



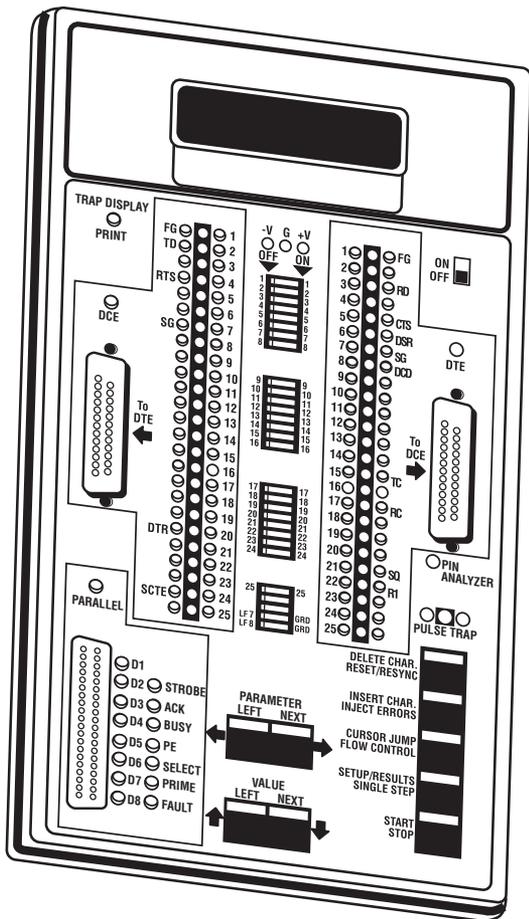
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# CommTool 1000



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This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

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## **NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT**

### **INSTRUCCIONES DE SEGURIDAD**

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
  - A: El cable de poder o el contacto ha sido dañado; u
  - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
  - C: El aparato ha sido expuesto a la lluvia; o
  - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
  - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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# 1. Specifications

**Speed**—Async: 50 bps to 192 kbps; Sync: 300 bps to 64 kbps

**Indicators**—(100) LEDs: (50) Red, (50) Green; 32-character LCD display

**Data Format**—ASCII, EBCDIC, Baudot, Transcode

**Interface**—RS-232 serial, Centronics parallel, Dataproducts parallel

**Connectors**—(2) DB25 female, (1) 36-pin Centronics female

**Power**—(3) 9V alkaline batteries, (1) AC adapter

**Size**—3.4"H x 6"W x 10.9"D (8.6 x 15.2 x 28 cm)

**Weight**—2.6 lb. (1.2 kg) including batteries

**Display**—32-character Liquid Crystal Display (LCD), arranged in two rows of 16 digits each; Adjustable viewing angle

**Keyboard**—Ten tactile keys with color-coded legends

**Power ON Reminder**—Beeps after five minutes of no activity

**Buffers**—Sixteen non-volatile variable length user message buffers totaling 2560 bytes. One 4096-byte buffer for data trap, separable into two 2048-byte buffers for dual line trapping Two configuration buffers for storage of frequently used test setups Storage buffer for all test results.

**Serial Format**—Asynchronous, synchronous, or SDLC

## **Serial Bit Rates**—

**Asynchronous Serial Mode**—50–38,400 baud

**Bias Distortion Test**—110–38,400 baud

**Synchronous Serial Mode**—300–64,000 bps or External Clock Source

**Synchronous BERT**—300–56,000 bps or External Clock Source

**Parallel Transmission Rate**—15,000 characters per second, transmit or receive

**Word Length**—5, 6, 7, or 8 bits per character plus parity (if applicable)

**Language Translation**—Baudot (level 5), IPARS (level 6), Transcode (level 6), ASCII (level 7 or 8), EBCDIC (level 8), and Hex (levels 5, 6, 7, or 8)

**Parity**—Even, Odd, Mark, Space, or None (Mark and space not supported with 8-bit word length)

**Stop Bits**—1, 1.5, or 2

**Flow Control Selection**—Hardware:

*Simulate DTE:*

<u>Control Line In</u>	<u>Control Line Out</u>
CTS (Pin 5)	RTS (Pin 4)
DSR (Pin 6)	Pin 11
DCD (Pin 8)	Pin 19
	DTR (Pin 20)

*Simulate DCE:*

<u>Control Line In</u>	<u>Control Line Out</u>
RTS (Pin 4)	CTS (Pin 5)
Pin 11	DSR (Pin 6)
Pin 19	DCD (Pin 8)
	DTR (Pin 20)

**Flow Control—Software**

<u>Control On</u>	<u>Control Off</u>
XON	XOFF
ACK	NAK
User Entry	User Entry

**BERT—**

**Test Patterns**—63 PR, 511 PR, 2047 PR, Mark, Space, Alternate Mark/Space, Fox, User-Defined

**Results**—Bits Received, Bit Errors, Bit Error Rate, Blocks Received, Block Errors, Block Error Rate, Elapsed Test Time, Error Seconds, % Error-Free Seconds, Sync Losses, Parity Errors, Power Losses; Results may be printed during or after a test

**Test Length**—Continuous or from 1 to 10,000 blocks

**Block Length**— $10^2$  to  $10^7$  bits per block

**Error Log**—25 error events maximum

**SDLC Performance Analysis—**

**Results**—Frames Received, Frames Aborted, Frames Rejected, FCS Errors, Error Seconds, % Error-Free Seconds, Data Interruptions; Elapsed Test Time; Results may be printed during or after a test

**Breakout Box—**

Buffered, four-state (On, Off, Clocking, and No Activity), with 25 switches and access to each side of the interface

Red and green LEDs for every line on each side of the interface (100 LEDs total); Breakout box can be configured for 25-conductor cable tester or parallel breakout box

**Signal Loading**—33K ohms per monitor circuit (16K ohms per signal line)

**Pulse Detection**—100 microseconds minimum pulse

**Pin Analyzer**—

**Input Impedance**—30K ohms

**Measurement Range**—-12.5V to +12.5V

**Maximum Input Voltage**—  $\pm 50V$

**Measurement Accuracy**—  $\pm 0.25V$

**Measurement Update**—3 times per second

**Power Supply**—

**External Power Supply**—Switchable 115/230 VAC 50/60 Hz, 4 Watts maximum

**Internal Batteries**—Three 9V alkaline batteries, Duracell MN1604 or equivalent

**Battery Life**—10 hours typical, 6 hours continuous use BERT test. No battery drain when using external power supply. Low battery indication provided on LCD

**Non-Volatile Memory Back-Up**—3V LiMnO<sub>2</sub> cell, CR2032 or equivalent; Battery life: 5 years typical

**Case**—Molded ABS plastic with detachable cover; Back-screened polycarbonate faceplate.

**Operating Temperature**—32 to 122°F (0 to 50°C)

**Storage Temperature**— -4 to +158°F (-20 to +70°C)

**Carrying Case**—Padded Cordura case with compartment for the tester, external power supply, cables, manual, and test accessories

**Serial Hook-Up Cable**—25-conductor, 36-inch (91.5-cm) cable with two DB25 male connectors and one DB25 female connector

**Parallel Hook-Up Cable**—36-conductor, 36-inch (91.5-cm) cable with two Centronics (male) connectors and one Centronics (female) connector

**Jumper Wire Set**—Five individual and two multi-point jumper wires

**Test Probe**

**Detachable Inline Power Supply**—Switchable 115/230 VAC, 50/60 Hz input,  $\pm 9$ -VDC output

## 2. Introduction

The CommTool 1000 is a general purpose, multi-function interface and data communication test instrument.

It is designed for the electronics technician or engineer who installs and troubleshoots computer systems, computer peripherals, and their connecting links, including off-site telecommunication connections.

With the CommTool 1000, you can test serial and parallel computer ports, serial and parallel computer peripherals (such as printers, plotters and buffers), interconnection cables, terminals, transmission equipment (such as modems, multiplexors, and line drivers), and other similar devices.

The CommTool 1000 will test RS-232 serial devices or parallel devices (both input and output). It can simulate a computer port to drive peripheral devices, simulate a peripheral device to receive and trap the output of a computer, or trap data transparently to simultaneously monitor both sides of a data transmission between a computer and a peripheral device.

You can identify drivers, receivers, opens, and grounds on an RS-232 interface and measure the mark and space voltage levels of RS-232 signals, even if they are active clock or data signals. Random asynchronous serial datastreams can be analyzed to determine baud rate, parity, word length, and stop bits.

In addition, the CommTool 1000 can perform sophisticated Bit Error Rate Tests (including error event logging), Bias Distortion measurements, Event Timing, Polling tests, Data Throughput Measurements, and SDLC Analysis.

### 2.1 CommTool1000 Test Capabilities

The following is a brief summary of the test capabilities of the CommTool 1000.

#### 2.1.1 PROGRAMMED TEST FUNCTIONS

The following tests have been programmed into the CommTool 1000 and can be selected for use by menu selection. Many of the tests provide a wide variety of options that can be specified by the user from intelligent menus that ask only appropriate questions based on previous menu selections.

**Pin Analyzer** You can determine which pins of the serial interface are drivers, which are receivers, which are grounds, and which are not connected.

You can measure the Mark and Space voltage levels of active drivers.

**Analyze Device** The Analyze Device test quickly determines whether the asynchronous peripheral connected to the serial interface is DTE or DCE.

The test will also determine and report the baud rate, parity, word length, and number of stop bits of an unidentified datastream. This function can also automatically configure your test setups to match the results of the test.

**Send Data** You can transmit a variety of messages to either a serial or a parallel device.

**Trap Data** You can trap up to 4096 characters from a serial or parallel datastream and save them in a buffer. Both TD and RD lines may be trapped simultaneously (2048 characters per line). Buffer contents can be viewed on the screen, or sent to a printer (either immediately after the test or later). The timing of data collection is selected by menu options.

**Printer Setup** The Printer Setup test outputs a message once every second to the printer in every configuration of baud rate, parity, and word length, until all possibilities have been exhausted. All configurations that are compatible with the device will be correctly printed. You can read the baud rate, parity, word length and stop bits directly from the printer output.

**Data Throughput** The characters per second throughput of serial or parallel channels are measured and displayed as a percent of ideal for serial channels. Serial asynchronous channels also give a Figure of Merit indication which is displayed as a percent of ideal channel throughput.

**BERT** The Bit Error Rate Test (BERT) measures errors in a standard data pattern received from a communication channel. The transmitted datastream may originate from the CommTool 1000 and be “looped-back” at the far end of the channel, or originate at the far end of the channel (for end-to-end testing), generated by a second CommTool 1000, or another industry-standard BERT tester.

By measuring the amount of errors and the rate at which errors are injected into the datastream by the transmission channel, you can measure the integrity of the transmission network. The BERT test measures bit errors, block errors, parity errors, and sync losses while counting the number of blocks received and timing the test duration. When a test is complete, the bit error and block error rates are calculated and displayed. Results may also be printed while a test is in process using a parallel printer. Power line losses during a BERT test are monitored and displayed so that data errors and sync losses may be correlated to power failures.

**Monitor SDLC** The Monitor SDLC test allows transparent monitoring of bidirectional SDLC channels, reporting frame error statistics and providing “BERT-like” error rates measured on an active transmission channel.

**Polling** This test enables you to send a polling message to one or more remote units and receive a response. You can configure the CommTool 1000 to simulate a master polling unit or a remote slave. The test counts transmitted polls as well as correct responses received.

**Bias Distortion** This test measures Mark/Space distortion induced by a transmission channel.

**Event Timing** The Event Timing function enables you to measure the delay between transitions on any serial control lead. A transition is a voltage shift from high to low or from low to high. You can specify the pin and the direction of the transition to start and to stop timing.

**Print Test Data** The Print Test Data function enables you send test results to either a serial or a parallel printer. You can print the contents of the trap buffer, the results of a BERT test, the results of an Analyze SDLC test, or each of the 16 user-defined messages.

**Load User Message** User messages can be directly downloaded from an external source into the user-message buffer.

**Self Test** The Self Test is a diagnostic test that enables you to calibrate the CommTool 1000's built-in voltmeter, and test the program and data memory, interface drivers and receivers, keyboard operation, LCD display, and alarm.

### 2.1.2 OTHER TEST CAPABILITIES

In addition to pre-programmed tests, the CommTool 1000 has several other built-in test capabilities.

**Breakout Box** Incorporated into the CommTool 1000 is a state-of-the-art Four-State 100-LED buffered breakout box. Fifty buffered monitor circuits provide bright visual indications of low-level signals. The breakout box can be reconfigured as a 25-line parallel breakout box suitable for testing the parallel ports of IBM PCs and compatible. Positive and negative forcing voltages are provided to drive control lines.

**Cable Testing** LED indicators on every connector pin of the breakout box allow the CommTool 1000 to be used for manual cable testing. A convenient test probe is provided to facilitate testing.

**Pulse Trap** A dual LED pulse trap is provided for detecting transient pulses too brief to see on an ordinary monitor LED. The pulse trap will display either a positive or a negative pulse transition

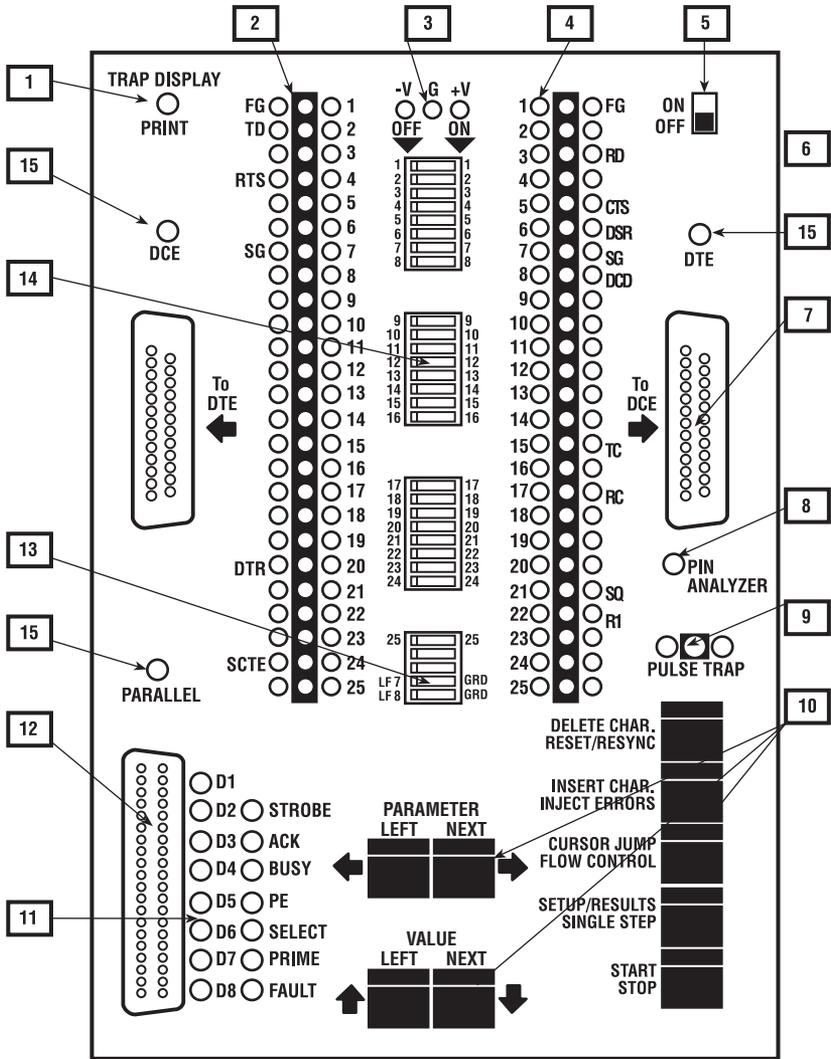
**Bi-Directional Parallel Interface** A Centronics® style parallel interface is provided to test parallel devices. Data can be sent, monitored, and trapped with complete flow control. Test results can be sent to a parallel printer through this port. Each of the data and control signal lines is monitored by a clearly labeled LED beside the pin. With appropriate interface cables, IBM PC parallel ports and Dataproducts® printer interfaces can also be tested.

## 2.2 CommTool 1000 Operating Controls

The following controls and features are used in the setup and operation of the CommTool 1000. The numbers to the left of the paragraph headings relate to Figure 2-1, “The CommTool 1000 Faceplate.”

### LCD

A 16-character by two-line Liquid Crystal Display (LCD) is provided to display menus used to set up test parameters, show operational status during a test, and display the results of a test, either during the test or after the test is complete.



**Figure 2-1. The CommTool 1000 Faceplate**

## 1 Trap Display/Print Key

While a Trap Data test is running, this key toggles the display between the TD and RD lines. While a BERT or Monitor SDLC test is running, this key causes the test status to be printed.

## 2 Line Status Indicators

Dual LEDs (red and green) on each side (DTE and DCE) of all interlace lines provide **Four-State** status at a glance. The **Four-State** conditions are MARK (green LED on), SPACE (red LED on), active data or CLOCKING (red and green LEDs on), and NO ACTIVITY (both LEDs off).

## 3 Forcing Voltages

Both positive (+V) and negative (-V) 9V DC voltage sources are provided to drive RS-232 control leads to desired logic levels. You can use these voltages with the test probe to test cables. A ground pin (G) is provided to reconfigure the signal ground assignment on the connector (typically for IBM parallel interfaces).

## 4 Jumper Pins

Industry-standard 0.025-inch square jumper pins enable you to reconfigure the serial interface with the jumper leads provided, when used in conjunction with the breakout switches (14).

## 5 Power Switch

Used to turn the CommTool 1000 On or Off. When the unit is Off, an internal battery maintains all tester memory, including all configuration and data buffers, in the state existing at power down.

## 6 External Power Supply

The CommTool 1000 comes with a desk-top power transformer that you can insert into the power jack provided on the right edge of the instrument, just below the On/Off switch. To conserve the batteries, use the external power supply whenever possible.

## CAUTION

**Always insert the external power supply cord into the CommTool 1000, then plug in the desk-top transformer to your AC power source. Failure to do this may result in undesirable arcing between the power cord and the receptacle on the side of test set, and possible damage to the power supply.**

**7 Bi-Directional Serial Connectors**

Used for RS-232 serial testing, downloading test patterns, and as a serial printer port for printing hard copy of test results and buffers. May also be used to monitor and reconfigure 25-pin IBM PC parallel interfaces. These connectors are also part of the integral breakout box and are wired to each other through the breakout switches in the center of the panel.

**8 Pin Analyzer Probe Connection Pin**

Connection point for the test probe (supplied) used in the Pin Analyzer test. Refer to **Section 4.8** for a complete test description.

**9 Pulse Trap**

Allows unattended detection of data or control line transitions or short signal pulses. The operation of the Pulse Trap is described in **Section 7.2**.

**10 Function Keys**

The nine function keys are arranged in two groups. One group of four function keys are labeled PARAMETER and VALUE. These four keys are used to select the options of a test and to view test results. On the right side arranged vertically, are five other function keys. The operation of all function keys is described in **Section 3.4**.

**11 Parallel Monitor LEDs**

Fifteen LEDs provide monitoring of the eight parallel data lines plus STROBE, ACKNOWLEDGE, BUSY, PAPER END, SELECT, INIT (Input Prime), and ERROR (Fault). Monitor LEDs are lit when a signal is true (active low or active high). LED pulse-stretching circuits are provided on STROBE, ACKNOWLEDGE, and INIT, to allow easy viewing of short duration pulses on these lines. Monitor circuits are buffered and do not interface with parallel interface signals.

**12 Bi-Directional Parallel Connector**

A Centronics style parallel interface is provided for testing parallel devices or for sending test results to a parallel port printer. The interface can be internally configured as either an input or output port and can support either Centronics or Dataproducts logic standards.

### 13 Signal Ground Switches

These switches allow you to disconnect the internal ground reference of the CommTool 1000 from Pin 7 (RS-232 Signal Ground). The left side switch (LF 7) and right side switch (RT 7) disconnect the ground from their respective interface connectors. In the ON position, the internal ground will be connected to Pin 7 Set both switches ON for normal RS-232 testing. In the OFF position, no ground reference is established to the connector. When using the breakout box function for IBM parallel interface testing, set both switches OFF and jumper the ground pin (G) to Pin 19 of the interface.

### 14 Breakout Switches

These switches are used to open individual connections between the two serial ports, essentially isolating single leads of the interface so that they can be reconfigured with the jumper pins and leads. These switches should be left in the ON position for normal serial testing and put in the OFF position only for cable testing or breakout box reconfiguration.

### 15 Active Port Indicators

LEDs are provided above each of the two serial connectors and the parallel connector to indicate the interface selection (and active connector) when a test is in progress. The LED will light whenever the CommTool 1000 is actively sending or receiving data from a particular connector.

## 2.3 Quick Start Exercise

The instructions in this section will guide you through a quick exercise of the Bit Error Rate Test (BERT). These instructions are not intended to explain every aspect of the operation of the CommTool 1000 during a BERT test, but only to get you started quickly using the CommTool 1000. For complete instructions on the BERT key functions, setup parameters, and parameter values, refer to **Chapters 3 and 4**.

While the CommTool 1000 is a portable instrument, it can also be powered externally. If you wish to do this test while on external power, first confirm that the external power supply is set for the correct voltage, then plug the external supply into the CommTool 1000 before plugging it into a wall outlet.

1. Remove all connections and jumpers from the front panel of the CommTool 1000.
2. Close all lines between the “TO DTE” connector and the “TO DCE” connector by setting all switches to the ON position (down on the right).

3. Connect a single jumper wire (supplied) between Pin 2 and Pin 3 on the left row of pins.
4. Turn the CommTool 1000 On. The initial configuration screen will be displayed and Last Set-up will be the initial value.
5. Press the NEXT VALUE key until the message “Default Set-up” is shown on the lower line of the display.
6. Press the NEXT PARAMETER key once to change the active parameter on the top line of the display to “TEST.”
7. Press the NEXT VALUE key until “BERT” is displayed on the bottom line of the display.
8. Press the START/STOP key to begin the test. The “DTE” LED and several other LEDs on the breakout box will light and the following message will be displayed.

BERT IN PROGRESS

Synchronized

The CommTool 1000 is now transmitting a BERT test pattern on TD (Pin 2) and receiving the same pattern on RD (Pin 3), looped back through the jumper wire.

9. After a second or two, press the INJECT ERROR key once to inject a single error into the test pattern. After a brief pause, the CommTool 1000 will emit a beep when the error is injected.
10. The real-time status of the test can be viewed with the PARAMETER and VALUE keys. Press the NEXT VALUE key to scroll through the test statistics. Each time you press the NEXT VALUE key, a different test statistic will be displayed on the second line. The eleven test statistics are: TEST STATUS, BITS, BIT ERRS, BER, BLKS RCVD, BLK ERRS, BLER, TIME, ERRD SECS, EFS, PWR LOSS, SYNC LOSS, and PAR ERRS. See **Section 4.2** for a description of each error statistic.

