



Tenor[®] AF VoIP Switch

Product Guide

P/N 480-0084-00-14

NEW HARDWARE SUPPORT

This unit contains new hardware, which requires newer software. This software was installed on the unit prior to leaving the factory.

If you must downgrade the software in this unit, please visit <https://support.sonus.net/display/PORTAL/Salesforce+Login> for a list of latest software patches that support this new hardware. Loading unsupported software will render this unit inoperable and will require physical access to this unit for recovery.

NOTE: The current release of the Tenor Monitor does not support the Tenor AF Series.

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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 AF* 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 AF* unit, including how to connect and power up the system.
- *Chapter 4: Diagnostic/Maintenance*. Describes how to troubleshoot and monitor the health of the system.
- *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 from the *Tenor Configuration Manager* User Guide or the *Command Line Interface* User Guide.

Chapter 1: Overview

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

- ❑ *A description of Tenor AF*
- ❑ *Features*
- ❑ *Capabilities*
- ❑ *Call Paths*
- ❑ *Advanced Features/Capabilities*

What is the *Tenor AF*?

The *Tenor AF* is a VoIP (Voice over Internet Protocol) H.323/SIP switch that digitizes voice, fax, and modem data, and transmits it over the IP network. Designed as a SOHO product, the *Tenor AF* gives small to medium sized businesses with analog voice infrastructure an easy, cost-effective way to capitalize on the power of Voice over IP (VoIP).

The *Tenor AF* integrates a gateway, gatekeeper, border element, intelligent call routing, and supports H.323/SIP all in one solution. The gateway converts regular phone calls to VoIP calls, the gatekeeper performs IP call routing functions, and the border element distributes the call routing directories throughout the network. Through the FXS port, you can connect to a telephone, key system or PBX; through the FXO port, you can connect to the PSTN (through direct connection to the Central Office).

Figure 1-1 Tenor AF VoIP Switch



The *Tenor AF* is available in several configuration types:

- **AFG VoIP Switch.** The *AFG VoIP Switch* is mainly intended for applications interfacing between the PBX and the VoIP network. The number of VoIP ports equals the number of FXS ports.
- **AFT VoIP Switch.** The *AFT VoIP Switch* is mainly intended for trunk side connections between the PSTN and the VoIP network. The number of VoIP ports is equal to the number of FXO ports.
- **AFM Multipath Switch.** The *AFM MultiPath Switch* is mainly intended for symmetrical multipath applications, with an equal number of FXO and FXS ports. The number of VoIP channels is equal to half the number of telephony (i.e. PSTN) channels.

With its MultiPath architecture, the *Tenor AF* can intelligently route calls between the FXS, FXO, and the VoIP network to achieve the best combination of cost and quality. The *Tenor AF* also routes calls over IP to reduce costs, and then transparently “hops off” to the PSTN, to reach off-net locations. Calls can be routed in any direction between any of the ports.

- **AFE Enterprise VoIP Gateway.** The *AFE VoIP Gateway* is mainly intended for applications interfacing between the PBX and the VoIP network.

Table 1-1 Tenor AF Configuration Types

Series	Configuration	FXS Ports	FXO Ports	VoIP Ports
AFG VoIP Switch	AFG200	2	0	2
	AFG400	4	0	4
	AFG800	8	0	8
AFT VoIP Switch	AFT200	0	2	2
	AFT400	0	4	4
	AFT800	0	8	8
AFM MultiPath Switch	AFM200	2	2	2
	AFM400	4	4	4
AFE Enterprise VoIP Gateway	AFE400	4	2	4
	AFE600	6	2	6

Whichever configuration you choose, the high performance unit provides one Autosensing 10/100 Base-T connection (mode is either in half or full-duplex), along with 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 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.

Features

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

Unique Design

The *Tenor AF* packs powerful VoIP features into one compact unit. The Tenor can be installed without upgrades to the existing voice or data network. You can install the unit in a home or office environment, without affecting the network infrastructure you already have in place. As with all Tenor products, the *Tenor AF* provides the power of VoIP in an easy-to-use product that takes just minutes to get up and running.

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

The *Tenor AF* is managed/monitored by the *Tenor Configuration Manager* and *Tenor Monitor*. Through the *Tenor Configuration Manager*, you can configure all options, such as dial plans, call routing numbers, etc. An easy-to-use Java-based installation process enables you to install the manager and start configuring within minutes. Through the *Tenor Monitor*, you can monitor the health of the system, including alarms, call detail records, etc. Both the *Tenor Configuration Manager* and *Tenor Monitor* provide comprehensive on-line help systems.

In addition, you can configure the unit via *Command Line Interface (CLI)*. Through a 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.

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 a static IP address. In addition, through the RS-232 port, you are able to configure the unit via the *Command Line Interface (CLI)*.

Powerful System Monitoring

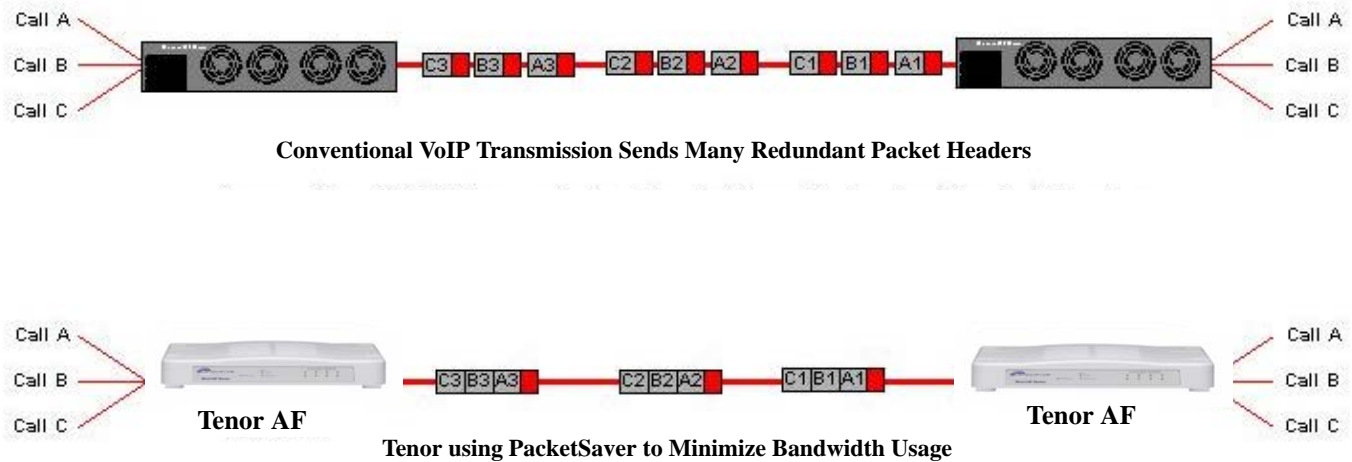
There are many different ways to monitor the health of the unit, including LEDs and alarms. LEDs appear on the front of the unit. The LEDs light up according to operations and alarms it is experiencing. Alarms indicate the unit's operational status.

Capabilities

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 packet 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. This also eliminates the transmission of redundant information.

Figure 1-2 PacketSaver



Virtual Tie Trunk

The Tenor unit can emulate a tie trunk by means of the “IP Extension” feature. 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 PSTN connection between two PBXs in separate locations. The virtual tie trunk bypasses the PSTN network, which results in considerable savings.) Your PBX does not need any additional configuration.

For example, the IP extension feature allows you to map and statically route on a one-to-one basis, each of the ports on a local Tenor to each of the ports on a remote Tenor. When the user at the remote location picks up the phone, they hear dial tone from the PBX. They get all the available PBX features, but over VoIP instead of directly. Likewise, an incoming call that would terminate otherwise onto eight telephones at the local Tenor, are instead routed via VoIP to the remote Tenor.

SNMP Support

The *Tenor AF* 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 AF* 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. The *Tenor AF* may store Call Detail Records locally or send them 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. For more information about CDR, see the *Billing Authentication Handbook*.

IVR/RADIUS Support

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

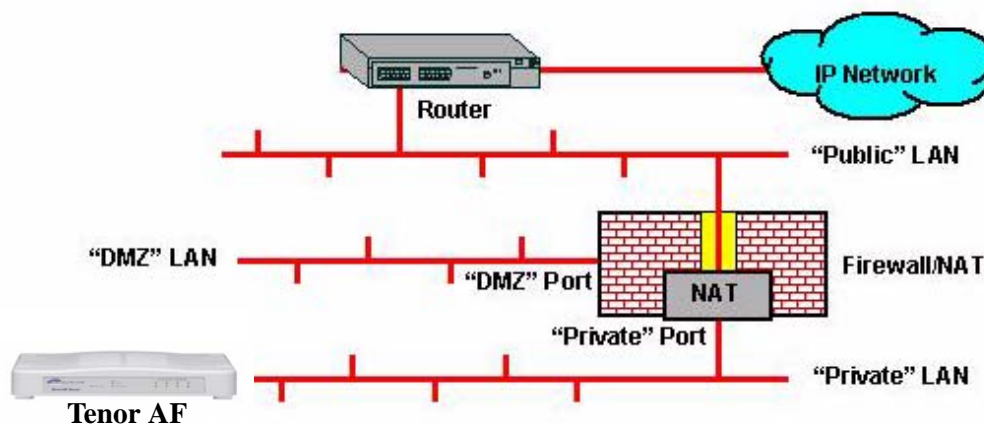
The Tenor uses the RADIUS (Remote Authentication Dial-In User Service), for authenticating and authorizing user access to the VoIP network, including ANI Authentication (Types 1 and 2). The RADIUS is a standard protocol which provides a series of standardized message formats for transmitting and receiving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

For more information about CDR, see the *Billing Authentication Handbook*.

