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SunSet T10™

User's Manual
SS150M
Version 2.20

MAN-10450-US001 Rev.B

Sunrise Telecom®... A Step Ahead

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

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Warnings!

- T1 span lines contain high voltage. These voltages may appear on the tip and ring of the bantam jacks used to connect the signal to the SunSet T10.
- Insert or remove software cartridges only with the power switched off. Otherwise, damage could result to the software cartridge.
- Use only the SunSet charger for your SunSet T10. Use only the printer charger for the printer. Improper use of any charger may damage your test set, the printer, or the chargers and will invalidate your warranty.
- When bringing the SunSet in from extreme cold to a warm environment allow the SunSet to warm up and allow any condensation to evaporate before use. Condensation may interfere with the operation of the SunSet and may result in damage.
- Do not immerse the SunSet in water and do not expose the SunSet to rain.
- Using the supplied equipment in a manner not specified by Sunrise Telecom may impair the protection provided by the equipment.

Chapter 1 Initial Setup

1.0 Unpacking the Test Set

Use the following procedures for unpacking and testing a new SunSet T10:

1. Remove the packing list from the shipping container.
2. Remove the SunSet T10 and accessories from the shipping container.
3. Inspect all items and immediately report any damage to both the carrier and Sunrise Telecom.
4. Verify that all parts specified on the packing list were received.
5. Complete the Warranty Registration Card and return it immediately to Sunrise Telecom.

Note: Sunrise Telecom must receive the Warranty Registration Card in order to provide updated software releases.

6. Ensure the software cartridge is fully seated in its slot. Refer to Figures 1 and 2.

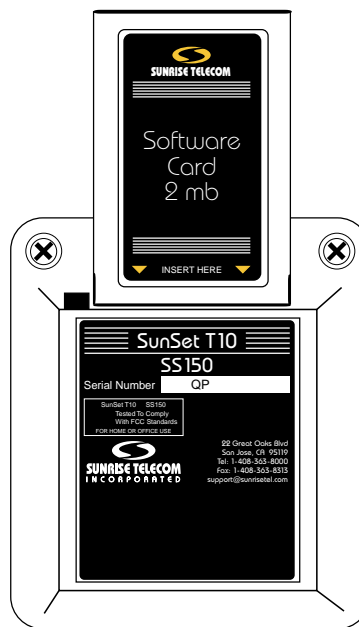


Figure 1 Cartridge Installation

- A. Figure 2 shows the cartridge after installation. Be sure that the top of the cartridge is in line with the top of the ejector button to the left.

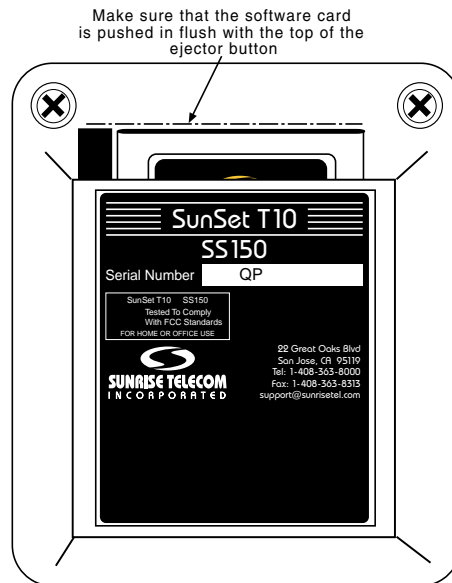


Figure 2 Cartridge After Installation

7. Plug the AC Battery Charger into an appropriate AC wall outlet: 110V/60 Hz for the SS128-B.
8. To install the instrument stand, refer to Figure 3 and the following procedure.

Note: Do not install the instrument stand if the protective jacket is used.

- A. Remove the two center screws from the rear of the SunSet T10. Save these screws if the instrument stand is to be removed at a later date.
- B. Remove the two bottom screws from the rear of the SunSet T10. These screws are slightly longer than the ones removed in step A. Save both of these screws for step E.
- C. Fit the instrument stand onto the back of the SunSet T10.
- D. Use the two long screws, provided with the instrument stand, to attach the instrument stand onto the SunSet T10 at the two bottom screw positions.

- E. Use the screws saved from step B to attach the instrument stand onto the SunSet T10 at the two center screw positions.

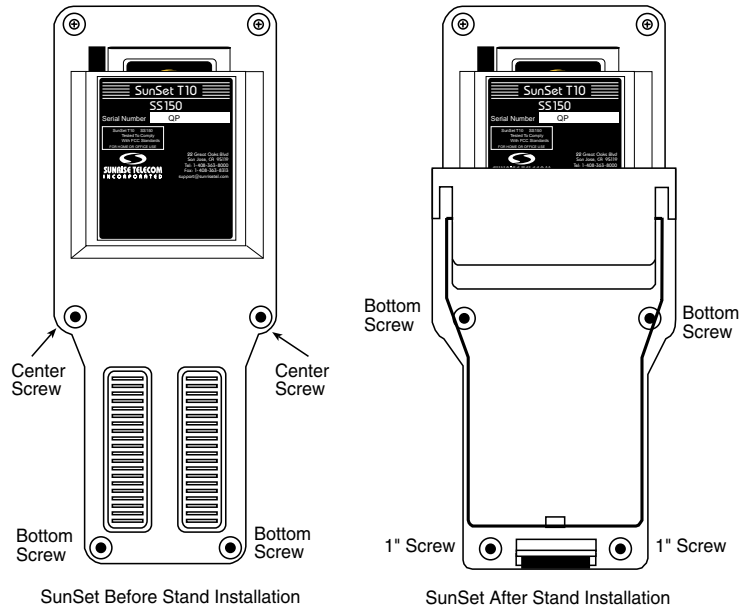


Figure 3 Instrument Stand Installation

9. Switch the SunSet T10 on and verify that it passes the SELF TEST. If the SunSet T10 does not turn on immediately, it may need to charge for up to 5 minutes before it can operate.
10. Charge the SunSet T10 for at least one hour before its first use, or leave the AC Battery Charger plugged in while operating the SunSet T10.

Notes:

- When ordering software upgrades, specify the serial number of the SunSet T10 into which the new cartridge will be installed.
- Each software cartridge is mated to a single SunSet T10. If the SunSet T10 does not start properly, verify that the serial number printed on the software cartridge matches the serial number on the back of the SunSet T10.

2.0 Check Out Procedure

1. Plug in the supplied AC charger.

WARNING!

Use only the SunSet charger for the SunSet T10. Use only the printer charger for the printer. Improper use of any charger may damage the SunSet T10, printer, or chargers and will invalidate the warranty.

2. Using a single bantam cord, plug one end of the cord into the LINE 1 RX jack and the other end into the LINE 1 TX jack. The SunSet T10 will receive the signal transmitted on LINE 1.
3. Press the POWER key on the keypad to turn the SunSet T10 on. Observe the SELF TEST. Verify that it displays a "NO ERRORS" message.
4. Observe the software logo screen that appears immediately after the "SELF TEST COMPLETE" message. Verify the serial and version numbers. To observe this screen again, turn off the SunSet T10 and then turn it back on.
5. Press the LIGHT key on the keypad to turn on the backlight.
 - A. Adjust the screen contrast by using the control thumb wheel on the left side of the SunSet T10.
6. After the SunSet logo screen appears, the SunSet T10 MAIN MENU screen will automatically appear.
 - A. Select TEST CONFIGURATION by using the up/down arrow keys on the keypad. Press the ENTER key on the keypad once TEST CONFIGURATION is highlighted. Configure as follows.

```
TEST MODE: T1SINGL
RxLVL-1: TERM
FRAMING: ESF
Tx CODING: B8ZS
Tx SOURCE: NORMAL
XMT CLK: INTERN
TEST RATE: Nx64K
LBO 1: 0 dB
```

Notes:

- If the cursor will not move, check the SHIFT indicator at the upper left hand corner of the screen. To turn it off press the SHIFT key on the keypad and the word "SHIFT" will disappear.
- Throughout this manual the > symbol is used. This means to select the indicated item and press the ENTER key on the keypad.

- B. After entering Nx64K for TEST RATE, the T10 TIME SLOT screen appears. The AUTO key can be used to configure the received fractional T1 circuit or it can be done manually. For now, press the ENTER key on the keypad to return to the TEST CONFIGURATION screen.

7. Press the GRAPHIC key on the keypad and refer to Figure 4.

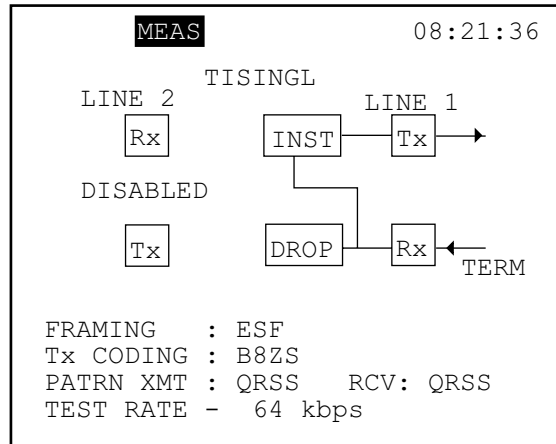


Figure 4 T1SINGL

- For LINE 1 and LINE 2, Rx is the SunSet T10's receiver.
 - Tx is the transmitter.
 - Notice that LINE 2 is disabled. This means that LINE 2's transmitter and receiver are disabled.
 - Observe the LEDs on the SunSet T10. If the ERRORS LED is red, the TEST CONFIGURATION screen is most likely setup for BRIDGE or DSXMON instead of TERM.
 - PULSES, B8ZS, PAT SYNC and ESF LEDs should be green. If any are red, check the TEST CONFIGURATION screen and cable setup.
8. Press the ESCAPE key on the keypad to return to the TEST CONFIGURATION screen.
- A. Select TEST RATE and press the 1.544M (F1) F-key.
- B. Press the GRAPHIC key on the keypad and notice the changes. Refer to Figure 5.

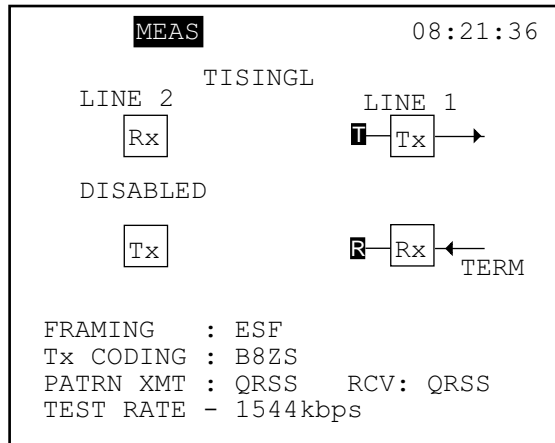


Figure 5 T1SINGL, Test Rate 1.544 kbps

- For LINE 1, Rx is the SunSet T10's receiver.
- For LINE 1, Tx is the transmitter.
- LINE 2 is disabled. This means that LINE 2's transmitter and receiver are disabled.
- If the ERRORS LED is red, TEST CONFIGURATION is most likely setup for BRIDGE or DSXMON instead of TERM.
- PULSES, PAT SYNC and ESF LEDs should be green. If any are red, check the TEST CONFIGURATION screen and cable setup.

C. Press the ESCAPE key on the keypad until the MAIN MENU is displayed.

9. Select LPBK & SPAN CONTROL > CSU & NI CONTROL and configure in the order shown.

```

TYPE: IN-BAND
CODE: NI
MODE: LOOP-UP

```

Note: Pressing the LOOP-UP (F1) F-key starts this function: highlight MODE and then press ENTER.

- A. After "PRE-EXISTING LOOP ONLY! hit ENTER to continue" is displayed, press the ENTER key on the keypad. If the ENTER key is not pressed immediately, the loop-up will be aborted.
- B. Press the ESCAPE key on the keypad twice to return to LPBK & SPAN CONTROL. If other choices are available within LPBK & SPAN CONTROL, select them and observe their functions.

- C. When finished, press the ESCAPE key on the keypad until the MAIN MENU is displayed.
10. Select SEND TEST PATTERN.
- Observe all of the available stress patterns. The SunSet T10 will synchronize only on the pattern it is sending.
 - Displayed is a USER (F1) F-key. This allows the creation of 10 user patterns up to 2048 bits each.
- A. Select the FOX test pattern. The SENDING line displays the FOX pattern.
- B. Press the ESCAPE key on the keypad to return to the MAIN MENU.
11. Select MEASUREMENT RESULTS and refer to Figure 6.

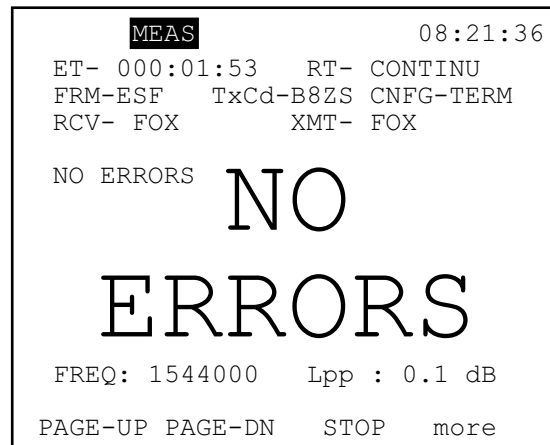


Figure 6 Measurement Results - NO ERRORS

- A. "NO ERRORS" should be displayed as shown in Figure 6.
- B. Verify that FREQ is 1544000 +/-1
- C. Verify that the Lpp is "0 dB" +/- 1.0
- D. Press the ERR INJ key on the keypad and observe the measurement counts. There should be 1 BPV and 1 BIT error shown in the LINE 1-SUMMARY screen.
- E. Pull out the bantam cable on the SunSet T10, wait a few seconds, and put it back in.
- F. The UAS (unavailable second) counter continues to count for 10 seconds after the cable is plugged back in and then decreases by 10.

- G. The ERRORS and BIT ERROR LEDs flash red. Press the HISTORY key on the keypad to clear the flashing LEDs.
 - H. Press the PAGE-DN (F2) F-key to observe the other measurements. There are seven available screens.
 - I. Press the ESCAPE key on the keypad to return to the MAIN MENU.
12. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA.
- A. Press the PAUSE (F3) F-key.
 - B. Press the PAGE-DN (F2) F-key to observe the FOX message in the ASCII column. Displayed is the binary and hex protocol. This data is presented by timeslot number within consecutive frames.
 - C. Verify that 60 screens are available.
 - D. Press the ESCAPE key on the keypad to return to the OTHER MEASUREMENTS menu.
13. Select PROPAGATION DELAY.
- A. Verify that RND TRIP DELAY is 0 or 1 UI.
 - B. Press the ESCAPE key on the keypad to return to the OTHER MEASUREMENTS menu.
14. Select QUICK TEST-I.
- A. Select TICKET and press the TOGGLE (F3) F-key to access the character grid.
 - B. Press the SELECT (F4) F-key to choose the letter A.
 - C. Move the cursor to B; it begins flashing and press the SELECT (F4) F-key to choose it.
 - D. Move the cursor to C; it begins flashing and press the SELECT (F4) F-key to choose it.
 - E. Press the TOGGLE (F3) F-key to escape out of the character grid.
 - F. Verify that the letter C is no longer flashing and the ticket line displays ABC.
15. Select LOOPBACK and choose NI.
- A. Observe the patterns and the times for this test.
 - B. Press the ENTER key on the keypad to begin the test.
 - C. Observe the pre-existing loopback message.
 - D. Press the ESCAPE key on the keypad to abort the test. Observe the results.
- The PAGE-DN F-key is available if the test finishes at least one of the test patterns.

- E. Press the ESCAPE key on the keypad to return to the OTHER MEASUREMENTS menu.
16. Select BRIDGE TAP DETECT
- A. Wait 30 seconds until the first pattern is finished and then press the PAGE-DN (F2) F-key to view the test summary.
- A perfect score is:
BIT errors: 0
ES (Errored Seconds): 0
AS (Available Seconds): 30
- B. Press the ESCAPE key on the keypad to return to the OTHER MEASUREMENTS menu.
17. If ordered, select PULSE MASK ANALYSIS.
- A. Select START NEW ANALYSIS.
- B. Observe the pulse shape.
- C. Press the T1.403 (F1) F-key and verify that T1.403 PASS is displayed.
- D. Press the ESCAPE key on the keypad until the MAIN MENU is reached.
18. Select VF CHANNEL ACCESS. Observe that the "PAT SYNC" LED turns off.
- A. Select VF MEASUREMENTS.
- B. Use the NEXT (F1) and PREV (F2) F-keys along with the arrow keys on the keypad to set Tx-1 and Rx-1 T/S to 01.
- C. Adjust the volume by pressing the VOL UP key on the keypad until something is heard.
- D. Talk into the microphone, located below the keypad. You should hear your voice through the speaker located on the LED panel.
- INSERT TYPE must be set for TALK in order to hear your voice through the speaker.
- E. Continue to configure VF MEASUREMENTS as follows:
- INSERT TYPE: TONE, a tone will sound after selecting TONE (reduce volume as needed).
- TONE FREQ Hz: 1004
- TONE LVL dBm: 0 dBm
- If optioned for LEVEL/FREQUENCY, verify the RxFRQ/LVL is 1004 Hz +/- 2 and 00.0 dBm +/- 0.3.

- F. Select Tx-1 A/B/C/D and press the OFFHOOK (F2) F-key. Verify that the Rx-1 A/B/C/D bits are all 1s. Press the ONHOOK (F1) F-key and verify that the Rx-1 A/B/C/D bits are all 0s.
- G. Set INSERT TYPE to TALK.
- H. Press the ESCAPE key on the keypad to return to the VF CHANNEL ACCESS menu.
19. Select PLACE/RECEIVE CALLS
- A. Select METHOD and press the DTMF (F2) F-key.
- B. Select NUMBER and press the SHIFT key on the keypad. Observe the SHIFT lock indicator on the display.
- C. Enter the number 4083638000 by using the keypad.
- D. Press the SHIFT key again to remove the SHIFT indicator.
- E. Press the ENTER key on the keypad to dial the number and verify that the dialing can be heard.
- F. Press the ESCAPE key on the keypad to return to the VF CHANNEL ACCESS menu.
20. Select VIEW SUPERVISION. Note that the speaker turns off.
- A. Verify the signaling of all columns are 0000 except for 1111 in column 1, row 1.
- B. Press the ESCAPE key on the keypad to return to the VF CHANNEL ACCESS menu.
21. Select and note the DIAL/SPRVIS Setup menu.
- A. Press the ESCAPE key on the keypad to return to the MAIN MENU.
22. Select OTHER FEATURES > SYSTEM CONFIG > VERSION/OPTION to view the ordered options. Press the PAGE DN (F2) F-key if the options take more than one screen.
- A. Press the ESCAPE key on the keypad to return to the SYSTEM CONFIG menu.
23. Select FULL SELF TEST and verify that there are no errors.
- If the SunSet T10 lost PAT SYNC during the self-test, press the RESYNC key on the keypad.
- A. Press the ESCAPE key on the keypad to return to the SYSTEM CONFIG menu.

24. Select ERASE NV RAM. This will reset the SunSet T10's non-volatile RAM and erase all programmed patterns and profiles.
 - A. Follow the on screen instructions.
 - B. Turn off the SunSet T10 for 5 seconds when the procedure is complete, then turn it back on to reload the default settings.
25. Select TEST CONFIGURATION
 - A. Configure as shown in step 6A.
 - B. Press the ESCAPE key on the keypad to return to the MAIN MENU.
26. Select OTHER FEATURES > SYSTEM CONFIG > SYSTEM PROFILES.
 - A. Press the VIEW (F1) F-key to view screen 1 and press the PAGE-DN (F2) F-key to view the other available screens.
 - SYSTEM PROFILES can store and recall up to 10 instrument configurations.
 - B. Press the ESCAPE key on the keypad until the OTHER FEATURES menu is displayed.
27. Select MEAS CONFIGURATION > ERROR INJECTION
 - A. Note the available options.
 - B. Press the ESCAPE key on the keypad to return to the MAIN MENU.
28. Select OTHER PARAMETERS.
 - A. Note the available options.
 - B. Press the ESCAPE key on the keypad to return to the MAIN MENU.
29. Select DATA LINK CONTROL.
 - A. Note the ESF datalink functions.
 - Displays SLC-96® functions, if the SunSet T10 is SLC-96® framed.
 - B. Press the ESCAPE key on the keypad to return to the MAIN MENU.
30. Select CSU/NI EMULATION.
 - A. Press the LLPBK-1 (F2) F-key.
 - B. Verify the loopback graphic.
 - C. Press the ESCAPE key on the keypad to return to the MAIN MENU.

31. If a Sunrise printer was ordered, connect the supplied charger to the printer and a power outlet.
- A. Connect the printer to the SunSet T10 using the Sunrise Telecom mini DIN 8 to RS-232C printer cable.
 - B. Turn on the printer and press the SHIFT key on the SunSet T10 keypad.
 - C. Press the PRN SCR N key on the keypad to print out the current screen.
 - D. Press the SHIFT key again to remove the SHIFT indicator.
32. If Remote Control was ordered, check out its operation by connecting the SunSet T10 to a PC with Microsoft HyperTerminal or other VT100 emulation software. Start by:
- A. Plugging the Sunrise SS122B null modem adapter DB9(F) into the PC's COM port 1.
 - B. Plug the Sunrise SS115B printer cable into the SS122B.
 - C. Plug the other end of the SunSet SS115B printer cable into the SunSet T10's serial port.
 - D. Configure Microsoft HyperTerminal as follows:
 - Connect tab
Connect using: Direct to COM1
 - Configure button
Bits per second: 9600
Data bits: 8 bits
Parity: none
Stop bits: 1
Flow control: Xon/Xoff
 - Setting tab
Use defaults.
Emulation: VT100
 - H. On the PC, type **logon**. The HyperTerminal window should display the remote control.
 - I. On the PC press **Q** for ESCAPE. Press ENTER for enter.
- U, W, and other commands are displayed at the left of the screen.
 - The LEDs are displayed as a table of current and history conditions. The menus and graphics duplicate the SunSet T10.
 - A local user and a remote user can work on a problem together.
 - The display of objects and graphs (i.e. configurations shown in Figures 4 and 5) are not supported in VT100 emulation.

33. The check out procedure is now complete. If there are any questions, or if any of the verification steps failed, please contact Customer Service at:

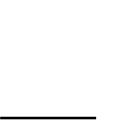
Sunrise Telecom Inc.
302 Enzo Drive
San Jose, CA 95138
USA

Toll Free: 1-800-701-5208, 24 hours per day, 7 days a week.

Fax: 1-408-363-8313

Internet: <http://www.sunrisetelecom.com>

E-Mail: support@sunrisetelecom.com



Chapter 2 Product Description

This chapter describes the general features of the SunSet T10. It explains the LEDs, keypad functions, and the connector panel. Shown in Figure 7 is the front view of the SunSet T10.

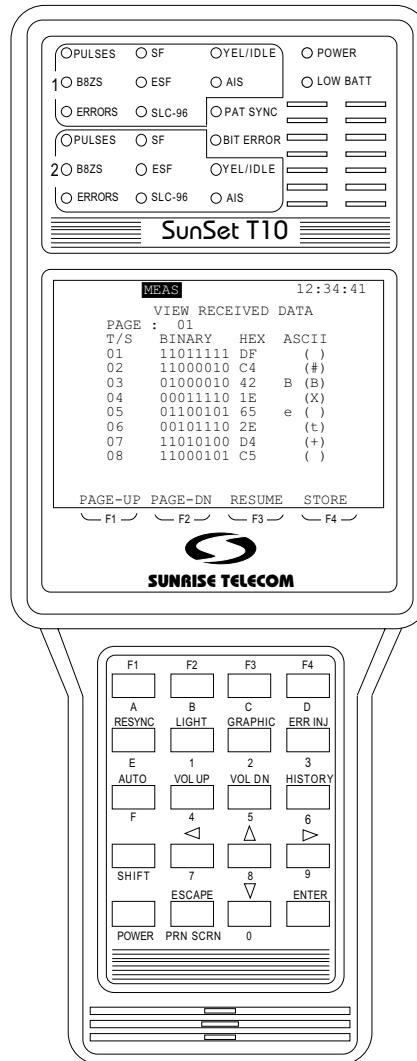


Figure 7 SunSet T10 Front View

1.0 Keypad Functions

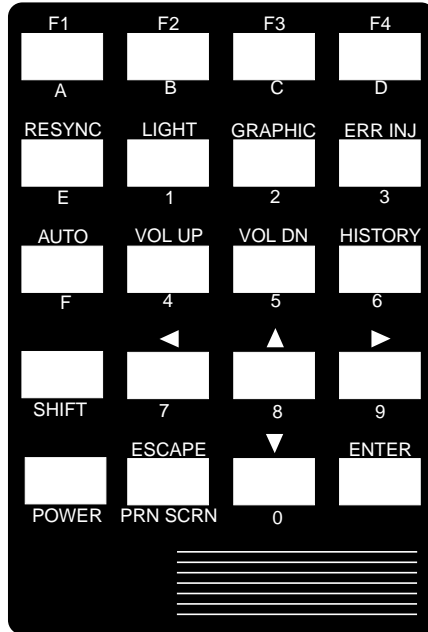


Figure 8 SunSet T10 Keypad

SunSet T10 keys can have two distinct meanings:

- The **White Label** above the key indicates what function will be performed if the key is pressed by itself (i.e. ERR INJ or HISTORY).
- The **Orange Label** below the key indicates what function will be performed if the SHIFT function is activated (i.e. numbers or PRINT).

1.1 Orange Label Keys

Shift Key Function

To activate the shift function:

1. Press and release the orange SHIFT key. Do not press the SHIFT key simultaneously with other keys. At this point, the SHIFT indicator will appear in the upper left-hand corner of the screen.
2. Then press the desired key marked in orange. The SunSet T10 will then perform the function indicated on the orange label.
3. Press the SHIFT key again to release the shift. Note that the SHIFT indicator is now gone.

Note: Check the shift indicator if the keys are not behaving as expected. If the shift indicator at the upper left-hand corner of the screen indicates the wrong shift status, press the SHIFT key.

A, B, C, D, E, F

Use these keys to enter DTMF tones (A-D), special MF tones, letters in labels, and hexadecimal numbers.

0 through 9

Use these keys to enter user test patterns, user loopback patterns, numbers in LABELS, and telephone numbers.

PRN SCRN

Press PRN SCRN to print the current screen to the SS118 High Capacity Thermal Printer. The image is converted to bitmap format so that any screen (menu, pulse mask, graphic) can be printed.

- This screen will not print to ASCII devices.
- When the PRINT F-key is present, the output is generally formatted in ASCII characters and can be used by common printers and computers.

1.2 White Label Keys

F1–F4

Use these keys to select choices at the bottom of the LCD display. If more than four F-key options are available, a “more” indicator will appear in the F4 position. Pressing the “more” (F4) F-key will display the other available keys.

- In most instances, when the desired F-key is pressed, the cursor will advance to the next display line automatically. If the settings of a previous line need to be changed, press the Up Arrow key on the keypad, then select the option using the appropriate F-key.
- At the bottom of the screen are options associated with a particular setup parameter within that screen. Changing the position of the cursor within that screen, the available F-key options will also change.

RESYNC

The RESYNC key re-synchronizes on the transmit pattern and restarts the in-progress measurement.

- If the transmit pattern is not found, the measurement begins in a live mode with the PATSYNC light off.
- If the transmit pattern is found, then the PATSYNC LED turns green and bit measurements are made.
- Bit measurements are discontinued during some operations like ISDN PRI Call Setup and VF Channel Access.

LIGHT

Use the LIGHT key to turn on and off the display backlight. Turning the backlight off can extend the run time of the battery.

- The backlight timer can be set in OTHER FEATURES > SYSTEM CONFIG > GENERAL CONFIG. If the timer is set, the backlight will automatically turn itself off after the specified amount of time has passed.
- The default is for a continuous backlight.

GRAPHIC

The graphic key presents a picture of the current circuit configuration. The graphic can be invoked during basic menus and basic operations such as Test Configuration, Send Test Pattern, Measurement Results, and LPBK & Span Control. Use the GRAPHIC key upon completing TEST CONFIGURATION to confirm the settings.

Graphics are also included as a basic part of several advanced features such as CSU/NI emulation, looping repeater menus, DATACOM, and PULSE MASK ANALYSIS. In these advanced menus, additional graphics are not available if the GRAPHIC key is pressed.

ERR INJ

Use the ERR INJ (error injection) key to inject errors on the SunSet T10's transmitted signal. Errors will be injected according to the configuration in OTHER FEATURES > ERROR INJECTION.

- When the ERR INJ key is pressed and the error injection MODE is set for RATE, errors will be injected at the specified rate and type selected in the OTHER FEATURES > ERROR INJECTION menu.
- An error inject indicator will be at the top of the display to the right of the MEAS indicator and will display the type of error.
- The types of errors are BPV, LOGIC, LOG+BPV, and FRAME.

AUTO

The AUTO key automatically synchronizes framing and test patterns. It also:

- restarts the test in progress and clears any history indicators.
- changes the transmit pattern to the received pattern.
- updates the framing in the TEST CONFIGURATION screen.
- updates the test pattern in the SEND TEST PATTERN and MEASUREMENT RESULTS screens.
- Note that other operations cannot be performed while the SunSet T10 is searching for the framing and pattern.

VOL UP & VOL DN

To adjust the speaker volume when using VF Channel Access use the VOL UP and VOL DN keys. Upon pressing these keys, a volume indicator will appear at the top right corner of the screen.

HISTORY

Use the HISTORY key to turn off flashing LEDs. LEDs flash to indicate an error or alarm that has occurred, but is no longer present.

ENTER

The ENTER key performs two functions:

1. When a menu item is highlighted and the ENTER key is pressed, the screen displays the new screen indicated by the menu choice.
2. The ENTER key is also used in a few screens to invoke an operation after the user is finished entering all data in a given screen. Pressing the ENTER key causes the SunSet T10 to carry out those specified inputs. This happens in just a few cases, like DTMF dialing and manual A/B (/C/D) bit entry.
 - In almost all of the high usage functions, it is not necessary to press the ENTER key to invoke the operation.
 - If the operation does not seem to be occurring, press the ENTER key.
 - When the ENTER key is used to invoke the operation, the ESCAPE key may need to be pressed to return to the previous menu once the operation is completed.

ESCAPE

This key has two functions:

1. It moves back toward the MAIN MENU, one screen at a time.
2. It is used to abort an unwanted action.

▲, ▼, ►, ◀ Cursor Keys

The cursor keys move the highlighted cursor in the indicated direction.

2.0 LEDs

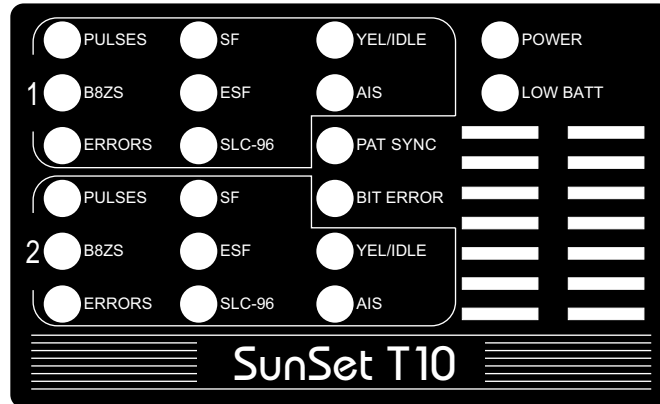


Figure 9 LED Panel

The LEDs (light emitting diodes) indicate the status of the received signal.

An LED lights continuously when the condition for that LED occurs on the received signal.

- After an alarm (red LED) condition ends; the LED will begin to blink. This blinking provides a history in case no one was present when the condition occurred.
- Pressing the HISTORY key at anytime clears the flashing LEDs.

Note: As various operations are performed on the SunSet T10, the LEDs automatically stop flashing.

BIT ERROR

The Bit Error LED lights if a Bit Error has been detected. This LED refers to the line selected (L1-Rx or L2-Rx) as Rx/DROP in the TEST CONFIGURATION screen.

PAT SYNC

The pattern synchronization LED lights green if the SunSet T10 receives the same pattern it transmits. Select this pattern in the SEND TEST PATTERN menu. View the transmit and receive pattern in the MEASUREMENT RESULTS and GRAPHIC screens.

The PAT SYNC LED will not light if there is no pattern synchronization. When synchronization occurs, the pattern synchro-

nization LED turns green. Once the LED turns green, if pattern synchronization is lost, the LED turns red. When pattern synchronization returns, the LED turns green again.

POWER

When switched on, the POWER LED lights green and indicates an adequate battery charge.

LOW BATT

The LOW BATT LED lights red when the SunSet T10's power battery has dropped to a low level.

- The SunSet T10 will shut itself down approximately 10 minutes after the LOW BATT LED lights. The auto shut down helps protect the battery from a damaging total discharge.

Plugging in the AC Battery Charger will allow use of the SunSet T10 indefinitely. However, to use the SunSet T10 for an extended period, it is advisable to plug the AC Battery Charger in before starting a test.

- If the charger is plugged in while a measurement is in process and the battery is low, the SunSet T10 may reset itself. In this case, the current measurement results would be lost.

1 and 2 LED Groups

The following LEDs provide the same functions for both Lines 1 and 2. In T1 SINGL mode, Line 2's LEDs are off. These LEDs are off in Datacom mode.

PULSES

This LED shows whether the SunSet T10 is receiving a T1 signal or not. If a signal is detected, this LED is green; if a loss of signal is detected, the LED is red.

B8ZS

This LED shows that B8ZS line coding is present on the received T1 signal. During severe BPV error conditions on an AMI line, the B8ZS light may also be on.

- B8ZS coding can only be observed on a line if at least 8 consecutive data zeroes are transmitted on the line.
- An AIS signal or other high ones-density signal can make it impossible to determine whether the line is optioned correctly for AMI or B8ZS.

ERRORS

If any error occurs, this LED lights red. This could be a framing bit, bit, CRC-6, or other error.

SF, ESF, SLC-96

These LEDs show whether the framing found on the received signal matches the framing selected in the TEST CONFIGURATION screen. If the framing matches, the appropriate framing LED will be green. If the framing does not match, then the framing LED selected in the TEST CONFIGURATION screen will be red.

Used on "A DS1" with the SLC-96® system is SLC-96® framing. The B and D DS1s use SF framing. The C DS1 will show SLC-96® framing in mode II.

Although the SunSet T10 will recognize an SLC-96® signal from an SLC system, it may not recognize SLC-96® framing from another test set. For the SunSet T10 to recognize SLC-96® framing, the other test set must include valid SLC-96® frame flags in its SLC-96® framing.

YEL ALM

This LED lights if the SunSet T10 detects a yellow alarm. An SF yellow alarm occurs when bit 2 is set to zero in all channels. An ESF yellow alarm is a data link message of 00000000 11111111.

AIS

This LED lights red if the SunSet T10 detects an all ones signal without framing on its active receive jack.

3.0 Connector Panel

The connector panel shown in Figure 10 is located on the right side of the SunSet T10.

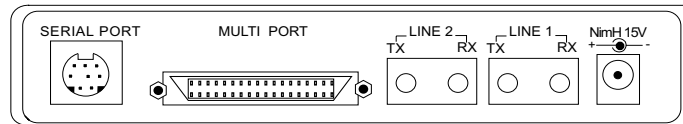


Figure 10 SunSet T10 Connector Panel

Line 1

Use these jacks for both T1SINGL and T1DUAL access modes.

Line 2

Use these jacks when T1DUAL is selected in the TEST CONFIGURATION screen. Also, use the Line 2 Rx jack as the reference frequency input in T1SINGL mode.

SERIAL PORT

Use this port for sending information to the printer and for the optional remote control.

MULTI PORT

This port is provided for Datacom testing.

NimH 15V

The SS104 Cigarette Lighter Charger and the SS128-B Battery Charger plug into the DC jack.

- Plugging the charger in enables the SunSet T10 to operate off a discharged battery.
- The battery will charge during operation while the SunSet T10 is running on the charger.

3.1 Using the Battery & AC Charger

NOTICE!

Use only the charger supplied with the SunSet T10. Use of other chargers will void the warranty.

Designed to provide power for portable testing, the battery uses a custom-designed charger. This charger is powerful enough to run the SunSet T10 continuously while keeping the battery charged.

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

Here are some tips for getting the best performance out of the battery:

- If not needed, turn the screen backlight off.
- Switch the power off on the SunSet T10 when it is not in use.
- Use the cigarette lighter battery charger when driving. This will help keep the battery charged when AC power is not available.
- If running an extended test and uncertain if the battery will last, plug the charger in at the beginning of the test so that the SunSet T10 will run indefinitely. Plugging the charger in while the battery is low during a test may cause the SunSet T10's processor to reset and drop the current test.
- Recharge the battery between uses, even if the time available for a recharge is short. The AC battery charger is a special two-stage design that charges the battery to approximately 80% of its capacity in just a few hours. The battery will fully charge overnight.
- If the LED is on continuously, then the charger is in high-output mode and is either fast charging the SunSet T10 or powering it during normal operation. When the LED blinks regularly, the charger is in trickle-charge mode. When the LED barely flickers at all, the battery is fully charged.

3.2 Printing from the Serial Port

The SunSet T10 is equipped with a standard serial port for printing and remote control operations.

3.2.1 Serial Port Settings

The Serial Port can be configured for baud rate, parity, stop bit, bits/character and carriage return/line feed. These settings are configured in MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > GENERAL CONFIG. In general, the SunSet T10's serial port settings will need to match the settings of the printer or remote control.

3.2.2 Configuring for Printing

An optional SS118 High Capacity Thermal Printer is available with the SunSet T10. This printer uses the 8-bit serial RS-232C port located at the top of the SunSet T10. The SS118 uses thermal paper; it has no ink cartridge or ribbon that needs replacing. Many other serial printers are available to the user; however, not all of these printers will operate correctly with the SunSet T10. In addition to the optional SS118 printer, the TTC PR40A printer will work, although it requires an optional SS122C Null Modem Adapter.

Use this information to setup the SunSet T10 with another printer. However, Sunrise Telecom does not warrant the operation of the SunSet T10 with any printer other than the one supplied by Sunrise Telecom.

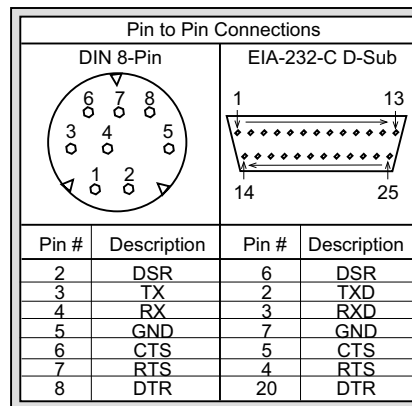


Figure 11 Printer Cable Pin Assignments

To use the SS122C Null Modem Adaptor with other brands of printers, refer to Figure 12.

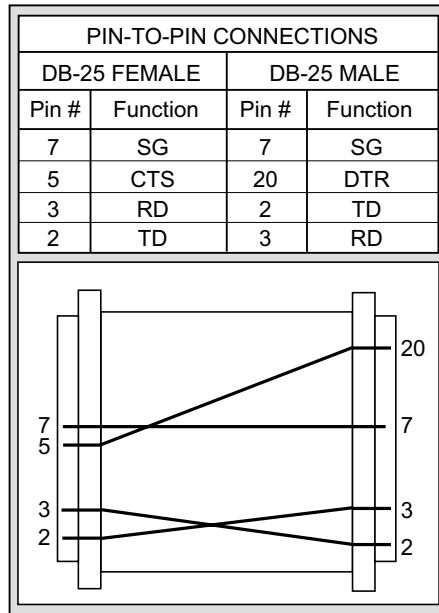


Figure 12 SS122C Null Modem Pin Assignments

To begin printing, follow this procedure:

1. Connect the Sunrise Telecom DIN-8 to RS232C Printer Cable (SS115) to the serial port at the top of the SunSet T10.
2. If using a Sunrise Telecom printer, skip this step. Otherwise, connect the Sunrise Telecom Null Modem Adapter (SS122C) to the free end of the Printer Cable. Note that the adapter ends are labeled "Test Set Cord" and "Printer, Terminal".
3. Confirm that the SunSet T10's serial port settings match those of the printer. Refer to the instructions that came with the printer on how to check or change the switch settings. If using the Sunrise Telecom thermal printer, refer to Table 1 for the correct switch settings. If using the SS118 printer, refer to Figure 13.

DIP SWITCH 1			
POSITION	DIP SWITCH SETTING	PARAMETERS	PARAMETER SETTING
1	OFF	INPUT	SERIAL
2	ON	PRINTING SPEED	HIGH
3	ON	AUTO LOADING	ON
4	OFF	AUTO LINE FEED	OFF
5	ON	SETTING COMMAND	ENABLE
6	OFF	PRINTING DENSITY	100%
7	ON		
8	ON		
DIP SWITCH 2			
POSITION	DIP SWITCH SETTING	PARAMETERS	PARAMETER SETTING
1	ON	PRINTING COLUMNS	40
2	ON	USER FONT BACK-UP	ON
3	ON	CHARACTER SELECT	NORMAL
4	ON	ZERO	NORMAL
5	ON	INTERNATIONAL CHARACTER SET	ENGLISH
6	ON		
7	OFF		
8	OFF		
DIP SWITCH 3			
POSITION	DIP SWITCH SETTING	PARAMETERS	PARAMETER SETTING
1	ON	DATA LENGTH	8 BITS
2	ON	PARITY SETTING	NO
3	ON	PARITY CONDITION	ODD
4	ON	BUSY CONTROL	H/W BUSY
5	OFF	BAUD RATE SELECT	9600 bps
6	ON		
7	ON		
8	ON		

Table 1 Switch Settings for SS118B, C & D Printers

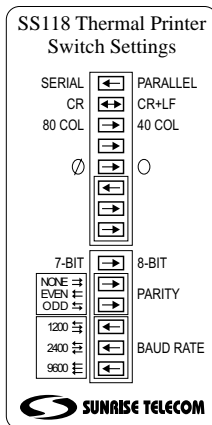


Figure 13 Switch Settings for SS118 Printer

3.2.3 Printing to a Parallel Printer

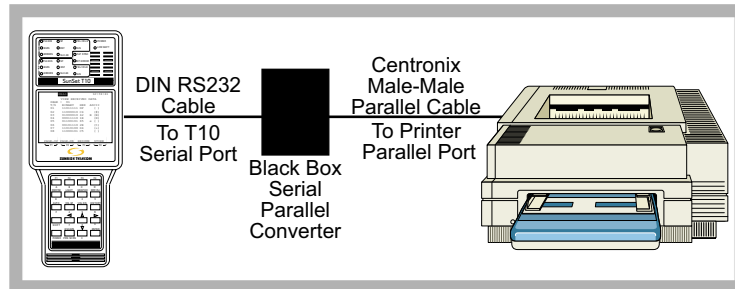


Figure 14 Printing to a Parallel Printer

In addition to printing out results on the SS118 series printer, any parallel printer can be used, i.e. HP or Epson. Refer to Figure 14 and use the following procedure:

1. Connect the Sunrise Telecom DIN-8 to RS232C Printer Cable (SS115) to the serial port at the top of the SunSet T10. Connect the other end to a serial to parallel converter. The Black Box PI 115A is recommended. Order the converter through Sunrise Telecom.
2. Configure the Black Box PI 115A converter:
 - Set the Black Box for DCE, since the SunSet T10 is set for DTE
 - Make sure that the Black Box is set for the Serial > Parallel Direction
 - Check that the converter's DIP settings correspond to those of the SunSet T10's serial port. Configure the SunSet T10's serial port settings in MAIN MENU > OTHER FEATURES, > GENERAL CONFIG. The SunSet T10's default settings are:

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

Note: The converter must supply its own power (or receive power from the parallel port). The SunSet T10 will not supply any power through the serial port.

3. Connect the Centronix cable (Black box #BC 001 01) to the Parallel connector on the Black Box converter and to the

Parallel Port of the printer. The Centronix cable is a male-male parallel connector.

4. Use this printer whenever a PRINT F-key option is available, as in the MEASUREMENT RESULTS or a VIEW/PRINT TRACER screen. Press the PRINT F-Key and the results will print out.

Notes:

- The PRINT SCREEN key does not work with a parallel printer.
- Parallel printers are not able to handle the SunSet T10's graphics; the HISTOGRAM ANALYSIS and PULSE MASK ANALYSIS results will not print, even though the PRINT F-Key is available.

4.0 Additional Controls

Contrast Control

This control adjusts the contrast of the LCD screen. It is located on the left-hand side of the SunSet T10.

5.0 Remote Control (SW100)

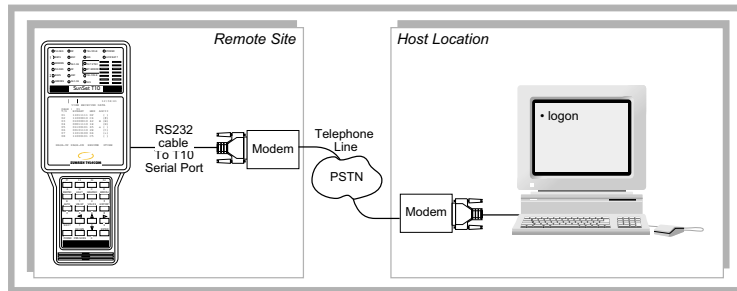


Figure 15 Remote Control Typical Layout

Controlling the SunSet T10 through the optional remote control is similar to controlling the SunSet T10 directly. Remote control allows a remote user and a local user to use the SunSet T10 together at the same time. This simultaneous-usage feature can help a team of people fix a problem.

Refer to Figure 11 for a diagram of the pin-to-pin assignments of the DIN to EIA-232-C cable supplied by Sunrise Telecom. Refer to Figure 12 for the pin-to-pin assignments of the Sunrise Telecom Null Modem Adapter.

A breakout box, null modem, patch-box and other RS-232C communications tools maybe needed to set up serial communications.

Configure the SunSet T10 as a DTE. A modified null modem cable is required to connect directly to a terminal. To modify, connect pin 20 (DTR) of the modem or terminal to pin 5 (CTS) of the SunSet T10 DB25 connector. Pin 5 of the SunSet T10 DB25 connector must show green on the breakout box in order for the remote control to work.

To begin remote operation, follow this procedure:

1. Connect the Sunrise Telecom DIN-8 to RS232C Printer Cable (SS115) to the SunSet T10.
2. Connect the Sunrise Telecom Null Modem Adapter (SS122B) to the free end of the Printer Cable. The ends are labeled "Test Set Cord" and "Printer Terminal".
3. Connect the null modem adapter to a gender changer. Normally this will be a female-to-female conversion.
4. Connect the gender changer to the cable, which connects to a computer or terminal.

5. Confirm that the SunSet T10's serial port settings correspond to those of the communications software or terminal. The SunSet T10's default settings are:

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

6. To configure the SunSet T10's serial port settings, use this lettered procedure:
 - A. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > GENERAL CONFIG
 - B. Select BAUD RATE. Four options are available: 1200 (F1), 2400 (F2), and 9600 (F3). These settings determine the rate at which the SunSet T10 transmits data to the computer or terminal. This setting must match the setting on the target computer or terminal, otherwise random characters will appear on the remote screen.
 - C. Select PARITY. Three options are available: NONE (F1), EVEN (F2), and ODD (F3). This setting must match the setting on the target computer or terminal.
 - D. Select STOP BIT. Two options are available: 1-BIT (F1) and 2-BIT (F2). This setting must match the setting on the target computer or terminal. The normal configuration is 1-BIT.
 - E. Select BITS/CHAR. Two options are available: 7-BIT (F1) and 8-BIT (F2). This setting must match the setting on the target computer or terminal. The normal configuration is 8-BIT.
7. Plug a modem into the serial port. A 9600-baud error-correcting modem is highly recommended. Some functions such as VF MEASUREMENTS will only work properly if a 9600-baud modem is used. Refer to Figures 11 and 12 for cable pin-out. A breakout box, appropriate tools, and training will be needed to make sure the SunSet T10 is appropriately connected to the modem the first time it is setup.
8. Plug the modem into the telephone network.
9. Setup a terminal to dial up the modem and commence communications. Any terminal or personal computer with VT100 terminal emulation software will work.
10. Call up the far modem with this terminal.

11. Establish communication with the far modem; log on to the SunSet T10 by typing in on the computer or terminal: **logon**

Notes:

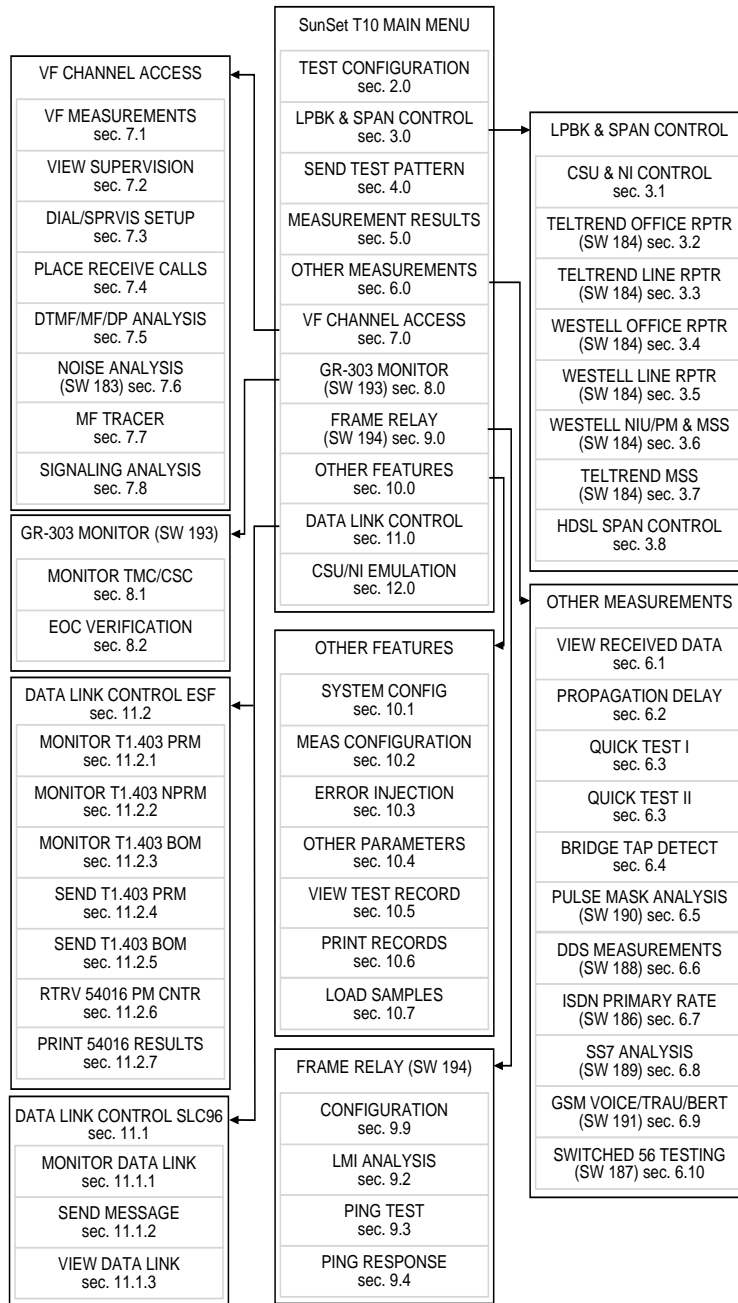
- The graphic may be distorted if logging into the SunSet T10 while it is in the graphic mode. Press the return key on the computer or terminal and then P (for graphic) to clear the distortion.
 - Do not press the return/enter key after typing the letters. The SunSet T10 will automatically repaint the screen with the MAIN MENU and other information.
 - If a mistake is made while typing **logon**, retype it.
12. Use the SunSet T10 just as if it would be used locally. The same menus will be displayed. There will be a prompt on the screen to show which keys to press to move the cursor (the terminal cursor keys will probably also work), to inject errors, and so on. Refresh means that pressing the **s** key causes the screen to refresh. Press the enter key on the terminal to simulate pressing the ENTER key on the SunSet T10.
13. When finished, type in: **logoff** and press enter on the computer or terminal's keyboard.
14. Terminate the phone connection by hanging up the near end modem.

A variety of asynchronous communications, in addition to modems, can be used over a public switched telephone network. Direct local connection, dedicated line, and packet are other communication alternatives. Provided in remote control is access to most of the SunSet T10's capabilities. However, there are a few differences, such as the following:

- The MEASUREMENT RESULTS screen is updated about once every five seconds instead of once each second.
- Do not use the local print commands during a remote control session because both the printer and the remote control use the same printer port. For instance, a local user presses the PRNT SCRN key on the keypad while a remote user is logged on. This causes the remote user to log off.
- The pulse mask feature is supported for pass/fail report and pulse statistics; however, the bit-mapped pulse graph is not drawn on the remote terminal screen.
- Talk/listen is not supported for remote operation.



Chapter 3 Menu Descriptions



Note: Some menu items are offered only as software options and may not appear on your SunSet T10. Parentheses (containing the SW option number) indicate such menu items.

Figure 16 SunSet T10 Menu Tree

1.0 Introduction

The SunSet T10 uses a menu driven format. Before entering a menu item, it must be selected (highlighted) by using the arrow keys on the keypad. A selected item is easily recognized because the surrounding area is black while the text is white. After selecting the item, execute the selection by pressing the ENTER key on the keypad. In a few specific cases, the simple action of selecting an item will execute the selection.

Note: The > symbol means to select the indicated item and press the ENTER key on the keypad.

Figure 16, SunSet T10 Menu Tree shows the location of major menu items. Refer to the subsection listed in the menu tree for a complete menu description. Some menu items are offered only with certain software options. Parentheses (containing the software option number) indicate such menu items.

2.0 Test Configuration Menu

Before connecting the SunSet T10 to a circuit, it must be configured for the type of circuit to be tested. This is done in the TEST CONFIGURATION screen. To access this screen, select MAIN MENU > TEST CONFIGURATION.

The F-keys show the available options for each setup parameter within TEST CONFIGURATION. In the TEST CONFIGURATION screen, as each F-key is pressed, the SunSet T10 immediately alters its configuration to reflect the new settings.

Notes:

- In order to avoid configuration mistakes, use the GRAPHIC key on the keypad to confirm any changes to TEST CONFIGURATION. Graphics are not available for DATACOM.
- The SunSet T10 can be configured to automatically detect incoming framing and test patterns by pressing the AUTO key on the keypad.

The first selection in TEST CONFIGURATION is TEST MODE. Four mode choices are available: T1SINGL, T1DUAL, T1-MUX, and DATACOM. The Test Configuration menu differs for each mode selected.

2.1 T1SINGL Test Mode

Select T1SINGL Test Mode for common T1 Line testing applications: loopback testing, frequency/slip measurements, and simple talk/listen operations. This is the simplest T1 mode and disables the LEDs for Line 2.

Refer to Figure 17 for the T1SINGL Configuration screen.

```
MEAS 08:21:36
TEST CONFIGURATION
TEST MODE : T1SINGL

RxLVL-1 : TERM
FRAMING : ESF
Tx CODING : B8ZS
Tx SOURCE : NORMAL
XMT CLOCK : INTERN
TEST RATE : 1.544M
LBO 1 : 0dB

T1SINGL T1DUAL T1-MUX DATACOM
```

Figure 17 T1 SINGL Test Configuration Screen

Figure 18 displays the graphic associated with the configuration in Figure 17.

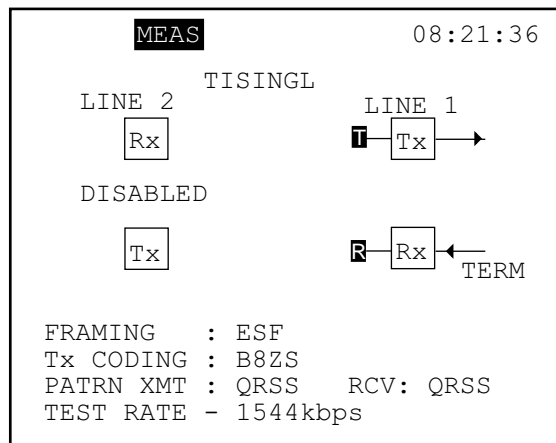


Figure 18 T1 SINGL Graphic

The following items are contained within the T1 SINGL Test Configuration screen.

RxLVL-1

Options: TERM (F1), BRIDGE (F2), DSXMON (F3)

RxLVL-1 configures the LINE 1 1.544 Mbps receiver. This setting lets the SunSet T10 electrically decode a 1.544 Mbps signal under a wide range of resistive or cable losses. It also determines which electrical load the SunSet T10 will place on the circuit. There is no effect on the transmitter. In a 1.544 Mbps circuit, there must be a receiver that applies the low impedance (100 Ω) termination. There should never be two or more receivers applying a low impedance termination.

Warning!

**If uncertain as to which option to choose, select BRIDGE.
This will protect the 1.544 Mbps signal.**

TERM: Use this mode when the SunSet T10 will send and receive a T1 signal. It requires that the circuit be disrupted for testing. The received signal is terminated by the SunSet T10 and is not obtained through a MONITOR jack. The received signal 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: When plugging the SunSet T10 into a DSX MON jack in the TERM mode, the BPV LED will probably light. Use DSXMON mode instead.

BRIDGE: The BRIDGE monitor is similar to the DSXMON monitor. However, in BRIDGE the SunSet T10 taps into a live, in-service, terminated DS1 signal with up to 36 dB cable loss. The SunSet T10 applies isolation resistors to protect the circuit from a hit. Select BRIDGE before clipping onto a live circuit. This will put the isolation resistors in place to ensure that the SunSet T10 does not place a hit on the circuit.

Notes:

- If BRIDGE mode is used on a DSXMON jack, there will be a 40 dB resistive isolation and the SunSet T10 will likely report loss of signal. 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, try BRIDGE mode first to see if this works, then try DSXMON if it does not.
- If BRIDGE mode is selected for a 3V signal from an OUT jack, then the BPV light will probably come on. Use TERM mode instead.

DSX MON: Used when a monitor measurement is made. The signal is 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 and the transmitter is sending the selected test pattern.

Notes:

- 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 and check for problems while the customer is using it.
- If DSXMON mode is selected when receiving a 3V signal, then the red BPV LED will turn on. This often happens if DSX MON is selected when the SunSet T10 is plugged into an OUT jack. In this case, select TERM mode instead of DSXMON mode.
- In some cases, it may not be clear if the monitor jack provides a bridged access or a 20 dB isolated monitor access. In this case, try BRIDGE mode first to see if this works; if it does not, try DSXMON mode.
- Use DSXMON mode if using the SunSet T10 with another test set that is already configured for auto framing.
- Use DSXMON mode if the SunSet T10 will control the framing on the T1 line.
- Use DSXMON mode if the SunSet T10 will provide a signal to itself without first passing through network equipment which will force a specific framing.

FRAMING

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

Chose a specific framing type when:

- the circuit uses a specific type of framing.
- there is no T1 signal available when plugging the SunSet T10 into the circuit.
- using the SunSet T10 with another test set that is configured for auto framing.
- the SunSet T10 will control the framing on the T1 line.
- the SunSet T10 will provide a signal to itself without first passing through network equipment which will force a specific framing.

Refer to Chapter 5, Reference, for specific details on each framing type.

UNFRAME: Select for no framing.

SF-D4: This is the simplest framing consisting of 12 grouped frames.

ESF: Extended Super Frame consists of 24 grouped frames.

SLC-96®: Introduced by AT&T and later standardized by Bellcore.

Note: If the framing on the received signal does not match the framing specified in the FRAMING menu, the SunSet T10 will show a frame loss. If the received framing changes during the middle of a test, the SunSet T10 will also show frame loss, even in the AUTO mode.

Tx CODING

Options: AMI (F1), B8ZS (F2)

AMI (Alternate Mark Inversion): This requires the terminal transmitting data to have at least a 12.5% average 1's density and a maximum of 15 consecutive zeroes.

B8ZS (Bipolar 8-Zero Substitution): This uses a bipolar violation substitution which guarantees the 12.5% average with a maximum number of 7 consecutive zeroes. B8ZS coding is preferred, because it reduces transmission problems caused in AMI.

Note: The B8ZS LED will be green only if 8 consecutive data zeroes are observed on the line. An AIS signal or other high-density ones pattern will make it impossible for the SunSet T10 to determine whether the line is optioned for AMI or B8ZS.

Tx SOURCE

Options: THRU (F1), NORMAL (F2)

THRU: This allows the signal received on the Rx jack to be transmitted out of the Tx jack for Line 1. The SunSet T10 will insert a signal on one or more channels on LINE 1. The channels and corresponding AB bits on that line that are not being used will be passed through the SunSet T10 unchanged from Rx to Tx.

NORMAL: Use NORMAL for out-of-service bit error rate testing. In this case, a test pattern is transmitted on LINE 1 Tx. During Nx64, NX56, or VF Channel Access testing, idle code is inserted on the unused channels.

Note: For NORMAL, a highlighted T is shown in the graphic screen. The T represents that the SunSet T10 is transmitting its own pattern. For THRU, there is no "T," since the SunSet T10 is not generating its own pattern.

XMT CLOCK

Options: L1-RX (F1), L2-RX (F2), INTERN (F3)

XMT CLOCK determines the timing source for the signal transmitted out Line 1.

Note: When THRU is chosen as the transmit source, XMT CLK is forced to L1-Rx.

Use L1-Rx if:

- plugging into a switch or other synchronous element, which requires the SunSet T10 to be slave timed.
- placing a voice or data call into a switch or DCS (digital cross-connect system). This ensures that the signal will not slip and cause repetitive slips or stuffs, which destroy circuit integrity.

Note: Using L1-Rx in the wrong application, such as loopback testing, may cause a loss of signal.

Use L2-Rx if:

- an external DS1 signal is needed to supply the L2-Rx jack in order to synchronize the signal coming out L1-Tx.
- a reference clock is required for measuring frequency synchronization and clock slips.

Note: The L2 receiver jack maybe used in T1SINGL Mode, but the receiver level of this jack cannot be controlled.

Use INTERN for most applications such as:

- loopback testing.
- simple talk/listen.
- point-to-point testing.
- anytime the SunSet T10 is to provide an independent signal.

Note: If unsure of the correct XMT CLOCK setting, choose INTERN.

TEST RATE

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

1.544M: Used for normal T1 and DS1 testing.

Nx56K: Use where the fractional circuit is any number (1-24) of 56 kbps channels within the DS1. In this case, the SunSet T10 will transmit a 1 in the eighth (least significant) bit of each fractional T1 channel.

Nx64K: Use for fractional T1 testing where the fractional circuit is any number (1-24) of 64 kbps channels within the DS1.

If any one of the fractional settings is selected, the screen shown in Figure 19 is displayed.

Note: If 1.544 was selected, the Fractional T1 screen is not needed. Move the cursor off TEST RATE or press the ESCAPE key on the keypad to return to the MAIN MENU. Pressing the ENTER key on the keypad while the cursor is on TEST RATE will automatically bring up the T10 Time Slot screen.

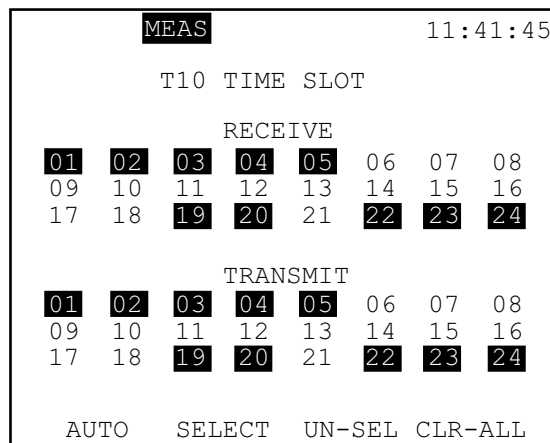


Figure 19 SunSet T10 Time Slot Screen

There are two options for selecting the desired combination of Fractional T1 channels:

- 1 Press the AUTO (F1) F-key and the SunSet T10 will automatically configure for all active fractional T1 channels. The SunSet T10 performs this AUTO configuration by searching for the 7F or FF idle codes (as selected in OTHER FEATURES > OTHER PARAMETERS) on any unused channels.
- 2 To manually select the exact channels to test, use the following procedure.
 - A. Use the arrow keys on the keypad to move the flashing cursor to the desired timeslot and press the SELECT (F2) F-key.
 - B. As the RECEIVE timeslots are selected, the SunSet T10 will fill in the corresponding TRANSMIT timeslots.

- C. If the TRANSMIT timeslots need to be configured differently, use the down arrow key on the keypad to access these numbers and set up the selections manually.
- D. If the wrong timeslot is selected, press the UN-SEL (F3) F-key or press the CLR-ALL (F4) F-key to deselect everything and start over again.
- E. Press the ESCAPE key on the keypad when finished.

LBO 1

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

LBO 1 refers to line build out for line 1. Use LBO to stress test a line by attenuating the dB to a chosen level.

Use 0 dB:

- when plugging the SunSet T10 in at the front panel jack of a DSX (CSU or NI equipment direction), channel bank, or other 3V test point.
- when there is 132 feet or less of cabling between the SunSet T10 and the DSX.
- under most conditions.

Use -7.5, -15, and -22.5 dB:

- 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 SunSet T10.
- when the signal should be transmitted at a lower level to prevent near end crosstalk problems.
- when the signal should be attenuated so that it arrives at the next repeater at approximately -31 dB dsx level.
- when testing the sensitivity of the network element's receiver to which the SunSet T10 is transmitting.

2.2 T1DUAL Test Mode

T1DUAL provides for the use of both LINE 1 and LINE 2. Use this mode to perform applications such as full duplex drop and insert, in-service VF channel access, ISDN PRI 46B+2D call setup/receive, and SS7. Shown in Figure 20 is an example configuration screen.

For T1DUAL, the LEDs for Lines 1 and 2 are activated. The PAT SYNC LED, BIT ERROR LED, and the logical/frequency screens in MEASUREMENT RESULTS refer to the Line selected as RX/DROP in the TEST CONFIGURATION screen.

```

MEAS 08:21:36
TEST CONFIGURATION
TEST MODE : T1DUAL

Tx/INSERT : L1-Tx
Rx/DROP   : L1-Rx
RxLVL-1  : TERM
RxLVL-2  : TERM
Tx SOURCE : TESTPAT
FRAMING  : ESF
Tx CODING : B8ZS
XMT CLOCK : INTERN
TEST RATE : 1.544M
LBO 1&2  : 0dB

T1SINGL  T1DUAL  T1-MUX  DATACOM
  
```

Figure 20 T1DUAL Test Configuration

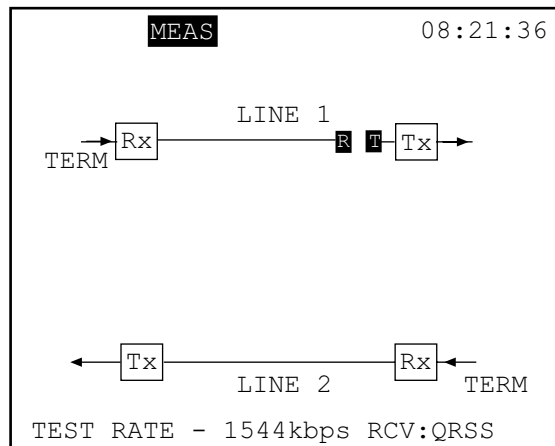


Figure 21 T1DUAL Graphic Test Mode

Figure 21 displays the graphic associated with the configuration of Figure 20. Access this graphic screen by pressing the GRAPHIC key on the keypad.

The following setup parameters are associated with T1DUAL mode:

Tx/INSERT

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

Tx/INSERT determines the line on which the SunSet T10 will transmit a test pattern or insert the dropped signal. This determines where the 1.544M test pattern, Nx64Kbps test pattern, Nx64Kbps multiplexed signal, Nx56Kbps test pattern, Nx56Kbps multiplexed signal, or voice frequency channel will be inserted. For example, if configuring Tx/INSERT for L2-Tx while talking on the SunSet T10, then your voice will be inserted on Line 2.

Rx/DROP

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

Rx/DROP determines the line on which the SunSet T10 will receive the test signal. This configures which receiver is used for measuring bit error rate, 1.544Mbps frequency, voice channel frequency, voice channel level, or voice channel Rx A/B/C/D. For example, to perform a bit error rate test on the received signal from Line 1, then select Rx/DROP = L1-Rx. The PAT SYNC and BIT ERROR LED refer to the Rx/DROP line.

RxLVL-1 & 2

Options: TERM (F1), BRIDGE (F2), DSXMON (F3)

Warning!

**If uncertain as to which option to choose, select BRIDGE.
This will protect the 1.544Mbps signal.**

RxLVL-1 and RxLVL-2 configure the two 1.544M receivers. These settings let the SunSet T10 electrically decode a 1.544 Mbps signal under a wide range of resistive or cable losses. They also determine which electrical load the SunSet T10 will place on the circuit. There is no effect on the transmitter. In a 1.544 Mbps circuit, there must be a receiver that applies the low impedance (100 Ω) termination. There should never be two or more receivers applying a low impedance termination.

TERM: Use TERM when the SunSet T10 will send and receive a T1 signal. The circuit will be disrupted for testing. The received signal is terminated by the SunSet T10 and is not obtained through a MONITOR jack. The received signal 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: If plugging the SunSet T10 in a DSX MON jack in the TERM mode, the BPV LED will probably come on. Use DSXMON mode instead.

BRIDGE: The BRIDGE monitor is similar to the DSXMON monitor. However, in BRIDGE, the SunSet T10 taps into a live, in-service, terminated DS1 signal with up to a 36 dB cable loss. The SunSet T10 applies isolation resistors to protect the circuit from a hit. Select BRIDGE before clipping onto the live circuit. This will put the isolation resistors in place and ensure that the SunSet T10 does not place a hit on the circuit.

Notes:

- When using BRIDGE mode on a DSXMON jack, there is a 40 dB resistive loss and the SunSet T10 will likely report loss of signal. In some cases, it may not be clear if the monitor jack used provides a bridged access or a 20 dB isolation monitor access. In this case, try BRIDGE first to see if this works and then try DSXMON if it does not.
- When using BRIDGE mode for a 3V signal from an OUT jack, the BPV light will probably come on. Use the TERM mode instead.

DSX MON: Use this access mode when making a monitor measurement. The provided signal is 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 and the transmitter is sending the selected test pattern.

Notes:

- 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 and check for problems while the customer is actually using it.
- If operating the SunSet T10 in DSXMON mode while receiving a 3V signal, the BPVLED will light red. (The SunSet T10 is plugged into an out jack.) In this case, select TERM instead of DSXMON.
- In some cases, it may not be clear if the monitor jack provides a bridged access or a 20 dB isolated monitor access. In this case, try BRIDGE mode first to see if this works; if it does not, select DSXMON mode.

Tx SOURCE

Options: THRU (F1), TESTPAT (F2)

THRU: Use THRU for full duplex drop and insert testing on an in-service line. In this case, the signal received on the Rx jack will pass through the SunSet T10 and be transmitted out the Tx jack for Lines 1 and 2. The SunSet T10 will be inserting a signal on one or more channels on the line chosen in Tx/INSERT. The channels and corresponding AB bits on that line that are not being used will be passed through the SunSet T10 unchanged from Rx to Tx.

TESTPAT: Use TESTPAT for out-of-service bit error rate testing. In this case, a test pattern is transmitted on the selected Tx/INSERT jack. Idle code is inserted on the unused channels during Nx64, NX56, or VF Channel Access testing. On the line not selected, the channels and A/B (/C/D) bits are passed unchanged from Rx to Tx.

FRAMING

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

Chose a specific framing type when:

- the circuit is provisioned for a specific type of framing.
- there is no T1 signal available when the SunSet T10 is plugged in.
- the SunSet T10 will be used with another test set that is already configured for auto framing.
- the SunSet T10 will control the framing that is put on the T1 line.
- the SunSet T10 will provide a signal to itself without first passing through network equipment that forces a specific framing.

Refer to Chapter 5, Reference, for specific details on each framing type.

UNFRAME: Select for no framing.

SF-D4: This is the simplest framing consisting of 12 grouped frames.

ESF: Extended Super Frame consists of 24 grouped frames.

SLC-96®: Introduced by AT&T and later standardized by Bellcore.

Note: If the framing on the received signal does not match the framing specified in the FRAMING menu, the SunSet T10 will show a frame loss. If the received framing changes during the middle of a test, the SunSet T10 will also show frame loss, even in the AUTO mode.

CODING

Options: AMI (F1), B8ZS (F2)

AMI (Alternate Mark Inversion): This requires that the terminal transmitting data have at least a 12.5% average 1's density and a maximum of 15 consecutive zeroes.

B8ZS (Bipolar 8-Zero Substitution): This uses a bipolar violation substitution which guarantees the 12.5% average with a maximum number of 7 consecutive zeroes. B8ZS coding is preferred, because it reduces transmission problems caused in AMI.

Note: The B8ZS LED will be green only if 8 consecutive data zeroes are observed on the line. An AIS signal or other high-density ones pattern will make it impossible for the SunSet T10 to determine line coding.

XMT CLOCK

Options: L1-Rx (F1), L2-Rx (F2), INTERN (F3)

The XMT CLOCK determines the timing source for the transmitted signal (the line selected as Tx/INSERT). The other Tx signal uses the timing recovered from its Rx signal. For instance, when TxINSERT=L1-Tx and XMTCLK=INTERN, the L1-Tx signal uses the internal timing of the SunSet T10. The L2-Tx signal uses the recovered timing from L2-Rx. When TxSource is set for THRU, the XMT CLOCK selection defaults to the Tx/Insert setting.

There are four different timing scenarios possible from the three F-Key options: Loop/Slave timing, Slave-to-Slave timing, External timing, and Internal/Master timing.

For Loop or Slave timing choose the same line for Tx/INSERT and XMTCLK. For instance, if Tx/INST = L1-Rx, then XMT CLOCK should be L1-Rx. In this case, the exchange or network element is configured to be a master timing source in relation to the SunSet T10. Loop/Slave timing is required when transmitting toward an exchange or other network element that requires synchronous signals. Figure 22 provides a graphic illustration of Loop/Slave timing.

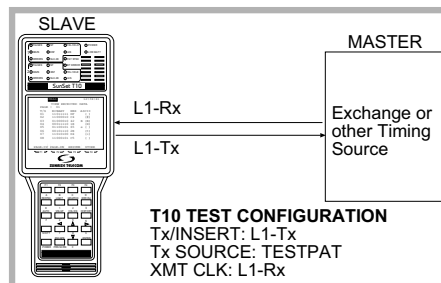


Figure 22 Loop or Slave Timing

Note: For DROP/INSERT testing, TxSOURCE must be set to THRU. XMT CLOCK will automatically be set for the same line as the Rx/DROP side.

If using Loop timing and the timing source is also using loop timing, there is no real clock source and the transmit signal may die. This is known as Slave-to-Slave timing, since there is no master timing source. Figure 23 depicts Slave-to-Slave timing.

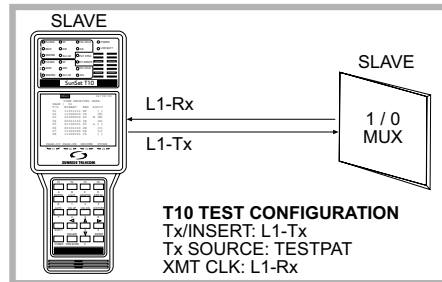


Figure 23 Slave-to-Slave Timing

External timing uses an external clock source to time the Tx/INSERT signal. Set the XMT CLOCK to the opposite line of the Rx/DROP selection. For instance, if Rx/DROP = L2-Rx, XMT CLOCK should be L1-Rx. Figure 24 demonstrates external timing.

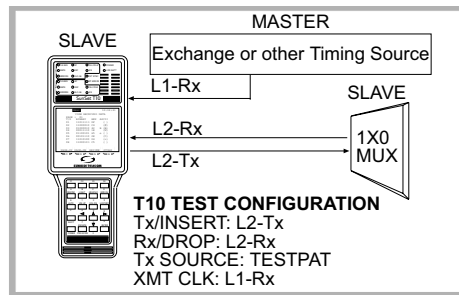


Figure 24 External Timing

Internal, or Master, timing is used in loopback testing where synchronization is not required. An internal clock provides a timing source, but the source is not synchronized to the network. The SunSet T10 uses a Stratum 3 clock for its internal timing. Figure 25 depicts Internal Timing.

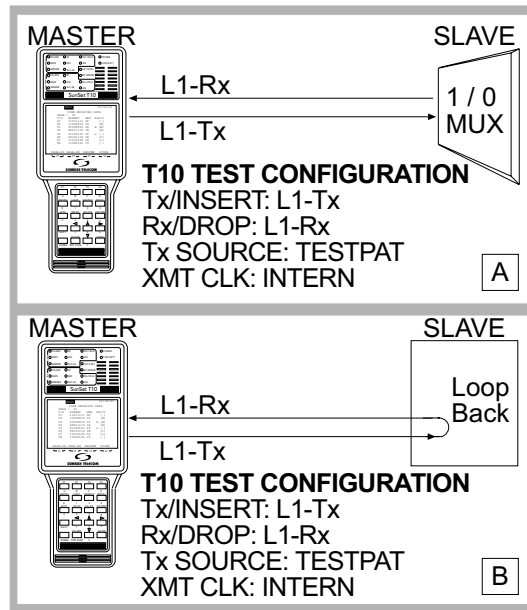


Figure 25 Internal Timing

TEST RATE

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

1.544M: Used for normal T1 and DS1 testing.

Nx56K: Use where the fractional circuit is any number (1-24) of 56 kbps channels within the DS1. In this case, the SunSet T10 will transmit a 1 in the eighth (least significant) bit of each fractional T1 channel.

Nx64K: Use for fractional T1 testing where the fractional circuit is any number (1-24) of 64 kbps channels within the DS1.

If choosing one of the fractional settings, the screen shown in Figure 26 appears.

Note: If 1.544 is selected, the Fractional T1 screen is not needed. Move the cursor off TEST RATE or press the ESCAPE key on the keypad to return to the MAIN MENU. Pressing the ENTER key on the keypad while the cursor is on TEST RATE will automatically bring up the T10 Time Slot screen.

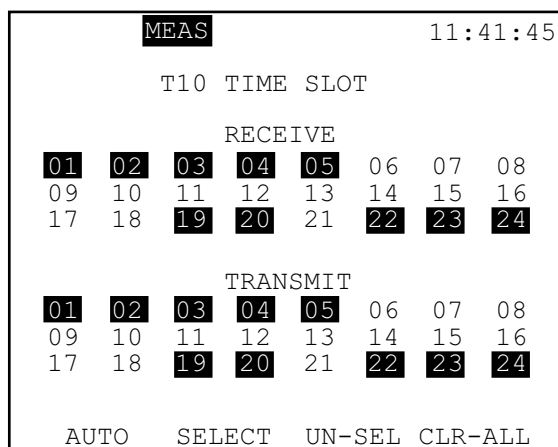


Figure 26 T10 Time Slot Screen

There are two options for selecting the desired combination of Fractional T1 channels:

- 1 Press the AUTO (F1) F-key and the SunSet T10 will automatically configure itself for all active fractional T1 channels. The SunSet T10 performs this AUTO configuration by searching for the 7F or FF idle codes (as selected in OTHER FEATURES > OTHER PARAMETERS) on any unused channels.
- 2 Manually select the exact channels to be tested using the following procedure.
 - A. Use the arrow keys on the keypad to move the flashing cursor to the desired timeslot and press the SELECT (F2) F-key.
 - B. As the RECEIVE timeslots are selected, the SunSet T10 will fill in the corresponding TRANSMIT timeslots.
 - C. If the TRANSMIT timeslots are to be configured differently, use the down arrow key on the keypad to access these timeslots and set up the selections manually.
 - D. If the wrong timeslot is selected, press the UN-SEL (F3) F-key or press the CLR-ALL (F4) F-key to deselect everything and start over again.
 - E. Press the ESCAPE key on the keypad when finished.

LBO 1&2

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

LBO 1 & 2 stands for line build out for line 1 and line 2. Use LBO to stress test a line by attenuating the dB to a chosen level.

Use 0 dB:

- when plugging the SunSet T10 in at the front panel jack of a DSX (CSU or NI equipment direction), channel bank, or other 3V test point.
- when there is 132 feet or less of cabling between the SunSet T10 and the DSX.
- under most conditions.

Use -7.5, -15, and -22.5 dB:

- 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 SunSet T10.
- when the signal should be transmitted at a lower level to prevent near end crosstalk problems.
- when the signal should be attenuated so that it arrives at the next repeater at approximately -31 dB dsx level.
- when testing the sensitivity of the network elements's receiver to which the SunSet T10 is transmitting.

2.3 T1 - MUX Test Configuration

T1-MUX provides for a multiplexing capability between the T1 line and multiport datacom signals. Use this mode to perform a synchronous Nx64K test through both a Datacom connector and a 1.544 Mbps connector at the same time. Refer to Figure 27.

```
MEAS 21:10:05
TEST CONFIGURATION
TEST MODE : T1-MUX

T1                                DATACOM
Tx/INST: L1-Tx                    TYPE : V.35
Rx/DROP: L1-Rx                    TxSRC: T1DRP
FRAMING: ESF                       MODE : DCE
CODING : B8ZS                      MUX
RxLVL-1: TERM                     BERT : V.35
RxLVL-2: TERM                     T1INS: PATRN
XMTCLK : L1-Rx                    T1T/S: Nx64K
LBO 1&2: 0 db

V.35  RS449  X.21  RS232
```

Figure 27 T1 - MUX Mode Configuration

The T1-MUX Configuration screen is divided into three sections. The T1 column at left provides the setup parameters for the 1.544Mbps T1 transmit and receive jacks. The Datacom section at top of the right column configures the multiport. The MUX settings at the bottom of the right column determine the SunSet T10's multiplexing operation.

