RS-232 SYNC/ISOCH DTE
DATA INTERFACE
(MODEL 40232)
OPERATING MANUAL

SEPTEMBER 1989

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GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains information on Telecommunications Techniques Corporation's (TTC) RS-232 Sync/Isoch DTE Data Interface (Model 40232). This information is divided into sections on: general information; interface description, installation, and set-up; mainframe set-up; interface specifications; and service information.

The RS-232 Sync/Isoch DTE Data Interface allows a FIREBERD mainframe to test both synchronous and isochronous (bit timing recovery) communications channels. This interface enables a FIREBERD 6000 or FIREBERD 4000 mainframe to emulate Data Terminal Equipment (DTE) for use in testing Data Communications Equipment (DCE).

The RS-232 signals are exchanged in serial binary format with either a synchronous clock signal (synchronous operation) or without a clock signal (isochronous operation) at signaling rates up to 20 kb/s. Signal levels above +3V but less than +25V are considered to be on for controls and a 0 (Space) for data. Signal levels more negative than -3V but less negative than -25V are considered to be off for controls and a 1 (Mark) for data.

1.2 INTERFACE FEATURES

The Model 40232 DTE Interface has the following features.

- Acts as data terminal equipment (DTE) for use in testing data communications equipment (DCE).

- Exchanges data in a serial binary format with synchronous data rates up to 20 kb/s.

- Exchanges data in a serial binary format in isochronous operation at selectable bit rates from 75 b/s to 9600 b/s.

1.3 INTERFACE COMPATIBILITY

The Model 40232 DTE Interface is designed in accordance with the following interface standards.

- V.24
- V.28
- EIA RS-232-C

1.4 OPTIONS AND ACCESSORIES

The following cables are available from TTC for the RS-232 Sync/Isoch DTE Data Interface (Model 40232).

- Model 10213, 6' cable with RS-232/V.24 male-to-male connectors.

- Model 10418, 10' cable with RS-232/V.24 male-to-male connectors.

Table 2-1
25-pin Connector Pin Assignments

PIN	CIRCUIT	RS-232 DESCRIPTION	LEAD STATUS Interface PANEL Connector (DTE Operation)	DTE End of Adaptor Cable (DCE Operation)
1	AA	Protective Ground	internally connected to Pin 7	
2	BA	Transmitted Data	output	input
3	BB	Received Data	input	output
4	CA	Request to Send	output	input
5	CB	Clear to Send	input	connected to Pin 4
6	CC	Data Set Ready	input	output
7	AB	Signal Ground (Common Return)	internally connected to Pin 1	
8	CF	Received Line Signal Detector	input	output
9	—	(Reserved for Data Set Testing)	open	open
10	—	(Reserved for Data Set Testing)	open	open
11		Unassigned	open	open
12	SCF	Secondary RLSD	open	open
13	SCB	Secondary CTS	open	open
14	SBA	Secondary Transmitted Data	open	open
15	DB	Transmit Signal Element Timing (DCE Source)	input	output
16	SBB	Secondary Received Data	open	open
17	DD	Receiver Signal Element Timing (DCE Source)	input	output
18	DD	Unassigned	open	open
19	SCA	Secondary RTS	open	open
20	CD	Data Terminal Ready	output	input
21	CG	Signal Quality Detector	FIREBERD use only	open
22	CE	Ring Indicator	open	open
23	CH/CI	Data Signal Rate Selector (DCE/DTE Source)	open	open
24	DA	Transmit Signal Element Timing (DTE Source)	output	input
25	—	Unassigned	FIREBERD use only	open

2.3 FUNCTIONAL DESCRIPTION

The RS-232 Sync/Isoch DTE Data Interface allows the FIREBERD Communications Analyzer to test both synchronous and isochronous RS-232-C and V.24/V.28 communications channels. A three-position toggle switch is used to select the interface operating mode. Three modes of interface operation are available: synchronous (DCE source), synchronous (internal or baud rate source), and isochronous. In the synchronous (Internal or Baud Rate Source) operating mode, the rotary switch is used to select the baud rate. Baud rate selections are: 75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 b/s.

During synchronous (DCE Source) operating mode, data is transmitted and received with a synchronous clock, and timing is provided by the DCE device under test or through the BNC connector on the FIREBERD mainframe rear panel.

