

A large graphic of the letters "D4" in a bold, blue, sans-serif font. The letters are set against a background of green diagonal stripes that create a sense of depth and perspective. The entire graphic is enclosed within a thin green rectangular border.

**D4**

# **TRANSMISSION MODULE USER'S MANUAL**

**AT&T 365-170-400**

TRANSMISSION MODULE  
USER'S MANUAL

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**FEDERAL COMMUNICATIONS COMMISSION (FCC)  
RULES AND REGULATIONS PART 68**

**NETWORK CONNECTION INFORMATION**

The FCC registration number for the D4 channel bank is EFE6BT 13792-WP-N for early versions or A5593M-17388-XD-E for later versions. The FCC registration number for the AT&T 551C-L1 Channel Service Unit used in the D4 Transmission Module is HBN3C8-17369-DE-N. Table A lists the registered D4 channel unit cards (ports).

**FEDERAL COMMUNICATIONS COMMISSION (FCC)  
RULES AND REGULATIONS PART 15**

**RADIO FREQUENCY DEVICES**

**WARNING**

New FCC rules require that you be notified of the following:

- This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications.
- The equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of the FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.
- Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures will be required to correct the interference.
- This equipment as ordered and shipped by AT&T, meets the requirements of the FCC rules, and has Underwriters Laboratory approval. Any changes (additions or deletions) to this equipment by a customer may result in not meeting these requirements.

**RURAL ELECTRIFICATION ADMINISTRATION (REA) ACCEPTANCE**

The AT&T D4 channel bank has received REA acceptance for the REA Specification PE-60A.

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**TABLE A**  
**LIST OF SYSTEM PORTS**  
**D4 CHANNEL UNITS FCC REGISTRATION NUMBER**  
**EFE6BT 13792-WP-N OR A5593M-17388-XD-E**

STATUS	INTERFACE TYPE	MFR. PART NUMBER	MNEMONIC NAME	SERVICE CODES	LEADS	USOC
R	TL11E	J98726BT-2,L2,T	2E&M6	9.0F	4	RJ2EX
R	TL11E	J98726BT-3,L3	2E&M6	9.0F	4	RJ2EX
R	TL12E	J98726BT-2,L2,T	2E&M6	9.0F	6	RJ2FX
R	TL12E	J98726BT-3,L3	2E&M6	9.0F	6	RJ2FX
R	TL31E	J98726BP-3,L3	4E&M ER	9.0F	6	RJ2GX
R	TL31E	J98726BP-3,L3,A	4E&M ER	9.0F	6	RJ2GX
R	TL32E	J98726BP-3,L3	4E&M ER	9.0F	8	RJ2HX
R	TL32E	J98726BP-3,L3,A	4E&M ER	9.0F	8	RJ2HX
R	TL31E	J98726BC-3,L3	4E&M	9.0F	6	RJ2GX
R	TL31E	J98726BC-4,L4	4E&M	9.0F	6	RJ2GX
R	TL32E	J98726BC-3,L3	4E&M	9.0F	8	RJ2HX
R	TL32E	J98726BC-4,L4	4E&M	9.0F	8	RJ2HX
R	TL31E	J98726BN-3,L3	PLR	9.0F	8	RJ2HX
R	TL31E	J98726BN-4,L4	PLR	9.0F	8	RJ2HX
R	TL32E	J98726BN-3,L3	PLR	9.0F	8	RJ2HX
R	TL32E	J98726BN-4,L4	PLR	9.0F	8	RJ2HX
R	04DU5-24	J98726DB-2 L4,A,D,G	OCU DP2.4	6.0Y	4	RJ48S/T
R	04DU5-48	J98726DB-2 L5,B,E,H	OCU DP4.8	6.0Y	4	RJ48S/T
R	04DU5-96	J98726DB-2 L6,C,F,J	OCU DP9.6	6.0Y	4	RJ48S/T
R	04DU5-24, 48,56,96	J98726DJ-1,L1,T	OCU DP Multispeed	6.0Y	4	RJ48S/T
R	04DU5-56	J98726DE-1 L1,A,B	OCU DP 56KB	6.0Y	4	RJ48S/T
R	02N02	J98726SJ-2 L2,T,C	2TO	9.0F	2	RJ21X
R	04N02	J98726SH-3,L3	4TO	9.0F	4	RJ2DC
R	04N02	J98726SH-3,L3,C	4TO	9.0F	4	RJ2DC
R	04N02	J98726SQ-3,L4	4ETO	9.0F	4	RJ2DC
R	04N02	J98726SQ-4,L4,C	4ETO	9.0F	4	RJ2DC

**TABLE A (Contd)**  
**LIST OF SYSTEM PORTS**  
**D4 CHANNEL UNITS FCC REGISTRATION NUMBER**  
**EFE6BT 13792-WP-N OR A5593M-17388-XD-E**

STATUS	INTERFACE TYPE	MFR. PART NUMBER	MNEMONIC NAME	SERVICE CODES	LEADS	USOC
R	2-Wire Loop (02LS2)	J98726BL-2,L2	2FXO-LS	0.7B	2	RJ21X
R	2-Wire Loop (02LS2)	J98726BE-4,L5	2FXO-LS	0.7B	2	RJ21X
R	2-Wire Loop (02LS2)	J98726BE-2,L3	2FXO	0.5B	2	RJ21X
R	2-Wire Grd. (Dual Purpose Unit) (02GS2)	J98726BE-2,L3	2FXO	0.5B	2	RJ21X
R	2-Wire Grd. (Dual Purpose Unit) (02GS2)	J98726BE-4,L5	2FXO	0.5B	2	RJ21X
R	2-Wire DID (02RV2-T)	J98726BA-5 L5,A	DPO	0.0B	2	RJ21X

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## 1. INTRODUCTION

### Overview

This document contains a physical and functional description of the Transmission Module and detailed installation and maintenance procedures. It is intended to be used by qualified technicians familiar with the Transmission Module equipment.

This document is not a technical specification. However, technical specifications for the products described in this manual are contained in other documents. The AT&T product warranty is set forth in the applicable sales documents or contracts under which the product is purchased and delivered.

### Reason For Reissue

This manual is reissued to include new capabilities and services available with the Transmission Module. All existing and new Transmission Modules can be configured and/or equipped to provide these new capabilities and services.

### What Is The Transmission Module and What Does It Do?

The Transmission Module contains equipment that sends and receives voice and data transmission signals. It accepts analog or digital signals from customer equipment, converts all signals to a specific digital format, and sends that digital format to another (far end) location. The digital format can be in the form of electronic signals or optical signals depending on the type of transmission facility used. At the far end location, the Transmission Module converts the received digital format signals into the original analog or digital signal sent by the customer equipment. The customer equipment can be telephones, data sets, or other related types of communication equipment. See Figure 1-1. The Transmission Module equipment is available installed in a 42-inch or 6-foot tall cabinet or in a 7-foot tall rack. It is available in several configurations consisting of one or more D4 channel banks and associated auxiliary and power equipment.

### Applications

The Transmission Module provides customer-to-public network (telephone company) transmission services or stand-alone transmission services. Examples of stand-alone transmission services include:

- Local networks (e.g., intracommunication between various points within a campus or within a business premises)
- Remote networks (e.g., intercommunication between various campuses or business locations).

The D4 channel bank functions as the "heart" of the Transmission Module. It can be configured to provide the following types of services and/or capabilities:

- Voice transmission (telephone to telephone)
- Data transmission (data set/computer to data set)
- Program transmission (audio television, AM and FM radio monaural and stereo, broadcast network remote and access links)

- Integrated Low Bit Rate Voice capability (transmitting up to 48 channels over one DS1 line facility)
- ESF (Extended Super Frame) for extending the capabilities of the present DS1 signal to provide in-service performance monitoring, a data link channel, and 16-state robbed-bit signaling
- B8ZS (Bipolar Eight Zero Substitution) for 64 kb/s clear channel data transmission
- Security transmission (remote indication for status of on-premises security or fire alarms)
- Lightguide transmission (transmission using a fiber optic line facility)
- Integrated Services Digital Network (ISDN) transmission by using the Basic Rate Interface Transmission Extension (BRITE) channel unit card
- T1 Data Multiplexer (T1DM) format interface for greater flexibility in data transmission over the standard D4 format.

The Transmission Module is versatile and can be used in a variety of applications such as:

- Seasonal or temporary demands (sports events, conventions, resort areas, or disaster areas)
- Digital Data System (DDS) services
- Market testing new services before deploying dedicated equipment
- Tariffed services offered by AT&T such as MEGACOM<sup>®</sup> service and MEGACOM 800 service, or ACCUNET<sup>®</sup> switched 56 digital transmission service.

Figure 1-1 illustrates some of the typical applications of the Transmission Module.

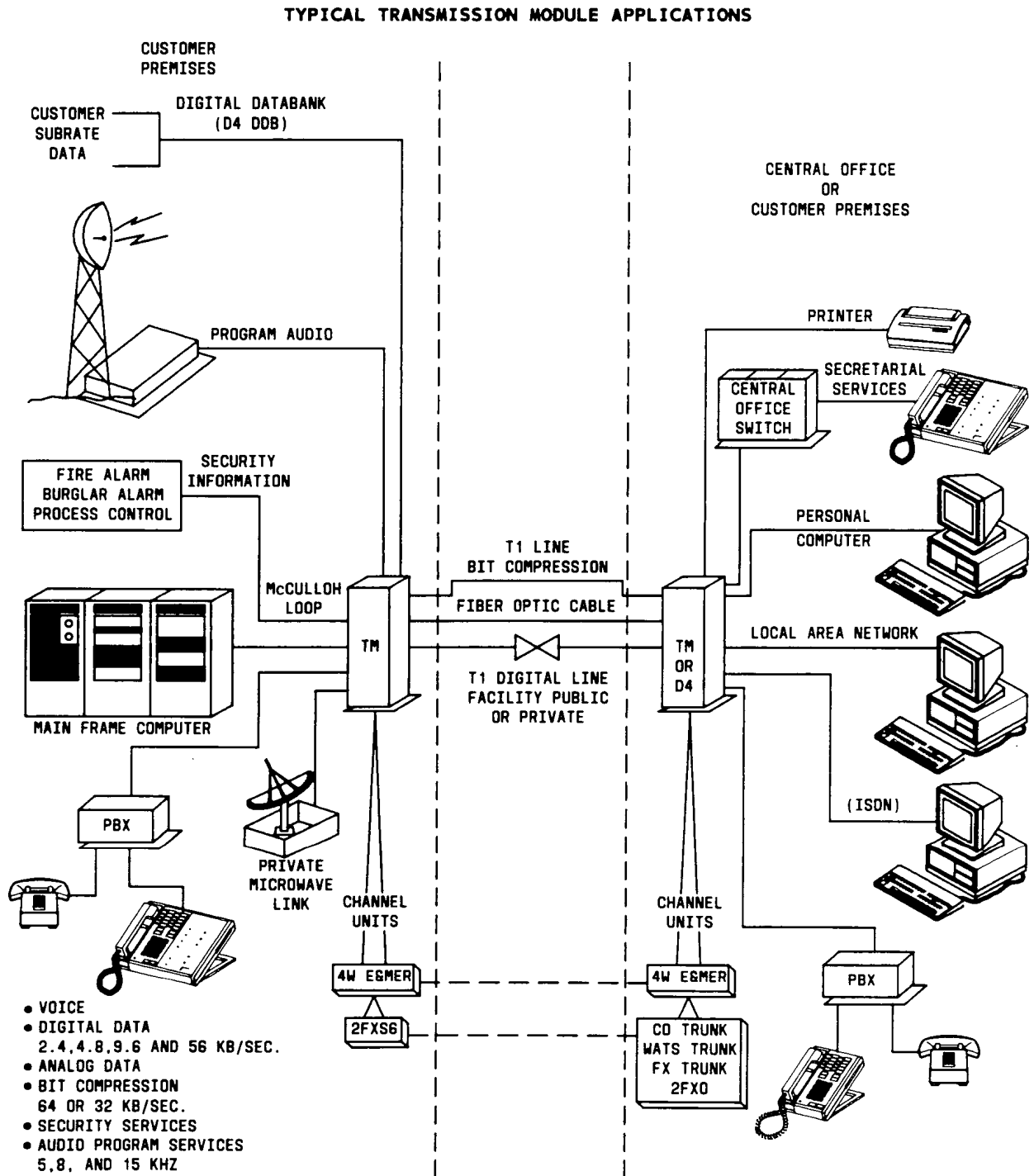


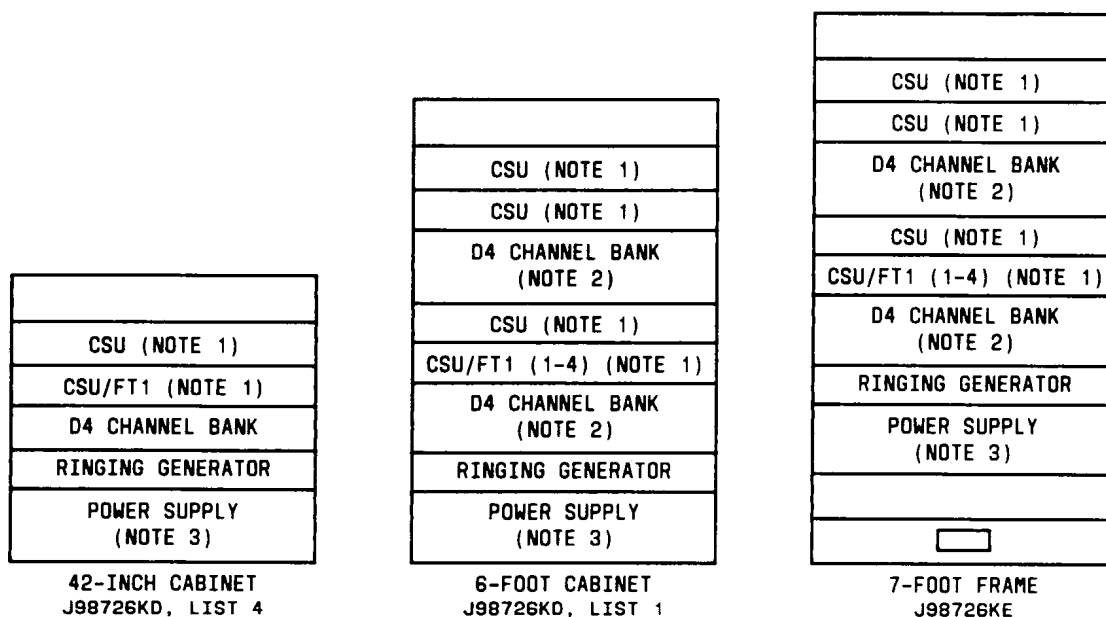
Figure 1-1. Typical Transmission Module Applications

**2. DESCRIPTION****Overview**

This section contains a physical and functional description of the Transmission Module and all its equipment. It also contains descriptions of transmission capabilities and services. The first part of this section contains the physical descriptions with the following parts containing the functional descriptions.

**Transmission Module Physical Description**

The Transmission Module equipment is available in a 42-inch tall (J98726KD, List 4) cabinet, a 6-foot tall (J98726KD, List 1) cabinet, or a 7-foot tall frame (J98726KE). See Figure 2-1. The Transmission Module operates within a temperature range of +40 to +100°F and a relative humidity of 20 to 55 percent.

**NOTES:**

1. A maximum of two CSUs required per D4 channel bank. Up to four FTIs can be used except in the 42-inch cabinet.
2. Contains a maximum of two D4 channel banks with an appropriate number of CSUs/FTIs.
3. Ringing Generator and Power Supply may be mounted together on the same shelf.

**Figure 2-1. Transmission Module Cabinet and Frame Versions**

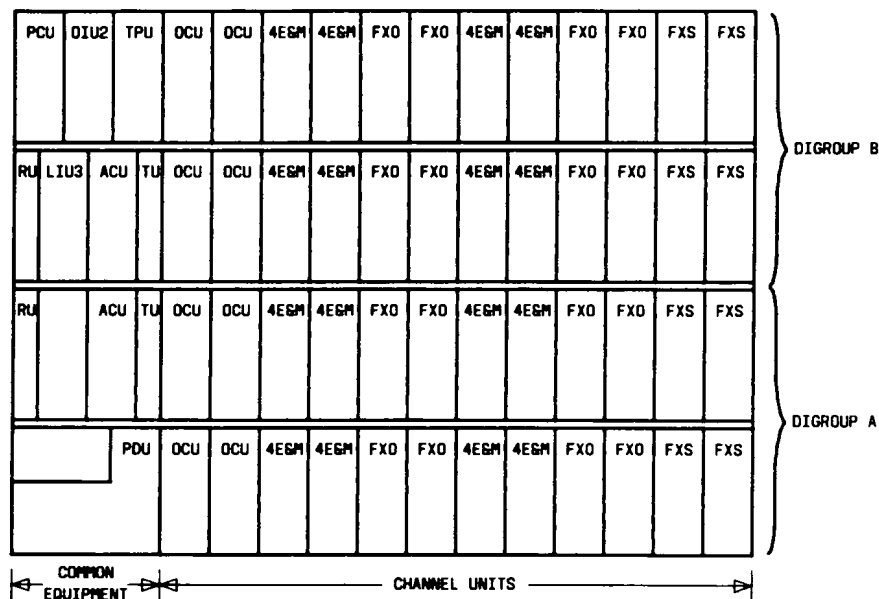
The Transmission Module contains a combination of the following equipment depending on how it is ordered:

- D4 Channel Bank(s) with appropriate common unit cards and channel unit cards
- 551C-L1 CSU(s) (Channel Service Unit)
- FT1(s) (Optical Transmission Unit)
- 20-Hz Ringer
- Power Supply.

Figure 2-1 shows the equipment locations for both the cabinet and frame versions of the Transmission Module. It may be ordered having one or more D4 channel banks with or without CSUs/FT1s.

#### D4 Channel Bank Physical Description

The D4 channel bank, Figure 2-2, contains a number of common unit cards and channel unit cards housed in four shelves. The common unit cards are located on the left side in each shelf with the channel unit cards located on the right side. The bank has 48 channel unit slots, 12 on each shelf.



**Figure 2-2.** Typical D4 Channel Bank With Sample Channel Units

The D4 channel bank is divided into two digroups. Each digroup consists of its common unit cards (RU, ACU, and TU) and up to 24 channels. The digroups are designated A and B. The two shelves of the bottom half of the bank house the A digroup cards. The two shelves of the top half house the B digroup cards. A functional description of the D4 channel bank including its cards is provided in the latter part of this section.

#### 551C-L1 Channel Service Unit Physical Description

The 551C-L1 CSU (Channel Service Unit) consists of a chassis with a top and rear cover. Its locations in the Transmission Module are shown in Figure 2-1. The CSU contains a F0003/1

Signal Monitor Unit and a F0003/2 Office Repeater. It has various T1 line alarm and status indicators, looping switches, and 310-type access jacks. The rear of the CSU contains a 15-pin customer interface connector and a 20-pin terminal strip for access to the T1 line facility and associated equipment. Other terminal strips for powering options and connections are also contained on the rear of the CSU. The rear cover must be removed to gain access to the connector and terminal strips. A functional description of the CSU including its indicators and switches is provided in the latter part of this section.

### **FT1 Optical Transmission Unit Physical Description**

There are three versions of the FT1 (NJ04073A-1) optical transmission unit that can be used in the Transmission Module. The three versions are Lists 1, 3, and 4. Each version can be placed on the FT1 shelf assembly as shown in Figure 2-1. The shelf assembly is equipped with a power strip for connecting power to the FT1 unit(s).

All three versions are the same size: 1.5 inches high, 4.5 inches wide, 7.5 inches deep, and weigh approximately 1.5 pounds each. The front panel of the unit contains four status indicators and the rear panel of the unit contains three connectors, a 3-position switch, and a power cord with spade-lug terminals.

A functional description of the FT1 units including their indicators and switches is provided later in this section.

### **20-Hz Ringer Physical Description**

Figure 2-1 shows the 20-Hz ringer mounted above the power supply near the bottom of each cabinet and near the bottom of the frame version of the Transmission Module. The 20-Hz ringer has no visual indicators (lamps) or switches. It has a 1-amp fuse located in the -48 volt input from the power supply. A functional description of the 20-Hz ringer is provided in the latter part of this section.

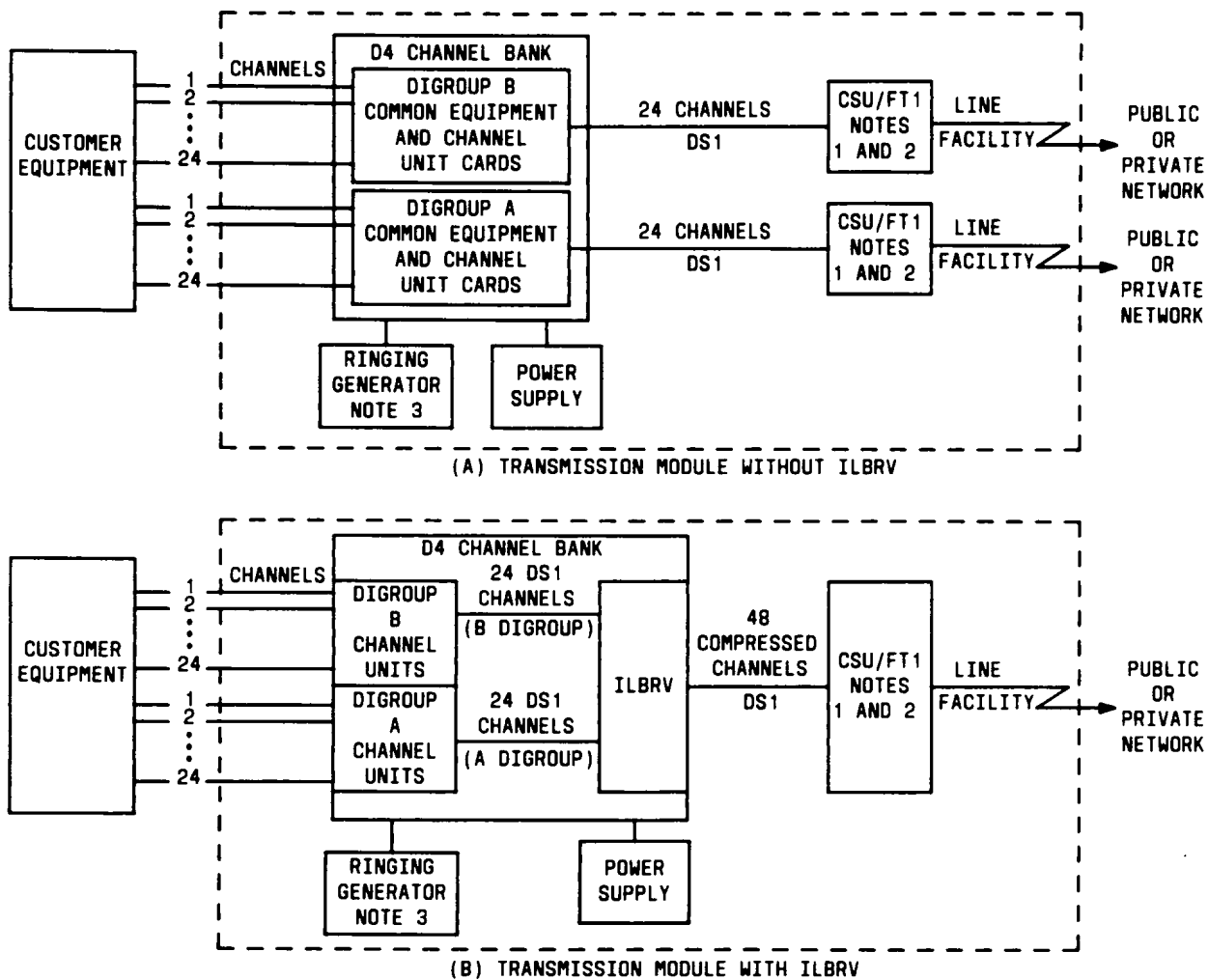
### **Power Supply Physical Description**

Figure 2-1 shows a power supply mounted in the bottom of each cabinet and at the bottom of the frame version of the Transmission Module. There are two power supplies available, depending on the equipment contained in the Transmission Module. The power supplies have no visual indicators (lamps) or switches. Each power supply has a power cord that connects to any standard 110 V ac outlet. A functional description of the power supply is provided in the latter part of this section.

### **Transmission Module Functional Description**

Figure 2-3 shows overall functions of typical Transmission Module configurations. Up to 48 individual analog or digital channels connect to the D4 channel bank from the customer equipment. The D4 channel bank can multiplex (combine) these channels for 48-channel transmission over one DS1 facility or 24-channel transmission over two separate DS1 facilities. The Transmission Module interfaces to the DS1 public or private network facility through a CSU or through a FT1 fiber transmission unit.





Notes:

1. CSU required if metallic line facility connects to Public Network and may be required if metallic line facility connects to Private Network.
2. FT1 required if fiber optic line facility connects to Public or Private network.
3. Required for Foreign Exchange Circuits which use 2FXS, 2FXS/LS, or 2FXS/GT channels units.

Figure 2-3. Transmission Module Functional Diagram

**D4 Channel Bank Functional Description**

The D4 channel bank converts voice-frequency analog or digital signals into a digital format for transmission over a digital carrier facility. It can operate in various modes called modes 1, 2, 3, 4, and 5. The mode of operation is determined by the type of common unit cards installed. For Transmission Module installations, the mode of operation is normally Mode 3. Therefore, this document supports Mode 3 operation, especially in the areas of installation and initial testing, service, and maintenance. The other modes of operation are defined in the Glossary section and are described in other AT&T Practices listed in the References

section. Mode 3 produces 2 separate DS1 signals with each DS1 signal consisting of 24 multiplexed channels. Figure 2-4 illustrates Mode 3 operation. Referring to Figure 2-4, Mode 3 operation divides the D4 channel bank into two digroups. The channel units (up to 24) of each digroup serve as interfaces to the customer's equipment. Each digroup has a transmit and a receive unit to handle transmission of data from and to the channel units and to the line interface unit. One line interface unit serves both digroups and is the D4 channel bank interface to the DS1 line facilities. The specific functions of the common unit and channel unit cards are described later in this section.

The D4 channel bank provides various types of transmission capabilities and services. These are available by selection of certain common unit and/or channel unit cards and/or with appropriate selections of options available on the cards. These transmission capabilities and services include the following:

- B8ZS (Bipolar Eight Zero Substitution) Format
- ESF (Extended Super Frame) Format
- ILBRV (Integrated Low Bit Rate Voice)
- ISDN (Integrated Services Digital Network) and Digital Pipe Applications
- D4 DDB (Digital Data Bank)
- Independent Digroup Timing
- T1DM (T1 Data Multiplexer) Format Interface.

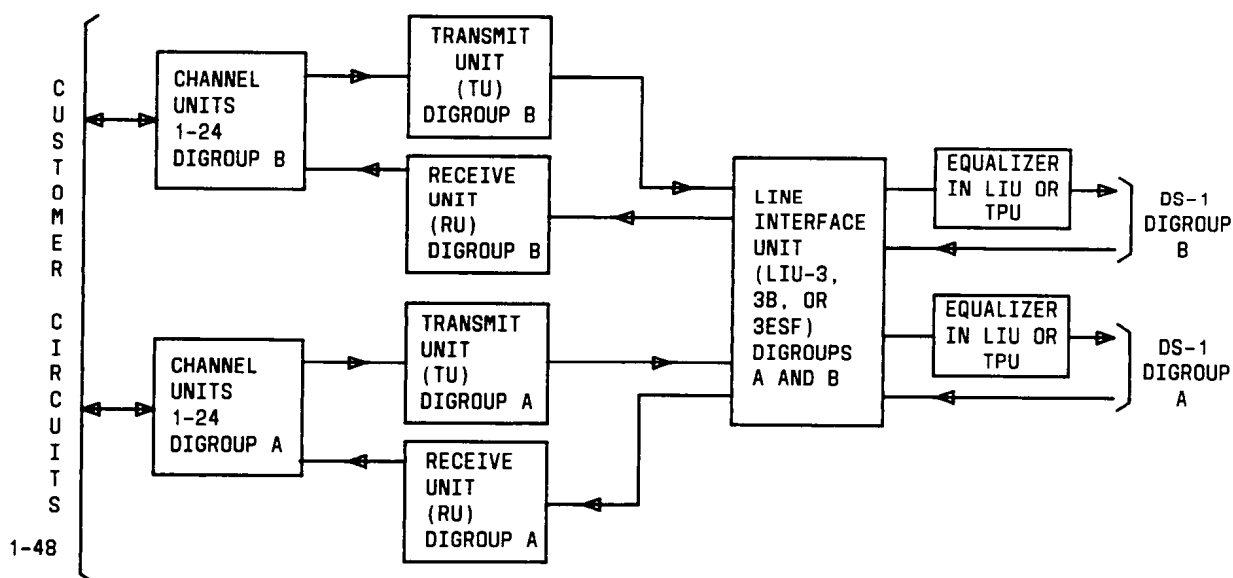


Figure 2-4. D4 Mode 3 Operation

### **D4 Channel Bank B8ZS/ZCS (Bipolar Eight Zero Substitution/Zero Code Suppression) Functional Description**

The B8ZS and ZCS line coding formats can be selected by options on the following LIU (Line Interface Unit) common unit cards: LIU-3B, LIU-3ESF, and LIU-7. The B8ZS line coding format is a technique used to provide 64 kb/s clear channel data transmission over DS1 facilities. In the transmit direction, the B8ZS encoder substitutes a certain code for each string of eight zeros. The code includes bipolar violations. In the receive side of the LIU card, the code is converted back to a string of eight zeros. The B8ZS code meets the ones density requirement of the T1 line.

The ZCS line coding format is the D4 zero suppression technique standard with all other LIUs is optional with LIU-3B, LIU-3ESF, and LIU-7. This technique substitutes a (1) for the seventh bit of an eight zero byte or word. This line coding format is used for voice and voiceband data transmission and satisfies the ones density requirement of the T1 line. However, the (1) is not removed at the receiving end. This makes the ZCS format not suitable for 64 kb/s clear channel data transmission.

### **D4 Channel Bank ESF/D4 (Extended Super Frame/D4 Framing) Functional Description**

ESF (Extended Super Frame) and the standard D4 framing formats can be selected by options on the LIU-3ESF and LIU-7 common unit cards. ESF provides in-service performance monitoring capability, a 4 kb/s data link channel, and 16-state robbed-bit signaling. ESF extends the capabilities of the present DS1 signal. It does this by dividing the 8 kb/s pattern previously used for mainframe and robbed-bit signaling synchronization into the following:

- 2 kb/s for mainframe and robbed-bit signaling synchronization
- 2 kb/s for cyclic redundancy check (CRC-6) providing transmission performance monitoring
- 4 kb/s for a data link to transmit maintenance information, supervisory signaling, and other network related information.

The standard D4 framing format is used when the ESF format is not desired. Standard D4 framing is used to separate each 24-channel block (frame) of data. It is required when using the LIU-3B and is standard with all other line interface units except the LIU-3ESF and LIU-7.

### **D4 Channel Bank ILBRV (Integrated Low Bit Rate Voice) Functional Description**

With an appropriate configuration of common unit cards, the D4 channel bank can provide Integrated Low Bit Rate Voice capability. This capability allows transmission of up to 48 channels over one standard DS1 facility. This is accomplished by a technique called "bit compression". This bit compression technique reduces a 64 kb/s channel to a 32 kb/s channel, thereby doubling the channel carrying capacity of a DS1 facility for voice and voiceband data channels. A compressed 32 kb/s channel carries sufficient information for excellent voice and voiceband data (2.4 or 4.8 kb/s) transmission. ILBRV is provided by the following two common unit cards:

- AHG6 CP LBRV -- Low Bit Rate Voice Unit
- AHG7 LIU-7 -- Line Interface Unit.

Typical ILBRV configurations are shown in Figure 2-5. For a more detailed description of ILBRV refer to AT&T Practice 365-170-604.

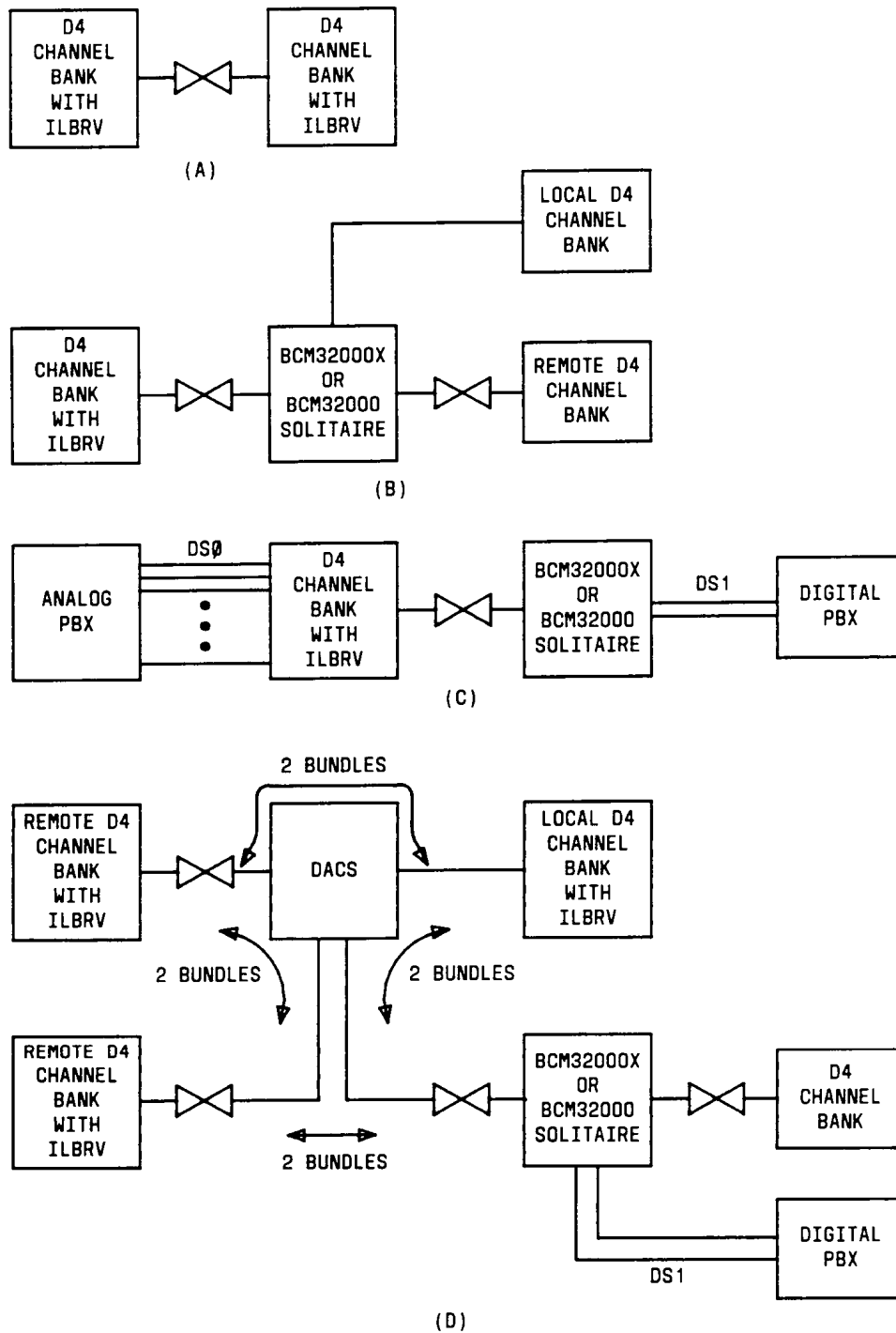


Figure 2-5. Typical ILBRV Applications

#### **D4 Channel Bank ISDN (Integrated Services Digital Network) Functional Description**

A channel unit card, called the BRITE (Basic Rate Interface Transmission Extension) unit, provides the D4 channel bank with the capability to function in either of the following applications:

- A transport for ISDN (Integrated Services Digital Network) service from a 5ESS<sup>®</sup> switch to remote customers
- A digital pipe which provides an end-to-end stand-alone nonswitched digital circuit for transmitting data directly between two or more connected customers.

An ISDN service application is shown in Figure 2-6A. In this particular application ISDN service is provided to remote customers. Tandem (back-to-back connected) D4 channel banks designated (2) and (3) are used to pass 64 kb/s clear channel data.

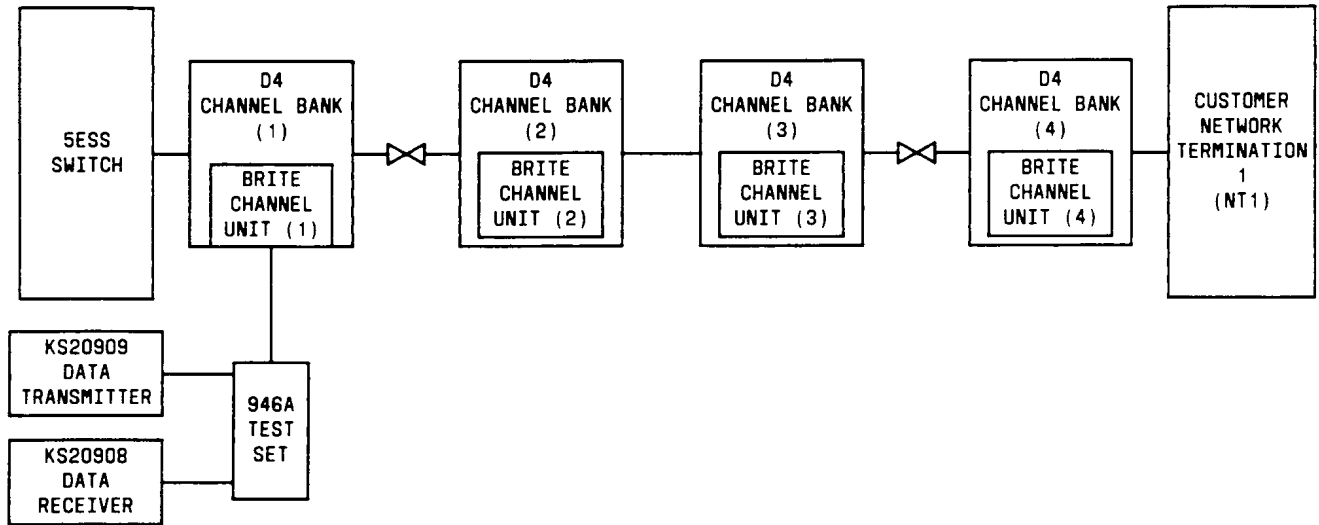
An ISDN circuit consists of two types of channels, B and D. There are two B channels and one D channel. The B channels transmit 64 kb/s clear channel data and are used in high-speed data applications such as video transmission. The D channel operates at 16 kb/s and is used by the 5ESS switch to transmit call set-up information such as supervision and billing. The D channel can also be used for packet switched low-speed data applications.

BRITE channel units can be optioned to provide several combinations of B and D channel services. Combinations for an ISDN circuit are as follows:

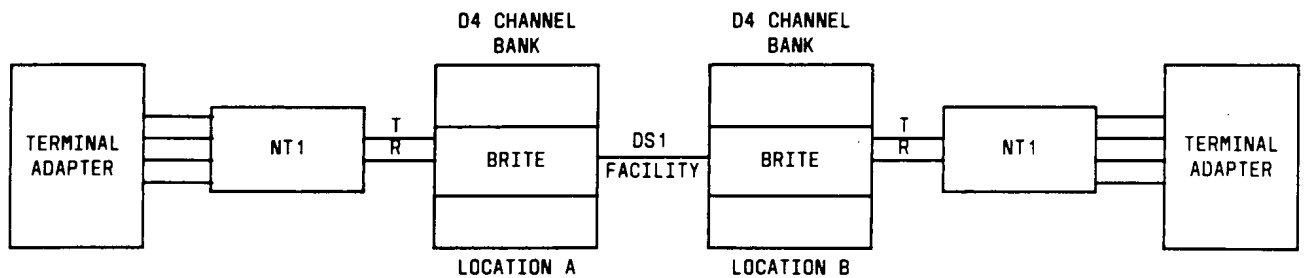
- One D channel only
- One B channel plus one D channel
- Two B channels plus one D channel.

In digital pipe applications data speed operation can be selected at 56 kb/s or 64 kb/s. A typical digital pipe application is shown in Figure 2-6B. In digital pipe applications, customer access to the BRITE channel unit must be through a NT1 unit and the BRITE channel unit(s) in the D4 channel banks must be optioned for digital pipe applications. If 64 kb/s clear channel data transmission is used in the digital pipe application, the D4 channel bank(s) must be configured for B8ZS line coding format.

For more detailed information about the BRITE channel unit in the D4 channel bank, refer to AT&T Practices 365-005-089 and 365-170-502.



A. ISDN APPLICATION USING BRITE CHANNEL UNITS



B. DIGITAL PIPE APPLICATION USING BRITE CHANNEL UNITS

Figure 2-6. Applications of the BRITE Channel Unit - ISDN Service and Digital Pipe

### D4 Channel Bank DDB (Digital Data Bank) Functional Description

Using various common unit cards, D4 channel banks can be configured to provide two types of DDB (digital data bank) transmission terminals. They are as follows:

1. D4 DDB-MJU (Multipoint Junction Unit) terminal
2. D4 DDB-SRMX (Subrate Multiplexer) terminal.

The D4 channel bank can operate exclusively as one of the two terminals or in a split bank arrangement to provide any two DDB terminal functions simultaneously. Also, one digroup can operate as a DDB terminal and the other digroup as a standard DS1 Mode 3 D4 terminal. Refer to Figure 2-7 for typical Multipoint Junction and Subrate Multiplexer applications.

