SUNRISE TELECOM
INCORPORATED

SunSet OCx

User's Manual

Preliminary Version

SA901

MAN-10870-001 Rev. A

Sunrise Telecom....a step ahead

22 Great Oaks Blvd.

Chapter 1
Initial Setup

Welcome to the SunSet OCx. This manual will take you through setting up and using your test set, helping you make full use of its extensive and flexible testing capabilities.

1.0 Unpacking the SunSet

Use the following procedure for unpacking your new SunSet:

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 both 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 or your national distributor.

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

6) Ensure the SunWare cartridge is fully seated in its slot (refer to Figure 1, SunWare Cartridge Installation).

7) Verify the plug is inserted in the OC1/3/3c Tx and Rx jacks, if the jacks are not in use, in order to keep the jacks clean.

8) Plug the AC Battery Charger, SS138, into an appropriate AC wall outlet:
120 VAC - 240 VAC

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 Battery Charger plugged in while operating the SunSet.

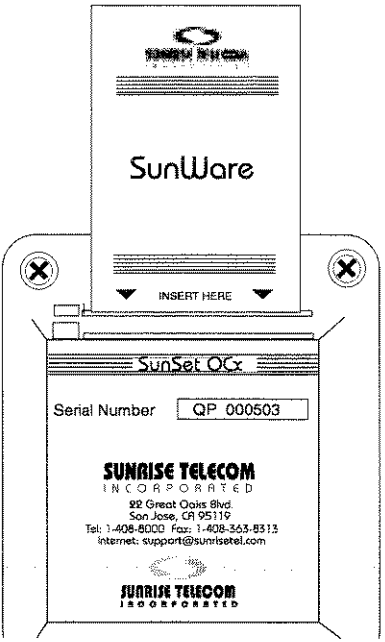

Figure 1
Cartridge Installation

NOTE: Each SunWare cartridge is mated to a single SunSet. If yourSunSet does not start properly, verify that the Serial Number printed on the SunWare Cartridge matches the Serial Number on the back of your SunSet.

When ordering SunWare upgrades, be sure to specify the Serial Number of the SunSet into which the new cartridge will be installed.

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

Please note your SunSet OCx features a second slot, which may hold an optional SRAM memory card.

2.0 Replacing the Battery Pack

1) Push down on the battery cover on the back panel, in the direction indicated by the arrow, to remove the battery cover. Refer to Figure 2.

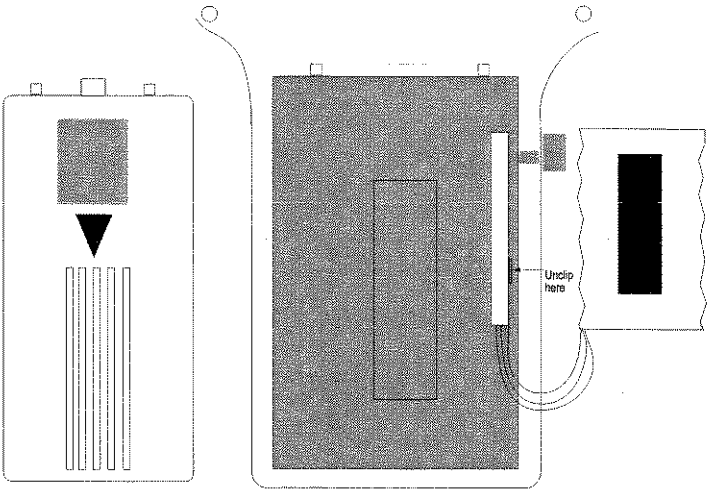

Figure 2 Replacing the Battery Pack

2) Pull the SS140 NimH battery pack off its velcro backing, and out of the set.

3) Unclip the battery pack, as indicated on Figure 2.

4) Clip in your new battery pack, replace it against the velcro inside the unit, and slide the battery cover back on, hooking the cover clips into the provided slots.
Please dispose of expired batteries safely.

Chapter 2
Test Set Description

1.0 Warnings

1.1 General

1) Insert and remove SunWare cartridges ONLY with the power switched OFF. Otherwise, SunWare cartridges may become damaged.

2) Use the SunSet charger only. It is marked with the Sunrise Telecom logo and AC Battery Charger name.

3) When bringing the SunSet from an extreme cold to warm environment, allow the SunSet to warm for at least 4 hours prior to use. Condensation may interfere with the operation of the test set and may result in damage if power is applied.

4) Do not immerse the set in water or expose the set to rain.

1.2 Laser Safety

This is a Class 1 laser product per IEC 825-1:1993 and CDRH, 21 CFR 1040.

Warning: Use of controls and procedures other than those specified in this manual may result in exposure to hazardous laser radiation.

Unterminated optical connectors may emit laser radiation. **Do not view with optical instruments.**

The LED on the optical panel and an indicator on the LCD indicates the status of the laser (ON/OFF). **Make sure to turn off the laser before connecting or disconnecting optical cables or before removing the protective plug**.

Optics Specifications
OC-3, OC-3c, OC-1
Single Tx/Rx, 1310 nm, SC Connectors
Transmit range: -8 to -15 dBm

2.0 Front View Description

Refer to Figure 3, SunSet OCx Front View for the front view of the SunSet OCx.

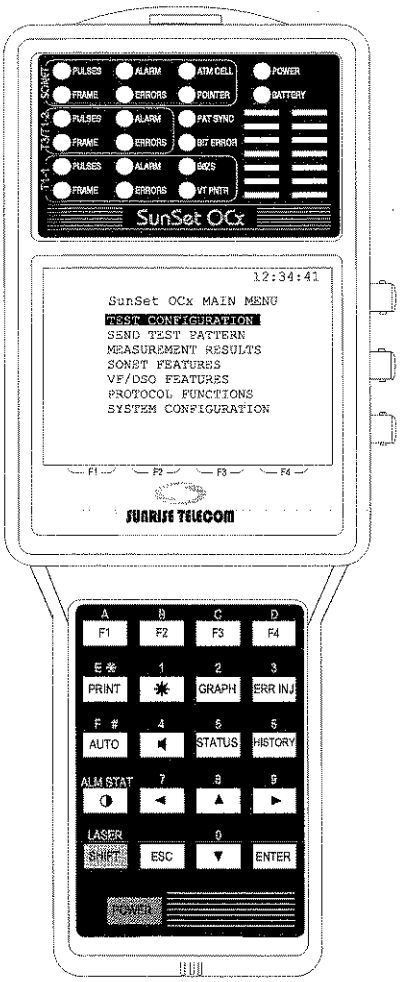

Figure 3 SunSet OCx Front View

2.1 Keys

Most SunSet keys perform two distinct operations. The white label on the key indicates what function will be performed if the key is pressed by itself. The orange label above the key shows what function will be performed if the SHIFT-lock key is pressed first. A SHIFT indicator will be displayed in the upper left-hand corner of the screen, in reverse video.

The SHIFT-lock key should not be pressed simultaneously with another key. Instead, the SHIFT-lock key should be pressed and then released. At this point the SHIFT indicator will appear. Any other key can now be pressed and released, and the SunSet 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 (upper left-hand corner of the screen) indicates the wrong shift status, simply press the SHIFT-lock key again.

White Labels

F-keys (F1, F2, F3, F4): These keys are used to select choices F1 through F4 at the bottom of the LCD display.

When you configure a setup screen, a number of options are typically available for each setup item. The available choices appear on the bottom of the screen. The desired option may be invoked by pressing the corresponding F-key directly below. Refer to Figure 4.

In Figure 4, the Framing is set to ESF by pressing the F1 key.

Note the following:

1) In most instances, when the desired F-key is pressed, the cursor will advance to the next line of the display automatically. To change the settings of a previous line, press the Up Arrow key, then re-select the option using the appropriate F-key.

2) 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.

3) 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 display the other options.

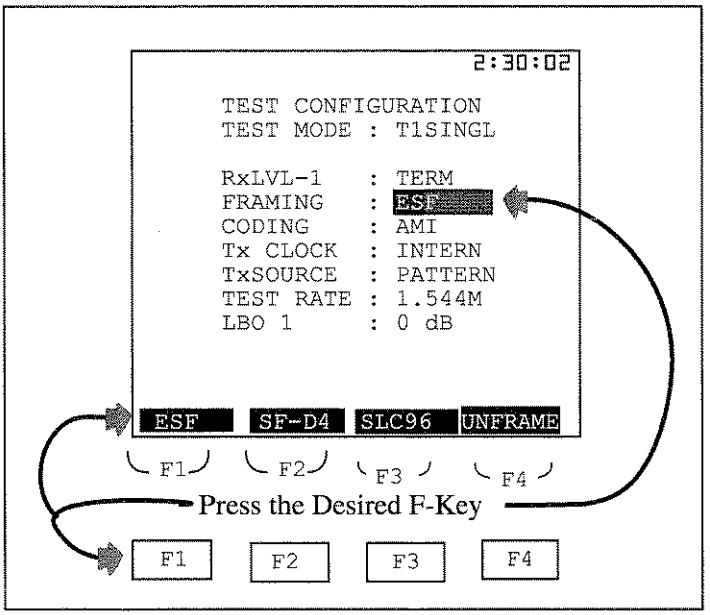

Figure 4 F-Keys

PRINT: The print key is used to print any alphanumeric and graphical information appearing on the screen.

✱ : 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 SunSet to maintain its battery charge approximately 15% longer.

GRAPH: The GRAPHic key displays a picture of the current circuit configuration and status. This function will be enabled in a future SunWare version.

ERR INJ: The ERRor INJect key is used to inject errors into the SunSet's transmitted signal. Errors are injected according to the current settings in the OTHER FEATURES/ ERROR INJECTION menu. If the error injection mode is set to rate, an error inject indicator (INJ) will appear on the top of the screen when you press this button.

AUTO: The AUTO key has two functions, which will be enabled at a future date:

1) AUTO lets the test set auto-synch on the received frame, and pattern.
2) Pressing the AUTO key will restart the measurements.

◀ : The volume key turns the speaker volume higher or lower via UP and DOWN F-keys on a graphical screen. Press EXIT (F3), ESCape, or ENTER when finished.

STATUS: Press this key to access the MEASUREMENT RESULTS menu. This function will be enabled in a future SunWare version.

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.

◑ : The CONTRAST key adjusts the contrast of the LCD screen. Press the key repeatedly until the contrast is as you wish.

▲, ▼, ▶, ◀ (Cursor or Arrow Up/Down/Left/Right): The arrow keys are used to move the cursor in the indicated direction.

ESCAPE: The ESCAPE key moves you back toward the main menu. To return to the main menu, keep pressing ESCAPE until you arrive there.

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, such as in Error Injection, pressing the ENTER key is required after the user finishes entering data in a given screen. In these cases, the SunSet will execute the inputs only after the ENTER key has been pressed. In most of the high usage functions, it is not necessary to press ENTER to invoke the operation. If the operation you are trying to perform will not begin, try pressing the ENTER key. When the ENTER key is used to invoke the operation, you may need to press ESCAPE to return to the previous menu.

Black Labels

SHIFT: The SHIFT-lock key is pressed to provide access to the functions specified by orange labels. The SHIFT-lock key should always be pressed first, then must be released before the desired orange-label key is selected. SHIFT-lock status is displayed in reverse video in the upper left-hand corner of the screen. The SHIFT-lock indicator must not be present when the white label functions are to be used. The SHIFT-lock indicator must be present when the orange-label functions are to be used.

POWER: The power key controls the ON/OFF function of the SunSet OCx. It is the red key located in the lower left-hand corner of the test set's keypad.

Orange Labels

LASER: This key toggles the LASER on and off. The laser automatically turns on when the test configuration is set to an optical rate. The LASER cannot be turned on unless the test configuration is set to an optical rate.

A, B, C, D, E*, F#: These keys are used to enter DTMF tones, 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.

2.2 LEDs

The bicolor LEDs provide a visual indication for the condition of the received signal. The LEDs provide enough diagnostic information at a glance that additional testing may not be required by some users. A LED will be lit green continuously when the particular condition for that LED is detected. For example, a continuous green light for T1-1 FRAME indicates that the test set has detected T1 framing for Line 1. A continuous red light denotes an alarm condition for the item. For example, the ERRORS LEDs light red if an error has been observed on the indicated signal.

Blinking lights provide historical information for the circuit condition. This is quite helpful if the user happened to be away from the set when the error or alarm condition occurred. Pressing the HISTORY key stops the blinking.

2.2.1 Common LEDs

PAT SYNC: Lights green if the unit has synchronized on the test pattern in the received signal. The received pattern must match the transmitted pattern. The pattern may be observed in MEASUREMENT RESULTS. When the unit is taking measurements, the SunSet will automatically attempt to synchronize on the pattern that is being sent. If synchronization is lost, the PATtern SYNChronization LED lights red.

No light indicates the set is receiving live data. If measurements are started, and the unit is detecting pules and framing but cannot achieve pattern synchronization, it will indicate LIVE data.

BIT ERR: Lights red if a BIT ERRor has been detected.

POWER: Lights green when the SunSet is switched on and has an adequate power source.

BATTERY: Lights green when the battery is being charged. The LED lights red when the SunSet's power supply voltage has dropped to a low level. A 15 minute countdown (900 seconds) is displayed after the BATTERY LED lights, indicating when the SunSet will automatically shut down.

Connecting the AC Battery Charger will allow you to use the SunSet indefinitely. However, if you plan to use the SunSet for an extended period of time, it is best to plug the AC Battery Charger in first. If the charger is plugged in while a measurement is in process and while the battery is not fully charged, the SunSet may automatically reset itself. In this case, the current measurement results would be lost.

2.2.2 SONET LEDs

(LASER) ON: This LED is located on the left side panel. It indicates the power status of the LASER.
Amber: LASER is ON.
No light: LASER is off.

PULSES
Green: Indicates that the test set is receiving valid SONET pulses.
Red: Indicates the test set is not receiving the expected SONET pulses, based on the test configuration.
No light: Indicates that SONET pulses are not expected with your particular test configuration.

FRAME
Green: Indicates that there is valid framing on the received SONET signal.
Red: Indicates the received framing is invalid.

ALARM
Red: Indicates that an alarm condition is detected on the received SONET signal.
No light: Indicates that no alarm condition appears on the received SONET signal.

ERRORS
Red: Indicates that some kind of error is detected on the received SONET signal.
No light: Indicates that there are no errors detected on the received SONET signal.

ATM CELL
No light: The LED is inactive and remains off until the user enters the ATM Functions menu tree. Note that ATM functionality will be enabled at a future date.
Green: The test set detects ATM cells, whether or not they have error or pass the receive filters.
Red: The test set does not detect ATM cells.

POINTER
Red: Indicates that the received OCx/STS signal has an invalid SPE pointer or 8 consecutive NDFs (New Data Flag).

No light: Indicates that the received SONET signal has a valid SPE pointer.

2.2.3 T3/T1-2 LEDs

These LEDs may apply to either a DS3 signal (received at the DS3 Rx jack, or embedded inside a SONET signal), or a second DS1 signal (T1DUAL mode), depending on your configuration.

PULSES

Green: Indicates that the test set is receiving valid T3 or T1 pulses from the selected source. The source could be the DS3 or T1-2 Rx jack, or a DS3 payload within a SONET signal.

Red: Indicates that the test set is not receiving the expected T3 or T1 pulses. The test set expects to receive these pulses based on your TEST CONFIGURATION.

No light: Indicates that T3 or T1 pulses are not expected with your particular TEST CONFIGURATION.

FRAME

Green: Indicates valid framing on the received DS3 or DS1 signal from the selected source. This will depend upon how the DS3 FRAME item has been configured in the TEST CONFIGURATION menu. The LED will light green only if the test set's framing configuration matches the framing found on the received DS3 or DS1 signal.

Red: Indicates that framing is specified in the TEST CONFIGURATION menu, but is not present on the received signal.

No light: Indicates that the received DS3 signal is specified as UNFRAMED in the SET UP INTERFACE menu.

ALARM

Red: Indicates that an alarm condition is appearing on the received DS3 or DS1 signal from the selected source.

ERRORS

DS3:

Red: Indicates that BPV, FBE, P-Bit parity, or C-Bit parity error(s) are currently appearing on the received DS3 signal.

No light: Indicates that no BPV, FBE, P-Bit parity, or C-Bit parity errors are appearing on the received DS3 signal.

T1-2:

Red: Indicates that BPV, FBE, CRC, or OOF error(s) are currently appearing on the received DS1 signal.

No light: Indicates that no BPV, FBE, CRC, or OOF errors are appearing on the received DS1 signal.

2.2.4 T1-1 LEDs

These LEDS apply to either a DS1 signal plugged in at the T1-1 Rx port, or a DS1/VT1.5 payload within a higher rate signal.

PULSES

Green: Indicates that the test set is receiving valid T1 pulses from the selected source.

Red: Indicates that the test set expects to receive valid T1 pulses from the selected source, but that none are appearing. The SunSet expects to receive these pulses based on your TEST CONFIGURATION.

No light: Indicates that T1 pulses are not expected with your particular TEST CONFIGURATION.

FRAME

Green: Indicates that valid SF, ESF, or SLC-96 framing has been observed on the received DS1 signal from the selected source. This will depend upon how the DS1 FRAME item has been configured in the TEST CONFIGURATION menu. The LED will light green only if the test set's framing configuration matches the framing found on the received DS1 signal.

Red: Indicates that the specified SF, ESF, or SLC-96 framing is not present on the received signal from the selected source.

No light: Indicates that the specified DS1 signal framing is UN-FRAMED, or that the no DS1 signal is selected.

ERRORS

Red: Indicates that BPV, FBE, CRC, or OOF error(s) are currently appearing on the received DS1 signal.

No light: Indicates that no BPV, FBE, CRC, or OOF errors are appearing on the received DS1 signal.

ALARM

Red: Indicates that an alarm condition is appearing on the received DS1 signal from the selected source.

B8ZS

Green: Indicates the set detects B8ZS line coding substitution on the received T1 signal from the selected source. B8ZS line coding will not appear on a DS1 signal which has been dropped out of a DS3 or STS-1.

No light: Indicates that B8ZS line coding is not present on the received T1 signal from the selected source.

Note: The B8ZS LED lights green only when B8ZS code substitution is detected (8 or more consecutive zeroes). An idle signal or other high ones-density signal does not cause B8ZS substitutions. In such cases, the test set will not light green.

VT PNTR (VT Loss Of Pointer)

Red: Indicates a VT frame with an invalid VT pointer or 8 consecutive NDFs.

2.3 Connector Panels

The SunSet OCx has two side connector panels, as shown in the following figures.

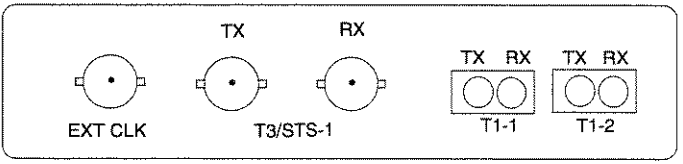

Figure 5 Right Side Connectors

EXT CLK: BNC connector used for external clock input from a frequency generator.

T3/STS-1 TX and RX: BNC connectors used for either a T3 or a STS-1 transmit and receive signal.

T1-1 TX and RX: Bantam connectors used for the Line 1 DS1 transmit and receive signal.

T1-2 TX and RX: Bantam connectors used for the Line 2 DS1 transmit and receive signal. T1-2 RX may also receive a BITS signal to use as an external clock.

Here is the left side panel:

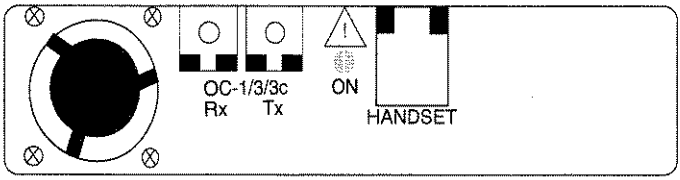

Figure 6 Left Side Connectors and LED

OC-1/3/3c TX and RX: Optical connectors used to transmit and receive an OC-1, OC-3, or OC-3c signal. Only one rate may be used at a time.

ON LED: This indicates the power status of the LASER. It lights amber when the LASER is ON. It does not light when the LASER is off. Note that the LASER automatically turns ON when an optical rate is selected.

WARNING: DO NOT STARE DIRECTLY INTO THE OC1/3/3c PORTS.

HANDSET: You may connect a handset here for VF talk and listen functions.

