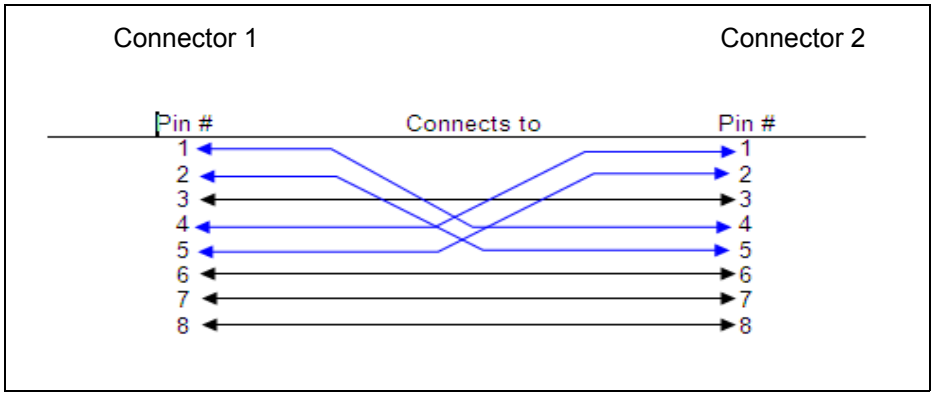


Table 2-7 RJ-45 Connector Pinouts for T1/E1/PRI (1-8) port

Pin #	Signal	Definition	Color for Connector 1	Color for Connector 2
1	RX ring	Receive Ring	White w/orange	Blue
2	RX tip	Receive Tip	Orange	White w/blue
3	RSVD	Reserved	-	-
4	TX ring	Transmit Ring	Blue	White w/orange
5	TX tip	Transmit Tip	White w/blue	Orange
6	N.C	No Connect	-	-
7	N.C.	No Connect	-	-
8	N.C.	No Connect	-	-

DB-9 Serial RS-232 Cable

The Serial RS-232 9-pin cable with a DB-9 male connector (with RS-232 interface) is used to connect the *Tenor DX* to your PC's asynchronous serial port. The pin order for DB-9 male and female connectors are shown in Figure 2-9 and Figure 2-10.

Figure 2-9 DB-9 Male Connector Pin Order

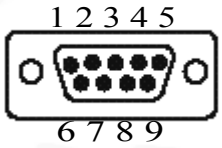


Figure 2-10 DB-9 Female Connector Pin Order

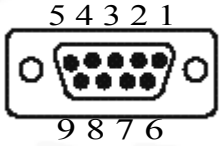


Figure 2-11 DB-9 Connector Pinouts

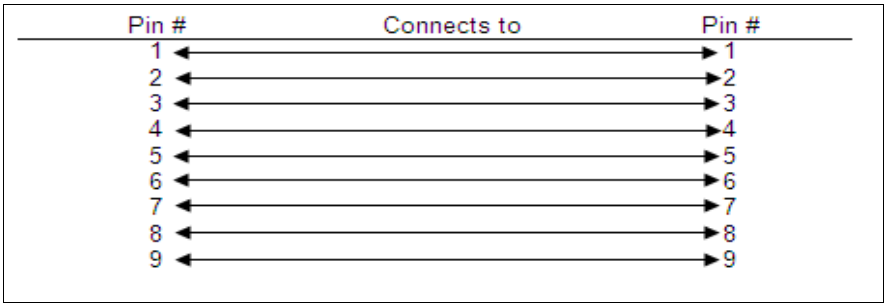


Table 2-8 DB-9 Connector Pinouts

Pin #	Function	Description	Pin #
1	DTR	Data Terminal Ready	1
2	TXD	TransmitData	2
3	RXD	Receive Data	3
4	CD	Carrier Detect	4
5	GND	Signal Ground	5
6	N.C.	No Connect	6
7	N.C.	No Connect	7
8	N.C.	No Connect	8
9	N.C.	No Connect	9

Chapter 3: Installation

This chapter gives you installation instructions, as well as how to position the *Tenor DX* successfully within your network.

Specifically, the following topics are covered:

- ❑ Installation
- ❑ Connection
- ❑ Install Ground Safety Cable
- ❑ Power up the System
- ❑ Assign IP Address

Installation

Before you begin the actual installation, review the pre-installation guidelines which follow and inspect the package contents.

Pre-Installation Guidelines

- Always use an anti-static wrist strap when handling the unit.
- Do not open the unit cover. Inside parts have hazardous voltages and are extremely sensitive to static. If the unit has been opened, your warranty is void.
- Do not connect equipment in wet conditions and keep away from dusty areas.
- The area must not exceed the temperature and humidity guidelines outlined in *Appendix A: Technical Specifications*.
- Avoid exposing the chassis to excessive vibrations.
- Mechanical loading of rack should be considered so that the rack remains stable and unlikely to tip over. Ensure no equipment is put on top of the chassis.

Inspect Package Contents

Before you install the hardware, ensure the following components are included in your shipment:

- Tenor *Tenor DX* and Mounting Hardware
- 1 AC Power Cable
- DB-9 RS-232 Serial Cable
- RJ-45 LAN Cable
- Correct quantity of RJ-45 cables associated with your custom configuration
- Product Guide in CD format

If a listed component is not included in your package, contact your customer service representative.

Rack Install

Locate the *Tenor DX* unit within the same area as your PBX, Ethernet hub, switch, router, and/or PSTN patch panel. The chassis is intended to be installed in a 19” rack.

Mounting brackets are attached to the chassis; the rack is not included with your system. Included with the chassis are the screws and clip nuts listed below. The sizes should allow installation in most racks. If your rack does not use the same size screws listed in the table, please consult the instructions you received with the rack.

Required Materials

- 19” rack (not included with system)
- #8 - 32 x 3/8 screws (qty: 2) (included with system)
- screws as required by your rack manufacturer

Install the chassis in a rack as follows:

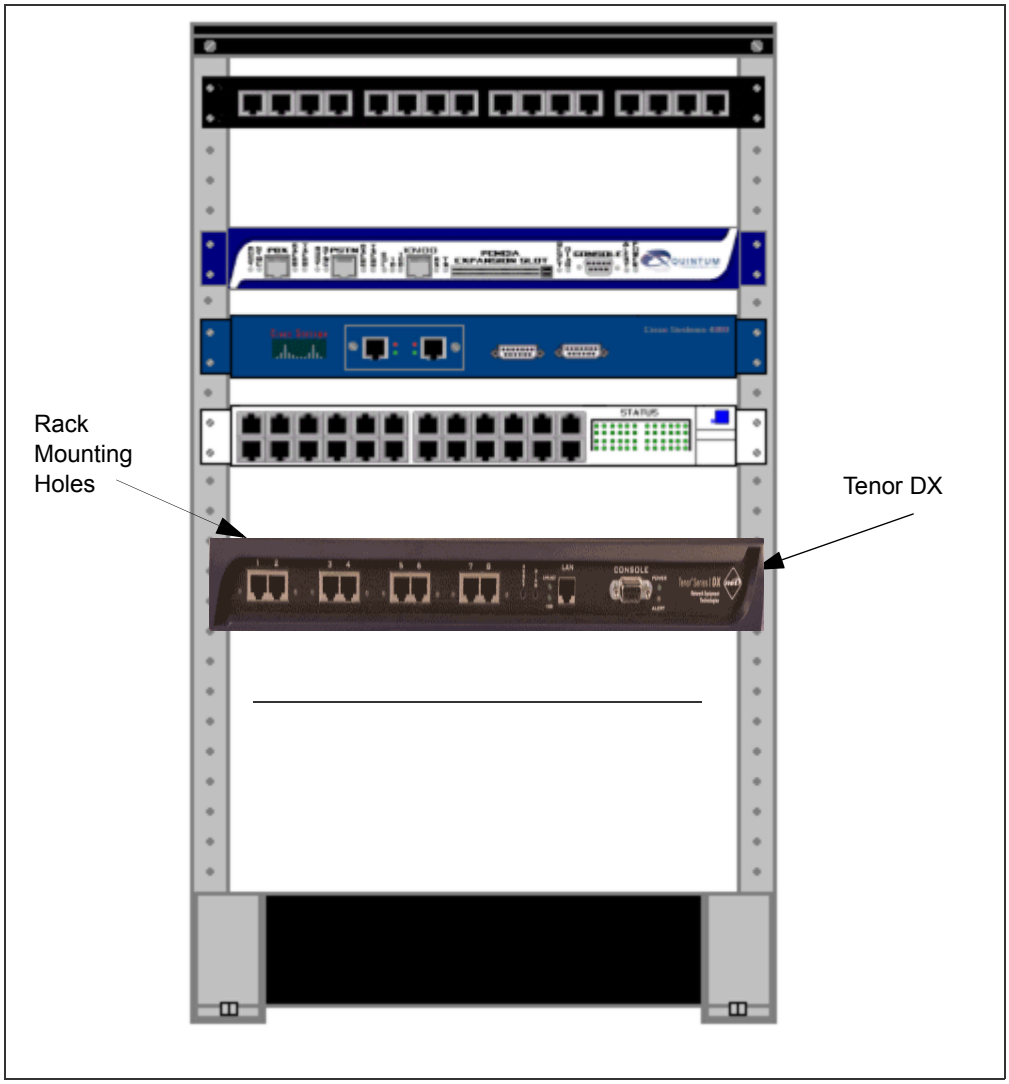
1. Choose a position for the chassis within the rack.

WARNING: If the *Tenor DX* unit is the only equipment installed in the rack, ensure it is level with the rack to avoid the rack from becoming unbalanced. Mount as low as possible to avoid a high center of gravity.

2. Align the unit’s mounting brackets flush with the rack’s mounting holes (see Figure 3-1) and follow the vendor specific instructions for rack installation. The screws provided require a Phillips #2 screwdriver.

3. Ensure the chassis is secured firmly to the rack.

Figure 3-1 Rack Installation (Front View)



Wall Mount

There are two mounting brackets available to mount the unit to the wall.

Pre-installation Guidelines

- Ensure the wall is level and stable.
- Do not attach the unit to a temporary wall.
- Ensure the wall mounting area is within cord distance of the power outlet.

Required Materials

- 2 wall mounting brackets (including 2 screws)
- Drill
- 3/16 drill bit
- Measuring tape or ruler

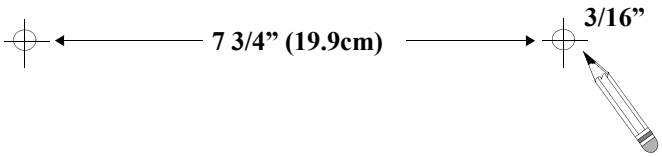
- Hammer
- Phillips head screwdriver

Attach the unit to the wall as follows:

1. Determine the wall area to mount the unit. With chalk or a soft pencil, mark the install area according to Figure 3-2.

NOTE: Ensure the unit is level.

