50- 11033-01

DDS DS0A/B
DATA INTERFACE
(MODEL 30678)
OPERATING MANUAL

June 1995

This Interface Manual applies to all FIREBERD 4000 Communications Analyzers Incorporating Software Revision 5.0, or later, and to all FIREBERD 6000 Communications Analyzers Incorporating Sofware Revision H, or later.

Rev. D

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GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains descriptions, set-up and operating instructions, specifications, maintenance, and service information for the Telecommunications Techniques Corporation (TTC) Model 30678 DDS DS0A/B Data Interface. The DDS DS0A/B Data Interface allows the FIREBERD 6000 and 4000 mainframes to be connected to Digital Data System (DDS) circuits for DS0A, DS0B, and clear channel testing and analysis.

1.2 INTERFACE FEATURES

The DDS DS0A/B Data Interface has the following features.

- Controlled through the FIREBERD front panel interface set-up menu or from a remote terminal.
- Analyzes DS0A-formatted data (full duplex, synchronous data) at 2.4, 4.8, 9.6, 19.2, and 56 kb/s; DS0B-formatted data at 2.4, 4.8, and 9.6 kb/s; and DS0 64 kb/s clear channel data.
- Analyzes DDS secondary channel data for either DS0A- or DS0B-formatted data at any applicable rate.
- Provides an RS-232-C Interface which allows another FIREBERD Communications Analyzer or a protocol analyzer to simultaneously test either the primary or secondary channel.
- Establishes and maintains alternating loopbacks at OCUs, DSUs, CSUs (with or without local loop repeaters), up to two 56 kb/s repeaters, and HL96NY terminals.
- Establishes latching loopbacks at compatible OCUs, CSUs, LSIs, MJUs, DS0-DPs, and DSUs.
- Generates a programmable data only, frame only, or data and frame bit error rate (fixed rate in the FIREBERD 4000).
- Establishes DDST loopback.
- Controls single or cascaded Multipoint Junction Units (MJUs).
- Tests integral subrate multiplexers (ISMX) or subrate data multiplexers (SRDM) by transmitting data in one format (DS0A or DS0B) and accepting data in another (DS0B or DS0A).
- Provides a byte encoder for testing circuit sensitivity to specific byte codes singly or continuously.
- Establishes an interface THRU mode for passing data through the interface without affecting the data (with or without error insertion).
- Samples and displays the received data bytes and identifies network control codes by name.

1.3 INTERFACE COMPATIBILITY

The DDS DS0A/B Data Interface is designed in consideration with the following publications and specifications.

- AT&T CB 126, April 1981, D3 and D4 56 Subrate Dataport Channel Unit Technical Reference and Compatibility Specification.

- AT&T CB 141, April 1981, D3 and D4 56 kb/s Dataport Channel Unit Technical Reference and Compatibility Specification.
- AT&T Communications Technical Reference PUB62120, April 1984, Digital Data System with Secondary Channel.
- AT&T Communications Technical Reference PUB62310, September 1983, Digital Data System Channel Interface Specification.
- Bellcore, TA-TSY-000055, Issue 3, April 1987, Basic Testing Functions for Digital Networks and Services.
- Bellcore, TA-TSY-000189, Issue 1, April 1986, Generic Requirements for the Subrate Multiplexer.
- Bellcore, TA-TSY-000192, Issue 2, April 1986, Digital Data System (DDS) Multipoint Junction Unit (MJU) Requirements.
- Bellcore, TR-NPL-000157, Issue 1, September 1985, Secondary Channel in the Digital Data System: Channel Interface Requirements.

1.4 OPTIONS AND ACCESSORIES

The following cables are available from TTC for the DDS DS0A/B Interface.

- Model 30488, 10' DS0 clock cable with 9-position D-type male to 5-pin female connectors (supplied with interface).
- Model 20309, 10' OIU adaptor cable with 9-position D-type male to 9-position D-type male connectors.
- Model 30611, 4' cable with 9-position D-type male to 5-pin male connectors.
- Model 30518, 14' cable with dual bantam plugs to 5-pin male connector.
- Model 10615, 10' bantam plug to bantam plug cable.
- Model 10648, 10' bantam plug to alligator clips cable.

SECTION 2
INTERFACE DESCRIPTION

2.1 INTRODUCTION

The DDS DS0A/B Data Interface is a menu controlled interface with no mechanical controls. This section describes the front panel connectors and functional descriptions of each interface capability and feature. All interface control is provided through the mainframe interface set-up menu or from a remote device. The DS0A/B Interface menu and remote control are described in Section 3 for the FIREBERD 6000 and Section 4 for the FIREBERD 4000.

2.2 PHYSICAL DESCRIPTION

The DDS DS0A/B Data Interface has clock (CLOCKS) and data (TX OUTPUT and RX INPUT) connections which allow the FIREBERD to connect to the DDS network (see Figure 2-1). The 25-pin connector (PROTOCOL PORT, DCE) provides full duplex access to unformatted primary or secondary channel data. The interface module slides into the rear panel interface slot in the FIREBERD and front panel slot in the interface extender unit (IEU), or ISU-6000.

NOTE: The FIREBERD 6000 Communications Analyzer requires Revision E software or greater to operate with the DDS DS0A/B Data Interface. All revisions of the FIREBERD 4000 operate with the interface.

2.2.1 Interface Clock Connection

The interface CLOCKS connector is a female, 9-pin, D-type, subminiature connector (see Figure 2-1). It provides input connections for logic and bipolar level bit (64 kb/s) and byte (8 kb/s) clocks. The clock level format is determined by the clock cable used. A clock cable (Model 30488) is supplied with the interface for connecting to 5-pin clock connectors. When combined with an adaptor cable (Model 30518), the clock cable permits access to separate bit and byte clocks through bantam jack connectors. An optional cable with 9-pin male-to-male connectors (Model 20309) is available to connect the FIREBERD to an office interface unit (OIU) in the D4 channel bank. The connector pin assignments are listed in Table 2-1.

Table 2-1
CLOCKS Connector Pin Assignments

Pin #	Description
1	Not connected
2	Signal ground
3	Logic level 64 kb/s bit clock input
4	Logic level 8 kb/s byte clock input
5	Signal ground
6	Bipolar 8 kb/s byte clock input (+)
7	Bipolar 8 kb/s byte clock input (-)
8	Bipolar 64 kb/s byte clock input (+)
9	Bipolar 64 kb/s byte clock input (-)

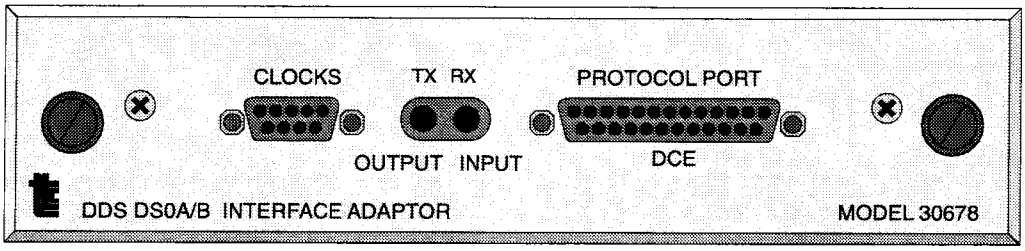

Figure 2-1
The DDS DS0A/B Data Interface

2.2.2 Interface Data Connections

The two interface data connections, labeled TX OUTPUT and RX INPUT, are bantam tip-ring-sleeve jacks. The jacks only accept bantam plugs. The RX INPUT jack can be terminated in the bipolar mode by grounding the jack sleeve lead. When the RX INPUT jack is terminated, the mainframe ALM1 LED illuminates. When the sleeve is not grounded, the RX INPUT can bridge an existing termination. Logic and bipolar signal formats are selectable through the DS0A/B Interface Connector menu. The bipolar signal which appears on the trip and ring jack lead is transmitted at ±5V. The interface can receive a bipolar signal from ±3.5 to ±5V. The bipolar signals are non-return-to-zero (NRZ) with alternate mark inversion (AMI) coding. The logic level signals appear on the tip jack leads when testing near-end circuits (LOGIC NEAR) and on the ring jack leads when testing the far-end circuits (LOGIC FAR). The logic signal level is 0V to +5V.

2.2.3 Protocol Port Connection

The DCE PROTOCOL PORT is an EIA RS-232-C, 25-pin, female connector that allows another FIREBERD or protocol analyzer to be connected to the interface for direct access to unformatted primary or secondary channel data. The auxiliary test set can transmit and receive data on the channel the FIREBERD is not testing. This permits simultaneous testing of both primary and secondary channels. RTS controls the port operation. When RTS is high, the port can transmit and receive data. When RTS is low, all Marks are substituted for port data. Table 2-2 lists the protocol port pin assignments.

Table 2-2
DCE PROTOCOL PORT Connector
Pin Assignments

Pin #	Abbrev.	Direction	Description
2	TD	Input	Transmit Data
3	RD	Output	Received Data
4	RTS	Input	Request to Send
5	CTS	Output	Clear to Send
6	DSR	+V	Data Set Ready
7	SGND	—	Signal Ground
8	RLSD	+V	Received Line Signal Detect
15	SCT	Output	Serial Clock Transmit
17	SCR	Output	Serial Clock Receive

RS-232-C compatible and configured as the DCE.
Pins 6 and 8 are internally tied high.

2.3 FUNCTIONAL DESCRIPTION

The DDS DS0A/B Data Interface provides the FIREBERD 6000 and 4000 Communications Analyzers with the ability to test and analyze Digital Data System (DDS) circuits at the DS0A and DS0B levels and 64 kb/s clear channel. With the DDS DS0A/B Interface, the FIREBERD can test the DDS network in a straightaway test with another FIREBERD or KS-type test set, or by itself with the network loopback capabilities. The following information provides a functional description of the clock and data signals, test modes, and capabilities of the interface.

2.3.1 Data and Clock Signals

All signals between the FIREBERD and DDS network are made through the DDS DS0A/B Interface. The DDS DS0A/B Interface operates with full duplex, synchronous data. The test data patterns are transmitted from the TX OUTPUT jack in either a DS0A or DS0B bipolar or logic level signal format at data rates of 2.4, 4.8, 9.6, 19.2, 56, and 64 kb/s. The RX INPUT jack accepts the DS0A or DS0B data from the DDS network for analysis at the same signal levels and data rates as the TX OUTPUT jack. Not only does the DDS DS0A/B Interface test and analyze the primary data channel, it also provides the capabilities to test the DDS secondary channel.

The bit (64 kb/s) and byte (8 kb/s) clocks are provided to the FIREBERD through the CLOCKS connector on the interface. The DDS bit and byte clocks supplied to the interface synchronize the interface and mainframe to the DDS network data and clocks for normal operation.

NOTE: The bit and byte clock signals must be supplied to the interface for all interface operating modes, including the mainframe SELF LOOP.

2.3.2 DS0A Channel Testing

When configured for DS0A operation, the interface formats the test pattern with the appropriate frame and control bits and byte stuffing format (as required) to bring the data rate up to the 64 kb/s rate. When the interface is operating at 19.2 kb/s, the front panel frame synchronization LED (FRM SYNC on FIREBERD 6000 and FRAME SYNC on FIREBERD 4000) illuminates indicating that the interface has synchronized with the received 19.2 kb/s framing pattern (01100). Once synchronized to the incoming signal, framing errors and other results are available.

2.3.3 DS0B Channel Testing

The interface can test DS0B signals and associated framing at 2.4, 4.8, and 9.6 kb/s on any one of up to 20 channels. The subrate used determines the number of available channels for which the subrate multiplexer is configured, i.e., 2.4 kb/s allow 20 channels, 4.8 kb/s allow 10 channels, and 9.6 kb/s allows 5 channels. When testing the DS0B channel, the test data is placed in the selected DS0B channel and the Unassigned Multiplex Channel (UMC) code is placed on the remaining channels. The subrate framing pattern within the DS0B signal identifies the subrate and number of customer signals or channels that are multiplexed into a single DS0B signal operating at 64 kb/s. The DS0B framing patterns are shown in Table 2-3 for each subrate and DS0B multiplexer configuration.

Table 2-3
DS0B Framing Patterns

Channels	Rate	Bit Pattern
1 to 5	9.6 kb/s	01100
1 to 10	4.8 kb/s	01100 10100
1 to 20	2.4 kb/s	01100 10100 11100 00100

The interface acquires frame synchronization after two complete unerrored framing patterns are detected. When DS0B frame synchronization has been achieved, the front panel frame synchronization LED (FRM SYNC on FIREBERD 6000 and FRAME SYNC on FIREBERD 4000) illuminates. Once framing synchronization has occurred, the FIREBERD monitors the framing and data patterns and reports inconsistencies in the mainframe analysis results display.

2.3.4 64 kb/s Clear Channel Testing

Pressing the CLRCH mode softkey automatically configures the interface for 64 kb/s clear channel operation. Data is then transmitted and received within the full 8-bit byte. Since there is no control bit, control commands such as loopbacks cannot be enabled. Test data generated by the mainframe is transmitted and received at 64 kb/s without control and framing bits. It should be noted that the BYTE encoder is disabled during clear channel operation.

NOTE: According to DDS circuit specifications, no more than seven consecutive zeros may be transmitted per data byte. Use the appropriate fixed (MARK, 1:1, or 1:7) or pseudorandom (63 or 511) test patterns to accomplish this requirement.

2.3.5 Primary and Secondary Channel Testing

In some DDS networks, a primary data channel and a secondary low-speed data channel are available to the customer. The DDS secondary channel provides the customer with the ability to communicate, manage, and test the network without interrupting the primary data channel. The secondary channel is made available by time-sharing every third control bit (bit 8) of the main data stream. The FIREBERD can test and analyze the secondary channel from the DS0A/B Interface with all modes except clear channel.

Both channels can be tested through the DS0A/B Interface, one at a time by the FIREBERD or simultaneously with a test instrument connected to the interface PROTOCOL PORT. The auxiliary CHAN menu controls which DDS channel the FIREBERD is testing. Pressing the PRI (primary) or SEC (secondary) softkey switches the FIREBERD between the channels. Normally, the FIREBERD transmits and receives data over the primary channel, while the secondary channel can be accessed through the PROTOCOL PORT. However, if the secondary channel is not provided, the PROTOCOL PORT can still be used to analyze the primary channel by changing the auxiliary CHAN menu to SEC. In this configuration, the mainframe MARK test pattern should be selected.

When testing the secondary channel with either the FIREBERD or an external analyzer, DDS data restrictions described in the AT&T PUB62120 and Bellcore TR-NPL-000157 publications must be observed. Only the 511- and 2047-bit pseudorandom test patterns meet these restrictions. Using other patterns might not produce the correct results.

The measured bit error rate indicated by the mainframe may actually be higher than the actual bit error rate of the secondary channel. This occurs because of the coding scheme of secondary channel. The normal secondary channel data rates are related to the primary channel data rate as follows:

PRIMARY CHANNEL DATA RATE	SECONDARY CHANNEL DATA RATE
2.4 kb/s	0.133 kb/s
4.8 kb/s	0.266 kb/s
9.6 kb/s	0.533 kb/s
19.2 kb/s	1.066 kb/s
56 kb/s	2.666 kb/s

2.3.6 Loopback Testing

The interface can test the DDS network using two loopback modes: alternating and latching. The interface allows either mode to be selected along with a number of selectable terminal loopbacks. Once the loop is established, the FIREBERD sends test patterns out to test and analyze the circuit between the FIREBERD and the looped terminal. The loopback tests can be performed in all modes but the MUXTST mode.

ALTERNATING LOOPBACK MODE

The interface enables the FIREBERD to test DDS networks from a single point of reference by establishing alternating loopbacks at one of several locations like those shown in Figure 2-2. Refer to Section 3.4.4 for a complete list of alternating loopbacks generated by the interface.

The Alternating Loop menu provides the nine loopback selections which can loop a single terminal even when another device is between the mainframe and the looped terminal. This is very helpful for instance, when establishing a channel (CSU) loop on a 56 kb/s circuit with local repeaters.

NOTE: Alternating loopback tests cannot be performed when testing the DDS secondary channel.

NOTE: Alternating loopback is synonymous with non-latching loopback.

The selected alternating loopback sequence (press the TYPE softkey) is transmitted when the mainframe LOOP UP switch is pressed. When the mainframe has synchronized with the returning loop code, the mainframe CODE LED illuminates and data and framing analysis begins. During the loopback test, the loop code and test pattern bytes are transmitted alternately. The sequence continues until either the LOOP DOWN switch is pressed or the sequence is interrupted. The appropriate test pattern can be generated using the mainframe pattern generator. During the loop-up and loop-down sequences, the mainframe displays messages indicating the progress of the sequence. A list of the displayed alternating loopback status messages is provided in Appendix B.

NOTE: Do not use the interface byte encoder when using alternating loopbacks.

When using alternating loopback procedures, the RCV FREQ results display indicates one-half the actual data rate. The mainframe only analyzes the received test pattern and not the combined loop code and data.