During synchronous (Internal or Baud Rate Source) operating mode, data is transmitted and received with a synchronous clock, and timing is generated by either the FIREBERD or by the interface baud rate generator. The rotary switch is used to select the baud rate. Baud rates selectable are: 75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, and 9600 b/s.

During isochronous operating mode, data is transmitted and received without a clock signal. Transmit timing is generated by the interface and receive timing is recovered internally from the data transitions.

The following paragraphs describe the interface toggle switches and the functions they control. When this interface is installed in the FIREBERD 6000 or the FIREBERD 4000, all of these switches are controlled at the interface front panel.

TIMING - This three-position toggle switch is used to select the interface timing mode. In the SYNCHRONOUS (DCE SOURCE) position, the timing source is from the DCE device under test. The clock source can be applied either to Pin 15 of the 25-pin D-type connector or to the BNC connector on the FIREBERD rear panel. In the ASYNC position, the isochronous mode is selected and the receive timing is generated by the interface through the use of a digital bit synchronizer (clock recovery circuit). The 11-position rotary switch (BAUD RATE GEN) is used to select the baud rate (75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 b/s). In the SYNCHRONOUS (INT OR BAUD RATE) position, the timing selection may either be from the FIRE-

BERD or from the interface. When the interface is used as the timing source, the 11-position rotary switch is used to select the baud rate.

BAUD RATE GEN (CLK SEL-EXT) - This 11-position rotary switch selects the the interface baud rate. The baud rate choices are: 75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 b/s. Baud rates are selected when the TIMING toggle switch is set to either the ASYNC or SYNCHRONOUS (INT OR BAUD RATE) position.

2.3.1 Synchronous (DCE Source) Operation

With the TIMING switch set to the up position, synchronous operation is selected. During synchronous (DCE Source) operating mode, data is transmitted and received with a synchronous clock, and timing is provided by the DCE device under test or through the BNC connector on the FIREBERD mainframe rear panel. The FIREBERD generator clock (GEN CLK or GENERATOR CLOCK) must be set to the external selection. The transmit timing clock can then either be applied to the mainframe BNC connector or to Pin 15 of the D-type connector.

Transmit data and clock are available, respectively, at connector Pins 2 and 24. Receive data and clock are expected to be present at Pins 3 and 17, respectively.

2.3.2 Isochronous Operation

With the TIMING switch set to the middle position (ASYNC), the isochronous operating mode is selected. During isochronous operating mode, data is transmitted and received without a clock signal. Transmit timing is generated by the interface and receive timing is recovered internally from the data transitions. When operating in the isochronous mode, the FIREBERD generator clock (GEN CLK or GENERATOR CLOCK) must be set to the interface (INTF) selection. The 11-position rotary switch (BAUD RATE GEN (CLK SEL-EXT) is used to select the transmit baud rate. Receive timing is generated by the interface through the use of a clock recovery circuit.

Transmit data is available from Pin 2 and receive data is expected at Pin 3 of the D-type connector. No transmit timing is provided in the isochronous mode and connector Pin 24 is held at a constant mark. Any signals present at Pins 15 and 17 are ignored by the interface.

Since the clock recovery circuit requires receive data transitions for synchronization, the interface can operate with any of the FIREBERD standard test patterns, except the MARK pattern.

2.3.3 Synchronous (Internal or Baud Rate Source) Operation

With the TIMING switch set to the down (SYNCHRONOUS INT OR BAUD RATE) position, the internal synchronous operating mode is selected. During synchronous (Internal or Baud Rate Source) operating mode, data is transmitted and received with a synchronous clock and timing is generated by either the FIREBERD or the interface baud rate generator. With the FIREBERD generator clock (GEN CLK or GENERATOR CLOCK) set to INTF, the 11-position rotary switch (BAUD RATE GEN) is used to select the baud rate. Baud rates selectable are: 75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, and 9600 b/s.

NOTE: When 75 is selected for the baud rate, the SECONDS, ERROR SECONDS, and PRINT TIMER functions operate slower than normal and should not be used.

Transmit data and clock are available, respectively, at connector Pins 2 and 24. Receive data and clock are expected, respectively at connector Pins 3 and 17. Any signals appearing at connector Pin 15 are ignored by the interface.

2.3.4 Timing Sources

Three clock timing sources are available for the FIRE-BERD: (1) the clock recovered by the interface from the incoming RS-232 signal; (2) the external BNC input, or (3) the FIREBERD mainframe synthesizer. Selection of the timing source is made by pressing the FIREBERD 6000 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 softkey pushbutton switches above the SETUP panel are used to select the INTRNL, INTF, or BNC timing source.