T1 Column

If necessary, refer to sections 2.1 and 2.2, T1 Test Configuration descriptions, for details of each T1 setup option.

Tx/INSERT

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

Select the 1.544 Mbps line 1 (either L1-Tx or L2-Tx) for the test signal insertion using the appropriate F-key. This is where the Nx64 kbps multiplexed signal is inserted. For example, if the SunSet T10 inserts the received V.35 signal on L2-Tx, the inserted signal is on line 2.

Rx/DROP

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

Select the 1.544 Mbps line (either L1-Rx or L2-Rx) to use for dropping an Nx64 kbps signal to the multiport. This selection also configures 1.544 Mbps line frequency and determines the VIEW RECEIVED DATA selection. For example, choose Rx/DROP as L1-Rx to drop a 64 kbps signal to V.35 from Line 1.

FRAMING

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

Choose the desired framing type by pressing the appropriate F-key.

CODING

Options: AMI (F1), B8ZS (F2)

Choose the desired coding type by pressing the appropriate F-key.

RxLVL-1 & RxLVL-2

Options: TERM (F1), BRIDGE (F2), DSXMON (F3)

RxLVL-1 and RxLVL-2 configure the two 1.544M receivers. These settings let the SunSet T10 electrically decode a 1.544 Mbps signal under a wide range of resistive or cable losses. They also determine which electrical load the SunSet T10 will place on the circuit.

TERM: This terminates the received signal and has no effect on the transmitter.

BRIDGE: The SunSet T10 applies high impedance resistors to the circuit under test; this isolation will protect the signal from disruption.

DSXMON: Choose DSXMON when plugging the SunSet T10 into a DSX monitor jack that has isolated the monitor signal from the live signal with a high impedance circuit.

XMTCLK

T1-MUX Mode uses a loop-timing clock. For loop timing, choose the same line for Tx/INSERT and XMTCLK. Therefore, XMTCLK is forced automatically to the Tx/INSERT choice.

LBO 1&2

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

Choose the desired line build out for both lines 1 and 2. Set this to 0 dB under most conditions. The T1 Test Configuration Menu descriptions in sections 2.1 and 2.2 provide information on selecting the proper dB level.

DATACOM Column

The Datacom settings configure the multipoint. The multipoint automatically configures for DCE. Press the right arrow key on the keypad to move the cursor over to the right side of the screen.

TYPE

Options: V.35 (F1), RS449 (F2), X.21 (F3), RS232 (F4)

TYPE determines the electrical interface at the multipoint.

Tx SRC

Options: PATRN (F1), T1DRP (F2)

Tx Source sets the transmit source for the multipoint. Set TxSRC to either PATRN or T1DRP and choose PATRN (F1) to send a test pattern out the multipoint. Choose T1DRP (F2) to send the dropped NX64 kbps signal out the multipoint.

MODE

For T1-MUX Mode, DCE is automatically set.

MUX Section

The MUX settings define the multiplexing configuration for the SunSet T10.

BERT

Options: T1DRP (F1), (F2) is the Datacom TYPE selected above, i.e. RS232

BERT determines which direction of the multiplexed circuit is bit error tested. T1DRP means that the Nx64 kbps signal dropped from the 1.544 Mbps signal is bit error tested. V.35 means the signal received coming from the low speed side is tested.

T1INS

Options: LOOP (F1), DATACOM TYPE, i.e. RS232 (F2), PATRN (F3).

T1 Insert determines which signal is inserted into the 1.544 Mbps line. T1 Insert can change only if TxSRC = T1DRP.

LOOP: All 24 channels will be looped through from 1.544 Mbps receive to 1.544 Mbps transmit; nothing will be inserted.

DATACOM TYPE: This means that the low speed Nx64 kbps signal will be inserted on the 1.544 Mbps transmit.

PATRN: This means that a test pattern will be inserted on the 1.544 Mbps transmit signal.

Note: When setting TxSRC (Datacom transmit source) for PATRN (pattern), T1INS is set for the Datacom type (F2); there is no option to change this. In this case, the SunSet T10 is transmitting the pattern out the multiport and inserting the received multiport low speed signal onto the T1 line.

T1T/S

Options: Nx64K (F1)

T1 T/S allows selection of which Nx64 kbps T1 timeslots to insert to and drop from the multiplexed signal. Press Nx64K (F1) to enter the T10 Time Slot screen. Refer to section 2.1 Test Rate for details on selecting timeslots. For RS232, only one time slot is allowed.

2.4 Datacom Operation Menus

Datacom testing allows the SunSet T10 to send and receive signals with other data communication equipment. Datacom uses a standard interface in order for two equipment elements to communicate with each other. The standard protocols available are: V.35, RS449, X.21, and RS232. Testing of only the low speed synchronous or asynchronous signal on the multiport is possible. A graphic diagram of the SunSet T10's configuration is not provided in the Datacom Mode.

2.4.1 Datacom Test Configuration

To use the SunSet T10 for Datacom testing, set up as follows.

1. Select MAIN MENU > TEST CONFIGURATION
2. Select TEST MODE and press the DATACOM (F4) F-key.
3. A screen similar to the one shown in Figure 28 appears.

```
MEAS 21:10:05
TEST CONFIGURATION
TEST MODE : DATACOM

TYPE      : RS449
MODE      : DCE
TEST RATE: 02x64k
REF CLOCK: INTERN

press Nx64K (F3) to
change test rate.

48k      Nx56k      Nx64k  more
```

Figure 28 Datacom Configuration Menu

TYPE

Options: V.35 (F1), RS449 (F2), X.21 (F3), RS232 (F4)

TYPE determines the electrical interface at the multiport.

MODE

Options if TYPE is V.35, RS449, or X.21: DTE (F1), DCE (F2)

DTE: Select DTE if the SunSet T10 emulates data terminal equipment and will plug into DCE equipment.

DCE: Select DCE if the SunSet T10 emulates data circuit equipment and will plug into DTE equipment.

Options if TYPE is RS232: DTE-SYN (F1), DCE-SYN (F2), DTE-ASY (F3), DCE-ASY (F4)

RS232 supports both synchronous and asynchronous transmission.

DTE-SYN: Select if the SunSet T10 emulates data terminal equipment-synchronous and will plug into DCE-SYN equipment.

DCE-SYN: Select if the SunSet T10 emulates data circuit equipment-synchronous and will plug into DTE-SYN equipment.

DTE-ASY: Select if the SunSet T10 emulates data terminal equipment-asynchronous and will plug into DCE-ASY equipment.

DCE-ASY: Select if the SunSet T10 emulates data circuit equipment-asynchronous and will plug into DTE-ASY equipment.

TEST RATE

Options: 300 (F1), 600 (F2), 1200 (F3), 2400 (more, F1), 4800 (more, F2), 9600 (more, F3), 14.4k (more, F1), 19.2k (more, F2), 38.4k (more, F3), 48k (more, F1), Nx56k (more, F2), Nx64k (more, F3)

Choose the desired test rate for the Datacom circuit testing. For Nx56k and Nx64k, select channels (1-24) by pressing the corresponding F-key until the desired channel is selected. Note for RS232, there is only one 64K or 56K channel.

REF CLOCK

Options: INTERN (F1), RECEIVE (F2)

The reference clock allows selecting the SunSet T10's internal clock or external timing received at the multiport for the transmit signal source.

INTERN: When selected, the SunSet T10 is the master timing source on the circuit.

RECEIVE: When selected the SunSet T10 is the slave to the device to which it is sending signals. On a synchronous circuit; one end should be the master timing source and the other end should be the slave.

Notes:

- For X.21; DTE is automatically configured for Receive and DCE for Intern; therefore, the reference clock for X.21 cannot be changed.
- The REF CLOCK selection applies only to synchronous transmission modes. If Type is RS232; mode must be either DCE-SYN or DTE-SYN in order to change the REF CLOCK.

The next three items apply only to asynchronous datacom transmission (RS232 DTE-ASY or RS232 DCE-ASY):

BIT/CHAR

Options: 6 (F1), 7 (F2), 8 (F3)

This selects how many bits used for each character of information. Both DTE and DCE should have the same number of bits per character.

STOP BITS

Options: 1 (F1), 2 (F2)

This selects how many stop bits used for each character of information.

PARITY

Options: EVEN (F1), ODD (F2), NONE (F3)

This selects the parity bits used for each character of information. Parity is a method of checking the accuracy of transmitted or stored data. A bit is added to the data as an accuracy check. The receiving element checks the parity bit and indicates an error if the total number of ones does not add up to the correct total.

EVEN: The total number of ones (including the parity bit) is even.

ODD: The total number of ones (including the parity bit) is odd.

NONE: Signifies no parity.

3.0 LPBK & Span Control

The Loopback & Span Control screen can operate many kinds of loopback devices on a T1 line. With the circuit looped back, it is possible to measure the transmission performance on the transmission path between the SunSet T10 and the loopback device. Displayed in Figure 29 are the various options.

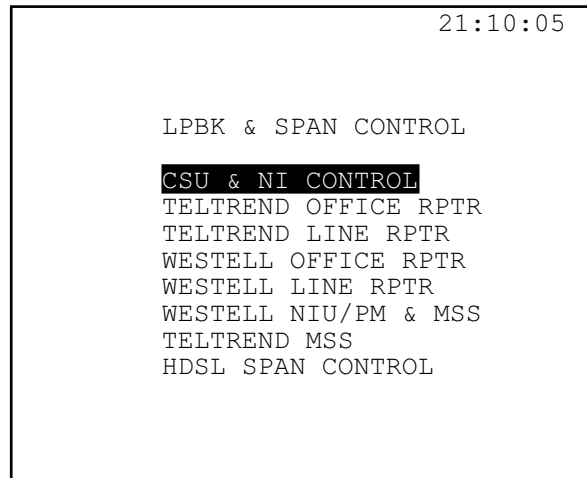


Figure 29 Loopback and Span Control Menu

Before proceeding, find out if the line to be tested has one or more loopback devices installed. If so; find out what type of loopback it is and how it operates.

3.1 CSU & NI Control

Use the CSU & NI Control screen to loop up/down a CSU or NI.

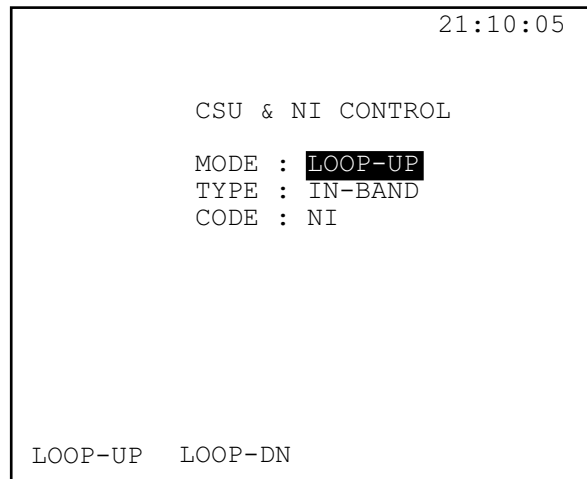


Figure 30 CSU and NI Control

The following items appear in the CSU and NI Control screen.

MODE

Options: LOOP-UP (F1), LOOP-DN (F2)

Note: Select this item last! Pressing the F1 or F2 F-keys causes the SunSet T10 to begin the specified procedure; therefore, if needed change either of the two settings below MODE first.

LOOP-UP: Use to loop up the circuit before testing.

LOOP-DN: Use to restore the circuit to normal once testing is complete.

TYPE

Options: IN-BAND (F1), ESF-DL (F2)

This determines the type of sent loopback code. Sent in the ESF framing data link are ESF-DL codes; therefore, *ESF framing must be used to select ESF-DL*.

IN-BAND is the most common type deployed in networks. IN-BAND can be transmitted with any type of framing. However, some loopback devices will not respond to IN-BAND loopback codes when transmitted with ESF framing. When in doubt, select IN-BAND when using SF framing and ESF-DL when using ESF framing.

CODE

This determines which loopback code will be sent. This code needs to be same as that of the equipment being looped back. Select a user code by pressing the USER (F4) F-key.

Options: The available options depend upon the type of loopback selected in TYPE (see Figure 30).

In-Band Codes: CSU (F1), NI (F2), 100000 (F3), USER (F4)

NI: This code is used for an industry-standard network interface unit (smart jack) if it is set to respond to in-band loopback codes. This loopback regenerates only the signal and should pass both BPVs and bit errors. The telephone company generally installs this unit at the customer premises.

CSU: Use this code for looping the customer-owned CSU.

100000: Use this code with a type of NIU (smart jack) that is installed in some parts of the country, particularly New England.

The transmitted in-band codes for each loopback are in Table 2.

Command	Inband Codes
CSU Loop Up	10000
CSU Loop Down	100
NI Loop Up	11000
NI Loop Down	11100
100000	100000

Table 2 In-band Codes

ESF-DL Codes: LINE (F1), PAYLOAD (F2), NETWORK (F3), USER (F4)

LINE: This code operates a line loopback at a CSU. This loopback regenerates only the signal. Bit errors and BPVs should pass through this loopback.

PAYLOAD: This code operates a payload loopback at a CSU. In this loopback, the 192-channel bits pass through, but the framing bits and line code are regenerated. Only bit errors will pass through this loopback.

NETWORK: This code operates an NIU (smart jack) loopback. This loopback regenerates only the signal and should pass both BPVs and bit errors.

Shown in Table 3 are the transmitted ESF-DL codes for each loopback.

Command	ESF-DL Codes
Line Loop Up	11111111 01110000
Line Loop Down	11111111 00011100
Payload Loop Up	11111111 00101000
Payload Loop Down	11111111 01001100
Network Loop Up	11111111 01001000
Network Loop Down	11111111 00100100

Table 3 ESF-DL Codes

3.1.1 Basic Loopback Procedure

1. Select MAIN MENU > LPBK & SPAN CONTROL > CSU & NI CONTROL
 - A. If TYPE and CODE are correct, proceed to step 4.
2. TYPE: Select TYPE and choose either IN-BAND (F1) or ESF-DL (F2).
3. CODE: Select CODE and choose the code depending upon the equipment to be looped back.
4. MODE: Select LOOP-UP (F1) to loop the circuit up before testing. Select LOOP-DN (F2) to restore the circuit to normal once testing is complete.
5. Once the loopback operation is finished, an appropriate message will appear on screen.
6. Press the ESCAPE key on the keypad three times to return to the MAIN MENU.

3.1.2 Select a User Loopback Code

1. In the CSU & NI CONTROL menu, select CODE and press the USER (F4) F-key. Be sure to press the USER (F4) F-key even if the USER item is already displayed as the selected CODE entry. This allows access to the USER LOOPBACK CODE screen.
2. Select the desired loopback code and press the ENTER key on the keypad.
3. Press the ENTER key on the keypad to begin the loopback operation and proceed to step 4 of the Basic Loopback Procedure.

3.1.3 View a User Loopback Code

1. In the CSU & NI CONTROL menu; select CODE and press the USER (F4) F-key. Be sure to press the USER (F4) F-key even if the USER item is already displayed as the selected CODE entry. This allows access to the USER LOOPBACK CODE screen.
2. Select the desired loopback code and press the VIEW (F1) F-key. The selected pattern will be displayed.
3. When finished, press the ESCAPE key on the keypad to return to the USER LOOPBACK CODE menu.

3.1.4 Program a User Loopback Code

1. In the CSU & NI CONTROL menu; select CODE and press the USER (F4) F-key.
2. Select a blank position on the user pattern list. Press the CREATE (F1) F-key. Displayed is the USER LOOPBACK CODE screen.
3. Press the TOGGLE (F3) F-key. The letter A will begin to flash on and off within the character grid.
 - A. Use the arrow keys on the keypad to move the flashing indicator to the desired character.
 - B. Press the SELECT (F4) F-key. The desired character will appear next to the LABEL line. Repeat this process until the desired LABEL name is complete.
4. When the LABEL is complete, press the TOGGLE (F3) F-key to move out of the character grid.
 - A. Press the down arrow key on the keypad to move to the CODE line.
 - B. Press the SHIFT key on the keypad. Using the keypad numbers, enter up to 32 1s and 0s to make up the desired pattern. Press SHIFT when completed.
5. Press the ENTER key to return to the USER LOOPBACK CODE menu. The new code is displayed.

3.1.5 Correcting a Mistake While Entering the Label

1. Start from step 3 of Program a User Loopback Code procedure while in the character grid. A letter within the grid should be flashing.
2. Press the TOGGLE (F3) F-key to move out of the character grid. Press the left arrow key on the keypad until the cursor is over the incorrect character.
3. Press the DELETE (F2) F-key to remove the selected character. Repeat as necessary.

3.1.6 Deleting a User Loopback Code

1. From the CSU & NI CONTROL menu, select CODE and press the USER (F4) F-key. Be sure to press the USER (F4) F-key even if the USER item is already displayed as the selected CODE entry. This allows access to the USER LOOPBACK CODE screen.
2. Select the desired code and press the DELETE (F3) F-key. Repeat as necessary
3. Press the ESCAPE key on the keypad to return to the CSU & NI CONTROL screen.

3.2 Teltrend Office Repeater (SW 184)

Teltrend provides a variety of office repeaters that are supported by the SunSet T10. Refer to Teltrend documentation for detailed information on the operations of these various repeaters. Figure 31 shows the Teltrend Office Repeater screen.

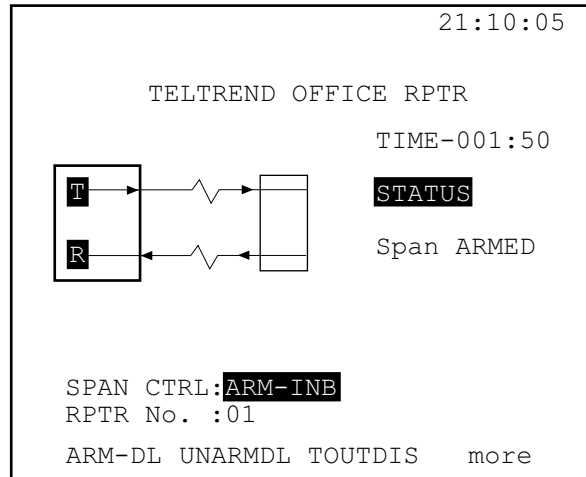


Figure 31 Teltrend Office Repeater

Figure 31 shows several aspects of the repeater control session. The items to the right of the diagram are not configured in this screen, but they provide information on the repeater control session. They are:

TIME

Time begins counting up from 000:00 (mmm: ss) as soon as the span is armed. This indicates of how much time is remaining until the repeater automatically drops its loopback. This usually occurs because of the repeater's time-out circuitry.

STATUS

The Status bar displays the current looping status of the span.

Span

The Span control line, shown ARMED in Figure 31, shows what span control function is currently under process or has been completed.

Configured in this screen are the items appearing below the diagram in Figure 31. They are:

SPAN CTRL

The exact options available depend upon the FRAMING selected in the TEST CONFIGURATION screen.

ESF framing: ARM-DL (F1), UNARMDL (F2), TOUTDIS (F3), LPBkQRY (more, F1), POWR-DN (more, F2), LOOP-UP (more, F1), LOOP-DN (more, F2), DUAL-LB (more, F3), UNBLOCK (more, F1), CLR-FT1 (more, F2), ARM-INB, (more, F3).

SF-D4 framing: ARM-INB (F1), TOUTDIS (F3), LPBkQRY (more, F1), POWR-DN (more, F2), UNIVLDN (more, F3), LOOP-UP (more, F1), LOOP-DN (more, F2), DUAL-LB (more, F3), UNBLOCK (more, F1), CLR-FT1 (more, F2).

ARMDL/INB: This arms the office repeater and the other repeaters on the span. In most cases, ARMDL and ARM-INB have the same function. Arming is required before the repeaters will actually loop up.

UNARMDL: This unarms the data link.

TOUTDIS: Time out disable will turn off the automatic time-out of the repeaters on the span. If selected; be sure to loop down all the repeaters on the span when finished.

LPBkQRY: Loopback query will query all repeaters on the span to see which one is actually looped back. If found the repeater number will be displayed in the graphic. Otherwise, LPBK will be displayed in either the looped or unlooped mode.

POWR-DN: Power down tells the office repeater to cut the power to the span. The power will remain cut until you choose another function or escape to the MAIN MENU. Powering down the span resets all the repeaters. Make sure to arm the office repeater before selecting POWR-DN.

UNIVLDN: This sends the NIU in-band loop down code to drop one Teltrend or NIU at a time.

LOOP-UP: This will loop up the office repeater. Arm the repeater before using this function. If the office repeater is an E-type, choose office RPTR number 1 through 3 in RPTR NO. Do this before pressing the LOOP-UP F-key. However, if the E-type repeater is configured for fractional T1 blocking, only repeater number 1 can be looped up. After the loop up is successful, a displayed message will show the fractional configuration of the office repeater.

LOOP-DN: This will loop down the office repeater. However, it will not loop down an E-type office repeater when it is in NIU emulation mode.

DUAL-LB: This will loop back an E-type office repeater in both directions, when DUAL-LB is configured for NIU mode and has already been looped up using the ARM-INB F-key.

UNBLOCK: This will unblock the office repeater to allow the NIU loop up code to pass through the customer premises toward the DSX. This function is necessary when testing from the customer premises and looping back an NIU that is on the other end of the circuit.

1. Send the NIU loop up code (ARM-INB). Sending the UNBLOCK code will temporarily inhibit the NIU blocking feature of the office repeater.
2. Send the NIU code (ARM-INB) again and the far end NIU will loop up.

CLR-FT1: Clear FT1 is used to temporarily re-configure an E-type office repeater in the fractional mode to through mode. This allows troubleshooting the span using 1.544 Mbps testing.

1. Press the ARM-INB F-key to arm the E-type repeater. This also loops back the NIU. Pattern synchronization will not occur, because the central office repeater is still blocking the unused channels.
2. Press the CLR-FT1 (more, F2) F-key. Pattern synchronization with no errors is now achieved.
3. When finished, press the UNIVLDN (more, F3) F-key. This will drop the NIU loop and return the office repeater to its fractional blocking mode.

RPTR NO

This specifies which repeater will be looped up. Press the SHIFT key on the keypad to use the keypad numbers to enter the desired repeater number.

3.3 Teltrend Line Repeater (SW 184)

Figure 32 displays several aspects of the repeater control session.

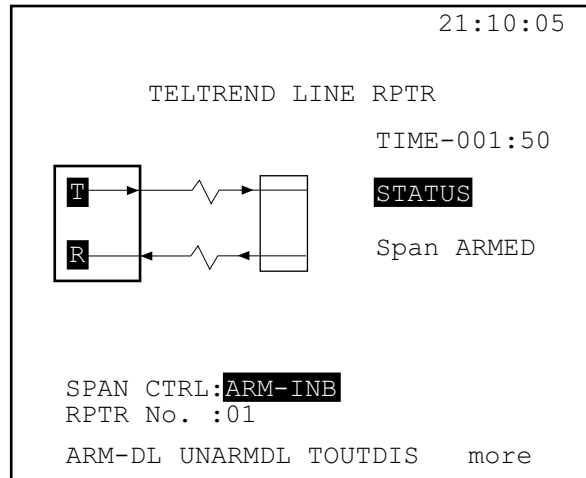


Figure 32 Teltrend Line Repeater

The items to the right of the diagram in Figure 32 provide information on the repeater control session and cannot be configured within this screen, they are:

TIME

Time begins counting up from 000:00 (mmm:ss) as soon as the span is armed. This indicates how much time is remaining until the repeater automatically drops its loopback. This usually occurs because of the repeater's time-out circuitry.

STATUS

The Status bar displays the current looping status of the span.

SPAN CTRL

The Span control line, shown ARMED in Figure 32, displays which span control function is currently under process or has been completed.

Configure the items appearing below the diagram in Figure 32. Those items are:

SPAN CTRL

The exact options available depend upon the FRAMING selected in the TEST CONFIGURATION screen.

ESF Framing: ARM-DL (F1), UNARMDL (F2), TOUTDIS (F3), LPBkQRY (more, F1), PWLPQRY (more, F2), PWCUTTH (more, F3), UNIVLDN (more, F1), LOOP-UP (more, F1), LOOP-DN (more, F2)

SF-D4 Framing: ARM-INB (F1), TOUTDIS (F3), LPBkQRY (more, F1), PWLPQRY (more, F2), PWCUTTH (more, F3), UNIVLDN (more, F1), LOOP-UP (more, F1), LOOP-DN (more, F2)

ARM-DL/INB: This arms the office repeater and line repeaters on the span. In most cases, ARM-INB and ARM-DL have the same function.

UNARMDL: This unarms the data link.

TOUTDIS: Time out disable will turn off the automatic time-out of the repeaters on the span. If pressed, be sure to loop down all the repeaters on the span when finished.

LPBkQRY: Loopback query will query all the repeaters on the span to see which one is actually looped back. If found the repeater number will be displayed in the graphic. Otherwise, LPBK will be displayed in either the looped or the unlooped mode.

PWLPQRY: Power loop query will query all repeaters on the span to see which one is looping the span simplex power. A message will appear if the power loop query finds a repeater in the power loop.

PWCUTTH: Power cut through will tell the repeater, which has looped the span power, to attempt to cut that power through the other repeaters on the span.

UNIVLDN: This causes the SunSet T10 to transmit the universal loop down code to loop down any looped repeaters.

LOOP-UP: This key loops up the specified line repeater. Arm the repeater before using this function. Enter the RPTR number before selecting the LOOP-UP command.

Note: Arming is required before the repeaters will actually loop up.

LOOP-DN: Loop Down loops down any line repeater; it does not loop down the NIU.

RPTR NO

Press the SHIFT key on the keypad and use the keypad numbers to enter the desired repeater number.

3.4 Westell Office Repeater (SW 184)

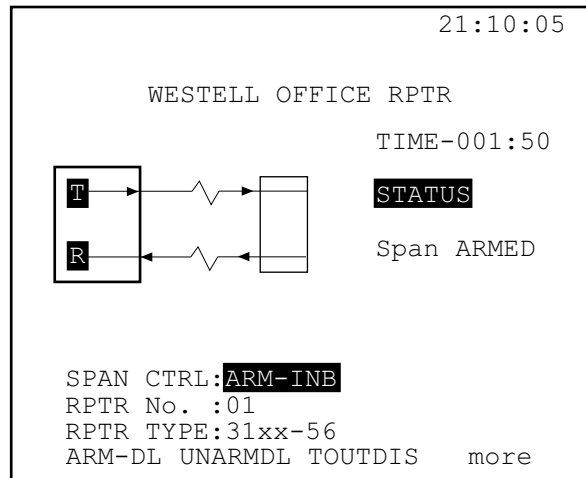


Figure 33 Westell Office Repeater

Westell repeaters are looped back similarly to the Teltrend, but there are a few important differences in using Westell repeaters:

- The Westell central office and line repeater F-key menus also include SEQLPBK (sequential loopback). This allows stepping quickly through the loopbacks on a line. To use this feature, arm the span and then press the SEQLPBK F-key and observe which repeater loops up. The repeater's address does not need to be entered. This feature is useful for tracking down misaddressed repeaters.
- To attempt a span power down with the Westell office repeater, it must first be looped up.
- The Westell central office repeater menus do not have fractional T1 blocking or the NIU-mode commands of the Teltrend.

This screen shown in Figure 33 depicts several aspects of the repeater control session.

The items to the right of the diagram in Figure 33 provide information on the repeater control session and cannot be configured within this screen, they are:

TIME

Time begins counting up from 000:00 (mmm:ss) as soon as the span is armed. This indicates of how much time is remaining until the repeater automatically drops its loopback. This usually occurs because of the repeater's time-out circuitry.

STATUS

The Status bar displays the current looping status of the span.

SPAN

The Span Control line, shown ARMED in Figure 33, displays which span control function is currently under process or complete.

Configured in this screen are the items appearing below the diagram in Figure 33. They are:

SPAN CTRL

The exact options available depend upon the FRAMING selected in the TEST CONFIGURATION screen.

ESF Framing: ARM-DL (F1), UNARMDL (F2), TOUTDIS (F3), LPBkQRY (more, F1), POWR-DN (more, F2), LOOP-UP (more, F1), LOOP-DN (more, F2), SEQLPBK (more, F3).

SF-D4 Framing: ARM-INB (F1), TOUTDIS (F3), LPBkQRY (more, F1), POWR-DN (more, F2), UNIVLDN (more, F3), LOOP-UP (more, F1), LOOP-DN (more, F2), SEQLPBK (more, F3).

ARM-DL/INB: This key arms the office repeater and line repeaters on the span. In most cases, ARM-INB and ARM-DL have the same function.

UNARMDL: This unarms the data link.

TOUTDIS: Time out disable will turn off the automatic time-out of the repeaters on the span. If pressed, be sure to loop down all the repeaters on the span when finished.

LPBkQRY: Loopback query will query all the repeaters on the span to see which one is actually looped back and if found, a repeater number will be displayed in the graphic. Otherwise, LPBK will display either the looped or the unlooped mode.

POWR-DN: Power down commands the office repeater to cut power to the span. The power will remain cut until another function is chosen or the MAIN MENU is accessed. Powering down the span resets all the repeaters. Arm the office repeater before selecting POWR-DN.

UNIVLDN: This causes the SunSet T10 to transmit the universal loop down code to loop down any looped repeaters. Pressing the LOOP-UP (more, F1) F-key loops up the specified line repeater. Arm the repeater and enter the RPTR number before using this function.

LOOP-UP: This key will loop up a specified line repeater. Arm the repeater and enter the RPTR number before using this function.

LOOP-DN: This key will loop down any line repeater; it will not loop down an NIU.

SEQLPBK: Sequential loopback allows the user to quickly step through the loopbacks on the line. This feature is useful for tracking down misaddressed repeaters. Arm the span before using this option.

Note: Arming is required before the repeaters will actually loop up.

RPTR NO

Press the SHIFT key on the keypad then use the keypad numbers to enter the desired repeater number. This specifies which repeater will be looped up.

RPTR TYPE

Options: 31xx-56 (F1), 31xx-80 (F2)

This item determines the type of Westell Repeater.

3.5 Westell Line RPTR (SW 184)

The Westell Line Repeater screen shows several aspects of the repeater control session. Refer to Figure 34.

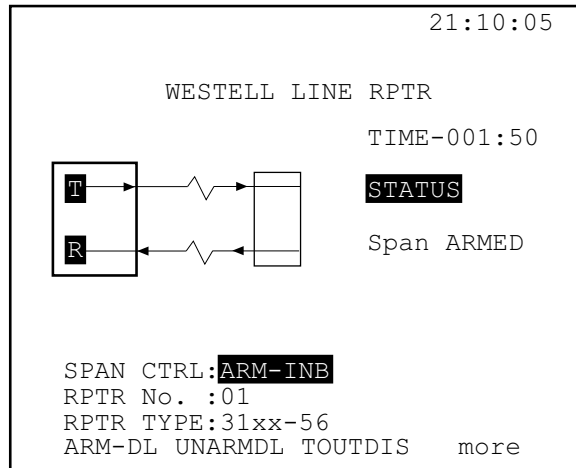


Figure 34 Westell Line Repeater

The items to the right of the diagram in Figure 34 provide information on the repeater control session and cannot be configured within this screen. They are:

TIME

Time begins counting up from 000:00 (mmm: ss) as soon as the span is armed. This indicates how much time is remaining until the repeater automatically drops its loopback. This usually occurs because of the repeater's time-out circuitry.

STATUS

The Status bar displays the current looping status of the span.

SPAN

The Span Control line, here displaying ARMED in Figure 34, displays what span control function is currently under process or complete.

Configured in this screen are the items appearing below the diagram in Figure 34. They are:

SPAN CTRL

The available options depend upon the FRAMING selected in the TEST CONFIGURATION screen.

ESF Framing: ARM-DL (F1), UNARMDL (F2), TOUTDIS (F3), LPBkQRY (more, F1), PWR-QRY (more, F2), LOOP-UP (more, F1), LOOP-DN (more, F2), SEQLPBK (more, F3).

SF-D4 Framing: ARM-INB (F1), TOUTDIS (F3), LPBkQRY (more, F1), PWR-QRY (more, F2), UNIVLDN (more, F3), LOOP-UP (more, F1), LOOP-DN (more, F2), SEQLPBK (more, F3).

ARM-DL/INB: This arms the office repeater and the line repeaters on the span. In most cases, ARM-INB and ARM-DL have the same function.

UNARMDL: This unarms the data link.

TOUTDIS: Time out disable will turn off the automatic time-out of the repeaters on the span. If selected, be sure to loop down all the repeaters on the span when finished.

LPBkQRY: Loopback query will query all the repeaters on the span to see which one is actually looped back and if found, a repeater number will be displayed in the graphic. Otherwise, LPBK will display either the looped or the unlooped mode.

PWR-QRY: Power query will query all repeaters on the span to see which one is looping the span simplex power. A message will appear if the power loop query finds a repeater in the power loop.

UNIVLDN: This causes the SunSet T10 to transmit the universal loop down code to loop-down any looped repeaters.

LOOP-UP: This key will loop up a specified line repeater. Arm the repeater and enter the RPTR number before using this function.

LOOP-DN: This key will loop down any line repeater; it will not loop down an NIU.

SEQLPBK: Sequential Loopback allows the user to quickly step through the loopbacks on the line. This feature is useful for tracking down misaddressed repeaters. Arm the span before using this option.

Note: Arming is required before the repeaters will actually loop up.

RPTR NO

Press the SHIFT key on the keypad and use the keypad numbers to enter the desired repeater number. This specifies which repeater will be looped up.

RPTR TYPE

Options: 31xx-56 (F1), 31xx-80 (F2)

This item determines the type of Westell Repeater.

3.6 Westell NIU/PM & MSS (SW 184)

Use the Westell NIU/PM & MSS menu when using the Westell Performance Monitoring NIU, Maintenance Switch, or Ramp features.

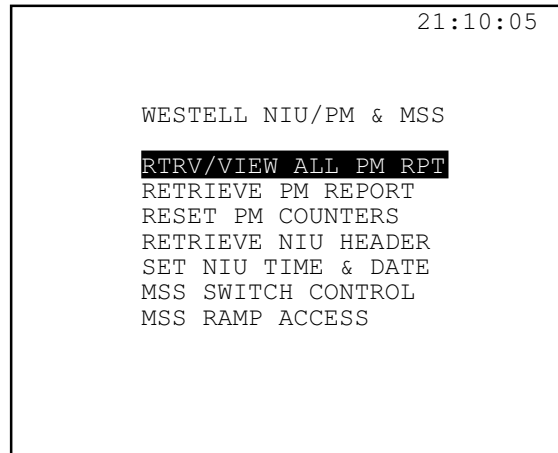


Figure 35 Westell NIU/PM & MSS Menu

The Westell Performance Monitoring NIU is a smart jack which constantly measures the performance of the received signals from both network and customer equipment. Use the SunSet T10 to poll the smart jack to provide information when troubleshooting the network. The Westell Maintenance Switch is a 1xN protection device that is used for manually restoring service to HICAP lines upon failure. With the Maintenance Switch Ramp Access function, use the SunSet T10 to non-intrusively poll the performance monitoring information from the NIU through the protection line.

All of these functions require the NIU to be looped back before beginning. The SunSet T10 takes care of this function automatically upon entering this menu. Further, the SunSet T10 will automatically switch itself into the required ESF mode.

The following procedure is for using the Westell Performance Monitoring NIU, Maintenance Switch, and Ramp features:

1. Plug into the DS1 line to be tested. This will be the customer's circuit if just using the PM NIU feature, or it will be the maintenance spare if using the RAMP or Maintenance Switch. Make sure the SunSet T10 is configured for SINGLE, TERM, and ESF.
2. Select MAIN MENU > LPBK & SPAN CONTROL MENU > WESTELL NIU/PM & MSS and refer to Figure 35.

Note: The SunSet T10 will proceed only if it is able to verify that a loopback is established.

3.6.1 RTRV/VIEW All PM RPT

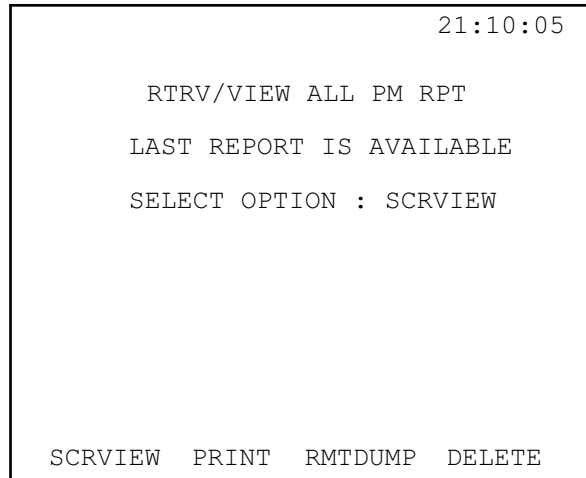


Figure 36 Retrieve View All PM Reports

This command retrieves all the performance information from the NIU. Refer to Figure 36 and use the following procedure:

1. Select RTRV/VIEW ALL PM RPT.
2. If this operation was performed after the NVRAM was erased, skip to step 3.
 - The SunSet T10 will then retrieve the data. This will take several minutes to complete. The operation is complete when "Retrieving data ..." changes to "All PM reports retrieved."
 - A. Press the ENTER key on the keypad to return to the WESTELL NIU/PM & MSS menu.
 - B. Press the ENTER key on the keypad to re-enter the RTRV/VIEW ALL PM RPT menu.
3. A screen will appear asking whether to Enable Printing. Enter either YES (F1) or No (F2).
4. Press the SCRVIEW (F1) F-key to view the performance data printed on the screen.
 - A. Press the PAGE-UP (F1) or PAGE-DN (F2) F-keys to view all the data.
 - B. If a displayed STAT message is unknown, press the STATUS (F3) F-key to get an interpretation of the STAT code.
 - C. Press the ESCAPE key on the keypad to get out of the STATUS interpretation screen and back to the performance results.

5. To poll the NIU again, press the DELETE (F4) F-key to clear the performance history that the SunSet T10 has gathered.

Note: If the results are not to be printed, then delete those results when entering this menu in order to retrieve current results.

The following are definitions of the displayed data.

PM PERIOD: This is the month-day-hour of the period observed.

ACCUM PRD: This is the period of time that the data was collected, either 1 hour or 1 day.

DIRECT: This is the measured direction. AZ is from the central office to the customer premises. ZA is from the customer premises to the central office.

CVL: coding violation-line (BPV)

CVP: coding violation-path (CRC-6 or SF error)

ESL: errored second-line

ESP: errored second-path

SESL: severely errored second-line

SESP: severely errored second-path

UASL: unavailable second-line

UASP: unavailable second-path

PDVS: pulse density violation second

B8ZS: a second in which a B8ZS was observed

MSEC: number of measured seconds

STAT: coded status message

3.6.2 Retrieve PM Report

This menu item allows retrieval of performance information from a single period.

1. Refer to the previous procedure and definitions in section 3.6.1. Specify the month, date, hour and direction of transmission that is to be polled.
2. Press the SHIFT key on the keypad to display the SHIFT indicator and type in the desired numbers for the day, date, and hour.
3. Press the SHIFT key on the keypad again to enter the accumulation period and direction using the F-keys.
4. When all the numbers and entries are as desired, press the ENTER key on the keypad to retrieve and view the data.

3.6.3 Reset PM Counters

Occasionally, the data at the NIU may become corrupted. This command allows resetting all of the NIU performance registers to zero.

1. When the warning message is displayed press the ENTER key on the keypad. All counters will reset to zero.

3.6.4 Retrieve NIU Header

This command displays the date and time set at the PM NIU.

3.6.5 Set NIU Time & Date

This command allows setting the NIU time and date in year-month-day and hour-minute-second format.

Note: Setting NIU time and date will cause all the registers to be reset to N/A (not available). Retrieve the available performance information before resetting the time and date.

3.6.6 MSS Switch Control

This command sends the control sequence to initiate the maintenance switch. Refer to Figure 37.

```
21:10:05
MSS SWITCH CONTROL
ACTION : SWITCH
LINE   : 01
SWITCH RELEASE
```

Figure 37 MSS Switch Control

Configure the following items in the MSS Switch Control screen:

ACTION

Options: SWITCH (F1), RELEASE (F2)

SWITCH: Select if connected to the maintenance switch and ready to switch a circuit over to the spare.

RELEASE: Select if connected to the customer's span and the customer is using the maintenance span.

LINE

Specify a line number if selecting SWITCH. Press the SHIFT key on the keypad and use the keypad numbers to enter the desired numbers.

Use the following procedure to initiate the maintenance switch:

1. Confirm an established loopback is at the maintenance switch.
 - A. Press the ERR INJ key on the keypad and verify that those errors are returning. If not, press the ESCAPE key on the keypad and select LPBK & SPAN CONTROL > WESTELL NIU/PM & MSS, this will automatically loop up the T1 Maintenance Switch card, or NIU.

2. Select MSS SWITCH CONTROL.
3. SWITCH (F1) the line if connected to the maintenance switch and ready to switch the circuit to the spare. Or, RELEASE (F2) the line if connected to the customer's span and the customer is using the maintenance span.
4. If selecting RELEASE, go to step 5. Otherwise, choose which line to switch to the maintenance spare.
 - A. Press the SHIFT key on the keypad to display the SHIFT indicator, and enter the desired numbers using the keypad.
 - B. Press the SHIFT key on the keypad and press the ENTER key on the keypad to begin the operation.
 - C. If the control sequence is successful, a message will be received indicating to go ahead and press the ENTER key on the keypad to activate the 10 second timer at the maintenance switch.
 - D. Connect the customer's span to the maintenance spare for the duration of the switch.
5. If selecting RELEASE (in step 3), there is no need to specify which line to release. The line is automatically selected.
 - A. Press the ENTER key on the keypad and the control sequence will start. When the maintenance switch is ready, reposition the cables on the span, and then press the ENTER key again to release the protection switch.

Notes:

- A loopback must be in place to perform the switch or release commands. If going directly from a switch to a release, the SunSet T10 at the switch will connect into the control unit, and then at the release into the NIU.
- The CCU will automatically loop up when entering into the Teltrend MSS menu. However, when plugging into the NIU to perform the release command, exit from the Teltrend MSS menu and re-enter it (as in step 1) to reestablish a loopback at the NIU.

Consult the Westell Maintenance Switch System practices manual for more information on the operation of the switch.

3.6.7 MSS Ramp Access

This command sends the necessary control codes to retrieve the performance information from the desired NIU. The advantage of this form of information retrieval is that the line remains in service while the information is polled. Figure 38 shows the MSS Ramp Access screen.

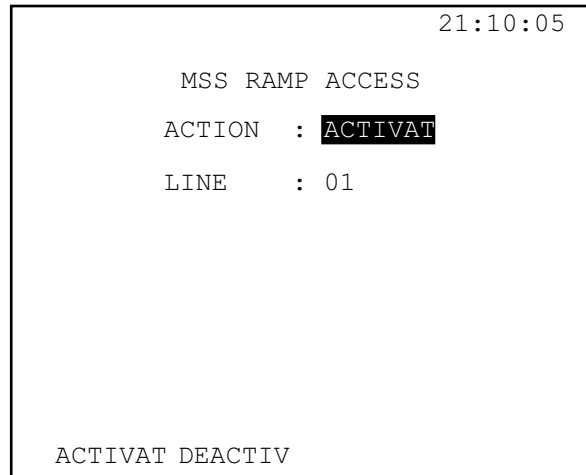


Figure 38 MSS Ramp Access

Configure the following items in the MSS Ramp Access screen:

ACTION

Options: ACTIVAT (F1), DEACTIV (F2)

- Select ACTIVAT to activate this command and retrieve the performance information from the NIU.
- Select DEACTIV when you are finished viewing the data.

LINE

Press the SHIFT key on the keypad and use the keypad numbers to enter the desired number.

Use the following procedure to send the control codes to retrieve the performance information:

1. Select MSS RAMP ACCESS.
2. Press the ACTIVAT (F1) F-key.
3. Choose the line to read the RAMP.
 - A. Press the SHIFT key on the keypad to display the SHIFT indicator on the screen.

- B. Enter the number of the line to read using the numbers on the keypad.
 - C. Press the ENTER key on the keypad.
4. When the "RAMP control has completed" message is shown, press the ESCAPE key on the keypad until WESTELL NIU/PM & MSS is reached.
 5. Select RTRV/VIEW ALL PM REPORT.
 - A. Press the DELETE (F4) F-key.
 - B. Retrieve the performance monitoring data as described in the "RTRV VIEW ALL PM RPT" procedure.
 - C. View and print the data as desired.
 6. When finished, press the ESCAPE key on the keypad until MSS RAMP ACCESS appears.
 7. Select DEACTVAT(F2) and press the ENTER key on the keypad. When the control sequences finish, the procedure is completed.

3.7 Teltrend MSS Switch Control (SW 184)

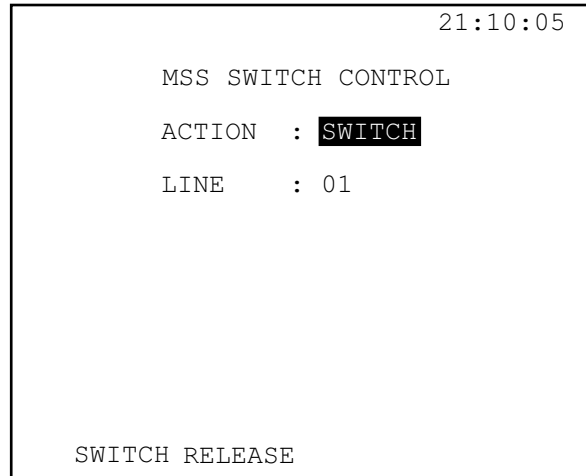


Figure 39 Teltrend MSS Switch Control

Configure the following items in the Teltrend MSS Switch Control screen:

ACTION

Options: SWITCH (F1), RELEASE (F2)

SWITCH: Select SWITCH if connected to the maintenance switch and are ready to switch the circuit over to the spare.

RELEASE: Select RELEASE if connected to the customer's span and the customer is using the maintenance span.

LINE

This specifies the position of the line to switch or release. Press the SHIFT key on the keypad and use the keypad numbers to enter the desired numbers. Use the following procedure to initiate the maintenance switch:

1. Upon entering TELTREND MSS, the SunSet T10 will attempt to loop up the CCU (maintenance switch common control unit).
2. Confirm that an established loopback is at the maintenance switch by pressing the ERR INJ key on the keypad; the LED display panel indicates any received errors.
3. If a successful loopback is not established, escape to LPBK & SPAN CONTROL > TELTREND MSS CONTROL. The

- SunSet T10 will automatically attempt to loop up the CCU or NIU.
4. Select TELTREND MSS CONTROL.
 5. If connected to the maintenance switch, and ready to switch the circuit over to the spare, press the SWITCH (F1) F-key
 - A. Press the RELEASE (F2) F-key if connected to the customer's span and the customer is using the maintenance span.
 - B. Press the SHIFT key on the keypad and enter the position of the LINE to switch or release.
 - C. Press the ENTER key on the keypad to start the control sequence.
 6. If choosing SWITCH, the SunSet T10 will indicate that it is sending the switch code; then it will attempt to verify the switch.
 - A. Once this operation has succeeded, a message will be displayed for the user to press the ENTER key on the keypad to switch the line.
 - B. After pressing the ENTER key, connect the customer's span to the maintenance spare for the duration of the switch.
 7. If choosing RELEASE in step 5, reposition the cables on the span.
 - A. Press the ENTER key on the keypad and wait until the control sequence has been executed. Once executed, the switch is released.

Notes:

- A loopback must be in place to perform the switch or release commands. To use the switch function, plug into the control unit. To use release, first plug into the NIU.
- The CCU will automatically loop up when accessing the Teltrend MSS menu. However, when plugging into the NIU to perform the release command, exit from the Teltrend MSS menu and re-enter it (as in step 2) to re-establish a loopback at the NIU.

Consult the Teltrend Maintenance Switch System Practices manual for extensive information on the operation of the switch.

3.8 HDSL Span Control

To test HDSL spans with the SunSet T10.

1. Select MAIN MENU > LPBK & SPAN CONTROL > HDSL SPAN CONTROL and the screen depicted in Figure 40 appears.

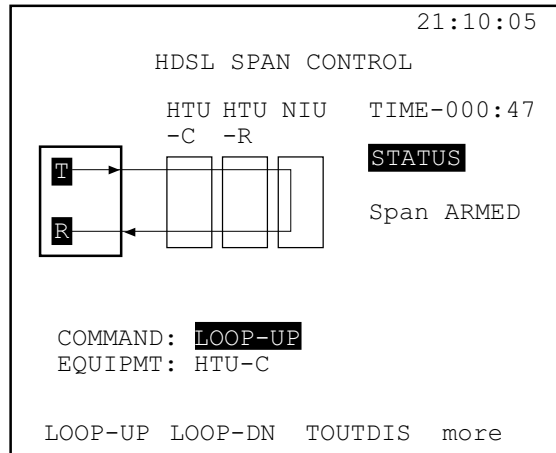


Figure 40 HDSL Span Control

The HDSL Span Control screen contains a graphic that updates according to circuit status. To send commands, use the F-key options for the COMMAND line.

Found in this screen are the following features:

Screen Graphic

- The box at the far left represents the SunSet T10. The “T” indicates the L1-Tx signal; “R” indicates L1-Rx signal.
- The network labeled boxes are: HTU-C, HTU-R, and NIU. When looping up a network element, the graphic updates. For example, Figure 40 shows a loopback at the NIU.
- TIME: Indicates the amount of time that has elapsed since arming the span.
- STATUS: Indicates the span’s status. This reports either “Span IDLE” or “Span ARMED.”

COMMAND

Options: ARM-INB (F1), UNARMIN (F2), LOOP-UP (more, F1), LOOP-DN (more, F2), TOUTDIS (more, F3), ARM-DL (more, F1), UNARMDL (more, F2)

ARM-INB: Arm in-band sends an in-band arming code. Arm most equipment before responding to loopback commands.

UNARMIN: Un Arm in-band sends an in-band disarming code.

LOOP-UP/LOOP-DN: These F-keys send a loop command for the specific network equipment specified in EQUIPMENT.

TOUTDIS: Time out disable will disable the automatic time-out of the span equipment. If selected, be sure to loop down all of the repeaters on the span when finished.

ARM-DL: Arm data link sends an arming command in the Datalink. This arms the equipment on the span. Arm most equipment before responding to loopback commands. This option is available only with ESF-DL framing.

UNARMDL: Un arm data link sends a disarming command in the Datalink. This option is available only with ESF-DL framing.

EQUIPMENT

Options: HTU-C (F1), HTU-R (F2), HRE (F3), HLU (F1), HRU (F2)

EQUIPMENT specifies which particular equipment will be looped up/down when sending a LOOP-UP or LOOP-DN command.

HTU-C and HLU: These functions refer to the HDSL transceiver at the central office. There is no difference in the code transmitted for HTU-C/HLU. This command invokes a loopback of the DS1 signal at the HTU-C/HLU toward the network. This loopback does not involve the 2B1Q HDSL span.

HTU-R and HRU: These functions refer to the remote HDSL unit. There is no difference in the code transmitted for HTU-R/HRU. This command invokes a loopback of the DS1 signal at the HTU-R/HRU toward the network. This is a far end loopback and involves the 2B1Q HDSL span.

HRE: This is an HDSL range extender, which can appear mid-span.

Notes:

- Sending a loopback command loops the DS1 signal towards the network.
- Arm the HDSL equipment before responding to loopback commands. Send an ARM-DL (ESF) or ARM-INB (SF) and then send the loop-up command.
- The arming command uses the same sequence as the standard NIU loop up code. An arming command will loop the far end NIU, if an NIU is present and if it responds to loopback commands. Alternatively, if the NIU loopback feature is enabled for the HDSL span, the arming sequence will activate the NIU loopback in the HTU-R.
- In some cases, the HTU-R can be configured to react to smartjack loopback commands, in which case the loop could be from the HTU-R instead of an NIU.

4.0 Send Test Pattern

Access the SEND TEST PATTERN screen from the MAIN MENU. Refer to Figure 41.

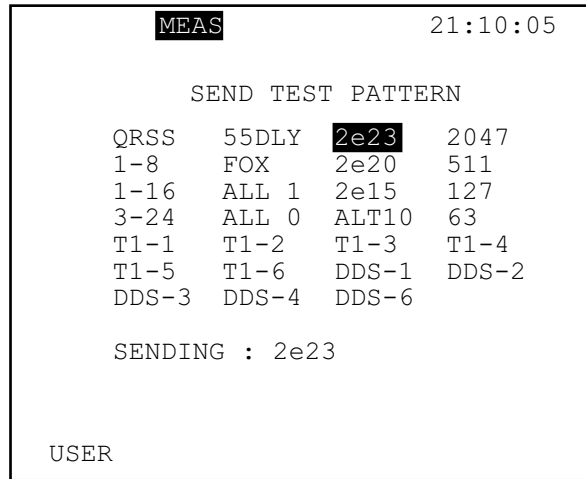


Figure 41 Send Test Pattern Menu

Use the following procedure to select and send a test pattern:

1. Select MAIN MENU > SEND TEST PATTERN, and use the arrow keys on the keypad to select the desired pattern. You can also select USER (F1).

Note: The SunSet T10 transmits a new test pattern each time a pattern is highlighted with the cursor. For a description of the Test Patterns, refer to Chapter 5, Reference.

USER

This selection allows a user-defined pattern with a maximum length of 2048 binary characters or 512 hexadecimal characters. Ten such patterns may be stored in the USER TEST PATTERN screen.

The SunSet T10 offers two pre-programmed user-patterns which are stored in slots 9 and 10 of the USER TEST PATTERN screen. Slot 9 is an IDLE signal, also known as Customer Disconnect Indicator, CDI. The IDLE pattern is 17 (HEX) or 0001 0111 (BINARY). Slot 10 is the YELLOW pattern. This pattern is BF (HEX) or 1011 1111 (BINARY).

4.1 Sending a USER Test Pattern

1. Select MAIN MENU > SEND TEST PATTERN and press the USER (F1) F-key. The USER TEST PATTERN screen appears.
2. The SunSet T10 will display a list of USER patterns. Use the up/down arrow keys on the keypad to select the desired pattern. Press the ENTER key on the keypad to transmit the selected pattern.
 - A. The SunSet T10 offers two pre-programmed, user-defined patterns. Line 9 contains the IDLE pattern and line 10 the YELLOW pattern.

4.2 Viewing a User Test Pattern

1. From step 1 of Sending a USER Test Pattern, select the desired test pattern and press the VIEW (F1) F-key.
2. The selected pattern will be displayed on the screen in hex, binary, and ASCII.
3. When finished viewing, press the ESCAPE key on the keypad to return to the USER TEST PATTERN screen.

4.3 Programming User-Defined Patterns

1. From step 1 of Sending a USER Test Pattern, select a blank position. Press the CREATE (F1) F-key.
2. Press the TOGGLE (F3) F-key. The letter A will begin to flash within the character grid.
3. Use the arrow keys on the keypad to select the desired character. Press the SELECT (F4) F-key. The character selected will appear on the LABEL line. Continue until the label is completed.
4. Press the TOGGLE (F3) F-key to escape out of the character grid and back to the LABEL line.
5. Press the down arrow key on the keypad to select FORMAT. Choose either BINARY (F1) or HEX (F2). The binary input is often simpler for entering short patterns.
 - BINARY mode, valid entries are '1' and '0'.
 - HEX mode, valid entries are: '0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.'
6. Press the down arrow key on the keypad to move to the pattern entry area.

- A. Press the SHIFT key on the keypad to display the SHIFT indicator.
 - B. Using the keypad, enter up to 2048 binary characters or 512 hexadecimal characters to create the desired pattern.
 - C. Press the SHIFT key on the keypad and the SHIFT indicator no longer appears on screen.
7. Press the ENTER key on the keypad to store the pattern and return to USER TEST PATTERN. Displayed within this screen is the new code
- A. Select the new pattern and press the ENTER key on the keypad to transmit it.

4.4 Correcting a Mistake in the Label

1. From step 2 of Programming User-Defined Patterns, press the TOGGLE (F3) F-key to exit the character grid and return to the LABEL line.
2. Press the left arrow key on the keypad to select the unwanted character.
3. Press the DELETE (F2) F-key to remove the character, repeat as necessary.
4. When the characters are removed, move the cursor to the right of the last character. If the LABEL is now correct, press the ENTER key on the keypad.
5. If more characters are needed for the label, press the TOGGLE (F3) F-key to return to the character grid.
6. Move the cursor to the desired character and press the SELECT (F4) F-key. Repeat until the LABEL is complete.
7. Press the ENTER key on the keypad to record the new LABEL, and return to USER TEST PATTERN. Alternatively, press the TOGGLE (F3) F-key to return to the LABEL line and continue entering or editing the pattern.

4.5 Correcting a Mistake in the Pattern

1. From step 6 of the Programming User-Defined Patterns procedure, the wrong digit is entered.
 - A. Press the SHIFT key on the keypad to remove the SHIFT indicator and use the arrow keys on the keypad to select the incorrect digit
 - B. Press the SHIFT key on the keypad to display the SHIFT indicator.
2. Enter the correct digit.
 - A. Press the SHIFT key on the keypad to remove the SHIFT indicator.
 - B. Using the arrow keys on the keypad move the cursor to the end of the line.
 - C. Press the SHIFT key on the keypad to display the SHIFT indicator.
 - D. Enter in the rest of the digits.

4.6 Editing a User Test Pattern

1. From the SEND TEST PATTERN menu, press the USER (F1) F-key to move into the USER TEST PATTERN screen.
2. Select the code to edit and press the EDIT (F2) F-key.
3. Using the procedure in Correcting a Mistake in the Label, edit the code's label
4. Press the ENTER key on the keypad to store the pattern.

4.7 Deleting a User Test Pattern

1. From the SEND TEST PATTERN screen, press the USER (F1) F-key to enter the USER TEST PATTERN screen.
2. Select the test pattern to delete and press the DELETE (F3) F-key.

5.0 Measurement Results

Measurement Results allows viewing of the accumulated measurement results. You may also restart the measurement process. Points to remember:

- The SunSet T10 continuously performs measurements on received signals.
- You do not need to access MEASUREMENT RESULTS in order to compile measurement results.
- Each time the test configuration is changed, measurements restart.

A key concept for Measurement Result screens is availability. *A circuit is available for use only when the bit error rate is low enough so that the signal can get through and be understood.*

- A circuit is unavailable at the beginning of 10 consecutive severely errored seconds.
- When the circuit is unavailable, errors, errored seconds, and severely errored seconds are not accumulated.

For example, start injecting errors continuously from the SunSet T10 at a 1×10^{-3} error rate. Displayed for the first 9 seconds are increasing bit errors, errored seconds, and severely errored seconds. At the tenth second, all the counts will decrease back to the values they had before the start of error injection, and the unavailable counter will increase by 10. Once a circuit is unavailable, it becomes available only after 10 consecutive seconds without severe errors.

Now turn off severe error injection, and insert 1 or 2 errors during the next 5 seconds. The unavailable second counter will continue to increase for the first 9 seconds, while the error counter stays the same. Then at the tenth second, the unavailable second counter decreases by 10, and the error counter increases by the amount of errors that were injected.

While unavailable seconds are being counted, other measurements, such as AS, BPV, BPVR, BIT, BER, FEB, CRC, ES, SES and %EFS are frozen. Once unavailable seconds are no longer counted, these measurements resume.

It may take the SunSet T10 one to three seconds to gain frame synch, pattern synch, coding synch, and to stop declaring any severe errors when the signal transitions from an unavailable state to an available state. To find out the exact number of seconds that contained a loss of signal condition, refer to the LOSS measurement result.

The actual Measurement Results screen and the displayed values depend upon the TEST MODE selected in the TEST CONFIGURATION screen. Figures 42 and 43 show sample Measurement Results screens for T1SINGL and T1DUAL.

```

MEAS 21:10:05
ET- 000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

LINE 1 - SUMMARY

BPV : 1 BPVR: 1.2e-09
BIT : 1 BER : 1.2e-09
FBE : 0 CRC : 0
ES : 1 EFS : 1380
%ES : 00.079 %EFS: 99.859
SES : 0 Lpp : -0.2 dB
UAS : 1 FREQ: 1544000

PAGE-UP PAGE-DN STOP more

```

Figure 42 T1 Single, Line 1 Summary Screen

```

MEAS 21:10:05
ET- 000:07:42 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

SUMMARY
-LINE 1- -LINE 2-

ES : 0 ES : 0
SES : 0 SES : 0
UAS : 2 UAS : 0
EFS : 454 EFS : 456
%EFS: 99.550 %EFS: 100
Lpp : 0.3 dB
FREQ: 1544000
BIT : 0

PAGE-UP PAGE-DN STOP more

```

Figure 43 T1 Dual Summary Screen

The following function keys are common to all MEASUREMENT RESULTS screens.

PAGE-UP (F1), PAGE-DN (F2): Use these F-keys to scroll through the MEASUREMENT RESULTS screens.

STOP/RESTART (F3): Pressing the STOP F-key causes the SunSet T10 to stop the test. Pressing the RESTART F-key restarts the measurement process and resets the elapsed time to zero.

HOLDSCR/CONTINU (more, F1): Hold screen allows observation of the measurement screen. The measurement count is still proceeding, but the counts are updated only in memory. When finished viewing the screen, press the CONTINU F-key to update the screen.

PRN-SAV (more, F2): Press this F-key to print the currently displayed results or save them in VIEW TEST RECORD.

In addition to measurement data, the screen displays the following data in the upper portion of the measurement screens:

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

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

- since switching on the SunSet T10.
- since configuring the SunSet T10 in the TEST CONFIGURATION screen.
- since restarting the test using the RESTART (F3) F-key.
- since pressing the AUTO key on the keypad.

Note: In the LOGICAL results screens LET replaces ET. LET refers to logical elapsed time. LET starts counting after achieving PAT SYNC.

RT: This is the remaining time of the test. The test runs continuously by default, until stopped by the user. For this reason, CONTINU (continuous) is displayed in the RT field. However, a specific run time can be entered from MAIN MENU > OTHER FEATURES > MEAS CONFIGURATION. For a run time you can enter up to 999 hours and 59 minutes.

FRM: transmitted framing

TxCd: transmitted line coding

CNFG: test mode configuration

RCV: received test pattern

XMT: transmitted test pattern

5.1 Measurement Result Screens

T1 SINGL Measurement Results can contain up to seven screens of results. Access the pages using the PAGE-UP and PAGE-DN F-keys. These screens are:

1. Line 1 Summary or No Errors
2. Line 1 Line
3. Line 1 Signal
4. Line 1 Frame
5. Line 1 ESF CRC-6*
6. Line 1 Logical
7. Line 1 Frequency

T1 Dual Measurement Results can contain up to eleven screens of results. These screens are:

1. Line 1& 2 Summary or No Errors
2. Line 1 Line
3. Line 2 Line
4. Line 1 Signal
5. Line 2 Signal
6. Line 1 Frame
7. Line 2 Frame
8. Line 1 ESF CRC-6*
9. Line 2 ESF CRC-6*
10. Line 1 or 2 Logical
11. Line 1 or 2 Frequency

***Note:** The ESF CRC-6 screens appear only if ESF framing has been selected in the TEST CONFIGURATION screen.

For most results, there are pages for both Line 1 and Line 2. However, the Logical and Frequency screens refer to whichever line was selected as Rx/DROP in the TEST CONFIGURATION screen.

5.1.1 Measurement Results Summary Screens

The summary screens contain the most significant measurement results. The screens contain measurement results for errored seconds, severely errored seconds, unavailable seconds, and bit errors. If there are no errors in the signal, the SunSet T10 displays the No Errors Screen in place of the Summary screen. Refer to Figures 44, 45, and 46.

```
MEAS 21:10:05
ET- 000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

LINE 1 - SUMMARY

BPV : 1          BPVR: 1.2e-09
BIT : 1          BER : 1.2e-09
FBE : 0          CRC : 0
ES : 1          EFS : 1380
%ES : 00.079    %EFS: 99.859
SES : 0          Lpp : -0.2 dB
UAS : 1          FREQ: 1544000

PAGE-UP PAGE-DN STOP more
```

Figure 44 T1 Single, Line 1 Summary Screen

```
MEAS 21:10:05
ET- 000:07:42 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

SUMMARY
-LINE 1- -LINE 2-
ES : 0          ES : 0
SES : 0          SES : 0
UAS : 2          UAS : 0
EFS : 454        EFS : 456
%EFS: 99.550    %EFS: 100
Lpp : 0.3 dB
FREQ: 1544000
BIT : 0

PAGE-UP PAGE-DN STOP more
```

Figure 45 T1 Dual Summary Screen

```
MEAS 21:10:05
ET- 000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

NO ERRORS NO
ERRORS

FREQ: 1544000 Lpp : 0.3 dB
PAGE-UP PAGE-DN STOP more
```

Figure 46 No Errors Screen

These are the SUMMARY definitions.

BPV: This is a count of the number of bipolar violations that occurred since the start of the test.

Usage: This measurement detects problems with the line to which the SunSet T10 is connected. BPVs are local, because any multiplexers, radio or fiber transmission links, switches, digital cross-connects, or other line-terminating devices will remove them as the signal passes through those devices. BPVs only pass through copper and regenerative repeaters. This measurement is also useful where the transmitted framing or data is unknown. Finally, many telephone companies use a given number of BPV counts as the maximum acceptable for a span.

BPVR: This is the average bipolar violation error rate since the beginning of the test.

Usage: 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.

BIT: This is a count of the number of bit errors that have occurred since the beginning of the test. BIT displays N/A when the SunSet T10 cannot synchronize on a pattern.

Usage: This is similar to BPV with the following differences. First, the SunSet T10 is measuring a known pattern. Hence, the

measurement covers transmission performance over the entire service, not just the local span or section. As a result, 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 average bit error rate since the beginning of the test. BER displays N/A when the SunSet T10 cannot synchronize on a pattern.

Usage: BER is used instead of a count when testing 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.

FBE: This is a count of the number of framing bit errors that have occurred since the beginning of the test. FBE displays N/A when the SunSet T10 cannot synchronize on a pattern.

Usage: Used for in-service testing on SF-D4 circuits where the customer is transmitting an unknown data stream. The advantage of this measurement is that the framing stays intact as it passes through various network elements (except fractional T1 circuits); hence, it depicts the overall transmission quality from the far end of the circuit to the SunSet T10.

A drawback with this measurement is that it only measures 1 out of every 193 bits, and so it gives only a sampling of the true transmission performance. Another drawback with this measurement is that it cannot measure the quality of transmission on the two outgoing directions from the SunSet T10 to the end of the circuit. It can only measure the quality on the two incoming directions of transmission.

CRC: This is the number of CRC-6 errors that have occurred since the beginning of the test. CRC displays N/A when the SunSet T10 cannot synchronize on an ESF signal.

Usage: CRC is a valuable complement to the BPV measurement. BPVs identify errored in-service transmission in the local part of the T1 path, and CRCs identify errored in-service transmission on the entire path from the origination point to the SunSet T10. If the number of BPV errors is about the same or a little bit less than the CRC errors, then there is a problem on the local span. However, if there are no BPV errors but many CRC errors, then the problem is on the other side of the multiplexers or other line-terminating equipment.

Note: For in-service testing, both CRC and BPV give information about errors on the incoming signals but not on the outgoing signals. To test the line with these measurements, take the line out of service and initiate a far end loopback.

ES: This is 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, FBE, or CRC-6 error. There is no count of ES during unavailable seconds.

Usage: Errored seconds are a key tariff parameter for T1 services. Acceptance limits rate the 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 it measures the quality of service as the user actually experiences it.

EFS: This is a count of error free seconds since the beginning of the test.

%ES: This is a count of the percentage of errored seconds (as defined in ES). This percentage is calculated by the formula, $\%ES = ES/AS \times 100$.

%EFS: This is a count of percentage of error free seconds since the beginning of the test.

Usage: %EFS is used for evaluating T1 services. Data customers typically expect this number to be anywhere from 95% to 99.5% or higher. %EFS and %AS are the two most significant parameters in gauging the quality of T1 service delivered to the customer.

SES: This is the number of severely errored seconds that have occurred since the beginning of the test. An SES is a second with a 10^{-3} error rate, where error rate is measured from bit errors, BPV errors, framing bit errors, and CRC-6 errors. An out of frame error will also generate a SES. There is no count of SES during unavailable seconds.

Usage: This measurement is sometimes used in combination with ES to describe overall in-service transmission performance. During an SES, the customer is likely to be experiencing trouble with the service but may still be able to use the service, such as PCM voice transmission.

Lpp: Level peak-to-peak is the peak-to-peak level of negative and positive pulses received by the SunSet T10.

Usage: Use to confirm that the signal is at the proper level. For example, at a DSX, the level should be 0 dB at the out jack, and about -20 dB at the monitor jack. At the customer premises, the received signal should be no lower than -15 dB, and the transmit signal should be about 0 dB. At a repeater, the input signals should be between -7.5 and -35 dB, and the output signals should be about 0 dB.

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

UAS is any second with a loss of signal, loss of frame, loss of pattern, or alarm indication signal. A UAS also occurs at the onset of 10 consecutive SESs. Once a UAS is declared, the following seconds are counted unavailable until declared available again. Service becomes available at the onset of 10 consecutive available non-severely errored seconds.

Usage: UASs are not permitted in any number in a 15-minute or 1 hour test. Telephone companies typically guarantee 3 hours maximum outage time per year with T1 service.

FREQ: This is the frequency of the signal as measured against the frequency of a reference clock. When measuring just one signal the reference is the SunSet T10's internal clock. The internal reference clock of the SunSet T10 has a stratum 3 accuracy. When both Rx jacks have signals plugged in, XMT CLOCK defaults to the received signal from the line selected in Tx/INSERT in the TEST CONFIGURATION screen.

5.1.2 Line/BPV Screen

Calculated from bipolar violation occurrences are the LINE screen measurements. Use these screens to perform an in-service test on an unframed signal. Figure 47 shows the LINE 1 LINE screen.

```
MEAS 21:10:05
ET- 000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

LINE 1 - LINE

BPV : 11
BER : 9.9e-09 CURBER: 0.0e-07
ES : 5 %ES : 00.692
SES : 0 %SES : 00.000
AS : 723 %AS : 100
UAS : 0 %UAS : 00.000
DGRM: 0 %DGRM : 00.000

PAGE-UP PAGE-DN STOP more
```

Figure 47 BPV Line 1 Line Screen

Defined as follows are the measurements in Figure 47.

BPV: This is the number of bipolar violations that have occurred since the beginning of the test.

BER: This is the bipolar violation error rate measured since the beginning of the test.

Usage: Use BER 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.

CURBER: This is the current bipolar violation bit error rate measured during the previous averaging interval. The interval is for one second.

Usage: CURBER is useful conducting long-term measurements. In this case, a single period of high errors can skew the average error rate high. It is then useful to know if the errors are still occurring.

ES: Errored seconds is a count of seconds with at least one bipolar violation since the beginning of the test. There is no count during BPV UASs.

%ES: This is a percentage of BPV ESs that has occurred since the beginning of the test. There is no count during BPV UASs.

SES: Severely errored seconds is a count of seconds with at least a 10^{-3} bipolar violation error rate since the beginning of the test. There is no count during BPV UASs.

%SES: This is the percentage of BPV SESs that have occurred since the beginning of the test.

AS: This is the number of available seconds that have occurred since the beginning of the test. A BPV AS is any second that is not a BPV UAS.

%AS: This is a percentage of available BPV seconds that have occurred since the beginning of the test.

UAS: This is the count of bipolar violation unavailable seconds since the beginning of the test. A UAS is counted if there is a loss of signal or at the onset of 10 consecutive BPV SESs. BPV UAS continues counting until the onset of 10 consecutive available non-SESs.

%UAS: This is a percentage of BPV UASs that have occurred since the beginning of the test.

DGRM: This is the number of BPV degraded minutes since the beginning of the test. A BPV DGRM is 60 consecutive non-severely errored seconds during which at least 92 BPVs occurred.

%DGRM: This is a percentage of BPV DGRMs that have occurred since the beginning of the test.

5.1.3 Signal Screen

The SIGNAL screen presents all measurements based on the actual T1 signal. Use this screen if concerned with the T1 signal. Several measurements are useful in just about any application. Shown in Figure 48 is the LINE 1 SIGNAL screen.

```
MEAS 21:10:05
ET- 000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

LINE 1 - SIGNAL

AS : 2270      FREQ : 1544000
UAS : 0        +LVL : 2.93 V
LOSS: 0        -LVL : 2.92 V
LDNS: 0       Lpp : 5.85 V
EXZS: 0        +LVL : -0.2 dB
AISS: 0        -LVL : -0.2 dB
%AS : 100      Lpp : -0.2 dB
%UAS: 00.000  SMPX : 0. mA

PAGE-UP PAGE-DN STOP more
```

Figure 48 Line 1 Signal Screen

Defined as follows are the measurements in Figure 48.

AS: Signal available seconds is the number of seconds during which signal was not lost.

UAS: Signal unavailable seconds is the number of seconds during which signal was lost.

%UAS: Signal percent unavailable seconds is the percentage of seconds during which LOS was detected since the beginning of the test.

Usage: A quick way to see a percentage of time in which there was no signal on the line.

LOSS: Signal 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 clues as to the nature of an out-of-service condition. For example, a break in the line causes a loss of signal at the SunSet T10 if there are no line terminating elements in between the break and the SunSet T10. However, if there is a line terminating element, then the same break in the line will cause an AISS.

LDNS: Signal low density seconds is a count of the number of seconds when the $8(n + 1)$ rule is broken.

Usage: This measurement can give an indication as to whether the customer is transmitting illegal strings of data or if B8ZS encoding equipment is working properly. For example, if line code is set for B8ZS at the SunSet T10, but the SunSet T10 is receiving LDNS counts, then a transmitter is not correctly sending the B8ZS code. Or, if testing an AMI line and getting excessive LDNS counts, this indicates that the customer is sending an unusual signal and perhaps that customer should be switched to a B8ZS line.

EXZS: Excess zero seconds is a count of the number of seconds in which excessively long strings of zeroes are detected. For AMI coding, this is 16 or more consecutive zeroes; for B8ZS this is 8 or more consecutive zeroes. This measurement is different from 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 for LDNS.

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

Usage: This measurement can provide clues as to the nature of an out-of-service condition. For example, a break in the line will cause a loss of signal at the SunSet T10 if there are no line-terminating elements between the break and the SunSet T10. However, if there is a line-terminating element, the same break will cause an AISS.

+LVL: Positive level is the level of positive pulses received by the SunSet T10.

Usage: The +LVL and -LVL measurements are useful for finding faults with the last repeater or transmitter that is generating the signal to the SunSet T10. If the value of the positive pulses is more than 1 dB different from the value of the negative pulse, this could cause problems. The level at a DSX should be approximately 3 volts. The level at a repeater should be between -10 dB and -35 dB. Level and simplex current measurements are only from L1-Rx.

-LVL: Negative level is the level of negative pulses received by the SunSet T10.

Usage: Refer to +LVL

Lpp: This is the peak-to-peak level of negative and positive pulses received by the SunSet T10.

Usage: The Lpp measurement saves time by adding the +LVL and -LVL values to calculate Lpp.

FREQ: This is the frequency of the signal as measured against the frequency of a reference clock. When measuring just one signal, the reference is the SunSet T10's internal clock. The internal reference clock of the SunSet T10 has a stratum 3 accuracy. When both Rx jacks have signals plugged in, XMT CLOCK defaults to the received signal from the line selected in Tx/INSERT in the TEST CONFIGURATION screen.

SMPX: This is the simplex DC current flowing from L1-Rx tip and ring through the SunSet T10 to L2-Tx tip and ring.

Usage: Use this measurement to verify proper simplex current flowing on a T1 span. The result should generally be 60 mA.

WARNING!

Unplug the SunSet T10 immediately if the current measurement exceeds 150 mA, as this may damage the SunSet T10's simplex current measuring circuit.

5.1.4 Frame Screen

The FRAME screen reports all related framing measurements of the tested line. These measurements are reported regardless of the type of framing on the line. An unframed signal will not have measurements reported in this screen.

Usage: The FRAME screen is particularly useful for D4 signals where CRC-6 errors are not available. Figure 49 shows the LINE 1 FRAME screen.

```
MEAS 21:10:05
ET- 000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

LINE 1 - FRAME

FBE : 5 FSLIP : NO L2
FBER: 9.8e-06 CUFBER: 0.0e-04
OOFs: 0 COFA : 0
YELS: 0 LOFS : 0
ES : 2 %ES : 01.563
SES : 0 %SES : 00.000
AS : 2270 %AS : 100
UAS : 0 %UAS : 00.000

PAGE-UP PAGE-DN STOP more
```

Figure 49 Line 1 Frame Screen

FBE: This is a count of framing bit errors that have occurred since the beginning of the test.

Usage: This is used for in-service testing on SF-D4 circuits, where the customer is transmitting an unknown data stream. The advantage of this measurement is that the framing stays intact as it passes through various network elements (except fractional T1 circuits); hence, it depicts the overall transmission quality from the far end of the circuit to the SunSet T10.

A limitation with this measurement is that it only measures one out of every 193 bits, and so it gives only a sampling of the true transmission performance. Another drawback is that it cannot measure the quality of transmission on the two outgoing directions of transmission. FBE can measure the quality only on the two incoming directions of transmission.

FSLIP: This is a count of line frame slips that have occurred since the beginning of the test. A frame slip occurs 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. Frequency synchronization can be the source of problems for channelized HICAP services that carry data and face a switch or a 1x0 digital cross-connect system.

FBER: This is the framing bit error rate measured since the beginning of the test.

Usage: Refer to the usage of FBE. This rate is a way of summarizing the information that is independent of the actual measurement period.

CUFBER: This is the current framing bit error rate.

Usage: This measurement is useful for determining if the circuit recently had major error problems. However, the limitation of this measurement is that the 1-second averaging interval is so short that it is not useful for finding error rates below 10^{-4} .

OOFS: This is a count of out-of-frame seconds that have occurred since the beginning of the test. Note that the conditions for out-of-frame may be adjusted in the MEASUREMENT PARAMETERS screen. An out-of-frame condition occurs when either 2-in-4 or 2-in-5 framing bits have been in error.

OOFS starts counting when an out-of-frame condition occurs. OOFS continues to increment until framing has reestablished, or until 3 consecutive seconds have been out-of-frame. In this case, LOF is declared, OOFS is decremented by 3, and LOFS is incremented by 3. Once an out-of-frame condition occurs, the SunSet T10 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. If the framing moves to a new position, then a COFA (change of frame alignment) is declared.

Usage: A large OOFS count is an indication of significant transmission problems.

COFA: This is a count of changes of frame alignment that have occurred since the beginning of the test. Refer to OOFS for the conditions that result in the declaration of a COFA.

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, a zero in bit 2 for all channels indicates YELS. 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 sig-

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

Usage: YELS is the only end-to-end service indicator that is available for in-service testing for D4, SLC-96®, and some ESF circuits. Use YELS to sectionize a fault. For example, if the signal on side A reaches the SunSet T10 without error, but the signal on side B shows a YELS, then side A must be failing somewhere downstream from the SunSet T10.

LOFS: This is the count of loss of frame seconds since the beginning of the test. LOFS occur at the onset of 3 consecutive OOFSSs. They count up until the onset of 10 consecutive non-SESs.

Usage: Used often on extended tests where sporadic intermittency problems are experienced.

ES: This is the count of frame errored seconds since the beginning of the test during which at least one framing bit error has occurred. There is no count during a frame unavailable second.

%ES: This is the percentage of frame errored seconds that have occurred since the beginning of the test.

SES: This is a count of frame severely errored seconds since the beginning of the test during which at least four framing bit errors have occurred, or at least one out-of-frame has occurred. There is no count during a frame unavailable second.

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

AS: This is a count of the frame available seconds since the beginning of the test. A frame available second is any frame error-free second, frame errored second, or frame severely errored second.

%AS: This is the percentage of frame available seconds since the beginning of the test.

UAS: A line 1 frame unavailable second occurs at the onset of 3 consecutive OOFSSs or 10 consecutive SESs. UASs continue counting until the onset of 10 consecutive frame error-free seconds or frame errored seconds.

%UAS: This is the percentage of frame unavailable seconds since the beginning of the test.

5.1.5 ESF CRC-6 Screen

The ESF CRC-6 screen displays all of the results derived from the CRC-6 (cyclic redundancy check code-6) bits within the ESF signal. They appear only with an ESF signal. Shown in Figure 50 is the LINE 1-ESF CRC-6 screen.

```
MEAS 21:10:05
ET- 000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

LINE 1 - ESF CRC-6

CRC : 0
CER : 0.0e-05 CURCER: 0.0e-03
ES : 2 %ES : 00.000
SES : 0 %SES : 00.000
AS : 2270 %AS : 100
UAS : 0 %UAS : 00.000

PAGE-UP PAGE-DN STOP more
```

Figure 50 Line 1 - ESF CRC-6 Screen

Defined as follows are the measurements in Figure 50.

CRC: This is a count of ESF CRC-6 block errors that have occurred since the beginning of the test. Each CRC-6 block error indicates that there is at least 1 bit error within an extended super frame. An extended super frame consists of 24 frames. Each frame contains 193 bits.

CER: This is the ESF CRC-6 block error rate since the beginning of the test.

CURCER: This is the current ESF CRC-6 error rate since the beginning of the test.