Notice that the BLKS RCVD and TIME displays are continuously updated as data is transmitted and the time accumulates. Press the NEXT VALUE key until the display reads:

BERT IN PROGRESS

Synchronized

11. To view status of the test when the error was detected, press the NEXT PARAMETER key once, then press the NEXT VALUE key until all eleven of the error event statistics have been viewed. Notice that BLKS RCVD and TIME are static and report the conditions just as the error occurred. The top line of the display will read:

BERT EVENT #1

12. Remove the jumper wire between Pin 2 and Pin 3 for a few seconds and then replace it. The display will change to:

BERT IN PROGRESS

Data Interrupted

When you have replaced the jumper between Pins 2 and 3, the display will change to read:

BERT IN PROGRESS

Sync Recovered

13. Using the PARAMETER and VALUE keys, examine the event statistics again. Note that three events have now been logged:

- The original error that was injected.
- The interruption of data when the jumper was removed.
- The re-synchronization that occurred when the data link was re-established.

14. Stop the test by pressing the START/STOP key. The display will read:

BERT TOTALS

Bits:

The PARAMETER and VALUE keys can be used to view the final error event statistics at the end of the test.

15. Press the SETUP/RESULTS key to return the CommTool 1000 to the Setup mode. Remove and store the jumper wire. The display will read:

TEST

BERT

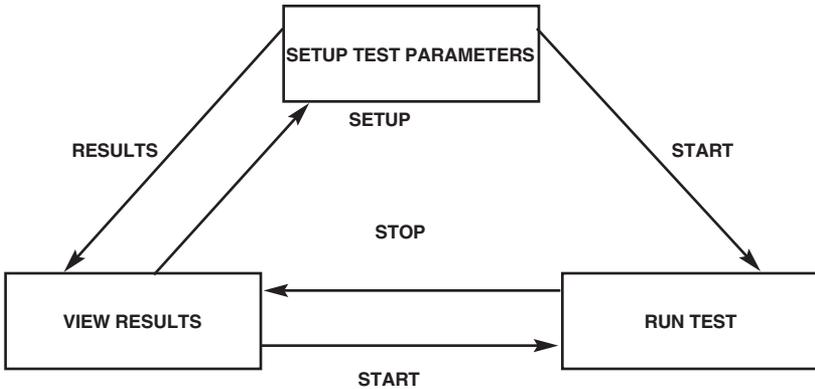
This completes the Quick Start exercise.

### **NOTE**

**You can also print a copy of the BERT results See “Print Test Data” in Section 5.27 for instructions on how to print the BERT error event statistics on a printer.**

## 3. Operational Summary

The CommTool 1000 has three operating modes: Setup mode, Run mode, and Results mode. The operation of the function keys varies from one operational mode to the next and they are marked differently to indicate their function in each mode. The relationship between the three operational modes is shown in Figure 3-1, “The CommTool 1000 Operational Modes.”



**Figure 3-1. The CommTool 1000 Operational Modes**

### 3.1 Setup Mode

Setup mode is used to select a test to perform, to select configuration parameters, and to define user messages. When the CommTool 1000 is turned On, the Setup mode is the active mode. The key functions that are labeled with white print are active in Setup mode.

In this mode, the CommTool 1000 presents a series of menu choices displayed on the LCD. Only menu choices that logically follow from previous choices are presented. Menu choices are presented one screen at a time. The top line of the LCD displays the current setup parameter, and the second line of the LCD shows its current value. Use the NEXT and LAST PARAMETER keys to select a parameter to set. Then use the NEXT and LAST VALUE keys to select a value for the parameter.

You can review current settings of parameter values by scrolling through the parameters using the NEXT and LAST PARAMETER keys. These keys do not alter the settings, but enable you to display the current values of the settings.

### **3.2 Run Mode**

The Run mode is entered when you press the START/STOP key from the Setup or Results mode. Programmed test functions execute in Run mode. You can toggle in and out of this mode by pressing the START/STOP key. When you are in Run mode, the key functions that are labeled in black are active, and the LCD displays information about the test that is executing. The CommTool 1000 will “beep” if you push a function key that is not supposed to be active for the test you are running. Depending upon the test that is running, LED indicators on the front panel of the CommTool 1000 will be illuminated to show active lines.

Refer to the description of each programmed test function for details on the operation of the keys and the LED indicators during each test.

### **3.3 Results Mode**

Results mode is entered after you complete a test. You can also enter Results mode from the Setup mode by pressing the SETUP/RESULTS key. If the test that you have selected does not produce results, the display shown below will appear.

NO TEST RESULTS

SETUP or START?

If there are results from the test, they will be displayed on the LCD. When there is more than one screen of results from the test, you can view the additional screens by pressing the NEXT or LAST PARAMETER key. Press the SETUP/RESULTS key to return to Setup mode or press the START/STOP key to run the test again.

Test results from the most recently executed test of each test function are stored in non-volatile memory. You can review the results of any test by pressing the SETUP/RESULTS key after you have selected a test and you are in the Setup mode.

Refer to the description of each programmed test function for details on the function of the keys and the display presentation of test results for each type of test.

### 3.4 Using the Function Keys

The CommTool 1000 has nine multi-function program keys. Each key is listed below and described on the following pages.

- **DELETE CHAR.** and *RESET/RESYNC*
- **INSERT CHAR.** and *INJECT ERRORS*
- **CURSOR JUMP** and *FLOW CONTROL*
- **SETUP/RESULTS** and *SINGLE STEP*
- **TRAP DISPLAY** and *PRINT*
- **NEXT PARAMETER**
- **LAST PARAMETER**
- **NEXT VALUE**
- **LAST VALUE**
- **START/STOP**

#### 3.4.1 START/STOP AND SETUP/RESULTS KEYS

When you have specified all of the parameter values for a particular test, you can press the START/STOP key to execute the test. It isn't necessary to go through all of the selections for each test. In fact, you need only view those parameters that you want to change from the previous setting, or from the stored setup that you select at the Configuration menu.

After you have pressed the START/STOP key to begin a test, you can press the START/STOP key to stop the test. You will enter the Results mode and be able to view any test results. You can restart the test at any time from either Setup or Results mode by pressing the START/STOP key again.

### **3.4.2 PARAMETER AND VALUE KEYS**

The PARAMETER and VALUE keys control the display menus. The two PARAMETER keys, LAST and NEXT, enable you to scroll the parameter displayed on the top line of the LCD. Press the NEXT PARAMETER key to scroll forward through the setup parameters. Press the LAST PARAMETER key to scroll backwards through the parameters. Hold the LAST PARAMETER key down to return to the TEST parameter message.

The two VALUE keys, LAST and NEXT, scroll the value displayed on the bottom line of the LCD. The NEXT VALUE key scrolls forward through the values, and the LAST VALUE key scrolls backward through the values.

Values are the settings of the parameters that you can change. For example, the value of the TEST parameter can be any one of the eleven programmed test functions: Analyze Device, Send Data, Trap Data, etc.

When you scroll to a new parameter with the LAST or NEXT PARAMETER key, or begin a test with the START/STOP key, the last value displayed is the setting of that parameter which the test will use.

### **3.4.3 DELETE CHAR., INSERT CHAR., CURSOR JUMP KEYS**

The Char key DELETE CHAR, INSERT CHAR, and CURSOR JUMP keys are text editing keys that work in conjunction with the VALUE and PARAMETER keys when you are editing user messages in Setup mode. The DELETE CHAR key deletes a character from the message buffer. The INSERT CHAR key inserts a 00H (null) character into the text. The CURSOR JUMP key jumps the cursor position in the message buffer between the beginning and the end of the message. For detailed instructions on using these keys, see the discussion in **Chapter 6, Creating and Revising Messages**.

### **3.4.4 RESET/RESYNC, INJECT ERRORS, FLOW CONTROL, SINGLE STEP, TRAP DISPLAY, AND PRINT KEYS**

The DELETE CHAR, INSERT CHAR, CURSOR JUMP, TRAP DISPLAY, and SETUP/RESULTS keys have a different function while a test is in progress. Each has, in black type, a label that indicates the function of the key while a test is in progress. These functions are described in the following paragraphs.

**RESET/RESYNC** During a BERT test, this key function resets the error counters and resynchronizes the receiver to the pattern of the incoming datastream. When you press this key during a test all the results count registers are set back to zero. These counters are all part of the BERT Event Log. See **Section 4.2.3, Event Log**, for a discussion of the BERT Event Log. This key also resets the Pulse Trap in any operational mode.

**INJECT ERRORS** This key function is active only during a BERT test. Its function is to inject bit errors into the datastream that is being transmitted. A single bit error is injected each time this key is pressed.

**FLOW CONTROL** This key function toggles the state of the output flow control while a test is running. If hardware flow control is selected, pressing this key will toggle the state of the selected Control Line Out lead from On to Off or Off to On. In parallel mode, the state of the busy lead is toggled. During the Trap Data test, if software flow control is selected, the selected Control On or Control Off character will be transmitted.

This key function is active during the Send Data, Trap Data, Printer Setup, BERT, Polling, and Print Test Data functions.

**SINGLE STEP** The SINGLE STEP key is active during the Send Data, Trap Data, and Printer Setup Tests. In the Send Data or Printer Setup tests, you enable the SINGLE STEP key by selecting the Single Message or the Character Single Character option of the MESSAGE MODE parameter. When you have enabled this key, you can send a single character or a single message by pressing the SINGLE STEP key after you have pressed the START/STOP key to begin the test. When the single character or message has been sent, you can send another one by pressing the SINGLE STEP key again.

In the Trap Data tests you must have enabled flow control and selected the Single Step option under the MESSAGE MODE parameter. The CommTool 1000 will set a flow control Off state as soon as it receives a character. When the SINGLE STEP key is pressed, a flow control On state is set until the next character is received. With serial transmission, it is normal to receive 2 or 3 characters with each press of the SINGLE STEP key, due to the response delay of the transmitting device.

**TRAP DISPLAY** The TRAP DISPLAY key is active during the Trap Data Test. While a test is running, the bottom line of the LCD will display the data being received. Press the TRAP DISPLAY key to change the display from the TD buffer to the RD buffer. You can also display both buffers on separate lines by pressing the TRAP DISPLAY key again.

**PRINT** The PRINT key is active during the BERT and Monitor SDLC tests. If you press the PRINT key while the test is running, the accumulated test results will be printed on the parallel port. If more than one errored second occurs while the results are printing, the CommTool 1000 will print the accumulated results of the last errored second. The results of the intermediate errored second will not be printed. An asterisk printed just in front of the word **Status** shows that an intermediate error that took place between the last two printed results was not printed.

## 4. Programmed Test Functions

The CommTool 1000 features fourteen programmed test functions, each of which is described in detail on the following pages. These programmed test functions are controlled by the function keys on the face of the CommTool 1000.

### 4.1 Analyze Device

The Analyze Device function enables you to quickly determine the type of asynchronous device (DCE or DTE) to which the CommTool 1000 is connected, and then automatically configure your test setup to match the device under test. Use this test at the beginning of a diagnostic session to determine the characteristics of serial transmitted data.

You can determine the baud rate, parity, word length, and the number of stop bits (if any) and then automatically configure your test setup to match.

To begin a test, press the START/STOP key. If the CommTool 1000 detects a signal on the line, it will determine what type of device is connected to it and display a message describing the device as a DTE or a DCE.

If the CommTool 1000 is being used as a monitor between two devices, it will report “2 Drivers Found:” on the top line of the LCD at the start of the test. You can specify the driver that you want to analyze, either RD (Pin 3) or TD (Pin 2).

If no transmitting device is detected on TD or RD, you will be prompted with the following message:

NO DATA SOURCE!

CONNECTIONS OK?

As soon as you connect an active data source, the test will continue.

The lower line of the display will read “Waiting for Data” until characters are received, and then change to “Collecting Data” while characters are being received.

For intermittent data, such as characters typed from a terminal, the test results will be displayed when 30 to 40 unique characters have been received. For accurate measurement, these characters should be a mix of numeric and alpha characters. For continuous data, such as a file downloaded from a computer, the CommTool 1000 samples the datastream and then evaluates the data samples to determine the result.

The display will change to “Evaluating Data” while the data samples are analyzed before the test results are displayed.

When the test is complete, the CommTool 1000 will beep and show a display similar to the following example.

BAUD	P	WL	SB
9600	N	8	1

The display indicates the baud rate of the datastream (BAUD), Odd, Even, or No parity (P), 5,6,7, or 8 bits word length (WL), and 1, 1.5, or 2 stop bits (SB).

If the datastream is not continuous, the CommTool 1000 will be unable to determine the number of stop bits. A question mark (?) will be displayed in the stop bits area of the display.

When the test is complete, press the SETUP/RESULTS key; “AUTO-CONFIGURE?” will be displayed on the top line. Press the NEXT VALUE key until the word Yes is on the second line and then press the SETUP/RESULTS key again to automatically configure the CommTool 1000 to match the values determined by the Analyze Data test. If Auto-Configure is set to NO, the setup configuration of the CommTool 1000 will not be altered.

## 4.2 BERT

The Bit Error Rate Test (BERT) enables you to test the integrity of a data transmission channel, in either a loopback or end-to-end configuration.

The CommTool 1000 transmits and receives six industry-standard test messages, plus a Fox message in any one of five languages (ASCII, EBCDIC, Baudot, Transcode, and IPARS). You can also create an additional 16 unique user messages. Instructions for creating and editing user messages are found in **Chapter 6**.

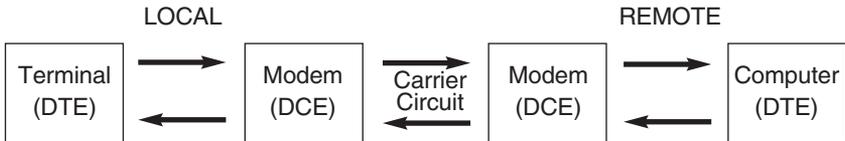
The CommTool 1000 can be configured to simulate a DTE or a DCE with internal or external clock sources. Message block length is adjustable from  $10^2$  to  $10^7$  bits. Tests can be continuous or you can limit the test length from 1 to 10,000 blocks.

An alarm can be enabled to sound when an errored second, a parity error, or a sync loss occurs. During a test, the BERT Event Log records the test status, the cumulative number of bits received, bit errors, bit error rate, blocks received, block errors, block error rate, time, errored seconds, the percent error free seconds, the number of sync losses, parity errors, and the power line losses which have been experienced. You can view these results during and after the test. The test results will remain in non-volatile memory until a new BERT test is initiated. You may also print these statistics on a parallel printer while the test is in progress.

The CommTool 1000 has an intelligent algorithm to detect sync losses. When the bit error rate exceeds 20% during a one-second period, a sync loss is detected. When synchronization is recovered, the error counts before the sync loss is restored.

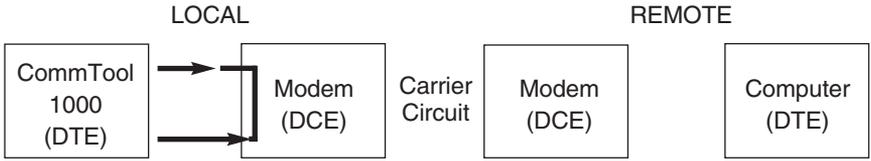
### 4.2.1 BERT TEST CONFIGURATIONS

Figure 4-1 shows a schematic diagram of a typical interface between a terminal, a modem, and a computer. To test this transmission link and isolate a faulty component, substitute the CommTool 1000 for the local terminal device (DTE).

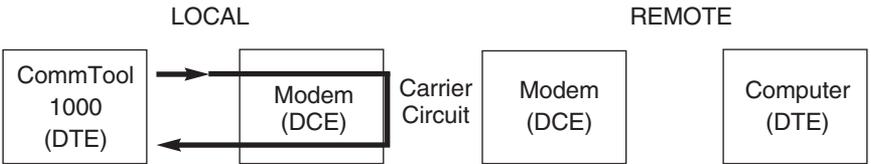


**Figure 4-1. Typical Terminal-to-Computer Link.**

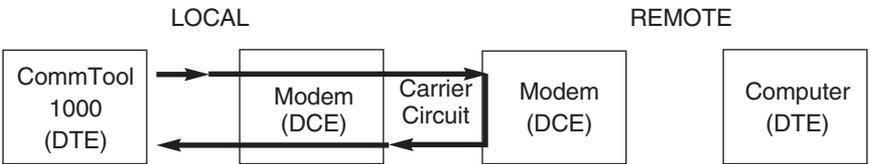
Beginning with digital loopback at the local modem, test each looped-back portion of the transmission channel (local digital, local analog, remote digital, and remote analog). You will detect a significant increase in the error rate on the faulty portion of the transmission channel. The four standard loopback test configurations are shown in Figure 4.2.



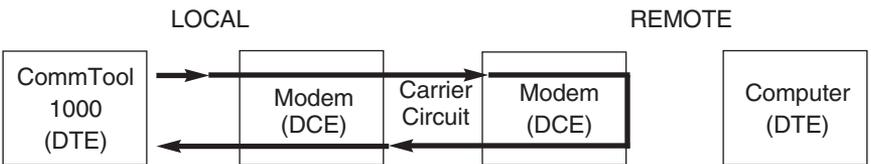
(A) Local Digital Loopback



(B) Local Analog Loopback

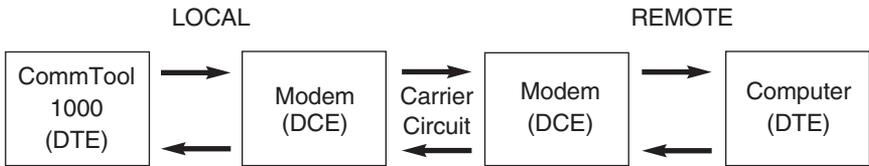


(C) Remote Analog Loopback



(D) Remote Digital Loopback

Because data is looped through both channels in loopback testing, this method will not determine which channel is causing transmission errors: the transmit channel or the receive channel. To identify the faulty channel, use the end-to-end method (shown in Figure 4-3) with a second tester at the remote interface. The second tester may be another CommTool 1000 or any other industry-standard BERT tested. Both units must be set for the same serial mode, bit rate, word length, parity, stop bits (if applicable), and test pattern. If the test pattern being used is a User Message, then end-to-end testing can also be performed by placing a PC at one end and the CommTool 1000 at the other end of the channel.



**Figure 4-3. End-to-End Testing.**

Errors registered at each test set indicate errors on the receive channel to that end of the transmission channel. Separate error rates may be measured for both the transmit and receive channels with this arrangement.

#### 4.2.2 CONDUCTING A BERT TEST

Press the START/STOP key to begin the test. All error counters will be set to zero, and all previously collected BERT results will be erased. You should connect the AC power supply if you want to use the Power Loss statistic.

At the start of the test and until the CommTool 1000 has synchronized with the incoming datastream, the display shown below will appear:

BERT IN PROGRESS

Waiting for Sync

When the CommTool 1000 is synchronized with the incoming datastream, the display will change to:

BERT IN PROGRESS

Synchronized

After synchronization, you can examine the contents of the current Event Log by pressing one of the VALUE keys.

You can stop the test at any time by pressing the START/STOP key. The display will change to:

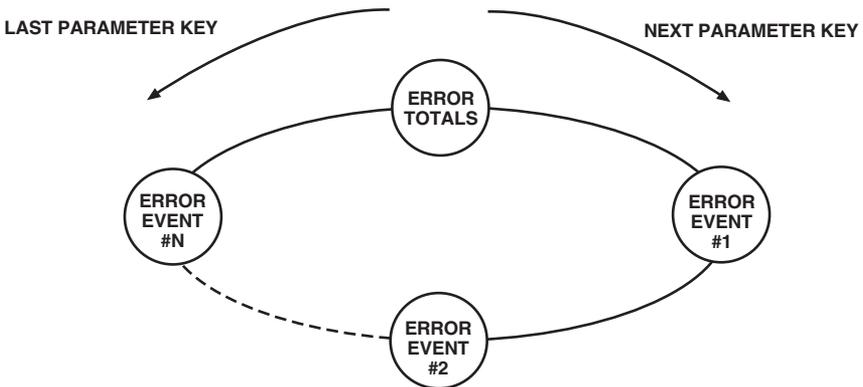
BERT TOTALS:

Bits: NNNNN

You are now in Results mode. Press SETUP/RESULTS to return to Setup mode, or START/STOP to begin a new test.

**4.2.3 THE EVENT LOG**

Each BERT error event log keeps a count of bits received, bit errors, blocks received, block errors, parity errors, sync losses, errored seconds, percent error free seconds, and the elapsed time during the test at which errors occurred. Figure 4-4 illustrates the sequential nature of the error event display.



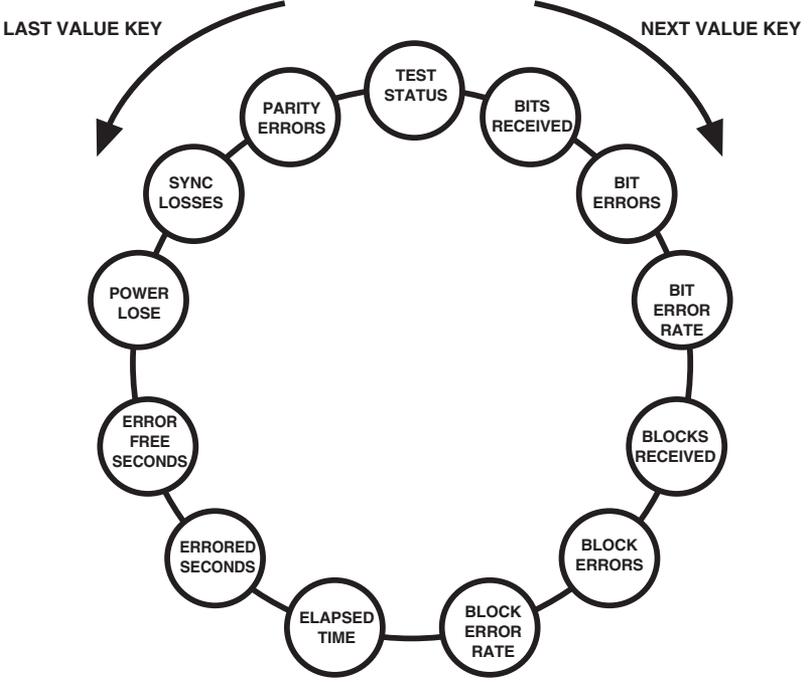
**Figure 4-4. The Event Log**

The top line of the LCD displays the name of the current event log. Each error event is numbered. Up to number 25 BERT error events can be recorded during a test.

