Voice Cards

Reference Guide

Trademarks:

5ESS is a registered trademark of Lucent Technologies

DMS-100 and DMS-200 are trademarks of Northern Telecom.

Nortel is a trademark of Northern Telecom

Electronic Business Sets, Meridian Digital Centrex are registered trademarks of Nortel

HyperTerminal is a registered trademark of Microsoft

Premisys is a registered trademark of Premisys Communications, Inc.

SLC is a registered trademark of Lucent Technologies

Windows 3.1 and 95 are registered trademarks of Microsoft

All other trademarks and registered trademarks are the property of their respective holders.

FCC Registration number:

1H5SNG-73866-DD-E (integral CSU)

B468NR-68618-DM-E (internal modem)

Canadian Certification Number: 1932 5217 A

Canadian DOC Load number: 5

Ringer Equivalence Number: 0.2A (internal modem)

Approvals:

UL listed to UL# 1459 Second Edition, Third Edition

CSA listed to C22.2 No. 950-M89

Product Description

The Voice Cards provide an interface between voice circuits and a digital network. Voice interface cards are intended for short loop applications that require high port densities.

This integrated access system offers voice cards that support E&M, FXS, FXO, FXS Coin, FXO Coin and P-Phone interfaces.

Voice Cards

- **E&M**   **E&M 2W*8 (810860),** *E&M-LB 4W*8 (811760),*
                   E&M 4W*8 (811960)

                   *E&M 2W*4-6 (8104), E&M 4W*2-6 (8812), E&M Wx2ER (8113)*

                   *E&M 4W*4-6 (8114), E&M 4W*ER (8115), E&M 4W*8-6 (8118)*

- **FXS**   **FXS 2W*8-6 (812960)**

                   *FXS 2W*2-9 (8122), FXS 2W*2-6 (8123), FXS 2W*4-9 (8124)*

                   *FXS 2W*4-6 (8125), FXS 2W*8-9 (8128)*

- **FXO**   **FXO 2W*8-6 (***813960***, 813970)**

                   *FXO 2W*2-9 (8132), FXO 2W*2-6 (8133),*

                   *FXO 2W*4-9 (8134), FXO 2W*4-6 (8135),*

                   *FXO 2W*8-9 (8138)*

- **FXS-C**   *FXS-C 2W*8-6 (814960)*

                   FXS-C 6-900 (8148)

- **FXO-C**   *FXO-C 2W*8-6 (815960)*

                   FXO-C 8-900 (8158)

- **LBVR**   *LBVR-8 Fax (830060)*

- **P-Phone**   *PPO (813160), PPS (812160)*

Note: *Cards listed in italics have been Manufacturing Discontinued (MD), but are supported under this product host code for backward compatibility.*

Using this Voice Card Reference Guide

This Voice Card Reference Guide provides technicians with switch settings, connector pinouts, configuration, and troubleshooting information for the voice cards.

Chapter 1. *E&M Card*

Chapter 2. *FXS Card*

Chapter 3. *FXO Card*

Contents

Contents

Figures

Figures

Tables

Chapter 1
E&M Card

1.1   Introduction

This chapter provides switch settings, connector pinouts, configuration, and troubleshooting information for the E&M Voice Cards. These cards are identified as the E&M 2W*8 (810860), E&M 4W*8 (811960), and on their faceplate ejectors.

The E&M cards manage the flow of toll-grade voice traffic through the Integrated Access System. Each card encodes an analog (voice, VF) signal to a digital bitstream at the local Integrated Access System for transmission over a T1 or E1 network. Each card also decodes the digital signal to analog at the remote system. Both cards support E&M signaling types I, II, IV, and V.

Each card connects to eight CPE voice circuits from a PBX or other user facility. Normal E&M, Transmission-Only, and E&M R2 signaling are supported. The E&M cards also can use the voice compression features of an ADPCM card.

1.2   E&M Card Descriptions

1.2.1   E&M 2W*8 Card Description (810860)

The E&M 2W*8 card has eight voice ports, each with 600-ohm terminating impedance.

<div align="center">

Notice!

</div>

UL STATEMENT

OPERATION OF THIS INTERFACE IS LIMITED TO INTRA-BUILDING CONNECTIONS ONLY

1.2.1.1   Card Switch Settings

The E&M 2W*8 card has four switches (S1 through S4) that you must set before inserting the card into the chassis. These switches establish the type of E&M the card will use on all eight ports. Figure 1-1 shows these switches, Table 1-1 defines their purposes, and Table 1-2 lists the settings for each signaling type.
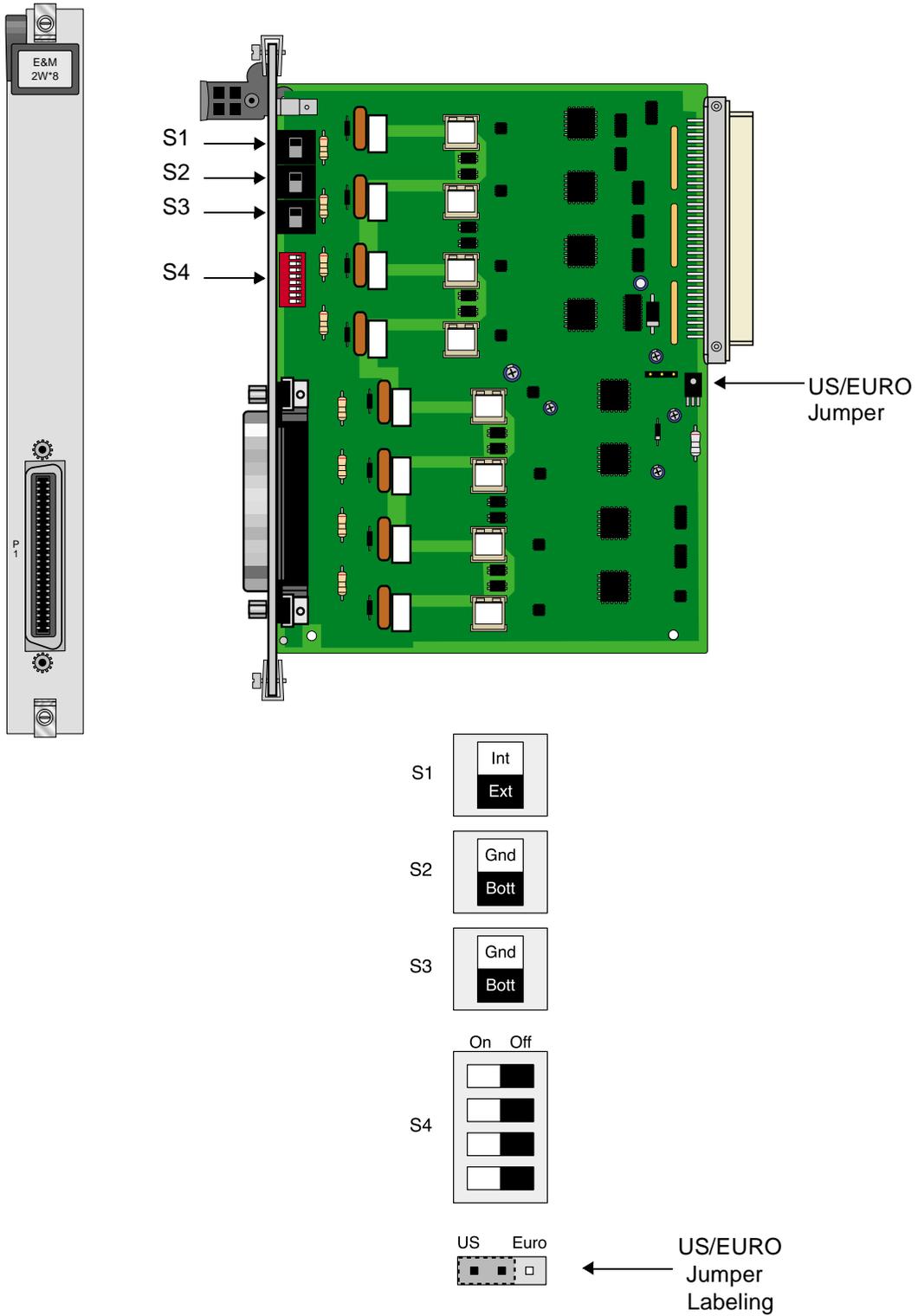
Figure 1-1. Typical E&M Card Switches

Table 1-1. Typical E&M Card Switch Definitions

Switch	Definition
S1	Source of the E (recEive or Earth) lead; can be internal (INT) or external (EXT).
S2	Type of internal source for the E lead; either battery (-48 VDC) or ground (GND).
S3	Type of internal source for the M (transMit or Magnetic) lead; either battery (-48 VDC) or ground (GND).
S4	Normal state of the E lead; either grounded (ON) or open (OFF). Each card port number is designated on the eight-position DIP switch. All eight switches must be set to the same position (all ON or all OFF).

Table 1-2. Typical E&M Card Switch Settings

E&M Type	Direction	S1	S2	S3	S4 (all switches)
I	Normal E&M*	INT	GND	GND	OFF
	Trunk**	INT	BAT	BAT	ON
II	Normal E&M*	EXT	BAT	GND	OFF
	Trunk**	EXT	GND	BAT	OFF
IV	Normal E&M*	EXT	GND	BAT	OFF
	Trunk**	EXT	GND	BAT	OFF
V	Normal E&M*	INT	GND	BAT	OFF
	Trunk**	INT	GND	BAT	OFF
Factory Settings (default)		INT	GND	GND	OFF

*Indicates that the port is attached to a device that generates signaling, such as a PBX.

**Indicates that the port is attached to a device that does not generate signaling, such as a channel bank. In this case, the Integrated Access System emulates a PBX and generates signaling. This configuration is also known as a Tandem E&M or Pulse Link Repeater (PLR) application.

1.2.1.2   Installing the E&M 2W*8 Card

Insert the E&M 2W*8 card into any user card slot. These slots are U1 to U8 on the two-sided chassis or the front-loading chassis with power supplies on top or P1 to P4 and W1-W4 on the front-loading chassis with power supplies on the side. This card allows you to connect the system to eight 2-wire voice circuits with E&M signaling.

1.2.2   E&M 4W*8 ER Card Description (811960)

The E&M 4W*8 ER card provides an extended transmit TLP range (-17.5 to +14.5 dB) for dedicated 4-wire modem applications. This range is required for data speeds of 19.2 kbps and higher.

Notice!

UL STATEMENT

OPERATION OF THIS INTERFACE IS LIMITED TO INTRA-BUILDING CONNECTIONS ONLY

1.2.2.1   Card Jumper/Switch Settings

The E&M 4W*8 card has four switches (S1 through S4) that you must set before inserting the card into the chassis. These switches establish the type of E&M the card will use on all eight ports. Figure 1-1 shows these switches, Table 1-1 defines their purposes, and Table 1-2 lists the settings for each signaling type.

1.2.2.2   Installing the E&M 4W*8 ER Card

Insert the E&M 4W*8 card into any user card slot. These slots are U1 to U8 on the two-sided chassis or the front-loading chassis with power supplies on top or P1 to P4 and W1-W4 on the front-loading chassis with power supplies on the side. This card allows you to connect the system to eight 4-wire voice circuits with E&M signaling.

1.3   E&M Card User Screens and Settings

1.3.1   E&M Card Main Screen

You must configure the E&M card for operation after installing it in the system chassis. This is done from the E&M Main Card Screen, which is shown in Figure 1-2. To go to that screen, highlight the desired card on the System Main Screen, then press <Enter>. The E&M Card Main Screen shows numerous columns of settings, each for one port of the card.
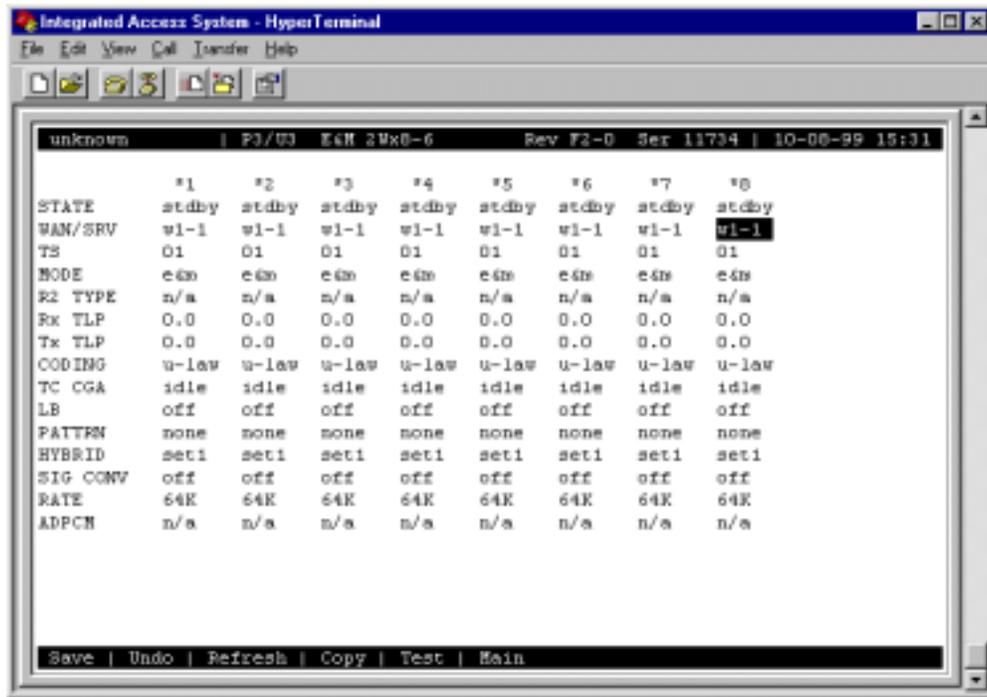
Figure 1-2. Typical E&M Card Main Screen

The bottom highlighted line of this screen shows various actions that you can perform from this screen. You perform the desired action by pressing the associated uppercase letter key. Table 1-3 summarizes these actions. For example, after you configure the E&M card ports, press "**s"** to save your settings.

Table 1-3. Main Screen Actions

Action	Function
Save	Saves changes to settings.
Undo	Returns all settings to the last saved state.
Refresh	Updates certain time-related information fields that are not automatically updated (i.e., test status).
Copy	Copies the contents of the current column to the next column. Useful if you change a lot of entries in one column and wants to repeat those changes in subsequent columns.
Test	Goes to the Test Screen, from which you can test the E&M card ports. Refer to the Test section of this chapter.
Main	Returns to the System Main Screen. If you make changes to settings and do not save them, you will be prompted to save or lose changes.

Table 1-4 summarizes the configuration settings for the E&M card, along with the available and factory-default option settings. The parameters and settings are also described in the following paragraphs.

Table 1-4. Main Screen Option Settings and Defaults

Parameter	User Options	Notes	Default
STATE	stdby actv		stdby
WAN/SRV	none wan serv user	1	w1-1
TS	01-24 01-31	2	01
MODE	e&m to e&mR2 R2mod		e&m
R2 TYPE	n/a (when MODE is set to e&mR2 or R2mod the default is s1-1)	3	n/a
Rx TLP	-16.3 dB to +7.5 dB		0
Tx TLP	-16.3 dB to +7.5 dB	4	0
CODING	u-law a-law a-inv	5	u-law
TC CGA	idle busy		idle
LB	off dgtl anlg		off
PATTRN	none D-mW quiet		none
HYBRID	n/a set1 to set8 user		n/a
SIG CONV	off on		off
RATE	64K 24K,1 32K,1 40K,1 24K,2 32K,2 40K,2		64K
ADPCM	n/a P1 P2 P3		n/a

Notes:

1. Choosing **wan** allows you to choose a WAN port (w1-1 through w4-2). Choosing **serv** lets you choose an ATM or FRS server card in slot P1, P2, or P3, followed by a logical port on that card. The **user** option is not used. See the WAN/SRV paragraph that follows.

