

Configuration Guide: Analog and Digital Voice

This Configuration Guide is designed to provide you with a basic understanding of the concepts behind configuring your NetVanta 950 IAD for analog and digital voice traffic. Two configuration methods are available for your NetVanta IAD:

- Web-Based GUI
- AOS CLI

The web-based GUI lets you configure the main settings and provides online guidance and explanations for each setting. However, use of the AOS CLI may be necessary for more advanced configurations.

Access the AOS CLI via the **CONSOLE** port or a Telnet session. For more details on CLI access, refer to the AOS Command Reference Guide on your *ADTRAN OS Documentation* CD (included in the shipment).

This guide consists of the following sections:

- Understanding Analog and Digital Voice on page 2
- Configuring Your IAD on page 4
- Verifying Your Configuration Using Show Commands on page 36
- *Testing Your System* on page 38
- Managing Event Messages on page 41

1. UNDERSTANDING ANALOG AND DIGITAL VOICE

Hardware Description

The applications discussed in this guide require the following hardware:

- One NetVanta 900 Series AC Chassis (P/N 1200786L1)
- One NetVanta 950 IAD Controller (P/N 1200788L1)
- One NetVanta 950 T1/V.35 Expansion Module (P/N 1200798L1)
- Five NetVanta 900 Series Octal FXS Access Modules (P/N 1200791L1)
- One NetVanta 900 Series Octal FXO Access Module (P/N 1200792L1)

Figure 1 shows the front view of the chassis.





The **CONSOLE** port and **T1 1/1** port are located on the front of the unit. The LEDs on the Controller, T1/V.35 Expansion Module, FXO Access Module, and FXS Access modules provide status information.



The tip/ring pairs for the analog voice ports connect to the right side of the chassis shown in Figure 2.

Figure 2. NetVanta 950 IAD Right Side Panel Layout

The T1s connect to the left side of the chassis as shown in Figure 3.



Figure 3. NetVanta 950 IAD Left Side Panel Layout

Common Applications

- POTS to PSTN via T1 less expensive than individual analog trunk lines
- POTS to Centrex service via T1
- PBX to PSTN via T1 or FXO
- OPX

Types of Signaling

- Analog: Loop Start, Ground Start, E&M, DPT (FXO only)
- Digital: Robbed-Bit, Clear Channel

2. CONFIGURING YOUR IAD

The remainder of this document provides examples designed to clarify the configuration of analog (FXS or FXO) or digital (T1) voice. Section 2a describes how to configure the IAD with the Web GUI. Section 2b (starting on page 16) describes how to configure the IAD with the CLI.

2a. Configuring your IAD with the Web GUI

You can configure your IAD with the interactive Web GUI. The web-based GUI lets you configure the main settings and provides online guidance and explanations for each setting. However, you may have to use the AOS CLI for more advanced configurations.

Logging In

Open a browser window and type the IP address for the unit in the address field. A login window (shown in Figure 4) displays.

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	GP
NetVanta	
User name:	2
Password:	
	Remember my password
	OK Cancel

Figure 4. Login Screen

Enter your **USER NAME** and **PASSWORD**; then click **OK**. The default username is *admin*, and the default password is *password*. The **IAD MANAGEMENT INTERFACE** for the NetVanta 950 displays as shown in Figure 5 on page 5. For information on setting your IP address and connecting the IAD to the LAN, refer to the NetVanta 950 IAD Quick Configuration Guide provided on your *ADTRAN OS Documentation* CD.

T1 Ports

When you log into the Web GUI, the **GENERAL SYSTEM INFORMATION** page displays in your browser window.



Figure 5. General System Information Page

In the left column select **PHYSICAL INTERFACES**, and the screen shown in Figure 6 displays. This screen shows all the physical interfaces that are installed in the system.

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System Setup Getting Started				
System	Physical	Interfaces		
Physical Interfaces Hostname / DNS Passwords	This is a lis connected its name.	t of all the pl via a plug-in	hysical interfaces that are either physically module. View or edit the configuration of a	tied to the product or n interface by clicking
Networking	Name	Logical In	iterface Line Status	Туре
IP Services	<u>t1 0/1</u>	none	Up	WAN-T1
IP Interfaces	t1 0/2 oth 0/1	none	Up	WAN-11 Ethernet
QoS Maps	fxp 6/1	none	Up Interface Disabled	Ethernet
Route Table	fx0 6/2	none	Interface Disabled	FXO
Routing	fxo 6/3	none	Interface Disabled	FXO
DHCP Server	fxo 6/4	none	Interface Disabled	FXO
Switch	fxo 6/5	none	Interface Disabled	FXO
Ports	<u>fxo 6/6</u>	none	Interface Disabled	FXO
VLANS	<u>fxo 6/7</u>	none	Interface Disabled	FXO
Firewall	<u>txo 6/8</u>	none	Interface Disabled	FXO
Eiremall Wizard	TXS //1 fixe 7/2	none	UnHook	FXS
General Firewall	fxs 7/2	none	Disabled	FXS
Socurity Zopos	fxs 7/4	none	Disabled	FXS
Observed Dearly	fxs 7/5	none	Disabled	FXS
Griannel Barik	fxs 7/6	none	Disabled	FXS
Connections	fxs 7/7	none	Disabled	FXS
Analog Ports	<u>fxs 7/8</u>	none	Disabled	FXS
Utilities				
Configuration				
Firmware				
Reboot Unit				~
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Figure 6. Physical Interfaces Page

View or edit the configuration of an interface by selecting its name. Select the **t1 0/1** port, and the **T1 0/1 CONFIGURATION** page displays as shown in Figure 7.

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ADIRAN	NetVanta 950	Save Logout	
System Setup	Physical Interfaces > T1 0/1		
Getting Started			
System Physical Interfaces	Configuration for T1 0/1		
Hostname / DNS	Basic configuration for the T1 interface.		
Passwords			
Networking IP Services	Description:	Description label (optional)	
IP Interfaces QoS Maps	Enable:	Enable or disable this interface	
Route Table Routing DHCP Server	<u>System Clock</u> Primary: t1 0/1 <u>Source</u> : Backup: t1 0/2	Click the link to adjust clock source for the system	
Switch Ports ¥LANs	Framing: ESF 💌	Select the framing that matches the network provider framing format	
Firewall Firewall Wizard General Firewall	Coding: B8ZS 💌	Select the coding that matches the network provider line coding	
Channel Bank Connections	FDL: ANSI 💌	Select the format for the facility data link 🛛 🌒 channel	
Analog Ports Utilities	Reset	pply	
Configuration Firmware Reboot Unit Telnet To Unit	Configured DSO Connections for T1 0/1		
	Use this dialog to connect a group of DS0's to a by this unit. To configure a connected interface'	particular interface or service provided s settings, click on the item in the list	~
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Figure 7. Configuration for T1 0/1

By default, the T1 interface is set for **ESF** framing and **B8ZS** coding. If you want to change settings, select different options from the pulldown menus. For example, if you want to change **FRAMING**, select the pulldown menu as shown in Figure 8. Select the new option from the list. When you are finished making changes, select **APPLY**.



Figure 8. Changing the Framing Configuration

System Clock Source

The clock source provides the reference point for all voice and data traffic in the system. There can only be one clock source for the system, otherwise clock slips may occur on the other T1 interfaces, resulting in noise on voice lines and errors on data circuits. Options include INTERNAL, t1 0/1, or t1 0/2. The default clock source is t1 0/1. Change the clock source by clicking on the PRIMARY CLOCK SOURCE menu and selecting another option. You can also select a backup source if more than one source exists; otherwise, Internal timing will be used as a backup. When you are finished making changes, click APPLY.

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ADRAN	NetVanta 950	ve Loga	out
System Setup	<u>System</u> > Clock Source		
Getting Started			
System Physical Interfaces	Set Primary / Backup Clock Source		
Passwords Networking	The NetVanta should have a Primary Clock or Timing source set. A backup so also be selected if more than one source exists, otherwise, Internal timing will as a backup.	urce can I be used	
IP Services IP Interfaces	Primary Clock ti 0/1 v Preferred timir Source: for the system	ng source	
yos maps Route Table Routing	Backup Clock Source: Data Deckup source Backup source	if the e fails	
DHCP Server	Cancel Apply		
Switch			
Ports			
VLANs			
Firewall			
Firewall Wizard General Firewall			
Security Zones			
Channel Bank			
Connections			
Analog Ports			
Configuration			
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Reboot Unit			_
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You can also check the configured settings as well as the current clock source on the **GENERAL SYSTEM INFORMATION** page as shown in Figure 5 on page 5.