NATAccess™

NATAccess 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. NATAccess simplifies deployment by eliminating the need to place the Tenor on a public IP network. Using NATAccess 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.

Figure 1-3 Tenor with NATAccess Deployment



Dynamic Call Routing

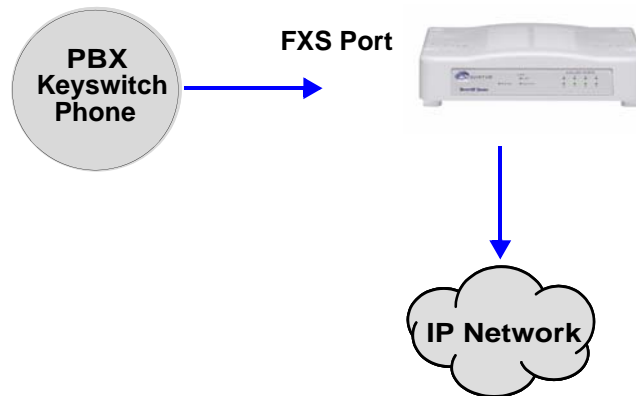
The *Tenor AF*'s intelligent call routing capabilities are state-of-the-art. The unit automatically detects and supports three call types: voice, fax, and modem. The Tenor will first identify the call origination site—Line/FXO or Phone/FXS—and then route the call according to the parameters you have configured in the routing database.

Tenor AF Call Paths

Tenor VoIP Switch (AFG200, AFG400, AFG800) Configuration

The Tenor VoIP Switch configuration is used for Phone/FXS ports connecting to the VoIP Network. The number of VoIP ports is equal to the number of FXS ports. Calls coming from the Phone/FXS interface (e.g., PBX) may be switched to the data network as a VoIP call. The routing decision made by the Tenor is based upon your configuration and the dialed number. See [Figure 1-4](#) for an example of a call originated from a PBX.

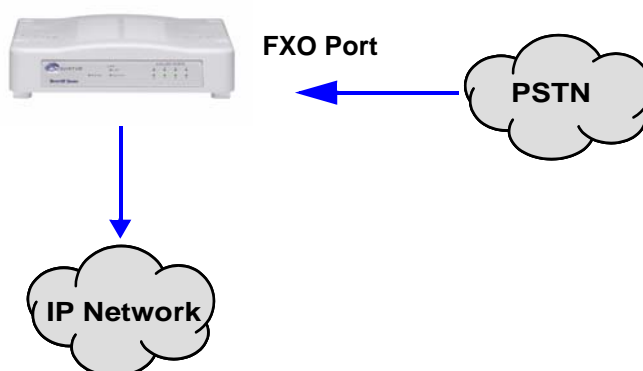
Figure 1-4 FXS (Phone) Originated Calls



Tenor VoIP Switch (AFT200, AFT400, AFT800) Configuration

The Tenor VoIP Switch configuration is used for trunk side PSTN (Line/FXO port) to VoIP connections. Calls coming from the Line/FXO interface (i.e., PSTN) may be switched to the data network as a VoIP call. See [Figure 1-5](#) for an example of a call originating from the PSTN.

Figure 1-5 FXO (Line) Originated Calls

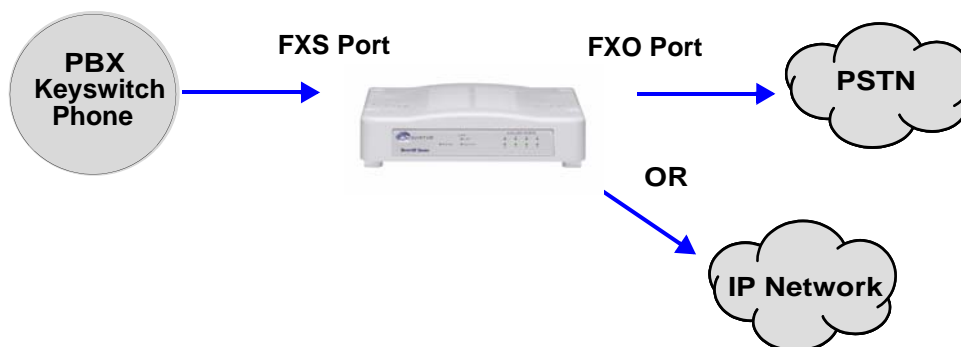


Tenor VoIP Switch (Tenor AFM200, AFM400)

The Tenor MultiPath Switch Configuration is symmetrical with an equal number of Phone/FXS and Line/FXO ports. Calls are routed from the Phone/FXS, Line/FXO, or IP Network. Calls can be routed in any direction between any of the ports.

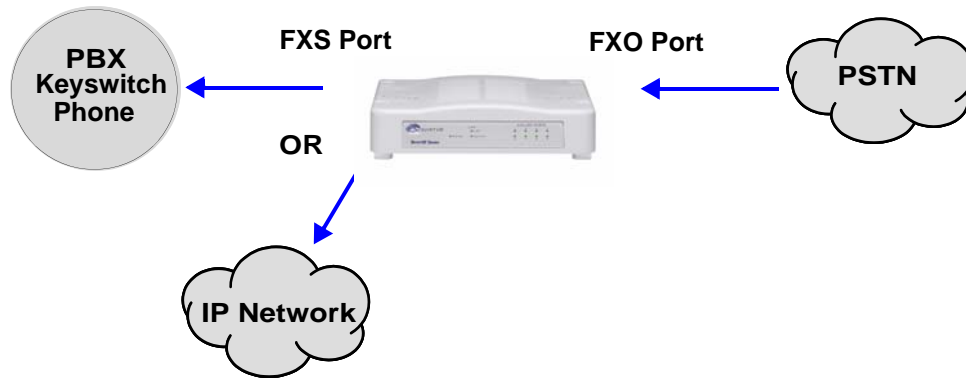
FXS (Phone) Originated Calls. Calls coming from the Phone/FXS interface (i.e. PBX) may be switched to either the data network as a VoIP call or to the FXO interface, typically for connection to another circuit switched network such as the PSTN. The routing decision made by the Tenor is based upon your configuration and the dialed number. See [Figure 1-6](#) for an example of a call originated from a PBX.

Figure 1-6 FXS (Phone) Originated Calls



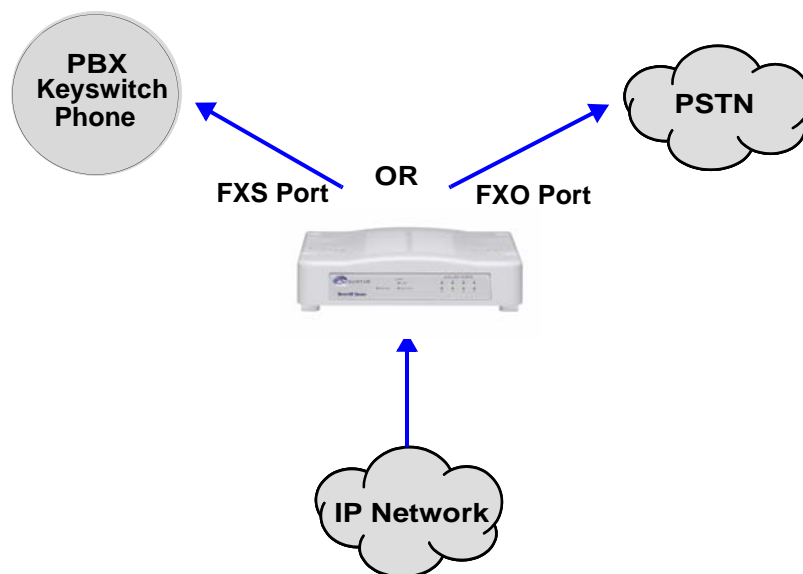
FXO (Line) Originated Calls. A call coming from a Line/FXO interface may be switched to either the data network as a VoIP call, a Line Circuit, or trunk typically for connection to a termination device on the user's premises such as a PBX. The routing decision made by the *Tenor AF* is based upon your configuration and the dialed number. See [Figure 1-7](#) for an example of a call originated from the PSTN.

Figure 1-7 FXO (Line) Originated Calls



IP Network Calls. Calls coming from the IP network (data network) can be routed to the Line/FXO or Phone/FXS interfaces. 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 Phone/FXS circuit for termination, otherwise the call is considered a “Hop-Off call” and the Tenor sends it out through a Line/FXO interface, typically connected to the PSTN. See [Figure 1-8](#) for an example of a call originated from the IP network.

