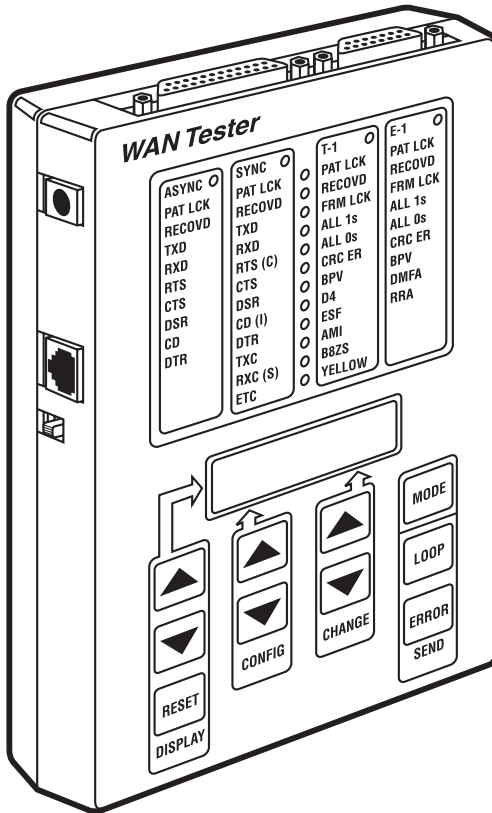


# WAN Tester



CUSTOMER  
SUPPORT  
INFORMATION

Order toll-free in the U.S.: Call 877-877-BBOX (outside U.S. call 724-746-5500)  
FREE technical support 24 hours a day, 7 days a week: Call 724-746-5500 or fax 724-746-0746  
Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018  
Web site: [www.blackbox.com](http://www.blackbox.com) • E-mail: [info@blackbox.com](mailto:info@blackbox.com)

**FEDERAL COMMUNICATIONS COMMISSION  
AND  
INDUSTRY CANADA  
RADIO FREQUENCY INTERFERENCE STATEMENTS**

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 J 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

*This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.*

*Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.*

## **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.

### TRADEMARKS USED IN THIS MANUAL

VT100™ is a trademark of Digital Equipment Corporation.

*Any other trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.*

## **Important Safety Instructions**

1. Do not allow anything to rest on the power cord and do not locate the product where persons will walk on the power cord.
2. Do not attempt to service this product yourself, as opening or removing covers may expose you to dangerous high-voltage points or other risks. Refer all servicing to qualified service personnel.
3. Cables that work with this product include TS941, TS942, and TS943. Special cables, which may be required by the regulatory inspection authority for this installation site, are the responsibility of the customer.
4. When installed in the final configuration, the product must comply with the applicable safety standards and regulatory requirements of the country in which it is installed. If necessary, consult with the appropriate regulatory agencies and inspection authorities to ensure compliance.
5. A rare phenomenon can create voltage potential between the earth grounds of two or more buildings. If products installed in separate buildings are interconnected, the voltage potential may cause hazardous conditions. Consult a qualified electrical consultant to determine whether or not this phenomenon exists and, if necessary, implement corrective action prior to interconnecting the products.

In addition, if the equipment is to be used with telecommunications circuits, take the following precautions:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.

# Contents

Chapter	Page
1. Specifications . . . . .	8
1.1 General . . . . .	8
1.2 Asynchronous Mode . . . . .	9
1.3 Synchronous Mode . . . . .	10
1.4 T1 Mode . . . . .	13
1.5 E1 Mode . . . . .	16
2. Introduction . . . . .	19
2.1 Description . . . . .	19
2.2 Applications . . . . .	20
3. Configuration . . . . .	22
3.1 General . . . . .	22
3.2 Operation . . . . .	22
3.3 Asynchronous Mode . . . . .	23
3.4 Synchronous Mode . . . . .	27
3.5 T1 Mode . . . . .	33
3.6 E1 Mode . . . . .	39
3.7 Utilities Mode . . . . .	43
4. Interfaces and Cables . . . . .	45
4.1 Network Interface . . . . .	45
4.2 X.21 Interface . . . . .	45
4.3 RS-232/RS-530/RS-422 Interfaces . . . . .	46
4.4 CCITT V.35 Interface . . . . .	48
4.5 Console Interface . . . . .	49
4.6 Cables . . . . .	49
5. Console Port . . . . .	57
5.1 General . . . . .	57
5.2 Cabling a Terminal to the Console Port . . . . .	57
5.3 Cabling a Modem to the Console Port . . . . .	57
5.4 Console Port Operation . . . . .	57
5.4.1 Activating the Console . . . . .	59
5.4.2 Displaying Screens for Each Mode . . . . .	59
5.4.3 Changing the Password . . . . .	59
5.4.4 Deactivating the Console . . . . .	59

<b>Chapter</b>	<b>Page</b>
5.5 T1 Menu .....	60
5.6 E1 Menu .....	61
5.7 Async Menu .....	62
5.8 Sync Menu .....	63
5.9 Utilities Menu .....	64
6. Battery Power .....	66
7. Troubleshooting .....	67
7.1 Calling Black Box .....	67
7.2 Shipping and Packaging .....	67



# 1. Specifications

## 1.1 General

**Switches:** (10) buttons: Display Reset, Display (Up Arrow and Down Arrow), Configure (Up Arrow and Down Arrow), Change (Up Arrow and Down Arrow), Send Loop, Send Error, Mode

**Console Port:** Compatible with VT100™ CRTs; RS-232 interface with speed of 9600 bps, 8 data bits, 1 stop bit, and no parity; Supports dial-in modems; Control “D” used for disconnect

**Loopbacks Generated:** V.54 Loop (T1, E1, and synchronous modes); CSU Loop (T1 only); Smart Jack 1 Framed Loop (T1 only); Smart Jack 1 Unframed Loop (T1 only); Smart Jack 2 Framed Loop (T1 only); Smart Jack 2 Unframed Loop (T1 only)

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

**Relative Humidity:** Up to 95% noncondensing

**Power:** Wall-mounted power pack, 90 to 130 VAC, 57 to 63 Hz, 6 watts, 21 BTU/hr.

**Size:** 5"H x 7"W x 1.6"D (12.7 x 17.8 x 4.1 cm)

**Weight:** 1 lb. (0.5 kg)

## 1.2 Asynchronous Mode

**Speed:** 28 standard speeds from 50 bps to 115,200 bps

**Interface:** Electrical: RS-232, RS-422/RS-530, CCITT V.35; Mechanical: DB25 pin female

**Indicators:** PAT LCK, RECOVD, TXD, RXD, RTS, CTS, DSR, CD, DTR

<b>Indicator</b>	<b>Function</b>
<b>PAT LCK</b>	<b>ON when the test pattern is good.</b>
<b>RECOVD</b>	<b>ON anytime the unit recovers synchronization.</b>
<b>TXD</b>	<b>ON when TX data is spacing from the tester to the DCE device.</b>
<b>RXD</b>	<b>ON when RX data is spacing from the DCE device to the tester.</b>
<b>RTS</b>	<b>ON when RTS from the tester to the DCE device is ON.</b>
<b>CTS</b>	<b>ON when CTS from the DCE device to the tester is ON.</b>
<b>DSR</b>	<b>ON when DSR from the DCE device to the tester is ON.</b>
<b>CD</b>	<b>ON when CD from the DCE device to the tester is ON.</b>
<b>DTR</b>	<b>ON when DTR from the tester to the DCE device is ON.</b>

**Displays:** CHAR ERRS, CHAR RCVD, TEST SEC, ERR SECS

<b>Display</b>	<b>Function</b>
<b>CHAR ERRS</b>	<b>Displays the number of characters in error received since the last Reset Display command. Counts up to 999,999,999 characters in error.</b>
<b>CHAR RCVD</b>	<b>Displays the total number of characters received since the last Reset Display command. Counts up to 999,999,999 characters.</b>
<b>TEST SEC</b>	<b>Displays the total number of seconds that the unit has been in test since the last Reset Display command. Counts up to 999,999 seconds.</b>
<b>ERR SECS</b>	<b>Displays the number of seconds the unit was in test with errors occurring during those seconds since the last Reset Display command. Counts up to 999,999 seconds.</b>

Pattern Generator and Checker	Function
511	Generates and checks a 511-bit pseudo-random pattern.
2 <sup>11</sup> (2047)	Generates and checks a 2 <sup>11</sup> (2047) bit pseudo-random pattern.
Binary	Generates and checks a sequential binary pattern.
Fox Test	Generates the fox message for testing terminals ( <i>THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG</i> ).
Mark	Generates and checks a pattern of continuous marks.
Space	Generates and checks a pattern of continuous spaces.

## 1.3 Synchronous Mode

**Speed:** 75 speeds from 1200 bps to 2.048 Mbps

**Interface:** Electrical: RS-232, RS-422/RS-530, CCITT V.35, X.21; Mechanical: RS-232, RS-422/RS-530, V.35 DB25 pin female, X.21 DB15 pin female

Indicator	Function
PAT LCK	ON when test pattern is good.
RECOVD	ON anytime unit recovers synchronization.
TXD	ON when TX data is spacing from tester to DCE device.
RXD	ON when RX data is spacing from the DCE device to the tester.
RTS (C)	ON when RTS (Control in X.21) from the tester to the DCE device is ON.
CTS	ON when CTS from the DCE device to the tester is ON.
DSR	ON when DSR from the DCE device to the tester is ON.
CD (I)	ON when CD (Indicator in X.21) from the DCE device to the tester is ON.
DTR	ON when DTR from the tester to the DCE device is ON.

Indicator	Function
TXC	ON when the tester is accepting Transmit Clock.
RXC (S)	ON when Receive Clock (Source in X.21) is present
ETC	ON when the tester is providing External Transmit Clock.

Displays	Function
ERRS	Displays up to 9,999,999,999 bit errors.
BER	Displays Bit Error Rate, which is the number of bits in error divided by the number of bits in scientific notation. Range is $1.00 \times 10^{e-11}$ to $9.99 \times 10^{e+11}$ .
TX FREQ	Measures the frequency of the Transmit Clock.
RX FREQ	Measures the frequency of the Receive Clock.
TEST SEC	Displays the total number of seconds the unit has been in test since the last Reset Display command. Counts up to 999,999 seconds.
ERR SECS	Displays the number of seconds the unit was in test with errors occurring during those seconds since the last Reset Display command. Counts up to 999,999 seconds.
SES	Displays the number of Severely Errored Seconds that have occurred since the last Reset Display command. A Severely Errored Second is any second that has a bit error rate of more than 1 error in every thousand bits ( $1 \times 10^{e-3}$ ). Counts up to 999,999 seconds.
DEG MIN	Displays the number of Degraded Minutes that have occurred since the last Reset Display command. A Degraded Minute is any minute with a bit error rate worse than 1 bit every million bits. Counts up to 999,999 seconds (11.57 days).
AVAIL	A period of Available Seconds begins when the bit error rate in each second is better than 1 error in every 1000 bits for a period of 10 consecutive seconds. These 10 seconds are considered to be available seconds. Each second thereafter with a bit error rate better than 1 in every 1000 bits is counted as an available second until unavailable time occurs. During available and unavailable time, seconds with a bit error rate of exactly 1 in 1000 are not counted.

Displays	Function
UNAVAIL	A period of Unavailable Seconds begins when the bit error rate in each second is worse than 1 error in every 1000 bits for a period of 10 consecutive seconds. These 10 seconds are considered to be unavailable seconds. Each second thereafter with a bit error rate worse than 1 in every 1000 bits is counted as an unavailable second until available time occurs. During available and unavailable time, seconds with a bit error rate of exactly 1 in 1000 are not counted.
RTS TIME	Displays the number of milliseconds that have elapsed from the tester raising RTS to receiving Clear-to-Send high since the last Reset Display command. Counts up to 9999 milliseconds (10 seconds).
BITS	Displays the number of bits received. Counts up to 9,999,999,999 bits.

Pattern Generator and Checker	Function
511	Generates and checks a 511-bit pseudo-random pattern.
$2^{11}$ (2047)	Generates and checks a $2^{11}$ (2047) bit pseudo-random pattern.
$2^{15}$ (32767)	Generates and checks a $2^{15}$ (32767) bit pseudo-random pattern.
QRSS	Generates and checks a Quasi-Random Signal Source.
$2^{20}$ (1,048,575)	Generates and checks a $2^{20}$ (1,048,575) bit pseudo-random pattern.
$2^{23}$ (8,388,607)	Generates and checks a $2^{23}$ (8,388,607) bit pseudo-random pattern.
1 of 8	Generates and checks a pattern of 1 bit marking and 7 bits spacing.
3 of 24	Generates and checks a pattern of 3 bits marking and 21 bits spacing.
Alt	Generates and checks a pattern of even bits marking and odd bits spacing between framing bits.