**DDB-MJU:** This terminal provides digital data multipoint circuits to allow transmission between a control station and two or more branch stations. Installing the J98726HB QMJU (Quad Multipoint Junction Unit) card into the digroup slots normally occupied by the ACU (alarm control unit) and TU (transmit unit) converts the digroup to the DDB-MJU terminal. The QMJU card operates at 2.4, 4.8, and 9.6 kb/s and performs all of the signal processing and alarm control functions for four multipoint junctions. A multipoint junction consists of one control and four branch ports. The DDB-MJU terminal uses standard D4 dataport channel units.

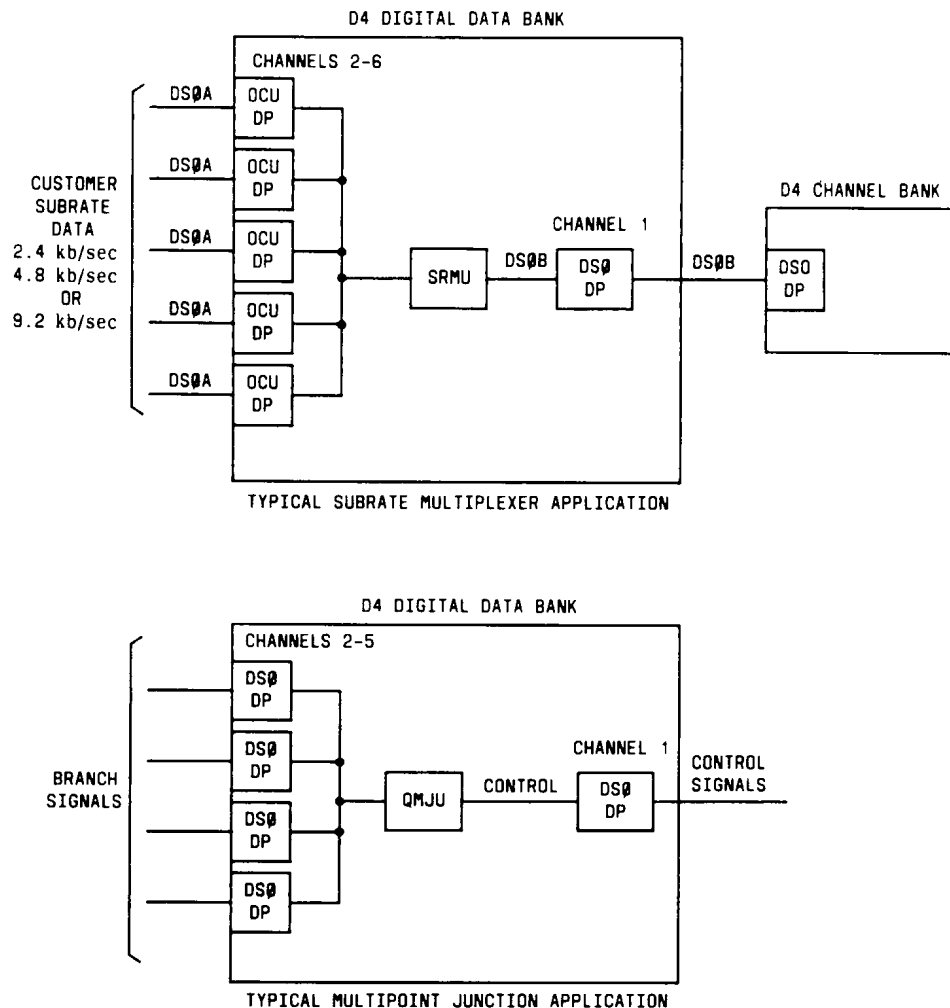
**DDB-SRMX:** This terminal provides a subrate multiplexing function that combines a group of 5, 10, or 20 subrate data channels into a single 64 kb/s DS0B channel. Installing the J98726HC SRMU (Subrate Multiplexer Unit) card into digroup slots occupied by the ACU (alarm control unit) and TU (transmit unit) converts the digroup to the DDB-SRMX terminal. The SRMU card performs all of the multiplexing and alarm control functions and can be configured for multiplexing 5, 10, or 20 channels by switch selection. The DDB-SRMX terminal uses standard D4 dataport channel units. The SRMU can be used to create from one to four subrate multiplexers in a digroup.

For detailed descriptive information on D4-DDB operation, refer to AT&T Practice 365-170-201. For D4-DDB acceptance and maintenance information, refer to AT&T Practices 365-170-210 (QMJU) and/or 365-170-220 (SRMX).

### D4 Channel Bank Timing Capabilities

The D4 channel bank can be optioned for local, loop, or external timing. Local timing consists of free-running, internally generated timing pulses to the transmit oscillator in the line interface unit. For looped timing, the transmit oscillator in the line interface unit is locked to DS1 line facility incoming timing pulses from the far end equipment such as a 4 ESS™ switching system. For external timing, the transmit oscillator in the line interface unit is locked to an external composite clock source such as the DDS (Digital Data System) clock.

Different types of channel services require different types of timing. For example, DDS dataport service requires external timing from the DDS network. The external DDS clock source is wired into the back of a D4 channel bank. When external timing is not available and DDS dataport service is required, the bank must be loop timed to the incoming T-line facility.



**Figure 2-7.** Typical Digital Data Bank Applications

Some systems such as an EES switch or DACS (Digital Access and Cross-Connect System) provide their own timing source. Therefore, a D4 channel bank must be loop timed when used with these systems.

The different timing options (loop, local, and external) are selected by positioning plugs or switches on the common unit OIU card. The nomenclature on the faceplate of one OIU card may differ from another OIU card depending on its application. However, the basic nomenclature is as follows:

- **LOC** -- Local timing
- **LT** -- Loop timing
- **EXT** -- External timing.

Normally, only one timing option (LOC, LT, or EXT) may be selected and it applies to both the A and B digroups simultaneously. This is the case for all OIU cards except the OIU-5. The OIU-5 card and TUI card working together allow for independent digroup timing so that digroups A and B can be optioned individually to separate timing sources.



### **Independent Digroup Timing Functional Description**

Independent digroup timing includes several timing capabilities. The B digroup can be optioned for local, loop, or external timing independent of the A digroup. The A digroup can be optioned for loop timing independent of the B digroup or it can be optioned to "lock to B digroup" timing. The lock to B digroup option times the A digroup to the B digroup and, therefore, to the timing source selected for B digroup. The timing option is set on the OIU-5 card faceplate. An application of independent digroup timing is shown in Figure 2-8.

Benefits of the independent digroup timing capability are as follows:

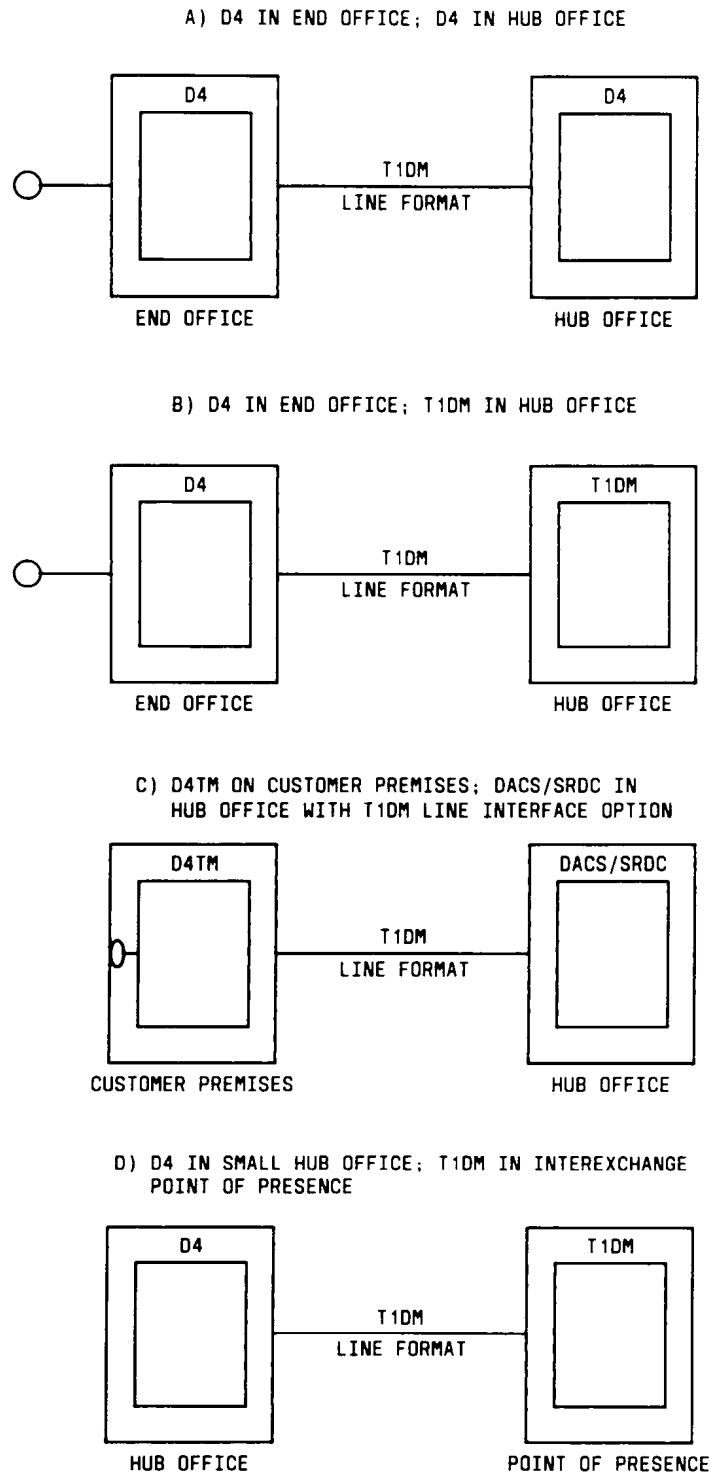
- More efficient and versatile use of the D4 channel bank
- Easily configured with no backplane wiring changes.

For more information about independent digroup timing, refer to AT&T Practice 365-170-600.

### **T1DM (T1 Data Multiplexer) Format Interface**

The T1DM format interface capability makes the D4 channel bank compatible (end-to-end) with the T1 Data Multiplexer terminal and other digital data terminals employing the T1DM format. The T1DM format provides for out-of-channel yellow alarm transmission and error performance monitoring. This format differs from the standard D4 format in the way it handles a yellow alarm (loss of framing at the far end). The D4 format transmits a yellow alarm as a zero in bit 2 of every channel byte in a DS1 frame. In data transmission this method can result in spurious yellow alarms. In the T1DM format the yellow alarm is transmitted in the 24th channel by setting the 190th bit of the DS1 frame to zero. The 191st bit of the DS1 frame of the same channel is used as a data channel for error performance monitoring in the DTSS (Digital Transmission Surveillance System).

The T1DM format capability allows the D4 channel bank to function as a digital transmission terminal used in various applications as shown in Figure 2-9. For more information about T1DM format capability, refer to AT&T Practice 365-170-605.

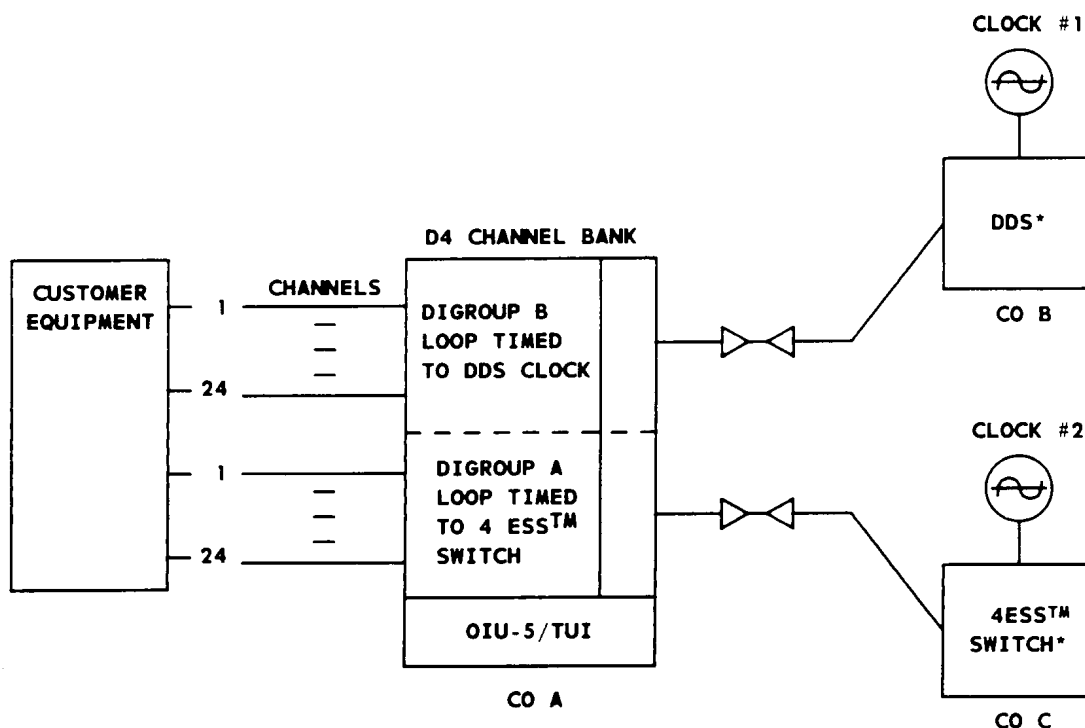


**Figure 2-8.** Applications of D4 Channel Bank with T1DM Format

#### D4 Channel Bank Channel Units

A wide variety of voice and data transmission services are available with the D4 channel bank by selecting the appropriate channel unit card(s). The channel unit cards provide an

interface between customer circuits and the D4 channel bank common unit cards. They accept signals from customer equipment and convert the signals into a format for application to the D4 common unit cards. Conversely, channel unit cards convert the format from the D4 common unit cards for application to customer equipment. Each channel unit card operates independently from all others and is dedicated to one customer circuit. Table 2-A gives the functions of the channel unit cards for the Transmission Module.



\* OR ANY DIGITAL FACILITY REQUIRING  
D BANK SYNCHRONIZATION

Figure 2-9. Typical Application of Independent Digroup Timing

*Channel Unit Placement Restrictions:* Most channel unit cards have no restrictions on the maximum number that can be used and what slots they can occupy in a D4 channel bank. The exceptions to this are the dataport cards, program cards, and BRITE cards. The following restrictions are on number and location which apply to these types of channel units. The restrictions are due to physical size and channel (time) slot usage.

- **BRITE:** Up to 8 BRITE channel unit cards can be used per digroup with (2B + D) service. Since (2B + D) service requires 3 time slots per BRITE card, the two physical channel slots adjacent to the right of the slot in which the BRITE card is located must remain empty. Also, with (2B + D) service BRITE cards cannot be used in slots 23 and 24. Up to 12 BRITE channel unit cards can be used per digroup with B + D service. B + D service requires 2 time slots. Therefore, the physical channel slot adjacent to the right of the slot in which the BRITE card is located must remain empty. Also, with B + D service a BRITE card cannot be used in slot 24. No restrictions apply with D only service.

- 56 kb/s data service requires the use of two physical channel slots when error correction is used. The slots required are the slot occupied by the unit and the slot adjacent to the right of the occupied slot. The adjacent slot must remain empty. This applies to the J98726DH and J98726DJ dataport channel unit cards optioned for 56 kb/s data with error correction.

**EXAMPLE:** 56 kb dataport card contained in channel slot 1 with channel slot 2 empty and contained in channel slot 3 with channel slot 4 empty. Also, since two channel slots are required for 56 kb data service with error correction, channel slot 24 cannot be used because there is no adjacent slot.

- **PG5T and PG5R Cards:** For these program cards two time slots are required: one for the physical channel slot in which the card is located and one that is 12 greater than the physical slot number. Therefore, for each channel slot equipped with one of these cards, the channel slot that is 12 greater than the equipped slot must contain either a blank card or an opposite direction program card.

*Caution: Service affecting -- with a PG5T, do NOT install a PG8T or PG5T exactly four slots apart. With a PG5R, do NOT install a PG8R or PG5R exactly four slots apart.*

**EXAMPLE:** If channel slot 5 contains a PG5R, install a blank card into slot 17. Slot 17 could also contain an opposite direction PG5T or PG8T. *DO NOT use a PG5R or PG8R card in slot 1 or 9.*

- **PG7.5T and PG7.5R Cards:** Each of these cards requires three physical channel slots and the associated three time slots. Physical channel slots 11, 12, 23, and 24 cannot contain these cards.
- **PG8T and PG8R:** For these program cards, three time slots are required: one for the physical channel slot in which the card is located, another for the one that is 8 greater than the physical slot number, and another that is 16 greater than the physical slot number. Therefore, for each channel slot containing one of these units, the channel slots 8 greater and 16 greater must contain either blank units or opposite direction program units.

*Caution: Service affecting -- with a PG8T, do NOT install a PG8T or PG5T exactly four slots apart. With a PG8R, do NOT install a PG8R or PG5R exactly 4 slots apart.*

**EXAMPLE:** If channel slot 5 contains a PG8R, install a blank unit into slots 13 and 21. Slots 13 and 21 could also contain an opposite direction PG5T or PG8T. *DO NOT install a PG5R or PG8R in slot 1 or 9.*

- **PG15T and PG15R:** A total of six adjacent time slots are required for these cards. Three physical channel slots are required to contain each card plus three more adjacent slots for the time slots. The three unoccupied physical channel slots must contain either blank cards or opposite direction program cards. Any of the opposite direction program cards (5-, 7.5-, 8- or 15-kHz) can occupy the slots provided the additional time slots required are also available. Thus, a digroup may provide four 15-kHz program channels in both directions, or four 15-kHz in one direction and various combinations of 8-kHz and/or 5-kHz service in the opposite direction.

TABLE 2-A. D4 CHANNEL UNIT CARD FUNCTIONS

D4 CARD	FUNCTION
OCU DP Channel Unit Cards (J98726DB, DJ, and DL)	Provides interface between a D4 channel bank and customer digital data signals. The DB card operates with customer subrate digital data rates of 2.4, 4.8, and 9.6 kb/s. The DJ card operates with all digital data rates of 2.4, 4.8, 9.6, and 56 kb/s and supports secondary channel operation. The DL card provides 56 kb/s direct digital single station access to a 4 ESS switch.
DSU DP Channel Unit Card (J98726DC)	Provides interface between D4 channel bank and customer data equipment using EIA Standard RS-449 interface. Additional Customer Service or Data Service Unit is not required.
DSU-II DP Channel Unit Card (J98726DN)	Provides interface between a D4 channel bank and a DTE (data terminal equipment) which uses the EIA RS-232 interface. Intended primarily for synchronous operation at the subrates of 2.4, 4.8, and 9.6 kb/s however, it can operate at 56 kb/s. It can operate asynchronously at 9.6 kb/s.
DSU-II DP Channel Unit Card (J98726DP)	Provides interface between a D4 channel bank and DTE (data terminal equipment) which uses the CCITT V.35 interface. Intended primarily for 56 kb/s operation however, it will operate at 2.4, 4.8, and 9.6 kb/s.
DS0 DP Channel Unit Cards (J98726DA, DH, and DK)	Provides interface between the D4 channel bank and the DDS (Digital Data System) network. The DA card operates with the DS0 64 kb/s digital data rate. The DH card operates with the DS0 56 kb/s and 64 kb/s digital data rates and supports secondary channel operation. The DK card provides 56 kb/s direct digital single station access to a 4 ESS switch.
2FXS (J98726BD) 2FXS/GT (J98726SG) 2FXS/LS (J98726BK) 2FXS6 (J98726SR) 4FXS6 (J98726SB) Channel Unit Cards	Provides interface between D4 channel bank and subscriber (customer) end of a foreign exchange circuit. A foreign exchange circuit provides service to a telephone switching office that does not normally serve that customer's location or line. It can also be used to provide off premises extension from a PBX.

TABLE 2-A. D4 CHANNEL UNIT CARD FUNCTIONS (Contd)

D4 CARD	FUNCTION
2FXO (J98726BE) 2FXO/GT (J98726SK) 2FXO/LS (J98726BL) 2FXO/LSN (J98726SU) 2FXO6 (J98726SS) 4FXO (J98726SC) Channel Unit Cards	Provides interface between D4 channel bank and a foreign exchange central office circuit. A foreign exchange circuit provides service to a telephone switching office that does not normally serve that customer's location or line. It can also be used to provide off premises extension from a PBX.
2E&M6 (J98726BT) 2E&M9 (J98726BJ) 4E&MER (J98726BP) Channel Unit Cards	Provides interface between D4 channel bank and a customer circuit with E&M signaling. The BT and BJ cards function with 2-wire circuits. The BP card functions with a 4-wire circuit.
DPT6 (J98726CH) DPT (J98726BB) Channel Unit Cards	Provides the interface between a D4 channel bank and a 600-or 900-ohm 2-wire dial pulse terminating circuit.
2DX/GT (J98726SD) 4DX (J98726SE) Channel Unit Cards	Provides interface between D4 channel bank and a customer circuit with duplex signaling. The SD card functions with a 2-wire circuit. The SE card functions with a 4-wire circuit.
4PLR Channel Unit Card (J98726BN)	Provides tandem (back-to-back) connection of an analog or D channel bank 4-wire circuit with E&M signaling to another D4 channel bank.
DPO (J98726BA) DPMO (J98726BM) Channel Unit Cards	Provides an interface between a D4 channel bank and a 2-wire dial pulse originating circuit.
4SF (J98726SW) Channel Unit Card	Provides an interface between a D4 channel bank and a voice-frequency facility using single frequency 2600-Hz signaling tones. The voice-frequency facility can be an analog carrier, a digital carrier, or a metallic facility.
2RD/PLAR (J98726SN) 4RD/PLAR (J98726SP) Channel Unit Cards	Provides an interface between a D4 channel bank and a special service circuit with 1-or 2-way ringdown signaling (RD) or an intercom type service (PLAR).
BRITE (AHG13) Channel Unit Card	Provides remote customers access to ISDN service from a 5ESS switch. It can also provide stand-alone nonswitched digital circuit (digital pipe).

TABLE 2-A. D4 CHANNEL UNIT CARD FUNCTIONS (Contd)

D4 CARD	FUNCTION
4TDM (J98726SF) Channel Unit Card	Provides interface between D4 channel bank and a 4-wire tandem (back-to-back) circuit. It is used with trunks requiring 3-or 2-state signaling.
2TO (J98726SJ) 4TO (J98726SH) 4ETO (J98726SQ) Channel Unit Cards	Provides interface between D4 channel bank and a private line voice-frequency circuit with no dc signaling. The SJ card functions with 2-wire circuits. The SH and SQ cards function with 4-wire circuits and can be used with an analog private line modem. The SQ card provides optional post equalization.
PG5T (J98726CA) PG5R (J98726CB) Channel Unit Cards	Provides interface between D4 channel bank and a 5-kHz analog program circuit. The CA card serves in the transmit direction. The CB card serves in the receive direction.
PG7.5T (J98726CN) PG7.5R (J98726CP) Channel Unit Cards	Provides interface between D4 channel bank and a 7.5-kHz analog program circuit. The CN card serves in the transmit direction. The CP card serves in the receive direction.
PG8T (J98726CC) PG8R (J98726CD) Channel Units	Provides interface between D4 channel bank and an 8-kHz analog program circuit. The CC card serves in the transmit direction. The CD card serves in the receive direction.
PG15T (J98726CE) PG15R (J98726CF)	Provides an interface between a D4 channel bank and a 15-kHz analog program circuit. The CE card serves in the transmit direction. The CF card serves in the receive direction.
SEC MC S (J98726GA) Channel Unit Card	Provides interface between the McCulloh alarm signal transmitting circuits and the D4 common unit cards at the station (customer) end of a security circuit.
SEC MC O (J98726GB) Channel Unit Card	Provides interface between the McCulloh alarm signal receiving circuits and the D4 common unit cards at the office end of a security circuit.
2PBX (J98726ST) Channel Unit Card	Provides Class 5 (end office) central office features in a D4 channel bank. Used to provide direct voice access between a PBX and a toll switch (i.e. 4 ESS).

**D4 Channel Bank Common Unit Cards**

The channel bank common unit cards provide the transmission (transmit and receive), power, timing, and alarm functions. The transmit function consists of multiplexing (combining) several channels together and coding their signals into a DS1 digital format. Conversely, the receive function consists of decoding the digital signal and demultiplexing (separating) the channels. The transmission functions are performed by the **TU**, **RU**, and **LIU** cards. The power function consists of providing various voltages to the bank cards. This is performed by the **PDU** and the **325 PU** cards. The timing function provides synchronization and is performed by the **OIU** card. The alarm function shows the operating status and removes channels from service during an equipment failure. This is performed by the **ACU** and **TPU** cards. Table 2-B gives the functions of the common unit cards for use in the Transmission Module.

**TABLE 2-B. D4 COMMON UNIT CARD FUNCTIONS**

<b>D4 CARD</b>	<b>FUNCTION</b>
TU (Transmit Unit) (J98726AA)	Converts analog voice-frequency or digital data signals from 24 channel units into the D4 channel bank digital bit stream or signal.
RU (Receive Unit) (J98726AB)	Converts incoming digital bit stream or signals from the digital line facility into analog voice-frequency or digital data signals for channel units.
DRU (Data Receive Unit) AHG20	Provides T1DM format interface capability for data transmission only. Two other common unit cards required are DAU and DACU.
LIUs (Line Interface Units)	Provides an interface between the D4 channel bank and the digital line facility. It provides necessary timing (clock) functions and converts between D4 channel bank format and digital line format.
TPU (Trunk Processing Unit) (J98726AD)	Removes channel units from service during facility failure, sets channel counting sequence, and provides line equalizers for cable loss compensation.
ACU (Alarm Control Unit) (J98726AC)	Detects alarm conditions in the D4 channel bank, controls local and remote alarm indicators, and starts trunk processing.
DAU (Data Alarm Unit) (AHG11)	Provides T1DM format interface capability for data transmission only. Two other common unit cards required are DRU and DACU.



**TABLE 2-B. D4 COMMON UNIT CARD FUNCTIONS (Contd)**

D4 CARD	FUNCTION
DACU (Data Alarm Control Unit) (AHG21)	Provides T1DM format interface capability for data transmission only. Two other common unit cards required are DAU and DRU.
OIUs (Office Interface Units)	Provides for synchronization of the bank internal clock to an incoming digital line facility or to an external clock source.
PDU (Power Distribution Unit) (J98726AK)	Provides -48 volt fusing and distribution in the D4 channel bank.
PU (Power Unit) 325A	Converts -48 volts into +5, +12 and -12 volts required by the D4 cards.
QMJU (Quad Multipoint Junction Unit) (J98726HB)	Used when D4 channel bank is configured as a DDB (digital data bank) having multipoint junction source. It performs all multipoint signal processing and alarm control for the four MJUs in the associated digroup. An MJU consists of a control bit stream and two or more remote or branch streams. The MJU broadcasts data from the control stream to all the branch streams; and, in the opposite direction, combines data from the branch streams into a single stream for delivery to the control stream.
SRMU (Subrate Multiplexer Unit) (J98726HC)	Used when D4 channel bank is configured as a DDB (digital data bank) having subrate multiplexing source. It performs all the SRMX multiplexing and alarm control functions for the associated digroup. The SRMX function consists of time-division multiplexing a group of 5, 10, or 20 subrate data channels into a single 64 kb/s channel.

### 551C-L1 CSU Functional Description

Basic functions of the 551C-L1 CSU are as follows:

- Provides an interface between the DS1 line facility and the other equipment in the Transmission Module.
- Insures that the signals entering the public network (DS1 line facility) from the D4 channel bank comply with the requirements of the DS1 line facility as defined in FCC Part 68 Requirements.
- Provides maintenance, diagnostic, and testing capabilities to the DS1 line facility side and to the Transmission Module equipment side.

Specific functions of the 551C-L1 CSU are as follows:

- It monitors the incoming bit stream on both the customer and facility sides and displays the status of each side.
- It transmits an all 1s signal to the DS1 line facility or loops back the DS1 line facility if the customer's signal fails.
- It provides the following status indicators:
  - Green (PULSE) Lamp -- Indicates the presence of normal DS1 line facility 1.544 Mb/s pulses.
  - Red (BPV) Lamp -- Indicates bipolar violations coming from the DS1 line facility.
  - Yellow (LOOPED) Lamp -- Indicates that the DS1 line facility loopback has been activated.
  - Yellow (LINE PWR) Lamp -- Indicates the presence of DS1 line facility powering current.
  - Red (AVG DENS) Lamp -- Indicates a problem with customer side DS1 line input signal.
  - Red (ZEROS) Lamp -- Indicates too many consecutive zeros in customer side DS1 line input signal.
- It provides the following jacks that can be used for test access or looping:
  - EQ IN, EQ OUT, EQ MON Jacks -- Provide access to the customer equipment side.  
  
EQ OUT = To customer equipment  
EQ IN = From customer equipment.
  - SM IN, SM OUT, SM MON Jacks -- Provide access to the DS1 line facility side.  
  
SM IN = To DS1 line facility  
SM OUT = From DS1 line facility.

The incoming DS1 line facility usually powers the CSU, but a separate power source may also be used to supply power to the CSU.

### FT1 Optical Transmission Unit Functional Description

The FT1 unit receives DS1 bipolar signals on shielded copper pairs from the D4 channel bank and converts these electrical signals into optical signals for transmission over lightguide cable. The List 1 version of the FT1 unit can only receive and transmit AMI (Alternate Mark Inversion) format DS1 signals. The Lists 3 and 4 versions can be optioned for either AMI or B8ZS (bipolar eight zero substitution) line coding format. The unit as shipped from the factory is available with the AMI line coding format option provided. The B8ZS line coding format allows for 64 kb/s clear channel data transmission. The FT1 unit complies with FCC requirements for Class A computing devices and can transmit digital signals at distances up to 20 km depending on the FT1 version and type of fiber used. The capabilities of the various FT1 unit versions are as follows:

- List 1 -- This FT1 unit is used for transmitting over a distance of 3 km using multimode fiber. It provides alternate mark inversion (AMI) line coding format but does not have 64 kb/s clear channel data transmission capability. The List 1 unit operates from a power

source of +5 volts drawing 125 mA.

- List 3 -- This FT1 unit is used for transmitting over a distance of up to 20 km using single-mode fiber or over a distance of 12 km using multimode fiber. It can be optioned for either AMI or B8ZS line coding format. The B8ZS line coding format enables 64 kb/s clear channel data transmission. This unit has a dry relay contact for remote alarm activation when loss of clock occurs. It operates from a power source of -48 volts drawing 125 mA.
- List 4 -- This FT1 unit is used for transmitting over a distance of up to 3 km using multimode fiber. It can be optioned for either AMI or B8ZS line coding format. This unit has a dry relay contact for remote alarm activation when loss of clock occurs. It operates from a power source of -48 volts drawing 125 mA.

Power for the FT1 units is derived from a terminal strip located on the FT1 shelf in the Transmission Module. A dc-to-dc converter located on the shelf provides the +5 volts when List 1 FT1 units are used.

Each FT1 unit has an alarm detector and a self-test feature that allow detection of a transmission failure and isolation of that failure to either the line facility/far-end equipment or to the local Transmission Module equipment.

The FT1 units provide the following status indicators:

- Yellow (**MOD.**) -- Indicates that the FT1 is looped toward the D4 channel bank.
- Yellow (**CUST.**) -- Indicates that the FT1 is looped toward both the fiber line facility and the D4 channel bank.
- Green (**PWR.**) -- Indicates that the FT1 is receiving required power.
- Red (**LOC.**) -- Indicates loss of clock or loss of transmission from the optical line.

The three connectors on the rear panel of the FT1 unit and their functions are as follows:

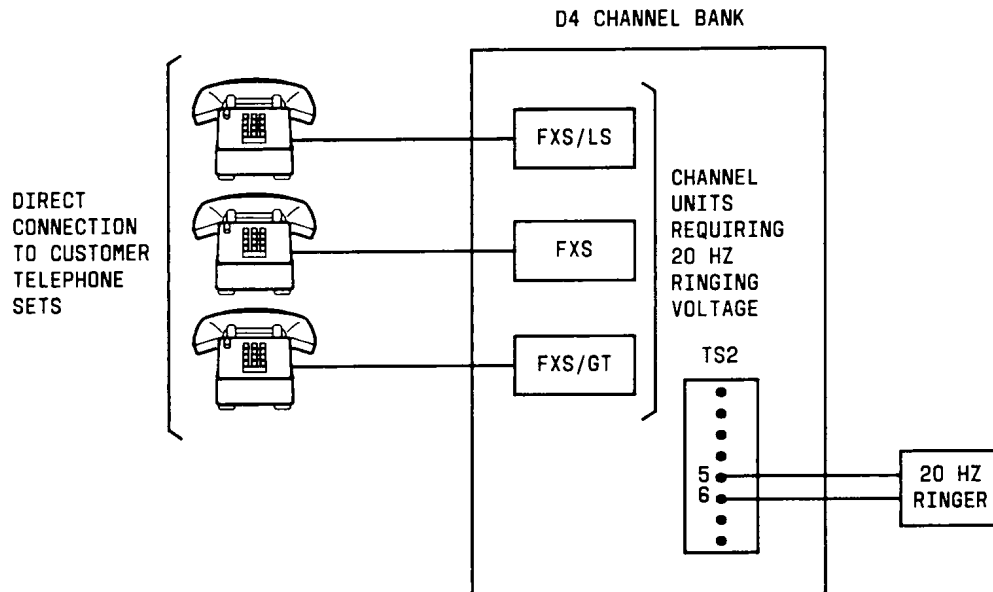
- **LT** -- Lightguide Transmit connector connects the fiber cable for transmitting toward the line facility.
- **LR** -- Lightguide Receive connector connects the fiber cable for receiving from the line facility.
- **DS1** -- A 15-pin connector connects the DS1 interface between the FT1 unit and the D4 channel bank.

The 3-position switch located on the rear panel provides loopback and normal operation settings as follows:

- **CUST.** position -- Provides two loopbacks simultaneously. One loopback goes toward the D4 channel bank and the other goes toward the fiber line facility.
- **NORM.** position -- Provides normal transmission operation (no loopbacks).
- **MOD.** position -- Provides a loopback toward the D4 channel bank only.

**20-Hz Ringer Functional Description**

The 20-Hz ringer provides a voltage of approximately 100 V ac to the D4 channel bank. The voltage is required to ring the customer equipment on foreign exchange subscriber circuits. The channel units used in this application are the 2FXS, 2FXS6, 2FXS/LS, 2FXS/GT, and 4FXS. A direct connection of these channel units to a customer telephone set requires a 20-Hz ringer. The 20-Hz ringer is not required when these channel units connect to a PBX. Figure 2-10 shows a 20-Hz ringer application.



**Figure 2-10.** Typical 20-Hz Ringer Application

**Power Supply Functional Description**

The power supply provides -48 V dc power to all equipment in the Transmission Module. The power supply operates on a standard commercial 110-120 V ac power source. There are two power supplies available. One is rated at 6 amps and the other at 12 amps. The particular power supply required depends on the equipment (number of D4 channel banks) contained in the Transmission Module. The ac power source must be capable of providing a maximum current service of 20 amps.

### 3. INSTALLATION AND INITIAL TESTING

#### Overview

This section contains information and procedures to start with a packaged Transmission Module or separately ordered piece of equipment for the module and end with it installed, connected, equipped, and operational. A procedure for trouble analysis during initial testing is included. All procedures for customer channel service are contained in the Customer Service Section.

#### Installation

Procedures 1 and 2A through 2H accomplish installation and all transmission, power, and alarm connections for all equipment in the Transmission Module. Normally, the Transmission Module will arrive factory-installed in a 7-foot frame or a 42-inch or 6-foot tall cabinet. All internal cabling such as power and transmission will be connected. It must be unpacked, installed into position, and externally connected. External cables will enter at the rear of the Transmission Module through the top opening. Procedures 1, 2A, 2B, 2C, and 2D accomplish these tasks on a Transmission Module having at least one D4 channel bank with CSUs or FT1 units.

However, if an additional piece of equipment such as a D4 channel bank is to be installed into an existing Transmission Module, then that equipment must be connected. Procedures 2A through 2H address all possible internal and external transmission, power, and alarm connections and must be used as needed depending on the type of equipment being installed. The beginning of each Procedure 2A through 2H contains application information to determine if that procedure is required for a specific equipment configuration.

#### Initial Testing

The equipment in the Transmission Module should be tested to verify proper transmission operation as a unit. Normally, the D4 channel bank will not have its cards installed. Therefore, Procedure 3 should be used to install the D4 cards followed by Procedures 4 through 8 to test the D4 channel bank. If a trouble occurs during initial testing, Procedure 9 should be used to locate the trouble. Table 3-A lists the Installation and Initial Testing procedures in this section.

TABLE 3-A. INSTALLATION AND INITIAL TESTING PROCEDURES

PROCEDURE NUMBER	PROCEDURE TITLE
1	Unpack and Install the Transmission Module
2A	Connect Voice-Frequency Cables Between D4 Channel Bank and Terminating Field
2B	Connect T1 Line Facility Cable, DS1 Cable From D4 Channel Bank, and Power Cable To CSU
2C	Connect FT1 Fiber Optic Cable, DS1 Cable From D4 Channel Bank, and Power Cable To FT1 Unit
2D	Connect External Clock (Timing) Cable To D4 Channel Bank
2E	Connect T1 Line Facility Cable To D4 Channel Bank
2F	Connect 20-Hz Ringer To Power Source And Ringing Voltage Cable To D4 Channel Bank
2G	Connect External Alarm Cables To D4 Channel Bank
2H	Connect Power Cable To D4 Channel Bank
3	Install D4 Channel Bank Common Equipment
4	Loop D4 Channel Bank Digroups
5	Calibrate the Channel Access Unit
6	Calibrate the 3-Type Noise Measuring Set
7	Perform D4 Channel Bank Looped Tests (Initial Testing)
8	Perform Facility End-to-End Transmission Test
9	D4 Initial Testing Trouble Analysis

**PROCEDURE 1 -- UNPACK AND INSTALL THE TRANSMISSION  
MODULE**

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STEP	PROCEDURE
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**IMPORTANT:** The Transmission Module equipment requires a controlled environment that must provide a temperature range of +40 to +100° F with a relative humidity of 20 to 55 percent.

1. Refer to shipping order equipment list and determine if Transmission Module is shipped in a frame or cabinet.
2. Observe crate or package for any unpacking instructions such as **Open Here, This End Up To Unpack, Lift Here**, etc.
3. Open crate and unpack equipment.
4. Refer to work order floor plan and position frame or cabinet in proper location. If required, attach frame or cabinet to floor or wall using hardware included.
5. Connect braided copper cable from Transmission Module to nearest available facility ground.
6. Locate power supply cord and connect it to ac power outlet. The ac source must be capable of providing a current service of 20 amps.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

## **PROCEDURE 2 -- CONNECT INTERNAL AND EXTERNAL CABLES TO TRANSMISSION MODULE**

Procedures 2A through 2H contain instructions for connecting all internal and external cables required by the equipment contained in the Transmission Module. Procedures 2B and 2C also contain information about option settings for the associated equipment. The procedures required depend upon the combinations of equipment used. Some combination of Procedures 2A through 2H will also be required if additional equipment is being installed into an existing Transmission Module. As previously stated, Transmission Modules may be ordered in different configurations. A Transmission Module with a CSU and a D4 channel bank will require Procedures 2A and 2B. A Transmission Module with a FT1 unit and D4 channel bank will require Procedures 2A and 2C. Refer to the application information at the beginning of each connection Procedure 2A through 2H to determine if that procedure is required for a specific equipment configuration.

- 2A. Connect Voice-Frequency Cables Between D4 Channel Bank And Terminating Field
- 2B. Connect T1 Line Facility Cable, DS1 Cable From D4 Channel Bank, and Power Cable To CSU
- 2C. Connect FT1 Fiber Optic Cable, DS1 Cable From D4 Channel Bank, and Power Cable To FT1 unit
- 2D. Connect External Clock (Timing) Cable To D4 Channel Bank
- 2E. Connect T1 Line Facility Cable To D4 Channel Bank
- 2F. Connect 20-Hz Ringer To Power Source And Ringing Voltage Cable To D4 Channel Bank
- 2G. Connect External Alarm Cables To D4 Channel Bank
- 2H. Connect Power Cable To D4 Channel Bank.



**PROCEDURE 2A -- CONNECT VOICE-FREQUENCY CABLES BETWEEN D4  
CHANNEL BANK AND TERMINATING FIELD*****IMPORTANT: Read Application before starting procedure!*****Application:** Perform this procedure to connect customer cables to a D4 channel bank.