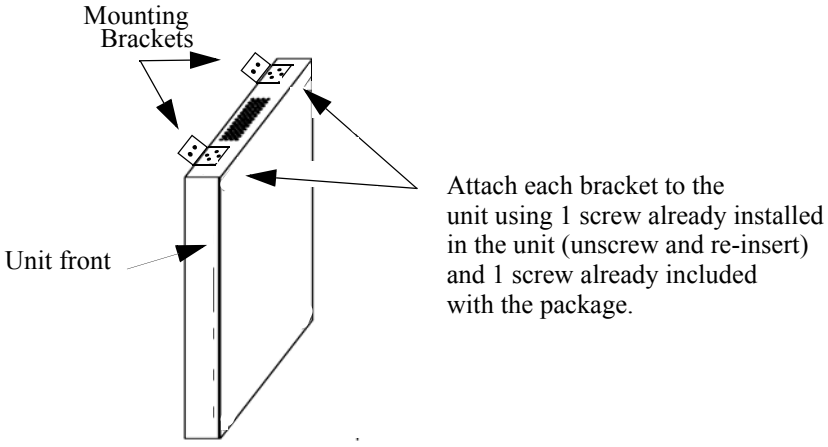
Figure 3-2 Wall Mounting Dimensions



2. Position and attach one mounting bracket to the unit using a screw existing in the system and one screw included with the package. See Figure 3-3.

3. Position and attach the other mounting bracket using a screw existing in the system and the remaining screw in the package. See Figure 3-3.

Figure 3-3 Wall Mount Installation



Note: Ensure unit is level.

4. Mount the unit to the wall using the four remaining screws included with the system.

5. Ensure the unit is firmly mounted against the wall.

Connection

Connect to Line Interface - PBX

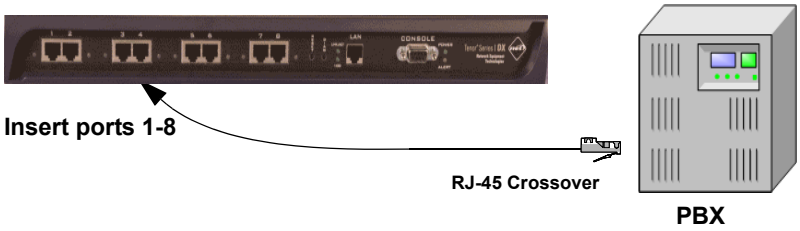
Since there are many different PBX devices and connection methods, your individual PBX will determine the connection method you use to connect to the unit. For example, your PBX may be connected using a patch panel, punch down block, wire wrapped blocks, etc. If you are not sure about installation procedures, contact the network administrator or review the documentation you received with the PBX.

Adjacent port pairs (i.e., 1/2, 3/4, etc.) are configured by default to connect to each other (power off bypass) when the unit is turned off, or when the unit is in Offline mode. This is the preferred method when connecting one of the lines to a PBX, and its adjacent pair to the PSTN. However, if you have adjacent port pairs that are connected to smaller devices (i.e., both going to PSTN) in which you do not want the two ports to be connected to each other in case of power off or offline, you should set the power off bypass = 0. Each pair of ports (1/2, 3/4, 5/6 and 7/8) have their own online/offline and power off bypass control. See the *Tenor Configuration Manager* online help or the *Command Line Interface (CLI)* guide for specific configuration information.

You may use your PBX documentation, along with other PBX materials, to determine how to connect the other end of the RJ-45 cable to your PBX. See *Chapter 2: Hardware Components* for the RJ-45 cable pinouts you can use to acquire another cable or adapter that may be required to connect your specific PBX to the unit. No changes are required to the PBX itself; you will need only the correct cable or adapter.

The instructions which follow tell you how to connect an RJ-45 cable (included in your package) between one of the eight network ports on the *Tenor DX* and a PBX. See *Chapter 2: Hardware Components* for a list of RJ-45 cable pinouts you can use to make a custom cable.

Figure 3-4 Connect to Line Interface



Connect to Line Interface as follows:

1. Plug one end of the crossover RJ-45 cable into one of the eight network ports on the front of the unit. (This cable from Quintum would be the red RJ-45 crossover cable.) See *Chapter 2: Hardware Components* for cable pinouts if you are making your own cable.

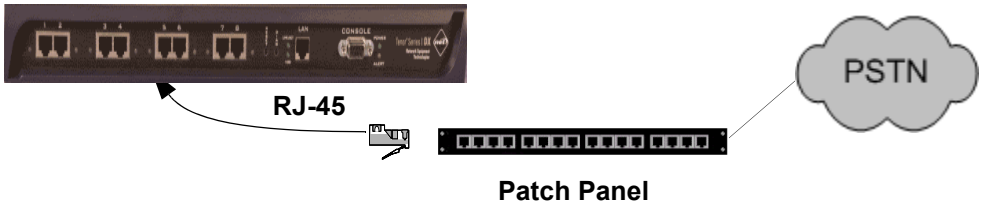
2. Connect the other end of the crossover RJ-45 cable into the appropriate port on the PBX. (If another cable or adapter is required, see *Chapter 2: Hardware Components* for RJ-45 crossover pinout information.)

NOTE: If you are connecting to an external CSU, ensure the Digital Interface is configured as short haul (or DSX-1); otherwise, configure the Digital Interface to DS-1 to enable the built in CSU via Command Line Interface (CLI). See *Chapter 4: Getting Started: Tenor Configuration Manager*.

Connect to Trunk Interface - PSTN

Adjacent port pairs (i.e., 1/2, 3/4, etc.) are configured by default to connect to each other (power off bypass) when the unit is turned off, or when the unit is in Offline mode. This is the preferred method when connecting one of the lines to a PBX, and its adjacent pair to the PSTN. However, if you have adjacent port pairs that are connected to smaller devices (i.e., both going to PSTN) in which you do not want the two ports to be connected to each other in case of power off or offline, you should set the power off bypass = 0. Each pair of ports (1/2, 3/4, 5/6 and 7/8) have their own online/offline and power off bypass control. See the *Tenor Configuration Manager* online help or the *Command Line Interface (CLI)* guide for specific configuration information.

Figure 3-5 Connect to Trunk Interface



1. Plug one end of the straight through RJ-45 cable into one of the eight network ports on the front of the unit. The cable from Quintum would be the green RJ-45 cable. See *Chapter 2: Hardware Components* for cable pinouts if you are making your own cables, or if you wish to attach the table to a punch down block.

2. Connect the other end of the RJ-45 straight cable to the patch panel which houses your telephone lines.

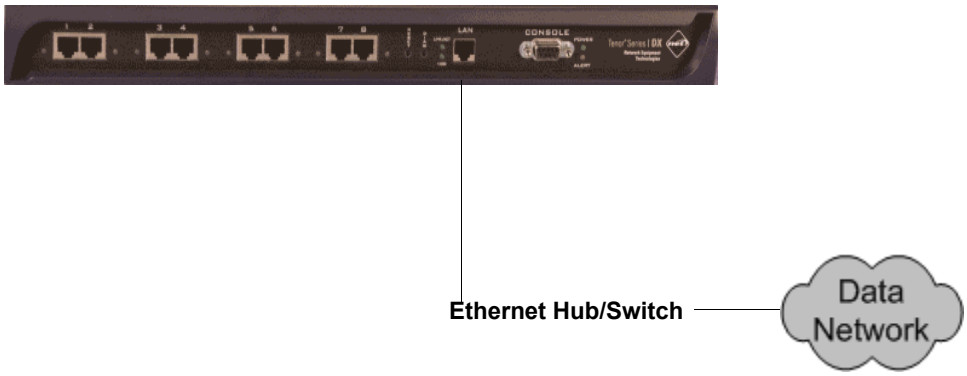
NOTE: If you are connecting to an external CSU, ensure the Digital Interface is configured as short haul (or DSX-1), otherwise, configure the Digital Interface to DS-1 to enable the built-in CSU via *Command Line Interface (CLI)*. See *Chapter 4: Getting Started: Tenor Configuration Manager*.

NOTE: Connecting to the patch panel may require trained telephone personnel.

Connect to Ethernet LAN

You can use these instructions for general connection purposes only. The Ethernet hub/switch manufacturer's documentation should provide specific instructions for connection to another device, such as the *Tenor DX*. Only LAN 1 is available for use; LAN 2 is reserved for future use.

Figure 3-6 Connect to Ethernet Hub/Switch



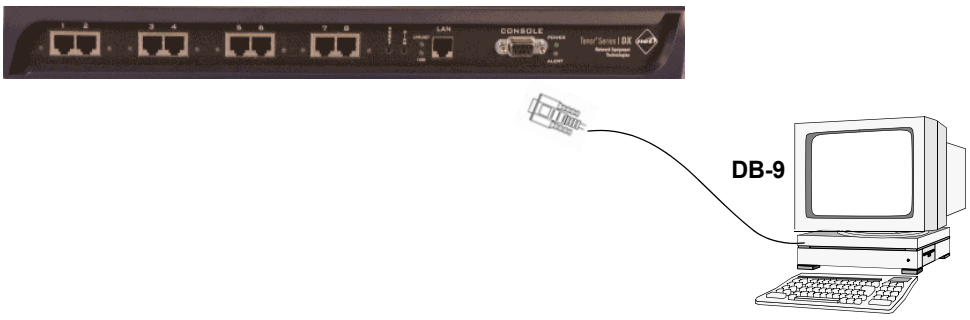
1. Plug one end of the grey or white RJ-45 Ethernet cable into the port labeled LAN 1.

2. Plug the other end of the cable into one of the Ethernet hub/switch ports. If a custom cable or adapter is required, see *Chapter 2: Hardware Components* for Ethernet RJ-45 10/100.

Connect to PC Console

You will need to connect the *Tenor DX* to your workstation's serial port via RS-232 connection. (This connection will be used when you assign an IP address to the unit.) For the instructions below, it is assumed you are connecting to a Windows PC.

Figure 3-7 Connect to PC Com Port



1. Insert the male end of the DB-9 cable into the port labeled *Console*. (See *Chapter 2: Hardware Components* for RS-232 connector pinouts.)

2. Insert the female end of the DB-9 cable into your workstation's serial port (see your PC documentation for more information about this port).

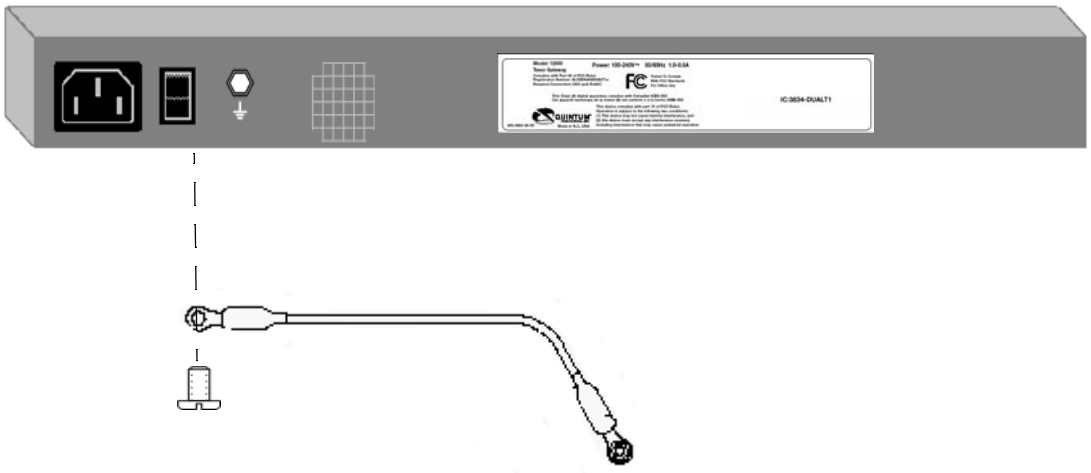
Install Ground Safety Cable (if required)

The *Tenor DX* provides an Earth Ground screw (a #6 screw). This screw provides earth ground to the unit if the AC power receptacle you are plugging into does not contain a ground prong (the Quintum supplied power cable has a three prong connector). To provide ground via the grounding screw, you will need to connect the grounding screw to a Ground Safety Cable, which can then be connected to an approved safety earth ground.