<b>Pattern Generator and Checker</b>	<b>Function</b>
<b>Mark</b>	<b>Generates and checks a pattern of continuous marks.</b>
<b>Space</b>	<b>Generates and checks a pattern of continuous spaces.</b>

## 1.4 T1 Mode

**Speed:** 1.544 ±50 bps

**Interface Termination:** 8-position RJ-45 and dual Bantam jacks in parallel; (2) BNC connectors

<b>Indicators</b>	<b>Function</b>
<b>PAT LCK</b>	<b>ON when test pattern is good.</b>
<b>RECOVD</b>	<b>ON anytime the unit recovers synchronization.</b>
<b>FRM LCK</b>	<b>ON when the unit is frame-locked to the T1 network.</b>
<b>ALL 1s</b>	<b>ON when all marks are detected on the receive data interface.</b>
<b>ALL 0s</b>	<b>ON when all spaces are detected on the receive data interface.</b>
<b>CRC ER</b>	<b>Blinks when a CRC error is detected on the receive data interface.</b>
<b>BPV</b>	<b>Blinks when a Bipolar Variation is detected on the receive data interface.</b>
<b>D4</b>	<b>ON when the unit is set to D4 framing mode.</b>
<b>ESF</b>	<b>ON when the unit is set to ESF framing mode.</b>
<b>AMI</b>	<b>ON when the unit is set to AMI coding.</b>
<b>B8ZS</b>	<b>ON when the unit is set to B8ZS coding.</b>
<b>YELLOW</b>	<b>ON when the unit detects a yellow alarm on the receive data.</b>
<b>Displays</b>	<b>Function</b>
<b>ERRS</b>	<b>Displays up to 9,999,999,999 bit errors.</b>

<b>Displays</b>	<b>Function</b>
<b>BER</b>	Displays Bit Error Rate, which is the number of bits in error divided by the number of bits in scientific notation. Range is $1.00 \times 10^{e-11}$ to $9.99 \times 10^{e-11}$ .
<b>TX FREQ</b>	Measures the frequency of the Transmit Clock.
<b>RX FREQ</b>	Measures the frequency of the Receive Clock.
<b>TEST SEC</b>	Displays the total number of seconds the unit has been in test since the last Reset Display command. Counts up to 999,999 seconds.
<b>ERR SECS</b>	Displays the number of seconds the unit was in test with errors occurring during those seconds since the last Reset Display command. Counts up to 999,999 seconds.
<b>SES</b>	Displays the number of Severely Errored Seconds that have occurred since the last Reset Display command. A Severely Errored Second is any second that has a bit error rate of more than 1 error in every thousand bits ( $1 \times 10^{-3}$ ). Counts up to 999,999 seconds.
<b>DEG MIN</b>	Displays the number of Degraded Minutes that have occurred since the last Reset Display command. A Degraded Minute is any minute with a bit error rate worse than 1 bit every million bits. Counts up to 999,999 seconds (11.57 days).
<b>AVAIL</b>	A period of Available Seconds begins when the bit error rate in each second is better than 1 error in every 1000 bits for a period of 10 consecutive seconds. These 10 seconds are considered to be available seconds. Each second thereafter with a bit error rate better than 1 in every 1000 bits is counted as an available second until unavailable time occurs. During available and unavailable time, seconds with a bit error rate of exactly 1 in 1000 are not counted.
<b>UNAVAIL</b>	A period of Unavailable Seconds begins when the bit error rate in each second is worse than 1 error in every 1000 bits for a period of 10 consecutive seconds. These 10 seconds are considered to be unavailable seconds. Each second thereafter with a bit error rate worse than 1 in every 1000 bits is counted as an unavailable second until available time occurs. During available and unavailable time, seconds with a bit error rate of exactly 1 in 1000 are not counted.

<b>Displays</b>	<b>Function</b>
<b>RX LEVEL</b>	Displays the receive level of the T1 signal in decibels. Range is +2 to -33 dB. The RX level measurement will vary depending on the type of T1 data being received.
<b>FE ERRS</b>	Displays the number of framing errors that have occurred since the last Reset Display command. Counts up to 999,999 FE errors.
<b>CRC ERRS</b>	When ESF framing is selected, displays the number of CRC (Cyclic Redundancy Check) errors that have occurred since the last Reset Display command. When D4 framing is selected, displays the number of Fs (Superframe alignment) errors. Counts up to 999,999 CRC or Fs errors.
<b>BPV ERRS</b>	Displays the number of BPV (Bipolar Violation) errors that have occurred since the last Reset Display command. Counts up to 999,999 BPV errors.

<b>Pattern Generator and Checker</b>	<b>Function</b>
<b>511</b>	Generates and checks a 511-bit pseudo-random pattern.
<b>2<sup>11</sup> (2047)</b>	Generates and checks a 2 <sup>11</sup> (2047) bit pseudo-random pattern.
<b>2<sup>15</sup> (32767)</b>	Generates and checks a 2 <sup>15</sup> (32767) bit pseudo-random pattern.
<b>QRSS</b>	Generates and checks a Quasi-Random Signal Source.
<b>2<sup>20</sup> (1,048,575)</b>	Generates and checks a 2 <sup>20</sup> (1,048,575) bit pseudo-random pattern.
<b>2<sup>23</sup> (8,388,607)</b>	Generates and checks a 2 <sup>23</sup> (8,388,607) bit pseudo-random pattern.
<b>1 of 8</b>	Generates and checks a pattern of 1 bit marking and 7 bits spacing.
<b>3 of 24</b>	Generates and checks a pattern of 3 bits marking and 21 bits spacing.
<b>Alt</b>	Generates and checks a pattern of even bits marking and odd bits spacing between framing bits.



<b>Pattern Generator and Checker</b>	<b>Function</b>
<b>Mark</b>	<b>Generates and checks a pattern of continuous marks on all bits between framing bits.</b>
<b>Space</b>	<b>Generates and checks a pattern of continuous spaces on all bits between framing bits.</b>
<b>T1 Daly FR</b>	<b>Generates and checks T1 Daly framed stress pattern.</b>
<b>T1 Daly UF</b>	<b>Generates and checks T1 Daly unframed stress pattern.</b>
<b>55 OCT FR</b>	<b>Generates and checks 55 Octet framed stress pattern.</b>
<b>55 OCT UF</b>	<b>Generates and checks 55 Octet unframed stress pattern.</b>

## 1.5 E1 Mode

**Speed:** 2.048 Mbps  $\pm$ 50 bps with HDB3 coding

**Interface Termination:** 8-position RJ-45 and dual Bantam jacks in parallel; (2) BNC connectors

<b>Indicators</b>	<b>Function</b>
<b>PAT LCK</b>	<b>ON when the test pattern is good.</b>
<b>RECOVD</b>	<b>ON anytime the unit recovers synchronization.</b>
<b>FRM LCK</b>	<b>ON when the unit is frame-locked to the E1 network.</b>
<b>ALL 1s</b>	<b>ON when all marks are detected on the receive data interface.</b>
<b>ALL 0s</b>	<b>ON when all spaces are detected on the receive data interface.</b>
<b>CRC ER</b>	<b>ON when a CRC error is detected on the receive data interface.</b>
<b>BPV</b>	<b>ON when a Bipolar Variation is detected on the receive data interface.</b>
<b>DMFA</b>	<b>ON when Distant Multiframe Alarm (bit 6 in timeslot 16 in frame 0) is set on the receive data interface.</b>

<b>Indicator</b>	<b>Function</b>
<b>RRA</b>	ON when Receive Remote Alarm (bit 3 in timeslot 0 in every odd-numbered frame) is set on the receive data interface.
<b>Display</b>	<b>Function</b>
<b>ERRS</b>	Displays up to 9,999,999,999 bit errors.
<b>BER</b>	Displays Bit Error Rate, which is the number of bits in error divided by the number of bits in scientific notation. Range is $1.00 \times 10^{e-11}$ to $9.99 \times 10^{e+11}$ .
<b>TX FREQ</b>	Measures the frequency of the Transmit Clock.
<b>RX FREQ</b>	Measures the frequency of the Receive Clock.
<b>TEST SEC</b>	Displays the total number of seconds the unit has been in test since the last Reset Display command. Counts up to 999,999 seconds.
<b>ERR SECS</b>	Displays the number of seconds the unit was in test with errors occurring during those seconds since the last Reset Display command. Counts up to 999,999 seconds.
<b>SES</b>	Displays the number of Severely Errored Seconds that have occurred since the last Reset Display command. A Severely Errored Second is any second that has a bit error rate of more than 1 error in every thousand bits ( $1 \times 10^{e-3}$ ). Counts up to 999,999 seconds.
<b>DEG MIN</b>	Displays the number of Degraded Minutes that have occurred since the last Reset Display command. A Degraded Minute is any minute with a bit error rate worse than 1 bit every million bits. Counts up to 999,999 seconds (11.57 days).
<b>AVAIL</b>	A period of Available Seconds begins when the bit error rate in each second is better than 1 error in every 1000 bits for a period of 10 consecutive seconds. These 10 seconds are considered to be available seconds. Each second thereafter with a bit error rate better than 1 in every 1000 bits is counted as an available second until unavailable time occurs. During available and unavailable time, seconds with a bit error rate of exactly 1 in 1000 are not counted.

<b>Display</b>	<b>Function</b>
<b>UNAVAIL</b>	A period of Unavailable Seconds begins when the bit error rate in each second is worse than 1 error in every 1000 bits for a period of 10 consecutive seconds. These 10 seconds are considered to be unavailable seconds. Each second thereafter with a bit error rate worse than 1 in every 1000 bits is counted as an unavailable second until available time occurs. During available and unavailable time, seconds with a bit error rate of exactly 1 in 1000 are not counted.
<b>Pattern Generator and Checker</b>	<b>Function</b>
<b>511</b>	Generates and checks a 511-bit pseudo-random pattern.
<b>2<sup>11</sup> (2047)</b>	Generates and checks a 2 <sup>11</sup> (2047) bit pseudo-random pattern.
<b>2<sup>15</sup> (32767)</b>	Generates and checks a 2 <sup>15</sup> (32767) bit pseudo-random pattern.
<b>QRSS</b>	Generates and checks a Quasi-Random Signal Source.
<b>2<sup>20</sup> (1,048,575)</b>	Generates and checks a 2 <sup>20</sup> (1,048, 575) bit pseudo-random pattern.
<b>2<sup>23</sup> (8,388,607)</b>	Generates and checks a 2 <sup>23</sup> (8,388,607) bit pseudo-random pattern.
<b>1 of 8</b>	Generates and checks a pattern of 1 bit marking and 7 bits spacing.
<b>3 of 24</b>	Generates and checks a pattern of 3 bits marking and 21 bits spacing.
<b>Alt</b>	Generates and checks a pattern of even bits marking and odd bits spacing between framing bits.
<b>Mark</b>	Generates and checks a pattern of continuous marks on all bits between framing bits.
<b>Space</b>	Generates and checks a pattern of continuous spaces on all bits between framing bits.

## 2. Introduction

### 2.1 Description

The WAN Tester is a sophisticated bit error rate tester in a compact, hand-held package. It can analyze asynchronous, synchronous, T1, Fractional T1, and Fractional E1 communications facilities and their respective NCTEs (DCEs).

The WAN Tester includes a 130-V power pack. It also includes a battery option, as described in **Chapter 6**.

The Tester comes with RS-232, RS-422/RS-530, V.35, X.21, DS1 (T1, 1.544 Mbps) and G.703 (E1, 2.048 Mbps) interfaces. The RS-232, RS-422/530 and V.35 interfaces are provided on DB25 connectors. The X.21 interface uses a DB15 connector. The T1 and E1 interfaces are provided on RJ-45 and bantam connectors. The Tester also includes two BNC connectors for T1 and E1 interfaces.

In the T1 and E1 modes, the WAN Tester counts and displays bit errors, transmit and receive frequency, test seconds, bit error rate, and G.821 performance measurements. In the T1 mode, it also displays receive level, FE errors, CRC errors, and BPV errors. A variety of test patterns can be inserted in all or selected time slots/DSOs, contiguous or non-contiguous, making the WAN Tester ideal for fractional T1 and E1 testing.

