

DS1/T1/D4/ESF/SLC-96
DATA INTERFACE
(MODEL 40540)
OPERATING MANUAL

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GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains information on Telecommunications Techniques Corporation's (TTC) DS1/T1/D4/ESF/SLC-96 Data Interface (Model 40540). This information is divided into sections on: general information; interface description, installation, set-up; mainframe set-up; interface specifications; and service information.

1.2 INTERFACE OVERVIEW

The DS1/T1/D4/ESF/SLC-96 Data Interface allows a FIREBERD mainframe to test communications systems that meet the Bell System T1 (DS1) 1.544 Mb/s Digital Channel Service Specifications, CCITT 1.544 Mb/s Recommendations, and AT&T Publication 54016 specifications for Extended Superframe. T1 signals represent serial digital data. Binary data is represented using a differential bipolar (3-level) return-to-zero (RZ) signal. Either alternate mark inversion (AMI) or bipolar with 8 zero substitution (B8ZS) coding can be used. The data interface operates with either framed data, required by Digital Access Crossconnect Switches (DACS) and channel banks, or with unframed data used in unswitched networks. This data interface can terminate, bridge, or loop a line. It also allows error analysis based on either bit errors or bipolar violations (BPVs). This interface is capable of transmitting either loop-up or loop-down codes and is also capable of operating in an Extended Superframe (ESF) environment.

1.3 INTERFACE FEATURES

The DS1/T1/D4/ESF/SLC-96 Data Interface has the following features.

- Accepts low-level degraded signals, regenerates the data, and recovers timing from the data.
- Can terminate or bridge a line and simultaneously perform bit error violation analysis.

- Transmits loop-up or loop-down codes to control loopbacks in compatible Channel Service Units (CSU).
- Receives and transmits data with or without D4, ESF, or SLC*-96 framing patterns.
- Analyzes live traffic for bipolar violations, framing errors, or CRC errors.
- Transmits loop-up and loop-down codes to control loopbacks in compatible CSUs.
- Accepts and generates either an AMI or B8ZS encoded signal.
- Measure and generate jitter (with FIREBERD 6000 Options 6001, 6002, and 6003).
- Echoes all received data to the transmit output. The user can insert jitter (with FIREBERD 6000 Options 6001, 6002, and 6003) or inject BPV or logic errors into the retransmitted data. Automatic protection switch (APS) testing and link simulation can be performed by inserting logic errors, bipolar violations, or both in the transmitted data.
- Transmits data at 1.544 Mb/s with the clock recovered from the received signal, generated by the synthesizer, or provided by an external source.

*SLC is a registered trademark of AT&T Technologies.

1.4 INTERFACE COMPATIBILITY

The DS1/T1/D4/ESF/SLC-96 Data Interface is designed in accordance with the following specifications.

- Bell System T1 (DS1) 1.544 Mb/s Digital Channel Service Specifications.
- CCITT 1.544 Mb/s Recommendations.
- AT&T Publication 54016 specifications for Extended Superframe.

1.5 OPTIONS AND ACCESSORIES

The following cables are available from TTC for use with the DS1/T1/D4/ESF/SLC-96 Data Interface.

- Model 10559, 10' cable with WECO 310 plug to bantam plug.
- Model 10599, 4' cable with WECO 310 plug to bantam plug.
- Model 10615, 10' cable with bantam plug to bantam plug.
- Model 10648, 7' cable with bantam plug to alligator clips.
- Model 30503, 10' cable with bantam plug (dual) to 15-pin D maleconnector.
- Model 40602, 10' cable with bantam plug (dual) to RJ45S.
- Model 40601, 10' cable with bantam plug (dual) to RJ48C.

INTERFACE DESCRIPTION

2.1 INTRODUCTION

The DS1/T1/D4/ESF/SLC-96 Data Interface is a menu-controlled interface. This section describes the interface connectors, the interface function, the timing sources, and the self-loop test.