ES: This is a count of ESF CRC-6 seconds since the beginning of the test that contain at least one ESF CRC-6 bit error. There is no count during a CRC-6 unavailable second

%ES: This is a percentage of ESF CRC-6 Errored Seconds since the beginning of the test.

SES: ESF CRC-6 severely errored seconds is a count of seconds with at least 320 CRC-6 errors since the beginning of the test. There is no count during a CRC-6 unavailable second.

%SES: This is a percentage of ESF CRC-6 severely errored seconds since the beginning of the test.

AS: ESF CRC-6 available seconds is a count of the CRC-6 error-free seconds, CRC-6 errored seconds, and CRC-6 severely errored seconds since the beginning of the test.

%AS: This is a percentage of ESF CRC-6 available seconds since the beginning of the test.

UAS: This is a count of ESF CRC-6 unavailable seconds since the beginning of the test. CRC-6 UASs are counted at the onset of 10 consecutive CRC-6 severely errored seconds or immediately on LOF or LOS. CRC-6 UAS continues counting until the onset of 10 CRC-6 error-free or CRC-6 errored seconds.

%UAS: This is a percentage of ESF CRC-6 unavailable seconds since the beginning of the test.

5.1.6 Logical Screen

The LOGICAL screen reports all of the parameters measured from a known test pattern. Reported results are available if synchronized with a pattern

Usage: Most users will refer only to bit error rate and bit error count displayed on the Summary screen. However, the bit slip measurement offered on this screen is a useful means of detecting this unusual circuit impairment. Refer to Figure 51.

```
MEAS 21:10:05
LET-000:37:50 RT- CONTINU
FRM-ESF TxCd-B8ZS CNFG-TERM
RCV-QRSS XMT-QRSS

LINE 1 - LOGICAL
BIT : 10 BTSLP : 0
BER : 9.7e-09 CURBER: 0.0e-07
ES : 3 %ES : 00.412
SES : 0 %SES : 00.000
AS : 2270 %AS : 100
UAS : 0 %UAS : 00.000
DGRM: 0 %DGRM : 00.000
SYLS: 0 %SYLS : 00.000

PAGE-UP PAGE-DN STOP more
```

Figure 51 Line 1 Logical Screen

LET: In this screen LET replaces ET. Logical Elapsed Time starts counting after achieving PAT SYNC.

BIT: This is a count of line 1 logical bit errors since the beginning of the test.

BTSLP: This is a count of line 1 logical bit slips that have occurred since the beginning of the test. A bit slip occurs when the synchronized pattern either loses a bit or has an extra bit stuffed into it.

Usage: BTSLP can be useful for finding frequency slip problems that are symptomatic of a network element that periodically drops or stuffs a bit.

BER: Line 1 logical bit error rate since the beginning of the test.

CURBER: Line 1 logical current bit error rate during the last averaging interval of one second.

ES: This is a count of line 1 logical bit errored seconds that have occurred since the beginning of the test. A bit errored second is a second with at least 1 bit error. There is no count during bit unavailable seconds.

%ES: This is a percentage of line 1 logical bit errored seconds that have occurred since the beginning of the test.

SES: This is a count of line 1 logical bit severely errored seconds that have occurred since the beginning of the test. A bit severely errored second is a second with at least 1,544 bit errors (10^{-3} error rate). There is no count during bit unavailable seconds.

%SES: This is a percentage of line 1 logical bit severely errored seconds that have occurred since the beginning of the test.

AS: This is a count of line 1 logical bit available seconds that have occurred since the beginning of the test. A bit available second is any bit error-free, bit errored, or bit severely errored second.

%AS: This is a percentage of line 1 logical bit available seconds since the beginning of the test.

UAS: This is a count of line 1 logical bit unavailable seconds since the beginning of the test. A bit unavailable second is a second during which the test pattern has lost synchronization. UASs start counting at the onset of 10 consecutive bit severely errored seconds. UASs continue counting until the onset of 10 bit non-severely errored seconds.

%UAS: This is a percentage of line 1 logical bit unavailable seconds since the beginning of the test.

DGRM: This is a count of line 1 logical bit degraded minutes that have occurred since the beginning of the test. A bit degraded minute is 60 non-severely errored seconds during which at least 92 errors occurred.

5.1.7 Frequency Screen

Figure 52 shows a LINE 1 FREQUENCY screen. T1SINGL and T1DUAL modes use the same screen.

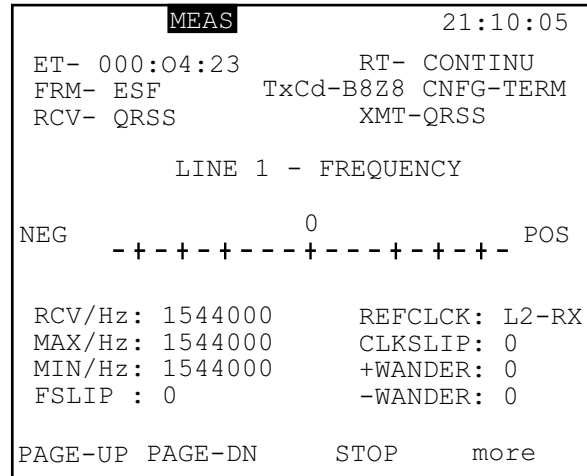


Figure 52 Frequency Screen

Defined as follows are the measurements in Figure 52.

RCV/Hz: Current frequency measured during the last second in Hertz.

MAX/Hz: Maximum frequency measured in Hertz since the beginning of the test.

MIN/Hz: Minimum received frequency in Hertz since the beginning of the test.

FSLIP: This is a count of frame slips that have occurred since the beginning of the test. A frame slip occurs each time the phase of the line under test has deviated from the phase of the reference clock by 193 bits. This value represents the total number of frame slips; 1 frame slip =193 bit slips.

REFCLCK: This is the reference clock. When no reference signal is present, the SunSet T10 uses its internal clock as a reference. In this case, the screen will still display the Min/Max/Avg frequency of the received signal, but it will not display any clock slip or wander information.

CLKSLIP: Clock Slip is the net value of the negative and positive wander.

+WANDER: 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: Maximum negative phase difference between the measured frequency and the reference frequency since the beginning of the test.

5.2 Datacom Measurement Results

The measurement results for Datacom Mode are on one screen, the DATACOM-BIT ERROR screen. Refer to Figure 53.

```
MEAS 21:10:05
ET- 000:02:44 RT- CONTINU
TYPE- X.21 MODE- DTE
RATE- 48k Hz RxHz- 48000
RCV- ALT10 XMT - ALT10

DATACOM- BIT ERROR
BIT - 0 RATE - 0.0e-07
ES - 0 %ES - 00.000
SES - 0 %SES - 00.000
EFS - 164 %EFS - 100
AS - 164 %AS - 100
UAS - 0 %UAS - 00.000
DGRM- 0 %DGRM - 00.000

HOLDSCR PRN-SAV STOP
```

Figure 53 Datacom Bit Error Screen

Defined as follows are the measurements in Figure 53.

BIT: This is a count of the number of bit errors that have occurred since the beginning of the test. There is no count during unavailable seconds.

RATE: This is the total number of bit errors divided by the total number of bits during available time since the beginning of the test.

ES: This is a count of the number of bit errored seconds that have occurred since the beginning of the test. ES is any second with at least one bit error. There is no count during an unavailable second.

%ES: This is a percentage of bit errored seconds since the beginning of the test.

SES: This is a count of severely bit errored seconds since the beginning of the test. SES is a second with a 10^{-3} bit error rate. There is no count during an unavailable second.

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

EFS: This is a count of number of bit error free seconds since the beginning of the test.

%EFS: This is a percentage of bit error free seconds since the beginning of the test.

AS: This is a count of bit available seconds since the beginning of the test. Bit available seconds equals the length of the total test time minus any UAS.

%AS: This is a percentage of bit available seconds since the beginning of the test.

UAS: This is a count of bit unavailable seconds since the beginning of the test. Bit UAS begins at the onset of 10 consecutive severely bit errored seconds and ends at the onset of 10 consecutive non-severely bit errored seconds. Loss of signal, loss of frame, and loss of pattern synchronization will also cause a bit UAS.

%UAS: This is a percentage of bit unavailable seconds 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 bit degraded minute is 60 non-severely errored seconds with at least 92 errors.

%DGRM: This is a percentage of bit degraded minutes that have occurred since the beginning of the test.

5.3 T1-MUX Mode Measurement Results

The measurement results presented for T1-MUX mode depend upon the BERT side selected in the TEST CONFIGURATION screen. The first nine screens are the same for both sides. They are:

1. Line 1 & Line 2 Summary
2. Line 1 Line
3. Line 2 Line
4. Line 1 Signal
5. Line 2 Signal
6. Line 1 Frame
7. Line 2 Frame
8. Line 1 ESF
9. Line 2 ESF

If MUX BERT: T1DRP was selected and therefore, looking at the signal dropped from the T1 side. Line Frequency and Line Logical screens appear at pages ten and eleven. If Line Rx/DROP was selected, these screens will present information for Line 1. Line 2 is shown if Rx/DROP= L2-Rx.

If MUX BERT was selected: Datacom type (i.e. X.21, RS232), a Datacom Bit Error screen will appear at page ten in place of Line Frequency and Logical.

If you have already reviewed the measurement results sections for T1SINGL, DUAL, and Datacom modes, the screen titles above should be familiar. If not, refer to section 5.0 Measurement Results Menu, for sample screens and definitions of all the Line result pages. Refer to section 5.2 Datacom Measurement Results for a sample screen and definitions for the Datacom Bit Error screen.

6.0 Other Measurements

```
MEAS 21:10:05
OTHER MEASUREMENTS
VIEW RECEIVED DATA
PROPAGATION DELAY
QUICK TEST I
QUICK TEST II
BRIDGE TAP DETECT
PULSE MASK ANALYSIS
DDS MEASUREMENTS
ISDN PRIMARY RATE
SS#7 ANALYSIS
GSM VOICE/TRAU/BERT
SWITCHED 56 TESTING
```

Figure 54 Other Measurements Menu

Many of the OTHER MEASUREMENTS menu items are software options and may not be present in your SunSet T10.

6.1 View Received Data

```
MEAS 21:10:05
VIEW RECEIVED DATA
PAGE : 01
T/S  BINARY  HEX  ASCII
01   01100010 62   b (F)
02   11110010 F2   (O)
03   00011010 1A   (X)
04   00000100 04   ( )
05   11111111 FF   ( )
06   11111111 FF   ( )
07   11111111 FF   ( )
08   11111111 FF   ( )
PAGE-UP PAGE-DN RESUME STORE
```

Figure 55 View Received Data

VIEW RECEIVED DATA displays the patterns (in binary, HEX, and ACSII) received on all 24 time slots. Refer to Figure 55, View Received Data for a typical screen display.

Note: VIEW RECEIVED DATA is not available in Datacom Mode.

To view the data, use the following procedure:

1. Select MAIN MENU > OTHER FEATURES > VIEW RECEIVED DATA.
2. View the live presentation of the T1 data. In Figure 55, Time slots 1–4 are selected in the Nx64K Select Time slot screen (in TEST CONFIGURATION). Therefore, the live pattern, which happens to be FOX, can be seen in time slots 1–4, while the IDLE pattern (FF) is seen in the other time slots.
 - The IDLE pattern can be determined in OTHER FEATURES > OTHER PARAMETERS.
3. Press PAUSE (F3) to trap the current data on the T1 line.
4. Press either PAGE-UP (F1) or PAGE-DN (F2) to view more data. Note the PAGE number in the upper left-hand portion of the screen. 60 screens (20 T1 frames) of data are available.
5. When finished, press the ESCAPE key twice to return to the MAIN MENU.

Defined as follows are the items in Figure 55.

PAGE: Indicates the displayed page number of the available 60 screens.

T/S: Specifies the current Time Slot.

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

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

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

The following F-Keys are available in this screen:

PAGE-UP (F1), PAGE-DN (F2): Allows access to the 60 pages of data.

PAUSE/RESUME (F3): Pause traps the current data on the T1 line to easily observe the pattern. Resume continues the live presentation of data.

STORE (F4): This saves the current received pattern in the USER TEST PATTERN screen. Pressing the STORE (F4) F-key, a message will appear at the bottom of the screen giving the label of the received pattern. View this pattern at any time by using the following procedure:

1. Select MAIN MENU > SEND TEST PATTERN.
2. Press the USER (F1) F-key.
3. Select the desired label and press the VIEW (F1) F-key.
4. The pattern can be deleted, edited, or the label can be edited.
For more details on these procedures, refer to Section 4.6, Editing a User Test Pattern.

Note: In order to store a pattern there must be an empty space in the User Test Pattern screen.

6.2 Propagation Delay

```
21:10:05  
  
PROPAGATION DELAY  
RND TRIP DELAY: 334      UI  
RND TRIP TIME : 216      uS  
ONE WAY DIST  : 84       kFT  
  
(ASSUMING 500 ft PER U.I.)  
  
RESTART
```

Figure 56 Propagation Delay

Use PROPAGATION DELAY only in T1 SINGL/T1DUAL modes. The PROPAGATION DELAY screen shown in Figure 56 displays the propagation delay on a looped back signal.

Use this procedure to measure propagation delay:

1. From the MAIN MENU, enter the TEST CONFIGURATION screen. Configure as follows:

TEST MODE: T1 SINGL or T1DUAL

TEST RATE: 1.544M

Press the ESCAPE key to return to the MAIN MENU when finished.

2. Select LPBK & SPANCONTROL > CSU & NICONCONTROL. Loop up the SunSet T10 following the procedure in section 3.1.1, Basic Loopback Procedure.
3. From MAIN MENU > OTHER MEASUREMENTS > PROPAGATION DELAY. View the propagation delay. Refer to the following comments for an explanation.
4. When finished, press the ESCAPE key to return to the MAIN MENU.

During measurement, the SunSet T10 measures the number of unit intervals that it takes for the signal to return. A unit interval is the amount of time it takes to transmit one bit (647 μ S for a T1 signal).

This number is translated into an exact number of microseconds of round trip delay and into an equivalent number of kilofeet.

Note that the exact number of kilofeet to the loopback will depend on several items such as number of regenerators, gauge of cable, type of transmission media, existence of any transmission devices with appreciable delay, etc. In the absence of equipment with dejittering circuits or other sources of significant delay, the kilofeet measurement is generally accurate to about +/- 1000 feet, and +/- 10%. It is suitable for determining where a looped repeater is located.

6.3 Quick Test - I and II

```
21:10:05  
  
QUICK TEST - I  
TICKET : 1234567890  
LOOPBAK : NONE  
PRINT : YES  
  
TEST PATTERN DURATION  
1.3-24 05 min  
2.ALL 1 05 min  
3.QRSS 15 min  
4.QRSS 15 min  
5.NONE 00 min  
  
CSU NI NONE
```

Figure 57 Quick Test - I

```
21:10:05  
  
QUICK TEST - II  
TICKET : 1234567890  
LOOPBAK : NONE  
PRINT : YES  
  
TEST PATTERN DURATION  
1.1-8 05 min  
2.ALL 1 05 min  
3.QRSS 15 min  
4.QRSS 15 min  
5.NONE 00 min  
  
CSU NI NONE
```

Figure 58 Quick Test - II

Quick tests save about a half-hour each time a new HICAP service needs to be accepted. In a Quick Test, the SunSet T10 sends out five patterns. The patterns and their durations may be changed or the default settings can be used.

Quick Test I and Quick Test II are similar, but the patterns and durations are different. Because of the default patterns and durations supplied, use Quick Test I for AMI lines (3-24 pattern)

and Quick Test II for B8ZS lines (1-8 pattern). Alternately you can set up the two tests to your needs.

Note: Unlike Measurement Results, Quick Test will not run in the background. The test will stop after escaping out of the Quick Test.

Use this procedure to run a Quick Test or adjust the default settings:

1. Before using Quick Test, configure the line interface in the TEST CONFIGURATION screen to the following settings:

```
TEST MODE: T1SINGL
RxLVL-1: TERM
FRAMING: per the line specification
Tx CODING: per the line specification
Tx SOURCE: NORMAL
XMT CLOCK: INTERN
TEST RATE: 1.544M
LBO 1: as appropriate for the test access point
```

Note: T1 Dual Mode does not support Quick Test.

2. Plug the cords into the appropriate jacks on the SunSet T10 as specified in the TEST CONFIGURATION screen, and also into the IN and OUT jacks on the DSX.
3. Select MAIN MENU > OTHER MEASUREMENTS, then select either QUICK TEST-I or QUICK TEST-II. The screen depicted in Figure 59 appears.

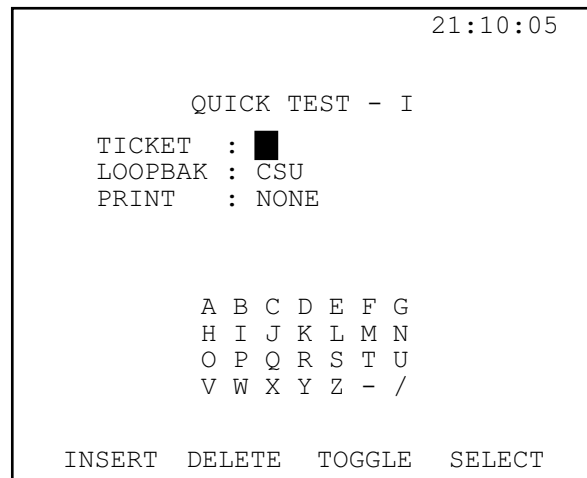


Figure 59 Ticket Label Entry

4. At TICKET enter a name with the following procedure.
 - A. Press the TOGGLE (F3) F-key to enter the character grid.
 - B. The letter A will flash. Select the desired character and press the SELECT (F4) F-key.
 - C. To enter numbers, use the SHIFT key and the number keypad. Press SHIFT when finished with the number keypad.
 - If an incorrect character for the TICKET is entered, press the TOGGLE F-key and select the incorrect character using the arrow keys on the keypad. Press the DELETE key (F2) F-key to remove the character. Note that the DELETE key can only be used when the cursor is out of the character grid.
 - D. When finished deleting letters, move the cursor back to the end of the TICKET line, press the TOGGLE (F3) F-key to return to the character grid, and enter any additional characters.
 - E. Repeat steps B and C until the TICKET line is complete. The line can contain maximum of ten characters.
 - F. When finished, press the TOGGLE (F3) F-key to escape the character grid and return to the TICKET line.
5. At LOOPBACK, choose CSU (F1), NI (F2), or NONE (F3). The SunSet T10 will attempt to automatically loop back the far-end based on its settings.
6. At PRINT, choose YES (F1) or NONE (F2).
 - A. If YES is chosen, connect the printer to the serial port; if a printer is not connected, the data cannot be retrieved for latter printing.
 - B. If NONE is chosen, the results can only be viewed while in the QUICK TEST screen. Escaping out erases the results.
7. If you wish to use the default test patterns and their durations, press the ENTER key on the keypad to start the test and go to step 9. If you wish to change these defaults, continue with the following steps.
8. Select the first TEST PATTERN. Select a new TEST PATTERN by using one of the following F-keys.

NONE (F1), QRS (F2), ALL 1 (F3), 1-8 (more, F1), 1-16 (more, F2), 3-24 (more, F3), 55DLY (more, F1), ALT10 (more, F2), ALL 0 (more F3)

After selecting the TEST PATTERN by pressing the corresponding F-key, the cursor moves to the DURATION field.

9. If necessary, change the DURATION using this procedure.
 - A. Press the SHIFT key on the keypad so that the SHIFT indicator is in the upper left-hand corner of the screen.
 - B. Enter in any number between 00 and 99 minutes. The cursor will automatically advance to the next line. Do not press the ENTER key on the keypad.
 - C. For the other patterns and durations, repeat steps 7 and 8.
10. When the QUICK TEST is configured, press the ENTER key on the keypad to begin testing. A SUMMARY screen is displayed during the test (see Figure 60). This screen shows elapsed time (ET), remaining time (RT), framing (FRM), transmitted code (TxCd), and configuration (CNFG) for each of the five stages of the test. Refer to section 5 of this chapter for measurement definitions.

```

                                     21:10:05
ET- 000:00:50   RT- 000:04:10
FRM-ESF   TxCd-AMI   CNFG-TERM
RCV-QRSS           XMT- QRSS

      LINE 1 - SUMMARY

BPV : 0           BPVR: 0.0e-09
BIT : 0           BER : 0.0e-09
FBE : 0           CRC : 0
ES : 0           EFS : 50
%ES : 00.000     %EFS: 100
SES : 0           Lpp : 0.2 dB
UAS : 0           FREQ: 1544000

```

Figure 60 Quick Test Summary

11. When the QUICK TEST has finished, a TEST RESULTS screen appears (see Figure 61). If printing was enabled and the printer is connected, the results will be printed.

```
21:10:05  
  
QUICK TEST - 1  
TEST RESULTS  
TICKET      -SUNRISE101  
  
LOOP UP     - N/A  
TEST PAT 1  - NO ERRORS  
TEST PAT 2  - NO ERRORS  
TEST PAT 3  - NO ERRORS  
TEST PAT 4  - NO ERRORS  
LOOP DOWN   - N/A  
  
PAGE-UP PAGE-DN
```

Figure 61 Quick Test Results

12. Press the PAGE-DN (F2) F-key to view the test results from each transmitted pattern. These screens are similar to the screen shown in Figure 60, except for the addition of the PAGE-UP (F1) and PAGE-DN (F2) F-keys.
13. Press the ESCAPE key on the keypad when finished to return to the OTHER MEASUREMENTS menu screen.

Note: The results are not stored. Once the ESCAPE key is pressed the results of the Quick Test are lost.

6.4 Bridge Tap Detect

The bridge tap detect test sends 21 different patterns through a looped up span. Each pattern is transmitted one at a time for 30 seconds. For perfect performance, there will be 0 errors, 0 errored seconds, and 30 available seconds. If there is a loss of signal or other unavailable service condition, then there will be less than 30 available seconds. Note that a declared ES (errored second) occurs when there are one or more errors during an AS (available second). Per ANSI and Bellcore standards, an ES is not counted during an UAS (unavailable second).

To run this test, use the following procedure:

1. A loopback must be in place on the circuit to be tested. Confirm that the SunSet T10 is properly configured in the TEST CONFIGURATION screen.
2. Select MAIN MENU > OTHER MEASUREMENTS > BRIDGE TAP DETECT. The testing will begin immediately.
3. To observe the progress of the test, refer to either the LINE 1 or LINE 2-LOGICAL screen. Use the PAGE-DN (F2) F-key to see the summary results. There are 21 patterns in all. Each listed pattern is in the order sent. IN PROG means that the 30-second measurement for that test pattern is still in progress.
4. When finished, press the ESCAPE key on the keypad to return to the MAIN MENU.

Note: Only a few of the results are stored in the summary listing. The information listed includes the pattern number (1 to 21), the pattern name, the number of bit errors detected, the number of errored seconds detected, and the number of available seconds detected. Table 4 lists the transmitted patterns.

#	Name	Pattern
1	ALL 1	11111...
2	1-in-2	010101...
3	1-in-4	0100...
4	1-in-6	010000...
5	1-in-7	0100000...
6	1-in-8	01000000...
7	2-in-10	1100000000...
8	2-in-11	11000000000...
9	2-in-12	110000000000...
10	2-in-13	1100000000000...
11	2-in-14	11000000000000...
12	2-in-15	110000000000000...
13	2-in-16	1100000000000000...
14	3-in-18	1101000000000000...
15	3-in-19	11001000000000000...
16	3-in-20	110001000000000000...
17	3-in-21	01000100000000000001...
18	3-in-22	01000100000000000010...
19	3-in-23	010001000000000000100...
20	3-in-24	01000100000000000000100...
21	QRSS	Quasi Random

Table 4 Bridge Tab Test Patterns

6.5 Pulse Mask Analysis (SW190)

Pulse Mask Analysis allows for the measurement and viewing of the quality of a T1 pulse. Refer to Figure 62.

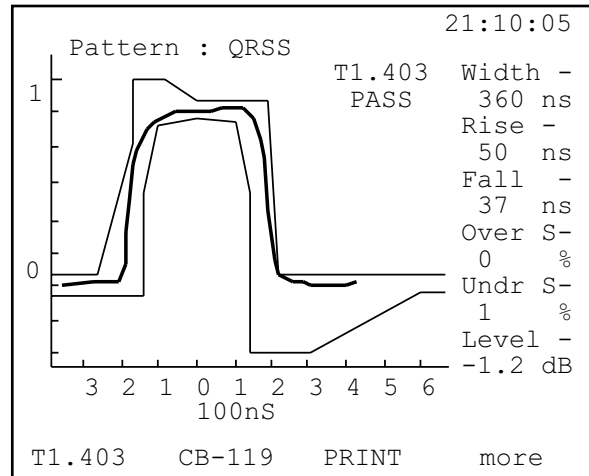


Figure 62 Pulse Mask Analysis

Use this procedure for performing a pulse shape analysis:

1. Select MAIN MENU > OTHER MEASUREMENTS > PULSE MASK ANALYSIS, and select either START NEW ANALYSIS, or VIEW LAST PULSE SHAPE.
3. After a few seconds, the pulse shape is displayed. Key pulse statistics are shown in the right-hand margin of the display.
4. If required, choose one of the industry standard masks for a pass/fail report. After selecting, a message similar to "T1.403 PASS" is displayed.
 - The F-key options for the available masks are: T1.403 (F1), CB-119 (F2), PRINT (F3), 62411 (more, F1), T1.102 (more, F2), PRINT (more, F3), G.703 (more, F1), NO-MASK (more, F2), and RESTART (more, F3).
5. Press the PRINT (F3) F-key to print the mask.
6. Press the RESTART (more, F3) F-key to do another measurement.
6. When finished, press the ESCAPE key on the keypad twice to return to the OTHER MEASUREMENTS menu.

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. PASS or FAIL is shown on-screen

The following are the pulse statistics shown in the right-hand margin of the display.

- Width: Pulse width in ns.
- Rise: Pulse rise time in ns
- Fall: Pulse fall time in ns.
- Over S: Pulse over shoot, as a percentage.
- Undr S: Pulse under shoot, as a percentage.
- Level: Pulse signal level, in dB.

6.6 DDS Measurements (SW188)

DDS Measurements enables the SunSet T10 to test and maintain DDS (Digital Data System) networks by performing basic DDS loopbacks and measurements. The SunSet T10's testing capabilities include:

- support for 2.4, 4.8, 9.6, 19.2, 56, and 64 kbps data rates.
- support for interleaved and latching loopbacks of various types.
- providing bit error and bit error rate measurements.
- sending and receiving special network control codes.

From the MAIN MENU > OTHER MEASUREMENTS > DDS MEASUREMENTS. The screen shown in Figure 63 appears.

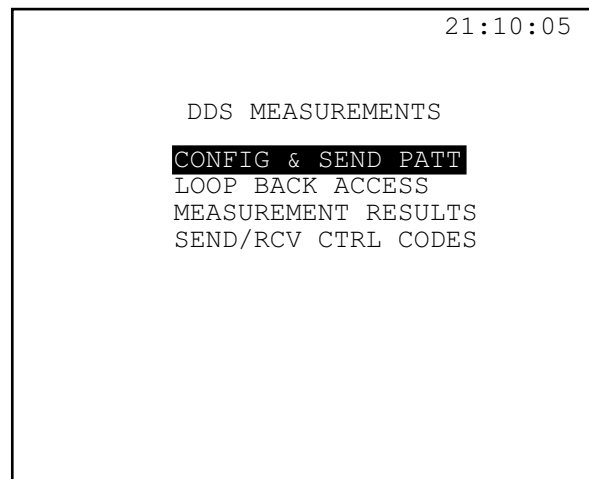


Figure 63 DDS Measurements Menu

6.6.1 Configuration & Send Pattern

1. From the DDS MEASUREMENTS menu, select CONFIG & SEND PATT and configure the TEST CONFIGURATION screen as required.

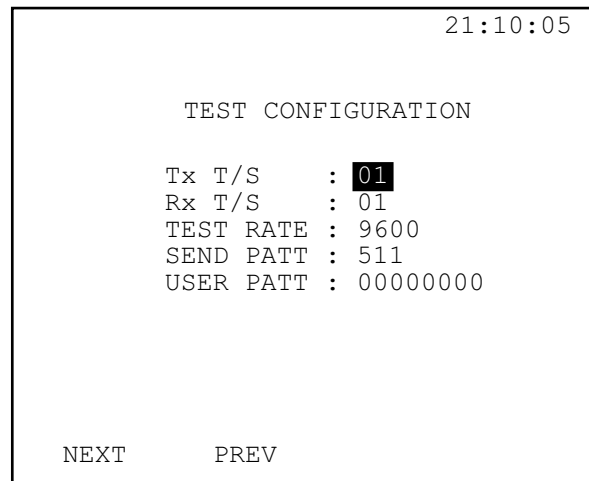


Figure 64 DDS Configuration & Send Pattern Screen

The DDS Configuration & Send Pattern Screen contains the following setup items:

Tx T/S

Options: 1–24

Use the F-Keys, NEXT (F1) and PREV (F2), to select Tx time slot and where the DDS control codes will be transmitted.

Rx T/S

Options: 1–24

Use the F-Keys, NEXT (F1) and PREV (F2), to select Rx time slot and where the DDS control codes will be received.

TEST RATE

Options: 2400 (F1), 4800 (F2), 9600 (F3), 19.2k (more, F1), 56k (more, F2), 64k (more, F3)

Press the appropriate F-Key to specify the test rate.

SEND PATT

Options: 2047 (F1), 511 (F2), 127 (F3), 63 (more, F1), 1111 (more, F2), 0000 (more, F3), DDS-1 (more, F1), DDS-2 (more, F2), DDS-3 (more, F3), DDS-4 (more, F1), DDS-6 (more, F3), USER (more, F1), 0101 (more, F2)

Select the test pattern to send. If sending a USER-defined test pattern, use the following procedure:

- A. At the SEND PATT line, press the USER (more F1) F-key.
 - B. Select USER PATT.
 - C. Press the SHIFT key on the keypad
 - D. Use the number keys on the keypad to define the transmitted 8-bit test pattern.
 - E. Press the SHIFT key on the keypad when the pattern is complete.
 - F. The pattern specified in the USER PATT line is active only if USER appears on the SEND PATT line above it.
2. When finished, press the ESCAPE key to return to the DDS MEASUREMENTS menu.

6.6.2 Loop Back Access

1. From the DDS MEASUREMENTS menu, select LOOPBACK ACCESS. Configure the LOOPBACK ACCESS screen as required.

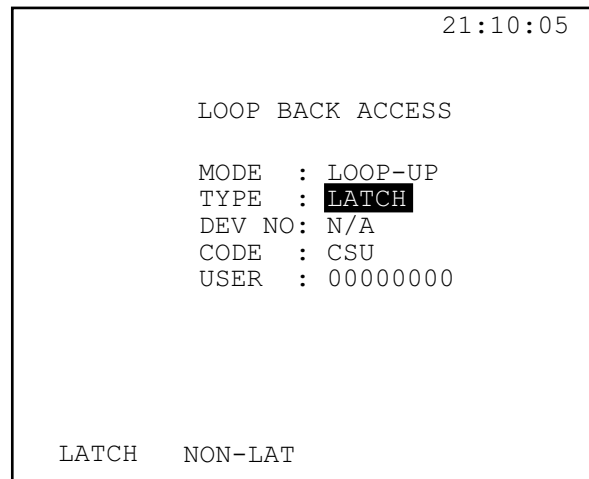


Figure 65 DDS Loop Back Access Screen

MODE

Options: LOOP-UP (F1), LOOP-DN (F2)

Select this item last! Pressing one of the F-Keys here will automatically begin its respective procedure. After setting all of the other items, press the LOOP-UP (F1) F-key to loop up or the LOOP-DN (F2) F-key to loop down.

TYPE

Options: LATCH (F1), NON-LAT (F2)

NON-LAT: This refers to the traditional loopback testing for the CSU, DSU, or OCU. This loopback type requires the continuous transmission of loopback control bytes in the test data.

LATCH: For Latched loopback, it is not necessary to continue to send the loopback code. A latched loopback will remain activated until receiving a release code.

DEV NO

Options: 1–8

Use the F-Keys, NEXT (F1) and PREV (F2), to select a device number from 1–8. This item applies only to the DS0-DP Code. For all other codes, this line will remain N/A.

CODE

Options:

For LATCH- CSU (F1), DSU (F2), OCU (F3), USER (more, F1), DSO-DP (more, F2)

For NON-LAT- CSU (F1), DSU (F2), OCU (F3), USER (more, F1)

Specify the loop up/down code for a specific equipment type to be looped up/down. The F-Keys available will depend upon the TYPE selected. The following codes are available:

- CSU- Channel Service Unit
- DSU- Data Service Unit
- OCU-Office Channel Unit
- DSO-DP- DS0 Dataport

To transmit a user loopback code, use the following procedure:

- A. Press the USER (more, F1) F-key.
- B. Select the USER loop back code.
- C. Enter an 8-bit loop back code by first pressing the SHIFT key on the keypad.
- D. Enter the 0/1 values directly from the keypad.
- E. Press the SHIFT key on the keypad when finished.
- F. The entered USER pattern will have no effect unless "USER" was specified for the CODE.

6.6.3 Measurement Results

```
21:10:05  
  
ELAP TIME- 000:01:23  
FRME- SF-D4      CODE- AMI  
RATE- 56k        PATT- 2047  
  
RESULTS  
  
BIT   : 0002      BER   : 1.04e-07  
UAS   : 0         %UAS  : 00.000  
  
RESTART
```

Figure 66 DDS Measurement Results

All results relate to the total elapsed time of the test (ELAP TIME). If necessary, use the RESTART (F1) F-key to restart the measurements. The following are the items found in Figure 66.

ELAP TIME: Elapsed Time is the total amount of time that has passed since the beginning of the measurement process (hhh: mm: ss).

FRME: Displays is the type of transmitted framing.

CODE: Displays the type of transmitted line coding.

RATE: Displays the test rate as specified in the CONFIG & SEND PATT menu.

PATT: Displays the transmitted test pattern, as specified in the CONFIG & SEND PATT menu.

BIT: Displays the total number of bit errors since the beginning of the test.

BER: Displays the bit error rate since the beginning of the test.

UAS: Displays the total number of unavailable seconds since the beginning of the test.

%UAS: Displays the percentage of unavailable seconds since the beginning of the test.

6.6.4 Send/Receive DDS Control Codes

This screen facilitates transmission of DDS control codes to the far-end; it also displays the received codes. Refer to Figure 67.

```

21:10:05

SENS/RCV CONTROL CODE

SEND MESG : (1) 0011010

RECEIVE
CODE : 10011010
MESG : MUX-OOS

ABNORML MUX-OOS  C IDLE  more
  
```

Figure 67 Send/Receive Control Code

Transmitting Codes

The SEND MESG line displays the transmitted code. To change this code, press the F-key of choice. Shown in Table 5, these F-keys list the 9 programmed codes available.

To enter a USER code:

1. Press the SHIFT key on the keypad.
2. Enter the binary digits (1 or 0) from the keypad.
3. When completed, press the SHIFT and then ENTER keys on the keypad to send the USER code.

F-key	Control Code	b1.....b8	Description
F1	ABNORMAL	10011110	Abnormal Station Condition
F2	MUX- 00S	10011010	Mux out of Sync
F3	C IDLE	11111110	Control Idle Code
more F1	D IDLE	11111111	Data Idle Code
more, F2	MAP0	10010011	Map 0 Confirmation Code (line side)
more, F3	MAP1	11101101	Map 1 Confirmation Code (drop side)
more, F1	T-ALERT	11101100	Test Alert
more, F2	TEST	10011100	Test Code
more, F3	UMC	10011000	Unassigned Mux Channel
Note: The least significant digit, b1, is always 1 and cannot be changed. Therefore, it appears in parentheses on the SEND MESG line.			

Table 5 DDS Control Codes

Other DDS codes can be sent using the previously described procedure. The following DDS codes may be of interest:

- Block: 10001010
- Far End Voice (FEV): 11011010
- MJU Alert (MA): 11110010
- Release: 11111000
- Transition in Progress (TIP): 10111010

Receiving Codes

The RECEIVE portion of the screen displays the DDS code received from the far-end. The SunSet T10 will display the received digits. If these bits correspond to one of the 9 programmed codes shown in Table 4, the message will be displayed in the lower portion of the screen.

6.7 ISDN Primary Rate Menus (SW186)

ISDN Primary Rate provides a comprehensive analysis of the ISDN protocol based on the CCITT Q.931 standard. The ISDN PRIMARY RATE menu, shown in Figure 68, is accessed from MAIN MENU > OTHER MEASUREMENTS > ISDN PRIMARY RATE.

```
21:10:05  
  
ISDN PRIMARY RATE  
CONFIGURATION  
START LINK/CALL SETUP  
BACKUP D CHNL TEST  
SETUP FILTER  
START TRACER  
VIEW/PRINT TRACER  
OTHER PARAMETERS
```

Figure 68 ISDN Primary Rate Menu

6.7.1 ISDN Configuration

CONFIGURATION configures EMULATION TYPE, STANDARD PROTOCOL, TEST PATTERN (for data calls) and USER PATTERN for ISDN analysis. Refer to Figure 69.

```
21:10:05  
  
CONFIGURATION  
  
EMULATE TYPE : TE  
Q.931 STD   : NTI  
TEST PATTERN : 2047  
USER PATTERN : 00110011  
  
TE      NT
```

Figure 69 ISDN Configuration

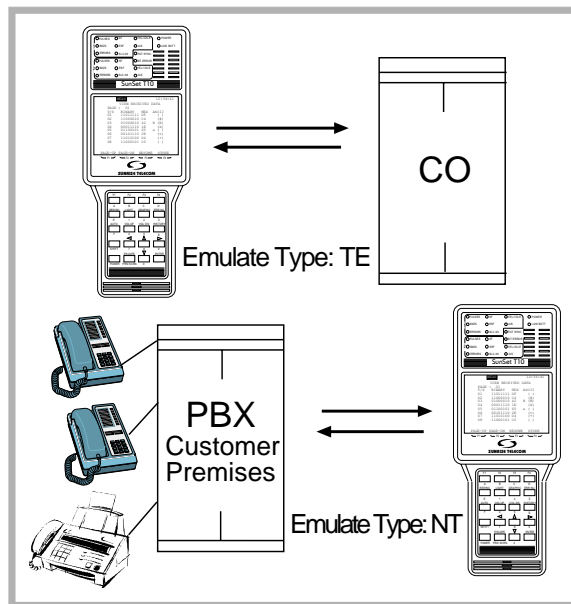


Figure 70 Emulate Type

EMULATE TYPE

Options: TE (F1), NT (F2)

This configures the emulation mode for the SunSet T10. Figure 70 displays the two uses.

- TE: Terminating Equipment used when the SunSet T10 is emulating customer equipment. TE uses the received signal to clock the transmitter.
- NT: Network Terminal is used when the SunSet T10 is emulating an ISDN switch, such as a DMS-100 or 5ESS. NT uses the SunSet T10's internal clock.

Note: When plugging the SunSet T10 into an ISDN PRI network element (i.e. PBX) and configured for TE, there is no clock. When selecting ISDN PRIMARY RATE, the clocking is determined by the EMULATE TYPE setting. After escaping out of the ISDN PRIMARY RATE menu, the SunSet T10's transmit clock reverts to the TEST CONFIGURATION XMT clock setting.

Q.931 STD

Options: AT&T (F1), NTI (F2), NATNL-2 (F3), ETSI (F4)

The Q.931 specification indicates which type of ISDN switch is to be tested. Try each type if the type of switch is unknown.

- AT&T relates to the 5ESS switch.
- NTI relates to the Northern Telecom DMS-100 switch.
- NATNL-2 is the National 2 standard.
- ETSI is the ETSI standard.

TEST PATTERN

Options: 2047 (F1), 511 (F2), 127 (F3), 63 (more, F1), 1111 (more, F2), 0000 (more, F3), USER (more, F1)

Select the test pattern to be transmitted on the B channel during data calls.

- Select a pattern by pressing the corresponding F-Key.
- If using a USER pattern, press the USER (more, F1) F-key and then enter the binary digits using the SHIFT key and keypad numbers.

To send a USER pattern.

1. Press the USER (more, F1) F-key.
2. Change the user pattern by pressing the SHIFT key on the keypad and then enter either a 1 or 0 to change the bit settings.
3. The INSERT (F1) F-key may be used to insert a bit, or the DELETE (F2) F-key may be used to delete the length of the user

pattern by one bit. The length of the user pattern may be up to one byte long.

4. After escaping from the CONFIGURATION screen, the specified values become the configuration for the ISDN Analysis.

6.7.2 Start Link/ Call Setup

Use the CALL SETUP screen to place a voice/data call, receive a voice/data call, or see more information about the call. Upon entering this screen, the SunSet T10 will automatically start the Layer 2 link. The SunSet T10 displays "USE LINE 1 ONLY FOR CALL SETUP!". This is followed by the screen shown in Figure 71.

In the START LINK screen, an indicator appears at the top of the screen. This indicator shows status of the D-channel and the Layer 2 link. READY indicates that the D-channel is operational and the SunSet T10 can send and receive calls. NOT READY indicates the SunSet T10 is not yet able to place or receive calls.

Note: Make sure that the settings in the ISDN PRIMARY RATE, CONFIGURATION, and OTHER PARAMETERS screens are correct before entering START LINK/CALL SETUP.

```
READY 21:10:05
CALL SETUP
SEND L1 SABME
SEND L1 UA
LINE 1
RECEIVED MESSAGE
Layer 2 mess UA
SAP:0 TEI:0

SEQTEST CALL more
```

Figure 71 Call Setup Screen

Figure 71 displays layer 2 ISDN messages. This screen will show the SEND and RECEIVED messages on the line. In Figure 71, the SunSet T10 has sent an SABME and a UA message, and has received a UA message on Line 1. These are Layer 2 messages and are defined as:

- SABME: Set asynchronous balanced mode extended
- UA: Unnumbered acknowledgment

Make sure that either a UA or RR, and a Receive Ready, has been received before placing a call.

- To stop ISDN messages:
 1. Press the more (F4) F-key.
 2. Press the STOP (F1) F-key. Pressing STOP removes all connections to the D channel and the layer 2 messages will stop.
- To see the previous or next messages press the NEXT (F2) or PREV (F3) F-keys.
- To restart the messages press the RESTART (F1) F-key.

6.7.2.1 Sequential Call (SW186)

Sequential Call is an automated stress test. In the Sequential Call test, the SunSet T10 places a call on all 23 B-channels sequentially.

1. From the MAIN MENU select OTHER MEASUREMENTS > ISDN PRIMARY RATE > START LINK/CALL SETUP and press the SEQTEST (F2) F-key. The sequential call setup screen as shown in Figure 72 appears.

```
READY 21:10:05
      SEQUENTIAL CALL
HOLD TIME(S) :10
MY PHONE NUMBER :3638000
SELF CALL :OFF
CALL TYPE :DATA-56
DIAL NUMBER :
 3638313█
`*' `#' call
```

Figure 72 Sequential Call Setup

Configure the following setup items. Press the call (F3) F-key when you are ready to make your call.

HOLD TIME

Options: 0–255 seconds

Hold Time determines how long the SunSet T10 will hold each call before releasing. Choose from 0–255 seconds. Use the F-keys or the SHIFT key with the keypad to enter in the hold time.

NEXT (F1): Advances by one second.

PREV (F2): Decrements by one second

MY PHONE NUMBER

Use the SHIFT key and keypad to enter the phone number.

* (F1): Enters in the star symbol.

(F2): Enters in the pound symbol.

SELF CALL

Options: OFF (F1), ON (F2), call (F3)

Determine if the SunSet T10 will place a self call.

ON: This places a self-call during the test. In this case, the SunSet T10 will call the number entered in CALLER NUMBER.

OFF: If not needed, select OFF. In this case, the SunSet T10 will call the number entered as DIAL NUMBER. Refer to DIAL NUMBER for the procedure.

CALL TYPE

Options: VOICE (F1), DATA-56 (F2), DATA-64 (F3) and 3.1k-AUD (F4)

Determine the type of call to place.

- VOICE: Select to place voice calls during the test.
- DATA-56: Select to place data calls at a 56 kbps rate.
- DATA-64: Select to place data calls at a 64 kbps rate.
- 3.1k-AUD: Select to use the 3.1 kHz audio bearer service for voice (analog) data.

DIAL NUMBER

If a self-call is not needed, this will be the number called.

To enter a number, use this procedure.

1. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
2. Enter the numbers directly from the keypad, if a mistake is made:
 - A. Press the SHIFT key on the keypad to remove the SHIFT indicator.
 - B. Use the arrow keys on the keypad to select the incorrect entry.
 - C. Press the SHIFT key on the keypad and enter the correct number directly from the keypad.
3. Use the F-keys to enter the "*" and "#" symbols.
4. Press the SHIFT key on the keypad to remove the SHIFT indicator.
5. When finished configuring these items, press the CALL (F3) F-key to begin the Sequential Call test.

A Sequential Call Results screen appears showing the status of each B channel. Refer to Figure 73.

READY			21:10:05
SEQUENTIAL CALL			
1	PASS	2	PASS
4	PASS	5	PASS
7	PASS	8	PASS
10	PASS	11	PASS
13	PASS	14	ACTIVE
16		17	
19		20	
22		23	
		24	D
STOP			

Figure 73 Sequential Call Results

Shown on this screen are all 23 B channels. Each channel may display one of the following status messages:

PASS: A call has been successfully connected and released.

FAIL: A call was attempted on the channel, but was not successful.

ACTIVE: The call is still in progress for this channel.

Notes:

- Channel 24 is marked as the D-channel.
- A blank indicates that a call has not yet been attempted for that channel.

6.7.2.2 Sequential BERT Test

For data calls, the SunSet T10 runs a BERT test on each channel and provides results. Figure 74 is an example of a live display.

```
READY 21:10:05
CH: 1 CONNECT
ET - 000:00:14 LINE - 1
Tx B#- 1 Rx B - 1
PATT - 2047 RATE - 56K

RESULTS
BIT : 3 BER : 3.8e-06
ES : 1 %ES : 07.143
SES : 0 %SES : 00.000
EFS : 13 %EFS : 92.857
UAS : 0 %UAS : 00.000
AS : 14 %AS : 100

PAUSE
```

Figure 74 BERT Test

The BERT Test screen provides a running account of the test for the data call. The features in this screen are:

CH: Channel displays the B channel currently used and the call status. It has two possible states:

- CONNECT: the call has successfully connected.
- FAIL: the call did not connect.

ET: Elapsed time is the amount of time since the call connected.

TxB# & RxB#: Displays which B channel is currently used.

PATT: Displays the current test pattern in use.

RATE: Displays the current line rate of the data call, either 56 k or 64 k.

The following RESULTS are provided:

BIT: Bit error count

BER: Bit error rate

ES: Errored Seconds

SES: Severely Errored Seconds

EFS: Error Free Seconds

UAS: Unavailable Seconds

AS: Available Seconds

When the sequential BERT test is finished, the screen displays a summary of all 23 data calls as shown in Figure 75

READY		21:10:05		
SEQUENTIAL BERT RESULTS				
Bch	STATUS	BIT	ES	UAS
1	PASS	3	1	0
2	PASS	0	0	0
3	PASS	0	0	0
4	PASS	0	0	0
5	PASS	0	0	0
6	17 USER BUSY			
7	PASS	0	0	0
8	17 USER BUSY			

PAGE-UP PAGE-DN PRINT

Figure 75 Sequential BERT Results

For each B channel, the following information is provided.

STATUS: Pass indicates that the call successfully connected. If the call did not connect, the cause value number and decode are provided. In Figure 75 the calls for B channels 6 and 8 have failed and the release message contained cause value 17, User Busy.

For successful calls, the summary screen provides the **BIT**, **ES**, and **UAS** as defined earlier in this section.

The following table lists the possible Q.931 cause values.

Class: Normal Event			
Cause			Cause Name
No.	Class	Value	
1	000	0001	Unallocated number
2	000	0010	No route to specified transit network
3	000	0011	No route to destination
6	000	0110	Channel Unacceptable
7	000	0111	Call awarded & being delivered in a established channel
16	001	0000	Normal Call Clearing
17	001	0001	User Busy
18	001	0010	No user responding
19	001	0011	No answer from user (user alerted)
21	001	0101	Call Rejected
22	001	0110	Number changed
26	001	1010	Non-selected user clearing
27	001	1011	Destination out of order
28	001	1100	Invalid number format (address incomplete)
29	001	1101	Facility Rejected
30	001	1110	Response to STATUS ENQUIRY
31	001	1111	Normal, unspecified
Class: Resource Unavailable			
Cause			Cause Name
No.	Class	Value	
34	010	0010	No circuit/channel available
38	010	0110	Network out of order
41	010	1001	Temporary Failure
42	010	1010	Switching equipment congestion
43	010	1011	Access information discarded
44	010	1100	Requested circuit Not Available
47	010	1111	Resources unavailable, unspecified
Class: Service or Option Not Available			
Cause			Cause Name
No.	Class	Value	
50	011	0010	Requested facility not subscribed
54	011	0110	Incoming calls barred
57	011	1001	Bearer capability not authorized
58	011	1010	Bearer capability not presently available
63	011	1111	Service or option not available, unspecified
Class: Service or Option Not Implemented			
Cause			Cause Name
No.	Class	Value	
65	100	0001	Bearer capability not implemented
66	100	0010	Channel type not implemented
70	100	0110	Only restricted digital information bearer capability is available
79	100	1111	Service or option not implemented, unspecified
Class: Invalid Message			
Cause			Cause Name
No.	Class	Value	
81	101	0001	Invalid call reference value
82	101	0010	Identified channel does not exist
83	101	0011	A suspended call exists, but this call identity does not
84	101	0100	Call identity in use
85	101	0101	No call suspended
86	101	0110	Call having the requested call identity has been cleared
88	101	1000	Incompatible destination
91	101	1011	Invalid transit network selection
95	101	1111	Invalid message, unspecified
Class: Protocol Error			
Cause			Cause Name
No.	Class	Value	
96	110	0000	Mandatory information element is missing
97	110	0001	Message type non-existent or not implemented
98	110	0010	Message not compatible with call state or message type non-existent or not implemented
99	110	0011	Information element non-existent or not implemented
100	110	0100	Invalid information element contents
101	110	0101	Message incompatible with call state
102	110	0110	Recovery on timer expiry
111	110	1111	Protocol error, unspecified
Class: Internetworking			
Cause			Cause Name
No.	Class	Value	
127	111	1111	Interworking, unspecified

Table 6 Q.931 Cause Values

6.7.2.3 Placing a Call

Press the call (F3) F-key to set up a call and then place it. Refer to Figure 76.

```
READY 21:10:05

START LINK/CALL SETUP

CALLED No. :
3638000

CALLER No. :
7771111

B CHANNEL # : 4
NSF CODE : NONE
NSF TYPE : SERVICE
CALL TYPE : VOICE

NEXT      PREV      call
```

Figure 76 Start Link/Call Setup

To configure the call setup, review the following:

CALLED No.

The SunSet T10 will prompt for a CALLED No. This is the number to dial to place the call.

The number is entered directly from the keypad. To do so:

1. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
2. Enter the numbers directly from the keypad, if a mistake is made:
 - A. Press the SHIFT key on the keypad to remove the SHIFT indicator.
 - B. Use the arrow keys on the keypad to select the incorrect entry.
 - C. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
 - D. Enter the correct number directly from the keypad.
3. When finished, press the SHIFT key on the keypad to remove the SHIFT indicator.

CALLER No.

Specifying a "CALLER No." is optional. This is the telephone number that the ISDN switch uses to identify the caller on the network. If a number is not needed, press the NONE (F4) F-key. To enter a number, use the same procedure as in CALLED No.

B CHANNEL

Options: 1–24, except for the selected D-channel in the in the OTHER PARAMETERS screen.

- Channel 24, used normally as the D-channel.
- Specify the B channel to place the call. Use the NEXT (F1) or PREV (F2) F-keys to change the channel number.
- If placing a 46B + 2D call or a 47B + D call, the B CHNL LINE must be specified.
- This selection specifies the PRI line used to place the call. Press the Line 1 (F1) or Line 2 (F2) F-keys.

NSF CODE

Options: 0–31

Specify the NSF (Network Specific Facilities) CODE using the NONE (F1) or NEXT (F2) F-keys.

- If an NSF CODE is to be entered, it can range from 0–31. This code specifies the invoked network facilities.
- Normally, for the TE mode, NSF is set to NONE. For NT mode, NSF is set to 2.
- To view NSF options as specified by either AT&T or Northern Telecom, press the TABLE (F3) F-key. This table gives the NSF CODE for certain options.

NSF TYPE

Options: SERVICE (F1), FEATURE (F2), TABLE (F4)

Specify the NSF type; this can be either FEATURE (F2) or SERVICE (F1).

- To view the NSF Type options as specified by either AT&T or Northern Telecom, press the TABLE (F3) F-key. This table gives the NSF Type and Code options.

CALL TYPE

Options: VOICE (F1), DATA-56 (F2), DATA-64 (more, F1), Nx56K (more, F2), 3.1k-AUD (more, F1)

Call Type determines what type of call is placed. Select CALL TYPE and press the ENTER key on the keypad. Select the corresponding F-Key:

VOICE: Allows the user to place a voice call.

DATA-56: Selects a 56 kbps data rate

DATA- 64: Selects a 64 kbps data rate.

Nx64: Refers to the multirate ISDN PRI with 64K for each channel. For Nx64, select the 64k channels using the SELECT (F2) F-key. The AUTO (F1) F-key may be used to automatically configure onto active, received Nx64 channels.

3.1k-AUD: Selects the 3.1 kHz audio bearer service for voice (analog) data.

Press the call (F4) F-key or the ENTER key on the keypad to begin the call.

Disconnecting

If satisfied with the call after it has connected with the switch, press the DISK (F2) F-key to disconnect and release the line.

6.7.2.4 Viewing Call Information

When a data/voice call is successfully placed or received, press the INFO (F1) F-key to see information about the call. Refer to Figure 77.

```
21:10:05  
  
CALL No: 1          DIR - SEND OUT  
CREF No: 1  
Bch CFG: TERM      CHANNEL: 1  
BEARER : DATA-56  
CLED ID: 363-8000
```

Figure 77 ISDN INFO Screen

CALL NO.: Displays the called number.

CREF NO.: Call reference number identifies the active cells affected by the message.

DIR: Shows the direction of the call. Displays either SEND OUT, for placing a call, or RECEIVE, for receiving a call.

Bch CFG: Displays the B channel configuration, TERM or LOOP.

BEARER: Displays the type of call, VOICE, DATA-56, or DATA-64.

CHANNEL: Displays the B channel used to make or receive the call.

CLED ID: Displays the called ID.

6.7.2.5 Performing a BERT Test

After successfully placing a data call, the BER (more, F2) F-key is available. Pressing this F-key displays the BER measurement screen. This screen presents the measurement parameters specified in G.821. Only DATA- 64, DATA-56, and NX64 CALL TYPEs in the CALL mode can give BER measurements. Refer to Figure 78.

Note: When viewing BER measurements, verify that both the PAT SYNC LED and the appropriate framing LED are green. These two LEDs signify that the patterns and framing match for the transmitting and receiving patterns.

```
21:10:05
ET - 000:00:40
TX B#- 1      RX B#- 1
PATT - 2047   RATE - 56K

RESULTS

BIT : 13      BER : 1.4e-06
ES  : 4       %ES : 02.345
SES : 4       %SES : 00.000
EFS : 341    %EFS : 98.349
UAS : 0       %UAS : 00.000
AS  : 435    %AS  : 1000

RESTART HOLDSCR
```

Figure 78 ISDN BER Measurements

The following F-keys are available in this screen.

RESTART (F1): This restarts the measurements clearing all results and resetting the elapsed time to 00:00.

HOLDSCR/CONTINU (F2): This freezes the measurement screen to allow viewing of the results. The SunSet T10 will continue to take measurements in the background, but the measurements are not be updated until the CONTINU F-key is pressed.

6.7.2.6 Receiving a Call

The READY indicator must be displayed to receive a call in the Start Link/Call Setup screen. When there is an incoming voice or data call, the SunSet T10 will ring and the screen shown in Figure 79 will appear.

```
READY 21:10:05
CALL SETUP
RECEIVE A CALL
LINE 1
RECEIVED MESSAGE
SETUP MESSAGE
CREF No.: 549
BEARER : VOICE CHANNEL: 1
CLER ID : 4083631331
          TYPE-2 NPI-1
CLED ID : 4083638000
          TYPE-4 NPI-1
REJECT ACC-TERM ACC-LOOP
```

Figure 79 Receiving a Call Screen

To accept a call, press the ACC-TERM (F2) F-key. To reject it, press the REJECT (F1) F-key. If a second call should come in while still connected to the first call, the SunSet T10 will ring. This call can be accepted or rejected. For accepting, there are two options available:

ACC-TERM (F2): Press ACC-TERM to accept the call in the terminated mode. For voice calls, this means that talking and listening on the other side of the call is possible. For data calls, a pattern is transmitted, as selected in the ISDN CONFIGURATION screen. Errors may be inserted to the other side using the ERR INJ key on the keypad.

ACC-LOOP (F3): In this mode only, the incoming voice is heard. For data calls, one can only receive data; inserting errors is not possible.

6.7.3 Backup D Channel Test

```
21:10:05
BACKUP D CHNL TEST
SEND L1 SABME
SEND L2 SABME

RECEIVED MESSAGE

L-STAT  DISC  CALL
```

Figure 80 Backup D Channel Status Screen

The SunSet T10 automatically configures to 46B+D+D upon entering the Backup D Channel Test. In this state, the information is transferred on 46 B channels on both Lines 1 and 2. One D channel controls transmission, the other acts as a backup and is activated when the first D channel is no longer in service.

Notes:

- The SunSet T10 must be in T1 DUAL mode to use the Backup D Channel Test.
- Emulation Mode must be set to TE to access the Backup D Channel Test.

This feature checks the backup D channel service. It shows the status for both Lines 1 and 2. In Figure 80, the F-keys provide three options:

CALL (F3) accesses the Call Setup screen, which allows a call to be placed.

DISC (F2) disconnects and releases the line. When satisfied with the call after it has connected with the switch, press the DISC F-key.

L-STAT (F1): Pressing this F-key displays the status for both Line 1 and Line 2. There are two F-keys available in the L-STAT screen (see Figure 81):

- DROP-L1 (F1), DROP-L2 (F2): These F-keys temporary disconnect the selected line. When disconnected, the F-key toggles to EST-L1 or EST-L2.

```
21:10:05

LINE 1 :
D-CHANNEL No - 24
INTERFACE ID - 0
In Service

LINE 2 :
D-CHANNEL No - 24
INTERFACE ID - 0
Stand By

DROP-L1 DROP-L2
```

Figure 81 L-STAT Screen

The following fields are displayed for each line in Figure 81:

D-CHANNEL No.: Displays the D-channel number. The D-channel numbers for each line are set in the OTHER PARAMETERS screen.

INTERFACE ID: Displays the Interface ID configured for the line. Configure both line interface IDs in the OTHER PARAMETERS screen.

Status line: Depending on the status of the D-channel, one of the following messages are displayed:

- **MOOS (Manual out of service):** In this state, the D-channel is not available. The D-channel may be moved to an available state only by manual intervention on the near end.
- **Out of Service:** In this state, the D-channel is not available and the maintenance entity will periodically attempt to move the channel to an in-service state.
- **In service:** In this state, the D-channel is available for transfer of call control and other Layer 3 messages.
- **Stand by:** In this state, only Layer 2 messages are established. Service is not yet available for the transfer of Layer 3 messages. If the other line's D-channel is unavailable, then this D-channel will move to In-service.

Depending on the status of the particular line, one of the following messages is displayed:

- SIG LOSS: Signal loss indicates that the line has lost signal.
- FRMLOSS: Frame loss indicates that the line has lost framing.

Press the ESCAPE key on the keypad to return to the BACKUP D CHNL TEST status screen.

6.7.4 Setup Filter

```
21:10:05
D CHANNEL FILTER
FILTER TYPE : CALLREF
NUMBER :
CALLREF CALLED# CALLER# NONE
```

Figure 82 D Channel Filter Setup Screen

There are four parameters for filtering ISDN messages. After selecting the particular parameter, enter the numeric value in the NUMBER field. The parameters are:

CALLREF (F1): Call reference number identifies which active call a message belongs to. The call reference number is established with setup message and is used on all following messages for that call. This value should be entered in decimal format.

CALLED# (F2): Called Number is the destination number of the transaction. This value should be entered in octet format.

CALLER# (F3): Caller number is the originating number of the transaction. This value should be entered in octet format.

NONE (F4): This provides no filtering elements. This allows the SunSet T10 to capture all ISDN messages.

If either CALL REF, CALLER #, or CALLED # was selected, select NUMBER and enter the desired number using the SHIFT key and number keys on the keypad. If a mistake is made while entering, press the SHIFT key on the keypad and select the incorrect number. Then press the SHIFT key again and enter the correct number. Note that any entered numbers to the right will be erased with this typeover.

6.7.5 Start Tracer

```
                21:10:05
BUFFR No.387   CURRENT No.83

RECEIVED-MESSAGE
LINE 1
95-01-01 02:33:54.04
SETUP MESSAGE:
CREF No:1
BEARER :DATA-64  CHANNEL:2
CALLER#:EMPTY
        TYPE-      NPI-
CALLED#:1112222
        TYPE- 4    NPI- 1

RESTART  PAUSE    HEX
```

Figure 83 Start Tracer Screen for ISDN

Start Tracer begins the tracing of ISDN messages in accordance with the filtering parameters in Setup Filter.

The following items appear in this screen.

BUFFR No.: Total number of messages stored in the buffer.

CURRENT No.: Current message number.

The following items can appear in this screen.

RECEIVED MESSAGE: always includes received message date and time stamp. It can include SETUP MESSAGE, CREF number., BEARER type and other call related items.

Three F- keys are available in this screen.

RESTART (F1): This will empty the existing buffer and restart the tracing process.

PAUSE/RESUME (F2): PAUSE stops the tracing process, but does not empty the buffer. No tracing is performed while the SunSet T10 is in pause. RESUME will continue the tracing.

DECODE/ HEX (F3): DECODE will decode the ISDN messages in detail. HEX will display the messages in hexadecimal format.

6.7.6 View/Print Tracer

View/Print Tracer allows viewing and printing of specific data captured by the SunSet T10. Refer to Figure 84.

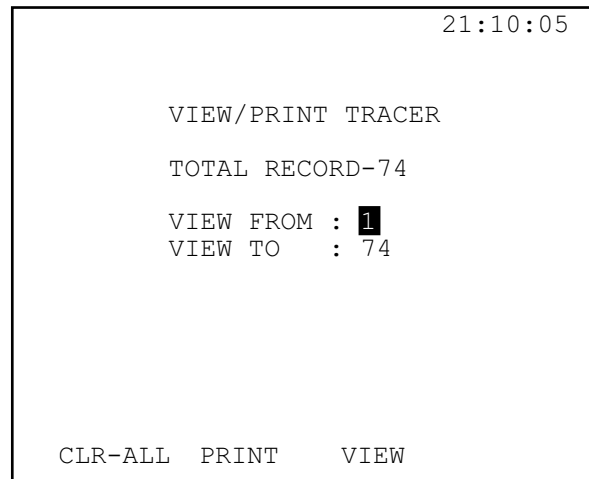


Figure 84 ISDN View/Print Tracer Screen

Three function keys are available within this screen:

CLR-ALL (F1): This erases the contents of the view/print buffer. Press the CLR-ALL F-key, and follow the on-screen instructions.

PRINT (F2): Press the PRINT F-key to print the contents of the buffer.

VIEW (F3): VIEW displays the contents of the buffer, as specified by the VIEW FROM and VIEW TO settings. Configure these settings, then press the VIEW F-key. The received messages will be shown individually on-screen. A sample screen is shown in Figure 85.

```
21:10:05  
  
RECEIVE MESG NO.11  
  
RECEIVED MESSAGE  
LINE 1  
95-01-01 01: 13: 51. 18  
02 01 06 04 08 01 00 46 18 03  
A9 83 97 79 01 80 10 22  
  
PAGE-UP PAGE-DN DECODE
```

Figure 85 ISDN HEX View Screen

The ISDN, HEX View screen displays one message. To view the other pages of messages, press the PAGE-UP (F1) or PAGE-DN (F2) F-keys. The message shown in Figure 85 is in hexadecimal code. The DECODE (F3) F-key, will decode the hexadecimal digits. Figure 86 displays the decoded version of Figure 85's hexadecimal message. If an informational element is present an InfoElm (F4) F-key appears. Refer to the D Channel Information Element Decoding section and Figure 87.

```
21:10:05  
  
RECEIVE MESG NO.11  
  
RECEIVED MESSAGE  
LINE 1  
RESTART  
CREf NO: 0  
CHANNEL NO: 23  
  
PAGE-UP PAGE-DN HEX
```

Figure 86 ISDN VIEW Message Screen - Decode View

The decoded view displays a RESTART message with a call reference number 0. In this screen, the HEX (F3) F-key allows the option of showing the message in hexadecimal format. If an informational element is present an InfoElm F-key appears. Refer to the D Channel Information Element Decoding section and Figure 87.

D Channel Information Element Decoding

The SunSet T10 provides D channel decoding of the information elements contained in each message. If the message contains an information element, the InfoElm (F4) F-key appears. Pressing this F-key brings up a screen similar to the one shown in Figure 87.

```
21:10:05  
  
INFORMATION ELEMENT  
AT&T Info Element Protocol  
  
BEARER CAPABILITY - 04h  
CODING STANDARD: 0h  
  CCITT Standardized coding  
INFO TRANSFER CAP:00h  
  Speech  
TRANSFER MODE:0h  
  Circuit mode  
INFO TRANSFER RATE:10h  
  64 kbit/s  
USER INFO LAYER 1 PROTOCOL:02h  
PAGE-UP  PAGE-DN          RETURN
```

Figure 87 Information Element

The Information Element screen displays the decoded elements. Press the RETURN (F4) F-key to return to the normal summary screen. If more than one page is available, the PAGE-UP (F1) and PAGE-DN (F2) F-keys appear. Use them to scroll through the various pages.

Press the ESCAPE key on the keypad when finished viewing.

6.7.7 Other Parameters

The OTHER PARAMETERS menu allows setup of additional specifications for ISDN analysis. Refer to Figure 88.

```
21:10:05  
  
OTHER PARAMETERS  
  
Line 1 D chnl :24  
L2 Bkup D chnl :24  
Layer 2 SAPI :0  
Layer 2 TEI :0  
L1 INTERFACE ID:0  
L2 INTERFACE ID:0  
47B+D CONFIG :DISABLE  
  
NEXT      PREV
```

Figure 88 ISDN Other Parameters

Line 1 D chnl

Options: 1–24

This specifies the Line 1 D channel for ISDN 23B+D, 46B+2D, and 47B+D.

- Use the F-Keys, NEXT (F1) or PREV (F2), to select a D channel.

L2Bkup D chnl

Options: 1–24

This specifies the backup D channel for Line 2 for 46B+2D. In 46B + 2D, one D channel is active at a time; the other channel is in standby mode and can become active if the first D channel should go out of service. View the status of the B channels in the Backup D Channel Test.

- Use the F-Keys, NEXT (F1) or PREV (F2), to select a D channel.

The following items use these F-keys

INC+10 (F1): Increment the selection by ten.

INC+1 (F2): Increment the selection by one.

DEC-10 (F3): Decrement the selection by ten.

DEC-1 (F4): Decrement the selection by one.

Layer 2 SAPI

Options: 0–63

F-Keys: INC+10 (F1), INC+1 (F2), DEC-10 (F3), DEC-1 (F4)

The Service Access Point Identifier identifies the point where Layer 2 services are provided to a Layer 3 entity. Select a number between 0–63 for the SAPI value. At this time, there are four assigned SAPI values:

- 0: Call Control Procedures
- 1: Packet Mode using Q.931 call procedures.
- 16: Packet communications conforming to X.25 Level 3 procedures.
- 63: Layer 2 management procedures.

Notes: All other values are reserved for future use. A value of 0 is normally used.

Layer 2 TEI

Options: 0–127

F-Keys: INC+10 (F1), INC+1 (F2), DEC-10 (F3), DEC-1 (F4)

The Terminal Endpoint Identifier identifies the terminal to which the message is intended. Select a value between 0–127. The values are grouped as follows:

- 0–63: fixed TEI assignment
- 64–126: automatic assignment
- 127: group TEI for broadcast data link connection

Note: A value of 0 is normally used.

L1 INTERFACE ID

Options: 0–127

F-Keys: INC+10 (F1), INC+1 (F2), DEC-10 (F3), DEC-1 (F4)

Used to select the L1 INTERFACE ID number. Enter a value from 0–127.

L2 INTRFACE ID

Options: 0–127

F-Keys: INC+10 (F1), INC+1 (F2), DEC-10 (F3), DEC-1 (F4)

Used to select the L1 INTRFACE ID number. Enter a value from 0–127.

47B + D CONFIGURE

Options: ENABLE (F1), DISABLE (F2)

Select ENABLE (F1) to configure for a 47B+D ISDN emulation or DISABLE (F2) for 23B+D or 46B+2D ISDN emulation.

6.8 SS7 Analysis (Option SW189)

The software option SW189, SS7 ANALYSIS can be accessed from the MAIN MENU > OTHER MEASUREMENTS > SS7 ANALYSIS. Refer to Figure 89.

Note: The SunSet T10 must be in T1DUAL Mode to enter SS7 ANALYSIS.

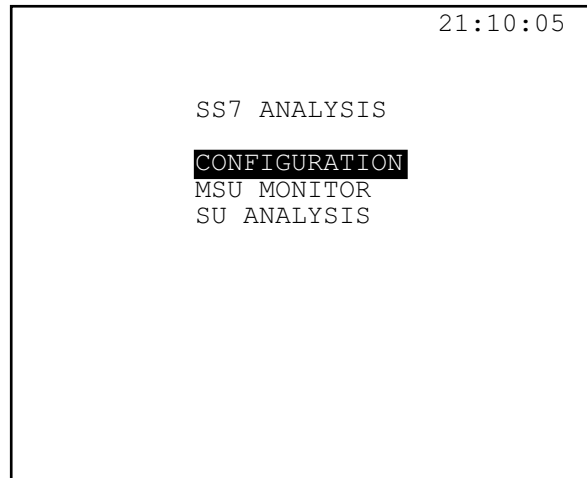


Figure 89 SS7 Analysis Menu

6.8.1 Configuration

```
21:10:05  
  
CONFIGURATION  
Line 1 Rx T/S: 1  
Line 2 Rx T/S: 1  
SS7 VERSION   : ANSI  
TRUNK RATE    : 56k  
DISPLAY INPUT: HEX  
  
ANSI  CCITT  CHINA24  CHINA14
```

Figure 90 SS7 Configuration

The following items are present in the SS7 Configuration screen:

Line 1 Rx T/S

Options: 1–24

- Select the receive time slot for Line 1 by using the F-keys, NEXT (F1) and PREV (F2).

Line 2 Rx T/S

Options: 1–24

- Select the receive time slot for Line 2 by using the F-keys, NEXT (F1) and PREV (F2).

SS7 VERSION

Options: ANSI (F1), CCITT (F2), CHINA24 (F3), CHINA14 (F4)

This line determines the SS7 protocol standard to be used during the analysis.

TRUNK RATE

Options: 56k (F1), 64k (F2)

Select the appropriate Trunk Rate.

HEX INPUT

Options: YES (F1), NO (F2)

Choose to enter the OPC, DPC, and CIC codes in either decimal or hexadecimal in the SETUP FILTER screen. Select YES (F1) to enter these codes in hex, or NO (F2) for decimal entering.

HEX INPUT also determines how the codes are displayed in the tracer.

6.8.2 MSU Monitor

MSUs (Message Signaling Units) are used by ISUP, TCAP, and TUP messages. They carry the content of the signaling message. There are three menu items within the MSU Monitor selection:

- Setup Filter
- Start Tracer
- View/Print Tracer

6.8.2.1 Setup Filter

The Setup Filter screen allows you to select different parameters for filtering SS7 messages. These parameters are used during SS7 trace procedures. Refer to Figure 91.

```
                21:10:05
                SETUP FILTER
LAYER 3
  LINE 1 DPC: 02-00-02
  LINE 1 OPC: XX-XX-XX
  SI FIELD  : ISUP
  CIC CODE  : NONE
  MSG TYPE  : 01
  ADDR SGNL : CALLED#
  ASSR NUMB : 3638000
LAYER 2
  BSN / BIB : XX / X
  FSN / FIB : XX/X
  FISU/LSSU : ON

NONE      SCCP      ISUP      more
```

Figure 91 Setup Filter

The following filter screens use these F-keys.

- NONE (F1): Use to capture all message types.
- INC+1 (F2): Increment the selection by one.
- DEC-1 (F3): Decrement the selection by one.
- 1/10/50 (F4): Determines increment/decrement values for the F2 and F3 keys.

Select the following filter items:

LINE 1 DPC

Options: 00-00-00 to FF-FF-FF

- Used to enter a Destination Point Code in hexadecimal form. The Destination Point Code indicates the signaling point for which the message is intended. Enter this code in decimal if selecting NO (F2) for HEX INPUT.

LINE 1 OPC

Options: 00-00-00 to FF-FF-FF

- Use to enter an Originating Point Code in hexadecimal form. The Originating Point Code indicates the signaling point that is the source of the message. If selecting NO (F2) for HEX INPUT, enter the code in decimal.

SI FIELD

Options: NONE (F1), SCCP (F2), ISUP (F3), SNT (more, F1), SNM (more, F2), TUP (more, F3)

Signaling handling functions to perform message distribution uses the Service Indicator Field. The SI Field indicates the user part to which the message belongs. This field further specifies the type of messages to filter.

- SCCP: Use to search for messages belonging to the Signaling Connection Control Part.
- ISUP: Use to search for ISDN User Part messages.
- SNM: Use to search for Signaling Network Maintenance messages.
- SNT: Use to search for Signaling Network Testing messages.
- TUP: Use to search for messages belonging to the Telephone User Part. Since ANSI protocol does not use the Telephone User Part, TUP will not be an available option if ANSI was selected as the SS7 Version in the SS7 Configuration screen.

Upon selecting a particular SI Field, more filtering choices will appear in the lower portion of the screen. They are described in the following sections.

6.8.2.1.1 TUP Filtering Fields

CIC CODE

Options: NONE (F1), 000 to FFF

F-keys, NONE (F1), INC+1 (F2), DEC-1 (F3), 1/10/50 (F4)

- Use to enter a Circuit Identification Code in hexadecimal form. The CIC is used as a label for circuit-related messages. CICs identify the telephone circuit connecting the Destination Point and the Originating Point. For TUP, the least significant 4 bits of the CIC field are the SLS. Signaling Link Selection is used to perform load sharing when needed.

HEAD CODE

Options: NONE (F1), 00 to FF

- The TUP Heading Code indicates the group to which the message belongs, as well as the name of the message. Table 7 lists the TUP Head codes.

ADDR SGNL

Options: NONE (F1), CALLED# (F2), CALLER# (F3)

- Adder Signal allows for filtering of messages using address numbers.
- CALLED#: Use to look for a specific called number: the destination of the call. After pressing the CALLED# (F2) F-key, a new line, ADDR NUMB will appear. On this line enter the specific number by pressing the SHIFT key on the keypad, and then entering the desired number using the keypad number keys.
- CALLER#: Use to look for a specific caller number: the origin of the call. After pressing the CALLER # (F3) F-key, a new line, ADDR NUMB, will appear. On this line enter the specific number by pressing the SHIFT key on the keypad, and then entering the desired number using the keypad number keys.

Code	TUP Heading	Hex Code
ACB	Access Barred Signal	A5
ACC	Automatic Congestion Control Information Message	1A
ACM	Address Complete Message	14
ADI	Address Incomplete Signal	45
ANC	Answer Signal, Charge	16
ANN	Answer Signal, No charge	26
ANU	Answer Signal, Unqualified	06
BLA	Blocking-Acknowledgment Signal	37
BLO	Blocking Signal	27
CBK	Clear-back Signal	36
CCF	Continuity Failure Signal	32
CCL	Calling Party Clear Signal	76
CCR	Continuity-Check-Request Signal	67
CFL	Call Failure Signal	55
CGC	Circuit-Group-Congestion Signal	25
CHG	Charging Message	24
CLF	Clear-Forward Signal	46
COT	Continuity Signal	32
DPN	Digital Path Not Provided Signal	B5
EUM	Extended Unsuccessful Backward Set-up Information Message	F5
FOT	Forward Transfer Signal	66
GRA	Circuit Group Reset Acknowledgment Message	A8
GRQ	General Request Message	13
GRS	Circuit Group Reset Message	98
GSM	General Forward Set-up Information Message	12
HGU	Hardware Failure Oriented Group Unblocking Message	78
HUA	Hardware Failure Oriented Group Unblocking Acknowledgment Message	88
IAI	Initial Address Message with Additional Information	21
IAM	Initial Address Message	11
LOS	Line-out-of-Service Signal	85
MBA	Maintenance Oriented Group Blocking Acknowledgment Message	28
MGB	Maintenance Oriented Group Blocking Message	18
MGU	Maintenance Oriented Group Unblocking Message	38
MPR	Misdialled Trunk Prefix	C5
MUA	Maintenance Oriented Group Unblocking Acknowledgment Message	48
RLG	Release Guard Signal	17
RSC	Reset-Circuit Signal	77
SAM	Subsequent Address Message	31
SAO	Subsequent Address Message with One Single	41
SBA	Software Generated Group Blocking Acknowledgment Message	C8
SEC	Switching-Equipment Congestion Signal	15
SGB	Software Generated Group Blocking Message	B8
SGU	Software Generated Group Unblocking Message	D8
SSB	Subscriber-Busy Signal	65
SST	Send Special Information Tone Signal	95
SUA	Software Generated Group Unblocking Acknowledgment	E8
UBA	Unblocking-Acknowledgment Signal	57
UBL	Unblocking Signal	47
UNN	Unallocated Number Signal	75

Table 7 TUP Heading Codes

6.8.2.1.2 Filtering Fields for ISUP

CIC CODE

Options: ANSI protocol: NONE (F1), 0000 to 3FFF

CCITT protocol: 000 to FFF, CHINA24, & CHINA14.

- Use to select a Circuit Identification Code. The CIC is used as a label for circuit-related messages. It identifies the telephone circuit among those interconnecting the Destination Point and the Originating Point.
- NONE: Use to capture all CICs.
- ANSI protocol uses 14 bits for CIC; ITU (CHINA14 & 24) uses 12 bits. Therefore, if ANSI was selected in the SS7 Configuration Screen, this field will be 4 hex digits long.
- For all other versions, this will be three hex digits long.

MESG TYPE

Options: NONE (F1), 00 to FF

- Used to select a Message Type. Refer to Table 8.

ADDR SGNL

Options: NONE (F1), CALLED # (F2), CALLER # (F3)

- Adder Signal allows filtering of messages by using address numbers.
- CALLED#: Use to search for a specific called number. Upon pressing the CALLED # (F2) F-key, a new line, ADDR NUMB appears. Enter the specific number by pressing the SHIFT key on the keypad, and using the number keys.
- CALLER#: Use to search for a specific caller number. Upon pressing the CALLER # (F3) F-key, a new line, ADDR NUMB appears. Enter the specific number by pressing the SHIFT key on the keypad, and using the number keys.

Code	Message Type	CCITT Only	ANSI Only	Code in HEX
ACM	Address Complete Message			06
ANM	Answer			09
BLA	Blocking Acknowledgment			15
BLO	Blocking			13
CCR	Continuity Check Request			11
CFN	Confusion			2F
CGB	Circuit Group Blocking			18
CGBA	Circuit Group Blocking Acknowledgment			1A
CGU	Circuit Group Unblocking			19
CGUA	Circuit Group Unblocking Acknowledgment			1B
CMC	Call Modification Completed	X		1D
CMR	Call Modification Request	X		1C
CMRJ	Call Modification Reject	X		1E
CON	Connect	X		07
COT	Continuity			05
CPG	Call Progress			2C
CQM	Circuit Query			2A
CQR	Circuit Query Response			2B
CRA	Circuit Reservation Acknowledgment		X	E9
CRG	Charge Information	X		31
CRM	Circuit Reservation		X	EA
CVR	Circuit Validation Response		X	EB
CVT	Circuit Validation Test		X	EC
DRS	Delayed Release	X		27
EXM	Exit		X	ED
FAA	Facility Accepted	X		20
FAR	Facility Request	X		21
FOT	Forward Transfer			08
FRJ	Facility Reject	X		1F
GRA	Circuit Group Reset Acknowledgment			17
GRS	Circuit Group Reset			29
IAM	Initial Address Message			01
INF	Information			04
INR	Information Request			03
LPA	Loop Back Acknowledgment			29
OLM	Overload	X		30
PAM	Pass Along			28
REL	Release			0C
RES	Resume			0E
RLC	Release Complete			10
RSC	Reset Circuit			12
SAM	Subsequent Address Message	X		02
SUS	Suspend			0D
UBA	Unblocking Acknowledgment			16
UBL	Unblocking Signal			14
USIS	Unequipped Circuit Identification Code			2E
USR	User to User Information			2D

Table 8 ISUP Message Types

6.8.2.1.3 Filtering Fields for SCCP

Selecting SCCP, the screen shown in Figure 92 appears.