In the asynchronous and synchronous test modes, the WAN Tester generates test data in a choice of patterns and formats. The user can choose from a selection of 28 asynchronous and 75 synchronous speeds. In the async mode, the tester counts and displays character errors, characters received, total test seconds and errored seconds. In the synchronous mode, it counts and displays bit errors, bit error rate, total test seconds, and errored seconds in addition to displaying transmit frequency, receive frequency, clear to send delay, bits received, and G.821 performance measurements (errored seconds, degraded minutes, and available and unavailable times).

The WAN Tester is extremely easy to use. It includes a 2-line by 16-character LCD display that shows selected mode, test, and operating parameters. Parameters are selected by scrolling through values stored in the tester.

The WAN Tester also includes a console port which supports VT100s, PCs in terminal emulation mode, and dial-in modems. Each unit includes a wall-mounted power pack.

The following is a sample list of some of the facilities and devices the WAN Tester can test:

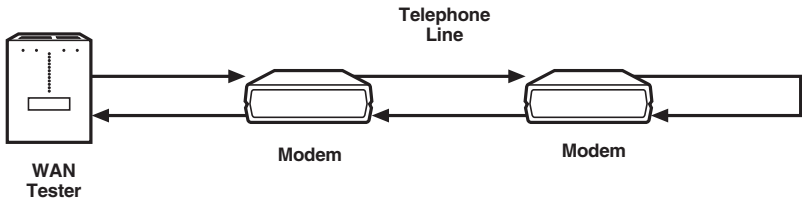
- A leased line with modems or LDMs on each end.
- A T1 facility with T1 CSUs on each end.
- A Fractional T1 facility.
- A DDS link with CSU/DSUs on each end.
- A satellite link with modems on each end.
- A 2.048-Mbps facility with Network Terminating Units on each end.
- Time-division, Statistical, T1, and E1 multiplexors.
- Terminals.

## 2.2 Applications

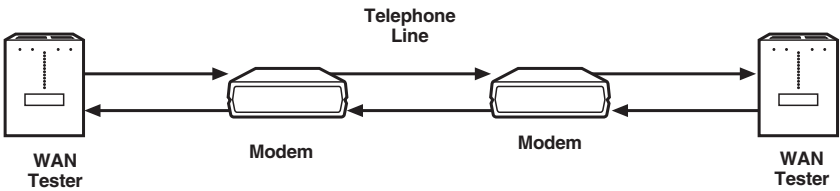
Designed to fulfill the requirements of a broad range of applications, the tester may be used to test data communications equipment, networks, systems, and line facilities. The tester simulates real data passing through a data communications link, and then determines the performance of a piece of equipment or that of a network. Many standard data patterns may be generated and recovered. The tester then monitors the data passing through the data communications link and indicates line quality by comparing the data that has been received with the data that was known to have been transmitted.

Typical applications include, but are not limited to, final test departments, field installations of data communications equipment, field evaluations of data communications equipment, field monitoring of data communications facilities, and field problem isolation.

You can use the WAN Tester by itself at either end of the system being tested as shown in Figure 2-1 or in pairs as illustrated in Figure 2-2.



**Figure 2-1.** This application shows a single WAN Tester testing a telephone line and a pair of modems. The remote modem is in loopback.



**Figure 2-2.** This application shows a pair of WAN Testers testing a telephone line and a pair of modems.

## 3. Configuration

### 3.1 General

The WAN Tester is very easy to program to meet a variety of user applications. The unit may be programmed using buttons on the front of the unit or through the async console port (described in **Chapter 5**). This chapter describes configuring the unit with the buttons.

The WAN Tester is shipped from the factory pre-programmed with a default configuration for all five MODES (Asynchronous, Synchronous, T1, E1, and Utilities). It is also programmed to power up in T1 Mode.

All of these pre-programmed configurations, as well as the power-on MODE, can be changed by the following procedure:

In each of the five MODES, there is a CONFIG display labeled "SAVE EEPROM." With the SAVE field displayed, hitting either the UP or DOWN CHANGE button will cause the current configuration *of that MODE only* to be saved to EEPROM (non-volatile memory which will retain the configuration after power is removed from the unit). In addition to saving the configuration of that MODE, it will make that MODE the new power-on default. This means that the last MODE saved before power is removed will be the new power-on default.

### 3.2 Operation

The WAN Tester includes a 2-line by 16-character backlit LCD display and 16 LED indicators that show test data and selected mode, test, and operating parameters. Select parameters by scrolling through values stored in the tester.

The backlit LCD display lights when the Tester is powered up.

If you do not press a key within four minutes, the backlit display turns off. The first key you press when the display is off lights the display and ignores the key you pressed.

All operations can be performed using only ten buttons. The buttons are described below.

**Display Reset:** The Display Reset button resets the counter of a selected field. The counters are shown on the first line of the display.

**Display Pair (Up/Down Arrows):** The Display Up/Down Arrow moves vertically through all the counter displays of a selected mode. If the desired display is passed when pressing the Up Arrow, the Down Arrow reverses the selection so you don't have to scroll all the way around the choices again.

**Config Pair (Up/Down Arrows):** The Config Up/Down Arrows move vertically through all the configuration parameters in each mode of operation (Asynchronous, Synchronous, T1, E1). The configuration parameters and options for each parameter are shown on the second line of the display.

**Change Pair (Up/Down Arrows):** The Change Up/Down Arrows select or change the configuration options for a selected parameter. The Change Down Arrow changes the choices for a selected parameter in the reverse direction. The Change Down Arrow is especially convenient when scrolling through a change field that has many choices for a selected parameter. If you pass the desired option when you press the Up Arrow, the Down Arrow reverses the selection so you don't have to scroll all the way around the choices again.

**Send Loop:** The Send Loop button initiates a loopback command whenever you are on a loop field.

**Send Error:** The Send Error button inserts an error into the data stream.

**Mode:** The Mode button changes the mode from any point on the LCD display. You do not have to be on the Mode field to change modes.

### **3.3 Asynchronous Mode**

**Parameter Fields:** There are eleven parameter fields in the Async Mode. The following is a description of these fields.

**Mode:** The mode field consists of five choices: Async, Sync, T1, E1, and Utilities. The mode can be changed by pressing the MODE button until the desired mode appears or by the following procedure.

Press the UP or DOWN CONFIG button until the MODE field is displayed. With the mode field displayed, press the UP or DOWN CHANGE button until the desired mode appears on the display. With the selected mode displayed, press the UP or DOWN CONFIG button to view the options for the selected mode.



**Output Data:** The Output Data field controls the output of the WAN Tester. The following describes the two selections in this field.

- **Norm:** The Normal selection permits data from the Pattern selection to be transmitted.
- **Loop:** The Loop selection inserts a bi-directional loopback at the output of the WAN Tester. This means data from the WAN Tester is looped back to itself and Received Data coming from the DCE is looped back to the DCE. This selection also is used to self-test the WAN Tester.

**Interface:** The interface field contains four different interface choices: V.35, RS-530, RS-422, and RS-232.

- **V.35:** The V.35 interface in the Async Mode provides five balanced interface signals, five unbalanced interface signals, and ground. When V.35 is selected, a 25-pin male to 34-pin male Winchester adapter cable may be used.
- **RS-530:** The RS-530 interface in the Async Mode provides seven balanced interface signals, three unbalanced signals, and ground through the DB25 pin female connector.
- **RS-422:** The RS-422 interface in the Async Mode provides seven balanced interface signals, three unbalanced signals, and ground through the DB25 pin female connector. When you select RS-422, you may use a 25-pin male to 37-pin male adapter cable.
- **RS-232:** The RS-232 interface in the Async Mode provides ten interface signals plus ground through the DB25 pin female connector.

**Speed:** The speed field in the Async Mode contains 28 speed choices. The following speeds in bps are available in this field:

50	600	4800	19,200
75	1000	7200	38,400
110	1200	9600	56,000
134.5	1800	12,800	57,600
150	2000	14,400	64,000
200	2400	16,000	72,000
300	3600	16,800	115,200

**Pattern:** In the Async Mode, the pattern field has six choices: 511, 2<sup>11</sup> (2047), Binary, Fox Test, Mark, and Space. With the exception of Mark and Space, the patterns are inserted into characters being transmitted.

The following is a description of the six pattern fields:

- 511: This pattern is a 511-bit pseudo-random pattern. It is inserted in the data bits in the transmitted character between the start space and parity bit/stop mark. The receiver checks for this pattern and will increment the Character Error counter for each character received that does not match it.
- 2<sup>11</sup> (2047): This pattern is a 2047-bit pseudo-random pattern. It is inserted in the data bits in the transmitted character between the start space and parity bit/stop mark. The receiver checks for this pattern and will increment the Character Error counter for each character received that does not match it.
- Binary: The Binary pattern is a binary up counter starting from all zeros (all data bits spacing) and counting up to all ones (all data bits marking). It is inserted in the data bits between the start space and parity bit/stop mark of the transmitted character. The receiver checks for this pattern and will increment the Character Error counter for each character received that does not match it.
- Fox Test: The Fox Test generates the following message: THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. It is inserted in the data bits in the transmitted character between the start space and parity bit/stop mark. This pattern is useful for testing devices such as terminals where a repetitive sentence is more easily recognizable than a complex test pattern. The Fox Test is not error-checked.
- Mark: The Mark selection overrides the character framing and transmits continuous marks out the Transmit Data lead. The Mark pattern is not error-checked.
- Space: The Space selection overrides the character framing and transmits continuous spaces out the Transmit Data lead. The Space pattern is not error-checked.

**Data Bits:** The Data Bits field selects the number of data bits in the character. There are four choices in this field: 5, 6, 7 and 8. The number of data bits does not include the start space, parity, or the stop mark.

**Stop Mark:** This selection adds 1, 1.5, or 2 stop marks to the character.

**Parity:** The Parity field has four choices: None, Mark, Odd, and Even. The following is a description of these fields:

- **None:** When the None selection for Parity is chosen, the character does not have any parity and consists of a start space, up to eight data bits, and up to two stop marks.
- **Mark:** The Mark Parity selection adds one marking parity bit to the character so the character will consist of one start space, up to eight data bits, one marking parity bit, and up to two stop marks.
- **Odd:** When Odd Parity is selected, an odd parity bit is added to the data bits in the character. If the data bits contain an even number of marking bits, the parity bit will be mark, making the number of marks in the data bits and parity bit Odd. If the data bits contain an odd number of marking bits, the parity bit will be space, leaving the total number of marks in the data bits and parity bit Odd. The character will consist of one start space, up to eight data bits, an odd parity bit, and up to two stop marks.
- **Even:** When Even Parity is selected, an even parity bit is added to the data bits in the character. If the data bits contain an even number of marking bits, the parity bit will be space, leaving the number of marks in the data bits and parity bit Even. If the data bits contain an odd number of marking bits, the parity bit will be even, making the total number of marks in the data bits and parity bit Even. The character will consist of one start space, up to eight data bits, an odd parity bit, and up to two stop marks.

**RTS:** RTS (Request-to-Send) has three selections: On, Off, and Auto:

- **On:** With the RTS selection set to ON, the WAN Tester raises the RTS control signal to the local DTE, telling it that the WAN Tester is ready to send.
- **Off:** With the RTS selection set to OFF, the WAN Tester lowers the RTS control signal to the local DTE, telling it that the WAN Tester is not ready to send.
- **Auto:** Setting the RTS selection to AUTO causes the WAN Tester to raise RTS to the local DCE. When the local DCE responds with CTS (Clear-to-Send) high, the WAN Tester transmits 100 characters of the selected pattern and then lowers RTS. This sequence repeats once a second.

**DTR:** DTR (Data Terminal Ready) has two selections: On and Off.

- On: Setting DTR to the ON selection raises the DTR signal to the local DCE, telling it that the WAN Tester is ready to receive.
- Off: Setting DTR to the OFF selection lowers the DTR signal to the local DCE, telling it that the WAN Tester is not ready to receive.

**Save EEPROM:** With the “SAVE” field displayed in the ASYNC mode, pressing either the UP or DOWN CHANGE button will cause the current configuration of the Async mode to be saved to EEPROM (non-volatile memory which will retain the configuration after power is removed from the unit).

### 3.4 Synchronous Mode

There are eleven parameter fields in the Sync Mode. The following is a description of these fields.