2.3.5 Self-Loop

This data interface includes a relay that is activated by the SELF LOOP pushbutton switch on the FIREBERD front panel. Pressing the SELF LOOP pushbutton connects the transmit clock and data to the receive clock and data. This provides quick verification of the FIREBERD and the data interface. User connections do not need to be removed during the test, since complete isolation is provided by the relay when testing in the Self-Loop mode. External timing for the Self-Loop test can be provided on the Transmit Signal Element Timing (DA) lead or through the rear panel BNC connector. The Self-Loop tests the drivers and receivers that are used in normal operation.

NOTE: The TX Timing (DB) driver and the adaptor cable are not tested.

INTERFACE INSTALLATION, SETUP, AND OPERATION

3.1 INTRODUCTION

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

3.2 FIREBERD 6000

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

3.2.1 Interface Installation

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

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

(1) Ensure that the POWER switch is in the OFF position on the FIREBERD mainframe front panel.

(2) Turn the FIREBERD mainframe around to expose the rear panel interface slot.

(3) Insert the interface module into the vacant interface slot, with the printed circuit (PC) board facing up. The PC board edges fit into slides on either side at the top edges of the interface slot.

(4) Press the interface module firmly into the mainframe mating connector, until the interface faceplate is flush with the mainframe rear panel.

(5) Secure the interface in the mainframe by turning the two interface front panel thumb screws clockwise, until finger tight.

3.2.2 FIREBERD 6000 Mainframe Set-Up

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

(1) With the RS-232 Sync/Isoch interface installed, turn the AC power on by pressing the front panel POWER switch to the ON position.

(2) Connect the RS-232 cable to the interface connector.

(3) Press the DATA pushbutton switch to select the desired data pattern. The data pattern selected is indicated by illuminating the LED next to the corresponding data pattern. Refer to the FIREBERD 6000 User's Guide for a description of the different data patterns available and their uses.

(4) Press the GEN CLK pushbutton to select the signal timing source for use during the test. With SYNTH selected for the GEN CLK reference, press the MENU pushbutton switch to illuminate the LED next to the SYNTH FREQ front panel label. Verify the selected synthesizer frequency is correct for the data rate. If it is not, press the MORE key to display the desired frequency and then press the corresponding softkey. Selecting the BNC signal timing source requires an external clock source from either the network or from another source.

(5) Set the TIMING MODE according to the mode of operation selected (RECOVD, ASYNC, or SYNC).

(6) Press the MENU pushbutton to illuminate the LED next to the INTF SETUP label. The message **INTERFACE: XXXXXX** is displayed on the top line and the available interfaces are displayed on the bottom line.

(7) Press the RS232 softkey to select the RS-232 Sync/Isoch Data Interface. Pressing this soft key displays **INTERFACE: RS-232** on the top line.

(8) After the interface has been selected, press the ENTER keypad pushbutton to display the interface top level menu (**INTERFACE: RS-232**).

(9) Press the MENU pushbutton to select other criteria required for the test to be performed.

(10) Set the other front panel controls (ANALYSIS RESULTS, ANALYSIS MODE, PRINTER, etc.) as required for the test to be performed.

(11) Press the SELF LOOP pushbutton switch to perform the self-test on the mainframe and installed interface.

3.2.3 Interface Set-Up

After the interface has been set up, according to the FIREBERD mainframe set-up procedures and the RS-232 interface has been selected, use the interface timing and baud rate switches (described in Section 3.2.5) for the test to be performed.

The RS-232 Sync/Isoch interface is controlled by the interface front panel controls. With the RS-232 Sync/Isoch interface selected, the front panel backlights EMULATE DTE and the column below this label, located at the right of the FIREBERD front panel.

3.2.4 Interface Indicators

With the RS-232 Sync/Isoch interface selected, the DTE emulation mode is automatically selected. In this mode the front panel label EMULATE DTE is backlit. The LEDs to the right of these labels are used to indicate activity on the associated interface connector lines. The following paragraphs describe what each LED indicates. The labels in parentheses are the RS-449 equivalents for the RS-232 line.