---

**STEP****PROCEDURE**

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1. Obtain B25A connectorized cables to connect voice-frequency circuits. These cables are shipped with the Transmission Module or are locally provided.
2. Refer to customer floor plan and run voice-frequency cables between D4 channel bank and cross-connect terminating field blocks. The field blocks are shipped with the Transmission Module or are locally provided. A wire-wrapping tool is required to wire wrap the leads to the 89-type terminating field blocks. Refer to Figure 3-1, Figure 3-2, or Figure 3-3 as applicable for orientation of cables.
3. Run the B25A connectorized cables to rear of the D4 channel bank so that when you face the rear, the connectors designated as **A** are on the right side and connectors designated as **B** are on the left side. The cables enter the cabinet through an opening in the top located just above the top-left corner.
4. For voice-frequency cable connections refer to Figure 3-1, Figure 3-2, and Figure 3-3 as applicable and connect the B25A connectorized cables to D4 channel bank plugs P38\_\_, P39\_\_, P40\_\_, and P42\_\_. If necessary, refer to Table 3-B. Note, that control leads 1 and 2 in P44\_\_ connector are seldom used.

**Note:** Presently two basic methods are used to connect dataport channels. One is to use DSU II channel unit cards with V.35 or RS-232C type cables connected to the backplane channel slot or cables connected directly to the faceplate connector. This method provides data service directly to either V.35 or RS-232C Data Terminal Equipment (DTE) and does not require the B25A voice-frequency cables. The other method is to use OCU or DS0 (as applicable) channel unit cards. These dataport channels are connected using the B25A voice-frequency cables requiring T/R and T1/R1 leads.

5. Are you going to connect cables for DSU II channel unit cards or for OCU/DS0 channel unit cards?

DSU II -- Continue with Step 6.

OCU/DS0 -- Go to Step 7.

6. For DSU II dataport cable connections to the backplane, refer to Figures 3-4 and 3-5. Use the short cable shipped with the DSU II channel unit cards to connect to the DSU II card slot at the backplane of the D4 channel bank. The other end of the short cable connects to the plug and cable coming from the customer Data Terminal Equipment (DTE). If necessary, refer to Table 3-C and Table 3-D.

For DSU II dataport cable connections to the faceplate connector, connect the DTE

**PROCEDURE 2A -- CONNECT VOICE-FREQUENCY CABLES BETWEEN D4 CHANNEL BANK AND TERMINATING FIELD (Contd)**

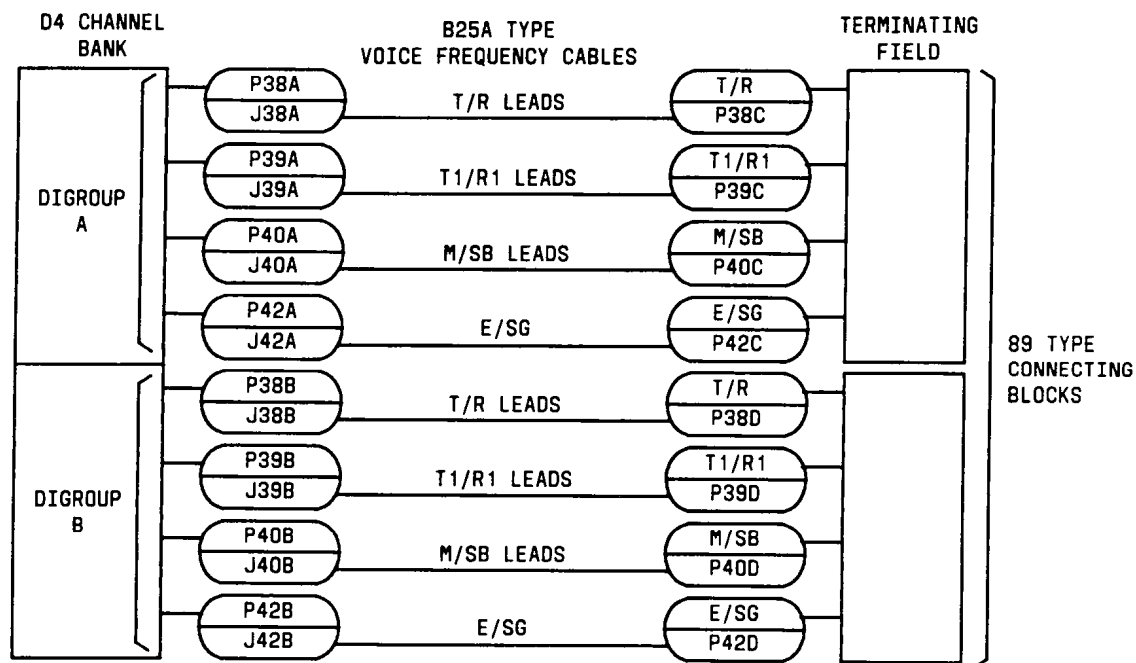
STEP	PROCEDURE
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	<p>cable connector directly to the faceplate connector. Note, that the 25-pin faceplate connector for V.35 requires an adapter to provide the V.35 physical interface. The adapter can be made by using the pin assignment information in Table 3-D.</p>
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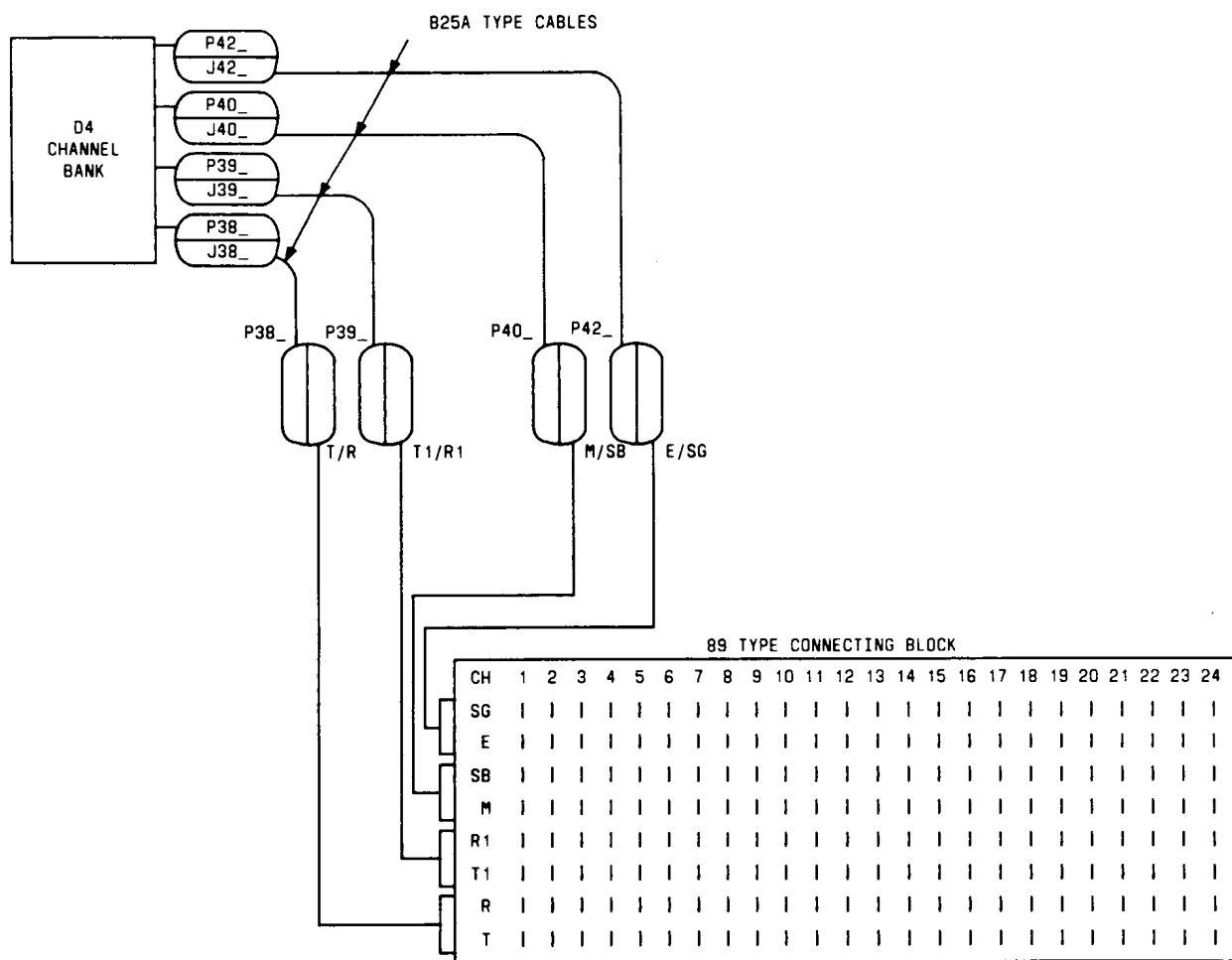
**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

7. OCU/DS0 dataport cable connections are through the cross-connect terminating fields similar to the voice-frequency cable connections shown in Figures 3-1, 3-2, and 3-3. To make these connections, use Figures 3-1, 3-2, and 3-3 with Table 3-B.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**



**Figure 3-1. Voice-Frequency Cabling Between D4 Channel Bank and Terminating Field**



**Figure 3-2.** Voice-Frequency Cable Connections to 89-Type Connecting Blocks for Either Digroup

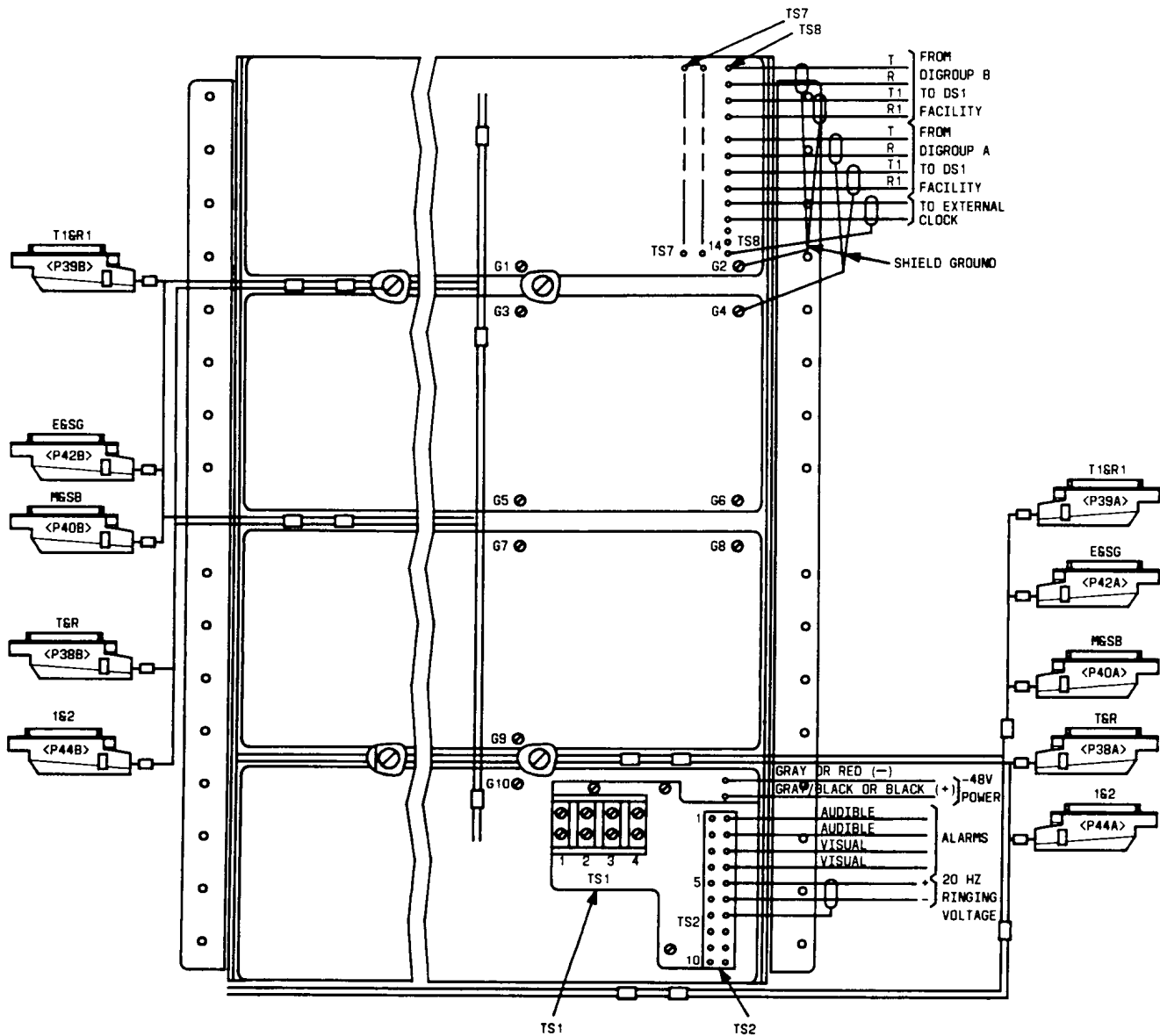
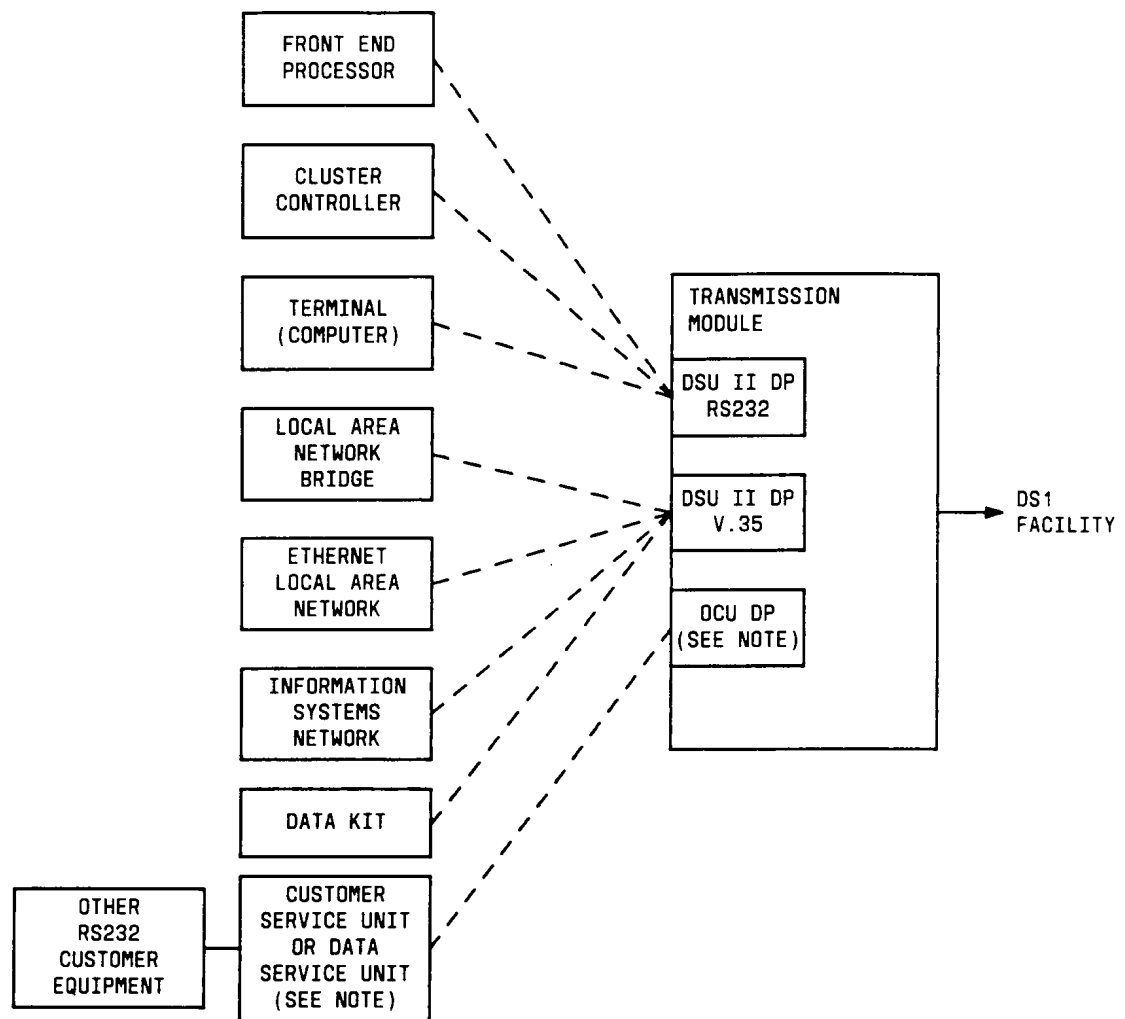
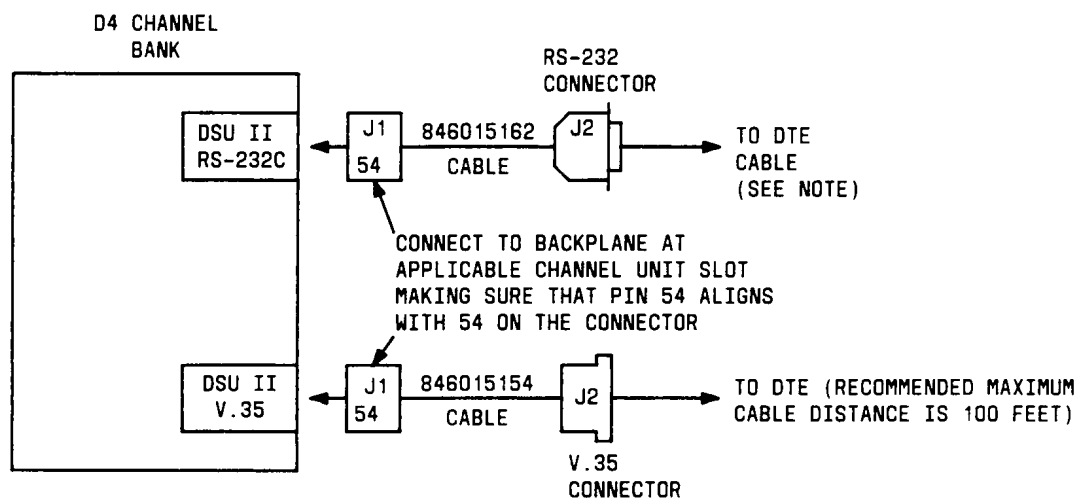


Figure 3-3. Cable Connection Layout at Rear of D4 Channel Bank

**NOTE:**

This combination of OCU DP and CUSTOMER SERVICE UNIT/DATA SERVICE UNIT can be replaced by a DSU II DP.

**Figure 3-4.** Typical DSU II and OCU Dataport Interfaces



NOTE: WITH THIS CABLE ARRANGEMENT TERMINAL TIMING (TT) ON THE DA LEAD IS NOT PROVIDED AS ON THE FACEPLATE CONNECTOR. HOWEVER, SEND TIMING (ST) FROM THE D4 CHANNEL BANK TO THE DTE IS PROVIDED ON DB LEAD.

V.35 INTERFACE			
LEAD	BACKPLANE PIN NO.	J1 PIN NO.	J2 PIN NO.
102	42	B13	B
115(A)	45	B10	V
115(B)	19	A9	X
114(A)	46	B9	Y
104(A)	20	A8	R
104(B)	47	B8	T
114(B)	48	B7	AA
109	49	B6	F
105	23	A5	C
103(A)	24	A4	P
103(B)	51	B4	S
106	25	A3	D
107	52	B3	E

RS-232C INTERFACE			
LEAD	BACKPLANE PIN NO.	J1 PIN NO.	J2 PIN NO.
AA	47	B8	1
BA	24	A4	2
BB	20	A8	3
CA	23	A5	4
CB	48	B7	5
CC	19	A9	6
AB	51	B4	7
CF	49	B6	8
DB	46	B9	15
DD	45	B10	17

Figure 3-5. DSU II Dataport Connections to DTE and Backplane of D4 Channel Bank

TABLE 3-B. CHANNEL/VOICE-FREQUENCY CABLE

LEAD DESIGNATIONS FROM D4 CONNECTORS					D4 CHAN NO.	LEAD COLOR	CONN PIN NO.	CONN BLK CHAN NO.  (NOTE)
P38	P39	P42	P40	P44				
T	T1	E	M	1	1	W-BL	26	1
R	R1	SG	SB	2		BL-W	1	1
T	T1	E	M	1	2	W-O	27	2
R	R1	SG	SB	2		O-W	2	2
T	T1	E	M	1	3	W-G	28	3
R	R1	SG	SB	2		G-W	3	3
T	T1	E	M	1	4	W-BR	29	4
R	R1	SG	SB	2		BR-W	4	4
T	T1	E	M	1	5	W-S	30	5
R	R1	SG	SB	2		S-W	5	5
T	T1	E	M	1	6	R-BL	31	6
R	R1	SG	SB	2		BL-R	6	6
T	T1	E	M	1	7	R-O	32	7
R	R1	SG	SB	2		O-R	7	7
T	T1	E	M	1	8	R-G	33	8
R	R1	SG	SB	2		G-R	8	8
T	T1	E	M	1	9	R-BR	34	9
R	R1	SG	SB	2		BR-R	9	9
T	T1	E	M	1	10	R-S	35	10
R	R1	SG	SB	2		S-R	10	10
T	T1	E	M	1	11	BK-BL	36	11
R	R1	SG	SB	2		BL-BK	11	11
T	T1	E	M	1	12	BK-O	37	12
R	R1	SG	SB	2		O-BK	12	12

Note: Connect leads to corresponding connecting block terminals for associated equipment.

TABLE 3-B. CHANNEL/VOICE-FREQUENCY CABLE (Contd)

LEAD DESIGNATIONS FROM D4 CONNECTORS					D4 CHAN NO.	LEAD COLOR	CONN PIN NO.	CONN BLK CHAN NO.  (NOTE)
P38	P39	P42	P40	P44				
T	T1	E	M	1	13	BK-G	38	13
R	R1	SG	SB	2		G-BK	13	13
T	T1	E	M	1	14	BK-BR	39	14
R	R1	SG	SB	2		BR-BK	14	14
T	T1	E	M	1	15	BK-S	40	15
R	R1	SG	SB	2		S-BK	15	15
T	T1	E	M	1	16	Y-BL	41	16
R	R1	SG	SB	2		BL-Y	16	16
T	T1	E	M	1	17	Y-O	42	17
R	R1	SG	SB	2		O-Y	17	17
T	T1	E	M	1	18	Y-G	43	18
R	R1	SG	SB	2		G-Y	18	18
T	T1	E	M	1	19	Y-BR	44	19
R	R1	SG	SB	2		BR-Y	19	19
T	T1	E	M	1	20	Y-S	45	20
R	R1	SG	SB	2		S-Y	20	20
T	T1	E	M	1	21	V-BL	46	21
R	R1	SG	SB	2		BL-V	21	21
T	T1	E	M	1	22	V-O	47	22
R	R1	SG	SB	2		O-V	22	22
T	T1	E	M	1	23	V-G	48	23
R	R1	SG	SB	2		G-V	23	23
T	T1	E	M	1	24	V-BR	49	24
R	R1	SG	SB	2		BR-V	24	24

Note: Connect leads to corresponding connecting block terminals for associated equipment.



TABLE 3-C. DSU II DATAPORT RS-232C INTERFACE

DESCRIPTION	RS-232C DESIGNATION	BACKPLANE PIN	BANK CONNECTOR	FACEPLATE CONNECTOR (RS-232C)
Send Data	BA	24	P38-T	2
Signal Ground	AB	51	P38-R	7
Receive Data	BB	20	P39-T1	3
Signal Ground	AB	47	P39-R1	1
Send Timing	DB	46*	P40-MA	15
Receive Timing	DD	45	P42-EA	17
Terminal Timing	DA	46*	P40-MA	24
Request-to-Send	CA	23	P44-2	4
Clear-to-Send	CB	48	P40-MB	5
Receive Line Signal Detector	CF	49	P44-1	8
Data Set Ready	CC	19	P42-EB	6

\* Send Timing Source Switch (S2-B) on the RS-232C DSU II dataport channel unit card must be in the DCE position to provide the ST-A interface circuit on backplane pin 46, and in the DTE position to provide the TT interface circuit on pin 46. Although either option can be provided at the faceplate connector, only the ST-A option is provided with the backplane cable connection.

**TABLE 3-D. DSU II DATAPORT V.35 INTERFACE**

DESCRIPTION	V.35 DESIGNATION	BACKPLANE PIN	BANK CONNECTOR	FACEPLATE CONNECTOR	V.35 CONNECTOR
Send Data	103(A)	24	P38-T	2	P
	103(B)	51	P38-R	14	S
Receive Data	104(A)	20	P39-T1	3	R
	104(B)	47	P39-R1	1	T
Send Timing	114(A)	46	P40-MA	15	Y
	114(B)	48	P40-MB	24	AA
Receive Timing	115(A)	45	P42-EA	17	V
	115(B)	19	P42-EB	25	X
Request-to-Send	105	23	P44-2	4	C
Clear-to-Send	106	25	-	5	D
Receive Line Signal Detector	109	49	P44-1	8	F
Data Set Ready	107	52	-	6	E
Signal Ground	102	5	-	7	B

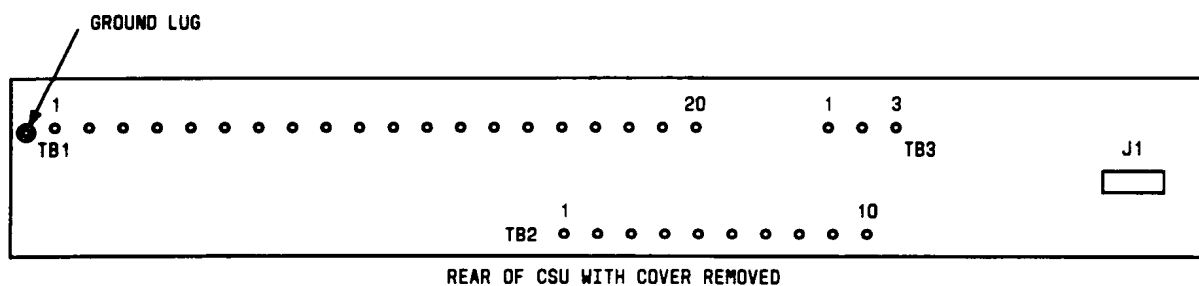
**PROCEDURE 2B -- CONNECT T1 LINE FACILITY CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO CSU*****IMPORTANT: Read Application before starting procedure!***

**Application:** This procedure is required if the Transmission Module, as shipped, contains a CSU or if a CSU was installed into an existing Transmission Module. The CSU requires two high frequency cable connections and power cable connections if local powering is desired. The DS1 cable from a D4 channel bank connects to the CSU at connector J1. The cable from the T1 line facility connects to the CSU at TB1. If the Transmission Module is shipped with CSU(s), the T1 line facility is the only connection required. Also, this procedure contains instructions to option the CSU for span line powering or local powering and to option the F0003/2 Office Repeater and F0003/1 Signal Monitor Unit contained in the CSU.

STEP	PROCEDURE
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**Connect Cable From the T1 Line Facility -- Steps 1 And 2.**

1. Remove the metal cover from the back of the CSU.
2. Connect the cable from the T1 line facility to **TB1** (Figure 3-6) of the CSU as follows:
  - a. T to **TB1-pin 1**
  - b. R to **TB1-pin 2**
  - c. T1 to **TB1-pin 4**
  - d. R1 to **TB1-pin 5**
  - e. T1 line shield leads to a ground terminal.

**Figure 3-6. CSU Terminal Strips and J1 Connector**

**PROCEDURE 2B -- CONNECT T1 LINE FACILITY CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO CSU (Contd)**

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STEP	PROCEDURE
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**Connect Selected Powering Option -- Steps 3 Through 6.**

3. Is CSU to have span line powering or local powering?

Span Line Powering -- Continue with Step 4.

Local Powering -- Go to Step 5.

4. Verify or install straps on **TB2** (Figure 3-6) for span line powering as follows:

- TB2-pin 1** to **TB2-pin 6**
- TB2-pin 2** to **TB2-pin 7**.

Go to Step 7 to continue CSU cable connections.

5. Verify or install straps on **TB2** and **TB3** (Figure 3-6) for local powering as follows:

- TB2-pin 1** to **TB2-pin 6**
- TB2-pin 2** to **TB2-pin 7**
- TB2-pin 8** to **TB3-pin 3**

6. Connect a ground lead from the ground (GRD) lug located at the bottom of the Transmission Module cabinet to **TB3-pin 3** on the CSU. Connect the -48V lead from **TB2** at lower right rear of the Transmission Module cabinet to **TB3-pin 2** on the CSU. Connect -48V RTN lead (+) from **TB1** at lower right rear of the Transmission Module cabinet to **TB3-pin 3** on CSU.

**Connect DS1 Cable Between D4 Channel Bank and CSU -- Steps 7 Through 9**

**Note:** If Transmission Module is shipped with CSU(s), these connections will have been performed at the factory.

7. Obtain cable having P1 connector at one end.

**PROCEDURE 2B -- CONNECT T1 LINE FACILITY CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO CSU (Contd)****STEP****PROCEDURE**

8. Connect wire end of P1 cable to D4 channel bank as follows:

D4 Digroup B	LEAD	P1
TS8 pin 1 (T)	GREEN	pin 1
TS8 pin 2 (R)	GREEN-WHITE	pin 9
G2 ground	SHIELD	pin 2
TS8 pin 3 (T1)	BLUE	pin 3
TS8 pin 4 (R1)	BLUE-WHITE	pin 11
G2 ground	SHIELD	pin 4

D4 Digroup A	LEAD	P1
TS8 pin 5 (T)	GREEN	pin 1
TS8 pin 6 (R)	GREEN-WHITE	pin 9
G4 ground	SHIELD	pin 2
TS8 pin 7 (T1)	BLUE	pin 3
TS8 pin 8 (R1)	BLUE-WHITE	pin 11
G4 ground	SHIELD	pin 4

9. At back of CSU, connect **P1** to **J1** (Figure 3-6) and install metal cover.

**PROCEDURE 2B -- CONNECT T1 LINE FACILITY CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO CSU (Contd)**

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<b>STEP</b>	<b>PROCEDURE</b>
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**Option Office Repeater -- Steps 10 Through 19**

10. Refer to installation or engineering records to determine repeater option requirements for T1 line facility.
11. Remove repeater from CSU.
12. Is the CSU optioned for span line powering or local powering?

Span line powering -- Continue with Step 13.

Local powering -- Go to Step 14.

13. For span line powering over T1 line, set repeater powering option switch **S1** as follows:

- |  |              |                  |
|--|--------------|------------------|
| A. Powers span line in series with "-" lead.   | C,E,K = IN   | All Others = OUT |
| B. Powers span line in series with span line from regulator.                             | A,G,M = IN   | All Others = OUT |
| C. Span line powered from far end. Places power supply in series with span line.         | D,K = IN     | All Others = OUT |
| D. Powers span line. Does not place power supply in span line.                           | B,E,H,N = IN | All Others = OUT |
| E. Same as D above but reverses polarity of span voltage.                                | A,F,H,N = IN | All Others = OUT |
| F. Closes loop. Does not power span line or place power supply in series with span line. | H,J,N = IN   | All Others = OUT |
| G. Same as B above but reverses polarity of span voltage.                                | B,D,G = IN   | All Others = OUT |

Go to Step 15 to continue setting office repeater options.

14. For local powering, set repeater powering option switch **S1** as follows:

- |                                    |            |                  |
|------------------------------------|------------|------------------|
| A. Dry loop (no sealing current)   | C,G,J = IN | All Others = OUT |
| B. Wet loop (with sealing current) | C,E,K = IN | All Others = OUT |

Continue with Step 15 to continue setting office repeater options.

**PROCEDURE 2B -- CONNECT T1 LINE FACILITY CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO CSU (Contd)**

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STEP	PROCEDURE
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15. Set **S5** for span pad option required as follows:

Set **S5** to 7.5 dB for 7.5 dB pad (normal)  
 Set **S5** to 15.0 dB for 15.0 dB pad  
 Set **S5** to 0.0 dB for 0.0 dB pad

16. Set **S2** and **S3** for voltage option required as follows:

Voltage	S3	S2
<hr/>		
-48	out	Y
+130	in	Z
+130 and -48	out	Z
+130 and -130	out	Z

17. Set **S4** for mode selector option required as follows:

**S4 = AA** -- For WEC0 236AA repeater operation  
**S4 = AB** -- For WEC0 236AB repeater operation

18. If external equipment is to be powered or if sealing current is to be supplied, set switch **S6** to **B**. If not, set **S6** to **A**.

19. Install repeater into CSU.

**Option F0003/1 Signal Monitor Unit -- Step 20**

20. Set following options in the F0003/1 unit as required.

All Ones Keep Alive Signal: Set **S1** to all ONES  
 Loopback of DS1 Facility Signal Upon Loss of Customer Signal: Set **S1** to **LB**  
 16 Consecutive Zeros LED Operation: Set **S1** to **16**  
 50 Consecutive Zeros LED Operation: Set **S1** to **50**  
 Inband Code Line Loopback Relay Activation: Set **S2** to **IN-BAND LLB**  
 DC Line Loopback Relay Activation: Set **S2** to **DC LLB**.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**PROCEDURE 2C -- CONNECT FT1 FIBER OPTIC CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO FT1 UNIT**

***IMPORTANT: Read Application before starting procedure!***

**Application:** This procedure is required if the Transmission Module, as shipped, contains a FT1 unit, or if a FT1 unit is to be installed into an existing Transmission Module. The FT1 unit requires fiber optic cable connections, a DS1 cable connection, and a connection to a power terminal strip. List 3 and List 4 versions of the FT1 unit can have remote alarming if desired and can be optioned for B8ZS or AMI line coding format. These units are shipped from the factory preset for AMI line coding format. A user's document is furnished with the unit providing instructions on how to set the options.

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**STEP**

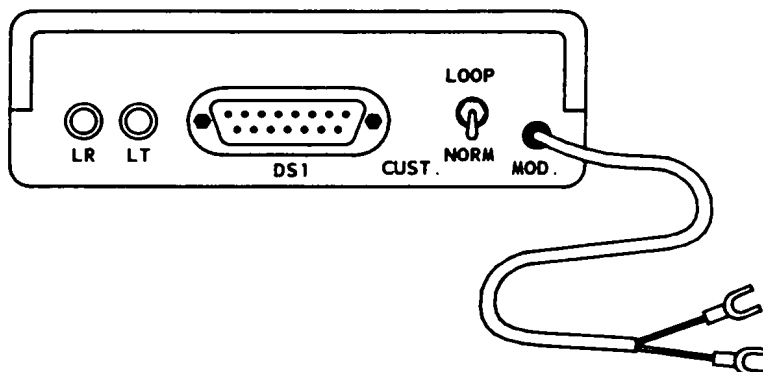
**PROCEDURE**

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***DANGER: UNTERMINATED OPTICAL CABLES AND/OR CONNECTORS MAY EMIT LASER RADIATION. EYE DAMAGE MAY RESULT IF THE LASER BEAM IS VIEWED WITH OPTICAL INSTRUMENTS.***

**Connect FT1 Fiber Optic Cable -- Step 1.**

1. At the rear of the FT1 unit connect the transmit fiber to the **LT** connector and the receive fiber to the **LR** connector. See Figure 3-7.



**Figure 3-7. Rear View of FT1 Unit**

**Connect DS1 Cable To D4 Channel Bank -- Step 2.**

**Note:** If Transmission Module is shipped with FT1(s), these connections will have been performed at the factory.



**PROCEDURE 2C -- CONNECT FT1 FIBER OPTIC CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO FT1 UNIT (Contd)****STEP****PROCEDURE**

2. Connect wire end of the DS1 cable to D4 channel bank as follows:

<b>D4 Digroup B</b>	<b>LEAD</b>	<b>P1</b>
TS8 pin 1 (T)	GREEN	pin 1
TS8 pin 2 (R)	GREEN-WHITE	pin 9
G2 ground	SHIELD	pin 2
TS8 pin 3 (T1)	BLUE	pin 3
TS8 pin 4 (R1)	BLUE-WHITE	pin 11
G2 ground	SHIELD	pin 4

<b>D4 Digroup A</b>	<b>LEAD</b>	<b>P1</b>
TS8 pin 5 (T)	GREEN	pin 1
TS8 pin 6 (R)	GREEN-WHITE	pin 9
G4 ground	SHIELD	pin 2
TS8 pin 7 (T1)	BLUE	pin 3
TS8 pin 8 (R1)	BLUE-WHITE	pin 11
G4 ground	SHIELD	pin 4

**PROCEDURE 2C -- CONNECT FT1 FIBER OPTIC CABLE, DS1 CABLE FROM D4 CHANNEL BANK, AND POWER CABLE TO FT1 UNIT (Contd)**

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STEP	PROCEDURE
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**Prepare unit for B8ZS or AMI Line Coding Format (List 3 or 4 units, only) -- Step 3.**

3. Refer to the user's document furnished with the FT1 unit to prepare it for either B8ZS or AMI line coding format. Note, that the unit is shipped from the factory initially preset for AMI line coding format.

**Connect Remote Alarm Cable (List 3 or 4 units, only) -- Step 4.**

4. Refer to the user's document furnished with the FT1 unit to connect remote alarm cable.

**Connect DS1 Cable To FT1 Unit -- Step 5.**

5. Connect the P1 connector to the DS1 connector on the rear of the FT1 unit. See Figure 3-7.

**Connect Power Cable -- Step 6.**

6. Remove the power terminal strip cover on the FT1 shelf assembly. Connect the red wire from the rear of the FT1 unit to a (-) terminal on the strip and connect the black wire to a (+) terminal.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**PROCEDURE 2D -- CONNECT EXTERNAL CLOCK (TIMING) CABLE TO D4  
CHANNEL BANK*****IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure if external clock is required by the D4 channel bank. External clock is required for DDB terminal or DDS dataport service.

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STEP	PROCEDURE
<hr/>	
1.	At the rear of the D4 channel bank, in the top right corner, locate the white plastic terminal strip designated <b>TS8</b> . See Figure 3-3 of Procedure 2A.
2.	Using wire wrapping tool, connect any one of the two external clock leads to <b>terminal 9</b> and the other to <b>terminal 10</b> of <b>TS8</b> .
	<b>Note:</b> On cabinet models, it may be necessary to remove cable duct on right side to make connections.
3.	Connect the shield to <b>terminal 14</b> of <b>TS8</b> .

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

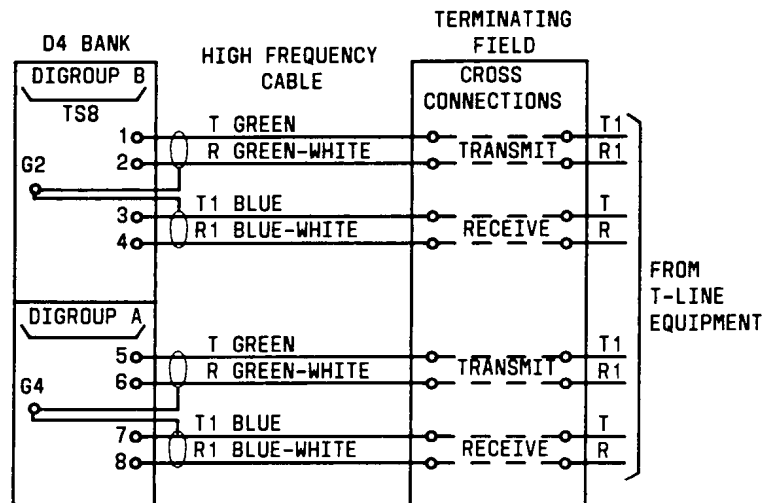
PROCEDURE 2E -- CONNECT T1 LINE FACILITY CABLE TO D4 CHANNEL BANK

**IMPORTANT: Read Application before starting procedure!**

**Application:** Perform this procedure if the Transmission Module does not contain a CSU or FT1 unit. If DS1 lines are to be connected between a D4 channel bank and either a CSU or FT1 unit, use Procedure 2B or 2C as applicable.

STEP	PROCEDURE
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1. Obtain shielded T1 line facility cable.
2. If needed, refer to customer floor plan and run cable between D4 channel bank and termination point for T-line facility.
3. Refer to Figure 3-8 and connect T1 line facility cable to D4 channel bank and to termination point. Connect cable shields at D4 channel bank and at termination point. Observe **T** and **R** are transmit leads and **T1** and **R1** are receive leads at the D4 channel bank end.



**Figure 3-8.** T1 Line Facility Connections Between D4 Channel Bank and Terminating Field

4. Refer to Figure 3-8 and make T1 line facility cable cross-connections at termination point. Observe that D4 bank **T/R** leads connect to T1 line facility **T1/R1** leads and that D4 channel bank **T1/R1** leads connect to T1 line facility **T/R** leads.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**PROCEDURE 2F -- CONNECT 20-HZ RINGER TO POWER SOURCE AND RINGING VOLTAGE CABLE TO D4 CHANNEL BANK*****IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure if any D4 channel bank in the Transmission Module requires ringing voltage and has not been connected to a ringing generator (20-Hz ringer) or if a ringing generator is being installed into the Transmission Module.

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**STEP****PROCEDURE**

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**Connect Ringing Generator to Power Source -- Step 1.**

1. At the rear of the Transmission Module on the lower right side, locate terminal blocks **TB1** and **TB2**. Connect the 48 RTN lead (20-gauge wire) from the ringing generator to terminal 2 on TB1. Connect the -48V lead (20-gauge wire) from the ringing generator to terminal 2 on TB2.