2.2 PHYSICAL DESCRIPTION

The DS1/T1/D4/ESF/SLC-96 Data Interface measures 7.3 inches (185 mm) wide, 1.5 inches (38 mm) high, and 5.1 inches (130 mm) deep. Two spring-tensioned screws secure the interface module to the FIREBERD Communications Analyzer rear panel. Connector pins on the interface module mate with the mainframe's connector receptacle when the interface panel is flush with the mainframe rear panel.

Bantam connectors are used to provide one input and four outputs for this interface. Figure 2-1 illustrates the DS1/T1/D4/ESF/SLC-96 Data Interface. Five bantam connectors provide the receiver input, the primary output, and the three auxiliary outputs.

2.3 FUNCTIONAL DESCRIPTION

The DS1/T1/D4/ESF/SLC-96 Data Interface allows the FIREBERD to test communications systems which use the T1 (DS1) 1.544 Mb/s digital channel service and other similar systems. This interface operates with either framed data, as required by Digital Access Crossconnect Switches (DACS) and channel banks, or with unframed data, as used in unswitched networks.

2.3.1 Timing Sources

On the FIREBERD 6000, one of three transmit timing sources can be selected: (1) the clock recovered by the interface from the incoming T1 signal; (2) the FIREBERD internal clock; or (3) the external BNC input. Selection of the timing source on the FIREBERD 6000 is made by pressing the front panel pushbutton switch labeled GEN CLK. Repeatedly pressing this pushbutton switch scrolls through the three timing source selections: SYNTH, INTF, or BNC.

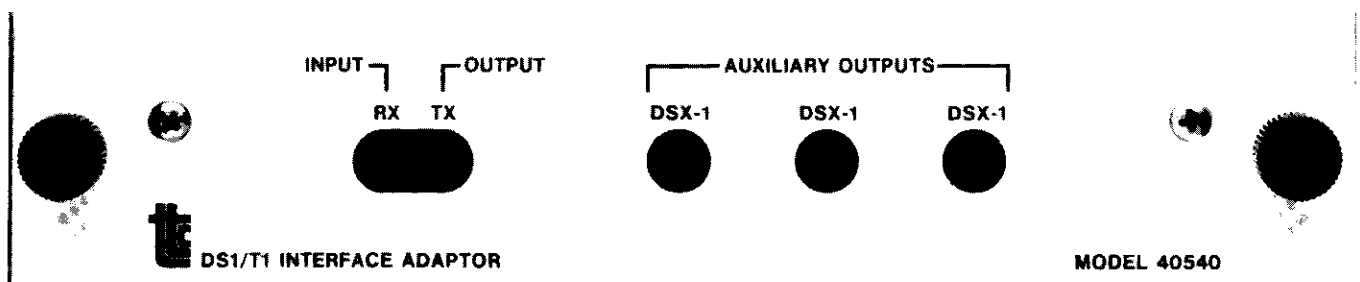


Figure 2-1
DS1/T1/D4/ESF/SLC-96 Data Interface (Model 40540)

Selection of the timing source on the FIREBERD 4000 is made by pressing the SETUP CATEGORY rocker switch until the LED next to the GENERATOR CLOCK label is illuminated. The three softkey pushbutton switches above the SETUP panel are used to select INTRNL, INTF, or BNC as the timing source. Selecting the DS1/T1/D4/ESF/SLC-96 Data Interface sets the internal timing source to 1544.0 kHz.

NOTE: The BPV/LOGIC error rate insertion rate is based on the internal timing source, which must be equal to 1544.0 kHz to be accurate.

2.3.2 Self-Loop

This data interface includes a relay that is activated by pressing the SELF LOOP pushbutton switch on the FIREBERD front panel. Pressing the SELF LOOP pushbutton switch connects the primary T1 driver to the line receiver. This provides quick verification of the FIREBERD and the data interface when performing bit error detection. The input and primary output connections do not need to be removed during the test, since complete isolation is provided by the relay, and the secondary outputs (DSX-1) are not affected by the Self-Loop mode.

