

MAN-10100-001 Rev. C00



# SunLite<sup>®</sup> E1

## User's Manual

### SS265



*Sunrise Telecom<sup>®</sup>...a step ahead*

302 Enzo Drive San Jose, CA 95138  
Tel: 1-408-363-8000 Fax: 1-408-363-8313

 **WARNING**

Using the supplied equipment in a manner not specified by Sunrise Telecom may impair the protection provided by the equipment.

Copyright 2004

Sunrise Telecom Incorporated

This device uses software either developed by Sunrise or licensed by Sunrise from third parties. The software is confidential and proprietary. The software is protected by copyright and contains trade secrets of Sunrise or Sunrise's licensors. The purchaser of this device agrees that it has received a license solely to use the software as embedded in the device, and the purchaser is prohibited from copying, reverse engineering, decompiling, or disassembling the software.

SunLite E1 User's Manual  
Table of Contents

<b>1 General Description .....</b>	<b>5</b>
1.1 LED Panel .....	6
1.2 Keys.....	8
1.3 Connectors, Controls, and Back Side .	10
1.4 Batteries .....	12
<b>2 Basic Definitions .....</b>	<b>13</b>
<b>3 Menus .....</b>	<b>14</b>
<b>4 Menu Parameters.....</b>	<b>15</b>
4.1 CONFIG (Configuration) Key .....	15
4.2 0101 (Test Pattern) Key.....	20
4.3 TX (Transmit) Key .....	22
4.4 [R] (Results) Key .....	23
4.5 Fn (Function) Key .....	33
4.6 [VF] (VF Measurements) Key .....	48
4.7 CAS (CAS) Key .....	50
4.8 [Histogram] (Histogram) Key .....	51
4.9 Sa (Sa Bits) Key .....	52
<b>5 Firmware Upgrading.....</b>	<b>53</b>
5.1 CPU Download .....	53
5.2 FLASH Memory Download .....	53
5.3 DSP Download .....	53
<b>6 Applications .....</b>	<b>54</b>
6.1 Accept a New 2.048 Mbit/s Circuit.....	54
6.2 Monitoring an In-Service Circuit .....	55
6.3 Measuring Propagation Delay .....	56
6.4 Frequency Synchronization .....	57
6.5 Measuring Signal Level .....	58
6.6 Channel Associated Signalling .....	59
6.7 Voice Frequency Channel Monitoring .....	59
6.8 Send/Receive Digital Tones.....	60
6.9 N (or M) x64 kbit/s Testing .....	61
<b>7 Specifications .....</b>	<b>62</b>
<b>8 Express Limited Warranty.....</b>	<b>68</b>
<b>9 Declaration of Conformity .....</b>	<b>71</b>
<b>Index .....</b>	<b>73</b>

### Important Safety Information

#### WARNINGS:

- Use NiMH batteries only.
- Use SA143 or equivalent AC adaptor to charge the NiMH batteries.
- Use only Sunrise Telecom 120-21011-120 replacement NiMH batteries

### Operating Environment

This test set is intended for operation in at least partly weather protected and temperature controlled locations, as per IEC 721-3-7, Class 7K2. Do not operate this test set in rain, or in a direct water splash environment.

### Input Connectors

These connectors are intended for connection to E1 circuits only.

- Maximum input voltage is 12VDC.

### Dip Switch Information

The six dip switches, located in the battery compartment (see Figure 6), are intended for factory test and programming use. They should be left in the positions indicated in the following figure for normal operation.



Figure 1 Dip Switch

## 1 General Description

Welcome to the SunLite E1. This compact, lightweight, and versatile test set allows you to perform many E1 tests. Accept a circuit, check for quality, observe signalling information; the SunLite E1 performs all of these functions and more via a simple keypad-oriented user interface. This manual will introduce you to the SunLite E1. You will be led through test setup and shown how to perform applications.

If you have questions, please call your distributor or Sunrise Telecom's Customer Service department.

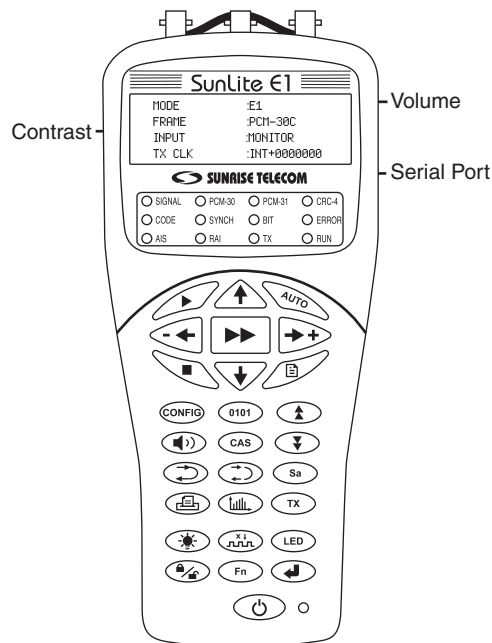



Figure 2 SunLite E1, Front View

### 1.1 LED Panel

Just below the LCD screen is a group of LEDs (see Figure 3). Most of these LEDs reflect received information. A flashing red LED indicates an error or alarm has occurred in the past, but is no longer occurring, press  to clear.

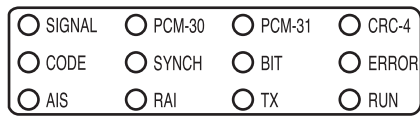


Figure 3 LEDs

#### SIGNAL

- Green: Receiving E1 pulses.
- Red: Not receiving pulses.

#### PCM-30, PCM-31

- Green: Receiving framing as expected.
- Red: Framing expected, not received.

#### CRC-4

- Green: CRC-4 received as expected.
- Red: CRC-4 expected, not received.

#### CODE

- Red: Code error received.

#### SYNCH

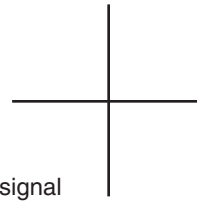
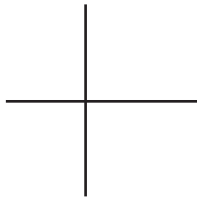
- Green: Synchronized on received test pattern.
- Red: Synchronization has not been achieved.

#### BIT

- Red: Bit error received.

#### ERROR

- Red: Code, bit, bit slip, CRC-4, E-bit, or Frame error received.

**AIS**

- Red: Receiving an unframed all ones signal (Alarm Indication Signal).

**RAI**

- Red: Remote Alarm Indication received.


**TX**

- Green: Transmitting.
- Flashing green: Transmitting in self-loop mode.
- No light: Not transmitting.

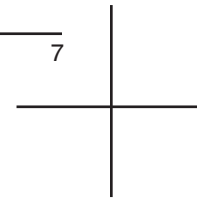
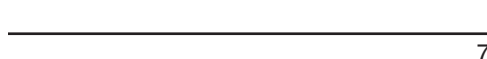
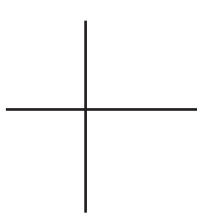
**RUN**

- Green: Measurements are being taken.

**Power**

Located to the right of the  power key.

- Red: Battery running low.
- Green: Test set is fully charged and/or plugged into the adaptor.



## 1.2 Keys

The test set has two sets of keys. The central set controls the most basic functions. The lower portion controls specific functions and actions.

### Notes

- When ►► (scroll) has been released for more than a second, the parameters are set.
- The -◀ cursor left/decrease key, decreases the internal clock frequency (for clock calibration) and the timeslot selection in VF measurements, as well as moves the cursor in the indicated direction.
- The ►+ cursor right/increase key, increases the internal clock frequency (for clock calibration) and the timeslot selection in VF measurements, as well as moves the cursor in the indicated direction.
- Repeatedly pressing ■ (stop) will have no affect.

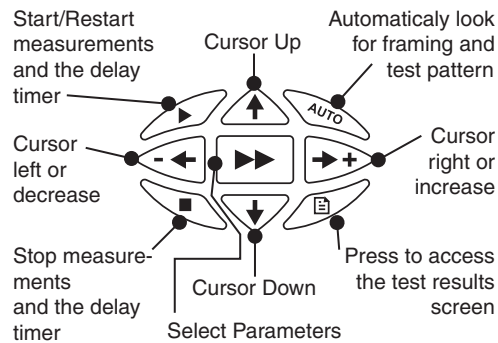























Figure 4 Center Keys



### Lower group of keys

The following keys are shown in Figure 2

- : Displays the configuration screen.
- : Displays the test pattern screen.
- : Page up through available screens.
- : Displays VF measurements.
- : View the Channel Associated Signalling on the received line.
- : Page down through available screens.
- : Send the Loop Down code selected in the Loop codes screen in the  menu.
- : Send the Loop Up code selected in the Loop codes screen in the  menu.
- : View the status of the received Sa 4-8 bits.
- : Print the screen. If viewing results or VF measurements, all screens will be printed. In profiles, the selected profile will be printed.
- : Displays histogram screens.
- : Turn the transmitter on/off, or to enter the self-loop mode.
- : Turn the backlight on/off.
- : Inject an error on the transmitted signal.
- : Press to clear blinking LEDs.
- : Press the lock/unlock key once to lock all keys. The test set will beep once, and its settings cannot be changed. Press the key twice, the keys will be unlocked, and the test set will beep twice.
- : Access the function menu to set various parameters.
- : Execute a specific action.
- : Turn the test set on/off. Note that if you quickly turn the test set on after turning it off, you may see static for a moment. It will clear and the normal start up screen will appear.

### 1.3 Connectors, Controls, and Back Side

This section describes the connectors and controls available on the test set.

#### Top Panel

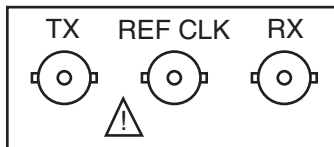


Figure 5 SunLite E1 Top Panel

#### WARNING

The connectors on this panel are intended for connection to E1 circuits only, as defined in EN60950. Maximum input voltage: 12VDC.

- TX: 75 $\Omega$  unbalanced BNC connector; transmits the E1 signal from the test set.
- REF CLK: BNC reference clock input connector; plug a 2.048 Mbit/s, AMI or HDB3, reference clock signal in here.
- RX: 75 $\Omega$  unbalanced BNC connector; receive the E1 signal here.

#### Right Side

- Volume Control: Adjusts speaker volume.
- Serial Port: This RJ-11 serial port is used to connect a printer or download firmware.

#### Left Side

- Contrast Control: Adjusts screen contrast.

#### Bottom Side

- 5VDC: Plug the power adaptor here. The test set may be operated with a discharged battery, provided the charger is connected. The battery will charge during operation.

### Back Side

This side of the test set contains :

- Speaker
- Microphone
- Battery Compartment

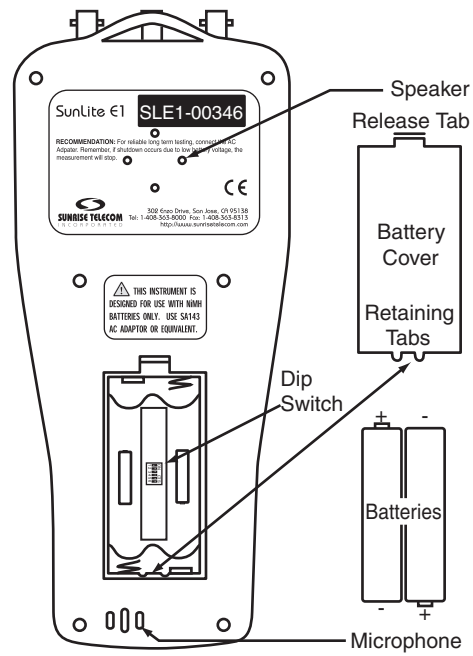


Figure 6 Sunlite E1 Back View

#### 1.4 Batteries

The test set's internal batteries are accessed through the back of the test set. Refer to Figure 6 and the following instructions on changing the batteries.