The top of the SunSet OCx also contains connectors. See Figure 7.

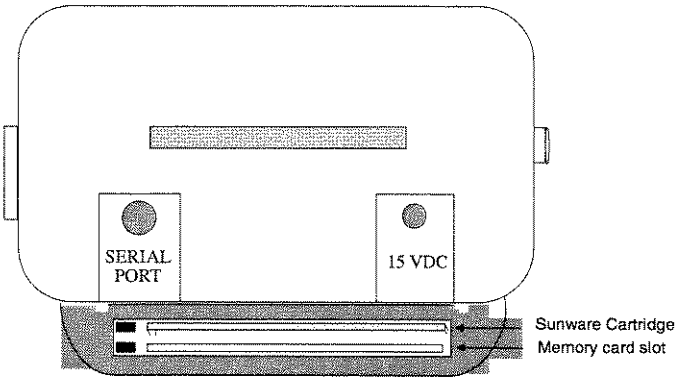

Figure 7 Top Panel

SERIAL PORT: The serial port is used for sending information to the Sunrise Telecom thermal printer or for operating the Remote Control. This port uses an RS-232C DTE configuration with hardware flow control when the 8-pin DIN to 25-pin D-Sub conversion cable is connected.

15 VDC: The SunSet charger, SS138, is plugged in here. 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.

Chapter 3
Menus

1.0 Introduction

The SunSet OCx operates with a menu-driven format. Before you can select a menu item, you must first highlight the desired line using the arrow keys. You can easily recognize a highlighted item, because the surrounding area is darkened while the writing is light-colored. This appearance is referred to as reverse-video in this manual. After highlighting the item, you may execute the selection by pressing the ENTER key, or the appropriate F-key when you are selecting an option. In a few specific cases, the simple action of highlighting an item will execute the selection. The SEND TEST PATTERN menu works in this way.

The following menu tree shows the location of each menu item. Items in italics will be available in a future SunWare release.

SunSet OCx MAIN MENU
TEST CONFIGURATION
LOOP BACK CONTROL
SEND TEST PATTERN
MEASUREMENT RESULTS
SONET FEATURES
  RECEIVE OVERHEAD BYTES
  TRANSMIT OVERHEAD BYTES
  ORDERWIRE CONTROL
DS3 FEATURES
DS1 FEATURES
VF/DS0 FEATURES
  VF MEASUREMENT
  VIEW SUPERVISION
  NOISE MEASUREMENT
OTHER FEATURES
  ERROR INJECTION
  PULSE MASK ANALYSIS
PROTOCOL FUNCTIONS
SYSTEM CONFIGURATION
  VERSION/OPTION
  ERASE NV RAM

The following sections within this chapter provide a detailed explanation of each menu item.

Get Started

Turn the unit by pressing the POWER key. The unit will perform a Self Test. You should see a NO ERRORS message when the test has completed. If you do see an error message, please contact Sunrise Telecom's Customer Service department at 1-800-701-5208.

Enter the TEST CONFIGURATION menu to configure the unit for testing.

2.0 Test Configuration

Before connecting the SunSet to your circuit, you must configure the TEST CONFIGURATION items properly. To access the TEST CONFIGURATION screen, press ESCAPE until you return to the Main Menu. Move the cursor to the TEST CONFIGURATION selection and press ENTER.

Setting up the TEST CONFIGURATION is the most important step in the entire test procedure. If the TEST CONFIGURATION items are configured improperly, all measurement results will be meaningless.

The F-keys show the available options for each setup parameter in the display. As the F-key is pressed in this screen, the SunSet immediately alters its configuration to reflect the new setting. The cursor will automatically move down to the next line.

The first selection in the TEST CONFIGURATION screen is TEST INTERFACE (or Mode, in the case of T1 SINGL and T1 DUAL), which is the high rate side of your test. Seven choices are available: OC-3c, OC-3, OC1, STS-1, DS3, T1 SINGL and T1 DUAL. The TEST CONFIGURATION menu differs for each mode selected.

After selecting the TEST INTERFACE, select the TEST PAYLOAD, which is the lower rate signal you will be testing within the higher (TEST INTERFACE) rate signal. The TEST PAYLOAD options will depend on the TEST INTERFACE selected.

Additionally, more than one payload rate is available for most of the Test Modes (such as OC-3 and STS-1). Hence, there are a variety of testing setups available. Not all settings or options listed for a particular Test Interface or payload will necessarily be available; it all depends on the requirements for a particular test.

Often times, an intermediary rate must also be configured; for

example, select OC-1 as your TEST CONFIGURATION, and DS1 as the PAYLOAD, and you will also have to configure the intermediary DS3 rate. Note that OC-3c, T1SINGL and T1DUAL do not have payload rates. The following table shows the rates and their payloads:

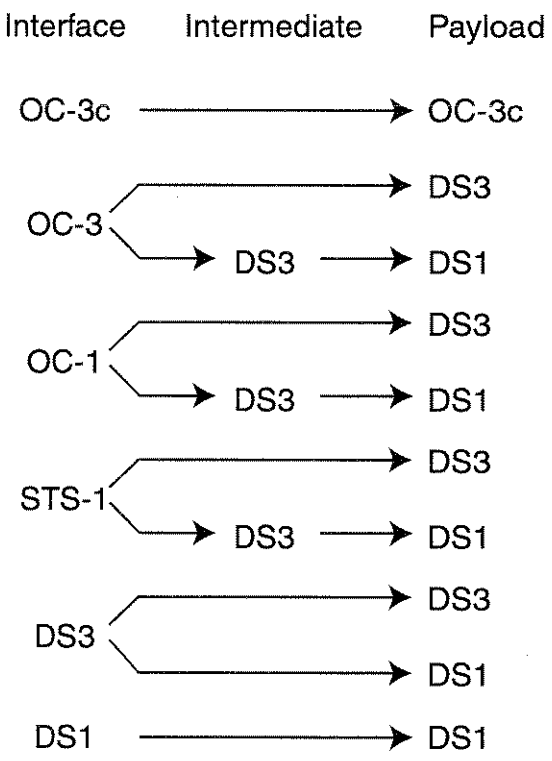

Figure 8 Rates and Payloads

Here are the test configurations:

T1SINGL Mode: Used for DS1-only testing.

T1DUAL Mode: Used to test two DS1 lines.

DS3 Mode: Used for DS3-only testing.

DS3/DS1 Mode: Used to test a channelized DS3; test a specfic DS1 inside a DS3. Select DS3 for the TEST INTERFACE and DS1 for the TEST PAYLOAD.

STS-1/DS1 Mode: Used to test one DS1 within an STS-1 signal.

Select STS-1 for the TEST INTERFACE and DS1 for the TEST PAYLOAD. You will also need to configure the DS3 settings.

STS-1/DS3 Mode: Used to test a single DS3 within an STS-1 signal. Select STS-1 as the TEST CONFIGURATION and DS3 as the TEST PAYLOAD for this type of testing.

OC-1/DS3 Mode: Used to test a DS3 within an OC-1 signal. Select OC-1 as the TEST INTERFACE and DS3 as the TEST PAYLOAD.

OC-1/DS1 Mode: Used to test a DS1 within a DS3 within an OC-1 signal. Select OC-1 as the TEST CONFIGURATION and DS1 as the TEST PAYLOAD.

OC3/DS3 Mode: Used to test a DS3 within an OC-3. Select OC-3 as the TEST INTERFACE and DS3 as the TEST PAYLOAD.

OC-3/DS1 Mode: Used to test a one of the 28 DS1s within one of three DS3s within an OC-3 signal. Choose OC-3 as the TEST INTERFACE and DS1 as the TEST PAYLOAD.

OC3-c: Used to test an OC-3cSelect OC-3c as the TEST INTERFACE. OC-3c is automatically set as the TEST PAYLOAD.

2.1 Configurations

This section contains the setup choices for the different rates. Note that not all settings are available under all test setups. Here are a few sample screens. In Figure 9, the user is testing a DS1 within an OC-3 signal.

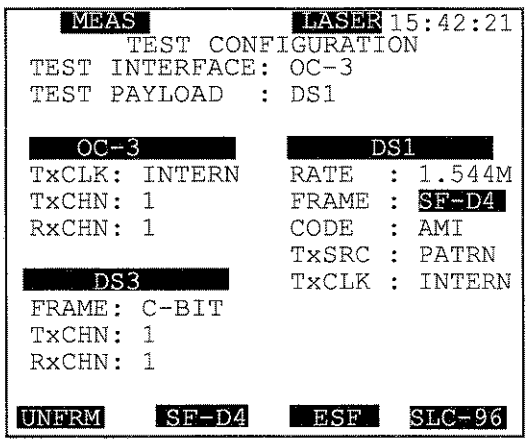

Figure 9 OC-3/DS1 Config

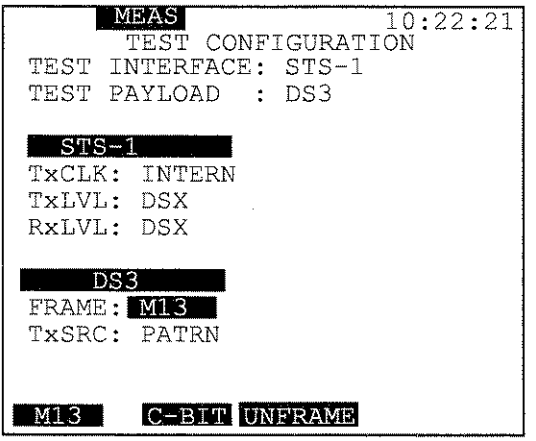

Figure 10 STS-1/DS3 Configuration Screen

In Figure 10, the user is testing a DS3 within an STS-1.

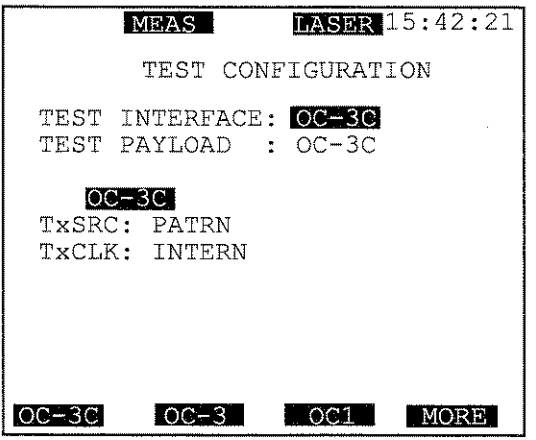

Figure 11 OC-3c Configuration

In Figure 11, the user is testing an OC-3c.

2.1.1 OC-3c Settings

TxSRC

Options: PATRN (F1), THRU (F2)

Determine the source of the OC-3c signal.

- Select PATRN (F1) to transmit a OC-3c test pattern in each time slot. This test pattern is configured in the SEND TEST PATTERN menu.
- Select THRU (F2) to loop the incoming OC-3c signal from the OC3 Rx to Tx.

TxCLK

Options: INTERN (F1), BITS (F2), OC3LOOP (F3)

Determine the clock source for the signal transmitted out the OC3 jack.

- Select INTERN (F1) to use the internal timing of the test set.
- Select BITS (F2) when a Building Integrated Timing Source is available. Plug the BITS in at the T1 Line 2 Rx port.
- Select OC3LOOP (F3) to have the set to use the timing signal received on OC3 Rx as the clock source for its OC-3 transmit signal.

2.1.2 OC-3 Settings

TxCLK

Options: INTERN (F1), BITS (F2), OC3LOOP (F3)

Determine the clock source for the signal transmitted out the OC3 jack.

- Select INTERN (F1) to use the internal timing of the test set.
- Select BITS (F2) when a Building Integrated Timing Source is available. Plug the BITS in at the T1 Line 2 Rx port.
- Select OC3LOOP (F3) to have the set to use the timing signal received on OC3 Rx as the clock source for its OC-3 transmit signal.

TxCHN

Options: 1 (F1), 2 (F2), 3 (F3)

Determine which STS inside the OC-3 will be used for transmit-

ting.

RxCHN
Options: 1 (F1), 2 (F2), 3 (F3)
Determine which STS inside the OC-3 will be used for receiving.

- As you change the TxCHN, the RxCHN will also correspondingly change, and should usually be the same. You may however set them to different numbers.

2.1.3 OC-1 Settings

TxCLK
Options: INTERN (F1), BITS (F2), OC1LOOP (F3)

- Select INTERN to use the unit's internal timing.
- Select BITS to use a Building Integrated Timing Source, plugged in at the T1-2 Rx port.
- Select OC1LOOP to use the timing received from the OC1 Rx port as the clocking source.

2.1.4 STS-1 Settings

TxCLK
Options: INTERN (F1), BITS (F2), STSLOOP (F3)
Determine the transmit clock for the signal transmitted out the STS-1 jack.

- Choose INTERN (F1) to use the unit's internal timing; when the 5 ppm accuracy of the INTERNal clock is sufficient.
- Select BITS to use a Building Integrated Timing Source, plugged in at the T1 Line 2 Rx port.
- Select STSLOOP (F3) to have the SunSet loop the timing received on the STS-1 Rx jack to the STS-1 Tx jack.

TxLVL
Options: HIGH (F1), DSX (F2), LOW (F3)
TxLVL sets the transmit signal level.

- High gives you the highest level pulse, .9V base to peak nominal voltage.
- DSX adheres to the GR-253-CORE standard for base to peak at a DSX-3, between .36V and .85V.
- Low sets a pulse of .15V base to peak nominal voltage.

RxLVL

Options: HIGH (F1), DSX (F2), LOW (F3), MON (F4)

Determine the received signal level.

- RxLVL does not necessarily have to be set at the same value as the TxLVL.
- Choose DSX when you are plugged into an STSX1 OUT jack.
- Select LOW when you are plugged into an STSX1MON jack.
- The HIGH option is generally not used.

2.1.5 DS3 Settings

TxCLOCK

Options: INTERN (F1), DS3LOOP (F2)

Determine the clock source for the signal transmitted out the DS3 jack.

- Select INTERN (F1) to use the internal timing of the test set.
- Pressing DS3LOOP (F2) uses the timing signal received on DS3 Rx as the clock source for the DS3 transmit signal.

TxLVL

Options: HIGH (F1), DSX (F2), LOW (F3)

TxLVL sets the transmit signal level.

- HIGH (F1) gives you the highest pulse, .9V base to peak nominal voltage.
- DSX (F2) adheres to the ANSI T1.102 standard for use at a DSX-3, in between .36V and .85V.
- LOW (F3) sets a pulse of .15V base to peak nominal voltage.

RxLVL

Options: HIGH (F1), DSX (F2), LOW (F3)

Determine the received signal level.

- RxLVL does not necessarily have to be set at the same value as

TxLVL.

- You should choose DSX (F2) when you are plugged into a DSX-3 OUT jack.
- Select LOW (F3) when you are plugged into a DSX-3 MON jack.
- Select HIGH (F1) when you are receiving a low .15V signal from other than a DSX-3 MON.

FRAME

Options: M13 (F1), C-BIT (F2)

Configure the DS3 signal framing.

TxSRC

Options: PATRN (F1), THRU (F2)

Determine the source of the DS3 signal.

- Select PATRN (F1) to transmit a DS3 test pattern. This test pattern is configured in the SEND TEST PATTERN menu.
- Select THRU (F2) to loop the incoming DS3 signal from the DS3 Rx to Tx.

Tx/27

Options: AIS (F1), BRDCAST (F2)

Determine what you will transmit on the 27 unused DS1s.

- Choose AIS to insert an AIS signal on the DS3 line. This might be used if the DS3 is out-of-service.
- Choose BRDCAST to transmit your selected test pattern on all 28 DS1s simultaneously. This is for out-of-service testing only.

TxCHN

Options: any number from 1-28

Determines which DS1 inside the DS3 to transmit on.

- Press NEXT (F1) and/or PREVIUS (F2) to select the desired DS1

RxCHN

Options: any number from 1-28

Determine which DS1 inside the DS3 toreceive on.

- As you change the TxCH, the RxCH will also correspondingly change. To select a different receive channel, cursor to RxCH, and use the NEXT (F1) and/or PREVIUS (F2) to select the

desired DS1.

- The Tx and Rx channel should usually be the same, unless you are testing across a 3x1 DCS where the DS1 signal has been switched from one channel to another as it passes through the DCS.

2.1.6 DS1 Settings

T1 may be either a payload, a single line under test, or two lines under test. Select T1SINGL for the TEST MODE to configure to test a single line. Choose T1DUAL to test two DS1 lines. Refer to Figure 12 for a sample T1SINGL screen, and Figure 13 for the T1DUAL screen.

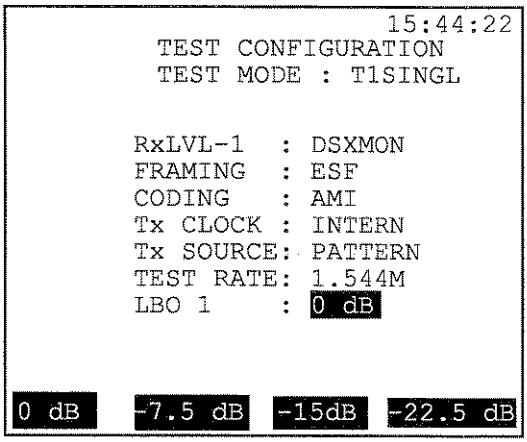

Figure 12 DS1 Single Mode Configuration

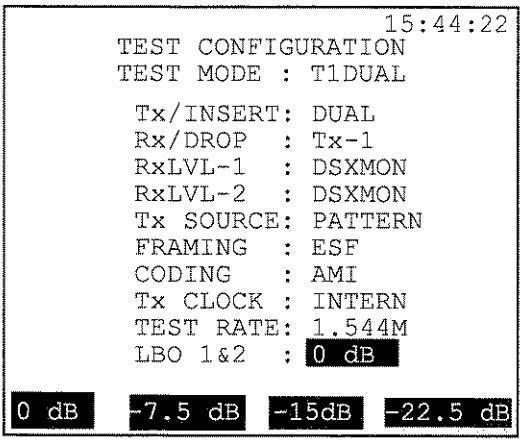

Figure 13 DS1 Dual Mode Configuration

The following items are available for configuration in the T1 modes. Note that a few items specific to only the DS1DUAL screen are included at the end of this section.

Rx LVL-1 and **RxLVL-2** (if present; appears in T1DUAL mode)
Options: TERM (F1), DSXMON (F2), BRIDGE (F3)
Configure the Line 1 or Line 2 DS1 receiver.

- The TERM mode should be used when you will both send and receive a T1 signal. It requires that the circuit be disrupted for testing. The received signal is terminated by the test set. It is not obtained through a MONITOR jack and it can have up to 36 dB of cable transmission loss (this is a different kind of loss than the 20 dB of resistive loss provided by a DSX MON jack).

Note that if you plug into a DSX MON jack in the TERM mode, the BPV LED will probably come on. Use the DSXMON mode instead.

- The DSXMON access mode should be used when a monitor measurement will be made. The signal is provided from the MON jack of a DSX, DS1 plug-in card, CSU, or NI. The DSX has isolated the MON signal from the live signal with a high impedance circuit. The transmitter is turned on and is sending the selected test pattern.

This mode is useful because the DSX monitor jack 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 using it and to see if there are any problems.

Note that if DSXMON mode is selected when a 3V signal is received, then the red ERRORS LED will be lit. This often happens if DSX MON is selected when the test set is plugged into an OUT jack. In this case, TERM should be selected instead of DSXMON. In some cases, it may not be clear if the MON jack provides a bridged access or a 20 dB isolated monitor access. In this case, you should try BRIDGE first to see if this work, and then try DSXMON if it doesn't.

- The BRIDGE monitor is similar to the DSXMON monitor. However, in BRIDGE, the test set taps into a live, in-service, terminated DS1 signal with up to 36 dB cable loss. The set applies isolation resistors to protect the circuit from a hit. Be sure to select BRIDGE before clipping onto the live circuit. This will put the isolation resistors in place and ensure that the test set does not place a hit on the circuit.

  If you use BRIDGE mode on a DSXMON jack, there will be a total of 40 dB resistive isolation, and the test set will likely report loss of signal. Also, in some cases it may not be clear if the monitor jack being used provides a bridged access, or a 20 dB isolation monitor access. In this case, you should try BRIDGE first to see if this works, and then try DSXMON if it doesn't.