NOTE: Do not set the generator clock (GEN CLK pushbutton switch on the FIREBERD 6000 or the GENERATOR CLOCK pushbutton switch on the FIREBERD 4000) to the INTF position during the Self-Loop mode. The THRU interface menu should be set to OFF.

INTERFACE INSTALLATION, SET-UP, AND OPERATION

3.1 INTRODUCTION

This section is divided into two major parts. Each part describes the installation, set-up, and operating procedures for the FIREBERD 6000 and the FIREBERD 4000 mainframes, respectively. Refer to the appropriate FIREBERD mainframe User's Guide and Operating Manual for mainframe operating procedures and for additional information.

3.2 FIREBERD 6000

The following sections describe installation, set-up, and operation of this interface for the FIREBERD 6000 mainframe.

3.2.1 Interface Installation

The following procedure describes the steps for installing the interface in a FIREBERD 6000 mainframe.

CAUTION: Turn the AC power OFF before installing the interface module in the FIREBERD mainframe.

- (1) Ensure that the POWER switch, located on the front panel, is in the OFF position on the FIREBERD mainframe.
- (2) Turn the FIREBERD mainframe around to expose the rear panel interface slot.
- (3) Insert the interface module into the vacant interface slot, with the printed circuit (PC) board facing up. The PC board edges fit into slides on either side at the top edges of the interface slot.
- (4) Press the interface module firmly into the mainframe mating connector, until the interface faceplate is flush with the mainframe rear panel.
- (5) Secure the interface in the mainframe by turning the two interface front panel thumb screws clockwise, until finger tight.

3.2.2 FIREBERD 6000 Mainframe Set-Up

The following steps outline the procedure for setting up a FIREBERD 6000 mainframe after the interface installation is complete.

- (1) With the DS1/T1 Data Interface installed, turn the AC power on by pressing the front panel POWER switch to the ON position.
- (2) Connect the T1 signal source to the rear panel bantam connector marked INPUT.
- (3) Press the DATA pushbutton switch to select the desired data pattern. A data pattern is selected when the LED is illuminated next to the data pattern label. Refer to the FIREBERD 6000 User's Guide for a description of the different data patterns available and their uses.
- (4) Press the GEN CLK pushbutton switch to select the signal timing source for use during the test. Selecting a signal timing source other than SYNTH requires an external clock source from either the network or from another source.
- (5) Setting the TIMING MODE is not necessary with the DS1/T1 Data Interface installed.
- (6) Press the MENU pushbutton switch to illuminate the LED next to the INTF SETUP (interface set-up) label. The message **INTERFACE: XXXXXX** is displayed on the top line and the available interfaces are displayed on the bottom line.
- (7) Press the DS1/T1 softkey to select the DS1/T1 Data Interface. Pressing this softkey displays **INTERFACE: DS1/T1** on the top line and three menu selections (**RESULT**, **THRU**, and **INPUT**) on the bottom line.
- (8) Once the desired menu parameter is visible in the display, press the corresponding softkey to change the interface operating parameter. Refer to Section 3.2.3 for a description of the menus and parameter choices.

- (9) After the interface parameters are set as desired, press the ENTER key to display the top level interface menu (**INTERFACE: D1/T1**).
- (10) Press the MENU pushbutton switch to select other criteria required for the test to be performed.
- (11) Set the other front panel controls (ANALYSIS RESULTS, ANALYSIS MODE, PRINTER, etc.) as required for the test to be performed.
- (12) Press the SELF LOOP pushbutton switch to perform the self-test on the mainframe and the installed interface.

3.2.3 Interface Set-Up

The DS1/T1 Data Interface is selected and controlled through the FIREBERD 6000 front panel controls. This section describes the interface selections available, after the mainframe has been configured.

