ML11037
Rev. A

LAB (TTL)
DATA INTERFACE
OPERATING MANUAL
(MODEL 40204)

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SECTION 1 GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains information on Telecommunications Techniques Corporation's (TTC) LAB (TTL) Data Interface (Model 40204). This information is divided into sections on: general information; interface description, installation, and set-up; mainframe setup; interface specifications; and service information.

1.2 OVERVIEW

The Lab Data Interface allows a FIREBERD mainframe to test a wide variety of data communications equipment and systems by converting TTL level signals used within the FIREBERD to either bipolar or unipolar format. The Lab Data Interface is capable of driving loads from 50 Ω to ≥8 kΩ. This interface allows different clock relationships between the data and clock. In addition, the interface is capable of unbalanced or balanced operation in either unipolar or bipolar operating mode.

1.3 INTERFACE FEATURES

The Lab Data Interface has the following features.

- Provides user-selectable input impedances (50 Ω, 75 Ω, 100 Ω, or BRIDGE)
- Operates in either bipolar or unipolar mode
- Provides choice of clock and data phasing

1.4 INTERFACE COMPATIBILITY

The Lab Data Interface is functionally compatible with the following standards, but does not guarantee to meet all the parameters of each standard.

- RS-422A
- RS-423A
- RS-232-C
- MIL-188-114 Unbalanced
- MIL-188-114 Balanced

1.5 OPTIONS AND ACCESSORIES

There are no special cables available from TFC for this interface. BNC connectors (available from a variety of sources) provide the input and output connections for this interface.

SECTION 2 INTERFACE DESCRIPTION

2.1 INTRODUCTION

The Lab Data Interface is controlled by the interface front-panel switches. This section describes the interface connectors and controls, the interface functions, and the timing sources.

2.2 PHYSICAL DESCRIPTION

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

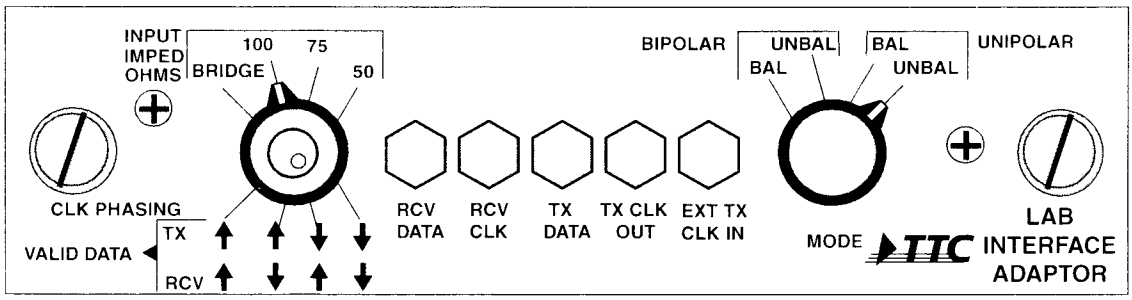


Figure 2-1. Lab Data Interface

Three rotary switches provide the interface hardware controls. By setting these switch positions, up to 64 operating modes can be accommodated. The following paragraphs describe these interface controls.

INPUT IMPED Switch - This 4-position rotary switch selects the interface input impedance. The input impedance values are: 50 Ω, 75 Ω, 100 Ω, or BRIDGE. This switch setting and the CLK PHASING switch setting are used together to provide functional compatibility with various data standards.

CLK PHASING Switch - This 4-position rotary switch selects the data and clock phase relationships for both the transmitter and receiver. For both the transmitter and receiver sides, either falling-edge valid or rising-edge valid can be selected. This switch setting and the INPUT IMPED switch are used to make the interface functionally compatible with various data standards.

MODE Switch - This 4-position rotary switch selects either the BIPOLAR or UNIPOLAR mode of operation. Bipolar or unipolar may be selected, whether in balanced or unbalanced mode.

2.3 FUNCTIONAL DESCRIPTION

The Lab Data Interface is designed to convert between the TTL signals used within the FIREBERD mainframe and the user-selected signal type and mode. Data generated by the FIREBERD is transmitted through the TX DATA connector. The synchronous transmitted clock signal is available at the TX CLK OUT connector. Data is fed to the FIREBERD for analysis through the RCV DATA connector and the synchronous received clock is accepted at the RCV CLK connector.