Note: Enter Layer 2 information before selecting SCCP. Follow this order because layer 2 information is not available if the SCCP F-key is used in the SI FIELD.

```
21:10:05
SCCP SETUP FILTER
SLS CODE   : NONE
MSG TYPE   : 006
ADDR SIGNL : CALLED#
4083638000
SUBSYS NO. : 03
SIG PT COD : XXX XXX XXX
TCAP FILTR : ON
ORIG TRXID = XXXXXXXX
&& DEST TRXID = XXXXXXXX

NONE  INC+1  DEC-1  1/10/50
```

Figure 92 SCCP Setup Filter

Select the following filtering items:

SLS CODE

Options: 0 to F

- The Signaling Link Selection Code is a 4 bit long code. It is used, where appropriate, in load sharing.

MESG TYPE

Options: 000 to 255 in decimal

- Use to select a Message Type. The SCCP message types are shown in Table 9.

Codes	SCCP Messages	ANSI Only	Decimal Code
AK	Data Acknowledgment		8
CC	Connection Confirm		2
CR	Connection Request		1
CREF	Connection Refused		3
DT1	Data Form 1		6
DT2	Data Form 2		7
EA	Expedited Data Acknowledgment		12
ED	Expedited Data		11
ERR	Error		15
IT	Inactivity Test		16
RLC	Release Complete		5
RLSD	Released		4
RSC	Reset Confirm		14
RSR	Reset Request		13
UDT	Unitdata		9
UDTS	Unitdata Service		10
XUDT	Extended Unitdata	X	17
XUDTS	Extended Unitdata Service	X	18

Table 9 SCCP Message Types

ADDR SGNL

Options: NONE (F1), CALLED # (F2), CALLER # (F3)

- Address Signal allows filtering of messages using address numbers.
- CALLED#: Use to search for a specific called number. Upon pressing the CALLED # (F2) F-key, a new line, ADDR NUMB appears. Enter the specific number by pressing the SHIFT key on the keypad, and using the number keys.
- CALLER#: Use to search for a specific caller number. Upon pressing the CALLER # (F3) F-key, a new line, ADDR NUMB appears. Enter the specific number by pressing the SHIFT key on the keypad, and using the number keys.

SUBSYS NO

Options: NONE (F1), 000 to 255

- Use subsystem number to select a Message Type.
- The SSN (subsystem number) identifies a SCCP user function. The SSN consists of one octet, as shown in Table 10.

Subsystem Number	Decimal Code
SSN not used or known	0
SCCP Management	1
Reserved	2
ISDN User Part	3
OMAP (Operations, Maintenance, and Administration Part)	4
MAP (Mobile Application Part)	5
Home Location Register	6
Visited Location Register	7
Mobile Switching Center	8
Equipment Identification Register	9
Authentication Center	10
Spare	11-254
Reserved for expansion	255

Table 10 Subsystem Numbers

Notes:

- Network specific SSNs should use the spare octets, 11 to 254 (decimal), in descending order (starting with 254).
- To enter an SSN, an address signal must be specified.

SIG PT COD

Options: NONE (F1), 000 to 255 - 000 to 255 - 000 to 255

- Use to enter a Signaling Point Code in decimal format.
- The Signaling Point Codes consists of three octets and are transmitted in the following order: Network Cluster Member, Network Cluster, and Network Identifier.

TCAP FILTR

Options: OFF (F1), ON (F2)

- Filters the Transaction Capability Application Part.
- OFF: Press the OFF (F1) F-key to turn off the TCAP filter.
- ON: Press the ON (F2) F-key to use the TCAP filter. The following two filtering items appear:

ORIG TRXID

Options: OFF (F1), ON (F2)

- This field contains the Transaction ID assigned by the originator. It consists of four octets.
- To capture a specific Originating Transaction ID, press the ON (F2) F-key; then press the SHIFT key on the keypad and enter the numbers for all eight digits using the keypad. Enter the Originating Transaction ID in hexadecimal form (indicated by the "h" at the right of this field).

DEST TRXID

Options: OFF (F1), ON (F2)

- This field contains the Transaction ID assigned by the responder. It consists of four octets.
- To capture a specific Destination Transaction ID, press the ON (F2) F-key; then press the SHIFT key on the keypad and enter the numbers for all eight digits using the keypad. Enter the Destination ID in hexadecimal form (indicated by the “h” at the right of this field).

Note: There is an AND/OR option for the two filtering fields. To access this option:

1. Select the first digit of the DEST TRXID.
 2. Move the cursor one spot to the left.
 3. The AND (F1), and the + OR (F2) F-keys will appear.
- The AND (F1) F-key allows the SunSet T10 to capture only those messages containing both Transaction IDs.
 - The OR (F2) F-key allows the SunSet T10 to capture any message with one of the Transaction IDs.

6.8.2.1.4 Layer 3 Filtering Fields for SNM

SLS CODE

Options: NONE (F1); 0 to F

- Used to select a Signaling Link Selection Code.

HEAD CODE

Options: NONE (F1), 00 to FF

- Used to select a Heading Code. Refer to Table 11.

Codes	SNM Heading Codes	HEX Codes
CBA	Changeback Acknowledgment Signal	61
CBD	Changeback Declaration Signal	51
CNP	Connection-Not-Possible Signal	48
CNS	Connection-Not-Successful Signal	38
COA	Changeover Acknowledgment Signal	21
COO	Changeover Order Signal	11
CSS	Connection Successful Signal	28
DLC	Signalling Data Link Connection Order Signal	18
ECA	Emergency Changeover Acknowledgment Signal	22
ECO	Emergency Changeover Order Signal	12
LFU	Link Forced Uninhibit Message	66
LIA	Link Inhibit Acknowledgment Message	36
LID	Link Inhibit Denied Message	56
LIN	Link Inhibit Message	16
LLI	Link Local Inhibit Test Signal	76
LRI	Link Remote Inhibit Test Signal	86
LUA	Link Uninhibit Acknowledgment	46
LUN	Link Uninhibit Message	26
RCP	Signalling Route Set Test Cluster Prohibited Signal	35
RCR	Signalling Route Set Test Cluster Restricted Signal	45
RCT	Signalling Route Set Congestion Test Signal	13
RSP	Signalling Route Set Test Prohibited Signal	15
RSR	Signalling Route Set Test Restricted Signal	25
TFA	Transfer Allowed Signal	54
TFC	Transfer Controlled Signal	23
TFP	Transfer Prohibited Signal	14
TFR	Transfer Restricted Signal	34
TRA	Traffic Restart Allowed Signal	17
UPU	User Part Unavailable Signal	1A

Table 11 SNM Heading Codes

6.8.2.1.5 Layer 3 Filtering Items for SNT

SLS CODE

Options: NONE (F1); 0 to F

- Use to select a Signaling Link Selection Code.

HEAD CODE

Options: NONE (F1), 00 to FF

- Use to select a Heading Code. Refer to Table 12.

Code	SNT Heading	Hex Code
STLA	Signaling Link Test Acknowledgment	12
SLTM	Signaling Link Test Message	11

Table 12 SNT Heading Codes

6.8.2.1.6 Layer 2 Filtering Items

Layer 2 filtering options are at the bottom of the screen in Figure 91. These options remain the same for each SI FIELD. Layer 2, the Signaling Link Control Layer, defines the functions and procedures for transmitting signaling information over one individual data link. Layer 2, along with Layer 1, provides a signaling link for reliable transfer of signaling messages between two points. The Layer 2 filtering options are:

BSN/BIB

Options: BSN- NONE (F1), 00 to 7F; BIB- NONE (F1), 0 (F2), 1 (F3)

Each message transmitted is numbered in sequence from 0 to 127. For backward signal units, this number takes the form of the BSN (Backward Sequence Number). When a backward message has been received correctly, the receiving terminal sends back the BSN and the BIB (Backward Indicator Bit) retains its value. If there is an error in this backward message, the receiving terminal rejects this message, sending back the BSN of the last correctly received signal, as well as an inverted BIB.

FSN/FIB

Options: FSN- NONE (F1), 00 to 7F; FIB- NONE (F1), 0 (F2), 1 (F3)

Each transmitted number is numbered in a sequence from 0 to 127. For forward signal units, this number takes the form of the FSN (Forward Sequence Number). In a correctly received forward message, the receiving terminal sends back the FSN and the FIB (Forward Indicator Bit) retains its value. If there is an error in this message, the receiving terminal rejects the message, sending back the FSN of the last correctly received signal, as well as an inverted FIB.

FISU/LSSU

Options: ON (F1), OFF (F2)

FISU, Fill-In Signal Unit, is an idle signal used for error surveillance. LSSU, Link Status Signal Unit, is used at start-up or when an error is found on the line.

Note: FISU/LSSU can be turned ON (F1) only when one of the above filters (BSN, BIB, FSN, FIB) has been set to 0 or 1. If NONE has been selected for all these filters, then FISU/LSSU cannot be selected.

6.8.2.2 Start Tracer

Access the START TRACER feature through the MSU MONITOR screen. This feature begins the tracing process based on the filter values specified in the SETUP FILTER screen. The tracer screen updates twice per second and can capture 50 messages per second.

This screen has three function keys to choose from:

- RESTART (F1): Causes the SunSet T10 to restart the trace process.
- PAUSE/ RESUME (F2): PAUSE freezes the display to allow observation of the data. Measurements are still occurring, but the counts are updated only in memory, and not on the display. RESUME will update all data to their current values.
- DECODE/HEX (F3): Displays the message contents for analysis.

6.8.2.3 View/Print Tracer

VIEW/PRINT TRACER allows viewing and printing of specific data captured by the SunSet T10. Refer to Figure 93.

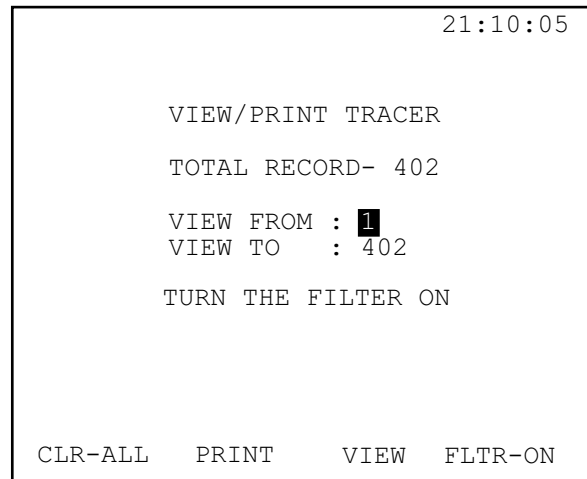


Figure 93 View/Print Tracer

To specify the records to view or print, use the following procedure.

1. Select VIEW FROM.
2. Press the SHIFT key on the keypad and enter the desired numbers from the keypad.
3. Press the SHIFT key to deactivate the SHIFT lock and select VIEW TO.
4. Press the SHIFT key and enter the desired numbers from the keypad.
5. Press the SHIFT key again to deactivate the SHIFT lock.
6. When satisfied with the settings, press the VIEW or PRINT F-keys.

The four F-keys available in this screen are:

CLR-ALL (F1): Erases the contents of the view/print buffer. Press the CLR-ALL F-key, and follow the on-screen instructions.

PRINT (F2): Print the contents of the buffer.

VIEW (F3): Displays the contents of the buffer, as specified by the VIEW FROM and VIEW TO settings.

FLTR-ON/FLTROFF (F4): Turns the filter assignments on or off. Turning the filter off displays all messages, while saving filter settings in the SETUP FILTER screen.

ANSI SCCP Message Example

```
21:10:05  
  
RCV MESG NO.1 (ANSI)  
LINE 2 01-10-02 00:10:48.77  
  
SCCP  
DPC: 194-000-000  
  
FF F0 2E 03 F0 00 00 6B 18 00  
01 06 03 00 00 82 01 1F E2 1D  
C7 04 00 00 00 00 E8 15 ED 13  
CF 01 00 D0 02 85 01 F2 0A 84  
08 01 02 11 07 37 17 11 01 57  
5B  
  
PAGE-UP PAGE-DN DECODE
```

Figure 94 ANSI SCCP Message, Hex View

The following information displayed in Figure 94.

- Message number, in this example the number of the message is 1.
- Receive line, in this example, the line receiving the message is line 2.
- The date and time of the message as received. In this example, the date is 01-10-02 and the time is 00:10:48.77.
- Service Indicator Field, in this example, it is SCCP.
- DPC, Destination Point Code, shown in decimal.
- The message is displayed in hexadecimal form.

Three F-keys are available in this screen:

PAGE-UP (F1): This F-key allows viewing other pages of data by showing the previous message. In Figure 94, pressing the PAGE-UP F-key displays the last message.

PAGE-DN (F2): This F-key allows viewing other pages of data by showing the next message. In Figure 94, pressing the PAGE-DN F-key displays message 2.

DECODE (F3): Decodes the hexadecimal form and displays the decoded message contents. Figure 95 shows a decoded message.

```

21:10:05

RCV MESG NO.1 (ANSI)
LINE 2 01-10-02 00:10:48.77

MSU- SCCP BSN:7F 1 FSN:42 1
SI :3 SSF:0 SLS:01
DPC: 194-000-000 OPC:139-024-000
mesg type 06h (DT1)
DEST REF: 03 00 00
SEG/REAS: 82
DATA :1D C7 04 00 00 00 00 >>

PAGE-UP PAGE-DN HEX L4deco

```

Figure 95 ANSI SCCP Message, Decode View

The following items appear in Figure 95:

- Message number, in this example the number of the message is 1.
- Receive line, in this example, the line receiving the message is line 2.
- The date and time of the message as received. In this example, the date is 01-10-02 and the time is 00:10:48.77.
- MSU (Message Signaling Unit), in this example, it is SCCP.
- DPC (Destination Point Code) and the OPC (Originating Point Code), displayed in decimal form.

View the following information:

mesg type: Displays both the hexadecimal form (Figures 95 and 96), and the message type in parentheses. In Figure 95, the message type is DT1. DT1 is the Dataform 1 message and is sent by either end of a signaling connection to pass SCCP user data between two SCCP nodes. Referring to Figure 94, the hex code is 06 in the second row. Table 9 lists the different SCCP message types.

DEST REF: The Destination Local Reference field is three octets long. This reference number is included in the SCCP message to allow the receiving node to identify the message with one particular connection session. It identifies a signaling connection in a node.

SEG/RES: The Segmenting/Reassembling parameter field is included in the data to serve a segmenting/reassembling function. This is the “more data bit” (M-bit). In this octet, bits 2–8 are spare. Bit 1 is the More Data indication and coded as:

- 0 = no more data
- 1 = more data

In Figure 95, the SEG/RES has a value of 82. In binary code, this translates to 10000010. Since bit 1=0, this indicates no more data.

DATA: This shows the rest of the data in hexadecimal form. The arrow sign at the right indicates that there is more data; press the HEX (F3) F-key to view all the data in hex form. Place the cursor on the DATA line, an L4dec (F4) F-key appears. This F-key will bring up the Layer 4 decoded information. This decodes several parts of the TCAP message. Refer to Figure 96.

The F-keys available in Figure 95 are:

PAGE-UP (F1): Allows viewing of the other pages of data by showing the previous message. Pressing the PAGE-UP F-key would display the last message.

PAGE-DN (F2): Allows viewing of the other pages of data by showing the next message. Pressing the PAGE-DN F-key would display message 2.

HEX (F3): This F-key displays the message in hexadecimal form.

L4deco (F4): This F-key appears only when the cursor is placed on the DATA line. The L4 decode F-key decodes several parts of the TCAP (Layer 4) message. Figure 96 shows the Layer 4 Decode screen.

```

21:10:05

TCAP MESSAGE

PACKAGE TYPE- QRY With PER
ORIG TRX ID : 00000000h
COMP TYPE   : Invoke (Not Last)

CompDec

```

Figure 96 Layer 4 Decoded TCAP Message

Figure 96 contains the following information:

PACKAGE TYPE: Describes what kind of TCAP interaction has taken place between two signaling nodes. Package Type is one octet long and is mandatory for all TCAP messages. Table 13 lists the package types.

Package Type Identifiers	H	G	F	E	D	C	B	A	HEX Code
Unidirectional	1	1	1	0	0	0	0	1	E1
Query with Permission	1	1	1	0	0	0	1	0	E2
Query without Permission	1	1	1	0	0	0	1	1	E3
Response	1	1	1	0	0	1	0	0	E4
Conversation with Permission	1	1	1	0	0	1	0	1	E5
Conversation without Permission	1	1	1	0	0	1	1	0	E6
Abort	1	1	0	1	0	1	1	0	D6

Table 13 TCAP Package Type Identifiers

The Package Type in Figure 96 is Query with Permission. In Figure 94, the hex message is E2 (the corresponding hex code) in the second row. Messages with these package types do the following:

- Unidirectional - sends information in only one direction; no reply is expected. There is no interaction made with TCAP.
- Query with Permission - initiates a TCAP transaction; informs the TCAP node that it may end the TCAP transaction.
- Query without Permission - initiates a TCAP transaction, but informs the destination node that it may not end the transaction.
- Response - ends the TCAP transaction.
- Conversation with Permission - a continuation of a TCAP transaction; informs the destination node that it may end the TCAP transaction.
- Conversation without Permission - a continuation of a TCAP transaction, but informs the destination node that it may not end the TCAP transaction.
- Abort - informs the destination node that the originating node has terminated the TCAP transaction.

ORIG TRX ID: The originator assigns the Transaction ID. It consists of 4 octets and is indicated by the "h" at right. Figure 94 shows the hexadecimal form.

COMP TYPE: Table 14 lists the TCAP Component Types.

Component Type Identifiers	H	G	F	E	D	C	B	A	HEX Code
Invoke (Last)	1	1	1	0	1	0	0	1	E9
Return Result (Last)	1	1	1	0	1	0	1	0	EA
Return Error	1	1	1	0	1	0	1	1	EB
Reject	1	1	1	0	1	1	0	0	EC
Invoke (Not Last)	1	1	1	0	1	1	0	1	ED
Return Result (Not Last)	1	1	1	0	1	1	1	0	EE

Table 14 TCAP Component Type Identifiers

In Figure 96 the ED HEX code is decoded under COMP TYPE. In Figure 94; ED is near the end of the third row. Invoke (Not Last) invokes an operation and indicates that further responding components are expected.

The Component Types are defined as:

Invoke (Last): Starts an operation and indicates that there are no further responding components.

Return Result (Last): Retrieves the results of an invoked operation. This indicates that there are no further responding components.

Return Error: Reports the unsuccessful completion of an operation.

Reject: Reports the rejection of an incorrect package or component type.

Invoke (Not Last): Starts an operation and indicates that further responding components are expected.

Return result (Not Last): Retrieves the results of an invoked operation. This indicates that there are further responding components.

Selecting the Component Type field, the CompDec (F4) F-key appears. This F-key provides further decoding of the Component Type. Figure 97 shows a sample Component Decode screen.

```
          SCROLL          21:10:05

  Invoke (Not Last)

CORRELATN ID: 00h
OPERATION CODE - NATIONAL
HGFEDCBA
10000101
H:   Reply Required
G-A: Operation Family
     Caller Interaction
01h: Operation Specifier
     Play Announcement

LIST OF PARAMETERS
```

Figure 97 Component Decode Screen

Figure 97 contains the following information:

CORRELATN ID: This must be included in a return result, and in an invoke component if the invoke component is responding to a previous invoke with an invoke ID. The correlation ID is identical to the invoke ID of the other component.

OPERATION CODE: This identifier indicates the particular standard the Operation Code follows. In Figure 97, defined by the ANSI T1.114 standard, is the operation code NATIONAL. Defined within a network specific TCAP application is the Private Code Identifier. An operation specifier that divides the Operation Code follows Operation Family. Each is one octet long. Figure 97 shows the Operation Family (10000101). This represents the caller interaction family, as shown in Table 13. This family tells the exchange to interact with the caller as determined by the Operation Specifier. In Figure 97, the Operation Specifier is Play Announcement; this identifies the announcement played to the caller. Refer to ANSI T1.114.5 specification for the definitions of other Operation Families and specifiers.

Appearing in Figure 97 is a SCROLL indicator. This indicates that more information is available. Use the up/down arrow keys on the keypad to move the cursor as needed to view other data.

6.8.3 SU Analysis

		21:10:05
SU ANALYSIS		
LINE 1		LINE 2
FISU -0		FISU -0
LSSU -0		LSSU -0
MSU -0		MSU -0
TOTAL-0		TOTAL-0
MSU MESSAGES		
SNM -0		SNM -0
SNT -0		SNT -0
TUP -0		TUP -0
ISUP -0		ISUP -0
SCCP -0		SCCP -0
PAUSE	RESTART	STATIST

Figure 98 SU Analysis, Count Screen

The SU (Signaling Unit) ANALYSIS selection is in the SS7 ANALYSIS menu. This screen, seen in Figure 98, shows the (Statistics) type and number of SS7 messages. The Statist screen shown in Figure 99, displays additional information. The SunSet T10 captures all types of signaling units based on the specified filtering setup. First, the analysis breaks the messages into the three basic message types: FISUs, LSSUs, and MSUs. Then, it further divides the MSU messages into five types: SNM, SNT, TUP, ISUP, and SCCP. In the Statistics screen, FIB (Forward Indicator Bit) and BIB (Backward Indicator Bit) counts are also available.

There are three function F-key options:

PAUSE/RESUME (F1): Pause freezes the display so the data may be easily observed. Recorded in the background are the measurements. Pressing the RESUME F-key will update the screen.

RESTART (F2): Causes the SunSet T10 to restart the trace process.

```
21:10:05
SU ANALYSIS
LINE 1          LINE 2
FISU%-         FISU%-
LSSU%-         LSSU%-
MSU %-         MSU %-

RETRANSMISSION
FIB -          FIB -
BIB -          BIB -

PAUSE  RESTART          COUNT
```

Figure 99 SU Analysis, Statist Screen

STATIST/COUNT (F4): STATIST displays FISU%, LSSU%, and MSU% for both lines, as well as the count of FIB and BIB retransmission bits. After pressing the STATIST (F4) F-key this F-key toggles to COUNT, pressing this F-key returns to the original SU Analysis screen.

6.9 GSM VOICE/TRAU/BERT Menus (SW191)

To enter the GSM VOICE/TRAU/BERT menus select MAIN MENU > OTHER MEASUREMENTS > GSM VOICE/TRAU/BERT. Refer to Figure 100.



Figure 100 GSM VOICE/TRAU/BERT Menu

6.9.1 GSM Monitor

The GSM Monitor screen allows you to:

- view 24 time slots and 96 sub-channels for lines 1 and/or 2.
- view the activity on each subchannel.
- drop the 16 kbps GSM channel at a 16 kbps voice rate to the speaker.

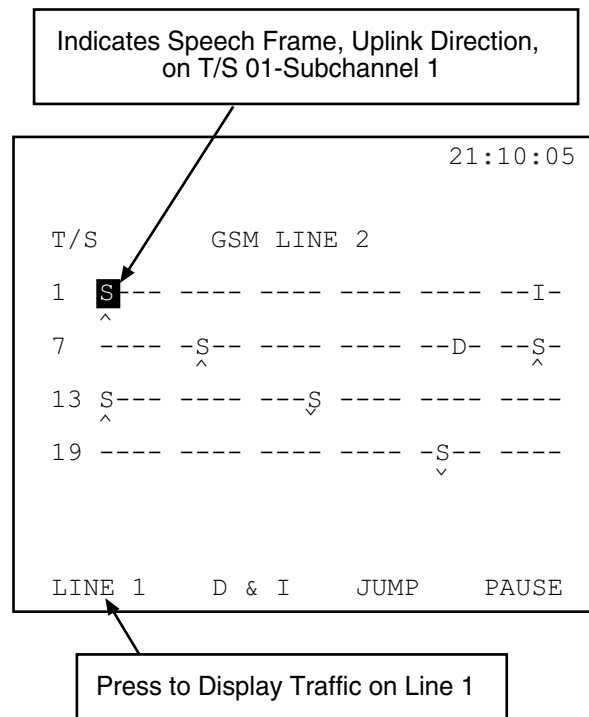


Figure 101 GSM Monitor Screen

Displayed within this screen are all 24-time slots. The top row contains time slots 1–6; the second row has 7–12, and so forth. Each time slot contains 4 sub-channels. Use this screen to monitor the traffic on each subchannel. The TRAU frames are decoded as follows:

- O = Operations & Maintenance
- S = Speech
- Abis = 64 kbps Abis Signaling
- I = Idle (speech idle)
- - = Unknown

To monitor speech calls with the SunSet T10:

1. Select an "S" frame.
2. Press the D&I (F2) F-key; the speech will be played on the SunSet T10's speaker.

The following F-Keys are available in this screen:

LINE 1/LINE 2 (F1): When in T1DUAL Mode, use this F-key to determine the monitor line.

D & I (F2): Drop and insert plays the 16 k speech channel on the SunSet T10's speaker. It will play the selected "S" frame.

JUMP (F3): Use this F-key to move the cursor from channel to channel. The arrow keys on the keypad will move the cursor at one subchannel intervals.

PAUSE/RESUME (F4): PAUSE freezes the live presentation of traffic. RESUME updates the screen and continues the live presentation.

6.9.2 VOICE/TRAU XMT

Use the Voice/TRAU XMT feature to:

- transmit a prerecorded speech message on any subchannel.
- observe the received C-bits.

```
21:10:05  
  
VOICE & TRAU XMT  
  
LINE NUMBER: LINE 1  
TIME SLOT : 07  
SUB CHANNEL: 1  
IDLE CODE : 11111111  
LINK DIRCTN: UPLINK  
TIME ALGMNT: DELAY 0 x500us  
  
RCV CBITS :  
  
PAUSE UPLINK DNLINK
```

Figure 102 VOICE/TRAU XMT Screen

Upon entering the screen shown in Figure 102, the SunSet T10 begins transmitting a 16k voice message on the selected time slot and subchannel. Provided in this screen are these settings.

LINE NUMBER

Options: LINE 1 (F1), LINE 2 (F2)

Select either Line 1 or 2 to transmit a voice message.

Note: Line 1 is fixed if in T1SINGL test mode.

TIME SLOT

Options: 1–24

Determines the time slot used for the transmitted message.

INC+1 (F2) increments the time slot number by one.

DEC-1 (F3) decrements the time slot number by one.

SUB CHANNEL

Options: 1–4

Determines the 16k subchannel used for the transmit message.

INC+1 (F2) F-key increments the subchannel number by one.

DEC-1 (F3) F-key decrements the subchannel number by one.

IDLE CODE

Options: 7F-HEX (F2), FF-HEX (F3)

Select the SunSet T10's idle code.

LINK DIRCTN

Options: UPLINK (F2), DOWNLINK (F3)

Determine the link direction of the transmitted message. Figure 103 illustrates the directions.

Uplink: Refers to the uplink direction from the customer up to the network (or BTS to BCS).

Downlink: Refers to the downlink direction from the network down to the customer (or BCS to BTS).

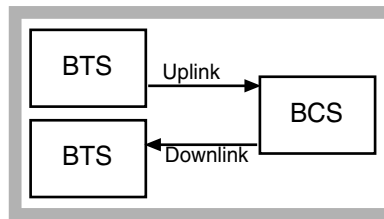


Figure 103 Uplink/Downlink Directions

TIME ALGMNT

Options: Delay, from 1 to 39 x 500 ms; Advance, 1 x 250 ms

Used to adjust the timing of the SunSet T10's transmit signal by either advancing or delaying the time.

- The default is no delay to the voice signal.
- To change the delay time use the F-keys.

INC+1 (F2) increments the delay in steps of 500 μ s.

DEC-1 (F3) decrements the delay in steps of 500 μ s.

INC +10 (F4) increments the delay in steps of 10 x 500 μ s.

RCV CBITS

Displays the received C-bits.

6.9.3 16k BERT

16k BERT allows observation of the quality of transmission for a selected time slot subchannel. Running a BERT test at 16 kbps accomplishes this.

Since this is a BERT test, verify in the TEST CONFIGURATION screen, that Tx SOURCE = NORMAL or TEST PAT.

```
21:10:05
GSM 16K BERT
LINE NUMBER: LINE 1
TIME SLOT   : 02
SUB CHANNEL: 2
PATTERN     : 2047
ELAPSED TIME: 000:08:37
ERROR: 0     RATE: 0.0e-06
ES   : 0     EFS : 0
SES  : 0     UAS : 0
LOSS : 0
STOP  2047   more  PRINT
```

Figure 104 GSM 16K BERT

The following two F-keys are constant within this screen:

STOP/RESUME (F1): Press the STOP (F1) F-key to stop the current measurement. Pressing the RESUME (F1) F-key causes a new measurement cycle to begin and resets the elapsed time to zero.

PRINT (F4): This F-key sends the data to a connected printer.

Configure the following items:

LINE NUMBER

Options: LINE 1 (F2), LINE 2 (F3)

Line Number corresponds to the line used for the BERT test. This will be the line used for transmitting the test pattern and receiving the results.

- This applies only to T1 Dual mode.

TIME SLOT

Options: 1–24

Select the time slot to use for the BERT test. Choose from 1–24 using the F-keys.

INC+1 (F2): increments the time slot number by one.

DEC-1 (F3): decrements the time slot number by one.

SUB CHANNEL

Options: 1–4

Select the 16k sub channel used for the BERT test. Change the selection using the following F-keys:

INC+1 (F2): increments the sub channel number by one

DEC-1 (F3): decrements the sub channel number by one

PATTERN

Options: 2047, ALL 1, ALL0, ALT10

Use the “more” (F3) F-key to choose the pattern. When the desired pattern appears, press the F2 key to begin transmitting the pattern.

The following measurements are displayed in the lower portion of the screen shown in Figure 104:

ELAPSED TIME: Elapsed time since the beginning of the test. This begins counting upon accessing the 16K BERT screen, or when the STOP/RESUME (F1) F-key is pressed.

ERROR: The number of bit errors that have occurred since the start of the test.

RATE: This the average bit error rate since the beginning of the test.

ES: Number of errored seconds since the beginning of the test.

EFS: The number of error-free seconds since the beginning of the test.

SES: The number of severely errored seconds since the beginning of the test. A severely errored second contains a 10e-03 error rate.

UAS: The number of unavailable seconds since the beginning of the test. An unavailable second begins after 10 consecutive SESs (Severely-Errored Seconds). UAS also occurs when there is a loss of signal.

LOSS: Loss of synchronization seconds is the number of seconds with pattern loss since the beginning of the test.

6.10 Switched 56 Testing (SW187)

Switched 56 Testing is a 56 kbps digital transmission that stuffs 1s into the eight bit to gain the DS1 ones density required for AMI lines. Switched 56 Testing checks the operation of switched 56 services at a DS1 access point. This allows the technician to setup a call to a digital loopback, choose a test pattern, and verify BER (bit error rate) performance. It also allows the technician to observe a Teleos call setup in process, monitoring both directions in sequence.

Select MAIN MENU > OTHER MEASUREMENTS > SWITCHED 56 TESTING.

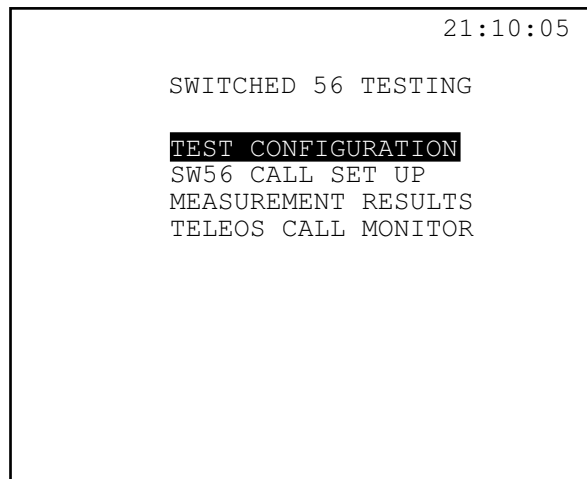


Figure 105 Switched 56 Testing Menu

6.10.1 Test Configuration

```
21:10:05

TEST CONFIGURATION

XMT CHANNEL : 24
RCV CHANNEL : 24
TEST PATTERN : 2047
USER PATTERN : 00000000
ON-HOOK AB : 0 0
OFF-HOOK AB : 1 1

2047      511      127      more
```

Figure 106 SW56 Test Configuration

Configure the following items for SW56 testing.

XMT CHANNEL

Options: 1–24

Determines the transmit channel.

- Use NEXT (F1) and PREV (F2) to increment or decrement the transmit channel.
- Upon changing the channel, the number will flash five times. The SunSet T10 will not actually begin transmitting on that channel until the flashing stops.

RCV CHANNEL

Options: 1–24

Determines the receive channel.

- Use NEXT (F1) and PREV (F2) to increment or decrement the receive channel.

TEST PATTERN

Options: 2047 (F1), 511 (F2), 127 (F3), 63 (more, F1), 1111 (more, F2), 0000 (more, F3), DDS-1 (more, F1), DDS-2 (more, F2), DDS-3 (more, F3), DDS-4 (more, F1), DDS-5 (more, F2), DDS-6 (more, F3), USER (more, F1), 0101 (more, F2)

Select a pattern to transmit. Press USER (more F1) to send a user pattern on this line.

USER PATTERN

To enter a User Pattern:

1. Press the SHIFT key on the keypad.
2. Enter the pattern using the 1 and 0 keys on the keypad. If a mistake is made:
 - A. Press the SHIFT key on the keypad to turn off the SHIFT indicator.
 - B. Use the arrow keys on the keypad to select the incorrect digit.
 - C. Press the SHIFT key.
 - D. Enter the number using the 1 and 0 keys.
 - E. When the digits are correct, press the SHIFT key to turn off the SHIFT indicator.

ON-HOOK A/B/C/D

Use the SHIFT key and numbers on the keypad to enter the signaling bits for an ON-HOOK condition. For ESF framing, there are four bits; for SLC96 and SF framing, there are two bits.

OFF-HOOK A/B/C/D

Use the SHIFT key and numbers on the keypad to enter the signaling bits for an ON-HOOK condition. For ESF framing, there are four bits; for SLC96 and SF framing, there are two bits.

When the settings are correct, press the ENTER key on the keypad.

6.10.2 SW56 Call Setup

Use this screen to place a SW56 call.

```
21:10:05
SW56 CALL SET UP
METHOD : MF
NUMBER : 2124596543
Rx A/B - 0 0
Tx A/B : 0 0
A = KP   B = ST
C = ST1  D = ST2
E = ST3  F = PAUSE (,)
MF      DTMF   DP
```

Figure 107 SW56 Call Setup Screen

METHOD

Options: MF (F1), DTMF (F2), DP (F3)

Use the F-keys to select the dial method:

- MF, multi frequency
- DTMF, dual tone multi frequency
- DP, dial pulse

NUMBER

To enter the number to dial use the following procedure.

1. Press the SHIFT key on the keypad.
2. Use the keypad to enter the numbers to dial. Use the keypad letters A, B, etc. to enter the special MF tones. For MF and DP dialing a pause (,) for one second is entered with the "F" key on the keypad
3. If a mistake is made while entering the number:
 - A. Press the SHIFT key on the keypad to remove the SHIFT indicator.
 - B. Use the arrow keys on the keypad to select the digit to be changed.
 - C. Press the SHIFT key and enter the number using the number keys on the keypad.

Note: All digits to the right will be erased. Enter a USER number either by entering the digits on this line and pressing the STORE (more, F2) F-key, or by pressing the USER (more, F1) F-key and then entering the digits.

4. Apply the appropriate supervision once the number is entered.
 - A. Select one: ON-HOOK (F1), OFF-HOOK (F2), or WINK (F3).
 - B. If a dial tone is expected, press the VOL UP key on the keypad until it can be heard.
 - C. Dial the number by pressing the ENTER key on the keypad.

6.10.3 Measurement Results

```
21:10:05
ELAP TIME- 000:09:51
FRME- SF-D4      CODE- B8ZS
RATE- 56K        PATT- 2047

Rx A/B  - 0 0
Tx A/B  : 0 0

RESULTS
BIT   : 0003    BER   : 8.8e-08
UAS   : 0       %UAS  : 00.000

RESTART ON-HOOK OFFHOOK WINK
```

Figure 108 Measurement Results Screen

The following items appear in Figure 108.

ELAP TIME: Elapsed time count starts counting after entering the Switched 56 Testing screen.

FRME: Displays the transmitted framing type.

CODE: Displays the transmitted coding type.

RATE: This is the test rate. In Figure 108, the RATE is 56k.

PATT: Displays the transmitted test pattern.

RXA/B: This is the received signaling bits. A/B format for SF-D4 and SLC96, A/B/C/D format for ESF framing.

TXA/B: Displays the transmitted signaling bits. To change them:

1. Press the appropriate F-key: ON-HOOK (F1), OFFHOOK (F2), or WINK (F3).
2. The actual bits sent for each condition can be set in the SW56 TEST CONFIGURATION screen.

BIT: Count of bit errors during the elapsed time.

BER: Rate of bit errors during elapsed time

UAS: Number of unavailable seconds during elapsed time

%UAS: Percentage of unavailable seconds during elapsed time.

To restart the measurements press the RESTART (F1) F-Key. Press the ESCAPE key on the keypad when testing is complete.

6.10.4 TELEOS Call Monitor

This feature allows the technician to observe a Teleos call setup in process, monitoring both directions in sequence. Refer to Figure 109.

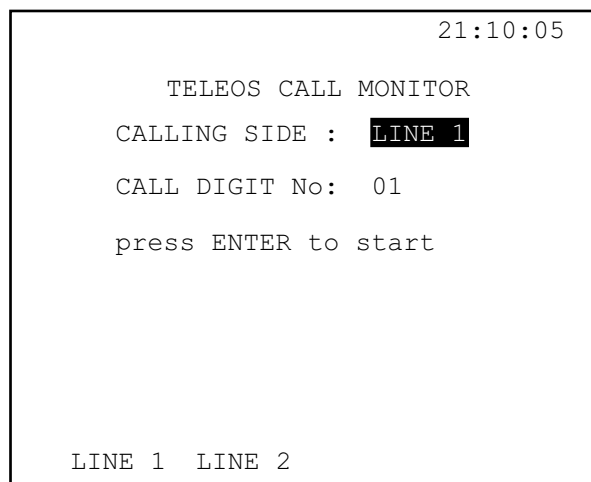


Figure 109 Teleos Call Monitor Setup Screen

To set up the Teleos call monitor:

1. Select the CALLING SIDE. Choose either Line 1 (F1) or Line 2 (F2).
2. Select the CALL DIGIT No by using the NEXT (F1) and PREV (F2) F-keys; select a value between 1 and 40.
3. Press the ENTER key on the keypad to start monitoring.

7.0 VF Channel Access

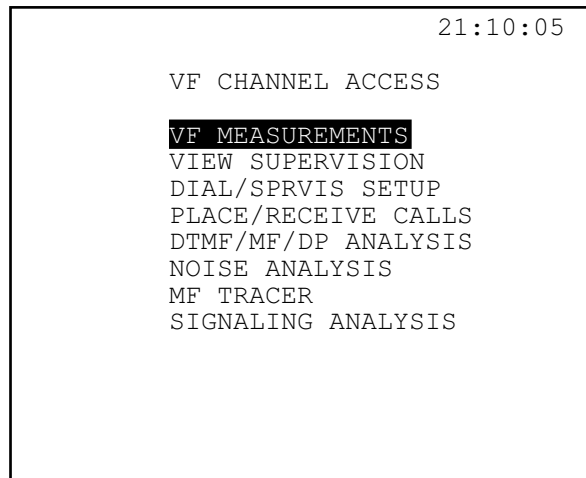


Figure 110 VF Channel Access Menu

Notes:

- VF CHANNEL ACCESS will not function properly if the SF, ESF, or SLC- 96 LED is not on. One of these three LEDs indicate that the framing found on the received signal matches the framing selected in the TEST CONFIGURATION menu. It is impossible to talk, listen, or perform other channelized functions in the absence of frame synchronization, since channels can be identified only within a framed signal.
- In VF CHANNEL ACCESS, when the TxSOURCE in the TEST CONFIGURATION screen is set to NORMAL/TESTPAT, an idle channel code and signaling will be inserted into channels that are not selected. The idle channel code is programmed from MAIN MENU > OTHER FEATURES > OTHER PARAMETERS > IDLE CHNL CODE.

7.1 VF Measurements

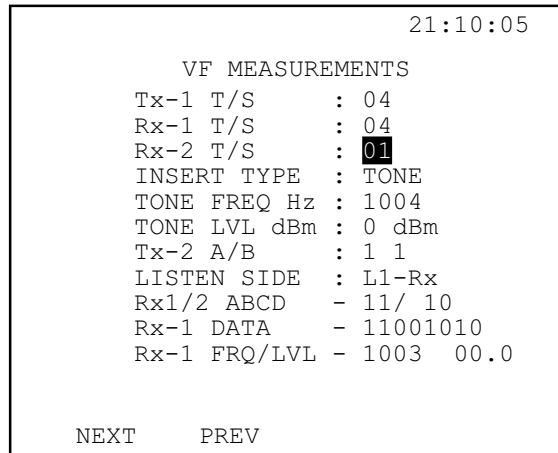


Figure 111 VF Measurements Setup Screen

The VF MEASUREMENTS setup screen determines:

- the channel to test for receiving and transmitting.
- whether to talk, send a tone, or place a quiet termination on the transmit signal. In T1DUAL mode, the test channel can pass through unchanged.
- tone frequency and level.
- signaling bits to send.
- line, or lines used for listening.

The VF MEASUREMENTS menu also shows the:

- received signaling bits.
- received 8 bit data.
- received frequency and level.

The following Voice Frequency features, as shown in Figure 111 should be configured in this screen:

Tx-1 T/S / Tx-2 T/S

Options: 1–24

Note: The VF Measurements Screen will display either Tx-1 T/S or Tx-2 T/S as the first field on the menu.

The display will show Tx-1 T/S when:

- T1SINGL was selected under TEST CONFIGURATION, or
- T1DUAL was selected under TEST CONFIGURATION and the value for Tx / INSERT is set to L1-Tx (Line 1).

The display will show Tx-2 T/S:

- when you have selected T1DUAL under TEST CONFIGURATION and the value for Tx / INSERT is set to L2-Tx (Line 2).
- Use the F-keys, NEXT (F1) or PREV (F2), to select the time slot value to which you will insert signals via Line 1 (Tx-1) or Line 2 (Tx-2).

Note: The SunSet T10 will begin insertion only after the selected time slot number has flashed five times. This momentary delay ensures that you do not insert data on each time slot that is displayed as you move to the correct selection.

Rx-1 T/S

Options:1–24

- Use this field to enter the received time slot value if:
 1. T1SINGL was selected under TEST CONFIGURATION, or
 2. T1DUAL was selected under TEST CONFIGURATION and the value for Rx / DROP is set to L1-Rx (Line 1).
- Use the F-keys, NEXT (F1) or PREV (F2), to select the time slot value from which you will drop signals via Line 1 (Tx-1).
- As the transmit time slot is changed, the receive time slot automatically changes. However, you can manually change the receive time slot if necessary.

Rx-2 T/S

Options:1–24

- Use this field to enter the received time slot value if:
 1. T1DUAL was selected under TEST CONFIGURATION and the value for Rx / DROP is set to L2-Rx (Line 2).
 - If T1SINGL was selected under TEST CONFIGURATION, this field will read N/A.
- Use the F-keys, NEXT (F1) or PREV (F2), to select the time slot value from which you will drop signals via Line 2 (Tx-2).
- As the transmit time slot is changed, the receive time slot automatically changes. However, you can manually change the receive time slot if necessary.

INSERT TYPE

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

Select the desired insert type.

TALK: Use to talk on the transmit signal. The SunSet T10 will transmit speech from the microphone, located at the bottom of the SunSet T10.

TONE: Use to insert a tone on the transmit signal.

QUIET: This places a quiet termination on the transmit signal.

Note: If selecting TONE, use the next two settings to set the tone frequency and level.

TONE FREQ Hz

Options: 50 Hz–3950 Hz

If selecting TONE as the INSERT TYPE, then select the tone frequency here. Change the frequency in two ways:

- Press the F-key corresponding to the desired frequency; five frequencies are available: 404, 1004, 1804, 2713, or 2804 Hz.
- Use the SHIFT and number keys on the keypad to enter the desired value. Select any value from 50–3950 Hz. If entering in a frequency with the keypad numbers, the ENTER key on the keypad will need to be pressed. Alternatively, move the cursor off the TONE FREQ line to start sending the new tone.

TONE LEVEL dBm

Options: -60 to 3 dBm

If selecting TONE as the INSERT TYPE, then select the tone level here. To change the tone level:

1. Press the SHIFT key on the keypad and enter the desired value from the keypad. Select any value from -60 to 3 dBm.
2. Press the SHIFT key on the keypad to release the SHIFT lock.
3. Press MINUS (F1) to select negative values.
4. To send the new tone level, press ENTER key on the keypad. Alternatively move the cursor off the TONE LEVEL dBm line.
5. There are two F-key choices provided, 0 dBm (F1), and -13 dBm (F3).

Tx-1 A/B/C/D

Options: ON-HOOK (F1), OFF-HOOK (F2), FLASH/WINK (F3), SEND (F4)

If desired, the signaling bits that are transmitted on the selected channel may be changed.

- If in T1SINGL mode, these bits are sent on line 1
- If in T1 DUAL Mode, they are sent on the line that has been selected for Tx/INSERT in the TEST CONFIGURATION screen.
- For SF-D4 and SLC96 framing, these will be A/B bits.
- For ESF framing, these will be A/B/C/D bits.

The exact bits sent for each condition will depend upon the supervision trunk chosen in Dial/SPRVIS SETUP. To manually change these bits use the following procedure.

1. Press the SHIFT key on the keypad, and use the 1 and 0 number keys to enter the bits.
2. Press the SHIFT key to release the SHIFT lock
3. Press the SEND (F4) F-key to send the A/B/C/D bits.

LISTEN SIDE

Options: L1-Rx (F1), L2-Rx (F2), BOTH (F3)

This setting determines the listen line(s). Listening on Line 1, Line 2, or on both lines is possible.

Note: For T1SINGL Mode, the Listen Side is automatically set for Line 1 and cannot be changed.

The last three lines of the VF Configuration screen contain default values that can not be changed from this screen. (This is indicated by the hyphen separating the field name from the field value).

Rx-1/Rx-2 A/B/C/D

This displays the signaling system (CAS) bits associated with the selected channel.

- For T1 SINGL, only Rx-1 bits are displayed.
- For T1 DUAL, both Rx-1 and Rx-2 bits are displayed.

Rx-1/Rx-2 DATA

This shows the live 8 bit channel data as it is received. The display will show Rx-1 DATA when:

- T1 SINGL was selected under TEST CONFIGURATION, or
- T1 DUAL was selected under TEST CONFIGURATION and the value for Rx/DROP is set to L1-Rx (Line 1).

The display will show Rx-2 DATA when:

- T1 DUAL was selected under TEST CONFIGURATION and the value for Rx/DROP is set to L2-Rx (Line 2).

Rx-1/Rx-2 FRQ/LVL

This shows the frequency and level as it is received. The display will show Rx-1 FRQ/LVL when:

- T1 SINGL was selected under TEST CONFIGURATION, or
- T1 DUAL was selected under TEST CONFIGURATION and the value for Rx/DROP is set to L1-Rx (Line 1).

The display will show Rx-2 FRQ/LVL when:

- T1 DUAL was selected under TEST CONFIGURATION and the value for Rx/DROP is set to L2-Rx (Line 2).

7.2 View Supervision

					21:10:05
T/S	ABCD	ABCD	ABCD	ABCD	
L 01	0000	0000	0000	0000	
I 05	0000	0000	0000	0000	
N 09	0000	0000	0000	0000	
E 13	0000	0000	0000	0000	
1 17	0000	0000	0000	0000	
21	0000	0000	1111	0000	
T/S	ABCD	ABCD	ABCD	ABCD	
L 01	0000	0000	0000	0000	
I 05	0000	0000	0000	0000	
N 09	0000	0000	0000	0000	
E 13	0000	0000	0000	0000	
2 17	0000	0000	0000	0000	
21	0000	0000	0000	0000	

Figure 112 View Line 1 & 2 CAS

VIEW SUPERVISION allows viewing of the signaling bits for all 24 channels, for both Lines 1 and 2. The status on all channels can be observed at the same time.

Shown on the first line in Figure 112 are time slots 1 through 4, shown on the second line are time slots 5 through 8, etc.

Note: SF-D4 and SLC-96® framed signals will show A/B bit signaling information. ESF will show A/B/C/D signaling bit information; for every six frames, the least significant bit is “robbed” and used to transmit signaling information.

7.3 Dial/Supervision Setup

```
21:10:05  
  
DIAL/SPRVIS SETUP  
  
DIAL PERIOD      : 100ms  
SILENT PERIOD   : 100ms  
TONE LEVEL dbm  : -5  
SUPERVISION  
TRUNK TYPE      : E & M  
EQUIPMENT       : N/A  
DIAL PULSE (10pps)  
%BREAK          : 60  
INTERDIGIT PRD : 500  
BKWD SPRVISN   : 1 0  
IDLE SPRVISN   : 0 0  
  
E & M  G-START L-START  USER
```

Figure 113 Dial/Supervision Setup

The DIAL/SPRVIS setup screen provides additional parameters for VF procedures. In this screen, the on and off time for the DTMF, MF, and DP digits can be varied. The SunSet T10 can be set up to send appropriate signaling bits for E&M, loop start, and ground start trunks with FX0 or FXS line cards.

1. Select MAIN MENU > VF CHANNEL ACCESS > DIAL/SPRVIS SETUP. Configure the following settings:

DIAL PERIOD

Options: 30 ms–999 ms

- Dial Period specifies the period in milliseconds for DTMF and MF dialing.
 - The default value is 100 ms
 - To select any value between 30 and 999 ms, use the following procedure.
1. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
 2. Enter the desired value from the keypad. To select a value less than 100 ms, add a 0 first, for example: 50ms = 050.
 3. Press the SHIFT key on the keypad to remove the SHIFT indicator.

SILENT PERIOD

Options: 30 ms–999 ms

- Silent Period specifies the period in milliseconds for DTMF and MF dialing.
 - The default value is 100 ms.
 - To select any value between 30 and 999 ms, use the following procedure.
1. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
 2. Enter the desired value from the keypad. To select a value less than 100 ms, add a 0 first, for example: 50ms = 050.
 3. Press the SHIFT key on the keypad to remove the SHIFT indicator.

TONE LEVEL dbm

Options: -25 to -5 dbm

Press the appropriate F-key, NEXT (F1) or PREV (F2), to select the desired tone level in 1 dB steps.

Supervision Trunk Type

Options: E&M (F1), G-START (F2), L-START (F3), USER (F4)

- Select the appropriate trunk type.
 - These trunk types will determine the exact signaling bits transmitted for each signaling condition.
 - To use custom on/off-hook signaling bits:
1. Press USER (F4) F-key and the user SPRVIS selection screen will appear.
 2. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
 3. Manually enter the OFF-HOOK/ON-HOOK signaling bits with the keypad numbers (1 and 0).
 4. Press the SHIFT key on the keypad to remove the SHIFT indicator.

EQUIPMENT

Options: FXO (F1), FXS (F2). For E/M Trunk Type, this will be N/A.

- If selecting either Ground-Start or Loop-Start trunk type, then select the equipment type on this line.

DIAL PULSE (10pps)

- Dial pulse is set for 10 pps and may not be changed.

% BREAK

Options: 40%, 50%, 60%

- Percent break is the ratio of the break (on-hook) interval to the total pulse cycle interval.
- Use the F-keys, NEXT (F1) and PREV (F2), to select the desired percentage.

INTERDIGIT PRD

Options: 100–900 (hundred intervals only)

- Use the F-keys, NEXT (F1) or PREV (F2), to select the interdigit period.

BKWRD SPRVISN

- In T1 Dual Mode, these bits are sent in the opposite direction of the inserted talk/tone.
 - For example if inserting a tone on T/S 06, and Tx/INSERT is set to L1-Tx (Line 1), then the SunSet T10 will transmit the backward supervision bits on T/S 06 of Line 2.
 - Use this procedure to set the backward supervision bits.
1. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
 2. Manually enter the backward supervision bits with the keypad numbers (1 and 0).
 3. Press the SHIFT key on the keypad to remove the SHIFT indicator

IDLE SPRVISN

- These bits are placed on idle channels.
 - Use this procedure to set the idle supervision bits.
1. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
 2. Manually enter the four idle supervision bits with the keypad numbers (1 and 0).
 3. Press the SHIFT key on the keypad to remove the SHIFT indicator.

7.4 Place/Receive Calls

```
21:10:05  
  
PLACE/RECEIVE CALLS  
  
METHOD : DTMF  
TX AB : 0 1 ON-HOOK  
NUMBER : 14542321  
  
TX CHNL : 01  
RX CHNL : 01  
RX AB : 0 1 OFFHOOK  
  
E = '*' F = '#'  
  
MF DTMF DP
```

Figure 114 Place/Receive Calls Menu

The Place/Receive Calls menu configures a number of dialing functions.

- Place a DTMF, MF, or DP call.
- Receive a DTMF, MF, or DP call.
- Control the transmitted supervision and observe the received supervision.
- Speed dial a stored number.
- Record a number with a label for future dialing.
- Edit or delete speed dial numbers.

The following selections are provided in the Place/Receive Calls Menu.

METHOD

Options: MF (F1), DTMF (F2), DP (F3)

MF: Multi Frequency is an addressing technique used for interoffice signaling in a telephone network. It uses a group of frequencies in pairs to form a single address tone. MF supports the digits 0 through 9, as well as many other control codes. When selecting MF these control codes appear at the bottom of the screen.

DTMF: Dual Tone Multi Frequency is the most commonly used addressing method on today's phones. Like MF, it uses pairs of tones to send a digit. Unlike MF, it uses two separate groups of tones. DTMF supports 16 digits: 0 through 9, #, *, and A through D.

DP: Dial Pulse is the oldest addressing technique. With pulse dialing, the phone goes on-hook and off-hook 10 times per second in order to dial a given number. To dial the number 7, the

SunSet T10 starts in the off-hook condition and then goes on-hook/ off-hook seven times. This type of addressing is used in switched 56 services.

TX AB

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

- TX AB selects the transmit signaling bits.
- The exact supervision will depend on the supervision trunk type and equipment settings in the DIAL/ SPRVIS SETUP screen.

OFF-HOOK: When in the OFF-HOOK state, you may select FLASH. FLASH transmits supervision bits creating a momentary on-hook state; the set automatically returns to off-hook.

ON-HOOK: When in the ON-HOOK state, you may select WINK. WINK transmits supervision bits creating a momentary off-hook state; the set automatically returns to on-hook.

NUMBER

- To enter the digits to be dialed:
 1. Press the SHIFT key on the keypad, the SHIFT indicator appears.
 2. Enter the desired numbers and letters if applicable using the keypad.
 - A. For DTMF and MF dialing, a legend appears at the bottom of the screen showing which keypad letters correspond to which control codes.
 3. Press the SHIFT key on the keypad to remove the SHIFT indicator.

Tx CHNL

F-keys: NEXT (F1), PREV (F2), SCAN (F3)

NEXT & PREV: Assigns the transmit channel. Use NEXT or PREV, to choose the desired transmit time slot for the T1 Line. Select from 1–24.

- If selecting T1 SINGL mode in the TEST CONFIGURATION screen, this line will be Line 1.
- If selecting T1 DUAL mode in the TEST CONFIGURATION screen, this will be the line selected for Tx/INSERT.

Note: The SunSet T10 will begin insertion only after the selected time slot number has been flashed five times. This momentary delay ensures that you do not insert data on each time slot that is displayed as you move to the correct selection.

SCAN: The SunSet T10 is in receive mode. The SunSet T10 searches all time slots for an on-hook to off-hook transition. When it finds this transition, it locks on that time slot and waits for the digits. The SunSet T10 will notify the user with the message, "Incoming call on Channel 01" (as appropriate). The user may then accept or reject this call.

Rx CHNL

F-keys: NEXT (F1), PREV (F2), SCAN (F3)

- Assigns the receive channel.
- If the transmit and receive channels are the same, changing the transmit (Tx) channel will automatically change the receive channel.
- If these channels to be different, select RxCHNL and use the F1 or F2 keys. Refer to TxCHNL for more details.

Rx ABCD

- Displays the received signaling bits; it is for viewing only.

7.5 DTMF/MF/DP Analysis

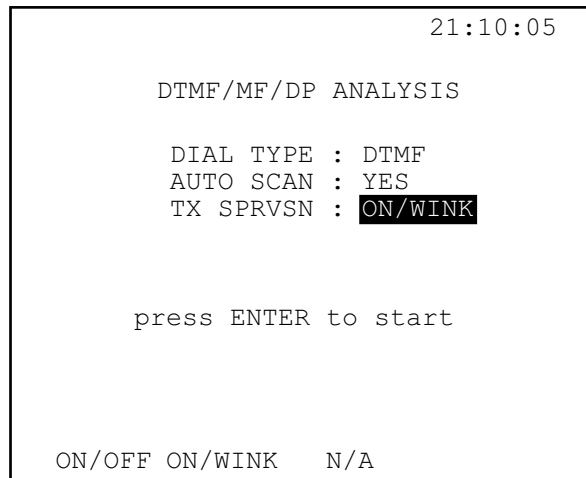


Figure 115 DTMF/MF/DP Analysis

To enter DTMF/MF/DP ANALYSIS, select from the MAIN MENU > VF CHANNEL ACCESS > DTMF/MF/DP ANALYSIS. Configure the following items.

DIAL TYPE

Options: MF (F1), DTMF (F2), DP (F3)

- Choose the dial type.

AUTO SCAN

Options: YES (F1), NO (F2)

YES: Enable auto scan by selecting YES. When in scan mode, the SunSet T10 will rapidly scan all 24 receive channels for any channel that goes from the on-hook to off-hook state. When the SunSet T10 finds a channel going off-hook, the SunSet T10 will lock onto that channel and wait for digits to be transmitted.

NO: If NO is selected, the transmit and receive time slots must be entered. In this mode, the SunSet T10 will analyze the selected receive channel only.

Tx SPRVN

Options: Auto Scan: ON/OFF (F1), ON/WINK (F2), N/A (F3)
1 channel: ON/OFF (F1), ON/WINK (F2), MANUAL (F3)

Transmit Supervision determines the reply to an off-hook.

ON/OFF: Choose to start sending an on-hook while sending an off-hook in response to a received off-hook.

ON/WINK: Choose to start sending an on-hook while sending a wink in response to a received off-hook.

MANUAL: Choose to manually send on-hooks, off-hooks, winks, and flashes in response to an off-hook.

N/A: For AUTO SCAN mode only. Returns to normal AUTO SCAN mode. No specification for Tx SPRVN.

After completing the settings, press the ENTER key on the keypad to begin the analysis. Continue reading for more information on the analysis procedure. DTMF digit scanning is used as an example; an MF or DP analysis will provide different information.

DTMF Analysis, an example

1. Configure the DTMF/MF/DP Analysis, as shown in Figure 115. When finished, press the ENTER key on the keypad.
2. If in the SCAN mode, a flashing "SCANNING" message on the CHANNEL line will be displayed. This message will continue to flash until the SunSet T10 finds a channel going from on to off-hook. The SunSet T10 will then show which channel, as well as the Rx and Tx supervision bits, it has found. Refer to Figure 116.
3. The received digits are 4083638000. Refer to Figure 116.
4. To scan again, press the SCAN (F2) F-key and the SunSet T10 will start looking for another channel going off-hook.
5. Pressing the ANALYZE (F1) F-key will give a detailed analysis of each digit. Refer to Figures 116 and 117.

Figure 117 displays information on the first three digits (4, 0, 8). Use the PAGE-DN (F2) F-key to view the other digits. The following information is provided for each digit:

- The High (H) and Low (L) frequencies in Hz and dBm.
- The interdigit period (INTD) in microseconds. Note that there is no INTD for the first digit.
- The dial period (PERD).
- The TWST (Twist), which is the difference in level between two frequencies.

```
21:10:05

DTMF/MF/DP ANALYSIS

DIAL TYPE : DTMF
CHANNEL   : 01
RX AB     : OFFHOOK
TX AB     : ON-HOOK

RxDIGIT:
4083638000

ANALYZE   SCAN
```

Figure 116 DTMF / MF / DP Analysis Screen 1

```
21:10:05

DTMF/MF/DP ANALYSIS

DIGIT-1 : 4          INTD:----ms
H/L Hz 1209/ 0767   PERD:0101ms
dbm-6.4/-4.6      TWST:+1.8

DIGIT-2 : 0          INTD:0099ms
H/L Hz 1336/ 0944   PERD:0101ms
dbm-6.4/-4.5      TWST:+1.9

DIGIT-2 : 8          INTD:0099ms
H/L Hz 1336/ 0852   PERD:0101ms
dbm-6.4/-4.6      TWST:+1.8

PAGE-UP   PAGE-DN
```

Figure 117 DTMF / MF / DP Analysis Screen 2

7.6 Noise Analysis (SW 183)

```
21:10:05
NOISE MEASUREMENT
MEASURE : 3K-FLAT
RX CHNL : 18
RESULTS
Signal to Noise:      dB
Noise C-Message:     dBrnC
Noise 3K-Flat   : 71.6 dBrn
Noise C-Notch   :     dBrn
S/N  C-MESG  3K-FLAT  C-NOTCH
```

Figure 118 Noise Analysis Menu

Noise Analysis measures noise using the following four parameters:

- Signal-to-Noise
- Noise C-Message filter
- Noise 3K- Flat filter
- Noise C-Notch filter

1. Press an F-key to begin one of the four noise measurements:

- Signal-to-Noise (F1)
- C-Message (F2)
- 3 kHz flat (F3)
- C-Notch (F4)

2. After an F-key is pressed, the measurement will start.

3. To change the noise measurement at any time, press a different F-key. The previous measurement results are kept, but only the result for the current measurement type is updated.

4. When the noise analysis is completed, press the ESCAPE key on the keypad to return to VF CHANNEL ACCESS.

7.7 MF Tracer

MF tracer analyzes ABCD bits and MF digits on both lines. MF tracer is not supported in the T1 SINGL test mode. Confirm that T1 DUAL is selected in the TEST CONFIGURATION screen. The MF tracer menu offers two options:

- MF TRACER: This function traces the received ABCD bits for both lines with time and date information.
- MF VIEW/PRINT TRACER: This function allows the user to view and print specific MF ABCD bits with time and date information.

7.7.1 MF Tracer

```
21:10:05
L1- RX CHANL : 21      L2- RX CHNL  :18
LINE-1#01/ sec      LINE-2#24/ sec
ABCD = 00 / INIT    ABCD= 00/ INIT
ABCD = 11 / 00.000
MFR1 =  KP/ 01.568
MFR1 =  1 / 01.768
MFR1 = ST1 / 01.968
MFR1 =  8 / 02.168
MFR1 =  6 / 02.368
MFR1 = ST2 / 02.568
MFR1 = ST1 / 02.768
                                ABCD= 11/05.587

STOP                          RESTART
```

Figure 119 MF Tracer Screen

MF TRACER traces the received ABCD bits and MF digits. MF TRACER may be used to time winks or other changes of state in the ABCD bits. Refer to Figure 119.

In Figure 119, the SunSet T10 receives MF forward digits from Line 1 (on time slot 1). The initial signaling state is shown for both Lines 1 and 2. Both start on-hook (00: E&M signaling). Line 1 shows an off-hook signal (11), followed by the digits (00.000). The KP (beginning of pulsing) and ST (end of pulsing) codes represent control signals used in the MF system.

Notes:

- Time records a 200 ms between digits; this is a combination of the dial period and the silent period
- Shown in this screen are two F-keys: STOP (F1) and RESTART (F3). Pressing the RESTART F-key will erase any displayed results. Pressing the STOP F-key will stop the tracing for viewing.
- After pressing the STOP (F1) F-key, a cursor appears at L1-Rx and L2-Rx . Change the received channels by pressing the F-key and entering a number from 01 through 24.

7.7.2 MF View / Print Tracer

F-keys: CLR-ALL (F1), PRINT (F2), VIEW (F3)

- This second option in the MF Tracer Menu allows for viewing and printing of specific MF ABCD bits and digits.

CLR-ALL: Clears all stored data. Upon pressing CLR-ALL, a warning message appears to prevent accidentally erasing the buffer contents. As the instructions indicate, press ENTER to continue (and erase) or ESCAPE to cancel (and keep the messages).

PRINT: Allows printing of selected pages.

VIEW: Allows viewing of selected pages of ABCD bits. Shown in Figure 120 is the MF View Tracer screen.

Note: To view, or print a limited number of these pages, use the SHIFT key and keypad numbers to enter the desired numbers in the VIEW FROM and VIEW TO lines.

```
21:10:05  
  
LINE 1    96-12-02  01:52:07  
          ST2/01.000  
  
LINE 1    96-12-02  01:52:07  
          ST1/01.200  
  
LINE 1    96-12-02  01:52:33  
ABCD=00  /INIT  
  
LINE 2    96-12-02  01:52:33  
ABCD=00  /INIT  
  
PAGE-UP  PAGE-DN
```

Figure 120 MF View Tracer Screen

As shown in Figure 120, the screen displays the Line (1 or 2), the digit (or signaling bits) and the time. A date/time stamp is provided for each digit and initial signaling state. Use the PAGE-UP (F1) and PAGE-DN (F2) F-keys to view the available screens.

7.8 Signaling Analysis

Supported in both T1SINGL and T1DUAL modes SIGNALING ANALYSIS analyzes the ABCD bits and timing at 1 ms resolution. SIGNALING ANALYSIS displays simultaneous ABCD changes at 3 ms resolution for both lines when the SunSet T10 is in the T1DUAL Mode.

Figure 121 shows the AB-Bits screen after the STOP (F1) F-key has been pressed. This screen shows the actual bits received on L1-Rx if running in T1SINGL mode. If in T1DUAL mode, another column will appear to the right of the L1-RX CHNL column displaying the bits from L2-Rx. A time stamp appears to the right of the bits; this represents the time since the beginning of the test.

```
21:10:05
L1-RXCHNL: 15
LINE-1#15/sec
ABCD=0000/INIT
ABCD=1111/00.000
ABCD=0000/38.156
ABCD=1111/41.036
ABCD=0000/45.356
ABCD=1111/45.815
ABCD=0000/50.438
ABCD=1111/52.496
ABCD=0000/52.757
ABCD=1111/56.999

PAGE-UP PAGE-DN RESTART DECODE
```

Figure 121 Signaling Analysis, AB-Bits

Options: STOP/PAGE-UP (F1), PAGE-DN (F2, appears after STOP is pressed), RESTART (F3), DECODE/AB-bits (F4)

STOP: Stops the analysis to view the results. STOP is replaced by PAGE-UP.

PAGE-DN: Appears after STOP is pressed. Use to page through the available screens.

RESTART: Restarts the analysis.

DECODE/AB bits: Toggles the display between the AB-Bits screen (Figure 121) and the DECODE screen (Figure 122).

Figure 122 shows the DECODE screen. DECODE displays the decoded state as defined by the signaling type selected in the DIAL/SPRVS SETUP screen.

```
21:10:05
L1-RXCHNL: 15
LINE-1#15/sec
ABCD=ONHK/INIT
ABCD=OFHK/00.000
ABCD=ONHK/38.156
ABCD=OFHK/41.036
ABCD=ONHK/45.356
ABCD=OFHK/45.815
ABCD=ONHK/50.438
ABCD=OFHK/52.496
ABCD=ONHK/52.757
ABCD=OFHK/56.999

PAGE-UP  PAGE-DN  RESTART  AB-bits
```

Figure 122 Signaling Analysis, DECODE

You may select either screen while the SunSet T10 is receiving data, but decoded results only appear after pressing the STOP (F1) F-key.

8.0 GR-303 Monitor (SW193)

Software option SW193 provides monitoring and analysis features for the TMC/CSC and *eoc* channels. Select MAIN MENU > GR-303 ANALYSIS. Upon display, two options are available:

- Monitor TMC/CSC: Select to monitor the call management channel: TMC or CSC.
- EOC Verification: Select to monitor the *eoc* channel.

8.1 Monitor TMC/ CSC

Selecting Monitor TMC/CSC displays a screen with six options. The following sections describe these options.

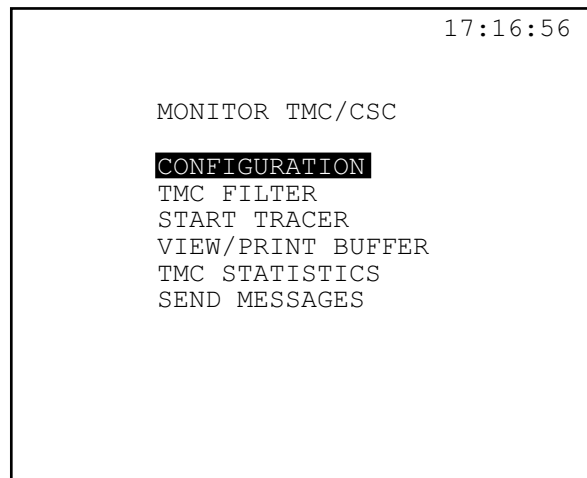


Figure 123 Monitor TMC/CSC Menu

8.1.1 Configuration

```
21:10:05
CONFIGURATION
TIME SLOT : 24
- TX ONLY -
LINE 1 DIR : RDT->IDT
INTERVAL   : 1 *100ms
MODE       : LOOP
COUNTS    : 1
INC+1     DEC-1     1/10
```

Figure 124 TMC Configuration Screen

The TMC configuration screen allows configuration of the SunSet T10 for monitoring of the TMC/CSC Time Slot. The TMC Time Slot can be changed if necessary (the default setting is Time Slot 24, as specified by GR-303-CORE). It also contains setup items to send TMC messages from the SunSet T10. Refer to Figure 124.

TIME SLOT

Options: 1–24

- Time slot determines which DS0 channel the SunSet T10 will monitor in TMC Start Tracer and TMC Statistics.
- The default channel is 24; this follows the GR-303-CORE specification. If required, a different channel maybe viewed.
- Press the INC+1 (F1) and DEC-1 (F2) F-keys to change the number. The 1/10 (F3) F-key adjusts the increment/decrement value of the F1 and F2 keys.

All other settings pertain to the send message feature only. Ignore these settings for monitoring. Send Messages allows programming a sequence of TMC messages (layer 2 and 3) for transmission.

8.1.2 TMC Filter

```
21:10:05
TMC FILTER
CRC CHECK      : OFF
LAYER-2 MSG    : REJECT
LAYER-3 MSG    : ON
CALL REF       : 100
DS1 NUMBER     : ALL
DS0 NUMBER     : ALL
CAUSE VALUE    : ALL
ALL  INC+100 DEC-100 1/10/100
```

Figure 125 TMC Filter

TMC Filter allows selective capturing of messages by layer, call reference, DS1/DS0 number, or cause value. The following settings are available:

CRC Check

Options: ON (F1), OFF (F2)

- CRC check determines if the SunSet T10 will detect and report Layer 2 CRC errors.

ON: Allows the SunSet T10 to capture invalid TMC messages and report them as a CRC ERROR.

OFF: This is the SunSet T10's default setting.

Layer-2 Msg

Options: REJECT (F1), ALL (F2)

REJECT: Select REJECT if interested only in call processing messages; Setup, Connect, and Release. The SunSet T10 will not capture any Layer 2 messages: RR, RNR, REJ, DM, SABME, UA, UI, DISC.

ALL: Select to capture all Layer 2 messages.

Layer-3 Msg

Options: REJECT (F1), ALL (F2), ON (F3)

REJECT: If selected, the SunSet T10 does not capture or display any Layer 3 messages.

ALL: Select to capture all Layer 3 messages.

ON: Provides further Layer 3 filtering. After selecting ON, more filter choices become available, as shown in Figure 125. This allows for filtering of specific Layer 3 messages (i.e. ones containing a particular call reference value).

Layer 3 Filter Settings

The following settings are available if Layer 3 is ON.

Call Ref

Options: 1–2048

- Allows the SunSet T10 to capture messages that contain a specific call reference number.
- A call reference number generally corresponds to the physical line termination port at the RDT, and thus, to a specific customer. If this is the case, the filter allows the SunSet T10 to capture messages belonging to a customer.

ALL (F1): Captures all call reference numbers.

INC+(F2) & DEC- (F3): Use the INC+ and DEC- F-keys to enter a specific call reference value. The SunSet T10 will now only capture messages containing the selected value. GR-303 specifies valid call reference values from 1–2048.

1/10/100 (F4): This key changes the increment/decrement value of the F2 and F3 keys.

DS1 Number

Options: 1–28

- The DS1 number feature allows the SunSet T10 to capture call control messages associated with a particular DS1 number.

ALL (F1): Captures all DS1 numbers.

INC+(F2) & DEC-(F3): Use the INC+ and DEC- F-keys to enter a specific call reference value. The SunSet T10 will now only capture messages containing this value. GR-303 specifies valid call reference values from 1–28.

1/10 (F4): Changes the increment/decrement value of the F2 and F3 keys.

DS0 Number

Options: 1–24

- Allows the SunSet T10 to capture call control messages associated with a particular channel. Depending on the DS1 number setting, this will be either one channel on all DS1 lines or one channel on a particular DS1.

ALL (F1): Captures all DS0 numbers.

INC+ (F2) & DEC-(F3): Use the INC and DEC keys to enter a specific DS0 number. The SunSet T10 will capture messages only containing this DS0 number. GR-303 specifies valid DS0 values from 1–24.

1/10 (F4): This key changes the increment/decrement value of the F2 and F3 keys.

CAUSE VALUE

- Allows the SunSet T10 to capture messages containing a specific cause value.
- Use this feature to monitor the GR-303 link and look for a protocol error (Invalid Information Content) or a release message saying channel unavailable.

ALL (F1): Captures all cause values.

SELECT (F2): To filter on a particular cause value:

1. Press the SELECT (F2) F-key. A Cause value screen is displayed showing all of the available cause value definitions.
2. Use the up/down arrow keys on the keypad to and press the ENTER key on the keypad to select the desired cause. Refer to Table 15.

Code #	Cause Value Definitions
016	Normal Clearing
027	Destination Out of Service
034	Channel Unavailable
035	Destination Channel Unavailable
041	Temporary Failure
044	Line Unit Unavailable
047	Ring Failure
081	Invalid Call Reference
096	Mandatory Element Missing
099	Information Element Unimplemented
100	Invalid Information Contents

Table 15 Cause Values

8.1.2.1 Pre and Post Filtering

The SunSet T10 provides for pre and post filters for GR-303 tracing. A pre-filter captures only specified messages in the buffer; it ignores the rest. A post-filter captures all messages in the buffer, then allows selective viewing of the messages.

To configure the SunSet T10 for pre-filtering:

1. Select MAIN MENU > GR-303 MONITOR > MONITOR TMC/CSC > START TRACER.
2. Press the more (F4) F-key, and press the FLTR-ON (F1) F-key.
3. A highlighted "FIL" indicator appears at the top of the screen. The SunSet T10 is now pre-filtering messages. It captures and stores only those messages matching the filter specified.
4. To disable the pre-filter, press the FLTR-OFF (F1) F-key; the FIL indicator disappears.

To post-filter messages:

Note: Make sure the Filter is off in the Start Tracer screen.

1. Select MAIN MENU > GR-303 MONITOR > MONITOR TMC/CSC > START TRACER, and allow the SunSet T10 to capture messages.
2. After tracing the messages press the ESCAPE key on the keypad and select VIEW/PRINT TRACER. The FLTR-ON (F4) F-key turns on the post-filter. The SunSet T10 displays the total number of messages captured, and then the total number of messages matching the filter criteria.
3. To turn off the post-filter, press the FLTR-OFF (F4) F-key.

8.1.3 Start Tracer

1. Select MAIN MENU > GR-303 MONITOR > MONITOR TMC/CSC > START TRACER.
2. The live messages appear on the display and are stored in the buffer.

Note: The Start Tracer screen must be displayed to capture messages.

```

          FIL 21:10:05
  BUFFER No.695  CURRENT No.15

  98-02-15 20:29:36
  RDT<-IDT

  STATUS
  CALL REF 1948
  CALL REF SUFFIX 0
  Non-ISDN
  CAUSE 81
  Invalid Call Reference
  CALL STATE 0
  Null

  RESTART PAUSE HEX more
```

Figure 126 Start Tracer Screen

The following information is displayed on this screen:

Buffer No: Total number of messages stored in the buffer.

Current No: Total number of messages captured since entering the Start Tracer screen.

Date and time stamp: Displays the capture time and date of the message.

RDT<-IDT: Displays the direction of the message, whether it came from the RDT (Remote Digital Terminal) or IDT (Integrated Digital Terminal).

Message Type and Information Element contents: Refer to section 8.1.4, View/Print Buffer for a description of message type and information element contents.

The following F-keys are within the Start Tracer screen:

Options: RESTART (F1), PAUSE/RESUME (F2), HEX (F3), FLTR-ON/FLTR-OFF (more, F1), SCROLL (more, F2), CLR-ALL (more, F3)

RESTART: Clears the current screen display and resets the current number to 0. RESTART does not erase any messages stored in the buffer.

PAUSE: Stops the live capture mode. After pressing the F2 key, a PAUSE indicator appears at the top of the screen. When this indicator is present, the SunSet T10 is not capturing messages. Press the RESUME (F2) F-key to start capturing messages again.

HEX: When a message is present, pressing the HEX F-key displays the message in hexadecimal format.

FLTR-ON: This F-key sets a pre-filter. When the FLTR-ON (F1) F-key is pressed, a FIL indicator appears at the top of the screen. When this is present, the SunSet T10 captures only those messages that match the TMC FILTER settings. To turn off the pre-filter, press the FLTR-OFF (F1) F-key.

SCROLL: Allows paging through the messages stored in the buffer. Upon pressing the SCROLL F-key, a SCR indicator appears at the top of the screen and two F-key options appear: PAGE-UP (F1) and PAGE-DN (F2). These allow viewing of all of the messages. Press the RETURN (F4) F-key to exit the scroll mode. Note that messages are captured and stored in scroll mode.

CLR-ALL: Clears all messages stored in the buffer. Upon pressing CLR-ALL, a warning message appears to prevent accidentally erasing the buffer contents. As the instructions indicate, press the ENTER key to continue (and erase) or the ESCAPE key to cancel (and keep the messages).

8.1.4 View / Print Buffer

```
21:10:05  
  
VIEW/PRINT TRACER  
  
TOTAL RECORD-371  
  
VIEW FROM : 1  
VIEW TO   : 371  
  
POST FILTER IS OFF  
  
CLR-ALL  PRINT  VIEW  FLTR-ON
```

Figure 127 View / Print Tracer

The View/Print Tracer screen allows viewing, or printing of all messages stored in the buffer. Figure 127 shows the initial screen.

F-keys: CLR-ALL (F1), PRINT (F2), VIEW (F3), FLTR-ON (F4)

CLR-ALL: Clears all messages stored in the buffer. Upon pressing a warning message appears, this prevents accidentally erasing the buffer contents. As the on screen instructions indicate, press the ENTER key to continue or the ESCAPE key to cancel.

PRINT: The buffer contents are sent to the SunSet T10's serial port for printing. Only those messages specified by the VIEW FROM and VIEW TO settings are sent. They may be sent to a serial printer or PC set for terminal emulation. The print out contains a time and date stamp, full decode, and hexadecimal for each message.

VIEW: Displays the messages as specified by the VIEW FROM and VIEW TO settings.

FLTR-ON: Enables post-filtering. This allows viewing only those messages that match the filter parameters set in TMC FILTER. Upon pressing FLTR-ON, the following screen shown in Figure 128 is displayed.

```
17:16:56
VIEW/PRINT TRACER

TOTAL RECORD-371
QUALIFIED   -32

VIEW FROM : 1
VIEW TO   : 32

POST FLITER IS ON

CLR-ALL  PRINT  VIEW  FLTR-OFF
```

Figure 128 View Tracer with Post-filter

View Tracer with Post-filter displays the total messages captured in the buffer. The following information is displayed.

QUALIFIED: Number of messages that match the filter settings specified in TMC FILTER. “No Match” is displayed, if no messages match the filter settings.

The following F-keys are available within this screen.

F-keys: CLR-ALL (F1), PRINT (F2), VIEW (F3), FLTR-OFF/FLTR-ON (F4)

CLR-ALL: Clears all messages stored in the buffer. Upon pressing, a warning message appears; this prevents accidentally erasing the buffer contents. As the on screen instructions indicate, press the ENTER key to continue or the ESCAPE key to cancel.

PRINT: Sends the buffer contents to the serial port for printing. It will send only those messages specified by the VIEW FROM and VIEW TO settings. The messages maybe printed to a serial printer or PC set for terminal emulation. The print out contains a time and date stamp, full decode, and hexadecimal for each message.

VIEW: Displays the messages as specified by the VIEW FROM and VIEW TO settings.

FLTR-OFF/FLTR-ON: Press FLTR-OFF to disable the post filter and view all messages in the buffer. Press FLTR-ON to enable the post-filter. This allows viewing only those messages that match the filter parameters set in TMC FILTER.

```

21:10:05
RECEIVE MESG NO.29

98-02-10 20:09:41
RDT<-IDT

RELEASE
CALL REF 97
CALL REF SUFFIX 0
Non-ISDN
DS1# 7
DS0# 14
CAUSE 16
Normal Clearing

PAGE-UP PAGE-DN HEX

```

Figure 129 Release Message

Figure 129 provides a sample message as seen when the VIEW (F3) F-key is pressed in Figure 128. Found in that message is the following information:

Date and time stamp (98-02-10, 20:09:41): Indicates the detection date and time of the message.

Direction of the message (RDT<-IDT): Indicates whether the message originated from the IDT (Integrated Terminal) or RDT (Remote Terminal).