**Connect Ringing Voltage to D4 Channel Bank -- Steps 2 Through 6.**

2. At the rear of the D4 channel bank on the lower right side, locate terminal strip **TS2**. See Figure 3-3 of Procedure 2A.
3. Using wire wrapping tool, connect ringing voltage cable as follows:
  - a. Connect incoming ringing positive lead to D4 channel bank **TS2**, pin 5 (either outside or inside row).
  - b. Connect incoming ringing ground lead to D4 channel bank **TS2**, pin 6 (either outside or inside row).

**Note:** On cabinet models, it may be necessary to remove cable duct on right side to make connections.

4. Determine if ringing voltage cable shield is connected at ringing generator (in the lower part of the cabinet or frame).
5. If Transmission Module as shipped from the factory contains a ringing generator, the ringing voltage cable shield is *not* connected at ringing generator. Therefore, connect the shield at D4 channel bank to **TS2**, pin 7.
6. If shield is connected at ringing generator, do not connect shield to D4 channel bank. Wrap shield at D4 bank with electrical insulation tape.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**PROCEDURE 2G -- CONNECT EXTERNAL ALARM CABLES TO D4 CHANNEL BANK**

***IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure if external alarms are to be connected to any D4 channel bank. The external alarm conditions on a D4 channel bank are controlled by a relay. The relay contacts are dry contacts (no power or ground). The D4 channel bank remote alarm indicator driving circuitry can handle a maximum current flow of 1 amp. External alarm indicator circuits must meet this requirement.

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STEP	PROCEDURE
<hr/>	
1.	The D4 channel bank remote alarm indicator driving circuitry can handle a maximum current flow of 1 amp. Before proceeding, verify that external alarm indicator circuits to be connected meet this requirement.
2.	At rear of D4 channel bank on lower right side, locate <b>TS2</b> (Terminal Strip 2). See Figure 3-3 of Procedure 2A.
3.	Using wire wrapping tool, connect incoming alarm leads to D4 channel bank <b>TS2</b> as follows: <ul style="list-style-type: none"><li>a. Audible hot lead to <b>TS2</b>, pin 1</li><li>b. Audible return lead to <b>TS2</b>, pin 2</li><li>c. Visual hot lead to <b>TS2</b>, pin 3</li><li>d. Visual return lead to <b>TS2</b>, pin 4.</li></ul>

**Note:** On cabinet models, it may be necessary to remove cable duct on right side to make connections.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**PROCEDURE 2H -- CONNECT POWER CABLE TO D4 CHANNEL BANK*****IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure if a D4 channel bank is being added to an existing Transmission Module or if a Transmission Module is ordered without a power supply.

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**STEP****PROCEDURE**

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1. At rear of D4 channel bank on lower right side, locate two 14-gauge stranded wires. See Figure 3-3 of Procedure 2A. The wires will be in one of two different color combinations. One combination has one **gray** wire and one **gray-black** wire. Another combination has one **red** wire and one **black** wire.
2. Using wire nuts or solder and electrical insulation tape, connect incoming power cable as follows:
  - a. Connect incoming -48 volt wire to D4 gray wire or red wire.
  - b. Connect incoming -48 volt ground wire to D4 bank gray-black wire or black wire.
3. Verify that 10-foot copper braided cable is connected to nearest available equipment ground and to the frame of the cabinet. If not, using the hardware provided, connect cable to holes near the lower right side of mounting frame, at the rear of the bank.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

### PROCEDURE 3 -- INSTALL D4 CHANNEL BANK COMMON EQUIPMENT

***IMPORTANT: Read Application before starting procedure!***

**Application:** This procedure contains instructions for installing the D4 channel bank common unit cards. Perform this procedure if a D4 channel bank is not equipped with common unit cards. This procedure does not equip channel unit slots for channel service. If any requirement cannot be met, refer to Procedure 9 to diagnose trouble.

**Apparatus:**

KS-20599 DVM (Digital Voltmeter) or equivalent

KS-21838, L1 Extractor Tool or Long-Nose Pliers

Ground Wrist Strap

Screwdriver.

***WARNING: The common unit cards contain electronic components that can be damaged by electrostatic discharge. When handling the cards, wear a ground wrist strap connected to frame ground on the Transmission Module.***

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STEP	PROCEDURE
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**PDU Card Installation -- Steps 1 Through 7.**

1. Connect static ground wrist strap to you and to frame ground of D4 channel bank.
2. Remove fuses labeled 10A, ALM, and -48 ABS from the PDU (power distribution unit) subassembly (Figure 3-9) on D4 channel bank.
3. Obtain PDU card. Straighten PDU leads so they extend back. Slide PDU into the bottom shelf, left slot of D4 channel bank (Figure 3-10). At rear of bank, screw fastener (Figure 3-11) into hole on back of PDU.
4. At rear of bank, loosen screws 2, 3, and 4 on terminal strip TS1 (Figure 3-11) and connect PDU spade lugs to terminals, matching lead, and terminal numbers.
5. At front of bank, install fuses in the subassembly, matching fuse bead color with color dot on subassembly (Figure 3-9). Install 10A fuse first.
6. Connect converter ac plug into AC POWER outlet.
7. At PDU, connect DVM (KS-20599 or equivalent) - (black) lead to black GRD jack and + (red) lead to red -48 V jack.

**Requirement:** -45 to -50 V dc.  
If not, go to Procedure 9.



PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

STEP

PROCEDURE

PCU Installation -- Step 8.

8. Obtain 325A PU card and install into PCU slot in top shelf of bank (Figure 3-10).

**Requirement:** FAIL lamp off. If FAIL lamp lights, go to Procedure 9.

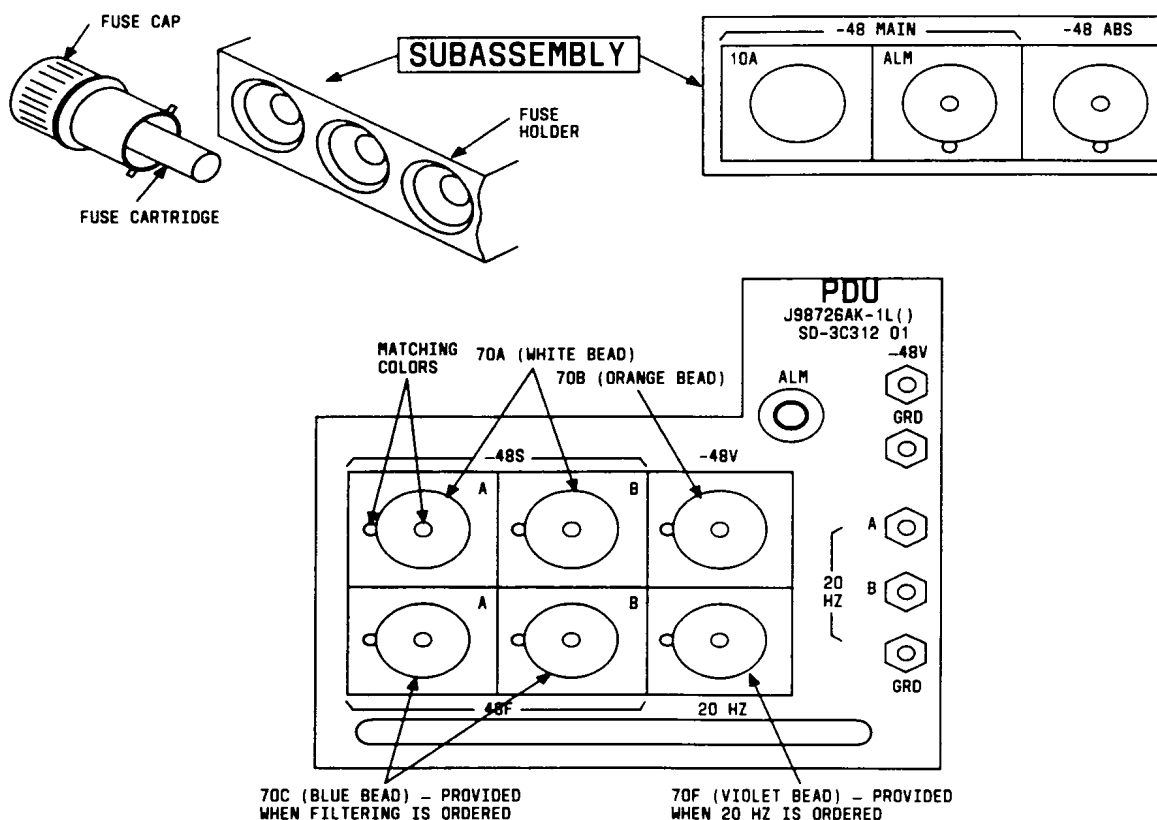


Figure 3-9. PDU Subassembly (Front View)

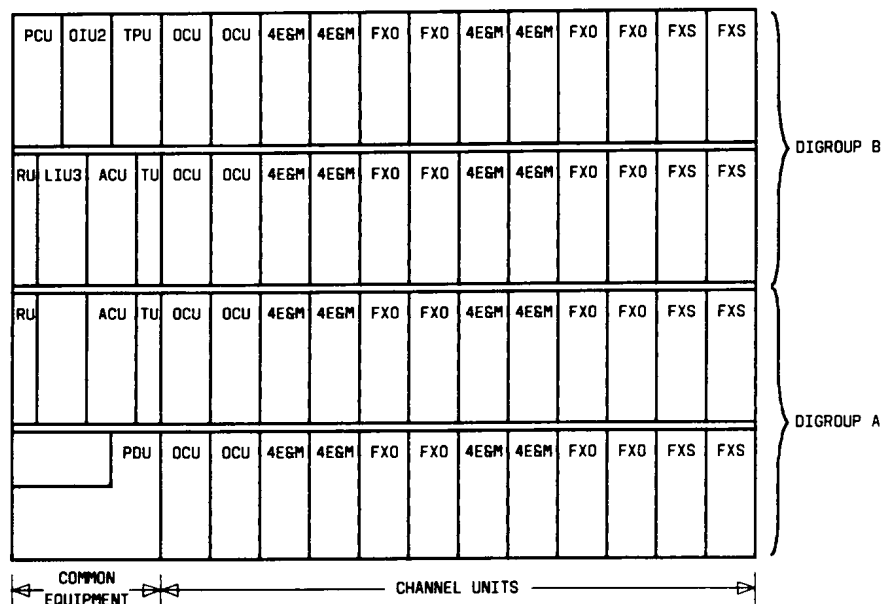
PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

STEP	PROCEDURE
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**TPU Card Installation -- Steps 9 Through 11.**

9. Obtain **TPU** card and determine if two white or green equalizer cards are installed. If not, obtain two ED-3C655-30, ED-3C585-30, or ED-3C656-30 cards as supplied and install them into **TPU** card according to instructions on **TPU**.
10. Look at faceplate of **TPU** card. Using long-nose pliers, position white plugs inside card to **SEQ** position in both **B** and **A** sections.
11. Install **TPU** in **TPU** slot (Figure 3-10).

**Requirement:** TPD lamps light. If not, replace lamps or **TPU** card.



**Figure 3-10.** D4 Channel Bank Configured For Mode 3 Operation

## PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

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STEP	PROCEDURE
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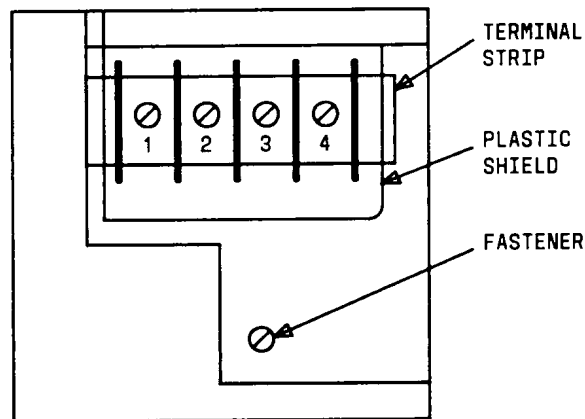


Figure 3-11. PDU Subassembly (Rear View)

12. Is D4 channel bank configured for **Independent Digroup Timing**? J98726JA TUI and J98726JB OIU-5 common unit cards will be furnished.  
Yes -- Go to Step 23.  
No -- Continue with Step 13.
13. Is D4 channel bank being configured for **ESF format or B8ZS format**? AHG8 LIU-3ESF or AHG9 LIU-3B common unit cards will be furnished.  
Yes -- Go to Step 28.  
No -- Continue with Step 14.
14. Is D4 channel bank being configured for **ILBRV** capability? AHG6 LBRV and AHG7 LIU-7 common unit cards will be furnished.  
Yes -- Go to Step 34.  
No -- Continue with Step 15.
15. Is D4 channel bank being configured for a **Digital Data Bank**? J98726HB QMJU and/or J98726HC SMRU common unit cards will be furnished.  
Yes -- Go to Step 47.  
No -- Continue with Step 16.
16. Is D4 channel bank being configured for **T1 Data Multiplexer Format Interface**? AHG11 DAU, AHG20 DRU, and AHG21 DACU common unit cards will be furnished.  
Yes -- Go to Step 50.  
No -- Continue with Step 17.

PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

STEP	PROCEDURE
17.	Obtain two <b>TU</b> (transmit unit) cards and two <b>RU</b> (receive unit) cards. Install them into their designated slots (Figure 3-10) of two middle shelves. If you have only one of each, install them into their slots in digroup A or B as applicable.
18.	Obtain one <b>LIU-3</b> and two <b>ACU</b> cards.
19.	Install <b>LIU-3</b> and <b>ACU</b> cards in two middle shelves as shown in Figure 3-10.
	<b>Requirement:</b> Alarm lamps on <b>ACU</b> cards light. If not, replace lamps or <b>ACU</b> cards.
20.	If <b>OIU</b> is not provided, you have completed this procedure. If <b>OIU</b> is provided, perform Steps 21 and 22.
21.	Refer to the <b>circuit or engineering specification document</b> for your particular installation and determine type of timing required along with which digroup (A or B) to be used as a reference. Select timing option by positioning white plugs in front window of <b>OIU</b> ( <b>OIU-4A</b> contains a rotary switch for selecting timing options). Using long-nose pliers, position plugs so they appear in proper place in front window to select loop ( <b>LT</b> ), local ( <b>LOC T</b> ), or external ( <b>EXT</b> ) timing and one digroup ( <b>A DGP</b> , <b>B DGP</b> ) as reference.
22.	Install <b>OIU</b> card in its designated slot of top shelf (Figure 3-10).

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**Independent Digroup Timing -- Steps 23 Through 27.**

23. For independent digroup timing, install **TUI** card into **TU** slot of digroup A.
24. Set timing options (**EXT**, **LT**, or **LOCT**) on **OIU-5** card as required or as specified by circuit or engineering specification document. Install **OIU-5** into **OIU** slot.
25. Install **TU** card into **TU** slot of digroup B. Install **ACU** cards into each **ACU** slot and **RU** cards into each **RU** slot of two middle shelves as shown in Figure 3-10.
26. Do you have a **LIU-3B** or a **LIU-3ESF** card?  
  
Yes -- Go to Step 28.  
  
No -- Continue with Step 27.
27. Install **LIU-3** card into **LIU** slot. Ignore any lighted lamps on the **ACU** card.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**ESF/B8ZS Format -- Steps 28 Through 33.**

28. For **ESF** format, obtain **LIU-3ESF** card. For **B8ZS** format, obtain **LIU-3B** card. For either card refer to Figure 3-12 and Table 3-E and set the S1 equalizer switch positions on the component board to the appropriate settings.

## PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

## STEP

## PROCEDURE

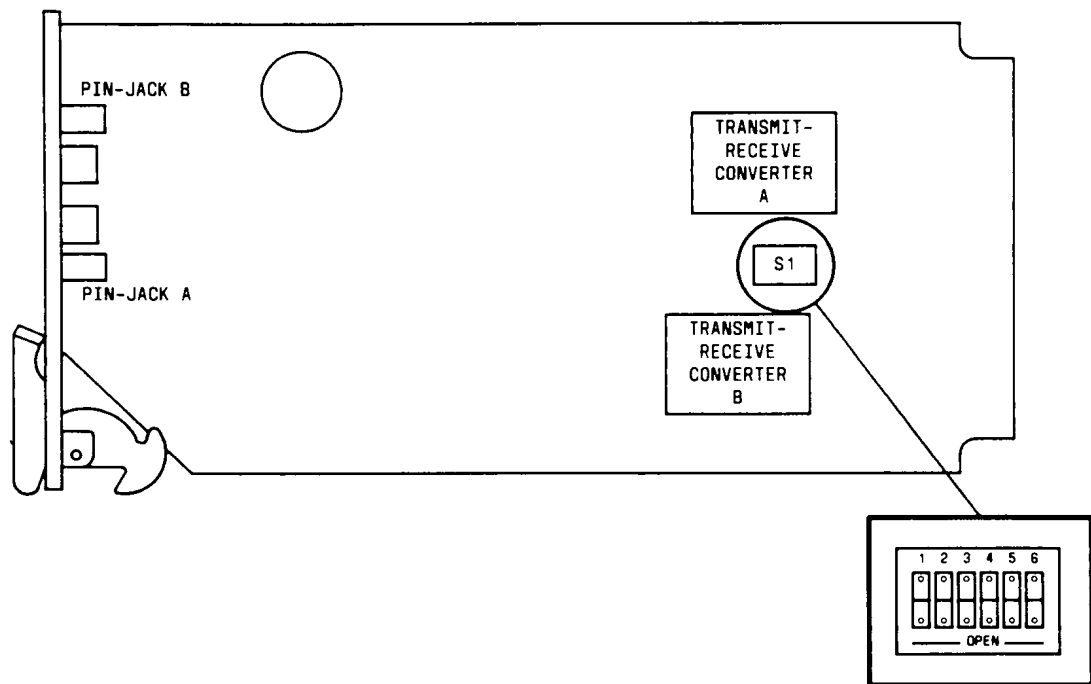


Figure 3-12. S1 Equalizer Switch Location on the LIU-3B or LIU-3ESF Cards

TABLE 3-E. EQUALIZER SETTINGS FOR LIU-3B AND LIU-3ESF

CABLE TYPE AND DISTANCE TO CROSS-CONNECT (FEET)		SWITCH S1 POSITIONS (NOTE)	
CABLE TYPE		DIGROUP A	DIGROUP B
750/1249	ABAM	1 2 3	4 5 6
0 to 90	0 to 133	O O O	O O O
90 to 180	133 to 267	O O C	O O C
180 to 270	267 to 400	O C O	O C O
270 to 360	400 to 533	O C C	O C C
360 to 450	533 to 655	C O O	C O O
Note: O = Switch open (depressed toward OPEN) C = Switch closed (depressed toward switch number)			

PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

STEP	PROCEDURE
29.	Set switches on the faceplate of <b>LIU-3B</b> or <b>LIU-3ESF</b> card as follows: Both <b>LP2</b> and <b>LP3</b> switches to <b>OFF</b> and <b>ESF/D4</b> and <b>B8ZS/ZCS</b> switches to applicable format as required or as specified by circuit or engineering specification document. Install <b>LIU-3B</b> or <b>LIU-3ESF</b> card into the <b>LIU</b> slot.
30.	Remove <b>TPU</b> card from the <b>TPU</b> slot of top shelf. Replace equalizer cards with <b>ED-3C656-30-G7</b> equalizer cards for both digroups or verify/install the <b>ED-3C656-30-G7</b> cards. Install <b>TPU</b> card into <b>TPU</b> slot.
31.	Install <b>ACU</b> card into each <b>ACU</b> slot and <b>RU</b> cards into each <b>RU</b> slot of two middle shelves as shown in Figure 3-10.
32.	Install <b>TU</b> card into each <b>TU</b> slot of two middle shelves as shown in Figure 3-10. Ignore any lighted lamps on the <b>ACU</b> cards.
33.	Have you installed an <b>OIU</b> card into <b>OIU</b> slot of the top shelf?  Yes -- <b>STOP! YOU HAVE COMPLETED THIS PROCEDURE.</b>  No -- Go to Step 20.

**ILBRV Operation -- Steps 34 Through 46.**

34. For ILBRV operation, obtain **AHG6 LBRV** and **AHG7 LIU-7** cards.
35. Using Figure 3-13, set the **BU/RB** signaling option on the **LBRV** card as required or as specified by circuit or engineering specification document. Install the **LBRV** card into the **SU** slot of the D4 channel bank.  
  
**Note:** The type of signaling must be consistent throughout the ILBRV facility.
36. On the **LIU-7** card remove the four screws that hold the "sub" board to the main board and separate the two boards. Using Figure 3-14, set the **S1** switch equalizer positions to the applicable settings as determined from the chart in Figure 3-14. Position and align the "sub" board with the main board and tighten the four screws. Note, that it is possible to reach **S1** positions 1, 2, and 3 from the rear of **LIU-7** by using a plastic "orange stick" or an equivalent tool and carefully go between the two boards to set the positions. The other three positions 4, 5, and 6 are not used for ILBRV applications.

## PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

## STEP

## PROCEDURE

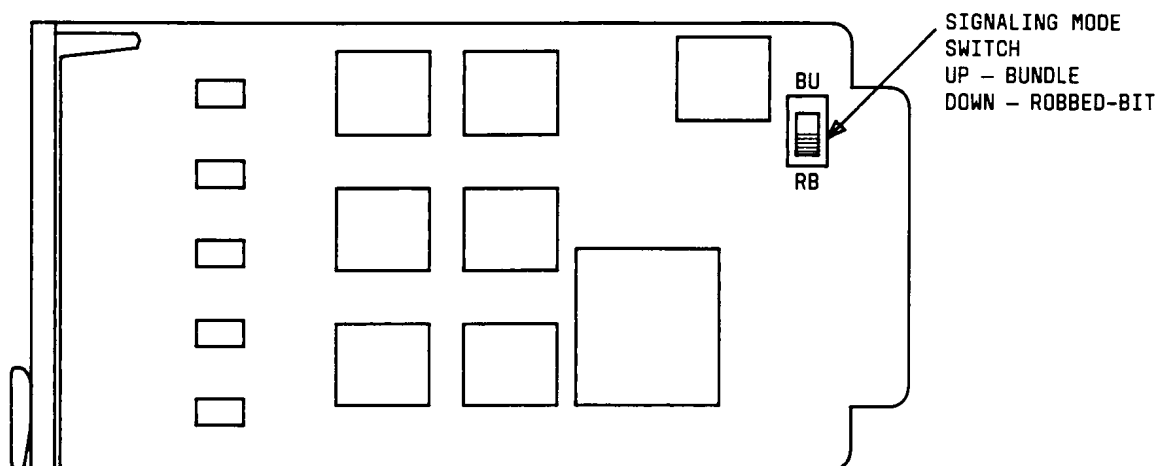
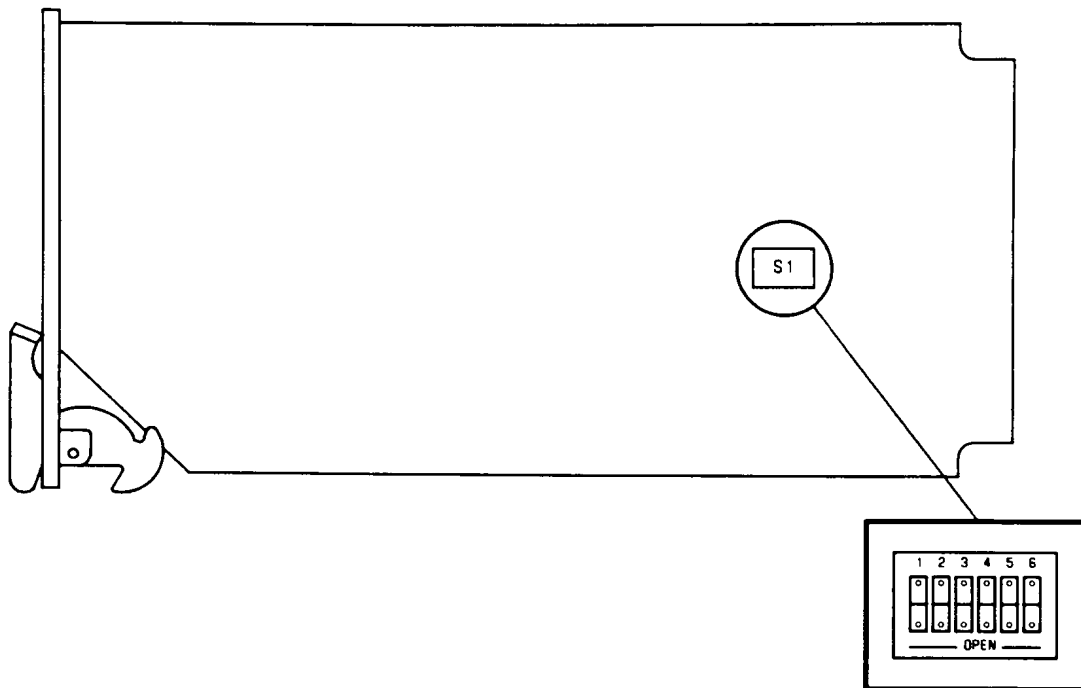


Figure 3-13. LBRV Card Signaling Switch (BU/RB) Location

37. On the faceplate of the LIU-7 common unit card, set the **ESF/D4** switch to the appropriate framing format and the **B8ZS/ZCS** switch to the appropriate line coding format as required or as specified by the circuit or engineering specification document. Set the **LP2** and **LP3** switches to the **OFF** position.
38. Install the LIU-7 into the LIU slot.
39. Is the LBRV card optioned for bundle signaling?
  - Yes -- Continue with Step 40.
  - No -- Go to Step 43.
40. Remove the -48ABS fuse from its holder at the Power Distribution Unit (PDU).
41. Connect alarm wires at the backplane of the D4 channel bank (see Figure 3-15) as follows:
  - A wire from J34 (SU) pin 22 to J35 (ACU) pin 35 (ACO lead)
  - A wire from J34 (SU) pin 20 to J35 (ACU) pin 17 (ALM lead)
  - A wire from J34 (SU) pin 19 to J26 (OIU) pin 19 (-48ABS lead).
42. Install the -48ABS fuse into its holder at the PDU.

PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

STEP	PROCEDURE
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S1 EQUALIZER SETTINGS				
CABLE TYPE AND CABLE DISTANCE TO CROSS-CONNECT FIELD (FEET)		SWITCH 1 (S1) POSITIONS (NOTE)		
750/1249	ABAM	1	2	3
0 TO 90	0 TO 133	0	0	0
90 TO 180	133 TO 267	0	0	C
180 TO 270	267 TO 400	0	C	0
270 TO 360	400 TO 533	0	C	C
360 TO 450	533 TO 655	C	0	0
NOTE: 0 - SWITCH OPEN (DEPRESSED TOWARD OPEN) C - SWITCH CLOSED (DEPRESSED TOWARD NUMBER)				

Figure 3-14. LIU-7 Card S1 Equalizer Switch Location and Settings

43. Remove TPU card from TPU slot of top shelf. Verify or install one equalizer card (ED-3C656-30-G7) in digroup A. The digroup B slot should not contain an equalizer card. Install TPU card into TPU slot.
44. Install TU and RU cards into each TU and RU slot of two middle shelves as shown in Figure 3-10.



## PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)

STEP	PROCEDURE
	<p><b>BUNDLE ALARM WIRE ROUTING:</b>  J34 PIN 22 TO J35 PIN 35  J34 PIN 20 TO J35 PIN 17  J34 PIN 19 TO J26 PIN 19</p>

WIRING  
HARNESS

**BUNDLE ALARM WIRE  
ROUTING:**  
J34 PIN 22 TO J35 PIN 35  
J34 PIN 20 TO J35 PIN 17  
J34 PIN 19 TO J26 PIN 19

**Figure 3-15.** D4 Channel Bank Rear View (Backplane) of Bundle Alarm Wire Connections

45. Install **ACU** card into **ACU** slot of digroup A. **ACU** slot of digroup B must be vacant. Ignore any lighted lamps on the **ACU** card.
46. Have you installed an **OIU** card into **OIU** slot of top shelf?

Yes -- **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

No -- Go to Step 20.

**PROCEDURE 3 — INSTALL D4 CHANNEL BANK COMMON EQUIPMENT (Contd)**

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STEP	PROCEDURE
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**Digital Data Bank Operation -- Steps 47 Through 49.**

47. For DDB operation, obtain J98726HB **QMJU** and/or J98726HC **SRMU** cards as applicable.
48. Refer to Figures 3-16, 3-17, 3-18, or 3-19. Equip the D4 channel bank as applicable for dedicated or split bank **QMJU** and/or **SRMU** operation.
49. The D4 channel is now equipped to operate as a DDB terminal. There are many aspects to the operation, service, and maintenance of a D4-DDB terminal. Therefore, this document does not contain service and maintenance information for a DDB terminal. However, refer to the REFERENCES Section for other documents relating to the type of DDB terminal you have. The documents can be ordered as listed in that section.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**T1 Data Multiplexer Format Interface -- Steps 50 Through 52.**

50. For T1DM format interface, obtain DAU, DRU, and DACU common unit cards. Two of each card are required if both digroups A and B are to be configured with T1DM format.
51. Install the DAU card into channel slot 24, the DRU card into the RU slot of the assigned digroup, and the DACU card into the ACU slot of the assigned digroup. If the other digroup is to be configured for T1DM format, repeat Steps 50 and 51.
52. Have you installed an **OIU** card into **OIU** slot of top shelf?

Yes -- **STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

No -- Go to Step 20.

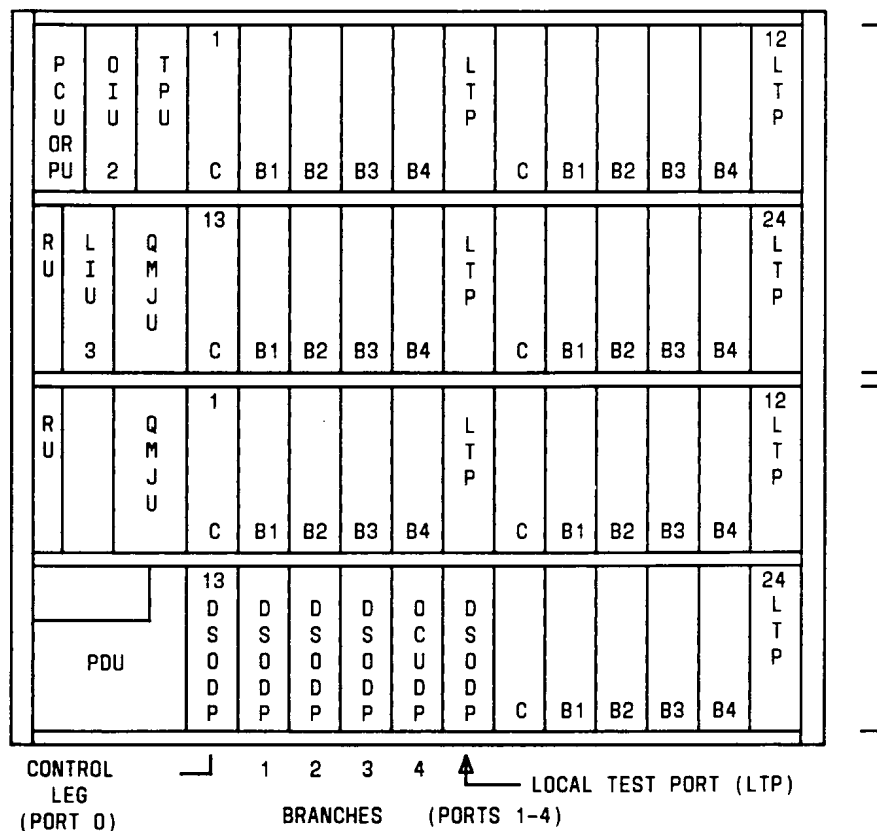


Figure 3-16. D4 DDB Terminal - Dedicated Multipoint Junction Unit Arrangement

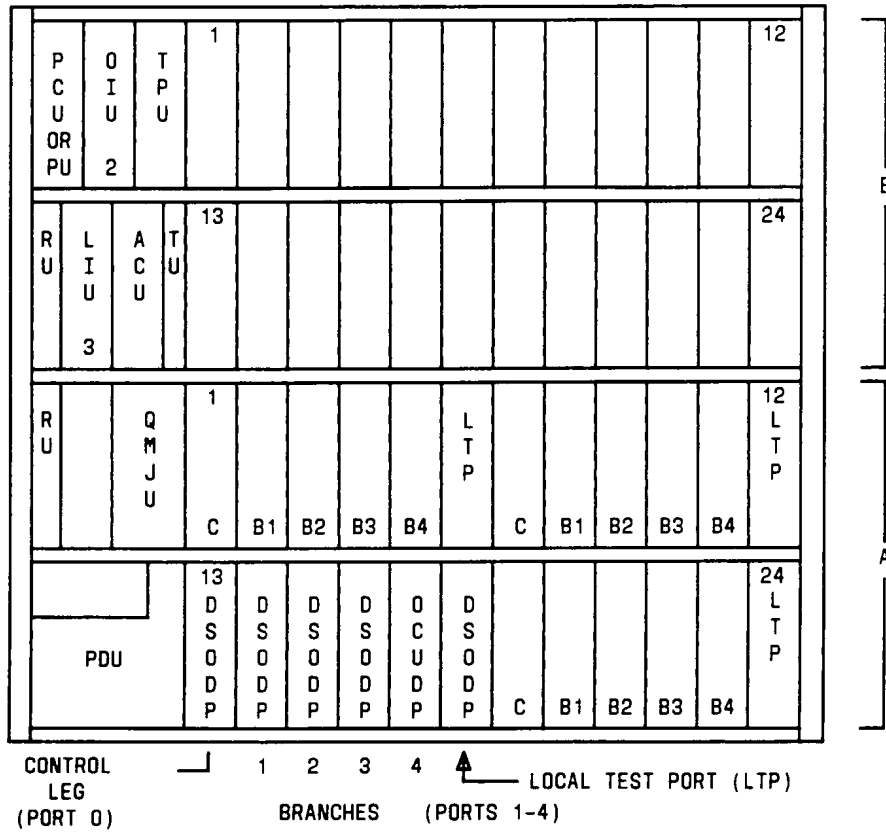


Figure 3-17. D4 DDB Terminal - Split Bank Multipoint Junction Unit Arrangement

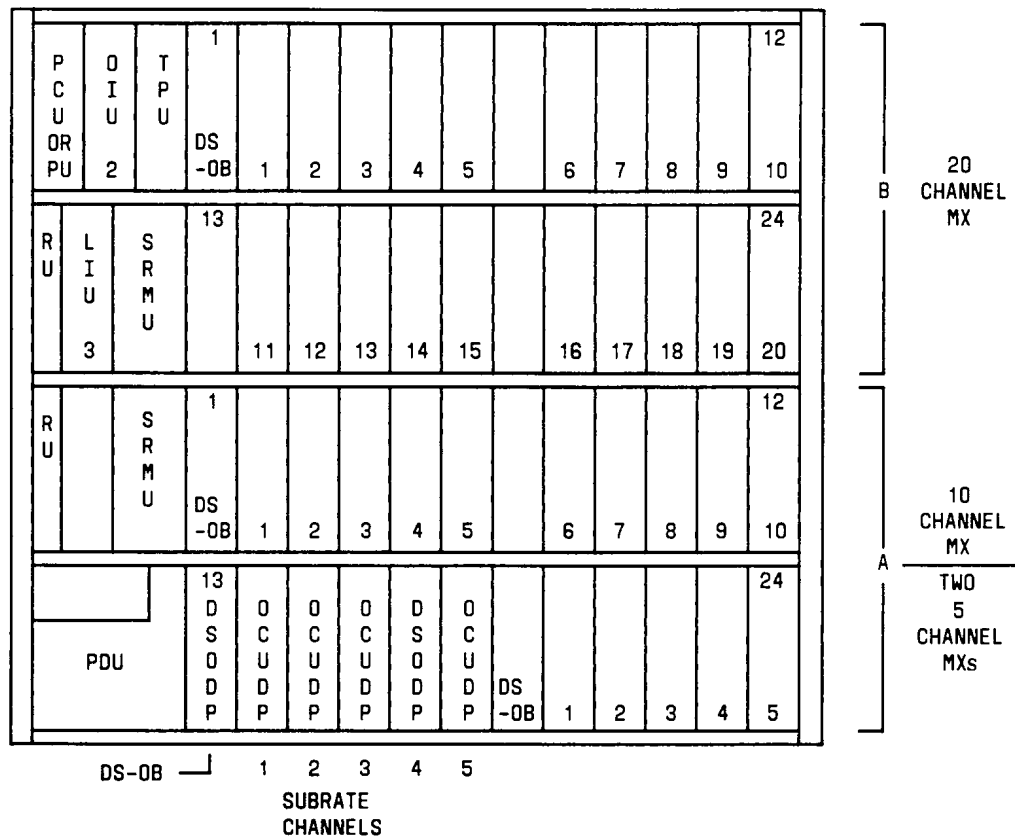


Figure 3-18. D4 DDB - Dedicated Subrate Multiplexer Arrangement

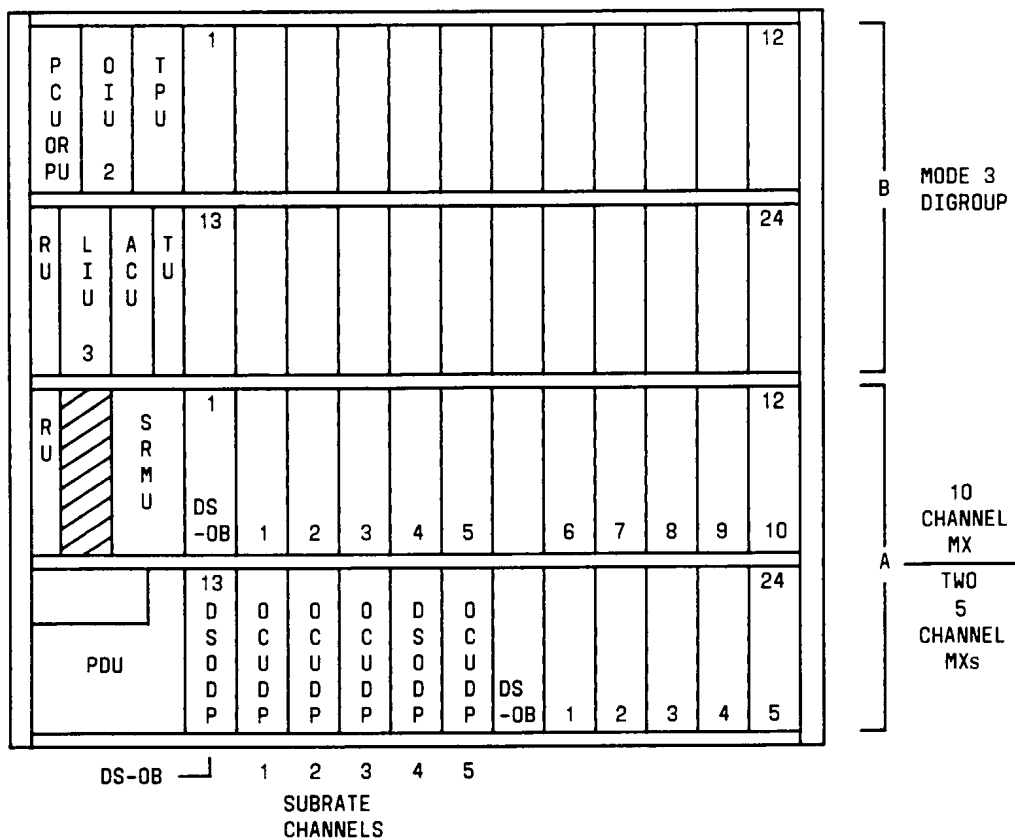


Figure 3-19. D4 DDB - Split Bank Subrate Multiplexer Arrangement

**Tools and Test Equipment**

Table 3-F lists all tools and test equipment required to perform initial testing on the D4 channel bank using Procedures 4 through 8.

**TABLE 3-F. D4 CHANNEL BANK TEST EQUIPMENT**

NUMBER	EQUIPMENT
KS-20599	Digital Voltmeter or equivalent
	Long-Nose Pliers, Screwdriver
J98718AL	D4 Portable Test Set with J98718AJ Channel Access Unit
431A-1	LSI Sierra Test Set (can be used in place of D4 Portable Test Set)
J94003A, B, or C	Noise Measuring Set or equivalent
J98726MH	SPTS Card (if available)
3P6A	Test Cords (two)
3P6D	Test Cord
P6AD	Test Cords (two)
KS-19531	Pin Plug or Meter Lead

## PROCEDURE 4 -- LOOP D4 CHANNEL BANK DIGROUPS

### **IMPORTANT: Read Application before starting procedure!**

**Application:** Perform this procedure to loop a D4 digroup's transmitter (TU) output to the receiver (RU) input. The digroups to be tested must be looped before the looped tests in Procedure 7 can be performed. This is accomplished at the ACU (alarm control unit). Perform all looped tests before unlooping the digroup(s). If any requirement cannot be met, refer to Procedure 9 to diagnose trouble. Figure 3-20 shows a digroup loop configuration.

STEP	PROCEDURE
1.	Digroup to be looped must first be in alarmed condition. If ACU indicates alarm (AR or AY lamp lighted), go to Step 2. If ACU does not indicate alarm, insert a pin plug (KS-19531) or meter lead into R CODE jack on the RU (receive unit) of digroup under test.
	<b>Requirement:</b> AR and TP lamps light on ACU for digroup under test.
2.	Momentarily depress ACO pushbutton on ACU.
	<b>Requirement:</b> ACO lamp lights on ACU.
3.	Set 3-position switch on ACU to LT.
	<b>Requirement:</b> LT lamp lights.
4.	Remove pin plug from the R CODE jack on RU.
5.	Loop other digroup by repeating Steps 1 through 4 on the other ACU card.