Figure 1-8 IP Network Originated Calls

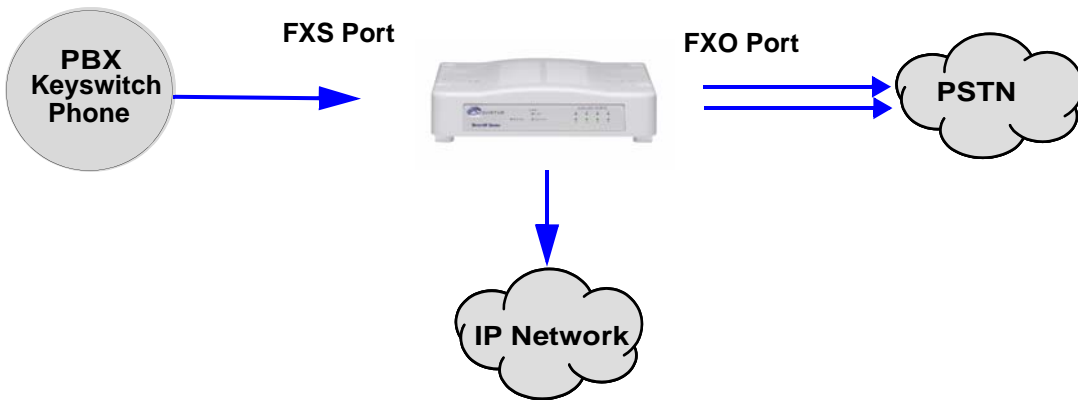


Tenor VoIP Switch (Tenor AFE400, AFE600)

The *Tenor AFE Enterprise VoIP Gateway* is mainly intended for applications interfacing between the PBX and the VoIP network, but it also includes two FXO ports for autoswitching PSTN back-up and 911 service provisioning. The number of VoIP ports is equal to the number of FXS ports. Calls can be routed in any direction between any of the ports.

See [Figure 1-9](#) for an example of a call originating from a PBX.

Figure 1-9 Tenor AFE Phone/FXS Originated Call Sample



Advanced Features/Capabilities

Call Management

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.

Hunt Local Directory Numbers. A Hunt group is a group of configured phone numbers (Hunt Local Directory Numbers, or HLDNs) assigned to a group of ports. An incoming call with a matching destination DN causes the Tenor to “hunt” for a port that is not in use.

Hop-Off Directory Number. A Hop-off PBX call travels over IP, and then “hops” off into the public network (PSTN) on the destination side to reduce or eliminate public toll charges (also known as Leaky Area Map call). 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 (although it does not have to be local).

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-Sonus gateways). A static route associates endpoints (as represented by their IP address) with Directory Number patterns.

Dial Plan Options

Public/Private Dial Plan Support. The *Tenor AF* 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 AF* to use for outgoing calls.

A private dial plan does not conform to a public dialing plan (e.g., 3 digit dialing plan); through the *Tenor AF* 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 route calls based on the UPDP rules, which are completely customizable sets 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 using the IP. There are several routing tables you can configure via the *Tenor Configuration Manager* to determine how the *Tenor AF* 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 AF* from a telephone or PBX 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 to the PSTN. (A hop-off PBX call is usually a toll call which passes through a network to reduce or elimi-

nate the toll charge.) They are entered in a Hop-off Number Directory and associated with trunks where matching calls should be sent.

Tenor AF supports those hop-off PBX calls where the destination *Tenor AF* is programmed to route the call to the PSTN. The destination *Tenor AF* unit is configured with the phone numbers to be “supported” for this feature.

H.323 Gatekeeper Services

The *Tenor AF* unit’s built-in H.323 gatekeeper performs IP call routing functions, such as call control and administrative services to another *Tenor AF* 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 AF* 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 AF* units, you can assign one unit as the Gatekeeper for the network. We recommend you configure each as its own gatekeeper.

Tenor AF 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 AF*), 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 AF*’s gatekeeper will act as the gatekeeper for that zone and all of the other endpoints will register with it.

Border Element. The *Tenor AF*’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 AF* 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; 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 AF* unit can use two border elements: primary and secondary. These work together to provide redundancy and fault tolerance.

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 AF* 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 Admission Request (ARQ), Admission Confirmation (ACF) and Admission 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. SIP also 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.

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*
- Specifications*

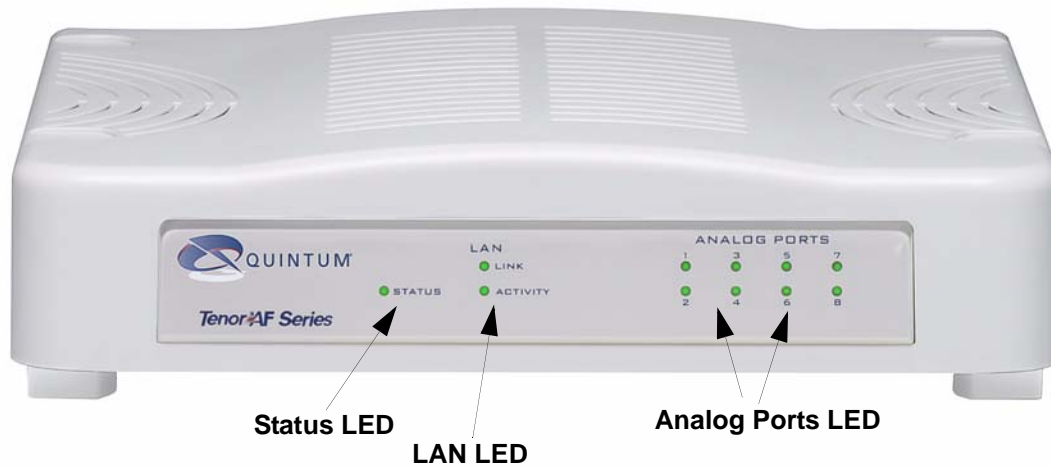
Hardware Description

The *Tenor AF* is a stackable device which provides Phone/FXS and Line/FXO connections as well as connections to the Ethernet LAN and a PC.

The unit's front panel includes LEDs; the back panel includes connection jacks, a diagnostics button, and a power adapter jack.

Front Panel LEDs

Figure 2-1 Tenor AF Front Panel



The LEDs display the health of the system. There are different types of LEDs: Status, LAN and Analog Port. A description of each is listed in [Table 2-1](#).

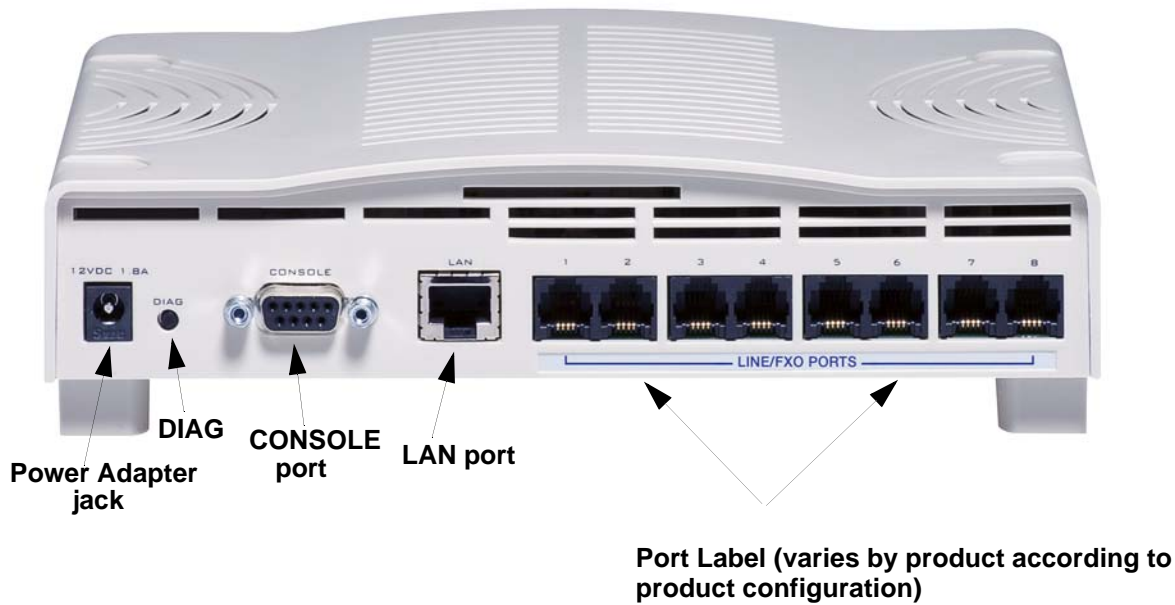
Table 2-1 Front Panel LEDs Definitions

LED	Label	LED Color	Description
Status	Status	Green	Operational Status. On: Unit is powered up. Off: No power.
LAN	Link	Green	On: Ethernet link is up. Off: Ethernet link is down.
	Activity	Green	Flashing: Activity (i.e., transmit, receive) on the line. Off: No activity on the line.

LED	Label	LED Color	Description
Analog Ports	1, 2 3, 4...8	Green	<p>On: Indicates the Line/FXO or Phone/FXS port is in use.</p> <p>Off: Indicates the Line/FXO or Phone/FXS port is not in use.</p>

Back Panel

Figure 2-2 Tenor AF Back Panel



- **Power Adapter jack.** Connection port to external power supply.
- **DIAG.** Enables you to perform software diagnostic procedures.
- **CONSOLE port.** This RS-232 connector is used for connection to a PC's serial port via a DB-9 serial cable at 38400 bps 8 N 1, no flow control. The input/output signals are listed in [Table 2-2](#).

