COASTCOM®

Dual 2-Wire FXS

Foreign Exchange Subscriber

CHANNEL CARDS
33242-104
33242-134

USER'S MANUAL

33242-104-MOD
ISSUE D
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DATE	ISSUE	ECO NO.	REASON FOR CHANGE
1993	A		Initial Release.
1994	B		Addendum for –24 Volt Systems
October 1996	C		Addendum of Product Notice page
January 2002	D	302-267	Add updated Product Notice page to manual; new Warranty page

REGULATORY INFORMATION

FCC NOTICE

Federal Communications Commission (FCC)
Part 15 Regulation For Telephone Equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
The product described herein complies with the requirements of FCC Rules Part 15, subpart B, for a Class A digital device when tested with shielded cables. Fully shielded cables are available from Coastcom. To ensure compliance with FCC rules regarding interference to radio communications, this equipment must be installed with shielded cables equivalent to those available from Coastcom.

FCC REQUIREMENTS

Note: FCC Part 68 rules require the following information to be included in this publication. Some information may not be relevant to Coastcom equipment.

General Information Regarding The Use Of Customer-Provided Telephone Equipment

FCC regulations and telephone company procedures prohibit connection of customer-provided equipment to telephone company-provided coin service central office implemented systems. Connection to party line service is subject to State tariffs.
If you have any questions about your telephone line, such as how many pieces of equipment you can connect to it, the telephone company will provide this information upon request.

INFORMATION FOR CANADIAN CUSTOMERS
Equipment Attachment Limitations
(Canada Only): CP-01, Part I, Section 10.1

NOTICE: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.
Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.
Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.
Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

CP-01, Part I, Section 10.2

NOTICE: The **Load Number** (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the LN (Load Numbers) of all the devices does not exceed 100.

PRODUCT DESCRIPTION

Coastcom
Dual 2-Wire FXS
Foreign Exchange Subscriber
User's Manual

Coastcom's Dual 2-Wire Foreign Exchange Subscriber (Dual 2-Wire FXS) plugs into Coastcom's D/I Mux III. It provides access to two 64-kbps PCM channels. It also features a 2-wire battery interface between the D/I Mux III common equipment and a variety of 2-wire trunk or line circuits, in both toll and subscriber applications. The Dual 2-Wire FXS channel card has two 600 or 900 ohm, 2-wire PCM message circuits. This manual is intended for use by technical planners as well as operation and installation personnel.

Multiplexer Requirements

Model:	D/I Mux III

Software version numbers for Control Units should be:

Common Control Unit (**CCU**) (30305-108)	8.8 (or above)
Common Control Unit (**CCU**) 30305-110)	1.9 (or above)
ALPS CCU (30305-109)	9.8 (or above)
Multiplexer Control Unit (**MCU**) (40305-103)	1.8(or above)
Advanced Multiplexer Control Unit (**AMCU**) (40305-104)	1.8 (or above)

Module

Number:	33242-104/134[1]
Revision:	A (or above)[1]

All equipment specifications subject to change without notice.

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1 The 33242-134 version of the channel unit operates with an extended temperature range of -40 to +75 degrees Celsius.

ADDENDUM (this Addendum applies only to –24 volt systems!)

PRODUCT DESCRIPTION

Coastcom
–24 Volt Dual 2-Wire FXS, Module Number 33242-124 Foreign Exchange Subscriber

User's Manual Addendum (-48 Volt Dual 2-Wire FXS User's Manual 33242-104-MOD, Issue D)

Coastcom's new –24 volt Dual 2-Wire Foreign Exchange Subscriber (Dual 2-Wire FXS) plugs into Coastcom's D/I Mux III and has the same operating characteristics and features as Coastcom's –48 volt unit. This –24 volt unit is designed for operation with a nominal –24 volt talk battery supply. When referring to the manual included with this shipment, all references to –48, -48v or –48 volts should be substituted with (-24 volts).

Since standard 2-wire loops are powered from a –48 volt talk battery, a –48 volt FXS unit can supply normal loop current to a long (high resistance) loop. When –24 volts is available for supplying talk battery, the range of loop resistance is substantially restricted. The new –24 volt unit will supply normal loop current to a subscriber's off-hook application provided the following condition is met.

For this –24 volt FXS unit operating with a –24 volt talk battery, the loop resistance (including the terminating device) may not exceed 650 ohms. This is a maximum of approximately two thousand feet of #26 gauge twisted pair loop length. Excessive loop resistance limits the available loop current from the –24 volt unit, and can lead to audio distortion on the Tip/Ring pair.

With the exception of the loop resistance limitation, this –24 volt FXS channel unit will meet all of the criteria detailed in the –48 volt operating manual.

Interchangeability:

Coastcom's –48 volt standard Dual 2-Wire FXS will operate in a –24 volt system, but the loop current will be set to a minimum value that may cause calls to be dropped, or operation to be unreliable.

Coastcom's new –24 volt Dual 2-Wire FXS will operate in a –48 volt system, but it will set the loop current to double the nominal amount. Although the unit will not be damaged, it may dissipate excessive heat in the loop current driver and in the system power source. It is not recommended for use in a –48 volt system.

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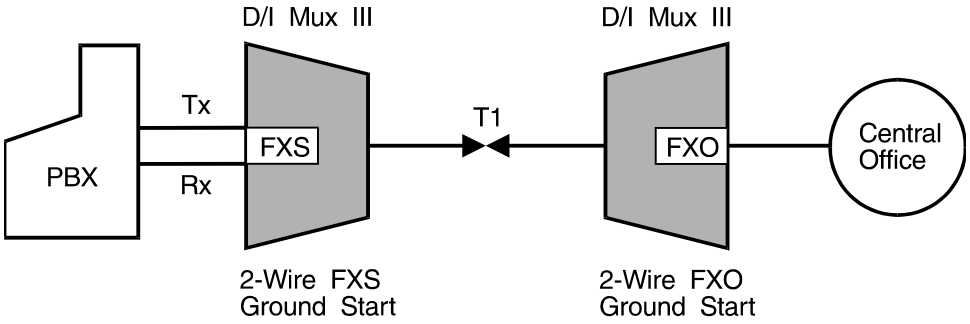
CHAPTER 1. APPLICATIONS

Coastcom's Dual 2-Wire Foreign Exchange Subscriber (Dual 2-Wire FXS) channel card plugs into Coastcom's D/I Mux Intelligent T1 Multiplexer shelves. The Dual 2-Wire FXS supports the following applications:

- Foreign Exchange Subscriber (FXS), Loop Start, Ground Start
- Private Line Automatic Ringdown (PLAR)
- Loop-Reverse Battery (LRB)
- Megacom
    1. 2-Way Megacom
    2. 2-Way Megacom with Battery Reversal
    3. 2-Way Megacom with Wink
    4. 2-Way Megacom with Battery Reversal and Wink
- Voice Transmission Only Application
- Ground-Start Special
- Dialed Number Identification System (DNIS)

FXS/UVG Channel Card Applications

In the Foreign Exchange Subscriber (FXS) ground-start mode, the Dual 2-Wire FXS unit can provide normal battery feed, open the tip, or apply ringing to the line. In the Universal Voice Grade (UVG) mode, the Dual 2-Wire FXS can also apply reverse battery to the line. This information is transmitted over the A and B PCM signaling highways. In the reverse direction, the A and B PCM signaling highways are used to transmit loop closure and ring ground from the subscriber end to the office. In the loop-start mode, the signaling highway is used to receive ringing from the central office and send loop closure to the central office. See Figure 1.



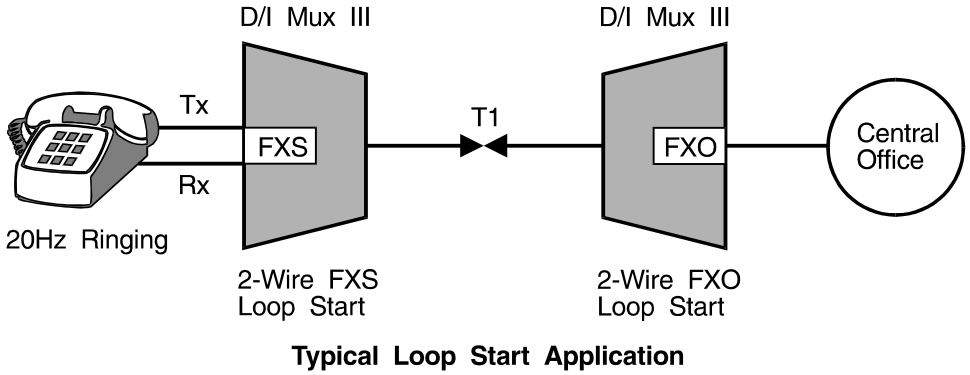


Figure 1. Typical FXS Applications

Private Line Automatic Ringdown (PLAR)

This configuration enables two phones to operate end-to-end without interfacing with a switching office. When one phone goes off-hook, the far-end phone rings. When the ringing phone is answered, conversation can begin. When one end hangs up, the call is terminated. See Figure 2.

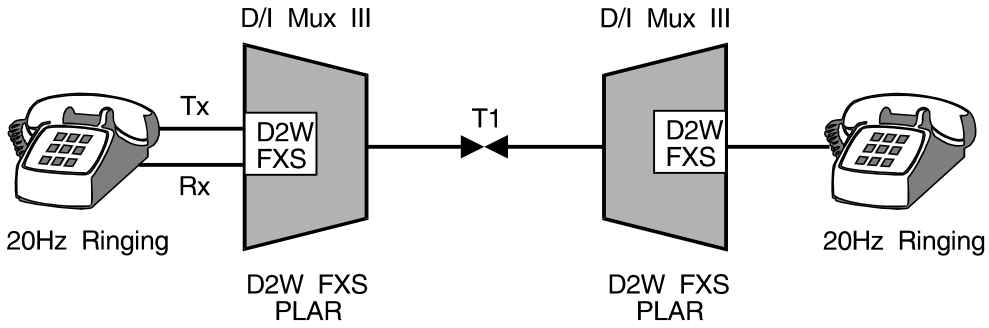


Figure 2. Typical PLAR Application

Loop-Reverse Battery

The Loop-Reverse Battery (LRB) signaling is used to provide Direct Inward Dialing (DID) service. The DID service is used to enable the network to transmit address information to PABX terminal equipment. DID trunks can be used for terminating calls only.