While a test is running, the cumulative totals for the test are viewed when the top line reads "BERT IN PROGRESS." After the test is complete, cumulative totals are viewed when the top line reads "BERT TOTALS." Cumulative totals at each event are viewed when the top line of the display reads "ERROR EVENT #N."

The error event display is controlled by the PARAMETER keys. While a test is in progress, you can look through the error events that have occurred by pressing the PARAMETER keys. Each error event and its associated error statistics will be displayed in sequence on the bottom line of the LCD. The totals from these events are also available for review. Each event log records eleven event statistics during a test.

The bottom line of the LCD will display a description of the error event that occurred and the error statistics for that error event. Use the VALUE keys to scroll through the error statistics. The error event/event statistics display relationship is illustrated in Figure 4.5.



**Figure 4-5. Error Event Statistics**

When you press the VALUE key during the execution of a BERT test, the display on the bottom line will change to report each error statistic of the event identified on the top line. These statistics are accessible in a sequential ring. You can move in either direction in the ring. Press the LAST VALUE key to move in one direction, and press the NEXT VALUE key to move in the other direction.

#### 4.2.4 ERROR STATISTICS

To display error statistics, press the VALUE keys. Each time you press a VALUE key, the bottom line of the display will change to another type of error statistic. The errors on which statistics are recorded are described below.

To print error statistics during a test on a parallel printer, press the PRINT key. Each time you press the PRINT key, the accumulated results will be printed. If more than one errored second occurs while the results are printing, the CommTool 1000 will print the accumulated results of the last errored second. Intermediate errored second results will not be printed. An asterisk printed just in front of the word **Status** shows that an intermediate error that took place between the last two printed results was not printed.

#### Test Status

This display shows the test status. For an error log event, the type of error event causing the log entry will be identified.

**Sync Lost** Synchronization of the received test pattern was lost. Sync loss is detected when the bit error rate exceeds 20 percent for a one-second period.

**Sync Recovered** Synchronization (pattern recognition) of the CommTool 1000 with the incoming datastream occurred after a loss of sync.

**Data Interrupted** No data was received for at least one second.

**Errored Second** One or more bit errors occurred during a one-second period.

**Parity Error** One or more parity errors occurred during a one-second period. Parity is checked only if it is selected during setup. Power Failed AC power was interrupted for more than one second.

**Power Restored** AC power was restored after a power loss. For short power interruptions (0.05 to 1 second), the error log will show only one "Power Restored" entry.

When the BERT IN PROGRESS (totals) screen is shown, the test status display shows the current state of the test:

**Waiting for Sync** Initial synchronization of the CommTool 1000 with the incoming datastream has not yet occurred.

**Synchronized** The CommTool 1000 is synchronized with the incoming datastream. No sync loss events have occurred.

**Sync Lost** Synchronization has been lost with the incoming datastream and the CommTool 1000 is attempting to resynchronize.

**Sync Recovered** The CommTool 1000 has successfully resynchronized with the incoming datastream after a sync loss event occurred.

**Data Interrupted** No characters are currently being received.

**Power Failed** AC power has been lost and the test is running on internal batteries.

**Power Restored** AC power has been restored after a power loss.

After a test is complete, the test status display will show “End of Test” for the BERT TOTALS: screen.

## **Bits**

A running total of the number of bits received during the test is recorded.

## **Bit Errors**

Each time a single bit error occurs (a 1 that is supposed to be a 0 or a 0 that is supposed to be a 1), the bit error register is incremented by one. The event log is updated once per second, so it is possible to get multiple bit errors logged in a single event log entry.

## **Bit Error Rate (BER)**

The number of bit errors divided by the number of bits received is shown with the error statistics display. BER is recorded in the Error Event Log.

## **Blocks Received**

A running total of the blocks received during the test is recorded in the event log. Typically the block length is  $10^3$  bits, but you can set the length of the block from  $10^2$  to  $10^7$  bits. The statistic is displayed in floating-point format.

## **Block Errors**

When a block is received that contains one or more bit errors, the block error register is incremented by one. The block length is defined in the test setup between  $10^2$  to  $10^7$  bits.

**Block Error Rate (BLER)**

The number of block errors divided by the number of blocks received is shown with the error statistics display.

**Time**

The elapsed time starting from initial pattern synchronization is displayed along with the statistics for each event. The time is reported in hours:minutes:seconds format.

**Errored Seconds**

Each second in which one or more bit errors occur is recorded as an errored second. Each errored second is recorded in the event log.

**Percent Error Free Seconds**

The percent of total in-service seconds which have been error free is shown with the error statistics. Time which elapses during a sync loss is not included in total in-service seconds. %EFS is recorded in the Error Event Log.

**Sync Losses**

When synchronization of the BERT messages is not maintained, an error event will be recorded in the event log and the message "Sync Loss" will be displayed on the LCD. When synchronization has been recovered the message displayed will change to "Sync Recovered." The test statistics are reset to the last error-free second before sync loss. Elapsed time is not reset.

**Parity Errors**

During a BERT test using either Fox or user messages, the parity of each character is compared with the setting that you have specified. Each time a character with incorrect parity appears, the parity error register is incremented by one. If no parity is specified during Setup, this statistic is not accumulated.

**Power Losses**

Power losses are detected when the CommTool 1000's internal battery voltage exceeds the voltage provided by the external power supply. Interruptions of the AC line voltage longer than 3 cycles (50 milliseconds) will be detected as a power loss. The CommTool 1000 keeps track of these power loss events so that error events can be correlated to these power losses. Each time the power is lost, the count increases by one.

### **4.3 Bias Distortion**

The Bias Distortion function measures the amount of time that a data line is in a Mark state versus the amount of time that it is in a Space state and reports this measurement as a ratio of Mark to Space percentages. Use this test to determine the amount of distortion that a modem chain or other communications link is adding to a datastream.

When configured to simulate a DTE, the CommTool 1000 generates a 50% duty cycle square-wave reference signal on TD (Pin 2), and measures the bias distortion of the incoming signal on RD (Pin 3). When configured to simulate a DCE, the CommTool 1000 generates the same reference signal on RD (Pin 3), and measures the bias distortion of the incoming signal on TD (Pin 2).

You can either loop-back the square wave signal provided by the CommTool 1000 or you can use another square-wave generator for the reference source. A random data source may also be used as a reference signal if the data source has 50% Mark and 50% Space data bits.

Press the START/STOP key to begin the test. The top line of the display will identify the pin being measured (Pin 2 if you set the interface to DCE or Pin 3 if you set the interface to DTE). Below the label "Mark:Space" will be the percentage of the time the circuit is in a Mark state versus a Space state. Measurements are updated approximately once per second on a continuous basis.

To Stop the test, press and hold the START/STOP key until the pin label display on the top line changes to "BIAS" and the CommTool 1000 beeps. You are now in Results mode with the last bias measurement displayed. Press the SETUP/RESULTS key to return to Setup mode, or press the START/STOP key to restart the test.

### **4.4 Data Throughput**

The Data Throughput test measures the characters per second throughput of serial or parallel data channels. It displays the characters per second throughput rate for either serial or parallel channels.

For asynchronous serial data measurements the test also displays a figure of merit indication. The figure of merit is expressed as a percentage of ideal channel throughput, based on the selected bit rate, parity, word length, and number of stop bits.

The CommTool 1000 can be set up to either passively monitor the channel or drive flow control for the channel.

Press the START key to begin the test. Throughput calculation will begin after the first character is received. The display continuously updates during the test.

Press the STOP key after data transmission is complete. The throughput calculation will discard any idle channel time after the last character was received so that a true throughput measurement is made for short bursts of data. For best accuracy, however, it is recommended that a minimum length datastream of 1000 characters is transmitted for measurement.

## 4.5 Event Timing

The Event Timing function enables you to measure the delay between transition events on any of the major control lines of the serial interface.

You can measure the time between On-to-Off and Off-to-On (or vice versa) transitions on lines 4, 5, 6, 8, 11, 19, and 20. If you want to time a transition event on any other lead, you can insert a jumper to an unused lead, (commonly Pin 11) from the pin that you wish to test, and set the transition detect for Pin 11 On-to-Off or Off-to-On.

A typical use of the Event Timing function is to time the delay between the transition from low to high on RTS (Pin 4) and the transition from low to high on CTS (Pin 5) to find the response time of a modem.

Press the START/STOP key to begin the test. The display will read:

TIMING EVENT:

Waiting to Start

When the Start event occurs, timing will begin. To guarantee timing accuracy for short-duration events, the timing value will not be displayed until one second has elapsed. Then, the display will change to:

TIMING EVENT

1 Seconds

The event time is shown in hours:minutes:seconds format. After the Stop event occurs, the CommTool 1000 changes to Results mode and the top line of the display changes to "EVENT TIME:." The bottom line shows the time measured between the Start and Stop timing events (accurate to 1 millisecond). After 1 minute the CommTool 1000 stops displaying milliseconds.

You can return to Setup mode by pressing the SETUP/RESULTS key, or time another event by pressing the START/STOP key.

## **4.6 Load User Message**

The Load User Message function allows you to easily download messages from an external device (such as a PC) directly into the user message memory of the CommTool 1000. The CommTool 1000 has 2560 characters of non-volatile user message memory. You may store up to 16 individual messages. There is no limit on individual message length within the total buffer limitation.

You may select which of the User Messages (1 to 16) you wish to load. You may also select whether you will download via a serial or parallel channel.

After selecting all the parameters, press the START key to begin the downloading process. When the message has been completely sent, press the STOP key. You can then select a new message to download and repeat the downloading process.

While the downloading is taking place, the CommTool 1000 will display the message LOADING USER #N.

## **4.7 Monitor SDLC**

The Monitor SDLC test provides transparent monitoring of a bidirectional SDLC channel. The CommTool 1000 accumulates statistics on frames received, frames rejected, frames aborted, FCS errors, and data loss, and calculates error rates measured on an active channel. The results can be printed by the Print Test Data function after the test is complete. Current test status can also be printed during a test by pressing the PRINT key.

Statistics accumulated include Frames Sent, Frames Received, Bad FCS, Aborted Frames, Reject Frames, Errored Seconds, Error Free Seconds, Percent Error Free Seconds, and Elapsed Time. Separate statistics are maintained for both the TD and RD channels.

You can choose to have the status printed by the PRINT key only, printed every hour, or printed when an errored second occurs. You can also have the CommTool 1000 signal with an alarm when it sees an errored second, sync loss, a rejected frame, or an aborted frame.

### 4.7.1 SDLC OVERVIEW

SDLC is a bit-oriented protocol for the data link control of a communications channel. Channel configurations are either multipoint or point-to-point, and may be either switched or nonswitched. Transmission may be full-duplex or half-duplex. SDLC provides error detection and recovery procedures for those errors introduced by the communications channel. It permits multiframe transmission before an acknowledgment is required.

#### Primary and Secondary Stations

An SDLC link has two or more stations located on it. Only one station is designated as a primary station; all other stations of the line are secondary stations. The primary station initiates all transmissions from secondary stations. In normal practice, the primary station deals with one secondary station at a time. The same station can function as either a primary or a secondary station in certain situations.

#### Transmission States

An SDLC link can be in one of three transmission states: transient, idle, or active. The transient state occurs when a station is preparing to transmit; it follows the poll (secondary station) and precedes the actual transmission of control information or data.

During the idle state, there is no transmission of control information or data; it is identified by a succession of 15 or more consecutive binary 1s.

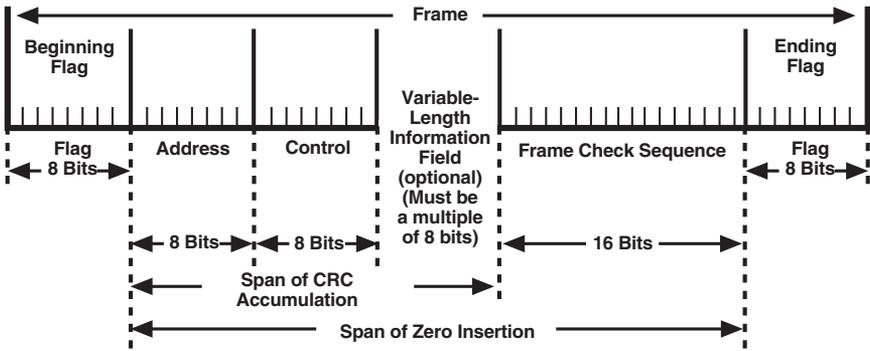
#### Transmission Mode

The primary station is in a permanent command mode. Secondary stations can be in one of three active modes, established by the primary station: Normal Response Mode (responds to a poll); Normal Disconnect Mode (Responds to polls with a request to be put online or to be initialized); Initialization Mode (procedures specified by system components).

If the secondary station is disabled and does not respond to a poll or responds with bits that do not result in frames, a time-out procedure is initiated by the primary station to determine the response condition. After a given number of retries, as determined by the procedures for the primary station, recovery action can be taken. SDLC includes a provision for a transmitting station, either primary or secondary, to abort specific transmission. Recovery is up to the primary station.

**SDLC Frame Structure**

SDLC frame layout is shown in Figure 4-6. The transmission frame consists of a Beginning Flag, Address Field, Control Field, Information Field, Frame Check Sequence, and an Ending Flag. Each field contains either eight bits or a multiple of eight bits. Only the Information (data) field is of variable length. The frame format enables a receiving station to determine the beginning and ending of a transmission, the station address, what actions should be taken, specific information for the receiving station, and whether the frame was received without error. SDLC has a method called zero insertion, which prevents unwanted flags from occurring in any of the other fields. This permits completely transparent data transfer.

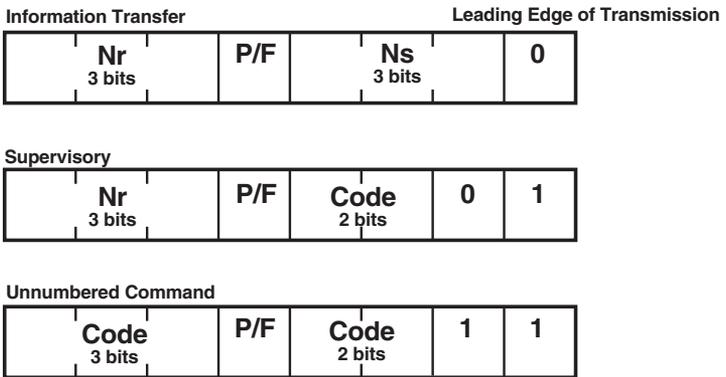


**Figure 4-6. SDLC Frame Format.**

The Flag field, both beginning and ending, is binary “01111110” (Hex 7E). The Idle state of the communications link is all 1s; the presence of a 0 causes the examination of the following bits to see if it matches the Flag pattern. If so, interpretation of the frame begins.

The Address field always contains the identity of the secondary station that is communicating with the primary station. In a poll, the Address field identifies the station being polled. In a response, it identifies the transmitting secondary station.

The Control field identifies the function of the frame. It can be in one of three formats: the unnumbered format, the supervisory format, or the information transfer format. The first two bits transmitted in the Control field identify the format as either Information, Supervisory, or Unnumbered. Figure 4-7 shows the Control field formats.



- Nr** Number of correct frames received since last acknowledgement. 7 maximum.
- Ns** Number of frames sent since last acknowledgement. 7 maximum.
- P** Poll bit, sent by primary station.
- F** Final frame, sent by secondary station.
- Code** Supervisory and Nonsequenced Command control codes.

**Figure 4-7. Control Field Formats**

All three Control field formats contain a poll/final (P/F) bit. A secondary station receives the P (poll) bit from the primary station. The P bit requires the secondary station to initiate transmission. The F (final) bit is transmitted by the secondary station to the primary station. It is inserted into the last frame to indicate the end of a transmission. The Information Transfer Format of the Control field contains information that tracks the number and sequence of frames sent and received. A station transmitting numbered information frames counts each frame and sends the count with the frame (shown in Fig 4-7 as Ns). A station receiving numbered

information frames accepts each numbered information frame that it receives, checks that it is error free and in sequence and, if so, advances its receive count for each such frame. The receiver count is Nr. The receiver returns its Nr count to the transmitting station.

The Nr count at the receiving station advances when a frame is checked and found to be error-free and in sequence. Nr then becomes the count of the “next expected” frame and should agree with the next incoming Ns count. If the incoming Ns does not agree with Nr, the frame is out of sequence and Nr does not advance. Out-of-sequence frames are not accepted. The receiver does accept the incoming Nr count (for confirmation purposes) if the out-of-sequence frame is otherwise error-free.

Nr and Ns are numbered 0–7. Up to 8 unconfirmed, numbered information frames may be outstanding at the transmitter. All unconfirmed frames are retained by the transmitter in case it is necessary to retransmit some or all of them if transmission errors or buffering constraints occur. The Nr and Ns counts of both stations are initialized (set to 0) by the primary station. The counts advance as numbered frames are sent and received.

In Supervisory Format, a code is used to identify any of three supervisory commands/responses: RR, RNR, and REJ. These commands and responses are interspersed with Information frames to supplement traffic control.

Receive Ready (RR) (Code bit pattern “00”) is sent by either the primary or a secondary station. It acknowledges numbered frames through Nr-1 and indicates that the station sending RR is ready to receive.

Receive Not Ready (RNR) (Code bit pattern “01”) is sent by either the primary or a secondary station and indicates a temporary busy condition due to buffering or other internal constraints. To indicate the clearing of an RNR condition, a primary station transmits an information frame with the P bit on, or an RR or REJ frame with the P bit on or off. A secondary station indicates that an RNR condition has been cleared by transmitting an I frame with the F bit on, or an RR or an REJ frame with the F bit on or off.

The Reject (REJ) command or response (Code bit pattern “10”) is sent by either the primary or a secondary station to request transmission or retransmission of numbered frames. REJ acknowledges that frames through Nr-1 were received without error and requests retransmission of numbered information frames starting at the Nr contained in the REJ frame. The REJ condition is cleared by the receipt of the requested frame or when a mode setting command has been correctly received.

The Unnumbered Format provides the commands and responses for the basic control of information exchanges. There are 14 Unnumbered Information (UI) commands and responses. The three commands most often used by the primary station are the mode setting commands.

Set Normal Response Mode (SNRM) “100P0011”

Disconnect (DISC) “010P0011”

Set Initialization Mode (SIM) “000P0111”

The four most common unnumbered responses from a secondary station are:

Unnumbered Acknowledgment (UA) “011 F0011”

Request Initialization Mode (RIM) “000F0111”

Disconnect Mode (DM) “000F1111”

Frame Reject (FRMR) “100F0111”

The Information field, which is optional, contains control information or data. The interpretation of the Control field determines whether an Information field is present. The Information field may be expanded to accommodate as much information as necessary, as long as it is expanded in eight-bit increments. Both numbered and unnumbered Information fields are possible.

The Frame Check Sequence field is used to check the received frame for errors introduced by the channel. It contains the Cyclic Redundancy Check (CRC) variable. The CRC is a unique 16-bit value that is generated by a mathematical combination of all data bits in the Address, Control, and Information fields. The result of the computation at the receiving end matches the received CRC if there have been no errors in transmission.

### **Abort Conditions**

An “abort” is the premature termination of the transmission of a frame. The abort pattern, a minimum of seven consecutive binary 1s with no zero insertion, terminates the frame without an FCS field or an ending flag. An abort is sent by the transmitting station. Zero insertion prevents an unintentional abort during normal data transfer. Following the abort, the link may go to the idle state (15 or more contiguous 1s) or may remain in the active state. Either a primary or secondary station may send an abort.

**Error Recovery**

SDLC recovers from an error condition by using either Link-Level Recovery, or Higher Level Recovery.

Link-Level recovery occurs at the data link level. SDLC procedures detect errors that may be recovered by retry or by retransmission. The types of errors recovered are: station busy; the received frame count does not match the frames sent count; the receiving station detects a CRC error, a numbered frame out of sequence, receiver busy, ending and beginning flags are not separated by a multiple of B bits, or a frame is less than 32 bits long. SDLC does not specify procedures for counting retry or retransmission attempts.

Higher-Level Recovery detects errors at the link level. It applies to the address, control information, and frame check sequence files of a frame. The station's decision-making power at a level higher than the data link level determines the type of intervention required. At a terminal, for example, operator intervention may be needed.

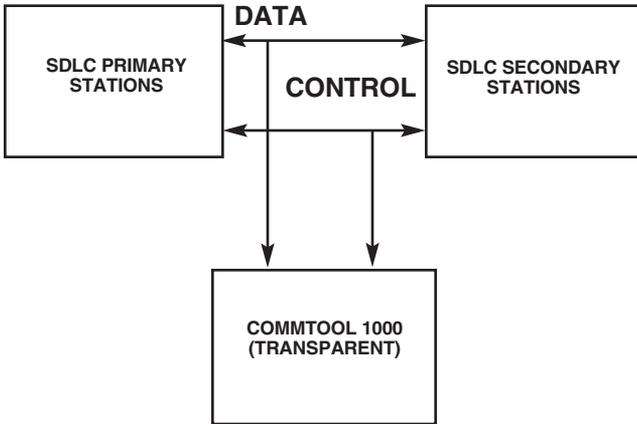
**Zero Insertion**

Two basic characteristics of SDLC require the use of a zero insertion technique: 1) the opening and closing Flag field must be unique to properly define the transmission frame and, 2) the protocol must be transparent to the data bit patterns.

Zero insertion prevents the occurrence of more than five consecutive binary 1s in the Address, Control Information, and Frame Check Sequence fields. The transmitting station automatically inserts 0 binary a following five binary 1s in every field except a Flag field or when transmitting an abort. The code patterns of the Flag and abort are easily distinguishable. The receiving station automatically discards any 0 following five consecutive 1s. If a 0 does not follow the five 1s, the receiving station checks for a flag or an abort condition.

**4.7.2 MONITOR SDLC TEST CONFIGURATION**

To conduct this test, the CommTool 1000 is connected between two SDLC stations as shown in Figure 4-8. The CommTool 1000 collects statistics from both the TD and RD signal lines and will display these statistics both during and after the test. The only configuration option which must be selected determines when the CommTool 1000 will print the error results: print key only, on every errored second, or every hour.



**Figure 4-8. Hookup for SDLC Analysis Test**

**Conducting a Monitor SDLC Test**

Press the START/STOP key to begin the test. All error counters will be set to zero, and all previously collected SDLC test results will be erased.

At the start of the test and until the CommTool 1000 has synchronized with the incoming datastream, the display will show:

TO CURRENT  
Waiting for Sync

When the CommTool 1000 is synchronized with the incoming datastream, the display will change to:

TD CURRENT

Synchronized

After synchronization, you can examine the contents of the current Event Log by pressing one of the VALUE keys. Press one of the PARAMETER keys to switch from the TD results buffer to the RD results buffer (or vice versa).

Press the PRINT key to print the currently selected TD or RD results buffer on a parallel printer.

