SUNRISE TELECOM
INCORPORATED

SunSet™ E1

User's Manual

Version 5.00

MAN-11000-US001 Rev. A

Sunrise Telecom® . . . a step ahead

SUNRISE TELECOM
INCORPORATED

DECLARATION OF CONFORMITY
for

SUNRISE TELECOM
SunSet E1

Manufacturer
Sunrise Telecom
22 Great Oaks Boulevard
San Jose, CA 95119
USA

Statement of Conformity
Based on test results using appropriate standards, the product is in conformity with
Electromagnetic Compatability Directive
89/336/EEC
Low Voltage Direction 73/23/EEC

Sample Tests
Standards used:

EN 55011 (1993)
Radio Frequency Product
Family Emission Standard

EN 50082-1 (1992)
Electromagnetic Compatability;
Generic Immunity Standard
IEC 801-2, IEC 801-3, IEC 801-4

IEC 950(1991)
Safety of Information Technology Equipment

The tests have been performed in a typical configuration.

The conformity is indicated by the symbol i.e., "Conformité eurpoéenne"

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Section 1 E1 Technology Overview

SECTION 1

1.1 Introduction

This section will discuss sampling a signal, converting the information into a bitstream, and dividing the bitstream into channels. This allows us to transmit data from a variety of sources simultaneously, and we can encode the data stream to check for errors and avoid physical problems with the transmission equipment.

1.2 Technical Standards

E1 transmission technology is defined by a number of technology standards. Having E1 transmissions conform to these standards allows equipment designers and service providers to ensure that various pieces of equipment are compatible, and that networks operate in a predictable, reliable manner.

The following standards cover many of the important aspects of E1 transmission technology:

- ITU-T G.703 Physical/electrical characteristics of interfaces
- ITU-T G.704 Synchronous frame structures
- ITU-T G.706 Frame alignment and CRC
- ITU-T G.821 Error performance of an international connection
- ITU-T G.826 Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate (revised draft 7/95)
- ITU-T M.550/M.2100 Bringing an international connection into service

Consult these standards when you need detailed information on particular aspects of E1 transmission technology.

1.3 Basic Definitions

Binary Data: A signal which has been converted into a format of 0s and 1s.

Bit Stream: Binary Data which has been placed in a sequence at a fixed rate.

Channel: A single portion of the bit stream which is available for communication.

1.4 Converting a Voice Signal

To transmit voice in a digital medium such as a 2.048 Mbps line, we first need to encode the analog voice signal in a binary format, then convert it to a **bit stream** suitable for digital transmission.

This can be achieved through Pulse Code Modulation. Refer to Figure 1.4A.

The Nyquist theorem requires that the signal be sampled at twice the signal's maximum frequency in order for it to be reproduced without a loss of information. For voice signals, a maximum frequency of 4000 Hz provides adequate clarity while conserving transmission bandwidth. Thus, we must sample our 4000 Hz voice signal at a frequency of 8000 Hz (8000 samples/second).

The amplitude of the analog voice signal is sampled 8000 times per second. Each amplitude value is expressed as an 8-bit code "word". These 8-bit words occurring 8000 times per second form a 64 Kbps digital bit stream.

The 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 samples into the 8-bit code words. Internationally, a companding characteristic known as "A-law" is used. The purpose of A-law is to provide optimum signal to noise performance over a wide range of transmission levels. Linear encoding provides a poorer signal to noise ratio at the -20 dB level typical of speech. In North America, the encoding is done according to the Mu-Law. Therefore, the type

of companding law used for encoding the voice signal must match that for decoding, for distortion-free transmission.

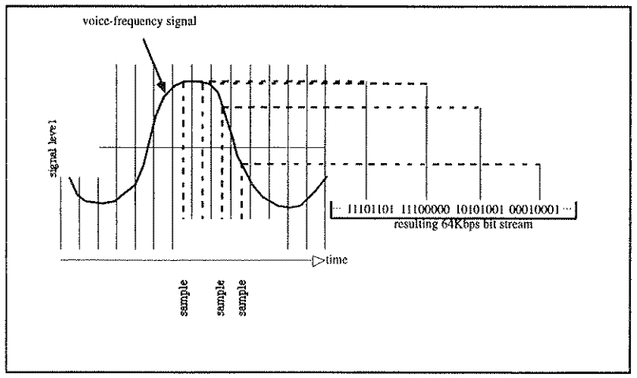


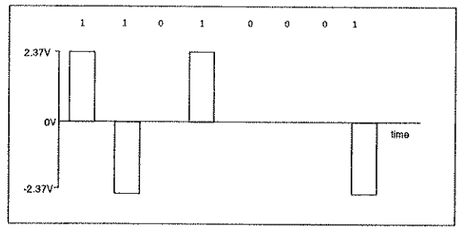
Figure 1.4A Converting a Voice Signal

1.5 2.048 Mbps Data Rate

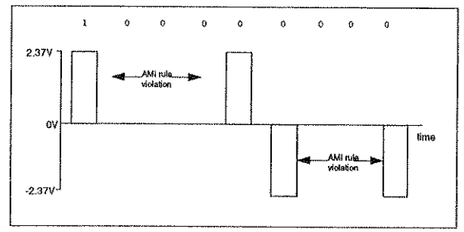
The E1 signal (bitstream) is transmitted at a rate of 2.048 Mbps (2 048 000 bits per second). This transmission rate is achieved by combining 32 individual 64 Kbps bitstreams:

64(Kbps/Channel)
x 32(Channels) = 2048 Kbps =
2.048 Mbps

This 2.048 Mbps signal is the overall E1 transmission rate.



AMI format



HDB3 format

Figure 1.6A Line Coding

1.6 Line Coding

Two types of line coding are used in a typical E1 network: AMI or HDB3.

1.6.1 AMI

This is the simplest of the two line coding formats. AMI stands for Alternate Mark Inversion, and is used to represent successive 1's values in a bitstream with alternating positive and negative pulses. Refer to Figure 1.6A. AMI is not used in most 2.048 Mbps transmission because synchronization loss occurs during long strings of data zeros.

1.6.2 HDB3

The HDB3 line coding format was adopted in order to eliminate these synchronization problems.

In the HDB3 format, a string of

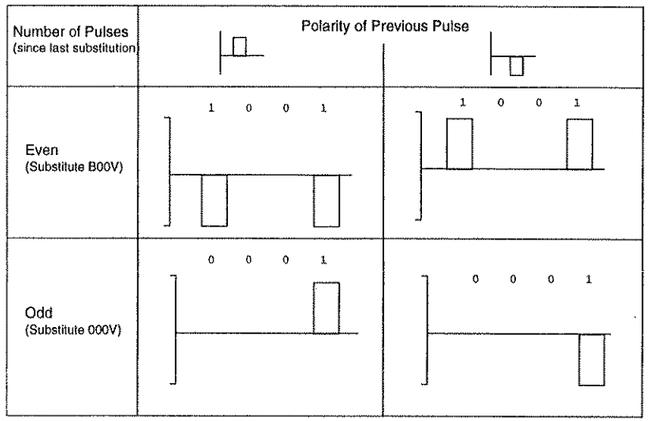


Figure 1.6B HDB3 Encoding

four consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. As the far end equipment receives the E1 signal, it examines the bit stream for these intentional bipolar code violations. It will then extract the code and reconstruct the original data. The HDB3 code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal. 2.048 Mbps transmission always or almost always uses HDB3 coding. Refer to Figure 1.6B.

The SunSet E1 is configured to detect the HDB3 substitution codes generated by older network equipment, even if they don't correspond exactly to current HDB3 standards. For instance, if an even code is used where an odd code should have been used, the SunSet E1 will still record four 0s.

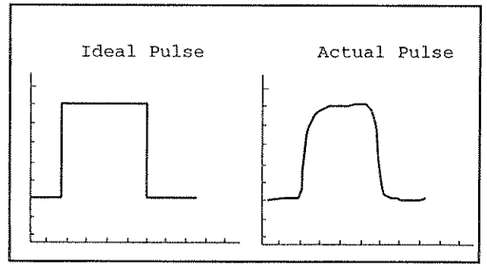


Figure 1.7A Pulse Shape

1.7 Signal Levels & Impedances

Once a signal has been encoded into a binary format and assembled into a bit stream, the pulses in the bit stream are then converted to actual voltage levels suitable for E1 transmission.

Referring to Figure 1.6A, we see that a typical signal level for an E1 pulse with 75 ohm impedance is either +2.37 volts/-2.37 volts (for a binary "1" value) or 0 volts (for a binary "0" value). Actual signal values would typically be +/- 10%.

Note the distinction between a logic pulse and a signal pulse: the logic pulse only indicates whether we have a "1" value or a "0" value. The signal pulse is the actual electrical signal which is used on the E1 line.

Ideally, each pulse transmitted would be perfectly symmetrical. However, in an actual situation, each pulse becomes slightly distorted when it is generated and travels along the circuit. Refer to Figure 1.7A for the shape of an "ideal" pulse vs. an actual pulse that would be encountered on an E1 line.

An E1 pulse may be required to conform to a standardized pulse shape. This is often determined by comparing it to a specified "mask". A common pulse mask is given by the ITU-T G.703 recommendation.

1.8 2.048 Mbps Framing

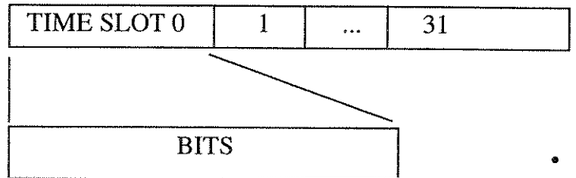
E1 transmission utilizes two main types of framing: Frame Alignment Signal (FAS) and MultiFrame Alignment Signal (MFAS). Framing is necessary in order for any equipment receiving the E1 signal to be able to identify and extract the individual channels. PCM-30 transmission systems use MFAS framing along with the FAS framing. PCM-31 transmission systems use only FAS framing.

1.8.1 Frame Alignment Signal (FAS)

The 2.048 Mbps frame consists of 32 individual time slots (numbered 0-31). As described previously, each time slot consists of an individual 64 Kbps channel of data.

In the FAS format, time slot 0 of

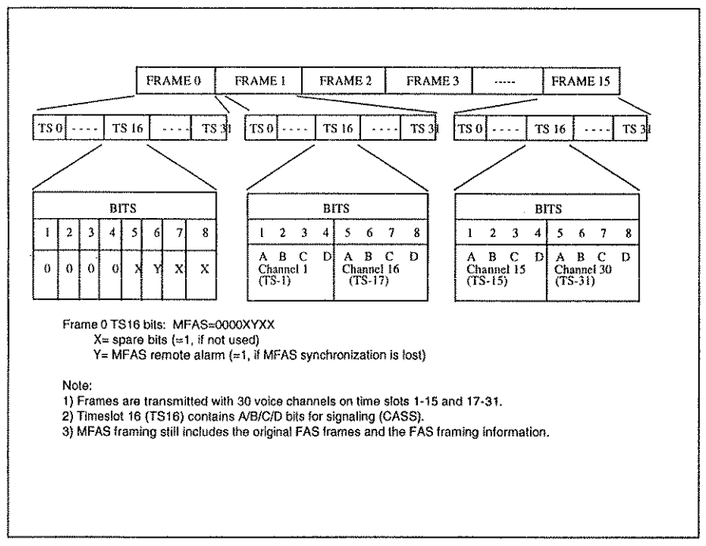
ONE 2.048 MBPS FRAME



	1	2	3	4	5	6	7	8
Even Frame: Contains Frame Alignment Signal (FAS)	E	0	0	1	1	0	1	1
Odd Frame: Does Not Contain Frame Alignment Signal (NFAS)	E	1	A	Sa	Sa	Sa	Sa	Sa

- Sa = Bit reserved for National use
- E = Bit reserved for International use
- A = Remote Alarm (FAS Remote Alarm Indication)
- Frame Alignment Signal Pattern = 0011011
- 8 bits per timeslot x 32 timeslots per frame x 8000 frames per second = 2.048 Mbps transmission rate

Figure 1.8A FAS Framing Format



Frame 0 TS16 bits: MFAS=0000XYXX
X= spare bits (=1, if not used)
Y= MFAS remote alarm (=1, if MFAS synchronization is lost)

Note:
1) Frames are transmitted with 30 voice channels on time slots 1-15 and 17-31.
2) Timeslot 16 (TS16) contains A/B/C/D bits for signaling (CASS).
3) MFAS framing still includes the original FAS frames and the FAS framing information.

Figure 1.8B MFAS MultiFrame Format

every other frame is reserved for the frame alignment signal (FAS) pattern. Alternate frames contain the FAS Distant Alarm indication bit and other bits reserved for National and International use. Hence, we utilize 31 time slots into which we can place data. Refer to Figure 1.8A.

The FAS format does not accommodate voice channel signalling.

1.8.2 MultiFrame Alignment Signal (MFAS)

MFAS framing uses Channel-Associated Signalling (CAS) to transmit A/B/C/D bit signalling information for each of 30 channels. This method uses the 32 timeslot frame format with timeslot 0 for the FAS and timeslot 16 for the MultiFrame Alignment Signal and the Channel Associated Signaling. As shown below, it takes 16 frames to make up a MultiFrame.

When we transmit the MFAS multiframe, we assemble 16 FAS frames together, dedicate timeslot 16 of the first frame to our MFAS framing information, then dedicate timeslot 16 of the remaining 15 frames to our A/B/C/D bits. Refer to Figure 1.8B.

Frame 0, timeslot 16: 8-bit MFAS signal

Frames 1-15, timeslot 16: (4 signaling bits/channel) x (30 channels) / (8 signaling bits/ frame timeslot 16) = 15 frames of timeslot 16 signaling

1.8.3 CRC-4 Error Checking with CRC-4 MultiFrame

A Cyclic Redundancy Check-4 (CRC-4) is often used in E1 transmission to identify possible bit errors. CRC-4 allows us to detect errors within the 2.048 Mbps signal while it is in service.

CRC-4 is based on a simple mathematical calculation performed on each sub-multiframe of data. CRC-4 will indicate whether an error probably occurred.

The equipment which originates the E1 data calculates the CRC-4 bits for one sub-multiframe. Then it inserts the CRC-4 bits in the CRC-4 positions in the next sub-multiframe. The receiving equipment then performs the reverse mathematical computation on the sub-multiframe. It examines the CRC-4 bits which

Multiframe	Sub-Multiframe	Frame#	TIME SLOT 0 Bits bit1	bit2	bit3	bit4	bit5	bit6	bit7	bit8
	SMF #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
	SMF #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

Note:
SMF#1 = Sub-Multiframe #1
SMF#2 = Sub-Multiframe #2
Sa = Spare bits reserved for National use
E = E-bit errors
A = Remote Alarm (FAS Remote Alarm Indication)
Frame Alignment Signal Pattern = 0011011
c1,c2,c3,c4 = CRC bits

CRC multiframe is not aligned with MFAS timeslot 16 multiframe

Figure 1.8C CRC-4 Multiframe Format

were transmitted in the next sub-multiframe, then it compares the transmitted CRC-4 bits to the calculated value. If there is a discrepancy in the two values, a CRC-4 error is reported.

There is one major disadvantage of relying on CRC-4 errors to determine the performance of an E1 circuit: each individual CRC-4 error does not necessarily correspond to a single bit error. Multiple bit errors within the same sub-multiframe 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 CRC-4 bits.

Thus, CRC-4 error checking provides a most convenient method of identifying bit errors within an in-service system, but provides only an approximate measure of the circuit's true performance.

Consider the MFAS framing, illustrated in Figure 1.8B. Each MFAS frame can be divided into "sub-multiframes". These are labeled SMF#1 and SMF#2 and consist of 8 frames apiece. We associate 4 bits of CRC information with each sub-multiframe. Refer to Figure 1.8C for an illustration of the CRC-4 bits and their placement.

The CRC-4 bits are calculated for each sub-multiframe, buffered, then inserted into the following sub-multiframe to be transmitted across the E1 span.

1.8.4 E-bit Performance Monitoring

When a 2.048 Mbps circuit's terminal equipment is optioned for CRC-4 transmission, E-bit transmission may also be enabled and E-bit performance monitoring of the circuit is possible. Check the specifications of your network equipment. Refer to Figure 1.8D.

When this type of terminal equipment detects an incoming CRC-4 error, it will respond by transmitting an E-bit error toward the other terminal. Test set 2, shown in the diagram, will be able to see the E-bit errors by plugging into a protected monitoring point. Note that the test set can not see the actual code errors, framing bit errors and CRC errors introduced at the trouble point. The test set can only see the

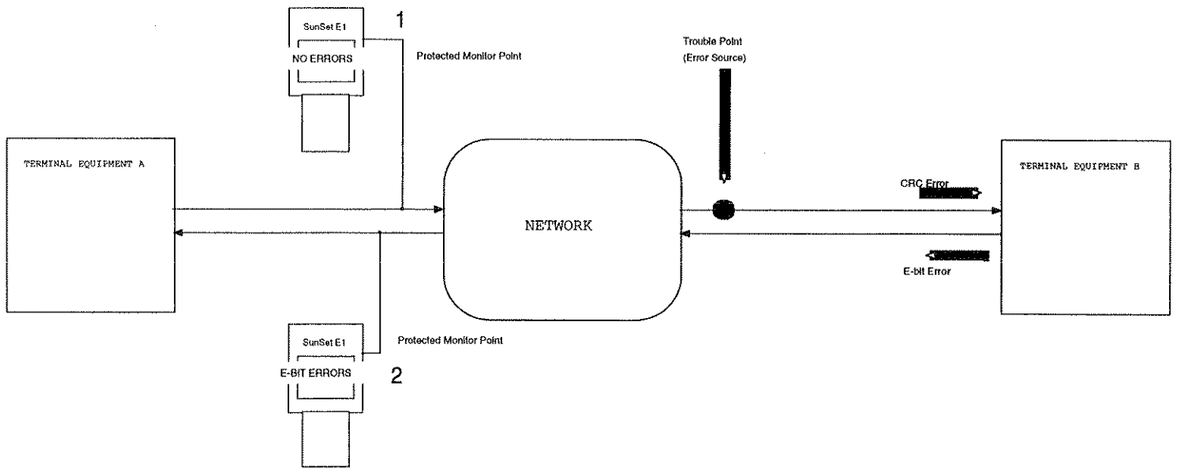


Figure 1.8D E-bit Performance Monitoring - In-Service Circuit

E-bit errors transmitted by Terminal B. Thus, E-bit error transmission allows a 2.048 Mbps in-service circuit to be reliably monitored for transmission performance from any point on the circuit.

Without E-bit error transmission, only a complete circuit failure can be reliably determined at any point on the circuit. With a complete circuit failure, the test set will see either loss of signal, alarm indication signal, or remote alarm indication.

Section 2 Product Overview

SECTION 2

Congratulations, you have just purchased the industry's leading hand-held E1 test set, the SunSet™ E1 equipped with software E1, and carrying the mark. This test set puts powerful test capabilities into a single, convenient, hand-held package.

The SunSet E1 is designed to help anyone who maintains or works with 2.048 Mbps circuits. Its broad range of capabilities combined with a convenient hand-held size make it the favorite of technicians in the telephone exchange, transmission operations and maintenance group, and corporate communications network. This test set helps diagnose E1 problems quickly and easily, whether the circuit is in-service or out-of-service.

This manual is designed to provide you with all the information you will need concerning your SunSet E1.

Each SunSet E1 provides:

- Circuit graphics to easily keep track of complicated circuit setups
- Software cartridges for fast and convenient feature upgrades
- Full-size display for more efficient operation and faster data correlation
- Menu-driven user interface for simple and efficient operation
- 20 super-bright LED indicators give circuit status and history at a glance
- Full range of in-service and out-of-service measurements
- Extensive error injection and alarm generation capacity
- Wide selection of test patterns
- Drop and insert to internal test circuitry N or M kbps, or A-law decoded VF
- N (contiguous) and M (noncontiguous) x64 kbps testing
- Printing ability
- View live 8 frame received E1 data: binary, hex, and ASCII formats.
- 2.048 Mbps signal level measurement
- DS0 level/frequency measurement
- Receive signal sensitivity to -43

dBdsx
- 5 ppm accuracy clock
- Transmitter Frequency Shift allows transmitter speed to be varied +/- 100 bps in 1, 5, & 25 ppm steps
- Framing: unframed, PCM-31, PCM-30, AUTO, with or without CRC-4
- Propagation delay measurement in microseconds and UI
- G.821 analysis
- G.826 analysis
- M2100/550 analysis
- On-screen Pulse Shape Analysis
- Talk/listen with DTMF dialing capability, PCM-30 signaling bit display and generation
- MF Dialing, including MFR2 forward and backward frequencies
- Built-in Microphone & Speaker

for Talk/Listen application
- View all 30 Channel A/B/C/D bits on a single display screen

Optional features give you even more diagnostic power:
- Graphical VT100 Remote Control allows menu-driven control of basic test functions
- View FAS and MFAS framing words: binary, hex, and ASCII formats.
- Enhanced Error Injection allows errors to be injected equally into all channels
- Advanced Frame Word Applications allows injection of Sa bits in 1, 0, or toggling formats. Displays FAS, NFAS, MFAS frame words
- E-bit Analysis and Injection allows E-bit G.821 measurement results and error injection

For further information, or if you encounter problems, please contact Sunrise Telecom Customer Service for assistance.

Customer Service
Sunrise Telecom Incorporated
22 Great Oaks Blvd.
San Jose, CA 95119
U.S.A.
Tel: 1 408 363 8000
Fax: 1 408 363 8313
Technical Support:
(24hrs) 1 800 701 5208
Email: support@sunrisetelecom.com
Internet: http://sunrisetelecom.com

Section 3 Product Configs & Options

Here are the various items that can be ordered with the SunSet E1. The following SunSet E1 Packages give you everything you will need in one convenient order number. However, if you prefer, you may order most items individually.

Model Name and Description

Packages*

SSE1P1B SunSet E1 Basic Package
Includes E1 Chassis, AC Battery Charger (220VAC, 0.6A), SunSet E1 User'sManual, Software E1 cartridge. Has basic measurements, stress patterns,VF channel capabilities including level and frequency measurement, DTMF and MF dialing, view received data, propagation delay, histogramanlysis, pulse shape analysis.

Note:
Replace BNC (f) with any of the following:
-B BR2 (120Ω, 3.00V) Connectors
-C Bantam (120Ω, 3.00V) Connectors
-D 1.6/5.6 mm (75Ω, 2.37V) Connectors

Example: SSE1P1B package with BR2 connectors would be specified as "SSE1P1B-B" on your order.

110, 120, or 240 VAC Battery Chargers may be substituted for the SS121-B 220 VAC charger.

SS213 Transmit Frequency Shift
Allows transmitter speed to be varied +/- 30 kbps in 2 kbps steps. Also allows +/- 200bps (100 ppm) in 2 bps (1 ppm) steps. Provides line build out of 0 dB or -6 dB.

SW100 Remote Control
Allows menu-driven remote control of basic test functions using a dumb terminal or personal computer equipped with VT100 terminal emultion software. Includes printer cable and null modem adapter. Referred to as option A in configuration screen.

SW171 Enhanced Error Injection
Allows errors to be injected equally in all channels.

SW210 Advanced Frame Word Applications
Allows injection of Sa bits in 1, 0, or toggling 1/0 (0/1) formats. Shows FAS, NFAS, MFAS frame words.

SW211 E-bit Analysis and Injection
Allows E-bit errors to be measured with G.821 performance results. AllowsE-bits to be transmitted in response to received submultiframe CRC errors. Allows E-bit errors to be injected through the ERR INJ key. Requires SW210.

Note:
1) Software cartridges may be upgraded to include additional options. Simply send in a purchase order with your test set serial number and the desired new option. We will mail you a new cartridge with all your original options plus the new ones. We will also enclose a stamped, preaddressed padded envelope for you to return the old cartridge. There is a $150 charge for replacing lost or unreturned cartridges.

SS101 Carrying Case

SS104 Cigarette Lighter Battery Charger
To be used with SunSets equipped with sealed lead acid battery.

SS113-A AC Battery Charger, 120 VAC
Provides continuous operation from 120 VAC source. For USA, Canada. Provides 0.6A output at 12 VDC. 2 stage operation for fast recharge then slow trickle charge.

SS113-B AC Battery Charger, 110 VAC
Provides continuous operaion from 110 VAC source. For Taiwan, Korea. Provides 0.6A output at 12 VDC. 2-stage operation for fast recharge then slow trickle charge.

SS115 DIN-8 to RS232C Printer Cable
Printer cable used to connect the SunSet T1 to a serial printer. Provided at no charge when either SW100 or SS118A/B is ordered

SS116 Instrument Stand.
Provides a convenient, hands-free viewing stand for the SunSet

SS117 Printer Paper, 5 rolls for SS118A/B

SS118 High Capacity Thermal Printer.
Includes rechargeable battery for operation without AC. Includes cable for connection to SunSet and 110 VAC charger. SS115 printer cable included. Order SS127 for 220VAC applications.
CPR: 674622
CLEI: T1TUW07HAA

SS121-A SunSet AC Charger, 230 VAC, 50/60 Cycle.
Provides continuous operation from 230 VAC source. Provides 0.6A output at 12 VDC. Charges battery. 2-stage operation for fast recharge then slow trickle charge. Two pin Euro-style connector.

SS121-B SunSet AC Charger, 220 VAC, 50/60 Cycle.
Provides continuous operation from 220 VAC source. Provides 0.6A output at 12 VDC. Charges battery. 2-stage operation for fast recharge then slow trickle charge. 3-prong IEC connector

SS122 Null Modem Adapter.
Increases the range of serial printers which operate with the SunSet E1.

SS123 SunSet Jacket.
Provides additional protection against handling, weather, splashes, dust, mud, etc for SunSets. Includes elastic handstrap, connector panel velcro flap, see-through front panel membrane, front-panel zip up cover, carabiner hook, and rugged padded synthetic fabric.

SS127 Printer Charger, 220 VAC, 50 60 Hz Charger for SS118 printer.

SS130A 9"/23" SunSet Rack Mount - Removable
Allows a Sunset to be mounted in 19" or 23" racks. However, SunSet must still be powered by its charger plugged into AC supply. Unit is strapped into rack mount and may be removed for portable use.

SS130B 19"/23"SunSet Rack Mount - Permanent Mount. Allows a Sunset to be mounted in 19" or 23" racks. However, SunSet must still be powered by its charger plugged into AC supply. Unit is screwed down for permanent installation.

SS209 SunSet E1 User's Manual

SS210 Conversion Cable, BNC (m) 75Ω to 3-pin banana (m) 120Ω, 2m

SS211 Cable, BNC (m) 75Ω to BNC (m) 75Ω, 2m

SS212 Conversion Cable, BNC (m) 75Ω to Bantam 120ý, 2m

SS214 3-pin Female to Female Adapter Plugs
Changes SS210 to female 3-pin banana.

SS217 Cable, 1.6/5.6 (m) 75Ω to 1.6 5.6 (m) 75Ω, 2m

SS218 Conversion Cable, 1.6/5.6 (m) 75Ω to 3- pin (m) 120Ω, 2m

SS220 1.6/5.6 Male to BNC Cable, 2m

Section 4 Unpacking & Checkout Procedure

Use the following procedure for unpacking and testing your new SunSet:

4.1 Unpacking

1) Remove the packing list from the shipping container.

2) Remove the SunSet and accessories from the shipping container.

3) Inspect all parts and immediately report any damage to the carrier and to Sunrise Telecom.

4) Verify that all parts specified on the packing list were received.

5) Complete the Warranty Registration Card and return it immediately to Sunrise Telecom.

NOTE: Sunrise Telecom must receive your warranty registration card in order to provide you with updated software releases

6) Ensure the software cartridge is fully seated in its slot (refer to Figure 4A, Software Cartridge Installation).

7) Plug the AC Battery Charger into an appropriate AC wall outlet:
120 VAC for SS113-A
110 VAC for SS113-B
230 VAC for SS121-A
220 VAC for SS121-B

8) If you choose to install the Instrument Stand, refer to Figure 4B, Instrument Stand Installation.

NOTE: If you plan to use the SunSet with its optional Protective Jacket (SS123), then do not install the Instrument Stand.

Use the following procedure:

a) Remove the two center screws from the rear of the SunSet. (Save these screws should you decide to remove the stand at a later date).

b) Remove the two bottom screws from the rear of the SunSet. These screws are slightly longer than the ones removed in step a). Save both of these screws for step e) below.