Latching Loopback Mode

The interface enables the FIREBERD to test DDS networks from a single point of reference by establishing latching loopbacks at one of several locations, like those shown in Figure 2-3.

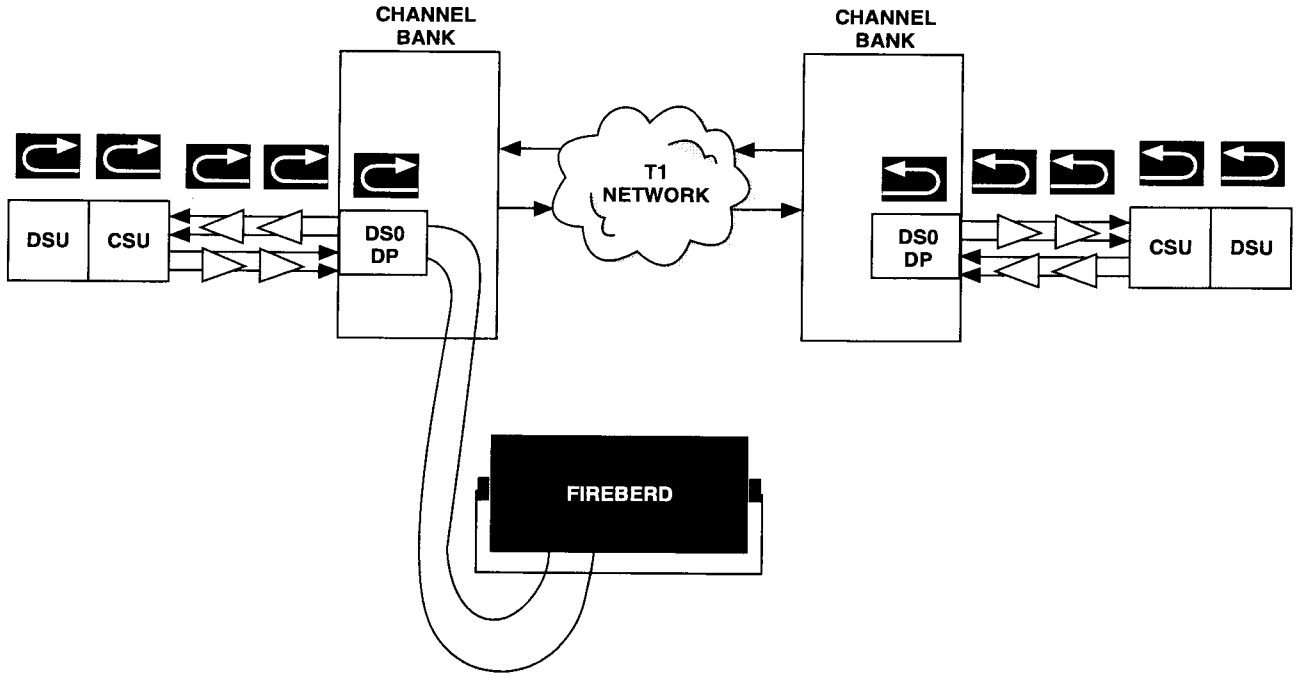

Figure 2-2
DDS Alternating Loopback Locations

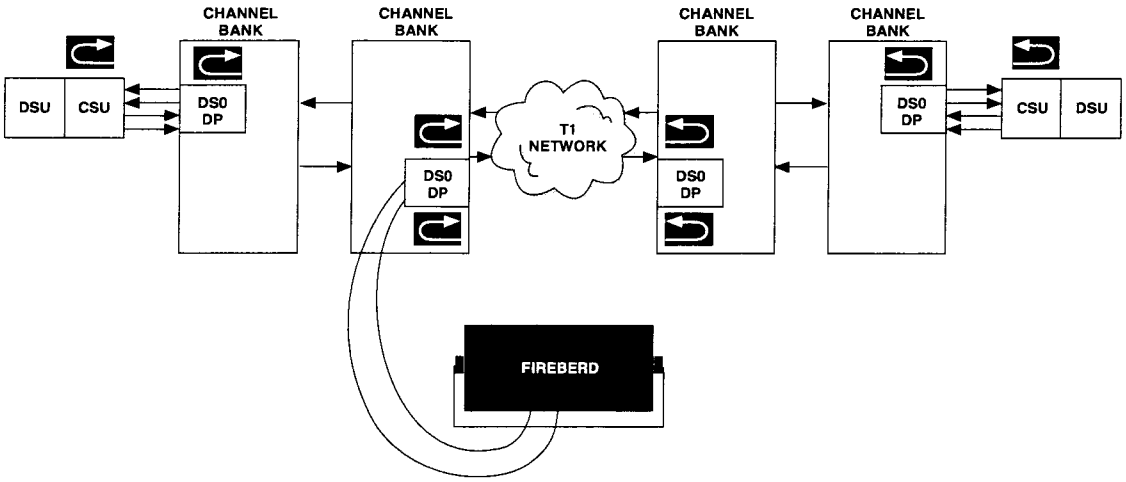

Figure 2-3
DDS Latching Loopback Locations

The Latching Loop menu provides the latching loopback selections that can loop a single terminal capable of responding to the appropriate latching loop codes. The selected latching loopback (use the TYPE and LOC softkeys) sequence is initiated by pressing the mainframe LOOP UP switch. When the loop is established and the confirmation code is received, the loopback is reported as successful and a confirmation message is displayed. The loop-down sequence (press mainframe LOOP DOWN switch) disables the loop.

During loop-up and loop-down sequences, the mainframe displays messages indicating the progress of the sequence. When a MJU loopback is established, the confirmation message also displays the MJU HUB ID number. A list of the displayed latching loopback status messages is provided in Appendix B.

When testing DS0-DPs, the confirmation message may also include the direction of the established loop by displaying "MAP0 line side" or "MAP1 drop side". The MAP0 confirmation code indicates that a loopback was achieved on the DS0-DP line side. The MAP1 confirmation code indicates that a loopback was achieved on the DS0-DP drop side. If no MAP code is reported by the DS0-DP, no additional information is displayed with the confirmation message. Up to eight DS0-DP locations (a location being the drop or line side of the DS0-DP) can be identified by pressing the LOCATN softkey (1-8) before sending the loop (up or down) code.

2.3.7 DS0B Subrate Multiplexer Testing

Another capability of the interface is DS0B subrate multiplexer testing (MODE, MUXTST). The interface allows the mainframe to test ISMXs and SRDMs by transmitting a DS0A- or DS0B-formatted test signal into one side of the multiplexer (input) and receiving the opposite format from the other side of the multiplexer (output). Figure 2-4 shows the FIREBERD connected to the SRDM.

The subrate multiplexer can be tested by passing a test pattern from the mainframe or BYTE encoder through the multiplexer and analyzing the results. Refer to Section 2.3.3 for additional information on DS0B channel testing.

NOTE: The mainframe SELF-LOOP test cannot be performed on the interface in the MUXTST mode

2.3.8 Multipoint Network Control and Testing

The FIREBERD can access, control, and test single or cascaded MJUs. The auxiliary MJU menu provides the FIREBERD with the ability to select the MJU branch (1-4), block or unblock a branch, release all branches from all MJU commands, and restore selected branches in the network. The MJU controls are provided for two reasons: (1) to block a branch from interfering (e.g., streaming) with normal network operation and (2) to select a remote branch for testing.

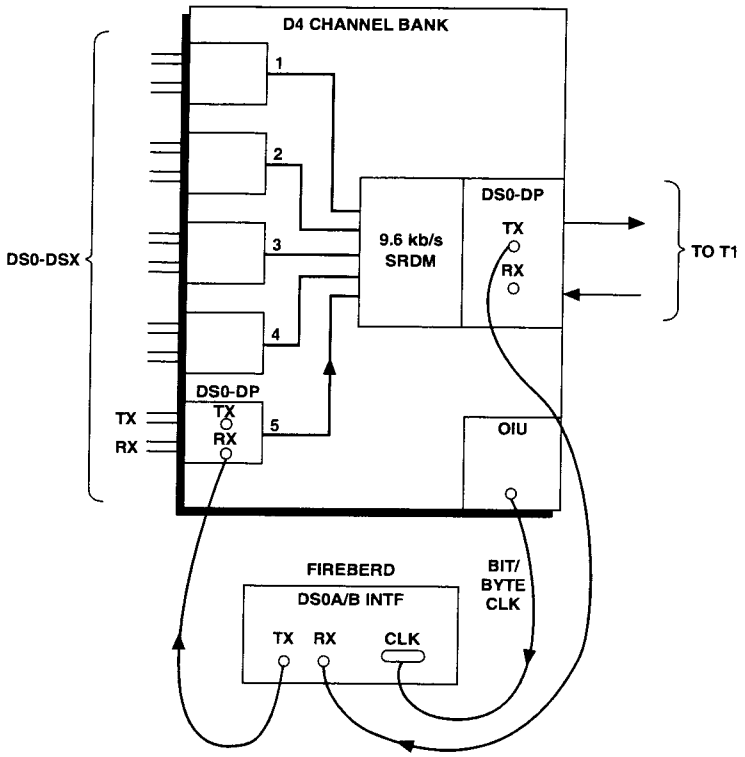

Figure 2-4
Testing Subrate Multiplexers

MJU Control Commands

To gain access and control over a branch, it must be selected. The MJU branch select sequence involves pressing the BRANCH softkey to identify the branch (1-4), then pressing the SELECT softkey to transmit the code sequence to the MJU. This connects the control channel to the selected branch and blocks the other branches. This makes the MJU transparent to the next branch select sequence or loopback test signals which would be transmitted down the branch to the next terminal (e.g., MJU or CSU). If a branch is not selected, the signal is transmitted on all unblocked branches. In networks with cascaded MJUs, repeat the branch select sequence to bypass any cascaded MJUs to reach the terminal being tested. Figure 2-5 shows a MJU configured in a branched state. When the branch select sequence is executed, the MJU reports its position in the network with the HUB ID number. When the select sequence is successful, the received HUB ID and selected branch number are displayed in the results display. The available MJU status messages are listed in Appendix B.

Once the branch is selected, the other MJU commands control the condition of the branch. When the BLOCK softkey is pressed, the block command is detected by the MJU and the selected branch is disconnected from the network (the other branches are restored). Figure 2-5 shows a MJU configured in a blocked state. If the selected branch is blocked, sending the unblock command (press UNBLK softkey) unblocks it and restores the other branches. To return the selected branches back to normal operation, press the RESTOR softkey. The restore command returns the MJU to normal operation without releasing the blocked branches (those blocked by the BLOCK command). The MJU release command (press the RELEAS softkey) releases all test modes and blocked and selected branches on all MJUs downstream within the multipoint network.

MJU Loopback Control

In a multipoint network, loopbacks must be established from the upstream side of the MJU. To test a terminal (e.g., DS0-DP, OCU-DP, or CSU) on the downstream side of the MJU, the appropriate MJU branch must be selected first (refer to MJU Control Command). Attempting to establish an upstream loopback from the downstream side of the MJU does not properly prepare the network for testing. The MJU itself may be looped using a latching loopback command. This is done through the Latching Loopback menu. Figure 2-5 shows a MJU configured in a latching loopback state.

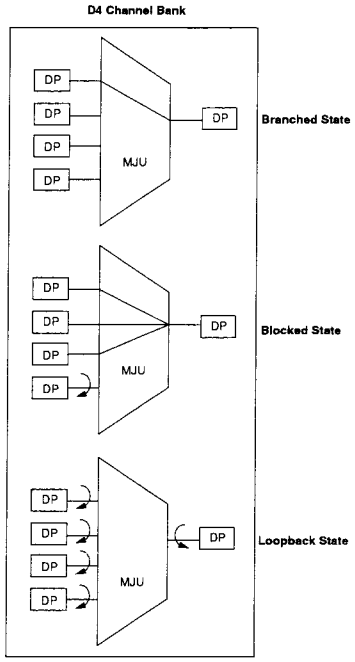

Figure 2-5
Multipoint Junction Unit Test States

2.3.9 Interface Byte Encoder

The DDS DS0A/B Interface provides a programmable 8-bit byte encoder that allows single or repeated transmission of any 8- bit byte sequence. The byte encoder can be used to transmit control codes and alarms. Commonly used control codes are listed in Appendix A. When the interface is configured for DS0A 19.2 kb/s or DS0B operation, bit 1 of the byte encoder is overwritten with the appropriate framing pattern.

When the SINGLE softkey is pressed, OFF is replaced with SINGLE in the upper right corner of the display once the code is sent. To send the code continuously, press the REPEAT softkey. In the repeat mode, turn the encoder off by pressing the OFF softkey. The HELP softkey (FIREBERD 6000 only) explains the constraints on the code entered, i.e., enter 8-bit binary code.

NOTE: When the encoder is active, the mainframe test pattern function is disabled. Also, the encoder cannot be used in the THRU mode, during alternating loopback tests, or during 64 kb/s clear channel testing.

2.3.10 Interface THRU Mode

The THRU mode places the interface in a transparent mode which allows the FIREBERD to be placed in series with the network. The interface loops the received data entering the RX INPUT jack to the TX OUTPUT jack as the transmit data. The mainframe cannot transmit its own test patterns during the THRU mode. However, the mainframe can still analyze the received data. The looped data can be altered by injecting a specified error rate from the interface error rate generator.

NOTE: The mainframe transmitter and interface byte encoder are disabled when using the THRU mode.

2.3.11 Interface ERROR Rate Generator

The DDS DS0A/B Interface contains a programmable bit-error-rate generator that is accessible through the DS0 A/B Interface menu. The generator can be activated on all transmitted signals regardless of the data source (e.g., mainframe test pattern, interface byte encoder, or THRU mode). On the FIREBERD 6000, the interface error rate generator supplements and operates

independently of the mainframe ERROR INSERT switch by providing a range of error rates that are entered using the mainframe keypad. The FIREBERD 4000 provides a fixed rate of 1E-6. The error rate can be programmed to have an effect only on data bits, only on framing bits, or on both data and framing bits at the same time. Unpredictable error rates can occur when both mainframe and interface error rate generators are used at the same time.

NOTE: The FIREBERD 6000 controls the generator output rate and should be set for 64 kb/s to maintain a match between the displayed and actual error rate being generated. Other frequencies can be used but the generator error rate does not match the displayed rate. On the FIREBERD 4000, the clock generator is automatically set for 64 kb/s.

2.3.12 Interface Protocol Port

The PROTOCOL PORT is an RS-232-C DCE configured interface that allows an external device to transmit and receive unformatted data through the DS0A/B Interface to and from the DDS network over the primary or secondary DDS channel. The interface provides the necessary DDS-to-RS-232 data conversion between the DDS network and the PROTOCOL PORT. This data conversion allows the port to operate at the selected DS0, DS0A, DS0B, or secondary channel data rate. When the PROTOCOL PORT is inactive (RTS is low), all 1's replace the transmit data on the selected channel. Any device connected to the PROTOCOL PORT must use the clocks provided by the port for both transmit and receive directions. The DSR (Pin 6) and RLSD (Pin 8) leads are permanently set high.

SECTION 3
FIREBERD 6000 INSTALLATION AND OPERATION

3.1 INTRODUCTION

This section describes how to install, configure, and operate the DDS DS0A/B Data Interface with a FIREBERD 6000 mainframe. Refer to the *FIREBERD 6000 User's Guide* or the *FIREBERD 6000 Reference Manual* for mainframe operating procedures.

NOTE: Configure the FIREBERD and DDS DS0A/B Interface before connecting the FIREBERD 6000 to the circuit under test. This will avoid unnecessary circuit downtime.

3.2 INTERFACE INSTALLATION

The following procedure describes how to install the interface in the FIREBERD 6000.

CAUTION: Before installing or removing the interface module, turn the AC power OFF to the FIREBERD 6000. Damage can occur to the interface and mainframe.

1. Turn the AC power OFF to the FIREBERD.
2. Face the FIREBERD rear panel. Position the interface in the interface slot with its plastic cover facing down and printed circuit (PC) board facing up.
3. Slide the module into the FIREBERD until the interface panel is flush with the rear panel. Make sure the PC board edges are fitted into the card guides in the mainframe.
4. Secure the interface with the thumbscrews on the interface panel.
5. Turn the AC power ON and configure the mainframe and interface as described in the following sections. Perform a SELF LOOP test as required to test the mainframe and interface.

NOTE: If a self-loop test is performed, the bit and byte clocks must be connected to the interface for proper operation.

3.3 FIREBERD 6000 MAINFRAME SET-UP

Perform this procedure to configure the FIREBERD 6000 with the DDS DS0A/B Data Interface.

1. Turn the AC power ON. If necessary, release SELF LOOP before starting.
2. Set the DATA switch to the appropriate test pattern. Refer to the *FIREBERD 6000 Reference Manual* for descriptions of the test patterns.
3. Set the GEN CLK switch to the INTF position. The INTF position is required for this interface.