2.3.1 Timing Sources

For the FIREBERD 6000, three transmit timing sources can be selected: (1) the clock received at the interface EXT TX CLK IN interface connector; (2) the synthesizer clock; or (3) the external BNC clock input. Selection of the timing source on the FIREBERD 6000 is made by pressing the front panel pushbutton switch labeled GEN CLK. Repeatedly pressing this pushbutton scrolls through its three selections (SYNTH, INTF, or BNC).

Selection of the timing source on the FIREBERD 4000 is made by pressing the SETUP CATEGORY rocker switch until the LED next to the GENERATOR CLOCK label is illuminated. The three pushbutton switches above the SETUP panel are used to select the INTRNL, INTF, or BNC timing source.

2.3.2 Self-Loop

The self-loop test is not supported by this data interface.

2.4 APPLICATION INFORMATION

The following information is provided to aid in using the Lab Data Interface to its best advantage. The interface switches mentioned in the following paragraphs are described in detail in Section 3.

When operating at a high bit rate or when driving long cables, it is recommended that a terminating impedance be placed at the receiving end. The Lab Data Interface line drivers are low-impedance drivers and can operate with any load, down to 50 Ω. The terminating impedance serves to reduce ringing and cable crosstalk.

When supplying the data interface with an external clock input, ensure that the external clock signal is in the same mode (e.g., unipolar or unbalanced) as the transmit and receive data and clock signals.

When operating in the unipolar unbalanced mode with the INPUT IMPED switch set to BRIDGE, the transmit and receive data and clock signals can be directly connected to any TTL family circuits. The data interface inputs and outputs are compatible with all TTL families (e.g., Schottky TTL or LS TTL).

When operating in the unipolar balanced mode with the INPUT IMPEDANCE switch set to either BRIDGE or 100 Ω and the CLOCK PHASING set to "↓↓", the data interface should be functionally compatible with the RS-422A systems*.

When operating in the bipolar unbalanced mode with the INPUT IMPEDANCE switch set to BRIDGE and CLOCK PHASING set to "↓↓", the data interface should be functionally compatible with RS-232C, RS-423A, or MIL-188-114 bipolar unbalanced systems*.

When operating in the bipolar balanced mode with the INPUT IMPEDANCE switch set to 100 OHMS and CLOCK PHASING set to "↓↓", the data interface should be functionally compatible with MIL-188-114 bipolar balanced, and with a pad on the outputs, V.35 systems*.

* Full compliance with the mentioned system parameters is not guaranteed.

resultant data/clock relationships. Figure 3-2 illustrates the voltage levels required at the RCV DATA, RCV CLK, and EXT TX CLK IN connectors for proper operation.

NOTE

The voltage levels required are independent of the input impedance.

MODE Switch - This 4-position rotary switch controls the mode of operation for all of the interface BNC connectors. The switch position selects between bipolar or unipolar mode of operation, and then either balanced (BAL) or unbalanced (UNBAL) for the selected mode. In bipolar mode, both the Mark and Space conditions are of opposite polarities, with respect to ground. In unipolar mode, the Mark and Space conditions are positive only with respect to ground. Selecting unbalanced for either mode ties the outer conductor to ground, and selecting balanced allows the outer conductor to be used as a complementing driver. Figure 3-3 illustrates the output voltage levels and the signal arrangements for each of the four MODE switch settings.