2. Time slot 16 is not available if the port is assigned to an E1 WAN link whose time slot 16 is programmed for **cas** or **ccs**.

3. The default is **sl-1** if the Mode is set to **e&mR2** or **R2mod**.

4. The extended setting range for the 8119 card is from **-16.3** to +**7.5 dB**.

5. The default coding is **a-inv** for E1 and **u-law** for T1.

Choosing a Rate other than **64K** allows you to select an ADPCM slot.

STATE

The State setting determines whether the port is active or inactive. An inactive port does not occupy a time slot on a WAN link. Set this field to **stdby** (standby) for ports that will not be used or that are not yet configured. Or, set it to **actv** (active) for ports that are ready for use.

WAN/SRV

The WAN/SRV setting identifies the WAN link or server card assigned to this port. If you choose **wan**, you also must select the desired port (w1-1 through w4-2) of a WAN card for transmission over a T1 or E1 link. Or, choose **serv** to assign the card port to a server card in the system. This can be an ATM or FRS card, which resides in chassis slot P1, P2, or P3. You must then choose a logical port on that card. The **user** option is not used.

It is not necessary to assign all ports of the same E&M card to the same WAN link or server card, or to contiguous time slots on a WAN link.

TS

The TS setting identifies the time slot on the WAN link to which this port is assigned. This value is from **1** to **24** for T1 links and **1** to **31** for E1 links. However, time slot 16 is not available for E1 links that are programmed for CAS or CCS signaling. For a display of available time slots, refer to the cross-connect map for the WAN link selected.

MODE

The Mode setting specifies whether or not a port uses E&M signaling, or if it operates in the Transmission-Only (TO) mode. Use the **to** mode if you are connecting the port to a four-wire, dedicated-line modem that does not require E&M signaling. The signaling type for all eight ports of an E&M card is defined by setting hardware switches S1 through S4 as described earlier in this chapter. Select **e&m** for standard Type I, II, IV, or V signaling. Select **e&mR2** for symmetrical R2 signaling for calls originating from either the digital or analog side. The **R2mod** setting provides modified R2 signaling for Motorola paging terminal equipment.

R2 TYPE

The R2 Type setting is set to **n/a** when the Mode is set to **e&m** or **to**. The signaling type for all eight E&M ports is established by setting hardware switches S1 through S4 as described earlier. If the Mode selected for the port is **e&mR2 or R2mod**, the R2 Type automatically defaults to **sl-1**.

Rx TLP

The Receive Transmission Level Point (TLP) setting controls the amount of gain or loss added to a signal after it is decoded to analog. To increase the signal level, set the Rx TLP field to a positive number (i.e., the larger the number, the more gain is added). To decrease the signal level, set the Rx TLP field to a negative number (i.e., the more negative the number, the more the signal level is decreased). For example, an incoming signal at -5 dBm can be increased to -2 dBm by setting Rx TLP to +**3 dB**. The Rx TLP range is **-16.3 dB** to +**7.5 dB**.

Tx TLP

The Transmit TLP setting controls the amount of gain or loss added to the voice signal coming in from the local CPE before it is encoded to digital PCM. To increase the incoming signal level, set the Tx TLP field to a negative value (i.e., the more negative the number, the more gain is added). To decrease the signal level, set the Tx TLP setting to a positive number (i.e., the more positive the number, the more the signal level is decreased). For example, an incoming signal at -16 dBm can be increased to 0 dBm by setting Tx TLP to **-16 dB**. For the E&M 4W*8 Card, the Tx TLP range is **-16.5 dB** to **+7.3 dB**. For the E&M 4W*8 ER E&M Card, this range is **-17.5 dB** to **+14.5 dB**.

CODING

The Coding field sets the PCM companding (coding) method used for a port. Generally, the North American T1 environment uses **u-law** (mu-law) coding, and the International E1 environment uses either **a-law** or **a-inv** (inverted A-law) coding. The **a-inv** setting provides a higher ones density on an E1 line than **a-law**. The coding default setting is defined by the type of associated WAN card.

TC CGA

The Trunk Conditioning during Carrier Group Alarm setting defines whether the E&M card port should be placed in the **idle** or **busy** mode upon declaration of a Carrier Group Alarm (CGA) on the WAN link to which the port is assigned. The TC CGA setting has no effect on Transmission-Only circuits, for which the **to** signaling mode is used.

In most cases, you should set this parameter to **busy**. If a call is in progress when the CGA alarm is received, the system holds the call for two seconds, drops it, and then busies out the port to the attached PBX for the duration of the alarm. Once the alarm clears, the system automatically places the port back in the **idle** mode, thereby making it available to the attached PBX.

LB

The LB setting allows you to loop a port back toward the network and far end for testing and troubleshooting. Figure 1-3 shows the available loopbacks. The **dgtl** (digital) loopback sends the incoming digital signal from the network back toward the far end, without decoding it. The **anlg** (analog) loopback sends the decoded analog signal back to the far end. To disable either loopback after testing, set this field to **off**.
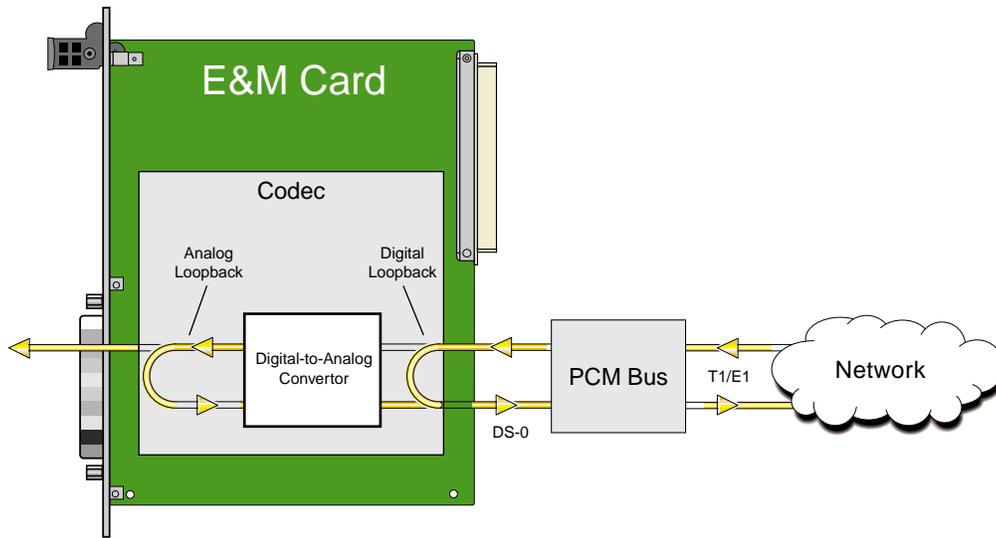
Figure 1-3. E&M Card Loopbacks

PATTRN

The Pattern is the outgoing test pattern to be sent to the selected port by the system. You can send a different pattern to each port. The **none** setting disables the test pattern. The **D-mW** (Digital milliwatt) option sends a 1 kHz tone at 0.0 dBm. The setting of the Rx TLP field adjusts the D-mW signal level before sending the signal to the CPE. The **quiet** option places a 600-ohm termination on the line so that no analog signal is sent (idle mode).

HYBRID

Available for the two-wire 8108 E&M card only, the Hybrid option assigns a three byte pattern to define the adjustment for return loss (similar to Build Out Capacitors). The default, **set1**, balances to the ideal termination of 900Ω @ 2.15mF. The other settings are reserved for future use.

SIG CONV

The Signaling Conversion parameter allows you to change the transmit ABCD signaling bits from ITU (E1) to ANSI (T1) standards. This conversion is completed regardless of the associated type of WAN (CSU/DSX or CEPT).

Select **off** if ANSI signaling is used, or select **on** to convert the transmit signaling from ANSI to ITU according to the Interface Card Conversion Table for E&M signaling. This setting also converts the receive signaling from ITU to ANSI format.

RATE

The Rate parameter allows you to use the voice compression capabilities of an ADPCM card. If that card is not present in the system, the Rate is set to **64k** and cannot be changed. The **64k** setting (default) is the normal encoding/decoding rate for voice circuits.

ADPCM voice channels are assigned in pairs by designating two voice ports (E&M, FXO or FXS) to the same WAN link and time slot, and then selecting rate settings for the pair that add up to 64 kbps. The following pairing combinations are possible:

24K,1+40K,2 (24 kb coding on one side of the time slot and 40 kb coding on the other side of the same time slot)

32K,1+32K,2 (32 kb encoding on each side of a time slot)

40K,1+24K,2 (40 kb coding on one side of the time slot and 24 kb coding on the other side)

Number **1** after the rate setting assigns that portion of the voice port pair to the odd side of the ADPCM pair. Number **2** after the rate setting assigns that portion of the voice port pair to the even side of the ADPCM pair.

For more information about voice port assignments to a time slot and ADPCM card.

ADPCM

The ADPCM parameter lets you assign the current port to an ADPCM card in the system. The default setting is **n/a** and only changes when a Rate smaller than **64k** is selected (see above). You can then select which ADPCM card to use for the port (this assignment is made by chassis slot number). The options are slots **P1**, **P2**, and **P3**.

1.3.2   Test Screen

The Test Screen (Figure 1-4) facilitates testing and maintenance by allowing you to monitor and set the status of the analog signals and/or the A, B, C, and D signaling bits of all E&M circuits on the card. In cross-connect systems, the test option can also send test patterns and tones towards the CPE and network sides of the system.

The Test Screen also shows the signaling type assigned to the card via the switch settings described earlier.
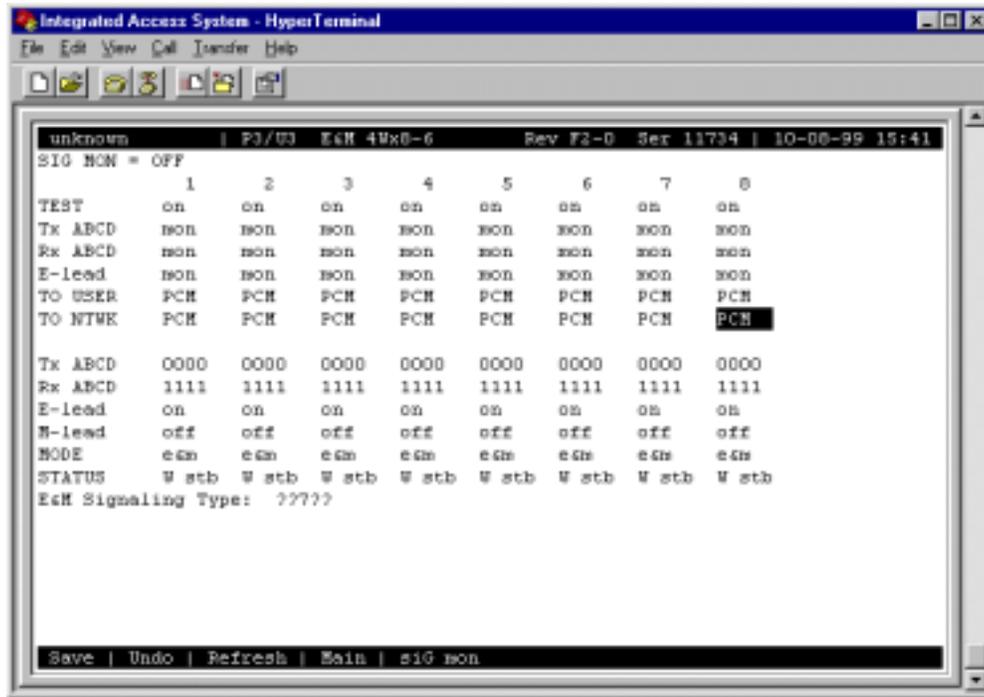
Figure 1-4. Typical E&M Card Test Screen

Table 1-6 lists various operations you can perform from this screen. These appear in the bottom highlighted line of the Test Screen.

Table 1-5. Test Screen Actions

Action	Function
Save	Saves changes to settings.
Undo	Returns all settings to the last saved state.
Refresh	Updates certain time-related information fields that are not automatically updated (i.e., test status).
Copy	Copies the settings of one port to another port that requires the same settings.
Main	Returns to the E&M Card Main Screen. If changes are made to settings and not saved, you will be prompted to save or lose changes.

Table 1-6 summarizes the available test parameters and option settings. The following paragraphs also describe these parameters and settings in detail.

Table 1-6. Test Screen Option Settings and Defaults

Parameter	User Options	Default

TEST	off on		off
Tx ABCD	mon set		mon
Rx ABCD	mon set		mon
E-lead	mon set		mon
TO USER	PCM 300Hz 1kHz 3kHz quiet		PCM
TO NTWK	PCM 300Hz 1kHz 3kHz quiet		PCM
Tx ABCD	Status information only; not user-editable		n/a
Rx ABCD	Status information only; not user-editable		n/a
E-lead	Status information only; not user-editable		n/a
M-lead	Status information only; not user-editable		n/a
MODE	Status information only; not user-editable		n/a
STATUS	Status information only; not user-editable		n/a

SIG MON

The Signaling Monitor feature works with the user card alarm system to detect excessive signaling bit transitions. The system will generate alarms if the number of transitions of any signaling bit in transmit or receive direction for an active port exceeds 255 in any four second interval. The options are **off** and **on**, and they are toggled by pressing "**g**".

TEST

The Test parameter shows if the port is in test mode or not. Inactive ports and ports that are assigned to inactive WANs will show a test status of **n/a**. The test status options for active ports are **off** and **on**.

Tx ABCD

The Transmit ABCD setting allows you to either monitor the status of the ABCD signaling bits being transmitted towards the network or set a specific ABCD pattern for testing the transmit side of the circuit. The options for this field are **mon** (monitor) or **set**. Choosing **set** will bring up a four digit field for users to input the ABCD pattern they want to transmit. Any four digit combination of ones and zeros is acceptable for this setting.

Rx ABCD

The Receive ABCD setting allows users either to monitor the status of the ABCD signaling bits being received from the network or to set a specific ABCD pattern for testing the receive side of the circuit.

The options for this field are **mon** (monitor) or **set**. Choosing **set** will bring up a four-digit field for you to specify the ABCD pattern you want to receive. Any four digit combination of ones and zeros is acceptable in this field. The Rx ABCD bits cannot be set in bus-connect systems and the only option is **mon** (monitor).

E LEAD

The E-lead setting allows you to either monitor or set the E-lead state. The options for this field are **mon** (monitor) or **set**. Choosing **set** will bring up the options **off** (which drops the E lead) and **on** (which raises the E lead).

TO USER

In cross-connect systems only, the **To User** parameter allows you to break the circuit and send a test tone toward the user side of the system. The options for this field are **PCM**, **300Hz**, **1 kHz**, **3 kHz** and **quiet**. Selecting **PCM** causes the PCM signal received from the network to continue to be sent to the user port in the normal manner.