NOTE: The TIMING MODE switch defaults to the SYNC timing mode and the SYNC LED does not illuminate when the DDS DS0A/B Interface is selected.

4. If the AUX FUNC IN USE indicator is illuminated, scroll through the Auxiliary Function IN USE list to identify Auxiliary Functions that might affect the operation of the DS0A/B Interface. The following mainframe Auxiliary Functions do not have any affect on the operation of the DDS DS0A/B Interface:

01	GEN CLK POL
02	RCVR CLK POL
05	INTF CONTROL
07	RCVR CLK SEL
08	OUT-BAND FLOW
09	IN-BAND FLOW
46	ASYNC TIMOUT

The other mainframe Auxiliary Functions can be configured at the user's discretion. Refer to the *FIREBERD 6000 Reference Manual* to determine the effect of the other Auxiliary Functions on the operation of the DS0A/B Interface.

5. Select the desired ANALYSIS MODE (right of ANALYSIS RESULTS panel): CONTINUOUS or SINGLE. Refer to Section 3.10 for information on analysis results as they relate to the DS0A/B Interface.

3.4 FIREBERD 6000 INTERFACE MENU

The following information describes how to access the interface menu and discusses each of the menu selections in the DDS DS0A/B Interface menu when installed in the FIREBERD 6000. The DDS DS0A/B Interface main menu has four selections that are used to configure and control the interface operation and network under test (see Figure 3-1). The Mode menu (MODE) is used to select the data format to be tested. The INTFC menu determines the transmit and receive (TX OUTPUT and RX INPUT) signal's electrical format required to connect with the circuit being tested. The Loopback menu (LOOP) is used to establish terminal loopbacks. The Interface Auxiliary menu (AUX) provides selections for byte encoding, error generation, MJU control, interface THRU mode, and channel analysis selections.

3.4.1 FIREBERD 6000 Menu Control

The DDS DS0A/B Interface menu is selected through the mainframe INTF SETUP menu. Press the DS0A/B softkey to access the DS0A/B Interface menu. Press the appropriate softkey to select a function or another menu. To return to the previous menu display press the mainframe keypad "up arrow" key. To return to the main interface menu, press the mainframe ENTER key. The Byte Encoder (BYTE) and Error Rate Generator (ERRGEN) menus require additional information to be entered using the keys on the mainframe keypad. When the new byte or error rate is typed in, press the ENTER key to enter the information into memory. Pressing a softkey in any menu either (1) scrolls a list of parameters that are automatically acted upon (e.g., selecting rates), (2) executes a function (e.g., activating the byte encoder), or (3) provides assistance (e.g., HELP screens). The Loopback menus (LOOP) require the use of the mainframe LOOP UP and LOOP DOWN switches to activate a loopback sequence or disable it after the loopback is selected. All interface menu settings are retained when mainframe power is turned off.

3.4.2 Operating Mode Menu

MODE - The Operating Mode menu allows the user to select DS0A, DS0B, clear channel (CLRCH), and multiplexer test (MUXTST) operating modes. The next menu level provides the channel data rates and channel number selections for each operating mode, except clear channel.

DS0A - The DS0A operating mode configures the interface to accept and test DS0A-formatted signals at the selected rate.

RATE - Selects DS0A data rates: 2.4, 4.8, 9.6, 19.2, and 56 kb/s.

DS0B - The DS0B operating mode configures the interface to test DS0B-formatted signals at the selected rate and channel.

RATE - Selects the DS0B signal rate: 2.4, 4.8, and 9.6 kb/s.

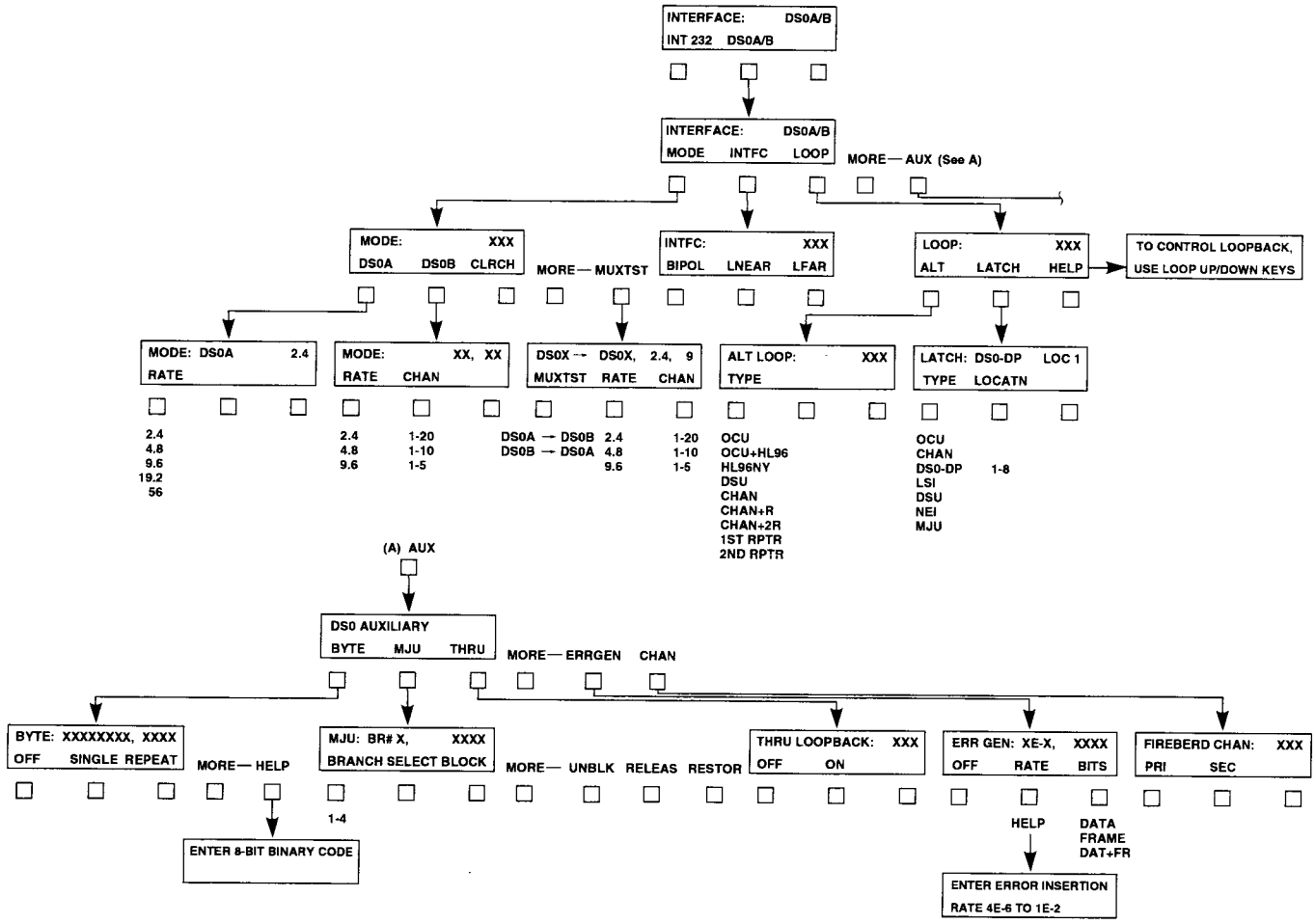

Figure 3-1
FIREBERD 6000 DDS DS0A/B Data Interface Set-Up Menu

CHAN - Selects the DS0B channel being tested at the selected rate:
5 channels at 9.6 kb/s,
10 channels at 4.8 kb/s, and
20 channels at 2.4 kb/s.

CLRCH - The clear channel mode allows the FIREBERD to transmit an unformatted DS0, 64 kb/s, clear channel signal.

MUXTST - The multiplexer test mode permits DS0B ISMX and SRDM testing. In the MUXTST mode, the FIREBERD transmitter and receiver operate independently in the DS0A and DS0B modes.

MUXTST - Selects direction and format of the transmitter and receiver: DS0A->DS0B (transmit DS0A, receive DS0B) and DS0B->DS0A (transmit DS0B, receive DS0A).

RATE - Selects the DS0A and DS0B signal rate: 2.4, 4.8, and 9.6 kb/s.

CHAN - Selects the DS0B channel being tested at the selected rate:
5 channels at 9.6 kb/s,
10 channels at 4.8 kb/s, and
20 channels at 2.4 kb/s.

3.4.3 Interface Connector Menu

INTFC - The Interface Connector menu controls the type of data interface to which the FIREBERD can connect and the direction of the test signals by configuring the TX OUTPUT and RX INPUT jacks.

BIPOL - When the BIPOL softkey is pressed, the interface is configured to transmit and receive bipolar test signals using both tip and ring leads.

LNEAR - When the LNEAR softkey is pressed, the interface is configured to transmit and receive logic level (0 to +5V) test signals only on the tip leads toward the near-end local loop or equipment side.

LFAR - When the LFAR softkey is pressed, the interface is configured to transmit and receive logic level (0 to +5V) test signals only on the ring leads toward the far-end local loop or line side.

3.4.4 Loopback Menu

LOOP - The loopback menu provides two loopback code formats: alternating (ALT) and latching (LATCH). The loopback types are selected through the ALT or LATCH loopback menus.

NOTE: Loopbacks established in DS0A 19.2 kb/s circuits do not have error correction capabilities.

ALT - The Alternating Loopback menu provides nine terminal loopback selections. Press the TYPE softkey to scroll through and select one of the following alternating loopbacks.

OCU - Prepares the interface to send the alternating Office Channel Unit loop code.

OCU+HL96 - Prepares the interface to send the alternating OCU loop code and, if in the circuit, bypass a HL96NY terminal.

HL96NY - Prepares the interface to send the alternating HL96NY terminal loop code.

DSU - Prepares the interface to send the alternating Data Service Unit loop code.

CHAN - Prepares the interface to send the alternating Channel Service Unit (CSU) loop code.

CHAN+R - Prepares the interface to send the alternating CSU loop code and, if in the local loop, bypass one repeater.

CHAN+2R - Prepares the interface to send the alternating CSU loop code and, if in the local loop, bypass two repeaters.

1ST RPTR - Prepares the interface to send the alternating repeater loop code to the first repeater in the local loop as the data leaves the channel bank.

2ND RPTR - Prepares the interface to send the alternating repeater loop code to the second repeater (bypassing the first repeater) in the local loop as the data leaves the channel bank.

LATCH - The Latching loopback menu has seven loop-code selections. Press the TYPE softkey to select one of the following loopback locations. The LOCATN (location) softkey only applies to the DS0-DP menu selection. Set the LOCATN to "1" on all other loop code selections.

OCU - Prepares the interface to send the latching Office Channel Unit loop-code sequence.

CHAN - Prepares the interface to send the latching Channel Service Unit loop-code sequence.

DS0-DP - Prepares the interface to send the latching Digital Signal Zero-Dataport loop-code sequence to one of eight possible DS0-DPs locations (LINE or DROP) in the circuit.

LSI - Prepares the interface to send the latching Loop Side Interface (HL222) loop-code sequence.

DSU - Prepares the interface to send the latching Data Service Unit loop-code sequence.

NEI - Prepares the interface to send the latching DDS Termination loop-code sequence.

MJU - Prepares the interface to send the latching Multipoint Junction Unit loop-code sequence.

HELP - Displays "To control loopback, use loop up/down keys" on the FIREBERD front panel.

3.4.5 DDS DS0A/B Auxiliary Menu

AUX - The DS0A/B Auxiliary menu provides selections for BYTE encoder, MJU controls and commands, THRU mode, ERRGEN generator, and channel analysis control (CHAN menu).

BYTE - The byte encoder enables the user to create an 8-bit byte and transmit the pattern once or repeatedly.

BYTE field - Enter the 8-bit byte through the mainframe keypad.

OFF - Press and release to disable byte encoder.

SINGLE - Press and release to transmit the entered code once.

REPEAT - Press and release to transmit the entered code continuously.

MJU - The MJU menu enables the interface to control DDS MJUs.

BRANCH - Press the BRANCH softkey to identify the MJU branch (1-4) being selected. Used in conjunction with the SELECT softkey.

SELECT - Press the SELECT softkey to access the identified branch (BRANCH softkey).

BLOCK - Press the BLOCK softkey to disconnect (block) the selected MJU branch from the network.

UNBLK - Press the UNBLK softkey to unblock the selected blocked branch and restore it to normal operation.

RELEAS - Press the RELEAS softkey to globally release all MJUs in the affected circuit and return them to normal operation.

RESTOR - Press the RESTOR softkey to deselect the previously selected branches and return them to normal operation.

THRU - The THRU mode places the interface in a looped mode.

OFF - Disables the loop and returns interface to normal operation.

ON - Enables the THRU mode to pass received data through the interface unaltered, unless ERRGEN is on.

ERRGEN - The error rate generator injects a programmed error rate into the transmitted data (standard or THRU mode) at 64 kb/s.

OFF - Disables the error rate generator.

RATE - Press the RATE softkey to enter the error rate through the mainframe keypad. The rate HELP softkey describes the error rate range: 4E-6 to 1E-2.

BITS - Press the BIT softkey to select where the errors are injected in the data stream; the data bits only (DATA), framing bits only (FRAME), or both (DAT+FR).

CHAN - The FIREBERD CHAN (channel) menu controls which DDS channel, primary or secondary, the FIREBERD analyzes.

PRI - Press the PRI softkey to connect the mainframe to the DDS primary channel. The DDS secondary channel is sent to the PROTOCOL PORT.

SEC - Press the SEC softkey to connect the mainframe to the DDS secondary channel. The primary channel is sent to the PROTOCOL PORT.

3.5 FIREBERD 6000 DDS DS0A/B INTERFACE SET-UP

The DDS DS0A/B Interface is accessed through the mainframe INTF SETUP menu. The interface menus are structured in a menu tree format as shown in Figure 3-1. Each menu level is accessed by pressing the appropriate softkey. To return to the previous level, press the mainframe keypad "up arrow" key. To return to the main interface setup menu, press the keypad ENTER key. The following procedures explain the setup sequences used to configure the interface to test and analyze DDS circuits.

Perform the following interface setup procedure for all test modes.

1. Use the mainframe **MENU** switch to select the **INTF SETUP** (interface setup) function.

2. Press the DS0A/B softkey to select the DS0A/B Interface menu (see Figure 3-1).

3. Press the MORE key, then the AUX softkey to select the interface AUX menu. Select each of the following functions and press the OFF softkey after selecting the function: BYTE encoder, THRU mode, and ERRGEN generator. Press the keypad "up arrow" after pressing the OFF softkey to return to the AUX menu. Select the auxiliary CHAN menu and press the PRI softkey.

4. Press the keypad ENTER key to return to the mainframe interface set-up menu.

5. Press the DS0A/B softkey again to select the DS0A/B Interface menu.

6. Press the MODE softkey to select the MODE menu. Press one of the following test mode softkey as required:

   - **DS0A** - Select DS0A to test DS0A-formatted signals. Press the RATE softkey to select the data rate: 2.4, 4.8, 9.6, 19.2, or 56 kb/s. *Go to Step (7) to continue.*

   - **DS0B** - Select DS0B to test one DS0B-formatted channel. Press the RATE softkey to select the channel data rate: 2.4, 4.8, or 9.6 kb/s. Press the CHAN softkey to select the channel being tested: 1 to 20 at 2.4 kb/s, 1 to 10 at 4.8 kb/s, or 1 to 5 at 9.6 kb/s. *Go to Step (7) to continue.*

   - **CLRCH** - Select CLRCH (clear channel) to test with a 64 kb/s clear channel signal. *Go to Step (7) to continue.*

   - **MUXTST** - Select MUXTST to configure the interface for subrate multiplexer testing. *Go to Section 3.7.3 for the multiplexer test setup procedure.*

7. Press the keypad "up arrow" key twice (once from CLRCH) to return to the main DS0A/B Interface menu.

8. Press the INTFC softkey to select one of the following test access point interface formats:

   NOTE: The interface connection signal format is determined by the terminal connections.

   - **BIPOL** - Select BIPOL (bipolar) to provide signals on the jack tip and ring leads.

   - **LNEAR** - Select LNEAR (logic near) to provide signals on the jack tip leads only to test toward the near-end.

   - **LFAR** - Select LFAR (logic far) to provide signals on the jack ring leads only to test toward the far-end.

9. Press the keypad "up arrow" key once to return to the main DS0A/B Interface menu.

3.6 FIREBERD 6000 TO DDS CONNECTIONS

Perform this procedure to connect the FIREBERD 6000 to the DDS test access point.

1. Connect the clock cable (9-pin D to 9-pin D or appropriate cable) between the interface CLOCKS connector and a DDS clock source (e.g., OIU).

   NOTE: The next step disrupts the end-to-end circuit transmissions and constitutes an out-of-service test.

2. Connect the bantam-plug cables between the DDS DS0A/B Interface TX OUTPUT and RX INPUT jacks and the circuit being tested.