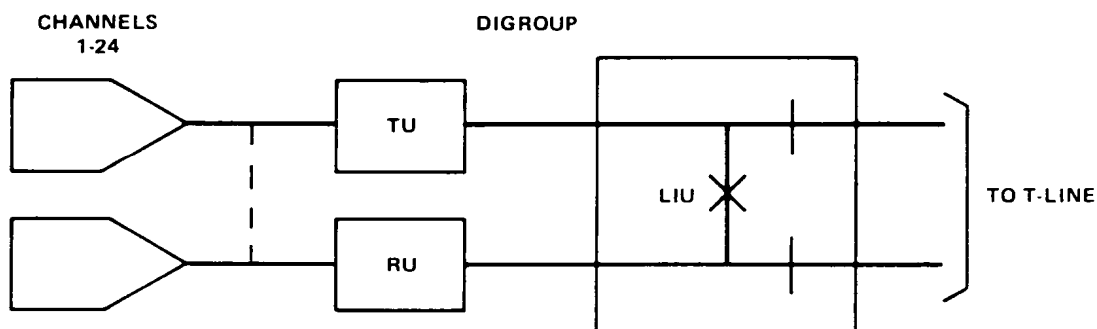


Figure 3-20. D4 Digroup Loop Configuration



**PROCEDURE 5 -- CALIBRATE THE CAU (CHANNEL ACCESS UNIT)*****IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure to calibrate the CAU (channel access unit) portion of the D4 PTS (portable test set). This test set is used for the D4 channel bank initial or trouble analysis tests. If any requirement cannot be met, obtain another test set.

**Apparatus:**

1 -- J98718AL D4 PTS (Portable Test Set) equipped with J98718AJ CAU (Channel Access Unit).

---

STEP	PROCEDURE
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---

1. Connect power cord to 115-V ac 60-Hz power outlet and set **POWER** switch to **ON**.

**Note:** Figure 3-21 shows the D4 portable test set with the CAU.

2. On the CAU, set the switches as follows:

CONTROL	POSITION
REJ FLT	OUT
SEND LEVEL DB	OFF
TEST	CAL

**Requirement:** Meter indicates in black area.

3. Set **TEST** switch to **CHAN LINE** and rotate **VOL** control fully counterclockwise if tone is not desired.

## PROCEDURE 6 -- CALIBRATE THE 3-TYPE NOISE MEASURING SET

### ***IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure to calibrate the 3-type NMS (noise measuring set). The NMS is used in the D4 channel bank initial and trouble analysis noise test. If you have a different type of noise measuring set, skip this procedure.

#### **Apparatus:**

- 1 -- J94003A, B, or C NMS (Noise Measuring Set)
- 1 -- J98718AL D4 PTS (Portable Test Set) with J98718AJ CAU (Channel Access Unit)
- 1 -- 3P6D Test Cord.

**Note:** Figure 3-21 shows a 3-type noise measuring set.

---

STEP	PROCEDURE
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---

1. Verify that weighting network on NMS is installed and that **C-MESSAGE** is aligned with **WTG**.
2. Rotate **DBRN** switch to **85**.
3. Rotate **FUNCTION** switch to **BAT**. The pointer indicates in shaded area marked **BAT**. If it does not, replace battery.
4. Set **DBRN** switch to **80**.
5. Set **FUNCTION** switch to **600** (or **NM600/900** for 3C NMS).
6. Set controls on **CAU** as follows:

CONTROL	POSITION
REJ FLT	OUT
TEST	CAL

7. Connect 3P6D cord from **EXT DETR** jack on D4 PTS to **310 IN** jack on NMS.

**Requirement:** NMS meter indicates 10 dBm. Adjust **CAL** screw on meter to obtain this reading.

8. Disconnect 3P6D cord and set **TEST** switch on **CAU** to **CHAN LINE**.

**PROCEDURE 7 -- PERFORM D4 CHANNEL BANK LOOPED TESTS  
(INITIAL TESTING)*****IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure to verify proper D4 channel bank operation. This procedure can be performed only after Procedure 4 (Digroup Looping) has been completed. Perform this procedure in the sequence listed on one digroup at a time. The channel bank is considered ready for service when the looped tests have been completed on both digroups. If any requirement cannot be met, refer to Procedure 9 to diagnose trouble. If using Sierra 431A-1 test set, refer to instructions contained with test set for use and connections.

**Apparatus:**

- 1 -- J98718AL D4 PTS (Portable Test Set) with J98718AJ CAU (Channel Access Unit) or LSI Sierra 431A-1 Test Set
- 1 -- J94003A, B, or C NMS (Noise Measuring Set) or equivalent
- 3 -- D4 Channel Units of any type except dataport, program, or security
- 1 -- KS-19531 Pin Plug or meter lead
- 2 -- P6AD Test Cords
- 1 -- 3P6A Test Cord
- 1 -- 3P6D Test Cord
- 1 -- SPTS (Signaling Path Test Set) Card (if available).

---

STEP	PROCEDURE
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---

**Looped Bank Signaling Test -- Steps 1 Through 4.**

1. Select digroup to be tested **A** or **B**. Install **SPTS** card into any channel unit slot of digroup to be tested (remove channel unit if installed). If **SPTS** is not provided, go to Step 5.
2. Set **A** switch on **SPTS** to **1** and **B** switch to **0**.

**Requirement:** A lamp lights.

3. Set **B** switch on **SPTS** to **1**.

**Requirement:** B lamp lights.

4. Remove **SPTS**.

**PROCEDURE 7 — PERFORM D4 CHANNEL BANK LOOPED TESTS (INITIAL TESTING)**  
**(Contd)**

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STEP	PROCEDURE
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---

**Looped Bank Transmission Test -- Steps 5 Through 10.**

5. Install one D4 channel unit of any type except dataport (DP), program (PG), or security (SEC) into any channel unit slot of digroup to be tested.
6. Set switches on D4 PTS CAU as follows:

SWITCH	POSITION
TEST	CHAN LINE
REJ FLT	OUT
SEND LEVEL DB	0

7. Make test connections shown in Figure 3-21, *but do not connect noise measuring set.*
8. Insert a pin plug (KS-19531) or meter lead into **R CODE** jack of **RU** (receive unit) for digroup under test.

**Requirement:** RCV lamp lights on **RU** and **CAU** meter indicates in black area. Sierra indicates around +4.0 dB. If not, go to Procedure 9.

9. Remove pin plug or meter lead from **R CODE** jack of **RU** (receive unit) for digroups under test.

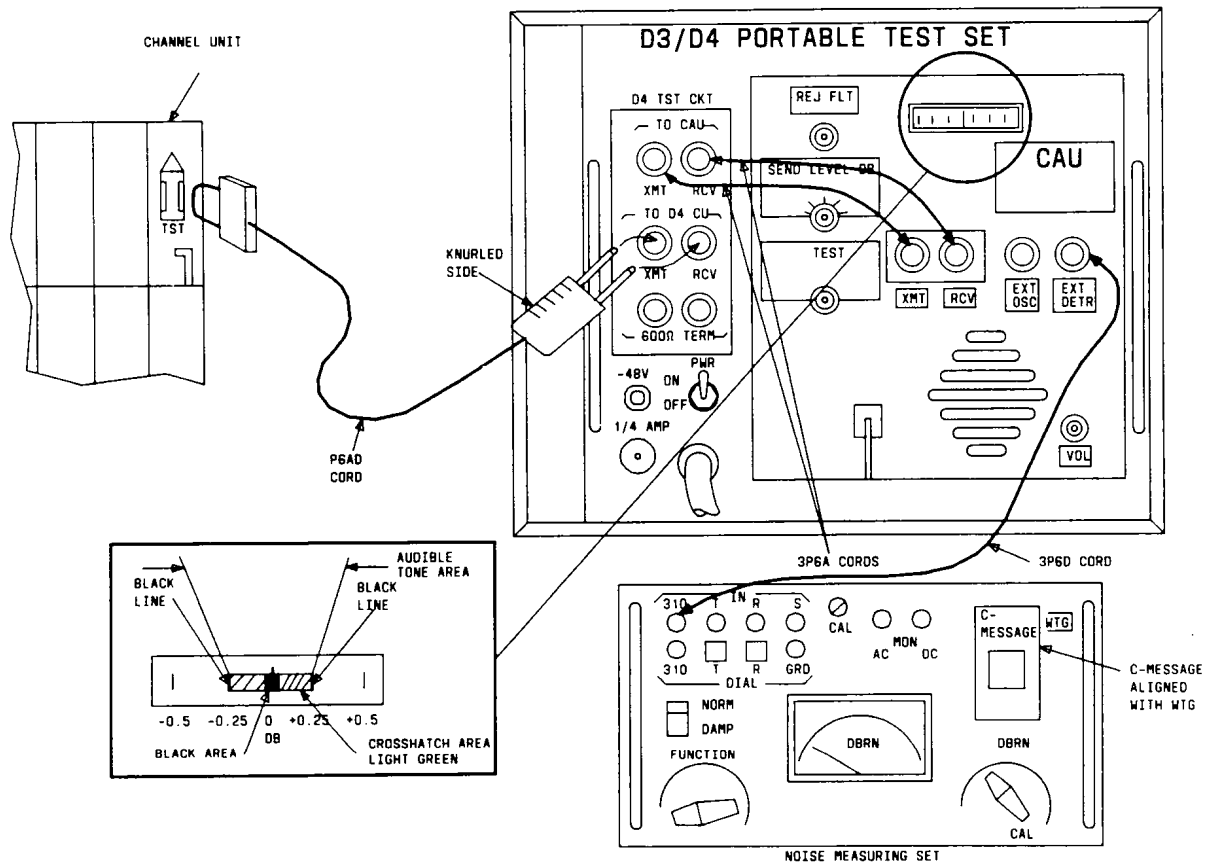
**Requirement:** **CAU** meter indicates in green-black-green area. Sierra indicates around +4.0 dB. If not, go to Procedure 9.

10. On **CAU**, set **SEND LEVEL DB** switch to **OFF**.

**PROCEDURE 7 — PERFORM D4 CHANNEL BANK LOOPED TESTS (INITIAL TESTING)**  
(Contd)

**STEP**

**PROCEDURE**



**Figure 3-21. D4 Test Connections**

**Looped Bank Idle Circuit Noise Test -- Steps 11 Through 13.**

11. Connect NMS (noise measuring set) to D4 PTS (portable test set) as shown in Figure 3-21.

**PROCEDURE 7 — PERFORM D4 CHANNEL BANK LOOPED TESTS (INITIAL TESTING)**  
(Contd)

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STEP	PROCEDURE
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---

12. On NMS, set controls as follows:

CONTROL	POSITION
FUNCTION	600 (or NM 600/900 for 3C test set)
NORM-DAMP	DAMP
DBRN	85
WTG	C-MESSAGE

13. On NMS, rotate **DBRN** switch counterclockwise until **DBRN** meter indicates an on-scale reading.

**Requirement:** NMS indicates 23 dBrnc or less. If not, go to Procedure 9.

**Looped Bank Distortion Test -- Steps 14 And 15.**

14. Set **CAU** switches as follows:

**REJ FLT** to **IN** and **SEND LEVEL DB** to **0**.

15. For each position of **CAU SEND LEVEL DB** switch listed below, observe NMS meter. Rotate **NMS DBRN** switch until an on-scale reading is found each time. Observe **DBRN** switch and meter indications.

**Requirement:** NMS meter indication must meet requirements listed below for each **SEND LEVEL DB** switch position. If not, go to Procedure 9.

**PROCEDURE 7 — PERFORM D4 CHANNEL BANK LOOPED TESTS (INITIAL TESTING)**  
(Contd)

STEP	PROCEDURE
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**LOOPED BANK DISTORTION REQUIREMENTS**

CAU SWITCH	POSITION	REQUIREMENTS
SEND LEVEL DB	0	56 dBrnc or less
	10	46 dBrnc or less
	20	36 dBrnc or less
	30	26 dBrnc or less
	40	22 dBrnc or less

**Looped Bank Crosstalk Test -- Steps 16 Through 21.**

16. Select a channel to be measured from either column with that heading and determine the two most likely interfering channels.

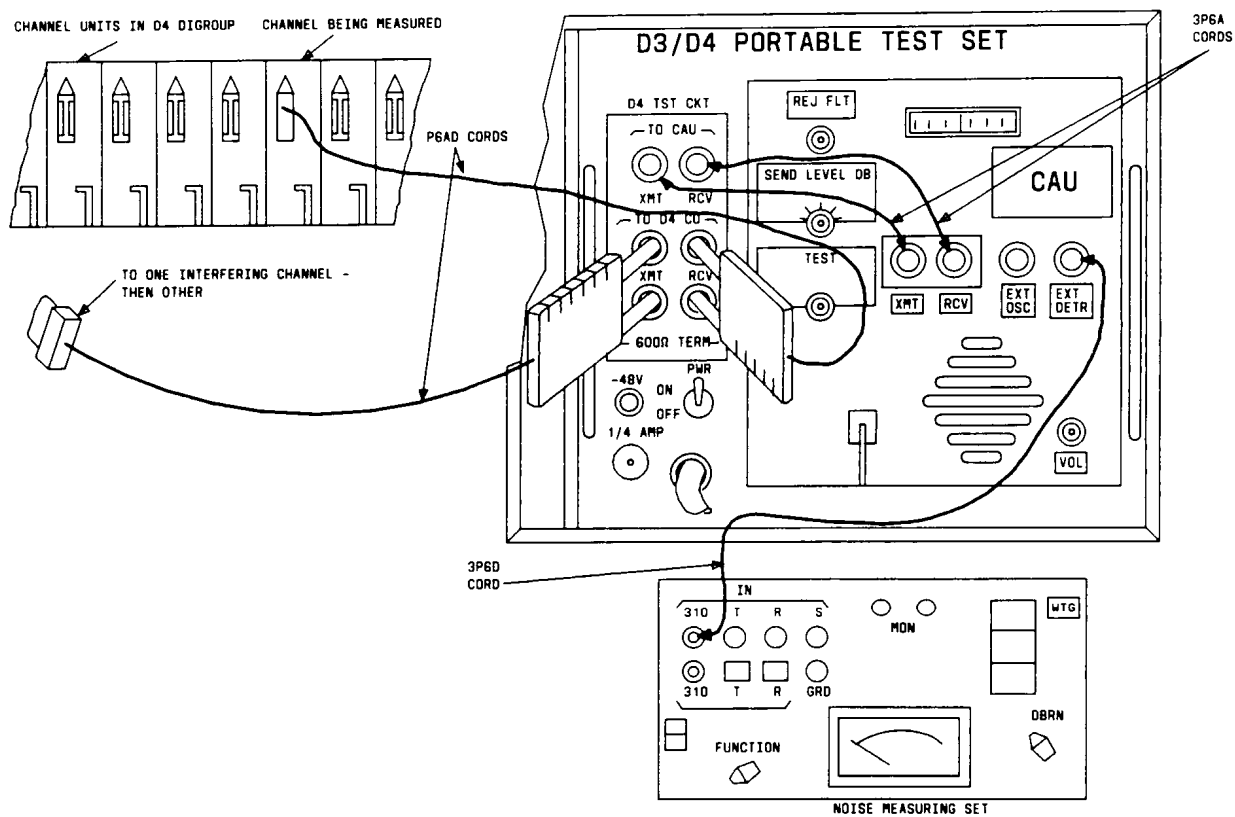
**INTERFERING CHANNELS FOR CROSSTALK TEST**

CHANNEL TO BE MEASURED (1-12)	MOST LIKELY INTERFERING CHANNELS		CHANNEL TO BE MEASURED (13-24)	MOST LIKELY INTERFERING CHANNELS	
1	24	23	13	12	11
2	1	24	14	13	12
3	2	1	15	14	13
4	3	2	16	15	14
5	4	3	17	16	15
6	5	4	18	17	16
7	6	5	19	18	17
8	7	6	20	19	18
9	8	7	21	20	19
10	9	8	22	21	20
11	10	9	23	22	21
12	11	10	24	23	22

**PROCEDURE 7 — PERFORM D4 CHANNEL BANK LOOPED TESTS (INITIAL TESTING)**  
(Contd)

STEP	PROCEDURE
------	-----------

- |     |   |
|-----|---|
| 17. | Install D4 channel units into channel unit slots for channel to be measured and for the two interfering channels. |
| 18. | Make test connections shown in Figure 3-22, first connecting to one interfering channel.                          |



**Figure 3-22. D4 Crosstalk Test Connections**

- On CAU, set **REJ FLT** to **OUT**.
- Rotate **DBRN** switch on NMS counterclockwise until meter indicates an on-scale reading.

**Requirement:** NMS indicates 27 dBrc or less. If not, go to Procedure 9.



**PROCEDURE 7 — PERFORM D4 CHANNEL BANK LOOPED TESTS (INITIAL TESTING)**  
**(Contd)**

---

STEP	PROCEDURE
<hr/>	
21.	Connect P6AD cord to other interfering channel unit.
	<b>Requirement:</b> NMS indicates 27 dBm or less. If not, go to Procedure 9.
22.	Remove test connections.
23.	Perform this procedure on other digroup.
24.	When facility is ready end-to-end, unloop digroup(s) by setting 3-position switch on <b>ACU</b> for each digroup to <b>NORM</b> .
	<b>Requirement:</b> All lamps extinguish. If AR or AY alarm lamps light, trouble is external to D4 channel bank. It is in the FT1 unit, CSU, or T1 line facility.

## PROCEDURE 8 -- PERFORM FACILITY END-TO-END TRANSMISSION TEST

### ***IMPORTANT: Read Application before starting procedure!***

**Application:** The end-to-end transmission test of this procedure is not required to verify operation of the D4 channel bank but may be performed to verify total facility operation. If the requirement cannot be met, refer to Procedure 15 in Maintenance section to diagnose trouble.

#### **Apparatus:**

1 -- J98718AL D4 PTS (Portable Test Set) with J98718AJ CAU (Channel Access Unit) or LSI Sierra 431A-1 Test Set

1 -- P6AD Test Cord

2 -- 3P6A Test Cords.

---

#### **STEP**

#### **PROCEDURE**

---

1. Verify that all equipment in Transmission Module at *both* ends is unlooped as follows:
  - FT1 lines unlooped -- **CUST/MOD** switch set to **NORM** on the FT1 unit
  - CSU lines unlooped -- no loop cords in **EQ** or **SM** jacks on the CSU.
2. Establish communication with far end of facility and determine channel(s) to be used for testing.
3. Install one D4 channel unit card into any channel slot of digroup to be tested.
4. Refer to Figure 3-23. Make test connections shown and verify that far end has done likewise. Do not connect NMS.
5. On **CAU**, set **SEND LEVEL DB** to **0**, **TEST** to **CHAN LINE**, and **REJ FLT** to **OUT** and verify far end has done likewise.

**Requirement:** CAU meter at each end indicates in green-black-green area. Sierra indicates +4.0 dB. If not, go to Procedure 9.

6. Perform this procedure on other digroup.
7. Disconnect all test equipment at each end. You have completed all tests. Transmission Module is ready for channel service.

PROCEDURE 8 — PERFORM FACILITY END-TO-END TRANSMISSION TEST (Contd)

STEP

PROCEDURE

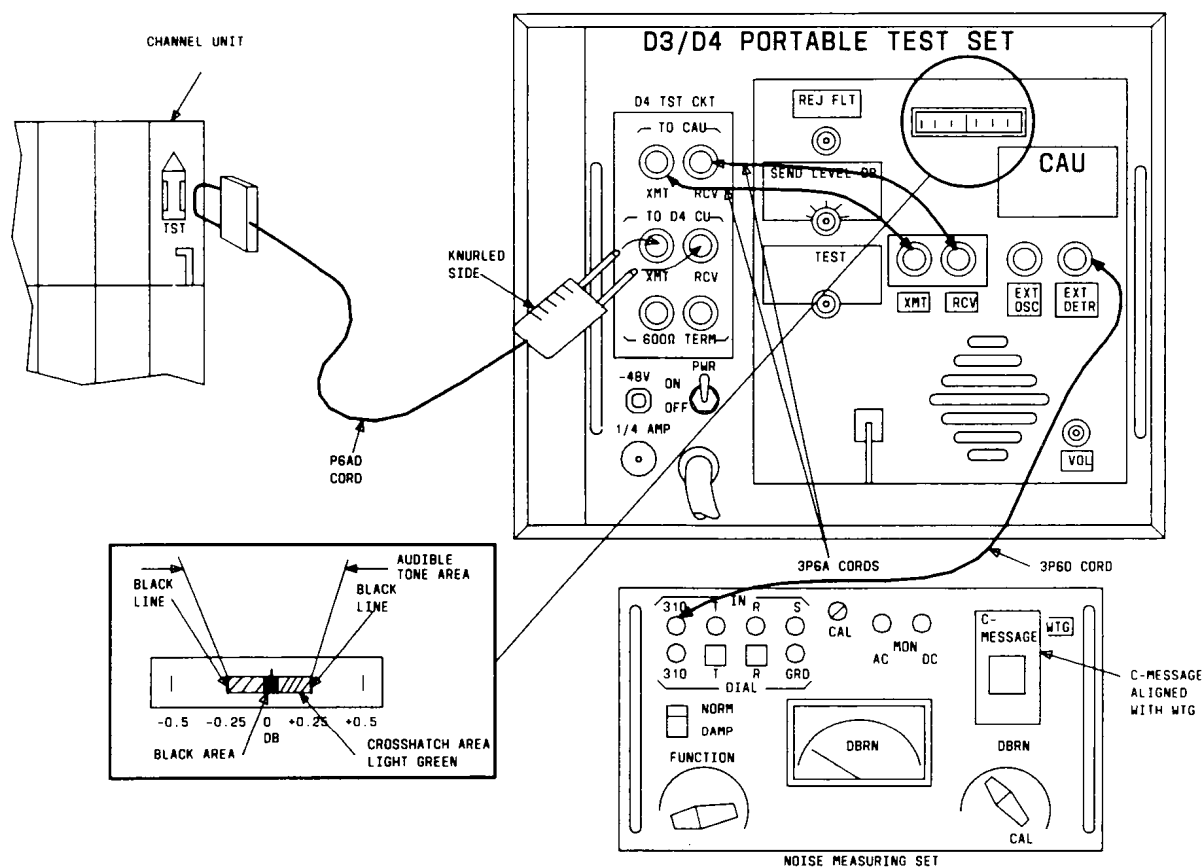


Figure 3-23. D4 Test Connections

## PROCEDURE 9 -- D4 INITIAL TESTING TROUBLE ANALYSIS

### ***IMPORTANT: Read Application before starting procedure!***

**Application:** Use this procedure to determine source of trouble in D4 channel bank. If replacement circuit pack (card) does not correct problem, install original circuit pack.

---

#### TROUBLE SPOT

#### ACTION

---

Procedure 3  
Step 7

1. Verify that all **PDU** fuses are good (no beads extended). If fuse is blown, replace it.
2. Check for battery voltage at terminals 3 and 4 (Figure 3-11) at rear of **PDU** (terminal 4 is positive ground). If voltage is present, replace **PDU**.
3. If voltage is not present, check that power connection exists from power supply to terminals 3 and 4 at rear of **PDU**.
4. Use local escalation procedures to clear trouble.

**PROCEDURE 9 — D4 INITIAL TESTING TROUBLE ANALYSIS (Contd)**

<b>TROUBLE SPOT</b>	<b>ACTION</b>
Procedure 3 Step 8	<ol style="list-style-type: none"><li>1. Replace <b>PU</b>.</li><li>2. Replace <b>PDU</b>.</li><li>3. Trouble is in bank backplane wiring. Use local escalation procedures to clear trouble.</li></ol>
Procedure 4 Step 1	<ol style="list-style-type: none"><li>1. Remove pin plug, replace <b>RU</b>, and insert pin plug in <b>R CODE</b> jack of replacement.</li><li>2. Replace <b>ACU</b>.</li><li>3. Trouble is in bank backplane wiring. Use local escalation procedures to clear trouble.</li></ol>
Procedure 4 Steps 2 and 3	<ol style="list-style-type: none"><li>1. Replace <b>ACU</b>.</li><li>2. Trouble is in bank backplane wiring. Use local escalation procedures to clear trouble.</li></ol>

PROCEDURE 9 -- D4 INITIAL TESTING TROUBLE ANALYSIS (Cont'd)

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TROUBLE SPOT	ACTION
Procedure 7 Step 2, 3, 8, 9, 13, 15, 20, or 21	<ol style="list-style-type: none"><li>1. Recheck test connections. If signaling test of Step 2 or 3, go to Step 3.</li><li>2. Replace channel unit used for test.</li><li>3. Replace RU.</li><li>4. Replace TU or TUI.</li><li>5. Replace LIU. If LIU-3B, LIU-3ESF, or LIU-7, set options in replacement card to match those of the original card.</li><li>6. Replace LBRV in SU slot if applicable. Set options in replacement card to match those of the original card.</li><li>7. Remove all channel units except test channel.</li><li>8. Replace remaining common equipment circuit packs one at a time.</li><li>9. Use local escalation procedures to clear trouble beyond this point.</li></ol>

## 4. CUSTOMER SERVICE

### Overview

This section contains information and procedures for establishing customer service in the Transmission Module.

### Establishing Customer Service

After the Transmission Module has been installed, connected, and tested, the D4 channel bank must be conditioned to meet the requirements for the type of service on each customer channel. This section contains two procedures (10 and 11) to condition the channels for service. Use Procedure 10 to establish customer service. Use Procedure 11 to supplement Procedure 10 if the D4 channel bank is to be configured with ILBRV transmission capability.

The D4 channel bank provides many types of customer services. A specific customer service requires the use of specific types of D4 channel units. Table 4-A and Figure 4-1 show the preferred (first choice) type of channel units that should be used for a given type of customer service or application between two locations A and Z. Refer to the Glossary for definitions of abbreviations and terms contained in Table 4-A.

Each D4 channel unit card must be conditioned for the applicable type of service. The applicable channel unit card for a given customer service must be optioned properly, installed into the correct channel slot in the D4 channel bank, and tested for proper transmission (if needed). Procedure 10 provides the steps to be done for each channel unit card that is to be put into service. Procedure 11 provides the steps to be done to set up each channel as a compressed channel or as a full-rate (noncompressed) channel if the D4 channel bank is configured for ILBRV capability.

TABLE 4-A. D4 CHANNEL UNIT SERVICE APPLICATIONS

LOCATION OR EQUIPMENT A (NOTE)	CHANNEL UNIT	TYPE SERVICE (TRUNK/LINE)	CHANNEL UNIT	LOCATION OR EQUIPMENT Z (NOTE)
CO	DPO	Direct Inward Dial Trunk	DPT	PBX
CO	FXO-9	Foreign Exchange Trunk	FXS-6	PBX
CO	FXO-9	Foreign Exchange Line	FXS-6	STATION
PBX	E&MER	Tandem Tie Trunk	E&MER	PBX
CO	FXO-9	Off Premises Extension Line	FXS-6	STATION
PBX	FXO-6	Off Premises Station Line	FXS-6	STATION
PBX	E&MER	Access Tie Trunk	E&MER	PBX
CO	FXO-9	PBX-CO Trunk	FXS-6	PBX
CO	FXO	IN-WATS Trunk	FXS	PBX
CO	FXO	IN-WATS Line	FXS	STATION
CO	FXO	OUT-WATS Trunk	FXS	PBX
CO	FXO	OUT-WATS Line	FXS	STATION
CO	FXO	Computerized Automatic Call Director IN-WATS Trunk	FXO	ACD
CO	FXO	Computerized Automatic Call Director FX Trunk	FXO	ACD
CO	FXO/DPO	Secretarial Line	FXS/DPT	SECB
CO	DS0	DDS or Stand-alone Digital Data	OCU	CO/STATION
MODEM	ETO	Analog Data	ETO	MODEM
STATION	PG T	Program	PG R	STATION
CO	VARIOUS	EPSCS	VARIOUS	PBX
CO/4 ESS Switch	2W/PBX	MEGACOM MEGACOM 800	2W/PBX	PBX
CO/4 ESS Switch	DDA-DSO	DDA Switched 56	DDA-OCU	STATION
CO/5ESS Switch	BRITE	ISDN	BRITE	STATION
STATION	BRITE	Stand-alone Digital Pipe	BRITE	STATION
OFFICE	DS0	Data Terminal (RS-232C or V.35)	DSU-II	STATION

**Note:** For improved return loss and balance, it is strongly recommended that 600-ohm type channel unit cards (i.e., DPT6, FXO6, FSO6) be used to interface with 600-ohm PBX equipment.



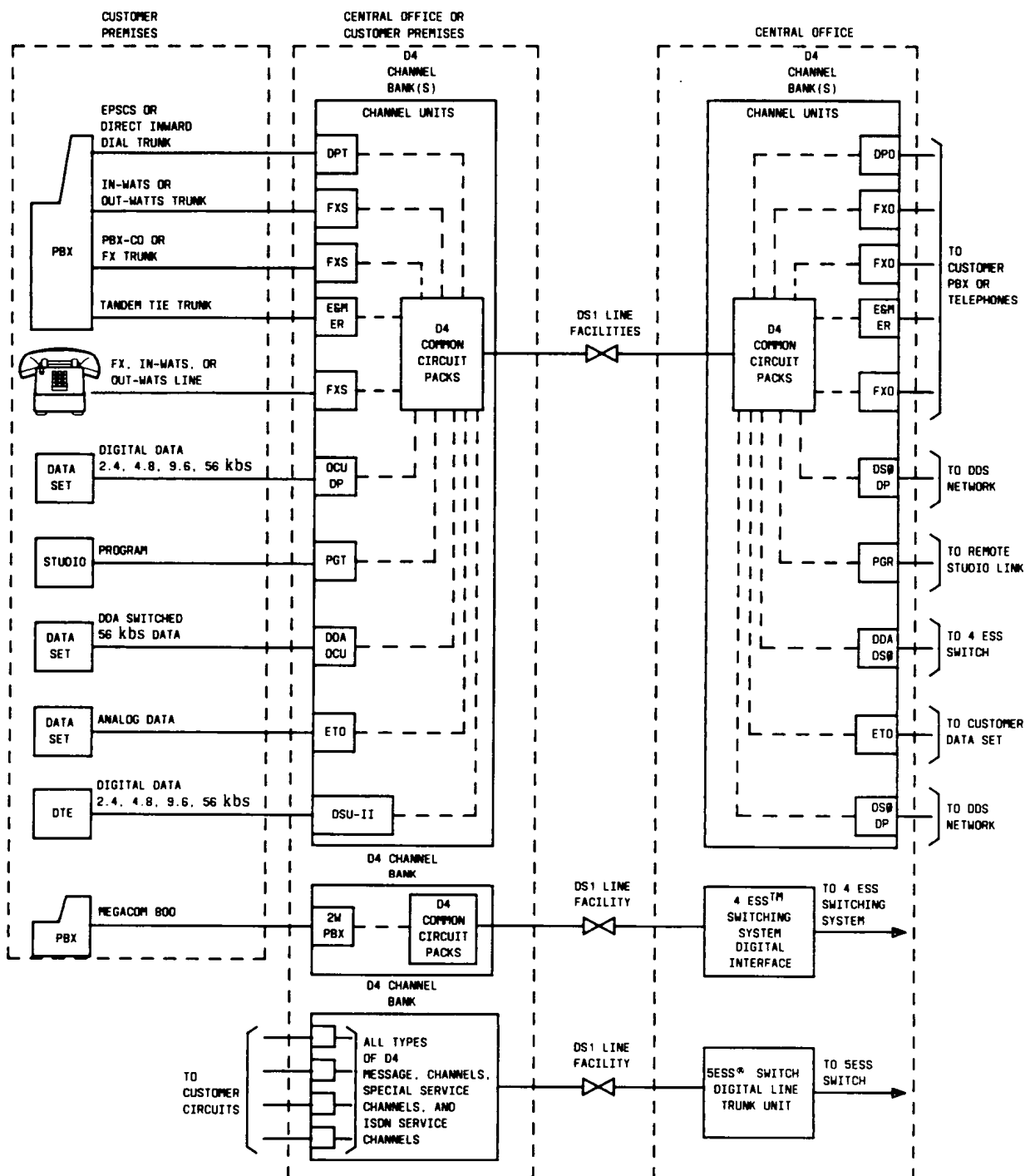


Figure 4-1. D4 Channel Unit Service Applications

## PROCEDURE 10 -- CONDITION D4 CHANNEL BANK TO ESTABLISH CUSTOMER CHANNEL SERVICE

### **IMPORTANT: Read Application before starting procedure!**

**Application:** Perform this procedure at the applicable D4 channel bank in the Transmission Module when starting customer channel service. If a problem occurs during this procedure, refer to the Maintenance Section of this document. Note, that a technician is required at the customer equipment location to perform this procedure.

---

#### STEP

#### PROCEDURE

---

1. Is D4 channel bank to be configured for ILBRV transmission?  
YES - Go to **Procedure 11**.  
NO - Continue with Step 2.
2. Establish communications with technician at customer equipment location and have the technician perform this procedure as applicable.
3. Attach the static ground wrist strap to your wrist and to frame ground of the D4 channel bank.
4. Refer to channel service order or engineering documents and determine the bank, digroup A and/or B, and channel slot 1 through 24 to be used for customer service.
5. Obtain specific channel unit card to be used for service. Refer to Table 4-B if necessary for channel unit card end-to-end compatibility information.
6. Using service order or engineering documents, determine and set all options in the channel unit card. If necessary, refer to Table 4-C for description and application information of the channel unit options. If it is desired to prescription set the channel unit card transmit and receive attenuators, use the following formulas:

$$ATT_T = 8.5 + G_T + TLP_T$$

where:

$ATT_T$  = Required transmit attenuator setting (TRMT or T)

$G_T$  = Channel unit card transmit insertion gain/loss from Table 4-D or Table 4-E.

$TLP_T$  = Customer signal level received at channel unit card input T/R leads.

$$ATT_R = 4.0 + G_R - TLP_R$$

where:

$ATT_R$  = Required receive attenuator setting (RCV or R).

$G_R$  = Channel unit card receive insertion gain/loss from Table 4-D or Table 4-E.

$TLP_R$  = Required signal level at channel unit card output leads T1/R1 (T/R for 2-wire).

**Note:** Calculation of channel unit card equalization settings or gain transfer settings is not included here because of the volume of charts necessary to determine prescription settings. Therefore, the equalizer settings for bandwidth (BW), height (HT), and slope

**PROCEDURE 10 -- CONDITION D4 CHANNEL BANK TO ESTABLISH CUSTOMER CHANNEL SERVICE (Contd)****STEP****PROCEDURE**

(SL) on the 4FXO, 4ETO, 4DX, 4FXS, and 4SF channel unit cards and the gain transfer settings (SL) on the 2FXO/GT, 2FXS/GT, and 2DX/GT should be set to zero. These settings are dependent on the make-up of the customer cable (length, gauge, loaded, or nonloaded). To set equalization or gain transfer to other than zero, refer to AT&T Practice 855-351-105, sections 8 and 9 and charts 1 through 48.

7. Install channel unit card into applicable slot 1 through 24 of applicable digroup A and B.
8. If channel unit card is dataport (OCU, DSU-II, or DS0) type, ignore remaining steps in this procedure. If channel unit card is not dataport type and you wish to monitor transmission levels and/or set attenuators, continue with this procedure.
9. Refer to Figure 4-2 and make test connections to channel but do not connect noise measuring set.
10. To monitor transmit level from drop side (customer) equipment, set CAU switches as follows: TEST to CHAN DROP, REJ FLT to OUT, and SEND LEVEL DB to OFF.

**Note:** D4 standard carrier TLP levels at the channel unit card are -8.5 dB TLP transmit toward the facility and +4.0 dB TLP receive from the facility. Figure 4-3 shows typical 2-wire and 4-wire channel unit card input/output levels, attenuation, TLPs, and  $G_T$  and  $G_R$ . Table 4-D provides the attenuation, transmission gain/loss parameters and recommended input and output levels for special service channel unit cards. Table 4-E provides the same information for message channel unit cards.

11. Monitor transmission level from drop side (customer) equipment. CAU should indicate in green-black-green area. External measuring set (Sierra 431A-1 or equivalent) should indicate around -8.5 dB TLP.
12. If proper level is not received, adjust transmit attenuator (TRMT or T) in channel unit card until proper level is received.
13. To send tone toward drop side (customer) equipment, set SEND LEVEL DB switch on CAU to 0.
14. Monitor transmission level at drop side (customer) equipment. If proper level is not received, adjust receive attenuator (RCV or R) in channel unit card until proper level is received. Check circuit document for drop side equipment receive level (TLP).