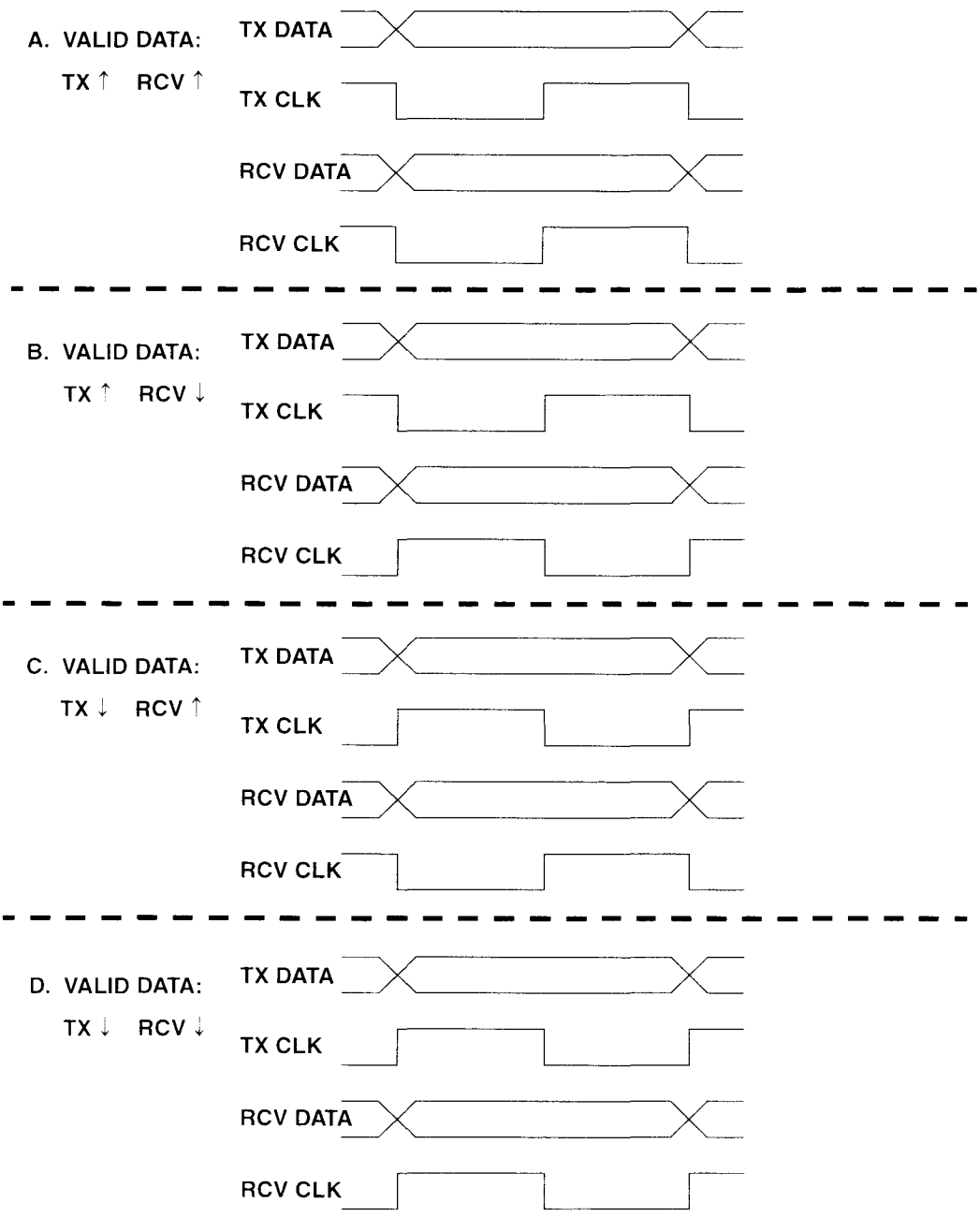
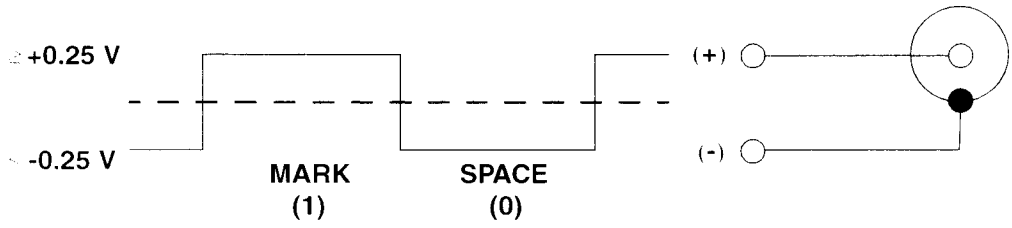
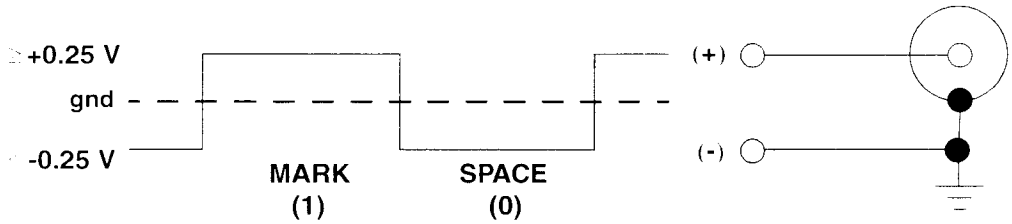