The LRB uses loop-open (on-hook) and closure (off-hook) from the network (central office) toward the terminal private access branch exchange (PABX). It uses battery polarity reversal from the terminal toward the network. A typical call sequence is as follows:

1. At idle, the network sends an on-hook, and the terminal a normal battery (tip at ground, ring at negative battery).
2. The network initiates a call by going off-hook.
3. When the terminal is ready to receive address information, it reverses the polarity of its battery feed, and then to normal (a wink).
4. The network out pulses the address of the extension.
5. The PABX rings the phone at the appropriate extension.
6. If the extension answers, the terminal reverses the polarity of the battery being applied back toward the network.
7. The call is ended, either by the network with a loop open or by the terminal with a reversal back to normal battery.

The Coastcom Dual 2-Wire Foreign Exchange Office (FXO) and Dual 2-Wire FXS channel cards can be used to provide DID service. The FXO card is connected to the customer terminal and the FXS is connected to the network central offices, as shown on Figure 3.

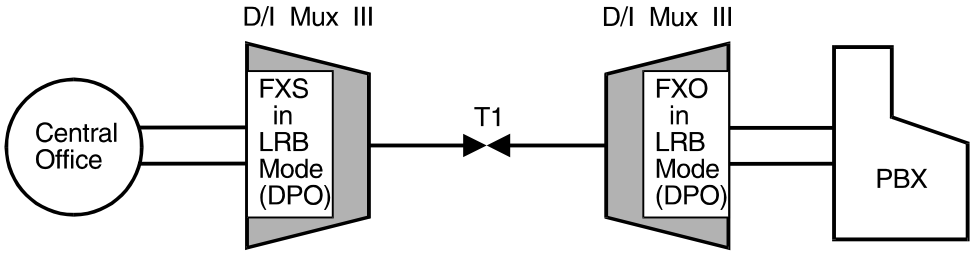


Figure 3. Typical Loop-Reverse Battery Application

The FXS and FXO cards must both be in either LRB mode or UVG mode. UVG mode passes loop start, ground start, and battery reversal signaling; therefore, it is suitable for DID applications when the voice cards at both ends of the T1 span are set for UVG mode.

For applications requiring strict compatibility with the Dial Pulse Origination/Dial Pulse Termination (DPO/DPT) implementation of LRB signaling, select the LRB mode. LRB mode provides standard LRB Carrier Group Alarm (CGA) processing as well as standard T1-level signaling.

The T1-level A and B signaling used in the Coastcom Dual 2-Wire FXS and FXO cards is compatible with the AT&T standard DPO, DPT signaling as defined by AT&T PUB #43801.

Coastcom's original implementation of LRB mode, used in early versions of FXO and FXS cards, was not compatible with standard DPO/DPT signaling (See Table 1). FXS cards with a software revision of A, B, C or D, use an LRB mode that is the same as UVG mode signaling rather than DPT signaling. FXO cards with a software revision of A or B implement an LRB mode which is the same as UVG mode rather than DPT signaling. To use one of these earlier version cards in an LRB application with a current version card, the current card must be in UVG mode. See Table 1.

Table 1. LRB/UVG Settings with Other Card Revision

FXS Revision	Card's LRB Mode	Card's UVG Mode
FXS, Rev A-D	UVG Standard	UVG Standard
FXO, Rev A,B		
FXS, Rev E-J	DPO/DPT Standard	UVG Standard
FXO, Rev C		

Megacom Modes

FXS cards with software revisions up to Revision D, have four modes:

- Megacom: allows outbound calls only.
- Megacom with reverse battery: allows outbound calls only.
- Megacom 800 mode: allows inbound calls only.
- Megacom 800 with wink: allows inbound calls only.

With these pre-software Revision F units, the card can be programmed to support incoming or outgoing calls, but not both.

The 2-Way Megacom Modes

FXS cards with software revisions of F and above, offer 2-way Megacom modes (both inbound and outbound calls are supported in the same mode as shown in Table 2). The following Megacom modes are available to allow any combination of an inbound 800-service with an outbound WATS service:

- 2-Way Megacom
- 2-Way Megacom with Reverse Battery
- 2-Way Megacom with Reverse Battery and Wink
- 2-Way Megacom with Wink

Table 2. Megacom Mode by Software Revision

Software Revision	Megacom Services
FXS Rev A-E	1 Way
FXS Rev F-J	2 Way

Megacom/Megacom 800

The Dual 2-Wire FXS in Megacom mode provides the analog interface between the customer's on-site equipment (CPE), such as a PBX or key system, and an AT&T #4 ESS tandem electronic switch (or equivalent) as shown on Figure 4.

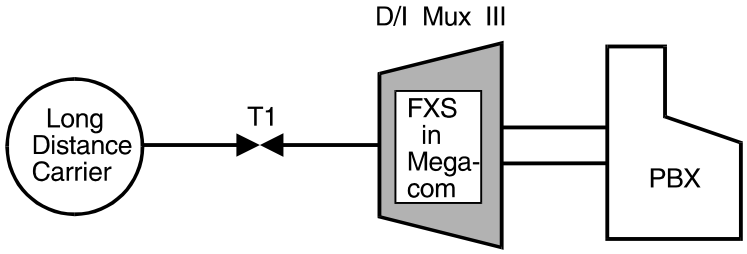


Figure 4. Dual 2-Wire FXS in Megacom

The Dual 2-Wire FXS in Megacom mode provides an interface for two services: Megacom and Megacom 800. Megacom is an outbound Wide Area Telephone Service (WATS). Megacom 800 is an inbound "800" (toll-free long distance) service.

When setting up either service using the Intelligent T1 Multiplexer as a transport, the proper interface options must be provided in the #4 ESS, the customer's on-site equipment and the Dual 2-Wire FXS unit.

Table 3 defines the pertinent options, and the following paragraphs describe the issues of concern.

Table 3. Megacom Service Options

Feature	Service	#4 ESS Trunk Designation	Megacom Options PBX	PBX Trunk Designation
Switch Dial Tone	Megacom	DTS	—	—
CPE Answer Supervision	Megacom	—	Reverse Battery Option	CPE Answer Supervision
Ground Start	Megacom/ Megacom 800	—	Ground Start	Ground Start
Loop Start	Megacom/ Megacom 800	—	Loop Start	Loop Start
CPE Wink Start	Megacom 800	ICOPNOP	Wink On	—
CPE Immediate Start	Megacom 800	MIOPNOP	Wink Off	—

Note: Switch wink start not supported.

Megacom WATS

Ground-start or loop-start supervision is selected according to the PBX (keyset) interface requirements.

The Dual 2-Wire FXS channel unit in Megacom mode is designed to interface trunks in which the switch generates dial tone upon seizure.

The Dual 2-Wire FXS channel unit in Megacom does not support wink-start operation.

On-site answer supervision is provided when the reverse battery on the Dual 2-Wire FXS channel is selected. This option is used for PBX systems requiring a tip-to-ring battery reversal when the outgoing call is answered. The Dual 2-Wire FXS channel unit will reverse the battery back to the CPE when answer supervision (T1 signaling bit A = 1) is received back from the switch.

Megacom 800

Ground-start or loop-start signaling is selected according to the PBX (keyset) interface requirements.

CPE Wink Start

Megacom 800 trunks can be optioned for wink-back supervision (required by some switch applications). The wink supervision option provides a 200-millisecond "wink" on the T1 A and B signaling bits from the Dual 2-Wire FXS channel units back to the switch upon incoming seizure from the switch. This wink simulates the wink normally provided by the PBX on a 2-wire switch interface.

The #4 ESS trunk designation for the wink-start feature listed in Table 4, ICOPNOP refers to "integrity check, with no out pulsing," which means no digits are sent by the switch; but, when the switch seizes a trunk toward the customer, the switch expects to see a wink back.

Table 4. Incoming Call Process

Incoming Call: FXS Detected State	**Tx**		**Rx**		**FXS Output State**
	A	**B**	**A**	**B**	
No Loop Closure No Ring Ground	0	1	1	1	No Tip Ground No Ringing No Battery Feed
	0	1	0 0	0 1	Battery Feed
Loop Closure	1	1	a	a	Battery Feed
Call Terminated by Customer					
Loop Closure	0	1	a	a	Battery feed is removed after a 2-second delay after which a new call can be started.
Call Termination by the Network is not processed.					

Note: This mode is compatible with the Link/2 FXO model #46479-1 by emulating the Link/2 FXS model #47478-1.

CPE Immediate Start

The #4 ESS trunk designation for the CPE immediate start feature (wink off) listed in Table 4, Miscellaneous Operator, No Out Pulsing (MICOPNOP), which means no digits are sent by the switch, and when the switch seizes a trunk toward the customer, the switch does not expect to see a wink back.

Grouped Ringing Applications and Considerations

Megacom 800 applications often have ringing on many or all of the incoming phone lines at the same time. The grouped ringing feature (see Set Line Card Configuration screen in *Chapter 3, Software Configuration*) can be used in this type of application to mitigate the need for an external high-capacity ringing generator. With grouped ringing enabled, the internal Coastcom AC power supply's ringing generator has sufficient capacity to ring the phone lines in nearly all Megacom 800 applications. ***However, if grouped ringing is not enabled, an external ringing generator is required to support a high-capacity Megacom 800 application.***

When grouped ringing is enabled and an incoming call is initiated, the Dual 2-Wire FXS channel card waits for its assigned ringing period before ringing is applied to the phone line. The maximum delay is six seconds before ringing is applied. In ground start applications, or applications with only incoming calls, this is not critical.

In a two way loop-start application, grouped ringing is not recommended due to the potential for both ends of a telephone line or trunk to be seized at the same time for different purposes or by different users. ***For such applications, an external ringing generator is required if the incoming call intensity and phone line ringer loading is sufficient to overload the internal AC power supply's ringing generator.*** See *Chapter 2, Installation*, for ringing generator capacity information.

Voice Transmission Only Application

In applications where signaling is not required, one or both of the FXS channels can be configured to ignore the received signaling. The FXS Transmission Only mode supplies battery feed, but does not require a DC loop closure to function properly. The transmitted signaling bits can be set to function as desired.

Ground-Start Special Signaling

This mode is for interfacing between ground-start customer premises equipment and a digital voice-access channel that utilizes standard ground-start foreign exchange signaling. However, once a call has been initiated in this mode, the call can only be terminated from the customer's equipment. This mode sacrifices the forward disconnect feature (disconnect from the network) to avoid any possibility of a premature disconnect.