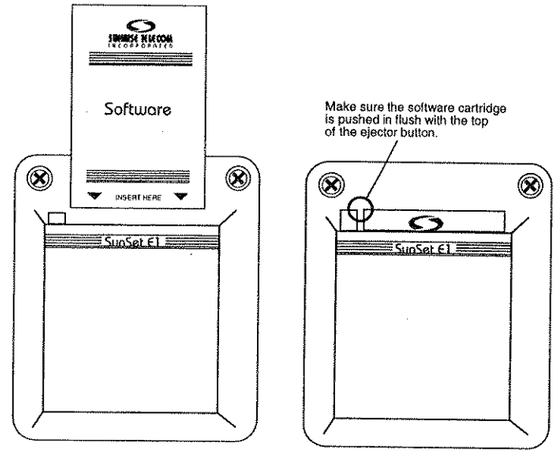


Figure 4A Software Cartridge Installation

c) Fit the Instrument Stand onto the back of the SunSet.

d) Use the two long screws (provided with the Instrument Stand) to screw the Instrument Stand onto the SunSet at the two bottom positions.

e) Use the screws saved from step b) to screw the Instrument Stand onto the SunSet at the two center positions.

9) Switch the set on and verify that it passes the SELF TEST. If the SunSet does not turn on immediately, it may need to charge for up to 5 minutes before it can run.

10) Charge the unit for at least one hour before its first use. Or, leave the AC Battery Charger plugged in while operating the SunSet.

11) Put the SunSet and accessories into the soft Carrying Case (if it was ordered).

NOTE: Each software cartridge is mated to a single SunSet. If your SunSet does not start properly, verify that the serial number printed on the software cartridge matches the serial number on the back of your SunSet.

When ordering software upgrades, be sure to specify the serial number of the SunSet into which the new cartridge will be installed.

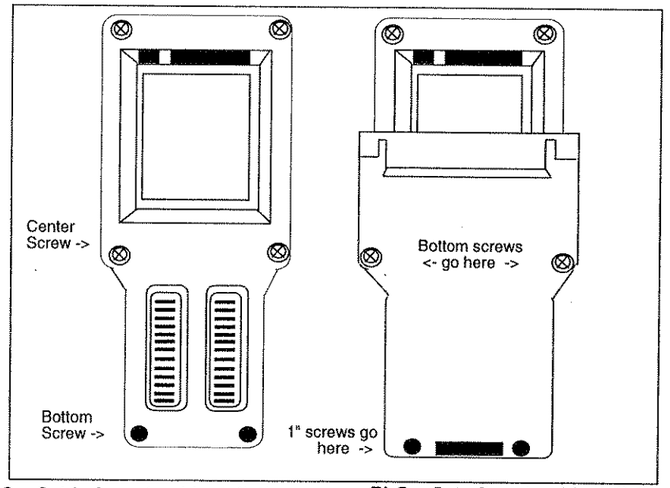


Figure 4B Instrument Stand Installation

Section 5 Product Description

5.1 Keys

Refer to Figure 5.1A, for front panel keys and other features.

Most SunSet keys perform two separate operations. The white label above the key indicates what function will be performed if the key is pressed by itself. The orange label below the key shows what function will be performed if the SHIFT-lock key is pressed first.

The SHIFT-lock key should not be pressed at the same time another key is pressed. Instead, the SHIFT-lock key should be pressed and then released. A SHIFT indicator will appear in the upper left-hand corner of the screen. Any other key can now be pressed, and the test set will perform the function indicated by the orange label.

If the keys are not behaving as expected, check the SHIFT indicator. If the SHIFT indicator displays the wrong shift status, simply press the SHIFT-lock key again.

5.1.1 White Labels

F1, F2, F3, F4
These keys are used to select choices F1 through F4 shown at the bottom of the LCD display. In Figure 5.1A, F1 would be used to select TERM, F2 to select MONITOR, F3 to select BRIDGE, and F4 to select additional F-key options.

ENTER
The ENTER key performs three functions:

1) When a menu item is highlighted and the ENTER key is pressed, the SunSet will display the screen for the highlighted menu item.
2) If setups are complete in a data entry screen, pressing ENTER will often return you to the previous menu.
3) In a few cases, pressing the ENTER key is required after the user finishes entering data in a given screen. In these cases, the test set will not execute the inputs until the ENTER key has been pressed. In these few cases, you may cancel all of the current entries in the screen by

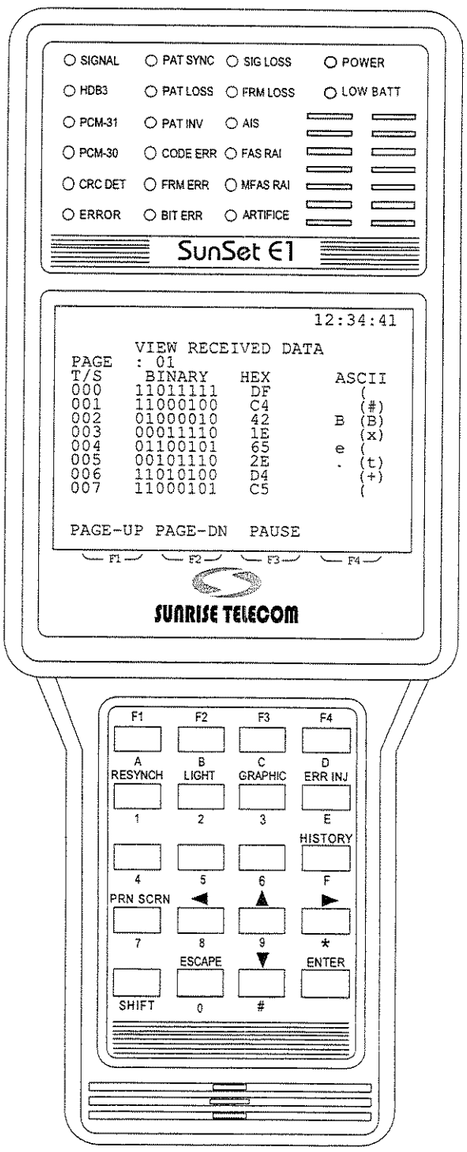


Figure 5.1A SunSet E1 Front View

pressing the ESCAPE key. When this occurs, the test set will retain its previous settings, and will ignore the information that was just entered.

▲Cursor Up Arrow)

The up arrow key is used to move the cursor up.

▼(Cursor Down Arrow)

The down arrow key is used to move the cursor down.

▶(Cursor Right Arrow)

The right arrow key is used to move the cursor to the right.

◀(Cursor Left Arrow)

The left arrow key is used to move the cursor to the left.

RESYNCH

The RESYNCH key will force the test set to search for frame alignment, coding, and all known test patterns.

Example 1: If the user is not in BASIC MEASUREMENTS and has specified AUTO framing, and the framing has been lost, the test set will indicate that the signal is unframed. Later, if it appears that framing has returned, the test set will be forced to search for framing when the RESYNCH key is pressed.

Example 2: If the user is not in BASIC MEASUREMENTS and pattern synch as been lost, the test set will indicate that a LIVE signal is present, and will no longer look for pattern synch. The user can force the test set to check for patterns again by pressing the RESYNCH key.

In BASIC MEASUREMENTS, the SunSet will require that the framing and pattern stay constant for the duration of the test. Therefore, if either the framing or pattern is lost and later returns, the SunSet will automatically detect the original framing or pattern. In BASIC MEASUREMENTS, pressing the RESYNCH key will restart the measurement, allowing the SunSet to detect framing and a new pattern.

RESYNCH will not cause the pattern to be detected in VIEW RECEIVED DATA and VF MEASUREMENTS, because the test set's pattern synchronization circuitry is turned OFF in these menus.

LIGHT
The backLIGHT key is used to switch the system backLIGHT off and on. Keeping the backLIGHT off when it is not needed will allow the test set to maintain its battery charge approximately 20% longer.

The SunSet's backLIGHT has a programmable timer for automatic shut-off. This timer can be set from 1 to 99 minutes or disabled completely. The backLIGHT may be configured in OTHER FEATURES, SYSTEM CONFIG, GENERAL CONFIG, BACK LIGHT.

GRAPHIC
The GRAPHIC key displays a picture of the current circuit configuration and status. After graphically viewing your configuration, you may return to your previous location by pressing either GRAPHIC, ESCAPE, or ENTER.

ERR INJ
The ERRor INJect key is used to inject errors into the test set's transmitted signal. Errors are injected according to the current settings in the OTHER FEATURES, TEST PARAMETERS, ERROR INJECTION menu.

HISTORY
The HISTORY key is used to turn off any flashing LEDs. The LEDs flash to indicate any error, alarm or caution condition which occurred previously but which is no longer present. Pressing the HISTORY key will not affect the measurement results.

PRN SCRN
The PRiNt SCReeN key is used to print any alphanumeric information appearing on the screen. This key will not allow screen graphics to be printed. If screen graphics are able to be printed, an F-key selection will appear for this purpose.

ESCAPE
Pressing the ESCAPE key one or more times moves you back to the SunSet-E1 MAIN MENU.

5.1.2 Orange Labels

SHIFT
The SHIFT-lock key is pressed to provide access to the functions specified by the orange labels. The SHIFT-lock key is always pressed first, then released before the desired orange-label key is pressed.

SHIFT-lock status is displayed in the upper left-hand corner of the screen. The SHIFT-lock indicator must not be present when you wish to use the white label functions.

A, B, C, D, E, F
These keys are used to enter DTMF tones (A-D) as well as hexadecimal numbers. They can also be used to provide labels for user-defined information.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9
These keys are used to enter user test patterns and telephone numbers. They can also be used to provide labels for user-defined information.

*
The * key is used in DTMF dialing to produce the * DTMF tone.

#
The # key is used in DTMF dialing to produce the # DTMF tone.

5.2 LEDs

The LEDs (Light Emitting Diodes) provide a visual indication for the condition of the received signal. An LED will be lit continuously when the particular condition for that LED is detected. If the condition should cease, then the following will result:

- For status (green) LEDs, the LED will turn off and remain off.
- For alarm (red) LEDs, the LED will flash to indicate a "history" condition.
- For caution (yellow) LEDs, the LED will flash to indicate a "pattern inverted" condition.

Blinking provides "historical" information on the circuit condition, in the event that the user was absent when the error or alarm condition occurred. The HISTORY key can be pressed to

stop the flashing.

SIGNAL
The SIGNAL LED indicates that the test set is receiving valid E1 pulses.

HDB3
The HDB3 LED indicates that HDB3 line coding is present on the received E1 signal.

HDB3 coding can only be observed on a line if at least 4 consecutive data zeroes are being transmitted. The presence of a pattern or signal without 4 consecutive data zeroes can mask the true line coding. In this case, the test set will not indicate that HDB3 coding is present.

PCM-31, PCM-30
These LEDs specify the type of framing detected on the received signal. PCM-31 indicates that the basic FAS (Frame Alignment Signal) has been detected. PCM-30 indicates that the MF-16 MultiFrame pattern has been detected in addition to the basic FAS pattern. If the received signal is unframed, neither LED will light.

If the test set is configured for AUTO framing in the LINE INTERFACE menu, it will autoframe on a signal when connected to the circuit. Once the test set has observed that a signal is remaining unframed, it will no longer attempt to search for valid framing on the signal. Frame resynchronization may be invoked manually by pressing the RESYNCH key.

If the SunSet has been configured for a particular type of framing in the LINE INTERFACE menu, then it will continuously search for that type of framing. The appropriate LED(s) will light whenever that framing is found.

CRC DET
The CRC DETect LED lights if CRC-4 check sequences are detected on the test set's received signal. The CRC check sequences are only available with PCM-31 or PCM-30 framing.

ERROR
The ERROR LED lights if any of the following kinds of errors have been observed: CODE errors, BIT errors, bitslip errors. The ERROR LED will also light if CRC-4 errors are detected when CRC error checking has been enabled, and FRAME errors are detected when the signal is a framed signal. The CRC-4 and framing are configured in the LINE INTERFACE menu.

PAT SYNC
The PATtern SYNChronization LED lights if the test set has synchronized on a known pattern in the received signal. The exact pattern may be observed by performing a BASIC MEASUREMENT or by pressing the GRAPHIC key.

The test set will automatically attempt to synchronize on a pattern when it is first connected to a circuit. The pattern detector searches for all pre-programmed and user-programmed patterns, and all of these patterns in inverted form. The test set can be forced to search for patterns at any time by pressing the RESYNCH key.

If you want the test set to obtain pattern synch only with the pattern it is transmitting, enter the OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA menu, and ENABLE the PATTERN LOCK. Now, the PAT SYNC LED will only light if the identical pattern is found. DISABLE the PATTERN LOCK if you wish to search the received signal for all possible test patterns.

The RESYNCH key is disabled, and the PAT SYNCH LED turns off, as you enter VF MEASUREMENTS, VIEW RECEIVED DATA, FAS FRAME WORDS, or MFAS FRAME WORDS.

PAT LOSS
The PATtern LOSS LED lights if pattern synchronization was first achieved but later lost.

PAT INV
The PATtern INVersion LED lights if the test pattern being received is a standard test pattern (or user-defined test pattern) with the ones and zeroes reversed.

CODE ERR
The CODE ERR LED lights if a Bipolar Violation is detected on the received signal.

FRM ERR
The FRM ERR LED lights if a FRaMing ERRor has been detected on the received signal.

BIT ERR
The BIT ERR LED lights if a BIT ERRor has been detected on the received signal.

SIG LOSS
The SIGnal LOSS LED lights if 150 consecutive zeroes are received.

FRM LOSS
The FRaMe LOSS LED lights if the test set has synchronized on a framing pattern and then has lost frame synchronization.

AIS
The AIS (Alarm Indication Signal) LED lights if the test set detects an unframed all ones signal on its receive jack.

FAS RAI
The FAS RAI LED lights if the test set detects a FAS remote alarm signal. The FAS alarm signal is timeslot 0, bit 3 = 1 in a frame not containing a frame alignment signal.

MFAS RAI
The MFAS RAI LED lights if the test set detects an MFAS remote alarm signal. The MFAS alarm is frame 0 time slot 16 bit 6 = 1.

ARTIFICE
The ARTIFICE LED lights when the test set detects an unframed signal of alternating 1s and 0s on its receive jack.

POWER
The POWER LED lights when the test set is switched on.

LOW BATT
The LOW BATTery LED lights when the test set's power supply voltage has dropped to a low level. Approximately 10 to 15 minutes after the LOW BATT LED lights, the test set will automatically shut down.

Connecting the AC Battery Charger will allow you to use the test set indefinitely. If you plan to use the test set for an extended period of time, it is best to connect the AC Battery Charger first. If the charger is connected while a measurement is in progress and while the battery is not fully charged, then the test set may automatically reset itself. In this case, the current measurement results would be lost.

5.3 Connector Panel

The SunSet E1 has a connector panel as shown in Figure 5.3A.

VOLUME
The volume control determines the loudness of the speaker during talk/listen and channel monitoring applications.

REF CLK
The REF CLK BNC connector is where a 2.048 Mbps reference clock signal can be connected to the SunSet. The reference clock source must be an HDB3 coded signal.

TX
The TX BNC connector is where the E1 signal is transmitted from the SunSet.

RCV
The RCV BNC connector is where the E1 signal is received by the SunSet.

SERIAL PORT
The serial port is used for sending information to a serial printer or for remote control operation. This port uses an RS-232C DTE configuration with hardware flow control when the 8-pin

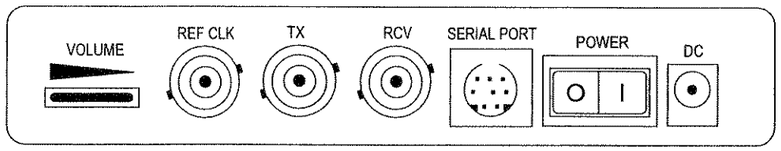


Figure 5.3A Connector Panel

DIN to 25-pin D-Sub conversion cable is connected.

POWER
The power switch is used to switch the SunSet on and off.

DC
The DC jack is where the AC Battery Charger is connected. The SunSet may be operated with a discharged battery, provided the charger is connected. The battery will charge while the SunSet is being operated if the charger remains connected.

5.4 Additional Controls

Contrast Control
The contrast control adjusts the contrast of the LCD screen. It is located on the left-hand side of the test set.

5.5 SunSet E1 Menu Tree

The following menu tree shows the organization of menus in the test set. Software option numbers are given in parentheses.

Refer to Section 6 for a detailed explanation of each item.

SunSet-E1 MAIN MENU
LINE INTERFACE
(set parameters here)
SEND TEST PATTERN
(select or user-define a test pattern)
BASIC MEASUREMENTS
RESULTS - SUMMARY
RESULTS - LINE
RESULTS - SIG/ALM
RESULTS - FRAME
RESULTS - G.821
RESULTS - E-BIT
RESULTS - FREQUENCY
RESULTS - M.2100/550

RESULTS - G.826
OTHER MEASUREMENTS
VIEW RECEIVED DATA
FAS FRAME WORDS
MFAS FRAME WORDS
PROPAGATION DELAY
HISTOGRAM ANALYSIS
PULSE SHAPE ANALYSIS
TRANSMIT STRESS
VF CHANNEL ACCESS
(dialing & VF measurement)
VF MEASUREMENTS
DTMF DIALING
VIEW 30 CHNL CAS
DIALING CONFIG
MF DIALING
OTHER FEATURES
SYSTEM CONFIG
TEST PARAMETERS
GENERATE ALARM
PRINT RECORDS
SEND FRAME WORDS
VIEW TEST RECORD

5.6 Measurement Definitions

This section defines each of the test set's measurements. The same acronym may be used in different screens due to space limitations within that screen. To reduce ambiguity, an appropriate prefix is added to the acronym. For instance, the ES shown in the RESULTS- G.821 screen is referred to as (BIT) ES in this context.

Likewise, the word RATE may appear in several places on a single screen. In this context, RATE always refers to the error rate of the associated error count. To reduce ambiguity, an appropriate prefix is added to the acronym. For instance, the RATE shown next to the BIT count in the RESULTS-SUMMARY screen is referred to as (BIT) RATE in this context.

All measurement definitions adhere to G.821 conventions.

5.6.1 RESULTS - SUMMARY Screen

The results summary screen presents the most significant measurement results. This screen contains measurement data related to specific types of impairments like code violations, bit errors, framing bit errors, and CRC-4 block errors. It also reports overall service performance measures such as errored seconds and percent errored seconds.

Most measurements consist of a count displayed in the left column, and the corresponding rate or percent displayed on the right column. For example, CODE is displayed on the left side of the first line, and the corresponding RATE is

displayed on the right side of the same line. CODE is the count of code errors, and RATE is the code error rate.

CODE
This is a count of the number of code errors which have occurred since the beginning of the test.

(CODE) RATE
This is the average code error rate since the beginning of the test.

BIT (ERROR)
This is a count of the number of bit errors that have occurred since the beginning of the test. This measurement is reported as N/A when the SunSet is not synchronized on a known received pattern.

(BIT ERROR) RATE
This is the average bit error rate since the beginning of the test. This measurement is reported as N/A when the test set is not synchronized on a known received pattern.

CRC
This is a count of the number of CRC-4 errored blocks which have occurred since the beginning of the test. This measurement is reported as N/A when the SunSet is not synchronized on a received CRC-4 check sequence.

(CRC) RATE
This is the average CRC-4 errored blocks rate since the beginning of the test. This measurement is reported as N/A when the test set is not synchronized on a received PCM-31 or PCM-30 signal.

FE
This is a count of the number of Frame word Errors which have occurred since the beginning of the test. This measurement is reported as N/A when the test set has not synchronized on a known framing pattern within the received signal.

MFE
This is a count of the number of MultiFrame word Errors which have occurred since the beginning of the test. This measurement is reported as N/A when there is no framing pattern within the received signal.

ES
This is a count of the number of Errored Seconds which have occurred since the beginning of the test. An errored second is any second with at least one code violation, bit error, FE, or CRC-4

error. An errored second is not counted during an Unavailable Second.

%ES
This is the percentage of Errored Seconds since the beginning of the test.

SES
This is a count of Severely Errored Seconds since the beginning of the test. A severely errored second is a second with a 10^{-3} error rate. A Severely Errored Second is not counted during an Unavailable Second.

%SES
This is percentage of Severely Errored Seconds since the beginning of the test.

UAS
This is a count of UnAvailable Seconds since the beginning of the test. Unavailable seconds begin at the onset of 10 consecutive severely errored seconds and end at the onset of 10 consecutive non-severely errored seconds. Loss of signal, loss of frame, and loss of pattern synchronization will also cause an UnAvailable Second.

%UAS
This is the percentage of UnAvailable Seconds since the beginning of the test.

%EFS
This is the percentage of Error Free Seconds since the beginning of the test.

%DM
This is the percentage of Degraded Minutes since the beginning of the test. A Degraded Minute occurs when there is a 10^{-6} error rate during 60 available, non-severely errored seconds. Errors during unavailable or severely errored seconds are not counted while the 60 available, non-severely errored seconds are being accumulated.

5.6.2 RESULTS - LINE Screen

The RESULTS - LINE screen presents the measurements which are related to code violations. The code violation is the fundamental measurement used to determine the health of a line. It is a measurement that is always available, regardless of whether a known pattern is on the line and regardless of framing.

CODE
This is a count of the number of CODE violations which have occurred since the beginning of the test.

(CODE) BER
This is the code Error Rate since the beginning of the test.

(CODE) CURBER
This is the CURrent CODE Error Rate measured during the last AVERAGING INTERVAL. The averaging interval is set in the OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA menu. The factory-default averaging interval is 10 seconds.

(CODE) ES
CODE Errored Seconds is a count of seconds with at least one code violation since the beginning of the test. CODE ESs are not counted during CODE UASs.

(CODE) %ES
This is the percentage of CODE Errored Seconds that have occurred since the beginning of the test.

(CODE) SES
CODE Severely Errored Seconds is the count of seconds with at least a 10^{-3} error rate since the beginning of the test. CODE SESs are not counted during CODE UASs.

(CODE) %SES
This is the percentage of CODE SESs that have occurred since the beginning of the test.

(CODE) AS
This is a count of the CODE Available Seconds that have occurred since the beginning of the test. A code available second is any code error-free, code errored, or code severely-errored second.

(CODE) %AS
This is the percentage of CODE Available Seconds since the beginning of the test.

(CODE) UAS
This is the count of code violation UnAvailable Seconds since the beginning of the test. CODE UASs are counted at the onset of 10 consecutive CODE SESs. CODE UASs continue to be counted until the onset of 10 consecutive non-SESs.

(CODE) %UAS
This is the percentage of CODE UASs that have occurred since the beginning of the test.

(CODE) DM
This is the number of CODE Degraded Minutes since the beginning of the test.

(CODE) %DM
This is the percentage of CODE DMs that have occurred since the beginning of the test.

5.6.3 RESULTS - SIG/ALM Screen

The RESULTS - SIG/ALM screen presents all measurement parameters relating to E1 signal and alarm information.

LOSS
Loss Of Signal Seconds is a count of the number of seconds for which signal has been lost during the test.

+LVL
Positive LeVeL is the level of positive pulses being received by the test set. Measurements are from the base of the pulse to its peak, and are displayed in both Volts (V) and decibels variance from DSX level (dB).

AISS
Alarm Indication Signal Seconds is a count of the number of seconds in which AIS was detected.

-LVL
Negative LeVeL is the level of negative pulses being received by the test set. Measurements are from the base of the pulse to its peak, and are displayed in both Volts (V) and decibels variance from DSX level (dB).

LOFS
Loss of Frame Seconds is a count of seconds since the beginning of the test that have experienced a loss of frame.

Lpp
Peak-to-peak Level is the peak-to-peak level of negative and positive pulses being received by the test

set. Measurements are displayed in both Volts (V) and decibels variance from DSX level (dB).

FALM
Frame ALarM seconds is a count of seconds that have had far-end frame alarm (FAS RAI) since the beginning of the test.

MFAL
Multi Frame ALarM seconds is a count of seconds that have had far-end multi frame alarm (MFAS RAI) since the beginning of the test.

ARTF
ARTF is a count of seconds that have had an ARTIFICE alarm since the beginning of the test. An ARTIFICE alarm is an unframed signal with a pattern of alternating 1s and 0s.

WNDR
This is the maximum absolute phase difference between the measured frequency and the reference frequency, since the beginning of the test, expressed in unit intervals.

FREQ
FREQuency is the frequency of the received signal as measured against the frequency of the MSRMT CLOCK specified in the LINE INTERFACE menu. The measurement reference clock is assumed to be a perfectly accurate 2,048,000 Hz frequency source.

5.6.4 RESULTS - FRAME Screen

The RESULTS - FRAME screen reports all of the measurements related to the framing of the line being tested. Measurement results are reported regardless of the type of framing on the line. An unframed signal will not have measurements reported here.

FASE
This is the count of Framing word Errors which have occurred since the beginning of the test.

FASER
This is the Framing word Error Rate measured since the beginning of the test.

MFSE
This is the number of MultiFrame word Errors which have been counted since the beginning of the test.

MFSER
This is the MultiFrame word Error Rate since the beginning of the test.

CRC
This is the count of CRC-4 errors since the beginning of the test.

CRCR
This is the CRC block error Rate since the beginning of the test.

(FRAME) ES
This is the count of frame Errored Seconds since the beginning of the test in which at least one framing bit error has occurred. A frame errored second is not counted during a frame unavailable second.

(FRAME) %ES
This is the percentage of frame Errored Seconds which has occurred since the beginning of the test.

(FRAME) SES
This is a count of the FRAME Severely Errored Seconds which has occurred since the beginning of the test. A frame severely errored second is a second with at least a 10^{-3} framing bit error rate. Framing bit severely errored seconds are not counted during bit unavailable seconds.

(FRAME) %SES
This is the percentage of the frame Severely Errored Seconds that have occurred since the beginning of the test.

(FRAME) UAS
This is a count of the frame UnAvailable Seconds since the beginning of the test. A frame unavailable second is a second during which the test set has lost frame synchronization. Frame unavailable seconds are also counted at the onset of 10 consecutive frame severely errored seconds. In this case, frame unavailable seconds continue to be counted until the onset of 10 frame error-free seconds or frame errored seconds.

(FRAME) %UAS
This is the percentage of frame UnAvailable Seconds since the beginning of the test.

(FRAME) DM
This is a count of the frame Degraded Minutes that have occurred since the beginning of the test.

(FRAME) %DM
This is the percentage of frame Degraded Minutes which has occurred since the beginning of the test.

(FRAME) EFS
This is the count of frame Error Free Seconds since the beginning of the test.

(FRAME) %EFS
This is the percentage of frame Error Free Seconds since the beginning of the test.

5.6.5 RESULTS - G.821 Screen

The RESULTS - G.821 screen reports all of the parameters that are measured from a known G.821 test pattern. These results are only reported if the SunSet is synchronized on a known test pattern.

BIT
This is a count of the BIT errors since the beginning of the test.

BTSLP
This is a count of the BiT SLiPs that have occurred since the beginning of the test. A bit slip is said to occur when the synchronized pattern either loses a bit or has an extra bit stuffed into it.

(BIT) BER
This is the Bit Error Rate since the beginning of the test.

(BIT) CURBER
This is the CURrent Bit Error Rate during the last AVERAGING INTERVAL. The averaging interval is set up within the OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA screen. The factory-default averaging interval is 10 seconds.

(BIT) ES
This is a count of the bit Errored Seconds that have occurred since the beginning of the test. A bit errored second is a second with at least 1 bit error. Bit errored seconds are not counted during bit unavailable seconds.

(BIT) %ES
This is the percentage of bit Errored Seconds that have occurred since the beginning of the test.

(BIT) SES
This is a count of the bit Severely Errored Seconds that have occurred since the beginning of the test. A bit severely errored second is a second with at least 10^{-3} error rate. Bit severely errored seconds are not counted during bit unavailable seconds.

(BIT) %SES
This is the percentage of the bit Severely Errored Seconds that have occurred since the beginning of the test.

(BIT) AS
This is a count of the bit Available Seconds that have occurred since the beginning of the test. A bit available second is any bit error-free, bit errored, or bit severely errored second.

(BIT) %AS
This is the percentage of bit Available Seconds since the beginning of the test.