Pressing the DS1/T1 softkey displays the top level of the DS1/T1 Data Interface. This menu displays the first three menu selections (RESULT, THRU, and INPUT) and illuminates the LED within the MORE key. Pressing the MORE key displays the next three menu selections (BPVINS, CODING, and FRAMED) and the MORE key is still illuminated. Pressing the MORE key again displays the last menu selection (LBO) and the MORE key is still illuminated. Pressing the MORE key again redisplay the first three menu selections. Use the MORE key to display the menu that you desire to verify or change and then press the corresponding softkey to enter that menu. Figure 3-1 illustrates the FIREBERD 6000 DS1/T1/D4/ESF/SLC-96 Data Interface menu.

The following paragraphs list each menu, along with a description of the selections available.

Once the DS1/T1 menu is selected, **INTERFACE DS1/T1** is visible on the first line of the display. Pressing the SETUP SELECT rocker switch displays the next menu available for the DS1/T1/D4/ESF/SLC-96 Data Interface. Repeatedly pressing this rocker switch displays all the available menus and then again displays the interface selection top level (home) menu. Pressing the up arrow key displays the next higher menu level.

After the interface parameters are set as desired, press the ENTER key to display the top level interface menu (**INTERFACE: DS1/T1**), or continue pressing the MORE key to continue through the other interface parameters.

RESULT

STD - Selects standard analysis results. Bit error, bipolar violation (BPV), framing error, and cyclic redundancy check (CRC) error analysis are performed. During the time interval when frame synchronization and frame losses are detected, framing error and CRC error analysis are not performed. Framing error analysis is only performed when this selection is combined with the FRAMED/D4 or FRAMED/SLC96 selection from the FRAMED menu. CRC error analysis is only performed when this selection is combined with the selection of Fe from the FRAMED menu.

LIVE - Selects live traffic analysis results. Bit error analysis is not performed, but BPV, framing error, and CRC error analysis are performed during the time that the signal is present. Framing error analysis is only performed when this selection is combined with the selection of D4 on the FRAMED menu. CRC error analysis is only performed when this selection is combined with the selection of Fe from the FRAMED menu.

THRU

OFF - Selects the interface normal operation, that is, received data is analyzed by the FIREBERD's data receiver and transmit data is generated by the FIREBERD's data generator.

LLB - Selects Line Loopback (LLB), causing the interface to act as a repeater. All data received is echoed, unchanged, on the transmitter output. This selection may be used to emulate a Channel Service Unit (CSU) in the loopback mode. The received signal is still analyzed by the FIREBERD's data receiver. **NOTE:** The LLB selection disables the ERRINS and CODING menus, and the data is not re-encoded prior to transmission.

TLB - Selects Test Loopback (TLB). This selection emulates a CSU or a channel bank in digital loopback. All received data is echoed on the transmitter output and the received signal is still analyzed by the FIREBERD's data receiver. ERRINS, CODING, and jitter generation (if this option is installed) remain active. BPVs and B8ZS coding are stripped from the received signal. The outgoing signal is re-encoded with AMI or B8ZS according to the CODING menu selection; BPV, LOGIC, or LOGIC & BPV errors are inserted depending on the ERRINS menu selection. The data is jittered if the Jitter Generator option (FIREBERD 6000 Option 6003) is installed and selected. **NOTE:** The THRU menu must be set to OFF for both the error insertion (ERRINS) and line coding (CODING) menus to operate.

The message **INTERFACE: XXXXXX** is displayed on the top line and a list of available interfaces is displayed on the bottom line.

- (7) Press the DS1/T1 softkey to select the DS1/T1 Data Interface. Pressing this softkey displays **INTERFACE: DS1/T1** on the top line. Pressing the right SETUP SELECT switch displays the first interface menu in the display. Repeatedly pressing the right SETUP SELECT rocker switch scrolls through the menus and back to the top level interface menu. Refer to Figure 3-2 for the FIREBERD 4000 mainframe DS1/T1D4/ESF/SLC-96 Data Interface menu.
- (8) Once the desired menu parameter is visible in the display, press the corresponding softkey to change the interface operating parameter. Refer to paragraph 3.3.3 for a description of the menus and parameter choices.
- (9) After the interface parameters are set as desired, press the HOME key to display the top level interface menu (**INTERFACE: DS1/T1**) or continue pressing the right SETUP SELECT rocker switch to resume scrolling through the other interface parameters.
- (10) Press the SETUP CATEGORY rocker switch to set or verify other criteria required for the test to be performed. Pressing the SETUP CATEGORY rocker switch to illuminate the LED next to the SETUP SUMMARY label displays the selected test pattern, interface, clock frequency, and the two most significant interface parameters.
- (11) Set the other front panel controls (RESULT SELECT, CATEGORY, PRINTER, etc.) as required to configure the mainframe for the test to be performed.
- (12) Press the SELF LOOP pushbutton switch to perform the self-test on the mainframe and installed interface.