   - Verify interface format: bipolar, logic near, or logic far.
   - Verify data format: DS0A, DS0B, or clear channel.

3. If required, connect an RS-232C compatible test instrument to the DCE PROTOCOL PORT for secondary or primary DDS channel analysis and testing.

4. Perform circuit testing and analysis as required.

3.7 FIREBERD 6000 DDS CIRCUIT TESTS

Perform any of the following test procedures to test the applicable DDS circuits. This procedure assumes that the initial set-up procedures previously described have been performed, including connecting the FIREBERD 6000 to the network.

- If a loopback test is required, go to Section 3.7.1 to establish the loopback.
- If a multipoint network is being worked on, go to Section 3.7.2 to establish control over the network MJUs.
- If a subrate multiplexer is being worked on, go to Section 3.7.3 for the setup procedure.
- If the byte encoder is required for testing, go to Section 3.7.4.
- If the error rate generator is required for testing, go to Section 3.7.5.
- If the THRU mode is required for testing, go to Section 3.7.6.
- If the DDS secondary channel requires testing, go to Section 3.7.7 to set up the mainframe and/or PROTOCOL PORT.

3.7.1 Establishing a Loopback Test

Perform this procedure to establish an alternating or latching loopback.

1. Press the LOOP softkey to select the LOOP menu.

2. *Go to Step (3) to establish an alternating loopback.*
   Go to Step (6) to establish a latching loopback.

   NOTE: Prior knowledge of the network circuits and their ability to respond to alternating or latching loop codes is necessary for proper operation.

3. Press the ALT softkey to select the ALT LOOP menu.

4. Press the TYPE softkey to select one of the following alternating loopbacks:

   - **OCU** - Office Channel Unit loopback
   - **OCU+HL96** - Office Channel Unit loopback behind HL96NY
   - **HL96NY** - HL96NY loopback
   - **DSU** - Data Service Unit loopback
   - **CHAN** - Channel Service Unit loopback
   - **CHAN+R** - Channel Service Unit loopback behind one repeater
   - **CHAN+2R** - Channel Service Unit loopback behind two repeaters
   - **1ST RPTR** - First local loop repeater loopback
   - **2ND RPTR** - Second local loop repeater loopback

5. *Go to Step (8) to continue.*

6. Press the LATCH softkey to select the LATCH LOOP menu.

7. Press the TYPE softkey to select one of the following latching loopbacks:

   - **OCU** - Office Channel Unit loopback
   - **CHAN** - Channel Service Unit loopback
   - **DS0-DP** - DS0-Dataport loopback (When more than one DS0-DP is present, press the LOCATN softkey to select the location of the DS0-DP being looped.)
   - **LSI** - Loop Side Interface (HL222) loopback
   - **DSU** - Data Service Unit loopback
   - **NEI** - DDS Termination loopback
   - **MJU** - Multipoint Junction Unit loopback

   NOTE: The LOC number should be set for "1" when the OCU, CHAN, LSI, or MJU loopback is selected.

8. Connect the FIREBERD to the network as described in Section 3.6

9. Press the mainframe LOOP UP switch to send the selected loopback sequence. Perform the desired tests and analysis.

10. To terminate the loopback, press the mainframe LOOP DOWN switch.

3.7.2 Multipoint Network Control and Test

Perform these procedures to control and test the multipoint network.

Selecting the MJU Branch

1. Select the interface AUX menu and press the MJU softkey to select the MJU menu.

2. Press the BRANCH softkey to identify the MJU branch (1-4) to be selected.

3. Press the SELECT softkey to select the identified branch. When the branch is selected, the MJU HUB ID and BRANCH number appear on the mainframe display.

4. Repeat Steps (2) and (3) if working with cascaded MJUs to gain access to other MJU branches downstream from the control channel access point.

NOTE: Once the MJU branch is selected, another MJU branch select sequence can be transmitted on the selected branch to the next MJU. The block, unblock, restore, or loopback commands are available to be transmitted down the selected branch.

Blocking a Branch

1. Select the MJU branch as described in *Selecting the MJU Branch.*

2. Press the BLOCK softkey to clock the selected branch.

3. Repeat Steps (1) and (2) as required.

Unblocking a Blocked Branch

1. Select the MJU branch as described in *Selecting the MJU Branch.*

2. Press the UNBLK softkey to unblock the selected branch.

3. Repeat Steps (1) and (2) as required.

Releasing the Network

Perform this procedure to release all MJUs downstream from the control channel.

1. Select the interface AUX menu and press the MJU softkey to select the MJU menu.

2. Press the RELEAS softkey to release ALL selected and blocked branches downstream from the control channel access point.

Restoring the Selected Branch

To restore the last selected branch, press the RESTOR softkey. This returns the selected branch to its previous condition.

Establishing a Loopback on the Selected Branch

Perform the procedure to establish a terminal loopback in a multipoint network.

1. Select the MJU branch as described in *Selecting the MJU Branch.*

2. Press the keypad "up arrow" key twice to return to the main DS0A/B Interface menu.

3. Press the LOOP softkey to select the LOOP menu.

4. *Go to Section 3.7.1 to establish the loopback on the selected branch.*

3.7.3 Subrate Multiplexer Testing

Perform this procedure to configure the DDS DS0A/B Interface to test ISMX and SRDM terminals.

1. Use the mainframe **MENU** switch to select the **INTF SETUP** (interface setup) function.
2. Press the DS0A/B softkey to select the DS0A/B Interface menu (see Figure 3-1).
3. Press the MODE softkey to display the MODE menu, then press the MORE key.
4. Press the MUXTST softkey to select the MUXTST mode.
5. Press the MUXTST softkey again to select the interface transmitter and receiver signal direction and format: DS0A->DS0B or DS0B ->DS0A.
   - Select DS0A->DS0B to transmit DS0A and receive DS0B signals.
   - Select DS0B ->DS0A to transmit DS0B and receive DS0A signals.
6. Press the RATE softkey to select the channel data rate: 2.4, 4.8, or 9.6 kb/s.
7. Press the CHAN softkey to select the channel being tested: 1 to 20 for 2.4 kb/s multiplexers, 1 to 10 for 4.8 kb/s multiplexers, or 1 to 5 for 9.6 kb/s multiplexers.
8. Press the keypad "up arrow" key twice to return to the main DS0A /B Interface menu.
9. Press the INTFC (interface) softkey, then press the BIPOL softkey. Only the BIPOLAR interface format is used in this procedure.
10. Press the keypad "up arrow" key once to return to the main DS0A/B Interface menu.
11. Connect the mainframe to the subrate multiplexer as follows:
    - If the DS0A ->DS0B direction was selected in Step (5), connect the interface TX OUTPUT to a bipolar DS0A input to the subrate multiplexer, and connect the interface RX INPUT to a bipolar DS0B output from the subrate multiplexer.
    - If the DS0B ->DS0A direction was selected in Step (5), connect the interface TX OUTPUT to a bipolar DS0B input to the subrate multiplexer, and connect the interface RX INPUT to a bipolar DS0A output from the subrate multiplexer.

3.7.4 Testing Circuit with Byte Encoder

Perform the following procedure to enable to the interface byte encoder.

NOTE: The byte encoder cannot be used in the THRU mode, clear channel (CLRCH) operation, or alternating (ALT) loopback tests.

1. Select the interface AUX menu and press the BYTE softkey to select the interface BYTE menu.
2. Key in the binary digits through the mainframe keypad and press ENTER to set the byte in memory.
3. Press the SINGLE softkey to send the pattern once. Press the REPEAT softkey to send the pattern continuously.
4. When the encoder is no longer needed, press the OFF softkey to turn it off.

3.7.5 Circuit Testing with Error Rate Generator

Perform the following procedure to enable the interface ERRGEN generator. The ERRGEN generator can be used in all operating modes.

1. Use the mainframe **MENU** switch to select the **SYNTH FREQ** (synthesizer frequency) function. Press the softkey labeled 64 to enter the synthesizer frequency of 64 kb/s.
2. Use the mainframe **MENU** switch to select the **INTF SETUP** (interface setup) function.
3. Press the DS0A/B softkey to select the DS0A/B Interface menu (see Figure 3-1).
4. Press the MORE key, then the AUX softkey.
5. Press the MORE key, then press the ERRGEN softkey to select the interface ERRGEN generator.
6. Press the RATE softkey to enter the error rate.
7. Key in the error rate through the mainframe keypad and press ENTER to set the rate in memory.
8. Press the "up arrow" key to return to the ERRGEN menu.
9. Press the BITS softkey to select the bits affected by the generator: DATA (data bits only), FRAME (framing bits only), or DAT+FR (data and framing bits).
10. When no longer needed, press the OFF softkey to turn off the generator.

3.7.6 Establishing Interface THRU Mode

Perform the following procedure to enable the interface THRU mode. In this test scenario, the FIREBERD would typically be connected a DS0-DSX.

1. Select the interface AUX menu.
2. Press the THRU softkey to select the interface THRU mode.
3. Press the ON softkey to establish the interface THRU mode (internal receive-to-transmit loop facing the network). The mainframe can still analyze the received signal, but it cannot transmit test patterns, loop codes, or other data to the network. The ERRGEN can be used to inject errors in the signal passing through the interface.
4. Press the OFF softkey to remove the loop and return the interface to normal operation.

3.7.7 Testing DDS Secondary Channels

Perform the following procedure to test the DDS secondary channel with the FIREBERD 6000.

1. Select the interface AUX menu.
2. Press the MORE key, then press the CHAN softkey to select the auxiliary CHAN menu.
3. Press the SEC softkey to select the DDS secondary channel for mainframe testing and analysis.
4. When secondary channel testing is complete, press the PRI softkey to return the mainframe back to the primary channel.

NOTE: The PROTOCOL PORT provides access to the primary channel when the mainframe is analyzing the secondary channel. The PROTOCOL PORT substitutes 1's for transmit data when RTS is low.

3.8 FIREBERD 6000 SELF-LOOP TEST

When the mainframe SELF LOOP switch is pressed, an interface relay loops the TX OUTPUT to the RX INPUT. This is used to test the operation of the mainframe and interface. The data cables do not need to be removed to perform the test. All interface operating modes, except MUXTST mode, can be tested with the SELF-LOOP test. Also, Thru mode does not work in self-test. Byte Encoder will not sync.

NOTE: The DS0A/B Interface requires bit and byte clock sources to be connected before the mainframe self-loop test can be performed.

3.9 INTERFACE STATUS INDICATORS AND SWITCHES

When the DDS DS0A/B Interface is used, the mainframe identifies the interface status indicators and switches (right side of mainframe) as follows: FRM SYNC, CODE, ALM 1, ALM 2, LOOP UP, and LOOP DOWN.

The FRM SYNC LED illuminates when the interface is configured to receive a DS0B signal at any rate or a DS0A 19.2 kb/s signal and the interface has synchronized on the appropriate framing pattern. The CODE LED illuminates when the interface has initiated an alternating loopback and is receiving the correct loop-code bytes interleaved with the test data. The ALM 1 LED illuminates when the RX INPUT jack is terminated and operating with bipolar signals. The ALM 2 LED is not used with this interface.

When the LOOP UP switch is pressed and released, the selected loopback sequence is transmitted to the appropriate terminal. The switch is illuminated while the loopback is being established. Pressing and releasing the LOOP DOWN switch transmits the appropriate release loop code. The switch is illuminated while the release loop code is being transmitted. Depending on the loop codes sent, status messages appear in the Results display.

3.10 FIREBERD 6000 DS0A/B ANALYSIS RESULTS

Table 3-1 lists the analysis results that are displayed when the DS0A/B Interface is installed in the FIREBERD 6000. Refer to the *FIREBERD 6000 Reference Manual* for results definitions not described in this section.

Two results unique to the DDS DS0A/B Interface are provided: RCV BYTE (received byte) and CTL CODE (control code). The received data bytes are sampled every 300 milliseconds and displayed in binary form in the SIGNAL category RCV BYTE results display. Each displayed byte is compared with a list of reportable DS0 control codes stored in memory. The recognized control code name is then reported in the SIGNAL category CTL CODE results display. If no match occurs, the CTL CODE result remains inactive (blank). The reportable DS0 control codes are listed in Appendix A.

Another SIGNAL category result affected by the interface is the REC FREQ results display. When testing a circuit using alternating loop codes, the RCV FREQ display indicates one half the actual circuit rate, e.g., a looped 9.6 kb/s circuit has a received frequency of 4.8 kb/s. The FIREBERD measures only the received test data and not the combined loop code and data. When testing the DDS secondary channel, the RCV FREQ display also displays the secondary channel data rate. When testing DS0A 19.2 kb/s and DS0B circuits, "No frame" appears in the RCV FREQ result when no signal is present.

When testing DS0B or DS0A 19.2 kb/s signals, the T-CARRIER category frame error (FRA ERR), frame error rate (F E RAT), average frame error rate (AVG FER), and frame sync loss (FRA LOSS) results are made available for reporting framing errors and frame synchronization losses. The frame sync loss is reported after three consecutive errored framing patterns are detected.

3.11 FIREBERD 6000 PRINTER OPERATION

Refer to the *FIREBERD 6000 Reference Manual* for printer set-up and operating instructions. Figure 3-2 shows a typical Results printout with the DS0A/B Interface RCV BYTE and CTL CODE results (highlighted) indicating the TA (Test Alert) byte and control code name. Figure 3-3 is a typical Controls printout showing a DS0A/B Interface setup. Figure 3-4 shows a typical MJU Status printout (available through Auxiliary Function 36, STATUS PRINT) also provided through the DS0A/B Interface.

Table 3-1
FIREBERD 6000 DS0A/B Interface Results

Category	Displayed Result	Description
ERROR	BIT ERR	Bit Errors
	BER	Bit Error Rate
	AVG BER	Average Bit Error Rate
	BLOCKS	Blocks Received
	BLK ERRS	Block Errors
	AVG BLER	Average Block Error Rate
	CLK SLIP	Clock Slip
PERFORMANCE	EFS	Error-Free Seconds
	ERR SEC	Errored Seconds
	%EFS	Percent Error-Free Seconds
	DEG MIN	Degraded Minutes
	%DEG MIN	Percent Degraded Minutes
	SES	Severely Errored Seconds
	%SES	Percent Severely Errored Seconds
	UNA SEC	Unavailable Seconds
	AVL SEC	Available Seconds
	%AVL SEC	Percent Available Seconds
	SYNL SEC	Sync-Loss Seconds
	%SYN SEC	Percent Sync Seconds
TIME	E A SEC	Error Analysis Seconds
	ERR EAS	Errored Error Analysis Seconds
	E F EAS	Error-Free Error Analysis Seconds
	ELAP SEC	Elapsed Seconds
	TIME	Time
	DATE	Date
SIGNAL	RCV BYTE	Received Byte (displays binary byte)
	CTL CODE	Control Code Names (displays abbreviated name)
	GEN FREQ	Generator Clock Frequency
	RCV FREQ	Received Clock Frequency
	DELAY	Delay
***T-CARRIER**	FRA ERR	Frame Errors
	F E RAT	Frame Error Rate
	AVG FER	Average Frame Error Rate
	FRA LOSS	Frame Synchronization Losses
ALARM	SYN LOSS	Synchronization Losses
	DATA LOSS	Data Losses
	PWR LOSS	Power Losses
	CLK LOSS	Clock Losses

* Only applicable when receiving DS0B or DS0A 19.2 kb/s signals.

```
MANUAL          PRINT
04:32:06 19 APR 89
SITE ID         Alpha
BIT ERRS        22704
AVG BER      1.45E-02
BER          1.30E-02
BLOCKS          1565
BLK ERRS         345
AVG BLER     2.45E-01
E A SEC          343
ERR EAS           87
E F EAS          256
FRA ERR        33970
AVG FER      1.25E-02
F E Rate
CLK SLIP         188
ELAP SEC         343
DELAY
RCV FREQ     19176.5
GEN FREQ     19222.9
RCV BYTE     11101100
CTL CODE           TA
FRA LOSS       1367
SYN LOSS          3
DAT LOSS          1
CLK LOSS          0
PWR LOSS          0
SYNL SEC        330
%SYN SEC      3.79%
AVL SEC           6
%DEG MIN      0.0%
%SES         66.67%
%DFS         33.33%
EFS               2
DEG MIN           0
ERR SEC           4
SES               4
UNA SEC         337
%AVL SEC      1.75%
IF            DS0A/B
FRAME SYNC PRESENT
RX TERM
NO LOOPBACK
SELF LOOP ON
```

Figure 3-2
Results Printout

```
CONTROLS PRINT
04:33:47 19 APR 89
SITE:           Alpha
DATA:             511
ERROR INS:        OFF
SELF LOOP:         ON
GEN CLOCK:      INTF
TIMING MODE:    SYNC
SYN FRQ:      64 kHz
INTERFACE:
 DS0A/DS0B
  TEST MODE:    DS0A
  RATE:         19.2
  DATA:        BIPOL
  LOOP:     LATCHING
  LOOP TYPE: DS0-DP
  LOOP LOC:        8
   BYTE ENC:     OFF
   MJU:          OFF
   THRU MODE:    OFF
   ERR GEN:      OFF
   FBERD CHAN:   PRI
EMULATE:          N/A
TEST INT:       10^5
ASYNC CHAR FORMAT:
 DATA BITS:         8
 STOP BITS:         1
 PARITY:          ODD
PRINT EVENT:     NOR
 TEST INT:       OFF
 SYNC LOSS:      OFF
 ERROR:          OFF
 TIME:           OFF
ANALY MODE:      CON
DISPLAY HOLD:    OFF
BLOCK LENGTH:
          1000 BITS
DELAY: DTR/    DTR/
XON CHARACTER:   11
XOFF CHARACTER:  13
AUX FUNC IN USE:
                NONE
REMOTE RS-232:
 DATA BITS          8
 PRINT SPEED:  FAST
 BAUD:          2400
 PARITY:        NONE
 TERM:         CR LF
REMOTE IEEE-488:
 PRINT SPEED:  FAST
 TERM:         CR LF
 SRQ MODE:       ERR
 MODE:           N/A
```

Figure 3-3
Controls Printout

```
MJU SELECT
  BRANCH            2
  HUB ID           77
SITE ID         Alpha
04:54:18 18 APR 89

MJU BLOCK
SITE ID         Alpha
04:55:38 18 APR 89

MJU UNBLOCK SENT
SITE ID         Alpha
04:57:25 18 APR 89

MJU RELEASE SENT
SITE ID         Alpha
05:24:13 18 APR 89

MJU RESTORE SENT
SITE ID         Alpha
05:32:20 18 APR 89
```

Figure 3-4
MJU Status Printout

3.12 FIREBERD 6000 REMOTE CONTROL COMMANDS

The FIREBERD 6000 remote control commands enable remote control over the DDS DS0A/B Data Interface. Remote interface operation is enabled through the INTF SELECT command. The DS0A/B commands listed in Table 3-2 are for FIREBERD 6000 units equipped with software Rev G or later. Refer to the appendix section for the remote control commands for FIREBERD 6000s equipped with Rev F software.