Stop the test at any time by pressing the START/STOP key. The display will change to:

TD TOTALS

TIME: 00:00:00

You are now in Results mode and can review the results for both the TD and RD lines by using the PARAMETER and VALUE keys. Press SETUP/RESULTS to return to Setup mode, or START/STOP to begin a new test.

### **4.7.3 THE EVENT LOG**

Each SDLC error event log keeps a count of the elapsed test time, frames received/sent, frames aborted, frames rejected, FCS errors, errored seconds, percent error free seconds (EFS), data loss, and test status.

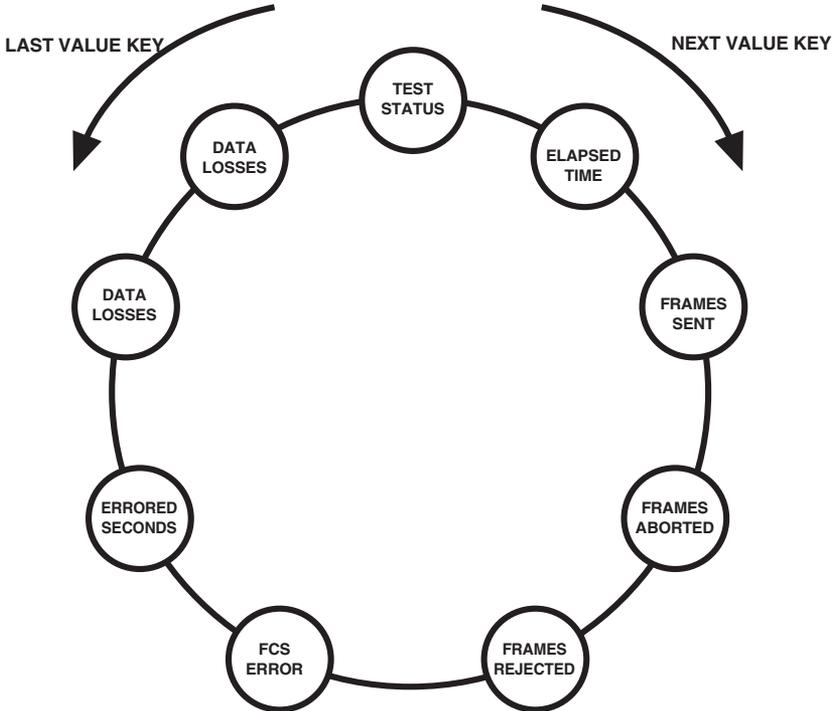
The top line of the LCD displays the name of the current line buffer (TD CURRENT or RD CURRENT). Each error event is numbered. Up to 25 SDLC error events can be recorded during a test.

While a test is running, the cumulative totals for the test are viewed when the top line reads "TO CURRENT:" (or "RD CURRENT:"). After the test is complete, cumulative totals are viewed when the top line reads "TO TOTALS:" (or "RD TOTALS:"). Cumulative totals at each error event are viewed when the top line of the display reads "ERROR EVENT #N."

The error event display is controlled by the PARAMETER keys. While a test is in progress, you can look through the error events that have occurred by pressing the PARAMETER keys. Each error event and its associated error statistics will be

displayed in sequence on the bottom line of the LCD. The totals from these events are also available for review. Each event log records eight event statistics during a test.

The bottom line of the LCD will display a description of the error event that occurred, and the error statistics for that error event. Use the VALUE keys to scroll through the error statistics. The error event/event statistics display relationship is illustrated in Figure 4-9.



**Figure 4-9. Error Event Statistics in the Event Log.**

When you press the VALUE keys during the execution of an SDLC test, the display on the bottom line will change to report each error statistic of the event identified on the top line. These statistics are accessible in a sequential ring. You can move in either direction in the ring. Press the LAST VALUE key to move in one direction, and press the NEXT VALUE key to move in the other direction.

Use the PARAMETER Keys to change between statistics for the TD channel or the RD channel. The top line of the display indicates which channel is currently being viewed.

#### 4.7.4 ERROR STATISTICS

To display error statistics, press the VALUE key. Each time you press a VALUE key, the bottom line of the display will change to another type of error statistic. The errors on which statistics are recorded are described below. Press the PRINT key to print error statistics on a parallel printer during a test. Each time you press the PRINT key, the accumulated results will be printed for the currently selected TD or RD channel (indicated on the top line of the LCD). If more than one errored second occurs while the results are printing, the CommTool 1000 will print the accumulated results. Of the last errored second. Intermediate errored second results will not be printed. An asterisk printed just in front of the word Status shows that an intermediate error that took place between the last two printed results was not printed.

##### **Test Status**

This display shows the test status. For an error log event, the type of error event causing the log entry will be identified:

**Sync Lost** Synchronization of the received SDLC signal was lost. Sync loss is detected when no valid frames are received for 1 second.

**Sync Recovered** Valid SDLC frames were received following a loss of sync.

**Data Interrupted** No data was received for at least one second.

**Errored Second** One or more FCS errors occurred during a one-second period.

**Rejected Frame** An SDLC frame(s) transmitted on this channel was rejected by the receiving station. A rejected frame is detected when a Reject (REJ) response is sent in the control field of a frame from the receiving station.

**Aborted Frame** An SDLC frame was detected which was aborted.

**No Change** the status displayed when either the TD or RD error event log has experienced no change from the previous error event (i.e. the event causing the log entry was on the opposite channel).

When the Monitor SDLC test is in progress, the LCD test status display shows the current state of the test.

**Waiting for Sync** Initial synchronization of the CommTool 1000 with the incoming datastream has not yet occurred. No valid SDLC frames have been received by the CommTool 1000.

**Synchronized** The CommTool 1000 is synchronized with the incoming datastream and receiving valid SDLC frames. No sync loss events have occurred.

**Data Interrupted** No data is currently being received.

**Sync Recovered** The CommTool 1000 has successfully resynchronized with the incoming datastream after a sync loss event occurred. Valid SDLC frames are being received.

**Sync lost** Synchronization has been lost with the incoming datastream and the CommTool 1000 is attempting to resynchronize. No valid SDLC frames are being received.

After the test is complete, the test status display will show “End of Test.”

### **Time**

The elapsed time starting from initial SDLC frame reception is displayed along with the statistics for each event. The time is reported in hours:minutes:seconds format.

### **Frames Sent**

The number of frames sent/received is displayed in floating point format.

### **Frames Aborted**

The number of frames aborted is displayed in decimal format. An aborted frame is one where more than seven consecutive ones bits are transmitted after a proper frame beginning flag, but before the proper frame ending sequence.

### **Frames Rejected**

The number of frames rejected is displayed in decimal format. A rejected frame is one which the receiving device rejects by sending a Reject (REJ) response back to the sender. REJ responses transmitted on RD are counted against the TD channel (and vice-versa).

### **FCS Errors**

The number of frame check sequence errors is displayed in decimal format. An FCS error occurs when the CommTool 1000's computation of the FCS does not match the FCS which the sending station originates.

**Errored Seconds**

Each second in which one or more FCS errors occurs is counted as an errored second. Each errored second is recorded in the error event log.

**Percent Error Free Seconds**

The percent of total in-service seconds which have been error free is shown with the error statistics. Time which elapses during a sync loss is not included in total in-service seconds. %EFS is recorded in the error event log.

**Data Losses**

The number of data losses experienced by the SDLC channel are displayed in decimal format. A data loss occurs when data is interrupted for more than one second.

**4.8 Pin Analyzer**

The Pin Analyzer test enables you to quickly identify drivers, receivers, grounds, and open circuits on an interface. You can also measure the voltage of each driver, even if the driver has a clocking signal. The LCD display shows both the Mark and Space voltage levels.

To measure the voltage on a line, connect the test probe or jumper wire to the pin labeled Pin Analyzer. Press the START/STOP key to begin measurement.

The top line of the display will show:

MARK – SPACE

The moving double bars in the center of the display are a visual indicator that the CommTool 1000 is taking measurements.

The top line of the display will remain the same throughout the test with the words MARK and SPACE on the left and right respectively. The lower line of the LCD will change to display the voltage level (if any) on the line.

Connect the unattached end of the probe or jump wire to one of the 50 pins of the breakout box. If it is an open circuit, the words NO CONNECTION will appear on the second line of the display.

When you connect the Pin Analyzer to a circuit that is a ground, the words SIGNAL GROUND will appear on the second line of the display. When a driver is connected that is all Space and no Mark, a display similar to that below will appear.

MARK – SPACE  
+ 11.5V

A signal that is all Mark will appear as shown below:

MARK – SPACE  
- 11.5V

When there is a clocking signal on the line, the CommTool 1000 will report both the Mark and the Space voltage, as shown below:

MARK – SPACE  
-11.5V +11.5V

When a receiver is connected, the display will change to resemble that shown below:

MARK – SPACE  
RECEIVER +.6V

The voltage reading on the right side of the display gives you more information about the receiver. If the display reads less than +9V, there is only an active receiver (impedance <8K ohms) connected to the pin. If the voltage reading is + 10V or greater, the receiver probably has a pull-up resistor connected to it. In the case of a control lead, the presence of a pull-up resistor may indicate that the input will be enabled with no active driver connection.

You can stop the test at any time to freeze a reading by pressing the START/STOP key. You are now in Results mode. Observe the double bars between the words MARK and SPACE. They will no longer appear when the test is stopped. To restart the test, press the START/STOP key. When you have stopped a test, you can press the SETUP/RESULTS key to change any of the setup parameters in Setup mode.

## 4.9 Polling

The Polling test measures the performance of modems in a point-to-point or multi-drop configuration by transmitting and receiving short bursts of serial data. The test can be performed using the CommTool 1000 as a master unit with one or two additional test sets as remote slave units, or the remote units can be simulated by analog or digital loopback. Either 2-wire or 4-wire systems can be tested.

You can configure the CommTool 1000 interface to simulate a DTE or a DCE and select full-duplex or half-duplex as the method of transmission. You can send or receive either a synchronous or an asynchronous polling message. The format of the message must be 8-bit word length with no parity, even parity, or odd parity and 1, 1.5, or 2 (async) stop bits.

The CommTool 1000 can operate as either the master unit or as Remote A or Remote B. As the master unit, the CommTool 1000 will poll either Remote A or Remote B, or alternately Remote A and Remote B. As a remote, the unit will respond to polls from the master for either Remote A or Remote B. The address for Remote A is ADH (in hexadecimal) and for Remote B it is B3H.

During Poll testing, the master unit sends the appropriate address and waits for the remote to respond with the same address. Analog or digital loopback at the remote modem will simulate a remote unit.

When the CommTool 1000 is configured as the master unit, it will wait 3 seconds for a response. If a correct response is received, the poll count for that address is incremented. If the response is incorrect or does not occur within 3 seconds, the master unit will beep before transmitting the next poll (if the alarm is enabled), and the received poll count will not be incremented.

When the CommTool 1000 serves as the master Unit, the display message will appear similar to that shown below:

```
POLLS SENT: NNNNN
```

```
A: NNNNN B: NNNNN
```

The top line of the display will show the number of polling messages that have been sent. The second line of the display will record the number of polling messages received from Remote A and/or Remote B. A ">" symbol will be displayed if any of the counts exceed 65535 (overflow).

The remote unit waits until it receives its address. It then increments its count of polls received and responds by retransmitting the same address. The remote units do not count errors; only correct polls received are counted. The message displayed when the CommTool 1000 is serving as a Remote A is shown below:

POLLS RECEIVED:

A:NNNN

The LCD message displayed when the CommTool 1000 is serving as Remote B is shown below:

POLL RECEIVED:

B:NNNN

In both instances, the display tells you how the CommTool 1000 is configured, as Remote A or as Remote B, and how many correct polling messages have been received.

#### 4.9.1 POINT-TO-POINT TESTING

To test a point-to-point modem configuration, first verify that the polling stations have all been configured alike. Each polling unit must have the same word-length, parity, stop bit, and bit rate settings. One unit must be set as the master and the other unit must be set as a remote (both with the same poll address), or the remote modem can be set to analog or digital loopback.

Press the START/STOP key on the remote unit first and then on the master unit to begin the Polling test. The master unit will transmit the poll address and will wait for the remote to respond with the same address. If the master receives the correct response within 3 seconds, the poll count for that address is incremented. If the response is incorrect or does not occur within 3 seconds, the master unit will emit a beep.

#### 4.9.2 MULTI-DROP TESTING

A multi-drop modem network consists of three or more modems in a communications link. You can test a multi-drop circuit by placing similarly configured test sets at two of the modem location and the polling master at a third. Set the Poll Mode of the CommTool 1000 that serves as the polling master to Master, and its Poll test to "Poll A and B". Then set the two test sets at the remote modems as Remote A and Remote B respectively. Both the master and remote units should be set for half-duplex transmission.

To begin the test, press the START/STOP key on the remote test sets first, then press the START/STOP key on the master polling station. The master unit will alternatively poll Remote A and Remote B and display the number of polls sent and correct responses received from each unit.

## 4.10 Print Test Data

The Print Test Data function enables you to print the contents of the Trap buffer, the results of the last BERT or Monitor SDLC test, or the contents of all 16 user messages. You can use the Print Test Data function to output data to either a serial or a parallel ASCII printer. The printout will show the selected language translation, with Hex notation listed above each printed character. You can stop the listing at any time by pressing the START/STOP key. After the printout is complete, the CommTool 1000 will display:

NO TEST RESULTS

SETUP or START?

Press SETUP/RESULTS to return to Setup mode or press START/STOP to make another printout.

## 4.11 Printer Setup

The Printer Setup test enables you to determine the baud rate, parity, word length, and number of stop bits of a serial printer.

The Printer Setup test outputs a message once every second to the printer in every configuration of baud rate, parity, and word length, until all possibilities have been exhausted. All configurations that are compatible with the device will be correctly printed. You can read the baud rate, parity, word length, and stop bits directly from the printer output.

To make the test as brief as possible, all configurations test for 2 stop bits only. When the correct printable combination has been found, you may configure a Send Data test to determine if the printer will also work with one stop bit.

Press the START/STOP key to begin the test. The display will show each setup configuration as it is sent to the printer. If you set MESSAGE MODE to Continuous, one configuration message will be sent per second. If you set MESSAGE MODE to Single Message, one configuration message will be sent each time you press the SINGLE STEP key.

The printer may correctly print more than one readable configuration. This is because the printer may ignore the eighth data bit and parity bits, since ASCII characters only use seven bits. Generally, the configuration with the longest word length is the best choice, although any of the readable configurations should work.

Sometimes incorrect configurations will cause the printer to “lock up” (not recognize any further messages) or enter unknown or undesirable operational states. If this happens, note the last configuration on the display, stop the test, and turn the printer Off. Press the SETUP/RESULT key to return to Setup mode and set the MESSAGE MODE parameter to “Single Message.” Next, start the test again (with the printer still turned Off). Single step the test until you are past the configuration which caused the printer to lock up. Turn the printer back On and single step each configuration message to the printer until it responds correctly. If the printer locks up again, you can turn it Off and On again to clear its internal buffers before single stepping the next configuration message.

When all readable messages have been printed, press the START/STOP key to end the test. The display will read:

NO TEST RESULTS

SETUP or START?

Press SETUP/RESULTS to return to Setup mode or press START/STOP to rerun the test.

## 4.12 Self Test

The Self Test functions enable you to verify the proper operation of the memory, interface drivers and receivers, keyboard, and the LCD display. Each test, and instructions for completing it, is described in the following paragraphs.

**NOTE: Once you have started a Self Test function by pressing the START/STOP key, you must complete the test before you can exit to the Setup mode.**

### 4.12.1 ROM CHECKSUM TEST

The ROM Checksum test verifies that the CommTool 1000s internal Read Only Memory (ROM) is correctly programmed and functioning properly.

Press the START/STOP key to begin a ROM Checksum test. If the test passes, the LCD display will be similar to that shown below:

CHECKSUM OK:3D4C

Press Any Key

Press any key to return to Setup mode. In the event that there is a problem with the ROM, an error message will be displayed. Call for service.

#### **4.12.2 DATA RAM TEST**

The Data RAM test verifies the data memory used for all functions of the CommTool 1000. This includes the configuration storage of pre-selected parameter values as well as the storage of all user-defined messages and test results. When you execute this test, the CommTool 1000 exercises each bit of every memory location without disturbing the original contents. This is a non-destructive test that will not alter configuration setups or test results.

Press the START/STOP key to begin this test.

If there is any problem with the internal data RAM, an error message will be displayed. Call for service. If the test passes, a message similar to the one below will be displayed:

RAM TEST PASSED

Press Any Key

Press any key to return to Setup mode.

#### **4.12.3 INTERFACE TEST**

This test verifies the operation of all of the serial interface drivers and receivers. It checks all of the control circuits plus RD (Pin 3), and TD (Pin 2). When the test executes, each control line is toggled high and then low, and then both TD and RD are toggled high and then low. In addition, the serial RAM used during the Analyze Device test is also tested. Finally, the internal USART (serial data formatting device) is tested.

Press the START/STOP key to start the Interface test. This test cannot be exited until it has been completed. The first message that is displayed is shown below:

REMOVE CABLES

Press Any Key

Remove any cables that are connected to the CommTool 1000 and press any key. The message that will be displayed is shown below:

DIP SWITCHES ON

Press Any Key

Verify that all of the DIP switches are in the On position then press any key. Each control driver will be cycled on and off as you press a key. If all of the control drivers and receivers function properly, the message shown below will be displayed:

**CONTROL LINES OK**

Press Any Key

Any control circuits that are not functional will be identified with a display similar to the following:

**RTS (Pin 4) BAD**

Press Any Key

Press any key to continue. A clocking signal will be applied to TC and RC. Both red and green LEDs on the TC and RC lines should light. After you press a key, a clocking signal will be applied to the SCTE line. Press any key to continue. The TD and RD lines will be checked. Both Space and Mark signals will be applied to each line. If they are functional, a message similar to the following will be displayed:

**TD & RD Lines OK**

Press Any Key

If either circuit is not functional, an error message will be displayed and the test will abort.

If the TD and RD test is successful, press any key to continue. The USART circuit will be tested. If the test is successful, the message that will be displayed is shown below:

**USART OK**

Press Any Key

Press any key to continue. The CommTool 1000 will return to Setup mode. This completes the interface portion of the Self Test.

#### **4.12.4 KEYBOARD TEST**

The Keyboard test checks the proper operation of each of the keyboard keys.

Press the START/STOP key to begin the Keyboard test. Then press each key. As you do, the name of each key will be displayed on the second line of the display.

When you have pressed each key at least once, press any key a second time to exit the Keyboard test.

#### **4.12.5 DISPLAY TEST**

The Display test exercises all functions of the LCD and indicator LEDs for proper operation. All of the LCD pixels are turned On first, then Off, and then all of the display character set and custom control codes are displayed. Then various indicator LEDs are lit.

Press the START/STOP key to begin the test.

Press any key to continue the test. All of the LCD pixels will turn on.

Repeatedly press any key. All of the pixels will turn Off and then the custom control codes will be displayed on the top line of the LCD. All of the LCD character set will be displayed, 16 characters at a time, for a total of 13 screens.

As you continue to press keys, the message "DCE LED ON" will be displayed and the DCE LED above the DB25 connector on the left side of the CommTool 1000 will light. Then the message "DTE LED ON" will be displayed and the DTE LED above the right side connector will light. Then the LED labeled PARALLEL (above the Centronics connector) will light.

Each of the amber, green, and red LEDs alongside the Centronics connector will light in turn, as the name of each one is displayed on the LCD. The LEDs labeled PE, INIT, and ERROR will not light. These three LEDs are device-driven; they are not driven by the CommTool 1000. You must connect a parallel device to the Centronics connector in order to light these LEDs.

When all of the LEDs next to the Centronics connector have been tested, press any key to return to Setup mode.

#### **4.12.6 ALARM TEST**

Press the START/STOP key to start the Alarm test. The audible alarm will sound. Press the START/STOP key to stop the Alarm test.

#### 4.12.7 CALIBRATE VOLTS

This test enables you to calibrate the voltmeter that is an integral part of the Pin Analyzer. This test also verifies the accuracy of the Analog to Digital Converter, which is the heart of the voltmeter circuit.

The Pin Analyzer voltmeter is factory-calibrated. You do not need to recalibrate the voltmeter unless you change the coin-cell battery or suspect the voltage readings on the Pin Analyzer tests are not accurate to within  $\pm 0.25V$ .

To calibrate the Pin Analyzer, you will need a 1000-volt DC power supply and two jumper wires.

Press the START/STOP key to begin the test. The message that will be displayed is shown below:

INPUT PIN OPEN

Press Any Key

Press any key, with the Pin Analyzer pin not connected to any other pin. The message shown below will be displayed.

INPUT PIN + 10V

Press Any Key

Connect the positive lead of the 10-volt power supply to the Pin Analyzer pin. Connect the negative power supply lead to the pin marked "G" at the top center of the breakout box. Press any key. The message shown below will be displayed.

INPUT PIN: -10V

Press Any Key

Reverse the connections. Connect the positive power supply lead to the pin marked "G" and connect the negative power supply lead to the Pin Analyzer lead. Press any key. The message shown below will be displayed.

INPUT PIN: GRD

Press Any Key

Connect the Pin Analyzer pin directly to the pin marked “G.” Press any key. The message shown below will be displayed.

VOLTS CALIBRATED

Press Any Key

Press any key to exit the Calibrate Volts test. If the calibration test fails at any stage, due to incorrect voltage connections, for example, the display shown below will appear and the original calibration values will not be altered.

A/D CONV. FAILED

Press Any Key

The calibration voltage must be 10.00 volts  $\pm 0.05$  volts. Recheck your connections and start the test again. If it fails again, call Technical Support.

## 4.13 Send Data

The Send Data Test enables you to transmit a specified data message to a serial or a parallel device. You can send one of the 16 user-defined messages stored in memory, the “Quick Brown Fox” message, or an 80- or a 132-character scrolling message. Data can be sent either asynchronously, synchronously, or in synchronous SDLC format.

You can send the selected message in the ASCII, EBCDIC, Baudot, Transcode, or IPARS language. The message may be transmitted continuously, one message (line) at a time, or one character at a time.

Press the START/STOP key to begin the test. The LED over the connector that is being driven will light. A message similar to that shown below will be displayed:

SENDING SERIAL

Fox

If one of the single step modes was selected, “(Step)” will appear on the right side of the second line of the LCD. Press the SINGLE STEP key to send one character or message at a time.

If transmission is interrupted by a hardware flow control off state, the second line will change to “HW Control OFF.” If transmission is stopped by receipt of a software control Off character, the second line will change to “SW Control OFF.”

When a Control On state is restored, the original second line message will reappear on the display.

If hardware flow control is selected, you can press the FLOW CONTROL key to toggle the state of the selected CTRL Line Out pin.

