

**51 ISDN**

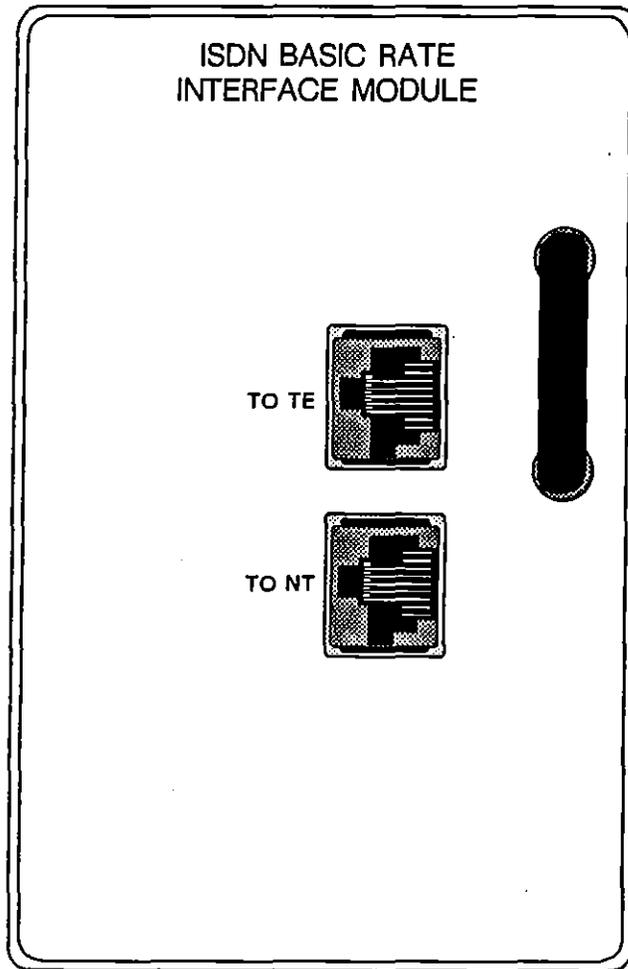


Figure 51-1 ISDN Interface Module.



Figure 51-2 ISDN LED overlay.

## 51 ISDN

ISDN is an optional interface in the INTERVIEW 7000 Series. The interface includes the ISDN Test Interface Module and the ISDN multiplexer board.

In order to capture ISDN data on the INTERVIEW, your unit must be equipped with the ISDN option (OPT-951-15-1 for North America or OPT-951-15-2 for Europe), which consists of an ISDN multiplexer board and the removable Test Interface Module (documented in the following paragraphs). The system software necessary to control the hardware and provide the user interface for the protocol is Software Version 5.02 or above. Once installed in your unit, the ISDN mux board will not interfere with the operation of other, non-multiplexed TIMs, such as RS-232 or X.21. It is not compatible with T1 or G.703 TIMs.

The TIM is installed as other interface TIMs are as described in Section 12. See Appendix J4 for installation of the mux board.

The ISDN Layer 1 protocol package (ISDN\_D) is presented in Section 41.

### 51.1 Overview of ISDN Testing Capabilities

ISDN relies on digital (vs. analog) telephone lines and switching for modemless data communication. Digitized data is sent over both B and D channels. Voice is transmitted on the B channels in digital form also.

The INTERVIEW 7000 Series supports both single-channel and dual-channel (one B channel plus the D channel) Basic Rate ISDN monitoring and emulation. Primary Rate ISDN is transmitted over T1 (Section 52) or G.703 (Section 53) lines.

#### (A) Physical Characteristics

The Basic Rate ISDN service provides an aggregate data rate of 192 Kbps, with 144 Kbps available to users: two 64 Kbps B-channels and one 16 Kbps D-channel per interface (2B+D). The additional 48 Kbps are used for framing and maintenance.

The INTERVIEW's physical interface conforms to CCITT I-Series Recommendations. The physical connectors and the ISDN Test Interface Module are discussed in Section 51.2.

The INTERVIEW normally transmits and expects to receive ISDN data encoded in Alternate Mark Inversion Format (AMI). In AMI, the polarity of each sequential one (mark) alternates with reference to the zero (space) voltage level. (See Figure 52-2.)

### **(B) B Channels**

The two ISDN B-channels transport either data or voice at 64 Kbps. They are designated as "B1" and "B2" and are selectable on the ISDN Interface Setup screen for monitoring or emulating. All bit patterns are acceptable user data and none of the bits are to be stolen for signaling. Common channel signaling for calls on the B channel is out-of-band, carried on the D channel. This speeds the sending of data on the B channel.

### **(C) D Channel**

The ISDN D-channel transports data (vs. voice) at 16 Kbps. It is selectable on the ISDN Interface Setup screen for monitoring or emulating. The D channel carries the common channel signaling for calls on the B channel, accessing a circuit switch network. These common channel signals are for establishing, maintaining, accounting for, and terminating connections.

The D channel uses LAPD protocol at Layer 2 and Q.931 at Layer 3 for signaling. The same D channel also accesses the X.25 packet-switching network. It uses X.25 at Layer 3 for packet-switching.

### **(D) Data Capture**

The Front-End Buffer can capture one ISDN channel in real-time for immediate analysis or recording and playback. Capture speeds are 64 Kbps for a B channel and 16 Kbps for the D-channel.

Unlike T1 and G.703 protocols, aggregate record is not available for ISDN. If high-speed record is selected on the Line Setup screen, the only channel recorded will be the channel selected on the Interface Control screen (even if the INTERVIEW is monitoring both the D channel and one of the B channels via the ISDN trace application package, OPT-951-35).

### **(E) Dual-Channel Testing**

Whenever you specify one of the B channels in the **Channel:** field on the ISDN Interface Setup menu, your configuration is "dual channel." This means that you have access to the specified B channel *plus* the D channel. You always have access to the D channel, whether your **Channel:** selection is the D channel or one of the B's. You never can access both B channels in a single test run.

The format and code selections you make on the Line Setup screen pertain to the single channel you have selected on the ISDN Interface Setup screen. These line-setup selections are indicated at the top of the run-time display and

determine the appearance of the data stream on the screen. Protocols selected on the Layer Setup screen also pertain to single specified channel only. This means that protocol-package traces and spreadsheet softkeys will be geared to the specified channel only.

In a dual-channel configuration (that is, when the specified channel is one of the B channels), the D channel is accessible for monitoring and for data transmissions *via C-language on the Protocol Spreadsheet*. See Section 41, "ISDN D Channel," and Section 79, "ISDN D Channel Library," for a discussion of the C-language tools available for dual-channel operation.

### (F) Single-Channel Testing

When you specify the D channel in the **Channel:** field on the ISDN Interface Setup menu, your configuration is "single channel." This means that your line setup, data display, and protocol packages (including traces and spreadsheet softkeys) all pertain to the D channel.

In single-channel operation, the C-language tools necessary for dual-channel operation are extraneous for monitoring or emulating on the D channel. The special ISDN D-Channel protocol package described in Section 41, "ISDN D Channel," is not necessary. The library of special C-language tools documented in Section 79, "ISDN D Channel Library," also is unnecessary.

### (G) Monitor Mode

When **Mode** is set to MONITOR on the Line Setup menu, the INTERVIEW may monitor either one of the B channels plus the D channel (or the D channel alone) passively. Once the initial cabling is done (see Section 51.3(C)), the ISDN circuit through the INTERVIEW is bridged, not broken—even when the unit is turned off—and the INTERVIEW does not interfere with communications in progress.

### (H) Emulate DTE or DCE

The INTERVIEW can also emulate a DTE or a DCE over ISDN lines, depending on the **Mode** selection made on the Line Setup menu. In an emulation mode, the INTERVIEW actively transmits and receives data as prescribed by ISDN protocol at 64 Kbps for one of the B channels and 16 Kbps for the D channel. See Section 51.3(C) for line cabling.

Either of the B channels plus the D channel may be selected for analysis. INTERVIEW test data can be transmitted on the outbound channels; incoming data on the corresponding channels is monitored. Higher layer protocols carried by the ISDN point-to-point protocol can be tested simultaneously as statistics on the performance of the ISDN circuit are taken and, at the user's need, displayed.

The INTERVIEW emulates by transmitting idle (F) to the unselected B channel(s).

## 51.2 Test Interface Module

### (A) Connectors

The ISDN Test Interface Module has just two ports on the face of the TIM (see Figure 51-1). One interface is for connection to the terminal (TO TE) and the other completes the connection on the network side (TO NT). Each is an RJ45 connector with eight wires in a standard ISDN setup. Four of the wires on each connector are for the ISDN bit stream. Two of them handle transmission in one direction and the other two handle transmission in the other direction. Two additional wires transfer power for the lines. The remaining two wires are unused.

### (B) Green-Red LEDs

The ISDN LED overlay (Figure 51-2) identifies two LED indicators, Remote and Freeze. These switch from green to red when the unit is in a particular mode. Remote means that the unit is under remote control via the REMOTE RS-232 connector on the rear of the unit. (The Remote function is not implemented in early releases of the INTERVIEW 7000 Series.) Freeze means the **FREEZE** key has been pressed and the data is "frozen" on the screen for examination.

## 51.3 Testing Configurations

See Section 12 for instructions on installing the TIM.

### (A) ISDN Physical Devices

Figure 51-3 illustrates a typical Basic Rate ISDN setup. The physical devices that constitute the common user interface are described in the following paragraphs.

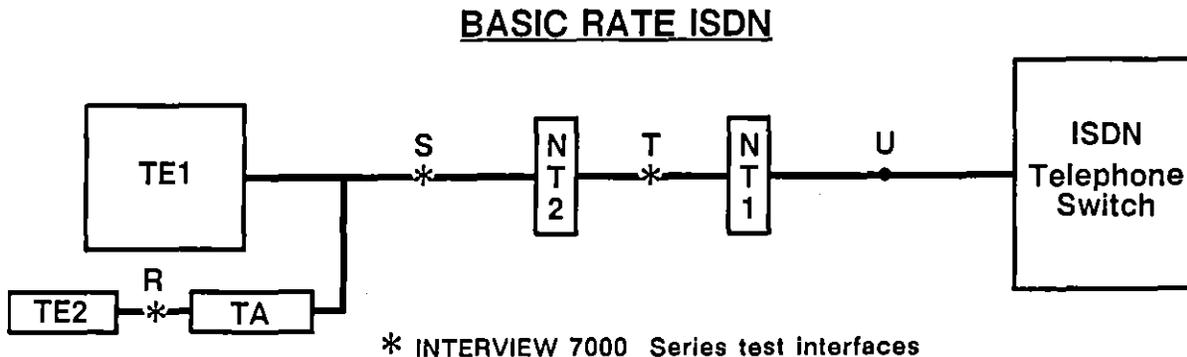


Figure 51-3 Typical Basic Rate ISDN configuration with INTERVIEW 7000 Series test interfaces.

1. **TE1.** (Terminal Equipment—Type 1) A terminal device equipped with a standard ISDN physical interface. May be ISDN-equivalent of TE2 device (a present-day telephone, data terminal, voice/data workstation, or similar communicating device), a terminal cluster controller, a multiplexer, or a very local branch of a local area network (LAN).
2. **TE2.** (Terminal Equipment—Type 2) A terminal device equipped with a non-ISDN physical interface such as V.24 (RS-232-C) or X.21. ISDN does not support this type, which would require a terminal adapter (TA). This is a non-ISDN terminal, usually a present-day telephone, data terminal, voice/data workstation, or similar communicating device.
3. **TA.** (Terminal Adapter) An interface adapter for connection of one or more TE2 devices to the network. Equivalent to a protocol or interface converter.
4. **NT2.** (Network Termination—Type 2) A possibly intelligent device responsible for the user's side of the connection to the network, performing such functions as multiplexing and switching. Could be a digital PBX or a local area network (LAN).
5. **NT1.** (Network Termination—Type 1) A device responsible for the carrier's side of the connection, performing such functions as signal conversion and maintenance of the loop's electrical characteristics. These functions are similar to those provided by DSU/CSUs.

## (B) ISDN Interfaces

Figure 51-3 also identifies four interfaces between the various physical devices. It is at these points the INTERVIEW is used to test the lines. They are defined in the following paragraphs.

1. **R.** The interface between a non-ISDN terminal (TE2) and an ISDN terminal adapter (TA).
2. **S.** The interface between an ISDN terminal and the network; the interface between TE1 or TA and NT2.
3. **T.** The interface between the subscriber's portion of the network and the carrier's portion; the interface between NT2 and NT1.
4. **U.** The carrier's local loop; the interface between NT1 and the telephone switch.

### (C) ISDN TIM Test Configurations

1. *Monitor.* Figure 51-4 shows the test configuration when the INTERVIEW is monitoring at the S or T interface. Connect both interfaces, TO TE and TO NT, to the line.

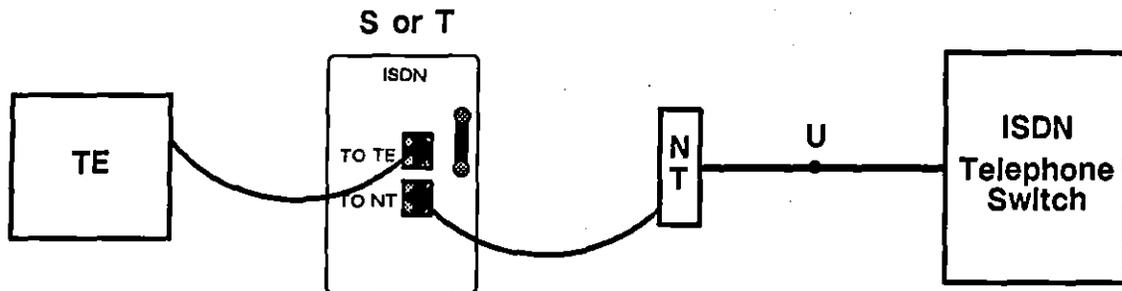


Figure 51-4 To monitor the line, connect both interfaces, TO TE and TO NT, to the line at the S or T interface.

2. *Emulate DCE in normal transmit mode.* Figure 51-5 shows the ISDN TIM test configuration when emulating DCE in normal transmit mode. Connect the TO TE interface to the ISDN terminal.

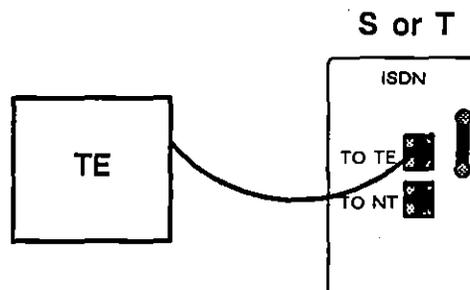


Figure 51-5 When emulating DCE in normal transmit mode, break the S or T interface toward the ISDN terminal (TE).

3. *Emulate DTE in normal transmit mode.* Figure 51-6 shows the ISDN TIM test configuration when emulating DTE in normal transmit mode. Connect the TO NT interface to the network side of the line.

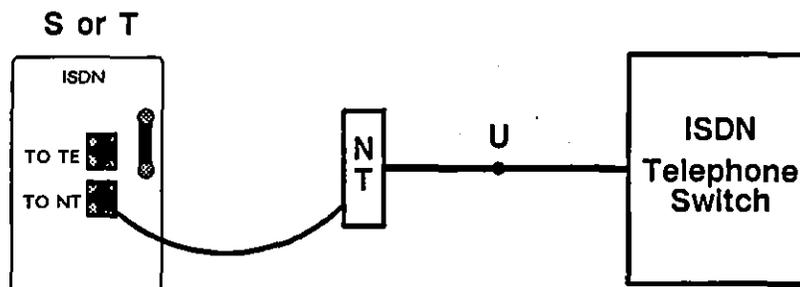


Figure 51-6 When emulating DTE in normal transmit mode, break the S or T interface toward the ISDN switch.

## 51.4 Setting Up Menus for ISDN Testing

The Line Setup menu (Section 5) and Layer Setup screen (Section 8) selections for ISDN testing are selected according to the data on the channel selected on the ISDN Interface Setup screen. See Section 51.5 below. When the D channel is the selected channel, the ISDN\_D protocol package should *not* be loaded at Layer 1.

For both single- and dual-channel monitoring or emulation, all the testing capabilities of the INTERVIEW are directed to the channel selected on the ISDN Interface Setup screen. For dual-channel operation, the user can enter an application program (such as the ISDN trace, OPT-951-35) to display the common channel signaling information in the User Trace screen.

## 51.5 ISDN Interface Setup Menu

Figure 51-7 shows the programming selections on the ISDN Interface Setup menu screen for ISDN.

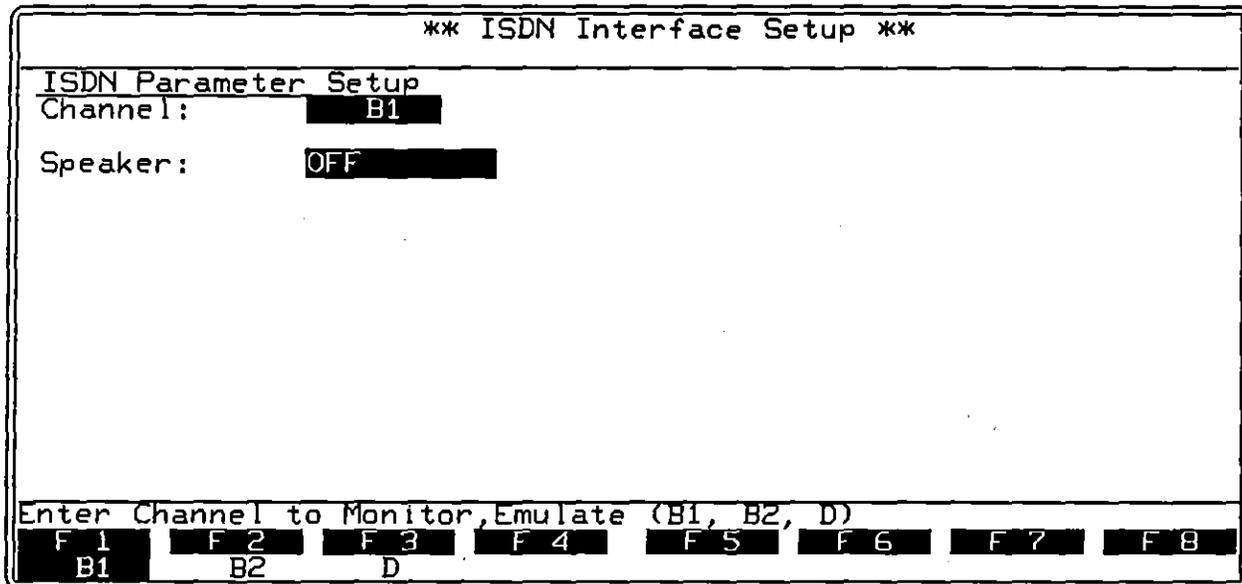


Figure 51-7 The channel selected on the ISDN Interface Setup screen is the channel tested by the INTERVIEW; the INTERVIEW setup parameters are for this selected channel.

**(A) Channel**

The user may select the channel to be monitored or emulated: **D**, **B1**, or **B2**.

**Channel: D** means that operation will be single channel. The line setup, data display, and protocol packages—including traces and spreadsheet softkeys—all will be directed at the 16 Kbps D channel. No B-channel operation of any kind will be possible.

**Channel: B1** or **Channel: B2** means that operation will be dual channel. The line setup, data display, and protocol packages—including traces and special softkeys—will be directed at the 64 Kbps B1 or B2 channel. The D channel, meanwhile, will be accessible via special C-language tools embedded in the ISDN\_D layer package at Layer 1. A sophisticated D-channel application program (the ISDN trace available as OPT-951-35) has been constructed with these tools and is available for dual-channel monitoring.

**(B) Speaker**

The user may elect to turn the speaker off (**OFF**) or to monitor voice on either B-channel (**Monitor B1** or **Monitor B2**). The **Speaker:** selection to monitor voice on one of the B channels is independent of the **Channel:** selection. That is, if **Channel: B1** and **Speaker: Monitor B2** are selected, the data tested, displayed, and traced will be on the B1 channel, but the speaker will pick-up voice or data-static of the B2 channel.

1. *Off*. This selection turns the speaker off.
2. *Monitor B1*. This selection allows the user to monitor the speaker on channel B1.
3. *Monitor B2*. This selection allows the user to monitor the speaker on channel B2.

## 51.6 ISDN Runtime Statistics Screen

The ISDN Runtime Statistics screen shown in Figure 51-8 displays information on the state of both the terminal equipment (TE Information) and network termination (NT Information), as well as the line status of both RD and TD. The version of the ISDN mux board installed in the unit is also displayed. Tabular and graphical statistics are also available via the indicated softkeys.

```

*MON/LINE/ISDN/B1*   BLK=_____  03/29/89 10:12
EBCDIC/8/NONE/SYNC/55

          ISDN Runtime Statistics
          ISS Board Version: 1.00

TE Information                NT Information
TE State:      F1                NT State:      G2
TD Line Status: E1              RD Line Status: ARU

F1  F2  F3  F4  F5  F6  F7  F8
TABULAR GRAPHIC ISDNSTS
  
```

Figure 51-8 ISDN Runtime Statistics screen.

### (A) TE State

The state of the terminal equipment is coded and displayed using alphanumeric characters F1 through F8.

1. *F1*. State F1 indicates the condition that the terminal-side equipment is not powered on.
2. *F2*. The terminal-side equipment has been powered on, but it has not determined the type of signal (if any) that the terminal-side equipment is receiving.

3. *F3*. This is the deactivated state of the physical protocol. Neither network-side equipment nor terminal-side equipment is transmitting.
4. *F4*. In this state, the terminal-side equipment is requested to initiate activation. It then transmits a signal (INFO 1) and waits for a response from the network-side equipment.
5. *F5*. At the first receipt of any signal from the network-side equipment, the terminal-side equipment ceases to transmit INFO 1 and awaits identification of signal INFO 2 or INFO 4 in State *F5*.
6. *F6*. In State *F6*, the terminal-side equipment receives an activation signal from the network-side equipment (INFO 2). It then responds with a signal (INFO 3) and waits for normal frames from the network-side equipment (INFO 4).
7. *F7*. This is the normal active state with the protocol activated in both directions. Both the network-side equipment and the terminal-side equipment are transmitting normal frames.
8. *F8*. State *F8* is the condition when the terminal-side equipment has lost frame synchronization and is awaiting resynchronization by receipt of INFO 2 or INFO 4 or deactivation by receipt of INFO 0:

### **(B) TD Line Status**

The status of the TD line is coded and displayed as explained in the following paragraphs.

1. *PU*—*Power up*. Module interface is clocked.
2. *DR*—*Deactivate request*. Deactivation Request Form S.
3. *SD*—*Slip detected*. Wander is greater than 18  $\mu$ s Peak-Peak.
4. *DIS*—*Disconnected*. PIN CON is at ground.
5. *EI*—*Error indication*. RST or Reset.
6. *RSY*—*Resynchronizing*. Level received, not synchronous.
7. *ARD*—*Activate request*. INFO 2 received.
8. *TI*—*Test indication*. Test loop or test mode.

9. *ATI—Awake test indication.* Level received during test loop.
10. *A18—Activate indication P10.* INFO 4 received, D channel priority is 8 or 9.
11. *A10—Activate indication P10.* INFO 4 received D channel priority is 10 or 11.
12. *DID—Deactivate indication.* Clocks are switched off, a quiescent state.