 **WARNING**

- Use NiMH batteries only.
- Use SA143 or equivalent AC adaptor to charge the NiMH batteries.
- Use only Sunrise Telecom 120-21011-120 replacement NiMH batteries.

#### Replacing the NiMH batteries

1. Remove the battery compartment cover by pressing the Release tab towards the center of the cover and then lift the cover off.
2. Remove the old batteries by pushing each battery against the spring and lifting upward. You may need a flat tool, such as a small screw driver to accomplish this.
3. Insert the new batteries by pressing the negative end of each battery against the spring (as indicated in the battery compartment) and push each battery into place.
4. Replace the cover by inserting the retaining tabs into their slots and then gently push the cover down into place.



## 2 Basic Definitions

Here are some abbreviations you will run into, and their definitions.

**AIS:** Alarm Indication Signal—an all 1s signal on the line. Indicates loss of signal or other severe problem.

**HH: MM:SS:** hours: minutes: seconds

**LT:** Line Termination

**LVL:** Level

**PMP:** Protected Monitoring Point

**RAI:** Remote Alarm Indication; notice that an alarm has occurred at the far end of the line

**UI:** Unit Interval; This is the time it takes to transmit 1 bit; .488 ms at 2.048 Mbit/s

**mS:** Microsecond

**VF:** Voice Frequency

### 3 Menus

The test set is key driven. The following table shows the organization of the keys and their options. To select a menu, press it's corresponding key. If you get lost in a menu, press the same key to start over.

Key	Page	Options or Screens	
CONFIG	15	MODE	
	16	FRAME	
	19	INPUT	
	19	TxCCLK	
0101	20	Test Patterns	
TX	22	MODE	
[ ]	23	SUMMARY	
	24	SIGNAL/FREQUENCY	
	25	ERRORS	
	28	SIGNAL ERRORS	
	28	FRAMING RAI	
	29	G.821	
	31	G.826	
	32	M.2100/550	
	Fn	33	TIME & DATE
		33	SET IDLE CODES
		34	PRINT PERIOD
34		PROFILE	
35		TEST DURATION	
36		TEST RESULTS	
37		DELAY TIMER	
38		SEND FRAME WORDS	
39		M.2100 PARAMETERS	
39		CLK CALIBRATION	
40		AUDIBLE ALARM	
40		ERROR INJECTION	
41		LOOP CODES	
42		ERASE NV RAM	
43		COMPANDING	
43		PROPAGATION DELAY	
44		LINE CODING	
44		FREQ. RESOLUTION	
45		AUTO STRESS	
45		LANGUAGE SELECTION	
45	LINE TERMINATION		
46	ALARM GENERATION		
46	G.821 ALLOCATION		
47	VIEW RECEIVED DATA		
[ ]	48	VF Setup and Measurements	
CAS	50	Observe Channel Associated Signalling on all 30 channels.	
[ ]	51	Histogram measurements	
Sa	52	Observe Sa-bit status	

## 4 Menu Parameters

This section will guide you in the key, menu, and option selections for setting up the test set. Technology Notes provide information about the technology behind the choices, and are enclosed in frames.

On power up, the test set does a self test, after which it displays the Version/Option screen. Press **CONFIG** to begin configuration. Use **←**, **→**, and **↔** to move to the cursor (  ). Press **↑** and **↓** to scroll between screens. Press **▶▶** to select options.

### 4.1 **CONFIG** (Configuration) Key

Before connecting, configure the test set.

```
MODE   :E1           ▶▶
FRAME  :UNFRAME
INPUT  :MONITOR
TX CLK :INT±00000
```

Figure 7 Set Up Screen

#### **MODE**

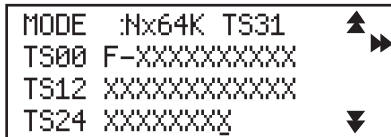
Select the test rate.

Options: E1, Nx64k

- E1: Test at a full 2.048 Mbit/s.
- Nx64k: Test at fractional testing. If Nx64k is selected, the timeslot selection screen is displayed after pressing **↓** or **↑**.

```
MODE  :Nx64K TS04   ▲▶▶
TS00  F-XXXXXXXXXX
TS12  XXXXMXXXXXXXX
TS24  XXXXXXXXX     ▼
```

Figure 8 PCM-30 Timeslot Screen



**Figure 9 PCM-31 Timeslot Screen**

1. Use ←, →, ↓, and ↑ to select the desired timeslot. The selected timeslot is underlined. Timeslots 0 and 16 will be skipped in PCM-30, and TS 0 will be skipped in PCM-31. The active timeslot is underlined (TS 4 in Figure 8, TS 31 in Figure 9). – = Unused timeslots, X = Active timeslots
2. Press ► to select and deselect timeslots.
3. Press (v) or (^) to return to the configuration screen.

**Technology Note: E1 Rate**

The E1 signal is transmitted at a rate of 2.048 Mbit/s. The rate is achieved by multiplexing 32 individual 64 kbit/s bitstreams (timeslots in the 2.048 signal).

**FRAME**

Select the desired framing type.

Options: PCM-30, PCM-30C, PCM-31, PCM-31C, UNFRAME

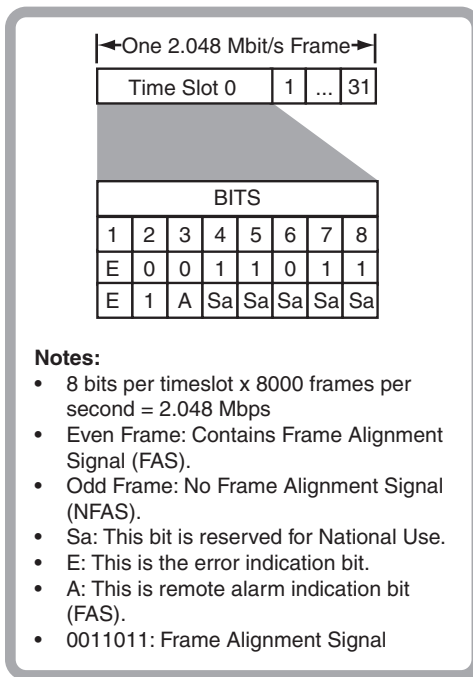
**Notes:**

- Press AUTO to have the test set auto-synch on the received E1 framing.
- A 'C' added to PCM-30 and PCM-31 indicates enabling of CRC-4 error checking.



**Technology Note: E1 Framing**

E1 transmission utilizes two main types of framing, Frame Alignment Signal (FAS), and MultiFrame Alignment Signal (MFAS). The next two figures show a graphic representation of these types of framing.



**Figure 10 FAS Framing Structure**

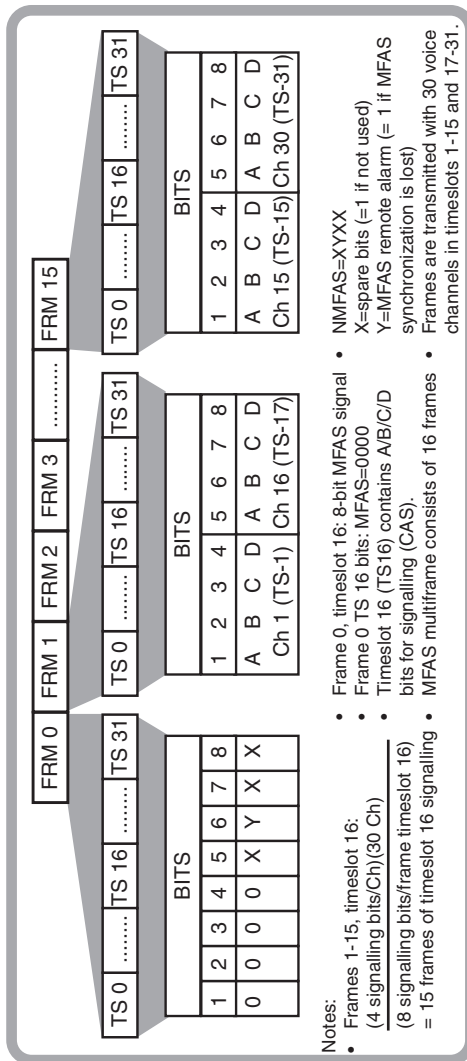


Figure 11 MFAS Frame Structure



### INPUT

Select the receiver level.

Options: TERM, HI-Z, MONITOR

- TERM: Terminates the line.
- HI-Z: Configures the test set for high impedance mode.
- MONITOR: Use when connecting the test set to a PMP.

### TxCLK

Select the transmit clock source.

Options: INTERNAL, EXTERNAL, RECEIVED, IN+/- XXXXX ppm or Hz

**Note:** If the test set does not have the clock offset option, this setting is fixed at INTERNAL.

- INTERNAL: Uses the test set's internal 2.048 MHz +/- 25 ppm clock.
- IN+/-XXXXX: Use to shift the internal transmit frequency, in ppm (up to 24400 ppm) or Hz (up to 50000 Hz). To do so:
  1. Press  $\rightarrow$  to move the cursor to each digit position.
  2. Use  $\blacktriangleright$  to select a digit from 0 to 5 for the first position, and from 0 to 9 for the remainder.
  3. Press any key to exit the screen.
- EXTERNAL: Use an external frequency source connected to the test set REF CLK input to provide timing for the transmitted E1 signal.
- RECEIVED: Recovers the clock from the received signal and uses it as your TxCLK.

#### 4.2 (Test Pattern) Key

Select or create a test pattern. The pattern is transmitted on the non-selected channels.

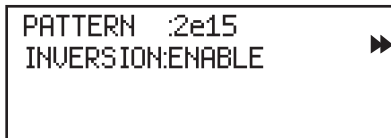


Figure 12 Test Pattern Selection Screen

#### PATTERN

Options: 2e15, 2e9, 2e11, 2e23, 1111, 0000, 1010, RICAR 3, User 1, User 2, User 3, LIVE, LOOP

- Select a standard test pattern; 2e15, 2e9, 2e11, 2e23, 1111, 0000, 1010, or RICAR 3.
- LIVE: This option has the test set stop looking for a test pattern, and simply measure the live signal. The test set will transmit idle code in all channels.
- LOOP: Transmits the received signal.

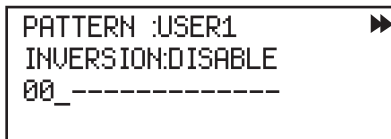


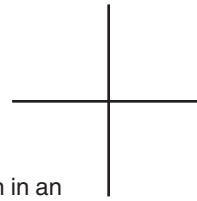
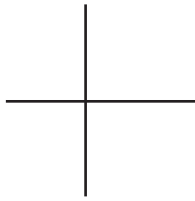


Figure 13 User Test Pattern Screen

- Select and Enter a User Pattern by:
  1. Pressing  to select User1, User2, or User3.
  2. Select the third line of the screen (as in Figure 13) and at each bit location, press  to select 0, 1, or none (-). A user pattern may be from 1 to 16 bits long. Select “none” in the middle of the pattern, and all remaining bits will be set to “none.”



### **INVERSION**

Choose whether to send the test pattern in an inverted form (1s and 0s reversed).

Options: DISABLE, ENABLE

#### **Technology Note: Standard Test Patterns**

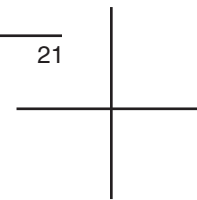
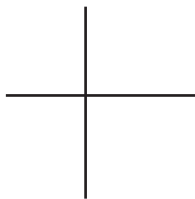
$2^n - 1$ , where  $n = 9, 11, 15, 20, 23$ : are pseudo-random bit sequences. The signal is formed from a 9, 11, 15, 20 or 23-stage shift register and is not zero-constrained. The patterns conform to the ITU O.151 technical standard.