The table includes an explanation of the commands and a brief example of the command usage. Bold characters are used to highlight the command itself, as well as the variables that can be used with the commands. Commands are used to set a parameter value or condition. Parameters within the brackets are the variable that must be used with the accompanying command to set the desired parameter value. Queries end with a question mark (?) and are used to determine the current parameter value or setting. A message is returned to the controller in response to a query.

Table 3-3 defines the remote control command abbreviations described in Table 3-2. For detailed instructions on remotely controlling the FIREBERD 6000, refer to the *FIREBERD 6000 Reference Manual.*

INTF:SELECT DS0A/B selects the DDS DS0A/B Interface.

Table 3-2
FIREBERD 6000 DDS DS0A/B Data Interface Remote Control Commands

Remote Command	Result
INTF:DS0A_B:MODE [CLEAR|DS0A|DS0B MUX_TEST]	Selects the DDS operating mode
INTF:DS0A_B:MODE?	Requests the current DDS operating mode
INTF:DS0A_B:DS0A [2.4|4.8|9.6|19.2|56]	Selects the DS0A data rate in kb/s

Table 3-2
FIREBERD 6000 DDS DS0A/B Data Interface Remote Control Commands (Continued)

Remote Command	Result
INTF:DS0A_B:DS0A?	Requests the DS0A data rate
INTF:DS0A_B:DS0B [2.4|4.8|9.6], (number)	Selects the channel number (1-20 for 2.4, 1-10 for 4.8, or 1-5 for 9.6) for the selected data rate
INTF:DS0A_B:DS0B?	Requests the selected DS0B rate and channel number
INTF:DS0A_B:MUX_TEST [A_B|B_A], [2.4|4.8|9.6], (number)	Selects the mux test direction (A to B or B to A), the data rate, and the channel where the number is (1-20 for 2.4, 1-10 for 4.8, or 1-5 for 9.6) for the selected data rate
INTF:DS0A_B:MUX_TEST?	Requests the current mux test parameters
INTF:DS0A_B:DATA_TYPE [BIPOLAR|LOGIC_NEAR|LOGIC_FAR]	Selects the data interface type connected to and the direction of the test signal
INTF:DS0A_B:DATA_TYPE?	Requests the current current interface type and direction of the test signal
INTF:DS0A_B:LOOP [ALTERNATING|LATCHING]	Selects the loopback type
INTF:DS0A_B:LOOP?	Requests the current loopback type
INTF:DS0A_B:LOOP:ALTERNATING [OCU|OCU+HL96|HL96NY|DSU|CHAN|CHAN+R|CHAN+2R|RPTR1|RPTR2]	Selects the type of alternating loopback
INTF:DS0A_B:LOOP:ALTERNATING?	Requests the current type of alternating loopback
INTF:DS0A_B:LOOP:LATCHING [OCU|CHAN|DS0_DP|LSI|MJU|DSU|DDST], (number)	Selects the type of latching loopback where the (number) is 1 to 8
INTF:DS0A_B:LOOP:LATCHING?	Requests the current type of latching loopback
INTF:DS0A_B:MJU:SELECT [1|2|3|4]	Selects the MJU branch for control
INTF:DS0A_B:MJU:BLOCK [1|2|3|4]	Selects the MJU branch to block
INTF:DS0A_B:MJU:UNBLOCK [1|2|3|4]	Selects the MJU branch to unblock
INTF:DS0A_B:MJU:RELEASE	Releases all MJUs in the selected circuit
INTF:DS0A_B:MJU:RESTORE	Restores the previously selected MJUs in the selected circuit
INTF:DS0A_B:THRU_MODE [ON|OFF]	Selects the THRU mode status
INTF:DS0A_B:THRU_MODE?	Requests the THRU mode status
INTF:DS0A_B:TX_BYTE [OFF|SINGLE|REPEAT]	Selects the transmit type

Table 3-2
FIREBERD 6000 DDS DS0A/B Data Interface Remote Control Commands (Continued)

Remote Command	Result
INTF:DS0A_B:TX_BYTE?	Requests the current transmit byte type
INTF:DS0A_B:TX_BYTE:DATA (Hex)	Sets the 8-bit transmit byte (in hexadecimal)
INTF:DS0A_B:TX_BYTE:DATA?	Requests the current transmit byte (in hexadecimal)
INTF:DS0A_B:CHANNEL [PRIMARY|SECONDARY]	Selects the channel
INTF:DS0A_B:CHANNEL?	Requests the current channel selection
INTF:DS0A_B:ERR_INSERT [OFF|DATA|FRAME| DAT+FR|RATE]	Selects the type of error insertion
INTF:DS0A_B:ERR_INSERT?	Requests the current type of error insertion
EXAMPLE:	
>INTF:SELECT? RS232 **>INTF:SELECT EXT** **>INTF:DS0A_B:DS0A 19.2** **>INTF:DS0A_B:DATA_TYPE:BIPOLAR** **>INTF:DS0A_B:LOOP ALTERNATING CHAN+R** **>INTF:DS0A_B:ERR_INSERT DATA** **>INTF:DS0A_B:AUX ERR_INSERT DAT+FR**	:requests the currently active interface :activate DDS DS0A/B Interface :activate DS0A mode at 19.2 kb/s :configure interface connection for bipolar operation :activate alternating channel with one repeater loopback :activate error generator with errors on the data bits :activate auxiliary error generator with errors on both data and frame bits

SECTION 4
FIREBERD 4000 INSTALLATION AND OPERATION

4.1 INTRODUCTION

This section describes how to install, configure, and operate the DDS DS0A/B Data Interface with the FIREBERD 4000. Refer to the *FIREBERD 4000 User's Guide* or the *FIREBERD 4000 Reference Manual* for mainframe operating procedures.

NOTE: Configure the FIREBERD 4000 and DDS DS0A/B Interface before connecting the FIREBERD 4000 to the circuit under test. This avoids unnecessary circuit downtime. Until the bit and byte clocks are connected to the interface CLOCKS connector, the message **GENERATOR CLK NOT PRESENT** flashes in the Results display.

4.2 INTERFACE INSTALLATION

The following procedure describes how to install the interface in the FIREBERD 4000.

CAUTION: Before installing or removing the interface module, always turn the AC power OFF to the FIREBERD 4000. Damage can occur to the interface and mainframe.

1. Turn the AC power OFF to the FIREBERD.
2. Face the FIREBERD rear panel. The FIREBERD 4000 may have two interface slots. SLOT1 (bottom slot) is the standard interface slot and SLOT2 (top slot) is the optional interface slot (Option 4001).
3. Insert the interface into a vacant interface slot with its plastic cover facing down and the printed circuit (PC) board facing up.
4. Slide the module into the FIREBERD until the interface panel is flush with the rear panel. Make sure the PC board edges are fitted into the card guides inside the interface slot.
5. Secure the interface with the two thumbscrews on the interface panel.

4.3 FIREBERD 4000 INTERFACE MENU

Read this section to familiarize yourself with the FIREBERD 4000 DDS DS0A/B Interface menus. The following information describes how to access the interface menu and discusses each of the menu selections in the DDS DS0A/B Interface menu.

The DDS DS0A/B Interface is controlled through the FIREBERD 4000 INTERFACE SETUP category, as shown in Figure 4-1. The Mode menu (MODE) is used to select the data format to be tested. The Interface Connector menu (INT) determines the transmit and receive (TX OUTPUT and RX INPUT) electrical signal format required to connect with the circuit being tested. The Loopback menu (LOOP) is used to establish terminal loopbacks. A series of other menus provide selections for byte encoding, error generation, MJU control, interface THRU mode, and channel analysis selections.

4.3.1 FIREBERD 4000 Menu Control

The DDS DS0A/B Interface menu is selected through the FIREBERD 4000 INTERFACE SETUP category. Press the DS0A/B softkey to access the DS0A/B Interface menu. Use the SETUP SELECT switch to step through the menus. Press the softkeys to select a function as indicated by the softkey labels on the bottom line of the display. To return to the interface selection menu, press the mainframe HOME key. Pressing a softkey in any menu either (1) scrolls a list of parameters which are automatically acted upon (selecting rates), (2) executes a function (activating the byte encoder), or (3) provides assistance (HELP screens). The Loopback menus (LOOP) require the use of the mainframe LOOP UP and LOOP DOWN switches to activate a loopback sequence or disable it after the loopback is selected. All interface menu settings are retained when power is removed from the mainframe.

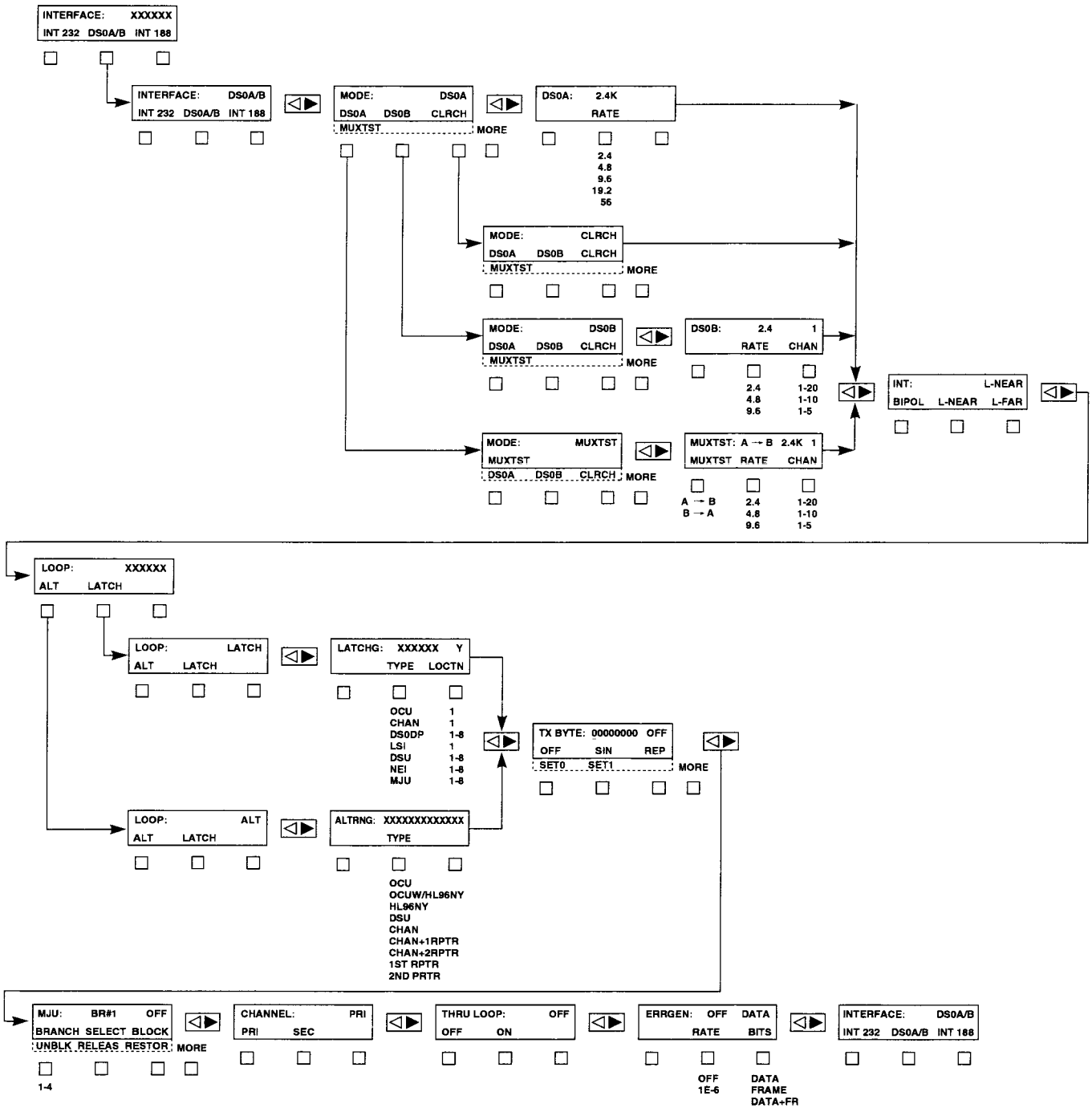

Figure 4-1
FIREBERD 4000 DDS DS0A/B Data Interface Set-Up Menu

4.3.2 Operating Mode Menu

The Operating Mode (MODE) menu allows the user to select DS0A, DS0B, clear channel (CLRCH), and multiplexer test (MUXTST) operating modes. Press the appropriate softkey to select the desired operating mode. Press the MORE key to display the MUXTST softkey label. Except for CLRCH, press the SETUP SELECT switch to access the appropriate operating mode menu.

DS0A - The DS0A operating mode configures the interface to accept and test DS0A-formatted signals at the selected rate.

RATE - Selects DS0A data rates: 2.4, 4.8, 9.6, 19.2, and 56 kb/s.

DS0B - The DS0B operating mode configures the interface to test DS0B-formatted signals at the selected rate and channel.

RATE - Selects the DS0B signal rate: 2.4, 4.8, and 9.6 kb/s.

CHAN - Selects the DS0B channel being tested at the selected rate: 5 channels at 9.6 kb/s, 10 channels at 4.8 kb/s, and 20 channels at 2.4 kb/s.

CLRCH - The clear channel mode allows the FIREBERD to transmit an unformatted DS0, 64 kb/s, clear channel signal.

MUXTST - The multiplexer test mode permits DS0B ISMX and SRDM testing. In the MUXTST mode, the FIREBERD transmitter and receiver operate independently in the DS0A and DS0B modes.

MUXTST - Selects direction and format of the transmitter and receiver signal: A->B (transmit DS0A, receive DS0B) and B->A (transmit DS0B, receive DS0A).

RATE - Selects the DS0A and DS0B signal rate: 2.4, 4.8, and 9.6 kb/s.

CHAN - Selects the DS0B channel being tested at the selected rate:

5 channels at
10 channels at 4.8 kb/s, and
20 channels at 2.4 kb/s.

4.3.3 Interface Connector Menu

The Interface Connector (INT) menu controls the type of data interface to which the FIREBERD can connect and the direction of the test signals by configuring the TX OUTPUT and RX INPUT jacks. Press the appropriate softkey to select the desired interface.

BIPOL - When the BIPOL softkey is pressed, the interface is configured to transmit and receive bipolar test signals using both tip and ring leads.

L-NEAR - When the L-NEAR softkey is pressed, the interface is configured to transmit and receive logic level (0 to +5 V) test signals only on the tip leads toward the near-end local loop or equipment side.

L-FAR - When the L-FAR softkey is pressed, the interface is configured to transmit and receive logic level (0 to +5 V) test signals only on the ring leads toward the far-end local loop or line side.

4.3.4 Loopback Menu

The Loopback (LOOP) menu provides two loopback code formats: alternating (ALT) and latching (LATCH). The loopback types are selected through the ALTRNG or LATCHG loopback menus. Press the appropriate softkey to select the desired loopback mode. Press the SETUP SELECT switch to access the appropriate loopback mode menu.