Connect the Ground Safety Cable as follows:

1. Unscrew the existing screw from the grounding hole.
2. Place the screw through the ring connector at one end of the ground safety cable.
3. Attach the screw securely to the threaded grounding hole.
4. Connect the other end of the ground safety cable to an approved electrically grounded object. Consult with a licensed electrician if you are unclear about this operation.

Figure 3-8 Install Ground Safety Cable



Power up the System

Once you have all cables connected properly, you are ready to turn the system on as follows:

1. Plug in the power cord to an AC outlet.

2. Locate the on/off switch on the back of the unit and click the switch to **On**.

The unit will power up and the LEDs will flash and turn off; the power LED will remain lit. For information about the LEDs, see *Chapter 2: Hardware Components*.

Once the unit is powered up, you are ready to assign an IP address. See the following section *Assign IP Address*.

Assign IP Address

Before you can configure a *Tenor DX*, you need to assign a valid IP address. When a *Tenor DX* is shipped to a customer, you need to assign a valid IP address for each unit. An IP address is a 32 bit (up to 12 numeric characters) address used to identify each network device in the TCP/IP network. If the unit does not have an IP address, data will not be able to be sent to or from the unit.

Communication between the Tenor and the PC is enabled via RS-232 connection and terminal emulation software. The instructions below assume you are running HyperTerminal (running Windows 95 or later) on your PC. For all other terminal emulation packages, the specific Tenor commands used to assign the IP address will be the same, but the software specific instructions will be different. Consult the applicable documentation for more information.

You can re-configure the IP address using the procedure which follows.

1. Press the Tenor DX's power switch to **On**.

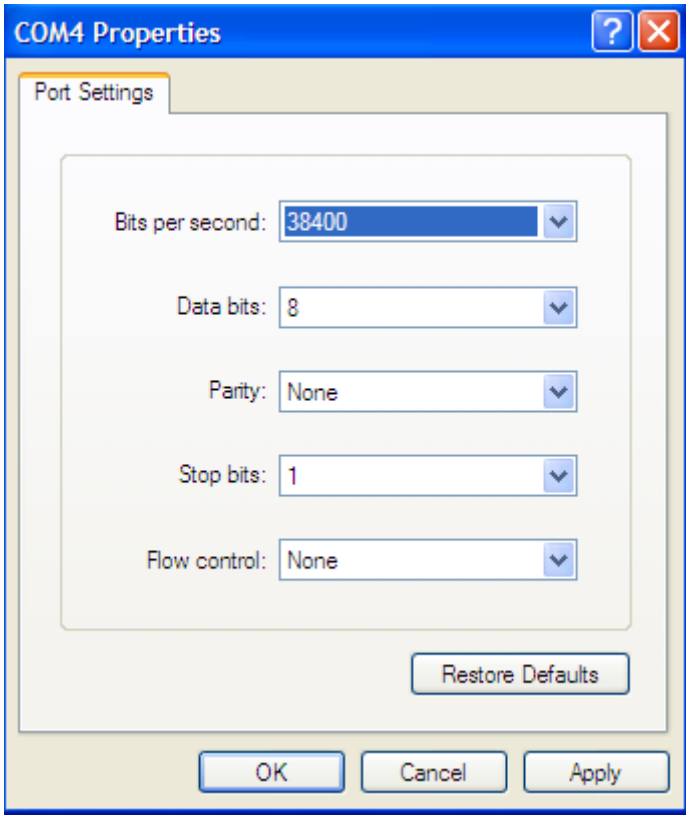
2. Click on *Start> Programs> Accessories> Communications>HyperTerminal> Run*. The *Connection Description* window will be displayed.

3. Enter a connection name (i.e., name for each unit such as *Tenor DX New Jersey*).

4. Click **Ok.**

5. Choose the serial port on your PC from the *Connect Using* drop down list box (i.e., Direct to Com 1). Click **Ok**. The *Com1 Properties* window will be displayed. See Figure 3-9.

Figure 3-9 *Port Settings* Window



6. From the *Bits Per Second* drop down list box, choose *38400*.

7. From the *Data Bits* drop down list box, choose *8*.

8. From the *Parity* drop down list box, choose *None.*

9. From the *Stop bits* drop down list box, choose *1*.

10. From the *Flow control* drop down list box, choose *None*.

11. Click **Ok** and a connection to the Tenor will be established. Information about the unit will scroll on the screen.

12. Enter **login** and **password**. Both are **admin** by default.

13. A message will appear on the screen "Tenor Analog does not have an Ethernet interface configured. Would you like to configure an Ethernet Interface?" (y/n).

14. Type **y**.

15. For *IP Address*, enter the IP address for the Tenor unit.

16. For *Subnet Mask*, enter the subnet mask. This address is used to differentiate the network portion of the IP address from the host portion of the IP address.

17. For *Default Gateway,* choose whether there should be a default gateway (router) which routes packet data outside of your LAN and enter its IP address.

18. A message will appear on the screen "Tenor Digital Ethernet Interface successfully configured." The Tenor will restart using the new Ethernet settings.

Tenor will restart using the new Ethernet settings.

Change IP Address

You are able to change the IP address in which the unit is attached as follows:

NOTE: The instructions below assume you are running Windows 2000 or above.

1. Press the Tenor DX's power switch to **On**.

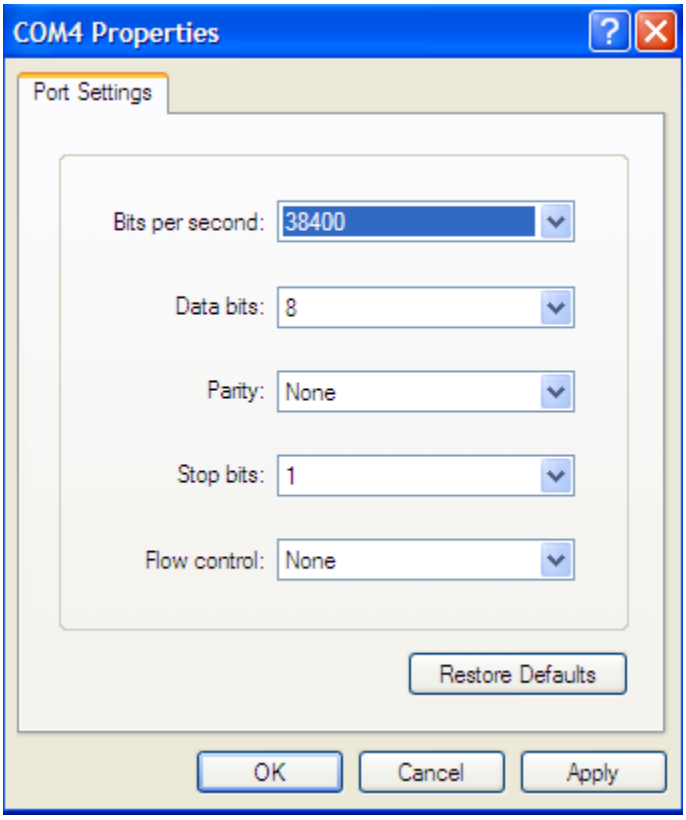
2. Click on *Start> Programs> Accessories> Communications>HyperTerminal> Run.* The *Connection Description* window will be displayed.

3. Enter a connection name (i.e., name for each unit such as *Tenor DX New Jersey*).

4. Click **Ok.**

5. Choose the serial port on your PC from the *Connect Using* drop down list box (i.e., Direct to Com 1). Click **Ok**. The *Com1 Properties* window will be displayed. See Figure 3-10.

Figure 3-10 *Port Settings* Window



6. From the *Bits Per Second* drop down list box, choose *38400*.
7. From the *Data Bits* drop down list box, choose *8*.
8. From the *Parity* drop down list box, choose *None*.
9. From the *Stop bits* drop down list box, choose *1*.
10. From the *Flow control* drop down list box, choose *None*.
11. Press the *Tenor DX* power switch to **On**. After the bootup sequence, the login prompt will appear.
12. Enter a login name. The default login name is *admin*.
13. Enter a password. The default password is *admin*. (Once you are up and running, changing the password is a good idea for security purposes). Step through each of the following parameters and enter the correct values for your installation: IP address, Subnet Mask and Default Gateway.
14. At the **Quintum** prompt, type **ei** to reach the Ethernet prompt and then type **config** to change to the Configuration mode.
15. To set the IP address, type **set ipa** followed by the IP address.
16. To set the Subnet Mask, type **set subnetmask**, followed by the subnet mask.
17. Type **siprd** to change to the Static IP Route Directory.

18. To set the Default Gateway IP, type **change 1 g** followed by the IP address for the default gateway IP.

19. Type **submit**.

20. Type **maint** to reach the maintenance mode and then **mc**. Type **reset**. A confirmation message will ask if you want to reset the unit. Type **yes** to reset the unit. The reboot enables the Tenor to incorporate the new settings.

Load Software Upgrade

To upgrade the software, download the upgrade from the CD ROM you received with the unit, or download the latest software/documentation from *www.net.com*.

Chapter 4: Getting Started: Tenor Configuration Manager

This chapter tells you how to get started configuring and monitoring the *Tenor DX* through the *Tenor Configuration Manager.*

- Overview
- Tenor Configuration Manager

Overview

The *Tenor Configuration Manager* is a user-friendly windows-based stand-alone GUI which enables you to configure a number of Quintum products, including the *Tenor DX*. The software was designed to run on any PC; you simply designate the IP address for the Tenor product (i.e., *Tenor DX*) on which you would like to configure or perform monitoring functions.

The *Tenor Configuration Manager* enables you to perform configuration tasks. For complete information, including all field definitions and extensive usage instructions, see the *Tenor Configuration Manager/Tenor Monitor User Guide* and the *Command Line Interface User Guide* (or the *Online Help* available with the software).

Tenor Configuration Manager

The *Tenor Configuration Manager* is used to configure all aspects of the *Tenor DX*, including system, Ethernet, CDR, signaling, circuit, and VoIP configuration. Through the *Configuration Manager,* you are able to configure all aspects of the Tenor unit.

The manager is a user-friendly GUI which enables you to configure Quintum products; you designate the IP address of the Tenor product you want to configure. A menu tree—which displays all configuration options in the system—is divided into four main areas: *System Wide Configuration*, *Ethernet Configuration, VoIP Configuration,* and *Circuit Configuration*.

- *System Wide Configuration.* The configuration items under *System Wide Configuration* include chassis, dial plan, and assorted server information.
- *Ethernet Configuration.* The *Ethernet Configuration* menu includes options for configuring Ethernet interface information as well as Static IP, NAT IP and Filter IP information.
- *VoIP Configuration.* The *VoIP Configuration* prompt contains the major sub-prompts for configuring the parameters which pertain to its VoIP element status, such as Gateway, Gatekeeper, Border Element, and Signaling Group.
- *Circuit Configuration.* Through the Circuit Configuration options, you are able to set auto-switch, signaling, and trunk group information.

Getting Started with Configuration

This section gives instructions for getting started with the *Tenor Configuration Manager.* For detailed information about the installation procedure, see the *Tenor Configuration Manager User's Guide.*

NOTE: As an alternate to configuring via *Tenor Configuration Manager,* you can configure the unit via *Command Line Interface (CLI)*. For information about the CLI, see *Chapter 5: Getting Started: Command Line Interface (CLI)* or the *Command Line Interface User Guide* you received with the unit.