3.3.3 Interface Set-Up

This section describes the interface selections available, after the mainframe has been configured. The DS1/T1 interface is selected and controlled by the mainframe front panel controls. If more than three interfaces are available, the MORE key illuminates. Press the softkey directly below the **DS1/T1** in the display window to select the DS1/T1 Data Interface. See Figure 3-2 for the FIREBERD 4000 DS1/T1/D4/ESF/SLC-96 Data Interface menu.

Once the DS1/T1 menu is selected, **INTERFACE DS1/T1** is visible on the first line of the display. Pressing the right SETUP SELECT rocker switch displays the next menu available for the DS1/T1 Data Interface. Repeatedly pressing this rocker switch displays all the available menus and then again displays the interface selection top level (home) menu.

After the interface parameters are set as desired, press the HOME key to display the top level interface menu (**INTERFACE: DS1/T1**), or continue pressing the right SETUP SELECT switch to continue through the other interface parameters.

The following paragraphs describe the interface menu options and menu selections for the DS1/T1/D4/ESF/SLC-96 Data Interface.

FRAMING

UNFRAM - Selects unframed data and performs data analysis on the full 1.544 Mb/s bandwidth of the T1 line. No framing bits are added during transmission and no data bits are stripped during reception. Results related to the framing signal are not available.

D4 - Allows the FIREBERD to transmit and analyze T1 signals with D4 (Superframe) framing. D4 framing occupies 8 kb/s of the 1.544 Mb/s bandwidth and the selected data pattern occupies the remaining 1.536 Mb/s. The D4 framing pattern is compatible with D1D, D2, D3, and D4 channel banks.

ESF - Allows the FIREBERD to transmit and analyze T1 signals with ESF (Extended Superframe) framing. With ESF (or Fe) framed signals, the framing pattern occupies 2 kb/s, the CRC check bits occupy 2 kb/s, the data link occupies 4 kb/s, and the selected data pattern occupies the remaining 1.536 Mb/s. The data link is transmitted with an all-ones pattern and is examined only for the presence of a Yellow Alarm signal.

SLC 96 - This selection transmits and analyzes T1 signals with SLC-96 framing. SLC-96 framing and the control channel occupy 8 kb/s of the 1.544 Mb/s bandwidth, with the selected data pattern occupying the remaining 1.536 Mb/s. The transmitted framing pattern is D4 compatible.

NOTE: During the D4 and ESF framing modes, receiver frequency measurements are available only when the data interface is in continuous frame synchronization to the incoming data. If there is intermittent frame synchronization or no frame synchronization at all (e.g., unframed data), receiver frequency measurements may be obtained by setting the FRAMED menu to OFF.

INPUT

TERM - Selects normal operation, terminating the input with 100 ohms and accepting a T1 signal attenuated with between 0 dB and 24 dB of cable loss.

BRIDGE - Allows monitoring of T1 lines that are already terminated. In this mode, the input exhibits an impedance greater than 1000 ohms, accepting signals attenuated between 0 dB and 24 dB due to cable loss.

DSXMON - Conditions the receiver to operate with signals from DSX-Monitor ports. In this mode, the input accepts T1 signals resistively attenuated between 10 dB and 30 dB, and terminates the line with 100 ohms.

THRU-DATA

OFF - Selects the interface normal operation, that is, received data is analyzed by the FIREBERD's data receiver and transmit data is generated by the FIREBERD's data generator.