This parameter is not supported in bus-connect systems and will always appear as **n/a**.

TO NTWK

In cross-connect systems only, the **To Network** parameter allows you to break the circuit and send a test tone toward the network side of the system. The options for this field are **PCM**, **300Hz**, **1 kHz**, **3 kHz** and **quiet**. Selecting **PCM** causes the PCM signal received from the user port to continue to be sent to the network in the normal manner.

This parameter is not supported in bus-connect systems and will always appear as **n/a**.

Tx ABCD

The Transmit ABCD information field shows the current values of the ABCD bits that are being transmitted to the network. If TX ABCD in the top half of the screen is changed via the **set** function mentioned above, and the settings are saved by the **Save** command in the Test Screen, the new bit pattern chosen will be reflected here.

Rx ABCD

The Receive ABCD information field shows the current values of the ABCD signaling bits that are received from the network. If RX ABCD in the top half of the screen is changed via the **set** function mentioned above, and the settings are saved by the **Save** command in the Test Screen, the new bit pattern chosen will be reflected here.

E-Lead

The E-lead information field shows the current status of the E-lead of this port. The settings are either **on** or **off**.

M-Lead

The M-lead information field shows the current status of the M-lead of this port. The settings are either **on** or **off**.

MODE

The Mode informational field shows the current mode of the port that was selected on the main E&M card screen. Valid settings are **e&m**, **to**, **e&mR2,** and **R2mod**.

STATUS

The Status information field shows the current status of the port. Table 1-7 describes the conditions reported by this field.

Table 1-7. Status Information Field Settings

Setting	Meaning
stdby	The E&M port is in standby.
W stb	The WAN card to which the E&M port is assigned is in standby.
W tst	The WAN card to which the E&M port is assigned is under test.
W OOS	The WAN card to which the E&M port is assigned is Out Of Service.
noWAN	No WAN card is configured in the slot to which the E&M port is assigned.
OOS	The E&M card is out of service.
call	Call set-up is in progress.
busy	Call is in progress.
idle	No call is in progress; circuit is available.
TC	The E&M circuit is undergoing Trunk Conditioning because a CGA alarm is in progress on the associated WAN port.
test	The port is under test (i.e., you are actively controlling the circuit by setting values for Tx ABCD, Rx ABCD, or E-lead).
maint	Maint is a status that tells that a specific port is under maintenance.

E&M Signaling Type

This field shows the card's current on-board switch settings, which define the type of E&M signaling used on each port. If necessary, remove the card and reset the switches as previously described until the desired signaling type appears in the screen. The E&M Signaling types are I, II, IV, and V, followed by a "**-t**" if the card is optioned to provide trunk signaling.

1.3.3   Loopback Screen

The Loopback (Figure 1-5) facilitates loopback detection by allowing the user to enable/disable automatic time out and also get the loopback status of the channel. This feature will provide the digital loopback (both audio and signaling) when activated by a 2713 Hz tone level and duration. When a validated tone is detected the channel disconnects the user and provides loopback of signals received from the network. This loopback is performed at "equal level" without inserting any gain or loss in the path. In addition a "make busy" signal is be applied toward the user. Table 1-8 shows the Loopback screen of actions.
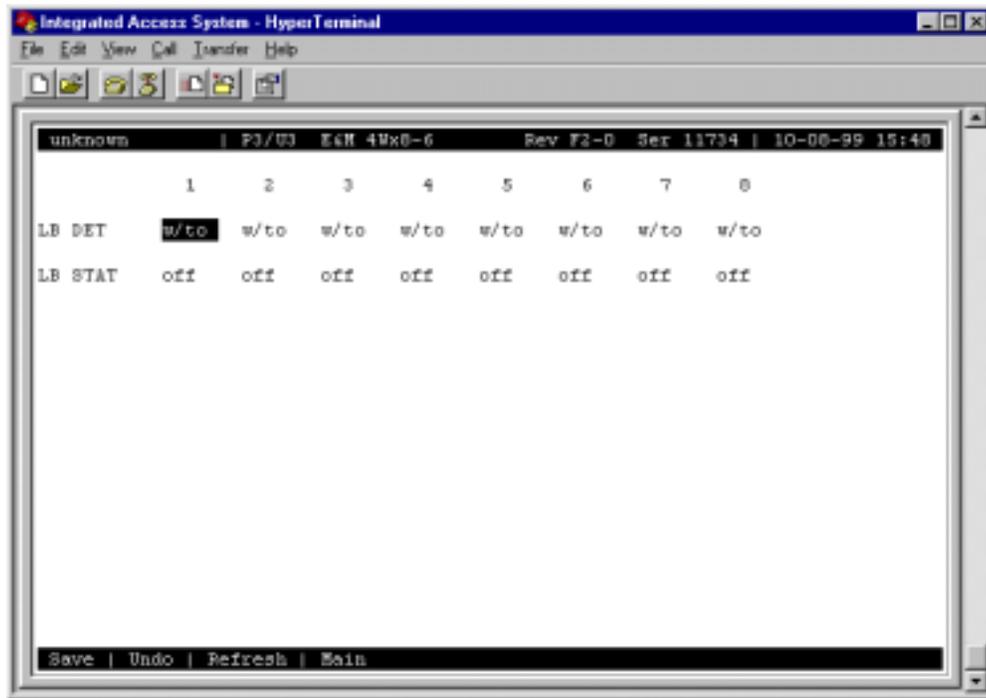
Figure 1-5. Typical E&M Loopback Screen

Table 1-8. Loopback Screen of Actions

Action	Function
Save	Saves changes to settings.
Undo	Returns all settings to the last saved state.
Refresh	Updates certain time-related information fields that are not automatically updated (i.e., loopback status).
Main	Returns to the E&M Card Main Screen. If changes are made to settings and not saved, you will be prompted to save or lose changes.

Table 1-9 summarizes the available loopback parameters and option settings. The following paragraphs also describe these parameters and settings in detail.

Table 1-9. Loopback Screen Option Settings and Defaults

Parameter	User Options	Default
LB DET	w/to on off	w/to
LB STAT	This is information only - no user input is allowed	

LB DET

The user can either enable or disable the loopback detection. The options available are **w/to**, **on** and **off**. The **w/to** option indicates the loopback detection is ON and 20 minute timeout is enabled. The **on** option indicates the loopback detection is ON and timeout is disabled. The **off** option is used for loopback detection is disabled. The default setting is **w/to**.

LB STAT

This is information only - no user input is allowed. This tells the user if a particular port is in loopback state or not.

1.4   E&M Card Error Messages

Refer to Appendix B in the System Reference Guide for further information on Error Messages regarding this card.

1.4.1   E&M Card Troubleshooting

The E&M card may be faulty if a voice signal is not received at one end of a circuit, or if E&M signaling is not detected. The following are possible causes:

* Faulty receiving CPE at the near end (where the problem was first noticed)

* Faulty transmitting CPE at the far (opposite) end

* Faulty cabling between the CPE and E&M card at either end

* Faulty E&M card at either end

* T1 or E1 network failure

* Improper card configuration at either end (e.g., time slot and/or WAN assignments)

First, verify that the T1 or E1 network has not failed. Check for a CGA-Red alarm on the associated WAN port at the end where the incoming VF signal loss is first noticed. The CGA indicates that the incoming network signal was lost (or that the receiving WAN port is out of frame). During the CGA, all voice ports with time slots on that WAN port will also be disabled, and the associated far-end WAN port will be in a CGA-Yellow alarm state. If the network is faulty, you must clear that trouble to restore your circuits.

If the network is okay, verify that the proper WAN ports and time slots are assigned to the associated E&M voice ports at both ends, as previously outlined in this chapter. In a point-to-point network, the near-end and far-end E&M ports should both be assigned the same WAN port and time slot number. Also make sure the other parameters (such as the transmit and receive TLPs) are set properly at both ends.

If the E&M card port parameters are correct at both ends, and if the network is okay, the trouble is isolated to the E&M card or the associated port. Proceed as follows:

1. At the far end, activate an analog loopback on the E&M card port.

2. Send a 0 dBm (digital milliwatt) test signal toward the CPE at that end. That signal will be substituted for the normal signal coming from the far-end CPE; it will be sent back to the CPE at your end via the loopback path.

3. Check your CPE for this signal. If it is present, the far-end CPE or cabling to the far-end E&M card is probably faulty. Disable the loopback and test signal there, and fix the problem. If you still don't receive a signal, go to step 4.

4. At your end, go to the E&M Card's Main Screen and send a digital milliwatt test tone (0 dBm) toward the CPE. If you still don't receive a signal, check the cabling from the E&M card to your CPE, and check the CPE itself. If those items are okay, replace the E&M card at your end.

5. If the E&M card is determined to be faulty, replace it and return the faulty unit for repair to the location specified by your distributor.

1.5 E&M Card Specifications

E&M Cards (810860, and 811960)	
Physical Interface (Models 810860 and 811960)	
Number of Ports	8
Connectors	1 female 50-pin telco connector
Transmission Performance	
Performance	Exceeds requirements of ITU-T G.712 (4-wire) and IT-T G.713 (2-wire)
Signaling	
Signaling Types	Switch selectable per card Types I, II, IV and V Normal (toward user) and Trunk/Tandem (toward CO)
Signal Modes	Software selectable per port Trasmit Only (to) Standard Type I, II, IV or V E&M (e&m) Symmetrical R2 signaling (e&mr2) Modified R2 (r2mod)

VF Transmission Characteristics	
Nominal Transmit TLP	Software selectable Model 810860 -16.5 dB to +7.3 dB in steps of 0.1 dB Model 811960 -17.5 dB to +14.5 dB in steps of 0.1 dB
Nominal Receive TLP	Software selectable All Models -16.3 dB to +7.5 dB in steps of 0.1 dB
Termination Impedance	with 2.16 µf capacitor in series 600 Ohms
PCM Encoding	Software selectable µ-law A-law A-law bit inverted

Attenuation Versus Frequency as per AT&T TR43801 - Relative to 1 kHz with 0 dBm0 input		
Frequency	Transmit (A to D)	Receive (D to A)
200 Hz	-0.25 to +3.0 dB	-0.25 to +2.0 dB
300 to 3000 Hz	-0.25 to +0.5 dB	-0.25 to +0.5 dB
3200 Hz	0.25 to +0.75 dB	-0.25 to +0.75 dB
3400 Hz	-0.25 to +1.5 dB	-0.25 to +1.5 dB

Return Loss	Against 600 Ohms, in series with 2.6 µf with additional 25 Ohms resistor between the channel unit and the return loss measurement set.
Model 810860 2-wire	Echo 28dB min. Singing 20dB min.
Model 811960 4-wire	1kHz 28dB min. 300 to 3000 Hz 23dB min.
4W Return Loss (at 1 kHz)	>20dB Typ > 27dB
2W Return Loss (at 1 kHz)	>15dB Typ> 20dB

Relative Transhybrid Loss	Against 600 Ohms, in series with 2.16 µf termination.
Model 810860	Echo 34dB Singing 20dB
Idle Channel Noise (rcv and xmt)	< -65Bm0p. Typically < -70 dBm0p or < 20 dBrnc0 <20dBBrnc0
Interchannel Crosstalk	Typ < -75 dBm0 using 7 adjacent channels being distributed with a signal of 0.0 dBm0.
Total Distortion including Quantization (Signal to Distortion Ratio) Input Frequencies 1004-1020 Hz	

Input Level	Rcv or Xmt	Overall
-30 to 0 dBm0	≥35 dB	≥33.9 dB
-40 dBm0	≥20 dB	≥27.6 dB
-45 dBm0	≥25dB	≥23 dB

Absolute group delay	< 600 microseconds
Group Delay Distortion vs. frequency	within boundaries of ITU-T Rec. G.712 Figure 2
Longitudinal Balance	>46 dB Typ > 50 dB
Variation of Gain with Input Level	within boundaries of ITU-T Rec. G.713 Figure 7 (2 wire) within boundaries of ITU-T Rec. G.712 Figure 7 (4 wire) Typical gain variation is within $\pm$ 0.25 dB from +3 to -50 dBm0

Diagnostic Capabilities	
Diagnostics	Analog loopback Digital loopback "Make Busy" signaling control

Standards Compatibility	
Bell System	TR43801

ITU-T	Recommendations G.711, G.712 and G.714
FCC Rules and Regulations	Part 68, and Part 15 - Subpart J

Chapter 2
FXS Card

2.1   Introduction

This chapter provides connector pinout, configuration, and troubleshooting information for the Foreign Exchange - Station (FXS) Voice Cards. These are labeled as the FXS 2W*4-6 and FXS 2W*8-6 cards on their faceplate ejectors.

These cards manage the flow of FXS voice traffic over the network. Each card encodes analog (voice, VF) signals to a digital bitstream at the local system for transmission over a T1 or E1 network. It also decodes the digital signals to analog at the remote system.

Each FXS card has two-wires interfaces that support FXS, Private Line Automatic Ringdown (PLAR), Foreign Exchange Station Defined Network (FXSDN), Dial-Pulse Originating (DPO), and Wink-start operations. The FXS cards also can use the voice-compression features of an ADPCM card.

Host code 5.1.6 adds the Answer Supervision function to both the loop start and ground start signal options. The new states (which are now combined with forward disconnect) are:

*   FXS loop start forward disconnect and answer supervision (lp-fa)

*   FXS ground start forward disconnect and answer supervision (gs-fa)

*   FXS ground start forward disconnect (gs-fd)

Answer Supervision (AS) is a supplemental feature available for analog voice-grade switched-access lines that use loop-start signaling or ground-start signaling. When the Answer Supervision feature is available, an originating call from a Customer Installation (CI) (or Customer's Premises) receives an electrical signal indicating that the terminating (called) CI has answered. The AS signal is a polarity reversal of the voltage that the network applies between the tip conductor and the ring conductor at the Network Interface. The most common application of AS is to determine if and when the called party has answered the phone for billing purposes.

2.2   FXS Card Descriptions

2.2.1   FXS 2W*8-6 Card Description (812960)

The FXS 2W*8-6 Card has eight ports and provides a 600-ohm terminating impedance on each port. All FXS features are supported by this card.

2.2.1.1   Card Jumper/Switch Settings

The FXS 2W*8-6 Card has two sets of jumpers on the motherboard. The jumper JP1 (US/EUR) has two settings. One set is for US domestic applications and the other is for European applications. The default position is U.S.

JP2 (LL/SL) has two settings. One position should be set to SL (Short Loop) for loops not exceeding 700 Ohms, and the other position should be set to LL (Long Loop) for loops comprised between 700 and 1800 Ohms. The default position is LL.