The details of the call process are in Tables 4 and 5.

Table 5. Outgoing Call Process

Outgoing Call FXS Detected State	Tx A	Tx B	Rx A	Rx B	FX Output State
No Loop Closure No Ring Ground	0	1	1	a	No Tip Ground No Ringing No Battery Feed
Ring Ground	0	0	—		
Loop Closure	0	0	0	1	Tip Ground
	1	1	a	a	Battery Feed
Call terminated by Customer					
Loop Open	0	1	a	a	Battery feed is removed after a 400 ms delay, after which a new call can be started.
Call Terminated by the Network is not Processed					

Note: a = Designates either 1 or 0.

Dialed Number Identification System (DNIS)

The following describes the DNIS applications using the Dual 2-Wire FXS in DNIS mode.

The DNIS modes are for applications such as automatic voice mail or paging systems with telephone interfaces for Plain Old Telephone Service (POTS) lines. These applications need to receive routing information that is supplied from the carrier or central office with a standard switch interface for passing digits. The routing information can be calling party area code, DID digits, calling parties or other phone numbers.

The Dual 2-Wire FXS can be used in the DNIS mode. This mode effectively emulates a PBX DID interface making it possible for a customer to receive a DID DS0 on a T1, and by using this DNIS FXS mode, interface to equipment designed for POTS lines.

The FXS unit is placed in loop start or ground start mode as required by the Customer Premises Equipment (CPE). The DID protocol expected by the Central Office or Carrier Switch is implemented by the Dual 2-Wire FXS unit. The 2-wire interface supplies POTS signaling to the CPE. Signaling conversion is made at the FXS with DID signaling passing over the T1 span.

The Coastcom DNIS modes support ground start or loop start analog 2-wire lines to the CPE. The digital interface to the switch can be configured for either of the following protocols for receiving digits from a switch:

1. Delay dialing with integrity check.
2. Wink start.

DNIS processing occurs on incoming calls only. Outgoing calls are handled in the same way as the Megacom modes. A typical incoming call sequence is as follows:

1. CPE detects ringing and/or tip ground indicating an incoming call.
2. CPE answers line with a loop closure.
3. Between 200 ms after the line is answered and 2.0 to 6.0 seconds, as set by the "hold time for digits" parameter, the CPE will receive digits from the Carrier or Central Office. Digits are sent MF or DTMF.
4. The CPE routes the call appropriately or drops the line before the "hold time for digits" has expired.
5. The carrier receives answer supervision and the caller is connected at the termination of the "hold time for digits."

It is important not to confuse the DNIS modes with caller identification services which send the callers' phone numbers to the called party between the first and second rings of the phone. These types of services are supported in the standard ground-start or loop-start modes and Universal Voice Grade (UVG) mode by enabling "On-Hook" Transmission. The Coastcom equipment is then transparent to the 1200-baud frequency shift key (FSK) data sent from the central office to the subscriber during the silent period between the rings. It is the CPE's responsibility to demodulate and process the data.

CHAPTER 2. INSTALLATION

The procedures necessary to install the Dual 2-Wire FXS channel card are discussed in this section. Configuring the FXS channel card using software is discussed in the Software Configuration Section.

Setting Switches

If not performing the configuration using software, prior to mounting the card in the shelf, set switches on S1 to their appropriate position for the application. S1 controls the option selection at power up. Figure 5 shows the location of the switch. The switch is "on" when it is positioned to the right.

S1-1 is used to select the 2-wire AC impedance for either 600 or 900 ohm operation.

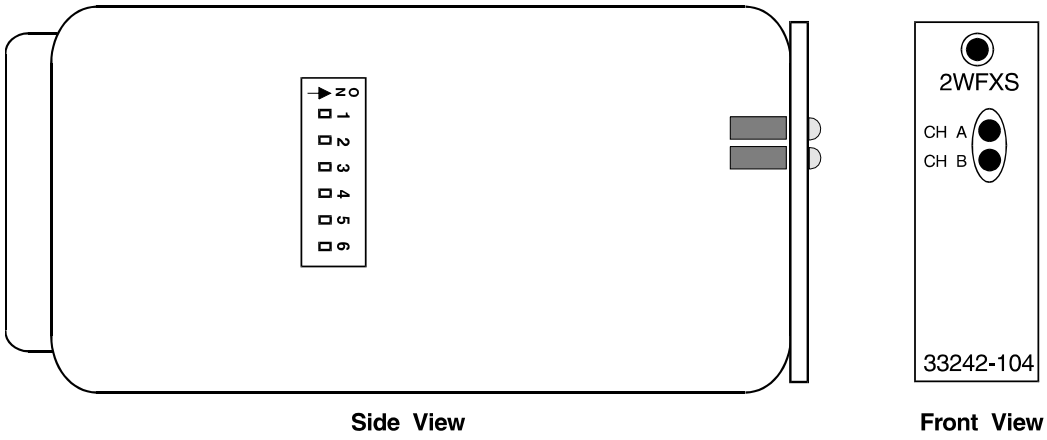


Figure 5. Dual 2-Wire FXS Channel Card Front and Side View

S1-2 is used to set the direction of transmission on the T1 side of the system to either east or west. Table 6 provides the switch settings.

S1-3, S1-4 and S1-5 are used in combination to select the mode of operation. Table 7 provides the switch settings.

S1-6 is used to set the default power-up selection to ground start or loop start. In UVG mode, the Dual 2-Wire FXS will pass the proper signaling states for ground or loop start regardless of the position of S1-6; the position of S1-6 determines how the signaling is controlled during CGA only. See Table 6.

Table 6. Switch Settings for S1-1, S1-2, S1-6

Switch	Off	On
S1-1	600 ohms	900 ohms
S1-2	East (T1-2)	West (T1-1)
S1-6	Ground Start	Loop Start

Table 7. Switch Settings to Set Mode

Mode	S1-3	S1-4	S1-5
FXS	On	On	On
PLAR	On	On	Off
UVG	On	Off	On
Loop Reverse Battery	On	Off	Off
Megacom	Off	On	On
Megacom with Reverse Battery	Off	On	Off
Megacom 800	Off	Off	On
Megacom 800 with Wink	Off	Off	Off

Alternate Battery Feed Mode Selection

Following are detailed instructions for selecting and configuring alternate battery feed modes on the Dual 2-Wire Foreign Exchange Subscriber (FXS) line card as appropriate to the application. Follow all instructions in the order given.

Electrostatic Precautions

Observe appropriate precautions to prevent electrostatic damage to plug-in units. Electrostatic damage can cause semiconductors and other static-sensitive components to fail, resulting in unexplainable test failures and/or degraded performance. A grounded wrist strap must be worn whenever handling static-sensitive line cards or components.

FXS Battery Feed Mode Selection

The FXS Battery Feed mode must be changed in the following circumstances.

1. If the equipment associated with the FXS card requires more loop current than the FXS card normally supplies, the FXS card should be optioned to Voltage Feed Only mode. A requirement for more loop current could be indicated by automatic answering or voice mail systems dropping off the line during the call.

2. If a “motorboating” sound is heard when used with certain PABXs, the FXS should be optioned to Voltage Feed Only mode.
3. If the tip ground provided by the FXS card is insufficient to be recognized by the associated PABX, the FXS should be optioned to Max T/R Voltage mode.

Configuring the FXS Card for Alternate Battery Feed Mode

Option the FXS card for Battery Feed mode by setting option jumpers located on the card for each line. Jumpers W1, W2, W3, and W4 allow specific parameters to be adjusted to provide compatibility with certain PABXs and KSUs. Table 1 below lists each jumper setting, along with the specific function it performs, and system compatibility.

Table 8. Dual FXS Battery Feed Mode Jumper Settings

Function	Compatibility	W1	W2	W3	W4
Normal Battery Feed	Most PABXs/KSUs	A	A	A	A
Voltage Feed Only *	Nortel “Norstar” KSUs	B	B	A	A
Max T/R Voltage	Toshiba PABXs NEC 2200/2400 PABXs	A	A	B	B

* When this option is enabled, the available system DC power sets a limit of eight Dual 2-Wire FXS cards per shelf, unless an external talk battery is used.

Figure 1 below illustrates the Dual 2-Wire FXS card, and the jumper locations referenced in this Product Notice.

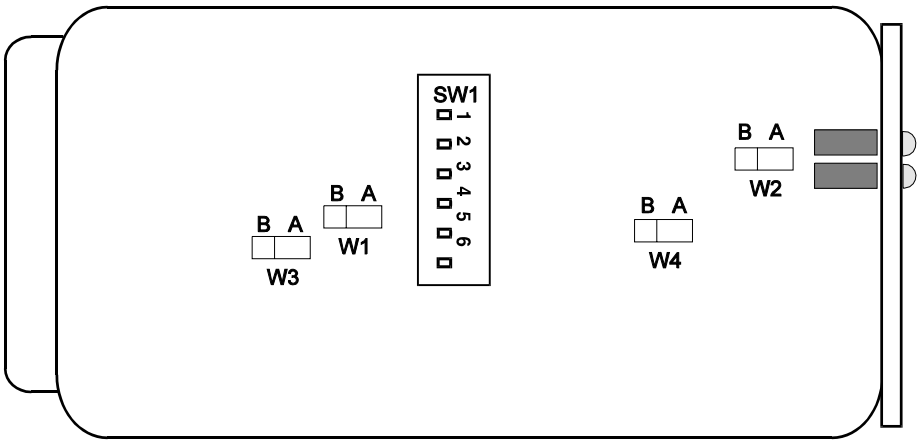


Figure 6. Dual 2-Wire FXS Card and Jumper Locations

External Talk Battery

If an AC-powered D/I Mux III shelf is populated with more than 8 Dual 2-Wire FXS cards which are optioned to operate in the Voltage Feed Only mode, an external talk battery supply must be used to provide the additional current required. This power supply should be a well-filtered -48 volt DC, 2 Ampere unit. To connect this supply, perform the following steps in the order given. (Refer to *Chapter 3. Installation* for the various backplane drawings as applicable.)

1. Place the Talk Battery Strap (W21) in the **OUT** position, and/or remove the wire connecting the BATT and TB terminals of TB1, on the D/I Mux III backplane.
2. Connect the external talk battery power supply to the GND and the TB terminals of TB1, with the -48 VDC lead connected to the TB terminal.