FRAME

Options: UNFRM (F1), SF-D4 (F2), ESF (F3), SLC-96 (F4)

- Select UNFRM (F1) for no framing
- Press (F2) for SF-D4 (Super Frame) framing
- Press (F3) for ESF (Extended Super Frame) framing
- Press (F4) for SLC-96 framing

CODE

Options: AMI (F1), B8ZS (F2)

Determine the line code which is to be transmitted on the test set's DS1 signal.

- AMI (Alternate Mark Inversion) uses alternating positive and negative pulses to represent successive 1 values. In AMI, there is a risk of synchronization loss during long strings of zeroes.
- B8ZS (Bipolar 8 Zero Substitution) uses intentional BPVs to encode strings of eight consecutive zeroes.

It is not always possible to determine the line coding of a circuit. For instance, an all 1s signal will mask the presence of B8ZS coding.

Be sure you choose this setting correctly. An incorrect AMI/B8ZS setting is the most common problem in setting up the test set to transmit to switches, channel banks, multiplexers, and digital cross connect systems. The test set's code setting must be the same as that of the equipment at the other end of a DS1 line.

TxCLK

Options: INTERN (F1), Rx-1 (F2), Rx-2 (F3), EXTERN (F4), LOOP (F4)

This item determines the source of the transmit clock.

Internal timing (F1) should be used when:
- an external frequency source is not available.
- the test set will not be transmitting towards synchronized network equipment.
- the test set will be supplying clock to the circuit to be tested such as a hi cap T1 loop, PBX, or remote terminal of a digital loop carrier.
- the 5 ppm accuracy of the INTERNal clock is sufficient.
- most kinds of loopback testing is performed.

DS1 received timing, received from a DS1 source plugged in at Line 1 (Rx-1, F2) or at Line 2 (Rx-2, F2) should be used when:
- the set should be synchronous to the network.
- the set is performing FT1 Nx64 measurements towards a switch or DCS.

External timing, plugged in at should be used when
- precise measurements are required
- an external frequency source such as the central office clock is plugged in.

Loop Timing

- select STS/LOOP or DS3/LOOP to drop the timing from the received signal and loop it.
- should be used when the set should be synchronous with the network.
- not available in T1SINGL or T1DUAL mode.

RATE

Options: 1.544M (F1), Nx64K (F2) , Nx56K (F3)

Set the desired test rate for your test signals.

- Choose 1.544M (F1) for full rate DS1 testing.
- Choose Nx64K (F2) for fractional T1 testing, where the fractional circuit is any number of 64 kbps channels within the DS1.
- Choose Nx56K (F3) where the fractional circuit is any number of 56 kbps channels within the DS1. In this case, the test set will transmit a 1 in the eighth (least significant) bit of each fractional T1 channel.

If you have chosen one of the fractional settings, you will see the following display shown in Figure 14:

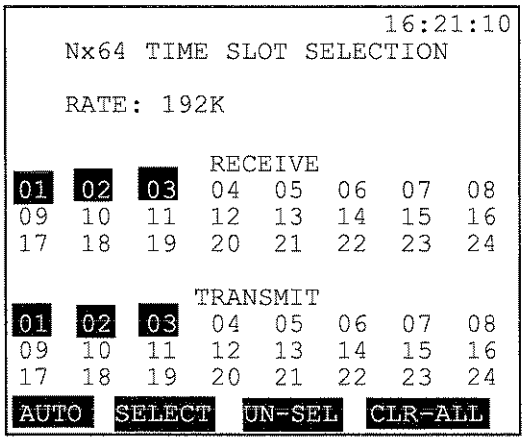

Figure 14 Fractional T1 Screen

To select the channels:

- To have the set automatically configure itself to the fractional T1 channel, press (F1) for AUTO. The test set performs this auto configuration by looking for the 7F or FF idle code, eliminating

the unused channels.

- To select the T1 channels manually, move the cursor to the desired channel using the arrow keys.
  a) Press SELECT (F2). The reported rate will change as you make or clear selections.
  b) Repeat this procedure until all the desired channels have been selected.
  c) As you configure the RECEIVE timeslots, the set will automatically simultaneously choose the corresponding TRANSMIT channels. To configure the TRANSMIT timeslots differently, cursor down and select the timeslots manually.
  d) If you inadvertently select an undesired channel, simply press the UN-SEL key (F3).
  e) Press CLR-ALL to deselect everything and start over again.

Note: Pressing the ENTER key will save your timeslot selections.

TxSRC or Tx Source

Options: PATTERN (F1), THRU (F2)

Determine the source of your DS1 test signal.

- Select PATTERN (F1) to transmit the DS1 test pattern. This test pattern is configured in the SEND TEST PATTERN screen.
- Select THRU (F2) to loop each of the incoming channels from the DS1-Rx to Tx without placing any test pattern onto the line. When you select THRU, the test set automatically adjusts the XMT CLK for DS1-Rx.

TxLBO (1&2 in T1DUAL Mode)

Options: 0 dB (F1), -7.5 dB (F2), -15 dB (F3), -22.5 dB (F4)

This item determines the Line Build Out (TxLBO) appearing on your transmitted T1 signal. Line Build Out is used to stress test a line by attenuating the dB to a certain level.

0 dB should be used when:

- the set is plugged in at the front panel jack of a DSX, CSU equipment direction, NI equipment direction, channel bank, or other 3V test point.
- under most conditions.

-7.5 dB , -15 dB, or -22.5 dB should be used when:

- transmitting toward the T1 span from a central office or customer

premises and a 7.5 dB, 15 dB or 22.5 dB attenuator is not in series with the set.

- when the signal should be transmitted at a lower level to prevent near-end cross talk problems.
- when the signal should be attenuated so that it arrives at the next repeater at approximately -31 dB DSX level.

Following are the additions for DS1DUAL:

Tx/INSERT

Options: L1-Tx (F1), L2-Tx (F2)

Determine on which line you will transmit a DS1 test pattern. The other line is passed through.

- Select F1 to transmit out the line 1 port
- Select F2 to transmit out the line 2 port

Rx/DROP

Options: L1-Rx (F1), L2-Rx (F2)

Determine on which receive line you will conduct measurements.

- Select F1 to test at the line 1 port
- Select F2 to test at the line 2 port

3.0 Send Test Pattern

The Send Test Pattern menu, as displayed below in Figures 15 and 16, may be accessed through the Main Menu. This screen and the available test patterns vary depending on the Mode selected in TEST CONFIGURATION. When a Payload of DS1 has been chosen, the screen appears as in Figure 15. See Figure 16 for the DS3 payload test patterns.

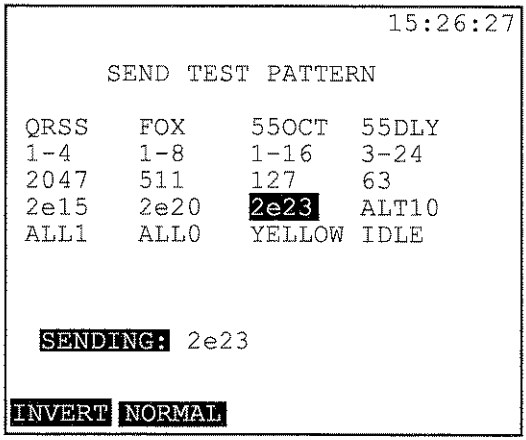

Figure 15 DS1 Send Test Pattern

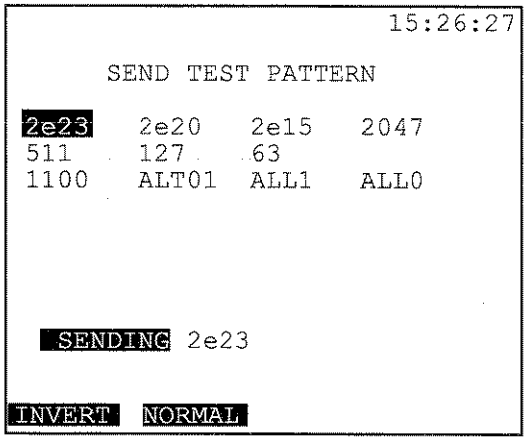

Figure 16 DS3 Test Patterns

Available Patterns:
DS1 test mode: all patterns, as shown in Figure 15.
DS3 test mode: 2e23, 2e20, 2e15, 2047, 511, 127, 63, 1100, ALT10, ALL1, ALL0
OC3c test mode: 2e23, 2e20, 2e15, 2047, 1100, ALT10, ALL1, ALL0

- Use the arrow keys to move the cursor to the test pattern of interest.

- Note that the SENDING message changes as each new pattern is highlighted.
- As each pattern is highlighted, the SunSet immediately begins transmitting that pattern.
- Press INVERT (F1) to send the selected pattern in an inverted form (1s and 0s reversed). Press NORMAL (F2) to return to normal .
- When a test pattern is being sent inverted, you will see an 'INVERTED' message after the pattern name in the SENDING field.
- When finished, press ENTER or ESCAPE to return to the Main Menu.

3.1 Standard Patterns

This section defines the patterns transmitted and recognized by the SunSet OCx. The long patterns are written in hexadecimal notation, 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.

2e23: 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 contains up to 22 zeroes in a row and violates standards for consecutive zeroes in AMI-coded transmission.

2e20: 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 contains up to 19 zeroes in a row and violates standards for consecutive zeroes in AMI-coded transmission. QRS is derived from this pattern.

2e15: The $2e^{15}$-1 pseudo random bit sequence. This signal is formed from a 15-stage shift register and is not zero-constrained. This pattern contains up to 14 zeroes in a row and does not violate standards for consecutive zeroes in AMI-coded transmission.

2047: The 2047 bit code used for DDS applications.

511: The 511-bit code used for DDS applications.

127: The 127-bit code used for DDS applications.

63: The 63-bit code used for DDS applications.

QRSS: This is the Quasi Random Signal pattern. It is formed from a 20-stage shift register and is zero-constrained for a maximum of 14 consecutive zeroes. When transmitted in a framed signal, up to 15 consecutive zeroes will occur, in accordance with AMI minimum density requirements.

1100: This pattern represents a DS3 idle code. The DS3 IDLE code is a signal with valid M-frame Alignment Channel and P-bit Channel and with an information bit sequence of 1100.

ALT10: The 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`

This pattern also represents a DS3 Alarm Indication Signal (AIS). The DS3 AIS is a signal with a valid M-frame Alignment Channel, M-subframe Alignment Channel and P-bit Channel. Bits X1 and X2 are set to 1, while bits C1, C2 and C3 are set to 0 and an information bit sequence of 1010... (beginning with a 1 after each M-frame Alignment, M-subframe Alignment, X-bit, P-bit and C-bit Channels) is transmitted on the returning DS3 signal.

ALL1: The all 1s pattern is used for stress testing T1 AMI and B8ZS lines. 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`

ALL0: The all zeroes pattern. This pattern is often used to make sure that clear-channel lines have been properly provisioned for B8ZS during circuit turn-up. If a portion of the circuit is AMI, then pattern synch and/or signal will be lost. The pattern is: `0000`

1-4: The one-in-four pattern is used for stress testing circuits. It is frame aligned. The pattern is `0100`

1-8: The 1 in 8 pattern is used for stress testing AMI and B8ZS lines. 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 1 in 16 pattern is used for overstressing AMI lines. It violates industry standards for pulse density. Therefore an AMI circuit that fails this test could still be a good circuit. The pattern is frame aligned ("f" is the framing bit) as shown in its binary form:

```
f 0100 0000 0000 0000
```

3-24: The 3 in 24 pattern is used for stress testing AMI lines. It is the 12.5% minimum 1s density pattern. The pattern is frame aligned ("f" is the framing bit) as shown in its binary form:

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

FOX: The industry-standard FOX pattern is used in data communications applications. The ASCII translation of the pattern is the " Quick brown fox jumped over the fence 0123456789 " 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
```

55OCT: This is the original 55-octet pattern. It is used for stress testing T1 circuits and network elements. If transmitted in a framed signal with AMI coding, it will violate the 15-zero constraint. It does not violate the zeroes constraint in an unframed signal. If framed, the framing bit is inserted at octet boundaries. Here is the actual pattern:

```
80, 80, 80, 80, 80 80, 00, 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
```

55DLY: The Daly 55 Octet pattern is a special stress pattern that obeys industry standards for pulse density and maximum con-

secutive zeroes in both AMI and B8ZS coded circuits. It is used for stress testing T1 circuits and network elements. If transmitted in a framed signal with AMI coding, it will violate the 15-zero constraint. It does not violate the zeroes constraint in an unframed signal. If framed, the framing bit is inserted at octet boundaries. Note that the Daly 55 octet pattern replaced the original 55 octet pattern. Here is the Daly 55 octet pattern:

```
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
```

IDLE: This is the industry-standard IDLE pattern. Here is the pattern:

```
f 0001 0111
```

YELLOW: This is the industry-standard YELLOW alarm pattern, used for SF framing. Here is the pattern:

```
f 1011 1111
```

4.0 Measurement Results

- The SunSet OCx continuously performs measurements on its received signal(s).
- The user need not access the Basic Measurements menu in order for measurement results to be compiled.
- Measurements are automatically restarted every time the configuration is significantly changed.
- The Measurement Results screen allows you to view the accumulated measurements and restart the measurement process.
- MEAS is shown in reverse video at the top left of the screen whenever measurements are in progress.
- The screens available will depend on your configuration; each rate will have its own results screens. Refer to the type of signal in the following sections to find the corresponding results available.

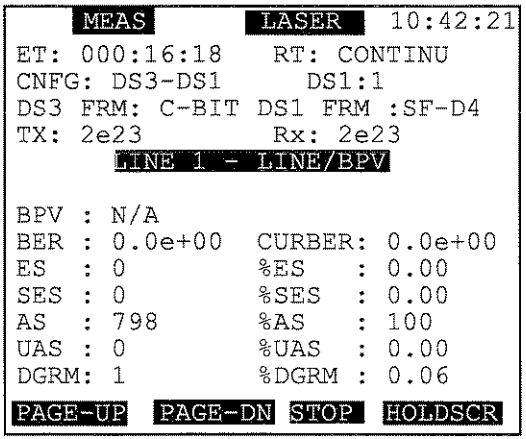

Figure 17 Measurement Results

The actual measurement results screen and the values displayed depend upon the Test Mode chosen in TEST CONFIGURATION. There are, however, some common features in all the Measurement Results screens. Figure 17 displays a sample Measurement Results screen.

Measurements may have a count number displayed on the left side of the screen, and the corresponding rate or percentage displayed on the same line on the right side. For example, ES, the

count of errored seconds, is displayed on the left column, while %ES, the percentage of errored seconds, is displayed on the right column, as shown in Figure 17.

Here are the function keys common to each of the screens:

PAGE-UP (F1), PAGE-DN (F2): These keys allows you to view each of the pages of available measurement results.

STOP/START (F3): Pressing STOP causes the SunSet to stop the test. Pressing START restarts the measurement process from within this menu.

HOLDSCR/CONTINU (F4): HOLDSCREEN freezes all of the measurement displays so they may be easily observed. The measurement count is still proceeding, but the counts are updated only in memory. You may now read the previous counts clearly. When you have finished viewing the screen, press the CONTINU key to view your updated measurement results, and return to a live display.

In addition to the actual measurement data, the following information is displayed in the upper portion of the measurement screens:

Current Time: The current time of day is displayed in the upper right-hand corner of the screen.

ET (Elapsed Time): Elapsed Time is the time that has passed since the test was started, or:

1. since the SunSet was switched on.
2. since the SunSet was reconfigured using the SET UP INTERFACE menu.
3. since the process was restarted using the (F3) RESTART key.

RT (Remaining Time): Remaining Time is the time that remains until the end of testing. The factory default condition is that the test runs continuously until the user stops it. For this reason, CONTINU is displayed in the RT field to denote a continuous test.

CNFG: This is your test configuration, as determined by your TEST CONFIGURATION and TEST PAYLOAD settings. The possible configurations are: OC3c, OC3-DS3 or DS1, OC1-DS3, or DS1, STS-DS3, DS3 or DS1, DS3, DS3-DS1, T1SINGL,

and T1DUAL. If there are a multiple payloads, there will often be bracketed numbers, indicating the number of each of the rates; for example, an OC1/ DS1 configuration might list STS[DS1]: 1[1], indicating the first DS1 within the first STS within the OC1 is under test.

Tx: This is the test pattern the unit is transmitting.

Rx: This is the test pattern the unit is receiving. Note that if Pattern Sync cannot be achieved, the unit will report 'LIVE' here.

Summary Screen

The first screen presented in MEASUREMENT RESULTS is the SUMMARY screen. It gives you an overview of the status of the line. NO ERRORS will be reported in bold letters if the line is error-free. The type of error received will be shown if errors are being received. This screen will update throughout the test.

Bit Performance Screen

This screen is a special case. It appears for the payload rate. It reports on any bit errors in the payload, or the G.821 specifications on a DS1 line. The final subsection covers these results.

4.1 SONET Measurements

These results report on the SONET rate. Here is a sample Summary screen:

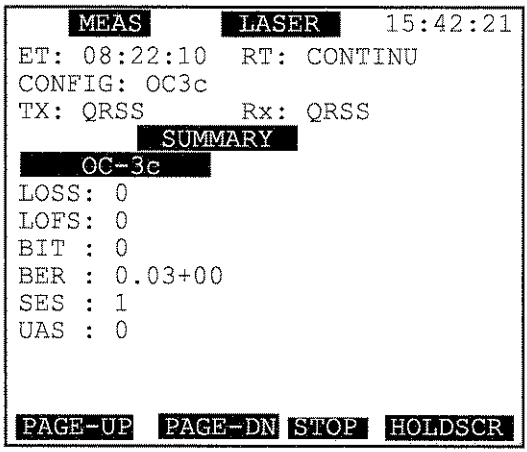

Figure 18 OC3c Summary Screen

4.1.1 SONET Results A Screen

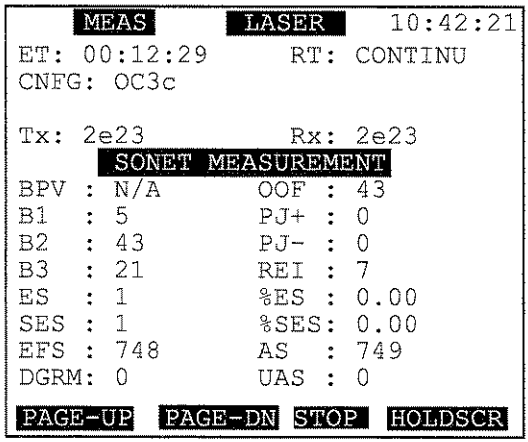

Figure 19 OC3c SONET Results A

BPV: Bipolar violations occur only in electrical signals. For OC

signals, BPV will read N/A.

B1: This is a count of the incoming BIP-8 parity errors in the first STS of an STS-N signal. The B1 byte is contained in the Section Overhead. This byte provides "section" error monitoring by means of bit-interleaved parity 8 code using even parity.

B2: This is a count of the incoming B2 BIP-8 parity errors. The B2 byte is contained in the Line Overhead and provides "line" error monitoring.

B3: This is a count of the incoming B3 BIP-8 parity errors. The B3 byte is contained in the Path Overhead and thus, provides a "path" error monitoring function.

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 available second with at least one B1, B2, B3, REI, or FE. An errored second is not counted during an unavailable second (UAS).

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

Usage: This is used as a key tariffed performance parameter. It is used over long periods of time such as a day, week, or year.

SES: This is a count of the number of Severely Errored Seconds that have occurred since the beginning of the test. A severely errored second is a second with a 10^{-3} error rate. An out of frame will also generate a severely errored second. A severely errored second is not counted during an unavailable second.

%SES: This is the percentage of severely errored seconds since the beginning of the test.

EFS: This is a count of seconds containing no errors.

DGRM: This is a count of the bit DeGRaded Minutes that have occurred since the beginning of the test. A bit degraded minute is 60 non-severely errored seconds with an error rate between 10e-03 and 10e-06.

OOF: This is the count of the Out-Of-Frame seconds that have occurred since the beginning of the test. An OOF signifies the failure to acquire a valid framing pattern for 4 consecutive frames. OOF is counted until the onset of a valid framing pattern exactly 6480 bits apart.

PJ+ (Pointer Justification +): This is the count of incoming pointer increments.

PJ- (Pointer Justification -): This is the count of incoming pointer decrements.

REI: This is the count of Remote Error Indications received. This block error measurement is often used for in-service detection. It finds errors that are occurring after (downstream) the test access point.

AS: This is the number of available seconds in which the signal was not lost.

UAS: This is a count of all the UnAvailable Seconds since the beginning of the test.

4.1.2 SONET Results B

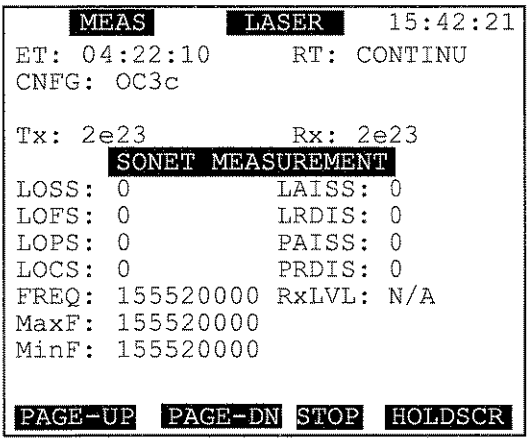

Figure 20 SONET Results, Screen B

LOSS: This is the count of the number of seconds in which the signal has been lost during the test. For SONET, a loss of signal will be detected when 20 µsec of all zeroes occurs.

LOFS : This is the count of the Loss of Frame Seconds since the beginning of the test. A loss of frame occurs at 24 consecutive frames with invalid framing. LOFs are counted until the onset of 8 consecutive frames with valid framing.

LOPS: This is the count of the number of seconds in which there was a loss of pointer or NDF (New Data Flag). A Loss of Pointer occurs for 8 consecutive frames of invalid pointer or NDF. LOPs are counted until the onset of 3 consecutive frames of valid pointer.

LOCS: This is the number of seconds in which there was a loss of clock. Loss of clock is counted until the onset of any transition of the receive line clock.

FREQ: This is the current frequency measured during the last second.

MaxF: This is the maximum frequency measured since the beginning of the test.

MinF: This is the Minimum frequency measured since the beginning of the test.

LAISS: Line Alarm Indication Signal Seconds is a count of the number of seconds in which LAIS was detected. Line AIS is detected when the test set receives 5 consecutive frames of 111 in the bits 2, 1, 0 (6,7,8, transmission standard) of the K2 byte. LAIS is counted until the set receives 5 consecutive frames of patterns other than 111 in the bits 2, 1, 0 of the K2 byte.

LRDIS: Line Remote Defect Indication Seconds is a count of the number of seconds in which Line RDI is detected.

PAISS: Path Alarm Indication Signal Seconds is a count of the number of seconds in which PAIS is detected. Path AIS is detected when the test set receives 3 consecutive frames of all ones in the H1, H2 bytes. AIS is counted until the onset of NDF with valid pointer or three successive frames with valid pointer.

PRDIS: Path Remote Defect Indication Seconds is a count of the number of seconds in which Path RDI is detected.

RxLVL: Receive Level is the positive or negative level of pulses being received by the unit. N/A for optical results

4.2 DS3 Measurements

The following screens appear in a DS3 configuration.

4.2.1 DS3 Measurements A

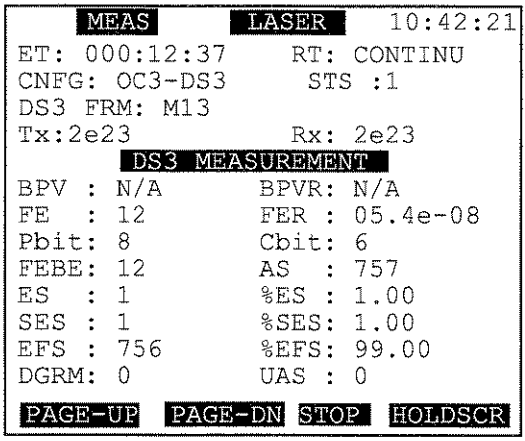

Figure 21 OC3/DS3 DS3 Results

BPV: This is a count of the number of BiPolar Violations that have occurred since the beginning of the test. Note that this measurement only applies to a straight DS3, not a DS3 payload.

Usage: This measurement detects problems with the line in the local office to which the set is attached. The problem is a local one, because DS3 electrical signals are only transmitted intra-office. This measurement is also useful where the framing or data being transmitted is unknown and helps to separate local troubles from remote troubles.

BPVR: This is the average BiPolar Violation error Rate since the beginning of the test.

Usage: The rate is sometimes used instead of a count when the measurement is conducted for a longer period.

FE: This is the count of Framing bit Errors that have occurred since the beginning of the test.

Usage: This measurement is often used for in-service testing on M13 framed circuits where the customer is transmitting an

unknown data stream. The advantage of the measurement is that the framing stays intact as it passes through various network elements, hence it depicts the overall transmission quality from the far end of the circuit to the test set.

FER: This is the Framing bit Error Rate measured since the beginning of the test.

Usage: See the discussion for FE. The rate is a nice way of summarizing the information in a way that is independent of the actual measurement period.

P-bit: This is the P-bit Parity Error count.

Cbit: This is the C-bit Block Error count.

Usage: This measurement is often used for in-service error detection. It is a more accurate error measurement than P-bit errors and is only found with C-bit framing. It shows that a problem has occurred between the source of the DS3 signal and the test set. This signal propagates through all media (fiber, coax, radio) that transport a DS3 signal.

FEBE: This is a count of Far End Block Errors received. FEBEs are transmitted by the DS3 terminating element at the end of the DS3 path when a C-bit error is received by the element.

Usage: This measurement is often used for in-service error detection. It finds errors that are occurring after (or downstream from) the test access point.

AS: This is the number of Available Seconds; elapsed time minus UASs.

ES: This is a count of the number of Errored Seconds that have occurred since the beginning of the test. An errored second is any available second with at least one BPV, bit error, FBE, or CRC-6 error. An errored second is not counted during an unavailable second.

Usage: Errored seconds are a key tariff parameter for T3 services. This measurement is attractive because it takes out the effects of burstiness on service performance and because it measures the quality of service as the user actually sees it.

%ES: This is the percentage of Errored Seconds since the

beginning of the test.

Usage: This is used as a tariffed performance parameter. It is used over longer periods of time such as a day, week or year. Common requirements are that errored seconds be less than 1% end to end. Some customers expect performance at less than 0.5%.

SES: This is a count of the number of Severely Errored Seconds that have occurred since the beginning of the test. A severely errored second is a second with a 10^{-3} error rate, where error rate is measured off of bit errors, BPV errors, framing bit errors, and CRC-4 errors. An out of frame will also generate a severely errored second. A severely errored second is not counted during an unavailable second.

Usage: This measurement is sometimes used in combination with errored seconds to describe overall in-service transmission performance. During a severely errored second, the customer is likely to be experiencing trouble with the service but may still be able to use the service, especially for PCM voice transmission.

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

Usage: This parameter is used over longer periods of time to give a uniform measure of the quality of service. A common end to end tariffed performance objective limit is 0.035%.

EFS: This is a count of Error Free Seconds since the beginning of the test. An error free second has no errors at all.

Usage: See discussion of %EFS below.

%EFS: This is the percentage of Error Free Seconds divided by the total (available + unavailable) seconds since the beginning of the test. An error free second has no errors at all.

Usage: Data customers typically expect this number to be 99% or higher. %EFS and %AS are probably the two most significant parameters in gauging the quality of T3 service delivered to the end user.

DGRM: This is a count of the bit DeGRaded Minutes that have occurred since the beginning of the test. A BIT or BPV degraded minute is 60 non-severely errored seconds during which a total of at least 2666 errors occurred.

Usage: This measurement may be called out in service appli-

cations governed by CCITT specifications.

UAS: This is a count of all the UnAvailable Seconds since the beginning of the test.

An unavailable second is any second with a loss of signal, loss of frame, loss of pattern, or alarm indication signal. Unavailable seconds are also counted at the onset of 10 consecutive severely errored seconds. Once an unavailable second has been declared, the following seconds continue to be counted as unavailable until the service is declared to be available again. Service becomes available at the onset of 10 consecutive available non-severely errored seconds.

Usage: Unavailable seconds are usually not permitted in any number in a 15 minute or one hour test.

4.2.2 DS3 Measurements B

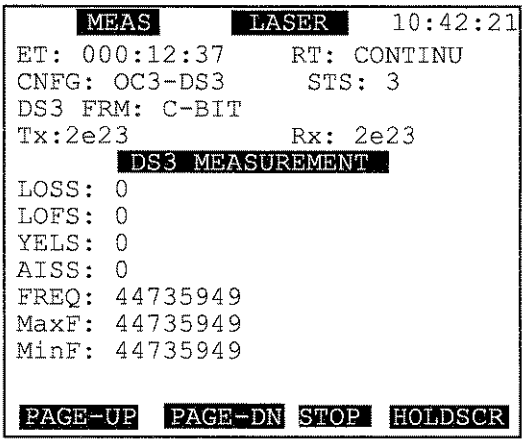

Figure 22 OC3/DS3 DS3 Results B

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

Usage: This measurement can provide you with clues as to the nature of an out-of-service condition. For instance, a break in the line will cause a loss of signal for the test set if there are no line terminating elements in between the break and the set. However, if there is a line terminating element, then the same break in the line will cause an AISS.

LOFS: This is the count of Loss Of Frame Seconds since the beginning of the test. A loss of frame second occurs at the onset of 3 consecutive OOFSs. LOFS are counted until the onset of 10 consecutive non-SESs.

Usage: This measurement is most often used on extended tests where sporadic intermittency problems are experienced.

YELS: This is the count of the number of seconds for which a YELlow Alarm has occurred since the beginning of the test. A DS3 Yellow Alarm occurs when a DS3 terminating device detects a loss of signal for which framing cannot be found.

The DS3 path terminating device will send a Yellow Alarm on its outgoing signal in response to loss of frame on its incoming signal. Thus, the yellow alarm signifies that the other side of the DS3 line has failed somewhere before the end of the circuit. It is given by the far-end equipment setting the X1 and X2 bits to zero in the returning DS3 signal.

Usage: Yellow Alarm is used to sectionalize a circuit fault. If the signal on side A reaches the test set without error, but the signal on side B shows a yellow alarm, then side A must be failing somewhere downstream from the test set.