Note: *Tip to Ring voltage on short loop option is -33 volts, while the long loop option is -48 volts.*

US/Euro
(J1 Jumper)

SL(Short Loop)
LL(Long Loop)
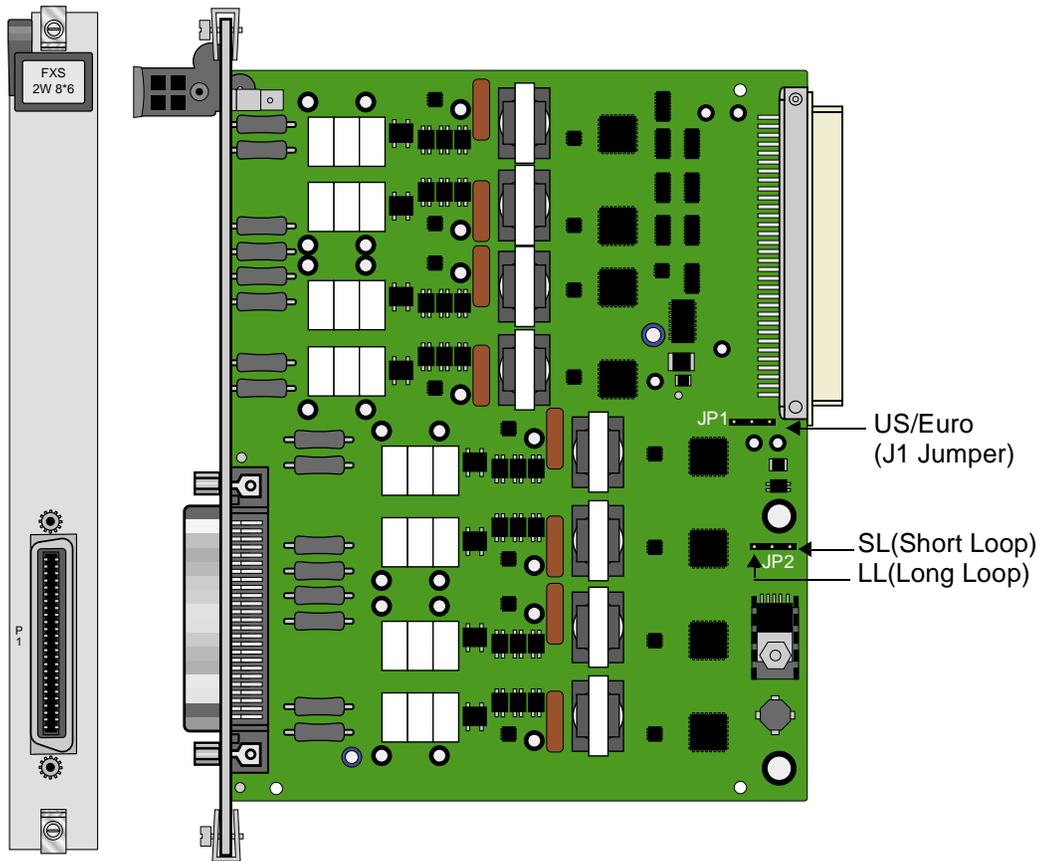
US/Euro jumper settings

US   Euro

Figure 2-1. FXS 2W*8-6 Card Jumpers Settings

2.2.1.2   Installing the Card

Install the FXS 2W*8-6 Card in any user card slot. These slots are U1 to U8 on the two-sided chassis and front-loading chassis with power supplies on top, or P1 to P4 and W1 to W4 on the front-loading chassis with power supplies on the side.

2.3 FXS Card User Screens and Settings

2.3.1 FXS Card Main Screen

You must configure the FXS card for operation after installing it into the system chassis. This is done from the FXS Card Main Screen (see Figure 2-2). To go to that screen, highlight the desired card in the System Main Screen and press <Enter>. This screen shows one configuration column for each port on the card.
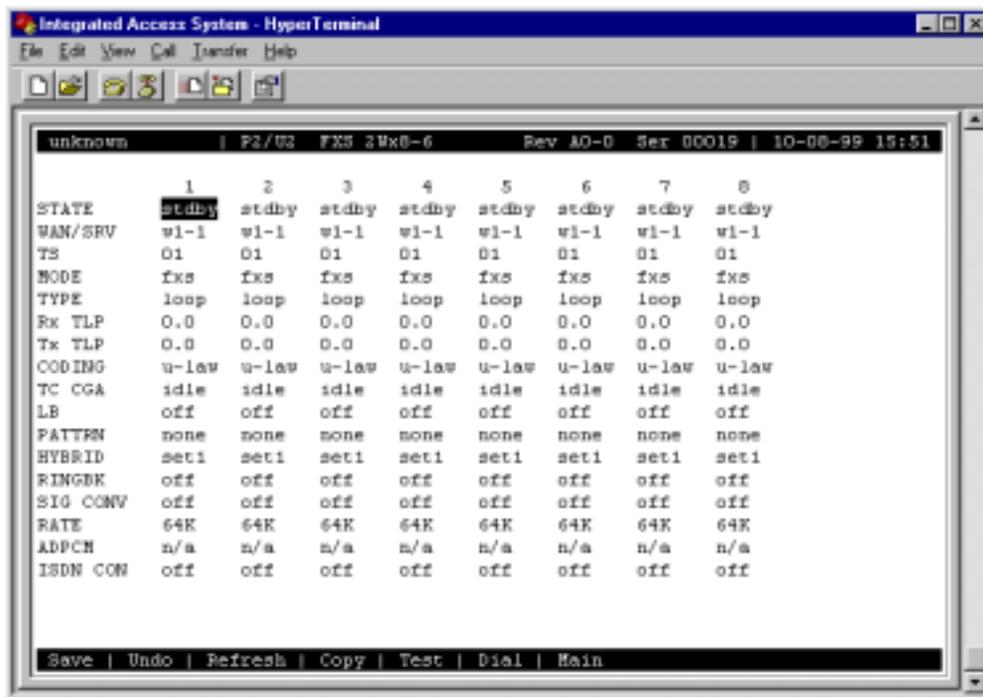
Figure 2-2. Typical FXS Card Main Screen

The bottom highlighted line of this screen shows various actions that you can perform from this screen. You perform the desired action by pressing the associated uppercase letter key. Table 2-1 summarizes these actions. For example, after you configure the FXS card ports, press "**s**" to save your settings.

Table 2-1. Main Screen Actions

Action	Function
Save	Saves changes to settings.
Undo	Returns all settings to the last saved state.
Refresh	Updates certain time-related information fields that are not automatically updated (i.e., test status).

Copy	Copies the contents of the current column to the next column. Useful if you change a lot of entries in one column and want to repeat those changes in subsequent columns.
Test	Initiates and monitors testing of all FXS card ports. Refer to the Test section of this chapter.
Dial	Primary or Hunt Group telephone number entry menu.
Main	Returns to the System Main Screen. If changes are made to settings and not saved, you will be prompted to either save or lose your changes.

Table 2-2 summarizes the configuration settings for the FXS cards, along with the available and factory-default option settings. The parameters and settings are also described in the following paragraphs.

Table 2-2. Main Screen Option Settings and Defaults

Parameter	User Options	Notes	Default
STATE	stdby actv		stdby
WAN/SRV	none wan serv user	1	w1-1
TS	01-24 01-31	2	01
MODE	fxs fxsdn wink plar dpo slc96		fxs
TYPE	loop lp-fa lp-fd gs gs-fa gs-fd gs-i gs-a 1s-R2 1sR2e R1.5i R1.50 sp	3	loop
Rx TLP	-10.0 dB to +2.0 dB		0.0
Tx TLP	-10.0 dB to +5.0 dB		0.0
CODING	u-law a-law a-inv	4	u-law
TC CGA	idle busy		idle
LB	off dgtl anlg		off
PATTERN	none D-mW quiet		none
HYBRID	set1 to set8 user	5	set1
RINGBK	off on		off
SIG CONV	off on		off
RATE	64K 24K,1 32K,1 40K,1 24K,2 32K,2 40K,2	6	64K
ADPCM	n/a P1 P2 P3		n/a
ISDN CON	off on		off

Notes:

1. Choosing **wan** allows you to choose a WAN port (w1-1 through w4-2). Choosing **serv** lets you choose an FRS server card in slot P1, P2, or P3, followed by a logical port on that card. *If your system has the FRS card installed and you want to use voice compression you need to install the Low Bit Rate Voice (LBRV) card.* The **user** option is not used. See the WAN/SRV paragraph that follows.

2. Time slot 16 is not available if the port is assigned to an E1 WAN link whose time slot 16 is programmed for CAS or CCS.

3. These options are only valid if the Mode is set to **fxs**. If the Mode is **fxsdn**, the Type options are the same as above with the addition of **fgd, boa,** and **lp-sr**. If the Mode is **plar**, the Type options are **d3** or **d4**. If the Mode is **dpo**, the Type setting will automatically default to **dpo**. If the Mode is **wink**, the Type options are **loop, lp-fd, gs, gs-i,** and **gs-a**.

4. The default is **a-inv** for E1 and μ**-law** for T1. These values will change depending upon the WAN link selected.

5. The default (**set1**) is the only active option. It balances to the ideal termination of 600 ohms + 2.15 uF. The other settings are reserved for future use.

6. Choosing a Rate other than 64K allows you to select an ADPCM.

STATE

The State setting determines whether the port is active or inactive. An inactive port does not occupy a time slot on a WAN link. Set the State setting to **stdby** (standby) for ports that are not to be used or that have not yet been configured. Set it to **actv** (active) for ports that are ready for use.

WAN/SRV

The WAN/SRV setting identifies the WAN link or server card assigned to this port. If you choose **wan**, you also must select the desired port (w1-1 through w4-2) of a WAN card for transmission over a T1 or E1 link. Or, choose **serv** to assign the card port to a server card in the system. This is an FRS card, which resides in chassis slot P1, P2, or P3. You must then choose a logical port on that card. The **user** option is not used.

It is not necessary to assign all ports of the same FXS card to the same WAN link or server card, or to contiguous time slots on a WAN link.

TS

The TS setting identifies the time slot on the WAN link to which this port is assigned. Values range from **1** to **24** for T1 links and **1** to **31** for E1 links. Time slot 16 is not available on E1 links that are programmed for **cas** or **ccs** signaling. For a display of the available time slots, refer to the cross-connect map for the WAN link; see Chapter 4, *System Configuration and Operation* in the System Reference Guide for information about viewing cross-connect maps.

MODE

The Mode setting should be determined by the type of equipment to which the user is connecting the port. All options use two-wire balanced connections. The **fxs** (Foreign Exchange Station) option allows users to connect the system to a two-way (both inbound and outbound calls) PBX trunk or a key system trunk. The system requires a ringing generator for

this option. The **fxsdn** (Foreign Exchange Station-Defined Network) option provides access to new services offered by advanced networks from many major carriers. The system requires a ringing generator for this option. The **wink** option uses the same type of signaling as **fxsdn** and provides a 150-millisecond delay, then a 200-millisecond "wink" back to the central office when the FXS card sees an off-hook condition from the central office. The system requires a ringing generator for this option.

The **plar** (private line automatic ringdown) option provides point-to-point unswitched connections between two telephone sets. This configuration is usually not attached to an exchange or switch; rather it provides a "hot line" between two locations. The unit requires a ringing generator for this option.

The **dpo** (Dial Pulse Originating) option allows the unit to attach to out-going one-way trunks from a PBX, key system, or a telephone set. This option is very similar to the **fxs** option; however, the system does not require a ringing generator.

The **slc96** (Subscriber Loop Carrier 96) option connects the card to one-way outgoing trunks from a PBX, CENTREX, key system, or telephone set to an SLC channel. The **slc96** mode also must be active on the associated WAN card.

TYPE

The Type setting matches the signaling behavior of the FXS equipment to the remote switch. Use the **loop** (loop-start) option with POTS stations and simple PBX trunks. Use the **lp-fd** (loop-start with Forward Disconnect) option when connecting to automated answering equipment. Use the **gs** (ground-start) option with two-way PBX trunks. This setting helps prevent glaring and call collisions. Use **gs-i** (ground-start immediate) for equipment requiring a fast response time to the station or PBX. Use **gs-a** (ground-start automatic) for equipment requiring fast-response time to the central office. Use **ls-R2** for CCITT signaling used internationally (immediate R2) which provides immediate seizure acknowledgment to the network. Your selection must match the behavior of both the station equipment and remote central office or PBX.

Use lp-fa or gs-fa when Answer Supervision is required. The selection of Answer Supervision will always use Forward Disconnect. The Forward Disconnect option can also be used without Answer Supervision in both loop and ground start modes (lp-fd and gs-fd).

The **lsR2e** R2 Signaling for Ericsson switch for incoming and outgoing call modes. The tables below represent FXS **ls-R23** signaling modes.

FXS-LS-R2E Office Originate - Incoming Calls (ls-R2e)

In this case, RxAB is Forward signaling. TxAB is Backward signaling. See Table 2-3.

Table 2-3. Incoming Calls (ls-R2e)

State	T/R Stat	T/R Cntl	TxAB	RxAB	Note
Idle/Released	Open	TgRb	10	10	
Seized	Open	Ringer	10	00*	Ringer 2s on, 4s off
Seizure Ack	Open or Loop		10	00	N/A
Answered	Loop*	TbRb	00	00	
Clear Forward	Loop	TgRb	00	10*	No action
Idle/Released	Open*	TgRb	10	10	
Clear Back	Open*	TgRb	10	00	
Idle/Released	Open	TgRb	10	10*	
Blocked	Open or Loop		11	10	N/A

FXS-LS-R2E Station Originate - Outgoing Calls (ls-R2e)

In this case, RxAB is forward signaling, RxAB is Backward signaling. See Table 2-4.

Table 2-4. Outgoing Calls (ls-R2e)

State	T/R Stat	T/R Cntl	TxAB	RxAB	Note
Idle/Released	Open	TgRb	10	10	
Seized	Loop*	TgRb	00	10	
Seizure Ack.	Loop	TgRb	00	10	N/A
Answered	Loop	TbRg	00	00*	Battery Reversal
Clear Forward	Open*	TbRg	10	00	
Idle/Released	Open	TgRb	10	10*	
Clear Bcak	Loop	TgRb	00	10*	Battery Normal
Idle/Released	Open*	TgRb	10	10	
Blocked			10	11	N/A

The **R1.5 Signaling** is a special state machine for Russia to support **R1.5** signaling. The IDLE signaling is asymmetrical which means that the state machines have to distinguish the direction of a call. Therefore there are different modes for incoming and outgoing calls that can be used for a call in one direction.

The two new types are supported in FXS Mode only and the types are **R1.5i** and **R1.5o**. **R1.5i** is for incoming calls (Office Originate) and **R1.5o** is for outgoing calls (Station Originate). The following tables below represent the FXS R1.5i and R1.5o signaling.

FXS-LS-R1.5 Office Originate - Incoming Calls (R1.5i)

In this case calls can only be originated from the network (incoming calls) RxAB is Forward signaling. TxAB is Backward signaling. See Table 2-5.

Table 2-5. Incoming Calls (R1.5i)

State	T/R Stat	T/R Cntl	TxAB	RxAB	Note
Idle/Released	Open	TgRb	01	11	
Seized	Open	Ringer	01	10*	Ringer 2s on, 4s off
SeizureAck	Open or Loop		11*	10	Automatic Ack. (200ms min)
Answered	Loop*	TgRb	10	10	
Clear Forward	Loop	TgRb	10	11 or 00*	
Released	Open*	TgRb	00	11	For 200 ms
Idle	Open	TgRb	01	11	Automatic in 200 ms
Clear Back	Open*		00	10	
Idle/Release	Open	TgRb	01	11*	
Blocked	Open or Loop		11*	11	Test mode

FXS-LS-R1.5 Station Originate - Outgoing Calls (R1.5o)

In this case calls can only be originated from the station or PBX ports (outgoing calls), TxAB is Forward signaling, RxAB is Backward Signaling. See Table 2-6.