Figure 2-3 DB-9 Female Connector Pin Order

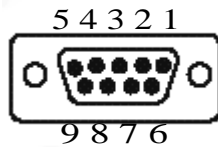


Table 2-2 Serial RS232 DB-9 Connector Pinouts

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
7	N.C.	No Connect
8	N.C.	No Connect
9	N.C.	No Connect

- **LAN port.** 10/100 Base-T Ethernet port. This port provides an RJ-45 jack for an individual connection to a 10/100 Ethernet LAN switch or hub via RJ-45 cable; the interface is individually configured with a unique IP and MAC address.

Figure 2-4 10/100 BASE-T Ethernet Port Pin Order**Table 2-3** 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

- **Port Label (Phone/FXS or Line/FXO ports).** For **Phone/FXS**, provides an RJ-11 jack for connection to a PBX, Keyphone or analog phone. For **Line/FXO**, enables connection to another piece of equipment that houses your telephone lines running to the PSTN, such as the patch panel.

Figure 2-5 RJ-11 Phone/FXS or Line/FXO Port Pin Order

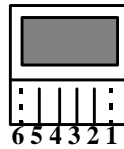
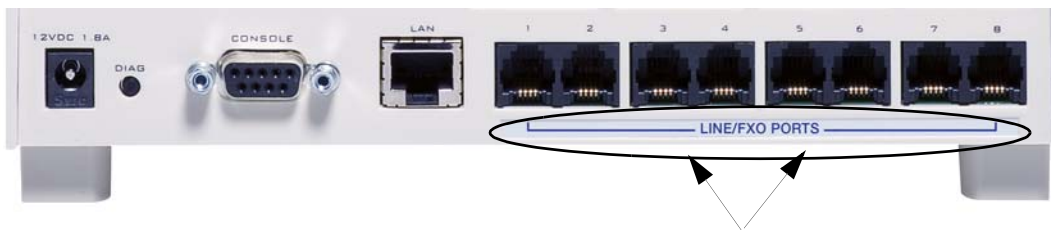


Table 2-4 Input/Output RJ-11 Phone

Pin #	Definition
1	No Connect
2	No Connect
3	Tip
4	Ring
5	No Connect
6	No Connect

- **Port Labels.** Each Phone/FXS or Line/FXO port is labeled according to the product configuration.



Label example shown for AFT800. See below for label information according to product configuration.

Figure 2-6 Label according to Product configuration

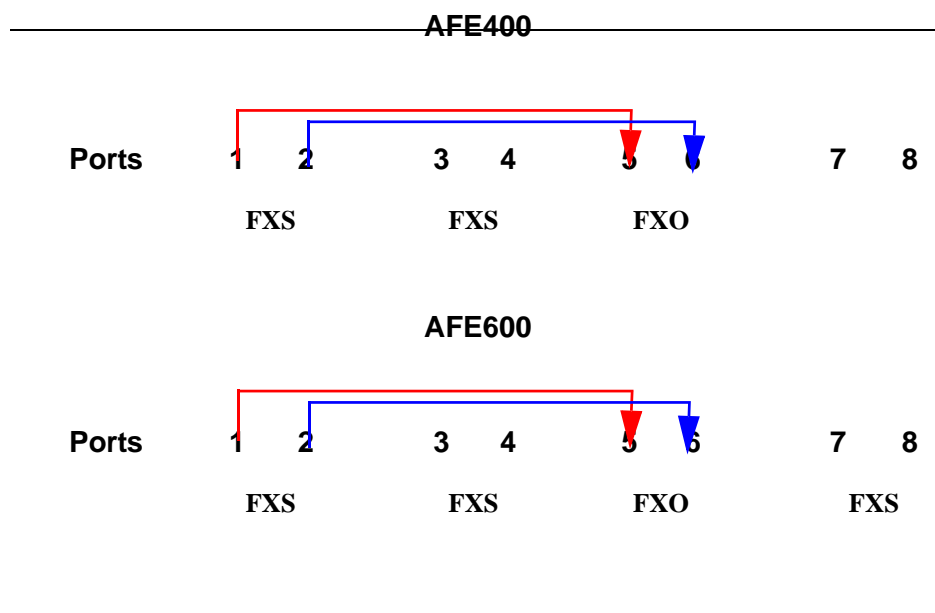
Product	Label Text	Label Color	Position on Unit
AFG200	Phone/FXS	Silver with Blue Text	Beneath ports 1 - 2
AFG400	Phone/FXS	Silver with Blue Text	Beneath ports 1 -2 & 3 - 4
AFG800	Phone/FXS	Silver with Blue Text	Beneath all ports
AFT200	Line/FXO	Silver with Blue Text	Beneath ports 1 - 2

Product	Label Text	Label Color	Position on Unit
AFT400	Line/FXO	Silver with Blue Text	Beneath ports 1 -2 & 3 - 4
AFT800	Line/FXO	Silver with Blue Text	Beneath all ports
AFM200	Phone/FXS	Silver with Blue Text	Beneath ports 1 - 2
	Line/FXO	Silver with Blue Text	Beneath ports 5 - 6
AFM400	Phone/FXS	Silver with Blue Text	Beneath ports 1 - 2 & 3 - 4
	Line/FXO	Silver with Blue Text	Beneath ports 5 - 6 & 7 - 8
AFE400	Phone/FXS	Silver with Blue Text	Beneath ports 3 - 4
	Line/FXO	Silver with Red Text	Beneath ports 1 - 2 & 5 -6
AFE600		Silver with Red Text	Beneath ports 1 - 2
	Phone/FXS	Silver with Blue Text	Beneath ports 3 - 4
		Silver with Blue Text	Beneath ports 7 - 8
	Line/FXO	Silver with Red Text	Beneath ports 5 - 6

Online/Offline Mode - AFE400/AFE600 only

If the FXS has a matching FXO port, the FXS will have online/offline capability. If the FXS goes offline, it will automatically connect to the corresponding port shown in [Figure 2-7](#). For detailed information about online/offline capability, see the Command Reference Guide.

Figure 2-7 Online/Offline Capability



Cables

The cables listed in [Table 2-5](#) are required to connect a *Tenor AF* to various interfaces. Contact Sonus for ordering information, if necessary.

Table 2-5 Cables Supported

Cable	Usage
RJ-11 to RJ-11 Cable	Connection to FXO/Line.
RJ-11 to RJ-11 Cable	Connection to FXS/Phone.
RJ-45 Ethernet cable	Connection to Ethernet LAN 10/100
DB-9 Serial RS-232	Connection to PC's asynchronous console port.

RJ-11 Cables

An RJ-11 to RJ-11 cable is used to connect the *Tenor AF* to an FXO or FXS external device. The RJ-11 cable connector pinouts are given in this section to help you identify the proper connector to accommodate your specific networking requirements. The pin order is shown in [Figure 2-8](#).

Figure 2-8 RJ-11 Pin Order

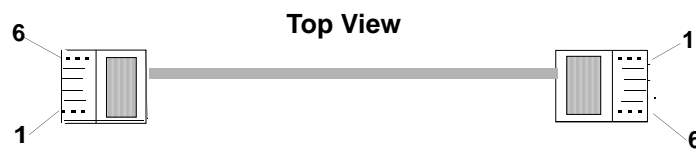


Figure 2-9 RJ-11 Connector Pinouts

Pin #	Connects to	Pin #
1	No Connect	1
2	No Connect	2
3	←————→	3
4	←————→	4
5	No Connect	5
6	No Connect	6

RJ-45 Ethernet Cable (10/100)

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 2-10*.

An RJ-45 (10/100 Base-T) straight through shielded cable is used to connect *Tenor AF* to an Ethernet LAN. Cable pinouts are listed in *Table 2-6*. Color specifications are applicable to the RJ-45 cable provided.

Figure 2-10 RJ-45 Pin Order

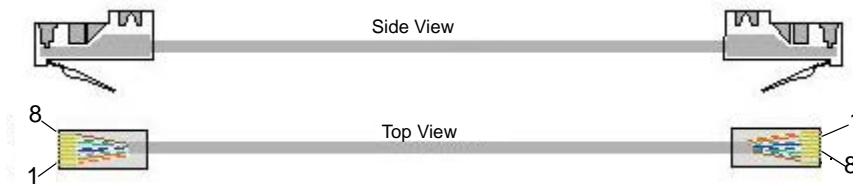


Figure 2-11 RJ-45 (10/100BT) Connector Pinouts

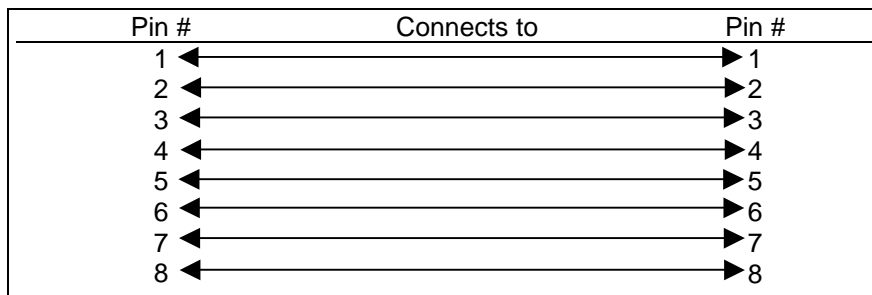


Table 2-6 RJ-45 (10/100BT) Connector Pinouts

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

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 AF* to your PC's asynchronous serial port. The pin order for DB-9 male and female connectors are shown in *Figure 2-12* and *Figure 2-13*.

