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SUNRISE TELECOM
INCORPORATED

SunSet xDSL

User's Manual
SS160

Revision B

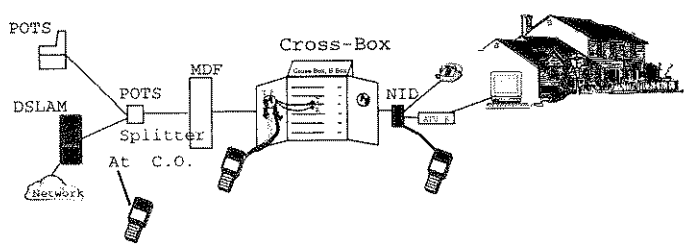
Sunrise Telecom.....a step ahead

22 Great Oaks Blvd. San Jose, CA 95119
Tel: 1-408-363-8000 Fax: 1-408-363-8313

SunSet xDSL Revision B
Table of Contents

Chapter 1 Introduction

You will soon find your SunSet xDSL an indispensable tool for troubleshooting and qualifying DSL circuits. The figure below shows the SunSet testing from the Central Office, the Cross-Box (or B-Box), and the NID (Network Interface Device).



Physical layer testing

Time Domain Reflectometer (TDR)

- Locate cable faults
- Determine distance to: open, short, load coil, bridge tap, water

Load Coil Detector

- Determine presence of load coils

Capacitance Meter

- Estimate loop length

Resistance Meter

- Verify isolation resistance for T-R, T-G, R-G
- Estimate loop length (with a short at far end)

DC Volt Meter

- Verify proper POTS line power
- Verify proper line powering for HTU-R (if necessary)

AC Volt Meter

- Detect presence of AC induced voltage T-R from adjacent power lines

Power Spectral Density (PSD) Attenuation Measurement

- Determine the loss characteristics for the entire DMT/CAP ADSL band.

Power Spectral Density Background Noise Measurement
- Characterize spectral compatibility in binder
- Measure ambient noise

xDSL Plug-in modules

The SunSet xDSL provides incredible versatility for a hand-held test set. Plug-in modules allow you to assemble the test set you need for testing digital subscriber lines or other technologies. The modular platform extends the life of your test equipment investment. You simply need to add a new module whenever the requirement for a new technology arises.

Currently, the following modules are available:

Alcatel ADSL ATU-R (SSxDSL-3)
This module performs Alcatel ATU-R emulation for both installing and troubleshooting ADSL circuits. A one-button acceptance test turns up the link with the DSLAM (ATU-C) and displays vital information- like current rate, maximum attainable rate, and noise margin- within seconds.

Additional information helps you troubleshoot marginal or troublesome circuits. A bits per tone graphic displays the precise bit assignment per tone. By checking the frequencies of low bit levels, you can detect possible interferers. Alarm status & Link measurements show any alarm or error conditions that have occurred at the near or far end. Both current and history information is shown providing you with the full picture. Optional software adds a second step by pinging the far end gateway to verify completion of virtual circuit provisioning.

Alcatel ADSL ATU-C (SSxDSL-4)
This module performs Alcatel ATU-C emulation for both installing and troubleshooting ADSL circuits. This is a key application for qualifying ADSL circuits before the DSLAM is installed and working in the central office. A one-button acceptance test turns up the link with the far end modem (ATU-R) and displays vital information- like current rate, maximum attainable rate, and noise margin- within seconds.

Comprehensive setup configurations give you ultimate trouble-

shooting tools. You may set the exact rate, noise margin, etc. for rate adaptive or fixed rate circuits. A carrier mask feature enables you to manually control the 256 tones to experiment and determine optimum settings for the DSLAM.

Pairgain T1 HDSL (SSxDSL-1)

This module performs Pairgain HDSL T1 emulation for installing and troubleshooting HDSL circuits. This module combines both HTU-C and HTU-R functions. Upon turn-up, the set provides a full report of span status including max/min/avg rate and noise margin for both HDSL loops. Further results provide error and alarm counters for bot the near and far end. Optional software provides basic testing at the T1 interface.

VF TIMS (SSxDSL-6)

This module provides baseband 20 Hz to 20 kHz TIMS testing from both 2-wire and 4-wire interfaces. Tone generation includes fixed tone, 3-tone slope, and configurable frequency sweep tests. Measurements include signal to noise, impulse noise, and noise with filters (3k-flat, 15k-flat, c-message). The module also contains signaling and dialing functions for placing calls.

IDSL (SSxDSL-5)

This module supports both IDSL and ISDN BRI testing. The IDSL capabilities support BERT Testing on both the U and the S/T Interface in a point-to-point mode. In addition, EOC commands support B1, B2, and 2B+D Loopbacks from the Central Office side (LT Interface) of the circuit, and allow for U-BRiTE card, Repeater, or NT1 looping. ISDN Basic Rate testing includes call setup and X.25 call setup.

Datacom/DDS (SSxDSL-9)

This module provides transmission and BERT testing from both Datacom and DDS-4W interfaces. Datacom testing supports DTE, DCE, and monitor modes from a V.35, RS232, RS449, RS530, or X.21 interface. The module performs DDS- 4wire testing at the CPE (DSU/CSU emulation) for both primary and secondary channels.

Chapter 2
Initial Setup

Section 1 Unpacking Procedure

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

1) Remove the packing list from the shipping container.

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

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

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

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

   NOTE: Sunrise Telecom must receive your Warranty Registration Card in order to provide you with updated SunWare releases.

6) Ensure that the SunWare cartridges are fully seated in their slots. When properly installed, the top of the cartridge is pushed flush with the top of the ejector button.

   The SunSet xDSL has two Sunware card slots:
   - The inside card contains the actual software and options needed to operate the SunSet. This card may be upgraded in the field to provide you with new Sunware options or software releases.
   - The outside slot may be used in the future for extra memory storage.

7) Plug the AC Battery Charger into an AC wall outlet and connect it to the SunSet. The charger plugs in at the top of the SunSet, where it is labelled 15VDC.

   NOTE: The SunSet xDSL uses a Ni-MH battery. Use only the 100-240 VAC AC Adapter supplied with the test set (SS138-X).

8) Power the set on (with the red POWER key at the bottom) and verify that it passes the SELF TEST. If the test set does not turn on immediately, it may need to charge for up to 5 minutes before it can run.

- Upon first powering up, the screen should show several Download and Calibrate messages. All should display "PASS" on the right side. If the ATU-R module is installed, the final message should read "Downloading ATU-R Module PASS."
- The SunWare xDSL main screen now appears.

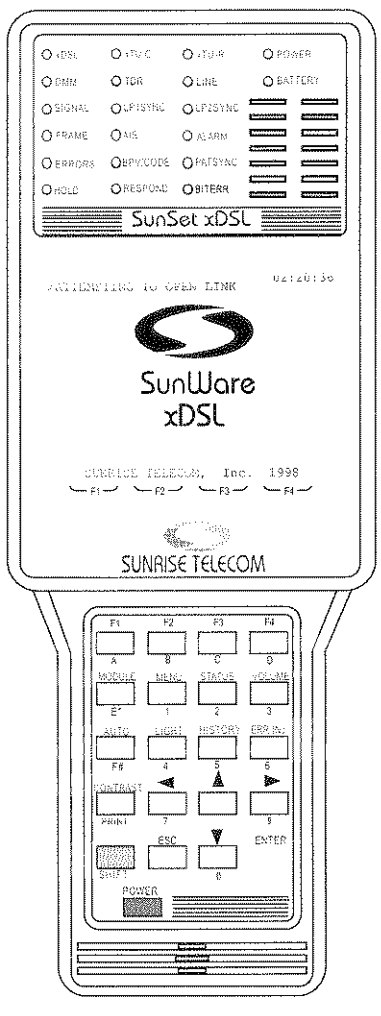
9) *Setting the System Clock:*
- To set the System Clock to the current time, press the MENU key.
- Cursor down to OTHER SETUP and press ENTER.
- Press the down arrow key to cursor down to the SYSTEM CLOCK. Press ENTER.
- At DATE: Use the INC (F1) and DEC (F2) to set the Month, date, and Year. Use the right and left arrow keys to move the cursor. When you're finished setting the date, press the down arrow key to access the TIME setting.
- At TIME: Use the INC (F1) and DEC (F2) keys to set the Hour, Minutes, and seconds.
- When you have finished entering the date and time, press SET (F3) save your entries.

10) Charge the unit overnight before its first use on battery. Or, leave the AC Battery Charger (SS138x) plugged in while operating the test set.

11) Put the test set and accessories into the soft carrying case (if it was ordered).

Chapter 3
Product Description

This chapter is dedicated to the general features of the SunSet xDSL. It explains the physical features of the product: the LEDs, keypad functions, and the connector panels. The front view of the SunSet xDSL is shown below.



Section 1 Keypad Functions

The SunSet xDSL keypad is shown in Figure 3-2.

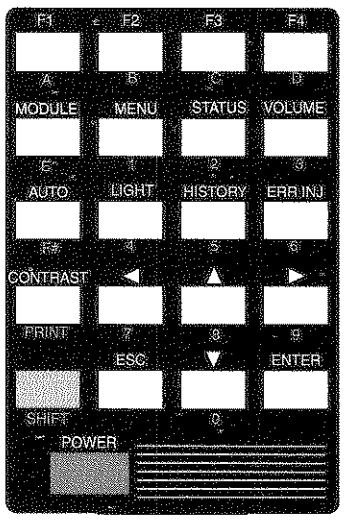


Figure 3-2 SunSet xDSL keypad

SunSet 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.MODULE or HISTORY).
- The **Orange Label** below the key shows what function will be performed if the SHIFT function is activated (i.e. numbers or PRINT).

Shift Key Functions

To activate the Shift function, press the orange SHIFT key. The SHIFT-lock key should not be pressed simultaneously with another key. Instead, the SHIFT-lock key should be pressed and released. At this point, a shift indicator will appear in the upper left hand corner of the screen. Then the other key should be pressed. The set will then perform the function indicated on the orange label. SHIFT-lock will remain activated until the SHIFT key

is pressed again and the SHIFT indicator disappears.

Note: The shift indicator should be checked 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, simply press the SHIFT-lock key.

1.1 White Label Keys

F1-F4: These keys are used to select choices F1 through F4 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 F4 key will display the other available F-keys.

MODULE: The MODULE key brings up the main menu of the module installed in the left side. Use this key to access all module functions.

MENU: The MENU key brings up the Main Menu. Use this key to access all non-module functions. The Main Menu contains items like Erase NV Ram, Serial Port Configuration, and System Clock Configuration.

STATUS: the STATUS key will be implemented in future SunWare revisions. This key will provide a quick summary on any error or alarm conditions indicated by the LED lights.

VOLUME: the VOLUME key adjusts the speaker's volume for talk/listen applications, like ISDN or TIMS testing.

AUTO: the AUTO key is applicable only to certain modules. Refer to the individual module chapters for specific details on the use of the AUTO key.

LIGHT: The LIGHT key manually turns on/off the LCD screen backlight. You may also set a timer for the backlight (i.e. the set automatically turns off the system backlight after 15 minutes). To program the backlight:

a. Press the MENU key.
b. Enter OTHER SETUP.

c. Enter SYSTEM CONFIG.
d. Cursor to BACKLIGHT.
e. Select the desired time.

HISTORY: The HISTORY key clears the flashing LEDS. LEDs flash to indicate a history condition, where an error or alarm condition occurred in the past, but is no longer present.

ERR INJ: The ERR INJ key injects errors on the transmit signal. This is applicable only to certain module functions.

CONTRAST: The CONTRAST key adjusts the contrast of the LCD display. Continue to press the CONTRAST key until you have achieved the desirable contrast level.

ESCAPE: The ESCAPE key moves you back toward the main SunSet xDSL menu. Each key press brings you a single step backward.

ENTER: The ENTER key enters the highlighted menu choice.

▲, ▼, ▶, ◀: The cursor keys move the highlighted cursor in the indicated direction.

1.2 Orange Label Keys

The SHIFT-key activates the orange label function written below some of the keys. The orange SHIFT key activates the SHIFT-lock, meaning that the keys perform the orange label function written below the key. You will need to press the SHIFT key again to deactivate the Shift-lock and return the keys to their normal, white label functions.

The orange shift keys have the following functions:

0-9: The 0-9 keys are used to enter numbers during testing. Examples are entering IP addresses during PING testing or entering user test patterns.

A-F: The A-F keys are used to enter hexadecimal values.

PRINT: The PRINT key prints the current screen display to the serial port. This key is functional only if you have selected a Graphic print mode. Refer to Chapter 7, Storing & Printing Results, for more details.

Section 2 LEDs

The LED (Light Emitting Diodes) lights provide valuable information on:

- the SunSet's current test mode. In TDR testing, the TDR LED lights green.
- the status of the received signal. When the SunSet xDSL detects an alarm, the ALARM LED lights red.
- the status of modem synchronization. In DSL testing, a solid green LED for XTU-R (for ATU-R testing) indicates the SunSet has achieved synchronization with the DSLAM.

Figure 3-3 shows the SunSet xDSL LED panel.

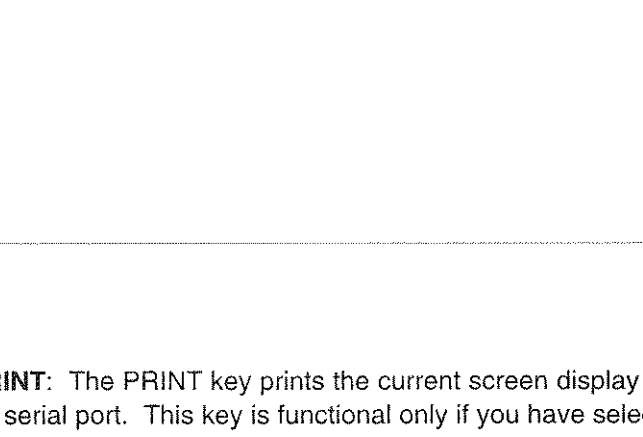


Figure 3-3 SunSet xDSL LED Panel

The LEDs have the following meanings:

xDSL

- Green: The xDSL LED lights green to indicate that the SunSet is in the xDSL mode. When a modem is installed, the SunSet

starts off in xDSL mode upon powering up.

xTU-C

This LED is active when the SunSet is emulating an XTU-C (i.e. ATU-C or HTU-C).

- Green: The xTU-C LED lights green when the set has synched with the XTU-R.
- Red: The SunSet has not connected with the XTU-R.
- Blinking Red: The SunSet is attempting to open the link with the XTU-R.

xTU-R

This LED is active when the SunSet is emulating an XTU-R (i.e ATU-R or HTU-R).

- Green: The xTU-R LED lights green when the set has synched with the XTU-C at the Central Office.
- Red: The SunSet has not connected with the XTU-C.
- Blinking Red: The SunSet is attempting to open the link with the XTU-C.

DMM

- Green: The DMM LED lights green to indicate that the SunSet is in the DMM mode.

TDR

- Green: The xDSL TDR lights green to indicate that the SunSet is in the TDR mode.

LINE

- Green: The LINE LED lights green to indicate that the SunSet is in the LINE mode.

T1/E1 SIG

This LED is active during test modes with T1 and E1 signals. For example, HDSL T1/E1 tests the T1/E1 signal.

- Green: The T1/E1 SIG LED lights green when the SunSet is receiving a T1 or E1 signal.
- Red: The SunSet is not receiving a T1/E1 signal as expected.

LP 1 SYNC

This LED is active during test modes with 2 loops. For example, in HDSL T1/E1 testing this LED displays the status of HDSL

loop 1.

- Green: The LP 1 SYNC LED lights green when loop 1 (i.e. HDSL Loop 1) is in sync.
- Red: This LED lights red when loop 1 is not in sync.

LP 2 SYNC

This LED is active during test modes with 2 loops. For example, in HDSL T1/E1 testing this LED displays the status of HDSL loop 2.

- Green: The LP 2 SYNC LED lights green when loop 2 (i.e. HDSL Loop 2) is in sync.
- Red: This LED lights red when loop 2 is not in sync.

FRAME

This LED is active when the SunSet is in a framed test mode (i.e T1/E1 framing for HDSL testing).

- Green: A green FRAME LED indicates that the SunSet has achieved frame sync and the framing found on the received signal matches the framing set in Test Configuration.
- Red: A red LED indicates that the configured framing type is not found on the received signal. This could indicate either a loss of framing on the received signal or a framing mismatch.

ALARM

- Red: The SunSet xDSL is currently detecting an alarm condition during modem testing. To determine the specific type of alarm, press the xDSL key, then cursor down to ALARM STATUS. Any current alarm conditions are recorded as "YES" under the Current columns for the near-end and far-end.
- Blinking Red: The SunSet xDSL previously detected an alarm, but that alarm condition is no longer present. To determine the specific type of alarm, enter Alarm Status. Any history alarm conditions are recorded as "YES" under the History columns.

ERRORS

- Red: The SunSet xDSL is currently detecting an error.
- Blinking Red: The SunSet xDSL previously detected an error, but that error is no longer present. Pressing the HISTORY key will clear this flashing light.

BPV/CODE

- Red: The SunSet xDSL is currently detecting a Bipolar Violation (BPV) or Code error.
- Blinking Red: The SunSet xDSL previously detected a BPV or code error, but that error condition is no longer present. Pressing the HISTORY key will clear this flashing light.

HOLD

- Green: indicates that you have pressed the HOLD key while in the TDR screen. This freezes the screen display . This LED is active only in TDR mode.

RESPOND

- Green: indicates that the test set is in responder mode. This is applicable only to LINE testing.

PAT SYNC

This LED is active whenever the SunSet is performing a BERT test with a known test pattern. For example, it is active in HDSL, IDSL, Datacom, or DDS-4W testing.

- Green: The PAT SYNC LED lights green when the set has achieved pattern synchronization.
- Red: The SunSet has lost pattern synchronization or cannot achieve pattern sync.

BIT ERR

This LED is active whenever the SunSet is performing a BERT test with a known test pattern. For example, it is active in HDSL, IDSL, Datacom, or DDS-4W testing.

- Red: The SunSet xDSL is currently detecting bit errors.
- Blinking Red: The SunSet xDSL previously detected bit errors, but they are no longer present. Pressing the HISTORY key will clear this flashing light.

POWER

- Green: indicates the test set is powered on.

BATTERY

- Green: indicates that the SS138-x AC Adaptor/Charger is connected and that the SunSet xDSL is charging.
- Red: indicates a low battery. You should connect the unit to the

SS138-x charger as soon as possible.

Section 3 Connector Panels

The SunSet xDSL contains two side panels. The left side contains a module slot to insert plug-in modules. This connector should always be used for module testing. The right side contains and RJ-45 for physical layer testing: LINE, DMM, and TDR. Make sure to use the correct connector for your test. The top panel of the SunSet has a serial port and DC power adapter jack.

3.1 TDR/TIMS/DMM Panel

The SunSet xDSL's right side contains the RJ-45 connector for all TDR, LINE,and DMM applications. Refer to Figure 3-4.

Figure 3-4 Right Side Panel

3.2 Module Side Panel

The left side of the SunSet xDSL contains a module slot to insert plug-in modules. Such modules include: ATU-R (SSxDSL-3), ATU-C (SSxDSL-4), T1 HDSL (SSxDSL-1), VF TIMS (SSxDSL-6), IDSL (SSxDSL-5). Upon ordering the SunSet with module, the module will already be inserted upon delivery.

To remove or change modules, use the following procedure:

1. Make sure the SunSet is powered off before removing the module.
2. Remove the two thumb screws on either side of the module.

3. Gently pull the module out from the slot. Place it in its hard case or protective wrapper.
4. While the set is powered off, insert the other module. Inserting the module with the power on may damage the module. Make sure it is firmly seated in the slot.
5. Screw in the two thumb screws. Make sure these are secure.
6. Power up the unit. The screen should show the set is downloading the new module and this should read PASS.
7. Erase NV RAM by pressing the MENU key and entering OTHER SETUP, NV RAM ERASE. You are now ready to begin testing with the new module.