### (C) NT State

The state of the network (NT) is coded and displayed using alphanumeric characters G1 through G4.

1. *G1.* This is the deactivated state; the network-side equipment is not transmitting.
2. *G2.* State G2 is a partially active state; the network-side equipment sends INFO 2.
3. *G3.* This is the normal active state where the network-side equipment to terminal-side equipment direction is active. The terminal-side to network-side direction may or may not be active. The network side may deactivate or maintain the active state when the terminal side stops transmitting. The choice to eventually deactivate is up to higher-layer protocols within the network side.
4. *G4.* When the network-side equipment wishes to deactivate, it may wait for a timer to expire before returning to the deactivated state in State G4.

### (D) RD Line Status

The status of the RD line is coded and displayed as explained in the following paragraphs.

1. *LSL—Lost signal level.* No received level.
2. *RSY—Resynchronizing.* Receiver not synchronous.
3. *ARU—Active request.* INFO 1 received.
4. *AIU—Active indication.* Receiver synchronous.
5. *DIU—Deactivate indication.* Time TS 6 or TS 7 after deactivation instruction is finished.



**52 T1**

**\*\* Interface Control \*\***

**T1 Line Setup**

Receiver Gain: 0 db 20 db  
 Termination: BRIDGED TERMINATED  
 Cable Type: MAT IQOT ABAM PIC PULP

Cable Length: 0-220 220-440 440-655

**T1 Transmit Setup**

Transmit Mode: NORMAL DROP/INS

Idle Select: 7F FF  
 Line Clock Select: INTERNAL EXTERNAL

**T1 Data Path Setup**

Framing Mode: D4

Data Path: 64K DATA CHANNEL 56K DATA CHANNEL A BORDED BITS B BITS  
 F1 BITS Fa BITS

Channel Number: (two decimal digits)

Yellow Alarm: F-BIT 12 = 1 DATA BIT 2 = 0  
 Sync Procedure: ALL F BITS F1 BIT ONLY

Data Path: 64K DATA CHANNEL 56K DATA CHANNEL A BITS B BITS C BITS D BITS  
 FACILITY DATA LINK

Channel Number: (two decimal digits)

Check CRC During Sync: YES NO

Sync Length: 10 bit 24 bit  
 B5ZS Coding: YES NO  
 Record Framing Bits: YES NO

**T1 Signal Channel Setup**

Signal Channel Number: 24 (two decimal digits)  
 Signal Channel Idle Char: 7E FF  
 Sig Channel Polarity: NORMAL INVERTED

Select Receiver Gain (in db)

F1	F2	F3	F4	F5	F6	F7	F8
0 db	20 db						

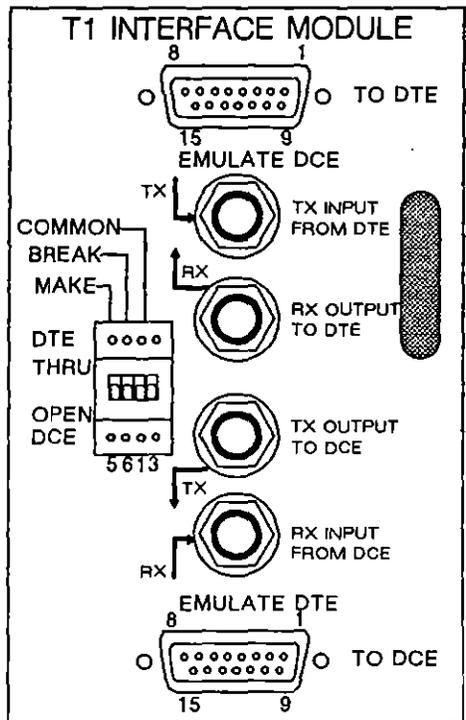


Figure 52-1 Interface Control screen (above) presents T1 options when a T1 TIM (below) is installed.

## 52 T1

T1 is a point-to-point protocol at the physical layer (Layer 1) used to transmit high-speed voice or data over telephone lines. The INTERVIEW 7000 Series, with T1 software and the T1 Test Interface Module installed, is capable of testing T1 circuits that comply with North American standards. In particular, the INTERVIEW tests circuits with a total bandwidth of 1.544 MHz (as opposed to 2.048 MHz circuits typically used in Europe). The bandwidth is divided into 24 channels with an absolute speed of 64 Kbps each.

In order to capture T1 on the INTERVIEW, your unit must be equipped with a T1 option (OPT-951-11-1 or OPT-951-11-2), which consists of a Multiplexer board and a removable Test Interface Module (documented in the following paragraphs).

The INTERVIEW supports T1 Primary Rate ISDN with 23 B-channels and one D-channel (23B+D).

### 52.1 Overview of T1 Testing Capabilities

#### (A) Physical Characteristics

The INTERVIEW's physical interface conforms to CCITT Recommendation G.703 for 1.544 MHz (DS1) circuits. The physical connectors and the T1 Test Interface Module are discussed in Section 52.2.

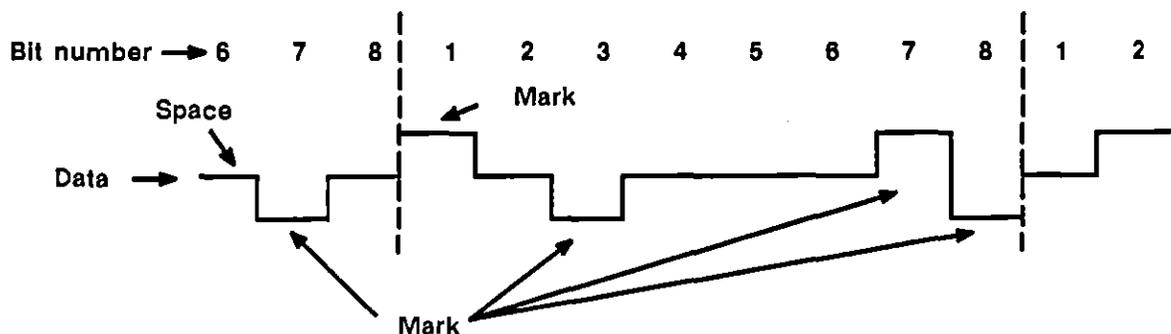


Figure 52-2 Alternate Mark Inversion.

The INTERVIEW normally transmits and expects to receive T1 data encoded in Alternate Mark Inversion Format (AMI). In AMI, the polarity of each sequential 1 (mark) alternates with reference to the zero (space) voltage level.

As an alternative, the user may select B8ZS (Binary 8 Zero Suppression), a transmission technique which is sometimes used to overcome the occurrence of long strings of zeroes and the associated timing problems. The B8ZS option is explained later in this section.

## **(B) Framing Characteristics**

Any T1 circuit that operates at 1.544 MHz and conforms to the basic physical characteristics laid out in Recommendation G.703 may be BERT-tested with the INTERVIEW; however, the full set of statistical analyses and protocol testing capabilities apply only to T1 circuits which employ D4 or Extended Superframe (ESF) framing structures. These framing structures are discussed in detail in CCITT Recommendation G.704; the major characteristics of the two schemes are outlined in Section 52.7. The INTERVIEW 7000 Series supports both in-band signalling (bit robbing) and clear channel (common channel or out-of-band) signalling.

**NOTE:** Hereafter, the word "circuit" will be used to indicate a DS1 circuit unless otherwise specified.

## **(C) T1 BERT**

The INTERVIEW can perform both framed and unframed BERT tests on T1 transmissions. An individual channel may also be BERT tested. Tests may be performed in a simple loopback configuration or in conjunction with another INTERVIEW or BERT tester. In Run mode, a separate T1 BERT display tracks test results. The contents of the display and BERT options and setup are described in Section 11.

## **(D) Channel Data Capture**

The Front-End Buffer can capture one T1 channel in real-time for immediate analysis or recording and playback. Maximum speed for T1 channel data capture is 64 Kbps, since this coincides with the absolute speed of the individual data channels. The user may specify any one of 24 data channels; or he may elect to capture specific framing or signalling bits.

**NOTE:** When recording the capture of a single channel to RAM, select **Record Speed:**  NORMAL  on the Record Setup menu. See Section 7.4.

When you enter Run mode configured to capture a single channel, 24 for example, the following message appears on the status line: "Ch24."

### (E) Aggregate T1 Record

To record the aggregate T1 data stream (1.544 Mbps), with or without framing bits, your unit must be equipped with an FEB board capable of high-speed recording (see Section 7.4.) and software revision 5.02, or higher. Select **Mode**: **MONITOR** on the Line Setup menu. Configure the Record Setup menu for **Capture Memory**: **RAM** and **Record Speed**: **HIGH SPEED**.

A **Record Framing Bits** field is present on the T1 Interface Control screen. See Section 52.5(P). Your selection for this field screen determines whether or not framing bits will be included in the aggregate data stream.

When you enter Run mode configured for aggregate T1 record, the status line will contain the following message: "HS AGG REC."

### (F) Monitor Mode

When **Mode** is set to **MONITOR** on the Line Setup menu, the INTERVIEW as T1 protocol analyzer may be used to monitor any one of the data channels or framing or signalling patterns passively. Once the initial cabling is done, the T1 circuit through the INTERVIEW is bridged, not broken — even when the unit is turned off — and the INTERVIEW does not interfere with communications in progress.

A special DSX monitor jack that is found at telco central offices may be used to monitor nonintrusively even when the INTERVIEW is not already cabled to the line. See Figure 52-9 for an illustration of this configuration.

### (G) Emulate DTE or DCE

The INTERVIEW can also emulate a DTE or a DCE over T1 lines, depending on the **Mode** selection made on the Line Setup menu. In an emulation mode, the INTERVIEW actively transmits and receives data as prescribed by T1 protocol at a maximum speed of 64 Kbps. A selection on the Interface Control screen allows the user to specify whether clocking is supplied externally or provided by the INTERVIEW.

Any of the 24 data channels on the circuit can be selected for analysis. INTERVIEW test data can be transmitted on the outbound channel; incoming data on the corresponding channel is available for display and test. Higher layer protocols carried by the T1 point-to-point protocol can be tested simultaneously as statistics on the performance of the T1 circuit are taken and, at the user's need, displayed.

The INTERVIEW emulates in two fashions: it can transmit idle to all but one channel to which it transmits data and which it monitors; or it can perform drop-and-insert emulation. When the drop-and-insert option is employed, transmissions on 23 channels are terminated and regenerated by the INTERVIEW, while the channel selected for analysis is terminated and INTERVIEW data is transmitted on the out-going channel.

### (H) Protocol Spreadsheet

T1 protocol cannot be controlled from the Protocol Spreadsheet. Other protocols operating above the physical interface may, however, be tested. Spreadsheet options for testing in this case will depend on the protocols you have loaded from the Layer Setup screen.

### (I) Data Displays

The format and code selections you make on the Line Setup screen, indicated at the top of the run-time display, determine the appearance of the data stream on the screen. Protocols selected on the Layer Setup screen will be available as trace displays. An alternate real-time display (see Figure 52-18) selection allows you to view T1 statistics and track performance on the T1 circuit only when the T1 TIM is in place. The T1 Statistics Display is described in Section 52.6.

### (J) Primary Rate ISDN

The INTERVIEW 7000 Series supports T1 Primary Rate ISDN at 1.544 Mbps (23B+D) with either version of the mux board and TIM option package (OPT-951-11-1 or OPT-951-11-2) and software revision 6.00, or higher. The ISDN\_D protocol package is used in T1 at Layer 1 to access the ISDN variables. See also Sections 41, 51, and 79 on Basic Rate ISDN.

The D channel selection (Signal Channel Number field) defaults to channel 24. For dual-channel monitoring and emulation, OPT-951-11-2 (T1 TIM and mux board option) is required; an ISDN trace application package (available as OPT-951-35) is also available for monitoring and emulating both single and dual channels. For dual-channel emulation, LAPD should be loaded at Layer 2 on the B channel.

Three fields (Signal Channel Number, Signal Channel Idle Char, and Sig Channel Polarity), present on the T1 Interface Control screen in the T1 Signal Channel Setup section, are applicable *only* when monitoring or emulating dual channels. Otherwise these fields are not used by the INTERVIEW.

## 52.2 The Test Interface Module

The T1 Test Interface Module (TIM), shown in Figure 52-1, is a removable module which may be replaced by different interfaces when other types of lines must be tested. The T1 TIM provides two 15-pin female connectors (top and bottom of module) labeled TO DTE and TO DCE. In addition, there are two pairs of WECO-310 connectors. All connectors are two-wire and attach to a standard DS1 line. The signal direction for each connector is indicated in Figure 52-5. An overlay which identifies active LEDs on the front panel accompanies the T1 TIM. In addition, there are three access points for testing a remote CSU.

Install the T1 Test Interface Module and insert the correct LED overlay as described in Section 1.10. Once the T1 module and the overlay are installed, TX and RX leads can be monitored on the front-panel green-red LEDs.

## (A) Connectors

When you break a data line for testing, you may connect the end of the line coming from the DTE (multiplexer, channel bank, PBX, or switch) to the TO DTE connector on the TIM (see top of Figure 52-3). Connect the other end of the line coming from the DCE (CSU or telco office repeater) to the TO DCE connector on the TIM. Even when the INTERVIEW is powered off, this provides a through connection for the data line.

*CAUTION: To connect the data line, you must interrupt the flow of data on the line. Be sure you have permission to break the line before doing so.*

If you are using the WECO 310 phone jacks, you may create a pass-through connection by connecting the top two jacks toward the DTE and the bottom two jacks toward the DCE.

When Mode: **MONITOR** or **AUTOMONITOR** is the program selection and the INTERVIEW is connected as a pass-through as described in the preceding paragraph, the INTERVIEW monitors data passively through either (or both) TO connectors on the TIM.

When the INTERVIEW is operating in **EMULATE DCE** mode (selected on the Line Setup menu), the INTERVIEW is transmitting and receiving data through the DA-15 connector labeled TO DTE, or through the top set of WECO 310 connectors, labeled TX DTE (for Transmit; that is, Input from the DTE) and RX DTE (for Receive; Output to the DTE).

When Mode: **EMULATE DTE** is the program selection, the INTERVIEW transmits and receives data through the TO DCE connector if the DA-15 connectors are in use, or through the bottom set of WECO 310 connectors, if these are connected. The WECO 310 connectors which are active in this case are labeled TX DCE (for Transmit; Output to the DCE) and RX DCE (for Receive; Input from the DCE).

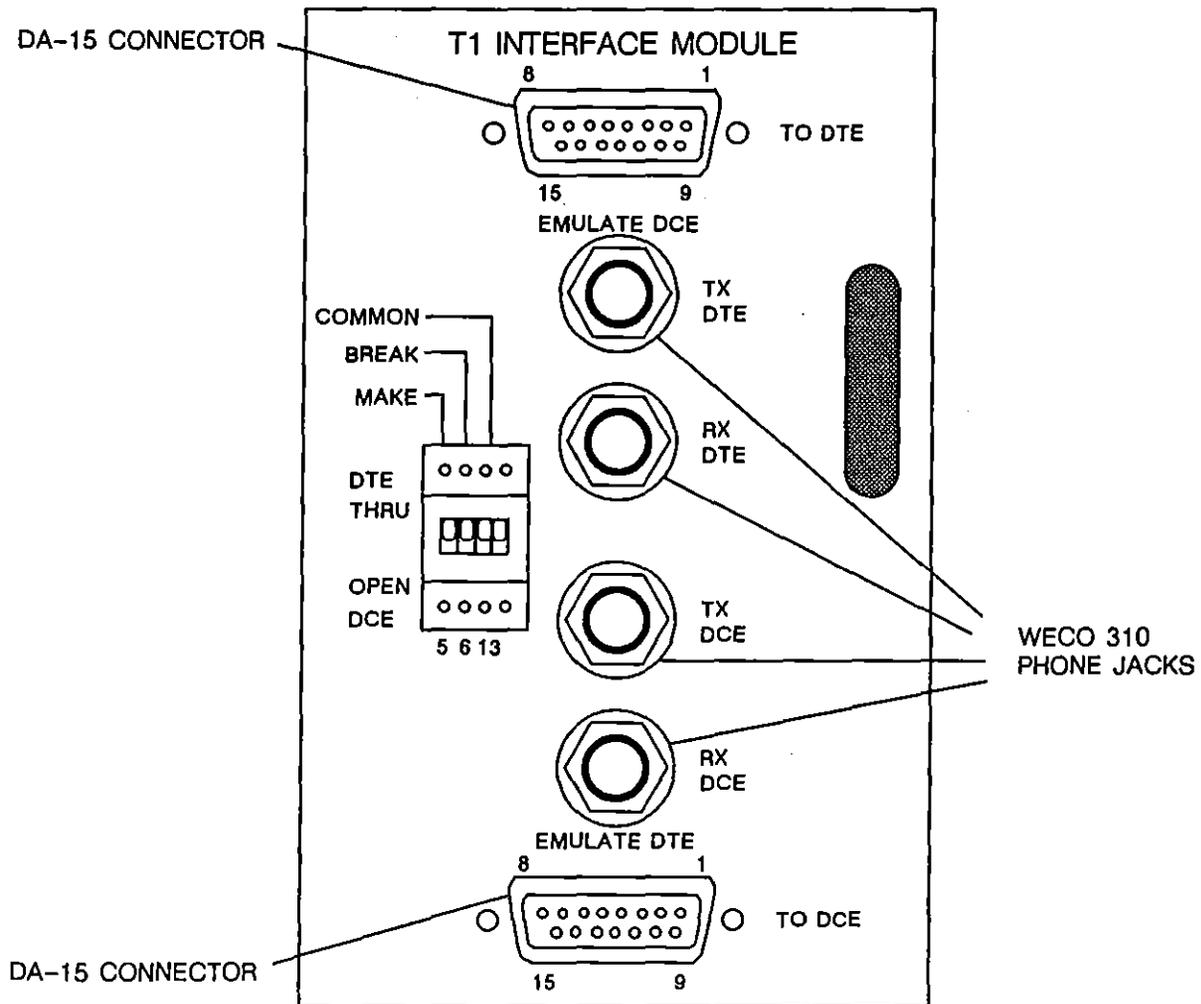


Figure 52-3 The T1 Test Interface Module provides both WECO 310 and DA-15 connectors for reception and transmission of data.

**(B) Green-Red LEDs**

Two of the front-panel LEDs are active when the unit is testing T1 protocol. These represent leads monitored at either of the line interfaces (TO DTE, TO DCE) on the test-interface module. An LED is dark when the unit is off, green when the unit is powered on but the lead is off (at mark voltage, representing 1) or unterminated, and red when the lead is on (representing space voltage or 0).

Data leads transition quite rapidly. As a result, their LEDs typically show a shade of orange that is intermediate between red and green when data is being transmitted. Data-lead LEDs will vary in color with the type of data.  $r_f$ -idle, for example, has no *on* transitions, while  $r_f$ -idle has only one, so both cause an LED to glow bright green.



Figure 52-4 T1 Green-Red LED Overlay.

Two of the LEDs switch to red when the unit is in a special mode, Remote mode or Freeze mode. Remote means that the unit is *under* remote control via the REMOTE port. (The remote-control feature is not implemented in the early releases of the INTERVIEW 7000 Series.)

The user-assigned lead (UA) to the far right of the panel is not employed in T1 testing.

It is important to note that the front-panel LED indicators always reflect TIM activity. If the LEDs are active while data is being played back from disk, the activity is on the line, not in the data stored on the disk.

### (C) Test Access Points

There are three test access points on the Test Interface Module. These points are labeled MAKE, BREAK, and COMMON and correspond to Pins number 5, 6, and 13, which are wired through to both connectors.

These three test points allow the user to place a CSU in test mode and to tear down test mode manually once it has been established.

To place a CSU in test mode, connect the test point labeled MAKE (pin 5) to the test point labeled COMMON (pin 13). Once this connection is made, the local CSU generates a Loop-up command to the remote CSU. This command allows any pattern of data to be transmitted to the remote CSU for any length of time desired. Assuming that the remote CSU is functioning properly, all data will be looped back on the corresponding return lead.

**NOTE:** The INTERVIEW can generate a loop-up or loop-down command in response to softkey selections when you are performing a preliminary BERT test with the CSU. It is not necessary to send the Loop-up command, however, when the INTERVIEW is troubleshooting the line while remotely connected to another BERT tester. Refer to Section 11 for more information on BERT testing.

Once you have completed testing the CSU, the loop must be torn down. This can be done by patching the COMMON test point to the test point labeled BREAK (pin 6). Once this connection is made, the CSU responds by transmitting a Loop-down command to the remote CSU, removing it from loopback mode.