Message Type(s):

- Setup: CSC and TMC
- Setup Acknowledge: CSC only
- Alerting: CSC only
- Call Proceeding: CSC only
- Notify: CSC only
- Information: TMC and CSC
- Connect: TMC and CSC
- Connect Acknowledge: TMC only
- Disconnect: TMC and CSC
- Release: TMC and CSC
- Release Complete: TMC and CSC
- Status: TMC and CSC
- Status Enquiry: TMC and CSC

CALL REF: Identifies the call (and customer) to which the message applies. Note that in many cases the CRV is associated with the LCA (Line Circuit Address), which is the physical location where the customer's distribution pair is terminated. Therefore, CRV identifies the customer. CRV values can range from 1–2048.

CALL REF SUFFIX: Identifies the particular call that applies to the message. The possible values are:

- Non-ISDN (or LT only supports one call at a time)
- B-channel 1 (ISDN BRI)
- B-channel 2 (ISDN BRI)

DS1 #: Identifies the DS1 line used for the call. This number can range from 1–28.

DS0 #: Identifies the DS0 channel used for the call. This number can range from 1–24.

CAUSE: Displays diagnostic information to the RDT or IDT as to why the call failed. For a listing of the possible GR-303 cause values and their meanings, refer to Table 15, Cause Values, in section 8.1.2, TMC Filter.

```
21:10:05
RECEIVE MSG NO. 161
98-02-10 20:15:23
RDT->IDT
SETUP
CALL REF 146
CALL REF SUFFIX 0
Non-ISDN
DS1# --
DS0# --
PAGE-UP PAGE-DN HEX INFO
```

Figure 130 Setup Message

The following F-Keys are available in Setup Message.

F-keys: PAGE-UP (F1), PAGE-DN (F2), HEX (F3), INFO (F4)

PAGE-UP: Scrolls to the previous message.

PAGE-DN: Scrolls to the next message.

HEX: Displays the message in hexadecimal format.

INFO: Displays a full decoding of any extra information elements contained in the message. The INFO F-key is not always displayed. Figure 129, Release Message, does not contain any other info elements, hence the INFO F-key is not present. The Setup Message screen shown in Figure 130 indicates extra information elements. Pressing the INFO F-key displays the decoded information elements.

The message displayed in Figure 130 is a Setup message sent by the RDT. The CRV is 146. The dashes next to the DS1 and DS0 numbers indicate that this information is not specified in this message. This is because the call is initiated by the RDT. When the IDT responds with a Setup Acknowledgment (CSC) or Connect (TMC) message, it will specify which DS1 and DS0 to use for the call.

8.1.5 TMC Statistics

21:10:05		
TMC STATISTICS	LINE1	LINE2
DEST OUT OF SERV :	0	0
CH UNAVAILABLE :	4	0
DIST CH UNAVAIL :	0	0
TEMP FAILURE :	0	1
LINE UNIT UNAVAIL:	0	0
RING FAILURE :	0	0
INVALID CALL REF :	3	3
MSG UNIMPLEMENTED:	0	0
INFO UNIMPLEMENT :	0	0
TOTAL TMC MSG :	567	603
RESTART PAUSE	%	

Figure 131 TMC Statistics

The TMC statistics page provides a running count of any cause values found in disconnect, release, release complete, and status messages. This screen must be active for the results to accumulate. Provided are results for both lines 1 and 2.

While in this screen, the messages are also stored in the View/Print Buffer. Therefore, if more details are needed for a certain cause value, review through the messages in View/Print Buffer. Setting a post-filter for the particular cause value will simplify the process.

The TMC filter also applies to the statistics screen. For example, if filtering on DS1 #5, only messages for DS1 #5 are recorded.

Note: Recorded at the bottom of the screen is the total TMC message count. This counts all valid TMC messages.

The following F-keys are available for the TMC Statistics screen.

F-keys: Restart (F1), Pause/Resume (F2), %/Count (F3)

Restart: This restarts the measurement and sets all counters to zero.

Pause/Resume: Pause stops the measurement. All counters remain at the current value, but do not increase. Press the Resume (F2) F-key to return to live measurements.

%/COUNT: Changes the results display to a percentage format. Press Count to return to a count display.

8.1.6 Send Messages

The SEND MESSAGES menu item allows sending messages from the SunSet T10 to another piece of test equipment. This has been included into this software option as a convenience item. It is not part of any standard test.

Select MAIN MENU > GR-303 MONITOR > MONITOR TMC/CSC > SEND MESSAGES and the following screen is displayed.

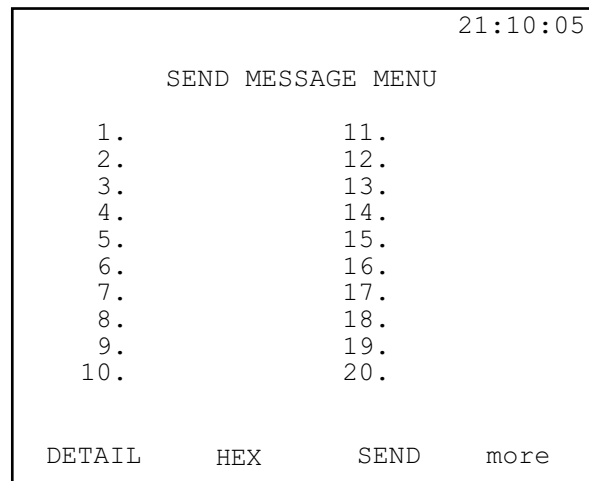


Figure 132 Send Message Menu

This menu facilitates sending user-programmed messages. Up to 20 messages may be stored. To send a message use the following procedure:

1. Select one of the messages
2. Press the SEND (F3) F-key.

The following F-keys are available within this menu.

F-keys: DETAIL (F1), HEX (F2), SEND (F3), INSERT (more, F1), DELETE (more, F2)

DETAIL: Displays the details of the selected message. If selecting no message, push this F-key to display the message composer.

HEX: Displays the HEX form of the selected message. If selecting no message, push this F-key to display the message HEX editor.

SEND: Transmits the selected message.

INSERT: At the selected message this F-Key inserts a blank line before the message.

DELETE: Deletes the selected message from the Send Message Menu.

To compose a new message, use the following procedure:

1. Select a empty message line from the SEND MESSAGE MENU and press the DETAIL (F1) F-key.
2. Displayed in to Figure 133 is the MESSAGE COMPOSER screen.

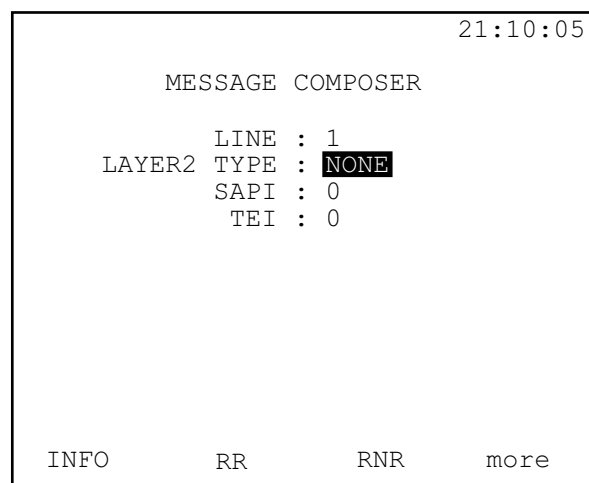


Figure 133 Message Composer

3. Four items are initially displayed.

LINE 1: This is the transmitting line for the message. This is pre-set and cannot be changed

LAYER 2 TYPE: Select from INFO (F1), RR (F2), RNR (F3), REJ (more, F1), SABME (more, F2), DM (more, F3), UI (more, F1), DISC (more, F2), UA (more, F3). Selecting any of the LAYER 2 TYPE moves the cursor to the next line, except for INFO. Press the INFO F-key and the following screen appears. Refer to Figure 134.


```
21:10:05
MESSAGE COMPOSER
LINE : 1
LAYER2 TYPE : INFO
SAPI : 0
TEI : 0
LAYER3 TYPE : SETUP
CALL REF : 1
DS1 : 1
DS0 : 1
BEARER CAP : 64Kbs,Circuit
SIGNAL : 64
INC+10 DEC+10 1/10
```

Figure 134 Message Composer with Layer 3

4. Make the following selections if selecting the INFO key from Figure 133.

LAYER 3 TYPE: SETUP (F1), SET-ACK (F2), ALERTIN (F3), CALPROC (more, F1), NOTIFY (more, F2), CONNECT (more F3), CON-ACK (more, F1), DISC (more, F2), RELEASE (more, F3), RELCOMP (more, F1), STATUS (more F2), STA-ENQ (more, F3) INFO (more, F1)

5. Make the following selections if SETUP was selected for LAYER # TYPE.

CALL REF: INC+1 (F1), DEC-1 (F2), 1/10/100 (F3). Use the 1/10/100 F-key to determine increment/decrement values for the F1 and F2 keys.

DS1: NONE (F1), INC+1 (F2), DEC-1 (F3), 1/10 (F4). Use the 1/10 F-key to determine increment/decrement values for the F2 and F3 keys.

DS0: NONE (F1), INC+1 (F2), DEC-1 (F3), 1/10 (F4). Use the 1/10 F-key to determine increment/decrement values for the F2 and F3 keys.

BEARER CAP: Fixed at 64kbs, Circuit.

SIGNAL: NONE (F1), NEXT (F2), PREV (F3). Use the NEXT or PREV F-keys to select from 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64, or 15.

6. If not selecting SETUP in step 4, select CALL REF, DS1, and DS0 from step 5.

7. For all selections, select SAPI and TEI

SAPI: INC+1 (F1), DEC-1 (F2), 1/10 (F3). Use the 1/10 F-key to determine increment/decrement values for the F1 and F2 keys.

TEI: INC+1 (F1), DEC-1 (F2), 1/10 (F3). Use the 1/10 F-key to determine increment/decrement values for the F1 and F2 keys.

8.2 EOC Verification

The eoc verification menu contains two items.

- EOC SETUP
- EOC STATISTICS

8.2.1 EOC Setup

The EOC SETUP screen allows configuring the SunSet T10 for monitoring the eoc channel. The eoc channel may be changed; the default setting is channel 12, as specified by GR-303-CORE. A filter may also be set to isolate a specific EOC datalink path.

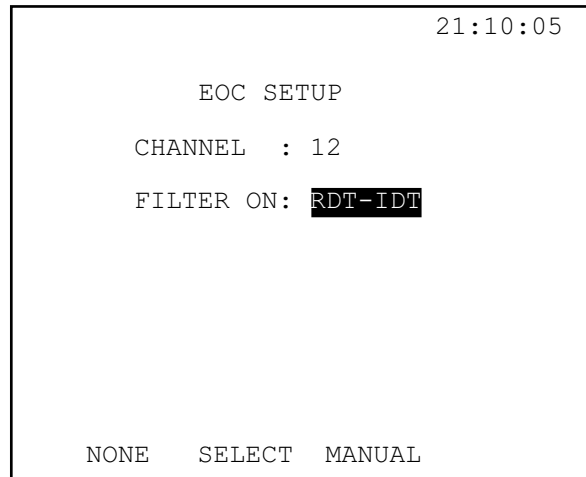


Figure 135 EOC Setup Screen

Configure the following:

CHANNEL

Options: 1–24

- Determines which DS0 the SunSet T10 will monitor in EOC Statistics.
- The default channel is 12; which follows the GR-303-CORE specification. If required, a different channel may be observed by using the F-keys.

INC+ (F1) & DEC- (F2): Press the INC+ and DEC- keys to change the value.

1/10 (F3): The 1/10 key adjusts the increment/decrement value.

FILTER ON

Options: NONE (F1), SELECT (F2), MANUAL (F3)

- Provides filtering when monitoring; the filter allows isolation of a particular eocdatalink path between the RDT and IDT (remote terminal and switch).
- Filtering is based on the SAPI/TEI values contained in the address field. Chapter 5, Reference provides definitions of all SAPI/TEI combinations, as defined in GR-303-CORE.

NONE: The SunSet T10 will capture all valid EOC SAPI/TEI values based on Bellcore's GR-303-CORE specification.

MANUAL: Manually enter the specific SAPI and TEI values. Upon selecting MANUAL, the SAPI and TEI filter settings appear. Select any value by pressing INC+1 (F1) and DEC-1 (F2). Refer to the following table, SAPI/TEI Valid Combinations, for a list of valid SAPI/TEI combinations.

SAPI	TEI	Data Link Function
1	0	EOC Path Switching Operations
1	1	RDT- Provisioning / Memory Administrative OS
1	2	RDT- Maintenance / Surveillance OS
1	3	RDT- Testing OS
1	4	RDT-IDT
1	5	RDT- Test System Controller 1
1	6	RDT- Test System Controller 2
1	7	RDT- Test System Controller 3
1	8-11	User Assignable

Table 16 SAPI/TEI Valid Combinations

SELECT: Allows filtering by link path. The SunSet T10 provides a listing of all Data-Link paths, as specified by their SAPI/TEI combination. Upon pressing SELECT (F2), the screen displays the EOC Filter Selection screen, as shown in Figure 136.

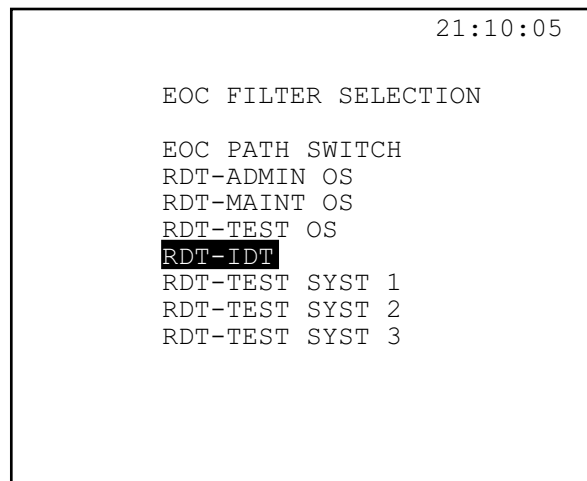


Figure 136 EOC Filter Selection

EOC FILTER SELECTION

- Use the up/down arrow keys to move the cursor to the desired selection.
- Pressing the ENTER key on the keypad saves this selection and returns to the setup screen where the new selection is displayed in the FILTER ON field.
- The SunSet T10 will now capture only the messages containing the particular SAPI/TEI values associated with the selection.

8.2.2 EOC Statistics

Entering the EOC STATISTICS screen, the SunSet T10 begins capturing and recording *eoc* message information. The following results apply to all valid *eoc* messages (if Filter=None) or to *eoc* messages containing filtered SAPI/TEI. On exiting all counts are reset to zero.

Two screens comprise EOC STATISTICS. Refer to Figure 137 for the first screen.

EOC STATISTICS				21:10:05
ET: 000:32:12				
		LINE 1	LINE 2	
TOTAL	FR.	57		
ERRORED	FR.	0		
DISCARD	FR.	0		
RR	FRAMES	32	N/A	
RNR	FRAMES	0		
REJ	FRAMES	4		
SABME	FRAMES	2		
DM	FRAMES	0		
INFO	FRAMES	19		
PAGE-UP	PAGE-DN	%	STOP	

Figure 137 EOC Statistics, Page 1

The following information appears in the first EOC STATISTICS screen:

ET: Elapsed time begins upon entering the EOC Statistics screen. ET will reset to zero after escaping.

TOTAL FR: A continuous count of the number of *eoc* messages.

ERRORED FR: Count of the number of *eoc* messages containing FCS (frame check sequence) errors.

DISCARD FR: A count of the number of *eoc* messages that have been discarded because:

- frames are either above or below the specified length.
- the total bit count is not divisible by 8.
- the message contains more than 6 consecutive ones.

The rest of the screen provides a running count of all valid EOC Layer 2 message types, which includes:

- RR: receiver ready
- RNR: receiver not ready
- REJ: reject (layer 2)
- SABME: set asynchronous balanced mode extended
- DM: disconnect mode
- INFO: information

The following F-keys are available.

F-keys: PAGE-UP (F1), PAGE-DN (F2), % / COUNT (F3), STOP/START (F4)

PAGE-UP and PAGE-DN: Use to scroll through the available pages of statistics.

%/COUNT: When the user presses the % F-key, the screen shows all values in terms of percent (i.e. the percentage of errored frames out of the total eoc frames received). COUNT returns the results back to a count.

STOP/START: This key stops the current measurement. The counters are frozen. To reset the counters, press the ESCAPE key on the keypad and return to EOC Statistics. START continues the current measurement.

Pressing the PAGE-DN (F2) F-key provides the second EOC Statistics screen, as shown in Figure 138. This provides a running count of the various eoc datalink paths. These paths are determined by the SAPI/TEI values outlined in chapter 5, Reference.

			21:10:05
EOC STATISTICS			
ET: 000:33:01			
	LINE-1	LINE-2	
EOC PATH SWITCH	12		
RDT-ADMIN OS	22		
RDT-MAINT OS	0		
RDT-TEST OS	0		
RDT-IDT	23	N/A	
RDT-Test SYST 1	0		
RDT-Test SYST 2	0		
RDT-Test SYST 3	0		
PAGE-UP	PAGE-DN	%	STOP

Figure 138 EOC Statistics, Page 2

9.0 Frame Relay (SW194)

The SunSet T10's frame relay option (SW194) provides a tool for the installation and verification of frame relay circuits. The SunSet T10 uses link management (LMI) signaling to verify that the user to network (UNI) link is active and properly configured. A PING test takes installation one-step further and confirms connectivity to the Internet provider.

Select from the MAIN MENU > FRAME RELAY, upon entering, four menu choices are available as shown in Figure 139.

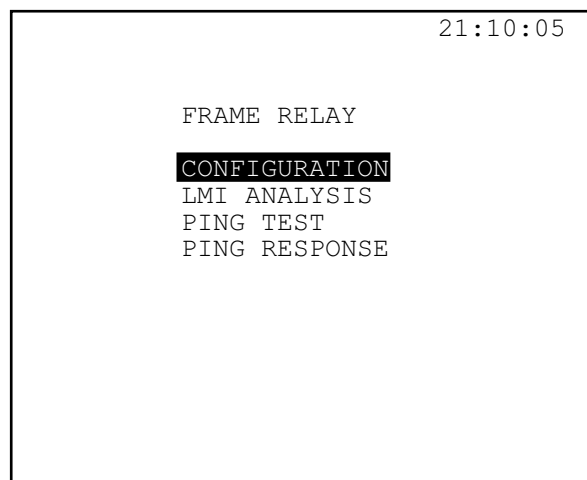


Figure 139 Frame Relay Menu

Configure the SunSet T10 for Frame Relay testing by using the following procedure.

1. Select MAIN MENU > TEST CONFIGURATION and configure the settings as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: per circuit or press the AUTO key on the keypad to configure.

TxCODING: per circuit

Tx SOURCE: NORMAL

XMT CLOCK: L1-Rx

*TEST RATE: Nx64K or Nx56K

LBO 1: 0 dB

***Note:** It is critical to select the proper test rate for the frame relay data. If the configured rate is unknown, press the AUTO (F1) F-key. The SunSet T10 automatically configures to the active channels, showing them as highlighted. Press the ENTER key on the keypad to return to the TEST CONFIGURATION screen.

Press the ENTER key on the keypad when completed.

4. Connect the SunSet T10 to the circuit using its Line 1 Rx and Tx jacks. Once connected, the PULSES and framing (e.g. ESF) LEDs should both be green. Flashing LEDs indicate a history condition. Press the HISTORY key on the keypad to clear.
5. Select MAIN MENU > MEASUREMENT RESULTS and confirm that there are no errors, valid frequency, and proper level. To restart the test, press the STOP (F3) F-key, then the RESTART (F3) F-key. After restart, a "NO ERRORS" message should appear on the summary screen. When finished, press the ESCAPE key on the keypad.
6. Select MAIN MENU > OTHER MEASUREMENTS > VIEW RECEIVED DATA. This screen shows the current idle and data channels. Idle channels display the circuit's idle code of FF or 7F. Press the PAGE-DN (F2) F-key to scroll through all timeslots; the first screen shows timeslots 1–8, the next screen shows 9–17, and the next shows 18–24. This is a method of determining the test rate of the circuit, and verifying the SunSet T10's test configuration. When finished, press the ESCAPE key on the keypad to return to the MAIN MENU.

9.1 Frame Relay Configuration

Select MAIN MENU > FRAME RELAY > CONFIGURATION and refer to Figure 140.

```
21:10:05
CONFIGURATION
INTERFACE : UNI
STANDARD  : ANSI617
DLCI LENGTH : 2
DLCI VALUE : 16
TIMER T391 : 10
N391      : 6
N392      : 3
N393      : 4
ANSI617   Q.933   LMI   AUTO
```

Figure 140 Frame Relay Configuration

Configure the following items:

INTERFACE

Option: UNI (F1)

- The SunSet T10 supports the UNI (User-to-Network) Interface, which specifies the interface between the user's equipment and the network.
- The SunSet T10 is the user side of this interface.

STANDARD

Options: ANSI617 (F1), Q.933 (F2), LMI (F3), AUTO (F4)

- Select the proper protocol for the interface tested.
- If the protocol is unknown, press the AUTO (F4) F-key and the SunSet T10 will poll the switch to determine the proper protocol used.

ANSI617: refers to ANSI standard T1.617 REV D.

Q.933: refers to ITU standard T Q.933 REV A.

LMI: refers to the LMI standard FRF1.1.

DLCI LENGTH

Options: 2 (F1), 3 (F2), 4 (F3), AUTO (F4)

- Enter the number of octets for the DLCI length.
- If the DLCI length used on the interface is unknown, press the AUTO (F4) F-key. The SunSet T10 will poll the switch to determine the proper DLCI length.

DLCI VALUE

- Select the DLCI value to use for testing.
- This DLCI value is only for PING testing (send and echo response). It is not for LMI analysis, as LMI uses the reserved DLCI value (0 or 1023) to carry signaling information.

TIMER

The last 4 settings (T391, N391, N392, N393) determine how often the full status enquiry/response is sent, how much time should elapse, and error thresholds. Use the default values unless a specific test is required to check these parameters. The default values are:

T391: 10
N391: 6
N392: 3
N393: 4

After configuring these settings, press the ESCAPE key on the keypad to return to the FRAME RELAY screen.

9.2 LMI Analysis

Link management interface signaling was developed to carry important status information between UNIs (user network links). LMI defines special management frames with a unique DLCI address passed between the network and local access device. Link management signaling confirms that the UNI is connected and active, and informs the user on the status of all virtual circuits at the interface. LMI reports on:

- whether the interface is active; this is often called a “heartbeat” or “keep-alive” signal.
- all valid DLCIs defined at that interface.
- the status of each PVC (permanent virtual circuit): new, active, and inactive. This shows the addition/deletion of virtual circuits and the availability of new virtual circuits.

To do the analysis, use the following procedure:

1. Select MAIN MENU > FRAME RELAY > LMI ANALYSIS
2. Upon accessing this screen, the SunSet T10 begins sending and responding to the link management signaling to check the status of the UNI. The SunSet T10 sends a status enquiry message per the T391 setting. The network must respond with a status message for each inquiry message. After sending and receiving the right number of inquiries, per the N391 setting, the SunSet T10 sends a full status inquiry to the network. When the SunSet T10 receives a full status message from the network, it reports, OK.

Note: Upon entering the screen, wait approximately 40 seconds (depending on parameters). If the SunSet T10 receives a proper response from the network, it reports OK. If the SunSet T10 does not receive a proper response from the network, it reports errors. Refer to Figure 141.

```
21:10:05
LMI ANALYSIS
ELAPSED TIME      : 000:01:43
TIMEOUT ERRORS   :
RESP. SEQ. NUM   : OK
WRONG MESSAGES   :
LINK ERROR TOTAL : 0
LINK OK TOTAL    : 16
PVC              STOP
```

Figure 141 LMI Analysis

LMI Analysis displays the following information:

ELAPSED TIME: This is the elapsed time of the test. The LMI Analysis restarts when accessing this screen, but the LMI link stays up.

TIMEOUT ERRORS: This counter increments when a proper status or full status message is not received from the network. After sending the status inquiry message, the SunSet T10 waits for a response per the T391 setting before a declaring a timeout error.

RESP SEQ NUM: Count of response sequence number errors, where the received frames are out of sequence.

WRONG MESSAGES: Counts the number of frames containing an invalid message.

LINK ERROR TOTAL: Total number of link errors.

LINK OK TOTAL: Counts when receiving a proper status or full status message from the network. Upon starting the test, the SunSet T10 waits until receiving a full status message; this takes approximately 40 seconds depending on the parameters. After receiving a full status message, the SunSet T10 counts LINK OK every time it receives a status message.

Press the PVC (F1) F-key to view the DLCI activity on the PVC. Figure 142 reports all configured PVCs and gives a status for each (active or idle).

```
21:10:05
PVC STATUS          PAGE:01/01

16                  ACTIVE
112                NEW    ACTIVE
116                  ACTIVE

PAGE-UP PAGE-DN LMI
```

Figure 142 PVC Status Screen

The PVC Status screen displays:

- any recently activated or active DLCIs, each corresponding to individual PVCs.
- when a DLCI shifts from NEW to ACTIVE after receiving a full status report from the DCE.
- the DLCIs, automatically sorted by number.
- more than one page of new or active DLCIs. Use the PAGE-UP (F1) or PAGE-DN (F2) F-keys to scroll through the results.

9.3 PING Test

Every Internet device has its own IP (Internet Protocol) address. Multiple LAN segments are connected via a frame relay network. A common way to discover whether two remote LAN segments using the TCP-IP protocol are connected is to send a PING (Internet control message protocol) message from one segment to another. When receiving a PING message, Internet devices acknowledge the message by sending an echo message back.

This test sends a PING message from a local to a destination IP address to verify continuity. Both users must be using TCP-IP protocol. A large difference between the maximum and minimum response times for each PING message indicates congestion in the network. Configure the SunSet T10 as follows:

```
21:10:05
PING CONFIGURATION
LOCAL IP      : 192.004.051.006
DEST. IP     : 192.006.051.003
NLPID       : IP
TIMEOUT     : 3
No. OF PINGS : 1
LMI MESSAGE : ON

IP          SNAPIP          START
```

Figure 143 Ping Test Configuration

Note: Before beginning, the proper DLCI value must be selected in FRAME RELAY > CONFIGURATION.

LOCAL IP

Enter the IP address of the local side that will send the PING. Use the following procedure to enter the number.

1. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
2. Enter the numbers directly from the keypad. If a mistake is made:
 - A. Press the SHIFT key on the keypad to remove the SHIFT indicator.

- B. Use the arrow keys on the keypad to select the incorrect entry.
- C. Press the SHIFT key on the keypad; the SHIFT indicator appears.
- D. Enter the correct number directly from the keypad.

DEST IP

Enter the destination IP address to receive the PING. Use the following procedure to enter the number.

1. Press the SHIFT key on the keypad; the SHIFT indicator will appear.
2. Enter the numbers directly from the keypad. If a mistake is made, use the procedure described in LOCAL IP.

NLPID

Options: IP (F1), SNAPIP (F2)

- The NLPID (network level protocol identifier) identifies the protocol or encapsulation type used in the frame.
- IP: Internet protocol
- SNAPIP: Sub network access protocol-IP.
- Refer to Network Working Group document RFC 1490.

TIMEOUT

Options: 1–10 seconds

F-Keys: INC+1 (F1), DEC-1 (F2)

- Determines how long (in seconds) the SunSet T10 will wait for a response before declaring a PING as unreachable.
- Use the INC+1 (F1) or DEC-1 (F2) F-keys to set this parameter.

NO OF PINGS

Options: 1–99

F-Keys: INC+1 (F1), DEC-1 (F2), 1/10 (F3)

- Determines how many PINGS are sent to the remote IP address during the test.
- Use the INC+1 (F1) or DEC-1 (F2) F-keys to set this parameter. The 1/10 (F3) key determines increment/decrement values for the F1 and F2 keys.

LMI MESSAGE

Options: ON (F1), OFF (F2)

- This setting activates or deactivates LMI signaling.
- ON activates LMI management and the SunSet T10 transmits status enquiry messages to the switch. Upon entering the FRAME RELAY menu, the SunSet T10 will begin sending LMI messages if this setting is ON.

When finished with configuration, press the START (F4) F-key to begin the test. The SunSet T10 displays the PING TEST screen, as shown in Figure 144.

With LMI activated, the SunSet T10 waits until it has received the proper number of responses to begin the test. When the SunSet T10 has received the proper number of status and full status messages, PVC STATUS changes from NOT READY, to READY and the SunSet T10 begins sending PING messages.

```
                21:10:05
PING TEST      ST- 21:09:05
                ET-000:01:00
LOCAL IP - 192.004.051.006
DEST IP - 192.006.051.003

PVC STATUS : READY

PINGS   : 20          ROUNDTRIP TIME
SENT    : 8
STATUS  : SENDING    CUR:      220 ms
RECEIVE: 7           AVG:      230 ms
UNREACH: 0           MAX:      255 ms
ERROR   : 0           MIN:      215 ms

                                RESTART
```

Figure 144 PING Test-in Progress

The RESTART (F4) F-key is available within the screen shown in Figure 144. This F-key restarts the test and resets ET to zero.

Figure 144 displays the following results:

PINGS: Number of PINGS to send during the test.

SENT: Number of PINGS currently sent.

STATUS: Current transmission status (i.e., sending a PING)

RECEIVE: Number of echo PINGS received.

UNREACH: Number of circuits not reached; or the number of PINGS not responded to.

ERROR: Number of echo PINGS received containing an error.

ROUND TRIP TIME: in milliseconds

CUR: This is the round trip time of the current PING.

AVG: Average round trip time of all PINGS

MAX: Maximum round trip time of all PINGS

MIN: Minimum round trip time of all PINGS

9.4 PING Response

Enter the PING RESPONSE screen to respond to incoming PING messages. Configure the local IP setting in the PING CONFIGURATION screen.

```
                21:10:05
ECHO PING      ST- 21:09:05
                ET-000:01:00
PR-ANSI617    IP-110.001.001.10

ECHOED IPS NO: 1    PAGE: 1/1

TIME          PING FROM          TOTAL
09:57:26     001.000.010                2

PAGE-UP    PAGE-DN    PAUSE
```

Figure 145 PING Response Screen

The following F-keys are within the PING Response screen.

PAGE-UP (F1)/PAGE-DN (F2): Allows the user to page up or down through the available information.

PAUSE/START (F3): Pauses the ET clock and test. Starts the test without resetting the ET clock.

Shown in Figure 145 are the following results:

ECHOED IPS NO: Number of IP addresses which sent PINGS to the SunSet T10.

PAGE: Lists the number of screens available, 1/1 in the sample figure.

TIME: This is the timestamp of the most recent PING received from the IP address that sent the PING message.

PING FROM: IP address that sent the PING.

TOTAL: Total number of PINGS received from the associated IP address.

10.0 Other Features

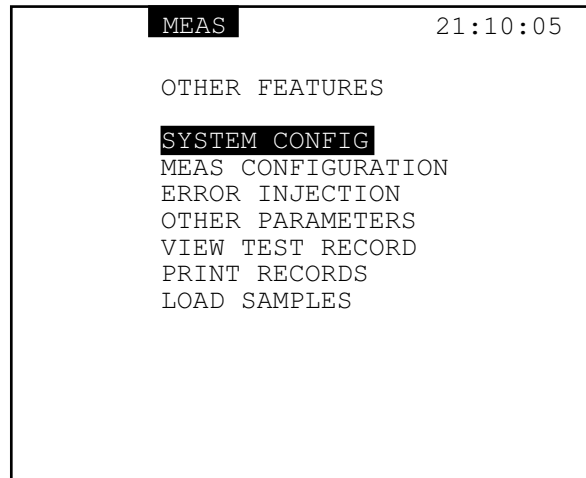


Figure 146 Other Features Menu

10.1 System Configuration

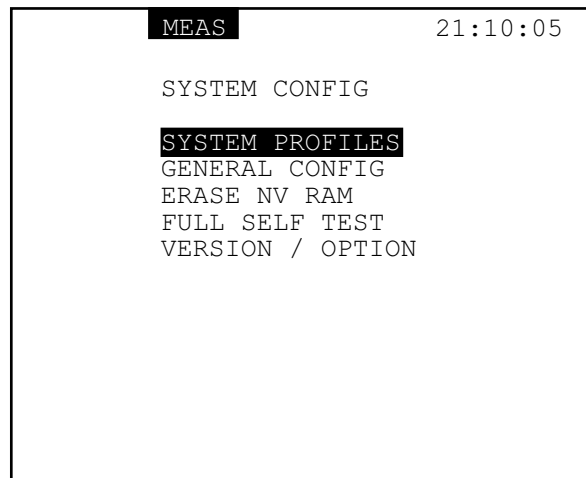


Figure 147 System Configuration Menu

10.1.1 System Profiles

A maximum of 10 system profiles can be stored in the SunSet T10. These profiles can save time while configuring the SunSet T10 for applications. The SunSet T10 can store the current configuration as a system profile. After naming a profile, it can be recalled at any time. Items that are stored in the profile are:

- General configuration settings
- Test configuration
- Measurement configuration
- Dial/supervision setup
- Error injection
- Other parameters
- Send test pattern

Note: The SYSTEM PROFILES menu does not operate like the user pattern menus. They may not be edited in the SYSTEM PROFILES menu. To modify a profile, use the modification procedure described in section 10.1.1.6.

10.1.1.1 Enter a New System Profile

1. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > SYSTEM PROFILES and press the STORE (F2) F-key.
2. Assign a LABEL to the profile by using the following procedure:
 - A. Press the TOGGLE (F3) F-key to toggle to the character grid. The letter A will start to flash.
 - B. Select the desired character with the arrow keys on the keypad and press the SELECT (F4) F-key.
 - C. Repeat step 2A as necessary until complete.
 - D. Press the TOGGLE (F3) F-key to leave the character grid.
3. Observe the file number under which the SunSet T10 will store the new profile. This number can be changed using the following procedure:
 - A. Select the FILE No. line.
 - B. Press the SHIFT key on the keypad to display the SHIFT indicator and then enter the desired number using the number keys.
 - C. Press the SHIFT key on the keypad to remove the SHIFT indicator when finished.
 - D. Press the ENTER key on the keypad to store the System Profile.

10.1.1.2 Invoke a Stored System Profile

1. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > SYSTEM PROFILES and select the desired profile.
2. Press the ENTER key on the keypad to invoke the profile.

10.1.1.3 View an Existing Profile

1. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > SYSTEM PROFILES and select the desired profile.
2. Press the VIEW (F1) F-key.
3. Press the PAGE-DN (F2) F-key to view the screens contained in the profile.

10.1.1.4 Activate the Default Profile

This procedure will return the SunSet T10's settings to its original default settings.

1. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > SYSTEM PROFILES and push the DEFAULT (F4) F-key.
2. Press the ENTER key on the keypad. The screen will return to SYSTEM CONFIG and the SunSet T10's configuration will revert to the defaults.

10.1.1.5 Delete a Profile

1. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > SYSTEM PROFILES and select the desired profile.
2. Press the DELETE (F2) F-key.

10.1.1.6 Modify an Existing Profile

1. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > SYSTEM PROFILES and select the desired profile.
2. Press the ENTER key on the keypad to invoke this profile.
3. Move to the other desired menus within the SunSet T10 to change the setup items.
4. Enter SYSTEM PROFILES and press the STORE (F2) F-key.
5. Give the profile a new name. Note that the new profile can have the same name as the old profile. The profiles are stored as file numbers.
6. Press the ENTER key on the keypad to return to SYSTEM PROFILES.
7. Select the old version of the profile and press the DELETE (F2) F-key.
8. Select the new profile and press the ENTER key on the keypad.

10.1.2 General Configuration

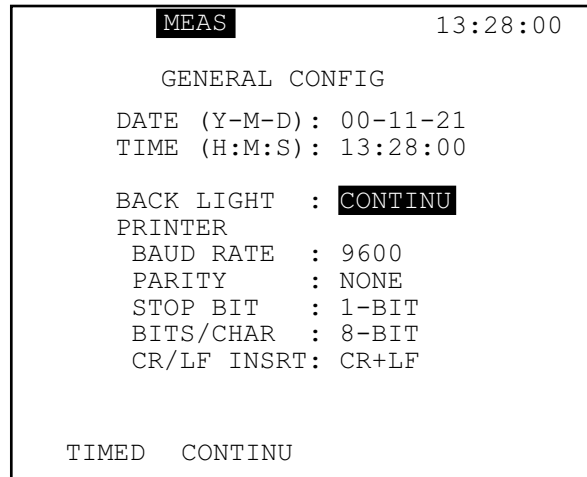


Figure 148 General Configuration Screen

The following items are configured in the GENERAL CONFIGURATION screen.

DATE (Y-M -D)

To set the date:

1. Press the SHIFT key on the keypad to display the SHIFT indicator.
2. Using the keypad, enter the appropriate numbers for the year, month and, day. The SunSet T10 inserts the hyphens automatically; out of range numbers are rejected.
3. When finished, press the SHIFT key on the keypad to remove the SHIFT indicator.

TIME (H :M :S)

To set the time:

1. Press the SHIFT key on the keypad to display the SHIFT indicator.
2. Using the keypad, enter the appropriate numbers for the hour, minute, and, second. The SunSet T10 inserts the colons automatically; out of range numbers are rejected.
3. When finished, press the SHIFT key on the keypad to remove the SHIFT indicator.

BACK LIGHT

Options: TIMED (F1), CONTINU (F2)

TIMED: This timer controls how long the backlight will stay on. When selecting TIMED, the backlight will automatically turn itself off after the indicated number of minutes has elapsed. To set the timer:

1. Press the TIMED (F1) F-key.
2. Press the SHIFT key on the keypad to display the SHIFT indicator.
2. Using the keypad, enter in the number of minutes between 1 and 99.
3. When finished, press the SHIFT key on the keypad to remove the SHIFT indicator.

CONTINU: Continuous is the default setting. Use the LIGHT key on the keypad to turn the light on and off.

PRINTER

The default settings work with the printer supplied by Sunrise Telecom. To use the SunSet T10 with another printer the BAUD RATE, PARITY, STOP BIT, BITS/CHAR, and CR/LF INSRT settings may need to be changed.

- Sunrise Telecom does not warrant the operation of the SunSet T10 with any printers not supplied by Sunrise Telecom.

BAUD RATE

Options: 1200 (F1), 2400 (F2), 9600 (F3), 19.2K (F4)

- The baud rate indicates the number of changes in tone per second.
- Default is 9600, which is for remote control operations.
- 1200 and 2400 will not support remote control features.

PARITY

Options: NONE (F1), EVEN (F2), ODD (F3)

- Parity is a method of checking the accuracy of transmitted or stored data. Parity is the sum total of all bits as either odd or even. A parity value is documented by adding an extra bit, known as a parity bit, to the data. This bit will be set to either 0 or 1 depending on what value is needed to pass the parity test.
- For example, if there is odd parity and the data is 10101010, the parity bit is 1. The total number is, including the parity bit, equals 5-an odd number. The receiving element checks the parity bit and indicates an error if the total number of ones does not add up to the correct total.

ODD: In odd parity, the total number of ones (including the added parity bit) is odd.

EVEN: In even parity, the total number of ones (including the added parity bit) is even.

NONE: This is the default setting, signifying no parity check.

STOP BIT

Options: 1-BIT (F1), 8-bit (F2)

- In asynchronous transmission, the stop bit is the last transmitted character that permits the receiver to establish an idle condition before accepting another character.

BITS/CHAR

Options: 7-BIT (F1), 8-BIT (F2)

- This determines the number of bits per character.

CR/LF INSRT

Options: CR (F1), CR+LF (F2)

- Settings for printer carriage.

CR: Selects carriage return

CR+LF: Selects carriage return + line feed, which adds an extra line space after every line.

10.1.3 Erase NV RAM

ERASE NV (non volatile) RAM erases all the user-stored information entered into the SunSet T10. *Always perform this operation after inserting a new software cartridge.*

Perform this operation as a last resort if the SunSet T10 is not performing properly. If this is the case, initiate ERASE NV RAM only after attempting to correct the problem:

1. Confirm the configuration for the application.
2. Turn the SunSet T10 off, wait 5 seconds, and then turn the SunSet T10 back on.
3. Perform a self-test, then repeat step 2 in this list.

WARNING!

Performing the NV RAM ERASE operation will erase all user-stored information.

Use the following procedure to perform ERASE NV RAM:

1. Select MAINMENU>OTHERFEATURES>SYSTEMCONFIG > ERASE NV RAM and press the ENTER key on the keypad after the warning message is displayed. The SunSet T10 will display a working message.
2. When the SunSet T10 is finished, turn the power off for 5 seconds and then turn the power back on.
3. Re-configure the SunSet T10 for the operations it needs to perform. TEST CONFIGURATION, SEND TEST PATTERN, and all other areas of the SunSet T10 will revert to the default settings.

10.1.4 Full Self Test

Use to perform a hardware self test on the SunSet T10. If it displays an error message after the self-test, please contact Sunrise Telecom Customer Service for assistance at the following:

- Voice Toll Free: 1-800-701-5208, available 24/7.
- Fax: 1-408-363-8313
- E-Mail: support@sunrisetelecom.com
- Shipping: contact Sunrise Telecom for instructions

10.1.5 Version/Option

```
MEAS 13:28:00
Version 2.20
S/N 004589
OPTION:
A: SW180 - Remote Control
B: SW190 - Pulse Mask
C: SW185 - MF/DTMF/DP
D: SW183 - Noise Analysis
E: SW189A- SS#7 Analysis
F: SW186 - ISDN Analysis
G: SS151 - DATACOM module
H: DATACOM MODE
I: SW189B- SS#7 TCAP Analy

PAGE-UP PAGE-DN
```

Figure 149 Version / Option Screen

The Version/Option screen displays the following items.

Version: software version that the SunSet T10 is currently using

S/N: software serial number

Note: The software serial number must match the hardware serial number on the back of the SunSet T10 in order for it to function.

OPTION: This is a listing of all of the installed software options.

There are two F-keys available.

PAGE-UP (F1) and PAGE-DN (F2): Use to scroll through the available screens.

Note: Depending on the number of options, PAGE-UP and PAGE-DN may not be available.

10.2 Measurement Configuration

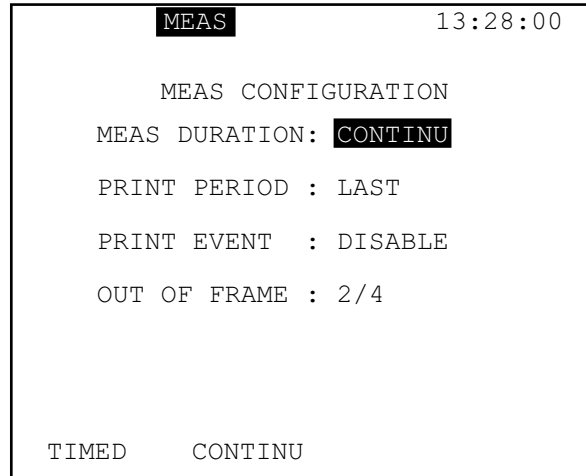


Figure 150 Measurement Configuration

Several measurement configuration items may be adjusted. Refer to Figure 150.

MEAS DURATION

Options: TIMED (F1), CONTINU (F2)

TIMED: A timed measurement will stop after the indicated amount of time has elapsed. This option is useful for making measurements of a specified length; 15 minute and 1 hour tests are common in the industry. When a timed test is in progress, the Remaining Time (RT) counter shows the remaining time before the end of the test. To enter a duration, use the following procedure.

1. Press the SHIFT key on the keypad to display the SHIFT indicator.
2. Using the keypad, enter the number between 1 min and 999 hr.
3. When finished, press the SHIFT key on the keypad to remove the SHIFT indicator.

CONTINU: A continuous test will run indefinitely until the RESTART F-key is pressed, or until some other setting is changed within the SunSet T10 that restarts the test.

PRINT PERIOD

Options: TIMED (F1), LAST (F2)

TIMED: In this mode, test results are printed and saved to the buffer every 1 to 99 minutes. If TIMED is selected use the following procedure to enter a period.

1. Press the SHIFT key on the keypad to display the SHIFT indicator.
2. Using the keypad enter in the number between 1 and 99 minutes.
3. When finished, press the SHIFT key on the keypad to remove the SHIFT indicator.

LAST: In this mode, the test results are printed at the end of a timed test or a continuous test that has ended due to a RESTART.

PRINT EVENT

Options: ENABLE (F1), DISABLE (F2)

ENABLE: Select this mode to print out an error message every second that one or more errors occur. Printed with every message is the date and time.

DISABLE: Disables the event error message printing function.

OUT OF FRAME

Options: 2/4 (F1), 2/5 (F2)

- Determines the condition for declaring an OOF (out of frame) error.
- Use this so that all test and monitoring equipment reports an OOF under the same conditions.
- OOF errors are recorded in the MEASUREMENT RESULTS frame screen.

2/4: Counts an OOF every time there are two framing bits in error out of 4 framing bits.

2/5: Counts an OOF when there are 2 framing bit errors out of every 5 framing bits.

10.3 Error Injection

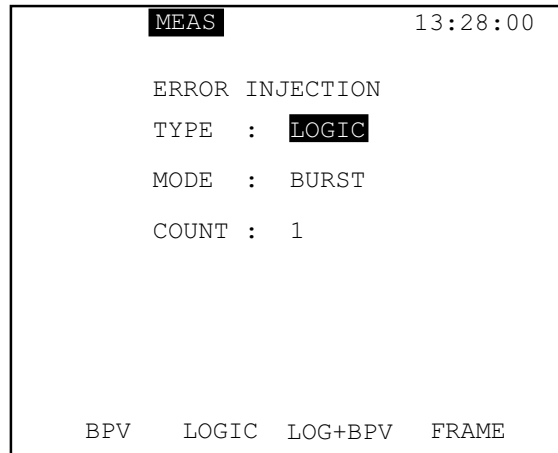


Figure 151 Error Injection Screen

This screen configures the type of errors, and the number of errors to be sent when the ERRINJ key on the keypad is pressed.

TYPE

Options: BPV (F1), LOGIC (F2), LOG+BPV (F3), FRAME (F4)

- Specifies the type of errors to be inserted.

BPV: Bipolar violation

LOGIC: Logic type error

LOG+BPV: Bipolar violation with logic error

FRAME: Frame type error

MODE

Options: RATE (F1), BURST (F2)

- Specifies the mode of error injection.
- The third line will vary depending upon the mode selected. For rate mode, this line will be RATE; for burst mode, this line will be COUNT.

RATE: This mode inserts errors at a specified rate. When injecting errors at a rate, an ERRINJ message is displayed at the top of the screen. This message specifies the type of errors inserted. To stop injecting errors, press the ERRINJ key on the keypad again and verify that the error indicator no longer appears on the screen.

BURST: This mode inserts a specified number of errors each time the ERRINJ key on the keypad is pressed.

COUNT

Options: 1 to 9999

- For BURSTMODE, choose the number of errors to be inserted each time the ERRINJ key on the keypad is pressed.

Use this procedure:

1. Press the SHIFT key on the keypad to display the SHIFT indicator.
2. Using the keypad, enter in any number between 1 and 9999. The errors will be inserted in approximately 1 second or less, and will cause from 1 to 3 errored seconds.
3. When finished, press the SHIFT key on the keypad to remove the SHIFT indicator.

RATE

Options: 1e-3 to 9e-9

- For RATE MODE, choose the error RATE number and exponent. The errors are inserted at a continuous rate as specified.

To start error injection, press the ERRINJ key on the keypad and the SunSet T10 will insert errors as specified. If the error injection is set for RATE mode, an ERINJ indicator will be displayed on screen.

10.3.1 Programming a Burst of 10 Errors

1. Select MAIN MENU > OTHER FEATURES > ERROR INJECTION.
2. Select TYPE and then press the LOGIC (F2) F-key.
3. The cursor automatically moves to MODE selection. Press the BURST (F2) F-key.
4. The cursor automatically moves to COUNT.
 - A. Press the SHIFT key on the keypad to display the SHIFT indicator.
 - B. Using the number keys on the keypad, press the 1 key followed by the 0 key. The COUNT should show 10.
 - C. Press the SHIFT key on the keypad to remove the SHIFT indicator.
5. Press ENTER on the keypad. The SunSet T10 is programmed to inject 10 CODE errors each time the ERRINJ key on the keypad is pressed.

10.3.2 Programming a 1e-06 Bit Error Rate

1. Select MAIN MENU > OTHER FEATURES > ERROR INJECTION.
2. At TYPE, press the LOGIC (F2) F-key.
3. The cursor automatically moves down to MODE selection. Press the RATE (F1) F-key.
4. The cursor automatically moves down to RATE.
 - A. Press the SHIFT key on the keypad to display the SHIFT indicator.
 - C. Use the keypad to enter the number.
 - D. Press the '1' key once; the multiplier position is showing '1'. The cursor moves to the exponent position.
 - E. Press the '6' key once; the '6' is entered.
 - F. Press the SHIFT key on the keypad to remove the SHIFT indicator.
5. Press the ENTER key on the keypad. The SunSet T10 is now programmed to inject bit errors at a rate of 1×10^{-6} each time the ERRINJ key on the keypad is pressed.

10.4 Other Parameters

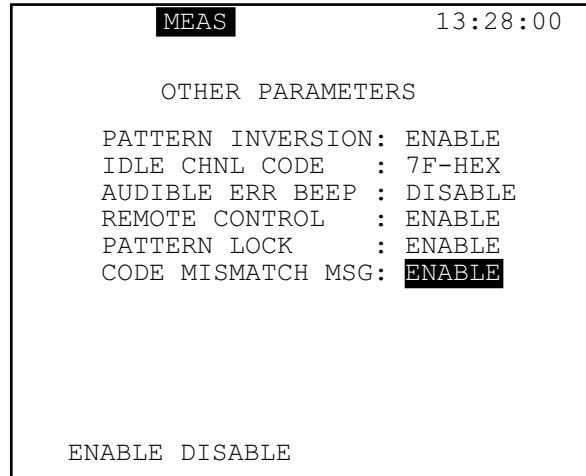


Figure 152 Other Parameters

The OTHER PARAMETERS menu contains the following items:

PATTERN INVERSION

Options: ENABLE (F1), DISABLE (F2)

- When enabled, transmitted pattern inversion turns ones into zeros and zeros into ones.
- For instance, a 3-in-24 pattern turns into a 21-in-24 pattern and is then transmitted. In addition, the PAT SYNC LED will light only if the SunSet T10 receives the same inverted pattern as it transmits.

IDLE CHANNEL CODE

Options: 7F-HEX (F1), FF-HEX (F2)

- Use Idle code during VF channel access operations when the Tx Source is set to the TESTPAT mode.
- Use in fractional T1 testing to fill up unused channels.

AUDIBLE ERROR BEEP

Options: ENABLE (F1), DISABLE (F2)

- When enabled, a beep will sound whenever the SunSet T10 receives an error (i.e. BPV, FBE) on the line.

REMOTE CONTROL (SW180)

Options: ENABLE (F1), DISABLE (F2)

- Refer to chapter 2, section 5, for more details on this option.

PATTERN LOCK

Options: ENABLE (F1), DISABLE (F2)

- Pattern Lock determines how the SunSet T10 achieves pattern synchronization.

ENABLE: When enabled, the SunSet T10 searches for and can only synchronize on its transmit pattern. Select the transmitted pattern in the SEND TEST PATTERN screen. When the AUTO key on the keypad is pressed, the SunSet T10 searches through all of the patterns and changes its' transmit pattern to match the received pattern.

DISABLED: When disabled, the SunSet T10 attempts to synchronize on any known test pattern, regardless of the SunSet T10's transmit pattern. When the AUTO key on the keypad is pressed, the SunSet T10 searches through all known patterns for synchronization and does not change its transmit pattern.

CODE MISMATCH MSG

Options: ENABLE (F1), DISABLE (F2)

- Provides a warning message when the SunSet T10's line coding is configured differently from the coding received.

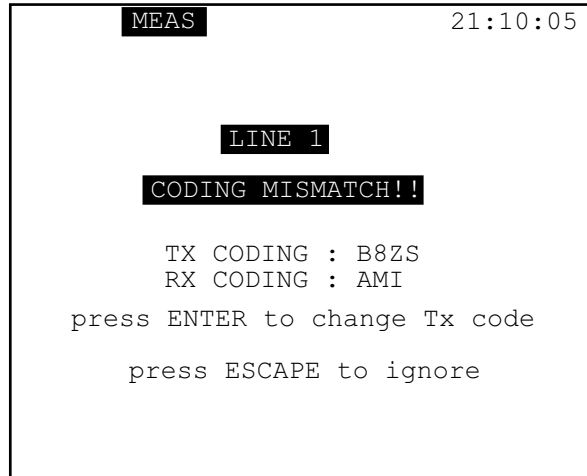


Figure 153 Coding Mismatch Message

ENABLE: This enables the visual warning whenever a code mismatch occurs.

- When the SunSet T10's code is AMI, and the SunSet T10 detects B8ZS coding, the SunSet T10 will display a message similar to the one in Figure 153.
- When the SunSet T10's code is B8ZS, and the SunSet T10 detects AMI coding, as represented by a string of seven consecutive zero's, the SunSet T10 will display the message as shown in Figure 153.

When this message occurs, two options are available:

- Press the ENTER key on the keypad to change the SunSet T10's transmit coding to match the received coding.
- Press the ESCAPE key on the keypad to ignore the message and keep the same coding. In this case, the mismatch message is not displayed again until the AUTO key on the keypad is pressed or the SunSet T10 is turned off and then back on.

DISABLE: This disables the visual warning. This is the SunSet T10's default condition.

10.5 View Test Record

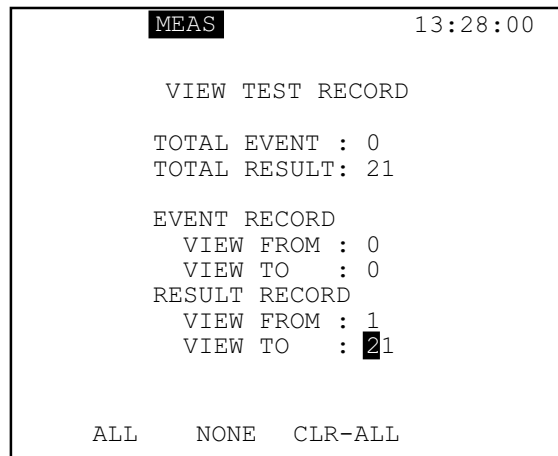


Figure 154 View Test Record

VIEW TEST RECORD allows viewing of stored results and events. The total event and total result numbers are shown in accordance with the events and results that are in memory. EVENT refers to an alarm or error; RESULT refers to all errors, measurements, etc. To view events; use the following procedure.

1. The cursor is automatically placed at VIEW FROM of the EVENT RECORD.
 - Press ALL (F1) to view all events
 - Press NONE (F2) to view no events
 - Press CLR-ALL (F3) to clear all events stored in memory.
 - To view specific events, press the SHIFT key on the keypad and enter the desired event range with the keypad numbers.
2. Press the ENTER key on the keypad to display all of the EVENT records that have been selected.
3. NEXT (F1) or PREV (F2) to view each event record.
4. Press the ESCAPE key on the keypad when finished.

To view results:

1. Select VIEW FROM on the RESULT RECORD line.
2. The same three function keys as above, as well as the SHIFT key options, are available for the RESULT range.
3. Press the ENTER key on the keypad to display all of the RESULT records that have been selected.
4. PAGE-UP (F1) or PAGE-DN (F2) to view different screens of results.
5. Press the ESCAPE key on the keypad when finished.

10.6 Print Records

PRINT RECORDS provides the ability to print the test results stored in the print buffer. Select either:

- ALL (F1) to print all test records
- NONE (F2) to print none of the test records
- NEXT (F3) to select a particular test record to print out.

10.7 Load Samples

LOAD SAMPLES loads five sample messages in the VIEW/PRINT TRACER for SS7, ISDN, and MF TRACER. These messages will automatically clear and replace all messages currently stored in these buffers.

11.0 Data Link Control

DATA LINK CONTROL applies to ESF and SLC-96 framing. DATA LINK CONTROL is not available if UNFRAME or SF-D4 is selected as framing in the TEST CONFIGURATION screen. ESF and SLC-96 have different DATA LINK CONTROL menus, each with different screens and options. Section 11.1 pertains to SLC-96 framing and Section 11.2 to ESF.

11.1 Data Link Control - SLC-96

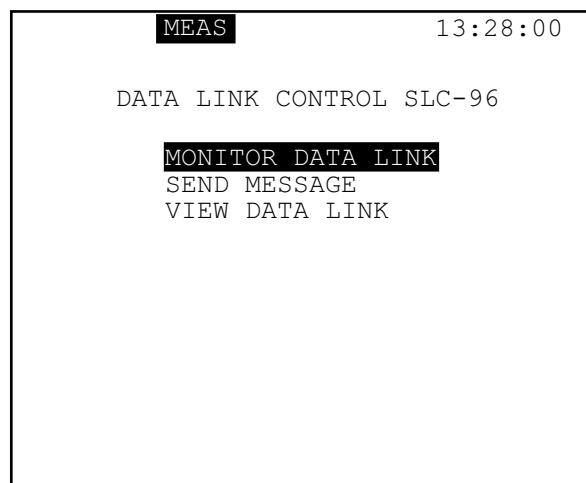


Figure 155 Data Link Control SLC-96

Select SLC-96 framing in the TEST CONFIGURATION screen before proceeding. Select MAIN MENU > DATA LINK CONTROL and refer to Figure 155. All capabilities are in conformance with Bellcore's standard TR-TSY-000008.

WARNING!

Using the SLC-96 send message capability can bring down an entire SLC system. Before proceeding, obtain proper training.

Monitoring the SLC datalink from a MON jack should not disrupt service.

11.1.1 Monitor Data Link

```
MEAS 13:28:00

DATA LINK MONITOR SLC-96

MODE : WP1 A FELP: CLR
MAJOR : ALM B-FELP: CLR
MINOR : CLR C-FELP: CLR
POWER : CLR D-FELP: CLR
A SHLF: CLR P-FELP: CLR
B SHLF: CLR M1 : CLR
C SHLF: CLR M2 : CLR
D SHLF: CLR M3 : CLR
PROTECT LINE SW : IDLE
C BITS: 11111111111

HOLDSCR
```

Figure 156 Monitor Data Link SLC-96

The DATA LINK MONITOR screen displays an English language translation of the information in the SLC data link. The following describes the items shown in Figure 156.

MODE: There are three data link modes specified in TR-TSY-000008, they are:

- NOTE and WP1B, which are 16-bit formats.
- WP1, which is a 13 bit format.

MAJOR: Indicates a major alarm on the data link.

MINOR: Indicates a minor alarm on the data link.

POWER: Indicates a power alarm.

A SHLF: Indicates an *A-shelf alarm*.

B SHLF: Indicates a *B-shelf alarm*.

C SHLF: Indicates a *C-shelf alarm*.

D SHLF: Indicates a *D-shelf alarm*.

PROTECT LINE SWITCH: Displays the switch-to-protection line switch message.

C BITS: Indicates the eleven C-Bits.

A-FELP: Indicates an *A digroup far end loop*.

B-FELP: Indicates a *B digroup far end loop*.

C-FELP: Indicates a *C digroup far end loop*.

D-FELP: Indicates a *D digroup far end loop*.

P-FELP: Indicates a Protection digroup far end loop.

M-BITS: Indicates the three M bits.

11.1.2 Send Message

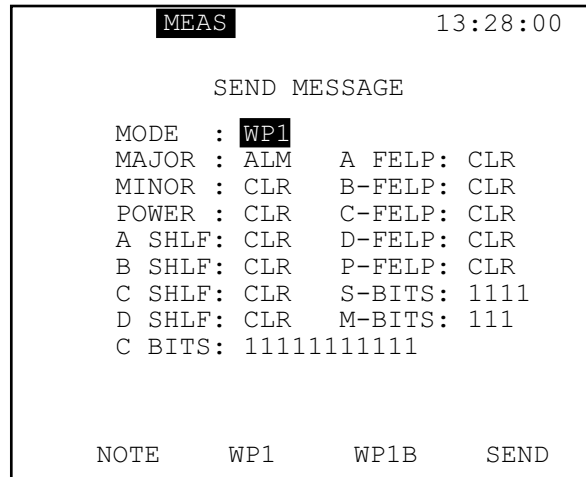


Figure 157 SLC-96 Send Message

The SunSet T10 displays an English-language table of messages that can be sent on the SLC-96 data link. Before entering this menu, confirm that:

1. The TEST CONFIGURATION screen is set up as follows:

TERM: SLC-96
Tx SOURCE: NORMAL for T1SINGL or
TxSOURCE: TESTPAT for T1DUAL

2. The transmit and receive cords must be plugged into the circuit and the SunSet T10. Refer to the applications chapter for diagrams on how to plug in the SunSet T10 into the circuit.

The following items are within Figure 157.

MODE: Determines which SLC-96 element the SunSet T10 will emulate as it sends the SLC-96 message. The three elements are NOTE, WP1, and WP1B.

MAJOR, MINOR, POWER, A SHLF, B SHLF, C SHLF, D SHLF: These categories allow setting the desired alarm message.

A-FELP, B-FELP, C-FELP, D-FELP, P-FELP: These categories allow setting a far end loop, or indicate the existence of a far end loop.

S-BITS, M-BITS, C-BITS: These categories allow direct entering of those SLC data link bits that are not otherwise defined.

SEND: This F-key function allows sending the message at any time.

Note: A message is not sent until the SEND F-key is pressed. This allows editing of the message. Once sent, the message will continue being sent until changed.

ACTION: Select either SWITCH (F1) or RELEASE (F2) to carry out the desired action.

LINE: Select the desired digroup (A–D) by pressing the appropriate F-key (F1–F4).

When the settings are correct, press the ENTER key on the keypad to send the message.

11.1.3 View Data Link

```
MEAS 13:28:00  
  
VIEW DATA LINK SLC-96  
PAGE :01  
  
DLF C-----CsssM-MAAS--Ss  
001 111111111101011101111111  
002 111111111101011101111111  
003 111111111101011101111111  
004 111111111101011100111111  
005 111111111101011101111111  
006 111111111101011101111111  
007 111111111101011101111111  
008 111111111101011101111111  
  
PAGE-UP PAGE-DN PAUSE
```

Figure 158 View Data Link

VIEW DATA LINK allows viewing of an active SLC-96 data link. The bits are arranged according to their place in the SLC-96 data link. This screen can be useful for those applications that do not follow TR-TSY-000008.

11.2 Data Link Control - ESF

```
MEAS 13:28:00  
  
DATA LINK CONTROL ESF  
  
MONITOR T1.403 PRM  
MONITOR T1.403 NPRM  
MONITOR T1.403 BOM  
SEND T1.403 PRM  
SEND T1.403 BOM  
RTRV 54016 PM CNTR  
PRINT 54016 RESULTS
```

Figure 159 Data Link Control - ESF

DATA LINK CONTROL ESF is provided when ESF framing is selected in the TEST CONFIGURATION screen. Select from MAIN MENU > DATA LINK CONTROL and refer to Figure 159.

11.2.1 Monitor T1.403 PRM

```
MEAS 13:28:00
DATA LINK MONITOR T1.403 PRM
ELAPS TIME - 000:03:40
DETEC TIME - 000:01:21
CRC=1 - 0      C=<5 - 0
C=<10 - 0      C=<100- 0
C=<319- 0     C>320 - 0
SEFE - 0      FSBEE - 0
BPV - 0       SLIP - 0
PLBSEC- 0     YELsec- 0
R - 0         U1 - 0
U2 - 0
RESTART HOLDSCR          SPRM
```

Figure 160 Monitor T1.403 PRM

The MONITOR T1.403 PRM screen allows viewing of:

- the T1.403 performance report message, as reported on the ESF data link.
- real-time end-to-end performance information, when the circuit is in-service.
- how many seconds has elapsed since a payload loopback message has appeared.
- a count of yellow alarm second messages.
- the total elapsed time monitoring the data link.
- how much time it took to receive a valid T1.403 data link message.

Options: RESTART (F1), HOLDSCR/CONTINU (F2), and SPRM/PRM (F4).

RESTART: Restarts the measurement.

HOLDSCR/CONTINU: Freezes the screen for observation. To update, press the CONTINU F-key.

SPRM/PRM: Allows access to the supplementary performance report or the performance report messages. Refer to Figure 161.

The following items appear in the MONITOR T1.403 PRM screen:

ELAPS TIME: Total amount of time that has passed since the start of data link monitoring.

DETEC TIME: Total amount of time (during the elapsed time) that the SunSet T10 has detected valid data link messages.

CRC-1: Number of seconds in which exactly 1 CRC-6 error was reported.

C=<5: Number of seconds that 2 to 5 CRC-6 errors were reported.

C=<10: Number of seconds that 6 to 10 CRC-6 errors were reported.

C=<100: Number of seconds that 11 to 100 CRC-6 errors were reported.

C=<319: Number of seconds that 101 to 319 CRC-6 errors were reported.

C>320: Number of seconds that 320 or more CRC-6 errors were reported.

SEFE: Number of severely errored framing events that were reported.

FSBEE: Number of reported frame synchronization bit error events.

BPV: Number of seconds during which at least one bipolar violation was reported.

SLIP: Number of seconds during which at least one frame slip occurred.

PLB sec: Number of seconds during which the device is looped back.

YEL sec: Number of seconds during which at least one yellow alarm message was received.

R: The R bit is the SPRM flag. This bit indicates if SPRMs are included in the PRM message. A count indicates the number of seconds during which SPRMs have been added.

U1: The U1 bit carries information on the DS1 signal as received from the *network* side. The count records the number of times that the U1-bit has been set to logical 1, indicating an error condition from the network direction. These errors include, CRC, BPV, SLIP, Yellow, Frame Synchronization Bit Error, or Payload Loopback.

U2: The U2-bit carries information on the DS1 signal as received from the *Customer Interface (CI)* side. The count records the number of times that the U2-bit has been set to logical 1, indicating an error condition from the customer direction. These errors include, CRC, BPV, SLIP, Yellow, Frame Synchronization Bit Error, or Payload Loopback.

Pressing the SPRM (F4) F-key displays a graphic of the SPRM information. Refer to Figure 161.

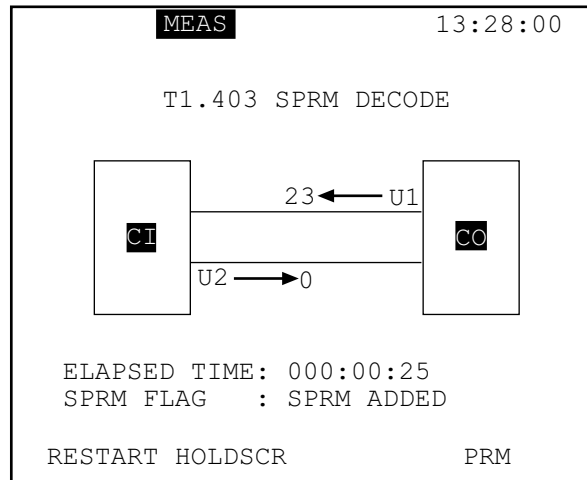


Figure 161 T1.403 SPRM Decode

The U1 and U2 counts provide the reported number of times an error condition occurred from either the Central Office (CO) or Customer Interface (CI), respectively.

11.2.2 Monitor T1.403 NPRM

NPRM information is contained within the MONITOR T1.403 NPRM Screen. Select MAIN MENU > DATA LINK CONTROL > MONITOR T1.403 NPRM. Refer to Figure 162.

```
MEAS 13:28:00
MONITOR T1.403 NPRM
ELAPS TIME - 000:32:21
DETEC TIME - 000:32:21
NEAR-END ERRORS
CRC=1 - 0          C<=100- 0
C<=319- 0        C>320 - 0
SES - 0
FAR-END ERRORS
CRC=1 - 21        C<=100- 8
C<=319- 0        C>321 - 0
SES - 0
PerAlert: 0      FrConv: 0
RESTART HOLDSCR
```

Figure 162 Monitor T1.403 NPRM Screen

The Monitor T1.403 NPRM Screen defines the CRC-6 error counts and SES counts as near-end and far-end errors. There are two available reports:

Per Alert: Performance alert. The network provider may define a performance threshold. This PA-bit will increment whenever the near end or far-end count has exceeded the predefined threshold. Note that some network equipment may not support this feature.

FrConv: The Frame Conversion field increments when the SF to ESF frame format conversion occurs.

11.2.3 Monitor T1.403 BOM

```
MEAS 13:28:00
VIEW DATA LINK T1.403 BOM
RECEIVE STATUS: MESSAGE
LAST MESSAGE:
(left most bit received 1st)
Current : 000000000001111111
1st last: 11100011000011000
2nd last: 11000110001100010
3rd last: 10011011010001101
4th last: 10010000000000011
```

Figure 163 Monitor T1.403 BOM

The MONITOR T1.403 BOM screen displays the message that the SunSet T10 receives over the data link. The receive status line shows MESSAGE if the SunSet T10 is currently receiving a message on the data link. This is displayed under the LAST MESSAGE line. If the SunSet T10 is not receiving a message, the MESSAGE line will say IDLE, and the last message received is displayed under the LAST MESSAGE line.

11.2.4 Send T1.403 PRM

```
MEAS 13:28:00
DATA LINK TRANSMIT T1.403 PRM
ELAPS TIME - 000:32:21
CRC=1 - 0      C=<5 - 0
C=<10 - 0      C=<100- 0
C=<319- 0      C>320 - 0
SEFE - 0      FSBEE - 0
BPV - 0       SLIP - 0
PLBsec- 0     YELsec- 0
```

Figure 164 Data Link Transmit T1.403 PRM

Configure the SunSet T10 to send the T1.403 performance report message by entering SEND T1.403. The SunSet T10 will broadcast the message on the currently selected TX jack according to the quality of the received signal. It does this on the currently selected received jack. The SunSet T10 will display a count of all the various errors recorded and transmitted since entering this menu. The SunSet T10 sends this message continuously until escaping from this menu.

11.2.5 Send T1.403 BOM

```
MEAS 13:28:00
DATA LINK SEND MESSAGE
ESF - T1.403
MESSAGE - 1111111100101000
REPETITION - CONTINU

YEL-ALM PLPK-UP PLPK-DN more
```

Figure 165 Data Link Send Message

Use SEND T1.403BOM to send data link, bit-oriented messages. In this screen, select a message and specify the number of repetitions. Use the following procedure:

1. Select the desired message. Do this by using the F-keys for predefined messages or by typing in the desired numbers.
 - To type in the message:
 - A. Select the desired position and enter the 1s and 0s using the SHIFT key and numbers on the keypad.
 - B. The cursor can be positioned only between the 10th and 15th bits of the message. The rest of the 16-bit message is fixed.

The following are the predefined messages:

- YEL-ALM sends the ESF datalink yellow alarm.
 - PLPK-UP sends the CSU payload loop up command.
 - PLPK-DN sends the CSU payload loop down command.
 - LLPK-UP sends the CSU line loop up command.
 - LLPK-DN sends the CSU line loop down command.
 - NLPK-UP sends the NIU loop up command.
 - NLPK-DN sends the NIU loop down command.
2. After selecting a message, select REPETITION. To send the message continuously, choose CONTINU (F2).
 - A. To send the message for a certain number of repetitions, press the NUMBER (F1) F-key.

- B. Press the SHIFT key on the keypad and enter in the number of repetitions between 01 and 99 using the keypad numbers.
- C. Press the SHIFT key again when finished.
3. Press the ENTER key on the keypad to send the pattern on the data link. The SunSet T10 will automatically exit from the SEND T1.403 BOM screen and start sending the desired message.
- If selected, CONTINU will send the message continuously while in the DATA LINK CONTROL ESF screen.
 - Exiting the menu or moving into a sub-menu will cause the message to stop.

Note for ESF NIU Loopbacks: This function can be used to loop-back a far end NIU from the customer premises side of the near end NIU. Set the message to NLPK-UP; set the repetition to 7 times. Seven repetitions will allow the far end NIU to loop up without letting the signal last long enough to loop up the near end.

11.2.6 RTRV 54016 PM CNTR

The performance monitoring data in Pub. 54016 conforming CSU can be retrieved with this menu item. Select MAIN MENU > DATA LINK CONTROL > RTRV 54016 PM CNTR. Refer to Figure 166.

Note: The line must be out of service to retrieve the information.

```
21:10:05
RTRV 54106 PM CNTR

CSU STATUS: NONE
CURRENT 15-minutes
MEASURE TIME (sec) - 602
ES   UAS  BES  SES  CSS  LOFC
0    584  0    0    0    0

PAST 24-hours
VALID INTERVAL - 96
ES   UAS  BES  SES  CSS  LOFC
0    1    0    0    0    0

PAGE-UP PAGE-DN
```

Figure 166 Retrieve Counter

The following items appear within this screen.

PAGE-UP (F1) and PAGE-DN (F2): Use to view other pages of available information.

ES: Count of errored seconds

UAS: Count of unavailable seconds

BES: Count of bit error seconds

SES: Count of severely errored seconds

CSS: Controlled Slip Seconds

LOFC: Loss of frame count

11.2.7 Print 54016 Results

Allows printing of 54016 PM results.

12.0 CSU/NI Emulation (SW181)

The CSU/NI Emulation software option allows for full-duplex emulation of a CSU or NI. With this capability, use the SunSet T10 to emulate a CSU or NI. The emulation screen displays:

- a pictorial explanation of the circuit status.
- measurement results.
- configuration commands to perform loopbacks.

While in this mode, the SunSet T10 will respond to CSU and NI loop up/down codes. Use CSU/NI Emulation in T1 Single and T1 Dual modes.

12.1 CSU/NI Emulation, T1 SINGL Mode

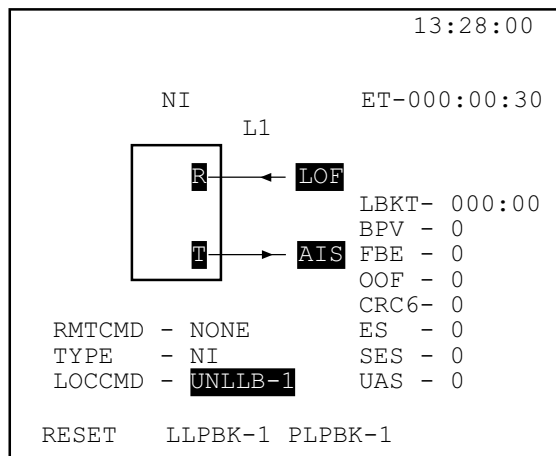


Figure 167 CSU/NI Emulation, T1 SINGL

1. Before entering CSU/NI Emulation, configure the TEST CONFIGURATION screen as follows:

TEST MODE: T1 SINGL
RxLvL-1: TERM, BRIDGE, or DSXMON
FRAMING: as appropriate for the circuit under test

- Cannot be AUTO framed.
CODING: as appropriate to the circuit under test
TX SOURCE: THRU, NORMAL
LBO 1&2: as appropriate for the circuit under test
TEST RATE: 1.544 M
- The CSU/NI Emulation screen is not available for fractional rates.

2. Plug the cords into the SunSet T10 and circuit under test. Confirm that signal coming from the network is connected to the Line 1 jacks. The SunSet T10 will then respond to loopback codes from the network and display the CSU/NI Emulation screen. See Figure 167.
3. Setup the SunSet T10 for either NI emulation or CSU emulation. Do this by selecting TYPE and then by selecting CSU (F1) or NIU (F2).
4. Observe any circuit error counts and verify that the SunSet T10 is receiving a remote loopback command. Note that the framing of the remote loopback command must be the same as the framing selected in the TEST CONFIGURATION screen.
5. If desired, operate any of the local commands as follows:
 - RESET (F1) resets the SunSet T10 to a through mode.
 - LLPBK-1 (F2) operates a line loopback from L1-Rx to L1-Tx. A line loopback regenerates the signal but does not reframe the signal. Hence, BPVs and frame errors will pass through the line loopback unchanged. Once invoked, the line loopback UNLLB-1 replaces the LLPBK-1 command. In this case, pressing the UNLLB-1 (F2) F-key will undo the loopback.
 - PLPBK-1 (F3) operates a payload loopback from L1-Rx to L1-Tx. A payload loopback regenerates the signal, and also re-frames and re-codes the signal. Hence, BPVs and frame errors are eliminated as they pass through the payload loopback. Once invoked, the payload loopback UNPLB-1 command replaces the PLPBK-1 command. In this case, pressing the UNPLB-1 (F3) F-key will undo the loopback.
6. When finished, press the ESCAPE key on the keypad to return to the MAIN MENU. This drops all loopbacks.

12.2 CSU/NI Emulation, T1 DUAL Mode

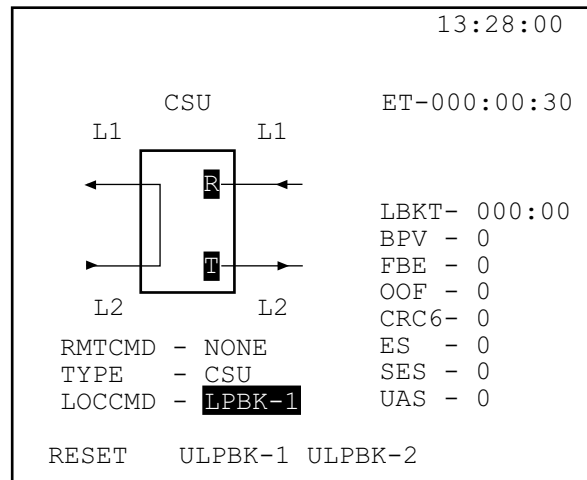


Figure 168 CSU/NI Emulation, T1DUAL

1. Before entering CSU/NI Emulation screen, configure the TEST CONFIGURATION screen as follows:

TEST MODE: T1DUAL

TXINSERT: L1-Tx

Rx/DROP: L1-Rx

RXLVL 1 AND 2: TERM, BRIDGE, or DSXMON

TXSOURCE: THRU or TESTPAT

FRAMING: as appropriate for the circuit under test

- Cannot be AUTO framed.

CODING: as appropriate for the circuit under test

XMTCLK: L1-Rx or INTERN

RATE: 1.544 M

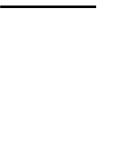
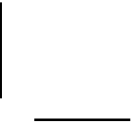
- CSU/NI Emulation screen is not available for fractional rates.

LBO 1 & 2: as appropriate for the line under test

Note: If setting TXINSERT and Rx/DROP to Line 2, the following message is displayed, "Support L1-Tx/L1-Rx Only".

2. Plug the cords into the SunSet T10 and circuit under test. Confirm that signal coming from the network is connected to the Line 1 jacks. The SunSet T10 will respond to loopback codes from the network and the CSU/NI Emulation screen will appear as shown in Figure 168.

3. Setup the SunSet T10 for either NI emulation or CSU emulation. Do this by selecting TYPE and choose either CSU (F1) or NIU (F2).
4. Observe any circuit error counts and verify that the SunSet T10 is receiving a remote loopback command. Note that the framing of the remote loopback command must be the same as the framing selected in the TEST CONFIGURATION screen.
5. If desired, operate any of the local commands as follows:
 - RESET (F1) resets the SunSet T10 to a through mode.
 - LLPBK-1 (F2) operates a line loopback from L1-Rx to L2-Tx. A line loopback regenerates the signal but does not reframe the signal. Hence, BPVs and frame errors will pass through the line loopback unchanged. Once invoked, the line loopback UNLLB-1 replaces the LLPBK-1 command. In this case, pressing the UNLLB-1 (F2) F-key will undo the loopback.
 - LLPBK-2 (F3) operates a line loopback from L2-Rx to L1-Tx. A line loopback regenerates the signal but does not reframe the signal. Hence, BPVs and frame errors will pass through the line loopback unchanged. Once invoked, the payload loopback UNPLB-2 command replaces the PLPBK-2 command. In this case, pressing the UNPLB-2 (F3) F-key will undo the loopback.
6. When finished, press the ESCAPE key on the keypad to return to the MAIN MENU. This drops all loopbacks



Chapter 4 Applications

1.0 Basic Applications

WARNING!

Plugging into a live T1 circuit may cause a loss in service for multiple customers. Proper training is required before proceeding.

Hazardous voltage is present on T1 spans. When plugging in at a repeater housing, plug the cord into the SunSet T10 before plugging into the repeater extender or repeater housing.

To perform a BRIDGE monitor access, select BRIDGE in the TEST CONFIGURATION screen before plugging into the circuit. This ensures that the isolation resistors are in place before the accessing the circuit.

1.1 Connecting the Cords

Figures, 169, 170, and 171 display various ways to plug the SunSet T10 into the circuit.