NOTE: Ensure the software is installed and running.

1. Access the *Tenor Configuration Manager* icon (located in the area in which you specified during installation). For example, click on *Start > Programs >Quintum Tenor Configuration Manager> Tenor Config Manager.* The *Tenor Configuration Manager* will launch. The *Specify Tenor IP Address* window will be displayed.

2. From the *Tenor IP Address* drop down box, click on *Specify New IP Address* (if the IP address is already listed from a previous login, select that IP address and you will automatically be connected).

3. Enter the IP address of the Tenor unit in which you would like to configure.

4. Enter the Tenor Server Port (the value must match the port numbers set via CLI; the default entry is **8080**).

5. Click Ok. The *Confirm Login and Password* screen will be displayed.

6. Enter a user name and password (the default user name is **admin**; the default password is **admin**). Click **ok**. You are now ready to configure the Tenor unit.

Once you have connected to the *Configuration Manager,* you can move around and configure data. For complete information about the field definitions, valid entries, and submit information, see the *VoIP Network Management Server's User Guide* or the online help system that came with the system.

Chapter 5: Getting Started: Command Line Interface (CLI)

This chapter tells you how to use access and use the CLI. Specifically, the following topics are included:

- CLI Description
- Access CLI
- Configuration via CLI

What is the Command Line Interface?

The Command Line Interface (CLI) is a Telnet-based (also accessible via serial port) list of menu options which enable you to configure and monitor any *Tenor DX* unit; you can configure features and capabilities such as numbering plans, channel usage, border element, signaling type, and routing information. In addition, you are also able to monitor system alarms and run diagnostic procedures. CLI attributes enable you to further configure CLI options; these provide additional configuration items according to the option type.

Through the CLI, there are also commands you execute to simplify the process of configuring and monitoring the *Tenor DX* unit. Some of these commands are globally used, others are specific to the mode in which you are working. For example, the *set* command, available globally from within the Configuration mode, enables you to set attributes for different options.

Options

Some configuration menu options can have multiple instances. As a result, those option types require an identifier to uniquely define a specific option type. Other options are part of the default system, such as dial plan. You can configure the dial plan and the corresponding attributes, but you cannot create a second dial plan. Default menu options cannot be deleted.

Other options are user-defined, such as Signaling Groups. These can be added or removed as necessary; you are able to assign an identifier to each option you create. For example, when creating a new ISDN signaling group, you may assign the name 5ESSPRI. From that point, you can enter ISDNSignalingGroup 5ESSPRI and you will be brought immediately to that option. As a result, you can assign relative names to your options that closely represent your actual network.

Modes

The CLI is divided into four different modes: Configuration, Maintenance, Monitoring, and Diagnostics. You can move from one mode to another according to the function you want to perform. See below for a definition of each mode.

Configuration. The Configuration mode enables you to configure all functions in the *Tenor DX*. Through this mode, you can access many configuration options and enter the desired information.

Maintenance. The Maintenance mode provides utilities for maintaining the system. Through this mode, for example, you can reset the system, if necessary.

Diagnostic. The Diagnostics mode provides a set of utilities to perform diagnostic and testing procedures. For example, through this mode you are able to ping other units.

Monitor. The Monitor mode provides a set of utilities to monitor the network and all system components, including chassis software components. In the Monitor mode, you are able to view alarms generated within the system, as well as view the call status.

Navigation

There are several options for navigating through the system. You can either type in the desired option at the prompt, or use global commands, such as the surf (**<** or **>** plus **Enter** key) to move between the menu options.

User Login IDs

There are two types of user logins: *user* and *admin.* The admin level enables you to view and change information. The user level enables you to view the information but not configure via CLI.

Access CLI

You can access the CLI through a Telnet session, a terminal-like access to any *Tenor DX* unit. If your PC is directly connected to the *Tenor DX* unit, you can configure the unit directly through the serial port using HyperTerminal. Both methods are described below.

NOTE: Alternatively, you may want to use other telnet clients, such as the Linux telnet client or free programs like Putty. If you choose to do so, you may have to make minor setting changes in the Telnet client in order to make it function correctly.

Telnet Connection

Once the *Tenor DX* has been initially configured with an IP address network and is connected, the easiest way to connect to the *Tenor DX* and use the CLI is through a standard Telnet session from any PC on your IP network. Connect to a *Tenor DX* unit via Telnet as follows:

For Windows 95/Windows 98:

1. Click on *Start> Run*. The *Run* dialog box will be displayed.
2. Type *telnet* and click on **Ok**.
3. Click on *Connect> Remote System*.
4. In the *Host Name field* type, enter the IP address assigned to your *Tenor DX*.
5. Click on **Connect.**

A connection to the *Tenor DX* unit will be established.

For Windows 2000 and above:

1. Click on *Start> Run*.
2. The *Open* dialog box will be displayed. Type *telnet* and click on **Ok**. (Or type *telnet* followed by the IP address and you will connect.)
3. At the telnet prompt, type *open* (followed by the IP address for the unit to which you want to connect.)

A connection to the *Tenor DX* unit will be established.

Serial Port Connection

When the *Tenor DX* is first shipped to you, you must connect to the unit using this method to assign an IP address. Once this is assigned, you can use the CLI to reach the serial port of the Tenor. A null-modem cable must be used to connect to the CLI using this port, if you are directly connected to the unit. To connect to the *Tenor DX* serial port, locate a workstation (PC) close to the *Tenor DX* unit. Connect as follows:

1. Insert one end of the DB-9 serial null modem cable into the *Tenor DX*'s serial port.

2. Insert the other end of the DB-9 serial cable into your workstation's Com/serial port.

Once the cable is connected and the *Tenor DX* is powered on, open a *HyperTerminal* session (or other terminal emulation program) as follows:

3. Click *Start* > *Programs* > *Accessories* > *Communications* > *HyperTerminal*. The *HyperTerminal* window will be displayed.

4. Click on **Hypertrm**.

5. Enter a connection description (i.e., name for each unit such as *Tenor DX 1*).

6. Click **Ok.**

7. Choose a connection port (on your PC) from the *Connect Using* drop down list box (i.e., Direct to Com 1). Click **Ok.** The *Com 1 properties* window will be displayed.

8. From the *Bit Per Second* drop down list box, choose 38400.

9. From the *Data Bits* drop down list box, choose 8.

10. From the *Parity* drop down list box, choose None.

11. From the *Stop bits* drop down list box, choose 1.

12. From the *Flow Control* drop down list box, choose None.

13. Click on *Call>Call.* A connection to the *Tenor DX* will be established.

14. Enter a login name. The default login name is *admin*.

15. Enter a password. The default password is *admin.* (To change this password later, see *Chapter 8: Diagnostics/Maintenance.*) Questions about the unit will scroll on the screen.

NOTE: Steps 16-18 are used for first time assignment of IP address.

16. For IP address, enter the IP address for the *Tenor DX* unit.

17. For *Subnet Mask for LAN* prompt, enter the subnet mask. This address is used to differentiate the network portion of the IP address from the host portion of the IP address.

18. For *Default Gateway* prompt, enter the IP address for the default gateway (router) which routes a packet data outside of your LAN.

The *Tenor DX* will reboot automatically.

Configuration via CLI

Once you are connected to the Command Line Interface, you can configure the system, as well as perform diagnostics and monitor system information. For specific information, see the *Online Help* you received with the CD.

Chapter 6: Call Detail Recording

This chapter tells you how to display and understand the Call Detail Recording (CDR) feature. Examples are included later.

Specifically, the following topics are included.

- Overview
- CDR Description
- Establish Connection
- CDR Output

Overview

There are two ways to view CDRs for the *Tenor DX* unit: through the *Command Line Interface (CLI)*. The information for accessing CDRs via CLI is detailed in this chapter.

What is a CDR?

A Call Detail Record (CDR) is a string of data which contains call information such as call date and time, call length, calling party, and called party. Through the Call Detail Recording (CDR) feature, the *Tenor DX* unit is able to generate a CDR at the completion of each call. CDRs are collected from multiple *Tenor DX* units simultaneously and continuously.

A CDR file can be created each day to collect CDRs from each *Tenor DX* that connects to the server. From this information you can capture billing type data which can be used by separate software components to create billing reports, view call records, and generate daily/weekly/monthly statistics reports.

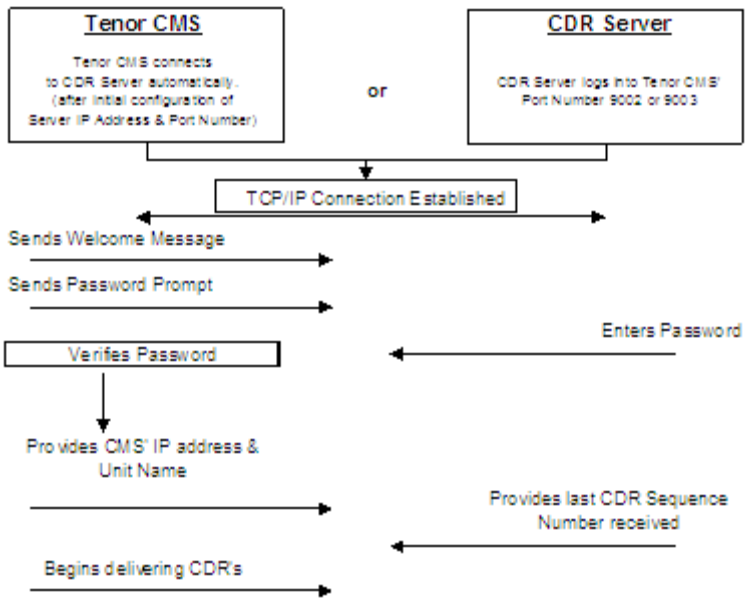
The last 9600 CDRs generated are stored by the *Tenor DX* unit in a circular buffer (this means that any number of CDRs over 9600 will overwrite the existing CDRs). We advise that you set up a PC or workstation to act as a CDR server responsible for receiving the CDRs as they are generated (up to four ports can be set up to collect CDRs from the *Tenor DX* unit). The server will be responsible for capturing CDRs via TCP/IP, processing/storing them in permanent memory, and producing billing records. Any CDRs not collected from the *Tenor DX* unit will be lost if the unit is powered down.

The CDR software and Billing software mentioned is 3rd party software, and is not supported by NET.

Establish connection between *Tenor DX* and CDR Server

In order to capture CDRs, a connection between the *Tenor DX* unit and the CDR server must be established. A *Tenor DX* can be configured to connect up to two CDR servers via port 9002, 9003, 9004, and 9005. Based on configuration, the *Tenor DX* unit can either establish a TCP/IP session with one or all of these CDR servers. A flow diagram (Figure 6-1) illustrates the general transfer of information.

Figure 6-1 Flow of CDR Information



Before attempting to collect CDRs, you should configure the desired information. You can assign a CDR server IP address, CDR server port number, CDR server password, and CDR format information using the following CLI commands: *cdrserverip*, *cdserverport*, *cdrpassword*, and *cdrformat.*

- **CDRServerIPAddr:** IP address of the CDR server. (Used when the *Tenor DX* unit established connection with the CDR server.)
- **CDRServerPort:** The application port numbers used by the CDRServer(s). (Used when the *Tenor DX* establishes connection with CDR server.)
- **CDRPassWord:** Password to be used by the CDR server(s).
- **CDRFormat:** This configuration parameter command is used to choose which of the possible Call Data Record output formats you would like to send to your CDR Server: Standard, Standard with session ID functionality, Extended, Extended with session ID functionality, or Extended with Incoming Slot/Device information. Possible entries are 0 (standard format), 1 (extended format), 3 (extended format), 4 (extended format), 100 (same as selection 0 with session ID functionality), 101 (same as selection 1 with session ID functionality), 103 (same as selection 3 with session ID functionality), 104 (same as selection 4 with session ID functionality).