Warning!
Inserting a module with the power on may damage the module. **Always verify that the power is off before changing/inserting modules.**

3.3 Top Panel

The top panel is shown in Figure 3-5.

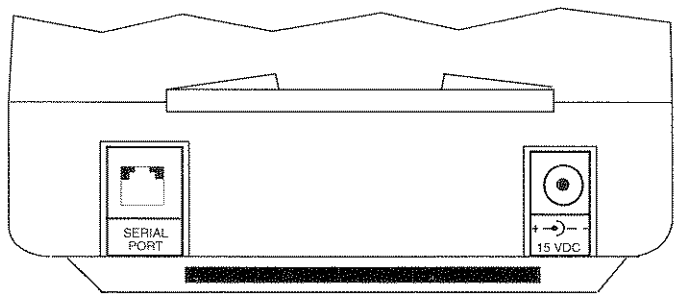


Figure 3-5
SunSet xDSL Top Panel

15 VDC
Plug the AC Adaptor/Charger into this 15VDC port. Sunrise Telecom provides the SS138-x Adaptor/Charger; its output is 15VDC, input 100-240 VAC. The unit may be operated while charging.

Caution:
Do not use the SS138 charger during normal operation. For optimum results, we recommend fully charging the SunSet- then performing your tests on battery power alone.

Do not use a charger other than the SunSet charger (SS138-x) provided with your test set. Use of other chargers may cause damage to the SunSet and will void your warranty.

• Serial Port
The RJ-11 Serial Port should be used for printing results. Sunrise Telecom provides three different cables for connecting to a printer: RJ-11 to DB-9 (SS144), RJ-11 to DB-25 (SS144A), and RJ-11 to RJ11 (SS144B). Refer to chapter 7, Storing & Printing results , for more details on the printer cables and connections.

Section 4 Replacing the Battery Pack

The SunSet xDSL is designed with a field-replaceable 9-cell NiMH battery pack. You may order a battery replacement (SS140) from Sunrise Telecom customer service (1-800-701-5208 or 1-408-363-8000).

Follow these steps to replace the battery pack:

1) Push down on the battery cover on the back panel, in the direction indicated by the arrow, to remove the battery cover Refer to Figure 3-6.

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

3) Unclip the battery pack, as indicated on Figure 3-6.

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

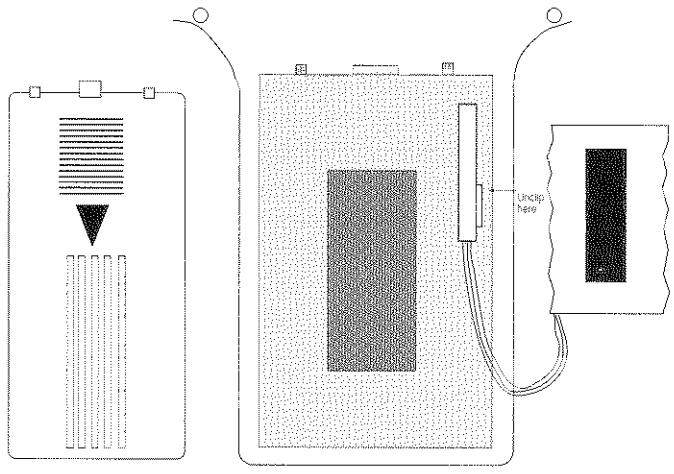


Figure 3-6 Replacing the Battery Pack

Note: Please recycle and dispose of expired batteries safely.

Section 5 Erase NV Ram

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

1) Making sure that the test set is properly configured for the application being attempted.
2) Turning the power switch off and on has not corrected the problem.

WARNING

Performing the NV RAM ERASE operation will erase all the user-storable information the user has entered into the test set. All stored results will be erased.

Use the following procedure to perform the ERASE NV RAM procedure:

1) Press the MENU key.
2) Enter OTHER SETUP.
3) Enter ERASE NV RAM.
4) Press ENTER again after the warning message is displayed. A WORKING message will be displayed.
5) After the set powers up, reconfigure the set for the operations you need to perform.

Chapter 4
TDR

A Time Domain Reflectometer (TDR) operates by sending a pulse of energy down the cable. It then measures any reflections or echoes that return to the set. These reflections are caused by faults or changes in impedance in the cable. For example, a load coil looks like a large increase in impedance (the high frequency pulses cannot pass through) and can easily be detected by a TDR. Any major change in the twisted pair's plastic insulation or the cable fill's material (like water in the cable) causes a reflection.

A TDR plays an integral role in testing DSL circuits. It can:

- locate bridge taps, indicating the presence of a bridge tap, the exact location, and the length of the lateral.
- locate load coils, showing the presence and exact location of load coils.
- detect any other circuit faults like an open, short, or wet cable.

Section 1 TDR Setup Screen

Pressing the **MENU Key** and entering TDR brings up the Setup screen. At any point, you may press the START (F3) or ENTER key to begin the TDR measurement.

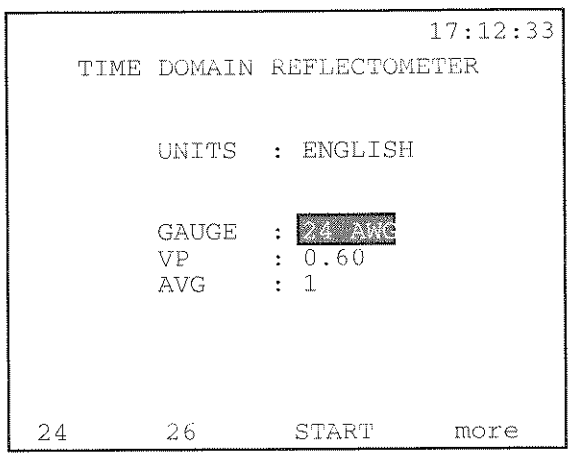


Figure 4-1
TDR Setup Screen

1) UNITS
Options: English or Metric.

This is for display only; you do not change the setting here. To change it:

- Press the MENU key.
- Enter OTHER SETUP.
- Enter SYSTEM CONFIG.
- Cursor to UNIT; you may now select either English (F1) or Metric (F2).

2) GAUGE
F-Key Options:
Eng: 24 (F1), 26 (F2), 19 (more, F1), 22 (more, F2), 28 (more, F1)
Metric: .4 (F1), .6 (F2), .8 (more, F1)

- This setting specifies the wire gauge. An incorrect setting will result in a reduction of measurement range. If you are testing a cable span with mixed gauge values, select the highest gauge value.
- The UNITS setting above determines if gauge will be expressed in AWG (English) or mm (Metric).
- In North America, thickness is expressed in AWG (American Wire Gauge). A value of 24AWG refers to wire that is 1/24" in diameter.
- Outside North America, wire gauge is expressed by the diameter in millimeters.
- .4mm roughly compares to 26AWG; .5mm roughly to 24 AWG.

3) VP
Options: from .40 to .99

- Use the (F1) and (F2) keys to change the Velocity of Propagation. The more (F4) key sets the increment/decrement factor at +/- .01 or +/-.01
- This setting is important for accurate results; if you are unfamiliar with Vp settings, please read the following.

Velocity of Propagation

Propagation Velocity (Vp) indicates the speed that the signal travels down the cable. It is a ratio of the speed in cable to the speed of light; a value of .65 means the signal travels down that cable at 65% the speed of light.

Setting the Propagation Velocity is crucial for using a TDR. This calibrates the SunSet for the particular cable type. You should be able to find the Vp in the Cable's specification sheet or from the manufacturer. If you cannot find it, take good cable of a known length and measure it with the SunSet's TDR. Change the Propagation Velocity setting until the SunSet provides an accurate distance reading.

4) AVG

Options: 1-5

This setting determines the number of times the SunSet sends the pulse. If this value is set for greater than one, the SunSet displays an average of all attempts. Sunrise Telecom recommends setting the AVG at 1.

Press the START (F3) key to begin the TDR Measurement.

Section 2 TDR Results

After pressing START, the TDR result appears. Look for any spikes, dips, or sudden changes in the pulse. These indicate possible faults. There are several different methods for finding faults:

1. Press the SEARCH key for auto search; the test set scans the cable for the first fault.
2. Press the ZOOM_OUT F-key to view the whole cable span.
3. Press the PAGE-RGT key to scroll through the various length segments.

Once you have located a fault, you can find its location using the cursor (solid line). Press the right/left arrow keys to move the cursor to the fault. The DISTANCE reading at top provides the location of the cursor.

Using the AUTO search function

The Auto Search feature searches for the first fault on the cable pair. The SunSet xDSL looks for any dips or spikes in the graph and displays that segment of the cable to you. Auto search is a quick and easy way to begin your TDR testing.

To use auto search:

1) Press the SEARCH (F3) key on the screen.
2) While the set is searching for a fault, it will display "SEARCHING" in the middle of the screen.
3) When it has found a fault, it will be displayed on the screen. "FOUND" appears at the top right, as shown in Figure 4-2.

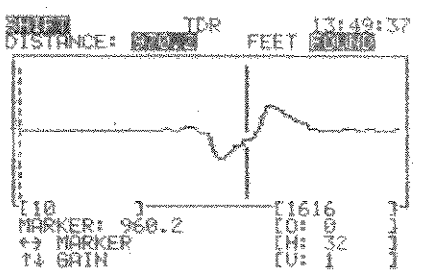


Figure 4-2 Auto Search

4) The set automatically places the cursor near the fault. The DISTANCE reading at the top left provides the cursor's location. Use the left and right arrow keys to adjust the position.

5) If the set does not find any faults, it will show NONE in the top right. You still may want to zoom out and manually search for any faults.

Adjusting the zoom

You can use the ZOOM_IN and ZOOM_OT F-keys to scan the entire cable span for faults of focus on a particular fault or cable segment. ZOOM_OUT shows more of the cable span, while ZOOM_IN focuses on shorter portions. Note the "H" (horizontal) value at bottom right displays the Zoom factor. It can range from 1-512 (1 being the closest range and 512 being the farthest out). Zooming out to the maximum value (H= 256 or 512) enables you to view the entire span length so you may better locate cable faults.

Zooming in allows you to interpret potential faults.

Upon entering the TDR screen, press the ZOOM_OT (F2) key until you have zoomed out all the way (H=256 or 512) to see the entire cable span.

Figure 4-3 shows a bridge tap with the zoom out (H=256). This screen shows the whole cable span: from 10 to 13,763 feet. You can start to make out a bridge tap in the far left of the screen. Use the right arrow key to move the cursor near the fault; the Distance reading shows it at 701 feet.

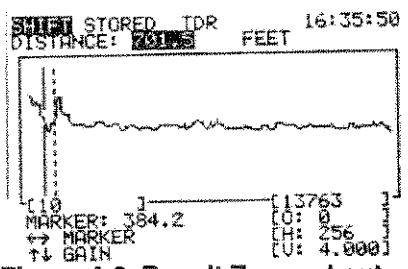
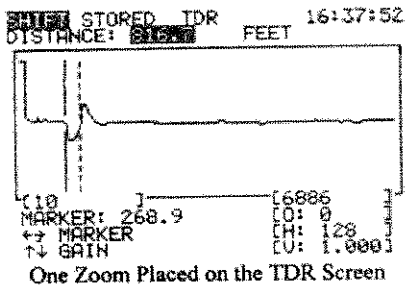


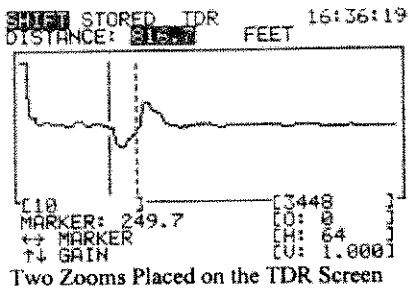
Figure 4-3 Result Zoomed out

Press the ZOOM_IN (F1) key to zoom in on the fault. Since the SunSet zooms in on the cursor's location, move the cursor to the fault- then press ZOOM_IN. This screen shows the set at H=128; the bridge tap is now more visible. The screen shows from 10 to 6,886 feet.



One Zoom Placed on the TDR Screen

Figure 4-4 Zooming in once



Two Zooms Placed on the TDR Screen

Press ZOOM_IN again to view the bridge tap. Here H=64. Notice that this screen displays cable from 10 to 3448 ft.

Figure 4-5 Zooming in twice

TDR F-key Definitions

There are several F-key options in the TDR screen. Pressing the more (F4) key scrolls through the various options.

ZOOM_OT/ZOOM_IN

These keys adjust the scale of the screen. ZOOM_OUT shows more of the cable span, while ZOOM_IN focuses on shorter portions. Note the "H" (horizontal) value at bottom right displays the Zoom factor.

SEARCH (F3)

The Auto Search feature searches for the first fault on the cable pair.

+OFFSET (F1) and -OFFSET (F2)

These keys control the vertical position of the pulse on the screen. +OFFSET moves the pulse up; -OFFSET moves the pulse down. The offset value is shown as "O" at the bottom of the screen.

ALIGN (F3)

Align shifts the cursor position (solid line) back to the left of the screen. The screen now displays to the right of the cursor.

PG_LFT (F1) and PG-RGT (F2)

These keys shift the page display 1/2 page to the left (F1), or 1/2 page to the right (F2).

CURSOR/MARKER (F1)

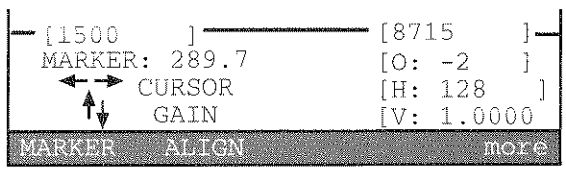
This key determines the left & right arrow key control. Press Cursor to move the *cursor, solid line*, with the left and right arrow keys. Press Marker to move the *marker, dotted line.*

Arrow Keys

1. The left and right arrow keys are used to move the position of the cursor or marker.
2. The up and down arrow keys are used to adjust the gain (pulse strength). Increasing the gain (up arrow) increases the strength of the reflection.

Lower Display Features

Below the reflection, there are several display items.



[1500] shows the distance at the left-most start of the screen
[8715] shows the distance at the right-most end of the screen

MARKER: shows the distance between the Marker and the Cursor. When the cursor is at the beginning of a bridge tap and the marker is at the open at the end, this value shows the length of your bridge tap.

O: shows the Offset value. Offset represents the vertical position of the pulse on the screen. This can range from +64 (high on screen) to -64 (low on screen).

H: shows the Zoom factor. Zoom refers to the scale of the screen. This can range from 1-512. 1 shows only a limited portion of the screen in more detail. 512 shows the whole cable span.

V: shows the Gain value. Gain adjusts the strength of the pulse. This can range from 32 (strongest) to .125 (weakest).

Finding multiple faults

You can see past a bridge tap, cable splice, wet cable, or other impairments with a TDR. However, a TDR cannot show beyond an open, load coil, or short. For example, if a load coil is detected, it must be removed before you can continue looking for more faults with the TDR.

Refer to the following scenario for locating multiple faults with your TDR.

A bridge tap is found at 1589 feet. Note the Cursor (solid line) indicate its location (DISTANCE). The Marker (dotted line) indicates the length of the lateral (MARKER).

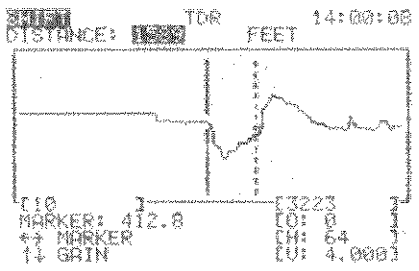


Figure 4-6 Bridge tap at 1589 ft

Pressing the PAGE_RT F-key to look past this length of cable. Pressing PAGE_RT one time displays the cable span from 1625 to 4838 feet.

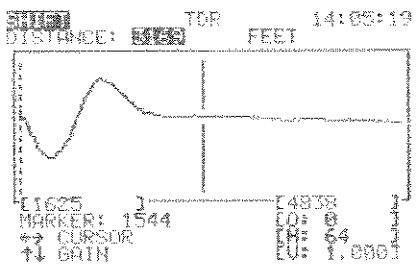


Figure 4-7 Page-right, viewing from 1544 to 4834 feet

Pressing PG_RGT again shows 4856 to 8069 feet. A potential fault begins to appear at the right of the screen. Pressing the ZOOM_OT key reveals more of the cable span. Remember that the set zooms in on the position of the cursor; to focus on a potential fault, move the cursor to that position.

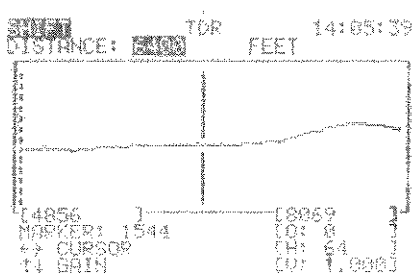
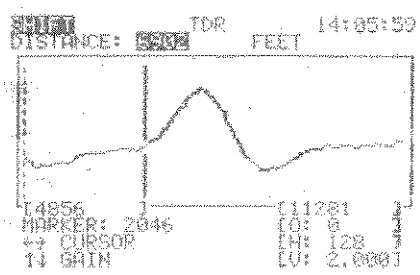


Figure 4-8 Page right, viewing from 4856 to 8069 feet

Pressing the ZOOM-OT displays from 4856 to 11281 feet. The open is now very visible. The position of the cursor shows it to be at 6902 feet.



Note: You may want to press the up arrow key once to increase the GAIN. This will make the fault more visible. Note that in this figure the GAIN value is 2.00, where it had been 1.00 previously.

Figure 4-9 Zoom out, viewing from 4856 to 11281 feet

TDR Hints

1) Adjust the zoom value to your approximate cable length; check the right-side distance in brackets. Zooming out as much as possible (H=256, 512) allows you to view the entire cable length, but it may make locating smaller or near faults more difficult to interpret.

2) The SunSet xDSL has a fixed pulse width. At times, when viewing far distant cable, you may want to increase the gain. This will make far away faults more visible. Press the up arrow key once to increase GAIN. Note the GAIN value at the lower right (V).

3) To find the exact distance between two points (i.e the start of a bridge tap and the end of that lateral), place the cursor at one end, and the marker at the other. The *MARKER* reading below the graph provides the difference between the two.

Sample Trouble Indications on the TDR

The polarity of the reflection reveals the type of fault:

Upwards spike: indicates open or load coil
Downwards spike: indicates short
Downwards followed by upwards: indicates bridge tap

Load Coil/Open

The sample graph shows a load coil or open at 3355 feet. Load coils are inductors (typically 88 mH) placed in long POTS circuits (longer than 18,000 ft). Since high frequency signals do not pass through load coils, ADSL circuits cannot tolerate load coils. *All load coils must be removed for ADSL transmission.*

One key to identifying load coils is location. Load coils are placed approximately 3000 ft from the Central Office. They are then placed every 6000 feet. Another key is shape: the waveform is typically more rounded than that of an open and the baseline after the reflection is lower than before the reflection.

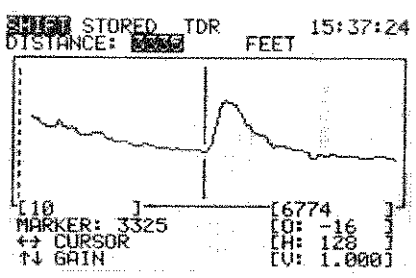


Figure 4-10
Typical Load Coil/Open

Bridge Tap

Figure 4-11 shows a typical bridge tap. The bridge tap begins at 835 feet and extends for 249 feet ("Distance" provides the beginning; "Marker" provides length). The bridge tap begins with the steep downward slope; the lateral continues until the sharp upward slope, or bump, which represents the open at the end.