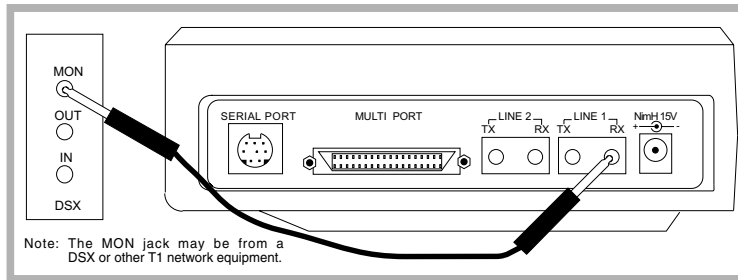


Figure 169 Plugging in-DSXMON Mode

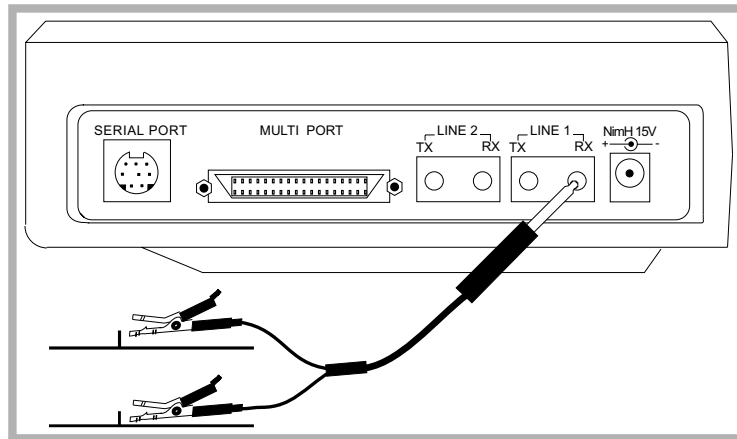


Figure 170 Plugging in-BRIDGE Mode

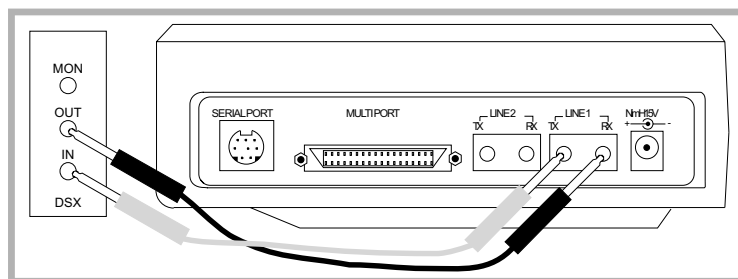


Figure 171 Plugging in-TERM Mode

1.2 Accepting a New Span/Loopback Test

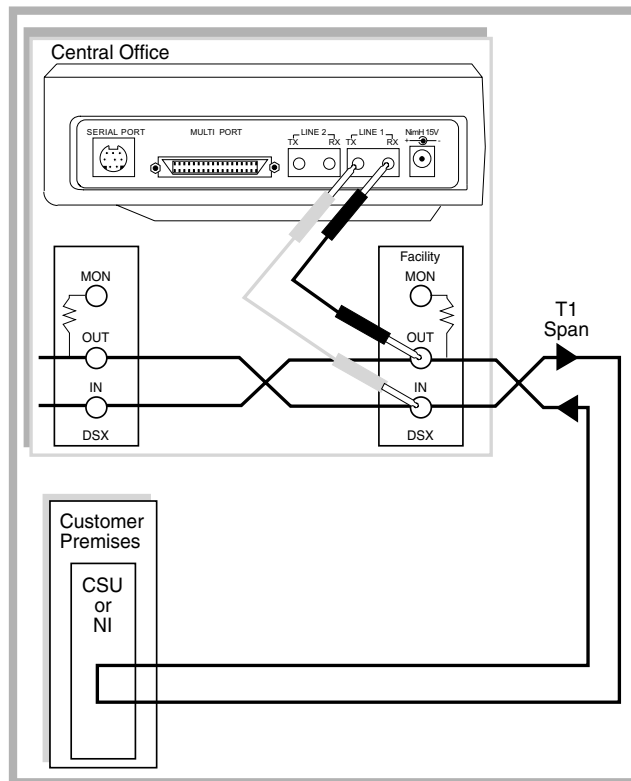


Figure 172 Accepting a New T1 Span

1. Verify that the span is not in service. This acceptance test will disrupt service. Find out the type of loopback device installed at the end of the span, and the loopback codes that operate it.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the circuit as shown in Figure 172. Press the HISTORY key on the keypad to clear the blinking history LEDs.
4. Select LPBK & SPAN CONTROL > CSU & NI CONTROL
 - For SF framing, setup as follows:
TYPE: IN-BAND
CODE: NI or CSU, as appropriate.
Note: Do not select the LOOP-UP entry until last.
 - For ESF framing, setup as follows:
TYPE: ESF-DL
CODE: NETWORK (NIU) or LINE (CSU), as appropriate.
Note: Do not select the LOOP-UP entry until last.
5. Press the LOOP-UP F-key, a “LOOPING UP” message will be displayed followed by a “LOOP UP SUCCEEDED” message.
6. Press the ESCAPE key on the keypad to return to MAIN MENU.
7. Select MAIN MENU > SEND TEST PATTERN and select a pattern to send, then push the ENTER key on the keypad.
8. Select MEASUREMENT RESULTS. Verify that the span performs to requirements for the delivered service.
9. When done with MEASUREMENT RESULTS, press the ESCAPE key on the keypad to return to the MAIN MENU.
10. Select LPBK & SPAN CONTROL > CSU & NI CONTROL and set the MODE to LOOP-DN to release the loopback. Leave the other settings as they were. Verify that a LOOP DOWN SUCCEEDED message appears.
12. Disconnect the SunSet T10 from the circuit.

1.3 Monitoring an In-service Circuit

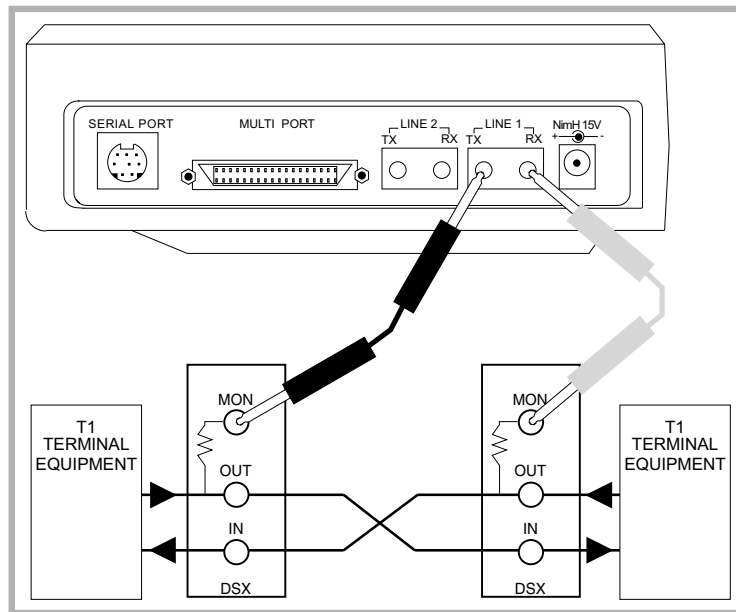


Figure 173 Monitoring an In-service Circuit

1. This test may be performed while the span is carrying live traffic.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL

TxINSERT: L1-Tx

RxDROP: L1-Rx

RxLVL-1: DSXMON

RxLVL-2: DSXMON

TxSOURCE: THRU

FRAMING: as specified by the circuit, or press the AUTO key on the keypad to find the correct framing.

Tx CODING: as specified by the circuit, or press the AUTO key on the keypad to find the correct coding.

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1&2: 0dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10's Line 1 and 2 Rx jacks to the MON jacks as shown in Figure 173. Press the HISTORY key on the keypad to clear any blinking history lights.
4. Examine the LEDs and the GRAPHIC screen for information about the circuit under test.
 - The PULSES LED should be green. A red PULSES LED is an indication of severe problems.
 - A valid framing type should be indicated in green (SF, ESF, or SLC-96). If one of the framing LEDs is red, this indicates severe problems.
 - An active ERRORS LED indicates that the circuit is working but is experiencing problems.
 - An active YEL LED indicates a problem on the other side of the circuit.
 - An active AIS LED may indicate a trouble condition where a network element transmitting to the SunSet T10 has lost its incoming T1 signal and has replaced it with the AIS signal.
 - A. If additional information is required, proceed to step 4; otherwise, disconnect the SunSet T10 from the circuit.
5. Make a basic measurement by selecting MEASUREMENT RESULTS. Verify that the span performs to requirements for the delivered service.
6. When finished, disconnect the SunSet T10 from the circuit.

1.4 Stressing a T1 Line

1.4.1 Using SEND TEST PATTERN

1. Set up the span for testing as outlined in section 1.2 of this chapter. Proceed up to the point of performing measurements.
2. Before performing MEASUREMENT RESULTS, select a stress pattern for the line.
 - A. Press the ESCAPE key on the keypad to reach the MAIN MENU.
 - B. Select SEND TEST PATTERN.
 - C. Select the desired stress pattern. The SunSet T10 will immediately begin transmitting the highlighted test pattern.
3. Once the pattern is sent, check if the BPV and/or ERRORS LEDs are on. If they are, the customer could be having a problem with the circuit. Try additional stress patterns as desired. QRSS is the original stress pattern and is used as the default stress pattern in the SunSet T10. Other stress patterns and their applications are listed in chapter 5.
4. When finished, release the loopback and disconnect the SunSet T10 from the circuit.

1.4.2 Using Bridge Tap Detect

1. Setup the span for testing as outlined in Section 1.2 of this chapter. Proceed up to the point of performing measurements.
2. Select MAIN MENU > OTHER MEASUREMENTS > BRIDGE TAP DETECT.
 - BRIDGE TAP DETECT is a collection of patterns that are known to show the presence of bridge taps. Observe the test in progress by looking at the RESULTS - LOGICAL screen and the BRIDGE TAP DETECT screen by pressing the PAGE-DN F-key. A performance score of 0 bit errors, 0 errored seconds, and 30 available seconds is ideal.
3. When finished, release the loopback and disconnect the SunSet T10 from the circuit.

1.5 Verify Proper B8ZS/AMI Optioning

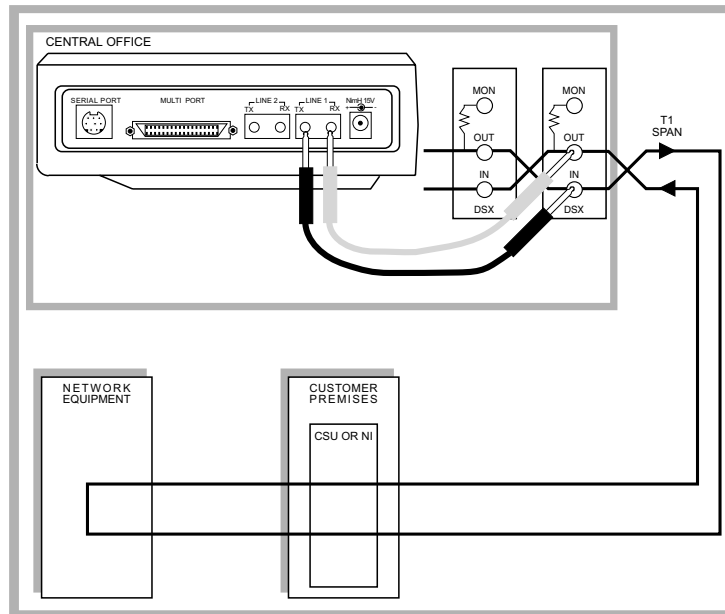


Figure 174 Verify Proper B8ZS/ AMI Optioning

A common fault in new circuits is a B8ZS/AMI optioning mismatch in one or more network elements. This procedure will determine if this exists in the circuit.

1. Setup the SunSet T10 and circuit as described in section 1.2 of this chapter. If testing one end of the circuit first, as in section 1, be sure to repeat the procedure on the other end of the circuit as well. Make sure the SunSet T10's line CODING is set to the same line coding as present on the circuit. Loop up the circuit for testing.
2. Transmit an all 1s signal and an alternating 1s and 0s signal. Verify that there are no errors with any of these signals. If there are any errors, then the problems are not associated with a B8ZS/AMI mismatch.
3. Transmit a 3-in-24 signal. If any equipment in the line has optioning that disagrees with the SunSet T10, a loss of pattern synchronization will occur.
4. Verify the diagnosis by transmitting QRSS. QRSS will also cause errors when there is an AMI/B8ZS mismatch in the circuit, but it will not cause a loss of pattern synchronization.

Note: Referring to the setups of section 1.2 of this chapter, the customer's T1 terminating equipment is isolated from the circuit. Thus, if the customer's equipment has the optioning problem, this procedure will not expose it while the circuit is looped up.

If the circuit tests OK while looped up, but fails when looped down, check if the line code monitored in one direction is not the same as the line code monitored in the other direction. If it is not, then the customer's equipment may be at fault. Perform a loop back from the central office to the network equipment (customer premises), as shown in Figure 174. If the problem still is not evident from the central office, then testing at the customer's premises will be required.

1.6 Checking for Frame Slips & Frequency Sync

Frequency synchronization can be a problem when:

- the customer purchases a channelized T1 circuit.
- the customer's circuit passes through a synchronous network element such as a switch, PBX, or a digital cross-connect system (DCS).
- the T1 circuit passes through more than one carrier.

Use this procedure to identify frequency synchronization problems:

1. Obtain a reference frequency source. This can be the other side of the customer's circuit or a 1.544 Mbps reference signal that is traceable to a stratum 1 level clock.
2. This test may be performed while the span is carrying live customer traffic.
3. Select MAIN MENU > TEST CONFIGURATION and configure as follows

TEST MODE: T1DUAL

TxINSERT: L1-Tx

RxDROP: L1-Rx

RXLVL-1: TERM, if a 3V source with up to 36 dB loss.

RXLVL-2: TERM, if a 3V source with up to 36 dB loss or DSXMON if a DSXMON signal is used.

Tx SOURCE: TESTPAT

FRAMING: As specified by the circuit

Tx CODING: As specified by the circuit

XMT CLOCK: L2-Rx

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

4. Connect the reference T1 signal to the LINE 2 jack on the side of the SunSet T10. Refer to Figure 175.
5. Plug the LINE 1 jack (side of SunSet T10) into the DSX MON jack or other MON jack of the circuit. Press the HISTORY key on the keypad to clear the blinking history LEDs.

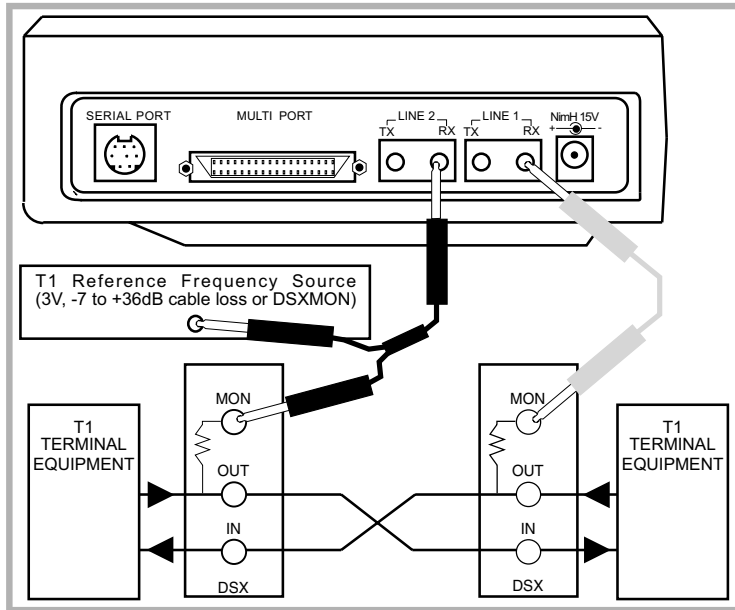


Figure 175 Frequency Synchronization Problems

6. Select MAIN MENU > MEASUREMENT RESULTS and press the PAGE-UP F-key once to view the LINE 1 - FREQUENCY screen. If there is a problem, the frequency slip bar will be moving across the screen. If there is no bar drawn, then no slippage is occurring.
7. If using an external signal source, be sure to check both sides of the circuit. If using one side of the circuit as the reference and the other side as the tested signal, then the test is completed. Disconnect the SunSet T10 from the circuit.

1.7 Measuring Signal Level

Signal level may be measured while performing one of the other tests, or by itself.

At a DSX OUT jack, the level should be 2.7 to 3.3 volts. At repeater outputs, the voltage should be 2.4 to 3.3 volts. The loss at the repeater inputs should generally be 10 to 35 dB.

The signal strength at the input of an office repeater bay CSU, or NI should be from 0 dB to -15 dB.

If there is a signal on the OUT jack, use the setup shown in Figure 176 to measure the level. Otherwise, use the setup shown in Figure 172.

1. Determine the type of access mode to use. This measurement can use TERM, DSXMON, or BRIDGE modes. TERM and BRIDGE provide the most accurate results, but DSXMON may be the most convenient mode. TERM will disrupt service. BRIDGE is accurate, but the results can be degraded by a low-quality termination at the network element terminating the T1 line. A DSXMON measurement should generally show a result of about -20 dB. For this example, we will use TERM mode. Verify that the span is not in service.

2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

```
TEST MODE: T1SINGL
RxLVL-1: TERM
FRAMING: as specified by the circuit
Tx CODING: as specified by the circuit
Tx SOURCE: NORMAL
XMT CLOCK: INTERN
TEST RATE: 1.544M
LBO 1: 0 dB
```

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the circuit as shown in Figure 176. Press the HISTORY key on the keypad to clear the blinking LEDs.
4. Select MEASUREMENT RESULTS. Press the PAGE-DN (F2) F-key twice to access the LINE 1-SIGNAL screen. Read the signal level. Separate readings are given for the positive and negative signals for more accurate information on a faulty regenerator.

5. When finished, disconnect the SunSet T10 from the circuit.

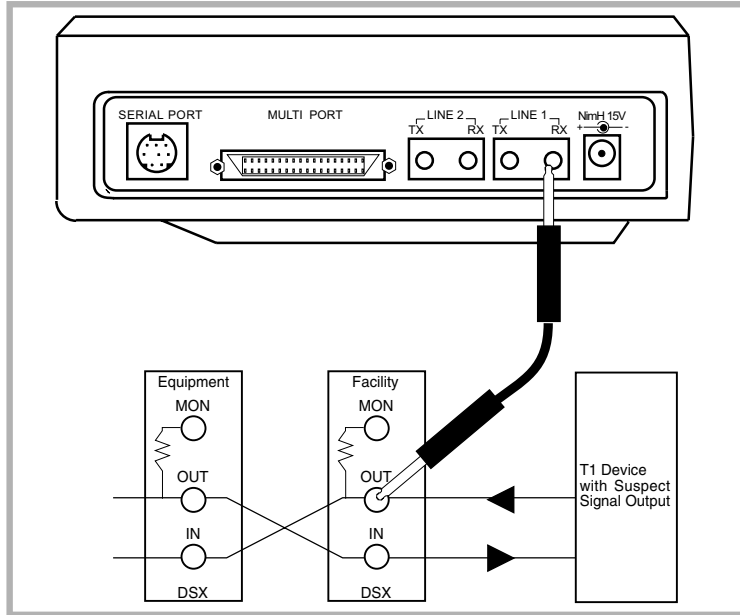


Figure 176 Measuring Signal Level

1.8 Running a Timed Test

Many network tests require the use of an exact period such as 15 minutes, 1 hour, or 24 hours over which to conduct a test. To set the timer for one of these tests use the following procedure:

1. Use the desired procedure in this chapter from section 1.2 or 1.3 as the basis for the testing.
2. Select MAIN MENU > OTHER FEATURES > MEASUREMENT CONFIGURATION
3. Select MEAS DURATION, and press the TIMED (F1) F-key.
4. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
5. Use the keypad to enter the desired number of hours and minutes. The format is (hhh:mm).
6. Press the SHIFT key on the keypad to remove the SHIFT indicator.
7. Press the ENTER key on the keypad when the setting is correct.
8. Press the ESCAPE key on the keypad to return to the MAIN MENU.
9. Proceed with the test procedure as outlined in section 1.2 or 1.3 of this chapter. When performing MEASUREMENT RESULTS, the test is timed. To determine how much time is remaining, observe the RT (Remaining Time) indicator in the upper right-hand corner of the display.

1.9 Checking DSX Wiring

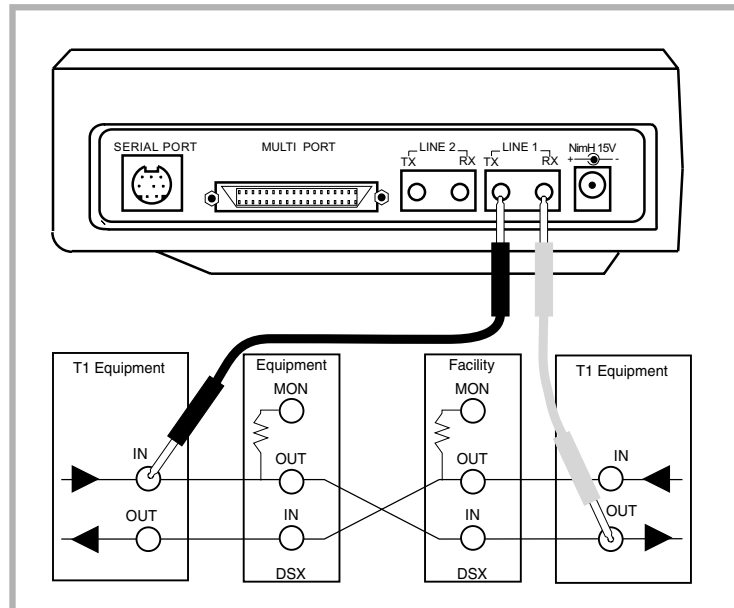


Figure 177 Checking DSX Wiring

An incorrectly wired DSX can be the source of a problem. Use the following procedure to verify proper wiring of the DSX:

Note: If the DSX is very large, you may need two SunSet T10s or a long cord for this test.

1. Verify that the span is not in service. This test will disrupt service.
2. Select MAIN MENU > TEST CONFIGURATION and configure each SunSet T10 as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by your design

Tx CODING: as specified by your design

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the circuit as shown in Figure 177. Use one SunSet T10 as shown in the diagram or two SunSet T10s if the two pieces of equipment are not located close to each other. Find a point on either side of the DSX to connect SunSet T10. Make sure that the circuit is open at each point so that the SunSet T10 is not bridge-tapped onto the existing circuit. Once connected to the circuit, press the HISTORY key on the keypad to clear the blinking LEDs.
4. Verify that the SunSet T10's PAT SYNC LED is green. The BIT ERROR and ERRORS LEDs are off. This indicates that the circuit is properly wired through the DSX.
5. Press the ERR INJ key on the keypad. Verify that the BIT ERROR and ERRORS LEDs turn on and then blink. This assumes that the SunSet T10 is configured to inject 1 BPV and 1 LOGIC error. This verifies that the SunSet T10 did not synchronize to a signal source on another circuit.
6. Repeat the procedure for the other direction of the circuit.
7. When finished, disconnect the SunSet T10 from the circuit.

1.10 Observing Network Codes or Channel Data

```
21:10:05
VIEW RECEIVED DATA
PAGE : 01
T/S   BINARY   HEX   ASCII
001   10111111  BF (FD) ( )
002   11101111  EF (F7) ( )
003   11111011  FB (DF) ( )
004   11111110  FE (7F) ( )
005   11111111  FF (FF) ( )
006   10111111  BF (FD) ( )
007   11101111  EF (F7) ( )
008   11111011  FB (DF) ( )
PAGE-UP PAGE-DN RESUME
```

Figure 178 Ten-Bit Pattern

The SunSet T10's display is useful for analyzing live circuit data. It also displays binary data, hexadecimal, and ASCII translations. Use this to decode T1 network control codes that are in use and to verify the contents of DDS channels.

Sixty screens of data are stored at once. This allows scrolling through the information, and observing changes over time. The number of screens can also reveal whether a T1 network pattern is interleaved with the framing bit or is overwritten by the framing bit. Use this procedure:

1. If BRIDGE or DSXMON access modes are used this test may be performed while the span is carrying live customer traffic. If TERM mode is used the test must be performed out-of-service.
2. Select MAIN MENU > TEST CONFIGURATION and specify DSXMON or BRIDGE mode if the circuit is carrying live traffic. Specify the other settings as desired. To have frame alignment on the received signal, be sure to set the correct framing.
3. Connect the SunSet T10 to the circuit as shown in Figures 169 (DSXMON) or 170 (Bridge). Press the HISTORY key on the keypad to acknowledge the blinking LEDs.
4. Press the ESCAPE key on the keypad to access the MAIN MENU.
5. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA.

6. Review the displayed live data. When the codes of interest appear, press the PAUSE (F3) F-key to trap the 60 screens of data. Then press the PAGE-DN (F2) F-key to scroll through the data. The data is presented as it appears on the T1 bit stream. The data is broken out into timeslots. Use Table 17, Channel Numbering and Table 18, Channel Numbering - SLC-96 to convert from timeslot number to channel number:
7. Figure 178 shows an example of the ten-bit pattern, 1011 1111 1
8. When finished, disconnect the SunSet T10 from the circuit.

Channel Numbering			
T/S	D3/D4	D1D	D2
1	1	1	12
2	2	13	13
3	3	2	1
4	4	14	17
5	5	3	5
6	6	15	21
7	7	4	9
8	8	16	15
9	9	5	3
10	10	17	19
11	11	6	7
12	12	18	23
13	13	7	11
14	14	19	14
15	15	8	2
16	16	20	18
17	17	9	6
18	18	21	22
19	19	10	10
20	20	22	16
21	21	11	4
22	22	23	20
23	23	12	8
24	24	24	24

Table 17 Channel Numbering

Channel Numbering - SLC-96				
T/S	SHLF A	SHLF B	SHLF C	SHLF D
1	1	25	49	73
2	13	37	61	85
3	2	26	50	74
4	14	38	62	86
5	3	27	51	75
6	15	39	63	87
7	4	28	52	76
8	16	40	64	88
9	5	29	53	77
10	17	41	65	89
11	6	30	54	78
12	18	42	66	90
13	7	31	55	79
14	19	43	67	91
15	8	32	56	80
16	20	44	68	92
17	9	33	57	81
18	21	45	69	93
19	10	34	58	82
20	22	46	70	94
21	11	35	59	83
22	23	47	71	95
23	12	36	60	84
24	24	48	72	96

Table 18 Channel Numbering - SLC-96

1.11 Determining Round Trip Circuit Delay

1. Verify that the span is not in service. This test will disrupt service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by your design

Tx CODING: as specified by your design

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the circuit as shown in Figure 172. Press the HISTORY key on the keypad to acknowledge the blinking LEDs.
4. Select LPBK & SPAN CONTROL > CSU & NI CONTROL
 - For SF framing, configure as follows:

MODE: LOOP-UP (Do not select this item until the other settings are correct)

TYPE: IN-BAND

CODE: NI or CSU, as appropriate
 - For ESF framing, configure as follows:

MODE: LOOP-UP (Do not select this item until the other settings are correct)

TYPE: ESF-DL

CODE: Network (NIU) or LINE (CSU), as appropriate
5. Select the MODE line and press the LOOP-UP (F1) F-key.
 - A. A message displaying "LOOPING UP" followed by a "LOOP UP SUCCEEDED" will be displayed.
 - B. Press the GRAPHIC key on the keypad for a visual confirmation.
- Refer to chapter 3, section 6, Loopback & Span Control for additional information about loopback capabilities.

6. Press the ESCAPE key on the keypad four times to return to the MAIN MENU.
7. Select MAIN MENU > OTHER MEASUREMENTS > PROPAGATION DELAY and the SunSet T10 will perform a propagation delay measurement on the looped-up circuit. Read the value of circuit delay reported in μS .
8. When finished, press the ESCAPE key on the keypad twice to return to the MAIN MENU
9. Select LPBK & SPAN CONTROL > CSU & NI CONTROL and select the MODE line.
10. Press the LOOP-DN (F2) F-key to release the loopback. Verify that the "LOOP DOWN SUCCEEDED" message is displayed.
11. Press the ESCAPE key on the keypad three times to return to the MAIN MENU.
11. Disconnect the SunSet T10 from the circuit.

1.12 Determine Distance to Loopback

1. Verify that the span is not in service. This test will disrupt service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by your design

Tx CODING: as specified by your design

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the circuit as shown in Figure 172. Press the HISTORY key to acknowledge the blinking LEDs.
4. Select LPBK & SPAN CONTROL > CSU & NI CONTROL

- For SF framing, configure as follows:

MODE: LOOP-UP (Do not select this item until the other settings are correct)

TYPE: IN-BAND

CODE: NI or CSU, as appropriate

- For ESF framing, configure as follows:

MODE: LOOP-UP (Do not select this item until the other settings are correct)

TYPE: ESF-DL

CODE: Network (NIU) or LINE (CSU), as appropriate

5. Select the MODE line and press the LOOP-UP (F1) F-key.
 - A. A message stating "LOOPING UP" followed by a "LOOP UP SUCCEEDED" will be displayed.
 - B. Press the GRAPHIC key on the keypad for a visual confirmation.

Note: This can be done for any type of loopback - hardware loopback, repeater loopback, and so on.

6. Press the ESCAPE key on the keypad four times to return to the MAIN MENU.
7. Select MAIN MENU > OTHER MEASUREMENTS > PROPAGATION DELAY and the SunSet T10 will perform a propagation delay measurement on the looped-up circuit.
 - A. Read the value of circuit delay reported in kFt. This shows how many kilofeet there are between the SunSet T10 and the loopback device. This measurement is accurate to about 1000 feet and is useful for making sure that the looped repeater is in the expected apparatus case.
- This measurement is valid only if the line does not pass through any network elements and/or transmission elements that introduce appreciable delay. Line repeaters will not cause a problem. Fiber muxes, 3x1 muxes, 3x1 digital cross-connect systems, and office repeater bays that are equipped with dejittering circuits will cause a problem.
- Even if there are devices that cause excessive delay, valuable data can be obtained by looking at the difference in delay time between a loopback at a known location and a loopback at the unknown location.
8. When finished, press the ESCAPE key on the keypad twice to return to the MAIN MENU.
9. Select LPBK & SPAN CONTROL > CSU & NI CONTROL and select the MODE line
10. Press the LOOP-DN (F2) F-key to release the loopback. Verify that the "LOOP DOWN SUCCEEDED" message is displayed.
11. Press the ESCAPE key on the keypad three times to return to the MAIN MENU.
12. Disconnect the SunSet T10 from the circuit.

1.13 Basic Dialing Procedure

This outlines the simplest dialing procedure used.

1. Select MAIN MENU > VF CHANNEL ACCESS > PLACE/RECEIVE CALLS and select the dialing METHOD line. Choose MF, DTMF, or DP.
2. Before dialing, make sure that OFFHOOK (F2) has been selected for the TX ABCD line and that a dial tone can be heard. The most recently dialed phone number will be shown.
 - To dial the previous number, press the ENTER key on the keypad.
 - To delete the previous number press the DELETE (F2) F-key until the number is completely deleted.
 - To enter a new number:
 - A. Press the SHIFT key on the keypad, the SHIFT indicator will appear.
 - B. Enter the numbers 0 through 9, A, B, C, D, E and F on the keypad. For MF method, * and # cannot be used. For DTMF dialing, use the "E" F-key for (*) and "F" F-key for (#). Entering up to 32 digits is permitted.
 - C. Press the SHIFT key on the keypad to remove the SHIFT indicator.
3. After a number is entered, press the ENTER key on the keypad to dial the number (remember to be OFFHOOK and listen for a dial tone). This will send the indicated digits with DIAL PERIOD and SILENT PERIOD as indicated in VF CHANNEL ACCESS, DIAL/SPRVIS SETUP.

Use this procedure to speed dial a preprogrammed user number:

1. Select MAIN MENU > VF CHANNEL ACCESS > DTMF/MF/DP DIALING and select the dialing method then NUMBER.
2. Press the USER (F1) F-key to get the list of USER DIAL NUMBERS. This is the speed dial list.
3. Select the desired number and press the ENTER key on the keypad twice to dial the number (Remember to be OFFHOOK and listen for a dial tone). The SunSet T10 automatically returns to the VF CHANNEL ACCESS screen.

1.14 Entering & Editing Speed Dialing Numbers

The SunSet T10 allows for storing of up to 10 DTMF, DP, or MF USER numbers. Each USER number can contain up to 32 digits. An character label up to ten characters long can be programmed for each phone number. The label makes it easier to remember what the number is used for.

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

1. Select MAIN MENU > VF CHANNEL ACCESS > PLACE/RECEIVE CALLS
2. Select the NUMBER line and press the USER (F1) F-key.
3. Select a blank space and press the CREATE (F1) F-key.
4. The cursor should now be at the LABEL editing position, ready to accept the entry.
5. Press the TOGGLE (F3) F-key. The letter A on the character grid starts blinking.
6. Use the arrow keys on the keypad to select the T character. Press SELECT (F4) F-key. The character T is now the first character of the label. Select the characters E, S, and T by using the same procedure.
7. After selecting the last T, press the TOGGLE (F3) F-key. The character grid will stop blinking.
8. Press the SHIFT key on the keypad to display the SHIFT indicator and use the keypad and press 0, then 1.
9. The label is now completed and TEST01 should appear next to the LABEL line.
10. Press the SHIFT key on the keypad to remove the SHIFT indicator.
11. Select the NUMBER line to enter the telephone number.
12. Press the SHIFT key on the keypad to display the SHIFT indicator.
13. Enter the phone number. Press the keys on the keypad to enter this number, 12345ABCD*#0.
14. When done, press the SHIFT key on the keypad to remove the SHIFT indicator.
15. Press the ENTER key on the keypad to accept the new USER DIAL NUMBER; it will be displayed on the list of USER DIAL NUMBERS.
16. To edit the number, select it and press the EDIT (F2) F-key.
17. The cursor is now positioned on the first character of the LABEL. Press the INSERT (F1) F-key to start inserting more digits at that position, or press the DELETE (F2) F-key to

- remove one or more digits at that position. The cursor may be moved to the right before pressing the INSERT or DELETE F-keys. Toggle into the character grid as described in steps 5 through 9, if needed.
18. When done with the LABEL as described in step 17, confirm that the SHIFT indicator is off and that the character on the character grid has stopped blinking. Then select the number line.
 - A. If needed, press the INSERT (F1) F-key to start inserting more digits at that position, or press the DELETE (F2) F-key to remove one or more digits at that position. The cursor may be moved to the right before pressing the INSERT or DELETE F-keys.
 - B. Press the SHIFT key on the keypad to display the SHIFT indicator to enter different numbers using the keypad.
 19. If a mistake is made while editing an existing user number, press the ESCAPE key on the keypad to abort editing. The original user number is not affected.
 20. When done, press the ENTER key on the keypad; the edited label will be displayed within the list. Press the ESCAPE key on the keypad twice to return to the VF CHANNEL ACCESS menu.

1.15 Monitor a Voice Frequency Channel

This procedure is for monitoring a voice frequency channel within a T1 circuit. Figure 179 illustrates the setup.

This test maybe performed while the span is carrying live customer traffic.

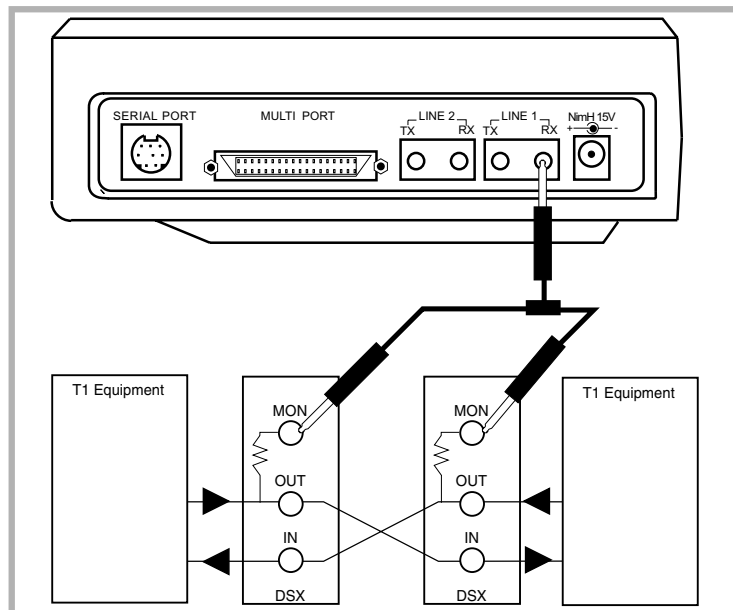


Figure 179 Monitoring an In-Service Voice Frequency Channel

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: BRIDGE or DSXMON

FRAMING: As specified by the circuit

Tx CODING: As specified by the circuit

TX SOURCE: THRU

XMT CLOCK: L1-Rx

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10 to the circuit as shown in Figure 179. Press the HISTORY key on the keypad to clear the blinking LEDs.
3. Select MAIN MENU > VF CHANNEL ACCESS > VF MEASUREMENTS
4. Select the desired transmit and receive channels, and LISTEN SIDE from which to monitor. The channel number is automatically converted to a timeslot number on SF-D4, ESF, and SLC-96 A-digroup DS1s. The SunSet T10 refers to the framing type to make this conversion. If another type of framing is used, refer to Table 17, Channel Numbering, and Table 18, Channel Numbering, SLC-96 to determine which timeslot to specify.
5. Adjust the volume to the desired level by using the volume keys on the keypad.

Note: If unable to monitor the channel, verify that frame synchronization is present. If it is not, press the AUTO key on the keypad. If framing is still not achieved, change the RxLvL in the TEST CONFIGURATION screen. The SunSet T10 cannot perform the monitor function if framing is unavailable.

1.16 Simple Talk/Listen

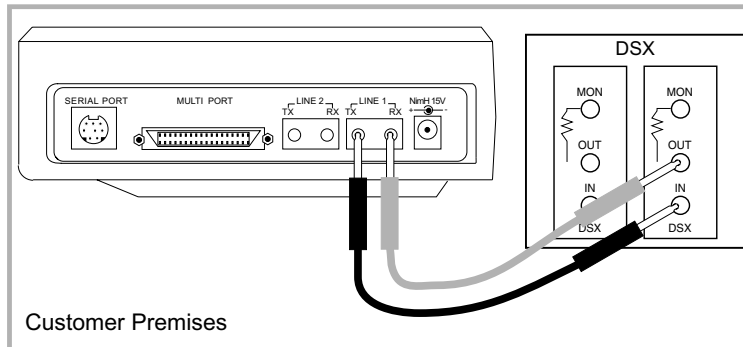


Figure 180 Simple Talk/Listen

This is the simplest procedure for talking and listening on a T1 circuit.

1. Verify that the span is not in service. This test will disrupt service for the 23 channels that are not in use.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by the circuit, except UNFRAME

Tx CODING: as specified by the circuit

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

Note: UNFRAME cannot be selected for the framing type. It is not possible to perform talk and listen functions on an unframed signal. One of the framing LEDs must be lit for this procedure to work.

3. Connect the SunSet T10 to the circuit as shown in Figure 180. Press the HISTORY key on the keypad to acknowledge the blinking history LEDs.
4. Select MAIN MENU > VF MEASUREMENTS and choose the receive (listen) and the transmit (talk) channels; they are usually the same. Talking and listening is now possible on the

channel selected. Adjust the volume to the desired level by using the volume keys on the keypad.

Note: The SunSet T10 will automatically convert the channel number to a timeslot on SF-D4, ESF, and SLC-96 A digroups. For other framing formats or digroups, refer to the channel numbering tables in Tables 17 and 18 to determine which “channel” to specify with the SunSet T10.

5. When finished, disconnect the SunSet T10 from the circuit.

1.17 Sending a Tone

This procedure will disrupt service. Be sure the T1 line is not carrying traffic and that it will be able to withstand the hits that this procedure will introduce.

1. Configure the SunSet T10 for the appropriate TEST CONFIGURATION mode for sending the tone:

Tx SOURCE: When TxSOURCE is set for NORMAL in the TERM mode, the SunSet T10 drops and inserts on the selected channels and fills the other 23 channels with idle code. The received signal is terminated at the SunSet T10 and is not retransmitted.

Tx SOURCE: When TxSOURCE is set for THRU mode, the talk/listen is performed on the LINE 1 or LINE 2 side of a full-duplex circuit. The other 23 channels of that side are transmitted through without disruption. All 24 channels of the other side are transmitted without disruption. There will be a momentary hit on both sides when the SunSet T10 is plugged into the circuit and when it is unplugged. There will also be a hit if the access modes are changed from one side to the other side, even when the cords are not disturbed.

2. When finished configuring the test, press the ENTER key on the keypad to return to the MAIN MENU.
3. Plug the SunSet T10 into the circuit. Refer to Figure 180, Simple/Talk Listen. Press the HISTORY key on the keypad to clear the blinking LEDs.
4. Select MAIN MENU > VF CHANNEL ACCESS > VF MEASUREMENTS and use the NEXT (F1) or PREV (F2) F-keys to set up the receive and transmit channels.
5. Select the INSERT TYPE line and press the TONE (F2) F-key.
6. Select the TONE FREQ Hz line and choose the desired frequency using the F-keys. Use the more (F4) F-key to display additional alternatives.
 - A. If needed, enter a tone frequency directly from the keypad using the SHIFT and number keys on the keypad. Enter a value between 50 Hz and 3950 Hz.
7. Select the TONE LVL dBm line and select either a 0 dBm level or a -13 dBm level.
 - A. If needed, enter the tone level directly from the keypad using the SHIFT and number keys on the keypad. Use the MINUS (F1) F-key if the entry is lower than 0 dBm.

8. Press the ENTER key on the keypad when the settings are completed. The SunSet T10 is now transmitting a tone on the selected channel.
9. When finished, disconnect the SunSet T10 from the circuit.

2.0 Advanced Applications

2.1 Fractional T1 Testing

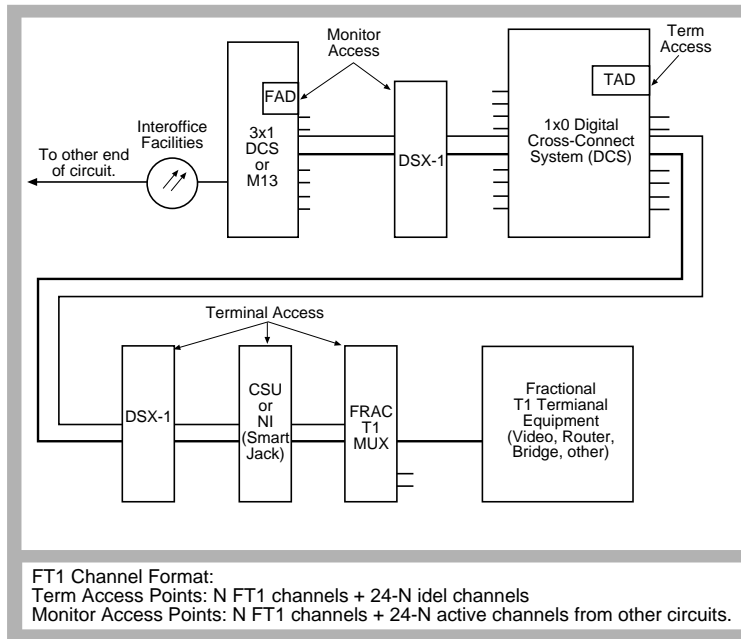


Figure 181 Fractional T1 Circuit

Fractional T1 circuits are circuits with data rates of $N \times 56$ kbps or $N \times 64$ kbps, where N can be from 1–24 channels. N channels of the T1 line are dedicated to the fractional T1 circuit. The remaining channels of the T1 line are filled with either an idle code or other revenue traffic.

A fractional T1 circuit typically starts out at the customer premises at a fractional T1 CSU. Refer to Figure 181. The purpose of this CSU is to convert the signal into a standard T1 signal suitable for transmission on the telephone company network. The CSU may also multiplex other fractional signals into an aggregate fractional signal within the T1.

The CSU is configured to place the data into either an $N \times 56$ or $N \times 64$ kbps format. $N \times 56$ utilizes the first 7 bits in each channel and allows the customer to transmit an unlimited number of zeroes even when the T1 line is optioned for AMI coding. The CSU places a 1 in the eighth bit to ensure 12.5% ones density even when the customer is transmitting all zeroes.

Nx64 is like Nx56, except the CSU inserts no ones. This format is generally used when the T1 line is configured using B8ZS line code or alternating channel assignment. In the B8ZS case, the line code ensures adequate pulse density regardless of the number of zeroes transmitted on the circuit. In the alternating channel assignment case, the idle pattern inserted into the alternating idle channels ensures adequate ones density regardless of the customer data transmitted in the alternating active channels.

The CSU must be configured to put the fractional T1 channels in the proper positions within the 24 T1 channels available in the T1 line. Three formats exist: sequential order, alternating order, and random order. Sequential order is different from alternating order in that all the fractional channels are located contiguously within the T1 frame. For example the same 384 kbps circuit might use channels 1 through 6 of the T1 line. The alternating order format was described in the previous paragraph. For example, a 384 kbps circuit (6x64) might use channels 1, 3, 5, 7, 9, and 11. Channels 2, 4, 6, 8, 10, and 12 might be filled with a 01111111 idle code. A randomly configured 384 kbps circuit might use channels 4, 9, 10, 17, 20, and 24.

In a fractional T1 circuit, such as a video circuit, it is vital that each channel of the circuit arrives in the same order (phase) that it leaves. If this does not happen, the signal becomes scrambled and the receiver cannot properly decode the information. The signal will generally arrive in phase only if the fractional T1 circuit travels as a bundle through the various network elements and transmission media. If individual channels should become split onto two different transmission paths, the transmission delay of the two paths will probably be different.

The function of the CSU in the fractional T1 circuit shown in Figure 181 has already been covered. Other elements serve different functions. For instance, the 1x0 DCS (Digital Cross-connect System) is used to cross-connect the incoming fractional T1 line onto the desired transport line. The 1x0 DCS allows many fractional T1 circuits to be combined with other channelized circuits onto more densely-packed T1s. The idle channels are simply discarded as they pass into the DCS. This reduces costs by providing highest utilization (fill) on the T1 paths in the long-haul portion of the network.

The M13 or 3x1 DCS allows the grouping of many T1s onto selected higher-speed transmission paths for long-haul transport. The fractional circuit passes through a similar group of network elements at the far end of the circuit.

2.1.1 FT1 Circuit Acceptance Test Procedure

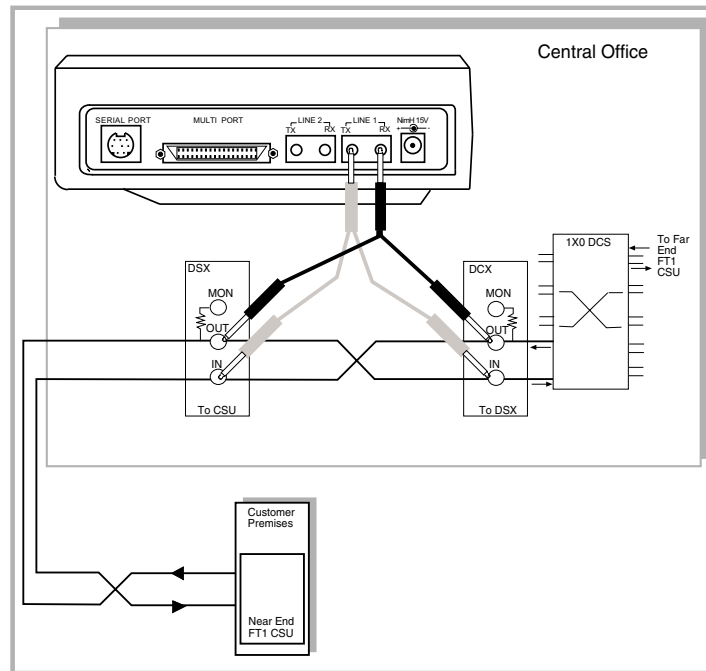


Figure 182 Plugging into the FT1 Circuit

This is an acceptance test for a fractional T1 circuit. It is an advanced procedure that should be attempted only by personnel familiar with the T1 test procedures described earlier in this section. This test may require assistance at the far end.

1. Verify that the fractional circuit is not in service. This acceptance test will disrupt service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL

Tx/INSERT: L1-Tx or L2-Tx

Rx/DROP: opposite of Tx/INSERT

RXLVL-1: DSXMON

RXLVL-2: DSXMON

Tx SOURCE: TESTPAT

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

XMT CLOCK: INTERN if facing the Fractional CSU, otherwise loop through L2-Rx if facing the 1x0 DCS

TEST RATE: Nx56 or Nx64, setup the desired channels for

transmit and receive. Press the ENTER key on the keypad when completed. The SunSet T10 will return to the TEST CONFIGURATION screen.

LBO 1&2: 0 dB (or as required)

When done with press the ENTER key on the keypad to return to the MAIN MENU.

Notes:

- When selecting Nx56 or Nx64, the screen will switch to the FT1 TIMESLOT screen. Manually set up the timeslots to the configuration indicated in the circuit record. If the timeslot configuration is unknown, press the AUTO (F1) F-key to configure the active channels.
 - AUTO configuration may not yield the proper channels if any of the active channels are transmitting an idle code. It will also not work properly if the idle code set in OTHER FEATURES > OTHER PARAMETERS > IDLE CHANNEL CODE is not the same as the idle code on the circuit being tested (7F = 01111111, FF = 11111111). One way to observe the idle and active channels is to plug the SunSet T10 in using the 1.544 Mbps test rate and then select MAIN MENU > VIEW RECEIVED DATA. This will allow you to verify what the SunSet T10 establishes for AUTO configuration.
3. Connect the SunSet T10 to the circuit as shown in Figure 182.
 4. Loop up the circuit toward the near end CSU. A standard CSU loopback code may be used from the access point illustrated in Figure 181, because the SunSet T10 has access to the entire T1 terminating at the CSU.

Note: The SunSet T10 may need to be configured back to the 1.544M TEST RATE in the TEST CONFIGURATION screen in order to loop up the CSU.

5. Change the Tx/INSERT to L1-Tx and Rx/DROP to L2-Rx to loop towards the far end.
6. Loopback the far end FT1 CSU. The loop code will need to be known to activate the far end FT1 CSU. This may require assistance at the far end.
7. Change the access Tx/INSERT to L1-Tx and Rx/DROP to L1-Rx. Press the GRAPHIC key on the keypad to verify that the SunSet T10 is sending and receiving across the entire length of the span from end to end.
8. From the MAIN MENU > MEASUREMENT RESULTS, perform the acceptance test. Verify that the fractional T1 service performs to the requirements for the service delivered.

2.2 SLC-96 Testing

This section contains application notes on SLC-96 testing. Refer to the digital loop carrier maintenance manual for detailed information also see TR-TSY-000008 for SLC-96 reference information. Note that most SLC-96 systems come with maintenance capabilities built into the system. Use these maintenance features as a first step in troubleshooting SLC-96 problems. T1 test equipment should be only be used when the SLC-96 maintenance features are not available.

WARNING!

SLC-96 systems carry up to 96 channels of customer traffic. Properly trained personnel should only use the test setups described here. Use these test setups only in conjunction with a SLC-96 maintenance manual. Verify with the manual that the planned maintenance activities will not cause a disruption in service.

Three typical SLC-96 maintenance applications are discussed in this section. The applications cover in-service data link monitoring, out-of-service testing, and in-service digroup testing. Use Figure 183 as a guide for each of these applications.

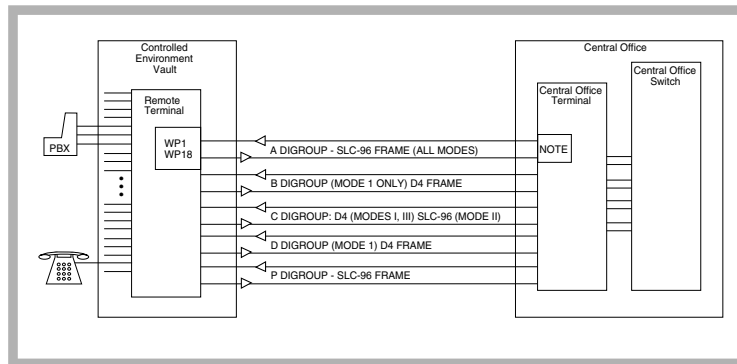


Figure 183 Typical SLC-96 System Configuration

SLC-96 systems are used to carry subscriber telephone service, as well as a variety of special services. The systems provide pair gain by multiplexing up to 96 metallic loops onto 4 T1 lines. These systems have a remote terminal located near the customer and a central office terminal located in the central office. The central office terminal may have a DS1 or analog metal-

lic test mode to the switch. Conversely, newer switches may be built with a TR-TSY-000008 test mode (SLC-96 test mode standard) so that there is no need for a central office SLC-96 terminal.

SLC-96 systems have three modes of operation.

- Mode I is where all 4 digroups are used; each channel of each digroup is reserved exclusively for a given customer.
- Mode II is where only 2 digroups are used for all 96 channels; the SLC-96 system keeps track of which channels are allocated to which customers through the C bits in the SLC data link.
- Mode III: the system serves only special service lines. This mode uses only two digroups, because only 48 channel units can be plugged into the terminals.

The A digroup transmits the system's data link through the SLC-96 framing format. The data link contains alarm, protection switching, far end looping, and other maintenance information. The B and D digroups use D4 framing. These digroups are not used in modes II and III. The C digroup also uses SLC-96 framing. The C datalink is used only in mode II. In this mode, it carries channel allocation information.

The SLC-96 system uses a protection digroup for ensuring a higher level of reliability. Either the remote terminal or the central office terminal may initiate a switch to the protection digroup if a transmission failure is encountered.

2.2.1 SLC-96 Data Link Monitoring

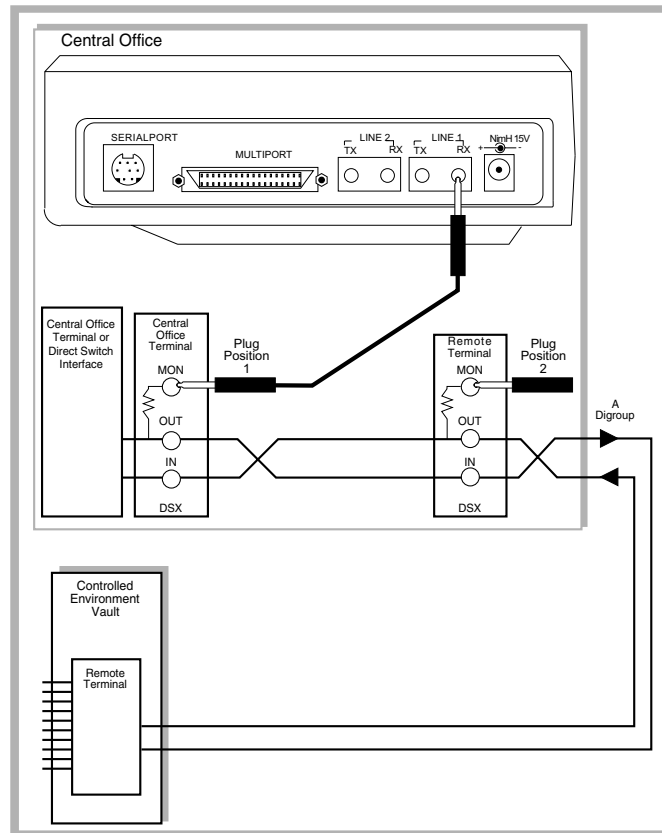


Figure 184 Monitoring the SLC Data Link

This procedure is for monitoring the “A data link” to observe the operational status of an in-service SLC-96 system.

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL
RxLVL-1: DSXMON
FRAMING: SLC-96
Tx CODING: AMI (or as provisioned)
Tx SOURCE: NORMAL
XMT CLOCK: INTERN
TEST RATE: 1.544M
LBO 1: 0 dB (or as required)

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10 to the circuit as shown in Figure 184, Plug Position 1.
3. Select MAIN MENU > MEASUREMENT RESULTS; observe if the signal has any BPVs or SLC-96 framing errors.
4. Press the ESCAPE key on the keypad to escape from MEASUREMENT RESULTS and select DATA LINK CONTROL > MONITOR DATA LINK. Observe if a protection switch is in place. If there is one, note which digroup and the direction of transmission. Observe if a far end loop is in place on any of the digroup; this will be signified by ALM next to the FELP category.
5. Reposition the plug into the remote terminal monitor jack. (Plug Position 2 in Figure 184). Observe:
 - the mode of the remote card (WP1, WP1B).
 - if there is a SLC-96 system alarm.
 - if any of the remote shelves are in alarm.
 - if there is a protection line switch in place.
 - if there is a far end loop in place.
6. Take appropriate maintenance action.
7. When done disconnect the SunSet T10 from the circuit.

2.2.2 Out-of-service SLC-96 Testing

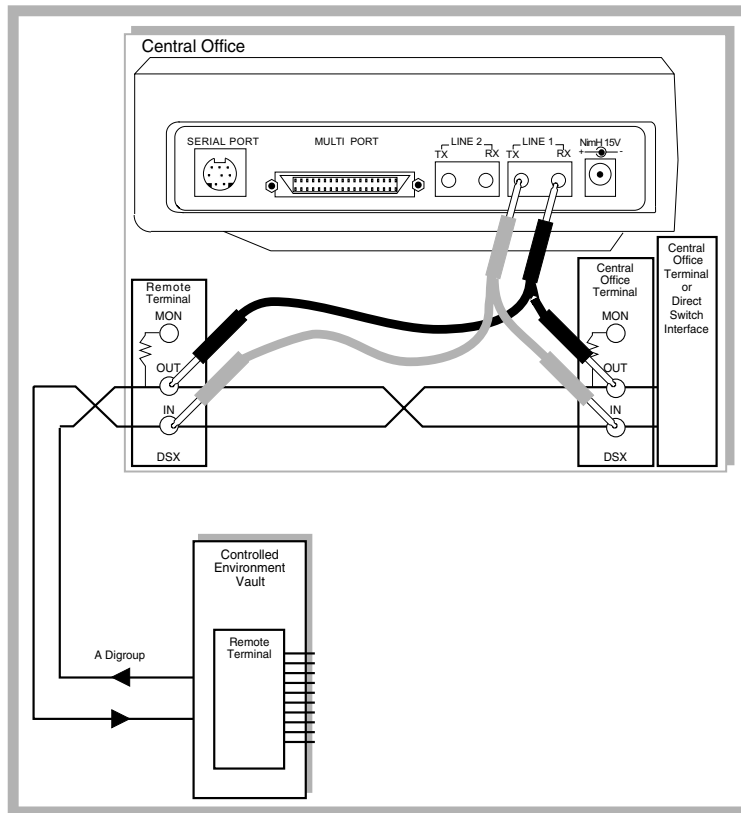


Figure 185 SLC-96 Out-of-Service Testing

This procedure is for out-of-service testing on an SLC-96 system. This test cannot be performed on a live circuit.

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL
RxLVL-1: TERM
FRAMING: SLC-96
Tx CODING: AMI (or as provisioned)
TX SOURCE: NORMAL
XMT CLOCK: INTERN
TEST RATE: 1.544M
LBO 1: 0 dB (or as required)

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10 to the circuit as required for testing. Refer to Figures 184, 185, and 186. More than one SunSet T10 may be necessary because of the need to transmit and receive maintenance commands on the A digroup while performing bit error testing on another digroup. Possible tests to perform include:
 - switching digroup A through D to protection.
 - looping back digroup A through D and P to verify transmission performance.
 - inducing the system to switch to protection by creating a loss of signal, loss of frame, or high bit error rate.
 - verifying transmission of proper alarm indication when a shelf or power source has gone down.
 - verifying the central office terminal transmits an AIS (blue alarm) in the downstream direction when signal has been lost in the upstream direction.
 - verifying that A digroup can do a half-switch when half of the A-digroup, and half of the protection digroup is not working.
 - verifying fast, and transparent protection switching so that users do not notice a problem.
 - verifying proper assignment of channels during mode II operation.
3. When finished, disconnect the SunSet T10 from the circuit.

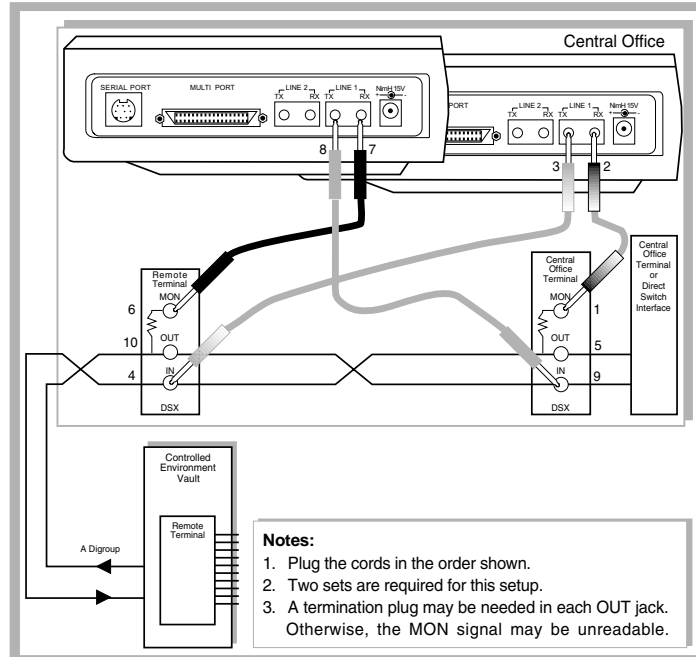


Figure 186 SLC-96 A Digroup Data Link Transmission

2.3 In-Service Hitless Dual Drop & Insert THRU Testing

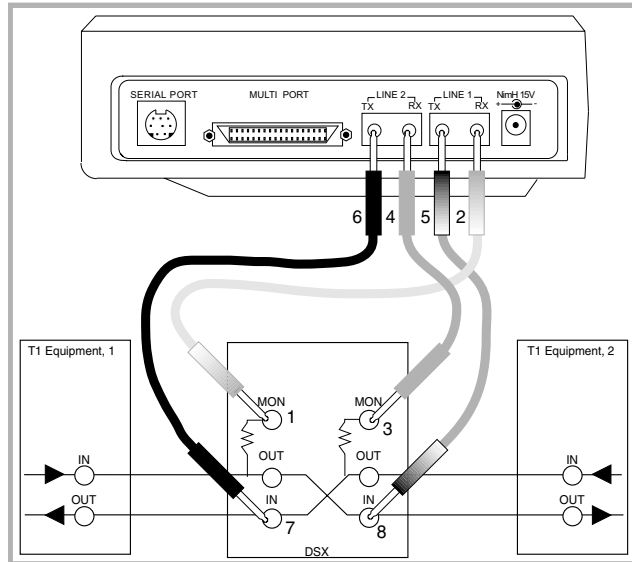


Figure 187 In Service Full Duplex THRU Drop and Insert

Warning!

Only experienced technicians should attempt this procedure. Any mistakes will disrupt service. By entering the VF CHANNEL ACCESS menu, the SunSet T10 will start sending a tone, or sound from the microphone, to the specified channel that is set in VF MEASUREMENTS. Make sure these settings are correct before continuing.

In-service drop and insert testing is useful for :

- placing a telephone call on a single channel.
- sending and receiving tones to test channels.

Use the following procedure:

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL

Tx/INSERT: L1-Tx

Rx/DROP: L2-Rx

RxLVL-1: DSXMON or BRIDGE

RxLVL-2: DSXMON or BRIDGE

Tx SOURCE: THRU

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

XMT CLOCK: L1-Rx

TEST RATE: 1.544M

LBO 1&2: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Depending on the test application, the following can be done:

- For talk and listen:
 - A. Select MAIN MENU > VF CHANNEL ACCESS > VF MEASUREMENTS, select the receive (listen) and transmit (talk) channels (they are usually the same channel number). Choose TALK for the INSERT TYPE and L1-Rx for the LISTEN SIDE. When connected to the circuit, talking, and listening can be done on the selected channel.
 - B. Adjust the volume to the desired level by pressing the volume keys on the keypad.

- To send and receive a tone:
 - A. Select MAIN MENU > VF CHANNEL ACCESS > VF MEASUREMENTS; use the NEXT (F1) or PREV (F2) F-keys to set up the receive and transmit channels. Select the rest of the menu items as follows:

Tx-1 T/S: Any

Rx-2 T/S: Any

Rx-1 T/S: Any

INSERT TYPE: TONE

TONE FREQ Hz: pick desired tone frequency

TONE LVL dBm: pick desired tone level

Tx-1 A/B/C/D: pick desired action

LISTEN SIDE: BOTH

Once connected to the circuit, a tone will be transmitted on the selected channel.

3. To conduct a hitless dual drop and insert THRU mode test on a line that is in service:

- make sure all the connections are made in accordance with the numbering procedure in Figure 187.
- If performed properly, this test will disrupt service for a few hundred milliseconds.

4. Press the HISTORY key on the keypad to clear the blinking LEDs.

- These procedures assume that both EQUIPMENT 1 and EQUIPMENT 2 are set to loopback mode.
5. If in talk and listen mode, talking and listening on the selected channel and line is possible.

If you selected CHANNEL 1 and set the LISTEN SIDE to L1-Rx, you should hear a voice conversation only on CHANNEL 1 from EQUIPMENT 1. EQUIPMENT 2 should also be able to hear only your voice on CHANNEL 1 since you are transmitting out to LINE 1 on that specific channel (see Figure 187).

If you change the channel, then you will be able to talk and listen on that specific channel. The unselected channels of both EQUIPMENT 1 and 2 should be uninterrupted.

For tones, check to see that the same tone frequency level is being received as was inserted on the specified channel (i.e. the TONE FREQ Hz specified should be the same as the Rx-1 FRQ/LVL). The transmitted A/B/C/D bits should be the same as the received A/B/C/D bits when the ONHOOK (F1), OFFHOOK (F2), and WINK (F3) F-keys are pressed.
 6. Try sending two different tones.
 - A. Have EQUIPMENT 1 send a 404 Hz tone on CHANNEL 1.
 - B. Have EQUIPMENT 2 send an 1804 Hz tone also on CHANNEL 1.
 - C. From the SunSet T10, the different tones should be audible on CHANNEL 1 by looking at the RxFREQ/LEVEL from the line that was specified in TEST CONFIGURATION.
 - CHANNEL 1 of LINE 1 should be a 404 Hz tone.
 - CHANNEL 1 of LINE 2 should be at 1804 Hz.
 - For LINE 1, make sure that the Rx-1 A/B/C/D bits for the SunSet T10 are the same as the transmitted A/B/C/D bits from EQUIPMENT 1.
 - The Line 1 Tx-1 A/B/C/D bits for the SunSet T10 should also be the same as the received A/B/C/D bits at EQUIPMENT 2.
 7. Check the other channels by repeating step 6. Both EQUIPMENT 1 and EQUIPMENT 2 should not be disturbed.
 8. Repeat the same checks for LINE 2.

2.4 Advanced Talk/ Listen

Advanced Talk/Listen allows use of different access modes, signaling, and other additional features. Use the Simple Talk/Listen procedure as a reference for this procedure.

1. Verify that the span is not in service if a disruptive access mode is used.
2. Select MAIN MENU > TEST CONFIGURATION, configure as needed:

Tx SOURCE: NORMAL. In the TERM mode, the SunSet T10 drops and inserts on the selected channels and fills the other 23 channels with idle code. The received signal is terminated at the SunSet T10 and is not retransmitted.

Tx SOURCE: THRU. In THRU mode, the talk/listen will be performed on the LINE 1, or the LINE 2 side of a full-duplex circuit. The other 23 channels of that side will be transmitted without disruption. All 24 channels of the other side will be transmitted without disruption. There will be a momentary hit on both sides when the SunSet T10 is plugged into the circuit and when it is unplugged. There will also be a hit if access modes are changed from one side to the other side.

3. Connect the SunSet T10 to the circuit according to the access mode selected.
4. Press the HISTORY key on the keypad to clear the blinking LEDs.
5. Select MAIN MENU > VF CHANNEL ACCESS > VF MEASUREMENTS
6. Select the receive (listen) and transmit (talk) channels.
7. Set the INSERT TYPE to TALK. If access to a D1D, D2, or SLC-96 digroups B-D is required, refer to Tables 17, Channel Numbering, and 18, Channel Numbering-SLC-96.
8. Talking and listening on the selected channel is now possible. Adjust the volume to the desired level by using the volume keys on the keypad.
9. If control supervision of the circuit is needed, go to Tx-1 or Tx-2 A/B/C/D and enter the supervision bits in order to go off-hook, on-hook, or wink. Use the appropriate F-keys, ON-HOOK (F1), OFFHOOK (F2), WINK (F3), or SEND (F4) to send the ABCD bits. View the supervision bits that are returned on this same screen in Rx-1 or Rx-2 A/B/C/D.

- A. Press the ESCAPE key on the keypad to exit this screen. The last supervision bits sent will be sent for the remainder of the session.
10. If dialing is to be performed on the circuit:
- A. Select DTMF DIALING and press the ENTER key on the keypad.
 - B. Enter the number to be dialed and then press the ENTER key on the keypad.
- 11 When finished, disconnect the SunSet T10 from the circuit.

For reference, the following tables list the common signaling arrangements used on D4 channel banks. TRMT refers to the signaling bits transmitted by the channel bank equipped with indicated channel card. RCV refers to the signaling bits received by the channel bank. * means that either a 1 or a 0 may appear.

Dial Pulse Originating (DPO)			
VF input to DPO	TRMT	RCV	DPO VF Output
	AB	AB	
Loop open	00	**	
Loop closure	11	**	
	**	0*	Normal batt
	**	1*	Reverse batt
Dial Pulse Terminating (DPT)			
VF input to DPT	TRMT	RCV	DPT VF Output
	AB	AB	
Normal batt	00	**	
Reverse batt	11	**	
	**	0*	Loop open
	**	1*	Loop closure
2- or 4-wire E&M			
E&M Input	TRMT	RCV	E&M Output
	AB	AB	
M-lead grd or open	00	**	
M-lead batt	11	**	
	**	0*	E-lead open
	**	1*	E-ld grd or looped
Revertive Pulse Originating (RPO)			
VF Input to RPO	TRMT	RCV	RPO VF Output
	AB	AB	
Loop open	00	**	
Loop closure	11	**	
	**	01	Normal batt, no RP
	**	00	Normal batt & RP
	**	1*	Reverse batt
Revertive Pulse Terminating (RPT)			
VF Input to RPT	TRMT	RCV	RPT VF Output
	AB	AB	
Normal batt	00	**	
Reverse batt	11	**	
	**	0*	Loop open
	**	1*	Loop closure
Sleeve Dial Pulse Originating (SDPO)			
VF input to SDPO	TRMT	RCV	SDPO VF output
	AB	AB	
Loop open	00	**	No sleeve gnd
Loop closure	11	**	Sleeve gnd
	**	0*	Normal batt
	**	1*	Reverse batt
Duplex (DX) 2-wire, 900 ohm or 4-wire, 600 ohm			
VF input to DX	TRMT	RCV	DX VF output
	AB	AB	
On-hook (idle)	00	**	
Off-hook (busy)	11	**	
	**	0*	On-hook (idle)
	**	1*	Off-hook (busy)
Equalized Transmission Only (ETO), or TO, 4- or 2-wire			
VF input to ETO	TRMT	RCV	ETO VF output
	AB	AB	
No signaling	**	**	No signaling

Table 19 D4 Channel Bank Signaling part 1 of 2

Foreign Exchange Office End (FXO), Gnd Start mode			
VF input to FXO	TRMT	RCV	FXO output
	AB	AB	
No tip gnd	1*	**	
Tip gnd	0*	**	
No ringing	*1	**	
Ringing	*0	**	
	**	0*	Loop open
	**	1*	Loop closure
	**	*1	No ring gnd
	**	*0	Ring gnd
Foreign Exchange Office End (FXO), Loop Start mode			
VF input to FXO	TRMT	RCV	FXO output
	AB	AB	
No ringing	01	**	
Ringing	00	**	
	**	0*	Loop open
	**	1*	Loop closure
Foreign Exchange Subscriber End (FXS) grd start mode			
VF input to FXS	TRMT	RCV	FXS VF output
	AB	AB	
Loop open, no ring gnd	01	**	
Ring gnd	00	1*	No tip gnd
Loop closure, or ring gnd	11	0*	Tip gnd
	**	1*	No tip gnd, no ring
	**	01	Tip gnd, no ringing
Loop open	01	00	Tip gnd, ringing
Loop closure	11	00	Tip gnd, no ringing
Foreign Exchange Subscriber End (FXS), loop start mode			
VF input to FXS	TRMT	RCV	FXS VF output
	AB	AB	
Loop open	01	**	
Loop closure	11	**	
	*1	*1	No ringing
Loop open	01	*0	Ringing
Loop closure	11	*0	No ringing
Pulse Link Repeater (PLR)			
VF input to PLR	TRMT	RCV	PLR E&M output
	AB	AB	
E-lead open	00	**	
E-lead grd or loop	11	**	
	**	0*	M-lead grd or open
	**	1*	M-lead batt or loop
Ringdown (RD) 2-wire, 900 ohm or 4-wire, 600 ohm			
Input to RD	TRMT	RCV	RD output
	AB	AB	
No ring to t,r simp'x	11	**	
20Hz ring t,r simp'x	00	1*	No ring to t,r pair
20Hz ring t,r simp'x	11	0*	ring on t,r pair
sg lead at grd	11	**	
sg lead at -48 Vdc	11	0*	48Vdc to sg lead
sg lead at -48 Vdc	00	1*	Grd sens relay to sg

D4 Channel Bank Signaling part 2 of 2

2.5 Testing SUPERTRUNK VF DS-0

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL- 1: TERM

FRAMING: SF- D4 or ESF, based on the design of the circuit

CODING: AMI

TxSOURCE: NORMAL

XMT CLOCK: L1- Rx

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Select SEND TEST PATTERN and select the 1–8 pattern.

Warning!

Failure to transmit this code back to the switch while measuring the T1 signal may result in the switch automatically removing the trunks from service and failing the T1 circuit.

3. Press the ENTER key on the keypad to return to the MAIN MENU.
4. Connect the SunSet T10 to the T1 circuit using the appropriate cord plugged into the Line 1 Tx and Rx jacks. If using the SunSet Dual Bantam to Modular Plug cord, the marked side of the Dual Bantam cord should be inserted into the Line 1 Rx jack.
5. Press the HISTORY key on the keypad to clear the flashing ERRORS LED.
6. Select MEASUREMENT RESULTS.
7. Press the STOP (F3) F-key and then press the RESTART (F3) F-key to restart the test.
 - Verify that the PULSES LED and the framing LED (SF or ESF) are green.
 - The MEASUREMENT RESULTS summary screen should indicate NO ERRORS.
8. Press the ESCAPE key on the keypad to return to the MAIN MENU.
9. Select VF CHANNEL ACCESS > VF MEASUREMENTS.
10. Select the Rx-1 T/S line and use the NEXT (F1) or PREV (F2) F-keys to select the DS-0 to be tested (1–24).
11. Select the INSERT TYPE line and press the TALK (F1) F-key.

12. Press the ESCAPE key on the keypad to return to VF CHANNELACCESS.
13. Select DIAL/SPRVIS SETUP and select the TRUNK TYPE line. Choose the appropriate trunk type, E&M, G-START, or L-START.
 - If selecting either G-START or L-START, then select the EQUIPMENT line. Choose FXO or FXS, as appropriate. EQUIPMENT is not applicable for Type E&M.
14. Press the ENTER key on the keypad to return to the VF CHANNELACCESS menu.
15. Select PLACE/RECEIVE CALLS and select the METHOD line. Press the DTMF (F2) F-key.
16. Select the NUMBER line.
 - A. Press the SHIFT key on the keypad.
 - B. Enter the number to be dialed using the keypad.
 - C. Press the SHIFT key again to release the SHIFT.
17. Select the Tx ABCD line and press the OFF-HOOK (F2) F-key.
 - If a dial tone is not received, the trouble is at the control office.
 - Look at the Rx ABCD bits. If using G-START or L-START trunk type, OFF-HOOK should be observed.
 - If using E&M trunk type, a wink should be received.
10. Select the NUMBER line and press the SEND (F2) F-key.
 - "DIALING A" should be displayed.
 - DTMF tones should be heard if the volume is set high enough.
11. The call should now be completed and a Talk/Listen test can now be performed.

3.0 Datacom Applications

3.1 Point to Point Datacom Testing

In this application, the SunSet T10 (DTE) is connected to a modem (DCE) to perform a simple BERT test. The V.35 interface will be used. This test will allow the SunSet T10 to send and receive signals with a DCE.

1. Verify that the datacom circuit is not in service. This test will disrupt the service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: DATACOM

TYPE: as required by interface; for this example use V.35.

MODE: DTE

TEST RATE: as required by modem

REF CLOCK: INTERN

Note: If the SunSet T10 supplies the timing source, select INTERN for REF CLOCK. If the SunSet T10 is using timing from the network, select RECEIVE. When the SunSet T10 uses received timing, the test rate selection is not significant, since the SunSet T10 will use its received rate.

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the modem as shown in Figure 188.

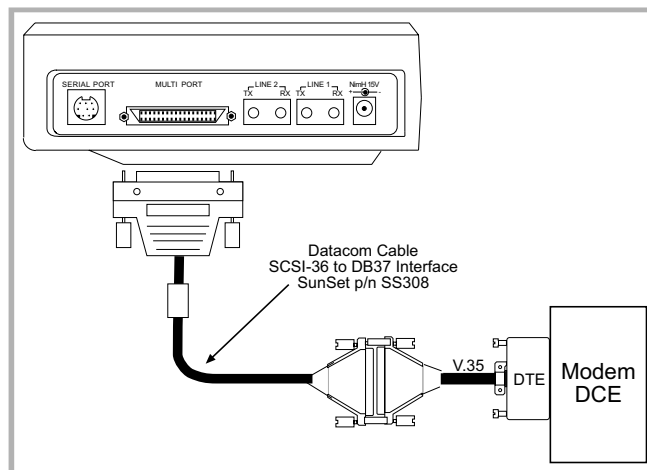


Figure 188 Modem Testing with Datacom

4. Select SEND TEST PATTERN and select a pattern. Certain patterns may not be available depending on the test rate. If a pattern is not available, a message will appear at the bottom of the display screen.
5. Press the ESCAPE on the keypad to return to the MAIN MENU.
6. Select DATACOM INTERFACE and refer to Figure 189.

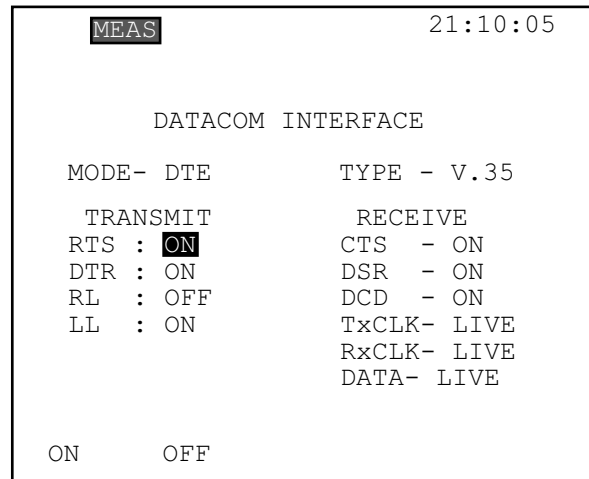


Figure 189 Datacom Interface Screen

7. Check that the transmit leads RTS and DTR are turned on. If not, select the lead and press the ON (F1) F-key.
 - A. Try turning these signals ON or OFF to test whether the modem is receiving the SunSet T10's signal.
8. Select LL, local loop and press the ON (F1) F-key This will activate a loop on the modem.
9. Examine the received information. TxCLK, RxCLK, and DATA should all show LIVE.
10. Press the ESCAPE key on the keypad to return to the MAIN MENU
11. Select MEASUREMENT RESULTS.
 - The RCV and XMT patterns should be the same.
 - The PAT SYNC LED should be green. If not, press the RESYNC key on the keypad. If the PAT SYNC LED still is not green, the modem may have a problem regenerating the pattern.
 - The RxHz should be the same as the transmitted rate. If there is a discrepancy, the modem may have a problem retransmitting the clock.

12. Test the validity of the loop by injecting errors and confirming that they come back. Do this by pressing the ERR INJ key on the keypad.

- The BIT ERROR LED should be red and one bit error should be recorded in MEASUREMENT RESULTS.

12. When finished, disconnect the SunSet T10.

3.2 Fault Location with Remote & Local Loops

This application provides a troubleshooting procedure using the remote and local loopback capabilities of the SunSet T10. Figure 190 shows a remote and local loopback.

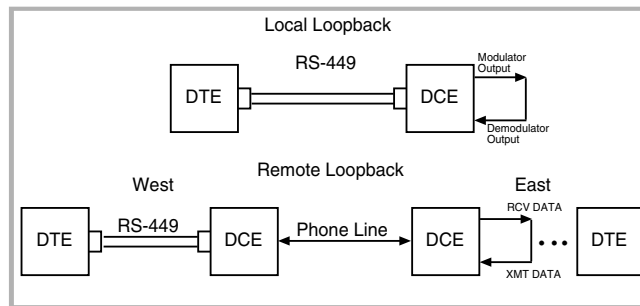


Figure 190 Local and Remote Loopback

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:
TEST MODE: DATACOM
TYPE: per interface
MODE: DTE
TEST RATE: per modem
REF CLOCK: INTERN
When done, press the ENTER key on the keypad to return to the MAIN MENU.
2. Connect the SunSet T10 to the modem under test.
3. Select DATACOM INTERFACE. Confirm that the transmit leads RTS and DTR are turned on. If not, select the lead and press the ON (F1) F-key.
4. Select the LL line and press the ON (F1) F-key, this activates a loop on the modem.
 - The transmit and receive data LEDs should light up.
 - If the received data LED of the modem lights up, but not the transmit data LED, then the modem is faulty. This is because it cannot transmit the received data back to the SunSet T10.
5. Press the ESCAPE key on the keypad to return to the MAIN MENU.
6. Select MAIN MENU > MEASUREMENT RESULTS and verify that the RxHz line is equivalent to the test rate. If there is a

- discrepancy, the modem will have a problem retransmitting the clock.
7. Check that the RCV and XMT patterns are the same.
 8. The PAT SYNC LED should be green.
 - A. If not, press the RESYNC key on the keypad.
 - B. If the LED is still red, the modem may have a problem regenerating the pattern.
 9. Test the validity of the loop by pressing the ERR INJ key on the keypad.
 - A. Verify that these errors come back.
 - B. The BIT ERROR LED should be red and a bit error should be recorded in MEASUREMENT RESULTS.
 9. If the previous steps have been completed successfully, then the local modem is not at fault.
 - A. Return to the DATACOM INTERFACE screen and turn off the LL (local loop) line.
 10. Now that the local modem is ruled out, the far end modem will need to be tested using a remote loopback.
 11. To test the remote loopback, check that the far end modem has a loopback capability at the interface (the modem must be able to loop TxDATA to the RxDATA. It also must loop TxCLK, RxCLK, and TCLK to TxDATA).
 12. To use the modem, it may be necessary to connect a PC to dial out. Once the connection is in place, disconnect the PC and replace it with the SunSet T10 datacom connector.
- Note:** It may also be necessary to set the DTR to be always on by using the PC so that the line is not dropped when switching from the PC to SunSet T10 datacom connector.
13. Select MAIN MENU > DATACOM INTERFACE; check that the transmit leads RTS and DTR are turned on. If not, select the lead and press the ON (F1) F-key. Select RL and press the ON (F1) F-key.
 14. Press the ESCAPE key on the keypad to return to the MAIN MENU.
 15. Select MEASUREMENT RESULTS and verify that the RxHz line is equivalent to the test rate.
 - If RxHz is low, then the clock is not being received properly from the far end modem.