**Mode:** The mode field consists of five choices: Async, Sync, T1, E1, and Utilities. The mode can be changed by pressing the MODE button until the desired mode appears or by the following procedure:

Press the UP or DOWN CONFIG button until the MODE field is displayed. With the mode field displayed, press the UP or DOWN CHANGE button until the desired mode appears on the display. With the selected mode displayed, press the UP or DOWN CONFIG button to view the options for the selected mode.

**Output Data:** The Output Data field controls the output of the WAN Tester. The following describes the three selections in this field.

- Norm: The Normal selection permits data from the Pattern selection to be transmitted.
- Loop: The Loop selection inserts a bi-directional loopback at the output of the WAN Tester. This means data from the WAN Tester is looped back to itself and Received Data coming from the DCE is looped back to the DCE. This selection also is used to self-test the WAN Tester.
- Invert: The Invert data selection inverts the data being sent out the Transmit Data lead and inverts the incoming Receiving Data lead. This selection is useful when testing new equipment.

**Interface:** The interface field contains five different interface choices: V.35, RS-530, RS-422, RS-232, and X.21.

- **V.35:** The V.35 interface in the Sync Mode provides five balanced interface signals, five unbalanced interface signals, and ground. When V.35 is selected, a 25-pin male to 34-pin male Winchester adapter cable may be used.
- **RS-530:** The RS-530 interface in the Sync Mode provides nine balanced interface signals, three unbalanced signals, and ground through the DB25 pin female connector.
- **RS-422:** The RS-422 interface in the Sync Mode provides nine balanced interface signals, three unbalanced signals, and ground through the DB25 pin female connector. When RS-422 is selected, a 25-pin male to 37-pin male adapter cable may be used.
- **RS-232:** The RS-232 interface in the Sync Mode provides twelve interface signals plus ground through the DB25 pin female connector.
- **X.21:** The X.21 interface in the Sync Mode provides five balanced interface signals plus ground through the DB15 pin female connector.

**Pattern:** In the Sync Mode, the pattern field has eleven choices: 511, 2<sup>11</sup> (2047), 2<sup>15</sup> (32767), QRSS, 2<sup>20</sup> (1,048,575), 2<sup>23</sup> (8,388,607), 1 of 8, 3 of 24, Alt, Mark, and Space.

### NOTE

**When using the WAN Tester in the Sync Mode to check a fractional T1 channel, patterns of 2<sup>15</sup> (32767), QRSS, 2<sup>20</sup> (1,048,575), 2<sup>23</sup> (8,388,607), 1 of 8, and 3 of 24 will cause density errors if the fractional T1 channel is not Clear Channel.**

The following is a description of the eleven pattern fields:

- **511:** This pattern is a 511-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **2<sup>11</sup> (2047)** This pattern is a 2047-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **2<sup>15</sup> (32767)** This pattern is a 32767-bit pseudo-random pattern. After the Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that doesn't match it.

- **QRSS:** This pattern is a Quasi-Random Signal Source. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **2<sup>20</sup> (1,048,575)** This pattern is a 1,048,575-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **2<sup>23</sup> (8,388,607)** This pattern is a 8,388,607-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **1 of 8:** This pattern is a continuous one bit marking seven bits spacing. The receiver checks for this pattern and will increment the Bit Error counter for each bit received after synchronization that does not match it.
- **3 of 24:** This pattern is a continuous three bits marking 21 bits spacing. The receiver checks for this pattern and will increment the Bit Error counter for each bit received after synchronization that does not match it.
- **Alternate:** This pattern generates an alternate 1's and 0's pattern. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it. This pattern should not be used when RTS selection is Auto.
- **Mark:** This pattern generates all marks from the WAN Tester. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it. This pattern should not be used when RTS selection is Auto.
- **Space:** This pattern generates all spaces from the WAN Tester. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it. This pattern should not be used when RTS selection is Auto.

**V.54 Loop:** There are two options for V.54 Loop: Send On and Send Off.

- **V.54 Send On:** This pattern sends a V.54 Loop On command. This feature is especially useful for looping CSU/DSUs since most of the units being sold currently respond to this command. This is a latching loop, so remember to remove this loopback when finished by sending the V.54 Loop Off command.

- **V.54 Send Off:** This pattern sends a V.54 Loop Off command and restores a previously looped CSU/DSU.

The V.54 Loops On and Off sent by the WAN Tester operate in the following manner:

V.54 must be displayed in the CONFIG field on the LCD and “SEND ON” must be displayed in the CHANGE field to send the V.54 Loop On pattern. Pressing the Send Loop key on the WAN Tester’s front panel will initiate a V.54 Loop On pattern while displaying the message “SENDING ON.” If the V.54 pattern sent causes a remote loopback, the V.54 pattern returned will be normal or inverted (depending on the manufacturer’s method of implementation of V.54 loopback). Upon detection of either of these patterns, the “ON ACK” message will be displayed on the LCD display. If the V.54 loop command never causes a loopback, the display will stay on “SENDING ON” and continue to send the pattern until the CHANGE or CONFIG buttons are pushed or a 12-second timeout is reached. When the “ON ACK” message is displayed, the V.54 loop has been established and the MODE LED (SYNC, T1, or E1) will blink to warn you that a latched V.54 loop has occurred. The ACK ON message will stay on for 1.5 seconds, and then the display will go to “SEND ON.” If the 12-second timeout is reached, the display will return to “SEND ON” and the V.54 Loop On pattern will be terminated.

When the V.54 Loop On is successful, the MODE LED is blinking, and the “SEND OFF” is displayed on the LCD, a V.54 Loop Off may be sent by hitting the Send Loop pushbutton again. When the V.54 Loop Off message is being sent, the LCD will display “SENDING OFF.” After a delay of 1.5 seconds, the received signal will be monitored for a V.54 Off pattern. If no V.54 pattern is detected (the V.54 Loop was reset), the “OFF ACK” message will be displayed and the MODE LED will stop blinking. After the “OFF ACK” message is displayed for 1.5 seconds, the LCD will return to “SEND ON.” If the V.54 Loop Off pattern is detected continuously from the remote, it means the V.54 loop did not get reset by Loop Off. After 12 seconds, the WAN Tester will timeout and restore the LCD to “SEND ON” and the V.54 Loop Off pattern will be terminated.

A V.54 Loop Off may also be sent without having sent a V.54 Loop On. To initiate a V.54 Loop Off, press either CHANGE button until “SEND OFF” is displayed, and then press the Send Loop button.

**Speed:** The speed field in the Sync Mode can generate 75 speeds from 1200 bps to 2,048,000 bps.

The WAN Tester permits setting speeds to 2,048,000 bps with all interfaces and timing options. Care must be used when selecting Speed, Interface, and Timing combinations, since not all combinations will work. For example, setting the speed to 2,000,000 bps when selecting the RS-232 interface will not work because the RS-232 interface typically will not operate above 128,000 bps.

Another combination to be careful of is setting speeds above 1,000,000 with the Timing option in Norm (accept Transmit Clock from the DCE) selected. With this combination, propagation delays through the interfaces in the WAN Tester and in the DCE accumulate and may be longer than one-half bit time, which will cause failure to Pattern Lock or erratic performance.

The following speeds in bps are available in this field:

1200	32,000	144,000	448,000	784,000	1,152,000	1,544,000
2400	38,400	168,000	504,000	832,000	1,176,000	1,600,000
4800	48,000	192,000	512,000	840,000	1,216,000	1,664,000
7200	50,000	224,000	560,000	896,000	1,232,000	1,728,000
9600	56,000	256,000	576,000	952,000	1,280,000	1,792,000
12,800	57,600	280,000	616,000	960,000	1,288,000	1,856,000
14,400	64,000	288,000	640,000	100,800	1,344,000	1,920,000
16,000	72,000	320,000	672,000	1,024,000	1,408,000	1,984,000
19,200	96,000	336,000	704,000	1,064,000	1,440,000	2,048,000
24,000	112,000	384,000	728,000	1,088,000	1,472,000	
28,800	128,000	392,000	768,000	1,120,000	1,536,000	

**TX Clock:** This TX Clock field has two options: Accept and Provide. The following is a description of these selections:

- **Accept:** With TX Clock ACCEPT selected, the WAN Tester accepts Transmit Clock from the DCE. The speed selection is ignored.
- **Provide:** With TX Clock PROVIDE selected, the WAN Tester provides External Transmit Clock to the DCE. The clock speed is determined by the selection in the speed field.

**TX Clock:** This TX Clock field has two options: Normal and Invert. The following is a description of these selections:

- **Normal:** With TX Clock NORMAL selected, the WAN Tester uses Transmit Clock to clock data.



- **Invert:** With TX Clock INVERT selected, the WAN Tester inverts Transmit Clock to clock data.

**RTS:** RTS (Request-to-Send) has three selections: On, Off and Auto.

- **On:** With the RTS selection set to ON, the WAN Tester raises the RTS control signal to the local DTE, telling it that the WAN Tester is ready to send.
- **Off:** With the RTS selection set to OFF, the WAN Tester lowers the RTS control signal to the local DTE, telling it that the WAN Tester is not ready to send.
- **Auto:** Setting the RTS selection to AUTO causes the WAN Tester to raise RTS to the local DCE. When the local DCE responds with CTS (Clear-to-Send) high, the WAN Tester transmits 1,000 bits of the selected test pattern and then lowers RTS. This sequence repeats every second. The Alternate, Mark, and Space selections should not be used in this mode.

**DTR:** DTR (Data Terminal Ready) has two selections: On and Off. The following is a description of these selections:

- **On:** Setting DTR to the ON selection raises the DTR signal to the local DCE, telling it that the WAN Tester is ready to receive.
- **Off:** Setting DTR to the OFF selection lowers the DTR signal to the local DCE, telling it that the WAN Tester is not ready to receive.

**Save EEPROM:** With the “SAVE” field displayed in the SYNC mode, pressing either the UP or DOWN CHANGE pushbutton will cause the current configuration of the Sync mode to be saved to EEPROM (non-volatile memory that will retain the configuration after power is removed from the unit).

### 3.5 T1 Mode

**Parameter fields:** There are 35 parameter fields in the T1 Mode. Since T1 always uses the DS1 interface and operates at 1,544,000 bps, no interface or speed options are available in this mode. The following is a description of these fields:

**Mode:** The mode field consists of five choices: Async, Sync, T1, E1, and Utilities. The mode can be changed by pressing the MODE button until the desired mode appears or by the following procedure:

Press the UP or DOWN CONFIG button until the MODE field is displayed. With the mode field displayed, press the UP or DOWN CHANGE button until the desired mode appears on the display. With the selected mode displayed, press the UP or DOWN CONFIG button to view the options for the selected mode.

**Output Data:** The Output Data field controls the output of the WAN Tester. The following describes the five selections in this field:

- **Norm:** The Normal selection permits data from the Pattern selection to be transmitted.
- **Loop:** The Loop selection inserts a bi-directional loopback at the output of the WAN Tester. This means data from the WAN Tester is looped back to itself and Received Data coming from the DCE is looped back to the DCE. This selection also is used to self-test the WAN Tester.
- **All Zeros (Red Alarm):** The All Zeros selection overrides the pattern selection and transmits continuous unframed spaces. If connected to a T1 mux, this signal will cause the T1 mux to transmit a Yellow Alarm back to the WAN Tester.
- **All Ones (Blue Alarm):** The All Ones selection overrides the pattern selection and transmits continuous unframed marks, also known as the Alarm Indication Signal (AIS). If connected to a T1 mux, this signal will cause the T1 mux to detect a Blue Alarm condition. When transmitting a Blue Alarm to some older D4 equipment, the Blue Alarm may be detected as a Red Alarm.
- **Yellow Alarm:** The Yellow Alarm selection overrides the pattern selection and writes a space in bit 2 of all DS0s if D4 framing is selected. It leaves the other bits in each DS0 undisturbed. If the framing format is ESF, the Yellow Alarm command is transmitted through the Facility Data Link (FDL) and does not disturb any data bits. If connected to a T1 mux, this signal will cause the T1 mux to detect a Yellow Alarm.

**Framing:** The framing field has two choices: D4 and ESF. The following is a description of these selections:

- D4: This selection sets the frame to D4 framing.
- SF: This selection sets the frame to ESF framing.