Press the START/STOP key to stop transmitting and end the test. The display will change to:

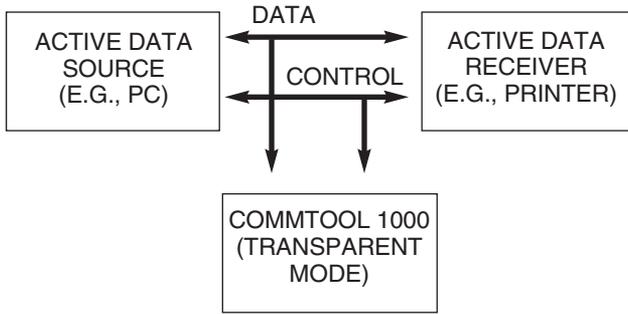
NO TEST RESULTS

SETUP or START?

Press the SETUP/RESULTS key to return to Setup mode, or press the START/STOP key to restart the test.

## 4.14 Trap Data

The Trap Data test enables you to capture up to 4096 characters from a communications link in either serial or parallel format. You can capture characters following a specified trigger event, prior to the trigger event, or both prior to and after the trigger event.



**Figure 4-10. Trap Mode: Transparent**

You can trap data in a transparent monitoring mode (See Figure 4-10, “Trap Mode: Transparent.”) in which the CommTool 1000 only “watches” data and control signals but does not drive the interface, or you can simulate an active receiving device (See Figure 4-11, “Trap Mode Drive Interface.”) and drive the appropriate interface signals. When in transparent mode, the CommTool 1000 is capable of simultaneously capturing both sides of a full-duplex line.



**Figure 4-11. Trap Mode: Drive Interface**

The trigger event can be the start of the test (immediate trigger), pressing the RESET key, a match with one of the 16 user defined messages, or a control transition (Control Off or Control On). For complete information about trigger events, refer to the Trap Data On parameter in **Chapter 5**.

You can view the trapped data on the display (16 characters at a time) or print the trapped data with the Print Test Data function.

**4.14.1 CONDUCTING A TRAP DATA TEST**

After you connect the CommTool 1000 to a data source, press the START/STOP key to begin a test. The LED above the active DTE, DCE, or parallel connector will light, indicating the format and interface selection. If DTE mode is active, data on RD (Pin 3) will be trapped. If DCE mode is active, data on TD (Pin 2) will be trapped. If you selected serial “Transparent” Monitor Mode, then the DTE and

DCE LEDs will both light and both the TD and RD signals will be trapped. If PARALLEL mode is active, data on the parallel interface will be trapped.

### **SDLC Trapping**

If you set the Serial Mode parameter to SDLC, data trapping will be synchronized to the start of SDLC frames. SDLC flags (7E Hex) are discarded and extra zeroes inserted in the datastream are removed. CRC characters at the end of each frame are also discarded and replaced by a single dot (FF Hex) idle line marker. The format of an SDLC frame is one flag byte (octet) followed by one address byte, one control byte, data bytes, a 2-byte frame check sequence (CRC-16), and ending with one or more flag bytes.

If you choose Selected Address trap, only frames matching the specified frame address or the global address (FF Hex) will be captured in the buffer. The Selected Address (or global address) is filtered out of the trapped data. Extended addressing is not supported for Selected Address trap.

If you select TRAP DATA ON: SDLC User Message, trapping will be on a match of an SDLC frame (beginning with the Address Byte) to a user message.

You may use Hex "FF" as a "wild card" for the Address and Control bytes in your User Message if you don't care what these values are for triggering purposes when matching.

In SDLC mode you can also trigger based on a Frame Check sequence (FCS) error. An SDLC sending device computes and sends a CRC-16 check on each frame. The CommTool 1000 calculates the FCS and compares it with the received FCS. If they don't match, the result is an FCS error.

SDLC protocol is more thoroughly described in Section 4.7, Monitor SDLC Test

### **Operation of the Trap Data Test**

The top line of the display will read "NO TRIGGER YET" until the trigger event occurs, and then change to "TRIGGER DETECTED" until enough data has been collected to fill the buffer after the trigger event, or the START/STOP key is pushed to abort the test.

The second line of the display reads "NO VALID DATA" until the first character is received from the data source. In synchronous mode, the second line will read "WAITING FOR SYNC" until the specified sync characters have been received and the buffer begins trapping data.

As soon as the CommTool 1000 begins receiving characters, the second line of the LCD will display the data as it is being received. The display shows a “snapshot” of the data which is updated four times each second. This allows perceptible viewing of the datastream, even though the data rate may be too fast to normally view. At rapid data rates, characters between “snapshots” may not be shown, but all data is trapped in the buffer for detailed study after the trigger event. If you selected “Transparent” Monitor Mode, then you may display either the TD or RD signal, or both simultaneously by pressing the TRAP DISPLAY key.

In Transparent Mode, single dot idle channel markers will appear on an inactive data channel when data is being received on the other channel. Press the TRAP DISPLAY key to view the active channel.

If the trap buffer is started in the middle of a continuous stream of asynchronous serial data, several characters at the beginning of the data buffer may be garbled until the CommTool 1000 can get “in sync” with the datastream (i.e., find the correct start bits of each character).

Each character is loaded into a “circular” buffer as it is received; that is, after the first 4096 characters are stored, as new characters are saved, the oldest characters in the buffer are destroyed so that a complete record of the most recent 4096 characters is retained. In transparent mode, each signal line has a 2048-character circular buffer available.

If you selected “Data Collection: Before Trigger,” the circular trap buffer data is “frozen” as soon as the trigger event is detected to save up to a full buffer of characters received before the trigger event. If you selected “Data Collection After Trigger,” one full buffer of data is collected after the trigger event.

If you selected “Data Collection: Before and After,” one-half buffer of data is collected after the trigger event so that you can see half of the buffer before the trigger event and half of the buffer after the trigger event. If less than half of a buffer was received before the trigger event, the remainder of the buffer will be collected after the trigger event.

If Single Step mode was selected, the CommTool 1000 will set a Control Off state as soon as a character is received. Press the SINGLE STEP key to set Control On and receive more characters.

In Parallel format, Single Step mode, the Busy signal is held high to prevent additional characters from being transmitted by the device under test. In Serial format, the CTRL Line Out signal is set Off or a Control Off character is sent (depending on the flow control selection) to stop data transmission. Because of transmission and response delays of the transmitting device, two or three characters may be received with each single step in serial transmission.

#### 4.14.2 VIEWING TRAP BUFFER DATA

After the trigger event occurs and the trap buffer is full, or the test is aborted with the START/STOP key, the port-activity LEDs will turn off, the CommTool 1000 will beep, and the display will become similar to that shown below:

```
TD C 0000 = 54H
```

```
The Quick Brown
```

You are now in Results mode, viewing the TD trap buffer data. The label in the upper left corner of the display indicates which buffer (TD or RD) is being viewed. The four digits to the right of "C" indicate the cursor position; 0000 is the trigger point (negative numbers are characters before the trigger event, positive numbers are characters after the trigger event). To the right of the equal sign (=) is the hex equivalent of the cursor position character.

The second line of the display shows the selected language translation (ASCII, EBCOIC, etc.) of 16 characters around the cursor position. The cursor position in the trap buffer is indicated by a flashing bar under the cursor position character in the second line.

You can use the PARAMETER, VALUE, and CURSOR JUMP keys to scroll through the trap buffer data. If you trapped the data in transparent mode, you can use the TRAP DISPLAY key to toggle between displaying either the TD buffer, the RD buffer, or both buffers simultaneously. When both buffers are displayed simultaneously, TD is shown on the top line and RD on the bottom line.

In dual line trapping (transparent) mode, the trap buffer preserves the time relationship between data on TD and RD. If characters are received on one channel while the other is idle, fill characters are inserted into the idle channel buffer as idle time markers. The idle time markers are FF Hex characters which appear on the display as a single dot.

The LAST PARAMETER key (left arrow), moves the cursor one position to the left.

The NEXT PARAMETER key (right arrow), moves the cursor one position to the right. The LAST VALUE key (down arrow), moves the cursor 16 characters (one screen) to the left.

The NEXT VALUE key (up arrow), moves the cursor 16 characters (one screen) to the right.

The CURSOR JUMP key jumps the cursor between the trigger point (0000), the end of the buffer, and the beginning of the buffer each time it is pressed.

When you are finished viewing the trap buffer data, press the SETUP/RESULTS key to return to Setup mode to change setup parameters, or press START/STOP to trap a new buffer of data.

## **CAUTION**

**When you press START/STOP to begin a new Trap Data test, all previously trapped data will be erased.**

If you return to Setup mode, you can print the data collected in the trap buffer with the Print Test Data test, or you can review the trap buffer data anytime by selecting the Trap Data test and pressing the SETUP/RESULTS key to change to Results mode. The trap buffer data is permanently retained (even when the power is turned Off) until a new Trap Data test is run or until the trap buffer is edited.

You can transfer up to 2560 characters in the trap buffer to a user message for a trigger event or Send Data message. For more information see **Chapter 6**, “Creating and Revising Messages,” or the “Load User Message” function described earlier in this chapter.

## 5. Setup Parameters

Each setup parameter is described on the following pages. The name of each parameter is underlined and appears at the top of a description of the parameter, which is followed by a list of the values available in each test and a list of the tests in which the parameter is applicable. In some tests, the setup parameters have different values available. In these instances, the values are grouped by the test in which they appear. Value names appear in bold typeface followed by a brief description of the effect of selecting the value.

The setup parameter descriptions are arranged in alphabetical order.

### 5.1 Alarm

#### Description

Enables you to activate an alarm that sounds at the occurrence of a specified event. The value selections are different for each test. They are described below, grouped according to the test in which they appear.

*Values* — BERT Test

**Off** No alarm.

**Errored Second** An audible alarm will sound each time there is an errored second. An errored second occurs when one or more bit errors occur during a one-second period of the test.

**Parity Error** Each time a parity error occurs, an audible beep will sound. Parity errors occur when the the parity of the received message does not agree with the parity setup.

**Sync Loss** An audible alarm will sound if synchronization is lost. Sync loss is detected when the bit error rate exceeds 20% over a one-second period.

*Values* — Event Timer Test

**Off** No alarm.

**Start Event** An audible alarm will sound when the condition you have specified for the start of timing occurs.

**Stop Event** An audible alarm will sound when the condition you have specified for the end of timing occurs.

**Start/Stop Event** An audible alarm will sound when the condition that you have specified for the start or end of timing occurs.

*Values* — Send Data Test, Print Test Data, Printer Setup

**Off** No alarm.

**Control ON/OFF** An audible beep will sound when there is a change in control state due either to the receipt of a Control On/Off character (if software flow control is selected) or a change in the state of the selected input control line (if hardware flow control is selected).

*Values* — Trap Data Test

**Off** No alarm.

**Trigger Event** An audible alarm will sound when the selected trigger event occurs. This could be the start of the test, pressing the RESET/RESYNC key, detection of a user message match, SDLC FCS error, or a control state shift.

*Values* — Monitor SDLC Test

**Off** No Alarm.

**Errored Second** An audible alarm will sound when an errored second (one or more FCS errors) occurs.

**Sync Loss** An audible alarm will sound after no valid frames have been received for one second.

**Rejected Frame** An audible alarm will sound when a reject (REJ) code is detected in the control field of an SDLC frame.

**Aborted Frame** An audible alarm will sound when an abort sequence is detected.

### *Applicability*

As specified for each list of values.

## 5.2 Bit Rate

### *Description*

The rate at which serial data is transmitted, expressed in baud (bits per second). Set this parameter to match the configuration of the device under test.

*Values* — Asynchronous Serial Mode

### **50–38,400 baud**

*Values* — Bias Distortion Test

### **110–38,400 baud**

*Values* — Synchronous Serial Mode

### **300–64,000 bps, or External Clock Source**

*Values* — Synchronous BERT

### **300–56,000 bps, or External Clock Source**

### *Applicability*

Serial Format

**NOTE:** In synchronous mode, if you select a numeric value for the bit rate (300–64,000) the CommTool 1000 uses an internal clock source. If you select “External”, the CommTool 1000 will use an external applied clock source to transmit and receive data. The function of TC (Pin 15), RC (Pin 17), and SCTE (Pin 24) varies depending upon the internal or external bit rate selection and the DTE or DCE interface selection. The clock pin functions are shown in Table 5-1, “Synchronous Clock Functions.”

**Table 5-1. Synchronous Clock Functions**

	SIMULATE DTE		SIMULATE DCE	
	INTERNAL CLOCK	EXTERNAL CLOCK	INTERNAL CLOCK	EXTERNAL CLOCK
TO (PIN 15)	NOT USED	TRANSMIT CLOCK INPUT	TRANSMIT CLOCK OUTPUT	OUTPUT DRIVEN BY BY SCTE (PIN 24)
RC (PIN 17)	RECEIVE CLOCK INPUT		RECEIVE CLOCK OUTPUT	
SCTE (PIN 24)	TRANSMIT CLOCK OUTPUT	OUTPUT DRIVEN BY TC (PIN 15)	NOT USED	TRANSMIT AND RECEIVE CLOCK INPUT

### 5.3 Block Size Description

Enables you to select the block length definition used for block error measurements in the BERT test. Set the block size to match a typical data block length of the data transmission system you are testing to get an accurate indication of the block retransmission rate in actual use.

*Values*

10<sup>2</sup> bits to 10<sup>7</sup> bits

*Applicability*

BERT test

## 5.4 Character Suppressed

### *Description*

Enables you to specify the single character which is to be suppressed during synchronous data trapping. The default value of the character is “FF” hex, which is the synchronous idle line character. This feature may be used to avoid filling the trap buffer with idle line characters between polling messages in a synchronous polling application.

### *Values*

The Value (second line) of the display shows the hexadecimal value assigned to the character along with the selected language and its translation:

(language)(translation) = (hex value)H

To change the value of each of the 2 hexadecimal digits, press the NEXT or LAST VALUE keys. The translation character will change as the hex value is modified. Press the NEXT or LAST PARAMETER key to alternate between right and left digits of the hex value. When both digits are set for the desired character, press the NEXT PARAMETER key until the Parameter (top line) of the display changes to the next setup parameter

### *Applicability*

Trap Data Test, in Synchronous Serial Mode

## 5.5 Configuration

### *Description*

The Configuration parameter enables you to recall three test configurations stored in memory — the most recent test configuration and two others. The two stored configurations will remain in memory indefinitely. Before you begin a test, you can choose to re-define the test parameters or use the ones the at you have stored.

### *Values*

**Set-up #1 and Set-up #2** All setup parameters will be loaded with previously saved configuration values.

**Last Set-Up** The most recently used test configuration (even it the CommTool 1000 has been turned Off) is unaltered by making this selection.

**Default Set-Up** The test parameters will be set as shown in Appendix I, “Default Set-up Parameter Values.”

*Applicability*

All Tests

## 5.6 Control Off

*Description*

The Control Off parameter enables you to specify the character used to turn off the flow of data between the CommTool 1000 and a device under test when software flow control is enabled. When the CommTool 1000 is running a Send Data test, receipt of the selected character will cause data transmission to stop until a Control-On character is received. In the Trap Data test, the selected Control-On and Control-Off characters are alternately transmitted each time the FLOW CONTROL key is pressed. The XOFF and ACK characters depend on the language which is selected. Table 5-2 shows the hex codes used for XON, XOFF, ACK, and NAK for each of the languages used by the CommTool 1000.

**Table 5-2. Control Characters Used for Each Language**

	XON	XOFF	ACK	NAK
ASCII	11H	13H	06H	15H
EBCDIC	11H	13H	2EH	3DH
BAUDOT	00H	00H	00H	00H
TRANSCODE	0AH	2EH	2DH	3DH
IPARS	20H	12H	3FH	3FH
HEX	11H	13H	06H	15H

*Values*

**XOFF (DCI)**

**NAK**

**User Character**

*Applicability*

Serial Format, Send Data, and Trap Data test when software flow control is enabled.

## **5.7 Control On**

*Description*

The Control On parameter enables you to specify the character used to start the flow of data between the CommTool 1000 and a device under test when software flow control is enabled. When the CommTool 1000 is running a Send Data test, receipt of the selected character will cause data transmission to resume after it has been stopped by a Control-Off character. In the Trap Data test, the selected Control-On and Control-Off characters are alternately transmitted each time the FLOW CONTROL key is pressed. The XON and ACK characters depend on the language which is selected. Refer to Table 5-2 in Section 5.6 for the actual hex codes used by each language.

*Values*

**XON (DCJ)**

**ACK**

**User Character**

*Applicability*

Serial Format, Send Data, and Trap Data tests when software flow control is enabled.

## 5.8 Ctrl Line In

### *Description*

This parameter enables you to select the hardware control line that causes the CommTool 1000 to start and stop its serial data transmission. The specific inputs available depend upon the test in which this parameter appears, and the interface selection. When the selected control line is driven high (positive voltage) by the device under test, the CommTool 1000 will transmit data. When the control line is driven low (negative voltage), the CommTool 1000 will stop transmitting data.

In the Trap Data test, the Ctrl Line in is the line that is monitored to trigger capture of data in the trap buffer.

*Values* — DTE Interface

**CTS (Pin 5)**

**DSR (Pin 6)**

**DCD (Pin 8)**

*Values* — DCE Interface

**RTS (Pin 4)**

**Pin 11**

**Pin 19**

**DTR (Pin 20)**

*Values* — Trap Data Test, Transparent Mode

**RTS (Pin 4)**

**CTS (Pin 5)**

**DSR (Pin 6)**

**DCD (Pin 8)**

**Pin 11**

**Pin 19**

**DTR (Pin 20)***Applicability*

Serial Format, Hardware Flow Control

**5.9 Ctrl Line Out***Description*

This parameter enables you to specify the hardware control line that the CommTool 1000 will drive high and low to control data transmission from a device under test. Although the CommTool 1000 will drive all appropriate control lines high, the selected line may be toggled high and low by the FLOW CONTROL key during a test.

Values — DTE Interface

**RTS (Pin 4)****Pin 11****Pin 19****DTR (Pin 20)**

Values — DCE Interface

**CTS (Pin 5)****DSR (Pin 6)****DCD (Pin 8)***Applicability*

Serial Format, Hardware Flow Control

## 5.10 Data Collection

### *Description*

Enables you specify the relative position of the trigger event in the trap buffer either at the beginning, middle, or end of the buffer.

### *Values*

**Before Trigger** When you specify Before Trigger, up to 4096 characters that were received before the trigger event was detected will be stored in the trap buffer. This option is not available if you have specified Start of Test under the Trap Data On parameter.

**After Trigger** When you specify After Trigger, the next 4096 characters that are received after the trigger event is detected will be captured in the trap buffer.

**Before and After** When you specify Before and After, 2047 characters preceding the trigger and 2048 characters following the trigger will be stored in the trap buffer. If less than 2047 characters are received when the trigger event occurs, the remainder of the 4096 buffer characters will be collected after the trigger event. For example, if only 100 characters were received before the trigger event, 3996 characters will be collected after the trigger event.

### *Applicability*

Trap Data Test

## 5.11 Flow Control

### *Description*

Selects the method by which serial data transmission is stopped and started. When the CommTool 1000 is receiving data, it toggles the the selected type of flow control between Control-On (transmission enabled) and Control-Off (transmission disabled) states with the FLOW CONTROL key. When the CommTool 1000 is transmitting data, it starts and stops its transmission based on the type and state of flow control received from the device under test.

### *Values*

**None** The CommTool 1000 will neither generate nor respond to any flow control signals.

**Both** The CommTool 1000 will generate both hardware and software flow control and respond to either type of signal.

**Hardware Flow Control** Hardware flow control uses a separate control line (other than TD or AD) to signal when data transmission is enabled and disabled. When the flow control line is in a Space state (positive voltage), transmission is enabled. When the flow control line is in a Mark state (negative voltage), transmission is disabled.

In systems that allow bi-directional data transmission (i.e., transmitting devices at each end of the communications link), separate control lines are used for each transmitting device. You can specify which control line the CommTool 1000 will monitor to start and stop sending its data with the CTRL LINE IN parameter selection. The CTRL LINE OUT parameter allows you to select which control line the CommTool 1000 will drive to start and stop data transmission from the device under test.

**Software Flow Control** Software (in-band) flow control uses a pair of control characters that are sent from the receiving device to the transmitting device on a regular data transmission line (AD if the receiver is DCE, TD if the receiver is DTE). When the transmitting device receives a Control-Off character, it stops transmitting until it receives a Control-On character. The flow control characters that the CommTool 1000 uses are specified in the CONTROL ON and CONTROL OFF parameter selections.

### *Applicability*

Serial Format

## **5.12 Format**

### *Description*

The Format parameter enables you to configure a test for serial or parallel data transmission.

### *Values*

**Serial** The CommTool 1000 will send and receive serial data (RS-232 standard) through either the DTE or DCE DB25 connectors.

**Parallel** The CommTool 1000 will send or receive parallel data (Centronics or Dataproducts standard) through the PARALLEL connector.

*Applicability*

Send Data, Trap Data, and Print Test Data functions. The Analyze Device, Printer Setup, BERT, Polling, and Bias Distortion tests are always serial format.

## 5.13 Form Feed

*Description*

This parameter specifies when form feed characters will be sent during a Print Test Data test.

*Values*

**Before Printout** The CommTool 1000 will send a form feed at the beginning of each printout. Use this setting if there may be a partial page listing already on the printer.

**After Printout** A form feed will be sent at the end of each printout. Use this setting for a laser printer to ensure that the last page of the printout is ejected from the printer.

**Before and After** Form feeds are sent at the beginning and end of each printout.

**None** No form feeds are sent.

*Applicability*

Print Test Data

## 5.14 Frame Address

*Description*

Enables you to specify the SDLC frame address field that is matched for selected address trapping. See TRAP parameter for more detail.

*Values*

The Value (second line of the display) shows the hex value that will be matched to the address field of each SDLC frame, along with the selected language and its translation in the following format.

(language)(translation) = (hex value)H

To change the value of each of the two hex digits, press the NEXT or LAST VALUE keys. The translation character will change as the hex value is modified. Press the NEXT (->) or LAST (<-) PARAMETER keys to alternate between right and left digits of the hex value. When both digits are set for the desired address, press the NEXT PARAMETER key until the parameter (top) line changes to the next setup parameter.

### *Applicability*

Trap Data, SDLC mode, Trap Selected Address

## 5.15 Interface Description

The Interface parameter enables you to configure the CommTool 1000 as either Data Terminal Equipment (DTE) or Data Circuit Terminating Equipment (DCE).

### *Values*

**Simulate DTE** The CommTool 1000 will transmit data on TD (Pin 2), receive data on RD (Pin 3), and drive control lines 4, 11, 19, and 20. Use this selection when connecting the CommTool 1000 to a modem or other DCE device.