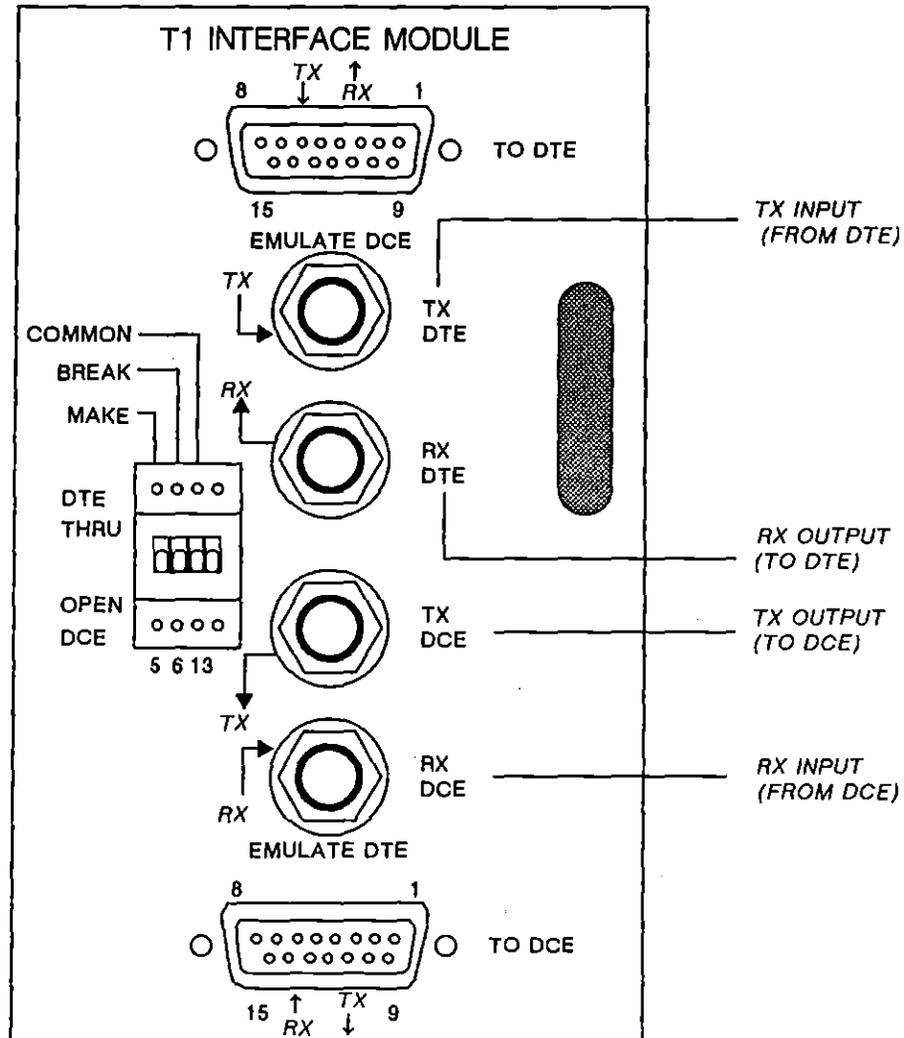
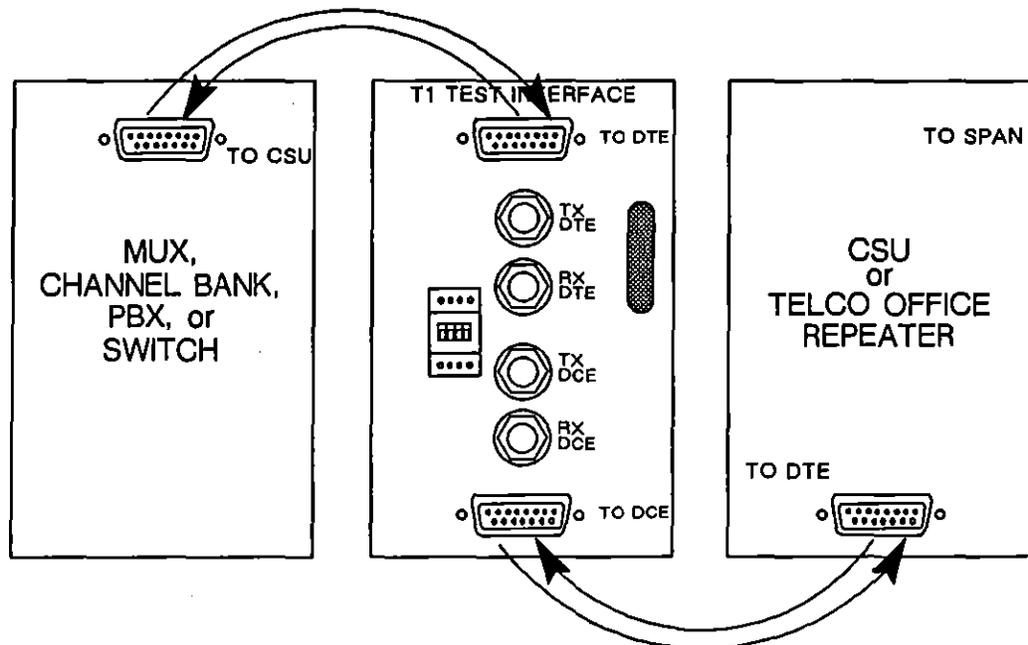


Figure 52-5 Signal direction for T1 connectors.

**CAUTION:** Do not activate the Make lead when a T1 BERT test is in progress. Since the Loop-up signal has already been sent, generating a second Loop-up signal risks locking up all equipment under test and the INTERVIEW in a continuous data loop. Activating the Break lead will interrupt the test in progress. The Loop-down signal can be generated from the T1 BERT screen.

## 52.3 Testing Configurations

### (A) Test at Line Levels (No Pad)



**Figure 52-6** Place the INTERVIEW between the multiplexer and the Channel Service Unit (for example) to monitor or emulate over the T1 circuit. The illustration indicates how cables equipped with DA-15 connectors would be connected.

Connect the INTERVIEW into the DS1 circuit between the DTE (multiplexer, channel bank, PBX, or switch) and the DCE (Channel Service Unit or telco office repeater) for T1 testing. In this position, the INTERVIEW may monitor a selected channel, emulate a T1 customer transmission, emulate the network on an individual channel towards a user terminal, or perform a BERT test. See Figure 52-6 and Figure 52-7.

To emulate one channel on the customer side of the conversation (for example), select **EMULATE DTE** as the operating Mode on the Line Setup screen. This breaks the line between the mux and the CSU as illustrated in Figure 52-6. The INTERVIEW communicates through the CSU in this configuration, transmitting and receiving over the DA-15 connector labeled TO DCE, or transmitting over the 310 connector labeled TX DCE and receiving over the connector labeled RX DCE when the WECO jacks are used (Figure 52-7).

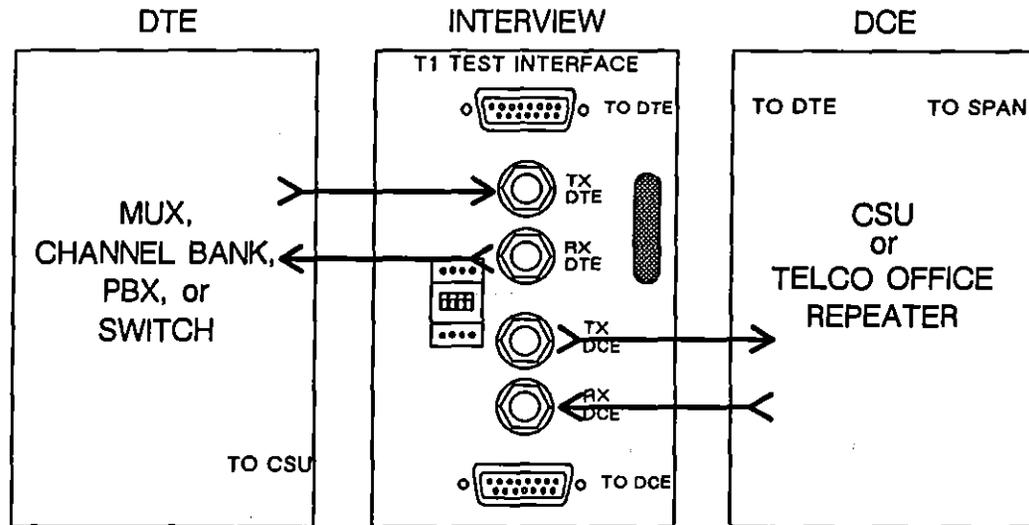


Figure 52-7 The same configuration may be achieved with WECO 310 connectors. Once the cables are in place, the INTERVIEW may monitor nonintrusively or break the line toward the DTE or DCE.

To emulate the network side of the conversation, select **EMULATE DCE** as the operating Mode on the Line Setup screen. This breaks the line between the mux and the CSU. The INTERVIEW then communicates through the attached mux, transmitting and receiving over the DA-15 connector labeled TO DTE (Figure 52-6), or transmitting over the 310 connector labeled RX DTE and receiving over the connector labeled TX DTE (Figure 52-7). Since no clocking is available from the network in this case, choose Line Clock Select: **INTERNAL** on the Interface Control screen.

### (B) Simplex Repeater Power

The T1 Test Interface Module will pass simplex repeater power down the transmit pair and the receive pair when it is patched in series into the powered portion of a T1 span. Figure 52-8 is the standard "looped-through" configuration shown in the previous figure, except that here the INTERVIEW has been placed on a powered span and is providing a DC path between input and output for both receive and transmit pairs. Both in monitor and emulate modes, a permanent DC path is maintained from TX DTE (in) to TX DCE (out) and from RX DCE (in) to RX DTE (out).

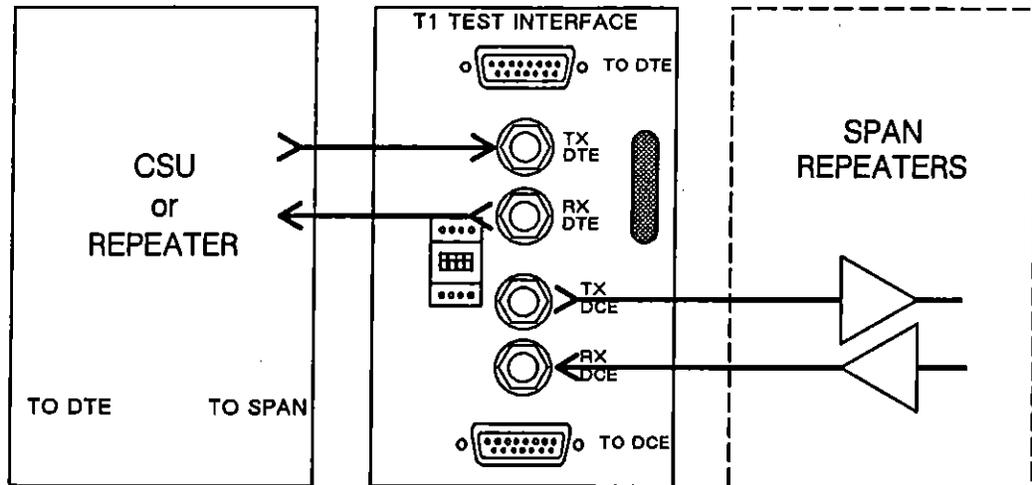
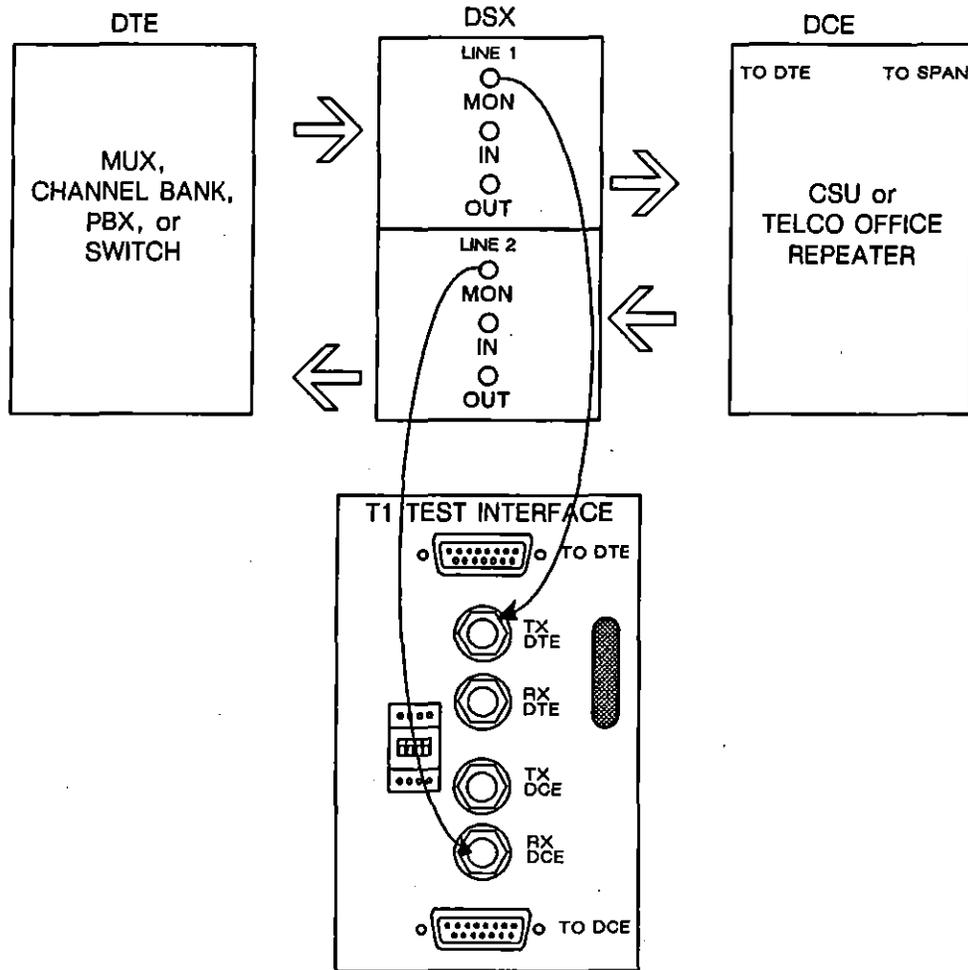


Figure 52-8 The INTERVIEW can be patched in series into the powered portion of a T1 span.

One of the functions of a CSU is to complete the simplex current path between the transmit pair and the receive pair. When the INTERVIEW is used to break the line toward the span and emulate the CSU, a simple patch connection (via one of the WECO 310 patch cords provided with the T1 option) between TX DTE and RX DTE will complete the DC current path.

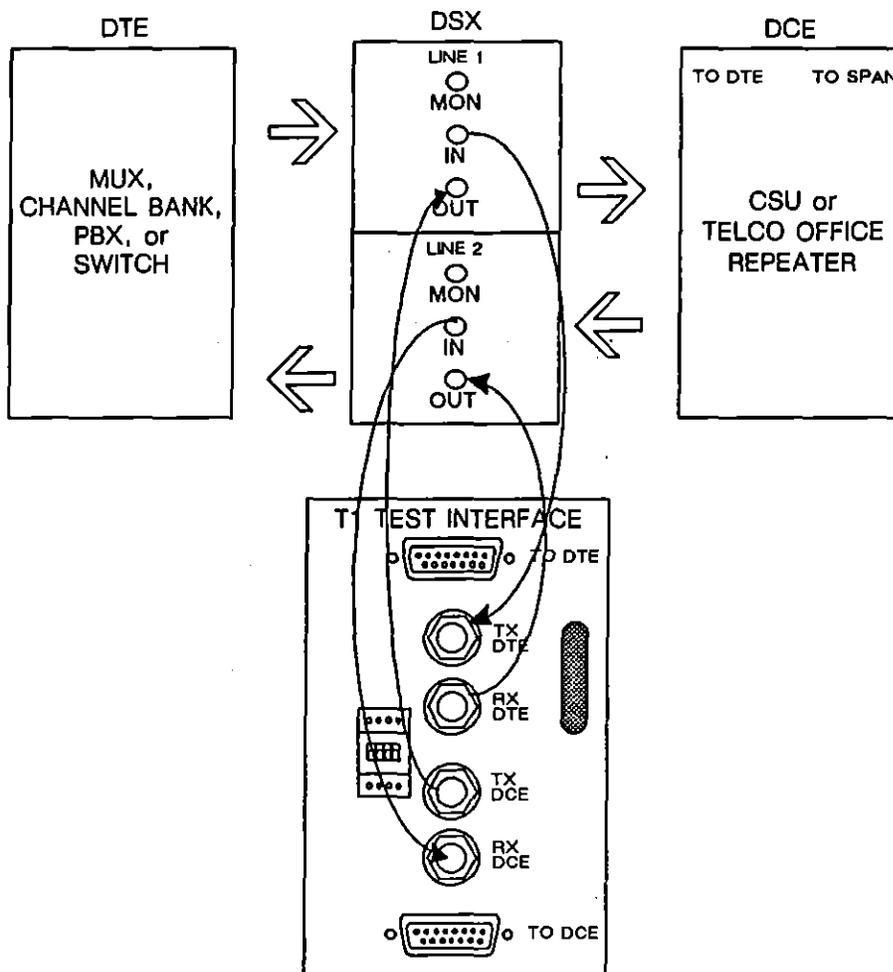
### (C) Test at DSX (20db Pad at Monitor Jack)

Many T1 sites have a special patch panel called a DSX that allows nonintrusive monitoring of lines. (Actual monitoring with the INTERVIEW always is passive and nonintrusive, but unless a DSX panel is installed at the test site, the line normally must be broken simply to cable the test equipment to the line.)



**Figure 52-9** If a DSX panel is available for patching at the telco office, the line can be monitored without even momentary intrusion.

Figure 52-9 shows a T1 test-interface module (TIM) cabled to the MONITOR jacks of two separate DSX panels. These panels handle Tx and Rx traffic separately. Because the DSX monitor jacks are isolated from the line by a 20 db "pad," these jacks may be patched into without disrupting traffic on the line. When the INTERVIEW monitors at this interface, 20 db of gain should be added to the signal via the Receiver Gain: 20 db selection on the Interface Control menu. See Section 52.5(A).



**Figure 52-10** This is a "permanent" INTERVIEW-to-DSX configuration. The line is broken once during installation. With the cables in place, the INTERVIEW may monitor nonintrusively or break the line toward the DTE or DCE.

Figure 52-10 shows a "permanent" installation of the INTERVIEW at a DSX location. Inserting connectors into the IN and OUT jacks on the DSX panel will break the line. Once the cables are in place, however, the INTERVIEW can be used to monitor the line nonintrusively or break the line toward the DTE or DCE.

There is no special "padding" at the IN and OUT interfaces on the DSX. Select **Receiver Gain: 0.06** on the Interface Control menu when you monitor or emulate at these interfaces.

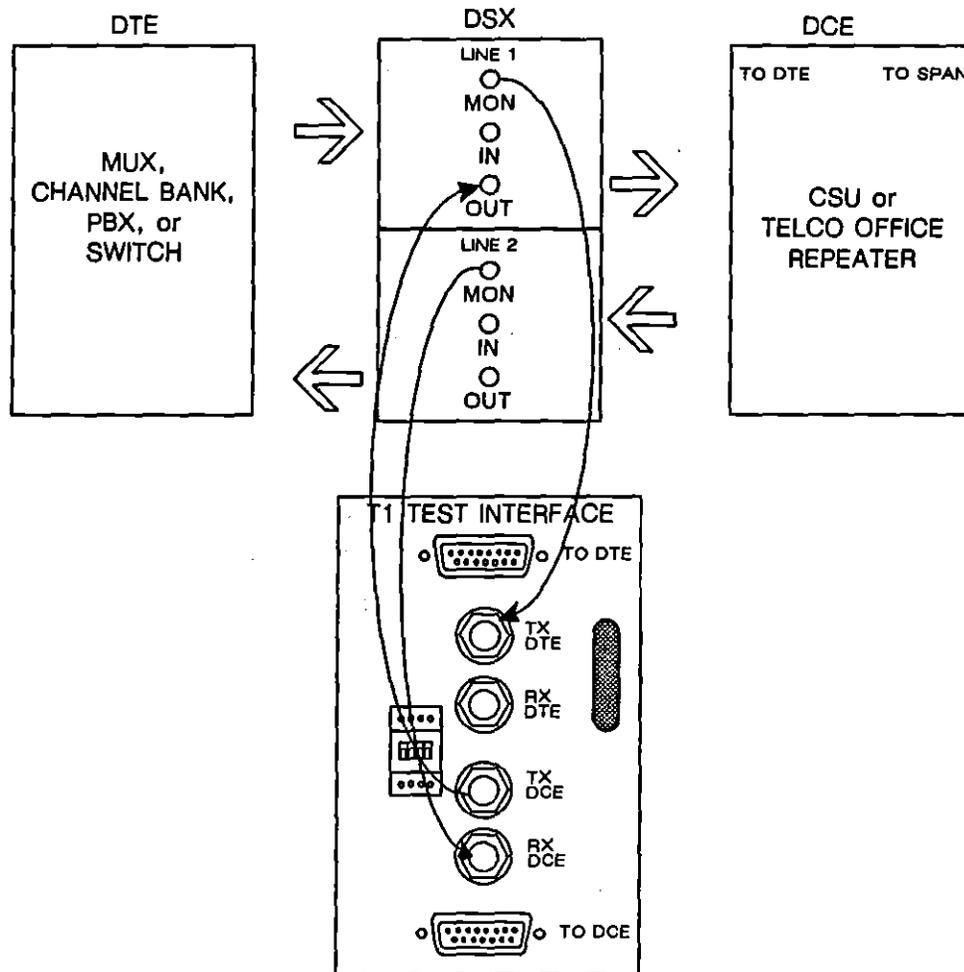


Figure 52-11 This is a "fast-emulate" configuration that minimizes disruption when the line must be broken toward the DCE.

Figure 52-11 is a configuration that minimizes the disruption caused by breaking the line at the DSX to emulate a DTE (toward the CSU or repeater). The sequence is as follows:

- 1) Select **Receiver Gain: 20 dB** on the Interface Control menu.
- 2) Set up the unit to emulate DTE.
- 3) Enter the desired emulate program.
- 4) Cable the DSX MONITOR jacks to the INTERVIEW TIM as shown.
- 5) Plug a cable connector into the TX DCE jack on the INTERVIEW but *do not patch the cable to the OUT jack on the DSX at this point.*
- 6) Press **AUX**.
- 7) With the test running and the INTERVIEW in sync with the T1 frames, complete the final cable connection that breaks the Tx line toward the DCE.

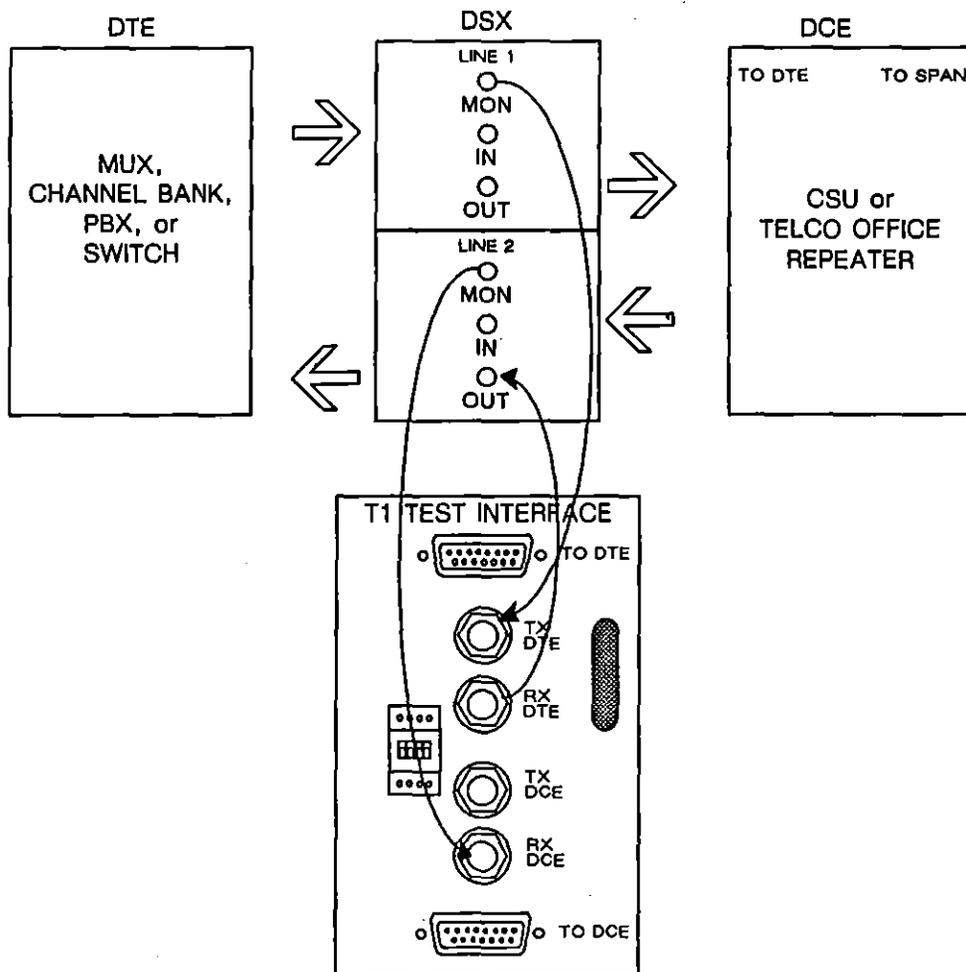


Figure 52-12 This DSX configuration minimizes disruption when the line must be broken toward the DTE.

Figure 52-12 illustrates the same configuration as Figure 52-11, except that here we are breaking the line toward the DTE.