Table 2-6. Outgoing Calls (R1.5o)

State	T/R Stat	T/R Cntl	TxAB	RxAB	Note
Idle/Released	Open	TgRb	11	01	
Seized	Loop*	TgRb	10	01	
Seizure Ack.	Loop	TgRb	10	11*	CO Ack.
Pulse Dial Break	Break*	TgRb	00	11	
Answered	Loop	TgRb	10	10*	
Busy	Loop	TgRb	10	00*	
Clear Forward	Open*	TgRb	11	10 or 00	
Clear Back	Open	TgRb	11	00*	Optional
Idle/Released	Open	TgRb	11	01 or 10 or 11*	
Clear Back	Loop	TgRb	10	00*	
Clear Forward	Open*	TgRb	11	00	Optional
Idle/Released	Open*	TgRb	11	01*	
Blocked		TgRb	11	11*	Blocked at CO

Use **sp** for Single Party signaling in an ESF (Extended SuperFrame) mode along with Feature Group "D" high-speed modem services that requires special software. The choice of **boa** (bill on answer) sends a signal back to the office when the customer answers the phone, to start

billing for the call. An additional choice of **lp-sr** (loop-start short ring) is the same as the loop option except that the ringing time is 1 second ON and 2 seconds OFF instead of 2 seconds ON and 4 seconds OFF (using existing option **loop/lp-fd**).

Selecting the **plar** option for the Mode of this port causes the system to offer **d3** and **d4**, which are the two common PLAR types. Both of these meet the pre-1988 and post-1988 specifications for PLAR circuits. If you select **dpo** as the Mode, the Type automatically defaults to **dpo**.

If **slc96** is selected for Mode, the two options supported are **sp** (single-party POTS) and **uvg** (universal voice-grade).

CAUTION!

Before activating this port, verify the behavior expected by both the station equipment and remote central office equipment, and be sure the systems are properly configured.

Rx TLP

The Receive Transmission Level Point (TLP) setting controls the amount of gain or loss added to the incoming signal after it is decoded to analog. To increase the signal level, set the Rx TLP setting to a positive value (i.e., the larger the number, the more gain is added). To decrease the signal level, set the Rx TLP setting to a negative value (i.e., the more negative the number, the more the signal level is decreased). For example, an incoming signal at -5 dBm can be increased to -3 dBm by setting Rx TLP to +**2 dB**. The Rx TLP range is **-10.0 dB** to +**2.0 dB**.

Tx TLP

The Transmit TLP setting controls the amount of gain or loss added to a voice signal from the CPE before it is encoded to digital PCM. To increase the signal level, set the Tx TLP setting to a negative value (i.e., the more negative the number, the more gain is added). To decrease the signal level, set the Tx TLP setting to a positive value (i.e., the more positive the number, the more the signal level is decreased). For example, an incoming signal at -5 dBm can be increased to -2 dBm by setting the Tx TLP to -**3 dB**. The Tx TLP range is **-10.0 dB** to +**5.0 dB**.

CODING

The Coding setting sets the PCM companding method used for a port. Generally, the North American T1 environment uses **m-law** coding, and the International E1 environment uses **a-law** or **a-inv** (inverted A-law) coding. The **a-inv** setting provides a higher ones density than **a-law**. The default coding setting is determined by the type of associated WAN card.

TC CGA

The Trunk Conditioning during Carrier Group Alarm setting defines whether the FXS port should be forced **idle** or **busy** upon declaration of a Carrier Group Alarm (CGA) on the WAN link to which the port is assigned. In most cases, you should set this parameter to **busy**. If a call is in progress when the CGA alarm is received, the system will hold the call for two seconds, drop it, and then busy out the port to the attached PBX for the duration of the alarm. Once the alarm clears, the system will automatically place the port back in the **idle** mode, making it available to the PBX.

LB

The Loopback field lets you loop the port back toward the network and far end. The **dgtl** (digital) loopback sends the incoming digital DS0 signal back to the far end without decoding it. The **anlg** (analog) loopback sends the decoded analog signal back to the far end after decoding and then re-encoding it. Figure 2-3 shows the loopback options, which allow you to test and troubleshoot the FXS card. To disable a loopback, set this field to **off**.
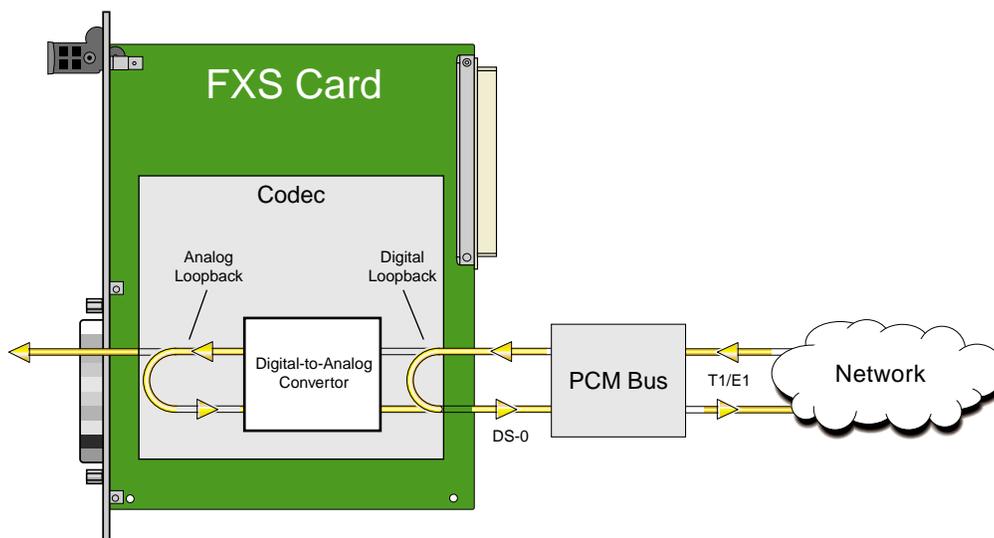
Figure 2-3. FXS Card Loopbacks

PATTRN

The Pattern field selects an outgoing test pattern for the current card port. The test pattern is generated by the system and sent to the selected port. You can select a different pattern for each port. The **none** option disables the test pattern. The **D-mW** (Digital milliwatt) option sends a 1 kHz tone at 0.0 dBm. The setting of the Rx TLP setting affects the D-mW signal level. The **quiet** option places a 600-ohm termination on the line so that no analog signal is sent (idle mode).

HYBRID

The Hybrid option assigns a three byte pattern to define the adjustment for return loss (similar to Build Out Capacitors). The default, **set1**, balances to the ideal termination of 600 ohms + 2.15 uF. The other settings are reserved for future use.

RINGBK

The ringback setting specifies whether a ringback tone is generated by the system and sent towards the network. Turn this option **off** when the network service does not provide an audible ringing tone to the calling party.

SIG CONV

The Signaling Conversion parameter allows you to change the transmit ABCD signaling bits from CCITT (E1) to ANSI (T1) standards. This conversion is completed regardless of the type of WAN card (CSU/DSX *or* CEPT) to which the FXS card is attached.

The options are **off** if ANSI signaling is used and **on** to convert transmit signaling from ANSI to CCITT format according to the Interface Card Conversion Table for FXS signaling. This setting also converts receive signaling from CCITT to ANSI.

RATE

The Rate parameter allows you to use the voice compression capabilities of an ADPCM card. If that card is not present in the system, the Rate stays at **64k** and cannot be changed. The **64k** option is the normal encoding/decoding rate for voice circuits.

ADPCM voice channels are assigned in pairs by designating two voice ports (E&M, FXO, or FXS) to the same WAN link and time slot, and selecting rate settings for the pair that add up to 64 kbps. The following combinations are possible:

- **24K,1+40K,2** (24 kb coding on one side of the time slot and 40 kb coding on the other side of the same time slot)
- **32K,1+32K,2** (32 kb encoding on each side of a time slot)
- **40K,1+24K,2** (40 kb coding on one side of the time slot and 24 kb coding on the other side)

Number **1** after the rate setting assigns that portion of the voice port pair to the odd side of the ADPCM pair. Number **2** after the rate setting assigns that portion of the voice port pair to the even side of the ADPCM pair.

The number **1** after the rate setting assigns that portion of the voice port pair to the odd side of the ADPCM pair. The number **2** after the rate setting assigns that portion of the voice port pair to the even side of the ADPCM pair.

For more information about voice port assignments to the ADPCM card, please consult the ADPCM section of the *Server Card Reference Guide*.

ADPCM

The ADPCM parameter lets the user choose which ADPCM card to place this E&M port. The default setting is **n/a** and only changes when a Rate smaller than **64k** is selected (see above). The user is then allowed to select which ADPCM card to use for the port (this assignment is made by chassis slot number). The options are slots **P1**, **P2**, and **P3**.

ISDN CON

The ISDN Connect parameter displays whether the ISDN connection is on or off. The default setting is always off.

2.3.2   Test Screen

The Test option facilitates testing and maintenance by allowing you to monitor and set the status of the analog interface leads, and to monitor or set the value of the A, B, C, and D signaling bits of all FXS circuits on that card. In cross-connect systems, the test option also allows you to apply test patterns and tones towards the user and network sides of the system.

Figure 2-4 shows the FXS Card Test Screen parameters, Table 2-7 lists some actions you can perform from this screen, and Table 2-8 shows the settings for each parameter.
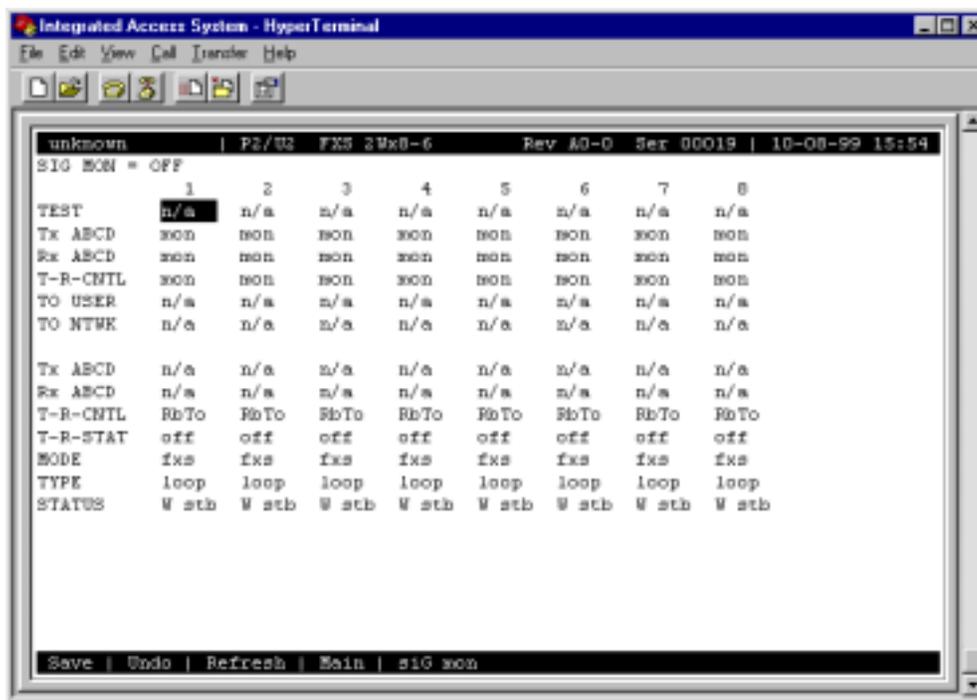
Figure 2-4. Typical FXS Card Test Screen

Table 2-7. Test Screen Actions

Action	Function
Save	Saves changes to settings.
Undo	Returns all settings to the last saved state.
Refresh	Updates certain time-related information fields that are not automatically updated (i.e. performance and test data).
Main	Returns to the FXS Card Main Screen. If changes are made to settings and not saved, you will be prompted to save or lose changes.
siGmon	Used with the user card alarm system to notify you of excessive signaling bit transitions.

Table 2-8. Test Screen Option Settings and Defaults

Parameter	User Options					Default
SIG MON	off	on				off
TEST	off	on				off
Tx ABCD	mon	set				mon
Rx ABCD	mon	set				mon
T-R-CNTL	mon	set				mon
TO USER	PCM	300Hz	1kHz	3kHz	quiet	PCM
TO NTWK	PCM	300Hz	1kHz	3kHz	quiet	PCM
Tx ABCD	Status information only; not editable					n/a

Rx ABCD	Status information only; not editable	n/a
T-R-CNTL	Status information only; not editable	n/a
T-R-STAT	Status information only; not editable	n/a
MODE	Status information only; not editable	n/a
TYPE	Status information only; not editable	n/a
STATUS	Status information only; not editable	n/a

SIG MON

The Signaling Monitor feature works with the user card alarm system to detect excessive signaling bit transitions. The system will generate alarms if the number of transitions of any signaling bit in transmit or receive direction for an active port exceeds 255 in any four second interval. The options are **off** and **on**, and they are toggled by pressing "**g**" (**siGmon** command) in the Test Screen.

TEST

The Test parameter shows if the port is in test mode or not. Inactive ports and ports that are assigned to inactive WANs will show a test status of **n/a**. The test status options for active ports are **off** and **on**.

Tx ABCD

The Transmit ABCD setting allows the user to either monitor the status of the ABCD signaling bits being transmitted towards the network or set a specific ABCD pattern for testing the transmit side of the circuit. The options for this field are **mon** (monitor) or **set**. Choosing **set** will bring up a four digit field for users to input the ABCD pattern they want to transmit. Any four-digit combination of ones and zeros is acceptable for this setting.

Rx ABCD

The Receive ABCD setting allows the user to either monitor the status of the ABCD signaling bits being received from the network or set a specific ABCD pattern for testing the receive side of the circuit. The options for this field are **mon** (monitor) or **set**. Choosing **set** will bring up a four digit field for users to input the ABCD pattern they want to receive. Any four digit combination of ones and zeros is acceptable.

T-R-CNTL

The Tip and Ring Control setting allows you to either **mon** (monitor) or **set** (set) the state of the Tip and Ring leads of an FXS port. Choosing **set** will display the following options (**b** = battery, **o** = open, **g** = ground):

- **RbTo** (-48V is applied to the Ring lead and the Tip lead is open)

- **TbRo** (-48V is applied to the Tip lead and the Ring lead is open)

- **RbTg** (-48V is applied to the Ring lead and the Tip lead is grounded)

- **TbRg** (-48V is applied to the Tip lead and the Ring lead is grounded)

TO USER

In cross-connect systems only, the To User parameter allows you to break the circuit and send a test tone on the user side of the system. The options for this field are **PCM**, **300Hz**, **1kHz**, **3kHz,** and **quiet**. Choose **PCM** if you do not want to inject a tone toward the CPE. In this case, the PCM signal received from the network is still sent to the CPE in the normal manner.

TO NTWK

In cross-connect systems only, the To Network parameter allows you to break the circuit and send a test tone on the network side of the system. The options for this field are **PCM**, **300Hz**, **1kHz**, **3kHz,** and **quiet**. Choose **PCM** if you do not want to inject a tone toward the network. In this case, the PCM signal received from the CPE is still sent to the network in the normal manner.

Tx ABCD

The Transmit ABCD informational field shows the current values of the ABCD bits that are being transmitted to the network. If TX ABCD in the top half of the screen is changed via the **set** function mentioned above, and the settings are saved by the Save command in the Menu of Actions, the new bit pattern chosen will be reflected here.