Configure *Tenor DX* for connection to CDR Server

NOTE: The CDR Server software is a Windows-based *.exe* file available on the CD you received with your system; this software is not supported by Quintum.

The instructions below are performed via Command Line Interface (CLI). See the Command Line Interface (CLI) user guide for specific information.

1. Through CLI, access the *Configuration* prompt.
2. Access the *config-CDRServer-1#* prompt (the number will change according to the desired server).
3. Type *set CDRServerIP* followed by the IP address of the CDR server and press **Enter**.
4. Type *set CDRServerPort* followed by the desired port number and press **Enter.** The default port is 9002.
5. Type set *CDRPassWord* followed by the desired password and press **Enter**. The password is an alphanumeric string.
6. Type *set CDRFormat* followed by the desired format (0, 1, 3, 4, 100, 101, 103 or 104) for displaying CDRs. See previous section for definitions.

Once you configure this information, you will be able to capture CDR reports through the CDR server and the *Tenor DX* unit, it will be able to establish a TCP/IP session with the server on its own.

Setup CDR Server and assign password

Before the CDR server can collect CDRs, you must install the *cdrserver.cfg* file *as follows:*

NOTE: The software is a Windows-based *.exe* file available on the CD you received with your system; this software is not supported by NET.

1. Create a directory in which to install the *cdrserver.cfg* file, such as c:\cdr.

NOTE: You can obtain the *cdrserver.cfg* file via Quintum Training class or through our web site at *www.net.com.*

2. Copy the *cdrserver.cfg* file and install it into the directory you created in step 1.
3. Copy the *cdrsrv.exe* file and install it into the directory you created in step 1.
4. Double-click on the *cdrserver.exe* file. The CDR files will be generated and saved to the directory in which you are working. File names are listed as the data/gateway from which the file was created.

Change CDR Password

Change the CDRserver password, if desired, as follows:

1. From the directory in which you are working, right click on the *cdrserver.cfg* file. At the *Open with* option, choose Notebook.
2. Scroll down to the line stating *cdr_password.* Next to that line, enter the password. Valid entry: up to 30 characters.

Tenor DX Establishes Connection with CDR Server

To capture CDR reports via CDR server (*i.e.,* a PC or workstation you use to capture CDR data) you must first configure the IP address and port number of the CDR server in the *Tenor DX* unit. Once these are configured, the *Tenor DX* unit will be able to establish a TCP/IP session with the server on its own.

CDR Server Establishes Connection with *Tenor DX*

If no IP address/port number is configured, the CDR server has to initiate the session. The *Tenor DX* unit uses TCP port numbers 9002, 9003, 9004, and 9005 on its side for the CDR sessions. The CDRServerport must still be configured to either 9002, 9003, 9004, or 9005 (see the Command Line Interface user guide for specific information).

Whether the *Tenor DX* unit establishes the connection with the CDR server or the CDR server attempts to establish the connection, there is a limit of 5 attempts to enter the correct password before the TCP session is terminated (to configure a password, see the CLI command *cdrpassword* in the previous section).

After the CDR server successfully logs into the CDR port of the *Tenor DX* unit, the CDR server will be provided with the IP address and unit name of the *Tenor DX*. The CDR server will then supply the sequence number of the last CDR that it has received from the *Tenor DX* unit. If the last CDR number is unknown, the server should send 0 for the sequence number. After this exchange, the *Tenor DX* will start delivering new CDRs to the server.

CDR Output

The following is an example of a CDR output. Each field in a CDR string is separated by a comma (any blank fields are designated by a comma). See below for field definitions.

There are four CDR format types:

- 0 (Standard CDR output)
- 1 (Extended CDR output)
- 3 (Extended Tenor DX output and CDR output)
- 4 (Extended Tenor DX output and CDR output)
- 100 (Standard CDR output same as selection 0 output plus session ID)
- 101 (Extended CDR output same as selection 1 output plus session ID)
- 103 (Standard CDR output same as selection 3 output plus session ID)
- 104 (Extended CDR output same as selection 4 output plus session ID)

Sample Record for Standard and Extended CDR Format 0, 1, 100, 101

Record 1 Sample: (includes fields for both Standard and Extended Formats)

1,17325551212,15,20000207062812,21060207062815,
2000020706283030,16,208.226.140.57,192.168.10.64,4,1,1,1,1,1,1,,0,0,1415551000,12345678901234,98
76543210,0123456789

Record 1 Field Definitions – Standard Formats 0 and 100

1 **(Call ID),** 17325551212 **(Called Number)**, 15 **(Duration),** 20000207062812 (**Call Initiation Time**), 20000207062815 **(Call Connected Time)**, 2000020706283030 **(Call Disconnected Time)**, 16 **(Cause Code)**, 208.226.140.57 **(Local IP Address)**, 192.168.10.64 **(Remote IP Address)**, 4 **(Origination Trunk ID)**, 1 **(Call Type)**, 1 **(Call Number Type)**, 1 **(Incoming Line)**,1 **(Incoming Channel)**, 1 **(Outgoing Line)**, 1 **(Outgoing Channel)**, blank **AutoSwitch Time**, blank (**AutoSwitch Duration),** 0 **(Bad IP Quality Events),** 0 **(AutoSwitch Flag)**

Record 1 Field Definitions – Extended Formats 1 and 101

The extended format includes all fields used in the standard format plus the following fields:

1415551000 **(Calling Party Number),** 12345678901234 **(PIN Code),** 9876543210 **(Remote Call ID #)**, 0123456789 **(Local Call ID #)**

Definitions for each field appear below.

Call ID: Sequence number. This is a unique number assigned to identify an individual call (i.e, 1, 2, 3,…). The sequence number starts from 1 and wraps around at 4,294,967,295. When a *Tenor DX* unit resets, the sequence number starts from 1 again. If the system has a problem and loses connectivity, the CDR server can send the *Tenor DX* unit the last Call ID that is received. The *Tenor DX* unit will reply with all records that contain a Call ID which is greater than the one last received.

Called #: The number called. This will be in international format except for a pass-through call going from PBX to PSTN or call going from PSTN to PBX.

Duration: Call duration. This value is in seconds, the value will be 0 if never connected.

Call Initiation Time: The date and time the call initiated. The time will be the local time configured on the *Tenor DX* unit. The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds).

Call Connected Time: The date and time the call was actually connected. The time will be the local time configured on the *Tenor DX* unit. The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds). This field will be blank if the call never connected.

Call Disconnected Time: The date and time the call disconnected. The time will be the local time configured on the *Tenor DX* unit. The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds).

Cause Code: The Q.931 cause value assigned if the call is not connected. Possible common entries are listed below. This field will be blank if the call was connected.

Cause Code	Definitions
16	**Normal Call Clearing.** The cause indicates that the call is being cleared because one of the users has requested that the call be cleared.
17	**User Busy.** The called system acknowledges the connection request but is unable to accept the call because all B channels are in use.
18	**No User Responding.** This cause is used when a user does not respond to a call establishment message with either an alerting or connect indication within the prescribed period of time allocated (in Q.931 by the expiry of either timer T303 or T310).
28	**Invalid Number Format (Address Incomplete).** The cause indicates that the called user cannot be reached because the called party number is not a valid format or is not complete.
31	**Normal, Unspecified.** This cause is used to report a normal event only when no other cause in the normal class applies.
34	**No Circuit/Channel Available.** The connection cannot be established because no appropriate channel is available to take the call.
47	**Resource Unavailable, Unspecified.** This cause is used to report a resource unavailable event only when no other cause applies.

Local IP Address: The IP address for the *Tenor DX* unit originating the CDR. The entry will be in the following format: xxx.xxx.xxx.xxx.

Remote IP Address: IP address for the remote destination *Tenor DX*. This will be generated only if the call is VoIP; if the call is circuit based, this field will be blank. The entry will be in the following format: xxx.xxx.xxx.xxx.

Origination Trunk ID: Identifies the origination trunk ID of the line that initiated the call. This field will be blank if no trunk ID is configured. The trunk ID is often configured with an account code.

Call Type: The type of call. Valid entry: 1 = voice, 2 = fax, 3 = modem, 4 = data.

Call Number Type: The called numbering plan used for the call per Q.931. Possible common entries are as follows: 1 = Public/E.164, 9 = Private.

Incoming Line: If the call is incoming, this field identifies which line the call came in on. Valid entry: 1 = PBX, 2 = PSTN. This field will be empty if the call is an incoming VoIP call.

Incoming Channel: If the call is incoming, this field identifies which channel the call came in on. Valid entry: 1-31. This field will be empty if the call is an incoming VoIP call.

Outgoing Line: If the call is outgoing, this field identifies which line the call is going out on. Valid entry: 1 = PBX, 2 = PSTN. This field will be empty if the call is an outgoing VoIP call.

Outgoing Channel: If the call is outgoing, this field identifies which channel the call went out on. Valid entry: 1-31. This field will be empty if the call is an outgoing VoIP call.

Autoswitch Time: This is the date and time the autoswitched occurred (when the call is switched from VoIP to circuit). The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds). If an autoswitch did not occur, this field will be blank.

AutoSwitch Duration: The number of seconds that the autoswitch call was active. Valid entry: xx.

Bad IP Quality Events: The number of bad quality events that occur during a VoIP call. This number determines the overall quality of the call.

Autoswitch Flag. The terminating side of the autoswitch call initially terminates to the internal autoswitch agent before the call is actually autoswitched. This termination generates an extra CDR in addition to the original call that is autoswitched. This field identifies a call that is terminated to the autoswitch agent, 0 = normal call, 1 = termination to the autoswitch agent.

The following are CDR fields used in the extended format (1 or 101) only.

Calling Party Number. The number called from. The format will be delivered in whatever format the PSTN or PBX delivers to the *Tenor DX*.

PIN Code. PIN code entered. 14 digits maximum. This field will be blank if a PIN code is not configured.

Remote Call ID #. Unique identification number, generated by the remote-side *Tenor DX*, for call record matching purposes. Only generated for IP calls. For a given IP call, Local Call ID on one Tenor should match the Remote Call ID of the other.

Local Call ID #. Unique identification number, generated by the local-side *Tenor DX*, for call record matching purposes. Generated for all IP calls. For a given IP call, the Local Call ID on one Tenor should match the Remote Call ID of the other.