RLSD - In DTE emulation, the Received Line Signal Detector LED (connector Pin 8) illuminates when this line is ON. In DCE emulation the pushbutton switch controls the state of the Received Line Signal Detector line. Pressing the RLSD pushbutton causes it to illuminate forcing this line ON. When the pushbutton LED is extinguished, the line is held OFF.

DSR - In DTE emulation, the Data Set Ready LED (connector pin 6) illuminates when this line is ON. In DCE emulation, pressing the corresponding pushbutton illuminates the LED and forces the DSR line ON. Pressing this pushbutton again extinguishes the LED and the DSR line is held OFF.

CTS - In DTE emulation, the Clear To Send LED illuminates when this line is ON. In DCE emulation, there is no corresponding LED for RS-232.

RTS - In DTE emulation, pressing the Request To Send pushbutton illuminates the LED and forces this line ON. Pressing this pushbutton again extinguishes the LED and holds the line OFF. In DCE emulation, there is no corresponding LED for RS-232.

DTR - In DTE emulation, pressing this pushbutton illuminates the LED and forces the Data Terminal Ready line ON. In DCE emulation, the LED illuminates, indicating that this line is ON.

3.2.5 Interface Controls

The following paragraphs describe the procedure for setting up this interface. Each switch is listed, along with a description of the selections available.

TIMING - This three-position toggle switch is used to select the interface timing mode. In the SYNCHRONOUS (DCE SOURCE) position, the timing source is from the DCE device under test. The clock source can be applied either to Pin 15 of the 25-pin D-type connector or to the BNC connector on the FIREBERD rear panel. In the ASYNC position, the isochronous mode is selected and the receive timing is generated by the interface through the use of a clock recovery circuit. The 11-position rotary switch (BAUD RATE GEN) is used to select the baud rate (75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 b/s). In the SYNCHRONOUS (INT OR BAUD RATE) position, the timing selection may either be from the FIREBERD or from the interface. When the interface is used as the timing source, the 11-position rotary switch is used to select the baud rate.

BAUD RATE GEN (CLK SEL-EXT) - This 11-position rotary switch selects the the interface baud rate. The baud rate choices are: 75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 b/s. Baud rates are selected when the TIMING toggle switch is set to either the ASYNC or SYNCHRONOUS (INT OR BAUD RATE) position.

3.3 FIREBERD 4000

The following sections describe installation, set-up, and operation of this interface in the FIREBERD 4000 mainframe.

3.3.1 Interface Installation

The following procedure describes the steps for installing the interface in a FIREBERD 4000 mainframe.

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

(1)   Ensure that the POWER switch is in the OFF position on the FIREBERD mainframe rear panel.

(2)   Turn the FIREBERD mainframe around to expose the rear panel interface slots. The FIREBERD 4000 may 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 optional.

(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 at either side at the top edges of the interface slot.

(4)   Press the interface module firmly into the mainframe mating connector, until the interface faceplate is flush with the mainframe rear panel.

(5)   Secure the interface in the mainframe by turning the two interface front panel thumb screws clockwise, until finger tight.

3.3.2 FIREBERD 4000 Mainframe Set-Up

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

(1)   With the RS-232 Sync/Isoch DTE Data Interface installed, turn the AC power on by pressing the rear panel POWER switch to the ON position.

(2)   Connect the RS-232 signal source to the interface 25-pin D-type connector.

(3)   Press the SETUP CATEGORY rocker switch to illuminate the LED next to the PATTERN label. This displays **PATTERN:** followed by the present data pattern. The first three data pattern choices are visible on the bottom line of the display. Pressing the MORE pushbutton switch displays additional

data patterns. Pressing the corresponding softkey selects that data pattern for transmission and reception. Select the desired pattern. Refer to the FIREBERD 4000 User's Guide for a description of the different data patterns available and their uses.

(4)   Press the SETUP CATEGORY rocker switch to illuminate the LED next to the label GENERA-TOR CLOCK to select the signal timing source for use during the test.

(5)   The front panel displays **GEN CLOCK: XXXXXX** on the top line and the three choices on the bottom line. Select the desired timing source for the selected mode of operation. Selecting the BNC signal timing source requires an external clock source from either the network or from 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 soft key below the RS-232 displayed on the bottom line to select the RS-232 Sync/Isoch interface. Pressing this soft key displays **INTER-FACE: RS-232** on the top line.

(9)   Press the ENTER keypad pushbutton to display the interface top level menu (**INTERFACE: RS-232**).