16. Check the RCV and XMT patterns, they should be the same.
The PAT SYNC LED should be green.

- If the items in step 15 are correct.
 - A. Perform a BERT test by pressing the ERR INJ key on the keypad.
 - B. Verify that the errors injected come back. The BIT ERROR LED should be red and a bit error should be recorded in MEASUREMENT RESULTS.
 - C. If this is successful, then the phone line and the far end modem are operating properly.
- If the BERT test is not successful, this indicates a problem with either the phone line or the far end modem.
 - A. To test the far end modem, perform a local loopback on that end, following steps 6—11 of this procedure.
 - If there are no problems with this local loopback, then the problem is with the phone line.
 - If there are problems, the modem is at fault.

3.3 Emulating a Terminal Multiplex

In the T1-MUX Mode, the SunSet T10 emulates a 64 kbps to 1.544 Mbps multiplexer. Use this procedure to multiplex one or more 64 kbps signals onto a 1.544 Mbps signal. This application is useful if you suspect a faulty multiplex. By successfully substituting the SunSet T10 for a MUX, you can isolate the problem to that replaced MUX.

1. From the MAIN MENU > TEST CONFIGURATION and configure as follows.

TEST MODE: T1-MUX

T1 section

Tx/INSERT: L1-Tx

Rx/DROP: L1-Rx

FRAMING: As specified by the span design

CODING: As specified by the span design

RxLVL-1: TERM

RxLVL-2: TERM

XMT CLK: L1-Rx

Note: In T1-MUX, the set is forced to received timing.

LBO 1&2: As specified by the span design

DATAKOM section

TYPE: Select the datacom interface that will provide a 64 kbps frame.

TxSRC: T1DRP

MODE: DCE; in T1-MUX the SunSet T10 is forced to DCE.

MUX section

BERT: T1DRP

T1INS: The same as DATAKOM TYPE (i.e. RS232).

T1T/S: Select the 64 kbps timeslot(s) to be multiplexed from the datacom to the T1 side (see step 3).

3. Select the 64Kbps timeslot(s) to be multiplexed.
- A. Press the Nx64K (F1) F-key to enter the T10 TIME SLOT screen.
 - B. Use the arrow keys to move the flashing cursor to the desired receive timeslot and press the SELECT (F2) F-key. As you select your receive timeslots, the respective transmit timeslots will also be highlighted. This is because the receive and transmit timeslots should normally be set to the same numbers.

- If you want these timeslots to differ, select the transmit section and manually set up the desired timeslots.
 - You may also press UN-SEL (F3) to de-select a particular timeslot or CLR-ALL (F4) to erase all the selected timeslots and start with a clear screen.
 - For RS232, you may select only one receive and transmit timeslot.
4. Connect the SunSet T10 to the circuit according to Figure 191.
 5. Press the HISTORY key to acknowledge any blinking history lights and turn them off.
 6. Verify that the PAT SYNC LED is lit green. If not, press the RESYNC key on the keypad.

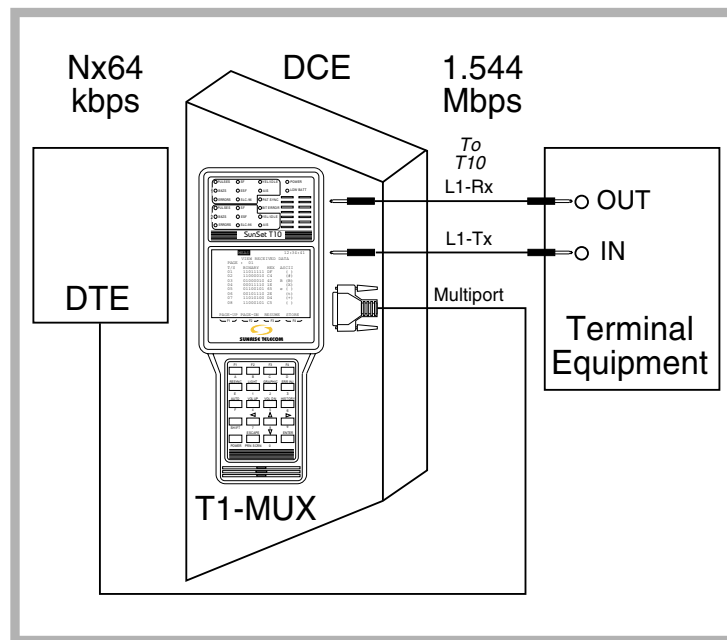


Figure 191 Emulating a Terminal Multiplex

- In Figure 191, the DTE supplies the transmitted 64 kbps signal, to the SunSet T10 through the multiport. The SunSet T10 multiplexes this 64 kbps signal onto a 1.544 Mbps T1 signal, which is then transmitted through the T1 L1-Tx jack.
In Figure 191, the SunSet T10 is connected to an IN/OUT

monitor jack. The 1.544M signal is passed from the IN to the OUT jack and back to the L1-Rx jack on the SunSet T10. This setup allows checking the multiplexed signal. Step 7 outlines the procedure for checking the multiplexed 1.544M signal.

7. Inject an error from the DTE.
 - A. Check that the BERT line in the TEST CONFIGURATION screen is set to T1DRP. This means that the LEDs will show information about the signal received on the T1 L1-Rx port.
 - B. Upon injecting the error, the ERRORS LED should light red. If it does, the multiplexing ability of the SunSet T10 has been verified. With this ability, the SunSet T10 can replace a MUX.
 - C. If a faulty MUX is suspected, replace it with the SunSet T10 by following the previous steps. If the circuit problems clear up with the SunSet T10, this verifies that the problems exist with the MUX.

3.4 Emulating an Add/Drop Multiplexer

The SunSet T10 has the capability to emulate an Add/Drop Multiplexer. Use this procedure to drop and insert 64 kbps timeslots between a datacom device and T1 lines.

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1 DUAL

Tx/INST: L1-TX

Rx/DROP: L2-RX

RxLVL-1: TERM

RxLVL-2: TERM

Tx SOURCE: THRU

FRAMING: as provisioned

Tx CODING: as provisioned

XMTCLK: L1-RX

TEST RATE: 1.554M

LBO 1&2: as provisioned

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10 to the two TEs (terminal equipment) in the order shown in Figure 192.
 - A. Plug into the OUT jack of TE 1; connect the same cord to LINE 1 Rx on the SunSet T10.
 - B. Plug a second bantam cord to the OUT jack on TE 2; connect this cord to LINE 2 Rx on the SunSet T10.
 - C. Plug the third bantam cord to LINE 1 Tx of the SunSet T10 and then plug a fourth cord into LINE 2 Tx. Do not connect either of these cords to the TE yet.
 - D. Verify that the SunSet T10's LEDs for LINE 1 and LINE 2 show proper framing, coding, and no errors. In other words, there should be green LEDs for CODING, FRAMING, and no red LEDs.
 - E. Press the GRAPHIC key on the keypad, and verify that the SunSet T10 is in THRU Mode.
 - F. Connect the cord from LINE 2 Tx to the IN jack of TE 1. The circuit will be disrupted for two or more seconds when the cords are connected.
 - G. Connect the cord from LINE 1 Tx to the IN jack of TE 2. The circuit will be disrupted for two or more seconds when the cords are connected.

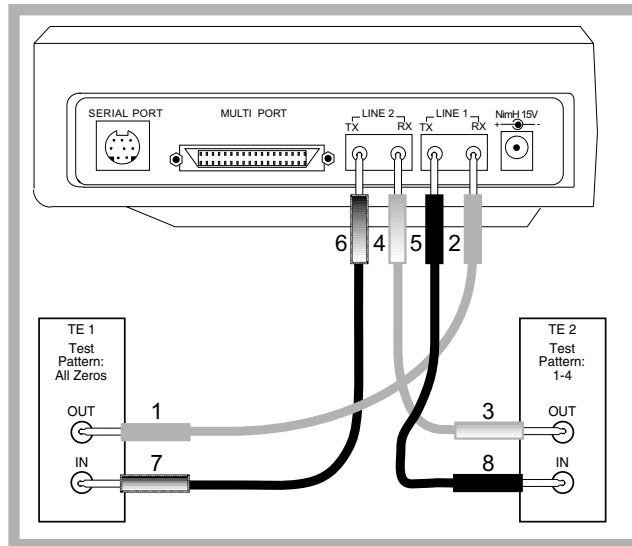


Figure 192 Emulating an Add/Drop Multiplex

3. Press the HISTORY key on the keypad to acknowledge any blinking LEDs. Verify that the PAT SYNC LED is green.
4. Select MAIN MENU > OTHER MEASUREMENTS > VIEW RECEIVED DATA.
 - A. Since Rx/DROP=L2-Rx in the TEST CONFIGURATION screen has been selected, the data displayed is from LINE 2 Rx.
 - B. Verify that the pattern sent by TE 2 is shown on all of the timeslots. According to Figure 192, the 1–4 pattern should be seen. This confirms that the SunSet T10 is receiving the LINE 2 signal properly.
 - C. Press the ESCAPE key on the keypad twice to return to the MAIN MENU.
5. Select MAIN MENU > TEST CONFIGURATION and change Rx/DROP to L1-Rx.
 - A. Press the ENTER key on the keypad to return to the MAIN MENU.
6. Select MAIN MENU > OTHER MEASUREMENTS > VIEW RECEIVED DATA.
 - A. This time, the data displayed refers to LINE 1 Rx.
 - B. Verify that the pattern transmitted by TE 1 is shown on all available timeslots in this screen. According to Figure 192,

the ALL ZEROES pattern should be on all timeslots. This confirms that the SunSet T10 is receiving the LINE 1 signal properly. Now the SunSet T10 is ready to connect to the Datacom device.

C. Press the ESCAPE key on the keypad twice to return to the MAIN MENU.

7. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1-MUX

T1 section

Tx/INST: L1-Tx

Rx/DROP: L1-Rx

FRAMING: as specified by the span design

CODING: as specified by the span design

RxLVL-1: TERM

RxLVL-2: TERM

XMTCLK: L1-RX

Note in T1-MUX, the SunSet T10 is forced to received timing.

LBO 1&2: as specified by the span design

DATACOM section

TYPE: Select the datacom interface that will provide a 64 kbps frame.

TxSRC: T1DRP

MODE: DCE, note in T1-MUX the SunSet T10 is forced to DCE.

MUX section

BERT: The same as DATACOM TYPE (i.e. RS232).

T1INS: The Datacom TYPE selected above (i.e. RS232).

T1T/S: Select the 64 kbps time slot(s) to be multiplexed from the datacom to the T1 side (see step 8).

8. Select the 64 kbps timeslot(s) to be multiplexed.

A. Press the Nx64K (F1) F-key to enter the T10 TIME SLOT screen.

B. Use the arrow keys to move the flashing cursor to the desired receive timeslot and press the SELECT (F2) F-key. As you select your receive timeslot, the respective transmit timeslot will also be highlighted. This is because the receive and transmit timeslots should normally be set to the same numbers.

- If you want these timeslots to differ, select the transmit section and manually set up the desired timeslots.

- You may also press UN-SEL (F3) to de-select a particular timeslot or CLR-ALL (F4) to erase all the selected timeslots and start with a clear screen.
 - For RS232, you may select only one receive and transmit timeslot.
- B. Press the ENTER key on the keypad when finished. You will return to the TEST CONFIGURATION screen.
9. Connect the SunSet T10 to the datacom device through the multiport. Refer to Figure 193.

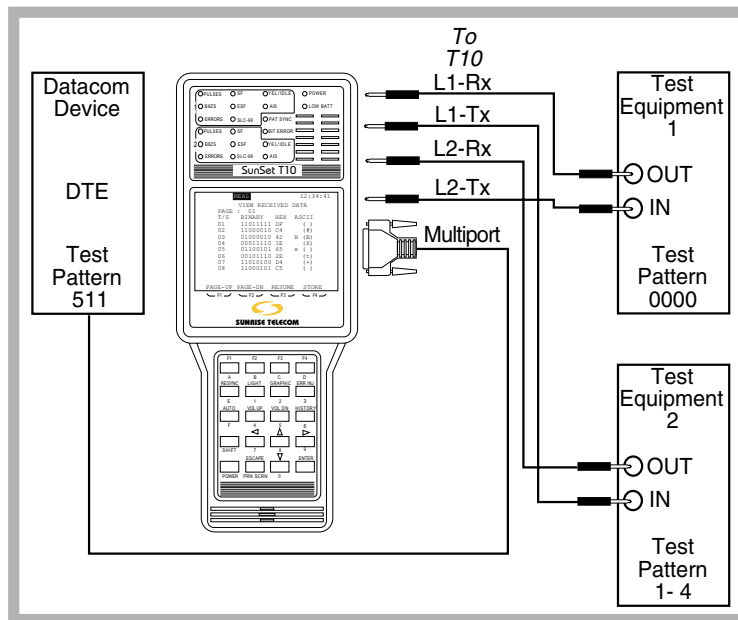


Figure 193 Emulating Add/Drop MUX

10. Press the HISTORY key on the keypad to clear any blinking LEDs.
11. Verify that the PAT SYNC LED is green and no red error LEDs appear.
12. Press the ESCAPE key on the keypad to return to the MAIN MENU.
13. Select MAIN MENU > OTHER MEASUREMENTS > VIEW RECEIVED DATA
 - A. Verify that the SunSet T10 is receiving DTE's test pattern on the multiport. Since the datacom type for BERT in the

TEST CONFIGURATION screen has been selected, the pattern received on the multipoint should be displayed in this screen. For Figure 193, 511 should be seen. Even if only a few Nx64 timeslots have been selected in the TEST CONFIGURATION screen, expect to see the datacom pattern on all timeslots.

14. Verified in the previous steps, the SunSet T10 is receiving a proper signal on both T1 Line receive jacks, as well as on the multipoint.
 - A. Verify that the SunSet T10 is inserting the datacom's signal on the selected timeslots.
 - On Line 1, the SunSet T10 transmits the signal received on L1-Rx, but it inserts the signal received on the multipoint into the Nx64K timeslots selected in the TEST CONFIGURATION screen. For this reason, TE 2 is the best place to check the SunSet T10's insert capability. TE 2 should receive the datacom's pattern, here 511, on the selected timeslots and TE 1's pattern, here all zeros, on all the other timeslots.
15. If TE 2 is not capable of displaying its received data, plug a second SunSet T10 into the monitor jack. Turn the second SunSet T10 on and in the TEST CONFIGURATION screen configure the second SunSet T10 as follows:

```
TEST MODE: T1SINGL
RxLVL-1: DSXMON
FRAMING: as required
Tx CODING: as required
Tx SOURCE: NORMAL
XMT CLOCK: INTERN
TEST RATE: 1.544M
LBO 1 : as required
```

When done, press the ENTER key on the keypad to return to the MAIN MENU.

16. Connect Line 1 Rx to the MON jack of TE 2.
17. Press the HISTORY key on the keypad to acknowledge any blinking LEDs.
18. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA and verify that the datacom's pattern is on the selected timeslots and that TE 1's pattern is on the other timeslots.
19. This verifies the proper insert operation of the SunSet T10. Disconnect the SunSet T10s from the circuit.

4.0 ISDN Applications

4.1 ISDN PRI Call Setup

This procedure outlines an ISDN call.

1. Verify that the span is not in service. This ISDN call will disrupt service.
2. Select MAIN MENU>TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

Tx SOURCE: NORMAL

XMT CLOCK: L1-Rx

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Select SEND TEST PATTERN and choose 1-8. Press the ENTER key on the keypad to return to the MAIN MENU.

Note: 1–8 should be used for all ISDN applications; QRS may bring down the switch.

4. Connect the SunSet T10 to the circuit as shown in Figure 194, if emulating TE (terminal equipment). Use Figure 195 if emulating NT (network terminal). Press the HISTORY key on the keypad to clear the blinking LEDs.
5. Select OTHER MEASUREMENTS>VIEW RECEIVED DATA, use the PAGE-DN (F2) F-key to view T/S 24. Six consecutive ones together with two zeroes should be displayed; for example, 00111111, 11001111, or 11110011. If this is not seen, then the D-channel is not set up to handle ISDN messages.
6. Press the ESCAPE key on the keypad until ISDN PRIMARY RATE is reached. Setup the CONFIGURATION and OTHER PARAMETERS screens according to the circuit.
7. Press the ESCAPE key on the keypad until START LINK/ CALL SETUP is reached. Check to see if a READY message is displayed. This signifies that the D-channel is running. Set up the call by pressing the CALL (F3) F-key. Enter the desired parameters. Press the CALL (F3) F-key to place a call.

Note: The SunSet T10 is able to call itself, which allows the testing of two channels at once. This call must be acknowledged. When the SunSet T10 rings, or displays the "Receive a Call" message, press the ACC-LOOP (F3) F-key to accept the looped call. When finished, press either DISC-1, or the DISC-2 F-keys, to disconnect the line.

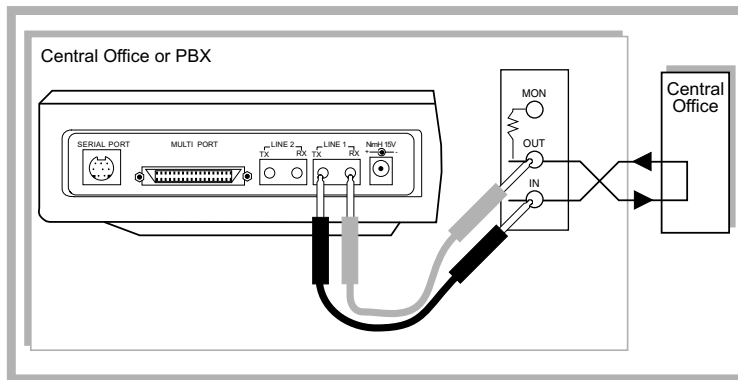


Figure 194 ISDN Call Setup - TE Mode

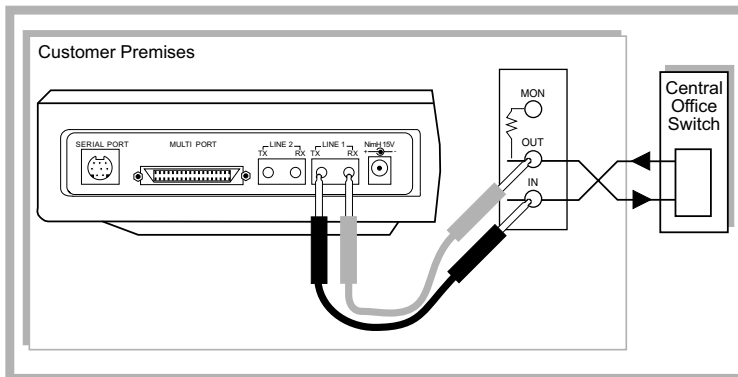


Figure 195 ISDN Call Setup - NT Mode

8. A "SENDL1 CONNECTIONACKNOWLEDGE" message should be observed. When finished with the call, press the DISC (F2) F-key to disconnect.
9. Disconnect the SunSet T10 from the circuit.

4.2 ISDN PRI Monitoring

The following procedure illustrates placing an ISDN call.

1. This test may be performed while the PRI line is in-service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL

Tx/INSERT: L1-Tx

Rx/DROP: L1-Rx

RxLVL-1: DSXMON

RxLVL-2: DSXMON

Tx SOURCE: TESTPAT

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

XMT CLOCK: L1-RX

TEST RATE: 1.544M

LBO 1&2: 0 dB (or as required)

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Select SEND TEST PATTERN and choose 1–8. Press the ENTER key on the keypad to return to the MAIN MENU.

Note: 1–8 is the normal pattern to use for ISDN applications; QRS may bring down the switch.

4. Connect the SunSet T10's LINE 1 and 2 Rx jacks to the DSX Monitor jacks, as shown in Figure 196. Press the HISTORY key on the keypad to clear the blinking LEDs. This test maybe performed anywhere access to the T1 circuit is provided, i.e. central office, customer premises, or span.
5. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA, use the PAGE-DN (F2) F-key to view T/S 24. Six consecutive ones together with two zeroes should be displayed; for example, 00111111, 11001111, or 11110011. If this is not seen, then the D-channel is not set up to handle ISDN messages.

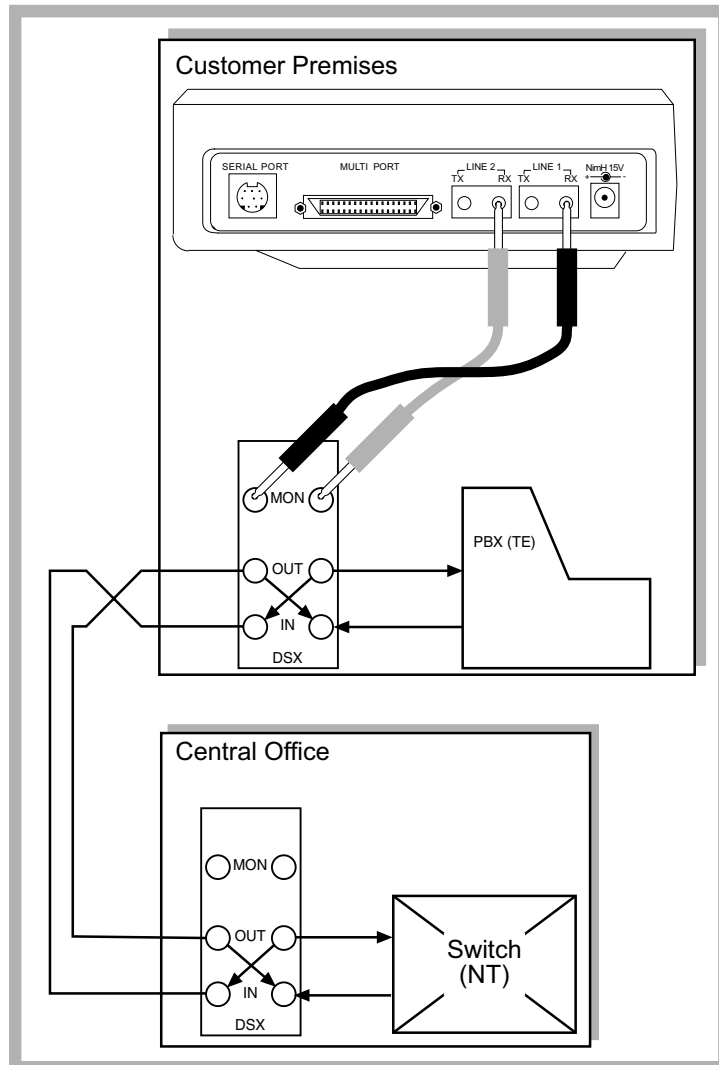


Figure 196 ISDN Monitoring

6. Select MAIN MENU > OTHER MEASUREMENTS > ISDN PRIMARY RATE > CONFIGURATION and select TE as the EMULATE TYPE and then choose Q.931 STD according to the circuit. Escape out to ISDN PRIMARY RATE
7. Select OTHER PARAMETERS, check these settings and decide if any need to be changed. Refer to Chapter 3; Section 6.7.7, Other Parameters for information on these settings.

8. To capture only a select group of messages, select SETUP FILTER from ISDN PRIMARY RATE. Here choose to capture only messages with a certain Call Reference value, Called Number, or Caller Number. To do so:
 - A. Select FILTER TYPE, press the F-Key corresponding to the desired type.
 - B. Select NUMBER. Press the SHIFT key on the keypad so the SHIFT indicator appears at top. Then enter the numbers from the keypad.
 - C. When finished, press the SHIFT key again to clear the SHIFT indicator.
 - D. To capture all messages, press the NONE (F4) F-key for Filter Type.
9. Escape out to ISDN PRIMARY RATE and select START TRACER. If a call is placed at either end then both LINE 1 and LINE 2 ISDN messages should be observed being sent and received. Press the PAUSE (F2) F-key to pause the messages. The RESTART (F1) F-key will restart the tracing process.
10. Escape out to ISDN PRIMARY RATE and select VIEW/PRINT TRACER. At the initial screen, choose to view, or print all of the messages, or a certain number of messages. To view/print a select number:
 - A. Select VIEW FROM.
 - B. Press the SHIFT key on the keypad and enter the number of the message to view with the number keypad.
 - C. Press the SHIFT key on the keypad to clear the SHIFT indicator.
 - D. Select VIEW TO. Repeat steps B and C to enter in the message number where to stop viewing.
11. When finished, disconnect The SunSet T10 from the circuit.

4.3 ISDN PRI Data Call Setup

This procedure illustrates an ISDN Data call. Illustrated in Figure 197 is a point-to-point call. Figure 198 illustrates a loopback device call. Calling a loopback device is quicker and less labor intensive than the point-to-point call. If making a point-to-point call, be sure each SunSet T10 is transmitting the same pattern.

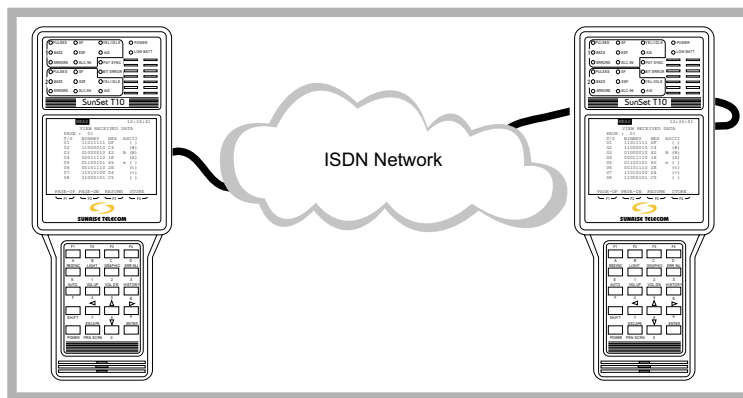


Figure 197 Point-to-Point Call

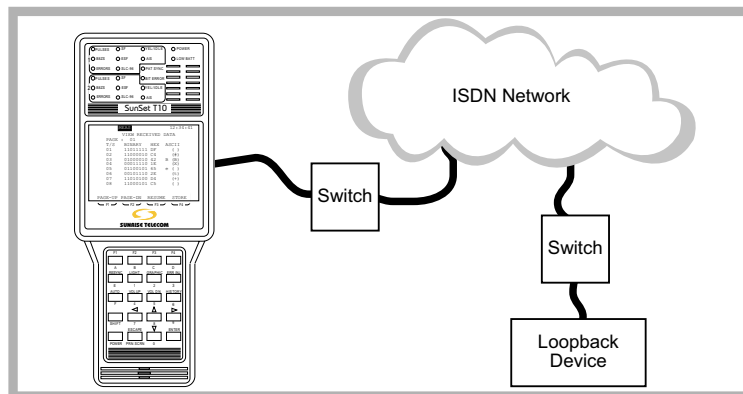


Figure 198 Loopback Call

1. Verify that the span is not in service. This ISDN call will disrupt service.

2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

Tx SOURCE: NORMAL

XMT CLOCK: L1-Rx

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the circuit as shown in Figure 194. Press the HISTORY key on the keypad to clear the blinking history lights.
4. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA; use the PAGE-DN (F2) F-key to view T/S 24. Six consecutive ones together with two zeroes should be observed; for example, 00111111, 11001111, or 11110011. If not observed, then the D-channel is not set up to handle ISDN messages.
5. Escape to the MAIN MENU and select OTHER MEASUREMENTS > ISDN PRIMARY RATE and set up the CONFIGURATION and OTHER PARAMETERS screens according to the circuit.
6. Escape out and select START LINK/CALL SETUP.
 - A. Wait and verify that the READY indicator is at the top of the screen. This indicates that the D-Channel is operational.
 - B. Set up the call by pressing the CALL (F3) F-key.
 - C. Enter the desired parameters making sure that CALL TYPE is DATA-56, or DATA-64.
 - D. Press the call (F3) F-key to place the call.
7. A "SENDL1 CONNECTIONACKNOWLEDGE" message should be displayed. After the message is displayed, press the BERT (F2) F-key to display the BERT measurements.
8. After finishing the call, press the DISC (F2) F-key to disconnect.
9. Disconnect the SunSet T10 from the circuit.

4.4 Emulate a ISDN Network Terminal or PBX

This procedure illustrates how the SunSet T10 can replace a NT, or PBX.

1. Verify that the span is not in service. This ISDN call will disrupt service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows.

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Select SEND TEST PATTERN and choose 1–8. Press the ENTER key on the keypad to return to the MAIN MENU.

Note: 1-8 is the normal pattern to use for ISDN applications; QRS may bring down the switch.

4. Connect the SunSet T10 to the circuit as shown in Figure 195. Press the HISTORY key on the keypad to acknowledge the blinking LEDs.
5. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA; use the PAGE-DN (F2) F-key to view T/S 24. Six consecutive ones together with two zeroes should be observed; for example, 00111111, 11001111, or 11110011. If not observed, then the D-channel is not set up to handle ISDN messages.
6. Escape to the MAIN MENU and select OTHER MEASUREMENTS > ISDN PRIMARY RATE and set up the CONFIGURATION and OTHER PARAMETERS screens according to the circuit. Make sure to set up EMULATE TYPE to NT in CONFIGURATION.
7. Escape out and select START LINK/CALL SETUP; verify that the READY indicator is at the top of the screen. This indicates that the D-Channel is operational and the SunSet T10 now emulating an ISDN NT device capable of receiving or placing a call.
8. Once finished, escape out, and disconnect the SunSet T10 from the circuit.

4.5 46B+2D Call Setup

This procedure illustrates making an ISDN call on a 46B+2D ISDN line. AT&T requires NATL-2 protocol to perform this test.

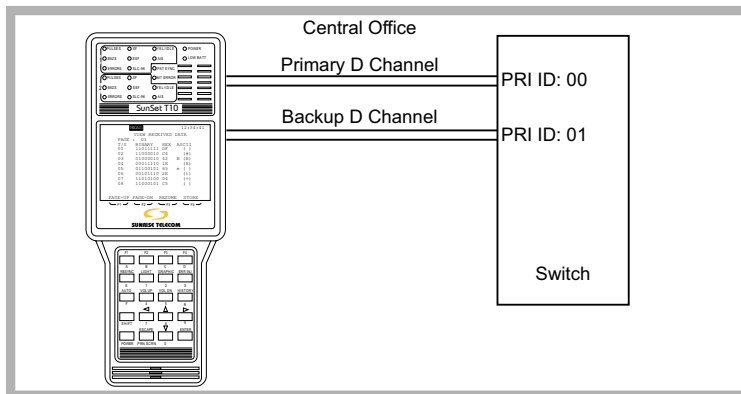


Figure 199 Back-up D Channel

1. Perform this test while the line is out of service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL

Tx/INSERT: L1-Tx

Rx/DROP: L1-Rx

RxLVL-1: TERM

RxLVL-2: TERM

Tx SOURCE: TESTPAT

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

XMT CLOCK: L1-Rx

TEST RATE: 1.544M

LBO 1&2: 0 dB (or as required)

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Connect the SunSet T10 to the circuit as shown in Figure 199. Press the HISTORY key on the keypad to clear the blinking LEDs.

4. Select ISDN PRIMARY RATE > CONFIGURATION and set up according to the circuit making sure the EMULATE TYPE is set for TE.
5. Escape out and select ISDN PRIMARY RATE > OTHER PARAMETERS. Set up "Line 1 D-chnl" and "L 2 Bkup D-Chnl" according to the circuit.
6. Escape out and select ISDN PRIMARY RATE > BACKUP D CHNL TEST. Both LINE 1 and LINE 2 ISDN messages should be sent, and information about a message should be received for either LINE 1 or LINE 2.
7. Press the L-STAT (F1) F-key to display the status of both lines. LINE 1 should display "In service", and LINE 2 should display "Standby". To test whether or not LINE 2 acts as a backup PRI line, press the DROP-L1 (F1) F-key to manually drop LINE 1. LINE 1 should display "Manual out of service" and LINE 2 should change now to "In service". To establish LINE 1 once again press the EST-L1 (F1) F-key and it should now display "Stand by". Wait until it changes to "In-Service."
8. Escape to the BACKUP D CHNL TEST and press the CALL (F3) F-key. Now enter the specific parameters related to the call, making sure to select either LINE 1, or LINE 2 for the B channel (B CHNLLINE). When the settings are complete, press the CALL (F3) F-key.
9. After successfully placing and receiving the call, the screen will display "SENDL1 CONNECTIONACKNOWLEDGE".
10. When finished with the call press the DISC (F2) F-key to disconnect.
11. Disconnect the SunSet T10 from the circuit.

4.6 47B+D Call Setup

This procedure illustrates making an ISDN call on a 47B+D ISDN line. Perform this test while the circuit is out-of-service.

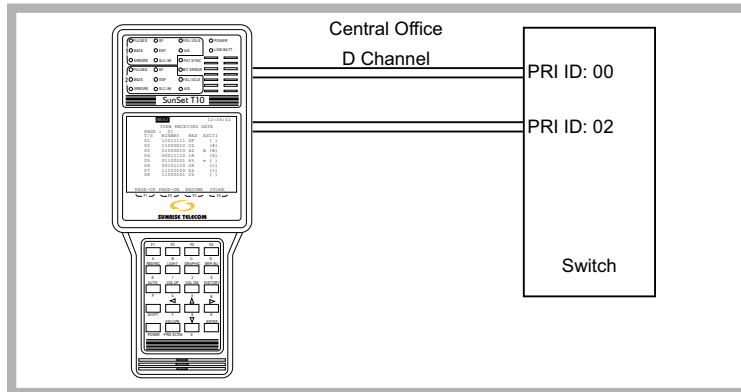


Figure 200 47B + D

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL
Tx/INSERT: L1-Tx
Rx/DROP: L1-Rx
RxLVL-1: TERM
RxLVL-2: TERM
Tx SOURCE: TESTPAT
FRAMING: as specified by the circuit
Tx CODING: as specified by the circuit
XMT CLOCK: L1-Rx
TEST RATE: 1.544M
LBO 1&2: 0 dB (or as required)
When done, press the ENTER key on the keypad to return to the MAIN MENU.
2. Connect the SunSet T10 to the circuit as shown in Figure 200. Press the HISTORY key on the keypad to clear the flashing LEDs.
3. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA, use the PAGE-DN (F2) F-key to view T/S 24. Six consecutive ones together with two zeroes should be displayed; for example, 00111111, 11001111, or 11110011. If not observed, then the D-channel is not set up to handle ISDN messages.

4. Escape and select ISDN PRIMARY RATE > CONFIGURATION. Set up according to the circuit, making sure the EMULATE TYPE is set for TE.
5. Escape and select ISDN PRIMARY RATE > OTHER PARAMETERS. Set up LINE 1 D-Channel. Set up for 47B+D emulation by setting the 47B+D CONFIG to ENABLE. Note that the L2 INTERFACE ID will automatically change to 2, when 47B + D is enabled.
6. Escape and select ISDN PRIMARY RATE > START LINK/ CALL SETUP. Press the call (F3) F-key. Now enter the specific parameters related to the call making sure to select either LINE 1, or LINE 2, to place the B-channel call found in B CHNL LINE. Press the call (F3) F-key to place the call.
7. After successfully placing and receiving the call, the SunSet T10 will display "SEND L1 CONNECTION ACKNOWLEDGE".
8. When finished with the call press the DISC (F2) F-key to disconnect.
9. Disconnect the SunSet T10 from the circuit.

4.7 Receiving Two Simultaneous B-Channel Calls

This procedure illustrates receiving two simultaneous B-Channel calls.

1. Verify that the span is not in service. This ISDN call will disrupt service.
2. Select MAIN MENU > TEST CONFIGURATION and configure as follows.

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

Tx SOURCE: NORMAL

XMT CLOCK: L1-Rx

TEST RATE: 1.544M

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

3. Select SEND TEST PATTERN and choose 1–8. Press the ENTER key on the keypad to return to the MAIN MENU.

Note: 1–8 is the normal pattern to use for ISDN applications; QRS may bring down the switch.

4. Connect the SunSet T10 to the circuit as shown in Figure 194. Press the HISTORY key on the keypad to clear the blinking LEDs.
5. Select OTHER MEASUREMENTS > VIEW RECEIVED DATA; use the PAGE-DN (F2) F-key to view T/S 24. Six consecutive ones together with two zeroes should be displayed; for example, 00111111, 11001111, or 11110011. If not observed, then the D-channel is not set up to handle ISDN messages.
6. Escape and select ISDN PRIMARY RATE. Set up the CONFIGURATION, and OTHER PARAMETERS screens according to the circuit. Make sure to set up EMULATE TYPE to TE in CONFIGURATION.
7. Escape and select START LINK/CALL SETUP. Verify that the READY indicator is at the top of the screen. This indicates that the D-Channel is operational.
8. When receiving a call, the SunSet T10 displays a "RECEIVE A CALL" message. Press the ACC-TERM (F2) F-key to accept

- the first call in a terminated mode. Press the INFO (F1) F-key for more information on the first call. Press the ESCAPE key on the keypad to return to the CALL SETUP screen.
9. When receiving another call, the SunSet T10 displays another "RECEIVE A CALL" message. The ACC-TERM (F2) and ACC-LOOP (F3) F-keys are now available. Pressing the INFO (F1) F-key displays information about both calls. Shown in Figure 201 is sample INFO screen.

```
21:10:05  
  
CALL No.1  
CREF No:579 DIR - RECEIVE  
Bch CFG: TERM      Bch LN#: LINE 1  
BEARER: VOICE CHANNEL: 3  
CLER ID: 4083638000  
  
CALL No.2  
CREF No:580 DIR - RECEIVE  
Bch CFG: LOOP Bch LN#: LINE 1  
BEARER: VOICE CHANNEL:10  
CLER ID: EMPTY
```

Figure 201 Receive a Call - INFO Screen

10. When finished disconnect from either call by pressing one of the following F-keys, DISC-1 (F2) for CALL No.1, or DISC-2 (F3) for CALL No. 2.
11. Disconnect the SunSet T10 from the circuit.

5.0 SS7 Applications

This application demonstrates how the SunSet T10 can receive SS 7 messages. In the following procedure, two SS7 nodes (SSPs) are sending basic call procedure messages to each other. The SunSet T10 can receive, and decode these messages to monitor the call procedure. Figure 202 shows part of the SS7 network.

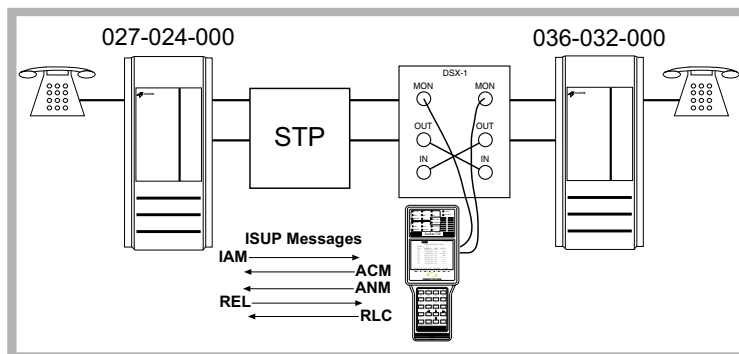


Figure 202 SS7 Network Testing

The following is a common configuration setting when testing a link. Use the following procedure:

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1 DUAL
Tx/INSERT: L1-TX
Rx/DROP: L1-TX
RxLVL-1: DSXMON
RxLVL-2: DSXMON
Tx SOURCE: THRU
FRAMING: SF-D4
Tx CODING: B8ZS
XMT CLOCK: L1-RX
TEST RATE: 1.544M
LBO 1 & 2: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect both LINE 1 and LINE 2 Rx to the DSX Monitor jacks. If red LEDs appear for framing, press the AUTO key on the keypad. The SunSet T10 will attempt to synchronize on the received framing.
3. Select OTHER MEASUREMENTS > SS7 ANALYSIS > CONFIGURATION and configure as follows:

Line 1 Rx T/S: 2

Line 2 Rx T/S: 2

SS7 VERSION: ANSI

TRUNK RATE: 56k

DISPLAY INPUT: HEX

When done, press the ENTER key on the keypad to return to the SS7 ANALYSIS menu.

In the above settings for both LINE 1 and 2, T/S 2 was selected, since that is the timeslot for the SS7 link. Also selected was a Trunk Rate of 56k, since that is a common rate for the United States.

4. Select SU ANALYSIS. A high number of FISUs and a low number of MSUs should be observed, unless this is a high traffic SS7 network.
5. Escape to SS7 ANALYSIS and select MSU MONITOR > START TRACER; the SunSet T10 should start displaying messages. To capture only a select group of messages, select the filtering fields within SETUP FILTER. Refer to chapter 3, section 6.8.2.1 for more information on each of the filtering types. In this application, ISUP messages are captured; therefore, SI FIELD: ISUP was selected.
6. To view each message individually, escape back to the MSU MONITOR and select VIEW/PRINT TRACER. To begin viewing, press the VIEW (F3) F-key. Figure 203 shows a sample screen.

```

02:08:58

          RCV MESG NO.65  (ANSI)
LINE 1   95-01-01  03:42:51.08

ISUP
DCP: 00-20-24

9C C1 26 85 24 20 00 1B 18 00
00 19 00 01 00 00 10 0A 03 05
0C 02 90 98 07 80 18 61 31 37
47 00 01 06 11 00 00 09 2D 20
00

PAGE-UP  PAGE-DN  DECODE

```

Figure 203 View Message, Hexadecimal

From Figure 203, observe this is message number 65 and it was received on LINE 1. This message shows the DPC in hexadecimal.

7. Press the DECODE (F3) F-key to see the decoded message. Refer to Figure 204.

```

02:15:34

          RCV MESG NO.65  (ANSI)
LINE 1   95-01-01  03:42:51.08
MSU- ISUP  BSN:1C 1  FSN:41 1
SI :5  SSF:8  CIC:0019
DPC: 036-032-000 OPC:027-024-000
mesg type 01  IAM
NOC INDI:00
FRW INDI:00 10
CLN CTGY:0A
USR INFO:90 98
CALLD NO:>> 161373740
CALL REF: 1 00 00 09 2D 20

PAGE-UP  PAGE-DN  HEX  L4deco

```

Figure 204 View Message, Decoded

The decoded screen in Figure 204 displays the DPC and OPC in decimal format. This is an ISUP Message Signaling Unit. The message type is IAM (Initial Address Message). Also shown on this screen are the hex values for:

- nature of connection indicator.
- forward call indicator.
- calling party category.
- user service information.
- called party number.
- call reference.

To find out the translation of these hex values, select the corresponding field and press the L4deco (F4) F-key. Figure 205 shows an example of one of the Layer 4 decodings and shows the decoding bit-by-bit according to ANSI documentation.

```
02:22:06
bits HGFEDCBA
      00000000

bits BA: Satellite Indicator
      00 no satellite circuit in
         the connection

bits DC: Continuity check ind
         continuity check not
         required

bit   E: Echo control device
      0 outgoing half echo
         control device not
         included

bits F-H:Spare
```

Figure 205 Nature of Connection, Layer 4 Decode

8. When finished viewing messages, disconnect the SunSet T10 from the circuit.

6.0 GSM Voice/TRAU/BERT Testing

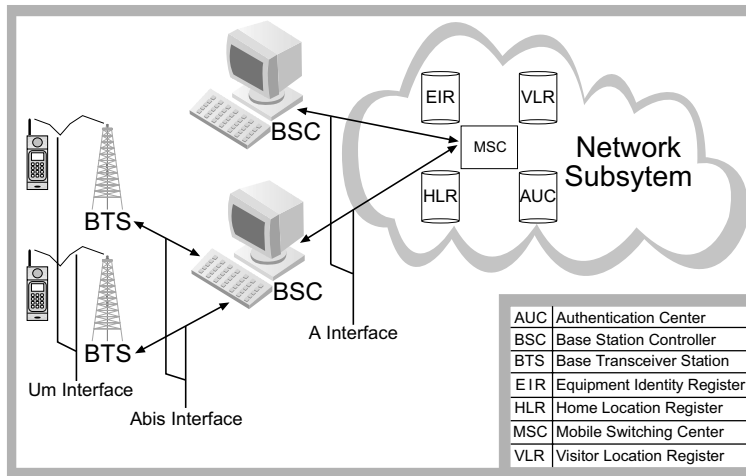


Figure 206 GSM Network

The SunSet T10 is a powerful tool for maintaining/installing GSM networks. It offers three tests for testing the TRAU (Transcoder and Rate Adaption Unit). They are:

- 16k TRAU frame BER testing.
- Check voice quality with real-time 13k speech monitoring.
- Insert GSM encoded speech message to test TRAU/BTS.

6.1 16K BER Testing

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO 1: 0dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10's LINE 1 transmit and receive jacks to the circuit under test.

3. Select OTHER MEASUREMENTS > GSM VOICE/TRAU BERT > 16K BERT, configure as shown in Figure 207.

```
21:10:05
GSM 16K BERT
LINE NUMBER: LINE 1
TIME SLOT   : 02
SUB CHANNEL: 2
PATTERN     : 2047
ELAPSED TIME: 000:08:37
ERROR: 0     RATE: 0.0e-06
ES   : 0     EFS : 0
SES  : 0     UAS : 0
LOSS : 0
STOP  2047   more  PRINT
```

Figure 207 GSM 16K BERT Screen

The following measurements are in the lower portion of the screen within Figure 207:

ELAPSED TIME: This is the elapsed time since the beginning of the test. This counter begins counting when entering the 16K BERT screen, or after pressing the STOP/ RESUME (F1) key.

ERROR: The number of bit errors that have occurred since the start of the test.

ES: This is the number of errored seconds since the beginning of the test.

EFS: This is the number of error-free seconds since the beginning of the test.

SES: This is the number of severely errored seconds since the beginning of the test. A severely errored second contains a 10^{-3} -error rate.

UAS: This is the number of unavailable seconds since the beginning of the test. An unavailable second begins after 10 consecutive severely errored seconds (SES). It also occurs when there is a loss of signal.

LOSS: Loss of signal seconds is a count of the number of seconds with a loss of signal since the beginning of the test. This refers to the loss of the entire 64 Kbps signal.

6.2 Monitoring Network Traffic & Voice Quality

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL

Tx/INSERT: L1-TX

Rx/DROP: L1-RX

RxLVL-1: DSXMON, if a DSX Monitor access point is available.

RxLVL-2: DSXMON, if a DSX Monitor access point is available.

Tx SOURCE: TESTPAT

FRAMING: as specified by the circuit

Tx CODING: as specified by the circuit

XMT CLOCK: L1-RX

TEST RATE: 1.544M

LBO 1&2: 0dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10's Line 1 and 2 receive jacks to the DSX Monitor jacks.
3. Select OTHER MEASUREMENTS > GSM VOICE/TRAU/BERT, GSM MONITOR. Refer to Figure 208.

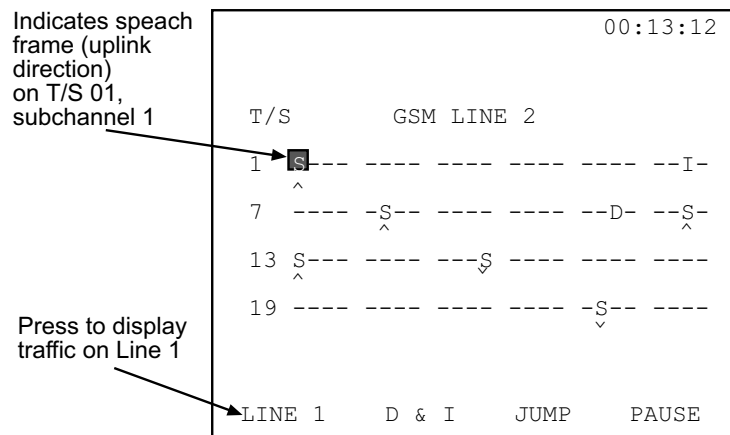


Figure 208 GSM Monitor Screen

Displayed in Figure 208 are all 24 timeslots. The top row contains timeslots 1–6; the second row has 7–12, and so on. Also shown in this screen are the 4 sub-channels contained within each timeslot. This screen shows the timeslots on LINE 2; alternately, press the LINE 1 (F1) F-key to view the activity on LINE 1. Use this screen to monitor for the following TRAU frames on each sub-channel:

S = Speech- This refers to the uplink direction.

D = Data

I = Idle (speech idle)

- = Unknown

The arrow below the “S” speech symbol indicates the direction:

^ = uplink direction (user to network)

v = downlink direction (network to user)

4. An “S” in one of the sub-channels indicates speech; this 13k GSM encoded speech can be dropped to the SunSet T10’s speaker to monitor voice quality. To do so:
 - A. Select a sub-channel displaying speech.
 - B. Press the D&I (F2) F-key to drop the sub-channel to the speaker.

6.3 Transmitting a GSM Encoded Voice Message

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL
RxLVL-1: TERM
FRAMING: as specified by the circuit
Tx CODING: as specified by the circuit
Tx SOURCE: NORMAL
XMT CLOCK: INTERN
TEST RATE: 1.544M
LBO 1: 0dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10's Line 1 transmit and receive jacks to the circuit under test.
3. Select OTHER MEASUREMENTS > GSM VOICE/TRAU/ BERT, VOICE/TRAU XMT and configure as shown in Figure 209.

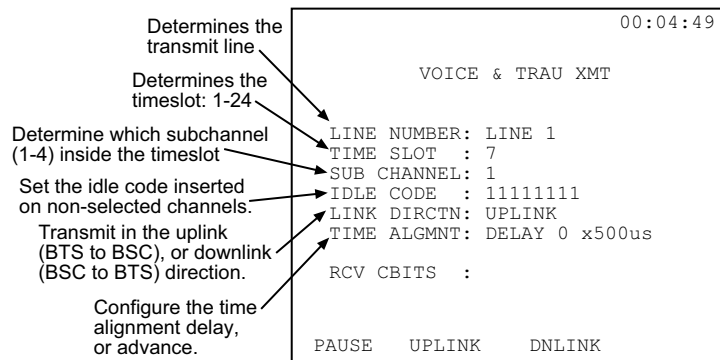


Figure 209 Voice & TRAU XMT Configuration Screen

4. The 13K RPE LTP coded message "Sunrise Telecom, a step ahead" will be transmitted on the selected line, timeslot, and sub-channel.

7.0 Installing a Frame Relay Circuit

7.1 PING Test

Every Internet device has its own IP (Internet Protocol) address. Multiple LAN segments can be connected via a Frame Relay network. A common way to discover whether two remote LAN segments using the TCP-IP protocol are connected is to send a PING (Internet Control Message Protocol) message from one segment to another. When a PING message is received, Internet devices acknowledge the message by sending an echo message back.

1. Select MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: per circuit, or use the AUTO key on the keypad to configure on the line's framing type.

Tx CODING: per circuit

Tx SOURCE: NORMAL

XMT CLOCK: L1-Rx

TEST RATE: Nx64K or Nx56K. It is crucial to select the proper test rate for the frame relay data. If the configured rate is unknown, press the AUTO (F1) F-key. The SunSet T10 automatically configures to the active channels. Active channels are highlighted. Press the ENTER key on the keypad to return to the TEST CONFIGURATION screen.

LBO 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

2. Connect the SunSet T10 to the circuit using its Line 1 Rx and Tx jacks. Once connected, the PULSES and framing (i.e. SF) LEDs should both be green. Flashing LEDs indicate a history condition. Press the HISTORY key on the keypad to clear the LEDs.
3. Select MEASUREMENT RESULTS to check for no errors, as well as a valid frequency and level. To restart the test, press the STOP (F3) F-key, and press the RESTART (F3) F-key. After restarting the test, the SunSet T10 should display "NO ERRORS" on the summary screen. When finished, press the ESCAPE key on the keypad.

4. Select MAIN MENU > OTHER MEASUREMENTS > VIEW RECEIVED DATA. This screen displays which channels are idle and which channels are used for data. Idle channels display the circuit's idle code of FF or 7F. Press the PAGE-DN (F2) F-key to scroll through all timeslots; the first page shows timeslots 1–8, next page shows 9–17, next shows 18–24. This is a way of determining the test rate of the circuit and to verify that the SunSet T10 is properly configured. When finished, press the ESCAPE key on the keypad twice to return to the MAIN MENU.
5. Select FRAME RELAY > CONFIGURATION and configure as follows:

INTERFACE: UNI

STANDARD: Press the AUTO (F4) F-key. The SunSet T10 automatically finds the standard for the circuit.

DLCI VALUE: Press the AUTO (F4) F-key. The SunSet T10 automatically finds the DLCI length of the circuit.

- The last 4 settings (T391, N391, N392, N393) determine how often the full status enquiry/response is sent, how much time should elapse, and error thresholds. Unless a specific test is needed to check these parameters, leave them at their default values:

T391: 10

N391: 6

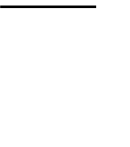
N392: 3

N393: 4

After these settings are configured, escape back to the FRAME RELAY menu

6. Select LMI ANALYSIS. Upon displaying this screen, the SunSet T10 begins sending/responding the link management signaling to check the status of the UNI (user-network interface). The SunSet T10 sends a status inquiry message every 10 seconds per the T391 setting.
 - A. The network must respond with a status message for each enquiry message. After sending/receiving the right number of enquires (as determined from N391 setting), the SunSet T10 sends a full status inquiry to the network. When the SunSet T10 receives a full status message from the network, it reports the "LINK OK".

- B. Upon entering LMI ANALYSIS, wait approximately 30 seconds (depending on the parameters). If the SunSet T10 received a proper response from the network, it displays "LINK OK". If the SunSet T10 does not receive a proper response from the network, it displays "LINK ERROR".
7. Press the PVC (F1) F-key to see the DLCI activity on the permanent virtual circuit. This screen reports all configured PVCs and gives a status for each (active, or idle).
 8. Press the LMI (F3) F-key to return to the LMI analysis screen.
 9. The link between the SunSet T10 and the network (UNI Interface) is now verified.



Chapter 5 Reference

1.0 Abbreviations

A

ACK - Acknowledge is a control character signaling that the receiver is ready to accept the next block.

AFBER - Average Framing Bit Error Rate

AIS - Alarm Indication Signal indicates an all ones signal on the active receive jack.

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

ALM - Alarm

AMI - Alternate Mark Inversion is a method of transmitting binary digits, in which successive "marks" are of alternating polarity, but of equal amplitude. A space designates zero amplitude.

ANSI- American National Standards Institute is the principal standards development organization in the US.

ARM-INB - Arm Inband

AS - Available Second

ASCII - American Standard Code for Information Interchange

AVBER - Average Bit Error Rate

AVCER - Average CRC-6 block Error Rate

B

B Channel - Bearer Channel is a 64 Kbps ISDN user channel that carries digital data, PCM-encoded digital voice, or a mixture of lower-speed data traffic.

B8ZS - Bipolar 8-Zero Substitution is a type of line coding format for T1 lines that uses bipolar violations to encode strings of eight consecutive zeroes.

BPV - Bipolar Violation

BTSLP - Bit Slip occurs when the synchronized pattern either loses a bit or gains an extra bit through stuffing.

BUFF - A Buffer is a device that stores data temporarily from a faster device.

C

CCITT - Comite Consultatif Internationale de Telegraphique et Telephonique is an international consultative committee that sets worldwide communications standards.

CER - CRC-6 Error Rate

Checksum - The total of a group of data items used for error-checking purposes.

CLR - Clear

COFA - Change of Frame Alignment indicates when the framing has moved to a new position.

CONFIG - Configuration

CRC-6 - Cyclic Redundancy Check Code - 6 is a method of error detection for link-layer data transmissions.

CSU - Customer Service Unit is a digital DCE used to terminate digital circuits (i.e. DDS, T1 lines) at the customer site.

CTL - Control

CUFBER - Current Framing Bit Error Rate

CURBER - Current Bit Error Rate

D

dB - Decibel is a unit of measure of signal strength, usually the relationship between a transmitted signal and a standard signal source.

dBdsx - decibel referenced to dsx power level

DCE - Data Communication Equipment is the equipment that enables a DTE to communicate over a telephone line or data circuit.

DCS - Digital Cross-connect System

DDS - Dataphone Digital Service is a private line digital service with typical data rates of 2.4, 4.8, 9.6, and 56 Kbps.

DENS - Density

DGRM - Degraded Minute

DLF - Data Link Frame

DS1 - Digital Signal 1 is the term for the electrical signal found at the metallic interfaces of T1 circuits where most testing is performed.

DSX - Digital Signal Cross-connect

DSXMON - DSX Monitor signal

DTE- Data Terminal Equipment is a user device such as terminals and computers that connects to DCE.

DTMF - Dual Tone Multi Frequency is a type of audio frequency signaling, generated by touchtone telephones.

E

E&M Signaling is a method of signaling between junction equipment in an exchange and a signaling unit associated with a transmission equipment using two leads- a receive (E) lead and a transmit (M) lead.

ERR INJ - Error Injection

ES - Errored Second

ESF - Extended Super Frame is a framing method with 24 frames grouped together.

ET - Elapsed Time is the total time during which a circuit is occupied by a connected call.

EXTERN - External

EXZS - Excess Zeroes Seconds

F

F1 - Function 1

FAC - Facility

FBE - Framing Bit Error

FBER - Framing Bit Error Rate

FDL - Facility Data Link

FELP - Far End Loop

FREQ - Frequency

FRM - Frame. In data transmission, the sequence of contiguous bits bracketed by and including beginning and ending flag sequences.

FSLIP - Frame Slip occurs each time the phase of the line under test has deviated from the phase of reference by 193 bits.

FT1 - Fractional T1 is a service aimed at customers who do not need all 24 channels of a full T1 line.

H

HEX - Hexadecimal 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, and F. This base-16 number system often used in computers.

HOLDSCRN - Hold Screen

Hz – Hertz is a unit of frequency, one cycle per second.

I

INTERN - Internal

INV - Inverted

ISDN - Integrated Services Digital Network is a CCITT standard for a network that accommodates a variety of mixed digital transmission services.

K

kFt - kilo (1000) Feet

L

LBO - Line Build Out

LDNS - Low Density Seconds is a count of the number of seconds where the n(n-1) rule is broken.

LLPBK - Line Loopback

LOFS - Loss of Frame Second occurs at the onset of three consecutive OOFs (Out Of Frame Seconds).

LOG - Logical

LOS - Loss of Signal

LOSS - Loss of Signal Second

LPBK - Loopback is a diagnostic procedure used for transmission devices. A test message is transmitted to the device being tested and then sent back to the originator, where it is compared to the original message.

LPBKQRY - Loopback Query

Lpp - Level peak-to-peak. The peak-to-peak level of negative and positive pulses received.

LVL - Level

M

mbps - megabits per second.

MON - Monitor

mW - milliwatt

N

NI - Network Interface

NOTE - Network Office Terminating Equipment

NV RAM - Non Volatile Random Access Memory

O

OOF - Out Of Frame

OOFS - Out of Frame Second is a count of out of frame seconds that have occurred since the beginning of the test.

P

PAT - Pattern

PLPBK - Payload Loopback

ppm - parts per million

PRBS - Pseudo Random Bit Sequence

PRN SCRN - Print Screen

PRNT - Print

PRNTR - Printer

PWRLPQRY - Power Loop Query

PWCUTTH - Power Cut Through

Q

QRS - Quasi Random Signal is a signal is formed from a 20-stage shift register and is zero-constrained for a maximum of 14 consecutive zeroes.

R

R - Receive

REF - Reference

RT - Remaining Time

Rx - Receive

S

SABME- Set Asynchronous Balanced Mode Extended

SAPI - Service Access Point Identifier

SCRN - Screen

SES - Severely Errored Second

SF - Super Frame.

SIG - Signal

SHLF - Shelf
SLC-96 - Subscriber Loop Carrier - 96 channel
SMPX - Simplex
SPLT - Split
SW - Switch
SYNC - Synchronized
SYLS - Synchronization Loss Second

T

T - Transmit
T/S - Time Slot
TEI- Terminal Endpoint Identifier
TERM - Terminated
TOUT - Time Out
TOUTDIS - Timeout Disable
Tx - Transmit

U

UA - Unnumbered Acknowledgment
UAS - Unavailable Second
UI - Unit Interval
UNIVLDN - Universal Loopdown
 μ S - microsecond

V

VF - Voice Frequency

Y

YEL - Yellow
YELS - Yellow Alarm Second

2.0 Standard Test Patterns

This section defines the various test patterns transmitted and recognized by the SunSet T10. The long patterns are written in hexadecimal form, also known as “HEX”. A pattern is written in HEX, if it is 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, and F. The HEX pattern 15 FA translates to the binary pattern 0001 0101 1111 1010, where the left-most bit is transmitted first.

QRSS

QRSS is the industry-standard Quasi Random Signal. This signal 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.

55DLY

The Daly 55 Octet pattern is a special stress pattern that obeys industry standards for pulse density and maximum consecutive zeroes in both AMI and B8ZS coded circuits. Framing bits occur at octet boundaries. Note that the Daly 55 octet pattern replaced the original 55 octet pattern (refer to T1–6). The Daly 55 octet pattern is as follows:

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

2e23

2e23 is the industry-standard $2e^{23}-1$ pseudo random bit sequence. This signal is formed from a 23-stage shift register and is not zero-constrained. This pattern contains up to 22 zeroes in a row and violates standards for consecutive zeroes in AMI-coded transmission.

2047

2047 is the industry-standard 2047 bit code used for DDS applications.

1-8

The industry-standard 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
```

FOX

The industry-standard FOX pattern is used in data communications applications. The ASCII translation of the pattern is the "Quick brown fox...." sentence. The pattern is frame aligned to ensure proper ASCII translation of the bits. Sending the pattern with signals is recommended; otherwise, ASCII translation is not possible. The FOX pattern is as follows:

```
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
```

2e20

2e20 is the industry-standard $2e^{20}-1$ pseudo random bit sequence. This signal is formed from a 20-stage shift register and is not zero-constrained. This pattern contains up to 19 zeroes in a row and violates standards for consecutive zeroes in AMI-coded transmission. The QRSS pattern is derived from 2e20.

511

511 is the industry standard 511-bit code used for DDS applications.

1-16

The industry-standard 1 in 16 pattern is used for over-stressing 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
```

ALL 1

The industry-standard all 1s pattern is used for stress testing AMI and B8ZS lines. If sending the pattern unframed, it is interpreted as an AIS (Alarm Indication Signal). The ALL 1 pattern is shown in its binary form as follows:

```
1111
```

2e15

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

127

127 is the industry-standard 127-bit code used for DDS applications.

3-24

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

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

ALL 0

ALL 0 is the industry-standard all zeroes pattern. This pattern is often used to make sure that clear-channel lines are properly provisioned for B8ZS during circuit turn-up. If a portion of the circuit is AMI, pattern synch and/or signal will be lost. The following is the actual pattern:

```
0000
```

ALT10

ALT 10 is the industry-standard alternating ones and zeroes pattern. The pattern is frame aligned with "f" showing the location of the framing bit. The following is the actual pattern:

```
f 0101 0101
```

63

63 is the industry-standard 63-bit code used for DDS applications.

T1-1

This 72-octet pattern is used for stress testing T1 circuits and network elements. The following is the actual pattern, with "f" showing the locations of the framing bit:

```
f 01, 01, 01, 01, 80, 00, 80, 80, 80, C0, 01, 80, 01, 80, 80, 01,
80, 44, 00, 04, 44, 00, 04, 55, f 55, 55, 55, 55, AA, AA, AA,
AA, 55, 55, 55, 55, AA, 55, 55, AA, AA, AA, 01, 01, FF, FF, FF,
FF, f FF, FF, FF, 7F, FF, FF, 24, 92, 49, 11, 11, 11, 08, 42,
10, 84, 21, 04, 10, 41, 02, 04, 08, 01
```

T1-2

This 96-octet pattern is used for stress testing T1 circuits and network elements. The pattern can cause framing problems and should not be used with SF framing. The following is the actual pattern, with "f" showing the locations of the framing bit:

```
f FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, f FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
f 55, 55, 55, 55, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01,
80, 01, 80, 01, 80, 01, 80, f 55, 55, 55, 55, 01, 80, 01, 80, 01, 80,
01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80
```

T1-3

This 54-octet pattern is used for stress testing T1 circuits and network elements. The framing bit is inserted at octet boundaries. The pattern violates the 15 zeroes constraint when transmitted in a framed AMI signal. However, in unframed transmission or B8ZS transmission it meets the zeroes constraint. The following 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, 80, 80, 80, 80, 80, 80,
FF, FF, FF, FF, FF, FF, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01
```

T1-4

This 120-octet pattern is used for stress testing T1 circuits and network elements. The following is the actual pattern, with "f" showing the locations of the framing bits:

```
f FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, f FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, f FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, f 55, 55, 55, 55, 08, 08, 08, 08, 08, 08, 08, 08,
08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, f 55, 55, 55, 55, 08, 08,
08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08
```

T1-5

This 53-octet pattern is used for stress testing T1 circuits and network elements. The framing bit is inserted at octet boundaries. The following is the actual pattern:

```
01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01,
80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 80, F5, 55, 80,
80, 80, 80, FF, FF, FF, FF, F5, 55, 80, 80, 80, 80, FF, FF, FF,
FF, FF, 80, 80, 80, 80, FF, FF, FF, FF, FF, FF, FF, FF, D3
```

T1-6 (55 octet)

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. The following 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
```

2.1 DDS Pattern Notes

The DDS test patterns were developed specifically for DDS applications. DDS-1, DDS-2, and DDS-6 should not be used as 1.544 Mbps T1 test patterns on AMI coded lines, because they have an excess of 150 consecutive zeroes. This will cause the T1 line to record a loss of signal. These patterns are used for DDS, fractional Nx56 T1 applications, and special laboratory applications.

DDS-3

```
01001100
```

DDS-4

```
00000010
```

DDS-6

```
FE, FE, FE, FE, FE, FE, FE, FE, FF
```

3.0 Frame Relay Technology

Frame relay is a packet-switching protocol that provides high bandwidth and low delay over a WAN (Wide Area Network). Packet switching organizes data into individually addressed frames, or packets instead of placing data into timeslots.

A frame relay network consists of endpoints (servers, PCs, hosts), access equipment (bridges, routers, FRADs), and network equipment (switches, network routers).

3.1 Frame Relay Structure

The frame structure is quite simple. The customer's data packets are not changed; frame relay adds a header to the frame. The header can be 2, 3, or 4 octets long. Figure 210 shows the different header formats.

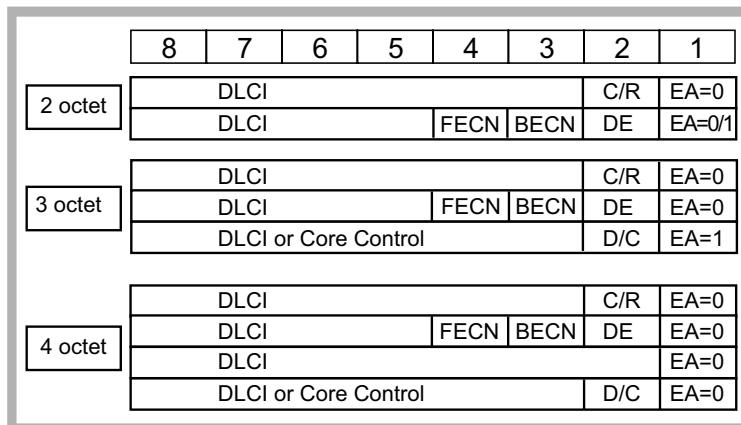


Figure 210 Frame Relay Header Formats

The following fields are included in the header:

DLCI: Data link connection identifier.

C/R: Command/response bit

EA: Extended address bit indicates whether there are more octets in the header. EA=0, more octets, EA=1, last octet.

FECN: Forward explicit notification bit. When frame relay equipment detects possible congestion, it notifies all downstream equipment of congestion with the FECN bit.

BECN: When frame relay equipment detects possible congestion, it notifies the upstream equipment of congestion with the bit backward explicit notification bit.

DE: Frames tagged with the discard eligibility bit will be the first discarded during times of congestion.

D/C: DL–Core/Control. This bit is used in 3–4 octet length headers to specify whether the last octet contains control bits or DLCI bits (D/C=0, DLCI, D/C=1, control bits).

3.1.1 DLCIs

The largest portion of the header is the DLCI. The DLCI can be 10 bits (2 octets), 16 bits (3 octets), or 23 bits (4 octets) long. The 10-bit DLCI is most commonly used. The DLCI identifies the connection in a frame relay link; DLCI identifies both the sender and destination. For LAN-WAN internetworking, the DLCI identifies the port to which the destination LAN is attached. Refer to Figure 211.

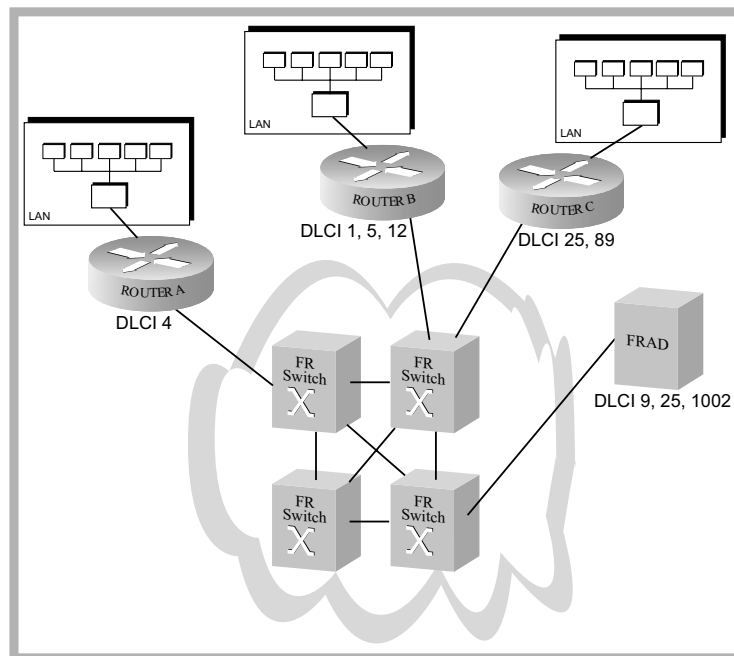


Figure 211 DLCI Values

DLCIs typically have local significance between the customer and the network. For example, Routers B and C cannot use the same DLCI values. However, Router C and the FRAD may use the same DLCI values, since they are connected to a different frame relay switch. This allows more connections on the network (otherwise, only 1023 connections could be established with the 10-bit DLCIs). Table 20 shows the possible DLCI length and corresponding possible addresses.

Bit Length	Address Range	DLCI Header
10	0 to 1023	2 octets
16	0 to 65535	3 octets
23	0 to 8388607	4 octets

Table 20 DLCI Length & Possible Addresses

Frames are routed through the network using the DLCI values. When a frame relay switch receives a frame, it checks its DLCI value. If it is a valid DLCI value, it sends the frame toward its destination. If the DLCI is not defined in its table, the frame relay switch discards the frame.

In Figure 211, note that each connection may have several DLCIs assigned. Frame relay allows users to send data to/from multiple locations over the same circuit. In Figure 211, Router C has 2 DLCIs assigned. Figure 212 shows a possible use for these 2 DLCI values.

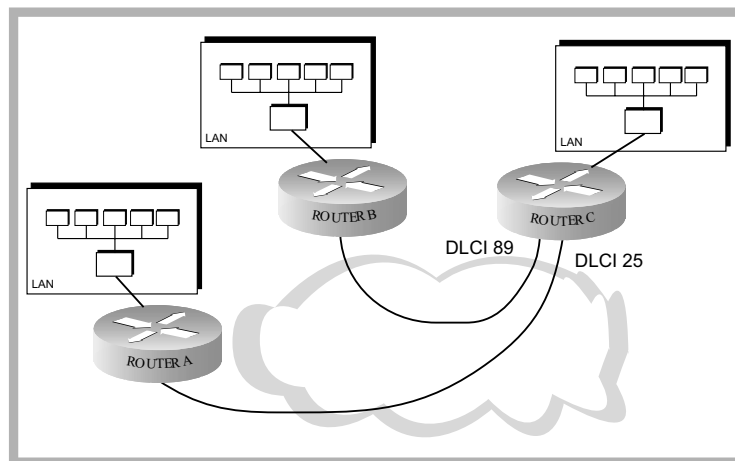


Figure 212 Multiple PVC Connections

Router C uses DLCI 89 to transmit/receive data to and from Router B. Router C also uses DLCI 25 to send data to and from Router A.

Several DLCI values are reserved for signaling. LMI signaling uses DLCIs 0 (for ANSI D) and 1023 (original LMI) to transmit link status information.

3.1.2 Link Management (LMI)

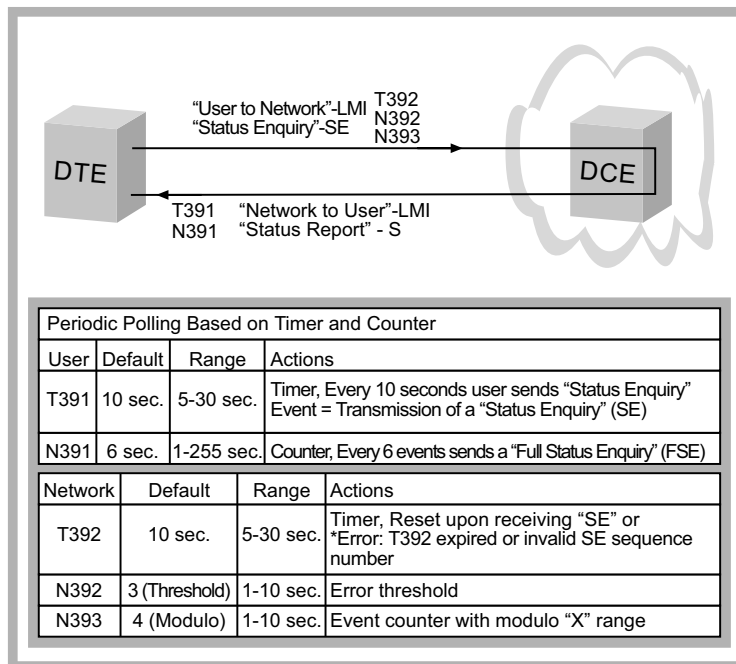


Figure 213 LMI Counters

Link management signaling was developed to communicate important status information between the user and network (over the UNI). LMI (Link Management Interface) defines special management frames with a unique DLCI address that are passed between the network and local access devices. Link management signaling checks if the user-network link is connected and active as well as informing the user on the status of all virtual circuits at that interface. It reports on:

- whether the interface is active; this is often called a "heartbeat" or "keep-alive" signal.
- all valid DLCIs defined at that interface.
- the status of each virtual circuit (PVC): new, active, or inactive.

Link management signaling shows the addition/deletion of virtual circuits and the availability of new virtual circuits. Three specifications define link management:

- ANSI T1.617, Annex D
- ITU Q.933, Annex A
- Original LMI (FRF.1.1)

The link management protocol must be configured the same on the network device, and on the switch. A mis-configuration will cause the network to declare this link inactive and discard any frames transmitted to or from this link.

The user device (router or test set) periodically sends a “STATUS ENQUIRY” message to the network to check if the link is still active. The network responds with a “STATUS” message. If a number of STATUS messages are not answered, the user declares the link down. The network also runs a timer to receive STATUS ENQUIRY message from the user. If it does not receive a STATUS ENQUIRY as expected, the network will declare the link down.

After a specified number of STATUS ENQUIRY/STATUS cycles, the user sends a FULL STATUS request; this requests the status of all PVCs from the network. The network sends a FULL STATUS, including the status of all PVCs (new, deleted, active, inactive).

Parameters determine how often the “KEEP ALIVE” message is sent, how often the full status enquiry/response is sent, and how much time should elapse when waiting for a response. Figure 213, LMI Counters illustrates some of these parameters.

4.0 HDSL Technology Overview

HDSL (High bit-rate Digital Subscriber Line) is a technology that provides high-speed digital transmission over existing copper lines. HDSL is symmetric, meaning it provides the same amount of bandwidth upstream and downstream. HDSL is commonly deployed as an alternative to repeated T1 lines. HDSL has a speed of 1.544 Mbps over two copper pairs and has an operating distance of 12,000 feet.

Investigated in the early 1990's was the use of 2B1Q line coding to carry DS1 services. By carrying half of the 1.544 Mbps DS1 rate on 2 line pairs, allows delivery of DS1 service on loops up to 12,000 feet without repeaters. The ANSI T1E1 group has endorsed both 2B1Q and CAP (Carrier Amplitude Phase) line coding for HDSL. Placed on both ends of the twisted-pair loop is a pair of HDSL transceivers. The transceivers provide the interface between DS1 and HDSL full-duplex links.

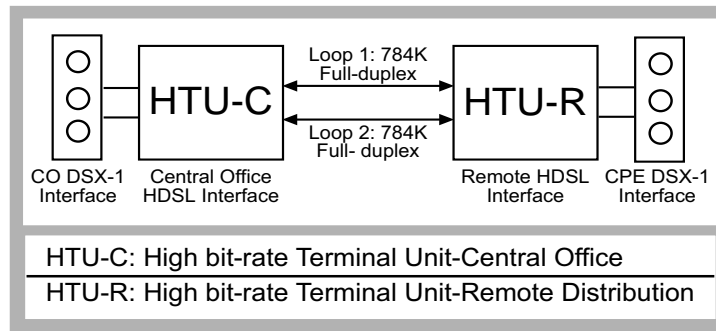


Figure 214 HDSL Span

Illustrated in Figure 214, the HDSL system is composed of two pairs of CSA-compatible loops (Loops 1 and 2). Bi-directional data at a rate of 784 Kbps is transmitted/received on each loop. The combined data from these loops forms a 1.544Mbps DS1 bit rate. Placed on each end of the HDSL system is an HTU (High bit-rate Terminal Unit). The HTUs receive the DS1 signal and generate a line signal to place on the loop. The receiving HTU takes this signal and recovers the original DS1 signal. An HTU in the CO (Central Office) is the HTU-C (High bit-rate Terminal Unit-Central Office). An HTU near the CI (Customer Installation) is the HTU-R (High bit-rate Terminal Unit- Remote Distribution).

With HDSL, T1 service can be provided wherever transceivers can be installed at both ends of the twisted-pair loop. This is more simple and cost-effective than repeater installation. Deploying HDSL circuits can be much quicker than traditional T1 circuits. Another benefit of HDSL is that bridge taps do not need to be removed if they total less than 2,500 ft.

5.0 GR-303 Technology Overview

GR-303 is a Bellcore-defined interface between the central office switch and a remote terminal to handle all call management and operation functions for the DLC (Digital Loop Carrier) system. Known formerly as TR-303, GR-303-CORE has replaced it. GR-303 is an IDLC (Integrated Digital Loop Carrier) system that consists of an IDT (Integrated Digital Terminal) and a RDT (Remote Digital Terminal). The IDT is part of the LDS (Local Digital Switch) in the Central Office. Figure 215 provides a basic illustration of a GR-303 IDLC system.

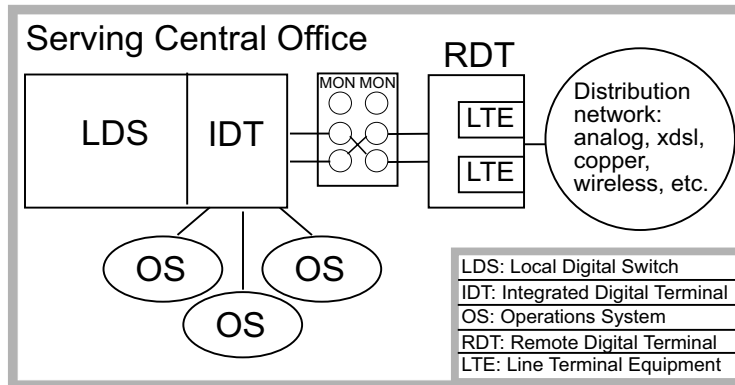


Figure 215 GR-303 System

The GR-303 Interface (IDT-RDT) can range from 2–28 DS1 lines. The 2-line minimum meets small-sized applications, while allowing for a back-up system. The 28-line maximum meets large-sized applications and is consistent with higher rate facilities (DS3). GR-303's main advantage is its flexible concentration; GR-303 may support up to 2048 subscribers sharing between the 2 and 28 DS1 lines. This reduces the hardware requirements at the LDS. The level of concentration is provisioned by the telco.