TDM Groups

TDM groups are used to assign a number of DS0s to a particular interface. By creating a TDM group, the user sets aside a block of T1 channels for use in a particular cross connect. To access the DS0 Connections, scroll down the browser screen until you see the configuration box shown below. You can assign 24 DS0s to a T1 interface by selecting a **DS0 RANGE** of 1 to 24 (as shown in Figure 10). For the **CONNECT TO** field, select **t1 0/1**. For the **STARTING DS0** select **1**. Click **ADD**. A TDM group is created for the interface and channels 1-24 are assigned to the TDM group. The new DS0 connection displays at the bottom of the box.

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Configuration					^
Firmware Reboot Unit	Configured DSO (Connections for T1	0/1		
Telnet To Unit	bet Onit Use this dialog to connect a group of DS0's to a particular interface or service provided by this unit. To configure a connected interface's settings, click on the item in the list below. To remap a group of DS0's that are currently in use, click the delete button to remove the connections group.				
	Add a Connection				
	DS0 Range: 1 v to 24 v			Set the range of DSOs to be mapped	
	Connect To:	t1 0/1 🔽		Select an interface type to map to the DS0s	
	Speed:	64kbps 💌		Select the speed for the DSOs being mapped	
	Starting DS0:	1 🔽		Set the starting DS0 on the target T1 interface	
	RBS Signaling:			Maintain robbed bit signalling on this T1 to T1 connection	
		(Add		
	Connected Interface	DSO's Use	d Group Numb	er Speed/RBS	
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Figure 10. TDM Groups



You can scroll down the page and use the **STATUS** box to view a snapshot of the current status and statistics or to get a continuous update of the status and statistics of the T1 port.

Configuring the FXS Card

To configure the FXS card, select **PHYSICAL INTERFACES** in the left pane. All of the available interfaces display as shown in Figure 6 on page 6. Select an FXS port, such as **fxs 7/1**, and the page shown in Figure 11 displays. Change any of the settings (discussed in detail below) as required. When you are finished, select **APPLY**. To apply changes to several ports at the same time, select the check box for each port at the top of the screen. To apply the changes to all of the ports, click **SELECT ROW**.

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Getting Started		- 600		
System				_
Physical Interfaces	Configuration f	or fxs 7/1		
Hostname / DNS Ba	asic configuration	n for the FXS ports. Use the select boxes	below to quickly apply this	
Passwords po	ort's settings to n	nultiple ports.		
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OoS Maps				
Route Table	Decoription		Optional descriptive label	
Routing	Description.		alphanumeric characters.	
DHCP Server		_	Enable or disable this	
Switch	Enable:		interface	
Ports			Set receive gain (-12.0 to	-
VLANS	Receive Gain:	-3.0	6.0)	
Firewall			Set transmit gain (-12.0 to	
Firewall wizard	Transmit Gain:	-6.0	6.0)	
Security Zones		(00.0)	Set the terminating	
Channel Bank	Impedance:	600 Onm	impedance for the interface	
Connections	Answer		Set answer supervision	
Analog Ports	Supervision:		secanswer supervision	
Utilities	Signaling Type:	Loop-start	Set the 4wire - 2wire	
Configuration	Signaling Type:	coop-start V	signaling mode	
Firmware			Enable ringback tone to far	
Reboot Unit			end	
Telnet To Unit	Dial-tone:		Enable local dial-tone generation	~
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Figure 11. FXS Card Configuration Settings

Settings

Click on **ENABLE** to enable the interface. The interface is disabled by default. The receive gain is configurable in 0.1 dB increments from -12 dB to +6 dB (default is -3 dB). Receive gain determines the amplification of the signal before sending the signal out the FXS interface. When increasing this value, the signal being received on this port from the network sounds louder. When decreasing this value, the signal being received on this port sounds softer.

The transmit gain is also configurable in 0.1 dB increments from -12 dB to +6 dB (default is -6 dB). Transmit gain determines the amplification of the signal before sending the signal towards the network. When increasing this value, the signal being transmitted to the far end sounds louder. When decreasing this value, the signal being transmitted to the far end sounds softer.

To change impedance, click the pulldown menu to select the appropriate terminating impedance for the interface. There are four possible impedance settings: **600** OHM, **600** OHM + **2.16**UF, **900** OHM, and **900** OHM +**2.16**UF.

Answer Supervision configures answer supervision for the appropriate voice port(s). Answer supervision (when the far end answers the call) is indicated by using reverse battery polarity. Enabling this option will cause the FXS interface to interpret reverse battery polarity on the 2-wire interface as LSAS (Line Side Answer Supervision) and transmit the appropriate signaling bits on the T1. The LSAS signaling is defined as 0100 (for ESF) or 01/00 (for D4). The carrier must configure the network T1 for LSAS (if this is not a point-to-point T1).

Signaling

Loop start signaling bridges tip and ring to indicate an off-hook (seizing the line) condition. Ground start signaling applies resistance to the tip conductor of the circuit to indicate an off-hook (seizing the line) condition. The signaling mode must match the configuration of the network and the expected operation with customer premise equipment. The FXS ports are set for loop start signaling by default.



You can scroll down the page and use the **STATUS** box to view a snapshot of the current status and statistics or to get a continuous update of the status and statistics of the FXS port.

Configuring the FXO Card

To configure the FXO card, select **PHYSICAL INTERFACES** in the left pane. All of the available interfaces display as shown in Figure 6 on page 6. Select an FXO port, such as **fxo 6/1**, and the page shown in Figure 12 displays. Change any of the settings (discussed in detail below) as required. When you are done editing, select **APPLY**. To apply changes to several ports at the same time, select the check box for each port at the top of the screen. To apply the changes to all of the ports, click **SELECT ROW**.

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ADIRAN	NetVanta 950	ogout
System Setup	Physical Interfaces > fxo 6/1 💙	
Getting Started		
System		_
Physical Interfaces	Configuration for fxo 6/1	_
Passwords	Basic configuration for the fxo ports. Use the select boxes below to quickly apply this	
Networking	port's settings to multiple ports.	
IP Services		
IP Interfaces		
QoS Maps	Ontional decorrintius label	
Route Table	Description: for this interface. Up to 80	
Routing	alphanumeric characters.	
Switch	Enable: Enable or disable this	
Ports	interface	
VLANs	Receive Gain: +0.0 Set receive gain (-6.0 to	
Firewall	10.0)	
Firewall Wizard	Transmit Gain: +0.0 Set transmit gain (-6.0 to	
General Firewall	10.0)	
Security Zones	Impedance: 600 Ohm+2.16uF V Set the terminating	
Channel Bank		
Connections	Answer Supervision	
Analog Ports		
Configuration	Signaling Type: Loop-start V Set the 4wire - 2wire signaling mode	
Firmware		
Reboot Unit	Reset Apply	
Telnet To Unit		
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Figure 12. FXO Card Configuration Settings

Settings

Click on **ENABLE** to enable the interface. The interface is disabled by default. The receive gain is configurable in 0.1 dB increments from -12 dB to +6 dB (default is -0 dB). Receive gain determines the amplification of the signal before sending the signal out the FXO interface. When increasing this value, the signal being received on this port from the network sounds louder. When decreasing this value, the signal being received on this port sounds softer.

The transmit gain is also configurable in 0.1 dB increments from -12 dB to +6 dB (default is -0 dB). Transmit gain determines the amplification of the signal before sending the signal towards the network. When increasing this value, the signal being transmitted to the far end sounds louder. When decreasing this value, the signal being transmitted to the far end sounds softer.

To change impedance, click the pulldown menu to select the appropriate terminating impedance for the interface. There are two possible impedance settings: **600 OHM +2.16UF** and **900 OHM +2.16UF**.

Answer Supervision configures answer supervision for the appropriate voice port(s). Answer supervision (when the far end answers the call) is indicated by using reverse battery polarity. Enabling this option will cause the FXO interface to interpret reverse battery polarity on the 2-wire interface as LSAS (Line Side Answer Supervision) and transmit the appropriate signaling bits on the T1. The LSAS signaling is defined as 0100 (for ESF) or 01/00 (for D4). The carrier must configure the network T1 for LSAS (if this is not a point-to-point T1).