AISS: Alarm Indication Signal Seconds is a count of the number of seconds in which AIS was detected. The DS3 AIS is a signal with valid M-frame alignment channel, M-subframe alignment channel and P-bit channel. The payload bits are set to a 10 pattern, starting with a 1 after each M-frame alignment, M-subframe alignment, X-bit, P-bit and C-bit channel. The C-bits are set to 0 and the X-bits are set to 1.

Usage: This measurement can provide you with clues as to the nature of an out-of-service condition. For instance, a break in the line will cause a loss of signal for the test set if there are no line terminating elements in between the break and the set. However, if there is a line terminating element, then the same break in the line will cause an AISS.

FREQ: This is the current frequency measured during the last second.

MaxF: This is the maximum frequency measured since the beginning of the test.

MinF: This is the minimum frequency measured since the beginning of the test.

4.3 DS2 Measurements

This screen gives results for the DS2 rate.

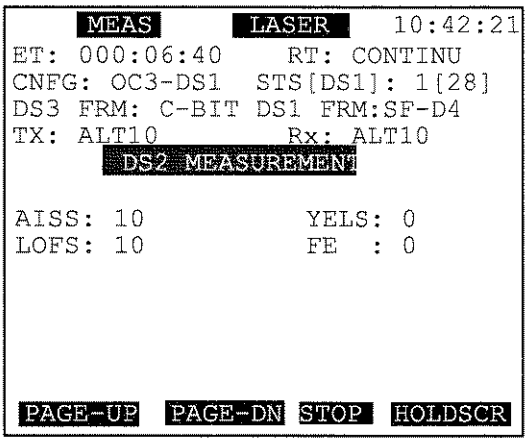

Figure 23 OC3/DS1 DS2 Results

AISS: Alarm Indication Signal Seconds is a count of the number of seconds in which AIS was detected. The DS2 AIS is an unframed all 1s signal.

Usage: This measurement can provide you with clues as to the nature of an out-of-service condition. For instance, a break in the line will cause a loss of signal for the test set if there are no line terminating elements in between the break and the set. However, if there is a line terminating element, then the same break in the line will cause an AISS.

LOFS: This is the count of Loss Of Frame Seconds since the beginning of the test. LOFS are triggered when an OOF condition occurs. LOFS stop counting as soon as the OOF condition ends.

Usage: This measurement is most often used on extended tests where sporadic intermittency problems are experienced.

YELS: This is the count of YELlow alarm Seconds since the beginning of the test.

The DS2 path terminating device will send a yellow alarm on its

outgoing signal in response to loss of frame on its incoming signal. Thus, the yellow alarm signifies that the other side of the DS2 line has failed somewhere before the end of the circuit. The DS2 Yellow Alarm is enabled by setting the X-bit to 0 on the returning DS2 signal.

Usage: Yellow alarm is used to sectionalize a circuit fault. If the signal on side A reaches the test set without error, but the signal on side B shows a yellow alarm, then side A must be failing somewhere downstream from the test set

FE: This is the count of DS2 Framing bit Errors that have occurred since the beginning of the test.

Usage: This measurement is an in-service measurement result for DS2 circuits. When the customer is transmitting an unknown data stream, the advantage of the measurement is that the framing stays intact as it passes through various network elements, hence it depicts the overall transmission quality from the far end of the circuit to the test set. One problem with the measurement is that it only measures 24 out of every 6.312 Mbits, and so it only gives a sampling of the true transmission performance. The other problem with the measurement is that it can't measure the quality of transmission on the two outgoing directions of transmission. It can only measure the quality on the two incoming directions.

4.4 DS1 Measurements

The DS1 results screens follow. In DS1 Dual Mode, Line 1 or Line 2 will show in the title, so you know which line you are looking at results for. See the next figure.

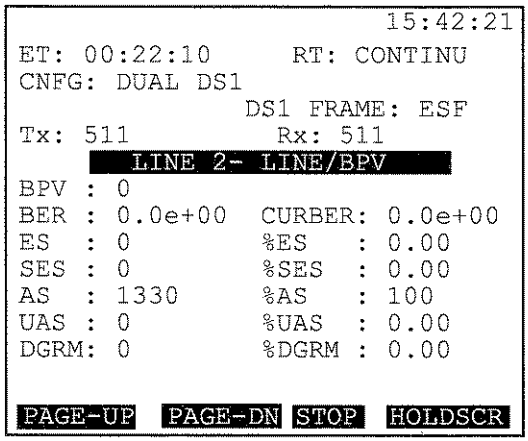

Figure 24 DS1 Line Measurements

Here is a sample Summary screen for DS1 Dual Mode:

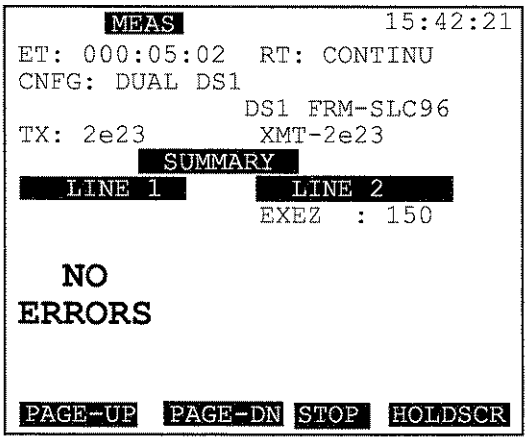

Figure 25 DS1 Dual Summary Screen

4.4.1 DS1 Line Measurements

This screen reports on the DS1 line.

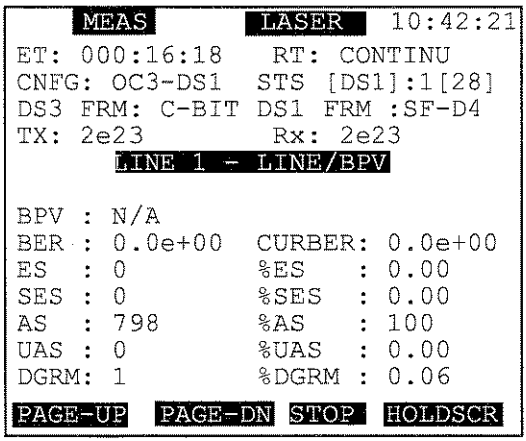

Figure 26 OC3/DS1 DS1 Results

BPV: This is a count of the number of BiPolar Violations that have occurred since the beginning of the test.

Usage: This measurement detects problems with the line that the set is attached to. The problem is a local one, because any multiplexers, radio or fiber transmission links, switches, digital cross-connects, or other line-terminating devices will strip bipolar violations as the signal passes through it. Bipolar violations only pass through copper and regenerative repeaters. This measurement is also useful where the framing or data being transmitted is unknown. Finally, many telephone companies use a given number of BPV counts as the maximum acceptable for a span.

BER: 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.

Usage: The rate is sometimes used instead of a count when the measurement is conducted for a longer period. 10^{-3} is a typical maintenance limit for voice transmission and 10^{-6} is a common acceptance limit for voice transmission. Many data customers require 10^{-9} or better.

ES: This is a count of the number of Errored Seconds that have occurred since the beginning of the test. An errored second is any second with at least one BPV, bit error, FE or CRC-6 error. An

errored second is not counted during an unavailable second.

Usage: errored seconds are a key tariff parameter for T1 services. Acceptance limits are often given for a number of errored seconds in a 5 minute, 15 minute, or 24-hour period. 7 errored seconds in 5 minutes and 20 errored seconds in 15 minutes are common acceptance limits, and 60 errored seconds in 5 minutes is a common immediate action limit. Some organizations accept no errors on a turn-up test.

The measurement is attractive because it takes out the effects of burstiness on service performance and because it measures the quality of service as the user actually sees it.

%ES: This is a percentage of Errored Seconds (as defined above) since the beginning of the test.

SES: This is a count of the number of Severely Errored Seconds that have occurred since the beginning of the test. A severely errored second is a second with a 10^{-3} error rate, where error rate is measured off of BPV, bit error, FE or CRC-6 errors. An out of frame error will also generate a severely errored second. A severely errored second is not counted during an unavailable second.

Usage: This measurement is sometimes used in combination with errored seconds to describe overall in-service transmission performance. During a severely errored second, the customer is likely to be experiencing trouble with the service but may still be able to use the service, especially for PCM voice transmission.

%SES: This is a count of the percentage of Severely Errored Seconds that have occurred since the beginning of the test. A severely errored second is a second with a 10^{-3} error rate, where error rate is a measurement of bit errors

AS: This is a count of Available Seconds since the beginning of the test. Available Seconds equals the length of the total test time minus any UAS.

%AS: This is the percentage of Available Seconds.

UAS: This is a count of all the UnAvailable Seconds since the beginning of the test. Note that a T1 service is not available during an UAS.

An unavailable second is any second with a loss of signal, loss of frame, loss of pattern, or alarm indication signal. Unavailable seconds are also counted at the onset of 10 consecutive severely errored seconds. Once an unavailable second has been declared, the following seconds continue to be counted as unavailable until the service is declared to be available again. Service becomes available at the onset of 10 consecutive available non-severely errored seconds.

Usage: Unavailable seconds are usually not permitted in any number in a 15 minute or 1-hour test. Telephone companies typically guarantee something like 3 hours maximum outage time per year on a T1 service.

%UAS: This is the percentage of UASs since the beginning of the test.

DGRM: This is a count of the bit DeGRaded Minutes that have occurred since the beginning of the test. A degraded minute is 60 non-severely errored seconds during which a total of at least 92 BPVs occurred.

%DGRM: This is the percentage of DGRMs since the beginning of the test.

4.4.2 Signal Results

This screen reports on the DS1 signal.

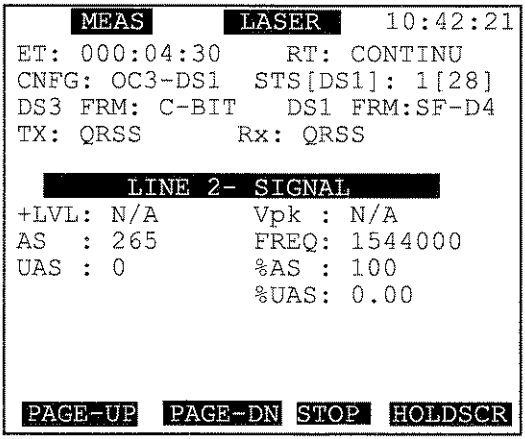

Figure 27 OC3/DS1 Line 2 Signal Results

+LVL: Positive LeVeL is the level of positive pulses received by the test set.

Usage: The +LVL measurement is useful for finding faults with the last repeater or transmitter that is generating the signal to the test set. The level at a repeater should be between -10 dB and -35 dB. Level is measured only on L1-Rx.

AS: This is the count of Available seconds since the beginning of the test. See the previous section for a complete description.

UAS: This is the count of UnAvailable seconds since the beginning of the test. See the previous section for a complete description.

Vpk: This is the DS1 voltage peak. The level at a DSX should be approximately 3 volts

FREQ: Frequency is the frequency of the signal as measured against the frequency of the reference clock. The set's internal clock is used to measure frequency when no external clock source is plugged in.

%AS: This is the percentage of Available seconds since the beginning of the test. See the previous section for a complete

description.

%UAS: This is the percentage of UnAvailable seconds since the beginning of the test. See the previous section for a complete description.

4.4.3 Alarms

This screen reports on any alarms received on the DS1 signal.

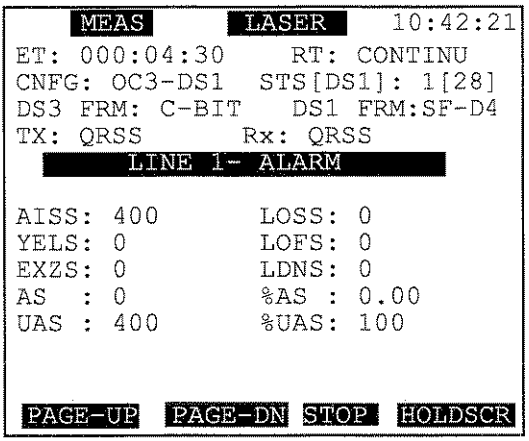

Figure 28 OC3/DS1 Line 1 Alarm Results

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

Usage: This measurement can provide you with clues as to the nature of an out-of-service condition. For instance, a break in the line will cause a loss of signal for the test set if there are no line terminating elements between the break and the set. However, if there is a line terminating element, the same break will cause an AISS.

YELS: This is the count of YELlow alarm Seconds since the beginning of the test. A yellow alarm takes different forms depending on the framing of the signal. For an SF signal, the yellow alarm is signified by a zero in bit 2 for all channels. For an ESF signal, the yellow alarm is 0000000011111111 in the facility data link.

The T1 path terminating device will send a yellow alarm on its outgoing signal in response to loss of frame on its incoming signal.

Thus, the yellow alarm signifies that the other side of the T1 line has failed somewhere before the end of the circuit.

Usage: Yellow alarm is the only end-to-end service indicator that is available for in-service testing on D4, SLC-96, and some ESF circuits. It is used to sectionalize a fault in this way. If the signal on side A reaches the test set without error, but the signal on side B shows a yellow alarm, then side A must be failing somewhere downstream from the test set.

EXZS: EXcess Zero Seconds is a count of the number of seconds in which excessively long strings of zeroes were detected. For AMI coding, this is 16 or more consecutive zeroes, for B8ZS this is 8 or more consecutive zeroes. This measurement is different than LDNS in that it looks for individual strings of zeroes rather than an average ones density over a large number of bits.

Usage: Refer to the usage of LDNS.

AS: This is a count of the Available seconds since the beginning of the test.

UAS: This is a count of all the UnAvailable Seconds since the beginning of the test. Note that a T1 service is not available during an UAS.

An unavailable second is any second with a loss of signal, loss of frame, loss of pattern, or alarm indication signal. Unavailable seconds are also counted at the onset of 10 consecutive severely errored seconds. Severely Errored Seconds caused by a 10^{-3} error rate, where error rate is measured off of BPV, bit error, FE and CRC-6 errors. Once an unavailable second has been declared, the following seconds continue to be counted as unavailable until the service is declared to be available again. Service becomes available at the onset of 10 consecutive available non-severely errored seconds.

Usage: Unavailable seconds are usually not permitted in any number in a 15 minute or 1-hour test. Telephone companies typically guarantee something like 3 hours maximum outage time per year on a T1 service.

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

LOFS: This is the count of Loss Of Frame Seconds since the

beginning of the test. A loss of frame second occurs at the onset of 3 consecutive OOFs. LOFS are counted until the onset of 10 consecutive non-SESs.

Usage: This measurement is most often used on extended tests where sporadic intermittency problems are experienced.

LDNS: Low DeNsity Seconds is a count of the number of seconds when the n(n-1) rule is broken.

Usage: This measurement can give you clues to whether the customer is transmitting illegal strings of data or whether B8ZS encoding equipment is working properly. For instance, if the line codes is set up to be B8ZS in the test set, but you are getting LDNS counts, then a transmitter is not correctly sending the B8ZS code to you . Or, if you have an AMI line and you get excessive LDNS counts, it will tell you that the customer is sending an unusual signal and perhaps that customer should be switched to a B8ZS line.

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

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

4.4.4 Frame Results

This screen reports on the DS1 framing.

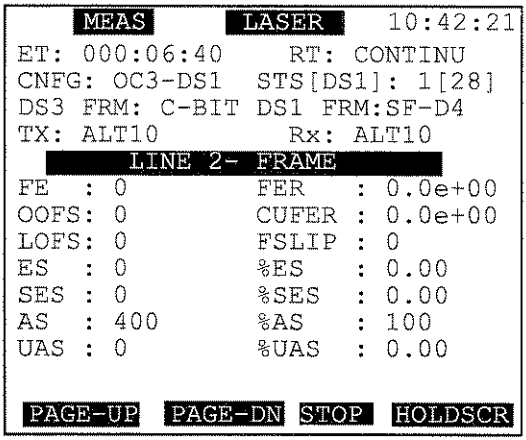

Figure 29 OC3/DS1 Frame Results

FE: This is the count of Framing bit Errors that have occurred since the beginning of the test.

Usage: This measurement is often used for in-service testing on SF-D4 circuits where the customer is transmitting an unknown data stream. The advantage of the measurement is that the framing stays intact as it passes through various network elements (fractional T1 circuits excepted); hence it depicts the overall transmission quality from the far end of the circuit to the test set. One problem with the measurement is that it only measures one out of every 193 bits, and so gives only a sampling of the true transmission performance. The other problem with the measurement is that it can't measure the quality of transmission on the two outgoing directions of transmission. It can measure the quality only on the two incoming directions of transmission.

FER: This is the Framing bit Error Rate measured since the beginning of the test.

Usage: See the discussion for FE. The rate is a nice way of summarizing the information in a way that is independent of the actual measurement period.

CUFER: This is the CUrrent Framing bit Error Rate.

Usage: This measurement is useful for seeing if the circuit

recently had major error problems. However the limitations of the measurement is that a one second averaging interval is so short this measurement that it is not very useful for finding error rates below 10^{-4}.

OOFS: This is the count of Out-Of-Frame seconds that have occurred since the beginning of the test. An out-of-frame condition occurs when either 2-in-4 or 2-in-5 framing bits have been in error.

OOF start counting when an out-of-frame condition occurs. OOF continue incrementing until framing has been reestablished, or until 3 consecutive seconds have been OOF. In this case, LOF is declared, OOF is decremented by 3, and LOFS is incremented by 3.

Once an out-of-frame condition occurs, the test set begins searching for a new framing position. The out-of-frame condition ends when framing has been reestablished. If the framing remains in the original position, then no further action takes place.

LOFS: This is the count of Loss Of Frame Seconds since the beginning of the test. A loss of frame second occurs at the onset of 3 consecutive OOFs. LOFS are counted until the onset of 10 consecutive non-SESs.

Usage: This measurement is most often used on extended tests where sporadic intermittency problems are experienced.

FSLIP: This is the count of Frame SLIPs that have occurred since the beginning of the test. A frame slip is said to have occurred each time the phase of the line under test has deviated from the phase of the reference clock by 193 bits. This count is not applicable when a reference signal is not plugged in.