(BIT) UAS
This is a count of the bit UnAvailable Seconds since the beginning of the test. A bit unavailable second is a second during which the test pattern has lost synchronization. Bit unavailable seconds are also counted at the onset of 10 consecutive bit severely errored seconds. In this case, bit unavailable seconds continue to be counted until the onset of 10 bit error-free seconds or bit errored seconds.

(BIT) %UAS
This is the percentage of bit UnAvailable Seconds since the beginning of the test.

(BIT) DM
This is a count of the bit Degraded Minutes that have occurred since the beginning of the test.

(BIT) %DM
This is the percentage of bit Degraded Minutes that have occurred since the beginning of the test.

SYLS
This is a count of the number pattern SYnchronization Lost Seconds since the beginning of the test.

%SYLS
This is the percentage of pattern SYnchronization Lost Seconds since the beginning of the test.

5.6.6 RESULTS - E-BIT Screen

The RESULTS - E-BIT screen presents the measurements which are related to the test set's E-bit analysis feature (option SW211). E-bits are generated by terminal equipment in response to incoming CRC-4 errors.

EBIT
This is a count of the number of E-BIT errors that have occurred since the beginning of the test.

EBER
This is the E-BIT Error Rate since the beginning of the test.

(E-BIT) CURBER
This is the CURrent E-bit Error Rate measured during the previous AVERAGING INTERVAL. The averaging interval is set in the OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA menu. The factory-default averaging interval is 10 seconds.

(E-BIT) ES
This is a count of the E-BIT Errored Seconds which have occurred since the beginning of the test. An E-bit errored second is a second with at least 1 E-bit error.

(E-BIT) %ES
This is the percentage of E-BIT Errored Seconds that have occurred since the beginning of the test.

(E-BIT) SES
This is a count of the E-BIT Severely Errored Seconds that have occurred since the beginning of the test. An E-bit severely errored second is a second with at least 10^{-3} error rate.

(E-BIT) %SES
This is the percentage of the E-BIT Severely Errored Seconds that have occurred since the beginning of the test.

(E-BIT) AS
This is a count of the E-BIT Available Seconds that have occurred since the beginning of the test. An E-bit available second is any bit error-free, bit errored, or bit severely errored second.

(E-BIT) %AS
This is the percentage of E-bit Available Seconds since the beginning of the test.

(E-BIT) UAS
This is a count of the E-bit UnAvailable Seconds since the beginning of the test. An E-bit unavailable second is a second during which the test pattern has lost synchronization. E-bit unavailable seconds are also counted at the onset of 10 consecutive bit severely errored seconds. In this case, E-bit unavailable seconds continue to be counted until the onset of 10 E-bit error-free seconds or E-bit errored seconds.

(E-BIT) %UAS
This is the percentage of E-bit UnAvailable Seconds since the beginning of the test.

(E-BIT) DM
This is a count of the E-bit Degraded Minutes that have occurred since the beginning of the test.

(E-BIT) %DM
This is the percentage of E-bit Degraded Minutes that have occurred since the beginning of the test.

5.6.7 RESULTS - FREQUENCY Screen

The RESULTS - FREQUENCY screen shows relevant frequency and clock slip information. The screen shows a bar graph which indicates how fast the signal is slipping in relation to the LINE INTERFACE MeaSuReMenT CLOCK. This bar graph is a nonlinear (logarithmic) indicator. A count of the number of clock slips is kept at the end of the bar for your reference. At 255 clock slips the graph will reset itself to the center of the display. One clock slip occurs when the measured frequency deviates from the reference frequency by one unit interval. A unit interval is the amount of time it takes to transmit a single E1 pulse.

RCV Hz
This is the current frequency measured during the last second. The variation is shown in both Hz and ppm.

MAX Hz
This is the maximum frequency measured since the beginning of the test. The variation is shown in both Hz and ppm.

MIN Hz
This is the minimum frequency measured since the beginning of the test. The variation is shown in both Hz and ppm.

CLKSLP
This is the number of clock slips which have occurred since the beginning of the test.

WNDR
This is the maximum absolute phase difference between the measured frequency and the reference frequency since the beginning of the test, expressed in unit intervals.

5.6.8 RESULTS - M.2100/550 Screen

The RESULTS - M.2100/550 screen shows the relevant M.2100/550 performance information. The measurement is based on the MEASUREMENT PERIOD and HRP MODEL % which is set in OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA.

P/F
This specifies whether the M.2100/550 test has Passed or Failed for the specified time period and HRP MODEL %.

%ES
This is the percentage of Errored Seconds that have occurred since the beginning of the test.

%SES
This is the percentage of the Severely Errored Seconds that have occurred since the beginning of the test.

5.6.9 RESULTS - G. 826 Screen

The RESULTS - G.826 screen reports all of the parameters measured from a G.826 test pattern. The SunSet must be synchronized on a known test pattern.

EB
The Errored Block counts the number of errored CRC-4 blocks received since the beginning of the test.

BBE
Background Block Errors count the number of errored CRC-4 blocks received, but not including those received during SES's or UAS's.

(BIT)ES
This is a count of the bit Errored Seconds which have occurred since the beginning of the test.

%ES
This is the percentage of bit Errored Seconds which have occurred since the beginning of the test.

SES
This is the number of Severely Errored Seconds (not including UAS's), defined as seconds during which 300 or more CRC-4 errors were detected.

%SES
This is the percentage of Severely Errored Seconds which have occurred since the beginning of the test.

(BIT)UAS
This is a count of the bit UnAvailable Seconds since the beginning of the test. Service becomes unavailable at the onset of 10 SES's, and available again after 10 consecutive non-SES's. Service also becomes unavailable upon loss of frame.

%UAS
This is the percentage of UnAvailable Seconds counted since the beginning of the test.

(BIT)AS
This is a count of the bit Available Seconds which have occurred since the beginning of the test.

%AS
This is the percentage of Available Seconds counted since the beginning of the test.

5.7 Test Patterns

This section defines the various test patterns transmitted and recognized by the SunSet E1. The long patterns are written in hexadecimal, also known as "hex". You can tell if a pattern is written in hex because it will be written with pairs of numbers separated by commas. Hex is a 16-digit number system consisting of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The hex pattern 15 FA translates to the binary pattern 0001 0101 1111 1010, where the left-most bit is transmitted first. Here are the test patterns:

1111
The industry-standard all 1s pattern is used for stress testing circuits. If the pattern is sent unframed, it will be interpreted as an AIS (Alarm Indication Signal). Here is the pattern in its binary form:

```
1111
```

0000
This is the industry-standard all zeroes pattern. If the circuit is AMI, then pattern synch and/or signal will be lost. The pattern is:

```
0000
```

0101
0101 is the industry-standard alternating ones and zeroes pattern. The pattern is frame aligned with "f" showing the location of the framing bit. The pattern is:

```
f 0101 0101
```

1-8
The industry-standard 1 in 8 pattern is used for stress testing circuits. The pattern is also called 1:7 in older literature. The pattern is frame aligned (f is the framing bit) as shown in its

binary form:

```
f 0100 0000
```

1-16
The industry-standard 1 in 16 pattern is used for stressing circuits. The pattern is frame aligned ("f" is the framing bit) as shown in its binary form:

```
f 0100 0000 0000 0000
```

3-24
The industry-standard 3 in 24 pattern is used for stress testing circuits. The pattern is frame aligned ("f" is the framing bit) as shown in its binary form:

```
f 0100 0100 0000 0000 0000
0100
```

2e6
2e6 is the industry-standard pseudo-random 63-bit code.

2e7
2e7 is the industry-standard pseudo-random 127-bit code.

2e9
511 is the industry-standard pseudo-random 511-bit code. This pattern conforms to the ITU V.52 technical standard.

2e11
2e11 is the industry-standard pseudo-random 2047 bit code. This pattern conforms to the ITU O.152 technical standard.

2e15
2e15 is the industry-standard $2e^{15}$-1 pseudo-random bit sequence. This signal is formed from a 15-stage shift register and is not zero-constrained. This pattern conforms to the ITU O.151 technical standard.

2e20
2e20 is the industry-standard $2e^{20}$-1 pseudo-random bit sequence. This signal is formed from a 20-stage shift register and is not zero-constrained. This pattern conforms to the ITU V.57 technical standard

2e23
2e23 is the industry-standard $2e^{23}$-1 pseudo-random bit sequence. This signal is formed from a 23-stage shift register and is not zero-constrained. This pattern conforms to the ITU O.151 technical standard.

20ITU
2e20 is the $2e^{20}$-1 pseudo random bit sequence. This signal is formed from a 20-stage shift register and is not zero-constrained. This pattern conforms to ITU O.153. However, this pattern is not identical to 2e20, because different feedback mechanisms are used when

the patterns are produced by means of shift registers. 20ITU suppresses consecutive sequences of more than 18 ZEROS, whereas there are 14 ZEROS in 2e20.

55oct
The 55 Octet pattern is as follows:

```
80, 80, 80, 80, 80, 80, 01,
80, 80, 80, 80, 80, 80, C0,
80, 80, 80, 80, E0, 80, 80,
80, 80, AA, AA, AA, AA, 55,
55, 55, 55, 80, 80, 80, 80,
80, 80, FF, FF, FF, FF, FF,
FF, 01, 80, 01, 80, 01, 80,
01, 80, 01, 80, 01, 80
```

USER FOX
The industry-standard FOX pattern is used in data communications applications. The ASCII translation of the pattern is " THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 1234567890 " sentence. The pattern is frame aligned to ensure proper ASCII translation of the bits. It is recommended that the pattern be sent with framed signals, otherwise, ASCII translation is not possible. Here is the pattern:

```
2A, 12, A2, 04, 8A, AA, 92,
C2, D2, 04, 42, 4A, F2, EA,
72, 04, 62, F2, 1A, 04, 52,
AA, B2, 0A, CA, 04, F2, 6A,
A2, 4A, 04, 2A, 12, A2, 04,
32, 82, 5A, 9A, 04, 22, F2,
E2, 04, 8C, 4C, CC, 2C, AC,
6C, EC, 1C, 9C, 0C, B0, 50
```

Section 6 Operating the SunSet

6.1 Warnings

- **Insert or remove software cartridges ONLY with power OFF.**
- **Use SunSet AC Charger ONLY. This is marked as either SS113-A, SS113-B, SS121-A, SS121-B or SS121-C AC Battery Charger.**
- **When bringing the SunSet in from extreme cold to a warm environment, allow it to warm for at least 4 hours prior to use. Permit no condensation.**
- **NEVER immerse the SunSet in water. DO NOT expose the SunSet to rain.**

6.2 Common Operations

Read this section before you try operating the test set.

Switching on the test set

Each time you switch on the test set, it will:

1) complete a SELF TEST
2) display any error codes resulting from the SELF TEST
3) display the Sunrise Telecom logo along with the SunSet serial number, software version number and software options
4) display a GRAPHIC of the current circuit configuration and status. The SunSet will power up in the configuration prior to the last power off. The graphical presentation will confirm your last settings and will also indicate which pattern the SunSet has synchronized on.
5) move to the MAIN MENU.

Menus

The test set operates by using menus. The user selects the menu item of interest, then enters the selection using the ENTER key.

Arrow Keys and Cursor

Before you can select a menu item, you must first highlight the desired item using the Arrow Keys. You will recognize the cursor as the darkened area with light-colored letter-

ing.

ENTER Key Operations

Press the ENTER key to perform the following actions:

1) Select a menu item highlighted by the cursor
2) Invoke the settings which you have just entered on a setup screen

Pressing the ENTER key will usually move you from the current screen to the next screen. If you press ENTER on a highlighted menu item, you will enter that menu item. This would result in either beginning a test, entering a setup screen or entering a sub-menu. When you are done, pressing ENTER or ESCAPE will return you to the previous menu.

In a few cases, pressing ENTER will invoke the settings you have just entered in a setup screen, but will cause you to remain in that screen. To move to the previous screen, press ESCAPE.

Using the F-Keys

When you are configuring a setup screen, a number of options are usually available for each of the items in that screen. The available choices will appear at the bottom of the LCD display. The desired option may be invoked by pressing the F-key below that option. Refer to Figure 6.2A.

In most cases, as the desired F-key is pressed, the cursor will automatically advance to the next line of the display. If you wish to change the settings of a previous line, simply press the Up Arrow key, then re-select the option using the appropriate F-key.

The options appearing at the bottom of the screen are associated with a particular setup parameter within that screen. As you change the position of your cursor within a setup screen, the F-key options available to you will also change.

If more than four F-key options are available to the user, a "more" indicator will appear in the F4 position. Pressing the F4 key will allow you to access these additional options.

As illustrated in Figure 6.2A, for a given menu item, the available choices are displayed at the bottom of the screen. In this example, AUTO framing has been selected by pressing the F1 key.

Using the ESCAPE Key

The ESCAPE key is used for:

1) Terminating an ongoing process (such as a measurement) before

it has completed.
2) Returning to a previous menu.

Note that if you become lost within any sub-menus or setup screens, you will always be able to return to the MAIN MENU by repeatedly pressing the ESCAPE key.

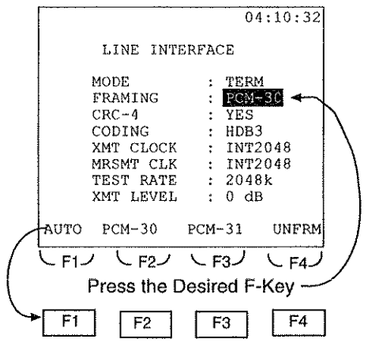


Figure 6.2A
F-Keys

SunSet Remembers Its Last Configuration

The test set will remember its configuration from the last time it was used.

If your test set is being operated by a number of different users, you may wish to reset it to the factory default settings before you begin testing. This option may be found by selecting OTHER FEATURES, SYSTEM CONFIG, FACTORY DEFAULTS.

If your SunSet is being operated by a number of different users or in several standard test configurations, refer to the discussion of SYSTEM PROFILES to save individual system configurations.

6.3 Basic Test Procedure

Use the following basic test procedure. Refer to the following sections for detailed directions for each of the operations.

Switch on the test set.

1) View the LEDs and circuit GRAPHIC to confirm the test set configuration prior to the last power off.

2) Configure the LINE INTERFACE menu for the circuit under test.

3) Connect the cables to the test set and then to the circuit, as specified by your LINE INTERFACE settings.

4) Select the Test Pattern you wish to transmit using the SEND TEST PATTERN menu.

5) Make your measurements using the BASIC MEASUREMENTS menu.

6) Disconnect the test set from the circuit.

6.4 Using the LINE INTERFACE menu

Before connecting the test set to your circuit, the LINE INTERFACE must be configured correctly. Refer to Figure 6.4A

To access the Line Interface screen, press ESCAPE until you reach the MAIN MENU, move the cursor to the LINE INTERFACE item, then press ENTER.

The F-keys show the available choices for each item on the LINE INTERFACE display. Within this screen, as each F-key is pressed, the SunSet immediately alters its configuration to reflect the new settings. For the Nx64 F-key option on the TEST RATE line, you will need to configure the individual timeslots and then press the ENTER key before the Nx64 configuration takes effect.

Note the following:

1) In order to avoid configuration mistakes, use the GRAPHIC key to confirm any changes to your Line Interface settings.
2) Using the AUTO selections, the test set can be configured to automatically detect incoming framing and CRC-4 bits.

The LINE INTERFACE items are described next.

6.4.1 MODE

You must specify the Line Interface MODE for your testing. TERM is the most common mode used for out-of-service testing. BRIDGE or MONITOR are commonly used for testing live circuits. If an incorrect test MODE is chosen, all test results will be meaningless. When the MODE is selected, if the CODE ERR and ERROR lights turn on, it is very likely that you have chosen the wrong MODE. If you are not certain you have chosen the correct MODE, try choosing each of the other modes to see if the error indicators stop.

Following are detailed explanations of the various MODEs. Diagrams of these MODES are presented in Figure 6.4A.

MONITOR

The MONITOR (protected monitoring point) mode is used when a monitor access is to be made. The signal is provided from the MON jack of an E1 network element. The network element has isolated the MON signal from the live signal with high impedance resistors. The test set has an Automatic Gain Control (AGC) circuit to compensate for the resistive loss from -15 dB to -30 dB. If the signal source is not a resistively attenuated MON output signal, the AGC will not operate properly, and as a result, CODE ERR and/or other problem indicators will be shown on the test set.

The MONITOR mode is useful because it protects the live signal from any possible disruptions caused by the testing process. It allows the technician to observe the line while the customer is actually

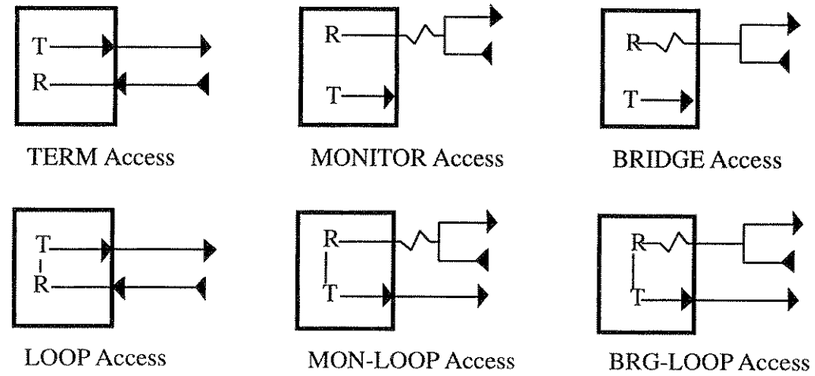


Figure 6.4A Line Interface Modes

using it and to see if there are any problems. Note that there is no need to plug into the TX jack of the test set while in this mode, and there is no need to specify a test pattern to be transmitted. However, the transmitter in the test set is continually sending the selected test pattern, framing, coding, and CRC for the rare occasion that it will be needed.

BRIDGE

The BRIDGE mode is similar to the MONITOR mode. However, in the BRIDGE mode, the test set applies high impedance isolation resistors to the circuit under test. This isolation circuitry will protect the signal from any possible disruption.

If a connection is made from the MON jack of a network element to the test set, and if the BRIDGE access mode is being used, there may be two isolation circuits on the signal. In this case, the test set will likely report a loss of signal and be unable to perform any measurements.

There is no need to plug into the TX jack of the test set while in the BRIDGE mode, and there is no need to specify a test pattern to be transmitted. However, the transmitter in the test set is sending the selected test pattern, framing, coding, and CRC for the rare occasion that it will be needed.

TERM

The TERM mode is used when you wish to send and receive an E1 signal. The test set terminates the received signal with a low impedance termination, and requires that the circuit be disrupted for testing. A 75 ohm termination is used for BNC and 1.6/5.6 mm connectors. A 120 ohm termination is used for BR2 and Bantam connectors.

LOOP

The LOOP mode is used to terminate a signal and loop it through the test set. The incoming RCV signal is terminated, regenerated, and retransmitted through the TX connector.

Code violations and frame errors are eliminated in this loopback. This mode is similar to the TERM mode, but the test set loops the signal internally instead of transmitting the selected test pattern.

There are two main applications for the LOOP mode. As shown in Figure 6.4A, LOOP can be used to loop a signal back to the direction which it came from. This is normally done if the circuit is out of service.

In the other application, one direction of a live circuit is passed

through the test set in the LOOP mode. In this way VF CHANNEL ACCESS menu items can be used on a selected channel without disturbing the other channels.

MON-LP
The MON-LOOP mode is used to loop a signal through the test set. The incoming RCV signal is regenerated and retransmitted out the TX BNC connector. The incoming RCV signal must be passed through the high impedance isolation resistors of a MON jack. The retransmitted signal does not contain any code violations of FAS (and/or MFAS) errors. This mode can be used to drop or insert a channel on a live, in-service circuit.

BRG-LP
The BRG-LOOP mode is used to loop a signal through the test set. The incoming RCV signal is regenerated and retransmitted out the TX BNC connector. The test set will insert isolation resistors to protect the live signal from any possible disruption.. The retransmitted signal does not contain any code violations of FAS (and/or MFAS) errors. This mode can be used to drop or insert a channel on a live, in-service circuit.

6.4.2 FRAMING

Choose the desired FRAMING type by selecting the appropriate F-key.

You may choose one of the following framing types:

- AUTO
- PCM31
- PCM30
- UNFRAME

AUTO framing allows the test set to AUTO-synch on the received E1 line framing. The received framing is then used on the transmitted signal. The framing type is displayed on both the LED (received) and screen (transmitted) indicators.

AUTO framing can cause unpredictable results if the test set is used in conjunction with another test set in the AUTO framing mode, or if the SunSet's transmit signal is looped back to its receive signal. AUTO framing should be avoided in these cases.

A specific framing type should be chosen when:

1) The circuit to be tested is provisioned for a known type of framing.
2) An unframed signal is fed to the test set.
3) The SunSet will be used with another test set that is already

configured for auto framing.

4) The SunSet will control the framing that is put on the E1 circuit.

If the framing of the received signal does not match the framing specified in the FRAMING menu item, the SunSet will not let a measurement begin and will display a Loss of Frame condition. Also, if the received framing changes after a test was started, the SunSet will display error conditions, even in the AUTO framing mode.

6.4.3 CRC-4

Choose between YES (F1) or NO (F2). This will allow the test set to measure CRC-4 errors on the incoming signal and also to transmit the CRC-4 bits on the outgoing signal. CRC-4 works with PCM-31 and PCM-30 framing only.

If AUTO framing has been selected, the test set will force the CRC-4 configuration to AUTO. If UNFRAME has been selected for framing, the test set will force the CRC-4 configuration to NO.

If you are unsure how to configure the CRC-4 option, choose NO.

If the AUTO setting has been invoked by selecting AUTO framing, the test set will examine the received signal for CRC-4 check bits. If check bits are found, the test set will calculate and send the CRC-4 check bits on its transmitted signal.

6.4.4 CODING

Choose between AMI (F1) or HDB3 (F2) for the CODING type. When in doubt, choose HDB3.

6.4.5 XMT CLOCK

The XMT (transmit) CLOCK setting determines the frequency of the E1 signal being transmitted from the test set. Three basic selections are available:

LOOP

LOOP timing uses timing which has been recovered from the received E1 signal (RCV connector).

EXTERN

EXTERNal timing uses the frequency source connected to the test set's REF CLK connector to provide timing for the transmitted E1 signal.

INT2048
INTernal timing uses the test set's internal clock source to provide timing for the transmitted E1 signal. The test set is equipped with a stratum 3 internal clock source which is accurate to within 5 ppm. Under most conditions, this clock source provides sufficient accuracy for most applications.

Test sets equipped with software option SS213, Transmit Frequency Shift, will also have additional options available. This feature allows you to vary the transmitter frequency ±30 Kbps in 2 Kbps steps, or ±200 bps (100 ppm) in 2 bps (1 ppm) steps. Press the "more" (F4) key one or more times to access these additional options:

INT+2K, INT-2K
Selecting these F-keys will adjust the transmitter frequency in 2 Kbps steps. The maximum adjustment range is ± 30 Kbps.

INT+1 & 1/5/25, Int-1 & 1/5/25
Selecting these F-keys will adjust the transmitter frequency by up to 100 ppm (±200 bps).

1) Press the "more" key (F4) to access these options.
2) Use the 1/5/25 key (F3) to adjust the transmitter frequency by steps of 1, 5, or 25.
3) Press the preferred INT key to make your adjustments.

For example, to obtain a frequency of 2048+100ppm, choose F3 for INT2048. Next press F4, for "more" options. Press F3, 1/5/25, three times, until the INT+/- keys read +/-25, then press the F1 key, INT+25, four times, to obtain 2048+100ppm.

6.4.6 MSRMT CLOCK
It is important to choose the correct timing mode, because your test results or test session may otherwise be impaired. When in doubt, choose the INTERN measurement clock. Here is an explanation of the types of MeaSuRMenT CLOCK modes:

EXTERN
EXTERNal timing should be used when:
1) Precise frequency measurements are required, and
2) An external 2.048 Mbps AMI or HDB3 frequency source is available.

The measurement frequency source should be connected to the REF CLK connector. The signal should be a bipolar signal with HDB3 coding and have a level between 0 dB to -30 dB.

INT2048

INTERNal timing should be used when:

1) an external frequency source is not available, or,
2) the test set will not be transmitting towards synchronized network equipment, or,
3) the test set will be supplying clock to the circuit to be tested such as a PBX or remote terminal of a digital loop carrier, or,
4) the 5 ppm accuracy of the INTERNal clock is sufficient, or,
5) most kinds of loopback testing is performed.

6.4.7 TEST RATE

Choose the desired TEST RATE of either N or M x64 or 2048K. If you are not sure which one to choose, press the F1 key for full rate testing at 2.048 Mbps.

For N or M x64 Kbps (Fractional E1) testing, follow this procedure:

1) Press the F2 key (Nx64). A SELECT TIME SLOT screen will let you choose each transmit and receive time slot in the Nx64 array.

2) If you are receiving a signal which is already formatted in the Nx64 fractional E1 format, it is quickest to press the AUTO (F1) key to select the time slots for testing. The SunSet will then determine which received timeslots have active data. It will then identify the corresponding transmit timeslots to be set up for fractional testing. If you are satisfied with the timeslots that the AUTO mode has selected, press the ENTER key and the settings will be invoked. You are now finished with the TEST RATE menu item.

If you are not satisfied with the AUTO mode selection, or if you are not receiving a signal which is already formatted in the Nx64 fractional E1 format, then proceed to step 3).

Note: In AUTO, the SunSet will automatically configure the timeslots by looking for active data. It will configure the transmit side to be the same as the active timeslots on the receive side.

The set determines which timeslots are active by first determining which timeslots are idle. Any timeslot that is not idle is assumed to be active. The set

determines that a timeslot is idle when it detects the circuit's idle channel code. This is specified in the OTHER FEATURES, TEST PARAMETERS, OTHER PARAMETERS, IDLE CHNL CODE. If the SunSet does not find this idle code, it will also look for the 01111111 or 11111111 idle channel codes.

3) If you cannot use the AUTO select feature, you may also manually select the N or M x64 timeslots for testing.

First select the timeslots to be used on the received signal. Choose any combination of timeslots from 1 to 31. Select each desired timeslot by moving the cursor to it by pressing the necessary arrow keys. Once the cursor is on the desired timeslot, press the SELECT (F2) key. Press the UN-SEL (F3) key if you need to deselect a timeslot. Press the CLR-ALL (F4) key if you want to erase all selections and start over again.

In PCM-31 framing, timeslots 1 through 31 correspond to channels 1 through 31. In PCM-30 framing, timeslots 1 through 15 correspond to channels 1 through 15, and timeslots 17 through 31 correspond to channels 16 through 30. In PCM-30, timeslot 16 is used for the multi frame alignment signal. Fractional E1 is not offered with unframed signals, because framing is required to determine the location of timeslots.

4) If you chose the receive timeslots manually as shown in step 3, next move your cursor down to the TRANSMIT section of the screen and select the desired timeslots. Use the method shown in step 3.

The time slots specified for transmit and receive need not be the same. Also, the number of selected timeslots can differ from the TX side to the RCV side. However, do not attempt to do loopback testing with a single test set if the number of transmitted and received channels is not the same.

The test set will assume that all incoming data is received byte by byte in ascending channel order.

5) Once all the timeslots are configured properly, press the ENTER key. The SunSet will configure itself to these new Nx64 settings.

6.4.8 XMT LEVEL

Choose the desired transmit signal level of either 0 dB (F1) or -6 dB (F2). If you are not sure which one to choose, press the F1 key for 0 dB.

6.5 Connecting the Cords

WARNING!
Plugging into a live E1 circuit may cause a loss of service for multiple customers. Be sure you are properly trained before proceeding.

WARNING!
To perform a BRIDGE access, do not plug into the circuit until you have pre-selected the BRIDGE or BRG-LOOP mode. The test set will not place isolation resistors on the line unless this MODE is specified.

Figures 6.5A through 6.5D show the various ways in which to connect the test set to the circuit.