Signaling

Loop start signaling bridges tip and ring to indicate an off-hook (seizing the line) condition. Ground start signaling applies resistance to the tip conductor of the circuit to indicate an off-hook (seizing the line) condition. DPT signaling is used when connecting the FXO interface to analog DPO ports on the customer premise equipment. The signaling mode must match the configuration of the network and the expected operation with customer premises equipment. The FXO ports are set for loop start signaling by default.



You can scroll down the page and use the **STATUS** box to view a snapshot of the current status and statistics or to get a continuous update of the status and statistics of the FXO port.

Analog Ports

The **ANALOG PORTS** page (Figure 13) shows the analog ports in the system. This is a subset of the **PHYSICAL INTERFACES** page. From here, you can go to the individual port page for configuration just as you did from the **PHYSICAL INTERFACES** page. See Figure 11 on page 10 and Figure 12 on page 12.

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System Setup							
Getting Started							
System Physical Interfaces	Analog	Ports Summary					
Hostname / DNS	Click on th	e name of the port	to configure additional po	ort settings and	view port		
Passwords	statistics.		· ·	-			
Networking	Port	Description	Signaling 📿	Connection	Status		
IP Services IP Interfaces	1 ml						
QoS Maps	<u>fxs 7/1</u>		Loop-Start	none	Disabled		
Route Table	<u>fxs 7/2</u>		Loop-Start	none	Disabled		
Routing	<u>fxs 7/3</u>		Loop-Start	none	Disabled		
Switch	<u>fxs 7/4</u>		Loop-Start	none	Disabled		
Ports	<u>fxs 7/5</u>		Loop-Start	none	Disabled		
VLANs	<u>fxs 7/6</u>		Loop-Start	none	Disabled		
Firewall	<u>fxs 7/7</u>		Loop-Start	none	Disabled		
Firewall Wizard	<u>fxs 7/8</u>		Loop-Start	none	Disabled		
Security Zones	<u>fxo 6/1</u>		Loop-Start	none	Disabled		
Channel Bank	<u>fxo 6/2</u>		Loop-Start	none	Disabled		
Connections	fxo 6/3		Loop-Start	none	Disabled		
Analog Ports	fxo 6/4		Loop-Start	none	Disabled		
Configuration	fxo 6/5		Loop-Start	none	Disabled		
Firmware	fx0.6/6		Loop-Start	none	Disabled		
Reboot Unit	fx0.6/7		Loop-Start	none	Disabled		
Telnet To Unit			Loop-Start	none		×	
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Figure 13. Analog Ports Summary Page

Connections

The **CONNECTIONS SUMMARY** page (Figure 14) shows every TDM connection in the system. You can go to the individual port page for configuration just as instructed for the **PHYSICAL INTERFACES** page.

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ADRAN	NetVa	anta 9	50	Save	Logout
System Setup					
Getting Started					
System	Connection	c Curren a mu			
Physical Interfaces	Connection	s summary			
Hostname / DNS	Click on the n	ame of the port to	configure additional por	t settings and view port	
Passwords	statistics.				
Networking	T1 Interface	DS0(s)	Connected Port	Speed/RBS	
IP Services	t1 0/1	1	fxs 7/1		
IP Interfaces	t1 0/1	2	fxs 7/2		
QoS Maps	t1 0/1	3	fxs 7/3		
Route Table	t1 0/1	4	<u>fxs 7/4</u>		
Routing	<u>t1 0/1</u>	5	<u>fxs 7/5</u>		
DHUP Server	<u>t1 0/1</u>	6	<u>fxs 7/6</u>		
Switch	<u>t1 0/1</u>	7	<u>fxs 7/7</u>		
Ports	<u>t1 0/1</u>	8	<u>fxs 7/8</u>		
VLANS	t1 0/2	1	<u>t1 1/1</u>	RBS: off	
Firewall	<u>t1 1/1</u>	1	<u>t1_0/2</u>	RBS: off	
Firewall Wizard	<u>t1 1/1</u>	4	<u>ppp 1</u>	64kbps	
General Firewall					
Security Zones					
Channel Bank					
Connections					
Analog Ports					
Utilities					
Configuration					
Firmware					
Reboot Unit					
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Figure 14. Connections Page

Saving Your Configuration

At the top of each page there are **SAVE** and **LOGOUT** links. To save your configuration, either select **SAVE** at the top of the page or select the **CONFIGURATION** option in the left column. The page shown in Figure 15 displays. From this page you can save your current configuration, download the configuration from the IAD to your PC, or upload a new configuration to the IAD. When you are finished, select **LOGOUT** at the top of the page to log out of the Web GUI.

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		~
ADIRAN	NetVanta 950 Save Log	out
System Setup		
Getting Started		
System	Save Config	
Physical Interfaces Hostname / DNS Passwords	Click Save to write the current configuration to NVRAM. Any changes made without saving will be lost after a power cycle or reboot.	
Networking	Save	
IP Services		
IP Interfaces	Configuration Successfully Saved	
QoS Maps	Download Config	
Route Table	Click Download to get the currently saved configuration from the NetVanta.	
Routing		
Switch	Download	
Ports		
VLANS	Usland Cashie	
Firewall	Opioad Coning	
Firewall Wizard	Upload your own configuration file for the NetVanta here. This will overwrite the	
General Firewall	configuration currently saved to NVRAM. You will need to reboot the NetVanta for the changes to take effect.	
Security Zones		
Channel Bank	Uploading will overwrite	
Connections	after a reboot	
Analog Ports		
Utilities	Cancel Upload	
Configuration		
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Figure 15. Save Configuration Page

2b. Configuring Your IAD with the CLI

This section describes how to configure the NetVanta 950 using the CLI. The following sections (T1 Ports, Voice Ports, and Connecting Interfaces) give an overview of the options and steps necessary when configuring analog or digital voice. See *Configuration Examples* on page 22 for additional information.

T1 Ports

From the prompt, **IAD#**, enter **configure terminal**. All interfaces will be configured from within the configure terminal mode. Enter interface **t1** 0/1 to configure the controller's first T1 port (0/1).

Settings

The T1 interface is set for B8ZS coding, ESF framing, and 0 dB line build out (LBO) by default. If the user wanted to change coding, for example, typing **coding ami** would configure the T1 port for AMI coding. For framing, type **framing d4** to configure the interface for D4 framing. The IAD supports four different settings for Line Build Out. Type **lbo -22.5** to set the Line Build out to **-22.5 dB**. Other settings include **-15** and **-7.5**. See the AOS Command Reference Guide for a complete list of all T1 commands, or type **?** at the prompt.

TDM Groups

TDM groups are used to assign a number of DS0s to a particular interface. By creating a TDM group, the user sets aside a block of T1 channels for use in a particular cross connect. You can assign 24 DS0s to a T1 interface by typing **tdm-group 1 timeslots 1-24**. This command creates TDM group 1 for the interface ("one" was chosen arbitrarily; it could be any value between 1 and 255) and assigns channels 1-24 to it.

Activation

The last step of the T1 interface configuration is to activate the T1 interfaces by typing **no shutdown** from the **IAD (config-t1 0/1)#** prompt for T1 WAN 0/1 or the **IAD (config-t1 0/2)#** prompt for T1 WAN 0/2. See *Verifying Your Configuration Using Show Commands* on page 36 section for more information on the status of the T1 port.

Clock Source

The clock source provides the reference point for all voice and data traffic in the system. There can only be one active clock source for the system; otherwise clock slips may occur on the other T1 interfaces resulting in noise on voice lines and errors on data circuits. Options include internal, t1 0/1, or t1 0/2. The default clock source is t1 0/1. For example, type clock source t1 0/2 to set the timing source to the controller's second T1 port. The system also allows a secondary clock source for backup timing. In the event of a failure of the primary source, the system switches over to the secondary source. To configure T1 0/1 as a secondary timing source, type clock source t1 0/1 secondary.

Voice Ports (FXS)

From the prompt, **IAD#**, enter **configure terminal**. All interfaces will be configured from within the configure terminal mode. Enter **interface fxs 2/1** to configure the first FXS port on the access module in slot 2.