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

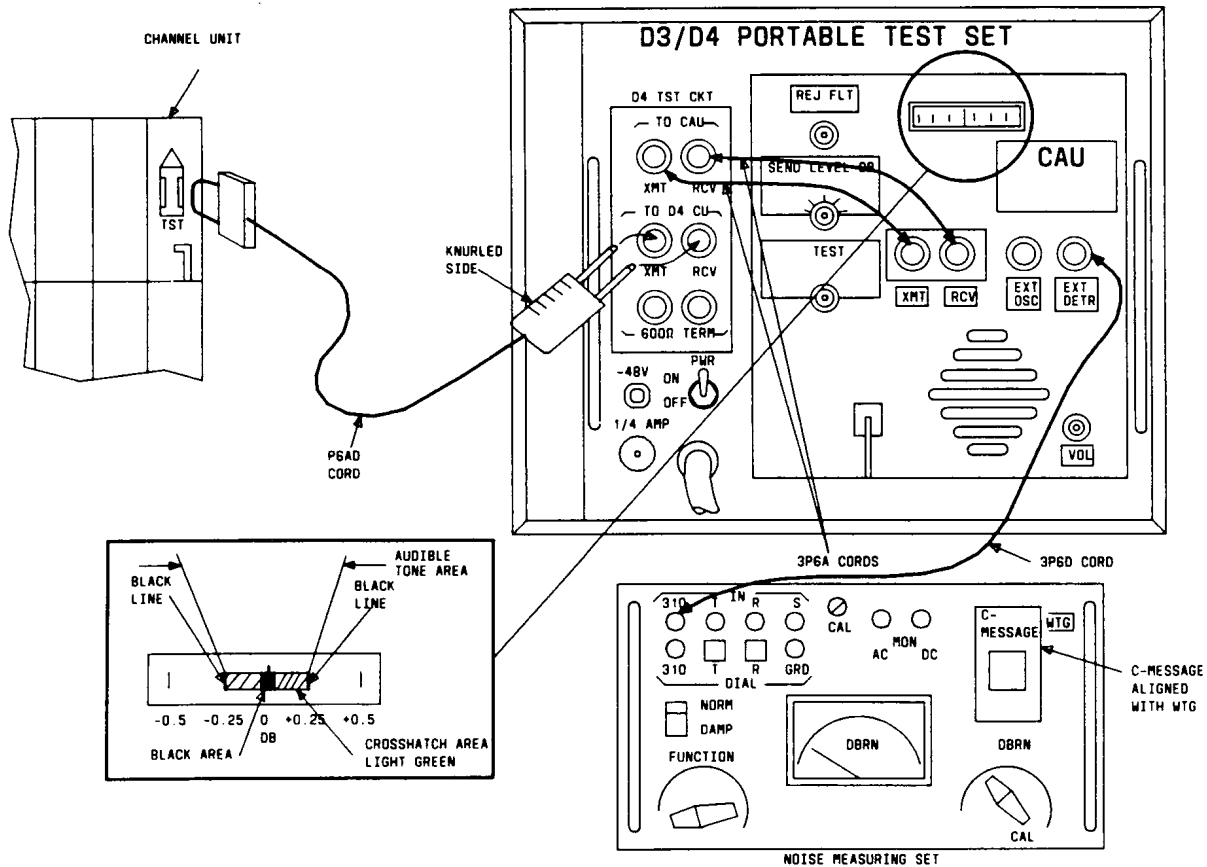
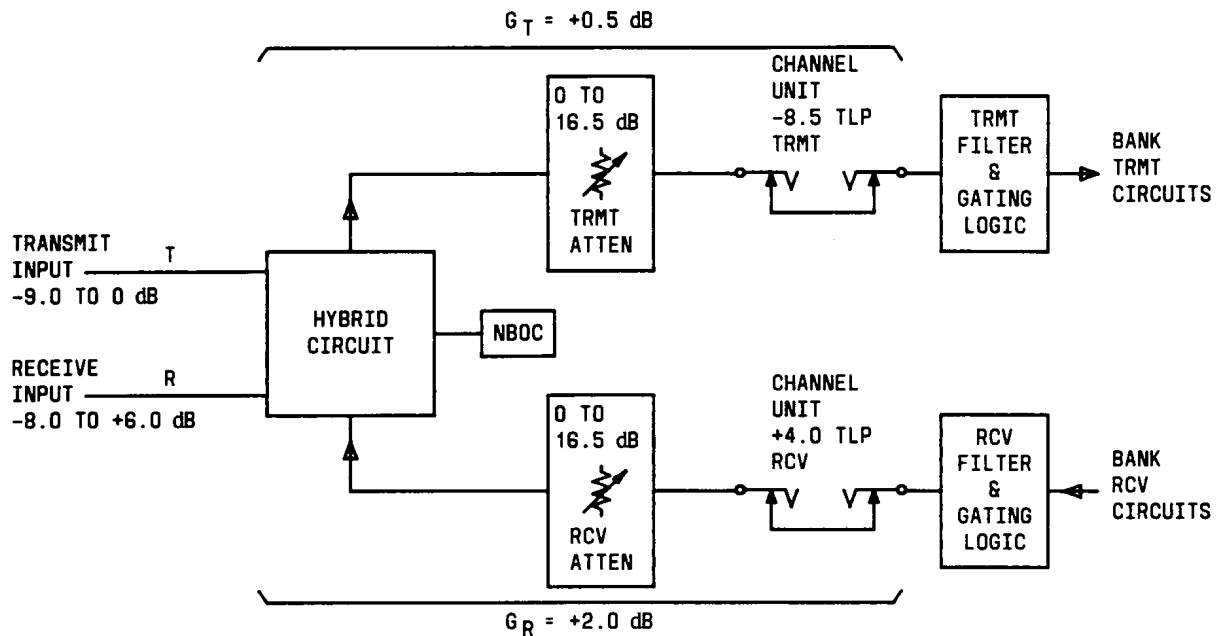
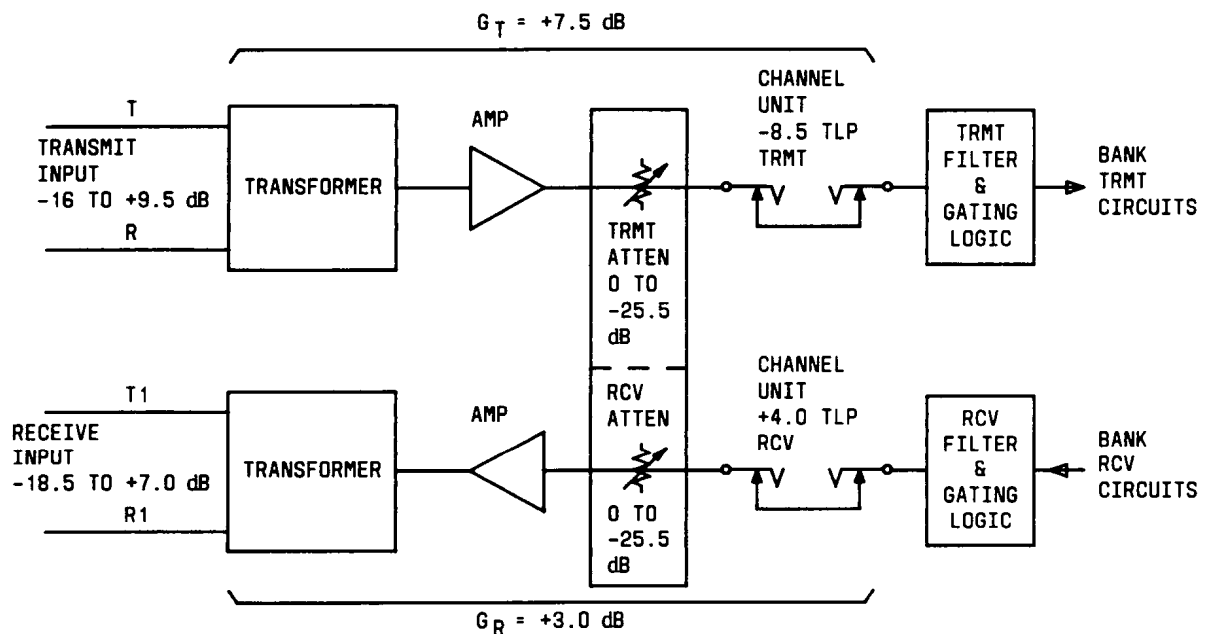


Figure 4-2. Test Connections



(a) Typical 2-Wire Channel Unit



(b) Typical 4-Wire Channel Unit

**Figure 4-3.** Transmission Paths And Parameters For Typical 2- and 4-Wire Channel Unit Cards

TABLE 4-B. CHANNEL UNIT CARDS COMPATIBILITY

CHANNEL UNIT CARD	COMPATIBLE WITH
CSDC MTCE DPMO DPO	NONE (MAINTENANCE ONLY) DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF
DPT DPT6	DPMO, DPO, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF DPMO, DPO, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF
PG15R PG15T PG8R PG8T	PG15T PG15R PG8T PG8R
PG7.5R PG7.5T PG5R PG5T	PG7.5T PG7.5R PG5T PG5R
PLR SEC MC O SEC MC S	DPMO, DPO, DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF SEC MC S, 4TDM, 4SF SEC MC O, 4TDM, 4SF
2DX/GT 2E&M 2E&M6	DPMO, DPO, DPT, PLR, SDPO, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF DPMO, DPO, DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF DPMO, DPO, DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF
2FXO or 2FXO6 2FXOLS	2FXS, 2FXS/LS, 2FXS/GT, 4FXS, 4TDM, 2FXS6, 4SF 2FXS, 2FXS/LS, 2FXS/GT, 4FXS, 4TDM, 2FXS6, 4SF
2FXO/GT 2FXS or 2FXS6 2FXS/LS	2FXS, 2FXS/LS, 2FXS/GT, 4FXS, 4TDM, 2FXS6, 4SF 2FXO, 2FXO6, 2FXOLS, 2FXO/GT, 4FXO, 4TDM, 4SF 2FXO, 2FXO6, 2FXOLS, 2FXO/GT, 4FXO, 4TDM, 4SF
2FXS/GT 2RD/PLAR 2PBX	2FXO6, 2FXO, 2FXOLS, 2FXO/GT, 4FXO, 4TDM, 4SF TDM, 2RD/PLAR, 4RD/PLAR 4ESS Switch
2TO 4DX 4ETO	2TO, 4ETO, 4TO, E&M (only VF applications), 4SF DPMO, DPO, DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF 2TO, 4ETO, 4TO, E&M (only VF applications), 4SF
4E&MER	DPMO, DPO, DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM, 4SF

**TABLE 4-B. CHANNEL UNIT CARDS COMPATIBILITY (Contd)**

<b>CHANNEL UNIT CARD</b>	<b>COMPATIBLE WITH</b>
4FXO	2FXS, 2FXS/LS, 2FXS/GT, 4FXS, 4TDM, 4SF
4FXS 4LSXO 4RD/PLAR 4TDM 4TO	2FXO, 2FXO6, 2FXOLS, 2FXO/GT, 4FXO, 4TDM, 4SF DPT, 2FXOLS, 2FXO/GT, 4FXO, 4TDM, 4SF TDM, 2RD/PLAR, 4RD/PLAR, 4SF (ALL UNITS EXCEPT 2TO, 4ETO, 4LSXO, 4TO) 2TO, 4ETO, 4TO, E&M (only VF applications)
4SF	4SF, 2FXO, 2FXO6, 2FXOLS, 2FXO/GT, 4FXO, 4TDM, 2TO, 4ETO, 4TO DPMO, DPO, DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4FXS, 2FXS
BRITE	BRITE

**TABLE 4-C. D4 CHANNEL UNIT OPTIONS**

UNIT	OPTION	DESCRIPTION
DPMO (J98726BM)	TRMT/RCV	Provides 0-6.3 dB attenuation in the transmit and receive transmission paths in steps of 0.1 dB. Total attenuation is the sum of all the values adjacent to the end of each depressed switch.
	NBO (J2)	Insert jumper plugs into J2 according to circuit requirements. NBO values are selected by inserting the jumper plugs with the white side showing for the corresponding values of capacitance.
	DP/MF (P/O J3)	Select DP option (black showing) when channel unit is used with dial pulse signaling and MF option (white showing) when channel unit is used with multifrequency signaling.
	1G (P/O J3)	Select option 1G (white showing) to provide a ground on the 1 lead during carrier failure. This is normally selected for all electromechanical switching machines except NO. 5 Crossbar.
	SD (P/O J3)	Select option SD (white showing) when the channel unit card is connected to a trunk circuit that requires reverse battery during carrier failure.
2FXS (J98726BD) or 2FXS6 J98726SR	TRMT/RCV	Switches insert 0 to 6.3 dB for 2FXS and 0 to 16.5 dB for 2FXS6 of attenuation into the transmit (TRMT) and receive (RCV) transmission paths in steps of 0.1 dB. The total amount of attenuation equals the sum of the values set to the IN position.
	NBOC (J2)	The NBOC (Network Build-Out Capacitance) options are used to balance the drop (customer) side wiring capacitance and are set according to circuit requirements. Each option has a capacitor value of 0.002, 0.004, 0.008, 0.016, 0.032, and 0.064 microfarad. Insert jumper plugs into black side (white showing) to select a capacitor value.
	SD (J5)	Select this option (white side showing) to make the circuit appear busy 2 seconds after a failure within the transmission facility. Normally, this option should be selected (white showing).



TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
2FXS/GT (J98726SG)	TRMT/RCV (S7/S8)	Switches insert 0 to 16.5 dB of attenuation into the TRMT (transmit) and RCV (receive) transmission paths in steps of 0.1 dB. The total amount of attenuation equals the sum of the values set to the IN position.
	SD (S12)	Set this switch option to SD position to make the circuit appear busy 2.5 seconds after a failure within the transmission facility. Normally, this option should be selected.
	72F/48F (S11)	Selects 72- or 48-volt channel unit application.
	SL (S2)	Selects slope equalization of 0 to 7.5 dB in the transmit and receive paths. The sum of the exposed numbers equals the slope setting.
	LBOC (S1)	Line build-out capacitance. Used to build out the end section of loaded cable to 6 kft for proper operation of the Precision Balance Network. Capacitance value is sum of lettered switches set to the IN position. Capacitance values are: A = 0.002, B = 0.004, C = 0.008, D = 0.016, E = 0.032, and F = 0.064 microfarad.
	CN/PBN (S10)	Selects the CBN (Compromise Balance Network) or PBN (Precision Balance Network).
	LOADED/ NONLOADED (S4)	Select LOADED or NONLOADED for customer cable type.
	R/R1 (S6)	When the L slide switch is positioned to IN position, the high frequency characteristics of the PBN are extended for synthesizing loaded MAT cable impedances. The remaining slide switches select the low frequency impedance characteristics of the PBN. The selected R setting for loaded cable or R1 setting for nonloaded cable equals the sum of the numbered switches that are set to the IN position.

**TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)**

UNIT	OPTION	DESCRIPTION
2FXS/GT (J98726SG) (Contd)	Z (S3)	Five switches select the impedance characteristics of the PBN independent of frequency. The sum of the exposed numbers (16, 8, 4, 2, 1) equals the amount of impedance.
	R2 (S5)	Four switches select the high frequency impedance characteristics of the PBN for nonloaded cable. The sum of the numbered (8, 4, 2, 1) switches that are set to the IN position equals the total amount of impedance.
2FXS/LS (J98726BK)	TRMT/RCV	Provides 0 to 6.3 dB of attenuation in the transmit (TRMT) and receive (RCV) transmission paths in steps of 0.1 dB. The total attenuation is the sum of all values adjacent to the end of each switch that is depressed.
	STA (J4)	Select STA (white showing) when channel unit is connected to a nonswitched loop that connects to a station set.
	4ESS	Select 4ESS (white showing) when interfacing a 4 ESS Switch.
2FXO (J98726BE) or 2FXO6 (J98726SS)	TRMT/RCV (S4/S5)	Provides 0 to 8.5 dB attenuation in transmit (T) and receive (R) transmission paths in steps of 0.1 dB. The total attenuation is equal to the sum of all values adjacent to the end of each switch that is set to IN position.
	NBO (S3)	Network build-out capacitance. Used to balance office wiring capacitance. Value is selected by setting switches to the IN position. Total amount selected is equal to the sum of each value (0.002, 0.004, 0.008, 0.016, 0.032, and 0.064) corresponding to each switch set to the IN position.
	LX1-2 (S1)	Set switch S1 to IN position when channel unit is connected to a cable loop having a resistance greater than 600 ohms. Do not use LX1 and LX2 if the channel terminating equipment provides a 72-volt talk battery.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
2FXO (J98726BE) or 2FXO6 (J98726SS) (Contd)	CN6/CN9 (S2)	Set CN9 switch to IN position to select 600 ohms + 2.15 $\mu$ . Set CN6 switch to IN position to select 900 ohms + 2.15 $\mu$ . Both switches should be set to the opposite of IN position when using a precision network connected to the PN1 and PN2 leads.
	LS (P/O S6)	Set LS switch to the IN position for loop start applications if permanent signal type of make busy is required during a carrier failure. For loop start applications to a 5ESS switch, line circuits provide both the LC and RG options.
	RG (P/O S6)	Set RG switch to the IN position when a ring ground type of permanent signal upon carrier failure is desired. For ground-start applications to a 5ESS switch, the line circuits provide both the RG and LS options.
	GS (S8)	Set S8 switch to the IN position for all ground-start circuits. Set to opposite position for loop-start circuits.
	G (P/O S6)	Set G switch to the IN position to provide a ground on the make-busy lead during carrier failure. Normally selected for all electromechanical switching machines except No. 5 Crossbar. Set the switch to the opposite position when trunk conditioning does not require a ground on the make busy lead.
	4E (P/O S6)	Set switch to the IN position when the far-end of the line facility is connected to a 4 ESS switch digroup terminal or digital interface frame providing a nail-up connection to another channel bank terminated in a similarly optioned FXS.

**TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)**

UNIT	OPTION	DESCRIPTION
2FXO/LSN (J98726SU)	T/R	Provides 0 to 6.3 dB attenuation in transmit (T) and receive (R) transmission paths in steps of 0.1 dB. The total attenuation is equal to the sum of all values adjacent to the end of each switch that is depressed.
	J2	Network build-out capacitance. Used to balance office wiring capacitance. Value is selected by inserting plugs into the black side of each value. Total amount selected is equal to the sum of each value (0.002, 0.004, 0.008, 0.016, 0.032, and 0.064) having black side covered.
	LX1, LX2 (J3)	Select LX1 and LX2 (white showing) when channel unit is connected to a cable loop having a resistance greater than 600 ohms. Do not use LX1 and LX2 if the channel terminating equipment provides a 72-volt talk battery.
	CN9 (J3)	Select CN9 (white showing) when precision balance network is not connected to the channel unit.
	LS (J4)	Select LS (white showing) for loop start applications if permanent signal type of make busy is required during a carrier failure.
2FXO/LS (J98726BL)	TRMT/RCV	Provides 0 to 6.3 dB of attenuation in the transmit (TRMT) and receive (RCV) transmission paths in steps of 0.1 dB. The total attenuation is the sum of all values adjacent to the end of each switch that is depressed.
	LX1/LX2 (J3 and J7)	Select options LX1 and LX2 (white side showing) when channel unit is connected to loop having more than 600 ohms of resistance.
	LS (J5)	Select LS option (white side showing) to make the circuit appear busy 2 seconds after a carrier failure.
	4ESS (J9)	Select option 4ESS (white showing) when channel unit interfaces a 4 ESS switch.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
2FXO/GT (J98726SK)	TRMT/RCV	Switches insert 0 to 16.5 dB of attenuation into the TRMT (transmit) and RCV (receive) transmission paths in steps of 0.1 dB. The total amount of attenuation equals the sum of the values set to the IN position.
	LBOC	Line build-out capacitance. Used to build out the end section of loaded cable to 6 kft for proper operation of the Precision Balance Network. Capacitance value is sum of visible letters A through F. A = 0.002, B = 0.004, C = 0.008, D = 0.016, E = 0.032, and F = 0.064 microfarad.
	G Strap	Provides a ground on the make busy lead during carrier failure. Normally selected (left intact) for all electromechanical switching machines except No. 5 Crossbar. Cut the strap when trunk conditioning does not require a ground on the make busy lead.
	LOADED/ NONLOADED (S4)	Select LOADED or NONLOADED for customer cable type. The selection is made by exposing the desired type on the switch.
	Z (S3)	Five switches select the impedance characteristics of the PBN independent of frequency. The sum of the exposed numbers (16, 8, 4, 2, 1) equals the Z setting.
	SL (S2)	Selects slope equalization of 0 to 7.5 dB in the transmit and receive paths. The sum of the exposed numbers equals the slope setting.
	R2 (S5)	Four switches select the high frequency impedance characteristics of the PBN for nonloaded cable. The sum of the exposed numbers (8, 4, 2, 1) equals the impedance setting.
	R/R1	When the L slide switch is positioned to expose L, the high frequency characteristics of the PBN are extended for matching loaded MAT cable impedances. The remaining slide switches select the low frequency impedance characteristics of the PBN. The selected R setting for loaded cable or R1 setting for nonloaded cable equals the sum of the exposed numbers.

**TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)**

UNIT	OPTION	DESCRIPTION
2FXO/GT (J98726SK) (Contd)	J6	Selects either the PBN (Precision Balance Network) or the CBN (Compromise Balance Network). To select PBN, expose white area. To select CBN, expose black area.
	LX	Option selected (white side showing) when the loop resistance is greater than 600 ohms, unless the connecting circuitry uses 72-volt battery such as a Loop Signaling Repeater.
	GS	Selects either ground-start (white showing) or loop-start (black showing) signaling.
	LS	Select LS option (white side showing) to make the circuit appear busy 2.5 seconds after a carrier failure.
	RG (J4)	Select RG (white showing) when trunk conditioning requires a ground on the R lead. Use in ground-start applications so the line appears busy 2 seconds after a carrier failure.
4FXO (J98726SC)	TRMT/RCV	Eight rocker switches provide 0 - 16.6 dB attenuation independently for the transmit and receive paths. The total amount of attenuation is equal to the sum of the numbers beside each switch set to the IN position.
	TRMT INPUT IMPEDANCE (S1)	Provides selection of terminating impedance for the T & R cable pair. Four positions on S1 provide selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.
	RCV OUTPUT IMPEDANCE (S2)	Provides selection of terminating impedance for the T1 & R1 cable pair. Four positions on S1 provide selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4FXO (J98726SC) (Contd)	HT (S3)	Height equalization used to adjust the amplitude response of the equalizer from 0 - 11.0 dB in 15 steps. Total height equalization is equal to the sum of exposed numbers on S3.
	SL (S4)	Slope equalization used to adjust the slope of the equalizer frequency response. S4 has 5 slide switches. The L/N slide switch is used to make an overall slope adjustment. The L position is for loaded cable and the opposite position is for nonloaded cable. The other four slide switches are set to provide finer adjustment. The switches are to be set such that the sum of the exposed numbers equals the SL setting required.
	BW (S5)	Bandwidth equalization used to adjust the bandwidth response of the equalizer from 200 Hz to 3.4 kHz in 15 steps. The switches on S5 are to set so that the sum of the exposed numbers equals the BW setting required.
	LX1 (P/O J2)	Select option LX1 (white showing) when the channel unit card is connected to a loop having more than 600 ohms of resistance.
	GS (P/O J2)	Select option GS (white showing) when the channel unit card is used in a ground start application.
	RG (P/O J3)	Select option RG (white showing) when trunk conditioning requires the application of a ground on the ring lead 2 seconds after a carrier failure in a ground start circuit.
	LS (P/O J3)	Select option LS (white showing) when the channel unit card is used in a loop start application.
	J4 and J5	J4 and J5 reverses the simplexed tip and ring leads of the loop.
4FXS (J98726SB)	TRMT/RCV	Eight rocker switches provide 0 - 16.6 dB attenuation independently for the transmit and receive paths. The total amount of attenuation is equal to the sum of the numbers beside each switch set to the IN position.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4FXS (J98726SB) (Contd)	TRMT INPUT IMPEDANCE (S1)	Provides selection of terminating impedance for the T & R cable pair. Four positions on S1 provide selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.
	RCV OUTPUT IMPEDANCE (S5)	Provides selection of terminating impedance for the T1 & R1 cable pair. Four positions on S1 provide selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.
	HT (S2)	Height equalization used to adjust the amplitude response of the equalizer from 0 - 11.0 dB in 15 steps. Total height equalization is equal to the sum of exposed numbers.
	SL and L/N (S4)	Slope equalization used to adjust the slope of the equalizer frequency response. S4 has 5 slide switches. The L/N slide switch is used to make an overall slope adjustment. The L position is for loaded cable and the opposite position is for nonloaded cable. The other four slide switches are set to provide finer adjustment. The switches are to be set such that the sum of the exposed numbers equals the SL setting required.
	BW (S3)	Bandwidth equalization used to adjust the bandwidth response of the equalizer from 200 Hz to 3.4 kHz in 15 steps. The switches on S3 are to set so that the sum of the exposed numbers equals the BW setting required.
	SD (J2)	The SD option (white showing) causes the trunk to appear busy 2.5 seconds after carrier failure. This option is used in ground start circuits.
	N/R (J3, J4)	When both plugs are placed in the normal position (white showing), the tip signaling lead is simplexed on to the T and R pair and the ring signaling lead is simplexed on to the T1 and R1 pair. With the plugs in the opposite position (black showing), the tip and ring signaling lead simplexes are reversed.



TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
2E&M9 (J98726BJ) and 2E&M6 (J98726BT)	T/R	Provides 0 to 6.3 dB attenuation in transmit (T) and receive (R) transmission paths in steps of 0.1 dB. Receive path of 2E&M6 has 12.7 dB maximum. The amount of attenuation equals the sum of the values set to the IN position.
	NBO (J2)	The NBOC (Network Build-Out Capacitance) options are used to balance the drop (customer) side wiring capacitance and are set according to circuit requirements. Each option has a capacitor value of 0.002, 0.004, 0.008, 0.016, 0.032, and 0.064 microfarad. Insert jumper plugs into black side (white showing) to select a capacitor value.
	Z (J3)	Select Z, white showing, when capacitance across A and B (T1 and R1) leads is 1.00 microfarad.
	X (J3)	Select X, white showing, when there is no capacitance across A and B leads.
	Y (J3)	Select Y, white showing, when capacitance across A and B leads is 4.0 microfarads or greater.
	CN (J3)	For the hybrid to operate properly, the impedance connected to the line side must be closely matched with the impedance connected to the network side of the hybrid. This is accomplished by either an internal CN (compromise network) or an external PBN (precision balancing network). This option allows the selection of either CN (insert plug with white showing) or PBN (insert plug with black showing).
	1G (J3)	Select 1G, white showing, when make busy lead ground is to be provided in channel unit. This option is normally selected for use with all electromechanical switching machines except No. 5 Crossbar switches.
	EG (J4)	Select EG (white showing) for Type I interface -- standard, for electromechanical switches or Type II interface -- partially looped for some electronic switches. Do not select EG option (black showing) for Type II interface -- completely looped, electronic switches.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
2E&M9 (J98726BJ) and 2E&M6 (J98726BT) (Contd)	EPD (J4)	Select EPD (white showing) to force E lead to on-hook condition 2.5 seconds before off-hook upon trunk processing. Normally selected when make-busy leads are not available at the originating end of a 1-way trunk or at either end of a 2-way trunk.
	EPI (J4)	Select EPI (white showing) to force E lead to off-hook immediately upon trunk processing. When used with a dial-long-line circuit, it suppresses erratic ringing at the subscriber end.
4E&MER (J98726BP) 4E&M (J98726BC)	T/R	Provides attenuation of 0 to 25.5 dB for the 4E&MER and 0 to 1.5 dB for the 4E&M in the transmit (T) and receive (R) transmission paths in steps of 0.1 dB. The amount of attenuation equals the sum of the values with switches set to the IN position.
	1G (P/O S1)	Select 1G option by setting rocker switch to number 4 position when make busy lead ground is to be provided in channel unit. This option is normally selected for use with all electromechanical switching machines except No. 5 crossbar switches.
	EG (P/O S1)	Select EG option by setting rocker switch to number 1 position for Type I interface -- standard, for electromechanical switches or Type II interface -- partially looped for some electronic switches. Do not select EG option for Type II interface -- completely looped, electronic switches.
	EPD (P/O S1)	Select EPD by setting rocker switch to number 2 position to force E lead to on-hook condition 2.5 seconds before off-hook upon trunk processing. Normally selected when make-busy leads are not available at the originating end of a 1-way trunk or at either end of a 2-way trunk.
	EPI (P/O S1)	Select EPI option by setting rocker switch to number 3 position to force E lead to off-hook immediately upon trunk processing. When used with a dial-long-line circuit, it suppresses erratic ringing at the subscriber end.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
2DX/GT (J98726SD)	TRMT/RCV	Provides 0 to 16.5 dB of attenuation in TRMT (transmit) and RCV (receive) transmission paths in steps of 0.1 dB. The amount of attenuation is equal to the sum of the numbers having switches depressed.
	RLP	DX signaling balancing. Should be set to equal customer loop resistance $\pm 250$ ohms.
	S7	Set to N (normal) or R (reversed) to match connection of signaling leads to the tip and ring of the loop.
	LBOC (S1)	Line build-out capacitance to build out cable end sections to 6 kft. Capacitance values of 2, 4, 8, 16, 32, and 64 microfarads equals A, B, C, D, E, and F, respectively. The total amount of capacitance equals the sum of the values associated with each letter exposed.
	SL (S2)	Four pairs of slide switches provide 0 to 7.5 dB of slope equalization (3-kHz gain relative to 1 kHz gain). The switches are ganged in pairs to provide the same slope equalization in the transmit and receive paths. The sum of the exposed numbers (8, 4, 2, 1) equals the selected SL setting.
	Z (S6)	Selects the impedance of precision balance network. Controls both high and low frequencies of the PBN. The sum of the exposed numbers (16, 8, 4, 2, 1) equals the selected Z setting.
	R2 (S4)	Selects the high frequency impedance of precision balance network. Sum of exposed numbers (8, 4, 2, 1) equals the selected R2 setting.
	R/R1 (S3)	Select L exposed for MAT cable. Other switches select low frequency impedance of precision balance network. The selected R setting (for loaded cable) or R1 setting (for nonloaded cable) equals the sum of the exposed numbers (4, 2, 1).
	LOADED/ NONLOADED (S5)	Select for LOADED or NONLOADED cable. It is selected by the word exposed on the switch.

**TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)**

UNIT	OPTION	DESCRIPTION
4DX (J98726SE)	TRMT/RCV (S1)	Provides 0 to 16.5 dB of attenuation in TRMT (transmit) and RCV (receive) transmission paths in steps of 0.1 dB. The amount of attenuation is equal to the sum of the numbers having switches set to the IN position.
	C (J2)	Select option C (white showing) to make circuit appear busy after carrier failure.
	IB (J3)	Select option IB (white showing) to provide immediate off-hook for applications in which on-hook state results in ringing the customer.
	HT (S2)	Adjusts the amplitude from 0 to 11 dB in 15 steps. The total height is the sum of the exposed numbers.
	BW (S3)	Adjusts the bandwidth from 0 to 11 dB in 15 steps. The total bandwidth is the sum of the exposed numbers.
	SL (S4)	Adjusts the slope in 15 steps. The total slope is the sum of the exposed numbers.
	TRMT INPUT IMPEDANCE (S1)	Loop terminating impedance for the transmit T and R cable pair. Use 150 for long nonloaded cable, 600 for short nonloaded cable or equipment, or 1200 for loaded cable. OPEN position opens the path but is not normally used.
	RCV OUTPUT IMPEDANCE (S5)	Loop terminating impedance for the receive T1 and R1 cable pair. Use 150 ohms for long nonloaded cable, 600 ohms for short nonloaded cable, or 1200 for loaded cable. OPEN position opens the path but is not normally used.
	RLP (R16)	Used for DX signaling balancing. Should be set to equal loop resistance $\pm 250$ ohms.
	NOR/REV (S6)	Set to NOR (normal) or REV (reverse) to match connection of signaling leads to the simplex leads of the loop.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4PLR (J98726BN)	T/R	Provides 0 to 6.3 dB of attenuation in T (transmit) and R (receive) transmission paths in steps of 0.1 dB. The amount of attenuation equals the sum of the numbers having a switch set to the IN position.
	MPD	The MPD option makes the circuit busy during carrier failure. This option is normally selected (white showing).
	MB, MG	Select white showing in both sides for Type I E&M interface -- standard for electromechanical switching systems. Select black showing in both sides for Type II interface -- completely looped, electronic switching. Select MB (white showing) and MG (black showing) for Type III interface -- partially looped, for some electronic switching machines.
2RD/PLAR (J98726SN)	TRMT/RCV	Provides 0 - 16.5 dB of attenuation in transmit and receive transmission paths in steps of 0.1 dB. The total amount of attenuation is equal to the sum of the switches set to the IN position.
	PLAR/RD (J3, J4, J8, J9)	For PLAR applications insert plugs to expose the black area. For RD applications insert plugs to expose the white area.
	DC/AC (P/O J2)	Insert plug to expose white area for ac (20 Hz) signaling. Insert plug to expose black area for dc (-48V) signaling.
	S (P/O J2)	Insert plug to expose white area for use with non-looped dc signaling.
	F (S6)	Insert plug to expose white area to select -48 volt talk battery or black area to select -72 volt battery.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
2RD/PLAR (J98726SN) (Contd)	M (S6)	The channel unit card must be removed from its channel slot before setting this option. Switch S6 has two section switches (1 and 2) for PLAR or RD applications. For PLAR applications, set switches 1 and 2 to expose the white area if the far end is D4 RD/PLAR. Set sections 1 and 2 to expose the red (or black) if the far end is D3 PLAR. For RD applications set sections 1 and 2 to expose white area for code select ringing mode. Set section 1 to expose the red (or black) area and section 2 to expose the white area for no code ringing. Set section 1 to expose the white area and section 2 to expose the red (or black) area for Repeat Input Timing with 2-second limit. Set sections 1 and 2 to expose the red (or black) for Repeat Input Timing with no limit.
	S7 and S8	Set switches S7 and S8 to expose the white area for PLAR applications. For RD and CODE SELECT ringing mode, use S7 and S8 to select a code by setting the appropriate section to expose its white number with all others set to hide their white numbers. Sections 1 - 7 on S7 and sections 8 - 15 on S8 select codes 1 - 15. For RD and the other ringing modes of the M option, set all sections of S7 and S8 to hide the white numbers.
4RD/PLAR (J98726SP)	TRMT/RCV	Provides 0 to 16.5 dB of attenuation in transmit and receive transmission paths in steps of 0.1 dB. The amount of attenuation is equal to the sum of the switches set to the IN position.
	TRMT/RCV LINE IMPEDANCE (S1 and S5)	Four position slide switches provide selection of terminating impedance for the T & R (S1) and T1 & R1 (S5) cable pairs. Four positions on S1 and S5 provide selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.
	SL (S2)	Slope equalization is provided by 4 binary weighted slide switches (1, 2, 4, 8) in conjunction with a fifth switch for selection of loaded (L) or nonloaded (NL) cable. Total slope is the sum of exposed numbers.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4RD/PLAR (J98726SP) (Contd)	BW (S3)	Bandwidth equalization is provided by 4 binary weighted slide switches (1, 2, 4, 8). The selection can be made from 200 Hz to 3.4 kHz in 15 steps.
	HT (S4)	Height equalization is provided by 4 binary weighted slide switches (1, 2, 4, 8). These switches adjust the amplitude response of the equalizer from 0 to 11 dB in 15 steps. The total height is equal to the sum of the exposed numbers on S4.
	-7 dB (S5)	This option is used for PLAR applications to reduce the insertion gain in the transmit direction by 7 dB. Insert the jumper plug to expose the white area. For RD applications insert the jumper plug to expose the black area.
	M (S6)	The channel unit card must be removed from its channel slot before setting this option. Switch S6 has two section switches (1 and 2) for PLAR or RD applications. For PLAR applications, set switches 1 and 2 to expose the white area if the far end is D4 RD/PLAR. Set sections 1 and 2 to expose the red (or black) if the far end is D3 PLAR. For RD applications, set sections 1 and 2 to expose white area for code select ringing mode. Set section 1 to expose the red (or black) area and section 2 to expose the white area for no code ringing. Set section 1 to expose the white area and section 2 to expose the red (or black) area for Repeat Input Timing with 2-second limit. Set sections 1 and 2 to expose the red (or black) for Repeat Input Timing with no limit.
	S7 and S8	Set switches S7 and S8 to expose the white area for PLAR applications. For RD and CODE SELECT ringing mode, use S7 and S8 to select a code by setting the appropriate section to expose its white number with all others set to hide their white numbers. Sections 1 - 7 on S7 and sections 8 - 15 on S8 select codes 1 - 15. For RD and the other ringing modes of the M option, set all sections of S7 and S8 to hide the white numbers.

**TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)**

UNIT	OPTION	DESCRIPTION
DPT6 (J98726CH) DPT (J98726BB)	TRMT/RCV	Switches provide for 0 to 6.3 dB attenuation in the T (transmit) and R (receive) transmission paths in steps of 0.1 dB. The total attenuation equals the sum of all values adjacent to each depressed switch.
	NBO (J2)	Network build-out balances the drop-side wiring capacitance. Select by inserting plugs into black side corresponding to the desired values of 0.002, 0.004, 0.008, 0.016, 0.032, and 0.064 F.
DPO (J98726BA)	TRMT/RCV	Provides 0 - 6.3 dB of attenuation in the transmit and receive transmission paths in steps of 0.1 dB. Total attenuation is the sum of the numbers adjacent to each switch set to IN position.
	NBO (J2)	Network build-out balances the drop-side wiring capacitance. Select by inserting plugs into black side corresponding to the desired values of 0.002, 0.004, 0.008, 0.016, 0.032, and 0.064 F.
	S, L, 1G (J3)	S and 1G options (white side showing) are selected when the channel unit card is used with a step-by-step office to split the S lead from an outgoing trunk circuit and ground the switch side of the S lead during a carrier failure. Option L (white side showing) is selected when a dry contact closure is required during a carrier failure.
	SD (J4)	This option (white side showing) makes the trunk appear busy during a carrier failure by applying a ground to the tip lead.
	DP/MF (J5)	Select DP option (black side showing) with dial pulse signaling or select MF option (white side showing) with multifrequency signaling.



TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4TDM (98726SF)	TRMT	Provides 0 to 16.5 dB of attenuation in TRMT (transmit) path in steps of 0.1 dB. The amount of attenuation equals the sum of the numbers beside each depressed switch.
	W (J4)	Select W (white showing) to connect the E1 signaling lead to the simplexed T-R pair.
	V (J5)	Select V (white showing) to connect EX1 lead to T1-R1 pair.
	E (J6)	Select E (black showing) for loop signaling between two tandem units.
	S (J7)	Select S (black showing) to provide the TSA (transmit signaling A) bit to be 1 for open and 0 for ground.
	T (J7)	Select T (white showing) to provide the TSA bit to be 0 for open and 1 for ground.
	R (J7)	Select R (white showing) to force the TSB bit to follow TSA bit during 2-state signaling. (Disable option V when using option R.)
	Y (J8)	Select Y (black showing) to provide RNDA (receive inverted digit A) to be 1 for open and 0 for ground.
	Z (J8)	Select Z (white showing) to provide RDA (receive digit A) to be 1 for open and 0 for ground.
	EG (J8)	Select EG (white showing) to make the circuit busy 2.5 seconds after carrier failure.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4SF (J98726SW)	TRMT/RCV (S6 and S7)	Provides 0 - 25.5 dB attenuation for the transmit and receive transmission paths. Total attenuation is equal to the sum of the numbers next to each switch set to the IN position.
	INPUT LINE IMPEDANCE (S1)	Two 4-position slide switches select the terminating impedance for the T and R and T1 and R1 cable pairs. Each four position switch on S1 provides selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.
	SC (S2)	Sealing current (30 mA) is used to break down a high resistance film which may build up at unsoldered hand-twisted splices on the cable pairs (T-R and T1-R1).
	ZAP (S3)	This option is used in conjunction with the SC option to increase the sealing current to 60 mA. The application of this higher current for a few seconds followed by a continuous sealing current will usually correct and sustain the normal resistance of the cable pairs.
	L/N (P/O S4)	Loaded/nonloaded option switch provides an overall slope adjustment to the equalizer response. Set the switch to L for loaded cable or to the opposite direction for nonloaded cable.
	SL (P/O S4)	Four binary weighted switches (1, 2, 4, 8) provide adjustment to the slope of the equalizer frequency response. The total slope equals the sum of the numbers adjacent to the switches set to the IN position.
	HT (P/O S5)	Four binary weighted switches (1, 2, 4, 8) provide adjustment to the amplitude response of the equalizer from 0 to 11 dB in 15 steps. Total height equals the sum of the numbers adjacent to the switches set to the IN position.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4SF (J98726SW) (Contd)	BW (P/O S5)	Four binary weighted switches (1, 2, 4, 8) provide adjustment to the bandwidth of the equalizer from 200 Hz to 3.4 kHz in 15 steps.
	SF/ETO (P/O S8)	SF option is set when the far end of the 4-wire voice frequency facility is terminated in a SF signaling converter. ETO option is set when a transmission only interface is required for D4 digital carrier system with a 4-wire metallic extension or when inband end-to-end signaling is used.
	E&M/FXO/FXS (P/O S9)	This switch provides one of the three operating modes: E&M mode if the far end unit is a 2-state unit (E&M, DX, DP, etc), FXO if the far end is terminated in an FXO type channel unit card, and FXS if the far end is terminated in an FXS type channel unit card.
	LS/GS (S8)	A 2-position switch provides selection of loop start or ground start operation when this channel unit card is optioned for FXO or FXS operating modes.
	A-CGA (S11)	S11 provides analog carrier group alarm through a 3-position switch. The three options are APO, APD, and API. Each transmits an SF facility failure toward the digital facility when a failure occurs. APO provides immediate on-hook. APD provides 2.5 seconds of on-hook followed by an off-hook (APD is the preferred setting for E&M mode, FXS ground start mode, and for both FXO modes). API provides immediate off-hook. API is the preferred setting for the FXS loop start mode.
	D-CGA (S10)	S10 provides digital carrier group alarm through a 3-position switch. The three options are DPO, DPD, and DPI. Each transmits a digital carrier failure toward the SF facility. DPO provides a TONE-ON (ON-HOOK) for the duration of the failure. DPD provides 2.5 seconds of TONE-ON (ON-HOOK) followed by a TONE-OFF for the duration of the failure. DPD is the preferred option for E&M mode, FXO ground start mode, and for both FXS modes. DPI provides an immediate TONE-OFF (OFF-HOOK) for the duration of the failure. DPI prevents ringing and is preferred for FXO loop start mode.

**TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)**

UNIT	OPTION	DESCRIPTION
2TO (J98726SJ)	TRMT/RCV	Provides 0 to 16.5 dB of attenuation in TRMT (transmit) and RCV (receive) transmission paths in steps of 0.1 dB. The attenuation equals the sum of values of the switches set to the IN position.
	SEALING CURRENT J2	Insert both plugs so that white is showing to produce 30 mA of sealing current. This sealing current breaks down a high resistance film that may build up at unsoldered hand-twisted splices.
	ZAP (S2)	When sealing current (J2) is enabled, depress ZAP to increase sealing current to 60 mA. This will usually correct and sustain the normal resistance of the cable pair.
4TO (J98726SH)	TRMT/RCV	Same as 2TO card.
	-7 dB TRMT (J3)	This determines gain of the 7.0 dB transmit amplifier. Insert plug into white side (black showing) to provide an overall gain of 0.5 dB in the transmit path. White showing provides 7.5 dB gain.
	-7 dB RCV (J2)	This determines gain of the 7.0 dB receive amplifier. Insert plug into white side (black showing) to provide an overall loss of 4.0 dB in the receive path. White showing provides 3.0 dB gain.
	SEALING CURRENT J4	Insert both plugs so that white is showing to produce 30 mA of sealing current. This sealing current breaks down a high resistance film that may build up at unsoldered hand-twisted splices.
	ZAP (S1)	When sealing current (J4) is enabled, depress ZAP to increase sealing current to 60 mA. This will usually correct and sustain the normal resistance of the cable pair.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4ETO (J98726SQ)	TRMT/RCV	Eight rocker switches provide 0 - 16.5 dB attenuation independently for the transmit and receive paths. The total amount of attenuation is equal to the sum of the numbers beside each switch set to the IN position.
	TRMT INPUT IMPEDANCE (S1)	Provides selection of terminating impedance for the T & R cable pair. Four positions on S1 provide selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.
	RCV OUTPUT IMPEDANCE (S5)	Provides selection of terminating impedance for the T1 & R1 cable pair. Four positions on S1 provide selection of 150 ohms, 600 ohms, 1200 ohms, and open circuit. The 150-ohm position is used for long nonloaded cable. The 600-ohm position is used for short nonloaded cable and the 1200-ohm position is used for loaded cable.
	HT (S4)	Height equalization used to adjust the amplitude response of the equalizer from 0 - 11.0 dB in 15 steps. Total height equalization is equal to the sum of exposed numbers on S4.
	SL (S2)	Slope equalization used to adjust the slope of the equalizer frequency response. S2 has 5 slide switches. The L/N slide switch is used to make an overall slope adjustment. The L position is for loaded cable and the opposite position is for nonloaded cable. The other four slide switches are set to provide finer adjustment. The switches are to be set such that the sum of the exposed numbers equals the SL setting required.
	BW (S3)	Bandwidth equalization used to adjust the bandwidth response of the equalizer from 200 Hz to 3.4 kHz in 15 steps. The switches on S3 are to set so that the sum of the exposed numbers equals the BW setting required.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
4ETO (J98726SQ) (Contd)	SEALING CURRENT (J2)	Insert both plugs so that white is showing to produce 30 mA of sealing current. This sealing current breaks down a high resistance film that may build up at unsoldered hand-twisted splices.
	ZAP (S6)	When S6 option is enabled, depress ZAP to increase sealing current to 60 mA. This will usually correct and sustain the normal resistance of the cable pair.
	-7 dB (J3)	This option reduces the insertion gain in the transmit direction by 7 dB. Insert a jumper plug into J3 to expose white area.
2PBX (J98726ST)	TRMT/RCV	Provides 0 to 16.5 dB of attenuation in TRMT (transmit) and RCV (receive) transmission paths in steps of 0.1 dB. The attenuation equals the sum of values of the switches set to the IN position.
	Trunk Type Selection	Selects specific trunk type being used. See Table 4-F for specific switch settings.
	Hybrid Select	The 2-wire interface to the PBX is through a custom electronic hybrid. Switch S1 sets the operating mode of the hybrid that controls the impedance termination (TERM), the gain (GAIN), the signaling mode (GROUND START), and the battery feed current limit (BATTERY FEED CURRENT). See Table 4-G for switch positions, settings, and functions.
	Fault Lamp	<p>A faceplate indicator that is illuminated when an internal test performed by the unit on itself at turn-up fails or when one of the following conditions occur:</p> <ul style="list-style-type: none"> <li>• Processor failure</li> <li>• -48V loss</li> <li>• Invalid option selected</li> <li>• CGA (Carrier group alarm)</li> </ul> <p>This lamp will flash when the PBX fails to return to a wink pulse or a line integrity test.</p>

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
PG5T (J98726CA)	TRMT	Provides 0 to 15 dB of attenuation in transmit path in steps of 1.0 dB. The sum of the exposed numbers equals the attenuation.
	IMP (J2)	Selects terminating impedance of T-R pair - 150 or 600 ohms.
	COMP (J3)	Delays sampling pulses A, B, C, or D to compensate for distortion.
	EQL (J4)	Provides equalization of up to 11 dB gain at 1-kHz. Total equalization equals the sum of numbers with plugs in white sides.
PG5R (J98726CB)	RCV	Provides 0 to 15 dB attenuation in receive path in steps of 1.0 dB. The sum of the exposed numbers equals the total attenuation.
	IMP (J3)	Selects terminating impedance of T1-R1 pair (150 or 600 ohms).
	COMP (J2)	Delays sampling pulses A, B, C, or D to compensate for distortion.
PG8T (J98726CC)	TRMT	Provides 0 to 15 dB of attenuation in TRMT (transmit) path in steps of 1.0 dB. The sum of the exposed numbers equals the attenuation.
	IMP (J2)	Selects terminating impedance of T-R pair (150 or 600 ohms).
	S1	Delays sampling pulses A, B, or C to compensate for distortion.
	EQL (J3)	Provides equalization of up to 11 dB gain at 1 kHz. Total equalization equals the sum of the numbers with plugs in the white sides.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
PG8R (J98726CD)	RCV	Provides 0 to 15 dB attenuation in receive path in steps of 1.0 dB. The sum of the exposed numbers equals the total attenuation.
	S1	Delays sampling pulses A, B, or C to compensate for distortion.
	IMP (J2)	Selects terminating impedance of T1-R1 pair (150 or 600 ohms).
PG7.5T (J98726CN) PG15T (J98726CE)	TRMT	Provides 0 to 16.5 dB of attenuation in transmit path in steps of 0.1 dB.
	IMP (J301)	Selects terminating impedance of T-R pair (150 or 600 ohms).
	EQL (J401)	Provides equalizer settings for various cable lengths. To set the equalizer, expose the numbers which total the desired equalization and cover the remaining numbers with option plugs. The unused plugs can be stored in J402.
PG7.5R (J98726CP) PG15R (J98726CF)	RCV	Provides 0 to 16.5 dB of attenuation in receive path in steps of 0.1 dB.
	IMP (J201)	Selects terminating impedance of T and R pair (150 or 600 ohms).



TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
SEC MC S (J98726GA)	M/S	Set jumper plug to M when channel unit is used in the main carrier link. Set jumper plug to S when channel unit is used in the alternate carrier link.
	DIV	Set J1 to white showing for the channel units in both the main and alternate carrier links when an alternate carrier link is in the system. If the system has a main link only, set J1 to black showing.
	T/R Test Switch	A manually operated switch that shorts the T and R leads and connects the R lead to ground for troubleshooting purposes.
	ALT CAR	Used in association with an office end security channel unit operating in the main link with the DIV option selected. This switch forces the channel unit to accept signals from the alternate carrier for test purposes.
	T, R, GRD Jacks	Used to monitor the T and R leads or used in conjunction with the TEST, LB, and ALT CAR switches to provide manual access to the T and R leads for test purposes.
	LC Lamp	Indicates the status of the LC signaling from the far end unit. It lights when there is a closure of the transmitter loop from the far end or when the test relay at the far end is operated in a test condition.
	GRD Lamp	Indicates the presence or absence of a ground signal. It lights when a ground signal is present in the transmitter loop or when the channel unit is in the test state and there is a closure of the test relay.
SEC MC O (J98726GB)	M/S	Same as SEC MC S.
	3/30	Set to 3 to send an open condition to the alarm company 3 seconds after a carrier failure. Set to 30 to send an open condition to the alarm company 30 seconds after a carrier failure.
	DIV	Same as SEC MC S.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
SEC MC O (J98726GB) (Contd)	-/+	Set to "-" for negative loop voltage. Set to "+" for positive loop voltage.
	HML	Used to build out the channel unit resistance to 4.7K (H), 2.7K (M), and 700 (L) ohms. Usually set to L option initially. Change to M or H based on customer's requirements.
	T/R Test Switch	Manually operated switch that shorts the T and R leads and connects the R lead to ground for troubleshooting purposes.
	LB Switch	Manually operated switch that generates an LB signal that is transmitted to the station end channel unit. The station end channel unit then loops the signal back to test the carrier transmission in both directions.
	ALT CAR	Used with an office end security channel unit operating in the main link with the DIV option selected. This switch forces the channel unit to accept signals from the alternate carrier for test purposes.
	T, R, GRD Jacks	Used to monitor the T and R leads or can be used in conjunction with the TEST, LB, and ALT CAR switches to provide manual access to the T and R leads for test purposes.
	LC Lamp	Indicates the status of the LC signaling from the far end unit. It lights when there is a closure of the transmitter loop from the far end or when the test relay at the far end is operated in a test condition.
	GRD Lamp	Indicates the presence or absence of a ground signal. It lights when a ground signal is present in the transmitter loop or when the channel is in the test state and there is a closure of the test relay.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
OCU DP (J98726DJ)	SC	Set to the <b>IN</b> position to enable secondary channel. Set to <b>OUT</b> to disable.
	2.4, 4.8, 9.6, 56	Set the appropriate switch to <b>IN</b> for desired data rate of the channel unit.
	EC	Set as follows for the desired application:  0 -- No error correction 1 -- 56-kb/s error correction, D4 2 -- 56-kb/s error correction, SLC® carrier mode 1, 3 4 -- 56-kb/s error correction, SLC carrier mode 2 9 -- Subrate error correction 3, 5-8 -- Not used
	D4/SM2	Set to D4 for all Transmission Module applications.
	ZS	Selected for DDS zero suppression by positioning white plug-in connector toward the top of the board.
OCU DP (J98726DB)	FLBO	Select <b>IN</b> to provide line build-out insertion loss. This is used when the loop is less than 10 dB. Selecting <b>OUT</b> removes insertion loss.
	D4-SLC	Set to D4 for all Transmission Module applications.
	EC IN-OUT	Select EC-IN if error correction is desired. Select EC-OUT for no error correction capability.  List 4 -- Provides for 2.4 kb/s service. List 5 -- Provides for 4.8 kb/s service. List 6 -- Provides for 9.6 kb/s service.
DS0 DP (J98726DA)	D4/SLC 96	Select D4 for all Transmission Module applications.
	D/T	Insert plug into D position.
	EC IN-OUT	Select EC-IN if error correction is desired. Select EC-OUT for no error correction.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
DS0 DP (J98726DH)	SM2/D4	Select D4 for all Transmission Module applications.
	EC	Set rotary switch to 0 for no error correction or to 1 for 56 kb/s error correction. Set to 9 for subrate error correction.
	LB and GRD Jacks	Connect the appropriate LB jack to the GRD jack to activate the DS0 or DS1 loopback.
	DS0 Lamp	Yellow lamp lights when a drop-side loopback has been latched.
	DS1 Lamp	Yellow lamp lights when a line-side loopback has been latched.
DSU DP (J98726DC)	RTM (S1)	Operate the RTM slide switch for remote terminal test. The RT lamp lights and RR lamp extinguishes.
	STM/RLM (S1)	Operate the switches for the self-test and the remote loopback test. The ST and RL lamps light.
	LLM (S1)	Operate to establish the local loopback test. The LL and RR lamps light.
	RLM (S1)	Operate the RLM switch ONLY for the remote loopback test.
	S2	Set the rotary switch as follows for desired data rate:  5 -- 2.4 kb/s 6 -- 4.8 kb/s 8 -- 9.6 kb/s
56 kb/s DDA OCU (J98726DL)	OCU LB Lamp	Lights when OCU loopback command activates the loopback relay. Also lights when using a manual loopback with the LB and GRD jacks.
	CSU Lamp	Lights in response to a loopback signal from the local telephone company office. The circuitry for this lamp detects a sealing current reversal on the drop side of the circuit and causes the lamp to light.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
56 kb/s DDA OCU (J98726DL) (Contd)	LB and GRD Test Jacks	Manually connecting the LB jack to the GRD jack activates a network side loopback.
	S6	When set to CSU (in conjunction with Jack J6), the channel unit provides CSU function for circuits operating between AT&T Communications offices and local telephone company offices. Set to OCU when not used in this application.
	J6	When plug is positioned to the CSU side (in conjunction with Switch S6), channel unit provides a CSU function for circuits operating between AT&T Communications offices and local telephone company offices. Set plug to the OCU side when not used in this application.
	SLC Carrier Mode 2 Option	Always position plug to the D4 side for Transmission Module application.
56 kb/s DDA DS0 (J98726DK)	SC/NSC (J2)	<i>Always</i> set plug to NSC side. Secondary channel capability is not presently available.
	LB and GRD Test Jacks	Manually connecting the appropriate LB jack to the GRD jack activates a DS0 or DS1 loopback.
	DS0 Lamp	Lights when a drop-side loopback has been latched.
	DS1 Lamp	Lights when a line-side loopback has been latched.
56 kb/s DDA DS0 (J98726DK)	SLC Carrier Mode 2	Always position plug to the D4 side for Transmission Module application.

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
DSU II DP (J98726DN)	EC IN-OUT (S2A)	When set to IN, S2A switch provides for subrate (2.4, 4.8, 9.6 kb/s) error correction. It should be set to OUT for subrate no error correction or for 56 kb/s operation.
	DCE/DTE (S2B)	S2B switch sets the source of timing (clock) for the transmit data. In the DCE position, a clock is provided from the DSU II channel unit card to the customer equipment. This is used in all applications except in back-to-back connections of the DSU II channel unit card and another data set. In the DTE position, the DSU II channel unit card receives a clock from the customer equipment. This is used when a data set is connected back-to-back with the DSU II channel unit card. Also, for applications in which back-to-back connections are made, the elastic store option of switch S1 should be set to ENABLE. Currently this switch must be in the DCE position if connection is made to DTE through the backplane cables.
	ENABLE/ DISABLE (S1)	<p><b>S1 switch has eight settings defined as follows:</b></p> <p><b>Position 1 (Remote Digital Loopback Enable)</b> - The ENABLE position causes the DSU II channel unit card to respond to a remote loopback test request from a far-end DSU or DSU II channel unit card. The DISABLE position ignores the request.</p> <p><b>Position 2 (Elastic Store)</b> - The ENABLE position connects elastic store circuitry in the transmit side of the DSU II channel unit card. It is used in conjunction with the DTE option in back-to-back connection applications. The DISABLE position is for all other applications.</p> <p><b>Position 3 (Circuit Assurance)</b> - In the ENABLE position, the DSU II channel unit card does not turn ON the DTE Clear-to-Send interface lead unless both the Clear-to-Send timing delay has expired and the DSU II channel unit card is receiving a data signal from the network. In the DISABLE position, the Clear-to-Send interface lead turns ON in response to the Request-to-Send lead if there is a valid data or control signal on the line.</p>

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION															
DSU II DP (J98726DN) (Contd)		<p><b>Position 4 (System Status)</b> - In the ENABLE position, the DSU II channel unit card turns OFF the DTE Data Set Ready interface lead when the network sends the Out-of-Service or Out-of-Frame message or, when no signal is received from the network. In the DISABLE position, the system status option is not used.</p> <p><b>Position 5 (Streaming)</b> - In the ENABLE position (with position 6 in the DISABLE position) the DSU II channel unit card detects when the DTE holds the Request-to-Send interface lead ON longer than 27 seconds for subrates or 3 seconds for the full rate. The DSU II channel unit card sends the control mode idle signal to the network and ignores the DTE interface until the DTE turns off the Request-to-Send lead. This option is overridden in all test modes and when the continuous Request-to-Send option is ENABLED.</p> <p><b>Position 6 (Continuous Switched Request-to-Send)</b> - In the ENABLE position, the DSU II channel unit card holds its internal Request-to-Send (RS) circuit ON independent of the DTE RS interface lead. In the DISABLE position, the DSU II channel unit card internal Request-to-Send circuit follows the DTE RS interface lead.</p> <p><b>Positions 7 and 8 (Speed)</b> - The DSU II channel unit card has four synchronous speed options. They are set as follows:</p> <table> <tr> <th>Position 7</th><th>Position 8</th><th>Speed</th></tr> <tr> <td>DISABLE</td><td>DISABLE</td><td>2400 b/s</td></tr> <tr> <td>DISABLE</td><td>ENABLE</td><td>4800 b/s</td></tr> <tr> <td>ENABLE</td><td>DISABLE</td><td>9600 b/s</td></tr> <tr> <td>ENABLE</td><td>ENABLE</td><td>56 kb/s</td></tr> </table>	Position 7	Position 8	Speed	DISABLE	DISABLE	2400 b/s	DISABLE	ENABLE	4800 b/s	ENABLE	DISABLE	9600 b/s	ENABLE	ENABLE	56 kb/s
Position 7	Position 8	Speed															
DISABLE	DISABLE	2400 b/s															
DISABLE	ENABLE	4800 b/s															
ENABLE	DISABLE	9600 b/s															
ENABLE	ENABLE	56 kb/s															

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION
DSU II 56 KB DP (J98726DP)	ENABLE/ DISABLE (S1)	<p><b>S1 switch has eight settings defined as follows:</b></p> <p><b>Position 1 (Remote Digital Loopback Enable)</b> - The ENABLE position causes the DSU II 56 KB channel unit card to respond to a remote loopback test request from a far-end DSU or DSU II 56 KB channel unit card. The DISABLE position ignores the request.</p> <p><b>Position 2 (Elastic Store)</b> - The ENABLE position connects elastic store circuitry in the transmit side of the DSU II 56 KB channel unit card. It is used in conjunction with the DTE option in back-to-back connection applications. The DISABLE position is for all other applications.</p> <p><b>Position 3 (Circuit Assurance)</b> - In the ENABLE position, the DSU II 56 KB channel unit card does not turn ON the DTE Clear-to-Send interface lead unless both the Clear-to-Send timing delay has expired and the DSU II 56 KB channel unit card is receiving a data signal from the network. In the DISABLE position, the Clear-to-Send interface lead turns ON in response to the Request-to-Send lead if there is a valid data or control signal on the line.</p> <p><b>Position 4 (System Status)</b> - In the ENABLE position, the DSU II 56 KB channel unit card turns OFF the DTE Data Set Ready interface lead when the network sends the Out-of-Service or Out-of-Frame message or, when no signal is received from the network. In the DISABLE position, the system status option is not used.</p> <p><b>Position 5 (Streaming)</b> - In the ENABLE position (with position 6 in the DISABLE position) the DSU II 56 KB channel unit card detects when the DTE holds the Request-to-Send interface lead ON longer than 27 seconds for subrates or 3 seconds for the full rate. The DSU II 56 KB channel unit card sends the control mode idle signal to the network and ignores the DTE interface until the DTE turns off the Request-to-Send lead. This option is overridden in all test modes and when the continuous Request-to-Send option is ENABLED.</p>



**TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)**

UNIT	OPTION	DESCRIPTION																																				
DSU II 56 KB DP (J98726DP) (Contd)		<p><b>Position 6 (Continuous Switched Request-to-Send) -</b> In the ENABLE position, the DSU II 56 KB channel unit card holds its internal Request-to-Send (RS) circuit ON independent of the DTE RS interface lead. In the DISABLE position, the DSU II 56 KB channel unit card internal Request-to-Send circuit follows the DTE RS interface lead.</p> <p><b>Positions 7 and 8 (Speed) -</b> The DSU II 56 KB channel unit card has four synchronous speed options. They are set as follows:</p> <table><tr><td><b>Position 7</b></td><td><b>Position 8</b></td><td><b>Speed</b></td></tr><tr><td>DISABLE</td><td>DISABLE</td><td>2400 b/s</td></tr><tr><td>DISABLE</td><td>ENABLE</td><td>4800 b/s</td></tr><tr><td>ENABLE</td><td>DISABLE</td><td>9600 b/s</td></tr><tr><td>ENABLE</td><td>ENABLE</td><td>56 kb/s</td></tr></table>	<b>Position 7</b>	<b>Position 8</b>	<b>Speed</b>	DISABLE	DISABLE	2400 b/s	DISABLE	ENABLE	4800 b/s	ENABLE	DISABLE	9600 b/s	ENABLE	ENABLE	56 kb/s																					
<b>Position 7</b>	<b>Position 8</b>	<b>Speed</b>																																				
DISABLE	DISABLE	2400 b/s																																				
DISABLE	ENABLE	4800 b/s																																				
ENABLE	DISABLE	9600 b/s																																				
ENABLE	ENABLE	56 kb/s																																				
BRITE AHG13	MODE	<p>Provides either D4 or D1D counting sequence on switch sections 1 and 2. Set sections for the type of counting sequence as follows:</p> <table><tr><td><b>COUNTING SEQUENCE</b></td><td><b>SECTION 1</b></td><td><b>SECTION 2</b></td></tr><tr><td>D1D</td><td>Closed</td><td>Closed</td></tr><tr><td>D4</td><td>Closed</td><td>Open</td></tr></table>	<b>COUNTING SEQUENCE</b>	<b>SECTION 1</b>	<b>SECTION 2</b>	D1D	Closed	Closed	D4	Closed	Open																											
<b>COUNTING SEQUENCE</b>	<b>SECTION 1</b>	<b>SECTION 2</b>																																				
D1D	Closed	Closed																																				
D4	Closed	Open																																				
	SERVICE	<p>Provides channel service options for B and/or D channels to be used for ISDN service or digital pipe service on sections 3, 4, and 5. Set sections for either service as follows:</p> <table><tr><td><b>SERVICE</b></td><td><b>SECTION 3</b></td><td><b>SECTION 4</b></td><td><b>SECTION 5</b></td></tr><tr><td>ISDN</td><td></td><td></td><td></td></tr><tr><td>2B+D</td><td>Open</td><td>Open</td><td>Closed</td></tr><tr><td>B+D</td><td>Open</td><td>Open</td><td>Open</td></tr><tr><td>D</td><td>Closed</td><td>Closed</td><td>Closed</td></tr></table> <hr/> <p>DGTL PIPE</p> <table><tr><td>2B 56 Kb/s</td><td>Open</td><td>Closed</td><td>Closed</td></tr><tr><td>2B 64 Kb/s</td><td>Open</td><td>Closed</td><td>Open</td></tr><tr><td>B 56 Kb/s</td><td>Closed</td><td>Open</td><td>Closed</td></tr><tr><td>B 64 Kb/s</td><td>Closed</td><td>Open</td><td>Open</td></tr></table>	<b>SERVICE</b>	<b>SECTION 3</b>	<b>SECTION 4</b>	<b>SECTION 5</b>	ISDN				2B+D	Open	Open	Closed	B+D	Open	Open	Open	D	Closed	Closed	Closed	2B 56 Kb/s	Open	Closed	Closed	2B 64 Kb/s	Open	Closed	Open	B 56 Kb/s	Closed	Open	Closed	B 64 Kb/s	Closed	Open	Open
<b>SERVICE</b>	<b>SECTION 3</b>	<b>SECTION 4</b>	<b>SECTION 5</b>																																			
ISDN																																						
2B+D	Open	Open	Closed																																			
B+D	Open	Open	Open																																			
D	Closed	Closed	Closed																																			
2B 56 Kb/s	Open	Closed	Closed																																			
2B 64 Kb/s	Open	Closed	Open																																			
B 56 Kb/s	Closed	Open	Closed																																			
B 64 Kb/s	Closed	Open	Open																																			

TABLE 4-C. D4 CHANNEL UNIT OPTIONS (Contd)

UNIT	OPTION	DESCRIPTION																																	
BRITE AHG13 (Contd)	CIRCUIT POSITION	<p>Applies the type of sealing current <b>SINK</b> or <b>SOURCE</b> with sections 6 and 7. The type of sealing current required depends upon the position of the BRITE channel unit in a given circuit. Set sections for the type of sealing current as follows:</p> <table> <tr> <th>POSITION</th><th>SECTION 6</th><th>SECTION 7</th></tr> <tr> <td>Tandem</td><td></td><td></td></tr> <tr> <td>Office</td><td></td><td></td></tr> <tr> <td>Sink</td><td>Closed</td><td>Open</td></tr> <tr> <td>Source</td><td>Closed</td><td>Closed</td></tr> <tr> <td colspan="3"><hr/></td></tr> <tr> <td>5ESS Switch</td><td></td><td></td></tr> <tr> <td>Sink</td><td>Open</td><td>Open</td></tr> <tr> <td colspan="3"><hr/></td></tr> <tr> <td>NT1</td><td></td><td></td></tr> <tr> <td>Source</td><td>Open</td><td>Closed</td></tr> </table>	POSITION	SECTION 6	SECTION 7	Tandem			Office			Sink	Closed	Open	Source	Closed	Closed	<hr/>			5ESS Switch			Sink	Open	Open	<hr/>			NT1			Source	Open	Closed
POSITION	SECTION 6	SECTION 7																																	
Tandem																																			
Office																																			
Sink	Closed	Open																																	
Source	Closed	Closed																																	
<hr/>																																			
5ESS Switch																																			
Sink	Open	Open																																	
<hr/>																																			
NT1																																			
Source	Open	Closed																																	

**TABLE 4-D. SPECIAL SERVICE CHANNEL UNIT CARD ATTENUATION, GAIN, AND LOSS PARAMETERS**

CARD	TRANSMIT PATH (T, R TO TST JACK -8.5 DB TLP POINT) (NOTE)				RECEIVE PATH [(TST JACK +4.0 DB TLP POINT TO T1, R1, OR T, R, 2(W)) (NOTE)			
	G <sub>T</sub> INSERTION GAIN (+) OR LOSS (-) dB	ATTEN RANGE dB	INPUT LEVEL AT T, R, (dB)		G <sub>R</sub> INSERTION GAIN (+) OR LOSS (-) dB	ATTEN RANGE dB	OUTPUT LEVEL AT T1, R1 (dB)	
			MIN	MAX			MIN	MAX
2FXO	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
2FXS	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
2FXS6	-2.3	0- 16.5	-6.2	0	-4.0	0- 16.5	-8.2	0
2FXO6	-4.0	0- 8.5	-4.5	+4.0	-4.0	0- 8.5	-8.5	0
2FXOLS	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
2FXSLS	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
4FXO*	+6.5	0-16.5	-15.0*	+1.0	+2.0	0-16.5	-10.5	+6.0
4FXS*	+6.5	0-16.5	-15.0*	+1.0	+2.0	0-16.5	-10.5	+6.0
2FXS/GT	+0.5	0-16.5	-9.0	0	+2.0	0-16.5	-8.0	+6.0
2FXO/GT	+0.5	0-16.5	-9.0	0	+2.0	0-16.5	-8.0	+6.0
2FXO/LSN	-4.0	0- 6.3	-4.5	+1.8	-4.0	0-6.3	-6.3	0
2TO	+0.5	0-16.5	-9.0	+5.0	-4.0	0-16.5	-10.5	0
4TO*	+7.5(HI) +0.5 (LO)	0-16.5	-16.0* -9.0	+0.5 +7.0	+3.0 (HI) -4.0 (LO)	0-16.5 -16.0	-9.5 0	+7.0
4ETO*	+7.0(HI) 0 (LO)	0-16.5	-15.0* -8.0	+1.0 +8.5	+3.0	0-16.5	-3.0	+7.0
2DX/GT	-0.5	0-16.5	-9.0	0	+2.0	0-16.5	-9.0	+6.0
4DX*	+6.5	0-16.5	-15.0*	0	+2.0	0-16.5	-7.0	+6.0
PLR	-12.6	0- 6.3	+4.1	+10.4	-16.3	0- 6.3	0- 6.3	-18.6
2RD/PLAR	+0.5	0-16.5	-9.0	0	-4.0	0-16.5	-10.5	0
4RD/PLAR	+7.5(HI) +0.5(LO)	0-16.5	-16.0(RD) -9.0(PLAR)	0(RD) +5.0(PLAR)	+3.0	0-16.5	-9.5	+6.0
4TDM	-4.9	0-16.5	-3.6	-2.1	-6.1	NONE	-2.1	-2.1
4E&MD	+9.0	0- 1.5	-17.5	-16.0	+4.5	0- 1.5	+7.0	+8.5

See Note and Footnotes at the end of this table.

**TABLE 4-D. SPECIAL SERVICE CHANNEL UNIT CARD ATTENUATION, GAIN, AND LOSS  
PARAMETERS (Contd)**

CARD	TRANSMIT PATH (T, R TO TST JACK -8.5 DB TLP POINT) (NOTE)				RECEIVE PATH [(TST JACK +4.0 DB TLP POINT TO T1, R1, OR T, R, 2(W)) (NOTE)			
	G <sub>T</sub> INSERTION GAIN (+) OR LOSS (-) dB	ATTEN RANGE dB	INPUT LEVEL AT T, R, (dB)		G <sub>R</sub> INSERTION GAIN (+) OR LOSS (-) dB	ATTEN RANGE dB	OUTPUT LEVEL AT T1, R1 (dB)	
			MIN	MAX			MIN	MAX
4SF* All Functions FXS,FXO,E&M TO,ETO	+7.5	0-25.5	-16.0	+7.0	+3.0	0-25.5	-16.0	7.0
PG5T PG5R	-9.5	0-15	-14.0 †	+1.0 † +12.0	0-15	-14.0 †	+1.0 †	
PG8T PG8R	-9.5	0-15	-14.0 †	+1.0 † -10.0	0-15	-14.0 †	+1.0 †	
PG7.5T PG7.5R	+7.0	0-16.5	-15.0	+1.5 +9.1	0-16.5	-15.4	+1.1	
PG15T PG15R	+7.0	0-16.5	-15.0	+1.5 +9.1	0-16.5	-15.4	+1.1	
2PBX	-4.0 or +2.0	0-16.5	-4.5 -14.5	+16.0 +2.0	-4.0	0-16.5	-16.5	0

**Note:** Special service channel unit input and output levels are recommended values. In some cases, attenuator ranges cover a wider distribution of levels. It is recommended that circuit levels be limited to the input and output levels specified in the table.

\* Units with active post equalization.

† These are dBm levels for -15 dBmO Test Tone Level.

**TABLE 4-E. MESSAGE CHANNEL UNIT CARD ATTENUATION, GAIN, AND LOSS PARAMETERS**

CARD	TRANSMIT PATH (T, R TO TST JACK -8.5 DB TLP POINT)				RECEIVE PATH [(TST JACK +4.0 DB TLP POINT TO T1, R1, OR T, R, 2(W)]			
	G <sub>T</sub> INSERTION GAIN (+) OR LOSS (-) dB	ATTEN RANGE dB	INPUT LEVEL AT T, R, (dB)		G <sub>R</sub> INSERTION GAIN (+) OR LOSS (-) dB	ATTEN RANGE dB	OUTPUT LEVEL AT T1, R1 (dB)	
			MIN	MAX			MIN	MAX
DPO	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
DPT or DPT6	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
DPMO	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
2E&M9	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
2E&M6	-4.0	0- 6.3	-4.5	+1.8	-2.6	0- 12.7	-11.3	+1.4
4E&M	+9.0	0- 1.5	-17.5	-16.0	+4.5	0- 1.5	+7.0	+8.5
4E&MER	+9.0	0- 25.5	-17.5	+8.0	+4.5	0- 25.5	-17.0	+8.5
4LSXO	+9.0	0-25.5	-17.5	+8.0	+4.5	0-25.5	-17.5	+8.5
RXO	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0
TRXS	-4.0	0- 6.3	-4.5	+1.8	-4.0	0- 6.3	-6.3	0

TABLE 4-F. 2PBX -- TRUNK TYPE SELECTION (SWITCH S101)

TRUNK TYPE	SUPERVISION		ADDRESSING		SIGNALING			SWITCH S101 POSITION (NOTE)			
	IMMED	WINK	DP	TT	GS	LS	LRB	4	3	2	1
DID	X		X				X	X	X	X	X
DID		X	X				X	X	X	X	O
DID		X		X			X	X	X	O	X
DOD	X				X	X		X	X	O	O
DOD	X						X	O	X	X	X
2-Way	X		X		X			X	O	X	O
2-Way	X			X	X	X		X	O	X	X
2-Way		X	X		X			X	O	O	O
2-Way		X		X	X			X	O	O	X
<p><b>Note:</b> If any combinations other than the ones shown in this table are selected, the Fault Lamp will flash until a valid selection is made.</p> <p><b>Legend:</b>  O -- OPEN  X -- CLOSED  IMMED -- Immediate  DP -- Dial Pulse  TT -- Touch-Tone  GS -- Ground Start  LS -- Loop Start  LRB -- Loop Reverse Battery</p>											

**TABLE 4-G. 2PBX -- HYBRID OPTIONS (SWITCH S1)**

<b>TERM/GAIN/GROUND START</b>		
<b>SWITCH POSITION</b>	<b>SETTING</b>	<b>FUNCTION</b>
1	Open Closed	600-ohm TERMination* 900-ohm TERMination
2	Open Closed	0 dB Transmit GAIN 6 dB Transmit GAIN
5	Open Closed	Loop Start GROUND START

<b>BATTERY CURRENT FEED</b>				
<b>SWITCH POSITION</b>	<b>CURRENT LIMIT</b>			
	<b>10 mA</b>	<b>20 mA</b>	<b>30 mA (NOTE 1)</b>	<b>40 mA (NOTES 1 &amp; 2)</b>
3	Closed	Open	Closed	Open
4	Closed	Closed	Open	Open

\*If 600-ohm termination is selected, an additional 1.8 dB must be taken into account when setting the TRMT and RCV attenuators.

Note 1: Do not use these options in DID mode.

Note 2: Typical for touch-tone.

## PROCEDURE 11 -- SET D4 CHANNEL BANK CHANNEL SERVICE FOR ILBRV OPERATION

### ***IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure to option each in-service channel for either channel compression or full-rate (noncompressed) ILBRV operation at the D4 channel bank. Data transmission of 9.6 kb/s and higher require full-rate channels.

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STEP	PROCEDURE
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**CAUTION:** *Service Affecting -- Removing either the LBRV card or the LIU-7 card will interrupt service on all 48 channels. Also, setting or changing any faceplate option on the LBRV card without a pin-plug in the TEMP SELECT jack will affect service.*

**Note:** All signaling options (BU/RB, ESF/D4, and B8ZS/ZCS) and applicable equalizer settings should have been set during initial installation. Refer to ILBRV operation in Procedure 3 of the installation and initial testing section to verify any of these settings.

1. Refer to your channel service, engineering, customer service order, or other applicable document to determine the type of channel conditioning (compressed or noncompressed) required for each channel in service.

**Note:** If the facility has a D4 channel bank at both ends and if it is in service, Step 2 should be performed at both ends at approximately the same time. This particular task requires coordination between the technicians at each end. If the facility has a BCM 32000X or BCM SOLITAIRE, then Step 2 is only performed at the D4 channel bank.

2. Insert a pin-plug into the TEMP SELECT jack located on the LBRV CP card faceplate. See Figure 4-4.
3. Using Figure 4-4 and Table 4-H for bundle signaling or Table 4-I for robbed-bit signaling, set each rotary switch to the desired setting (template) and set each rocker switch to the appropriate position (OPEN for templates 0-15 or 1,2,3,4 for templates 16-31).
4. Establish communication with the technician at the other end to remove pin-plugs at approximately the same time (if required). Remove the pin-plug(s) from the TEMP SELECT jack(s).

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**



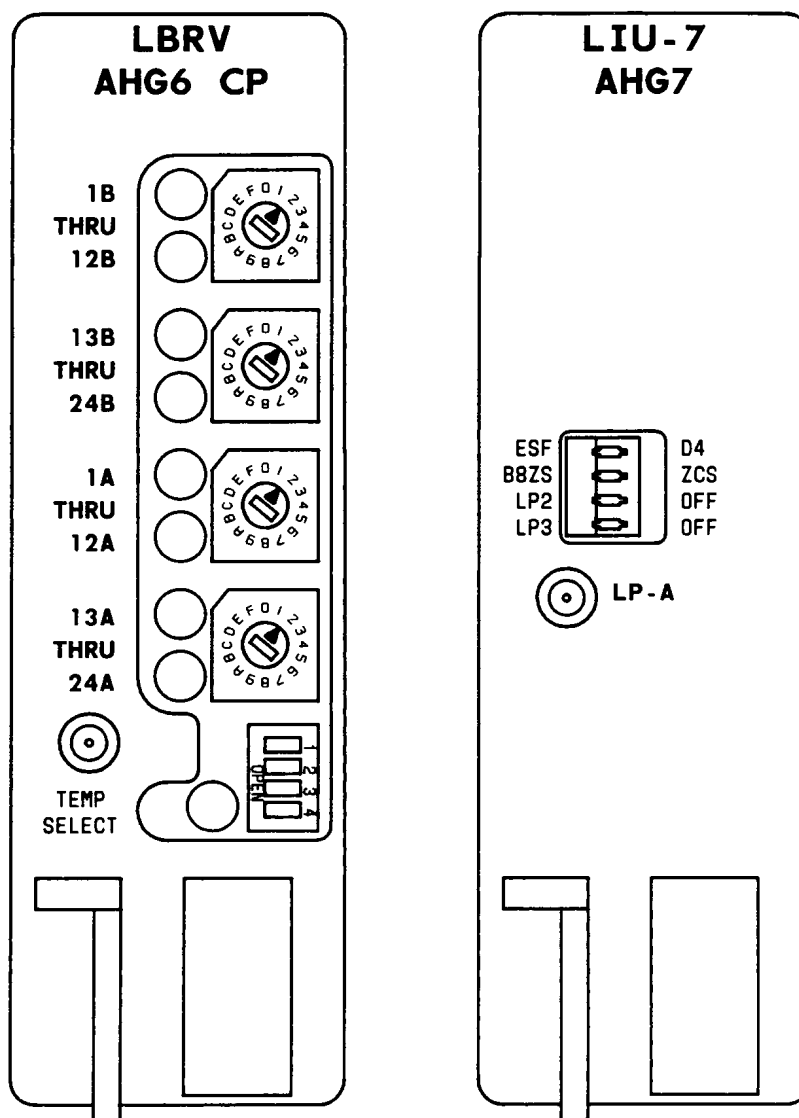


Figure 4-4. LBRV CP Card and LIU-7 Card Faceplates

TABLE 4-H. TEMPLATES FOR BUNDLE SIGNALING FORMAT

TEM- PLATE NO. •	ROT SW POS	ROCK SW POS †	CHANNEL NUMBER AND CONFIGURATION											
			1 13	2 14	3 15	4 16	5 17	6 18	7 19	8 20	9 21	10 22	11 23	12 24
0 (0)	0	I	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s	Δ
1 (1)	1	I	64n	-	32s	32s	32s	32s	32s	32s	32s	32s	32s	Δ
2 (3)	2	I	64n	64n	-	-	32s	32s	32s	32s	32s	32s	32s	Δ
3 (6)	3	I	64n	64n	64n	-	-	-	32s	32s	32s	32s	32s	Δ
4 (10)	4	I	64n	64n	64n	64n	-	-	-	-	32s	32s	32s	Δ
5 (15)	5	O	64n	64n	64n	64n	64n	-	-	-	-	-	32s	Δ
6 (21)	6	P	64n	64n	64n	64n	64n	64n	-	-	-	-	-	-
7 (30)	7	E	64n	-	64n	-	32s	32s	32s	32s	32s	32s	32s	Δ
8 (31)	8	N	64n	-	64n	-	64n	-	32s	32s	32s	32s	32s	Δ
9 (32)	9	I	64n	-	64n	-	64n	-	64n	-	32s	32s	32s	Δ
10 (2)	A	I	64s	-	32s	32s	32s	32s	32s	32s	32s	32s	32s	Δ
11 (4)	B	I	64n	64s	-	-	32s	32s	32s	32s	32s	32s	32s	Δ
12 (5)	C	I	64s	64s	-	-	32s	32s	32s	32s	32s	32s	32s	Δ
13 (7)	D	I	64n	64n	64s	-	-	-	32s	32s	32s	32s	32s	Δ
14 (8)	E	I	64n	64s	64s	-	-	-	32s	32s	32s	32s	32s	Δ
15 (9)	F	I	64s	64s	64s	-	-	-	32s	32s	32s	32s	32s	Δ
16 (11)	0	I	64n	64n	64n	64s	-	-	-	-	32s	32s	32s	Δ
17 (12)	1	I	64n	64n	64s	64s	-	-	-	-	32s	32s	32s	Δ
18 (13)	2	I	64n	64s	64s	64s	-	-	-	-	32s	32s	32s	Δ
19 (14)	3	I	64s	64s	64s	64s	-	-	-	-	32s	32s	32s	Δ
20 (16)	4	I	64n	64n	64n	64n	64s	-	-	-	-	-	32s	Δ
21 (17)	5	N	64n	64n	64n	64s	64s	-	-	-	-	-	32s	Δ
22 (18)	6	U	64n	64n	64s	64s	64s	-	-	-	-	-	32s	Δ
23 (19)	7	M	64n	64s	64s	64s	64s	-	-	-	-	-	32s	Δ
24 (20)	8	B	64s	64s	64s	64s	64s	-	-	-	-	-	32s	Δ
25 (22)	9	E	-	-	-	-	-	-	64n	64n	64n	64n	64n	64n
26 (24)	A	R	-	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	64n
27 (25)	B	I	64n	-	-	32n	32n	32n	32n	32n	32n	32n	32n	64n
28 (23)	C	I	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n
29 (33)	D	I	64n	-	32n	32n	32n	32n	32n	32n	32n	32n	32n	32n
30 (34)	E	I	64n	64n	-	-	32n	32n	32n	32n	32n	32n	32n	32n
31 (35)	F	I	64n	64n	64n	-	-	-	32n	32n	32n	32n	32n	32n

\* The template numbers in parenthesis represent the corresponding template numbers for the BCM32000X and BCM32000 SOLITAIRE.

† OPEN = Applicable rocker switch is set toward position marked "OPEN"; NUMBER = Applicable rocker switch is set toward position marked with a number (1, 2, 3, 4). The setting of Rocker Switch 1 combines with the setting of the top Rotary Switch (1B THRU 12B); the setting of Rocker Switch 2 combines with the setting of the second Rotary Switch (13B THRU 24B), etc., to provide the appropriate channel configuration.

Δ = Delta channel used for signaling (not for service).

- = Channel unavailable for service or signaling.

s/n = Channel with signaling (s) or with no signaling (n).