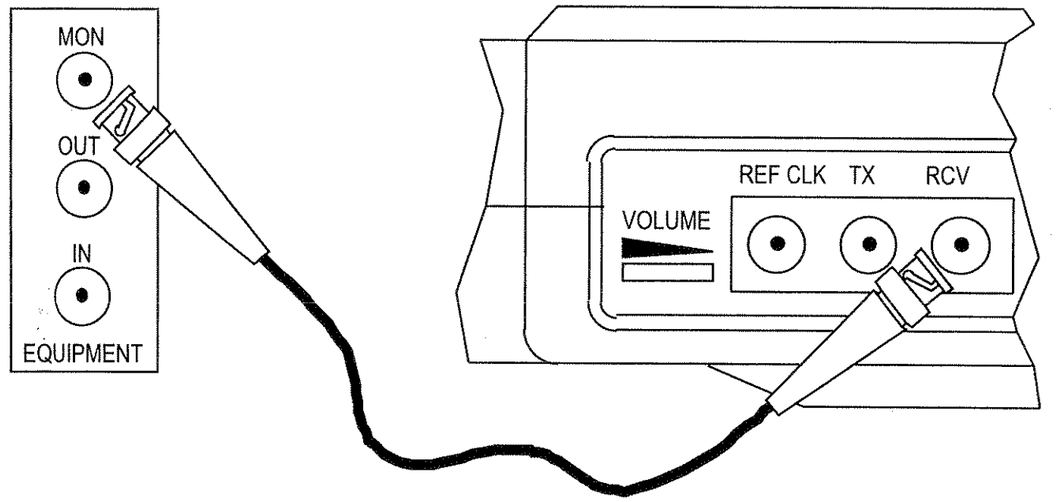


Figure 6.5A Plugging in - MONITOR Mode

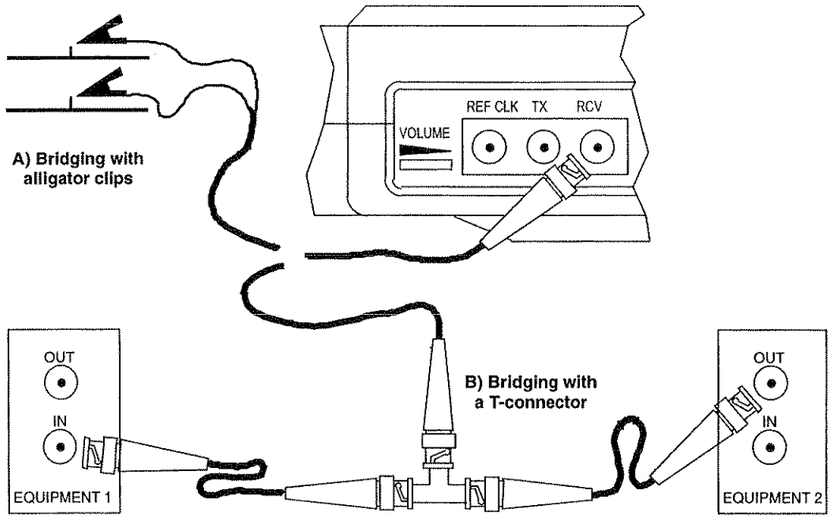


Figure 6.5B Plugging in - BRIDGE Mode

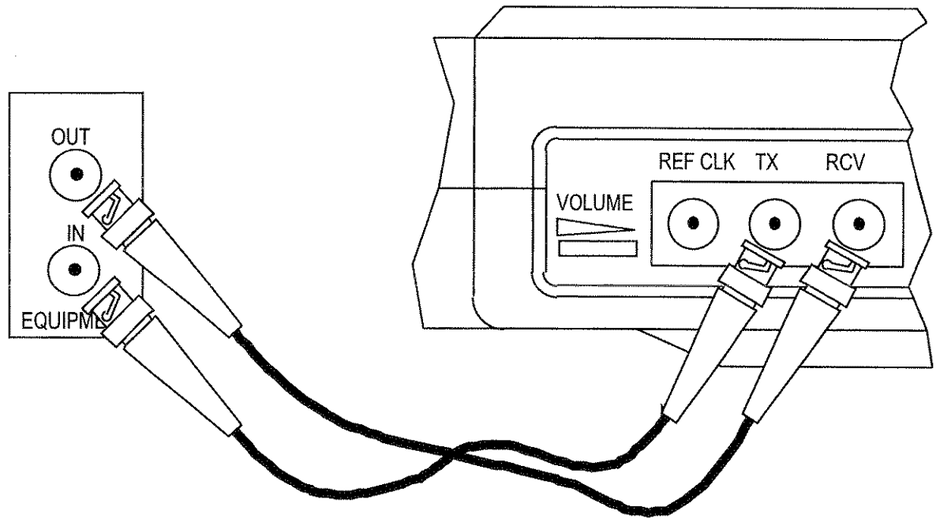


Figure 6.5C Plugging in - TERM Mode

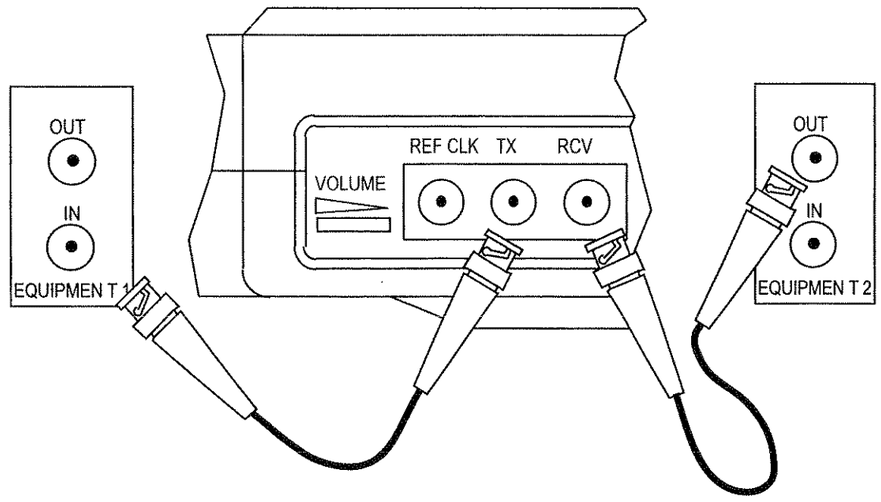


Figure 6.5D Plugging in - LOOP Mode

6.6 Using the SEND TEST PATTERN menu

Refer to Figure 6.6A.

```
                                        15:26:27

                    SEND TEST PATTERN

    20ITU   55oct   2e23    2e11
    1-8     USER    2e20    2e9
    1-16    1111    2e15    2e7
    3-24    0000    0101    2e6
```

Figure 6.6A
Sending a Test Pattern

Select a different test pattern as follows:

1) Press the ESCAPE key until you have returned to the MAIN MENU. Highlight the SEND TEST PATTERN menu item. Press ENTER.

2) Press the down, up, left and right arrow keys as necessary until you have highlighted your desired test pattern.

The test set immediately begins transmitting the test pattern as each new pattern is highlighted.

6.6.1 Programming User-defined Patterns

You can program and store up to 10 individual test patterns in the test set. Each pattern can be from 1 to 2048 bits in length and can be stored with a label of up to 10 characters. You can also VIEW, EDIT, STORE, or DELETE your programmed test patterns at any time.

Use the following procedure to program a 16 bit test pattern of 10001100 11101111 (8C EF hex) with a label of "TEST01".

Entering the Menu

1) From the Main Menu, use the down arrow key to move the cursor to SEND TEST PATTERN. Press ENTER.

2) Use the arrow keys to move the cursor to USER. Press ENTER.

3) Using the arrow keys, move the cursor to a blank space anywhere between 1 and 10. Choose CREATE (F1).

4) The cursor is now ready to accept the "TEST01" label.

Creating the LABEL

5) Choose TOGGLE (F3). Notice that the A begins blinking on the alphabet grid.

6) Use the cursor keys to move around the alphabet grid until the T begins blinking. Choose SELECT (F4). The T is now displayed as the first character of the label. Select the letters E, S, and T by following the same procedure.

7) After this has been completed, choose TOGGLE (F3). The alphabet grid will stop blinking. Press the SHIFT-lock key and verify that the SHIFT indicator is displayed in the upper left-hand corner of the screen.

8) Press the 0 key (orange label) followed by the 1 key (orange label). You have now completed the label entry procedure. DO NOT PRESS the ENTER key.

Choosing BINARY or HEX

9) Press the SHIFT-lock key and verify that the SHIFT indicator has turned off. Press the down arrow key once.The cursor should move to the FORMAT selection.

10) Choose BINARY (F1) to select a binary entry format. The binary input method is often the simplest for entering short patterns. Press the down arrow key once to move the cursor to the first bit location.

Entering the Pattern

11) Press the SHIFT-lock key. Verify that the SHIFT indicator appears on the screen.

12) Press the 0 and the 1 keys until all of the 16 bits have been entered. Press ENTER after this is complete.

Sending the Pattern

13) You should now see the USER TEST PATTERN menu with your new pattern (TEST01) listed on the screen. Move the cursor to the TEST01 item and press ENTER. The new pattern is now being transmitted.

Verifying the Pattern

14)Verify the pattern you are sending is correct by moving the cursor to the OTHER MEASUREMENTS item with the cursor keys. Press ENTER. Move the cursor to the VIEW RECEIVED DATA menu item. Press ENTER. Plug the test set's transmit signal into its receive jack. You should see your pattern displayed on the VIEW RECEIVED DATA screen.

Editing a Pattern

If you wish to edit the test pattern, use the cursor keys to move the cursor to where you want to start editing. Choose INSERT (F1) if you need to start inserting more bits or press DELETE (F2) if you need to remove one or more bits. You may use the same procedure to edit an existing test pattern.

If you make a mistake while editing an existing test pattern, press the ESCAPE key to abort editing. The original test pattern will not be affected.

6.7 Using the BASIC MEASUREMENTS menu

To perform BASIC MEASUREMENTS:

1) Select BASIC MEASUREMENTS from the MAIN MENU.
2) Press the ESCAPE key when you are finished.

Figure 6.7A shows a typical BASIC MEASUREMENTS display. Several F-key options are available during the measurement process:

RESTART

Pressing the RESTART key (F3) causes the test set to restart the test. This is often useful if some undesired occurrence has made the current test invalid. When the test set's Framing and/or Coding (LINE INTERFACE menu) are configured for AUTO, pressing RESTART will allow the test

set to resynch on the pattern, framing, and line coding.

```
                                  17:31:55
ET- 000:00:19       RT- CONTINU

FRM-PCM-30 COD-HDB3   CNFG-TERM
RCV-55oct    XMT-55oct    CRC-YES

        RESULTS - SUMMARY
CODE- 1           RATE - 3.4e-08
BIT - 1           RATE - 3.4e-08
CRC - 0           RATE - 0.0e-05
FE  - 0           MFE  - 0
ES  - 1           %ES  - 05.263
SES - 0           %SES - 00.000
UAS - 0           %UAS - 00.000
%EFS- 95.236      %DM- 94.737

PAGE-UP PAGE-DN RESTART    more
```

Figure 6.7A
Basic Measurements

PAGE-UP, PAGE-DN
PAGE-UP (F1) and PAGE-DOWN (F2) keys allow you to view each of the pages of available measurement results. Measurement RESULTS pages are labeled: SUMMARY (or NO ERRORS), LINE, SIG/ALM, FRAME, G.821, E-BIT (option SW211), FREQUENCY, M.2100/550, and G.826.

HOLDSCR/LOCK
Press MORE (F4) to access further options. HOLDSCR (F1) freezes all of the measurement displays so they can be easily observed. Measurements are still occurring, but the counts are only updated in memory, and not on the display. Once you are finished inspecting the frozen counts, the CONTINUe F-key can be pressed to update all of the counts to their current values.

LOCK (F2) disables the test set's keypad. This is useful if you are running a long-term test and do not wish to have the test disturbed. When LOCK is pressed, an indicator appears at the top of the LCD display. Pressing the F2 key again (UNLOCK), will re-enable the test set's keypad. Using the LOCK/UNLOCK function will not disturb any of your measurement results.

To access these next features, press the More (F4) key twice. You will be presented with RECORDS (F1) and HISTOGraM (F2)

RECORDS (F1)
Pressing RECORDS takes you directly into the VIEW TEST RECORD screen. You may scroll through all the pages of stored data. See Section 6.15 for instructions on using the VIEW TEST RECORD menu.

Observing these records does not interrupt your current test measurements.

To return to the BASIC MEASUREMENTS screen, press ESCAPE. The ENTER key is disabled.

HISTOGRAM (F2)

Pressing HISTOGRM takes you directly into the HISTOGRAM ANALYSIS screen, without disrupting your current test measurements. The Histogram is updated every fifteen minutes. You may VIEW, PRINT, or SAVE your analysis. See section 6.8.5 for instructions on using the HISTOGRAM ANALYSIS menu.

To return to the BASIC MEASUREMENTS screen, press ESCAPE. The ENTER key is disabled.

Several different items are displayed in the BASIC MEASUREMENTS screen (Figure 6.7A). For an explanation of each of the individual measurements, refer to the measurement definitions in Section 5. In addition to the measurements, the following items are displayed on each measurement screen:

Time of day
Time of day is displayed in the upper right-hand corner of the screen.

ET
The Elapsed Time is the time that has passed since the test was started or restarted.

RT
The Remaining Time is the time that is left before the test is completed. The factory default condition is that the test will run until you stop it. For this reason, CONTINUe is normally displayed to denote a continuous test. However, in the OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA, MEAS DURATION menu item, you may specify a specific amount of time such as 15 minutes, 1 hour, or even 999 hours. In this case, the Remaining Time will count down to zero during the measurement.

FRM
The transmitted FRaMing is displayed here.

COD
The received line CODe is displayed here.

CNFG
The access mode is displayed here.

RCV
The ReCeiVed test pattern is displayed here. If the pattern is lost during BASIC MEASUREMENTS, the test set will display NO SYNC. If no pattern can be found, then the test set will display LIVE. LIVE indicates that the signal is

probably live customer traffic. If you have ENABLEd PATTERN LOCK in the TEST PARAMETERS menu, the SunSet will only search for the same pattern it is transmitting. DISABLE the PATTERN LOCK feature if you want the SunSet to search the received signal for all known test patterns.

XMT
The test set displays what pattern it is TRANSMiTting.

CRC
The test set displays whether or not it is transmitting/receiving CRC errors.

6.8 Using the OTHER MEASUREMENTS menu

6.8.1 VIEW RECEIVED DATA

Refer to Figure 6.8A and use the following procedure:

1) From the MAIN MENU, move the cursor to the OTHER MEASUREMENTS; press ENTER.

2) Move the cursor to the VIEW RECEIVED DATA item; press ENTER. The pattern synchronization circuitry is automatically disabled as this menu item is entered (PAT SYNC LED turns off).

3) View the live presentation of the E1 data.

4) Choose PAUSE (F3) to trap the current data on the E1 line.

```
                                   07:31:55

        VIEW RECEIVED DATA
PAGE : 01
T/S   BINARY    HEX   ASCII
000   11011111   DF     ( )
001   11000100   C4     (#)
002   01000010   42   B (B)
003   00011110   1E     (x)
004   01100101   65   e ( )
005   00101110   2E   . (t)
006   11010100   D4     (+)
007   11000101   C5     ( )

PAGE-UP PAGE-DN   PAUSE
```

Figure 6.8A View Received Data

5) Choose PAGE-UP (F1) or PAGE-DN (F2) to page through the screens of data. Note the

PAGE number in the upper left-hand portion of the screen. 32 pages of data are available.

6) When you have finished, press the ESCAPE key until you have returned to the MAIN MENU.

Here are the display definitions:

PAGE
Indicates which of the available 32 pages of data is currently being displayed.

ASCII
Displays the ASCII representation of the 8-bit binary framing word which has been received. The character displayed to the left of the parentheses represents the 8-bit framing words translated in their present order. The character displayed within the parentheses represents the 8 bits translated in reverse order.

T/S
Specifies the Time Slot being viewed.

BINARY
This column shows the binary data actually being received on the line. Each line represents the 8-bit time slot.

HEX
This column shows the hexadecimal representation of the 8 bits being transmitted in each time slot.

6.8.2 FAS FRAME WORDS (option SW210)

Refer to Figure 6.8B. FAS frame words are available for viewing as long as valid PCM-31 or PCM-30 framing is detected on the received E1 signal.

1) From the MAIN MENU, move the cursor to OTHER MEASUREMENTS; press ENTER.

2) Move the cursor to FAS FRAME WORDS; press ENTER. The pattern synchronization circuitry is automatically disabled as this menu item is entered (PAT SYNC LED turns off).

3) View the live presentation of E1 FAS framing words. If necessary, refer to the discussion of FAS (PCM-31) framing in Section 1.

```
                                        07:45:00

          FAS FRAME WORDS

FRM   12345678     FRM   12345678
      c0011011           i1asssss
  0   10011011       1   01011111
  2   00011011       3   01011111
  4   00011011       5   11011111
  6   10011011       7   01011111
  8   00011011       9   11011111
 10   00011011      11   11011111
 12   10011011      13   11011111
 14   10011011      15   11011111

PAUSE
```

Figure 6.8B FAS Frame Words

4) Choose PAUSE (F1) to trap the received framing words.

5) When you are done, press ESCAPE until you have returned to the MAIN MENU.

6.8.3 MFAS FRAME WORDS (option SW210)

Refer to Figure 6.8C. MFAS frame words are available for viewing as long as valid PCM-30 framing is detected on the received E1 signal.

1) From the MAIN MENU, move the cursor to OTHER MEASUREMENTS; press ENTER.

2) Move the cursor to MFAS FRAME WORDS; press ENTER. The pattern synchronization circuitry is automatically disabled as this menu item is entered (PAT SYNC LED turns off).

```
                                        07:45:00

          MFAS FRAME WORDS

FRM   12345678     FRM   12345678
      0000xyxx           ABCDabcd
  0   00001011       1   11011101
  2   11011101       3   11011101
  4   11011101       5   11011101
  6   11011101       7   11011101
  8   11011101       9   11011101
 10   11011101      11   11011101
 12   11011101      13   11011101
 14   11011101      15   11011101

PAUSE
```

Figure 6.8C MFAS Frame Words

3) View the live presentation of E1 MFAS framing words. If necessary, refer to the discussion of MFAS (PCM-30) framing in Section 1.

4) Choose PAUSE (F1) to trap the received framing words.

5) When you are done, press ESCAPE until you have returned to the MAIN MENU.

6.8.4 PROPAGATION DELAY

The Propagation Delay screen shown in Figure 6.8D displays the propagation delay on a looped back signal. The circuit must be looped back at the far end in order for the test set to perform this measurement.

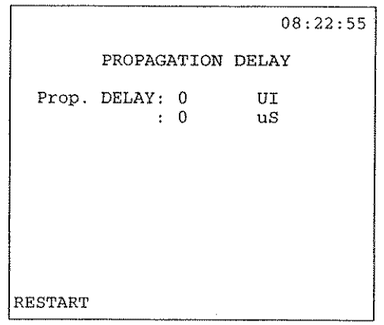


Figure 6.8D Propagation Delay

This measurement is performed in the TERM , MONITOR, or BRIDGE configurations only. The test set measures the number of unit intervals required for the signal to travel down the line and then return. This number is translated into an exact number of microSeconds of round trip delay. A E1 UI (Unit Interval) equals .488 uS (microSeconds).

Use this procedure:

1) From the MAIN MENU, move the cursor to OTHER MEASUREMENTS; press ENTER.

2) Move the cursor to PROPAGATION DELAY; press ENTER.

3) The propagation delay measurement will automatically be performed, then displayed. Use the RESTART (F1) key to perform another propagation delay measurement, if necessary.

6.8.5 HISTOGRAM ANALYSIS

Refer to Figure 6.8E. The HISTOGRAM ANALYSIS feature displays the type of errors and their individual histories which occurred during the last BASIC MEASUREMENTS performed.

Note: If you interrupt your timed measurements to review the results, the SunSet will begin a new histogram analysis when you return to BASIC MEASUREMENTS.

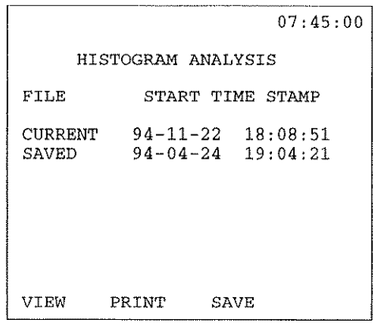


Figure 6.8E Histogram Analysis

Use this procedure:

1) From the MAIN MENU, move the cursor to OTHER MEASUREMENTS; press ENTER.

2) Move the cursor to HISTOGRAM ANALYSIS; press ENTER.

3) The CURRENT date and time correspond to the last time you entered BASIC MEASUREMENTS. The histogram results from this session may be VIEWed (F1), PRINTed (F2), or SAVEd (F3). If you wish to SAVE your CURRENT histogram data for future reference, then pressing the F3 key will store it in memory, also thereby erasing any previously stored data. Your CURRENT histogram data is also being stored, but it will be erased the next time you enter BASIC MEASUREMENTS. Note that if you attempt to print, and no printer is hooked up, the SunSet will stop sending results after one second.

4) Using the Up and Down arrow keys, highlight either the CURRENT or SAVED histogram data. Press the VIEW (F1) key and refer to Figure 6.8F. (A PRINT (F2) option is also available, see below).

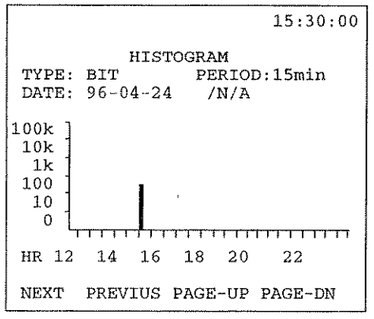


Figure 6.8F View Histogram

The history of each error type is displayed individually. The error TYPE is specified in the upper portion of the screen. You may scroll through the different error types by pressing either the NEXT (F1) key or the PREVIUS (F2) key. In this manner, you may examine the individual histories of BIT, MFAL, FALM, SYLS, LOFS, AISS, LOSS, FASE, CRC, and CODe.

The PAGE-UP (F3) and PAGE-DN (F4) keys are used to alter the displayed time frame. The most recent 24 hour period consists of two full screens of data, while the most recent 24 hour period along with the previous 7 days consist of four full screens of information, with two days of data on each screen. A date with no results available will report N/A. For example, a screen may show a date, such as 96-06-17, on the right column, with corresponding data listed beneath, and a date of N/A on the left column, with no date (indicating measurements were not recorded on day during a give 7 day period) beneath.

To use the PRINT feature, refer to Figure 6.8G.

```
SUNRISE TELECOM Inc. 2001
HISTOGRAM REPORT
Date      Hr    Min    Param Count
94-04-24  15    00-15  BIT   1213
94-04-24  15    00-15  BPV   1287
94-04-24  15/16        BIT   1213
94-04-24  15/16        BPV   1287
```

Figure 6.8G
Print Analysis

The PRINT feature prints all of the information contained in the VIEW screen, but in a non-graphical format.

The PRINT feature will allow you to print the histogram data as many times as you desire.

A current PRINTing session may be aborted by pressing the ESCAPE key. In this case, printing may still be performed at a later time.

6.8.6 PULSE SHAPE ANALYSIS

Refer to Figure 6.8H. The Pulse Shape Analysis is performed for any combination of received test pattern and line interface mode.

The received signal shape is displayed on-screen. The ITU-T G.703 pulse mask can be superimposed for PASS/FAIL results. The test set will automatically store the previous analysis for future viewing.

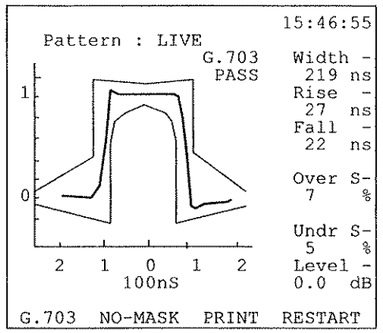


Figure 6.8H Pulse Shape Analysis

Start a New Pulse Shape Analysis

1) Configure the LINE INTERFACE settings correctly for the circuit under test.

2) In the MAIN MENU, move the cursor to OTHER MEASUREMENTS; press ENTER.

3) Move the cursor to PULSE SHAPE ANALYSIS; press ENTER.

4) Move the cursor to START NEW ANALYSIS; press ENTER. In 4 to 5 seconds, the received pulse shape will be displayed on the screen.

5) Press the F1 key to see if this received pulse conforms to an industry-standard G.703 mask.

View the Last Pulse Shape

The last pulse shape may be viewed whenever you like. You can even view the last pulse shape after the SunSet has been turned off for an extended period of time. Follow this procedure:

1) In the MAIN MENU, move the cursor to OTHER MEASUREMENTS; press ENTER.

2) Move the cursor to PULSE SHAPE ANALYSIS; press ENTER.

3) Move the cursor to VIEW LAST PULSE SHAPE; press ENTER. The most recently stored pulse shape will be displayed on the screen.

Pulse Shape Function Keys

There are four function keys to choose from:

G.703 (F1)
This function key displays the ITU-T G.703 mask with the captured signal. A pass/fail indication is shown.

NO-MASK (F2)
This function key removes the displayed G.703 mask.

PRINT (F3)
This function key is used to print the pulse shape screen on the Sunrise SS118 Thermal Printer.

RESTART (F4)
This function key starts a new pulse shape capture and analysis.

6.8.7 TRANSMIT STRESS (option SS213)

Refer to Figure 6.8I.

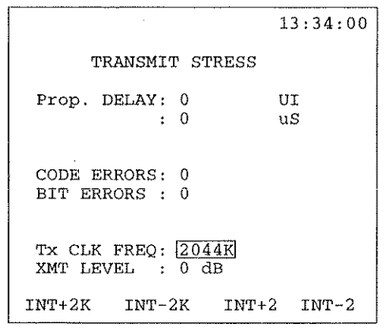


Figure 6.8I
Transmit Stress Menu

Use the following procedure:

1) From the MAIN MENU, enter OTHER MEASUREMENTS, TRANSMIT STRESS. Your round-trip circuit delay (Propagation DELAY) will be displayed in both Unit Intervals and microSeconds.

2) Press ENTER to continue with the procedure. The number of CODE and BIT errors received is displayed, along with the Transmit CLOCK FREQUENCY and Transmit signal LEVEL.

3) The F-keys allow you to vary the frequency of the transmitted signal in order to stress your E1 circuit. Press the F1 (INT+2K) or F2 (INT-2K) to change the transmitted frequency in 2000 Hz steps. The Tx CLK FREQ indicator will display the new transmitted frequency.

   Press the F3 (INT+1) or F4 (INT-1) to change the transmitted frequency in 1 ppm steps. As the transmitted frequency is changed, the test is automatically restarted.

   You may also change the line build-out of your transmitted signal. Choose F1 to transmit at 0 dB or F2 to transmit with a line build-out of -6 dB.

4) When you are finished with your TRANSMIT STRESS testing, press ESCAPE. Upon exiting this screen, the test set's transmit clock and transmit level will automatically reset to the XMT CLOCK and XMT LEVEL values specified in the LINE INTERFACE menu.

6.9 Using the VF CHANNEL ACCESS menu

Refer to Figure 6.9A.

```
                                    08:22:56

        VF CHANNEL ACCESS

        VF MEASUREMENTS
        DTMF DIALING
        VIEW 30 CHNL CAS
        DIALING CONFIG
        MF DIALING
```

Figure 6.9A
VF Channel Access

The VF CHANNEL ACCESS menu is used to perform a variety of talk/listen functions. Do not attempt to enter the VF CHANNEL ACCESS menu if the PCM-31 LED or the PCM-30 LED is not lit. These two LEDs indicate whether or not a framed signal is being received. It is impossible to talk, listen, or perform other channelized functions in the absence of frame or multiframe synchronization.

Note: During VF CHANNEL ACCESS, if the LINE INTERFACE MODE is set to TERM, MONITOR, or BRIDGE, then idle channel codes and signalling will be inserted into the unselected channels. The idle channel code and signalling can be configured in the OTHER FEATURES, TEST PARAMETERS, OTHER PARAMETERS, IDLE CHNL CODE and IDLE CHNL A/B/C/D items.

If the mode is set to LOOP, MON-LOOP, or BRG-LOOP, then the unselected channels and signalling will be looped through the test set, undisturbed.

6.9.1 VF MEASUREMENTS

The VF MEASUREMENTS menu lets you choose:

- which channel to test,
- whether to talk or send a tone,
- which signalling bits to send.