Usage: FSLIPs are useful for finding frequency synchronization problems in the network. Frequency synchronization can be the source of problems for channelized hi cap services that carry data and face a switch or 1x0 digital cross-connect system.

ES: This is a count of the number of Errored Seconds that have occurred since the beginning of the test. An errored second is any second with at least one BPV, FE, or CRC-6 error. An errored second is not counted during an unavailable second.

Usage: errored seconds are a key tariff parameter for T1 services. Acceptance limits are often given for a number of errored seconds in a 5 minute, 15 minute, or 24-hour period. 7 errored

seconds in 5 minutes and 20 errored seconds in 15 minutes are common acceptance limits, and 60 errored seconds in 5 minutes is a common immediate action limit. Some organizations accept no errors on a turn-up test.

The measurement is attractive because it takes out the effects of burstiness on service performance and because it measures the quality of service as the user actually sees it.

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

SES: This is a count of the number of Severely Errored Seconds that have occurred since the beginning of the test. A severely errored second is a second with a 10^{-3} error rate, where error rate is a measurement of, BPV errors, framing bit errors, and CRC-6 errors. An out of frame error will also generate a severely errored second. A severely errored second is not counted during an unavailable second.

Usage: This measurement is sometimes used in combination with errored seconds to describe overall in-service transmission performance. During a severely errored second, the customer is likely to be experiencing trouble with the service but may still be able to use the service, especially for PCM voice transmission.

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

AS: This is a count of the Available seconds since the beginning of the test.

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

UAS: This is a count of all the UnAvailable Seconds since the beginning of the test. Note that a T1 service is not available during an UAS.

An unavailable second is any second with a loss of signal, loss of frame, loss of pattern, or alarm indication signal. Unavailable seconds are also counted at the onset of 10 consecutive severely errored seconds. Severely Errored Seconds caused by a 10^{-3} error rate, where error rates in this case taken as a measurement of BPV errors, Framing Bit errors, and CRC errors. Once an unavailable

second has been declared, the following seconds continue to be counted as unavailable until the service is declared to be available again. Service becomes available at the onset of 10 consecutive available non-severely errored seconds.

Usage: Unavailable seconds are usually not permitted in any number in a 15 minute or 1-hour test. Telephone companies typically guarantee something like 3 hours maximum outage time per year on a T1 service.

%UAS: This is the percentage of UASs since the beginning of the test.

4.4.5 Frequency Results

This screen provides frequency and clock slip measurements on the line specified as Rx/Drop in the Test Configuration.

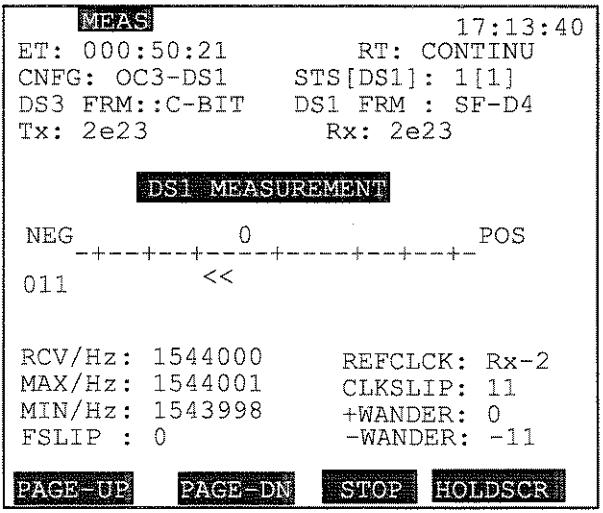

Figure 30 Frequency Results

- The bar graph indicates how fast the signal is slipping in relation to the external reference clock.
- A count of the number of clock slips is kept at the end of the bar.
- One clock slip occurs when the measured frequency deviates from the reference frequency by one unit interval. A DS1 unit interval is equal to 647 nanoseconds.

RCV Hz: This is the current frequency measured during the last second.

FREQ: Frequency is the frequency of the signal as measured against the frequency of the reference clock.

MAX, MIN Hz: These are the maximum and minimum frequencies measured since the beginning of the test.

FSLP: This is the count of Frame SLiPs that have occurred since the beginning of the test. A frame slip is said to have occurred each time the phase of the line under test has deviated from the phase of the reference clock by 193 bits.

Usage: FSLiPs are useful for finding frequency synchronization problems in the network.

REFCLCK: The reference clock is the clock the frequency is compared against. The Rerence Clock is the internal clock at this time. The INTERN reference clock of the set has stratum 3 accuracy.

CLKSLIP: A 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 one T1 pulse.

+WANDER: This is the maximum positive phase difference between the measured frequency and the reference frequency, since the beginning of the test. A signal whose frequency is wandering, i.e. whose frequency alternately goes faster and then slower than the reference frequency, will show both positive and negative wander.

-WANDER: This is the maximum negative phase difference between the measured frequency and the reference frequency since the beginning of the test.

4.5 Bit Performance

This screen reports on the G.821 parameters if on a DS1 line, or on any bit errors in a payload (regardless of rate).

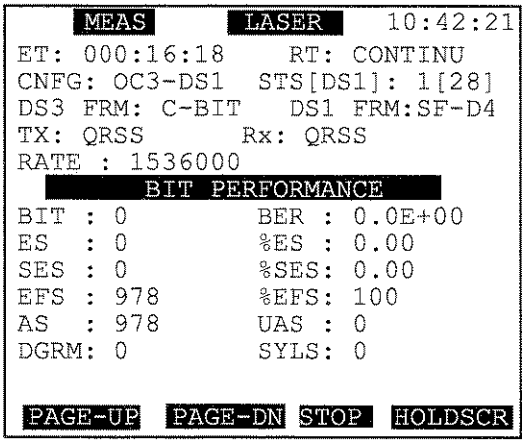

Figure 31 OC3/DS1 Bit Performance Results

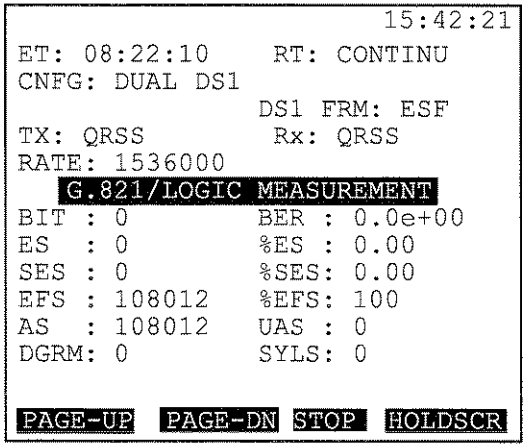

Figure 32 T1Dual G.821 Screen

BIT: This is a count of the number of bit errors which have occurred since the beginning of the test. A bit error is a difference between the pattern of the incoming signal and the reference pattern

detected after pattern synchronization.

Usage: The test set is measuring a known pattern, so the measurement covers transmission performance over the entire service, not just a local section. This is the preferred measurement for out-of-service testing, and service acceptance tests. The measurement is often performed in conjunction with a loopback device at the far end.

BER: This is the averaging 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.

Usage: The rate is sometimes used instead of a count, when the measurement is conducted for a longer period. 10^{-3} is a typical maintenance limit for voice transmission and 10^{-6} is a common acceptance limit for voice transmission. Many data customers require 10^{-9} or better.

ES: This is a count of the number of Errored Seconds which have occurred since the beginning of the test.

- An ES is a one-second period in the AS during which one or more bit errors are detected.
- An errored second is not counted during an unavailable second.

Usage: errored seconds are a key tariff parameter for T1 services. Acceptance limits are often given for a number of errored seconds in a 5 minute, 15 minute, or 24-hour period. 7 errored seconds in 5 minutes and 20 errored seconds in 15 minutes are common acceptance limits, and 60 errored seconds in 5 minutes is a common immediate action limit. Some organizations accept no errors on a turn-up test.

The measurement is attractive because it takes out the effects of burstiness on service performance and because it measures the quality of service as the user actually sees it.

%ES: The %ES is the ratio of ES to the AS expressed as a percentage

Usage: This is used as a tariffed performance parameter. It is used over longer periods of time such as a day, week or year. Common requirements are that errored seconds be less than 5%. Some customers expect performance at less than 0.5%.

SES: This is a count of the number of Severely Errored Seconds that have occurred since the beginning of the test. A SES is a one-

second period in the AS during which either one or more of the followings occur:

a) BER is equal to or worse than 1×10^{-3}.
b) Alarm indication signal
c) Loss of signal
d) Loss of frame alignment
e) Loss of pattern synchronization
f) Uncontrolled pattern slip

The SES is a subset of ES, therefore a SES will also cause a ES count. A severely errored second is not counted during an unavailable second.

Usage: This measurement is sometimes used in combination with errored seconds to describe overall in-service transmission performance. During a severely errored second, the customer is likely to be experiencing trouble with the service, but may still be able to use the service, especially for PCM voice transmission.

%SES: The %SES is the ratio of SES to the AS expressed as a percentage, since the beginning of the test.

EFS: This is a count of Error Free Seconds since beginning of the test. An EFS is a one-second period in the AS during which no bit errors and no pattern slips have been detected.

%EFS: This is the percentage of Error Free Seconds since the beginning of the test which have not contained errors.

AS: The count of Available Seconds is the available time in the total observation time. It is the difference between the elapsed time and the UAS and is expressed in seconds.

UAS: This is a count of all the UnAvailable Seconds since the beginning of the test. Note that a T1 service is not available during an UAS. The UAS register displays the unavailable time in seconds in the total observation time.

A period of unavailable time begins at the onset of a period of ten consecutive SES. The unavailable time ends when the first second of a period of ten consecutive non-SES seconds.

Usage: Unavailable seconds are usually not permitted in any number in a 15 minute or one hour test. Telephone companies typically guarantee something like 3 hours maximum outage time per year on a T1 service.

DGRM: This is the number of DeGRaded Minutes since the beginning of the test. A DGRM is a block in which the BER is worse than 1×10^{-6}. However, for 64 kbps only blocks containing more than 4 bit errors are considered degraded.

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

5.0 Sonet Features

This menu gives you access to the OCx's SONET capacities. You may transmit selected overhead bytes, as well as view received overhead bytes, Enter SONET FEATURES from the MAIN MENU. You will enter this screen:

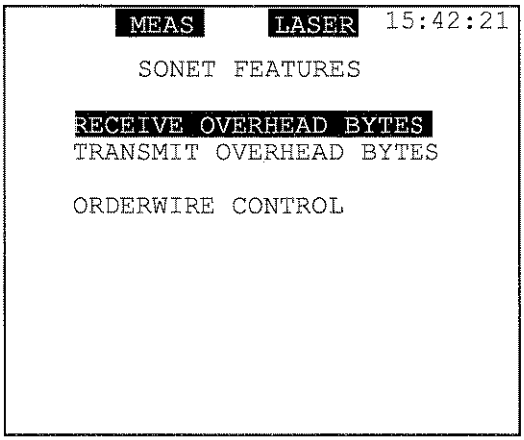

Figure 60 SONET Features Menu

Since overhead bytes are transmitted within the OC/STS signal, you must have selected a TEST INTERFACE of STS-1, OC-1, OC-3, or OC-3c in the TEST CONFIGURATION in order to access this menu item.

The SONET system has embedded overhead capabilities within the STS signal; this makes the high level of network management possible for SONET.

There are three defined overhead areas in the STS-1 signal: Path, Line, and Section:

- Path-level overhead is carried from end-to-end.
- Line-level overhead travels between STS-n multiplexers.
- Section overhead is used for communications between adjacent network elements, such as regenerators.

Within these overhead areas, there are transmission error detection and report features, communication channels, pointers, and frame content codes.

5.1 Receive Overhead

- This feature displays the overhead bytes of the received SONET signal.
- There are four Receive SONET OH Bytes screens containing Section, Line, J1 Path, and Path overhead information.
- The Section Overhead screen appears first.
- Use the PAGE-UP (F1) and PAGE-DN (F2) keys to move between the screens of OH.
- For the OC-3 rate, press NEXTSTS (F4) to scroll through the overhead available for all three STS-1s. The STS-1 No. line in the header will show the selected STS-1.

5.1.1 Receive Section Overhead

A sample Section overhead screen is shown in the next figure:

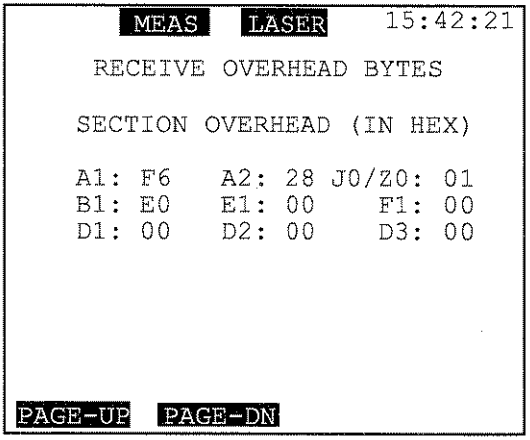

Figure 61 Receive Section OH

The nine bytes of the section overhead are used as follows:

A1, A2 - Frame alignment pattern, F6 28 (1111 0110 0010 1000)
J0/Z0 - STS-1 identification; a binary number corresponding to its appearance in an interleaved STS-N. Here, 01 (0000 0001) signifies the first signal, J0. 2 through N signifies the rest of the signals, in Z0.
B1 - Parity check
E1 - Local orderwire channel for voice communication between

regenerators
F1 - User's purposes
D1,D2,D3 - Data communications channel

5.1.2 Receive Line Overhead

The next figure shows a sample Receive Line Overhead screen.

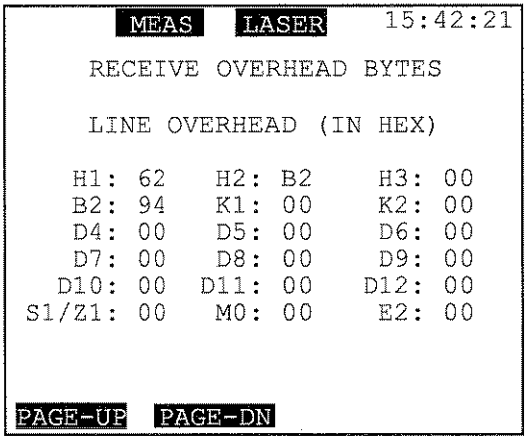

Figure 62 Receive Line OH

The 18 bytes of the STS-1 Line Overhead are used as follows:

H1,H2,H3 - Payload pointers
B2 - Parity check
K1,K2 - APS (Automatic Switching Protection) between line terminating equipment
D4-D12 - Data communications channel
S1/Z1 - Synchronization messages; S1 is in the first STS-1 of an STS-N signal. Z1 is in signals 2 through N
M0 - REI, provides a count of the far end line B2 errors
E2 - Express orderwire channel for voice communication

5.1.3 Receive J1 Path Overhead

The next figure shows the J1 Path Overhead screen:

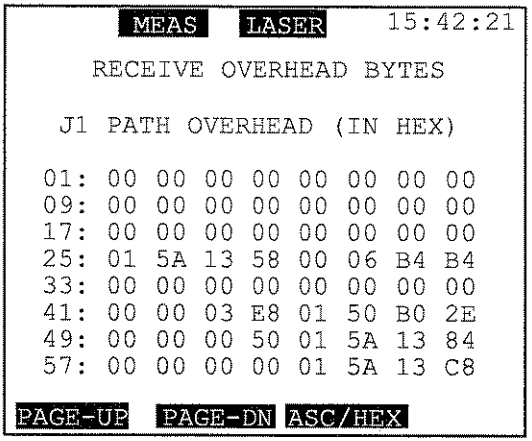

Figure 63 Receive J1 OH

The J1 bytes are used to repetitively transmit a 64-byte string, so that the continued connection to the source of the path signal can be verified at any receiving terminal along the path.

- Use the ASC/HX (F3) key to change how the data is displayed; ASCII or Hex format.

5.1.4 Receive Path Overhead

See the following figure for a sample Receive Path OH screen.

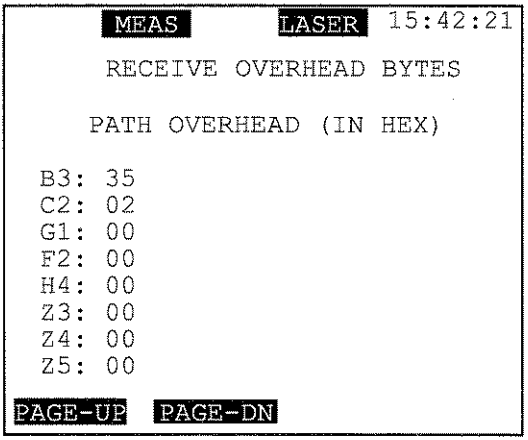

Figure 64 Receive Path OH

The 8 bytes of the Path Overhead are used as follows:

B3 - Parity check

C2 - Indicates the construction and content of the STS SPE. In Figure 64, C2 has a value of 02, which signifies Floating VT Mode. Currently, there are 8 defined codes:

00	Unequipped
01	Equipped - Nonspecific
02	VT - Structured STS-1 SPE (Floating VT Mode)
03	Locked VT Mode
04	Asynchronous mapping for DS3
12	Asynchronous mapping for DS4NA
13	Mapping for ATM
14	Mapping for DQDB
15	Asynchronous mapping for FDDI

G1 - Conveys the path terminating status and performance. Bits 1 through 4 of the G1 byte carry a REI code to convey the count of interleaved- bit blocks which have been detected by the Path BIP-8 code. This count can have 9 values, 0 to 8 errors. In Figure 64, the G1 byte, 00, indicates 0 errors.

F2 - User's purposes

H4 - The Floating VT Mode, indicated in Figure 64, uses the H4 byte to indicate the V1 through V4 bytes in a 500- ms (4-frame) Superframe. The correspondence of the H4 code and the V1 through V4 bytes is as follows:

H4 Byte	VT Byte
11111100	V1
11111101	V2
11111110	V3
11111111	V4

Z3, Z4 - Reserved for future use

Z5 - Tandem Path Performance; conveys information, like incoming error count and a tandem data link, about the tandem connection.

5.2 Transmit Overhead

This feature allows you to control the user's overhead bytes of the transmitted SONET signal. As seen, this function separates the OH bytes into Section, Line, J1 Path, and Path bytes.

If necessary, please refer to Section 5.1, Receive Overhead Bytes, to learn how these bytes are used.

- For the OC-3 rate, press NEXTSTS (F4) to scroll through the overhead available for all three STS-1s. The STS-1 No. line in the header will show the selected STS-1.

5.2.1 Transmit Section Overhead

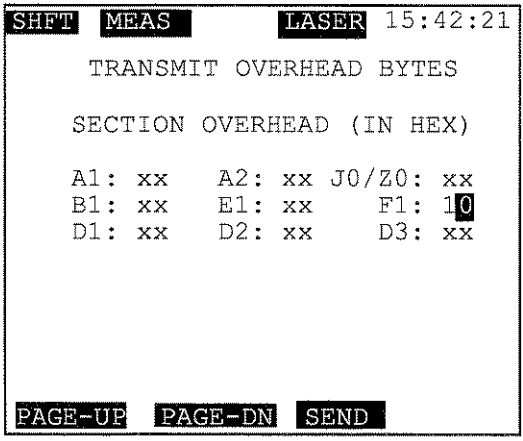

Figure 65 Transmit Section OH

Please note that any byte labelled xx may not be changed. Thus, you may manually control only byte F1:

a) Use the SHIFT key and keypad letters/numbers to enter in the desired hexadecimal code, ranging from 00 to FF.
b) When you have finished, press SEND (F3) to send this byte.

5.2.2 Transmit Line Overhead

To control the user-defined line overhead bytes, PAGE-DN to the Line Overhead selection.

The screen will appear as in the next figure.

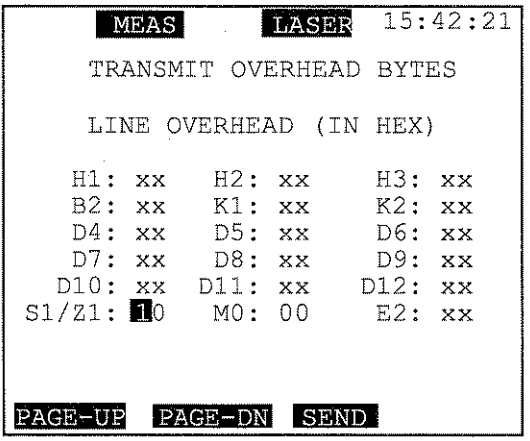

Figure 66 Transmit Line OH

Please note that any byte labelled xx may not be changed. Thus, you may manually control only bytes Z1 and MO. To change these bytes:

a) Use the arrow keys to move the cursor to Z1 or M0.
b) Use the SHIFT key and keypad letters/numbers to enter in the desired hexadecimal code, ranging from 00 to FF.
c) When you have finished, press SEND (F3) to send this byte.

Z1 and MO overhead bytes are used as follows:
Z1 - Synchronization messages
MO - REI, provides a count of the far end line B2 errors

5.2.3 Transmit J1 Path Overhead

To control the J1 Path Overhead Bytes, PAGE-DN to the J1 Path Overhead Bytes selection.

The screen will appear as in the next figure.

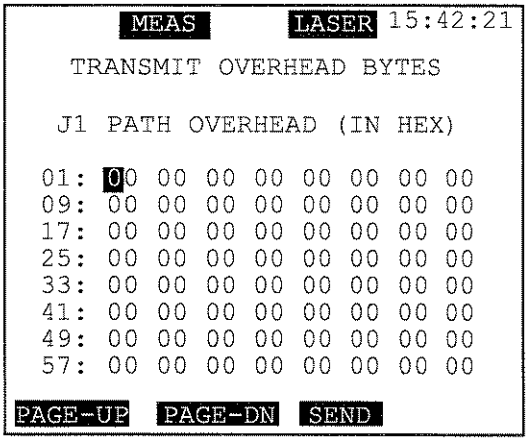

Figure 67 Transmit J1 OH

The J1 byte is the Path trace message. The J1 bytes repetitively transmit a 64-byte string. Any receiving terminal along the path can verify the continued connection of the signal.

You may control all 64 of these bytes:

a) Move the cursor to the desired byte.
b) Activate the SHIFT key.