1111: The all 1s pattern is used for stress testing circuits. If the pattern is sent unframed, it will be interpreted as an AIS.

1010: This is the alternating ones and zeros pattern. The pattern is frame aligned with "f" showing the location of the framing bit. The pattern is: f 0101 0101.

0000: This is the all zeros pattern. If the circuit is AMI, the pattern synch and/or signal will be lost.

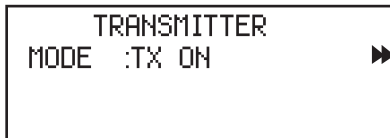
RICAR 3: Fixed 24 bit pattern used in France. The pattern is: 1000 1000 1000 1111 1111 1111.



### 4.3 (Transmit) Key

Determine the test set's transmitter status.


Options: TX ON, TX OFF, SELF-LOOP

















**Figure 14 Transmitter Screen**

- TX ON: Activates the transmitter.
- TX OFF: Deactivates the transmitter.
- SELF-LOOP: The test set sends its transmit signal directly to its receiver, in order to verify the test set is configured properly and is able to achieve pattern synchronization, before connecting to the line.

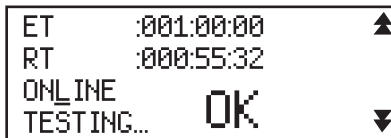
#### 4.4 (Results) Key

Press  to view test results. There are a number of screens, including counts and percentages.

##### Taking Measurements




1. Set up the configuration screen and press .
2. Press  and the RUN LED will turn green.
3. During measurement, , , , , , and  are deactivated.
4. Press  to stop measurements. The RUN LED will turn off.
5. Press  to see test results.
  - Many results are available in percentage formats as well as counts. Press  to access these results. For example, the G.821 screen shows EF, UAS and AS counts. Press  and the screen shows %EFS, %UAS, %AS.
  - Press  and  to page through the measurement results screens.

##### Summary Results

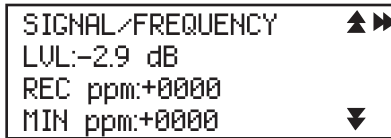


```
ET      :001:00:00  ▲
RT      :000:55:32
ONLINE
TESTING...  OK      ▼
```

Figure 15 Summary Results Screen

- Overall summary (OK; no errors or alarms detected).
- **ET**: Elapsed Time since pressing . This is reset to zero after pressing , then .
- **RT**: If the test is timed, this shows the Remaining Time of the test in Hours: Minutes: Seconds. If the test is continuous it will display “---:--:--”.

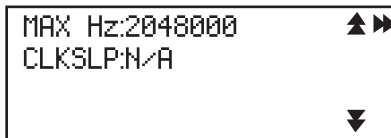
### Signal/Frequency Results



```
SIGNAL/FREQUENCY  ▲▶▶
LVL:-2.9 dB
REC ppm:+0000
MIN ppm:+0000     ▼
```

Figure 16 Signal/Frequency Results Screen

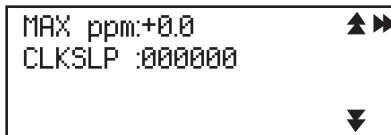
- **LVL:** Negative and positive level of the pulses being received by the test set. Measurements are from the base of the pulse to its peak, and are displayed in decibel variance from DSX level (dB).
- **REC ppm:** Received frequency variance from 2.048 MHz in parts per million. For example, if the received frequency is 2048010.24 Hz, the test set will report 2048010.24/5 ppm. Press ▶▶ to see in Hz.
- **MIN ppm:** Minimum frequency variance value which has been measured in parts per million. Press ▶▶ to see in Hz.



```
MAX Hz:2048000    ▲▶▶
CLKSLP:N/A
                  ▼
```

Figure 17 Frequency Results Screen

- **MAX HZ:** Maximum frequency measured since the beginning of the test. This variance is shown in both Hz and ppm. Scroll to the next screen to see the measurement in ppm.



```
MAX ppm:+0.0     ▲▶▶
CLKSLP :000000
                  ▼
```

Figure 18 Frequency in ppm Screen



- **CLK SLP:** Number of clock slips since the beginning of the test. A clock slip occurs when the measured frequency deviates from the reference frequency by one unit interval.  
**Note:** If there is no reference frequency, CLK SLP is reported as N/A.

**Errors**

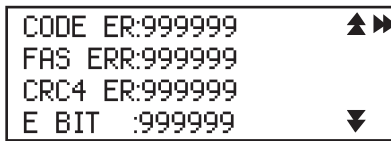


Figure 19 Error Screen

- **CODE ER:** Count of the number of code errors since the beginning of the test.
- **FASERR:** Count of Frame Alignment Signal errors.
- **CRC4 ER:** Count of the number of CRC-4 errored blocks since the beginning of the test. This measurement is N/A when the test set is not synchronized on a received CRC-4 multiframe.
- **E BIT:** Count of the number of E-bits which have been received since the beginning of the test.

**Note:** Press ▶▶ to see the error rates, as in Figure 20:

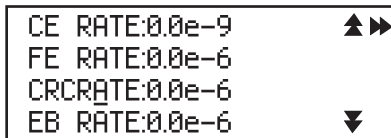


Figure 20 Error Rates Screen

**Technology Note: CRC-4**

The equipment which originates the E1 data calculates the CRC-4 bits for one submultiframe. It inserts the CRC-4 bits in the next submultiframe. The receiving equipment performs the reverse mathematical computation on the submultiframe. It compares the transmitted and calculated values. If there is a discrepancy in the two values, a CRC-4 error is reported.

Each CRC-4 error does not necessarily correspond to a single bit error. Multiple bit errors within the same submultiframe will lead to only one CRC-4 error for the block. Also, it is possible that errors could occur such that the new CRC-4 bits are calculated to be the same as the original bits.

CRC-4 uses a multiframe structure consisting of 16 frames, as shown in the next figure. The CRC-4 multiframe is not necessarily aligned with the MFAS multiframe. Each CRC-4 multiframe can be divided into 2 submultiframes (SMF). These are labeled SMF#1 and SMF#2 and consist of 8 frames apiece. We associate four bits of CRC information with each submultiframe.

M-FRM	SM-FRM	FRM	Time Slot 0							
			Bit							
			1	2	3	4	5	6	7	8
	1	0	c1	0	0	1	1	0	1	1
		1	0	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
		2	c2	0	0	1	1	0	1	1
		3	0	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
		4	c3	0	0	1	1	0	1	1
		5	1	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
		6	c4	0	0	1	1	0	1	1
	7	0	1	A	Sa4	Sa5	Sa6	Sa7	Sa8	
	2	8	c1	0	0	1	1	0	1	1
		9	1	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
		10	c2	0	0	1	1	0	1	1
		11	1	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
		12	c3	0	0	1	1	0	1	1
		13	E	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
		14	c4	0	0	1	1	0	1	1
15		E	1	A	Sa4	Sa5	Sa6	Sa7	Sa8	

- Notes:**
- SM-FRM+1: Sub-Multiframe #1
  - Sa: Spare bit reserved for National Use
  - A: Remote Alarm (FAS Remote Alarm Indication)
  - Frame Alignment Signal Pattern: 0011011
  - CRC-4 Frame Alignment Signal: 001011
  - CRC multiframe is not aligned with MFAS timeslot 16 multiframe
  - SM-FRM 2: Sub-Multiframe #2
  - E: E-bit Errors
  - c1, c2, c3, c4: CRC bits

**Figure 21 CR-4 Multiframe Format**

**Technology Note:**  
**E-bit Performance Monitoring**

When the terminal equipment of a 2.048 circuit is optioned for CRC-4 transmission, E-bit transmission may also be enabled. The terminating equipment transmits E-bits on the 2.048 Mbit/s line, when it receives a CRC-4 error. E-bit error transmission is a relatively new feature in 2.048 transmission. E-bit transmission allows a 2.048 Mbit/s in-service circuit to be reliably monitored for transmission performance from any point on the circuit.

### Signal Errors

LOSS	:000000
LOFS	:000032
SYLS	:000000
AIS	:000032

Figure 22 Signal Errors Screen

- **LOSS:** Loss of Signal Seconds is the number of seconds during which the signal was lost during the test.
- **LOFS:** Loss of Frame Seconds is a count of seconds in the test which experience a loss of framing.
- **SYLS:** Count of the number of pattern Synchronization Lost Seconds, since the beginning of the test.
- **AIS:** Count of the number of seconds since the beginning of the test in which the test set received an AIS (all 1s) signal.

### Framing RAI

FAS RAI:000010	▲
MFASRAI:000000	▼

Figure 23 Framing RAI Screen

- **FAS RAI:** Count of the seconds during which Frame Alignment Signal Remote Alarm Indication was received.
- **MFAS RAI:** Count of the seconds during which Multiframe Alignment Signal Remote Alarm Indication was received.

### G.821 Results

```
G.821 (1/6)  ▲▶▶
BIT ERR:0
ES   :0
SES  :0      ▼
```

Figure 24 G.821 Results Screen 1

- **BIT ERR:** Count of Bit Errors received since the beginning of the test. BER in the percentage screen is Bit Error Rate.
- **ES:** Count of Errored Seconds received since the beginning of the test. An errored second is any second with at least one BPV, bit error, FBE, or CRC-4 error.
- **SES:** Count of the Severely Errored Seconds received since the beginning of the test. An SES has an error rate of  $10^{-3}$  or higher.

```
G.821 (3/6)  ▲▶▶
EFS   :100
UAS   :0
AS    :100   ▼
```

Figure 25 G.821 Results Screen 2

- **EFS:** Count of Error Free Seconds since the beginning of the test.
- **UAS:** Count of Unavailable Seconds since the beginning of the test. This begins at the onset of 10 consecutive SES, or at a loss of signal, frame, or pattern.
- **AS:** Count of Available Seconds, which is the length of the total test time, minus any UAS.

#### Notes:

- The G.821 standard is set in (Fn)/G.821 ALLOCATION.

- When the LIVE pattern is selected, G.821 measurements will be reported as N/A, as in the following figure:

G.821 (2/6)	L	▲▶▶
BER :N/A	I	
%ES :N/A	U	
%SES :N/A	E	▼

Figure 26 G.821 LIVE Screen

G.821 (5/6)		▲▶▶
DGRM :0		
%ES P/F:P		
%SES P/F:P		▼

Figure 27 G.821 DGRM Screen

- DGRM:** Count of Degraded Minutes; a block in which there is a  $10^{-6}$  bit error rate during 60 available, non-severely errored seconds.
- Press ▶▶ to see the results in a percentage format.
- %ES P/F:** Reports "PASS" or "FAIL" for the G.821 %ES standard.
- %SES P/F:** Reports "PASS" or "FAIL" for the G.821 %SES standard.

**G.826 Results**

G.826	(1/4)	▲▶▶
EB	:0	
BBE	:0	
SES	:0	▼

**Figure 28 G.826 Measurements Screen 1**

- **EB:** Count of Errored Blocks, which contain bit errors.
- **BBE:** Count of Background Block Errors. A BBE is an EB not occurring during an SES.
- **SES:** Count of Severely Errored (block) Seconds. An SES containing equal or greater than 30% EBs.
- Press ▶▶ to see the results in a percentage format.

G.826	(3/4)	▲▶▶
ES	:999999	
UAS	:999999	
AS	:999999	▼

**Figure 29 G.826 Measurements Screen 2**

- **ES:** Count of Errored Seconds.
- **UAS:** Count of Unavailable Seconds.
- **AS:** Count of Available Seconds.

### M.2100/550 Results

M.2100/550		▲
%ES	:55.555	
%SES	:55.555	
P/F	:FAILED	▼

Figure 30 M.2100/550 Results Screen

Measurements are based on the MEASUREMENT PERIOD and HRP MODEL %, which is set via  $\text{Fn}$ .