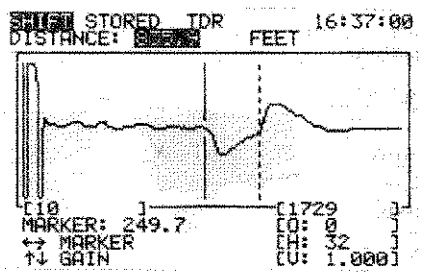


Figure 4-11
Typical Bridge Tap

Here are some guidelines for bridge taps in DSL circuits:

- The sum of all bridge taps must be less than 2500 ft (Bellcore TA-NWT-00120, for HDSL circuits).
- One individual bridge tap may be no longer than 2000 ft (Bellcore TA-NWT-00120, for HDSL circuits).

After finding and removing a lateral, you should retest the cable for any other laterals or faults that may have been missed.

Typical Short

Figure 4-12 shows a sample short occurring at 3355 feet. A short is represented as a sharp dip in the waveform.

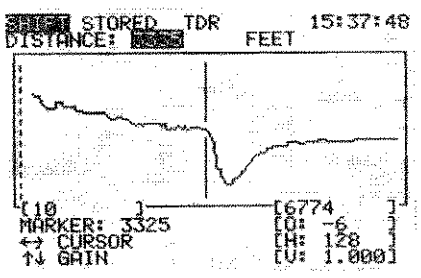


Figure 4-12
Typical Short

Section 3 Performing a TDR Measurement

Follow this step-by-step procedure for making an xDSL measurement with the SunSet xDSL:

1) Press the **MENUkey** located on the second row of the keypad.
2) Enter TDR. Note that TDR LED lights green.

3) Configure this menu as follows. Refer to Section 1 for more information on each of the settings:
   UNITS: ENGLISH or METRIC, as required
   GAUGE: as specified by circuit cable
   VP: as specified by circuit cable. If you don't know the specific VP, keep the default setting provided by the SunSet.
   AVG: 1

4) Connect to the cable pair. A common method for connecting uses an RJ-45 to alligator clip cable. Plug the RJ-45 into the jack on the right side of the SunSet (labeled DMM/TDR/LINE). Use the alligator clips to clip directly to the cable pair. Refer to Figure 4-13.

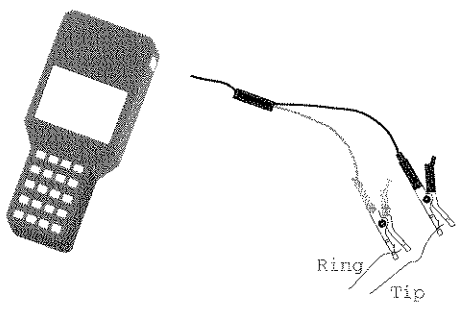


Figure 4-13 Connecting to the Cable Pair

5) Press the **START (F3) key** when you have completed your settings and have connected to the pair.

6) The waveform is now shown on the screen.

7) Press the SEARCH (F3) key. The SunSet now begins to look for the first fault. The screen shows SEARCHING while it scans the result.

8) When a fault is found, it appears on the screen. FOUND is displayed at the top right. Refer to Figure 4-14.

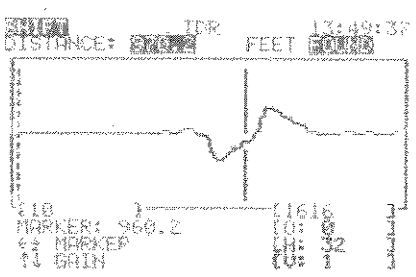


Figure 4-14 Fault found

9) Use the left or right arrow keys to move the cursor to the beginning of the reflection.

- The DISTANCE reading at top shows the location of the cursor. By placing the cursor at the beginning of the reflection, you have identified the fault location.
- If you need to adjust the display vertically, press the +OFFSET and -OFFSET F-keys.

10) If the reflection indicates a bridge tap, you'll want to know the length of the lateral. To find this, press MARKER (F1); you will probably need to press the more (F4) key to find this option. Now use the right arrow key to move the dotted line, marker. Position the Marker at the end of the bridge tap. The MARKER reading at the bottom shows the distance between the Cursor and Marker.

11) To look past this bridge tap for other possible faults, either press the ZOOM_OT or PAGE-RGT keys. Refer to "Finding Multiple Faults" in this chapter for more details.

Chapter 5
DMM Applications

Digital Multimeter tests should be used for *qualifying or troubleshooting the physical layer*. They verify required conditions on the line.

Pressing the MENU Key, then entering DMM, brings up the Digital Multimeter functions. Here you may measure:

1) Capacitance
2) Resistance
3) AC Voltage
4) DC Voltage

The Digital Multimeter menu appears in Figure 5-1.

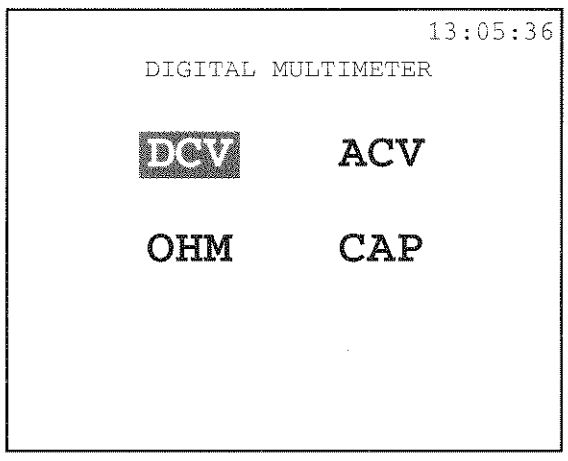


Figure 5-1 Digital Multimeter Screen

- Use the arrow keys to move the cursor to the correct DMM measurement. Press the ENTER key to take that measurement.

Sections 1-4 provide specific requirements and interpretations for each of the measurement types. Section 5 provides a sample step-by-step procedure for performing DMM tests.

1.0 Measuring Capacitance

To measure capacitance, move the cursor to CAP; then press ENTER. The SunSet can measure from 1 nF to 1 µF.

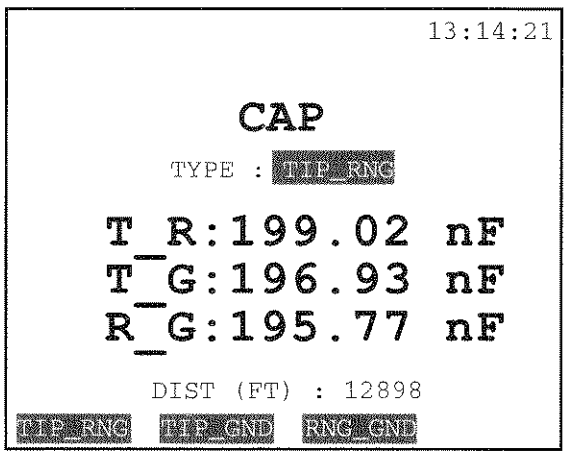


Figure 5-2 Capacitance

First, select the type of measurement to be performed:

- Press TIP_RNG (F1) to measure tip to ring.
- Press TIP_GND (F2) to measure tip to ground.
- Press RNG_GND (F3) to measure ring to ground.

Note: All three measurements are displayed simultaneously. However, only the selected measurement is a live, updating result.

This measurement can be used to:

1) Estimate Loop Length (tip-ring)
   - This test measures the loop to the far end with an open circuit.
   - The bottom line provides the distance calculation; it is based on the conversion factor, 83 nF/mile, as specified in ANSI T1.601 Annex E.
   - This calculation assumes there are no bridge taps present. It will add any bridge tap lengths into the total distance.

2.0 Measuring Resistance

To measure resistance, move the cursor to OHM; then press ENTER. The SunSet can measure from 1Ω to 5 M Ω.

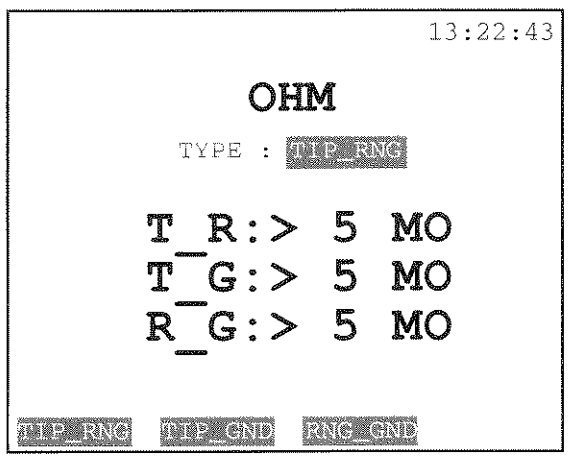


Figure 5-3 Measuring Resistance

First, select the type of measurement to be performed:

- Press TIP_RNG (F1) to measure tip to ring.
- Press TIP_GND (F2) to measure tip to ground.
- Press RNG_GND (F3) to measure ring to ground.

Note: All three measurements are displayed simultaneously. However, only the selected measurement is a live, updating result.

This measurement is a pre-qualification test to make sure the loop meets the proper metallic criteria. You should use it to:

1) Measure Isolation DC Resistance for T-G/ R-G:
   - Tip to Ground should be >5MΩ.
   - Ring to Ground should be >5MΩ.
   - *Check for grounds*: If either value is *less* than 5MΩ, a ground exists in the circuit.

2) Measure Isolation DC Resistance for T-R:
   - Tip to Ring should be >5MΩ.
   - Check for shorts: If it is less than 5MΩ, a short exists in the circuit.

Note: Use a TDR to locate the short or ground.

3.0 Measuring AC Voltage

To measure AC voltage, move the cursor to ACV; then press ENTER. The SunSet can measure up to 250 VAC.

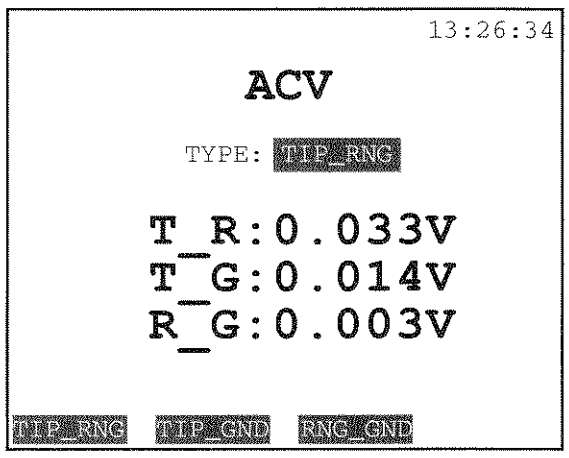


Figure 5-4 AC Voltage

First, select the type of measurement to be performed:

- Press TIP_RNG (F1) to measure tip to ring.
- Press TIP_GND (F2) to measure tip to ground.
- Press RNG_GND (F3) to measure ring to ground.

Note: All three measurements are displayed simultaneously. However, only the selected measurement is a live, updating result.

An AC Voltmeter should be used for *troubleshooting* the loop. It can identify unwanted power influence.

Warning! AC Power can be hazardous!

4.0 Measuring DC Voltage

To measure DV voltage, move the cursor to DCV; then press ENTER. The SunSet can measure voltage up to 350V.

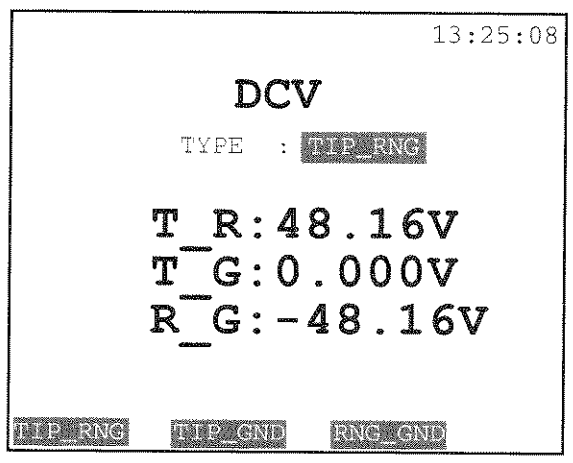


Figure 5-5 DC Voltage

First, select the type of measurement to be performed:

- Press TIP_RNG (F1) to measure tip to ring.
- Press TIP_GND (F2) to measure tip to ground.
- Press RNG_GND (F3) to measure ring to ground.

Note: All three measurements are displayed simultaneously. However, only the selected measurement is a live, updating result.

A DC Volt meter should be used to verify that there is appropriate powering on the line:

1) For ADSL circuits that support POTS, verify POTS Voltage: POTS, which is offered on the same circuit, requires line power:

- Tip to Ring: +48 VDC
- Ring to Ground: -48 VDC

2) For HDSL circuits, verify powering for the HDSL Remote Unit:

- HTU-R requires 140-225 VDC line power (unless it is locally powered).

Section 5 DMM Application

Refer to this step-by-step sample procedure for performing a DMM measurement.

1) Press the **MENU Key** on the 2nd row of the keypad.
2) Enter DMM.
3) Connect to the circuit. A common method is to use an RJ-45 to alligator clip cable. Plug the RJ-45 into the SunSet, at the jack on the right side. Use the alligator clips to clip directly onto the copper pair at the NID, Cross-Box (B-Box), aerial or other access points. Refer to Figure 5-6.

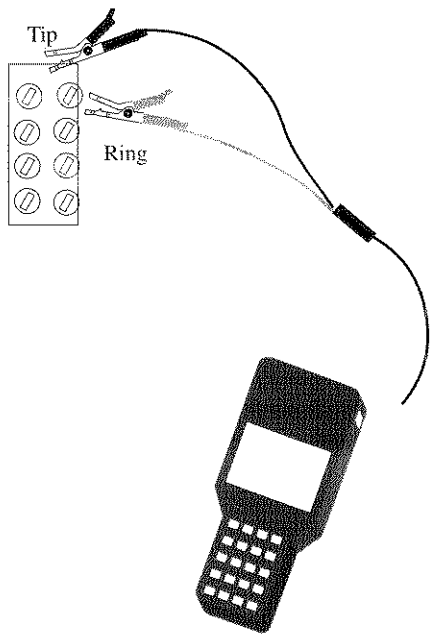


Figure 5-6 Connecting the SunSet with RJ-45 to Alligator Clips

4) Use the arrow keys to move the cursor to the measurement you want to take: then press ENTER.

5) Once you're in a measurement screen, select the measurement type:
   - Press TIP_RNG (F1) to measure tip to ring.
   - Press TIP_GND (F2) to measure tip to ground.
   - Press RNG_GND (F3) to measure ring to ground.

Refer to the previous menu sections to learn the significance and requirements for each of your results.

Chapter 6
Line Measurements

There are two types of Line Measurements: single-ended and paired tests. Single-ended tests require one SunSet xDSL; the test set performs the test and takes the measurement from one end of the cable. Refer to Figure 6-1.

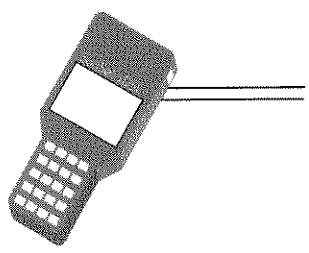


Figure 6-1 Single-ended test

The single-ended tests are described in Section 1. They are:

- Background Noise: checks for interfering services or noise.
- Coil Detection: detects load coils in the circuit.
- Impulse noise: checks for any transient noise sources.
- Frequency generator and level meter: sends and receives test tones.

Paired tests require two SunSet xDSLs- one on each end of the cable pair. There is a Controller unit, which sends the commands and takes the measurement. The Responder unit at the far end responds to commands, by sending the tone or shorting the far end. Refer to Figure 6-2.

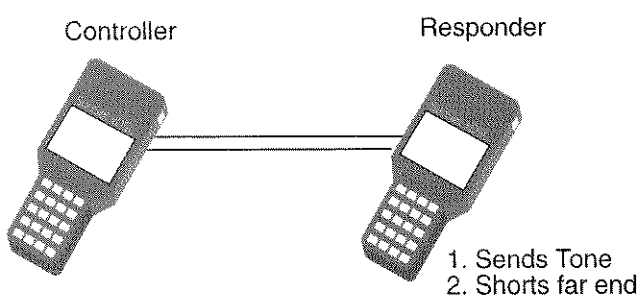


Figure 6-2 Paired Tests

The dual-ended tests are:

- Insertion Loss: measures attenuation over the ADSL spectrum or for a single frequency.
- Signal to Noise: measures the signal to noise ratio over the ADSL spectrum.
- Loop resistance: determines loop length by measuring loop resistance with a responder SunSet at the far end providing a short. This could also be a single-ended test with a short at the far end.

Section 1 Single-ended line tests

1.1 Background Noise

The Background Noise Test is used to detect interferers from such sources as: other digital services or AM radio. This is a single-ended test.

You may test for noise at the full ADSL spectrum (22 kHz to 1.6 MHz), or choose to place a filter which tests at ISDN BRI or HDSL frequencies. For ADSL testing, common interferer templates can be placed on the screen so you may easily determine the type of interferer on your circuit.

1.1.1 PSD (ADSL DMT/CAP) Background Noise Measurement

The PSD (Power Spectral Density) background noise measurement includes the full frequency bandwidth for both ADSL and CAP services.

Note: If this is the first time running the background nose test, you will need to calibrate your unit. Make sure the SunSet is disconnected from the circuit. Press the MENU key; then enter LINE, CALIBRATION, BACKGROUND NOISE. Calibration may take up to 20 seconds. You should see a "Calibrate is Done!" message when finished. If the calibration fails, try to run it again. Then you may proceed with your background noise test.

1) Connect the SunSet to the pair to be tested with the TDR/LINE/ DMM jack. Refer to Figure 6-3. In this figure, alligator clips are used to connect to the copper pair.

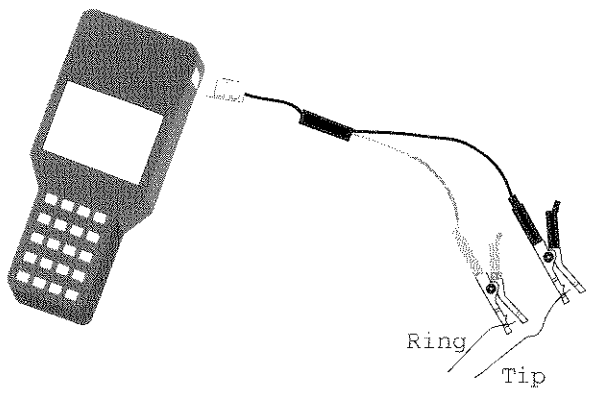


Figure 6-3 Connecting the SunSet to Tip & Ring

2) Press the MENU Key on the 2nd row of the keypad.
3) Enter LINE. The LINE LED will light green indicating the set is performing a Line measurement.
4) Enter BACKGROUND NOISE.
5) The setup screen appears as follows:

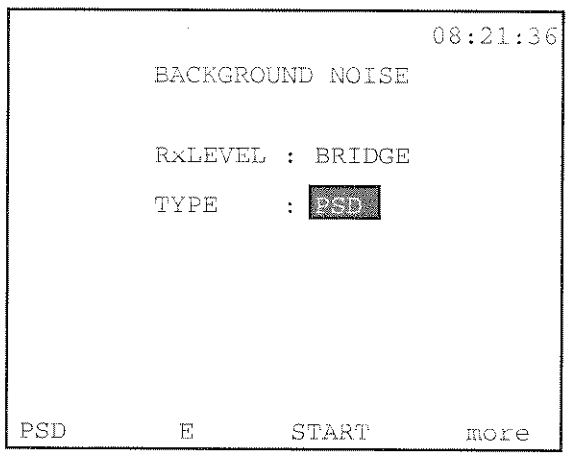


Figure 6-4 Background Noise Setup

1) RxLEVEL
F-Key Options: TERM (F1), BRIDGE (F2)

Set the receiver level for the test set:

- TERM (F1) places a 100 ohm termination on the received signal. This should be used for out-of-service testing only. When you have selected TERM, you can use interferer templates in the measurement screen.
- BRIDGE (F2) is a high-impedance mode that protects the live signal. You may use this mode for in-service testing. When you have selected BRIDGE, you may use noise masks in the measurement screen.

Note: If you are connecting to a live circuit- be sure to select BRIDGE mode before connecting.