c) Use the keypad numbers/letters to enter in a hexadecimal code ranging from 00 to FF.
d) When you have finished, press SEND (F3) to send the bytes.

5.2.4 Transmit Path Overhead

Enter Transmit Overhead Bytes, then scroll down to the Path Overhead Bytes screen, in order to control the Path Overhead Bytes.

The screen will appear as in the next figure.

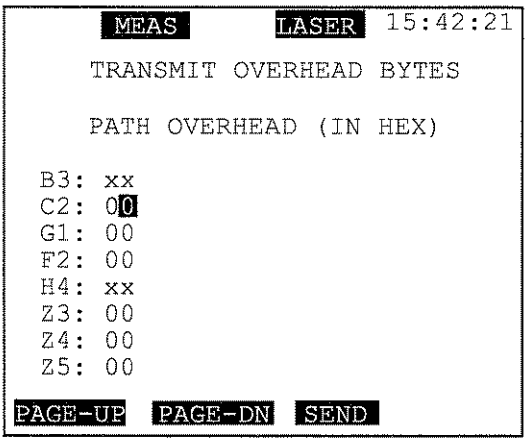

Figure 68 Transmit Path OH

As in the other transmit byte screens, any byte labelled xx may not be changed. In the Path OH screen, you may manually control bytes C2, G1 (only 1/2), F2, Z3, Z4, and Z5.

To change these bytes:

a) Use the arrow keys to move the cursor to the desired byte.
b) Activate the SHIFT key
c) Press the keypad letters/numbers to enter in the desired hexadecimal code, ranging from 00 to FF.
d) When you have finished, press SEND (F3) to send this byte.

6.0 VF/DS0 Features

In order to access the VOICE FREQuency/DSO FUNCTIONS menu, the signal under test must have valid framing. Channels can only be identified in a framed signal.

See the next figure.

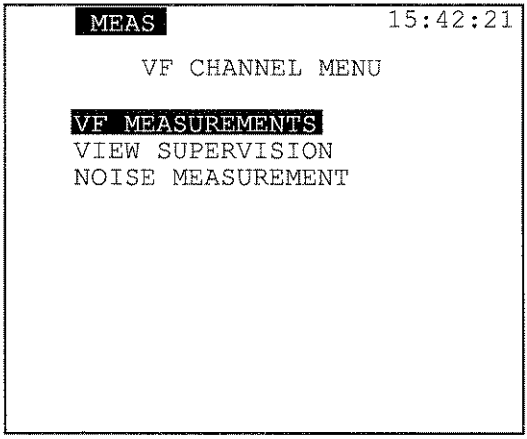

Figure 69 VF Channel Menu

6.1 VF Measurements

From the VF Channel Menu, enter VF Measurements. You will see the following screen:

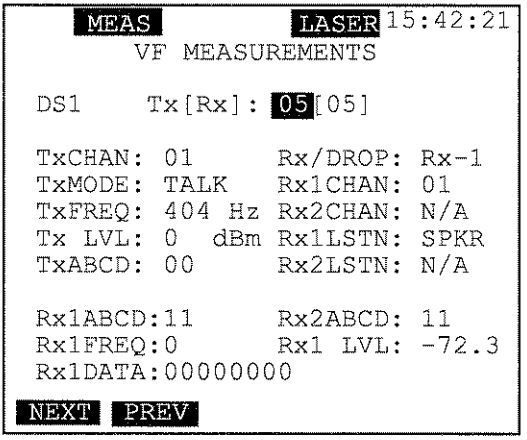

Figure 70 VF Measurements, Single/Payload Mode

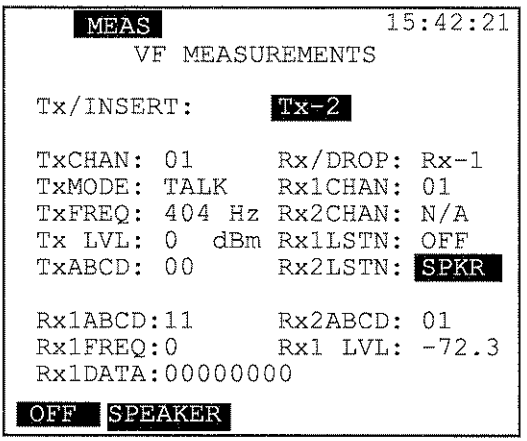

Figure 71 VF Measurements, T1Dual Mode

Note that the first line in the T1 Single/Payload Mode screen lists the Transmit and Receive channels in brackets (05, 05 in the sample screen). The first line of the T1 Dual Mode tells you the line you are transmitting/inserting on (Line 2 in the sample screen). You may select between Tx-1 (F1) and Tx-2 (F2).

Here are the settings:

TxCHAN

Options: 1-24

Configure the transmit channel.

- Use the NEXT (F1) and PREVious (F2) keys to select a channel.

TxMODE

Options: TALK (F1), TONE (F2) , QUIET (F3)

Select the insert type.

- Select TALK to talk on the transmit channel; you can talk into the microphone located on the bottom of the test set.
- Select TONE to insert a tone on the transmit channel. If you select TONE, configure the next two settings.
- Select QUIET to place a quiet termination on the signal; the unit's microphone will not operate.

TxFREQ

Options: 404 (F1), 1004 (F2), 1804 (F3), 2713 (more, F1), 2804 (more, F2)

Select the transmit frequency of your inserted tone, in Hz.

- You may also manually enter a specific frequency using the keypad.

Tx LVL

Options: +/- (F1), 0 (F2), -13 (F3)

Determine the transmit level for your inserted tone, in dBm.

- Select 0 to send the tone at the selected frequency level. This is the default setting.
- Select -13 to use a standard -13 dBm level.
- To select your own level, press the SHIFT and required number keys, then use the +/- (F1) key to determine if the level will be positive or negative.

TxABCD

Options: ON-HOOK (F1), OFFHOOK (F2), WINK (F3)

Determine the supervision to send on the transmit channel.

As you select one of these choice, the supervision will imme-

diately be sent.

If you wish, you may enter the A/B/(C/D) supervision state manually:

a) Press the SHIFT key to display the SHIFT indicator in the upper left portion of the LCD screen.

b) Press the 1 and/or 0 key as appropriate. If you make a mistake, press the SHIFT key again to turn off the indicator, cursor back to the digit to be changed, press the SHIFT key again, then enter the correct number.

c) When the digits are correct, press SHIFT again. Make sure the SHIFT indicator has vanished.

Rx/DROP

Rx-1 (F1), Rx-2 (F2)

Select the line to receive on.

- Select Rx-1 to receive on Line 1.
- Select Rx-2 to receive on Line 2.
- In T1SINGL or DS1 payload setup, this is set at Rx-1.

Rx1CHAN and **Rx2CHAN** (if T1DUAL)

Options: 01-24

Select the receive channel.

- Use the NEXT (F1) and PREVious keys to select the channel.

Rx1LSTN

Options OFF (F1), SPEAKER (F2), HANDSET (F3)

Determine how you will listen to line 1.

- Select OFF to not listen on line 1.
- Select SPEAKER to use the unit's speaker.
- Select HANDSET to plug a handset into the unit's handset port.

Rx2LSTN (if T1DUAL)

Options: OFF (F1), SPEAKER (F2)

- Select OFF to not listen on line 2.
- Select SPEAKER to use the unit's speaker.

Measurements

The following measurements are only for observation. Measurements are shown for the line selected as Rx/DROP in the section above. The RxABCD for the line not selected will show N/A.

Rx1ABCD and Rx2ABCD

Observe the signalling bits for the indicated receive channel (Line 1 or Line 2)

Rx1/2FREQ

View the received channel's frequency.

Rx1/2DATA

View the received channel's data.

Rx1/2 LVL

View the received channel's level.

6.2 View Supervision

You may find it helpful to view all 24 channels of received supervision bits simultaneously. In this way, you can observe the status of all calls on the line at the same time. Refer to the next figure.

Use the following procedure:

1) From the MAIN MENU, enter the VF/DS0 FUNCTIONS item.

2) Select the VIEW SUPERVISION menu item.

3) Observe the signalling bits of all channels simultaneously. Note that SF-D4 and SLC96 framed signals will show A/B bit signalling information, and ESF framed signals will show A/B/C/D signaling bit information.
   - Channels 1 through 4 are shown on the first line, 5-8 on the second, and so on.

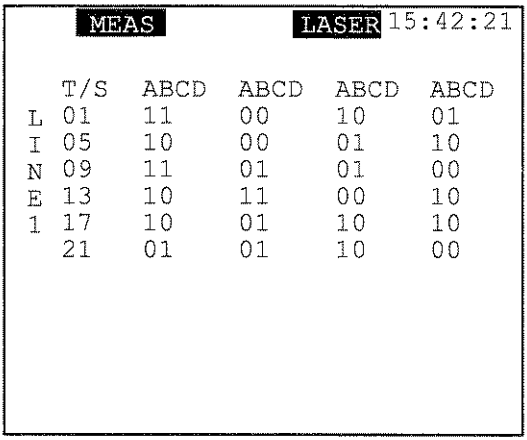

Figure 72 View Supervision Screen

6.3 Noise Measurement

Refer to Figure 73 and use this procedure:

1) In the VF/DS0 FUNCTIONS menu, cursor down to the NOISE MEASUREMENT menu item and press ENTER.

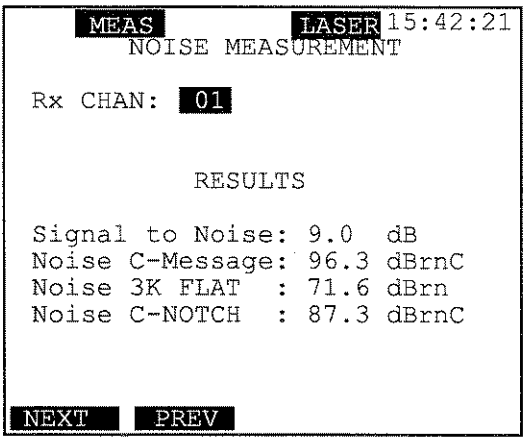

Figure 73 Noise Measurement

2) RX CHNL

Select the channel you wish to perform measurements on.

- Use the NEXT (F1) and PREVious (F2) keys to change the channel.

3) Observe the noise measurement RESULTS. Results are taken from the line designated as Rx/DROP in the VF MEASUREMENTS screen.

Signal to Noise
C-Message
3kHz flat (3-K FLAT)
C-Notch

4) After your desired measurement results are complete, press ESCAPE to return to the VF/DS0 FUNCTIONS menu.

7.0 Other Features

Refer to the following figure for the Other Features menu.

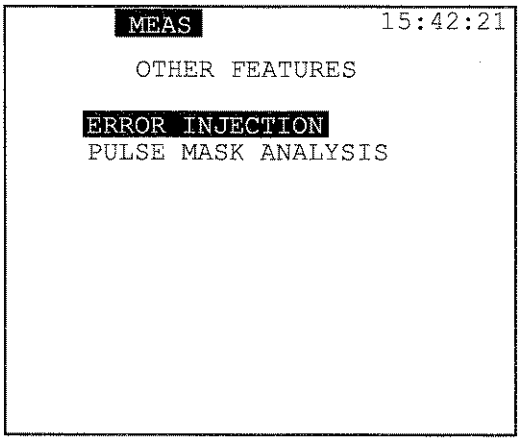

Figure 74 Other Features Menu

7.1 Error Injection

You may insert errors on a payload rate. You may choose the payload to inject errors on. T1SINGL, T1DUAL, and OC-3c configurations do not have a separate payload to configure, as shown in Figure 75. See Figure 76 for a multirate setup. Use this procedure:

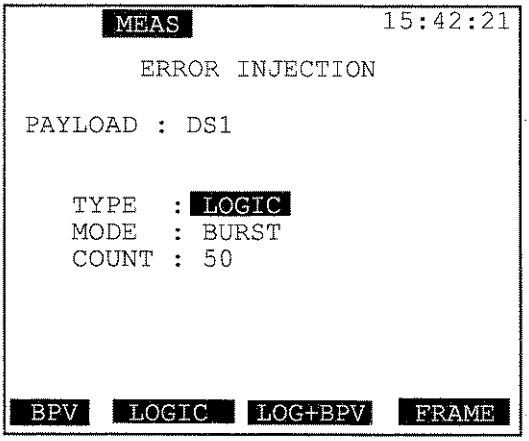

Figure 75 Error Injection, Single Rate (DS1)

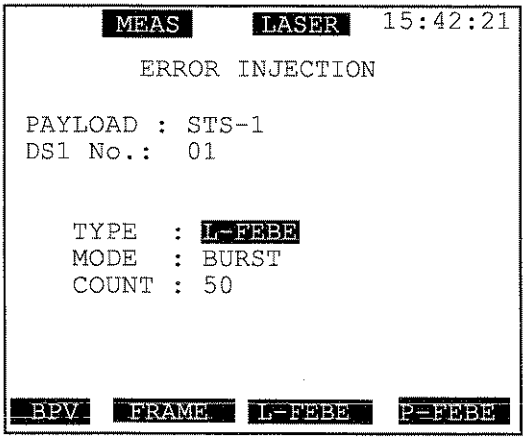

Figure 76 Error Injection, Multirate (STS-1)

PAYLOAD

Options: Depends on the Test Interface. See the following table for the options:

Payload	Errors Available	Burst/Rate
SONET	Logic	B, R
	Frame	B, R
	L-FEBE	B
	P-FEBE	B
STS-1	Frame	B
	L-FEBE	B
	P-FEBE	B
DS3	Frame	B
	P-Bit	B (1)
	C-Bit	B (1)
	FEBE	B (1)
DS1	Logic	B, R
	Frame	B (1)

Figure 77 Error Injection Options

TYPE

Select the type of errors you wish to insert.

Options: See above table for errors available for each rate.

- Select BPV for Bipolar Violations.
- Select LOGIC for bit errors.
- Select LOG+BPV to generate logic and bit errors simultaneously.
- Select FRAME to generate a framing bit error.
- Select L-FEBE to send a Line FEBE.
- Select P-FEBE to send a Path FEBE.
- Select P-Bit to send a P-bit parity error.
- Select C-bit to send a C-bit error.
- Select FEBE to send a Far End Block Error.

MODE

Select the error injection method.

Options: RATE (F1), BURST (F2)

- BURST mode allows a set number of errors to be injected with each press of the ERR INJ key.
  a) Cursor down to COUNT.
  b) Press the SHIFT-lock key and observe the SHIFT indicator in the upper left-hand corner of the screen.

c) Using the keypad, enter the number of errors you wish to inject each time the ERR INJ key is pressed. The SunSet will accept values between 1 and 999.

d) Note that many errors are set at a Burst Count of 1 (examples include FRAME for DS1 and FEBE for DS3).

- RATE mode allows errors to be injected continuously at a specified rate.
  a) Select RATE at the MODE item. The cursor automatically moves down to the next item, RATE.
  b) Press the SHIFT-lock key and observe the SHIFT indicator in the upper left-hand corner of the screen.
  c) Enter the constant rate at which you wish to inject errors when the ERR INJ key is pressed. The SunSet will accept values between 1e-3 and 9e-9.
  d) Note that RATE is not available to all errors.

4) When the settings are complete, press ENTER.

Error injection is usually performed to verify presence of a loopback. Simply press the ERR INJ key and the SunSet will insert the type and quantity of errors you have specified. If you are looped back, the ERRORS LED will light.

When you actually inject the errors, the errors will be inserted during a 1 second period, and will cause from 1 to 2 errored seconds.

7.2 Pulse Mask Analysis

- Measure and view the quality of a DS1 or DS3 pulse.
- You must be connected to the physical DS1 or DS3 line to do a pulse mask analysis.
- See the following figures for samples of a DS1 and a DS3 pulse.

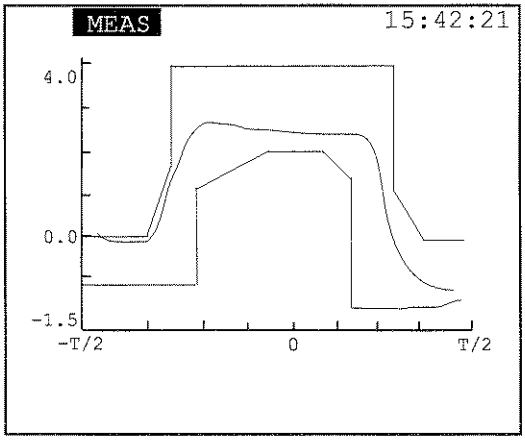

Figure 78 DS1 Pulse Mask

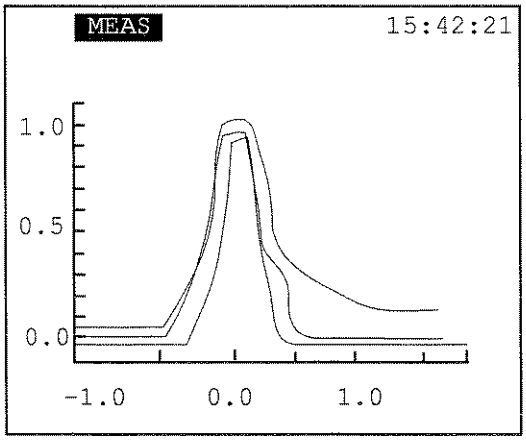

Figure 79 DS3 Pulse Mask

Use this procedure:
1) Configure the unit for DS1 or DS3 point-to-point testing.

2) Connect to the line.

3) From the MAIN MENU, enter OTHER FEATURES.

4) Enter PULSE MASK ANALYSIS.
a) You will see a "Preparing Data" message.
b) After several seconds the pulse shape will be displayed.

Screen Definitions:
- The center line is the actual captured pulse.
- The inner and outer lines are the specified pulse mask upper and lower limits.
- As long as the captured pulse falls within the inner and outer lines, it passes for quality. The standard used for the DS1 pulse is ANSI T1.403. TheANSI T1.404 standard is applied to the DS3 pulse.

8.0 System Configuration

The System Configuration menu can be accessed from the Main Menu. See the next figure.

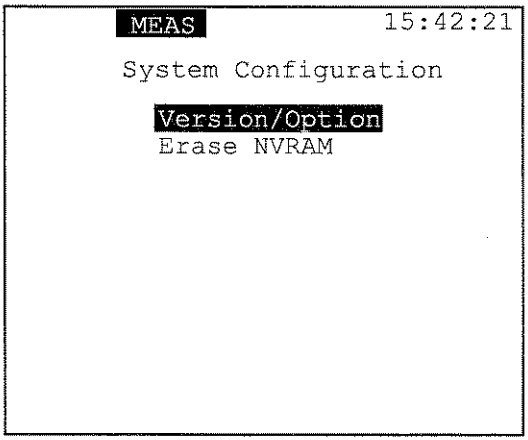

Figure 80 System Configuration Menu

8.1 Version/Option

This screen displays the SunWare version, type, serial number, and options installed in your OCx. PAGE-UP (F1) and PAGE-DN (F2) as necessary. Figure 81 depicts a sample Version/Option screen.

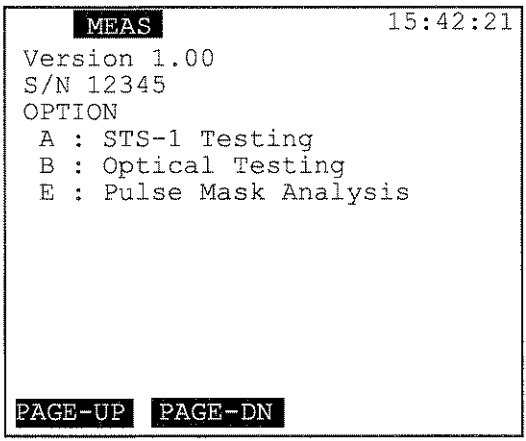

Figure 81 Version/Option Screen

8.2 Erase NV RAM

- Erase NV (Non Volatile) RAM erases all the user-storable information entered into the test set.
- This operation should always be performed when inserting a new SunWare cartridge.
- This operation can also be tried as a last resort if the set is not performing properly. If this is the case, you should initiate Erase NV RAM, only after attempting to correct the problem by:

1) Making sure that the test set is properly configured for the application being attempted.
2) Turning the power switch off and on.
3) Performing a self test and turning the power off and on again.

WARNING: Performing the ERASE NV RAM operation will erase all the user-storable information the user has entered into the test set. All user transmit patterns, telephone num-

bers, and settings will be erased.

Use the following procedure to perform ERASE NV RAM :

1) From the main menu, enter the SYSTEM CONFIGURATION menu, then enter the ERASE NV RAM menu item.

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

3) When the test set is finished with the operation, turn the power off for 5 seconds, then turn the power back on.

4) Reconfigure the set for the operations you need to perform. TEST CONFIGURATION, TEST PATTERNS, and all other areas of the set will be restored to the factory defaults.

Chapter 4
Specs & Configs

1.0 Specifications

CONNECTORS
OC-1/3/3c: SC
STS-1 and DS3: BNC
DS1: Bantam, Line 1 and 2
External Clock: BNC
Handset Port: 4-pin modular plug
Serial Port: 8-pin Mini DIN RS232C (V.24), DTE
DC Power

STATUS/ALARM INDICATORS
Power and low battery LED indicators
Logic: Pattern Sync and Bit Error
SONET: Pulses, Alarm, Frame, Errors, Pointer, and ATM Cell
DS3: Pulses, Alarm, Frame, and Errors
DS1: Pulses, Alarm, Frame, Errors, B8ZS, and VT Pointer

SONET
Rates: STS-1, OC-1, OC-3
Payloads: OC-3c, DS3, DS3/DS1, VT1.5 Asynchronous
Clock Source
- Internal: 19.44 MHz, ±5 ppm
- Loop: Recovered, ±300 ppm
- BITS: ±5 ppm

Framing: Conforms to ANSI T1.105 and Bellcore TR-253
Coding: B3ZS
Optical Transmitter
- Wavelength: 1310 nm
- Power: -15 to -8 dBm

Optical Receiver
- Mode: Single Mode (SC duplex-type)
- Wavelength: 1310 nm (1261-1360 nm)
- Input Sensitivity: -31 dBm (max) (ITU-T G.958)
- Max. Input power: -8 dBm (min)

STS-1 Transmitter
- High, DSX, Low. DSX conforms to ANSI T1.102 and Bellcore TR-NWT-000253

STS-1 Receiver
- Input Impedance: 75 ohm
- Input Sensitivity: +3 dB to –26 dB resistive loss or 450 ft cable loss from STSX-1

OC-3c Test Patterns

2^{23}-1, 2^{20}-1, 2^{15}-1, 2047, 1100, 0101, 1111, 0000

10 user patterns defined up to 16 bits. Pattern names up to 10 characters

Test pattern inversion

Other Test Patterns based on DS3, DS1, or VT1.5 payload

Error Injection

Frame, Line FEBE, Path FEBE, VT FEBE, VT BIP, Bit, plus payload errors

Alarm Generation

AIS, Line AIS, Line RDI, Line LOP, Path AIS, Path RDI, Path LOP, VT AIS, VT RDI, VT LOP

DS3

Clock Source

Internal: 44.736 MHz, ±5 ppm

Loop: Recovered, ±300 ppm

Framing

Unframed, M13, and C-BIT

Conforms to ANSI T1.102, 107, 107A, 403, and 404 as well as Bellcore TR-TSY-000009 and TR-TSY-000191

Coding: B3ZS

Transmitter

High, DSX, Low

Pulse Shape: Conforms to CCITT G.703, Bellcore TR-TSY-000499

Receiver

Input Impedance: 75ohm

DSX: up to 26 dB resistive or 6 dB cable loss from DSX

High/Low: +6 dB to -26 dB resistive loss

Jitter tolerance: Conforms to TR-TSY-000009

Test Patterns

2^{23}-1, 2^{20}-1, 2^{15}-1, 2047, 511, 127, 63, 1100, 0101, 1111, 0000

10 user patterns defined up to 24 bits. Pattern names up to 10 characters

Test pattern inversion

Error Injection

BPV, Logic, Logic+BPV, Frame, C-Bit, P-Bit, FEBE

Programmable error burst 1 to 9999 count, or error rate 2×10^{-3} to 1×10^{-9}

Alarm Generation

AIS, Yellow, DS2 AIS, DS2 Yellow, Idle

DS1

Clock Source

Internal: 1.544 MHz, ±5 ppm

External: ±300 ppm, TTL, 0 to -30 dB resistive

Loop: Recovered, ±300 ppm

Framing

Unframed, SF-D4, ESF, SLC-96*. Conforms to ANSI T1.102, 107, 107A, 403, and 404. Also Bellcore TR-TSY-000009 and TR-TSY-000191. *SLC is a registered trademark of AT&T

Coding: AMI, B8ZS

Transmitter

Line Build Out (LBO): 0, -7.5, -15, -22.5 dB

Pulse shape conforms to TR-TSY-000499; reference: G.703, CB113, CB119, CB132, CB143, PUB62508, PUB62411

Receiver

Terminate: +6 to -36 dB cable loss, 100 ohm, ±1%

Bridge: +6 to -36 dB cable loss, >1000 ohm

DSX Monitor: -15 to -25 dB, resistive; 100 ohm, ±1%

Test Patterns

2^{23}-1, 2^{20}-1, 2^{15}-1, 2047, 511, 127, 63, QRSS, 0101, 1111, 0000, 1-8, 1-16, 3-24, 1-4, 55-DALY, 55-Octet, FOX, Yellow, Idle

10 user patterns defined up to 32 bits. Pattern names up to 10 characters

Test pattern inversion

Error Injection

BPV, Logic, Logic+BPV, Frame

Programmable error burst 1 to 9999 count, or error rate 2×10^{-3} to 1×10^{-9}

Alarm Generation: AIS, Yellow, Idle

Fractional T1

Error measurements, channel configuration verification

Nx64 kbps, Nx56 kbps, N=1 to 24

MEASUREMENTS

G.821 and general errors: Bit error, bit error rate, errored seconds, % errored seconds, severely errored seconds, % severely errored seconds, error-free seconds, % error-free seconds, available seconds, unavailable seconds, synch loss seconds, degraded minutes

SONET: Signal loss second, frame loss second, loss of clock

second, out of frame, loss of pointer second, path AIS second, line AIS second, path RDI, REI second, section CV B1, line CV B2, path CV B3, BPV, Positive/Negative pointer adjustments, Path REI, frequency, STS-1 peak voltage (V), STS-1 power (dBm)

VT1.5: VT LOP seconds, FEBE, VT RDI seconds, VT AIS seconds, BIP-2 error, VT pointer Positive/Negative adjustment

DS3: Frame loss seconds, loss of signal seconds, BPV, BPV rate, F-bit error, F-bit error rate, P-bit error, C-bit error, FEBE, available seconds, errored seconds, % errored seconds, severely errored seconds, % severely errored seconds, error-free seconds, % error-free seconds, unavailable seconds, degraded minutes, AIS seconds, yellow alarm seconds, frequency, maximum frequency, minimum frequency, peak voltage (V), power (dBm)