**%ES:** Percentage of Errored Seconds which have occurred since the start of the test.

**%SES:** Percentage of Severely Errored seconds which have occurred since the start of the test.

**P/F:** Specifies whether the M.2100/550 test is "PASS" or "FAIL" for the specified HRP MDEL% and time period.



#### 4.5 (Function) Key

Select function parameters from six screens.

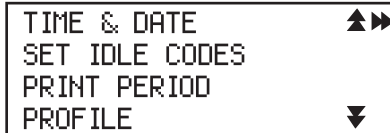


Figure 31 Function Menu Screen 1

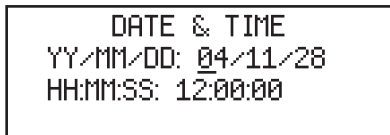








Figure 32 Date & Time Screen

#### TIME & DATE

Set the current time and date in the set.

1. Press  or  to place the cursor.
2. Press  to select and set each digit.
3. Press  or  to select the other line.
4. Press  to return to the Function menu.

#### SET IDLE CODES

Determine the pattern the unit will send on unused channels. Channel Associated Signalling (CAS) idle code is also set in this screen.

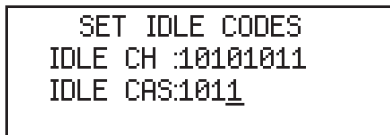








Figure 33 Set Idle Codes Screen


1. Press  or  to place the cursor.
2. Press  to select and set each digit.
3. Press  or  to select the other line.
4. Press  to return to the Function menu.

**Note:** The default idle code is 00000000, the default idle CAS is 1101.

### PRINT PERIOD

Determine when the test set will send results to the serial port to be printed.

Options: NOW, 5 MIN, 15 MIN, 1 HR, 24 HRS, LAST, EVENT, OFF

- NOW: The results are printed every time  is pressed.
- 5 MIN, 15 MIN, 1 HR, or 24 HRS: Results are printed every time the selected period of time has passed.
- LAST: Results are printed when the measurements are finished, or stopped.
- EVENT: Prints a event report.
- OFF: Disables the print function.

### PROFILE

Save or invoke a system profile. A system profile includes configuration and function parameters. The test set will power up using its last configuration.

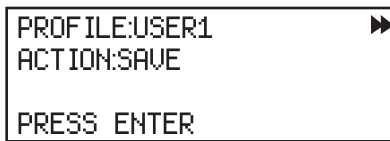






Figure 34 Profile Screen

Options: USER1 to USER10, CURRENT

Action: SAVE, RECALL, DELETE, PRINT

- USER1 to 10: The following actions are available:
  - SAVE: Use to save the Current Profile via the following procedure:
    1. Press  to select a USER number for the name of the profile.
    2. Press  to select ACTION.
    3. Press  to select SAVE.
    4. Press .

**Note:** If 10 profiles are stored, any new profile will overwrite a previous profile.

- PRINT: Use to print a profile by:
  1. At PROFILE, select a USER profile.
  2. Press  $\downarrow$  to select ACTION.
  3. Press  $\blacktriangleright$  to select PRINT.
  4. Press  $\odot$ .
- RECALL: Activate a Stored Profile by:
  1. At PROFILE, select a USER profile.
  2. Press  $\downarrow$  to select ACTION.
  3. Press  $\blacktriangleright$  to select RECALL.
  4. Press  $\odot$ .
- DELETE: Remove a Stored Profile
  1. At PROFILE, select a USER profile.
  2. Press  $\downarrow$  to select ACTION.
  3. Press  $\blacktriangleright$  to select DELETE.
  4. Press  $\odot$ .
- CURRENT: Prints the current profile. This is the only action available.

The next Function menu screen contains:

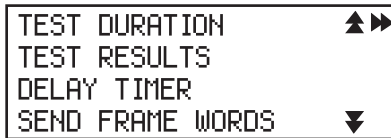


Figure 35 Function Menu Screen 2

#### TEST DURATION

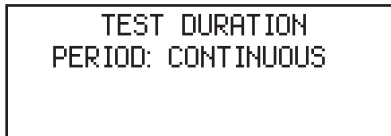



Figure 36 Test Duration Screen

This screen contains the following:

## PERIOD

Determine the measurement duration.

Options: CONTINUOUS, 15 MIN, 1 HR, 12 HRS, 24 HRS, PROG

- CONTINUOUS: Test will run until ■ is pressed.
- 15 MIN, 1 HR, 12 HRS, 24 HRS or PROG: Select a timed period or choose a duration time by selecting PROG and then:
  1. Press ↓ to select the DD/HH/MM line.
  2. Press ►► to select a digit to use.
  3. Press ←◀ or ▶➤ to move the cursor.
  4. Press  to return to the Function menu.

## TEST RESULTS

View, print, delete, label, or lock/unlock measurement test results.

Options: RESULTS: 1 through 10

ACTION: VIEW, PRINT, DELETE, NONE, LOCK, UNLOCK

### Create or Edit a Results Label

At the RESULTS line, rename the label with a name up to eight characters long.

1. Press ►► to move through the saved test results. At a test of interest press ▶➤ and the cursor will move under the first character.
2. Press ↓ and ↑ to move through the characters at the RESULTS label line.
3. When you have selected a character to use press ▶➤ to enter the character and move the cursor to the next character.
  - Leave a blank space by moving the cursor without choosing an entry.
  - Press ►► while on a character to erase all characters to the right of it.
  - Clear the entire label by pressing ►► with the cursor at the left of the label.

4. When done, move the cursor to the left of the label and the label is stored.

#### TEST RESULTS ACTION Choices

1. Select the test results of interest.
2. Press  $\downarrow$  to select the ACTION line.
3. Press  $\blacktriangleright$  to choose an action, then press  $\leftarrow$  to carry out the selected action
  - If DELETE is selected, a warning message is displayed, press  $\leftarrow$  to delete, press any other key to escape and keep the test.
  - Press  $\leftarrow$  after selecting ACTION PRINT to print the selected test results.
  - A "START MEASUREMENTS FIRST" message is displayed if you attempt to print, save, view, or delete records when no measurements have been made.
  - The date and time of a result is displayed at the bottom of any saved results screen.
  - Press  $\leftarrow$  to prevent changes, press it again to unlock the saved test.

#### DELAY TIMER

Set a start time before measurements begin.

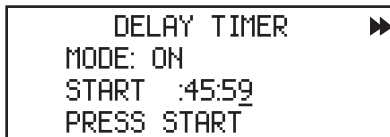


Figure 37 Deley Timer Setup Screen

Options: MODE: ON, OFF

Press  $\blacktriangleright$  to select OFF/ON. If ON, START is available. Enter the delay desired (01 minutes - 99 hours, 99 minutes), by pressing  $\blacktriangleright$  to select a digit and  $\leftarrow/\rightarrow$  to move the cursor. Press  $\blacktriangleright$  and the countdown screen is displayed as in Figure 38. Measurements will begin when the delay has expired. Press  $\blacksquare$  to cancel.

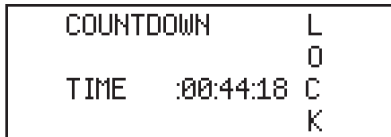


Figure 38 Delay Timer Countdown Screen

**SEND FRAME WORDS**

Modify the frame words, if desired.

- E-bit: 00, 01, 10, 11, AUTO (where the test set replies to an incoming CRC-4 error).
- FAS W: Modify the first bit, to 1 or 0.
- MFAS: Modify bits 5-8, to 0 or 1.
- NFAS: Modify the Si (bit 1), A-bit (bit 2), and Sa bits (4-8). When no CRC-4 is detected, Si is set to 1. You may set the NFAS words for 8 frames (1, 3, 5, 7, 9, 11, 13, 15).

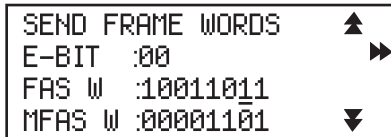


Figure 39 Send Frame Words Screen

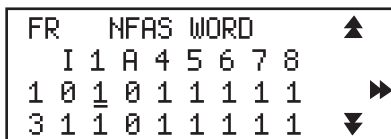
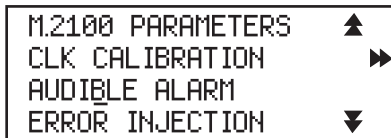


Figure 40 Send NFAS Frame Words Screen

- Factory defaults: E-bit-Auto; MFAS-00001101, NFAS-I, bit=1, A=0, Sa 4-8=1111.

Here is the next Function menu screen:



M.2100 PARAMETERS ▲  
CLK CALIBRATION ►  
AUDIBLE ALARM  
ERROR INJECTION ▼

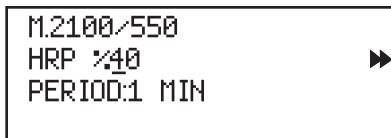
Figure 41 Function Menu Screen 3

### M.2100 PARAMETERS

Set M.2100/550 parameters.

HRP% Options : 00 to 99%

PERIOD Options: 1 MIN, 15 MIN, 1 HR, LAST



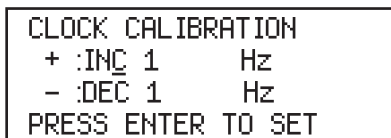
M.2100/550  
HRP %40 ►  
PERIOD:1 MIN

Figure 42 M.2100/550 Parameters Screen

1. At HRP%, press ► to enter a digit, press -◀/▶ to move the cursor.
2. At PERIOD, press ► to select a period.

### CLK CALIBRATION

Set the internal clock frequency.



CLOCK CALIBRATION  
+ :INC 1 Hz  
- :DEC 1 Hz  
PRESS ENTER TO SET

Figure 43 Clock Calibration Screen

1. Press **CONFIG** and set TX CLK: INT+/-00000.
2. Connect the TX port to a calibrated unit or an external frequency counter.
  - If using an external frequency counter, change the LINE CODING in **Fn** to AMI, then select 1111 PATTERN in **0101**.

3. Press  $\rightarrow$ \*/ $\leftarrow$  to increase or decrease the internal clock frequency in 1 Hz steps.
4. Look at the frequency counter or calibrated unit to check the alignment.
5. Continue until the frequency is measured at 2048000 Hz, if using a calibrated unit, or at 102400 (half the frequency) if using an external frequency counter.
6. Press  $\odot$  to set the calibration.

#### AUDIBLE ALARM

Options: ON, OFF

If ON, a beep sounds during an error or alarm.

#### ERROR INJECTION

Set the error injection parameters.

- TYPE: BIT, CODE, BIT&CODE, CRC-4, FRAME, EBIT, ZEROES
- MODE: RATE, BURST (dependent on error type)
- RATE:  $1 \times 10^{-2}$  to  $1 \times 10^{-7}$
- ZEROES: 8, 16, 24....128
- BIT=1-50
- BIT+CODE=1-16

1. Press  $\blacktriangleright$  to select the type of error to inject.
2. For all errors except for ZEROES, FRAME, and EBIT, use BURST to inject a single error. Use RATE to insert a continuous stream of errors at a given rate, then press  $\blacktriangleright$  to select the rate in the following screen:

```


ERROR INJECTION
TYPE :BIT+CODE      ►►
MODE  :RATE
RATE  :1x10-2

```

Figure 44 Error Injection Screen

3. Select RATE to pick the injection rate.



4. Press  and errors of the specified TYPE and COUNT or RATE are injected.
  - If ZEROES is selected as the error TYPE, the mode will be BURST. The test set will inject consecutive zeroes in the test pattern to the selected INSERT NUMBER.
  - Select FRAME or EBIT errors, and a single error is injected at a time.

Here is the next Function screen:

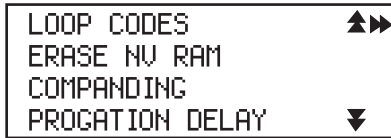




Figure 45 Function Menu Screen 4

**Technology Note: Standard Loopbacks**

Loopback 1 is based on ETR 001. Sa6 bits have a 1111 code. When the loopback is complete, the Sa5 bit sent from the digital switch to the terminal equipment will be 0.