## 52.4 Setting Up Menus for T1 Testing

```
          ** INTERVIEW 7500 **  
  
DISKS: FLOPPY 1 FLOPPY 2 HARD DISK(20M)  
PROCESSORS: 4  
SELF TEST ERRORS: NONE  
  
Press:  
[PROGRAM] to enter the menu page  
[RUN]     to run the default program  
  
Software Version: 8.00  
Firmware  Version: 5.00  
  
OPTIONS: 11-1  
  
TIM: T1  
  
Copyright (c) 1987, 1990  
Telenex Corporation
```

Figure 52-13 Power-up screen, INTERVIEW 7500. *OPTIONS:* field could also display *OPTIONS: 11-2.*

T1 testing can be done only when the TIM described in Section 52.2 is in place. Install the T1 TIM and connect to a data source before power up as described in Section 1.10. Compare the Power Up screen to the one shown in Figure 52-13. It should indicate that the correct TIM is in place and that the unit is equipped with a mux board (OPT-951-11-1 or OPT-951-11-2).

**NOTE:** If you plan to perform a T1 BERT test, refer to Section 11.

Before you run a T1 test, you must configure the Line Setup screen for the type of testing you wish to do. Select *Mode:* **MONITOR** if you plan to monitor a T1 exchange. If the INTERVIEW is to perform an interactive test (that is, will be required to transmit), select *Mode:* **EMULATE DCE** or *Mode:* **EMULATE DTE**.

**CAUTION:** When the INTERVIEW operates in an emulate mode, it interrupts the regular exchange of data on the circuit. Be certain you have permission to test the circuit before you proceed.

Select the **Code** and **Format** required for accurate interpretation of the data stream.

Clocking of T1 data is not provided by the standard data clock. As a result, the **Clock Source** selection on the Line Setup screen is overridden. An applicable clock selection is provided on the Interface Control screen, described in Section 52.5.

If you plan to test higher-layer protocols (such as Common Channel Signalling System #7, LAPD, ISDN, or any others carried on the T1 circuit), you must first load them from the Layer Setup screen. The Layer Setup screen is documented in Section 8.

## 52.5 Interface Control Screen

Certain T1 characteristics are selectable. All options specific to T1 are selected on the Interface Control screen, which is accessed from the main Program menu. With the Program menu displayed, press **F1** (for Setup), then **F2** (for T1) to obtain the screen shown in Figure 52-14. The full set of options available on the Interface Control screen is illustrated in Figure 52-1.

```

** Interface Control **

T1 Line Setup
Receiver Gain: 0 db
Termination: BRIDGED
Cable Type: MAT
Cable Length: 0-220

T1 Data Path Setup
Framing Mode: D4
Data Path: 64K DATA CHANNEL
Channel Number: 01
Yellow Alarm: F-BIT 12 = 1
Sync Procedure: ALL F-BITS
Sync Length: 10 bit
B8ZS Coding: NO

T1 Transmit Setup
Transmit Mode: NORMAL
Idle Select: 7F
Line Clock Select: INTERNAL

Record Framing Bits: YES

T1 Signal Channel Setup
Signal Channel Number: 24
Signal Channel Idle Char: 7E
Sig Channel Polarity: NORMAL

Select Receiver Gain (in db)
F 1  F 2  F 3  F 4  F 5  F 6  F 7  F 8
0 db  20 db

```

Figure 52-14 Interface Control screen for T1 Protocol. Transmit Setup selections apply when an Emulate mode is selected on the Line Setup screen. Line Clock is available for master T1 transmit clocking. T1 Signal Channel Setup selections apply only for dual-channel monitoring or emulating in Primary Rate ISDN.

### (A) Receiver Gain

A DSX monitor jack at the telco office is isolated from the line by 430 ohm resistors in series with both the tip and ring. The resistors combine with a 100 ohm termination at the monitoring device to form a 20 db pad.

In order for the INTERVIEW to compensate for the padding at this monitor jack, select **Receiver Gain: 20 dB** to add 20 db of gain to the line signal. (Also select **Termination: TERMINATED**; see below.)

## (B) Termination

Line termination is selectable by the user for data in both directions in monitor mode and for Receive data (that is, data coming *from* the device under test) in emulate mode.

In a normal "looped-through" monitor configuration (see Figure 52-6 or Figure 52-8), the appropriate termination is **BRIDGED**. When you are monitoring at a DSX jack, select **Termination: TERMINATED**.

When you are in emulate mode and have selected **Transmit Mode: NORMAL**, all channels on the line that is transmitting data toward the device under test (toward DTE or DCE, depending on the emulate setup on the Line Setup menu) are terminated automatically. The channels that are coming *from* the device under test may be terminated or bridged by menu selection. Since in this transmit mode you are emulating the end user on the circuit, you normally would select **Termination: TERMINATED**.

When you are emulating in the drop-and-insert mode, the 24 channels going toward the device under test are *terminated automatically*. 23 of these channels are regenerated and "passed through" transparently to the device under test. The 24th channel is the one you have selected, via the **Channel Number** field, for drop-and-insert.

The channels that are moving data *from* the device under test may be terminated or bridged by menu selection. Normally in drop-and-insert mode, the appropriate termination is **BRIDGED**. Receive data that is terminated is *not* regenerated outbound.

## (C) Cable Type

1. **MAT**. Select **MAT** if you are testing a 25-gauge Metropolitan Area Trunk.
2. **ICOT**. Select **ICOT** if you are testing a 24-gauge Inter-city trunk.
3. **ABAM**. Select **ABAM** if you are testing a PBX with an internal 22-gauge PIC cable.
4. **PIC**. Select **PIC** if you are testing a jelly-filled cable.
5. **PULP**. Select **PULP** if you are testing a paper-filled cable.

### (D) Cable Length

For MAT and ICOT cable, you must specify the length of the cable between the INTERVIEW and the device under test to achieve proper test results. The three lengths available are 0-220 , 220-440 , and 440-660 . Lengths are calculated in feet. No length selection is available for ABAM, PIC, or PULP cables. These cables must be 0 to 137 feet in length for T1 testing.

### (E) Transmit Mode

The Transmit Mode options control the INTERVIEW's transmissions on the 24 channels of the circuit under test. The field is applicable when Mode: EMULATE DCE or Mode: EMULATE DTE is selected on the Line Setup screen. (The Transmit Mode options have a special meaning in BERT DTE and BERT DCE operating modes. See Section 11.11.)

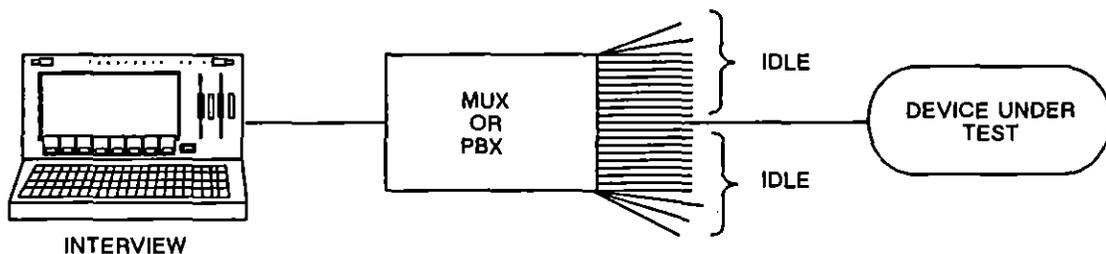


Figure 52-15 The INTERVIEW 7000 Series in normal T1 emulation mode.

1. *Normal mode.* When emulating in normal mode (that is, as the only end user on an otherwise inactive T1 circuit), the INTERVIEW should be set up to terminate all 24 receive channels. See the discussion of the **Termination** option in Section 52.5(B). The INTERVIEW will isolate one incoming channel for capture and transmit on the corresponding outbound channel. On all other channels, the INTERVIEW transmits the idle line character selected in the **Idle Select** field. If ESF framing is used, the circuit's Frame Data Link (FDL; see Table 52-2 and description in Section 52.7) is filled in with the standard milliwatt pattern of all one's. Statistics are maintained on the selected incoming channel.
  - When the transmit mode is **NORMAL** , the sub-field **Idle Select** appears. Available selections are **7F** and **FF** (hex).

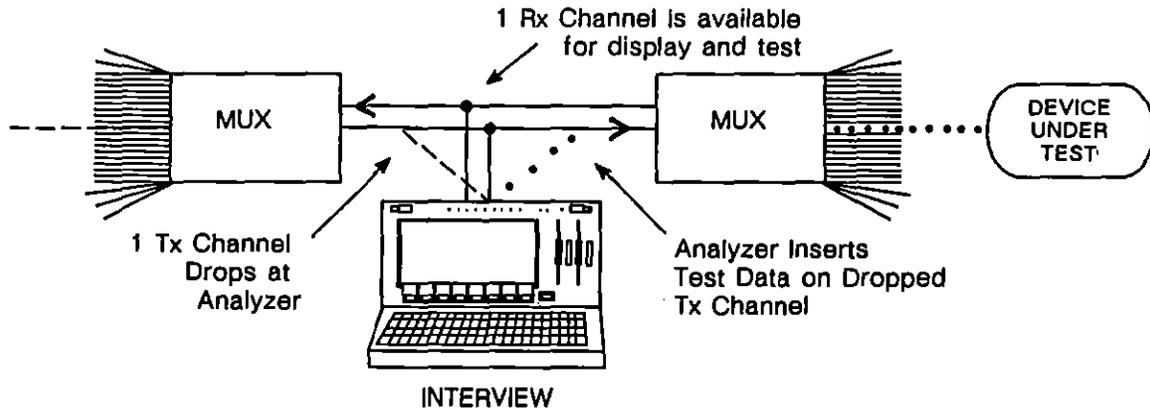


Figure 52-16 The INTERVIEW 7000 Series in drop-and-insert mode.

2. *Drop-and-insert mode.* This type of transmission (illustrated in Figure 52-16) is useful for testing a single channel over an active T1 circuit. If the user selects drop-and-insert mode, the INTERVIEW receives all 24 channels in both directions (left to right and right to left in Figure 52-16). The transmissions on 23 of the left-to-right channels are terminated and passed through (regenerated) outbound. The remaining channel is terminated, and higher-layer test data is inserted into the corresponding outbound channel. All the while, T1 protocol is maintained at the physical level. The INTERVIEW recalculates the correct CRC for the superframe. Data on the Frame Data Link is relayed without change. Drop-and-insert mode may be used in either direction, towards DTE or DCE. Statistics are maintained on the selected channel.

The INTERVIEW should be set up to *bridge* the data moving right-to-left in Figure 52-16. See the discussion of **BRIDGED** as a *Termination* option in Section 52.5(B).

#### (F) Idle Select

In Normal transmit mode, the INTERVIEW will isolate one incoming channel for capture and transmit on the corresponding outbound channel. On all other channels, the INTERVIEW transmits the idle line character selected in the **Idle Select** field. This field defaults to **7F** (hex) but **FF** (hex) may be alternately selected.

#### (G) Line Clock Select

Two selections are available to the user in the **Line Clock Select** field, internal and external. Select **Line Clock Select: EXTERNAL** when performing normal emulation or normal channel BERT and an external clock source is used. Otherwise, the field defaults to internal.

## (H) Framing Mode

The INTERVIEW can recognize either standard D4 or ESF Superframes. Statistics automatically performed on the T1 circuit are based on the Framing Mode you have selected. This selection also dictates the frame format anticipated or transmitted by the INTERVIEW.

D4 or ESF framing can be accurately interpreted whether or not robbed-bit signalling is employed. For a circuit which uses robbed-bit (in-band) signalling, select Data Path: **56K DATA CHANNEL** when you wish to view data. For a circuit which uses clear channel signalling, select **64K DATA CHANNEL** as the data path.

**NOTE:** Make any Code and Format selections you wish on the Line Setup screen, as these can be accurately transmitted and interpreted, even when 56 Kbps is the usable data speed per channel (seven valid bits per channel) due to robbed-bit signalling.

**NOTE:** The data rate of originating terminals is likely to vary from the rate of the data channel. The Interface Control selection pertains only to the maximum usable data rate for a single multiplexed time-slot (channel).

Robbed-bit paths are an accurate reflection of signalling only when in-band signalling is employed in T1; otherwise, these data paths will show a random pattern for data bits which coincide with the robbed-bit positions. For the location of robbed bits within a D4 frame, see Table 52-1; see Table 52-2 for their positions in an ESF frame.

Other Data Path selections which appear are valid for frames which employ either in-band or clear channel signalling.

1. *D4 framing.* With **D4** selected, the INTERVIEW expects 12-frame superframes with a prescribed format, described in Section 52.7. When D4 framing is selected, Data Path options change and two new fields, Yellow Alarm and Sync Procedure, appear. These fields are described in subsequent paragraphs.
2. *ESF framing.* The INTERVIEW expects a 24-frame superframe when ESF framing is selected. The ESF frame structure is described in Section 52.7. When you select **ESF**, Data Path selections are modified. The field Check CRC During Sync, described in following paragraphs, appears.

### (I) Data Path

Choose the data path for which you wish to display data. A data channel must be selected if you plan to test or view a higher layer protocol.

1. *64K data channel.* This option applies to both D4 and ESF framing. It should not be selected if in-band signalling is employed on the T1 circuit. Recommended selection for Primary Rate ISDN.
2. *56K data channel.* This option applies to both D4 and ESF framing. Select it when in-band signalling is employed on the T1 circuit.
3. *A or B robbed bits.* These selections are available for both D4 and ESF; however, they provide accurate signalling data only when in-band signalling is used on the circuit. A and B paths are distinct to the channel (time slot) designated in the **Channel Number** field.
4. *C or D robbed bits.* These selections are available only for ESF framing. The signalling pattern shown with either selection is valid only when in-band signalling is used on the circuit. C and D paths are distinct to the channel (time slot) designated in the **Channel Number** field.
5. *Ft bits.* This selection applies only to D4 framing. Ft bits are the transmission framing bits used for frame alignment. There are 6 Ft bits per frame. See Table 52-1 for their location.
6. *Fs bits.* This selection applies only to D4 framing. Fs bits are the frame signalling bits used for superframe alignment and indication of yellow alarms in some instances. There are 6 Fs bits per frame. See Table 52-1 for their location.
7. *FDL.* This selection, representing the Frame Data Link, applies only to ESF framing. The 12 FDL bits per frame provide measurements on line performance. See Table 52-2 for its location.

### (J) Channel Number

This field appears when a 56K data channel, a 64K data channel, or a robbed bit path has been selected. Valid entries are 1 through 24 (decimal). For Primary Rate ISDN, this entry is the B channel selection (recommended B channels are 1 through 23, with channel 24 for use as the D channel).

### (K) Yellow Alarm

When  is selected as the **Framing Mode**, this field appears. Since yellow alarms are tracked as part of the T1 statistics package and since D4 framing has two alternatives for conveying these alarms, you must indicate the type of alarm used.

1. *F-bit 12 = 1*. Select this option if yellow alarms are indicated in the last F-bit (the sixth Fs bit) in the frame. When this selection is made, synchronization is not influenced by the value of Bit 12 (see the description of the syncing procedure in the following section).
2. *Data bit = 0*. Select this option if the second data bit in every channel is set to zero to indicate a yellow alarm.

### (L) Sync Procedure

When  is selected as the Framing Mode, this field appears. There are two means of synchronizing the frame for statistical analysis and display of its contents.

1. *All F bits*. Make this selection to allow synchronization only when all 12 framing bits have been received. Aligns on Ft bits for individual frames and cross-checks Fs to provide additional protection against false framing errors. (Bit 12 is not checked if  has been indicated as the Yellow Alarm mode.) The delay for synchronization will be greater in this case.
2. *Ft bits only*. This selection allows the frame to sync more rapidly, on only the Frame Transmission (Ft) bits. Use this selection when non-standard Fs patterns are in use.

### (M) Check CRC During Sync

This field appears only when ESF framing has been selected. An ESF frame carries a six-bit CRC among its framing bits (see Table 52-2) to indicate the accuracy of the transmission. If you select  in this field, the INTERVIEW will not synchronize on a frame which produces a bad CRC. This provides an added safeguard to the framing pattern, for transmissions which must be precise. Select  to allow the INTERVIEW to synchronize more quickly, on a correct framing pattern, regardless of the block check results.

**NOTE:** The T1 CRC is entirely distinct from the block checking which may be performed for a protocol operating at a higher layer. The T1 CRC is included in statistical measurements only on the T1 statistics screens (where it is included in both CRC and ESF errors).

### (N) Sync Length

Indicate in this field the number of bits validated before sync is declared. Selections are  and . The 10-bit test minimizes reframe time; 24-bit testing provides more protection against false framing.

**(O) B8ZS Coding**

By default, the INTERVIEW sends and expects to receive T1 transmissions encoded in Alternate Mark Inversion format. The user has the option, however, of switching to Binary 8 Zero Suppression (B8ZS).

When you select B8ZS: **YES**, the INTERVIEW transmits any occurrence of eight consecutive zero bits as a special bit pattern containing two intentional bipolar violations in defined positions. These anticipated bipolar violations (BPV) are removed and the eight zero bits are restored at the receiving end. The INTERVIEW also performs the restoration function when it is the receiver.

The BPV's associated with B8ZS occur in the fourth and seventh bit positions of the inserted code. The code inserted is 000+-0-+ if the preceding one bit was positive; and 000-+0+- if the preceding one bit was negative.

The intentional bipolar violations which occur with B8ZS are not included in BPV calculations on the T1 statistics screen when B8ZS: **YES** is selected.

```

** Interface Control **

T1 Line Setup
Receiver Gain: 0 db
Termination: BRIDGED
Cable Type: MAT
Cable Length: 0-220

T1 Data Path Setup
Framing Mode: D4
Data Path: 64K DATA CHANNEL
Channel Number: 01
Yellow Alarm: F-BIT 12 = 1
Sync Procedure: ALL F-BITS
Sync Length: 10 bit
B8ZS Coding: NO

Record Framing Bits: YES

T1 Signal Channel Setup
Signal Channel Number: 24
Signal Channel Idle Char: 7E
Sig Channel Polarity: NORMAL

Select Receiver Gain (in db)
F 1  F 2  F 3  F 4  F 5  F 6  F 7  F 8
0 db  20 db
    
```

Figure 52-17 The T1 Interface Control screen in monitor (or automonitor) mode, configured to include framing bits in recorded aggregate data.

**(P) Record Framing Bits**

This field relates to aggregate T1 record and appears only when 1) your unit is equipped with a T1 mux board, Revision E or higher; 2) Mode: **MONITOR** is selected on the Line Setup menu; and 3) Capture Memory: **RAM** and Record Speed: **HIGH SPEED** are selected on the Record Setup menu. See also Sections 7.4(A) and 52.1(E).

Select **Record Framing Bits**:  **YES**, the default selection, to include all framing bits in the aggregate T1 data stream. See Figure 52-17. Choose  **NO** if you want to exclude framing bits from the recorded data-stream.

Use the recorded data for later playback and analysis. Note, however, that a specific channel cannot be isolated from the aggregate data stream for monitoring and analysis.

During high-speed recording, data display and program conditions (or triggers) based on incoming data are disabled. The T1 Statistics display, however, remains active. Use the **T1 LINE CONDITIONS** field on this display to check for TD and RD in sync as a condition for recording. See Section 52.6.

### (Q) Signal Channel Number

This field is applicable only for T1 Primary Rate ISDN dual-channel monitoring or emulation, with *only* BOP format on the D channel; it defaults to 24, the recommended signalling channel for Primary Rate ISDN. When monitoring dual channels, the number in the **Channel Number** field is the selected B channel and the number in the **Signal Channel Number** field is the D channel.

### (R) Signal Channel Idle Char

This field is applicable only for T1 Primary Rate ISDN dual-channel emulation, with *only* BOP format on the D channel; it defaults to  $r_e$ , with an alternate selection of  $r_f$ . The **Signal Channel Idle Char** field allows the user to enter the idle character to be sent on the signalling channel selected in the **Signal Channel Number** field.

### (S) Sig Channel Polarity

This field is applicable only for T1 Primary Rate ISDN dual-channel monitoring or emulation, with *only* BOP format on the D channel; it defaults to  **NORMAL**, with an alternate selection of  **INVERTED**. Normal polarity means the bits on the signalling channel selected in the **Signal Channel Number** field will be sent normally; inverted polarity means those bits will have their polarity reversed—1's become 0's and 0's become 1's.

## 52.6 Interpreting the T1 Statistics Display

The T1 Statistics Display can be viewed in Run Mode when the T1 TIM is installed. To access the statistics screen, press **[F5]** (for **STATS**), then **[F3]** (for **T1STATS**) while the **INTERVIEW** is actively monitoring or testing the line. You may alternate between the statistics screen and any other displays listed at the bottom of the screen by pressing the function key indicated. A sample T1 Statistics screen is shown in Figure 52-18. For more information on alternate run-time displays, refer to Section 6.

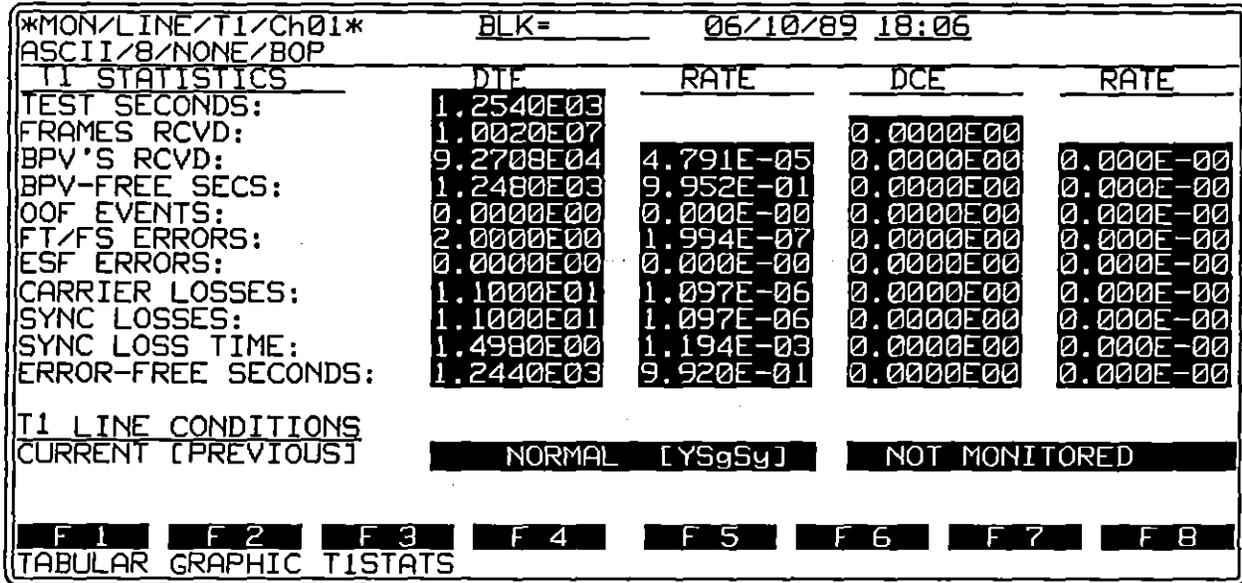


Figure 52-18 T1 Statistics Display reports on T1 transmissions in real time and is an alternate screen to data or trace displays in Run mode when the T1 TIM is installed.