LLB - Selects Line Loopback (LLB), causing the interface to act as a repeater. All data received is echoed, unchanged, on the transmitter output. This selection may be used to emulate a Channel Service Unit (CSU) in the lineback mode. The received signal is still analyzed by the FIREBERD's data receiver.

NOTE: The LLB selection disables the ERRINS and CODING menus, and the data is not re-encoded prior to transmission.

TLB - Selects Test Loopback (TLB). This selection emulates a CSU or a channel bank in digital loopback. All received data is echoed on the transmitter output and the received signal is still analyzed by the FIREBERD's data receiver. ERRINS, CODING, and jitter generation (if this option is installed) remain active. BPVs and B8ZS coding are stripped from the received signal. The outgoing signal is re-encoded with AMI or B8ZS according to the CODING menu selection; BPV, LOGIC, or LOGIC & BPV errors are inserted depending on the ERRINS menu selection.

NOTE: The THRU menu must be set to OFF for both the error insertion (ERRINS) and line coding (CODING) menus to appear.

LBO

0 dB - Sets the primary output (TX) to the DSX level with no line build-out (0 dB attenuation).

-7.5 dB - Provides a -7.5 dB line build-out, attenuating the primary output with 7.5 dB of simulated cable loss.

-15 dB - Provides a -15 dB line build-out, attenuating the primary output with 15 dB of simulated cable loss.

LINE CODING

AMI - Allows Alternate Mark Inversion (AMI) coding. AMI is encoded by transmitting a pulse of alternating polarity for each "one" (Mark) and no pulse for each "zero" (Space).

B8ZS - Allows Bipolar with 8 Zero Substitution (B8ZS) coding which also transmits a pulse of alternating polarity for each "one" and no pulse for each "zero", except that strings containing 8 consecutive zeros are replaced by a zero substitution code. This causes the series of 8 zeros to be replaced by 00V10V1, where 0 represents a Space, 1 represents a Mark, and V represents a bipolar violation. The B8ZS decoder restores a detected B8ZS pattern to the original 8 zeros.

ERRINS

OFF - Selects the normal mode of operation in which no errors are transmitted.

SINGLE - This selection allows a single BPV insertion each time the SINGLE softkey is pressed. After the BPV is inserted, the INSERTION RATE: line again displays OFF.

1E-6 - Causes BPVs to be inserted at a fixed rate of 1E-6 bits (1 in one million).

BPV - Selects BPV as the type of error to be inserted.

LOGIC - Selects logic errors to be inserted. These errors may fall on any bit (either data for framing).

L+BPV - Selects the type of error emulation that typically occurs on repeated lines by adding or deleting a pulse after the T1 signal has been encoded with AMI or B8ZS coding.

NOTE: If B8ZS coding is selected, BPV and logic error multiplication occur when the LOGIC & BPV error is inserted inside of a B8ZS code.

NOTE: To ensure accurate error insertion rates, the internal frequency must be set to 1544 kHz. Any other setting causes inaccurate insertion rates.

3.3.5 FIREBERD 4000 Interface Remote Control

Using the built-in RS-232 interface or the optional IEEE-488 interface, the FIREBERD mainframe can be remotely controlled. It is assumed that the operator is already familiar with the FIREBERD 4000 remote operation. The Remote

Control Commands Handbook describes the mainframe remote control capabilities.

Only the remote control commands specific to this interface are included in Table 3-2. For additional information concerning remote control of the FIREBERD mainframe, refer to the Remote Control Commands Handbook.