The user may configure each port one at a time or use the **range** command to set a group of ports at the same time. To use the **range** command, type **interface range fxs** *slot x/port a-b, fxs slot y/port a-b* where slot x and y are slots with FXS cards installed and port a-b specifies the range of ports to be configured. For example, to configure FXS slot 3, ports 1-8 and FXS slot 5, ports 1-4, from the Global configuration prompt, type **interface range fxs 3/1-8, fxs 5/1-4**. Then type the desired command to configure all 12 of the specified ports identically.

For additional information about the available settings for the FXS card, see *Configuring the FXS Card* on page 10.

All other interface configuration options are dependent on the type of signaling used. These settings are described in the Signaling section. See the *AOS Command Reference Guide* for a complete list of all FXS commands, or type **?** at the prompt.

Signaling

Loop start signaling bridges tip and ring to indicate an off-hook (seizing the line) condition. Ground start signaling applies resistance to the tip conductor of the circuit to indicate an off-hook (seizing the line) condition. The signaling mode must match the configuration of the network and the expected operation with customer premises equipment. The FXS ports are set for loop start signaling by default. The other option is ground start signaling. To change the signaling type to ground start, type **signal ground-start**.

E&M Tandem conversion is a setting used to convert E&M signaling on a T1 to FXS loop start or ground start signaling. The **em-conversion** command has two possible settings, **immediate** and **wink**. Type **em-conversion immediate** to transmit DTMF digits toward the 2-wire interface immediately following an off-hook condition. Type **em-conversion wink** to implement a wink process for inbound calls. Use the **no** command to disable **em-conversion** (em-conversion is disabled by default).

There are several other settings that are only valid if E&M Conversion is enabled. These include **dial-tone**, **dnis-delay**, **dnis-wink-timeout**, **forward-disconnect delay**, **forward-disconnect battery**, and **ringback**. Type **dial-tone** to enable dial-tone and type **ringback** to enable ringback. They should be enabled whenever the central office switch does not provide those features. They are only necessary in E&M applications and **em-conversion** must be configured.

The **dnis-delay** and **dnis-wink-timeout** commands are used in conjunction with the **em-conversion wink** setting. Use **dnis-delay** to define the time delay after transmitting a wink in response to the 2-wire interface going off-hook (after ringing) before transmitting off-hook towards the T1 interface. **Dnis-delay** is only valid when **em-conversion** is configured for wink. By default, **dnis-delay** is disabled. The no version of this command disables **dnis-delay**. Possible settings range from 500 ms to 3000 ms in 500 ms increments. For example, type **dnis-delay 1500** to set the delay to 1.5 seconds. When **dnis-delay** is specified and **dnis-wink-timeout** is enabled, a wink is returned to the originating switch after five seconds if the port does not detect an off-hook condition. Disabling this option allows the FXS port to ring without winking until the call is answered. By default this option is enabled when **dnis-delay** is activated.

NOTE

Trunks may be taken out of service by the central office switch if no wink is received. Use caution when disabling this option.

Finally, **forward-disconnect delay** and **forward-disconnect battery** are used together to define the actions of the FXS port when the remote equipment ends the call. Both commands are disabled by default and are only used when the interface is configured for **loop-start** and **em-conversion** is enabled. The **forward-disconnect delay** specifies the number of milliseconds the FXS module waits after initiating a disconnect sequence on the FXS interface as a result of remote end terminating the call, before returning to an idle condition. By default, **forward-disconnect delay** is disabled. If

configured, the recommended initial setting is 1000 ms. Possible settings are 250, 500, 750, 1000, and 2000 ms.

Use **forward-disconnect battery** to specify the behavior of the battery when the remote equipment ends the call. Possible settings are **remove** and **reverse**. Selecting **remove** configures the FXS to remove battery from the circuit when the remote equipment ends the call. Selecting **reverse** configures the FXS to reverse battery polarity on the circuit when the remote equipment ends the call. By default, **forward-disconnect battery** is disabled. Setting **forward-disconnect battery** is only necessary when **em-conversion** is configured and a **forward-disconnect delay** specified. If configured, the recommended initial setting is **forward-disconnect battery** remove.

CAUTION Making configuration changes while a port is active will cause the call to drop.

TDM Groups

An FXS port can only connect to a single DS0, so there are no TDM groups for FXS ports. FXS ports are assigned to DS0s using the **cross-connect** command discussed in *Connecting the Interfaces* on page 21.

Activation

The user may activate each port individually, or if the **range** command is used many ports can be activated simultaneously. To activate each port one at a time, first enter **interface fxs 2/1** from the Global configuration mode. Type **no shutdown**. Then type **interface fxs 2/2** to move to the next port and repeat through **interface fxs 6/8**.

To activate all the ports with the range command, type interface range fxs 2/1-8, fxs 3/1-8, fxs 4/1-8, fxs 5/1-8, fxs 6/1-8 and then type no shutdown.

See *Verifying Your Configuration Using Show Commands* on page 36 for more information on the status of each FXS port.

Voice Ports (FXO)

From the prompt, **IAD#**, enter **configure terminal**. All interfaces will be configured from within the configure terminal mode. Enter **interface fxo 7/1** to configure the first FXO port on the access module in slot 7.

The user may configure each port one at a time or use the **range** command to set a group of ports at the same time. To use the **range** command, type **interface range fxo** *slot x/port a-b, fxo slot y/port a-b* where slot x and y are slots with FXO cards installed and port a-b specifies the range of ports to be configured. For example, to configure FXO slot 3, ports 1-8 and FXO slot 5, ports 1-4, from the Global configuration prompt, type **interface range fxo 3/1-8, fxo 5/1-4**. Then type the desired command to configure all 12 of the specified ports identically.

Settings

Each FXO interface is set for Loop Start signaling, $600\Omega + 2.16$ impedance, answer supervision disabled and with receive and transmit gains both set to 0 dB. If, for example, the user wanted to change impedance, typing **impedance 600c** would configure the FXO port for $600\Omega+2.16$ uF impedance. There are two possible impedance settings: **600c** ($600 \Omega + 2.16$ uF complex) and **900c** ($900 \Omega + 2.16$ uF complex).

Answer Supervision enables answer supervision for the FXO port. Answer supervision (when the far end answers the call) is indicated by using reverse battery polarity. Enabling this option will cause the FXO interface to interpret reverse battery polarity on the 2-wire interface as LSAS (Line Side Answer Supervision) and transmit the appropriate signaling bits on the T1. The LSAS signaling is defined as 0100 (for ESF) or 01/00 (for D4). The carrier must configure the network T1 for LSAS (if this is not a point-to-point T1).

The receive gain is configurable in 0.1 dB increments from -6 dB to +10 dB (default is 0 dB). Receive gain determines the amplification of the signal before sending the signal out the FXO interface. When increasing this value, the signal being received on this port from the network sounds louder. When decreasing this value, the signal being received on this port sounds softer. Type **rx-gain -10** to set the receive gain to -10 dB, for example.

The transmit gain is also configurable in 0.1 dB increments from -6 dB to +10 dB (default is 0 dB). Transmit gain determines the amplification of the signal before sending the signal towards the network. When increasing this value, the signal being transmitted to the far end sounds louder. When decreasing this value, the signal being transmitted to the far end sounds softer. Type **tx-gain 4.8** to set the transmit gain to +4.8 dB, for example.

See the AOS Command Reference Guide for a complete list of all FXO commands, or type ? at the prompt.

Signaling

The FXO supports three types of signalling: Loop Start, Ground Start, and DPT. Loop start signaling bridges tip and ring to indicate an off-hook (seizing the line) condition. Ground start signaling applies resistance to the tip conductor of the circuit to indicate an off-hook (seizing the line) condition. DPT signaling is used when connecting the FXO interface to analog DPO ports on the customer premise equipment. The signaling mode must match the configuration of the network and the expected operation with customer premises equipment. The FXO ports are set for loop start signaling by default. To change the signaling type to ground start, type **signal ground-start**, for example.



Making configuration changes while a port is active will cause the call to drop.

TDM Groups

An FXO port can only connect to a single DS0, so there are no TDM groups for FXO ports. FXO ports are assigned to DS0s using the **cross-connect** command discussed in *Connecting the Interfaces* on page 21.