### (A) Layout of the Screen

The statistics display is divided into two general regions. T1 statistics appear at the top of the screen; information pertaining to line conditions appears at the bottom of the screen.

All values displayed in the statistics region are cumulative. That is, calculations begin when you press **RUN** and continue until you press **RUN** again. Freezing the trace or character displays has no effect on the statistics gathered, although the statistics will not be updated until the screen is unfrozen.

**NOTE:** Pressing **RUN** resets all timer and counters and clears all values from the T1 Statistics screen. It also clears buffer memory and RAM.

Values are given in scientific notation, shown to a maximum of four decimal places. The right-most positions of each highlighted field are reserved for display of the exponent. The capital letter **E** sets off the exponent from the base number. The **E** is followed by a minus sign to indicate a negative exponent for a value less than one.

There are four columns for each T1 measurement. The left-most column displays the current measurement calculated on the DTE side of the line. The next column displays a cumulative rate when applicable. The two columns on the right display the same type of measurement calculated for the DCE and the rate, if any, on the DCE side. The various statistics measurements are explained in the following paragraphs.

T1 line conditions are listed in two columns, one for DTE and one for DCE. Both current and previous conditions are shown. Line conditions which may be displayed are described in Section 52.6(O).

### (B) Test Seconds

**TEST SECONDS** indicate elapsed time. The count begins from zero when you press **RTN**.

### (C) Frames Received

The value listed in the **FRAMES RCVD** row is equal to the number of bits received divided by 193. Thus, the value represents the number of individual frames rather than the number of superframes received. The frame count is not incremented unless a valid frame is received. The definition of a valid frame may vary depending on the Interface Control selections you have made pertinent to the syncing procedure (see Section 52.5, **Syno Procedure, Check CRC During Syno, and Syno Length**).

### (D) BPV's Received

The row labeled **BPV'S RECVD** displays the number of bipolar violations received in valid frames during the test. Anticipated bipolar violations used to maintain one's density are not included in these values if B8ZS encoding is selected on the Interface Control screen (see Section 52.5).

The **RATE** column equals **BPV'S RECVD** divided by total number of bits received in valid frames.

### (E) BPV-Free Seconds

This reading gives elapsed test time free of BPV errors. If B8ZS is selected, BPV's anticipated as part of the pattern are not subtracted from the total time.

**NOTE:** Time out of sync is included in the time displayed.

The **RATE** column equals **BPV-FREE SECS** divided by total test seconds.

### (F) Sync Losses

**SYNC LOSSES** records the number of sync loss incidents. A sync loss occurs when two or more consecutive framing bits are in error.

The **RATE** column shows total sync losses divided by total valid frames received.

**(G) Sync Loss Time**

SYNC LOSS TIME displays time out of sync. Time out of sync may vary slightly, depending on selections made pertaining to resync on the Interface Control screen (see Section 52.5, Sync Procedure, Check CRC During Sync, and Sync Length).

The RATE column shows sync loss time divided by total test seconds.

**(H) OOF Events**

OOF EVENTS is the number of out-of-frame (OOF) errors since **NUM** was pressed. An out-of-frame error occurs when two out of four framing bits are in error.

The value in the RATE column equals framing errors divided by the number of valid frames received.

**(I) CRC-6 Errors**

CRC-6 ERRORS indicates total CRC errors since **NUM** was pressed. This field is present when the T1 Interface Control screen shows Framing Mode: **ESF**.

The RATE is equal to total CRC errors divided by the total number of superframes received.

**(J) FT/FS Errors**

This field is present when the T1 Interface Control screen shows Framing Mode: **DA** and Sync Procedure: **ALL F-BITS**. FT/FS ERRORS indicates total Ft and Fs errors since **NUM** was pressed.

The RATE is equal to total Ft and Fs errors divided by the total number of frame-alignment words.

**(K) FT Errors**

This field is present when the T1 Interface Control screen shows Framing Mode: **DA** and Sync Procedure: **F1 BITS ONLY**. FT ERRORS indicates total Ft errors since **NUM** was pressed.

The RATE is equal to total Ft errors divided by the total number of frame-alignment words.

**(L) ESF Errors**

ESF ERRORS indicates the combined total for OOF errors and CRC errors.

**(M) Error-Free Seconds**

This row lists total seconds free of CRC-6 errors (or Ft/Fs or Ft errors), OOF errors, and bipolar violations.

The RATE column lists error-free seconds divided by test seconds.

**NOTE:** This measurement differs from error-free seconds measured in T1 BERT statistics. The BERT measurement includes bit errors as well.

### (N) Carrier Losses

This value is the number of times signal was lost on the monitored circuit long enough for 32 consecutive zeroes to be received. Refer to Section 52.6(O), below, for a description of how Carrier Loss is posted as a line condition.

### (O) T1 Line Conditions

When an error condition occurs, the status of the line under test appears in the **T1 LINE CONDITIONS** area at the bottom of the T1 Statistics Screen. DTE line conditions appear in the highlighted box to the left; DCE conditions in the highlighted box to the right. Once the current condition changes, an abbreviation for the error is posted in the brackets which follow the current condition. This bracketed area contains an abbreviation for up to four previous conditions which have occurred in the present testing session.

**NOTE:** The order of the abbreviations in the previous conditions field is not necessarily a chronological representation of events.

When there is no longer an error condition on the line, **NORMAL** is displayed in the left-hand box. The types of errors that may appear as line conditions are explained in the following paragraphs.

1. *Yellow alarm.* A yellow alarm (YEL. ALARM; Y to indicate a previous condition) is sent to alert the remote site that the sender is experiencing an out-of-frame condition. The yellow alarm signal can be transmitted in two manners as explained in Section 52.5(K). The user must indicate the type of signal in use in order for yellow alarm conditions to be accurately detected, included in statistics, and displayed as a line condition.
2. *Blue alarm.* A blue alarm (B in the previous conditions area) indicates that the sender is experiencing a loss-of-signal condition.
3. *Loss of Signal.* Signal loss is indicated in one of two ways. If after  is pressed no signal is received from the line under test, the condition **NO SIGNAL** is posted. Any time a received signal is lost for a minimum of 150 ms, the message **SIGNAL LOST** is posted. Either type of signal loss is recorded as **Sg** in the line conditions box to indicate a previous condition.
4. *Loss-of-Sync.* This condition is displayed anytime two or more consecutive framing bits are found to be in error. The abbreviation **Sy** within brackets is used to indicate a previous loss of sync.

When an emulate mode has been selected on the Line Setup screen *and* Transmit Mode: **NORMAL** has been selected on the Interface Control screen, the words NOT MONITORED appear on the side of the line that the INTERVIEW is emulating. If Transmit Mode: **DROP/INS** is selected on the Interface Control screen, both sides of the line are monitored. (On the side of the line which the INTERVIEW is monitoring, the incoming channel — rather than the inserted INTERVIEW data — is analyzed.)

### (P) T1 Statistics as an Alternate Display to T1 BERT

The function keys shown in Figure 52-19 appear at the bottom of the T1 Statistics display when the INTERVIEW is running a T1 BERT test. Press **F8** to display T1 BERT Statistics; other display options are not available during a BERT test. Although they can be executed with regular T1 statistics displayed, the commands in this bank of softkeys apply for the most part to the BERT test. Consult Section 11 for a description of these commands, BERT testing, and statistics.

One command in this group which does affect the T1 Statistics display is **RESET**, **F3**. **RESET** sets the value of all timers and counters, including T1 counters, to zero. The BERT test continues, however, even though the elapsed time (**TEST SECONDS**) at the top of the screen is reset.

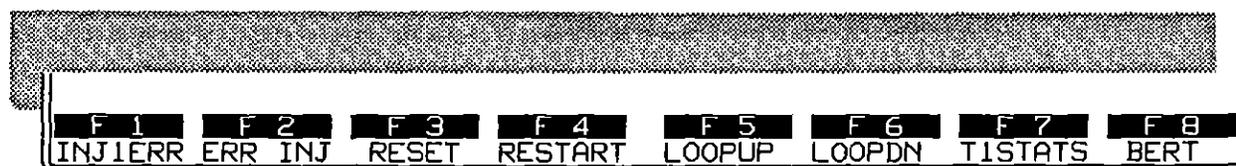


Figure 52-19 Run-time function keys available with T1 Statistics Display when performing a T1 BERT test

## 52.7 D4 and Extended SuperFrame Structures

A D4 superframe contains twelve frames of 193 bits each; that is,  $12 ( 24 \times 8 + 1 )$ , where 24 is the number of time slots, 8 the number of bits per time slot, and 1 the framing bit which precedes each component frame (see Figure 52-20 and Figure 52-21). In extended superframing (ESF), 24 of these 193-bit frames are contained within one superframe. Framing (F) bit patterns and in-band signalling (if employed) differ in the two schemes as illustrated in Table 52-1 through Table 52-2.

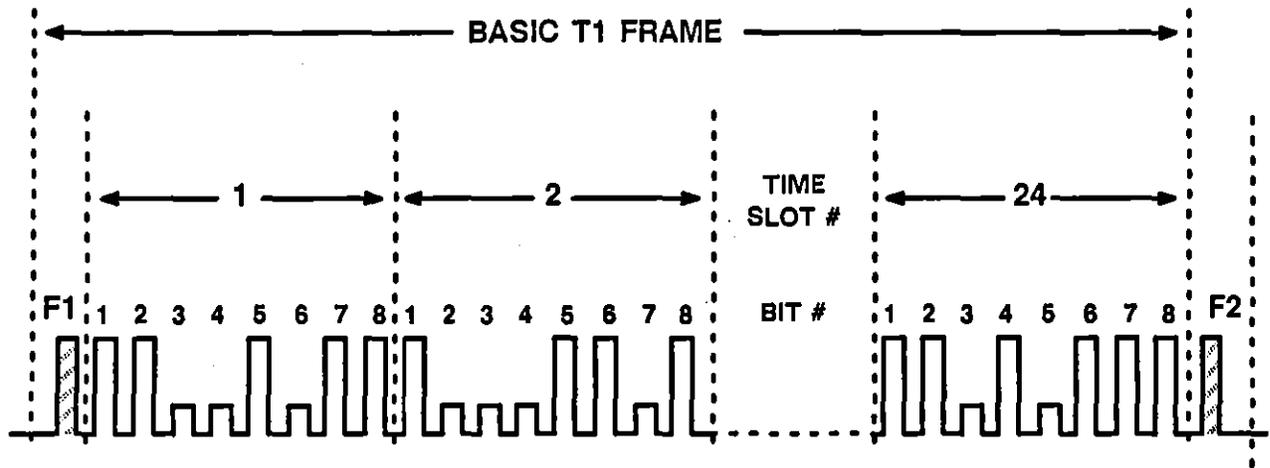


Figure 52-20 193-bit frame which serves as the component in both D4 and ESF extended framing formats.

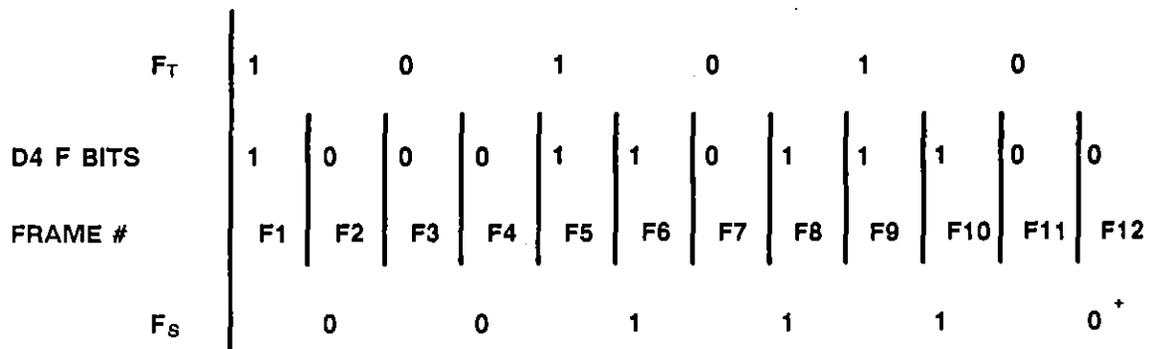


Figure 52-21 D4 framing bits are always set to 100011011100. A yellow alarm is an exception: In this case, Bit 12 may be set to 1.

In the table which follows, A and B indicate robbed bits. When the bit-robbing technique is used, maximum data speed = 56 Kbps. With clear-channel signalling, these bits are used for data, increasing the data speed to 64 Kbps.

**Table 52-1  
D4 Frame with In-Band Signalling**

FRAME #	F	TIME SLOT 1 of 24								TIME SLOT 2 of 24...
		bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	bit 8	
1	1 FT	d	d	d	d	d	d	d	d	d
2	0 FS	d	d	d	d	d	d	d	d	d
3	0 FT	d	d	d	d	d	d	d	d	d
4	0 FS	d	d	d	d	d	d	d	d	d
5	1 FT	d	d	d	d	d	d	d	d	d
6	1 FS	d	d	d	d	d	d	d	d	A
7	0 FT	d	d	d	d	d	d	d	d	d
8	1 FS	d	d	d	d	d	d	d	d	d
9	1 FT	d	d	d	d	d	d	d	d	d
10	1 FS	d	d	d	d	d	d	d	d	d
11	0 FT	d	d	d	d	d	d	d	d	d
12	0 FS	d	d	d	d	d	d	d	d	B

The ESF Framing Pattern Sequence (referred to as FPS or FAS) is always equal to 001011. Extended Super-Frame format uses a 6-bit Block Check (CRC-6) and a 12-bit Frame Data Link (FDL) to measure line performance and transmit statistical information. There are four in-band signalling bits per frame (A, B, C, and D) if robbed-bit signalling is used. In-band signalling reduces the maximum data rate to 56 Kbps. With clear-channel signalling, these four bits become data bits, and the data rate is 64 Kbps.

Table 52-2  
ESF Frame with In-Band Signalling

FRAME #	F	TIME SLOT 1 of 24								TIME SLOT 2 of 24...
		bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	bit 8	
1	FDL1	d	d	d	d	d	d	d	d	d
2	CRC1	d	d	d	d	d	d	d	d	d
3	FDL2	d	d	d	d	d	d	d	d	d
4	0	d	d	d	d	d	d	d	d	d
5	FDL3	d	d	d	d	d	d	d	d	d
6	CRC2	d	d	d	d	d	d	d	d	A
7	FDL4	d	d	d	d	d	d	d	d	d
8	0	d	d	d	d	d	d	d	d	d
9	FDL5	d	d	d	d	d	d	d	d	d
10	CRC3	d	d	d	d	d	d	d	d	d
11	FDL6	d	d	d	d	d	d	d	d	d
12	1	d	d	d	d	d	d	d	d	B
13	FDL7	d	d	d	d	d	d	d	d	d
14	CRC4	d	d	d	d	d	d	d	d	d
15	FDL8	d	d	d	d	d	d	d	d	d
16	0	d	d	d	d	d	d	d	d	d
17	FDL9	d	d	d	d	d	d	d	d	d
18	CRC5	d	d	d	d	d	d	d	d	C
19	FDL10	d	d	d	d	d	d	d	d	d
20	1	d	d	d	d	d	d	d	d	d
21	FDL11	d	d	d	d	d	d	d	d	d
22	CRC6	d	d	d	d	d	d	d	d	d
23	FDL12	d	d	d	d	d	d	d	d	d
24	1	d	d	d	d	d	d	d	d	D



**53 G.703**

**\*\* Interface Control \*\***  
**G.703 / 2.048MBPS**

**Line Setup**  
Coding Type: HDB3 AMI  
Line Impedance: 75 OHMS 120 OHMS  
Receiver Gain: 0 db 20 db  
Termination: BRIDGED TERMINATED

**Transmit Setup**  
Transmit Mode: NORMAL DROP/INS

Line Clock Select: INTERNAL EXTERNAL  
Xmit Signalling All 1's (CCS Signalling Only): YES NO  
Xmit Distant MF Alarm (CAS Signalling Only): YES NO  
Xmit Remote Alarm: YES NO

**Data Path Setup**  
Data Path: 64K DATA CHANNEL SIGNALLING BITS

Channel Mode: SAME SPLIT

Channel Number:     (two decimal digits)    Channel Number RD:     TD:     (two decimal digits)

Enable CRC-4: YES NO  
Signalling Type: CAS    CCS

Begin CAS MF W/Frame Containing Frame Align. Signal: YES NO

Extra Bits:     (three binary digits: 0 or 1)

National Bits:     (five binary digits: 0 or 1)  
International Bit:     (one binary digit: 0 or 1)

CAS MF Sync Criteria: NORMAL EXTENDED  
CAS MF Resync Criteria: NORMAL EXTENDED

Signal Channel Number: 16 (two decimal digits)  
Signal Channel Idle Char: 7E FF

Frame Resync Criteria: NORMAL EXTENDED  
Record Ch16: YES NO

Select Coding Type:

F1	F2	F3	F4	F5	F6	F7	F8
HDB3	AMI						

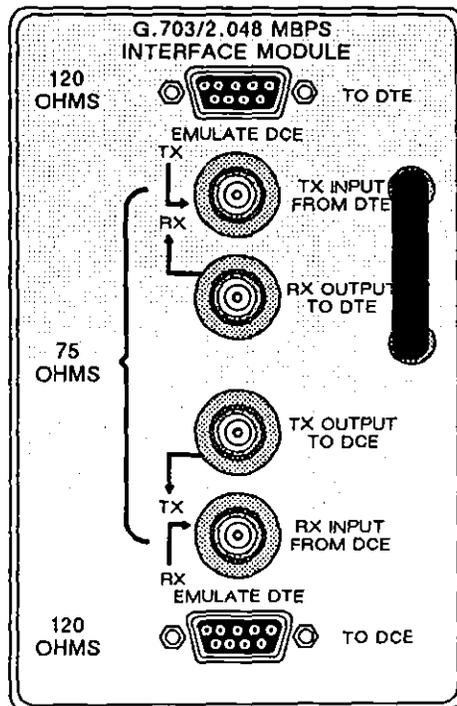


Figure 53-1 Interface Control screen (above) presents G.703 options when a G.703 TIM (below) is installed.

## 53 G.703

G.703 is a point-to-point protocol at the physical layer (Layer 1) used to transmit high-speed voice or data over telephone lines. The INTERVIEW 7000 Series, with G.703 software and the G.703 Test Interface Module installed, is capable of testing G.703 circuits that comply with European standards. In particular, the INTERVIEW tests circuits with a total bandwidth of 2.048 MHz (as opposed to 1.544 MHz circuits typically used in North America). The bandwidth is divided into 32 channels with an absolute speed of 64 Kbps each.

Only channels 1 through 31 are available for testing—channel 0 contains framing bits and is transparent to the user. Additionally, channel 16 is set aside for signalling and framing in CAS (Channel Associated Signalling) mode. The user should keep this in mind when this manual refers to the "32 channels" in G.703.

The INTERVIEW monitors the equivalent of both sides of a line, RD (DCE) and TD (DTE), or emulates RD or TD. The INTERVIEW allows the user to select a single channel on which to monitor (or emulate RD or TD) or to "split" the line and select RD and TD on different channels. Hereafter, references to monitoring or emulating a channel will inherently refer to the selection of split channels.

In order to capture G.703 on the INTERVIEW 7000 Series, your unit must be equipped with the G.703 option (OPT-951-24-1), which consists of a Multiplexer board and a removable Test Interface Module (documented in the following paragraphs).

The INTERVIEW supports G.703 Primary Rate ISDN with 30 B-channels and one D-channel (30B+D) in CCS (Common Channel Signalling) mode.

### 53.1 Overview of G.703 Testing Capabilities

#### (A) Physical Characteristics

The INTERVIEW's physical interface conforms to CCITT Recommendation G.703 for 2.048 MHz circuits. The physical connectors and the G.703 Test Interface Module are discussed in Section 53.2.

The INTERVIEW can transmit and receive G.703 data encoded in Alternate Mark Inversion Format (AMI) or High Density Bipolar 3 (HDB3). In AMI, the polarity of each sequential 1 (mark) alternates with reference to the zero (space) voltage level. HDB3, the default selection, is a transmission technique which is used to overcome the occurrence of long strings of zeroes and the associated timing problems. HDB3 is explained later in this section.

## (B) Framing and Signalling Characteristics

Any G.703 circuit that operates at 2.048 MHz and conforms to the basic physical characteristics laid out in Recommendation G.703 may be BERT tested with the INTERVIEW; however, the full set of statistical analyses and protocol testing capabilities apply to G.703 circuits which employ CAS or CCS framing structures. These framing structures are discussed in detail in CCITT Recommendation G.704; the major characteristics of the scheme are outlined in Section 53.7.

1. *Channel 0.* Channel 0 is the channel reserved in G.703 for frame alignment information and remote alarms, including the optional CRC for detecting transmission errors and for synchronization. The international and national bits are also carried *transparently* on channel 0, even though they are selectable on the Interface Control screen. Channel 0 cannot be emulated or monitored; it cannot be recorded for playback, even when aggregate recording is selected. Regardless of which Transmit mode is used, the INTERVIEW sends the framing information on channel 0 along with the selected channel(s).
2. *Channel 16.* Signalling bits are carried on Channel 16 when CAS mode is selected for the signalling type on the Interface Control screen. These ABCD bits can also be displayed when in Run mode by selecting first **F1**, DATA, and then **F5**, CAS SIG (Figure 53-18). For specific bit information, see Figure 53-22.

In CCS mode, channel 16 can be used either as a data channel or for special signalling.

When recording the aggregate G.703 data stream, selecting **Record Ch16:** **YES** on the Interface Control screen will include the information from channel 16 in the aggregate data stream.

## (C) G.703 BERT

The INTERVIEW can perform both framed and unframed BERT tests on G.703 transmissions. An individual channel may also be BERT tested. Tests may be performed in a simple loopback configuration or in conjunction with another INTERVIEW or BERT tester. In Run mode, a separate G.703 BERT display tracks test results. The contents of the display and BERT options and setup are described in Section 9.

## (D) Channel Data Capture

The Front-End Buffer can capture both sides of one G.703 channel in real-time for immediate analysis or recording and playback. Or, the user may elect to "split" the channel mode and to use *two* channels: one for RD and one for

TD. These selections are explained in Sections 53.5(K) and (L). The user may specify any one of channels 1 through 31; or split TD and RD on two of those channels.

**NOTE:** When recording the capture of a single channel to RAM, select **Record Speed:** **NORMAL** on the Record Setup menu. See Section 11.4(A).

When you enter Run mode configured to capture a single channel, channel 30 for example, the following message appears on the status line: "Ch30." When capturing split channels (channel 4 for RD and channel 7 for TD, for example), the following message appears on the status line: "R04T07."

### (E) Aggregate G.703 Record

To record the aggregate G.703 data stream (2.048 Mbps), with or without channel 16, your unit must be equipped with an FEB board capable of high-speed recording (see Section 11.4). Select **Mode:** **MONITOR** on the Line Setup menu. Configure the Record Setup menu for **Capture Memory:** **RAM** and **Record Speed:** **HIGH SPEED**.

Your selection for the **Record Ch16** field on the G.703 Interface Control screen determines whether or not information on channel 16 will be included in the aggregate data stream. See Section 53.5(X). Note that while channel 0 is always transmitted, it is never recorded for playback, even when aggregate recording has been selected.