2) TYPE
F-Key Options: PSD (F1), E (F2), F (more, F1), G (more, F2)

There are four different types of tests. Select the F-key corresponding to the desired test:

- PSD (F1): measures noise in the full **ADSL DMT/CAP** spectrum: 22 kHz to 1.6 MHz.
- E (F2): measures noise in the spectrum for **ISDN BRI** at an impedance of 135Ω for term mode. Filter sections:
  High Pass: 3 dB down 1 kHz
  Low Pass: 3 dB down 50 kHz
- F (more, F1): measures noise in spectrum for **HDSL** at an impedance of 135Ω for term mode. Filter sections:
  High Pass 3 dB down: 5 kHz
  Low Pass 3 dB down: 245 kHz
- G (more, F2): measures noise in spectrum for **ADSL** at an impedance of 100Ω for term mode. Filter sections:
  High Pass 3 dB down: 20 kHz
  Low Pass 3 dB down: 1.1 MHz

Note: We recommend a 100Ω to 135Ω converter cable for E and F filter measurements.

6) For ADSL DMT/CAP, press PSD (F1). Then, press START (F3) to begin the measurement.

7) The results are shown below in Figure 6-5.

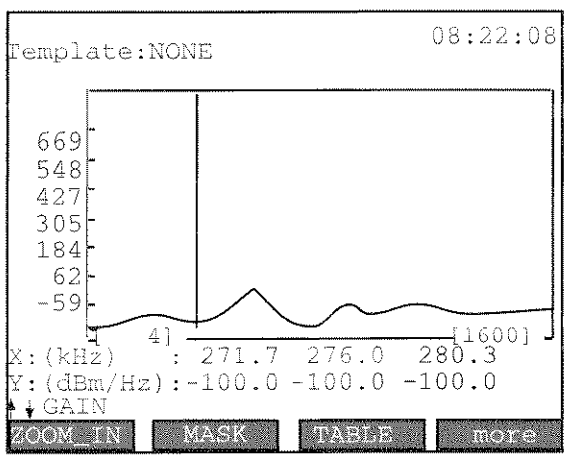


Figure 6-5 PSD Background Noise Results

The F-Keys in this screen are used as follows:

ZOOM_OUT/IN (F1): The ZOOM key sets the display scale for the screen. Press ZOOM-OUT to display the full 1.6 MHz bandwidth on the screen. The resolution is 3 tones/pixel with the highest noise value of the three tones plotted on the screen.

> Note: When you have Zoomed in the full amount, two more F-keys are available: PG_LFT (more, F1) moves the screen display to the left to display the lower tone frequencies. PG_RGT (more, F2) moves the screen display to the right to display the higher tone frequencies.

MASK (F2): MASK places various templates of noise masks on the screen to help you determine the interferer type. After pressing MASK, use the left and right arrow keys to scroll through the various template masks. The exact mask displayed is shown on the 2nd line at Template.

CURSOR (F2): Press the CURSOR key to move the cursor on the display. This can tell you the exact frequency of a disturber. After pressing CURSOR, use the left and right arrow keys to move the cursor. Check the Frequency reading at the bottom

to know the exact frequency .

dBm and dBm/Hz (more, F1): These keys toggle the noise reading at the bottom of the screen. dBm is a pure power reading with a reference to 1 milliwat. The dBm/Hz measurement uses a reference of a certain frequency resolution bandwidth (4.3125 kHz) for the reading.

Testing Interferers in TERM Mode

TERM Mode is for out-of-service testing only. Before plugging into the circuit in TERM Mode, be certain that this circuit can be taken out of service. Follow this procedure (in the exact order):

1) Press the MENU Key on the 2nd row of the keypad.
2) Enter LINE.
3) Enter BACKGROUND NOISE.
4) In the Setup screen, select:
   RxLEVEL: TERM
   TYPE: PSD
5) Connect the SunSet to the circuit. It is important to connect the SunSet to the circuit before starting the measurements for accurate results.
6) After connecting to the circuit, press START (F3). A sample screen appears in Figure 6-6.

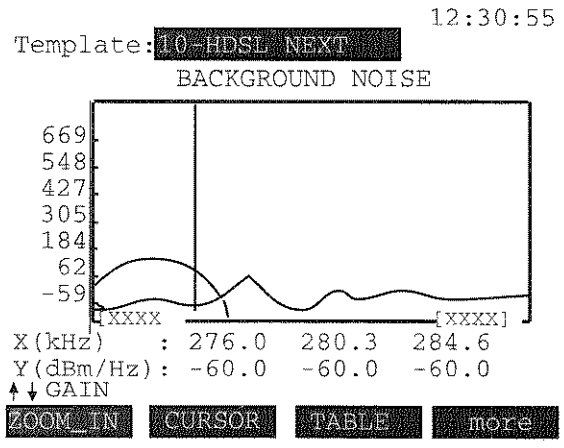


Figure 6-6 Background Noise-TERM Mode

7) If you do not see a strong signal at first, try increasing the vertical gain. Keep pressing the up arrow key until the signal appears.
8) If you want to display an interferer mask on the screen, press MASK (F2) key. Then use the left and right arrow keys to select the interferer type. These interferer types comply to the cross-talk models defined in ANSI T1.413 based on the number and type of disturber. They are:

- 24-DSL NEXT:
  24 IDSL services in the same binder group.
- 10-HDSL NEXT:
  10 HDSL services in the same binder group.
- 4-T1 ADJ NEXT:
  4 T1 services in an adjacent binder group.
- 24-T1 ADJ NEXT:
  24 T1 services in an adjacent binder group
- 10-ADSL DN NEXT:
  10 ADSL downstream services in the same binder group
- 10-ADSL UP NEXT:
  10 ADSL upstream services in the same binder group
- T1.601 NEXT:
  ANSI T1.601 Basic Rate ISDN in the same binder pair
- 10-DSL NEXT:
  10 IDSL services in the same binder group.
- 10-ADSL NEXT:10 ADSL services in the same binder group
- 10-T1 ADJ NEXT:
  10 T1 services in an adjacent binder group
- INT AMI 2M:
  International 2.048 Mbps AMI signal (E1)
- ETSI BRA:
  ETSI Basic Rate ISDN service
- ETSI HDSL:
  ETSI HDSL service
- ADSL XTALK, ANSI 7,13:
  ADSL cross-talk ANSI loops 7 & 13
- ADSL XTALK CSA 4:
  ADSL cross-talk, CSA loop 4
- ADSL XTALK CSA 6:
  ADSL cross-talk, CSA loop 6
- ADSL XTALK CSA 7:
  ADSL cross-talk, CSA loop 7

- DSL NEXT:
  IDSL service in the same binder group
- HDSL NEXT:
  HDSL service in the same binder group
- G.DMT EC ADSL UP NEXT:
  G.DMT Echo-cancellation ADSL upstream service in the same binder group
- G.DMT FDM ADSL UP NEXT:
  G.DMT Frequency division multiplexing ADSL upstream service in the same binder group
- HDSL2 DN NEXT:
  HDSL2 downstream service in the same binder group
- HDSL2 UP NEXT:
  HDSL2 upstream service in the same binder group
- T1 NEXT:
  T1 service in the same binder group
- EC ADSL DN:
  Echo-cancellation downstream ADSL
- G.DMT FDM ADSL DN NEXT
  G.DMT Frequency division multiplexing ADSL downstream service in the same binder group

These masks represent the common disturbers associated with ADSL circuits. If you see an increase in the background noise level (Y-value), try scrolling through the various templates, until a template matches the signal. This indicates the interfering service on your circuit.

9) You could also view your results in a tabular format. This format provides a list of the background noise measurements for each tone level. To view the table, press TABLE (F3).

Testing Interferers in BRIDGE Mode

In BRIDGE Mode, the test set places a high impedance on the received signal to protect the circuit. There will be a slight hit on the circuit, which may result in momentary alarms.

Warning: Bridge mode testing does not interfere with standard digital line technologies such as T1 and E1. However, for complex technologies using modem communications, like ADSL, bridging onto the circuit can cause a significant drop in the noise margin

causing the ADSL circuit to lose synchronization and then resynchronize.

Follow this procedure (in the exact order):
1) Press the MENU Key on the 2nd row of the keypad.
2) Enter LINE.
3) Enter BACKGROUND NOISE.
4) In the Setup screen, select:
   RxLEVEL: BRIDGE
   TYPE: PSD

5) Connect the SunSet to the circuit. It is important to connect the SunSet to the circuit before starting the measurements for accurate results. Also, try to be as close to the transmitter as possible. For example, when checking the ATU-C Tx signal, connect as close to the DSLAM as possible.

   You may clip directly onto the transmit pair with alligator clips, or you could use a RJ-45 Y-adapter.

6) After connecting to the circuit, press START (F3). A sample screen appears in Figure 6-7.

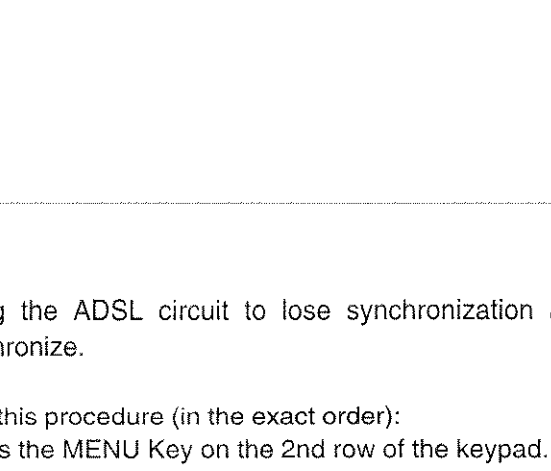


Figure 6-7 Background Noise- BRIDGE Mode

7) If you do not see a strong signal at first- try increasing the vertical gain. Keep pressing the up arrow key until the signal appears.

8) If you want to display a template mask on the screen, press the MASK (F2) key. Then use the left and right arrow keys to scroll through the different masks. The options are:

- G.DMT ATU-C
- G.DMT ATU-R
- ETR 152 CAP 1-PAIR
- ETR 152 CAP 2-PAIR
- ETR 152 2B1Q 392K
- ETR 152 2B1Q 584K
- ETR 152 2B1Q 1160K
- CLASS1 PSD
- CLASS 2 PSD
- CLASS 3 PSD
- CLASS 4TU-C
- CLASS 4TU-R
- CLASS 7 PSD
- ATU-C Tx
- ATU-R Tx

- Each template is displayed on the 2nd line of the screen. In Figure 6-7, ATU-R Tx is displayed. This template is based on ANSI standard T1.413.
- A pass/fail indicator is displayed right next to the template type. This PASS/FAIL refers to the cursor position only. To check if the overall signal meets the background noise requirement, check the graphic and verify that the signal does not overlap (cross above) the template mask. For example, in Figure 6-7, the cursor is at 271 kHz; the PASS refers to this frequency only. You can move the position of the cursor with the right and left arrow keys.
- Note the zoom factor. The screen starts out displaying the full 1.6 MHz bandwidth in one screen. This means that each pixel actually represents three tones (the highest noise level for those three tones is displayed). For better resolution, press the ZOOM_IN (F1) key. You can use the Page-Right and Page-Left keys to shift the screen display from the higher and lower tones.

9) You could also view your results in a tabular format. This format provides a list of the background noise measurements for each tone level. To view the table, press TABLE (F3).

1.1.2 Other Background Noise Tests

In addition to the ADSL DMT/CAP background noise test described in section 1.1.1, you also may test background noise in the ISDN BRI, HDSL, or ADSL spectrums. Refer to the following procedure:

1) Press the MENU Key on the 2nd row of the keypad.
2) Enter LINE.
3) Enter BACKGROUND NOISE.
4) Select the Rx Level:
   - TERM (F1) places a 100 ohm termination on the received signal. This should be used for out-of-service testing only.
   - BRIDGE (F2) is a high-impedance mode that protects the live signal. You may use this mode for in-service testing.

   Note: If you are connecting to a live circuit- be sure to select BRIDGE mode before connecting.

5) Select the type.

   - E (F2): measures noise in the spectrum for **ISDN BRI** at an impedance of 135Ω. Filter sections:
     High Pass: 3 dB down 1 kHz
     Low Pass: 3 dB down 50 kHz
   - F (more, F1): measures noise in spectrum for **HDSL** at an impedance of 135Ω. Filter sections:
     High Pass 3 dB down: 5 kHz
     Low Pass 3 dB down: 245 kHz
   - G (more, F2): measures noise in spectrum for **ADSL** at an impedance of 100Ω. Filter sections:
     High Pass 3 dB down: 20 kHz
     Low Pass 3 dB down: 1.1 MHz

     Note: We recommend a 100Ω to 135Ω converter cable for E and F filter measurements.

6) Press START (F3). The results provide the filter type and the noise reading.

1.2 Level Meter

The level meter can be used to measure the frequency and level of a received tone. It can be connected to a conventional TIMS tone generator or a frequency oscillator at the far end. It measures the highest power frequency. Refer to Figure 6-8.

To enter level meter:
1) Press the MENU key.
2) Enter LINE.
3) Enter LEVEL METER. A sample screen appears in Figure 6-8.

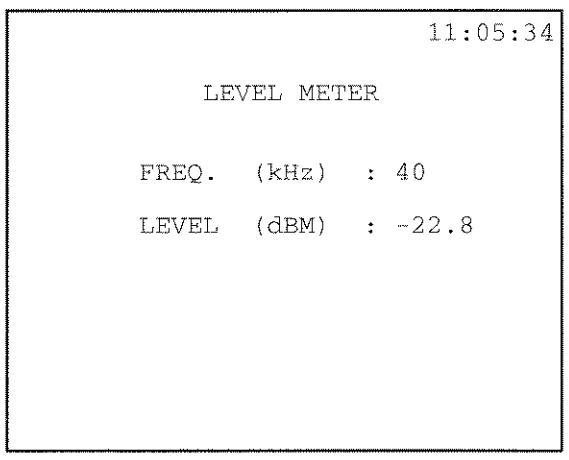


Figure 6-8 Level Meter

1.3 Frequency Generator

You may use the SunSet xDSL to send a tone at a specified frequency and level. You can use a tone analyzer at the far end to measure the level and frequency. To send a tone, refer to the following procedure:

1) Press the MENU key on the 2nd row of the keypad.
2) Enter LINE.
3) Cursor down to FREQUENCY GENERATOR. Press ENTER.
4) The screen is shown in Figure 6-9.

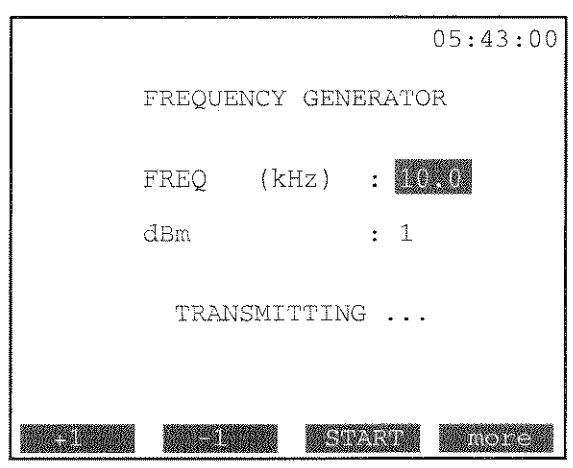


Figure 6-9 Frequency Generator

You may adjust the frequency and level of your tone.

1) FREQ
Range: 10 to 1600 kHz

- Use the F-keys (F1) and (F2) to adjust the tone frequency.
- The following increment/decrement values are available (press the more key): +/- 0.1, +/-1, +/- 10, +/- 100.

2) dBm
Range: -10 to +26 dBm

- Use the F-keys +1 (F1) and -1 (F2) to adjust the tone level.

Once you have set your frequency and level, press the START (F3) key. The test set is now transmitting the specified tone- until you escape out of the screen.

1.4 Coil Detection

The Coil Detection test is a quick and easy way to check for load coils on your cable. It does not provide a location for the load coils (you will need to use the TDR for this)- but it will show you if any

are present.

The standard spacing for load coils is every 6000ft. For the most accurate results, there should be 3000ft. between load coils.

What is a Load Coil?

Over long cable lengths, high-frequency signals are attenuated due to increased capacitance. Phone companies deal with these long loops (greater than 18,000 feet) by placing load coils at regular intervals. A load coil is an inductor, typically 88 mH. Load coils are placed at regular intervals on cable longer than 18,000 feet. The first appears 3,000 feet from the C.O. or exchange. Then, load coils are placed every 6,000 feet.

Loaded cable enables transmission in 300 Hz to 3.1 kHz at a higher power level than unloaded cable. However, after 3 kHz, the power level drops below that of an unloaded circuit. The result is that higher frequencies (>3 kHz) are more heavily attenuated with load coils. *Therefore, high frequency signals, like ADSL, cannot pass through load coils.*

Performing a Coil Detection Test

Follow this step-by-step procedure to perform the Coil Detection test. For accurate results, the load coils on the circuit should comply to standard spacing rules.

1) Connect the SunSet to the circuit with the TDR/LINE/DMM jack. A sample diagram is shown in Figure 6-10. Plug an RJ-45 into the SunSet's TDR/TIMS/DMM jack. Connect the alligator clips at the other end directly to the cable pair. There must be an open at the far end for this test.

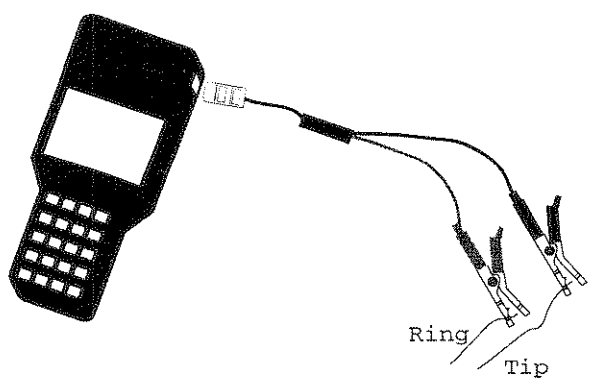


Figure 6-10 Connecting the SunSet to the Cable Pair

2) Press the MENU Key on the 2nd row of the keypad.
3) Enter LINE. The LINE LED will light green indicating the set is performing a Line measurement.
4) Cursor down to COIL DETECTION. Press ENTER.
5) Refer to the top row on the screen to read the status messages. There are two states:

   - PROCESSING: The test set has finished initializing and is in the process of making the measurement. The processing stage takes approximately 20 seconds.
   - COMPLETED: The test set has completed the measurement and now displays the results. These results do not constantly update; you will need to press the RESTART (F4) key to restart the test and update the results.

6) Refer to the graph. The plot measures impedance (y-axis) by frequency (x-axis). Refer to Figure 6-11.

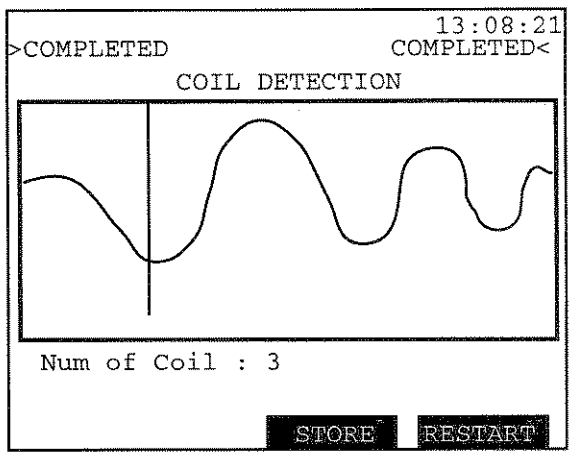


Figure 6-11 Coil Detection

- A load coil causes a change in impedance. This is picked up in the graph. A big dip in the impedance (y) represents a load coil.
- The number of load coils is displayed at the bottom of the screen. In Figure 6-11, there are three load coils (and three dips in the graph). The SunSet xDSL is able to detect 5 load coils with proper spacing.
- The screen display does not update. Press the RESTART (F4) key to retake the measurement.