**Table 3-2
FIREBERD 4000 DS1/T1 Data Interface Remote Commands**

Remote Command	Result
INT SET	Displays the active interface
INT SEL SLOT 1	Selects interface slot 1
INT SEL SLOT 2	Selects interface slot 2
INT SET DS1/T1 THR TLB	Selects the test loopback data mode
INT SET DS1/T1 THR LLB	Selects the line loopback data mode
INT SET DS1/T1 THR OFF	Disables the loopback data mode
INT SET DS1/T1 INP TER	Selects normal (100-ohm) input termination
INT SET DS1/T1 INP BRI	Selects bridge (1000-ohm) input termination
INT SET DS1/T1 INP DSX MON	Selects DSX-Monitor (100-ohm) resistive input termination
INT SET DS1/T1 COD AMI	Selects AMI coding
INT SET DS1/T1 COD B8Z	Selects B8ZS coding
INT SET DS1/T1 FRA OFF	Selects unframed format
INT SET DS1/T1 FRA D4	Selects D4 framing format
INT SET DS1/T1 FRA ESF	Selects ESF framing format
INT SET DS1/T1 FRA SLC	Selects SLC-96 framing format
INT SET DS1/T1 LBO 0	Selects 0 dB line build-out
INT SET DS1/T1 LBO -7.5	Selects -7.5 dB line build-out
INT SET DS1/T1 LBO -15	Selects -15 dB line build-out
INT SET DS1/T1 ERR INS OFF	Disables error insertion mode
INT SET DS1/T1 ERR INS BPV	Selects bipolar violation error insertion mode
INT SET DS1/T1 ERR INS LOG	Selects logic error insertion mode
INT SET DS1/T1 ERR INS L+BPV	Selects logic and bipolar violation error insertion mode
INT SET DS1/T1 ERR INS SIN	Selects the single error insertion mode
INT SET DS1/T1 ERR INS 1E-6	Selects the 1E-6 fixed error rate

INTERFACE SPECIFICATIONS

4.1 INTRODUCTION

This section contains the specifications for the DS1/T1/D4/ESF/SLC-96 Data Interface. This information is listed in Table 4-1.

Table 4-1
DS1/T1/D4/ESF/SLC-96 Data Interface Specifications

Item	Specification
<u>Pulse Mask</u>	
Pulse Amplitude:	$\pm 3V (\pm 0.3V)$, with a maximum imbalance of $\pm 0.15V$.
Half Amplitude Pulse Width:	324 ns (± 24 ns), with a maximum imbalance of ± 15 ns.
Rise and Fall Times:	100 ns maximum (10% to 90%).
Trailing Edge Overshoot:	10% to 30% of pulse height with decay to 10% of pulse height, within 400 ns.
Line Codes:	Bipolar (pseudoternary); selectable AMI or B8ZS.
<u>Loopback Code Generation</u>	
Loop-Up Code:	Repetitive "10000".
Loop-Down Code:	Repetitive "100".
<u>Line Build-out (Primary Circuit Only)</u>	
-7.5 dB LBO:	-7.5 dB ± 1 dB attenuation at 772 kHz.
-15 dB LBO:	-15.0 dB ± 1 dB attenuation at 772 kHz.
<u>T1 Input Circuit</u>	
Input Impedance:	100 ohms $\pm 5\%$ in TERM or DSXMON position. 1000 ohms (minimum) in BRDG position.
Input Level:	$\pm 3V$ typical, with 0 dB to 24 dB cable attenuation in BRDG and TERM, with 10 dB to 30 dB resistive attenuation in DSXMON.

**Table 4-1
DS1/T1/D4/ESF/SLC-96 Data Interface Specifications (Continued)**

Item	Specification
<u>T1 Input Circuit (Continued)</u>	
Data Rate Range:	1.544 Mb/s \pm 500 b/s minimum.
Jitter Analysis Input Level:	\pm 3V (DSX-1) with 0 dB to 15 dB resistive attenuation in TERM. \pm 3V (DSX-1) with 0 dB to 24 dB cable attenuation in BRDG. \pm 3V (DSX-1) with 10 dB to 30 dB resistive attenuation in DSXMON.
Thru Data LLB Input Level:	\pm 3V (DSX-1) with 0 dB to 24 dB cable attenuation in TERM. \pm 3V (DSX-1) with 0 dB to 24 dB cable attenuation in BRDG. \pm 3V (DSX-1) with 10 dB to 30 dB resistive attenuation in DSXMON.
Line Code:	Bipolar (pseudoternary), AMI with automatic detection of B8ZS coding.
Jitter Tolerance:	Meets jitter mask given in CCITT Recommendation G.703 and in Bell publications PUB 41451 and PUB 62411.
Excess Zero Detection:	16 or more sequential zeros.
<u>Simplex Current Path</u>	
Current:	60 mA typical, 145 mA maximum.
Voltage Drop:	7.3V \pm 0.5V at 60 mA.
Polarity:	Bi-directional - either pair may be positive with respect to the other pair.
Breakdown Voltage:	\pm 150V minimum, from Tip and Ring to Chassis Ground.