NOTE: Loopbacks established in DS0A 19.2 kb/s circuits do not have error correction capabilities.

ALTRNG - The Alternating Loopback menu provides nine terminal loopback selections. Press the TYPE softkey to scroll through and select one of the following alternating loopbacks.

OCU - Prepares the interface to send the alternating Office Channel Unit loop code.

OCU w/ HL96NY - Prepares the interface to send the alternating OCU loop code and, if in the circuit, bypass a HL96NY terminal.

HL96-NY - Prepares the interface to send the alternating HL96NY terminal loop code.

DSU - Prepares the interface to send the alternating Data Service Unit loop code.

CHAN - Prepares the interface to send the alternating Channel Service Unit (CSU) loop code.

CHAN + 1 RPTR - Prepares the interface to send the alternating CSU loop code and, if in the local loop, bypass one repeater.

CHAN + 2 RPTR - Prepares the interface to send the alternating CSU loop code and, if in the local loop, bypass two repeaters.

1ST RPTR - Prepares the interface to send the alternating repeater loop code to the first repeater in the local loop as the data leaves the channel bank.

2ND RPTR - Prepares the interface to send the alternating repeater loop code to the second repeater (bypassing the first repeater) in the local loop as the data leaves the channel bank.

LATCHG - The Latching Loopback menu has seven loop-code selections. Press the TYPE softkey to select one of the following loopback locations. The LOCATN (location) softkey currently applies to the DS0-DP menu selection only. Set the LOCATN to "1" on all other loop-code selections. Specifications allow for future use of "location" in selecting loopbacks within a DDS network.

OCU - Prepares the interface to send the latching Office Channel Unit loop-code sequence.

CHAN - Prepares the interface to send the latching Channel Service Unit (CSU) loop-code sequence.

DS0DP - Prepares the interface to send the latching Digital Signal Zero-Dataport loop-code sequence to one of eight possible DS0-DPs locations (LINE or DROP) in the circuit.

LSI - Prepares the interface to send the latching Loop Side Interface (HL222) loop-code sequence.

DSU - Prepares the interface to send the latching Data Service Unit loop-code sequence.

NEI - Prepares the interface to send the latching DDS Termination loop-code sequence.

MJU - Prepares the interface to send the latching Multipoint Junction Unit loop-code sequence.

4.3.5 Transmit Byte Encoder Menu

Press the **SETUP SELECT** switch until the Transmit Byte Encoder (TX BYTE) menu appears. The **TX BYTE** menu enables the user to create an 8-bit byte and transmit the pattern singly or repeatedly. The byte field on the top line of the menus displays the 8-bit byte and cursor. Press the mainframe cursor keys to move the cursor in the top line of the display. When changing the byte, press the ENTER key to save the changes. The **TX BYTE** menu softkeys are described as follows:

OFF - Press to disable the byte encoder.

SIN - Press to transmit a single 8-bit byte.

REP - Press to transmit the 8-bit byte repeatedly.

SET0 - Press to set the bit over the cursor to a zero.

SET1 - Press to set the bit over the cursor to a one.

4.3.6 Multipoint Junction Unit Menu

Press the SETUP SELECT switch until the Multipoint Junction Unit (MJU) menu appears. The **MJU** menu enables the interface to control DDS MJUs. All but the BRANCH softkey execute the specified command. OFF appears in the top line when no command is being sent. The BRANCH number also appears in the top line. During the execution of a command, status messages appear in the Results display. The **MJU** menu softkeys are described as follows:

BRANCH - Press the BRANCH softkey to identify the MJU branch (1 - 4) being selected. Used with the SELECT softkey.

SELECT - Press the SELECT softkey to access the identified branch (BRANCH softkey).

BLOCK - Press the BLOCK softkey to disconnect (block) the selected MJU branch from the network.

UNBLK - Press the UNBLK softkey to unblock the selected blocked branch and restore it to normal operation.

RELEAS - Press the RELEAS softkey to globally release ALL MJUs in the affected circuit and return them to normal operation.

RESTOR - Press the RESTOR softkey to deselect the previously selected branches and return them to normal operation.

4.3.7 Channel Control Menu

Press the SETUP SELECT switch until the Channel Control (CHANNEL) menu appears. The **CHANNEL** menu controls which DDS channel, primary or secondary, the FIREBERD 4000 analyzes. The **CHANNEL** menu softkeys are described as follows:

PRI - Press the PRI softkey to connect the mainframe to the DDS primary channel. The DDS secondary channel is sent to the PROTOCOL PORT.

SEC - Press the SEC softkey to connect the mainframe to the DDS secondary channel. The primary channel is sent to the PROTOCOL PORT.

4.3.8 Interface THRU Loop Mode Menu

Press the SETUP SELECT switch until the Interface Thru Loop (THRU LOOP) menu appears. The THRU LOOP mode places the interface in the THRU loop mode. The **THRU LOOP** menu softkeys are described as follows:

OFF - Disables the loop and returns interface to normal operation.

ON - Enables the THRU LOOP mode to pass received data through the interface unaltered, unless ERRGEN is on.

4.3.9 Error Rate Generator Menu

Press the SETUP SELECT switch until the Error Rate Generator (ERRGEN) menu appears. The **ERRGEN** injects a programmed error rate into the transmitted data (standard or THRU modes) at 64 kb/s. The **ERRGEN** menu softkeys are described as follows:

RATE - Press the RATE softkey to either select the bit error rate of 1E-6 or turn the generator OFF.

BITS - Press the BIT softkey to select where the errors are injected in the data stream: data bits only (DATA), framing bits only (FRAME), or both (DATA+FR).

4.4 FIREBERD 4000 DDS DS0A/B INTERFACE SET-UP

The DDS DS0A/B Interface is set-up through the mainframe INTERFACE SETUP category. The interface menus are shown in Figure 4-1. Perform the following interface set-up procedure for all test modes.

1. Use the CATEGORY SETUP switch to select the **INTERFACE SETUP** category.

2. Press the DS0A/B softkey to select the DS0A/B Interface menu (see Figure 4-1).

3. Press the right SETUP SELECT switch arrow. The MODE menu appears. Press one of the following mode softkeys to configure the interface:

   - **DS0A** - Press the DS0A softkey to test DS0A-formatted signals. Press the right SETUP SELECT switch arrow to access the DS0A mode menu. Press the RATE softkey to select the appropriate data rate: 2.4, 4.8, 9.6, 19.2, or 56 kb/s. *Go to Step (4) to continue.*

   - **DS0B** - Press the DS0B softkey to test one DS0B-formatted channel. Press the right SETUP SELECT switch arrow to access the DS0B mode menu. Press the RATE softkey to select the channel data rate: 2.4, 4.8, or 9.6 kb/s. Press the CHAN softkey to select the channel being tested: 1 to 20 at 2.4 kb/s, 1 to 10 at 4.8 kb/s, or 1 to 5 at 9.6 kb/s. *Go to Step (4) to continue.*

   - **CLRCH** - Press the CLRCH (clear channel) softkey to test with a 64 kb/s clear channel signal. *Go to Step (4) to continue.*

   - **MUXTST** - Press the MUXTST softkey to configure the interface for subrate multiplexer testing. *Go to Section 4.7.3 for the multiplexer test set-up procedure.*

4. The next interface menu is the Interface (INT) Connector menu. Press the right SETUP SELECT switch arrow until the INT menu appears. Press the appropriate softkey to select one of the following test access point interface formats:

   NOTE: The interface connection signal format is determined by the terminal connections.

   - **BIPOL** - Select BIPOL (bipolar) to provide signals on the jack tip and ring leads.

   - **LNEAR** - Select LNEAR (logic near) to provide signals on the jack tip leads only to test toward the near-end.

   - **LFAR** - Select LFAR (logic far) to provide signals on the jack ring leads only to test toward the far-end.

5. Press the right SETUP SELECT switch arrow to select the LOOP menu or any of the other menus described in Section 4.7.

4.5 FIREBERD 4000 MAINFRAME SET-UP

Perform this procedure to configure the FIREBERD 4000 with the DDS DS0A/B Data Interface.

1. If necessary, turn the AC power ON and release the SELF LOOP switch before starting.

2. Press the SETUP CATEGORY switch and select the GENERATOR CLOCK category. The GEN CLOCK menu should indicate INTF (interface) on the top line. The interface supplies the bit and byte clocks to the mainframe and INTF is automatically selected when the interface is selected.

   NOTE: Whenever the DDS DS0A/B Interface is deselected and another interface is selected that does not require the INTF clock source, the GENERATOR CLOCK category needs to be accessed and changed manually to select the appropriate source.

3. Press the SETUP CATEGORY switch and select the PATTERN category. Select the desired test pattern by pressing the appropriate softkey (and MORE key). With the DDS DS0A/B Interface selected, up to four DDS stress patterns are also available through the PATTERN menu. Refer to Section 4.8 for additional information.

4. Return to the INTERFACE SETUP category to prepare for testing the DDS circuits.

4.6 CONNECTING FIREBERD 4000 TO DDS

Perform this procedure to connect the FIREBERD 4000 to the DDS test access point.

1. Connect the clock cable (9-pin D to 9-pin D or appropriate cable) between the interface CLOCKS connector and a DDS clock source (e.g., OIU). When the FIREBERD 4000 detects the clock signals, the **GENERATOR CLK NOT PRESENT** message disappears from the Results display.

   NOTE: The next step disrupts the end-to-end circuit transmissions and constitutes an out-of-service test.

2. Connect the bantam-plug cables between the FIREBERD interface TX OUTPUT and RX INPUT jacks and the circuit being tested.

   - Verify interface connector format: bipolar, logic near, or logic far.

   - Verify data format: DS0A, DS0B, or clear channel.

3. If required, connect an RS-232C compatible test instrument to the DCE PROTOCOL PORT for secondary or primary DDS channel analysis and testing.

4. Perform circuit testing and analysis as described in the next section.

4.7 FIREBERD 4000 DDS CIRCUIT TESTS

Perform any of the following test procedures to test the applicable DDS circuits. These procedures assume that the initial set-up procedures previously described have been performed, including connecting the FIREBERD 4000 to the network.

- If a loopback test is required, go to Section 4.7.1, Establishing Loopback Tests, to establish the loopback.

- If a multipoint network is being worked on, go to Section 4.7.2, Controlling and Testing Multipoint Networks, to establish control over the network MJUs.

- If a subrate multiplexer is being worked on, go to Section 4.7.3, Testing Subrate Multiplexers, for the set-up procedure.

- If the byte encoder is required for testing, go to Section 4.7.4, Testing Circuits with Byte Encoder.
- If the error rate generator is required for testing, go to Section 4.7.5, Testing Circuits with Error Rate Generator.
- If the THRU mode is required for testing, go to Section 4.7.6, Establishing Interface THRU Mode.
- If the DDS secondary channel requires testing, go to Section 4.7.7, Testing DDS Secondary Channels, to set-up the mainframe and/or PROTOCOL PORT.

4.7.1 Establishing Loopback Tests

Perform this procedure to establish an alternating or latching loopback test.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.
2. Press the SETUP SELECT switch until the LOOP menu appears.
   - *Go to Step (3) to establish an alternating loopback.*
   - *Go to Step (7) to establish a latching loopback.*

   NOTE: Prior knowledge of the network circuits and their ability to respond to alternating or latching loop codes is necessary for proper operation.
3. Press the ALT softkey to select the Alternating Loop menu.
4. Press the right SETUP SELECT switch arrow to access the ALTRNG menu.
5. Press the TYPE softkey to select one of the following alternating loopbacks:
   - **OCU** - Office Channel Unit loopback
   - **OCU w/ HL96NY** - Office Channel Unit loopback behind HL96NY
   - **HL96-NY** - HL96NY loopback
   - **DSU** - Data Service Unit loopback
   - **CHAN** - Channel Service Unit loopback
   - **CHAN + 1 RPTR** - Channel Service Unit loopback behind one repeater
   - **CHAN + 2 RPTR** - Channel Service Unit loopback behind two repeaters
   - **1ST RPTR** - First local loop repeater loopback
   - **2ND RPTR** - Second local loop repeater loopback
6. *Go to Step (10) to continue.*
7. Press the LATCH softkey to select the Latching Loop menu.
8. Press the right SETUP SELECT switch arrow to access the LATCHG menu.

9. Press the TYPE softkey to select one of the following latching loopbacks:

   - **OCU** - Office Channel Unit loopback
   - **CHAN** - Channel Service Unit loopback
   - **DS0DP** - DS0-Dataport loopback (When more than one DS0-DP is present, press the LOCATN softkey to select the location of the DS0-DP being looped.)
   - **LSI** - Loop Side Interface (HL222) loopback
   - **DSU** - Data Service Unit loopback
   - **NEI** - DDS Termination loopback
   - **MJU** - Multipoint Junction Unit loopback

   NOTE: The LOCATN number should be set for "1" when the OCU, CHAN, LSI, or MJU loopback is selected.

10. Connect the FIREBERD to the network as described in Section 4.6.

11. Press the mainframe LOOP UP switch to send the selected loopback sequence. Perform the desired tests and analysis. An appropriate status message appears in the Results display during the loop up sequence to identify success or failure of the sequence.

12. To terminate the loopback, press the mainframe LOOP DOWN switch.

4.7.2 Controlling and Testing Multipoint Networks

Perform these procedures to take control and test the multipoint network.

MJU Branch Selection

Perform this procedure to select the MJU branch being controlled.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.
2. Press the SETUP SELECT switch until the MJU menu appears.
3. Press the BRANCH softkey to identify the MJU branch (1-4) to be selected.
4. Press the SELECT softkey to select the identified branch. When the branch is selected, the MJU HUB ID number appears on the mainframe display.
5. If working with cascaded MJUs, repeat Steps (3) and (4) to gain access to other MJU branches downstream from the control channel access point.

NOTE: Once the MJU branch is selected, another MJU branch select sequence can be transmitted on the selected branch to the next MJU. The block, unblock, restore, or loopback commands are available to be transmitted down the selected branch.

Block a Branch

Perform this procedure to block the selected MJU branch.

1. Select the MJU branch as previously described.
2. Press the BLOCK softkey to black the selected branch. **BLOCK** appears in the top line of the menu and a status message appears in the Results display indicating the success or failure of this step.
3. Repeat steps (1) and (2) as required.

Unblock a Blocked Branch

Perform this procedure to unblock the selected MJU branch.

1. Select the MJU branch as previously described.
2. Press the UNBLK softkey (press MORE key) to unblock the selected branch. **UNBLOCK** appears in the top line of the menu and a status message appears in the Results display indicating the success or failure of this step.
3. Repeat Steps (1) and (2) as required.

Release the Network

Perform this procedure to release ALL MJUs downstream from the control channel.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.
2. Press the SETUP SELECT switch until the MJU menu appears.
3. Press the MORE key to locate the RELEAS softkey.
4. Press the RELEAS softkey to release ALL selected and blocked branches downstream from the control channel access point. **RELEASE** appears in the top line of the menu and a status message appears in the Results display indicating the success or failure of this step.

Restore Selected Branch

To restore the last selected branch, press the RESTOR softkey. This returns the selected branch to its previous condition. **RESTORE** appears in the top line of the menu and a status message appears in the Results display indicating the success or failure of this step.

Establish a Loopback on Selected Branch

Perform this procedure to establish a terminal loopback in a multipoint network.

1. Select the MJU branch as previously described.
2. Press the left SETUP SELECT switch arrow until the LOOP menu appears in the display.
3. Press the LATCH or ALT softkey to select the Latching or Alternating Loopback menu.
4. Press the right SETUP SELECT switch arrow to display the LATCHG or ALTRNG menu.

5. Press the TYPE softkey to select the appropriate terminal loop code to be sent. The MJU loop code is listed in the LATCHG menu.

6. Press the the Interface Status panel LOOP UP switch to establish the loop. Perform the desired tests and analysis. An appropriate status message appears in the Results display during the loop up sequence to identify success or failure of the sequence.

7. To terminate the loopback, press the mainframe LOOP DOWN switch.

4.7.3 Testing Subrate Multiplexers

The following procedure configures the DDS DS0A/B Interface to test ISMX and SRDM terminals.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.

2. Press the SETUP SELECT switch until the MODE menu appears.

3. Press the MORE key, if necessary, to display the MUXTST softkey.

4. Press the MUXTST softkey. **MUXTST** appears on the top line of the display.

5. Press the SETUP SELECT switch to access the MUXTST menu.

6. Press the MUXTST softkey to select the interface transmitter and receiver signal direction and format: A->B or B->A.

   - Select **A->B** to transmit DS0A and receive DS0B signals.
   - Select **B->A** to transmit DS0B and receive DS0A signals.

7. Press the RATE softkey to select the channel data rate: 2.4, 4.8, or 9.6 kb/s.

8. Press the CHAN softkey to select the channel being tested:

   1 to 20 for 2.4 kb/s multiplexers,

   1 to 10 for 4.8 kb/s multiplexers, or

   1 to 5 for 9.6 kb/s multiplexers.