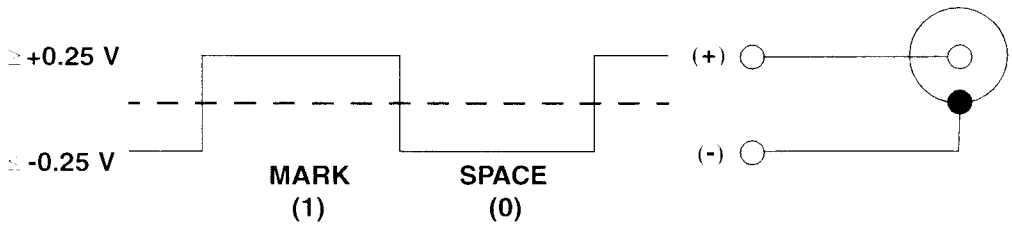
Figure 3-1. Clock Phasing Selections



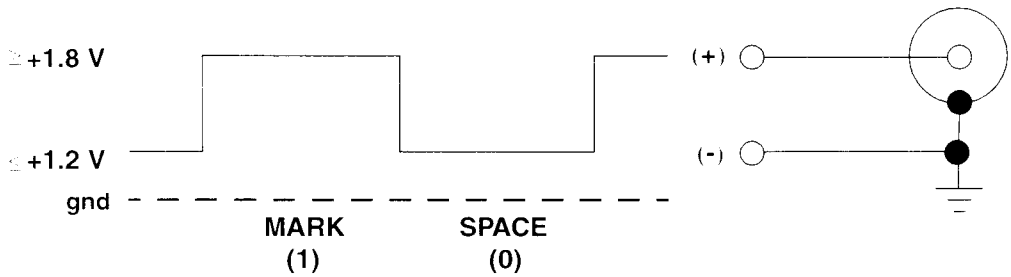
A. Bipolar Balanced (differential voltage)



B. Bipolar Unbalanced

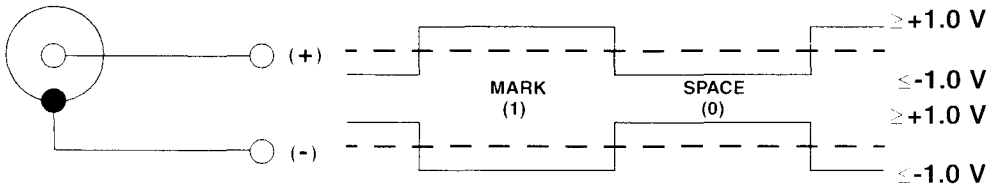


C. Unipolar Balanced (differential voltage)

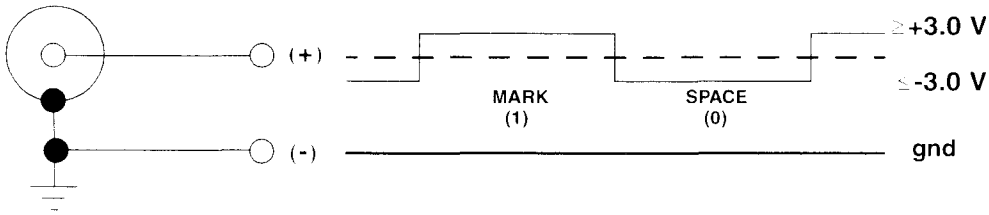


D. Unipolar Unbalanced

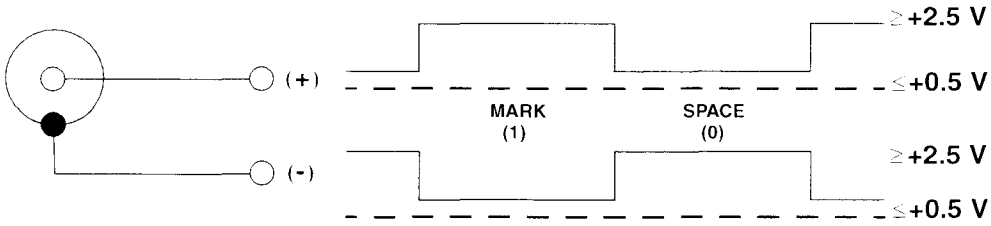
Figure 3-2. Minimum Required Input Levels for Each Operating Mode



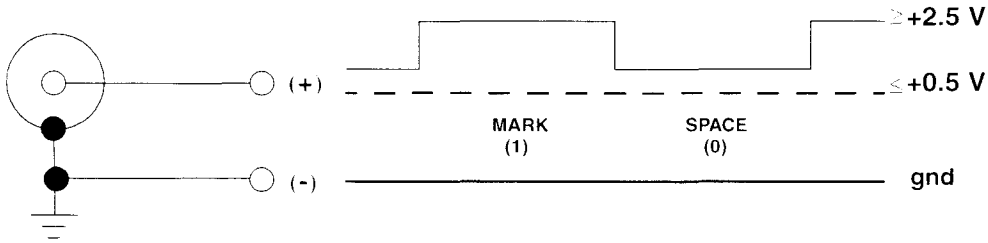
A. Bipolar Balanced



B. Bipolar Unbalanced



C. Unipolar Balanced



D. Unipolar Unbalanced

Figure 3-3. Selectable Operating Modes Transmit Data and Clock Outputs

3.3 FIREBERD 4000

The following sections describe the installation, setup, and operation of the Lab Data Interface in the FIREBERD 4000 mainframe.