Sample Record for Extended Tenor DX CDR Format 3, 4, 103, 104:

Record 1 Sample: (includes fields for formats 3 and 103)

1,17325551212,15,20000207062812,21060207062815,2000020706283030,16,208.226.140.57,192.168.10.64,4,1,1,1,2,0,1,1,2,0,1,1,,0,0,1415551000,12345678901234,9876543210,0123456789,12138765432

Record 1 Field Definitions - Tenor DX Extended Formats (3 and 103)

1 **(Call ID),** 17325551212 **(Called Number)**, 15 **(Duration),** 20000207062812 (**Call Initiation Time**), 20000207062815 **(Call Connected Time)**, 2000020706283030 **(Call Disconnected Time)**, 16 **(Cause Code)**, 208.226.140.57 **(Local IP Address)**, 192.168.10.64 **(Remote IP Address)**, 4 **(Origination Trunk ID)**, 1 **(Call Type)**, 1 **(Call Number Type)**, 2 **(Incoming Slot),** 0 **(Incoming Device),** 1 **(Incoming Digital Interface)** 1 **(Incoming Channel),** 2 **(Outgoing Slot),** 0 **(Outgoing Device),** 1 **Outgoing Digital Interface),** 1 **(Outgoing Channel),** blank **(AutoSwitch Time),** blank **(AutoSwitch Duration),** 0 **(Bad IP Quality Events),** 0 **(AutoSwitch Flag),** 1415551000 **(Calling Party Number),** 12345678901234 **(PIN Code),** 0123456789 **(Local Call ID #),** 9876543210 **(Remote Call ID #)**

The 4 and 104 extended format includes all fields used in the 3 and 103 extended format plus the following field:

12138765432 **(Incoming/Outgoing IP DN).**

Definitions for each field appears below.

Call ID: Sequence number. This is a unique number assigned to identify an individual call (i.e, 1, 2, 3,…). The sequence number starts from 1 and wraps around at 4,294,967,295. When a Tenor unit resets, the sequence number starts from 1 again. If the system has a problem and loses connectivity, the CDR server can send the *Tenor DX* unit the last Call ID that it received. The *Tenor DX* unit will reply with all records that contain a Call ID which is greater than the one last received.

Called #: The number called. This will be in international format except for a pass-through call going from PBX to PSTN or a call going from PSTN to PBX.

Duration: Call duration. This value is in seconds, the value will be 0 if never connected.

Call Initiation Time: The date and time the call initiated. The time will be the local time configured on the *Tenor DX* unit. The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds).

Call Connected Time: The date and time the call was actually connected. The time will be the local time configured on the *Tenor DX* unit. The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds). This field will be blank if the call never connected.

Call Disconnected Time: The date and time the call disconnected. The time will be the local time configured on the *Tenor DX* unit. The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds).

Disconnect Cause Code: The Q.931 cause value assigned if the call is not connected. Possible common entries are listed below. This field will be blank if the call was connected.

Cause Code	Definitions
16	**Normal Call Clearing.** The cause indicates that the call is being cleared because one of the users has requested that the call be cleared.
17	**User Busy.** The called system acknowledges the connection request but is unable to accept the call because all B channels are in use.
18	**No User Responding.** This code is used when a user does not respond to a call establishment message with either an alerting or connect indication within the prescribed period of time allocated (in Q.931 by the expiry of either timer T303 or T310).
28	**Invalid Number Format (Address Incomplete).** The cause indicates that the called user cannot be reached because the called party number is not a valid format or is not complete.
31	**Normal, Unspecified.** This code is used to report a normal event only when no other cause in the normal class applies.
34	**No Circuit/Channel Available.** The connection cannot be established because no appropriate channel is available to take the call.
47	**Resource Unavailable, Unspecified.** This code is used to report a resource unavailable event only when no other code applies.

Local IP Address: The IP address for the *Tenor DX* unit originating the CDR. The entry will be in the following format: xxx.xxx.xxx.xxx.

Remote IP Address: IP address for the remote destination *Tenor DX*. This will be generated only if the call is VoIP; if the call is circuit-based, this field will be blank.

Origination Trunk ID: Identifies the origination trunk ID of the line that initiated the call. This field will be blank if no trunk ID is configured. The trunk ID is often configured with an account code.

Call Type: The type of call. Valid entry: 1 = voice, 2 = fax, 3 = modem, 4 = data.

Call Number Type: The called numbering plan used for the call per Q.931. Possible common entries are as follows: 1 = Public/E.164, 9 = Private.

Incoming Slot: The slot number to which a call enters. This entry is fixed at 2.

Incoming Device: If the call is incoming, this field identifies which Digital Interface the call came in on. This entry is fixed at 0.

Incoming Digital Interface: If the call is incoming, this field identifies which device interface the call came in on. Valid entry: 1 = PBX, 2 = PSTN. This field will be empty if the call is an incoming VoIP call.

Incoming Channel: If the call is incoming, this field identifies which channel the call came in on. Valid entry: 1-31. This field will be empty if the call is an incoming VoIP call.

Outgoing Slot: If the call is outgoing, this field identifies the slot the call is going out on. This entry is fixed at 2.

Outgoing Device. If the call is outgoing, this field identifies the Device the call is going out on. This field is fixed at 0.

Outgoing Digital Interface. If the call is outgoing, this field identifies which Digital Interface the call is going out on. Valid entry: 1 = PBX, 2 = PSTN. This field will be empty if the call is an outgoing VoIP call.

Outgoing Channel. If the call is outgoing, this field identifies which channel the call went out on. Valid entry: 1-31. This field will be empty if the call is an outgoing VoIP call.

Autoswitch Time: This is the date and time the autoswitched occurred (when the call is switched from VoIP to circuit). The entry will be in the following format: yyyymmddhhmmss where yyyy (4 digits for year), mm (2 digits for month), dd (2 digits for day), hh (2 digits for hour), mm (2 digits for minutes), ss (2 digits for seconds). If an autoswitch did not occur, this field will be blank.

AutoSwitch Duration: The number of seconds that the autoswitch call was active. Valid entry: xx.

Bad IP Quality Events: The number of bad quality events that occur during a VoIP call. This number determines the overall quality of the call.

Autoswitch Flag. The terminating side of the autoswitch call initially terminates to the internal autoswitch agent before the call is actually autoswitched. This termination generates an extra CDR in addition to the original call that is autoswitched. This field identifies a call that is terminated to the autoswitch agent, 0 = normal call, 1 = termination to the autoswitch agent.

Calling Party Number. The number called from. The format will be delivered in whatever format the PSTN or PBX delivers to the *Tenor DX*.

PIN Code. PIN code entered. 14 digits maximum. This field will be blank if a PIN code is not configured.

Local Call ID #. Unique identification number, generated by the local-side *Tenor DX*, for call record matching purposes. Generated only for IP calls.

Remote Call ID #. Unique identification number, generated by the remote-side Tenor side *Tenor DX*, for call record matching purposes. Only generated for IP calls.

The following is a CDR field used in the extended format 4 and 104:

Incoming/Outgoing IP DN. If this is an incoming IP call, the number displayed will be the number as received from the other endpoint. If this number is an Outgoing IP call, the number displayed will be the DN as it was sent out over IP (Outgoing number plus prepended digits).

Chapter 7: System Alarms

This chapter tells you how to use the *Alarm Manager* to view and understand alarms generated by the system.

Specifically, the following topics are included:

- ❑ Overview
- ❑ Monitor Alarms
- ❑ View Alarms

Overview

There are two ways to view alarms for the *Tenor DX* unit: through the *Command Line Interface (CLI)*. The information for accessing alarms via CLI is detailed in this chapter.

Monitor Alarms

Alarms are brief text messages that appear on your workstation when the *Tenor DX* unit encounters a problem, such as a failed interface, disconnected call, etc. You can reach the *Alarm Manager* through the *Command Line Interface (CLI)* alarm monitoring system.

How to Read Alarms

The *Alarm Manager* reports alarms according to criteria such as the alarm's severity level, line number the alarm occurred on, channel number, etc. There are two alarm types displayed: Active Alarms and Alarm History. An Active Alarm list displays all the alarms still active on the system; these alarms have not been cleared or deleted. An Alarm History is a list of the last 100 alarms stored in the system since the last time you performed a delete operation.

Definitions for generated alarm fields appear in Table 7-1.

Table 7-1 Alarm Fields and Definitions

Field	Definition	Valid Entry
IP #	The unit's IP address (32 bit address).	Example:192.168.1.34.
Sequence #	Internal number used to identify alarms.	01, 02, 03, etc.
Type (displays only if you generate an Alarm History)	The type of alarm generated.	ALR = Alarm. This indicates an active alarm. CLR= Clear. This indicates an alarm that has been cleared from the system. RPT= Report. This indicates that the alarm has been generated for a report. This entry is for internal use only; if you see an alarm that is causing problems, contact customer service.
Severity	Level or alarm severity.	1 = Critical (complete system is affected). 2 = Major (major problem is detected). 3 = Minor (minor problem is detected). 4 = Info (Information about a minor problem).

Field	Definition	Valid Entry
Description	A text description of the alarm; see Table 7-2 for detailed description.	Varies.
Slot #	Defines which slot the alarm occurred on.	Slot 1 or 2. Slot 1 refers to the system controller functions; slot 2 refers to DSP functions.
Device #	Defines which device the alarm occurred on.	Always device 0.
Digital Interface	Defines which interface (line) the alarm occurred on.	Line 1 through 8.
Channel #	Specifies which channel the alarm occurred on.	Channels 1-24 (for T1) or 1-31 (for E1).
Date/Time	Date/time the event occurred on.	Day of week: name of day. Month: Jan, Feb, March, etc. Day of month: 1 or 2 digits. Time: 6 digits (hour minutes seconds based on a 24-hour clock). Year: 4 digits.

Valid Alarms

The following is a list of all alarm descriptions (text that appears in the Alarm Description field) for all possible alarms the system can generate. In the generated alarm list, the alarm description appears as part of the Description field.

Table 7-2 List of Valid Alarms

Severity (appears as part of severity field)	Alarm Description (text appears in desc field)	Definition
Critical	Loss of Framing (Red Alarm)	Signal is not being transmitted; there is no layer 1 synchronization.
Critical	Remote Alarm indication (Yellow Alarm)	*Tenor DX* is receiving a yellow alarm signal from the network.
Critical	Loss of signal	A loss of signal (32 consecutive zeros) at least once during a 1 second period.
Critical	AIS Reception (Blue Alarm)	Alarm Indication Signal. An all ones condition used to alert the *Tenor DX* that its incoming signal (or frame) has been lost.
Critical	Layer 2 Down	Indicates that Layer 2 protocol is down.
Critical	Ethernet Disconnected	Ethernet cable has been disconnected from the System Controller or CPU Card, or Ethernet connectivity has been lost. No new VoIP calls will be made and existing PSTN calls will be switched to the PSTN.
Critical	Call Handler not registered with Gatekeeper	The Call Handler process cannot be registered with the Gatekeeper.
Critical	Critical Software Error	A software error has occurred that affects the operability of the complete system.
Critical	*Tenor DX* Chassis reset	The chassis has reset.
Critical	Primary Digital Interface Clock Loss	Clock source has been lost for T1 lines. The unit will automatically switch to the secondary digital interface clock source.
Critical	Secondary Digital Interface Clock Loss	All clock sources have been lost, both primary and secondary. Check the T1 lines for the possible cause.
Critical	Configuration Data Missing	Configuration via CLI is missing. Check the configuration data and add the necessary information.