Use the recorded data for later playback and analysis. Note, however, that a specific channel cannot be isolated from the aggregate data stream for monitoring and analysis.

During high-speed recording, data display and program conditions (or triggers) based on incoming data are disabled. The G.703 Statistics display, however, remains active. To optimize recording, however, do the following:

1. select **Initial Cond:** **NOT RECORD** on the Line Setup screen along with the high-speed recording selections and press **RUN**;
2. access the G.703 Statistics display by pressing **F5** (for STATS), then **F3** (for G703STA); use the **G703 LINE CONDITIONS** field on the G.703 Statistics display to check for TD and RD in sync as a condition for recording (see Section 53.6);
3. press **DONE** to return to the data screen;
4. press **F7**, **NO DISP**; and
5. then press **RECORD** to begin high-speed recording.

See also Section 11.4(A).

When you enter Run mode configured for aggregate G.703 record, the status line will contain the following message: "HS RCRD" and "Monitoring is disabled for high speed ram recording."

#### **(F) Monitor Mode**

When Mode is set to **MONITOR** on the Line Setup menu, the INTERVIEW as G.703 protocol analyzer may be used to monitor any one (or the split RD and TD of two) of the data channels or signalling patterns passively. Once the initial cabling is done, the G.703 circuit through the INTERVIEW is bridged, not broken — even when the unit is turned off — and the INTERVIEW does not interfere with communications in progress.

A BNC connector may be used to monitor nonintrusively even when the INTERVIEW is not already cabled to the line. See Figure 53-9 for an illustration of this configuration.

#### **(G) Emulate DTE or DCE**

The INTERVIEW can also emulate a DTE (multiplexer) or a DCE (network) over G.703 lines, depending on the Mode selection made on the Line Setup menu. In an emulation mode, the INTERVIEW actively transmits and receives data as prescribed by G.703 interface at a maximum channel speed of 64 Kbps. A selection on the Interface Control screen allows the user to specify whether clocking is provided by the INTERVIEW or recovered from the incoming data.

Any of the 30 data channels on the circuit (or channel 16) can be selected for analysis. INTERVIEW test data can be transmitted on the outbound channel; incoming data on the corresponding channel is available for display and test. Higher layer protocols carried by the G.703 point-to-point protocol can be tested simultaneously as statistics on the performance of the G.703 circuit are taken and, at the user's need, displayed.

The INTERVIEW emulates in two fashions: it can transmit idle to all but one channel to which it transmits data and which it monitors; or it can perform drop-and-insert emulation. When the drop-and-insert option is employed, transmissions on 31 channels are passed through the INTERVIEW, while the channel selected for analysis is terminated and INTERVIEW data is transmitted on the outgoing channel.

#### **(H) Protocol Spreadsheet**

G.703 protocol cannot be controlled from the Protocol Spreadsheet. Other protocols operating above the physical interface may, however, be tested. Spreadsheet options for testing in this case will depend on the protocols you have loaded from the Layer Setup screen.

## (I) Data Displays

The format and code selections you make on the Line Setup screen, indicated at the top of the run-time display, determine the appearance of the data stream on the screen. Protocols selected on the Layer Setup screen will be available as trace displays. One alternate real-time display (see Figure 53-2) selection allows you to view G.703 statistics and track performance on the G.703 circuit. The G.703 Statistics Display is described in Section 53.6.

Additionally, another alternate real-time display (see Figure 53-18) is reached by selecting first **F1**, DATA, and then **F3**, CAS SIG. This screen displays a matrix of the ABCD bits in each channel transmitted on timeslot 16 of every frame, as shown in Figure 53-22.

*BERTDCE/QRSS*				
G703/FRAMED/WITHOUT CH16				
G.703 STATISTICS	DTE	RATE	DCE	RATE
TEST SECONDS:	2.7000E01			
FRAMES RCVD:	1.9276E05		0.0000E00	
BPV'S RCVD:	0.0000E00	0.000E-00	0.0000E00	0.000E-00
BPV-FREE SECS:	2.3000E01	8.571E-01	0.0000E00	0.000E-00
FRAMING ERRORS:	3.0000E00	1.503E-05	0.0000E00	0.000E-00
SYNC LOSSES:	1.0000E00	5.010E-06	0.0000E00	0.000E-00
SYNC LOSS TIME:	3.5150E00	1.255E-01	0.0000E00	0.000E-00
ERROR-FREE SECS:	2.2000E01	8.214E-01	0.0000E00	0.000E-00
G703 LINE CONDITIONS				
CURRENT [PREVIOUS]	REMOTE ALRM [RSgSy]		NOT MONITORED	
<b>F 1</b>	<b>F 2</b>	<b>F 3</b>	<b>F 4</b>	<b>F 5</b>
INJIERR	ERR INJ	RESET	RESTART	
				<b>F 6</b>
				<b>F 7</b>
				<b>F 8</b>
				G703STA
				BERT

Figure 53-2 G.703 alternate statistics screen display.

## (J) Primary Rate ISDN

The INTERVIEW supports G.703 Primary Rate ISDN at 2.048 MHz (30B+D) with the mux board and TIM option package (OPT-951-24-1) and software revision 6.00, or higher. The ISDN\_D protocol package is used in G.703 at Layer 1 to access the ISDN variables. See also Sections 38, 47, and 74 on Basic Rate ISDN.

For ISDN, select Signalling Type: **CCS** and then select the Signal Channel Number for the D channel on the G.703 Interface Control Screen. See Section 53.5. For dual-channel monitoring and emulation, load the LAPD personality package at Layer 2 for the B channel under test. A ISDN trace package (OPT-951-35) is also available for monitoring either the D channel alone or the D channel and one of the B channels.

## 53.2 The Test Interface Module

The G.703 Test Interface Module (TIM), shown in Figure 53-3, is a removable module which may be replaced by different interfaces when other types of lines must be tested. The G.703 TIM provides two 9-pin female connectors (top and bottom of module) labeled TO DTE and TO DCE, which attach to a twisted pair cable. (See Table I-10 for pin specifications.) In addition, there are two pairs of BNC connectors. All connectors are two-wire and attach to a standard line. The signal direction for each connector is indicated by the arrows to the left of the BNC connectors on the TIM as shown in Figure 53-4. An overlay (Figure 53-5) which identifies active LEDs on the front panel accompanies the G.703 TIM.

Install the G.703 Test Interface Module and insert the correct LED overlay as described in Section 1.10. Once the G.703 module and the overlay are installed, TX and RX leads can be monitored on the front-panel green-red LEDs.

### (A) Connectors

When you break a data line for testing, you may connect the end of the line coming from the DTE (multiplexer, channel bank, PBX, network, or switch) to the TO DTE (or to terminal equipment or "to TE") connector on the TIM (see top of Figure 53-3). Connect the other end of the line coming from the DCE (terminal equipment or telephone company office repeater) to the TO DCE (or to network termination or "to NT") connector on the TIM. Even when the INTERVIEW is powered off, this provides a through connection for the data line.

*CAUTION: To connect the data line, you must interrupt the flow of data on the line. Be sure you have permission to break the line before doing so.*

If you are using the BNC connectors, you may create a pass-through connection by connecting the top two jacks toward the DTE (to TE) and the bottom two jacks toward the DCE (to NT).

When Mode: **MONITOR** or **AUTOMONITOR** is the program selection and the INTERVIEW is connected as a pass-through as described in the preceding paragraph, the INTERVIEW monitors data passively through either (or both) TO connectors on the TIM.

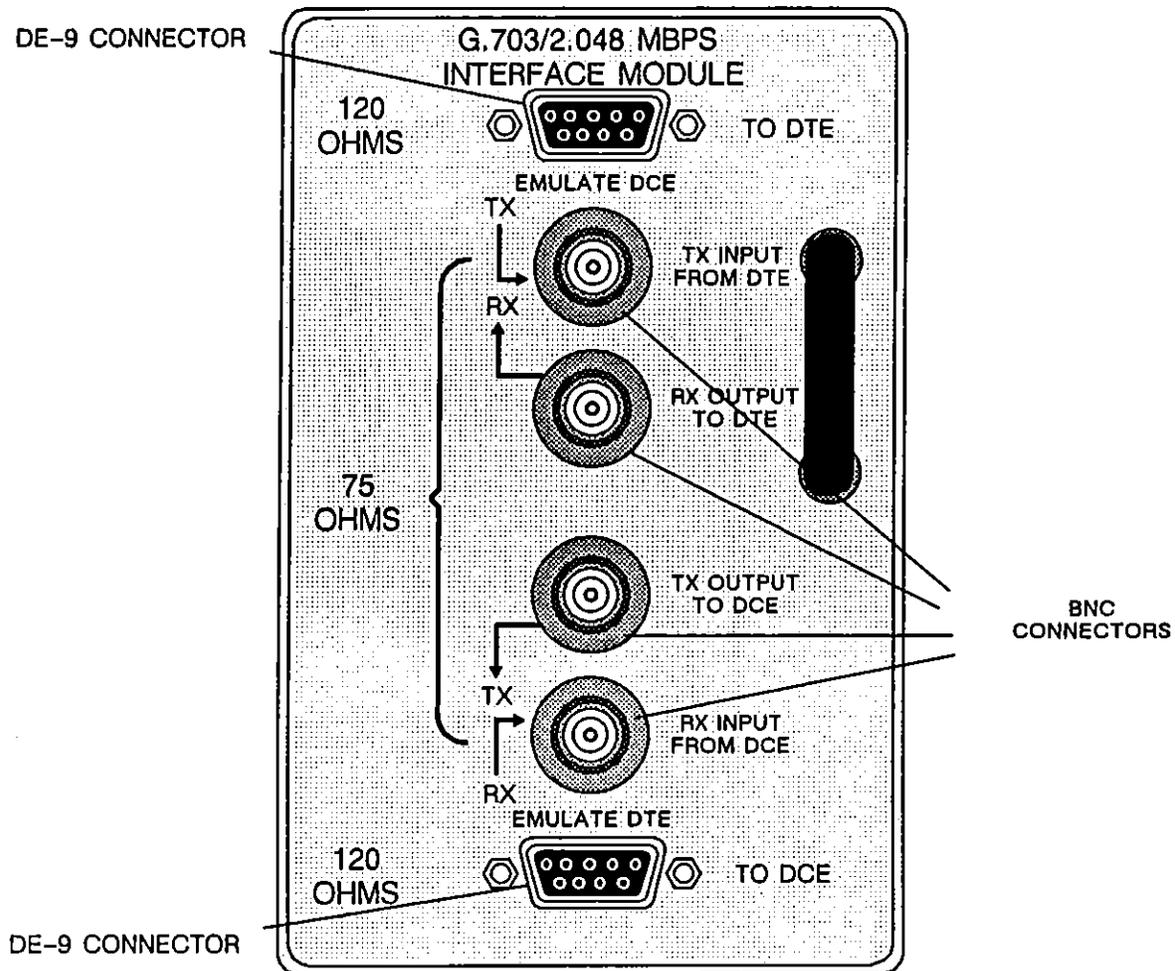


Figure 53-3 The G.703 Test Interface Module provides both BNC and DE-9 connectors for reception and transmission of data.

When the INTERVIEW is operating in **EMULATE DCE** mode (selected on the Line Setup menu), the INTERVIEW is transmitting and receiving data through the DE-9 connector labeled TO DTE (to TE), or through the top set of BNC connectors, labeled TX INPUT FROM DTE (for Transmit; that is, Input from the DTE or TE) and RX OUTPUT TO DTE (for Receive; Output to the DTE or TE).

When Mode: **EMULATE DTE** is the program selection, the unit transmits and receives data through the TO DCE (to NT) connector if the DE-9 connectors are in use, or through the bottom set of BNC connectors, if these are connected. The BNC connectors which are active in this case are labeled TX OUTPUT TO DCE (for Transmit; Output to the DCE or to NT) and RX INPUT FROM DCE (for Receive; Input from the DCE or from NT).

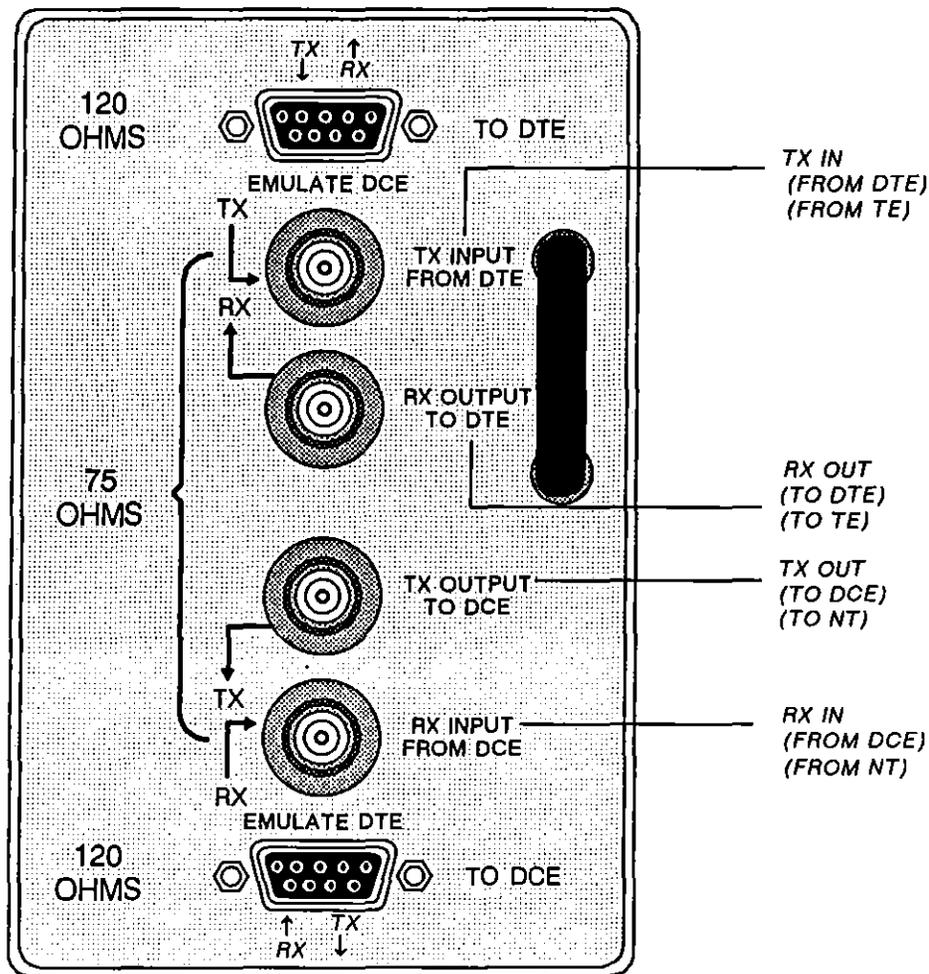


Figure 53-4 Signal direction for G.703 connectors.

### (B) Green-Red LEDs

Two of the front-panel LEDs are active when the unit is testing G.703 interface. These represent leads monitored at either of the line interfaces (TO DTE or TE, TO DCE or NT) on the test-interface module. An LED is dark when the unit is off, green when the unit is powered on but the lead is off (at mark voltage, representing 1) or unterminated, and red when the lead is on (representing space voltage or 0).

Data leads transition quite rapidly. As a result, their LEDs typically show a shade of orange that is intermediate between red and green when data is being transmitted. Data-lead LEDs will vary in color with the type of data.  $f_r$ -idle, for example, has no *on* transitions, while  $f_r$ -idle has only one, so both cause an LED to glow bright green.



Figure 53-5 G.703 Green-Red LED Overlay.

Two of the LEDs switch to red when the unit is in a special mode, Remote mode or Freeze mode. Remote means that the unit is *under* remote control via the REMOTE port. (The remote-control feature is not implemented in the early releases of the INTERVIEW 7000 Series.)

It is important to note that the front-panel LED indicators always reflect TIM activity. If the LEDs are active while data is being played back from disk, the activity is on the line, not in the data stored on the disk.

### 53.3 Testing Configurations

#### (A) Test at Line Levels (No Pad)

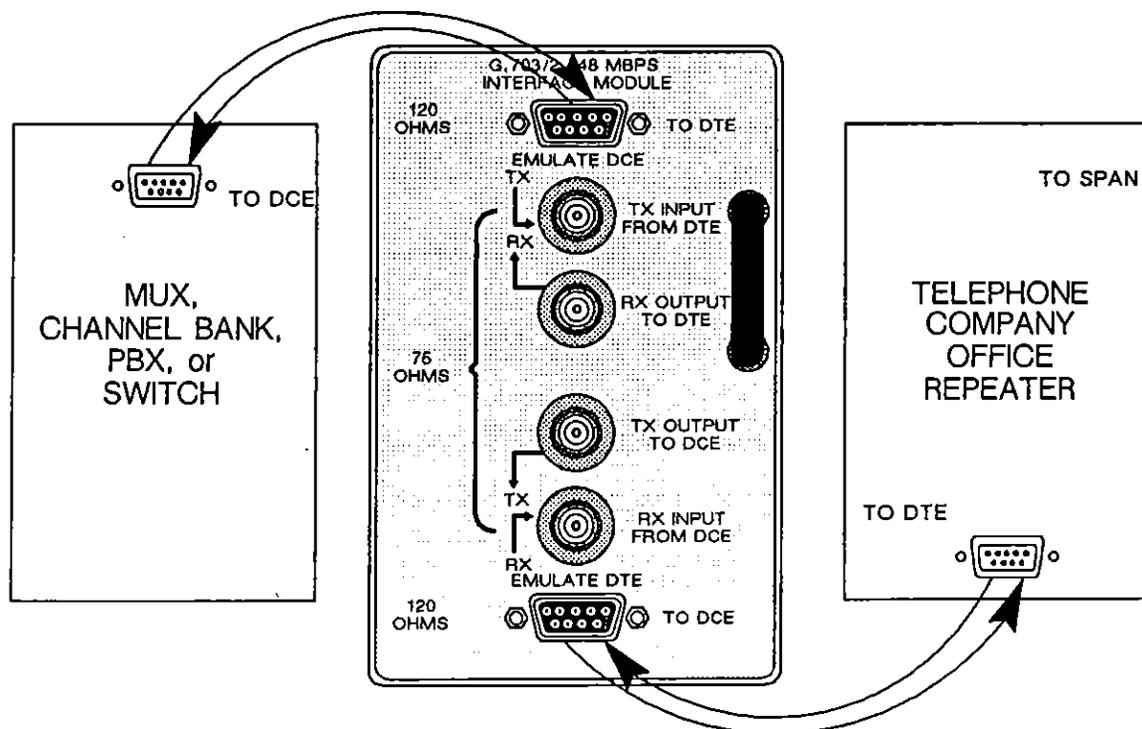


Figure 53-6 Place the INTERVIEW 7000 Series between the multiplexer and the telephone company office repeater (for example) to monitor or emulate over the G.703 circuit. The illustration indicates how cables equipped with DE-9 connectors would be connected.

Connect the INTERVIEW into the circuit between the DTE (multiplexer, channel bank, PBX, TE, or switch) and the DCE (telephone company office repeater) for G.703 testing. In this position, the INTERVIEW may monitor a selected channel, emulate a G.703 customer transmission, emulate the network on an individual channel towards a user terminal, or perform a BERT test. See Figure 53-6 and Figure 53-7.

To emulate one channel on the customer side of the conversation (for example), select **EMULATE DTE** as the operating Mode on the Line Setup screen. This breaks the line between the mux and the repeater as illustrated in Figure 53-6. The INTERVIEW communicates through the repeater in this configuration, transmitting and receiving over the DE-9 connector labeled TO DCE (to NT), or transmitting over the BNC connector labeled TX OUTPUT TO DCE and receiving over the connector labeled RX INPUT FROM DCE when the BNC jacks are used (Figure 53-7).

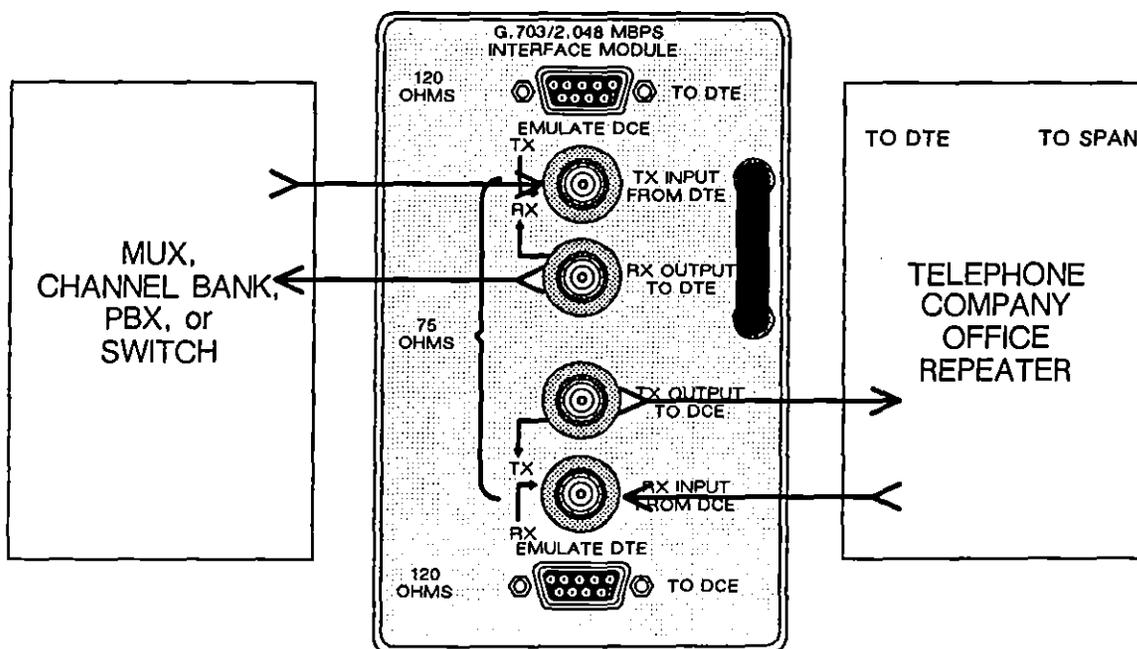


Figure 53-7 The same configuration may be achieved with BNC connectors. Once the cables are in place, the INTERVIEW may monitor nonintrusively or break the line toward the DTE or DCE.

To emulate the network side of the conversation, select **EMULATE DCE** as the operating Mode on the Line Setup screen. This breaks the line between the mux and the repeater. The INTERVIEW then communicates through the attached mux, transmitting and receiving over the DE-9 connector labeled TO DTE (to TE) (Figure 53-6), or transmitting over the BNC connector labeled RX OUTPUT TO DTE and receiving over the connector labeled TX INPUT FROM DTE (Figure 53-7).

### (B) Simplex Repeater Power

The G.703 Test Interface Module will pass simplex repeater power down the transmit pair and the receive pair when it is patched in series into the powered portion of a G.703 span. Figure 53-8 is the standard "looped-through" configuration shown in the previous figure, except that here the INTERVIEW has been placed on a powered span and is providing a DC path between input and output for both receive and transmit pairs. Both in monitor and emulate modes, a permanent DC path is maintained from TX INPUT FROM DTE (in) to TX OUTPUT TO DCE (out) and from RX INPUT FROM DCE (in) to RX OUTPUT TO DTE (out).