It also tells you:

- the received signalling bits
- the received 8-bit data
- the received frequency and level

```
                                    08:22:56

          VF MEASUREMENTS

     RCV TIMESLOT: 01
     XMT TIMESLOT: 01
     INSERT TYPE : [TALK]
     Tx A/B/C/D  : 0 0 0 0


     Rx A/B/C/D  - 0 0 0 0
     Rx DATA     - 11010001
     Rx Freq   Hz- 1265
     Rx Level dBm- -39.1

TALK  1020Hz  820Hz
```

Figure 6.9B VF Measurements

Refer to Figure 6.9B, and use this procedure:

1) From the MAIN MENU, highlight the VF CHANNEL ACCESS item and press ENTER.

2) Highlight the VF MEASUREMENTS item; press ENTER.

3) Choose the desired RCV TIMESLOT by pressing the NEXT (F1) or PREVIUS (F2) keys.

4) Cursor down and choose the desired XMT TIMESLOT by pressing the NEXT (F1) or PREVIUS (F2) keys. The XMT TIMESLOT will typically be the same as the RCV TIMESLOT.

5) If desired, change the INSERT TYPE. Press F1 to TALK, utilizing the speaker and microphone in the test set. Press F2 to insert a 1020 Hz tone. Press F3, and a 820Hz tone will be transmitted.

6) If desired, change the signalling bits being transmitted on the transmit timeslot. Cursor down to Tx A/B/C/D. Press and release the SHIFT-lock key. Press the 1 key and 0 key as desired to enter the signalling bits. Signalling bits will only be transmitted if PCM-30 framing has been selected.

   If you need to reenter a bit, press and release the SHIFT-lock key to remove the SHIFT indicator in the upper left-hand corner of the screen. Then press the Arrow key to cursor back to the number that needs to be changed. Press and release the SHIFT-lock key, then press 1 or 0 as desired.

   Press ENTER to begin sending the A/B/C/D bits.

7) View the various measurements. Rx A/B/C/D shows the Channel

Associated Signalling system (CAS) bits. These bits are only meaningful if the PCM-30 LED is lit. Ignore these bits if the PCM-30 LED is not lit.

Rx DATA shows the live 8-bit channel data as it is being received. Rx Freq and Rx Level show the A-law decoded VF signal.

6.9.2 DTMF DIALING

The DTMF dialing menu lets you perform a number of dialing functions:

- dial a DTMF number
- speed dial a stored number
- record a number with a label for future dialing
- edit or delete speed dial numbers

Basic dialing procedure

1) In the VF CHANNEL ACCESS menu, move the cursor to DTMF DIALING; press ENTER.

2) The last phone number, if any, dialed will be shown on the screen. To dial this number, simply press the ENTER key. You can also delete the previous number by pressing the DELETE (F2) key as needed until the existing number is completely erased.

3) You can enter a new number. First press and release the SHIFT-lock key to display the SHIFT indicator. Now you can enter the numbers 1 through 9, *, #, A, B, C, D, and E. The E key inserts a 1 second pause. You may program up to 32 digits.

4) After the new number is entered, press the ENTER or SEND (F3) key to dial the number. This will send your DTMF digits with DIAL PERIOD and SILENT PERIOD as specified in VF CHANNEL ACCESS, DIALING CONFIG. Factory default values are 100 ms (milliseconds) for both the Dial and Silent periods.

Speed Dialing Procedure

Use this procedure to speed dial a user number which was programmed at an earlier time:

1) From the VF CHANNEL ACCESS menu, cursor down to DTMF DIALING and press ENTER.

2) Choose more (F4) and then choose USER (F1) to access the USER DIAL NUMBERS list.

These are the stored speed dialing numbers.

3) Move the cursor down to the desired entry and press ENTER to dial the number. You will be returned to the VF CHANNEL ACCESS screen.

Entering speed dialed (USER) numbers

The test set allows you to program and store up to 10 DTMF or MF numbers. Each stored number can have up to 32 digits. An alphanumeric label 10 characters long can be used to store each phone number. The label makes it easier to remember what each number is used for.

Follow this procedure to program the number 12345,ABCD*#0 with a label of TEST01:

1) From the VF CHANNEL ACCESS menu, highlight the DTMF DIALING item; press ENTER.

2) In the DTMF DIALING screen, choose "more" using the F4 key. Choose USER (F1).

3) At the USER DIAL NUMBER menu, move the cursor to a blank line and choose CREATE (F1).

4) The cursor is now ready to accept the "TEST01" label.

5) Choose TOGGLE (F3). The letter A on the alphabet grid will begin blinking.

6) Use the cursor keys to move around the alphabet grid until the T starts blinking. Choose SELECT (F4). You should now see T as the first character of the label. Select the E, S, and T letters by following the same procedure.

7) After you have selected the last T, choose TOGGLE (F3). The alphabet grid should stop blinking. Press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen.

8) Press the 0 key, then press the 1 key.

9) Now you have entered the label. You should see TEST01 displayed as the LABEL. Press the SHIFT-lock key to remove the SHIFT indicator. DO NOT PRESS the ENTER key.

10) Press the Down arrow key to move the cursor to the NUMBER

section. Now you are ready to enter the telephone number.

11)Press the SHIFT-lock key. Verify that the SHIFT indicator appears in the upper left-hand corner of the screen.

12)Enter the phone number. Press the keys to enter the following number: 12345,ABCD*#0. Use the E key to enter the one second pause shown by the comma. When you are finished, press the SHIFT-lock key to remove the SHIFT indicator.

13)Press the ENTER key to accept the new USER DIAL NUMBER. You will now see it displayed on the list of USER DIAL NUMBERs.

Editing a Number

14)If you wish to edit the number, move the cursor down until the number is highlighted. Choose EDIT (F2).

15)The cursor will now be on the first character of the LABEL. Choose INSERT (F1) if you need to start inserting more digits at that position. Or choose DELETE (F2) if you need to remove one or more digits at that position. You can also move your cursor to the right before using INSERT or DELETE. You may also toggle into the alphabet grid as described in steps 5 through 9.

16)When you are done with the LABEL as described in step 15, be sure the SHIFT indicator is off and the alphabet grid has stopped blinking. Then you can move the cursor down to the number.

Choose INSERT (F1) if you need to start inserting more digits at that position. Or choose DELETE (F2) if you need to remove one or more digits at that position. You can also move your cursor to the right before using INSERT or DELETE.

Press SHIFT-lock to display the SHIFT indicator if you would like to enter different numbers.

17)If you made a mistake while editing an existing user number, press the ESCAPE key to abort editing. The original user number will not be affected.

If you want to keep the edited changes when you are done editing the number, press ENTER. You will see the edited label in the list.

18) You have finished this procedure. Press ESCAPE as necessary to return to the VF CHANNEL ACCESS menu.

6.9.3 VIEW 30 CHNL CAS

Refer to Figure 6.9C.

```
                                        07:31:55

          VIEW 30 CHNL CAS


  T/S    ABCD   ABCD   ABCD   ABCD
  001    0000   1101   1101   1101
  005    1101   1101   1101   1101
  009    1101   1101   1101   1101
  013    1101   1101   1101
  017    1101   1101   1101   1101
  021    1101   1101   1101   1101
  025    1101   1101   1101   1101
  029    1101   1101   1101

HOLDSCR
```

Figure 6.9C View 30 Channel CAS

The VIEW 30 CHNL CAS screen lets you see the signalling bits of all 30 channels simultaneously. The PCM-30 LED must be lit in order for the signalling bits to be displayed. Channels 1 through 4 are shown on the first line, 5 through 8 are shown in the second line, etc.

Use this procedure:

1) From the VF CHANNEL ACCESS menu, move the cursor to VIEW 30 CHNL CAS; press ENTER.

2) If necessary, use the HOLDSCR (F1) key to temporarily freeze the signalling states, then CONTINU (F1) to resume the dynamic signalling bit display.

6.9.4 DIALING CONFIG

The DIALING CONFIGuration screen allows the user to specify both the DIAL PERIOD and SILENT PERIOD for DTMF and MF dialing.
Factory default settings are:
DIAL PERIOD: 100 ms
SILENT PERIOD: 100 ms

Use this procedure:

1) From the VF CHANNEL ACCESS menu, move the cursor to DIALING CONFIG; press ENTER.

2) Using the SHIFT-lock key, enter the DIAL PERIOD value from the keypad. You may specify a value in the range from 40 ms to 999 ms.

3) Press the SHIFT-lock key again to remove the SHIFT indicator (upper left-hand corner of the screen).

4) Press the Down arrow key to access the SILENT PERIOD setting.

5) Using the SHIFT-lock key, enter the SILENT PERIOD value from the keypad. You may specify a value in the range from 40 ms to 999 ms.

6) Press ENTER when your settings are complete.

6.9.5 MF DIALING

MF dialing is useful in inter-switch addressing applications. Refer to Figure 6.9D and use this procedure:

```
                                        09:01:20

                    MF DIALING

MODE     : FORWARD
NUMBER   :


COMBINATION No : 1 - 15

A = 10      B = 11
C = 12      D = 13
E = 14      F = 15


FORWARD BACKWARD SEND
```

Figure 6.9D MF Dialing

1) From the MAIN MENU, enter the VF CHANNEL ACCESS menu.

2) Cursor down to the MF DIALING menu selection; press ENTER.

3) Choose between the forward or backward MR2 tone set by pressing either the FORWARD (F1) or BACKWARD (F2) key.

4) Press the Down arrow key to access the NUMBER line.

5) Enter the number to be dialed by first pressing and releasing the SHIFT-lock key. The shift indicator should appear in the upper left-hand corner of the screen. Now enter the number by using the keypad. Letters A-F correspond to numbers 10-15, respectively.

If you make a mistake while entering the number, simply press and release the SHIFT-lock key to remove the SHIFT indicator from the screen. Then press the arrow key to cursor over to the digit that needs to be changed. Press the DELETE (F2) key to delete the number, or the INSERT (F1) key to insert an additional number. Pressing the DELETE key removes the number that the cursor is on.

6) Ensure that the VOLUME control is turned up so that the incoming signal can be heard.

7) Dial the number by pressing the SEND (F3) key or by pressing ENTER.

8) You will be returned to the VF CHANNEL ACCESS menu.

When entering MF DIALING, the previous number, if any, which was entered will be displayed on the screen. To dial this number, simply press the SEND (F3) key or the ENTER key. You can also delete the previous number by pressing the DELETE (F2) key as needed until the existing number is completely erased.

6.10 Using the SYSTEM CONFIG menu

The following menu items are accessed from the MAIN MENU by entering OTHER FEATURES, SYSTEM CONFIG.

6.10.1 SYSTEM PROFILES

The test set's System Profiles are accessed by entering OTHER FEATURES, SYSTEM CONFIG, SYSTEM PROFILES from the MAIN MENU. These profiles allow you to instantly recall the settings associated with a particular system configuration. You can store up to 10 system profiles in the test set. These profiles can save time when configuring the SunSet. Items which are stored in each System Profile are: GENERAL CONFIG settings, LINE INTERFACE settings, OTHER PARAMETERS settings, MEASUREMENT CRITERIA settings, DIALING CONFIGURATION settings, SEND TEST PATTERN setting, ERROR INJECTION settings, VF CHANNEL ACCESS settings and GENERATE ALARM settings.

The SYSTEM PROFILES menu operates differently from other menu items. You do not specify SYSTEM PROFILE settings from within the menu, nor can you edit an existing system profile.

Use the following procedure:

To Enter a New System Profile

1) From the MAIN MENU, select OTHER FEATURES, SYSTEM CONFIG, SYSTEM PROFILES.

2) Select the STORE (F2) key.

3) Type in the LABEL (name) you wish to store the profile under:
   a) press TOGGLE (F3) to toggle to the alphabet grid (letter A on the alphabet grid begins flashing).
   b) cursor to the desired letter and press the SELECT (F4) key.
   c) repeat this until your label is complete.
   d) choose toggle (F3) to leave the alphabet grid (letter stops flashing).

4) You may change the FILE number corresponding to your

stored system profile:
a) press the Down arrow key to access the FILE No. line.
b) press the SHIFT-lock key to display the SHIFT indicator in the upper right-hand corner of the screen.
c) type in the desired number from the keypad.

5) Press ENTER to store the SYSTEM PROFILE.

To Invoke a Stored System Profile

1) Enter the SYSTEM PROFILES menu.

2) Cursor down to the desired system profile.

3) Press the ENTER key. The test set will immediately reconfigure itself to your selected system profile.

To View an Existing Profile

1) Enter the SYSTEM PROFILES menu.

2) Cursor down to the desired profile and choose VIEW (F1)

3) Press the PAGE-DN (F2) key to view the various elements of the profile.

To Return to the System's Factory-default Profile

1) Enter the SYSTEM PROFILES menu. The 0. CURRENT- line will indicate NEW.

2) Choose DEFAULT (F4). The 0. CURRENT- line will now indicate DEFAULT.

3) Press the ENTER key. You will be returned to the SYSTEM CONFIG menu and the test set's configuration will return to its factory-default settings.

6.10.2 GENERAL CONFIG

The GENERAL CONFIGuration screen lets you set the time and date, backlight duration, and serial port characteristics. Setting the correct time and date is important for determining exactly when errors or alarm conditions occur during your testing. The serial port settings are important when configuring the test set for printing or for use with the remote control (option SW100). Refer to Figure 6.10A.

```
                                        06:44:12

                GENERAL CONFIG

  DATE (Y-M-D): 95-08-03
  TIME (H:M:S): 06:43:55

  BACK LIGHT  : CONTINU
  PRINTER
   BAUD RATE  : 9600
   PARITY     : NONE
   STOP BIT   : 1-BIT
   BITS/CHAR  : 8-BIT
   CR/LF INSRT: CR
```

Figure 6.10A General Configuration

Follow this procedure:

1) From the MAIN MENU, enter OTHER FEATURES, SYSTEM CONFIG, GENERAL CONFIG.

2) Press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Enter the DATE (year:month:day) directly from the keypad. The "-" characters will be automatically inserted. Numbers that are out of range will be rejected. When you are finished, press the SHIFT-lock key to remove the SHIFT indicator.

3) Press the Down arrow key to access the TIME. Press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Enter the TIME (hour:minute:second) directly from the keypad. The ":" characters will be automatically inserted. Numbers that are out of range will be rejected. When you are finished, press the SHIFT-

lock key to remove the SHIFT indicator.

4) Press the Down arrow key to access the BACK LIGHT.
   Choosing CONTINU (F2) will allow the system backLIGHT to stay on continuously after you press the LIGHT key.
   Choosing TIMED (F1) will cause the system backLIGHT to automatically turn off after the indicated amount of minutes. To specify your desired time:
   a) Press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen.
   b) Enter the number of minutes between 1 and 99, directly from the keypad. Numbers that are out of range will be rejected.
   c) When you are finished, press the SHIFT-lock key to remove the SHIFT indicator.

5) Move the cursor down to the BAUD RATE menu item in the PRINTER category. The factory default settings work with the printer supplied by the factory.
   However, you have access to the settings in case you want to try to make the SunSet E1 work with another serial printer or modem for remote control. Refer to figure 6.16A for a diagram of the pin-to-pin assignments of the DIN to EIA-232-C cable supplied by Sunrise Telecom.
   You are free to use this information to attempt to set up the SunSet E1 with another printer. However, Sunrise Telecom does not warrant the operation of the test set with any printer other than supplied by Sunrise Telecom.

   To change the settings for your printer:

   a) choose a BAUD RATE of 1200 (F1), 2400 (F2), 9600 (F3), or 19.2K (F4). For remote control, the setting of 9600 is recommended. 1200 and 2400 will not support all remote control features.
   b) Choose a PARITY of NONE (F1), EVEN (F2), or ODD (F3).
   c) Choose a STOP BIT of 1-BIT (F1) or 2-BIT (F2).
   d) Choose a BITS/CHAR of 7-BIT (F1) or 8-BIT (F2).
   e) Choose whether you wish to have a Carriage Return only (F1), or both a Carriage Return and Line Feed in-

serted at the end of each line (F2).

6.10.3 ERASE NV RAM

This operation is performed as a last resort if the test set is not performing properly. Perform this operation only after attempting to correct the problem by:

- Making sure that the test set is configured properly for the circuit under test.
- Turning the power switch off and on.
- Performing a SELF TEST, then turning the power off and on.

WARNING!

Performing the ERASE NV RAM operation will erase all of the user-storable information which you have entered into the test set. All user test patterns, telephone numbers, system profiles and measurement results will be erased.

Use the following procedure:

1) From the MAIN MENU, enter OTHER FEATURES, SYSTEM CONFIG, ERASE NV RAM.

2) Press ENTER after the warning message is displayed. A "WORKING . . ." message will be displayed.

3) When the test set has completed the operation turn the power off for at least 5 seconds.

4) The test set is now configured to its factory-default values.

5) Reconfigure the test set for the circuit under test.

6.10.4 SELF TEST, FREQUENCY CALIBRATION

This operation is performed in order to:

- Have the test set perform an internal hardware check.
- Calibrate the Transmitter Frequency Shift feature (option SS213)

Use this procedure:

1) From the MAIN MENU, enter OTHER FEATURES, SYSTEM CONFIG, SELF TEST, FREQ CAL.

2) A "SELF TESTING . . ." message will be displayed. If the Transmitter Frequency Shift option (SS213) is installed, a "CALIBRATING" message will be displayed.

3) When this has completed, any ERROR CODES will be displayed.

4) If no error codes are present, the test set should be functioning normally. If any error codes are displayed, contact Sunrise Telecom Customer Service for further information.

6.10.5 CLR PRINT BUFFER

You can save yourself a lot of unwanted printing by clearing the print buffer before you use the printer. If you don't clear the print buffer, then the test set will print the entire contents of the buffer when you first enable the printer. For instance, the test set could have over 10 BASIC MEASUREMENTS or 800 events stored in the print buffer. These would all be printed before the current test or events were printed.

Use this procedure:

- From the SYSTEM CONFIG menu, enter CLR PRINT BUFFER. You will see the screen flash quickly. The print buffer is now erased.

6.10.6 VERSION/OPTION

This menu displays:

- The test set's serial number
- The software version
- The options installed on your software cartridge

Use the following procedure:

1) From the MAIN MENU, enter OTHER FEATURES, SYSTEM CONFIG, VERSION / OPTION.

2) The S/N (serial number) displayed in this screen should agree with the serial number on the back of the test set.

6.10.7 FACTORY DEFAULTS

This menu item automatically resets the test set to its factory-default values:

Line Interface: MONITOR mode, AUTO framing, AUTO CRC-4 detection, HDB3 line coding, INT2048 transmit clock, INT2048 measurement clock, 2048K test rate, 0 dB transmit level.

Send Test Pattern: 2e15

VF Measurements: transmit and receive on timeslot 1, DISABLE 1020 Hz test tone, transmit 0s for signalling bits.

Dialing Config: dial period and silent period set to 100 ms.

(Enhanced) Error Injection: inject 1 CODE and 1 BIT error in burst mode.

Measurement Criteria: CONTINUous measurement duration, averaging interval of 10 seconds, print period of LAST, print on error/alarm events DISABLEd, pattern lock DISABLEd, M.2100/550 measurement period of 15 minutes, LOW SIGnal THREShold of -06 dB, and HRP MODEL % of 40.0.

Other Parameters: pattern inversion is DISABLEd, programmable NFAS and MFAS bits are set to 1s, idle channel code set to 11010101, idle channel a/b/c/d set to 1101, and MEASurement START TIME is DISABLEd.

Generate Alarm: all alarms are DISABLEd.

Use this procedure:

1) From the MAIN MENU, enter OTHER FEATURES, SYSTEM CONFIG, FACTORY DEFAULTS.

2) The test set will automatically reset itself to factory-default values.

6.11 Using the TEST PARAMETERS menu

The following menu items are accessed from the MAIN MENU by entering OTHER FEATURES, TEST PARAMETERS.

6.11.1 (ENHANCED) ERROR INJECTION

This menu title will appear as ERROR INJECTION, or ENHANCED ERROR INJECT if option SW171 has been ordered.

Errors which may be injected are:

- CODE errors in burst or rate modes
- BIT errors in burst or rate modes
- BIT+CODE errors simultaneously in burst or rate modes
- CRC-4 errors in burst or rate modes
- Inject 1-5 FAS word errors; manually, or in a rate mode
- Single Bit Slip errors
- BIT errors simultaneously in all time slots in burst or rate modes (requires option SW171)
- Single E-bit errors (requires option SW211)

```
                                    11:41:45
      ERROR INJECTION
  TYPE     : [BIT+COD]
  MODE     : RATE
  RATE     : 1e-3



  CODE     BIT     BIT+COD    more
```

Figure 6.11A Error Injection

Refer to Figure 6.11A and use this procedure:

1) From the MAIN MENU, enter OTHER FEATURES, TEST PARAMETERS, (ENHANCED) ERROR INJECTION.

2) Select the TYPE of errors to be inserted: CODE (F1), BIT (F2), BIT+CODE (F3), (press the "more" (F4) key), CRC-4 (F1), FRAME (F2), BITSLIP (F3), (press the "more" (F4) key), ALLCHNL (F1) (option SW171), E-BIT (F2) (option SW211).

3) Choose the MODE of error injection: BURST or RATE. These modes only apply to CODE and BIT errors. Other kinds of errors may only be inserted one at a time.

4) For BURST MODE, choose the COUNT of errors to be inserted. Type in any number between 1 and 9999. The errors will be inserted in an approximate 1 second period, and will cause from 1 to 3 errored seconds.

5) For RATE MODE, choose the error RATE number and exponent. The errors will then be inserted at a continuous rate as specified in this entry.

In ALLCHNL injection mode, only $1x10^{-3,4,5,6,7,8,9}$ error rates can be selected.

To start the error injection, simply press the ERR INJ key and the test set will insert the type of errors you have specified. You can use error injection to make sure that the signal you are transmitting is the one being measured.

If the error injection is set to RATE mode, an ERINJ indicator will be displayed at the top of the screen.

Programming a Burst of 10 Errors

Here is a sample procedure for programming a burst of 10 errors.

1) Power up the set, wait for the self test to finish. At the graphic screen, press ENTER to go to the MAIN MENU.

2) Use the cursor keys to move the cursor to OTHER FEATURES and press ENTER.

3) In the OTHER FEATURES menu, move the cursor to TEST PARAMETERS and press ENTER.

4) In the TEST PARAMETERS menu, select ERROR INJECTION (or ENHANCED ERROR INJECT if your set has SW171 option) by pressing ENTER.

5) Choose CODE (F1) to select the error type.

6) The cursor moves down to MODE selection automatically. Press BURST (F2) key.

7) The cursor moves down to COUNT automatically. Press the SHIFT-lock key once to display the SHIFT indicator.

8) Press the 1 key followed by 0 key. The COUNT should show 10.

9) Press ENTER. You have just programmed the set to inject 10 CODE errors each time you press the ERRINJ key.

Programming a 10^{-6} Error Rate

Use this procedure to program a 10^{-6} error rate:

1) Power up the set, wait for the self test to finish. At the graphic screen, press ENTER to go to the MAIN MENU.

2) Use the cursor keys to move the cursor to OTHER FEATURES and press ENTER.

3) In the OTHER FEATURES menu, move the cursor to TEST PARAMETERS and press ENTER.

4) In the TEST PARAMETERS menu, select ERROR INJECTION (or ENHANCED ERROR INJECT if your set has SW171 option) by pressing ENTER.

5) Choose CODE (F1) to select the error type.

6) The cursor moves down to MODE selection automatically. Choose RATE (F2).

7) Cursor moves down to RATE automatically. Press the SHIFT-lock key once. Verify that the SHIFT indicator is shown on the upper left-hand corner of the screen. Your key pad now allows you to enter the numeric number.

8) Press the '1' key once. The multiplier position is showing '1'. The cursor moves to the exponent position automatically.

9) Press the '6' key once. A '6' is entered.

10) Press ENTER. You have just programmed the set to inject CODE errors at 1x10-6 rate each time you press the ERRINJ key.

Note that when the test set is injecting errors at a constant rate, a ERRINJ indicator will be shown at the top of the screen. To turn off the error rate injection, press the ERRINJ key once and verify that the ERRINJ indicator has turned off.

6.11.2 MEASUREMENT CRITERIA

Enter OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA and refer to Figure 6.11B.

```
                                    11:41:45

        MEASUREMENT CRITERIA

  MEAS DURATION: CONTINU
  AVG INTERVAL : 00:00:10
  PRNT PERIOD  : LAST
  PRINT EVENTS : DISABLE
  PATTERN LOCK : DISABLE
  LOW SIG THRES: -06 dB
  FREQ THRES   : 25000Hz
  M.2100/550 PARAMETERS
  MEAS PERIOD  : 15 min
  HRP MODEL %  : 040.0

 ENABLE  DISABLE
```

Figure 6.11B Measurement Criteria

MEASUREMENT DURATION
Set the MEASurement DURATION. Choose TIMED (F1) or CONTINU (F2). A timed measurement will stop automatically after the specified amount of time has elapsed. This is useful for making measurements of a specific length. 15 minute and 1 hour tests are commonly used in the industry. When a timed test is in progress, the Remaining Time (RT) counter shows how much time is left before the end of the test. A CONTINUous test will run indefinitely until you press either the RESTART or ESCAPE key.

If you choose TIMED (F1), press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Then enter a number between 999 hr: 59 min and 000 hr: 01 min. Press the SHIFT-lock key again when you are finished.

The test set's factory-default setting is for a CONTINUous test.

AVERAGING INTERVAL
Move the cursor to the AVeraGing INTERVAL item. Using the SHIFT-lock key, enter the interval in hours:minutes:seconds that you want to average your current test results over. Refer to the measurement definitions section for the exact measurements that use this averaging interval.

During tests that run a long time, it is useful to have measurements of current conditions as well as measurements of conditions since the beginning of the test. You may select what period of time you wish to use to report these current measurements. The factory default is 10 seconds. In this way, you get a report of the bit error rate and other measurements, over the previous 10 second interval. The report is then updated once every 10 seconds. You may set the averaging interval between 24:59:59 (24 hours: 59 minutes: 59 seconds) and 00:00:01 (1 second).

PRINT PERIOD
Move the cursor to PRNT PERIOD. Configure the printing mode:

a) You may now set any interval Print Period you desire, from 001 minutes to 999 hours. The F-key options for timed printing are min (F1) and Hr (F3). After choosing minutes or hours, press the SHIFT key, then use the numeric keys to enter your three digit interval. The SunSet will print results at the interval you enter.
b) choose LAST (F2) if you would like the printer to print out your results only at the conclusion of your BASIC MEASUREMENTS.

The factory-default setting for the print period is LAST.

PRINT EVENTS
Move the cursor to PRNT EVENTS. Choose ENABLE (F1) if you would like the printer to print out a time and date-stamped result every time an error or an alarm condition is detected. The PRINT EVENTS setting is independent of the PRINT PERIOD setting.

PATTERN LOCK
Move the cursor to the PATTERN LOCK item. Select either ENABLE (F1) or DISABLE (F2). The factory-default setting is DISABLE.

Having the pattern lock disabled will allow the test set to attempt to resynchronize on any known test pattern, any user-defined pattern,

and all patterns in inverted form. When the test set loses pattern sync, it will automatically attempt to resynch onto any received pattern (outside of a BASIC MEASUREMENTS). If a new pattern is detected, the test set will display it on the GRAPHIC screen and the PAT SYNC LED will light. If no test pattern is detected, it will declare the signal as "LIVE". Pressing the RESYNCH key will cause the test set to search the received signal for any known test pattern.

Having the pattern lock enabled causes the test set to search the received signal only for the pattern which it is currently transmitting. This is specified in the SEND TEST PATTERN menu. If the test set does not detect this particular pattern, then it will declare the signal as "LIVE". If the received pattern changes, the test set will not automatically try to resynch on the new pattern. Pressing the RESYNCH key will cause the test set to search only for the same pattern that it is currently transmitting.

LOW SIGnal THREShold
Use the arrow keys to direct the cursor to where you wish to change a number. Press the SHIFT key to access the number pad. After entering the decibel setting, push the SHIFT key again. If the received signal goes below the selected decibel level, a LOWSIG warning will display in reverse video, at the top of the BASIC MEASUREMENTS screen.

FREQ THRES
ENABLE (F1) or DISABLE (F2) the Frequency Threshold at this line. If you ENABLE this function, you will be able to use the SHIFT and numeric keys to enter a Frequency Threshold of up to 30000. If the received frequency is greater or lesser than the range this number represents, an Event will be triggered.

M.2100/550 PARAMETERS
The M.2100 and M.550 parameters provide limits for bringing into service and maintenance of digital transmission lines in order to achieve specific performance objectives in a multi-service environment.