Figure 2-12 DB-9 Male Connector Pin Order

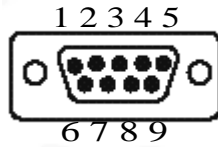


Figure 2-13 DB-9 Female Connector Pin Order

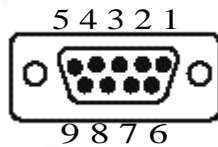


Figure 2-14 DB-9 Connector Pinouts

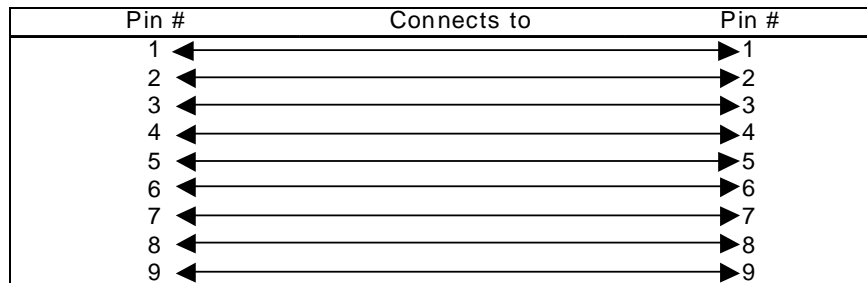


Table 2-7 DB-9 Connector Pinouts

Pin #	Function	Description	Pin #
1	DTR	Data Terminal Ready	1
2	TXD	Transmit Data	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

Specifications

Voice/Fax

Call Routing:	FXO/FXS
Coding:	A-law, mu-law
Voice Algorithms:	G.723.1A (5.3, 6.3 Kbps), G.726 (16, 24, 32, 40 Kbps), G.729A, G711
Fax Support:	Group III at 2.4, 4.8, 7.2, 9.6, 12, 14.4 Kbps
Automatic Call Detection:	Voice/Modem/Fax

PSTN/PBX Connections

Interface:	Analog, FXO Interface (PSTN side), FXS Interface (PBX side)
Connector:	RJ-11
Ringing Cadence:	Adjustable, country-dependent
Maximum Loop Current:	24 mA
Ringer Equivalence Number:	0-3 REN (FXO port)
Ringing Frequency:	Adjustable, country-dependent
Ringing Voltage:	52v RMS (1000 feet of 24 AWG wire with 3 REN LOAD)

LAN Connection

LAN Support:	10/100 Mbps Ethernet
Connection Type:	Autosensing of speed and mode

Physical

Depth:	7" (18.73 cm)
Height:	2" (5.1 cm)
Width:	8 1/4 (21 cm)
Weight:	1.3 lbs (0.6 kg)

Electrical

Ethernet:	Standard 10/100 Base-T RJ-45 interface (IEEE 802.3)
FXO/FXS:	Standard RJ-11 connectors
Console Port:	RS-232/DB-9 Female
AC Power:	100-240 Volts AC, 50/60 Hz, 22 Watts

Environmental

Operating Temperature:	40° to 104° F (5 - 40° C)
Operating Humidity:	20% to 80% non-condensing
Altitude:	-200 to 10,000 feet, or -60 to 3,000 meters
Storage Temperature:	14° to 140° F, or -10° to 60° C

Chapter 3: Installation

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

Specifically, the following topics are covered:

- Installation*
- Power up the System*
- Login Without PC's COM Port/Obtain IP Address from Ethernet*
- Login Through PC's COM Port*

Installation

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

Pre-Installation Guidelines

- Do not make connections from the Tenor to your public phone lines during any kind of electrical storm. It is possible to receive a serious injury.
- 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 locations and keep away from dusty areas.
- The area must not exceed the temperature and humidity guidelines outlined in [Chapter 2: Hardware Components](#).
- Avoid exposing the unit to excessive vibrations.

Inspect Package Contents

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

- Tenor AF
- 1 - AC Power adapter/cord
- 1 - DB-9 RS-232 Serial Cable
- 1 - RJ-45 to RJ45 Cable
- RJ11 to RJ11 Cables (Qty depends on model ordered)
- Product Guide in CD format

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

Wall Mount (Optional)

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.

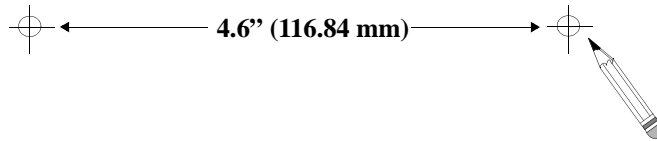
Required Materials


- 2 screws, #4 (diameter measure of 0.112 inches, 2.845 mm).
- Drill
- Measuring tape or ruler

The Tenor AF has two wall-mount slots, which are located on the bottom of the unit. 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 3-1*.

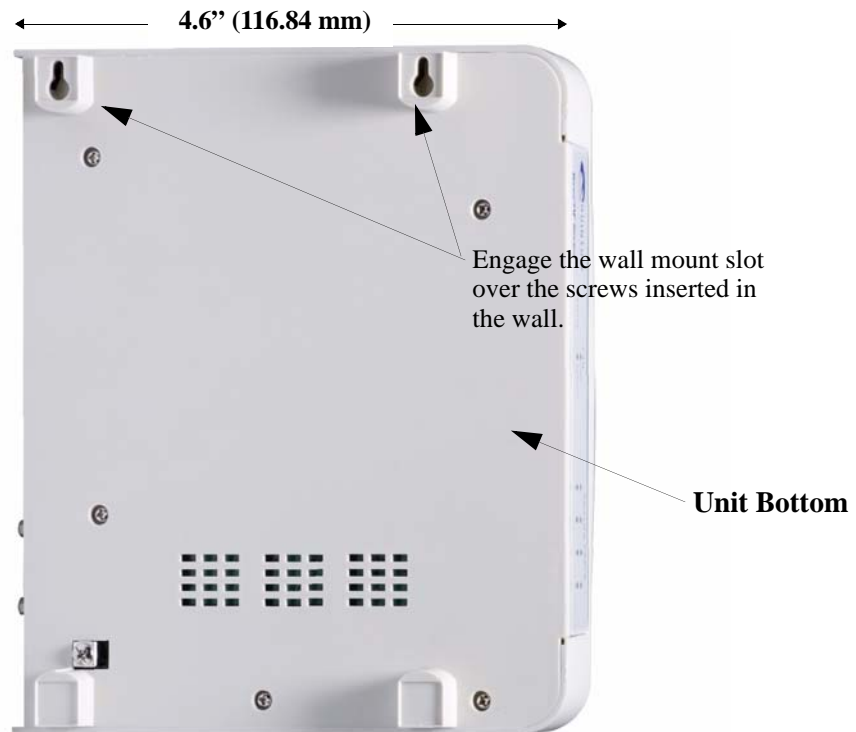
Figure 3-1 Wall Mounting Dimensions



 **NOTE:** Ensure the unit is level.

2. Drill two holes in the wall. Ensure the holes are 4.6 inches (116.84 mm) apart. See *Figure 3-1*.
3. Insert a screw in each hole, leaving 0.25 inches (6.35 mm) out. (The screws are not included with the unit.)
4. Line up the wall-mount slots (located on the bottom of the unit) with the 2 screws.
5. Engage the wall-mount slots over the screws and slide the unit down until the screws fit snugly onto the slots. See *Figure 3-2*.

Figure 3-2 Engage Wall Mount Slots over Screws in Wall



Connect to Phone/FXS Interface

Since there are many different PBX devices, key systems, fax machines and phones you can connect to the *Tenor AF*, the instructions which follow explain the general procedure for connecting an RJ-11 cable (included in your package) between the Phone/FXS port and an external device. Use the phone/FXS ports for on-premise wiring only.

See [Chapter 2: Hardware Components](#) for the RJ-11 cable pinouts you can use to acquire another cable or adapter that may be required to connect to the specific external device.


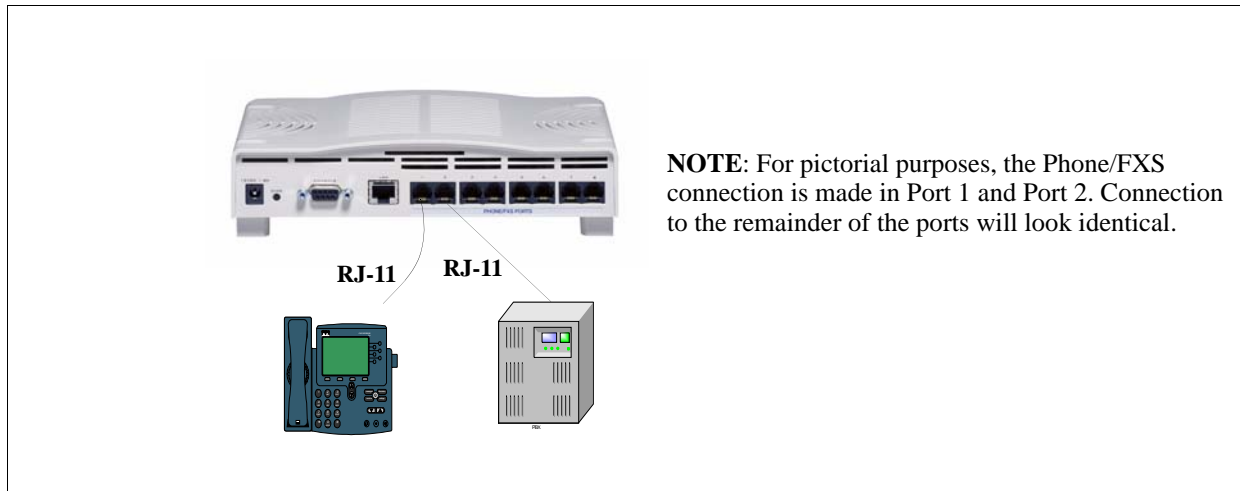

 **NOTE:** This step is not applicable if you have a configuration of all Line/FXO ports.

Figure 3-3 Connect to Phone/FXS Interface



Connect to Phone/FXS port as follows:

 **CAUTION:** Connect the Phone/FXS ports to a telephone, fax machine, PBX, or key system only. Connecting to other devices/networks (i.e., telephone wall jack) will cause damage to the unit.