Rx ABCD

The Receive ABCD informational field shows the current values of the ABCD signaling bits that are received from the network. If RX ABCD in the top half of the screen is changed via the **set** function mentioned above, and the settings are saved by the Save command in the Menu of Actions, the new bit pattern chosen will be reflected here.

T-R-CNTL

The Tip and Ring Control informational field shows the current status of the Tip and Ring leads of the FXS port from the perspective of the system. The possible values are as follows (**b** = battery, **o** = open, **g** = ground):

- **RbTo** (-48V is applied to the Ring lead and the Tip lead is open)

- **TbRo** (-48V is applied to the Tip lead and the Ring lead is open)

- **RbTg** (-48V is applied to the Ring lead and the Tip lead is grounded)

- **TbRg** (-48V is applied to the Tip lead and the Ring lead is grounded)
- **ring (**the ringing voltage is applied between Tip and Ring)

T-R-STAT

The Tip and Ring Status informational field describes what the attached device is doing with the Tip and Ring leads of the FXS port. The possible values are:

- **loop** (attached device is connecting Tip and Ring together)
- **rgnd** (the Ring lead is grounded by the attached device)
- **open** (Ring lead is not connected to either the Tip lead or to ground)

MODE

The Mode informational field shows the current mode of the port that was selected on the main FXS card Screen. Valid settings are **fxs**, **fxsdn**, **wink**, **plar, dpo,** or **slc96**.

TYPE

The Type informational field shows the current status of the signal field selected on the main FXS card screen for this port. Valid settings for **fxs** and **wink** modes are **loop** (loop start), **lp-fd** (loop start–forward disconnect), **gs** (ground start), **gs-i** (ground start immediate) and **gs-a** (ground start automatic). Valid settings for **fxsdn** modes are **loop** (loop start), **lp-fd** (loop start–forward disconnect), **gs** (ground start), **gs-i** (ground start immediate), **gs-a** (ground start automatic) and **fgd** (Feature Group "D"). Valid settings for the **plar** mode are **d3** and **d4**. The only valid setting for the **dpo** mode is **dpo** (dial pulse originating).

STATUS

The Status field shows the current status of the port. Table 2-9 lists and describes all of the possible conditions reported by this field.

Table 2-9. Status Information Field Settings

Setting	Meaning
stdby	The FXS port is in standby.
W stb	WAN card to which the FXS port is assigned is in standby.
W tst	WAN card to which the FXS port is assigned is under test.
W OOS	WAN card to which the FXS port is assigned is out of service.
noWAN	There is no WAN card configured in the slot to which the FXS port is assigned.
call	Call set-up is in progress.
busy	Call is in progress.

idle	No call is in progress (port is available for a call).
TC	The port is in Trunk Conditioning because a CGA alarm occurred on the associated WAN port.
test	A test is in progress on the port (i.e., you are actively controlling the circuit by setting values for Tx ABCD or Rx ABCD).
maint	The port is in a maintenance condition.

2.4   FXS Error Messages

Refer to Appendix B in the System Reference Guide for further information on Error Messages regarding this card.

2.5   FXS Card Troubleshooting

The FXS card may be faulty if a voice signal is not received at one end of a circuit, or if signaling is not detected. The following are possible causes:

- Faulty receiving CPE at the near end (where the problem was first noticed)

- Faulty transmitting CPE at the far (opposite) end

- Faulty cabling between the CPE and FXS card at the near end

- Faulty cabling between the CPE and FXS or FXO card at the far end

- T1 or E1 network failure

- Improper card configuration at either end (e.g., time slot and/or WAN port assignments)

First, verify that the T1 or E1 network has not failed. Check for a CGA-Red alarm on the associated WAN port at the end where the incoming VF signal loss is first noticed. The CGA indicates that the incoming network signal was lost (or that the receiving WAN port is out of frame). During the CGA, all voice ports with time slots on that WAN port will also be disabled, and the associated far-end WAN port will be in a CGA-Yellow alarm state. If the network is faulty, you must clear that trouble to restore your circuits.

If the network is okay, verify that the proper WAN ports and time slots are assigned to the associated FXS and FXO voice ports at both ends, as previously outlined in this chapter. In a point-to-point network, the near-end and far-end FX card ports should both be assigned the same WAN port and time slot number. Also make sure the other parameters (such as the transmit and receive TLPs) are set properly at both ends.

If the FX card port parameters are correct at both ends, and if the network is okay, the trouble is isolated to the FXS card or the associated port. Proceed as follows:

1. At the far end, activate an analog loopback on the FX card port.

2. Send a 0 dBm (digital milliwatt) test signal toward the CPE at that end. That signal will be substituted for the normal signal coming from the far-end CPE; it will be sent back to the CPE at your end via the loopback path.

3. Check your CPE for this signal. If it is present, the far-end CPE or cabling to the far-end FX card is probably faulty. Disable the loopback and test signal there, and fix the problem. If you still don't receive a signal, go to step 4.

4. At your end, go to the FXS Card Main Screen and send a digital milliwatt test tone (0 dBm) toward the CPE. If you still don't receive a signal, check the cabling from the FXS card to your CPE, and check the CPE itself. If those items are okay, replace the FXS card at your end.

5. If the FXS card is determined to be faulty, replace it and return the faulty unit for repair to the location specified by your distributor.

2.6   FXS Card Specifications

FXS Cards (812960 2-wire)		
Number of Ports		
Model 812960	8 ports	
Physical Interface		
Connector	1 female 50-pin telco connector	
Transmission Performance		
Performance	Exceeds requirements of ITU-T Rec. G.713	
Signaling Modes		
Model 812X Signaling Modes	Software selectable on a per port basis Foreign Exchange Station (FXS) Loop Start and Ground Start Foreign Exchange Station - Defined Network (FXSDN) Private Line Automatic Ringdown (PLAR) Dial Pulse Originating (DPO)	
Termination Impedance		
Model 812960	600 Ohms with 2.16 μF	
VF Transmission Characteristics		
Nominal Transmit TLP	-10.0 dB to +5.0 dB in steps of 0.1 dB	
Nominal Receive TLP	-10.0 dB to +2.0 dB in steps of 0.1 dB	
PCM Encoding	Software selectable on a per port basis	
Attenuation Versus Frequency Relative to 1 kHz with 0 dBm0 input		
Frequency	Transmit (A to D)	Receive (D to A)
200 Hz	-0.25 to +3.0 dB	-0.25 to +2.0 dB
300 to 3000 Hz	-0.25 to +0.5 dB	-0.25 to +0.5 dB
3200 Hz	0.25 to +0.75 dB	-0.25 to +0.75 dB
3400 Hz	-0.25 to +1.5 dB	-0.25 to +1.5 dB
Return Loss (at 1 kHz)	≥28 dB	
Transhybrid Loss	34dB	

Idle Channel Noise (rcv and xmt)	< -65 dBm0p Typ < -70 dBmop or < 20 dBrnc0	
Interchannel Crosstalk	Typ < -75 dBm0 using 7 adjacent channels being disturbed with a signal of 0.0 dBm0	
Total Distortion including Quantization (Signal to Distortion Ratio) Input Frequencies 1004-1020 Hz		
Input Level	**Rcv or Xmt**	**Overall**
-30 to 0 dBm0	≥35 dB	≥33 dB
-40 dBm0	≥29 dB	≥27 dB
-45 dBm0	≥25dB	≥22 dB
Absolute group delay	< 750 microseconds	
Group Delay Distortion vs. frequency	within boundaries of ITU-T Rec. G.713 Figure 2	
Longitudinal Balance	Nom > 46 dB	
	Typ > 50 dB	
Variation of Gain with Input Level	within boundaries of ITU-T Rec. G.713 Figure 7	

Chapter 3
FXO Card

3.1 Introduction

This chapter provides installation, configuration, and troubleshooting information for the Foreign Exchange - Office (FXO) Card, which is identified as a FXO 2W*8-6 card on its faceplate ejector.

The FXO 2W*8-6 Card manages the flow of FXO voice traffic through the Integrated Access System. Each card encodes analog (voice, VF) signals to a digital bloodstream at the local system for transmission over a T1 or E1 network. It also decodes the digital signals to analog at the remote system.

The card has a two-wire interface and supports Foreign Exchange - Office (FXO), Manual Ringdown (MRD), Foreign Exchange Office-Defined Network (FXODN), and Dial-Pulse Terminating (DPT) operations.

The FXO card also can use the voice compression features of an ADPCM card.

Host code 5.1.6 adds the Answer Supervision function to both the loop start and ground signal options. The new states (which are now combined with forward disconnect) are:

- FXO loop start forward disconnect and answer supervision (lp-fa)

- FXO ground start forward disconnect and answer supervision (gs-fa)

- FXO ground start forward disconnect (gs-fd)

Answer Supervision (AS) is a supplemental feature available for analog voice-grade switched-access lines that use loop-start signaling or ground-start signaling. When the Answer Supervision feature is available, an originating call from a Customer Installation (CI) (or Customer's Premises) receives an electrical signal indicating that the terminating (called) CI has answered. The AS signal is a polarity reversal of the voltage that the network applies between the tip conductor and the ring conductor at the Network Interface. The most common application of AS is to determine if and when the called party has answered the phone for billing purposes.

Host code 5.1.6 also adds the ability to detect 25 HZ ringing frequency in both options. The specification for incoming ringing signal detection at the switch end is 17 to 28 Hz, at 40 to 110 Vrms. Ringing output at the FXS end is governed by the ring generator.

3.2 FXO Card Descriptions

3.2.1 FXO 2W*8-6 Card Description (813970)

The FXO 2W*8-6 Card is a eight-port voice card with a 600-ohm terminating impedance on each port. All FXO features are supported by this card.

Notice!

UL STATEMENT

OPERATION OF THIS INTERFACE IS LIMITED TO INTRA-BUILDING CONNECTIONS ONLY

> *Note:* *The 813970 retains all the functionality of the 813960, and, in addition, offers improved ground start signaling operation.*

3.2.1.1 Card Jumper/Switch Settings

The FXO 2W*8-6 Card has eight sets of jumpers that you must set before inserting the card into a system chassis. Figure 3-1 shows these jumpers, which allow you to configure individual ports of the card for either FXO or MRD operation.

To set up a port for MRD operation, insert shorting jumpers vertically between pins 1 and 2 for that port, as shown. Each port has two associated jumpers. To use FXO operation on any port, remove its associated jumpers, and store them on pin 2 for future use.
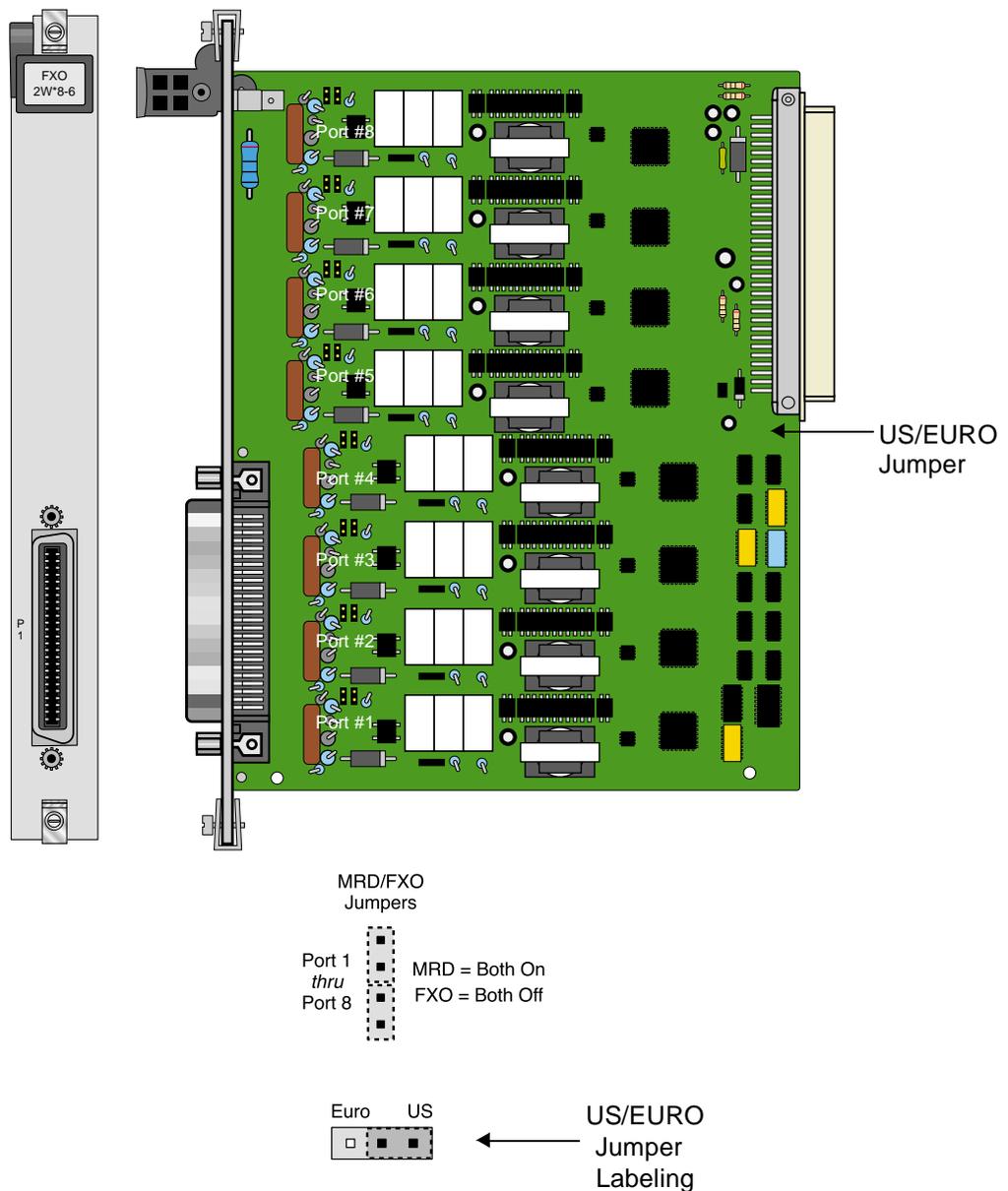
Figure 3-1. FXO 2W*8-6 Card Jumper Settings

3.2.1.2 Installing the Card

Install the FXO 2W*8-6 card in any user card slot. These slots are U1 to U8 on the two-sided chassis and front-loading chassis with power supplies on top, or P1 to P4 and W1 to W4 on the front-loading chassis with power supplies on the side.