TABLE 4-I. TEMPLATES FOR ROBBED-BIT SIGNALING FORMAT

TEM- PLATE NO. •	ROT SW POS	ROCK SW POS †	CHANNEL NUMBER AND CONFIGURATION											
			1 13	2 14	3 15	4 16	5 17	6 18	7 19	8 20	9 21	10 22	11 23	12 24
0 (0)	0	OPEN	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s
1 (1)	1	OPEN	64n	-	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s
1 (2)	1	OPEN	64s	-	32s	32s	32s	32s	32s	32s	32s	32s	32s	32s
2 (3)	2	OPEN	64n	64n	-	-	32s	32s	32s	32s	32s	32s	32s	32s
2 (4)	2	OPEN	64n	64s	-	-	32s	32s	32s	32s	32s	32s	32s	32s
2 (5)	2	OPEN	64s	64s	-	-	32s	32s	32s	32s	32s	32s	32s	32s
2 (6)	2	OPEN	64s	64n	-	-	32s	32s	32s	32s	32s	32s	32s	32s
3 (7)	3	OPEN	64n	64n	64n	-	-	-	32s	32s	32s	32s	32s	32s
3 (8)	3	OPEN	64n	64n	64s	-	-	-	32s	32s	32s	32s	32s	32s
3 (9)	3	OPEN	64n	64s	64s	-	-	-	32s	32s	32s	32s	32s	32s
3 (10)	3	OPEN	64s	64s	64s	-	-	-	32s	32s	32s	32s	32s	32s
4 (11)	4	OPEN	64n	64n	64n	64n	-	-	-	-	32s	32s	32s	32s
4 (12)	4	OPEN	64n	64n	64n	64s	-	-	-	-	32s	32s	32s	32s
4 (13)	4	OPEN	64n	64n	64s	64s	-	-	-	-	32s	32s	32s	32s
4 (14)	4	OPEN	64n	64s	64s	64s	-	-	-	-	32s	32s	32s	32s
4 (15)	4	OPEN	64s	64s	64s	64s	-	-	-	-	32s	32s	32s	32s
5 (16)	5	OPEN	64n	64n	64n	64n	64n	-	-	-	-	-	32s	32s
5 (17)	5	OPEN	64n	64n	64n	64n	64s	-	-	-	-	-	32s	32s
5 (18)	5	OPEN	64n	64n	64n	64s	64s	-	-	-	-	-	32s	32s
5 (19)	5	OPEN	64n	64n	64s	64s	64s	-	-	-	-	-	32s	32s
5 (20)	5	OPEN	64n	64s	64s	64s	64s	-	-	-	-	-	32s	32s
5 (21)	5	OPEN	64s	64s	64s	64s	64s	-	-	-	-	-	32s	32s
6 (22)	6	OPEN	64n	64n	64n	64n	64n	64n	-	-	-	-	-	-
6 (23)	6	OPEN	64s	64s	64s	64s	64s	64s	-	-	-	-	-	-
6 (24)	6	OPEN	64n	64n	64s	64s	64s	64s	-	-	-	-	-	-
6 (25)	6	OPEN	64n	64s	64s	64s	64s	64s	-	-	-	-	-	-
6 (26)	6	OPEN	64n	64n	64n	64n	64s	64s	-	-	-	-	-	-
6 (27)	6	OPEN	64s	64s	64n	64n	64n	64n	-	-	-	-	-	-

\* The template numbers in parenthesis represent the corresponding template numbers for the BCM32000X and BCM32000 SOLITAIRE.

† OPEN = Applicable rocker switch is set toward position marked "OPEN". The setting of Rocker Switch 1 combines with the setting of the top Rotary Switch (1B THRU 12B); the setting of Rocker Switch 2 combines with the setting of the second Rotary Switch (13B THRU 24B), etc., to provide the appropriate channel configuration.

- = Channel unavailable for service.

s = Channel with signaling.

n = Channel with no signaling.

TABLE 4-I. TEMPLATES FOR ROBBED-BIT SIGNALING FORMAT (Contd)

TEM- PLATE NO. •	ROT SW POS	ROCK SW POS †	CHANNEL NUMBER AND CONFIGURATION											
			1 13	2 14	3 15	4 16	5 17	6 18	7 19	8 20	9 21	10 22	11 23	12 24
7 (28)	7	OPEN	64n	-	64n	-	32s	32s	32s	32s	32s	32s	32s	32s
7 (29)	7	OPEN	64s	-	64s	-	32s	32s	32s	32s	32s	32s	32s	32s
7 (30)	7	OPEN	64s	-	64n	-	32s	32s	32s	32s	32s	32s	32s	32s
7 (31)	7	OPEN	64n	-	64s	-	32s	32s	32s	32s	32s	32s	32s	32s
8 (32)	8	OPEN	64n	-	64n	-	64n	-	32s	32s	32s	32s	32s	32s
8 (33)	8	OPEN	64s	-	64s	-	64s	-	32s	32s	32s	32s	32s	32s
8 (34)	8	OPEN	64n	-	64s	-	64s	-	32s	32s	32s	32s	32s	32s
8 (35)	8	OPEN	64n	-	64n	-	64s	-	32s	32s	32s	32s	32s	32s
9 (36)	9	OPEN	64n	-	64n	-	64n	-	64n	-	32s	32s	32s	32s
9 (37)	9	OPEN	64s	-	64s	-	64s	-	64s	-	32s	32s	32s	32s
9 (38)	9	OPEN	64n	-	64n	-	64n	-	64s	-	32s	32s	32s	32s
9 (39)	9	OPEN	64n	-	64s	-	64s	-	64s	-	32s	32s	32s	32s
9 (40)	9	OPEN	64n	-	64n	-	64s	-	64s	-	32s	32s	32s	32s
25 (41)	9	NUM	-	-	-	-	-	-	64n	64n	64n	64n	64n	64n
25 (42)	9	NUM	-	-	-	-	-	-	64s	64s	64s	64s	64s	64s
25 (43)	9	NUM	-	-	-	-	-	-	64n	64n	64n	64s	64s	64s
25 (44)	9	NUM	-	-	-	-	-	-	64s	64s	64n	64n	64n	64n

\* The template numbers in parenthesis represent the corresponding template numbers for the BCM32000X and BCM32000 SOLITAIRE.

† OPEN = Applicable rocker switch is set toward position marked "OPEN"; NUM = Applicable rocker switch is set toward position marked with a number (1, 2, 3, 4). The setting of Rocker Switch 1 combines with the setting of the top Rotary Switch (1B THRU 12B); the setting of Rocker Switch 2 combines with the setting of the second Rotary Switch (13B THRU 24B), etc., to provide the appropriate channel configuration.

- = Channel unavailable for service.

s = Channel with signaling.

n = Channel with no signaling.

## 5. MAINTENANCE

### Overview

This section describes the alarm and status indicators on the Transmission Module equipment. It also contains loop testing, trouble isolation, and trouble analysis procedures that can be used to correct a trouble within the Transmission Module.

### Transmission Module Alarm Indicators

The various pieces of equipment in the Transmission Module (D4 channel bank, FT1, and CSU) contain alarm and status indicators (lamps). The alarm lamps light when a transmission failure occurs somewhere in the transmission facility (near end Transmission Module, DS1/FT1 line facility, or far end Transmission Module). The failure may or may not be in the equipment containing the lighted alarm lamps. Thus, a trouble isolation procedure is included to aid in determining the location of a failure within the Transmission Module.

### D4 Channel Bank Alarm and Status Indicators

The D4 channel bank has several alarm and status indicators (lamps). The red **AR** and yellow **AY** lamps on the **ACU** cards, are the two to observe. All other alarm lamps are redundant with these two. When all the equipment of the DS1/FT1 facility is operating properly, the alarm lamps will be off.

The status lamps light to indicate a condition such as trunk processing or looping. Table 5-A lists the D4 channel bank alarm and status lamps and their meanings.

Remote audible (bell) and visual (lamp) alarm indicators can be connected to the D4 channel bank. If remote alarm indicators are used, they will be located on the customer's premises. The D4 bank remote alarm indicator driving circuitry can handle a maximum current flow of 1 ampere. This must be considered if any remote alarm circuitry is to be used.

### D4 Channel Bank Loop Testing

The D4 channel bank can be tested by looping its transmit and receive circuits to each other. If an **AR** or **AY** alarm indication is present, the D4 channel bank can be looped to determine the location of the failure. If the lamps extinguish after the bank is looped, it is operating properly and the failure is toward the DS1/FT1 line facility. If the alarm lamps remain lighted after the bank is looped, the failure is in the bank. In Mode 3 operation, each digroup can be independently looped. When a digroup is alarmed or looped, service is interrupted on all of its 24 channels. Therefore, *never loop a bank in service unless there is an alarm indication.*

**TABLE 5-A. D4 CHANNEL BANK ALARM AND STATUS INDICATORS**

LAMP	LOCATION	DEFINITION
Red AR	ACU Cards	Alarm - Loss of incoming transmission signal to the near end D4 channel bank. This alarm results in a loss of service to a maximum of 24 channels.
Yellow AY	ACU Cards	Alarm - Loss of incoming transmission signal to the far end D4 channel bank. This results in a loss of service to a maximum of 24 channels.
Red RCV	RU Cards	Alarm - Loss of incoming transmission signal. Redundant with AR and AY alarms. This alarm results in a loss of service to a maximum of 24 channels.
Red ALM	PDU Card	Alarm - Same as red AR. This alarm results in a loss of service to a maximum of 48 channels.
Red FAIL	PCU Card	Alarm - Loss of power. This alarm results in a loss of service to a maximum of 48 channels.
Yellow TPD A and TPD B	TPU Card	Status - Digroup A and/or digroup B channels processed out of service during an alarm condition.
Yellow TP	ACU Cards	Status - Trunk processing (channel out of service) memory lamp.
Green ACO	ACU & PCU Cards	Status - Remote audible alarms, if any, are silenced. ACO button must be depressed before bank/digroup can be looped.
Green LT	ACU Cards	Status - D4 digroup (24 channels) is looped transmit to receive. Used for testing and trouble analysis.
Green LL	ACU Cards	Status - Line loop function. Disregard, as the need for this condition is diminished.

## CSU and FT1 Loop Testing

The CSU and FT1 units contain loop testing capabilities which can be used to isolate failures to the Transmission Module, the DS1/FT1 facility or far-end equipment, and to the specific CSU or FT1 unit.

Procedure 13 uses the CSU and FT1 loop testing capabilities. The Description Section in this manual lists and defines the alarm and indicator lamps and looping methods for the CSU and FT1 units.

## Spare Common Unit and Channel Unit Cards and Spare Fuses

Depending on the type of service and the critical nature of the service, a customer may want to keep spare fuses and spare cards on hand. Some guidelines to determine which spare fuses and cards would be needed is listed below:

- All fuses on the D4 channel bank are service affecting. Therefore, it is recommended that you keep a few spare fuses of each type.
- A particular channel can be affected by its particular channel unit card. Therefore, it is recommended that the inventory of spare channel unit cards be based on the prevailing types of service.
- Common unit cards affect either one digroup (24 channels) or both digroups (48 channels). It is recommended that you keep at least one spare of each common unit card. The common unit cards that affect all 48 channels are as follows:
  - TPU
  - ACU with ILBRV capability
  - LIU
  - SU
  - LBRV
  - PDU
  - PCU or 325A
  - OIU.
- The common unit cards that affect 24 channels within a digroup are as follows:
  - RU
  - TU
  - ACU.

## Trouble Analysis Procedures

Channel service troubles or failures are divided into two types. One type is a channel(s) trouble or failure in a D4 channel bank with no alarm indication at any Transmission Module equipment. The other type is a trouble or failure in the facility causing an alarm indication at some or all equipment in the Transmission Module. If a facility failure occurs, all channels in an alarmed digroup of the D4 channel bank will be automatically processed out of service by D4 equipment.

This maintenance section contains three in-service trouble analysis procedures listed in Table 5-B. Each procedure contains application information to determine when it should be used.

**TABLE 5-B. TRANSMISSION MODULE IN-SERVICE TROUBLE ANALYSIS PROCEDURES**

PROCEDURE	TITLE
12	No AR or AY Alarm at D4 Channel Bank -- Perform D4 Channel Bank Channel(s) Trouble Analysis
13	AR or AY Alarm at D4 Channel Bank -- Trouble Isolation -- Determine Location of Facility Failure
14	AR or AY Alarm at Looped D4 Channel Bank -- Perform D4 Channel Bank Trouble Analysis



**PROCEDURE 12 -- NO AR OR AY ALARM AT D4 CHANNEL BANK --  
PERFORM D4 CHANNEL BANK CHANNEL(S) TROUBLE ANALYSIS*****IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure if a D4 channel bank channel(s) trouble exists without an AR or AY alarm. The most likely cause of channel trouble within the D4 channel bank is the channel unit card. If the channel unit card is working properly, the cause is usually external to the D4 bank.

---

STEP	PROCEDURE
<hr/>	
1.	If available, attach static ground wrist or ankle strap to you and to frame ground of D4 bank.
2.	Determine bank, digroup A or B, and channel(s) 1 through 24 having service trouble or failure. If necessary, remove service from affected channel(s).
3.	Does noise trouble exist on all or most channels in digroup(s)?
	YES -- Go to Step 11.
	NO -- Continue with Step 4.
4.	Obtain replacement channel unit card.
5.	Remove original channel unit card from faulty channel.
6.	Refer to original channel unit card and set all option switches in replacement channel unit card. Be sure <b>all</b> options are set <b>exactly</b> the same in replacement card.
7.	Install replacement channel unit card and determine if trouble is corrected.
8.	If trouble is not corrected, install original channel unit card and perform Steps 4 through 8 on all faulty channels, one at a time.
9.	If trouble is not corrected, have far end replace channel unit card(s) per Steps 4 through 8.
10.	If replacement channel unit cards do not correct trouble, continue with Step 11.
11.	Have service removed from all channels in digroup.
12.	Loop digroup. Insert pin plug or meter lead into <b>R</b> CODE jack on <b>RU</b> and set switch on <b>ACU</b> to <b>LT</b> position. Remove pin plug or meter lead.

**PROCEDURE 12 -- NO AR OR AY ALARM AT D4 CHANNEL BANK -- PERFORM D4  
CHANNEL BANK CHANNEL(S) TROUBLE ANALYSIS (Contd)**

---

<b>STEP</b>	<b>PROCEDURE</b>
<hr/>	
13.	Perform noise tests per Steps 11 through 13 of Procedure 7. If requirements are met, trouble is not in D4 bank. If requirements are not met, noise or transmission loss can be caused by any D4 circuit card or by the external power supply (-48 volt converter). Unseat all channel unit cards in the applicable digroup except the one being tested. If noise requirement is not met, reseal channel unit cards one at a time until faulty card is found. If channel unit cards are not causing trouble, replace common unit cards one at a time. Be sure to set any options in the replacement cards to match the original cards.
14.	If trouble is not corrected, use local escalation procedures to clear trouble beyond this point.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**PROCEDURE 13 -- AR OR AY ALARM AT D4 CHANNEL BANK --  
TROUBLE ISOLATION -- DETERMINE LOCATION OF FACILITY  
FAILURE*****IMPORTANT: Read Application before starting procedure!***

**Application:** Use this procedure to determine if any equipment in the Transmission Module is causing facility alarms. The facility consists of the near end Transmission Module, the DS1/FT1 line facility equipment, and the far end Transmission Module or other type of far end equipment. This procedure is for a Transmission Module containing at least one CSU or FT1 unit, and one or two D4 channel banks. Start at Step 1. If your Transmission Module does not contain equipment addressed in given steps, proceed to the next step(s) covering equipment (D4 channel bank, CSU, FT1 unit as applicable).

---

**STEP****PROCEDURE**

---

**At D4 Channel Bank:**

1. Locate D4 channel bank with red **AR** or yellow **AY** lamps lighted.
2. Depress **ACO** and set toggle switch to **LT** on **ACU** card(s) having alarm lamps lighted.
3. Do alarm lamps (**AR** and **AY**) go out within 20 seconds?

YES -- Go to Step 5.

NO -- Continue with Step 4.

4. Trouble is in D4 channel bank. Go to Procedure 17 to correct D4 channel bank trouble.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

5. Set switch on **ACU** to **NORM**.
6. Does Transmission Module have a CSU or FT1 unit?

CSU -- Continue with Step 7.

FT1 unit -- Go to Step 11.

**At CSU:**

7. At CSU with lighted alarm lamps, connect looping cords between **SM IN** and **SM OUT** jacks.
8. Within 20 seconds, do all alarm lamps extinguish in Transmission Module?

YES -- Continue with Step 9.

NO -- Go to Step 10.

**PROCEDURE 13 -- AR OR AY ALARM AT D4 CHANNEL BANK -- TROUBLE ISOLATION -- DETERMINE LOCATION OF FACILITY FAILURE (Contd)**

---

**STEP**

**PROCEDURE**

---

9. Trouble is in DS1 line facility or far end equipment. At CSU, remove looping cords. Alarms will clear when DS1 line or far end equipment trouble is cleared.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

10. At CSU with lighted alarm lamps, replace F0003/1 card. If you do not have a spare F0003/1 card or if replacement card does not correct trouble, use local escalation procedures to repair or replace CSU.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**At FT1 Unit:**

11. At the FT1 unit with lighted red LOC alarm lamp, set the MOD/CUST switch located at the rear of the unit to the MOD position. The yellow MOD lamp on the front panel will light.
12. Do all alarm lamps extinguish in the Transmission Module?
- YES -- Continue with Step 13.
- NO -- Go to Step 14.
13. Trouble is in DS1/FT1 facility or far end equipment. At the FT1 unit set the MOD/CUST switch to the OFF position. This removes the loop and when the DS1/FT1 line facility or far end equipment trouble is cleared, the alarms will clear.
14. Use local escalation procedures to replace the FT1 unit. The FT1 unit cable connection procedures of Section 3 can be used to connect the FT1 unit.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**PROCEDURE 14 -- AR OR AY ALARM AT LOOPED D4 CHANNEL BANK -- PERFORM D4 CHANNEL BANK TROUBLE ANALYSIS*****IMPORTANT: Read Application before starting procedure!***

**Application:** Perform this procedure when the cause of an AR or AY alarm has been isolated to a D4 channel bank via Procedure 16. In this case, a looped D4 channel bank will have an AR and/or AY alarm lamp lighted.

---

**STEP****PROCEDURE**

---

1. If available, attach static ground wrist or ankle strap to you and to frame ground of D4 bank.
2. Observe fuses located at **PDU**, **PD & OTU**, or **PD & ORU** (lower left) of D4 bank.
3. Are any fuses blown (indicated by extended bead)?

YES -- Continue with Step 4.

NO -- Go to Step 10.

4. Replace blown fuse.
5. Does fuse blow again?

YES -- Continue with Step 6.

NO -- Go to Step 9.

6. Unseat all bank cards including channel units except **PDU** and power unit in the **PCU** slot. Replace blown fuse.
7. Does fuse blow again?

YES -- Trouble is in any of the following:

**PDU**

**PU or 325A PU**

Bank wiring

External power supply.

NO -- Continue with Step 8.

8. Reseat all cards one at a time until fuse blows again. Replace the card that causes fuse to blow and replace fuse. Reseat all remaining cards. If **OIU** card is replaced, set timing option in replacement **OIU** to match option on the faulty card. If **TPU** card is replaced, set counting option to **SEQ** and install equalizers in replacement **TPU**. If a channel unit card is replaced, set all options on replacement card to match options on faulty card. If an **LIU-3ESF**, **LIU-3B**, or **LIU-7** card is replaced, set options on the

**PROCEDURE 14 -- AR OR AY ALARM AT LOOPED D4 CHANNEL BANK -- PERFORM  
D4 CHANNEL BANK TROUBLE ANALYSIS (Contd)**

---

**STEP**

**PROCEDURE**

---

replacement card to match options on the faulty card. If **LBRV** card is replaced, set signaling option and channel template options to match settings on the faulty card. Refer to Procedure 16 in the Customer Service Section if necessary.

9. Do all the alarm lamps clear within 20 seconds?

YES -- Restore service. Trouble is repaired.

NO -- Continue with Step 10.

10. Depress **ACO** button on **ACU(s)** with lighted red **AR** or yellow **AY** lamps.  
11. Set top switch on alarmed **ACU(s)** to **LT** position.  
12. Do **AR** and/or **AY** lamps extinguish within 20 seconds?

YES -- Trouble is not in your D4 channel bank. Trouble is in DS1/FT1 line facility, other near end Transmission Module equipment, or far end equipment. Set the top switch on **ACU** to **NORM** and depress **ACO** button. When trouble is cleared, all bank alarms will extinguish and channel service may be restored.

NO -- Trouble is in your D4 channel bank. Continue with Step 13.

13. Unseat all channel unit cards in digroup associated with alarmed **ACU(s)**.  
14. Do **AR** and/or **AY** lamps extinguish within 20 seconds?

YES -- Continue with Step 15.

NO -- Go to Step 17.

15. Reseat all channel unit cards one at a time until alarm condition returns.  
16. Replace channel unit card causing alarm condition. Refer to defective channel card unit to set option switches in replacement channel unit. Go to Step 20.  
17. Replace D4 common unit cards **one at a time** while observing for alarm lamps to extinguish. Common unit cards to replace are **LBRV**, **RU(s)**, **TU(s)**, **LIU**, **ACU(s)**, **TPU** and, if present, **OIU**. If **ACU** is replaced, depress **ACO** and set switch to **LT**. If **TPU** is replaced, set counting option to **SEQ** and install equalizers. If **OIU** is replaced, set timing option as set on faulty **OIU** card.  
18. Do alarm lamps extinguish?

YES -- Go to Step 20.

NO -- Continue with Step 19.

**PROCEDURE 14 -- AR OR AY ALARM AT LOOPED D4 CHANNEL BANK -- PERFORM  
D4 CHANNEL BANK TROUBLE ANALYSIS (Contd)**

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**STEP****PROCEDURE**

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19. Trouble is in **PU**, **PDU**, or bank wiring. Use local escalation procedures to clear trouble beyond this point. When repaired, set top switch on **ACU(s)** to **NORM**. When alarm lamps extinguish, service may be restored.
20. With alarm lamps extinguished, reseal all channel unit cards.
21. Set top switch on **ACU(s)** to **NORM**.
22. When all alarm lamps extinguish, restore service.

**STOP! YOU HAVE COMPLETED THIS PROCEDURE.**

**6. RECORDS AND COMMENTS****Records**

In order to properly maintain a transmission facility, some records of status and events should be available. This section has an example of two types of records that, if kept, will aid in maintaining D4 channel banks. One record is called Administration which is a log of D4 channel assignments. Another record is called Maintenance which is a log of all D4 maintenance activities pertaining to trouble analysis. If desired, make copies of these record forms and file them with each customer installation.

**Comments**

Comments and/or questions regarding this manual may be submitted by calling:

**1-800-334-0404**

8:00am -- 4:00pm Eastern Time  
Monday through Friday

In North Carolina, call:

**919-727-3167**



ADMINISTRATION RECORD FORM

D4 BANK LOCATION		CHANNEL UNIT TYPE	CHANNEL INFORMATION SERVICE FROM — TO
DIGROUP A OR B	CHANNEL SLOT		
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
	10		
	11		
	12		
	13		
	14		
	15		
	16		
	17		
	18		
	19		
	20		
	21		
	22		
	23		
	24		

# MAINTENANCE RECORD FORM

[illegible]

**7. GLOSSARY**

**Adaptive Differential Pulse Code Modulation** -- A 32 kb/s encoding algorithm that allows up to 48 voice and/or voiceband data channels to be carried on one DS1 facility.

**ACCUNET® Digital Service** -- A dedicated high capacity digital service that can be used to connect two customer locations, a customer location to a central office, or two central offices.

**ACD** -- Automatic Call Distributor - The customer premises equipment that provides computerized Automatic Call services.

**Alternate Mark Inversion (AMI)** -- A standard DS1 line coding format in which a positive 1 pulse remains at the same positive amplitude for at least 50% of the clock cycle.

**Amplitude Pulses** -- Electrical pulses at varying voltages.

**Analog Signal** -- Electrical signal in which the output varies as a continuous function of the input.

**Asynchronous Transmission** -- Related to D4 Mode 2 operation, independent digroup (24 channel) operation but combining both A and B digroups to form a DS1C 48-channel transmission signal.

**Attenuation** -- The decrease in amplitude (size) of a signal during its transmission from one point to another.

**Bandwidth** -- The range of frequencies which a transmission system receives or transmits without undue loss or distortion of the signal.

**Binary Encoded** -- A signal on a scale of two such as: on or off, high or low level, one or zero, or presence or absence of a signal.

**Bit** -- A unit of digital information.

**Bits Per Second** -- Digital information rate expressed as the number of binary information units transmitted in one second.

**Bit Stream** -- A digital signal or series of pulses.

**Bipolar Signals** -- A digital transmission technique whereby the polarity of each consecutive pulse alternates.

**Bipolar Violations** -- A method for determining errors in a digital signal by monitoring the bit stream for two or more successive pulses having the same polarity.

**Blank Unit or Filler** -- A "dummy" card or circuit pack that has no electrical function but serves as a filler in a slot.

**Bundle Signaling** -- A signaling option with the ILBRV capability in which the individual customer channel signaling bits are extracted from the customer channel bit stream and transmitted on a separate channel (called a delta channel). The signaling bits contain on hook, off hook, and ringing information.

**BRITE** -- Basic Rate Interface Transmission Extension. The channel unit card used for ISDN service or for a stand-alone digital service.

**Cards** -- D4 Channel Bank circuit packs.

**Carrier** -- The equipment required to transmit a signal between two locations.

**CBN** -- Compromised Balanced Network. Circuitry in a D4 channel unit card that provides a matching interface to the customer loop to facilitate proper transmission characteristics.

**Channel** -- One customer circuit or communications line.

**Channel Slot** -- Spaces in the D4 channel bank that contain individual channel units to serve a customer channel or circuit.

**Channel Unit Card** -- D4 circuit pack that serves at the interface between a customer circuit and the D4 channel bank.

**CO (Central Office)** -- The telephone company office that serves a given customer.

**Common Unit Cards** -- Circuit packs in the D4 channel bank that provide the transmission, power, timing, and alarm functions.

**Composite Clock** -- A clock used as a Digital Data Service standard. It consists of a 64 kHz bit stream with every eighth bit being a bipolar violation which is used to align the byte, bit, and frequency.

**Compression** -- The reduction of a parameter of a signal such as bandwidth, amplitude, etc., while preserving its information. For the ILBRV capability, reducing the sampling frequency of one channel from 64 kb/s to 32 kb/s.

**Connecting Blocks** -- Terminal or connecting point for channel cables from the Transmission Module and from the customer transmission equipment (i.e., telephone).

**Customer's Equipment** -- Transmission equipment at the customer premises (i.e., telephone set, data set, etc.).

**Customer Interface Connector** -- The connector on the CSU (Channel Service Unit) that connects to the customer equipment cable.

**Customer Service** -- The act of transmitting a customer's communications signals to and from a customer through a facility or network.

**Cyclic Redundancy Check (CRC-6)** -- A method of monitoring and detecting errors in the T-line bit stream (within 12 frames) and providing the error indication from one end to the other.

**D4 Bank Backplane** -- The back of the D4 channel bank where all internal and external wiring is connected.

**DACS** -- Digital Access and Cross-Connect System.

**Dataport** -- A channel that transmits data signals.

**Data Rates** -- Speeds at which digital signals are transmitted (usually in bits/second).

**Data Sets** -- A modem or device that converts the digital signals from customer equipment to signals that are suitable for transmission over communication lines and vice versa.

**DDA** -- Direct Digital Access - a 56 kb/s digital data access through a 4 ESS switch.

**DDS (Digital Data System)** -- A network that transmits data signals from one customer to another.

**Digital Line** -- The facility that carries the digital bit stream from one location to another.

**Digital Signal** -- Electrical signal that has been converted to a series of pulses based on binary encoding.

**Digroup** -- A group of 24 customer channels.

**Direct Inward Dial Trunk** -- A service that automatically switches a dialed call to the called party telephone set without operator assistance.

**Dry Relay Contacts** -- Contacts that are not connected to either a voltage source or a ground.

**DS0** -- Digital Signal - level 0 - 64 kb/s.

**DS1** -- Digital Signal - level 1 - 1.544 Mb/s.

**Duplex** -- Simultaneous operation of transmitting and receiving equipment at two locations.

**Echo Canceler** -- A device that digitally compensates for echo signals that appear on telecommunications circuits.

**EIA Interface** -- Electronic Industry Association - A set of properties (time, voltage, and current) specified by EIA for business machine or data set communications.

**Electromechanical Switching Machine** -- Switching machines such as No. 4 and 5 Crossbar and Step-by-Step that use relays for circuit switching.

**Electronic Switching Machine** -- Switching machines such as the 1 or 1A ESS switch, 2 ESS switch, 3 ESS switch, 4 ESS switch and 5ESS switch. These machines use transistors or integrated circuits for circuit switching.

**Engineering Records** -- Documents containing specific information about customer transmission equipment such as floor location, powering, services to be provided, etc.

**EPSCS** -- Enhanced Private Switch Communication Service - A customer private line switching service that accesses a private switching network and can also access the public switching network.

**Equalization** -- The process of compensating for the differences in attenuation and/or time delay at the various frequencies in the transmission band. This allows transmitting various frequencies at the same level within a given transmission band.

**Expansion** -- To return a compressed signal to its original value. For the ILBRV capability, expanding the sampling frequency of one channel from 32 kb/s to 64 kb/s.

**External Timing** -- Use of a timing source that is external to the transmission system. This timing source synchronizes the transmit and receive circuits within a given facility.

**Facility** -- Equipment that provides a communications path from one location to another.  
*Example:* D4 channel bank to DS1 facility to D4 channel bank.

**Far End** -- The opposite end of a transmission facility. Opposite of near end.

**Fault Locating Filter** -- A filter that passes one specific frequency and rejects all others. It is used to determine the location of a trouble in a DS1 facility.

**Foreign Central Office** -- A telephone switching office in a remote location to a given customer that does not normally serve that customer. It can be connected to that customer through foreign exchange circuits.

**Foreign Exchange** -- A service that connects a given customer to a telephone switching office that does not normally serve that customer.

**Format** -- A specified grouping of digital bits to facilitate transmission of information.

**Framing** -- A technique whereby a 24-channel segment of digital information is represented by 192 bits of data. An additional bit is included to make a frame (193 bits long). Standard D4 framing format includes 12 frames and ESF framing format includes 24 frames.

**Hot Lead** -- Connected, alive, or energized lead from the voltage source. Not grounded.

**ILBRV** -- Integrated Low Bit Rate Voice - A capability of the D4 channel bank that transmits and receives 64 kb/s channels at a 32 kb/s rate allowing up to 48 channels to be transmitted over one DS1 1.544 Mb/s facility.

**ISDN** -- Integrated Services Digital Network - A proposed worldwide digital transmission network.

**INWATS** -- Incoming Wide Area Telephone Service calls to a WATS customer. Opposite of OUTWATS.

**Line** -- The T1 facility equipment consisting of cables and repeaters that connect one location to another.

**Local Escalation Procedures** -- The local processes or actions that a customer applies when a trouble occurs with transmission equipment owned and/or operated by that customer.

**Local Timing** -- Timing source generated within a given transmission equipment that serves to synchronize its transmit and receive circuits.

**Loop Timing** -- To use timing signals that are transmitted over a transmission facility from one end (source) to the other (loop to source).

**Mb/s** -- A digital transmission rate in megabits per second.

**McCulloh Alarm Signal** -- A type of security alarm signal sent and received by McCulloh Alarm System equipment.

**MEGACOM Service** -- Alternative service similar to AT&T WATS.

**MEGACOM 800 Service** -- Alternative services similar to AT&T 800 toll free services.

**Mode 1 (D4)** -- Both A and B digroups are combined through an LIU 1 card. Two TUs and two RUs operate synchronously in this mode and produce a 3.152 Mb/s 48-channel DS1C signal for application to a T1C line. Common equipment failures are monitored by a single ACU. Another D4 channel bank equipped for Mode 1 is required at the far end of the T1C line.

**Mode 2 (D4)** -- Provides independent, asynchronous, digroup operation to produce a 3.152 Mb/s 48-channel DS1C signal for application to a T1C line. The T1C line can be terminated in a D4 channel bank equipped for Mode 2 or in an M1C multiplexer. The multiplexer can

connect to 4 ESS switch Digital Interfaces or Digroup Terminals, or D1D, D2 or D3 channel banks. An LIU 2 and SYNDES (synchronizer-desynchronizer) card provides Mode 2 operation while two ACUs provide separate alarm monitoring and display for each digroup. Maintenance operations can usually be carried out on one failed digroup without affecting the other.

**Mode 3 (D4)** -- Provides two independent 1.544 Mb/s 24-channel DS1 signals for application to two DS1 lines. The LIU 3 card conditions the bank for independent digroup operation and two ACUs provide separate alarm monitoring and display for each digroup.

**Mode 4 (D4)** -- Two D4 channel banks are wired together and their signals are combined to form a 6.312 Mb/s 96-channel DS2 signal for application to a T2 line.

**Mode 5 (D4)** -- Same as Mode 4 only Mode 5 conditions the D4 channel bank for use with Fiber Optic facilities. In Mode 5 operation, the D4 channel bank contains an optical transmitter and receiver for direct transmission over a Fiber Optic line.

**Modem** -- See Data Set.

**Monaural** -- Transmission signals sent on one channel.

**Multimode Fiber** -- Optical fiber that transmits two or more different wavelengths.

**Multiplexer** -- A device for grouping signals from two or more channels for transmission over a common transmission medium (pair of wires).

**Network Channel Terminating Equipment** -- Equipment used at the customer premises to provide facility termination and signaling compatibility. Also called channel service unit (CSU).

**Near End** -- The referenced end of a transmission facility where the operator or technician is present. Opposite of far end.

**Noncompressed** -- To pass a 64 kb/s channel through without being compressed into 32 kb/s.

**Optical Fiber** -- A transmission medium (line) made of glass fiber that can transport data in the form of light impulses.

**OUTWATS** -- Outgoing Wide Area Telephone Service calls from a WATS customer. Opposite of INWATS.



**PBN** -- Precision Balanced Network. Circuitry in a D4 channel unit card that provides a matching interface to the customer loop to facilitate proper transmission characteristics.

**PBX** -- Private Branch Exchange - Equipment that provides telephone switching service at a customer location.

**Pad** -- A device inserted into a circuit that introduces transmission loss or that matches impedances.

**Parity** -- A method of checking the accuracy of binary encoded signals.

**Post Equalization** -- A method of equalizing the signal that comes from the customer equipment to the D4 channel bank. Equalization provides a near linear level for all frequencies in the voice-frequency band.

**Private Network (Private Line)** -- Telecommunication network owned by the customer or reserved for exclusive use by the customer.

**Public Telephone Network** -- Telecommunications network owned and maintained by the local telephone company or a commercial long distance carrier.

**Remote Alarms** -- Alarm indications or status that are displayed at a foreign location to the transmission equipment.

**Repeater** -- For digital transmission, a device that receives a digital signal from an incoming line, regenerates it, and sends it to an outgoing line.

**Robbed-Bit Signaling** -- An option of the ILBRV capability in which the customer channel signaling bits are inserted into the least significant bit slot of the channel once every six frames. The signaling bits contain on-hook, off-hook, and ringing information.

**SECB** -- Secretarial Board - The customer premises equipment that provides secretarial service.

**Secretarial Line or Service** -- An automatic answering service.

**Service** -- A communication link to a customer.

**Shield Lead** -- In an electrical cable, the separate conductor surrounding a single or multiple conductor within the cable. It minimizes the effects of adjacent electrical circuits.

**Simplex** -- Transmission of information in one direction between two or more terminals.

**Single-mode Fiber** -- Optical fiber that transmits one specific wavelength.

**Span Line** -- The T1 line facility between two locations.

**SPTS Card** -- Signal Path Test Set. Used to test channel signaling capability in a D4 channel bank.

**Station** -- The customer location or customer equipment.

**Stereo** -- Transmission signals sent on two separate channels.

**Subrate** -- A customer channel transmission rate less than 64 kb/s. *Example:* 2.4, 4.8, or 9.6 kb/s.

**Subscriber** -- A customer.

**Synchronous Transmission** -- Related to D4 Mode 1 operation, combining digroup A signals with digroup B signals to form a 48-channel DS1C transmission signal.

**Synchronization** -- To provide timing pulses that serve to maintain the proper identity between the transmitted and received pulses.

**T/R Leads** -- The designation (T/R) for a pair or several pairs of wires going to a customer location.

**T1/R1 Leads** -- The designation (T1/R1) for a pair or several pairs of wires going to a customer location.

**T1DM Format** -- T1 Data Multiplexer Format. A format used only for data transmission in which yellow alarm and error performance monitoring information are transmitted in the 24th channel.

**T1 Digital Line Facility** -- The T1 line equipment (wires, repeaters, etc.) that transmits a digital signal.

**Tandem Connection** -- A back-to-back connection of channel units to provide a communication path or link.

**Template** -- An ILBRV channel configuration that determines the number of through channels (noncompressed) and channel signaling available to the user. The connecting equipment must have service that matches one of the ILBRV channel template configurations.

**Terminal Alarms** -- Alarm indications at the transmission equipment terminals such as a D4 channel bank.

**Terminal Strip** -- An electrically insulated base or board equipped with terminals for connecting wiring.

**Termination Point** -- The ending point of a circuit.

**Timing Pulses** -- Pulses used for synchronizing the transmit and receive circuits of a transmission facility. They can be generated from a local, loop, or external source.

**Trunk** -- The entire link between two switching points that is necessary to carry transmission from one switch to another.

**Trunk Processing** -- To disconnect channel units from service so that customer access is denied. This is done automatically by D4 equipment when a facility failure occurs.

**Type I** -- E&M type signaling interface to an electromechanical switching system.

**Type II** -- Completely looped E&M type signaling interface to an electronic switching system.

**Type III** -- Partially looped E&M type signaling interface to an electronic switching system.

**V ac** -- Volts, alternating current.

**V dc** -- Volts, direct current.

**Voice-Frequency** -- The frequency range of normal speech; approximately 300 - 3000 Hz.

**Wire Wrapping Tool** -- Tool that aids in connecting individual wires to terminal strips.

**Wrist Strap** -- Metallic strap that "grounds" the service technician. It connects to the wrist and the frame of the Transmission Module. This prevents damage to electronic equipment from static electrical charges.

**8. REFERENCES**

The following documents contain additional information which may help you to better understand the operation and maintenance of the D4 Transmission Module. Any of these documents may be ordered from the AT&T Customer Information Center by calling:

**1-800-432-6600.**

<b>AT&amp;T PRACTICE</b>	<b>INFORMATION</b>
365-170-100	D4 Channel Bank Description
365-170-101	General Channel Unit Description
356-170-140	Channel Unit Test Extender Description
365-170-150	Dataport Latching Loopback Procedure - Dataport Channel Units
365-170-201	Digital Data Bank - Description and Application Information
365-170-210	Digital Data Bank - Multipoint Junction Unit - Acceptance and Maintenance Procedures
365-170-220	Digital Data Bank - Subrate Multiplexer Unit - Acceptance and Maintenance Procedures
365-170-501	15-kHz Program Channel Units Alignment Procedures
365-170-502	BRITE Channel Unit Installation and Trouble Clearing
365-170-600	TUI and OIU-5 - Independent Digroup Timing Circuit Packs - Data Sheet
365-170-601	LIU-3B Line Interface Unit - Bipolar Eight Zero Substitution - Data Sheet
365-170-602	LIU-3ESF Line Interface Unit - Extended Superframe Format - Data Sheet
365-170-603	AHG12 OIU-4A - Office Interface Unit Circuit Pack - Data Sheet
365-170-604	Integrated Low Bit Rate Voice - Data Sheet
365-170-605	T1 Data Multiplexer Format Interface - Data Sheet

The following list includes the D4 channel unit data sheets that describe the channel unit cards, their options, and some applications. The list includes those data sheets applicable to the D4 Transmission Module as of January, 1988. Any new data sheets will be listed in AT&T Practice 365-000-000 Division Index. The index and these data sheets can be ordered from the AT&T Customer Information Center by calling 1-800-432-6600.

**D4 CHANNEL UNIT DATA SHEETS**

<b>CHANNEL UNIT CARD</b>	<b>CODE</b>	<b>DATA SHEET</b>
2E&M9	J98725BJ	365-005-001
DPMO	J98726BM	365-005-008
2FXO/GT	J98726SK	365-005-014
4FXO/GT	J98726SC	365-005-016
2DX/GT	J98726SD	365-005-018
PLR	J98726BN	365-005-020
4TDM	J98726SF	365-005-021
2TO	J98726SJ	365-005-022
PG5T	J98726CA	365-005-025
PG5R	J98726CB	365-005-026
PG8T	J98726CC	365-005-027
PG8R	J98726CD	365-005-028
DSU/DP	J98726DC	365-005-033
DPT6	J98726CH	365-005-040
2FXO6	J98726SS	365-005-041
2FXS6	J98726SR	365-005-042
DPO	J98726BA	365-005-043
2RD/PLAR	J98726SN	365-005-044
4RD/PLAR	J98726SP	365-005-045
SEC MCS	98726GA	365-005-046
SEC MC 0	J98726GB	365-005-047
PG15T	J98726CE	365-005-048
PG15TR	J98726CF	365-005-049
2E&M6	J98726BT	365-005-054

## D4 CHANNEL UNIT DATA SHEETS (Contd)

CHANNEL UNIT CARD	CODE	DATA SHEET
2FXO	J98726BE	365-005-056
OCU DP	J98726DB	365-005-058
DSO DP	J98726DA	365-005-059
4TO	J98726SH	365-005-060
4ETO	J98726SQ	365-005-061
2PBX	J98726ST	365-005-062
2FXO/LSN	J98726SU	365-005-063
2FXO/LS	J98726BL	365-005-064
DSO DP ALLRATE	J98726DH	365-005-067
2FX/LS	J98726BK	365-005-068
OCU DP ALLRATE	J98726DJ	365-005-069
4SF	J98726SW	365-005-070
PG 7.5T	J98726CN	365-005-071
PG 7.5R	J98726CP	365-005-072
2FXS	J98726BD	365-005-074
4FXS	J98726SB	365-005-075
4DX	J98726SE	365-005-076
2FXS/GT	J98726SG	365-005-078
DDA OCU	J98726DL	365-005-081
DPT	J98726BB	365-005-083
DDA DSO	J98726DK	365-005-085
DSU-II	J98726DN	365-005-086
DSU-II 56KB	J98726DP	365-005-087
BRITE	AHG13	365-005-089
2FXO	J98726BE	365-005-090
4E&MER	J98726BP	365-005-091
4E&M	J98726BC	365-005-092
2RD/PLAR	J98726SN	365-005-095