Removing Load Coils

The Coil Detection test is the fastest method for determining the *presence of load coils*. If this test proves the presence of load coils, you will need to use the SunSet's TDR to determine the exact location of the load coils for removal. The safest method to ensure that all load coils are removed is to remove the first load coil, then run the test again to check if there are more farther down the cable. Continue this same process: find a load coil, remove it, then check for another one.

Remember: all load coils must be removed for DSL transmission.

1.5 Impulse Noise

The SunSet xDSL's Impulse Noise feature detects impulse noise spikes on the signal and keeps a running count of the number of impulse events over time. Impulse noise is defined as a random pulse whose amplitude is much higher than that of background noise. IEEE defines impulse noise as any burst of noise that produces a voltage exceeding the rms value of the background or quantizing noise by more than 12 dB [IEEE 743-1995].

Use the following procedure to test for impulse noise:

1) Connect the SunSet to the circuit with the TDR/LINE/DMM jack. A sample diagram is shown in Figure 6-12. Plug an RJ-45 into the SunSet's TDR/TIMS/DMM jack. Connect the alligator clips at the other end directly to the cable pair.

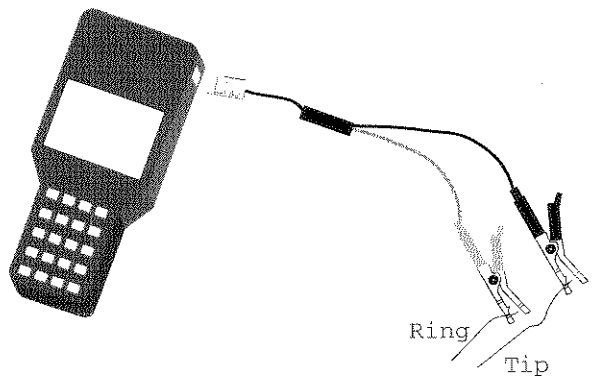


Figure 6-12 Connecting the SunSet to the Cable Pair

2) Press the MENU key on the 2nd row of the keypad.
3) Enter LINE. The LINE LED lights green indicating the set is in the Line testing mode.
4) Cursor down to IMPULSE NOISE. Press ENTER.
5) The Impulse Noise Setup screen appears in Figure 6-13.

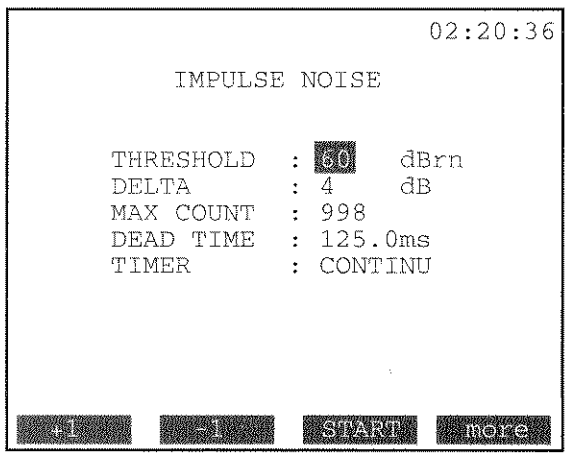


Figure 6-13 Impulse Noise Setup

This screen contains the following setup parameters:

1) Threshold
Range: 50 dBrn to 102 dBrn

This defines the lower threshold value for an impulse noise event. When the test set detects noise above this threshold, the SunSet records it as an impulse noise event.

- Use the +1 (F1) and -1 (F2) keys to adjust this value.
- Press more (F4) to access +10 (F1) and -10 (F2).

2) Delta
Range: 2 to 6

Delta sets the difference between the Low, Middle, and High event counts. In Figure 6-13, the threshold is set for 60 dBrn; this is the Low count. The delta value is set for 4. Therefore, the low count refers to any noise between 60 and 64; the middle count refers to any noise between 64 and 68. High refers to anything above 68 dBrn.

- Use the +1 (F1) and -1 (F2) keys to adjust this value.

3) Max Count
Range: 1 to 9999

Max count refers to the maximum number of impulse events that will be counted during a single measurement.

- Use the +1 (F1) and -1 (F2) keys to adjust this value.
- Press more (F4) to access +10 (F1) and -10 (F2).
- Press more (F4) again to access +100 (F1), -100 (F2)
- Press more (F4) again to access +1000 (F1), -1000 (F2)

4) Dead Time
Range: 0.1ms to 255 ms

Dead Time refers to the measurement delay after the unit detects the initial impulse. Dead Time begins as soon as the SunSet detects the initial impulse. The test set resumes measuring events after the dead time has elapsed. This prevents the SunSet from measuring the same impulse noise spike multiple times.

5) Timer
Range: 1 to 9999, Continu

Timer sets the duration time of the measurement. You can run your test from 1 to 9999 minutes. As soon as you start the measurement, the elapsed time starts counting up to this value. When it reaches the timer value, the test stops. To run a continuous test, press the more (F4) key several times, then select CONTINU (F1).

When you have completed your settings, press the START (F3) key to begin the test. A sample results screen is shown in Figure 6-14.

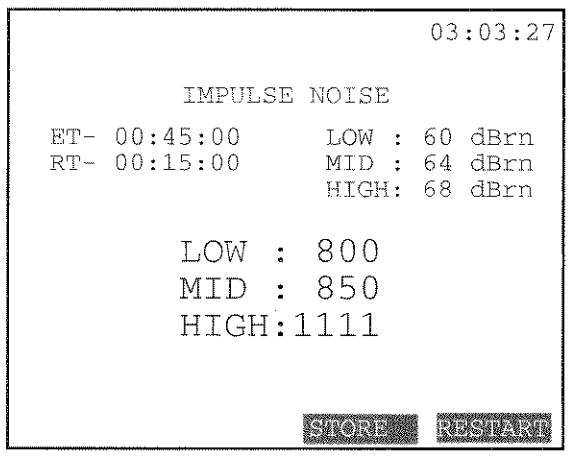


Figure 6-14 Impulse Noise Results

The following information is provided in the top half of the screen:

ET: Elapsed Time. ET begins counting as soon as you start the measurement- whether by pressing START from the Setup screen or pressing the RESTART (F4) key from this screen. ET continues counting until it reaches your set TIMER value.

RT: Remaining Time. RT is a count-down from the time set as TIMER. It shows you how much time is left until the end of the test.

LOW: Displays the noise level for a LOW count. This is equal to the THRESHOLD setting in the Setup screen.

MID: Displays the noise level for a MID count. This is equal to the THRESHOLD setting plus the DELTA value.

HIGH: Displays the noise level for HIGH count. This is equal to MID plus the DELTA count.

The following results are provided at the bottom half of the screen:

LOW: The number of impulse noise spikes detected whose level falls within the Low value shown above (in between LOW and MID)

MID: The number of impulse noise spikes detected whose level falls within the MID value shown above (in between MID and

HIGH).
HIGH: The number of impulse noise spikes detected whose level falls within the High value shown above (above HIGH).

Press RESTART (F4) to restart the measurement and reset all counters to zero.
Press STORE (F3) to save your results.

Section 2 Controller tests

There are three tests listed under the Controller menu: Insertion Loss, Signal to Noise, and Loop Resistance. These are paired tests and require another SunSet xDSL in responder mode at the far end. Section 2 outlines the controller set for each application. Section 3 discusses how to set the xDSL for responder mode.

2.1 Insertion Loss

Insertion loss testing is an excellent pre-qualification tool. It measures attenuation using two SunSet xDSLs: the Responder unit sends the tones from the far end, while the Controller SunSet conducts the measurement. It provides loss characteristics up to 1.6 MHz, including the entire ADSL band (both DMT and CAP). Single frequency measurements are also available. It can be used to qualify HDSL transmission (196 kHz), T1 (772 kHz), U-Interface ISDN (40 kHz), etc.

2.1.1 Insertion Loss for DMT/CAP Frequency Band

Both ADSL CAP and DMT frequencies are covered with the ADSL PSD (Power Spectral Density) test. For DMT ADSL, the attenuation measurement must be made for the entire DMT frequency band: 22 kHz to 1.1 MHz. The SunSet measures beyond this range to 1.6 MHz to test for CAP ADSL. The Responder unit sends the frequency sweep tones; the Controller unit takes the measurement.

Follow these steps to configure the Controller unit:

Note: If this is the first time running the insertion loss test, you will need to calibrate your unit. Make sure the SunSet is disconnected from the circuit. Press the MENU key; then enter LINE, CALIBRATION, INSERTION. Calibration may take up to 20 seconds. You should see a "Calibrate is Done!" message when finished. Then you may proceed with your insertion loss test.

1) Connect the SunSet to the circuit with the TDR/LINE/DMM jack. Refer to Figure 6-15. In this figure, alligator clips are used to connect to the tip & ring wires.

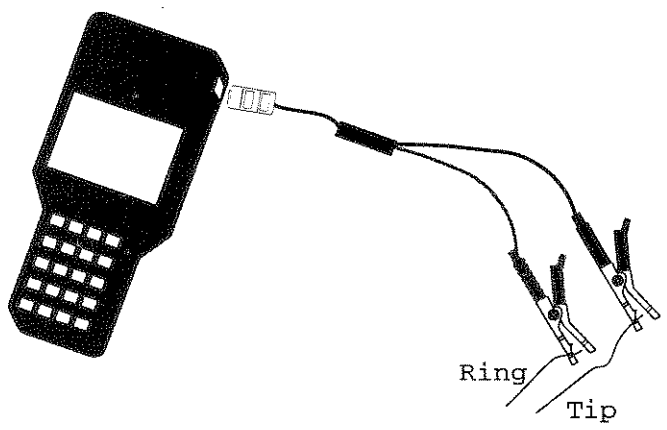


Figure 6-15 Connecting the SunSet to Tip & Ring

2) Press the MENU Key on the 2nd row of the keypad.
3) Enter LINE. The LINE LED will light green indicating the set is performing a Line measurement.
4) Enter CONTROLLER.
5) Enter INSERTION LOSS.
6) Enter ADSL PSD. ADSL PSD includes both the DMT and CAP bandwidth.
7) The top line of the screen shows the Responder unit's status:
   Right Side: displays Responder's LINE status; a proper response will show "Connected."
   Left Side: displays the Responder's STATUS; a proper response should show "Completed." This could also display Processing (meaning the Responder has received the command is in process of sending a tone), Received (meaning the Responder has received the Controller's command, but has not responded yet), or

IDLE (meaning the Responder has not received any command).

8) The results show a Level vs. Frequency plot. Refer to Figure 6-16.

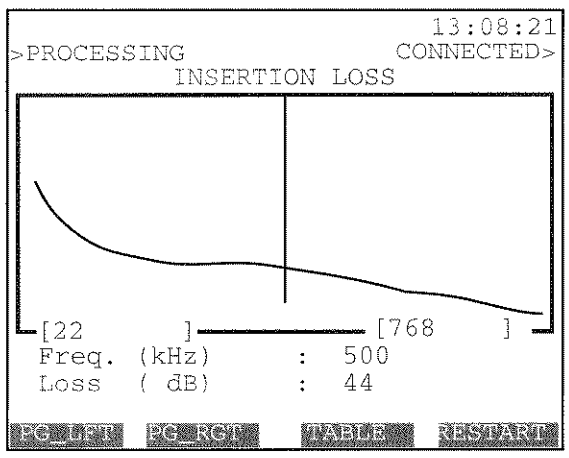


Figure 6-16 ADSL PSD Insertion Loss Result

- ANSI T1.413 specifies required insertion loss results for various loops and impaired lines. Variables in these results include: wire gauge, impairments, and temperature.

- To find the exact insertion loss for a particular frequency, refer to the results provided below the graph. Use the right and left arrow keys to move the cursor. Check the frequency reading (Freq. kHz) until the cursor has reached the desired frequency. Then refer to the loss reading (Loss dB) for that particular frequency.

The F-Keys in this screen are used for:

PG_LFT (F1) and PG_RGT (F2): these keys move the screen display to the left or right. The following screen displays are available:
22 kHz to 768 kHz
397 kHz to 1143 kHz
772 kHz to 1518 kHz
854 kHz to 1600 kHz

TABLE (F3): This key displays the loss readings in a table format for each particular tone. A sample screen is provided in Figure 6-17.

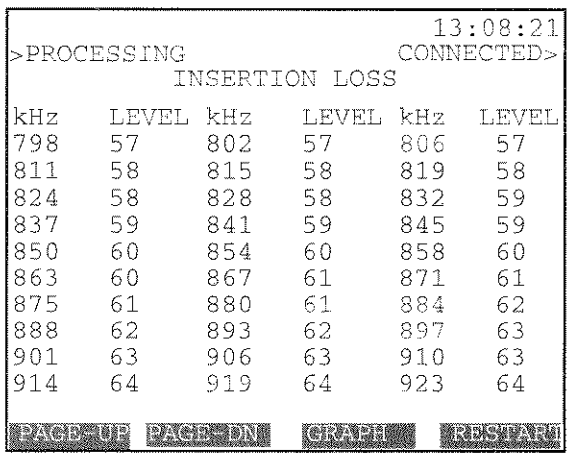


Figure 6-17 Insertion Loss- Table format

RESTART (F4): this key restarts the measurement and updates the results.

BRG_TAP (F1): this key searches for and reports any bridge taps on the cable pair.

Note: You may store and print both the Insertion Loss graphic and table results to a serial port printer. Refer to the Printing & Storage chapter for more details.

Detecting bridge taps with insertion loss

Insertion loss may be used as an alternative method for detecting bridge taps on the cable pair. Insertion loss can be advantageous because it allows you to test out to approximately 25,000 feet. This method shows the presence of bridge taps and can calculate the approximate length. However, a TDR is still needed to determine the exact location.

1) In the Insertion Loss screen, press BRG_TAP (F1). You may need to press more (F4) first.
2) The set looks for any dips in the frequency curve. A typical

insertion loss result without any faults is a linear curve sloping downward. A bridge tap will appear as a subtle dip in the curve. The bridge tap length affects different frequencies.

3) If the set finds a bridge tap, it moves the cursor to the dip. It reports the length of the bridge tap (BT Ln) in feet at the bottom of the screen. Note that this is the length of the bridge tap, not the location.
4) The set calculates the length based on the Vp (Velocity of Propagation) setting shown above. The default setting is 0.66. If you know the specific Vp setting, use the +VP (F2) and -VP (F3) keys to adjust the value. The Vp setting will affect the length calculation for the bridge tap. Refer to Chapter 4 for more details on Vp.
5) Insertion loss can detect multiple bridge taps on the cable pair. After it has detected the first bridge tap, simply press BRG_TAP (F1) again to detect the next tap.

Note: Insertion loss checks for dips in the frequency curve. These dips could be cause by other impairments or cable factors. You should verify the presence of a bridge tap with a TDR.

2.1.2 Single Frequency Insertion Loss Tests

The other Insertion Loss tests measure loss at one particular frequency. Each can be used to qualify the span for a particular transmission type (i.e HDSL, T1, ISDN BRI).

Follow these steps to configure the Controller unit:
1) Connect the SunSet to the span.
2) Press the MENU Key on the 2nd row of the keypad.
3) Enter LINE.
4) Enter CONTROLLER.
5) Enter INSERTION LOSS.

6) Cursor down to the desired Insertion Loss test. Press ENTER. The tests should be used as follows:

- HDSL (European): 150 kHz
- HDSL, 2 pair T1: 196 kHz
- HDSL 1 pair T1: 392 kHz
- HDSL E1: 260 kHz

- ISDN BRI at the U-Interface: 40 kHz
- ISDN BRI at the S-Interface: 96 kHz
- DDS: 82 kHz
- T1: 772 kHz
- E1: 1.024 MHz

7) The results show the single frequency tested and the dB loss at this frequency. Refer to Figure 6-18.

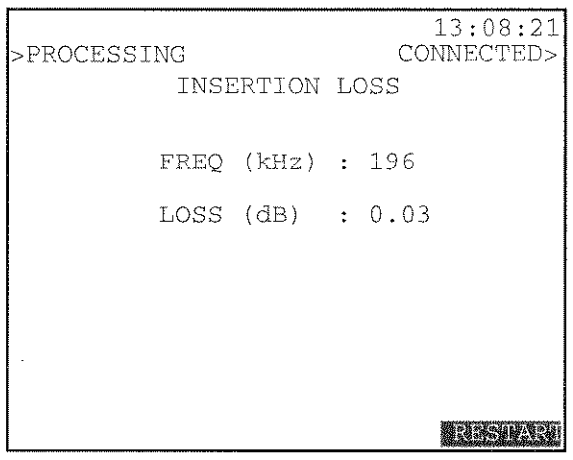


Figure 6-18 Single Frequency Insertion Loss

2.2 Signal to Noise Test

After running an insertion loss test, you can also measure the signal to noise ratio for each tone tested. The Signal to Noise test is a good tool to characterize the line interface conditions. It independently measures the achievable signal to noise performance over the full range of frequencies used by DSL modems. These results correlate to the SNR measurements used by DMT modems to adjust bit distribution and transmit power level. It can identify frequencies which have low noise margins.

The Signal to Noise test is another paired test. The Responder unit transmits tones; the Controller unit measures the level of each tone, as well as the background noise, and yields a signal-to-noise

ratio.

Important: The Signal to Noise test depends on an Insertion Loss measurement. Therefore, you must first perform an Insertion Loss Measurement for ADSL PSD, then measure Signal to Noise for ADSL PSD.

Follow this procedure for measuring Signal-to-Noise:

1) Connect the SunSet to the span.
2) Perform an Insertion Loss measurement for ADSL PSD (refer to Section 2.1 for more details).
3) After measuring Insertion Loss, escape back to the Controller menu. Cursor down to SIGNAL TO NOISE; press ENTER.
4) The results show a signal-to-noise (dB) vs. frequency plot. Refer to Figure 6-19.

Figure 6-19 Signal to Noise Result for ADSL DMT PSD

- This test measures noise in a 22 kHz to 1.6 MHz spectrum. The first screen displays tones from 22 Hz to 768 kHz. The second screen displays tones from 344 kHz to 1.6 MHz. Use the PG_LFT (F1) and PG_RGT (F2) keys to change between these two screens.

- To learn the exact S/N reading at a particular frequency, refer to the results below the graph. Use the left and right arrow keys to move the cursor to the desired frequency (as read at Freq.

kHz). The S/N (dB) shows the exact signal to noise ratio for that frequency.

- A vertical double dot will appear above the signal to noise reading when the background noise measured is <120 dBm/Hz or the Signal to Noise ratio is <0 dB.

2.3 Loop Resistance Test

The Loop Resistance Test provides an estimated loop length. It is measured with a short at the far end. This test can be a single-ended test if a short can be manually placed at the far end. Loop Resistance could also be a paired test with the Responder unit providing the short at the far end.

To measure loop resistance, follow these steps:

1) Connect the SunSet to the circuit. Refer to Figure 6-20. In this figure, alligator clips are used to connect to the tip & ring at a cross-box. **There must be a short at the far end to perform this measurement.**

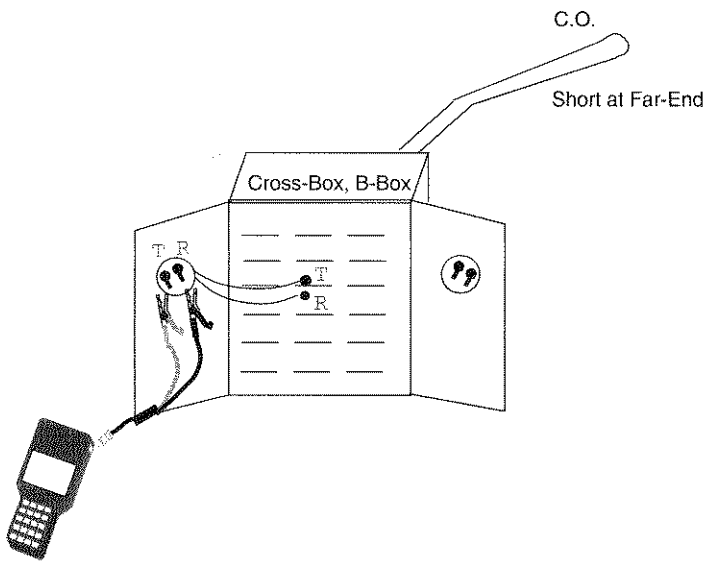


Figure 6-20 Connecting the SunSet to the Circuit to Measure Resistance

Note: You may also use another SunSet xDSL to provide the short at the far end. If you do so, it is recommended to wait 10 seconds before restarting the measurement due to communication between the two units.