3.3   FXO Card User Screens and Settings

3.3.1   FXO Card Main Screen

The FXO Card must be configured for operation after installing it into the system chassis. This is done from the FXO Card Main Screen (see Figure 3-2). To go to that screen, use the directional arrow keys to highlight the desired card in the System Main Screen, and press <Enter>. This screen shows one configuration column for each port on the card.
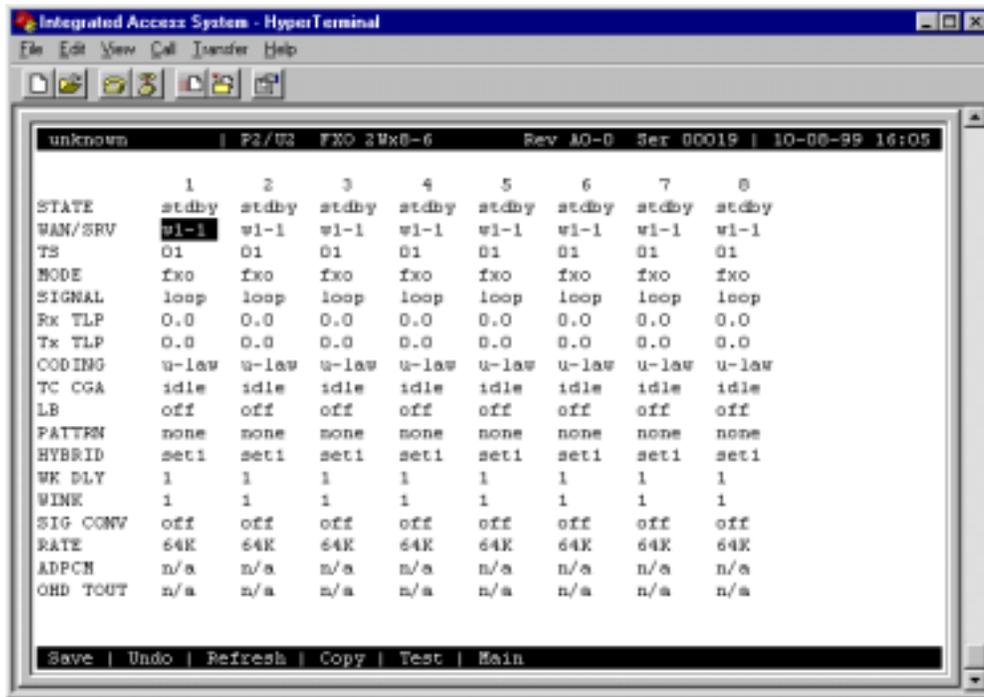
Figure 3-2. Typical FXO Card Main Screen

The bottom highlighted line of this screen shows various actions that you can perform from the screen. You perform the desired action by pressing the associated uppercase letter key. Table 3-1 summarizes these actions. For example, after you configure the FXO card ports, press "**s**" to save your settings.

Table 3-1. Main Screen Actions

Action	Function
Save	Saves changes to settings.
Undo	Returns all settings to the last saved state.
Refresh	Updates certain time-related information fields that are not automatically updated (e.g. test status).

Copy	Copies the contents of the current column to the next column. Useful if you change a lot of entries in one column and want to repeat those changes in subsequent columns.
Test	Initiates and monitors testing of all FXO card ports. Refer to the Test section of this chapter.
Main	Returns to the System Main Screen. If changes are made to settings and not saved, you will be prompted to save or lose changes.

Table 3-2 summarizes the configuration settings for the FXO card, along with the available and factory-default option settings. The M key will return you to the Main Menu. The parameters and settings are also described in the following paragraphs.

Table 3-2. Main Screen Option Settings and Defaults

Parameter	User Options	Notes	Default
STATE	stdby actv		stdby
WAN/SRV	none wan serv user	1	w1-1
TS	01-24 01-31	2	01
MODE	fxo fxodn dpt mrd		fxo
SIGNAL	loop gs lp-fd 1s-R2 gs-a lp-em lp-fa gs-fa gs-fd	3	loop
Rx TLP	-10.0 dB to +2.0 dB		0.0
Tx TLP	-10.0 dB to +5.0 dB		0.0
CODING	μ-law a-law a-inv	4	μ-law
TC CGA	idle busy		idle
LB	off dgtl anlg		off
PATTERN	none D-mW quiet		none
HYBRID	set1 to set8 user	5	set1
WK DLY	00-99	6	0
WINK	00-199	6	0
SIG CONV	off on		off
RATE	64K 24K,1 32K,1 40K,1 24K,2 32K,2 40K,2	7	64K
ADPCM	n/a P1 P2 P3		n/a
OHD TOUT	1600ms - 3300ms		3700ms

Notes:

1. Choosing **wan** allows you to choose a WAN port (w1-1 through w4-2). Choosing **serv** lets you choose an ADPCM server card in slot P1, P2, or P3, followed by a logical port on that card. *If your system has the FRS card installed and you want to use voice compression you need to install the Low Bit Rate Voice (LBRV) card.* The **user** option is not used. See the WAN/SRV description that follows.

2. Time slot 16 is not available if the port is assigned to an E1 WAN link whose time slot 16 is programmed for **CAS** or **CCS**.

3. These options are only valid if the option selected is **fxo**, or **fxodn**. If the mode is **dpt**, then the Signal options are **dpt** (default), **R2, i-R2** or **dp-em**. If the Mode is **mrd**, then the Signal setting will automatically default to **mrd**. CallerID can be activated or deactivated using the SIGNAL configuration for each port. For more information on CallerID, refer to the **SIGNALS - CallerID** description on Page 3-7.

4. The default is **a-inv** for E1 and **μ-law** for T1. These values will change depending upon the WAN link selected.

5. The default, **set1**, is the only active option. It balances to the ideal termination of 600 ohms + 2.15 μF. The other settings are reserved for future use.

6. These settings should be used with **fxodn** and **dpt** modes only.

7. Choosing a Rate other than **64K** allows you to select an ADPCM slot.

STATE

The State setting determines whether the port is active or inactive. An inactive port does not occupy a time slot on a WAN link. Set the State setting to standby (**stdby**) for ports you are not using, or have not yet configured. Set it to active (**actv**) for ports that are ready for use.

WAN/SRV

The WAN/SRV setting identifies the WAN link or server card assigned to this port. If you choose **wan**, you also must select the desired port (w1-1 through w4-2) of a WAN card for transmission over a T1 or E1 link. Or, choose **serv** to assign the card port to a server card in the system. This can be an ADPCM or FRS card, which resides in chassis slot P1, P2, or P3. You must then choose a logical port on that card. The **user** option is not used.

It is not necessary to assign all ports of the same FXO card to the same WAN link or server card, or to contiguous time slots on a WAN link.

TS

The TS setting identifies the time slot on the WAN link to which this port is assigned. Values range from **1-24** for T1 links and **1-31** for E1 links. Time slot 16 is not available on E1 links that are programmed for **cas** or **ccs** signaling. For a display of the available time slots, refer to your cross-connect map for the WAN link.

MODE

The Mode setting should be determined by the type of equipment to which you connect the port. All options use two-wire balanced connections. The **fxo** (Foreign Exchange Office) option allows you to connect the system to a 2 way PBX trunk (both inbound and outbound calls) or a key system trunk. The **fxodn** (Foreign Exchange Office-Defined Network) option provides access to new services offered by advanced networks from many major carriers. The **dpt** (Dial Pulse Terminating) option allows the unit to attach to incoming one-way trunks from a PBX, key system, or a telephone set.

The **mrd** (manual ringdown) option provides point-to-point unswitched connections between two telephone sets. This configuration is usually not attached to an exchange or switch; rather it provides a "hot line" between two locations. *The system requires hardware changes and a ringing generator for this option (see instructions later in this chapter).*

SIGNALS

The Signal setting matches the signaling behavior of the FXS equipment and the local switch. Use the **loop** (Loop Start) option with CO lines and simple PBX trunks. Use the **gs** (Ground Start) option with two-way PBX trunks because it helps to prevent glaring or call collisions. Use the **lp-fd** (Loop Start–Forward Disconnect) option with automated answering equipment at the far end. The **ls-R2** (Loop Start–R2 protocol) option is provided for a CCITT R2 interface.

Use **gs-a** (ground-start automatic) option for equipment requiring fast-response time to the central office. The **lp-em** (Loop Start–R2 electromechanical) option for use on Russian telephone systems.

The CallerID writeup on **page 3-7** and the OHD TOUT writeup on **page 3-11** describes how you set the on-hook data time out between power rings. If the line goes off-hook before or during the data transmission, data transmission shall be pre-empted or stopped and normal call completion treatment shall be provided.

If you selected the **dpt** option for the Mode of any port, then the three options that are supported under Signal are **dpt** for standard Dial Pulse Termination signaling used in North America, **R2** for CCITT signaling used internationally, **i-R2** (immediate R2) which provides immediate seizure acknowledgment to the network and **dp-em** (Dial Pulse Electromechanical) used for timing relays that are specific to Russia. If you select **mrd** as the Mode, then Signal will automatically default to **mrd**. If you select **fxodn** in Mode the options are **loop, gs, lp-fd, R2, gs-a** and **lp-em.** For **fxo** the option is listed **ls-R2** instead of **R2**, but the options are the same.

Use lp-fa or gs-fa when Answer Supervision is required. The selection of Answer Supervision will always use Forward Disconnect. The Forward Disconnect option can also be used without Answer Supervision in both loop and ground start modes (lp-fd and gs-fd).

CAUTION!

Before activating a port, verify the behavior expected by both the station equipment and the remote central office equipment and ensure that you have the system properly configured.

Rx TLP

The Receive Transmission Level Point setting controls the amount of gain or attenuation added to signals after they are decoded to analog signals. To increase the signal level, set the Rx TLP setting to a positive number (i.e., the larger the number, the more gain is added). To decrease the signal level, set the Rx TLP setting to a negative number (i.e., the more negative the number, the more the signal level is decreased). For example, an incoming signal at -5 dBm can be increased to -3 dBm by setting Rx TLP to +2 dB. Acceptable values range from **-10.0 dB to +2.0 dB**.

Tx TLP

The Transmit Transmission Level Point setting controls the amount of gain or attenuation added to signals after they are received from the local analog port, and before they are encoded to digital PCM signals. To increase the signal level, set the Tx TLP setting to a negative number (i.e., the more negative the number, the more gain is added). To decrease the signal level, set the Tx TLP setting to a positive number (i.e., the more positive the number, the more the signal level is decreased). For example, an incoming signal at -5 dBm can be increased to -2 dBm by setting Tx TLP to -3 dB. Acceptable values range from **-10.0 dB to +5.0 dB**.

CODING

The Coding setting sets the PCM companding method used for a port. Generally, the North American T1 environment uses **m-law** coding. The International E1 environment uses **a-law** or **a-inv** (inverted A-law) coding, and **a-inv** provides a higher ones density than **a-law**. The coding default is determined by the type of card in the WAN port you select.

TC CGA

The Trunk Conditioning during Carrier Group Alarm setting defines whether the FXO port should be placed in **idle** or **busy** mode upon declaration of a Carrier Group Alarm (CGA) on the WAN link to which the port is assigned. In most cases, you should set this parameter to **busy**. If a call is in progress when the CGA alarm is received, the system will hold the call for two seconds, drop it and then busy out the port to the attached PBX for the duration of the alarm. Once the alarm clears, the system will automatically place the port back in **idle** mode thereby making it available to the attached PBX.

LB

The Loopback field lets you loop the port back toward the network and far end. The **dgtl** (digital) loopback sends the incoming digital DS0 signal back to the far end without decoding it. The **anlg** (analog) loopback sends the decoded analog signal back to the far end after decoding and then re-encoding it. Figure 3-3 shows the loopback options, which allow you to test and troubleshoot the FXS card. To disable a loopback, set this field to **off**.
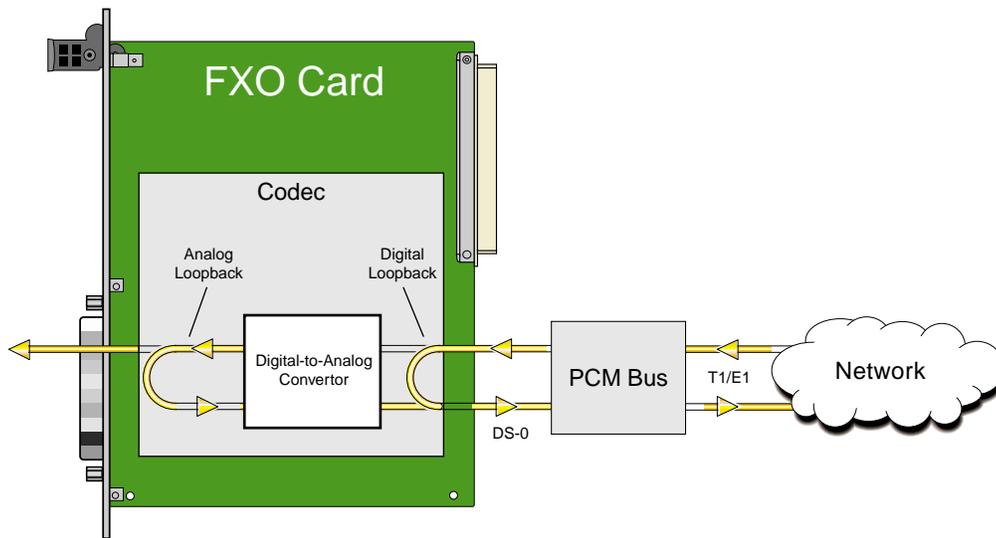
Figure 3-3. FXO Card Loopbacks

PATTRN

The Pattern setting sets the outgoing test pattern for this analog port. The pattern, generated by the system, is sent only to the currently selected port. The **none** option disables sending a test pattern. The **D-mW** (Digital milliwatt) option sends a 1 kHz tone at 0.0 dBm. The Rx TLP setting affects the D-mW signal level. The **quiet** option places a termination on the line so that no analog signal is sent.

HYBRID

The Hybrid option assigns a three-byte pattern to define the adjustment for return loss (similar to Build-Out Capacitors). The default, **set1**, balances to the ideal termination of 600 ohms + 2.15 uF. The other settings are reserved for future use.

WK DLY

The Wink Delay setting allows you to set the wink delay time. The options are units of 100 milliseconds. Settings are **1-99** (100 milliseconds to 9.9 seconds). The Wink Delay and Wink options are applicable to CCITT systems for determining the delay of the R2 state machine. They should only be used with modes **fxodn** and **dpt** (**R2** and **i-R2**).

WINK

The Wink setting allows you to set the wink duration time. The options are units of 100 milliseconds. Settings are **1-99** (100 milliseconds to 9.9 seconds). This option is only applicable with modes **fxodn** and **dpt** (**R2** and **i-R2**).

SIG CONV

The Signaling Conversion parameter allows you to change the ABCD signaling bits from CCITT (E1) to ANSI (T1) standards. This conversion is completed regardless of the type of WAN aggregate (CSU/DSX **or** CEPT) to which it is attached. The options are **off** (which means that ANSI signaling is used) and **on** (which converts transmit signaling from ANSI to CCITT format according to the Interface Card Conversion Table for FXO signaling, and also converts receive signaling from CCITT to ANSI).

RATE

The Rate parameter allows you to use the voice compression capabilities of the ADPCM resource card. If that card is not present in the system, changes cannot be made to this setting. The **64K** option (default) does not use ADPCM resources (it is the normal operation rate for voice circuits).

ADPCM voice channels are assigned in pairs by designating two voice ports (E&M, FXO or FXS) to the same WAN link and time slot and selecting rate settings for the pair that add up to 64kbps (i.e. [24K,1+40K,2],[32K,1+32K,2] and [40K,1+24K,2]). The numeral 1 after the rate setting assigns that portion of the voice port pair to the odd side of the ADPCM pair. The numeral 2 after the rate setting assigns that portion of the voice port pair to the even side of the ADPCM pair.

For more information about voice port assignments to the ADPCM card, please consult the ADPCM section of the manual.

ADPCM

The ADPCM parameter lets you choose the ADPCM card on which to place this FXO port. The default setting is **n/a** and only changes when a Rate smaller than **64k** is selected (see above). You can then select which ADPCM card to use for the port (assignment is made by chassis slot number). The options are **P1**, **P2,** and **P3**.