System Power Supply Considerations

The system power source requirements and line requirements are shown on Table **Error! Bookmark not defined.**. This table relates ringing generator capacity to the number of standard phones with one Ringer Equivalence Number (REN) loading. The number of phone lines (see Table **Error! Bookmark not defined.**) can be doubled (as shown in parenthesis) if an electronic load, such as a PBX with a half REN per line, is connected to the D/I Mux III.

Table 9. System Power Supply Considerations

			Number of Lines With One Standard Phone	
Coastcom P/N	**Power Source**	**Ringing Supply**	**Grouped Ringing Enabled**	**Normal Ringing**
30315-105 with 30338-103	110 V AC	Internal	24 (48)	12 (24)
30308-102 not available for 12-slot shelf	110 V AC	Internal	24 (48)	12 (24)
30338-102 with/without a second redundant 30338-102 or one 30338-103	-48 V DC	External	48[1]	48[2]
30314-101	-24 V DC	External	48[1]	48[2]

Note 1: The external ringing generator must supply 1 watt of continuous power for every three standard phones that are ringing provided they are in separate ringing groups.

Note 2: The external ringing generator must supply 1 watt of peak power for each standard phone that is ringing.

Note 3: If using an external ringing generator and an internal AC supply in the multiplexer, disable the ringing generator on the power supply before connecting the external ringing generator. See the shelf installation manual for information on disabling the ringing generator on the AC power supply.

System Wiring

The Coastcom D/I Mux III shelf must have a well-filtered -48 volt DC supply connected to the "TB" talk battery terminal on the back of the shelf. The talk battery is used to provide loop current. If a separate talk battery supply is not available, connect the TB terminal to the -48 volt DC supply, shown in Figures 6 and 7. The multiplexer shelf must also be equipped with either an internal or external ringing voltage generator. If an external ringing generator is used, it must provide a continuous AC ringing voltage (typically 105 volts AC @ 20 or 30 Hz) super-imposed on -48 volts DC. The -48 volt DC biasing of the ringing voltage is typically achieved by connecting one output wire of the ringing generator to the -48 volt shelf supply "BATT" (Terminal 1) and the other output wire to the 20 Hz ringing terminal "20 Hz" or "RNG." See Figures 7 and 8.

Note: When used in the Universal 8-slot shelf (Rev C and Below), the talk battery (W21) connection (T1-1 to T1-5) should be installed.

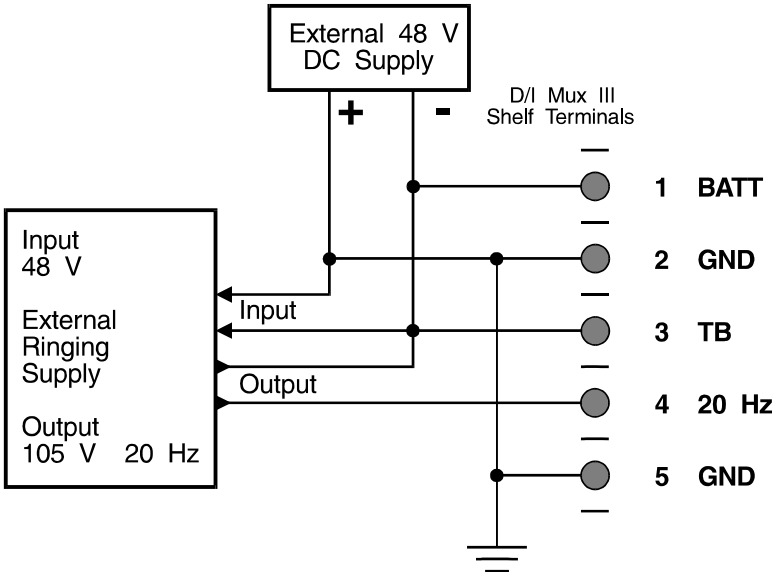


Figure 7. Typical Shelf Wiring for a FXS Application

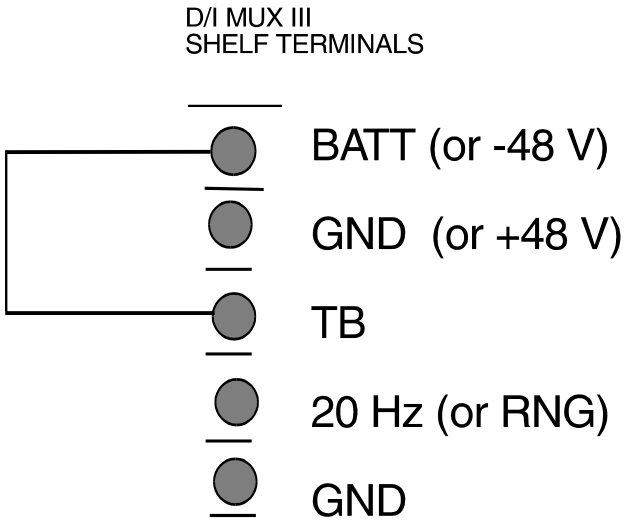


Figure 8. Typical Internal AC-powered Shelf Wiring for a Dual 2-Wire FXS Application

Note: All D/I Mux III 8-slot shelves require talk battery connections.

Electrostatic Precautions

Take precautions to prevent electrostatic damage to plug-in units. Electrostatic damage can cause semiconductors and other static-sensitive components to fail, resulting in unexplainable test failures and degraded performance. To prevent electrostatic damage, follow this procedure when plugging cards into the shelf and unplugging them.

Set up and install the channel card according to the following procedure.

1. Put on a grounded wrist strap. The wrist strap should touch the skin and be grounded through an approximately one-megaohm resistor to an unused terminal block screw labeled GND on the D/I Mux III's backplane.
2. Remove the plug-in card from the static-shielded bag.
3. Loosen the captive screw at the top of the front panel of the Dual 2-Wire FXS channel card.
4. Pull the front panel forward until it is at a right angle from its former position.
5. Slide the channel card unit as far as it can go into the desired card slot in the D/I Mux III shelf.
6. Move the front panel to its upright position so that it is locked into the shelf and then tighten the captive screw.
7. Be sure the channel card is securely seated in the card slot.

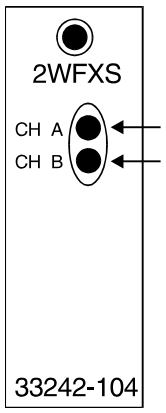
Removing Cards From Shelf

To remove channel cards from the shelf, perform the following procedure:

1. Loosen the captive screw at the top of the front panel of the Dual 2-Wire FXS card.
2. Pull the top of the front panel forward until it is at a right angle from its former position.
3. Slide the channel card unit out of the card slot in the D/I Mux III shelf.
4. Move the front panel to its upright position then tighten the captive screw.
5. Place the card in a static-shielded bag.

Installation of the Channel Card

The Dual 2-Wire FXS unit is a plug-in card that slides into a Coastcom D/I Mux III shelf. It requires one physical card slot. See Figure 9.



Status LED for Channel A
Status LED for Channel B

The status LED indicates when the line is out-of-service, idle, busy or ringing.

1. Channel out of service: the LED blinks in a pattern of one second on, then one second off.
2. Channel idle: the LED is continuously off.
3. Channel busy: the LED is continuously on.
4. Channel ringing: the LED blinks in cadence with the ringing.

Figure 9. Dual 2-Wire FXS Plug-In Card

Set up and install the channel card according to the following procedure:

1. If a control terminal is not available, set the option switches for the desired operation.
2. Loosen the captive screw at the top of the front panel of the line card.
3. Pull the top of the front panel forward until it is at a right angle from its former position.

4. Slide the unit as far as it can go into the desired card slot in the D/I Mux III shelf.
5. Move the front panel to its upright position so that it is locked into the shelf and tighten the captive screw.
6. Be sure the card is securely seated in the card slot.

Install Default Setup

At power up, in the absence of the Common Control Unit override, the options are set according to the settings of S1 and several fixed internal defaults.

The transmit level defaults to 0 dBm; the receive level defaults to -2 dBm.

The line build out capacitance defaults to 0 nano Farads. In ground start, the CGA defaults to two seconds idle followed by busy, or immediately idle in loop start.

Coastcom provides auto mapping. If you want maps which differ from the defaults provided, refer to the channel assignments section in *Chapter 3, Software Configuration*.

Cable Connections

Following are cable connections for the Dual 2-Wire FXS.

Individual Connections

Individual connection to the Dual 2-Wire FXS channel cards can be made using the 25-pin female D-type connectors on the back of the multiplexer. There is a 25-pin connector which corresponds to each channel card slot of the multiplexer. The 25-pin wiring connections are listed in Table 10 and shown on 10.

Table 10. 25-Pin Connections

Designation	Channel A Pin Number	Channel B Pin Number
Tip	21	5
Ring	14	4

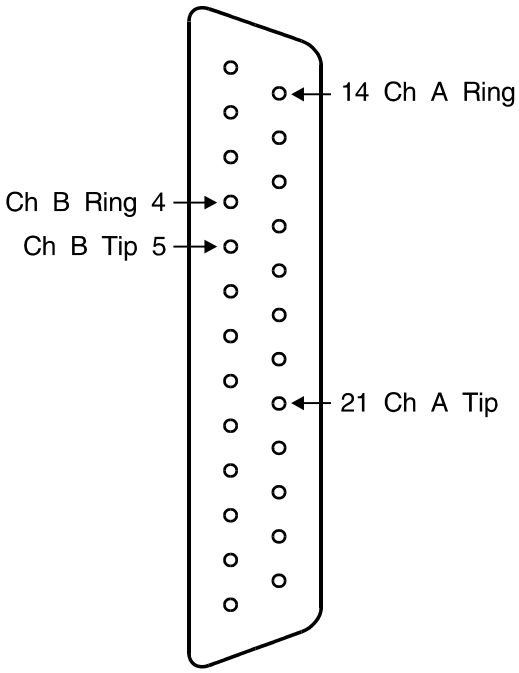


Figure 10. 25-Pin Connector

Bundled Connections

Alternatively, the connection to the Dual 2-Wire FXS can be established using the appropriate pins on the separate 50-pin male T&R connector. The 50-pin wiring connections are listed in Table 11.