**Simulate DCE** The CommTool 1000 will transmit data on RD (Pin 3), receive data on TD (Pin 2), and drive control lines 5, 6, and 8. Use this selection when connecting to a terminal, serial printer, or other DTE device.

### *Applicability*

Serial Format

## **5.16 Language**

### *Description*

This parameter enables you to specify the communication language in which to send or receive a message. Refer to the appendices for the hexadecimal translation of each language.

### *Values*

**Hex (ASCII)**

**ASCII**

**EBCDIC**

**Baudot**

**Transcode**

**IPARS**

### *Applicability*

BERT-Fox or User Message pattern, Trap Data, Print Test Data, Send Data tests

## **5.17 Match Message**

### *Description*

Enables you to select one of the sixteen user messages to match to the received datastream for a trigger event. The trigger point in the trap buffer will be the match to the last character of the user message.

### *Values*

**User Message #1 through #16**

### *Applicability*

Trap Data Test-Trap Data On: User Message Match

## 5.18 Message Choice

### *Description*

Enables you to select a user message to revise.

### *Values*

**User #1 to User #16**

### *Applicability*

BERT — User Message pattern Send Data–User Message, Load User Message

## 5.19 Message Mode

### *Description*

Enables you to select the repetition mode for message transmission.

*Values* — Trap Data Test

**Continuous** Data is continuously received.

**Single Step** A Control-Off (control character, interface line, or both) state is established by the CommTool 1000 as soon as it receives a character. Control-On is re-established when the SINGLE STEP key is pressed. In this manner, characters are “single stepped” out of the transmitting device into the CommTool 1000.

*Values* — Send Data Test, Printer Setup Test

**Continuous** Data is continuously transmitted.

**Single Message** A single message is transmitted each time the SINGLE STEP key is pressed.

**Single Character** A single character is transmitted each time the SINGLE STEP key is pressed. (Not available for Printer Setup Test.)

**NOTE:** Multiple characters or messages may be transmitted by holding down the SINGLE STEP key until it auto-repeats.

*Applicability*

As specified for each list of values.

**5.20 Monitor Mode***Description*

Enables you to specify the interface mode used during the Trap Data test. See the Trap Data test description in **Section 4.14** for a detailed description of this parameter Values.

**Transparent** The CommTool 1000 monitors control lines and data lines, but does not drive any interface leads. Use this selection when monitoring transmission between two active devices. In this mode, the CommTool 1000 will not affect any of the control or data lines. Data on both TD and RD is trapped.

**Drive Interface** The CommTool 1000 simulates an active receiving device. Appropriate control and data lines are driven. Use this selection when connecting the CommTool 1000 directly to a single transmitting device. Data on either TD or RD (not both) is trapped.

*Applicability*

Trap Data Test

**5.21 MSG x C 0000=\_ H***Description*

User Message Revision Display. See **Chapter 6** for a detailed description.

*Applicability*

User Message Revision

## 5.22 Parity Description

Enables you to specify the type of parity checking used with serial transmission.

If parity is enabled, an additional parity bit is appended to each data character to allow the data receiver to detect single bit errors in each transmitted character. The DataTool will generate parity bits when it transmits data and will check parity when it receives data. Set this parameter to match the configuration of the device under test.

### *Values*

**None** Parity generation and detection is disabled. No parity bits are added to data characters. Baudot code is restricted to no parity.

**Even** The parity bit added to each character is set so that the total number of “1’s” in the character (including the parity bit) is even.

**Odd** The parity bit added to each character is set so that the total number of “1’s” in the character is odd

**Mark** The parity bit is always set to a Mark (Logic “1”) level.

**Space** The parity bit is always set to a Space (Logic “0”)

### *Applicability*

Serial Format

## 5.23 Pattern

### *Description*

Enables you to select the pattern used in the Bit Error Rate Test.

### *Values*

**63 PR** Industry standard pseudorandom bit pattern of length 63 bits.

**511 PR** Industry standard pseudorandom bit pattern of length 511 bits.

**2047 PR** Industry standard pseudorandom bit pattern of length 2047 bits.

**Alternating 1/0** Alternating Mark/Space (square wave) pattern.

**Mark** All Mark (logic “1”) signal.

**Space** All Space (logic “0”) signal.

**Fox** The following characters:

THE QUICK BROWN FOX JUMPS OVER A LAZY DOG 0123456789<CR><LF>

If synchronous transmission is used, two sync characters are added to the beginning of each message.

**User Message** Enables you to use on of the 16 user messages.

*Applicability*

BERT test

## **5.24 Poll Mode**

*Description*

The Poll Mode parameter enables you to specify which function the CommTool 1000 emulates in a poll system test.

*Values*

**Master** The CommTool 1000 will generate polls, and count correctly received responses.

**Remote A** The CommTool 1000 will listen for “A-type” polls (ADH) and respond by transmitting the poll back to the master. A count of polls received is maintained.

**Remote B** The CommTool 1000 will listen for “B-type” polls (B3H) and respond by transmitting the poll back to the master. A count of polls received is maintained.

*Applicability*

Poll Test

## 5.25 Poll Test

### *Description*

Enables you to poll either Remote A or Remote B or both A and B alternately as a master polling unit.

### *Values*

**Poll A** Only "A-type" polls are sent and received.

**Poll B** Only "B-type" polls are sent and received.

**Remote A and B** Polls are alternately sent to and received from Remote A and Remote B.

### *Applicability*

Poll Test, Master Poll Mode

## 5.26 Power Reminder

### *Description*

This parameter enables you to activate or deactivate an audible alarm that will sound three short beeps if you leave the CommTool 1000 turned On for a period of five minutes without pressing a key or running a test. When the Power Reminder sounds, a message will be displayed, reminding you that the power is On. Press any key to return to the menu and function that was active when the power reminder sounded or turn the power switch to Off to conserve the batteries.

### *Values*

**On** Alarm enabled.

**Off** Alarm disabled. Use this choice when operating a non-programmed test function such as the breakout box.

### *Applicability*

All Tests

## 5.27 Print

### *Description*

The Print parameter enables you to select which test result will be printed with the Print Test Data function.

### *Values*

**User Messages** Prints all sixteen of the user messages. The user messages are printed 20 characters to a line, with the hexadecimal value of each character printed above the selected language translation for the character.

**Trap Buffer Data** The contents of the trap buffer will be printed in the same format as user messages. The trigger point will be indicated by a caret (^) symbol.

**BERT Results** Prints the complete event log from the most recent BERT test.

**SDLC Results** Prints the complete event log from the most recent Monitor SDLC test.

### *Applicability*

Print Test Data

## 5.28 Print Status On

### *Description*

Allows you to specify conditions that will cause the test status to be printed out on the parallel port during a test. Test status can be requested manually at any time by pressing the PRINT key.

### *Values*

**Print Key Only** Test status is printed only when the PRINT key is pushed. (No automatic printouts).

**Errored Second** Current test status is printed after an errored second. If sequential errored seconds occur, the printout will occur on the first error-free second following the errors.

**Every Hour** Test status will be printed every hour.

**Sync Loss** Test status is printed after a sync loss (BERT only).

*Applicability*

BERT, Monitor SDLC

**5.29 Printer Type***Description*

Enables you to Specify the logic format of the parallel interface.

*Values*

**Centronics** Configures the parallel port as a Centronics type printer port. Use this selection for all printer types except Dataproducts.

**Dataproducts** Configures the parallel port as a Dataproducts type printer port. The strobe and busy signals are logic inverted (i.e. strobe is active high, busy is active low). Use either a Centronics to MRA-style Dataproducts adapter cable or a Centronics to DB50-Style Dataproducts adapter cable to connect to the Dataproducts printer.

*Applicability*

Parallel Format

**5.30 Revise Message***Description*

Enables you to create and revise user messages. See **Chapter 6** for a complete description of the user message revision process.

*Values*

**No Change** User message selection is not altered.

**Edit Message** Enables you to revise an existing message.

**Erase Message** Enables you to enter a new user message and erases any existing message.

**Load from Trap** Loads data from the trap buffer into the specified user message. Limited by available User Message space.

*Applicability*

BERT-User Message pattern, Send Data Test-User Message, Trap Data Test-User Message Match trigger

**5.31 Self Test***Description*

Enables you to select a CommTool 1000 Self Test function. Refer to the Self Test function description in **Chapter 3** for a complete description of this parameter.

*Values*

**ROM Checksum** Internal Program memory is tested.

**Data RAM** Internal Data memory is tested.

**Interface** Serial interface drivers and receivers are tested.

**Keyboard** Keyboard switch functions are tested.

**Display** LCD and LED display functions are tested.

**Alarm** Audible alarm is tested.

**Calibrate Volts** Allows you to calibrate the internal A/D converter used to measure voltage in the Pin Analyzer test.

*Applicability*

Self Test

## 5.32 Send Message

### *Description*

Enables you to select the message to be transmitted in the Send Data test.

### *Values*

**Fox** The following characters:

THE QUICK BROWN FOX JUMPS OVER A LAZY DOG 0123456789 <CR> <LF>

If synchronous transmission is used, one or two sync characters are added to the beginning of each message.

**80 Wide Scroll** A “barber pole” format of all printable characters in the selected language is sent. A carriage return (CR) and line feed (LF) is inserted every 80 characters. This selection is used to test an 80-column printer or terminal device. If synchronous transmission is used, one or two sync characters are added to the beginning of each line.

**132 Wide Scroll** A “barber pole” format of all printable characters in the selected language is sent. A carriage return (CR) and line feed (LF) is inserted every 132 characters. This selection is used to test a 132-column printer or terminal device. If synchronous transmission is used, one or two sync characters are added to the beginning of each line.

**User Message** Enables you to send one of the 16 user-defined messages. No sync characters are added to a user message. If you are using synchronous transmission and want to have sync characters sent with your message, you must add them to the user message with the Edit Message function. Refer to **Chapter 6** for a detailed description.

**Trap Buffer** Data previously captured in the trap buffer can be sent as if it were a User Message.

### *Applicability*

Send Data Test

### **5.33 Serial Mode Description**

Enables you to select the data clocking method used for serial transmission.

#### *Values*

Asynchronous Data characters are transmitted with start and stop bits. No other clock signals are transmitted.

Synchronous Data bits are synchronized with clock signals on TC (Pin 15), RC (Pin 17), or SCTE (Pin 24).

**SDLC** Synchronous mode transmission as defined above, following SDLC framing protocol.

#### *Applicability*

Serial Format

### **5.34 Start Timer On**

#### *Description*

Enables you to specify a transition event on which to begin timing. The event timer will begin timing when the selected control lead transition occurs On->Off indicates a positive-to-negative (Space-to-Mark) voltage transition: Off->On is a negative-to-positive (Mark-to-Space) transition.

#### *Values*

**RTS Pin 4 Off->On**

**RTS Pin 4 On->Off**

**CTS Pin 5 Off->On**

**CTS Pin 5 On->Off**

**DSR Pin 6 Off->On**

**DSR Pin 6 On->Off**

**DCD Pin 8 Off->On**

**DCD Pin 8 On->Off**

**Pin 11 Off->On**

**Pin 11 On->Off**

**Pin 19 Off->On**

**Pin 19 On->Off**

**DTR Pin 20 Off->On**

**DTR Pin 20 On->Off**

*Applicability*

Event Timing Test

## **5.35 Stop Bits**

*Description*

Enables you to specify the number of stop bits used in asynchronous serial transmission.

Stop bits are the minimum number of idle (Mark state) bit periods between characters in continuous asynchronous datastreams. Set this parameter to match the configuration of the device under test. If the number of stop bits is unknown, set the CommTool 1000 stop bits to 2 if it is transmitting data, or 1 if it is receiving data. Baudot code is restricted to 1 or 1.5 stop bits.

*Values*

**1 bits**

**1.5 bits**

**2 bits**

*Applicability*

Asynchronous Serial Transmission

## 5.36 Stop Timer On

### *Description*

Enables you to specify a transition event on which to stop timing. The Event Timer will stop timing when the selected control lead transition occurs. On->Off indicates a positive-to-negative (Space-to-Mark) voltage transition; Off->On is a negative-to-positive (Mark-to-Space) transition.

The event time displayed after the Stop timer event occurs will be the time between the Start Timer event and the Stop Timer event.

### *Values*

Same as Start Timer On values.

### *Applicability*

Event Timing Test

## 5.37 Store Setup

### *Description*

This parameter enables you to save the current values of all setup parameters for recall later.

### *Values*

**No** None of the configuration memories are altered.

**Setup #1** The current configuration will be stored in Setup #1. You can recall this setup by selecting Setup #1 at the Configuration parameter.

**Setup #2** The current configuration will be stored in Setup #2. You can recall this setup by selecting Setup #2 at the Configuration parameter.

### *Applicability*

All Tests

## 5.38 Suppress Characters

### *Description*

Character suppression is the ability to throw away a continuously repeated idle line character when trapping synchronous data, so that the buffer doesn't fill up with (usually) meaningless data. You can specify that the CommTool 1000 keep up to 4 of the characters before beginning suppression. You can specify the individual character to be suppressed.

After the specified number of suppressed characters has been received, the CommTool 1000 will initiate a sync hunt sequence and will ignore all further characters received until synchronization is re-established.

### *Values*

No suppression

**> 1 in a Row to >4 in a row** The indicated number of characters before suppression begins. For example, if you select ">4 in a Row," the CommTool 1000 will begin throwing away suppressed characters after it has received 4 such characters in a row.

### *Applicability*

Trap Data Test, in Synchronous Serial Mode

## 5.39 Sync Characters

### *Description*

In synchronous communication, special characters are used to synchronize the receiving device with the incoming datastream. This parameter allows you to configure the CommTool 1000 to communicate with a device that uses a one- or a two- character sync pattern.

### *Values*

**1 character (monosync)**

**2 characters (bisync)**

*Applicability*

**Synchronous Serial Mode** Not used with BERT because the CommTool 1000 derives its own sync pattern from the test pattern.

## 5.40 Sync Char. #1

*Description*

Enables you to specify the single character used for synchronization in a one-character sync pattern, or to specify the first sync character in a two-character sync pattern.

*Values*

The Value (second) line of the display shows the hexadecimal value assigned to the sync character along with the selected language and its translation of the sync character in the following format:

$$(language) (translation) = (hex\ value)H$$

To change the value of each of the two hexadecimal digits, press the NEXT or LAST VALUE keys. The translation character will change as the hex value is modified. Press the NEXT (->) or LAST (<-) PARAMETER keys to alternate between right and left digits of the hex value. When both digits are set for the desired sync character, press the NEXT PARAMETER key until the parameter (top) line changes to the next setup parameter.

*Applicability*

Synchronous Serial Mode, in Send Data, Print Test Data, or Trap Data tests

## 5.41 Sync Chac #2

*Description*

Enables you to specify the second character used for synchronization in a two character sync pattern.

*Values*

Refer to the Values section of the Sync Char #1 parameter for selection procedure.

*Applicability*

Synchronous Serial Mode in Send, Data Print Test Data or Trap Data tests, with two sync characters

**5.42 Test***Description*

Allows you to select the test that will be executed. Refer to **Chapter 4** for a complete description of each test.

*Values*

**Pin Analyzer**

**Analyze Device**

**Send Data**

**Trap Data**

**Printer Setup**

**Data Throughput**

**BERT**

**Monitor SDLC**

**Polling**

**Bias Distortion**

**Event Timing**

**Print Test Data**

**Load User Message**

**Self Test**

*Applicability*

All tests

## 5.43 Test Length

### *Description*

Enables you to define the length of a BERT test. The CommTool 1000 will stop transmitting and receiving and show test results when the specified number of data blocks have been received. If you set the test length to continuous, the BERT test will run until you press the START/STOP key to end the test. You can set the number of bits in a block with the BLOCK SIZE parameter.

### *Values*

#### **Continuous**

#### **1 Block**

#### **10 Blocks**

#### **100 Blocks**

#### **1000 Blocks**

#### **10000 Blocks**

### *Applicability*

BERT Test

## 5.44 Transmission Description

Enables you to specify full- or half-duplex as the method of communication during a polling test.

### *Values*

**Half Duplex** The CommTool 1000 will set its control line out (usually RTS) high and wait for its control line in (usually CTS) to go high before transmitting a message. When the message has been transmitted, the CommTool 1000 will set its control line out back to low.

**Full Duplex** The CommTool 1000 will not change its control line out (unless you press the FLOW CONTROL key) and will transmit messages whenever its control line in is high (Control-On state).

*Applicability*

Polling Test

**5.45 Trap***Description*

Allows you to trap only SDLC frames matching a specified address field. All other frames except the global address (FF Hex) are discarded.

*Values*

**All Frames** All frames are trapped. The first byte of each frame in the trap buffer is the address field.

**Selected Address** Only frames matching the address field specified in the FRAME ADDRESS parameter or the global address are trapped. The address byte does not appear in the trapped frame.

*Applicability*

Trap Data-SDLC Mode

**5.46 Trap Buffer***Description*

Allows you to specify which trap buffer is used for a Send Data Message or to load into a User Message.

*Values*

**TD**

**RD**

*Applicability*

Send Data-Trap Buffer, User Message-Load from Trap. Trap buffer contains dual line data.

## 5.47 Trap Data On

### *Description*

Enables you to specify when to trigger the capture of data in the Trap Data test.

### *Values*

**Start of Test** The trap buffer will begin collecting data as soon as you press the START/STOP key to begin the test. As soon as the first 4096 characters are received, the trap buffer will be full and the test will be complete. The trigger point will be the first character in the trap buffer.

**Reset Key** The trap buffer trigger event occurs when you push the RESET/RESYNC key. Use this selection to manually trigger the trap buffer after data has been collected for awhile.

**User Msg Match** The trigger event will be a match in character strings between one of the user-defined messages stored in User #1 through User #16 and the character string that is received from the device under test. The trigger point in the trap buffer will be the last character of the user message match.

You can use the FFH character as a wild card in User Message matching. For example, if you want to trap on matching a message at “123\_12\_” where you don’t care what the blanks are, you would insert the FFH code in those two positions “123(FFH) 12(FFH).”

The length of the user message match string must be limited to ensure that characters are not lost from the trap buffer. Table 5-3 “User Message Match Length,” shows the maximum user message length for 9600 bps and above.

**SDLC User Msg** In SDLC mode, user messages are always matched to SDLC frames beginning with the address field.

**Send Control Off** The trap buffer trigger event occurs when you press the FLOW CONTROL key to transmit a Control-Off state. Use this selection to check how the device under test responds to flow control. The trigger point in the trap buffer will be the first character that is received after the control line state changes to a Mark (control-off) level (hardware flow control) or transmission of a Control-Off character (software flow control).

**Table 5-3 User Message Match Length**

Bit Rate	Maximum User Message Match Length (Characters)	
	7 Bit/No Parity	8 Bit/No Parity
9600 bps	165	180
19,200 bps	59	64
38,400 bps	25	29
56,000 bps	14	17
64,000 bps	11	14

**NOTE:** This selection is available only if you have set the **MONITOR MODE** parameter to “Drive Interface” and have flow control enabled.

**Send Control On** The trap buffer trigger event occurs when you press the FLOW CONTROL key to transmit a Control-On state. The trigger point in the trap buffer will be the first character that is received after the control line state changes to a Space (Control-On) level (hardware flow control) or transmission of a Control-On character (software flow control).

**NOTE:** This selection is available only if you have set the **MONITOR MODE** parameter to “Drive Interface” and have flow control enabled.

**Control On -> Off** The trap buffer trigger event occurs when there is a Control-On to Control-Off (space-to-Mark) transition generated by the device under test on the hardware flow control line in (selected in the CTRL LINE IN parameter selection). The trigger point in the trap buffer will be the first character received after the control line transition. If the control line is in a Control-Off state when the test is begun, triggering will not occur until the control line changes to a Control-On state and then back to a Control-Off state.

**NOTE:** This selection is available only if you have set the **MONITOR MODE** parameter to “Transparent” and have hardware flow control enabled.

**Control Off -> On** The trap buffer trigger event occurs when there is a Control-Off to Control-On (Mark-to-Space) transition generated by the device under test on the hardware flow control line in (selected in the CTRL LINE IN parameter selection). The trigger point in the trap buffer will be the first character received after the control line transition. If the control line is in a Control-On state when the test is begun, triggering will not occur until the control line changes to a Control-Off state and then back to a Control-On state.

**NOTE:** This selection is available only if you have set the **MONITOR MODE** parameter to 'Transparent' and have hardware flow control enabled.

**FCS Error** In SDLC Mode, if the computed CRC-16 frame check sequence bytes do not match the received FCS bytes, then an FCS error occurs. You can trigger based on an FCS error.

**NOTE:** This selection is available only if you have set the **Serial mode** parameter to **SDLC**.

*Applicability*

Trap Data Test

## **5.48 User Control Off**

*Description*

Enables you to define a Control-Off character for software (in-band) flow control.

*Values*

The Value (second) line of the display shows the hexadecimal value assigned to the User Control Off character along with the selected language and its translation of the control character in the following format:

(language) (translation) =(hex value)H

To change the value of each of the two hexadecimal digits, press the **NEXT** or **LAST VALUE** keys. The translation character will change as the hex value is modified. Press the **NEXT (->)** or **LAST (<-)** **PARAMETER** keys to alternate between right and left digits of the hex value. When both digits are set for the desired control character, press the **NEXT PARAMETER** key until the parameter (top) line changes to the next setup parameter.

*Applicability*

Software Flow Control, User Control Off character

### 5.49 User Control On Description

Enables you to define a Control-On character for software (in-band) flow control.

*Values*

Refer to the Values section of the User Control Off parameter for selection procedure.

*Applicability*

Software Flow Control, User Control-On character

### 5.50 Word Length

*Description*

Enables you to define the number of bits in a character, excluding start, stop, and parity bits. Set this parameter to match the configuration of the device under test.

Word length is often defined by the language which you have selected under the Language parameter. The word length for each language is shown in the list below:

<u>Language</u>	<u>Word Length (bits)</u>
Baudot	5
IPARS	6
Transcode	6
EBCDIC	8
ASCII	7 or 8

**NOTE:** Word length is always 8 bits for the Polling test and BERT tests with bit-oriented patterns (63PR, 511 PR, 2047PR, AL T, Mark, or Space).

*Values*

**5 bits**

**6 bits**

**7 bits**

**8 bits**

*Applicability*

Send Data, Trap Data, BERT, Print Test Data tests

## 6. CREATING AND REVISING USER MESSAGES

The CommTool 1000 Revise Message function enables you to create and revise user messages stored in the sixteen user message memories, or load data from the trap buffer into a user message. Each of these sixteen user messages can contain a variable number of characters with the total for all messages being 2560 characters.

The Revise Message function is accessible after you have selected a User Message Pattern for the BERT test, User Message for the Send Data Test, or Trap Data on User Message Match for the Trap Data Test. After you have selected a message with the MESSAGE CHOICE parameter, you can accept it as is (No Change), enter a new message (Edit Message), or load it with the contents of the trap buffer (Load from Trap). Each of these selections is described in the following sections.