Loopback 2 is based on ETS 300 011. Sa6 bits have a 1010 code, and the Sa5 bit received after the loopback is complete will be 0.

**LOOP CODES**

Select the loop code to be transmitted after pressing  or .

Options: TYPE: PATTERN, STANDARD: LOOPBACK 1, LOOPBACK 2

SA BIT: SA4 through SA8

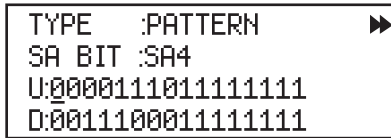



Figure 46 Loop Code Screen

1. Decide whether to send a standard loop code, or to enter your own pattern:
  - If you choose to send a STANDARD pattern, you have two choices:
    - Loopback 1 is a complete, transparent loopback located in the LT.
    - Loopback 2 is a complete, transparent loopback located in the NT1.
  - If you choose PATTERN, enter the code you want to send:
    - Choose the Sa bit, from Sa4 to Sa8.
    - Enter the Up and Down loopback codes, using ►► to select between 1 and 0.
2. The loopback codes will be sent when you press the appropriate key. See Figure 47 for a sample screen:


```

TYPE :STANDARD ►►
SA BIT : SA6
LOOP UP:LOOPBACK1
LOOP DN:RELEASE
  
```

**Figure 47 Loopback Screen**

- 3 Press  to take the loop down. After the loopback release is complete, the Sa5 bit sent to the TE will be set to 1.

#### **ERASE NV RAM**

Use this function as a last resort if the test set is not functioning properly. Initiate Erase NV RAM only after making sure the test set is configured properly. Press  to start.

**Note:** All user-stored information will be erased.

## COMPANDING

Select the companding characteristic.

Options: A-law, U-law


### Technology Note:

#### Companding Characteristic

An 8-bit code word is formed by comparing the amplitude of the analog sample to a companding characteristic. The companding characteristic is a formula which translates the amplitudes of the 8000 Hz samples (voice to digital) into the 8-bit code words. Internationally, a companding characteristic known as "A-law" is used. A-law intends to provide optimum signal-to-noise performance over a wide range of transmission levels. In North America, the encoding is done according to the  $\mu$ -law. Therefore, the companding law used for encoding the voice signal must match that for decoding, for distortion-free transmission.

## PROPAGATION DELAY

Measure the propagation delay on a looped back signal.

1. The circuit must be looped at the far end to perform this measurement. If no loopback is in place, you will see a warning message.
2. Press  to start measuring.
3. The measurements are displayed in Unit Intervals and micro seconds.

```
PROPAGATION DELAY
UI      :0
uS     :0
PRESS ENTER
```

Figure 48 Propagation Delay Screen

Here is the next Function menu screen:

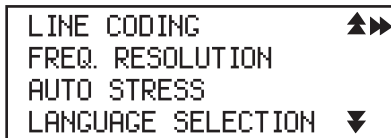


Figure 49 Function Menu Screen 5

#### LINE CODING

Set the line coding.

Options: HDB3 (default), AMI

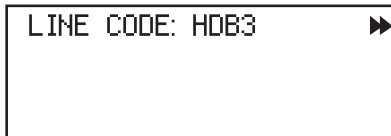


Figure 50 Line Code Selection Screen

#### FREQ. RESOLUTION


Set the frequency resolution of the measurement.

Options: 1 HZ, 0.1 HZ, 0.01 Hz

1 Hz is the default setting. In order to have a frequency resolution of 0.1 or 0.01 Hz, the test set will take 10 or 100 seconds to show the actual value, and will update the value every 10 or 100 seconds.

#### AUTO STRESS

Test a looped back signal.

The test set will change the frequency in steps to both the maximum and minimum frequencies until bit and/or code errors are received. Press  to begin testing with the following screen:

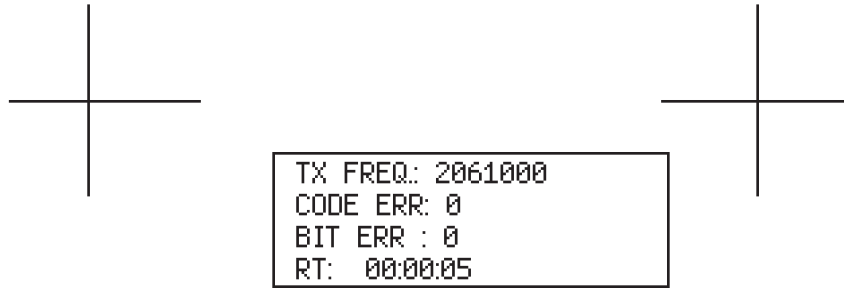


Figure 51 Auto Stress Results Screen

### LANGUAGE SELECTION

Choose the test set's working language.

Options: English, French, Italian, German

Here is the final Function menu screen:

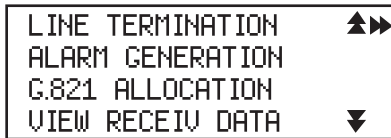


Figure 52 Function Menu Screen 6

### LINE TERMINATION

Adjust the calibration table for signal level measurement, depending on the unit's installed interface.

Options: 75 OHM, 120 OHM

#### Technology Note: Alarms

**AIS:** Generated upstream in response to a loss of signal.

**FAS RAI:** Frame Alignment Signal Remote Alarm Indication. Indicates upstream loss of FAS framing. Framing required.

**MFAS RAI:** Multiframe Remote Alarm Indication. Indicates upstream loss of MFAS framing. Only with PCM-30 framing.

### ALARM GENERATION

If desired, choose an alarm to generate for network testing.

Options: AIS, FRAI, MFRAI

- Press ►► to ENABLE or DISABLE each alarm. Remember to DISABLE all alarms when you are through testing.

### G.821 ALLOCATION

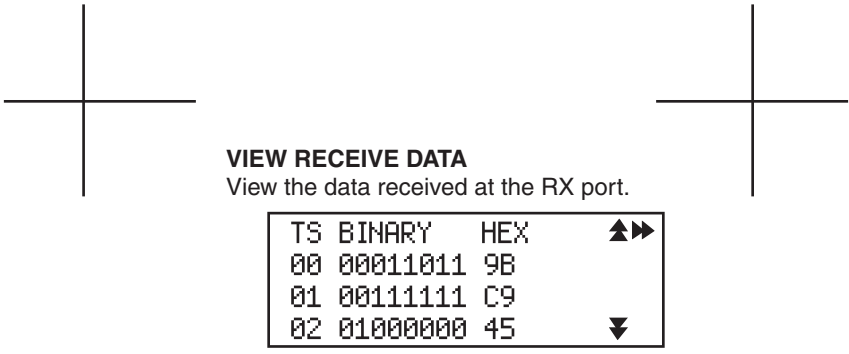
Program certain G.821 threshold parameters to be met in the Results.

Options:


- SES: G.821,  $1.0 \times 10^{-3}$  –  $9.9 \times 10^{-9}$
- DGRM: G.821,  $1.0 \times 10^{-3}$  –  $9.9 \times 10^{-9}$
- HRX: 15, 30, 70, 85, 100, OFF

In order to enter your own values in the following selections, press ►► to increase the value of the digit you have selected. Press ►\* to move cursor within the rate.

- **SES:** Severely Errored Seconds
  - Select G.821, and the threshold is set to the G.821 standard of  $1 \times 10^{-3}$ .
  - Use the ►► and ◀ keys to enter your own standard.
- **DGRM:** Degraded Minutes
  - Select G.821, and the threshold is set to the G.821 standard of  $1 \times 10^{-6}$ .
  - Use the ►► and ◀ keys to enter your own standard.
- **HRX:** Define the portion of the international connection.
  - The default setting is OFF.
  - Use the ►► and ◀ keys to enter your own standard.



**Figure 53 View Received Data Screen**

- The data for each timeslot (TS) is displayed in binary and hexadecimal formats.
- Press  to view all of the timeslots.

#### 4.6 (VF Measurements) Key

Press to access Voice Frequency functions.

- The speaker turns on automatically.
- Framing is required for VF functions.
- You can monitor a voice channel, and observe various results.
- Only available with the VF hardware option.

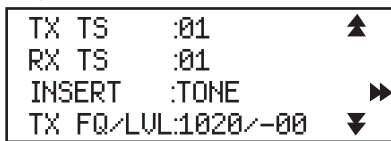






Figure 54 VF Screen 1


Options: TX TS (Transmit Timeslot): 1 to 31

RX TS (Receive Timeslot) 1 to 31

INSERT: TONE, TALK, QUIET

Tx FQ/LVL: 0 to 3999 Hz/ +3 to -60 dBm

1. Select the Tx TS, the timeslot you want to transmit on, using  and .
2. Select the Rx TS, the timeslot you want to receive and take measurements on, using  and .
3. Select one of the following:
  - TONE: Inserts a tone on the selected Tx timeslot.
  - TALK: Inserts your voice on the transmit signal via the test set's microphone.
  - QUIET: Place a quiet termination on the transmit signal (a highly attenuated low frequency signal).
4. Set the Tx FQ (frequency, in Hz)/LVL (level, in dB). Press to change each number, and cursor to each digit.

Press  to view the screen shown in Figure 55.



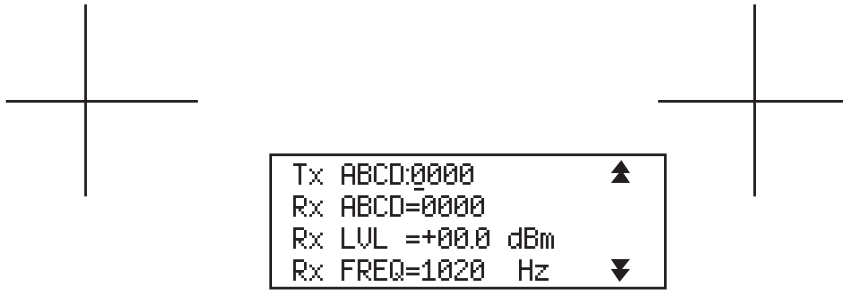



Figure 55 VF Screen 2

5. You may change the transmitted signalling (ABCD) bits at the first line. Press to select 1 or 0 for each position.  
**Note:** ABCD bits transmission requires PCM-30 or PCM-30C framing.
6. Observe the VF measurements:
  - **Rx ABCD:** Received Channel Associated Signalling System (CAS) bits. They are meaningful only with valid PCM-30 framing.
  - **Rx LVL:** Received level, in dBm.
  - **Rx FREQ:** Received frequency, in Hz.

Press  to view the screen shown in Figure 56.

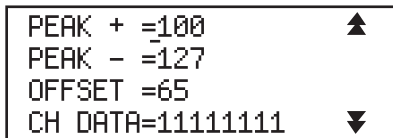



Figure 56 VF Screen 3

- **PEAK +:** Binary value of the codes that will produce the maximum decoder output level.
- **PEAK -:** Binary value of the codes that will produce the minimum decoder output level.
- **OFFSET:** Binary value of the difference between the code that is supposed to result from a zero-voltage input to the encoder, and the code that actually occurs.
- **CH DATA:** View the live 8-bit channel data.

Press  to view the screen shown in Figure 57.

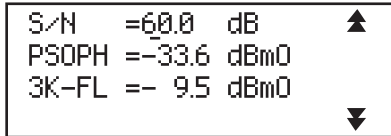


Figure 57 VF Screen 4

- **S/N**: Signal-to-Noise ratio, reported in dB.
- **PSOPH**: Psophometric filter measurement.
- **3K-FL**: 3-K Flat noise measurement.

#### 4.7 (CAS) Key

- Observe the Channel Associated Signalling on all 30 channels.
- You must have PCM-30/C framing or a "PCM-30FRAMINGREQUIRED" message is displayed if you attempt to enter CAS without proper framing.