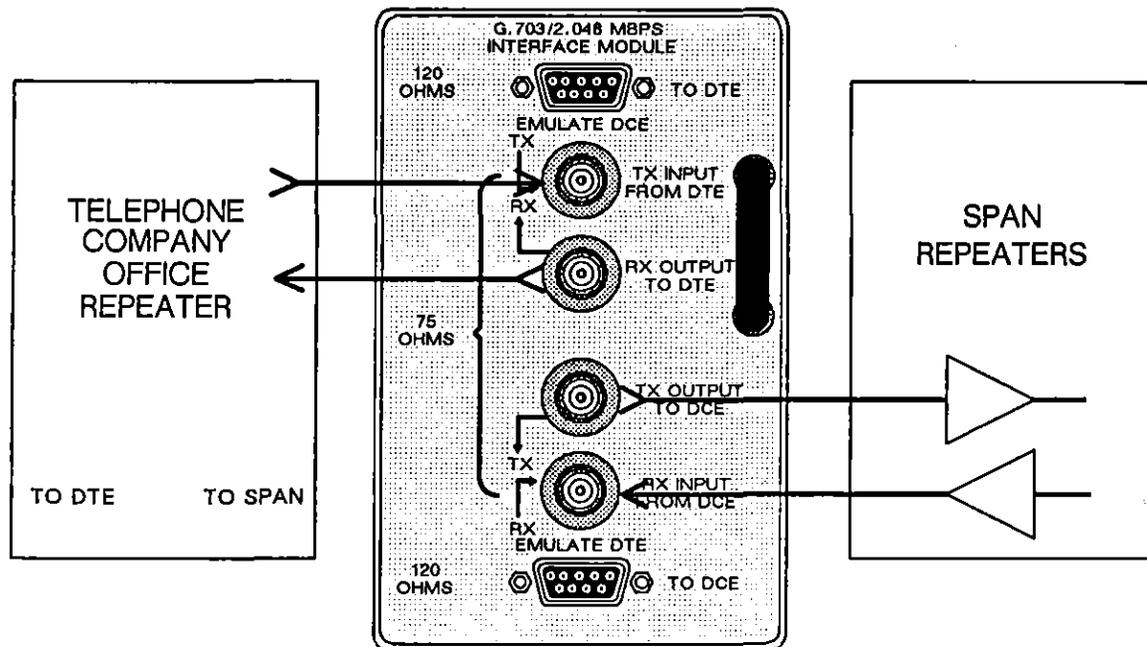


Figure 53-8 The INTERVIEW can be patched in series into the powered portion of a G.703 span.

One of the functions of a repeater is to complete the simplex current path between the transmit pair and the receive pair. When the INTERVIEW is used to break the line toward the span and emulate the repeater, a simple patch connection (via one of the BNC patch cords provided with the G.703 option) between TX INPUT FROM DTE and RX OUTPUT TO DTE will complete the DC current path.

**(C) Test at Patch Panel (20db Pad at Monitor Jack)**

Many G.703 sites have a special patch panel that allows nonintrusive monitoring of lines. (Actual monitoring with the INTERVIEW 7000 Series always is passive and nonintrusive, but unless a patch panel is installed at the test site, the line normally must be broken simply to cable the test equipment to the line.)

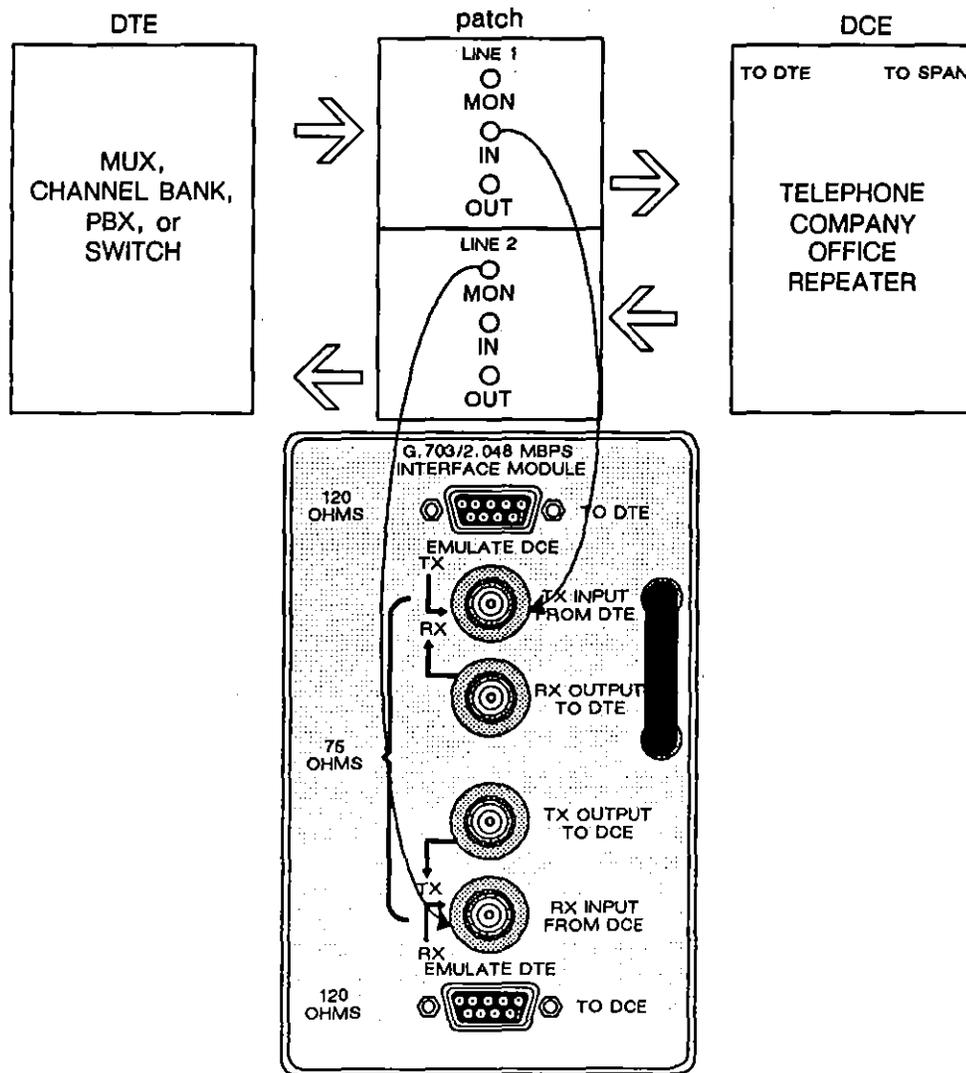


Figure 53-9 If a patch panel is available for patching at the telephone company office, the line can be monitored without even momentary intrusion.

Figure 53-9 shows a G.703 test-interface module (TIM) cabled to the MONITOR jacks of two separate patch panels. These panels handle Tx and Rx

traffic separately. Because the monitor jacks are isolated from the line by a 20 db "pad," these jacks may be patched into without disrupting traffic on the line. When the INTERVIEW monitors at this interface, 20 db of gain should be added to the signal via the Receiver Gain: ~~20 db~~ selection on the Interface Control menu—see Section 53.5(C). Terminate the line as well—select Termination: ~~TERMINATED~~ on the Interface Control screen.

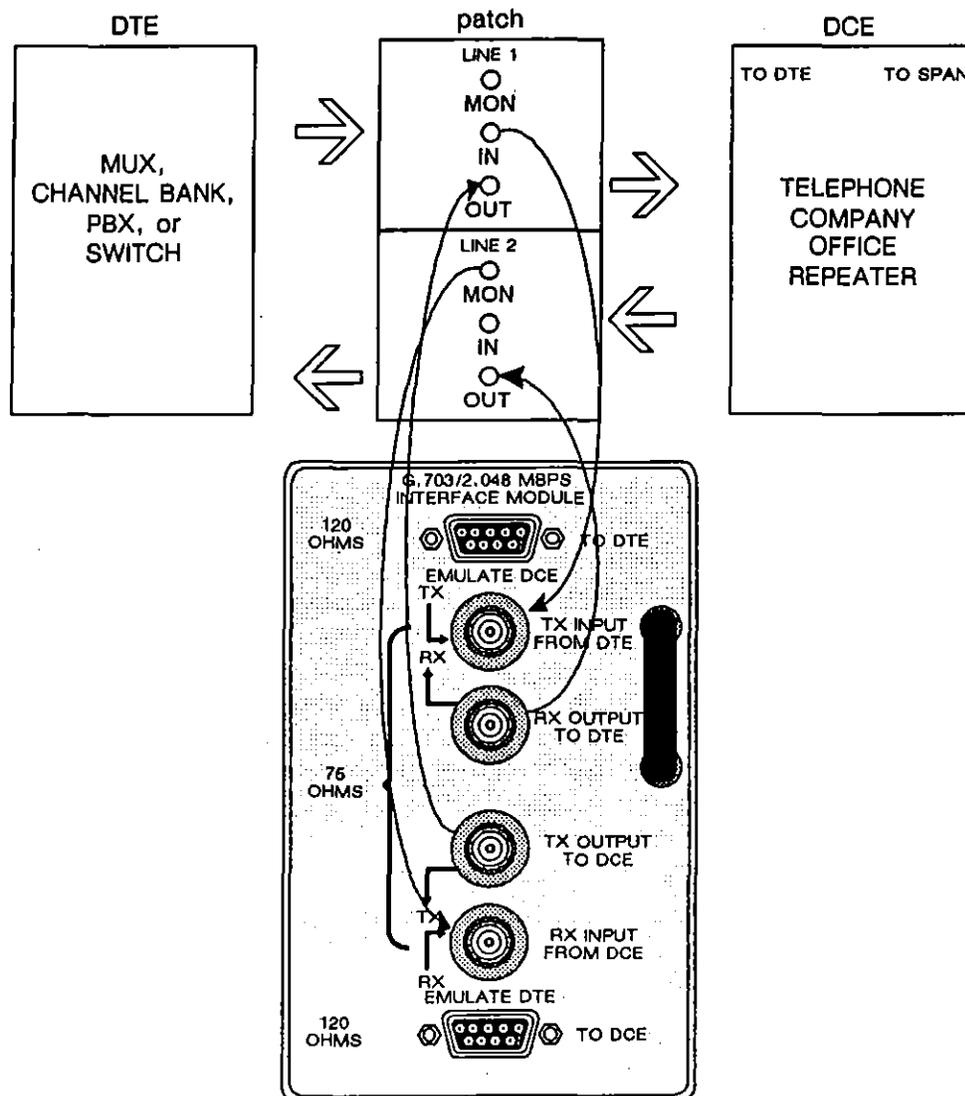


Figure 53-10 This is a "permanent" INTERVIEW-to-patch panel configuration. With the cables in place, the INTERVIEW may monitor nonintrusively.

Figure 53-10 shows a "permanent" installation of the INTERVIEW 7000 Series at a patch panel location. Once the cables are in place, the INTERVIEW can be used to monitor the line nonintrusively.

There is no special "padding" at the IN and OUT interfaces on the patch panel. Select **Receiver Gain: 0.45** on the Interface Control menu when you monitor or emulate at these interfaces. In this case, do not terminate the line—select **Termination: BRIDGED** on the Interface Control screen.

## 53.4 Setting Up Menus for G.703 Testing

```
          ** INTERVIEW 7500 **  
DISKS: FLOPPY 1 FLOPPY 2 HARD DISK(20M)  
PROCESSORS: 4  
SELF TEST ERRORS: NONE  
  
Press:  
[PROGRAM] to enter the menu page  
[RUN]     to run the default program  
  
Software Version: 8.00  
Firmware  Version: 5.00  
  
OPTIONS: 24-1  
  
TIM: G.703  
  
Copyright (c) 1987, 1990  
Telenex Corporation
```

Figure 53-11 Power-up screen, INTERVIEW 7500.

G.703 testing can be done only when the TIM described in Section 53.2 is in place. Install the G.703 TIM and connect to a data source before power up as described in Section 1.10. Compare the Power Up screen to the one shown in Figure 53-11. It should indicate that the correct TIM is in place and that the unit is equipped with a G.703 mux board (Option 24-1).

**NOTE:** If you plan to perform a G.703 BERT test, refer to Section 9.

Before you run a G.703 test, you must configure the Line Setup screen for the type of testing you wish to do. Select **Mode: MONITOR** if you plan to monitor a G.703 exchange. If the INTERVIEW is to perform an interactive test (that is, will be required to transmit), select **Mode: EMULATE DCE** or **Mode: EMULATE DTE**.

**CAUTION:** When the INTERVIEW operates in an emulate mode, it interrupts the regular exchange of data on the circuit. Be certain you have permission to test the circuit before you proceed.

Select the **Code** and **Format** required for accurate interpretation of the data stream.

Clocking of G.703 data is not provided by the standard data clock. As a result, the **Clock Source** selection on the Line Setup screen is overridden. An applicable clock selection is provided on the Interface Control screen, described in Section 53.5.

If you plan to test higher-layer protocols (such as Common Channel Signalling System #7, LAPD, ISDN, or any others carried on the G.703 circuit), you must first load them from the Layer Setup screen. The Layer Setup screen is documented in Section 6.

### 53.5 Interface Control Screen

Certain G.703 characteristics are selectable. All options specific to G.703 are selected on the Interface Control screen, which is accessed from the main Program menu. With the Program menu displayed, press **F1** (for Setup), then **F2** (for G.703) to obtain a screen similar to those shown in Figure 53-12. The full set of options available on the Interface Control screen is illustrated in Figure 53-1.

** Interface Control **	
G.703 / 2.048MBPS	
<u>Line Setup</u>	<u>Data Path Setup</u>
Coding Type: <b>HDB3</b>	Data Path: <b>64K DATA CHANNEL</b>
Line Impedance: <b>75 OHMS</b>	Channel Mode: <b>SAME</b>
Receiver Gain: <b>0 db</b>	Channel Number: <b>01</b>
Termination: <b>BRIDGED</b>	Enable CRC-4: <b>NO</b>
	Signalling Type: <b>CAS</b>
<u>Transmit Setup</u>	Begin CAS MF W/Frame Contain- ing Frame Align. Signal: <b>YES</b>
Transmit Mode: <b>NORMAL</b>	Extra Bits: <b>111</b>
Line Clock Select: <b>INTERNAL</b>	National Bits: <b>11111</b>
Xmit Signalling All 1's (CCS Signalling Only): <b>NO</b>	International Bit: <b>1</b>
Xmit Distant MF Alarm (CAS Signalling Only): <b>NO</b>	CAS MF Sync Criteria: <b>NORMAL</b>
Xmit Remote Alarm: <b>NO</b>	CAS MF Resync Criteria: <b>NORMAL</b>
	Frame Resync Criteria: <b>NORMAL</b>
Begin CAS Multiframe with Frame Containing FAS?	
<b>F 1</b>	<b>F 2</b> <b>F 3</b> <b>F 4</b> <b>F 5</b> <b>F 6</b> <b>F 7</b> <b>F 8</b>
<b>YES</b>	<b>NO</b>

Figure 53-12 Interface Control screen for G.703 Protocol with *Transmit Mode: NORMAL* and *Signalling Type: CAS* selected. Transmit Setup selections apply when an Emulate mode is selected on the Line Setup screen. Line Clock is available for master G.703 transmit clocking.

<p><u>Line Setup</u>                  Coding Type: <b>HDB3</b>                  Line Impedance: <b>75 OHMS</b>                  Receiver Gain: <b>0 db</b>                  Termination: <b>BRIDGED</b></p>	<p><u>Data Path Setup</u>                  Data Path: <b>64K DATA CHANNEL</b>                  Channel Mode: <b>SAME</b>                  Channel Number: <b>01</b>                  Enable CRC-4: <b>NO</b>                  Signalling Type: <b>CCS</b></p>
<p><u>Transmit Setup</u>                  Transmit Mode: <b>NORMAL</b>                  Line Clock Select: <b>INTERNAL</b>                  Xmit Signalling All 1's                  (CCS Signalling Only): <b>NO</b>                  Xmit Distant MF Alarm                  (CAS Signalling Only): <b>NO</b>                  Xmit Remote Alarm: <b>NO</b></p>	<p>National Bits: <b>11111</b>                  International Bit: <b>1</b>                  Signal Channel Number: <b>16</b>                  Signal Channel Idle Char: <b>7E</b>                  Frame Resync Criteria: <b>NORMAL</b></p>

Figure 53-13 Interface Control screen for G.703 Protocol in Emulate mode with *Transmit Mode: NORMAL* and *Signalling Type: CCS* selected.

<p><u>Line Setup</u>                  Coding Type: <b>HDB3</b>                  Line Impedance: <b>75 OHMS</b>                  Receiver Gain: <b>0 db</b>                  Termination: <b>BRIDGED</b></p>	<p><u>Data Path Setup</u>                  Data Path: <b>64K DATA CHANNEL</b>                  Channel Mode: <b>SPLIT</b>                  Channel Number RD: <b>10</b> TD: <b>11</b>                  Enable CRC-4: <b>NO</b>                  Signalling Type: <b>CCS</b></p>
<p><u>Transmit Setup</u>                  Transmit Mode: <b>DROP/INS</b></p>	<p>Frame Resync Criteria: <b>NORMAL</b></p>

Figure 53-14 Interface Control screen for G.703 Protocol in Emulate mode with *Transmit Mode: DROP/INS*, *Signalling Type: CCS*, and *Channel Mode: SPLIT* selected.

<p><u>Line Setup</u>                  Coding Type: <b>HDB3</b>                  Line Impedance: <b>75 OHMS</b>                  Receiver Gain: <b>0 db</b>                  Termination: <b>BRIDGED</b></p>	<p><u>Data Path Setup</u>                  Data Path: <b>64K DATA CHANNEL</b>                  Channel Mode: <b>SAME</b>                  Channel Number: <b>01</b>                  Enable CRC-4: <b>NO</b>                  Signalling Type: <b>CAS</b>                  Begin CAS MF W/Frame Contain-                  ing Frame Align. Signal: <b>YES</b>                  Extra Bits: <b>111</b>                  National Bits: <b>11111</b>                  International Bit: <b>1</b>                  CAS MF Sync Criteria: <b>NORMAL</b>                  CAS MF Resync Criteria: <b>NORMAL</b>                  Frame Resync Criteria: <b>NORMAL</b>                  Record Ch16: <b>NO</b></p>
---	---

Figure 53-15 Interface Control screen for G.703 Protocol in Monitor mode; the *Transmit Setup* fields disappear, but the *Line Setup* and these *Data Path Setup* fields are available. The *Record Ch16* field only appears when high-speed record has been selected on the *Line Setup* screen.

The Interface Control screen for G.703 is divided into three sections: Line Setup, Transmit Setup, and Data Path Setup. The fields and selections for these setups are described in the following paragraphs. The appearance of some of the fields relies on selections made for preceding fields on this screen, such as those shown in Figure 53-12 through Figure 53-15.

### (A) Coding Type

The first field in the Line Setup section of the Interface Control screen is the **Coding Type** field. The two options in the **Coding Type** field are AMI (Alternate Mark Inversion) and HDB3 (High-Density Bipolar 3); the default in this field is HDB3. AMI is described in Section 53.1(A).

When you select **Coding Type: HDB3**, the INTERVIEW transmits any occurrence of four consecutive zero bits as a special bit pattern containing an intentional bipolar violation in the fourth zero bit. These anticipated bipolar violations (BPV) are removed and the four zero bits are restored at the receiving end. The INTERVIEW also performs the restoration function when it is the receiver.

### (B) Line Impedance

The user may select 75 ohms or 120 ohms line impedance, depending on the type of connection made to the TIM (Figure 53-3). If the coaxial connector is used, select 75 ohms (which is also the default for this field). If the DE-9 connector is used, 120 ohms is the proper selection.

### (C) Receiver Gain

The **Receiver Gain** field defaults to 0 db, but if circumstances of the line setup require input gain for the INTERVIEW to recognize the data, the alternate selection of 20 db should be chosen.

A padded monitor jack at the telephone company office is isolated by resistors in series with both the tip and ring. The resistors combine with a 75 or 120 ohm termination at the monitoring device to form a 30 db (or less) pad.

In order for the INTERVIEW to compensate for the padding at this monitor jack, select **Receiver Gain: 20 db** to add 20 db of gain to the line signal. (Also select **Termination: TERMINATED**; see below.) With **20 db** gain selected, the unit will work with up to a -40 db signal received.

### (D) Termination

Line termination is selectable by the user for data in both directions in monitor mode and for Receive data (that is, data coming *from* the device under test) in emulate mode.

In a normal "looped-through" monitor configuration (see Figure 53-6 or Figure 53-8), the appropriate termination is **BRIDGED**, the default selection. When you are monitoring at a padded jack, select **Termination: TERMINATED**.

When you are in emulate mode and have selected **Transmit Mode: NORMAL**, the channels that are coming *from* the device under test may be terminated or bridged by menu selection. Since in this transmit mode you are emulating the end user on the circuit, you normally would select **Termination: TERMINATED**.

When you are emulating in the drop-and-insert mode, 31 of the 32 channels going toward the device under test are "passed through" transparently to the device under test. The 32nd channel is the one you have selected, via the **Channel Number** field, for drop-and-insert.

The channels that are moving data *from* the device under test may be terminated or bridged by menu selection. Normally in drop-and-insert mode, the appropriate termination is **BRIDGED**. Receive data that is terminated is *not* regenerated outbound.

### (E) Transmit Mode

The first field in the Transmit Setup section of the Interface Control screen is the **Transmit Mode** field. The **Transmit Mode** options control the INTERVIEW's transmissions on the 32 channels of the circuit under test. The field is applicable when **Mode: EMULATE DCE** or **Mode: EMULATE DTE** is selected on the Line Setup screen. (The **Transmit Mode** options have a special meaning in **BERT DTE** and **BERT DCE** operating modes. See Section 9.12.)

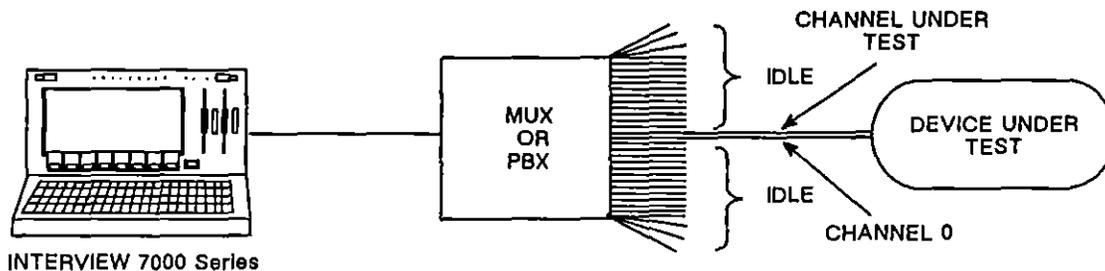


Figure 53-16 The INTERVIEW 7000 Series in normal G.703 emulation mode in CCS mode. Note that framing and signalling information is also transmitted (channel 0 and optional channel 16 in CAS mode).

1. *Normal mode.* When emulating in normal mode (that is, as the only end user on an otherwise inactive G.703 circuit), the INTERVIEW should be set up to terminate the line. See the discussion of the **Termination** option in Section 53.5(D). The INTERVIEW will isolate one incoming channel for capture and transmit on the outbound channel along with channel 0, as well

as providing multiframe synchronization in frame 0 of channel 16 when in CAS mode—see Section 53.5(N). On all other channels, the INTERVIEW transmits the idle line character  $0\frac{1}{2}$  (hex D5). Statistics are maintained on the selected incoming circuit or line.