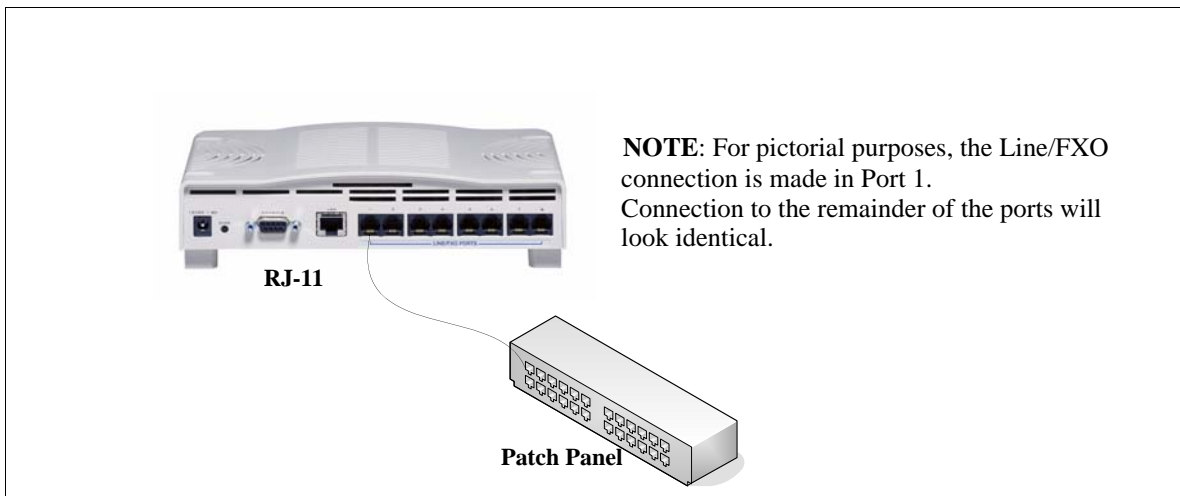
1. Plug one end of the RJ-11 cable into one of the ports on the rear of the unit labeled **Phone/FXS**. See [Chapter 2: Hardware Components](#) for cable pinouts.
2. Insert the other end of the RJ-11 cable into the appropriate analog port on the PBX or key system, or into the jack on the back or underside of a phone or fax machine. For a PBX connection, see the PBX documentation port requirements for connection specifics.
3. Repeat for each RJ-11 port labeled **Phone/FXS**.

Connect to Line/FXO Interface

To connect to the Line/FXO port, you can first connect the analog phone lines to another piece of equipment that houses your telephone lines running to the PSTN, such as the patch panel. If you are unsure of the installation procedures, contact the network administrator or review the documentation you received with the PBX.

See [Chapter 2: Hardware Components](#) for the RJ-11 cable pinouts you can use to acquire another cable or adapter that may be required to connect to the specific external device.

Figure 3-4 Connect to Line/FXO Interface



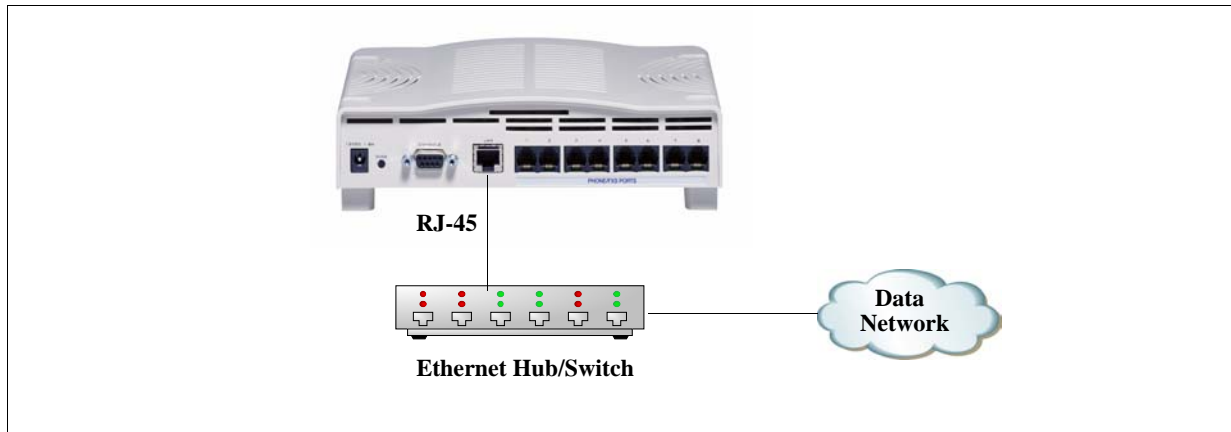
NOTE: If you are connecting to a punchdown block, we recommend you use solid conductor between size 22 AWG and 26 AWG, twisted pair cables.

1. Plug one end of the RJ-11 cable into one of the ports on the rear of the unit labeled **Line/FXO**. See [Chapter 2: Hardware Components](#) for cable pinouts if you are making your own cable.
2. Insert the other end of the RJ-11 cable to the patch panel (or other external device) which houses your telephone lines.
3. Repeat for each RJ-11 port labeled Line/FXO.

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 AF*.

Figure 3-5 Connect to Ethernet Hub/Switch



1. Plug one end of the RJ-45 ethernet cable into the port labeled **LAN**.
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 the Ethernet RJ-45 10/100 cable specifications.

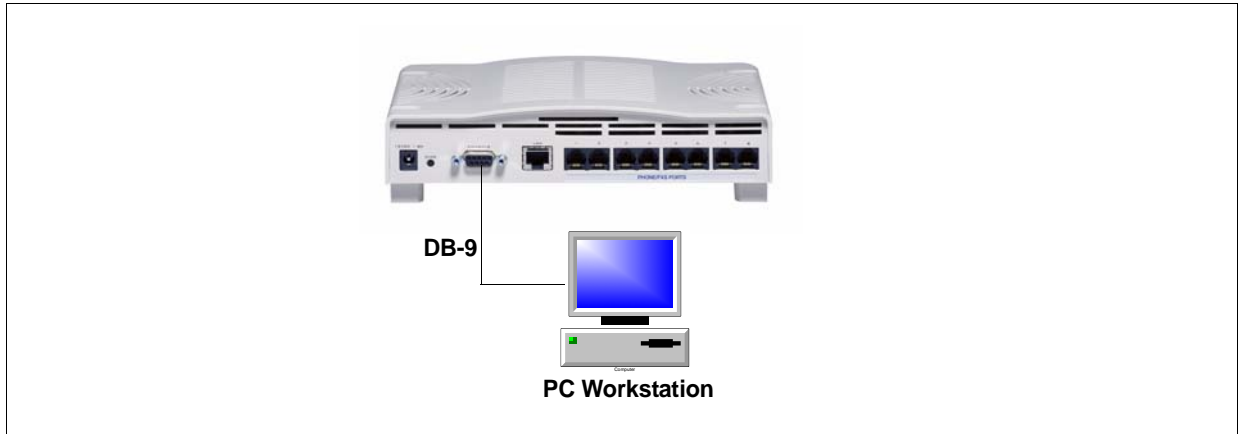
Connect to PC Console (if required, see Note)



NOTE: This step is not required for installation unless you would like to connect to the PC's COM port to configure a Static IP address.