3.3.1 Interface Installation

The following procedure describes the steps for installing the Lab Data Interface into a FIREBERD 4000 mainframe.

****
* **CAUTION** *
****

Turn the AC power OFF before installing the Lab Data Interface module in the FIREBERD mainframe.

1. Ensure the POWER switch, located on the rear panel, is in the OFF position on the FIREBERD mainframe.
2. Turn the FIREBERD mainframe around to expose the rear panel interface slot(s). The FIREBERD mainframe can have two interface slots, if Option 4001 (optional interface) is installed. Slot 1 (the bottom slot) is standard and Slot 2 (the top slot) is the optional slot.
3. Insert the interface module into the vacant interface slot, with the printed circuit (PC) board facing up. The PC board edges fit into slides on either side at the top edges of the interface slot.
4. Press the interface module firmly into the mainframe mating connector, until the back of the interface faceplate is flush with the mainframe rear panel.
5. Secure the interface in the mainframe by turning the two screws on the interface front panel clockwise, until finger tight.

3.3.2 FIREBERD 4000 Mainframe Setup

The following steps outline the procedure for setting up the FIREBERD 4000 mainframe after the interface installation is complete.

1. With the Lab Data Interface installed, turn the AC power on by pressing the POWER switch to the ON position.
2. If the FIREBERD is used in the TERM mode, connect the signal clock source to the interface panel RCV CLK connector and then connect the data source cable to the RCV DATA connector. If the FIREBERD is used as the clock source, a cable must be connected to the interface TX CLK OUT connector.

3. Press the **PATTERN** pushbutton switch to select the desired data pattern. The first three data patterns are visible on the bottom line of the display. Pressing the **MORE** pushbutton switch displays up to three additional data patterns. Pressing the softkey below the desired pattern selects that data pattern for transmission and reception. Refer to the *FIREBERD 4000 Reference Manual* for a list of the different patterns available and their uses.
4. Press the **SETUP CATEGORY** rocker switch to illuminate the LED next to the GENERATOR CLOCK label to select the signal timing source from either the network or from another source.
5. The front panel displays `GEN CLOCK:XXXXXX` on the top line and the three choices on the bottom line. Selecting the BNC signal timing source requires an external clock source from either the network or another source.
6. Press the **SETUP CATEGORY** rocker switch to illuminate the LED next to the INTERFACE label. The message `INTERFACE: XXXXXX` is displayed on the top line and a list of available interfaces is displayed on the bottom line.
7. Press the softkey below LAB to select the Lab Data Interface. Pressing this softkey displays `INTERFACE: LAB` on the top line.
8. Press the **SETUP CATEGORY** rocker switch to set or verify other criteria required for the test to be performed. Pressing the **SETUP CATEGORY** rocker switch to illuminate the LED next to the SETUP SUMMARY label displays the selected test pattern, interface selected, and clock frequency.
9. Set the other front panel controls (RESULT SELECT, CATEGORY, Printer, etc.) as required to configure the mainframe for the test to be performed.

3.3.3 Interface Setup

This section describes the interface selections available for the FIREBERD 4000 after the mainframe has been configured. The Lab Data Interface is selected through the FIREBERD 4000 front panel controls and is then controlled through the interface panel rotary switches. The following paragraphs describe the interface panel switches, their functions, and selections.

INPUT IMPED Switch - This 4-position rotary switch selects the input impedance for the RCV DATA, RCV CLK, and TX CLK IN connectors. The switch setting determines the input impedance placed across these three connectors. The input impedance selections are: 50 Ω, 75 Ω, 100 Ω, or BRIDGE. The BRIDGE position allows the input signals to be connected directly to the line receiver ICs without any other resistive termination. The input impedance in the BRIDGE position is 8 kΩ or greater.