Activation

The user may activate each port individually, or if the **range** command is used many ports can be activated simultaneously. To activate each port one at a time, first enter **interface fxo 7/1** from the Global configuration mode. Type **no shutdown**. Then type **interface fxo 7/2** to move to the next port and repeat through **interface fxo 7/8**.

To activate all the ports with the **range** command, type **interface range fxo 7/1-8** and then type **no shutdown**.

See *Verifying Your Configuration Using Show Commands* on page 36 for more information on the status of each FXO port.

Connecting the Interfaces

The **cross-connect** command is used to connect DS0s and ports together. The format of the command is:

cross-connect A t1 <slot/port> <TDM Group.DS0> <interface> <slot/port>

where **A** is a number chosen arbitrarily, although it must be unique for each cross-connect. The **<TDM Group.DS0>** nomenclature allows the system to connect a specific DS0 from a specific TDM group to a voice interface. For example, a 2.13 in that field would connect DS0 13 from TDM group 2 to the interface specified subsequently.

Note that the **range** command also works with the cross-connect command. The format of the command is very similar to the individual command:

cross-connect range A t1 <slot/port><TDM group.starting DSO> <interface> <slot/port>

where **A** is a number chosen arbitrarily, although it must be unique for each cross-connect. The **<TDM** group.starting DS0> nomenclature allows the system to connect a specific DS0 from a specific TDM group to a voice interface. The **<starting DS0>** is the first DS0 in the range. Subsequent DS0s will be mapped to subsequent ports. The **<interface**> **<slot/port**> tells the system the starting slot/port and the ending slot/port. This information is listed as a range. It may be listed as a contiguous range, individual interface, or both. For example, to map FXS 2/1, 2/2, 3/1, and FXO 7/4, type:

FXS 2/1-2, FXS 3/1, FX0 7/4



When using the **range** command, cross-connects are still displayed individually in the configuration.

To delete connections, use the **no** form of the command and specify the particular cross-connect number to be deleted. For example, type **no cross-connect 1** to delete cross-connect number 1. All other connections will remain in place.

If you wish to change an existing cross-connect, you must delete it and then re-create it as a new connection. If you try to modify a cross-connect, the system will respond with "cross-connect ID already exists."

Configuration Examples

The following configurations are given in detail as examples:

- 12 Channels of FXS Loop Start Signaling
 - Step-by-step Configuration: 12 Channels of FXS Loop Start Signaling on page 23
 - Sample Script on page 23
- 12 Channels of FXS Ground Start Signaling
 - Step-by-step Configuration: 12 Channels of FXS Ground Start Signaling on page 25
 - Sample Script on page 25
- 12 Channels of FXS Tandem E&M with Loop Start Signaling
 - Step-by-step Configuration: 12 Channels of FXS Tandem E&M with Loop Start Signaling on page 27
 - *Sample Script* on page 29
- 4 Channels of Robbed-Bit Signaling to a T1 Interface
 - Step-by-step Configuration: 4 Channels of Robbed-Bit signaling to a T1 Interface on page 32
 - Sample Script on page 33
- 8 Channels of FXO Loop Start Signaling
 - Step-by-step configuration: 8 Channels of FXO Loop Start Signaling on page 33
 - Sample Script on page 34

Configuration steps for each example are provided in the tables that follow the configuration description. You can follow the given steps by entering the command text shown in bold (modifying as needed for your application).

> Please note that these examples are given for your study and consideration only. They are to help you reach a better understanding of the fundamental concepts before configuring your own application. It will be necessary for you to modify these examples to match your own network configuration.



NØTE

Use the sample scripts in this section as a shortcut to configuring your unit. Use the text tool in Adobe Acrobat to select and copy the scripts; then you can paste them into any text editing program, modify as needed, and paste them directly into your AOS command line.

Example 1: 12 Channels of FXS Loop Start Signaling

This example connects twelve channels from T1 0/1 to 12 FXS ports, starting in Slot 2. They will be running loop start signaling. The NetVanta 950 is loop timed from T1 0/1. This example is the most common, and most of the settings are the default settings.

Step	Command	Description
1	IAD > enable	Enter Enable Security mode
2	IAD# configure terminal	Enter Global configuration mode
3	IAD (config)# interface t1 0/1	Enter configuration mode for T1 interface 0/1
4	IAD (config-t1 0/1)# tdm-group 1 timeslots 1-12	Create a TDM group of timeslots 1 through 12 on T1 0/1
5	IAD (config-t1 0/1)# no shutdown	Activate T1 0/1
6	IAD (config-t1 0/1)# exit	Exit to Global configuration mode
7	IAD (config)# clock source t1 0/1	Set the system clock source to T1 interface 0/1
8	IAD (config)# interface range fxs 2/1-8, fxs 3/1-4	Enter configuration mode for fxs interfaces 2/1-8 and 3/1-4
9	IAD (config-fxs 2/1-8, fxs 3/1-4)# no shutdown	Activate all FXS interfaces from Slot 2/1 to Slot 3/4
10	IAD (config-fxs 2/1-8, fxs 3/1-4)# exit	Exit to Global configuration mode
11	IAD (config)# cross-connect range 1 t1 0/1 1.1 fxs 2/1-8, fxs 3/1-4	Create a connection between T1 0/1 TDM group 1, DS0 1 and FXS 2/1 through DS0 12 and FXS 3/4
12	IAD (config)# exit	Exit Global configuration mode

This configuration must be saved to maintain settings after a unit reboot. Type **copy running-config startup-config** to save the running configuration to the start-up configuration.

Sample Script

NOTE

A copy of the entire configuration script is shown below:

enable configure terminal interface t1 0/1 tdm-group 1 timeslots 1-12 no shutdown exit clock source t1 0/1 interface fxs 2/1 cross-connect 1 t1 0/1 1.1 fxs 2/1 no shutdown

interface fxs 2/2 cross-connect 2 t1 0/1 1.2 fxs 2/2 no shutdown

interface fxs 2/3 cross-connect 3 t1 0/1 1.3 fxs 2/3 no shutdown

interface fxs 2/4 cross-connect 4 t1 0/1 1.4 fxs 2/4 no shutdown

interface fxs 2/5 cross-connect 5 t1 0/1 1.5 fxs 2/5 no shutdown

interface fxs 2/6 cross-connect 6 t1 0/1 1.6 fxs 2/6 no shutdown

interface fxs 2/7 cross-connect 7 t1 0/1 1.7 fxs 2/7 no shutdown

interface fxs 2/8 cross-connect 8 t1 0/1 1.8 fxs 2/8 no shutdown

interface fxs 3/1 cross-connect 9 t1 0/1 1.9 fxs 3/1 no shutdown

interface fxs 3/2 cross-connect 10 t1 0/1 1.10 fxs 3/2 no shutdown

interface fxs 3/3 cross-connect 11 t1 0/1 1.11 fxs 3/3 no shutdown

interface fxs 3/4 cross-connect 12 t1 0/1 1.12 fxs 3/4 no shutdown exit

Example 2: 12 Channels of FXS Ground Start Signaling

This example connects twelve channels from T1 0/1 to twelve FXS ports starting in Slot 3. They will be running ground start signaling. The NetVanta 950 is loop timed from T1 0/1.

Step	Command	Description
1	IAD > enable	Enter Enable Security mode
2	IAD# configure terminal	Enter Global configuration mode
3	IAD (config)# interface t1 0/1	Enter configuration mode for T1 interface 0/1
4	IAD (config-t1 0/1)# tdm-group 2 timeslots 13-24	Create a TDM group of timeslots 13 through 24 on T1 0/1
5	IAD (config-t1 0/1)# no shutdown	Activate T1 0/1
6	IAD (config-t1 0/1)# exit	Exit to Global configuration mode
7	IAD (config)# clock source t1 0/1	Set the system clock source to T1 interface 0/1
8	IAD (config)# interface range fxs 3/5-8, fxs 4/1-8	Enter configuration mode for fxs interfaces 3/5-8 and 4/1-8
9	IAD (config-fxs 3/5-8, fxs 4/1-8)# signal ground-start	Set all FXS interfaces from Slot 3/5 to Slot 4/8 to Ground Start Signaling
10	IAD (config-fxs 3/5-8,fxs 4/1-8)# no shutdown	Activate all FXS interfaces from Slot 3/5 to Slot 4/8
11	IAD (config-fxs 3/5-8, fxs 4/1-8)# exit	Exit to Global configuration mode
12	IAD (config)# cross-connect range 13 t1 0/1 2.13 fxs 3/5, fxs 4/8	Create a connection between T1 0/1 TDM group 2, DS0 13 and FXS 3/5 through DS0 24 and FXS 4/8
13	IAD (config)# exit	Exit Global configuration mode.