2) Press the MENU Key on the 2nd row of the keypad.
3) Enter LINE. The LINE LED will light green indicating the set is performing a Line measurement.
4) Enter CONTROLLER.
5) Cursor down to LOOP RESISTANCE. Press ENTER.
6) The screen is shown in Figure 6-21.

Figure 6-21 Loop Resistance Screen

You need to configure two settings for this measurement:

1) TYPE
F-Key Options: TIP_RNG (F1), TIP_GND (F2), RNG_GND (F3)

Press the F-key corresponding to the measurement you want to make: tip-ring, tip-ground, or ring-ground.

2) TEMP (F)

Use the INC (F1) and DEC (F2) keys to select the temperature.

• Remember the far end must be shorted in order to run this test. If it is not shorted, the screen will read "OPEN" and will not provide a measurement.

A loop resistance measurement can be used to:

• *Estimate Loop Length.* Loop Resistance can be used to estimate loop length. The SunSet xDSL provides the calculation for you, based on ANSI T1.601, Annex G. This conversion factor is based on cable type, AWG (cable width), and temperature.

• *Verify circuit has acceptable loop resistance (tip-ring)*
HDSL Requirement: 900 Ω
ADSL Requirement: 1300 Ω
These are maximum values with the far end shorted.

Section 3 Responder testing

The paired tests (Insertion Loss, Signal to Noise, and Loop Resistance) require a SunSet xDSL in responder mode at the far end. This unit responds to commands from the controller unit.

To set up the Responder unit, refer to the following steps:

1) Connect the SunSet to the span with the TDR/LINE/DMM jack. A common method is to use an RJ-45 to alligator/probe-clip cable. Clip directly onto the copper pair with the alligator clips; plug the RJ-45 into the SunSet.
2) Press the MENU Key on the 2nd row of the keypad.
3) Enter LINE. The LINE LED will light green indicating the set is performing a Line measurement.
4) Enter RESPONDER. Note that the RESPOND LED lights green indicating the set is in responder mode.
5) The SunSet will now automatically respond to commands from the Controller unit. You must remain in this screen to respond to commands. These commands and the unit's status are displayed on the screen. Refer to Figure 22.

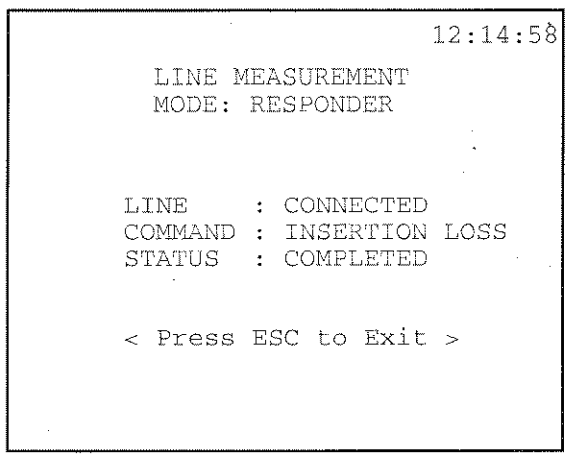


Figure 22 Responder Mode

There are three lines of information on this screen:

- LINE: shows the connection with the Controller unit. LINE displays *IDLE* (when it's not receiving anything from the Controller) or *CONNECTED* (when it is receiving messages from the Controller).
- COMMAND: refers to the type of command received from the Controller unit. Here, the Controller unit is running an Insertion Loss test.
- STATUS: shows the Responder unit's status. This can be either:
  Received: the set received the command from the controller unit.
  Processing: the set is in the process of responding to the controller's commands.
  Completed: the set responded to the controller's command.

Chapter 7
Printing & Storing Results

Section 1 Storing Results

You may store results to view/print at a later time. Each result can be labelled with both a Label name and Circuit ID for easy identification. For ATU-R/C testing, you may store up to 50 separate results. Each result includes Link Turn up, General Status, Link Measurements, and Alarm Status information. For physical layer testing, you may store up to 10 results for each test (i.e 10 TDR results; 10 Insertion Loss tests).

Use the STORE F-key found in results screens to store and recall results. For example, the Link Turn-up results or TDR results screen contains a STORE F-key. You may need to press the more (F4) key several times to access STORE.

Upon pressing a STORE F-key, you will see the STORED RESULTS menu screen. This screen lists all other results that have already been stored in the buffer. Refer to Figure 7-1.

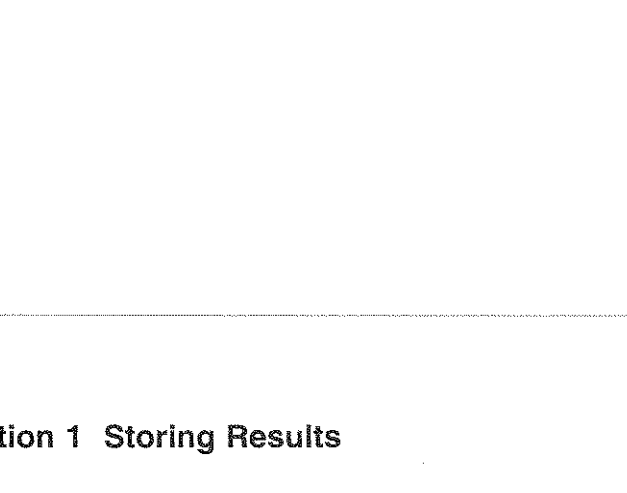


Figure 7-1 Stored Results Menu

You may refer to the following procedures for instructions on saving, viewing, locking, and clearing stored results.

Storing Results

Use the following procedure to store your results:

1) Press the STORE F-key found in a results screen.
2) The STORED RESULTS screen appears as in Figure 7-1.
3) Use the down arrow key to move the cursor to a blank line. If more than 10 results are stored, you will need to press the PAGE-DN (F2) key to find a blank line.
4) Press the EDIT F-key.
5) The Edit Results screen appears as shown in Figure 7-2.

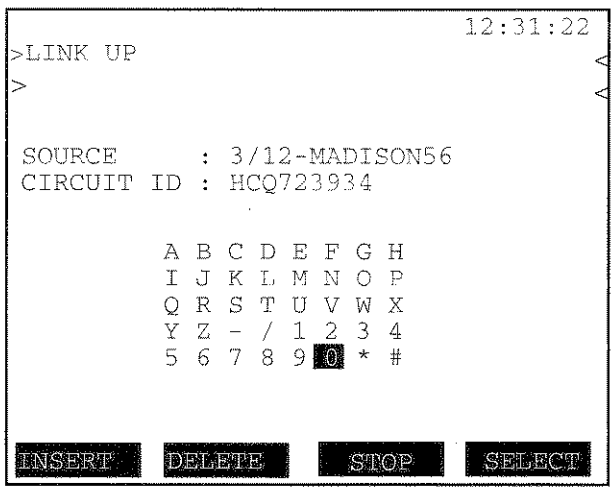


Figure 7-2 Saving a Result

6) You will need to create a label for your result. The SOURCE line appears in the Stored Results menu as the label. To enter the SOURCE:

a. Press EDIT (F1). Now the character grid appears as shown in Figure 7-2.
b. Press the INPUT (F3) key. Note a cursor appears on "A" in the character grid.
c. Use the arrow keys to move the cursor to the desired letter/ number/symbol.
d. When the cursor is on the right letter, press the ENTER key. You should now see this letter appear on the Source line.
e. Continue this process until you have completed your Source label. You may enter up to 15 characters.
f. When your entry is complete, press STOP (F3) again to exit the character grid.

g. Press SAVE (F4) to save this SOURCE label.

7) If desired, you may also enter a Circuit ID. Move the cursor to the CIRCUIT ID line and follow the same steps outlined in step 6. You may enter up to 15 characters for CIRCUIT ID.

8) To save your result, press SAVE (F4). These results will now be stored in the menu as your SOURCE entry.

Viewing Stored Results

Refer to the following procedure to view your stored results at a later time:

1) Press the STORE F-key found in a results screen.
2) The STORED RESULTS screen appears as in Figure 7-1.
3) Use the down arrow key to move the cursor to the result you wish to view. If more than 10 results are stored, you may need to press the PAGE-DN (F2) key to find the result.
4) When the cursor has highlighted the correct result, press the VIEW (F2) key.

Locking Stored Results

You may lock your results to prevent them from being accidentally erased. When a result is locked, it cannot be edited or deleted (except by Erase NV Ram) until it is unlocked. To lock a result:

1) In the Stored Results menu, use the down arrow key to move the cursor to the result you wish to lock. If more than 10 results are stored, you may need to press the PAGE-DN (F2) key to find the result.
2) When the cursor is highlighting the correct result, press the more (F4) key; then press UN/LOCK (F2). The UN/LOCK key toggles between locked and unlocked.
3) Note the right column now shows this result as locked.
4) In order to unlock this result (to edit or delete it), press the UN/LOCK F-key.

Clearing Stored Results

Refer to the following procedure to clear a stored result:

1) In the Stored Results menu, use the down arrow key to move the cursor to the correct result.
2) Make sure the right column shows this result to be unlocked. If not, you will need to press MORE (F4), then UN/LOCK (F2). A result cannot be deleted while locked.
3) When the cursor is highlighting the correct result, press the CLEAR (F3) key.
4) The result should now deleted and this space free to store another result.

Storing/ Recalling Results

To store and access results, you must be in a measurement screen:

- For ADSL, this can be the Link Turn-up Results, General Status, Link Measurements, Bits per tone, and Alarm Status screens.
- For DMM, this is any of the DMM result screens (i.e DCV screen).
- For TDR, you must have started the TDR measurement.
- For LINE, you must have started the LINE measurement (i.e. you must be in the COIL DETECTION results screen).

Section 2 Printing Results

You may print the results in two ways:

1) *Printing Results*: If you have stored results, as described in Section 1, you may print out the stored information.
1) *Printing individual screens*: Pressing the orange Shift-function PRINT key prints the single screen.

2.1 Configuring the Serial Port

In order to print correctly, the SunSet xDSL's serial port must be configured to match the destination printer/PC.

To configure the serial port:
1) Press the MENU white key.
2) Cursor down to OTHER SETUP. Press ENTER.
3) Cursor down to SERIAL PORT CONFG. Press ENTER.
4) Refer to Figure 7-3 and the following description of each setting.

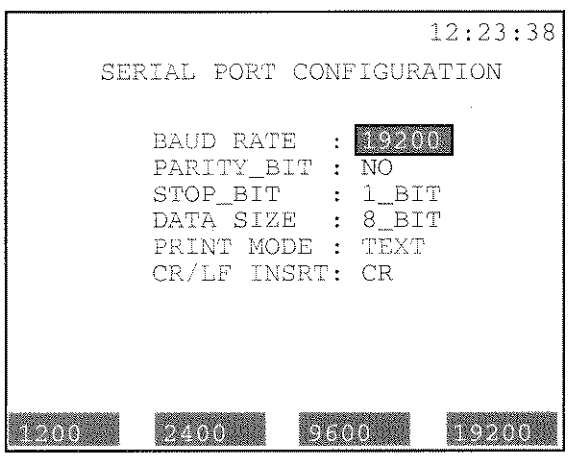


Figure 7-3 Serial Port Configuration

1) BAUD RATE
Options: 1200 (F1), 2400 (F2), 9600 (F3), 19200 (F4)

Press the F-key that correspond to your desired baud rate setting. *Make sure this setting matches that of the destination printer.*

2) PARITY BIT
Options: NO (F1), ODD (F2), EVEN (F3)

Parity is a method of checking the accuracy of transmitted or stored data. An extra bit, known as a parity bit, is added to the data as an accuracy check. *Make sure this setting matches that of the destination printer.*

- In Odd Parity (F2), the total number of ones (including the added parity bit) is odd.
- In Even Parity (F3), the total number of ones (including the added parity bit) is even.

• None (F1) signifies no parity checking.

3) STOP BIT
Options: 1-BIT (F1), 2-BIT (F2)

In asynchronous transmission, the stop bit is the last transmitted character which permits the receiver to come into an idle condition before accepting another character. *Make sure this setting matches that of the destination printer.*

4) DATA SIZE
Options: 5_BIT (F1), 6_BIT (F2), 7_BIT (F3), 8_BIT (F4)

Data Size specifies the number of bits per character. *Make sure this setting matches that of the destination printer.*

- Press (F1) to select 5 bits per character.
- Press (F2) to select 6 bits per character.
- Press (F3) to select 7 bits per character.
- Press (F4) to select 8 bits per character.

5) PRINT MODE
F-Key Options: TEXT (F1), GRAPHIC (F2)

- Text (F1) prints a text-only format. If you are in text mode, you can only print from Stored Results screen. The Print key is disabled. From the Stored Results menu, text mode prints out the Link Turn-up results and General Status information. You cannot print any physical layer measurements (LINE, DMM, TDR). You should use text mode when your printer does not support graphics.
- Graphic (F2) allows you to print both physical and ATU-R results. Graphic mode also allows you to print any single screen display using the PRINT Shift-function key. In ATU-R, graphic mode prints out: Link Turn-up Results, General Status, Link Measurements, and Alarm Status. Not all printers support graphics. Sunrise Telecom guarantees graphical printing only with the SS118 printer provided by Sunrise Telecom.

6) CR/LF INSRT
F-Key Options: CR (F1), CR+LF (F2)

- Press CR (F1) to select carriage return.
- Press CR+LF (F2) to select carriage return and line feed. This mode inserts an extra line space after every line.

2.2 Printing from the SunSet

Follow these steps to print from the SunSet xDSL.

1) Verify that the SunSet's serial port is configured correctly for your printer.
   - Press the MENU key, then enter OTHER SETUP, SERIAL PORT CONFIG. Refer to Section 2.1 for more details on each setting.

2) Connect the SunSet to the printer. Plug the printer cable to the RJ-11 serial port located at the top of the set. Sunrise Telecom provides three different printer cables:
   - SS144: RJ-11 to DB-9
   - SS144A: RJ-11 to DB-25
   - SS144B: RJ-11 to RJ-11

3) You may print out the results in two ways:

   - *Printing Single Screen display*

   To print a single screen to the printer, simply press the PRINT key on the keypad. This prints a bit-map graphic of the screen; the print out looks identical to the screen display. Since the PRINT key prints as a bit-map, it functions only when you have selected graphic print mode in Serial Port Config and your printer supports graphic.

   - *Printing Stored Results*

   When you have stored results, you may print out a full results report. From a measurement screen, press the STORE F-key, then use the down arrow key to move the cursor to the desired result.

- You may see a combination of 4 different print F-key options. Press the more (F4) key to scroll through the various F-key choices.

PRINT: prints the stored result; this record consists of only one page of results. An example is DMM; where the PRINT F-key prints one measurement, like ACV.

PRN-ALL: Prints multiple pages of information associated with this record. For example, in ATU-R testing, PRN-ALL prints all the expected pages of ATU-R results.

PRN-TBL: Prints the results in a tabular format. This is applicable only for Insertion Loss, Background Noise, and ADSL Bits per Tone measurements.

PRN-GPH: Prints the results in a graphical format. This is applicable only for Insertion Loss, Background Noise, and ADSL Bits per Tone measurements.

- When printing ATU-R stored results, text mode prints out both the Link Turn-up Results and General Status information, along with the Source label and Circuit ID.
- When printing ATU-R stored results, graphic mode prints out: Link Turn-up, General Status, Alarm Status, and Link Measurements.

2.3 Printing to a TAN printer

Refer to the following procedure if you are printing to a TAN printer:

1) Verify that the SunSet's serial port is configured correctly for your printer.
   - Press the MENU key, then Other Setup, Serial Port Config.
   - Configure the setup items as follows:

     BAUD RATE : 1200
     PARITY_BIT : NO
     STOP_BIT : 1_BIT
     DATA SIZE : 8_BIT
     PRINT MODE:TEXT
     CR/LF INSRT: CR

2) Use the SS144B, RJ-11 to RJ-11, printer cable. Plug one end

into the TAN printer. The printer's red light should now turn green. If it does not, try the other end of the cable. Connect the other end of the cable into the SunSet's serial port- located on the top panel of the unit.

3) Since your Print Mode is set for text, you may print only the stored ATU-R results. Refer to Section 1 for details on storing results. To print results:
   - From either the Link Turn-up results or General Status screens, press the STORE F-key.
   - Cursor down to your desired result.
   - Press more (F4), then PRN-ALL (F1)
   - Both the Link Turn-up Results and General Status screens will print.

2.4 Printing to a PC

In addition to printing to a serial port printer, you may also send your data to a PC configured for VT100 terminal emulation (i.e. Hyperterminal).

1) Verify that your serial port is configured properly for both the computer and SunSet.

2) Connect the SunSet to the PC. You must use a null modem adapter for this application.

3) The following data can be printed to your computer:
   - Text Mode: ADSL Modem Status and Link Turn-up Results.
   - Graphic Mode: print table for Bits per Tone, Insertion Loss, and Background Noise.

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
- Repairs malfunctioning SunSets promptly
- Provides information about product upgrades

A Return Merchandise Authorization (RMA) Number is required before any product may be shipped to Sunrise Telecom for repair. Out-of-warranty repairs require both an RMA and a Purchase Order before the unit is returned. All repairs are warranted for 90 days.

Please contact Customer Service if you need additional assistance:

Customer Service
Sunrise Telecom Inc.
22 Great Oaks Blvd.
San Jose, CA 95119
U.S.A.
Tel: 1 408 363 8000 or 1-800-701-5208
Fax: 1 408 363 8313
Internet: http://www.sunrisetelecom.com
Email: support@sunrisetelecom.com

XDSL Support Hotline

In addition to the general customer service, a 24-hour xDSL support line is available for dedicated xDSL technical support. Our knowledgeable xDSL support staff is ready to help you with any questions you might have regarding xDSL testing.

Call: 1-888-922-XDSL

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.

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

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Alcatel ATU-R Module Revision B
Table of Contents

Section 1 ATU-R Quick Test

The SunSet xDSL offers the simplest method for testing ADSL spans: plug into the ATU-C, power the set on, and the SunSet automatically connects to the ATU-C and provides all significant results within seconds, including bit rate and noise margin. Follow these steps to test the ATU-C:

Note: The most important point is to first connect the SunSet to the circuit, then power on the set. As soon as the SunSet powers up, it immediately tries to connect to the ATU-C and provide results.

1) Connect the SunSet xDSL to the circuit. The ADSL module on the left side contains an RJ-45 jack. Depending on your access point, you may use an RJ-45 to RJ-45 cable, RJ-45 to RJ-11, or RJ-45 to alligator clips.

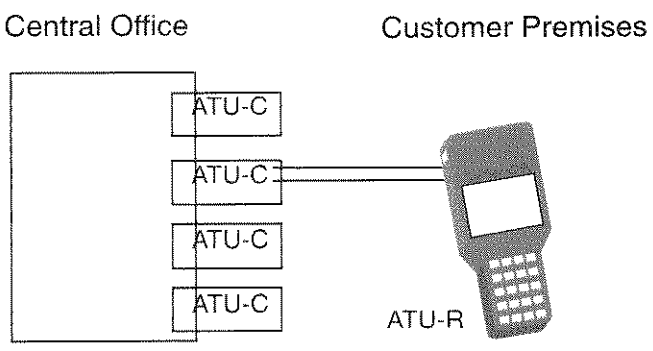


Figure 1 Connecting to the ATU-C

2) Power on the unit. The SunSet automatically theirs to open the link with the ATU-C. Refer to the top lines for status information.