9. Press the right SETUP SELECT switch arrow to display the Interface Connector menu. Press the BIPOL softkey to select the bipolar interface connection format. Only the BIPOLAR interface format is used in this procedure.

10. Connect the FIREBERD 4000 to the subrate multiplexer as follows:

    - If the **A->B** direction was selected in Step (6), connect the interface TX OUTPUT to a bipolar DS0A input to the subrate multiplexer, and connect the interface RX INPUT to a bipolar DS0B output from the subrate multiplexer.
    - If the **B->A** direction was selected in Step (6), connect the interface TX OUTPUT to a bipolar DS0B input to the subrate multiplexer, and connect the interface RX INPUT to a bipolar DS0A output from the subrate multiplexer.

4.7.4 Testing Circuits with Byte Encoder

Perform this procedure to enable the interface byte encoder.

NOTE: The byte encoder cannot be used in the THRU mode, clear channel (CLRCH) operation, or alternating (ALT) loopback tests.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.
2. Press the SETUP SELECT switch until the TX BYTE menu appears.
3. Press the MORE key to display the SET0 and SET1 softkeys. Use the cursor keys to position the cursor in the top line of the display. Press the SET0 or SET1 softkey to key in a zero or one at the position of the cursor.
4. Press the ENTER key to save the keyed in binary byte.
5. Press the MORE key to display the OFF, SIN, and REP softkeys.
6. Press the SINGLE softkey to send the pattern once. Press the REPEAT softkey to send the pattern continuously.
7. When the encoder is no longer needed, press the OFF softkey to turn it off.

4.7.5 Testing Circuits with Error Rate Generator

Perform this procedure to enable the interface ERRGEN generator. The ERRGEN generator can be used in all operating modes.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.
2. Press the SETUP SELECT switch until the ERRGEN menu appears.
3. Press the RATE softkey to turn the generator on and off. When on the generator injects an error rate of 1E-6.
4. Press the BITS softkey to select the type of bits affected by the generator: DATA (data bits only), FRAME (framing bits only), or DATA+FR (data and framing bits).
5. When no longer needed, press the RATE softkey to turn the generator off.

4.7.6 Establishing Interface THRU Mode

Perform this procedure to enable the interface THRU mode. In this test scenario, the FIREBERD would typically be connected at a DS0-DSX.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.
2. Press the SETUP SELECT switch until the THRU LOOP menu appears.
3. Press the ON softkey to establish the interface THRU mode (internal receive-to-transmit loop facing the network). The mainframe can still analyze the received signal, but cannot transmit test patterns, loop codes, or other data to the network. However, the ERRGEN can be used to inject errors in the signal passing through the interface.
4. Press the OFF softkey to remove the loop and return the interface to normal operation.

4.7.7 Testing DDS Secondary Channels

Perform this procedure to test the DDS secondary channel with the FIREBERD.

1. Press the SETUP CATEGORY switch to select the INTERFACE category.
2. Press the SETUP SELECT switch until the CHANNEL menu appears.

3. Press the SEC softkey to select the DDS secondary channel for mainframe testing and analysis.

4. When secondary channel testing is complete, press the PRI softkey to return the mainframe back to the primary channel.

NOTE: The PROTOCOL PORT provides access to the primary channel when the mainframe is analyzing the secondary channel. The PROTOCOL PORT substitutes 1's for transmit data when RTS is low.

4.8 FIREBERD 4000 DDS STRESS PATTERNS

When the DDS DS0A/B Interface is selected, four additional test patterns are made available through the PATTERN SETUP category. These patterns (labeled DDS-1, DDS-2, DDS-3, and DDS-4) are used to stress the DDS circuits. They can be used in end-to-end and latching loopback test configurations. Each pattern octet is transmitted with the control and framing bits interleaved to generate the appropriate data pattern. The patterns are defined as follows:

DDS-1 - Long User Pattern repeating pattern of 100 octets of 1111 1111 and 100 octets of 0000 0000. This pattern provides a minimum and maximum ones density which can stress the DDS signal recovery circuits.

DDS-2 - Long User Pattern repeating pattern of 100 octets of 0111 1110 and 100 octets of 0000 0000. This pattern provides a minimum ones density and simulates bit oriented protocol flags (e.g., HDLC) to ensure the DDS can pass the signal properly.

DDS-3 - This pattern is a continuous series of octets of 0011 0010 which provides a minimum ones density and simulates a typical signal transmitted over DDS.

DDS-4 - This pattern is a continuous series of octets of 0100 0000 which provides a low ones density.

DDS-5 - Long User Pattern is a 7-octet fixed pattern of 1111 1110, followed by 1 octet of 1111 1111. This pattern simulates a DDS signal transition from IDLE mode to DATA mode.

DDS-6 - Long User Pattern consisting of DDS patterns 1-4. Provides a quick test for those wishing to test a circuit with DDS patterns 1-4.

DDS-1, DDS-2, DDS-5, and DDS-6 are only available when Option 4006, Synchronous User Pattern, is installed. DDS-3 and DDS-4 are always available when the DDS DS0A/B Interface is selected. If one of the stress patterns is selected when the interface is changed, the pattern defaults to 2^{15}-1. Refer to the *FIREBERD 4000 Reference Manual* for additional information regarding other test pattern capabilities.

4.9 FIREBERD 4000 SELF-LOOP TEST

When the mainframe SELF LOOP switch is pressed, an interface relay loops the TX OUTPUT to the RX INPUT. This is used to test the operation of the mainframe and interface. The data cables do not have to be removed to perform the test. The DS0A/B Interface requires bit and byte clock to be connected before the mainframe self-loop test can be performed. The MUXTST mode cannot be tested in self-loop mode. Also, THRU mode does not work in self-test. Byte Encoder will not sync.

4.10 INTERFACE STATUS INDICATORS AND SWITCHES

When the DDS DS0A/B Interface is used, the mainframe backlights the interface status indicators and switches (right side of mainframe) as follows: CODE, ALM1, LOOP UP, and LOOP DOWN.

The CODE LED illuminates when the interface has initiated an alternating loopback and is receiving the correct loop-code bytes interleaved with the test data. The ALM 1 LED illuminates when the RX INPUT jack is terminated and operating with bipolar signals.

When the LOOP UP switch is pressed and released, the selected loopback sequence is transmitted to the appropriate terminal. The switch is illuminated while the loopback is being established. Pressing and releasing the LOOP DOWN switch transmits the

appropriate release loop code. The switch is illuminated while the release loop code is being transmitted. These two switches are not illuminated in clear channel (CLRCH) mode. Status messages appear in the Result display indicating the status of the loop code responses.

When testing DS0B or DS0A 19.2 kb/s signals, the RECEIVER panel FRAME SYNC LED and ALARMS panel FRAME LOSS LED indicate framing conditions. The frame sync loss is reported after three consecutive errored framing patterns are detected.

4.11 FIREBERD 4000 DS0A/B ANALYSIS RESULTS

Table 4-1 lists the analysis results that are displayed when the DS0A/B Interface is installed in the FIREBERD 4000. Refer to the *FIREBERD 4000 Reference Manual* for results definitions not described in this section.

Two results unique to the DDS DS0A/B Interface are provided: RCV BYTE (received byte) and RCV CODE (received control code). The received data bytes are sampled every 300 milliseconds and displayed in binary form in the INTERFACE category RCV BYTE results display. Each displayed byte is compared with a list of reportable DS0 control codes stored in memory. The recognized control code name is then reported in the INTERFACE category RCV CODE results display. If no match occurs, the RCV CODE result remains inactive (blank). The reported DS0 control codes are listed in Appendix A.

Another INTERFACE category result affected by the interface is the RCV FREQ results display. When testing a circuit using alternating loop codes, the RCV FREQ display indicates one half the actual circuit rate, e.g., a looped 9.6 kb/s circuit has a received frequency of 4.8 kb/s. The FIREBERD measures only the received test data and not the combined loop code and data. When testing the DDS secondary channel, the RCV FREQ display also displays the secondary channel data rate. When configured to receive DS0B or DS0A 19.2 kb/s signals and no frame bits are detected, **No frame** appears in the RCV FREQ display.

When testing DS0B or DS0A 19.2 kb/s signals, the INTERFACE category frame error (FRA ERR) and average frame error rate (AVG FER) results are made available for reporting framing errors.

Table 4-1
FIREBERD 4000 DS0A/B Interface Results

Category	Displayed Result	Description
ERROR	AVG BER	Average Bit Error Rate
	AVG BLER	Average Block Error Rate
	BER	Bit Error Rate
	BIT ERRS	Bit Errors[1]
	BLK ERRS	Block Errors
	BLOCKS	Blocks
	PAT LOSS	Pattern Synchronization Loss[1]
	PAT SLIP	Pattern Slips[1]
INTERFACE	AVG FER	Average Frame Error Rate[2]
	FRA ERR	Frame Errors[1,2]
	RCV BYTE	Receive Byte Code
	RCV CODE	Receive Code Name
TIME & SIGNAL	%EFS	Percent of Error-Free Seconds
	DATE	Date
	ELAP SEC	Elapsed Seconds
	ERR SEC	Errored Seconds
	GEN FREQ	Generator Clock Frequency

Table 4-1
FIREBERD 4000 DS0A/B Interface Results (Continued)

Category	Displayed Result	Description
TIME & SIGNAL	PATL SEC	Pattern Loss Seconds
	RCV FREQ	Receiver Clock Frequency
	TEST SEC	Test Seconds
	TIME	Time
PERFORMANCE[3]	%AVL SEC	Percent of Available Seconds
	%DEG MIN	Percent of Degraded Minutes
	%SES	Percent of Severely Errored Seconds
	AVL SEC	Available Seconds
	DEG MIN	Degraded Minutes
	G %EFS	G.821 Percent of Error Free Seconds
	G EFS	G.821 Error Free Seconds
	GERR SEC	G.821 Errored Seconds
	SES	Severely Errored Seconds
	UNA SEC	Unavailable Seconds

[1] Appears in SUMMARY Category.

[2] Only appears when receiving DS0B or DS0A 19.2 kb/s signals.

[3] Requires Option 4004.

4.12 FIREBERD 4000 PRINTER OPERATION

Refer to the *FIREBERD 4000 Reference Manual* for printer set-up and operating instructions. Figure 4-2 shows a typical Results printout with the DS0A/B Interface RCV BYTE and RCV CODE results indicating the TA (Test Alert) byte and control code name. Figure 4-3 is a typical Controls printout showing a DS0A/B Interface set-up. Figure 4-4 shows a typical MJU status message printouts (available through AUXILIARY SETUP category, STATUS PRINT menu) which is provided through the DS0A/B Interface.

```
MANUAL PRINT00:03:18 19 JAN 90
BIT ERRS          283    AVG BER      8.83E-04
BER         1.0 E-03     PAT SLIP            0
BLK ERRS             8   BLOCKS              9
AVG BLER  9.   E-01      PAT LOSS            0
PATL SEC             0   ERR SEC           118
%EFS           11.28%    TEST SEC          133
ELAP SEC           134   GEN FREQ      2400.04
RCV FREQ      2400.04    RCV BYT      11111011
RCV COD                  AVL SEC           133
UNA SEC              0   %AVL SEC      100.00%
DEG MIN              1   %DEG MIN      1000.0%
G EFS               15   GERR SEC          118
G %EFS         11.28%    SES                47
%SES           35.34%    LOOPBACK           NO
RX         TERMINATED    SELF LOOP OFF
IF              DS0A/B
```

Figure 4-2
Long Results Printout

```
CONTROLS PRINT11:12:23 13 SEP 89
PATTERN      2 15-1      ERROR INSERT    OFF
SELF LOOP         ON     GEN CLOCK      INTF
DISPLAY HOLD    OFF      SETUP PROGRAM  NO.1
AUXILIARY SETUP
FLOW TR/DTR     OFF      FLOW DM/DSR     OFF
FLOW RS/RTS     OFF      FLOW CS/CTS     OFF
FLOW RR/RLSD    OFF      SYN LOS ACT    HALT
SYN LOS THR NORMAL       USER SYN THR     10
BLOCK LENGTH  PATT       PRINT FMT      LONG
STATUS PRINTS   OFF      PRINT EVENT     OFF
INTERFACE SLOT2          DS0A/B
MODE            DS0A     DATA RATE     19.2K
DATA TYPE   BIPOLAR      LOOP TYPE    ALTRNG
ALT LOOP         OCU     TX BYTE    00000001
TX MODE          OFF     MJU              BR2
MJU ACTION       OFF     THRU LOOP        OFF
ERR RATE          ON     ERR TYPE    DATA+FR
CHANNEL     PRIMARY
```

Figure 4-3
Controls Printout

```
STATUS MESSAGE          14:00:35 15 SEP 89
MJU LOOP COMPLETE       HUB ID 01

STATUS MESSAGE          14:05:45 15 SEP 89
MJU LOOP COMPLETE       NOT CONFIRMED

STATUS MESSAGE          14:13:25 15 SEP 89
MJU BLOCKED

STATUS MESSAGE          14:25:45 15 SEP 89
MJU RELEASED

STATUS MESSAGE          14:27:55 15 SEP 89
MJU SELECT FAILED
```

Figure 4-4
MJU Status Message Printouts

4.13 FIREBERD 4000 REMOTE CONTROL COMMANDS

The FIREBERD 4000 remote control commands enable remote control over the DDS DS0A/B Data Interface. The DS0A/B Interface commands listed in Table 3-2 are for FIREBERD 4000 units equipped with software Rev 5. Refer to the appendix section for the FIREBERD 4000 remote commands for software revisions prior to Rev 5. The spacing used on each command line must be used as indicated. For detailed instructions on remotely controlling the FIREBERD 4000, refer to the *FIREBERD 4000 Reference Manual.*

INTF:SELECT [INT232|INT188|EXT1|EXT2] selects the interface by slot.

SECTION 5
INTERFACE SPECIFICATIONS

This section contains the specifications for the DDS DS0A/B Data Interface. This information is listed in Table 5-1.

Table 5-1
DDS DS0A/B Data Interface Specifications

Item	Specification
Operating modes	64 kb/s clear channel 64 kb/s byte encoder 64 kb/s THRU data DS0A or DS0B straightaway DS0A or DS0B loopback Secondary channel Subrate multiplexer test Multipoint Junction Unit control
Data format	Full-duplex, synchronous data
DS0A data rates	2.4, 4.8, 9.6, 19.2, and 56 kb/s
DS0B data rates	2.4, 4.8, and 9.6 kb/s
Test modes	
Alternating loopback modes	OCU, OCU+HL96, DSU, CHAN, CHAN+(1st) repeater, CHAN+(2nd) repeater, 1st & 2nd 56 kb/s repeaters, and HL96NY
Latching loopback modes	DS0-DP, OCU, CSU, LSI (HL222), DSU, NEI, and MJU
MJU control codes	Branch select, branch block, branch unblock, restore, and release
Error generation	
Operation	Continuous
Bit error rates	4E-6 to 1E-2 (1E-6 only on FIREBERD 4000)
Bit error format	Data bits only, frame bits only, or both
Clock input	
Connector	9-pin female D-type subminiature
Pin Assignments	1 Not connected 2 Signal ground 3 Logic level 64 kb/s bit clock input 4 Logic level 8 kb/s byte clock input 5 Signal ground 6 Bipolar 8 kb/s byte clock input (+) 7 Bipolar 8 kb/s byte clock input (-) 8 Bipolar 64 kb/s byte clock input (+) 9 Bipolar 64 kb/s byte clock input (-)
Signals	Logic and bipolar bit (64 kb/s) and byte (8 kb/s)

Table 5-1
DDS DS0A/B Data Interface Specifications (continued)

Item	Specification
Logic Level Clock Input	
Input impedance	1000 Ω ± 10%
Threshold	~ 1.4V
Hysteresis	~ 69 mV
Bipolar Clock Input	
Input impedance	1000 Ω ± 10%
Threshold	0.1V differential
Hysteresis	~ 69 mV
Bipolar data input	
Input connection	Bantam jack, color-coded red
Unterminated impedance	1000 Ω minimum (sleeve open)
Terminated impedance	135 Ω ± 10% (sleeve grounded)
Operating signal level	±3.5 to ±5.5 V with 0 to 1500 ft. of 24 gauge interconnecting cable
Bipolar data output	
Output connection	Bantam jack, color-coded white
Test load impedance	135 Ω, resistive
"Zero" output level	0.7 V maximum
Pulse amplitude	±5.0 ±0.5 V with maximum imbalance of ±0.25 V
Half amplitude pulse width	15.6 ±0.5 microseconds with maximum imbalance of ±0.7 microseconds
Rise and fall times	0.5 microseconds maximum
Data format	Alternate mark inversion, non-return to zero
Logic data input	
Input connection	Bantam jack, color-coded red
High level input voltage	1.6 V minimum, open circuit pulled up to logic high
Low level input voltage	0.9 V maximum
High level input current	1 mA at 5.0 V
Low level input current	1 mA at 0.7 V
Logic data output	
Output connection	Bantam jack, color-coded white
High level output	3.5 V minimum for output current less than 1 mA
Low level output	0.7 V maximum for input current less than 10 mA
Format near logic	Tip only
Format far logic	Ring only
Protocol Port	Configured as an RS-232-C DCE connection
	2 TD Input Transmit Data 3 RD Output Received Data 4 RTS Input Request to Send 5 CTS Output Clear to Send 6 DSR +V Data Set Ready 7 SGND — Signal Ground 8 RLSD +V Received Line Signal Detect 15 SCT Output Serial Clock Transmit 17 SCR Output Serial Clock Receive
Dimensions	7.3"W x 1.5"H x 5.1"D (185mm x 38mm x 130mm)

SECTION 6
MAINTENANCE AND SERVICE

6.1 INTRODUCTION

This section contains information on maintenance and service for the DDS DS0A/B Data Interface. It also describes TTC's warranty policies and repair procedures.