Severity (appears as part of severity field)	Alarm Description (text appears in desc field)	Definition
Critical	IVR Configuration Missing	Appears if an attempt to make an IVR call has been made when a valid IP address is not configured. Occurs if an IVR call has been passed through accidently, without a real intention to use IVR for subsequent calls, while both of the servers were disabled. In order to clear the alarm, a user will have to change one of the IP addresses to some value, and then disable it again.
Critical	RADIUS Configuration Missing	Appears when a RADIUS request is made and one or more required configuration parameters are missing. This alarm is cleared when the required RADIUS parameters are configured via CLI.
Critical	RADIUS Server Not Responding	Appears when none of the configured RADIUS servers respond. This alarm is cleared when any of the RADIUS servers respond or the RADIUS server is disabled via CLI.
Major	Major Software Error	A software error has occurred that affects system signaling, interfaces, or other major operation.
Major	File Missing in the File Server	This alarm will be reported to the system when a particular voice prompt file is not found in the IVR Prompt Server. This alarm applies only to the system with enabled IVR functionality.
Major	Switch to other RADIUS server	Appears when the current RADIUS server stops responding after three consecutive calls end in timeouts and another RADIUS server is configured, the Tenor will then switch to the next RADIUS server.
Minor	Call Event(s) Lost	A call has failed.
Minor	Missing or Incorrect Profile	The configuration profile has caused a problem.
Minor	Minor Software Error	A software error has occurred but will not affect the operation of the complete system.
Minor	No response to seizure	There has been a problem with the T1 line.
Minor	Remote end did not back off in a glare situation	An incoming and outgoing call went through at the same time, and the remote end call did not back off.
Minor	Unit resource constrained	A shared resource in the unit loads the system.

Severity (appears as part of severity field)	Alarm Description (text appears in desc field)	Definition
Minor	Hardware component failed	A hardware component has failed. Check all components, hardware connections, etc.
Minor	Log RADIUS server error	Displayed when the RADIUS server fails to send required data or the data sent by the RADIUS server has improper values. Incorrect information may contain the following: RADIUS Server: Credit amount (-1) RADIUS Server: Credit minus amount RADIUS Server: Not supported currency RADIUS Server: Credit time (-1) RADIUS Server: Credit time < 6 sec RADIUS Server: Invalid error code
Informational	Gatekeeper status	Reports the status of the Gatekeeper.
Informational	Miscellaneous information	Miscellaneous information about the unit is reported. The contents of this alarm will vary.
Informational	Info Software Error	Indicates information about miscellaneous software error. This does not affect system operation.
Informational	Glare occurred	An incoming and outgoing call went through at the same time, and the remote end call did not back off, but the situation was corrected.

View Alarms

The Command Line Interface (CLI) enables you to view alarms through the Monitor mode. You can view active alarms, as well as view an alarm history list.

You are now ready to view active alarms and an alarm history, or both. See the sections which follow:

Display all Alarms

You are able to display both active alarms and an alarm history as follows:

1. Through CLI, access the *Monitor* prompt.

2. Type *alarm.* Both active alarms and the alarm history will be displayed. See section *How to Read Alarms* for field definitions.

Figure 7-1 Alarm sample

IP# Sequence#Type#Severity# Desc# Slot# Device# Digital Interface# Channel# Date/Time

192.168.20.136:947:ALR:1:Yellow Alarm:1:0:1:0:THU APR 14 00:00:04 2016

Display Active Alarms

1. Through CLI, access the *Monitor* prompt.

2. Type *alarm a.* The active alarms will be listed. See section *How to Read Alarms* for field definitions. If you enter *alarm* without a command following it, both active alarms and the alarm history will be displayed.

Figure 7-2 Active Alarm Sample

IP# Sequence#Type#Severity# Desc# Slot# Device#Digital Interface# Channel# Date/Time

192.168.20.136:947:ALR:1:Yellow Alarm:1:0:1:0:THU APR 14 00:00:04 2016

Display Alarm History

1. Through CLI, access the *Monitor* prompt.

2. Type *alarm h*. An alarm history will be displayed. See section *How to Read Alarms* for field definitions. If you enter *alarm* without a command following it, both active alarms and the alarm history will be displayed.

Figure 7-3 Alarm History Sample

IP# Sequence#Type#Severity# Desc# Slot# Device# Digital Interface# Channel# Date/Time

192.168.20.136:947:ALR:1:Yellow Alarm:1:0:1:0:THU APR 14 00:00:04 2016

192.168.20.136:948:ALR:1:Loss of Framing(Red Alarm):1:0:2:0:THU APR 14 00:00:04

192.168.20.136:949:CLR:1:Yellow Alarm:1:0:1:0:THU APR 14 00:00:08 2016

Chapter 8: Diagnostics/Maintenance

This chapter tells you how to troubleshoot *Tenor DX* operation, as well as how to maintain the health of your system. You will find information about how to view the unit's LEDs, as well as how to interpret the chassis' alarms and check basic connections.

Specifically, the following topics are included:

- ❑ Before you Begin
- ❑ Monitor LEDs
- ❑ Diagnostics
- ❑ Monitoring
- ❑ General Maintenance
- ❑ Finding Help

Before you Begin

Before you begin troubleshooting a potential malfunction, it is a good idea to check your basic hardware connections. See below.

- Ensure power cord is firmly installed in the back panel's power jack and the other end is plugged into the AC power source.
- Ensure the unit's power switch is in the On position. If the unit is not working, toggle the power switch to reset the system. If the unit is reset, the settings you configured may be lost.
- Verify that all RJ-45 and DB-9 cables fit snugly in each front panel jack. Faulty connections may cause a number of network interfacing or connection issues.

If you suspect the problem to be on the network end, contact your Central Office to verify proper operation.

Monitor LEDs

LEDs monitor the health of the system; they are the first signal that the unit is not working properly or that an internal or external error has occurred. LEDs appear on the front of the unit (LED descriptions are detailed in *Chapter 2: Hardware Components*.

Check *Chapter 2: Hardware Components* to ensure the correct lighting of each LED and then see *Common Symptoms/Problems* for troubleshooting information. If the LEDs are not lighting at all, check the AC power source to ensure power is being supplied to the unit.

Diagnostics

Common Symptoms/Problems

Below is a list of common symptoms and problems you may encounter. Use this list as a guideline; if your problem is not listed, use the diagnostic procedure explained in the beginning of this chapter.

Table 8-1 Common Symptoms/Problems

Common Symptom/Problem	Description/Solution
Unit will not turn on.	Check AC power source.
Communication between *Tenor DX* and the PBX or PSTN cannot be established.	There are several reasons why communication may not be successful. A few of the most common are listed below. Verify correct cables are installed in the T1/E1/PRI ports. See *Chapter 3: Installation*. Unit configuration may be wrong. Examine the configuration parameters via *Configuration Manager* or CLI. Network issues may cause a number of problems. Contact the Central Office to perform test procedures.
Communication with *Command Line Interface (CLI)* cannot be established using Telnet.	The IP address of the *Tenor DX* unit may be incorrect. Check Ethernet Cable. Verify the IP address of *Tenor DX*. Check the Default Gateway Subnet Mask. Check Ethernet connection via RS-232 connection. See *Chapter 3: Installation.* Verify network connectivity using *ping* from another network host. See *Chapter 8: Diagnostics/Maintenance*.
ALERT LED is on and not flashing.	One or more internal diagnostic tests have failed. Contact customer service. LED will stay on for a minute or so when the unit is powered up.
Communication with Ethernet Hub, or switch cannot be established.	Verify RJ-45 cable is firmly installed in the Ethernet port. Check MDI/MDIX configuration. Check duplex setting on the switch in which they were connected and the speed of 10MB or 100 MB.
Communication between computer's COM port and *Tenor DX* serial port cannot be established.	Verify DB-9 cable is firmly placed in the unit's console port and your PC's serial port. Verify Terminal port settings at 38400 BPS 8N1 No Flow Control.

Common Symptom/Problem	Description/Solution
Tenor DX cannot receive or transmit calls.	Check DS1 card *Span Status* LEDs. If unlit, it indicates that the T1 or E1 lines may be down. Generate alarm list for more information. Contact Central Office for interface issues.
For DC only: The breaker trips due to excessive current.	Power on/off using the circuit breaker.

Verify Unit Provisioning

An error with *Tenor DX*'s provisioning may cause a number of problems. It may be a simple error, such as an incorrect IP address or telephone number, or it may be something more complex, such as incorrect T1/E1 parameters.

Evaluate your system provisioning. Check all data provisioning information, and re-configure if necessary. See *Chapter 5: Getting Started: Command Line Interface (CLI)*.

Ping Unit

Ping enables you to ping an IP address. See *Chapter 8: Diagnostics/Maintenance* for more information.

Monitoring

Alarms

Alarms help you identify where a specific problem is occurring with the *Tenor DX* unit. Through the CLI, you can review alarms via Command Line Interface (CLI). Verify all severity 1 alarms first; these alarms indicate that the unit is in critical condition and the entire system is affected.

See *Chapter 7: System Alarms* for specific information about obtaining and reading alarms.

General Maintenance

Restore Factory Defaults

You can set all system configuration settings back to their factory defaults via *Command Line Interface (CLI)* as follows:

1. Access the CLI through a Telnet session. See *Chapter 5: Getting Started: Command Line Interface (CLI)* for more information.

2. Access the *Config-VOIPNetwork-1* prompt.

3. Type *setfactory*. You will be asked if you are sure you want to set the unit back to factory defaults.

4. Type **yes** to confirm (type no to cancel the restore).

Reset System

Reset the system as follows: turn the power switch to “off” and then back “on”.

Change Password

For security purposes, you may want to change your password. You can change the password via *Command Line Interface (CLI)* as follows:

1. Access the CLI through a Telnet session. See *Chapter 5: Getting Started: Command Line Interface (CLI)* for more information.

2. Access the *Maintain* module.

3. Type *password*. A prompt will ask you for the old password.

4. Type the old password and press **Enter.** A prompt will ask you for the new password. Type the new password and press **Enter.** A confirmation will ask you to confirm the new password.

5. Re-type the new password and press **Enter**.

A message will tell you the password was changed successfully.

Change Unit Date and Time

You can change the unit's date and time via *Command Line Interface (CLI)* as follows:

1. Access the CLI through a Telnet session. See *Chapter 5: Getting Started: Command Line Interface (CLI)* for more information.

2. Access the Config module.

3. Type *date* followed by *mm/dd/yy/hh:mm:ss* and press **Enter**.

4. For example, type **config# date 06/14/02/22:14:00.** This command will set the current time to June 14, 2002 at 10:14 p.m.

If you need Additional Help

The NET Technical Assistance Center (TAC) engineers are available by telephone 24 hours a day, seven days a week. Warranty and contract customers receive first consideration in the scheduling of technical resources. Before contacting TAC for help, review and verify the provisions contained in your warranty or contract. Depending on those provisions, there may be a charge for service.

When contacting the NET Support Center, please ensure to review the NET Customer Support Handbook, and have the Serial Number or Hardware ID of your product available. This information assists Support Engineers in opening a support case and confirming your support contract status.

When authorized, TAC engineers can diagnose most network problems remotely over the internet. When a service technician is required, TAC will dispatch the nearest NET or third-party Field Service engineer.

To register your fault use the *NET Support.net.com web portal*. Alternatively you can call U.S: +1 800-800-4638 | International: +1 703-948-1999

Appendix A: Specifications/Approvals

Voice/Fax

Call Routing:	Line Side Interface/Trunk Side Interface
Coding:	A-law, u-law
Voice Algorithms:	G.723, G.723.1A (5.3, 6.3 Kbps), G.726 (16, 24, 32, 40 Kbps), G.729, G.711
Fax Support:	Group III at 2.4, 4.8, 7.2, 9.6, 12, 14.4 Kbps
Automatic Call Detection:	Voice/Modem/Fax

Line Side (PBX) / Trunk Side (PSTN) Connections

Interface:	T1/E1 and Fractional T1/E1 with a built in CSU.
T1/E1 Signaling:	Channel Associated Signaling (CAS) Common Channel Signaling (CCS)
Impedance:	E1 - 120 Ohms balanced T1 - 100 Ohms balanced
Jack:	RJ48C (Cable to trunk side interference, RJ-45 straight through twisted pair. A green cable provided by NET). RJ48C (Cable to line side interface, RJ-45 crossover twisted pair. A red cable provided by NET).