MEASUREMENT PERIOD
This is the interval over which the M.2100/550 testing is performed. The factory-default value is 15 minutes. You may enter any interval between 1 minute and 99 minutes. Press the SHIFT-lock key to show the SHIFT indicator in the upper left-

hand corner of the screen. Then enter the number of minutes you want each M.2100/550 test to run for.

HRP MODEL %
This is the Hypothetical Reference Performance Model percentage for international primary rate paths and 64 Kbps paths. The factory-default value is 40.0%. You may enter a value between 000.1% and 100.0%. Press the SHIFT-lock key to show the SHIFT indicator in the upper left-hand corner of the screen. Then enter the HRP MODEL % from the keypad.

6.11.3 OTHER PARAMETERS
Enter OTHER FEATURES, TEST PARAMETERS, OTHER PARAMETERS and refer to Figure 6.11C.

PATTERN INVERSION
You may ENABLE (F1) or DISABLE (F2) pattern inversion. When pattern inversion is enabled, transmitted 1s will be turned into 0s and transmitted 0s will be turned into 1s. For instance, with pattern inversion selected, a 3-in-24 pattern will actually be transmitted as a 21-in-24 pattern.

```
                                    11:26:59

                OTHER PARAMETERS

PATTERN INVERSION: DISABLE
FREQ RESOLUTION  : 0.1 HZ
IDLE CHNL CODE   : 11010101
IDLE CHNL A/B/C/D: 1101
MEAS START TIME  : DISABLE
 DATE (Y-M-D) :  96-11-14
 TIME (H:M:S) :  00:00:00




1Hz   0.1 Hz  0.01 Hz
```

Figure 6.11C Other Parameters

FREQ RESOLUTION
This line item allows you to select the resolution of the frequency measurement. Select a value by pressing the 1 Hz (F1), 0.1 Hz (F2)

or 0.01 (F3) F-key.

1 Hz (F1) is the default Frequency Resolution. Note that in order to have a frequency resolution of 0.1 or 0.01 Hz, the unit will take 10 or 100 seconds to show the actual value, and will update the value every ten or 100 seconds.

Also note that VIEW RECEIVED DATA, VIEW FAS WORDS, VIEW MFAS WORDS, and the VF CHANNEL ACCESS features, as well as the Auto detection of active timeslots function in the Nx64 screen, are disabled when a Frequency Resolution of other than 1 Hz is selected. You will see an advisory message to change the FREQ RESOLUTION to 1 Hz if you attempt to enter any of these screens

IDLE CHANNEL CODE
You may program the idle code to be any 8-bit pattern you wish. This code is then used during VF channel access operations when the line interface is set to the TERM mode. The idle code is also used in fractional E1 testing to fill up the unused channels.

IDLE CHANNEL ABCD
You may program the idle channel signalling bits of channels 1 through 30 in the PCM-30 framing mode. These signalling bits are found in time slot 16 of frames 1 through 15. The factory default is set in accordance to ITU-T G.704.

MEASurement START TIME
Choose F1 to ENABLE a measurement period to begin at a future time. Choose F2 to DISABLE the timer, to allow immediate measurement.

If you choose ENABLE, then cursor down to set your measurement DATE and TIME, using your SHIFT key to access the numeric keys.

6.12 Using the GENERATE ALARM menu

Enter OTHER FEATURES, GENERATE ALARM and refer to Figure 6.12A. The test set will allow you to generate alarms to test the response of network equipment, to make sure the network is performing as expected. To generate the desired alarm, simply cursor down to it and enable it with the ENABLE (F1) key.

The test set will continue to transmit any enabled alarms even after you exit the GENERATE ALARM menu. You can then continue to transmit these alarms while making measurements, viewing data, performing talk/listen, etc. If you do not intend to transmit alarms when you exit this screen, be sure to disable all of the alarms first.

```
                                07:31:55

          GENERATE ALARM

     FAS DISTANT   : DISABLE

     MFAS DISTANT  : DISABLE

     AIS           : DISABLE

     T/S-16 AIS    : DISABLE

     ARTIFICE      : ENABLE


ENABLE DISABLE
```

Figure 6.12A
Generate Alarm

FAS DISTANT
For this alarm, the test set transmits a 1 in every third bit of each timeslot 0 frame that does not contain the frame alignment signal. The FAS DISTANT alarm may only be transmitted with PCM-31 or PCM-30 framing.

MFAS DISTANT
For this alarm, the test set transmits a 1 in the sixth bit of each time slot 16 in the zero frame. The MFAS distant alarm may only be transmitted with PCM-30 framing.

AIS
For this alarm, the test set transmits all 1s in an unframed signal. This alarm overrides the framing choice in the LINE INTERFACE menu. For instance, even though you have selected PCM-30 framing, generating an AIS alarm will cause the set to transmit an unframed all 1s signal.

T/S-16 AIS
For this alarm, the test set transmits all 1s in all time slot 16s of all frames. Note that a test set or piece of network equipment that receives this alarm will lose PCM-30 framing.

It is not possible to transmit voice frequency signalling bits while sending this alarm because the T/S-16 AIS signal overwrites all the channel associated signalling information.

This alarm should only be transmitted when the test set is configured for PCM-31 framing.

ARTIFICE
For this alarm, the test set transmits an alternating 10 pattern in an unframed signal. This alarm overrides the framing choice in the LINE INTERFACE menu. For instance, even though you have selected PCM-30 framing, generating an ARTIFICE alarm will cause the set to transmit an unframed signal of alternating 1s and 0s.

6.13 Using the PRINT RECORDS menu

Refer to Figure 6.13A.

```
                                        02:22:13

                    PRINT RECORDS

TEST RESULT BUFF  : YES
VIEW DATA BUFFER  : NONE
SYSTEM PROFILE    : NONE
USER TEST PATTERN: FOX
USER DIAL NUMBER  : NONE




NEXT    PREVIUS    ALL    NONE
```

Figure 6.13A Print Records Menu

You may print out a variety of information using the PRINT RECORDS menu.

Use the following procedure:

1) Connect the test set to the printer. Be sure that both the test set and the printer are receiving power.

WARNING!

Ensure that the proper AC Battery Charger is connected to the printer and to the test set. Connecting the incorrect charger may cause permanent damage and will void the Sunrise Telecom warranty.

2) From the MAIN MENU, select OTHER FEATURES; press ENTER. Select PRINT RECORDS; press ENTER.

3) Press the PRN SCRN key to verify that the printer will print the current screen information. If the screen information prints correctly, go to step 4).

If printing does not occur, user the following procedure:

a) Verify the correct serial port configuration of the printer. The optional printer supplied by Sunrise Telecom can be configured by using the switches on the bottom of the printer. Refer to the printer's user manual for the correct switch settings.

b) Verify the proper serial port settings on the test set. The test set's serial port is configured by entering OTHER FEATURES, SYSTEM CONFIG, GENERAL CONFIG from the MAIN MENU. Although you can configure the test set and printer in a variety of ways, the following factory-default settings are recommended:

BAUD RATE: 9600
PARITY: NONE
STOP BIT: 1-BIT
BITS/CHAR: 8-BIT
CR/LF INSRT: CR

4) Select the items you wish to be printed:

- TEST RESULT BUFF: The test results buffer stores the last 800 individual error/alarm events or 27 sets of BASIC MEASUREMENTS results, or a combination of these results. This function requires a lot of time to complete so don't use it until you are ready to leave the printer and test set in a printing mode for a long time.
- VIEW DATA BUFFER: This buffer prints all 32 pages of data that are stored in the VIEW

RECEIVED DATA buffer.

- SYSTEM PROFILE: This buffer prints all of the current setup parameters for your test set.
- USER TEST PATTERN: This buffer prints all of the user-defined test patterns along with their labels.
- USER DIAL NUMBER: This buffer prints all of the user-defined telephone numbers along with their labels.

6.14 Using the SEND FRAME WORDS menu

Refer to Figure 6.14A.

```
                                        04:12:23

      SEND FRAME WORDS

                          NFAS WORD
                          S       SaSaSaSaSa
                          i 1 A 4 5 6 7 8
CRC: YES                  C 1 0 1 1 1 1 1
E-BIT: 1                  C 1 0 1 0 0 1 1
                          C 1 0 1 1 1 1 1
FAS WORD                  C 1 0 1 0 0 1 1
C0011011                  1 1 0 1 1 1 1 1
                          1 1 0 1 0 0 1 1
MFAS WORD
00001011
                          MFAS ABCD: 1101
SET=0    AUTO             DEFAULT
```

Figure 6.14A
Send Frame Words Menu

You may manually specify the E and Sa bit states which the test set transmits, along with the FAS WORD, MFAS WORD and MFAS ABCD.

1) From the MAIN MENU, select OTHER FEATURES, SEND FRAME WORDS.

2) Use the Left arrow and Right arrow keys to highlight the E or Sa bits which you are interested in setting, then press the F1 (SET=0/1) key to change the bit states.

   For the Sa bits, you may also toggle the bits between 0 and 1 states. Press the F2 (TOG-ON) key to do this. The new bit states are immediately transmitted. To return the bit states to their factory-default values, press the F3 (DEFAULT) key.

3) Use the Up arrow and Down arrow keys to highlight the FAS WORD, MFAS WORD and MFAS ABCD items which you are interested in setting, then press the SET=0 (F1) or SET=1 (F2) keys along with the Left and Right arrow keys to change the bit states.

Access to the FAS WORD item is available only if no CRC-4 checking is present.

6.15 Using the VIEW TEST RECORD menu

Refer to Figure 6.15A.

```
                                    01:16:58

        VIEW TEST RECORD

1   RESULT RECORD UNLOCK
    START 67-06-16 00:26:00
    STOP  67-06-16 00:26:07

2   RESULT RECORD LOCK
    START 67-06-16 00:48:59
    STOP  67-01-16 00:49:30


PAGE-UP PAGE-DN  UN/LOCK  VIEW
```

Figure 6.15A
View Test Record Menu

Use the following procedure:

View and print the SunSet's measurements and event records from this menu. Each record can store up to 40 events, or one measurement result. The buffer holds twenty records.

When you enter VIEW PRINT RECORD you will see a list of records. Use the PAGE-UP (F1) and PAGE-DN (F2) keys to scroll through the records to find the which ones you want to view and/or print. The screen will report "Empty" for the unused records if the buffer is not full.

When new data is ready to be stored, the SunSet looks for an empty record to write in, then for the oldest unlocked record to overwrite.

```
                                    01:16:58

          VIEW TEST RECORD

  5  EMPTY                 UNLOCK

  6  EMPTY                 UNLOCK



PAGE-UP PAGE-DN  UN/LOCK  VIEW
```

Figure 6.15B Empty Records

You may Lock or Unlock records, using the F3 key. When a record is locked, it may not be written over when the SunSet is saving records. Only 18 records may be locked at a time. If you attempt to save (lock) additional records, you will receive a "2 records must remain unlocked" warning message.

Press VIEW (F4) to view the record. The first page of the result will be an overview. See the next figure.

```
                                    01:16:58


 Record number: 0001
   START    67-06-16 00:26:00
   STOP     67-06-16 00:26:07
ET- 000:00:06     RT- CONTINU
FRM-PCM30 COD-HDB3 CNFG-TERM
RCV-2e15    XMT-2e15  CRC-YES



PAGE-UP PAGE-DN PRINT
```

Figure 6.15C Record Header Sample

This screen tells you the Start and Stop times of the measurement or event. It also reports the Framing, Coding, Configuration, test patterns received and sent, and for how long the test took place. In the sample figure, the test was 7 seconds long. The framing was PCM-30, the coding HDB3, and the SunSet was configured for TERM. The test pattern 2e15 was being both received and transmitted.

Use the PAGE-UP (F1) and PAGE-DN (F2) keys to scroll through the rest of the record. Press PRINT (F3) to print the record. If you do not wish to print the entire record, use the PRN SCRN key.

Printing does not affect the records.

Notes:

- NV RAM ERASE will unlock and erase all records.

- You will not be able to print test records from the PRINT RECORDS

6.16 Using the GRAPHIC Screen

Following is an explanation of the items shown on the GRAPHIC screen in Figure 6.16A. The GRAPHIC screen is useful for verifying that you are using the correct test set configuration, and for quickly checking the circuit status.

Access to the GRAPHIC screen is available from almost any menu in the test set. Press the GRAPHIC key to view this screen. Press GRAPHIC, ESCAPE, or ENTER to return to your previous position.

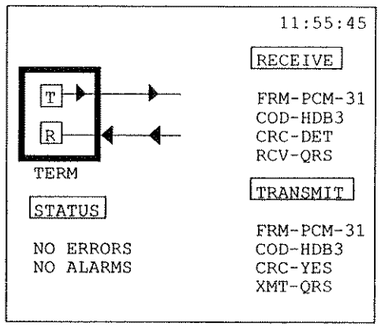


Figure 6.16A GRAPHIC Screen

T
Represents the test set's Transmitter.

R
Represents the test set's Receiver.

TERM
Indicates that a TERMinated line interface mode has been selected.

STATUS
Displays the current circuit status information. In Figure 6.16A, no errors or alarms are being detected.

RECEIVE
Displays information about the received signal:

FRM
The framing detected
COD
The line coding detected
CRC
Whether CRC (Cyclic Redundancy Check) sequences are detected
RCV
The test pattern detected

TRANSMIT
Displays information about the transmitted signal:

FRM
The framing type you have selected
COD
The line coding you have selected
CRC
Whether the CRC (Cyclic Redundancy Check) checking has been enabled
XMT
The test pattern you have selected

6.17 Using the Battery & AC Charger

Do not use any other charger with the SunSet. Using another charger may cause permanent damage and will void the Sunrise Telecom warranty.

The test set is powered by an internal lead-acid battery. The battery is designed to provide ample power for portable testing applications. The battery is charged by a custom-designed charger to provide optimum performance. This charger is powerful enough to run the test set continuously while keeping the battery charged.

The charger features a special fast-charge design which recharges a discharged battery quickly so that the user can return to the field. This fast charging action causes no damage to

the battery. The charger operates at:

- 120 VAC, 60 Hz for the SS113-A
- 110 VAC, 60 Hz for the SS113-B
- 230 VAC, 50/60 Hz for the SS121-A
- 220 VAC, 50/60 Hz for the SS121-B

The charger recognizes when the battery is nearly fully charged. When this happens the charger converts over to a trickle-charging mode that completes the charging process for maximum battery output. This trickle-charging mode is also non-damaging to the battery over extended periods. However, to get maximum life from your battery, remove it from the charger when it is fully charged.

Here are some tips for getting the best performance from your battery:

1) Use the backLIGHT only if it is needed. The SunSet may operate over 2 hours and 15 minutes with a fully charged battery when the backLIGHT is off. However, it may operate less than 2 hours when the backLIGHT is turned on.

2) Turn the power switch off when the set when is not in use.

3) Use the optional Cigarette Lighter Battery Charger, SS104, when transporting the test set in the field. This will help keep the battery charged when AC power is not available.

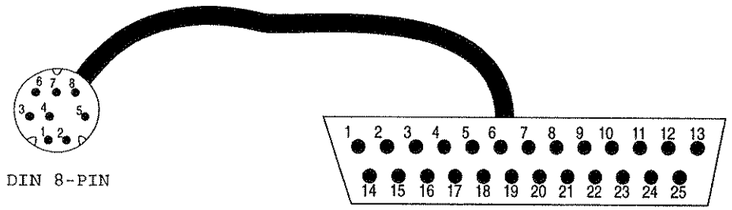
4) If you are going to perform extended testing and you are not sure if the battery will last long enough, plug the charger in at the beginning of the test so that the set will run indefinitely. If you wait until the battery is low during the middle of the test when you plug the charger in, the set's processor may reset and drop the current test as the charger is plugged in.

5) Recharge the battery between uses, even if the time available for a recharge is short. The AC Battery Charger's two-stage design charges the battery to approximately 80% of it's full capacity in just a few hours. The set will charge fully overnight.

6) To determine the if the battery is fully charged, observe the LED indicator on the charger. If the light is lit continuously, then the charger is in a high-output mode and is either fast-charging the set or powering it during normal operation. When the LED indicator begins to blink, the charger is in a trickle-charge mode. When the light barely flickers at all, the battery is fully

charged.

7) Let the battery charge overnight, if possible, to ensure that it is fully charged when you begin testing.



------ PIN-TO-PIN CONNECTIONS -----

DIN 8-PIN PIN#	DESCRIPTION	EIA-232-C D-SUB PIN#	DESCRIPTION
2	DSR	6	DSR
3	TX	2	TXD
4	RX	3	RXD
5	GND	7	GND
6	CTS	5	CTS
7	RTS	4	RTS
8	DTR	20	DTR

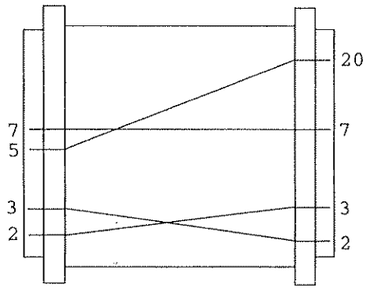
Figure 6.18A Printer Cable Pin Assignments

6.18 Using the Serial Port

The test set is equipped with a standard Serial Port for both printing and remote control operations.

6.18.1 Serial Port Settings

The Serial Port is configurable for: baud rate, parity, stop bit, bits/character and carriage return/line feed. These settings are configured from within OTHER FEATURES, SYSTEM CONFIG, GENERAL CONFIG, from the MAIN MENU. In general, the SunSet's serial port settings will need to match the settings of your printer or remote control. Configuring the SunSet's serial port is described in detail in the procedures which follow.



------ PIN-TO-PIN CONNECTIONS -----

DB-25 FEMALE PIN#	DESCRIPTION	DB-25 MALE PIN#	DESCRIPTION
7	SG	7	SG
5	CTS	20	DTR
3	RD	2	TD
2	TD	3	RD

Figure 6.18B Null Modem Pin Assignments

DIP SWITCH 1 POSITION	DIP SW SETTING	PARAMETERS	PARAMETER SETTING
1	OFF	INPUT	SERIAL
2	ON	PRINTING SPEED	HIGH
3	ON	AUTO LOADING	ON
4	OFF	AUTO LINE FEED	OFF
5	ON	SETTING COMMAND	ENABLE
6	OFF	PRINTING DENSITY	100%
7	ON		
8	ON		

DIP SWITCH 2 POSITION	DIP SW SETTING	PARAMETERS	PARAMETER SETTING
1	ON	PRINTING COLUMNS	40
2	ON	USER FONT BACK UP	ON
3	ON	CHARACTER SELECT	NORMAL
4	ON	ZERO	NORMAL
5	ON	INTERNATIONAL CHARACTER SET	ENGLISH
6	ON		
7	OFF		
8	OFF		

DIP SWITCH 3 POSITION	DIP SW SETTING	PARAMETERS	PARAMETER SETTING
1	ON	DATA LENGTH	8 BITS
2	ON	PARITY SETTING	NO
3	ON	PARITY CONDITION	ODD
4	ON	BUSY CONTROL	H/W BUSY
5	OFF	BAUD RATE SELECT	9600 bps
6	ON		
7	ON		
8	ON		

Figure 6.18C Printer Switch Settings

6.18.2 Configuring for Printing

The test set may be ordered with an optional High Capacity Thermal Printer (SS118). This printer operates by an 8-bit serial RS-232C method, and uses thermal paper (ie. it has no ink cartridge or ribbon which needs to be replaced). Many other serial printers are available to the user; however, not all of these printers will operate correctly with the SunSet. In addition to the printer which may be ordered with the test set, the TTC PR40A printer will work, although it requires an optional Null Modem Adapter (SS122).

You are free to use this information to attempt to set up the test set with another printer. However, Sunrise Telecom does not warrant the operation of the test set with any printer other than the one supplied by Sunrise Telecom.

Refer to Figure 6.18A for a diagram of the pin-to-pin assignments of the DIN to EIA-232-C cable supplied by Sunrise Telecom.

If you wish to connect to a modem or other brand of printer, you may find the SS122 Null Modem Adapter useful. Refer to Figure 6.18B.

To begin printing, follow this procedure:

1) Connect the Sunrise Telecom DIN-8 to RS232C Printer Cable (SS115) to the SunSet E1.

2) If you are using a Sunrise Telecom printer, skip this step. Otherwise, you may need to connect the Sunrise Telecom Null Modem Adapter (SS122) to the free end of the Printer Cable. Note that the Adapter is labeled for the "Test Set Cord" end and the "Printer, Terminal" end.

3) Confirm that the SunSet's serial port settings match those of your printer. The switches to configure your printer's serial port and print characteristics are usually located on the back or bottom of the printer. If you are using the Sunrise Telecom thermal printer, refer to Figure 6.18C for the correct switch settings.

The SunSet's factory default serial port settings are:

BAUD RATE: 9600
PARITY: NONE
STOP BIT: 1-BIT
BITS/CHAR: 8-BIT
CR/LF INSRT: CR+LF

If you need to reconfigure the SunSet's serial port settings to match the settings of your printer, use the following procedure:

a) From the MAIN MENU, select the OTHER FEATURES item, then the SYSTEM CONFIG item.
b) Select the GENERAL CONFIG item.
c) Use the Down Arrow key to access the BAUD RATE setting. Four selections are available: 1200 (F1), 2400 (F2), 9600 (F3) and 19.2K (F4). These settings determine the rate at which the SunSet transmits data (characters) to the printer. This setting must match the setting on your printer, otherwise random characters will appear on your printout.
d) Access the PARITY setting. Three options are available here: NONE (F1), EVEN (F2), and ODD (F3). This setting must match with the configuration of your printer.
e) Access the STOP BIT setting. Two options are available: 1-BIT (F1) and 2-BIT (F2). This setting must match with the configuration of your printer. Normally this is configured as 1-BIT.
f) Access the BITS/CHAR setting. Two options are available: 7-BIT (F1) and 8-BIT (F2). This setting must match with the configuration of your printer. Normally this is configured as 7-BIT.
g) Access the CR/LF INSRT setting. Two options are available: CR (F1) and CR+LF (F2).
4) Set up printer's printing instructions by escaping to the MAIN MENU, then entering OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA. For the PRNT PERIOD line:

TIMED: Choose TIMED (F1) if you would like to have the printer print out results at a regular interval during a BASIC MEASUREMENT. The default time is 5 minutes. You may enter any interval between 1 minute and 99 minutes.

To change the interval, press the SHIFT-lock key to display the SHIFT indicator. Then enter the desired numbers from the keypad. Press SHIFT-lock again to remove the SHIFT indicator.

LAST: Choose LAST (F3) if you would like the printer to print out the measurement results only at the conclusion of a test.

For the PRINT EVENTS line, choose ENABLE (F1) if you would like the printer to print out a time and date-stamped result every time an error or alarm condition is reported.

Note that each result can only be printed once and then the printer buffer is emptied.

5) Confirm that the DIP switch settings (or other switch settings) on your printer correspond to those of the SunSet's serial port above. If you have changed the DIP switch settings, switch the printer off and then on before continuing.
6) Ensure that the printer is powered up and "on-line".

7) Ensure that the SunSet is not displaying its GRAPHIC screen. This screen is non-printable.

8) Press the PRN SCRN (print screen) key on the SunSet's keypad.

9) The SunSet's current screen should now print. If it doesn't, check the connections, configuration and switch settings.

6.18.3 Using the Remote Control (option SW100)

The SunSet E1 comes with an optional remote control feature. Controlling the SunSet through the remote control is similar to controlling the SunSet directly.

The remote control allows a remote user and a local user to use the test set together at the same time. This simultaneous-usage feature can help a team of people fix a problem faster.

Refer to Figure 6.18A for a diagram of the pin-to-pin assignments of the DIN to EIA-232-C cable supplied by Sunrise Telecom. Refer to Figure 6.18B for the pin-to-pin assignments of the Sunrise Telecom Null Modem Adapter.

You may need a break-out box, null modem, patch-box and other RS-232C communications tools if you wish to set up your own serial

communications. Here are some helpful hints. The test set is configured as a DTE. You will need a modified null modem cable if you wish to connect directly to a terminal.

It often is successful if pin 20 (DTR) of the modem or terminal is connected to pin 5 (CTS) of the test set DB25 connector. Pin 5 of the test set DB25 connector must show green on a breakout box in order for the test set to print.

To begin remote operation, follow this procedure:

1) Connect the Sunrise Telecom DIN-8 to RS232C Printer Cable (SS115) to the SunSet E1.

2) Connect the Sunrise Telecom Null Modem Adapter (SS122) to the free end of the Printer Cable. Note that the Adapter is labeled for the "Test Set Cord" end and the "Printer, Terminal" end.

3) Connect the Null Modem Adapter to a "gender changer". Normally this will be a female-to-female conversion.

4) Connect the gender changer to the cable which connects to your computer or terminal.

5) Confirm that the SunSet's serial port settings correspond to those of your communications software or terminal. The SunSet's factory default settings are:
   BAUD RATE: 9600
   PARITY: NONE
   STOP BIT: 1-BIT
   BITS/CHAR: 8-BIT
   CR/LF INSRT: CR

If you need to reconfigure the SunSet's serial port settings, use the following procedure:

a) From the MAIN MENU, select OTHER FEATURES, then SYSTEM CONFIG.
b) Select the GENERAL CONFIG item.
c) Use the Down Arrow key to access the BAUD RATE setting. Four selections are available: 1200 (F1), 2400 (F2), 9600 (F3) and 19.2K (F4). These settings determine the rate at which the SunSet transmits data (characters) to the computer or terminal. This setting must match the setting on your computer or terminal, otherwise random characters will appear on your remote screen.

d) Access the PARITY setting. Three options are available here: NONE (F1), EVEN (F2), and ODD (F3). This setting must match with the configuration of your remote control.
e) Access the STOP BIT setting. Two options are available: 1-BIT (F1) and 2-BIT (F2). This setting must match with the configuration of your remote control. Normally this is configured as 1-BIT.
f) Access the BITS/CHAR setting. Two options are available: 7-BIT (F1) and 8-BIT (F2). This setting must match with the configuration of your remote control. Normally this is configured as 7-BIT.

6) Plug a modem into the serial port. A 9600 baud error-correcting modem is highly recommended. Some functions such as VF MEASUREMENTS will only work properly if a 9600 baud modem is used. Refer to Figures 6.18A and B for cable pinouts. You may need a breakout box, appropriate tools, and training to make sure the test set is appropriately connected to the modem the first time you set it up.

7) Plug the modem into the telephone network.

8) Set up a terminal to dial up the modem and commence communications. Any terminal or personal computer with VT100 terminal emulation software should work.

9) Call up the far modem with your terminal.

10) Once communication has been established with the far modem, log on to the SunSet E1 by typing in:

logon

You do not need to press the return key after typing the letters. The test set will automatically repaint the screen with the main menu and other information. If you make a mistake while typing logon, just type it again.

Note: If you log into the set while it is in graphic mode, the graphic may be distorted. Simply press the return key on your terminal and then P (for graphic) to see the graphic in its proper form.

11) Use the SunSet E1 just like you would use it locally. The same menus will be presented to you.

There will be a prompt on the screen to show you which keys to press to move the cursor (your terminal cursor keys will probably also work just fine), to inject errors, and so on. For instance refreSh means that you press the s key to repaint the screen. Press the Return key on your terminal to simulate pressing the Enter key on your test set.

12)When you are finished with the SunSet E1, type in:

logoff

13)Terminate the phone connection by hanging up your near-end modem.

Note that you can use a variety of asynchronous communications in addition to modems over the public switched telephone network. Direct local connection, dedicated line, and packet are other communication alternatives.

In remote control, you have access to most of the test set's capability. However, you will notice a few differences, such as the following:

- The MEASUREMENT RESULTS screen will be updated about once every 5 seconds instead of once each second.

- Local usage of print commands is not recommended during a remote control session because both the printer and the remote control use the same printer port. For instance, if a remote user is logged on, pressing the PRNTR key will log the user off.

- The pulse mask feature is supported for pass/fail report and pulse statistics, however, the specially bit-mapped pulse graph is not drawn on the remote terminal screen.

- Talk/listen is not supported remotely.

6.18.4 Using Remote Control from Windows 95

Here's a brief rundown on how to get your SunSet to work by remote control, when you are operating out of Windows 95.