Assigned for call-processing operations is one DS0. The TMC (Timeslot Management Channel) occupies channel 24. There is a primary TMC (possibly, though not necessarily on DS1 #1) and a back-up TMC on a separate DS1 line, thereby robbing two DS0's for call management. When a customer goes off-hook, the TMC is used to dynamically assign a DS0 for the call. Once assigned a DS0, the robbed ABCD bits for that DS0 are used for call supervision. When the customer goes on-hook (ABCD bits), the IDT releases the DS0 through TMC messages. The TMC uses a subset of Q.931 protocol for its messages. Q.931 is the standard used by ISDN. In fact, if ISDN is known, most of the GR-303 messages and call procedures should be familiar.

GR-303 has an alternative method of call management. Instead of a TMC, a system might use a CSC (Common Signaling Channel) to handle call processing. Found on channel 24 and backed up on channel 24 of a different DS1 line is the CSC. CSC versus TMC is an either/or situation. The CSC differs from TMC because it does not use ABCD robbed-bit signaling. Accomplished by the protocol messages in the CSC are both timeslot assignment and call supervision.

Allocated for operational functions is another DS0. This is the eoc (Embedded Operations Channel). Assigned to channel 12 of one DS1; its backup is on channel 12 of another DS1. The eoc handles provisioning, performance monitoring, and alarm reporting.

5.1 TMC and Hybrid Signaling

Used for dynamic timeslot assignment is TMC. Its main function is to assign the timeslot used for each call. Once assigned to the line unit for a call, ABCD bits on a specified DS0 handle the supervision. In Figure 216, the IDT initiates the call.

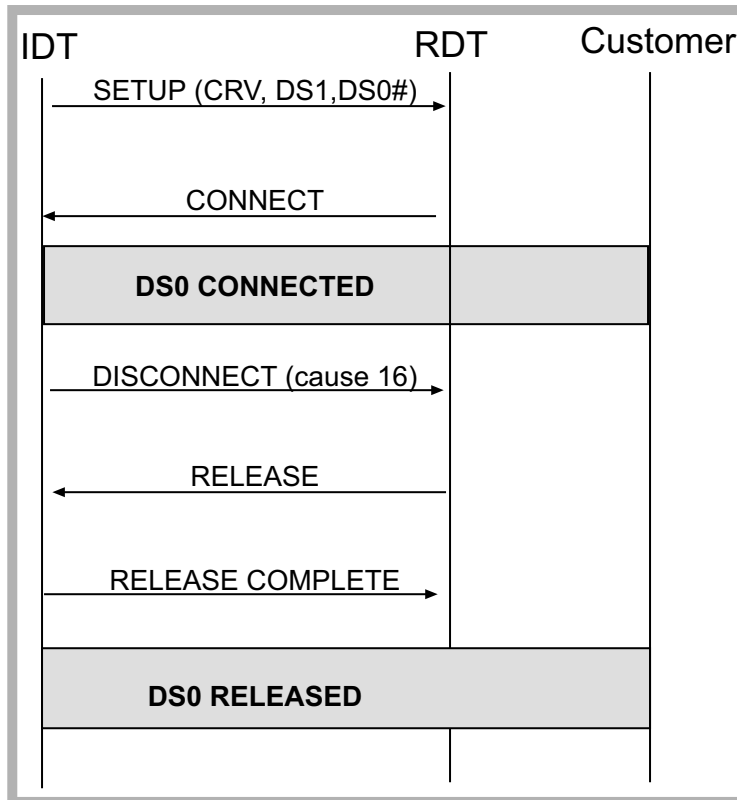


Figure 216 TMC Call Procedure, Initiated by IDT

The IDT sends a SETUP message identifying the called line termination (via the Call Reference Value) and allocates the DS1/DS0 for the call. Before it sends the SETUP message, it also begins transmitting ABCD signaling on the allocated DS0. When the RDT receives the SETUP message, it connects the line termination unit to the designated DS0 channel. The RDT also begins transmitting/responding to ABCD signaling on the DS0. It responds on the TMC with a CONNECT message. When the IDT receives an on-hook indication for the call, it sends a DISCONNECT message to the RDT. When the RDT receives the DISCONNECT message, it disconnects the line termination from the DS0 and sends a RELEASE message to the IDT. The IDT then disconnects this

DS0 and sends a RELEASE COMPLETE message to the RDT. This DS0 is now available for other calls. When the RDT initiates the call, the procedure differs. Refer to Figure 217.

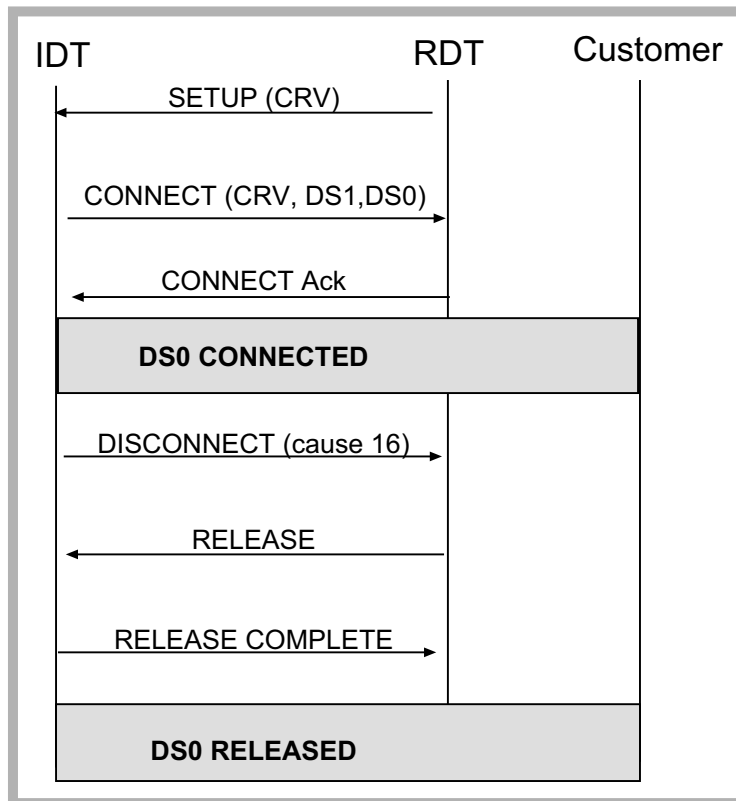


Figure 217 TMC Call Procedure, Initiated by RDT

When the RDT detects a service request from a customer, the RDT sends a SETUP message indicating the line termination (by the CRV). When the IDT receives this SETUP message, it responds with a CONNECT which tells the RDT which DS1/DS0 to use for the call. The IDT also begins transmitting ABCD signaling on this designated DS0. When the RDT receives the CONNECT message, the RDT determines that this DS0 is available for the call. If the DS0 is available, the RDT begins transmitting/responding to ABCD signaling on this channel. The RDT also sends a CONNECT ACKNOWLEDGE message on the TMC to the IDT. When the IDT receives the CONNECT ACK, it begins responding to ABCD signaling on the DS0. The clearing procedure is the same as described previously.

5.2 CSC and Out-of-Band Signaling

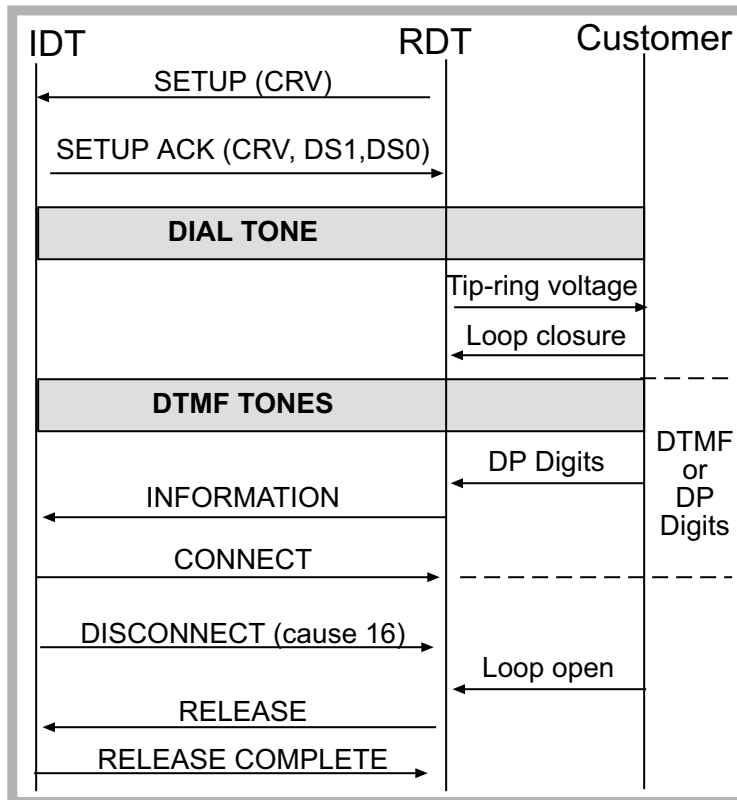


Figure 218 CSC Call Procedure, Customer Initiated

In this case, for all signaling and timeslot assignments the CSC is used. Robbed bit ABCD signaling is not used. In the first example, the customer initiates the call. Refer to Figure 218.

When the RDT detects that a customer is requesting service, it sends a SETUP message to the IDT indicating the Call Reference Value of the customer requesting service. The IDT responds with a SETUP ACKNOWLEDGE message indicating which DS1/DS0 to use for the call. When the RDT receives this SETUP ACKNOWLEDGE, the RDT connects the line unit to the indicated DS0. When the IDT initiates call clearing, it sends a DISCONNECT message. The RDT then disconnects the line unit from the DS0 and sends a RELEASE message. The IDT then sends a RELEASE COMPLETE message and the DS0 is disconnected. If the RDT initiates call clearing, it sends a DISCONNECT to the IDT. The IDT sends a NOTIFY message to the RDT, while the LDS determines if it can clear the call. If the LDS can clear the

call, the IDT disconnects the DS0 and sends a RELEASE message. The RDT responds with a RELEASE COMPLETE message and disconnects the line unit from the DS0.

When initiating the call from the IDT, the IDT sends the SETUP message identifying the DS1/DS0 to use for the call. When the RDT determines it can complete the call. The RDT then sends a CALL PROCEEDING message to the IDT informing the IDT that customer alerting has begun. When the RDT detects that the customer has been connected (i.e. loop closure on a loop start circuit), it removes the alerting signal and sends a CONNECT message to the IDT.

5.3 Embedded Operations Channel

The eoc (Embedded Operations Channel) uses LAP-D protocol for Layer 2 operations. For the application layer, the eoc uses CMISE/ASN.1 (Common Management Information Services/ Abstract Syntax Notation.1). The CMISE model is defined in TR-303 Supplement 3 and GR-2833. Although GR-2833 is replacing parts of TR-303, the TR-303 model is still in use.

For LAP-D, specific SAPI/TEI combinations have fixed assignments in the eoc. Shown in Table 21 is a quick-reference table.

SAPI	TEI	Data Link Function
1	0	EOC Path Switching Operations
1	1	RDT- Provisioning / Memory Administrative OS
1	2	RDT- Maintenance / Surveillance OS
1	3	RDT- Testing OS
1	4	RDT-IDT
1	5	RDT- Test System Controller 1
1	6	RDT- Test System Controller 2
1	7	RDT- Test System Controller 3
1	8-11	User Assignable

Table 21 SAPI/TEI Valid Combinations

Used as follows are these combinations:

- SAPI=1, TEI=0: used for eoc path switching operations. In response to operations messages received from an OS, the IDT or RDT will initiate a switch from the active eoc or TMC to the standby eoc or TMC.
- SAPI=1, TEI=4: used for operations interactions between the IDT and RDT.
- SAPI=1, TEI=1: used for provisioning and memory administration OS (Operations System) to communicate with the RDT when provided with an OIM with a gateway function.
- SAPI=1, TEI=2: used for a maintenance and surveillance OS to communicate with the RDT when provided with an OIM with a gateway function.
- SAPI=1, TEI=3: used when a testing OS communicates with the RDT when provided with an OIM with a gateway function.
- SAPI=1, TEI=5: used when a TSC communicates with the RDT when an OIM with provided with a gateway function.

5.4 TMC/CSC Cause Values

The following is a table of cause values that the switch and RDT must support, as defined by GR-303-CORE.

Value	Definition
16: Normal Clearing	Sent by the RDT/IDT to indicate that call clearing has begun, after recognizing that the customer went on-hook.
27: Destination out-of-service	Sent by the IDT to indicate that call clearing was initiated because the customer is in a permanent signal state.
30: Response to Status Enquiry	Sent by the RDT in Status messages, which is sent in response to Status Enquiry messages.
34: Channel Unavailable	Sent by the IDT to reject a call setup when there is no DS0 available to carry the call. In addition, the RDT may reject a call with this cause value if it believes that the DS0, specified by the IDT, is already in use or is unavailable.
35: Distribution Channel Unavailable	Sent by the RDT to reject call establishment when the distribution channel, as indicated by the CRV, is blocked.
41: Temporary Failure	Sent by the IDT to initiate call clearing after recognizing that there is a call state mismatch. The RDT may also send this message in a STATUS message if it believes there is a call state mismatch. In addition, the IDT and RDT may send this message to indicate call clearing due to a call failure event like a timer expiry, or if a resource becomes unavailable during the call.
44: Line Unit Unavailable	Sent by the IDT/RDT to reject a call setup when the line termination, as indicated by the CRV, is incapable of providing service. After receiving a Release Complete message with this cause value, the RDT/IDT immediately stops call establishment.
47: Ring Failure	Sent by the RDT to reject call establishment when the line indicated by the CRV fails the ring pre-trip test.
81: Invalid Call Reference	Sent by the RDT/IDT to reject a message that contains an invalid call reference value.
96: Mandatory Element Missing	Sent by the RDT/IDT to reject a message that does not contain a required information element.
97: Message Unimplemented	Sent by the RDT/IDT to reject an unrecognizable message.
99: Information Element Unimplemented	Sent by the RDT/IDT to indicate that it did not recognize an information element in the received message.
100: Invalid Information Element Contents	Sent by the RDT/IDT to reject a message that contains an invalid information element (coded incorrectly).

Table 22 GR-303-CORE Cause Values

6.0 GSM TRAU Technology Overview

6.1 GSM Network Architecture

Governed by the ETSI standards series 12 is GSM (Global System for Mobile Communication). GSM technology uses a digital standard for voice and data applications. Figure 219 shows a typical GSM network.

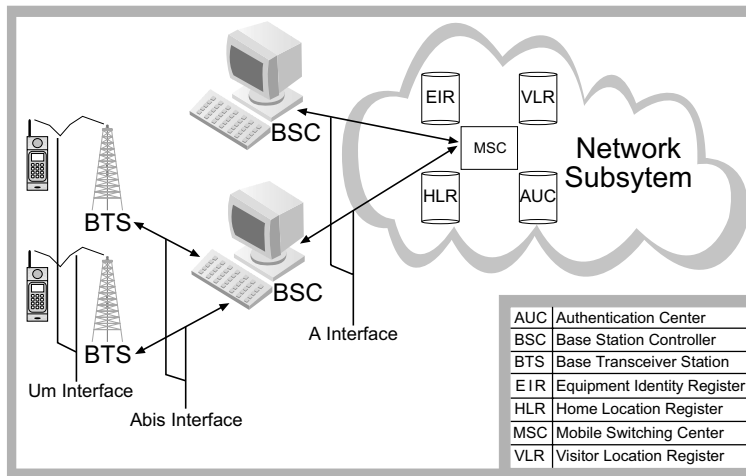


Figure 219 GSM Network

The three major components of a GSM network include the MS (Mobile Station), BSS (Base Station Subsystem), and NS (Network Subsystem). It is then connected to a fixed network like a PSTN (Public Switched Telephone Network).

A MS consists of a ME (Mobile Equipment) and SIM (Subscriber Identity Module). The SIM is physically a smart card that identifies the subscriber to the GSM network. It also authenticates and encrypts a subscriber's voice identified by the IMSI (International Mobile Subscriber Identity). Once a SIM card is inserted to a GSM terminal, or ME, it becomes a MS. Like the SIM, the ME can also be identified using the IMEI (International Mobile Equipment Identity).

While a subscriber roams or is stationary, the MS transmits a radio signal to one of the many BTSs (Base Transceiver Station). These BTS cells are equipped with radio transceivers to send and receive signals using a radio-link protocol via an Um interface.

The BTSs are in turn managed by a BSC (Base Station Controller). Using the A-bis interface, the BSC handles radio-channel setup, frequency hopping for security measures, and handovers. In some instances, a TRAU (Transcoder Rate Adaptation Unit) is placed at a BTS to perform transcoding between 64 Kbps A-law speech and 13 Kbps RPE/LTP speech. The TRAU may also be located at or in conjunction with the BSC. The BSC then connects the MS to the MSC (Mobile Switching Center) using the A-interface.

Using four registers, the MSC handles subscriber registration, authentication, location updates, handovers, and call roaming. The HLR (Home Location Register) is the central database for all subscribers holding the identity of the subscriber, services accessible to the subscriber, and current location of the MS. Given a MS ISDN (MSISDN) number; a call is routed by looking up the corresponding IMSI found in the HLR.

The VLR (Visitor's Location Register) contains information about all MSs within the area served by the MSC. Found in the VLR is information such as MS identity, the area in which it was last registered, additional information pertaining to the subscriber, and any supplementary services available.

A MSC refers to the VLR each time a MS receives or makes a call. A security register called the AUC (Authentication Center) validates a SIM and performs a mathematical calculation on the same secret information stored in SIM. Another security register is the EIR (Equipment Identity Register). Using a list of three categories, the EIR ensures that all MEs used are valid and authorized to function on the PLMN (Public Land Mobile Network). Together, the MSC, HLR, VLR, AUC, and EIR make up the Network Subsystem that connects the GSM network to a fixed network.

6.2 TRAU Frames

A TRAU may be located at the BTS, BSC, or MSC. Figure 220 shows the different placements of transcoders.

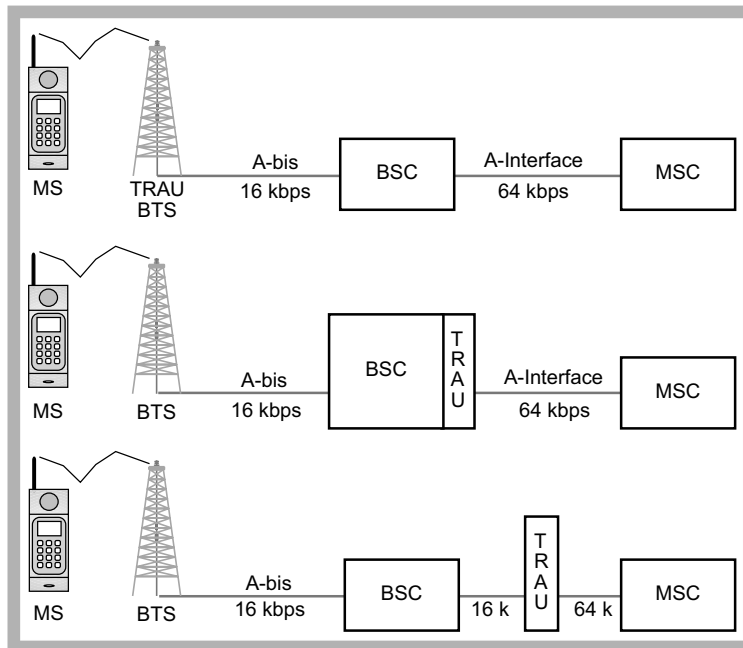


Figure 220 TRAU Locations

When positioning the transcoder remotely to the BTS (i.e. at the BSC), the CCU (Channel Codec Unit) in the BTS controls some of the functions of the remote TRAU at the BSC. In-band signaling performs this remote control. These signaling bits are known as C-bits. C-bits control:

- shift between data and speech frames.
- rate adaptation for data calls.
- downlink time framing for speech frames.
- transfer DTX information.

6.2.1 TRAU Frame

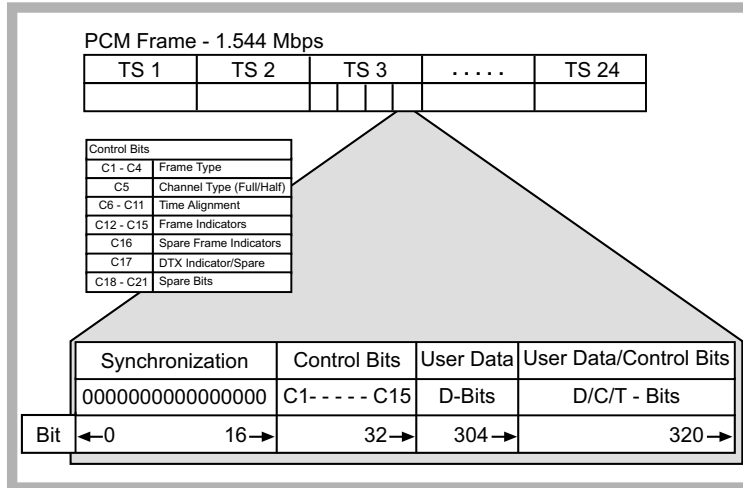


Figure 221 16 Kbit TRAU Frame

Divided into four 16 kbps sub-channels are the 64 kbps timeslots. Each devotes 13 kbps to voice, with 3 kbps remaining for spare bits. A TRAU (Transcoder and Rate Adaption Unit) does the required transcoding between the 64 kbps and 16 kbps channels. A TRAU may be located at the BTS, BSC or MSC. If located outside the BTS, the TRAU is controlled by in-band signaling, using some of the spare bits.

A TRAU frame, containing 320 bits, is used to send signals between the BSC and the TRAU. Its use is mandatory when the A-bis interface is applied.

7.0 T1 Technology

This section is an overview of T1 technology, and equipment. It also explains the basics of troubleshooting and sectionizing problems with T1 circuits. T1 is a general term that refers to the transmission of 1.544 Mbps digital circuits over any media. T1 can be transported over copper, fiber, or radio. DS1 is the term for the electrical signal found at the metallic interfaces for this circuit where most testing is performed.

7.1 T1 Transmission

7.1.1 T1 Usage

Used for a variety of purposes are T1 circuits. They are widely embedded in the network distribution architecture as a convenient means of reducing cable pair counts by carrying 24 voice channels in one 4 wire circuit. End users have migrated their private networks onto leased T1s as a means of reducing their network operation costs. DS1 is a universal digital access point to traditional digital networks and newer fiber optic synchronous networks.

7.1.2 T1 Services

Telephone companies are now selling T1 point-to-point circuits in a variety of formats. Channelized T1 circuits are often sold as a means of connecting PBXs (Private Branch Exchanges) or ACDs (Automatic Call Distributors) to a central office switch. In this case, the telephone company may also install and maintain a channel bank for the customer at their premises. T1 “pipes” are sold to more sophisticated users who only require point-to-point connectivity of a T1 circuit from the telephone company.

7.1.3 DS1 Network Elements

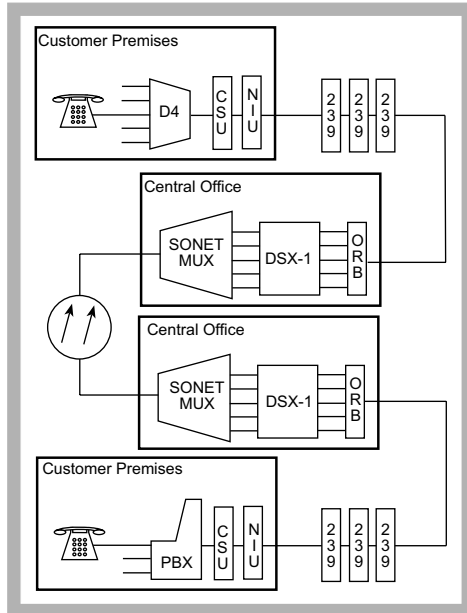


Figure 222 DS1 Network Elements

As shown in Figure 222, a rich variety of equipment is available for T1 circuits.

CSUs (Customer Service Units) can convert a V.35 or other computer-based synchronous signal format into the DS1 format and insert the appropriate DS1 framing. CSUs also provide loopback capability, indicator lights, monitor jacks, and split access for troubleshooting and installation debugging.

Installed by the telephone company at customer premises for a variety of maintenance reasons, the NIUs (Network Interface Units) provide a loopback, at the telephone company's control. This loopback allows the telephone company to verify that the circuit works all the way to the point of interface with the customer's network. The NIUs may also be configured to loopback signal, send AIS, or send idle signal when the customer signal is unplugged. New kinds of NIUs even provide performance monitoring information and maintenance switching capability.

T1 can be transmitted over twisted pair, fiber, or digital radio. Twisted pair (normal telephone wire) is the most widely spread form of transmission and has several types of associated network elements. Regenerative repeaters, for example AT&T's 239 series, are located up to 6000 feet apart on a twisted pair span.

The repeaters are in apparatus cases, which are located within 3000 feet of the central office and the customer premises. This avoids cross-talk problems when the signal is on building wiring. Newer line repeaters offer loopback capability for faster span sectionalization. Central office repeaters provide the 60 mA span current used for powering the regenerative repeaters on the span. Housed in ORBs (Office Repeater Bays), these newer central office repeaters automatically adjust the supplied voltage to adapt to varying numbers of repeaters plugged into the span. They also may have fractional T1 blocking capability to allow the telephone company to sell a reduced price T1 that only carries a certain number of channels. They also may have automated loopback capability and span power-down/power-up capability.

Found at the ends of DS1 lines, is a variety of equipment. D4 channel banks are a traditional form of multiplexer that converts ordinary telephone wires to 64 kbps channels for multiplexing onto a DS1. Newer D4 banks offer a wide variety of channel plug-ins to handle DDS-style circuits, private line circuits, and even ISDN. Found in the Bell environment are AT&T SLC-96[®] and SLC-5 system. These Bell systems are enhancements to the older D4 style.

M13 multiplexes are a traditional higher-order multiplexer for DS1s. These multiplexers take up to 28 DS1s and multiplex them into a single DS3. Note that the DS1 framing and payload still exist inside the DS3 signal, but not passed through is the DS1 line coding.

Often found at the end of T1 lines are toll switches and PBXs class 5 switches (central office switches connected to local subscribers). These elements use DS1s as a way of concentrating their connections to local subscribers and interoffice trunks. The function of these elements is to take supervision and addressing information from subscribers, set up a call throughout the world network for the subscriber, connect the subscriber through when the path is setup, and terminate the call when the subscriber is finished.

A variety of DCSs (Digital Cross-connect Switches) connect to DS1 lines. DCSs commonly reduce the space required for achieving channel cross-connection, eliminate the manual labor associated with cross connection, and can provide fast computerized rerouting of facilities in the event of a network outage. The common DCSs are type 1x0, 1x1, and 3x1. A 1x0 DCS has DS1 ports interfacing the network. Internally it cross-connects DS0s between the DS1s according to instructions entered through an administrative terminal. The 1x0 DCS takes the place of many racks of 1x0 multiplexes combined with a DSX-0 manual cross-connect bay. Another name for a 1x1 DCS is an electronic DSX-1. Designed as a replacement for the DSX-1, a 3x1 DCS has DS3 ports and possibly DS1 ports facing the network. This replaces a bank of M13 multiplexes and the DSX-1.

Deployed in the network is a wide variety of SONET (Synchronous Optical Network) equipment. This equipment operates at higher rates and introduces a wide variety of new signal formats, both optical and electrical. Designed to interface to an embedded network, most SONET equipment also has DS1 and DS3 interfaces. SONET equipment replaces equipment like M13 multiplexes and 3x1 DCSs.

7.1.4 DS1 Standards

Many standards govern various parts of DS1 transmission and network elements. The two most important standards are:

- ANSI T1.102 - 1987, Digital Hierarchy, Electrical Interfaces
- ANSI T1.403, Network-to-Customer Installation - DS1 Metallic Interface

7.1.5 DS1 Signal

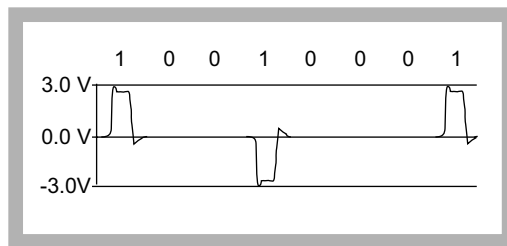


Figure 223 DS1 Pulse Transmission

The DS1 signal is a 1.544 Mbps, 3V signal. Like the DS3 signal, it uses a bipolar format. Unlike DS3, there are two line codes used in transmission, AMI (Alternate Mark Inversion) and B8ZS (Bipolar 8-Zero Substitution). When DS1 was first introduced AMI was the original line code. However, its use is not optimal in today's networks, which mix data transmission with voice transmission and which require near error-free quality. The drawback with AMI line coding is that it requires the terminal transmitting data to have at least a 12.5% average 1s density and a maximum of 15 consecutive zeroes. This data content is impossible to guarantee when computer data is transmitted, so transmission quality can suffer. In comparison, B8ZS uses a bipolar violation substitution which guarantees the 12.5% average with a maximum number of 7 consecutive 0s. Consequently, networks are moving towards B8ZS line code usage. Refer to Figure 223, DS1 Pulse Transmission for an illustration of the DS1 signal.

7.1.6 T1 Framing

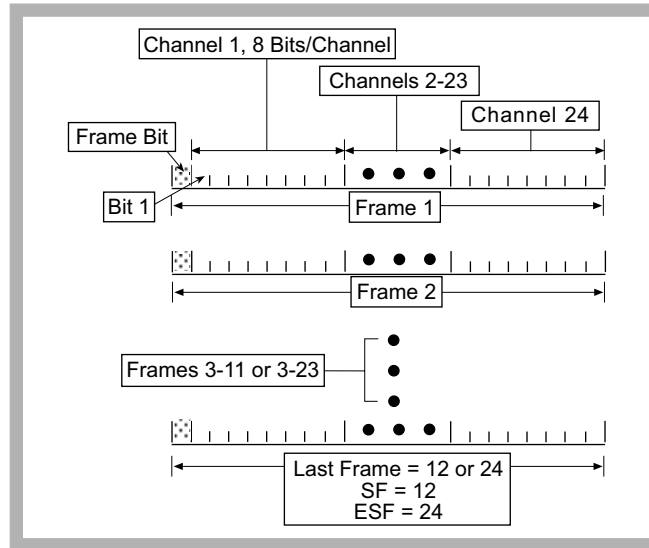


Figure 224 DS1 Frame Structure

T1 framing is simpler than DS3 framing. In T1, there are 192 data bits and 1 framing bit. With framing the first bit of the frame is easily found. Most T1s are arranged with 24 channels of data, with one byte (8 bits) transmitted per channel per frame. Channel 1 is the first 8 bits after the frame bit channel 2 is the second 8 bits after the framing bit and so on. 8000 frames per second are transmitted. Each channel provides 64 kbps bandwidth. Refer to Figure 224.

There are 3 kinds of standardized T1 framing in use today, SF, ESF, and SLC-96®.

The simplest is SF (Super Frame), which consists of 12 T1 frames grouped together. The 12 framing bits are transmitted in a recognizable pattern such that the super frame is organized into frame number 1, frame number 2, and so on.

ESF (Extended Super Frame) groups 24 SF frames together. Of the 24 framing bits, only 6 are used to establish the frame position, i.e. which frame is number 1, which frame is number 2, and so on. ESF uses another 6 framing bits for a CRC-6 (Cyclic Redundancy Check code - 6), and uses another 12 framing bits for the FDL (Facility Data Link).

The CRC-6 bits are the remainder from a division of the bits of the previous frame by a sixth-order polynomial and if the two figures are not identical then the monitoring device can assume that a transmission error has occurred somewhere between the measurement point and the origin of the ESF-framed signal. Any

monitoring device along the line can do the same division process and compare its remainder to the CRC-6 bits.

The FDL is a 4 kbps data channel that allows terminal-to-terminal communications on an in-service circuit. One example of in-service communication is the performance report message broadcasted once per second on an in-service circuit. This message is discussed later in the End-to-end Performance Monitoring section in this chapter. The FDL also provides a secure communication channel that the customer cannot influence. For instance, ESF NIU loopback commands are transmitted on the data link so that there is no chance that the customer's own payload data will accidentally loop up the NIU.

The SLC-96® framing is used on AT&T's SLC-96® product line. The framing supports a broad variety of maintenance functions such as alarm transmission, automatic switching to protection line, and far end loop back. The DS1 link in between the central office terminal and the remote terminal uses SLC-96® framing.

7.1.7 PCM

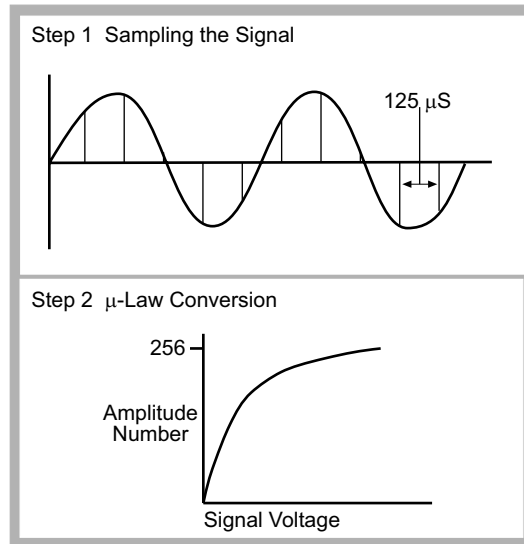


Figure 225 PCM Sampling and μ -Law Encoding

PCM (Pulse Code Modulation) is a technology that allows digitization of a voice conversation and inserting it on a T1 line. The voice conversation, a 4 kHz analog bandwidth is transmitted through the network.

Through the Nyquist theorem, 8000 samples per second are taken in order to achieve the 4000 Hz bandwidth requirement. As shown in Figure 225, PCM Sampling and μ -Law Encoding, the analog signal is sampled at 125 μ S intervals, 8000 times per second. Each sample is a measurement of the voltage of the analog signal. The voltage level is then converted to an 8-bit binary word.

An 8-bit word provides 256 different levels, which is not enough to produce a quality sound. To produce a quality sound a μ -law transformation is applied, which puts a constant dB level in between each voltage step. This creates a nonlinear relationship between the pulse amplitude and the level number, but it is more pleasing to the ear because it provides a more constant signal-to-noise ratio at a wide range of volumes.

Each 8-bit word occupies one channel in one frame. Because there are 24 channels available, up to 24 conversations can be on the T1 signal.

7.1.8 Switching

An understanding of switching is helpful when troubleshooting T1 circuits. DS1, DS2, and DS3 signals are plesiochronous, that is, they are not frequency-locked with respect to each other. The DS2 and DS3 signals have stuff bits built into the framing. This allows for slippage of all signals with respect to each other, and not cause any transmission errors. The frequencies are required to be about +/- 20 to 50 ppm of center frequency for error free transmission.

After adopting digital plesiochronous (sometimes called asynchronous) transmission technology, switches began converting from analog to digital technology. Unfortunately, the original DS1 framing concept never anticipated a need to cross-connect DS0s directly from one DS1 to another DS1, which is what happens inside a digital switch. A call that comes in one channel of a DS1 goes out on another channel of another DS1.

8000 times a second, a switch takes 1 received frame from each of the DS1s connected to it. The switch disassembles each frame into the 24 independent timeslots. It checks its call map to see where to send each of the received timeslot bytes. Then it sends each byte to the appropriate DS1 transmit port. It then assembles all the bytes for each transmit DS1, inserts any idle code on timeslots that are not actively in the middle of a call, and inserts an appropriate framing bit for the frame type being used. Finally, it transmits each DS1 frame every 1/8000 of a second. There are several 125 mS periods of delay for a byte as it moves through the switch.

Not all DS1s will have frames ending at exactly the same moment in time. For this reason, the switch maintains a buffer for each transmitted and received DS1 signal. Each buffer provides an elastic store of bits, so that the switch will always have bits available to transmit or receive at the required moment.

The received and transmitted DS1s must be at the same frequency of the switch. Any received DS1 that is going too slowly will eventually run out of bits in its buffer. This is because the switch is taking bits out of the buffer faster than the DS1 is filling the buffer. When the buffer is empty, the switch must insert extra data in each of the transmitted timeslots on the cross-connected channels. An error has now occurred, because the transmitted bits do not match the received bits. Likewise, if any of the received DS1's frequency is higher than the switch, the receive buffer will overflow. This is because the bits are coming in faster than they are leaving. Once the buffer overflows, some of the received bits are not transmitted on the cross-connected channel. An error has again occurred; this time because data has been lost.

The deployment of digital switches has resulted in an effort to synchronize all DS1s so that errors will not occur in switched circuits that use DS1 for transport.

7.1.9 Synchronization

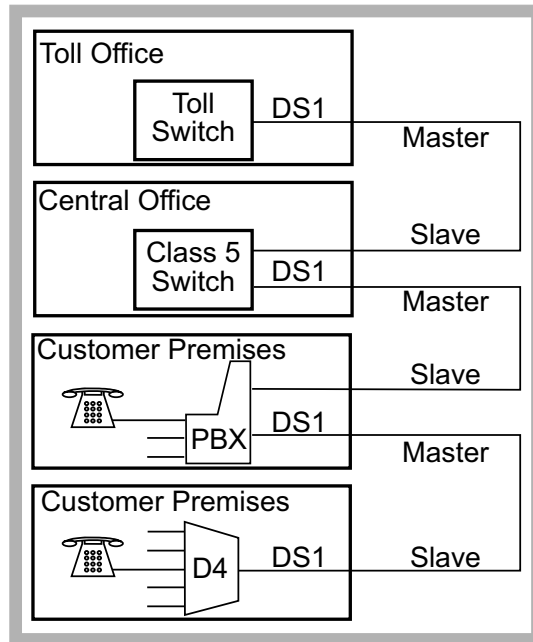


Figure 226 Timing Distribution

DS1 circuits need synchronization with each other to avoid the switching problems described in the previous section. Minor frequency deviations will cause only pops and crackles on a voice circuit. Rendered virtually useless by the regular errors resulting from frequency slippage are data circuits. If a DS1 is slipping by more than 100 to 300 bps, a digital switch may even put the DS1 out of service, and declare an alarm.

Synchronization is achieved when all signals can have their frequency traced back to the same clock. When installing a network element, its timing relationship is one of the items that need consideration. This is usually one of master/slave. For instance, if connecting a PBX to a central office switch via a T1 line, usually the central office switch is synchronized to the network. Therefore, the DS1 signal received by the PBX from the central office is synchronized to the network. Thus, the PBX should be setup for slave timing mode, with the DS1 signal received from the central office used as the timing source. In turn, a D4 channel bank that is connected to the PBX should be slaved to the PBX. Illustrated in Figure 226 is one possible distribution of clocking in the network.

Note that a network element which is slave timed to another network element may also be the master to other network elements attached to it. Also, note that loop timing, or receive timing is the same as slave timing. Loop timing, because the received timing is looped out the transmitter. Receive timing, because the timing source is from the received signal.

Another method is internal timing. The advantage of this is that the element will always be able to generate a signal, so no clock signal is required. Test sets performing acceptance testing usually use internal timing. Note that internal timing is not acceptable when the test set will be transmitting toward a switch for Nx64 kbps testing; the switch is drawing its timing from something other than the test set. In this case, the test set should be loop timed.

7.1.10 Supervision

Common T1 framing methods transmit supervisory information through robbed bit signaling. Every 6 frames the least significant bit in the PCM byte for every channel is robbed. This robbed bit transmits the signaling information.

In SF framing, the robbed bits in the sixth and twelfth frames form the A and B signaling bits for each channel. The type of circuit carried in the channel determines the bit interpretation. For instance, on an E&M circuit, when A= 0 and B= 0, the circuit is idle, (the user is on-hook). When A = 1 and B = 1, the circuit is seized (the user is off-hook).

In ESF framing, there are 24 frames grouped together, with bit 8 of each channel in frames 6, 12, 18, and 24 as the ABCD signaling bits. Most ESF signaling is identical to SF signaling, the C and D bits are copies of the A and B bits.

The SLC-96[®] data link handles SLC-96[®] supervision.

7.1.11 Addressing

Addressing is the process of sending a telephone subscriber address to setup a call. The oldest addressing technique in use today is pulse dialing. With pulse dialing, the phone goes on-hook and off-hook 10 times per second, in order to dial a number. For example, to dial a 7, the system starts in the off-hook condition, and then goes on-hook/off-hook 7 times. Rotary phones use this technique. The addressing information is transmitted through a T1 line by toggling the A and B bits from the off-hook state to the on-hook state at a rate of 10 times per second. In switched 56 services, this addressing is now common.

MF (Multi Frequency) is an addressing technique used for interoffice signaling in a telephone network. It uses a group of paired frequencies to form a single address tone. In addition to supporting the digits 0 through 9, MF offers many other control codes for specialized network applications like billing, pay phones, etc.

DTMF (Dual Tone Multi Frequency) is the common addressing method on today's phones. Like MF, it uses pairs of tones to send a digit. Unlike MF, it uses two separate groups of tones. DTMF supports 16 digits, 0 through 9, #, *, and A through D.

7.1.12 AIS and Yellow Alarms

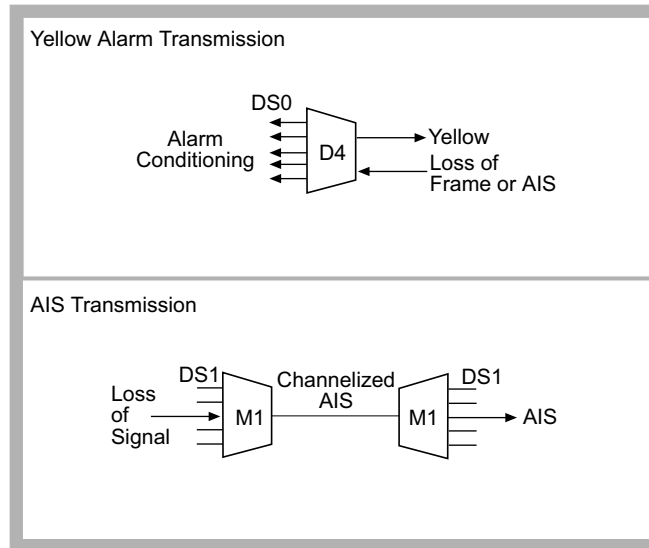


Figure 227 AIS and Yellow Alarms

In DS1, AIS and yellow alarms work just as they do in DS3. An intermediate network element such as an M13 multiplex, 1x1 DCS, or SONET mux, transmits AIS downstream when it receives a loss of signal. The DS1 AIS is an all 1s unframed signal. A terminating network element such as a D4 channel bank, PBX, central office switch, or 1x0 DCS sends a yellow alarm back towards the other end when it receives a loss of frame. Note that receiving an AIS means there is a loss of frame.

Terminating elements also need to condition the DS0s that the DS1 carries when the frame is lost. For instance, a D4 channel bank is to condition its channel cards to take them out of service. Then it transmits an appropriate out-of-service signal to any low speed equipment. Refer to Figure 227 for diagrams of how the transmission of AIS and yellow alarms works.

7.1.13 Loopbacks

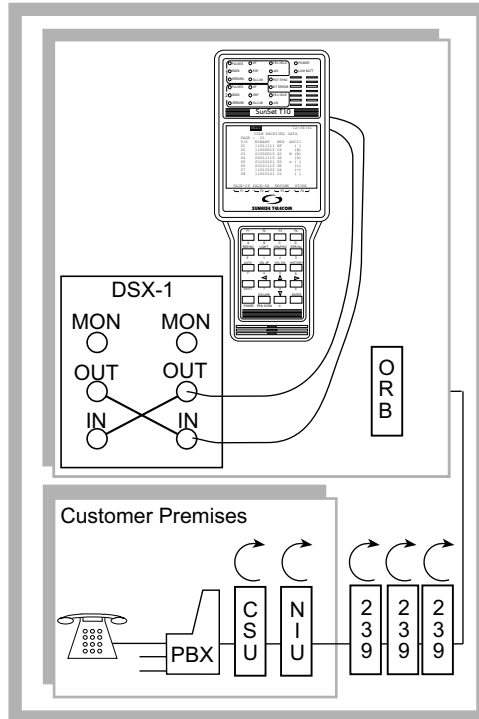


Figure 228 DS1 Loopback Testing

To quickly verify the performance of a new DS1 circuit, use loopback testing. It can also greatly speed up the fault sectionalization process on a circuit that is not working properly.

A variety of equipment provides loopback capabilities, newer central office repeaters, newer regenerative line repeaters, NIUs, CSUs, and M13 multiplexes. Discussed in the previous DS1 equipment section are the general characteristics of this equipment. Figure 228 shows the variety of loopback points available from the central office for a fault sectionalization process.

7.1.14 End-to-End Performance Monitoring

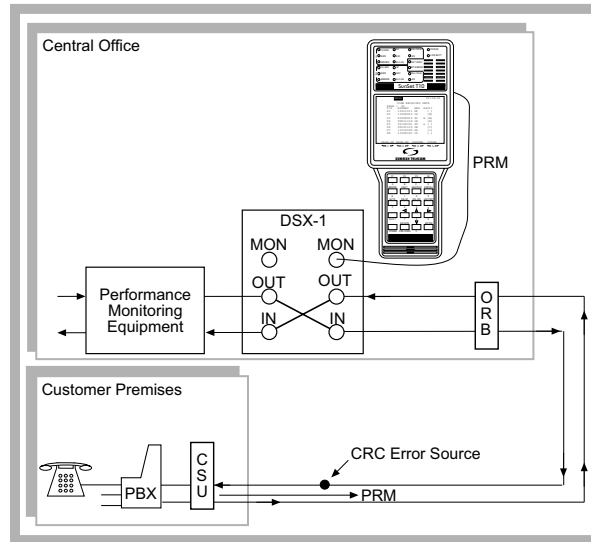


Figure 229 DS1 Performance Monitoring

End-to-end performance monitoring is possible through ESF framing and CSUs that support PRM (Performance Report Messaging) on ESF FDL. Specified in ANSI T1.403 is this capability.

The concept is similar to that described in the DS3 performance monitoring section. In ESF performance monitoring, any CRC-6 error, or bipolar violation that the CSU receives is transmitted towards the other direction in the PRM on the FDL. This way various telephone companies that provide transport service can have an equal ability to see the quality of the end-to-end transmission, while the circuit is in-service. Before this capability was available, the circuit would have to be out of service in order to measure the performance.

This end-to-end performance monitoring capability gives the customer a way to verify the quality of the service that the telephone company is delivering. It also allows the telephone company to setup internal monitoring systems to report on the average grade of service provided to customers. The telephone company may also receive early warning of some failures, i.e. those failures preceded by a gradual period of deterioration. This early warning allows the telephone company to fix the problem before the service is lost.

Illustrated in Figure 229 is End-to-end performance monitoring. In this, a fault on the transmission line induces repeated errors on the service. The CSU at the end of the line sees the errors as CRC-6 errors and generates a PRM in the other direction. The installed performance monitoring equipment in the central office and the technician using their SunSet T10 can both see the message.

7.2 Troubleshooting and Fault Sectionalization

This section will help locate problems on T1 circuits. First is a checklist on various problems that often happen with T1 circuits followed by information about errors and alarms to help quickly find the problem.

- Is the circuit properly wired? Check for loose wire wraps, bad splices, connections to wrong pairs, etc.
- Are there any cable problems? For example: bridge taps, "wet" cable, paper insulated cable, shorts, or grounds.
- Is the cable T-screened? Ideal T1 transmission cables use a screen to separate the two directions of transmission to prevent cross talk. Are the T1s in the screened cable properly separated into transmit and receive binder groups?
- Is the circuit properly connected at all of the offices along its route?
- Is transmit and receive plugged in backwards? A surprising number of circuits are backwards. Try the other way.
- Are there any AMI/B8ZS mismatches? AMI and B8ZS line codes are incompatible. Both ends of a T1 line must use the same coding. If all ones work correctly, QRS has errors and 3-in-24 will not synchronize, it is probably an AMI/B8ZS mismatch.
- Is the CSU, or other element set to stuff 1s to prevent low density? This is required for AMI circuits but will cause loss of synchronization on 3-in-24, errors on QRS, and no errors on all 1s circuits.
- Is there a framing mismatch? Check that the framing is the same on both sides.
- Does the problem reappear when dropping the loopback? The problem is probably with the equipment on the far side of the loopback.
- Is a switch or PBX connected? Look for frequency mismatch.
- Are DS1 signals used throughout? Sometimes a DS1 is plugged into a DS1C by mistake, or other signal format incompatibility maybe present.

- Is there a double loopback? Sometimes two or more loopbacks of the same type are present where only one is expected. In this case a double or triple loop may occur on a loopback code and the loopdown code may have to be transmitted two or more times before all the loops come down.
- Is there a termination problem? All lines should have only one 100Ω termination. Other terminations should be high impedance. If not sure, try TERM, BRIDGE, and MONITOR.
- Is the level too low? The received level should be at least -15 dB dsx for most equipment.
- Is there a frequency synchronization problem? Refer to the frequency synchronization discussion in this chapter.
- Is there a cross-talk problem? If the signal level is lower than -12 dB, another signal could be cross talking onto the received T1 line.
- Are there repeaters and are they at the right spacing?
- Is there a span power problem? 60 mA span power needs to be delivered to all repeaters on the span; all repeaters should have their power switches properly set to LOOP or THRU. The central office automatic span-powering repeater should be delivering the proper voltage to power the span. All the repeaters before the farthest one away from the central office should be set to THRU. Is the farthest repeater or the NIU set to LOOP? Too many repeaters will overload the central office repeater.
- Is the span to power the NIU and is it providing the proper power?
- Is the central office repeater transmitting a 6V signal that is not being padded to 3V before it gets to the next equipment?
- Is the test cord broken or dirty? This can cause misleading test results.
- Is the test set working properly? This can also cause confusion when troubleshooting problems. A quick way to check the test set is to loop the test cord from transmit to receive, checking both the cord and the set at the same time. Common test set problems are wrong termination (TERM, BRIDGE, DSXMON), wrong clock setting (INTERNAL is right for most cases), wrong framing, wrong line code, wrong Nx64 selection, and wrong test pattern.

7.2.1 Fault Sectionalization

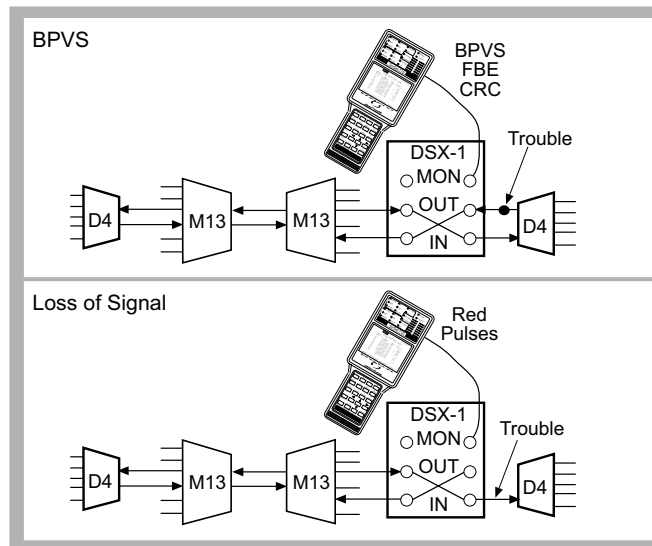


Figure 230 BPVs & LOS in DS1 Fault Sectionalization

Fault sectionalization techniques vary depending on whether the T1 circuit is in-service or out of service. If out of service, then start from the middle and loop back the circuit in each direction to see which side has the problem. Next, go to the middle of the problem side and do another loopback in each direction. Repeat this procedure until the problem is located. Refer to Figure 228 for an illustration of the loopback test. This figure shows many of the loopbacks that may be available in one direction from the central office. Note that there also may be DS3 loopbacks available if the circuit is a DS3 circuit, or DS1 channel loopbacks may be available in higher order multiplexes.

If the circuit is in service, non-disruptive performance monitoring techniques are used. Simply plugging into monitoring jacks and observing the information can show much about the circuit. Be sure to plug into the monitor jack for each direction and look at the results.

The following paragraphs tell what conclusions can be made from various results at different monitor points. In the accompanying diagrams, a SunSet T10 shows what abnormal conditions it is seeing from its monitor point. In the diagrams, a black dot indicates a line impairment that is causing steady or bursty errors. A missing signal arrow indicates a loss of signal. If the circuit uses ESF framing then CRC is in the diagram. Likewise, if C-bit parity error is listed, this is only if C-bit parity framing is used.

7.2.2 Bipolar Violations and Loss of Signal

If seeing DS1 or DS3 bipolar violations or loss of signal then the fault is close to the tester. DS1 bipolar violations pass through line repeaters, office repeaters, and NIUs, but cannot pass through multiplexes, DCSs, switches, signal format changes (i.e. from optical to electrical), and some types of CSUs. DS3 bipolar violations indicate that the problem is between the test set and the nearest DS3 equipment, within a few hundred feet.

The DS3 format only exists at interconnections between equipment. Different formats are for transmission over long distances. In comparison, transmitting a DS1 electrical signal through regenerative line repeaters for hundreds of miles is possible. Thus, a DS1 bipolar violation indicates a transmission problem between the test set and the last multiplex, DCS, or other element that stops bipolar violations. Figure 230 illustrates the DS1 case.

7.2.3 Frame Bit, Bit, CRC-6, and C-Bit Parity Errors

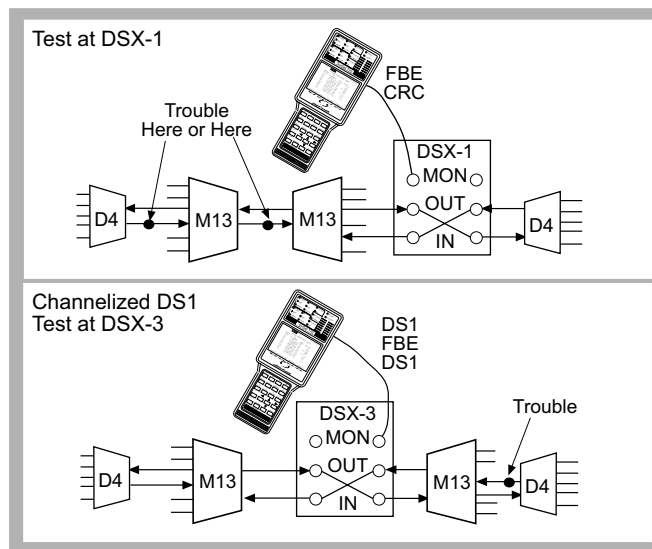


Figure 231 FBE and CRC in DS1 Testing

Frame Bit, Bit, CRC-6, and C-Bit Parity Errors travel with the DS1 circuit for the entire length of the circuit. They pass through higher order multiplexes. They also pass through changes in line format from copper-to-fiber, fiber-to-radio, etc. If they are occurring with bipolar violations, then the problem is local and if occurring without bipolar violations, then the problem is behind the last format change. Figure 231 shows what these errors mean when seen without BPVs.

7.2.4 AIS and Yellow Alarm

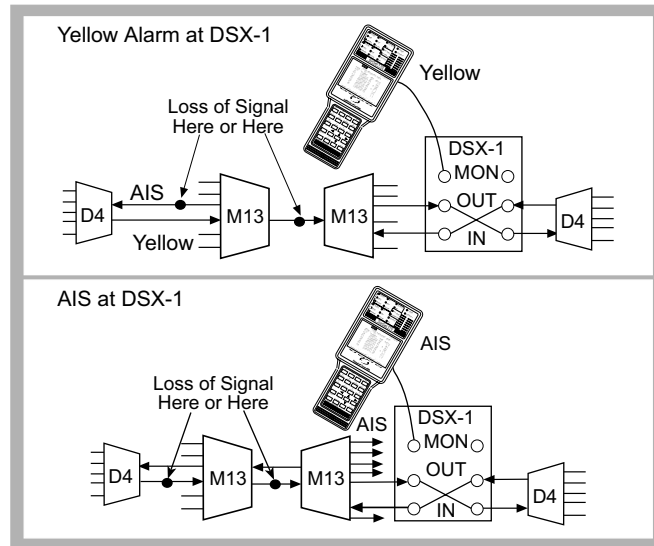


Figure 232 DS1 Yellow and AIS

AIS indicates that the line problem is somewhere behind the last multiplex, DCS, fiber mux, or other device that replaces a loss of signal with AIS.

Yellow alarm means the received signal has been lost at the end of the line that generated the monitored signal. When monitoring in the other direction, if it is a framed signal, then the problem must exist between the test set and the end of the line generating the Yellow alarm. If it is an unframed signal (i.e. AIS or loss of signal) the problem is between the test set and the other end of the circuit.

Figure 232 shows how the AIS and Yellow alarms show up in DS1 and DS3 fault sectionalization.

7.2.5 FEBE or ESF PRM Errors

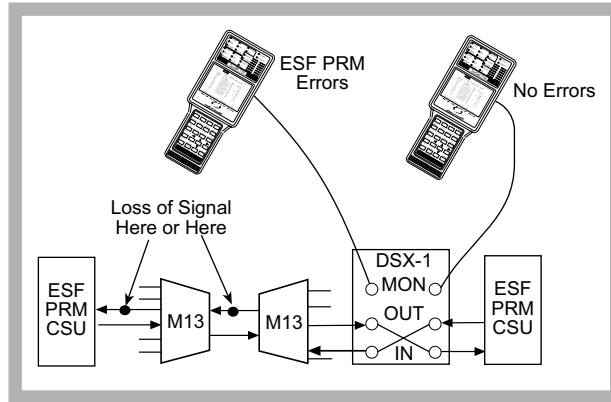


Figure 233 DS1 ESF PRM Errors

Both of these alarms indicate that the received errors are at the end of the line that is generating these messages. If seeing no errors on the other direction of the monitored line, then the problem exists between the test set and the end generating the FEBE or PRM error messages.

If the other side shows BPVs, CRC-6, frame, or other errors, then the problem exists between the test set and the end of the circuit that is not generating the FEBE or PRM error messages.

If both DS3 FEBEs and DS1 PRM errors are seen while monitoring a DS1 circuit from a DS3 access point. Then the problem exists before the end of the DS3.

If seeing ESF PRM errors but FEBEs are not seen on a C-bit parity framed DS3 while monitoring a DS1, then the problem exists between the side of the circuit generating the ESF PRMs and the end of the DS3 mux. Figure 233 shows a typical example of a network fault leading to this indication.

8.0 SS7 Technology Overview

SS7/CCS7 (Signaling System Number 7) is a common channel signaling system conceived to provide services such as inter-processor transaction for call/remote control, maintenance/network management signaling. This is a reliable means for information transfer in the correct sequence without loss or duplication. A number of applications are supported by SS7: PSTN (Public Switching Telephone Network), ISDN (Integrated Services Digital Network), SCP (Service Control Point) services, PLMN (Public Land Mobile Network), and Operations administration and Maintenance of networks.

8.1 SS7 Network Architecture

The SS7 network is comprised of signaling points (SPs) connected together by dedicated circuits identified as signaling links. There are three types of SPs: Service Switching Point (SSP), Signaling Transfer Point (STP), and Service Control Point (SCP). Depicted in Figure 234 is a typical SS7 network.

The primary purpose of the SSP is to originate and process requests for trunks. In addition, it originates requests for network services. Every SSP is connected to a pair of STPs for load sharing and backup purposes. The primary purpose of a STP is to route signaling messages between different SSPs in the network. Usually, there are two levels of hierarchy in arranging STPs: local level and regional level. The local level STP pair routes signaling traffic within a specified local area. While regional level STPs route traffic between the specified local areas. SCP's primary function is to process database query messages for advanced network services such as 800 numbers and alternative billing. SCPs are paired to protect the SS7 against loss of data in case of SCP failure. Each SCP is connected to the regional STP, thus providing regional service.

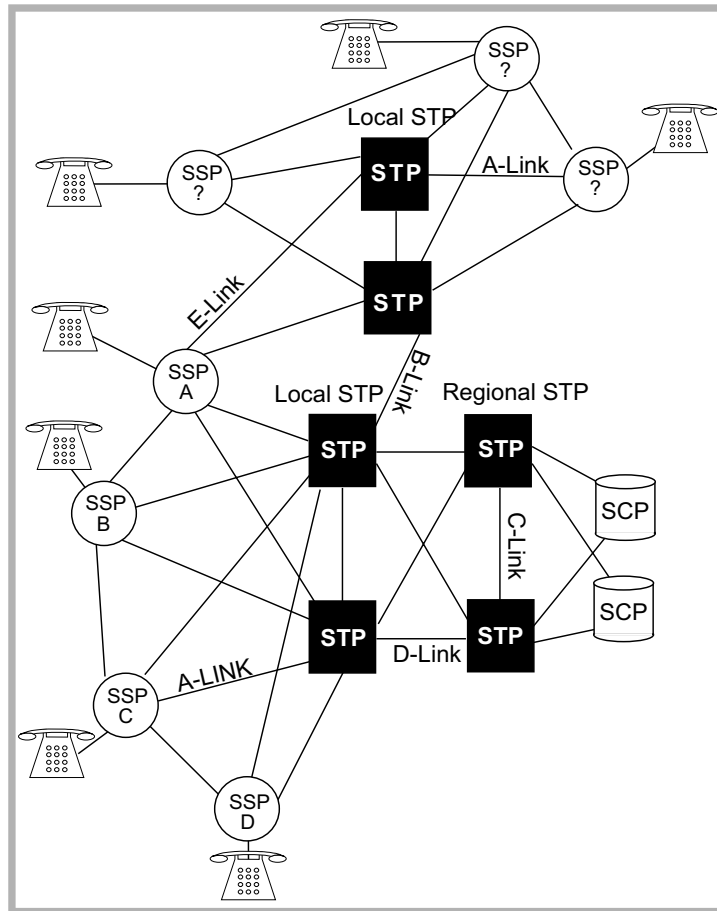


Figure 234 SS7 Network

In reference to Figure 234, the following list identifies the link nomenclature:

- A link: Access links that connect switching offices to the STPs.
- B link: Bridge links that connect one mated pair of STPs to the second mated pair.
- C link: Cross links that connect a mated pair of STPs to each other.
- D link: Down links that connect the RSTPs to the LSTPs
- E link: Extended links that connect the switching offices to the STP pairs other than its home pair.
- F link: Links that connect one SP to another, but neither SP is an STP.

8.2 SS7 Protocol

The first three levels of the SS7 protocol follow the OSI (Open System Interconnect) definition quite closely. However, due to the dedicated link nature of SS7, many of the upper OSI layer functionalities were deemed redundant. Figure 235 illustrates the correlation.

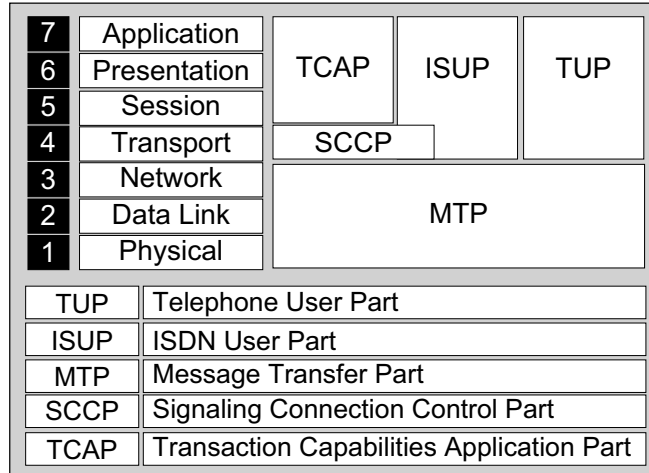


Figure 235 SS7 and OSI Protocol Architecture

MTP

The MTP (Message Transfer Part) performs functions such as transmitting bits, detecting and correcting errors, and end-to-end routing. The MTP layer is divided into three levels, each of which provides a unique function.

- Level 1 (*Physical Level*) - provides the physical, electrical, and procedural characteristics of a SS7 link
- Level 2 (*Data Link Level*) - provides the functionality needed to do SU alignment, error detection/ correction, link synchronization, and flow control
- Level 3 (*Signaling Network Level*) - provides two major sub-functions: signaling message handling and signaling network management. Signaling message handling contains a discrimination function (determining if a message is destined to its node), a distribution function (delivering a message to the appropriate user part), and a routing function (picking the appropriate route to a destination node). The signaling network management provides the procedures needed to restore normal signaling conditions in the event of failure or link congestion.

SCCP

The Signaling Connection Control Part provides the routing capabilities for signaling messages through the GTT (Global Title Translation) process. Using the SCP as the main database for storing SP addresses, other SPs can be freed of this task.

SCCP provides the functionality needed for non-circuit services (i.e. transactional services for database access). These services are divided into two groups: connection-oriented and connectionless. Connection-oriented services provide segmenting and reassembly capabilities of the network service data units that need to be transmitted through the SS7 network. Connectionless services provide the capability to transfer one data unit. Segmentation and reassembly are not available in connectionless services.

ISUP

The ISDN User Part is used in SS7 to support basic bearer services (which involve the setup and release of 64 Kb/s network switched circuit exchanges) and supplementing services such as call forwarding, calling, line identification, user-to-user signaling, closed user groups, and direct dialing. Another service supported by ISUP is call switching of basic phone calls for both speech and data calls, as specified by its standards for international semi-automatic and automatic telephone and circuit switched traffic.

TUP

The Telephone User Part is used with SS7 to support international telephone call control signaling.

TCAP

Transaction Capability Application Part refers to the building blocks of the Application layer network services used by SS7 users to provide a standard procedure of adding network services. The current list of application uses includes:

- mobile service application.
- operation and maintenance.
- non circuit control related exchange of signaling information.
- registration and activation of supplementary services.

8.3 SS7 Messages

There are three basic message types:

- *Message Signaling Unit (MSU)* - The MSUs are the units used by the ISUP, TUP, and TCAP messages. They provide the structure to house the messages. A description of each field is shown in Figure 236.

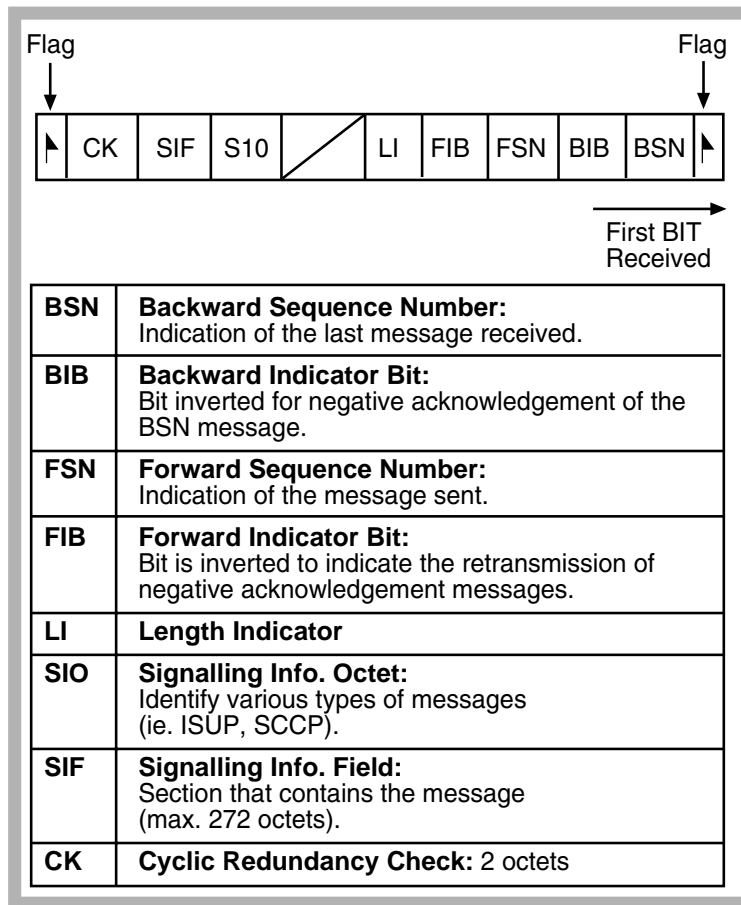


Figure 236 MSU Message Structure

- *Link Status Signal Unit (LSSU)* - LSSUs are used to indicate the status of a node's level 2 message handling capabilities over a specific link. They are used to inform other nodes in the event of congestion, outage, link reset, etc. A description of each field is shown in Figure 237.

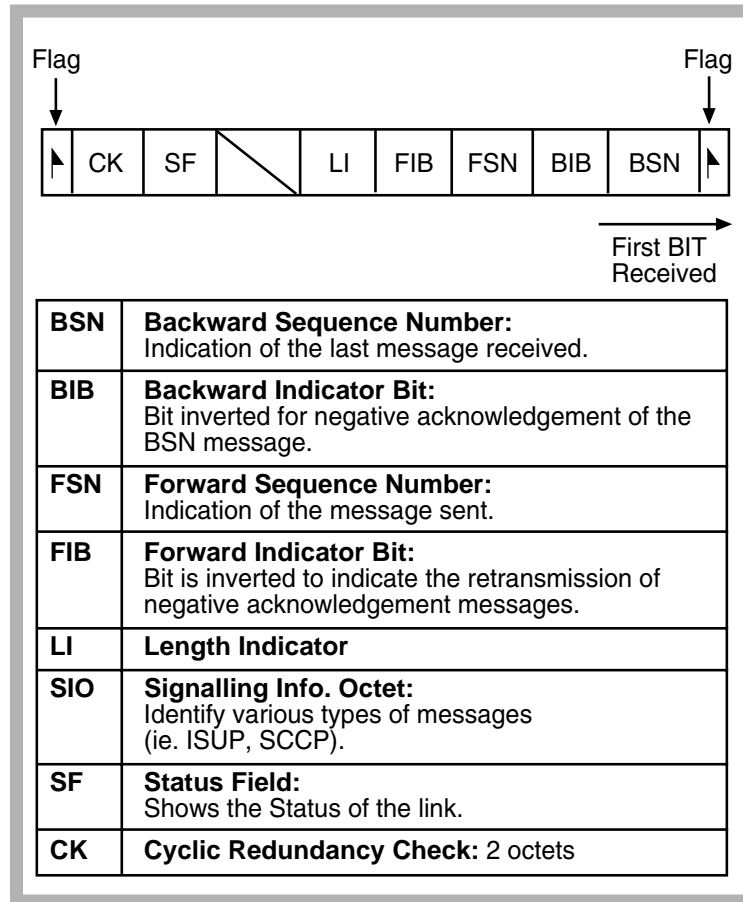


Figure 237 LSSU Message Structure

- *Fill-In Signal Unit (FISU)* - As named, FISUs are used to "fill in" when there is no traffic on the link. This keeps the link aligned.

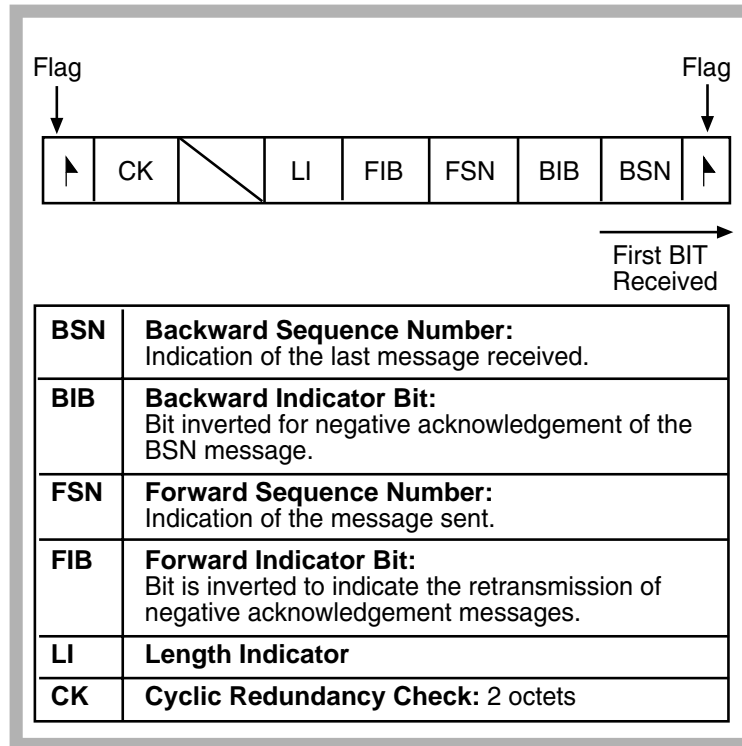


Figure 238 FISU Message Structure

8.4 ISUP Message Example

ISUP messages are used to provide circuit-related control information. In general, the most basic application used today for ISUP is call set-up. The IAM (Initial Address Message) is the first message sent for setting up a call. Subsequently, there are a number of other messages being exchanged to connect and eventually release the call. Figure 238 shows the complete call process.

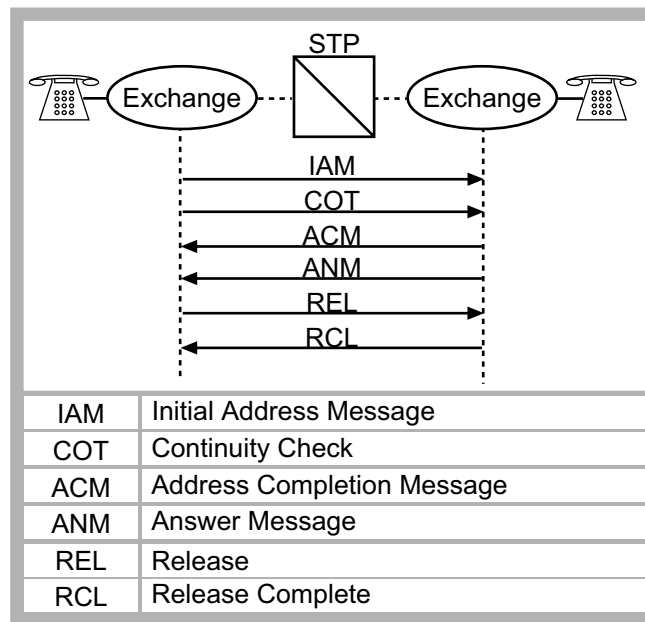


Figure 239 Typical Phone Call ISUP Messages

IAM contains the essential information required for the call. It has the flexibility to expand with additional parameters, as new service is required. Figure 239 illustrates the typical information in an IAM message.

Message Type:	IAM
Nature of Connection:	Continuity Check
Forward Call Indicator:	National; no interworking; caller: ISDN
Calling Party's Category:	Ordinary
Uses Service Info:	Speech; Circuit
Called Party Number:	14158552301
Calling Party Number:	14083638000; presentation allowed

Table 23 Typical IAM Information Fields

Chapter 6 Troubleshooting & Customer Information

1.0 Troubleshooting

The following are suggestions for when the SunSet T10 is not performing as expected.

- Problem: Continuous BPVs show on screen even though there should be no problem with the signal.

Suggestion: Check the line interface:

- do not use DSXMON for a full 3V signal
 - do not use TERM for a monitor jack
 - try both BRIDGE and DSXMON for a mon jack
 - do not use BRIDGE or DSXMON on a signal that has been opened and is no longer properly terminated
- Problem: The SunSet T10 performs improperly

Suggestions:

1. Perform a SELF TEST and see if the problem has been resolved. If the SELF TEST shows an ERROR CODE, repeat the test to see if the SunSet T10 was able to automatically correct the problem.
2. Try turning the SunSet T10 off wait 10 seconds and then turn the SunSet T10 on again.
3. Try ERASE NV RAM. Select MAIN MENU > OTHER FEATURES > SYSTEM CONFIG > ERASE NVRAM and follow the on-screen instructions.

WARNING!

Performing an Erase NVRAM will erase all user-programmed information, measurement results and history buffers.

Note: Be sure to turn the power off for at least 5 seconds after completing the ERASE NV RAM operation

- Problem: The SunSet T10 does not power up properly

Suggestions:

1. Confirm that the battery is charged or the charger is connected. The SunSet T10's charger is powerful enough to power the SunSet T10 and recharge the battery simultaneously.
2. Confirm that a correctly installed software cartridge is in place. A flickering screen usually indicates that the software cartridge is either loose or missing. Refer to the cartridge installation procedure if necessary.

- Problem: The SunSet T10 displays a Security Violation when switched on.

Suggestion:

1. Make sure the serial number of the software cartridge matches the serial number on the back of the SunSet T10. Each software cartridge is setup for a specific SunSet T10. If swapped between SunSet T10s, the SunSet T10 may not work properly.

- Problem: Keypad keys do not work properly.

Suggestions:

1. Verify the SHIFT status by pressing and releasing SHIFT key on the keypad. Observe the SHIFT indicator on the display.
2. Do not press SHIFT key simultaneously with another key on the keypad.
3. Press the SHIFT key again. The SunSet T10 may not have registered it the first time.
4. Turn the SunSet T10 off wait 10 seconds and then turn it on again.

- Problem: Measurement is not working properly (loss of signal, no pattern synch).

Suggestions:

1. Verify signal TEST MODE and RxLVL-1, or RxLVL-2 settings in the TEST CONFIGURATION screen.
2. Verify that proper cable connections are in accordance with the circuit to the circuit graphic.
3. Make sure that OUT is plugged to IN and vice-a-versa.
4. Twist the plugs inside the jacks and check for proper insertion.
5. Check continuity of the cables.

- Problem: Test Patterns will not synchronize.

Suggestions:

1. Press RESYNCH on the keypad to force the SunSet T10 to re-synchronize on the pattern, framing type, and line coding.
2. Verify that the sent pattern is the desired pattern. Check this in the SEND TEST PATTERN screen.
3. Verify that there is no AMI/B8ZS mismatch.

- Problem: Test patterns will not synchronize with other test equipment.

Suggestions:

1. Verify that PATTERN INVERSION is set for DISABLE in the OTHER FEATURES > OTHER PARAMETERS screen.
2. Use VIEW RECEIVED DATA to look at the pattern the other test set is sending.

- Problem: Voice Frequency section does not work.

Suggestions:

1. Verify that the SunSet T10 has a valid framing type showing in the LED indicators. If there is no valid framing, put proper framing on the T1 signal.
2. Make sure that the timeslot number is not confused with the channel number.
3. Make sure the received channel and the transmit channel are correct.

2.0 Calibration

The SunSet T10 is self-calibrating. It requires no adjustments and does not need to be returned to Sunrise Telecom for calibration.

If required to perform a periodic calibration on the SunSet T10, use this procedure:

1. Switch the SunSet T10 on.
2. Verify that all LEDs blink in sequence and that each LED lights properly. The POWER LED should always be green and the LOW BATT LED should light only when the battery is nearly discharged.
3. Verify that there are no errors listed at the completion of the self-test.
4. Connect a single bantam to single bantam cord from LINE 1 TX to LINE 1 RX.
5. From the MAIN MENU > TEST CONFIGURATION and configure as follows:

TEST MODE: T1SINGL

RxLVL-1: TERM

FRAMING: ESF

Tx CODING: B8ZS

Tx SOURCE: NORMAL

XMT CLOCK: INTERN

TEST RATE: 1.544M

LBO - 1: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

6. If necessary, press the HISTORY key to acknowledge any flashing history LEDs. Verify that the PULSES, ESF, and PAT SYNC LEDs are green. The B8ZS LED maybe on, depending on the test pattern transmitted.
7. Select MEASUREMENT RESULTS. Using the PAGE-UP (F1) and PAGE-DN (F2) F-keys, access the "LINE 1 - SIGNAL" screen. Verify that the +LVL is 3.00V +/- 10% and that the -LVL is 3.00V +/- 10%.
8. Verify that the FREQ is 1544000 +/- 1 Hz.
9. Press the ESCAPE key on the keypad to return to the MAIN MENU.
10. Connect a single bantam to single bantam cord from LINE 2 TX to LINE 2 RX.

11. Select TEST CONFIGURATION and configure as follows:

TEST MODE: T1DUAL
Tx/INSERT: L2-Tx
Rx/DROP: L2-Rx
RxLVL-1: TERM
RxLVL-2: TERM
Tx SOURCE: TESTPAT
FRAMING: SF-D4
Tx CODING: AMI
XMT CLOCK: INTERN
TEST RATE: 1.544M
LBO 1&2: 0 dB

When done, press the ENTER key on the keypad to return to the MAIN MENU.

12. If necessary, press the HISTORY key on the keypad to acknowledge any flashing history LEDs. Verify that the PULSES, SF and PAT SYNC LEDs are green.
13. Select MEASUREMENT RESULTS. Using the PAGE-UP (F1) and PAGE-DN (F2) keys, access the "LINE 1 SIGNAL" screen. Verify that the +LVL is 3.00V +/- 10% and that the -LVL is 3.00V +/- 10%.
14. Verify that the FREQ is 1544000 +/- 1 Hz.
15. Press the ESCAPE key on the keypad to return to the MAIN MENU. The calibration procedure is now complete.

3.0 Customer Information

3.1 Customer Service

General Sunrise Telecom Customer Service is available from 7:30 AM to 5:30 PM Pacific Standard Time (California, U.S.A.).

Customer Service performs the following functions:

- Answers customer questions over the phone on such topics as product operation and repair.
- Facilitates prompt repair of malfunctioning SunSet s.
- Provides information about product upgrades.

A RMA (Return Merchandise Authorization) Number is required before shipping any product to Sunrise Telecom for repair. Out-of-warranty repairs require both an RMA and a Purchase Order before returning the unit. All warranted repairs are good for 90 days.

Please contact Customer Service if any additional assistance is required:

Customer Service:

Sunrise Telecom Incorporated
302 Enzo Drive
San Jose, CA 95138
U.S.A.

Toll Free: 1-800-701-5208, 24 hours per day, 7 days a week.

Fax: 1 408 363 8313

Internet: <http://www.sunrisetelecom.com>

Email: support@sunrisetelecom.com

3.2 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 and patches to the original product specifications sold 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. This warranty does not cover upgrade or enhancements to product software and firmware.
- 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.

G. 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.

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