Table 11. 50-Pin Connections

Card Slot Designation		Channel A Ring	Channel A Tip	Channel B Ring	Channel B Tip
1	13	1	26	13	38
2	14	2	27	14	39
3	15	3	28	15	40
4	16	4	29	16	41
5	17	5	30	17	42
6	18	6	31	18	43
7	19	7	32	19	44
8	20	8	33	20	45
9	21	9	34	21	46
10	22	10	35	22	47
11	23	11	36	23	48
12	24	12	37	24	49
Not Used	—	—	—	25	50

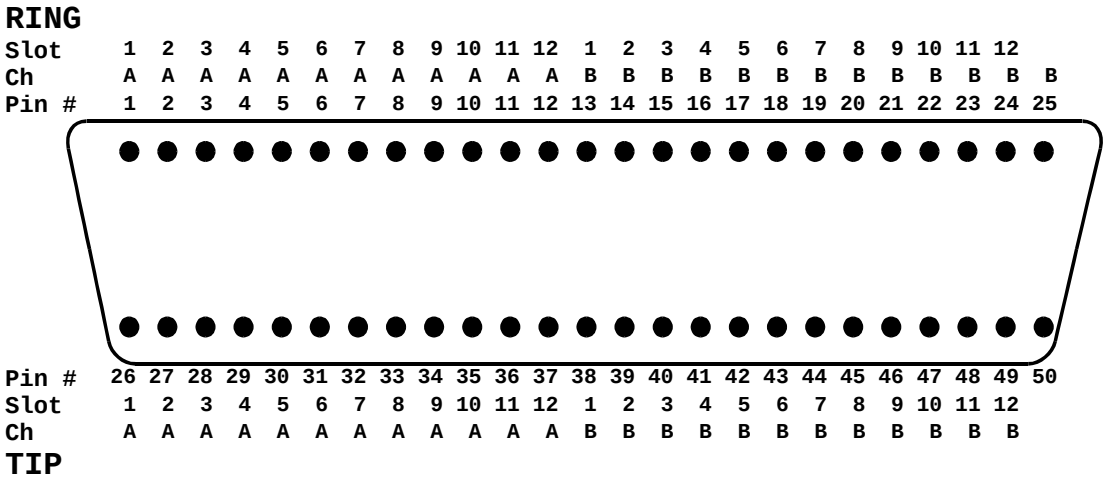


Figure 11. 50-Pin Tip and Ring Connector on 12-Slot and Lower Half of 24-Slot

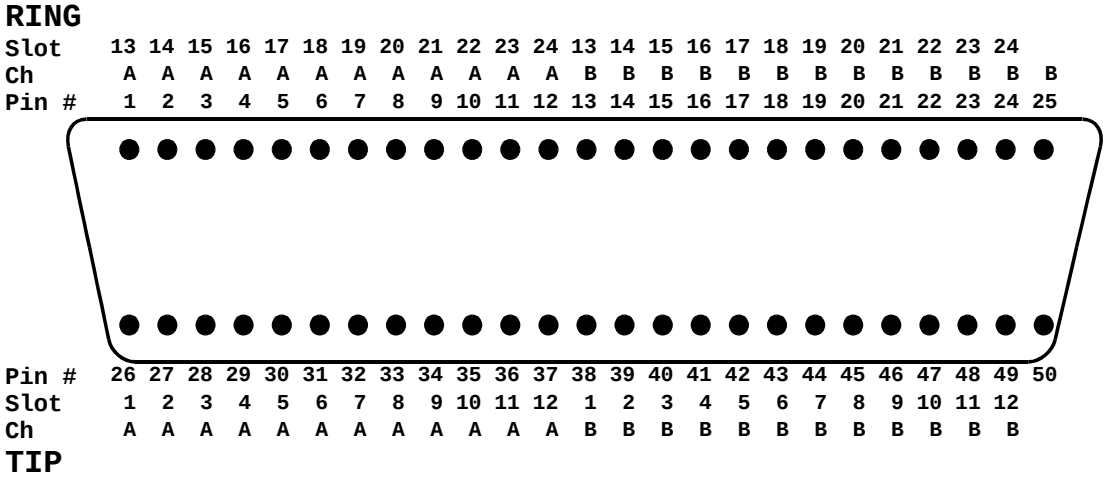


Figure 12. 50-Pin Tip and Ring for Upper Half of 24-Slot Shelf

In order to use the 50-pin connectors, the DATA/VF (voice frequency) jumpers on the back of the D/I Mux III must be placed in the VF position corresponding to the slot being used. DATA/VF jumpers disconnect 50-pin VF connector wires when placed in the DATA position.

DATA/VF jumpers operate only in vertical orientation. The electrical connections should be between pins that are in a vertical position. Jumpers should never be placed in a horizontal orientation.

DATA/VF jumpers allow both voice and data circuits to be installed in a D/I Mux III shelf with voice connections on the 50-pin connectors and data connections on the 25-pin D connectors. These DATA/VF jumpers disconnect the 50-pin VF connector wires when in the DATA position. This enables both voice and data circuits to be installed in a D/I Mux III shelf with data isolated from the 50-pin voice cables. This isolates data from voice wiring and eliminates possible data hits created by voice and signaling crosstalk. The J1 and J4 connectors provide Tip and Ring (T, R).

Grouped Ringing

To maximize the effectiveness of grouped ringing, the cards should be placed in the shelf to equally distribute the ringing loads. The groups are arranged so that if cards are loaded sequentially into the shelf, the groups are automatically distributed. See Table 12.

Table 12. Dual 2-Wire FXS Location vs. Grouped Ringing Assignment

	Ringing Group A	Ringing Group B	Ringing Group C
	1	2	3
	4	5	6
Channel	7	8	9
Card	10	11	12
Slot #	13	14	15
	16	17	18
	19	20	21
	22	23	24

External Ringing Generator Capacity

The total REN per phone line multiplied by the number of lines to be simultaneously rung determines the ringing generator capacity required for the application.

Ringing generator capacity will generally be rated in REN; however, some generators are rated in watts. A simplified method of converting from the required ringing generator capacity in REN to capacity in watts is to multiply the REN amount times 125 percent. For example, if the calculated REN is 18 then the wattage required is 18 (x) 125 percent or 22.5 watts.

Do not supply power for an externally mounted ringing generator from the Coastcom internal AC power supply's 48-volt output. For AC powered installations, the ringing generator should also be AC powered.

Contact Coastcom Customer Service if further assistance is necessary.

CHAPTER 3. SOFTWARE CONFIGURATION

The following procedure provides the user with the necessary data to configure the Dual 2-Wire FXS channel card using the software. See *Chapter 2, Installation* for hardware configuration. The channel card setup procedure can vary depending on the Common Equipment Feature Group (CEFG) and revision. The D/I Mux III must be connected to an asynchronous ASCII terminal (or equivalent). Follow the system configuration and initialization procedures detailed in the appropriate system installation manual.

The option of using the card's switch settings or software command settings is available upon power up. Hardware and software control cannot be intermixed. The following section describes the software configuration process. Perform the steps as outlined. The commands that must be entered are shown in **UPPER CASE BOLDFACE TYPE**. A screen example figure follows each procedure description. Values shown in square brackets (**[ ]**) are default values. If you change the default value, the new value appears in the brackets the next time that parameter is edited. The Enter indicated by **[ENTER]** in the text, must be pressed after each entry. To make corrections, simply backspace and retype entries.

Channel Assignments

Enter **[M], [H]** or **[?]** for a list of the main menu commands. To assign DS0 transmission channels for the two circuits of the Dual 2-Wire FXS channel card enter the Main Menu **[M]** of the D/I Mux III Multiplexer. Select the Edit Map Matrix **[SM]** (set-map) command to create or edit a map matrix. The circuits must be assigned a transmission channel for operation.

After creating a working map and assigning it a map number, select the new map through the Set Working Map **[SN]** (set number of map) command on the Main Menu. For more information on mapping, see the *Shelf Installation Manual*.

Note: Channels A and B must be assigned different DS0s if both channels are needed. If only one channel is needed, assign only that channel to a DS0.

Display Line Card Configuration (DD)

The **DD** command displays the configuration settings and status information of a specific channel card. Perform Steps 1 and 2 below to display line card configuration:

1. To display the configuration, enter the number of the Dual 2-Wire FXS channel card. See Slot Number Screen, below.

```
dd
01 Slot Number
] 01
```

2. Enter the slot number where the card resides. The system displays the current configuration screen. See the Line Card Configuration Screen, below.

```
5:24:34 ----------[ Slot 01:D2W FXS ]---------- 05/04/92

Current Status
  Ch. A : Enabled
  Ch. B : Disabled

Direction
    : T1-1    Loopback                                                    :  Not
Active
Ground/Loop Start                                                         : Loop
Start CGA :  Type-3
Impedance                                                                 : 900
ohm
Card Config.  Ch A                                                        : TO
(A =1, B =1)
Card Config.  Ch B                                                        :
PLAR       Signaling  :  Pre D4

Chan.    Label    Tx Level    Rx Level      Bld Out Cap.    On-hook Trans.
--------  --------  -----------  ------------  ----------------  -----------------
  A        x317      +0.0 dBm   -2.0 dBm      0 nF              Enabled
  B        x318      +0.0 dBm   -2.0 dBm      0 nF              Disabled

              --------- Hardware--------    Serial              Software
Card Type      Part Number    Rev     Number           Revision
-------------------------------------------------------------------------------------
D2W FXS         33242-104       H       123456-7890         J             11/14/91
-------------------------------------------------------------------------------------
 1 ] ol
```

Set Line Card Configuration

1. Use the **SL** command to set the line card operating configuration.
2. Enter the slot number as shown on the Set Line Card Configuration Screen, below.
3. Enter a label for the card slot or **[ENTER]** for no label.

```
Enter Line Card Configuration Information

Slot Number
[16]

Set D2W FXS Line Card Configuration

Label for Slot 16, Channel A (up to 10 Characters)
[screen]

Label for Slot 16, Channel B (up to 10 Characters)
[scrb]
```

4. Enter **N** or **O** to select the source of configuration settings after a power cycle—either **NVRAM** or manual option switches. If you select the **N** program it will take you through the subsequent screens. If **O** is selected, go to Step 15.

```
Source of Configuration Settings after a Power Cycle
 N) NVRAM
 O) Option Switches
[N]
```

5. Enter **1** through **9** or **A** to select mode. Both channels A and B can only be set up for one type of signaling. For example, Channel A and B would be set for FXS if **0** is selected.