**Coding:** The coding field has two choices: AMI and B8ZS. The following is a description of these selections:

- AMI: This selection sets the choice to AMI (Alternate Mark Inversion). When AMI is selected, the transmit section of the network interface is set to AMI and the receive section is always set to B8ZS (AMI and B8ZS coding can both be detected in B8ZS). If B8ZS coding is detected when set to AMI, the B8ZS LED will flash to warn that there may be a mismatch in coding.
- B8ZS: This selection sets the choice to B8ZS (Binary 8 Zero Substitution) Coding. With this coding choice, the transmit side of the network interface is set to B8ZS. This selection is used for Clear Channel, which permits 64,000 bps of all twenty-four DS0s to be used without violating density requirements.

## CAUTION

**The T1 facility must be configured with B8ZS to use this selection.**

**Pattern:** In the T1 Mode, the pattern field has fifteen choices: 511, 2<sup>11</sup> (2047), 2<sup>15</sup> (32767), QRSS, 2<sup>20</sup> (1,048,575), 2<sup>23</sup> (8,388,607), 1 of 8, 3 of 24, Alt, Mark, Space, T1 Daly Framed, T1 Daly Unframed, 55 Octet Framed, and 55 Octet Unframed. All of the patterns will increment the Errored Seconds counter whenever the pattern is received wrong, and only one error per second will be recorded by the Errored Second counter regardless of how many bit errors occurred.

When testing for BPV Errors in B8ZS format, 1 of 8 and 3 of 24 patterns will permit some BPV Errors to pass through undetected because of the repetitive groups of zeros in these two patterns.

Density Errors will occur when using 2<sup>15</sup> (32767), QRSS, 2<sup>20</sup> (1,048,575), 2<sup>23</sup> (8,388,607), and 3 of 24 patterns with the DS0 bandwidth set to 64,000, if the T1 facility is not Clear Channel.

The following is a description of the fifteen pattern fields:

- 511: This pattern is a 511-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.

- $2^{11}$  (2047): This pattern is a 2047-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- $2^{15}$  (32767): This pattern is a 32767-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it. If the DS0 bandwidth is set to 64,000 and the T1 facility is not Clear Channel, this pattern will cause Density Errors because of the number of consecutive zeros it generates.
- QRSS: This pattern is a Quasi-Random Signal Source. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it. If the DS0 bandwidth is set to 64,000 and the T1 facility is not Clear Channel, this pattern will cause Density Errors because of the number of consecutive zeros it generates.
- $2^{20}$  (1,048,575): This pattern is a 1,048,575-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it. If the DS0 bandwidth is set to 64,000 and the T1 facility is not Clear Channel, this pattern will cause Density Errors because of the number of consecutive zeros it generates.
- $2^{23}$  (8,388,607): This pattern is a 8,388,607-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it. If the DS0 bandwidth is set to 64,000 and the T1 facility is not Clear Channel, this pattern will cause Density Errors because of the number of consecutive zeros it generates.
- 1 of 8: This pattern is a continuous one bit marking seven bits spacing. The receiver checks for this pattern and will increment the Bit Error counter for each bit received after synchronization that does not match it.
- 3 of 24: This pattern is a continuous three bits marking 21 bits spacing. The receiver checks for this pattern and will increment the Bit Error counter for each bit received after synchronization that does not match it. If the DS0 bandwidth is set to 64,000 and the T1 facility is not Clear Channel, this pattern will cause Density Errors because of the number of consecutive zeros it generates.

- **Alternate:** This pattern consists of even bits marking and odd bits spacing in each selected DS0. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **Mark:** This pattern puts all 8 bits in each selected DS0 to marks. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **Space:** This pattern puts all 8 bits in each selected DS0 to spaces. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **T1 Daly Framed:** This pattern is a T1 Daly framed stress pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **T1 Daly Unframed:** This pattern is a T1 Daly unframed stress pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **55-Octet Framed:** This pattern is a 55 Octet framed stress pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- **55-Octet Unframed:** This pattern is a 55 Octet unframed stress pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.

**Timing:** The Timing Bits field selects the Transmit clocking option used by the WAN Tester. There are two selections in this field: Internal and Network.

- **Internal:** With this selection, TX data timing is locked to the Wan Tester's internal oscillator.
- **Network:** With this selection, TX data timing is locked to RX data.

**Level:** The Level selection controls the output level of the T1 pulses being transmitted. The nine choices with this selection are: 0 dB, -7.5 dB, -15 dB, -22.5 dB, 133 ft., 266 ft., 399 ft., 533 ft., and 655 ft. 0 through -22.5 dB are long-haul settings with the normal setting being 0 dB. 133 through 655 ft. are short-haul settings. When using the short-haul settings, the setting should match the cable length between the tester and the device being tested.

**LP Type:** The LP type selection determines the type of loopback being sent. There are six options, all of which are latching loopbacks. Operation of these loopbacks is the same. The options are as follows:

- CSU: This pattern sends a CSU Loop Up/Loop Down command to the remote unit.
- SJ1F: This pattern sends a Smart Jack 1 Framed Loop Up/Loop Down command to the remote unit. The framing bits overwrite the pattern.
- SJ1U: This pattern sends a Smart Jack 1 Unframed Loop Up/Loop Down command to the remote unit. The pattern is sent without framing bits.
- SJ2F: This pattern sends a Smart Jack 2 Framed Loop Up/Loop Down command to the remote unit. The framing bits overwrite the pattern.
- SJ2U: This pattern sends a Smart Jack 2 Unframed Loop Up/Loop Down command to the remote unit. The pattern is sent without framing bits.
- V.54: This pattern sends a V.54 Loop On/Loop Off command to the remote unit. This selection is especially useful for looping CSU/DSUs since most units being sold currently respond to this command.

**Loop:** There are two options for Loop: Send On and Send Off.

- Send On: This pattern sends a Loop On command. This is a latching loop so remember to remove this loopback when finished by sending the Loop Off command.
- Send Off: This pattern sends a Loop Off command and restores a previously looped CSU/DSU.

The Loops On and Off sent by the WAN Tester operate in the following manner:

LP Type must be displayed in the CONFIG field on the LCD and the desired loopback type (CSU, SJ1F, SJ1U, SJ2F, SJ2U, or V.54) must be displayed in the CHANGE field. Hit the DOWN CONFIG button until Loop is displayed in the CONFIG field on the LCD. Then hit the UP CHANGE button until "SEND ON" is

displayed in the CHANGE field. Hitting the Send Loop key on the WAN Tester's front panel will initiate a Loop On pattern while displaying the message "SENDING ON." If the pattern sent causes a remote loopback, the loopback will be returned.

### NOTE

**If V. 54 was selected, the V. 54 pattern returned will be normal or inverted, depending on the manufacturer's method of implementation of V.54 loopback.**

Upon detection of the pattern, the "ON ACK" message will be displayed on the LCD display. If the loop command never causes a loopback, the display will stay on "SENDING ON" and continue to send the pattern until the CHANGE or CONFIG buttons are pushed or a 12-second timeout is reached. When the "ON ACK" message is displayed, the V.54 loop has been established and the MODE LED (SYNC, T1, or E1) will blink to warn user that a latched loop has occurred. The ACK ON message will stay on for 1.5 seconds, and then the display will go to "SEND ON." If the 12-second timeout is reached, the display will return to "SEND ON" and the Loop On pattern will be terminated.

When the Loop On is successful, the MODE LED is blinking, and the "SEND OFF" is displayed on the LCD, a Loop Off may be sent by hitting the Send Loop button again. When the Loop Off message is being sent, the LCD will display "SENDING OFF." After a delay of 1.5 seconds, the received signal will be monitored for a Loop Off pattern. If no pattern is detected (the Loop was reset), the "OFF ACK" message will be displayed and the MODE LED will stop blinking. After the "OFF ACK" message is displayed for 1.5 seconds, the LCD will return to "SEND ON." If the Loop Off pattern is detected continuously from the remote, it means the loop did not get reset by Loop Off. After 12 seconds, the WAN Tester will timeout and restore the LCD to "SEND ON," and the Loop Off pattern will be terminated.

A Loop Off may also be sent without having sent a Loop On. To initiate a Loop Off, press either CHANGE button until "SEND OFF" is displayed, and then press the Send Loop button.

**DS01 through DS24:** Each DS0 field has two choices: On and Off.

- On: If a DS0 selection is ON, its bandwidth is used in the T1 frame.
- Off: If a DS0 selection is OFF, its bandwidth is not used in the T1 frame.

**DS0 Bandwidth:** The DS0 Bandwidth field has two choices: 56,000 and 64,000.

- 56,000: When 56,000 bps is selected, all 24 DS0s in the T1 frame have bit 8 marking and only allow for 56,000 bps worth of bandwidth per DS0.
- 64,000: When 64,000 bps is selected, all 24 DS0s in the T1 frame have the full 64,000 bps available for data. Care should be used when selecting this option since it may violate the bit density requirements of some networks.

**Save EEPROM:** With the “SAVE” field displayed in the T1 mode, hitting either the UP or DOWN CHANGE button will cause the current configuration of the T1 mode to be saved to EEPROM (non-volatile memory which will retain the configuration after power is removed from the unit).

### 3.6 E1 Mode

**Parameter Fields:** There are 40 parameter fields in the E1 Mode. Since E1 always uses the G.703 interface and operates at 2,048,000 bps with HDB3 coding, no interface or speed options are available in this mode. The following is a description of these fields:

**Mode:** The mode field consists of five choices: Async, Sync, T1, E1 and Utilities. The mode can be changed by pressing the MODE button until the desired mode appears or by the following procedure:

Hit the UP or DOWN CONFIG button until the MODE field is displayed. With the mode field displayed, hit the UP or DOWN CHANGE button until the desired mode appears on the display. With the selected mode displayed, hit the UP or DOWN CONFIG button to view the options for the selected mode.

**Output Data:** The Output Data field controls the output of the WAN Tester. The following describes the four selections in this field:

- Norm: The Normal selection permits data from the Pattern selection to be transmitted.
- Loop: The Loop selection inserts a bi-directional loopback at the output of the WAN Tester. This means data from the WAN Tester is looped back to itself. TX Data is still transmitted from the WAN Tester. This selection also is used to self-test the WAN Tester.
- All Zeros: The All Zeros selection overrides the pattern selection and transmits continuous unframed spaces.



- All Ones: The All Ones selection overrides the pattern selection and transmits continuous unframed marks.

**Pattern:** In the E1 Mode, the pattern field has eleven choices: 511,  $2^{11}$  (2047),  $2^{15}$  (32767), QRSS,  $2^{20}$  (1,048,575),  $2^{23}$  (8,388,607), 1 of 8, 3 of 24, Alt, Mark, and Space. All of the patterns will increment the Errored Seconds counter whenever the pattern is received wrong and only one error per second will be recorded by the Errored Second counter regardless of how many bit errors occurred.

When testing for BPV Errors in B8ZS format, 1 of 8 and 3 of 24 patterns will permit some BPV Errors to pass through undetected because of the repetitive groups of zeros in these two patterns.

The following is a description of the eleven pattern fields:

- 511: This pattern is a 511-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- $2^{11}$  (2047): This pattern is a 2047-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- $2^{15}$  (32767): This pattern is a 32767-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- QRSS: This pattern is a Quasi-Random Signal Source pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- $2^{20}$  (1,048,575): This pattern is a 1,048,575-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- $2^{23}$  (8,388,607): This pattern is a 8,388,607-bit pseudo-random pattern. After the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- 1 of 8: This pattern is a continuous one bit marking seven bits spacing. The receiver checks for this pattern and will increment the Bit Error counter for each bit received after synchronization that does not match it.

- 3 of 24: This pattern is a continuous three bits marking 21 bits spacing. The receiver checks for this pattern and will increment the Bit Error counter for each bit received after synchronization that does not match it.
- Alternate: This pattern consists of the E1 frame with the even bits marking and the odd bits spacing in all timeslots that are selected. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- Mark: This pattern consists of the E1 frame with all timeslots that are selected marking. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.
- Space: This pattern consists of the E1 frame with all timeslots that are selected spacing. When the WAN Tester establishes synchronization, the receiver checks for this pattern and will increment the Bit Error counter for each bit received that does not match it.

**Timing:** The Timing Bits field selects the Transmit clocking option used by the WAN Tester. There are two selections in this field:

- Internal: With this selection, TX data timing is locked to the Wan Tester's internal oscillator.
- Network: With this selection, TX data timing is locked to RX data.