MAINTENANCE AND SERVICE

5.1 INTRODUCTION

This section contains information on maintenance and service for the DS1/T1/D4/ESF/SLC-96 Data Interface, including TTC's warranty policies and repair procedures.

5.2 MAINTENANCE

5.2.1 In Case of Difficulty

If the mainframe totally fails to operate after installing the interface module (i.e., no panel indicators light), check the following items:

- Verify that the supply line voltage is present.
- Verify that the AC line cord is supplying the line voltage to the mainframe.
- On the FIREBERD 6000, verify the proper line voltage selection.
- On the FIREBERD 6000, verify that the fuse is not blown and that it is correct for the supplied line voltage.
- Verify that the interface is properly seated in the mainframe.

If some of the indicators light but the unit fails to operate, verify that the interface installed is the correct type and that it is properly installed. Be sure to turn the power off before trying to remove or reseal the interface. If another interface module is available, turn off the power and substitute the other interface.

If troubles still persist, follow the self-test procedures in the FIREBERD Operating Manual as an aid in localizing the problem. If the mainframe continues to be inoperative, refer to the following sections for service information, or call the TTC Customer Service Department for assistance.

5.3 SERVICE

5.3.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

Data interfaces, accessories, cables, breakout boxes, and all equipment (other than FIREBERD mainframes) will be repaired or replaced (at our option), at no charge, for a period of one (1) year after shipment to the customer.

Liability under this warranty extends only to the replacement value of the equipment. This warranty is void if:

- (1) Equipment has been altered or repaired without specific written authorization from TTC.
- (2) Equipment is installed or operated other than in accordance with instructions contained in TTC literature and operating manuals.

No other warranty is expressed or implied. TTC is not liable for consequential damages.

5.3.2 In-Warranty Service

Equipment in warranty must be returned to the factory with shipping prepaid. The equipment should be packed and shipped in accordance with the instructions in Section 5.3.4 of this manual. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Repair Department. The RA number should be included on all paperwork and be clearly marked on the outside of the shipping container.

After the equipment is repaired by TTC, it will be tested to applicable specifications, burned-in for at least 24 hours, retested, and returned to the customer with shipping prepaid.

A brief description of the work performed and the materials used will be provided on the Equipment Repair Report that will be furnished with the returned equipment.

5.3.3 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty. However, there is a minimum charge applied to each request for out-of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment be repaired. Contact the TTC Repair Department for specific information on the minimum out-of-warranty repair charge.

The customer will be billed for parts and standard labor rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair work can be started. A hard copy of the purchase order must be received by TTC before the repaired equipment can be shipped to the customer. A description of the materials used will be provided in the Equipment Repair Report.

Once an out-of-warranty repair is made, the repaired part or component is warranted for 90 days. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the 90-day repair warranty.

5.3.4 Equipment Return Instructions

To all equipment returned for repair, the customer should attach a tag that includes the following information.

- (1) Owner's name and address.
- (2) A list of equipment being returned and the corresponding serial number(s).
- (3) A detailed description of the problem or of the service requested.
- (4) The name and telephone number of the person to contact regarding questions concerning the repair(s).
- (5) The Return Authorization (RA) number.

If possible, the customer should return the equipment in the original shipping container and material. If the original container is not available, the unit should be carefully packaged so that it will not be damaged in transit. TTC is not liable for any damage that occurs during shipment. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