LAN Connection

LAN Support:	10/100 Mbps Ethernet
Connection Type:	Full Duplex/Half Duplex

Physical

Position:	19” (48.7 cm) rack mountable or wall-mountable
Depth:	10 3/4” (27.6 cm)
Width	17 3/8” (44.5 cm)
Height:	1 3/4 ” (4.5 cm)
Weight	7.2 lbs (3.24 kg)

Electrical

Ethernet:	Standard 10/100Base-T RJ-45 interface (IEEE 802.3)
PBX/PSTN	Standard RJ-45
Connectors	8 RJ-45 connectors for T1/E1 connection to the PBX and the digital network.
Console Port:	RS-232/DB-9 Female
Power	100-240 VAC, 2-1A, 50-60 Hz

Environmental

Operating Temperature:	32° to 104 ° F (0-40° C)
Operating Humidity:	20% to 80% non-condensing
Operating Altitude:	-200 to 10,000 feet (-60 to 3,000 meters)
Storage Temperature:	14° to 140° F, (-10 to 60°C)

Agency Approvals

EMC	FCC Part 15, Class A ICES-003 AS/NZS 354:95 EN55022:98 Class A EN55024:98 EN61000-3-2:95 EN61000-3-3:95
TELECOM	FCC Part 68 CS-03 TS016 TS038 TBR4 ISDN Layer4
SAFETY	UL/cUL 60950 EN60950:92 TS001

FCC WARNINGS

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interface will not occur in a particular installations. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 68 of the FCC Rules and the requirements adopted by ACTA. On the back of this equipment is a label that contains, among their information, a product identifier in the format US:6LCDDNANDS1NIC. If requested, this information must be provided by the Telephone Company.

The REN (Ringer Equivalence Number) is used to determine the number of devices that may be connected to a telephone line. Excessive RENs on a telephone line may result in the devices not ringing in response to an incoming call. In most but not all areas, the sum of RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company. For products approved after July 23, 2001, the REN for this product is part of the product identifier that has the format US:AAAEQ##TXXXX. The digits represented by ## are the REN without a decimal point (e.g., 03 is a REN of 0.3). For earlier products, the REN is separately shown on the label.

Facility Interface Codes For Digital Services supported:

- 04DU9-BN 1.544 Mbps Superframe Format (SF) without line power.
- 04DU9-DN 1.544 Mbps SF and B8ZF without line power.
- 04DU9-1KN 1.544 Mbps ANSI ESF without line power.
- 04DU9-1SN 1.544 Mbps ANSI ESF and B8ZF without line power.

Service Order Codes For Digital Services supported:

- 6.0Y We do provide billing and encoded analog protection.

An FCC compliant telephone cord with a modular plug is provided with this equipment. This device connects to the telephone network via an RJ45 plug and jack. The plug and jack also comply with FCC part 68 rules.

If this device causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But, if advance notice is not 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 effect the operation of the equipment. If this happens, the Telephone Company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this device, for repair and warranty information, please refer to the Technical Support insert for repair information and the warranty section of this Getting Started Guide for warranty information.

In the event of device malfunction, all repairs should be performed by Quintum Technologies, Inc. or an authorized agent. It is the responsibility of users requiring service to report the need for service to Quintum Technologies or to one of our authorized agents. In the event service is required, refer to the Technical Support insert for information.

If the device is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

This registered device is capable of providing users access to interstate providers of operator services through those of equal access codes.

This registered device provides proper answer supervision to the PSTN when DID calls are answered by the called station, answered by the attendant, routed to a recorded announcement that can be administered by the CPE user, or routed to a dial prompt and this device returns answer supervision on all DID calls forwarded to the PSTN. Permissible exceptions are as follows: a call is unanswered, a busy tone is received, a recorded tone is received.

NET Corporate Headquarters

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Canadian Notice

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

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

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

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

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

EU Directive on Disposal of Waste Electrical and Electronic Equipment (WEEE)

This equipment is classified as Type 3 IT and Telecommunications Equipment under the terms of EU Directives 2002/96/EC and 2003/108/EC. These directives are now being transposed into law by the individual EU member states.

At the end of life of this equipment it must be disposed of in an approved manner according to the laws of the EU member state in which the equipment is located. The equipment should be returned to the registered producer, from which it was obtained, for disposal.

Network Equipment Technologies
(A Subsidiary of Sonus Networks, Inc.)
6900 Paseo Padre Parkway
Fremont, CA 94555
U.S.A.
Tel. 510-713-7300

December 10, 2012

Declaration of Conformity

We,
Network Equipment Technologies, Inc.
(A subsidiary of Sonus Networks, Inc.)
6900 Paseo Padre Parkway
Fremont, CA94555
USA

Declare under our sole responsibility that the products
NET – Quintum Tenor DX Series.

Where appropriate, are in conformity with the following harmonized standards.

Emissions: EN55022
EN61000–3-2
EN61000–3-3

Immunity: EN55024
EN61000–4-2
EN61000–4-3
EN61000–4-4
EN61000–4-5
EN61000–4-6
EN61000–4-11

Safety: IEC60950-1, 2nd Edition / Amendment 1.

Telecom: TBR4, TBR12 and TBR13.

RoHS 2: EN50581:2012.

Following the provision of the EC Directives:

72/23/EEC and 2006/95/EC	–	**Low Voltage Directive**
89/336/EEC and 2004/108/EC	–	**EMC Directive**
1999/5/EC	–	**Radio Equipment & Telecom Terminal Equipment Directive**
2011/65/EU	–	**RoHS 2 Directive**

Authorized signatory

Lawrence J. Miller
Assistant General Counsel

INDEX

GLOSSARY

A

Alarm. A brief message that appears on your screen when the *Tenor DX* encounters a problem (i.e., failed interface). Alarms can be viewed through CLI (see *Command Line Interface*) or a Telnet connection.

Auto Switching. If a network packet delay for an IP call becomes unacceptable, the *Tenor DX* will automatically switch the call to PSTN.

B

Border Element. Provides access into or out of an administrative domain. The *Tenor DX* has two types of Border Elements: Primary and Secondary.

Bypass Number. A telephone number that is automatically sent to the PSTN, without going VoIP.

C

CAS. Channel Associated Signaling. A form of circuit switched signaling.

CCS. Common Channel Signaling. A form of signaling that uses the D channel as the signal channel.

CDR. Call Detail Recording. A string of data which contains call information such as call date and time, call length, calling party and called party.

CDR Server. The server (or workstation) responsible for receiving and processing CDRs as they are generated.

CLI. See *Command Line Interface*.

Command Line Interface (CLI). A configuration system you use to configure and monitor the *Tenor DX* unit via telnet connection.

Configuration Mode. A CLI module which enables you to configure all functions in the *Tenor DX*.

Console port. RS-232 connector is used for connection to a PC's serial port via DB-9 null modem cable.

CSU. Channel Service Unit. A component used to terminate a digital circuit (i.e., T1 line) at a customer site.

D

Diagnostic Mode. A CLI module which provides a set of utilities to perform diagnostic and testing procedures.

DSP. Digital Signal which provides the required signal processing for the *Tenor DX*.

E

ESD. Electrostatic Discharge occurs as a result of improperly handled electrostatic components. An ESD Antistatic Strap must be used to prevent ESD.

Ethernet. A Local Area Network (LAN) data network design that connects devices like computers, printers, and terminals. It transmits data over twisted pair or coaxial cable at speeds of 10 to 100 Mbps.

Ethernet port. A port on the Tenor DX which provides RJ-45 jacks for connection to a 10/100 Ethernet LAN switch or hub via RJ-45 cable.

Extranet. Communications with a source outside your company.

G

Gatekeeper. See *H.323 Gatekeeper.*

Gateway. A device (i.e., Tenor CMS) which connects IP-based networks and circuit-switched networks.

Ground Strap. A ground connection on the front of the chassis is provided for ESD protection.

H

H.323. A protocol standard for sending multimedia communications (i.e., voice/data) simultaneously over packet-based networks, such as IP.

H.323 Gatekeeper. An H.323 built in gatekeeper which performs IP call routing functions such as call control and administrative services to another *Tenor DX* unit or another H.323 endpoint.

Hop-off PBX Call. A toll call which is "leaked out" of a PBX into a private network in order to eliminate toll charges.

I

Internet. A packet based network which transports voice/video/data over TCP/IP.

Intranet communication. Communication within the

same company, usually through an Ethernet hub.

IP Address. A unique 32 bit address that identifies a network device is connected to the network via TCP/IP.

IVR. Interactive Voice Response enables you offer services, such as Pre-paid calling cards and Post-paid accounts to your customers.

L

LAN. Local Area Network. A local area network that carries data between workstations in the same location. Workstations in a LAN are connected together— typically by an Ethernet hub— to share information.

LEDs. Indicators as to the status of the chassis and other components of the system. LEDs appear on the chassis and other components.

M

Maintenance Mode. A CLI module which provides utilities for maintaining the system.

Monitor Module. A CLI module which provides a set of utilities to monitor the network and all system components.

N

Null modem cable. A 9-pin cable used to connect the *Tenor DX* to a PC's asynchronous console port.

P

PacketSaver. A packet multiplexing technology which reduces the amount of IP bandwidth require to support multiple calls flowing between two networks.

PBX. Private Branch Exchange. Telephone switch located on a customer's premises that establishes circuits between users and the PSTN (public network).

Power Inlet. Inlet for which you insert the supplied AC power cord. The unit requires a 110-220 VAC.

PSTN. Public Switched Telephone Network (also known as Central Office). Telephone Company Switching facility.

R

RJ-45. A CAT 5 cable used to connect the *Tenor DX* to an Ethernet, Line Circuit or Trunk Circuit.

RADIUS. When using IVR, the RADIUS (Remote Authentication Dial-In User Service) is used for authenticating and authorizing user access to the VoIP network.

S

SIP. A signaling protocol used to establish a session on an IP network.

SNMP. Simple Network Management Protocol (SNMP) is the standard protocol used to exchange network information between different types of networks.

Subnet Mask. An IP address that determines how an IP address is divided into network and host portions according to the bits.

TCP/IP. Transmission Control Protocol/Internet Protocol. TCP/IP is a standard communications protocol divided into seven layers of activity. Each layer defines a different aspect of how two devices should talk to each other (i.e., when a network device should send/receive data). For example, layer one is the physical means of communications (e.g., modem), whereas layer 3 is the network type (e.g, Internet). For TCP/IP, it is a combination of two layers of communication protocol. TCP (layer 4) does the actual transport of data; IP (layer 3) sets the rules for moving the data from one end of the network to another. TCP/IP uses an IP address to identify a location for specific network devices.

Transition Module. The RJ-48 ports on the rear of the E1, T1 or DS1 card used for connectivity to the network.

Trunk Group. A collection of T1 or E1 channels used to connect the *Tenor DX* to the network or another piece of equipment.

W

WAN. Wide Area Network. A number of LANs connected together through a long distance communications medium. For example, your company may have a LAN in New York, a LAN in Tokyo, and a LAN in Los Angeles. When these sites connect together over the data network or the public network, it is considered a WAN. As a result, intra-corporate information is passed through the data network from one LAN to another LAN site in a remote location.

Zone. A group of endpoints (e.g, gateways, terminals, etc.) in one corporate site.

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