CLK PHASING Switch - This 4-position rotary switch is used to control the data and clock phase relationships for both the transmitter and receiver. The switch setting controls which edge (rising or falling) of the pulse is valid. This allows the interface to be used in a variety of different timing environments. Figure 3-1 illustrates the different clock phasing selections available and the resultant data/clock relationships. Figure 3-2 illustrates the voltage levels required at the RCV DATA, RCV CLK, and EXT TX CLK IN connectors for proper operation.

NOTE

The voltage levels required are independent of the input impedance.

MODE Switch - This 4-position rotary switch controls the mode of operation for all of the interface BNC connectors. The switch position selects between bipolar or unipolar mode of operation and then either balanced (BAL) or unbalanced (UNBAL) for the selected mode. In bipolar mode, both the Mark and Space conditions are of opposite polarities, with respect to ground. In unipolar mode, the Mark and Space conditions are positive only with respect to ground. Selecting unbalanced for either mode ties the outer conductor to ground, and selecting balanced allows the outer conductor to be used as a complementing driver. Figure 3-3 illustrates the output voltage levels and the signal arrangements for each of the four MODE switch settings.

SECTION 4 INTERFACE SPECIFICATIONS

4.1 INTRODUCTION

This section contains the Lab Data Interface specifications. The Lab Data Interface specifications are listed in Table 4-1.

Table 4-1. Lab Data Interface Specifications

Item	Specification
Output Levels	
Bipolar Balanced	±2.0 V, minimum differential voltage (+19.0 dBm, into 50 Ω) (+17.3 dBm, into 75 Ω)
Bipolar Unbalanced	±3.0 V, minimum (+22.6 dBm minimum, into 50 Ω) (+20.8 dBm minimum, into 75 Ω)
Unipolar Balanced	±2.0 V, minimum differential voltage (+19.0 dBm, into 50 Ω) (+17.3 dBm, into 75 Ω)
Unipolar Unbalanced	+2.5 V minimum Mark (logic 1) +0.5 V maximum Space (logic 0)
Input Levels	
Bipolar Balanced	±0.25 V, minimum differential voltage (+1.0 dBm, into 50 Ω) (-0.5 dBm, into 75 Ω) ±12.0 V maximum with respect to FIREBERD ground
Bipolar Unbalanced	+0.25 V, minimum Mark (logic 1) -0.25 V minimum Space (logic 0) (+1.0 dBm, into 50 Ω) (-0.5 dBm, into 75 Ω)
Unipolar Balanced	±0.25 V, minimum differential voltage (+1.0 dBm, into 50 Ω) (-0.5 dBm, into 75 Ω) ±12.0 V maximum with respect to FIREBERD ground
Unipolar Unbalanced	+1.8 V minimum Mark (logic 1) +1.2 V maximum Space (logic 0)

Table 4-1. Lab Data Interface Specifications (Continued)

Item	Specification
Maximum Input Levels	
The following voltage levels are not to be exceeded at any time (differential voltage for balanced operation and Vdc for unbalanced operation):	
50 Ω	±3.3 V (23.4 dBm)
75 Ω	±4.0 V (23.3 dBm)
100 Ω	±4.7 V (23.4 dBm)
BRIDGE	±15.0 V

SECTION 5 MAINTENANCE AND SERVICE

5.1 INTRODUCTION

This section contains information on maintenance and service for the Lab Data Interface, including TTC's warranty policies and repair procedures.

5.2 MAINTENANCE

5.2.1 In Case of Difficulty

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

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

If some of the indicators light but the unit fails to operate, verify that the interface module installed is the correct type and that it is properly seated in the mainframe connector.

****
* **CAUTION** *
****

Be sure to turn the mainframe power OFF before trying to remove or reseat the interface module.

If another interface module is available, turn the mainframe power OFF and substitute the other interface module.

If troubles still persist, follow the self-test procedures in the FIREBERD Reference Manual as an aid in localizing the problem. If the mainframe and/or interface continues to be inoperative, refer to the following paragraphs in this section, or call the TTC Technical Assistance Center for assistance.

5.3 SERVICE

5.3.1 Warranty Policy

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

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

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

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

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

5.3.2 In-Warranty Service

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

After the equipment is repaired by TTC, it will be tested to applicable specifications, burned-in for at least 24 hours, retested, and returned to the customer with shipping prepaid. A brief description of the work performed and the materials used will be provided on the Equipment Repair Report that will be furnished with the returned equipment.

5.3.3 Out-of-Warranty Service

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

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

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

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

5.3.4 Equipment Return Instructions

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

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

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