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

Figure 3-6 Connect to PC Console (if required, see note)



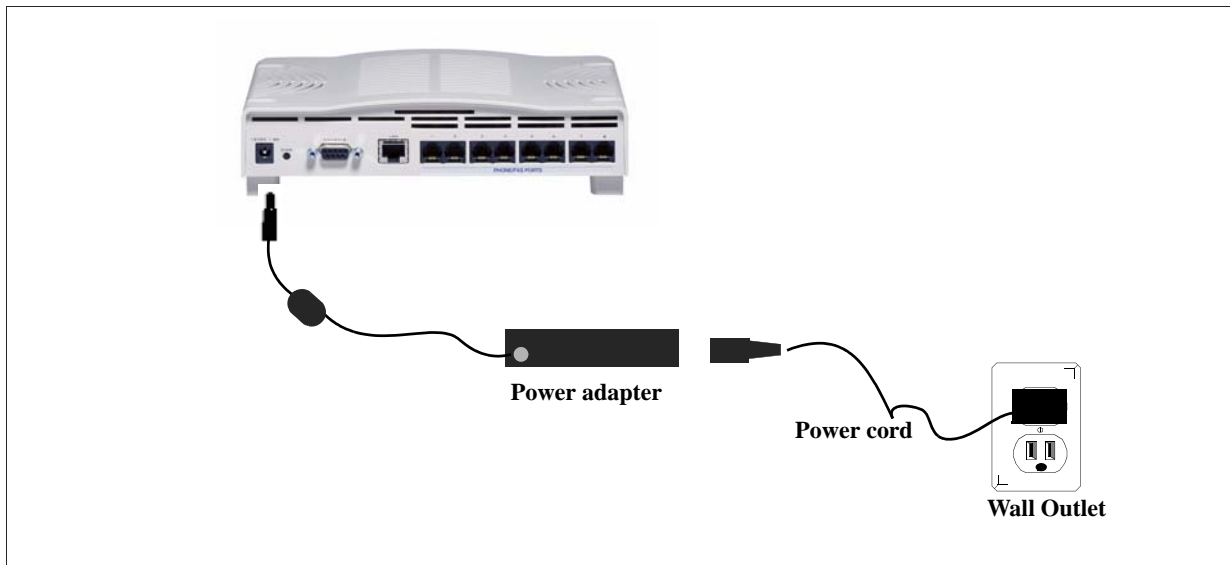
1. Insert the male end of the DB-9 cable into the port labeled **Console**.
2. Insert the female end of the DB-9 cable into your workstation's serial port (see your PC documentation for more information about this port).

Power up the System

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

1. Plug the Power adapter end into the port on the *Tenor AF* labeled **12VDC 1.8 A**.
2. Connect the other end of the Power adapter to the Power cord.
3. Plug the Power cord into the wall outlet.

Figure 3-7 Connect Power adapter



The unit will power up and the Status LED will light up and remain lit. For information about the LEDs, see [Chapter 2: Hardware Components](#).

Login without the PC's COM port/Obtain IP Address from Ethernet

Factory defaults are the configuration elements set on the unit new from the factory. By default, when the Tenor is shipped from the factory, the ability to support DHCP (Dynamic Host Configuration Protocol) is enabled. That way, you can obtain an IP address upon bootup and log into the system, without needing the COM port.

Through the **LAN** port on the *Tenor AF*, you can connect to a port on a router that is capable of providing DHCP. You can then look at the active lease table of the firewall to get an IP address. If there is no DHCP service available when you turn the unit on, the Tenor gets an IP address of **169.254.xx.xx**, where **xx** and **yy** are the last two bytes of the serial number (in decimal), which allows it to be connected to a PC with an IP on the same subnet.

Login through the PC's COM port (if required, see note)



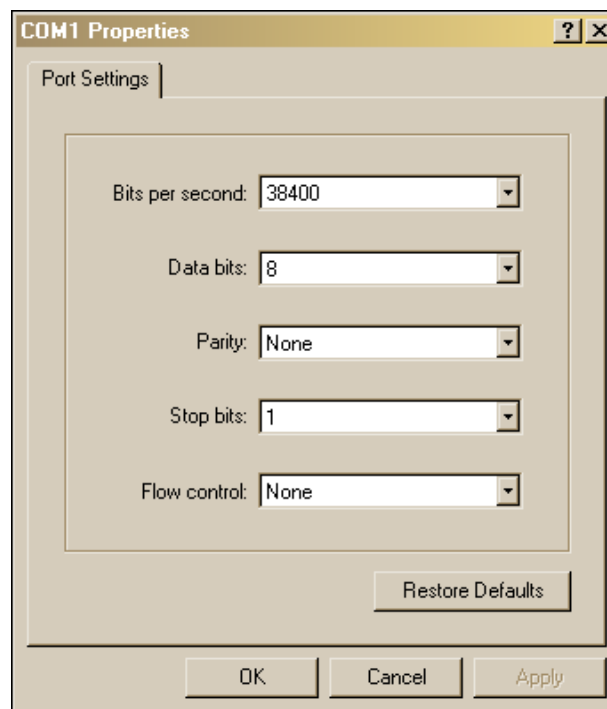
NOTE: This step is **only necessary** if you wish to set a static IP address.

If you do have a COM port on your PC, when you log into a unit through the COM port at bootup, you have the option either to restore factory defaults or to configure the static IP address in the Tenor. The instructions which follow are for configuring a static IP address.

Connect through the COM port as follows:

1. Click on *Start > Programs > Accessories > Communications > HyperTerminal*. The *Connection Description* window is displayed.
2. Enter a connection name (i.e., name for the unit such as Tenor AF NJ). Click **OK**.
3. 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 is displayed. See [Figure 3-8](#).

Figure 3-8 COM1 Properties Window



4. Select the following information:

- Bits per Second: **38400**
- Data Bits: **8**
- Parity: **None**
- Stop bits: **1**

- Flow control: **None**
5. Click **OK**.
 6. Power up the unit via *Power up the System*. A connection to the Tenor will establish. Information about the unit will scroll on the screen, followed by a message, "WITHIN 4 SECONDS, PRESS 'r' FOR FACTORY DEFAULTS or 'i' to SET STATIC IP".
 7. Select 'i' - Set Static IP. The login prompt is displayed. The default user name/password is **admin**. The current IP address, Subnet Mask, and Default Gateway are displayed. A message asks you whether you would like to change these.
 8. Type **y**. Follow the prompts to change the ethernet information. A message is displayed to tell you the Ethernet interface has been successfully configured and the unit will be restarted. (If you type **n**, the procedure will be cancelled).

You have completed login configuration.

Chapter 4: Diagnostics/Maintenance

This chapter explains the advanced topics for diagnosing problems with the unit, viewing system alarms, and performing maintenance procedures, such as upgrading the software.

- Common Symptoms/Problems*
- Monitor LEDs*
- Monitor Alarms*
- Verify Unit Provisioning*
- Perform Maintenance*
- Find Additional Help*

Common Symptoms/Problems

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

- Ensure the AC external power adapter is firmly installed in the back panel's power adapter port and the AC power cord is plugged into the power source.
- Verify that all RJ-45 to RJ-45, RJ-11 to RJ-11, and DB-9 cables fit snugly in each back 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.

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 4-1 Common Symptoms/Problems

Common Symptom/Problem	Description/Solution
Unit will not turn on.	Check AC power source.
Communication between <i>Tenor AF</i> and the FXO or FXS cannot be established.	<p>There are several reasons why communication may not be successful. A few of the most common are listed below.</p> <p>Verify correct RJ-11, RJ-45 and DB-9 cables are installed in the correct ports.</p> <p>Ensure the unit is on.</p> <p>Network issues may cause a number of problems. Contact the Central Office to perform test procedures.</p> <p>Verify that the unit is online.</p>
Communication with <i>Command Line Interface (CLI)</i> cannot be established using Telnet.	<p>The IP address of the <i>Tenor AF</i> unit may be incorrect.</p> <p>Check Ethernet Cable.</p> <p>Verify the IP address of <i>Tenor AF</i>. Check the Default Gateway Subnet Mask. These can be verified using an RS-232 connection via Console connection.</p> <p>Verify network connectivity using <i>ping</i> from another network host.</p>

Common Symptom/Problem	Description/Solution
Communication with Ethernet Hub, or switch cannot be established.	<p>Verify RJ-45 cable is firmly installed in the LAN port.</p> <p>Check MDI/MDIX configuration. Verify the mode setting on the <i>Tenor AF</i> matches the mode setting on the hub/switch. Check duplex setting on the switch in which they were connected and the speed of 10 Mb/sec or 100 Mb/sec.</p>
Communication between the computer's COM port and <i>Tenor AF</i> serial port cannot be established.	<p>Verify DB-9 cable is firmly placed in the unit's console port and your PC's serial port.</p> <p>Verify Terminal port settings are 38400 BPS 8N1 No Flow Control.</p>
<i>Tenor AF</i> cannot receive or transmit calls.	<p>Ensure FXO/FXS ports are working correctly.</p> <p>Generate alarm list for more information.</p> <p>Verify that your Ethernet connection is working. Use pin to verify.</p> <p>Verify that your VoIP configuration is set correctly. Use the <i>Tenor Configuration Manager</i> to view settings.</p> <p>Verify the settings under <i>Analog-Interface Phone and Line</i> are correct and associated correctly.</p> <p>Contact Central Office for interface issues.</p>
<i>Tenor AF</i> does not have dial tone.	<p>Verify the online command is enabled through either <i>Command Line Interface (CLI)</i> or the <i>Configuration Manager</i>. For specific information about this command, see the Command Reference Guide.</p>

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. See [Chapter 2: Hardware Components](#) to ensure the correct lighting of each LED. If the LEDs are not lighting at all, check the AC power source to ensure power is being supplied to the unit.

Monitor Alarms

Alarms are brief text messages that appear on your workstation when the *Tenor AF* unit encounters a problem, such as a failed interface, disconnected call, etc. Alarms help you identify where a specific problem is occurring with the *Tenor AF* unit.

There are two ways to view alarms for the *Tenor AF* unit: through the *Command Line Interface (CLI)* or through the *Tenor Monitor*. The instructions in this section are for obtaining alarms through the CLI; see the *Tenor Monitor* Product Guide for information about obtaining alarms through the *Tenor Monitor*.

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 4-2.

Table 4-2 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.