NOTE

This configuration must be saved to maintain settings after a unit reboot. Type **copy running-config startup-config** to save the running configuration to the start-up configuration.

Sample Script

A copy of the entire configuration script is shown below:

enable configure terminal interface t1 0/1 tdm-group 2 timeslots 13-24 no shutdown exit

clock source t1 0/1

interface fxs 3/5 signal ground-start cross-connect 13 t1 0/1 2.13 fxs 3/5 no shutdown

interface fxs 3/6 signal ground-start cross-connect 14 t1 0/1 2.14 fxs 3/6 no shutdown

interface fxs 3/7 signal ground-start cross-connect 15 t1 0/1 2.15 fxs 3/7 no shutdown

interface fxs 3/8 signal ground-start cross-connect 16 t1 0/1 2.16 fxs 3/8 no shutdown

interface fxs 4/1 signal ground-start cross-connect 17 t1 0/1 2.17 fxs 4/1 no shutdown

interface fxs 4/2 signal ground-start cross-connect 18 t1 0/1 2.18 fxs 4/2 no shutdown

interface fxs 4/3 signal ground-start cross-connect 19 t1 0/1 2.19 fxs 4/3 no shutdown

interface fxs 4/4 signal ground-start cross-connect 20 t1 0/1 2.20 fxs 4/4 no shutdown

interface fxs 4/5 signal ground-start cross-connect 21 t1 0/1 2.21 fxs 4/5 no shutdown

interface fxs 4/6 signal ground-start cross-connect 22 t1 0/1 2.22 fxs 4/6 no shutdown

interface fxs 4/7 signal ground-start cross-connect 23 t1 0/1 2.23 fxs 4/7 no shutdown

interface fxs 4/8 signal ground-start cross-connect 24 t1 0/1 2.24 fxs 4/8 no shutdown exit

Example 3: 12 Channels of FXS Tandem E&M with Loop Start Signaling

This example connects twelve channels from T1 0/2 to twelve FXS ports starting in Slot 5. They will be running loop start signaling and performing E&M conversion. The Central Office switch does not provide dial-tone or ringback. The DNIS delay should be 1 second. The forward disconnect delay should be 1 second, and the battery should be reversed when the remote equipment ends the call. The NetVanta 950 is loop timed from T1 0/1 (previously connected).

Step	Command	Description
1	IAD > enable	Enter Enable Security mode
2	IAD# configure terminal	Enter Global configuration mode
3	IAD (config)# interface t1 0/2	Enter configuration mode for T1 interface 0/2
4	IAD (config-t1 0/2)# tdm-group 1 timeslots 1-12	Create a TDM group of timeslots 1 through 12 on T1 0/2
5	IAD (config-t1 0/2)# no shutdown	Activate T1 0/2
6	IAD (config-t1 0/2)# exit	Exit to Global configuration mode
7	IAD (config)# clock source t1 0/1	Set the system clock source to T1 interface 0/1
8	IAD (config)# interface range fxs 5/1-8, fxs 6/1-4	Enter configuration mode for fxs interfaces 5/1-8 and 6/1-4
9	IAD (config-fxs 5/1-8, fxs 6/1-4)# em-conversion wink	Configures the FXS interfaces for E&M conversion with a wink
10	IAD (config-fxs 5/1-8, fxs 6/1-4)# forward-disconnect delay 1000	Configures the FXS interfaces to wait for 1 second before initiating a disconnect sequence

Step	Command	Description
11	IAD (config-fxs 5/1-8, fxs 6/1-4)# forward-disconnect battery reverse	Configures the FXS interfaces to reverse the battery polarity on the circuit when the remote equipment ends the call
12	IAD (config-fxs 5/1-8, fxs 6/1-4)# dnis-wink-timeout	Configures the FXS interface to return a wink to the originating switch after five seconds if it does not detect an off-hook condition
13	IAD (config-fxs 5/1-8, fxs 6/1-4)# dnis-delay 1000	Configures the FXS interfaces to delay 1 second before activating an off-hook condition
14	IAD (config-fxs 5/1-8, fxs 6/1-4)# dial-tone	Configures the FXS interfaces to provide dial-tone
15	IAD (config-fxs 5/1-8, fxs 6/1-4)# ringback	Configures the FXS interfaces to provide ringback
16	IAD (config-fxs 5/1-8, fxs 6/1-4)# no shutdown	Activate all FXS interfaces from Slot 5/1 to Slot 6/4
17	IAD (config-fxs 5/1-8, fxs 6/1-4)# exit	Exit to Global configuration mode
18	IAD (config)# cross-connect range 25 t1 0/2 1.1 fxs 5/1, fxs 6/4	Create a connection between T1 0/2 TDM group 1, DS0 1 and FXS 5/1 through DS0 12 and FXS 6/4
19	IAD (config)# exit	Exit Global configuration mode



This configuration must be saved to maintain settings after a unit reboot. Type **copy running-config startup-config** to save the running configuration to the start-up configuration.

Sample Script

A copy of the entire configuration script is shown below:

enable configure terminal interface t1 0/2 tdm-group 1 timeslots 1-12 no shutdown exit

clock source t1 0/1

interface fxs 5/1 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 25 t1 0/2 1.1 fxs 5/1 no shutdown

interface fxs 5/2 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 26 t1 0/2 1.2 fxs 5/2 no shutdown

interface fxs 5/3 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 27 t1 0/2 1.3 fxs 5/3 no shutdown

interface fxs 5/4 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 28 t1 0/2 1.4 fxs 5/4 no shutdown

interface fxs 5/5 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 29 t1 0/2 1.5 fxs 5/5 no shutdown

interface fxs 5/6 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 30 t1 0/2 1.6 fxs 5/6 no shutdown

interface fxs 5/7 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 31 t1 0/2 1.7 fxs 5/7 no shutdown

interface fxs 5/8 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone

ringback cross-connect 32 t1 0/2 1.8 fxs 5/8 no shutdown interface fxs 6/1 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 33 t1 0/2 1.9 fxs 6/1 no shutdown interface fxs 6/2 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 34 t1 0/2 1.10 fxs 6/2 no shutdown interface fxs 6/3 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 35 t1 0/2 1.11 fxs 6/3 no shutdown interface fxs 6/4 em-conversion wink forward-disconnect delay 1000 forward-disconnect battery reverse dnis-wink-timeout dnis-delay 1000 dial-tone ringback cross-connect 36 t1 0/2 1.12 fxs 6/4 no shutdown exit

Example 4: 4 Channels of Robbed-Bit signaling to a T1 Interface

This example connects four channels from T1 0/2 to four channels on T1 1/1. They will be robbed-bit signaling. The NetVanta 950 is loop timed from T1 0/1. The settings in this example are common, and most of the settings are the default settings.

Step	Command	Description	
1	IAD> enable	Enter Enable Security mode	
2	IAD# configure terminal	Enter Global configuration mode	
3	IAD (config)# interface t1 0/2	Enter configuration mode for T1 interface 0/2	
4	IAD (config-t1 0/2)# tdm-group 2 timeslots 13-16	Create a TDM group of timeslots 13 through 16 on T1 0/2	
5	IAD (config-t1 0/2)# no shutdown	Activate T1 0/2	
6	IAD (config-t1 0/2)# exit	Exit to Global configuration mode	
7	IAD (config)# interface t1 1/1	Enter configuration mode for T1 interface 1/1	
8	IAD (config-t1 1/1)# tdm-group 1 timeslots 1-4	Create a TDM group of timeslots 1 through 4 on T1 1/1	
9	IAD (config-t1 1/1)# no shutdown	Activate T1 1/1	
10	IAD (config-t1 1/1)# exit	Exit to Global configuration mode	
11	IAD (config)# clock source t1 0/1	Set the system clock source to T1 interface 0/1	
12	IAD (config)# cross-connect 37 t1 0/2 2 t1 1/1 1 rbs	Create a connection between T1 0/2 TDM group 2 and T1 1/1 TDM group 1 and preserves robbed-bit signaling	
13	IAD (config)# exit	Exit Global configuration mode	



This configuration must be saved to maintain settings after a unit reboot. Type **copy running-config startup-config** to save the running configuration to the start-up configuration.