1) From Accessories, start HyperTerminal
   a. Click to open the Hyper Terminal window

2) Double click on Hypertrm

3) At New Connection, enter "Sunrise Remote"
   a. Select an icon
   b. Click on Ok

4) In the Phone Number screen, click on the down arrow of the "Connect using:" box
   a. Select the modem or com port number you are using (note: if you are connected directly to a com port, you will need to use a Null Modem Adaptor)
   b. Click Ok

5) At the Port Settings, configure the settings as follows (matching those of your SunSet as set in the General Config screen):
   Bits per second: 9600 or 19200
   Data (or Char) bits: 8
   Parity: none
   Stop bits: 1
   Flow Control: none

   a. Click Ok when done

6) In the HyperTerminal screen, click on VIEW (IMPORTANT!)

7) Highlight and click on FONT

8) Highlight Terminal
   a. Set the Style and Size as you wish

9) Type "LOG-ON"

10) Remote control should work!

Section 7 Applications

7.1 Accept a New 2.048 Mbps Circuit

Here is a procedure for accepting a new circuit. The setup is illustrated in Figure 7.1A.

1) Verify that the circuit is not in service. This acceptance test will disrupt service. Ensure that there is a loopback device at the far end of the circuit.

2) Switch on the test set. Wait for the circuit graphic to be displayed. Press the ENTER key to move to the MAIN MENU.

3) Highlight the LINE INTERFACE menu item; press ENTER. Use the following configuration:

   MODE: TERM
   FRAMING: as specified by the circuit design (not AUTO)
   CRC-4: as specified by the circuit design
   CODING: HDB3
   XMT CLOCK: INT2048
   MSRMT CLOCK: INT2048
   TEST RATE: 2048K
   XMT LEVEL: 0 dB

   Press ENTER when all of the settings are correct.

4) Move the cursor to the SEND TEST PATTERN menu item and press ENTER. Highlight the pattern you want to send. Press ENTER.

5) Connect the SunSet to the circuit as shown in Figure 7.1A. Press the HISTORY key to acknowledge any blinking history lights and turn them off.

6) Enter the BASIC MEASUREMENTS menu item. Verify that the circuit performs to your company's requirements for the service delivered. If necessary, refer to the Measurement Definitions section for an explanation of the BASIC MEASUREMENTS parameters. Use the PAGE-UP (F1) and PAGE-DN (F2) to access each of the individual

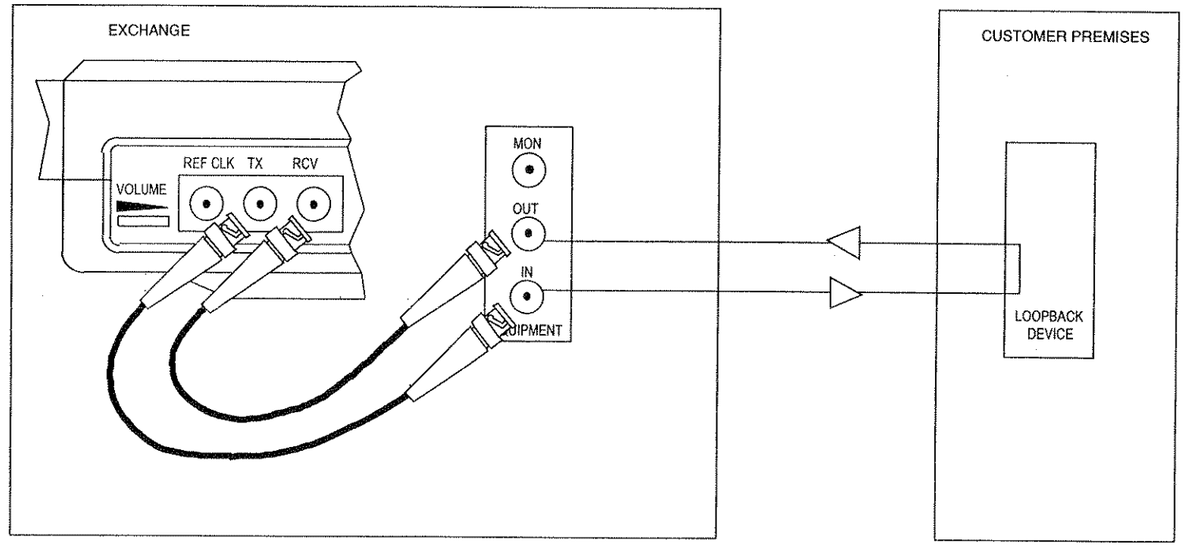


Figure 7.1A Accepting a New Circuit

measurement screens.

7) When your BASIC MEASUREMENTS have been completed, press the ESCAPE key to return to the MAIN MENU.

8) Remove the loop at the far end of the circuit.

9) Unplug the test set, turn it off, and put it away.

7.2 Monitor an In-Service Circuit

Here is a procedure for monitoring a circuit that is in-service. The setup is illustrated in Figures 7.2A and 7.2B.

1) This test may be performed while the circuit is carrying live customer traffic.

2) Press the ESCAPE key until you arrive at the MAIN MENU. Move your cursor to the LINE INTERFACE item and press ENTER. Use the following configuration:

   MODE: MONITOR
   FRAMING: AUTO
   CRC-4: AUTO
   CODING: AMI or HDB3
   XMT CLOCK: INT2048
   MSRMT CLOCK: INT2048
   TEST RATE: 2048K
   XMT LEVEL: 0 dB

   Press the ENTER key when all of the settings are correct.

3) Connect the test set to the circuit as shown in Figure 7.2A or 7.2B. Press the HISTORY key to acknowledge any blinking history lights and turn them off.

4) Examine the LEDs and the GRAPHIC screen for information about the circuit under test.

   The SIGNAL light should be lit and a valid framing type should be indicated. A steady ERROR or CODE ERR light will tell you that the circuit is working but that it is experiencing trouble. SIG LOSS and

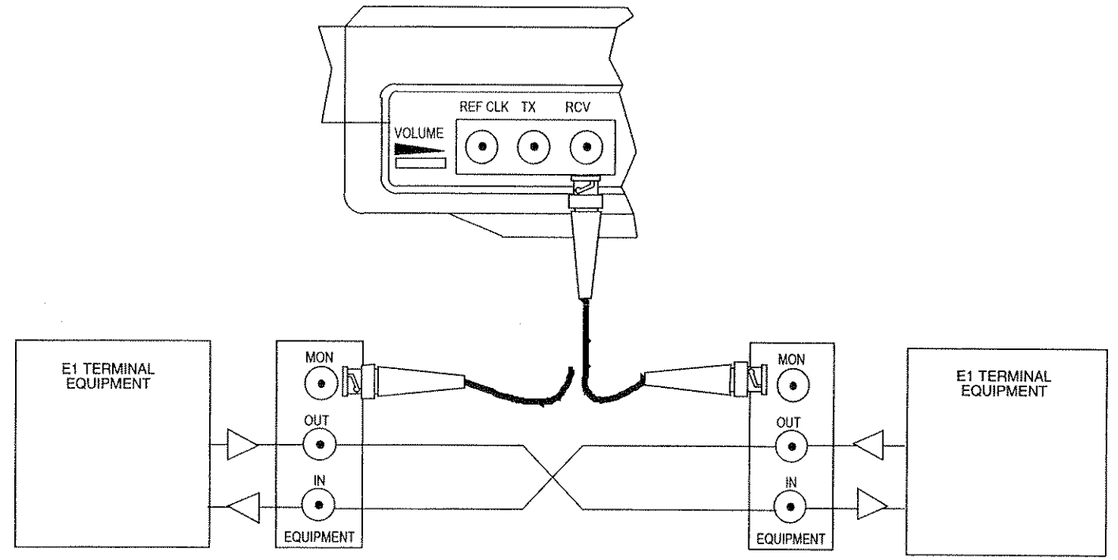


Figure 7.2A Monitoring an In-Service Circuit - Monitor Mode

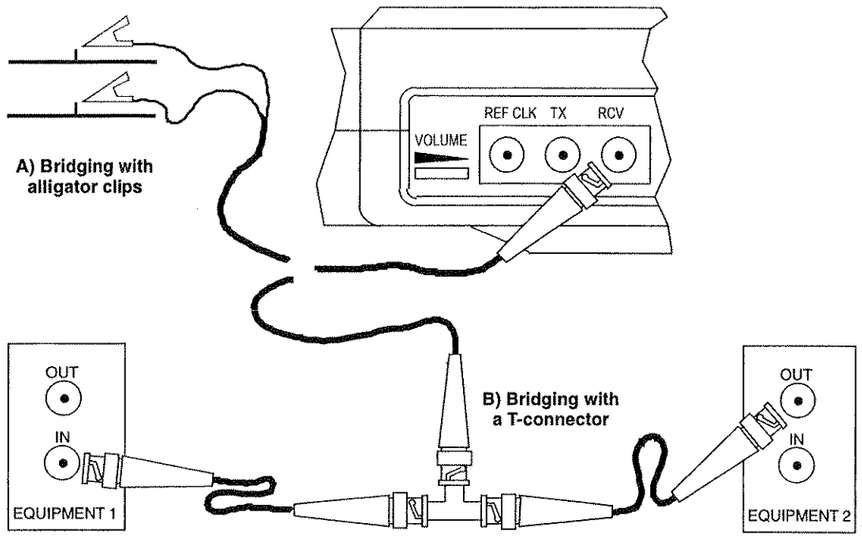


Figure 7.2B Monitoring an In-Service Circuit - Bridge Mode

FRM LOSS are indications of severe problems. A FAS RAI/MFAS RAI indication will show a problem on the other side of the circuit. AIS may indicate a trouble condition where a network element transmitting to the test set has lost its incoming signal and has replaced it with the AIS signal.

The GRAPHIC screen will show what kind of pattern, if any, is being received by the test set.

5) To make a basic measurement:
   a) Press ESCAPE as necessary until you arrive at the MAIN MENU
   b) Move your cursor to the BASIC MEASUREMENTS menu item. Press the ENTER key. Verify that the circuit performs to your company's requirements for the service delivered.

6) Unplug the test set from the circuit.

7.2.1 In-Service E-bit Measurements

To measure the E-bit performance of your in-service circuit, use this procedure:

1) Follow steps 1) to 5) above.

2) In the BASIC MEASUREMENTS menu, press the PAGE-UP (F1) or PAGE-DN (F2) key to view the RESULTS - E-BIT screen.

3) Verify that the E-bit error rates of your circuit conform to your company's' requirements.

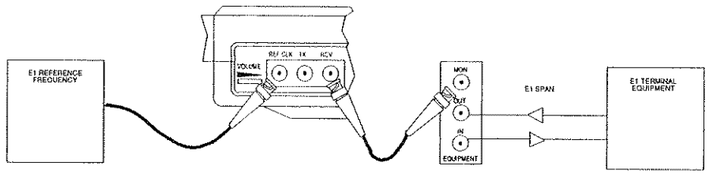
4) Unplug your test set from the circuit.

7.3 Checking for Frequency Synch

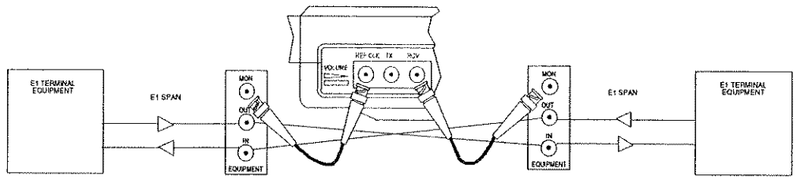
Frequency synchronization can be a problem when:

- the customer purchases a channelized E1 circuit
- the customer's circuit passes through a synchronous network element such as an exchange, PBX, or a digital cross-connect system (DCS)
- the E1 circuit passes through more than one carrier

Frequency synchronization problems result in frame slips, a major source of service impairment. Use this procedure to identify frequency synchronization problems:



a) Reference Frequency Source



b) End-to-end Circuit Timing

Figure 7.3A Frequency Synchronization

1) This test may be performed while the circuit is carrying live customer traffic.

2) Obtain a 2.048 Mbps reference frequency source, or compare the end-to-end timing of the circuit. Refer to Figure 7.3A. Note that the SunSet E1 requires a 2.37 Volt or 3.00 Volt AMI or HDB3 reference source. The SunSet E1 will terminate the source in a 75Ω unbalanced or 120Ω balanced resistance. The 2.37 Volt / 75Ω source is used with the BNC to BNC cable. The 3.00 Volt / 120Ω source is used with the BNC to Banana 3-pin cable.

3) Enter the LINE INTERFACE menu item by pressing the ENTER key. Set the screen settings to:

MODE: MONITOR
FRAMING: AUTO
CRC-4: AUTO
CODING: AMI or HDB3
XMT CLOCK: INT2048
MSRMT CLOCK: EXTERN
TEST RATE: 2048K
XMT LEVEL: 0 dB

Press ENTER when all of the settings are correct.

4) Plug the reference E1 signal into the REF CLK jack.

5) Plug the test set's RCV jack into the circuit's DSX MON jack or other MON jack. Press the HISTORY key to acknowledge any blinking history lights and turn them off.

6) From the MAIN MENU move your cursor to the BASIC MEASUREMENTS menu item and press ENTER. Press the PAGE-DN (F2) key to access the RESULTS - FREQUENCY screen. This will graphically display frequency variation and frame slips. You can see if there is a problem because the frequency value will vary from the 2.048 MHz reference frequency. Note also the WNDR value. This will provide an indication of any low-frequency variation in the signal's frequency.

7) If you are using an external frequency source, be sure to check both sides of the circuit. If you have used one side of the circuit as your reference and the other side as the tested signal, then your testing is complete

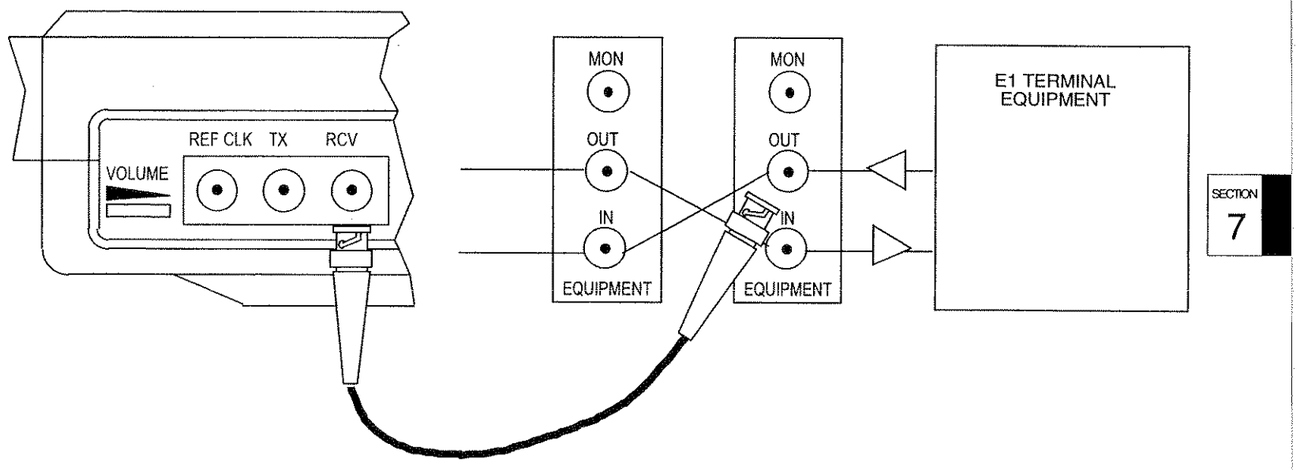


Figure 7.4A Measuring Signal Level

7.4 Measure Signal Level

A signal level measurement can be performed by itself or with one of the other tests.

1) Choose what kind of access mode you want to use. You can make the measurement in TERM, MONITOR, and BRIDGE modes. TERM and BRIDGE provide the most accurate results, but MONITOR may be the most convenient mode. TERM may also disrupt service. A BRIDGE measurement result may be degraded by a low-quality termination at the network element terminating the E1 line.

   The rest of this procedure will use the TERM mode for illustrative purposes. Verify that the circuit is not in service. Using the TERM method described here will disrupt service.

2) Switch on the test set. Enter the LINE INTERFACE item. Set the screen settings for:

   MODE: TERM
   FRAMING: AUTO
   CRC-4: AUTO
   CODING: AMI or HDB3
   XMT CLOCK: INT2048
   MSRMT CLOCK: INT2048
   TEST RATE: 2048K
   XMT LEVEL: 0 dB

   Press ENTER when your settings are correct.

3) Plug the set into the circuit as shown in Figure 7.4A. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

4) Move the cursor to the BASIC MEASUREMENTS menu item and press ENTER.
   a) Press the PAGE-DN (F2) key twice to access the RESULTS-SIG/ALM screen. Read the signal level. Separate readings are given for the positive and negative (base to peak) signals so that you can get more accurate information on a faulty regenerator.

5) Unplug the test set from the circuit.

7.5 Run a Timed Test

7.5.1 Manual Start

Many network tests require the use of an exact time period such as 15 minutes, 1 hour, or 24 hours over which to conduct a test. In this section you will configure the timer for one of these tests. Use the following procedure:

1) Use the procedure from Application 7.1 or 7.2 as the basis for your test.

2) Switch on the test set.

3) In the MAIN MENU, move the cursor to the OTHER FEATURES item and press ENTER.
   a) Move the cursor to the TEST PARAMETERS item and press ENTER.
   b) Move the cursor to the MEASUREMENT CRITERIA item and press ENTER.
   c) With the cursor on MEAS DURATION, press TIMED (F1)
   d) Press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Enter in the number of hours and minutes that you want the test to run. When you are satisfied that the entry is correct, press ENTER.
   e) Press the ESCAPE key until you have returned to the MAIN MENU.

4) Proceed with the test procedure outlined in Application 7.1 or 7.2.

When you perform the BASIC MEASUREMENTS, the test will now be timed. You can see how much time remains on your test by viewing the RT (Remaining Time) indicator in the upper right-hand corner of the screen. The ET indicator shows how much time has elapsed since the beginning of your test.

7.5.2 Auto Start

To have the test set begin measuring at a future date and time, set the desired MEASUREMENT CRITERIA, then escape back to the TEST PARAMETERS menu. Enter OTHER PARAMETERS.

1) Cursor down to MEASurement START TIME, and use the F1 key to ENABLE it.

2) Cursor down to enter the DATE (Year:Month:Day) you wish measuring to start. Use the SHIFT key to access the numeric key pad.

3) Cursor down to enter the TIME you want measuring to begin (Hour:Minute:Second). Press SHIFT again.

The test set will begin measuring at your programmed time; however, you must be in the BASIC MEASUREMENTS screen for the test to automatically start.

Note: You may combine procedures 7.5.1 and 7.5.2 to have a test of a specific length begin automatically at a given time and date.

7.6 Observe Network Codes or Channel Data

The SunSet E1 provides a large screen display which is useful for analyzing live circuit data. In addition to a display of the binary data, hexadecimal and ASCII translations are provided for you. This display can be used to decode E1 network control codes that are in use, and can also be used to verify the content of individual channels. Refer to Figure 7.6A.

32 pages of data are stored at once so that you can scroll down through the information and observe the changes which have occurred over time. Use this procedure:

1) This test may be performed while the circuit is carrying live customer traffic if either a BRIDGE or MONITOR access mode is used. The test can also be performed out-of-service if the TERM mode is used.

2) Switch on the test set.

3) Use Application 7.1 or 7.2 as the basis for your test. The test set must detect valid framing on the received signal.

4) Connect the test set to the circuit as shown in Figure 7.1A or 7.2A or B. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Press ESCAPE to arrive at the MAIN MENU.
   a) Enter the OTHER MEASUREMENTS item

```
                                    07:31:55

          VIEW RECEIVED DATA
PAGE :    01
T/S    BINARY      HEX      ASCII
000    11011111     DF         ( )
001    01000000     40       @ ( )
002    01000000     40       @ ( )
003    01000000     40       @ ( )
004    01000000     40       @ ( )
005    01000000     40       @ ( )
006    01000000     40       @ ( )
007    01000000     40       @ ( )


PAGE-UP   PAGE-DN   PAUSE
```

Figure 7.6A
View Received Data

b) Enter the VIEW RECEIVED DATA item. You will now receive a live display of the E1 data.

Valid framing is required in order to enter the VIEW RECEIVED DATA menu.

The test set's pattern synchronization circuitry is disabled upon entering the VIEW RECEIVED DATA menu. If the PAT SYNC LED was lit, it will turn off.

6) Review the live data as it is displayed. When the codes that you are interested in appear, press the PAUSE key (F3) to trap 32 pages of data. Press PAGE-DN (F2) to scroll through the data. The data are presented as they appear in the E1 bit stream. The data are broken out into timeslots for you.

Note the presence of control information in time slot 000 for PCM-31 framing, and the presence of control information in time slots 000 and 016 for PCM-30 framing. All other channels (time slots) should contain actual voice/data signals or your transmitted test pattern.

7.7 Determine Round Trip Circuit Delay

Refer to Figure 7.1A and use this procedure:

1) Verify that the circuit is not in-service. This test will disrupt service.

2) Switch on the test set.

3) Enter the LINE INTERFACE menu. Set the screen settings to:

   MODE: TERM
   FRAMING: as specified by the circuit design (not AUTO)
   CRC-4: as specified by the circuit design
   CODING: as specified by the circuit design
   XMT CLOCK: INT2048
   MSRMT CLOCK: INT2048
   TEST RATE: 2048K
   XMT LEVEL: 0 dB

   Press ENTER when your settings are correct.

4) Connect the test set to the circuit as shown in Figure 7.1A. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Ensure that there is a loopback device at the far end of the circuit.

6) From the MAIN MENU, move the cursor to the OTHER MEASUREMENTS item and press ENTER.
   - Move the cursor to the PROPAGATION DELAY item and press ENTER. The test set will perform a propagation delay measurement for you on the looped circuit. Read the value of circuit delay reported in both UI (Unit Intervals and uS (microSeconds).

   1 Unit Interval is equal to the duration of a single pulse (1 / 2 048 000 = 0.488 microSeconds).

   1 microSecond is equal to 1 / 1 000 000 seconds (one one-millionth of a second).

7) Unplug the test set from the circuit.

7.8 Monitor a Voice Frequency Channel

Here is a procedure for monitoring a voice frequency channel within an E1 circuit. The setup is illustrated in Figures 7.2A or B.

1) This test may be performed while the circuit is carrying live customer traffic.

2) Switch on the test set.

3) Enter the LINE INTERFACE menu. Use the following settings:

   MODE: BRIDGE or MONITOR
   FRAMING: AUTO
   CRC-4: AUTO
   CODING: AMI or HDB3
   XMT CLOCK: INT2048
   MSRMT CLOCK: INT2048
   TEST RATE: 2048K
   XMT LEVEL: 0 dB

   Press ENTER when your settings are correct.

4) Connect the test set to the circuit as shown in Figure 7.2A or B. Press the HISTORY key to acknowledge the blinking history lights and turn them off. Verify that the PCM-31 or PCM-30 LED is lit.

5) From the MAIN MENU
   a) Move your cursor to the VF CHANNEL ACCESS item and press ENTER.
   b) Enter VF MEASUREMENTS.
   c) Select your desired receive (RCV) timeslot. The channel number will bypass any timeslots containing the E1 framing information. In PCM-31 framing, no access is granted to timeslot 00, while in PCM-30 framing, access to timeslots 00 and 16 is denied.

   Adjust the volume to the desired level by using the volume control on the right-hand side of the test set.

NOTE: If you are not able to monitor the channel, verify that the AUTO framing of the test set was able to synch on a recognized framing type. The test set will not perform the monitor function if framing is unavailable. Press the RESYNCH key to restart the auto framer if a valid frame type is not shown. If this doesn't work, try unplugging and replugging the

receive cord. This will verify that there is no recognizable framing at this moment.

6) When you are finished, disconnect the test set from the circuit.

7.9 Simple Talk/Listen

Here is the simplest procedure for talking and listening on an E1 circuit. The setup is illustrated in Figure 7.1A, however, instead of having a loopback at the far end of the circuit, your might have another test set, a multiplex, a switch, or other E1 terminating network element.

Use this procedure:

1) Verify that the circuit is not in service. This test will disrupt service for all of the channels that you are not using.

2) Switch on the test set.

3) Enter the LINE INTERFACE menu by pressing the ENTER key. Configure the interface as follows:
   MODE: TERM
   FRAMING: as specified by the circuit design
   CRC-4: as specified by the circuit design
   CODING: as specified by the circuit design
   XMT CLOCK: INT2048
   MSRMT CLOCK: INT2048
   TEST RATE: 2048K
   XMT LEVEL: 0 dB
   Press ENTER when your settings are correct.

NOTE: If you select AUTO for the framing type, the circuit may have an unframed signal during this test condition. It is not possible to perform talk and listen on an unframed signal. One of the framing

LEDs must light for this procedure to work.

4) Connect the test set to the circuit as shown in Figure 7.1A. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) From the MAIN MENU
   a) Move your cursor to the VF CHANNEL ACCESS item and press the ENTER key.
   b) Enter the VF MEASUREMENTS item.
   c) Select the receive (listen) and transmit (talk) channels (they are usually the same channel number). You can now talk and listen on the channel which you have selected. Adjust the volume to the desired level by using the volume control on the right-hand side of the test set.

6) When you are finished, disconnect your test set from the circuit.

7.10 Send/Receive a 1020Hz Tone

Here is a procedure for sending a tone:

1) This is an intrusive test. Be sure the E1 line is not carrying traffic.

2) Enter the LINE INTERFACE menu. Configure the settings for:

MODE: TERM
FRAMING: as specified by the circuit design
CRC-4: as specified by the circuit design
CODING: as specified by the circuit design
XMT CLOCK: INT2048
MSRMT CLOCK: INT2048
TEST RATE: 2048K

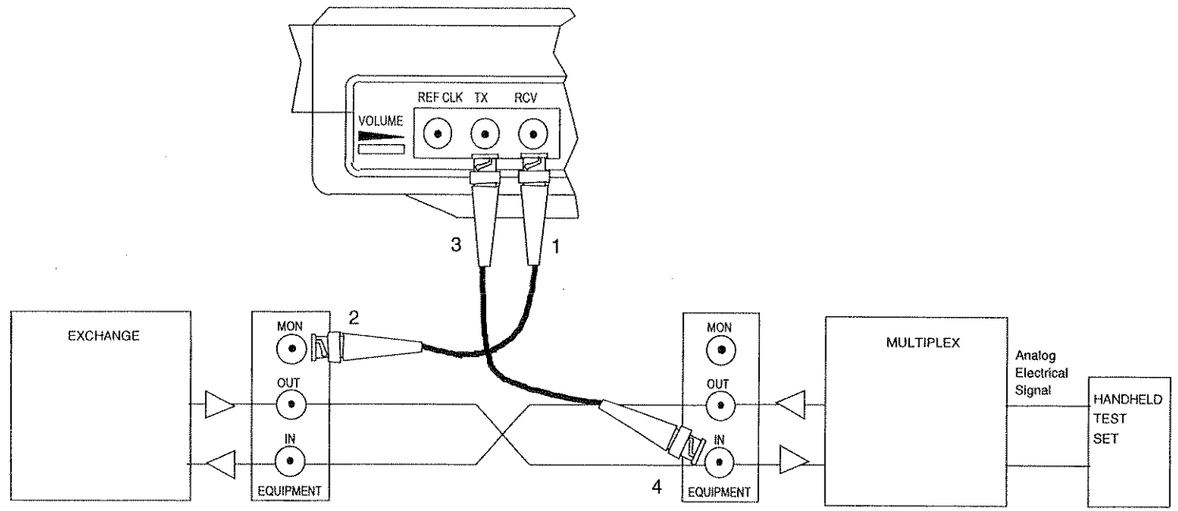


Figure 7.11A Inserting a 1020 Hz Tone Hitlessly

XMT LEVEL: 0 dB

Press ENTER when your settings are correct.

3) Connect the test set to the circuit as in Figure 7.1A. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

4) From the MAIN MENU
   a) Move the cursor to the VF CHANNEL ACCESS item and press ENTER.
   b) Enter the VF MEASUREMENTS item.
   c) Use the NEXT (F1) or PREVIUS (F2) to set up the receive (RCV) and transmit (XMT) timeslots correctly (these will normally be the same number).
   d) Move the cursor to the 1020Hz TONE item and press ENABLE (F1). You are now transmitting a tone on the selected transmit channel.

      You may also view the received Level and Frequency.

5) When you are finished, disconnect your test set from the circuit.