### 6.1 No Change

When you select No Change, the message that you have selected under Message Choice will be retained as it was previously set.

### 6.2 Edit Message

When you want to change the selected user message, press the NEXT VALUE key at the REVISE MESSAGE menu until Edit Message is displayed on the bottom line of the LCD. Then press the NEXT PARAMETER key to edit the message that you have selected. You will enter the Edit mode. The message that you have selected will be displayed on the lower line of the LCD. The display will be similar to the following example:

MSG 1 C 0000=54H

THE QUICK BROWN

The top line of the display is the Status line. The bottom line of the display is the Message line. There is a flashing cursor on both lines of the display.

On the Status line, the number of the message that you are editing, the cursor position, and the hexadecimal value of the character at the cursor position on the Message line are displayed. In the example above, Message 1 is being edited. The Message line cursor is at the T character (in the word “The”) in position 0000 at the beginning of the message. The cursor position begins at 0000 and goes up to the number of character positions in the message. The Status line cursor is under

one of the hex digits followed by an H to indicate hexadecimal notation. The Status line cursor alternates between the first and second positions of the hex notation and is controlled by the LAST and NEXT PARAMETER keys.

The Message line shows the selected language translation (ASCII, EBCDIC, Baudot, etc.) of the message. The Message line cursor is under the character indicated by the cursor position number on the Status line. The LAST and NEXT PARAMETER keys move the cursor to the left and right as indicated by the arrows beside the keys. When you press one of the PARAMETER keys, the cursor moves one hexadecimal digit position to the right or left on the STATUS line. Since each character on the Message line consists of two hexadecimal digits, the cursor will move one position on the message line for every two pushes of a PARAMETER key. When the cursor reaches the end of the Message line, the display window will shift one character position, leaving the cursor at the end of the line.

The LAST and NEXT VALUE keys enable you to change the hexadecimal digit on the status line and, consequently, the character translation in the cursor position on the Message line. Each time you press the NEXT VALUE (up arrow) key, the hex digit increments by one. The hex digit decrements by one when you press the LAST VALUE (down arrow) key.

For example: When you are editing a Fox message and the Message cursor is under the U in QUICK, the hex value of U, 55H, will be displayed on the Status line. When the Status line cursor is under the left-hand digit of the hex number and you press the NEXT VALUE key, the hex value will change from 55H to 65H, and the upper-case U will become a lower-case e.

By pressing the PARAMETER keys, you can scroll left and right on both the Message and the Status lines, through all of the characters of the message and back and forth between hexadecimal digits of the hex value for each character. By pressing the VALUE keys, you can scroll through each of the hexadecimal values for each digit (0 to F). Therefore, the value of the character on the Message line can be set to any value between 00H and FFH.

By pressing the CURSOR JUMP key, you can move the cursor from its current position to the end of the message, and then to the beginning of the message.

By pressing the DELETE CHAR. key, you can delete the character at the current position of the Message cursor.

By pressing the INSERT CHAR. key you can insert a null (00H) character to the left of the current Message cursor position, which you can then alter using the VALUE keys. However, the total for all messages cannot exceed 2560 characters. If you try to insert additional characters into a message when memory is full, an error beep will sound and the message “USER MEMORY FULL” will be displayed.

To add characters to the end of a message, press CURSOR JUMP to shift the cursor to the end of the message and then press the NEXT PARAMETER key to move to a new character position. A new null (00H) character will be added to the message buffer when you press the NEXT or LAST VALUE key.

Frequently when you are triggering a Trap Data Test using a match to a User Message, you will want to be able to ignore some characters in the message. You can use the FFH character as a wild card in your User Message to tell the DataTool to ignore any characters in that position. See **Section 5.47**, “Trap Data On” for more information.

You can exit the Edit mode, and save the changes you have made, by pressing the START/STOP or SETUP/RESULTS key. The entire edited message will be saved regardless of the current cursor position, and you will be at the next parameter in the Setup menu.

### 6.3 Erase Message

Erase Message allows you to erase the complete contents of a message buffer without having to delete it character by character. You can specify this option and enter the Edit mode by pressing the NEXT PARAMETER key when “Erase Message” is displayed on the VALUE line of the display.

Any message previously stored will be erased. You will be in the Edit Message mode. The display will show:

MSG x C 0000 = \_ H

Use the NEXT and LAST VALUE keys to enter and modify the hexadecimal value of each digit. Use the NEXT and LAST PARAMETER keys to switch between digits. Operation of all key functions is more fully described in **Section 6.2**, “Edit Message.”

When you have completed entry of both hex digits of a character, press the NEXT PARAMETER key to move to the next character position. No additional character will be added to the message buffer until you change the cursor hex display on the Status line from blank to 00H by pressing NEXT or LAST VALUE. You can go back and edit any previously entered characters by pressing the NEXT and LAST

PARAMETER keys, or insert or delete characters in the middle of the message with the INSERT CHAR. and DELETE CHAR. keys.

After all the characters of your message have been entered, press the START/STOP key to save the message you have created and exit Edit mode. The full message will be saved, regardless of the current cursor position. You will return to the next parameter selection in the Setup menu.

## **6.4 Load from Trap**

The Load from Trap function copies as many characters from the trap buffer into a user message as memory space allows, and then allows you to review and edit the contents of the message.

You can enter or download a user message directly from a terminal or PC into the trap buffer with the Trap Data test, and then transfer the message to a user message for use in the Send Data, BERT, or Trap Data tests. This feature allows you to create user messages with a PC text editor, or type a message directly with a terminal, rather than use hexadecimal character entry described in **Sections 6.2 and 6.3**. Alternately, you can directly load user messages by selecting the “Load User Message” test.

You can specify this function and enter the Edit mode by pressing the NEXT PARAMETER key when “Load from Trap” is displayed on the Value line of the display. All previously entered characters in the user message will be replaced by the characters in the Trap buffer and you will be in the Edit mode with the cursor at the start of the message buffer. All previously entered characters in the user message are lost even if the trap buffer contains fewer characters than were in the original user message. Refer to **Section 6.2**, “Edit Message,” for instructions on reviewing and modifying the message.

If the trap buffer contains dual line data, then you must select either the TD or RD buffer to load into the user message.

If only enough memory is available to load part of the buffer, you will see the message:

PARTIAL TRANSFER

Press Any Key

If no memory is available, no transfer will be made and you will get the message:

**USER MEMORY FULL**

Press Any Key

If this happens you can erase or edit some other user message to make room available.

When you are finished reviewing and editing the message, press the START/STOP key to exit Edit mode. This saves the message and returns you to the next parameter in the Setup menu.

## 7. Breakout Box and Pulse Trap

The CommTool 1000 comes equipped with a 100-LED breakout box and a dual-LED pulse trap. This section describes the use of both of these features.

### 7.1 Breakout Box

The CommTool 1 000 features a four-state 100-LED breakout box interface tester with inline DIP switches and positive and negative voltages for forcing control lines either high or low. The principal purpose of the breakout box is to test RS-232 standard interface connections. This section describes the breakout box, the establishment of the RS-232 standard, and the solution to the problem of connecting devices using the RS-232 convention.

#### 7.1.1 DIP SWITCHES

The top 25 DIP switches, labeled 1 through 25, will break open the data and control lines when pushed down to the left. When starting to test an interface, all the switches should be open. The bottom two DIP switches on the face of the CommTool 1000 connect the battery and LED ground lines to Pin 7 on the right and left side of the breakout box. Because the RS-232 specification defines Pin 7 as Signal Ground, these two switches are normally in the closed position (right side down) when testing RS-232 interface circuits. To isolate the CommTool 1000's logic ground circuitry so that it may be strapped to any other pin, both switches should be pushed down to the left. A jumper strap may then be connected between the ground post and any other pin identified as logic ground.

#### 7.1.2 SIGNAL POLARITY

The LED indicators on each side of each circuit will indicate the polarity of the logic level present on the data or control lines. The red LEDs will light when a positive voltage greater than +3V is present. A positive voltage is known as a "binary zero," "signal space" or "control on" condition. The green LEDs will light at the opposite negative voltage level. A negative voltage is known as a "binary one," "signal mark," or "control off" condition. When the signal is alternating between binary zero and binary one ("clocking" or "data"), both the red and green LEDs will light. At high data rates, both red and green LEDs will appear to be in a steady lighted condition.

### 7.1.3 FORCING VOLTAGES

Both positive and negative voltage sources are provided on jumper posts at the top of the faceplate. These voltages can be used to strap an interface control line to a logic high or low condition. In addition, these voltages may be used to test cables for continuity, opens and bridging. A logic common (ground pin) is also provided for strapping an interface control line to ground.

**NOTE:** There are 330-ohm current-limiting resistors in both the positive and negative voltage outputs. Care should be taken so that the supply voltages are not shorted to ground or logic ground lines (pins 1 and 7 in RS-232) for any length of time. No damage will occur to the CommTool 1000, but the battery life may be substantially shortened.

### 7.1.4 RS-232 STANDARD

In August 1969, the Electronic Industries Association (EIA), an industry trade group based in Washington, D.C., established the “EIA RS-232 Standard” to govern interchange of serial data between communications and terminal equipment over telephone lines.

Specifically, RS-232 deals with the digital interface between the Data Terminal Equipment (DTE) and Data Circuit- Terminating Equipment (DCE). An entirely different set of standards governs the analog side (channel side) of the DCE (modem standards).

The original specification presumed that a data terminal (DTE) would talk to a modem (DCE), which would talk to another modem, which would talk to the computer (DTE). The signals on the DB25 connectors were assigned with this particular environment in mind. The designers of the RS-232 interface did not anticipate that their interface scheme would also be chosen to locally connect terminals to computers (two DTE devices together without modems), personal computers to plotters and printers, etc. Printers, in fact, are usually the most interesting, because the original RS-232 designers never dreamed their interface would be required to signal that a device was out of paper, or a buffer was full. You will find no RS-232 pin labeled “Paper Out” or “Printer Off-Line.”

**The RS-232 Connector** The RS-232 connector (DB25) contains 25 pins. Conveniently, the majority of these pins can be categorized into four distinct groups:

**Data Signals** These are the paths for serial data being transmitted and received. Pins 2 and 3 are in this category. The EIA standard defines a data signal as a logic 0 or Space when a positive voltage of greater than 3 volts is present on a data signal pin. The same signal is defined as a logic 1 or Mark when a negative voltage is present of less than -3 volts.

**Control Signals** These signals coordinate and control the flow of data. Although the majority of RS-232 pins ( 4, 5, 6, 8, 12, 13, 19, 20, 21, 22, 23, 25) are control signals, only a few are commonly used (4, 5, 6, 8, 20). Some serial printers also use either pins 11 or 19 for their flow-control outputs. Referring to the EIA standard, a control signal with a positive voltage greater than 3 volts is termed a “Control On” (red LED), and a negative voltage less than minus 3 volts is termed a “Control Off” (green LED). Understanding the functions of these 5 pins is the key to interfacing RS-232 devices. You will find some devices use all of the signals and other devices use none.

**Timing Signals** These signals (15,17, 24) commonly called “clock signals”, are used in a synchronous environment to allow both transmitting and receiving devices to synchronize their data rates. These signals are not used with asynchronous devices. Timing signals use the same voltage standard as data signals.

**Ground Signals** Frame or Protective ground (1) and Signal ground (7) are the two signals in this category. Pin 7 on both sides of the interface must always be connected. DCE devices should make no connection to frame ground (Pin 1). Refer to the devices’ operation manual to see if the equipment connects to frame ground (sometimes called “protective ground”).

Fortunately, only 9 of the 25 pins are commonly used in asynchronous applications (1, 2, 3, 4, 5, 6, 7, 8, 20). With synchronous applications, only two more are normally used (15, 17).

The number of connector pins utilized by an RS-232 device does not necessarily indicate the number of wires needed to connect it to another RS-232 device. Some interfaces that use 9 or more pins only require 3 wires between connector-transmit and receive data and signal ground (2, 3, 7).

This occurs quite often in full-duplex environments where each RS-232 device has its own communication path to the other. Consequently, there is no need for control signals to coordinate the sharing of a single line. In such cases, it is common practice to tie the control signals to a continual “Control-On” state.

Beware of the labeling. You should note that the labeling of the pins (e.g. Transmit Data, Clear to Send, etc.) is always the same, no matter whether the device is a DTE or DCE. The actual function of a DTE's pins, however, is not the same as a DCE's. You will find it helpful to start thinking of the pins as "inputs" and "outputs" along with their function labeling. As an example, you should think of a DTE's Request To Send as a control output requesting permission to send data. A DCE's RTS, on the other hand, is a control input indicating when another RS-232 device is asking for permission to send data.

"How do I know whether a device is a DTE or DCE?" The answer is simple! A "DTE" is a device that transmits data on pin 2.

A "DCE" is a device that transmits data on pin 3. Remember this definition. It is the foundation by which you can characterize any RS-232 interface.

### 7.1.5 APPLICATIONS

This section contains instructions for two common applications of the breakout box: verifying RS-232 data and control signal outputs, and resolving non-standard interfaces.

#### Verifying RS-232 Data and Control Signal Outputs

The 100 LEDs are used to determine the signal status of all lines on each side of the breakout switches. Connect the device under test to either side of the CommTool 1000. Set the RT7 and LF7 DIP switches to the ON position, and all other DIP switches to the OFF position. The red LED on each driven lead will light when the signal is between +3 volts to +25 volts. The green LED will light when the voltage is between -3 volts to -25 volts.

If you have connected the breakout box to a DTE device, one of the LEDs on Pin 2 (typically green) will light. If you are connected to a DCE device, one of the LEDs on Pin 3 (also typically green) will light (of course, this is only true if the DTE or DCE device is powered on). If the device you are testing is DTE, you should expect to find output drivers on pins 4, 11, 19, or 20 and input receivers on pins 5, 6, or 8. If the device you are testing is DCE, you may find drivers on pins 5, 6, or 8 and receivers on pins 4 or 20. Since pins that have receiver connections will not light monitor LEDs, you can verify the existence of control inputs by trial-and-error use of forcing voltages (to attempt to stop data transmission) or with the Pin Analyzer Test of the CommTool 1000 (Refer to **Section 4.8**).

## Non-Standard Interfaces

Non-standard interfaces are resolved by reconfiguring individual lines. Each rocker DIP switch allows you to break the numbered line between the two connectors. Each jumper pin on either side of the switches can be a terminal point to attach a jumper to cross-connect a line to another pin position on the other connector. An example of this would be strapping “Request To Send” (Pin 4) on one connector to “Clear To Send” (Pin 5) on the other connector.

## 7.2 Pulse Trap

The Pulse Trap allows unattended detection of data or control line transitions, or short signal pulses. To detect a pulse transition, connect one of the jumper pins of the breakout box to the PULSE TRAP pin with a jumper lead.

The “+” LED will light when a positive transition is detected and the “-” LED will light when a negative transition is detected. Only one transition (positive or negative) will be trapped at a time.

Press the RESET/RESYNC key to reset the pulse trap.

## 7.3 Testing IBM Parallel Devices

The CommTool 1000’s high-impedance, buffered LED monitors will readily interface to TTL (5V) logic circuits with minimal degradation in performance.

The CommTool 1000 has automatic detection of parallel devices to prevent accidental connection to serial drivers. If you initiate a serial test (such as Send Data) while the DB25 connector is attached to an IBM parallel port, a warning message is displayed and the serial interface drivers will not turn on.

**Reconnect Signal Ground** The first step when using the CommTool 1000’s breakout box to test parallel devices is to disconnect the ground connection to Pin 7 of the connector and reconnect it to a defined signal ground. Pin 7 of the IBM parallel interface is used for data bit 6 and must not be shorted to ground.

Set the LF7 and RT7 DIP switches (near the bottom of the faceplate) to the OFF position. Jumper Pin G (signal ground) at the top of the panel to a defined ground pin on the connector, typically Pin 19. Set Switch 19 to the ON position so that ground is connected to both connectors.

**LED Indication** Refer to **Appendix B**, “Parallel Interface Signal Definitions,” for parallel signal definitions. Control signals such as “Acknowledge,” “Busy,” and “Strobe” will light the red LEDs when their signal levels are above +2.5 volts (logic 1). Data lines will activate their respective red LEDs as the data is passed through the interface tester. Green LEDs will not light, since there are no negative voltage signals on the interface.

**Connect Devices** Set all line switches ON and connect the interface tester in-line between the two devices being tested. It does not matter which side of the interface tester is connected to the printer.

## 8. Cable Testing

The CommTool 1000 breakout box can also be used as an effective cable tester to verify DB25 cables for continuity, opens, and bridging. Follow the steps described below to test cables.

1. Open all breakout box DIP switches by pressing down on the left side of each switch.
2. Connect each end of the test cable to a DB25 connector on each side of the breakout box.
3. Connect the test probe to either the -V or +V, forcing voltage terminal.
4. Touch the test probe tip to each pin of the breakout box.

If there is continuity (a pin in one connector hooked to a pin in the other connector) through the cable, the appropriate LEDs will light on both sides of the tester. If there is no connection, only one LED will light on the side to which the test voltage is applied.

Bridging or shorts will be indicated by two or more LEDs lighting on the same side of the tester. This common occurrence indicates that various pins are bridged inside a connector or cable.

5. To fully characterize an unknown cable, scan both sides of the breakout box. This procedure will detect bridging on one end of the cable that does not feed through to the other end.

## 9. Maintenance

The CommTool 1000 is a completely solid-state test instrument which requires no user maintenance except cleaning and the occasional replacement of both the 9-volt and the lithium coin cell batteries.

### 9.1 Cleaning the CommTool 1000

To clean the CommTool 1000, wipe the case and faceplate with a clean, dry, lint-free cloth. Do not use abrasives or solvents.

### 9.2 Changing the 9-Volt Batteries

Remove the battery compartment cover located on the back of the CommTool 1000 by pressing down on the battery cover near the arrows on the case and sliding it toward the top of the instrument. Replace all three batteries whenever the Low-Battery warning message appears on the display. Use 9V alkaline batteries (Duracell MN1604 or equivalent).

### 9.3 Changing the Lithium Coin-Cell Battery

The lithium coin cell battery maintains the non-volatile memory in the CommTool 1000. This is the storage memory for parameter selection from the last use of the test set as well as Set-up configurations, user messages, and test results. The battery must be replaced whenever it is low, at approximately 5-year intervals. When this battery has failed, the message "RAM BATTERY BAD" will appear on the LCD immediately following the log-on message when you turn the power switch On. To replace the lithium coin cell, remove the four screws from the back of the CommTool 1000. Inside the test set, on the right side directly below the power jack, is a black, disk-shaped battery holder. Insert a non-metallic prying tool under the coin-shaped battery and pry up against the spring holding the battery until you can slide the battery out of its holder. Replace with the same type battery (CR2032 or equivalent). Insert the replacement battery with the positive (+) side turned upward, toward the front panel.

### 9.4 Calibrating the Internal Voltmeter

The internal voltmeter function used in the Pin Analyzer Test should be recalibrated whenever the lithium coin cell is replaced or if you suspect it is providing incorrect voltage measurements.

# APPENDIX A: RS-232 Interface Signal Definitions

PIN	NAME	SOURCE	FUNCTION
1	FG	—	<b>Frame Ground</b> Electrically connected to the equipment frame or 3rd wire of power cord. DCE equipment should make no connection to this pin.
2*	TD	DTE	<b>Transmitted Data</b> Data from terminal (DTE) to modem (DCE).
3*	RD	DCE	<b>Received Data</b> Data from modem (DCE) to terminal (DTE).
4*	RTS	DTE	<b>Request to Send</b> Indicates to modem that terminal is ready to transmit data.
5*	CTS	DCE	<b>Clear to Send</b> Indicates to terminal that modem is ready to receive data.
6*	DSR	DCE	<b>Data Set Ready</b> Indicates to terminal that modem is connected to a communication channel and not in a test or loopback mode.
7*	SG	—	<b>Signal Ground</b> Common ground reference potential for all circuits, except Frame Ground.
8*	DCD	DCE	<b>Data Carrier Detect</b> Indicates to terminal that modem is detecting carrier from a remote transmitting modem.
9		DCE	<b>Unassigned</b> Sometimes has positive (+12V) voltage available for testing.
10		DCE	<b>Unassigned</b> Sometimes has negative (-12V) voltage available for testing.
11		DTE	<b>Unassigned</b> Sometimes used as a printer ready flow control signal.
12	SDCD	DCE	<b>Secondary Data Carrier Detect</b> Indicates to terminal that modem is detecting secondary channel carrier from a remote transmitting modem.

PIN	NAME	SOURCE	FUNCTION
13	SCTS	DCE	<b>Secondary Clear to Send</b> Indicates to terminal that modem is ready to receive data on the secondary channel.
14	STD	DCE	<b>Transmitted Data</b> Data from terminal (DTE) to modem (DCE) on secondary channel.
15*	TC	DCE	<b>Transmitter Clock</b> Timing signal to clock synchronous data on TD (Pin 2).
16	SRD	DEC	<b>Secondary Received Data</b> Data from modem (DCE) to terminal (DTE) on secondary channel.
17*	SRTS	DTE	<b>Receiver Clock</b> Timing signal to clock synchronous data on RD (Pin 3).
19*	SRTS	DTE	<b>Secondary Request to Send</b> Indicates to modem that terminal is ready to transmit data on the secondary channel. Sometimes used as a printer-ready flow control signal.
20*	DTR	DTE	<b>Data Terminal Ready</b> Indicates to modem that terminal is able to receive and transmit data. Sometimes used as a printer ready flow control signal.
not 21	SQ	DCE	<b>Signal Quality Detect</b> Indicates that there is a high probability of error in the received data from the modem.
22	RI	DCE	<b>Ring Indicator</b> Indicates that the modem is receiving a ringing signal on the communication line.
23	DRS	DTE/DCE	<b>Data Rate Selector</b> Selects between two data rates for dual-rate modems.
24*	SCTE	DTW	<b>Serial Clock Transmit External</b> Timing signal, supplied by terminal, to clock synchronous data on TD (Pin 2).
25		DTE	<b>Unassigned</b> Used as Make Busy/Analog Loop signal to Bell 103 and 113 modems.

\* Signals supported by the CommTool 1000 in all serial tests. They may simulate either a terminal (DTE device) or a modem (DCE device).

# Appendix B: Parallel Interface Signal Definition

The following is a list of the parallel signals used by most of the manufacturers of equipment using the Centronics parallel interface. There is no established standard and so some small variations occur between manufacturers. Typically these differences do not cause operational difficulty, but you should keep this in mind for some specialized applications.