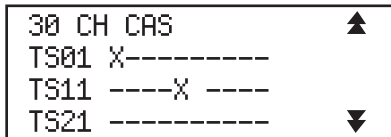


Figure 58 CAS Screen

- Timeslots 1 to 10 are shown on the first line, 11 to 20 on the second, and 21 to 30 on the third.
- Idle channels are marked with an -.
- Active channels are marked with a X.

#### 4.8 (Histogram) Key

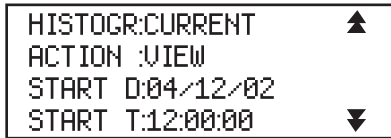


Figure 59 Histogram Menu Screen

View, print, or save a histogram.

Options: HISTOGR: CURRENT, SAVED

ACTION: VIEW, PRINT SAVE

1. Select a histogram to view by pressing ►►.
2. Select an ACTION:
  - VIEW: Press ◀ and a Histogram data screen is displayed as in Figure 60.
  - PRINT: Press ◀ and the histogram is printed.
  - SAVE: Press ◀ and the measurement will be saved with a date and time stamp.
  - To select the time period that the results will show, select PERIOD. Select from DAYS, HOURS, or MINUTES.
3. Observe the START and STOP times of the selected histogram.
4. Press ►► to page through the errors.



Figure 60 Histogram Measurements Screen

5. To choose which result you will see first, select TYPE and choose LOSS, AISS, LOFS, FAS RAI, MFAS RAI, BIT, CODE, or FE. In the Histogram screen, press ►► to see all results.

6. Interpreting Measurements
  - Horizontal axis: A period of time (day, hour, or minute) for every two dots.
  - Vertical axis: Error count value every three dots, starting with 10, ending with 10,000,000.
  - Press  $\blacktriangledown$  to see the period of time for the graphic screen.
  - Press  $\blacktriangleright$  to go to the associated screens (for example, one day with one minute resolution will have 24 screens).
  - The test set can show up to 24 pages of 1 hour with 1 minute resolution.
  - Type: Error types: BIT, CODE, FE, LOSS, AISS, LOFS, FAS RAI, MFAS RAI.  
See *Section 4.4* for error definitions.
7. Press  $\blacksquare$  to stop an in progress histogram analysis.

**4.9  $\text{\textcircled{Sa}}$  (Sa Bits) Key**

- Press  $\text{\textcircled{Sa}}$  to observe Sa-bit status.
- The bits are reported horizontally, from Frame 1 through 15.
- Press  $\text{\textcircled{\blacktriangledown}}/\text{\textcircled{\blacktriangleup}}$  to view all screens.

FR1 . . . . . FR15	$\blacktriangleup$
SA4 11111111	
SA5 11111111	
SA6 11111111	$\blacktriangledown$

**Figure 61 Sa-bits Screen**



## 5 Firmware Upgrading

Use one of the following procedures to upgrade your firmware via the serial port.


### 5.1 CPU Download

1. On the DIP switch (DP1) inside the battery compartment, set SW 1, SW 2, SW 4, and SW 5 to ON (to the right).
2. Plug in the charger and turn on the power.
3. Run the program SUNLITEE1.EXE. Go to VIEW and select SEND MSG.
4. Click "OK" on all of the small windows. You will see a final display of "DOWNLOAD IS DONE. HAVE A NICE DAY!"
5. When done, turn off the test set and reset the DIP switch as shown in Figure 1.

### 5.2 FLASH Memory Download

1. On the DIP switch (DP1) inside the battery compartment, set SW 1 and SW 3 to ON (to the right).
2. Plug in the charger and turn on the power.
3. Select FLASH MEMORY and press .
4. Run the program SUNLITEE1DLG.EXE. Click "OK" until you see "PROGRAMMING IN PROGRESS". You will be asked to Erase NV RAM, press  to complete.
5. When done, turn off the test set and reset the DIP switch as shown in Figure 1.

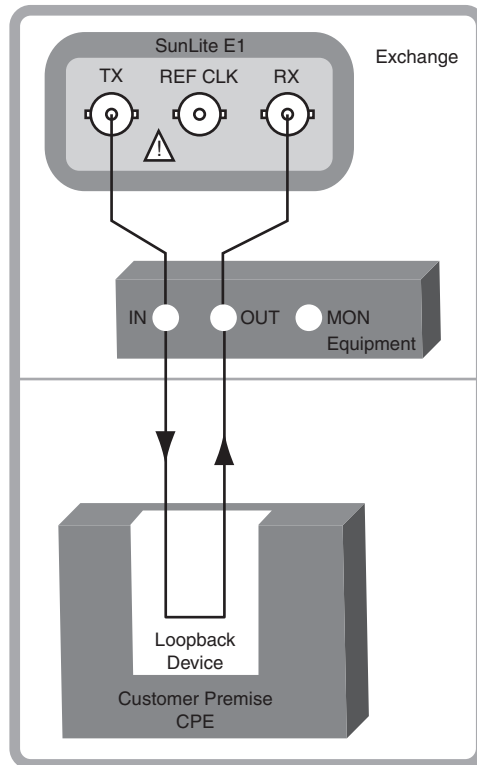
### 5.3 DSP Download

1. On the DIP switch (DP1) inside the battery compartment, set SW1 and SW 3 to ON (to the right).
2. Plug in the charger and turn on the power.
3. Select DSP and press .
4. Run the program.
5. When done, turn off the test set and reset the DIP switch as shown in Figure 1.

## 6 Applications

Here is a list of a variety of the applications you can undertake with your test set. Accompanying each listing is a graphic showing you how to plug in.

### 6.1 Accept a New 2.048 Mbit/s Circuit



**Figure 62** Accepting a New Circuit

## 6.2 Monitoring an In-Service Circuit

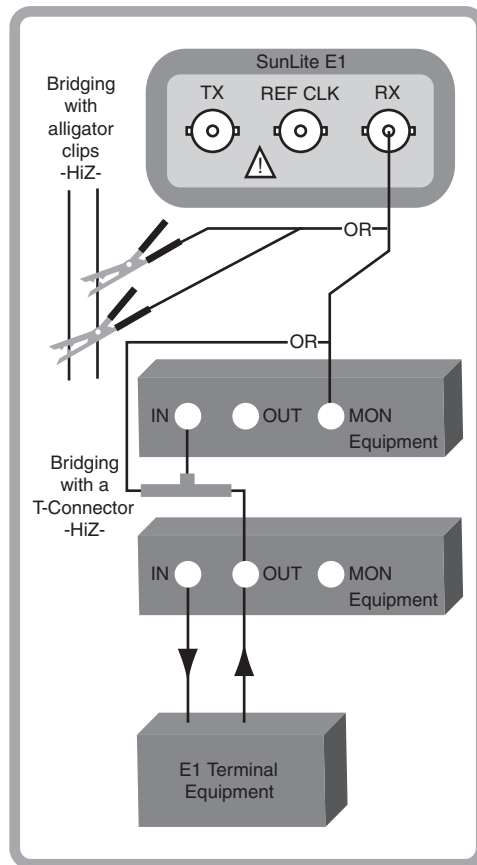


Figure 63 Monitoring an In-Service Circuit

### 6.3 Measuring Propagation Delay

1. Press **CONFIG** and configure the test set as required.
2. Connect to the circuit as shown in Figure 64.

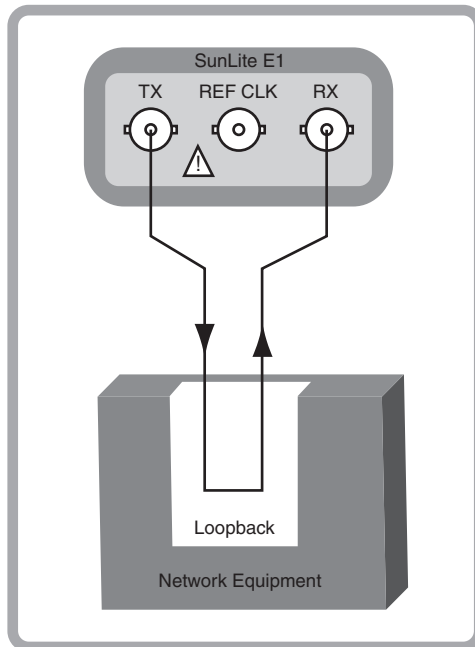


Figure 64 Propagation Delay

3. Press **▶** then press **Fn**.
4. Select PROPAGATION DELAY and press **↵**.
5. Observe the delay on the looped circuit.



## 6.4 Frequency Synchronization

Set TxCLK to EXTERNAL when checking for frequency synchronization.

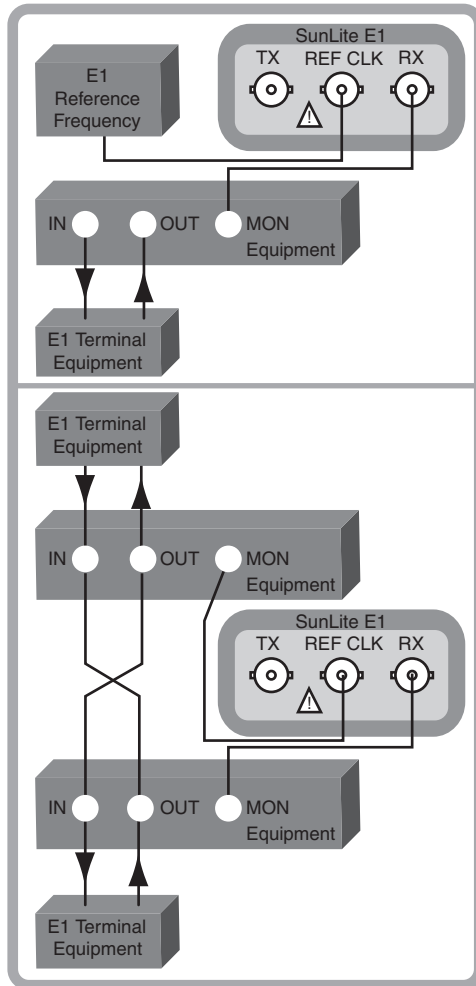


Figure 65 Frequency Synchronization

### 6.5 Measuring Signal Level

1. Press **CONF** and configure the test set as required.
2. Connect to the circuit as in Figure 66.

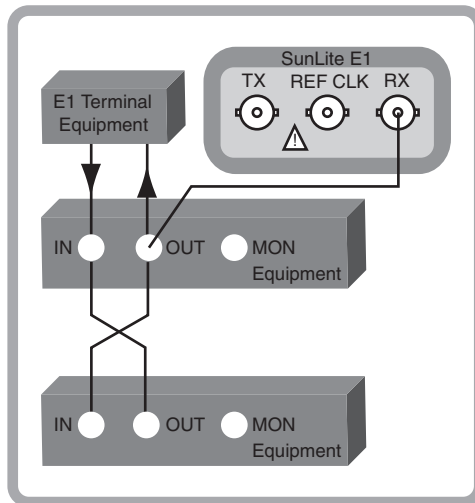



Figure 66 Measuring Signal Level

3. Press **▶** and then **⏏**.
4. Page down to the SIGNAL/FREQUENCY screen and observe LVL (signal level).

```
SIGNAL/FREQUENCY  ▲▶▶
LVL:-2.9 dB
REC ppm:+0000
MIN ppm:+0000     ▼
```

Figure 67 Signal/Frequency Screen


### 6.6 Channel Associated Signalling

1. Connect to the circuit as in Figure 63.
2. Press  and observe the Channel Associated Signalling for each timeslot, as in Figure 68.

```
30 CH CAS
TS01 X-----
TS11 ----X----
TS21 -----
```