Set card to one of the modes
0) FXS
1) PLAR
2) UVG
3) Loop reverse Battery
4) 2 WAY MEGACOM
5) 2 WAY MEGACOM with Reverse Batt.
6) 2 WAY MEGACOM w/Rev. Batt. and Wink
7) 2 WAY MEGACOM with Wink
8) Ground Start Special
9) DNIS Delay Dialing
A) DNIS Enter Line Card Configuration Information
Wink Start
(Transmission Only Mode Is Selectable On A Per Channel Basis
[PLAR]

6. The Channel A configuration is followed by the Channel B configuration. Transmission-only mode can be selected for an individual channel as shown on the Channel A Selections Screen, below.
7. Make Analog Tx, and Rx Levels and Line Build-Out Capacitance selections.
8. Select **1** or **2** to enable or disable On-Hook Transmission.

Channel A
Transmission Only Mode
1) Set TO
2) Clear TO
[TO]

Transmit Signaling Bits*
0) Zero Both Sig. Bits
1) Set Sig. Bit A Only
2) Set Sig. Bit B Only
3) Set Both Sig. Bits

Enable/Disable Channel
1) Enable When Mapped
2) Disable Permanently
[2]

Analog Tx Level (-17.5..2.8 dBm)
[+0.5]

Analog Rx Level (-21.5..0.8 dBm)
[-2.0]

Line Build-Out Cap. (0..126 nF - in 2 nF increm.)
[0]

***** This appears only when TO is selected.

9. Channel B Screen appears as shown below. Select **1** or **2**.
10. Make Analog Tx, Rx, Level and Line Build-Out Capacitance selections.
11. Select **1** or **2** to enable or disable on-hook transmission.

Channel B

Transmission Only Mode
1) Set TO
2) Clear TO
[Clear]

Enable/Disable Channel
1) Enable When Mapped
2) Disable Permanently
[2]

Analog Tx Level (-17.5..2.8 dBm)
[+0.0]

Analog Rx Level (-21.5..0.8 dBm)
[-2.0]

Line Build-Out Cap. (0..126 nF - in 2 nF increm.)
[0]

On-hook Transmission
1) Enable
2) Disable
[2]

12. Specify CGA Type by selecting **0** or **1** or **2** or **3**. The screen will appear as it does below.
13. Select **1** or **2** to Set Impedance Value for both channels.
14. Select **1** or **2** for Ground or Loop Start.
15. Select **Y** or **N** to apply changes.

```
CGA Type
0) Ignore CGA

 1) Type-1
 2) Type-2
 3) Type-3
[3]

Set impedance value for both channels
 1) 600 Ohm
 2) 900 Ohm
[2]

Grouped Ringing
 1)  ON
 2)  OFF
[1]

Apply Changes
 Y) Yes
 N) No
[Y/N] y
] DC
```

Operate Line Card Diagnostics

The **OL** command allows access to the channel card's maintenance and diagnostic capabilities. See the Operate Line Card Diagnostics screen below. The features of the OL screen are described in the following sections.

```
19:35:35----------[Operate Slot 7: D2W FXS] ----------04/12/92

Current Status
  Ch A: Disabled
  Ch B: Disabled

1)  Disable channels on next idle
2)  Disable channels immediately
3)  Set/Clear digital loopback
4)  Line Build-Out Cap. adjustment
5)  Report signaling bits status
6)  Enable channels
7) Ch A Transmit Override Status
8) Ch B  Transmit Override Status

R) Reset card
Q) Quit q
1 ] SL
```

Disable Channels On Next Idle

This feature allows channels to be removed from service without cutting off active calls.

Disable Channels Immediately

This option has the same result as disabling channels using the **SL** command.

Set Clear Digital Loopback

The Set/Clear digital loopback enables the receive digital voice and signaling data to be transmitted back on the digital span. Voice data are looped back in the codecs and signaling bits are looped back in the microcontroller.

Line Build-Out Adjustment

This feature allows direct access to the LBOC settings for interactive adjustment.

Report Signaling Bits Status

Report signaling bits status allows non-intrusive examination of the transmitted and received signaling bits. At the OL screen, select Option 5 to view signaling bit status. This is just a snapshot of the signaling bits at the instant you request the status.

Enable Channels

This feature has the same result as enabling channel using the **LS** command.

Reset Card

The **R** reset card command performs a software restart of the line card resulting in a momentary interruption of service while the system reconfigures the card.

Transmit Override Status

Enabling override suspends normal operation of the channel. The channel can be temporarily set to apply a tip ground, a battery reversal, ringing cadences with or without a ringback tone, a particular Tx signaling state or to turn the LED on or off. This control is useful for diagnostic purposes.

CHAPTER 4. TROUBLESHOOTING

The system control terminal can provide access to the internal self-check capabilities of the channel card. Through the terminal, the operator can request gain-setting status, channel-enable status, card type, card serial number, card revision, firmware revision and a general health check that reports on the status of various parts accessed by the microcontroller.

The individual channels can be looped back for maintenance testing (digital loopback). The channel is looped back toward the T1 side in the digital section of the codec.

The status LEDs on the front panel indicate activity and status of the individual channels. See Table 13.

Table 13. LED Indicators

LED STATUS	CHANNEL STATUS
Steady OFF	Idle
Steady ON	Busy
ON/OFF Following Ringing	Ringing
1 Second On/1 Second OFF	Out of Service

For access to the Dual 2-Wire FXS channel card through the 50-pin connectors, the DATA/VF jumpers must be in the VF position.

If the Dual 2-Wire FXS channel card performs an immediate ring trip upon application of ringing to an open circuit or high impedance, an excessively high ringing voltage should be suspected. Peak voltages in excess of 210 volts activate the over-voltage protection circuitry effectively shorting the ring lead to ground and causing a ring trip.

If a ground-start seizure cannot be made, ensure that the tip and ring connections are not reversed (the open circuit ring voltage is approximately -40V). The ring lead is pulled toward ground to seize the line.

If the unit behaves abnormally, check that both a -48 volt talk battery power supply and an AC ringing voltage supply are connected to the back of the D/I Mux III shelf.

Caution

If the internal AC power supply has a built-in ringer, do not make an external connection to the ringing terminal on the back of the shelf unless the internal supply is optioned for external ringer. See *Chapter 2, Installation*, for more information.

Field repair of line cards is not recommended. Return defective units to Coastcom for prompt repair.

Grouped Ringing

If, under heavy incoming call activity, and some or all of the phones or associated devices do not ring reliably, then the ringing generator is probably being overloaded. This can be verified by measuring the ringing voltage on one of the phone lines during times of heavy ringing demand. If the voltage is less than 50 volts RMS, the ringing generator is overloaded. ***All high capacity Megacom 800 applications that do not have grouped ringing enabled will require an external ringing generator.*** If the application requires more ringing generator capacity, three possible remedies are:

1. Enable grouped ringing (see *Grouped Ringing Applications and Considerations* in *Chapter 1, Applications*).
2. Reduce the total REN per line. This can be done by selecting phones and associated devices that have a lower numerical REN rating. Each FCC-registered phone device has an FCC part 68 label that identifies the REN rating of the device.
3. Option the internal ringing generator to "off" (see Figures 7 and 8) and connect an externally mounted, -48 V biased, continuous output ringing generator to the rear of the shelf (see *Chapter 2, Installation*, for connection information).

FXS circuit cards provide ringing voltage to ring phones and associated devices. The internal AC power supply ringing generator, with grouped ringing enabled, has enough capacity to handle most FXS applications, including high capacity Megacom 800 service. For some heavy duty applications, an external ringing generator may be necessary. ***All high capacity Megacom 800 applications that do not have grouped ringing enabled will require an external ringing generator.*** See *External Ringing Generator Capacity* in *Chapter 2, Installation*, to determine ringing generator capacity.

CHAPTER 5. SPECIFICATIONS

Table 14 displays the specifications of the Dual 2-Wire FXS.

Table 14. Specifications

PARAMETER	PERFORMANCE
Nominal Transmission Levels Transmit Receive	 -17.5 to 2.8 dBm -21.5 to +0.8 dBm
Adjustability	0.1 -dB steps
Accuracy	± 0.25 dB
Line Build Out Range	0 to 126 nF
Frequency Response (expressed as level in dB with respect to level at 1,000 Hz) 60 200 300 - 3,000 3,200 3,400 4,000	 Tx (dB) Rx (dB) < -20, NA +0.25, -3 +0.25, -3 +0.25, -0.5 +0.25, -0.75 +0.25, -0.75 +0.25,-0.75 +0.25, -1.5 +0.25, -0.75 <-14 <-14
2-Wire Impedance	600 ohms or 900 ohms selectable
2-Wire Return Loss ERL SRL	 >28 dB >20 dB
4-Wire Return Loss ERL SRL	 >34 dB >20 dB

Table 14. Specifications (Continued)

PARAMETER	PERFORMANCE
Longitudinal Balance (measured according to IEEE 455) Frequency (Hz) 200 500 1,000 3,000	 Balance (dB) 58 min 58 min 58 min 53 min
Idle Channel Noise (end-to-end)	<20 dBrn CO
Crosstalk (loss at 200 to 3,400)	>65 dB
Signal to Distortion Input Level (dBm0) 0 to -30 -40 -45	 Tx or Rx (db) 35 min 29 min 25 min
Tracking Error **Input Level (dBm0)** +3 to -37 -37 to -50	 **Tx or Rx (dB)** 0.25 max 0.5 max
Dial Pulse Distortion	46% to 75% break at the COT when the RT sees 8 to 12 pulses per second when at 58% to 64% break to any loop less than 1,500 ohms
Maximum Loop Length	1,500 ohms or approximately 9 K ft. of 26-gauge twisted pair wire with a 430 ohm phone
Operating Environment Temperature Humidity	Extend range for use in 8- or 24-slot shelves: 0 to 50 degrees Celsius -40 to +75 degrees Celsius* 0 to 95% noncondensing * For the 30355-134 version

APPENDIX A. SIGNALING TABLES

APPENDIX A. SIGNALING TABLES

This appendix provides the user with signaling tables for the Dual 2-Wire FXS channel card.