(10)   Press the CATEGORY rocker switch to set or verify other criteria required for the test that is 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, and clock frequency.

(11)   Set the other front panel controls (RESULT SE-LECT, CATEGORY, PRINTER, etc.) as required to configure the mainframe for the test to be performed.

(12)   Press the SELF LOOP pushbutton switch to perform the self-test on the mainframe and the installed interface.

3.3.3 Interface Set-Up

After the interface has been set up, according to the FIREBERD mainframe set-up procedures, and the RS-232 Sync/Isoch Data Interface is selected, EMULATE DTE and

INTERFACE SPECIFICATIONS

4.1 INTRODUCTION

This section contain the interface specifications for the RS-232 Sync/Isoch DTE Data Interface. This information is listed in Table 4-1.

Table 4-1
RS-232 Sync/Isoch DTE Interface Specifications

Item	Specification
General	
Maximum Synchronous Speed:	20 kb/s.
Isochronous Baud Rates:	75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 baud.
Line Drivers:	
Slew rate:	30V per microsecond.
Impedance:	100 ohms, maximum.
Short Circuit Current:	50 mA, maximum.
Data Mark (binary 1)	-3.0V, maximum.
Data Space (binary 0):	+3.0V, minimum.
Signal Swing:	10V ±2V, typical with a 7K ohm load.
Line Receivers	
Load Impedance:	3K ohms, minimum
	7K ohms, maximum.
Maximum Input Voltage:	±25V.
Data Mark (binary 1)	0.0V, maximum.
Data Space (binary 0)	2.0V, minimum.

the column below it are backlit. The FIREBERD mainframe is now ready to begin transmitting data to the DCE under test.

3.3.4 Interface Indicators

With the RS-232 Sync/Isoch interface selected, use the interface timing and baud rate switches (described in Section 3.2.5) for the test to be performed.

In DTE emulation mode, the front panel label EMU-LATE DTE is backlit. The LEDs to the right of these labels are used to indicate activity on the associated interface connector lines. The following paragraphs describe what each LED indicates. The labels in parentheses are the RS-449 equivalents for the RS-232 line.

RLSD - In DTE emulation, the Received Line Signal Detector LED (connector Pin 8) illuminates when this line is ON. In DCE emulation the pushbutton switch controls the state of the Received Line Signal Detector line. Pressing the RLSD pushbutton causes it to illuminate forcing this line ON. When the pushbutton LED is extinguished, the line is held OFF.

DSR - In DTE emulation the Data Set Ready LED (connector Pin 6) illuminates when this line is ON. In DCE emulation, pressing the corresponding pushbutton illuminates the LED and forces the DSR line ON. Pressing this pushbutton again extinguishes the LED and the DSR line is held OFF.

CTS - In DTE emulation, the Clear To Send LED illuminates when this line is ON. In DCE emulation, there is no corresponding LED for RS-232.

RTS - In DTE emulation, pressing the Request To Send pushbutton illuminates the LED and forces this line ON. Pressing this pushbutton again extinguishes the LED and holds the line OFF. In DCE emulation, there is no corresponding LED for RS-232.

DTR - In DTE emulation, pressing this pushbutton illuminates the LED and forces the Data Terminal Ready line ON. In DCE emulation, the LED illuminates, indicating that this line is ON.

3.3.5 Interface Controls

The following paragraphs describe the procedure for setting up this interface. Each switch is listed, along with a description of the selections available.

TIMING - This three-position toggle switch is used to select the interface timing mode. In the SYNCHRO-

NOUS (DCE SOURCE) position, the timing source is from the DCE device under test. The clock source can be applied either to Pin 15 of the 25-pin D-type connector or to the BNC connector on the FIREBERD rear panel. In the ASYNC position, the isochronous mode is selected and the receive timing is generated by the interface through the use of a clock recovery circuit. The 11-position rotary switch (BAUD RATE GEN) is used to select the baud rate (75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 b/s). In the SYNCHRO-NOUS (INT OR BAUD RATE) position, the timing selection may either be from the FIREBERD or from the interface. When the interface is used as the timing source, the 11-position rotary switch is used to select the baud rate.

BAUD RATE GEN (CLK SEL-EXT) - This 11-position rotary switch selects the the interface baud rate. The baud rate choices are: 75, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, and 9600 b/s. Baud rates are selected when the TIMING toggle switch is set to either the ASYNC or SYNCHRONOUS (INT OR BAUD RATE) position.