6.2 MAINTENANCE

6.2.1 In Case of Difficulty

If the unit fails to operate and no front or rear panel indicators illuminate, check the following:

- AC power cord and AC power supply
- AC fuse and fuse rating
- Interface clock connection

If some indicators illuminate but the unit fails to operate, verify that the interface in use is the correct type and is properly inserted (turn off power before inserting or removing interface). Check the interface cable and connections to the FIREBERD. Try substituting another interface if one is available.

Follow the self-test procedures in the FIREBERD Reference Manual as an aid in localizing the problem. If the unit continues to be inoperative, refer to the following sections for service information or call the TTC Instrument Service Center for applications assistance.

NOTE: Verify that the interface clock source is connected before attempting self-test.

6.3 SERVICE

6.3.1 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.

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

1. Equipment has been altered or repaired without specific 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.

6.3.2 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 6.3.4 of this manual. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Instrument Service Center. The RA number should then appear 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 furnished with the returned equipment.

6.3.3 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 used as credit against actual materials and labor costs should the equipment be repaired. Contact the TTC Instrument Service Center for specific information on the minimum out-of-warranty repair charge.

The customer will be billed for parts plus 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, and a hard copy of the purchase order must be received by TTC before the repaired equipment may be shipped to the customer. A description of the labor and 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.

6.3.4 Equipment Return Instructions

The customer should attach a tag to all equipment returned for repair that includes the following information:

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

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

APPENDIX A
CONTROL CODES

Table A-1
Latching and Alternating Loop Codes

Control Code	Control Byte b1 ..... b8	Description
CHAN	x 0 1 0 1 0 0 0	Alternating Channel (CSU) Loopback
DSU	x 0 1 0 1 1 0 0	Alternating DSU Loopback
OCU	x 0 1 0 1 0 1 0	Alternating OCU Loopback
LCHAN	x 0 1 1 0 0 0 1	Latching Channel (CSU) Loopback
DS0-DP	x 0 0 0 0 1 0 1	Latching DS0-Dataport Loopback
LSI (HL222)	x 1 0 0 0 1 1 1	Latching Loop Side Interface Loopback
MLB	x 1 0 1 0 0 0 1	Latching Multipoint Junction Unit Loopback
LOCU	x 1 0 1 0 1 0 1	Latching Office Channel Unit Loopback
DSU	x 1 1 1 0 1 1 1	Latching Data Service Unit Loopback
NEI	x 1 0 0 0 0 0 1	Latching DDS Termination Loopback

"x" See Notes.

Table A-2
DS0 Control Codes

Control Code	Control Byte b1 ..... b8	Description
ASC	x 0 0 1 1 1 1 0	Abnormal Station Condition
C IDLE	x 1 1 1 1 1 1 0	Control Idle Code
D IDLE	x 1 1 1 1 1 1 1	Data Idle Code
FEV	x 1 0 1 1 0 1 0	Far End Voice
LBE	x 1 0 1 0 1 1 0	Loopback Enable
MAP 0	x 0 0 1 0 0 1 1	MAP 0 Confirmation Code (line side)
MAP 1	x 1 1 0 1 1 0 1	MAP 1 Confirmation Code (drop side)
MOS	x 0 0 1 1 0 1 0	Mux Out of Sync
TA	x 1 1 0 1 1 0 0	Test Alert
TEST	x 0 0 1 1 1 0 0	Test Code
TIP	x 0 1 1 1 0 1 0	Transitions In Progress
UMC	x 0 0 1 1 0 0 0	Unassigned Mux Channel

"x" See Notes.

Table A-3
MJU Control Codes

Control Code	Control Byte b1 ..... b8	Description
BLOCK	x 0 0 0 1 0 1 0	MJU Block Code
MA	x 1 1 1 0 0 1 0	MJU Alert Code
MSB1	x 0 1 0 1 0 0 1	MJU Select Branch 1
MSB2	x 0 1 0 1 0 1 1	MJU Select Branch 2
MSB3	x 0 1 0 1 1 0 1	MJU Select Branch 3
MSB4	x 0 1 0 1 1 1 1	MJU Select Branch 4
RELEASE	x 1 1 1 1 0 0 0	MJU Release Code

"x" See Notes.

Table A-4
Reportable DS0 Control Codes

Control Code	Control Byte b1 ..... b8	Description
ASC	x 0 0 1 1 1 1 0	Abnormal Station Condition
BLOCK	x 0 0 0 1 0 1 0	MJU Block Code
C IDLE	x 1 1 1 1 1 1 0	Control Idle Code
CHAN	x 0 1 0 1 0 0 0	Alternating Channel (CSU) Loopback
D IDLE	x 1 1 1 1 1 1 1	Data Idle Code
DSU	x 0 1 0 1 1 0 0	Alternating DSU Loopback
FEV	x 1 0 1 1 0 1 0	Far End Voice
LBE	x 1 0 1 0 1 1 0	Loopback Enable
MA	x 1 1 1 0 0 1 0	MJU Alert Code
MAP 0	x 0 0 1 0 0 1 1	MAP 0 Confirmation Code (line side)
MAP 1	x 1 1 0 1 1 0 1	MAP 1 Confirmation Code (drop side)
MOS	x 0 0 1 1 0 1 0	Mux Out of Sync
OCU	x 0 1 0 1 0 1 0	Alternating OCU Loopback
RELEASE	x 1 1 1 1 0 0 0	MJU Release Code
TA	x 1 1 0 1 1 0 0	Test Alert
TEST	x 0 0 1 1 1 0 0	Test Code
TIP	x 0 1 1 1 0 1 0	Transitions In Progress
UMC	x 0 0 1 1 0 0 0	Unassigned Mux Channel

"x" See Notes.

NOTES: x is subrate framing bit when the byte is transmitted or received as a DS0B signal. Framing bit pattern determined by DS0B data rate.
x is in a "don't care" mode when the byte is received at a DS0A subrate.
x is a "1" when the byte is transmitted at a DS0A subrate.
x is a "0" when control codes (except IDLE) are transmitted at the DS0A 56 kb/s rate.
x is in a "don't care" mode when control codes (except IDLE) are received at the DS0A 56 kb/s rate.
x is a "1" when the IDLE code is transmitted or received at the DS0A 56 kb/s rate.

APPENDIX B
INTERFACE STATUS MESSAGES

Table B-1
FIREBERD 6000 DDS DS0A/B Interface Front Panel Messages

MESSAGE TYPES			
Operation	**In-Progress Message**	**Confirmation Message**	**Other Message**
MJU Control Messages			
SELECT	Selecting MJU. Please wait ...	MJU branch selected Branch x HUB ID yy	MJU timeout exceeded.[1]
BLOCK	Blocking MJU. Please wait ...	MJU branch blocked	MJU timeout exceeded.[2]
UNBLK	Unblocking MJU. Please wait ...	——	MJU unblock code sent.[1]
RELEAS	Releasing MJU. Please wait ...	——	MJU release code sent.[1]
RESTOR	Restoring MJU. Please wait ...	——	MJU restore code sent.[1]
Latching Loop Up Messages			
OCU, CHAN, and LSI	Transmitting loop code. Please wait ...	Latching loop achieved.	Loop code sent.[1]
DS0-DP	Transmitting loop code. Please wait ...	Latching loop achieved. (MAP0 Line side) or (MAP1 Drop side)	Loop code sent.[1]
MJU	Transmitting loop code. Please wait ...	Latching loop achieved. HUB ID yy	Loop code sent.[1]
Latching Loop Down Messages			
All modes	Transmitting loop code. Please wait ...	Loop down achieved.	Loop code sent.[1]

[1]Success of this operation cannot be confirmed.
[2] Indicates a failed operation.

Table B-1
FIREBERD 6000 DDS DS0A/B Interface Front Panel Messages (continued)

MESSAGE TYPES			
Operation	**In-Progress Message**	**Confirmation Message**	**Other Message**
Alternating Loop Up Messages			
All modes	Transmitting loop code. Please wait ...	Alternating loop achieved.	Loop code timeout exceeded.[2]
Alternating Loop Down Messages			
All modes	—	Loop down achieved.	—

[1]Success of this operation cannot bc confirmed.
[2] Indicates a failed operation.

Table B-2
FIREBERD 4000 DDS DS0A/B Interface Front Panel Messages

MESSAGE TYPES			
Operation	**In-Progress Message**	**Confirmation Message**	**Other Message**
MJU Control Messages			
SELECT	—	MJU SLCT COMPLETE HUB xx BRANCH xx	MJU SEL FAILED
BLOCK	—	MJU BLOCK COMPLETE	MJU OPERATION FAILED
UNBLK	—	MJU UNBLOCK COMPLETE	MJU OPERATION FAILED
RELEAS	—	MJU RELEASE COMPLETE	MJU OPERATION FAILED
RESTOR	—	MJU RESTORE COMPLETE	MJU OPERATION FAILED
Latching Loop Up Messages			
OCU,	LATCHING LOOP-UP	LOOP-UP COMPLETE	LOOP-UP COMPLETE
CHAN, LSI,	IN PROGRESS	CONFIRMED	NOT CONFIRMED
DS0DP	LATCHING LOOP-UP	LOOP-UP COMPLETE	LOOP-UP COMPLETE

Table B-2
FIREBERD 4000 DDS DS0A/B Interface Front Panel Messages (Continued)

Latching Loop Up Messages (continued)			
MJU	IN PROGRESS LATCHING LOOP-UP IN PROGRESS	MAP0-Line Side or MAP1-Drop Side MJU LOOP COMPLETE HUB ID xx	NOT CONFIRMED MJU LOOP COMPLETE NOT CONFIRMED
Latching Loop Down Messages			
All modes	LATCHING LOOP-DN IN PROGRESS	LOOP-DN COMPLETE CONFIRMED	LOOP-DN COMPLETE NOT CONFIRMED
Alternating Loop Up Messages			
All modes	ALTNG LOOP-UP IN PROGRESS	ALTNG LOOP-UP CONFIRMED	ALT LOOP-UP NOT CONFIRMED
Alternating Loop Down Messages			
All modes	—	ALTNG LOOP-DN COMPLETE	—

APPENDIX C
INTERFACE REMOTE CONTROL COMMANDS

DS0A/B Interface remote control commands for FIREBERD 6000 units equipped with software Rev F, or earlier, and FIREBERD 4000 units equipped with software Rev 4, or earlier, are listed in Table C-1. With the exception of the RATE command value (6000 only), all commands apply for both the FIREBERD 6000 and FIREBERD 4000.

Table C-1
FIREBERD 6000 DDS DS0A/B Data Interface Remote Control Commands

Remote Command	Result
INT SET DS0A/B	Selects DDS DS0A/B Interface and prints current set-up
INT SET DS0A/B MOD CLR	Selects clear channel mode
INT SET DS0A/B MOD DS0A	Selects DS0A mode and prints current set-up
INT SET DS0A/B MOD DS0A RAT (xxxK)	Selects DS0A data rate (xxxK = 2.4K, 4.8K, 9.6K, 19.2K, or 56K)
INT SET DS0A/B MOD DS0B	Selects DS0B mode and prints current set-up
INT SET DS0A/B MOD DS0B RAT (xxxK)	Selects DS0B data rate (xxxK = 2.4K, 4.8K, or 9.6K)
INT SET DS0A/B MOD DS0B CHA (xx)	Selects DS0B channel (xx = 1-20 for 2.4K, 1-10 for 4.8K, and 1-5 for 9.6K)
INT SET DS0A/B MOD MUX	Selects MUXTST mode and prints current set-up
INT SET DS0A/B MOD MUX TXA	Selects MUXTST Tx DS0A/Rx DS0B and prints current set-up
INT SET DS0A/B MOD MUX TXA RAT (xxxK)	Selects MUXTST Tx DS0A/Rx DS0B data rate (xxxK = 2.4K, 4.8K, or 9.6K)
INT SET DS0A/B MOD MUX TXA CHA (xx)	Selects MUXTST Tx DS0A/Rx DS0B channel (xx = 1-20 for 2.4K, 1-10 for 4.8K, or 1-5 for 9.6K)
INT SET DS0A/B MOD MUX TXB	Selects MUXTST Tx DS0B/Rx DS0A and prints current set-up
INT SET DS0A/B MOD MUX TXB RAT (xxxK)	Selects MUXTST Tx DS0B/Rx DS0A data rate (xxxK = 2.4K, 4.8K, or 9.6K)
INT SET DS0A/B MOD MUX TXB CHA (xx)	Selects MUXTST Tx DS0B/Rx DS0A channel (xx = 1-20 for 2.4K, 1-10 for 4.8K, or 1-5 for 9.6K)
INT SET DS0A/B INT	Prints current interface mode
INT SET DS0A/B INT (xxx)	Selects interface mode (xxx = BIP, LNE, or LFA)
INT SET DS0A/B LOO	Prints current loopback mode set-up
INT SET DS0A/B LOO ALT	Selects alternating loop and prints current set-up
INT SET DS0A/B LOO ALT (xxxxxx)	Selects alternating loop type (xxxxxx = OCU+, OCU, HL9, CHAN+2, CHAN+R, CHA, DSU, 1ST, or 2ND)

Table C-1
FIREBERD 6000 DDS DS0A/B Data Interface Remote Control Commands (Continued)

Remote Command	Result
INT SET DS0A/B LOO LAT	Selects latching loop and prints current set-up
INT SET DS0A/B LOO LAT LOC (x)	Selects latching DS0-DP location, LOC 1 for others (x = 1-8)
INT SET DS0A/B AUX	Prints current DS0A/B Auxiliary function set-ups
INT SET DS0A/B AUX BYT	Prints current byte encoder set-up
INT SET DS0A/B AUX BYT (xxx)	Selects byte encoder operation (xxx = OFF, SIN, or REP)
INT SET DS0A/B AUX BYT COD (xxxxxxxx)	Enters byte encoder 8-bit binary code (xxxxxxxx = 1s and/or 0s)
INT SET DS0A/B AUX MJU	Prints current MJU control set-up
INT SET DS0A/B AUX MJU BRA (x)	Identifies MJU branch being controlled (x = 1-4)
INT SET DS0A/B AUX MJU TYP (xxx)	Selects MJU command type (xxx = OFF, SEL, BLO, UNB, REL, or RES)
INT SET DS0A/B AUX THR	Prints current THRU mode set-up
INT SET DS0A/B AUX THR (xxx)	Controls THRU mode operation (xxx = ON or OFF)
INT SET DS0A/B AUX ERR	Prints current ERRGEN set-up
INT SET DS0A/B AUX ERR (xxx)	Selects ERRGEN format (xxx = OFF, DAT+, DAT, or FRA)
INT SET DS0A/B AUX ERR RAT	Enables ERRGEN and prints current error rate
INT SET DS0A/B AUX ERR RAT xE-y	Selects ERRGEN error rate (4E-6 < xE-y < 1E-2, x and y are single digits)
INT SET DS0A/B AUX CHA	Prints current channel being tested by mainframe
INT SET DS0A/B AUX CHA (xxx)	Selects channel being tested by mainframe (xxx = PRI or SEC)
EXAMPLE:	
>INT SET	:display current active interface.
RS232	
>INT SET DS0A/B	:activate DDS DS0A/B Interface.
>INT SET DS0A/B MOD DS0A RAT 19.2K	:activate DS0A mode at 19.2 kb/s.
>INT SET DS0A/B INT BIP	:configure interface connection for bipolar operation
>INT SET DS0A/B LOO ALT CHAN+R	:activate alternating channel with one repeater loopback.
>INT SET DS0A/B AUX BYT COD 10011001	:select auxiliary byte encoder and enter code.
>INT SET DS0A/B AUX BYT REP	:activate auxiliary byte encoder and repeat byte.
>INT SET DS0A/B AUX ERR RAT 3E-6	:activate auxiliary error generator with an error rate of 3E-6.
>INT SET DS0A/B AUX ERR DAT+	:activate auxiliary error generator with errors on both data and frame bits.

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