Field	Definition	Valid Entry
Type (displays only if you generate an Alarm History)	The type of alarm generated.	<p>ALR = Alarm. Exceptional condition which may be a critical, major, or minor condition which impacts the ability to make calls. An ALR is cleared when the abnormal condition is remedied.</p> <p>CLR = Clear. This indicates an alarm that has been cleared from the system.</p> <p>RPT = Report. Exceptional event which indicates a problem, but which is never cleared (i.e., it is a transitory event).</p>
Severity	Level or alarm severity.	<p>1 = Critical (complete system is affected).</p> <p>2 = Major (major problem is detected).</p> <p>3 = Minor (minor problem is detected).</p> <p>4 = Info (Information about a minor problem).</p>
Description	A text description of the alarm; see Table 4-3 for detailed description.	Varies.
Slot #	Defines which slot the alarm occurred on.	<p>Slot 1 or 2.</p> <p>Slot 1 refers to the system controller functions.</p> <p>Slot 2 refers to DSP functions.</p>
Device #	Defines which device the alarm occurred on.	Always device 0.
Analog Interface	Defines which interface (line) the alarm occurred on.	<p>1 = PBX</p> <p>2 = PSTN</p>
Channel #	Specifies which channel the alarm occurred on.	Channel the alarm occurred on.

Field	Definition	Valid Entry
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 4-3 List of Valid Alarms

Severity (appears as part of severity field)	Alarm Description (text appears in desc field)	Definition
Critical	Loss of signal	A loss of signal (32 consecutive zeros) at least once during a one second period.
Critical	Ethernet Disconnected	Ethernet cable has been disconnected from the unit, or Ethernet connectivity has been lost. No new VoIP calls will be made and existing 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	<i>Tenor AF</i> Chassis reset	The chassis has reset.
Critical	Configuration Data Missing	Configuration is missing. Check the configuration data and add the necessary information.
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 accidentally, without a real intention to use IVR for subsequent calls, while both of the servers were disabled. In order to clear the alarm, you 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.

Severity (appears as part of severity field)	Alarm Description (text appears in desc field)	Definition
Critical	RADIUS Server Not Responding	<p>Appears when none of the configured RADIUS servers respond.</p> <p>This alarm is cleared when any of the RADIUS servers responds or the RADIUS server is disabled via CLI.</p>
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	<p>This alarm will be reported to the system when a particular voice prompt file is not found in the IVR Prompt Server.</p> <p>This alarm applies only to the system with enabled IVR functionality.</p>
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.
Major	Border Element connection lost.	Indicates that the Gatekeeper lost connection with the Border Element. This is cleared if the connection is re-established.
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	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.
Minor	Hardware component failed	A hardware component has failed. Check all components, hardware connections, etc.

Severity (appears as part of severity field)	Alarm Description (text appears in desc field)	Definition
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 a 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.

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 4-1 Alarm sample

IP#	Sequence#	Type#	Severity#	Desc#	Slot#	Device#	Analog	Interface#	Channel#	Date/Time
192.166.28.230	944	ALR	3	Border Element connection lost	0	0	0	0	TUE	OCT 14 14:05:27 2005
192.166.28.230	946	RPT	4	Gatekeeper status (Gatekeeper(0.0.0.0) removed)	0	0	0	0	TUE	OCT 14 14:05:27 2005

Display Active Alarms

You are able to display all active alarms as follows:

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 4-2 Active Alarm Sample

IP#	Sequence#	Type#	Severity#	Desc#	Slot#	Device#	Analog	Interface#	Channel#	Date/Time
192.166.28.230	944	ALR	3	Border Element connection lost	0:0:0	0:0:0	TUE	OCT 14	14:05:27	2005

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 4-3 Alarm History Sample

IP#	Sequence#	Type#	Severity#	Desc#	Slot#	Device#	Analog	Interface#	Channel#	Date/Time
192.166.28.230	944	ALR	3	Border Element connection lost	0:0:0	0:0:0	TUE	OCT 14	14:05:27	2005
192.166.28.230	945	RPT	4	Gatekeeper status (Gatekeeper(192.168.20.175) removed)	0:0:0	0:0:0	TUE	OCT 14	14:05:27	2005
192.168.20.175	946	RPT	4	Gatekeeper status (Gatekeeper(0.0.0.0) removed)	0:0:0	0:0:0	TUE	OCT 14	14:05:27	2005

Verify Unit Provisioning

An error with provisioning the *Tenor AF* may cause a number of problems. It may be a simple error, such as an incorrect IP address or telephone number. See the *Command Line Interface (CLI)* guide or the *Tenor Configuration Manager Product Guide* for configuration information.

Perform Maintenance

The following are advanced maintenance procedures you can do through the *Command Line Interface (CLI)* or through the *Tenor Configuration Manager*. See the applicable user documentation you received with the unit for detailed information.

Restore Factory Defaults (including password)

Before the unit is shipped, it is set to a default factory configuration. There are several ways to restore factory defaults to the system: through the *Command Line Interface (CLI)*, through the *Configuration Manager*, or through the COM port.

Command Line Interface

1. Access **config** and type **setfactory**. A message will display asking whether you are sure you want to set to factory defaults.
2. Type **yes**. The unit is set back to factory defaults, including the password (the default password is **admin**).

Configuration Manager

1. Access and log into the *Tenor Configuration Manager*. For more information on this step, see the *Tenor Configuration Manager Product Guide*
2. From the main tool bar menu, select **Tools > Set Factory**. The *Confirm Set Factory* dialog box is displayed.
3. Click **Yes**. Your unit's configuration, including the password, is reset to factory defaults. A message appears when the unit has finished being set to defaults. A dialog box tells you the unit must be reset.
4. Click **OK** to reset the unit.

PC's COM port

You are able to change the unit back to factory defaults, including the password, after initial configuration.

1. Click on *Start > Programs > Accessories > Communications > HyperTerminal*. The *Connection Description* window is displayed.
2. Enter a connection name (i.e., name for the unit such as Tenor AF NJ). Click **OK**.
3. 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 is displayed.
4. Select the following information:
 - Bits per Second: **38400**
 - Data Bits: **8**
 - Parity: **None**
 - Stop bits: **1**
 - Flow control: **None**
5. Reset the unit. Information about the unit will scroll on the screen, followed by a message, "WITHIN 4 SECONDS, PRESS 'r' FOR FACTORY DEFAULTS or 'i' to SET STATIC IP".
6. Type **'r'**. A message asks you to confirm the factory default.
7. Type **y**. The configuration sets to factory defaults and the IP address related information will remain unchanged. The login prompt is displayed. The default user name and password is **admin**.

Reset System

The Reset system feature enables you to reset the system, including hardware and software. You can reset through the *Command Line Interface (CLI)* as follows:

1. Access the CLI through a Telnet session. See the *Command Line Interface (CLI)* guide for more information.
2. Access the *Maintain-MasterChassis-1#* prompt.
3. Type **reset**. You will be asked if you want to set the unit back to factory defaults.
4. Type **yes** to confirm (type **no** to cancel the restore). The system resets.

Change Password

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

1. Access the CLI through a Telnet session. See the *Command Line Interface (CLI)* guide 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

If the Tenor is reset, the time will be set back to default. 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 the *Command Line Interface (CLI)* guide 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 06/14/05/22:14:00**. This command will set the current time to June 14, 2005 at 10:14 p.m.

GLOSSARY

A

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

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

B

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

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

C

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. CDRs can be viewed through the *Tenor Monitor*.

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

Command Line Interface: Used to configure and monitor the *Tenor AF* unit via telnet connection.

Configuration Manager. A GUI interface which enables you to configure all functions in the *Tenor AF*.

Console port. RS-232 connector on the rear of the unit which is used for connection to a PC's serial port via serial modem cable.

D

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

E

ESD. Electrostatic Discharge (ESD). The rapid discharge of static electricity from one conductor to another. An ESD Antistatic Strap must be used to prevent damage to sensitive components.

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 AF* which provides RJ-45 jacks for connection to a 10/100 Ethernet LAN switch or hub via RJ-45 cable.

Extranet. Provides communications with a source outside your company.

F

FXO port. Foreign Exchange Office. Provides an RJ-11 jack for connection to the Central Office to provide direct connection to the PSTN.

FXS port. Foreign Exchange Station. Provides an RJ-11 jack for connection to a PBX, Keyphone or phone.

G

Gatekeeper. See *H.323 Gatekeeper*.

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 AF* 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 global packet based network which transports voice/video/data using TCP/IP.

Intranet communication. Web-based communication within the same company, using TCP/IP and a web browser.

IP Address. A unique 32 bit address that identifies a TCP/IP node on an IP network.

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. Light indicators on the Tenor AF which indicates the unit status. LEDs are mounted on the front of the unit.

P

PacketSaver. A packet multiplexing technology which reduces the amount of IP bandwidth required 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).

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

R

RJ-11. A cable used to connect the *Tenor AF* to an FXO or FXS interface.

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

SelectNet™. Monitors your data network for jitter, latency, and packet loss, and transparently switches customer calls to the PSTN when required.

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

SNMP. Simple Network Management Protocol (SNMP) is the standard protocol made up of agents and requestors used to manage complex networks.

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

T

TCP. Transmission Control Protocol. Used in conjunction with IP, TCP is used to connect hosts on the Internet and transfer data.

Tenor Monitor. A GUI interface which provides a set of utilities to monitor the network and all system components.

W

WAN. Wide Area Network. Any 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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