Megacom Signaling

FXS Signaling

PLAR Signaling

Universal Voice Grade

Loop Reverse Battery Signaling (LBR)

DNIS

How To Use The Tables

For Tables 15 and 16 if you are selecting Option 1 (CPE Disconnects Call), use step numbers in Option 1 Column. If you are selecting Option 2 (Switch Disconnects Call) use Option 2 Column.

For Tables 17 and 18, any one of the four possible call progressions listed in the first four columns can be followed by the step numbers of that column.

Tables 19 through 24 show the relationship between the FXS detected analog state and the transmitted A and B signaling bits, as well as the relationship between the received A and B signaling bits and the generated 2-wire signaling output.

Tables 25 through 27 indicate call progressions. The different possible call termination sequences are denoted by letters associated with the step numbers.

In tables, text which is set in bold type indicates changed state.

Megacom Signaling

The following tables detail types of Megacom signaling.

Table 15. Megacom Call Progress for a Switch-Originated Call in Ground-Start Mode

1*	2*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
1	1	Idle	Open	Open	-48	Open	0/a	0/0	n/a
2	2	Switch initiates call (seizure)	**GND[b]**	Open	-48	Open	**1/a[b]**	0/0 0/1/0 Send wink 140-290 ms	n/a
3	3	Megacom rings into CPE	GND	Open	**-48/20 Hz 4-sec 2-sec cycle[b]**	Open	1/a	0/0	Ringback supplied to switch from Megacom coincident with ring cycle
4	4	CPE answers	GND	**Loop[b]**	-48	**Loop[b]**	1/a	**1/1[b]**	Loop detect or ring tip as required
5		CPE disconnects call	GND	**Open[b]**	-48	**Open[b]**	1/a	**0/0[b]**	n/a
6		Switch recognizes release (idle)	**GND[b]**	Open	-48	Open	**0/a[b]**	0/0	n/a

Note: In Table 15, the following notations apply:

*1. Reverse battery ON or OFF - CPE disconnects call.

*2. Reverse battery ON or OFF - Switch disconnects call.

[a]= Does not matter.

[b] = Changed state.

Table 15. Megacom Call Progress for a Switch-Originated Call in Ground-Start Mode (Continued)

1*	2*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
7		FXS/TA unit opens tip	Open	Open	-48	Open	0/a	1/1	n/a
	5	Switch disconnects call	GND	Loop	-48	Loop	**0/a[b]**	**1/1[b]**	n/a
	6	FXS/TA unit opens tip	**Open**	Loop	-48	Loop	0/a	**0/0[b]**	n/a
	7	CPE recognizes release (idle)	Open	**Open[b]**	-48	**Open[b]**	0/a	0/0	n/a

Note: In Table 15, the following notations apply:

*1. Reverse battery ON or OFF - CPE disconnects call.

*2. Reverse battery ON or OFF - Switch disconnects call.

a = Does not matter.

b = Changed state.

Table 16. Megacom Call Progress for a Switch-Originated Call in Loop-Start Mode

1*	2*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
1	1	Idle	GND	Open	-48	Open	**0/a**	0/0	n/a
2	2	Switch initiates call (seizure)	GND	Open	-48	Open	**1/a**	0/0 0/1/0 Send wink 140-290 ms[b]	n/a
3	3	Megacom rings into CPE	GND	Open	**-48/20 Hz 4-sec 2-sec cycle [b]**	Open	1/a	0/0	Immediate start of ringing cycle —ringback supplied to switch from Megacom coincident with ring cycle
4	4	CPE answers	GND	**Loop[b]**	-48	**Loop[b]**	1/a	**1/1[b]**	Loop detect or ring tip as required
5		CPE disconnects call	GND	**Open[b]**	-48	**Open[b]**	1/a	**0/0[b]**	n/a
6		Switch recognizes release (idle)	GND	Open	-48	Open	**0/d[b]**	**0/0b**	n/a

Note: In Table 16, the following notations apply:

*1. Reverse battery ON or OFF - CPE disconnects call.

*2. Reverse battery ON or OFF - Switch disconnects call.

a = Does not matter.

b = Changed state.

Table 16. Megacom Call Progress for a Switch-Originated Call in Loop-Start Mode (Continued)

1*	2*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
	5	Switch disconnects call	GND	Loop	-48	Loop	**0/a[b]**	1/1	n/a
	6	FXS/TA unit opens Tip	**Open[b]**	Loop	-48	Loop	0/a	**0/0[b]**	Tip is open for 500 ms; CPE must open loop
	7	CPE recognizes release (idle)	GND	**Open[b]**	-48	**Open[b]**	0/a	**0/0[b]**	n/a

Note: In Table 16, the following notations apply:

*1. Reverse battery ON or OFF - CPE disconnects call.

*2. Reverse battery ON or OFF - Switch disconnects call.

a = Does not matter.

b = Changed state.

Table 17. Megacom Call Progress for a CPE-Originated Call in Ground-Start Mode

1*	2*	3*	4*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
1	1	1	1	Idle	Open	Open	-48	Open	**0/a**	0/0	n/a
2	2	2	2	CPE initiates call (seizure)	Open	Open	-48	**GND[b]**	0/a	0/0	CPE applies GND to ring
3	3	3	3	Megacom signals switch	Open	Open	-48	GND	0/a	**1/1b**	Megacom waits 100 ms
4	4	4	4	Megacom applies tip to GND	**GND[b]**	Open	-48	GND	0/a	1/1	n/a
5	5	5	5	CPE converts ring GND to loop	**GND[b]**	Loop	-48	**Loop[b]**	1/a	1/1	n/a
6	6	6	6	CPE Dials	GND	**Loop, Make/ Break or DTMF[b]**	-48	Loop Make/B reak, or DTMF	0/a	**1-0-1 or 1[b]**	Loop, Make/Break converted to Tx Sig A/B, or DTMF sent through VVF path
7	7	7	7	Switch answers	GND	Loop	-48	Loop	1/a	1/1	n/a
8	8			Megacom reverses battery toward CPE	**-48[b]**	Loop	**GND[b]**	Loop	1/a	1/1	n/a

Note: In Table 17, the following notations apply:

*1. Reverse battery ON - CPE disconnects call.
*2. Reverse battery ON - Switch disconnects call.
*3. Reverse battery OFF - CPE disconnects call.
*4. Reverse battery OFF - Switch disconnects call.
a = Does not matter.
b = Changed state.

Table 17. Megacom Call Progress for a CPE-Originated Call in Ground-Start Mode (Continued)

1*	2*	3*	4*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
9				CPE disconnects call	-48	**Open[b]**	GND	**Open[b]**	1/a	**0/0[b]**	n/a
10				Switch recognizes release	-48	Open	GND	Open	**0/a[b]**	0/0	n/a
11				Megacom returns to idle	**Open[b]**	Open	**-48[b]**	Open	0/a	**0/0[b]**	Delay = 500 ms
	9			Switch disconnects call	-48	Loop	GND	Loop	**0/a[b]**	1/1	n/a
	10			Megacom opens tip and returns to normal battery	**Open[b]**	Loop	**-48[b]**	Loop	0/a	**0/0[b]**	Delay = 500 ms
	11			CPE recognizes release	Open	**Open[b]**	-48	**Open[b]**	0/a	0/0	n/a
		8		CPE switch disconnects call	GND	**Open[b]**	-48	**Open[b]**	1/a	0/0	n/a
		9		Switch recognizes release (idle)	GND	Open	-48	Open	0/a	0/0	n/a

Note: In Table 17, the following notations apply:

*1. Reverse battery ON - CPE disconnects call.
*2. Reverse battery ON - Switch disconnects call.
*3. Reverse battery OFF - CPE disconnects call.
*4. Reverse battery OFF - Switch disconnects call.

a = Does not matter.
b = Changed state.

Table 17. Megacom Call Progress for a CPE-Originated Call in Ground-Start Mode (Continued)

1*	2*	3*	4*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
		10		Megacom returns to idle	**Open[b]**	Open	-48	Open	0/a	0/0	n/a
			8	Switch disconnects call	GND	Loop	-48	Loop	**0/a**	1/1	n/a
			9	Megacom opens tip	**Open[b]**	Loop	-48	Loop	0/a	**0/0[b]**	n/a
			10	After 500 ms, Megacom returns to idle	Open	**Open[b]**	-48	**Open[b]**	0/0	**0/0[a]**	n/a

Note: In Table 17, the following notations apply:

*1. Reverse battery ON - CPE disconnects call.
*2. Reverse battery ON - Switch disconnects call.
*3. Reverse battery OFF - CPE disconnects call.
*4. Reverse battery OFF - Switch disconnects call.

a = Does not matter.
b = Changed state.

Table 18. Megacom Call Progress for a CPE-Originated Call in Loop-Start Mode

1*	2*	3*	4*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
1	1	1	1	Idle	GND	Open	-48	Open	**0/a**	0/0	n/a
2	2	2	2	CPE initiates call (seizure)	GND	**Loop[b]**	-48	**Loop[b]**	1/a	**1/1b**	CPE applies DC loop between tip and ring
3	3	3		CPE dials	GND	**Loop, Make/ Break or DTMF[b]**	-48	**Loop, Make/ Break or DTMF[b]**	0/a	**1-0-1 or 1[b]**	Dialing should start at least 220 ms after seizure
4	4	4	4	Switch answers	GND	**Loop[b]**	-48	**Loop[b]**	1/a	**1/1[b]**	n/a
5	5			FXS/TA reverses battery toward CPE	-48	Loop	GND	Loop	**1/a[b]**	1/1	n/a
6				CPE dis-connects call	**-48[b]**	Open	**GND[b]**	Open	1/a	0/0	n/a
7				Switch recognizes release	-48	**Open[b]**	GND	**Open[b]**	0/a	0/0	n/a
8				Megacom returns to idle	GND	Open	-48	Open	**0/a[b]**	0.0	Delay = 500 ms
	6			Switch disconnects call	**-48b**	Loop	**GND[b]**	Loop	**0/a[b]**	1/1	n/a

Note: In Table 18, the following notations apply:

*1. Reverse battery ON - CPE disconnects call.
*2. Reverse battery ON - Switch disconnects call.
*3. Reverse battery OFF - CPE disconnects call.
*4. Reverse battery OFF - Switch disconnects call.

a = Does not matter.
b = Changed state.