<b>PIN</b>	<b>NAME</b>	<b>SOURCE</b>	<b>FUNCTION</b>
1*	STROBE	Computer	Pulse used to transfer data into the printer. Pulse width must be between 0.5 microsecond and 500 microseconds for most printers. Active low signal for Centronics type printer, active high for dataproducs printer.
2*	DATA1	Computer	Least significant Data bit, High = 1.
3*	DATA2	Computer	Data bit 2, High = 1.
4*	DATA3	Computer	Data bit 3, High = 1.
5*	DATA4	Computer	Data bit 4, High = 1.
6*	DATA5	Computer	Data bit 5, High = 1.
7*	DATA6	Computer	Data bit 6, High = 1.
8*	DATA7	Computer	Data bit 7, High = 1.
9*	DATA8	Computer	Most significant data bit, High = 1.
10*	ACKNOWLEDGE	Printer	Active low pulse indicates that data has been received and the printer is ready to accept more data. Not used with Dataproducts printer.
11*	BUSY	Printer	Indicates that the printer cannot receive data. High level indicates busy for Centronics type printer, low level indicates busy for Dataproducts printer.
12*	PAPER END	Printer	A high signal indicates that the printer is out of paper.
13*	SELECT OUT	Printer	A high signal indicates that the printer is on-line.

<b>PIN</b>	<b>NAME</b>	<b>SOURCE</b>	<b>FUNCTION</b>
14	AUTO FEED	Computer	A low signal indicates to the printer that a line feed is required after each Carriage Return. This signal is used as a ground line by some manufacturers.
15	OSCXT	Printer	A 100- to 200-KHz signal used by true Centronics printers only. Most manufacturers do not use this signal.
16	GROUND	—	Signal Ground.
17	FRAME GRD	—	Frame or Chassis Ground.
18	+5V	Printer	+5 volts power, provided by some manufacturers, not used by others.
19*	STROBE RTN	—	Ground return line for STROBE signal.
20*	STROBE RTN	—	Ground return for DATA1.
21*	DATA2 RTN	—	Ground return for DATA2.
22*	DATA3 RTN	—	Ground return for DATA3.
23*	DATA4 RTN	—	Ground return for DATA4.
24*	DATA5 RTN	—	Ground return for DATA5.
25*	DATA6 RTN	—	Ground return for DATA6.
26*	DATA7 RTN	—	Ground return for DATA7.
27*	DATA8 RTN	—	Ground return for DATA8.
28*	ACK RTN	—	Ground return for ACK.
29*	BUSY RTN	—	Ground return for BUSY.
30*	PRIME RTN	—	Ground return for PRIME.
31*	PRIME	Computer	A low signal resets the printer to its power-up state and clears the print buffer (if any).
32*	FAULT	Printer	A low signal indicates that the printer is in an off-line, paper-end, or error state.
33*	GROUND	—	Signal Ground. Some manufacturers do not use this line, others use it for other purposes.
34	LINE COUNT	Printer	Used by true Centronics printers only. Most manufacturers do not use this line.
36	SELECT IN	Computer	A high signal indicate to the printer that a DC1/DC3 code is valid. This signal is used by a few manufacturers and is not used by most.

\* Signals supported by the CommTool 1000. In the Send Data and Print Test Data tests, the CommTool 1000 simulates a computer (output device). In the Trap Data test, the CommTool 1000 simulates a printer (input device).

## Parallel Interface LED Indicators

The following parallel interface signals are monitored by LEDs:

<b>Signals</b>	<b>Pin</b>	<b>Color</b>	<b>LED Illuminated Indicates</b>
STROBE	1	Red	*Active Strobe (low)
DATA-DATA8	2–9	Yellow	Logic “1” state
ACK	10	Green	*Active Acknowledge (low)
BUSY	11	Red	Printer Busy state
PE	12	Red	Paper End state
SELECT	13	Green	Printer Selected (on-line)
PRIME	31	Red	*Active Initialize printer (low)
FAULT	32	Red	Printer Fault (low)

\* These signals have pulse-stretching circuitry which lengthens the time that the monitor LED is illuminated for short pulses. The stretching circuitry only affects the LED illumination and does not affect the signal itself.

# Appendix C: Adapter Cables

## C.1 IBM PC Parallel Interface Adapter Cable

The parallel interface on the IBM PC, PC/XT™, AT®, PS/2®, and compatible is similar to the Centronics standard, but different in that a DB25 connector is used instead of a 36-pin Centronics connector. Set the CommTool 1000 Printer Type parameter to “Centronics” when testing this type of parallel interface. The pin-out of the conversion cable is shown below:

Signal	CommTool 1000 IBM PC 36-pin Centronics Pin	DB25P Pin
STROBE	1	1
DATA 1	2	2
DATA 2	3	3
DATA 3	4	4
DATA 4	5	5
DATA 5	6	6
DATA 6	7	7
DATA 7	8	8
DATA 8	9	9
ACKNOWLEDGE	10	10
BUSY	11	11
PAPER END	12	12
SELECT	13	13
AUTO FEED	14	14
PRIME	31	16
FAULT	32	15
SELECT IN	36	17
DATA 1 RTN	19	19
GROUND	21	20
GROUND	23	21
GROUND	25	22
GROUND	27	23
GROUND	29	24
GROUND	30	18
GROUND	33	18

## **C.2 Dataproducts Winchester® MRA Style Adapter Cable**

The parallel interface on B-Series Dataproducts printers uses a different logic and connector standard than Centronics type printers. Set the CommTool 1000 Printer Type parameter to “Dataproducts” when testing this type of parallel interface. The pin-out of the MRA style conversion cable is shown below:

<b>Signal</b>	<b>CommTool 1000 36-pin Centronics</b>	<b>Dataproducts MRA 50-Pin</b>
DATA STROBE	1	-j
DATA 1	2	-B
DATA 2	3	-F
DATA 3	4	-L
DATA 4	5	-R
DATA 5	6	-V
DATA 6	7	-Z
DATA 7	8	-n
DATA 8	9	-u
DEMAND	11	-E
ON LINE	13	-y
READY	32	-CC
DATA STROBE RTN	19	-m
DATA 1 RTN	20	-D
DATA 2 RTN	21	-J
DATA 3 RTN	22	-N
DATA 4 RTN	23	-T
DATA 5 RTN	24	-X
DATA 6 RTN	25	-b
DATA 7 RTN	26	-k
DATA 8 RTN	27	-w
DEMAND RTN	29	-C
ON LINE RTN	30	-AA
READY RTN	33	-EE

### C.3 Dataproducts DB50P Style Adapter Cable

The parallel interface on B-Series Dataproducts printers uses a different logic and connector standard than Centronics type printers. Set the CommTool 1000 Printer Type parameter to “Dataproducts” when testing this type of parallel interface. The pin-out of the DB50P style conversion cable is shown below:

<b>Signal</b>	<b>CommTool 1000 36-pin Centronics Pin</b>	<b>Dataproducts DB50P Pin</b>
DATA STROBE	1	38
DATA 1	2	19
DATA 2	3	20
DATA 3	4	1
DATA 4	5	41
DATA 5	6	34
DATA 6	7	43
DATA 7	8	36
DATA 8	9	28
DEMAND	11	23
ON LINE	13	21
READY	32	22
DATA STROBE RTN	19	37
DATA 1 RTN	20	3
DATA 2 RTN	21	4
DATA 3 RTN	22	2
DATA 4 RTN	23	40
DATA 5 RTN	24	18
DATA 6 RTN	25	42
DATA 7 RTN	26	35
DATA 8 RTN	27	44
DEMAND RTN	29	7
ON LINE RTN	30	5
READY RTN	33	6

# Appendix D: ASCII to Hexadecimal Translation Table

CHAR HEX		CHAR HEX		CHAR HEX		CHAR HEX	
A	41	a	61	0	30	(	28
B	42	b	62	1	31	)	29
C	43	c	63	2	32	<	3C
D	44	d	64	3	33	=	3D
E	45	e	65	4	34	>	3E
F	46	f	66	5	35	%	25
G	47	g	67	6	36	@	40
H	48	h	68	7	37	_	5F
I	49	i	69	8	38	\	5C
J	4A	h	6A	9	39	{	7B
K	4B	k	6B	Space	20	}	7D
L	4C	l	6C	!	21	'	60
M	4D	m	6D	.	2E		7C
N	4E	n	6E	,	2C	~	7E
O	4F	o	6F	?	3F	^	5E
P	50	p	70	*	2A	[	5B
Q	51	q	71	\$	24	]	5D
R	52	r	72	#	23		
S	53	s	73	\	2F		
T	54	t	74	-	2D		
U	55	u	75	+	2B		
V	56	v	76	"	22		
W	57	w	77	&	26		
X	58	x	78	'	27		
Y	59	y	79	;	3B		
Z	5A	z	7A	:	3A		

**ASCII Control Codes**

<b>ASCII CHARACTER</b>	<b>HEX VALUE</b>	<b>CHARACTER DISPLAYED</b>	<b>DESCRIPTION</b>	<b>CONTROL CODE</b>
NUL	00	NU	NULL	CTRL @
SOH	01	SH	START OF HEADING	CTRL A
STX	02	Sx	START OF TEXT	CTRL B
ETX	03	Ex	END OF TEXT	CTRL C
EOT	04	ET	END OF TRANSMISSION	CTRL D
ENQ	05	EQ	ENQUIRY	CTRL E
ACK	06	Ak	ACKNOWLEDGE	CTRL F
BEL	07	BL	BELL	CTRL G
BS	08	BS	BACKSPACE	CTRL H
HT	09	HT	HORIZONTAL TAB	CTRL I
LF	0A	LF	LINE FEED	CTRL J
VT	0B	VT	VERTICAL TAB	CTRL K
FF	0C	FF	FORM FEED	CTRL L
CR	0D	CR	CARRIAGE RETURN	CTRL M
SO	0E	SO	SHIFT OUT	CTRL N
SI	0F	SI	SHIFT IN	CTRL O
DLE	10	DL	DATA LINK ESCAPE	CTRL P
DC1	11	D1	DEVICE CTRL 1 (XON)	CTRL Q
DC2	12	D2	DEVICE CTRL 2	CTRL R
DC 3	13	D3	DEVICE CTRL 3 (XOFF)	CTRL S
DC4	14	D4	DEVICE CTRL 4	CTRL T
NAK	15	Nk	NEGATIVE ACKNOWLEDGE	CTRL U
SYN	16	SY	SYNCHRONOUS IDLE	CTRL V
ETB	17	EB	END OF TRANS. BLOCK	CTRL W
CAN	18	CN	CANCEL	CTRL X
EM	19	EM	END OF MEDIUM	CTRL Y
SUB	1A	SB	SUBSTITUTE	CTRL Z
ESC	1B	EC	ESCAPE	CTRL [
FS	1C	FS	FILE SEPARATOR	CTRL \
GS	1D	GS	GROUP SEPARATOR	CTRL ]
RS	1E	GS	RECORD SEPARATOR	CTRL ^
US	1F	US	UNIT SEPARATOR	CTRL _
DEL	7F	■	DELETE	DEL

**NOTE:** Control codes appear on the LCD display in a single character position, written sideways. The display shows specific control codes only in the cursor position, and the first 7 unique control codes reading from the left of the screen. If more than 8 unique control codes appear in one screen, additional control characters will be indicated as non-displayable control codes by a "■" symbol. You can display the actual control character by moving the display cursor to that position.

# Appendix E: EBCDIC to Hexadecimal Translation Table

CHAR HEX		CHAR HEX		CHAR HEX		CHAR HEX	
A	C1	a	81	0	F0	(	4D
B	C2	b	82	1	F1	)	5D
C	C3	c	83	2	F2	<	4C
D	C4	d	84	3	F3	=	7E
E	C5	e	85	4	F4	>	6E
F	C6	f	86	5	F5	%	6C
G	C7	g	87	6	F6	@	7C
H	C8	h	88	7	F7	_	6D
I	C9	i	89	8	F8	\	E0
J	D1	j	91	9	F9	{	C0
K	D2	k	92	Space	40	}	D0
L	D3	l	93	!	5A	'	79
M	D4	m	94	.	4B		6A
N	D5	n	95	,	6B	~	A1
O	D6	o	96	?	6F	^	5F
P	D7	p	97	*	5C	¢	4A
Q	D8	q	98	\$	5B		4F
R	D9	r	99	#	7B		
S	E2	s	A2	/	61		
T	E3	t	A3	-	60		
U	E4	u	A4	+	4E		
V	E5	v	A5	"	7F		
W	E6	w	A6	&	50		
X	E7	x	A7	'	7D		
Y	E8	y	A8	;	5E		
Z	E9	z	A9	:	7A		

**EBCDIC**

<b>EBCDIC CHARACTER</b>	<b>HEX VALUE</b>	<b>CHARACTER DISPLAYED</b>	<b>DESCRIPTION</b>
NUL	00	NU	Null
SOH	01	SH	Start of Heading
STX	02	Sx	Start of Text
ETX	03	Ex	End of Text
EOT	37	ET	End of Transmission
ENQ	2D	EQ	Enquiry
ACK	2E	Ak	Acknowledge
BEL	2F	BL	Bell
BS	16	BS	Backspace
HT	05	HT	Horizontal Tab
LF	25	LF	Line Feed
VT	0B	VT	Vertical Tab
FF	0C	FF	Form Feed
CR	0D	CR	Carriage Return
SO	0E	SO	Shift Out
SI	0F	SI	Shift In
DLE	10	DL	Data Link Escape
DC1	11	D1	Device Ctrl (XON)
DC2	12	D2	Device Ctrl 2
DC3	13	D3	Device Ctrl 3 (XOFF)
DC4	3C	D4	Device Ctrl 4
NAK	3D	Nk	Negative Acknowledge
SYN	32	SY	Synchronous Idle
ETB	26	EB	End of Trans. Block
CAN	18	CN	Cancel
EM	19	EM	End of Medium
SUB	3F	SB	Substitute
ESC	27	EC	Escape
IFS	1C	IF	File Separator
IGS	1D	IG	Group Separator
IRS	1E	IR	Record Separator
IUS	1F	IU	Unit Separator
DEL	7F	■	Delete
PF	04	PF	
LC	06	LC	
RLF	09	RL	
SMM	0A	MM	
RES	14	RE	
NL	15	NL	New Line
IDL	17	IL	

<b>EBCDIC CHARACTER</b>	<b>HEX VALUE</b>	<b>CHARACTER DISPLAYED</b>	<b>DESCRIPTION</b>
CC	1A	CC	
CU1	1B	C1	
CU2	2B	C2	
CU3	3B	C3	
DS	20	DS	
SOS	21	SS	
BYP	24	BP	
SM	2A	SM	
PN	34	PN	
RS	35	RS	
UC	36	UC	

**NOTE:** Control codes appear on the LCD display in a single character position, written sideways. The display shows specific control codes only in the cursor position, and the first 7 unique control codes reading from the left of the screen. If more than 8 unique control codes appear in one screen, additional control characters will be indicated as non-displayable control codes by a “J” symbol. You can display the actual control character by moving the display cursor to that position.

# APPENDIX F: Baudot to Hexadecimal Translation Table

CHAR.	SHIFT	HEX	CHAR.	SHIFT	HEX
A	L	03	0	F	16
B	L	19	1	F	17
C	L	0E	2	F	13
D	L	09	3	F	01
E	L	01	4	F	0A
F	L	0D	5	F	10
G	L	1A	6	F	15
H	L	14	7	F	07
I	L	06	8	F	06
J	;	0B	9	F	18
K	L	0F	SPACE	L/F	04
L	L	12	!	F	0D
M	L	1C	.	F	1C
N	L	0C	,	F	0C
O	L	18	?	F	19
P	L	16	\$	F	09
Q	L	17	#	F	15
R	L	0A	/	F	1D
S	L	05	-	F	03
T	L	10	"	F	11
U	L	07	&	F	1A
V	L	1E	'	F	0B
W	L	13	;	F	1E
X	L	1D	:	F	0E
Y	L	15	(	F	0F
Z	L	11	)	F	12

L = Letters Shift  
 F = Figures Shift

**NOTE:** The character translation shown on the LCD display depends on the most recent shift character (figures or letters) in the data buffer.

<b>BAUDOT CHARACTER</b>	<b>SHIFT</b>	<b>HEX VALUE</b>	<b>CHARACTER DISPLAY</b>	<b>DESCRIPTION</b>
NUL	L/F	00	NU	Null
BEL	F	05	BL	Bell
LF	L/F	02	LF	Line Feed
CR	L/F	08	CR	Carriage Return
FS	L/F	1B	FS	Figures Shift
LS	L/F	1F	LS	Letters Shift

**NOTE:** Control codes appear on the LCD display in a single character position, written sideways. The display shows specific control codes only in the cursor position, and the first 7 unique control codes reading from the left of the screen. If more than 8 unique control codes appear in one screen, additional control characters will be indicated as non-displayable control codes by an “]” symbol. You can display the actual control character by moving the display cursor to that position.

# APPENDIX G: Transcode to Hexadecimal Translation Table

CHAR.	HEX	CHAR.	HEX
A	01	0	30
B	02	1	31
C	03	2	32
D	04	3	33
E	05	4	34
F	06	5	35
G	07	6	36
H	08	7	37
I	09	8	38
J	11	9	39
K	12	SPACE	1A
L	13	.	0B
M	14	,	2B
N	15	*	1C
O	16	\$	1B
P	17	#	3B
Q	18	/	21
R	19	-	20
S	22	&	10
T	23	<	0C
U	24	%	2C
V	25	@	3C
W	26		
X	27		
Y	28		
Z	29		

**Transcode Control Codes**

<b>TRANSCODE CHARACTER</b>	<b>HEX VALUE</b>	<b>CHARACTER DISPLAYED</b>	<b>DESCRIPTION</b>
SOH	00	SH	Start of Heading
STX	0A	Sx	Start of Text
ETX	2E	Ex	End of Text
EOT	1E	ET	End of Transmission
ENQ	2D	EQ	Enquiry
BEL	0D	BL	Bell
HT	2F	HT	Horizontal Tab.
DLE	1F	DL	Data Link Escape
NAK	3D	Nk	Negative Acknowledge
SYN	3A	SY	Synchronous Idle
ETB	0F	EB	End of Trans. Block
EM	3E	EM	End of Medium
SUB	0E	SB	Substitute
ESC	2A	EC	Escape
US	1D	US	Unite Separator
DEL	3F	■	Delete

**NOTE:** Control codes appear on the LCD display in a single character position, written sideways. The display shows specific control codes only in the cursor position, and the first 7 unique control codes reading from the left of the screen. If more than 8 unique control codes appear in one screen, additional control characters will be indicated as non-displayable control codes by a “]” symbol. You can display the actual control character by moving the display cursor to that position.

# APPENDIX H: IPARS to Hexidecimal Translation Table

<b>IPARS CHARACTER</b>	<b>HEX VALUE</b>	<b>CHARACTER DISPLAYED</b>	<b>DESCRIPTION</b>
NUL	3F	NU	Null
STX	20	Sx	Start of Text
ETX	12	Ex	End of Text
EOT	13	ET	End of Transmission
BS	30	BS	Backspace
CR	33	CR	Carriage Return
SYN	00	SY	Synchronous Idle
EM	20	EM	End of Medium
ESC	11	EC	Escape
GS	03	GS	Group Separator
DEL	3E	■	Delete

# APPENDIX I: Default setup Parameter Values

PARAMETER	APPLICABILITY	DEFAULT
ALARM	BERT	ERRORED SECOND
	SEND DATA, MONITOR	OFF
	SDLC	
	TRAP	TRIGGER EVENT
	POLLING MASTER	MISSED RESPONSE
BIT RATE	EVENT TIMER	START EVENT
	ASYNCH MODE	9600
	BIAS DISTORTION	9600
BLOCK SIZE	SYNC MODE	EXTERNAL
	BERT	10 <sup>3</sup> BITS
CHAR SUPPRESSED	SYNC	OFFH
CONFIGURATION	ALL	LAST SETUP
CONTROL INPUT	TRAP	CTS (PIN 5)
	DTE, HW FLOW	CTS (PIN 5)
	DTE, HW FLOW	CTS (PIN 20)
	DCE, HW FLOW	RTS (PIN 4)
CONTROL OUTPUT	DTE, HW FLOW	CTS (PIN 5)
	DCE, HW FLOW	XON
CONTROL ON	SW FLOW CONTROL	XOFF
CONTROL OFF	SW FLOW CONTROL	AFTER TRIGGER
DATA COLLECTION	TRAP	NONE
FLOW CONTROL	SERIAL FORMAT	SERIAL
FORMAT	ALL	BEFORE PRINTOUT
FORM FEED	PRINT TEST DATA	00H
FRAME ADDRESS	TRAP SDLC	SIMULATE DTE
INTERFACE	SERIAL FORMAT	ASCII
LANGUAGE	ALL	USER#1
MATCH MESSAGE	USER MESSAGE	
	MATCH	
MESSAGE CHOICE	USER MESSAGE	CONTINUOUS
MESSAGE MODE	SEND/TRAP DATA	DRIVE INTERFACE
MONITOR MODE	TRAP	NONE
PARITY	SERIAL FORMAT	63PR
PATTERN	BERT	MASTER
POLL MODE	POLLING	POLL A
POLL TEST	POLL MASTER	

<b>PARAMETER</b>	<b>APPLICABILITY</b>	<b>DEFAULT</b>
POWER REMINDER	ALL	ON
PRINT	PRINT TEST DATA	TRAP BUFFER DATA
PRINTER TYPE	PARALLEL FORMAT	CENTRONICS
PRINT STATUS ON	BERT, MONITOR SDLC	PRINT KEY ONLY
REVISE MESSAGE	USER MESSAGE	NO CHANGE
SELF TEST	SELF TEST	ROM CHECKSUM
SEND MESSAGE	SEND DATA	FOX
SERIAL MODE	SERIAL FORMAT	ASYNCHRONOUS
START TIMER ON	EVENT TIMER	RTS (PIN 4) OFF->ON
STOP BITS	ASYNCH MODE	1
STOP TIMER ON	EVENT TIMER	CTS (5) OFF->ON
STORE SETUP?	ALL	NO
SYNC CHARACTERS	SYNC MODE	2
SYNC CHAR. #1	SYNC MODE	16H
SYNC CHAR. #2	SYNC MODE	16H
SUPPRESS CHARS	SYNC	NONE
TRAP	TRAP SDLC	ALL FRAMES
TRAP BUFFER	SEND, USER MESSAGE	TD
TRAP DATA ON	TRAP DATA	START OF TEST
TRANSMISSION	POLLING	FULL DUPLEX
TEST	ALL	ANALYZE DEVICE
TEST LENGTH	BERT	CONTINUOUS
USER CONTROL ON	USER CHARACTER	11H
USER CONTROL OFF	USER CHARACTER	13H
WORD LENGTH	ALL	8 BITS