Figure 68 CAS Sample Screen

### 6.7 Voice Frequency Channel Monitoring

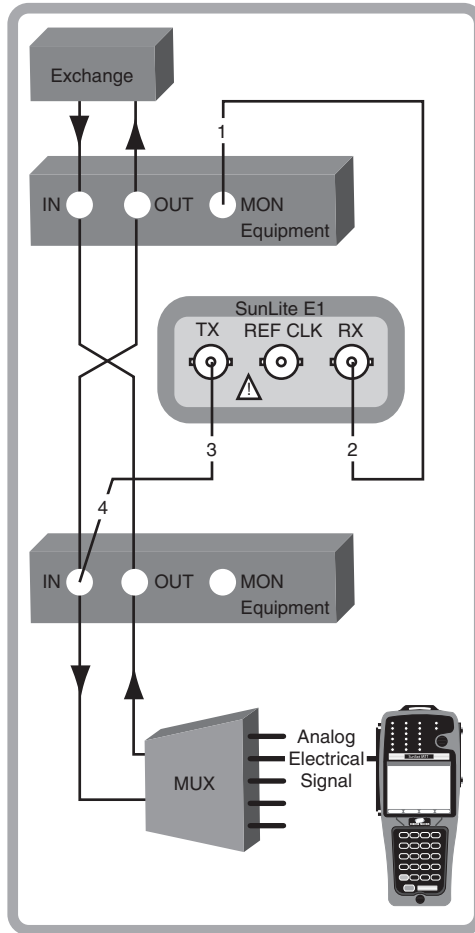
1. Connect to the circuit as in Figure 63
2. Press  to access the VF screen shown in Figure 69.

```
TX TS :01      ▲
RX TS :01
INSERT :QUIET  ►
TX FQ/LVL:1020/-00 ▼
```

Figure 69 Voice Frequency Monitoring Screen

3. If necessary, change the transmit and receive timeslots.
4. Set QUIET for INSERT.

## 68 Send/Receive Digital Tones



**Figure 70 Insert a Hitless Digital Tone**

1. Connect the cords in the order indicated.
2. Select TONE as the INSERT type in VF.

### 6.9 N (or M) x64 kbit/s Testing

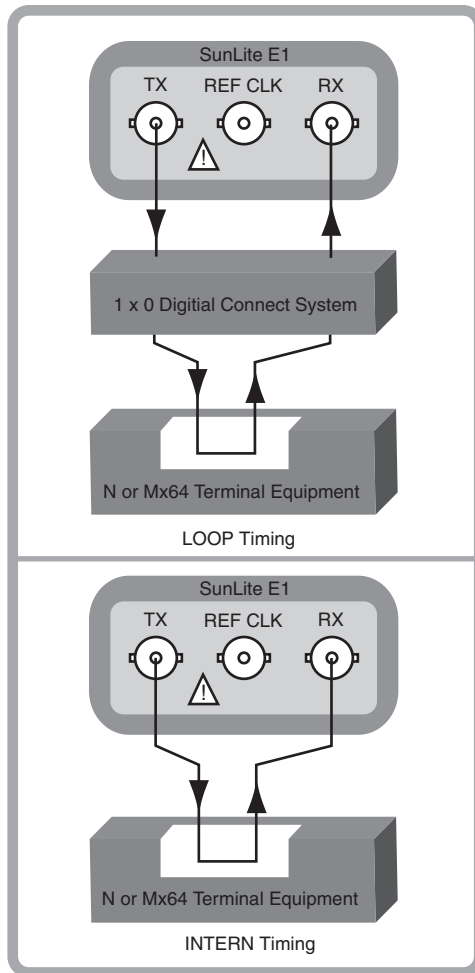


Figure 71 Fractional E1 Testing

## 7 Specifications

**Note:** This information is subject to change.

### Connectors and Ports

2.048 Mbit/s E1 interfaces: Tx, Rx, Ext Clock  
Standard: BNC (f), 75Ω unbalanced connectors  
Optional: BR2 (f) 120Ω balanced connectors;  
Bantam (f) 120Ω balanced connectors  
Serial Port: RS-232/v.24, RJ-11, 6-pin connector  
Charger: 1 mm, DC jack

### Status Indicators (LEDs)

13 super-bright LED indicators  
Current status and alarm history  
SIGNAL: red, no signal; green, signal; flash red, history, PCM-30 (bi-color), CRC-4 (bi-color), SYNC (bi-color)  
TX: solid green, transmitter activated; flash green in self loop mode; off, transmitter deactivated  
RUN: green, measurement running; off measurement stop  
RAI: red, MFAS RAI or FAS RAI; flash red, history  
AIS: red, AIS; flash, history  
CODE: red, code error; flash, history  
ERROR: red, CRC-4, E-bit, FAS E; flash, history  
BIT: red, logical bit error; flash red, history  
Power/low battery: slow flash green, power on and battery fully charged; solid green, battery being charged; red, low battery



### **E1 General**

Bit Error test rates: 2.048 Mbit/s, N (contiguous) and M (noncontiguous) x64 kbit/s (N & M=1 to 31)

Drop and insert to internal test circuitry N or Mx64 kbit/s  $\mu$ /A-law decoded VF channel to built-in speaker

Line Coding: HDB3 & AMI

Framing: Unframed, PCM-30, PCM-30C, PCM-31, PCM-31C. Conforms to ITU-T G.704

### **TEST PATTERN GENERATOR**

General: 1111..., 0000..., 0101..., RICAR 3

PRBS:  $2n-1$ ,  $n=9, 11, 15, 23$ . Conforms to ITU-T O.151, O.152, O.153, and ANSI V.52, V.57

Programmable: 3 patterns, each up to 16 bits long

Test pattern inversion

### **Transmitter**

Clock source:

- Internal clock: 2.048 MHz  $\pm$  25 ppm
- Received: locked to received signal
- External: locked to Reference clock input signal

Line coding: HDB3 & AMI

Pulse shape: Conforms to ITU-T G.703. 75 $\Omega$ /  
Unbal.:  $\pm$  2.37 Vbp ( $\pm$ 10%)

Programmable Timeslot 0: Programmable loop up/loop down code, and NFAS word

Set idle channel code and ABCD bits (IDLE/NOT IDLE state)

Transmit signal can be turned ON/OFF or internally looped

Error injection: BIT, CODE, BIT+CODE, single or rate of  $1 \times 10^{-7}$  to  $1 \times 10^{-2}$  CRC-4, FRAME, E-bit: single 0-128 bit zero insertion in 8 bit steps

**Receiver**

Frequency range: 2.048 Mbit/s  $\pm$  6000 bit/s for SLE1

Input Sensitivity

- Terminate Hi-Z: 6 to -43 dB with Automatic Line Build Out (ALBO)
- Monitor: -20 dB resistive loss combined with -6 dB cable loss

Auto configuration for framing (PCM-30, PCM-30C, PCM-31, PCM-31C, Unframed), and test pattern

Impedances

- Terminate, Monitor: 75 $\Omega$  unbalanced
- Hi-Z: > 2000 $\Omega$

Return loss performance according to ITU-T G.703

Jitter tolerance according to ITU-T G.823

**External Clock Interface**

Input Impedance: 75 $\Omega$  Unbalanced

Input Sensitivity: -20 dB resistive loss combined with -6 dB cable loss

Line Coding: HDB3 & AMI

**Measurements**

E1 signal level: +0 to -43 dB resolution: 1 dB

Frequency measurement (Hz and ppm): Selectable frequency resolution (1 Hz, 0.1 Hz and 0.01 Hz) Current, Max, Min

Clock slips count

Code errors: error count and ratio

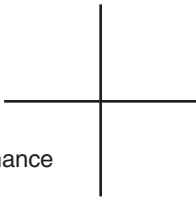
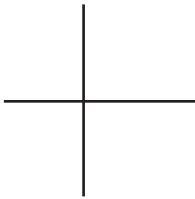
Frame errors: FAS and CRC-4 errors count and error ratios

Count of LOS, Loss of Sync (SYLS), LOF, AIS, FAS RAI, and MFAS RAI seconds

Bit errors: ITU-T G.821 analysis with allocation, programmable HRX%

ITU-T G.826 measurements





ITU-T M.2100 measurements (in conformance with M.2101)

E-bit errors: error count and ratio

Setup and test results printing

Test Duration, programmable

Print interval, programmable: NOW, 5 minute, 15 minute, 1 hour, 24 hours, LAST, EVENT, OFF

Time stamped events printing

Delay timer programmable up to 99 hours, 59 minutes.

Audible alarm: indicates an error or alarm, programmable ON/OFF

Alarm Generation: AIS, FAS RAI, MFAS RAI

#### **Other Measurements**

Save 10 test results, available to screen view or print with user defined label.

Histograms: G.821 basic measurements, up to 60 days of histograms, 1 day resolution and the last 24 hours with 1 minute resolution. 2 HISTOGRAMS stored; CURRENT and SAVED

Propagation Delay measurements in UI and  $\mu$ s, 1  $\mu$ s resolution

Range: from 100  $\mu$ s to 10 seconds

#### **Voice Frequency Capability**

Talk/listen by using the built-in microphone/speaker

Companding: A-law or  $\mu$ -law (selectable)

Monitor and CAS modes

ABCD bits display for a selected timeslot

CAS signaling monitoring (IDLE/NOT IDLE state)

Set ABCD bits to 1 or 0 of selected timeslot

Set CAS state IDLE/NOT IDLE

Set Idle Channel code

**Frame Word Settings**

Sa bits read, write with all 40 bits independently settable

Selectable loopback/release commands

Set Loop Up/Loop Down Sa4-8 bit code or transmit pattern

**SLE-01 Clock Offset Option****Transmitter**

Frequency programmable to 2.048 Mbit/s  $\pm$  24,400 ppm: 2.048 MHz

Accuracy:  $\pm$  2 ppm after external calibration

**Receiver**

Frequency range: 2.048 Mbit/s  $\pm$  24,400 ppm

Other measurements: Automatic stress automatically determines the receiving equipment's upper and lower frequency capture range

**SLE1-02 VF Measurement Option**

VF Measurement: 50 to 3950 Hz, 1 Hz Resolution; +3 dBm0 to -60 dBm0, 1 dB resolution

Send/Receive tone: 50 to 3950 Hz, res. 1 Hz; +3 to -60 dBm0, res. 1 dB

Noise (S/N, psophometric, 3K) level measurement: +3 to -60 dBm0

Digital representation of sinusoidal signals in a selected timeslot:

A-law and  $\mu$ -law coding to ITU-T G.711

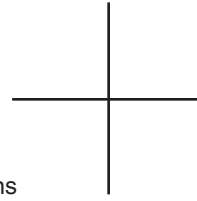
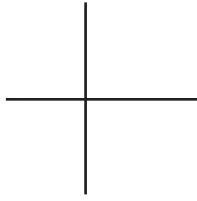
Coder offset and peak code measurement

**Environmental**

Operating temperature: 0° C to 50° C

Storage temperature: -20° C to +70° C

Humidity: 5% to 90% non-condensing



**General**

Store: Up to 10 instrument configurations

Display: 122 x 32 dots (4 x 20 characters, 6 x 8 dots size) with LED backlight

Internal Battery: NiMH rechargeable

Battery Life: 4 hours with transmitter off

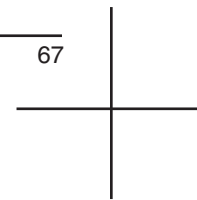
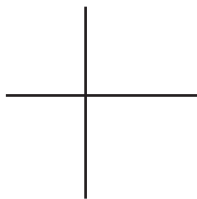
Charge Time: 7 hours

Charger: 5V @ 2A, 90 to 265 VAC, 50-60 Hz

Languages: English, Italian, French, German

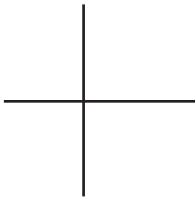

Size: 175 mm (l) x 75 mm (w) x 35 mm (d)

Weight: ~0.4 kg



## 8 Express Limited Warranty

- A. Hardware Coverage. COMPANY warrants hardware products against defects in materials and workmanship. During the warranty period COMPANY will, at its sole option, either (i) refund of CUSTOMER'S purchase price without interest, (ii) repair said products, or (iii) replace hardware products which prove to be defective; provided, however, that such products which COMPANY elects to replace must be returned to COMPANY by CUSTOMER, along with acceptable evidence of purchase, within twenty (20) days of request by COMPANY, freight prepaid.
- B. Software and Firmware Coverage. COMPANY warrants software media and firmware materials against defects in materials and workmanship. During the warranty period COMPANY will, at its sole option, either (i) refund of CUSTOMER'S purchase price without interest, (ii) repair said products, or (iii) replace software or firmware products which prove to be defective; provided, however, that such products which COMPANY elects to replace must be returned to COMPANY by CUSTOMER, along with acceptable evidence of purchase, within twenty (20) days of request by COMPANY, freight prepaid. In addition, during the warranty period, COMPANY will provide, without charge to CUSTOMER, all fixes, patches, new releases and updates which COMPANY issues during the warranty period. COMPANY does not warrant or represent that all software defects will be corrected. In any case where COMPANY has licensed a software product "AS-IS," COMPANY'S obligation will be limited to replacing an inaccurate copy of the original material.