NOTE

The same script may be used for four channels of clear channel instead of robbed-bit signaling by omitting the **rbs** flag on the cross-connect command.

Sample Script

A copy of the entire configuration script is shown below:

enable configure terminal interface t1 0/2 tdm-group 2 timeslots 13-16 no shutdown

interface t1 1/1 tdm-group 1 timeslots 1-4 no shutdown exit

clock source t1 0/1

cross-connect 37 t1 0/2 2 t1 1/1 1 rbs exit



The same script may be used for four channels of clear channel instead of robbed-bit signaling by omitting the **rbs** flag on the cross-connect command.

Example 5: 8 Channels of FXO Loop Start Signaling

This example connects eight channels from T1 0/2 to eight FXO ports starting in Slot 7. They will be running loop start signaling. The NetVanta 950 is loop timed from T1 0/1. This example is the most common, and most of the settings are the default settings.

Step	Command	Description
1	IAD > enable	Enter Enable Security mode
2	IAD# configure terminal	Enter Global configuration mode
3	IAD (config)# interface t1 0/2	Enter configuration mode for T1 interface 0/2
4	IAD (config-t1 0/2)# tdm-group 3 timeslots 17-24	Create a TDM group of timeslots 17 through 24 on T1 0/2
5	IAD (config-t1 0/2)# no shutdown	Activate T1 0/2
6	IAD (config-t1 0/2)# exit	Exit to Global configuration mode
7	IAD (config)# clock source t1 0/1	Set the system clock source to T1 interface 0/1
8	IAD (config)# interface range fxo 7/1-8	Enter configuration mode for fxo interfaces 7/1-8

Step	Command	Description
9	IAD (config-fxs 7/1-8)# no shutdown	Activate all FXO interfaces from Slot 7/1 to Slot 7/8
10	IAD (config-fxs 7/1-8)# exit	Exit to Global configuration mode
11	IAD (config)# cross-connect range 38 t1 0/2 3.17 fxo 7/1-8	Create a connection between T1 0/2 TDM group 3, DS0 17 and FXO 7/1 through DS0 24 and FXO 7/8
12	IAD (config)# exit	Exit Global configuration mode.

This configuration must be saved to maintain settings after a unit reboot. Type copy running-config startup-config to save the running configuration to the start-up configuration.

Sample Script

A copy of the entire configuration script is shown below:

enable configure terminal interface t1 0/2 tdm-group 3 timeslots 17-24 no shutdown exit clock source t1 0/1

interface fxo 7/1 cross-connect 38 t1 0/2 3.1 fxo 7/1 no shutdown

interface fxo 7/2 cross-connect 39 t1 0/2 3.2 fxo 7/2 no shutdown

interface fxo 7/3 cross-connect 40 t1 0/2 3.3 fxo 7/3 no shutdown

interface fxo 7/4 cross-connect 41 t1 0/2 3.4 fxo 7/4 no shutdown interface fxo 7/5 cross-connect 42 t1 0/2 3.5 fxo 7/5 no shutdown

interface fxo 7/6 cross-connect 43 t1 0/2 3.6 fxo 7/6 no shutdown

interface fxo 7/7 cross-connect 44 t1 0/2 3.7 fxo 7/7 no shutdown

interface fxo 7/8 cross-connect 45 t1 0/2 3.8 fxo 7/8 no shutdown

exit

3. VERIFYING YOUR CONFIGURATION USING SHOW COMMANDS

Use the following AOS **show** commands to display information regarding your configuration. While in configuration mode, enter the **do** command followed by the **show** commands.

For example: (config-t1 0/1)# do show interface t1 0/1

Command	Description	Sample Output			
show interface t1 0/1	Shows current settings, status for T1 interface 0/1	t1 0/1 is UP 1 T1 coding is B8ZS, framing is ESF FDL type is ANSI Line build-out is 0dB No remote loopbacks, No network loopbacks Acceptance of remote loopback requests enabled			
		Last clearing of counters never loss of frame: 0 loss of signal: 0 AIS alarm: 0 Remote alarm: 0			
		DS0 Status:			
		1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4			
		N N N N N N N N N N N N N N N N N N N			
		Status Legend: '-' = DS0 is unallocated			
		'N' = DS0 is dedicated (nailed)			
		Signaling Bit Status:			
		1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4			
		RxA: 000000000000000000000000000			
		RxB: 111111111111111111111111111			
		TxA: 00000000000000000000000000			
		TxB: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
		1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4			
		Line Status: No Alarms			
		Current Performance Statistics: 10 Errored Seconds, 0 Bursty Errored Seconds 0 Severely Errored Seconds, 10 Severely Errored Frame Seconds 10 Unavailable Seconds, 0 Path Code Violations 0 Line Code Violations, 1 Controlled Slip Seconds 0 Line Errored Seconds, 0 Degraded Minutes TDM group 1, connection is RBS Cross-connected to analog interfaces TDM group 2, connection is RBS			

Command	Description	Sample Output
show interface fxs 2/1	Shows current settings, status for FXS interface 2/1	fxs 2/1 is UP Description of possible port status values: administratively down: Port is shutdown dormant: Port is not in service UP: Port is active DOWN: Port is not available IN TEST: Port is in test mode Two-wire Status is: Disabled Test Status is INACTIVE No Tests Impedance is: 600 Ohm Transmit Gain is: +0.0dB Receive Gain is: -10.0dB Signal Mode: Loop-Start Answer-Supervision: Disabled
show interface fxo 7/1	Shows current settings, status for FXO interface 7/1	fxo 7/1 is UP Description of possible port status values: administratively down: Port is shutdown dormant: Port is not in service UP: Port is active DOWN: Port is not available IN TEST: Port is in test mode Two-wire Status is: Disabled Test Status is INACTIVE No Tests Impedance is: 600 Ohm +2.16uF Transmit Gain is: +0.0dB Receive Gain is: +10.0dB Signal Mode: Loop-Start Answer-Supervision: Disabled
show system	Shows system settings such as firmware version, serial number, clock settings and power source	ADTRAN, Inc. OS version b-07.01.00 Checksum: 2A6CF621, built on Wed July 28 13:22:17 2004 Boot ROM version b-07.01.00 Checksum: A4E1, built on: Wed July 28 13:27:08 2004 Copyright (c) 1999-2004, ADTRAN, Inc. Platform: NETVANTA 950 SCU, part number 1200788L1 Serial number E1900AE0F Flash: 8388608 bytes DRAM: 33554431 bytes IAD uptime is 0 days, 6 hours, 5 minutes, 6 seconds System returned to ROM by Warm Start Current system image file is "070100.biz" Boot system image file is "070100.biz" Power Source: AC System primary clock source configuration: t1 0/1 System secondary clock source configuration: t1 0/2 System current active clock source: t1 0/2 Alarm Relay status: OPEN

4. TESTING YOUR SYSTEM

Use the following AOS commands to test different interfaces in the system. The Web GUI does not support test commands, so you must use the CLI for these functions. Each test command must be issued from within the appropriate interface.

The T1 interface and the T1 line can be tested in several ways. The unit can send a loop up command to the remote end of the T1 line and send a test pattern, or the unit itself can be put into loopback. A T1 BERT or other T1 equipment must be connected to the T1 interface for the tests to pass. During each type of test, that particular port's LED will turn amber, indicating test mode operation. Each of the following commands must be made from within the prompt for the interface under test. For example, to test T1 0/2, all test commands must be made from the **IAD (config-t1 0/2)#** prompt.