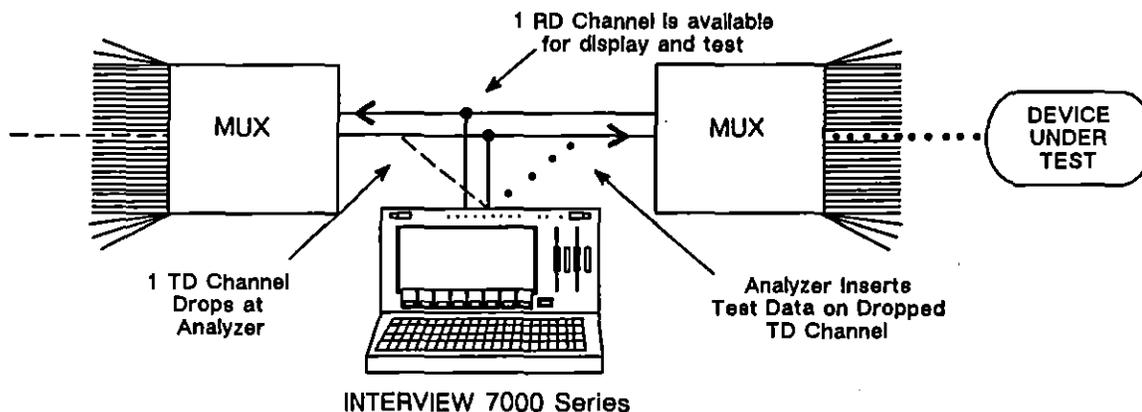


Figure 53-17 The INTERVIEW 7000 Series in drop-and-insert mode.

2. *Drop-and-insert mode.* This type of transmission (illustrated in Figure 53-17) is useful for testing a single channel over an active G.703 circuit. If the user selects drop-and-insert mode, the INTERVIEW receives all 32 channels in both directions (left to right *and* right to left in Figure 53-17). The transmissions on 32 of the left-to-right channels are passed through outbound. The remaining channel is terminated, and higher-layer test data is inserted into the corresponding outbound channel. All the while, G.703 protocol is maintained at the physical level. The INTERVIEW recalculates the correct CRC for the multiframe. Drop-and-insert mode may be used in either direction, towards DTE or DCE. Statistics are maintained on the selected line. Extra bits, national bits, international bits, and alarms are passed through without change.

The INTERVIEW should be set up to *bridge* the data moving right-to-left in Figure 53-17. See the discussion of `BRIDGED` as a Termination option in Section 53.5(D).

## (F) Line Clock Select

Two selections are available to the user in the `Line Clock Select` field, internal and external. Select `Line Clock Select: EXTERNAL` when performing normal emulation or normal channel BERT and an external clock is used (clock recovered from the incoming signal). Otherwise, the field defaults to internal.

### (G) Transmit Signalling All 1's

The Xmit Signalling All 1's (CCS Signalling Only) field defaults to  NO; if  YES is selected, the INTERVIEW fills the signalling channel (channel 16) with logic 1's continuously. This field only appears in Normal Transmit mode and is applicable when Signalling Type:  CCS is selected—see Section 53.5(N).

### (H) Transmit Distant Multiframe Alarm

The Xmit Distant MF Alarm (CAS Signalling Only) field defaults to  NO; if  YES is selected, bit 2 of channel 16 of frame 0 (in the CAS multiframe—see Figure 53-22) is continuously set to indicate a signalling alarm condition to the remote end. This field only appears in Normal Transmit mode and is applicable when Signalling Type:  CAS is selected—see Section 53.5(N).

### (I) Transmit Remote Alarm

The Xmit Remote Alarm field defaults to  NO; if  YES is selected, bit 5 of channel 0 of frames which do not contain the frame alignment signal (see Figure 53-22) is continuously set to indicate a G.703 line alarm condition to the remote end. This field only appears in Normal Transmit mode.

### (J) Data Path

The first field in the Data Path Setup section of the Interface Control screen is the Data Path field. Choose the data path for which you wish to monitor or emulate data. A data channel must be selected if you plan to test or view a higher layer protocol.

1. *64K data channel.* This option selects a 64K data channel from 1 to 31.
2. *Signalling bits.* This option gives signalling bits on channel 16, except in frame 0, for both TD and RD. (Frame 0 of channel 16 contains the multiframe alignment code.)

### (K) Channel Mode

This field appears when a 64K data channel path has been selected. The Channel Mode field offers the user the choice of selecting RD and TD from the same or from two different channels.

1. *Same.* Selecting Channel Mode:  SAME enables the user to select RD and TD on the same channel in the Channel Number field.
2. *Split.* Selecting Channel Mode:  SPLIT enables the user to select RD and TD on two *different* channels in the Channel Number RD: \_\_ TD: \_\_ field.

## (L) Channel Number

This field appears when a 64K data channel path has been selected. Valid entries in the Channel Number field are 1 through 31 (decimal). Channel 0 exists but cannot be selected; it contains frame alignment words, CRC checksums and international/national bits, but no data.

When Channel Mode: **SAME** is selected, only one channel number field appears for an entry in the Channel Number field, as the data is both received and sent on the channel number entered. When Channel Mode: **SPLIT** is selected, however, the field becomes Channel Number RD: \_\_ TD: \_\_ and the user enters one channel number for RD and one for TD.

## (M) Enable CRC-4

The Enable CRC-4 field defaults to **NO**. Selecting **YES** enables the CRC checksum generation and error checking, as well as implementing the CRC multiframe structure. This structure makes use of channel 0 for checksums and the CRC multiframe alignment word for synchronization. Error count is displayed on the G.703 Run-Time statistics screen (Figure 53-19).

**NOTE:** The G.703 CRC is entirely distinct from the block checking which may be performed for a protocol operating at a higher layer. The G.703 CRC is included in the **CRC-4 ERRORS** and **ERROR-FREE SECS** statistical measurements on the G.703 statistics screens.

## (N) Signalling Type

The Signalling Type field has two selections for the type of signalling sent on the line. Each signalling type generates its own set of selection fields on the Interface Control screen. See Figure 53-1 for a complete view of these selections.

1. **CAS**. CAS (Channel Associated Signalling), the default selection, is a bit-oriented signalling technique which uses a 16-frame multiframe to provide four bits for each data channel, transmitted on channel 16 (see Figure 53-22). Channel 16 may be observed "as is" in Run mode, but a better view of the channel activity is obtained by pressing the softkey **CAS SIG** after selecting **DATA**—see Figure 53-18. This figure shows the ABCD bits from all channels presented in the form of a matrix. Figure 53-12 illustrates the Interface Control screen selections when Signalling Type: **CAS** is selected.

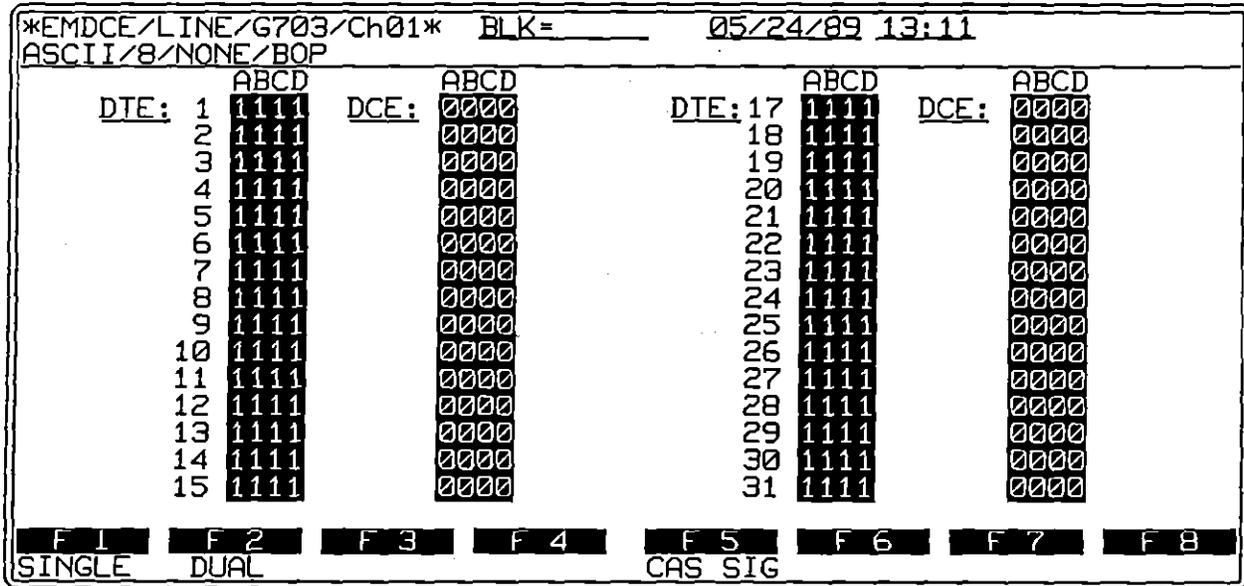


Figure 53-18 Selecting CAS SIG displays the ABCD bits for each data channel.

2. CCS. CCS (Common Channel Signalling), the optional selection, has no multiframe architecture. In this mode of signalling, a channel is set aside for receiving and sending signal information, such as implementing SS#7 or Primary Rate ISDN.

Figure 53-13 and Figure 53-14 illustrate Interface Control screen selections when Signalling Type: **CCS** is selected.

**(O) Begin CAS Multiframe With Frame Containing Frame Alignment Signal**

This field only appears when in CAS mode. The **Begin CAS MF W/Frame Containing Frame Allgn. Signal** field defaults to **YES**, providing even frames of the CAS multiframe in which to place the Frame Alignment Signal (in channel 0); selecting **NO** provides odd frames of the CAS multiframe for the FAS. The frames which do not contain the FAS provide international and national bits and remote alarm indication in channel 0. This option does not exist in CCS signalling and is ignored when CRC-4 is selected because the CRC multiframe must begin with a frame containing the FAS.

**(P) Extra Bits**

This field only appears when in Normal Transmit and CAS Signalling modes. Three bits may be set by the user (to 0 or 1) to be transmitted in channel 16 of frame 0 of the CAS multiframe in bits 3, 1, and 0. This field defaults to 111.

**(Q) National Bits**

This field only appears when in Normal Transmit mode. Five bits may be set by the user (to 0 or 1) to be transmitted in channel 0 (bits 4 – 0) of frames not containing the FAS (Frame Alignment Signal) in that channel. This field defaults to 11111.

**(R) International Bit**

This field only appears when in Normal Transmit mode. One bit may be set by the user (to 0 or 1) to be transmitted in channel 0 (bit 7) of frames not containing the FAS in that channel. If CRC is selected, the international bit will only be transmitted in frames 13 and 15 of the multiframe. This field defaults to 1.

**(S) CAS Multiframe Sync Criteria**

The CAS MF Sync Criteria field allows selection of extended sync criteria for determining sync status of the CAS multiframe; the field only appears when in CAS mode.

1. *Normal.* The default selection in this field is **NORMAL**. This is declared when the multiframe alignment pattern is properly detected and timeslot 16 of the previous frame contains code other than zeros. If no valid pattern can be found in 12 to 14 milliseconds, the frame search is restarted.
2. *Extended.* The optional selection in this field is **EXTENDED**. This selection declares sync when fixed criteria are met and two additional consecutive valid multiframe alignment signals are detected.

**(T) CAS Multiframe Resync Criteria**

The CAS MF Resync Criteria field allows selection of extended sync criteria for determining sync status of the CAS multiframe; the field only appears when in CAS mode.

1. *Normal.* The default selection in this field is **NORMAL**. This selection automatically initiates frame search whenever two consecutive CAS multiframe alignment words are received in error.
2. *Extended.* The optional selection in this field is **EXTENDED**. This selection resynchronizes if fixed criteria are met and/or if two consecutive timeslot 16 words have values of zero in the first four MSB positions: 0000XXXX. (See Figure 53-22.)

**(U) Signal Channel Number**

This field is applicable only for G.703 Primary Rate ISDN dual-channel monitoring or emulation, with *only* BOP format on the D channel. It appears when Signalling Type: **CCS** is selected. Enter a value from 1 through 31; the

default entry is 16, the recommended signalling channel for Primary Rate ISDN. When monitoring dual channels, the number in the **Channel Number** field is the selected B channel and the number in the **Signal Channel Number** field is the D channel.

#### (V) Signal Channel Idle Char

This field is applicable only for G.703 Primary Rate ISDN dual-channel emulation, with *only* BOP format on the D channel. It appears when **Signalling Type:**  **CCS** is selected. Select either  $\tau_e$  or  $\tau_f$ ; the default selection is  $\tau_e$ . The **Signal Channel Idle Char** field allows the user to enter the idle character to be sent on the signalling channel selected in the **Signal Channel Number** field.

#### (W) Frame Resync Criteria

The **Frame Resync Criteria** field allows selection of extended sync criteria for determining sync status of the frames.

1. *Normal.* The default selection in this field is  **NORMAL**. This selection automatically initiates frame search whenever the frame alignment word is received in error three consecutive times.
2. *Extended.* The optional selection in this field is  **EXTENDED**. This selection resynchronizes if fixed criteria is met and/or if bit 2 in timeslot 0 of non-align frames is received in error on three consecutive occasions.

#### (X) Record Ch16

This field relates to aggregate G.703 record and appears only when 1) your unit is equipped with a high-speed FEB board (Rev H or higher); 2) **Mode:**  **MONITOR** is selected on the Line Setup menu; and 3) **Capture Memory:**  **RAM** and **Record Speed:**  **HIGH SPEED** are selected on the Record Setup menu. See also Sections 7.4(A) and 53.1(E).

To include channel 16 information in the aggregate G.703 data stream, select **Record Ch16:**  **YES**. See Figure 53-22. Choose  **NO** if you want to exclude channel 16 from the recorded data-stream.

## 53.6 Interpreting the G.703 Statistics Display

The G.703 Statistics Display can be viewed in Run Mode when the G.703 TIM is installed. To access the statistics screen, press **F5** (for **STATS**), then **F3** (for **G703STA**) while the INTERVIEW is actively monitoring or testing the line. You may alternate between the statistics screen and any other displays listed at the bottom of the screen by pressing the function key indicated. A sample G.703 Statistics screen is shown in Figure 53-19; the statistics displayed are those tallied when the line is in sync. For more information on alternate run-time displays, refer to Section 6.

### (A) Layout of the Screen

The statistics display is divided into two general regions. G.703 statistics appear at the top of the screen; information pertaining to line conditions appears at the bottom of the screen.

All values displayed in the statistics region are cumulative. That is, calculations begin when you press **[M]** and continue until you press **[M]** again. Freezing the trace or character displays has no effect on the statistics gathered, although the statistics will not be updated until the screen is unfrozen.

Values are given in scientific notation, shown to a maximum of four decimal places. The right-most positions of each highlighted field are reserved for display of the exponent. The capital letter E sets off the exponent from the base number. The E is followed by a minus sign to indicate a negative exponent for a value less than one.

*EMDCE/LINE/G703/R01T01 BLK= _____ 05/24/89 13:02					
EBCDIC/8/NONE/SYNC/??					
G.703 STATISTICS		DTE	RATE	DCE	RATE
TEST SECONDS:	8.3000E01				
FRAMES RCVD:	6.6513E05			0.000E-00	
BPV'S RCVD:	0.0000E00		0.000E-00	0.000E-00	0.000E-00
BPV-FREE SECS:	8.3000E01		1.000E-00	0.000E-00	0.000E-00
FRAMING ERRORS:	0.0000E00		0.000E-00	0.000E-00	0.000E-00
CRC-4 ERRORS:	0.0000E00		0.000E-00	0.000E-00	0.000E-00
SYNC LOSSES:	0.0000E00		0.000E-00	0.000E-00	0.000E-00
SYNC LOSS TIME:	0.0000E00		0.000E-00	0.000E-00	0.000E-00
ERROR-FREE SECS:	8.3000E01		1.000E-00	0.000E-00	0.000E-00
G703 LINE CONDITIONS					
CURRENT [PREVIOUS]		NORMAL [ ]		NOT MONITORED	
F 1		F 2		F 3	
F 4		F 5		F 6	
F 7		F 8			
TABULAR GRAPHIC G703STA					

Figure 53-19 G.703 Statistics Display reports on G.703 transmissions in real time and is an alternate screen to data or trace displays in Run mode when the G.703 TIM is installed.

There are four columns for each G.703 measurement. The left-most column displays the current measurement calculated on the DTE side of the line. The next column displays a cumulative rate when applicable. The two columns on the right display the same type of measurement calculated for the DCE and the rate, if any, on the DCE side. The various statistics measurements are explained in the following paragraphs.

G.703 line conditions are listed in two columns, one for DTE and one for DCE. Both current and previous conditions are shown. Line conditions which may be displayed are described in Section 53.6(K).

**(B) Test Seconds**

TEST SECONDS indicate elapsed time. The count begins from zero when you press **[RUN]**.

**(C) Frames Received**

The value listed in the FRAMES RCVD row is equal to the number of bits received divided by 256. Thus, the value represents the number of individual frames rather than the number of multiframes received. The frame count is not incremented unless a valid frame is received. The definition of a valid frame may vary depending on the Interface Control selections you have made pertinent to the syncing procedure (see Section 53.5, Resync Procedure).

**(D) BPV's Received**

The row labeled BPV'S RECVD displays the number of bipolar violations received in valid frames during the test. Anticipated bipolar violations used to maintain one's density are not included in these values if HDB3 encoding is selected on the Interface Control screen (see Section 53.5).

The RATE column equals BPV'S RECVD divided by the total number of bits received in valid frames.

**(E) BPV-Free Seconds**

This reading gives elapsed test time free of BPV errors. If HDB3 is selected, BPV's anticipated as part of the pattern are not subtracted from the total time.

NOTE: Time out of sync is included in the time displayed.

The RATE column equals BPV-FREE SECS divided by total test seconds.

**(F) Framing Errors**

The FRAMING ERRORS row displays the count of the individual errors in received Frame Alignment Signals.

The RATE column equals FRAMING ERRORS divided by FRAMES RCVD.

**(G) CRC-4 Errors**

CRC-4 ERRORS indicates total CRC-4 code word errors since **[RUN]** was pressed. This field is present when the G.703 Interface Control screen shows Enable CRC-4: **YES**.

The RATE is equal to total CRC-4 code word errors divided by the total number of CRC-4 code words received.

### (H) Sync Losses

**SYNC LOSSES** records the number of sync loss incidents. A sync loss occurs when the resync criteria, specified on the Interface Control screen, are met.

The **RATE** column shows total sync losses divided by total valid frames received.

### (I) Sync Loss Time

**SYNC LOSS TIME** displays time out of sync. Time out of sync may vary slightly, depending on selections made pertaining to resync on the Interface Control screen (see Section 53.5, **Resync Procedure**).

The **RATE** column shows sync loss time divided by total test seconds.

### (J) Error-Free Seconds

**ERROR-FREE SECS** displays the number of seconds free of CRC-4 errors, framing errors, and BPV's. To count a second as an error-free second, the line must be in sync during the *entire* second; if during any part of that second the line is out-of-sync, that second is not considered error-free.

The **RATE** column lists error-free seconds divided by total test seconds.

**NOTE:** This measurement differs from error-free seconds measured in G.703 BERT statistics. The BERT measurement includes bit errors as well.

### (K) G703 Line Conditions

When an error condition occurs, the status of the line under test appears in the **G703 LINE CONDITIONS** area at the bottom of the G.703 Statistics Screen. DTE line conditions appear in the highlighted box to the left; DCE conditions in the highlighted box to the right. Once the current condition changes, an abbreviation for the error is posted in the brackets which follow the current condition. This bracketed area contains an abbreviation for up to four previous conditions which have occurred in the present testing session.

**NOTE:** The order of the abbreviations in the previous conditions field is not necessarily a chronological representation of events.

When there is no longer an error condition on the line, **NORMAL** is displayed in the left-hand box. The types of errors that may appear as line conditions are explained in the following paragraphs.

1. *Remote alarms.* A remote alarm is sent to alert the remote site that the sender is experiencing an out-of-frame condition. The remote alarm signal can be transmitted as explained in Section 53.5(I) and displayed as **REMOTE ALRM**. The abbreviation **R** within brackets is used to indicate a remote alarm as a previous condition.

2. *Distant multiframe alarms.* A distant multiframe alarm indicates that the sender is experiencing some type of problem, such as losing sync or power loss. See Section 53.5(H). When a distant multiframe alarm occurs, the condition MULTIFR ALM is posted. The abbreviation M within brackets is used to indicate a previous distant multiframe alarm.
3. *Out-of-Sync.* This condition, OUT OF SYNC, is displayed anytime the frame resync criteria are met. The abbreviation Sy within brackets is used to indicate a previous loss of sync.
4. *Loss-of-signal.* Signal loss is indicated in one of two ways. If after **[NUM]** is pressed no signal is received from the line under test, the condition NO SIGNAL is posted. Any time a received signal is lost for a minimum of 150 ms, the message SIGNAL LOST is posted. Either type of signal loss is recorded as Sg within brackets in the line conditions box to indicate a previous condition.

When an emulate mode has been selected on the Line Setup screen *and* Transmit Mode: **NORMAL** has been selected on the Interface Control screen, the words NOT MONITORED appear on the side of the line that the INTERVIEW is emulating. If Transmit Mode: **DROPINS** is selected on the Interface Control screen, both sides of the line are monitored. (On the side of the line which the INTERVIEW is monitoring, the incoming channel — rather than the inserted INTERVIEW data — is analyzed.) This also holds true for the specific channels chosen for RD and TD when Channel Mode: **SPLIT** has been selected.

#### (L) G.703 Statistics as an Alternate Display to G.703 BERT

The function keys shown in Figure 53-20 appear at the bottom of the G.703 Statistics display when the INTERVIEW is running a G.703 BERT test. Press **[F8]** to display G.703 BERT Statistics; other display options are not available during a BERT test. Although they can be executed with regular G.703 statistics displayed, the commands in this bank of softkeys apply for the most part to the BERT test. Consult Section 9 for a description of these commands, BERT testing, and statistics.

One command in this group which does affect the G.703 Statistics display is RESET, **[F3]**. RESET sets the value of all timers and counters, including G.703 counters, to zero. The BERT test continues, however, even though the elapsed time (TEST SECONDS) at the top of the screen is reset.

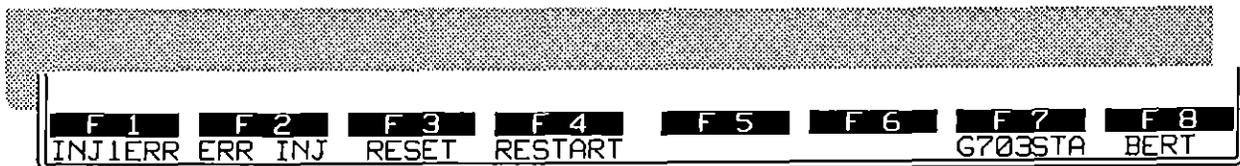


Figure 53-20 Run-time function keys available with G.703 Statistics Display when performing a G.703 BERT test