**Term:** The termination field consists of two choices: 75 ohms and 120 ohms.

- 75 ohms: This selection sets the TX and RX Impedance to 75 ohms.
- 120 ohms: This selection sets the TX and RX Impedance to 120 ohms.

**V.54 Loop:** There are two options for V.54 Loop: Send On and Send Off.

- V.54 Send On: This pattern sends a V.54 Loop On command. This feature is especially useful for looping CSU/DSUs since most of the units being sold currently respond to this command. This is a latching loop, so remember to remove this loopback when finished by sending the V.54 Loop Off command.
- V.54 Send Off: This pattern sends a V.54 Loop Off command and restores a previously looped CSU/DSU.

The V.54 Loops On and Off sent by the WAN Tester operate in the following manner:

V.54 must be displayed in the CONFIG field on the LCD and “SEND ON” must be displayed in the CHANGE field to send the V.54 Loop On pattern. Hitting the Send Loop key on the WAN Tester’s front panel will initiate a V.54 Loop On pattern while displaying the message “SENDING ON.” If the V.54 pattern sent causes a remote loopback, the V.54 pattern returned will be normal or inverted, depending on the manufacturer’s method of implementation of V.54 loopback. Upon detection of either of these patterns, the “ON ACK” message will be displayed on the LCD display. If the V.54 loop command never causes a loopback, the display will stay on “SENDING ON” and continue to send the pattern until the CHANGE or CONFIG buttons are pushed or a 12-second timeout is reached. When the “ON ACK” message is displayed, the V.54 loop has been established and the MODE LED (SYNC, T1, or E1) will blink to warn you that a latched V.54 loop has occurred. The ACK ON message will stay on for 1.5 seconds, and then the display will go to “SEND ON.” If the 12-second timeout is reached the display will return to “SEND ON” and the V.54 Loop On pattern will be terminated.

When the V.54 Loop On is successful, the MODE LED is blinking, and the “SEND OFF” is displayed on the LCD, a V.54 Loop Off may be sent by hitting the Send Loop button again. When the V.54 Loop Off message is being sent, the LCD will display “SENDING OFF.” After a delay of 1.5 seconds, the received signal will be monitored for a V.54 Off pattern. If no V.54 pattern is detected (the V.54 Loop was reset), the “OFF ACK” message will be displayed and the MODE LED will stop blinking. After the “OFF ACK” message is displayed for 1.5 seconds, the LCD will return to “SEND ON.” If the V.54 Loop Off pattern is detected continuously from the remote, it means the V.54 loop did not get reset by Loop Off. After 12 seconds, the WAN Tester will timeout and restore the LCD to “SEND ON,” and the V.54 Loop Off pattern will be terminated.

A V.54 Loop Off may also be sent without having sent a V.54 Loop On. To initiate a V.54 Loop Off, press either CHANGE button until “SEND OFF” is displayed, and then press the Send Loop button.

**Timeslot 01 through Timeslot 31:** Each Timeslot field has two choices: On and Off.

- On: If a Timeslot selection is ON, its bandwidth is used in the E1 frame.
- Off: If a Timeslot selection is OFF, its bandwidth is not used in the E1 frame.

**DMFA:** The Distant Multiframe Alarm (DMFA) field has two choices: Off and On. The following is a description of the two fields:

- **DMFA Off:** When DMFA Off is selected, the WAN Tester will reset bit 6 in Frame 0 of Timeslot 16 (TS16) to 0.
- **DMFA On:** When DMFA On is selected, the WAN Tester will set bit 6 in Frame 0 of Timeslot 16 (TS16) to 1.

**RRA:** The Receive Remote Alarm (RRA) field has two choices: Off and On. The following is a description of the two fields:

- **RRA Off:** When RRA Off is selected, the WAN Tester will reset bit 3 in Timeslot 00 (TS00) in every odd-numbered frame to 0. The odd-numbered frames 1, 3, 5, 7, 9, 11, 13, and 15 are referred to as the non-alignment frames.
- **RRA On:** When RRA On is selected, the WAN Tester will set bit 3 in Timeslot 00 (TS00) in every odd-numbered frame to 1. The odd-numbered frames 1, 3, 5, 7, 9, 11, 13, and 15 are referred to as the non-alignment frames.

**Save EEPROM:** With the “SAVE” field displayed in the E1 mode, hitting either the UP or DOWN CHANGE button will cause the current configuration of the E1 mode to be saved to EEPROM (non-volatile memory which will retain the configuration after power is removed from the unit).

### **3.7 Utilities Mode**

**Parameter Fields:** There are 4 parameter fields in the Utilities Mode. The following is a description of these fields:

**Mode:** The mode field consists of five choices: Async, Sync, T1, E1, and Utilities. The mode can be changed by pressing the MODE button until the desired mode appears or by the following procedure:

Press the UP or DOWN CONFIG button until the MODE field is displayed. With the mode field displayed, press the UP or DOWN CHANGE button until the desired mode appears on the display. With the selected mode displayed, press the UP or DOWN CONFIG button to view the options for the selected mode.

**Run:** The Run field has two choices: Manual and Continuous. The following is a description of the two fields:

- **Manual:** When Manual is selected, the tester can freeze all displays. When the RESET button is pushed the first time in the Manual mode, the tester resets all the displays and then updates the displays as events occur after the reset. When the RESET button is pushed a second time, the tester freezes all the displays. Pushing the RESET button again starts the cycle over again, resetting all the displays and then updating them.
- **Continuous:** When Continuous is selected, the tester continuously sends a test pattern. When the RESET button is pushed, the tester resets all the displays and continues to run.

**Audible Alarm:** The Audible Alarm field has two choices: On and Off. The following is a description of the two fields:

- **On:** When Audible Alarm On is selected, the tester sends a Bell character to the console port and sounds an audible alarm for every Errored Second that occurs.
- **Off:** When Audible Alarm Off is selected, the audible alarm feature is disabled.

**Save EEPROM:** With the “SAVE” field displayed in the Utilities mode, pressing either the UP or DOWN CHANGE button will cause the current configuration of the Utilities mode to be saved to EEPROM (non-volatile memory which will retain the configuration after power is removed from the unit).

# 4. Interfaces and Cables

## 4.1 Network Interface

You may choose between Bantam connectors or an RJ-45 connector for the NI (Network Interface) termination. Both the Bantam connectors and the RJ-45 connector are wired in parallel. The interface pins on these connectors on the right side of the WAN Tester are as follows:

**Table 4-1. RJ-45 8-position modular connector on side of unit.**

Pin Number	Direction
1	from Network
2	from Network
4	to Network
5	to Network

## 4.2 X.21 Interface

The DB15 female connector on the rear of the unit supplies the X.21 interface. The signals on this connector appear as a DTE (terminal) to the Data Communications Equipment. The X.21 interface connector on the rear of the unit is wired as follows:

**Table 4-2. The X.21 interface 15-pin female connector wiring on rear of unit when X.21 is selected.**

Pin Number	Signal Name	Direction
1	Shield ground	both ways
2	Transmit Data (A)	from tester
9	Transmit Data (B)	from tester
4	Receive Data (A)	to tester
11	Receive Data (B)	to tester
3	Control (A)	from tester
10	Control (B)	from tester
5	Indicator (A)	to tester
12	Indicator (B)	to tester

**Table 4-2 (continued). The X.21 interface 15-pin female connector wiring on rear of unit when X.21 is selected.**

<b>Pin Number</b>	<b>Signal Name</b>	<b>Direction</b>
6	Signal Element (A)	to tester
13	Signal Element (B)	to tester
8	Signal Ground	both ways

### **4.3 RS-232/RS-530/RS-422 Interfaces**

The DB25 female on the rear of the unit may be used for either RS-232 or for RS-422/RS-530 interfaces. This interface will appear as a DTE (terminal) to the Data Communications Equipment. When RS-232 is selected, the interface on the rear of the unit will appear as follows:

**Table 4-3. DB25 female connector wiring on rear of unit when RS-232 is selected.**

<b>Pin Number</b>	<b>Signal Name</b>	<b>Direction</b>
1	Shield	both ways
2	Transmitted Data	from tester
3	Received Data	to tester
4	Request to Send	from tester
5	Clear to Send	to tester
6	Data Set Ready	to tester
7	Signal Ground	both ways
8	Carrier	to tester
15	Transmit Sig Elem Timing	to tester
17	Receiver Sig Elem Timing	to tester
18	-10 volts	from tester
20	Data Terminal Ready	from tester
21	-10 volts	from tester
24	External Transmit Timing	from tester

When RS-530/422 interface is selected, the signals on the DB25 pin connector will also appear as a DTE (terminal) to the Data Communications Equipment. The interface actually is wired for RS-530. A 25-pin-to-37-pin RS-422 adapter cable (not

supplied) may be used for RS-422. When RS-530 is selected, the interface on the rear of the unit will appear as follows:

**Table 4.4. DB25 female connector wiring on rear of unit when RS-530 is selected.**

Pin Number	Signal Name	Direction
1	Shield	both ways
2	Transmit Data (A)	from tester
14	Transmit Data (B)	from tester
3	Receive Data (A)	to tester
16	Receive Data (B)	to tester
4	Request to Send (A)	from tester
19	Request to Send (B)	from tester
5	Clear to Send (A)	to tester
13	Clear to Send (B)	to tester
6	Data Set Ready (A)	to tester
22	Data Set Ready (B)	to tester
7	Signal Ground	both ways
8	RLSD or Carrier (A)	to tester
10	RLSD or Carrier (B)	to tester
15	Transmit Signal Elem Timing (A)	to tester
12	Transmit Signal Elem Timing (B)	to tester
17	Receiver Sig Elem Timing (A)	to tester
9	Receiver Sig Elem Timing (B)	to tester
18	-10 volts	from tester
20	Data Terminal Ready (A)	from tester
23	Data Terminal Ready (B)	from tester
21	-10 volts	from tester
24	External Transmit Timing (A)	from tester
11	External Transmit Timing (B)	from tester



## 4.4 CCITT V.35 Interface

When V.35 is selected, the V.35 signals will be present on the DB25 connector. The signals on this connector appear as a DTE (terminal) to the Data Communications Equipment. This interface is wired as follows:

**Table 4-5. DB25 female connector wiring on rear of unit when V.35 is selected.**

<b>Pin Number</b>	<b>Signal Name</b>	<b>Direction</b>
1	Shield	both ways
2	Transmit Data (A)	from tester
14	Transmit Data (B)	from tester
3	Receive Data (A)	to tester
16	Receive Data (B)	to tester
4	Request to Send	from tester
5	Clear to Send	to tester
6	Data Set Ready	to tester
7	Signal Ground	both ways
8	RLSD or Carrier	to tester
15	Transmit Sig Elem Timing (A)	to tester
12	Transmit Sig Elem Timing (B)	to tester
17	Receive Sig Elem Timing (A)	to tester
9	Receive Sig Elem Timing (B)	to tester
18	-10 volts	from tester
20	Data Terminal Ready	from tester
21	-10 volts	from tester
24	External Transmit Timing (A)	from tester
11	External Transmit Timing (B)	from tester

## 4.5 Console Interface

The Console Interface is a 6-position modular connector. This connector is used to connect the console or modem to the WAN Tester. This optional 6-position modular cable with the DB25 male hood is connected to the ASCII terminal. The cable and 25-pin hood are described at the end of this section. The interface pins on the 6-position modular connector are described as follows:

**Table 4-6. 6-position modular Console connector on left side of unit.**

Pin Number	Signal Name	Direction
1	Receive Data	to tester
2	Ground	both ways
3	RLSD or Carrier	to tester
4	Data Terminal Ready	from tester
5	Data Set Ready	to tester
6	Transmit Data	from tester

## 4.6 Cables

Optional cables and hoods are available from Black Box for the WAN Tester. Call Technical Support at 724-746-5500 for details.

**Table 4-7. Optional cables and hoods.**

Cable	Description
*See Figures 4-1, 4-2, and 4-3 for pinout.	Cable used for connecting the unit's modular console connector to either the DB9 or DB25 hood.
*See Figure 4-2 for pinout.	DB9 hood used for connecting to the console's DB25 connector.
*See Figure 4-3 for pinout.	Hood used when connecting the console port to a modem.