Table 18. Megacom Call Progress for a CPE-Originated Call in Loop-Start Mode (Continued)

1*	2*	3*	4*	Signaling Condition	Tip to CPE	Tip from CPE	Ring to CPE	Ring from CPE	Rx Sig A/B	Tx Sig A/B	Comments
	7			Megacom opens tip, returns to normal battery	**Open[b]**	Loop	**48[b]**	Loop	**0/a[b]**	**0/0**	Tip is open for 500 ms; CPE must open loop
	8			After 500 ms, Megacom returns to idle	**GNDb**	**Open[b]**	-48	**Open[b]**	0/a	0/0	Delay= 500 ms
		5		CPE disconnects call	GND	**Open[b]**	-48	**Open[b]**	1/a	1/1	n/a
		6		Switch recognizes release (idle)	GND	**Open[b]**	-48	**Open[b]**	0/a	**0/0[b]**	n/a
			5	Switch dis-connects call	GND	Loop	-48	Loop	0/a[b]	xx	xx
			6	Megacom opens tip	**Open[b]**	Loop	-48	Loop	**0/a[b]**	**0/0[b]**	Tip is open for 500 ms; CPE must open loop
			7	After 500 ms, Megacom returns to idle	**GND[b]**	**Open[b]**	-48	**Open[b]**	0/a	0/0	n/a

Note: In Table 18, the following notations apply:

*1. Reverse battery ON - CPE disconnects call.
*2. Reverse battery ON - Switch disconnects call.
*3. Reverse battery OFF - CPE disconnects call.
*4. Reverse battery OFF - Switch disconnects call.

a = Does not matter.
b = Changed state.

FXS Signaling

The following tables detail types of FXS signaling.

Ground Start Mode

Table 19. Foreign Exchange Subscriber End

Foreign Exchange Subscriber End (FXS) Ground-Start Mode					
VF Input to FXS	**Transmit (Tx)a**		**Receive (Rx)a**		**FXS VF Output**
	A	**B**	**A**	**B**	
Loop open no ring (ground)	0	1			
Ring ground	0	0	**1[c]**		No tip ground
Loop closure	1	1	**0[c]**	1	Tip ground
			1	**b**	No tip ground No ringing
			0	1	Tip ground No ringing
Loop Open[b]			0	0	Ringing
Loop Closure[b]			0	0	Tip ground

Note: In Table 19, the following notations apply:

[a] = Signaling channel states in the DS1 Signal.

[b] = Designates either 1 or 0.

[c] = Indicates information is "Qualifier Blanks Indicate No Effect."

Table 20. FXS Subscriber Loop-Start Mode

Loop Start Mode					
VF Input to FXS	**Transmit (Tx)[a]**		**Receive (Rx)[a]**		**FXS VF Output**
	A	**B**	**A**	**B**	
Loop Open	0	1			
Loop Closure	1	1			
			b	1	No Ringing
			b	1	No Ringing
Loop Open[c]			**b**	0	Ringing
Loop Closure[c]			**b**	0	No Ringing

Note: In Table 20, the following notations apply:
[a] = Signaling channel states in the DS0 Signal.
[b] = Designates either 1 or 0.
[c] = Indicates information is "Qualifier Blanks Indicate No Effect."

PLAR Signaling

The following tables detail types of PLAR signaling.

Table 21. Private Line Auto Ring (PLAR) for D4

Private Line Auto Ring (PLAR) For D4					
VF Input to PLAR	**Transmit (Tx)[a]**		**Receive (Rx)[a]**		**PLAR VF Output**
	A	**B**	**A**	**B**	
Loop Open	1	1	**b**	**b**	
Loop Closed	0	0	**b**	**b**	
Loop Open	1	1	1	**b**	No Ringing
Loop Open	1	1	0	**b**	20 Hz Ringing
Loop Closed	0	0	0	**b**	No Ringing

Note: In Table 21, the following notations apply:
[a] = Signaling channel states in the DS1 Signal.
[b] = Designates either 1 or 0.
PLAR will apply ringing only if loop is open when Rx A switches from 1 to 0.

Table 22. Private Line Auto Ring (PLAR) for PRE D4

Private Line Auto Ring (PLAR) for PRE D4					
VF Input to PLAR	**Transmit (Tx)[a]**		**Receive (Rx)[a]**		**PLAR VF Output**
	A	**B**	**A**	**B**	
Loop Open	0	0	**b**	**b**	
Loop Closed	1	1	**b**	**b**	
Loop Open	0	0	0	**b**	No Ringing
Loop Open	0	0	1	**b**	20 Hz Ringing
Loop Closed	1	1	1	**b**	No Ringing

Note: In Table 22, the following notations apply:
[a] = Signaling channel states in the DS0 Signal.
[b] = Designates either 1 or 0.
PLAR will apply ringing only if loop is open when Rx A switches from 0 to 1.

UVG Signaling

The following table details UVG signaling.

Table 23. UVG Ground-Start/Loop-Start Signaling

Universal Voice Grade					
VF Input to FXS	**Transmit (Tx)[a]**		**Receive (Rx)[a]**		**FXS VF Output**
	A	**B**	**A**	**B**	
Loop Open No Ring Ground	0	1			
Ring Ground	0	0	**1[b]**		No Tip Ground
Loop Closure	1	1	**0[b]**		Tip Ground
			1	1	No Tip Ground No Ringing
			0	1	Tip Ground No Ringing
Loop Open[b]			0	0	Ringing
Loop Closure[b]			0	0	Tip Ground
Loop Closure[b]			1	0	Reverse Battery
Loop Open[b]			1	0	Tip Ground

Note: In Table 23, the following notations apply:
[a] = Signaling channel states in the DS0 Signal.
[b] = Indicates information is Qualifier, Blanks Indicate No Effect.

LRB Signaling (Loop Reverse Battery)/DPO

The following tables detail types of LRB signaling/DPO.

Table 24. LRB Signaling/DPO

Dial Pulse Originating (DPO)					
VF Input to DPO	**Transmit[a] (Tx)**		**Receive[a] (Rx)**		**DPO VF Output**
	A	**B**	**A**	**B**	
Loop Open	0	0			
Loop Closure	1	1			
			0		Normal Battery
			1		Reverse Battery

Note: In Table 24, the following notations apply:
[a] = Signaling channel states in the DS0 Signal.

DNIS (Wink Start or Delay - Dial Mode)

The following tables detail types of DNIS signaling.

Table 25. DNIS Delay Dialing Call Process (Incoming)

FXS Detected State	Transmit (Tx) A	Transmit (Tx) B	Receive (Rx) A	Receive (Rx) B	FXS Output State
No Loop Closure No Ring Ground	0	0	0	a	GS: No Tip Ground LS: Tip Ground
	0	0	1	a	Apply two seconds on, four seconds off ringing (no ringback tone)
90 ms after Rx A=1	1	1			
Loop Closure	0	0			Digits are sent from the network DTMF or MF
After the hold time for digits	1	1			Digits are sent from the network DTMF or MF
Call Terminated by Customer					
Loop Open	0	0	0	a	Switch recognizes release
Call Terminated by Network					
	0	0	0	a	For more than 500 ms LS: Tip Open for 500 ms GS: Tip Open
Customer Recognizes Release Within 500 ms					

Note: In Table 25, the following notations apply:
[a] = Designates either 1 or 0.

Table 26. DNIS in Wink Start Mode (Incoming)

Incoming Call in Wink Start Mode	FXS Detected State	Transmit (Tx) A	Transmit (Tx) B	Receive (Rx) A	Receive (Rx) B	FXS Output State
1	No Loop Closure No Ring Ground	0 0		0 a		No Tip Ground No Ringing
2		0 0		1 a		Two seconds on, four seconds off ringing (with ringback tone) is applied.
3	Loop Closure	200 ms wink followed by the hold time for DTMF or MF digits from the Network. After which Tx A=1, B=1.				
4	After the hold time (default of 2.5 sec.)	1 1				If customer goes back on-hook during hold time for digits, answer supervision is not sent.
5A	Call terminated by customer; Loop Open	0 0		0 a		Switch recognizes release
5B	Call terminated by Network	0 0		0 a		For more than 500 ms LS: Tip open for 500 ms GS: Tip open.
6B	Customer recognizes release within 500 ms; Loop Open.	0	0	0 a		

Note: In Table **Error! Bookmark not defined.**, the following notations apply:
a = Designates either 1 or 0.

Table 27. DNIS Outgoing Call (Wink Start or Delay-Dial Mode)

Outgoing Call in Wink Start or Delay Dial Mode	FXS Detected State	Transmit (Tx) A B	Receive (Rx) A B	FXS Output State
1	No Loop Closure No Ring Ground	0 0	0 a	GS: Top Tip Ground LS: Tip Ground
2	GS: Ring ground followed by Loop Closure	1 1	0 0	GS: Tip ground
3	DTMF, MF or DP dialing			Winks and open intervals are tolerated with no resultant forward disconnect. Some carriers wink after receiving digits.
4			1 1	Call complete.
Call Terminated by Customer				
	Loop Open	0 0	0 a	Switch recognizes release
Call Terminated by Network				
			0 a	For more than 500 ms LS: Tip Open for 500 ms GS: Tip Open
	Loop Open	0 0	0 a	

Note: In Table 27, the following notations apply:
a = Designates either 1 or 0.

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Hardware Warranty and 90-Day Support Agreement

Coastcom warrants that hardware products of its own manufacture shall, at date of shipment and for 24* months from said date, be free from defect in materials. These products will perform substantially as described in applicable Coastcom written materials and support services shall be substantially as described in applicable Coastcom written materials.

*Please note the following exceptions:

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- Any product, part or assembly not manufactured by Coastcom is subject to such warranty of the original manufacturer as negotiated by Coastcom.

If any Coastcom product shall be determined by Coastcom to be defective in material or workmanship under normal intended usage and maintenance during the warranty period, then Coastcom shall repair or replace, with substantially equivalent product, at Coastcom's sole discretion, such defective product. Such replacement shall not include the cost of labor by Buyer's own employees, agents or contractors in identifying, removing or replacing the defective product. Coastcom's liability for breach of any and all warranties hereunder is expressly limited to the repair or replacement of defective products as set forth in this section. In no event shall Coastcom be liable for special, incidental or consequential damages by reason of any breach of warranty or defect in material or workmanship. Coastcom shall not be responsible for the repair or replacement of products which have been subjected to neglect, accident or improper use or installation, acts of God, or which have been altered by other than authorized Coastcom personnel. This warranty is not transferable except from a VAR or Distributor to an end-user.

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