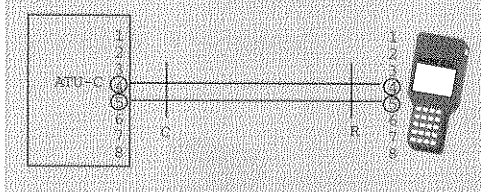
3) You may need to change the operating mode for the ADSL link. To do so:
   - Press the MODULE key.
   - Enter SETUP.
   - Select the proper operating mode.
   - Press RETRAIN (F4) if you've changed the setting.

Pin Out connection at the customer premise, in North America

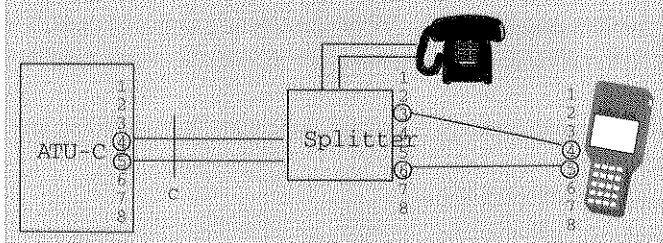
At the customer premise, a splitter divides the ADSL and POTS signal. Access to the ADSL signal may differ at the NID and inside the Customer premise in North America. At the NID, the ADSL and POTS signals are carried on the inner pins: pins 4 & 5 for an 8-pin connection or pins 3 & 4 for a 6-pin connection. After the splitter at the Customer Premise, the ADSL signal is carried on the outer pins: pins 3 & 6 for an 8-pin connection 2 & 5 for a 6-pin connection.

The SunSet xDSL is designed to connect directly to the network. Per ANSI T1.413, it transmits and receives the ADSL signal on the inner pins, 4 & 5.

The following figure shows the pin connections when connecting straight to the ATU-C. There is a straight connection on pins 4 & 5.



The next graphic illustrates that the POTS Splitter uses the two outer pins for the ADSL signal. For 8 pin, this is pins 3 & 6. For 6 pin, this is pins 2 & 5. *If you need to test after the splitter and direct clipping is not possible, you will need a special adapter cable to cross the pins, which is available at Sunrise Telecom.* Whenever possible, Sunrise Telecom recommends using RJ45 to alligator clip cables.



4) Refer to the message at the top left of the screen. While the SunSet is trying to connect with the ATU-C, this message reads "Attempting to open link..." At this stage, the XTU-R LED blinks red.

When the SunSet xDSL recognizes the ATU-C's response, it shows "Initializing." This indicates that it has made contact with the ATU-C and is beginning the hand-shaking procedure to open the link.

If the SunSet successfully connects with the ATU-C, the screen automatically displays the turn-up results. The message now reads "Link Up." The XTU-R LED is solid green.

If unsuccessful, an error message appears and no results are displayed. The XTU-R LED is solid red. The following is a list of possible error messages and their meanings:

- "Unable to lock with ATU-C": the test set can't lock with the ATU-C.
- "Requested Bitrate Too High": the bit rate requested by the ATU-C cannot be supported by the ATU-R, ATU-C, or both.
- "A failure occurred during the initialization process": there was a protocol error during the turn-up process.
- " A message received from the ATU-C was invalid": a CRC error was detected during the turn-up procedure.

If you receive one of these messages during turn-up, try opening the link several times to make sure it's not a temporary fault. To try reopening the link, refer to section 2.1.4 Opening the link.

5) After the SunSet connects successfully with the ATU-C, it displays the results. Refer to Figure 2. These are the results from the link turn up .

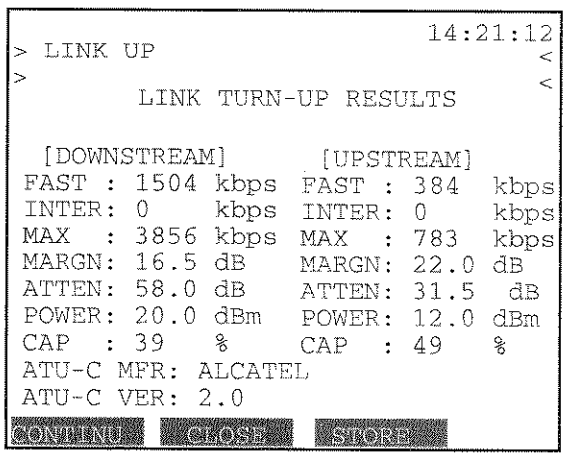


Figure 2 Link Turn-Up Results

The left column displays the downstream results- indicating the direction from the DSLAM to the customer. The right column shows the upstream results from the customer to the DSLAM. For each direction, the following information is provided:

- FAST: Displays the *Fast Path bit rate.* This is the actual bit rate between the ATU-R and ATU-C (when fast path is used).
- INTER: Displays the *Interleaved bit rate.* This is the actual bit rate between the ATU-R and ATU-C (when the interleaved path is used). Interleaving adds some additional flow control and error correction- by adding delay to the data.

Note: Current Alcatel implementation allows for fast path only or interleaved path only profiles. This is set in the DSLAM. Dual latency is not supported. Therefore, you should see a bit rate only in one of these fields.

- MAX: Displays the maximum attainable bit rate that the circuit will support.
- MARGN: Indicates the realized *Noise Margin.* This is the margin above the signal to noise ratio required to support the bit rate.
- ATTEN: Total *attenuation*; this is the measured difference in dB between the power transmitted at the near end and received at the far end.
- POWER: Indicates the *aggregate power level.* This specifies

the maximum aggregate power level allowed at the transmitter. For the downstream, the ATU-C has a maximum power level of 20 dBm. For the upstream, the ATU-R has a maximum level of 13 dBm. The maximum levels are specified at the DSLAM. The modems will use the appropriate power level to achieve the bit rate over a given distance. A longer distance will require a higher output power than a shorter distance for the same bit rate.

- Cap: Indicates the *Capacity*. This measurement is an indication of line capability. It is a ratio of (achieved line rate / attainable line rate) x 100. For example, a CAP reading of 85% means the modem has the capability to transmit 15% more line rate if required.

- In addition, the ATU-C Manufacturer and software version is displayed.

CONTINUE (F1): Press the Continue key to perform more ADSL testing. Refer to Section 2 for a description.

CLOSE (F2): Press CLOSE (F2) when you have finished testing to close the link with the ATU-C.

STORE (F3): Press the STORE (F3) key to store your turn-up results. You may refer to the end of this section, as well as the *Printing & Storing Results* chapter for more details.

Interpreting the Results

A. Fixed rate circuits

If you are testing a Fixed Rate service, look at the following measurements. Fixed rate service specifies an exact data rate for the customer.

1) Fast Rate: The majority of circuits will be provisioned using the Fast path only. For those circuits, make sure that the FAST value equals the fixed rate set for this circuit, in both the upstream and downstream directions. For example, if the circuit under test is configured for 384 downstream/ 128 upstream, you should see Downstream Fast at 384 and Upstream Fast at 128.

2) Noise Margin: Check to make sure the noise margin complies

with your company's requirements. A common standard is 6 dB. Higher values can provide more room for any introduced noise in the future.

3) Capacity: A high capacity value (79%, for example) has less room for increases in noise. This noise can be caused by additional interferers- like HDSL or T1- added in the same or adjacent binder group.

B. Rate adaptive circuits

If you're testing a Rate Adaptive service, you should check for the following. Rate adaptive circuits specify a minimum and a maximum data rate for the circuit, and try to attain the maximum rate set by the DSLAM.

1) Fast: the Fast value should be between the minimum and maximum thresholds set for the circuit.
2) Noise Margin: the Noise margin value also needs to be above the minimum allowable margin. A commonly used industry standard for target noise margin is 6 dB; your noise margin should be 6 dB or higher. Since rate adaptive circuits try to use all the possible bandwidth, the noise margin will typically be very close to 6 dB (or the minimum value).
3) Capacity: the capacity value will typically be high (around 90%). This is because rate adaptive circuits use as much bandwidth as possible.

Two Turn-up Examples

An ADSL service provider offers a fixed rate service at 1504 Kbps downstream/ 384 Kbps upstream. The technician turned up two different circuits. Both met the required bit rate; however, there were some crucial differences in results.

Example 1

```
                                                    14:21:12
> LINK UP                                                  <
>                                                          <
          LINK TURN-UP RESULTS

  [DOWNSTREAM]        [UPSTREAM]
 FAST : 1504 kbps   FAST : 384  kbps
 INTER: 0    kbps   INTER: 0    kbps
 MAX  : 3856 kbps   MAX  : 783  kbps
 MARGN: 16.5 dB     MARGN: 22.0 dB
 ATTEN: 58.0 dB     ATTEN: 31.5  dB
 POWER: 20.0 dBm    POWER: 12.0 dBm
 CAPAC: 39   %      CAPAC: 49   %
 ATU-R MFR: ALCATEL
 ATU-R VER: 2.0
 CONTINUE   CLOSE
```

Figure 3 Results from a Good Circuit

Figure 3 represents a good circuit. The fast rate matches the specified fixed rate. The noise margin is high (16 dB); this allows for future interferers to be introduced without affecting service. This is reflected in the low capacity (39%), meaning that the customer data uses only about one-third of the available bandwidth.

Example 2

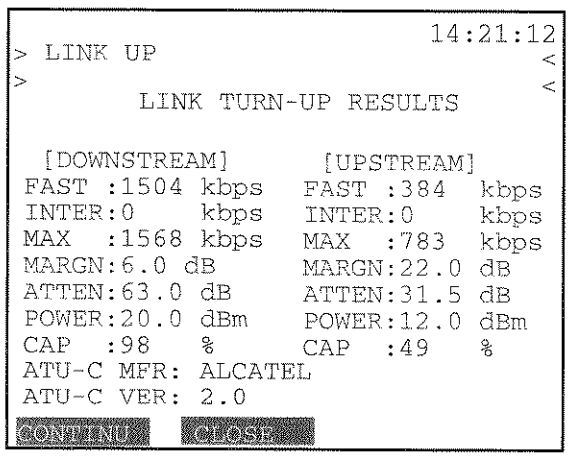


Figure 4 Results from a Borderline Circuit

Figure 4 is an example of a borderline circuit. The fast rate does meet the specified 1504 Kbps downstream and 384 Kbps upstream. However, the Margin is only 6 dB, and the Capacity is 98%. Any introduced interferers may affect this circuit's performance and the bit rate may drop below the specified fixed rate.

Storing Link Turn-up Results

You may store up to 50 different link turn up results to view or print at a later time. In addition to the initial turn-up results, the corresponding General Status, Bits per Tone, Alarm Status, and Link Measurements are also stored. To store results, refer to the following procedure. You may also refer to the *Storing & Printing Results* chapter, for more details.

1) After connecting to the ATU-C and viewing the results in the screen, press the STORE F-key in the Link Turn Up Results screen.
2) This brings you to the Stored Results screen.
3) Use the arrow keys to move the cursor to an empty line.
4) Press more (F4), then EDIT (F2).

5) Enter the Source; this is the label reference for the result.
   - Press EDIT (F1). The character grid now appears.
   - Press INPUT(F3).
   - Use the arrow keys to move the cursor to the desired letter/ number. Then press the ENTER key.
   - Continue this process until you have completed the label. Press STOP (F3) to escape the alphabet grid.
   - Press SAVE (F4) to save the SOURCE name.
   - You may enter up to 15 characters.
6) You may also enter a Circuit ID. Follow the same procedure as above.

To print stored results:

1) Enter into either the Link Turn-up Results or General Status screen. Press the STORE (F3) key.
2) Use the arrow keys to move the cursor to the correct label. You may need the PAGE-UP (F1) and PAGE-DN (F2) keys to scroll through the multiple pages, if you have more than 10 stored entries.
3) Press the more (F4) key, then press PRN-ALL (F1). This prints all the stored results if you are in graphic mode: Link Turn-up, General Status, Link Measurements, and Alarm Status to the serial port. If you are in Text mode, it prints only the Link Turn-up and General Status.

Refer to *Printing & Storing Results* for more details.

Section 2 ATU-R Menus

After initial modem turn-up, you may want to perform other tests on the ADSL circuit:
- View the Live modem status.
- View any line errors, such as CRC, FEC, HEC.
- View the alarm status: current and history.
- View the exact number of bits assigned per tone.

To continue ADSL testing after modem turn-up, perform the following steps:

1) From the Link Turn-up Results screen, press the CONTINUE (F1) key.

2) This brings you to the ADSL menu screen. Refer to Figure 5.

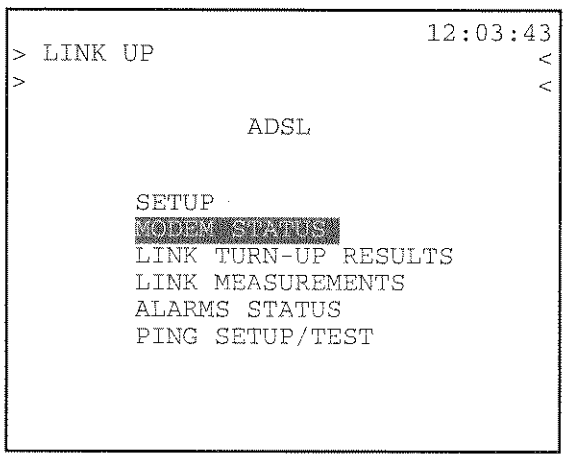


Figure 5 ADSL Menu

These menu items are used as follows:

- The MODEM STATUS menu contains various result displays like a live status report on the modem, or the number of bits assigned per tone. It also allows you to close and open the link.
- LINK TURN-UP RESULTS shows the results from the initial link turn-up.
- LINK MEASUREMENTS provides a count of errors, events, or anomalies on the line.
- ALARMS STATUS provides a current and history status of any near-end and far-end alarms.
- PING TEST provides ICMP PING with ATM encapsulation testing (SWxDSL-3A required).

2.1 Setup

Enter the Setup screen to select the proper ADSL operating mode for your circuit. There are three options: ANSI, G.DMT, and

G.LITE. After changing the mode, press the RETRAIN (F4) key to reset the modem connection with your new setting.

The three options are:
- ANSI (F1): this follows the ANSI T1.413 standard.
- G.DMT (F2): this follows the ITU-T G.992.1 standard.
- G.LITE (F3): this follows the ITU-T G.992.2 standard.

2.2 Modem Status

Selecting Modem Status brings you to another menu screen. Refer to Figure 6.

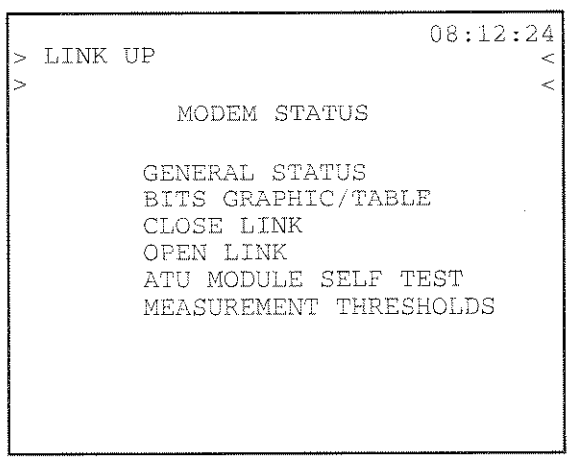


Figure 6 Modem Status Menu

2.2.1 General Status

The General Status screen provides a live report on the modem status and is constantly updated. Refer to Figure 7.

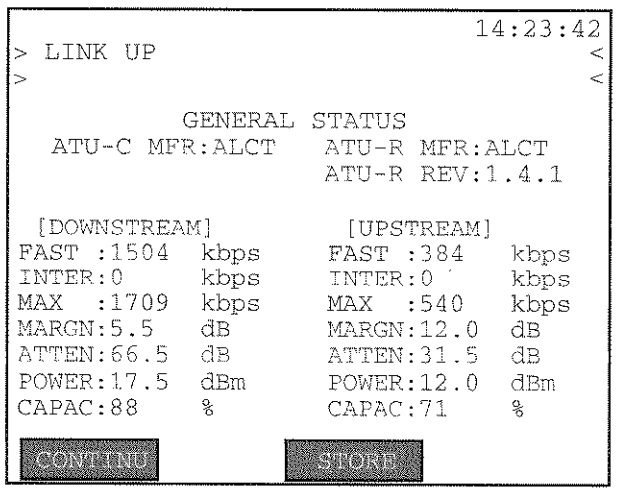


Figure 7 General Status Screen

This screen provides the following information:

ATU-C MFR: the ATU-C manufacturer. In Figure 7, the manufacturer is Alcatel.

ATU-R MFR: the ATU-R manufacturer. In Figure 7, the manufacturer is Alcatel.

ATU-R REV: the ATU-R software revision.

Downstream and Upstream Results are displayed for:

Fast Rate: Current rate for fast path bit rate
Inter Rate: Current rate for interleaved data flow
Max Rate: Maximum attainable bitrate
Margin: Noise margin
Atten: Total attenuation
Power: Total output power
Capac: Capacity (current/ max)

Refer to Section 1 for more information on interpreting the results.

Note: Because this screen is constantly updating, some of the values may slip below the requirements at times. The requirements specify what is needed for the link to turn up. Section

1 mentioned that 6 dB is the minimum noise margin. This minimum is for link turn up. Occasionally the value can slip slightly, as in Figure 7, without losing sync.

2.2.2 Bits Graphic/ Table

The Bits graphic/table feature measures the bits per tone distribution used by the modem to transmit the provisioned rate. It displays the number of bits assigned per tone in either a graphic or table format.

During modem initialization, a signal to noise measurement is made for each tone; bit distribution is then optimized to meet the desired bit rate. Each tone can support a theoretical maximum of 15 bits. During operation, the bit distribution may be adjusted to optimize bandwidth. The modems constantly monitor the signal to noise ratio for each tone. If a tone degrades in quality, a bit swap command can be sent to adjust the amount of bits assigned to that particular tone. These bits may be added to a different tone or taken out completely.

Figure 8 shows the bits per tone in graphic format.

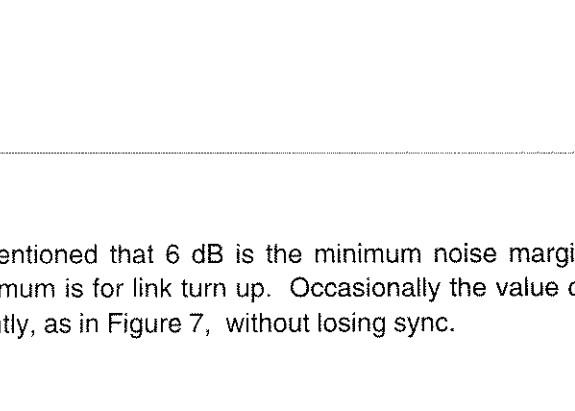


Figure 8 Bits per Tone Graphic

The block of bits at the left of the screen represents the

upstream signal. The highest frequency for the upstream should be 140 kHz. The group at the right- at the higher frequencies- represents the downstream signal. There can be anywhere from a 20 to 40 kHz buffer between the upstream and downstream frequencies. In Figure 8 above, the arrow is pointing at this buffer space. Note that there are zero bits assigned to tones 36 and 37 (frequencies 159 and 163 kHz).

To learn the exact bit count at a specific tone, refer to the top two lines. They provide the bit count for the tones marked by the arrow. In Figure 8, tone 36 has 0 bits and tone 37 has 0 bits. To move the arrow:

- Press the right and left arrow keys to move the arrow one space at a time.
- Press the << (F1) and >> (F2) keys to jump the arrow key.

The Graphic can be displayed in two different scales:

- One mode shows all 256 tones on the same screen, as in Figure 8. In this screen each bar actually represents two tones. The higher bit number of the two tones is displayed. In Figure 8, both tones 36 and 37 are represented by the same bar. This is the best mode to see the overall picture of bit assignment across the whole spectrum.
- The other mode splits the tones in half. The first screen displays tones 1-128; the next shows 129-256. This mode provides more resolution, as each bar represents only one tone.
- Use the ALL and HALF (F3) to toggle between these two modes.