**Table 4-7 (continued). Optional cables and hoods.**

<b>Cable</b>	<b>Description</b>
EVN530-0005-MM	DB25 male to DB25 male straight-through 5-ft. (1.5-m) cable used to connect the WAN Tester's DB25 female interface port (RS-232/RS-530/RS-422/V.35) to a DCE's DB25 pin female interface port.
EGM16E-0005-MM	DB15 male to DB15 male straight-through 5-ft. (1.5-m) cable used to connect the WAN Tester's DB15 female interface port (X.21) to a DCE's DB15 female interface port.
TS940A	DB25 male to DB34 male adapter 6-ft. (1.8-m) cable used to connect the WAN Tester's DB25 female interface port (RS-530) to a DCE's DB34 female interface port (V.35).
*See Figure 4-5 for pinout information.	DB25 male to DB37 male adapter 6-ft. (1.8-m) cable used to connect the WAN Tester's DB25 female interface port (RS-530) to a DCE's DB37 pin female interface port (RS-422).
**Please contact Technical Support (custom cable).	Bantam to Bantam cable used to connect Bantam connectors on the WAN Tester to Bantam connectors. This cable is used for T1 and E1 applications.
*See Figure 4-6. Please contact **Technical Support (custom cable).	Dual Bantam to DB15 male cable used to connect dual Bantam connectors on the WAN Tester to a DB15 female interface port on a DCE. This cable is used for T1 and E1 applications.
TS942A	Dual Bantam to RJ-45 cable used to connect dual Bantam connectors on the WAN Tester to an RJ-45 pin modular interface port on a DCE. This cable is used for T1 and E1 applications.

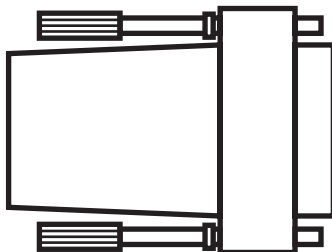
**Table 4-7 (continued). Optional cables and hoods.**

<b>Cable</b>	<b>Description</b>
**Please contact Technical Support (custom cable).	Bantam to BNC cable used to connect the Bantam connector on the WAN Tester to a BNC connector on a DCE. This cable is typically used for E1 applications.

With the exception of the straight-through adapter cables, all cables and hoods are depicted on the following pages.



**Figure 4-1. RJ-11C 6-pin modular to modular straight-through 6-ft. (1.8-m) cable—WAN Tester console to DB9 hood when connecting to console.**

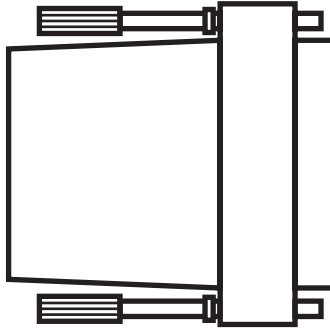


**Figure 4-2. DB9 hood used to connect modular cables from the WAN Tester console port to a terminal.**

**Table 4-8. DB9 hood pinning.**

<b>6-Pin Modular</b>	<b>Signal Name</b>	<b>DB9 Female</b>
1	Transmit Data	3
2	Ground	5
6	Receive Data	2
—	RTS to CTS to RLSD	1 to 7 to 8
—	DSR to DTR	6 to 4

\*\*For this cable, call Technical Support at 724-746-5500 to special-order.



**Figure 4-3. DB25 hood used to connect modular cable from the WAN Tester console port to a modem.**

**Table 4-9. DB25 hood pinning.**

<b>6-Pin Modular</b>	<b>Signal Name</b>	<b>DB25 Male</b>
1	Receive Data	3
2	Ground	7
3	RLSD or Carrier	8
4	Data Terminal Ready	20
5	Data Set Ready	6
6	Transmit Data	2

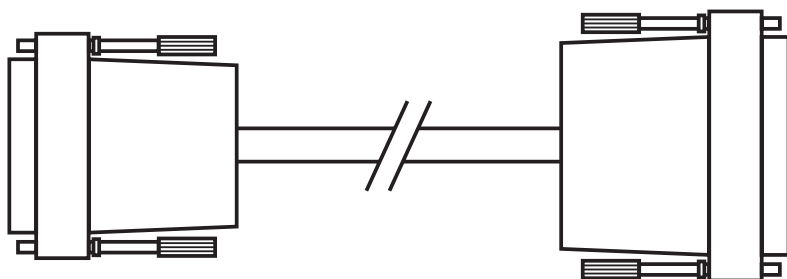


Figure 4-4. DB25 male to DB34 male adapter 6-ft. (1.8-m) cable used to connect WAN Tester's DB25 pin female interface port (RS-530) to DCE's DB24 female interface port (V.35).

Table 4-10. DB25 male to DB34 male adapter pinning.

DB25 Male	Signal Name	DB34 Male
7	Ground	B
2	Transmit Data (A)	P
14	Transmit Data (B)	S
3	Receive Data (A)	R
16	Receive Data (B)	T
6	Data Set Ready	E
8	Carrier Detect	F
24	External TXC (A)	U
11	External TXC (B)	W
15	Transmit Clock (A)	Y
12	Transmit Clock (B)	AA (a)
17	Receive Clock (A)	V
9	Receive Clock (B)	X
20	Data Terminal Ready	H
4	Request to Send	C
5	Clear to Send	D
18	-10 volts	L
21	-10 volts	N
25	Test Mode	MM (m)

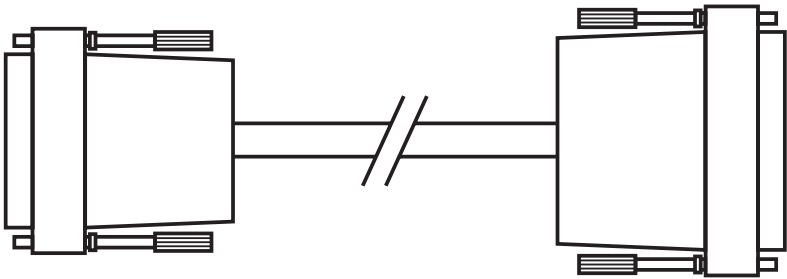


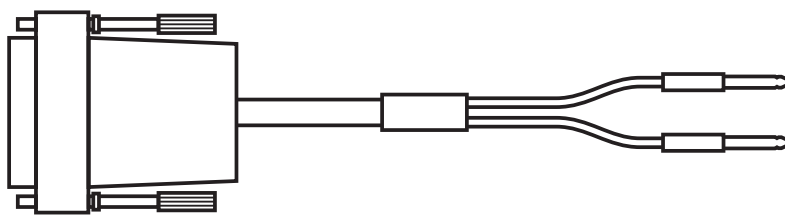
Figure 4-5. DB25 male to DB37 male adapter 6-ft. (1.8-m) cable used to connect WAN Tester's DB25 female interface port (RS-530) to DCE's DB37 female interface port (RS-422).

Table 4-11. DB25 male to DB37 male adapter pinning.

DB25 Male	Signal Name	DB37 Male
1	Ground	1
7	Ground	19
2	Transmit Data (A)	4
14	Transmit Data (B)	22
3	Receive Data (A)	6
16	Receive Data (B)	24
6	Data Set Ready (A)	11
22	Data Set Ready (B)	29
8	Carrier Detect (A)	13
10	Carrier Detect (B)	31
25	Test Mode	18
24	External TXC (A)	17
11	External TXC (B)	35
15	Transmit Clock (A)	5
12	Transmit Clock (B)	23
17	Receive Clock (A)	8
9	Receive Clock (B)	26
18	-10 volts	10
21	-10 volts	14
20	Data Terminal Ready (A)	12

**Table 4-11 (continued). DB25 male to DB37 male adapter pinning.**

<b>DB25 Male</b>	<b>Signal Name</b>	<b>DB37 Male</b>
23	Data Terminal Ready (B)	30
4	Request to Send (A)	7
19	Request to Send (B)	25
5	Clear to Send (A)	9
13	Clear to Send (B)	27

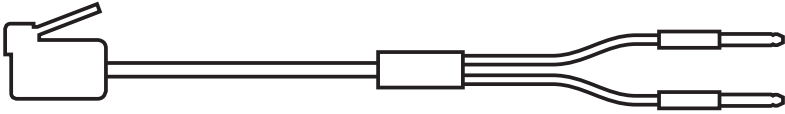


**Figure 4-6. Dual Bantam to DB15 male 6-ft. (1.8-m) adapter cable used to connect dual Bantam connectors on the WAN Tester to a DB15 female interface port on a DCE.**

**Table 4-12. Dual Bantam to DB15 male pinning.**

<b>Dual Bantam</b>	<b>DB15 Male</b>
Tip	1, 3
Ring	9, 11
Sleeve	Shield





**Figure 4-7. Dual Bantam to RJ-45 6-ft. (1.8-m) adapter cable used to connect dual Bantam connectors on the WAN Tester to an RJ-45 modular interface port on a DCE.**

**Table 4-13. DB25 male to DB37 male adapter pinning.**

<b>Dual Bantam</b>	<b>Signal Name</b>	<b>RJ-45 Male</b>
Tip Ring	Twisted Pair	1 2
Sleeve		Shield
Tip Ring	Twisted Pair	4 5

# 5. Console Port

## 5.1 General

The WAN Tester console supports dial modems and VT100 terminals. The speed of the console port is 9600 bps.

## 5.2 Cabling a Terminal to the Console Port

To cable a terminal to the console port, an optional cable and hood are required. Call Black Box Technical Support at 724-746-5500 for details. The cable is a six-conductor straight through RJ-11 modular cable (see Figure 4-1) and the hood is an RJ-11 modular to DB9 female (see Figure 4-2) as described in **Chapter 4**. One end of the RJ-11 cable is inserted into the connector on the left side of the unit and the other end into the modular connector in the hood. Plug the hood into the DB9 connector on the VT100 terminal.

## 5.3 Cabling a Modem to the Console Port

To cable a modem to the Console Port, an optional hood and cable are required. Call Black Box Technical Support at 724-746-5500 for details. The cable is an RJ-11C six-pin modular straight-through cable (see Figure 4-1) and the hood is an RJ-11 modular to DB25 male (see Figure 4-3). Wiring diagrams appear in **Chapter 4**.

## 5.4 Console Port Operation

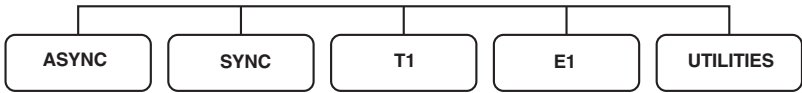
The console port and the ASCII terminal or modem must be programmed for the same speed to use the console feature. The settings of the console port on the WAN Tester is 9600 bps, 8 data bits, 1 stop mark, and no parity.

The console is user-friendly and very simple to operate, since only a few keys are needed. Except for the two control keys, all keys are described on the bottom lines of the screens where they are used. A description of these keys appears in Table 5-1.

Table 5-1. Keys.

Key	Description
Arrow Keys	Pressing the arrow keys on all screens advances the blinking cursor to the next field.
ENTER	Pressing Enter causes one of two things to happen, depending on the field displayed. In the MODE field, it selects and displays the next screen. In the other fields, Enter selects the next choice in the field.
B/b	Typing the letter B or b (case-insensitive) on all screens selects the previous choice in the field.
D/d	Typing the letter D or d (case-insensitive) on all screens deactivates the console.
E/e	Typing the letter E or e (case-insensitive) on all screens inserts an error into the data stream.
P/p	Typing the letter P or p (case-insensitive) on all screens enables you to change the password.
R/r	Typing the letter R or r (case-insensitive) on all screens resets all the counters being displayed.
S/s	Typing the letter S or s (case-insensitive) on all screens sends a loop command to the remote unit.
Control D	Holding the Control key down and then pressing the letter D or d disconnects the modem.
Control R	Holding the Control key down and then pressing the R or r refreshes the screen.

The console is easy to use because the screen hierarchy is very flat. There is only one screen displayed for each mode. The screen hierarchy is shown in Figure 5-1.



**Figure 5-1. Screen hierarchy.**

#### 5.4.1 ACTIVATING THE CONSOLE

To activate the console, you must enter a password. The default password when shipped from the factory is the ENTER key. Pressing Enter will activate the console and bring up the T1 menu.

#### 5.4.2 DISPLAYING SCREENS FOR EACH MODE

To display any of the five screens listed in Figure 5-1, advance the blinking cursor to the MODE field and press the ENTER key until the desired screen appears.

#### 5.4.3 CHANGING THE PASSWORD

To change the password, type “P” on any screen. The following prompt will appear:

Enter New Password:

Type the new password, followed by ENTER. The unit will then ask you to verify your entry:

Re-Enter Password: For Verification

Again, type the new password, followed by ENTER.