- 
- 
- C. Period. The warranty period for Hardware, Software and Firmware will be One (1) Year from date of shipment to CUSTOMER. The COMPANY may also sell warranty extensions or provide a warranty term of three years with the original sale, which provide a longer coverage period for the test set chassis, software and firmware, in which case the terms of the express limited warranty will apply to said specified warranty term.
- D. Only for CUSTOMER. COMPANY makes this warranty only for the benefit of CUSTOMER and not for the benefit of any subsequent purchaser or licensee of any merchandise.
- E. LIMITATION ON WARRANTY. THIS CONSTITUTES THE SOLE AND EXCLUSIVE WARRANTY MADE BY COMPANY WITH RESPECT TO HARDWARE, SOFTWARE AND FIRMWARE. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED. COMPANY SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. COMPANY'S LIABILITY UNDER THIS AGREEMENT WITH RESPECT TO A PRODUCT, INCLUDING COMPANY'S LIABILITY FOR FAILURE AFTER REPEATED EFFORTS TO INSTALL EQUIPMENT IN GOOD WORKING ORDER OR TO REPAIR OR REPLACE EQUIPMENT, SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OR LICENSE FEE FOR THAT PRODUCT, NOR SHALL COMPANY IN ANY EVENT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, ARISING FROM OR

RELATED TO THE SALE OF THE MERCHANDISE HEREUNDER, INCLUDING BUT NOT LIMITED TO DAMAGES ARISING FROM OR RELATED TO LOSS OF BUSINESS, LOSS OF PROFIT, LOSS OF GOODWILL, INJURY TO REPUTATION, OVERHEAD, DOWNTIME, REPAIR OR REPLACEMENT, OR CHARGE-BACKS OR OTHER DEBITS FROM CUSTOMER OR ANY CUSTOMER OF CUSTOMER.

- F. No Guaranty. Nonapplication of Warranty. COMPANY does not guaranty or warrant that the operation of hardware, software, or firmware will be uninterrupted or error-free. Further, the warranty shall not apply to defects resulting from:
- (1) Improper or inadequate maintenance by CUSTOMER;
  - (2) CUSTOMER-supplied software or interfacing;
  - (3) Unauthorized modification or misuse
  - (4) Operation outside of the environmental specifications for the product;
  - (5) Improper site preparation or maintenance; or
  - (6) Improper installation by CUSTOMER.

## 9 Declaration of Conformity

**Application of Council Directive(s):**

- 89/336/EEC – the EMC directive

**Manufacturer's Name:**

- Sunrise Telecom Inc.

**Manufacturer's Address:**

- 302 Enzo Drive, San Jose, CA 95138 USA

**Manufacturer's Telephone Number:**

- TEL: (408) 363-8000, FAX: (408) 363-8313

**Equipment Type/Environment:**

- Measurement, Control and Laboratory Equipment

**Trade Name/Model Number:**

- SLE1 Sunlite E1

**Standard(s) to which Conformity is Declared:**

- EN 61326:1998/IEC 61326:1997
  - Electrical Equipment for Measurement, Control and Laboratory Use—EMC Requirements
- EN 55022:1995 (Class-A)
  - Radiated & Line Conducted Emissions Requirements for ITE.
- EN 61010-1
  - Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use –Part 1: General Requirements

Immunity Standard	Description	Severity Applied	Performance Criteria
IEC 1000-4-2 EN 61000-4-2	Electrostatic Discharge	4 kV direct and indirect contact, 4 kV air	C
IEC 1000-4-3 ENV 50140-204	Radiated RF Immunity	3V/m, 80–1000 MHz 80% AM with 1 kHz sine wave	A
IEC 1000-4-4 EN 61000-4-4	Electrical Fast Transient/Burst	+/-1 kV on AC lines,+/-0.5 kV on I/O lines	B
IEC 1000-4-5 ENV 50142	Surge Immunity Test	+/-0.5 kV IM +/-0.5 kV CM1.2ms / 50ms T / Th	B
IEC 1000-4-6 ENV 50141	Conducted RF Immunity	I/O lines > 3 m and AC, DC, and Earth Port lines 3V rms, 0.15 – 80 MHz 150 ohms, 1 kHz 80% AM modulation	A

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standards.



Full Name: Dennis Koo                      Position: VP Quality Group  
 Company: Sunrise Telecom Inc.  
 Address: 302 Enzo Drive, San Jose, CA 95138 USA  
 Telephone: (408) 363-8000              Facsimile: (408) 363-8313  
 Date: 10/20/04







**Index**

**A**

ABCD Bits; 49  
ALARM GENERATION; 46  
Applications; 54  
    Accept a New 2.048 Mbps Circuit; 54  
    Channel Associated Signalling; 59  
    Measure Propagation Delay; 56  
    Measure Signal Level; 58  
    Monitor an In-Service Circuit; 55  
    Monitor a Voice Frequency Channel; 59  
    N (or M) x64 kbps Testing; 61  
    Send/Receive Digital Tones; 60  
Audible Alarm; 40  
Auto Stress; 44

**B**

Batteries; 12

**C**

CAS; 33  
Channel Associated Signalling; 50  
Clock Calibration; 39  
coding; 44  
Companding Characteristic; 43  
Connectors  
    5VDC; 10  
    BNC; 10  
    Rx; 10  
Connectors and Controls; 10  
Controls  
    Contrast Control; 10  
    Volume Control; 10  
CRC-4; 27

**D**

Definitions; 13  
Delay Timer; 37  
dip switches; 4

## **E**

E-bit Transmission; 27  
Erase NV RAM; 42  
Error Injection; 40

## **F**

### Figures

- 01 Dip Switch; 4
- 02 SunLite E1, Front View; 5
- 03 LEDs; 6
- 04 Center Keys; 8
- 05 SunLite E1 Top Panel; 10
- 06 Sunlite E1 Back View; 11
- 07 Set Up Screen; 15
- 08 PCM-30 Timeslot Screen; 15
- 09 PCM-31 Timeslot Screen; 16
- 10 FAS Framing Structure; 17
- 11 MFAS Frame Structure; 18
- 12 Test Pattern Selection Screen; 20
- 13 User Test Pattern Screen; 20
- 14 Transmitter Screen; 22
- 15 Summary Results Screen; 23
- 16 Signal/Frequency Results Screen; 24
- 17 Frequency Results Screen; 24
- 18 Frequency in ppm Screen; 24
- 19 Error Screen; 25
- 20 Error Rates Screen; 25
- 21 CRC-4 Multiframe Format; 27
- 22 Signal Errors Screen; 28
- 23 Framing RAI Screen; 28
- 24 G.821 Results Screen 1; 29
- 25 G.821 Results Screen 2; 29
- 26 G.821 LIVE Screen; 30
- 27 G.821 DGRM Screen; 30
- 28 First G.826 Measurements Screen; 31
- 29 Second G.826 Screen; 31
- 30 M.2100/550 Results Screen; 32
- 31 Function Menu Screen 1; 33
- 32 Date & Time Screen; 33

33	Set Idle Codes Screen; 33
34	Profiles Screen; 34
35	Function Menu Screen 2; 35
36	Test Duration Screen; 35
37	Deley Timer Setup Screen; 37
38	Delay Timer Countdown Screen; 38
39	Send Frame Words Screen; 38
40	Send NFAS Frame Words Screen; 38
41	Function Menu Screen 3; 39
42	M.2100/550 Parameters Screen; 39
43	Clock Calibration Screen; 39
44	Error Injection Screen; 40
45	Function Menu Screen 4; 41
46	Loop Code Screen; 41
47	Loopback Screen; 42
48	Propagation Delay Screen; 43
49	Function Menu Screen 5; 44
50	Line Code Selection Screen; 44
51	Auto Stress Results Screen; 45
52	Function Menu Screen 6; 45
53	View Received Data Screen; 47
54	VF Screen 1; 48
55	VF Screen 2; 49
56	VF Screen 3; 49
57	VF Screen 4; 50
58	CAS Screen; 50
59	Histogram Menu Screen; 51
60	Histogram Measurements; 51
61	Sa-bits Screen; 52
62	Accept a New Circuit; 54
63	Monitoring an In-Service Circuit; 55
64	Propagation Delay; 56
65	Frequency Synchronization; 57
66	Measuring Signal Level; 58
67	Signal/Frequency Screen; 58
68	CAS Sample Screen; 59
69	Voice Frequency Monitoring; 59
70	Insert a Hitless Digital Tone; 60
71	Fractional E1 Testing; 61

fractional testing; 15  
Frame Words; 38  
Frequency Resolution; 44

## **G**

G.821  
Allocation; 46  
Threshold; 46  
General Description; 5

## **H**

Histogram; 51

## **I**

IDLE CODES-SET; 33  
Internal Transmit Frequency; 19

## **K**

Keys; 8  
0101; 9  
Backlight; 9  
CAS; 9,50  
CONFIG; 9  
Enter; 9  
ERR INJ; 9  
Histogram; 9  
HISTORY; 9  
Lock/Unlock; 9  
Loop down; 9  
Loop up; 9  
OTHERS; 9  
Page down; 9  
Page up; 9  
Power; 9  
Print; 9  
RESULTS; 23  
Sa BITS; 9  
Tx; 9  
VF Measurements; 9



**L**

Language Selection; 45

**LEDs**

AIS; 7

BIT; 6

CODE; 6

CRC-4; 6

ERROR; 6

PCM-30, PCM-31; 6

POWER; 7

RAI; 7

RUN; 7

SIGNAL; 6

SYNC; 6

TX; 7

Line Coding; 44

Line Termination; 45

Loop Codes; 41

**M**

M.2100 Parameters; 39

**Measurements**

Errors; 25

Framing RAI; 28

G.821; 29

G.826 Results; 31

M2100/550 Results; 32

Signal/Frequency Results; 24

Signal Errors; 28

taking; 23

Menu Tree; 14

**P**

Print Period; 34

Profile; 34

Propagation Delay; 43

## **R**

Receiver Level; 19  
Reference Clock; 10

## **S**

SA Bits; 41  
Self-Loop; 22  
Send Frame Words; 38  
Serial Port; 10  
Software Download Procedure; 53  
Specifications; 62  
System Profile; 34

## **T**

Technology Notes  
  Alarms; 46  
  Companding Characteristic; 43  
  CRC-4; 27  
  Standard Loopbacks; 41  
  Standard Test Patterns; 21  
Test Duration; 35  
Test Pattern; 20  
Test Results  
  ACTION Choices; 37  
  configure; 36  
  Label; 36  
Time & Date; 33  
Top Panel; 10  
Transmit Clock; 19

## **U**

User Pattern-Select or Create; 20

## **V**

VF Measurements; 49  
VIEW RECEIV DATA; 47

## **W**

Warnings; 4, 10, 12  
Warranty; 68