7.11 Insert a 1020 Hz Tone Hitlessly

Here is a procedure for hitlessly inserting a 1020 Hz tone into your circuit. Refer to Figure 7.11A.

1) This is a non-intrusive test, however, as the final connection to the circuit is made, a momentary hit will occur. This will not usually cause a problem with the circuit's operation.

2) From the MAIN MENU, enter the LINE INTERFACE item. Configure the interface as follows:

   MODE: MON-LP
   FRAMING: AUTO
   CRC-4: AUTO
   CODING: as specified by the circuit design

XMT CLOCK: INT2048
MSRMT CLOCK: INT2048
TEST RATE: 2048K
XMT LEVEL: 0 dB

Press ENTER when your settings are correct.

3) From the MAIN MENU
   a) Enter the VF CHANNEL ACCESS item.
   b) Enter VF MEASUREMENTS.
   c) Using the Down arrow key, access the XMT TIMESLOT item.
   d) Using the F1 (NEXT) and F2 (PREVIUS) keys, select the timeslot onto which the tone will be transmitted.

4) Using the Down arrow key, access the 1020Hz TONE item.
   a) Press the F1 key to ENABLE the tone. You are now configured to hitlessly insert a 1020 Hz tone.

5) Connections must be made in the order indicated in Figure 7.11A. Failure to follow the proper connection sequence may result in the circuit being taken out of service. Use this procedure:
   a) Connect a cable to the RCV jack of the test set.
   b) Connect the other end of this cable to the protected MONITOR jack of the circuit.
   c) By examining the LEDs, confirm that the test set has frame synchronization. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

WARNING: If frame sync has not been achieved and you continue with the procedure, you may take the circuit out of service.

   d) Connect a cable to the TX jack of the test set.
   e) Connect the other end of this cable to the IN jack of the circuit.

6) You are now transmitting a 1020 Hz tone hitlessly on the selected timeslot. All of the circuits' remaining timeslots are being passed through the test set without disruption.

7) When you are finished, unplug the test set by:
   a) Unplugging the circuit's IN connector (connector 4 in Figure 7.11A).
   b) Unplugging the circuit's MON

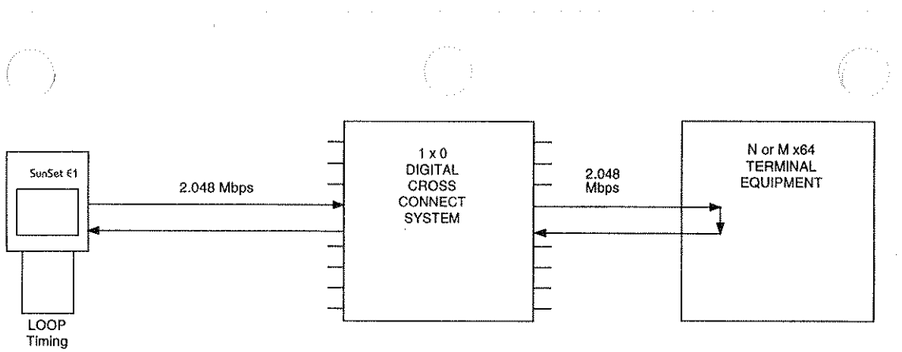


Figure 7.12A Fractional E1 Testing

connector (connector 2 in Figure 7.11A).

7.12 N (or M) x64 kbps Testing

Fractional E1 circuits are circuits of data rate N or M x64 Kbps, where N can be anywhere from 1 to 31 channels. N channels of the E1 line are dedicated to the fractional E1 circuit. The remaining channels of the E1 line are designated M, and are either filled with an idle code, other revenue traffic or framing information.

Use the following procedure:

1) Verify that the fractional circuit is not in service. This test will disrupt service.

2) Switch on the test set.

3) Enter the LINE INTERFACE menu. Configure the interface for:

MODE: TERM
FRAMING: as specified by the circuit design
CRC-4: as specified by the circuit design
CODING: as specified by the circuit design
XMT CLOCK: LOOP or INT2048 (refer to Figure 7.12A)
MSRMT CLOCK: INT2048
TEST RATE: Nx64K
XMT LEVEL: 0 dB

As illustrated in Figure 7.12A, LOOP timing may be required for the SunSet E1 to transmit at the same rate as the DCS.

When you press Nx64K, the test set will display a fractional E1 timeslot screen. Manually configure the timeslots as desired. If the timeslot configuration is not known,

AUTO configure to the active channels.

AUTO configuration may not yield the proper channels if any of the active channels are transmitting an idle code. It will also not work properly if the idle code set up in OTHER FEATURES, TEST PARAMETERS, OTHER PARAMETERS, IDLE CHNL CODE is not the same as the idle code of the circuit being tested (usually 1101 0101).

A good way for you to observe the idle and active channels for yourself is to plug the test set in using the 2.048 Mbps test rate and then enter OTHER MEASUREMENTS, VIEW RECEIVED DATA. This will allow you to double check the information being transmitted on a channel-by-channel basis.

Press the ENTER key when your timeslot settings are correct. This will return you to the LINE INTERFACE menu. When your LINE INTERFACE settings are correct, press ENTER.

4) Connect the test set to the circuit as shown in Figure 7.1A.

5) Ensure that a loop is in place at the far end of the circuit.

6) Press the HISTORY key to acknowledge any blinking history lights and turn them off.

7) Enter the BASIC MEASUREMENTS menu and perform your acceptance test. Verify that the fractional E1 service performs to your company's' requirements for the service delivered.

8) When you are finished, disconnect your test set from the circuit.

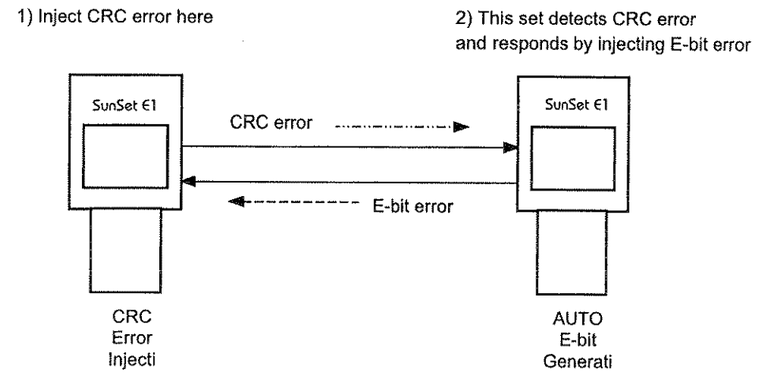


Figure 7.13A AUTO E-bit Generation

7.13 E-bit Applications

Use the following procedures if your test set is equipped with software option SW211, E-bit Analysis and Injection and SW210, Advanced Frame Word Applications. Refer to Section 1 for a description of E1 technology, including troubleshooting circuit problems using E-bits.

7.13.1 Troubleshooting Multiplex E-bit Functions

This procedure is useful for troubleshooting problems with E1 multiplex equipment.

You may automatically generate E-bit errors in response to incoming CRC errors which the test set detects. Refer to Figure 7.13A and use this procedure:

1) Verify that the circuit is not in service. This test will disrupt service.

2) From the MAIN MENU, enter the LINE INTERFACE item. Configure the settings for:

   MODE: TERM
   FRAMING: as specified by the circuit design (not AUTO)
   CRC-4: YES
   CODING: as specified by the circuit design
   XMT CLOCK: INT2048
   MSRMT CLOCK: INT2048
   TEST RATE: 2048K
   XMT LEVEL: 0 dB

   Press the ENTER key when all of the settings are correct.

3) Connect the test set to the circuit as shown in Figure 7.1A. Press the HISTORY key to acknowledge any blinking history lights and turn them off.

4) From the MAIN MENU, select OTHER FEATURES, SEND FRAME WORDS.

5) With the cursor on the first line (E-BIT:), press the AUTO (F2) key. Two "A" indicators will now appear. The test set is now automatically transmitting E-bits as incoming CRC errors are detected.

7) When you are finished, disconnect the test set from the circuit.

Section 8 Troubleshooting

Here are some helpful suggestions for when your test set is not performing as expected.

Problem: CODE ERR light, FRM LOSS light, and other error lights are on, but there should be no problem.
Suggestions:

1) LINE INTERFACE MODE may be wrong. Try, TERM, MONITOR, BRIDGE.
2) Check the cords; they may be loose or dirty.
3) Try reversing the TX and RCV cords.

Problem: Keys do not work properly.
Suggestions:

1) Verify SHIFT status by pressing and releasing the SHIFT-lock key. Press and release the SHIFT-lock key until the SHIFT status indicator in the upper left hand corner of the screen achieves the desired condition.
2) Do not press the SHIFT-lock key simultaneously with another key.
3) Press the key again. The test set may not have registered it the first time.

Problem: Test set will not power up properly.
Suggestions:

1) Make sure the battery is charged or the charger is plugged in. The test set's battery charger is powerful enough to power the test set and recharge the battery simultaneously.
2) Make sure the software cartridge is inserted firmly and seated correctly. A flickering screen usually indicates that the software cartridge is either loose or missing. Refer to the cartridge installation procedure if necessary.

Problem: Test set powers up, but screen is blank or unreadable.
Suggestions:

1) Adjust the contrast control knob (left side of the test set).
2) Try switching on the screen back-light with the LIGHT key.

Problem: Test set shows Security Violation when switched on.
Suggestion:
1) Make sure the serial number on the back of the software cartridge matches the serial number on the back of the test set. Each software cartridge is programmed for a specific test set. If software cartridges are swapped between test sets, the test set will not work properly.

Problem: Test set performs improperly.
Suggestion:
1) Try switching the test set off, then switching it on again.
2) Try the ERASE NV RAM menu item. WARNING: this operation will erase all user-programmed information and history buffers within the test set. When the ERASE NV RAM has completed, switch off the test set for 5 seconds, then switch it on.

Problem: Measurements are not working properly (Loss of Signal, no Pattern Synch).
Suggestions:
1) Verify that the MODE setting in the LINE INTERFACE menu is correct.
2) Verify that all jacks are connected properly, according to the circuit graphic.
3) Ensure that the OUT and IN connections are not reversed.
4) Twist the plugs inside of the jacks and ensure that all plugs are inserted fully.

Problem: Test Patterns will not synch.
Suggestions:
1) Press RESYNCH to force the test set to resynchronize on the test Pattern.
2) Verify that you are transmitting the desired pattern in the SEND TEST PATTERN menu.
3) Enter the MEASUREMENT CRITERIA menu, and make sure the PATTERN LOCK has been DISABLEd.

Problem: Test patterns will not synch with other test equipment.
Suggestions:
1) Verify that the test set is configured for the same Framing and line Coding as the other test equipment. If you are unsure of the Framing and Coding, use the AUTO settings in

the LINE INTERFACE menu.

2) Verify that PATTERN INVERSION is DISABLED in the OTHER FEATURES, TEST PARAMETERS, OTHER PARAMETERS menu.
3) Use VIEW RECEIVED DATA to examine the pattern being received. The pattern being received may not be a standard test pattern.

8.1 Calibration

The SunSet E1 is a self-calibrating test set. It does not require you to perform any adjustments, and does not need to be returned to Sunrise Telecom for calibration. If you wish to reset the unit, from the Main Menu, enter Other Features, then System Configuration, and enter Factory Defaults. The E1 will return to the defaults setup.

If the Transmitter Frequency Adjustment, Option SS213, has been purchased, you will want to occasionally do a frequency calibration, especially after the SunSet has been exposed to temperature changes. Follow this procedure, after ensuring the SunSet has returned to the factory defaults:

1) From the MAIN MENU, enter the OTHER FEATURES menu
2) Enter the SYSTEM CONFIG MENU
3) Enter the SELF TEST, FREQ CAL item. The procedure will take approximately 30 seconds to complete.

Section 9 Specifications

9.1 CONNECTORS/PORTS
2.048 Mbps E1 interfaces: Tx, Rx, Ext Clock
75Ω: unbalanced/BNC (f) standard
Optionally, replace all BNC (f) with: 75Ω unbalanced 1.6/5.6 mm; 120Ω balanced BR2; or 120Ω Bantam
Printer/Remote Control: 8-pin mini DIN, RS232C/V.24 serial port, DTE
DC input for charging internal battery

9.2 STATUS/ALARM INDICATORS
20 super-bright LED indicators
Current status and alarm history
Power (green, on), Battery (red, when low)
Green:
Signal, HDB3 detected, PCM-31, PCM-30, CRC-4 detected, pattern sync
Red:
For Alarms: LOS, LOF (FAS, MFAS or MFAS-CRC), AIS, FAS
RAI, MFAS RAI, ALL TS AIS, Patt Sync Loss
For Errors: Code, Frame, Bit, (any) Error
Yellow:
Pattern Inverted

9.3 E1 GENERAL
Bit Error test rates: 2.048 Mbps, N (contiguous) and M (non-contiguous) x64 kbps (N & M=1to 31). Separate and independent receive and transmit time slot selection. Automatic configuration to time slots containing test pattern
Drop and insert to internal test circuitry N or M x64 kbps test pattern; or 64 kbps A-law decoded VF channel to built-in speaker/microphone
Line Coding: HDB3, AMI selectable
Framing: Unframed, PCM-30, PCM-31 with or without CRC-4. Conforms to ITU-T G.704
Graphical display of test set configuration. Key parameters for Tx and Rx interfaces and current status of alarms and errors

9.4 TEST PATTERN GENERATOR
General: 1111..., 0000..., 0101..., 1-in-8, 1-in-16, 3-in-24
PRBS: 2^n-1, n= 6, 7, 9, 11, 15, 20, 23. Conforms to ITU-T O.151, O.152, O.153, and ANSI V.52, V.57
Others: QRSS, 55 Octet, FOX
Programmable: 8 patterns, up to 2048 bits long with user-definable labels of up

to 10 alphanumeric characters for each pattern
Send and receive inverted test pattern
Send pattern independent of receive pattern

9.5 TRANSMITTER
Clock source:
Internal: 2.048 MHz (±5 ppm). Adjustable over ±30 kbps/2kbps steps and ±200 bps/2 bps steps (±100 ppm/1 ppm steps) with option SS213.
Loop: (recovered from Rx port) AMI or HDB3
External clock input port: (REF. CLK) 75Ω; 120Ω optionally
Line coding: HDB3, AMI
Pulse shape: Conforms to ITU-T G.703.
75ý/Unbal.: ±2.37V_{bp} (±10%) or
120ý/Bal.: ±3.0V_{bp} (±10%) with optional balanced interface
Programmable Send Frame Words:
Programmable NFAS Sa4-Sa8 bits (Option SW210), manual/auto E-bit setting (SW211). Set NFAS bit 3 (FAS RAI), set 4 bit NMFAS Word to 1 or 0 (SW210)
Set idle channel code and ABCD bits

9.6 ERROR/ALARM INJECTION
Code and/or bit error: programmable burst of 1 to 9999 errors manually, or continuous rate of $2x10^{-3}$ to $1x10^{-9}$
FAS: Error consecutive frames, programmable 1 to 5 FAS Words manually, or continuous rate of $2x10^{-3}$ to $1x10^{-9}$
CRC-4: Single, or continuous rate of $2x10^{-3}$ to $1x10^{-9}$
E-bit (Option SW211), Bit-Slip:Single manually
All channels: Single per time slot manually or continuous rate of $2x10^{-3}$ to $1x10^{-9}$. Errors injected equally in all selected channels in N or M x64 kbps (N & M=1 to 31), or all 30, 31 or 32 channels in E1 (Option SW171)
Generate AIS, TS16-AIS (PCM-30), MFAS RAI (PCM-30), FAS RAI (PCM-30 and -31), ALL TS AIS (PCM-30 and -31) alarms

9.7 RECEIVER
Frequency range: 2.048 Mbps ±30 kbps (±6 kbps from clock)
Input sensitivity:
Terminate, Bridge: +6 to -43 dB with Automatic Line Build Out (ALBO)
Monitor: -15 to -30 dB resistive loss
Auto configuration for framing (PCM-30, PCM-31 or unframed), CRC-4 (with or without) and line coding (AMI or HDB3)
Impedances:
Terminate, Monitor: 75Ω unbalanced, 120Ω balanced (option)
Bridge: > 5000ý
Jitter tolerance to ITU-T G.823

9.8 EXTERNAL CLOCK INTERFACES
Input Impedance: 75Ω unbalanced, 120Ω balanced (option)
Input Sensitivity: 0 to -30 dB resistive
Line Coding: HDB3
Frequency Range: 2.048 Mbps ±300 ppm

9.9 MEASUREMENTS
Large character display of NO ERRORS
All measurement screen headers include Elapsed Time, Remaining Time, Framing Type, Code, Input Port Termination State, Tx Pattern, Rx Pattern and CRC-4 state
Code errors: error count, ratio and current ratio, ES, %ES, SES, %SES, UAS, %UAS, AS, %AS, DM, %DM
Frame errors: FAS, MFAS and CRC-4 errors count and error ratios, ES, %ES, SES, %SES, UAS, %UAS, EFS, %EFS, DM, %DM
Bit errors: G.821 analysis; bit error, ratio and current error ratio, ES, %ES, SES, %SES, UAS, %UAS, AS, %AS, DM, %DM, Count and % of loss of pattern sync seconds, bit slip count
Signal and Alarm: Count of LOS seconds, AIS seconds, LOF seconds, FAS RAI seconds, MFAS RAI seconds, ALL TS AIS seconds; frequency in Hz, deviation in ppm, wander in UI
E-bit Errors (Option SW211): error count, ratio and current ratio, ES, %ES, SES, %SES, UAS, %UAS, AS, %AS, DM, %DM
Frequency Measurements: Max, Min, Current in Hz; Deviation from 2.048 Mbps in ppm; Clock Slip and Wander in UI. Bar graph indicates the direction and rate of signal frequency slipping in relation to measurement clock.
Signal level (V_{bp+}, V_{bp-} and V_{pp} in dBdsx) range: +7 to -36 dB
M.2100/550 Measurements: pass/fail status, %ES, %SES. Programmable measurement period and %HRP.
ITU-T G.826 Analysis: CRC-4 block based. EB, BBE, %BBE, ES, %ES, SES, %SES, UAS, %UAS, AS, %AS
Settable threshold for "low signal" range, 0 to -40 dB. Indication via reverse video message at the top of the screen.
Print on event, can be enabled or disabled
Automatic printout at settable time intervals
Measurement duration continuous or timed; settable up to 999 hours
Programmable time and date for start and stop of measurement

9.10 OTHER MEASUREMENTS
View received data View live traffic 2048 bits long (8 frames or one sub-multi-frame) in PCM-30, PCM-31 or unframed.
Display 8 time slots per screen
Stores 32 scrollable screens, hold

screen, print
Information displayed in ASCII, reverse ASCII, binary and hex
View time slot 0 (FAS, NFAS, CRC, MFAS/CRC Words, E-bits, Sa4-Sa8, A-bit) in PCM-30 and -31: 16 frames (Option SW210)
View time slot 16 (MFAS, NMFAS, ABCD bits for all 30 channels) in PCM-30: 16 frames (Option SW210)
Propagation Delay
Round trip signal transmission delay
Measures in microseconds and UIs (Unit Intervals).
Histogram Analysis
Graphical display of accumulated errors count (Bit, Code, CRC, FAS/ MFAS) and alarm seconds (LOS, AIS, LOF, Patt Sync Loss, FAS RAI, MFAS RAI)
Stores current results and past 7 days per hour, most recent 24 hours per 15 minutes
Pulse Shape Analysis
Scan period, 500 nsec
On screen pulse shape display with G.703 pulse mask verification and pass/fail indication
Displays pulse width, rise time, fall time in nsec (resolution 1 nsec), % over-shoot, % undershoot (resolution 1%), level in dB (resolution 0.1 dB)
Pulse mask storage and printing on a Seiko DPU-411 or equivalent printer
Transmit Stress: simultaneous display of code and bit errors, propagation delay; set internal clock over ±100 ppm with 1 ppm step
Save 15 test results and 1000 error and alarm events, available to screen view or print

9.11 VOICE FREQUENCY CAPABILITY

Tone generation: 0 dBm0/1020 Hz, can be enabled or disabled. Selectable Tx time slot.
VF Measurement: 30 Hz to 3904 Hz, 1 Hz resolution; +3 dBm0 to -60 dBm0, 0.1 dB resolution.
Companding: A-law
Built-in microphone for talk
Monitor speaker with volume control
ABCD bits monitor & transmit and view channel data byte (binary format) in selected channel
Simultaneous view of 30 channels ABCD signalling bits (PCM-30)

9.12 DIALING CAPABILITIES

DTMF dialing
32 digits, 10 speed dial numbers with alphanumeric names,
send digits 0..9 and pause
Programmable dial and interdigit (silent) period
MF dialing
32 digits, transmits CCITT MR2 MF tones, send digits 0..9 and pause

Programmable dial and interdigit (silent) period
MF dialing
32 digits, transmits CCITT MR2 MF tones,send digits 0..9 and combination 11 to 15
Choice of forward or backward tone sent

9.13 REMOTE CONTROL (SW100)
VT102 terminal emulation remote control via 8-pin mini DIN RS232C/V.24 DTE port
Same graphical interface on terminal/ PC monitor as on the test set
Circuit status table provides current and historical information on test set LEDs
Bit-mapped histogram and pulse shape cannot be remoted

9.14 ENHANCED ERROR INJECTION (SW171)
Errors are injected equally in all selected channels for N (contiguous) or M (non-contiguous) x64 kbps. For 2 MBps, N=30 for PCM-30, N=31 for PCM-31, N=32 for unframed.
Inject burst of 1 manually or rate from $2x10^{-3}$ to $1x10^{-9}$

9.15 ADVANCED FRAME WORD APPLICATIONS (SW210)
One-screen display of NFAS words for 6 odd-numbered frames
Set Sa4, Sa5, Sa6, Sa7, and Sa8 to 1, 0 or alternate 1/0 or 0/1
Set 4 bits of NMFAS bits to 1 or 0
Set ABCD bits of selected TS to 1 or 0
Set Bit 3 of NFAS word to 0 or 1 (FAS RAI)

9.16 E-BIT ANALYSIS AND INJECTION (SW211)
E-bit error measurement with ITU-T G.821 analysis
Transmit E-bits in response to received CRC-4 error
Inject E-bit error manually (single)

9.17 GENERAL
CE mark
Languages: English, French, German or Spanish (specify)
Field upgradable PCMCIA firmware card
Store and recall 10 instrument configurations by name
16 line x 32 character LCD display screen with electroluminescent backlight
Backlight continuous or time-settable from 1 to 99 minutes
Internal Battery: lead acid type
Battery operation time: 2 hrs., 15 min.

nominal
Unit charging time: 8 hours nominal
Power Source: 110/120/220/230/240 Vac @ 50/60 Hz
Printer/Communication port:
Text: standard ASCII scape sequence code
Graphics: standard Bit-image Graphic Mode (dot matrix)
Baud rate: 1.2, 2.4, 9.6 and 19.2 kbps. 9.6 kbps preferred.
Parity: none, even or odd
Stop-bit: 1 or 2 bits
Bits per character: 7 or 8
Selection of CR ot CR+LF
Print Screen via dedicated key
Self test and internal Tx frequency deviation calibration
Clear print buffer, erase NVRAM
Configure test set to pre-programmed factory default
Display version/option configuration of the test set

9.18 ENVIRONMENTAL

Operating Temperature: 0½ C to 50½ C
Storage Temperature: -20½ C to 70½ C
Humidity: 5% to 90% non-condensing
Size: 10.5 cm (W) x 6 cm (H) x 27 cm (L)
Weight: 1.2 kg (approx.)

Section 10 Customer Service

Sunrise Telecom Customer Service is available from 7:30 AM to 5:30 PM Pacific Standard Time (California, U.S.A.). Service is also available from Sunrise Telecom distributors.

Customer Service performs the following functions:

- Answers customer questions over the phone on such topics as product operation and repair
- Repairs malfunctioning SunSets promptly
- Provides information about product upgrades

The warranty period covering the SunSet E1 is 1 year from the date of shipment. A Return Merchandise Authorization (RMA) Number is required before any product may be shipped to Sunrise Telecom for repair. Out-of-warranty repairs require both an RMA and a Purchase Order before the unit is returned. All repairs are warranted for 90 days.

Please contact Customer Service if you need additional assistance:

Customer Service
Sunrise Telecom Incorporated
22 Great Oaks Blvd.
San Jose, CA 95119
U.S.A.
Tel: 1 408 363 8000
Fax: 1 408 363 8313

Technical Support:
(24 hrs) 1 800 701 5208
Email: support@sunrisetelecom.com
Internet:
http://www.sunrisetelecom.com

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, 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.

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.

Section 11 Abbreviations

A

AC - Alternating Current
ACK - Acknowledge
AIS - Alarm Indication Signal
AISS - Alarm Indication Signal Seconds
ALM - Alarm
ALT - Alternating
AMI - Alternate Mark Inversion
AS - Available Second
AVG - Average

B

BATT - Battery
BER - Bit Error Rate
BIT - Bit Error
BPV - Bipolar Violation (CODE error)
BTSLP - Bit Slip
BUFF - Buffer

C

CAS - Channel Associated Signalling
CER - CRC-4 Error Rate
CLK - Clock
CLKSLP - Clock Slip
CNFG - Configuration
COD - Code
CODE - Code Error
CONFIG - Configuration
CR - Carriage Return
CRC - Cyclic Redundancy Check
CRC-4 - Cyclic Redundancy Check Code - 4
CRCR - Cyclic Redundancy Check Block Error Rate
CURBER - Current Bit Error Rate

D

dB - decibel
dBdsx - decibel referenced to G.703 power level
dBm - decibel referenced to one milliwatt
DC - Direct Current
DCE - Data Communications Equipment
DCS - Digital Cross-Connect System
DET - Detected
DM - Degraded Minute
DIG - Digital
DN - Down
DSX - Digital Signal Cross-Connect
DTE - Data Terminal Equipment
DTMF - Dual Tone Multi Frequency

E

E1 - 2.048 Mbps signal
EBER - E-bit Error Rate
EBIT - E-bit
EFS - Error-Free Seconds
ENA - Enable
ERR INJ - Error Injection
ES - Errored Second
ET - Elapsed Time
EXTERN - External

F

F1 - Function 1
FALM - Frame Alarm Seconds
FAS - Frame Alignment Signal
FASE - Framing Word Errors
FASER - Framing Word Error Rate
FBE - Framing Bit Error
FBER - Framing Bit Error Rate
FE - Framing Bit Error
FE1 - Fractional E1
FER - Framing Bit Error Rate
FREQ - Frequency
FRM - Frame

H

HDB3 - High Density Bipolar Three
HEX - hexadecimal
HOLDSCRN - Hold Screen
Hz - Hertz

I

INTERN - Internal
INV - Inverted

L

LBO - Line Build Out
LED - Light Emitting Diode
LF - Line Feed
LOFS - Loss of Frame Second
LOG - Logical Error (BIT error)
LOS - Loss of Signal
LOSS - Loss of Signal Second
Lpp - Level peak-to-peak
LVL - Level

M

MAX - maximum
Mbps - megabits per second
MFAL - Multiframe Alarm Seconds
MFAS - Multiframe Alignment Signal
MFSE - Multiframe Word Error
MFSER - Multiframe Word Error Rate
MFRM - Multiframe
MIN - minimum
MON - Monitor
mS - Millisecond
MSRMT - Measurement

N

NV RAM - Non Volatile Random Access Memory

O

OCT - octet

P

P/F - Pass/Fail
PAT - Pattern
PBX - Private Branch Exchange
ppm - parts per million
PRBS - Pseudo Random Bit Sequence
PRN SCRN - Print Screen
PRNT - Print
PRNTR - Printer

Q

QRS - Quasi Random Signal

R

R - Receive
RAI - Remote Alarm Indication
RCV - Receive
REF - Reference
RESYNCH - Resynchronization
RT - Remaining Time
RX - Receive

S

SCRN - Screen
SES - Severely Errored Second
SIG - Signal
SMF - Sub-Multiframe
SS - SunSet
SW - Software
SYLS - Synchronization Lost Seconds
SYNC - Synchronization

T

T - Transmit
T/S - Time Slot
TS-16 - Time Slot 16
TERM - Terminated
TX - Transmit

U

UAS - Unavailable Second
UI - Unit Interval
uS - microSecond

V

V - Volts
VAC - Volts AC
VF - Voice Frequency

W

WNDR - Wander

X

XMT - Transmit

Section 12 Index

D

E

F

G

H

R