Interface	Command	Description
T1	loopback network line	Initiates an internal physical loopback of the local T1 circuit
Т1	loopback network payload	Initiates an internal loopback of the local circuit including the T1 framer
Т1	no loopback network	Deactivates the local internal loopback
Τ1	loopback remote line	Sends a command to the remote T1 device to initiate a physical loopback of the T1 circuit
Т1	loopback remote payload	Sends a command to the remote T1 device to initiate a loopback of the circuit including the T1 framer
T1	no loopback remote	Sends a command to the remote T1 device to deactivate the remote loopback
Т1	test-pattern p215	Sends a repeating 2 ¹⁵ -1 pseudo random binary sequence
Т1	test-pattern qrss	Sends a QRSS test pattern
T1	test-pattern ones	Sends all ones (framed)
T1	test-pattern zeros	Sends all zeros
T1	test-pattern insert	Inserts an error into the currently active test pattern
Т1	test-pattern clear	Clears the test pattern error count
T1	show test-pattern	Shows errored seconds on currently active test pattern
T1	no test-pattern	Deactivates the test pattern

The FXS interface can be tested in several ways. There are tests for the network side for signaling and talk path and tests for the FXS interface side. An analog phone must be connected to the FXS interface for some tests, and other network equipment must be connected for other tests. During each type of test, that particular port's LED will turn amber, indicating test mode operation. Each of these commands must be made from within the prompt for the interface under test. For example, to test FXS 4/7, all test commands must be made from the IAD (config-fxs 4/7)# prompt.

Interface	Command	Description	
FXS	loopback analog	Initiates an internal loopback toward the analog phone interface (2-wire interface)	
FXS	loopback digital	Initiates an internal loopback toward the network interface (2-wire interface)	
FXS	no loopback	Deactivates loopback	
FXS	test tone near	Sends a 1kHz test tone toward the analog phone interface	
FXS	test tone far	Sends a 1kHz test tone toward the network interface	
FXS	no test tone	Deactivates test tone	
FXS	test battery	Provides battery on the analog phone interface. Any digits dialed on the analog phone should be heard in the handset speaker.	
FXS	no test battery	Deactivates battery test	
FXS	test reverse-battery	Reverses polarity of the battery on the analog phone interface. Any digits dialed on the analog phone should be heard in the handset speaker.	
FXS	no test reverse-battery	Deactivates battery test	
FXS	test signaling-bits	Transmits either 0000, 0101, 1010, or 1111 toward the network	
FXS	no test signaling-bits	Deactivates signaling bits test	
FXS	test ringing	Rings the analog phone with a 2 seconds on and 4 seconds off cadence	
FXS	no test ringing	Deactivates the ringing test	
FXS	test dtmf <0-9, #, *, A-D>	Sends the DTMF tones for up to 25 specified digits to the analog interface	
FXS	no test dtmf	Deactivates DTMF tone test	
FXS	test tip-open	Provides battery on ring and high impedance on tip. Useful when troubleshooting ground start interfaces	
FXS	no test tip-open	Deactivates the tip open test	

The FXO interface can be tested in several ways. There are tests for the network side for signaling and talk path and tests for the 2-wire interface side. External 2-wire interface equipment must be used for some tests, and other network equipment must be connected for other tests. During each type of test, that particular port's LED will turn amber, indicating test mode operation. Each of these commands must be made from within the prompt for the interface under test. For example, to test FXO 4/7, all test commands must be made from the IAD (config-fxo 4/7)# prompt.

Interface	Command	Description
FXO	loopback analog	Initiates an internal loopback toward the 2-wire interface
FXO	loopback digital	Initiates an internal loopback toward the network interface (4-wire interface)
FXO	no loopback	Deactivates loopback
FXO	test tone near	Sends a 1kHz test tone toward the 2-wire interface
FXO	test tone far	Sends a 1kHz test tone toward the network interface
FXO	no test tone	Deactivates test tone
FXO	test signaling-bits	Transmits either 0000, 0101, 1010, or 1111 toward the network
FXO	no test signaling-bits	Deactivates signaling bits test
FXO	test loop closed	Closes the loop (hook-switch) on the 2-wire interface
FXO	test loop open	Opens the loop (hook-switch) on the 2-wire interface
FXO	no test loop	Deactivates the loop test
FXO	test ring-ground	Sets the 2-wire interface to ring-ground
FXO	no test ring-ground	Deactivates the ring-ground test

5. MANAGING EVENT MESSAGES

The AOS provides multiple levels of event messages. Event messages are only visible with the CLI and are not available through the Web GUI. You can manage these messages in several ways, based on their assigned priority level. The levels are listed below, from least to most critical.

Priority Level Number	Priority Level
5	Debug
4	Information
3	Notice
2	Warning
1	Error
0	Fatal

There are two management options for the event messages displayed on the console. The default behavior is to display levels 0-3 (i.e., Notice, Warning, Error, and Fatal messages). To display all levels, turn debugging on (using the **debug interface** command). If you turn debugging off (**no debug interface**), you fall back to displaying Notice and higher priority levels (i.e., everything but Information and Debug). Use the **debug interface** command to activate debug messages for a particular interface, such as **debug interface fxs**, for example. You can specific port by typing **debug interface <type> <slot/port>** or **debug interface t1 0/1**, for example.

There are additional management options available for event history storage, email notification, and syslog forwarding. You can use the following commands to set an explicit priority level for these options:

- **event-history priority** *<priority level#>*: Sets the threshold for events stored in the event history. The event log is displayed using the **show event-history** command.
- **logging email priority-level** *<priority level#>*: Sets the threshold for events sent to the configured email addresses (specified using the **logging email address-list** command).
- **logging forwarding priority-level** *<priority level#>*: Sets the threshold for events sent to the configured syslog server (specified using the **logging forwarding receiver-ip** command).

When setting the *<priority level#>*, keep the following in mind:

- When priority 4 is selected, all events (priorities 0 through 4) are logged.
- When priority 3 is selected, events with priority 3, 2, 1, or 0 are logged.
- When priority 2 is selected, events with priority 2, 1, or 0 are logged.
- When priority 1 is selected, events with priority 1 or 0 are logged.
- When priority 0 is selected, only events with priority 0 are logged

Event Message	Interface	Priority Level
Idle	FXS	Debug
Tip Grounded	FXS	Debug
Forward Disconnect	FXS	Debug
Ringing	FXS	Debug
Reverse Battery	FXS	Debug
Onhook Detected	FXS	Debug
Offhook Detected	FXS	Debug
Ring Ground Detected	FXS	Debug
Tip-Open Test - Ring Ground Detected	FXS	Debug
Ringing Test - Offhook Detected	FXS	Debug
Battery Test - Offhook Detected	FXS	Debug
Battery Test - Onhook Detected	FXS	Debug
Ringing Test - Ring Ground Detected	FXS	Debug
Card Initialized	FXS	Debug
Temperature fault, port disabled for 30 seconds	FXS	Debug
Temperature fault cleared, port available	FXS	Debug
Changed state to <up, down,<br="">administratively down, testing></up,>	T1	Error
No Alarms, Yellow, Tx Yellow, Blue Tx, Blue, Red, LOS, Loopback, No Signaling	T1	Warning
Controlled Slip Seconds <cumulative number of slip seconds></cumulative 	T1	Info
<time stamp=""> Rx bits 0xXX</time>	T1	Debug
<time stamp=""> Tx bits 0xXX</time>	T1	Debug

Event Message	Interface	Priority Level
Onhook	FXO	Debug
Offhook	FXO	Debug
Ring Grounded	FXO	Debug
Ringing Detected	FXO	Debug
No Battery Detected	FXO	Debug
Normal Battery Detected	FXO	Debug
Reverse Battery Detected	FXO	Debug
Tip Ground Detected	FXO	Debug
Ringing Removed	FXO	Debug
Battery Test - Onhook Detected	FXO	Debug
Ringing Test - Ring Ground Detected	FXO	Debug
Card Initialized	FXO	Debug
Changed state to <up, down,<br="">administratively down, testing></up,>	T1	Error
No Alarms, Yellow, Tx Yellow, Blue Tx, Blue, Red, LOS, Loopback, No Signaling	T1	Warning
Controlled Slip Seconds <cumulative number of slip seconds></cumulative 	T1	Info
<time stamp=""> Rx bits 0xXX</time>	T1	Debug
<time stamp=""> Tx bits 0xXX</time>	T1	Debug
Loop Open Test - Ringing Detected	FXO	Debug
Loop Open Test - Ringing Removed	FXO	Debug
Loop Closed Test - No Battery Detected	FXO	Debug
Loop Closed Test - Reverse Battery Detected	FXO	Debug
Loop Closed Test - Normal Battery Detected	FXO	Debug
Ring Ground Test - Tip Ground Detected	FXO	Debug
Ring Ground Test - Tip Ground Removed	FXO	Debug

Table 2. FXO Analog/Digital Voice Events