You may also press the TABLE (F4) key to view the bits per tone in a tabular format. Here each tone is listed along with the number of bits assigned.

Interpreting the Results

- As mentioned earlier, the lower frequency tones (lower than 140 kHz) represent the bandwidth used for the upstream signal. The higher frequency tones at the right show the frequencies used for the downstream signal.
- The bits should drop to zero around 140 kHz. This is the buffer

between the upstream and downstream signals. The actual size of this buffer varies.

- If you see a major drop in bits in either the downstream or upstream section, this is a good indication that there is an interferer at that frequency. For example, if there is a major drop at 772 kHz, this most likely represents an interfering T1 signal.

2.2.3 Close Link

When you have finished testing, you should close the link with the ATU-C:

1) From the Modem Status menu, enter CLOSE LINK.
2) Follow the screen instructions, and press ENTER.
3) The screen displays "Close Command Sent" when finished. Also note that the top message shows "Link Down."

Note: It is a good idea to manually close the link instead of just unplugging the signal. When you close the link, the SunSet sends a Close Command message to the DSLAM. The DSLAM then knows why the signal is lost when you disconnect the set.

2.2.4 Open Link

The SunSet xDSL automatically opens the link upon powering up. However, if you ever need to reopen the link, select this menu item.

1) From the Modem Status menu, enter OPEN LINK.
2) Follow the screen instructions, and press ENTER.
3) You should see an "Attempting to Open Link" message at the top left of the screen. The XTU-R LED should be blinking red, indicating the SunSet is trying to connect with the ATU-C.
4) When the ATU-C recognizes the SunSet ATU-R, the screen shows "Initializing."
5) If there is a successful connection with the ATU-C, the screen displays the Link Turn-up results. Also note that the top message shows "Link Open." The XTU-R LED lights solid green, indicating a successful connection with the ATU-C.

If unsuccessful, an error message appears and no results are displayed. The XTU-R LED is solid red. The following is a list of possible error messages and their meanings:

- "Unable to lock with ATU-C": the test set can't lock with the ATU-C.
- "Requested Bitrate Too High": the bit rate requested by the ATU-C cannot be supported by the ATU-R.
- "A failure occurred during the initialization process": there was a protocol error during the turn-up process.
- " A message received from the ATU-C was invalid": a CRC error was detected during the turn-up procedure.

If you receive one of these messages during turn-up, try opening the link several times to make sure it's not a temporary fault.

Note: If you try to perform an Open Link when the test set is already trying to open the link, you will see an "OPEN REJECTED " message at the top left.

2.2.5 ATU Module Self Test

Enter this menu item to perform a self test on the ATU Module. As soon as you enter the screen, it begins the test. When finished, it provides the results.

2.2.6 Measurement Thresholds

The Measurement Threshold feature allows you to set specific thresholds for the downstream margin, capacity, and fast rate. Whenever your link drops below these values, a warning message will pop up on the screen. For example, if you set your capacity threshold for 75% and at some point during your testing, the achieved capacity is greated than 75%, a warning message will appear.

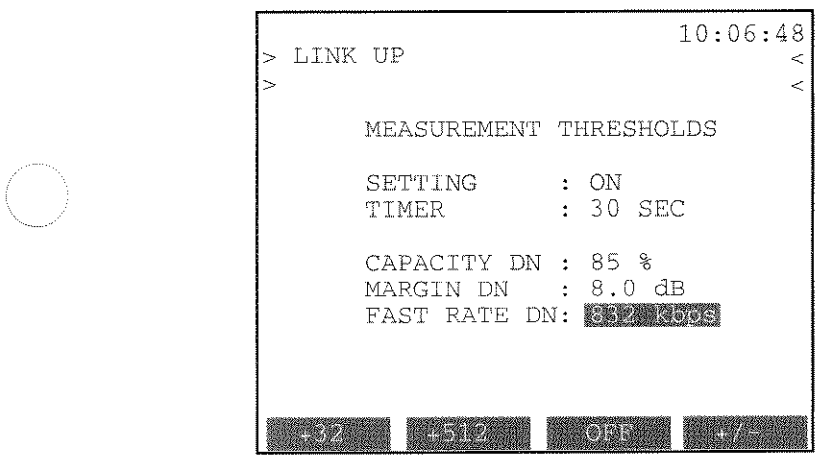


Figure 9 Measurement Thresholds

You should configure the following settings for Measurement Thresholds.

1) SETTING
F-Key Options: ON (F1), OFF (F2)

- Select ON to enable the measurement threshold warning.
- Select OFF to disable the warning.

2) TIMER
F-Key Options: 15 SEC (F1), 30 SEC (F2)

The Timer setting determines how frequently the pop-up warning message will appear. For example, in Figure 9, the warning message will appear every 30 seconds. You may choose to show the message every 15 or 30 seconds.

3) CAPACITY DN
Options: 0 to 100 %

This sets the threshold for the downstream capacity value. When the link's downstream capacity exceeds this threshold, the warning message will appear.

- Use the (F1) and (F2) keys to set the value from 0 to 100 %.
- Use the +/- (F4) key to change the direction of the (F1) and

(F2) keys.
- You can also select OFF (F3) to disable the capacity threshold.

4) MARGIN DN
Options: 0 to 31 dB

This sets the threshold for the downstream noise margin value. When the link's downstream margin drops below this threshold, the warning message will appear.
- Use the (F1) and (F2) keys to set the value from 0 to 100 %.
- Use the +/- (F4) key to change the direction of the (F1) and (F2) keys.
- You can also select OFF (F3) to disable the margin threshold.

5) FAST RATE DN
Options: 32 to 9856 kbps

This sets the threshold for the downstream fast rate value. When the link's downstream fast rate drops below this threshold, the warning message will appear.
- Use the (F1) and (F2) keys to set the value from 0 to 100 %.
- Use the +/- (F4) key to change the direction of the (F1) and (F2) keys.
- You can also select OFF (F3) to disable the fast rate threshold.

After setting your thresholds, continue with your ADSL testing. If your link values ever drop/exceed the given thresholds here, a warning message will pop up alerting you. You may need to try a different ATU-C profile for that circuit.

2.3 Link Turn-Up Results

This screen displays the results from the initial modem turn-up. Figure 10 displays a sample screen. You may refer to Section 1 for definitions and interpretations of each of the measurements.

```
                                        14:21:12
> LINK UP                                      <
>                                              <
          LINK TURN-UP RESULTS

  [DOWNSTREAM]        [UPSTREAM]
 FAST : 1504 kbps   FAST : 384  kbps
 INTER: 0    kbps   INTER: 0    kbps
 MAX  : 3856 kbps   MAX  : 783  kbps
 MARGN: 16.5 dB     MARGN: 22.0 dB
 ATTEN: 58.0 dB     ATTEN: 31.5  dB
 POWER: 20.0 dBm    POWER: 12.0 dBm
 CAP  : 39   %      CAP  : 49   %
 ATU-C MFR: ALCATEL
 ATU-C VER: 2.0
 CONTINU    CLOSE     STORE
```

Figure 10 Link Turn-up Results

These results are from the initial link turn-up; they are not updated. You may look at General Status for updated/current results.

2.4 Link Measurements

The Link Measurement screens provide information on errors and events. Three measurement screens are available. Use the PAGE-UP (F1) and PAGE-DN (F2) keys to scroll through the pages. Figure 11 displays the first link measurement screen.

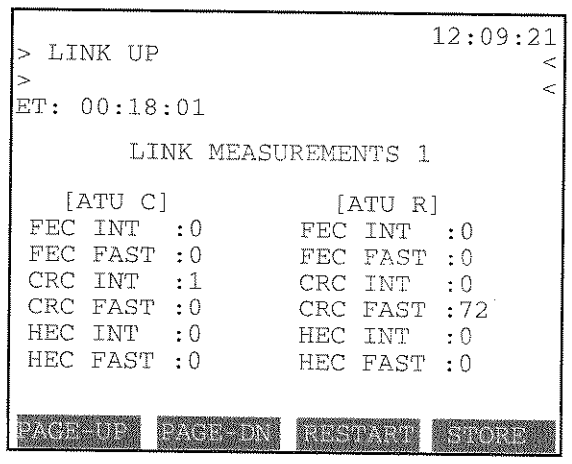


Figure 11 Link Measurements 1

The following results are shown in this screen:

ET: Elapsed Time, this is the amount of time that has elapsed since the beginning of the test. Press RESTART (F3) to restart ET.

The left column displays results for the upstream signal (received by the ATU-C); the right column shows results for the downstream signal (received by the ATU-R). Each result is shown for the interleaved and fast path. A circuit will be using one or the other. Therefore, if the circuit under test uses the fast path, refer to the FAST results.

FEC INT: Forward Error Correction Interleaved. FEC INT indicates that errors have been corrected in the codeword for the interleaved data stream. Alcatel defines FEC as an *event that does not affect service performance.*

FEC FAST: Forward Error Correction Fast. FEC FAST indicates that errors have been corrected in the codeword for the fast data stream. Alcatel defines FEC as an *event that does not affect service performance.*

CRC INT: Cyclic Redundancy Check Error Interleaved. This indicates that in the interleaved data stream, a received CRC-

8 code is not identical to the locally calculated CRC-8 code. Alcatel defines CRC as an *anomaly that affects service performance.*

CRC FAST: Cyclic Redundancy Check Error Fast. This indicates that in the fast data stream, a received CRC-8 code is not identical to the locally calculated CRC-8 code. Alcatel defines CRC as an *anomaly that affects service performance.*

HEC INT: Header Error Control Error Interleaved. This indicates that an ATM cell with an incorrect HEC is contained in the interleaved data stream. Alcatel defines HEC as an *anomaly that affects service performance.*

HEC FAST: Header Error Control Error Fast. This indicates that an ATM cell with an incorrect HEC is contained in the fast data stream. Alcatel defines HEC as an *anomaly that affects service performance.*

Press PAGE-DN (F2) to view the next page of results. Figure 12 shows the second Link Measurements screen.

```
                                        12:09:44
> LINK UP                                      <
>                                              <
ET: 00:10:46

        LINK MEASUREMENTS 2

ERR SEC          :0
SEVERE ERR SEC   :0
UNAVAILABLE SEC  :0
BLK ERR RATE     :0
LOSS OF SIG SEC  :0
#OF LINK DROPS   :0


PAGE-UP  PAGE-DN  RESTART  STORE
```

Figure 12 Link Measurements 2

The second screen reports on the status of the received signal only. Therefore, for ATU-R emulation, it shows results for the downstream direction. The following results are shown:

ERR SEC: An errored second is defined as one second containing 1 or more CRC-8 defects or loss of signal.

SEVERE ERR SEC: A severely errored second is defined as one second containing 18 or more CRC-8 defects (a 30% errored block rate). A severely errored second is also counted at loss of signal.

UNAVAILABLE SEC: An unavailable second begins after 10 consecutive severely errored seconds.

BLK ERR RATE: This reports the block error rate. Block error rate is calculated by: (# of CRC-8 defects/ ET) / (59 CRC-8 defects / sec).

LOSS OF SIG SECONDS: This parameter counts the number of seconds during which the set lost its received signal.

OF LINK DROPS: This parameter counts the number of times the set lost synchronization.

Press PAGE-DN (F2) to view the third link measurements page. Figure 13 displays the third link measurements screen.

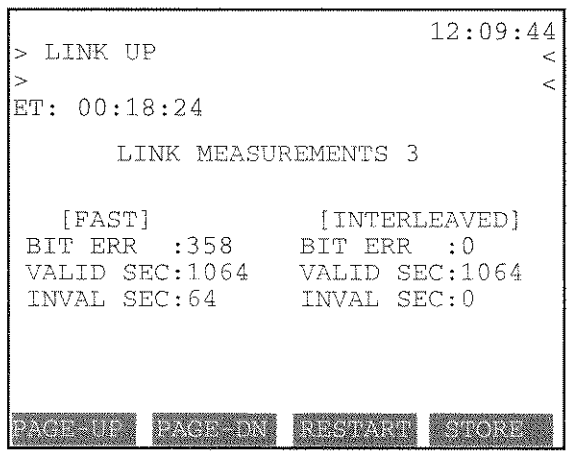


Figure 13 Link Measurements 3

BIT ERR: This indicates the number of bit errors that have occurred in the BER test cells of the fast or interleaved channel.

VAL SEC: These are the valid seconds during the test for the fast or interleaved channel.

INV SEC: These are the invalid seconds during the test for the fast or interleaved channel.

2.5 Alarms Status

The Alarms Status screen provides a current and history status of any alarm conditions. Refer to Figure 14.

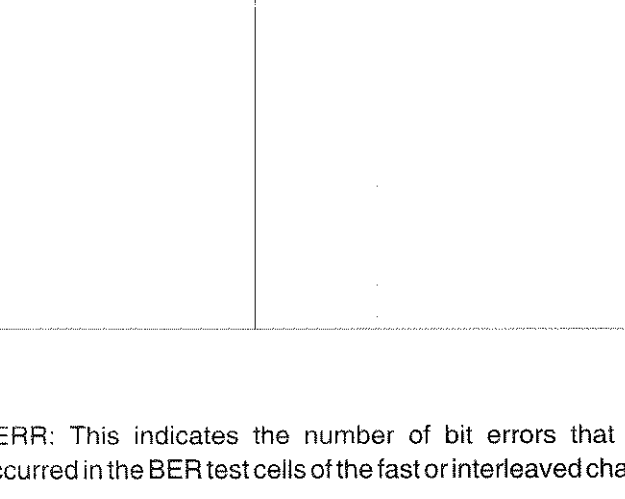


Figure 14 Alarm Status Screen

Alarm information is provided simultaneously for the near-end and far-end. The near-end refers to the ATU-R side of the link, far-end to the ATU-C side of the link. The screen also displays both current and history results. A history alarm means that the alarm condition was detected in the past, but has been cleared.

Pressing the HISTORY (F1) clears the flashing history LEDs and

the history counters in this screen. The following alarm information is shown:

Here are the possible alarm combinations:

Current YES: The particular alarm condition is currently detected.
History YES: The particular alarm condition had been detected in the past, but is no longer present.
Current NO: This alarm condition is not detected currently.
History NO: This alarm condition has never been detected since the start of the test or since pressing the History (F1) key.

Here are the possible alarm types:

• LOS: Loss of Signal
Near-End: occurs when the received pilot tone power is 6 dB or more below the reference power (over 100 ms).
Far-End: indicates that a near-end loss of signal was detected in the previous superframe.

• LOF: Loss of Frame
Near-End: indicates that the sum of the number of tones with a mismatch between the expected and measured bit pattern exceeds the threshold in 2 consecutive synchronization symbols. If the threshold equals the number of active tones (which is the default), an LOF indicates that half of the active tones carry the wrong information.
Far-End: indicates that a near-end loss of frame was detected in the previous superframe.

• LOP: Loss of Power
Near-End: occurs when the ATU-R power level drops below the nominal power level needed for proper operation of the ATU-R
Far-End: indicates that an LOP indicator has been received.

• LCD INTERL: Loss of Cell Delineation, interleaved

• LCD N-INTERL: Loss of Cell Delineation, non-interleaved

• LOM: Loss of Margin
Near-End: occurs when the measured signal-to-noise ratio (near-

end) is below the required signal-to-noise ratio, as provided by the operator.

Far-End: occurs when the downstream signal-to-noise margin is below the minimum required downstream signal-to-noise margin, as required by the operator.

Section 3 PING Testing

SunWare number SWxDSL-3A provides PING testing for the SSxDSL-3 Alcatel ATU-R module. ADSL link turn-up verifies connectivity to the local DSLAM. PING testing takes the turn-up procedure one step farther and verifies connectivity to the far end network. PING is a common method to discover whether two remote LAN segments using TCP-IP protocol are connected. When a PING message is received, internet devices acknowledge the message by sending an echo message back.

After turning up the link, escape back to the ADSL menu. Enter PING SETUP/TEST. You first must configure the test. Refer to Figure 15.

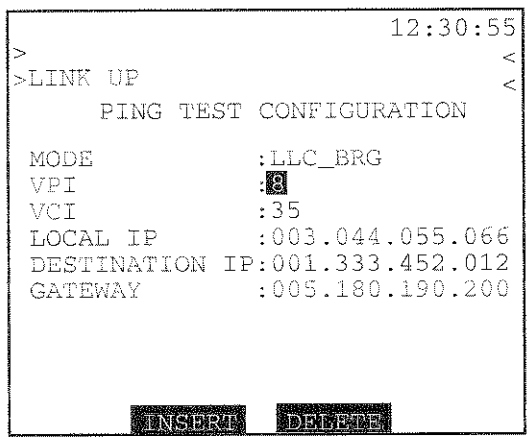


Figure 15 Ping Test Configuration Screen

You may use the SHIFT key and keypad numbers to enter values for these configuration settings. To enter numbers:

1) Press the SHIFT key; note the SHIFT-lock indicator appears at the top left of the screen.
2) Enter the desired number from the keypad.
3) Press the SHIFT key to remove the SHIFT-lock.
4) You may use the INSERT and DELETE F-keys to edit your value.
5) Remember: the SHIFT-lock must be off in order to use the F-keys or arrow keys.

You must make sure that all 5 settings are exactly correct for the test to be successful.

1) MODE
Set at LLC_BRG

- Currently, the SunSet xDSL supports PING testing over Alcatel ADSL /ATM lines, using the LLC_BRG mode.

2) VPI
Range: 1 to 255

- The VPI default is 8, which is the typical ethernet customer assignment.
- Along with the VCI, the VPI identifies the next destination of a cell as it moves through a series of ATM switches on the way to its destination. It is typically assigned by the service provider.

3) VCI
Range: 1 to 65535

- The VCI default is 35, which is the typical ethernet customer assignment.
- Along with the VPI, the VCI identifies the next destination of a cell as it moves through a series of ATM switches on the way to its destination. It is typically assigned by the service provider.

4) LOCAL IP

- Local IP specifies the IP address of the circuit you're testing.

5) DESTination IP

- Destination IP specifies the IP address of the device you plan to PING.

6) GATEWAY

- Gateway specifies the gateway address.
- A gateway is a device which connects dissimilar networks and passes information between them. In TCP/IP, the default gateway address is the address where the Internet Protocol sends packets destined for remote networks, unless a different route is configured.

Press ENTER to begin the test. You will see an IN PROGRESS... message as the test proceeds.

- The SunSet will send 10 pings, at a one second interval.
- One or more responses are considered a pass. See the following figure for a pass sample:

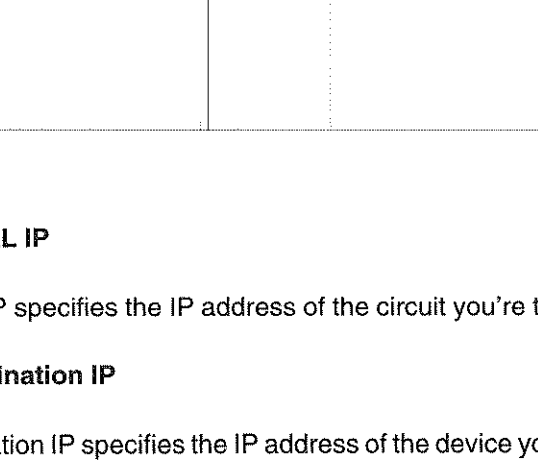


Figure 16 Ping Test Passed

- PING OK means the destination has received the PING message

and properly responded to the SunSet. This indicates that the set can connect to the internet.

- If no responses are received, you will see a PING NG (Ping No Good) message.
- You may press STOP (F4) to stop the test, then START (F4) to restart it.

In addition to the PING TEST results, this screen also presents the Local and Destination IP addresses, as well as the START time (when the test began) and the Elapsed Time (how long the test has run so far).

Note: If you lose the signal (physical layer) during the test, wait for the ADSL signal to re-establish the link. If it does, simply restart the PING test. If it does not, escape back to the ADSL menu. Enter Modem Status, Open Link and manually open the link. Then you can return back to your PING testing.