DS2: F-bit error, frame loss seconds, AIS seconds, Yellow alarm seconds

DS1: BPV, BPV rate, F-bit error, bit error, CRC-6 block error, CRC-6 block error rate, BPV, out of frame count, errored seconds, % errored seconds, severely errored seconds, % severely errored seconds, error-free seconds, available seconds, degraded minutes, unavailable seconds, frequency, AIS seconds, loss of frame seconds, loss of signal seconds, yellow alarm seconds, low density seconds, excess zeroes seconds

Signal Measurements

Signal available seconds count and percent, loss of signal seconds count and percent, low density seconds count, excess 0s seconds count, AIS seconds count

Receive bit rate: 1542 to 1546 kbps, ±1 bps, external or internal clock

Receive level (volts and dBdsx): Vpk

Frequency Measurements

Moving bar graph of slip count, max frequency, min frequency, clock slips, frame slips, max positive wander, max negative wander

General

Continuous measurement

Elapsed time, remaining time

View Received Data

View T1 data in binary, hex, ASCII formats

Displays data in bytes by time slot

Displays 8 time slots per display page

Capture and store 256 consecutive time slots as test pattern,

10 patterns

LOOPBACK AND SPAN CONTROL

Inband, ESF datalink, and user programmable 24 bits
M13 C-bit loopbacks per TR-TSY-000009
DS3 FEAC loopbacks per ANSI T1.404

VOICE FREQUENCY FUNCTIONS

Monitor speaker with volume control for Line 1 & 2
Built-in microphone/speaker or optional handset
View all 24 channel A,B (C,D) bits for Line 1 & 2
Control A,B (C,D) bits (E&M, on/off hook, wink)
Companding law - u Law
VF Level and Frequency Measurement
  Level: +3 to -60 dBm, resolution 0.1 dBm
  Frequency: 50 to 3950 Hz, resolution 1 Hz
VF tone generation
  Variable tone: 50 to 3950 Hz @ 1 Hz step. +3 to -60 dBm @ 1 dBm
  Fixed tones: 404, 1004, 1804, 2713, 2804 Hz @ 0 dBm and -13 dBm
Signal to Noise (S/N)
Noise with filters: 3-kHz flat, C-message, C-notch

SUNWARE OPTIONS

VF MEASUREMENT AND DIALING (SW0Cx-C)

MF/DTMF/DP dialing up to 32 digits, 10 user programmable quick dial number for each tone type
MFR1 digits, 0 - 9, KP, ST, ST1-3, Pause
DTMF digits, 0 - 9, *, #, A, B, C, D, Pause
DP digits, 0 - 9, Pause
Programmable interdigital period, tone period, and tone level (MF, DTMF)
Programmable %break and interdigital period @ 10 pps (DP)
MF/DTMF decode up to 40 received digits. Analyze number, high/low frequencies, high/low levels, twist, tone period, interdigital time. Analyzer dynamic range: 0 to -25 dBm
DP decode up to 40 digits. Analyze number, %break, PPS, interdigital time

DS3 FEAC (SW0Cx-D)

Provides analysis, control and loop back of the DS3 FEAC data link in C-bit parity framing format

PULSE MASK ANALYSIS (SW0Cx-E)

DS1 and DS3 Pulse Mask

Measurements: Pass/Fail, rise time, fall time, pulse width, % overshoot, % undershoot

DS1 Resolution: 1 ns

DS3 Resolution: 1.65 ns

DS1 Masks: ANSI T1.102, T1.403. AT&T CB119, Pub 62411

DS1 Scan Period: 800 ns

DS3 Masks: T1.404

Pulse/Mask Display: Test set screen and printer

ISDN PRI (SW0Cx-F)

TE/NT Emulation

Place/receive calls: voice, Data-56K, Data-64K, Nx64K, 3.1k audio

Protocols: National ISDN-2, Northern Telecom DMS-100, AT&T Custom

Supports 23B+D, 46B+2D, 47B+D configurations

Built-in microphone/speaker for talk/listen or optional handset

Data calls: bit error rate with G.821 analysis

Data calls: generate 2047, 511, 127, 63, ALL 1, ALL 0, 1010, QRS

Backup D-channel testing in 46B+2D

Bi-directional D-channel monitoring

Full D-channel decoding to Layer 3

Trace filters: Layer 2, Layer 3, Call reference value, Caller number, Called number

Trace storage holds 1000 messages with date and time stamps

GENERAL

Upgrades: SW options upgradeable via SunWare™ in-field cartridge replacement

Display: Backlit 32 characters by 16 lines

Printer

Print screen

ENVIRONMENTAL

Operating temperature: 0 ½C to 50 ½C (32 to 122 ½F)

Operating humidity: 5% to 90%, noncondensing

Storage temperature: -20 ½C to 70 ½C (-4 to 158 ½F)
Size: 10.5 x 7 x 27 cm (4 x 2.8 x 10.5 in)
Weight: 1.2 kg (2.75 lb)
Battery
Built-in NimH rechargeable battery pack
Operation time: 2.5 to 3 hours
AC operation: 100 to 240 VAC, 50/60 Hz universal charger
3 year warranty on chassis
1 year warranty on accessories and battery

2.0 Configurations

Here are the various items which can be ordered,in addition to teh basic SunSet OCx. The following package provides everything you will need in one convenient order number. However, if you prefer, you may order most items separately.

Model	Name and Description
Test Set	
SSOCx-A	DS1 to DS3 Includes Dual DS1 testing through bantam jacks and DS3 testing through BNC connectors CLEI: TEDQADFWAA CPR: 774326

Configuration Note: Each test set includes SunWare Cartridge (SW2502) with basic test operations. Internal NimH battery (SS140), Universal Charger (SS138D), Power Cord (SS431), User's Manual (SA901), and Protective Cartridge (SW2504) for 2nd Memory card slot. Three year warranty on chassis, one year warranty on accessories and battery

SunWare Options	
SWOCx-A	STS-1 Interface testing
SWOCx-B	OC-3/OC-3c Interface testing
SWOCx-C	VF Dialing and Analysis Provides dialing, decoding, and digit analysis for MF, DTMP, and Pulse Dialing
SWOCx-D	DS3 FEAC Provides analysis, control, and loop back of the DS3

	FEAC data link in C-bit parity framing format
SWOCx-E	Pulse Mask Analysis DS1 and DS3 pulse masks
SWOCx-F	ISDN PRI Call Set Up & Monitor Provides ability to place/receive voice and data calls, talk/listen/BERT, and monitor D-Channel

ACCESSORIES

SS101	Carrying case
SS104C	NimH cigarette lighter Battery Charger Output 15.5 VDC @ 2.5A. To be used with SunSets equipped with NimH batteries only
SS105	Repeater Extender
SS106	Cable, single bantam to single bantam, 6'
SS108	Cable, single bantam to single 310, 6'
SS109	Cable, single bantam to probe clip, 6'
SS110	Cable, dual bantam to 15-pin D connector (m), 6'
SS111	Cable, dual bantam to 15-pin D connector (f), 6'
SS112	Cable, 2 single bantams to RJ-48 8-position modular plug, 6'
SS115	DIN-8 to RS232C Printer Cable Replacement printer cable for earlier serial printers such as SS118
SS115B	DIN-8 to DB-9 Printer Cable Included when either SWOCx-01 or SS118B/C is ordered
SS115C	DIN-8 to 6-pin RJ-11 Printer Cable Compatible with the STAR DP-8340 printer interface
SS117	Printer Paper, 5 rolls, for SS118B/C
SS118B	High Capacity Thermal Printer. With internal rechargeable battery. Includes cable (SS115B) for connection to SunSet and 110 VAC charger
SS118C	High Capacity Thermal Printer. With internal rechargeable battery. Includes cable (SS115B) for connection to SunSet and 220 VAC charger
SS122	Null Modem Adapter Replacement null modem adapter for earlier serial printers such as SS118
SS122A	Null Modem Adapter DCE to DCE, DB9 conversion. Included with SW352

SS123A	SunSet Jacket Provides additional weather protection for SunSets. Includes SS123B Carabiner Hook
SS138D	SunSet AC Adapter, 100-240 VAC, 50/60 Hz input, output 15 VDC @ 2.6A. Only for use with SunSets equipped with NimH battery pack
SS140	High Capacity NimH Battery Pack. 9-Cell, 10.8 VDC, 1.8 Ahr
SS143B	Rubber Protector Rubber protective covering with integrated instru ment stand
SS211	Cable, BNC (m) 75W to BNC (m) 75ohm 2m
SS303	WECO 440A to BNC Coaxial Cable, 6'
SS427	Handset
SS430W	Sunrise T3 Cable Kit Includes Carrying Case, 2 Bantam to Bantam, 2 Bantam to 310, 2 Bantam to Test Clip, 1 RJ45 to 'Y' Bantam, 2 BNC to BNC, plus the following adapters: 4 BNC to 440A, 2 BNC to 358A, 2 TAD 3 adapters, 1 Multiuse Tool, 1 Small Mini Maglite, 1 Banjo adapter

OPTICAL ACCESSORIES

SA501	Optical Cable FC to FC, 2m
SA502	Optical Cable FC to SC, 2M
SA503	Optical Cable FC to ST, 2m
SA511	Optical Cable SC to SC, 2m
SA512	Optical Cable SC to ST, 2m
SA521	Optical Attenuator FC, -10 dB
SA531	Optical Attenuator SC, -10 dB
SA541	Optical Splitter FC, 90/10
SA545	Optical Splitter FC, 50/50
SA551	Optical Splitter SC, 90/100

SA555 Optical Splitter
SC, 50/50

EXPRESS LIMITED WARRANTY

A. Hardware Coverage. COMPANY warrants hardware products against defects in materials and workmanship. During the warranty period COMPANY will, at its sole option, either (i) refund of CUSTOMER'S purchase price without interest, (ii) repair said products, or (iii) replace hardware products which prove to be defective; provided, however, that such products which COMPANY elects to replace must be returned to COMPANY by CUSTOMER, along with acceptable evidence of purchase, within twenty (20) days of request by COMPANY, freight prepaid.

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

C. Period. The warranty period for Hardware, Software and Firmware will be One (1) Year from date of shipment to CUSTOMER. The COMPANY may also sell warranty extensions or provide a warranty term of three years with the original sale, which provide a longer coverage period for the test set chassis, software and firmware, in which case the terms of the express limited warranty will apply to said specified warranty term.

D. Only for CUSTOMER. COMPANY makes this warranty only for

the benefit of CUSTOMER and not for the benefit of any subsequent purchaser or licensee of any merchandise.

E. LIMITATION ON WARRANTY. THIS CONSTITUTES THE SOLE AND EXCLUSIVE WARRANTY MADE BY COMPANY WITH RESPECT TO HARDWARE, SOFTWARE AND FIRMWARE. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED. COMPANY SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. COMPANY'S LIABILITY UNDER THIS AGREEMENT WITH RESPECT TO A PRODUCT, INCLUDING COMPANY'S LIABILITY FOR FAILURE AFTER REPEATED EFFORTS TO INSTALL EQUIPMENT IN GOOD WORKING ORDER OR TO REPAIR OR REPLACE EQUIPMENT, SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OR LICENSE FEE FOR THAT PRODUCT, NOR SHALL COMPANY IN ANY EVENT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, ARISING FROM OR RELATED TO THE SALE OF THE MERCHANDISE HEREUNDER, INCLUDING BUT NOT LIMITED TO DAMAGES ARISING FROM OR RELATED TO LOSS OF BUSINESS, LOSS OF PROFIT, LOSS OF GOODWILL, INJURY TO REPUTATION, OVERHEAD, DOWNTIME, REPAIR OR REPLACEMENT, OR CHARGE-BACKS OR OTHER DEBITS FROM CUSTOMER OR ANY CUSTOMER OF CUSTOMER.

F. No Guaranty, Nonapplication of Warranty. COMPANY does not guaranty or warrant that the operation of hardware, software, or firmware will be uninterrupted or error-free. Further, the warranty shall not apply to defects resulting from:

(1) Improper or inadequate maintenance by CUSTOMER;
(2) CUSTOMER-supplied software or interfacing;
(3) Unauthorized modification or misuse;
(4) Operation outside of the environmental specifications for the product;
(5) Improper site preparation or maintenance; or
(6) Improper installation by CUSTOMER.

SUNRISE TELECOM
INCORPORATED

Certificate of Origin

To Whom It May Concern:

We, Sunrise Telecom, with principle location of business at 22 Great Oaks Blvd., San José CA 95119, do hereby certify that the following product is manufactured in the United States of America.

Model	Name
SSE20	SunSet OCx

All versions of SunWare software.

This supplement covers the changes to the Test Configuration process. Various other items have been added to the SunSet OCx, such as ISDN testing and VF dialing; these items will be covered in a future edition of the User's Manual.

Test Configuration

Test configuration (Ch. 3, section 2.1) is now a two-step process. Upon powering up, the unit will present the following screen:

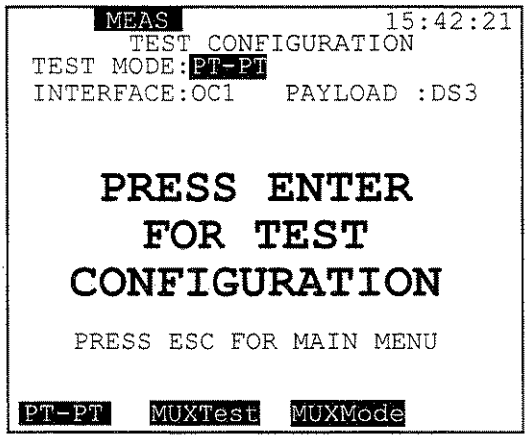

Figure 1 Test Configuration, Screen 1

In this screen, you configure the Test Mode and higher-order settings such as the high and low rates and the test payload.

TEST MODE

Options: PT-PT (F1), MUXTest (F2), MUXMode (F3)

Choose the type of test to perform.

- PT-PT (F1) configures the unit for basic point-to-point testing.
- MUXTest (F2) configures the unit to test through a multiplexer or demultiplexer. The set generates a test pattern for the transmit source.
- MUXMode (F3) configures the unit to emulate a multiplexer/

demultiplexer. The set passes the payload between the received and transmitted rate, for a THRU transmit source.

- Here are the available configurations:

DS1 – DS3 DS1 – STS-1 DS1 – OC-1 DS1 – OC-3
DS3 – OC1 DS3 – OC3

NOTE: For VT1.5 mapping, select a PAYLOAD of VT15.

The TEST MODE selection determines which configuration items next appear.

For Point-to-point:

INTERFACE

Options: OC3 (F1), OC1 (F2), STS1 (F3), DS3 (MORE, F1), DS1 (MORE, F2)

Determine the high rate side of your test.

PAYLOAD

Options: OC3 (F1), DS3 (F2), DS1 (F3), VT15 (F4); Note that the options available will depend on your INTERFACE selection.

Determine the low rate side of your test.

NOTE: For OC-3c testing, select OC3 as your INTERFACE and your PAYLOAD. When you enter the second TEST CONFIGURATION screen, the rate heading will appear as OC-3c.

The following graphics show different ways point-to-point testing may work, depending on the TxSRC selection:

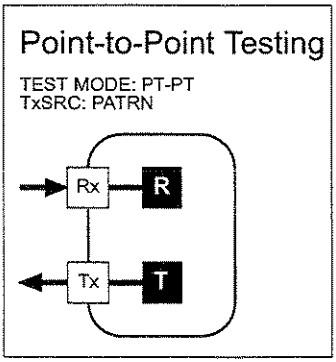

Figure 2 Point-to-Point: TxSRC - PATRN

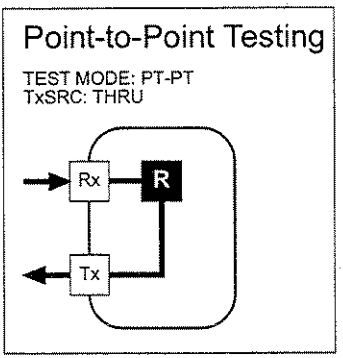

Figure 3 Point-to-Point: TxSRC - THRU

For MUXTest and MUXMode:

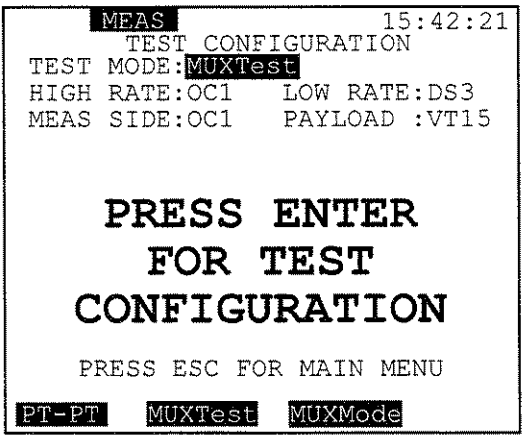

Figure 4 MUXTest Configuration

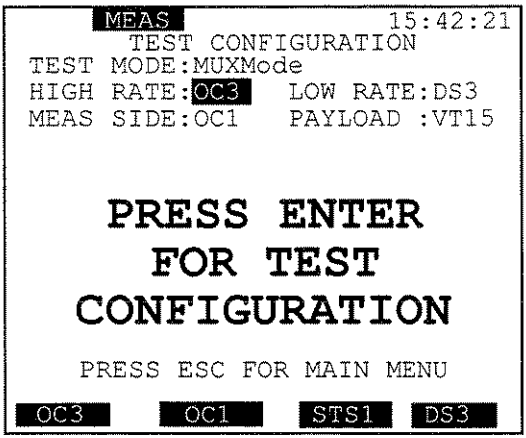

Figure 5 MUXMode Configuration

HIGH RATE

Options: OC3 (F1), OC1 (F2), STS1 (F3), DS3 (F4)

Determine the high rate side of your test.

LOW RATE

Options: DS3, DS1; Note that the options available will depend on your HIGH RATE selection.

Determine the low rate side of your test.

MEAS SIDE

Options: OC3, OC1, STS1, DS3, DS1; Note that the options available will be the same as your HIGH and LOW RATE selections.

Determine on which side the unit will take measurements.

- Select the same rate as your HIGH RATE side, and the unit will test (MUXTest) a multiplexer or emulate (MUXMode) a demultiplexer.
- Select the same rate as your LOW RATE side, and the unit will test (MUXTest) a demultiplexer or emulate (MUXMode) a multiplexer.

The following graphics show the differences in how MUXTest and MUXMode work. Note that both the TEST MODE and MEAS

SIDE choices determine how the test functions.

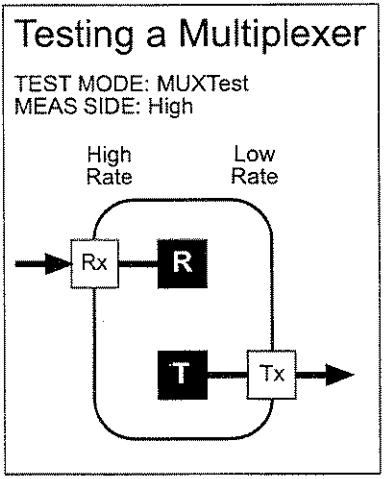

Figure 6 Test a Multiplexer: MUXTest, MEAS Side - High

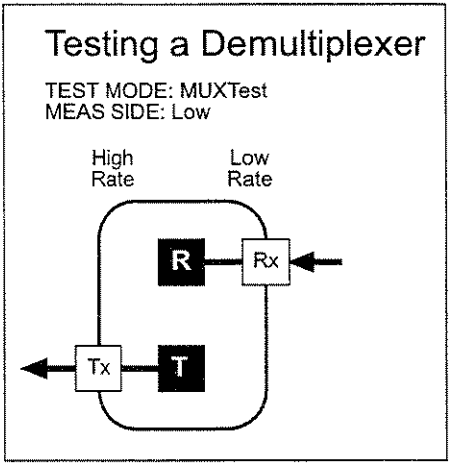

Figure 7 Test a Demultiplexer: MUXTest, MEAS Side - Low

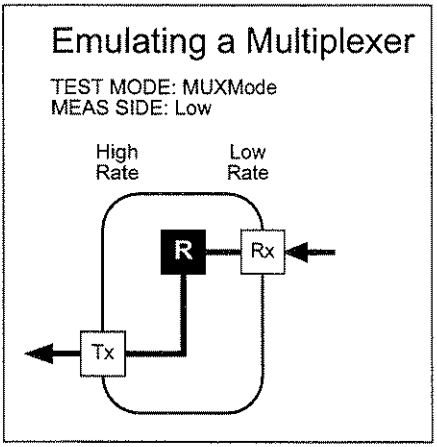

Figure 8 Emulate a Multiplexer: MUXMode, MEAS Side - Low

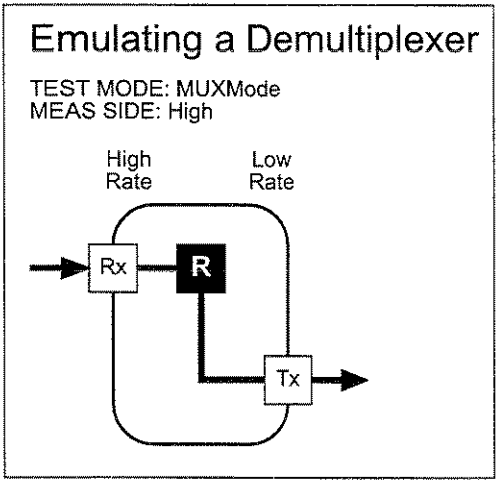

Figure 9 Emulate a Demultiplexer MUXMode, MEAS Side - High

PAYLOAD

Options: DS3, VT15, DS1; Note that the options available will depend on your LOW RATE selection.

The payload may be the same rate as the LOW side, or a signal

within that LOW RATE.

When you have completed this stage of the Test Configuration, press ENTER. Press ESCape if you do not want to keep the changes you have configured.

You will enter the second configuration screen after pressing ENTER. This screen closely resembles the previous, single TEST CONFIGURATION screen. The order of some of the items has been rearranged, and a separate SIGNAL LEVEL configuration has been added.

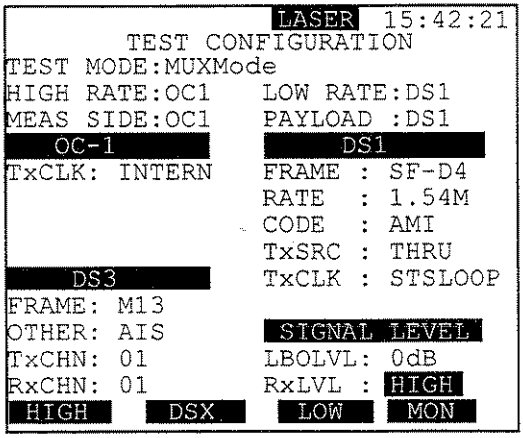

Figure 10 MUXMode Configuration, Screen 2

The following information is presented in the header. All of the items were configured in the previous screen.

TEST MODE: Test mode - point-to-point, muxtest, or muxmode

HIGH RATE: High rate side of the test

LOW RATE: Low rate side of the test

MEAS SIDE: Side measurements are taken on

PAYLOAD: Payload rate

Configure this screen basically as presented in the User's Manual, chapter 3, section 2.1. Note that the VT1.5 rate is available in some configurations.

Signal Level Settings

TxLVL; may also be LBOLVL, if DS1 LOW RATE
Options:
DS1: 0 db (F1), -7.5 dB (F2), -15 dB (F3), -22.5 dB (F4)
Other rates: HIGH, DSX, LOW
Determine the received signal level.

- In the first TEST CONFIGURATION screen, MEAS SIDE is set to either the HIGH RATE or LOW RATE side. The Transmit Level setting here applies to whichever of those two (HIGH or LOW) settings was NOT chosen for the MEAS side. See the following example:

HIGH RATE: OC1 LOW RATE: DS3
MEAS SIDE: OC1 PAYLOAD: DS1

- since OC1 has been selected as the MEAS SIDE, the TxLVL setting applies to the DS3 signal

RxLVL
Options: HIGH (F1), DSX (F2), LOW (F3)
Determine the received signal level

- This level applies to the receive/measure side.