If you enter an invalid password, the following message appears:

Hit any key to exit or “P” to re-enter.

#### 5.4.4 DEACTIVATING THE CONSOLE

To deactivate the console, type “D” on any screen. The console will be deactivated and the password will be required to activate the console again.

**5.5 T1 Menu**

```

                                WAN TESTER

DISPLAYS                                REL 2.03
ERRS: 000000000    BER: 0.00 x 10e-07    TEST SEC: 000013    ERR SECS: 000000
SES: 000000        DEG MINS: 000000      AVAIL: 000013      UNAVAIL: 000000
TX FREQ: 1544039   RX FREQ: 1544039      RX LVL: 0 DB       FE ERRS: 029974
                                                           CRC ERRS: 000000   BPV ERRS: 000005

LEDS (*=LED ON)
PAT LOCK           PAT RECOVD:          FRAME LOCK:        ALL 1'S:
ALL 0'S: *        CRC ERRS:            BPVS:              YELLOW

CONFIGURATION
MODE: T1           DS0-02: ON            DS0-12: ON        DS0-22: ON
OUTPUT: NORMAL     DS0-03: ON            DS0-13: ON        DS0-23: ON
FRAMING: D4        DS0-04: OFF           DS0-14: ON        DS0-24: ON
CODING: AMI        DS0-05: ON            DS0-15: ON        DS0BW: 64000
PAT: 2047          DS0-06: ON            DS0-16: ON        SAVE: EEPROM
TIMING: NETWORK    DS0-07: ON            DS0-17: ON
LEVEL: 0 DB        DS0-08: ON            DS0-18: ON
LP TYPE: CSU       DS0-09: ON            DS0-19: ON
LOOP: SEND ON      DS0-10: ON            DS0-20: ON
DS0-01: ON         DS0-11: ON            DS0-21: ON

RESET DISPLAYS=[R]  SEND LOOP=[S]                INSERT ERROR=[E]
ADVANCE=[ARROWS]  DEACTIVATE=[D]  CHANGE PASSWORD=[P]  CHANGE=[ENTER/B]

```

**Figure 5-2. T1 Menu.**

The T1 Menu is the first screen displayed (see Figure 5-2). The blinking cursor will be positioned on the MODE field under CONFIGURATION. Use the arrow keys to advance the cursor to the next field and the ENTER key to change any of the configuration selections.

**NOTE**

**By hitting ENTER on the MODE field, you change the mode and cause the screen for that mode to appear.**

To reset the displays at the top of the screen, simply type the letter “R.” To insert an error, type the letter “E.” See **Chapter 2** for a detailed description of each of the displays and LEDs. See **Chapter 3** for a detailed description of each of the Configuration parameters.

To send a loop, select the loopback type by advancing to the LP Type field and hitting the ENTER key until the desired loopback type appears. Go to the LOOP field and select “Send On.” With the LP type and Loop fields programmed, type the letter “S” to send the loop.

**5.6 E1 Menu**

WAN TESTER			
<u>DISPLAYS</u>			REL. 2.03
ERRS: 000000000	BER: 0.00 x 10e-07	TEST SEC: 000013	ERR SECS: 000000
SES: 000000	DEG MINS: 000000	AVAIL: 000013	UNAVAIL: 000000
TX FREQ: 2047998	RX FREQ: 2047998		
 <u>LEDS (*=LED ON)</u>			
PAT LOCK: *	PAT RECOVD:	FRAME LOCK:	ALL 1'S:
ALL 0'S: *	CRC ERRS: *	BPVS: *	DMFA: RRA:
 <u>CONFIGURATION</u>			
MODE: E1	TS-05: ON	TS-15: ON	TS-25: ON
OUTPUT: all 0'S	TS-06: ON	TS-16: SIG	TS-26: ON
PAT: SPACE	TS-07: ON	TS-17: ON	TS-27: ON
TIMING: NETWORK	TS-08: ON	TS-18: ON	TS-28: ON
TERM: 75 OHMS	TS-09: ON	TS-19: ON	TS-29: ON
V54: SEND ON	TS-10: ON	TS-20: ON	TS-30: OFF
TS-01: OFF	TS-11: ON	TS-21: ON	TS-31: ON
TS-02: ON	TS-12: ON	TS-22: ON	DFMA: OFF
TS-03: ON	TS-13: ON	TS-23: ON	RRA: ON
TS-04: ON	TS-14: OFF	TS-24: ON	SAVE: EEPROM
RESET DISPLAYS=[R]	SEND LOOP=[S]	INSERT ERROR=[E]	
ADVANCE=[ARROWS]	DEACTIVATE=[D]	CHANGE PASSWORD=[P]	CHANGE=[ENTER/B]

**Figure 5-3. E1 Menu.**

The E1 Menu is displayed in Figure 5-3. The blinking cursor will be positioned on the MODE field under CONFIGURATION. Use the arrow keys to advance the cursor to the next field and the ENTER key to change any of the configuration selections. Note that by hitting ENTER on the MODE field, you change the mode and cause the screen for that mode to appear.

To reset the displays at the top of the screen, simply type the letter “R.” To insert an error, type the letter “E.” Refer to **Chapter 2** for a detailed description of each of the displays and LEDs. Refer to **Chapter 3** for a detailed description of each of the Configuration parameters.

To send a loop, select the loopback type by advancing to the LP Type field and hitting the ENTER key until the desired loopback type appears. Go to the LOOP field and select “Send On.” With the LP type and Loop fields programmed, type the letter “S” to send the loop.

## 5.7 Async Menu

```

                                WAN TESTER

DISPLAYS
C ERR: 000000000   C RCVD: 0000001692   TEST SEC: 002560   ERR SECS: 000000
                                CRC ERRS: 000000   BPV ERRS: 000005

LEDS (*=LED ON)
PAT LOCK          PAT RECOVD:   TXD:    RXD:    RTS: *   CTS:
DSR:   DTR: *

CONFIGURATION
MODE: ASYNC      SPEED: 64000      DATA BITS: 6      RTS: ON
OUTPUT: NORMAL  PAT: 511         STOP MARKS: 2     DTR: ON
INTERFACE: RS232      PARITY: NONE     SAVE: EEPROM

RESET DISPLAYS=[R]  SEND LOOP=[S]          INSERT ERROR=[E]
ADVANCE=[ARROWS]  DEACTIVATE=[D]      CHANGE PASSWORD=[P]  CHANGE=[ENTER/B]
```

Figure 5-4. Async Menu.

The Async Menu is displayed in Figure 5-4. The blinking cursor will be positioned on the MODE field under CONFIGURATION. Use the arrow keys to advance the cursor to the next field and the ENTER key to change any of the configuration selections.

## NOTE

**By pressing ENTER on the MODE field, you change the mode and cause the screen for that mode to appear.**

To reset the displays at the top of the screen, simply type the letter “R.” To insert an error, type the letter “E.” Refer to **Chapter 2** for a detailed description of each of the displays and LEDs. Refer to **Chapter 3** for a detailed description of each of the Configuration parameters.

To send a loop, select the loopback type by advancing to the LP Type field and hitting the ENTER key until the desired loopback type appears. Go to the LOOP field and select “Send On.” With the LP type and Loop fields programmed, type the letter “S” to send the loop.

## 5.8 Sync Menu

```

                                WAN TESTER

DISPLAYS
ERRS: 000000000   BER: 0.00 x 10e-07   TEST SEC: 000007   ERR SECS: 000000
SES: 000000       DEG MINS: 000000   AVAIL: 999999     UNAVAIL: 999999
TX FREQ: 0029134  RX FREQ: 0000000   RTS TIME: 6409

LEDS (*=LED ON)
PAT LOCK          PAT RECOVD:   TXD:    RXD: *    RTS: *    CTS:
DSR:   DTR: *

CONFIGURATION
MODE: SYNC        PAT: 2047          SPEED: 50000      RTS: AUTO
OUTPUT: NORMAL    V.54: SEND ON     TX CLK: PROVIDE   DTR: ON
INTERFACE: V.35   TX CLK: NORMAL    SAVE: EEPROM

RESET DISPLAYS=[R]  SEND LOOP=[S]          INSERT ERROR=[E]
ADVANCE=[ARROWS]  DEACTIVATE=[D]        CHANGE PASSWORD=[P]  CHANGE=[ENTER/B]

```

**Figure 5-5. Sync Menu.**



The Sync Menu is displayed in Figure 5-5. The blinking cursor will be positioned on the MODE field under CONFIGURATION. Use the arrow keys to advance the cursor to the next field and the ENTER key to change any of the configuration selections.

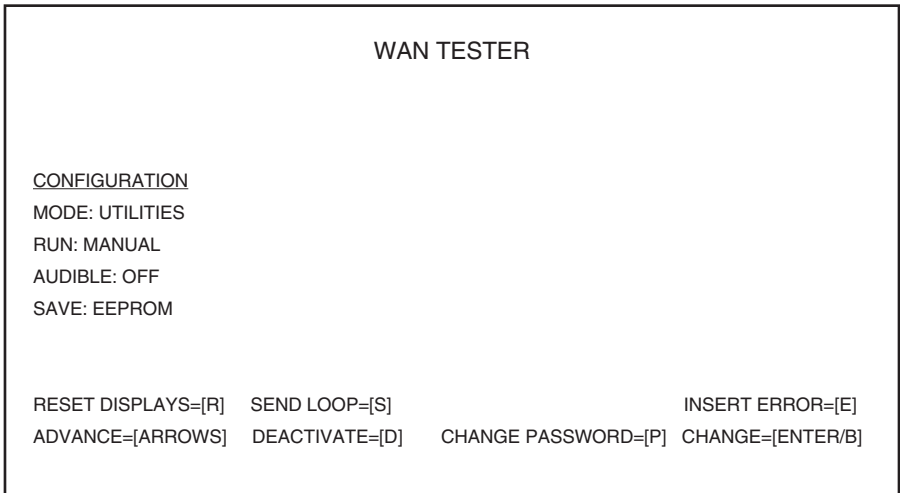
## NOTE

**By hitting ENTER on the MODE field, you change the mode and cause the screen for that mode to appear.**

To reset the displays at the top of the screen, simply type the letter “R.” To insert an error, type the letter “E.” Refer to **Chapter 2** for a detailed description of each of the displays and LEDs. Refer to **Chapter 3** for a detailed description of each of the Configuration parameters.

To send a loop, select the loopback type by advancing to the LP Type field and hitting the ENTER key until the desired loopback type appears. Go to the LOOP field and select “Send On.” With the LP type and Loop fields programmed, type the letter “S” to send the loop.

## 5.9 Utilities Menu



**Figure 5-6. Utilities Menu.**

The Utilities Menu is displayed in Figure 5-6. The blinking cursor will be positioned on the MODE field under CONFIGURATION. Use the arrow keys to advance the cursor to the next field and the ENTER key to change any of the configuration selections.

**NOTE**

By hitting ENTER on the MODE field, you change the mode and cause the screen for that mode to appear.

Refer to **Chapter 3** for a detailed description of each of the Configuration parameters.

## 6. Battery Power

The WAN Tester is equipped with a battery option. Eight rechargeable Nickel Metal Hydride batteries power the unit. These state-of-the-art batteries do not require discharging before recharging, which means you do not have to wait for the battery to run down before recharging. The batteries do not retain memory; you can recharge them anytime. In addition, they are non-toxic to the environment.

An ON/OFF switch (located below the console port on the left side of the unit) is used to invoke the battery option.

- **OFF:** This selection is used to charge the batteries. The AC adapter must be plugged into the wall when this selection is made. The unit requires 14 hours in the OFF position to charge the batteries for one period of 5 hours.
- **ON:** This selection is used to provide battery power for the tester. If the AC adapter is not plugged into the wall, the tester runs off the batteries. The batteries have a charge life of 5 hours.

### NOTE

**If the AC adapter is plugged into the wall when the switch is in the ON position, the tester runs off the AC power and simultaneously charges the batteries. Charge time takes considerably longer than in the OFF position.**

We recommend replacing the batteries once a year to protect the unit from being damaged by battery erosion.

# 7. Troubleshooting

## 7.1 Calling Black Box

If you determine that your WAN Tester is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

## 7.2 Shipping and Packaging

If you need to transport or ship your WAN Tester:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the WAN Tester for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.



© Copyright 2001. Black Box Corporation. All rights reserved.

---

1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746