OHD TOUT

The OHD TOUT field is used to activate CallerID and setting the On Hook Data Timeout (OHD TOUT). OHD TOUT is a value between 1600ms and 3300ms and indicates the length of time after the first ring that the FXO card will accept data, such as CallerID.

Note: *This field is only applicable if MODE is set to **fxo** and SIGNAL is set to either **loop**, **gs**, **lp-fd** or **gs-a**. For the **ls-R2** and **lp-em** options and modes different from fxo, CallerID is not supported, and n/a will be displayed in the OHD TOUT configuration.*

Activate CallerID by highlighting the appropriate port (1-8) then highlight the OHD TOUT configuration row. After highlighting your selection, press the return key. The options **on** and **off** will be displayed on bottom of the screen.

1. Highlight **off**, press the return key and the OHD TOUT configuration indication will be **off**, indicating that CallerID is OFF.

2. Highlight **on** and press the return key. **Enter number <1600 - 3300>: 3300** will be displayed. Enter the new configuration time ranging from 1600-3300 in milliseconds, and press the return key. The OHD TOUT configuration time will be displayed for that port, indicating that CallerID is ON.

3.3.2   Test Screen

The Test option facilitates testing and maintenance by allowing you to monitor and set the status of the analog interface leads as well as monitoring and setting the value of the A, B, C and D signaling bits of all FXO circuits on that card. In cross-connect systems only, the test option also allows you to apply test patterns and tones towards the user and network sides of the system.

Figure 3-4 shows a typical FXS Card Test Screen, Table 3-3 lists some actions you can perform from this screen, and Table 3-4 shows the option settings and defaults for each parameter.
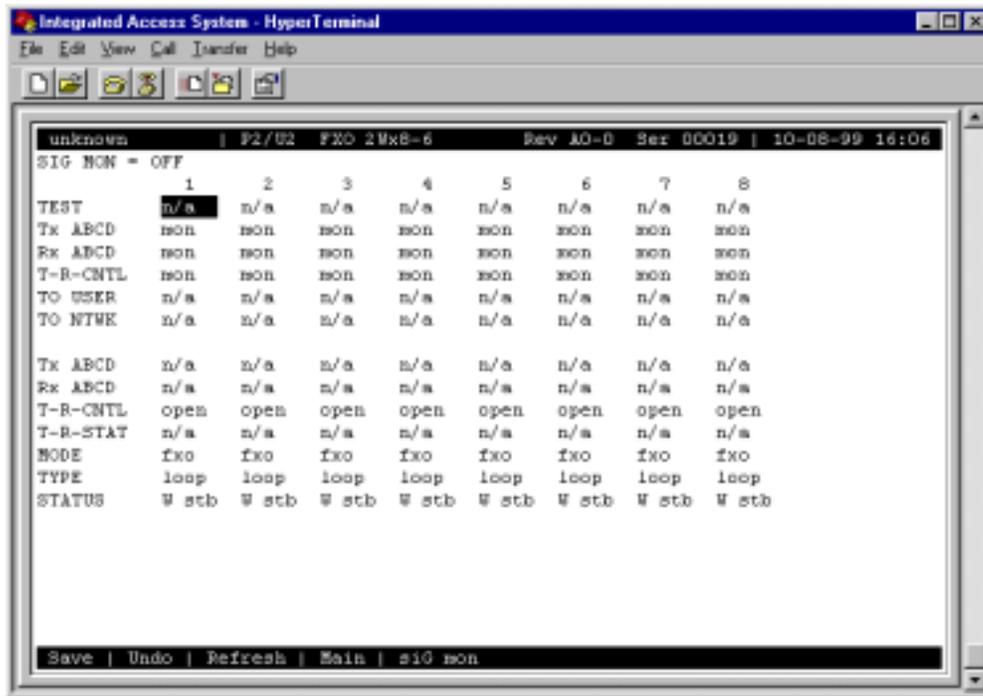
Figure 3-4. Typical FXO Card Test Screen

Table 3-3. Test Screen Actions

Action	Function
Save	Saves changes to settings.
Undo	Returns all settings to the last saved state.
Refresh	Updates certain time-related information fields that are not automatically updated (i.e., test data).
Main	Returns to the FXO Card Main Screen. If changes are made to settings and not saved, you will be prompted to save or lose changes.
siG mon	Used with the user card alarm system to notify you of excessive transitions of signaling bits.

Table 3-4. Test Screen Option Settings and Defaults

Parameter	User Options	Default
SIG MON	off on	off
TEST	off on	off
Tx ABCD	mon set	mon
Rx ABCD	mon set	mon
T-R-CNTL	mon set	mon
TO USER	PCM 300Hz 1kHz 3kHz quiet	PCM
TO NTWK	PCM 300Hz 1kHz 3kHz quiet	PCM
Tx ABCD	Status information only; not editable	n/a
Rx ABCD	Status information only; not editable	n/a

T-R-CNTL	Status information only; not editable	n/a
T-R-STAT	Status information only; not editable	n/a
MODE	Status information only; not editable	n/a
TYPE	Status information only; not editable	n/a
STATUS	Status information only; not editable	n/a

SIG MON

The Signaling Monitor feature works with the user card alarm system to detect excessive signaling bit transitions. The system will generate alarms if the number of transitions of any signaling bit in transmit or receive direction for an active port exceeds 255 in any four second interval. The options are **off** and **on**, and they are toggled by pressing "**g**" (**siGmon** command) in the Test Screen.

TEST

The Test Parameter shows if the port is in the test mode or not. Inactive ports and ports that are assigned to inactive WANs will show a test status of **n/a**. The test status options for active ports are **off** and **on**.

Tx ABCD

The Transmit ABCD setting allows you to either monitor the status of the ABCD signaling bits being transmitted towards the network or set a specific ABCD pattern for testing the transmit side of the circuit. The options for this field are **mon** (monitor) or **set**. Choosing **set** will bring up a four digit field for you to input the ABCD pattern you want to transmit. Any four digit combination of ones and zeros is acceptable for this setting.

Rx ABCD

The Receive ABCD setting allows you to either monitor the status of the ABCD signaling bits being received from the network, or set a specific ABCD pattern for testing the receive side of the circuit. The options for this field are **mon** (monitor) or **set**. Choosing **set** will bring up a four-digit field for you to input the ABCD pattern you want to receive. Any four digit combination of ones and zeros is acceptable for this setting.

T-R-CNTL

The Tip and Ring Control setting allows you to either monitor (**mon**) or set (**set**) the state of the Tip and Ring leads of an FXO port. Choosing **set** will bring up the following options:

- **loop** (the Tip and Ring leads are tied together)

- **open** (the Ring lead is not connected to either Tip or ground)

TO USER

In cross-connect systems only, the To User parameter allows you to break the circuit and send a test tone toward the user side of the system. The options for this field are **PCM**, **300Hz**, **1 kHz**, **3 kHz** and **quiet**. Selecting **PCM** means that you do not want to inject a tone toward the user and that the PCM signal received from the network should continue to be sent to the user port in the normal manner.

TO NTWK

In cross-connect systems only, the To Network parameter allows you to break the circuit and send a test tone toward the network side of the system. The options for this field are **PCM**, **300Hz**, **1 kHz**, **3 kHz** and **quiet**. Selecting **PCM** means that you do not want to inject a tone toward the network and that the PCM signal received from the user port should continue to be sent to the network in the normal manner.

Tx ABCD

The Transmit ABCD information field shows the current values of the ABCD bits that are being transmitted to the network. If TX ABCD in the top half of the screen is changed via the **set** function mentioned above, and the settings are saved by the Save command in the Menu of Actions, the new bit pattern chosen will be reflected here.

Rx ABCD

The Receive ABCD information field shows the current values of the ABCD signaling bits that are received from the network. If RX ABCD in the top half of the screen is changed via the **set** function mentioned above, and the settings are saved by the Save command in the Menu of Actions, the new bit pattern chosen will be reflected here.

T-R-CNTL

The Tip and Ring Control information field shows the current status of the Tip and Ring leads of the FXO port from the perspective of the system. The possible values are:

- **loop** (the Tip and Ring leads are tied together)
- **open** (the Ring lead is not connected to either the Tip or to ground)
- **rgnd** (the Ring lead is grounded)
- **lpgnd** (the Tip and Ring leads are tied together and the Tip is grounded)
- **ring** (ringing voltage is present on Tip and Ring)

T-R-STAT

The Tip and Ring Status information field describes what the attached device is doing with the Tip and Ring leads of the FXO port. The possible values are:

- **ring** (attached device is applying ringing voltage between Tip and Ring)
- **TbRg** (attached device is applying -48V battery to Tip and grounding Ring)
- **ToRo** (attached device is leaving both the Tip and Ring leads open)
- **TgRo** (attached device is grounding the Tip lead and is leaving the Ring lead open)
- **RbTg** (attached device is applying -48V battery to Ring and grounding Tip)
- **RbTo** (attached device is applying -48V battery to Ring and leaving Tip open)
- **TgR*** (attached device is grounding Tip, and the Ring lead state is unknown)
- **ToR*** (attached device is leaving Tip open, and the Ring lead state is unknown)
- **RoT*** (attached device is leaving Ring open, and the Tip lead state is unknown)
- **n/a** (information is not available)

MODE

The Mode information field shows the current mode of the port that was selected on the main FXO card Screen. Valid settings are **fxo**, **fxodn**, **dpt** or **mrd**.

TYPE

The Type information field shows the current status of the signal field selected on the main FXO card screen for this port. Valid settings for both **fxo** and **fxodn** modes are **loop** (loop), **gs** (ground start), **lp-fd** (loop start-forward disconnect) and **R2** (R2). Valid settings for the **dpt** mode are **dpt** (dial pulse terminating), **R2** (R2), **i-R2** (immediate R2), and **dp-em** (Dial Pulse Electromechanical). The only valid setting for the **mrd** mode is **mrd** (manual ringdown).

STATUS

The Status information field shows the current status of the port Table 3-5 lists and describes all of the possible conditions that are reported in this field.

Table 3-5. Status Information Field Settings

Setting	Meaning
stdby	The FXO port is in standby.
W stb	The WAN card to which the FXO port is assigned is in standby.
W tst	The WAN card to which the FXO port is assigned is under test.
W OOS	The WAN card to which the FXO port is assigned is out of service.

noWAN	No WAN card is configured in the slot to which the FXO port is assigned.
call	Call setup is in progress.
busy	Call is in progress.
idle	No call in progress (port is available for a call).
TC	Port is in Trunk Conditioning because a CGA alarm occurred on the associated WAN port.
test	Port is under test (i.e., you are actively controlling the circuit by setting values for Tx ABCD or Rx ABCD).
maint	The port is in a maintenance condition.

3.4   FXO Card Error Messages

Refer to Appendix B in the System Reference Guide for further information on Error Messages regarding this card.

3.5   FXO Card Troubleshooting

The FXO card may be faulty if a voice signal is not received at one end of a circuit, or if signaling is not detected. The following are possible causes:

- Faulty receiving CPE at the near end (where the problem was first noticed)

- Faulty transmitting CPE at the far (opposite) end

- Faulty cabling between the CPE and FXO card at the near end

- Faulty cabling between the CPE and FXO or FXS card at the far end

- T1 or E1 network failure

- Improper card configuration at either end (e.g., time slot and/or WAN port assignments)

First, verify that the T1 or E1 network has not failed. Check for a CGA-Red alarm on the associated WAN port at the end where the incoming VF signal loss is first noticed. The CGA indicates that the incoming network signal was lost (or that the receiving WAN port is out of frame). During the CGA, all voice ports with time slots on that WAN port will also be disabled, and the associated far-end WAN port will be in a CGA-Yellow alarm state. If the network is faulty, you must clear that trouble to restore your circuits.

If the network is okay, verify that the proper WAN ports and time slots are assigned to the associated FXO and FXS voice ports at both ends, as previously outlined in this chapter. In a point-to-point network, the near-end and far-end FX card ports should both be assigned the same WAN port and time slot number. Also make sure the other parameters (such as the transmit and receive TLPs) are set properly at both ends.

If the FX card port parameters are correct at both ends, and if the network is okay, the trouble is isolated to the FXO card or the associated port. Proceed as follows:

   1. At the far end, activate an analog loopback on the FX card port.

2. Send a 0 dBm (digital milliwatt) test signal toward the CPE at that end. That signal will be substituted for the normal signal coming from the far-end CPE; it will be sent back to the CPE at your end via the loopback path.

3. Check your CPE for this signal. If it is present, the far-end CPE or cabling to the far-end FX card is probably faulty. Disable the loopback and test signal there, and fix the problem. If you still don't receive a signal, go to step 4.

4. At your end, go to the FXO Card Main Screen and send a digital milliwatt test tone (0 dBm) toward the CPE. If you still don't receive a signal, check the cabling from the FXO card to your CPE, and check the CPE itself. If those items are okay, replace the FXO card at your end.

5. If the FXO card is determined to be faulty, replace it and return the faulty unit for repair to the location specified by your distributor.

3.6   FXO Card Specifications

FXO Cards (813970 2-wire)		
Number of Ports		
	8 ports	
Physical Interface		
Connector	1 female 50-pin telco connector	
Transmission Performance		
Performance	Exceeds requirements of ITU-T Rec. G.713	
Signaling Modes		
Signaling Modes	**Software selectable on a per port basis:** Foreign Exchange Office (FXO) Foreign Exchange Office- Defined Network (FXSDN) Manual Ringdown (MRD) Dial Pulse Termination (DPT)	
Termination Impedance		
	600 Ohms with 2.16 µF	
VF Transmission Characteristics		
Nominal Transmit TLP	-10.0 dB to +5.0 dB in steps of 0.1 dB	
Nominal Receive TLP	-10.0 dB to +2.0 dB in steps of 0.1 dB	
PCM Encoding	Software selectable on a per port basis	
Attenuation Versus Frequency Relative to 1 kHz with 0 dBm0 input		
Frequency	**Transmit (A to D)**	**Receive (D to A)**
200 Hz	-0.25 to +3.0 dB	-0.25 to +2.0 dB
300 to 3000 Hz	-0.25 to +0.5 dB	-0.25 to +0.5 dB
3200 Hz	0.25 to +0.75 dB	-0.25 to +0.75 dB
3400 Hz	-0.25 to +1.5 dB	-0.25 to +1.5 dB
Return Loss (at 1 kHz)	$\geq$28 dB	
Transhybrid Loss	34dB	
Idle Channel Noise (rcv and xmt)	< -65 dBm0p Typ < -70 dBmop or < 20 dBrnc0	

Interchannel Crosstalk	Typ < -75 dBm0 using 7 adjacent channels being disturbed with a signal of 0.0 dBm0	
Total Distortion including Quantization (Signal to Distortion Ratio) Input Frequencies 1004-1020 Hz		
Input Level	**Rcv or Xmt**	**Overall**
-30 to 0 dBm0	≥35 dB	≥33 dB
-40 dBm0	≥29 dB	≥27 dB
-45 dBm0	≥25dB	≥22 dB
Absolute group delay	< 750 microseconds	
Group Delay Distortion vs. frequency	within boundaries of ITU-T Rec. G.713 Figure 2	
Longitudinal Balance	Nom > 46 dB Typ > 50 dB	
Variation of Gain with Input Level	within boundaries of ITU-T Rec. G.713 Figure 7	
Ringing Signal		
Input level	17 to 28 Hz @ 40 to 110 Vrms	